APPENDIX A

TECHNICAL MEMORANDUM FOR FIELD ACTIVITIES

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CONTENTS

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TABLES

FIGURES

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ACRONYMS

AOC	area of contamination
bgs	below ground surface
BHHRA	baseline human health risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
DPT	direct push technology
EPA	U.S. Environmental Protection Agency
ES&H	environment, safety, and health
FS	feasibility study
KPDES	Kentucky Pollutant Discharge Elimination System
OU	operable unit
PCB	polychlorinated biphenyl
PEMS	Project Environmental Measurements System
PGDP	Paducah Gaseous Diffusion Plant
PPE	personal protective equipment
QC	quality control
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
SERA	screening-level ecological risk assessment
SWMU	solid waste management unit
VOC	volatile organic compound

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A.1. INTRODUCTION

The purpose of this memorandum is to provide certain technical details regarding field activities pertaining to the Soils Operable Unit (OU) Remedial Investigation (RI). A brief summary of project objectives is provided below; a more thorough discussion is contained in the body of the report.

The Soils OU is one of the operable units located within the Paducah Gaseous Diffusion Plant (PGDP). This operable unit consists of contamination associated with PGDP's soils, which are listed in Tables ES.1 and 1.2 in the main text of the RI Report.

The primary focus of this RI was to collect field and fixed-base analytical data necessary to determine the nature and extent of any soil contamination. The data will be used to support the completion of a baseline human health risk assessment (BHHRA) and a screening-level ecological risk assessment (SERA). The data also will be used, in conjunction with other data that may be necessary to evaluate appropriate remedial alternatives, as necessary, at each of the solid waste management units (SWMUs).

Table A.1 presents procedures and work instructions that were used to complete the fieldwork conducted as part of the Soils OU RI.

Table A.1. Examples of Procedures Used in the RI of the Soils OU

Work Instructions or Procedures Required for Fieldwork and Sampling Activities
Archival of Environmental Data Within the Environmental Restoration Program
Chain-of-Custody
Cleaning and Decontaminating Sample Containers and Sampling Equipment
Data Entry
Data Management Coordination
Data Validation
Environmental Radiological Screening
Equipment Decontamination
Field Quality Control
Identification and Management of Waste Not From a Radioactive Material Management Area
Labeling, Packaging, and Shipping of Environmental Field Samples
On-Site Handling and Disposal of Waste Materials
Opening Containerized Waste
Paducah Contractor Records Management Program
Quality Assured Data
Sampling of Soil
Composite Sampling
Use of Field Logbooks

The existing data for 32 SWMUs/areas of concern (AOCs) was determined in the RI/Feasibility Study (FS) Work Plan to be sufficient to evaluate the nature and extent of contamination; therefore, no additional samples were collected for those. The 54 remaining SWMUs/AOCs were investigated per the RI/FS Work Plan as described in the follow chapters of this appendix.

Activities addressed in this technical memorandum (Appendix A) are discussed in the following chapters:

- Chapter 2—Soil Sampling Strategy
- Chapter 3—Surveying

- Chapter 4—Sampling Procedures
- Chapter 5—Field Decontamination
- Chapter 6—Waste Management
- Chapter 7—Environment, Safety, and Health
- Chapter 8—Fieldwork Documentation
- Chapter 9—Rectification of Planned Sample Locations

A.2. SOIL SAMPLING STRATEGY

The field sampling strategy used for the RI consisted of intrusive media sampling (surface and subsurface soil). The investigation activities used standard industry practices that were consistent with U.S. Environmental Protection Agency (EPA) procedures and protocols. Sampling activities at the Soils OU SWMUs/AOCs focused on the soils from 0-10 ft below ground surface (bgs) and down to a depth of 16 ft bgs at the invert of a pipeline.

Soil samples were generally taken by hand using a hand-auger for the 0-1 ft bgs and in 3 ft increments (1-4, 4-7, 7-10) with a track-mounted rig capable of direct push technology (DPT) drilling. The depths of 4-7, and 7-10 ft bgs were only taken when field laboratory results indicated the need for contingency/step-out sampling as described in the RI/FS Work Plan (Work Plan) (DOE 2010). This track-mounted drill rig utilized push rods to advance a soil sample tube with an acetate liner to collect undisturbed soil samples. If refusal was met using the push rods, the sample was offset 10 ft and attempted again up two times. Samples consisted of a five-point composite in each 45 ft by 45 ft grid and for each depth interval, as described in the Work Plan.

The field crew sampled the soil borings in accordance with U.S. Department of Energy (DOE) Prime Contractor-approved procedures, consistent with *Environmental Investigation Standard Operating Procedures and Quality Assurance Manual*, EPA Region 4, November 2001. As soon as the drill crew recovered the acetate liner containing the soil sample, the soil core was placed in the sample preparation area. A health and safety officer and radiation control officer scanned the acetate sleeve and the ends of the soil core for volatile organic compounds (VOCs) and radiation before releasing the core to the sample crew. Once the soil core in acetate sleeve was cleared, the sample crew opened the acetate sleeve with a utility knife and, once again, a health and safety officer and radiation control officer scanned the sample for contamination. When contamination was found, the health and safety officer and radiation control officer directed the field crew in any additional personal protective equipment (PPE) requirements and appropriate handling precautions.

Immediately upon approval from the health and safety officer and radiation control officer for the field crew to sample the soil core, the field crew collected the samples by placing the soil in a clean bowl and mixed thoroughly. Samplers placed the resulting soil mixture in the appropriate sample jars for analysis.

The contingency/step-out grids were composite sampled, as explained above. The contingency/step-outs were determined by preliminary results from field analysis of grid sampling at the surface and/or 1 ft to 4 ft bgs depth. Project action levels were set as the benchmarks to determine whether step-out grid sampling was necessary and if additional depth samples (4–7 and 7–10 ft bgs) were necessary. The project action levels are shown in Chapter 2, Table 2.2, which is from the Work Plan. If a project action level was exceeded (i.e., surface migration pathways) an additional grid (up to two) was placed until a boundary was reached (e.g., road, another SWMU, ditch). If the exceedance was for the 1–4 ft bgs sample, then collection of depth samples (4 ft to 7 ft and 7 ft to 10 ft bgs) also were performed in the original grid.

A.3. SURVEYING

As the field crew performed the Soils OU RI sampling, they marked the boring locations using flagging and/or paint. Global Positioning System units with submeter accuracy documented the sample locations. The Soils OU RI included surveying of sampling center grid locations prior to sampling activities. This survey work was performed by or under responsible charge of a Professional Land Surveyor registered in the Commonwealth of Kentucky, locating each sample point with its horizontal and vertical position using the PGDP coordinate system for horizontal control. Additionally, the survey identified the State Plane Coordinates for each sample location using the U.S. Coast and Geodetic Survey North American Datum of 1983. The datum for vertical control was the U.S. Coast and Geodetic Survey North American Vertical Datum of 1988. Accuracy for this work was that of a Class 1 First Order survey.

Project personnel entered the coordinates into the Paducah Project Environmental Measurements System (PEMS), and the coordinate locations were transferred with the station's ready-to-load file to the Paducah Oak Ridge Environmental Information System.

The Soils OU RI also performed nonintrusive data collection (gamma radiological walkover surveys) for all of the Soils OU SWMUs/AOCs. Biased, 0–6 inch samples were taken at the highest reading above the action level each SWMU/AOC and sent to the fixed-base laboratory for radionuclide analysis. The action level inside the PGDP industrial area was 10,300 net cpm was calculated as 171 pCi/g U-238. The action level outside the PGDP industrial area was 1,800 net cpm calculated as 30 pCi/g U-238.

A.4. SAMPLING PROCEDURES

During the sampling event, two types of samples—soil and field quality control (QC)—were collected and submitted for analysis. Prior to initiation of field sampling, all sample team members completed all required training.

The sampling team collected, stored, and shipped the samples according to preestablished QC protocols and approved project procedures, which were consistent with EPA Region 4 sampling methodologies. Sample container, preservation, and holding time requirements were in accordance with the EPA Engineering Support Branch Standard Operating Procedures.

Samples collected for this project were assigned unique sample identifiers that were recorded on the sample labels and chain-of-custody forms.

An example of the sample numbering scheme used for the Soils OU project, as discussed in the Work Plan, is provided below.

ssseenMA000

where	sss	Identifies the SWMU/AOC being investigated
	ee	Identifies the exposure unit
	n	Identifies the sequential station number (based on the same numbering scheme, sss-ee-n identifies the location name)

M	Identifies the media type (W identifies the sample as water, S identifies the sample as soil)
A	Identifies the sequential sample (usually "A" for a primary sample and "B" for a secondary sample) If additional rounds of sampling are required, the sequential letter designations will continue.
000	Identifies the planned depth of the sample in ft bgs

Sample team crew members directly affixed labels to the sample containers that included the following information:

- Station name
- Sample identification number
- Sample matrix
- Sample type
- Type or types of analysis required
- Date and time of collection
- Sampler name
- Sample preservation (if required)
- Destination laboratory

The sampling team wore proper PPE during sampling. PPE consisted of, in part, company-issued clothing, safety glasses, and latex gloves. Sampling in radiological contamination areas sometimes necessitated modifications of the PPE requirements (as prescribed in work permits and directed by the project's health physics technician).

A.4.1 SOILSAMPLES

Samples were collected in accordance with the Work Plan (DOE 2010). The field crew sampled the soil borings in accordance with DOE Prime Contractor-approved procedures, consistent with *Environmental Investigation Standard Operating Procedures and Quality Assurance Manual*, EPA Region 4, November 2001, collecting soil for VOC analysis (if required), followed by the remaining soil was placed in a clean stainless steel bowl and mixed thoroughly using a stainless steel spoon to homogenize the soil taken from the sample interval before sampling for other analyses.

Sample team members filled the sample containers and ensured that each lid was securely tightened. The sample container then was placed in a cooler with an ice pack to maintain a preservation temperature of 4°C. Crew members recorded all required information in the sampling logbook.

A.4.2 FIELD QC SAMPLES

To ensure reliability of the analytical data and to meet the data quality objectives for the project, the following QC sample types were obtained during sample collection:

- Trip Blanks—Analysis of trip blanks documented the occurrence of cross contamination by VOCs during sample handling and shipping. The sample crew prepared trip blanks by filling VOC vials with deionized water before collection of the field samples. These trip blanks accompanied the filled sample bottles in ice chests in the field and during shipment and through interim storage in secured refrigerators until laboratory analysis. The trip blanks were analyzed for VOCs only.

- Field Blanks—Field blanks served as a check for potential airborne environmental contamination at the sample site. For the field blanks, the sample crew typically filled sample bottles with deionized water for samples required for fixed-base laboratory analysis and with clean soil for samples required for field laboratory analysis in the project's sample staging area and transported the bottles to the field sample station, where they were opened during the sampling process. Field blanks also were used as a reagent blank, as needed. The Soils OU RI required field blanks at a frequency of 1 in 20 samples (5%) for each sample matrix.

- Field Duplicate Samples—Field duplicate samples determined the sampling variance. The sampling crew collected 1 duplicate for every 20 samples (5%), per matrix. The field duplicate was analyzed for the same set of analytical parameters as the sample it duplicated.

- Equipment Blanks or Rinseate Samples—Equipment blanks provided a measure of the decontamination process effectiveness and were used as reagent blanks, as needed. These equipment blanks were required only when nondisposable equipment was being used. The equipment blanks consisted of deionized water passed through or over decontaminated sampling equipment and analyzed for the same parameters as the samples collected with the equipment. Equipment blanks were collected at a frequency of 1 for every 20 samples (5%).

In addition to the QC samples that were collected for laboratory analysis, temperature blanks accompanied the soil samples in the transport coolers to document proper preservation of the samples. All transport coolers contained temperature blanks.

A.5. FIELD DECONTAMINATION

The field decontamination procedure, *Decontamination of Sampling Equipment and Devices* (PAD-ENM-2702), determined the decontamination activities for the stainless steel spoons and bowls used in soil sampling. This procedure, as applied during the RI, is summarized as follows:

- Equipment first was cleaned with tap water and nonphosphate detergent, using a brush if necessary, to remove particulate matter and surface films.

- The equipment then was rinsed thoroughly with tap water, followed by an analyte-free water rinse, and then wiped with an isopropyl alcohol towelette.

- The inside of the pump and tubing was cleaned by purging soap water, followed by tap water and analyte-free water, through the pump and tubing.

- Cleaned sample equipment was allowed to air dry.

- Cleaned equipment was handled only by personnel wearing clean latex gloves to prevent recontamination.

- If cleaned sampling equipment was not reused immediately, it was wrapped in aluminum foil.

Large Equipment Decontamination (PAD-DD-2701) governed the cleaning of other sampling equipment such as the drill rigs and associated tooling. This procedure provides for the use of high-pressure steam as the primary cleaning agent. The on-site decontamination facility, C-416, supported cleaning activities for the drill rig and associated tooling during sampling at all other (on-site) Soils OU RI locations.

A.6. WASTE MANAGEMENT

The RI Work Plan included a project-specific waste management plan to provide instruction regarding waste storage and disposition. A variety of wastes were generated during the field investigation, including sample residuals and associated waste derived from sample collection. The waste generated was stored in Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) waste storage areas within the CERCLA AOC during the characterization period and prior to disposal. Consistent with EPA Policy, the storage of waste within the CERCLA AOC does not trigger Resource Conservation and Recovery Act (RCRA) storage requirements (similarly, movement of waste within a CERCLA AOC does not trigger RCRA disposal requirements). As a best management practice, waste storage areas within the CERCLA AOC were managed in accordance with the substantive requirements of RCRA; because this is a CERCLA project, the administrative requirements do not apply.

PPE was considered to fall into the same waste classification as the environmental media with which it came into contact. PPE, plastic, and paper were segregated by classification, collected in plastic bags, and labeled appropriately. These items then were handled as solid waste and is dispositioned based on the waste classification of the residual soil samples.

Decontamination water that included small quantities of soil/mud was generated from cleaning the equipment. The water was collected and stored in a polyethylene tank and discharged to the Kentucky Pollutant Discharge Elimination System (KPDES) Outfall 001 after final characterization documented that the stored water met release criteria in the KPDES permit for Outfall 001.

Solid waste was containerized in 55-gal drums, or approved equivalent, that were lined with a thick plastic liner and placed in CERCLA waste storage areas. The amount of free liquid was minimized. Any substantial amount of free liquid was decanted and placed in an approved container. Drummed soils and other solid wastes were being disposed of in the C-746-U Landfill.

All clean trash (i.e., trash that was not chemically or radiologically contaminated) was segregated according to established guidelines and then collected and disposed of. Examples of clean trash are office paper, aluminum cans, packaging materials, glass bottles not used to store potentially hazardous chemicals, aluminum foil, and food items.

Based on sample analyses, existing data, or process knowledge, the waste was classified into one of the following categories:

- RCRA-listed hazardous waste
- RCRA-characteristic hazardous waste
- Polychlorinated biphenyl (PCB) waste
- Low-level waste
- Mixed waste
- Nonhazardous waste

Applicable waste minimization requirements were implemented and included those established by the 1984 Hazardous and Solid Waste Amendments of RCRA; DOE Orders 5400.1, 5400.3, 435.1; and DOE Prime Contractor's requirements. Requirements specified in the waste management plan regarding waste generation, waste tracking, waste reduction techniques, and the waste reduction program, in general, also were implemented.

To support DOE's commitment to waste reduction, an effort was made during field activities to minimize waste generation as much as possible, largely through ensuring that potentially contaminated wastes were localized and did not come into contact with any clean media (which could create more contaminated waste). Waste minimization also was accomplished through waste segregation, selection of PPE, waste handling (spill control), and the use of alternative treatment standards.

A.7. ENVIRONMENT, SAFETY, AND HEALTH

A project-specific environment, safety, and health (ES&H) plan was included as Chapter 10 in the approved work plan and was used to provide instruction regarding safety and health of workers, the public, and the environment. The ES&H plan established the specific applicable standards and practices to be used during execution of the RI to protect the safety and health of workers, the public, and the environment. The document contained information about the sites, potential contaminants and hazards that may be encountered on-site, and hazards inherent in routine procedures. The list of contaminants was site-specific and based on previous investigations. The plan also outlined directly, or by reference, federal and state standards, pertinent consensus standards, and applicable contract requirements. The ES&H plan was implemented in accordance with 29 *CFR* § 1910.120, Hazardous Waste Operations and Emergency Response. Additional health and safety requirements were incorporated into the ES&H plan for the various field activities through preparation of project-specific activity hazard analyses.

The project team held daily safety and plan of the day meetings at the beginning of each shift. This approach ensured that the planned daily activities were reviewed prior to execution and the potential hazards were identified and discussed with the entire field team. These meetings are documented in the project work package and in the field logbooks.

A.8. FIELDWORK DOCUMENTATION

Field documentation was maintained throughout the Soils OU RI in various types of documents and formats, including the field logbooks, sample labels, sample tags, chain-of-custody forms, and field data sheets. The following general guidelines for maintaining field documentation was implemented. Documentation requirements are listed below. Entries were written clearly and legibly using indelible ink.

- Corrections were made by striking through the error with a single line that did not obliterate the original entry. Corrections were dated and initialed.

- Dates and times were recorded using the format "mm/dd/yy" for the date and the military (i.e., 24-hour) clock for the time.

- Zeroes were recorded with a slash (/) to distinguish them from letter Os.

- Blank lines were prohibited. Information was recorded on each line or a blank line was lined out, initialed, and dated.

- No documents were altered, destroyed, or discarded, even if they were illegible or contained inaccuracies that required correction.

- Information blocks on field data forms were completed or a line was drawn through the unused section, and the area was dated and initialed.

- Unused logbook pages were marked with a diagonal line drawn from corner to corner and a signature and date was placed on the line.

- Photocopies of logbooks, field data sheets, and chain-of-custody forms were made and stored in the project file.

- The following information was recorded on the outside of the front cover of each logbook using indelible ink:

  - Project name
  - Unique logbook name and number
  - Client and contract number
  - Task and document control number
  - Activity or site name
  - Start and completion date of the logbook

Quality assurance personnel conducted periodic reviews of the data forms and logbooks (including data forms placed in the logbooks) prepared by field personnel to verify the following:

- Accuracy of entries;
- Legibility and clarity of entries;
- Completeness, to ensure that at least the minimum required information was recorded;
- Consistency of information recorded; and
- Signature and date of entries by the designated team member.

A.9. RECTIFICATION OF PLANNED SAMPLE LOCATIONS

A.9.1 INTRODUCTION

A Geographic Information System provided sample coordinates from maps of the intended sample locations in the Soils OU RI/FS Work Plan. Conventional survey methods were used to locate the center point sample coordinates at each grid within each SWMU.

A.9.2 DISCUSSION OF PLANNED SAMPLE LOCATIONS

During the survey and location of the sample boreholes, there were some boreholes that could not be located at the planned coordinates due to steep topography and surface structures (i.e., roads, concrete slabs, etc.). When obstructions or conditions prevented location/collection of a sample at the planned location, the samples locations were offset by 10 ft up to 2 times. This section presents a summary of the sampling effort.

A.9.2.1 Group 1

Former facility areas

Table A.2 is a summary of the number of samples planned and the number of samples collected. Figures A.1–A.4 show the locations of samples not obtained.

Table A.2. Former Facility Samples Collected

SWMU/ AOC	Planned Grid Samples	Collected Grid Samples	Contingency/ Step-out Samples Anticipated	Contingency/ Step-out Samples Collected	Planned Pipeline Samples	Collected Pipeline Samples
99B	12	6	74	46	8	4
194	788	651	70	58	0	0
196	2	2	0	0	2	0
489	2	2	0	0	0	0
531	14	14	4	0	0	0

SWMU 99 is composed of an active facility (cylinder yard) and a historical septic system; therefore, sampling was limited due to safety concerns and the dense compacted gravel which prevented penetration and collection of samples in the active portion. Other issues preventing sample collection for the septic portion were utilities, asphalt, and gravel. Collected were 6 of 102 planned grid samples, grids 1 through 48 do not have samples for depths at 1 and 4 ft bgs (which is the active part of the facility). There were 46 of 74 contingency/step-out/step-out samples collected; grids 49a, 49d, 49e, 50b, 50c, 51d, and 51e do not have samples for depths at 1, 4, 7, and 10 ft bgs. Of the planned pipeline samples, 4 out of 8 were collected; samples 2, 3, 6, and 7 were not collected.

SWMU 194 sampling was limited due to asphalt surface, slope of ditch, addition to an existing building, gravel/concrete refusal, dense woods, and utilities. Collected were 651 out of 788 planned grid samples; grids 164, 165, 167, 168, 169, 170, and 171 do not have samples for depths at 1ft bgs with all other planned grids not collected missing samples for depths at 1 and 4 ft bgs. There were 58 out of 70 contingency/step-out/step-out samples that were collected; grids 163a, 163b, 205a, 205b, 219a, and 219b do not have samples for depths at 1 and 4 ft bgs. No pipeline samples were planned.

SWMU 196 sampling was limited by dense underground utilities. Collected were 2 out of 2 planned grid samples. There were no needed contingency/step-out samples. Of the planned pipeline samples, 0 out of 2 were collected.

SWMU 489 had 2 out of 2 planned grid samples that were collected. Contingency/step-out samples were not needed and there were no planned pipeline samples.

SWMU 531 sampling was limited due to ongoing plant operations, which made the area inaccessible. Collected were 14 out of 14 planned grid samples. There were 0 out of 4 contingency/step-out samples collected; grid 7 does not have samples for depths at 7 and 10 ft bgs and grid 7a does not have samples for depths at 1 and 4 ft bgs. No pipeline samples were planned.

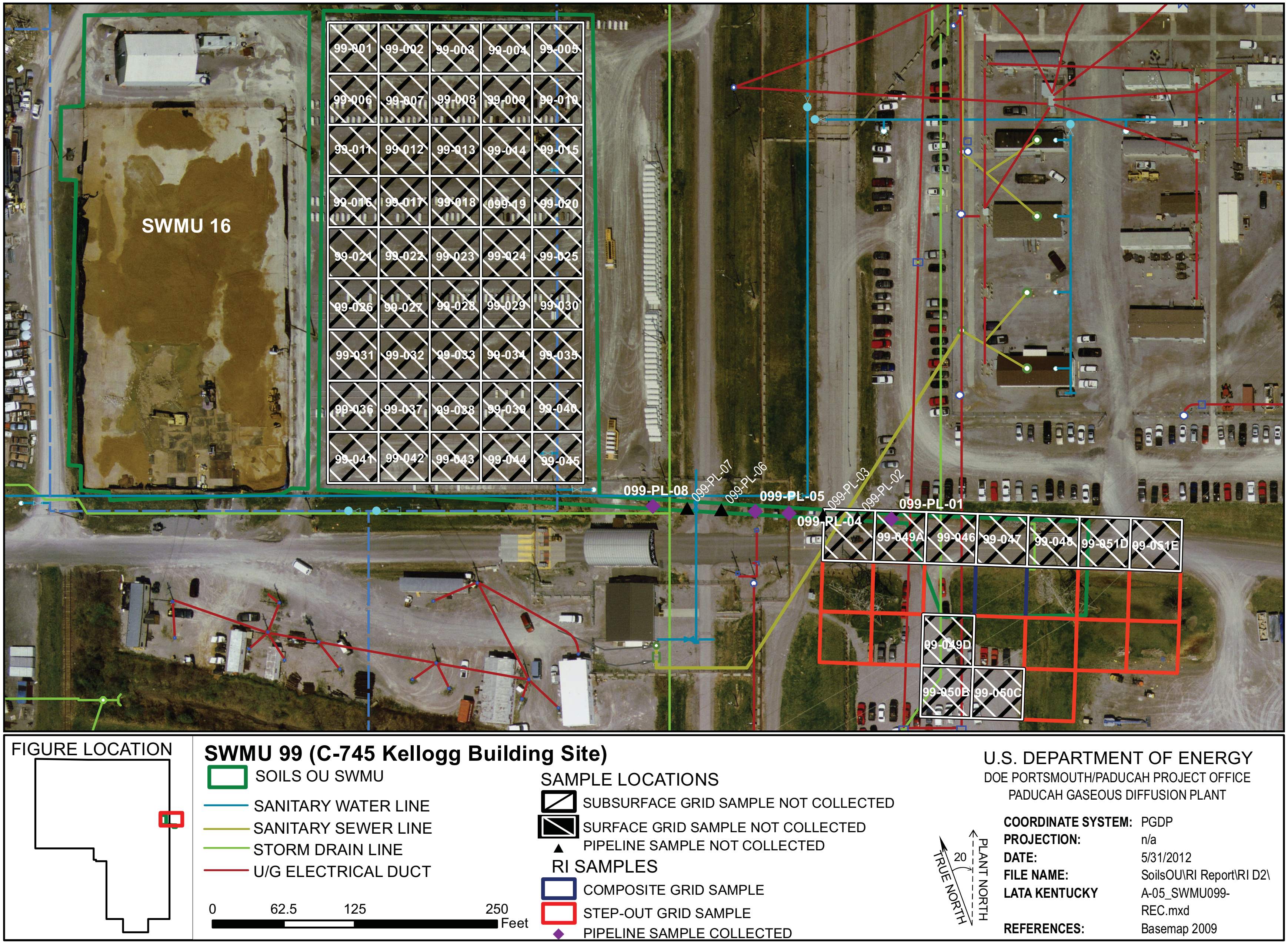


Figure A.1. SWMU 99 Sampling Rectification Map

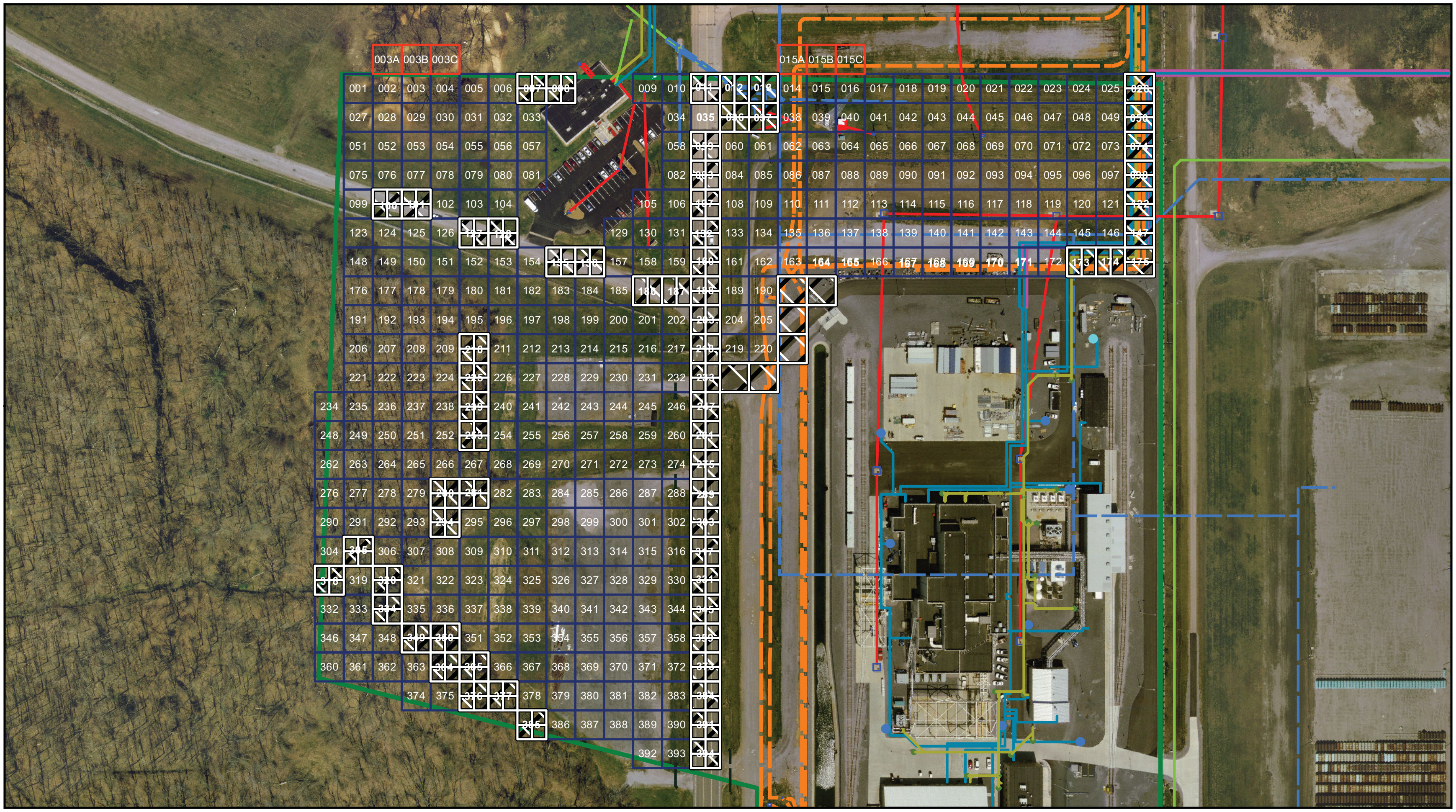
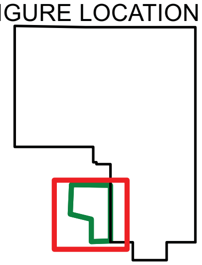


FIGURE LOCATION



SWMU 194 (DUF$_6$ Facility, McGraw Construction Facilities)

SOILS OU SWMU

SANITARY WATER LINE

SANITARY SEWER LINE

STORM DRAIN LINE

U/G ELECTRICAL DUCT

U/G COMMUNICATION

0 125 250 500 Feet

SAMPLE LOCATIONS

SUBSURFACE GRID SAMPLE NOT COLLECTED

SURFACE GRID SAMPLE NOT COLLECTED

RI SAMPLES

COMPOSITE GRID SAMPLE

STEP-OUT GRID SAMPLE

TRUE NORTH 20 PLANT NORTH

U.S. DEPARTMENT OF ENERGY

DOE PORTSMOUTH/PADUCAH PROJECT OFFICE

PADUCAH GASEOUS DIFFUSION PLANT

COORDINATE SYSTEM:	PGDP
PROJECTION:	n/a
DATE:	5/31/2012
FILE NAME:	SoilsOU\RI Report\RI D2\
LATA KENTUCKY	A-05_SWMU194-REC.mxd
REFERENCES:	Basemap 2009

Figure A.2. SWMU 194 Sampling Rectification Map

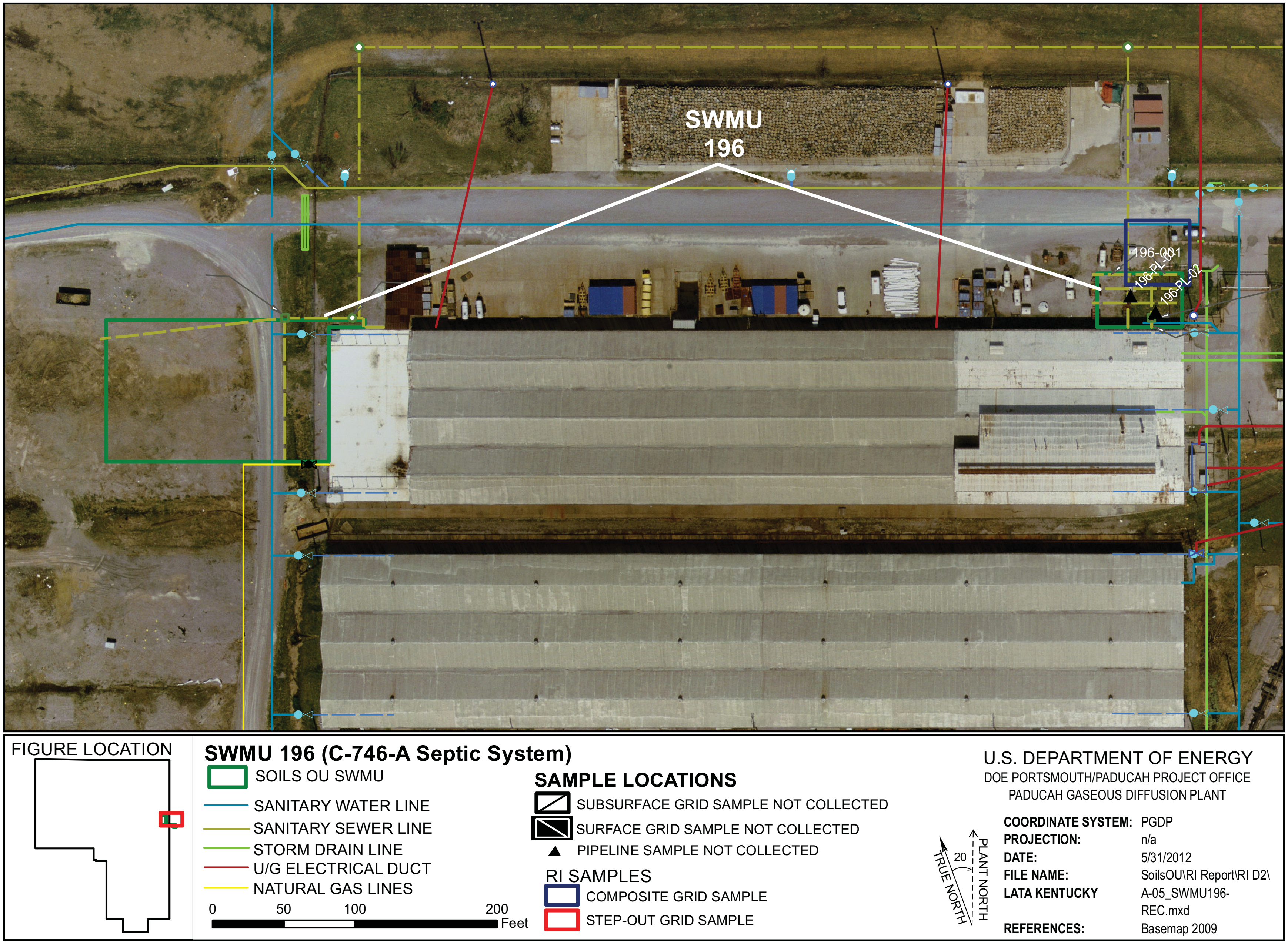


Figure A.3. SWMU 196 Sampling Rectification Map

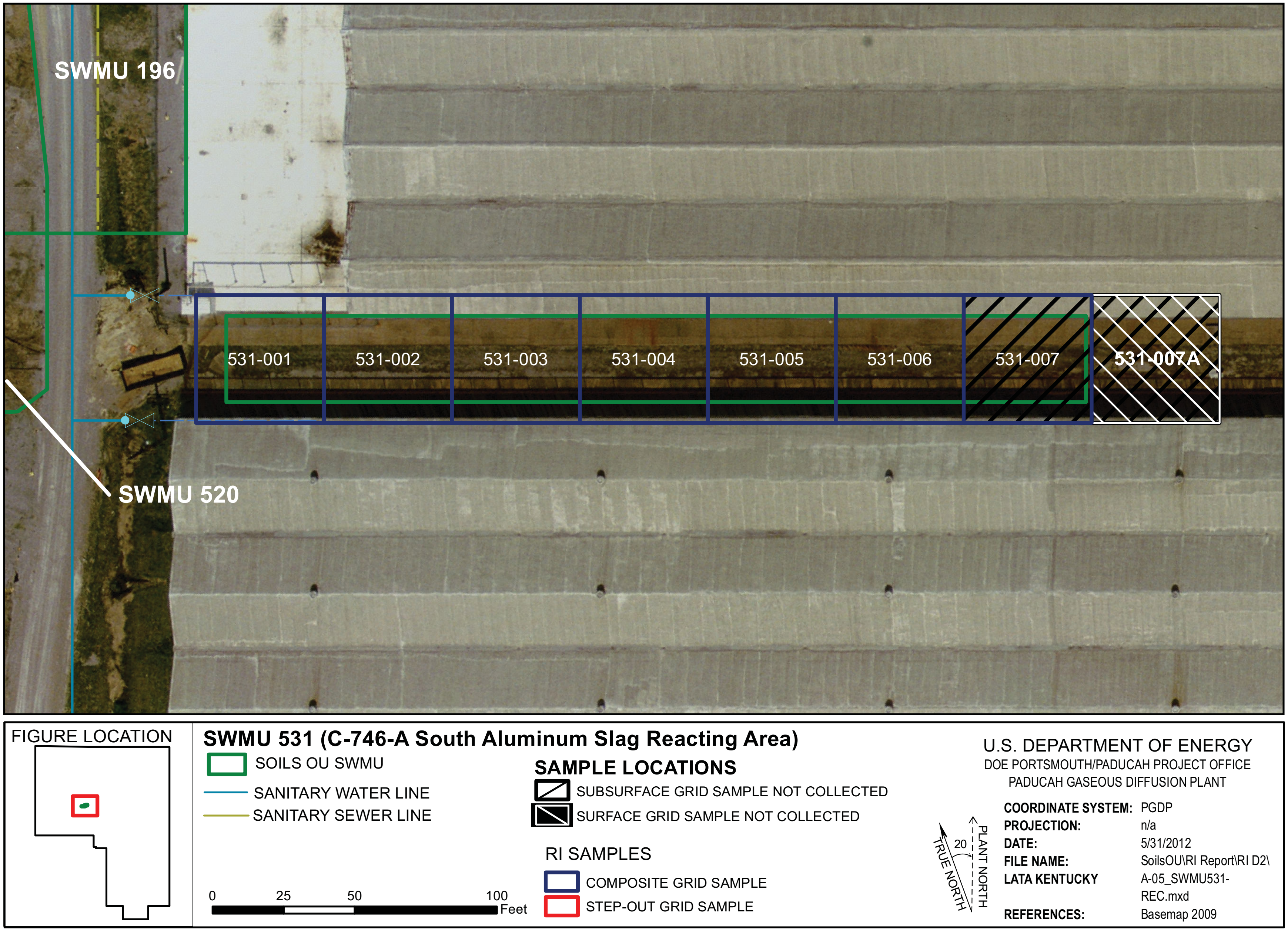


Figure A.4. SWMU 531 Sampling Rectification Map

Storage area

Table A.3 is a summary of the number of samples planned and the number of samples collected. Figures A.5–A.11 show the locations of samples not obtained.

Table A.3. Storage Area Samples Collected

SWMU/ AOC	Planned Grid Samples	Collected Grid Samples	Contingency/ Step-out Samples Anticipated	Contingency/ Step-out Samples Collected	Planned Pipeline Samples	Collected Pipeline Samples
200	28	26	66	34	0	0
212	4	4	18	2	6	6
213	1	1	22	18	0	0
214	1	1	0	0	0	0
215	1	1	17	17	0	0
216	1	1	0	0	0	0
217	36	36	42	20	10	10
221	1	1	70	28	5	2
222	1	1	35	29	0	0
227	54	52	58	2	0	0
228	10	10	10	10	0	0

SWMU 200 sampling was limited due to underground utilities, concrete, dense gravel/refusal, and inaccessibility. Collected were 26 out of 28 planned grid samples; grid 14 does not have samples for depths at 1 and 4 ft bgs. There were 34 out of 66 contingency/step-out samples collected; grids 7b, 7c, 9c, 9d, 9e, 9f, and 9g do not have samples for depths 1 and 4 ft bgs; grids 11b, 11c, 11d, 11e, and 11h do not have samples for depths 7 and 10 ft bgs; grids 11g and 11i do not have samples for depths 1, 4, 7, and 10 ft bgs. No pipeline samples were planned.

SWMU 212 sampling was limited due to utilities, proximity to a cylinder yard, and standing water. Collected were 4 out of 4 planned grid samples. There were 2 out of 18 contingency/step-out samples collected; grids 1a, 1c, 1d, 1e, 2a, 2b, 2c, and 2d do not have samples for depths 1 and 4 ft bgs. Of the planned pipeline samples, 6 out of 6 were collected.

SWMU 213 sampling was limited due to proximity to cylinder yard (dense gravel) and a ditch. Collected was 1 out of 1 planned grid sample. There were 18 out of 22 contingency/step-out samples collected; grids A1 and A2 do not have samples for depths 1 and 4 ft bgs. No pipeline samples were planned.

SWMU 214 had 1 out of 1 planned grid sample that was collected. Contingency/step-out samples were not needed and there were no planned pipeline samples.

SWMU 215 had 1 out of 1 planned grid sample collected. There were 17 out of 17 contingency/step-out samples collected. No pipeline samples were planned.

SWMU 216 had 1 out of 1 planned grid sample that was collected. Contingency/step-out samples were not needed and there were no planned pipeline samples.

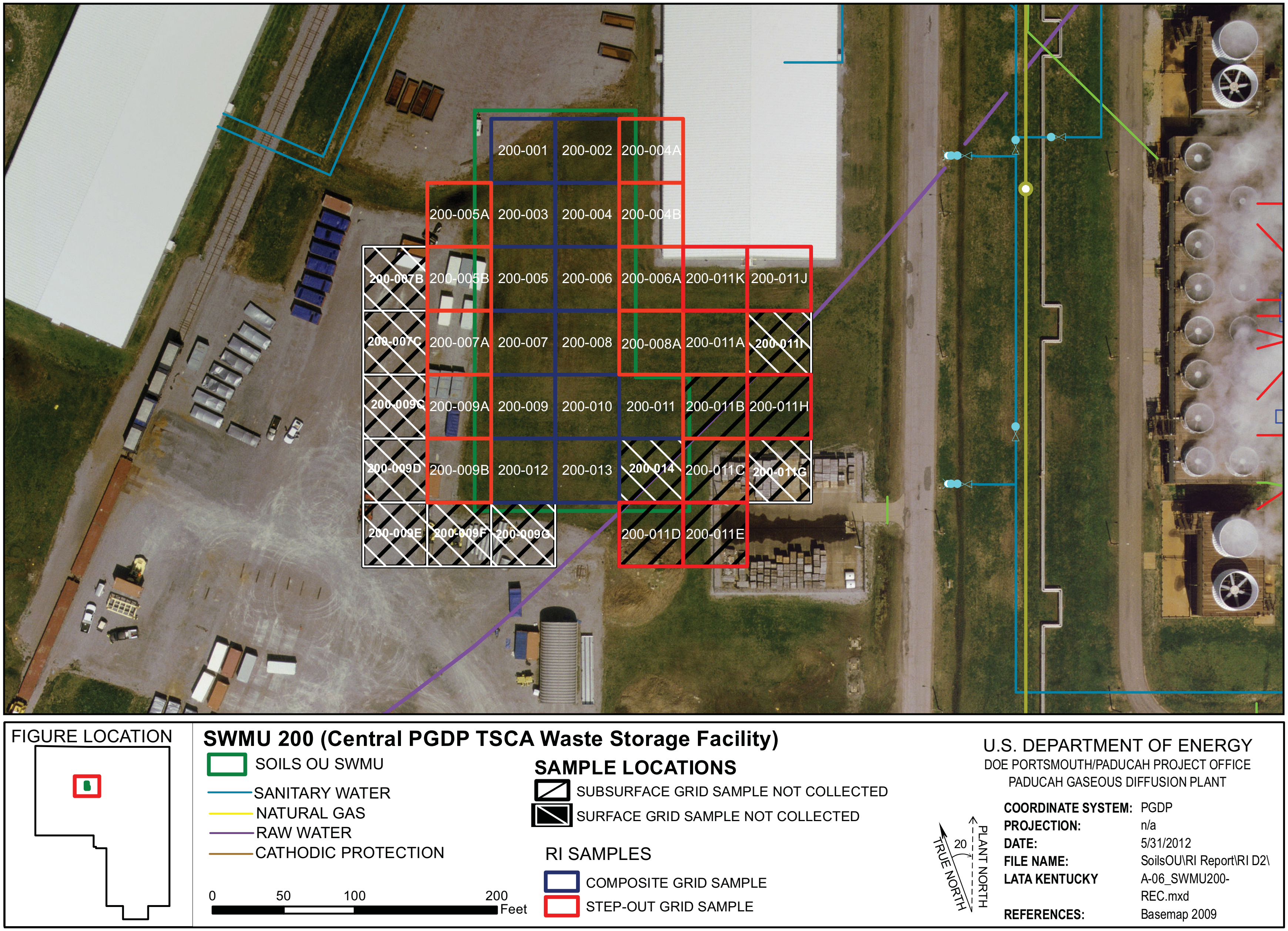


Figure A.5. SWMU 200 Sampling Rectification Map

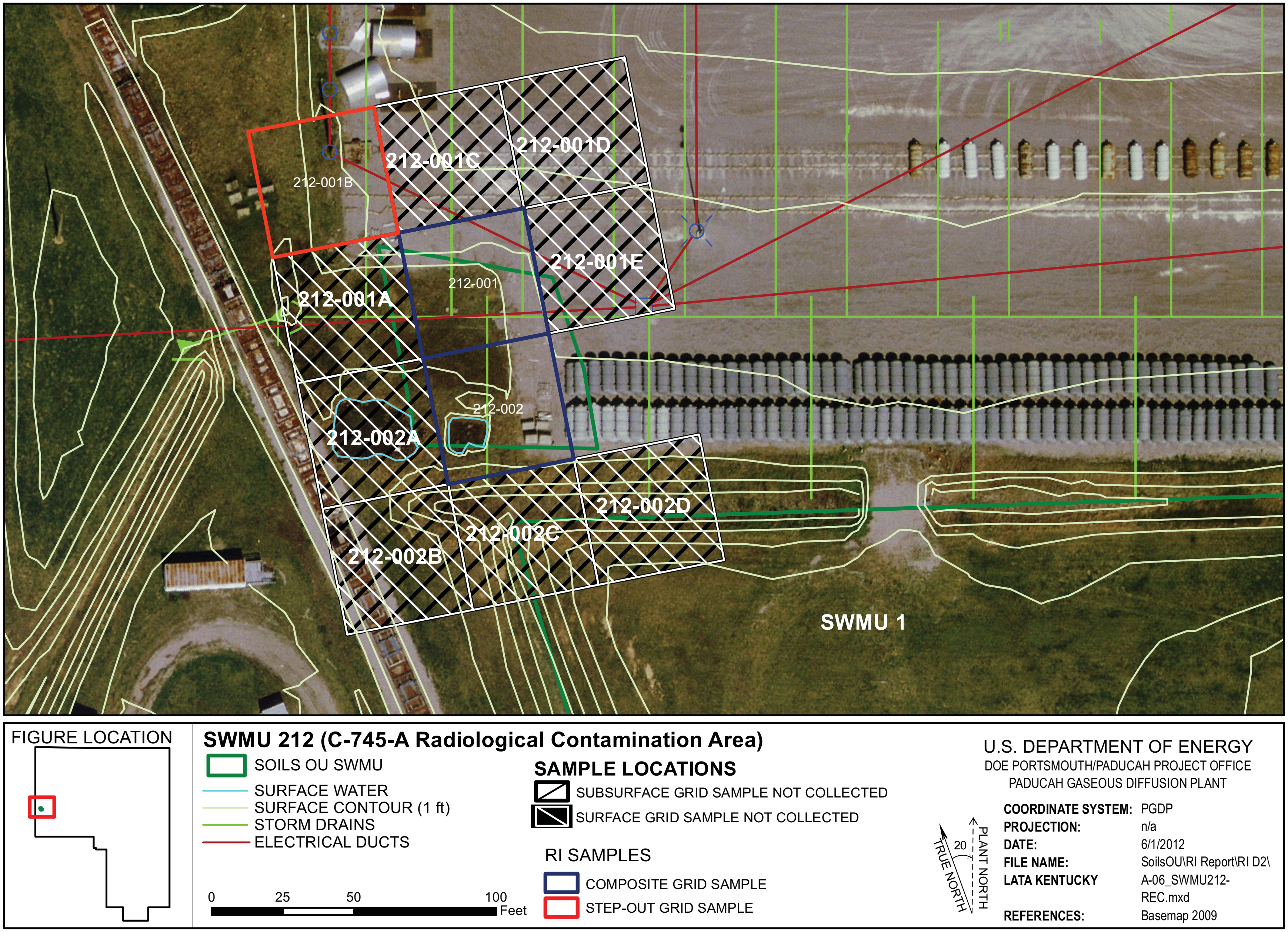


Figure A.6. SWMU 212 Sampling Rectification Map

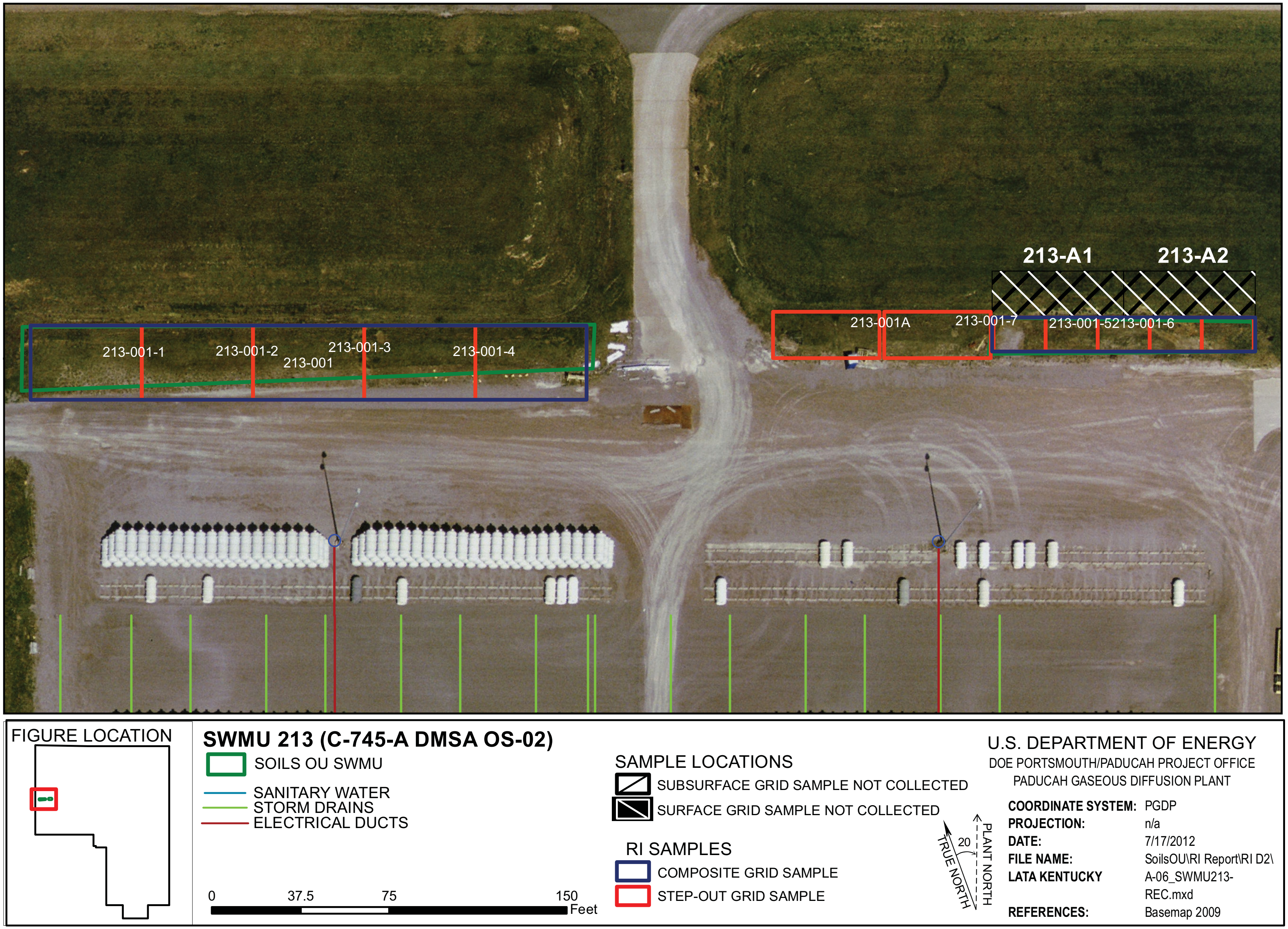


Figure A.7. SWMU 213 Sampling Rectification Map

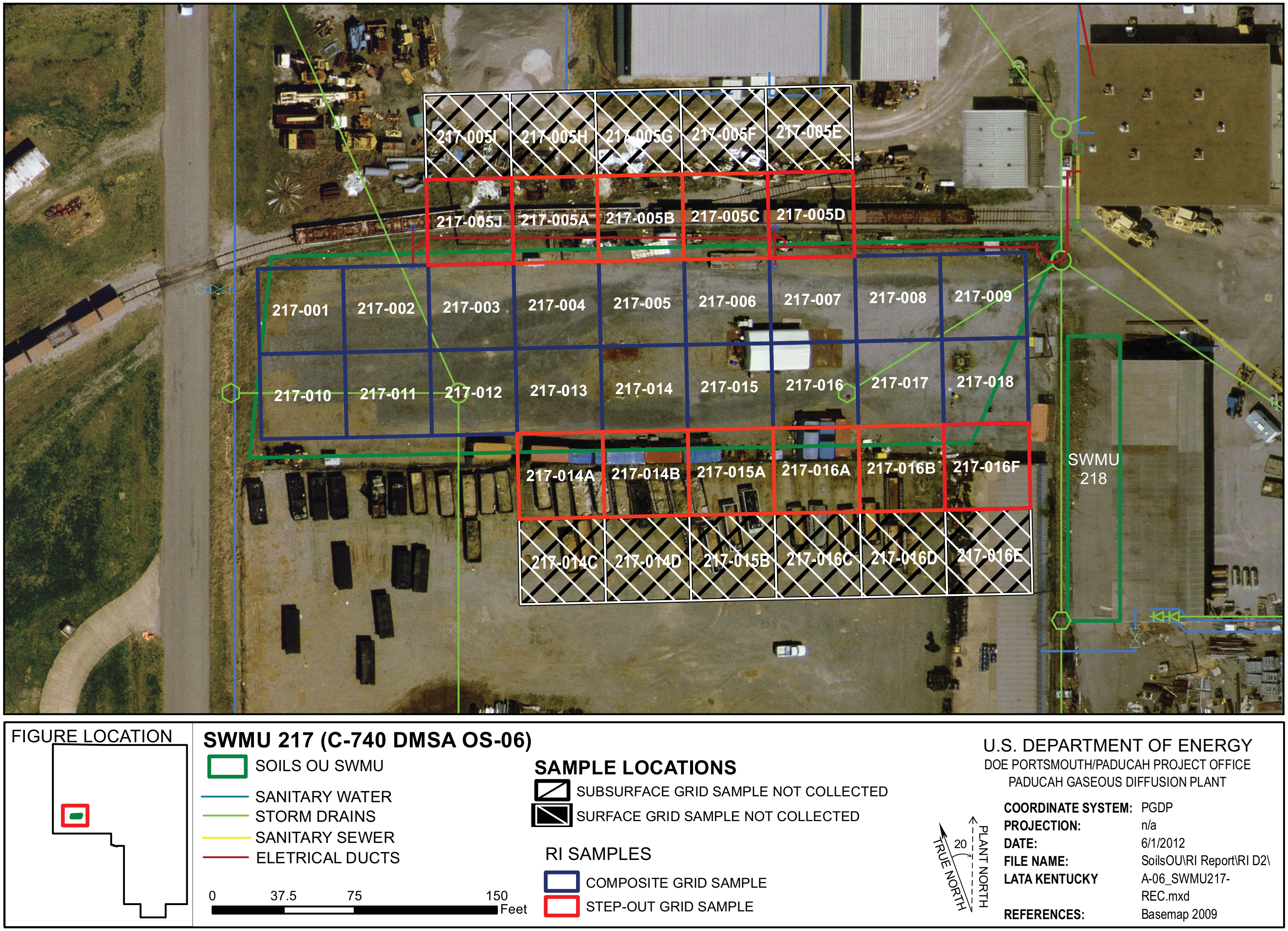


Figure A.8. SWMU 217 Sampling Rectification Map

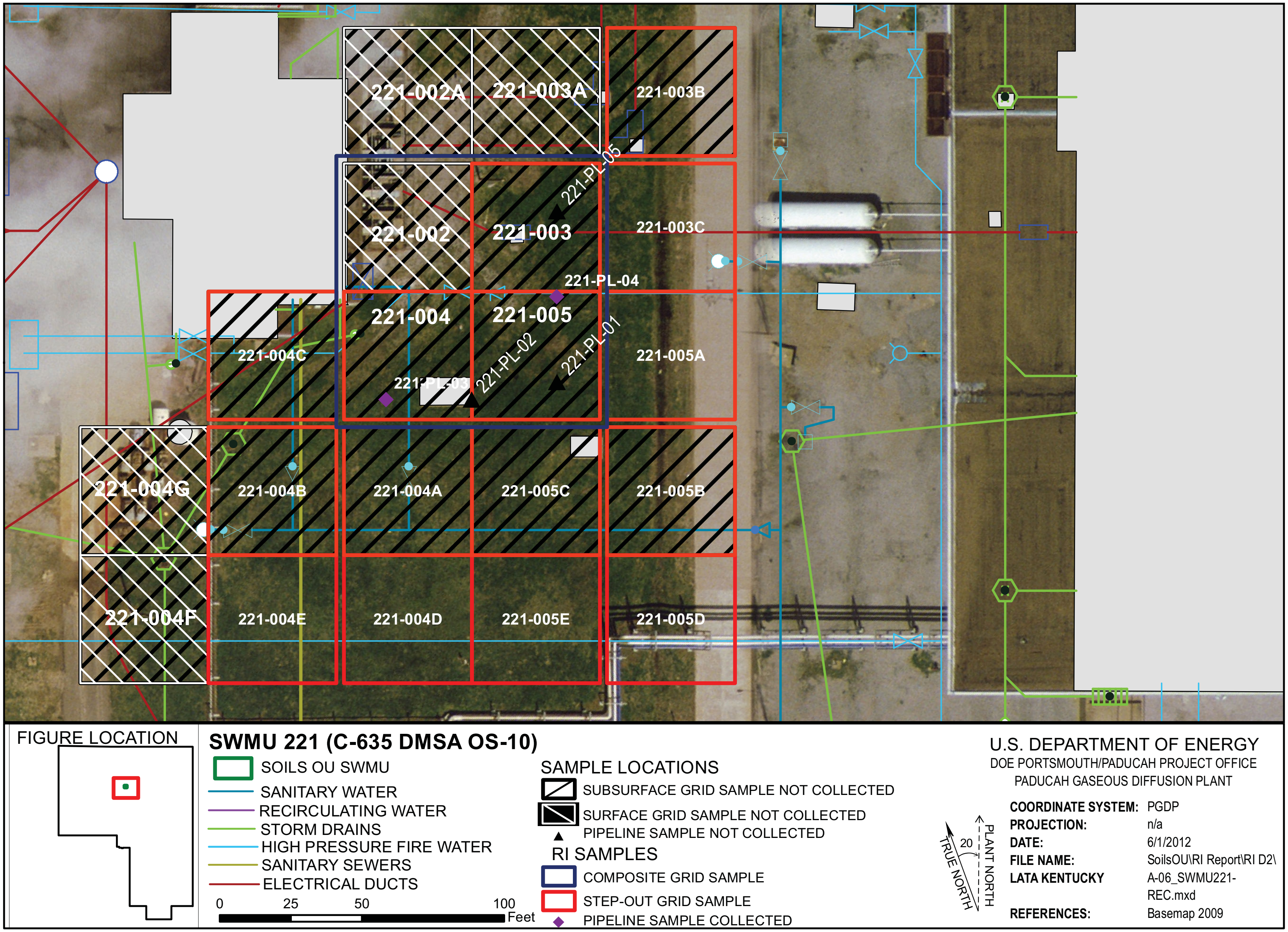


Figure A.9. SWMU 221 Sampling Rectification Map

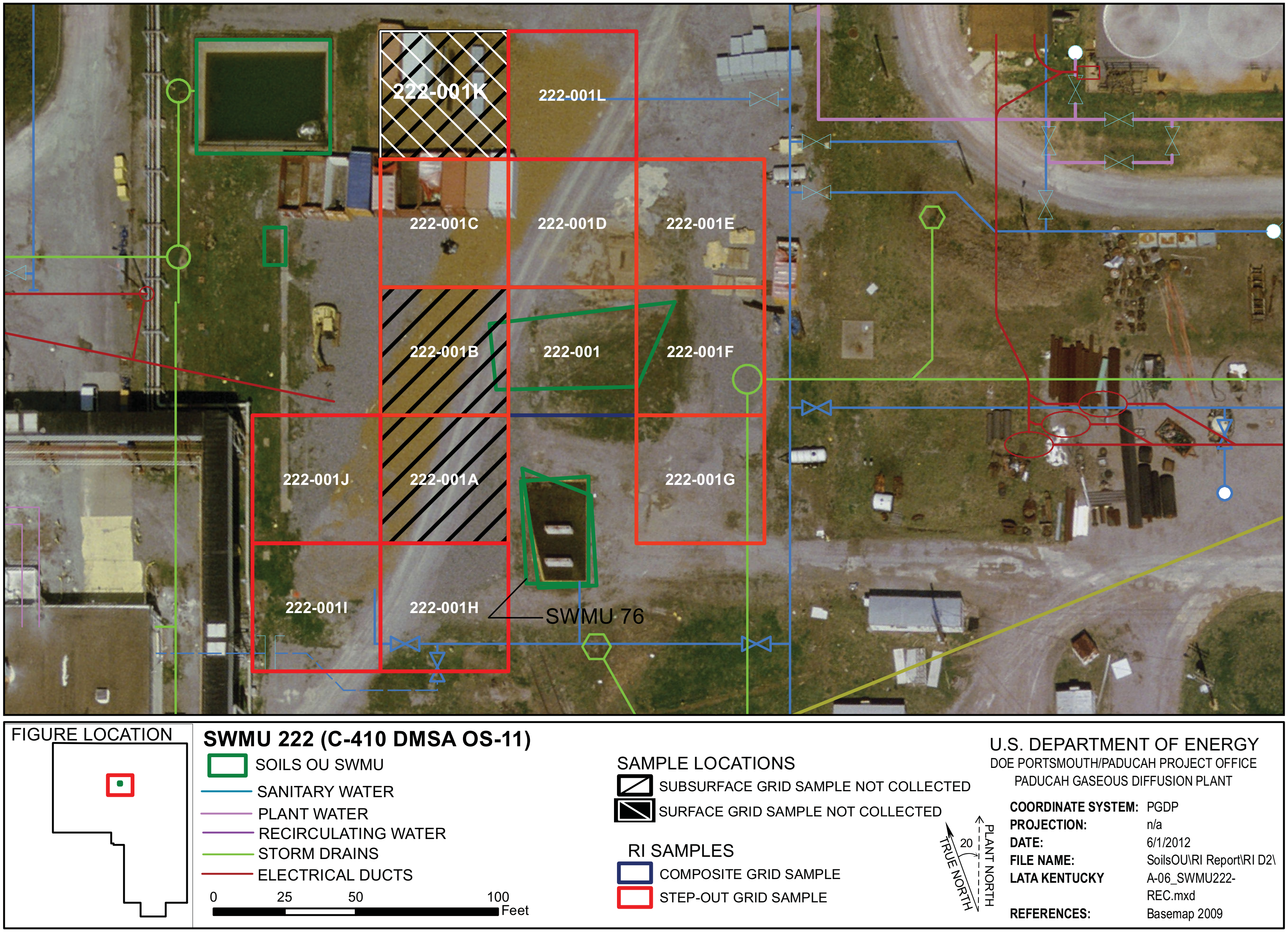


Figure A.10. SWMU 222 Sampling Rectification Map

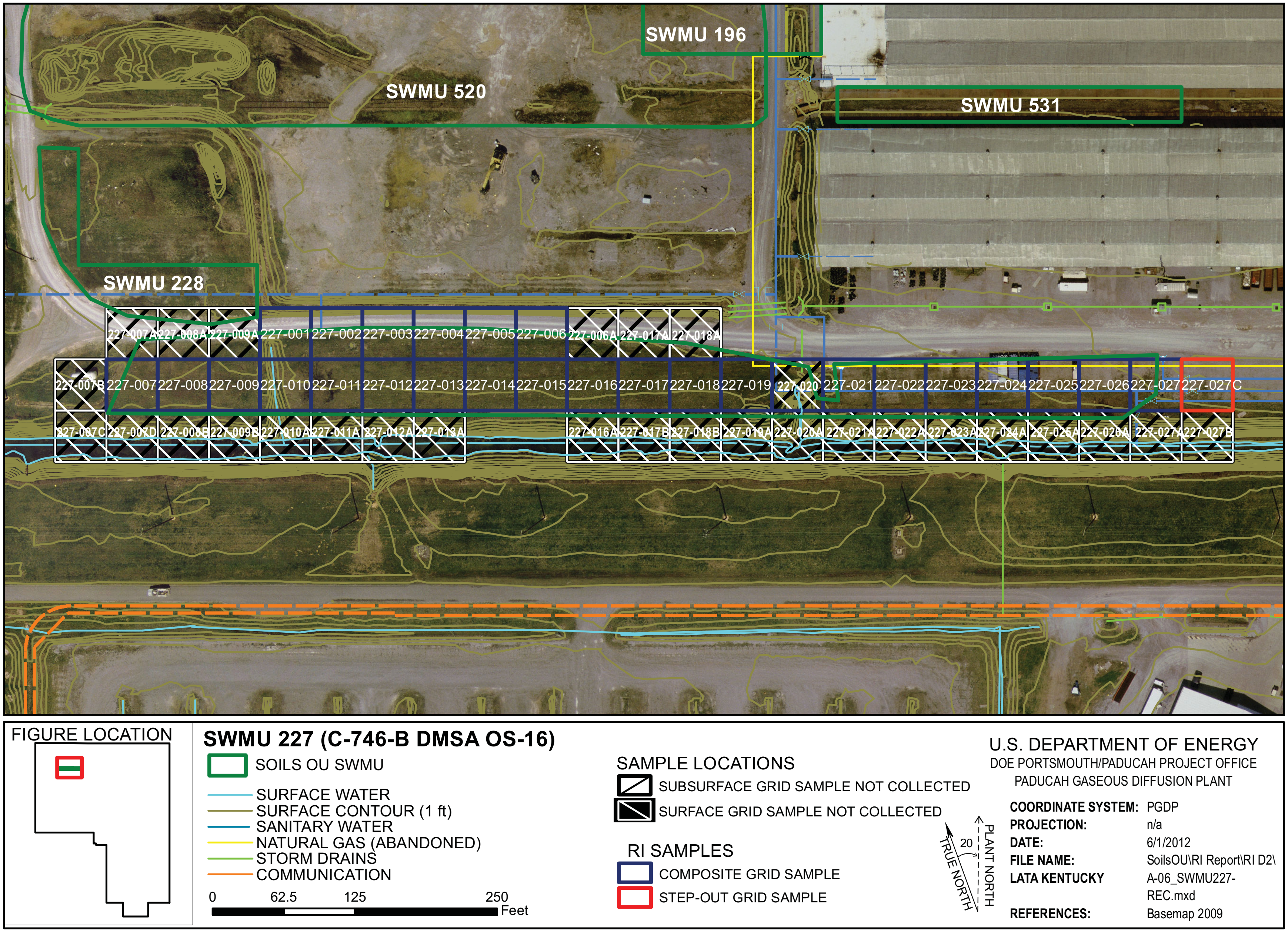


Figure A.11. SWMU 227 Sampling Rectification Map

SWMU 217 sampling was limited due to the samples not being accessible. Collected were 36 out of 36 planned grid samples. There were 20 out of 42 contingency/step-out samples collected; grids 5e, 5f, 5g, 5h, 5i, 14c, 14d, 15b, 16c, 16d, and 16e do not have samples for depths 1 and 4 ft bgs. Of the planned pipeline samples, 10 out of 10 were collected.

SWMU 221 sampling was limited due to utilities and no recovery. Collected was 1 out of 1 planned grid sample. There were 28 out of 70 contingency/step-out samples collected; grids 4f and 4g do not have samples for depths 1 and 4 ft bgs; grids 3, 3b, 4a, 4b, 4c, 5, 5b, and 5c do not have samples for depths 4, 7, and 10 ft bgs; grid 4 does not have a samples for depths 7 and 10 ft bgs; and grids 2, 2a, and 3a do not have samples for depths 1, 4, 7, and 10 ft bgs. Of the planned pipeline samples 2 out of 5 were collected.

SWMU 222 sampling was limited due to gravel and sample not being recoverable. Collected was 1 out of 1 planned grid sample. There were 29 of 35 contingency/step-out samples collected; grid 1k does not have samples for depths 1 and 4 ft bgs; grids 1a, and 1b do not have samples for depths 7 and 10 ft bgs. No pipeline samples were planned.

SWMU 227 sampling was limited due to steep banks of a ditch and a gravel road. Collected were 52 out of 54 planned grid samples; grid 20 does not have samples for depths 1 and 4 ft bgs. There were 2 out of 58 contingency/step-out samples collected; grids 6a, 7a, 7b, 7c, 7d, 8a, 8b, 9a, b, 10a, 11a, 12a, 13a, 16a, 17a, 17b, 18a, 18b, 19a, 20a, 21a, 22a, 23a, 24a, 25a, 26a, 27a, and 27b do not have samples for depths 1 and 4 ft bgs. No pipeline samples were planned.

SWMU 228 had 10 out of 10 planned grid samples and 10 out of 10 contingency/step-out (additional depth in planned grids only) samples that were collected. No pipeline samples were planned.

A.9.2.2 Group 2

Underground/tank

Table A.4 is a summary of the number of samples planned and the number of samples collected.

SWMU 76 had 2 out of 2 planned grid samples that were collected. Contingency/step-out samples were not needed and there were no planned pipeline samples.

Table A.4. Underground/Tank Samples Collected

SWMU/ AOC	Planned Grid Samples	Collected Grid Samples	Contingency/ Step-out Sample Expected	Contingency/ Step-out Samples Collected	Planned Pipeline Samples	Collected Pipeline Samples
76	2	2	0	0	0	0

Chromium areas

Table A.5 is a summary of the number of samples planned and the number of samples collected. Figures A.12–A.13 show the locations of the samples not obtained.

Table A.5. Chromium Samples Collected

SWMU/ AOC	Planned Grab Samples	Collected Grab Samples	Contingency/ Step-out Sample	Contingency/ Step-out Samples Collected	Planned Pipeline Samples	Collected Pipeline Samples
158	50	26	34	30	2	1
169	10	10	36	24	0	0

SWMU 158 sampling was limited due to roadways, grounding mat for the building, and utilities. Collected were 26 out of 50 planned grab samples; grids 1, 2, 3, 4, 12, 16, 17, 18, 21, 22, 24, and 25 do not have samples for depths 1 and 4 ft bgs. There were 30 out of 34 contingency/step-out samples collected; grids 14d and 20c do not have samples for depths 1 and 4 ft bgs. Of the planned pipeline samples, 1 out of 2 was collected.

SWMU 169 sampling was limited due to utilities. Collected were 10 out of 10 planned grab samples. There were 24 out of 36 contingency/step-out samples collected; grids 3c, 3d, 4a, and 4b do not have samples for depths 1 and 4 ft bgs; grid 5d does not have samples for depths 1, 4, 7, and 10 ft bgs. No pipeline samples were planned.

Soil/rubble pile

Table A.6 is a summary of the number of samples planned and the number of samples collected. Figures A.14–A.16 show the locations of the samples not obtained.

Table A.6. Soil/Rubble Pile Samples Collected

SWMU/ AOC	Planned Grid Samples	Collected Grid Samples	Contingency/ Step-out Sample Expected	Contingency/ Step-out Samples Collected	Planned Pipeline Samples	Collected Pipeline Samples
138	48	48	91	84	1	1
180	92	92	74	32	0	0
195	418	418	52	49	0	0
493	4	4	0	0	0	0
517	2	2	0	0	0	0

SWMU 138 sampling was limited due to underground utilities. Collected were 48 out of 48 planned grid samples. There were 84 out of 91 contingencies collected; grids 16a, 24c, and 24b do not have samples for depths 1 and 4 ft bgs; grid 21 does not have a sample for depth 10 ft bgs. Of the planned pipeline samples, 1 out of 1 was collected.

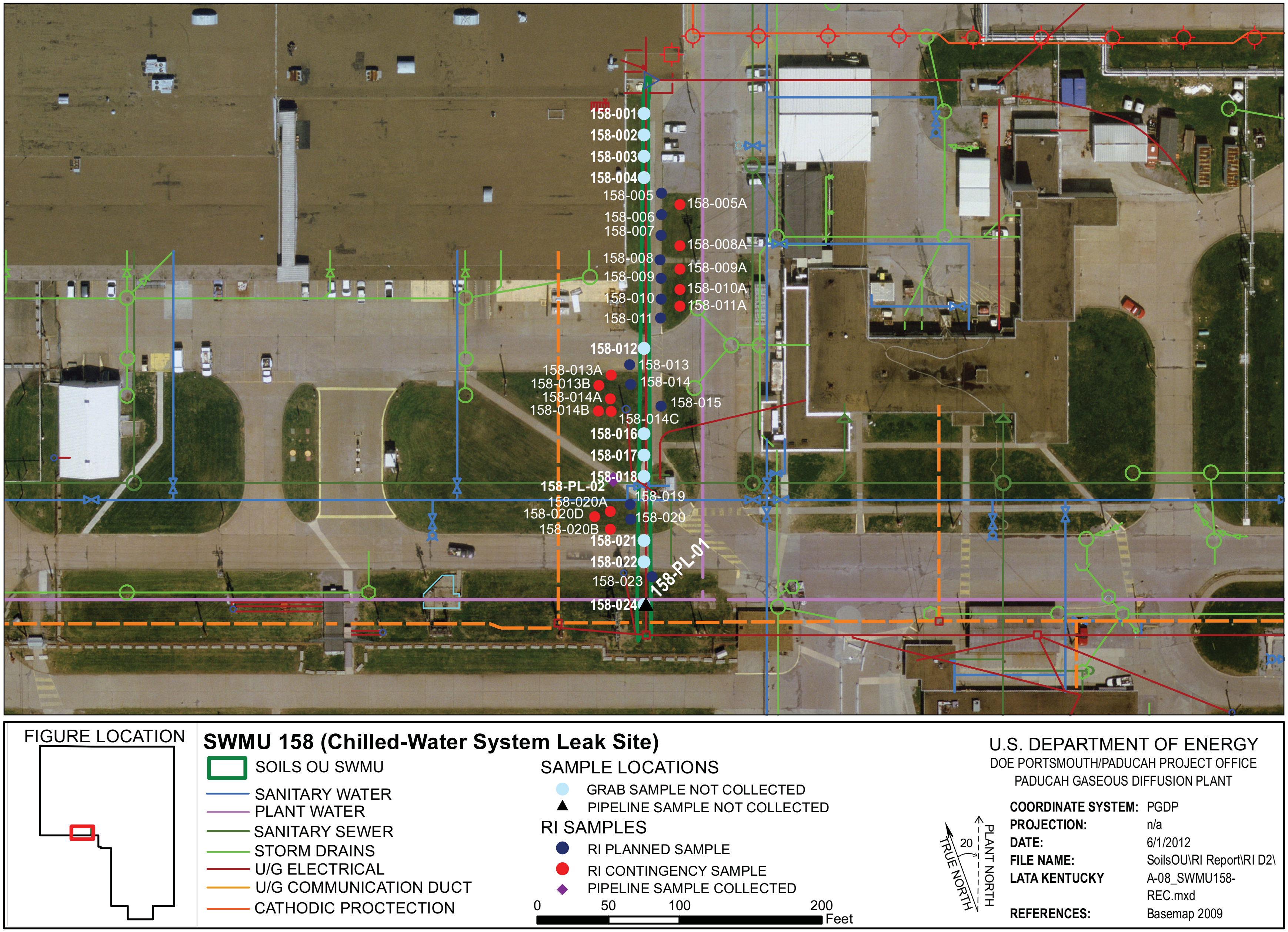


Figure A.12. SWMU 158 Sampling Rectification Map

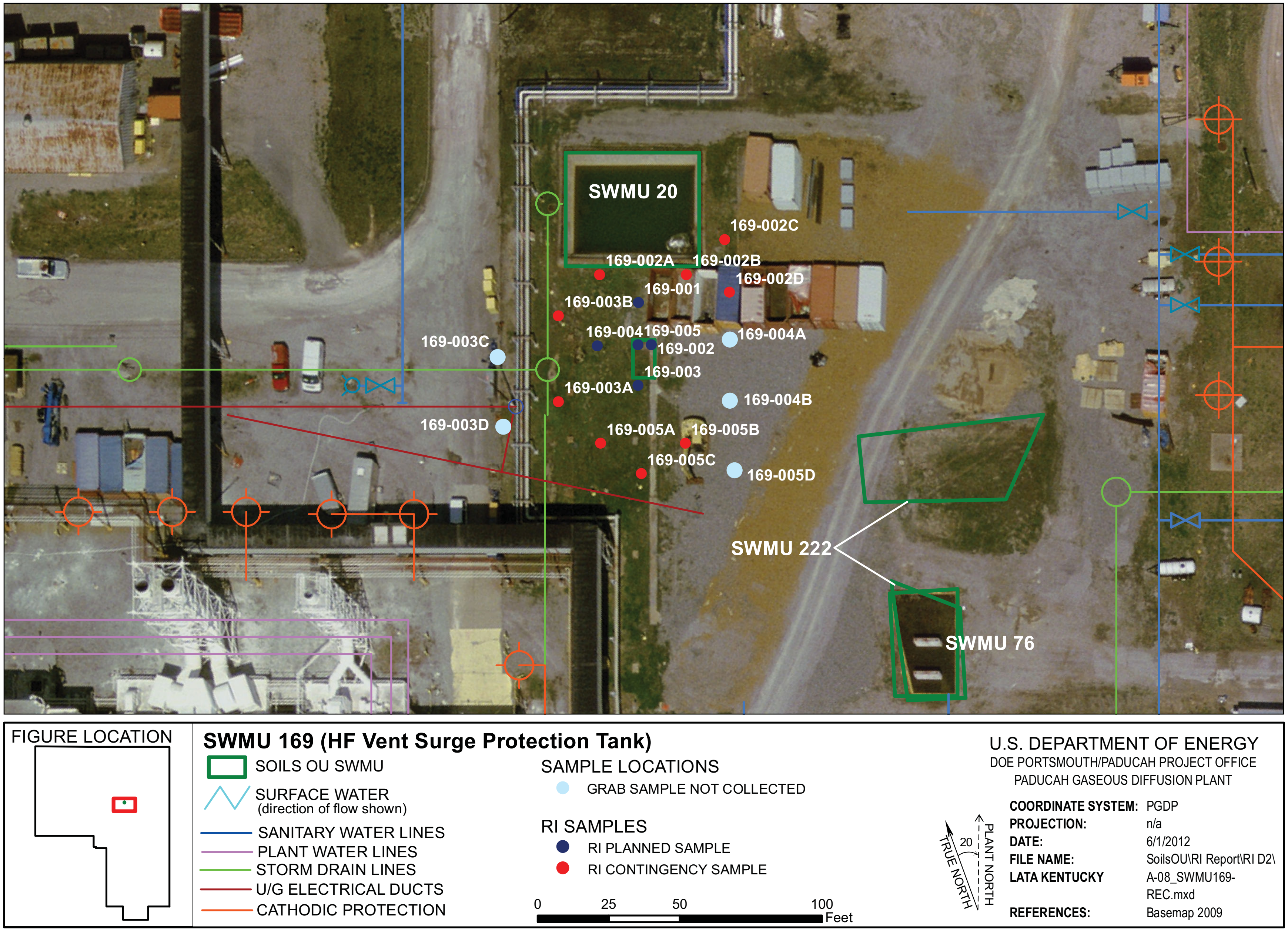


Figure A.13. SWMU 169 Sampling Rectification Map

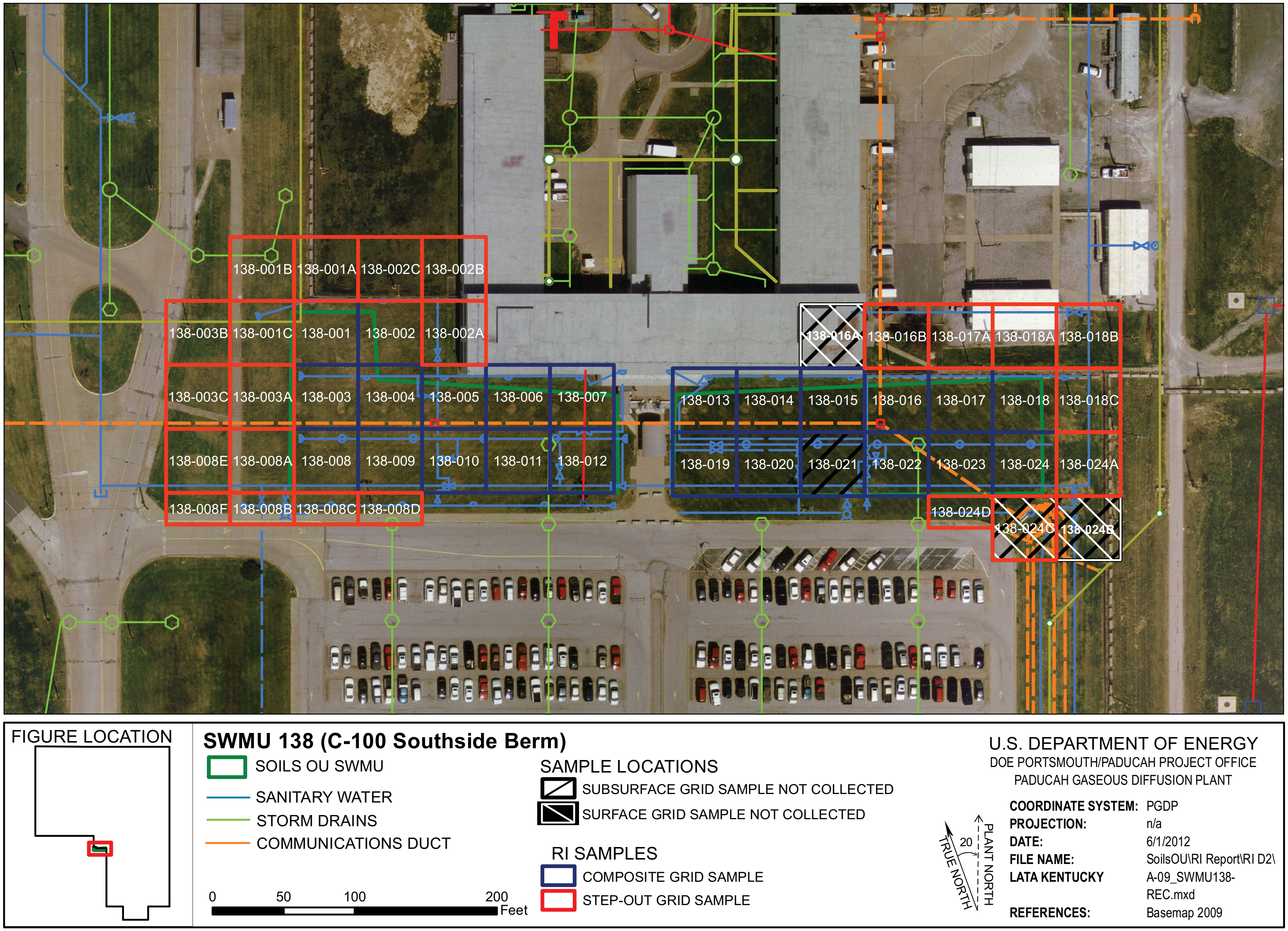


Figure A.14. SWMU 138 Sampling Rectification Map

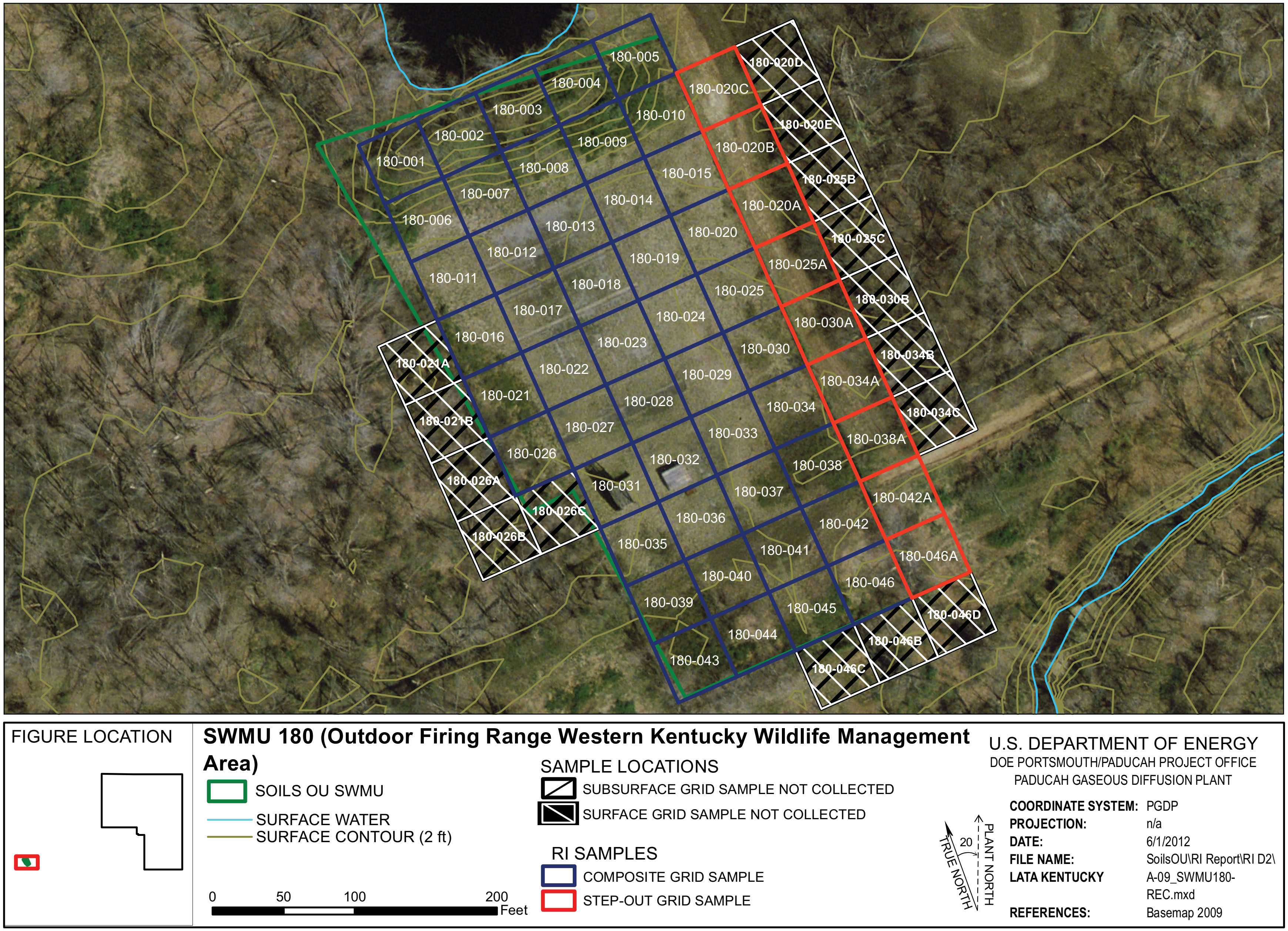


Figure A.15. SWMU 180 Sampling Rectification Map

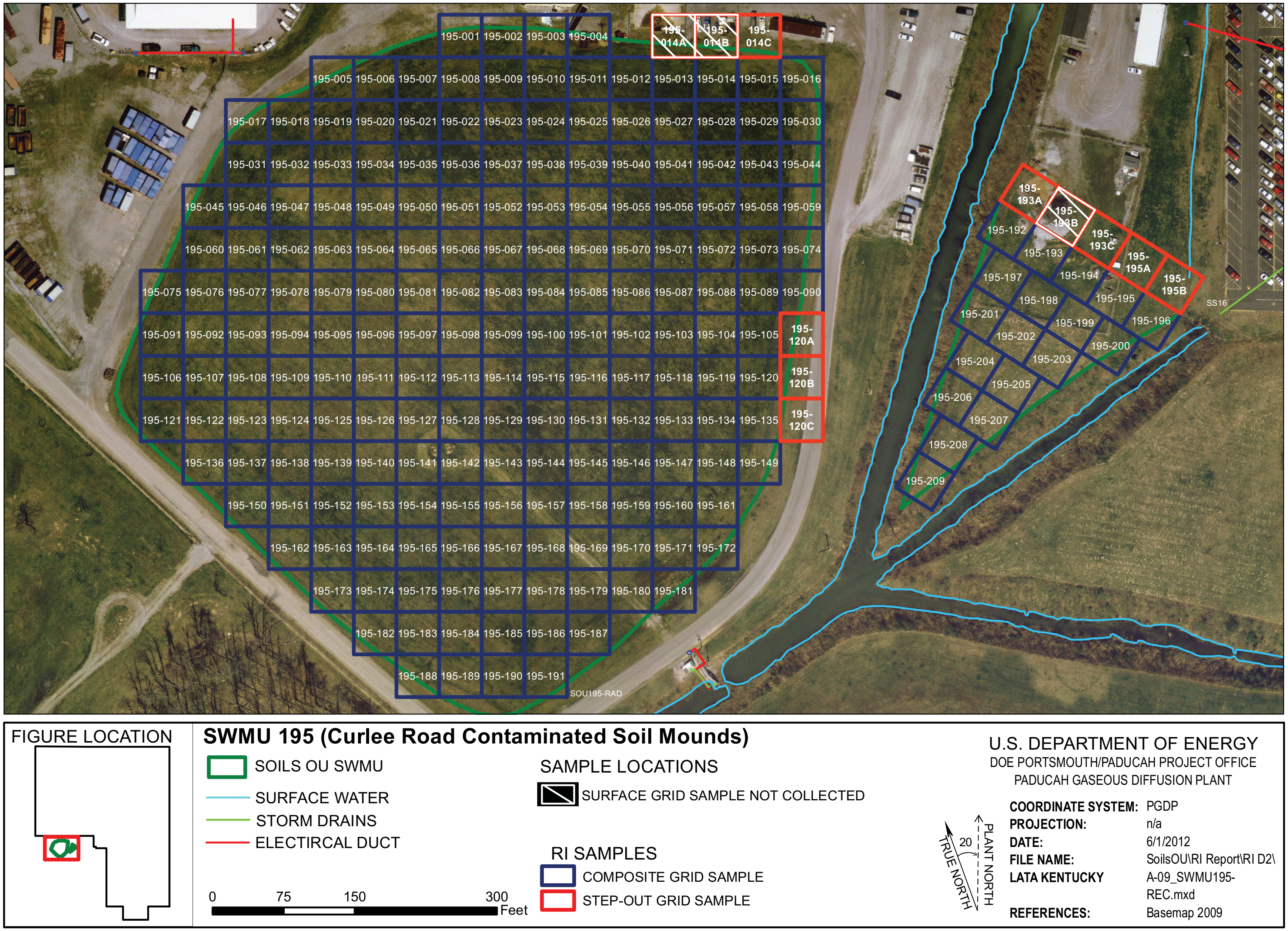


Figure A.16. SWMU 195 Sampling Rectification Map

SWMU 180 sampling was limited due to the wooded wildlife area and standing water surrounding the SWMU. Collected were 92 out of 92 planned samples. There were 32 out of 74 contingency/step-out samples collected; grids 16a, 24b, 24c, 20d, 20e, 21a, 21b, 26a, 26b, 26c, 34b, 34c, 46b, 46c, and 46d do not have samples for depths 1 and 4 ft bgs; grids 25b, 25c, and 30b do not have samples for depths 1, 4, 7, and 10 ft bgs. No pipeline samples were planned.

SWMU 195 sampling was limited due to concrete rubble. Collected were 418 out of 418 planned samples. There were 49 out of 52 contingency/step-out samples collected; grids 14a, 14b, and 193b do not have samples for depth 1 ft bgs. No pipeline samples were planned.

SWMU 493 had 4 out of 4 planned grid samples that were collected. Contingency/step-out samples were not needed and there were no planned pipeline samples.

SWMU 517 had 2 out of 2 planned grid samples that were collected. Contingency/step-out samples were not needed and there were no planned pipeline samples.

A.9.2.3 Group 3

Scrap yard

Table A.7 is a summary of the number of samples planned and the number of samples collected. Figures A.17–A.18 show the locations of the samples not obtained.

Table A.7. Scrap Yard Samples Collected

SWMU/ AOC	Planned Grid Samples	Collected Grid Samples	Contingency/ Step-out Sample Expected	Contingency/ Step-out Samples Collected	Planned Pipeline Samples	Collected Pipeline Samples
14	242	239	32	31	0	0
520	140	120	6	6	0	0

SWMU 14 sampling was limited due to refusal and sample not recoverable. Collected were 239 of 242 planned grid samples; grid 52 does not have samples for depths 1 and 4 ft bgs; and grid 119 does not have a sample for depth 1 ft bgs. There were 31 of 32 contingency/step-out samples collected; grid 111 does not have a sample for depth 10 ft bgs. No pipeline samples were planned.

SWMU 520 sampling was limited due to utilities, standing water in ditch, and a rubble pile. Collected were 120 of 140 planned grid samples; grids 28, 38, 39, 40, 41, 43, 44, 45, 46, and 60 do not have samples for depths 1 and 4 ft bgs. There were 6 out of 6 contingency/step-out samples collected. No pipeline samples were planned.

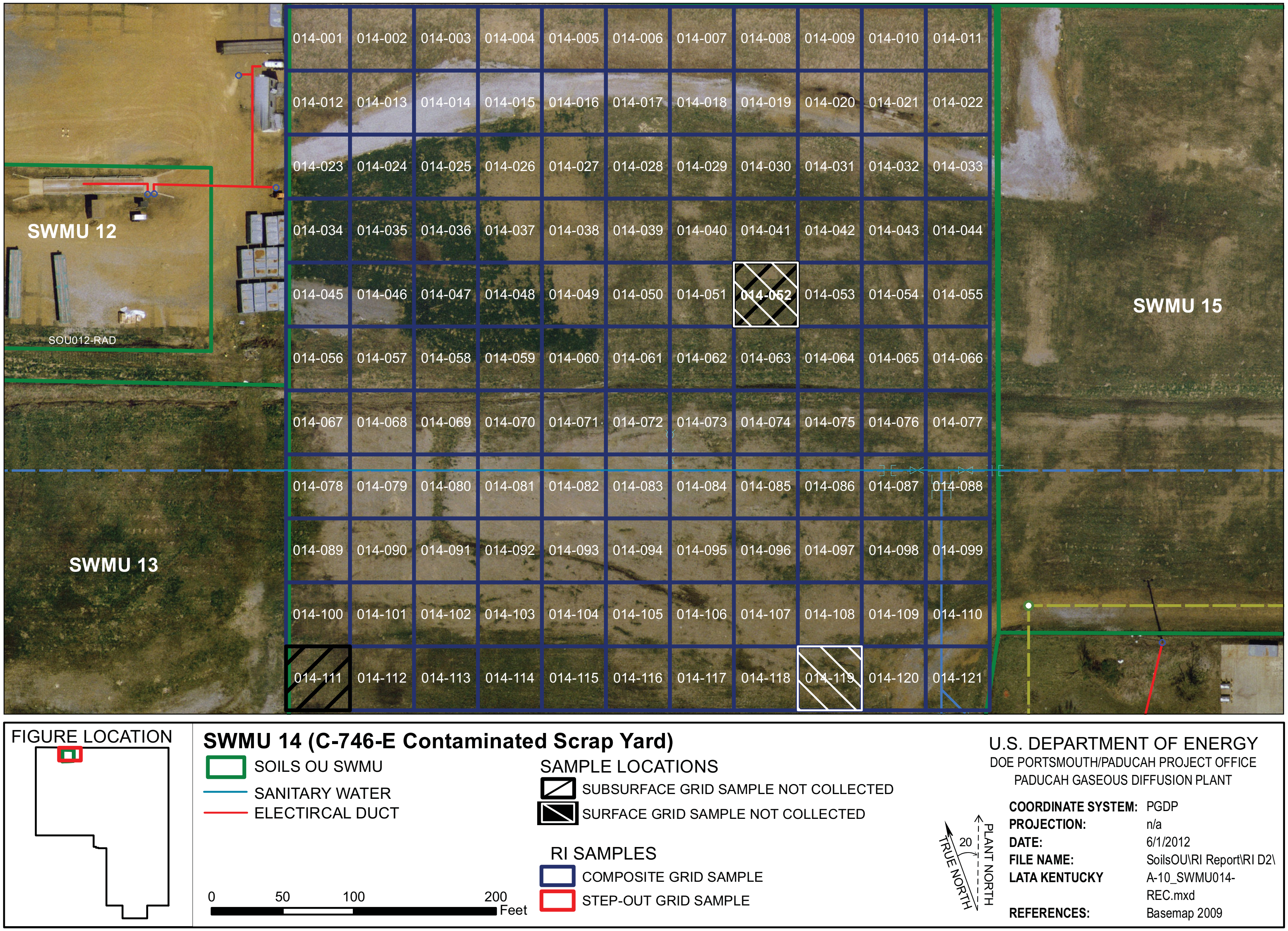


Figure A.17. SWMU 15 Sampling Rectification Map

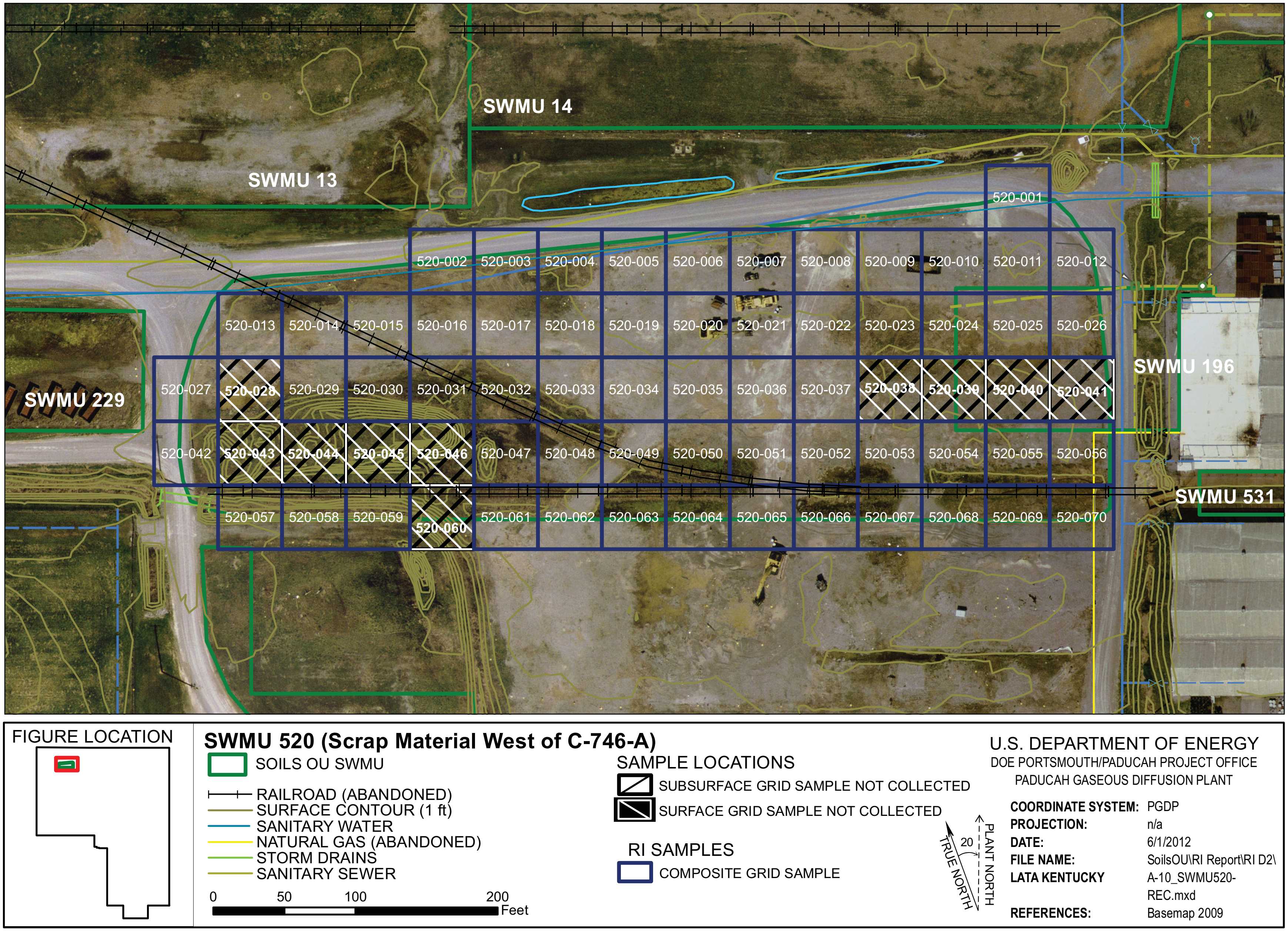


Figure A.18. SWMU 520 Sampling Rectification Map

PCBs

Table A.8 is a summary of the number of samples planned and the number of samples collected. Figures A.19–A.22 show the locations of the samples not obtained.

Table A.8. PCBs Samples Collected

SWMU/ AOC	Planned Grid Samples	Collected Grid Samples	Contingency/ Step-out Samples Expected	Contingency/ Step-out Sample Collected	Planned Pipeline Samples	Collected Pipeline Samples
81	16	14	46	34	0	0
153	20	11	14	0	2	2
156	20	16	0	0	6	3
160	4	4	0	0	0	0
163	4	2	27	24	0	0
219	2	2	0	0	0	0
488	2	2	0	0	1	1

SWMU 81 sampling was limited due to a building, road, and concrete. Collected were 14 of 16 planned grid samples; grid 8 does not have samples for depth 1 and 4 ft bgs. There were 34 out of 46 contingency/step-out samples were collected; grids 5d, 6a–b, and 6e do not have samples for depths 1 and 4 ft bgs; grid 1i does not have samples for depths 1, 4, 7, and 10 ft bgs. No pipeline samples were planned.

SWMU 153 sampling was limited due to the surface being a dense chip seal and asphalt with a gravel base. Surface soil samples were not recoverable except at one location. Collected were 11 of 20 planned grid samples; grids 2–10 do not have samples for depth 1 ft bgs. There were 0 out of 14 contingency/step-out samples collected; grid 3 does not have samples for depths 7 and 10 ft bgs; grids 3a–c do not have samples for depths 1, 4, 7, and 10 ft bgs. Of the planned pipeline samples, 2 of 2 were collected.

SWMU 156 sampling was limited due to dense utilities. Collected were 16 of 20 planned grid samples; grids 9 and 10 do not have samples for depths 1 and 4 ft bgs. Of the planned pipeline samples, 3 of 6 were collected. Contingency/step-out samples were not needed.

SWMU 160 had 4 out of 4 planned grid samples that were collected. Contingency/step-out samples were not needed and there were no planned pipeline samples.

SWMU 163 had additional information located in regard to the geothermal system during penetration permitting. Sampling was limited due to the depth of the system and probe refusal. As a result of the information, planned grids were sampled only from 0–1 ft; therefore, collected were 2 out of 4 planned grid samples. Also, based on the information, 27 contingency/step-out grab samples were planned around the perimeter of the system at a depth of 4–7 ft (the approximate depth of the system). There were 24 out of 27 contingency/step-out samples collected. No pipeline samples were planned.

SWMU 219 had 2 out of 2 planned grid samples that were collected. Contingency/step-out samples were not needed so there were no planned pipeline samples.

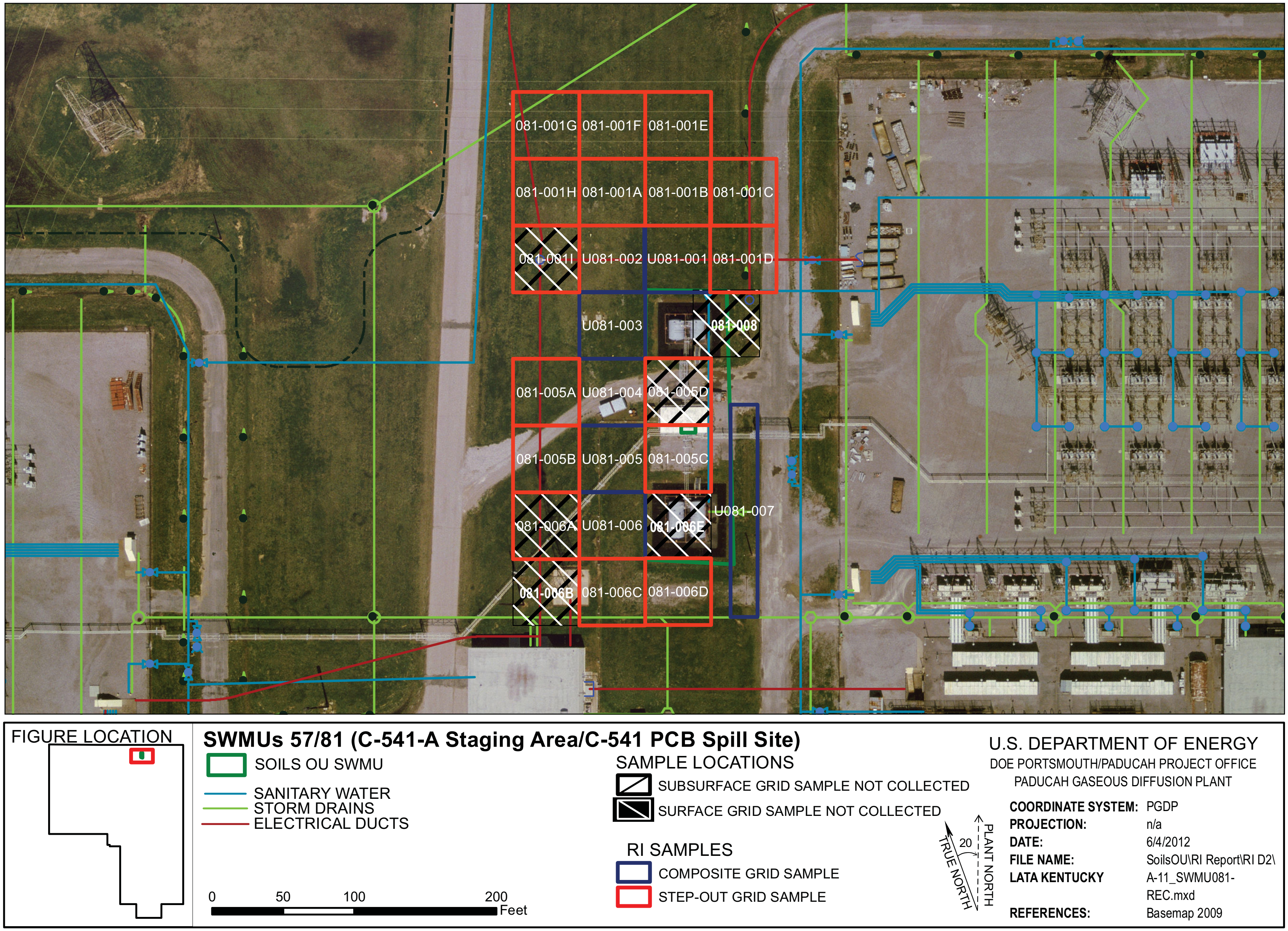


Figure A.19. SWMU 81 Sampling Rectification Map

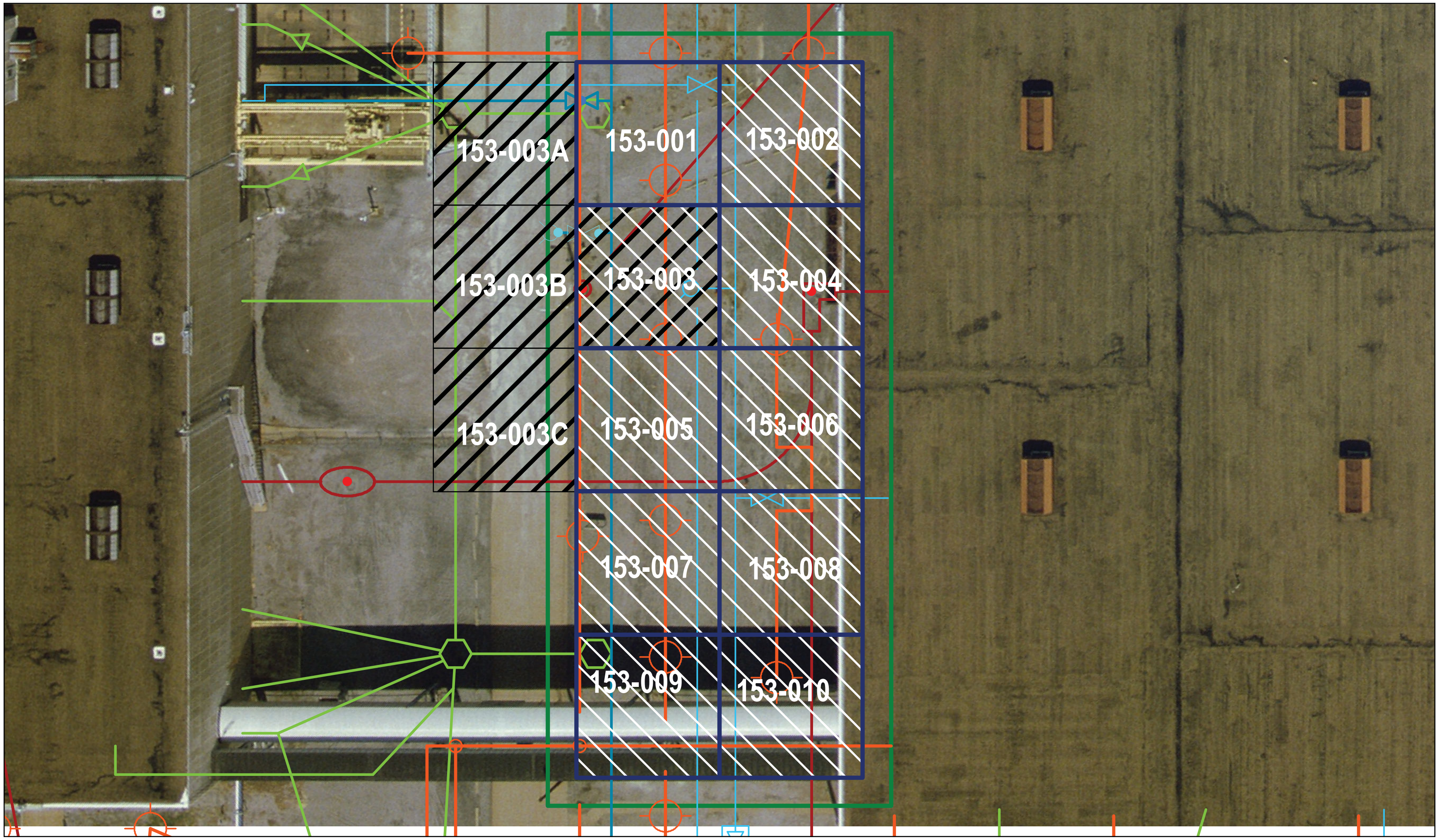
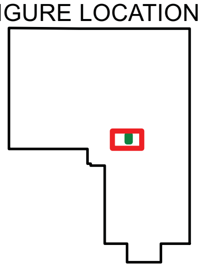


FIGURE LOCATION



SWMU 153 (C-331 PCB Soil Contamination-West)

SOILS OU SWMU

SANITARY WATER
HIGH PRESSURE FIRE WATER
STORM DRAINS
SANITARY SEWER
ELECTRICAL DUCTS
CATHODIC PROTECTION

0 25 50 100 Feet

SAMPLE LOCATIONS

SUBSURFACE GRID SAMPLE NOT COLLECTED
SURFACE GRID SAMPLE NOT COLLECTED

RI SAMPLES

COMPOSITE GRID SAMPLE
STEP-OUT GRID SAMPLE

TRUE NORTH 20 PLANT NORTH

U.S. DEPARTMENT OF ENERGY
DOE PORTSMOUTH/PADUCAH PROJECT OFFICE
PADUCAH GASEOUS DIFFUSION PLANT

COORDINATE SYSTEM:	PGDP
PROJECTION:	n/a
DATE:	6/4/2012
FILE NAME:	SoilsOU\RI Report\RI D2\
LATA KENTUCKY	A-11_SWMU153-REC.mxd
REFERENCES:	Basemap 2009

Figure A.20. SWMU 153 Sampling Rectification Map

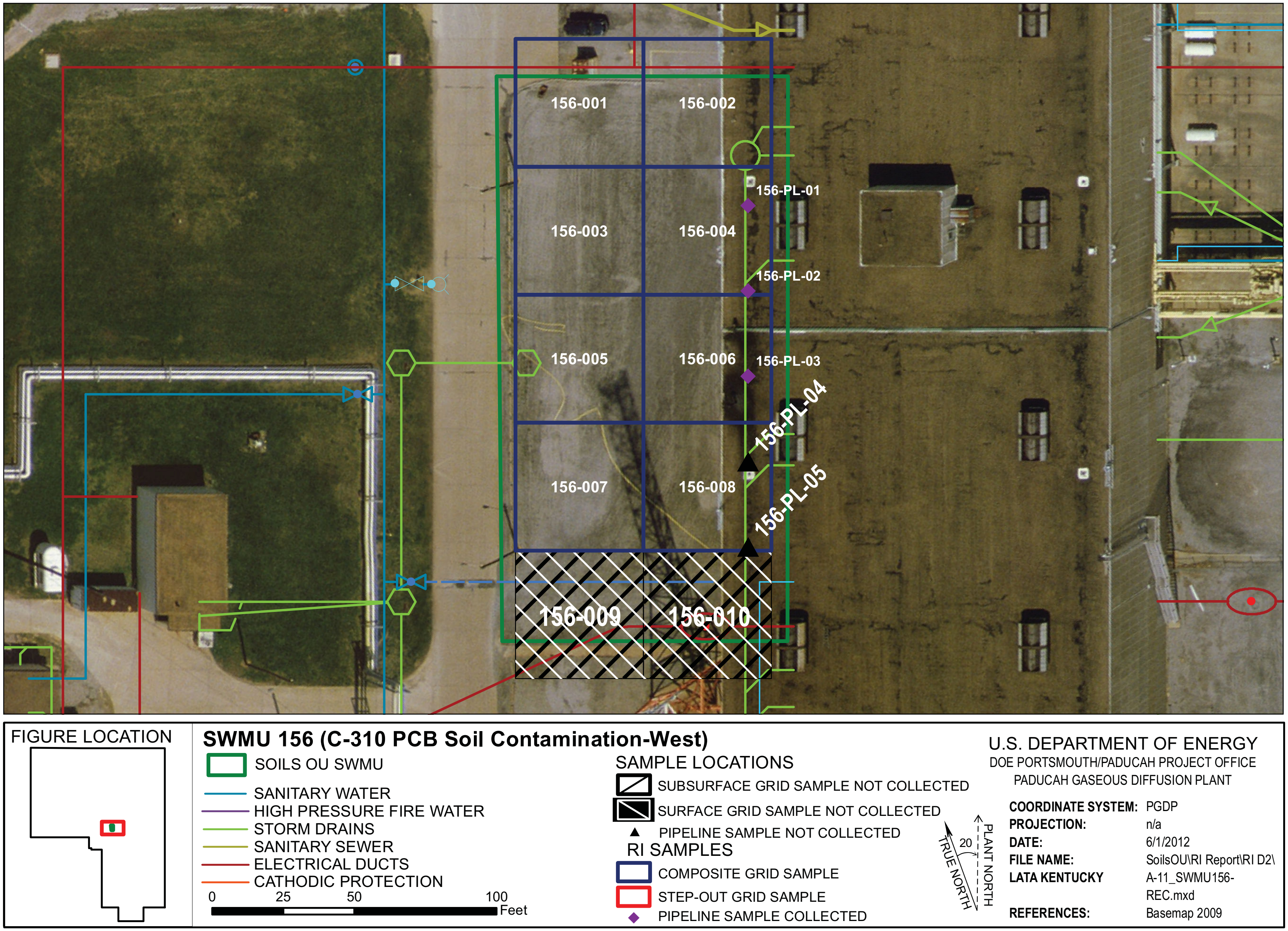


Figure A.21. SWMU 156 Sampling Rectification Map

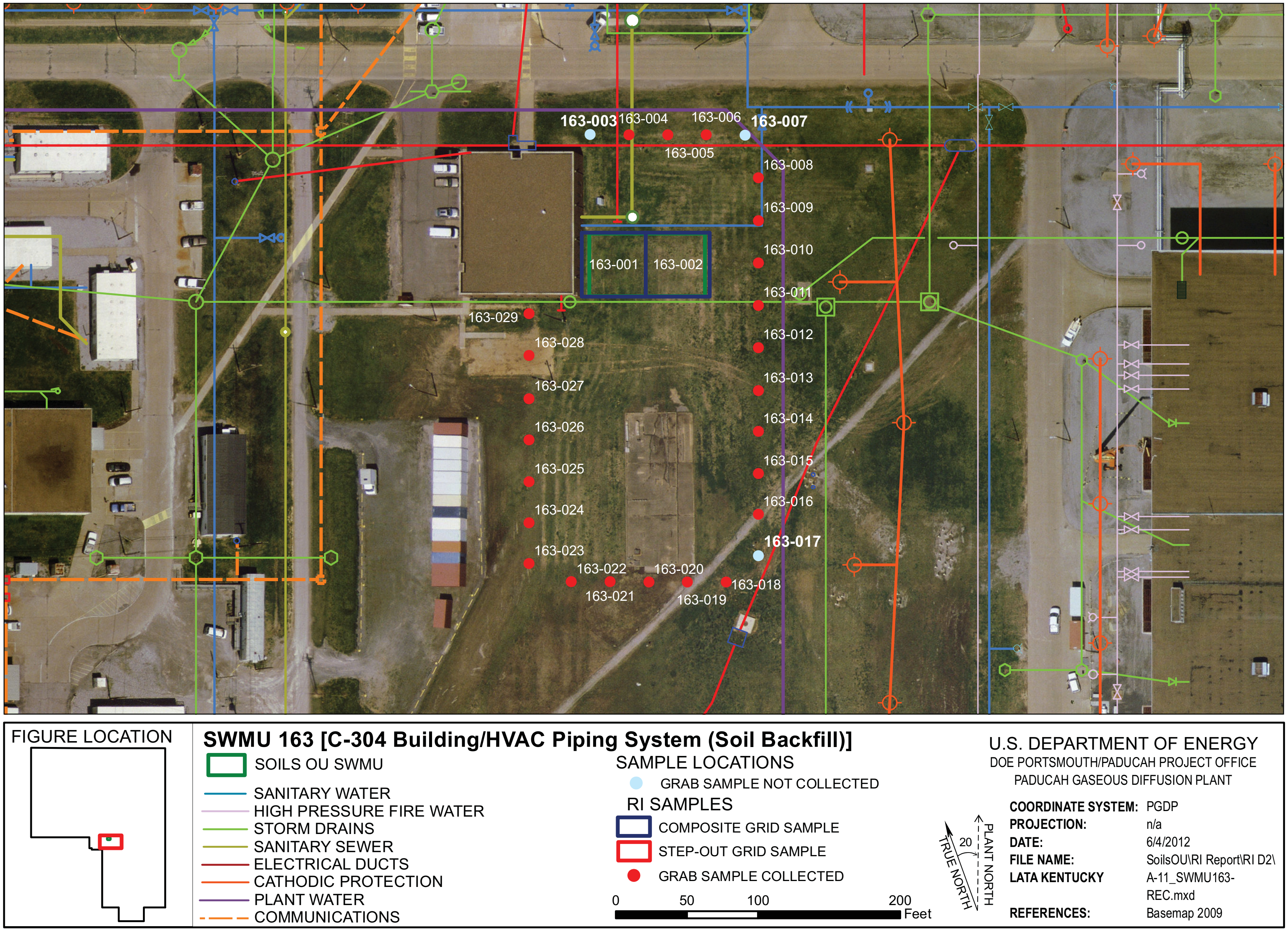


Figure A.22. SWMU 163 Sampling Rectification Map

SWMU 488 had 2 out of 2 planned grid samples and 1 out of 1 planned pipeline sample that were collected. Contingency/step-out samples were not needed.

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APPENDIX B

DATA QUALITY ANALYSIS

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Numerous investigations have been conducted over the past 20 years that have provided soil data that may be considered in drawing conclusions for the Soils Operable Unit (OU). The most recent sampling and analysis strategy was implemented according to the agreed upon protocols to support characterization and risk-based decisions at the OU. These data were collected to supplement the historical information, providing a robust data set representative of the soils at these sites.

The goals, as stated in the work plan (DOE 2010), include providing data for characterization of source zones, defining extent of contamination in soil, risk characterization, and evaluation of remedial alternatives. This section provides a review of the overall data set to determine potential data quality issues that limit the uses of some of these data to support decisions at these sites.

The data to support the Remedial Investigation (RI) includes historical data that were evaluated during development of the work plan (DOE 2010) relative to the data quality objectives (DQOs). The work plan then identified a sampling strategy to address data gaps for each solid waste management unit (SWMU)/area of concern (AOC) that included supplementing collection of laboratory analytical data with field data that included results from X-ray fluorescence (XRF) and polychlorinated biphenyl (PCB) field test kits.

In some cases, the historical data were determined to delineate adequately the nature and extent, requiring only limited additional data to be collected. The following is a general overview of the data set whose results may be used in one or more of the decision units (Table B.1).

Table B.1. Summary of Sampling

	Surface Fixed-base Laboratory	Surface Field Laboratory	Subsurface/ Shallow Fixed-base Laboratory	Subsurface/ Shallow Field Laboratory	Surface Historical Data	Subsurface/ Shallow Historical Data
Total:	192	1,298	222	1,820	1,865	1,454

Sampling Location/ ID Number	Depth	Analytical Group	Number of RI Samples	Number of Historical Samples
Total	Surface[1]	VOCs	2	172
		SVOCs	128	342
		PCBs	125	1,531
		Metals	154	887
		Radionuclides	177	315
		Metals by XRF	1,298	282
		PCBs by test kit	1,214	282
	Subsurface [1]	VOCs	12	676
		SVOCs	144	442
		PCBs	152	725
		Metals	206	801
		Radionuclides	139	489
		Metals by XRF	1,820	377
		PCBs by test kit	1,567	272

[1] For the Soils OU RI, Surface is defined as 0–1 ft bgs and Subsurface is defined as 1–16 ft bgs.

The field sampling strategy for the RI included elements of stratified sampling, grid sampling, adaptive cluster sampling, composite sampling, and random sampling. These data, as described in detail for each exposure unit (EU), were collected consistent with the protocols documented in the work plan.

B.1. HISTORICAL DATA

The historical data set which the Data Quality Analysis (DQA) evaluates is primarily defined in the Soils Operable Unit (OU) Remedial Investigation (RI)/Feasibility Study (FS) Work Plan (DOE 2010). This evaluation will look only at whether the location from which the data were collected is representative of the Solid Waste Management Unit (SWMU)/area of concern (AOC) area (i.e., was the sample collected within the area of the influence of the SWMU) and whether the data itself was analyzed to a quality adequate for decision-making for this Soils OU RI/FS.

Some of the decision rules that will be used in the DQA when determining the usability of historical data were established in the RI/FS Work Plan. Those rules are the following:

- Historical data that has been qualified as rejected by data validation or by data assessment will not be included in the historical data set.
- Historical data that contain units inconsistent with the sampled media or with the analysis will not be included in the historical data set (e.g., a soil sample with analytical units reported in mg/L or a radiological result with units reported in mg/kg).
- Historical data for radionuclide results with no minimum detectable concentration recorded will not be included in the historical data set.
- Historical data for nonradionuclide results with no reported result and no detection limit recorded will not be included in the historical data set.
- Historical data for radionuclide results with a null or zero recorded as a counting error will not be included in the historical data set.
- Data assessment qualifiers previously placed on the data will be noted and applied as appropriate.
- A result will be considered a nondetect if it is qualified by the reporting laboratory with the following:
    - A “U” qualifier or a “<” qualifier or
    - An “A” qualifier if the result is a radiological result analyzed by a laboratory with codes “PGDP” or “PARGN.”
- A result will be considered a nondetect if it has a “U” validation code or a “U” data assessment code.
- A radiological result may be considered a nondetect if the reported total propagated uncertainty is greater than the reported result.[1]

Any exceptions to these rules will be documented in this DQA.

Historical data that no longer are representative of current site conditions are excluded. Use of historical

[1] For this project, all radiological data were managed as if they were detects through the data screening process.

data for constituents like polycyclic aromatic hydrocarbons (PAHs), whose concentrations may decrease over time due to weathering, may overestimate current conditions. Similarly, volatile organic compound (VOC) data from historical samples will not be used to estimate current conditions.

Individual evaluations of SWMU-specific historical data can be found in Attachment B.1. All figures referred to in B.1 are found in the main text of the Soils OU RI/FS.

B.2. RI LABORATORY ANALYTICAL DATA

Consistent with the work plan, the following analytical data that are not considered usable for the RI:

- Data qualified as rejected by data validation.
- Data qualified as rejected by data assessment.

Validation showed some results for 2-butanone, 2-chloroethyl vinyl ether, acetone, acrylonitrile, and neptunium-237 were rejected. These data will not be used in the RI.

B.3. FIELD RESULTS

For many sites, field laboratory data such as XRF data and results from polychlorinated biphenyl (PCB) field test kits are available in addition to the laboratory analytical data. The primary use of such data is for site characterization, but these survey-type data also can play a role in risk-based decision making. Survey-type data assist in determining the distribution of chemicals of potential concern (COPCs) and can be used to identify which sets of laboratory data should be combined to develop site average contaminant concentrations. As stated in the work plan, survey-type data also could be combined with lab data in a risk assessment to determine the average concentrations for contaminants, but this would require demonstrating that the lab and survey-type data possess similar detection limits and analytical uncertainty, and data sets are comparable and representative of the site conditions. This is the one focus of the considerations in determining the usability of these results.

Per the EPA data usability guidance (EPA 1992), the analytical data objective for baseline risk assessment is that uncertainty is known and acceptable, not that uncertainty be reduced to a particular level. In addition, because sampling variability typically contributes much more to total error than analytical variability, the use of a larger number of field method results to characterize the site may provide a better estimate of the average concentration, provided these data are defensible.

The following discussions consider whether the detection limits are sufficiently low to distinguish from background or risk-based concentrations, detected concentration ranges and ability to use to identify "hot spots" (values above action levels), potential for false negatives that could result in underestimating risks, and comparison of field results with confirmatory samples. Although this RI is focused on 50 SWMUs/AOCs, the entire data set collected during the RI is considered in the following discussions.

B.3.1 XRF

XRF data were evaluated in multiple stages. The initial comparison of XRF and fixed-base laboratory data include correlation and graphical comparison between paired data (i.e., composite split samples with both XRF and fixed-base results). The second stage of comparison includes false negative/false positive comparison (assuming fixed-base laboratory data represents the soil sample concentration).

A summary of the XRF data collected for this RI is presented in Table B.2.

Table B.2. Ranges of XRF Results

		ALL XRF DATA		PAIRED XRF DATA	
Analysis	**UNITS**	**Min**	**Max**	**Min**	**Max**
Antimony	mg/kg	30	283.01	30	175.41
Arsenic	mg/kg	4.92	137.97	4.92	24.83
Barium	mg/kg	47.25	2573.22	54.85	750.78
Cadmium	mg/kg	10.64	34.95	12	28.33
Chromium	mg/kg	28.16	897.61	30.41	897.61
Copper	mg/kg	15.79	6122.47	18.97	897.35
Iron	mg/kg	531.24	142401.3	4576.71	88278.97
Lead	mg/kg	5.94	1992.17	5.94	508.49
Manganese	mg/kg	47.97	4146.45	51.29	2805.54
Mercury	mg/kg	6	43.71	6.57	10
Molybdenum	mg/kg	5.6	94.89	15	34.19
Nickel	mg/kg	52.15	3787.15	56.36	1231
Selenium	mg/kg	3.06	30.65	3.06	20
Silver	mg/kg	8.06	17.99	8.51	14.13
Uranium	mg/kg	5.13	4325.1	7.13	1379.58
Vanadium	mg/kg	57.89	131.86	66.74	106.37
Zinc	mg/kg	9.87	3168.62	12.41	1384.86

B.3.1.1 Initial Comparison

Data collected from the Soils OU RI to evaluate the nature and extent of metals in surface and subsurface soils yielded approximately 334 laboratory analyses that were supplemented with approximately 3,390 field analyses using XRF. As expected, the XRF data correlated better with the lab data for many constituents, but not all constituents (Johnson 2008). This discrepancy provides an uncertainty that is documented in this DQA and will be addressed in the Soils OU baseline risk assessment(s) sections of the RI to support remedial decision making. Attachment B.2 of this DQA provides additional statistics for the XRF data.

B.3.1.2 Graphical Comparison of Paired Samples Based Upon Analytical Method

The results for approximately 334 soil samples analyzed by cup XRF and laboratory methods were assessed graphically. These pairs were sorted graphically by increasing XRF and laboratory result and by sample number. In general, it appears, that XRF results have higher detection limits and higher reported values than the lab results. There are exceptions to this generalization and other factors, such as laboratory dissolution methods, may contribute to the higher reported values for the XRF. Thus, using the higher value (typically the XRF value) in a risk assessment typically will overstate the risk/hazard (hereafter referred to as risk) associated with a given EU. Table B.3 lists observations from the initial review of the data.

Table B.3. Summary of Initial Observations by Analyte

Analyte	Correlation[1]	Notes
Antimony	No	XRF results are much greater than fixed based lab results
Arsenic	-0.23/-0.08	Most values below background
Barium	No	XRF results mostly above background; lab results mostly < background
Cadmium	No	XRF results mostly above background; lab results ~= background
Chromium	No	XRF results mostly >background; lab results mostly ~equal to or below background
Copper	Poor	Most XRF above background; lab results mostly below background
Iron	0.22/0.67	Most results below background for both methods
Lead	0.42/0.63	Most results below background for both methods
Manganese	0.19/0.43	Most results below background for both methods
Mercury	N/A	No results>XRF reporting limit; a few lab results above background
Molybdenum	N/A	No results > XRF reporting limit; only a few detections in lab
Nickel	Poor/Moderate	Few detected XRF/lab results; XRF reporting limit > background
Selenium	N/A	No XRF detections; few lab detections
Silver	N/A	Few detections by either method
Uranium	0.65/0.86	Good correlation
Vanadium	N/A	Few detections by XRF. Lab results mostly <background
Zinc	0.61/0.75	Good correlation

[1] Pearson correlation coefficient for subsurface/surface soil sample pairs

Note: Additional information regarding XRF performance by analyte at Paducah Gaseous Diffusion Plant (PGDP) can be found in Johnson 2008.

B.3.1.2.1 Differences between XRF results and fixed-based lab results

Some differences between XRF results and fixed-based lab results are expected due to the differences in how the constituents were measured [i.e., the XRF measures the secondary (fluorescent) X-rays emitted by elements after they have been stimulated by (primary) X-rays]. Thus, this technique tends to measure the concentrations of elements located near the surface of the sample while the fixed-base laboratory method theoretically measures the concentration of an element located throughout the entire sample volume (assuming homogeneity and complete dissolution).

The XRF and the fixed-base laboratory results are expected to correlate generally (because they are expected to correlate generally, higher XRF results would be expected to be found when the laboratory result is higher). Many of the data collected with the XRF are consistent with the lab results; however, the degree to which these data correlate varies by analyte.

B.3.1.2.2 Graphical presentation

The graphs for comparison are presented in Attachment B.3. The graphs illustrate the differences in results for the samples in which both a XRF and a fixed-base laboratory result were obtained. Three graphs are shown for each constituent. The initial graph illustrates the results obtained by the two different methods (on the same sample), sorted by increasing XRF result; the second graph for each metal illustrates the results obtained by the two different methods sorted by increasing fixed-base lab results; the third graph illustrates the results sorted by increasing sample number in order to determine clustered values. The same evaluation was conducted on both surface and subsurface samples. Each graph also shows the XRF reporting limits, the background values, and the industrial worker action/no action levels (DOE 2011).

B.3.1.3 Comparison of Uranium Analyses

Total uranium was analyzed by three distinct methods during this investigation: by field method (XRF), by fixed-base laboratory utilizing method SW846-6020, and by fixed-base laboratory utilizing alpha spectroscopy [Total uranium concentration (mg/g) is calculated by (1) conversion of the activity (pCi/g) for each uranium isotope from alpha spectroscopy analysis to units of mass (mg/g) and (2) then the mass (mg/g) of the isotopes is summed]. Graphs are presented in Attachment B.4 to show how the results from the methods correlate, comparing the result from the lab method SW846-6020 against the alpha spectroscopy method result (including uncertainty) and comparing the XRF result to the alpha spectroscopy value (including uncertainty). The background values for uranium are included on the graphs.

In addition to the graphical evaluation, the results of the XRF analysis were compared to the laboratory analysis and a relative percent difference (RPD) calculated and graphed. These results also are provided in Attachment B.4. There were 64 results that had a uranium concentration detected by both XRF and the laboratory. The average RPD was 4.6%, ranging from +44% to -40% (for those samples that had detectable levels of uranium by both methods).

There were 269 pairs of results where the XRF did not detect uranium at a limit of 20 mg/kg. The corresponding lab results all were below 20 mg/kg except for two results: 23.3 mg/kg and 24.1 mg/kg. Thus, the XRF results correlate well with the lab results, showing no apparent bias and, perhaps more importantly, no false negative results except for the two noted, which are similar to (within one significant digit) the detection limit of 20.

Additionally, uranium results were evaluated graphically for those pairs of samples that had no detectable uranium using XRF.

B.3.1.4 Summary of Frequencies of Detection of Analytes and False Positive/Negative Results

A summary of frequencies of false positive and false negative results in field data are compiled in Table B.4.

The graphs and Table B.4 indicate that all metals except arsenic, zinc, iron, lead, and manganese have a greater tendency toward a false positive XRF result. Thus, using these XRF data will overstate the risk from these constituents.

Table B.4. Summary of Frequencies of False Positive and False Negative Results in Field Data

Analyte	Frequency of Detection for Field Data	Surface Background mg/kg	Subsurface Background mg/kg	Frequency of False Positive Results	Frequency of False Negative Results
Antimony	270/335[1]	0.21	0.21	43/270	0/270
Arsenic	126/334	12	7.9	24/126	25/126
Barium	330/334	200	170	287/330	1/330
Cadmium	33/334	0.21	0.21	20/33	0/33
Chromium	130/334	16	43	62/130	0/130
Copper	46/334	19	25	11/46	1/46
Iron	334/334	28,000	28,000	2/334	19/334
Lead	311/334	36	23	10/311	27/311

Table B.4. Summary of Frequencies of False Positive and False Negative Results in Field Data (Continued)

Analyte	Frequency of Detection for Field Data	Surface Background mg/kg	Subsurface Background mg/kg	Frequency of False Positive Results	Frequency of False Negative Results
Manganese	328/334	1,500	820	5/328	26/328
Mercury	9/334	0.2	0.13	8/9	0/9
Molybdenum	1/334	n/a	n/a	n/a	n/a
Nickel	72/334	21	22	44/72	0/72
Selenium	4/334	0.8	0.7	¼	0/4
Silver	14/334	2.3	2.7	14/14	0/14
Uranium	64/334	4.9	4.6	10/64	0/64
Vanadium	11/334	38	37	10/11	0/11
Zinc	332/334	65	60	17/332	18/332

[1] One antimony result was received from the fixed-base laboratory on a sample that was not scheduled to receive metals analysis.
n/a – not applicable: no background value available

B.3.1.5 Summary

Evaluation of the XRF data with laboratory data indicate the use of results for copper, iron, lead, nickel, uranium and zinc present the strongest case. Molybdenum, mercury, selenium, and silver can be used for risk, as these results are generally below the reporting limits and will not lead to incorrect decisions in the risk assessment; however, these results may not provide much useful information for nature and extent determination.

Use of XRF results for arsenic, chromium, manganese has uncertainties; however, higher values in the complete data set indicate overall patterns in SWMUs. Of these three metals, arsenic will be reevaluated in the risk assessment, since detections at high concentrations, may lead to underestimating risk.

For vanadium, comparison with the laboratory data indicate risks derived from XRF data will be significantly overstated for detects. Results for antimony, barium, and cadmium will not be used in this RI for any purpose.

In general, because of differences in detection limits, XRF detections near or below their detection limits may incorrectly suggest the presence of the metal is present above background levels.

Table B.5 summarizes the findings based on this DQA.

B.3.2 PCBs

Consistent with the work plan, 2,781 samples were analyzed for PCBs using field test kits, and approximately 10% of these were split with the analytical laboratory to evaluate potential uncertainties or biases in the results.

Table B.6 is an overview of the results from the field tests.

Table B.5. DQA Findings for Use of XRF Data

Analysis	Correlation	Use for Nature and Extent/Hot Spots?	Use for Risk Assessment?	Comments
Antimony	No	No	No	No correlation with laboratory results; overestimates the presence and distribution of antimony and will incorrectly estimate an unacceptable risk, potentially leading to incorrect decisions. The maximum antimony concentrations (283 mg/kg by XRF; 24.5 mg/kg laboratory) are far below the action level for IW of 1510 mg/kg, so hot spots were not identified by these data sets.
Arsenic	No	As possible	Yes, with uncertainties	The data are not correlated. Data suggest that for samples with low laboratory results, concentrations will be overestimated and frequently may lead to the incorrect conclusion that background levels are exceeded. More importantly, XRF underestimates concentrations for the laboratory samples with the highest concentrations in the paired data set. The highest XRF result in the paired data set (24 mg/kg) was associated with the highest lab result of 85 mg/kg. The maximum XRF is above the IW AL of 100 mg/kg, suggesting additional review of these higher concentrations are warranted, and these may be considered an uncertainty in the risk assessment.
Barium	No	No	No	No correlation; did not correctly identify highest laboratory results; the maximum HI for these data is less than 0.5. For ~300 laboratory samples below background; ~95% of the XRF results would falsely suggest background is exceeded. None of the XRF results exceed the IW AL level of 378,000 mg/kg
Cadmium	No	No	No	Data were not correlated; all values below the AL.
Chromium	No	As Possible	Yes, with uncertainties	Data were not correlated, in part because of uncertainties near the XRF DL of 85 mg/kg and only two laboratory values exceeded this level. All values were below the AL; the maximum XRF result of 898 mg/kg appears to be an outlier and had a corresponding laboratory result of 22 mg/kg. This suggests uncertainty in hot spot identification. Not a significant contributor to risks or decisions.
Copper	Yes	Yes	Yes	
Iron	Marginal	Yes	Yes	Correlation is marginal; there are occasional outliers by both methods including uncertainties in the ICP results.
Lead	Yes	Yes	Yes	Removing one outlier, the correlation is strong. Most values well below 400 mg/kg; should identify hot spots.
Manganese	No	As possible	Yes, with uncertainties	In addition to lack of correlation, XRF results underestimate concentrations, do not capture higher lab results, and do not form a pattern across the SWMUs.

Table B.5. DQA Findings for Use of XRF Data (Continued)

Analysis	Correlation	Use for Nature and Extent/Hot Spots?	Use for Risk Assessment?	Comments
Mercury	No	As possible	Yes, with uncertainties	Not recommended. Infrequently and randomly detected at levels below the MDL in the paired data set that are not supported by the laboratory results. The maximum is above the DL and should be evaluated.
Molybdenum	NA	As possible	Yes, with uncertainties	Only one detect by XRF not at maximum value by ICP. Not significant contributor to risk; no impact on decisions.
Nickel	Marginal	Yes	Yes	XRF DLs are 65 mg/kg as compared <1 mg/kg for ICP. This typically results in an overestimation of concentrations near the detection limit.
Selenium	No	As possible	Yes, with uncertainties	All paired data below the DL of 20 mg/kg; 4 of 334 samples; each detect in a different SWMU; and higher than the associated laboratory results.
Silver	No	As possible	Yes, with uncertainties	Not well correlated, in part because of uncertainties and differences in the detection limits; low frequency of detection. Only 2/334 lab results were above background.
Uranium	Yes	Yes	Yes	
Vanadium	No	No	Yes, with uncertainties	Not well correlated, in part because of uncertainties near the detection limits. Only 4 of 334 laboratory results exceeded the XRF DL
Zinc	Yes	Yes	Yes	

AL = action level
DL = detection limit
ICP = inductively coupled plasma
IW = industrial worker
MDL = method detection limit
SWMU = solid waste management unit
XRF = X-ray fluorescence

Table B.6. Ranges of PCB Test Kit Results

		ALL PCB DATA			PAIRED PCB DATA		
Analysis	**UNITS**	**FOD**	**Min**	**Max**	**FOD**	**Min**	**Max**
Total PCBs	mg/kg	51/2781	5	50	5/264	5	5

FOD = frequency of detection

The detection limit for the field test kits was 5 mg/kg, as compared to <1 mg/kg for the laboratory results. While this concentration is above the industrial worker no action level (NAL) of (0.133 mg/kg), these data adequately delineate to the risk management level of 5 mg/kg and will identify hot spots. These will be used in the risk assessment recognizing the following: for non-PCB sites where PCBs were not detected in the laboratory of field results, PCBs would not be a chemical of potential concern (COPC). For sites with detectable PCBs, the exposure point concentration (EPC) may overestimate the exposure concentration when incorporating the field results that were below detection limits, an issue to be discussed in the uncertainty section.

The 264 confirmatory samples were collected to evaluate the results of the field data. Of these results, 256 of 259 of the field results reported below 5 mg/kg were confirmed with the laboratory results. The five detected PCB concentrations reported in the field samples are typically higher concentrations than the laboratory result, suggesting field results are not expected to underestimate the levels of PCBs.

The PCB field results are usable both for identification of hot spots, and can support the risk assessment recognizing risks may be overestimated.

B.3.3 GAMMA WALKOVER SURVEYS

The gamma walkover survey (GWS) and the XRF field laboratory analysis were not implemented in a manner that permitted a direct comparison between the two data sets. The XRF was a composite sample that was composed of five single grab samples. The XRF composite sample was collected over a 45 x 45 ft area. The composite sample was homogenized and a subsample analyzed by XRF. The GWS provides measurements for an area of approximately a 1 m^2. In order to compare the XRF to the GWS data, discrete gamma measurements would need to have been taken at each location where a sample was to be collected. The sample collected for XRF analysis would need to be representative of the 1 m^2 area of the gamma measurement. Since the major contaminant being measured during a GWS at PGDP is uranium-238, the *in situ* gamma measurement would most likely represents an activity to an approximate depth of 4 inches below ground surface (bgs). In contrast to the GWS, the XRF sample was collected at a depth of 0 to 1 ft bgs.

Differences between the GWS and the biased fixed-base laboratory sample prevented an accurate comparison. Noted differences are the following:

1. The biased sample was a homogenized 0 to 6-inch single grab sample verses the GWS that provides measurements for an area of approximately a 1 m^2 area. In addition, the GWS measurement most likely would represent an activity to a depth of approximately 4 inches bgs.

2. The GWS measures an area for only approximately two seconds. As indicated above, discrete gamma measurements would need to be conducted, and XRF measurements would need to be representative of the 1 m^2.

3. Since shielding was not used for the gamma detector, the GWS potentially could be impacted by shine from the cylinder yards as demonstrated by the 1992 and the 2009 Aerial Radiation Surveys. Soil samples collected in the same areas as the GWS are not impacted by shine from the cylinder yards.

B.4. REFERENCES

DOE 2010. *Work Plan for the Soils Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant Paducah, Kentucky*, LATA Environmental Services of Kentucky, DOE/LX/07-0120&D2/R2, June.

DOE 2011. *Methods for Conducting Risk Assessment and Risk Evaluations at the Paducah Gaseous Diffusion Plant Paducah, Kentucky, Volume 1. Human Health*, LATA Environmental Services of Kentucky, DOE/LX/07-0107&D2/R1/V1, February.

EPA 1992. *Guidance for Data Useability in Risk Assessment (Part A)* U. S. Environmental Protection Agency 9285.7-09A, April.

Johnson, R.L. 2008. *Real Time Demonstration Project XRF Performance Evaluation Report for Paducah Gaseous Diffusion Plant AOC 492*. Kentucky Research Consortium for Energy and Environment, April 3.

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ATTACHMENT B1

HISTORICAL DATA REVIEW

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HISTORICAL DATA REVIEW FOR EACH SWMU

B1.1.1 GROUP 1, FORMER FACILITY AREAS

This section presents the Data Quality Analysis (DQA) analysis for historical data for each of the SWMUs includes in the Group 1, Former Facility Areas Group.

B1.1.1.1 SWMU 001, C-747-C Oil Landfarm

Data Evaluation and Screening

Historical data for this solid waste management unit (SWMU) from the surface soils include dioxins/furans, metals, pesticides/polychlorinated biphenyls (PCBs), radionuclides, semivolatile organic compounds (SVOCs), and volatile organic compounds (VOCs). The data from the shallow subsurface include dioxins/furans, metals, pesticides/PCBs, SVOCs, and VOCs. These data were collected from the following projects:

- Agreement in Principle (AIP) Soil Remediation PR June 2004 Split w/DOE AIPSORUPRSP06-04
- Remedial Action Site Investigation (SI)—Phase 1
- Remedial Action SI—Phase 2
- Southwest Plume SI SWMU001 ERI04SW-SWMU001
- Southwest Plume SI SWMU001—Head Space 2 Day Turn ERI04SW-001HS-2
- Southwest Plume SI SWMU001—Head Space 7 Day Turn ERI04SW-001HS-7
- Surface Water OU—Activity 1 ISOCS data SWOU05-ISOCS
- Surface Water OU—Kentucky Pollutant Discharge Elimination System (KPDES) Outfall 008 Activity 1 Exposure Unit (EU)07 SWOU05-K008A107
- Surface Water OU—KPDES outfall 008 Activity 1 EU08 SWOU05-K008A108
- Surface Water OU—KPDES outfall 008 Activity 2 EU07 AND EU08 SWOU05-K008A20708
- Waste Area Group (WAG) 23 Excavation Sampling
- WAG 23 Phase 1
- WAG 23 Phase 2
- WAG 27 Excavation Sampling
- WAG 27 Remedial Investigation (RI) Sampling

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 5 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 001. For use in the Remedial Action (RA), data within the SWMU boundary and contingency, or "step-out," sampling were assigned to the SWMU.

Usability of Historical Data

Validation: Validation was performed for 10% of the AIP Soil Remediation project, Phase 1 and 2 SIs, WAG 23, and WAG 27 projects. The validation qualifiers that have been applied to this data are "?," "=," E, J, N, U, and V.

Data Assessment: The assessment qualifiers that have been applied to the data set for SWMU 001 are as presented in Table B1.1.1.1-1.

Table B1.1.1.1-1. Assessment Qualifiers Applied to SWMU 1 Historic Data

Assessment Qualifier	Definition
BL-T	Result may be biased low; sample holding time exceeded.
J	Result estimated
U	Not detected.
USECNITRIC-CF	During the period from May 2004 to September 2009, the United States Enrichment Corporation (USEC)-Paducah Gaseous Diffusion Plant (PGDP) laboratory used method RL-7128-NITRIC for isotopic uranium analysis by alpha spec. Method RL-7128-NITRIC utilizes only nitric acid for dissolution rather than hydrofluoric/nitric acid. The use of nitric acid only is a less aggressive dissolution for isotopic uranium analysis by alpha spec. It has been demonstrated that Method RL-7128-NITRIC can be utilized only for isotopic uranium analysis of soil with activity greater than 10 pCi/g due to low recoveries below that level. If the data from Method RL-7128-NITRIC will be screened against the background values reported in *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the PGDP* (1997), the following adjusted background values must be used: U-234: 1.73 pCi/g surface and 1.63 pCi/g subsurface; U-235: 0.10 pCi/g; and U-238: 0.40 pCi/g [*Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant*, Appendix E (2009)]. Risk assessors may use data from this time period for comparison against other thresholds below 10 pCi/g without adjusting the values as long as the level of uncertainty and its impact on the risk assessment/evaluation are adequately discussed. No additional action is required for comparisons to thresholds above 10 pCi/g.

It was noted in the Surface Water Operable Unit (SWOU) SI/Baseline Risk Assessment (BRA) that data for cesium-137 and uranium-238 were produced using an *In Situ* Object Counting System (ISOCS) unit, as opposed to a fixed-base laboratory. The data are considered screening level only (its intended purpose) and did not meet data evaluation methods; therefore, they could not be used in the risk assessment (DOE 2008). These data subsequently were removed from the Soils OU data set.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data that had no reported result and no detection limit have been removed from the data set.

There are 43 chemicals that are nondetects and have their sample quantitation limit (SQL)/minimum detectable concentrations (MDCs) greater than background or the child resident no action limit (NAL). Those chemicals and referenced values are shown in Table B1.1.1.1-2.

Table B1.1.1.1-2. Analytes with SQL or MDC Greater that Background or Child Resident NAL for SWMU 001

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	12.2	0.552	0.21	0.21
Arsenic	mg/kg	4.83	0.238		
Beryllium	mg/kg	0.48	0.00567		
Cadmium	mg/kg	1.95	0.811	0.21	0.21
Silver	mg/kg	3.5	2.61	2.3	2.7
Thallium	mg/kg	19.5	0.368	0.21	0.34
Organics					
1,2,3,7,8-Pentachlorodibenzofuran	mg/kg	0.001	0.0000447		
2,3,4,7,8-Pentachlorodibenzofuran	mg/kg	0.001	0.00000447		
2,3,7,8-Tetrachlorodibenzofuran	mg/kg	0.001	0.0000326		
2,3,7,8-Tetrachlorodibenzo-p-dioxin	mg/kg	0.001	0.00000263		
Heptachloro-dibenzo[b,e][1,4]dioxin	mg/kg	0.002	0.000275		
Heptachlorodibenzofuran	mg/kg	0.001	0.000134		
Hexachloro-dibenzo[b,e][1,4]dioxin	mg/kg	0.002	0.0000275		
Hexachlorodibenzofuran	mg/kg	0.001	0.0000134		
Pentachloro-dibenzo[b,e][1,4]dioxin	mg/kg	0.001	0.00000275		
Dieldrin	mg/kg	0.93	0.0106		
Heptachlorodibenzofuran	mg/kg	0.0007	0.000134		
Hexachlorodibenzofuran	mg/kg	0.0004	0.0000134		
PCB, Total	mg/kg	1.9	0.0648		
PCB-1016	mg/kg	4.7	0.0633		
PCB-1221	mg/kg	4.7	0.0437		
PCB-1232	mg/kg	4.7	0.0437		
PCB-1242	mg/kg	4.7	0.0644		
PCB-1248	mg/kg	0.94	0.0682		

Table B1.1.1.1-2. Analytes with SQL or MDC Greater that Background or Child Resident NAL for SWMU 001 (Continued)

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
PCB-1254	mg/kg	9.3	0.0501		
PCB-1260	mg/kg	9.3	0.0662		
2,3,4,7,8-Pentachlorodibenzofuran	mg/kg	0.00013	0.00000447		
2,3,7,8-Tetrachlorodibenzofuran	mg/kg	0.0002	0.0000326		
2,3,7,8-Tetrachlorodibenzo-p-dioxin	mg/kg	0.0002	0.00000263		
2-Nitrobenzenamine	mg/kg	2.5	0.296		
Benz(a)anthracene	mg/kg	2.5	0.196		
Benzo(a)pyrene	mg/kg	2.5	0.0197		
Benzo(b)fluoranthene	mg/kg	2.5	0.197		
Benzo(k)fluoranthene	mg/kg	2.5	1.96		
Dibenz(a,h)anthracene	mg/kg	2.5	0.0197		
Hexachlorobenzene	mg/kg	2.5	0.0492		
Indeno(1,2,3-cd)pyrene	mg/kg	2.5	0.197		
Naphthalene	mg/kg	2.5	1.15		
N-Nitroso-di-n-propylamine	mg/kg	2.5	0.0189		
1,1-Dichloroethene	mg/kg	3.5	0.0237		
cis-1,2-Dichloroethene	mg/kg	3.5	1.05		
Trichloroethene	mg/kg	1	0.0234		
Vinyl chloride	mg/kg	3.5	0.0824		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

Radionuclide historical data records that have no MDCs and no counting errors reported have been removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

SWMU 001 was not grid sampled during this RI. The historic sampling stations have been assigned to grids developed during the Soils OU RI. The assignments are shown in Table B1.1.1.1-3.

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.1.1-4.

Table B1.1.1.1-3. Stations and Grids for Historical Data from SWMU 001

Station Name	Grid No.
SOU001-001	001-110
SOU001-001	23-0111
SOU001-001	23-0145
SOU001-001	OF08A-227
SOU001-001	OF08A-229
SOU001-002	001-109
SOU001-002	23-0109
SOU001-002	23-0110
SOU001-002	OF08A-225
SOU001-003	001-108
SOU001-003	23-0107
SOU001-003	23-0108
SOU001-003	OF08A-222
SOU001-003	OF08A-223
SOU001-004	001-107
SOU001-004	23-0105
SOU001-004	23-0106
SOU001-004	OF08A-221
SOU001-005	001-106
SOU001-005	23-0104
SOU001-005	OF08A-219
SOU001-005	OF08A-220
SOU001-006	23-0102
SOU001-006	23-0103
SOU001-006	OF08A-218
SOU001-007	001-105
SOU001-007	23-0101
SOU001-007	OF08A-215
SOU001-007	OF08A-217
SOU001-007	OF08B-08-02
SOU001-008	001-104
SOU001-008	23-0144
SOU001-008	23-0144-1
SOU001-008	23-0144-2
SOU001-008	23-0144-3
SOU001-008	OF08A-213
SOU001-009	001-103
SOU001-009	001-150
SOU001-009	OF08A-207

Station Name	Grid No.
SOU001-009	OF08A-210
SOU001-010	001-102
SOU001-010	OF08A-201
SOU001-010	OF08A-205
SOU001-011	001-111
SOU001-011	001-179
SOU001-011	23-0146
SOU001-011	OF08A-233
SOU001-011	OF08A-235
SOU001-012	001-173
SOU001-012	23-0112
SOU001-012	23-0132
SOU001-012	23-0133
SOU001-013	001-201
SOU001-013	23-0113
SOU001-013	23-0114
SOU001-013	23-0131
SOU001-013	23-0131-1
SOU001-013	23-0131-2
SOU001-013	23-0131-3
SOU001-013	H258
SOU001-014	001-155
SOU001-014	001-156
SOU001-014	001-166
SOU001-014	23-0115
SOU001-014	23-0116
SOU001-014	23-0129
SOU001-014	23-0129-1
SOU001-014	23-0129-2
SOU001-014	23-0129-3
SOU001-014	23-0130
SOU001-014	H009
SOU001-015	001-157
SOU001-015	001-158
SOU001-015	001-202
SOU001-015	23-0117
SOU001-015	23-0117-1
SOU001-015	23-0117-2
SOU001-015	23-0117-3

Station Name	Grid No.
SOU001-015	23-0117-4
SOU001-015	23-0118
SOU001-015	23-0127
SOU001-015	23-0127-1
SOU001-015	23-0127-2
SOU001-015	23-0127-3
SOU001-015	23-0128
SOU001-015	23-0129
SOU001-016	001-161
SOU001-016	001-168
SOU001-016	001-203
SOU001-016	23-0119
SOU001-016	23-0126
SOU001-016	H051
SOU001-017	001-001
SOU001-017	001-002
SOU001-017	001-003
SOU001-017	001-005
SOU001-017	001-171
SOU001-017	23-0120
SOU001-017	23-0121
SOU001-017	23-0124
SOU001-017	23-0125
SOU001-017	23-0125-1
SOU001-017	23-0125-2
SOU001-017	23-0125-3
SOU001-017	H050
SOU001-018	23-0122
SOU001-018	23-0123
SOU001-018	23-0147
SOU001-018	23-0147-1
SOU001-018	23-0147-2
SOU001-018	23-0147-3
SOU001-022	001-112
SOU001-022	OF08A-234
SOU001-022	OF08A-236
SOU001-022	OF08B-08-03
SOU001-023	001-113
SOU001-023	23-0134

Table B1.1.1.1-3. Stations and Grids for Historical Data from SWMU 001 (Continued)

Station Name	Grid No.
SOU001-024	001-114
SOU001-024	23-0135
SOU001-024	23-0136
SOU001-025	001-115
SOU001-025	001-152
SOU001-025	001-153
SOU001-025	001-154
SOU001-025	001-172
SOU001-025	23-0137
SOU001-025	23-0138
SOU001-026	001-116
SOU001-026	001-159
SOU001-026	23-0139
SOU001-026	23-0140
SOU001-026	23-0140-1
SOU001-026	23-0140-2
SOU001-026	23-0140-3
SOU001-026	H356
SOU001-027	001-117
SOU001-027	001-160
SOU001-027	23-0141
SOU001-028	001-004
SOU001-028	23-0142
SOU001-028	23-0143
SOU001-028	H210
SOU001-028	H357
SOU001-029	001-118
SOU001-029	23-0155
SOU001-030	001-119
SOU001-031	001-120
SOU001-032	001-121
SOU001-033	001-131
SOU001-033	23-0154
SOU001-034	001-130
SOU001-034	001-162
SOU001-034	23-0153
SOU001-035	001-129
SOU001-035	001-174
SOU001-035	23-0152
SOU001-036	001-128
SOU001-036	23-0151
SOU001-037	001-127
SOU001-037	23-0150
SOU001-038	001-126
SOU001-038	23-0149
SOU001-040	001-125
SOU001-040	23-0148
SOU001-041	001-124
SOU001-042	001-123
SOU001-042	001-145
SOU001-042	OF08A-204
SOU001-042	OF08A-206
SOU001-043	001-132
SOU001-043	001-170
SOU001-043	OF08A-228
SOU001-043	OF08A-230
SOU001-043	OF08B-08-04
SOU001-044	001-133
SOU001-044	H208
SOU001-044	OF08A-224
SOU001-044	OF08A-226
SOU001-045	001-134
SOU001-045	H355
SOU001-046	001-135
SOU001-046	H052
SOU001-047	001-136
SOU001-047	H358
SOU001-049	001-137
SOU001-049	H209
SOU001-050	001-138
SOU001-050	OF08A-212
SOU001-051	OF08A-175
SOU001-051	OF08A-208
SOU001-051	OF08A-209
SOU001-051	OF08A-211
SOU001-051	OF08B-08-01
SOU001-052	001-144
SOU001-052	001-148
SOU001-052	OF08A-189
SOU001-052	OF08A-190
SOU001-053	001-143
SOU001-053	H259
SOU001-053	OF08A-188
SOU001-053	OF08B-07-01
SOU001-054	001-142
SOU001-054	OF08A-186
SOU001-054	OF08A-187
SOU001-055	001-141
SOU001-055	OF08A-185
SOU001-056	001-140
SOU001-056	OF08A-183
SOU001-056	OF08A-184
SOU001-056	OF08B-07-02
SOU001-057	001-147
SOU001-057	OF08A-182
SOU001-058	001-139
SOU001-058	001-146
SOU001-058	H260
SOU001-058	OF08A-180
SOU001-058	OF08A-181
SOU001-058	OF08A-216
SOU001-059	OF08A-179
SOU001-059	OF08A-214

Table B1.1.1.1-4. Summary of SWMU 001 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	101/102	1.04E+03	7.72E+03	1.43E+04	1/102	94/102
Antimony	12/95	1.30E-02	1.30E+00	5.00E+00	11/95	10/95
Arsenic	99/105	1.00E+00	4.91E+00	1.67E+01	6/105	99/105
Barium	105/105	1.27E+00	1.07E+02	2.47E+02	6/105	14/105
Beryllium	96/102	5.94E-03	7.70E-01	1.05E+01	17/102	96/102
Cadmium	50/105	4.33E-03	1.80E+00	6.50E+00	40/105	34/105
Calcium	102/102	2.29E+01	1.86E+03	3.10E+04	0/102	0/102
Chromium	104/105	1.29E-01	1.70E+01	2.58E+02	6/105	22/105
Cobalt	101/102	5.76E-02	5.81E+00	1.54E+01	3/102	100/102
Copper	102/102	2.09E-01	1.32E+01	2.31E+02	3/102	1/102
Iron	102/102	1.41E+02	1.38E+04	2.48E+04	0/102	101/102
Lead	96/105	1.02E-01	1.33E+01	3.23E+02	2/105	0/105
Magnesium	102/102	1.17E+02	1.59E+03	1.12E+04	10/102	0/102
Manganese	102/102	3.04E+00	4.47E+02	2.16E+03	7/102	38/102
Mercury	67/105	2.71E-04	1.59E-01	7.70E+00	3/105	2/105
Molybdenum	1/6	1.42E+01	1.42E+01	1.42E+01	0/6	0/6
Nickel	101/105	2.98E-01	1.44E+01	8.54E+01	10/105	68/105
Potassium	81/102	6.20E+00	3.64E+02	1.29E+03	0/102	0/102
Selenium	31/105	8.91E-02	2.81E-01	9.80E-01	1/105	0/105
Silver	7/105	1.85E-03	1.95E+01	7.39E+01	5/105	4/105
Sodium	91/102	5.22E+00	2.70E+02	5.70E+02	28/102	0/102
Thallium	29/105	1.17E-01	2.17E-01	1.56E+00	2/105	2/105
Uranium	6/6	2.86E+00	5.07E+00	9.86E+00	3/6	6/6
Vanadium	101/102	2.31E-01	2.20E+01	5.33E+01	4/102	101/102
Zinc	102/102	7.40E+00	4.77E+01	3.90E+02	17/102	0/102
Organics (mg/kg)						
Cyanide	1/95	7.10E-01	7.10E-01	7.10E-01	0/95	0/95
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	1/1	3.05E-03	3.05E-03	3.05E-03	0/1	0/1
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1/2	2.40E-04	2.40E-04	2.40E-04	0/2	2/2
Heptachloro-dibenzo[b,e][1,4]dioxin	1/10	5.35E-03	5.35E-03	5.35E-03	0/10	1/10
Octachloro-dibenzo[b,e][1,4]dioxin	8/10	1.60E-03	7.29E-03	3.93E-02	0/10	1/10

Table B1.1.1.1-4. Summary of SWMU 001 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Octachlorodibenzofuran	3/10	2.00E-04	9.33E-04	1.80E-03	0/10	0/10
Tetrachloro-dibenzo[b,e][1,4]dioxin	1/10	1.38E-03	1.38E-03	1.38E-03	0/10	0/10
3- and 4- Methylphenol	1/2	2.30E+00	2.30E+00	2.30E+00	0/2	0/2
4,4'-DDT	1/30	2.20E-02	2.20E-02	2.20E-02	0/30	0/30
PCB, Total	32/288	2.00E-02	1.74E+00	3.50E+01	0/288	31/288
PCB-1242	1/190	6.10E-01	6.10E-01	6.10E-01	0/190	1/190
PCB-1248	23/218	2.00E-02	2.31E+00	3.50E+01	0/218	22/218
PCB-1254	8/217	9.30E-02	2.30E-01	4.18E-01	0/217	8/217
PCB-1260	1/217	1.30E-01	1.30E-01	1.30E-01	0/217	1/217
1,2,3,4,6,7,8-Heptachlorodibenzofuran	4/4	7.00E-06	4.40E-05	1.30E-04	0/4	0/4
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	5/5	7.00E-06	1.23E-04	3.40E-04	0/5	0/5
1,2,3,4,7,8,9-Heptachlorodibenzofuran	2/5	3.00E-06	5.50E-06	8.00E-06	0/5	0/5
1,2,3,4,7,8-Hexachlorodibenzofuran	3/5	3.00E-06	2.10E-05	5.00E-05	0/5	0/5
1,2,3,6,7,8-Hexachlorodibenzofuran	5/5	1.00E-05	3.60E-05	8.00E-05	0/5	0/5
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	5/5	1.00E-05	4.00E-05	8.00E-05	0/5	0/5
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	1/5	1.00E-05	1.00E-05	1.00E-05	0/5	0/5
1,2,3,7,8-Pentachlorodibenzofuran	5/5	2.00E-05	5.40E-05	9.00E-05	0/5	3/5
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	1/1	6.00E-05	6.00E-05	6.00E-05	0/1	0/1
1,2-Benzenedicarboxylic acid	8/8	1.00E-01	2.75E-01	4.00E-01	0/8	0/8
1,2-Dichlorobenzene	2/103	8.50E-02	1.03E-01	1.20E-01	0/103	0/103
1-Octadecene	2/2	6.00E-01	6.50E-01	7.00E-01	0/2	0/2
2,3,4,7,8-Pentachlorodibenzofuran	2/5	1.00E-05	3.00E-05	5.00E-05	0/5	2/5
2,3,4-Trimethylhexane	1/1	5.00E-01	5.00E-01	5.00E-01	0/1	0/1
2,3,7,8-Tetrachlorodibenzofuran	5/13	1.00E-05	4.20E-05	1.10E-04	0/13	3/13
2,3,7,8-Tetrachlorodibenzo-p-dioxin	3/11	1.00E-05	2.00E-05	4.00E-05	0/11	6/11

Table B1.1.1.1-4. Summary of SWMU 001 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
2-Methylnaphthalene	1/102	9.00E-02	9.00E-02	9.00E-02	0/102	0/102
4-alpha-Cumylphenol	2/2	1.60E+00	1.60E+00	1.60E+00	0/2	0/2
4-Methylphenol	1/89	8.50E-01	8.50E-01	8.50E-01	0/89	0/89
Benz(a)anthracene	2/108	5.70E-02	6.05E-02	6.40E-02	0/108	0/108
Benzo(a)pyrene	2/108	6.40E-02	7.10E-02	7.80E-02	0/108	4/108
Benzo(b)fluoranthene	3/108	8.70E-02	3.62E-01	8.70E-01	0/108	1/108
Benzo(k)fluoranthene	2/108	8.10E-02	8.20E-02	8.30E-02	0/108	0/108
Benzoic acid	3/103	5.10E-02	1.31E+00	3.80E+00	0/103	0/103
Bis(2-butoxyethyl) ether	1/1	6.80E-01	6.80E-01	6.80E-01	0/1	0/1
Bis(2-ethylhexyl)phthalate	27/102	6.20E-02	2.80E-01	1.50E+00	0/102	0/102
Butyl benzyl phthalate	1/102	2.00E-01	2.00E-01	2.00E-01	0/102	0/102
Chrysene	3/108	8.40E-02	2.30E-01	5.10E-01	0/108	0/108
Di-n-butyl phthalate	12/104	4.80E-02	2.71E+00	2.20E+01	0/104	0/104
Fluoranthene	4/108	8.30E-02	3.54E-01	6.20E-01	0/108	0/108
Hexadecane	1/1	1.80E-01	1.80E-01	1.80E-01	0/1	0/1
Naphthalene	1/108	6.30E-02	6.30E-02	6.30E-02	0/108	0/108
N-Nitrosodiphenylamine	3/102	4.80E-02	5.87E-02	6.40E-02	0/102	0/102
n-Octacosane	2/2	2.90E-01	3.20E-01	3.50E-01	0/2	0/2
Octachloro-dibenzo[b,e][1,4]dioxin	5/5	4.00E-05	1.80E-03	4.03E-03	0/5	0/5
Octachlorodibenzofuran	5/5	1.00E-05	6.80E-05	1.60E-04	0/5	0/5
Octadecene	2/2	6.00E-01	7.00E-01	8.00E-01	0/2	0/2
Pentachlorophenol	2/107	5.50E-02	8.25E-02	1.10E-01	0/107	0/107
Phenanthrene	3/108	4.50E-02	2.33E-01	6.00E-01	0/108	0/108
Phenol	3/103	7.00E-01	6.50E+00	1.70E+01	0/103	0/103
Pyrene	4/108	9.50E-02	3.46E-01	6.80E-01	0/108	0/108
Tetrachlorobiphenyl	4/4	4.00E-01	5.50E-01	7.00E-01	0/4	0/4
Total Cresols	2/18	2.30E+00	3.35E+00	4.40E+00	0/18	0/18
Total PAH	3/108	7.93E-02	8.84E-02	9.83E-02	0/108	3/108
1,1,1-Trichloroethane	3/46	5.00E-04	7.30E-03	1.30E-02	0/46	0/46
1,1,2-Trichloroethane	1/40	2.40E-03	2.40E-03	2.40E-03	0/40	0/40
1,1-Dichloroethane	2/52	2.40E-03	2.51E-01	5.00E-01	0/52	0/52
1,1-Dichloroethene	1/161	8.30E-03	8.30E-03	8.30E-03	0/161	0/161
1,2,4-Trimethylbenzene	1/3	4.80E-02	4.80E-02	4.80E-02	0/3	0/3
4-Methyl-3-penten-2-one	2/2	1.80E-01	2.35E-01	2.90E-01	0/2	0/2
Acetone	12/40	3.00E-03	8.41E-02	4.00E-01	0/40	0/40

Table B1.1.1.1-4. Summary of SWMU 001 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Benzene	1/43	9.00E-03	9.00E-03	9.00E-03	0/43	0/43
Carbon disulfide	5/40	1.00E-03	1.80E-03	2.00E-03	0/40	0/40
Chlorobenzene	1/43	1.00E-03	1.00E-03	1.00E-03	0/43	0/43
Chloroform	3/43	2.00E-04	1.61E-03	4.00E-03	0/43	0/43
cis-1,2-Dichloroethene	12/139	2.60E-02	2.01E+02	2.40E+03	0/139	5/139
Decane	1/1	9.70E-02	9.70E-02	9.70E-02	0/1	0/1
Methylene chloride	10/40	3.50E-03	5.28E-02	1.40E-01	0/40	0/40
Toluene	5/40	2.00E-03	2.60E-03	4.00E-03	0/40	0/40
trans-1,2-Dichloroethene	17/137	4.50E-04	3.09E+00	1.60E+01	0/137	5/137
Trichloroethene	43/184	6.00E-04	6.90E+00	8.70E+01	0/184	37/184
Trichlorofluoromethane	1/3	1.40E-03	1.40E-03	1.40E-03	0/3	0/3
Vinyl acetate	1/36	5.70E-03	5.70E-03	5.70E-03	0/36	0/36
Vinyl chloride	7/173	4.50E-03	1.07E+00	4.80E+00	0/173	6/173
Radionuclides (pCi/g)						
Americium-241	6/6	-1.94E-02	2.32E-01	9.98E-01	0/6	0/6
Cesium-137	22/22	8.78E-02	8.72E+00	7.24E+01	2/22	22/22
Cobalt-60	6/6	-2.26E-02	-3.10E-03	2.20E-02	0/6	1/6
Neptunium-237	6/6	-3.33E-03	1.14E-01	6.63E-01	1/6	1/6
Plutonium-238	6/6	-8.63E-03	2.63E-02	1.11E-01	1/6	0/6
Plutonium-239/240	6/6	2.21E-03	2.20E+00	9.05E+00	4/6	1/6
Technetium-99	6/6	3.43E-01	3.93E+00	8.29E+00	5/6	0/6
Thorium-228	6/6	2.52E-01	4.46E-01	7.64E-01	0/6	0/6
Thorium-230	6/6	3.37E-01	1.56E+01	6.50E+01	4/6	3/6
Thorium-232	6/6	1.59E-01	4.79E-01	7.94E-01	0/6	0/6
Uranium-234	6/6	4.70E-01	1.27E+00	3.44E+00	2/6	0/6
Uranium-235	6/6	2.26E-02	7.21E-02	1.93E-01	3/6	1/6
Uranium-238	28/28	5.97E-01	9.68E+00	3.06E+01	2/28	28/28

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.1.2 SWMU 99, C-745- Kellogg Building Site (WAG 28)

There are no historical data for SWMU 99.

B1.1.1.3 SWMU 194, DUF_6 Facility, McGraw Construction Facilities

<u>**Data Evaluation and Screening**</u>

Historical data for surface soils from this SWMU include metals, pesticides/PCBs, radionuclides, SVOCs, and VOCs. The historical data for the shallow subsurface soils include metals, pesticides/PCBs, and VOCs. These data were collected from the following projects:

- AIP Sediment Toxicity Study for Bayou Creek and Little Bayou Creek January 2002 AIPSERV01-02
- Groundwater Monitoring Phase IV
- Historical data from AnaLIS for WAG 28 Data Quality Objectives (DQOs)
- RCRA Characterization Waste Characterization (RCWC) Data
- Remedial Action SI—Phase 1
- UF_6 Conversion Facility Sediment
- WAG 28—SWMU 194

<u>**Sampling Representative of the SWMU/AOC Area?**</u>

Figures in Chapter 5 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 194. For use in the RA, data within the SWMU boundary and contingency, or "step-out," sampling were assigned to the SWMU.

<u>**Usability of Historical Data**</u>

Validation: Validation was performed for 10% of the AIP sediment Toxicity Study, Phase 1, and the UF_6 Conversion Facility sediment projects. The validation qualifiers that have been applied to this data set include "?," "=," J, U, and "V."

Data Assessment: The assessment qualifiers listed in Table B1.1.1.3-1 have been applied to the data for SWMU 194.

Table B1.1.1.3-1. Assessment Qualifiers Applied to SWMU 194 Historic Data

Assessment Qualifier	Definition
J	Result estimated
KYRHTAB-50	Kentucky Radiation Health and Toxic Agents Branch (KYRHTAB) has performed an independent data evaluation (not to be confused with data verification and validation) and the rad error accounts for greater than 50% of the results.
U	Not detected.

<u>**Units of Results**</u>

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data for which there were no reported result and no detection limit have been removed from the data set.

There are 24 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. Those chemicals and referenced values are shown in Table B1.1.1.3-2.

Table B1.1.1.3-2. Analytes with SQL or MDC Greater that Background or Child Resident NAL for SWMU 194

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	20	0.552	0.21	0.21
Arsenic	mg/kg	5	0.238		
Beryllium	mg/kg	0.5	0.00567		
Cadmium	mg/kg	2	0.811	0.21	0.21
Silver	mg/kg	4	2.61	2.3	2.7
Thallium	mg/kg	20	0.368	0.21	0.34
Organics					
Dieldrin	mg/kg	0.02	0.0106		
PCB, Total	mg/kg	0.2	0.0648		
PCB-1016	mg/kg	0.1	0.0633		
PCB-1221	mg/kg	0.1	0.0437		
PCB-1232	mg/kg	0.1	0.0437		
PCB-1242	mg/kg	0.1	0.0644		
PCB-1248	mg/kg	0.1	0.0682		
PCB-1254	mg/kg	0.2	0.0501		
PCB-1260	mg/kg	0.2	0.0662		
2-Nitrobenzenamine	mg/kg	2.1	0.296		
Benz(a)anthracene	mg/kg	0.47	0.196		
Benzo(a)pyrene	mg/kg	0.47	0.0197		
Benzo(b)fluoranthene	mg/kg	0.47	0.197		
Dibenz(a,h)anthracene	mg/kg	0.47	0.0197		
Hexachlorobenzene	mg/kg	0.47	0.0492		
Indeno(1,2,3-cd)pyrene	mg/kg	0.47	0.197		
N-Nitroso-di-n-propylamine	mg/kg	0.47	0.0189		
Chromium, hexavalent	mg/kg	0.5	0.0486		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limi

Radionuclide Counting Errors

Radionuclide historical data records that have no MDCs and no counting errors reported have been removed from the data set. Alpha and beta activity results have been removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

SWMU 194 was grid sampled during this RI; therefore, the historical data points have been assigned to grids developed during the Soils OU RI sampling effort. The grid assignments for the historic data are listed in Table B1.1.1.3-3.

Table B1.1.1.3-3. Stations and Grids for Historical Data from SWMU 194

Station Name	Grid No.
SOU194-088	194-7
SOU194-091	H015
SOU194-126	194-6
SOU194-172	194-4
SOU194-214	194-5
SOU194-272	194-3
SOU194-296	194-2
SOU194-318	RC-3874
SOU194-318	RC-3876
SOU194-318	RC-3877
SOU194-318	RC-3878
SOU194-318	RC-3879
SOU194-318	RC-3880
SOU194-318	RC-3881
SOU194-318	RC-3882
SOU194-318	RC-3883
SOU194-318	RC-3884
SOU194-318	RC-3885
SOU194-318	RC-875
SOU194-321	BC@017
SOU194-358	194-010
SOU194-390	194-011
SOU194-RAD	UFSS-02

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.1.3-4.

Table B1.1.1.3-4. Summary of SWMU 194 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	8/8	4.38E+03	8.96E+03	1.45E+04	2/8	7/8
Arsenic	1/8	4.40E+00	4.40E+00	4.40E+00	0/8	1/8
Barium	8/8	2.05E+01	7.00E+01	1.25E+02	0/8	0/8
Beryllium	3/8	8.00E-01	2.14E+00	4.80E+00	3/8	3/8
Cadmium	1/29	8.55E+00	8.55E+00	8.55E+00	1/29	1/29
Calcium	8/8	5.68E+02	1.33E+03	2.40E+03	0/8	0/8
Chromium	29/29	8.24E+00	2.17E+01	1.03E+02	4/29	15/29
Cobalt	7/7	3.00E+00	5.08E+00	9.46E+00	0/7	7/7
Copper	8/8	2.41E+00	7.25E+00	1.67E+01	0/8	0/8
Iron	7/7	6.41E+03	1.17E+04	2.00E+04	0/7	7/7
Lead	18/29	5.03E+00	2.91E+01	3.60E+02	1/29	0/29
Lithium	6/6	2.41E+00	6.48E+00	9.00E+00	0/6	0/6
Magnesium	7/7	4.15E+02	1.30E+03	2.34E+03	2/7	0/7
Manganese	7/7	3.49E+01	2.07E+02	6.91E+02	0/7	1/7
Nickel	4/8	7.26E+00	9.37E+00	1.19E+01	0/8	2/8
Potassium	7/7	1.53E+02	3.93E+02	6.32E+02	0/7	0/7
Sodium	6/7	6.21E+01	3.00E+02	3.69E+02	3/7	0/7
Strontium	6/6	3.92E+00	1.10E+01	1.68E+01	0/6	0/6
Uranium	12/12	1.00E+00	2.17E+00	3.00E+00	0/12	12/12
Vanadium	8/8	1.16E+01	1.86E+01	2.39E+01	0/8	8/8
Zinc	7/8	1.81E+01	4.90E+01	1.34E+02	2/8	0/8
Organics (mg/kg)						
PCB, Total	1/12	1.80E+01	1.80E+01	1.80E+01	0/12	0/12
Di-n-butyl phthalate	1/2	1.20E+01	1.20E+01	1.20E+01	0/2	0/2
Ethylbenzene	1/22	1.50E-02	1.50E-02	1.50E-02	0/22	0/22
Total Xylene	1/22	5.00E-03	5.00E-03	5.00E-03	0/22	0/22
Radionuclides (pCi/g)						
Americium-241	1/1	2.50E-03	2.50E-03	2.50E-03	0/1	0/1
Americium-243	1/1	1.07E-01	1.07E-01	1.07E-01	0/1	0/1
Cesium-137	2/2	-3.90E-02	1.16E-02	6.21E-02	0/2	1/2
Cobalt-60	1/1	4.58E-03	4.58E-03	4.58E-03	0/1	0/1

Table B1.1.1.3-4. Summary of SWMU 194 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Lead-212	1/1	6.60E-01	6.60E-01	6.60E-01	0/1	0/1
Lead-214	1/1	6.80E-01	6.80E-01	6.80E-01	0/1	0/1
Neptunium-237	1/1	6.81E-03	6.81E-03	6.81E-03	0/1	0/1
Neptunium-239	1/1	-4.03E-02	-4.03E-02	-4.03E-02	0/1	0/1
Plutonium-238	1/1	-7.61E-02	-7.61E-02	-7.61E-02	0/1	0/1
Plutonium-239/240	1/1	1.07E-02	1.07E-02	1.07E-02	0/1	0/1
Potassium-40	2/2	4.74E+00	5.62E+00	6.50E+00	0/2	0/2
Protactinium-234m	1/1	1.90E+00	1.90E+00	1.90E+00	0/1	0/1
Radium-226	1/1	3.33E-01	3.33E-01	3.33E-01	0/1	0/1
Technetium-99	2/2	-6.00E-01	-5.30E-02	4.94E-01	0/2	0/2
Thorium-228	1/1	1.61E-01	1.61E-01	1.61E-01	0/1	0/1
Thorium-230	1/1	1.49E-01	1.49E-01	1.49E-01	0/1	0/1
Thorium-232	1/1	1.28E-01	1.28E-01	1.28E-01	0/1	0/1
Thorium-232 Daughters	1/1	6.50E-01	6.50E-01	6.50E-01	0/1	0/1
Uranium-234	1/1	5.70E-01	5.70E-01	5.70E-01	0/1	0/1
Uranium-235	2/2	1.10E-02	1.43E-02	1.75E-02	0/2	0/2
Uranium-238	1/1	5.90E-01	5.90E-01	5.90E-01	0/1	1/1

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.1.4 SWMU 196, C-746-A Septic System

Data Evaluation and Screening

Historical data for this SWMU from the surface soils include metals, pesticides/PCBs, radionuclides, SVOCs, and VOCs. The data from the shallow subsurface include metals, SVOCs, and VOCs. These data were collected from the following projects:

- Excavation of petroleum-contaminated soil associated with UST #5 EF02-27
- Excavation of petroleum-contaminated soil associated with UST #5—Resample event EF02-30
- Surface Water OU—Activity 1 ISOCS data SWOU05-ISOCS
- Surface Water OU—Outfall 001 Activity 1 EU12 SWOU05-K001A112
- WAG 15
- WAG 15 PAH Sampling
- WAG 27 RI Sampling

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 5 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundaries was selected and assigned to SWMU 196. For use in the RA, data within the SWMU boundary and contingency, or "step-out," sampling were assigned to the SWMU.

Usability of Historical Data

Validation: Validation was performed for 10% of the WAG 15, and WAG 27 projects. The validation qualifiers that have been applied to this data are "=," J, U, and V.

Data Assessment: The assessment qualifiers that have been applied to the data set for SWMU 001 are listed in Table B1.1.1.4-1.

Table B1.1.1.4-1. Assessment Qualifiers Applied to SWMU 196 Historic Data

Assessment Qualifier	Definition
BH-LAB	Result may be biased high; compound is a known or probable laboratory contaminant.
BL-T	Result may be biased low; sample holding time exceeded.
J	Result estimated
U-RAD	Result considered a nondetect; instrument measurement error is equal to or greater than the reported result.

It was noted in the SWOU SI/BRA that data for cesium-137 and uranium-238 were produced using an ISOCS unit, as opposed to a fixed-base laboratory. The data are considered screening level only (its intended purpose) and did not meet data evaluation methods; therefore, they could not be used in the risk assessment (DOE 2008). These data subsequently were removed from the Soils OU data set.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data that had no reported result and no detection limit have been removed from the data set.

There are 19 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. Those chemicals and referenced values are shown in Table B1.1.1.4-2.

Radionuclide Counting Errors

Radionuclide historical data records that have no MDCs and no counting errors reported have been removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Table B1.1.1.4-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 196

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	18.4	0.552	0.21	0.21
Arsenic	mg/kg	17.4	0.238	12	7.9
Beryllium	mg/kg	0.1811	0.00567		
Selenium	mg/kg	35.8	23	0.8	0.7
Silver	mg/kg	4.48	2.61	2.3	2.7
Thallium	mg/kg	0.534	0.368	0.21	0.34
Organics					
PCB-1016	mg/kg	0.1	0.0633		
PCB-1221	mg/kg	0.13	0.0437		
PCB-1232	mg/kg	0.1	0.0437		
PCB-1248	mg/kg	0.1	0.0682		
Benz(a)anthracene	mg/kg	0.5	0.196		
Benzo(a)pyrene	mg/kg	0.5	0.0197		
Benzo(b)fluoranthene	mg/kg	0.5	0.197		
Dibenz(a,h)anthracene	mg/kg	0.5	0.0197		
Indeno(1,2,3-cd)pyrene	mg/kg	0.5	0.197		
1,1-Dichloroethene	mg/kg	1.3	0.0237		
cis-1,2-Dichloroethene	mg/kg	1.3	1.05		
Trichloroethene	mg/kg	1.3	0.0234		
Vinyl chloride	mg/kg	1.3	0.0824		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Assignment of Historical Data to RI Sampling Grids

Each of the historic data points have been assigned to grids that encompass the area of the SWMU. The historic sampling location grid assignments are listed in Table B1.1.1.4-3.

Table B1.1.1.4-3. Stations and Grids for Historical Data from SWMU 196

Station Name	Grid No.
SOU196-002	196-008
SOU196-002	196-009
SOU196-002	196-010
SOU196-002	196-011

Table B1.1.1.4-3. Stations and Grids for Historical Data from SWMU 196 (Continued)

Station Name	Grid No.
SOU196-002	196-013
SOU196-002	196-014
SOU196-002	196-015
SOU196-003	139-001
SOU196-003	139-002
SOU196-003	139-003
SOU196-003	139-004
SOU196-003	139-005
SOU196-003	139-006
SOU196-003	139-008
SOU196-003	139-009
SOU196-003	139-01
SOU196-003	139-02
SOU196-003	139-03
SOU196-003	139-04
SOU196-003	139-05
SOU196-003	139-06
SOU196-003	139-07
SOU196-003	196-001
SOU196-003	196-002
SOU196-003	196-006
SOU196-003	196-017
SOU196-003	UST5-BOTTOM
SOU196-003	UST5-E/SWALL
SOU196-003	UST5-EWALL
SOU196-003	UST5-NBOTTOM
SOU196-003	UST5-SBOTTOM
SOU196-003	UST5-SWALL
SOU196-003	UST5-W/SWALL
SOU196-003	UST5-WWALL
SOU196-004	196-004
SOU196-004	196-007
SOU196-004	OF01A-373

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.1.4-4.

Table B1.1.1.4-4. Summary of SWMU 196 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	72/72	6.21E+02	8.31E+03	1.79E+04	10/72	67/72
Antimony	28/72	2.92E-01	1.97E+01	1.21E+02	28/72	26/72
Arsenic	72/78	1.76E+00	4.12E+00	1.05E+01	1/78	72/78
Barium	78/78	1.84E+01	1.02E+02	3.89E+02	6/78	11/78
Beryllium	69/70	4.90E-02	2.09E+00	1.13E+02	6/70	69/70
Cadmium	38/78	5.50E-02	3.76E+00	1.16E+02	21/78	10/78
Calcium	70/70	5.89E+02	2.21E+04	2.23E+05	15/70	0/70
Chromium	78/78	3.07E+00	1.47E+01	1.12E+02	4/78	22/78
Cobalt	70/70	1.97E-01	6.49E+00	1.12E+02	3/70	68/70
Copper	70/70	1.68E+00	1.14E+01	1.12E+02	3/70	0/70
Iron	70/70	1.10E+02	1.23E+04	2.96E+04	1/70	67/70
Lead	72/78	9.37E-01	1.17E+01	1.16E+02	2/78	0/78
Magnesium	72/72	4.76E+02	2.09E+03	1.00E+04	17/72	0/72
Manganese	70/70	5.68E+01	3.39E+02	1.98E+03	2/70	13/70
Mercury	70/78	9.40E-03	2.73E-02	9.30E-02	0/78	0/78
Nickel	72/72	3.66E+00	3.19E+01	5.87E+02	11/72	48/72
Potassium	67/70	1.26E+02	5.38E+02	6.43E+03	5/70	0/70
Selenium	48/78	1.39E-03	1.60E+00	6.29E+01	3/78	1/78
Silver	16/78	1.93E-01	4.49E+00	6.54E+01	1/78	1/78
Sodium	70/70	8.71E+01	3.02E+02	5.92E+03	8/70	0/70
Thallium	8/70	1.23E-01	1.44E+01	1.14E+02	1/70	1/70
Vanadium	70/70	2.49E+00	2.11E+01	4.38E+01	2/70	70/70
Zinc	72/72	7.12E+00	8.25E+01	1.65E+03	21/72	1/72
Organics (mg/kg)						
PCB, Total	2/12	6.75E-01	1.09E+00	1.51E+00	0/12	2/12
PCB-1242	1/10	6.75E-01	6.75E-01	6.75E-01	0/10	1/10
PCB-1254	1/10	1.06E+00	1.06E+00	1.06E+00	0/10	1/10
PCB-1260	1/10	4.50E-01	4.50E-01	4.50E-01	0/10	1/10
Acenaphthene	6/31	1.70E-01	6.48E-01	1.50E+00	0/31	0/31
Acenaphthylene	2/31	3.47E-01	3.89E-01	4.30E-01	0/31	0/31
Anthracene	5/31	8.50E-01	1.56E+00	2.90E+00	0/31	0/31
Benz(a)anthracene	5/31	2.20E-01	3.06E+00	6.90E+00	0/31	5/31
Benzo(a)pyrene	5/31	2.40E-01	2.83E+00	7.00E+00	0/31	10/31
Benzo(b)fluoranthene	5/31	3.40E-01	3.73E+00	8.70E+00	0/31	5/31
Benzo(ghi)perylene	4/22	4.40E-01	1.76E+00	4.40E+00	0/22	0/22
Benzo(k)fluoranthene	4/31	6.20E-01	1.66E+00	3.10E+00	0/31	1/31

Table B1.1.1.4-4. Summary of SWMU 196 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Chrysene	5/31	2.50E-01	3.21E+00	7.50E+00	0/31	0/31
Decane	1/9	1.71E-01	1.71E-01	1.71E-01	0/9	0/9
Dibenz(a,h)anthracene	3/31	1.40E-01	2.13E-01	2.90E-01	0/31	3/31
Diesel Range Organics	2/9	1.34E+00	1.44E+00	1.53E+00	0/9	0/9
Dodecane	2/9	7.72E-01	1.53E+00	2.28E+00	0/9	0/9
Fluoranthene	10/31	1.50E-01	4.81E+00	1.80E+01	0/31	0/31
Fluorene	8/31	2.50E-01	1.05E+00	2.30E+00	0/31	0/31
Hexadecane	2/9	7.09E-01	1.56E+00	2.41E+00	0/9	0/9
Indeno(1,2,3-cd)pyrene	4/31	4.80E-01	1.90E+00	4.40E+00	0/31	4/31
Naphthalene	2/31	4.30E-01	7.65E-01	1.10E+00	0/31	0/31
Phenanthrene	8/31	3.60E-01	4.23E+00	1.40E+01	0/31	0/31
Pyrene	11/31	1.30E-01	3.42E+00	1.60E+01	0/31	0/31
Tetradecane	2/9	5.00E-02	9.35E-01	1.82E+00	0/9	0/9
Total PAH	6/40	2.96E-01	3.28E+00	9.04E+00	0/40	6/40
Radionuclides (pCi/g)						
Alpha activity	70/70	-3.54E-01	1.01E+01	1.77E+01	0/70	0/70
Uranium-238	1/1	4.50E+00	4.50E+00	4.50E+00	0/1	1/1

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.1.5 SWMU 489, C-710 North Septic Tank

There are no historical data for SWMU 489.

B1.1.1.6 SWMU 531, C-746-A South Aluminum Slag Reacting Area

The historical data presented in the RI Work Plan for SWMU 531 is from the drainage ditch that receives runoff from SWMU 531. The drainage ditch receives runoff from other areas of PGDP upstream of SWMU 531; therefore, the data from the drainage ditch would not be representative of site conditions at SWMU 531, and the data has been removed from the data set. As a result, there is no DQA for the historic data formerly attributed to SWMU 531.

B1.1.2 GROUP 1, STORAGE AREAS

This section presents the DQA analysis for historical data for each of the SWMUs includes in the Group 1, Storage Areas Group.

B1.1.2.1 SWMU 200, Central PGDP TSCA Waste Storage Facility

Data Evaluation and Screening

Historical data for this SWMU from the surface soils only, and include pesticides/PCBs. These data were collected from the RCWC Data project.

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 6 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundaries was selected and assigned to SWMU 200. For use in the RA, data within the SWMU boundary and contingency, or "step-out," sampling were assigned to the SWMU.

Usability of Historical Data

Validation: Validation has not been performed on the historic data associated with this SWMU.

Data Assessment: There have been no assessment qualifiers been applied to data associated with this SWMU.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data that had no reported result and no detection limit have been removed from the data set.

There are no chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL for SWMU 200.

Radionuclide Counting Errors

There are no historic radionuclide data for this SWMU.

Nondetect Result Qualifiers

There were no analyses with nondetected results for this SWMU.

Assignment of Historical Data to RI Sampling Grids

Both of the historic data points have been assigned to grids that were developed during the Soils OU RI sampling effort. The historic sampling location assignment is listed in Table B1.1.2.1-1.

Table B1.1.2.1-1. Stations and Grids for Historical Data from SWMU 200

Station Name	Grid No.
SOU200-002	RC-5538
SOU200-004A	RC-5535

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.2.1-2.

Table B1.1.2.1-2. Summary of SWMU 200 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Organics (mg/kg)						
PCB, Total	2/2	3.00E-01	1.45E+00	2.60E+00	0/2	2/2

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.2.2 SWMU 212, C-745-A Radiological Contamination Area

Data Evaluation and Screening

Historical data for this SWMU from the surface soils include metals, pesticides/PCBs, radionuclides, SVOCs, and VOCs. The data from the shallow subsurface include metals, pesticides/PCBs, SVOCs, and VOCs. These data were collected from the following projects:

- Surface Water OU—Activity 1 ISOCS data SWOU05-ISOCS
- Surface Water OU—Outfall 008 Activity 1 EU04 SWOU05-K008A104
- Surface Water OU—Outfall 008 Activity 1 EU08 SWOU05-K008A108
- Surface Water OU—Outfall 008 Activity 2 EU03 AND EU04 SWOU05-K008A20304
- WAG 23 Phase 1
- WAG 27 RI Sampling

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 6 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundaries was selected and assigned to SWMU 212. For use in the RA, data within the SWMU boundary and contingency, or "step-out," sampling were assigned to the SWMU.

Usability of Historical Data

Validation: Validation was performed for 10% of the WAG 23, and WAG 27 projects. The validation qualifiers that have been applied to this data are "=," J, U, and V.

Data Assessment: The assessment qualifier that has been applied to this data is listed in Table B1.1.2.2-1.

It was noted in the SWOU SI/BRA that data for cesium-137 and uranium-238 were produced using an ISOCS unit, as opposed to a fixed-base laboratory. The data are considered screening level only (its intended purpose) and did not meet data evaluation methods; therefore, they could not be used in the risk assessment (DOE 2008). These data subsequently were removed from the Soils OU data set.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data that had no reported result and no detection limit have been removed from the data set.

Table B1.1.2.2-1. Assessment Qualifiers Applied to SWMU 212 Historic Data

USECNITRIC-CF	During the period from May 2004 to September 2009, the USEC-PGDP laboratory used method RL-7128-NITRIC for isotopic uranium analysis by alpha spec. Method RL-7128-NITRIC utilizes only nitric acid for dissolution rather than hydrofluoric/nitric acid. The use of nitric acid only is a less aggressive dissolution for isotopic uranium analysis by alpha spec. It has been demonstrated that Method RL-7128-NITRIC can be utilized only for isotopic uranium analysis of soil with activity greater than 10 pCi/g due to low recoveries below that level. If the data from Method RL-7128-NITRIC will be screened against the background values reported in *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the PGDP* (1997), the following adjusted background values must be used: U-234: 1.73 pCi/g surface and 1.63 pCi/g subsurface; U-235: 0.10 pCi/g; and U-238: 0.40 pCi/g [*Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant*, Appendix E (2009)]. Risk assessors may use data from this time period for comparison against other thresholds below 10 pCi/g without adjusting the values as long as the level of uncertainty and its impact on the risk assessment/evaluation are adequately discussed. No additional action is required for comparisons to thresholds above 10 pCi/g.

There are 22 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. Those chemicals and referenced values are shown in Table B1.1.2.2-2.

Table B1.1.2.2-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 212

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	9.74	0.552	0.21	0.21
Beryllium	mg/kg	0.48	0.00567		
Cadmium	mg/kg	1.95	0.811	0.21	0.21

Table B1.1.2.2-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 212 (Continued)

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Thallium	mg/kg	19.5	0.368	0.21	0.34
Organics					
PCB, Total	mg/kg	1	0.0648		
PCB-1016	mg/kg	0.1	0.0633		
PCB-1221	mg/kg	0.13	0.0437		
PCB-1232	mg/kg	0.1	0.0437		
PCB-1248	mg/kg	0.1	0.0682		
PCB-1254	mg/kg	0.09	0.0501		
PCB-1260	mg/kg	0.1	0.0662		
2-Nitrobenzenamine	mg/kg	1.65	0.296		
Benz(a)anthracene	mg/kg	0.49	0.196		
Benzo(a)pyrene	mg/kg	0.49	0.0197		
Benzo(b)fluoranthene	mg/kg	0.49	0.197		
Dibenz(a,h)anthracene	mg/kg	0.49	0.0197		
Hexachlorobenzene	mg/kg	0.33	0.0492		
Indeno(1,2,3-cd)pyrene	mg/kg	0.49	0.197		
N-Nitroso-di-n-propylamine	mg/kg	0.33	0.0189		
1,1-Dichloroethene	mg/kg	0.8	0.0237		
Trichloroethene	mg/kg	0.8	0.0234		
Vinyl chloride	mg/kg	0.8	0.0824		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

Radionuclide historical data records that have no MDCs and no counting errors reported have been removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

Each of the historic data points has been assigned to grids developed during the Soils OU RI. The historic sampling location assignments are listed in Table B1.1.2.2-3.

Table B1.1.2.2-3. Stations and Grids for Historical Data from SWMU 212

Station Name	Grid No.
SOU212-001A	OF08A-091
SOU212-001B	OF08A-090
SOU212-001B	OF08B-04-01
SOU212-002B	OF08A-238
SOU212-002C	001-111
SOU212-002C	001-149
SOU212-002C	001-179
SOU212-002C	OF08A-232
SOU212-002C	OF08A-235
SOU212-002C	OF08A-237
SOU212-002D	001-110
SOU212-002D	23-0111
SOU212-002D	23-0145
SOU212-002D	OF08A-229

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.2.2-4.

Table B1.1.2.2-4. Summary of SWMU 212 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Organics (mg/kg)						
Aluminum	5/5	6.63E+03	8.68E+03	9.89E+03	0/5	5/5
Antimony	3/5	5.52E-01	1.02E+00	1.40E+00	3/5	2/5
Arsenic	5/5	1.63E+00	3.89E+00	5.60E+00	0/5	5/5
Barium	5/5	2.87E+01	8.89E+01	1.52E+02	0/5	1/5
Beryllium	4/5	4.54E-01	5.56E-01	6.99E-01	1/5	4/5
Cadmium	2/5	1.27E-01	2.07E-01	2.87E-01	1/5	0/5
Calcium	5/5	6.04E+02	1.35E+03	1.74E+03	0/5	0/5
Chromium	5/5	1.23E+01	2.21E+01	5.62E+01	1/5	1/5
Cobalt	5/5	4.51E+00	6.06E+00	9.87E+00	0/5	5/5
Copper	5/5	6.62E+00	9.67E+00	1.35E+01	0/5	0/5
Iron	5/5	1.04E+04	1.55E+04	2.35E+04	0/5	5/5
Lead	4/5	6.25E+00	8.02E+00	1.02E+01	0/5	0/5
Magnesium	5/5	3.51E+02	1.38E+03	2.16E+03	1/5	0/5
Manganese	5/5	1.25E+02	3.55E+02	5.90E+02	0/5	2/5
Mercury	3/5	2.43E-02	2.63E-02	2.99E-02	0/5	0/5
Nickel	5/5	4.61E+00	1.18E+01	2.68E+01	1/5	2/5
Potassium	5/5	1.92E+02	4.57E+02	6.75E+02	0/5	0/5
Sodium	4/5	5.36E+01	2.40E+02	4.31E+02	2/5	0/5

Table B1.1.2.2-4. Summary of SWMU 212 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Organics (mg/kg)						
Uranium	1/1	3.58E+00	3.58E+00	3.58E+00	0/1	1/1
Vanadium	5/5	2.14E+01	2.87E+01	5.33E+01	1/5	5/5
Zinc	5/5	1.92E+01	3.70E+01	6.70E+01	1/5	0/5
Inorganics (mg/kg)						
PCB, Total	1/15	1.80E-01	1.80E-01	1.80E-01	0/15	1/15
PCB-1254	1/12	1.80E-01	1.80E-01	1.80E-01	0/12	1/12
Radionuclides (pCi/g)						
Americium-241	1/1	1.19E-02	1.19E-02	1.19E-02	0/1	0/1
Cesium-137	4/4	6.01E-01	3.82E+00	8.85E+00	1/4	4/4
Cobalt-60	1/1	8.76E-03	8.76E-03	8.76E-03	0/1	1/1
Neptunium-237	1/1	1.23E-02	1.23E-02	1.23E-02	0/1	0/1
Plutonium-238	1/1	-5.59E-03	-5.59E-03	-5.59E-03	0/1	0/1
Plutonium-239/240	1/1	3.65E-01	3.65E-01	3.65E-01	1/1	0/1
Technetium-99	1/1	1.05E+00	1.05E+00	1.05E+00	0/1	0/1
Thorium-228	1/1	3.77E-01	3.77E-01	3.77E-01	0/1	0/1
Thorium-230	1/1	3.61E+00	3.61E+00	3.61E+00	1/1	0/1
Thorium-232	1/1	4.35E-01	4.35E-01	4.35E-01	0/1	0/1
Uranium	1/1	2.03E+00	2.03E+00	2.03E+00	0/1	1/1
Uranium-234	1/1	4.87E-01	4.87E-01	4.87E-01	0/1	0/1
Uranium-235	1/1	3.73E-02	3.73E-02	3.73E-02	0/1	0/1
Uranium-238	5/5	6.76E-01	1.01E+01	1.50E+01	0/5	5/5

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.2.3 SWMU 213, C-745-A DMSA OS-02

The historical data used in scoping for this project was collected from the drainage ditch that runs alongside the SWMU. The drainage ditch receives runoff from several other areas of PGDP upstream of SWMU 213; therefore, data from the drainage ditch are not likely to be representative of conditions within the boundaries of SWMU 213 and have been removed from the data set.

B1.1.2.4 SWMU 214, C-611, DMSA OS-03, RCRA Closure, NFA Pending

There are no historic data for this SWMU.

B1.1.2.5 SWMU 215, C-743, DMSA OS-04, Rail Car Tank

There are no historic data for this SWMU.

B1.1.2.6 SWMU 216, C-206 DMSA OS-05 RCRA Closure, NFA Pending

Data Evaluation and Screening

Historical data for this SWMU from the surface soils include pesticides/PCBs and radionuclides. No historical data for SWMU 216 from the shallow subsurface is available. The data are from the following projects:

- Surface Water OU—Activity 1 ISOCS data SWOU05-ISOCS
- Surface Water OU—Outfall 008 Activity 1 EU09 SWOU05-K008A109

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 6 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundaries was selected and assigned to SWMU 216. For use in the RA, data within the SWMU boundary and contingency, or "step-out," sampling were assigned to the SWMU.

Usability of Historical Data

Validation: No validation qualifiers have been applied to the data from SWMU 216.

Data Assessment: No assessment qualifiers have been applied to this data.

It was noted in the SWOU SI/BRA that data for cesium-137 and uranium-238 were produced using an ISOCS unit, as opposed to a fixed-base laboratory. The data are considered screening level only (its intended purpose) and did not meet data evaluation methods; therefore, they could not be used in the risk assessment (DOE 2008). These data subsequently were removed from the Soils OU data set.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data that had no reported result and no detection limit have been removed from the data set.

There are seven chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. Those chemicals and referenced values are shown in Table B1.1.2.6-1.

Radionuclide Counting Errors

Radionuclide historical data records that have no MDCs and no counting errors reported have been removed from the data set.

Table B1.1.2.6-1. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 216

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Organics					
PCB, Total	mg/kg	0.13	0.0648		
PCB-1016	mg/kg	0.1	0.0633		
PCB-1221	mg/kg	0.13	0.0437		
PCB-1232	mg/kg	0.1	0.0437		
PCB-1248	mg/kg	0.1	0.0682		
PCB-1254	mg/kg	0.09	0.0501		
PCB-1260	mg/kg	0.1	0.0662		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data location has been assigned to a gird that was developed during the Soils OU RI. The historic sampling location assignment is listed in Table B1.1.2.6-2.

Table B1.1.2.6-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 216

Station Name	Grid No.
SOU216-001	OF08A-264

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.2.6-3.

Table B1.1.2.6-3. Summary of SWMU 216 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Radionuclides (pCi/g)						
Cesium-137	1/1	7.60E-01	7.60E-01	7.60E-01	0/1	1/1
Uranium-238	1/1	1.75E+00	1.75E+00	1.75E+00	0/1	1/1

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection; NAL = no action level

B1.1.2.7 SWMU 217, C-740 DMSA OS-06 RCRA Closure, NFA Pending

Data Evaluation and Screening

Historical data for this SWMU from the surface soils include metals, pesticides/PCBs, radionuclides, SVOCs, and VOCs. Historical data from the shallow subsurface include metals, pesticides/PCBs, SVOCs, and VOCs. The data are from the following projects:

- C-733 Sprinkler System Installation SM02-02
- WAGs 1 and 7

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 6 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundaries was selected and assigned to SWMU 217. For use in the RA, data within the SWMU boundary and contingency, or "step-out," sampling were assigned to the SWMU.

Usability of Historical Data

Validation: Validation was performed for 10% of the WAGs 1 and 7 project. The validation qualifiers that have been applied to this data are "?," J, and U.

Data Assessment: No assessment qualifiers have been applied to this data.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data that had no reported result and no detection limit have been removed from the data set.

There are 14 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. Those chemicals and referenced values are shown in Table B1.1.2.7-1.

Table B1.1.2.7-1. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 217

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	20	0.552	0.21	0.21
Arsenic	mg/kg	5	0.238		
Beryllium	mg/kg	0.5	0.00567		

Table B1.1.2.7-1. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 217 (Continued)

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Cadmium	mg/kg	2	0.811	0.21	0.21
Silver	mg/kg	4	2.61	2.3	2.7
Thallium	mg/kg	20	0.368	0.21	0.34
Uranium	mg/kg	200	13.8	4.9	4.6
Organics					
PCB, Total	mg/kg	0.1	0.0648		
PCB-1221	mg/kg	0.1	0.0437		
PCB-1232	mg/kg	0.09	0.0437		
PCB-1242	mg/kg	0.07	0.0644		
PCB-1248	mg/kg	0.08	0.0682		
PCB-1254	mg/kg	0.06	0.0501		
PCB-1260	mg/kg	0.09	0.0662		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

Radionuclide historical data records that have no MDCs and no counting errors reported have been removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data have been assigned to the grids that were developed during the RI field effort. The historic sampling location assignments are as listed in Table B1.1.2.7-2.

Table B1.1.2.7-2. Stations and Grids for Historical Data from SWMU 217

Station Name	Grid No.
SOU217-005F	C733003
SOU217-016B	36-SB-001
SOU217-016B	36-SB-002
SOU217-016B	36-SO-001
SOU217-016B	36-SO-002

Table B1.1.2.7-2. Stations and Grids for Historical Data from SWMU 217 (Continued)

Station Name	Grid No.
SOU217-016F	36-SB-004
SOU217-016F	36-SB-005
SOU217-017	36-SB-003
SOU217-017	36-SO-003

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.2.7-3.

Table B1.1.2.7-3. Summary of SWMU 217 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	24/24	3.84E+03	9.47E+03	1.44E+04	6/24	23/24
Antimony	5/23	1.70E+00	2.44E+00	3.10E+00	5/23	5/23
Arsenic	15/19	1.20E+00	3.39E+00	6.10E+00	0/19	15/19
Barium	24/24	3.14E+01	7.80E+01	1.53E+02	0/24	1/24
Beryllium	22/24	2.00E-01	4.30E-01	8.80E-01	1/24	22/24
Cadmium	2/24	2.60E-01	2.65E-01	2.70E-01	2/24	0/24
Calcium	24/24	4.84E+02	2.24E+03	2.58E+04	0/24	0/24
Chromium	24/24	7.90E+00	1.43E+01	2.90E+01	1/24	9/24
Cobalt	23/24	2.00E+00	6.83E+00	2.70E+01	3/24	23/24
Copper	24/24	1.90E+00	6.03E+00	1.74E+01	0/24	0/24
Iron	24/24	6.02E+03	1.32E+04	2.89E+04	1/24	24/24
Kjeldahl Nitrogen	1/1	3.20E+00	3.20E+00	3.20E+00	0/1	0/1
Lead	23/24	3.60E+00	7.53E+00	1.29E+01	0/24	0/24
Magnesium	24/24	1.72E+02	1.13E+03	2.05E+03	0/24	0/24
Manganese	23/24	3.94E+01	2.56E+02	8.56E+02	0/24	4/24
Mercury	3/24	3.90E-01	1.33E+00	3.20E+00	3/24	3/24
Nickel	24/24	2.40E+00	8.51E+00	2.01E+01	0/24	5/24
Potassium	23/23	1.15E+02	3.90E+02	6.46E+02	0/23	0/23
Selenium	5/15	1.60E-01	7.54E-01	1.67E+00	2/15	0/15
Sodium	23/23	3.69E+01	2.21E+02	6.30E+02	2/23	0/23
Thallium	1/24	1.40E-01	1.40E-01	1.40E-01	0/24	0/24
Vanadium	23/24	8.90E+00	2.04E+01	3.79E+01	1/24	23/24
Zinc	24/24	9.00E+00	2.07E+01	4.01E+01	0/24	0/24

Table B1.1.2.7-3. Summary of SWMU 217 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Organics (mg/kg)						
Ammonia as Nitrogen	1/1	9.90E-01	9.90E-01	9.90E-01	0/1	0/1
Cyanide	10/12	2.83E-01	4.58E-01	6.38E-01	0/12	0/12
Sulfate	1/1	9.72E+02	9.72E+02	9.72E+02	0/1	0/1
Benz(a)anthracene	1/23	3.80E-01	3.80E-01	3.80E-01	0/23	1/23
Benzo(a)pyrene	1/23	5.20E-01	5.20E-01	5.20E-01	0/23	2/23
Benzo(b)fluoranthene	1/23	6.40E-01	6.40E-01	6.40E-01	0/23	1/23
Benzo(ghi)perylene	1/23	2.70E-01	2.70E-01	2.70E-01	0/23	0/23
Benzo(k)fluoranthene	1/23	2.30E-01	2.30E-01	2.30E-01	0/23	0/23
Bis(2-ethylhexyl)phthalate	1/23	1.00E-01	1.00E-01	1.00E-01	0/23	0/23
Chrysene	1/23	4.50E-01	4.50E-01	4.50E-01	0/23	0/23
Dibenz(a,h)anthracene	1/23	8.10E-02	8.10E-02	8.10E-02	0/23	1/23
Di-n-butyl phthalate	1/23	2.20E-01	2.20E-01	2.20E-01	0/23	0/23
Fluoranthene	1/23	3.40E-01	3.40E-01	3.40E-01	0/23	0/23
Indeno(1,2,3-cd)pyrene	1/23	3.10E-01	3.10E-01	3.10E-01	0/23	1/23
Phenanthrene	1/23	7.90E-02	7.90E-02	7.90E-02	0/23	0/23
Pyrene	1/23	2.80E-01	2.80E-01	2.80E-01	0/23	0/23
Total PAH	1/23	7.37E-01	7.37E-01	7.37E-01	0/23	1/23
1,1,1-Trichloroethane	1/23	6.10E-01	6.10E-01	6.10E-01	0/23	0/23
1,1-Dichloroethene	2/23	1.50E-02	2.25E-02	3.00E-02	0/23	1/23
1,2-Dichloroethane	1/23	1.20E-02	1.20E-02	1.20E-02	0/23	0/23
Acetone	3/23	2.30E-02	4.67E-02	7.10E-02	0/23	0/23
Benzene	5/23	2.00E-03	4.40E-03	1.00E-02	0/23	0/23
Ethylbenzene	1/23	2.00E-03	2.00E-03	2.00E-03	0/23	0/23
Methylene chloride	1/23	1.20E-02	1.20E-02	1.20E-02	0/23	0/23
Toluene	1/23	7.00E-03	7.00E-03	7.00E-03	0/23	0/23
Total Xylene	1/23	1.70E-02	1.70E-02	1.70E-02	0/23	0/23
Trichloroethene	3/23	2.00E-03	6.67E-03	1.40E-02	0/23	0/23

Table B1.1.2.7-3. Summary of SWMU 217 Detected Chemicals (Continued)

Chemical		FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]
Radionuclides (pCi/g)						
Americium-241	1/1	1.81E-02	1.81E-02	1.81E-02	0/1	0/1
Cesium-134	1/1	2.90E-03	2.90E-03	2.90E-03	0/1	0/1
Cesium-137	1/1	-1.17E-02	-1.17E-02	-1.17E-02	0/1	0/1
Cobalt-60	1/1	-2.72E-03	-2.72E-03	-2.72E-03	0/1	0/1
Neptunium-237	1/1	1.46E-02	1.46E-02	1.46E-02	0/1	0/1
Plutonium-238	1/1	-5.64E-02	-5.64E-02	-5.64E-02	0/1	0/1
Plutonium-239/240	1/1	-5.54E-03	-5.54E-03	-5.54E-03	0/1	0/1
Technetium-99	1/1	1.89E+00	1.89E+00	1.89E+00	0/1	0/1
Thorium-228	1/1	4.20E-01	4.20E-01	4.20E-01	0/1	0/1
Thorium-230	1/1	4.38E-01	4.38E-01	4.38E-01	0/1	0/1
Thorium-232	1/1	4.04E-01	4.04E-01	4.04E-01	0/1	0/1
Uranium-234	1/1	9.24E-01	9.24E-01	9.24E-01	0/1	0/1
Uranium-235	1/1	4.38E-02	4.38E-02	4.38E-02	0/1	0/1
Uranium-238	1/1	7.72E-01	7.72E-01	7.72E-01	0/1	1/1

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.2.8 SWMU 221, C-635 DMSA OS-10

Data Evaluation and Screening

Historical data for this SWMU from the surface soils includes PCBs. There is no shallow subsurface data available for this SWMU. The data are from the following project:

- Historical data from AnaLIS for WAG 28 DQO

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 8 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundaries was selected and assigned to SWMU 221. For use in the RA, data within the SWMU boundary and contingency, or "step-out," sampling were assigned to the SWMU.

Usability of Historical Data

Validation: Validation was performed for 10% of the WAG 28 project. The validation qualifier that has been applied to this data is "?."

Data Assessment: No assessment qualifiers have been applied to this data.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data that had no reported result, and no detection limit have been removed from the data set.

There are no chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL.

Radionuclide Counting Errors

There are no radionuclide data for this SWMU.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data have been assigned to the grids that were developed during the RI field effort. The historic sampling location assignments are listed in Table B1.1.2.8-1.

Table B1.1.2.8-1. Stations and Grids for Historical Data from SWMU 221

Station Name	Grid No.
WC-2423	SOU221-001A

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.2.8-2.

Table B1.1.2.8-2. Summary of SWMU 221 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Organics (mg/kg)						
PCB, Total	1/1	5.00E-01	5.00E-01	5.00E-01	/1	1/1
PCB-1254	1/1	5.00E-01	5.00E-01	5.00E-01	/1	1/1

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.2.9 SWMU 222, C-635 DMSA OS-11 RCRA Closure, NFA pending

Data Evaluation and Screening

No historical data are available for this SWMU from the surface soils. The shallow subsurface soils include metals, PCBs, and radionuclides. The data are from the following project:

- WAGs 9 and 11 Site Evaluation

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 8 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundaries was selected and assigned to SWMU 222.

Usability of Historical Data

Validation: Validation was performed for 10% of the WAGs 9 and 11. The validation qualifiers that have been applied to this data are "=," U, and V.

Data Assessment: Data Assessment: The assessment qualifiers that have been applied to the data set for SWMU 222 are shown in Table B1.1.2.9-1.

Table B1.1.2.9-1. Assessment Qualifiers Applied to SWMU 222 Historic Data

KYRHTAB-50	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the rad error accounts for greater than 50% of the results.
KYRHTAB-OK	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the data is acceptable for use.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data that had no reported result and no detection limit have been removed from the data set.

There are no chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL.

Radionuclide Counting Errors

Radionuclide historical data records that have no MDCs and no counting errors reported have been removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data have been assigned to the grids that were developed during the RI field effort. The historic sampling location assignments are listed in Table B1.1.2.9-2.

Table B1.1.2.9-2. Stations and Grids for Historical Data from SWMU 222

Station Name	Grid No.
SOU222-001C	020-015
SOU222-001C	020-016
SOU222-001D	020-017
SOU222-001J	020-012

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.2.9-3.

Table B1.1.2.9-3. Summary of SWMU 222 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	5/5	1.08E+04	1.22E+04	1.42E+04	2/5	5/5
Arsenic	5/5	4.00E+00	6.70E+00	8.80E+00	1/5	5/5
Barium	5/5	8.35E+01	9.41E+01	1.07E+02	0/5	0/5
Beryllium	5/5	4.10E-01	4.94E-01	5.90E-01	0/5	5/5
Calcium	5/5	1.03E+03	8.36E+03	1.75E+04	3/5	0/5
Chromium	5/5	1.28E+01	1.54E+01	1.99E+01	0/5	1/5
Cobalt	5/5	5.80E+00	7.58E+00	1.01E+01	0/5	5/5
Copper	5/5	9.70E+00	1.43E+01	1.74E+01	0/5	0/5
Iron	5/5	1.62E+04	1.78E+04	1.96E+04	0/5	5/5
Lead	5/5	7.40E+00	9.88E+00	1.22E+01	0/5	0/5
Magnesium	5/5	1.63E+03	2.16E+03	2.67E+03	2/5	0/5
Manganese	5/5	2.66E+02	3.72E+02	6.05E+02	0/5	2/5
Nickel	5/5	1.01E+01	1.35E+01	1.62E+01	0/5	4/5
Potassium	5/5	4.69E+02	5.68E+02	7.21E+02	0/5	0/5
Sodium	5/5	1.65E+02	2.13E+02	3.24E+02	0/5	0/5
Vanadium	5/5	1.91E+01	2.07E+01	2.25E+01	0/5	5/5
Zinc	5/5	3.55E+01	5.15E+01	5.95E+01	0/5	0/5
Organics (mg/kg)						
PCB, Total	5/5	8.00E-02	2.24E-01	6.00E-01	0/5	5/5
PCB-1254	5/5	6.30E-02	1.79E-01	4.86E-01	0/5	5/5

Table B1.1.2.9-3. Summary of SWMU 222 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Organics (mg/kg)						
PCB-1260	5/5	1.70E-02	4.40E-02	1.10E-01	0/5	1/5
Radionuclides (pCi/g)						
Americium-241	1/1	2.51E-02	2.51E-02	2.51E-02	0/1	0/1
Cesium-137	1/1	-1.43E-02	-1.43E-02	-1.43E-02	0/1	0/1
Cobalt-60	1/1	6.54E-03	6.54E-03	6.54E-03	0/1	1/1
Neptunium-237	1/1	-1.59E-02	-1.59E-02	-1.59E-02	0/1	0/1
Uranium-234	1/1	1.77E+00	1.77E+00	1.77E+00	1/1	0/1
Uranium-238	1/1	1.43E+00	1.43E+00	1.43E+00	1/1	1/1

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.2.10 SWMU 227, C-745-B DMSA OS-16, RCRA Closure, NFA Pending

Data Evaluation and Screening

Historical data for this SWMU from the surface soils include metals, PCBs, radionuclides, SVOCs and VOCs. Historical data for this SWMU from the shallow subsurface include metals, PCBs, radionuclides, SVOCs and VOCs. The data is from the following projects:

- Characterization of Drainage Ditches SY01-DCH
- Remedial Action SI—Phase 1
- Surface Water OU— Activity 1 ISOCS data SWOU05-ISOCS
- Surface Water OU—Outfall 001 Activity 1 EU09 SWOU05-K001A109
- Surface Water OU—Outfall 001 Activity 1 EU11 SWOU05-K001A111
- Surface Water OU—Outfall 001 Activity 1 EU12 SWOU05-K001A112
- Surface Water OU—Outfall 001 Activity 1 EU13 SWOU05-K001A113
- Surface Water OU—Outfall 001 Activity 2 EU09 AND EU10 SWOU05-K001A20910
- Surface Water OU—Outfall 001 Activity 2 EU11 AND EU12 SWOU05-K001A21112
- WAG 3—SWMU 5
- WAG 3—SWMU 6

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 6 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundaries was selected and assigned to SWMU 227. For use in the RA, data within the SWMU boundary and contingency, or "step-out," sampling were assigned to the SWMU.

Usability of Historical Data

Validation: Validation was performed for 10% of the Phase 1 project. The validation qualifiers that have been applied to this data are "?," "=," J, and N.

Data Assessment: Data Assessment: The assessment qualifiers that have been applied to the data set for SWMU 227 are listed in Table B1.1.2.10-1.

It was noted in the SWOU SI/BRA that data for cesium-137 and uranium-238 were produced using an ISOCS unit, as opposed to a fixed-base laboratory. The data are considered screening level only (its intended purpose) and did not meet data evaluation methods; therefore, they could not be used in the risk assessment (DOE 2008). These data subsequently were removed from the Soils OU data set.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data that had no reported result and no detection limit have been removed from the data set.

There are 26 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. A summary of those chemicals is presented in Table B1.1.2.10-2.

Table B1.1.2.10-1. Assessment Qualifiers Applied to SWMU 227 Historic Data

KYRHTAB-50	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the rad error accounts for greater than 50% of the results.
KYRHTAB-OK	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the data is acceptable for use.
USECNITRIC-CF	During the period from May 2004 to September 2009, the USEC-PGDP laboratory used method RL-7128-NITRIC for isotopic uranium analysis by alpha spec. Method RL-7128-NITRIC utilizes only nitric acid for dissolution rather than hydrofluoric/nitric acid. The use of nitric acid only is a less aggressive dissolution for isotopic uranium analysis by alpha spec. It has been demonstrated that Method RL-7128-NITRIC can be utilized only for isotopic uranium analysis of soil with activity greater than 10 pCi/g due to low recoveries below that level. If the data from Method RL-7128-NITRIC will be screened against the background values reported in *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the PGDP* (1997), the following adjusted background values must be used: U-234: 1.73 pCi/g surface and 1.63 pCi/g subsurface; U-235: 0.10 pCi/g; and U-238: 0.40 pCi/g [*Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant*, Appendix E (2009)]. Risk assessors may use data from this time period for comparison against other thresholds below 10 pCi/g without adjusting the values as long as the level of uncertainty and its impact on the risk assessment/evaluation are adequately discussed. No additional action is required for comparisons to thresholds above 10 pCi/g.

Table B1.1.2.10-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 227

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	20	0.552	0.21	0.21

Table B1.1.2.10-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 227 (Continued)

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Arsenic	mg/kg	5	0.238		
Beryllium	mg/kg	0.5	0.00567		
Cadmium	mg/kg	2	0.811	0.21	0.21
Cobalt	mg/kg	2.5	1.37		
Silver	mg/kg	4	2.61	2.3	2.7
Thallium	mg/kg	20	0.368	0.21	0.34
Uranium	mg/kg	200	13.8	4.9	4.6
Organics					
Dieldrin	mg/kg	0.02	0.0106		
PCB, Total	mg/kg	105	0.0648		
PCB-1016	mg/kg	105	0.0633		
PCB-1221	mg/kg	0.13	0.0437		
PCB-1232	mg/kg	0.105	0.0437		
PCB-1242	mg/kg	0.105	0.0644		
PCB-1248	mg/kg	0.105	0.0682		
PCB-1254	mg/kg	0.2	0.0501		
PCB-1260	mg/kg	0.2	0.0662		
2-Nitrobenzenamine	mg/kg	2.1	0.296		
Benz(a)anthracene	mg/kg	0.5	0.196		
Benzo(a)pyrene	mg/kg	0.5	0.0197		
Benzo(b)fluoranthene	mg/kg	0.5	0.197		
Dibenz(a,h)anthracene	mg/kg	0.5	0.0197		
Hexachlorobenzene	mg/kg	0.5	0.0492		
Indeno(1,2,3-cd)pyrene	mg/kg	0.5	0.197		
N-Nitroso-di-n-propylamine	mg/kg	0.5	0.0189		
Vinyl chloride	mg/kg	21	0.0824		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

Radionuclide historical data records that have no MDCs and no counting errors reported have been removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data have been assigned to the grids that were developed during the RI field effort. The historic sampling location assignments are as listed in Table B1.1.2.10-3.

Table B1.1.2.10-3. Stations and Grids for Historical Data from SWMU 227

Station Name	Grid No.
SOU227-001	006-003
SOU227-019	H001
SOU227-020	OF01A-368
SOU227-025	OF01B-09-01
SOU227-028	OF01A-248
SOU227-029	OF01A-249
SOU227-030	OF01A-250
SOU227-032	OF01A-251
SOU227-033	OF01A-252
SOU227-033	OF01B-09-03
SOU227-034	OF01A-253
SOU227-035	006-021
SOU227-035	006-022
SOU227-036	SYD013
SOU227-041	OF01A-254
SOU227-043	SYD014
SOU227-053	005-004
SOU227-053	OF01A-320
SOU227-053	OF01A-322
SOU227-053	OF01A-323
SOU227-054	OF01A-324
SOU227-054	OF01A-325
SOU227-054	OF01A-326
SOU227-055	OF01A-328
SOU227-055	OF01A-329
SOU227-055	OF01A-330
SOU227-056	OF01A-331
SOU227-056	OF01B-11-04
SOU227-057	OF01A-333
SOU227-057	OF01A-334

Table B1.1.2.10-3. Stations and Grids for Historical Data from SWMU 227 (Continued)

Station Name	Grid No.
SOU227-058	OF01A-335
SOU227-058	OF01A-336
SOU227-058	OF01A-337
SOU227-059	OF01A-339
SOU227-059	OF01A-340
SOU227-059	OF01A-341
SOU227-060	OF01A-342
SOU227-060	OF01A-343
SOU227-060	OF01A-344
SOU227-063	OF01A-351
SOU227-063	OF01A-352
SOU227-063	OF01A-353
SOU227-064	OF01A-354
SOU227-064	OF01A-355
SOU227-064	OF01A-356
SOU227-065	OF01A-357
SOU227-065	OF01A-358
SOU227-065	OF01A-359
SOU227-065	OF01B-12-03
SOU227-066	OF01A-360
SOU227-066	OF01A-361
SOU227-066	OF01A-362
SOU227-067	OF01A-363
SOU227-067	OF01A-366
SOU227-067	OF01A-374
SOU227-067	OF01B-12-04
SOU227-068	OF01A-377
SOU227-068	OF01A-378
SOU227-069	OF01A-379
SOU227-069	OF01A-380
SOU227-069	OF01A-381
SOU227-069	OF01A-382
SOU227-070	OF01A-383
SOU227-070	OF01A-384
SOU227-070	OF01A-385

Table B1.1.2.10-3. Stations and Grids for Historical Data from SWMU 227 (Continued)

Station Name	Grid No.
SOU227-071	OF01A-386
SOU227-071	OF01A-387
SOU227-071	OF01A-388
SOU227-072	OF01A-389
SOU227-072	OF01A-390
SOU227-072	OF01A-391
SOU227-073	OF01A-392
SOU227-073	OF01A-393
SOU227-073	OF01A-394
SOU227-074	OF01A-395
SOU227-074	OF01A-396
SOU227-075	OF01A-397
SOU227-075	OF01A-398
SOU227-075	OF01A-399
SOU227-075	OF01A-400

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.2.10-4.

Table B1.1.2.10-4. Summary of SWMU 227 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	15/15	5.01E+03	8.09E+03	1.17E+04	0/15	15/15
Arsenic	4/15	3.30E+00	4.52E+00	5.70E+00	0/15	4/15
Barium	15/15	4.07E+01	8.00E+01	1.97E+02	1/15	1/15
Beryllium	6/15	5.00E-01	6.28E-01	9.00E-01	2/15	6/15
Calcium	15/15	1.06E+03	1.44E+04	7.35E+04	1/15	0/15
Chromium	15/15	7.38E+00	1.15E+01	1.82E+01	1/15	3/15
Cobalt	14/15	2.61E+00	5.45E+00	1.48E+01	1/15	14/15
Copper	15/15	5.72E+00	8.33E+00	1.73E+01	0/15	0/15
Iron	15/15	6.08E+03	1.19E+04	1.84E+04	0/15	15/15
Lead	2/15	1.04E+01	1.16E+01	1.28E+01	0/15	0/15
Magnesium	15/15	6.96E+02	1.47E+03	2.72E+03	1/15	0/15
Manganese	15/15	1.11E+02	3.85E+02	1.15E+03	1/15	5/15
Molybdenum	1/6	5.21E+00	5.21E+00	5.21E+00	0/6	0/6
Nickel	14/15	7.20E+00	1.21E+01	2.18E+01	0/15	8/15

Table B1.1.2.10-4. Summary of SWMU 227 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Potassium	12/13	2.18E+02	4.15E+02	7.18E+02	0/13	0/13
Selenium	1/15	1.37E+00	1.37E+00	1.37E+00	1/15	0/15
Sodium	9/13	1.22E+02	2.07E+02	2.75E+02	0/13	0/13
Uranium	6/8	1.09E+00	4.98E+00	1.24E+01	2/8	0/8
Vanadium	15/15	1.04E+01	2.13E+01	3.92E+01	1/15	15/15
Zinc	14/15	1.31E+01	4.31E+01	9.10E+01	2/15	0/15
Organics (mg/kg)						
PCB, Total	53/86	1.20E-01	1.60E+00	1.26E+01	0/86	53/86
PCB-1254	23/87	1.20E-01	1.71E+00	6.99E+00	0/87	23/87
PCB-1260	52/87	1.00E-01	8.73E-01	5.65E+00	0/87	52/87
Benz(a)anthracene	2/17	1.18E-01	1.18E-01	1.18E-01	0/17	0/17
Benzo(a)pyrene	2/17	2.77E-01	2.77E-01	2.77E-01	0/17	4/17
Benzo(b)fluoranthene	3/17	2.84E-01	4.06E-01	6.50E-01	0/17	3/17
Benzo(ghi)perylene	2/17	1.17E-01	1.17E-01	1.17E-01	0/17	0/17
Benzo(k)fluoranthene	2/15	4.50E-01	4.50E-01	4.50E-01	0/15	0/15
Chrysene	3/17	2.17E-01	3.51E-01	6.20E-01	0/17	0/17
Di-n-butyl phthalate	4/9	7.40E-01	7.80E-01	8.60E-01	0/9	0/9
Fluoranthene	4/15	2.49E-01	5.85E-01	1.20E+00	0/15	0/15
Indeno(1,2,3-cd)pyrene	2/17	1.59E-01	1.59E-01	1.59E-01	0/17	0/17
Phenanthrene	1/17	6.40E-01	6.40E-01	6.40E-01	0/17	0/17
Pyrene	4/17	2.69E-01	4.65E-01	8.30E-01	0/17	0/17
Total PAH	2/16	6.56E-02	2.02E-01	3.38E-01	0/16	0/16
Trichloroethene	2/14	1.10E-03	2.45E-03	3.80E-03	0/14	0/14
Radionuclides (pCi/g)						
Americium-241	10/10	-1.08E-01	-1.13E-02	4.22E-02	0/10	0/10
Cesium-134	2/2	2.76E-03	2.80E-03	2.84E-03	0/2	0/2
Cesium-137	11/11	-3.80E-02	2.31E-01	1.48E+00	0/11	4/11
Cobalt-60	8/8	-3.18E-02	3.59E-03	3.47E-02	0/8	4/8
Neptunium-237	10/10	-4.40E-03	1.74E-02	5.49E-02	0/10	0/10
Plutonium-238	7/7	-1.31E-02	-8.31E-04	1.36E-02	0/7	0/7
Plutonium-239/240	10/10	-1.53E-02	-3.65E-03	2.56E-02	1/10	0/10
Radium-226	2/2	1.15E+00	1.38E+00	1.60E+00	1/2	0/2

Table B1.1.2.10-4. Summary of SWMU 227 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Radionuclides (pCi/g)						
Technetium-99	12/12	-5.34E-01	4.55E+00	1.39E+01	7/12	0/12
Thorium-228	8/8	1.85E-01	3.34E-01	5.24E-01	0/8	0/8
Thorium-230	8/8	1.66E-01	3.67E-01	6.43E-01	0/8	0/8
Thorium-232	8/8	2.01E-01	3.61E-01	5.46E-01	0/8	0/8
Thorium-234	2/2	6.09E-01	6.17E-01	6.24E-01	0/2	0/2
Uranium	6/6	1.08E+00	4.85E+00	1.77E+01	2/6	1/6
Uranium-234	8/8	2.62E-01	7.21E-01	1.93E+00	1/8	0/8
Uranium-235	8/8	4.78E-03	4.63E-02	1.49E-01	2/8	1/8
Uranium-238	19/19	3.59E-01	5.83E+00	1.67E+01	3/19	16/19

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection; NAL = no action level

B1.1.2.11 SWMU 228, C-747-B DMSA OS-17

Data Evaluation and Screening

There is no historical data for this SWMU from the surface soils. Historical data for this SWMU from the shallow subsurface include metals, PCBs, and radionuclides. The data is from the following project:

- Burial Ground OU SWMU 6 Angle Borings BGOU07-SWMU6ASB1

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 6 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundaries was selected and assigned to SWMU 228. For use in the RA, data within the SWMU boundary and contingency, or "step-out," sampling were assigned to the SWMU.

Usability of Historical Data

Validation: Validation was performed for 10% of the Burial Grounds project. The validation qualifiers that have been applied to this data are "=," J, and U.

Data Assessment: Data Assessment: The assessment qualifier that has been applied to the data set for SWMU 228 is listed in Table B1.1.2.11-1.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data that had no reported result and no detection limit have been removed from the data set.

Table B1.1.2.11-1. Assessment Qualifiers Applied to SWMU 228 Historic Data

USECNITRIC-CF	During the period from May 2004 to September 2009, the USEC-PGDP laboratory used method RL-7128-NITRIC for isotopic uranium analysis by alpha spec. Method RL-7128-NITRIC utilizes only nitric acid for dissolution rather than hydrofluoric/nitric acid. The use of nitric acid only is a less aggressive dissolution for isotopic uranium analysis by alpha spec. It has been demonstrated that Method RL-7128-NITRIC can be utilized only for isotopic uranium analysis of soil with activity greater than 10 pCi/g due to low recoveries below that level. If the data from Method RL-7128-NITRIC will be screened against the background values reported in *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the PGDP* (1997), the following adjusted background values must be used: U-234: 1.73 pCi/g surface and 1.63 pCi/g subsurface; U-235: 0.10 pCi/g; and U-238: 0.40 pCi/g [*Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant*, Appendix E (2009)]. Risk assessors may use data from this time period for comparison against other thresholds below 10 pCi/g without adjusting the values as long as the level of uncertainty and its impact on the risk assessment/evaluation are adequately discussed. No additional action is required for comparisons to thresholds above 10 pCi/g.

There are 12 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. A summary of those chemicals is presented in Table B1.1.2.11-2.

Table B1.1.2.11-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 228

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	9.72	0.552	0.21	0.21
Beryllium	mg/kg	0.494	0.00567		
Cadmium	mg/kg	1.98	0.811	0.21	0.21
Thallium	mg/kg	1.98	0.368	0.21	0.34
Organics					
PCB, Total	mg/kg	0.1	0.0648		
PCB-1016	mg/kg	0.1	0.0633		
PCB-1221	mg/kg	0.1	0.0437		
PCB-1232	mg/kg	0.1	0.0437		
PCB-1242	mg/kg	0.1	0.0644		
PCB-1248	mg/kg	0.1	0.0682		
PCB-1254	mg/kg	0.1	0.0501		
PCB-1260	mg/kg	0.1	0.0662		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

Radionuclide historical data records that have no MDCs and no counting errors reported have been removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data have been assigned to the grids that were developed during the RI field effort. The historic sampling location assignments are listed in Table B1.1.2.11-3.

Table B1.1.2.11-3. Stations and Grids for Historical Data from SWMU 228

Station Name	Grid No.
SOU228-002	006-102

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.2.11-4.

Table B1.1.2.11-4. Summary of SWMU 228 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Organics (mg/kg)						
Aluminum	3/3	8.10E+03	8.73E+03	9.55E+03	0/3	3/3
Arsenic	3/3	1.53E+00	3.01E+00	5.94E+00	0/3	3/3
Barium	3/3	6.44E+01	7.16E+01	8.42E+01	0/3	0/3
Calcium	3/3	9.42E+02	1.13E+03	1.37E+03	0/3	0/3
Chromium	3/3	1.15E+01	1.45E+01	1.90E+01	0/3	1/3
Cobalt	3/3	4.23E+00	4.64E+00	5.00E+00	0/3	3/3
Copper	3/3	4.81E+00	7.55E+00	1.30E+01	0/3	0/3
Iron	3/3	7.83E+03	1.01E+04	1.45E+04	0/3	3/3
Lead	3/3	7.12E+00	7.68E+00	8.80E+00	0/3	0/3
Magnesium	3/3	9.18E+02	1.12E+03	1.40E+03	0/3	0/3
Manganese	3/3	2.16E+02	2.60E+02	2.88E+02	0/3	0/3
Nickel	3/3	7.56E+00	9.38E+00	1.29E+01	0/3	1/3
Uranium	1/3	1.02E+00	1.02E+00	1.02E+00	0/3	0/3
Vanadium	3/3	5.94E+00	9.97E+00	1.60E+01	0/3	3/3
Zinc	1/3	3.21E+01	3.21E+01	3.21E+01	0/3	0/3

Table B1.1.2.11-4. Summary of SWMU 228 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Radionuclides (pCi/g)						
Americium-241	3/3	-2.85E-03	-1.70E-03	-1.06E-04	0/3	0/3
Cesium-137	3/3	-2.40E-02	-1.37E-02	1.09E-03	0/3	0/3
Cobalt-60	3/3	-8.68E-05	6.14E-03	1.29E-02	0/3	2/3
Neptunium-237	3/3	-2.50E-03	-1.32E-03	-4.98E-04	0/3	0/3
Plutonium-238	3/3	-4.27E-03	-2.08E-03	1.10E-03	0/3	0/3
Plutonium-239/240	3/3	-2.56E-03	-1.67E-03	8.53E-05	0/3	0/3
Technetium-99	3/3	-2.85E-01	-2.28E-01	-1.49E-01	0/3	0/3
Thorium-228	3/3	3.05E-01	3.31E-01	3.68E-01	0/3	0/3
Thorium-230	3/3	2.00E-01	2.32E-01	2.57E-01	0/3	0/3
Thorium-232	3/3	2.75E-01	3.22E-01	3.73E-01	0/3	0/3
Thorium-234	3/3	9.65E-01	1.24E+00	1.49E+00	0/3	0/3
Uranium-234	3/3	9.54E-04	3.36E-02	8.22E-02	0/3	0/3
Uranium-235	3/3	-1.27E-02	-7.62E-03	-4.11E-03	0/3	0/3
Uranium-238	3/3	-2.65E-03	3.65E-02	9.57E-02	0/3	0/3

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection; NAL = no action level

B1.1.3 GROUP 2, UNDERGROUND TANKS

B1.1.3.1 SWMU 27 (C-722 Acid Neutralization Tank)

Data Evaluation and Screening

Historical data for surface soils from this SWMU include metals, PCBs, and VOCs. Historical data for the shallow subsurface soils from this SWMU include metals, pesticides/PCBs, and VOCs. These data were collected from the following project:

- WAGs 9 and 11 Site Evaluation

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 7 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 27. For use in the RA, data within the SWMU boundary and contingency, or "step-out," sampling were assigned to the SWMU.

Usability of Historical Data

Validation: Validation was performed for 10% of the WAGs 9 and 11 Site Evaluation project. Validation qualifiers applied to the data include =, U, and XV. Rejected data has been removed from the data set.

Data Assessment: The data assessment qualifiers that have been applied to the data for this SWMU are listed in Table B1.1.3.1-1.

Table B1.1.3.1-1. Assessment Qualifiers Applied to SWMU 27 Historic Data

ASSESSMENT	DESCRIPTION
KYRHTAB-50	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the rad error accounts for greater than 50% of the results.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data for which there are no results and no detection limit recorded have been removed from the data set for SWMU 27. For radionuclide historical data, no MDCs or counting errors were reported.

There is one chemical that is a nondetect and has its SQL/MDCs greater than background or the child resident NAL. The chemical and referenced value is shown in Table B1.1.3.1-2.

Table B1.1.3.1-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 27

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Organics					
PCB, Total	mg/kg	0.1	0.0648		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

Much of the historical data available for SWMU 27 was assessed independently by KYRHTAB (note that KYRHTAB is now KYRHB). Assessment qualifiers were applied. These data were not removed from the dataset based on their qualification. Alpha and beta activity and calculated total uranium reported in pCi/g were removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory or validator qualification.

Assignment of Historical Data to RI Sampling Grids

SWMU 27 was not grid sampled during this RI. Historical data was assigned to grids developed during the Soils OU RI Report. The assignments are listed in Table B1.1.3.1-3.

Table B1.1.3.1-3. Stations and Grids for Historical Data from SWMU 27

Station Name	Grid No.
SOU027-002	027-007
SOU027-005	027-001
SOU027-005	027-006
SOU027-008	027-002
SOU027-008	027-003

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.3.1-4.

Table B1.1.3.1-4. Summary of SWMU 27 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	9/9	4.37E+03	6.43E+03	8.23E+03	0/9	8/9
Arsenic	9/9	2.30E+00	3.23E+00	4.80E+00	0/9	9/9
Barium	9/9	2.69E+01	6.18E+01	1.10E+02	0/9	0/9
Beryllium	9/9	2.50E-01	3.99E-01	6.60E-01	0/9	9/9
Calcium	9/9	5.93E+02	9.53E+03	2.62E+04	5/9	0/9
Chromium	9/9	6.10E+00	1.07E+01	1.32E+01	0/9	0/9
Cobalt	9/9	2.80E+00	5.70E+00	1.05E+01	0/9	9/9
Copper	9/9	2.20E+00	8.81E+00	2.30E+01	0/9	0/9
Iron	9/9	7.45E+03	1.01E+04	1.68E+04	0/9	9/9
Lead	9/9	4.70E+00	7.62E+00	1.71E+01	0/9	0/9
Magnesium	9/9	3.38E+02	1.12E+03	2.66E+03	1/9	0/9
Manganese	9/9	5.45E+01	2.11E+02	5.19E+02	0/9	1/9
Mercury	2/9	3.20E-02	4.05E-02	4.90E-02	0/9	0/9
Nickel	9/9	3.60E+00	1.12E+01	3.97E+01	1/9	2/9
Potassium	9/9	1.22E+02	2.33E+02	3.07E+02	0/9	0/9
Sodium	9/9	4.58E+01	8.79E+01	1.73E+02	0/9	0/9
Vanadium	9/9	1.35E+01	1.66E+01	2.44E+01	0/9	9/9
Zinc	9/9	1.13E+01	2.45E+01	4.10E+01	0/9	0/9

Table B1.1.3.1-4. Summary of SWMU 27 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Organics (mg/kg)						
PCB, Total	2/9	3.20E-02	5.20E-02	7.20E-02	0/9	1/9
PCB-1016	3/3	1.30E-02	1.90E-02	2.80E-02	0/3	0/3
PCB-1260	2/2	3.20E-02	3.80E-02	4.40E-02	0/2	0/2
1,1,1-Trichloroethane	1/9	1.50E-02	1.50E-02	1.50E-02	0/9	0/9
cis-1,2-Dichloroethene	1/9	4.00E-03	4.00E-03	4.00E-03	0/9	0/9
Radionuclides (pCi/g)						
Americium-241	2/2	3.92E-02	4.54E-02	5.16E-02	0/2	0/2
Cesium-137	2/2	-9.19E-03	-9.06E-03	-8.92E-03	0/2	0/2
Cobalt-60	2/2	5.11E-03	7.61E-03	1.01E-02	0/2	1/2
Neptunium-237	2/2	-3.91E-03	1.57E-02	3.53E-02	0/2	0/2
Uranium-234	2/2	3.34E-01	6.17E-01	9.00E-01	0/2	0/2
Uranium-238	2/2	7.46E-01	7.65E-01	7.83E-01	0/2	4/2

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection NAL = no action level

B1.1.3.2 SWMU 76 (C-632-B Sulfuric Acid Storage Tank)

Data Evaluation and Screening

No historical data for this SWMU are available in OREIS.

B1.1.3.3 SWMU 165 (C-616-L Pipeline and Vault Soil Contamination)

Data Evaluation and Screening

Historical data for this SWMU include metals, pesticides/PCBs, radionuclides, SVOCs, and VOCs in the surface and shallow subsurface soils. These data were collected from the following projects:

- Historical data from AnaLIS for WAGS 9 and 11 DQO
- RCWC Data
- Remedial Action SI—Phase 1
- Surface Water OU—Activity 1 ISOCS data SWOU05-ISOCS
- Surface Water OU—Outfall 015 Activity 1 EU04 SWOU05-K015A104
- Surface Water OU—Outfall 015 Activity 2 EU03 AND EU04 SWOU05-K015A20304
- SWMU 165 samples taken during WAGs 1 and 7
- Verification Sampling—Post Excavation Sampling (Activity II)—SECTION 1 ERI04-NS-VEREXC1

- Verification Sampling—Remedial Action Support Survey (Activity 1)—SECTION 1 ERI04-NS-VERPCB

- WAGs 9 and 11 Site Evaluation

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 7 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 165. Data outside the influence of the SWMU have been removed from the data set (e.g., data across NSDD).

Usability of Historical Data

Validation: Validation was performed for 10% of the WAGs 9 and 11 Site Evaluation Project, for the Remedial Action SIs Phase 1, and for the Verification sampling, Post Excavation Sampling. Validation qualifiers "?," =, J, N, U, and V were applied to the applicable data. Rejected data have been removed from the data set.

Data Assessment: The data assessment qualifiers that have been applied to the data for this SWMU are listed in Table B1.1.3.3-1.

Table B1.1.3.3-1. Assessment Qualifiers Applied to SWMU 165 Historic Data

ASSESSMENT	DESCRIPTION
KYRHTAB-50	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the rad error accounts for greater than 50% of the results.
KYRHTAB-ER	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the data presents error problems (i.e., no counting uncertainty or zero counting uncertainty).
KYRHTAB-LT	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the results are less than (LT) the maximum detectable activity (MDA) or detection limit and should not be plotted.
KYRHTAB-OK	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the data is acceptable for use.
USECNITRIC-CF	During the period from May 2004 to September 2009, the USEC-PGDP laboratory used method RL-7128-NITRIC for isotopic uranium analysis by alpha spec. Method RL-7128-NITRIC utilizes only nitric acid for dissolution rather than hydrofluoric/nitric acid. The use of nitric acid only is a less aggressive dissolution for isotopic uranium analysis by alpha spec. It has been demonstrated that Method RL-7128-NITRIC can be utilized only for isotopic uranium analysis of soil with activity greater than 10 pCi/g due to low recoveries below that level. If the data from Method RL-7128-NITRIC will be screened against the background values reported in *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the PGDP* (1997), the following adjusted background values must be used: U-234: 1.73 pCi/g surface and 1.63 pCi/g subsurface; U-235: 0.10 pCi/g; and U-238: 0.40 pCi/g [*Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant*, Appendix E (2009)]. Risk assessors may use data from this time period for comparison against other thresholds below 10 pCi/g without adjusting the values as long as the level of uncertainty and its impact on the risk assessment/evaluation are adequately discussed. No additional action is required for comparisons to thresholds above 10 pCi/g.

It was noted in the SWOU SI/BRA that data for cesium-137 and uranium-238 were produced using an ISOCS unit, as opposed to a fixed-base laboratory. The data are considered screening level only (its intended purpose) and did not meet data evaluation methods; therefore, they could not be used in the risk assessment (DOE 2008). These data subsequently were removed from the Soils OU data set.

Units of Results

Reported units within the data set not appropriate for the analytical types have been removed from the data set (i.e., ng/g for radionuclides).

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data for which there are no reported results and no detection limit recorded have been removed for the data set for SWMU 165. For radionuclide historical data, records in which no MDCs and no radionuclide counting error are reported have been removed from the data set.

There are 22 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. Those chemicals and referenced values are shown in Table B1.1.3.3-2.

Radionuclide Counting Errors

Much of the historical data available for SWMU 165 was assessed independently by KYRHTAB (note that KYRHTAB is now KYRHB). Assessment qualifiers were applied. These data were not removed from the dataset based on their qualification. Alpha and beta activity and calculated total uranium reported in pCi/g were removed from the data set.

Table B1.1.3.3-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 165

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	10	0.552	0.21	0.21
Arsenic	mg/kg	20	0.238	12	7.9
Cadmium	mg/kg	2	0.811	0.21	0.21
Thallium	mg/kg	19.6	0.368	0.21	0.34
Organics					
Dieldrin	mg/kg	0.5	0.0106		
PCB, Total	mg/kg	2	0.0648		
PCB-1016	mg/kg	2.5	0.0633		
PCB-1221	mg/kg	2.5	0.0437		
PCB-1232	mg/kg	2.5	0.0437		
PCB-1242	mg/kg	2.5	0.0644		
PCB-1248	mg/kg	2.5	0.0682		
PCB-1254	mg/kg	5	0.0501		
PCB-1260	mg/kg	0.21	0.0662		
2-Nitrobenzenamine	mg/kg	3.3	0.296		

Table B1.1.3.3-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 165 (Continued)

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Organics					
Benz(a)anthracene	mg/kg	0.66	0.196		
Benzo(a)pyrene	mg/kg	0.66	0.0197		
Benzo(b)fluoranthene	mg/kg	0.66	0.197		
Dibenz(a,h)anthracene	mg/kg	0.66	0.0197		
Hexachlorobenzene	mg/kg	0.66	0.0492		
Indeno(1,2,3-cd)pyrene	mg/kg	0.66	0.197		
N-Nitroso-di-n-propylamine	mg/kg	0.66	0.0189		
Total PAH	mg/kg	20	0.0197		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration; NAL = no action level; SQL = sample quantitation limit

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data points were assigned to grids developed during the Soils OU RI Report. The assignments are listed in Table B1.1.3.3-3.

Table B1.1.3.3-3. Stations and Grids for Historical Data from SWMU 165

Station Name	Grid No.
SOU165-001	RU21S
SOU165-002	RC-3762
SOU165-002	RC-4509
SOU165-002	RC-4899
SOU165-002	RU20C
SOU165-002	RU20S
SOU165-003	RU19C
SOU165-003	RU19S
SOU165-004	H069
SOU165-004	OF15A-099
SOU165-004	OF15B-04-04
SOU165-005	165-001
SOU165-005	LB021
SOU165-005	OF15A-097
SOU165-005	OF15A-098

Table B1.1.3.3-3. Stations and Grids for Historical Data from SWMU 165 (Continued)

Station Name	Grid No.
SOU165-005	RC-3763
SOU165-005	RC-4508
SOU165-006	OF15A-096
SOU165-008	RC-4507
SOU165-013	RC-2439
SOU165-013	RC-3964
SOU165-013	RC-3965
SOU165-013	RC-3966
SOU165-013	RC-3972
SOU165-013	RC-3973
SOU165-013	RC-3974
SOU165-014	165-002
SOU165-014	RC-3175
SOU165-014	RC-3967
SOU165-014	RC-3968
SOU165-014	RC-3975
SOU165-014	RC-3976
SOU165-016	RC-3901
SOU165-016	RC-3905
SOU165-016	RC-3921
SOU165-016	RC-3925
SOU165-016	RC-3941
SOU165-016	RC-3945
SOU165-017	RC-3902
SOU165-017	RC-3903
SOU165-017	RC-3904
SOU165-017	RC-3906
SOU165-017	RC-3907
SOU165-017	RC-3908
SOU165-017	RC-3922
SOU165-017	RC-3923
SOU165-017	RC-3924
SOU165-017	RC-3926
SOU165-017	RC-3927
SOU165-017	RC-3928
SOU165-017	RC-3942
SOU165-017	RC-3944
SOU165-017	RC-3946

Table B1.1.3.3-3. Stations and Grids for Historical Data from SWMU 165 (Continued)

Station Name	Grid No.
SOU165-017	RC-3947
SOU165-017	RC-3948
SOU165-017	RC-3978
SOU165-017	RC-3979
SOU165-017	RC-3980
SOU165-017	RC-3981
SOU165-017	RC-3982
SOU165-017	RC-3983
SOU165-017	RC-3984
SOU165-017	RC-3985
SOU165-017	RC-3986
SOU165-018	RC-3961
SOU165-018	RC-3962
SOU165-018	RC-3969
SOU165-018	RC-3970
SOU165-019	165-003
SOU165-019	65-SB-001
SOU165-019	65-SB-002
SOU165-019	65-SO-001
SOU165-019	65-SO-002
SOU165-020	RC-4136
SOU165-020	RC-4137
SOU165-020	RC-4138
SOU165-020	RC-4139
SOU165-020	RC-4140
SOU165-020	RC-4141
SOU165-020	RC-4143
SOU165-020	RC-4144
SOU165-020	RC-4146
SOU165-020	RC-4147
SOU165-021	165-007
SOU165-021	RC-3909
SOU165-021	RC-3913
SOU165-021	RC-3929
SOU165-021	RC-3933
SOU165-021	RC-3949
SOU165-021	RC-3953
SOU165-022	165-005

Table B1.1.3.3-3. Stations and Grids for Historical Data from SWMU 165 (Continued)

Station Name	Grid No.
SOU165-022	165-006
SOU165-022	RC-3910
SOU165-022	RC-3911
SOU165-022	RC-3912
SOU165-022	RC-3914
SOU165-022	RC-3915
SOU165-022	RC-3916
SOU165-022	RC-3930
SOU165-022	RC-3931
SOU165-022	RC-3932
SOU165-022	RC-3934
SOU165-022	RC-3935
SOU165-022	RC-3936
SOU165-022	RC-3950
SOU165-022	RC-3951
SOU165-022	RC-3952
SOU165-022	RC-3954
SOU165-022	RC-3955
SOU165-022	RC-3956
SOU165-023	165-016
SOU165-023	RC-2437
SOU165-025	RC-3917
SOU165-025	RC-3937
SOU165-025	RC-3957
SOU165-025	RC-3977
SOU165-026	165-008
SOU165-026	RC-3918
SOU165-026	RC-3919
SOU165-026	RC-3920
SOU165-026	RC-3938
SOU165-026	RC-3939
SOU165-026	RC-3940
SOU165-026	RC-3958
SOU165-026	RC-3959
SOU165-026	RC-3960
SOU165-027	165-015
SOU165-027	RC-2440

Table B1.1.3.3-3. Stations and Grids for Historical Data from SWMU 165 (Continued)

Station Name	Grid No.
SOU165-028	165-009
SOU165-030	165-014
SOU165-030	RC-2436
SOU165-030	RC-2438
SOU165-031	165-010
SOU165-033	165-013
SOU165-035	165-011
SOU165-036	165-012

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.3.3-4.

B1.1.3.4 SWMU 170 (C-729 Acetylene Building Drain Pits)

Data Evaluation and Screening

Historical data for the surface soils from this SWMU includes radiological analyses only. Historical data from the shallow subsurface soils included pesticides/PCBs, radionuclides, and VOCs. These data were collected from the following projects:

- RCWC Data
- RCWC Data 92-53
- WAGs 9 and 11 Site Evaluation

Table B1.1.3.3-4. Summary of SWMU 165 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	12/12	1.10E+00	4.66E+03	1.30E+04	2/12	6/12
Antimony	2/13	2.20E+00	2.20E+00	2.20E+00	2/13	2/13
Arsenic	24/25	1.10E-01	2.79E+01	1.30E+02	6/25	20/25
Barium	24/24	1.10E-01	2.99E+02	1.14E+03	5/24	9/24
Beryllium	13/13	1.10E-01	3.72E-01	1.08E+00	2/13	13/13
Cadmium	4/25	2.20E-01	2.45E-01	3.20E-01	4/25	0/25
Calcium	12/12	2.20E-01	8.52E+03	8.30E+04	1/12	0/12
Chromium	25/25	2.20E-01	1.88E+01	6.66E+01	5/25	12/25
Cobalt	12/12	2.20E-01	3.99E+00	1.31E+01	1/12	5/12
Copper	13/13	2.20E-01	1.15E+01	6.60E+01	2/13	0/13

Table B1.1.3.3-4. Summary of SWMU 165 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Iron	13/13	2.20E-01	7.68E+03	2.14E+04	0/13	6/13
Lead	20/25	2.20E-01	1.40E+01	5.15E+01	2/25	0/25
Magnesium	12/12	1.90E+00	8.69E+02	4.41E+03	0/12	0/12
Manganese	13/13	1.10E-01	2.34E+02	6.96E+02	0/13	5/13
Mercury	6/24	9.70E-02	4.61E-01	9.00E-01	2/24	4/24
Nickel	25/25	4.40E-01	1.83E+01	3.92E+01	6/25	17/25
Potassium	12/12	4.50E+00	2.20E+02	6.30E+02	0/12	0/12
Selenium	16/25	1.10E-01	3.43E+00	1.25E+01	6/25	0/25
Silver	7/25	2.20E-01	3.79E+01	8.33E+01	3/25	6/25
Sodium	12/12	1.50E+00	1.25E+02	5.73E+02	2/12	0/12
Thallium	2/21	1.10E-01	1.10E-01	1.10E-01	0/21	0/21
Uranium	9/9	4.00E+00	3.13E+01	1.87E+02	2/9	3/9
Vanadium	13/13	1.10E-01	1.22E+01	3.48E+01	0/13	13/13
Zinc	11/12	1.10E-01	1.94E+01	1.22E+02	1/12	0/12
Organics (mg/kg)						
Cyanide	2/11	1.00E-02	2.75E-01	5.40E-01	0/11	0/11
Decachlorobiphenyl	1/7	9.49E-02	9.49E-02	9.49E-02	0/7	0/7
PCB, Total	33/214	2.00E-01	4.07E+00	5.10E+01	0/214	33/214
PCB-1254	1/24	3.70E-01	3.70E-01	3.70E-01	0/24	1/24
PCB-1260	3/24	3.80E-01	5.23E+00	1.10E+01	0/24	3/24
Tetrachloro-m-xylene	1/7	1.04E-01	1.04E-01	1.04E-01	0/7	0/7
1-Propanol	3/3	6.00E-02	8.67E-02	1.00E-01	0/3	0/3
2-Methylnaphthalene	3/13	3.70E-01	3.73E-01	3.80E-01	0/13	0/13
Acenaphthene	1/17	3.70E-01	3.70E-01	3.70E-01	0/17	0/17
Acenaphthylene	1/14	3.60E-01	3.60E-01	3.60E-01	0/14	0/14
Anthracene	3/17	3.60E-01	4.53E-01	6.30E-01	0/17	0/17
Benz(a)anthracene	5/17	3.60E-01	6.22E-01	1.50E+00	0/17	5/17
Benzo(a)pyrene	4/17	3.60E-01	6.50E-01	1.40E+00	0/17	8/17
Benzo(b)fluoranthene	4/17	3.60E-01	9.20E-01	2.40E+00	0/17	4/17
Benzo(ghi)perylene	3/17	3.70E-01	6.27E-01	9.30E-01	0/17	0/17
Benzo(k)fluoranthene	4/17	3.60E-01	5.10E-01	8.40E-01	0/17	0/17
Bis(2-ethylhexyl)phthalate	4/13	3.80E-01	6.98E-01	1.10E+00	0/13	0/13
Butyl benzyl phthalate	2/13	3.60E-01	3.70E-01	3.80E-01	0/13	0/13
Carbazole	1/11	3.70E-01	3.70E-01	3.70E-01	0/11	0/11

Table B1.1.3.3-4. Summary of SWMU 165 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Chrysene	5/17	3.60E-01	7.38E-01	1.90E+00	0/17	0/17
Cineole	1/1	2.40E-02	2.40E-02	2.40E-02	0/1	0/1
Dibenz(a,h)anthracene	1/17	9.30E-01	9.30E-01	9.30E-01	0/17	1/17
Dibenzofuran	2/13	3.70E-01	3.75E-01	3.80E-01	0/13	0/13
Di-n-butyl phthalate	10/13	8.40E-02	3.02E-01	4.10E-01	0/13	0/13
Fluoranthene	6/17	3.60E-01	1.06E+00	4.00E+00	0/17	0/17
Indeno(1,2,3-cd)pyrene	3/17	3.70E-01	6.60E-01	9.30E-01	0/17	3/17
Naphthalene	4/17	3.70E-01	1.79E+00	4.70E+00	0/17	2/17
Pentachlorophenol	1/13	2.10E+00	2.10E+00	2.10E+00	0/13	0/13
Phenanthrene	6/17	3.60E-01	1.48E+00	3.80E+00	0/17	0/17
Pyrene	5/17	3.60E-01	9.70E-01	2.90E+00	0/17	0/17
Total PAH	5/31	3.84E-02	8.86E-01	1.87E+00	0/31	5/31
1,1,2-Trichloroethane	1/15	6.00E-03	6.00E-03	6.00E-03	0/15	0/15
1,4-Cineole	1/1	3.30E-02	3.30E-02	3.30E-02	0/1	0/1
2-Butanone	2/16	5.00E-03	6.25E-02	1.20E-01	0/16	0/16
2-Hexanone	1/15	6.00E-02	6.00E-02	6.00E-02	0/15	0/15
2-Propanol	3/3	2.00E-01	2.67E-01	4.00E-01	0/3	0/3
4-Methyl-2-pentanone	1/17	6.00E-02	6.00E-02	6.00E-02	0/17	0/17
Acetone	10/17	2.10E-02	9.58E-02	1.20E-01	0/17	0/17
Chlorobenzene	1/17	6.00E-03	6.00E-03	6.00E-03	0/17	0/17
Ethylbenzene	1/17	6.00E-03	6.00E-03	6.00E-03	0/17	0/17
Methylene chloride	10/17	5.00E-03	1.91E-02	6.80E-02	0/17	0/17
Tetrachloroethene	1/17	6.00E-03	6.00E-03	6.00E-03	0/17	0/17
Toluene	4/17	6.00E-03	7.30E-02	2.10E-01	0/17	0/17
Total Xylene	2/17	6.00E-03	6.00E-03	6.00E-03	0/17	0/17
Trichloroethene	2/18	6.00E-03	6.00E-03	6.00E-03	0/18	0/18
Radionuclides (pCi/g)						
Americium-241	2/2	-1.29E-02	6.26E-02	1.38E-01	0/2	0/2
Cesium-137	6/6	-1.45E-02	4.41E+00	1.18E+01	1/6	5/6
Cobalt-60	1/1	-1.42E-02	-1.42E-02	-1.42E-02	0/1	0/1
Neptunium-237	5/5	6.00E-02	3.28E-01	5.27E-01	2/5	4/5
Plutonium-238	2/2	1.00E-02	1.11E-02	1.22E-02	0/2	0/2
Plutonium-239	2/2	1.00E-03	1.96E-01	3.90E-01	0/2	0/2
Plutonium-239/240	2/2	9.63E-03	5.10E-01	1.01E+00	1/2	0/2
Plutonium-242	1/1	0.00E+00	0.00E+00	0.00E+00	0/1	0/1

Table B1.1.3.3-4. Summary of SWMU 165 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Technetium-99	10/10	-9.00E-02	1.46E+01	6.00E+01	4/10	0/10
Thorium-228	2/2	2.70E-01	3.31E-01	3.91E-01	0/2	0/2
Thorium-230	5/5	2.20E-01	2.80E+00	8.73E+00	1/5	1/5
Thorium-232	2/2	2.20E-01	3.14E-01	4.07E-01	0/2	0/2
Uranium	1/1	8.60E+00	8.60E+00	8.60E+00	1/1	0/1
Uranium-233/234	1/1	1.10E+00	1.10E+00	1.10E+00	0/1	0/1
Uranium-234	14/14	1.00E-02	1.23E+01	1.40E+02	1/14	3/14
Uranium-235	14/14	0.00E+00	5.19E-01	4.70E+00	3/14	4/14
Uranium-238	19/19	1.00E-02	1.70E+01	1.50E+02	2/19	22/19

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

<u>Sampling Representative of the SWMU/AOC Area?</u>

Figures in Chapter 7 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 170. Data within the adjacent facility and at the fringe of the boundary have been removed from the data set.

<u>Usability of Historical Data</u>

Validation: Validation was performed for 10% of the WAGs 9 and 11 Site Evaluation project, validation qualifiers =, U, and V were applied to the applicable data. Rejected data has been removed from the data set.

Data Assessment: The data assessment qualifiers that have been applied to the projects within this SWMU are listed in Table B1.1.3.4-1.

Table B1.1.3.4-1. Assessment Qualifiers Applied to SWMU 170 Historic Data

ASSESSMENT	DESCRIPTION
KYRHTAB-50	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the rad error accounts for greater than 50% of the results.
KYRHTAB-OK	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the data is acceptable for use.

<u>Units of Results</u>

Reported units within the data set are appropriate for the analytical types.

<u>Detection Limits/Minimum Detectable Concentration</u>

All of the nonradionuclide historical data for which there are no reported results and no detection limit have been removed from the data set for SWMU 170. For radionuclide historical data, MDCs are reported for all of the remaining data set.

There are no chemicals that are a nondetect and have their SQL/MDCs greater than background or the child resident NAL.

Radionuclide Counting Errors

Much of the historical data available for SWMU 170 was assessed independently by KYRHTAB (note that KYRHTAB is now KYRHB). Assessment qualifiers were applied. These data were not removed from the dataset based on their qualification. Alpha and beta activity and calculated total uranium reported in pCi/g were removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

Each of the historic samples was assigned to grids developed during the Soils OU RI Report. The assignments are listed in Table B1.1.3.4-2.

Table B1.1.3.4-2. Stations and Grids for Historical Data from SWMU 170

Station Name	Grid No.
SOU170-002	RC-4694
SOU170-003	RC-4695
SOU170-004	WC-702
SOU170-004	WC-703
SOU170-005	170-001
SOU170-005	170-002
SOU170-005	170-003
SOU170-005	170-004
SOU170-006	170-005

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.3.4-3.

Table B1.1.3.4-3. Summary of SWMU 170 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Radionuclides (pCi/g)						
Americium-241	2/2	8.95E-04	2.66E-02	5.23E-02	0/2	0/2
Cesium-137	2/2	5.16E-03	7.96E-02	1.54E-01	0/2	1/2
Cobalt-60	2/2	-3.31E-03	3.10E-03	9.50E-03	0/2	1/2

Table B1.1.3.4-3. Summary of SWMU 170 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Neptunium-237	2/2	3.43E-03	2.35E-02	4.36E-02	0/2	0/2
Uranium-234	2/2	9.38E-01	9.89E-01	1.04E+00	0/2	0/2
Uranium-238	2/2	1.40E+00	1.98E+00	2.55E+00	2/2	4/2

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.4 GROUP 2, CHROMIUM AREAS

B1.1.4.1 SWMU 158 (Chilled Water System Leak Site)

Data Evaluation and Screening

There are no historical data for SWMU 158 for surface soils. Historical data for shallow subsurface soils for this SWMU include metals, pesticides/PCBs, SVOCs, and VOCs. These data were collected from the following project:

- WAG 27 RI Sampling

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 8 illustrate the location of the historical data points associated with this SWMU. Only subsurface historical data is available. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 158.

Usability of Historical Data

Validation: Validation was performed for 10% of the WAG 27 RI project; however, no validation was performed on these data points.

Data Assessment: No qualifiers have been applied to the data from SWMU 158.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data for which there are no reported result and no detection limit have been removed from the data set for SWMU 158.

There are 15 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. Those chemicals and referenced values are shown in Table B1.1.4.1-1.

Table B1.1.4.1-1. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 158

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Thallium	mg/kg	0.534	0.368	0.21	0.34
Organics					
PCB, Total	mg/kg	1	0.0648		
2-Nitrobenzenamine	mg/kg	2.3	0.296		
Benz(a)anthracene	mg/kg	2.3	0.196		
Benzo(a)pyrene	mg/kg	2.3	0.0197		
Benzo(b)fluoranthene	mg/kg	2.3	0.197		
Benzo(k)fluoranthene	mg/kg	2.3	1.96		
Dibenz(a,h)anthracene	mg/kg	2.3	0.0197		
Hexachlorobenzene	mg/kg	2.3	0.0492		
Indeno(1,2,3-cd)pyrene	mg/kg	2.3	0.197		
Naphthalene	mg/kg	2.3	1.15		
N-Nitroso-di-n-propylamine	mg/kg	2.3	0.0189		
1,1-Dichloroethene	mg/kg	0.9	0.0237		
Trichloroethene	mg/kg	0.9	0.0234		
Vinyl chloride	mg/kg	0.9	0.0824		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

No historical isotopic data are available. Alpha and beta activity results have been removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic sampling stations have been assigned to grids developed during the Soils OU RI field effort. The assignments are listed in Table B1.1.4.1-2.

Table B1.1.4.1-2. Stations and Grids for Historical Data from SWMU 158

Station Name	Grid No.
SOU158-002	720-021
SOU158-013	720-001

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.4.1-3.

Table B1.1.4.1-3. Summary of SWMU 158 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics—Metals (mg/kg)						
Aluminum	2/2	3.70E+03	5.21E+03	6.72E+03	0/2	1/2
Arsenic	2/2	3.33E+00	4.36E+00	5.38E+00	0/2	2/2
Barium	2/2	3.06E+01	5.54E+01	8.01E+01	0/2	0/2
Beryllium	2/2	4.62E-01	5.13E-01	5.64E-01	0/2	2/2
Cadmium	1/2	2.49E-01	2.49E-01	2.49E-01	1/2	0/2
Calcium	2/2	6.14E+02	7.62E+02	9.09E+02	0/2	0/2
Chromium	2/2	2.21E+01	4.70E+01	7.18E+01	1/2	2/2
Cobalt	2/2	6.28E+00	8.24E+00	1.02E+01	0/2	2/2
Copper	2/2	3.58E+00	5.24E+00	6.89E+00	0/2	0/2
Iron	2/2	1.57E+04	1.64E+04	1.70E+04	0/2	2/2
Lead	2/2	8.23E+00	9.77E+00	1.13E+01	0/2	0/2
Magnesium	2/2	3.29E+02	4.22E+02	5.14E+02	0/2	0/2
Manganese	2/2	3.64E+01	9.57E+01	1.55E+02	0/2	0/2
Nickel	2/2	4.20E+00	4.37E+00	4.54E+00	0/2	0/2
Potassium	2/2	8.20E+01	1.20E+02	1.57E+02	0/2	0/2
Selenium	1/2	1.02E-01	1.02E-01	1.02E-01	0/2	0/2
Silver	1/2	3.45E-01	3.45E-01	3.45E-01	0/2	0/2
Sodium	2/2	2.12E+02	2.68E+02	3.23E+02	0/2	0/2
Vanadium	2/2	2.96E+01	3.25E+01	3.53E+01	0/2	2/2
Zinc	2/2	6.91E+00	7.86E+00	8.81E+00	0/2	0/2

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.4.2 SWMU 169 (C-410-E HF Vent Surge Protection Tank)

Data Evaluation and Screening

Historical data for surface soil for this SWMU include metals, and pesticides/PCBs. Historical Data for the shallow subsurface soils include metals, pesticides/PCBs, radionuclides, and VOCs. These data were collected from the following project:

- WAGs 9 and 11 Site Evaluation

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 8 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 169.

Usability of Historical Data

Validation: Validation was performed for 10% of the WAGs 9 and 11 Site Evaluation project, validation qualifiers =, U, J, and X were applied to the applicable data.

Data Assessment: The data Assessment qualifiers that have been applied to the data for this SWMU are listed in Table B1.1.4.2-1.

Table B1.1.4.2-1. Assessment Qualifiers Applied to SWMU 169 Historic Data

ASSESSMENT	DESCRIPTION
KYRHTAB-50	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the rad error accounts for greater than 50% of the results.
KYRHTAB-OK	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the data is acceptable for use.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data for which there are no reported result and no detection limit have been removed from the data set for SWMU 169.

There is one chemical that is a nondetect and has its SQL/MDCs greater than background or the child resident NAL. The chemical and referenced value is shown in Table B1.1.4.2-2.

Radionuclide Counting Errors

Radionuclide counting errors have been applied to all radionuclide data. Much of the historical data available for SWMU 169 was assessed independently by KYRHTAB (note that KYRHTAB is now KYRHB). Assessment qualifiers were applied. These data were not removed from the dataset based on their qualification. Alpha and beta activity and calculated total uranium reported in pCi/g were removed from the data set.

Table B1.1.4.2-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 169

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Organics					
PCB, Total	mg/kg	0.1	0.0648		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration; NAL = no action level; SQL = sample quantitation limit

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic sampling locations have been assigned to grids developed in the Soils OU RI field effort. Those assignments are listed in Table B1.1.4.2-3.

Table B1.1.4.2-3. Stations and Grids for Historical Data from SWMU 169

Station Name	Grid No.
SOU169-001	020-001
SOU169-002	020-002
SOU169-003	020-004
SOU169-003	020-014
SOU169-003	020-015
SOU169-004	020-006
SOU169-005	020-009
SOU169-005	020-010
SOU169-005	020-013
SOU169-008	020-011

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.4.2-4.

Table B1.1.4.2-4. Summary of SWMU 169 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics—Metals (mg/kg)						
Aluminum	20/20	5.47E+03	1.03E+04	2.06E+04	3/20	20/20
Arsenic	20/20	2.10E+00	5.46E+00	8.70E+00	1/20	20/20
Barium	20/20	7.07E+01	9.53E+01	1.62E+02	0/20	1/20
Beryllium	20/20	3.00E-01	5.90E-01	2.30E+00	4/20	20/20
Cadmium	3/20	1.40E-01	3.10E-01	6.10E-01	1/20	0/20

Table B1.1.4.2-4. Summary of SWMU 169 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Calcium	20/20	8.72E+02	3.30E+04	1.79E+05	6/20	0/20
Chromium	20/20	1.05E+01	1.60E+01	3.31E+01	3/20	7/20
Cobalt	16/20	3.30E+00	6.11E+00	1.29E+01	0/20	16/20
Copper	20/20	5.90E+00	3.71E+01	4.28E+02	2/20	1/20
Iron	20/20	8.66E+03	1.44E+04	1.97E+04	0/20	20/20
Lead	20/20	6.80E+00	1.27E+01	2.79E+01	1/20	0/20
Magnesium	20/20	1.19E+03	2.42E+03	6.20E+03	6/20	0/20
Manganese	20/20	1.71E+02	2.89E+02	4.27E+02	0/20	1/20
Nickel	20/20	9.90E+00	5.58E+01	8.04E+02	2/20	18/20
Potassium	20/20	2.78E+02	8.95E+02	5.44E+03	4/20	0/20
Selenium	9/20	2.70E-01	3.66E-01	6.40E-01	0/20	0/20
Sodium	20/20	6.45E+01	2.33E+02	1.23E+03	2/20	0/20
Thallium	1/20	4.60E-01	4.60E-01	4.60E-01	1/20	1/20
Vanadium	20/20	1.60E+01	2.10E+01	3.51E+01	0/20	20/20
Zinc	20/20	1.67E+01	5.78E+01	1.36E+02	5/20	0/20
Organics—Metals (mg/kg)						
PCB, Total	17/20	3.00E-02	5.48E-01	3.20E+00	0/20	13/20
PCB-1248	1/1	7.00E-03	7.00E-03	7.00E-03	0/1	0/1
PCB-1254	18/18	2.10E-02	4.15E-01	2.70E+00	0/18	13/18
PCB-1260	16/16	1.40E-02	1.35E-01	6.00E-01	0/16	8/16
Radionuclides (pCi/g)						
Americium-241	3/3	-7.29E-03	2.61E-02	4.85E-02	0/3	0/3
Cesium-137	3/3	5.17E-03	8.43E-03	1.02E-02	0/3	0/3
Cobalt-60	3/3	-5.80E-03	2.71E-03	7.40E-03	0/3	2/3
Neptunium-237	3/3	-2.39E-02	-3.85E-03	1.49E-02	0/3	0/3
Plutonium-239/240	2/2	1.99E-03	2.30E-03	2.60E-03	0/2	0/2
Thorium-230	2/2	2.95E-01	3.09E-01	3.23E-01	0/2	0/2
Uranium-234	3/3	3.23E-01	1.15E+00	1.85E+00	2/3	0/3
Uranium-238	3/3	8.05E-01	1.50E+00	2.25E+00	2/3	6/3

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.5 GROUP 2, SOIL/RUBBLE PILES

B1.1.5.1 SWMU 19 (C-410-B HF Emergency Lagoon)

Data presented in the Removal Action report for *Soils Operable Unit Inactive Facilities Solid Waste Management Units 19 and 181 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2010) will be used for the characterization of SWMU 19.

B1.1.5.2 SWMU 138 (C-100 Southside Berm)

Data Evaluation and Screening

Only surface soils data are available as historic data for this SWMU. The historical data for this SWMU include metals, pesticides/PCBs, SVOCs, and VOCs. These data were collected from the following projects:

- RCWC Data
- RCWC Data 91-37

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 10 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within the RI sampling grid boundary and associated step-out grids were selected and assigned to SWMU 138.

Usability of Historical Data

Validation: Data validation was not performed on these data.

Data Assessment: No data assessment qualifiers have been applied to the data within this SWMU.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data for SWMU 138 that had no detection limits recorded within the data set have been removed; however, there are reported results for the nondetects.

There are no chemicals that are a nondetect and have their SQL/MDCs greater than background or the child resident NAL.

Radionuclide Counting Errors

Of the historical data available for SWMU 138, no counting errors were reported for radionuclide data. The historical radionuclide data will not be used.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

Historical data have been assigned to RI sampling grids as shown in Table B1.1.5.2-1.

Table B1.1.5.2-1. Stations and Grids for Historical Data from SWMU 138

Station Name	Grid No.
SOU138-003	RC-5045
SOU138-004	RC-5044
SOU138-004	RC-5046
SOU138-005	RC-5048
SOU138-006	RC-5051
SOU138-007	RC-5052
SOU138-009	RC-5047
SOU138-009	RC-5049
SOU138-010	RC-5050
SOU138-011	RC-5053
SOU138-012	RC-5054
SOU138-012	RC-5055
SOU138-016B	WC6-287
SOU138-017A	RC-4515
SOU138-018B	RC-4510

Summary of Detected Chemicals

A summary of detected chemicals is presented as in Table B1.1.5.2-2.

Table B1.1.5.2-2. Summary of SWMU 138 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Antimony	1/13	7.34E+00	7.34E+00	7.34E+00	0/13	1/13
Arsenic	10/10	3.68E+00	6.14E+00	8.08E+00	0/10	10/10
Barium	12/12	6.59E+01	1.14E+02	1.69E+02	0/12	1/12
Cadmium	3/13	5.00E+00	5.86E+00	7.30E+00	0/13	3/13
Chromium	11/13	6.46E+00	2.49E+01	4.46E+01	0/13	7/13
Lead	13/13	7.20E+00	1.21E+02	2.81E+02	0/13	0/13
Mercury	13/13	2.16E+00	8.18E+00	2.13E+01	0/13	13/13
Nickel	9/13	6.05E+00	1.22E+01	1.86E+01	0/13	6/13
Selenium	11/13	5.48E-01	9.95E-01	1.66E+00	0/13	0/13
Organics (mg/kg)						
PCB, Total	5/13	4.00E-01	4.20E-01	5.00E-01	0/13	5/13
PCB-1260	1/3	9.20E-02	9.20E-02	9.20E-02	0/3	1/3

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.5.3 SWMU 180 (Outdoor Firing Range WKWMA)

Data Evaluation and Screening

No historical data for this SWMU are available.

B1.1.5.4 SWMU 181 (Outdoor Firing Range PGDP)

Data Evaluation and Screening

Historical data for this SWMU include metals, PCBs, radionuclides, and SVOCs in the surface and subsurface soils. These data were collected from the following projects:

- C-218 Firing Range SOU09-RANGE
- C-218 Firing Range (SWMU 181) - Post Excavation Confirmation of Lead
- AIP Soil Samples C-218 Firing Range C21803, C21804, C21805 & C21806 11/08 Split w/DOE AIPSOSLSP11-08
- RCWC Data (93-19)

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 9 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 181. Data collected from the RCWC project were removed from the data set because they represent the condition of the berm prior to excavation. Data from soil borings collected during the project "SOU09-RANGE" and the split sampling project "AIPSOSLSP11-08," were left in the data set because they were intended to represent the berm outside the influence of the lead bullets.

Usability of Historical Data

Validation: Validation was performed for 10% of the AIP soil split sampling project and the C-218 Firing Range (SWMU 181) - Post Excavation Confirmation of Lead projects. The validation qualifiers that have been applied to this data are "=," J, and U.

Data Assessment: Only the data assessment qualifier USECNITRIC-CF has been applied to the data within this SWMU. This qualifier indicates the following:

During the period from May 2004 to September 2009, the United States Enrichment Corporation (USEC)-PGDP laboratory used method RL-7128-NITRIC for isotopic uranium analysis by alpha spec. Method RL-7128-NITRIC utilizes only nitric acid for dissolution rather than hydrofluoric/nitric acid. The use of nitric acid only is a less aggressive dissolution for isotopic uranium analysis by alpha spec. It has been demonstrated that Method RL-7128-NITRIC can be utilized only for isotopic uranium analysis of soil with activity greater than 10 pCi/g due to low recoveries below that level. If the data from Method RL-7128-NITRIC will be screened against the background values reported in *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the PGDP* (1997), the following adjusted background values must be used: U-234: 1.73 pCi/g surface and 1.63 pCi/g subsurface; U-235: 0.10 pCi/g; and U-238: 0.40 pCi/g [*Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant*, Appendix E (2009)]. Risk assessors may use data from this time period for comparison against other thresholds below 10 pCi/g without adjusting the values as long as the level of uncertainty and its impact on the risk assessment/evaluation are discussed adequately. No additional action is required for comparisons to thresholds above 10 pCi/g.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data that had no reported result and no detection limit have been removed from the data set.

Chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL are shown in Table B1.1.5.4-1.

Table B1.1.5.4-1. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 181

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Organics					
PCB, Total	mg/kg	0.14	0.0648		
Metals					
Antimony	mg/kg	8.85	0.552	0.21	0.21
Cadmium	mg/kg	2.5	0.811	0.21	0.21
Thallium	mg/kg	9.98	0.368	0.21	0.34

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration; NAL = no action level; SQL = sample quantitation limit

Radionuclide Counting Errors

Of the historical data available for SWMU 181, counting errors were reported for all remaining radionuclide data.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

Historical data have been assigned to RI sampling grids as shown in Table B1.1.5.4-2.

Summary of Detected Chemicals

A summary of detected chemicals is presented as in Table B1.1.5.4-3.

Table B1.1.5.4-2. Stations and Grids for Historical Data from SWMU 181

Station Name	Grid No.
181RU1-1	SOU181-001
181RU1-2	SOU181-001
181RU1-3	SOU181-001
181RU1-4	SOU181-001
181RU2	SOU181-002
181RU2-1	SOU181-002
181RU2-2	SOU181-002
181RU2-3	SOU181-002
181RU2-4	SOU181-002
181RU3-1	SOU181-003
181RU3-2	SOU181-003
181RU3-3	SOU181-003
181RU3-4	SOU181-003
181RU4-1	SOU181-004
181RU4-2	SOU181-004
181RU4-3	SOU181-004
181RU4-4	SOU181-004
181RU5	SOU181-005
181RU5-1	SOU181-005
181RU5-2	SOU181-005
181RU5-3	SOU181-005
181RU5-4	SOU181-005
181RU6-1	SOU181-006
181RU6-2	SOU181-006
181RU6-3	SOU181-006
181RU6-4	SOU181-006
181RU7-1	SOU181-007
181RU7-2	SOU181-007
181RU7-3	SOU181-007
181RU7-4	SOU181-007
181RU8-1	SOU181-008
181RU8-2	SOU181-008
181RU8-3	SOU181-008
181RU8-4	SOU181-008
181RU9-1	SOU181-009
181RU9-2	SOU181-009
181RU9-3	SOU181-009
181RU9-4	SOU181-009
181RU10	SOU181-010
181RU10-1	SOU181-010
181RU10-2	SOU181-010
181RU10-3	SOU181-010
181RU10-4	SOU181-010
181RU11-1	SOU181-011
181RU11-2	SOU181-011
181RU11-3	SOU181-011
181RU11-4	SOU181-011

Table B1.1.5.4-2. Stations and Grids for Historical Data from SWMU 181 (Continued)

Station Name	Grid No.
181RU12-1	SOU181-012
181RU12-2	SOU181-012
181RU12-3	SOU181-012
181RU12-4	SOU181-012
181RU13-1	SOU181-013
181RU13-2	SOU181-013
181RU13-3	SOU181-013
181RU13-4	SOU181-013
SOU181-RAD	SOU181-013
181RU14	SOU181-014
181RU14-1	SOU181-014
181RU14-2	SOU181-014
181RU14-3	SOU181-014
181RU14-4	SOU181-014
181RU15-1	SOU181-015
181RU15-2	SOU181-015
181RU15-3	SOU181-015
181RU15-4	SOU181-015
181RU16-1	SOU181-016
181RU16-2	SOU181-016
181RU16-3	SOU181-016
181RU16-4	SOU181-016
181RU17	SOU181-017
181RU17-1	SOU181-017
181RU17-2	SOU181-017
181RU17-3	SOU181-017
181RU17-4	SOU181-017
181RU18-1	SOU181-018
181RU18-2	SOU181-018
181RU18-3	SOU181-018
181RU18-4	SOU181-018
181RU19-1	SOU181-019
181RU19-2	SOU181-019
181RU19-3	SOU181-019
181RU19-4	SOU181-019
181RU20-1	SOU181-020
181RU20-2	SOU181-020
181RU20-3	SOU181-020
181RU20-4	SOU181-020
181RU21-1	SOU181-021
181RU21-2	SOU181-021
181RU21-3	SOU181-021
181RU21-4	SOU181-021
181RU22	SOU181-022
181RU22-1	SOU181-022
181RU22-2	SOU181-022
181RU22-3	SOU181-022
181RU22-4	SOU181-022
181RU23	SOU181-023

Table B1.1.5.4-2. Stations and Grids for Historical Data from SWMU 181 (Continued)

Station Name	Grid No.
181RU23-1	SOU181-023
181RU23-2	SOU181-023
181RU23-3	SOU181-023
181RU23-4	SOU181-023
181RU24-1	SOU181-024
181RU24-2	SOU181-024
181RU24-3	SOU181-024
181RU24-4	SOU181-024
181RU25-1	SOU181-025
181RU25-2	SOU181-025
181RU25-3	SOU181-025
181RU25-4	SOU181-025
C21805	SOU181-BACK
C21806	SOU181-BACK
C21807	SOU181-BACK
C21808	SOU181-BACK
C21801	SOU181-EAST
C21802	SOU181-EAST
C21803	SOU181-EAST
C21804	SOU181-EAST
C21809	SOU181-WEST
C21810	SOU181-WEST

Table B1.1.5.4-3. Summary of SWMU 181 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	54/54	5270	7504	105000	0/54	54/54
Antimony	5/54	0.19	0.24	0.28	4/54	0/54
Arsenic	42/54	3.88	5.02	6.99	0/54	42/54
Barium	54/54	87.9	105.5	141	0/54	1/54
Beryllium	13/54	0.45	0.478	0.521	0/54	13/54
Cadmium	24/54	0.46	0.605	0.707	24/54	0/54
Calcium	54/54	79800	133478	182000	38/54	0/54
Chromium	54/54	9.91	15.46	47.9	4/54	16/54
Cobalt	54/54	5.81	7.18	8.7	0/54	54/54
Copper	54/54	20.1	30.5	44.7	47/54	0/54
Iron	54/54	13600	18002	24600	0/54	54/54
Lead	147/177	8.2	21.22	88.41	52/177	0/177
Magnesium	54/54	2320	2998	4060	38/54	0/54

Table B1.1.5.4-3. Summary of SWMU 181 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Manganese	54/54	369	435	551	0/54	31/54
Mercury	54/54	0.065	0.096	0.14	2/54	0/54
Nickel	54/54	7.26	8.73	10.3	0/54	0/54
Silver	5/54	0.1	0.12	0.16	0/54	0/54
Sodium	5/54	227	240	254	0/54	0/54
Thallium	1/54	3.5	3.5	3.5	1/54	1/54
Uranium	2/50	1.05	1.71	2.37	0/50	0/50
Vanadium	54/54	11.5	15.8	25.2	0/54	54/54
Zinc	54/54	46.2	62.1	85.5	29/54	0/54
Organics (mg/kg)						
PCB, Total	1/55	0.17	0.17	0.17		1/55
Anthracene	2/5	0.0036	0.00465	0.0057		0/5
Benzo(ghi)perylene	5/5	0.013	0.0156	0.02		0/5
Fluoranthene	5/5	0.017	0.0262	0.046		0/5
Naphthalene	5/5	0.0045	0.0049	0.0053		0/5
Phenanthrene	5/5	0.014	0.0198	0.033		0/5
Pyrene	5/5	0.023	0.0332	0.06		0/5
Total PAH	6/6	0.021076	0.026537	0.039144		6/6
Radionuclides (pCi/g)						
Americium-241	46/46	-0.00659	-0.00302021	0.00405	0/46	0/46
Cesium-137	50/50	-0.1	0.0661532	0.125	0/50	46/50
Neptunium-237	47/47	-0.0113	-0.00281468	0.0113	0/47	0/47
Plutonium-238	43/43	-0.00794	-0.00388195	0.019	0/43	0/43
Plutonium-239/240	46/46	-0.00318	0.002255183	0.0167	0/46	0/46
Technetium-99	50/50	0.0105	0.661554	1.57	0/50	0/50
Thorium-228	50/50	0.19	0.28952	0.84	0/50	0/50
Thorium-230	50/50	0.161	0.27658	0.8	0/50	0/50
Thorium-232	50/50	0.164	0.25664	0.71	0/50	0/50
Uranium-234	50/50	0.0575	0.189528	0.74	0/50	0/50
Uranium-235	48/48	-0.00136	0.006683792	0.0157	0/48	0/48
Uranium-235/236	1/1	0.022	0.022	0.022	0/1	0/1
Uranium-238	50/50	0.0548	0.174438	0.79	0/50	/50

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.5.5 SWMU 195 (Curlee Road Contaminated Soil Mounds)

Data Evaluation and Screening

Historical data for this SWMU include metals, pesticides/PCBs, radionuclides, and VOCs in the surface soils. These data were collected from the following projects:

- Annual Sediment Sampling 1989
- Annual Sediment Sampling 1990
- Annual Sediment Sampling 1991
- Historical data from AnaLIS for WAG 28 DQO
- RCWC Data ESO16937

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 9 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 195. All of these sampling locations represent conditions sampled outside the probable influence of the SWMU; therefore, they have been removed from the data set.

B1.1.5.6 SWMU 486 (Rubble Pile WKWMA)

Data Evaluation and Screening

No historical data for this SWMU are available in OREIS.

B1.1.5.7 SWMU 487 (Rubble Pile WKWMA)

Data Evaluation and Screening

No historical data for this SWMU are available in OREIS.

B1.1.5.8 AOC 492 (Contaminated Soil Area, North of Outfall 10)

Data Evaluation and Screening

Historical data for this SWMU include metals, pesticides/PCBs, radionuclides, SVOCs, and VOCs in the surface soils. Only surface soil data is available for this SWMU. These data were collected from the following projects:

- Remedial Action SI—Phase 2
- Soil Piles Little Bayou Creek Field Screen Data—SP09-LBC-FIELD
- Soil Piles Little Bayou Creek Subunit 3 (Addm 1B) SP09-LBC-SU3
- Special Soil Sampling @ Little Bayou Creek and K011 ESSPSO01-01

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 9 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 492. Those sampling locations that represent conditions sampled outside the probable influence of the SWMU have been removed from the data set.

Usability of Historical Data

Validation: Data validation was performed on 10% of the Soil Piles fixed-base laboratory project data (although the data associated with this SWMU were not validated) and the Remedial Action Phase 2 sampling projects. Qualifiers of "?," =, J, and N. [Presumptively present at an estimated quantity (for use with TICS only)] were applied to the data. Qualifiers of NJ were applied to lead results. These data will remain in the data set.

Data Assessment: The data assessment qualifiers that have been applied to the data associated with this SWMU are listed in Table B1.1.5.8-1.

Table B1.1.5.8-1. Assessment Qualifiers Applied to AOC 492 Historic Data

ASSESSMENT	DESCRIPTION
NOVAL	Validation requested, but qualifier not provided due to missing Form I

It was noted in the Site Evaluation Report (SER) for Soil Pile I that uranium-238 data from ISOCS should not be used to support risk assessment, nor as the sole basis for making regulatory related decisions (DOE 2008). These data subsequently were removed from the Soils OU data set.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data for SWMU 492 that had no have detection limits or results were removed from the data set. All of the radionuclide historical data have MDCs and counting errors.

There are 22 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. The chemical and referenced values are shown in Table B1.1.5.8-2.

Table B1.1.5.8-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for AOC 492

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	20	0.552	0.21	0.21
Beryllium	mg/kg	0.478	0.00567		
Silver	mg/kg	4	2.61		
Thallium	mg/kg	20	0.368	0.21	0.34
Organics					
Dieldrin	mg/kg	0.02	0.0106		
PCB, Total	mg/kg	0.13	0.0648		
PCB-1016	mg/kg	0.1	0.0633		

Table B1.1.5.8-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for AOC 492 (Continued)

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
PCB-1221	mg/kg	0.13	0.0437		
PCB-1232	mg/kg	0.1	0.0437		
PCB-1242	mg/kg	0.1	0.0644		
PCB-1248	mg/kg	0.1	0.0682		
PCB-1254	mg/kg	0.2	0.0501		
PCB-1260	mg/kg	0.2	0.0662		
2-Nitrobenzenamine	mg/kg	2	0.296		
Benz(a)anthracene	mg/kg	0.5	0.196		
Benzo(a)pyrene	mg/kg	0.5	0.0197		
Benzo(b)fluoranthene	mg/kg	0.5	0.197		
Dibenz(a,h)anthracene	mg/kg	0.5	0.0197		
Hexachlorobenzene	mg/kg	0.41	0.0492		
Indeno(1,2,3-cd)pyrene	mg/kg	0.5	0.197		
N-Nitroso-di-n-propylamine	mg/kg	0.41	0.0189		
Total PAH	mg/kg	0.2	0.0197		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

Radionuclide data without counting uncertainty (referred to as "RAD_ERR" in the data set) have been removed from the data set. Additionally, alpha, beta, and gamma activity (nonisotope-specific analyses) have been removed from the data set because they are not quantifiable isotopes; calculated total uranium reported in pCi/g has been removed from the data set because it is not usable in quantifying risk.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data have been assigned to grids, as listed in Table B1.1.5.8-3.

Summary of Detected Chemicals

A summary of detected chemicals is presented as in Table B1.1.5.8-4.

B1.1.5.9 SWMU 493 (Concrete Rubble Piles near Outfall 001)

There are no historic data for this SWMU.

B1.1.5.10 SWMU 517 (Rubble and Debris Erosion Control Fill Area)

There are no historic data for this SWMU.

Table B1.1.5.8-3. Stations and Grids for Historical Data from SWMU 492

Station Name	Grid No.
SOU492-001	K11LBC1
SOU492-001	K11LBC2
SOU492-001	K11LBC3
SOU492-001	LBC004
SOU492-001	LBCAR01
SOU492-001	LBCAR02
SOU492-001	LBCAR03
SOU492-001	LBCAR04
SOU492-001	LBCAR05
SOU492-001	LBCAR06

Table B1.1.5.8-4. Summary of AOC 492 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	7/7	3.04E+03	6.14E+03	9.92E+03	0/7	4/7
Arsenic	7/7	2.76E+00	6.70E+00	1.47E+01	1/7	7/7
Barium	19/19	3.53E+01	2.13E+02	3.80E+02	11/19	11/19
Beryllium	5/7	5.20E-01	4.33E+00	1.04E+01	2/7	5/7
Cadmium	5/7	1.60E+00	2.45E+00	3.14E+00	2/7	5/7
Calcium	7/7	5.30E+02	1.38E+03	2.11E+03	0/7	0/7
Chromium	7/19	6.20E+00	2.89E+02	1.04E+03	2/19	5/19
Cobalt	7/7	3.34E+00	6.35E+00	1.07E+01	0/7	7/7
Copper	7/7	4.50E+00	2.63E+01	8.47E+01	0/7	0/7
Iron	7/7	6.91E+03	1.15E+04	1.69E+04	0/7	7/7
Lead	17/19	6.91E+00	1.37E+01	2.80E+01	0/19	0/19
Magnesium	7/7	3.21E+02	7.64E+02	1.25E+03	0/7	0/7
Manganese	7/7	1.81E+02	3.40E+02	4.26E+02	0/7	1/7
Mercury	2/7	1.70E-02	1.85E-02	2.00E-02	0/7	0/7
Nickel	6/7	5.90E+00	1.13E+01	1.67E+01	0/7	3/7
Potassium	5/5	1.47E+02	3.84E+02	5.96E+02	0/5	0/5
Selenium	2/4	3.40E-01	4.95E-01	6.50E-01	0/4	0/4
Sodium	2/7	4.04E+01	1.69E+02	2.97E+02	0/7	0/7

Table B1.1.5.8-4. Summary of AOC 492 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Uranium	5/17	1.03E+00	7.53E+02	1.77E+03	0/17	3/17
Vanadium	7/7	1.03E+01	2.30E+01	4.32E+01	1/7	7/7
Zinc	6/7	2.50E+01	2.10E+02	6.62E+02	0/7	0/7
Organics (mg/kg)						
PCB, Total	3/17	1.09E+01	2.79E+01	4.41E+01	0/17	3/17
PCB-1248	3/7	5.80E+00	1.23E+01	1.87E+01	0/7	3/7
PCB-1254	3/7	2.80E+00	9.37E+00	1.54E+01	0/7	3/7
PCB-1260	3/7	2.30E+00	6.23E+00	1.00E+01	0/7	3/7
Radionuclides (pCi/g)						
Americium-241	5/5	-2.51E-03	3.32E-01	7.39E-01	0/5	0/5
Cesium-134	3/3	-7.21E-03	8.80E-03	2.28E-02	0/3	0/3
Cesium-137	17/17	-3.00E-02	8.22E-02	3.46E-01	0/17	10/17
Cobalt-60	3/3	-5.83E-03	-6.53E-04	9.63E-03	0/3	1/3
Iodine-131	3/3	-3.33E-02	-2.24E-02	-1.53E-03	0/3	0/3
Neptunium-237	5/5	-4.08E-03	8.91E-02	2.09E-01	0/5	2/5
Plutonium-238	5/5	-4.16E-03	1.43E-02	3.36E-02	0/5	0/5
Plutonium-239/240	5/5	-8.91E-04	2.24E-02	5.31E-02	0/5	0/5
Potassium-40	3/3	6.97E+00	7.52E+00	7.82E+00	0/3	0/3
Protactinium-234m	3/3	1.92E+02	3.89E+02	5.37E+02	0/3	0/3
Radium-226	3/3	5.74E-01	6.45E-01	7.39E-01	0/3	0/3
Strontium-90	3/3	-1.20E+00	-7.95E-01	-7.44E-02	0/3	0/3
Technetium-99	5/5	-3.46E-02	4.75E+00	1.40E+01	0/5	0/5
Thorium-228	5/5	2.74E-01	5.45E-01	7.38E-01	0/5	0/5
Thorium-230	5/5	1.92E-01	5.53E-01	9.71E-01	0/5	0/5
Thorium-232	5/5	2.98E-01	5.34E-01	7.03E-01	0/5	0/5
Thorium-234	3/3	1.32E+02	2.70E+02	3.75E+02	0/3	0/3
Uranium-234	5/5	1.33E-01	2.18E+01	5.39E+01	0/5	3/5
Uranium-235	5/5	3.12E-03	2.41E+00	5.72E+00	0/5	3/5
Uranium-238	17/17	-3.70E+00	4.94E+01	3.83E+02	5/17	20/17

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.5.11 AOC 541 (Contaminated Area by Outfall 011)

<u>Data Evaluation and Screening</u>

Historical data for this SWMU include metals, pesticides/PCBs, radionuclides, SVOCs, and VOCs in the surface and shallow subsurface soils. These data were collected from the following projects:

- AIP Soil Samples (Addendum 1b) LBCO055, LBCO070 & LBCO72 December 2008 Split w/DOE AIPSOSLSP12-08
- Soil Contamination Area South of Outfall 011 SM02-21
- Soil Piles Little Bayou Creek Field Screen Data—SP09-LBC-FIELD
- Soil Piles Little Bayou Creek Addendum 1B Additional Evaluation
- Soil Piles Little Bayou Creek Subunit 3 (Addm 1B) SP09-LBC-SU3
- Storm Water Collection Basin near Outfall 008 ERI02-BSN011

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 9 illustrate the locations of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to AOC 541. These data locations have been refined so that data within the soil pile are considered representative of the SWMU/AOC.

Usability of Historical Data

Validation: Data validation was performed on 10% of the Soil Piles fixed-base laboratory project data and 100% of the AIP sampling projects. Qualifiers of =, J, and U, were applied to the data.

Data Assessment: The data assessment qualifiers that have been applied to the data for this SWMU is shown in Table B1.1.5.11-1.

Table B1.1.5.11-1. Assessment Qualifiers Applied to AOC 541 Historic Data.

ASSESSMENT	DESCRIPTION
NOVAL	Validation requested but qualifier not provided due to missing Form I

It was noted in the SER for Soil Pile I that uranium-238 data from ISOCS should not be used to support risk assessment, nor as the sole basis for making regulatory related decisions (DOE 2008). These data were subsequently removed from the Soils OU data set.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data for AOC 541 that had no detection limits or results recorded have been removed from the data set. For radionuclide historical data, all data have MDCs recorded within the data set.

There are 23 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. The chemical and referenced values are shown in Table B1.1.5.11-2.

Table B1.1.5.11-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for AOC 541

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	20	0.552	0.21	0.21
Arsenic	mg/kg	5	0.238		
Beryllium	mg/kg	0.5	0.00567		
Cadmium	mg/kg	2.49	0.811	0.21	0.21
Thallium	mg/kg	20	0.368	0.21	0.34
Uranium	mg/kg	100	13.8	4.9	4.6
Organics					
PCB, Total	mg/kg	0.13	0.0648		
PCB-1016	mg/kg	1	0.0633		
PCB-1221	mg/kg	1.29	0.0437		
PCB-1232	mg/kg	1	0.0437		
PCB-1242	mg/kg	0.6	0.0644		
PCB-1248	mg/kg	0.1	0.0682		
PCB-1254	mg/kg	0.41	0.0501		
PCB-1260	mg/kg	0.1	0.0662		
2-Nitrobenzenamine	mg/kg	0.5	0.296		
Benz(a)anthracene	mg/kg	0.5	0.196		
Benzo(a)pyrene	mg/kg	0.5	0.0197		
Benzo(b)fluoranthene	mg/kg	0.5	0.197		
Dibenz(a,h)anthracene	mg/kg	0.5	0.0197		
Hexachlorobenzene	mg/kg	0.5	0.0492		
Indeno(1,2,3-cd)pyrene	mg/kg	0.5	0.197		
N-Nitroso-di-n-propylamine	mg/kg	0.5	0.0189		
Polycyclic aromatic hydrocarbons (PAH)	mg/kg	0.2	0.0197		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

Records with no radionuclide counting errors and radionuclide counting errors equal to 0 have been removed from the data set. Additionally, alpha and beta activity and calculated total uranium reported in pCi/g was removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data points have been assigned to grids developed during the Soils OU RI. Those assignments are listed in Table B1.1.5.11-3.

Table B1.1.5.11-3. Stations and Grids for Historical Data from AOC 541

Station Name	Grid No.
SOU541-001	011CA-1
SOU541-001	011CA-12
SOU541-001	011CA-13
SOU541-001	011CA-4
SOU541-001	011CA-9
SOU541-001	BSN011-24
SOU541-001	BSN011-28
SOU541-001	LBCBV01
SOU541-001	LBCBV02
SOU541-001	LBCBV03
SOU541-001	LBCO001
SOU541-001	LBCO002
SOU541-001	LBCO003
SOU541-001	LBCO004
SOU541-001	LBCO005
SOU541-001	LBCO006
SOU541-001	LBCO007
SOU541-001	LBCO008
SOU541-001	LBCO009
SOU541-001	LBCO010
SOU541-001	LBCO011
SOU541-001	LBCO012
SOU541-001	LBCO013
SOU541-001	LBCO014
SOU541-001	LBCO015
SOU541-001	LBCO016
SOU541-001	LBCO017
SOU541-001	LBCO018
SOU541-001	LBCO019
SOU541-001	LBCO020
SOU541-001	LBCO021

Table B1.1.5.11-3. Stations and Grids for Historical Data from AOC 541 (Continued)

Station Name	Grid No.
SOU541-001	LBCO022
SOU541-001	LBCO023
SOU541-001	LBCO024
SOU541-001	LBCO025
SOU541-001	LBCO026
SOU541-001	LBCO027
SOU541-001	LBCO028
SOU541-001	LBCO029
SOU541-001	LBCO030
SOU541-001	LBCO031
SOU541-001	LBCO032
SOU541-001	LBCO033
SOU541-001	LBCO034
SOU541-001	LBCO035
SOU541-001	LBCO036
SOU541-001	LBCO037
SOU541-001	LBCO038
SOU541-001	LBCO039
SOU541-001	LBCO040
SOU541-001	LBCO041
SOU541-001	LBCO042
SOU541-001	LBCO043
SOU541-001	LBCO044
SOU541-001	LBCO045
SOU541-001	LBCO046
SOU541-001	LBCO047
SOU541-001	LBCO048
SOU541-001	LBCO049
SOU541-001	LBCO050
SOU541-001	LBCO051
SOU541-001	LBCO052
SOU541-001	LBCO053
SOU541-001	LBCO054
SOU541-001	LBCO055
SOU541-001	LBCO056
SOU541-001	LBCO057

Table B1.1.5.11-3. Stations and Grids for Historical Data from AOC 541 (Continued)

Station Name	Grid No.
SOU541-001	LBCO058
SOU541-001	LBCO059
SOU541-001	LBCO060
SOU541-001	LBCO061
SOU541-001	LBCO062
SOU541-001	LBCO063
SOU541-001	LBCO064
SOU541-001	LBCO065
SOU541-001	LBCO066
SOU541-001	LBCO067
SOU541-001	LBCO068
SOU541-001	LBCO069
SOU541-001	LBCO070
SOU541-001	LBCO071
SOU541-001	LBCO072
SOU541-001	LBCO073
SOU541-001	LBCO074
SOU541-001	LBCO075
SOU541-001	LBCO076
SOU541-001	LBCO077
SOU541-001	LBCO078
SOU541-001	LBCO079
SOU541-001	LBCO080
SOU541-001	LBCO081
SOU541-001	LBCO082
SOU541-001	LBCO083
SOU541-001	LBCO084
SOU541-001	LBCO085
SOU541-001	LBCO086
SOU541-001	LBCO087
SOU541-001	LBCO088
SOU541-001	LBCO089
SOU541-001	LBCO090
SOU541-001	LBCO091
SOU541-001	LBCO092
SOU541-001	LBCO093

Table B1.1.5.11-3. Stations and Grids for Historical Data from AOC 541 (Continued)

Station Name	Grid No.
SOU541-001	LBCO094
SOU541-001	LBCO095
SOU541-001	LBCO096
SOU541-001	LBCO098
SOU541-001	LBCO099
SOU541-001	LBCO100
SOU541-001	LBCO101
SOU541-001	LBCO102
SOU541-001	LBCO103
SOU541-001	LBCO104
SOU541-001	LBCO105
SOU541-001	LBCO106
SOU541-001	LBCO107
SOU541-001	LBCO108
SOU541-001	LBCO109
SOU541-001	LBCO110
SOU541-001	LBCO111
SOU541-001	LBCO112
SOU541-001	LBCO113
SOU541-001	LBCO114
SOU541-001	LBCO115
SOU541-001	LBCO116
SOU541-001	LBCO117
SOU541-001	LBCO118
SOU541-001	LBCO119
SOU541-001	LBCO120
SOU541-001	LBCO121
SOU541-001	LBCO122
SOU541-001	LBCO123
SOU541-001	LBCO124
SOU541-001	LBCO125
SOU541-001	LBCO126
SOU541-001	LBCO127
SOU541-001	LBCO128
SOU541-001	LBCO129
SOU541-001	LBCO130

Table B1.1.5.11-3. Stations and Grids for Historical Data from AOC 541 (Continued)

Station Name	Grid No.
SOU541-001	LBCO131
SOU541-001	LBCO132
SOU541-001	LBCO133
SOU541-001	LBCO134
SOU541-001	LBCO135
SOU541-001	LBCO136
SOU541-001	LBCO137
SOU541-001	LBCO138
SOU541-001	LBCO139
SOU541-001	LBCO140
SOU541-001	LBCO141
SOU541-001	LBCO142
SOU541-001	LBCO143
SOU541-001	LBCO144
SOU541-001	LBCO145
SOU541-001	LBCO146
SOU541-001	LBCO147
SOU541-001	LBCO148
SOU541-001	LBCO149
SOU541-001	LBCO150
SOU541-001	LBCO151
SOU541-001	LBCO152
SOU541-001	LBCO153
SOU541-001	LBCO154
SOU541-001	LBCO155
SOU541-001	LBCO156
SOU541-001	LBCO157
SOU541-001	LBCO158
SOU541-001	LBCO159
SOU541-001	LBCO160
SOU541-001	LBCO161
SOU541-001	LBCO162
SOU541-001	LBCO163
SOU541-001	LBCO164
SOU541-001	LBCO165
SOU541-001	LBCO166

Table B1.1.5.11-3. Stations and Grids for Historical Data from AOC 541 (Continued)

Station Name	Grid No.
SOU541-001	LBCO167
SOU541-001	LBCO168
SOU541-001	LBCO169
SOU541-001	LBCO170
SOU541-001	LBCO171
SOU541-001	LBCO172
SOU541-001	LBCO173
SOU541-001	LBCO174
SOU541-001	LBCO175
SOU541-001	LBCO176
SOU541-001	LBCO177
SOU541-001	LBCO178
SOU541-001	LBCO179
SOU541-001	LBCO180
SOU541-001	LBCO181
SOU541-001	LBCO182
SOU541-001	LBCO183
SOU541-001	LBCO184
SOU541-001	LBCO185
SOU541-001	LBCO186
SOU541-001	LBCO187
SOU541-001	LBCO188
SOU541-001	LBCO189
SOU541-001	LBCO190
SOU541-001	LBCO191
SOU541-001	LBCO192
SOU541-001	LBCO193
SOU541-001	LBCO194
SOU541-001	LBCO195
SOU541-001	LBCO196
SOU541-001	LBCO197
SOU541-001	LBCO198
SOU541-001	LBCO199
SOU541-001	LBCO200
SOU541-001	LBCO201
SOU541-001	LBCO202

Table B1.1.5.11-3. Stations and Grids for Historical Data from AOC 541 (Continued)

Station Name	Grid No.
SOU541-001	LBCO203
SOU541-001	LBCO204
SOU541-001	LBCO205
SOU541-001	LBCO206
SOU541-001	LBCO207
SOU541-001	LBCO208
SOU541-001	LBCO209
SOU541-001	LBCO210
SOU541-001	LBCO211
SOU541-001	LBCO212
SOU541-001	LBCO213
SOU541-001	LBCO214
SOU541-001	LBCO215
SOU541-001	LBCO216
SOU541-001	LBCO217
SOU541-001	LBCO218
SOU541-001	LBCO219
SOU541-001	LBCO220
SOU541-001	LBCO221
SOU541-001	LBCO222
SOU541-001	LBCO223
SOU541-001	LBCO224
SOU541-001	LBCO225
SOU541-001	LBCO226
SOU541-001	LBCO227
SOU541-001	LBCO228
SOU541-001	LBCO229
SOU541-001	LBCO230
SOU541-001	LBCO231
SOU541-001	LBCO232
SOU541-001	LBCO233
SOU541-001	LBCO234
SOU541-001	LBCO235
SOU541-001	LBCO236
SOU541-001	LBCO237
SOU541-001	LBCO238

Table B1.1.5.11-3. Stations and Grids for Historical Data from AOC 541 (Continued)

Station Name	Grid No.
SOU541-001	LBCO239
SOU541-001	LBCO240
SOU541-001	LBCO241
SOU541-001	LBCO242
SOU541-001	NONCA-1
SOU541-001	NONCA-2

Summary of Detected Chemicals

A summary of detected chemicals is presented as in Table B1.1.5.11-4.

Table B1.1.5.11-4. Summary of AOC 541 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	67/67	5.07E+03	1.23E+04	1.92E+04	32/67	67/67
Arsenic	58/67	1.28E+00	6.09E+00	2.33E+01	4/67	58/67
Barium	448/480	4.44E+01	2.93E+02	5.48E+02	342/480	368/480
Beryllium	28/67	3.40E-01	7.00E-01	1.46E+00	10/67	28/67
Cadmium	32/67	4.60E-02	7.88E-01	2.75E+00	30/67	10/67
Calcium	67/67	6.82E+02	3.53E+03	5.92E+04	2/67	0/67
Chromium	311/480	8.77E+00	1.39E+02	3.35E+03	265/480	301/480
Cobalt	67/67	2.88E+00	6.06E+00	1.23E+01	0/67	67/67
Copper	66/67	5.80E+00	2.00E+01	1.61E+02	13/67	0/67
Iron	67/67	7.08E+03	1.40E+04	2.96E+04	2/67	67/67
Lead	440/480	5.91E+00	1.62E+01	9.43E+01	35/480	0/480
Lithium	2/2	5.39E+00	6.13E+00	6.86E+00	0/2	0/2
Magnesium	67/67	6.39E+02	1.61E+03	4.42E+03	3/67	0/67
Manganese	67/67	8.70E+01	3.15E+02	8.21E+02	0/67	12/67
Mercury	48/67	1.60E-02	4.74E-02	6.70E-01	3/67	2/67
Molybdenum	1/48	5.62E+00	5.62E+00	5.62E+00	0/48	0/48
Nickel	67/67	5.19E+00	1.07E+01	3.28E+01	3/67	23/67
Potassium	17/17	4.09E+02	8.33E+02	1.78E+03	4/17	0/17
Selenium	11/67	1.02E+00	1.34E+00	2.00E+00	11/67	0/67
Silver	1/67	3.30E-01	3.30E-01	3.30E-01	0/67	0/67
Sodium	3/65	3.57E+01	4.01E+01	4.50E+01	0/65	0/65

Table B1.1.5.11-4. Summary of AOC 541 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Tin	1/2	1.26E+02	1.26E+02	1.26E+02	0/2	0/2
Uranium	446/477	1.39E+00	7.70E+02	2.02E+04	442/477	428/477
Vanadium	67/67	1.25E+01	2.66E+01	5.17E+01	7/67	67/67
Zinc	66/67	2.01E+01	1.04E+02	1.09E+03	23/67	0/67
Organics (mg/kg)						
PCB, Total	96/479	1.50E-01	2.92E+01	9.40E+01	0/479	96/479
PCB-1248	38/69	1.50E-01	3.33E+00	2.05E+01	0/69	38/69
PCB-1254	51/69	1.60E-01	4.74E+00	4.60E+01	0/69	51/69
PCB-1260	55/69	8.00E-02	4.34E+00	4.80E+01	0/69	55/69
Acenaphthene	4/64	5.40E-01	1.08E+00	2.00E+00	0/64	0/64
Anthracene	5/64	6.40E-01	1.44E+00	2.60E+00	0/64	0/64
Benz(a)anthracene	12/64	5.20E-01	2.31E+00	6.40E+00	0/64	12/64
Benzo(a)pyrene	11/64	5.70E-01	2.20E+00	5.10E+00	0/64	22/64
Benzo(b)fluoranthene	12/64	8.40E-01	3.60E+00	1.10E+01	0/64	12/64
Benzo(ghi)perylene	8/64	5.30E-01	1.15E+00	1.80E+00	0/64	0/64
Benzo(k)fluoranthene	11/62	5.00E-01	1.91E+00	3.90E+00	0/62	5/62
Carbazole	2/16	6.40E-01	8.20E-01	1.00E+00	0/16	0/16
Chrysene	12/64	6.90E-01	2.67E+00	6.70E+00	0/64	0/64
Dibenz(a,h)anthracene	1/64	5.20E-01	5.20E-01	5.20E-01	0/64	1/64
Dibenzofuran	1/15	6.00E-01	6.00E-01	6.00E-01	0/15	0/15
Di-n-butyl phthalate	8/14	6.40E-01	9.10E-01	1.40E+00	0/14	0/14
Fluoranthene	16/62	4.60E-01	4.90E+00	2.40E+01	0/62	0/62
Fluorene	3/64	5.50E-01	9.53E-01	1.50E+00	0/64	0/64
Indeno(1,2,3-cd)pyrene	8/64	7.00E-01	1.45E+00	2.30E+00	0/64	8/64
Naphthalene	2/64	5.00E-01	1.15E+00	1.80E+00	0/64	1/64
Phenanthrene	14/64	4.60E-01	4.09E+00	1.90E+01	0/64	0/64
Polycyclic aromatic hydrocarbons (PAH)	49/413	2.00E-05	5.10E-01	4.34E+00	0/413	44/413
Pyrene	14/64	4.80E-01	4.22E+00	1.40E+01	0/64	0/64
Total PAH	12/64	1.56E-01	2.76E+00	7.63E+00	0/64	12/64
Methylene chloride	5/14	1.00E-02	1.10E-02	1.20E-02	0/14	0/14
Radionuclides (pCi/g)						
Americium-241	64/64	-5.12E-02	7.37E-01	2.73E+01	0/64	6/64
Cesium-134	16/16	-1.38E-01	-1.31E-02	3.10E-02	0/16	0/16
Cesium-137	482/482	-4.00E-02	1.32E-01	2.33E+00	26/482	388/482
Cobalt-60	16/16	-2.02E-02	-2.34E-03	1.83E-02	0/16	4/16
Iodine-131	14/14	-1.94E-01	-8.94E-03	8.89E-02	0/14	0/14
Neptunium-237	61/61	-2.85E-02	5.67E-03	1.81E-01	1/61	2/61
Plutonium-238	57/57	-4.65E-02	-9.80E-03	1.70E-02	0/57	0/57

Table B1.1.5.11-4. Summary of AOC 541 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Plutonium-239/240	66/66	-8.68E-03	1.30E-02	1.56E-01	7/66	0/66
Potassium-40	14/14	8.81E+00	1.01E+01	1.15E+01	0/14	0/14
Protactinium-234m	14/14	5.12E+01	1.13E+03	6.83E+03	0/14	0/14
Radium-226	14/14	6.14E-01	8.10E-01	1.15E+00	0/14	0/14
Strontium-90	10/10	4.47E-01	2.32E+00	3.78E+00	0/10	0/10
Technetium-99	64/64	2.01E-02	3.41E+00	3.65E+01	12/64	0/64
Thorium-228	66/66	3.03E-01	4.98E-01	1.07E+00	0/66	0/66
Thorium-230	66/66	2.66E-01	4.73E-01	1.33E+00	0/66	0/66
Thorium-232	66/66	2.96E-01	4.85E-01	1.08E+00	0/66	0/66
Thorium-234	14/14	3.63E+01	7.51E+02	4.36E+03	0/14	0/14
Uranium-234	66/66	8.20E-02	3.58E+01	7.13E+02	54/66	40/66
Uranium-235	66/66	8.94E-05	5.19E+00	6.51E+01	60/66	53/66
Uranium-238	482/482	-3.12E+00	2.70E+02	5.57E+03	466/482	940/482

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.5.12 SWMU 561 (Soil Pile I)

Data Evaluation and Screening

Historical data for this SWMU include metals, pesticides/PCBs, radionuclides, SVOCs, and VOCs in the surface and shallow subsurface soils. These data were collected from the following projects:

- AIP Soil Samples from Surface Locations taken June 2007 (Soil Piles) AIPSOSL06-07
- AIP Soil Samples Little Bayou Creek Soil Pile Investigation November 2006 Split with DOE AIPSOSLSP1
- KYRAD Soil Piles Data July 2007 Split with DOE KYRADSP07
- Soil Piles Little Bayou Creek Field Screen Data—SP07-LBC-FIELD
- Soil Piles Little Bayou Creek Subunit 1 SP07-LBC-SU1
- Soil Piles Little Bayou Creek Subunit 2 SP07-LBC-SU2
- Soil Piles Little Bayou Creek Subunit 3 SP07-LBC-SU3SF
- Soil Piles Little Bayou Creek Subunit 3 SP07-LBC-SU3SSF
- Soil Piles Little Bayou Creek Subunit 3 Additional Field Screen SP07-LBC-SU3SSF-FS

- Soil Piles Little Bayou Creek Subunit 3 Contingency SP07-LBC-SU3C
- Soil Piles Little Bayou Creek Subunit 4 SP07-LBC-SU4SF
- Soil Piles Little Bayou Creek Subunit 4 SP07-LBC-SU4SSF
- Soil Piles Little Bayou Creek Subunit 4 Subsurface Field Screen SP07-LBC-SU4SSF-FS
- Special Soil Sampling along Little Bayou Creek, North of McCaw Road EMSPSO07-01

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 9 illustrate the locations of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 561.

Usability of Historical Data

Validation: Data validation was performed on 10% of the Soil Piles fixed-base laboratory project data and a portion of the AIP sampling projects. Qualifiers of =, J, and U were applied to the data.

Data Assessment: The data assessment qualifiers that have been applied to the data for this SWMU are listed in Table B1.1.5.12-1.

Table B1.1.5.12-1. Assessment Qualifiers Applied to SWMU 561 Historic Data

ASSESSMENT	DESCRIPTION
?	Other, defined in COMMENTS column
BH-RI	Result may be biased high, chemical detected in associated equipment rinsate.
USECNITRIC-CF	During the period from May 2004 to September 2009, the USEC-PGDP laboratory used method RL-7128-NITRIC for isotopic uranium analysis by alpha spec. Method RL-7128-NITRIC utilizes only nitric acid for dissolution rather than hydrofluoric/nitric acid. The use of nitric acid only is a less aggressive dissolution for isotopic uranium analysis by alpha spec. It has been demonstrated that Method RL-7128-NITRIC can be utilized only for isotopic uranium analysis of soil with activity greater than 10 pCi/g due to low recoveries below that level. If the data from Method RL-7128-NITRIC will be screened against the background values reported in *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the PGDP* (1997), the following adjusted background values must be used: U-234: 1.73 pCi/g surface and 1.63 pCi/g subsurface; U-235: 0.10 pCi/g; and U-238: 0.40 pCi/g [*Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant*, Appendix E (2009)]. Risk assessors may use data from this time period for comparison against other thresholds below 10 pCi/g without adjusting the values as long as the level of uncertainty and its impact on the risk assessment/evaluation are adequately discussed. No additional action is required for comparisons to thresholds above 10 pCi/g.

It was noted in the SER for Soil Pile I that uranium-238 data from ISOCS should not be used to support risk assessment, nor as the sole basis for making regulatory related decisions (DOE 2008). These data subsequently were removed from the Soils OU data set.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All nonradionuclide historical data that had no records have detection limits and results were removed from the data set. All radionuclide historical data have MDCs.

There are 20 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. The chemical and referenced values are shown in Table B1.1.5.12-2.

Table B1.1.5.12-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 561

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	13.9	0.552	0.21	0.21
Arsenic	mg/kg	20	0.238	12	7.9
Beryllium	mg/kg	0.499	0.00567		
Cadmium	mg/kg	2	0.811	0.21	0.21
Thallium	mg/kg	20	0.368	0.21	0.34
Organics					
PCB, Total	mg/kg	0.4	0.0648		
PCB-1016	mg/kg	0.98	0.0633		
PCB-1221	mg/kg	1.28	0.0437		
PCB-1232	mg/kg	0.98	0.0437		
PCB-1242	mg/kg	0.59	0.0644		
PCB-1248	mg/kg	0.16	0.0682		
PCB-1254	mg/kg	0.09	0.0501		
2-Nitrobenzenamine	mg/kg	2.2	0.296		
Benz(a)anthracene	mg/kg	0.44	0.196		
Benzo(a)pyrene	mg/kg	0.44	0.0197		
Benzo(b)fluoranthene	mg/kg	0.46	0.197		
Dibenz(a,h)anthracene	mg/kg	0.44	0.0197		
Hexachlorobenzene	mg/kg	0.5	0.0492		
Indeno(1,2,3-cd)pyrene	mg/kg	0.44	0.197		
N-Nitroso-di-n-propylamine	mg/kg	0.44	0.0189		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

Radionuclide data that had no radionuclide counting error, or had an error of 0, but did have total propagated uncertainty (which includes consideration of counting errors), were retained in the data set. Additionally, alpha and beta activity and calculated total uranium reported in pCi/g was removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data were assigned to grids developed for the Soils OU RI. These assignments as listed in Table B1.1.5.12-3.

Table B1.1.5.12-3. Stations and Grids for Historical Data from AOC 561

Station Name	Grid No.
SOU561-001	LBC2L002
SOU561-001	LBC2L003
SOU561-001	LBC2L004
SOU561-001	LBC2L005
SOU561-001	LBC2L006
SOU561-001	LBC2L007
SOU561-001	LBC2L008
SOU561-001	LBC2L009
SOU561-001	LBC2L010
SOU561-001	LBC2L011
SOU561-001	LBC2L012
SOU561-001	LBC2L013
SOU561-001	LBC2L014
SOU561-001	LBC2L015
SOU561-001	LBC2L016
SOU561-001	LBC2L017
SOU561-001	LBC2L018
SOU561-001	LBC2L019
SOU561-001	LBC2L020
SOU561-001	LBC2L021
SOU561-002	LBC2F01
SOU561-002	LBC2L022
SOU561-002	LBC2L024
SOU561-002	LBC2L025
SOU561-003	LBC2F02

Table B1.1.5.12-3. Stations and Grids for Historical Data from AOC 561 (Continued)

Station Name	Grid No.
SOU561-004	LBC2F03
SOU561-004	LBC2L026
SOU561-004	LBC2L027
SOU561-004	LBC2L028
SOU561-004	LBC2L029
SOU561-004	LBC2L030
SOU561-004	LBC2L031
SOU561-004	LBC2L032
SOU561-004	LBC2L033
SOU561-004	LBC2L035
SOU561-005	LBC2F04
SOU561-005	LBC2L034
SOU561-005	LBC2L036
SOU561-005	LBC2L037
SOU561-005	LBC2L038
SOU561-005	LBC2L039
SOU561-005	LBC2L040
SOU561-005	LBC2L041
SOU561-005	LBC2L042
SOU561-005	LBC2L043
SOU561-005	LBC2L044
SOU561-005	LBC2L045
SOU561-005	LBC2L046
SOU561-005	LBC2L047
SOU561-005	LBC2L048
SOU561-005	LBC2L049
SOU561-005	LBC2L050
SOU561-006	LBC2F05
SOU561-007	LBC2F06
SOU561-007	LBC2F07
SOU561-008	LBC2F08
SOU561-008	LBC2L051
SOU561-008	LBC2L052
SOU561-008	LBC2L053
SOU561-009	LBC2L054
SOU561-009	LBC2L055
SOU561-009	LBC2L056
SOU561-009	LBC2L057
SOU561-009	LBC2L058
SOU561-009	LBC2L059

Table B1.1.5.12-3. Stations and Grids for Historical Data from AOC 561 (Continued)

Station Name	Grid No.
SOU561-009	LBC2L060
SOU561-009	LBC2L061
SOU561-009	LBC2L062
SOU561-009	LBC2L063
SOU561-009	LBC2L064
SOU561-009	LBC2L065
SOU561-009	LBC2L066
SOU561-009	LBC2L067
SOU561-009	LBC2L068
SOU561-009	LBC2L069
SOU561-009	LBC2L070
SOU561-009	LBC2L071
SOU561-009	LBC2L072
SOU561-009	LBC2L073
SOU561-009	LBC2L074
SOU561-009	LBC2L075
SOU561-010	LBC2F09
SOU561-010	LBC2F10
SOU561-011	LBC2F11
SOU561-012	LBC2F12
SOU561-012	LBC4L053
SOU561-012	LBC4L054
SOU561-012	LBC4L059
SOU561-012	LBC4L063
SOU561-013	LBC2F13
SOU561-013	LBC2L076
SOU561-013	LBC2L077
SOU561-013	LBC2L078
SOU561-013	LBC2L079
SOU561-013	LBC2L080
SOU561-013	LBC2L081
SOU561-013	LBC2L082
SOU561-013	LBC2L083
SOU561-013	LBC2L084
SOU561-013	LBC2L085
SOU561-013	LBC2L086
SOU561-013	LBC2L087
SOU561-013	LBC2L088
SOU561-013	LBC2L089
SOU561-013	LBC2L090

Table B1.1.5.12-3. Stations and Grids for Historical Data from AOC 561 (Continued)

Station Name	Grid No.
SOU561-013	LBC2L091
SOU561-013	LBC4L068
SOU561-013	LBC4L069
SOU561-013	LBC4L073
SOU561-014	LBC2L092
SOU561-014	LBC2L093
SOU561-014	LBC2L094
SOU561-014	LBC2L095
SOU561-014	LBC2L096
SOU561-014	LBC2L097
SOU561-014	LBC2L098
SOU561-014	LBC2L099
SOU561-014	LBC2L100
SOU561-014	LBC4L083
SOU561-015	LBC2F14
SOU561-015	LBC2F15
SOU561-015	LBCSO1
SOU561-016	LBC2F16
SOU561-017	LBC2L001
SOU561-017	LBC4F01
SOU561-017	LBC4F02
SOU561-017	LBC4L001
SOU561-017	LBC4L002
SOU561-017	LBC4L004
SOU561-017	LBC4L005
SOU561-017	LBC4L006
SOU561-017	LBC4L007
SOU561-017	LBC4L010
SOU561-018	LBC2L023
SOU561-018	LBC4L009
SOU561-018	LBC4L011
SOU561-018	LBC4L014
SOU561-018	LBC4L015
SOU561-018	LBC4L016
SOU561-018	LBC4L017
SOU561-018	LBC4L019
SOU561-018	LBC4L020
SOU561-018	LBC4L021
SOU561-018	LBC4L022
SOU561-018	LBC4L023

Table B1.1.5.12-3. Stations and Grids for Historical Data from AOC 561 (Continued)

Station Name	Grid No.
SOU561-018	LBC4L024
SOU561-018	LBC4L025
SOU561-019	LBC4F03
SOU561-019	LBC5F01
SOU561-020	LBC4F04
SOU561-020	LBC4F05
SOU561-020	LBC4F06
SOU561-021	LBC4F07
SOU561-022	LBC4L026
SOU561-022	LBC4L027
SOU561-022	LBC4L029
SOU561-022	LBC4L030
SOU561-022	LBC4L031
SOU561-022	LBC4L032
SOU561-022	LBC4L033
SOU561-022	LBC4L034
SOU561-022	LBC4L035
SOU561-022	LBC4L036
SOU561-022	LBC4L037
SOU561-022	LBC4L038
SOU561-022	LBC4L039
SOU561-022	LBC4L040
SOU561-022	LBC4L041
SOU561-022	LBC4L042
SOU561-022	LBC4L043
SOU561-022	LBC4L045
SOU561-022	LBC4L048
SOU561-022	LBC4L049
SOU561-023	LBC4F08
SOU561-023	LBC4L046
SOU561-023	LBC4L047
SOU561-023	LBC4L050
SOU561-023	LBC5F06
SOU561-023	LBC5F10
SOU561-024	LBC4F09
SOU561-025	LBC4F10
SOU561-025	LBC4F11
SOU561-025	LBC5F11
SOU561-025	LBC5F15
SOU561-026	LBC4F12

Table B1.1.5.12-3. Stations and Grids for Historical Data from AOC 561 (Continued)

Station Name	Grid No.
SOU561-026	LBC4F13
SOU561-027	LBC4F14
SOU561-028	LBC4F15
SOU561-028	LBC4L051
SOU561-028	LBC4L052
SOU561-028	LBC4L055
SOU561-028	LBC4L056
SOU561-028	LBC4L057
SOU561-028	LBC4L058
SOU561-028	LBC4L060
SOU561-028	LBC4L061
SOU561-028	LBC4L062
SOU561-028	LBC5F20
SOU561-029	LBC4L064
SOU561-029	LBC4L065
SOU561-029	LBC4L066
SOU561-029	LBC4L067
SOU561-029	LBC4L070
SOU561-029	LBC4L071
SOU561-029	LBC4L072
SOU561-029	LBC4L074
SOU561-029	LBC4L075
SOU561-029	LBC5F16
SOU561-030	LBC4F16
SOU561-030	LBC4L076
SOU561-030	LBC4L077
SOU561-030	LBC4L078
SOU561-030	LBC4L079
SOU561-030	LBC4L080
SOU561-030	LBC4L081
SOU561-030	LBC4L082
SOU561-030	LBC4L084
SOU561-030	LBC4L100
SOU561-031	LBC4L085
SOU561-031	LBC4L086
SOU561-031	LBC4L087
SOU561-031	LBC4L088
SOU561-031	LBC4L089
SOU561-031	LBC4L090
SOU561-031	LBC4L091

Table B1.1.5.12-3. Stations and Grids for Historical Data from AOC 561 (Continued)

Station Name	Grid No.
SOU561-031	LBC4L092
SOU561-031	LBC4L093
SOU561-031	LBC4L094
SOU561-031	LBC4L095
SOU561-031	LBC4L096
SOU561-031	LBC4L097
SOU561-031	LBC4L098
SOU561-031	LBC4L099
SOU561-033	LBC1L001
SOU561-033	LBC1L006
SOU561-033	LBC1L016
SOU561-033	LBC3F01
SOU561-033	LBC3F02
SOU561-033	LBCSO2
SOU561-034	LBC1L002
SOU561-034	LBC1L003
SOU561-034	LBC1L004
SOU561-034	LBC1L005
SOU561-034	LBC1L007
SOU561-034	LBC1L008
SOU561-034	LBC1L013
SOU561-034	LBC1L015
SOU561-035	LBC1L020
SOU561-035	LBC1L021
SOU561-035	LBC3L001
SOU561-035	LBC3L002
SOU561-035	LBC3L003
SOU561-035	LBC3L004
SOU561-035	LBC3L005
SOU561-035	LBC3L006
SOU561-035	LBC3L007
SOU561-035	LBC3L008
SOU561-035	LBC3L009
SOU561-035	LBC3L010
SOU561-035	LBC3L011
SOU561-035	LBC3L012
SOU561-035	LBC3L013
SOU561-035	LBC3L014
SOU561-035	LBC3L015
SOU561-035	LBC3L017

Table B1.1.5.12-3. Stations and Grids for Historical Data from AOC 561 (Continued)

Station Name	Grid No.
SOU561-035	LBC3L021
SOU561-036	LBC1L009
SOU561-036	LBC1L010
SOU561-036	LBC1L014
SOU561-036	LBC1L017
SOU561-036	LBC1L018
SOU561-036	LBC1L019
SOU561-036	LBC1L022
SOU561-036	LBC1L023
SOU561-036	LBC1L024
SOU561-036	LBC1L025
SOU561-037	LBC1L011
SOU561-037	LBC1L026
SOU561-037	LBC1L027
SOU561-037	LBC1L030
SOU561-037	LBC1L031
SOU561-037	LBC1L032
SOU561-037	LBC3F03
SOU561-037	LBC3L018
SOU561-037	LBC3L019
SOU561-037	LBC3L020
SOU561-037	LBC3L022
SOU561-037	LBC3L023
SOU561-037	LBC3L024
SOU561-037	LBC3L025
SOU561-038	LBC1F01
SOU561-038	LBC1L012
SOU561-038	LBC1L028
SOU561-038	LBC1L029
SOU561-038	LBC1L033
SOU561-039	LBC1L034
SOU561-039	LBC1L035
SOU561-039	LBC1L036
SOU561-039	LBC1L037
SOU561-039	LBC1L040
SOU561-039	LBC1L041
SOU561-039	LBC1L042
SOU561-039	LBC1L045
SOU561-039	LBC1L046
SOU561-039	LBC1L047

Table B1.1.5.12-3. Stations and Grids for Historical Data from AOC 561 (Continued)

Station Name	Grid No.
SOU561-039	LBC1L050
SOU561-039	LBC3L026
SOU561-039	LBC3L027
SOU561-039	LBC3L028
SOU561-039	LBC3L029
SOU561-039	LBC3L030
SOU561-039	LBC3L032
SOU561-039	LBC3L033
SOU561-039	LBC3L034
SOU561-039	LBC3L035
SOU561-039	LBC3L036
SOU561-039	LBC3L037
SOU561-040	LBC1L038
SOU561-040	LBC1L039
SOU561-040	LBC1L043
SOU561-040	LBC1L044
SOU561-040	LBC1L048
SOU561-040	LBC1L049
SOU561-041	LBC3F04
SOU561-041	LBC3L038
SOU561-041	LBC3L039
SOU561-041	LBC3L040
SOU561-041	LBC3L041
SOU561-041	LBC3L042
SOU561-041	LBC3L043
SOU561-041	LBC3L044
SOU561-041	LBC3L045
SOU561-041	LBC3L046
SOU561-041	LBC3L047
SOU561-041	LBC3L048
SOU561-041	LBC3L049
SOU561-041	LBC3L050
SOU561-041	LBCSO3
SOU561-041	LBCSO4
SOU561-042	LBC1F02
SOU561-042	LBC1F03
SOU561-043	LBC3F05
SOU561-043	LBC3F06
SOU561-043	LBC3F07
SOU561-043	LBCSO5

Table B1.1.5.12-3. Stations and Grids for Historical Data from AOC 561 (Continued)

Station Name	Grid No.
SOU561-044	LBC1F04
SOU561-044	LBC1F05
SOU561-045	LBC1F06
SOU561-045	LBC3F08
SOU561-047	LBC1F07
SOU561-047	LBC3F09
SOU561-047	LBC3F10
SOU561-048	LBC1F08
SOU561-048	LBC1L053
SOU561-049	LBC1L051
SOU561-049	LBC1L055
SOU561-049	LBC1L056
SOU561-049	LBC1L060
SOU561-049	LBC1L061
SOU561-049	LBC3F11
SOU561-050	LBC1L052
SOU561-050	LBC1L054
SOU561-050	LBC1L057
SOU561-050	LBC1L058
SOU561-050	LBC1L059
SOU561-050	LBC1L062
SOU561-050	LBC1L063
SOU561-050	LBC1L064
SOU561-050	LBC1L065
SOU561-050	LBC1L066
SOU561-051	LBC1F09
SOU561-051	LBC1L067
SOU561-051	LBC1L070
SOU561-051	LBC1L071
SOU561-051	LBC1L075
SOU561-051	LBC3F13
SOU561-051	LBC3L053
SOU561-051	LBC3L054
SOU561-051	LBC3L055
SOU561-051	LBC3L056
SOU561-051	LBC3L057
SOU561-051	LBC3L058
SOU561-051	LBC3L059
SOU561-051	LBC3L060
SOU561-051	LBC3L061

Table B1.1.5.12-3. Stations and Grids for Historical Data from AOC 561 (Continued)

Station Name	Grid No.
SOU561-051	LBC3L062
SOU561-051	LBC3L064
SOU561-051	LBC3L065
SOU561-051	LBC3L066
SOU561-051	LBC3L067
SOU561-051	LBC3L068
SOU561-051	LBC3L069
SOU561-051	LBC3L070
SOU561-051	LBC3L072
SOU561-051	LBC3L073
SOU561-051	LBC3L074
SOU561-051	LBC3L075
SOU561-052	LBC1L068
SOU561-052	LBC1L069
SOU561-052	LBC1L072
SOU561-052	LBC1L073
SOU561-052	LBC1L074
SOU561-053	LBC1F10
SOU561-053	LBC3F12
SOU561-053	LBC3L051
SOU561-053	LBC3L052
SOU561-053	LBC3L063
SOU561-055	LBC1F11
SOU561-055	LBC1F12
SOU561-055	LBC3L076
SOU561-055	LBC3L077
SOU561-055	LBC3L078
SOU561-055	LBC3L079
SOU561-055	LBC3L080
SOU561-055	LBC3L081
SOU561-055	LBC3L082
SOU561-055	LBC3L083
SOU561-055	LBC3L084
SOU561-055	LBC3L085
SOU561-055	LBC3L086
SOU561-055	LBC3L087
SOU561-055	LBC3L088
SOU561-055	LBC3L089
SOU561-055	LBC3L090
SOU561-055	LBC3L091

Table B1.1.5.12-3. Stations and Grids for Historical Data from AOC 561 (Continued)

Station Name	Grid No.
SOU561-055	LBC3L092
SOU561-055	LBC3L093
SOU561-055	LBC3L094
SOU561-055	LBC3L095
SOU561-055	LBC3L096
SOU561-055	LBC3L098
SOU561-055	LBC3L099
SOU561-055	LBC3L100
SOU561-057	LBC1F13
SOU561-057	LBC3F14
SOU561-057	LBC3F15
SOU561-057	LBC3L097
SOU561-059	LBC1F14
SOU561-059	LBC1L076
SOU561-059	LBC3F16
SOU561-060	LBC1L077
SOU561-060	LBC1L078
SOU561-061	LBC1L080
SOU561-061	LBC1L081
SOU561-061	LBC1L082
SOU561-061	LBC1L085
SOU561-061	LBC1L086
SOU561-061	LBC1L090
SOU561-061	LBC1L091
SOU561-061	LBC1L095
SOU561-061	LBC1L096
SOU561-062	LBC1L079
SOU561-062	LBC1L083
SOU561-062	LBC1L084
SOU561-062	LBC1L087
SOU561-062	LBC1L088
SOU561-062	LBC1L089
SOU561-062	LBC1L092
SOU561-062	LBC1L093
SOU561-062	LBC1L094
SOU561-062	LBC1L097
SOU561-062	LBC1L098
SOU561-063	LBC1F15
SOU561-063	LBC1F16

Table B1.1.5.12-3. Stations and Grids for Historical Data from AOC 561 (Continued)

Station Name	Grid No.
SOU561-063	LBC1L099
SOU561-063	LBC1L100

Summary of Detected Chemicals

A summary of detected chemicals is presented as in Table B1.1.5.12-4.

Table B1.1.5.12-4. Summary of SWMU 561 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	162/162	3.50E+03	8.50E+03	1.76E+04	8/162	161/162
Antimony	156/162	8.00E-02	4.32E-01	2.20E+01	38/162	10/162
Arsenic	158/162	2.40E+00	8.99E+00	3.96E+01	43/162	158/162
Barium	831/832	4.28E+01	3.42E+02	7.04E+02	666/832	672/832
Beryllium	157/162	1.20E-01	5.07E-01	1.50E+00	13/162	157/162
Boron	5/9	2.90E+00	4.54E+00	7.10E+00	0/9	0/9
Cadmium	153/162	1.50E-02	8.56E-02	1.20E+00	7/162	1/162
Calcium	162/162	3.28E+02	8.71E+02	2.31E+03	0/162	0/162
Chromium	166/832	7.80E+00	7.71E+01	1.37E+03	96/832	123/832
Cobalt	162/162	3.00E+00	6.85E+00	3.10E+01	6/162	162/162
Copper	162/162	4.80E+00	1.14E+01	6.25E+01	9/162	0/162
Iron	162/162	6.38E+03	1.37E+04	4.85E+04	1/162	162/162
Lead	495/832	6.80E+00	2.07E+01	2.25E+02	43/832	0/832
Magnesium	162/162	4.92E+02	1.09E+03	2.19E+03	2/162	0/162
Manganese	162/162	3.35E+01	5.90E+02	5.23E+03	10/162	89/162
Mercury	142/162	7.50E-03	4.04E-02	1.39E-01	1/162	0/162
Molybdenum	149/157	2.20E-01	6.35E-01	2.40E+00	0/157	0/157
Nickel	162/162	3.00E+00	9.79E+00	2.28E+01	1/162	50/162
Potassium	13/14	3.50E+02	5.46E+02	7.19E+02	0/14	0/14
Selenium	109/162	1.60E-01	3.63E-01	1.10E+00	1/162	0/162
Silicon	9/9	6.97E+02	1.15E+03	1.66E+03	0/9	0/9
Silver	146/157	3.20E-02	5.67E-02	1.40E-01	0/157	0/157
Sodium	147/162	1.45E+01	4.85E+01	2.42E+02	0/162	0/162
Thallium	149/162	9.10E-02	2.22E-01	1.20E+00	38/162	18/162
Uranium	309/828	5.00E-01	1.62E+02	6.41E+03	237/828	224/828
Vanadium	162/162	8.60E+00	2.53E+01	8.69E+01	10/162	162/162
Zinc	162/162	9.40E+00	6.97E+01	1.13E+03	35/162	0/162

Table B1.1.5.12-4. Summary of SWMU 561 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Organics (mg/kg)						
PCB, Total	57/824	5.00E-02	3.70E+00	7.90E+01	0/824	54/824
PCB-1248	37/165	4.60E-02	4.53E+00	5.70E+01	0/165	29/165
PCB-1254	48/165	4.70E-02	1.64E+00	1.60E+01	0/165	46/165
PCB-1260	77/164	4.50E-02	6.40E-01	6.40E+00	0/164	60/164
2-Methylnaphthalene	1/149	6.20E-02	6.20E-02	6.20E-02	0/149	0/149
Acenaphthene	3/150	1.10E-01	1.14E+00	2.70E+00	0/150	0/150
Anthracene	3/150	2.00E-01	2.00E+00	4.90E+00	0/150	0/150
Benz(a)anthracene	11/149	4.30E-02	4.02E-01	1.90E+00	0/149	4/149
Benzo(a)pyrene	12/150	5.30E-02	1.08E+00	8.80E+00	0/150	24/150
Benzo(b)fluoranthene	12/150	3.80E-02	4.05E-01	1.80E+00	0/150	4/150
Benzo(ghi)perylene	9/150	5.10E-02	8.45E-01	4.90E+00	0/150	0/150
Benzo(k)fluoranthene	12/150	4.60E-02	6.23E-01	3.90E+00	0/150	1/150
Benzoic acid	3/150	4.70E-01	6.13E-01	7.30E-01	0/150	0/150
Bis(2-ethylhexyl)phthalate	9/148	4.30E-02	7.03E-01	5.10E+00	0/148	0/148
Butyl benzyl phthalate	2/148	5.90E-02	1.20E-01	1.80E-01	0/148	0/148
Carbazole	1/2	1.40E+00	1.40E+00	1.40E+00	0/2	0/2
Chrysene	15/150	3.90E-02	9.25E-01	8.80E+00	0/150	0/150
Dibenz(a,h)anthracene	4/149	7.10E-02	2.73E-01	5.00E-01	0/149	0/149
Dibenzofuran	3/150	5.50E-02	4.92E-01	1.10E+00	0/150	0/150
Diethyl phthalate	1/150	7.20E-02	7.20E-02	7.20E-02	0/150	0/150
Di-n-butyl phthalate	3/150	4.40E-02	5.20E-02	6.80E-02	0/150	0/150
Fluoranthene	23/152	4.30E-02	1.49E+00	2.20E+01	0/152	0/152
Fluorene	3/150	9.50E-02	9.38E-01	2.20E+00	0/150	0/150
Indeno(1,2,3-cd)pyrene	8/150	5.90E-02	9.90E-01	5.20E+00	0/150	5/150
Naphthalene	2/150	1.00E-01	3.25E-01	5.50E-01	0/150	0/150
Phenanthrene	13/149	4.40E-02	7.51E-01	4.90E+00	0/149	0/149
Pyrene	19/150	4.40E-02	5.28E-01	4.70E+00	0/150	0/150
Total PAH	13/151	3.90E-05	3.67E-01	2.63E+00	0/151	10/151
Acetone	1/13	7.80E-03	7.80E-03	7.80E-03	0/13	0/13
Ethylbenzene	2/18	5.70E-04	7.35E-04	9.00E-04	0/18	0/18
m,p-Xylene	2/18	1.20E-03	1.40E-03	1.60E-03	0/18	0/18
Methylene chloride	1/18	3.50E-03	3.50E-03	3.50E-03	0/18	0/18
Toluene	6/18	6.10E-04	1.86E-02	6.60E-02	0/18	0/18

Table B1.1.5.12-4. Summary of SWMU 561 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Radionuclides (pCi/g)						
Actinium-228	11/11	7.00E-01	9.93E-01	1.41E+00	0/11	0/11
Americium-241	151/151	-1.51E-02	-3.57E-03	1.86E-01	0/151	0/151
Bismuth-212	4/4	5.90E-01	7.93E-01	9.80E-01	0/4	0/4
Bismuth-214	11/11	8.00E-01	1.01E+00	1.46E+00	0/11	0/11
Cesium-137	826/826	-1.05E-01	2.06E-01	1.01E+00	34/826	747/826
Cobalt-60	153/153	-1.44E-01	4.80E-03	2.97E-01	0/153	72/153
Lead-210	3/3	7.00E-01	2.63E+00	4.20E+00	0/3	0/3
Lead-212	11/11	1.13E+00	1.41E+00	1.86E+00	0/11	0/11
Lead-214	11/11	8.20E-01	1.10E+00	1.37E+00	0/11	0/11
Neptunium-237	160/160	-1.21E-02	3.96E-03	1.90E-01	3/160	3/160
Plutonium-238	151/151	-3.04E-02	1.42E-02	6.30E-01	5/151	0/151
Plutonium-239/240	162/162	-7.00E-03	6.11E-03	1.58E-01	12/162	0/162
Potassium-40	16/16	-7.93E-02	8.91E+00	1.38E+01	0/16	0/16
Protactinium-234m	3/3	1.90E+01	7.03E+01	1.02E+02	0/3	0/3
Radium-226	149/149	5.47E-01	8.97E-01	1.46E+00	0/149	0/149
Technetium-99	157/157	-6.45E-01	5.81E-01	8.38E+00	1/157	0/157
Thallium-208	11/11	2.60E-01	4.04E-01	5.00E-01	0/11	0/11
Thorium-228	148/148	1.90E-01	4.08E-01	1.12E+00	0/148	0/148
Thorium-230	153/153	1.47E-01	3.69E-01	2.23E+00	1/153	0/153
Thorium-232	148/148	2.29E-01	4.25E-01	1.09E+00	0/148	0/148
Thorium-234	156/156	1.04E+00	3.00E+01	1.55E+03	0/156	0/156
Uranium	10/10	3.30E+00	5.82E+01	3.60E+02	4/10	4/10
Uranium-234	170/170	1.06E-01	6.30E+00	1.36E+02	62/170	28/170
Uranium-235	166/166	4.35E-03	1.06E+00	1.96E+01	87/166	76/166
Uranium-235/236	6/6	3.40E-02	5.78E-02	6.90E-02	3/6	0/6
Uranium-238	838/838	-2.56E+01	2.17E+01	2.18E+03	539/838	1182/838

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.5.13 AOC 562 (Soil Piles C, D, E, F, G, H, J, K, and P in Subunit 1)

<u>Data Evaluation and Screening</u>

Historical data for this SWMU include metals, pesticides/PCBs, radionuclides, and SVOCs in the surface and shallow subsurface soils. These data were collected from the following projects:

- Soil Piles Little Bayou Creek Field Screen Data—SP09-LBC-FIELD
- Soil Piles Little Bayou Creek Addendum 1B Additional Evaluation
- Soil Piles Little Bayou Creek Subunit 1 (Addm 1B)—Contingency SP09-LBC-SU1C
- Soil Piles Little Bayou Creek Subunit 1 (Addm 1B) SP09-LBC-SU1

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 9 illustrate the locations of the historical data points associated with this SWMU. Data collected for the characterization of soil piles associated with AOC 562 are included in the data set.

Usability of Historical Data

Validation: Data validation was performed on 10% of the Soil Piles fixed-base laboratory project data. Qualifiers of =, J, and U, were applied to the data.

Data Assessment: The data assessment qualifiers that have been applied to the data for within this SWMU are shown in Table B1.1.5.13-1.

Table B1.1.5.13-1. Assessment Qualifiers Applied to SWMU 562 Historic Data

ASSESSMENT	DESCRIPTION
BL-TEMP	Result biased low due to a temperature exceedances
NOVAL	Validation requested but qualifier not provided due to missing Form I
USECNITRIC-CF	During the period from May 2004 to September 2009, the USEC-PGDP laboratory used method RL-7128-NITRIC for isotopic uranium analysis by alpha spec. Method RL-7128-NITRIC utilizes only nitric acid for dissolution rather than hydrofluoric/nitric acid. The use of nitric acid only is a less aggressive dissolution for isotopic uranium analysis by alpha spec. It has been demonstrated that Method RL-7128-NITRIC can be utilized only for isotopic uranium analysis of soil with activity greater than 10 pCi/g due to low recoveries below that level. If the data from Method RL-7128-NITRIC will be screened against the background values reported in *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the PGDP* (1997), the following adjusted background values must be used: U-234: 1.73 pCi/g surface and 1.63 pCi/g subsurface; U-235: 0.10 pCi/g; and U-238: 0.40 pCi/g [*Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant*, Appendix E (2009)]. Risk assessors may use data from this time period for comparison against other thresholds below 10 pCi/g without adjusting the values as long as the level of uncertainty and its impact on the risk assessment/evaluation are adequately discussed. No additional action is required for comparisons to thresholds above 10 pCi/g.

It was noted in the SER for Soil Pile I that uranium-238 data from ISOCS should not be used to support risk assessment, nor as the sole basis for making regulatory related decisions (DOE 2008). These data subsequently were removed from the Soils OU data set.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All nonradionuclide historical data records have detection limits or results recorded within the data set. All of the radionuclide historical data have MDCs recorded within the data set.

There are 16 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. The chemical and referenced values are shown in Table B1.1.5.13-2.

B.1.1.5.13-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 562

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	9.89	0.552	0.21	0.21
Beryllium	mg/kg	0.499	0.00567		
Thallium	mg/kg	2	0.368	0.21	0.34
Organics					
PCB, Total	mg/kg	0.13	0.0648		
PCB-1016	mg/kg	0.1	0.0633		
PCB-1221	mg/kg	0.13	0.0437		
PCB-1232	mg/kg	0.1	0.0437		
PCB-1248	mg/kg	0.1	0.0682		
PCB-1254	mg/kg	0.09	0.0501		
PCB-1260	mg/kg	0.1	0.0662		
Benz(a)anthracene	mg/kg	0.5	0.196		
Benzo(a)pyrene	mg/kg	0.5	0.0197		
Benzo(b)fluoranthene	mg/kg	0.5	0.197		
Dibenz(a,h)anthracene	mg/kg	0.5	0.0197		
Indeno(1,2,3-cd)pyrene	mg/kg	0.5	0.197		
Polycyclic aromatic hydrocarbons (PAH)	mg/kg	0.2	0.0197		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration; NAL = no action level; N SQL = sample quantitation limit

Radionuclide Counting Errors

Alpha and beta activity and calculated total uranium reported in pCi/g were removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historical data was assigned to grids developed during the Soils OU RI. The assignments are listed in Table B1.1.5.13-3.

Table B1.1.5.13-3. Stations and Grids for Historical Data from SWMU 562

Station Name	Grid No.
SOU562-002	LBCC01
SOU562-003	LBCC02
SOU562-003	LBCC03

Table B1.1.5.13-3 Stations and Grids for Historical Data from SWMU 562 (Continued)

Station Name	Grid No.
SOU562-005	LBCC04
SOU562-006	LBCC05
SOU562-006	LBCC05C1
SOU562-006	LBCC05C2
SOU562-006	LBCC05C3
SOU562-006	LBCC05C4
SOU562-007	LBCD01
SOU562-007	LBCD01C1
SOU562-007	LBCD01C2
SOU562-007	LBCD01C3
SOU562-007	LBCD01C4
SOU562-008	LBCD02
SOU562-008	LBCD03
SOU562-009	LBCE01
SOU562-009	LBCE02
SOU562-011	LBCF01
SOU562-013	LBCG01
SOU562-014	LBCG02
SOU562-015	LBCG03
SOU562-012	LBCH01
SOU562-016	LBCJ01
SOU562-016	LBCJ01C1
SOU562-016	LBCJ01C2
SOU562-016	LBCJ01C3
SOU562-016	LBCJ01C4
SOU562-018	LBCJ02
SOU562-018	LBCJ03
SOU562-019	LBCJ04
SOU562-004	LBCP01

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.5.13-4.

Table B1.1.5.13-4. Summary of SWMU 562 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	27/27	4.46E+03	6.60E+03	9.34E+03	0/27	27/27
Arsenic	27/27	1.75E+00	3.72E+00	1.18E+01	1/27	27/27
Barium	106/107	4.30E+01	2.38E+02	4.11E+02	77/107	79/107
Beryllium	1/27	6.81E-01	6.81E-01	6.81E-01	0/27	1/27
Cadmium	4/27	4.87E-01	5.46E-01	6.23E-01	4/27	0/27
Calcium	27/27	2.74E+02	6.94E+02	1.32E+03	0/27	0/27
Chromium	69/107	7.41E+00	6.17E+01	3.15E+02	37/107	55/107
Cobalt	27/27	2.95E+00	4.74E+00	9.29E+00	0/27	27/27
Copper	27/27	4.09E+00	7.42E+00	1.43E+01	0/27	0/27
Iron	27/27	6.36E+03	8.65E+03	1.98E+04	0/27	27/27
Lead	95/107	6.41E+00	1.25E+01	3.57E+01	1/107	0/107
Magnesium	27/27	4.66E+02	6.62E+02	8.72E+02	0/27	0/27
Manganese	27/27	1.94E+02	3.81E+02	5.49E+02	0/27	11/27
Mercury	16/27	1.60E-02	2.18E-02	3.10E-02	0/27	0/27
Nickel	18/27	4.73E+00	6.12E+00	8.77E+00	0/27	0/27
Uranium	81/107	4.62E+00	4.87E+01	2.27E+02	81/107	62/107
Vanadium	27/27	1.02E+01	1.48E+01	2.80E+01	0/27	27/27
Zinc	24/27	1.94E+01	3.42E+01	8.36E+01	3/27	0/27
Organics (mg/kg)						
PCB, Total	14/109	1.30E-01	7.59E-01	2.01E+00	/109	14/109
PCB-1254	14/29	1.00E-01	4.23E-01	1.23E+00	0/29	14/29
PCB-1260	13/29	1.00E-01	3.62E-01	7.80E-01	0/29	13/29
Benz(a)anthracene	1/27	5.20E-01	5.20E-01	5.20E-01	0/27	1/27
Benzo(b)fluoranthene	2/27	7.00E-01	7.15E-01	7.30E-01	0/27	2/27
Chrysene	2/27	5.00E-01	5.30E-01	5.60E-01	0/27	0/27
Fluoranthene	3/27	6.20E-01	1.07E+00	1.50E+00	0/27	0/27
Phenanthrene	2/27	5.70E-01	8.35E-01	1.10E+00	0/27	0/27
Polycyclic aromatic hydrocarbons (PAH)	2/80	9.00E-05	1.10E-01	2.20E-01	0/80	1/80
Pyrene	2/27	9.80E-01	1.04E+00	1.10E+00	0/27	0/27
Total PAH	2/27	7.05E-02	9.80E-02	1.26E-01	0/27	2/27
Radionuclides (pCi/g)						
Americium-241	28/28	-1.11E-02	-4.71E-03	2.80E-03	0/28	0/28
Cesium-137	109/109	-2.27E-02	7.60E-02	4.91E-01	3/109	58/109

Table B1.1.5.13-4. Summary of SWMU 562 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Neptunium-237	25/25	-2.67E-02	-1.63E-02	6.30E-03	0/25	0/25
Plutonium-238	24/24	-3.07E-02	-9.19E-03	-1.59E-03	0/24	0/24
Plutonium-239/240	27/27	-6.71E-03	1.57E-04	9.50E-03	0/27	0/27
Technetium-99	29/29	-5.40E-01	4.63E-01	4.36E+00	3/29	0/29
Thorium-228	29/29	1.81E-01	3.48E-01	1.06E+00	0/29	0/29
Thorium-230	29/29	1.00E-01	2.73E-01	1.01E+00	0/29	0/29
Thorium-232	29/29	2.48E-01	3.82E-01	1.07E+00	0/29	0/29
Uranium-234	29/29	7.27E-02	4.47E+00	5.34E+01	9/29	2/29
Uranium-235	29/29	-3.41E-03	6.62E-01	8.96E+00	14/29	11/29
Uranium-238	109/109	-4.19E+00	1.95E+01	5.81E+02	92/109	186/109

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.5.14 AOC 563 (Soil Piles 20 and BW in Subunit 4)

__Data Evaluation and Screening__

Historical data for this SWMU include metals, pesticides/PCBs, radionuclides, and SVOCs in the surface and shallow subsurface soils. These data were collected from the following projects:

- Soil Piles Little Bayou Creek Field Screen Data—SP09-LBC-FIELD
- Soil Piles Little Bayou Creek Addendum 1B Additional Evaluation
- Soil Piles Little Bayou Creek Subunit 4 (Addm 1B) SP09-LBC-SU4

__Sampling Representative of the SWMU/AOC Area?__

Figures in Chapter 9 illustrate the locations of the historical data points associated with this SWMU. Data collected to represent the soil pile have been included in the data set.

__Usability of Historical Data__

Validation: Data validation was performed on 10% of the Soil Piles fixed-base laboratory project data; however, data in this SWMU was not validated.

Data Assessment: The data assessment qualifiers that have been applied to the projects within this SWMU are shown in Table B1.1.5.14-1.

Table B1.1.5.14-1. Assessment Qualifiers Applied to SWMU 563 Historic Data

ASSESSMENT	DESCRIPTION
USECNITRIC-CF	During the period from May 2004 to September 2009, the USEC-PGDP laboratory used method RL-7128-NITRIC for isotopic uranium analysis by alpha spec. Method RL-7128-NITRIC utilizes only nitric acid for dissolution rather than hydrofluoric/nitric acid. The use of nitric acid only is a less aggressive dissolution for isotopic uranium analysis by alpha spec. It has been demonstrated that Method RL-7128-NITRIC can be utilized only for isotopic uranium analysis of soil with activity greater than 10 pCi/g due to low recoveries below that level. If the data from Method RL-7128-NITRIC will be screened against the background values reported in *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the PGDP* (1997), the following adjusted background values must be used: U-234: 1.73 pCi/g surface and 1.63 pCi/g subsurface; U-235: 0.10 pCi/g; and U-238: 0.40 pCi/g [*Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant*, Appendix E (2009)]. Risk assessors may use data from this time period for comparison against other thresholds below 10 pCi/g without adjusting the values as long as the level of uncertainty and its impact on the risk assessment/evaluation are adequately discussed. No additional action is required for comparisons to thresholds above 10 pCi/g.

It was noted in the SER for Soil Pile I that uranium-238 data from ISOCS should not be used to support risk assessment, nor as the sole basis for making regulatory related decisions (DOE 2008). These data subsequently were removed from the Soils OU data set.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data records that had no detection limits or results recorded within the data set have been removed. All radionuclide historical data have MDCs recorded within the data set.

There are 16 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. The chemical and referenced values are shown in Table B1.1.5.14-2.

B1.1.5.14-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 563

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	8.27	0.552	0.21	0.21
Beryllium	mg/kg	0.499	0.00567		
Thallium	mg/kg	2	0.368	0.21	0.34
Organics					
PCB, Total	mg/kg	0.13	0.0648		
PCB-1016	mg/kg	0.1	0.0633		
PCB-1221	mg/kg	0.13	0.0437		

B1.1.5.14-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 563 (Continued)

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
PCB-1232	mg/kg	0.1	0.0437		
PCB-1248	mg/kg	0.1	0.0682		
PCB-1254	mg/kg	0.09	0.0501		
PCB-1260	mg/kg	0.1	0.0662		
Benz(a)anthracene	mg/kg	0.5	0.196		
Benzo(a)pyrene	mg/kg	0.5	0.0197		
Benzo(b)fluoranthene	mg/kg	0.5	0.197		
Dibenz(a,h)anthracene	mg/kg	0.5	0.0197		
Indeno(1,2,3-cd)pyrene	mg/kg	0.5	0.197		
Total PAH	mg/kg	0.2	0.0197		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

<u>Radionuclide Counting Errors</u>

Calculated total uranium reported in pCi/g was removed from the data set.

<u>Nondetect Result Qualifiers</u>

All usable data records that were considered nondetect were considered so due to laboratory qualification.

<u>Assignment of Historical Data to RI Sampling Grids</u>

The historic data was assigned to grids developed during the Soils OU RI Report. The assignments are listed in Table B1.1.5.14-3.

Table B1.1.5.14-3. Stations and Grids for Historical Data from SWMU 563

Station Name	Grid No.
SOU563-001	LBC2001
SOU563-001	LBCBW01
SOU563-002	LBCBW02
SOU563-004	LBCBW03
SOU563-006	LBCCC01
SOU563-005	LBCCC02
SOU563-006	LBCCC03

Summary of Detected Chemicals

A summary of detected chemicals is presented as in Table B1.1.5.14-4.

Table B1.1.5.14-4. Summary of SWMU 563 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	8/8	7.11E+03	8.14E+03	9.50E+03	0/8	8/8
Arsenic	8/8	3.42E+00	5.81E+00	7.40E+00	0/8	8/8
Barium	22/22	7.60E+01	2.34E+02	4.39E+02	14/22	14/22
Cadmium	6/8	6.17E-01	7.39E-01	8.96E-01	6/8	1/8
Calcium	8/8	1.26E+03	2.40E+03	3.78E+03	0/8	0/8
Chromium	16/22	1.18E+01	1.50E+02	3.34E+02	13/22	14/22
Cobalt	8/8	4.18E+00	6.72E+00	8.91E+00	0/8	8/8
Copper	8/8	7.94E+00	1.26E+01	1.90E+01	0/8	0/8
Iron	8/8	9.01E+03	1.19E+04	1.35E+04	0/8	8/8
Lead	22/22	8.71E+00	1.43E+01	2.48E+01	1/22	0/22
Magnesium	8/8	8.56E+02	1.02E+03	1.28E+03	0/8	0/8
Manganese	8/8	1.91E+02	4.00E+02	5.80E+02	0/8	4/8
Mercury	6/8	1.70E-02	2.52E-02	3.50E-02	0/8	0/8
Nickel	8/8	5.31E+00	7.78E+00	9.05E+00	0/8	0/8
Uranium	10/22	1.10E+00	7.74E+00	1.51E+01	7/22	1/22
Vanadium	8/8	1.54E+01	1.96E+01	2.53E+01	0/8	8/8
Zinc	8/8	2.92E+01	1.10E+02	2.37E+02	4/8	0/8
Organics (mg/kg)						
PCB, Total	6/23	3.20E-01	1.50E+00	3.54E+00	0/23	6/23
PCB-1248	2/9	1.78E+00	1.87E+00	1.95E+00	0/9	2/9
PCB-1254	6/9	2.00E-01	6.08E-01	1.16E+00	0/9	6/9
PCB-1260	6/9	1.20E-01	2.67E-01	4.30E-01	0/9	6/9
Radionuclides (pCi/g)						
Americium-241	9/9	-4.98E-03	-2.57E-03	-5.61E-04	0/9	0/9
Cesium-137	23/23	-2.00E-02	1.27E-01	6.47E-01	3/23	17/23
Neptunium-237	9/9	-2.60E-02	2.12E-02	1.20E-01	0/9	1/9
Plutonium-238	8/8	-7.96E-03	-4.77E-03	-8.21E-04	0/8	0/8
Plutonium-239/240	9/9	-2.15E-03	8.39E-03	3.07E-02	0/9	0/9
Technetium-99	9/9	-5.51E-01	9.24E-01	3.13E+00	2/9	0/9
Thorium-228	9/9	3.30E-01	4.41E-01	9.03E-01	0/9	0/9
Thorium-230	9/9	2.45E-01	3.86E-01	1.06E+00	0/9	0/9
Thorium-232	9/9	3.19E-01	4.35E-01	7.85E-01	0/9	0/9
Uranium-234	9/9	1.20E-01	5.87E-01	1.03E+00	0/9	0/9

Table B1.1.5.14-4. Summary of SWMU 563 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Uranium-235	9/9	-1.54E-04	4.24E-02	7.87E-02	3/9	0/9
Uranium-238	23/23	-9.10E-01	2.17E+00	6.70E+00	15/23	34/23

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.5.15 AOC 564 (Soil Pile AT in Subunit 5)

Data Evaluation and Screening

Historical data for this SWMU include metals, pesticides/PCBs, radionuclides, and SVOCs in the surface and shallow subsurface soils. These data were collected from the following projects:

- AIP Soil Samples (Addendum 1b) LBCAT01 and LBCAU01 October 2008 Split w/DOE) AIPSOSLSP10-08
- Soil Piles Little Bayou Creek Field Screen Data—SP09-LBC-FIELD
- Soil Piles Little Bayou Creek Subunit 5 (Addm 1B)—Contingency SP09-LBC-SU5C
- Soil Piles Little Bayou Creek Subunit 5 (Addm 1B) SP09-LBC-SU5
- Surface Water OU—NSDD Activity 1—EU7 SWOU05-NSDDA107

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 10 illustrate the locations of the historical data points associated with this SWMU. Data collected to represent the soil pile have been included in the data set.

Usability of Historical Data

Validation: Data validation was performed on 10% of the Soil Piles fixed-base laboratory project data. Qualifiers of J and U were applied to the data.

Data Assessment: The data assessment qualifiers that have been applied to the projects within this SWMU are shown in Table B1.1.5.15-1.

Table B1.1.5.15-1. Assessment Qualifiers Applied to AOC 564 Historic Data

ASSESSMENT	DESCRIPTION
USECNITRIC-CF	During the period from May 2004 to September 2009, the USEC-PGDP laboratory used method RL-7128-NITRIC for isotopic uranium analysis by alpha spec. Method RL-7128-NITRIC utilizes only nitric acid for dissolution rather than hydrofluoric/nitric acid. The use of nitric acid only is a less aggressive dissolution for isotopic uranium analysis by alpha spec. It has been demonstrated that Method RL-7128-NITRIC can be utilized only for isotopic uranium analysis of soil with activity greater than 10 pCi/g due to low recoveries below that level. If the data from Method RL-7128-NITRIC will be screened against the background values reported in *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the PGDP* (1997), the following adjusted background values must be used: U-234: 1.73 pCi/g surface and 1.63 pCi/g subsurface; U-235: 0.10 pCi/g; and U-238: 0.40 pCi/g [*Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant*, Appendix E (2009)]. Risk assessors may use data from this time period for comparison against other thresholds below 10 pCi/g without adjusting the values as long as the level of uncertainty and its impact on the risk assessment/evaluation are adequately discussed. No additional action is required for comparisons to thresholds above 10 pCi/g.

It was noted in the SER for Soil Pile I that uranium-238 data from ISOCS should not be used to support risk assessment, nor as the sole basis for making regulatory related decisions (DOE 2008). These data subsequently were removed from the Soils OU data set.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data that had no detection limits or results recorded were removed from the data set. All radionuclide historical data have MDCs recorded within the data set.

There are 13 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. The chemical and referenced values are shown in Table B1.1.5.15-2.

Table B1.1.5.15-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for AOC 564

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	8.83	0.552	0.21	0.21
Thallium	mg/kg	1.95	0.368	0.21	0.34
Organics					
PCB-1016	mg/kg	0.1	0.0633		
PCB-1221	mg/kg	0.13	0.0437		

Table B1.1.5.15-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for AOC 564 (Continued)

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
PCB-1232	mg/kg	0.1	0.0437		
PCB-1248	mg/kg	0.1	0.0682		
PCB-1254	mg/kg	0.09	0.0501		
Benz(a)anthracene	mg/kg	0.49	0.196		
Benzo(a)pyrene	mg/kg	0.49	0.0197		
Benzo(b)fluoranthene	mg/kg	0.49	0.197		
Dibenz(a,h)anthracene	mg/kg	0.49	0.0197		
Indeno(1,2,3-cd)pyrene	mg/kg	0.49	0.197		
Total PAH	mg/kg	0.2	0.0197		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

Two radionuclide records do not have recorded counting errors. These records have been removed from the data set. Calculated total uranium reported in pCi/g was removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

Each of the historic data points was assigned to a grid developed during the Soils OU RI. Those assignments are listed in Table B1.1.5.15-3.

Table B1.1.5.15-3. Stations and Grids for Historical Data from AOC 564

Station Name	Grid No.
SOU564-001	LBCAT01
SOU564-001	LBCAT01C1
SOU564-001	LBCAT01C2
SOU564-001	LBCAT01C3
SOU564-001	LBCAT01C4
SOU564-001	NSDDA-168

Summary of Detected Chemicals

A summary of detected chemicals is presented as in Table B1.1.5.15-4.

Table B1.1.5.15-4. Summary of AOC 564 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	4/4	7.12E+03	1.04E+04	1.27E+04	0/4	4/4
Arsenic	4/4	1.83E+01	2.54E+01	4.30E+01	3/4	4/4
Barium	14/14	6.27E+01	2.23E+02	3.80E+02	9/14	10/14
Beryllium	4/4	1.71E+00	1.93E+00	2.12E+00	3/4	4/4
Cadmium	4/4	1.40E+00	1.61E+00	1.96E+00	3/4	4/4
Calcium	4/4	1.03E+03	1.60E+03	1.95E+03	0/4	0/4
Chromium	12/14	1.69E+01	4.67E+01	8.32E+01	9/14	12/14
Cobalt	4/4	4.33E+00	5.58E+00	6.60E+00	0/4	4/4
Copper	4/4	1.81E+01	3.28E+01	4.63E+01	2/4	0/4
Iron	4/4	1.79E+04	2.59E+04	3.66E+04	0/4	4/4
Lead	14/14	1.19E+01	2.54E+01	4.09E+01	3/14	0/14
Magnesium	4/4	4.10E+02	7.05E+02	9.12E+02	0/4	0/4
Manganese	4/4	2.58E+02	3.77E+02	4.87E+02	0/4	1/4
Mercury	4/4	1.70E-01	2.03E-01	2.30E-01	3/4	1/4
Molybdenum	3/3	6.29E+00	6.88E+00	7.84E+00	0/3	0/3
Nickel	4/4	1.40E+01	1.79E+01	2.24E+01	0/4	4/4
Potassium	1/1	8.57E+02	8.57E+02	8.57E+02	0/1	0/1
Selenium	4/4	2.18E+00	2.54E+00	2.82E+00	3/4	0/4
Silver	1/4	2.00E-01	2.00E-01	2.00E-01	0/4	0/4
Sodium	1/4	9.57E+01	9.57E+01	9.57E+01	0/4	0/4
Thallium	2/4	2.30E+00	2.33E+00	2.36E+00	1/4	2/4
Uranium	12/13	1.57E+01	3.37E+01	5.83E+01	12/13	12/13
Vanadium	4/4	5.62E+01	6.87E+01	8.06E+01	3/4	4/4
Zinc	4/4	7.58E+01	9.62E+01	1.06E+02	3/4	0/4
Organics (mg/kg)						
PCB, Total	4/14	2.80E-01	1.03E+00	1.93E+00	0/14	4/14
PCB-1254	1/5	1.06E+00	1.06E+00	1.06E+00	0/5	1/5
PCB-1260	5/5	1.90E-01	6.46E-01	1.15E+00	0/5	5/5
Radionuclides (pCi/g)						
Americium-241	3/3	-8.09E-03	1.79E-03	9.00E-03	0/3	0/3
Cesium-137	14/14	2.00E-02	2.38E-01	4.75E-01	2/14	13/14
Neptunium-237	3/3	-2.58E-03	-1.33E-03	3.47E-04	0/3	0/3
Plutonium-238	2/2	-2.64E-03	-1.86E-03	-1.07E-03	0/2	0/2
Plutonium-239/240	3/3	2.06E-02	2.11E-02	2.17E-02	0/3	0/3
Technetium-99	3/3	2.97E-01	3.27E+00	9.21E+00	1/3	0/3
Thorium-228	3/3	3.13E-01	3.35E-01	3.53E-01	0/3	0/3

Table B1.1.5.15-4. Summary of AOC 564 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Thorium-230	3/3	1.39E+00	1.65E+00	1.87E+00	2/3	0/3
Thorium-232	3/3	3.22E-01	3.37E-01	3.63E-01	0/3	0/3
Uranium-234	3/3	4.18E+00	5.82E+00	6.70E+00	3/3	2/3
Uranium-235	3/3	2.43E-01	3.09E-01	3.48E-01	3/3	3/3
Uranium-238	14/14	3.30E+00	6.01E+00	8.55E+00	13/14	28/14

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection; NAL = no action level

B1.1.5.16 AOC 567 (Contaminated Soil Area K013)

<u>Data Evaluation and Screening</u>

Historical data for this SWMU include metals, pesticides/PCBs, radionuclides, SVOCs, and VOCs in the surface soils. These data were collected from the following projects:

- Soil Piles near Outfall 013
- Outfalls 011/012 Time Critical Removal

<u>Radionuclide Counting Errors</u>

Radionuclide historical data records that have radionuclide counting errors reported as 0 do have a quantified total propagated uncertainty (which includes consideration of counting errors) reported; therefore, these data have been utilized.

<u>Sampling Representative of the SWMU/AOC Area?</u>

Figures in Chapter 9 illustrate the locations of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to AOC 567. Those sampling locations that represent conditions sampled outside the probable influence of the SWMU have been removed from the data set.

<u>Usability of Historical Data</u>

Validation: Data validation was performed on 10% of the soil piles, fixed-base laboratory project data; however, data in this SWMU was not validated.

Data Assessment: The data assessment qualifier that has been applied to the projects within this SWMU is shown in Table B1.1.5.16-1.

<u>Units of Results</u>

Reported units within the data set are appropriate for the analytical types.

Table B1.1.5.16-1. Assessment Qualifiers Applied to AOC 567 Historic Data

ASSESSMENT	DESCRIPTION
USECNITRIC-CF	During the period from May 2004 to September 2009, the USEC-PGDP laboratory used method RL-7128-NITRIC for isotopic uranium analysis by alpha spec. Method RL-7128-NITRIC utilizes only nitric acid for dissolution rather than hydrofluoric/nitric acid. The use of nitric acid only is a less aggressive dissolution for isotopic uranium analysis by alpha spec. It has been demonstrated that Method RL-7128-NITRIC can be utilized only for isotopic uranium analysis of soil with activity greater than 10 pCi/g due to low recoveries below that level. If the data from Method RL-7128-NITRIC will be screened against the background values reported in *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the PGDP* (1997), the following adjusted background values must be used: U-234: 1.73 pCi/g surface and 1.63 pCi/g subsurface; U-235: 0.10 pCi/g; and U-238: 0.40 pCi/g [*Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant*, Appendix E (2009)]. Risk assessors may use data from this time period for comparison against other thresholds below 10 pCi/g without adjusting the values as long as the level of uncertainty and its impact on the risk assessment/evaluation are adequately discussed. No additional action is required for comparisons to thresholds above 10 pCi/g.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data records that had no detection limits or results recorded within the data set have been removed. All radionuclide historical data have MDCs recorded within the data set.

Sixteen chemicals are nondetects and have their SQL/MDCs greater than background or the child resident NAL. The chemical and referenced values are shown in Table B1.1.5.16-2.

B.1.5.16-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 562

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	8.32	0.0635	0.21	0.21
Arsenic	mg/kg	4.44	0.132	12	7.9
Beryllium	mg/kg	0.496	0.16	0.67	0.69
Cadmium	mg/kg	2.48	2.64	0.21	0.21
Selenium	mg/kg	4.96	12.1	0.8	0.7
Thallium	mg/kg	9.93	0.107	0.21	0.34
Uranium	mg/kg	4.96	2.16	4.9	4.6
Organics					
PCB, Total	mg/kg	0.13	0.0574		
PCB-1016	mg/kg	0.1	0.0574		
PCB-1221	mg/kg	0.13	0.0574		
PCB-1232	mg/kg	0.1	0.0574		
PCB-1242	mg/kg	0.06	0.0574		
PCB-1248	mg/kg	0.1	0.0574		

Table B1.1.5.16-2. Analytes for SQL or MDC Greater than Background or Child Resident NAP for SWMU 562 (Continued)

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
PCB-1254	mg/kg	0.09	0.0388		
PCB-1260	mg/kg	0.1	0.0574		
Benz(a)anthracene	mg/kg	0.5	0.067		
Benzo(a)pyrene	mg/kg	0.5	0.0067		
Benzo(b)fluoranthene	mg/kg	0.5	0.067		
Dibenz(a,h)anthracene	mg/kg	0.5	0.0067		
Indeno(1,2,3-cd)pyrene	mg/kg	0.5	0.067		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

Calculated total uranium reported in pCi/g was removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data were assigned to grids developed during the Soils OU RI Report. The assignments are listed in Table B1.1.5.16-3.

Table B1.1.5.16-3. Stations and Grids for Historical Data from AOC 567

Station Name	Grid No.
K013201	SOU567-005
K013101	SOU567-006
OF-12-03	SOU567-007
K013303	SOU567-017
K013406	SOU567-031
K013501	SOU567-039

B1.1.6 GROUP 3, SCRAP YARDS

B1.1.6.1 SWMU 14, C-746-E Scrap Yard

Data Evaluation and Screening

Historical data for this SWMU is for the subsurface only. The analytical types available include metals, pesticides/PCBs, radionuclides, SVOCs, and VOCs. These data were collected from the following project(s):

- Burial Ground OU SWMU 7 Angle Borings BGOU07-SWMU7ASB4
- False Claims Investigation—DOE Headquarters-Soils/Sediment

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 10 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 14.

Usability of Historical Data

Validation: Validation was performed for 10% of the Burial Grounds Project, but not for the False Claims investigation. Validation qualifiers applied to these data were "=," J, and U.

Data Assessment: The data Assessment qualifiers that have been applied to the data for this SWMU are shown in Table B1.1.6.1-1.

Table B1.1.6.1-1. Assessment Qualifiers Applied to SWMU 014 Historic Data

Assessment qualifier	Definition
KYRHTAB-OK	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the data is acceptable for use.
USECNITRIC-CF	During the period from May 2004 to September 2009, the USEC-PGDP laboratory used method RL-7128-NITRIC for isotopic uranium analysis by alpha spec. Method RL-7128-NITRIC utilizes only nitric acid for dissolution rather than hydrofluoric/nitric acid. The use of nitric acid only is a less aggressive dissolution for isotopic uranium analysis by alpha spec. It has been demonstrated that Method RL-7128-NITRIC can be utilized only for isotopic uranium analysis of soil with activity greater than 10 pCi/g due to low recoveries below that level. If the data from Method RL-7128-NITRIC will be screened against the background values reported in *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the PGDP* (1997), the following adjusted background values must be used: U-234: 1.73 pCi/g surface and 1.63 pCi/g subsurface; U-235: 0.10 pCi/g; and U-238: 0.40 pCi/g [*Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant*, Appendix E (2009)]. Risk assessors may use data from this time period for comparison against other thresholds below 10 pCi/g without adjusting the values as long as the level of uncertainty and its impact on the risk assessment/evaluation are adequately discussed. No additional action is required for comparisons to thresholds above 10 pCi/g.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data records that had no reported results and detection limits have been removed from the data set.

There are 23 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. Those chemicals and referenced values are shown in Table B1.1.6.1-2.

Table B1.1.6.1-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 014

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	9.77	0.552	0.21	0.21
Arsenic	mg/kg	0.935	0.238		
Beryllium	mg/kg	0.467	0.00567		
Cadmium	mg/kg	1.87	0.811	0.21	0.21
Cobalt	mg/kg	2.34	1.37		
Thallium	mg/kg	1.87	0.368	0.21	0.34
Vanadium	mg/kg	2.34	0.0365		
Organics					
PCB, Total	mg/kg	0.1	0.0648		
PCB-1016	mg/kg	0.1	0.0633		
PCB-1221	mg/kg	0.1	0.0437		
PCB-1232	mg/kg	0.1	0.0437		
PCB-1242	mg/kg	0.1	0.0644		
PCB-1248	mg/kg	0.1	0.0682		
PCB-1254	mg/kg	0.1	0.0501		
PCB-1260	mg/kg	0.1	0.0662		
2-Nitrobenzenamine	mg/kg	0.5	0.296		
Benz(a)anthracene	mg/kg	0.5	0.196		
Benzo(a)pyrene	mg/kg	0.5	0.0197		
Benzo(b)fluoranthene	mg/kg	0.5	0.197		
Dibenz(a,h)anthracene	mg/kg	0.5	0.0197		
Hexachlorobenzene	mg/kg	0.5	0.0492		
Indeno(1,2,3-cd)pyrene	mg/kg	0.5	0.197		
N-Nitroso-di-n-propylamine	mg/kg	0.5	0.0189		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

Radionuclide historical data records that have no MDCs and no counting errors reported have been removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

Both of the historic data has been assigned to grid 2, which was developed during the Soils OU RI field effort.

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.6.1-3.

Table B1.1.6.1-3. Summary of SWMU 14 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	2/2	7.32E+03	7.39E+03	7.46E+03	0/2	2/2
Arsenic	1/2	3.80E+00	3.80E+00	3.80E+00	0/2	1/2
Barium	2/2	7.77E+01	1.14E+02	1.50E+02	0/2	1/2
Calcium	2/2	1.08E+03	1.34E+03	1.59E+03	0/2	0/2
Chromium	2/2	1.05E+01	1.18E+01	1.31E+01	0/2	0/2
Cobalt	1/2	7.85E+00	7.85E+00	7.85E+00	0/2	1/2
Copper	2/2	5.71E+00	8.56E+00	1.14E+01	0/2	0/2
Iron	2/2	5.36E+03	7.25E+03	9.13E+03	0/2	2/2
Lead	2/2	6.69E+00	7.48E+00	8.26E+00	0/2	0/2
Magnesium	2/2	8.83E+02	1.24E+03	1.59E+03	0/2	0/2
Manganese	2/2	6.69E+01	1.72E+02	2.77E+02	0/2	0/2
Nickel	2/2	7.79E+00	1.19E+01	1.61E+01	0/2	1/2
Sodium	2/2	1.46E+02	1.50E+02	1.53E+02	0/2	0/2
Vanadium	1/2	6.75E+00	6.75E+00	6.75E+00	0/2	1/2
Zinc	1/2	3.35E+01	3.35E+01	3.35E+01	0/2	0/2
Organics (mg/kg)						
PCB, Total	1/3	5.00E-01	5.00E-01	5.00E-01	0/3	1/3
PCB-1260	1/3	5.00E-01	5.00E-01	5.00E-01	0/3	1/3
Radionuclides (pCi/g)						
Americium-241	3/3	-5.21E-03	5.47E-01	1.65E+00	0/3	1/3
Cesium-137	3/3	-2.65E-02	1.99E-02	9.70E-02	0/3	1/3
Cobalt-60	2/2	1.69E-02	2.06E-02	2.42E-02	0/2	2/2

Table B1.1.6.1-3. Summary of SWMU 14 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Neptunium-237	3/3	-1.64E-03	9.08E-02	2.73E-01	0/3	1/3
Plutonium-238	2/2	-3.40E-03	-1.67E-03	5.40E-05	0/2	0/2
Plutonium-239/240	3/3	-5.43E-03	9.29E-02	2.83E-01	0/3	0/3
Technetium-99	3/3	9.75E-01	1.36E+02	4.06E+02	0/3	1/3
Thorium-228	2/2	3.57E-01	4.32E-01	5.06E-01	0/2	0/2
Thorium-230	3/3	3.69E-01	1.33E+00	3.17E+00	0/3	0/3
Thorium-232	2/2	4.73E-01	5.04E-01	5.35E-01	0/2	0/2
Thorium-234	2/2	1.30E+00	1.44E+00	1.57E+00	0/2	0/2
Uranium-234	2/2	8.38E-02	1.13E-01	1.42E-01	0/2	0/2
Uranium-235	2/2	7.91E-03	9.61E-03	1.13E-02	0/2	0/2
Uranium-238	2/2	7.92E-02	1.00E-01	1.21E-01	0/2	0/2

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.6.2 SWMU 518, Field South of P1 Yard

Data Evaluation and Screening

Historical data for this SWMU from the surface soils was analyzed for metals, pesticides/PCBs, radionuclides, SVOCs, and VOCs. The analytical types for the shallow subsurface soil are metals, pesticides/PCB, SVOCs, and VOCs. These data were collected from the following project(s):

- Remedial Action SI—Phase 2
- Scrap Metal Site Characterization for C-746-P1 Yard—Resample SY01-C746P1-R
- Scrap Metal Site Characterization for C-746-P1 Yard SY01-C746P1
- Surface Water OU—Activity 1 ISOCS data SWOU05-ISOCS
- Surface Water OU—Outfall 001 Activity 1 EU08 SWOU05-K001A108
- Surface Water OU—Outfall 001 Activity 2 EU7 AND EU8 SWOU05-K001A20708
- WAG 3—SWMU 5

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 10 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 518.

Usability of Historical Data

Validation: Validation was performed on 10% of the data collected during the Phase 2 and WAG 3 projects. Validation qualifiers applied to the SWMU 518 data set include “?,” “=,” J, and N.

Data Assessment: The data assessment qualifiers that have been applied to the Scrap Yard Profile of Soil—C746C SYSSP04-C746C project within this SWMU are shown in Table B1.1.6.2-1.

Table B1.1.6.2-1. Assessment Qualifiers Applied to SWMU 518 Historic Data

Assessment qualifier	Definition
KYRHTAB-OK	Kentucky Radiation Health and Toxic Agents Branch (KYRHTAB) has performed an independent data evaluation (not to be confused with data verification and validation) and the data is acceptable for use.
USECNITRIC-CF	During the period from May 2004 to September 2009, the USEC-PGDP laboratory used method RL-7128-NITRIC for isotopic uranium analysis by alpha spec. Method RL-7128-NITRIC utilizes only nitric acid for dissolution rather than hydrofluoric/nitric acid. The use of nitric acid only is a less aggressive dissolution for isotopic uranium analysis by alpha spec. It has been demonstrated that Method RL-7128-NITRIC can be utilized only for isotopic uranium analysis of soil with activity greater than 10 pCi/g due to low recoveries below that level. If the data from Method RL-7128-NITRIC will be screened against the background values reported in *Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the PGDP* (1997), the following adjusted background values must be used: U-234: 1.73 pCi/g surface and 1.63 pCi/g subsurface; U-235: 0.10 pCi/g; and U-238: 0.40 pCi/g [*Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant*, Appendix E (2009)]. Risk assessors may use data from this time period for comparison against other thresholds below 10 pCi/g without adjusting the values as long as the level of uncertainty and its impact on the risk assessment/evaluation are adequately discussed. No additional action is required for comparisons to thresholds above 10 pCi/g.

It was noted in the SWOU SI/BRA that data for cesium-137 and uranium-238 were produced using an ISOCS unit, as opposed to a fixed-base laboratory. The data are considered screening level only (its intended purpose) and did not meet data evaluation methods; therefore, they could not be used in the risk assessment (DOE 2008). These data subsequently were removed from the Soils OU data set.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data records without either results or detection limits have been removed from the data set.

There are 26 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. Those chemicals and referenced values are shown in Table B1.1.6.2-2.

Table B1.1.6.2-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 518

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	20	0.552	0.21	0.21

Table B1.1.6.2-2. Analytes for SQL or MDC Greater than Background or Child Resident NAL for SWMU 518 (Continued)

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Arsenic	mg/kg	5	0.238		
Beryllium	mg/kg	0.5	0.00567		
Cadmium	mg/kg	2	0.811	0.21	0.21
Silver	mg/kg	4	2.61	2.3	2.7
Thallium	mg/kg	20	0.368	0.21	0.34
Uranium	mg/kg	2000	0.517	4.9	4.6
Uranium	mg/kg	2000	13.8	4.9	4.6
Organics					
Dieldrin	mg/kg	0.1	0.0106		
PCB, Total	mg/kg	1	0.0648		
PCB-1016	mg/kg	0.52	0.0633		
PCB-1221	mg/kg	0.52	0.0437		
PCB-1232	mg/kg	0.52	0.0437		
PCB-1242	mg/kg	0.52	0.0644		
PCB-1248	mg/kg	0.52	0.0682		
PCB-1254	mg/kg	1	0.0501		
PCB-1260	mg/kg	1	0.0662		
2-Nitrobenzenamine	mg/kg	2.4	0.296		
Benz(a)anthracene	mg/kg	0.5	0.196		
Benzo(a)pyrene	mg/kg	0.5	0.0197		
Benzo(b)fluoranthene	mg/kg	0.5	0.197		
Dibenz(a,h)anthracene	mg/kg	0.5	0.0197		
Hexachlorobenzene	mg/kg	0.5	0.0492		
Indeno(1,2,3-cd)pyrene	mg/kg	0.5	0.197		
Naphthalene	mg/kg	2.4	.15		
N-Nitroso-di-n-propylamine	mg/kg	2.4	0.0189		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration; NAL = no action level; SQL = sample quantitation limit

Radionuclide Counting Errors

Radionuclide historical data records that have no MDCs and no counting errors reported have been removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data have been assigned to grids developed during the Soils OU RI. The assignments are listed in Table B1.1.6.2-3.

Table B1.1.6.2-3. Stations and Grids for Historical Data from SWMU 518

Station Name	Grid No.
SOU158-002	720-021
SOU158-013	720-001

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.6.2-4.

Table B1.1.6.2-4. Summary of SWMU 518 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	11/11	3.17E+03	6.57E+03	1.17E+04	0/11	10/11
Arsenic	5/11	3.00E+00	5.51E+00	9.30E+00	1/11	5/11
Barium	11/11	3.33E+01	8.10E+01	1.32E+02	0/11	0/11
Beryllium	5/11	3.50E-01	5.08E-01	6.30E-01	0/11	5/11
Calcium	11/11	6.62E+02	7.85E+04	2.07E+05	1/11	0/11
Chromium	11/11	5.37E+00	9.21E+00	1.40E+01	0/11	0/11
Cobalt	11/11	2.50E+00	5.35E+00	1.76E+01	1/11	11/11
Copper	11/11	2.50E+00	5.87E+00	1.08E+01	0/11	0/11
Iron	11/11	4.50E+03	9.67E+03	1.70E+04	0/11	11/11
Lead	5/11	6.90E+00	1.63E+01	3.19E+01	0/11	0/11
Magnesium	11/11	6.31E+02	2.32E+03	4.78E+03	0/11	0/11
Manganese	11/11	1.78E+02	3.40E+02	4.93E+02	0/11	3/11
Nickel	11/11	5.80E+00	1.01E+01	2.48E+01	1/11	3/11
Potassium	6/6	2.13E+02	4.43E+02	5.44E+02	0/6	0/6
Selenium	1/11	1.06E+00	1.06E+00	1.06E+00	1/11	0/11
Sodium	5/6	7.60E+01	1.40E+02	2.20E+02	0/6	0/6
Uranium	2/6	6.20E+00	1.12E+02	2.17E+02	2/6	3/6
Vanadium	11/11	6.80E+00	1.60E+01	2.54E+01	0/11	11/11
Zinc	6/11	2.31E+01	3.90E+01	7.61E+01	1/11	0/11
Organics (mg/kg)						
PCB, Total	3/17	6.80E-02	9.09E-01	1.64E+00	0/17	3/17
PCB-1260	3/17	6.80E-02	9.09E-01	1.64E+00	0/17	3/17
Acenaphthene	7/27	5.80E-01	7.14E+00	3.10E+01	0/27	0/27
Acenaphthylene	1/27	1.20E+00	1.20E+00	1.20E+00	0/27	0/27
Anthracene	8/27	7.30E-01	9.04E+00	4.00E+01	0/27	0/27
Benz(a)anthracene	13/27	6.00E-02	1.62E+01	1.10E+02	0/27	12/27
Benzo(a)pyrene	13/27	6.70E-02	1.37E+01	8.00E+01	0/27	26/27
Benzo(b)fluoranthene	13/27	8.20E-02	2.20E+01	1.70E+02	0/27	12/27
Benzo(ghi)perylene	10/27	6.10E-02	5.55E+00	2.80E+01	0/27	0/27
Benzo(k)fluoranthene	2/6	5.10E-02	5.88E+00	1.17E+01	0/6	1/6

Table B1.1.6.2-4. Summary of SWMU 518 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Bis(2-ethylhexyl)phthalate	16/26	4.40E+00	4.93E+00	5.70E+00	0/26	0/26
Carbazole	5/22	5.90E-01	1.13E+01	3.70E+01	0/22	1/22
Chrysene	13/27	6.70E-02	1.55E+01	9.50E+01	0/27	4/27
Dibenzofuran	1/5	1.65E+00	1.65E+00	1.65E+00	0/5	0/5
Fluoranthene	2/6	1.30E-01	6.12E+00	1.21E+01	0/6	0/6
Fluorene	6/27	7.40E-01	7.41E+00	2.70E+01	0/27	0/27
Indeno(1,2,3-cd)pyrene	10/27	5.40E-02	7.30E+00	3.70E+01	0/27	9/27
Phenanthrene	13/27	8.50E-02	1.80E+01	6.40E+01	0/27	0/27
Pyrene	17/27	9.80E-02	1.88E+01	1.50E+02	0/27	1/27
Total PAH	2/27	8.72E-02	6.40E+00	1.27E+01	0/27	2/27
Acetone	1/9	1.30E-01	1.30E-01	1.30E-01	0/9	0/9
Methylene chloride	4/9	3.00E-03	4.75E-03	6.00E-03	0/9	0/9
Radionuclides (pCi/g)						
Americium-241	6/6	-1.01E-02	2.03E-02	5.28E-02	0/6	0/6
Cesium-134	5/5	-5.48E-03	8.66E-04	4.02E-03	0/5	0/5
Cesium-137	6/6	3.16E-02	4.76E-02	7.41E-02	0/6	6/6
Cobalt-60	6/6	-1.06E-02	-2.43E-03	4.46E-03	0/6	0/6
Neptunium-237	6/6	-4.88E-03	4.12E-03	1.51E-02	0/6	0/6
Plutonium-238	6/6	-7.90E-02	-5.34E-02	-1.17E-02	0/6	0/6
Plutonium-239/240	6/6	-7.62E-03	-1.59E-03	7.62E-03	0/6	0/6
Technetium-99	6/6	8.11E-01	5.95E+00	1.73E+01	3/6	0/6
Thorium-228	6/6	2.28E-01	3.02E-01	4.22E-01	0/6	0/6
Thorium-230	6/6	2.35E-01	3.37E-01	3.89E-01	0/6	0/6
Thorium-232	6/6	2.62E-01	3.18E-01	3.82E-01	0/6	0/6
Uranium	1/1	8.09E+00	8.09E+00	8.09E+00	1/1	1/1
Uranium-234	6/6	3.51E-01	8.32E-01	2.06E+00	1/6	0/6
Uranium-235	6/6	2.40E-02	4.18E-02	9.25E-02	1/6	0/6
Uranium-238	7/7	6.47E-01	2.57E+00	1.09E+01	1/7	7/7

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.6.3 SWMU 520 C-746-A Scrap Material

No historical data for this SWMU are available in OREIS.

B1.1.7 GROUP 3, PCB AREAS

B1.1.7.1 SWMU 57, C-541-A PCB Waste Staging Area

The historic data for this SWMU used for scoping are located several ft from the boundary of the SWMU; therefore, the data will not be used in the risk assessment and are not evaluated in this appendix.

B1.1.7.2 SWMU 81, C-541 PCB Spill Site

Data Evaluation and Screening

Historical samples collected from surface soil at this SWMU were analyzed for dioxins/furans, metals, pesticides/PCBs, SVOCs, and VOCs. The analytical types for the shallow subsurface soil are pesticides/PCB, SVOCs, and VOCs. These data were collected from the following project(s):

- Remedial Action SI—Phase 1
- Remedial Action SI—Phase 2
- WAG 23 Excavation Sampling
- Wag 23 Phase 1
- WAG 23 Phase 2

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 11 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 81.

Usability of Historical Data

Validation: Validation was performed on 10% of the data collected during the Phase 1, Phase 2, and WAG 23 projects. Validation qualifiers applied to the SWMU 81 data set include "?," "=," E, J, N, U, and V.

Data Assessment: The data assessment qualifier that has been applied to the data from SWMU 81 is shown in Table B1.1.7.2-1.

Table B1.1.7.2-1. Assessment Qualifiers Applied to SWMU 081 Historic Data

KYRHTAB-ER	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the data presents error problems (i.e., no counting uncertainty or zero counting uncertainty).

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data records without either results or detection limits have been removed from the data set.

There are 29 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. Those chemicals and referenced values are shown in Table B1.1.7.2-2.

Table B1.1.7.2-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 081

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	13.1	0.552	0.21	0.21
Manganese	mg/kg	714	419		
Thallium	mg/kg	0.8	0.368	0.21	0.34
Vanadium	mg/kg	27.4	0.0365		
Organics					
Heptachloro-dibenzo[b,e][1,4]dioxin	mg/kg	0.001	0.000275		
Heptachlorodibenzofuran	mg/kg	0.001	0.000134		
Hexachloro-dibenzo[b,e][1,4]dioxin	mg/kg	0.001	0.0000275		
Hexachlorodibenzofuran	mg/kg	0.001	0.0000134		
Pentachloro-dibenzo[b,e][1,4]dioxin	mg/kg	0.001	0.00000275		
Dieldrin	mg/kg	1	0.0106		
PCB, Total	mg/kg	0.2	0.0648		
PCB-1016	mg/kg	12	0.0633		
PCB-1221	mg/kg	12	0.0437		
PCB-1232	mg/kg	12	0.0437		
PCB-1242	mg/kg	12	0.0644		
PCB-1248	mg/kg	12	0.0682		
PCB-1254	mg/kg	24	0.0501		
PCB-1260	mg/kg	0.2	0.0662		
2,3,4,7,8-Pentachlorodibenzofuran	mg/kg	0.00016	0.00000447		
2-Nitrobenzenamine	mg/kg	2.2	0.296		
Benz(a)anthracene	mg/kg	0.43	0.196		
Benzo(a)pyrene	mg/kg	0.43	0.0197		

Table B1.1.7.2-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 081 (Continued)

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Benzo(b)fluoranthene	mg/kg	0.43	0.197		
Dibenz(a,h)anthracene	mg/kg	0.43	0.0197		
Hexachlorobenzene	mg/kg	0.43	0.0492		
Indeno(1,2,3-cd)pyrene	mg/kg	0.43	0.197		
N-Nitroso-di-n-propylamine	mg/kg	0.43	0.0189		
1,1-Dichloroethene	mg/kg	0.031	0.0237		
Trichloroethene	mg/kg	0.031	0.0234		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

There are no historic radionuclide data for SWMU 81.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data has been assigned to grids developed during the Soils OU RI. The assignments are listed in Table B1.1.7.2-3.

Table B1.1.7.2-3. Stations and Grids for Historical Data from SWMU 081

Station Name	Grid No.
SOU081-001	23-5736
SOU081-001A	23-5738
SOU081-001B	23-5737
SOU081-001C	081-002
SOU081-001C	081-003
SOU081-001C	23-5719
SOU081-001C	23-5720
SOU081-001C	H043
SOU081-001D	081-001
SOU081-001D	23-5721
SOU081-001D	23-5722

Table B1.1.7.2-3. Stations and Grids for Historical Data from SWMU 081 (Continued)

Station Name	Grid No.
SOU081-001D	H332
SOU081-001H	23-5749
SOU081-001I	23-5748
SOU081-002	23-5739
SOU081-003	23-5740
SOU081-003	H333
SOU081-003B	23-5723
SOU081-003B	23-5723-1
SOU081-003B	23-5723-2
SOU081-003B	23-5723-3
SOU081-003B	H335
SOU081-004	23-5741
SOU081-004	23-5741-1
SOU081-004	23-5741-2
SOU081-004	23-5741-3
SOU081-004	H041
SOU081-004	H331
SOU081-005	081-005
SOU081-005	23-5742
SOU081-005A	23-5746
SOU081-005B	23-5745
SOU081-005C	057-001
SOU081-005C	057-002
SOU081-005C	057-003
SOU081-005C	057-004
SOU081-005C	23-5727
SOU081-005C	23-5728
SOU081-005C	23-5729
SOU081-005C	23-5733
SOU081-005C	23-5733-1
SOU081-005C	23-5733-2
SOU081-005C	23-5733-3
SOU081-005C	23-5733-4
SOU081-005D	23-5726
SOU081-005D	23-5750-1
SOU081-005D	23-5751-1
SOU081-005D	H042
SOU081-006	23-5743
SOU081-006A	23-5744

Table B1.1.7.2-3. Stations and Grids for Historical Data from SWMU 081 (Continued)

Station Name	Grid No.
SOU081-006B	H334
SOU081-006D	23-5730
SOU081-006D	23-5731

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.7.2-4

Table B1.1.7.2-4. Summary of SWMU 81 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	3/3	9.18E+03	1.12E+04	1.30E+04	0/3	3/3
Arsenic	3/3	9.10E+00	1.08E+01	1.34E+01	1/3	3/3
Barium	3/3	7.88E+01	9.18E+01	1.06E+02	0/3	0/3
Beryllium	3/3	7.00E-01	9.00E-01	1.00E+00	3/3	3/3
Calcium	3/3	3.40E+03	4.53E+03	5.20E+03	0/3	0/3
Chromium	3/3	1.20E+01	1.25E+01	1.32E+01	0/3	0/3
Cobalt	3/3	6.20E+00	7.60E+00	1.03E+01	0/3	3/3
Copper	3/3	1.50E+01	1.90E+01	2.12E+01	2/3	0/3
Iron	3/3	1.80E+04	2.30E+04	2.59E+04	0/3	3/3
Lead	3/3	1.72E+01	1.92E+01	2.19E+01	0/3	0/3
Magnesium	2/3	2.14E+03	2.31E+03	2.47E+03	0/3	0/3
Manganese	2/3	1.34E+02	1.45E+02	1.55E+02	0/3	0/3
Nickel	3/3	1.45E+01	1.48E+01	1.52E+01	0/3	3/3
Silver	3/3	2.30E+00	2.47E+00	2.70E+00	2/3	1/3
Sodium	2/3	5.78E+01	6.09E+01	6.40E+01	0/3	0/3
Uranium	17/18	2.60E+03	4.12E+03	6.50E+03	17/18	34/18
Vanadium	2/3	2.89E+01	2.94E+01	2.98E+01	0/3	2/3
Zinc	2/3	6.68E+01	7.11E+01	7.53E+01	2/3	0/3
Organics (mg/kg)						
Octachloro-dibenzo[b,e][1,4]dioxin	3/3	2.14E-03	3.21E-03	4.30E-03	0/3	0/3
2,2',3,3',5,6'-Hexachlorobiphenyl	1/1	4.20E-01	4.20E-01	4.20E-01	0/1	0/1
2,2',3,4',5',6-Hexachloro-1,1'-biphenyl	1/1	1.00E+00	1.00E+00	1.00E+00	0/1	0/1
PCB, Total	38/65	1.50E-02	1.24E+01	3.70E+02	0/65	29/65
PCB-1016	1/20	7.00E-01	7.00E-01	7.00E-01	0/20	1/20

Table B1.1.7.2-4. Summary of SWMU 81 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
PCB-1260	37/60	1.50E-02	1.27E+01	3.70E+02	0/60	28/60
Polychlorinated biphenyls 153	3/3	3.50E-01	8.83E-01	1.20E+00	0/3	0/3
Polychlorinated biphenyls 170	1/1	8.10E-01	8.10E-01	8.10E-01	0/1	0/1
Polychlorinated biphenyls 171	1/1	5.10E-01	5.10E-01	5.10E-01	0/1	0/1
Polychlorinated biphenyls 174	1/1	6.10E-01	6.10E-01	6.10E-01	0/1	0/1
Polychlorinated biphenyls 180	1/1	9.50E-01	9.50E-01	9.50E-01	0/1	0/1
1,2,3,4,6,7,8-Heptachlorodibenzofuran	4/4	4.90E-05	1.71E-04	4.19E-04	0/4	0/4
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	4/4	1.16E-04	2.92E-04	5.71E-04	0/4	0/4
1,2,3,4,7,8,9-Heptachlorodibenzofuran	3/5	1.30E-05	1.43E-05	1.60E-05	0/5	0/5
1,2,3,4,7,8-Hexachlorodibenzofuran	3/4	2.40E-05	2.83E-05	3.30E-05	0/4	0/4
1,2,3,6,7,8-Hexachlorodibenzofuran	5/5	4.00E-05	8.40E-05	2.37E-04	0/5	0/5
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	5/5	4.70E-05	1.13E-04	3.54E-04	0/5	0/5
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	3/5	6.00E-06	1.07E-05	1.50E-05	0/5	0/5
1,2,3,7,8-Pentachlorodibenzofuran	5/5	5.60E-05	8.40E-05	1.58E-04	0/5	5/5
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	2/2	5.00E-05	9.20E-05	1.34E-04	0/2	0/2
2,3,4,6,7,8-Hexachlorodibenzofuran	1/5	3.00E-06	3.00E-06	3.00E-06	0/5	0/5
2,3,4,7,8-Pentachlorodibenzofuran	1/3	1.50E-05	1.50E-05	1.50E-05	0/3	1/3
2,3,7,8-Tetrachlorodibenzofuran	5/5	3.10E-05	4.14E-05	6.20E-05	0/5	4/5
2,3-Dimethylheptane	3/3	3.60E-01	4.40E-01	5.10E-01	0/3	0/3
2,4-Dimethylheptane	1/1	6.80E-01	6.80E-01	6.80E-01	0/1	0/1

Table B1.1.7.2-4. Summary of SWMU 81 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
2,5-Hexanedione	1/1	2.00E-01	2.00E-01	2.00E-01	0/1	0/1
2,6-Dimethylheptane	3/3	2.60E-01	2.93E-01	3.30E-01	0/3	0/3
2-Methyloctane	1/1	6.00E-01	6.00E-01	6.00E-01	0/1	0/1
3-Methylene-heptane	1/1	2.00E-01	2.00E-01	2.00E-01	0/1	0/1
Bis(2-ethylhexyl)phthalate	1/10	4.50E-01	4.50E-01	4.50E-01	0/10	0/10
Dioctyl hexanedioate	1/1	5.70E-01	5.70E-01	5.70E-01	0/1	0/1
Hexachlorobiphenyl	6/6	7.30E-01	9.72E-01	1.20E+00	0/6	0/6
Octachloro-dibenzo[b,e][1,4]dioxin	5/5	1.35E-03	2.57E-03	3.10E-03	0/5	0/5
Octachlorodibenzofuran	5/5	1.01E-04	4.46E-04	1.60E-03	0/5	0/5
Octane	1/1	1.90E-01	1.90E-01	1.90E-01	0/1	0/1
2,5-Dimethylheptane	3/3	6.60E-01	7.53E-01	8.50E-01	0/3	0/3
2-Methyl-2-heptene	1/1	1.90E-01	1.90E-01	1.90E-01	0/1	0/1
2-Methyldecane	1/1	2.50E-01	2.50E-01	2.50E-01	0/1	0/1
3,4-Dimethylheptane	2/2	2.20E-01	2.30E-01	2.40E-01	0/2	0/2
4-Heptanone	2/2	3.40E-01	3.55E-01	3.70E-01	0/2	0/2
4-Methyl-3-penten-2-one	4/4	3.00E-01	3.15E-01	3.40E-01	0/4	0/4
Acetone	1/10	1.70E-01	1.70E-01	1.70E-01	0/10	0/10
Methyl Isobutyl Carbinol	1/1	2.40E-01	2.40E-01	2.40E-01	0/1	0/1

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.7.3 SWMU 153, C-331 PCB Soil Contamination (west)

Data Evaluation and Screening

There is one historical sample collected from this SWMU. It was analyzed for PCBs and is from the RCWC Data project.

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter11 illustrate the location of the historical data point associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 153.

Usability of Historical Data

Validation: The data for this SWMU have not been validated.

Data Assessment: There have been no data assessment qualifiers applied to the data from SWMU 153.

Units of Results

Reported units for the single analysis in the data set is appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

The detection limits for this single analysis is appropriate.

Radionuclide Counting Errors

There are no historic radionuclide data for SWMU 153.

Nondetect Result Qualifiers

There are no nondetected analyses for SWMU 153.

Assignment of Historical Data to RI Sampling Grids

The historic data point has been assigned to grid 5, which was developed during the Soils OU RI field effort.

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.7.3-1.

B1.1.7.4 SWMU 156, C-310 PCB Soil Contamination (west)

Data Evaluation and Screening

There are two historical samples collected from this SWMU; both are for the surface only and they were analyzed for PCBs. These data were collected from the RCWC Data project.

Table B1.1.7.3-1. Summary of SWMU 153 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Organics (mg/kg)						
PCB, Total	1/1	6.00E-01	--	--	n/a	1/1

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 11 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 156.

Usability of Historical Data

Validation: The data for this SWMU have not been validated.

Data Assessment: There have been no data assessment qualifiers applied to the data from SWMU 156.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data records without either results or detection limits have been removed from the data set.

There are no chemicals that are a nondetect and have their SQL/MDCs greater than background or the child resident NAL.

Radionuclide Counting Errors

There are no historic radionuclide data for SWMU 156.

Nondetect Result Qualifiers

There were no nondetected analyses for data from SWMU 156.

Assignment of Historical Data to RI Sampling Grids

SWMU 156 was grid sampled during this RI. The historic data have been assigned to sampling grids used during the Soils OU RI field effort. The grid assignments are shown in Table B1.1.7.4-1.

Table B1.1.7.4-1. Stations and Grids for Historical Data from SWMU 156

Station Name	Grid No.
SOU156-006	RC-3703
SOU156-008	RC-3702

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.7.4-2.

Table B1.1.7.4-2. Summary of SWMU 156 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Organics (mg/kg)						
PCB, Total	1/2	3.00E-01	3.00E-01	3.00E-01	0/2	1/2

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.7.5 SWMU 160, C-745 Cylinder yard (PCB soils) Spoils

Data Evaluation and Screening

Historical samples collected from this SWMU are for the surface only, which were analyzed for PCBs and radionuclides. These data were collected from the RCWC Data 92-82A project.

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 11 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 160.

Usability of Historical Data

Validation: The data for this SWMU have not been validated.

Data Assessment: There have been no data assessment qualifiers applied to the data from SWMU 160.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data records without either results or detection limits have been removed from the data set.

There are no chemicals that are a nondetect and have their SQL/MDCs greater than background or the child resident NAL.

Radionuclide Counting Errors

Radionuclide historical data records that have no MDCs and no counting errors reported have been removed from the data set.

Nondetect Result Qualifiers

There are no nondetected results in the SWMU 160 data set.

Assignment of Historical Data to RI Sampling Grids

The historic data have been assigned to sampling grid 2, which was developed for the Soils OU RI field effort.

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.7.5-1.

Table B1.1.7.5-1. Summary of SWMU 160 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Radionuclides (pCi/g)						
Technetium-99	1/1	1.70E+01	1.70E+01	1.70E+01	0/1	0/1
Uranium	1/1	2.40E+00	2.40E+00	2.40E+00	0/1	1/1

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.7.6 SWMU 163, C-304 HVAC Piping System (soil backfill from C-611)

Data Evaluation and Screening

Historical samples collected from this SWMU for surface soil were analyzed for metals, PCBs, radionuclides, SVOCs, and VOCs. The data for the shallow subsurface had the same analytical types as the surface soil. All of this data was collected from the WAG 23, SWMU 193 project.

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 11 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 163.

Usability of Historical Data

Validation: Validation was performed on 10% of the data from the WAG 23 project. The validation qualifiers assigned to data from this SWMU are "=," J, and U.

Data Assessment: Assessment qualifiers assigned to data from SWMU 163 are shown in Table B1.1.7.6-1.

Table B1.1.7.6-1. Assessment Qualifiers Applied to SWMU 163 Historic Data

KYRHTAB-50	KYRHTAB has performed an independent data evaluation (not to be confused with data verification and validation) and the rad error accounts for greater than 50% of the results.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data records without either results or detection limits have been removed from the data set.

There are 25 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. Those chemicals and referenced values are shown in Table B1.1.7.6-2.

Table B1.1.7.6-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 163

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Inorganics					
Antimony	mg/kg	20	0.552	0.21	0.21
Arsenic	mg/kg	5	0.238		
Beryllium	mg/kg	0.5	0.00567		
Cadmium	mg/kg	2	0.811	0.21	0.21
Silver	mg/kg	4	2.61	2.3	2.7
Thallium	mg/kg	15	0.368	0.21	0.34
Organics					
PCB, Total	mg/kg	0.116	0.0648		
PCB-1016	mg/kg	0.116	0.0633		
PCB-1221	mg/kg	0.116	0.0437		
PCB-1232	mg/kg	0.116	0.0437		
PCB-1242	mg/kg	0.116	0.0644		
PCB-1248	mg/kg	0.116	0.0682		
PCB-1254	mg/kg	0.116	0.0501		
PCB-1260	mg/kg	0.116	0.0662		
2-Nitrobenzenamine	mg/kg	0.5	0.296		
Benz(a)anthracene	mg/kg	0.5	0.196		
Benzo(a)pyrene	mg/kg	0.5	0.0197		

Table B1.1.7.6-2. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 163 (Continued)

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Benzo(b)fluoranthene	mg/kg	0.5	0.197		
Dibenz(a,h)anthracene	mg/kg	0.5	0.0197		
Hexachlorobenzene	mg/kg	0.5	0.0492		
Indeno(1,2,3-cd)pyrene	mg/kg	0.5	0.197		
N-Nitroso-di-n-propylamine	mg/kg	0.5	0.0189		
1,1-Dichloroethene	mg/kg	0.308	0.0237		
Trichloroethene	mg/kg	0.308	0.0234		
Vinyl chloride	mg/kg	100	0.0824		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

Radionuclide historical data records that have no MDCs and no counting errors reported have been removed from the data set.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data have been assigned to sampling grids used during the Soils OU RI field effort. The data has been assigned to grid 026.

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.7.6-3.

Table B1.1.7.6-3. Summary of SWMU 163 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Inorganics (mg/kg)						
Aluminum	2/2	4.65E+03	8.28E+03	1.19E+04	0/2	2/2
Barium	2/2	3.91E+01	5.15E+01	6.38E+01	0/2	0/2
Beryllium	1/2	5.50E-01	5.50E-01	5.50E-01	0/2	1/2
Chromium	2/2	7.26E+00	1.75E+01	2.77E+01	0/2	1/2
Cobalt	2/2	2.25E+00	2.85E+00	3.44E+00	0/2	2/2

Table B1.1.7.6-3. Summary of SWMU 163 Detected Chemicals (Continued)

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Copper	2/2	4.95E+00	5.06E+00	5.16E+00	0/2	0/2
Iron	2/2	6.72E+03	1.05E+04	1.42E+04	0/2	2/2
Lithium	2/2	3.78E+00	6.23E+00	8.67E+00	0/2	0/2
Magnesium	2/2	1.29E+03	9.15E+03	1.70E+04	1/2	0/2
Manganese	2/2	1.50E+02	1.57E+02	1.63E+02	0/2	0/2
Nickel	1/2	5.50E+00	5.50E+00	5.50E+00	0/2	0/2
Potassium	2/2	3.42E+02	3.80E+02	4.17E+02	0/2	0/2
Sodium	1/2	2.39E+02	2.39E+02	2.39E+02	0/2	0/2
Strontium	2/2	7.56E+00	7.73E+01	1.47E+02	0/2	0/2
Vanadium	2/2	9.80E+00	1.84E+01	2.70E+01	0/2	2/2
Zinc	2/2	2.21E+01	3.88E+01	5.54E+01	0/2	0/2
Organics (mg/kg)						
Anthracene	1/3	1.16E-01	1.16E-01	1.16E-01	0/3	0/3
Benz(a)anthracene	1/3	1.60E-01	1.60E-01	1.60E-01	0/3	0/3
Benzo(a)pyrene	1/3	2.50E-01	2.50E-01	2.50E-01	0/3	2/3
Benzo(b)fluoranthene	1/3	5.10E-02	5.10E-02	5.10E-02	0/3	0/3
Benzo(ghi)perylene	1/3	1.66E-01	1.66E-01	1.66E-01	0/3	0/3
Bis(2-ethylhexyl)phthalate	1/3	1.70E-01	1.70E-01	1.70E-01	0/3	0/3
Chrysene	1/3	1.70E-01	1.70E-01	1.70E-01	0/3	0/3
Diethyl phthalate	1/3	4.00E-01	4.00E-01	4.00E-01	0/3	0/3
Fluoranthene	1/3	3.10E-01	3.10E-01	3.10E-01	0/3	0/3
Indeno(1,2,3-cd)pyrene	1/3	1.38E-01	1.38E-01	1.38E-01	0/3	0/3
Pyrene	2/3	2.10E-01	2.53E-01	2.95E-01	0/3	0/3
Total PAH	1/3	2.85E-01	2.85E-01	2.85E-01	0/3	1/3
Radionuclides (pCi/g)						
Technetium-99	2/2	3.40E-01	8.55E-01	1.37E+00	0/2	0/2

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

B1.1.7.7 SWMU 219, C-728 DMSA OS-08, Empty Fiberglass Tank

There are no historical data for SWMU 219.

B1.1.7.8 SWMU 488, C-410 Trailers, PCB Contamination Area

Data Evaluation and Screening

Historical samples collected from this SWMU are for the surface soil only, and were analyzed for PCBs. All of this data was collected from the Characterization of the D&D/DMSA Trailer Complex Site—SM01-05.

Sampling Representative of the SWMU/AOC Area?

Figures in Chapter 11 illustrate the location of the historical data points associated with this SWMU. For project scoping, all data within a 50-ft boundary of the SWMU administrative boundary were selected and assigned to SWMU 488.

Usability of Historical Data

Validation: No assessment qualifiers have been assigned to the data for this SWMU.

Data Assessment: No assessment qualifiers have been assigned to data from SWMU 488.

Units of Results

Reported units within the data set are appropriate for the analytical types.

Detection Limits/Minimum Detectable Concentration

All of the nonradionuclide historical data records without either results or detection limits have been removed from the data set.

There are 5 chemicals that are nondetects and have their SQL/MDCs greater than background or the child resident NAL. Those chemicals and referenced values are shown in Table B1.1.7.8-1.

Table B1.1.7.8-1. Analytes with SQL or MDC Greater than Background or Child Resident NAL for SWMU 488

Chemical	Unit	Maximum SQL/MDC for Nondetects	NAL[1]	Background[1]	
				Surface	Subsurface
Organics					
PCB-1016	mg/kg	0.1	0.0633		
PCB-1221	mg/kg	0.1	0.0437		
PCB-1232	mg/kg	0.1	0.0437		
PCB-1242	mg/kg	0.1	0.0644		
PCB-1248	mg/kg	0.1	0.0682		

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
MDC = minimum detectable concentration
NAL = no action level
SQL = sample quantitation limit

Radionuclide Counting Errors

There were no radionuclide data included in the data for this SWMU.

Nondetect Result Qualifiers

All usable data records that were considered nondetect were considered so due to laboratory qualification.

Assignment of Historical Data to RI Sampling Grids

The historic data has been assigned to the single sampling grid that was used during the Soils OU RI field effort.

Summary of Detected Chemicals

A summary of detected chemicals is presented in Table B1.1.7.8-2.

Table B1.1.7.8-2. Summary of SWMU 488 Detected Chemicals

Chemical	FOD	Minimum Detected Result	Average Detected Result	Maximum Detected Result	FOD above Bkgd[1]	FOD above NAL[1]
Organics (mg/kg)						
PCB, Total	1/1	1.03E+01	1.03E+01	1.03E+01	0/1	1/1
PCB-1254	1/1	5.40E+00	5.40E+00	5.40E+00	0/1	1/1
PCB-1260	1/1	4.90E+00	4.90E+00	4.90E+00	0/1	1/1

[1] NAL Child Resident NAL as shown in Appendix D. Background values reported in the Risk Methods Document (DOE 2011).
FOD = frequency of detection
NAL = no action level

REFERENCE

DOE 2008. *Surface Water Operable Unit (On-Site) Site Investigation and Baseline Risk Assessment Report at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0001&D2/R1, U.S. Department of Energy, Paducah, KY.

ATTACHMENT B2

XRF STATISTICS

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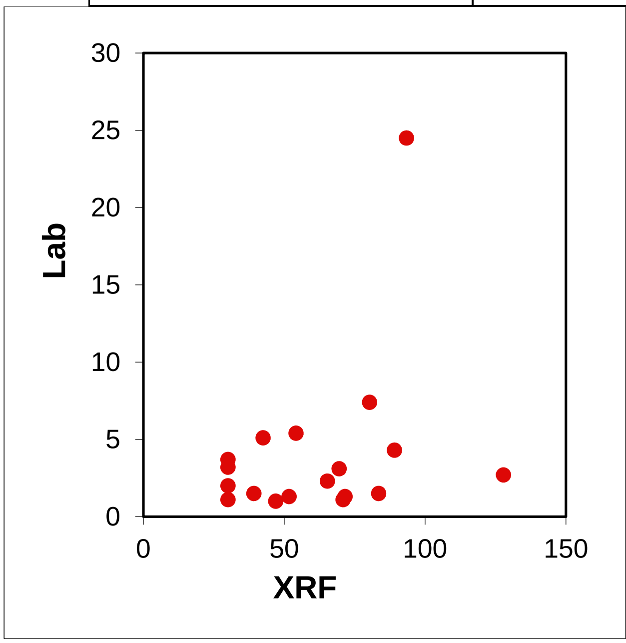
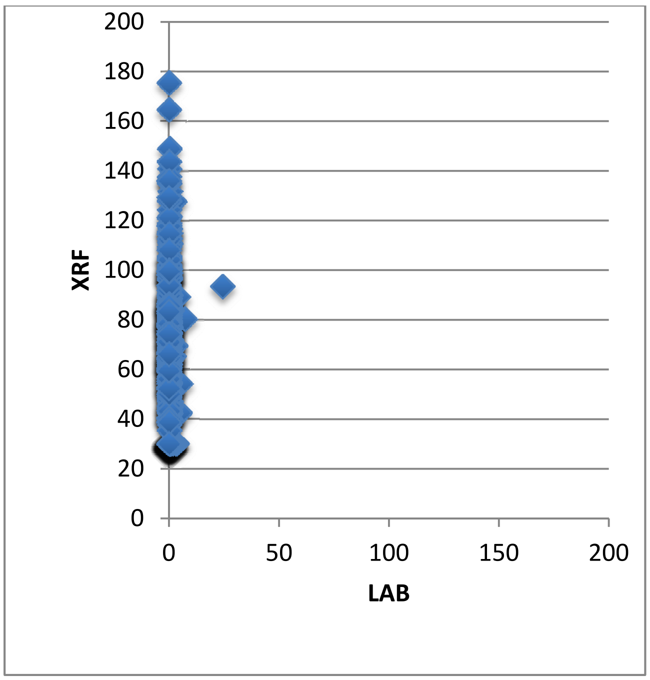
The XRF data correlated better with the lab data for many constituents, but not all constituents (Johnson 2008). This discrepancy provides an uncertainty that is documented in this DQA and will be addressed in the Soils OU Baseline Risk Assessment(s) sections of the RI to support remedial decision making. This attachment provides additional statistics for the XRF data to support Section B.3.1.1, Initial Comparison.

Antimony

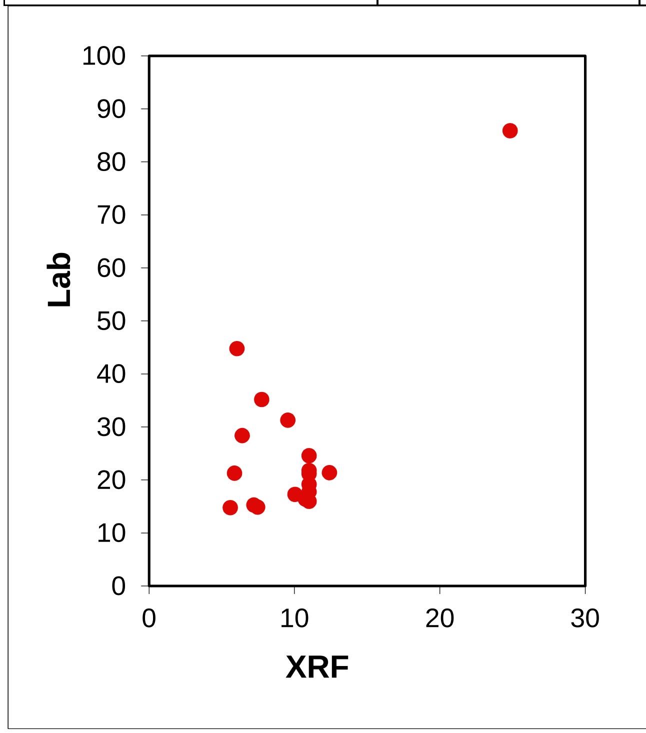
Spearman's rho:	-0.030	Bkg	0.21
degrees of freedom:	382	NAL	25.3
P-value:	0.5625	AL	1510

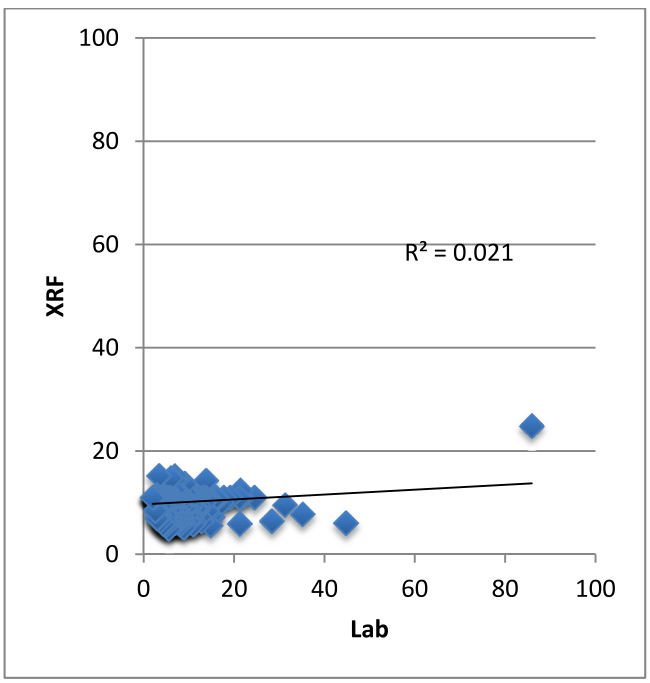




Arsenic

Spearman's rho:	-0.177	Bkg (low)	B.5. 7.9
degrees of freedom:	331	IW NAL	1
P-value:	0.001196		





XRF results over estimate concentrations at lower concentrations when detected, leading to some uncertainty regarding background comparisons and risks.

There is a bias that suggests for the higher laboratory results, XRF may underestimate the concentration.

Even with these limitations, it is recommended the XRF arsenic concentrations be evaluated in the nature and extent and risk assessment.

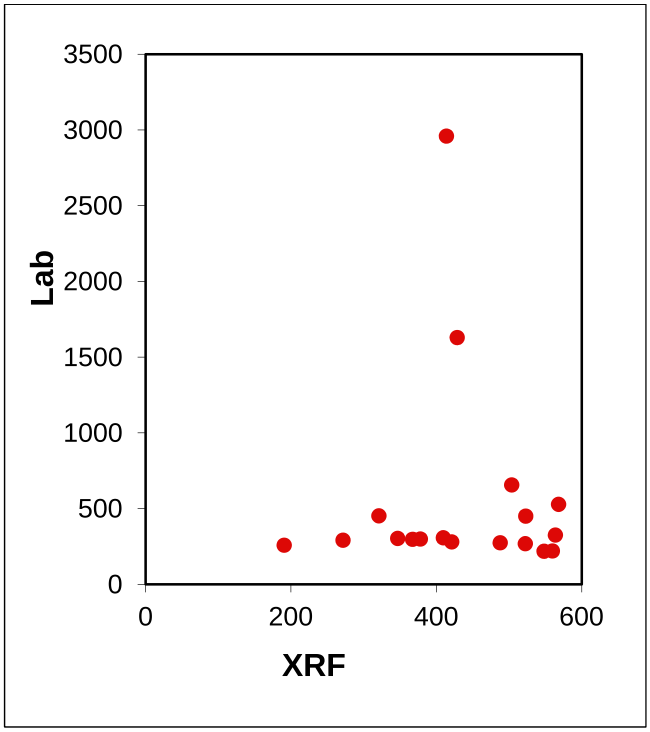
The highest XRF result in the paired samples (~24 mg/kg) is associated with the highest laboratory result.

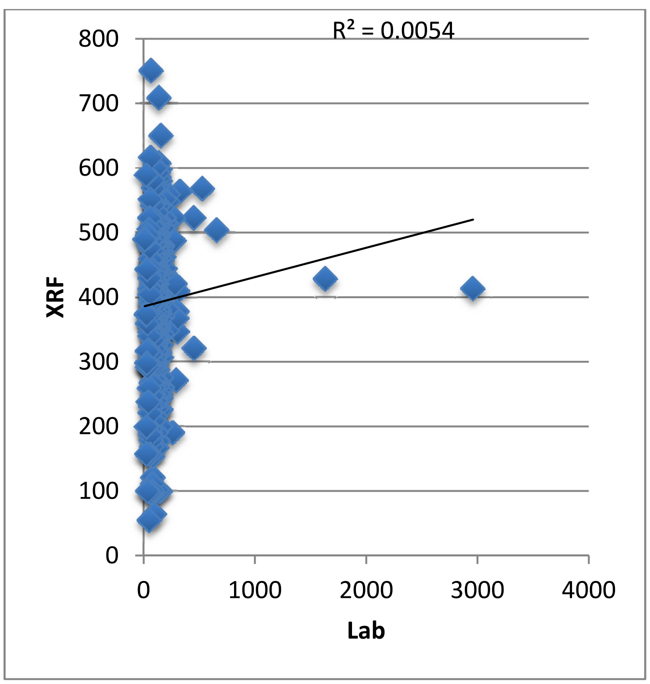
In the complete data set, there are 20 values > 24 mg/kg, with two results above the industrial worker action level of 100 mg/kg.

This information is critical for decision making, both for hot spots and risk estimates in these EUs.

Barium

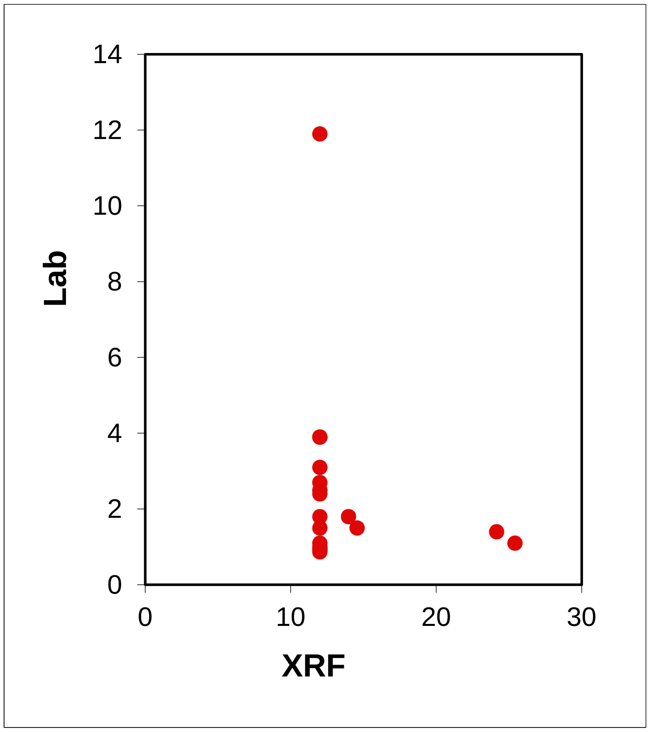
Spearman's rho:	0.163	Bkg	170
degrees of freedom:	331	NAL	592
P-value:	0.002892		





Cadmium

Spearman's rho:	0.059	Bkg	0.21
degrees of freedom:	331	NAL	3.16
P-value:	0.2821		

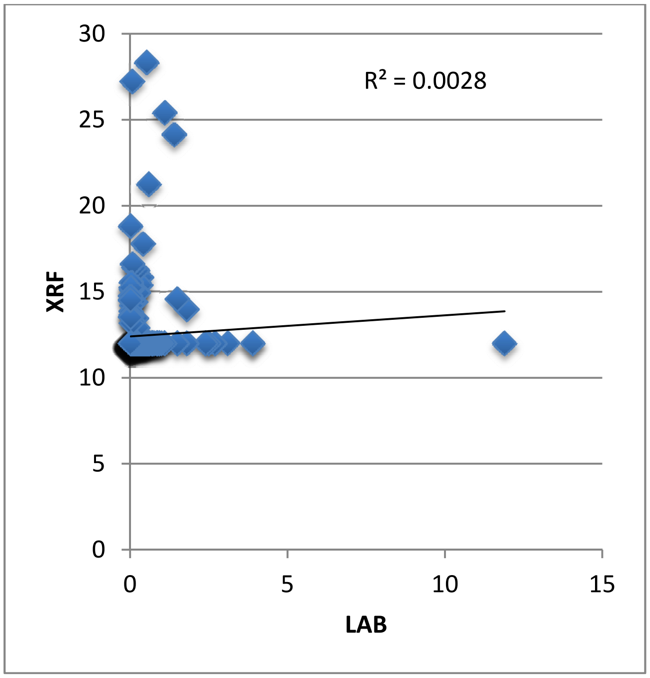


There are no “hot spots” – that is values much higher than the paired data results.

Approximately 10% of the XRF values were detects, with concentrations from ~13-25 mg/kg. The laboratory results ranged from 0.015 to 1.8 mg/kg (all below the IW NAL).

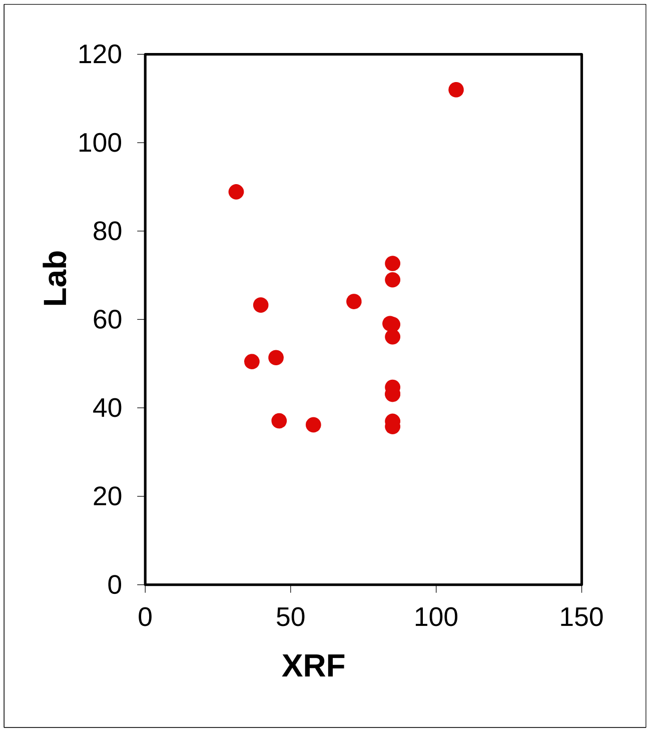
Detects of cadmium in the complete XRF data set also suggest ~10% detects in the similar concentration range.

Use of these data will not accurately reflect the risks and distribution of cadmium.



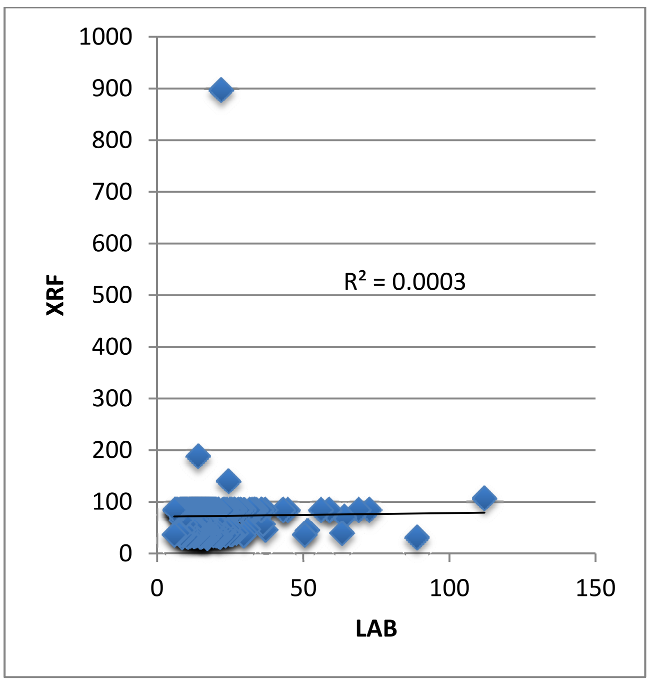
Chromium

Spearman's rho:	-0.092	Bkg	16
degrees of freedom:	331	NAL	30
P-value:	0.0942		



Correlations do not accurately reflect appropriate uses of these data, in part because only four values were reported above the XRF detection limit of 85 mg/kg. Of the XRF values reported as detects below this concentration, most were below either background or the IW NAL.

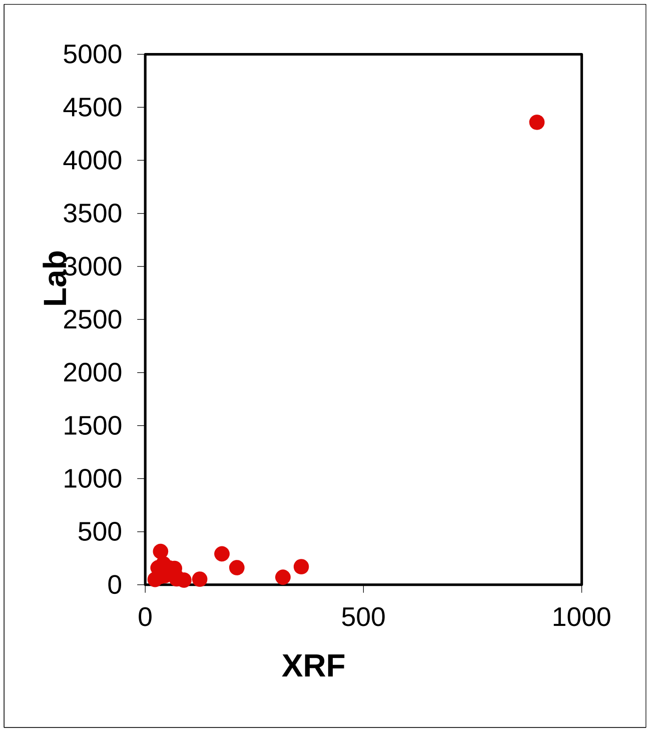
Values above 85 mg/kg will be further evaluated for their location, correlations, and potential impact on decisions.

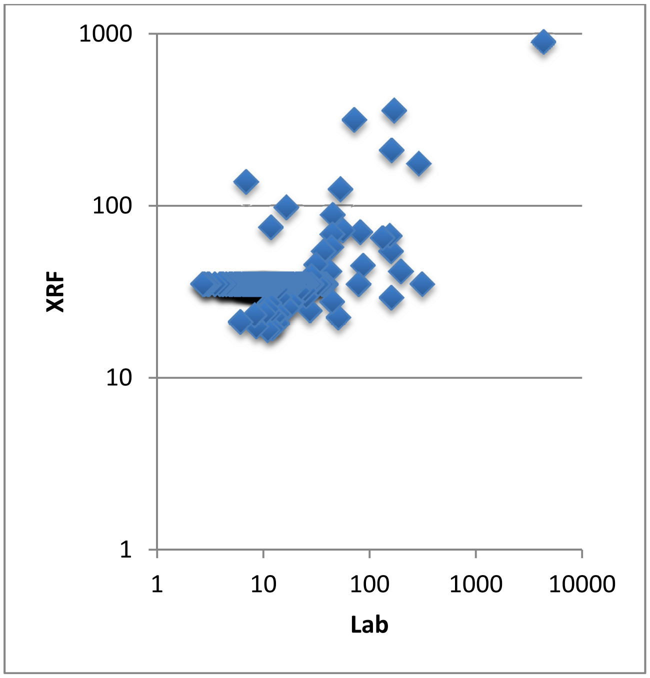


Copper

Spearman's rho:	0.135	Bkg	21
degrees of freedom:	331	NAL	43
P-value:	0.0139		

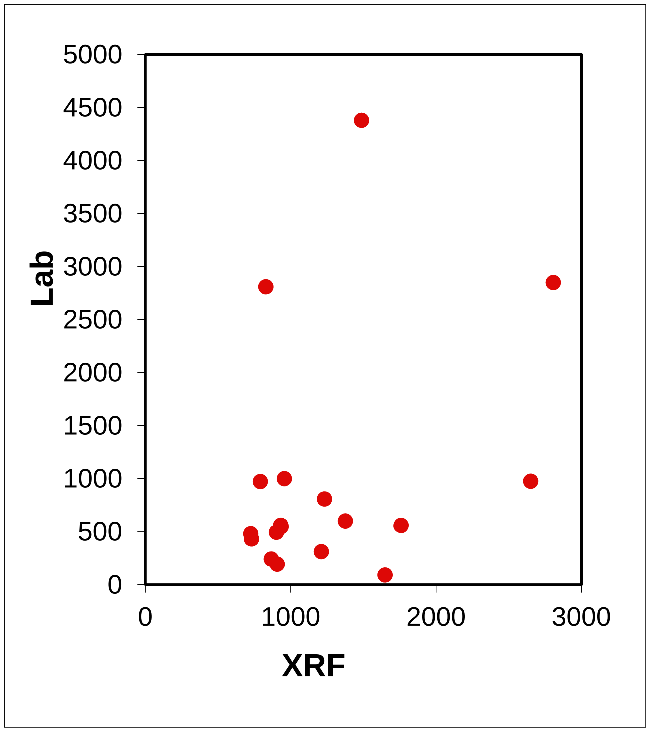
R2 0.78

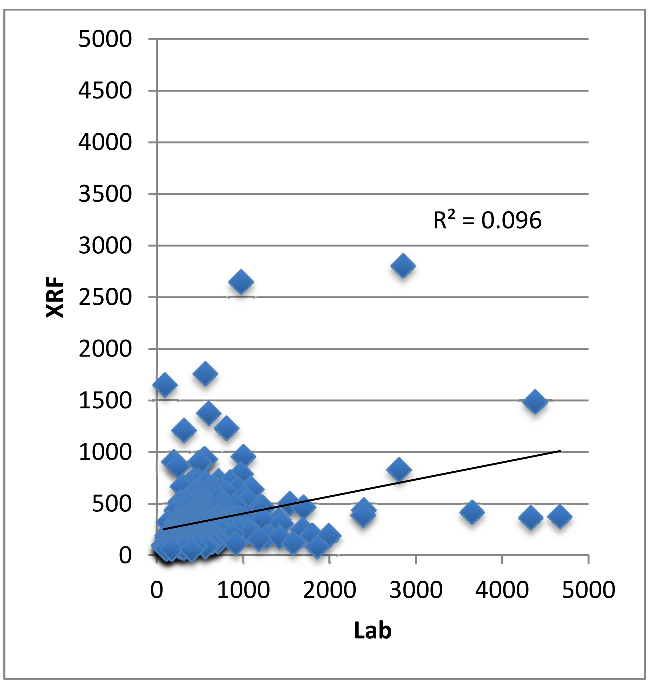




Manganese

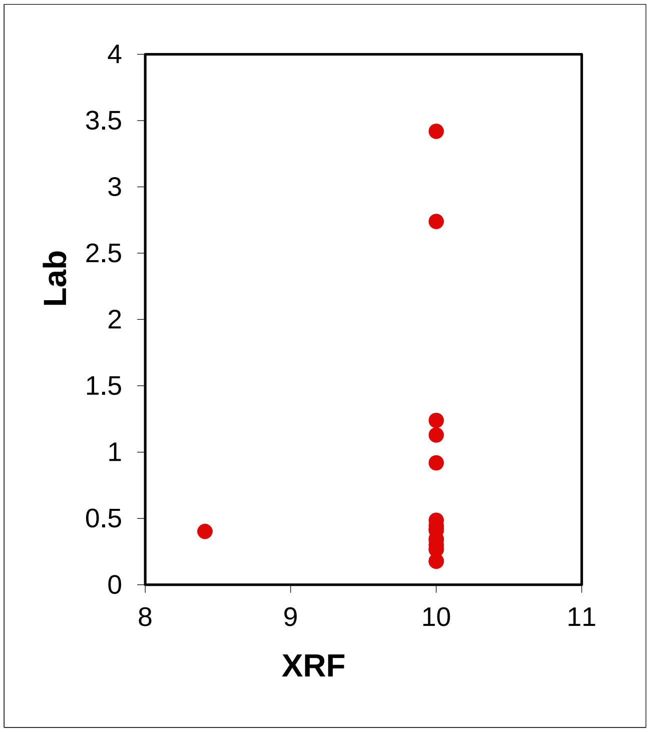
Spearman's rho:	0.417	Bkg	820
degrees of freedom:	329	NAL	2580
P-value:	2.26E-15		

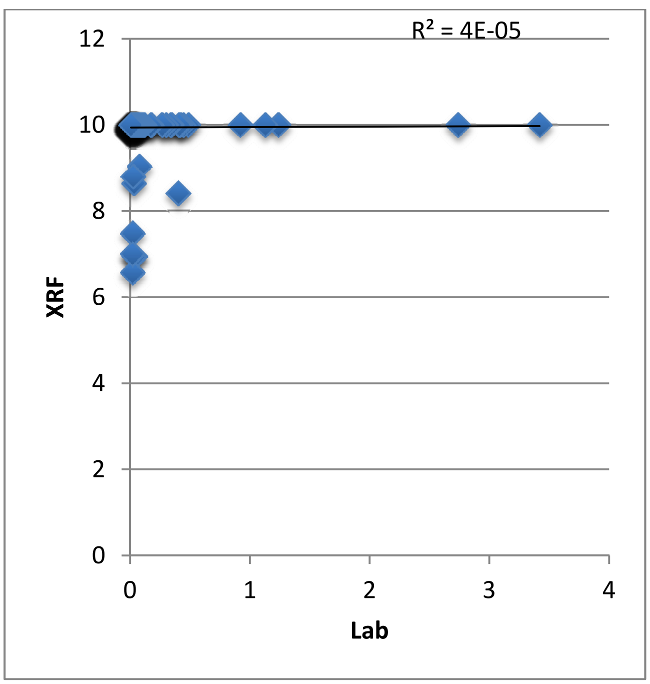




Mercury

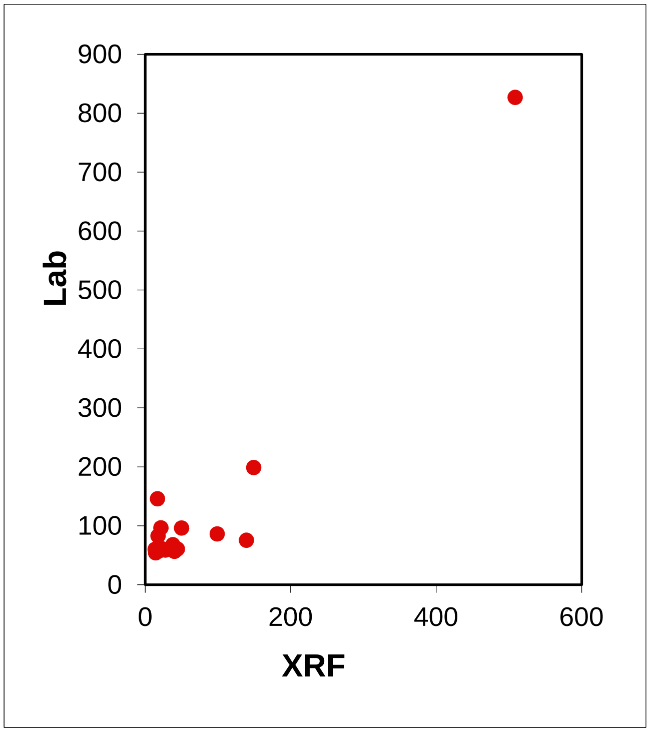
Spearman's rho:	-0.040	Bkg	21
degrees of freedom:	331	NAL	43
P-value:	0.4641		





Lead

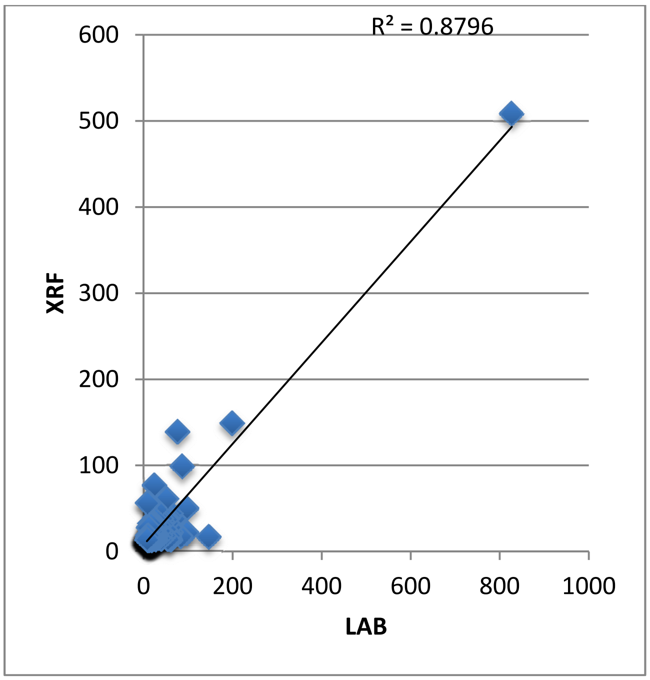
Spearman's rho:	0.545	Bkg	23
degrees of freedom:	156	NAL	400
P-value:	1.34E-13		



Interpretation of lead is particularly strong at higher concentrations.

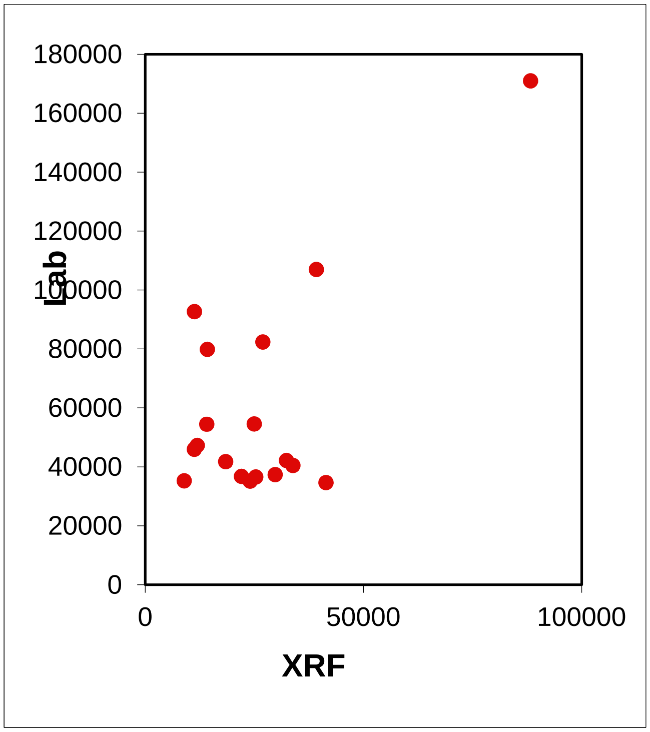
Comparison of XRF data with the background value may overstate the presence; the more important use is in comparison with higher concentrations, particularly the NAL of 400 mg/kg. Several values in the complete data set exceed this value.

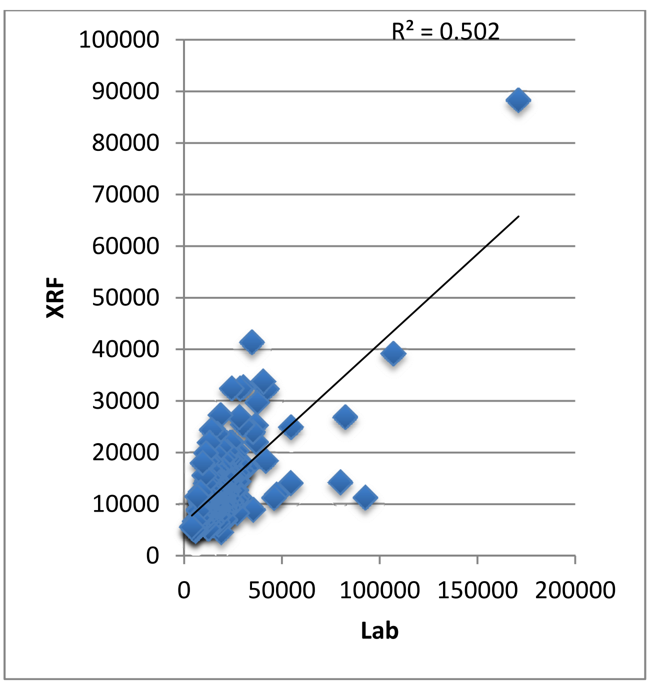
Needed for both delineation of hot spots and risk.



Iron

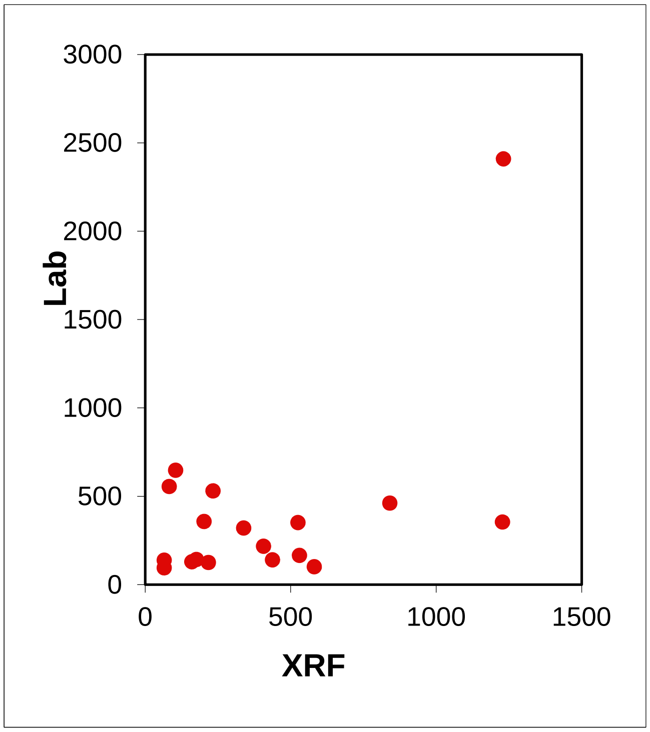
Spearman's rho:	0.541	Bkg	28000
degrees of freedom:	330	NAL	25100
P-value:	1.38E-26		

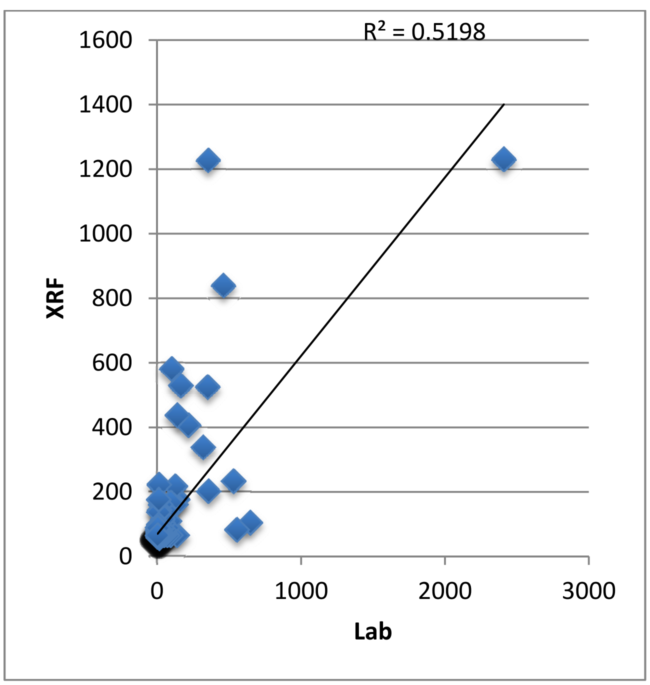




Nickel

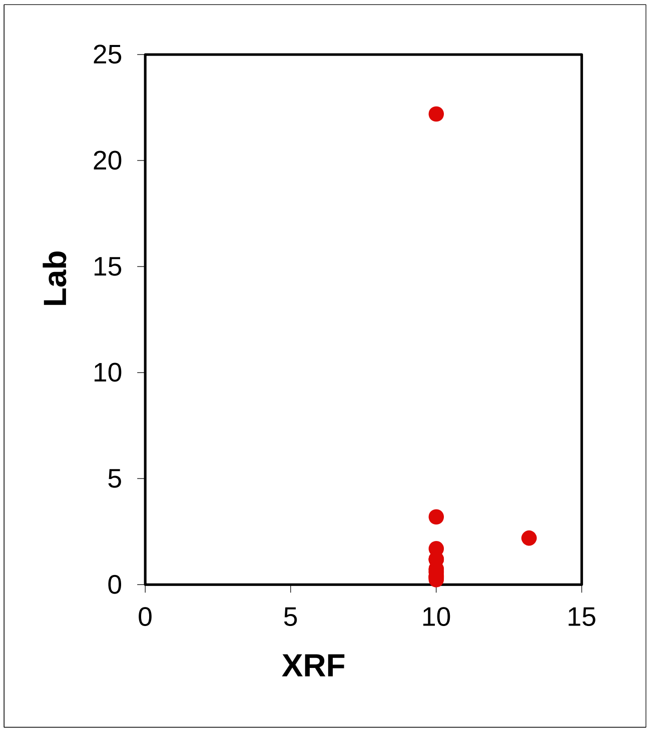
Spearman's rho:	0.369	Bkg	21
degrees of freedom:	331	NAL	43
P-value:	3.45E-12		

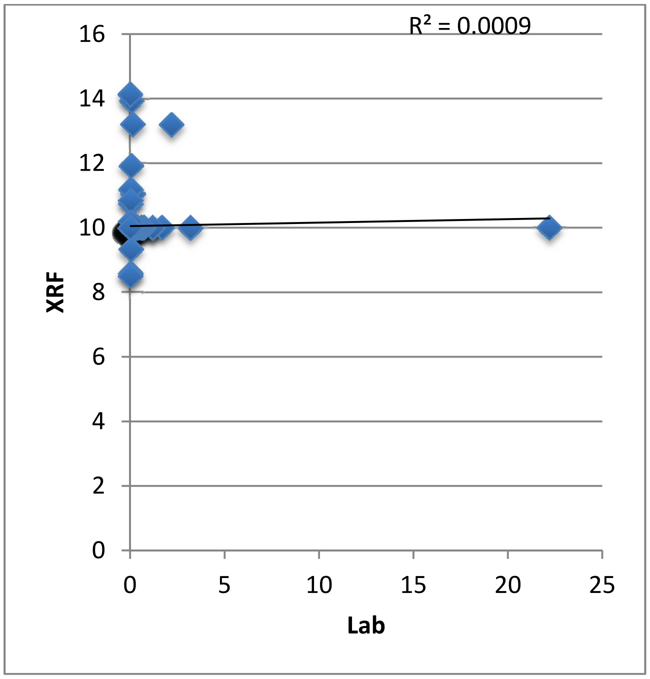




Silver

Spearman's rho:	0.094	Bkg	2.3
degrees of freedom:	331	NAL	11
P-value:	0.0877		



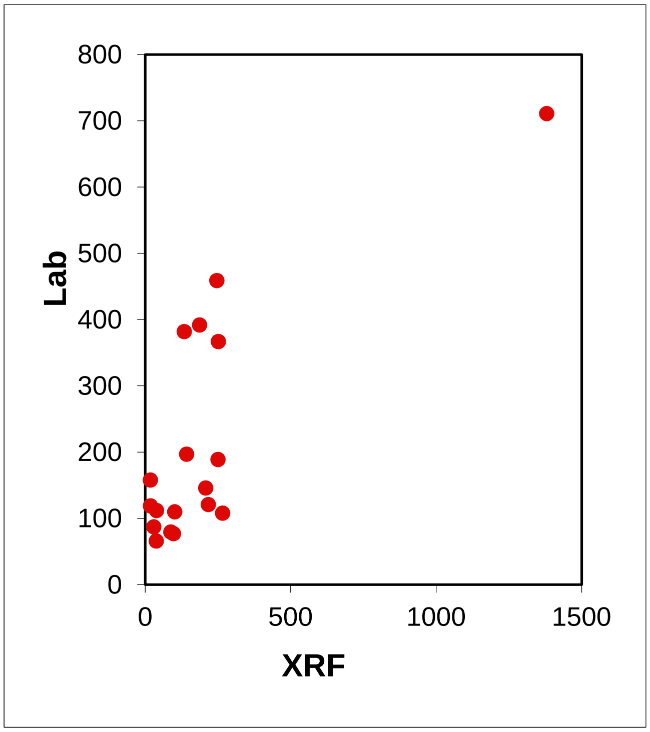


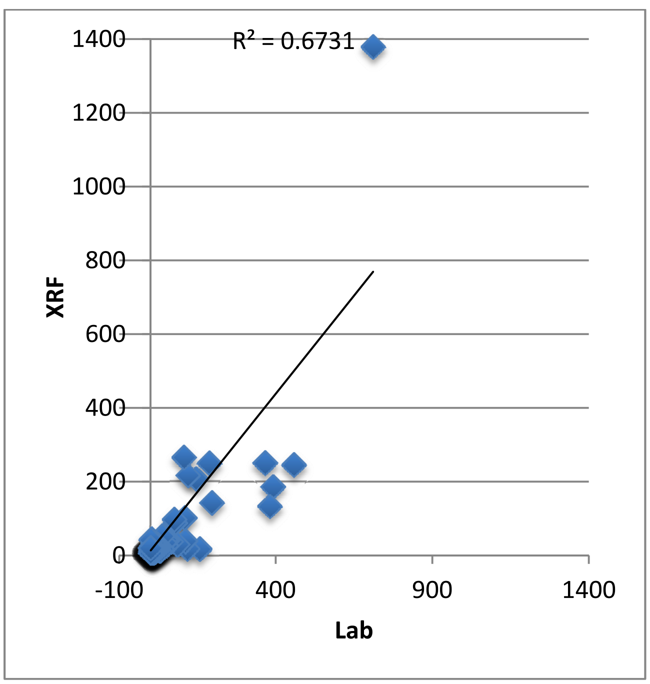
Not strong comparisons because few detects.

Use of detected values will not result in incorrect decisions.

Uranium

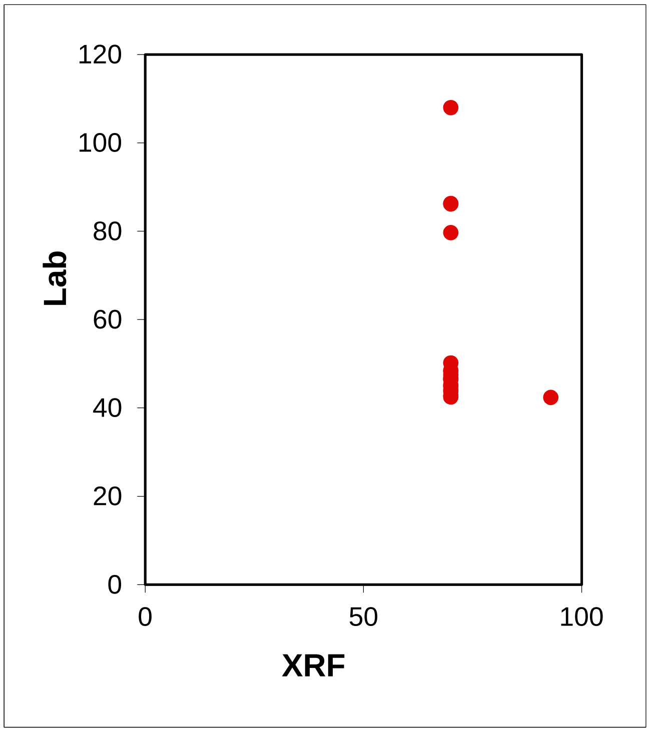
Spearman's rho:	0.165	Bkg	4.6
degrees of freedom:	331	NAL	107
P-value:	0.002465		

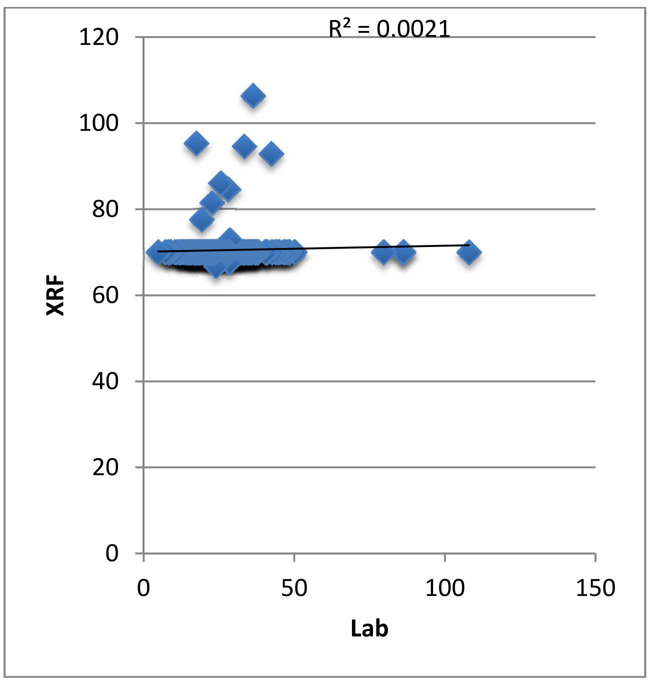




Vanadium

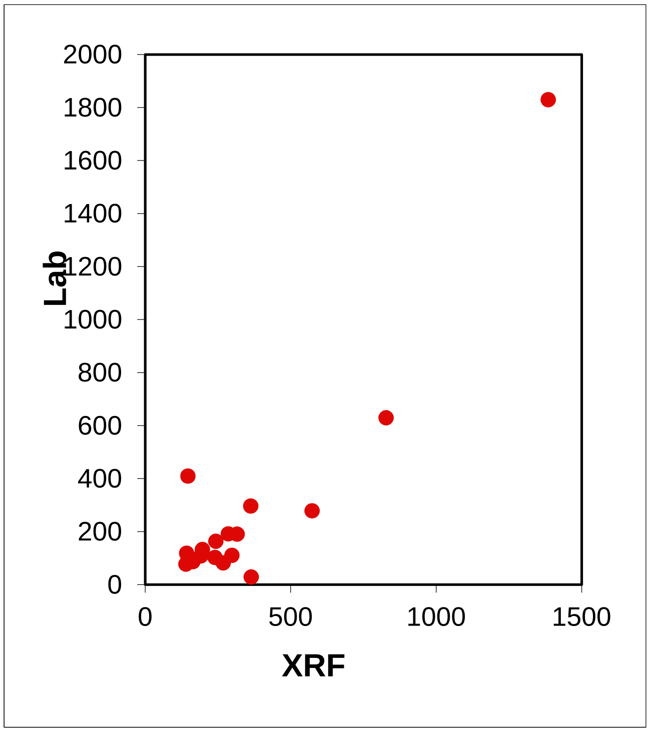
Spearman's rho:	0.035	Bkg	37
degrees of freedom:	331	NAL	0.15
P-value:	0.526		

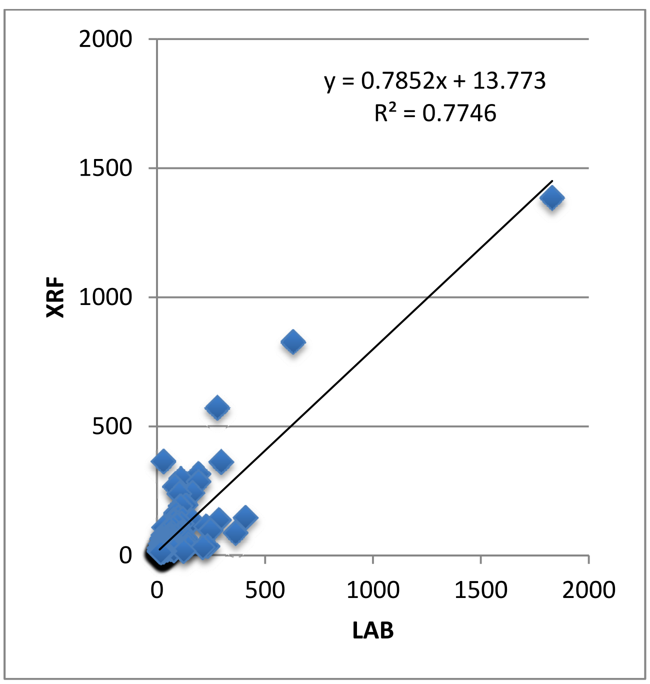




Zinc

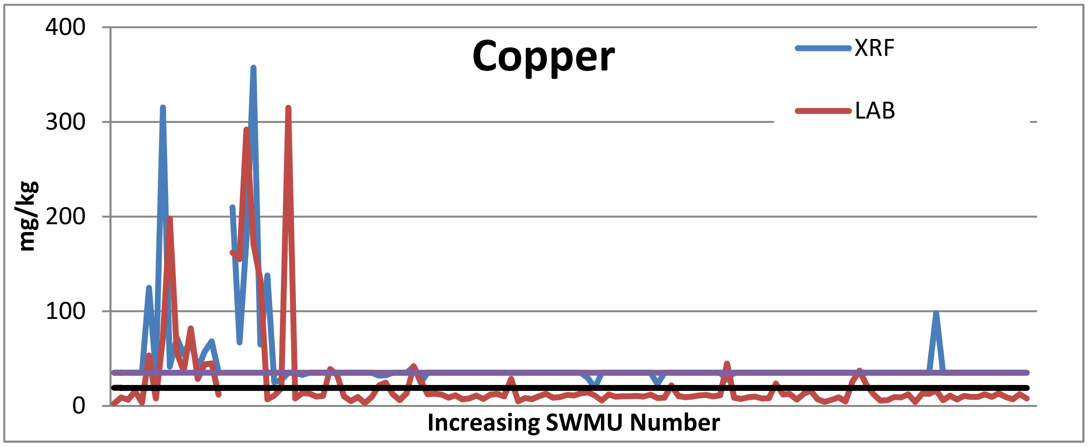
Spearman's rho:	0.692	Bkg	60
degrees of freedom:	331	NAL	10800
P-value:	8.89E-49		

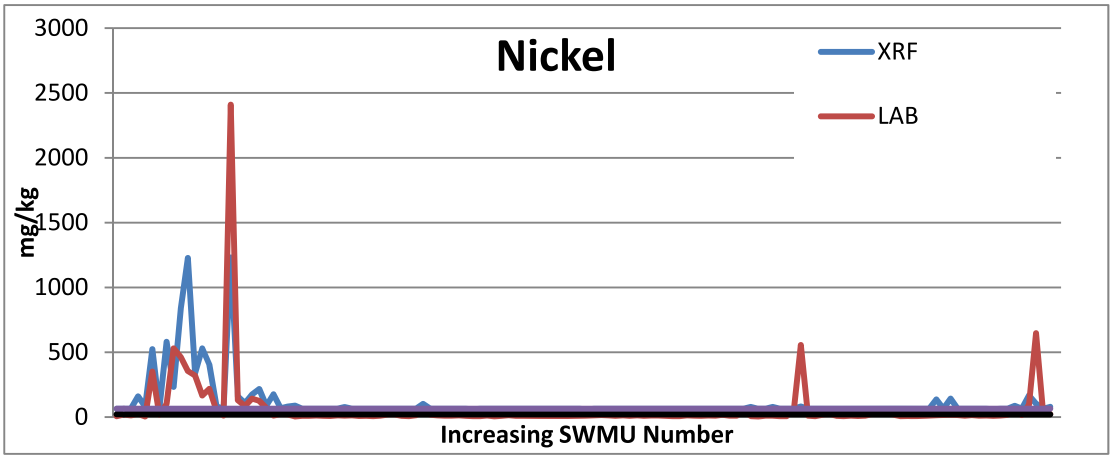


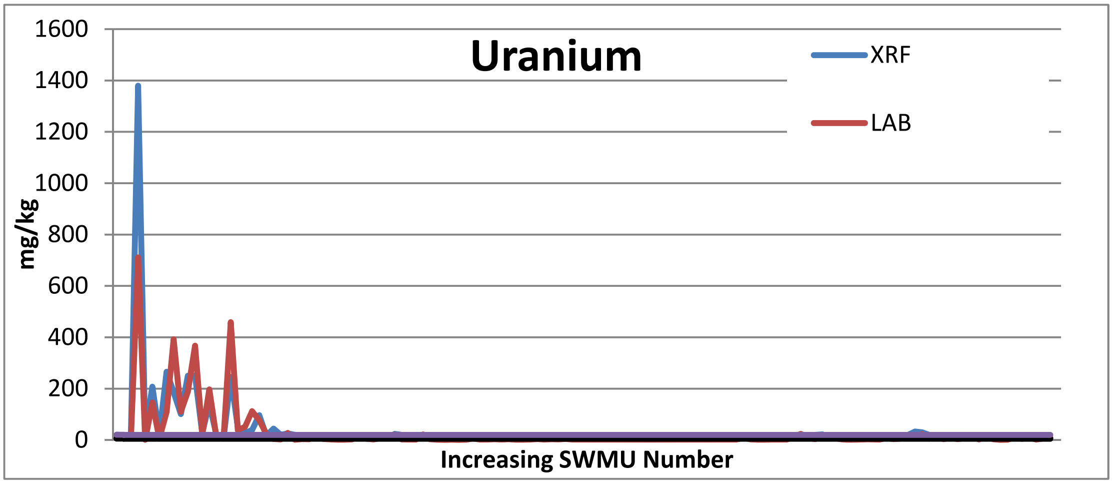


As stated in B.3.1.2, Graphical Comparison of Paired Samples Based upon Analytical Method, the results for approximately 334 soil samples analyzed by cup XRF and laboratory methods were assessed graphically. These pairs were sorted graphically by increasing XRF and laboratory result and by sample number. In general, it appears, that XRF results have higher detection limits and higher reported values than the lab results. There are exceptions to this generalization and other factors, such as laboratory dissolution methods, may contribute to the higher reported values for the XRF. Thus, using the higher value (typically the XRF value) in a risk assessment typically will overstate the risk/hazard (hereafter referred to as risk) associated with a given EU.

The following are for paired surface soil results and Attachment B3 are the graphical correlation patterns.






Uranium
XRF
LAB
1600
1400
1200
1000
800
600
400
200
0
mg/kg
Increasing SWMU Number

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ATTACHMENT B3

GRAPHICAL COMPARISON

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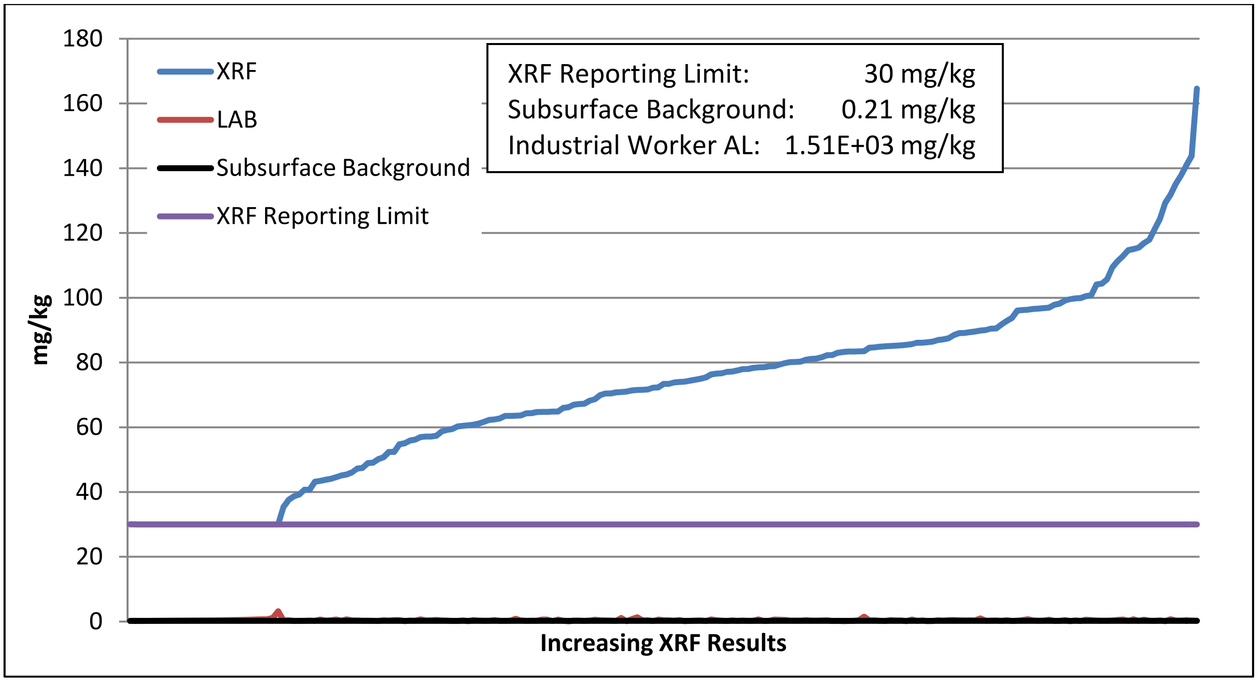
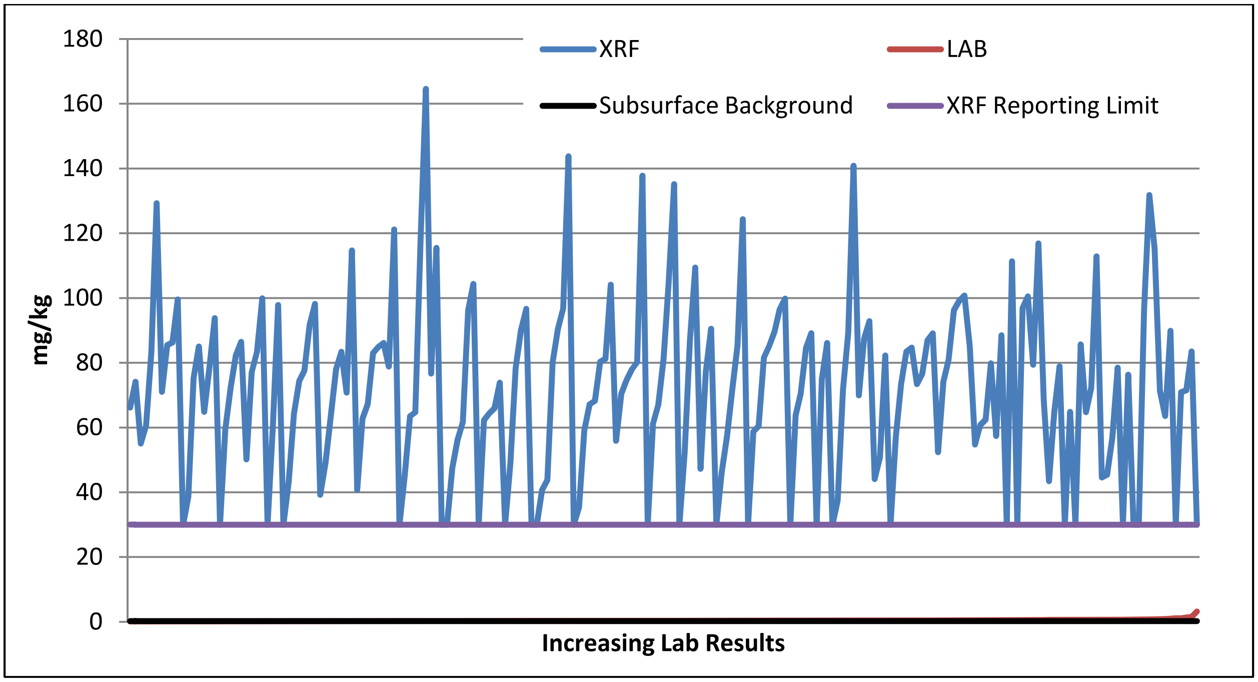
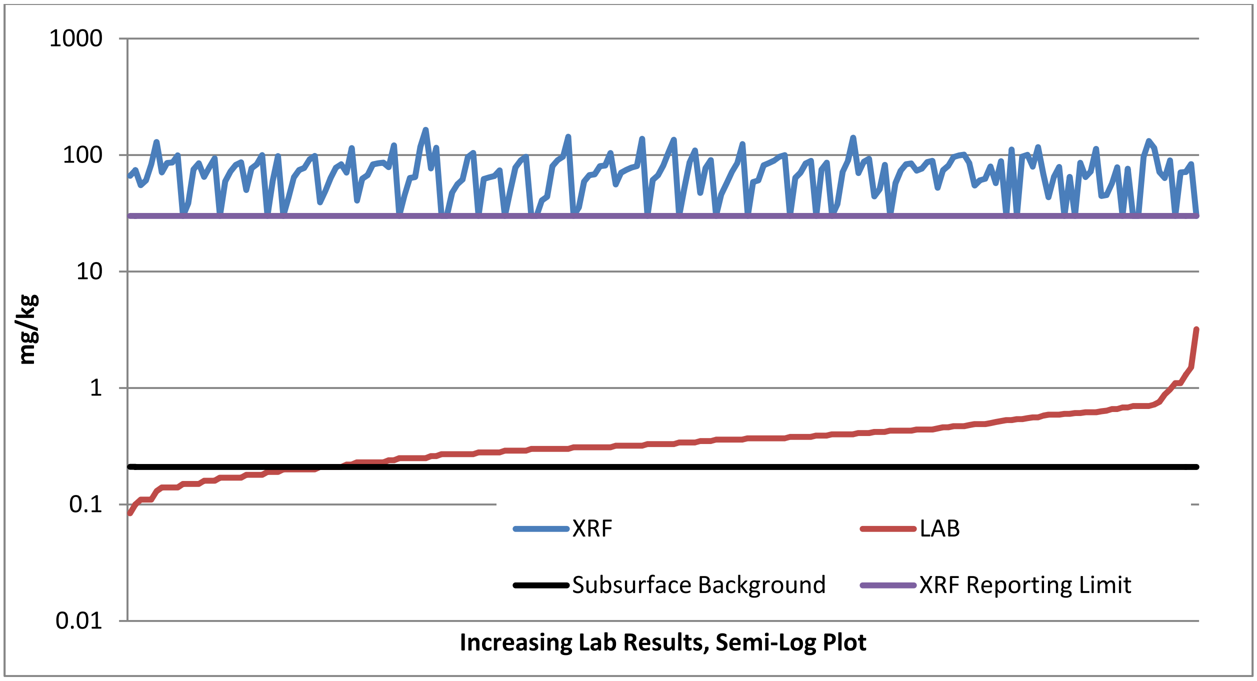
Antimony—Subsurface

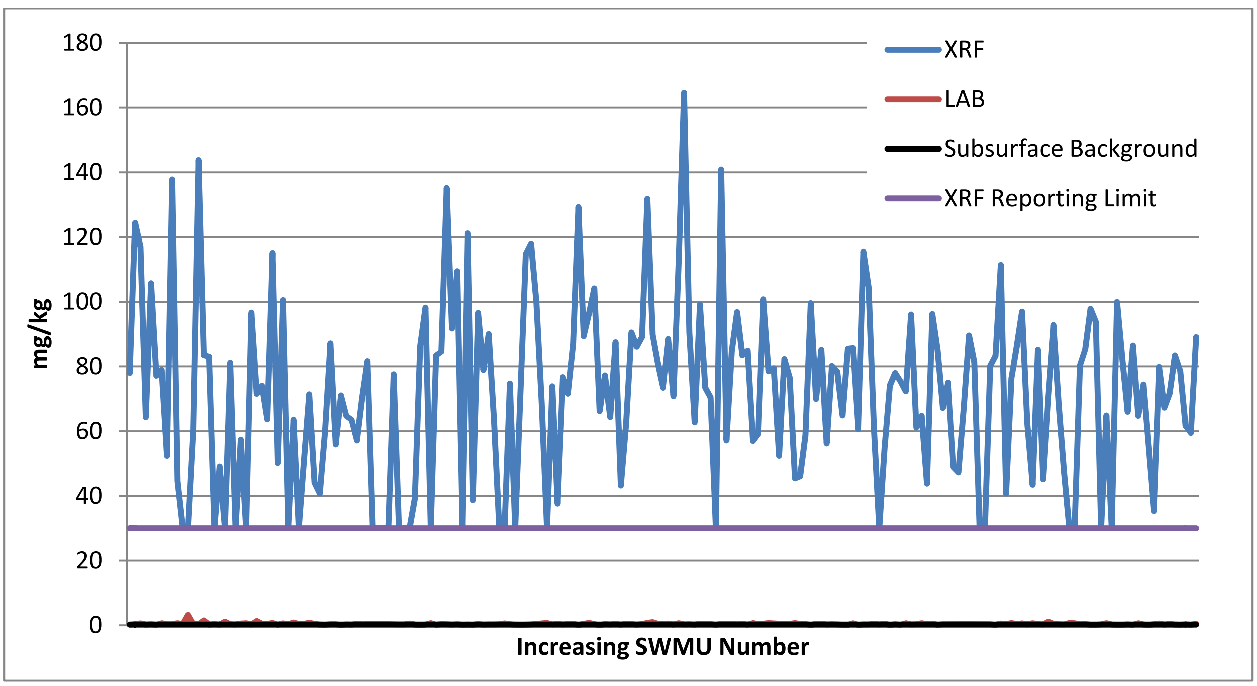
Results for surface and subsurface antimony do not correlate with the XRF and the fixed-base laboratory. All XRF results are reported higher than the fixed-base laboratory results; the XRF screening results are not acceptable for use in determining risk associated with antimony in soils and will lead to incorrect decisions.





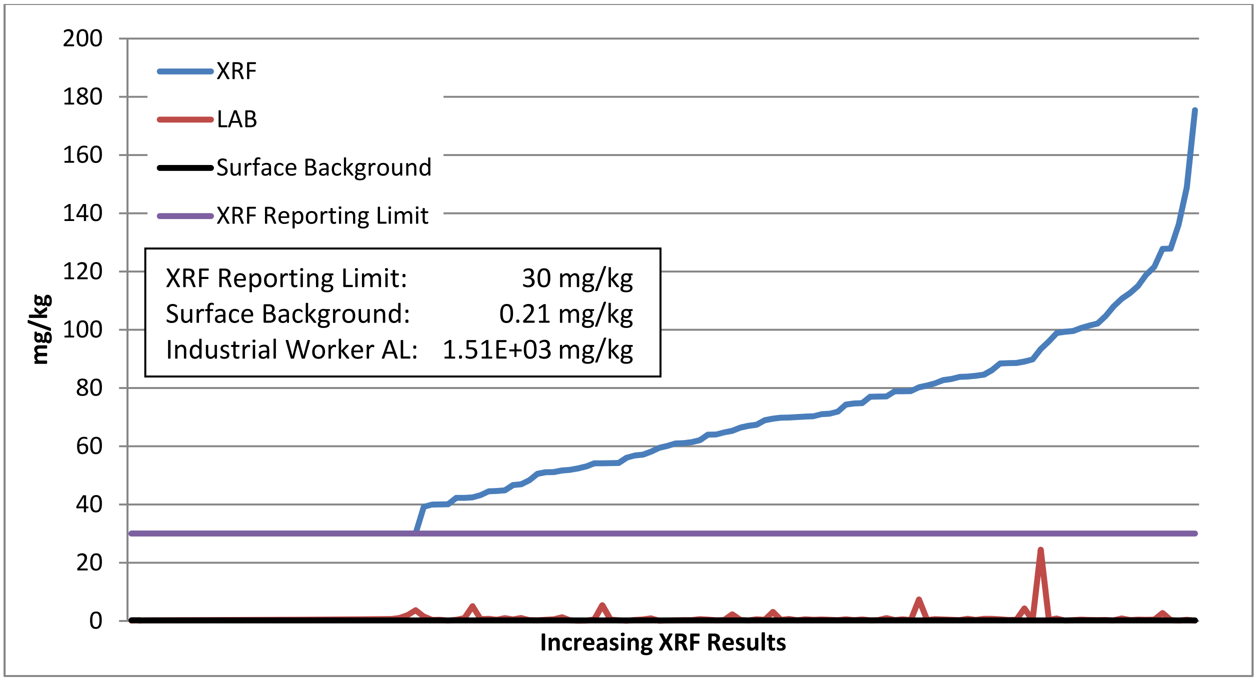
Antimony—Subsurface (Continued)

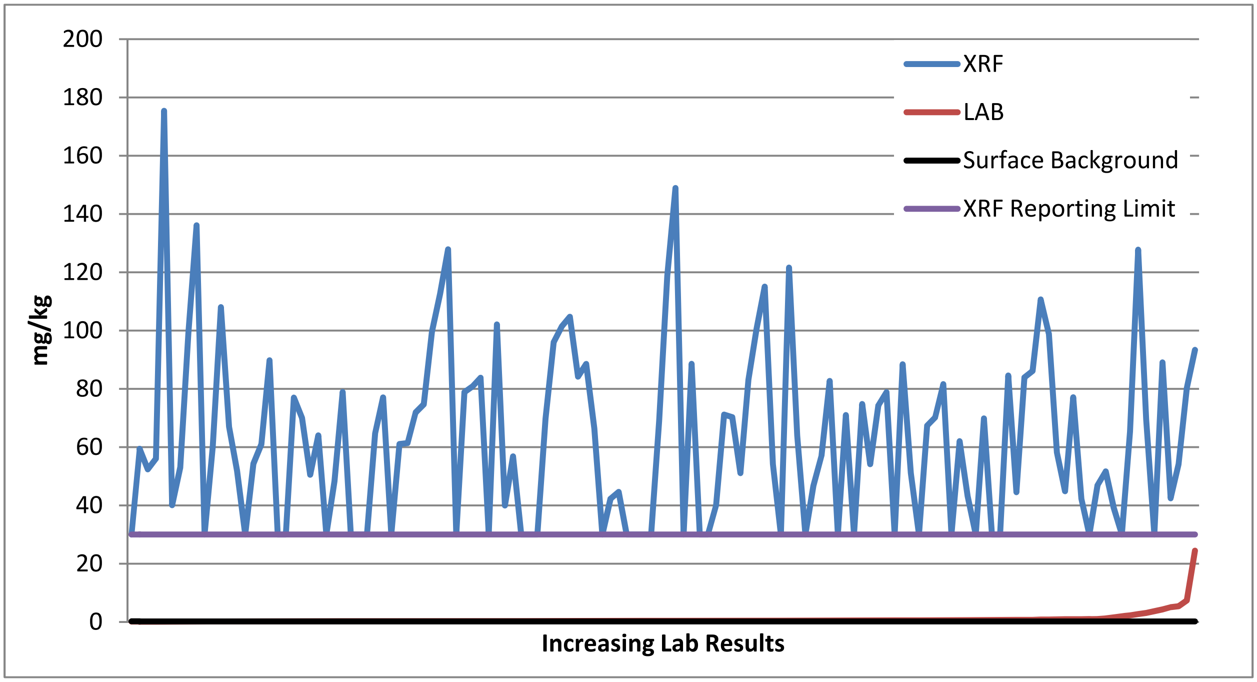




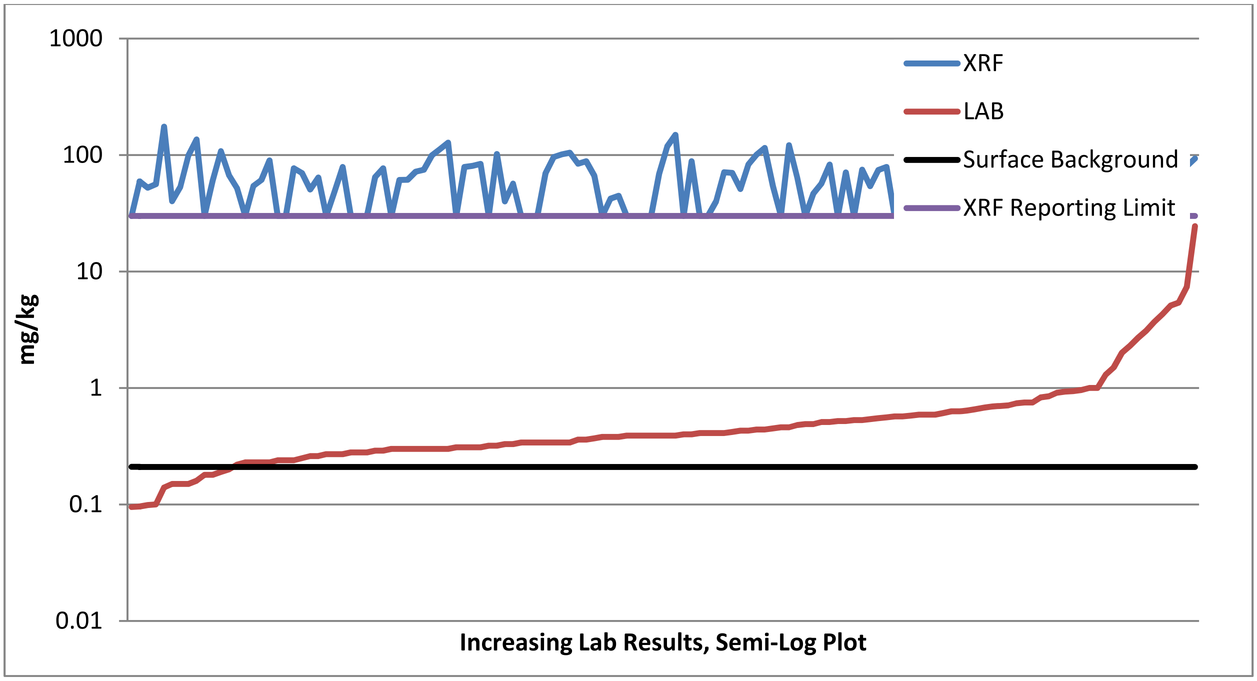
XRF Reporting Limit:	30 mg/kg
Subsurface Background:	0.21 mg/kg
Industrial Worker AL:	1.51E+03 mg/kg

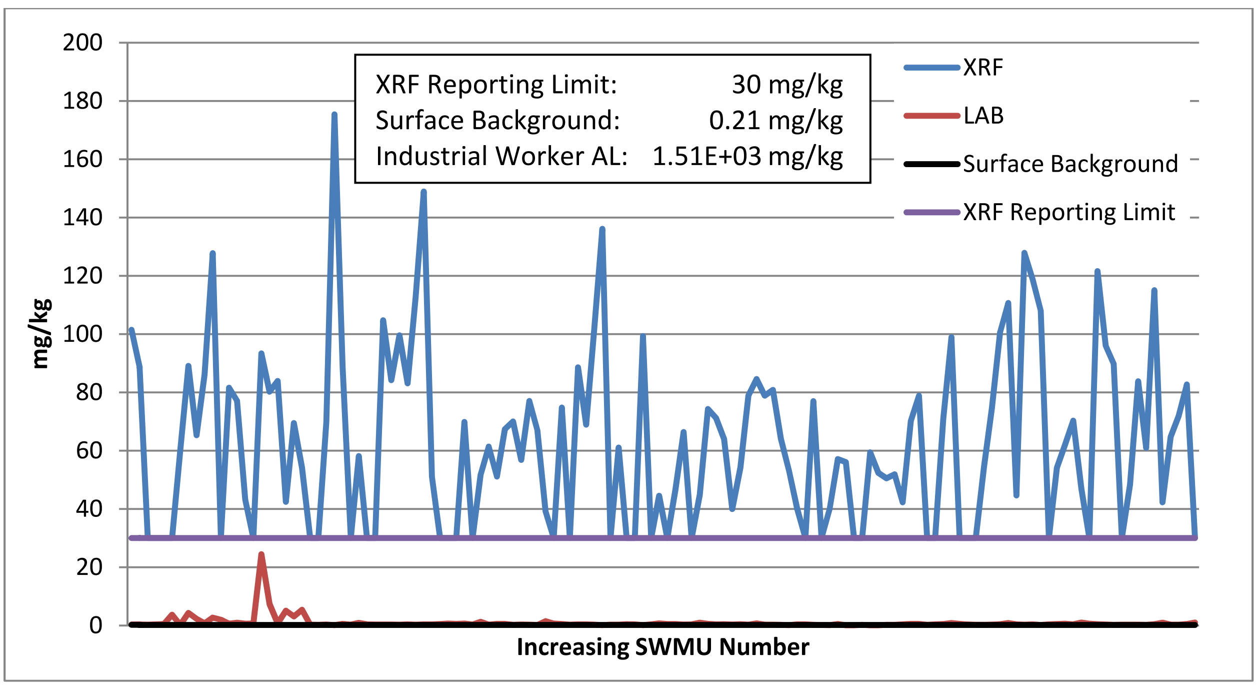
Antimony—Surface





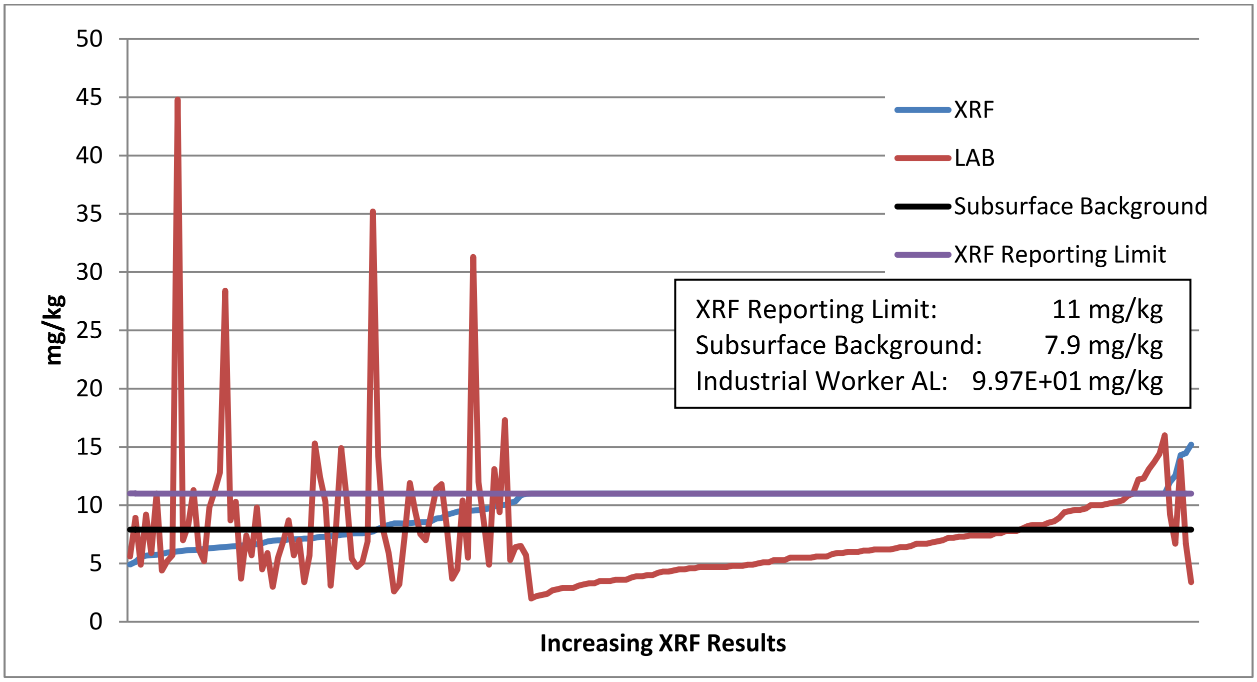
Antimony—Surface (Continued)

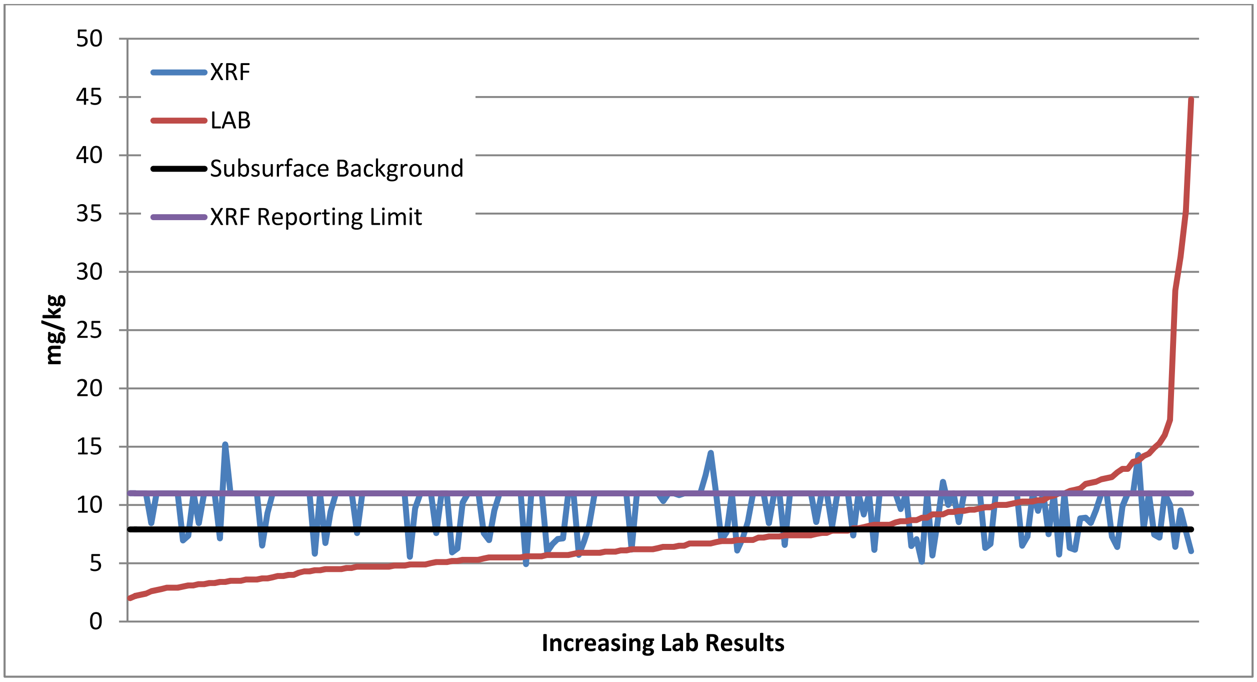




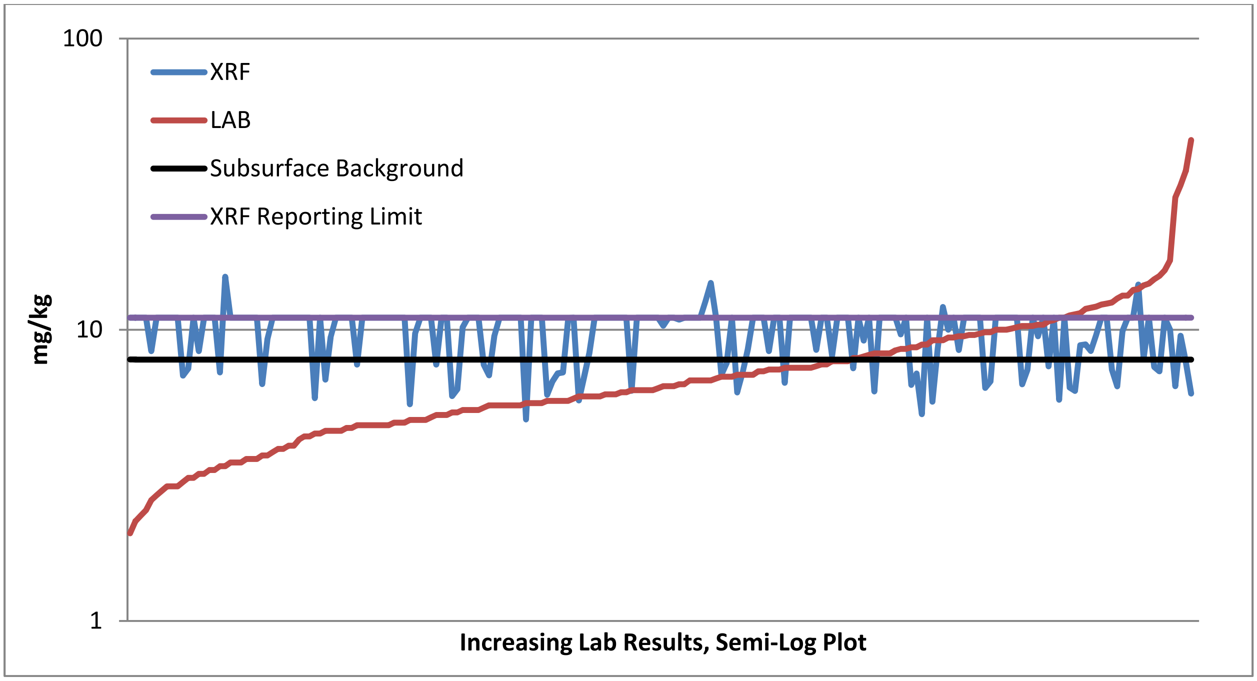
Arsenic—Subsurface

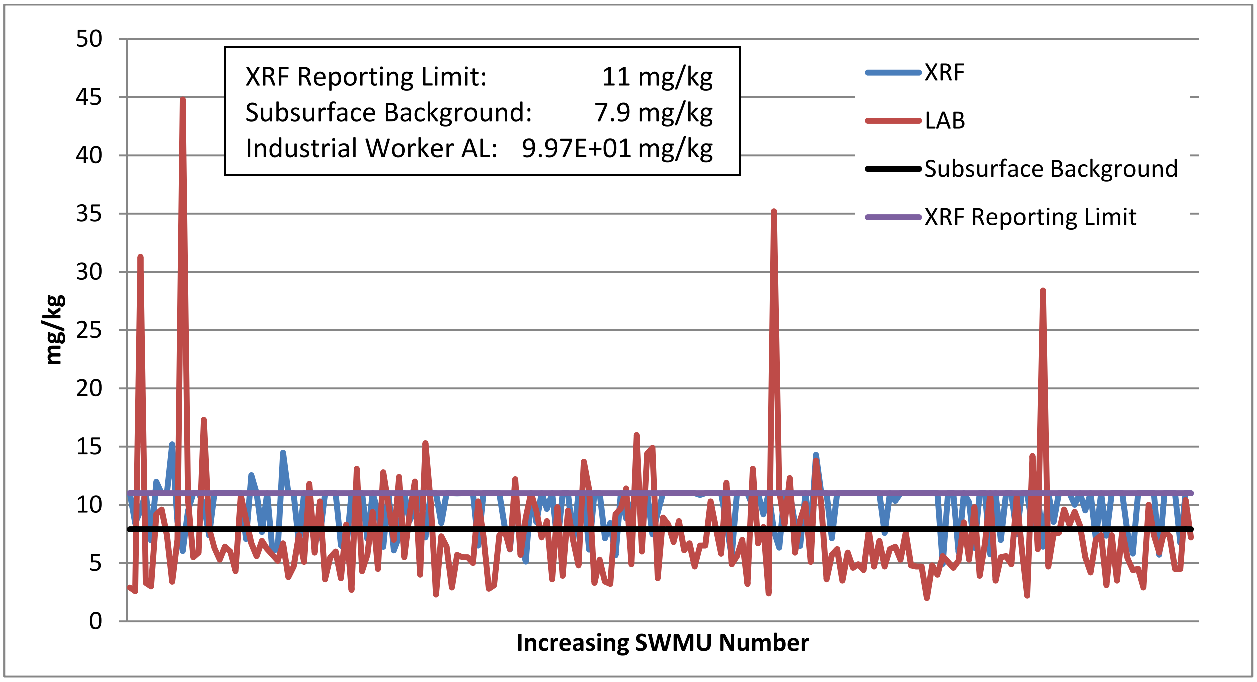
The Pearson correlation coefficient for subsurface arsenic is -.24.





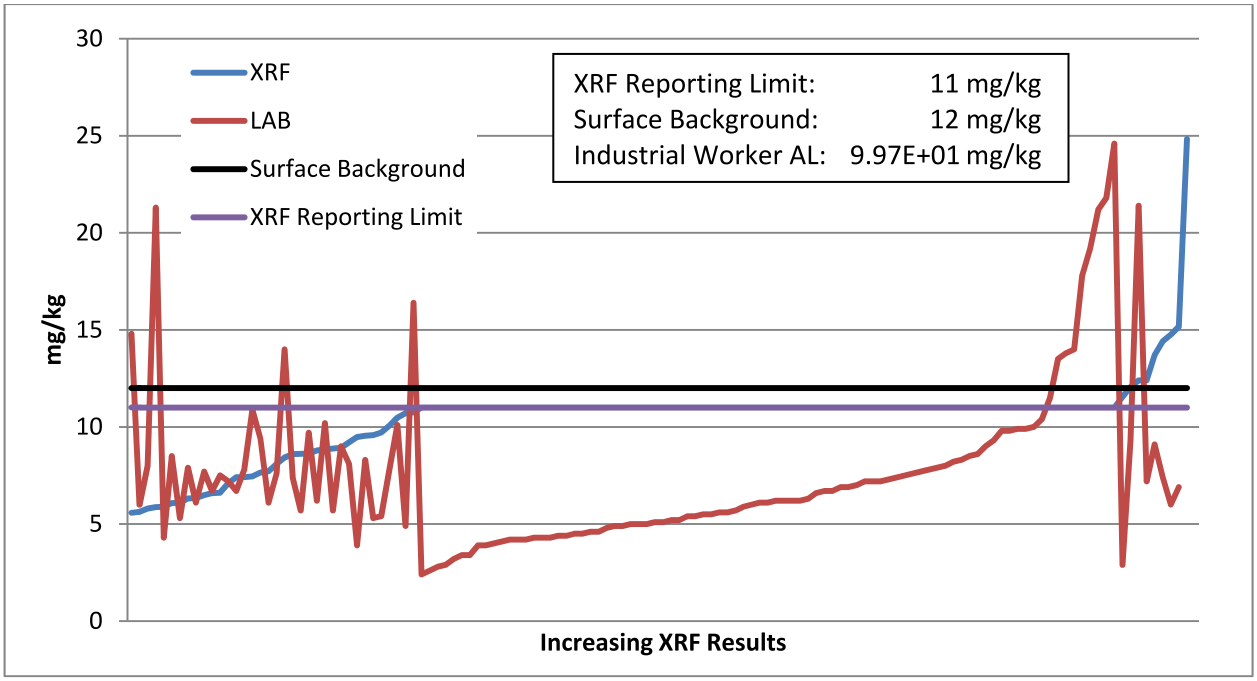
Arsenic—Subsurface (Continued)

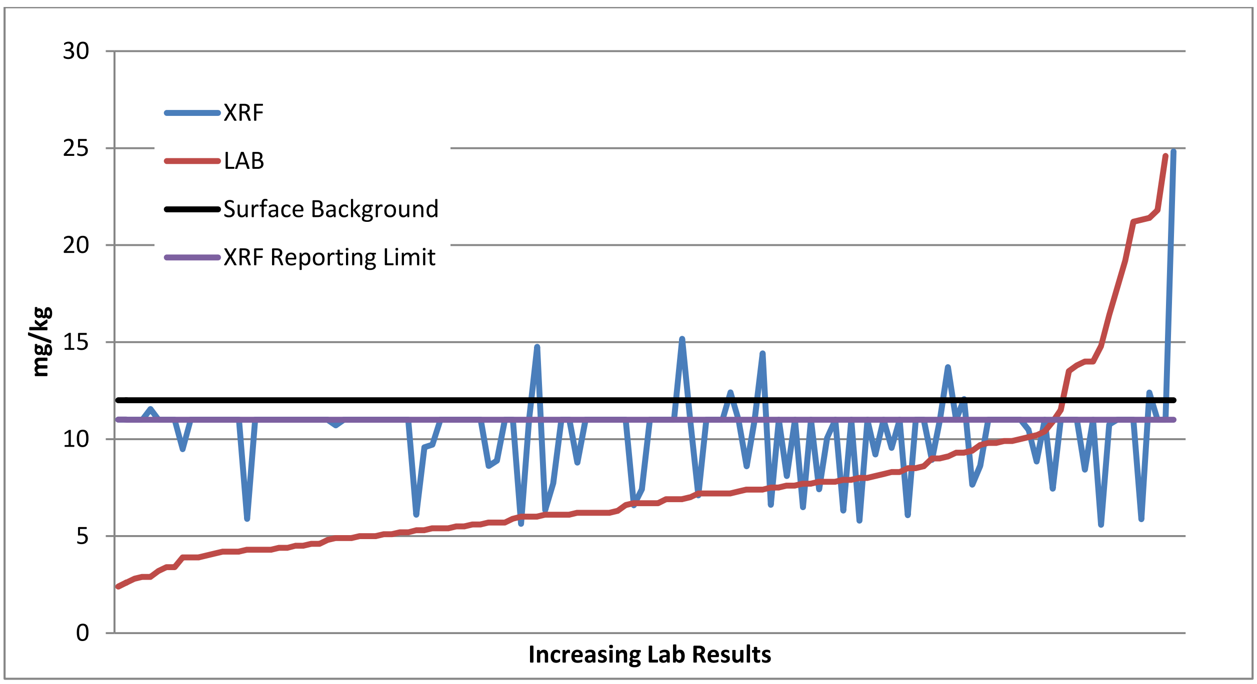




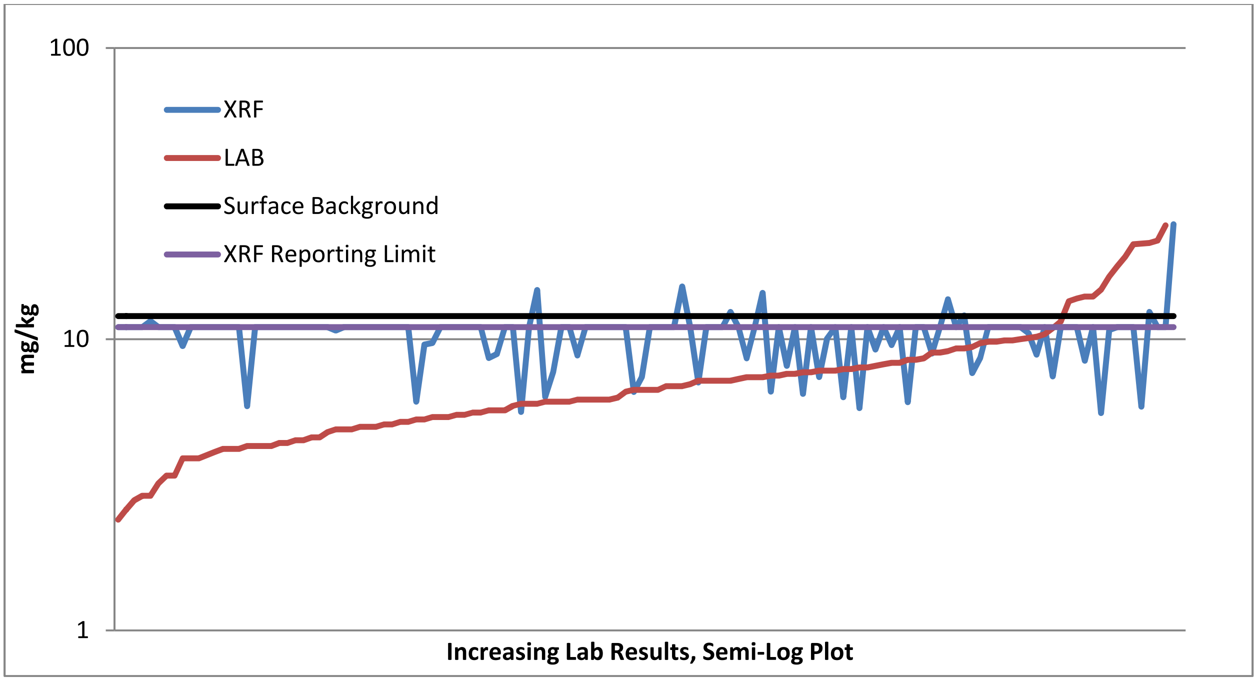
Arsenic—Surface

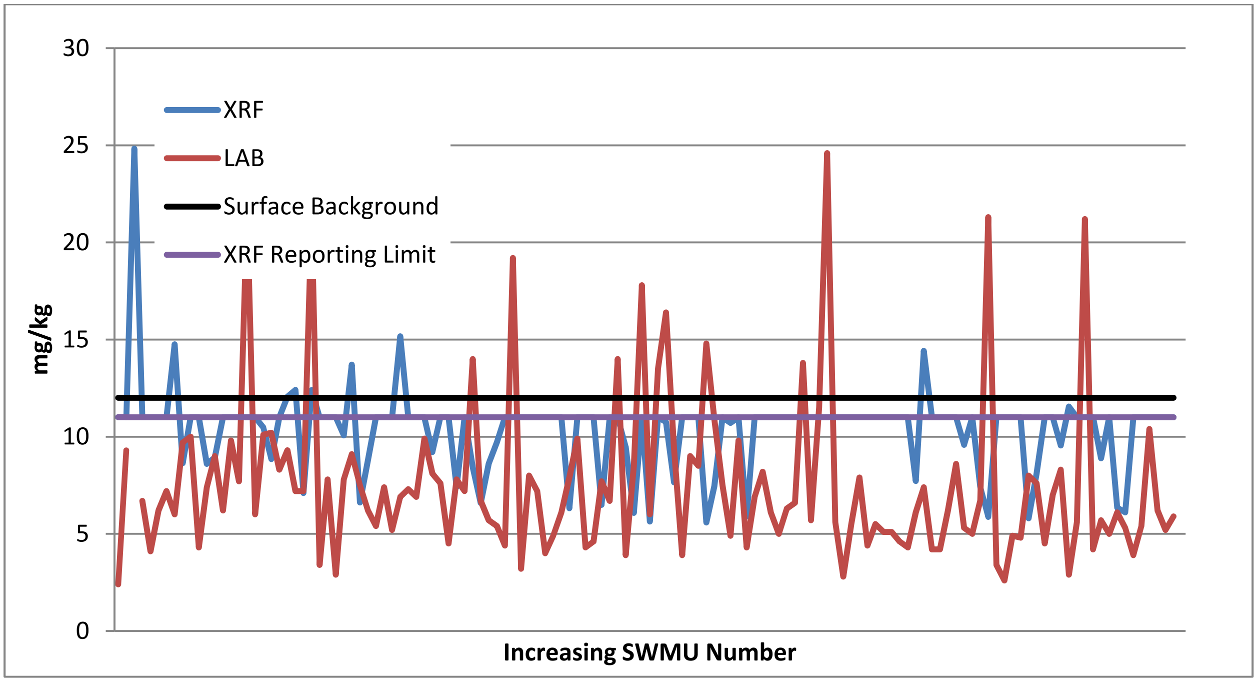
The Pearson correlation coefficient for surface arsenic is -0.18.





Arsenic—Surface (Continued)



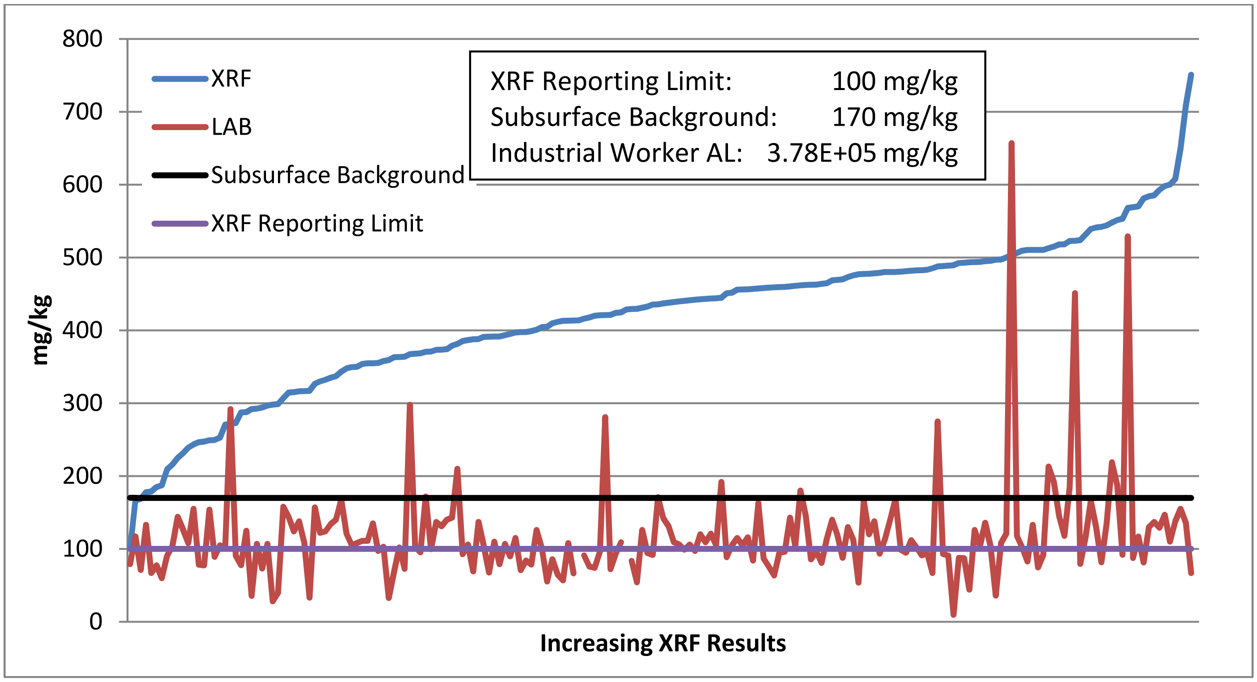


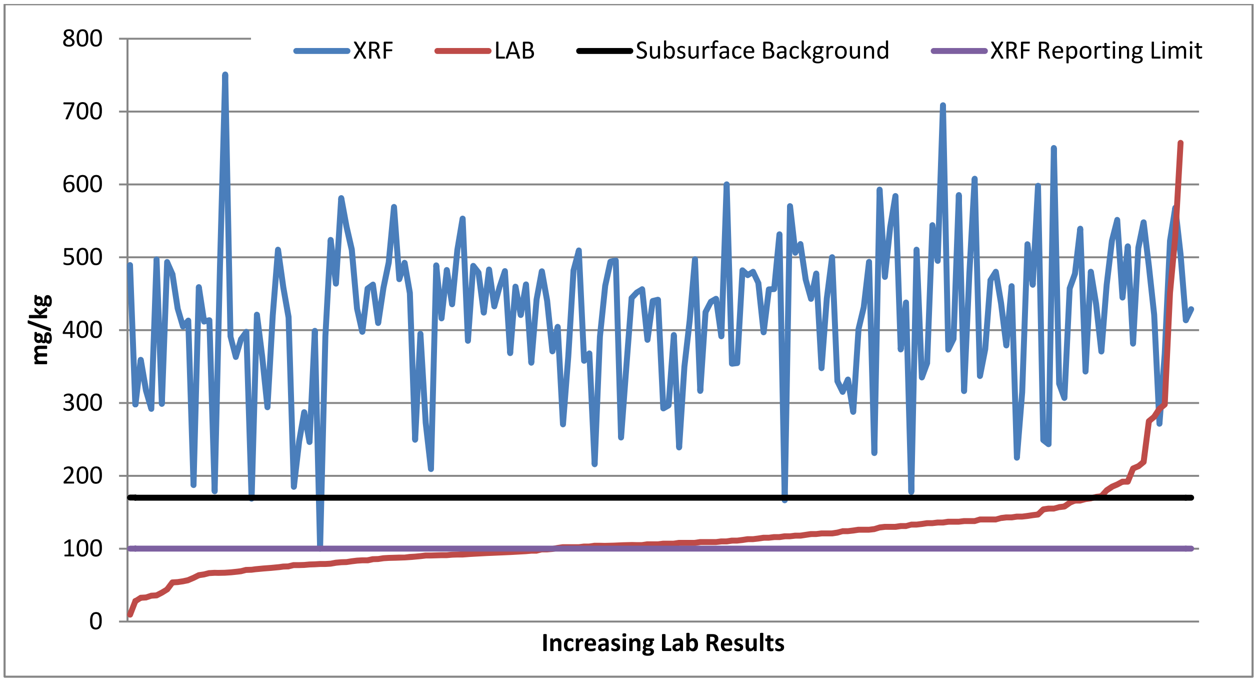
*The value 86 mg/kg (analyzed by the fixed-base laboratory in sample SOU012010ASA001) was removed as an outlier from the graphs.

XRF Reporting Limit:	11 mg/kg
Surface Background:	12 mg/kg
Industrial Worker AL:	9.97E+01 mg/kg

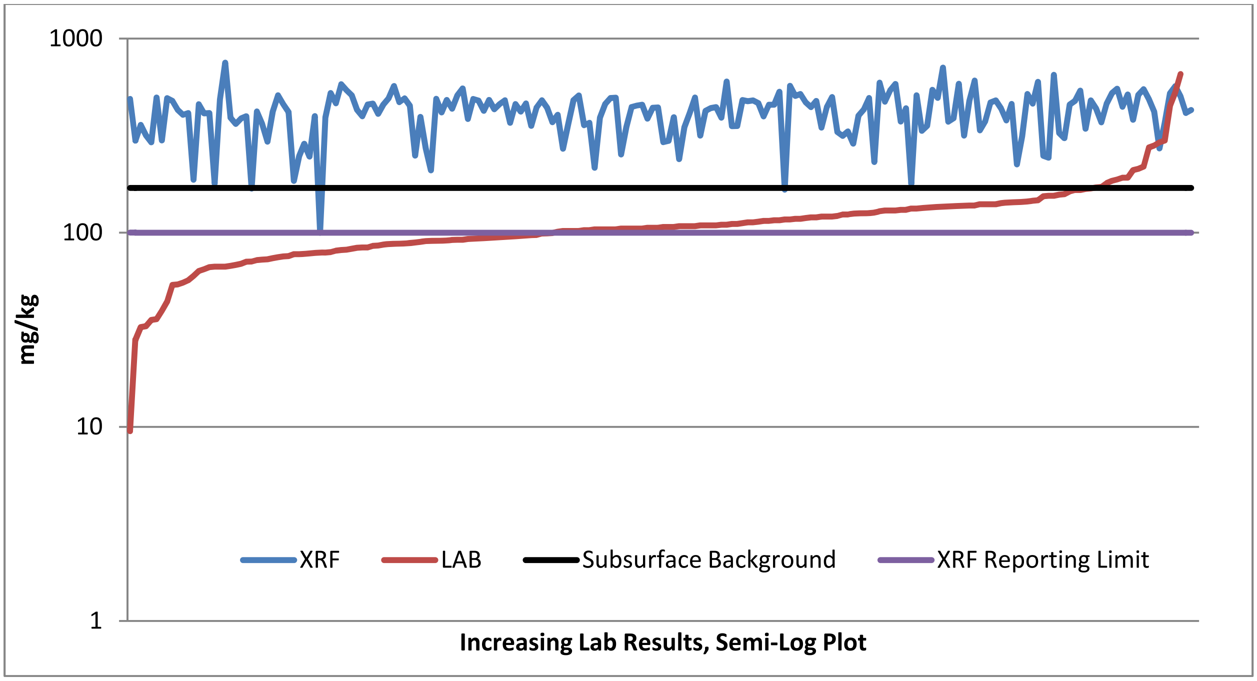
Barium—Subsurface

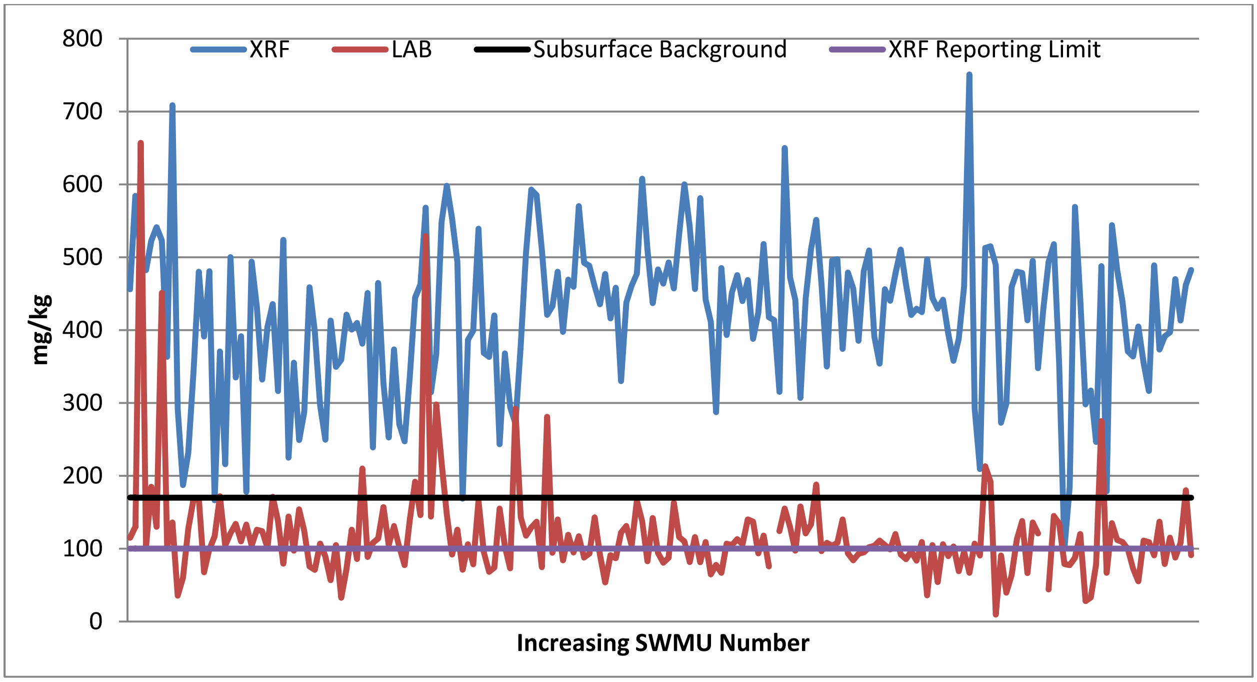
Results for surface and subsurface XRF data for barium do not correlate with the fixed-base laboratory.





Barium—Subsurface (Continued)



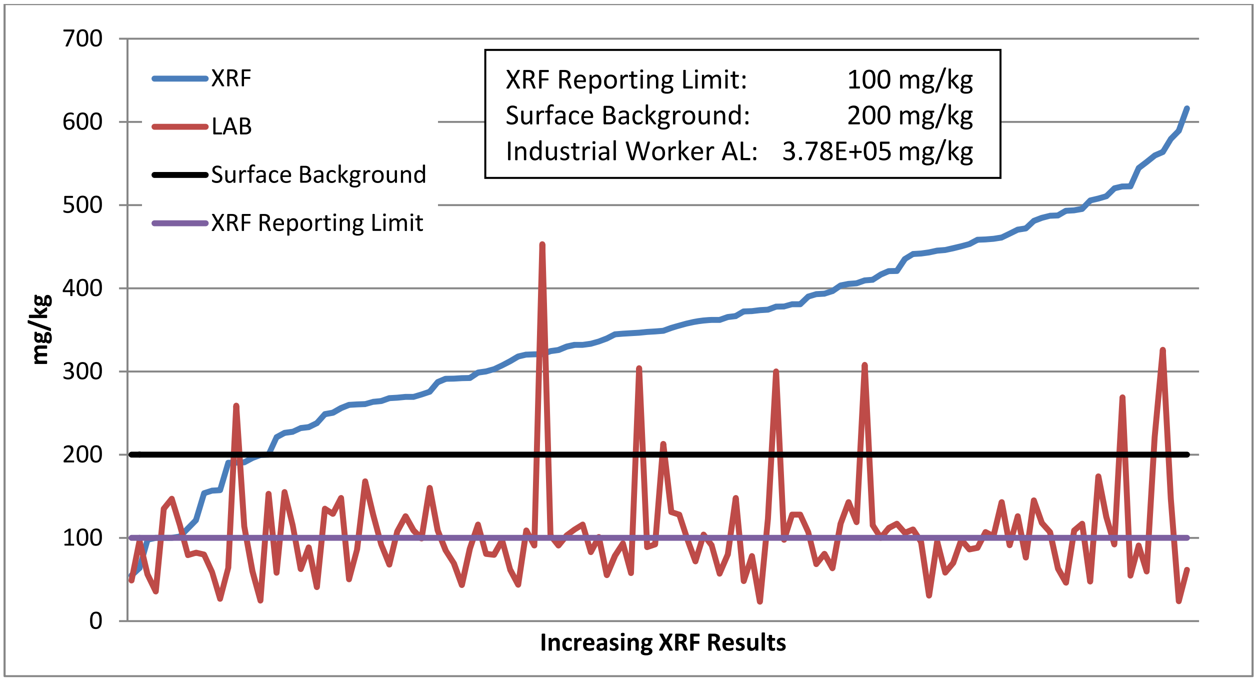


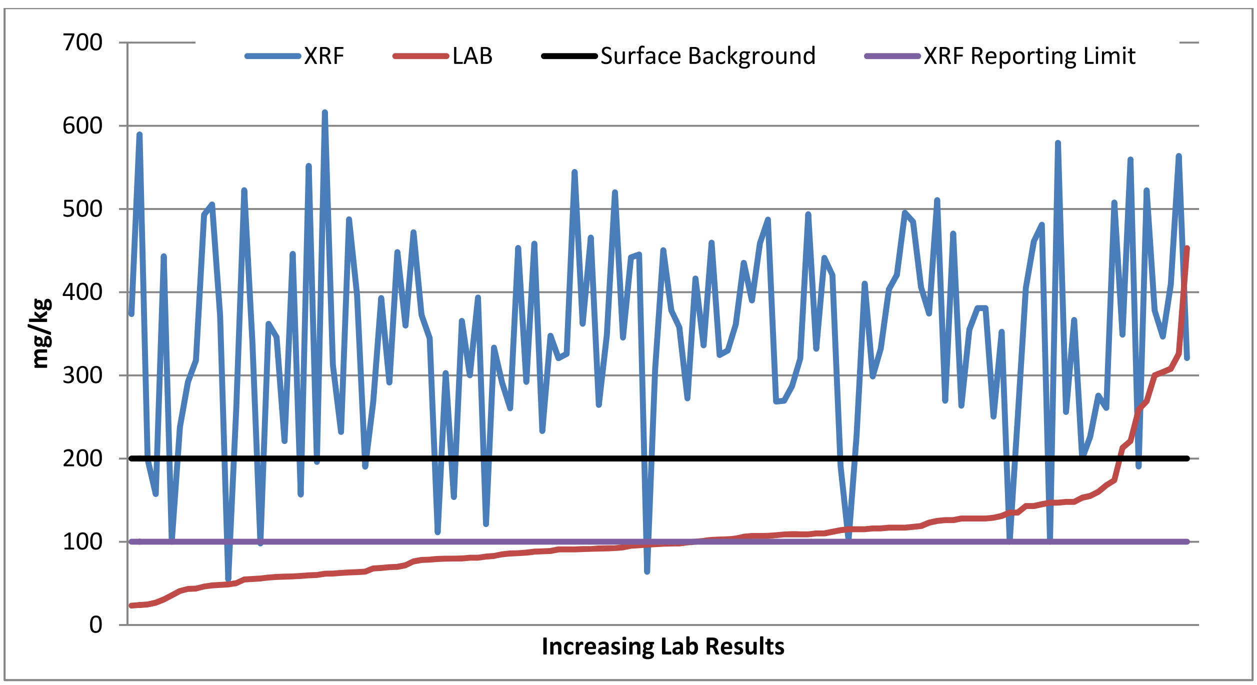
*The values 2,960 and 1,630 mg/kg (analyzed by the fixed-base laboratory in samples SOU194302SA004 and SOU221005ASA004, respectively) were removed as outliers from the graphs.

XRF Reporting Limit:	100 mg/kg
Subsurface Background:	170 mg/kg
Industrial Worker AL:	3.78E+05 mg/kg

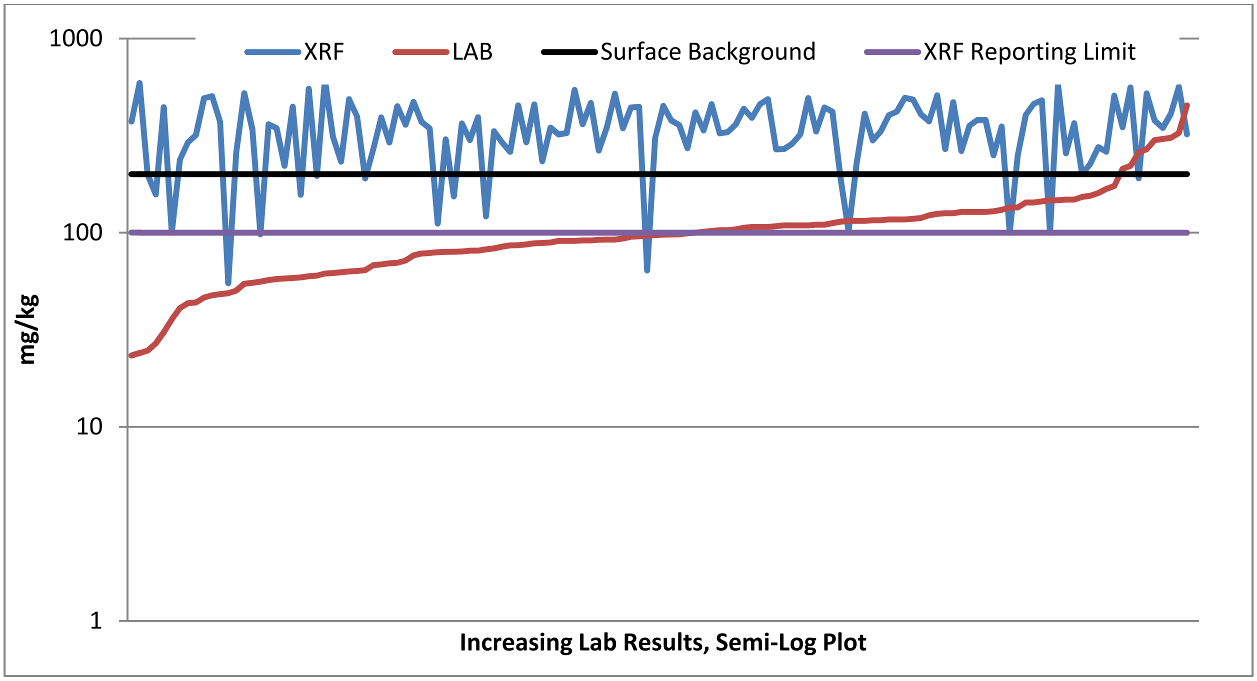
Barium—Surface

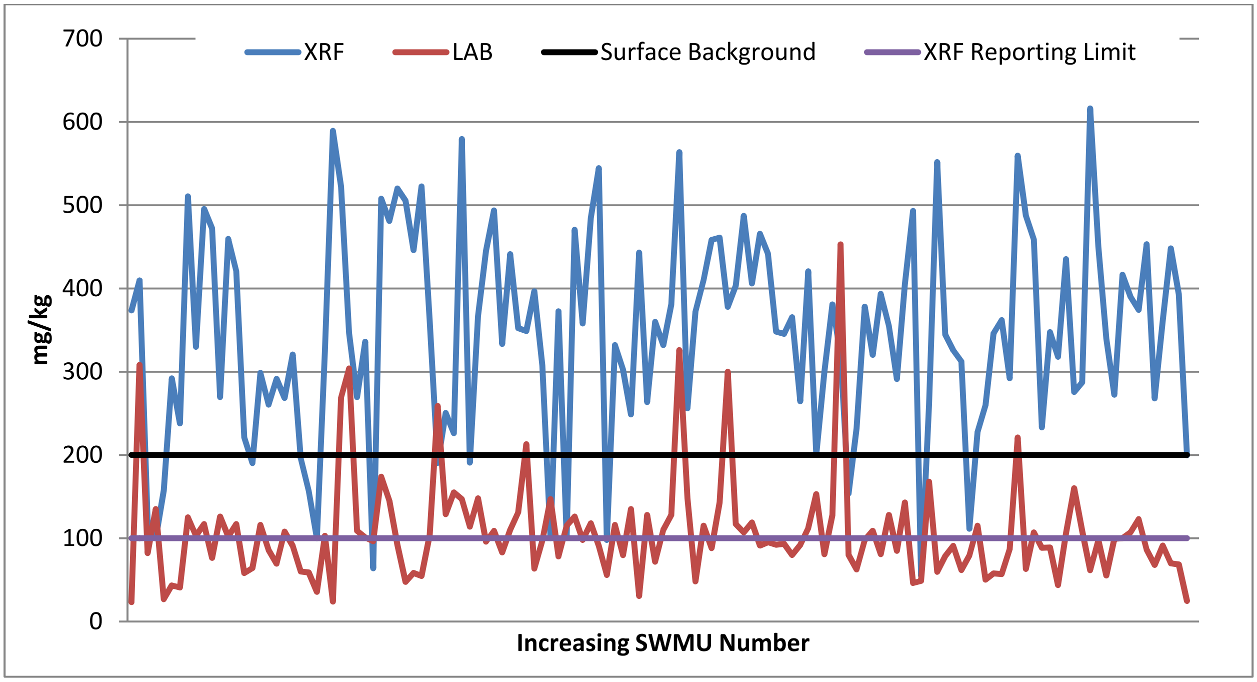
Results for surface barium do not correlate well between the XRF and the fixed-base laboratory.





Barium—Surface (Continued)

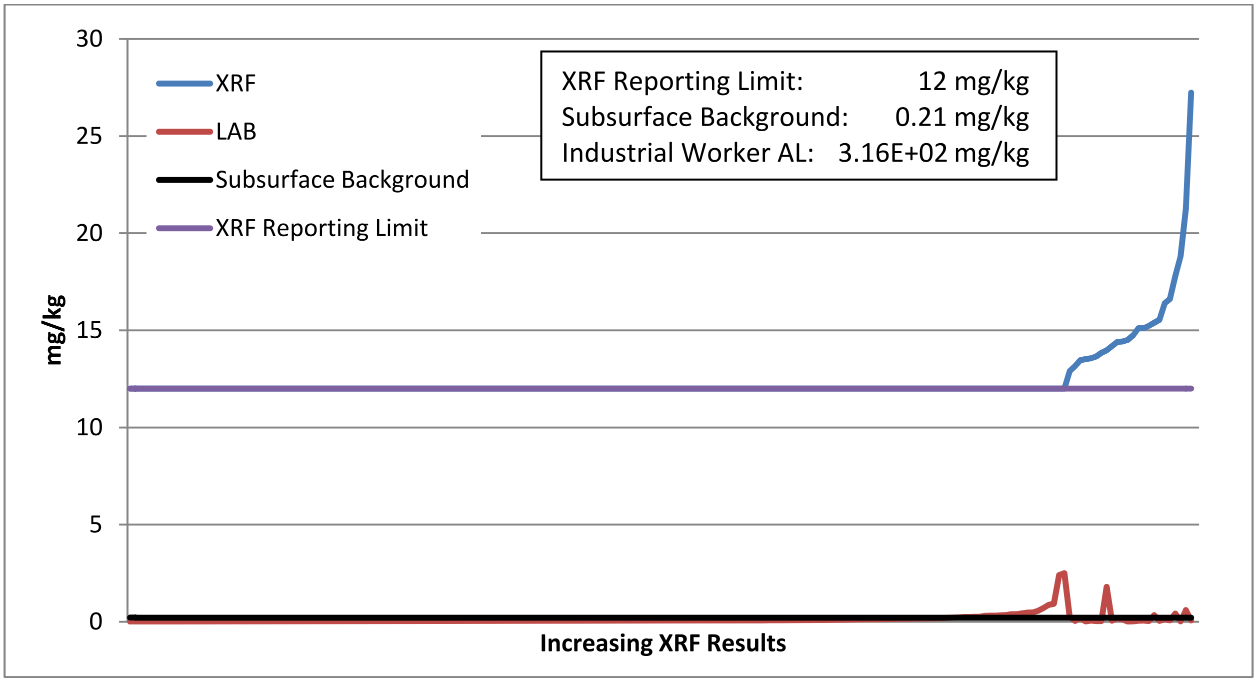


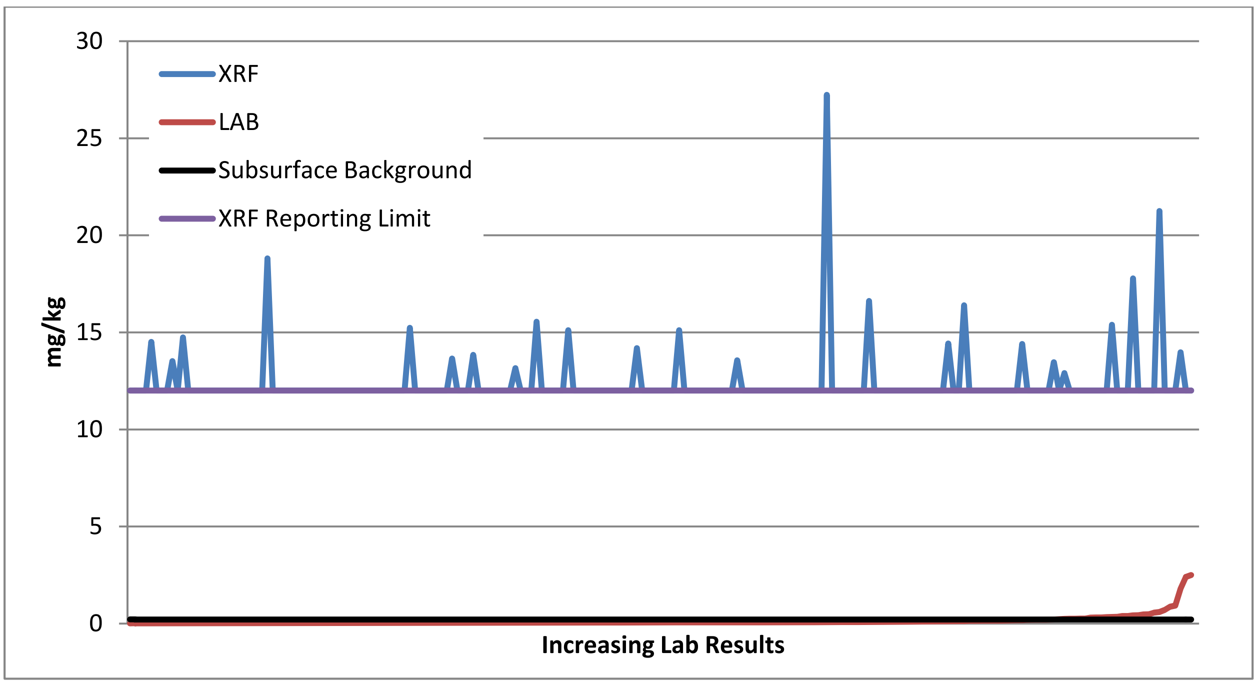


XRF Reporting Limit:	100 mg/kg
Surface Background:	200 mg/kg
Industrial Worker AL:	3.78E+05 mg/kg

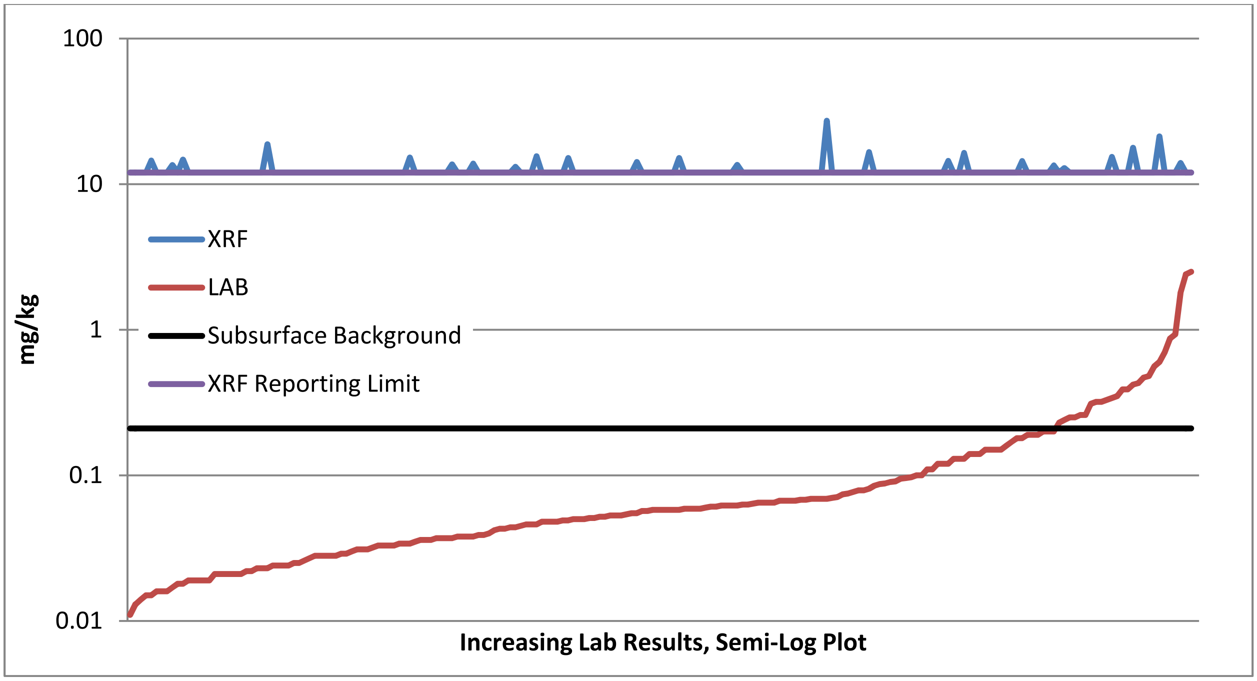
Cadmium—Subsurface

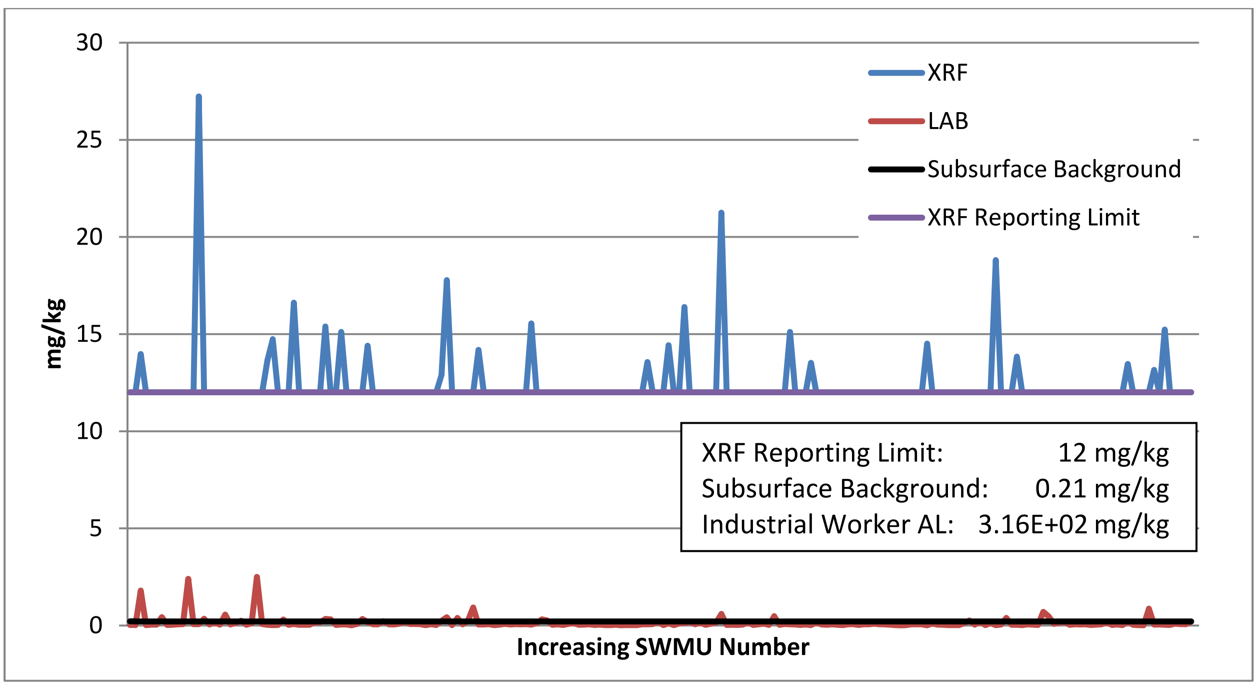
Results for subsurface cadmium do not correlate well between the XRF and the fixed-base laboratory.





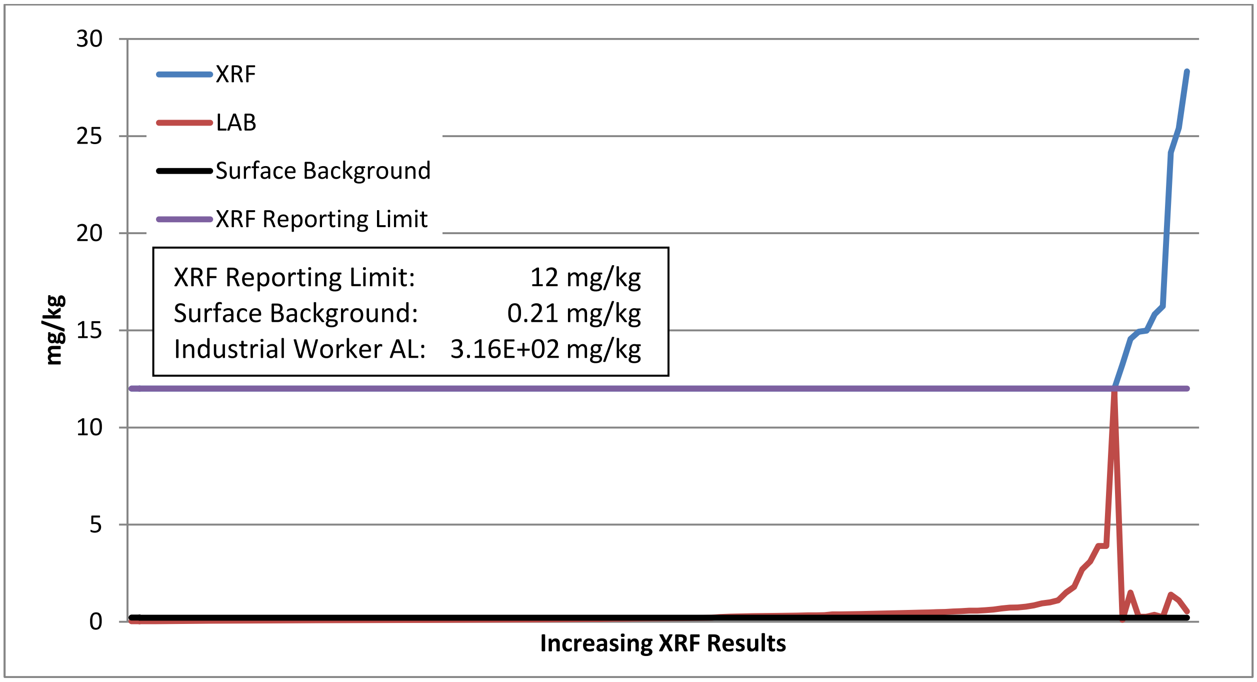
Cadmium—Subsurface (Continued)

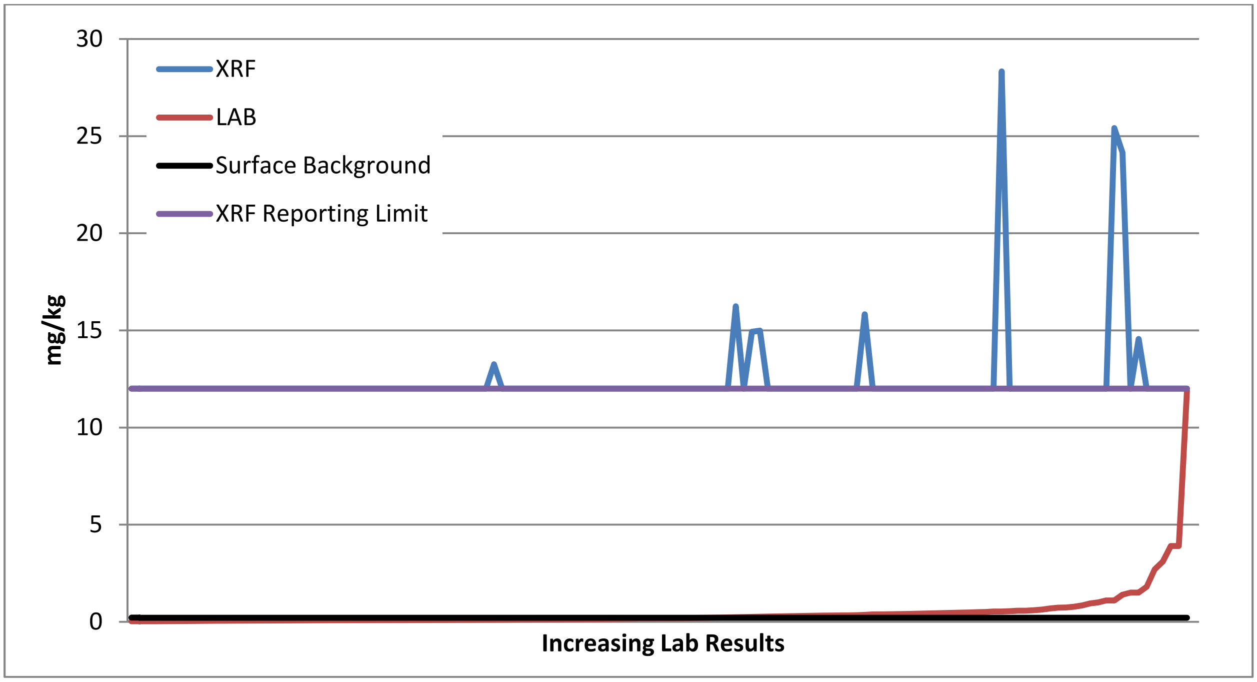




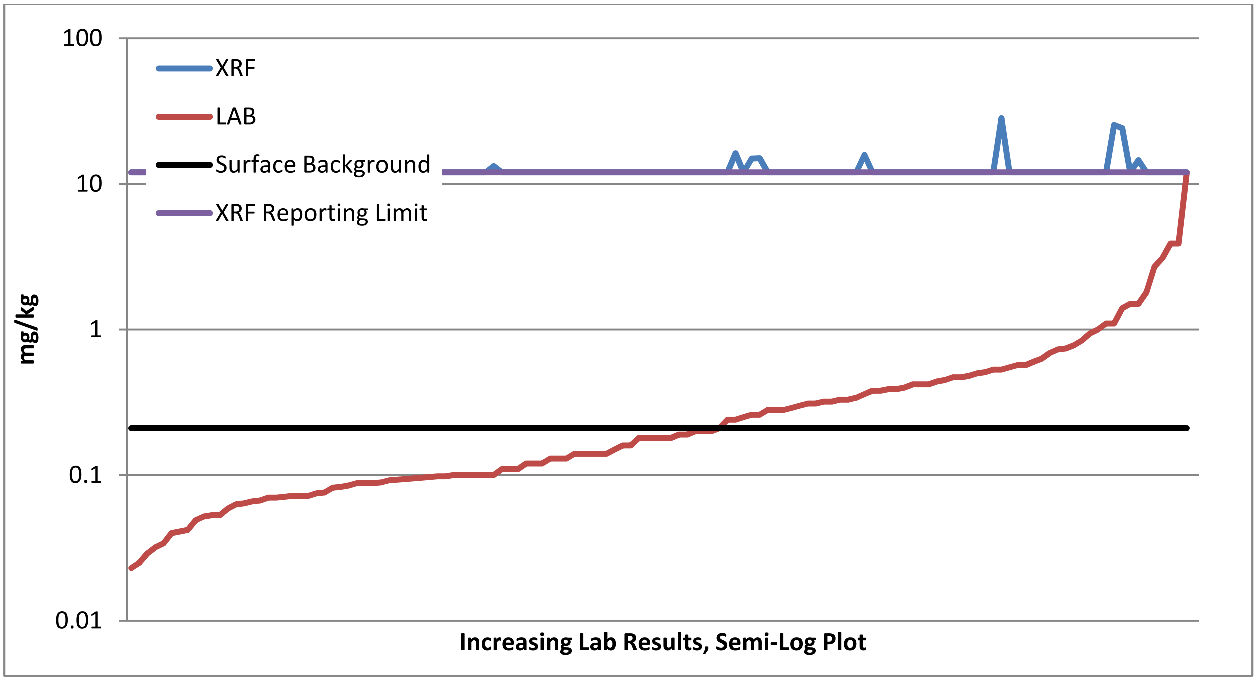
Cadmium—Surface

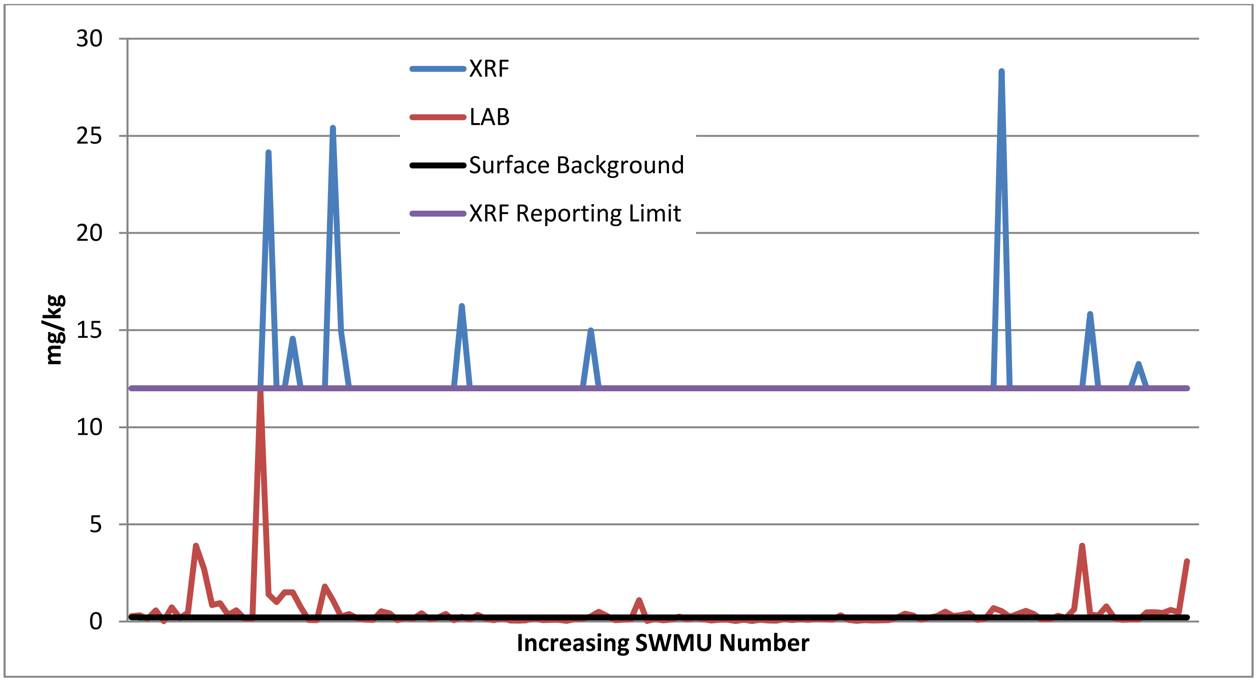
Results for surface cadmium do not correlate well between the XRF and the fixed-base laboratory.





Cadmium—Surface (Continued)

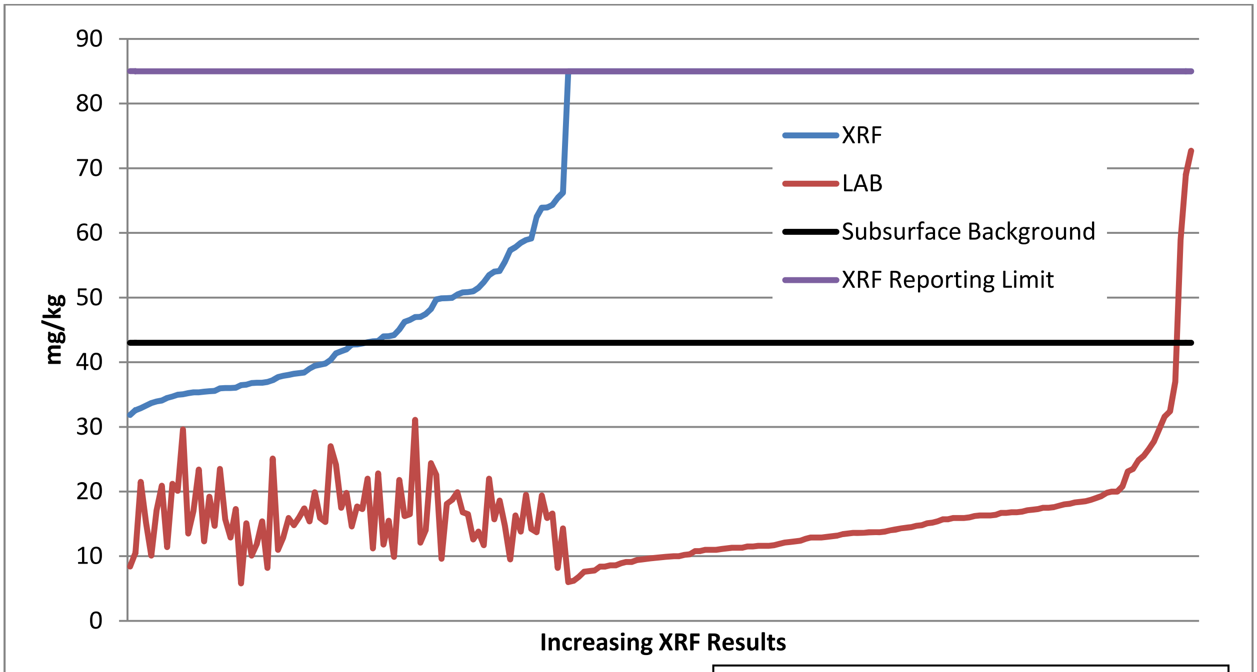




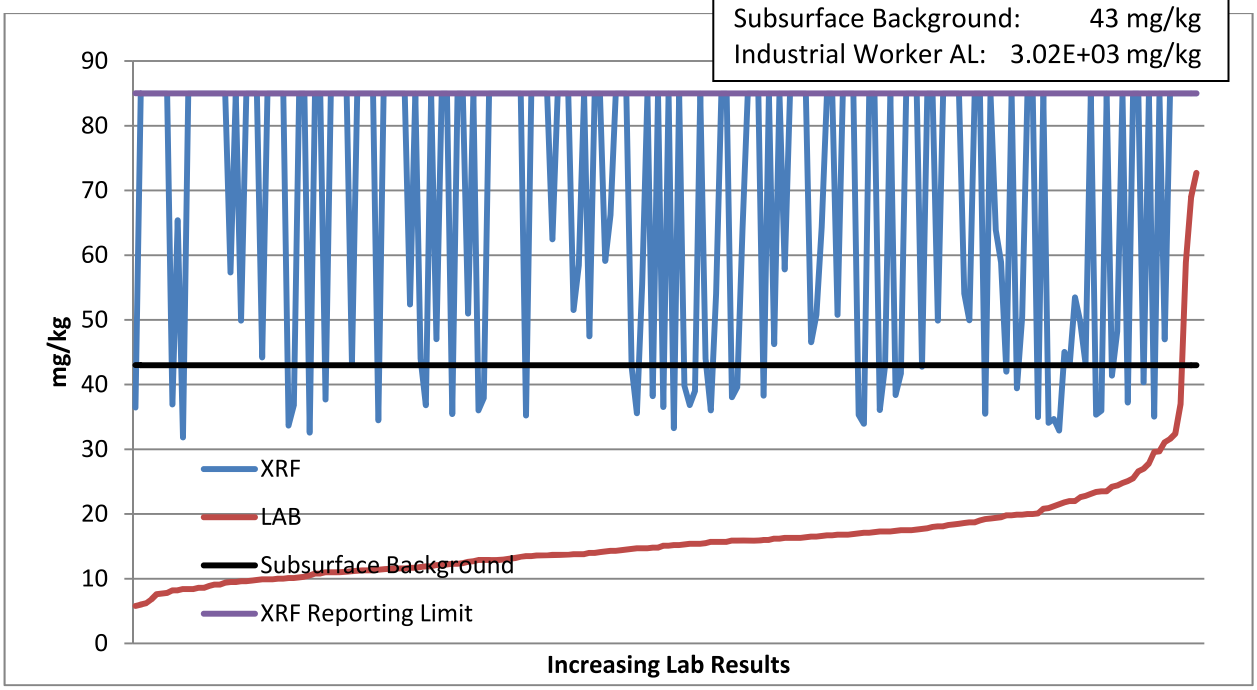
XRF Reporting Limit:	12 mg/kg
Surface Background:	0.21 mg/kg
Industrial Worker AL:	3.16E+02 mg/kg

Chromium—Subsurface

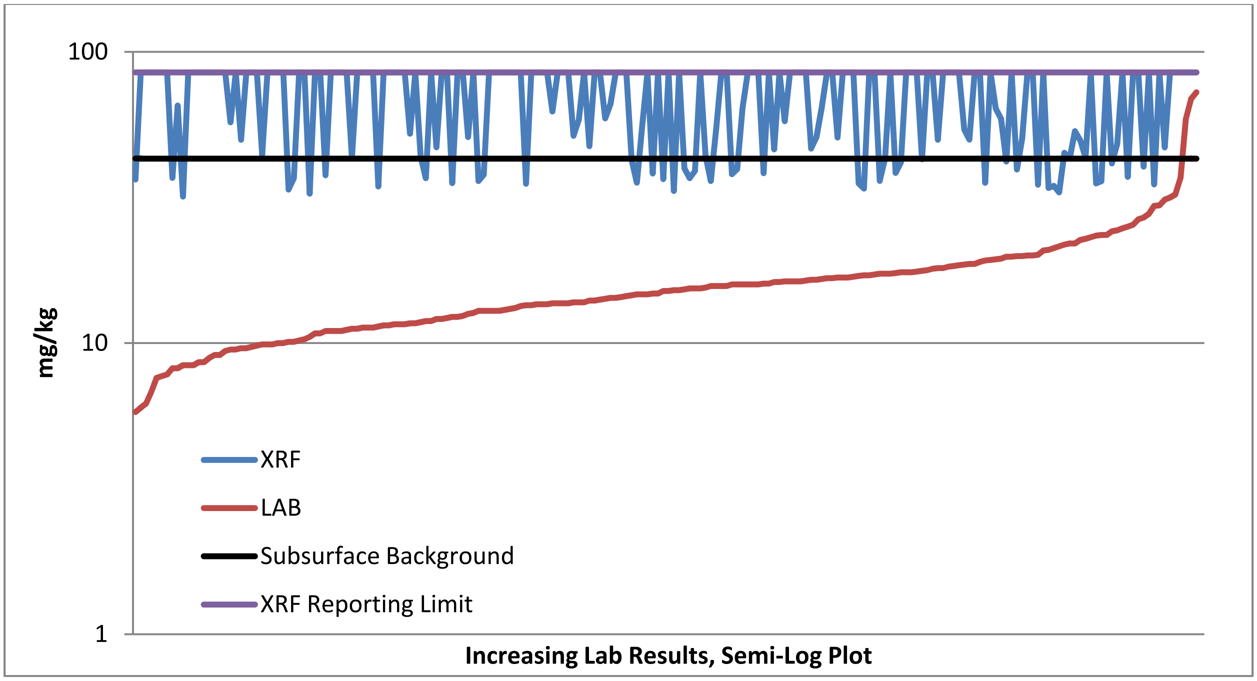
No results for subsurface chromium analyzed by the XRF are detected above the reporting limit; therefore a correlation could not be established; however, all fixed-base laboratory results are detected at levels lower than the XRF screening results.

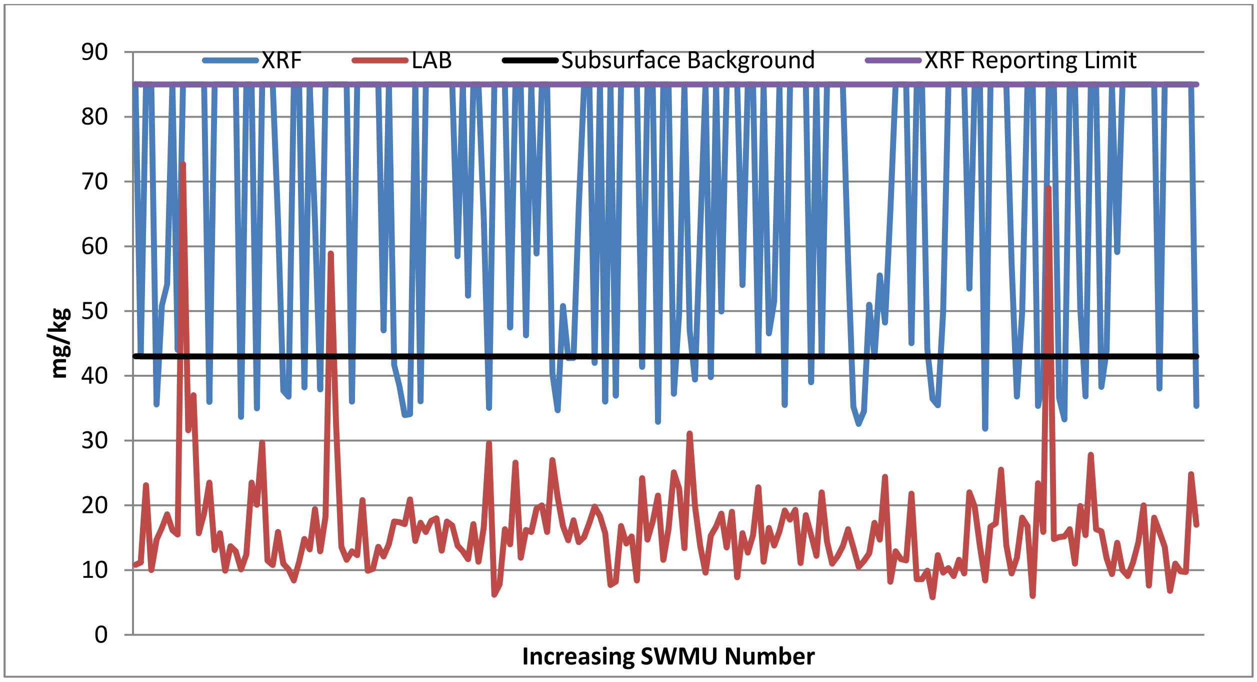


XRF Reporting Limit:	85 mg/kg
Subsurface Background:	43 mg/kg
Industrial Worker AL:	3.02E+03 mg/kg



Chromium—Subsurface (Continued)

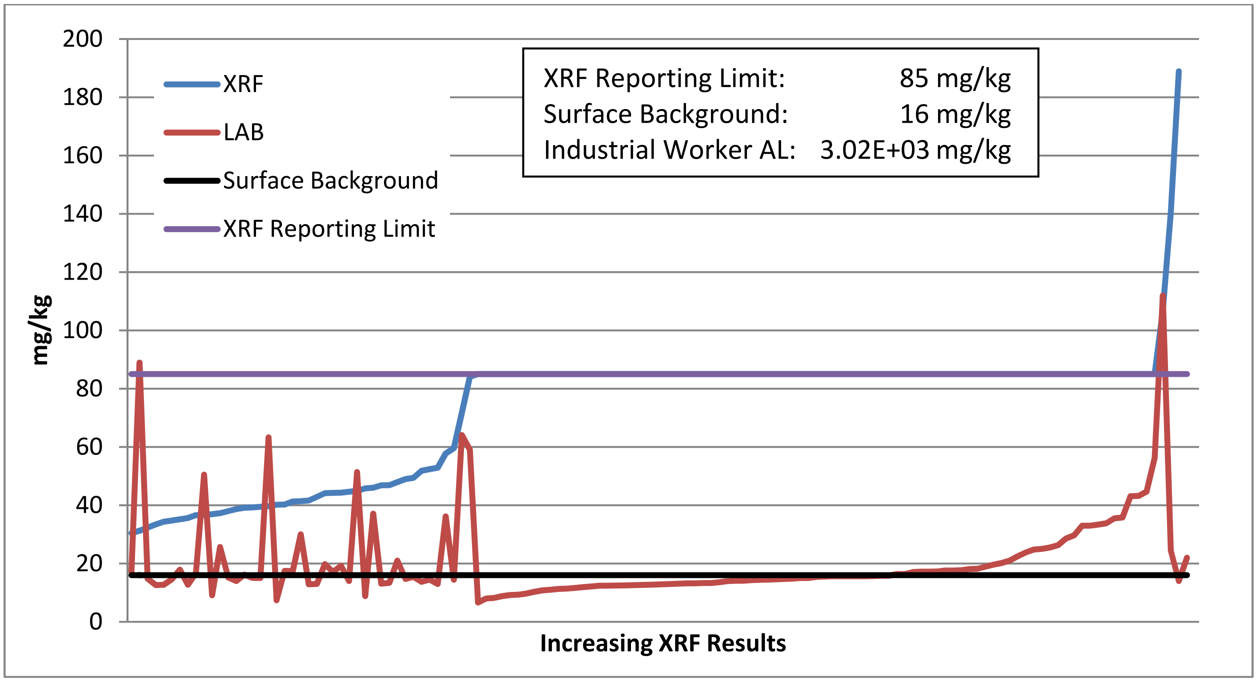


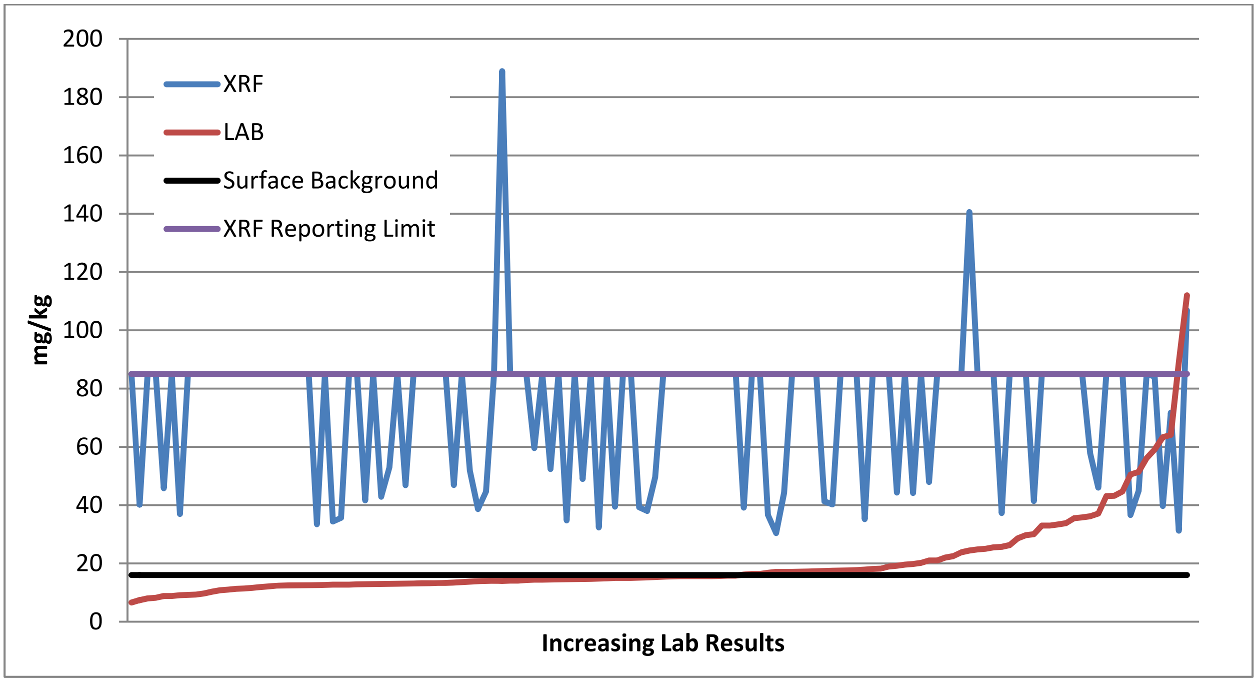


XRF Reporting Limit:	85 mg/kg
Subsurface Background:	43 mg/kg
Industrial Worker AL:	3.02E+03 mg/kg

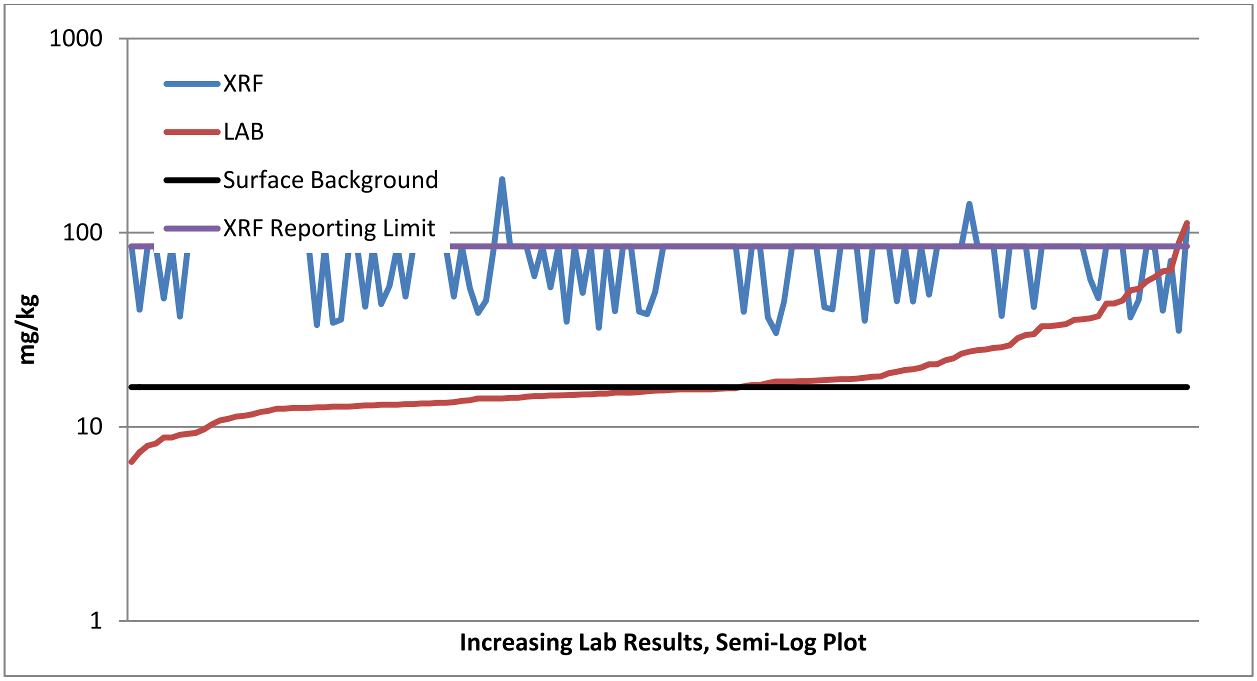
Chromium—Surface

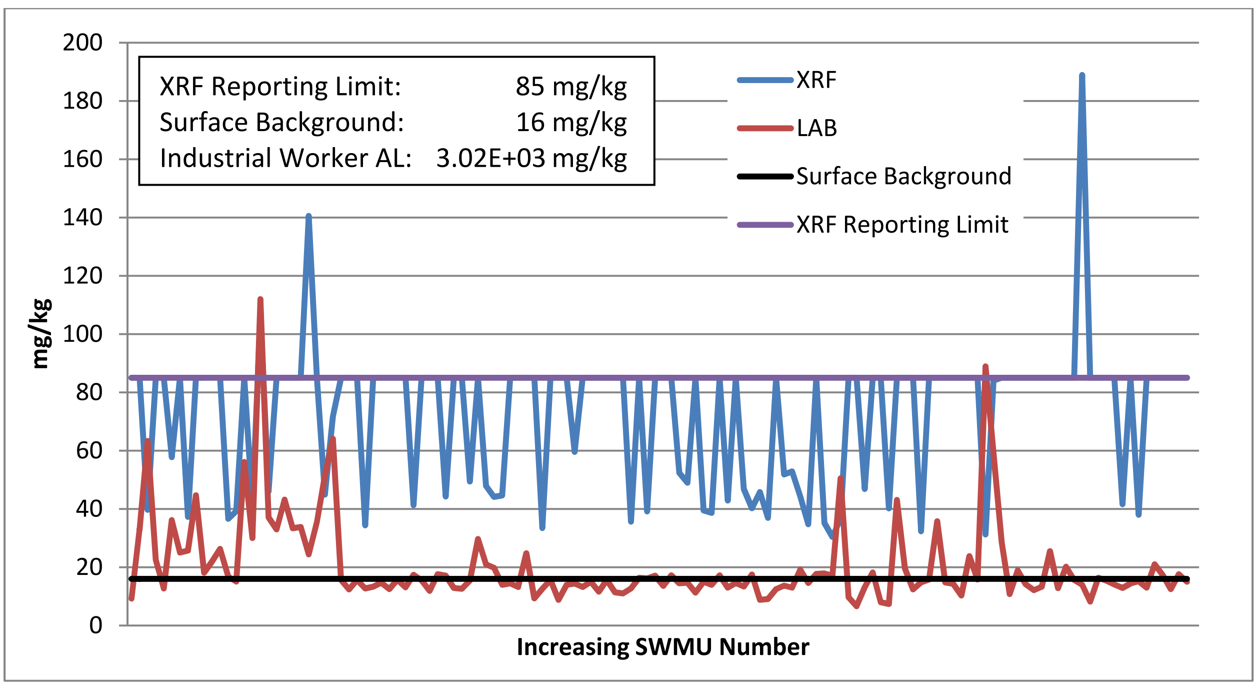
The correlation coefficient for surface chromium is relatively good. The majority of fixed-base chromium detections are below the XRF reporting limit.





Chromium—Surface (Continued)

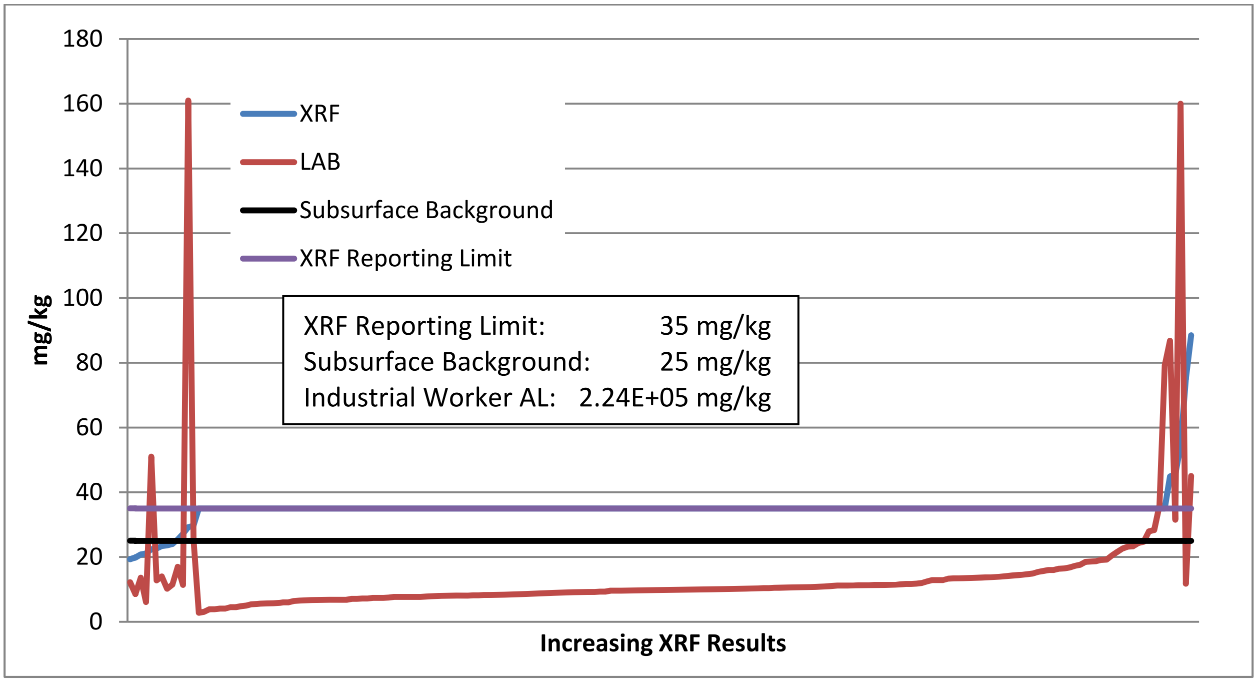


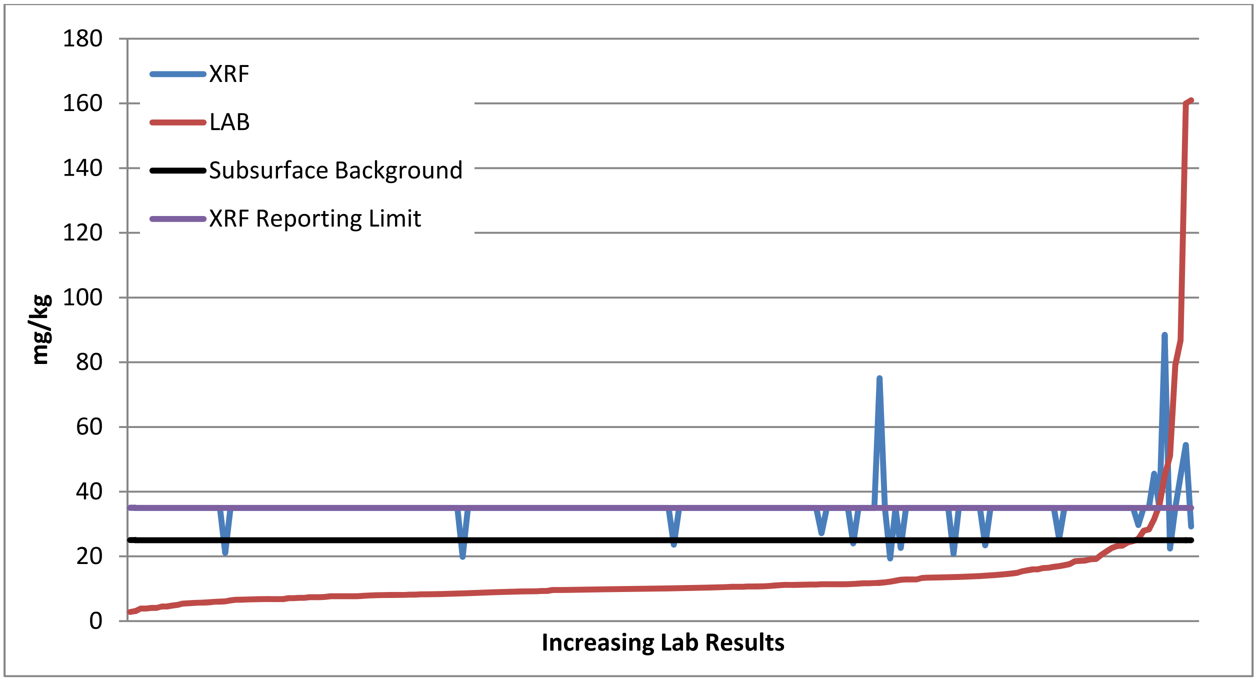


*The value 897.61 mg/kg (analyzed by the field-base XRF in sample SOU014079SA001) was removed as an outlier from the graphs.

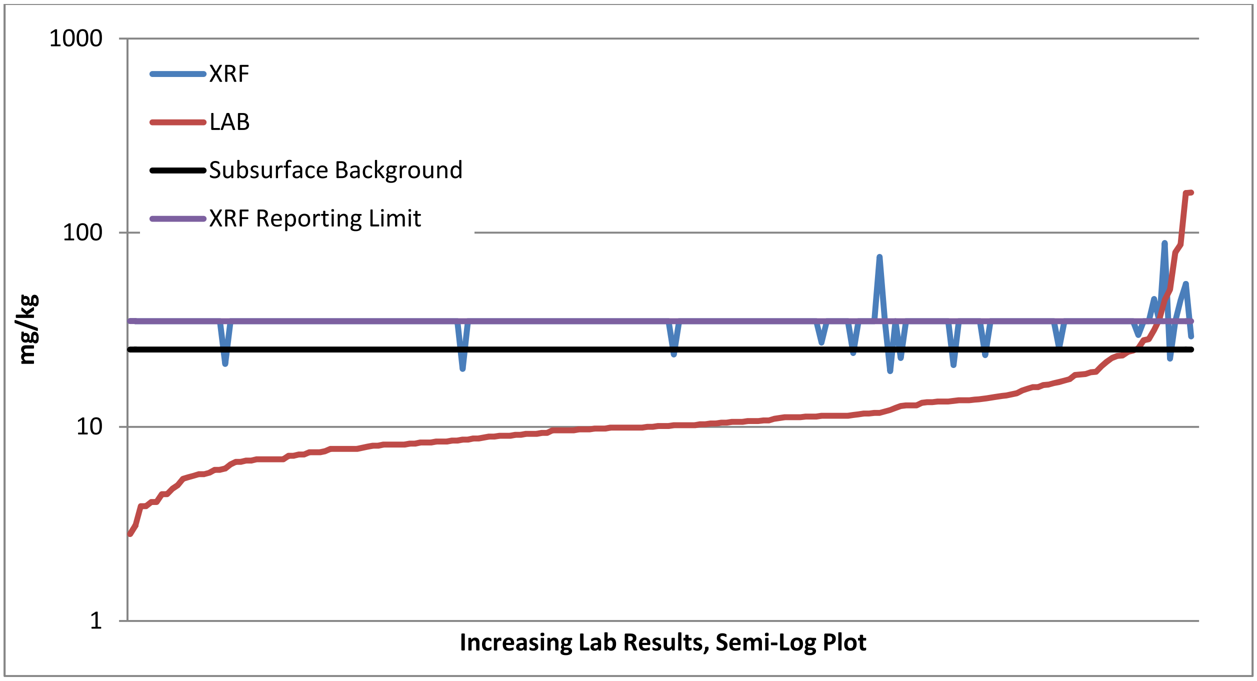
Copper—Subsurface

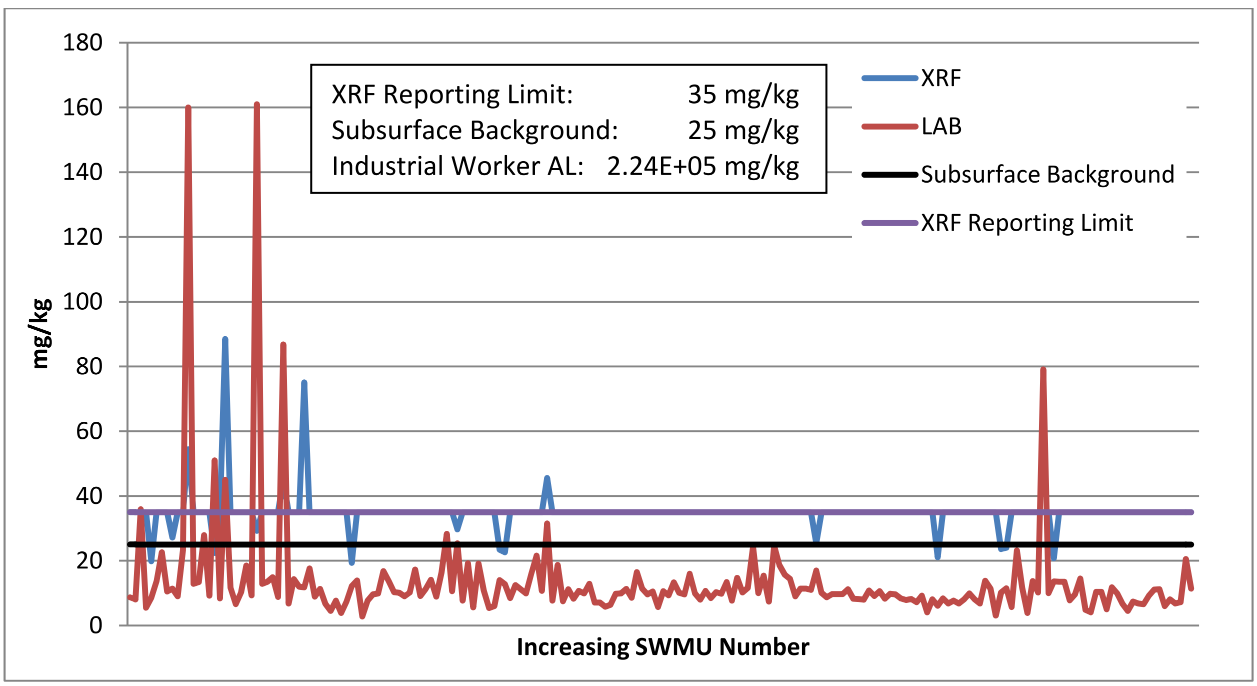
Results for subsurface copper correlate poorly between the XRF and the fixed-base laboratory. Since the majority of XRF results are reported higher than the fixed-base laboratory results, the XRF screening results are acceptable for use in determining risk associated with copper in subsurface soils.





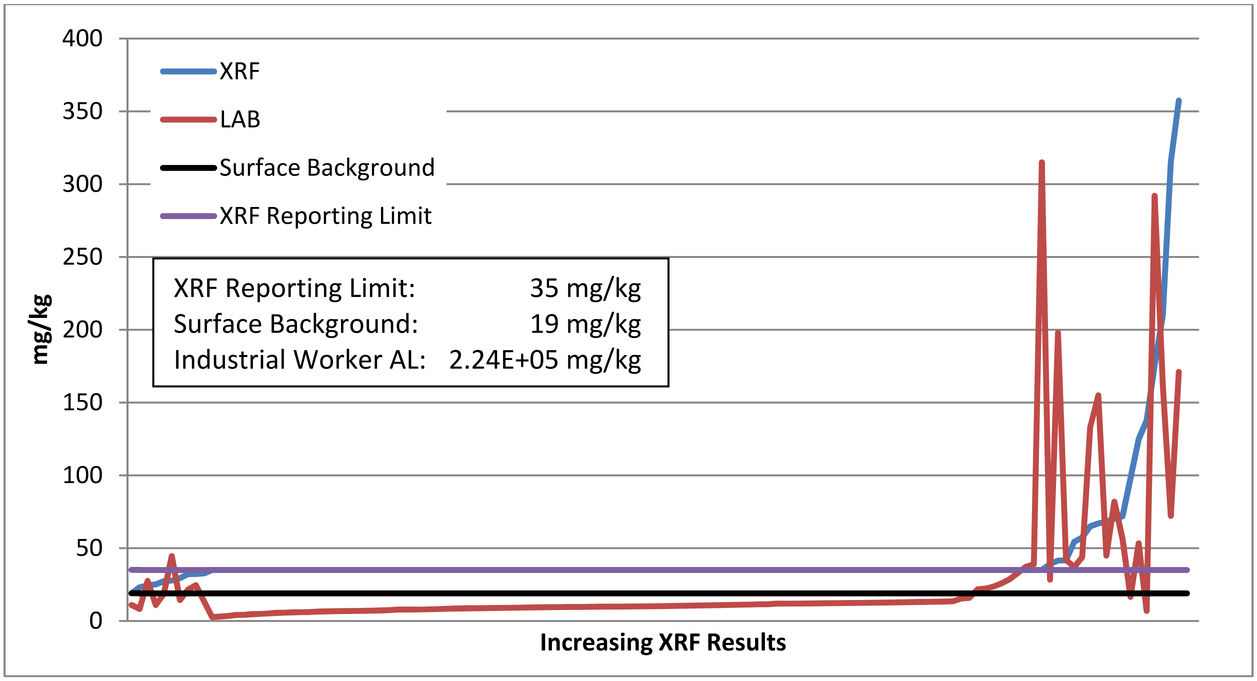
Copper—Subsurface (Continued)

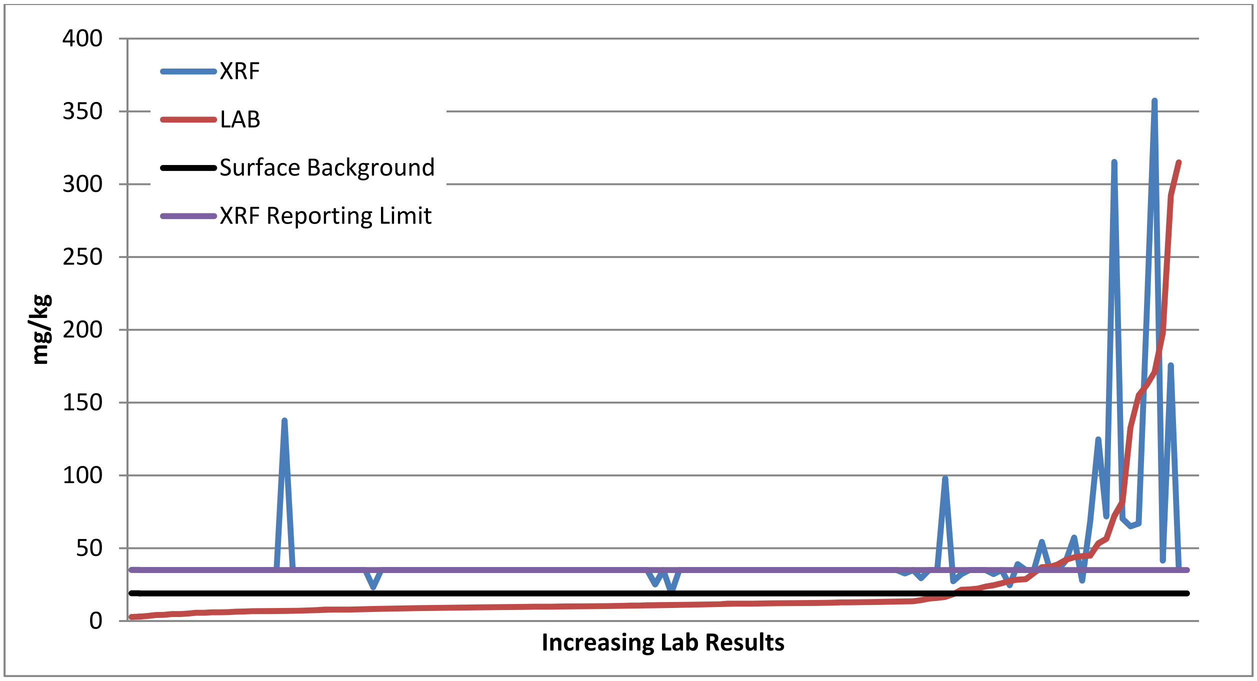




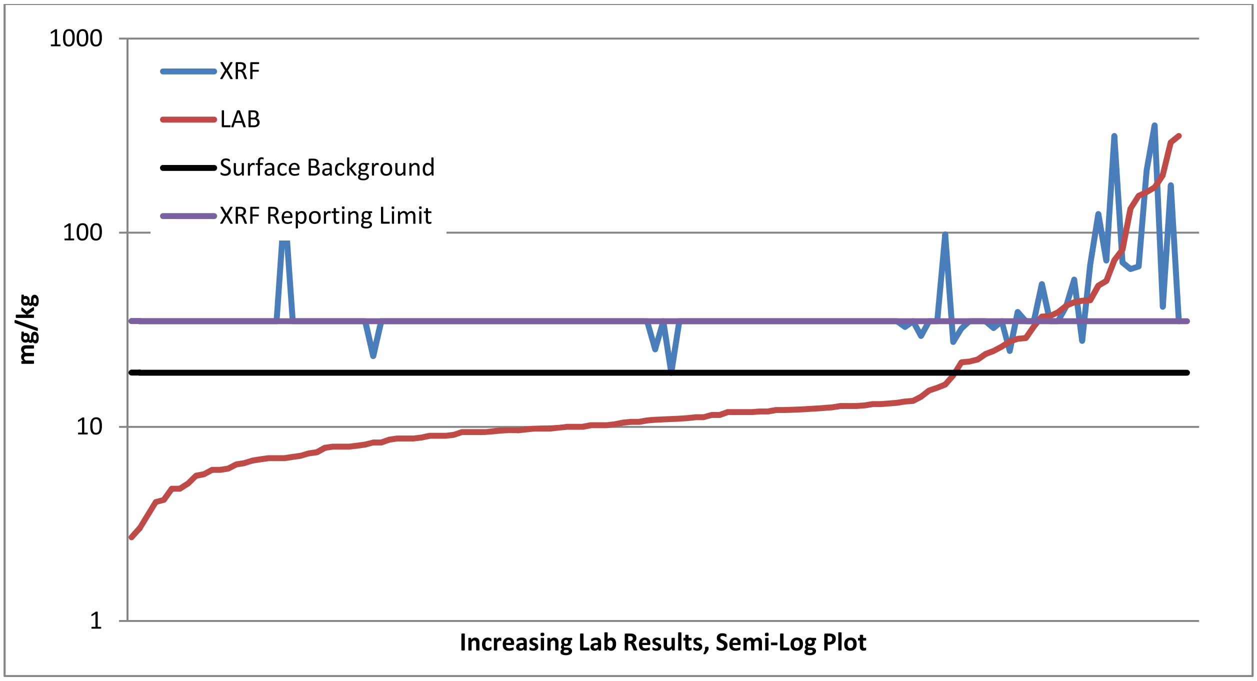
Copper—Surface

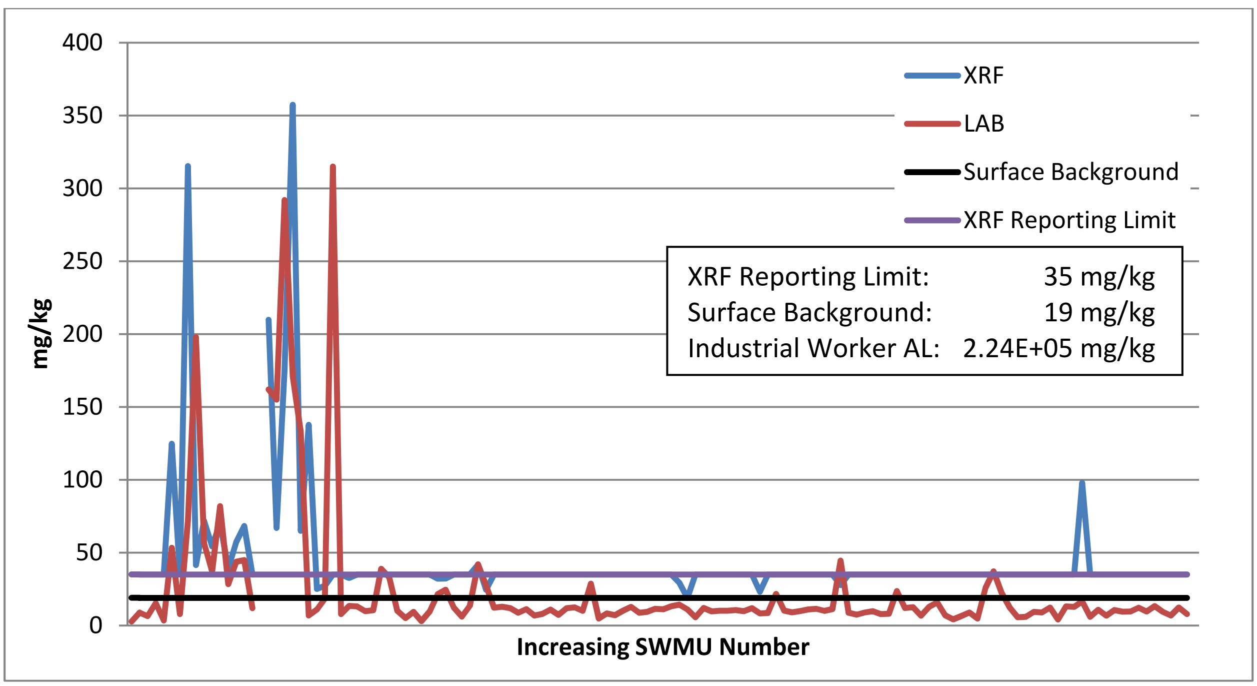
Results for surface copper correlate poorly between the XRF and the fixed-base laboratory. Since the majority of XRF results are reported higher than the fixed-base laboratory results, the XRF screening results are acceptable for use in determining risk associated with copper in surface soils.





Copper—Surface (Continued)

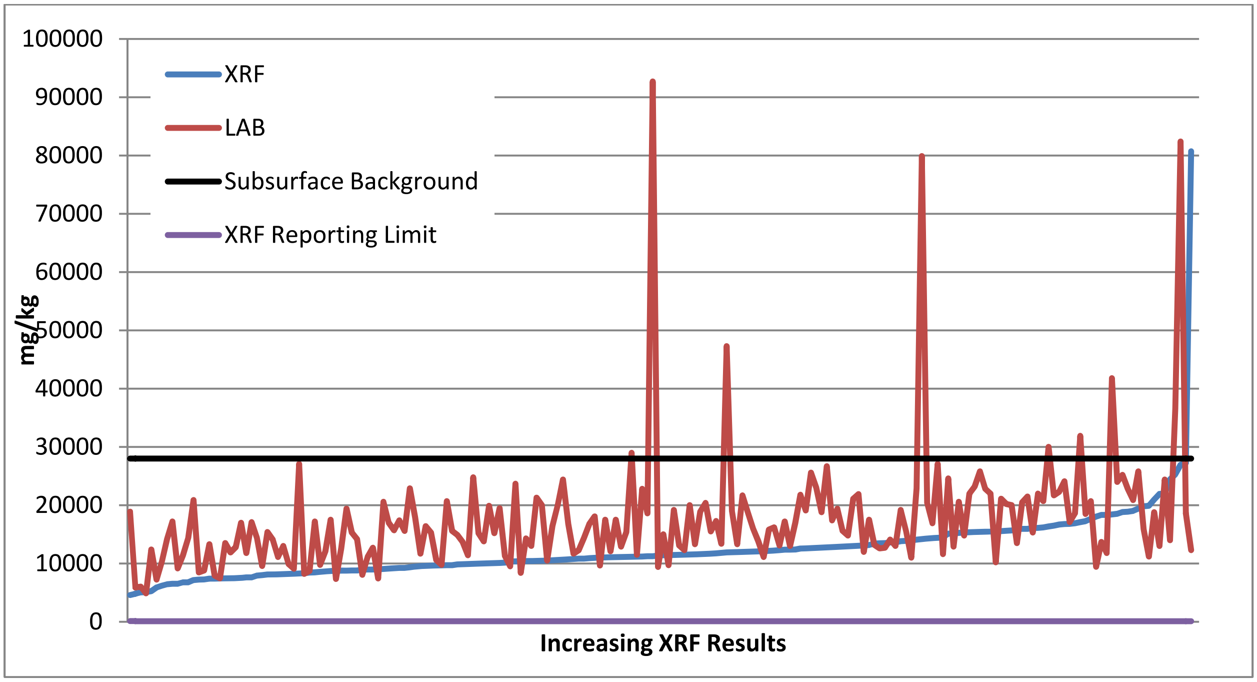


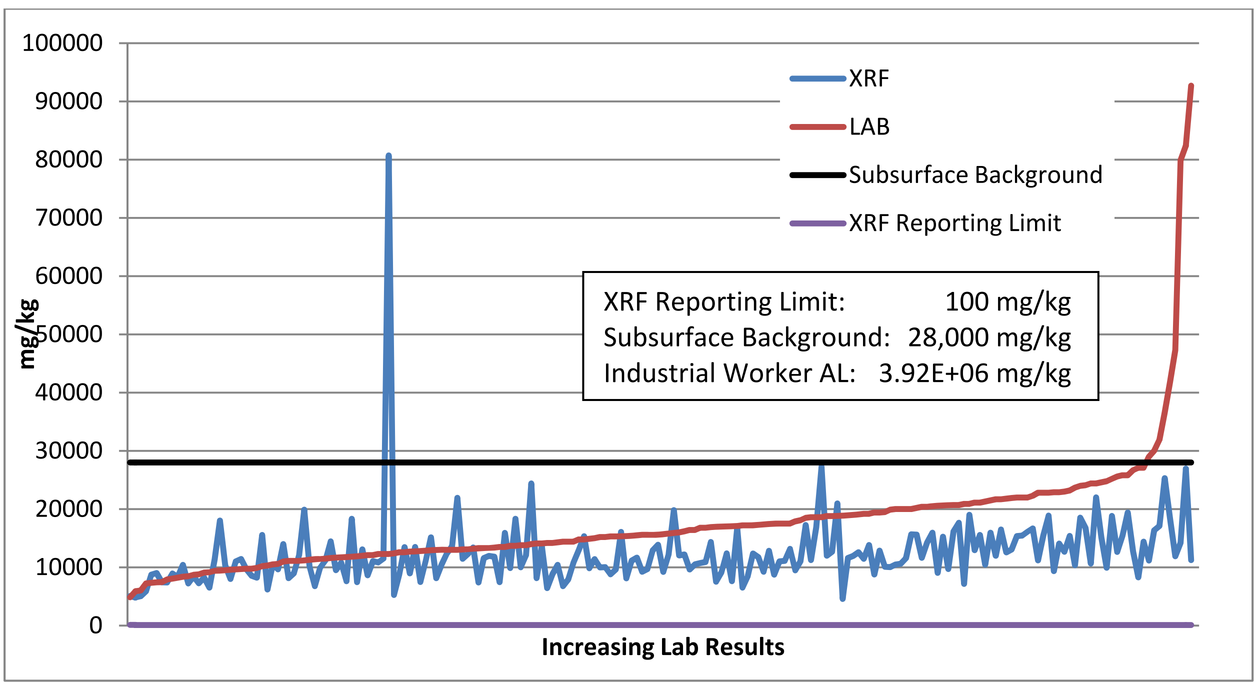


*The value 4,360 mg/kg (analyzed by the fixed-base laboratory in samples SOU015033SA001) and the corresponding value of 897.35 mg/kg (analyzed by the field-base XRF) were removed as outliers from the graphs.

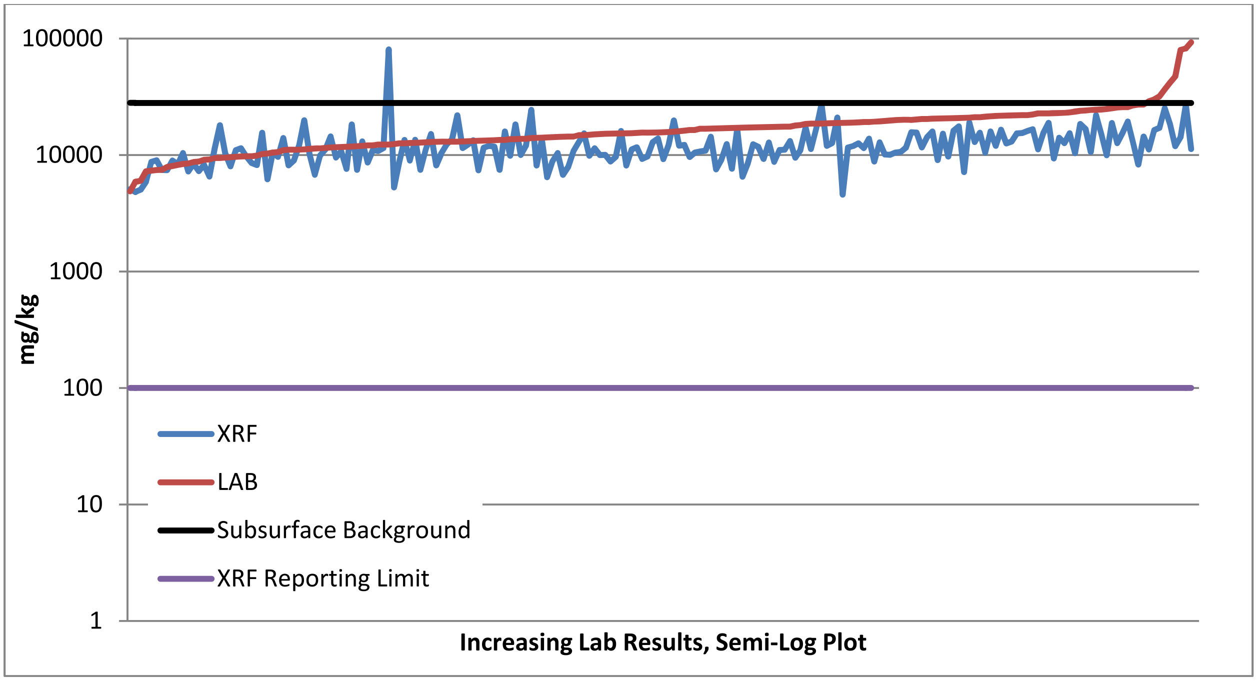
Iron—Subsurface

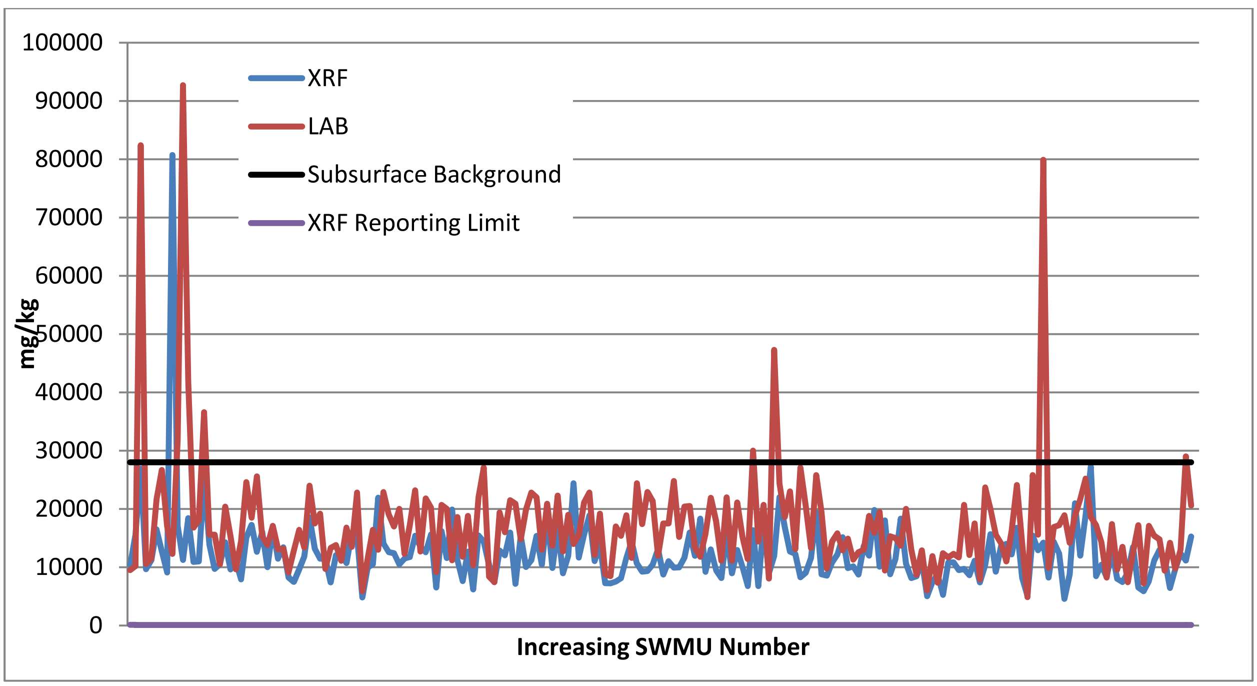
The Pearson correlation coefficient for subsurface iron is 0.22.





Iron—Subsurface (Continued)

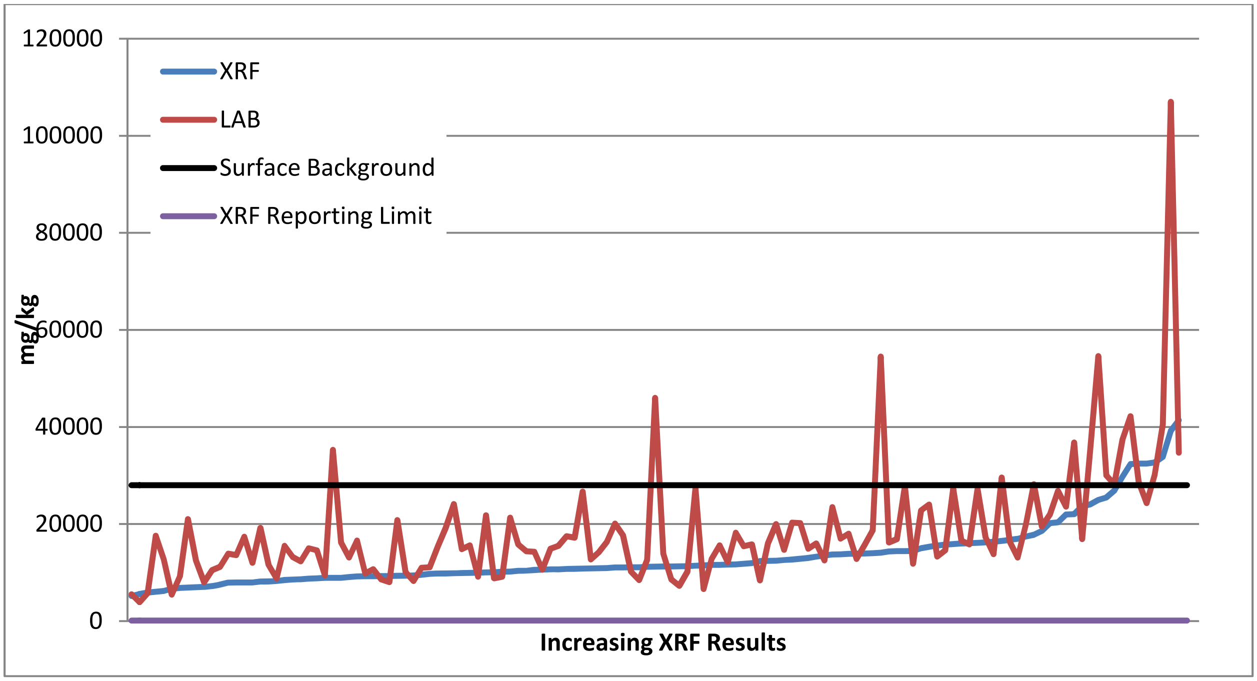


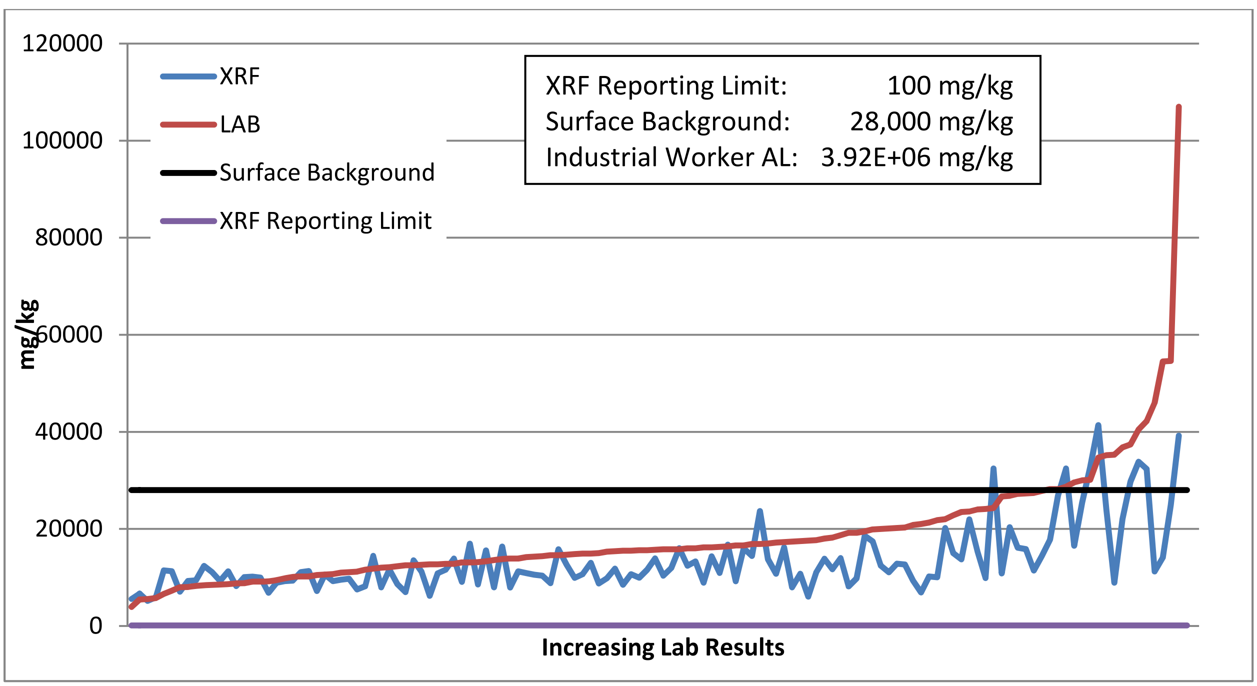


XRF Reporting Limit:	100 mg/kg
Subsurface Background:	28,000 mg/kg
Industrial Worker AL:	3.92E+06 mg/kg

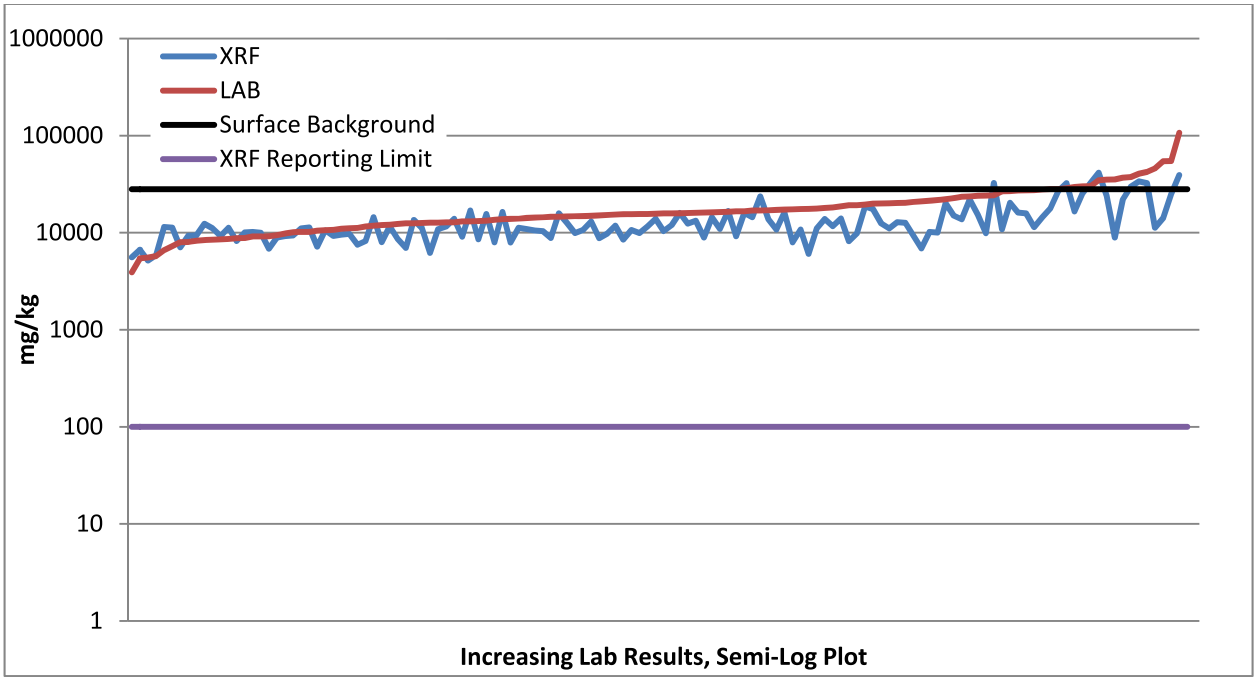
Iron—Surface

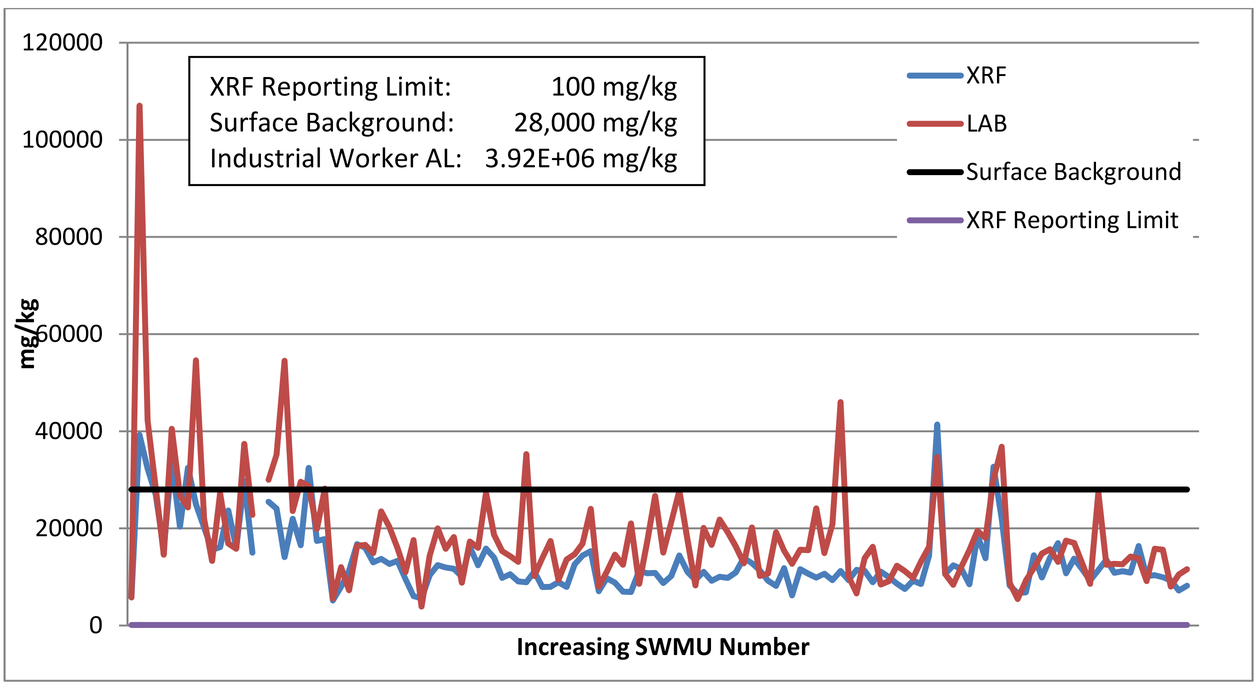
The Pearson correlation coefficient for surface iron is 0.67.





Iron—Surface (Continued)

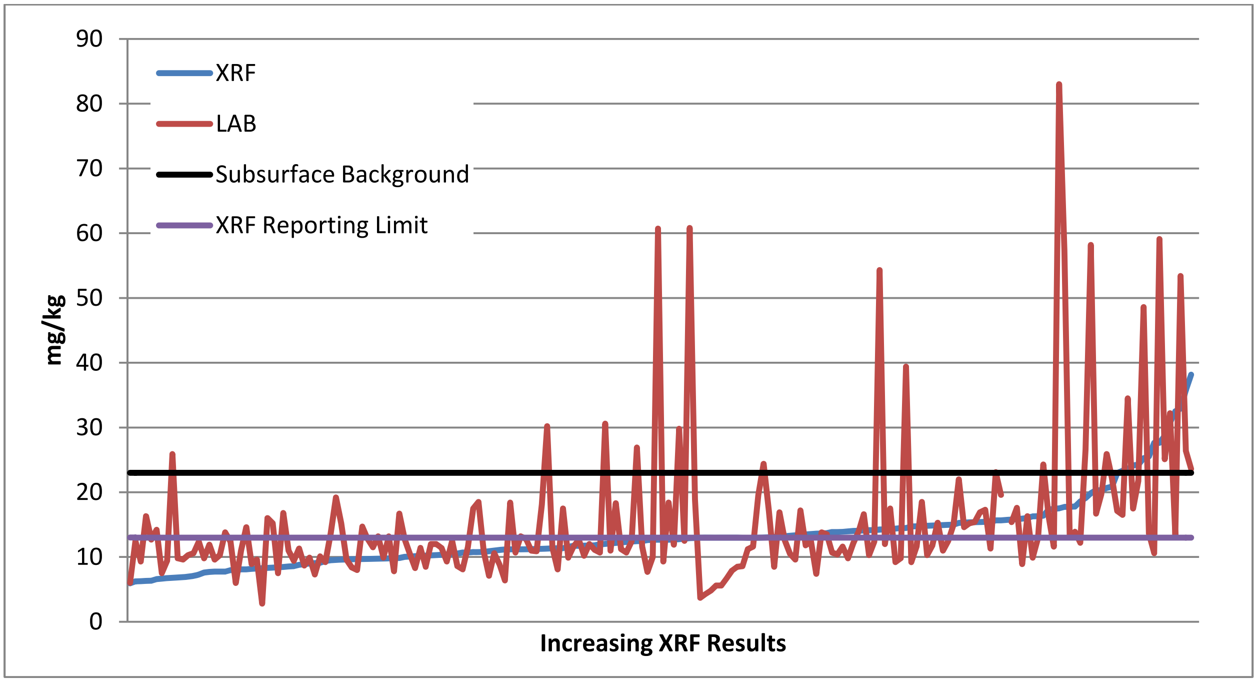


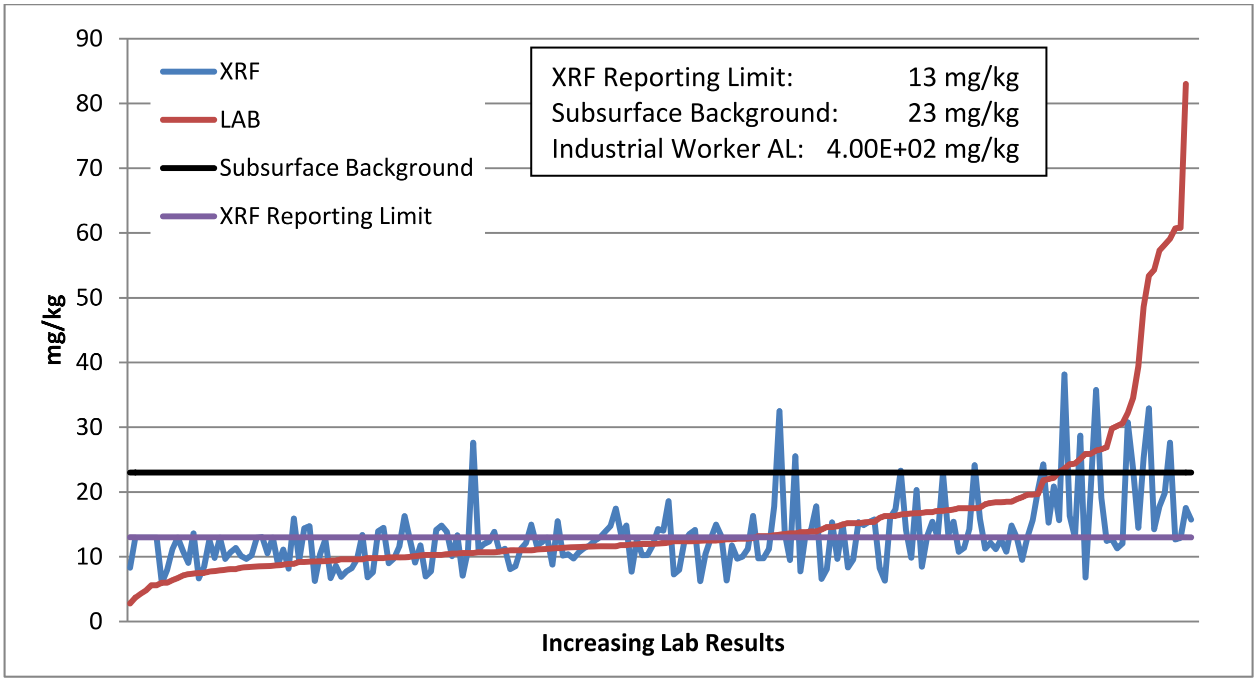


*The value 171,000 mg/kg (analyzed by the fixed-base laboratory in sample SOU015033SA001) and the corresponding value of 88,278.97 mg/kg (analyzed by the field-base XRF) were removed as outliers from the graphs.

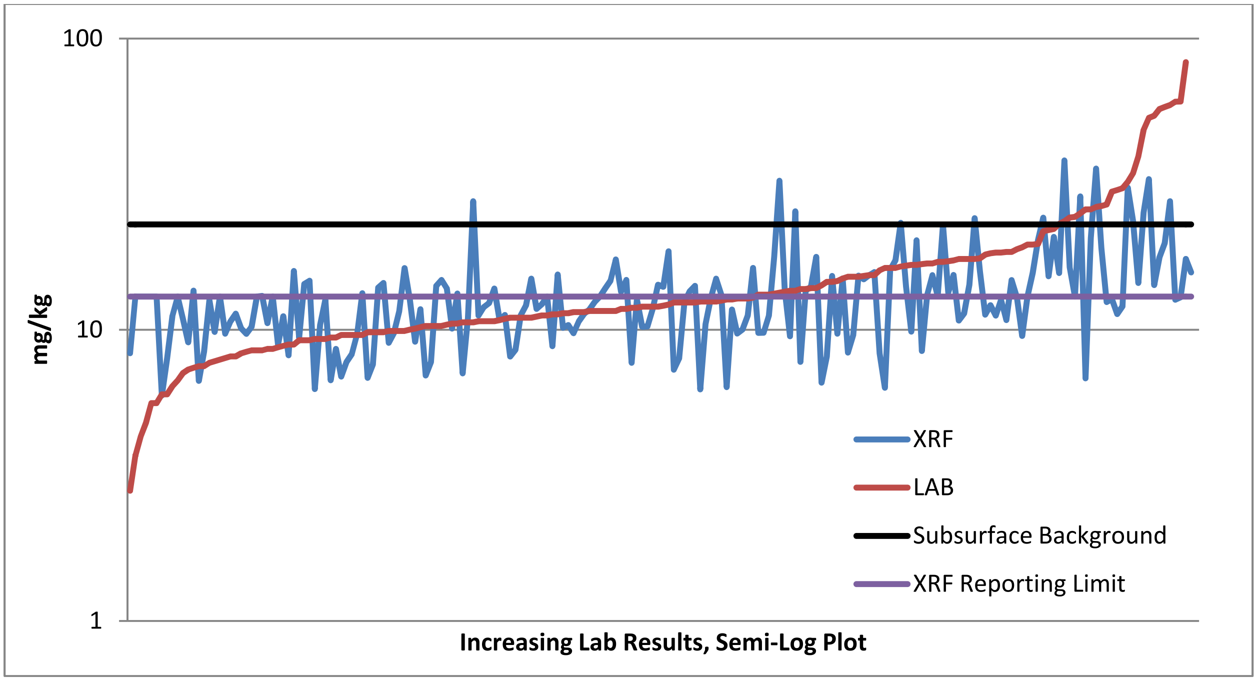
Lead—Subsurface

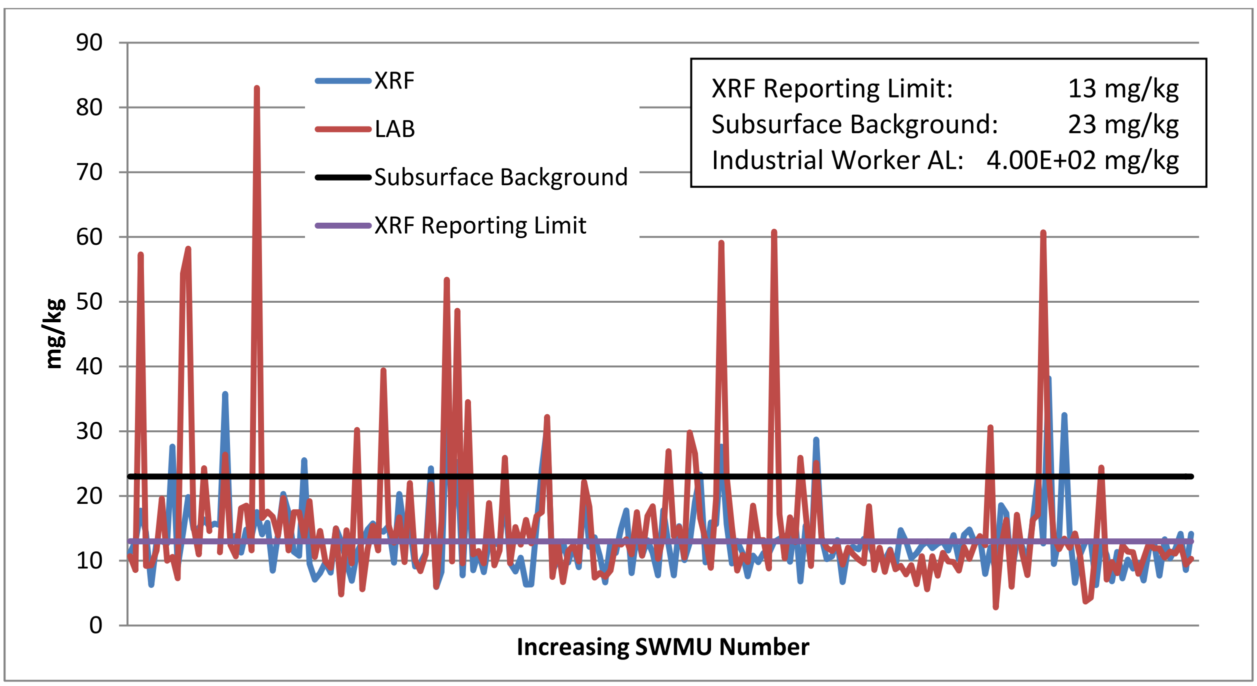
The Pearson correlation coefficient for subsurface lead is 0.36.





Lead—Subsurface (Continued)

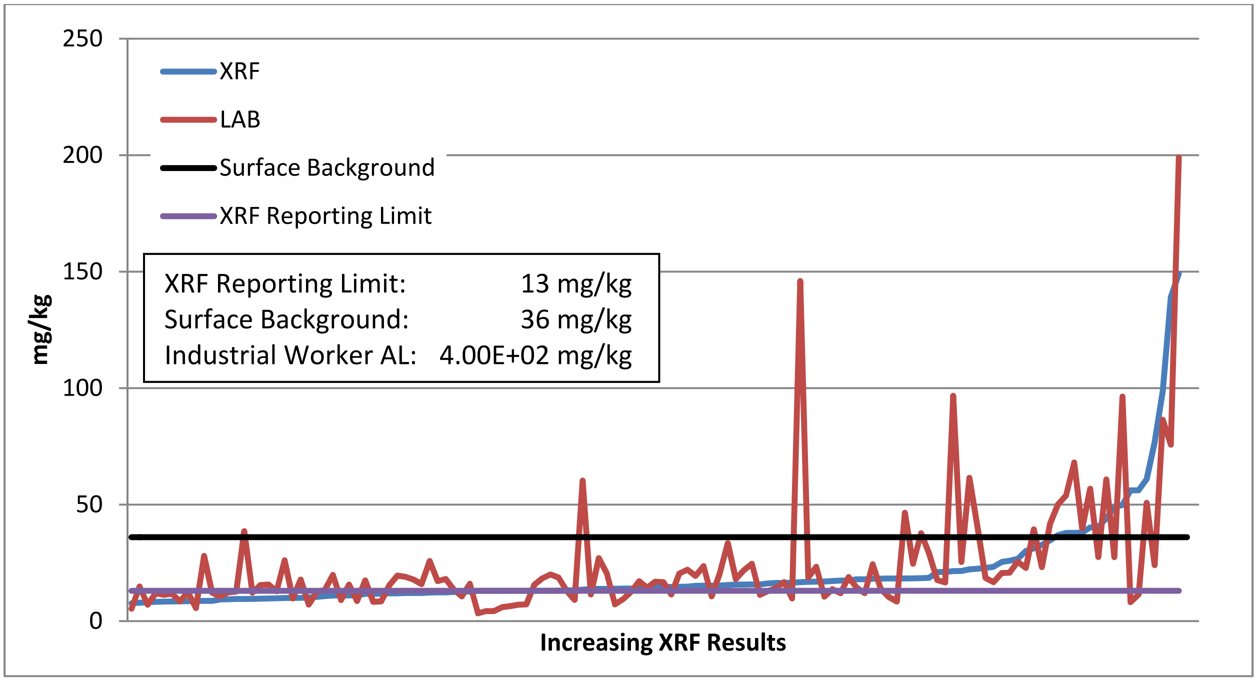


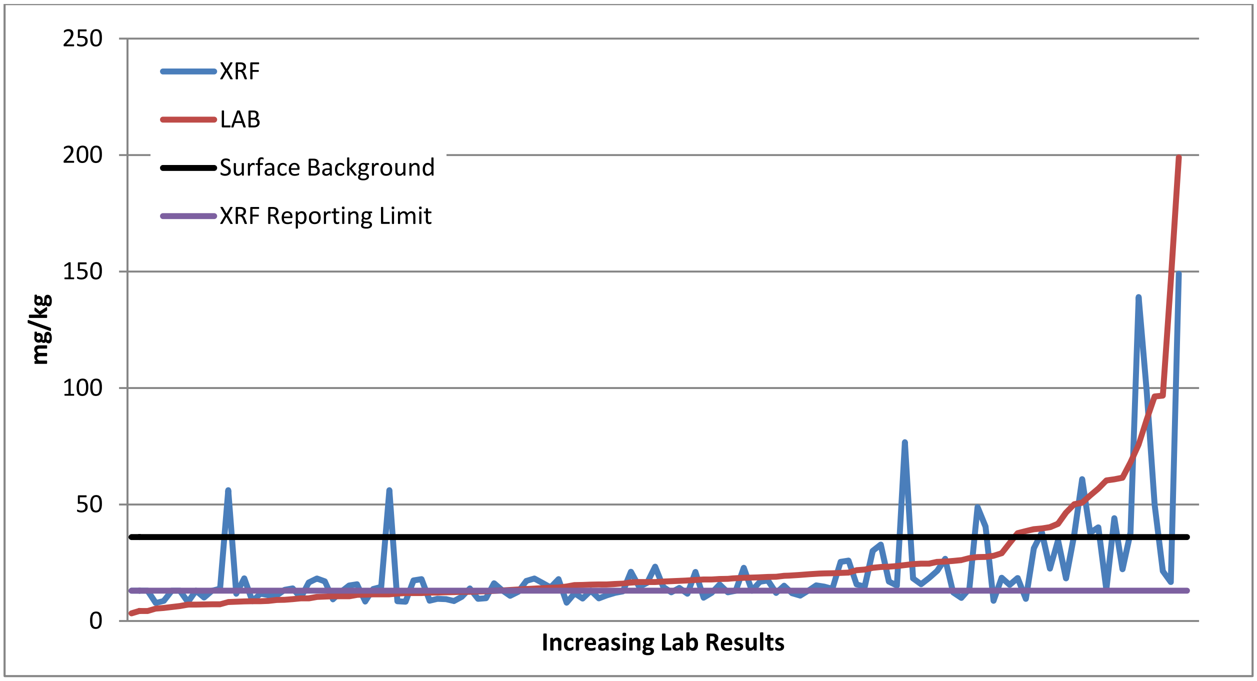


*The value 944 mg/kg (analyzed by the fixed-base laboratory in sample SOU014085SA004) was removed as an outlier from the graphs.

Lead—Surface

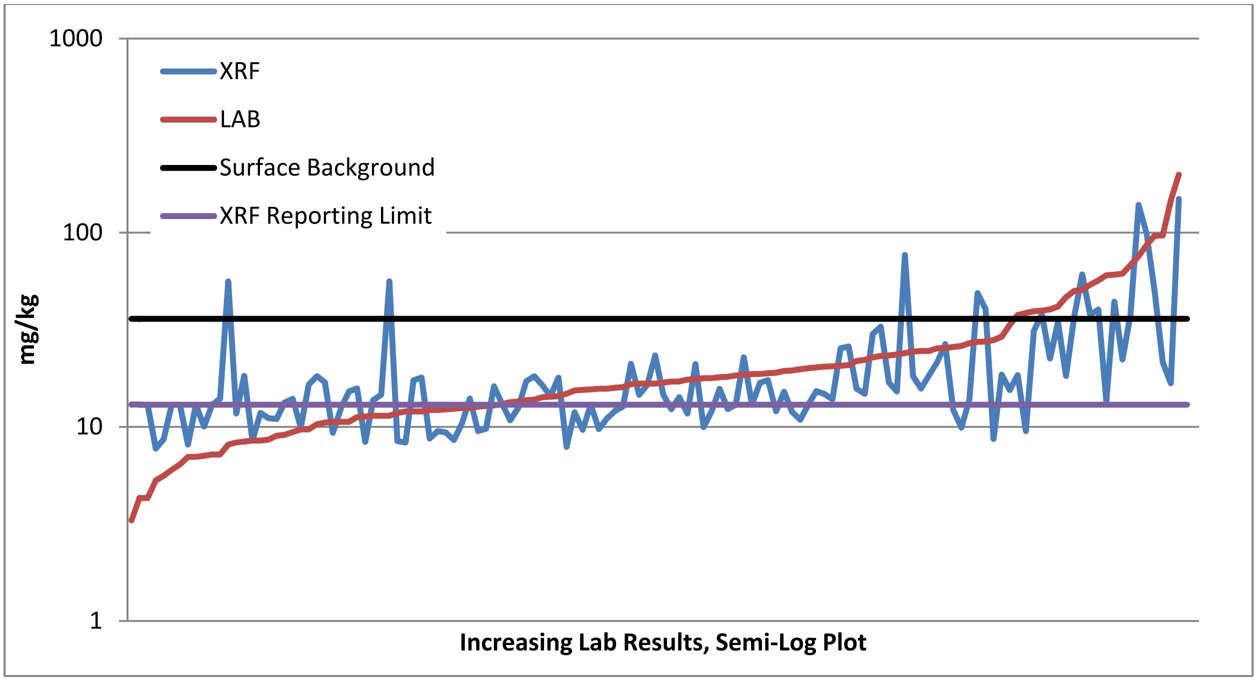
The Pearson correlation coefficient for surface lead is 0.63.

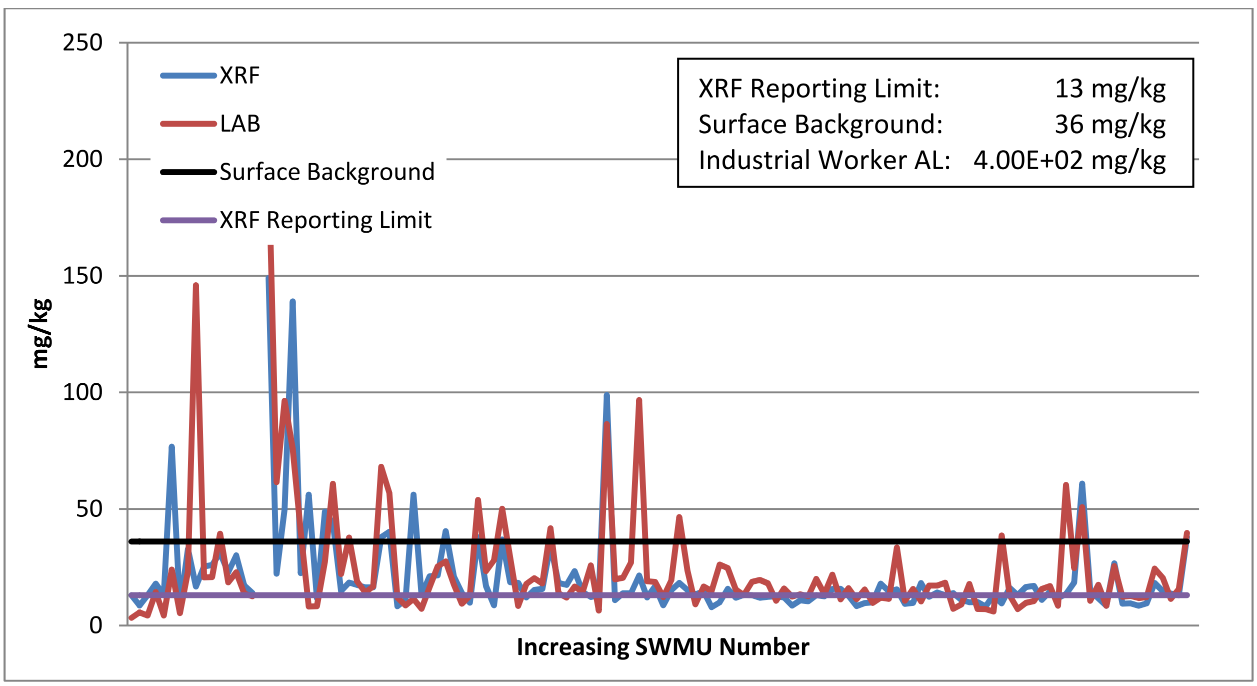




*The value 827 mg/kg (analyzed by the fixed-base laboratory in sample SOU015033SA001) and the corresponding value of 508.49 mg/kg (analyzed by the field-base XRF) were removed as outliers.

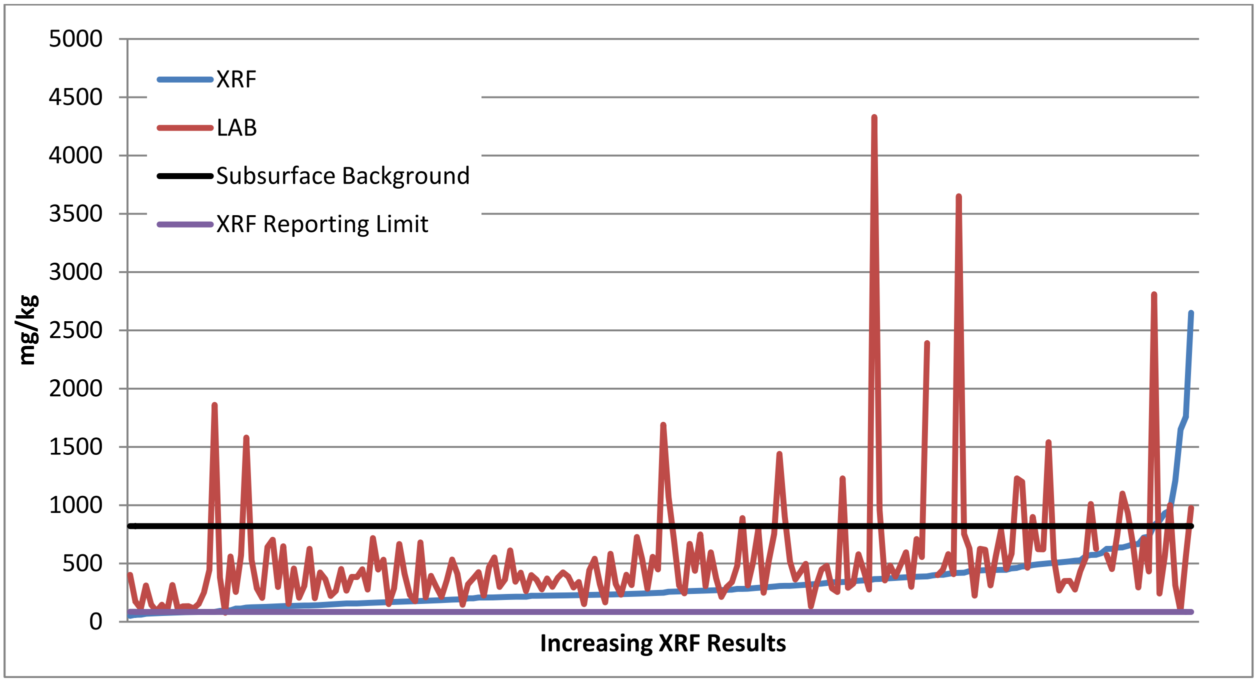
Lead—Surface (Continued)

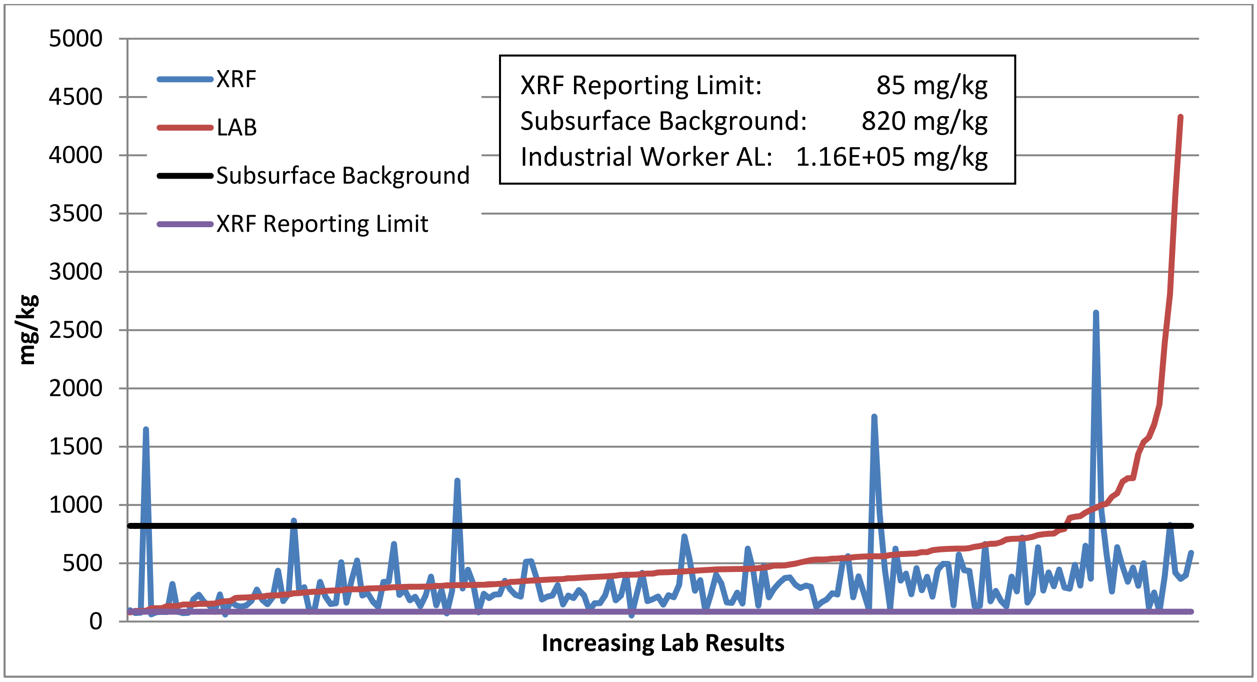




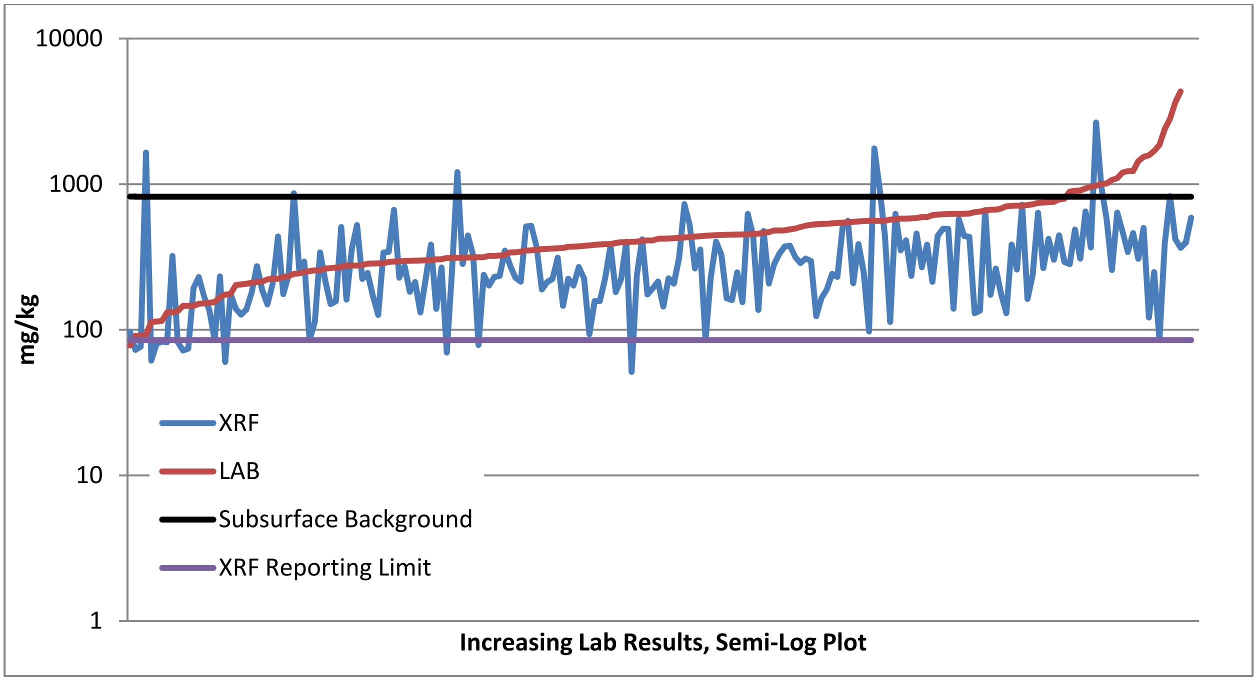
Manganese—Subsurface

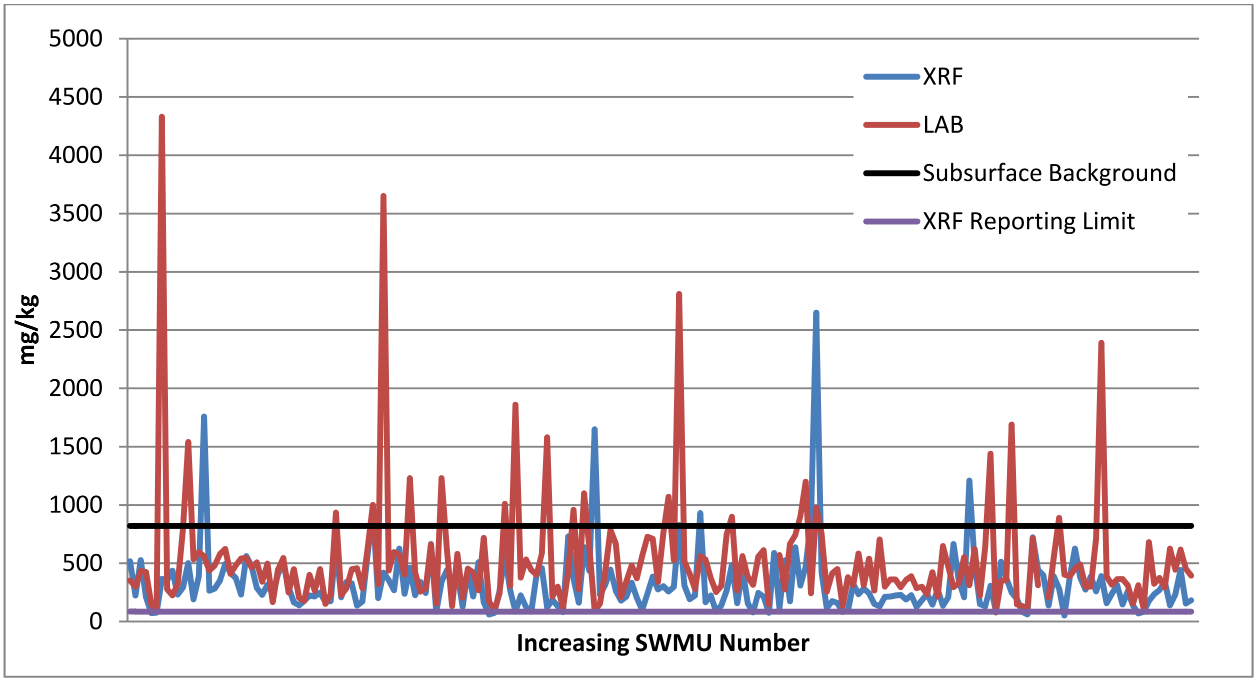
The Pearson correlation coefficient for subsurface manganese is 0.19.





Manganese—Subsurface (Continued)



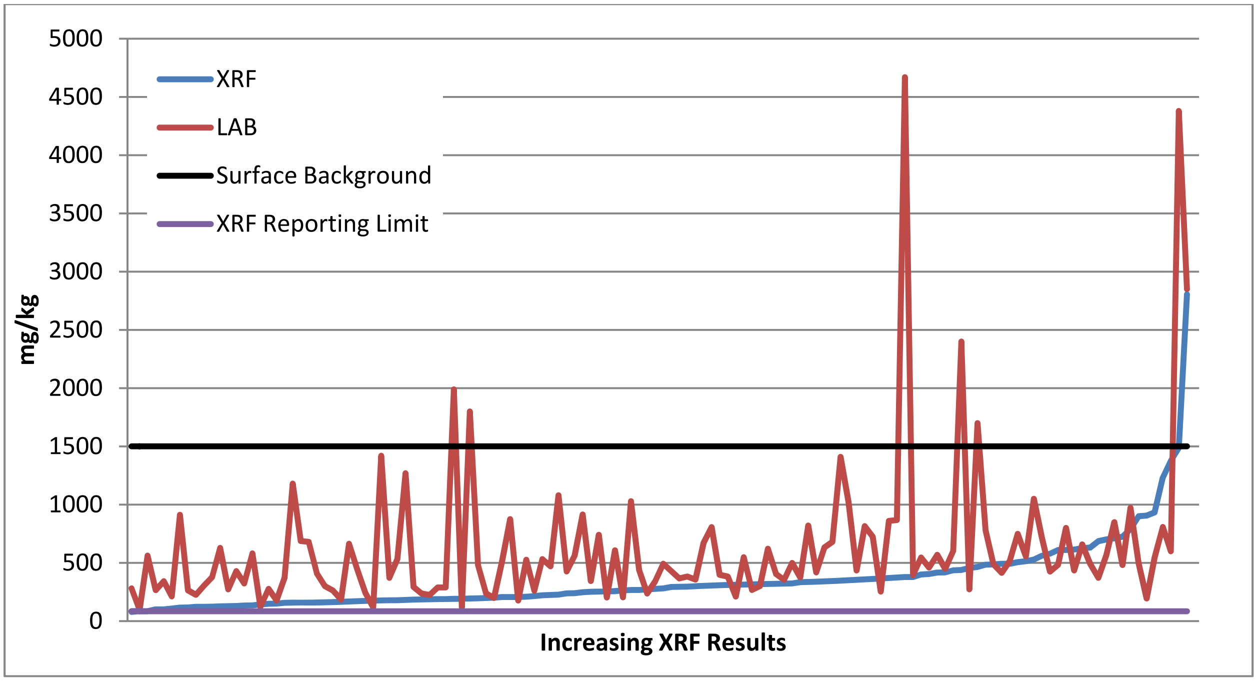


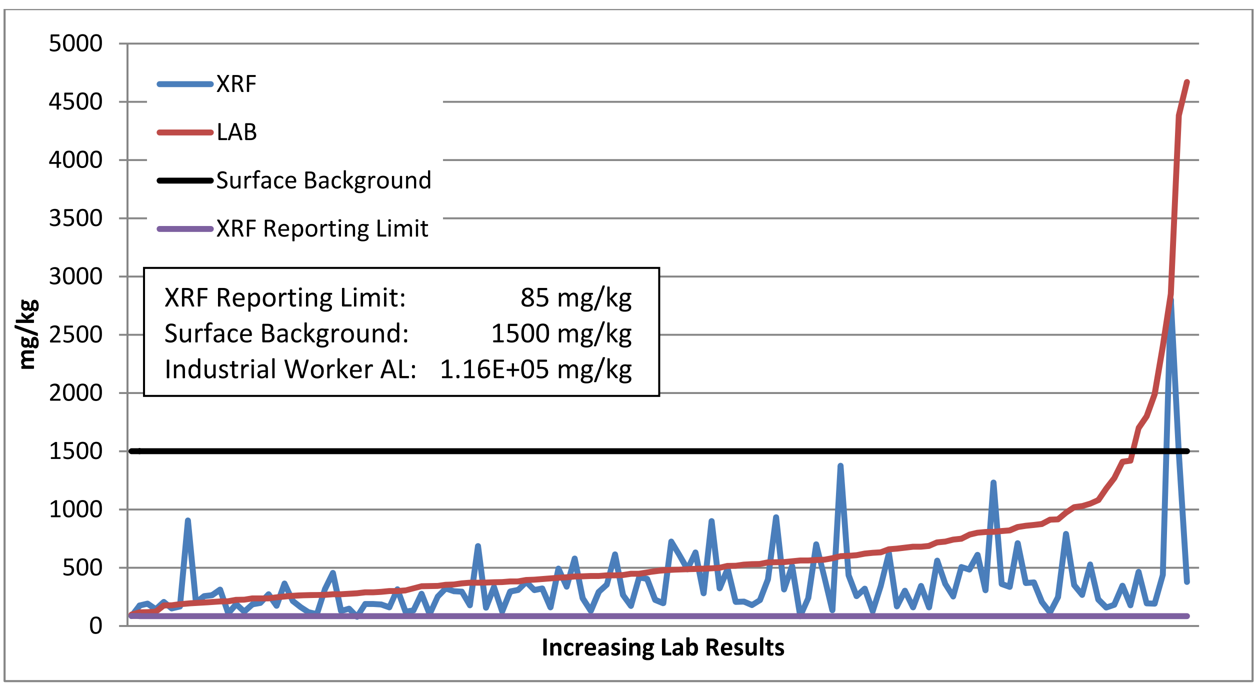
*The values 31,100 and 13,100 mg/kg (analyzed by the fixed-base laboratory in samples SOU194302SA004 and SOU221005ASA004) were removed as outliers from the graphs.

XRF Reporting Limit:	85 mg/kg
Subsurface Background:	820 mg/kg
Industrial Worker AL:	1.16E+05 mg/kg

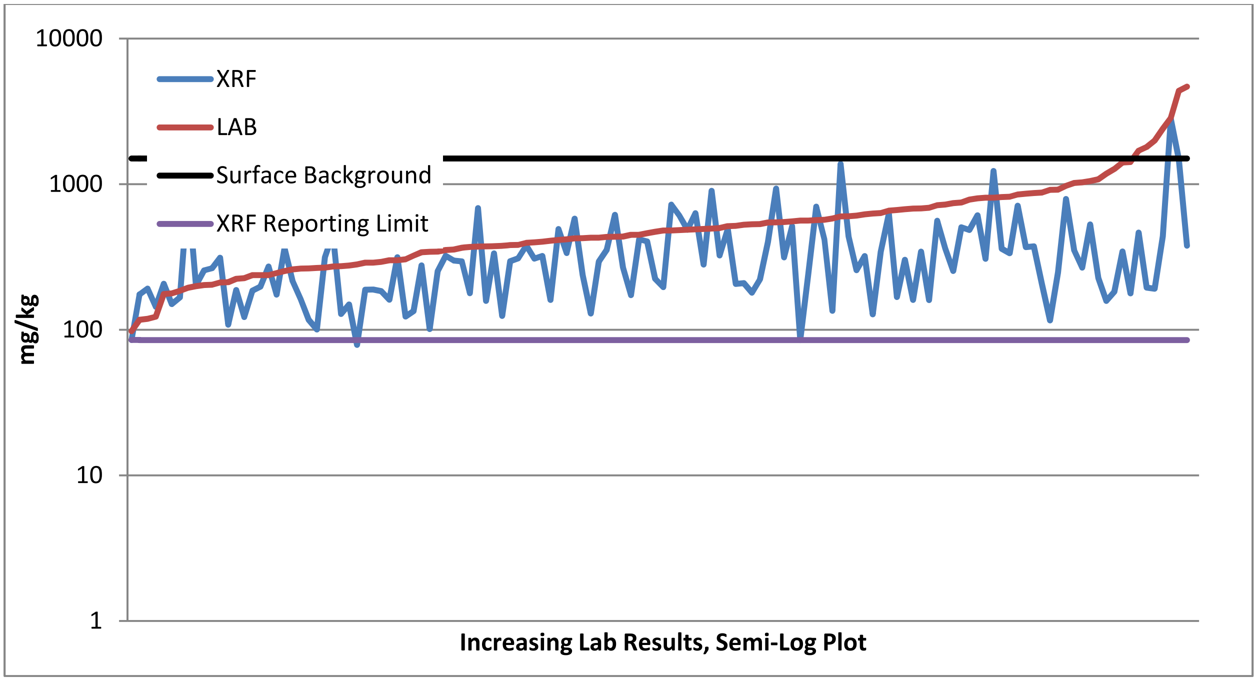
Manganese—Surface

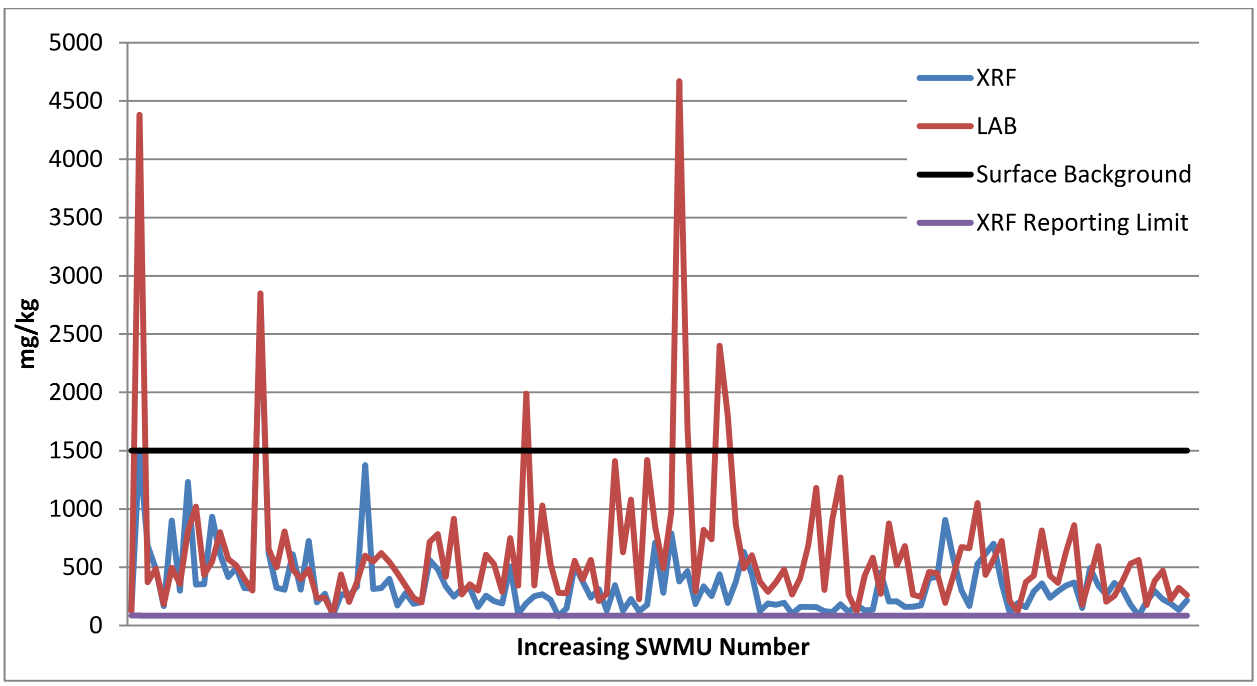
The Pearson correlation coefficient for surface manganese is 0.43.





Manganese—Surface (Continued)

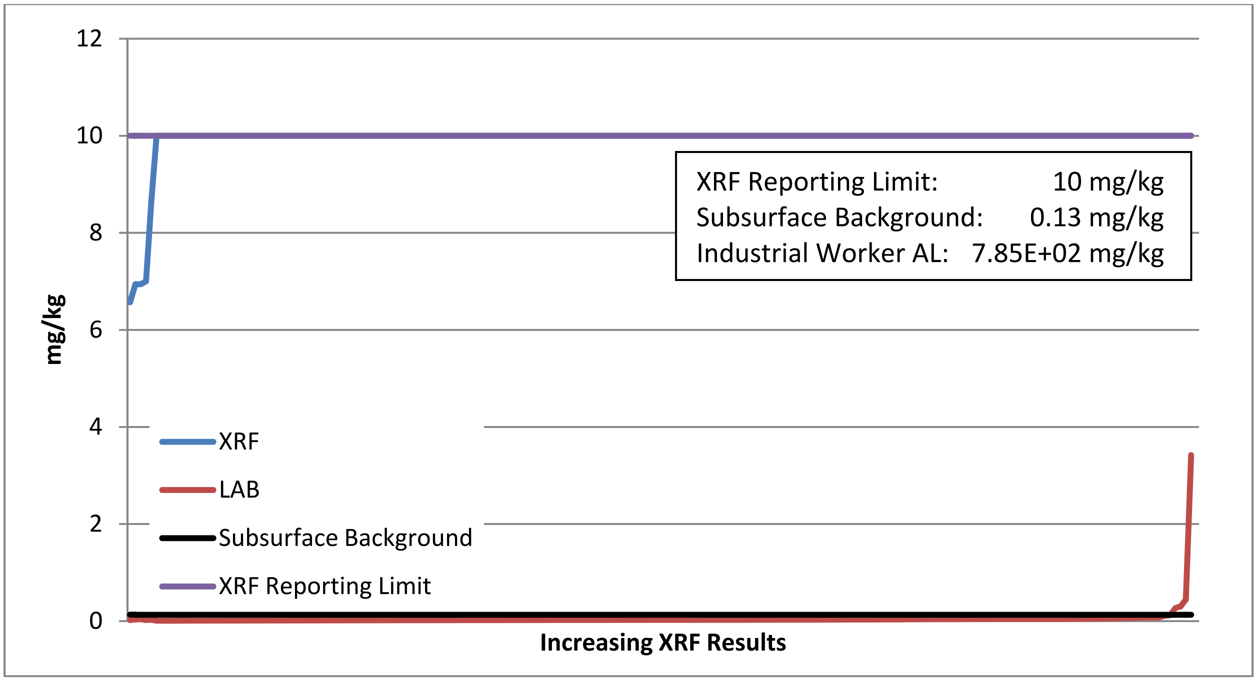


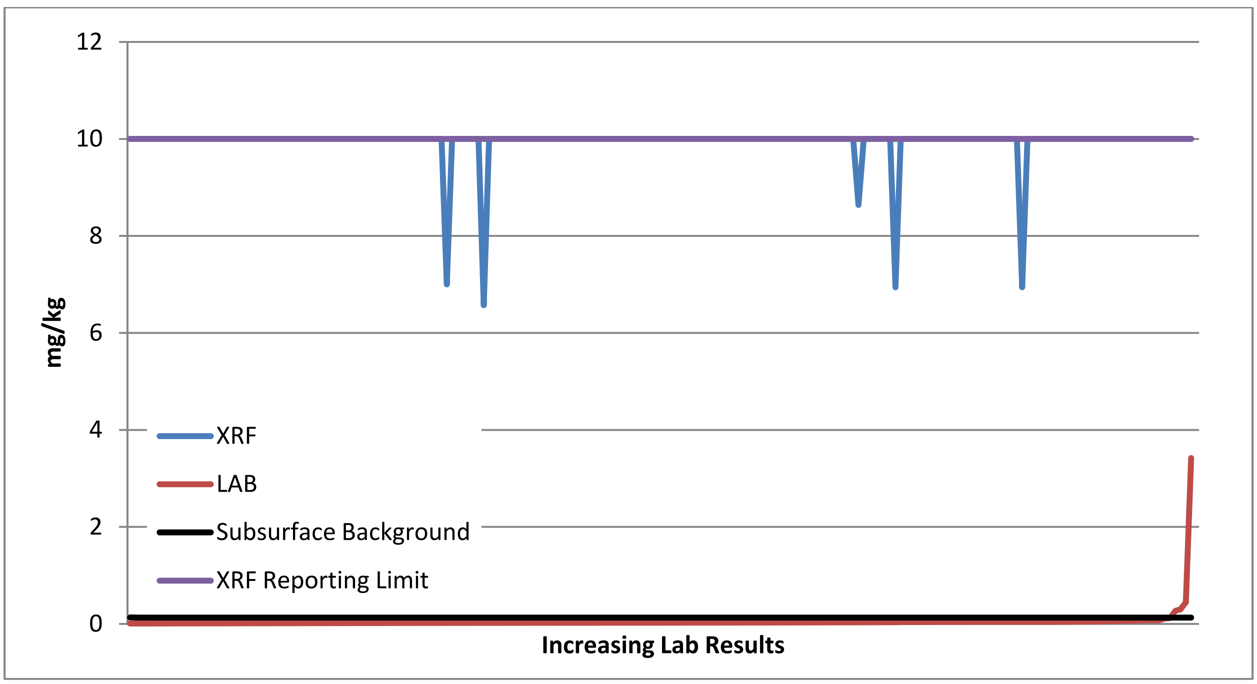


XRF Reporting Limit:	85 mg/kg
Surface Background:	1500 mg/kg
Industrial Worker AL:	1.16E+05 mg/kg

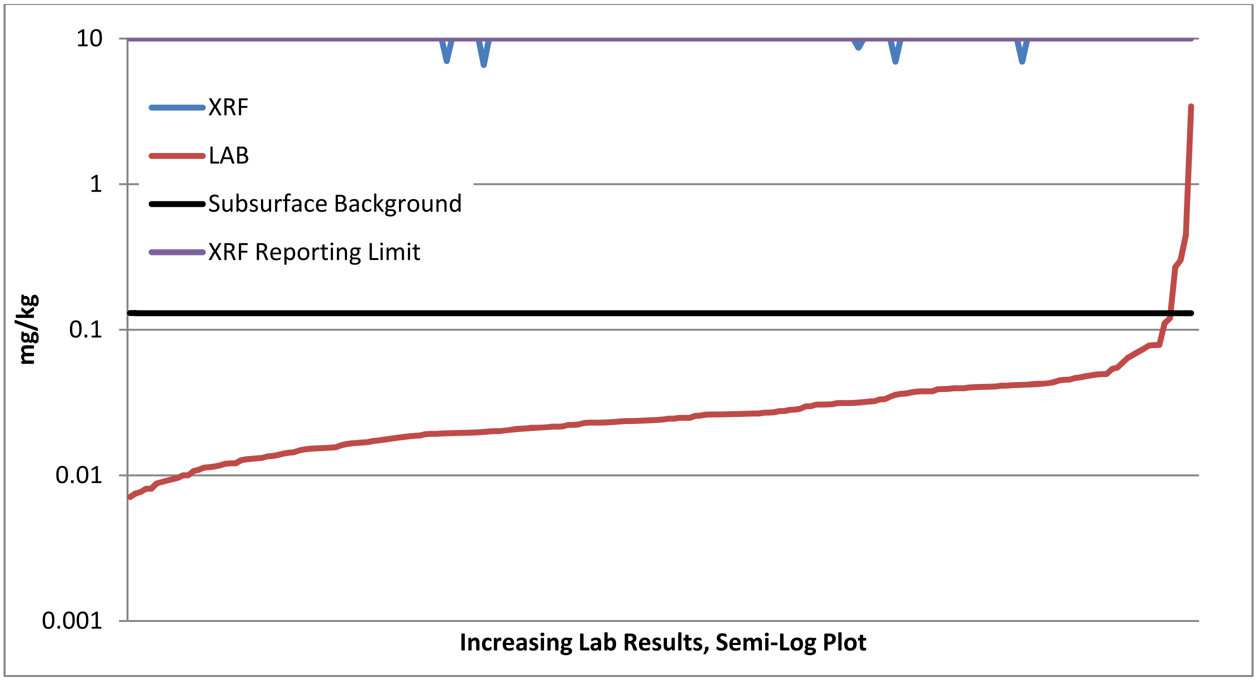
Mercury—Subsurface

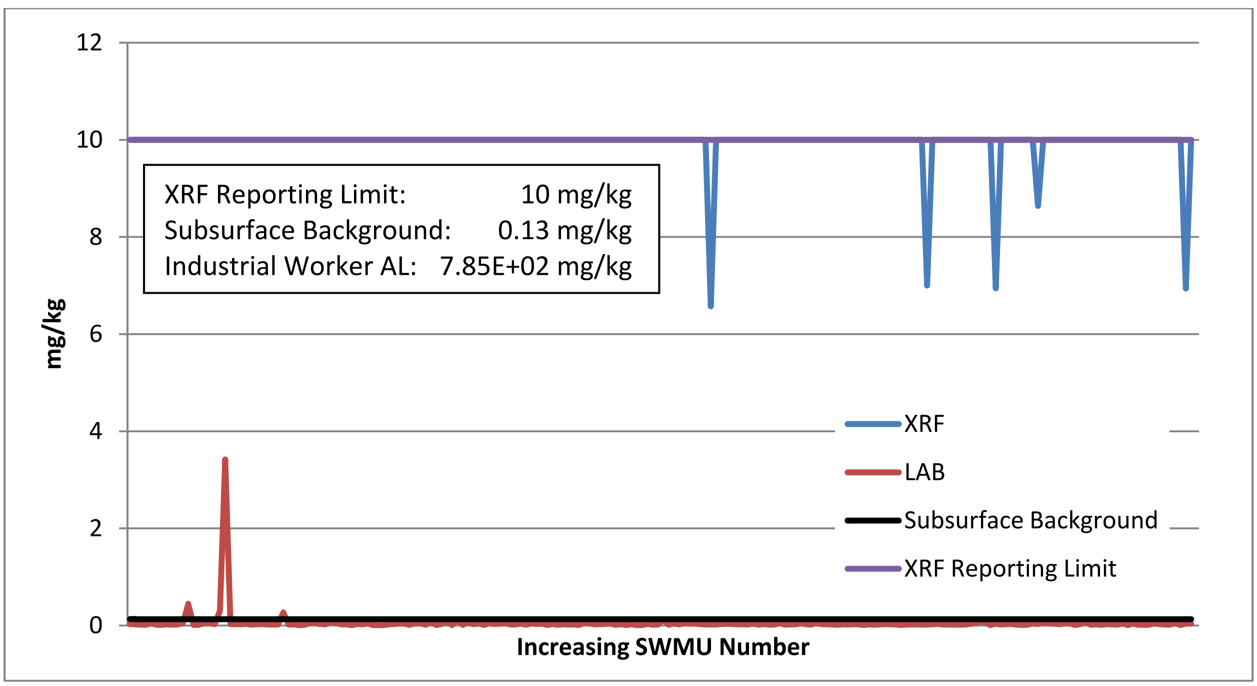
No results for subsurface mercury were detected above the reporting limit for the XRF. Since all XRF results are reported higher than the fixed-base laboratory results, the XRF screening results are acceptable for use in determining risk associated with mercury in subsurface soils. The uncertainty of overestimating risk should be acknowledged.





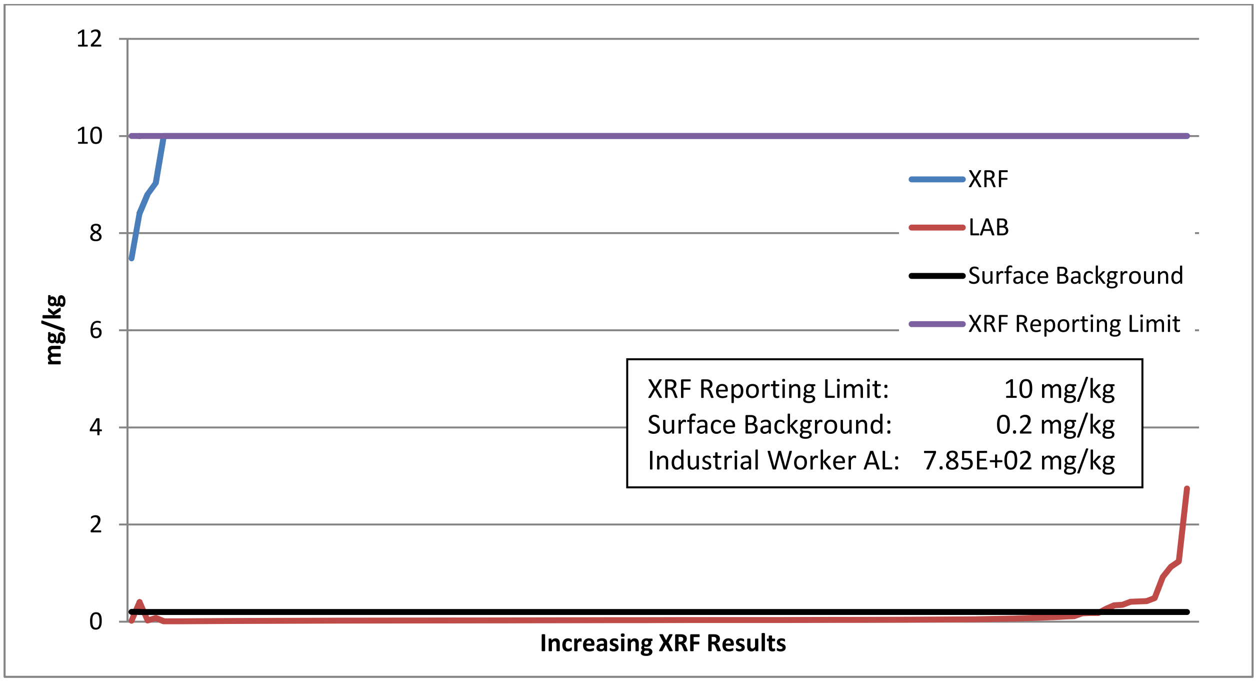
Mercury—Subsurface (Continued)

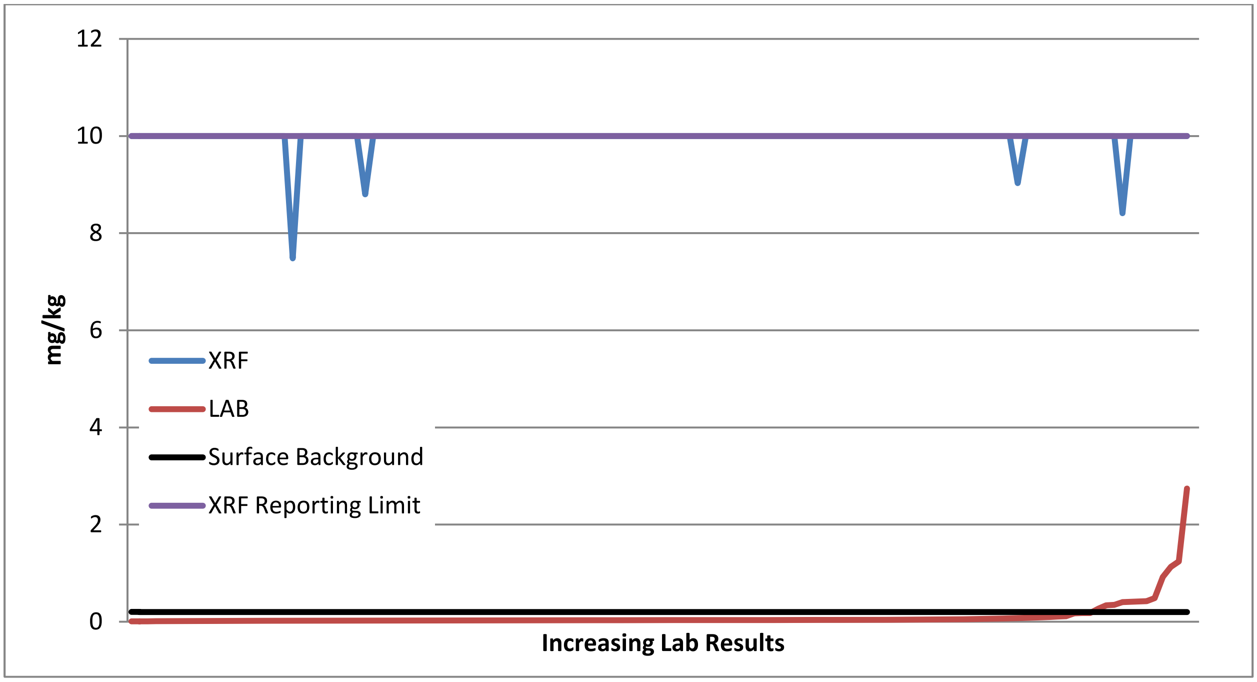




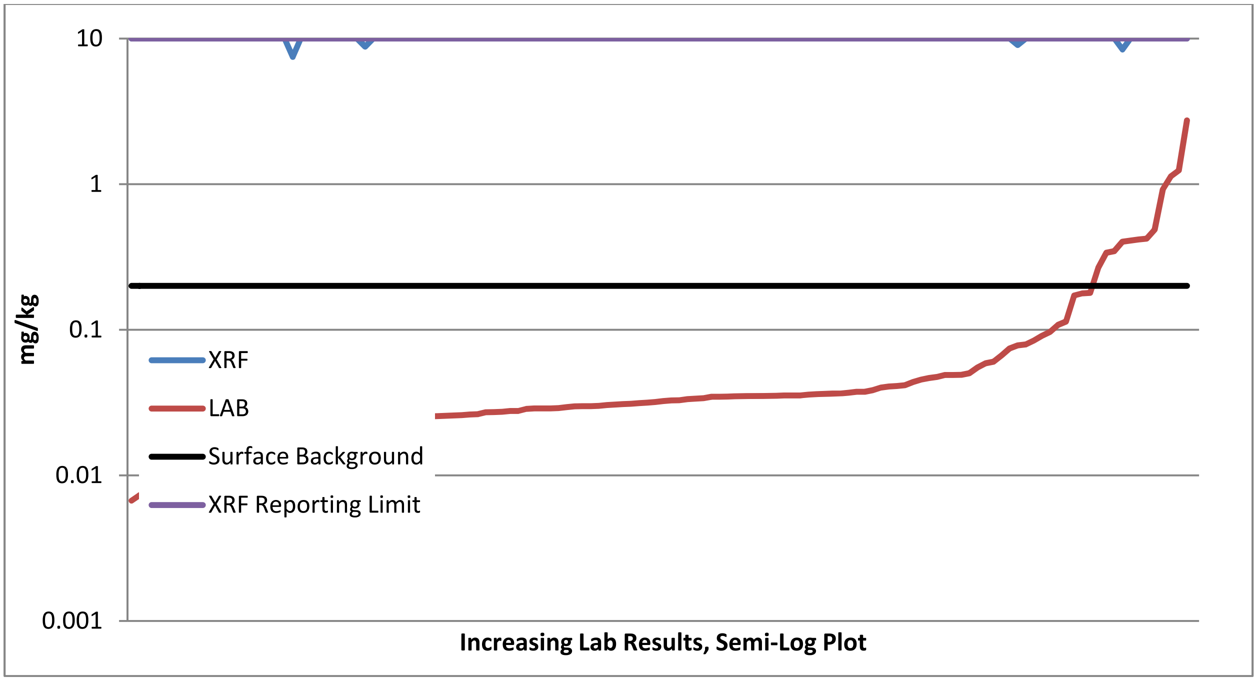
Mercury—Surface

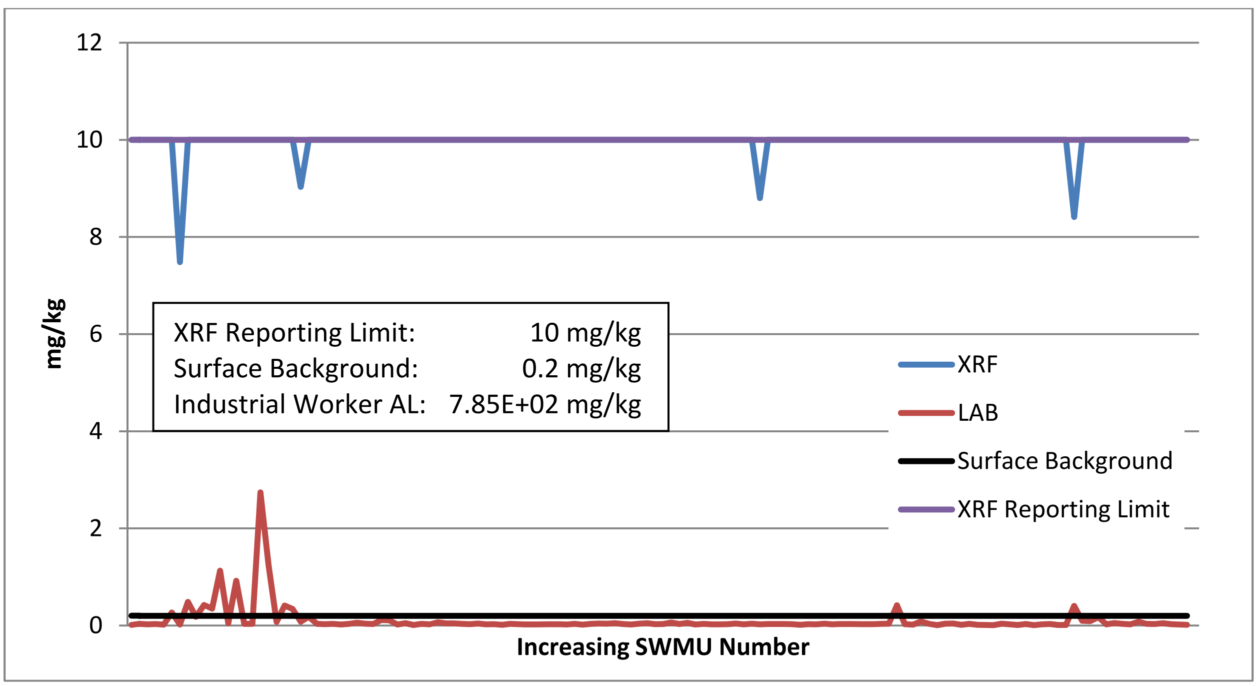
No results for surface mercury were detected above the reporting limit for the XRF. Since all XRF results are reported higher than the fixed-base laboratory results, the XRF screening results are acceptable for use in determining risk associated with mercury in surface soils. The uncertainty of overestimating risk should be acknowledged.





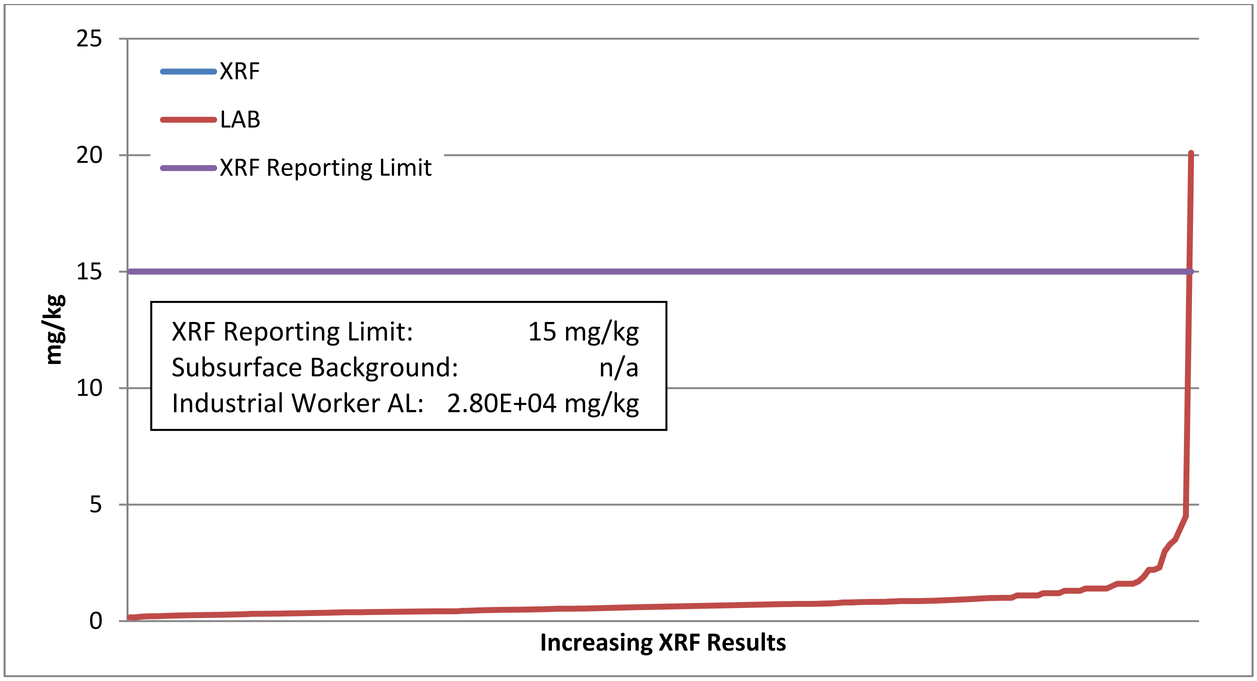
Mercury—Surface (Continued)

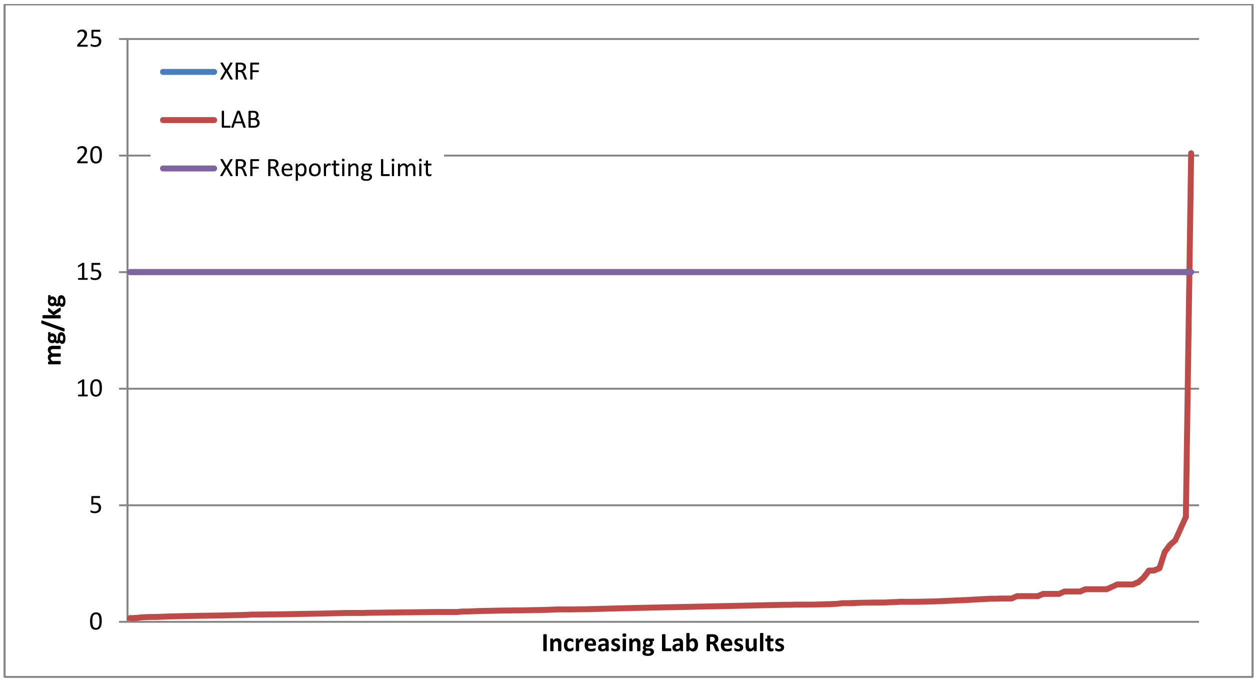




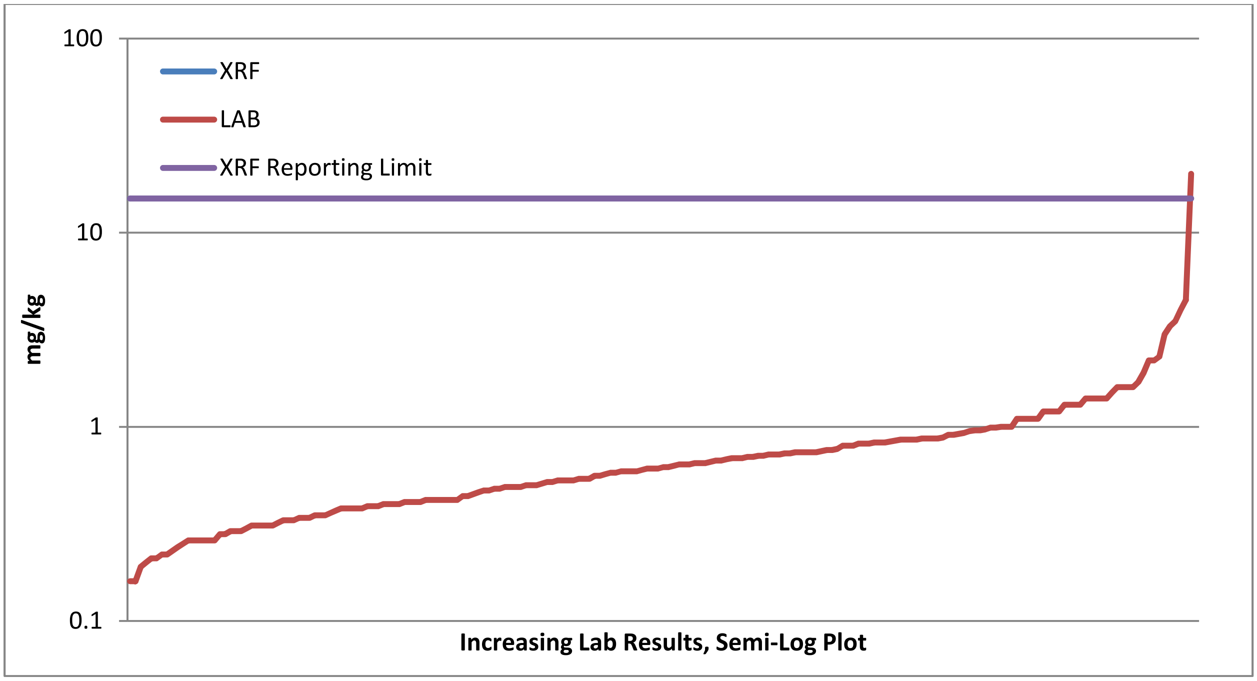
Molybdenum—Subsurface

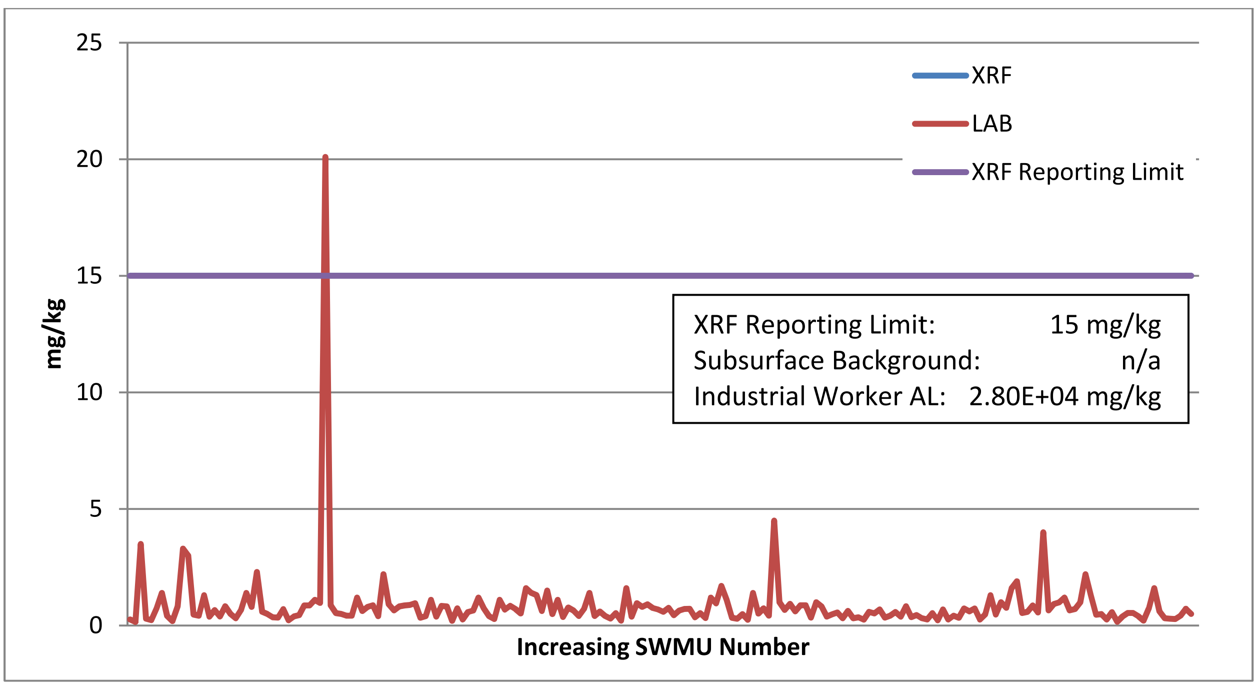
No results for subsurface molybdenum were detected above the reporting limit for the XRF. Since all XRF results are reported higher than the fixed-base laboratory results with the exception of one, the XRF screening results are acceptable for use in determining risk associated with molybdenum in subsurface soils.





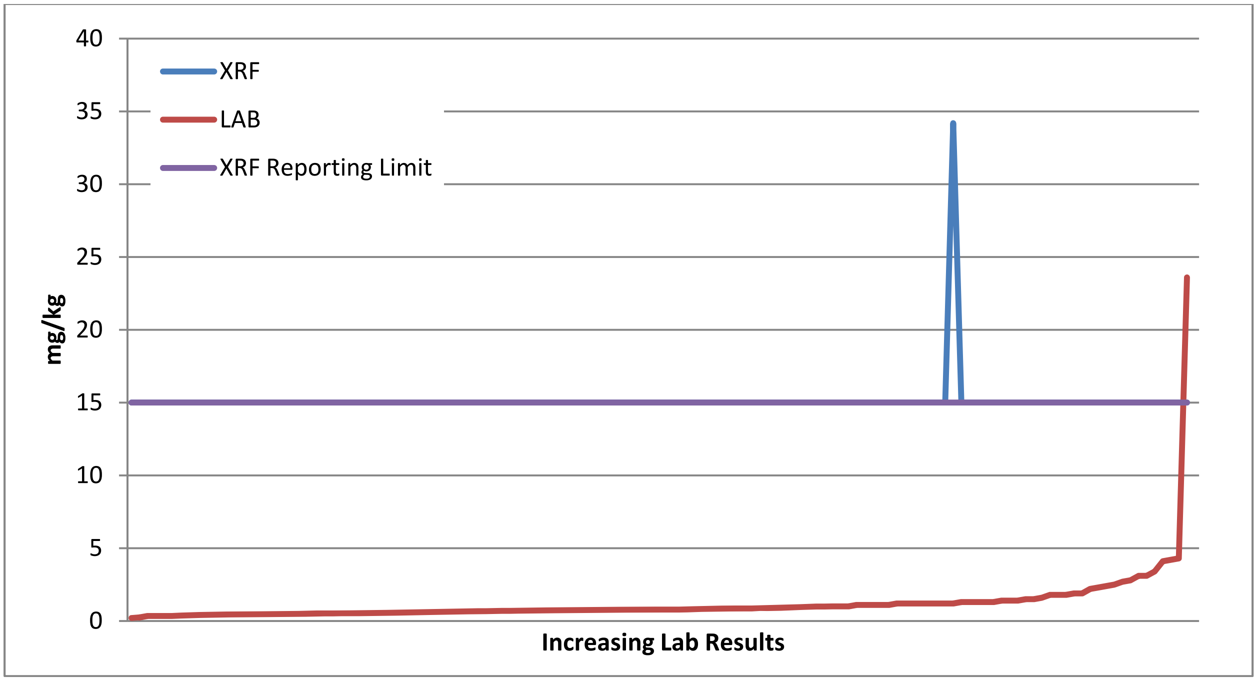
Molybdenum—Subsurface (Continued)



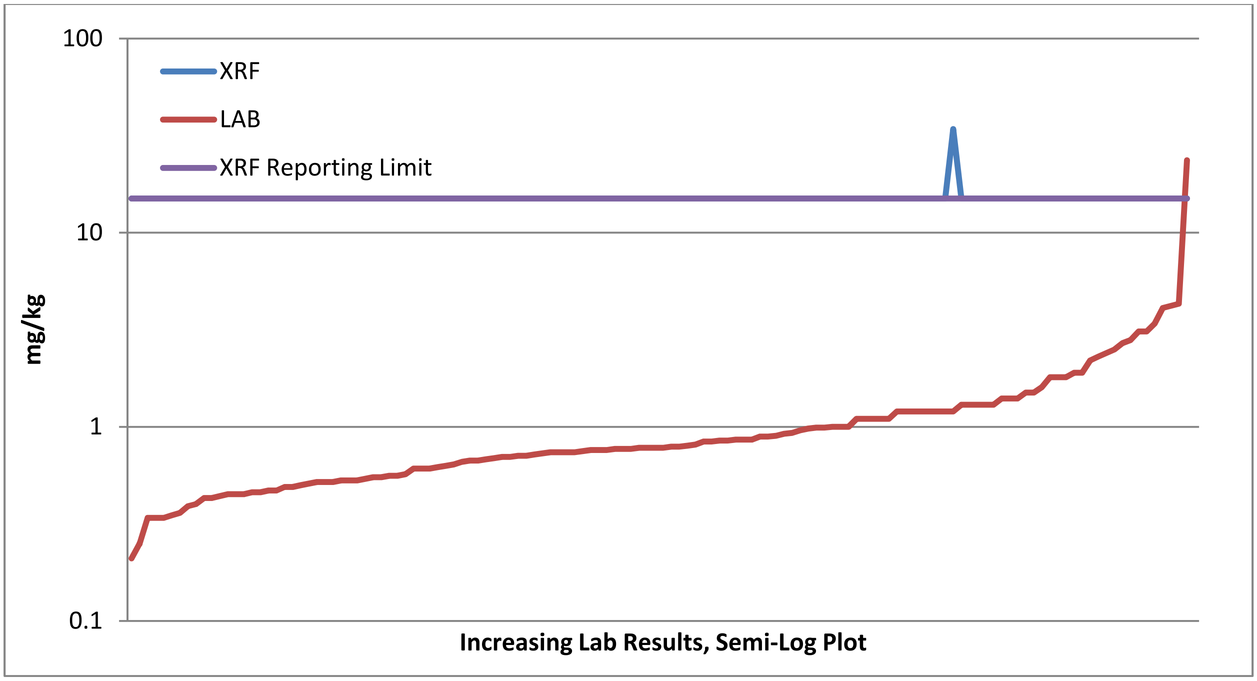


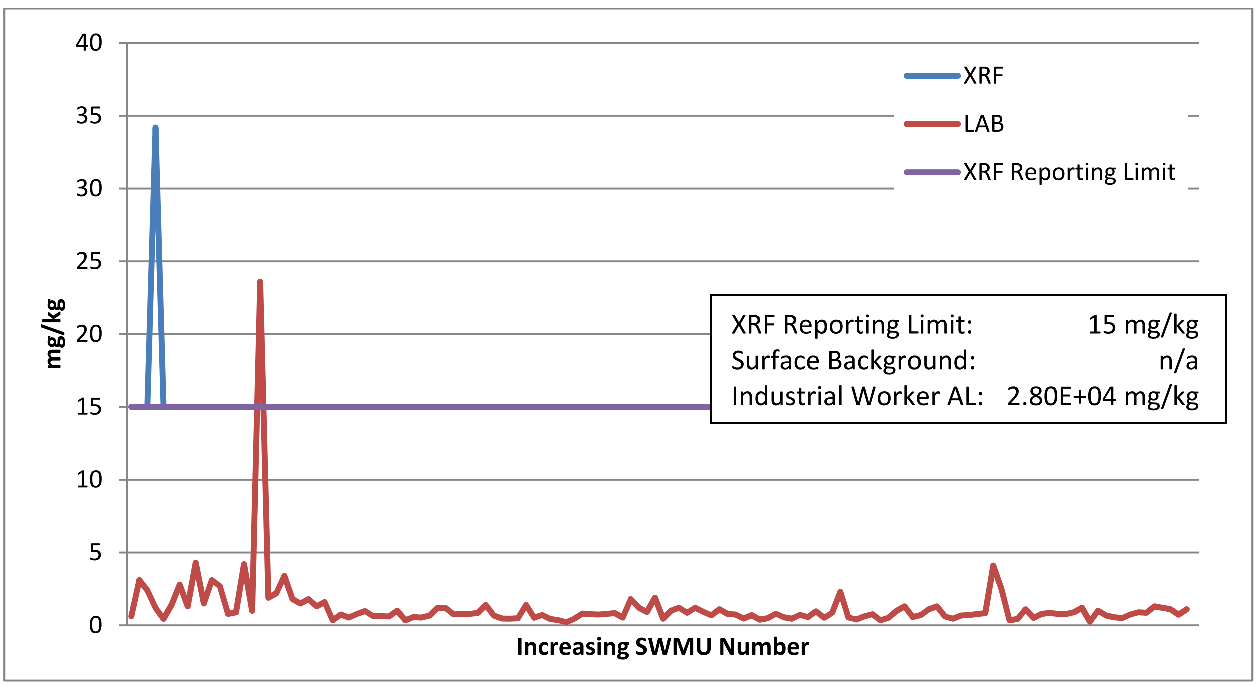
Molybdenum—Surface

Only one result for surface molybdenum was detected above the reporting limit for the XRF. Since all XRF results are reported higher than the fixed-base laboratory results with the exception of one, the XRF screening results are acceptable for use in determining risk associated with molybdenum in surface soils.



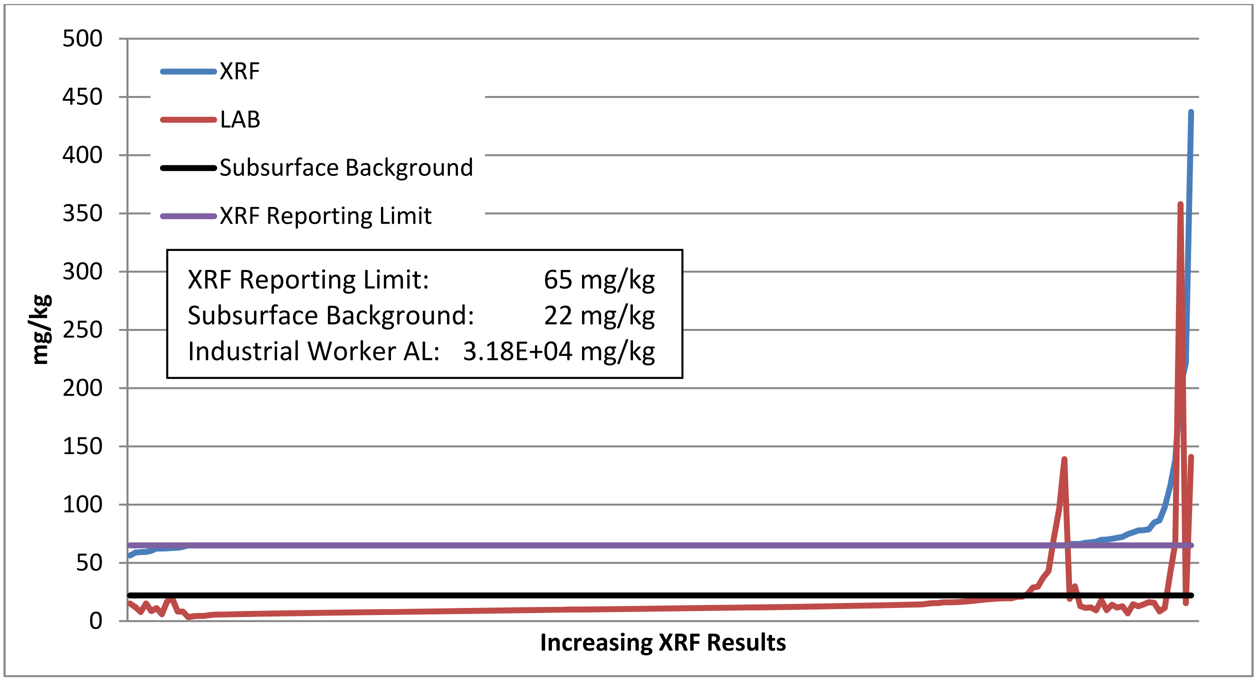
Molybdenum—Surface (Continued)

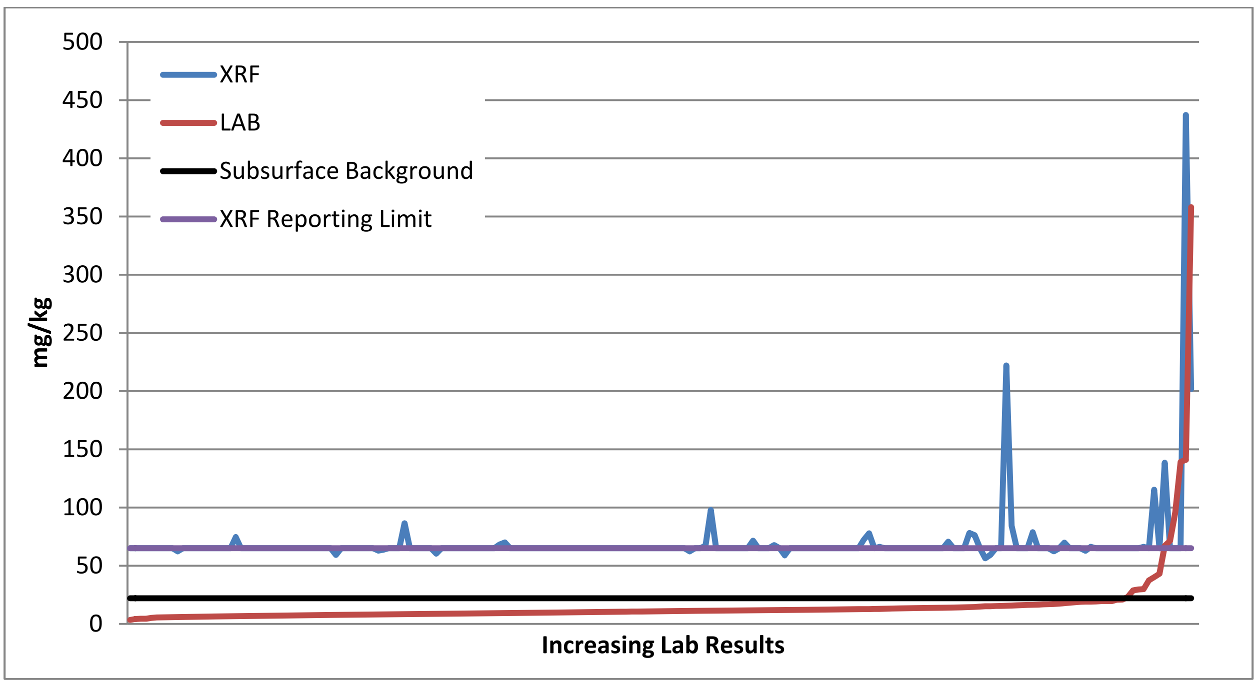




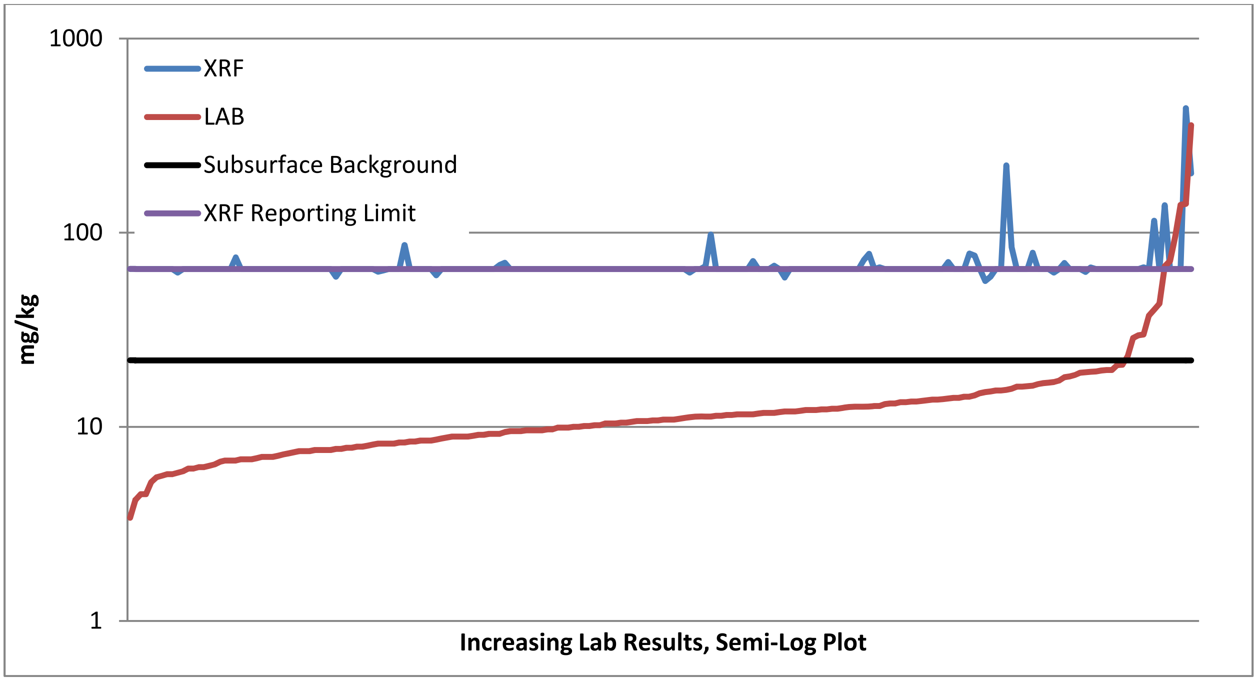
Nickel—Subsurface

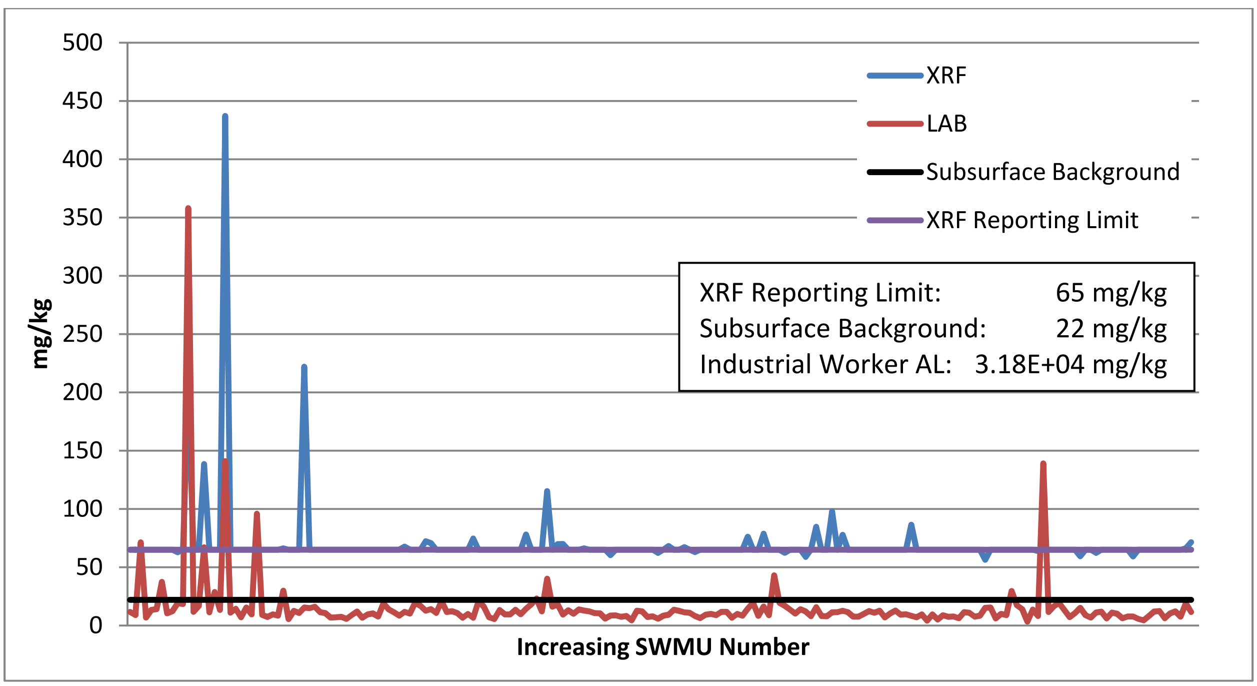
Results for subsurface nickel correlate moderately well between the XRF and the fixed-base laboratory; however, since the majority of XRF results are reported higher than the fixed-base laboratory results, the XRF screening results are acceptable for use in determining risk associated with nickel in subsurface soils.





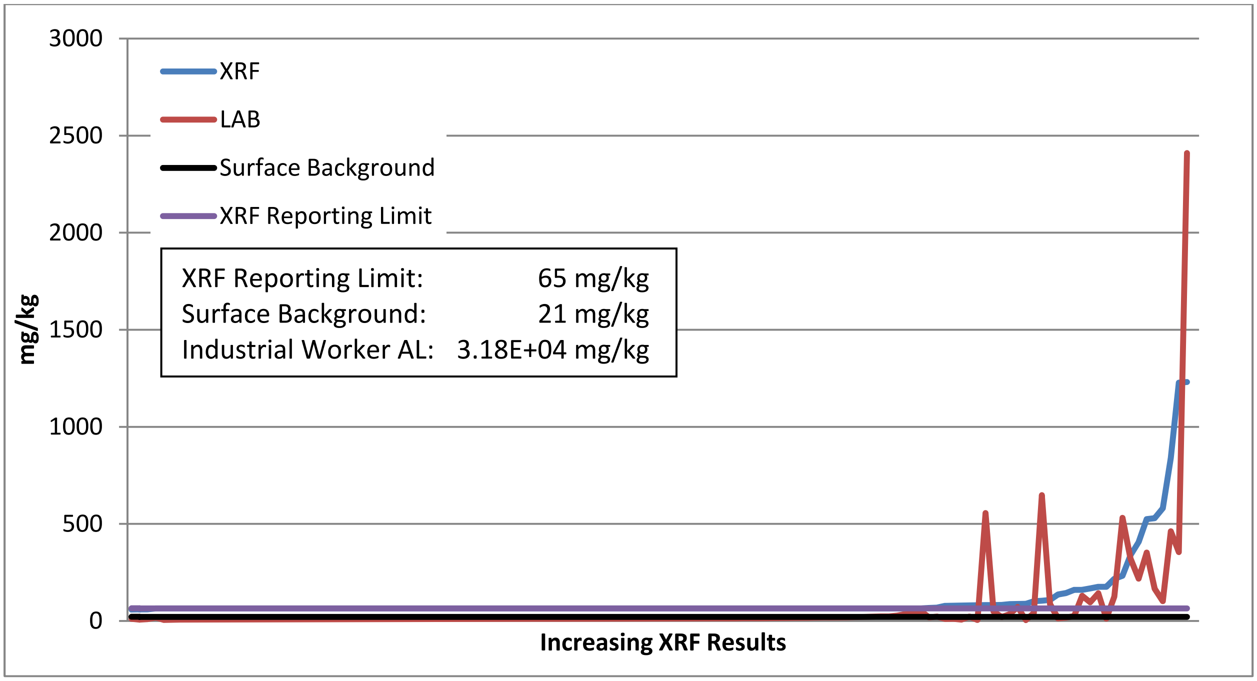
Nickel—Subsurface (Continued)

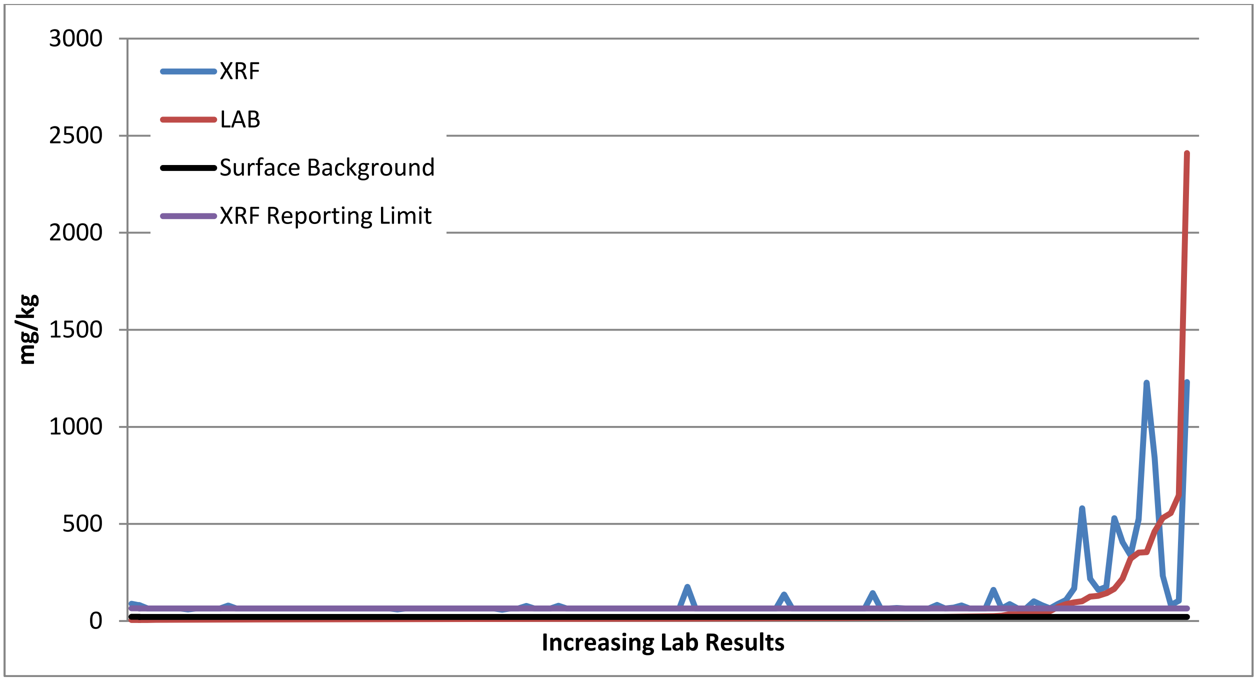




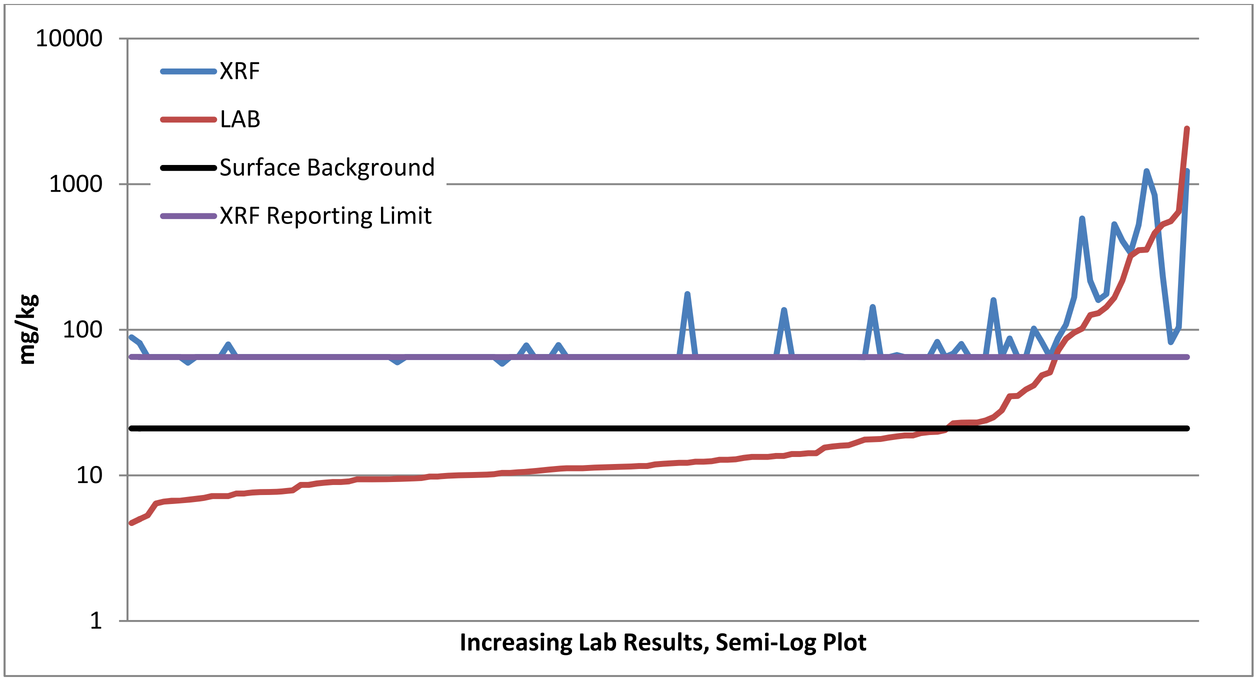
Nickel—Surface

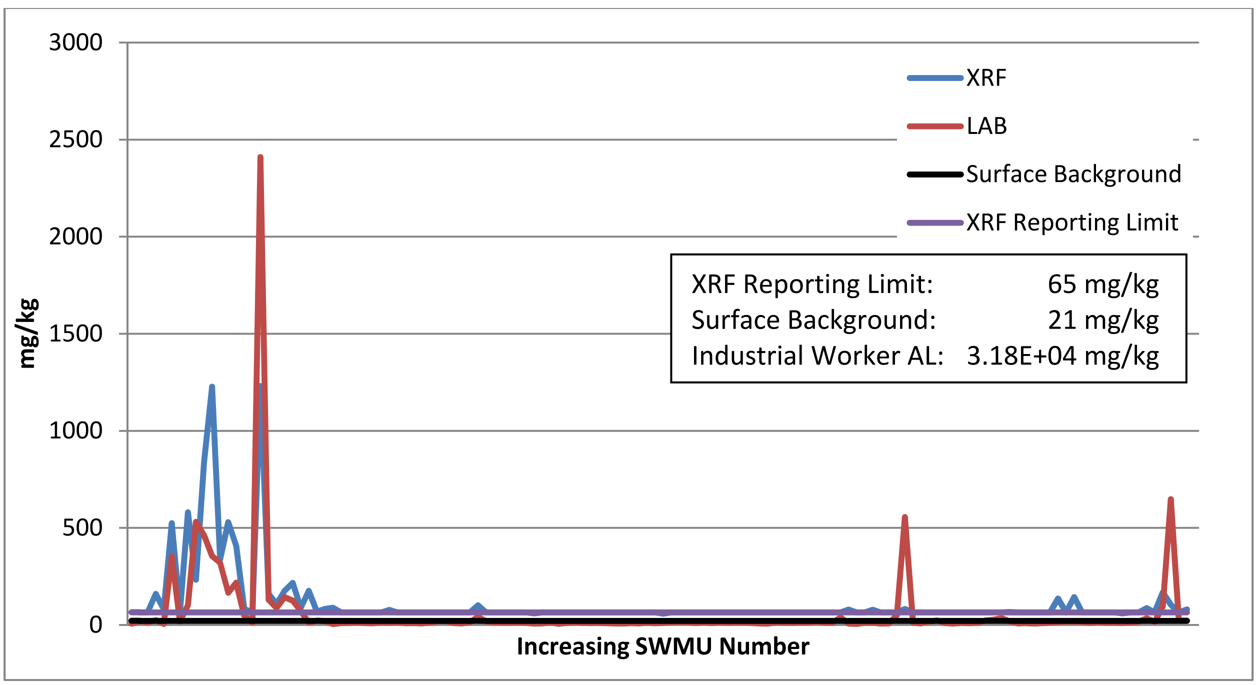
Results for surface nickel correlate moderately well between the XRF and the fixed-base laboratory; however, since the majority of XRF results are reported higher than the fixed-base laboratory results, the XRF screening results are acceptable for use in determining risk associated with nickel in surface soils.





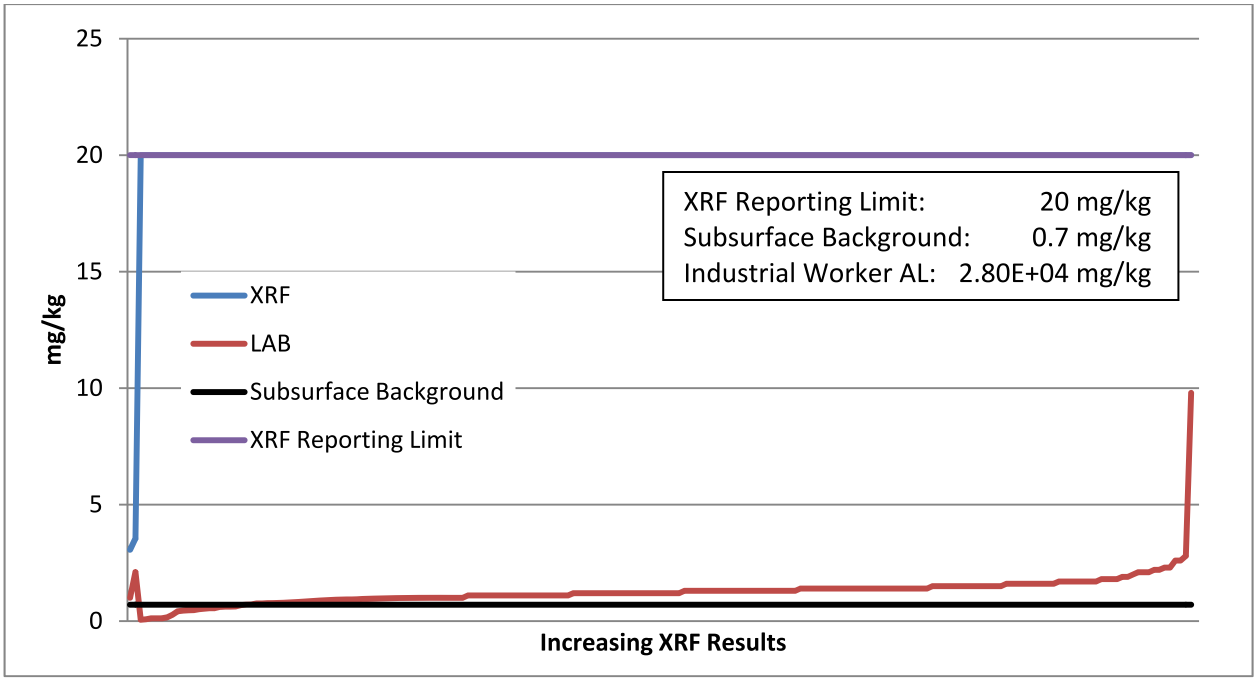
Nickel—Surface (Continued)

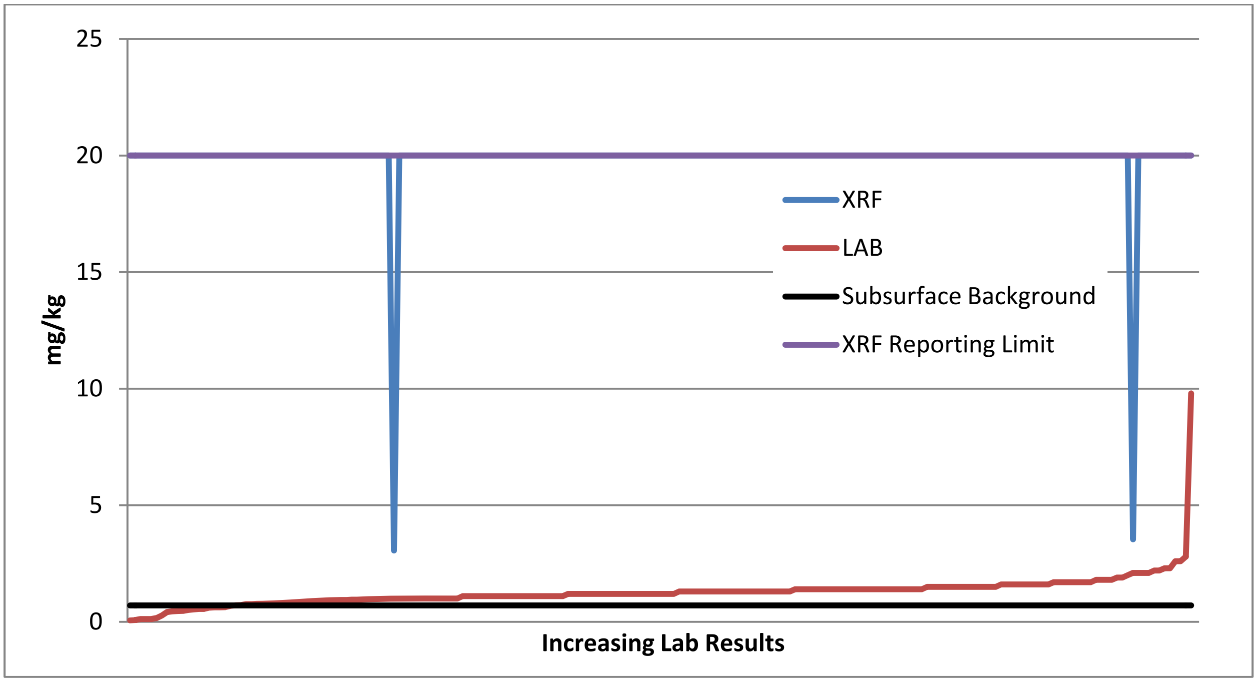




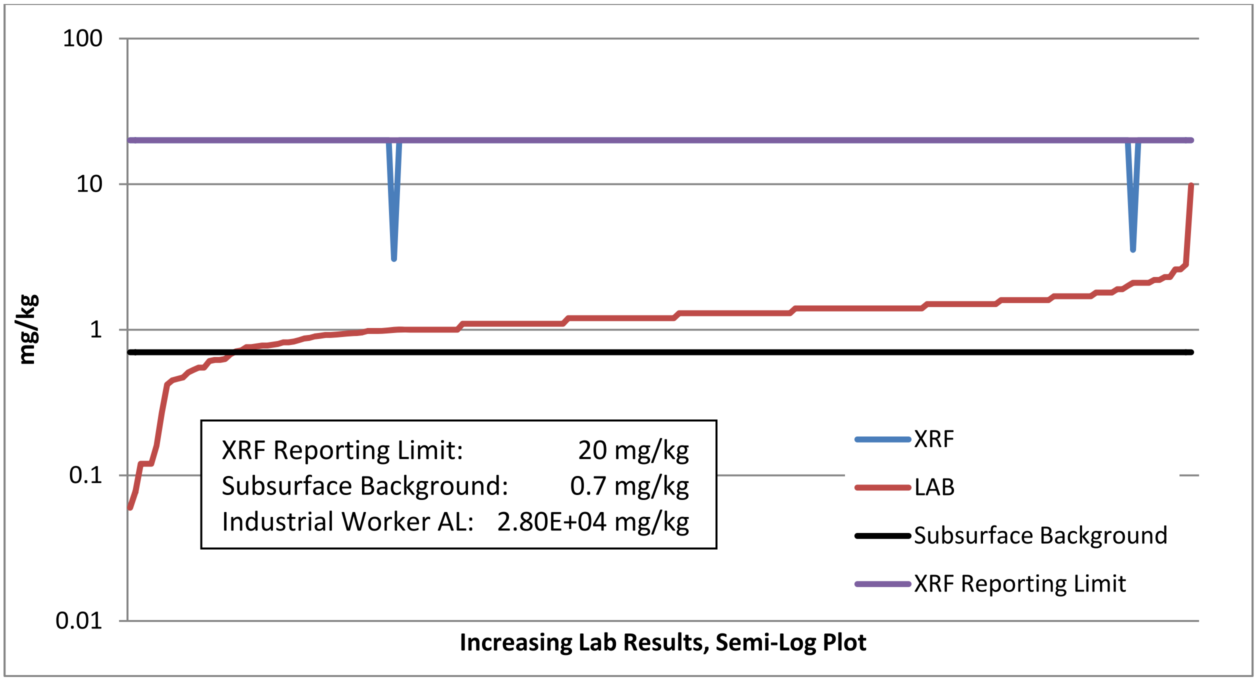
Selenium—Subsurface

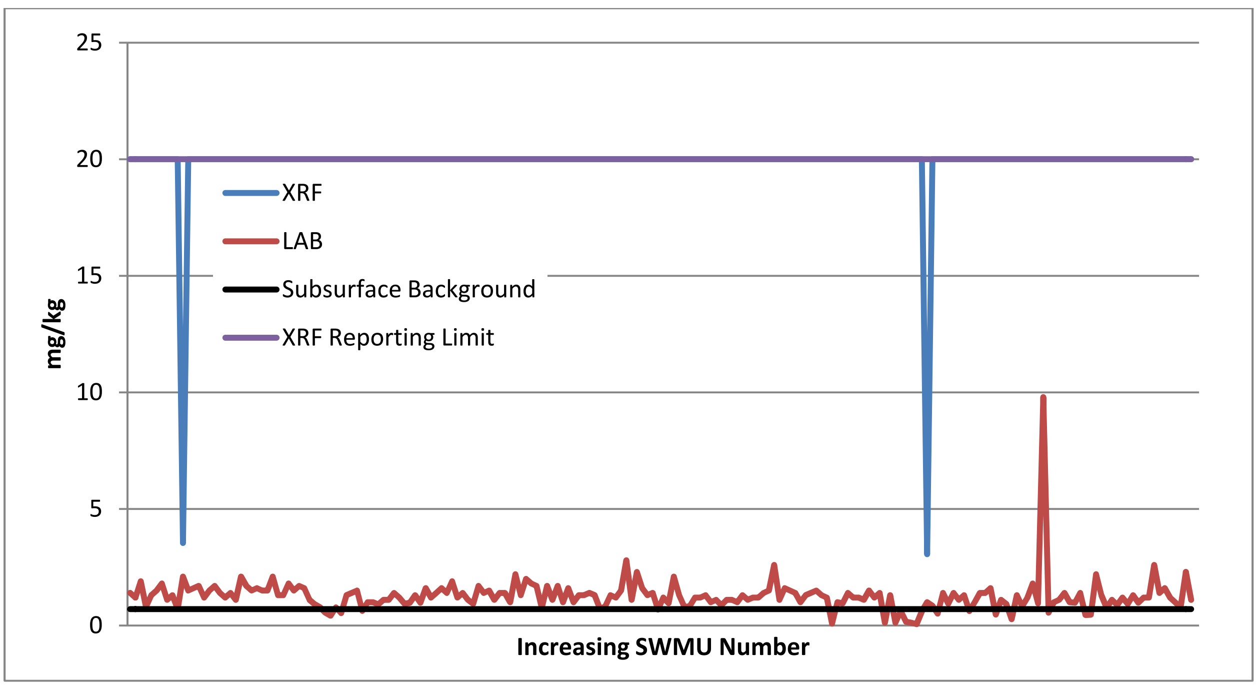
No results for subsurface selenium analyzed by the XRF are detected above the reporting limit; therefore a correlation could not be established; however, all fixed-base laboratory results are detected at levels lower than the XRF screening results. Use of the XRF screening results are acceptable for use in determining risk associated with selenium in subsurface soils.





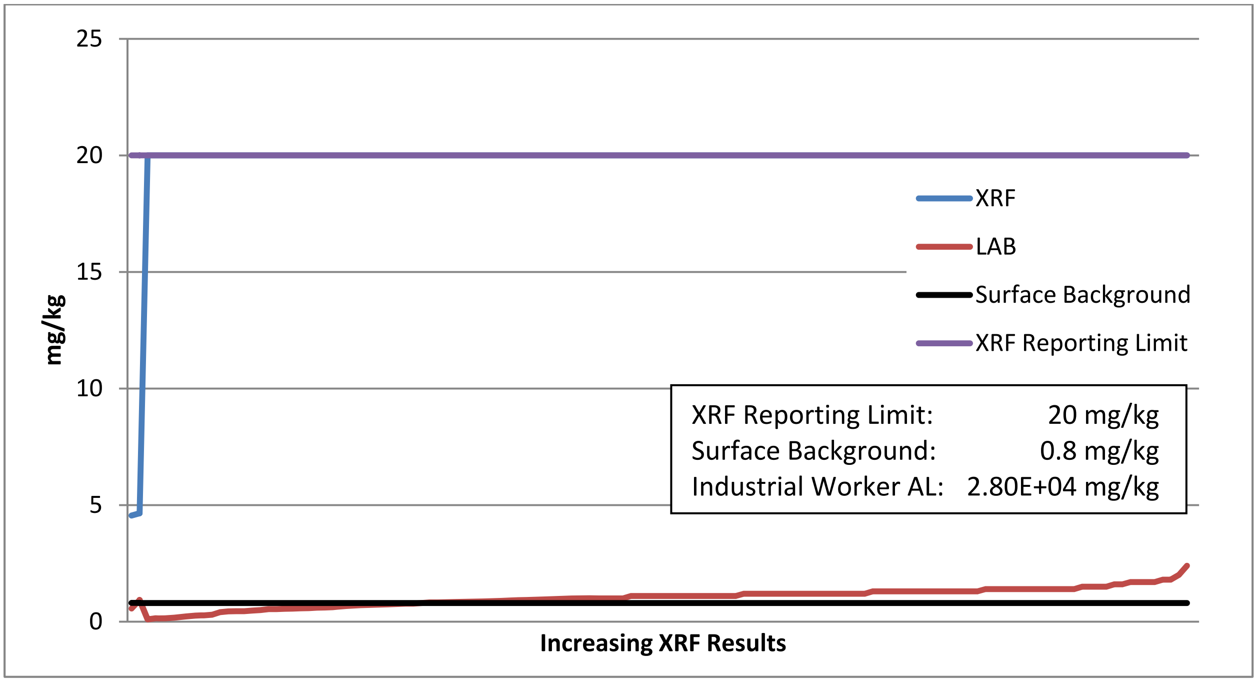
Selenium—Subsurface (Continued)

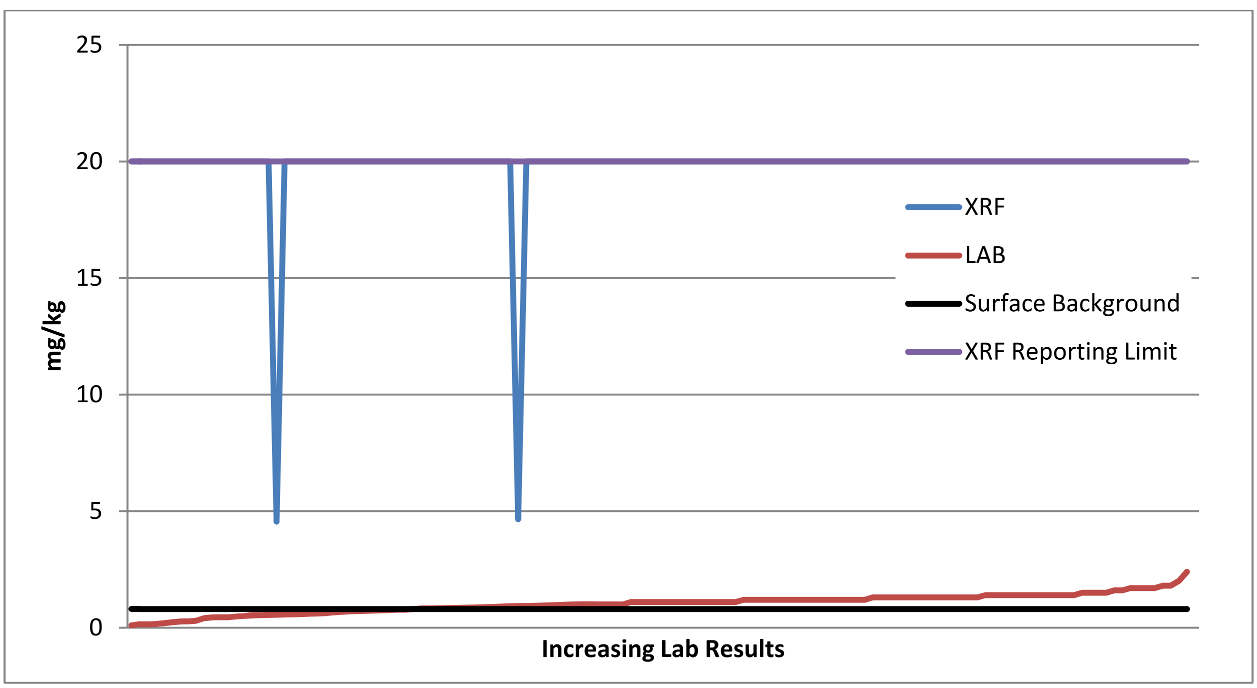




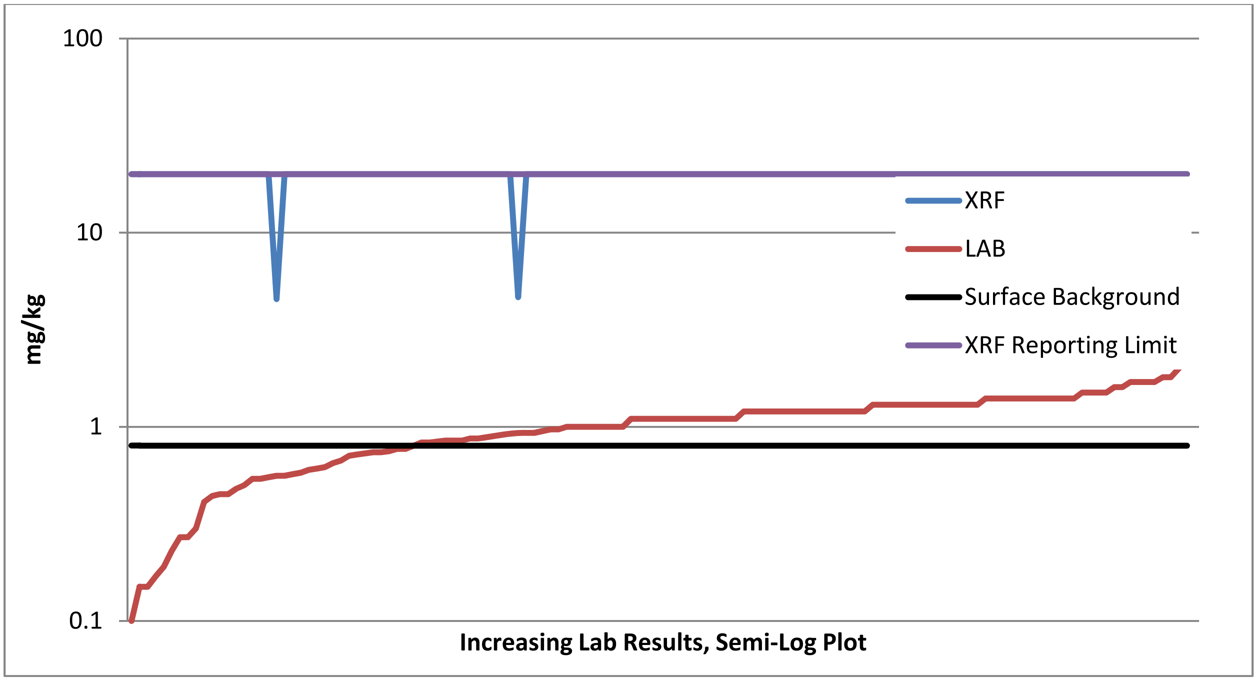
Selenium—Surface

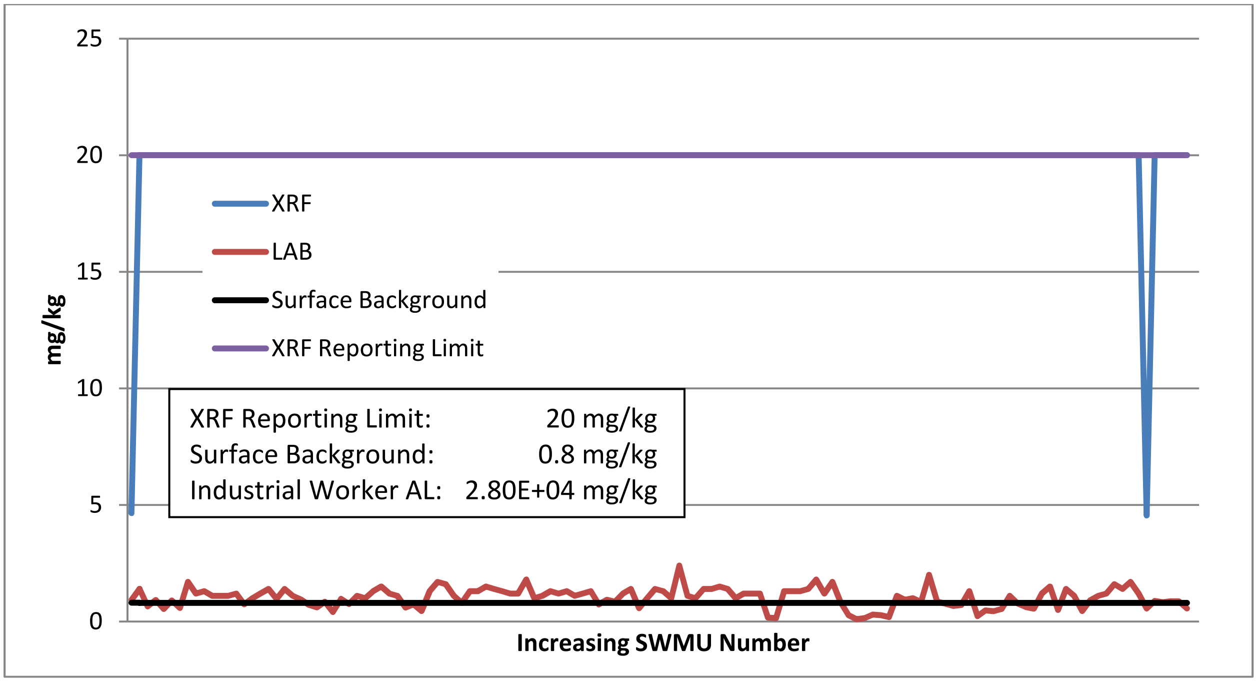
No results for surface selenium analyzed by the XRF are detected above the reporting limit; therefore a correlation could not be established. However, all fixed-base laboratory results are detected at levels lower than the XRF screening results. Use of the XRF screening results are acceptable for use in determining risk associated with selenium in surface soils.





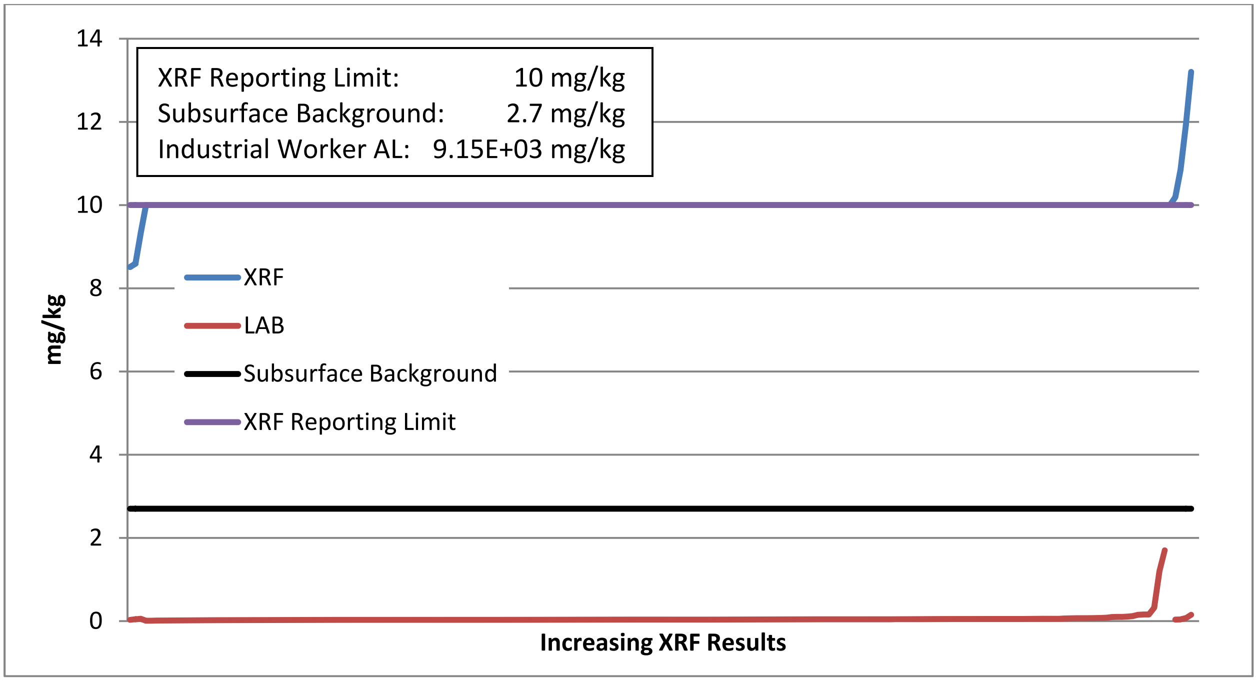
Selenium—Surface (Continued)

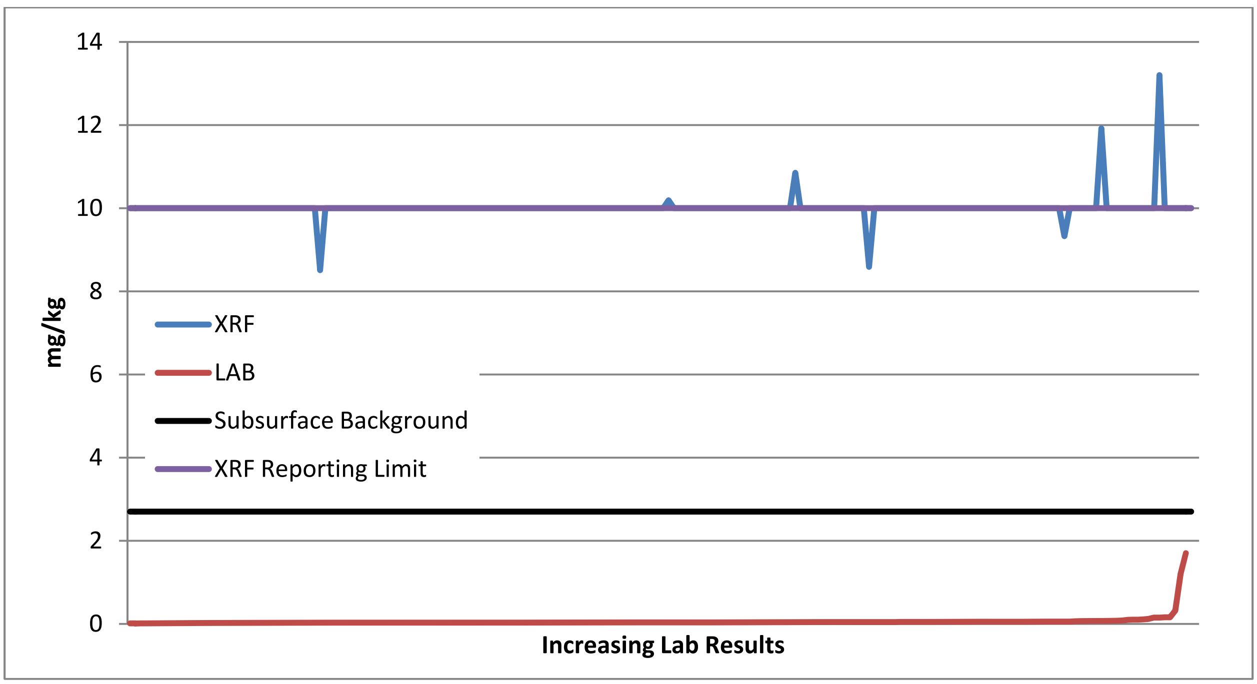




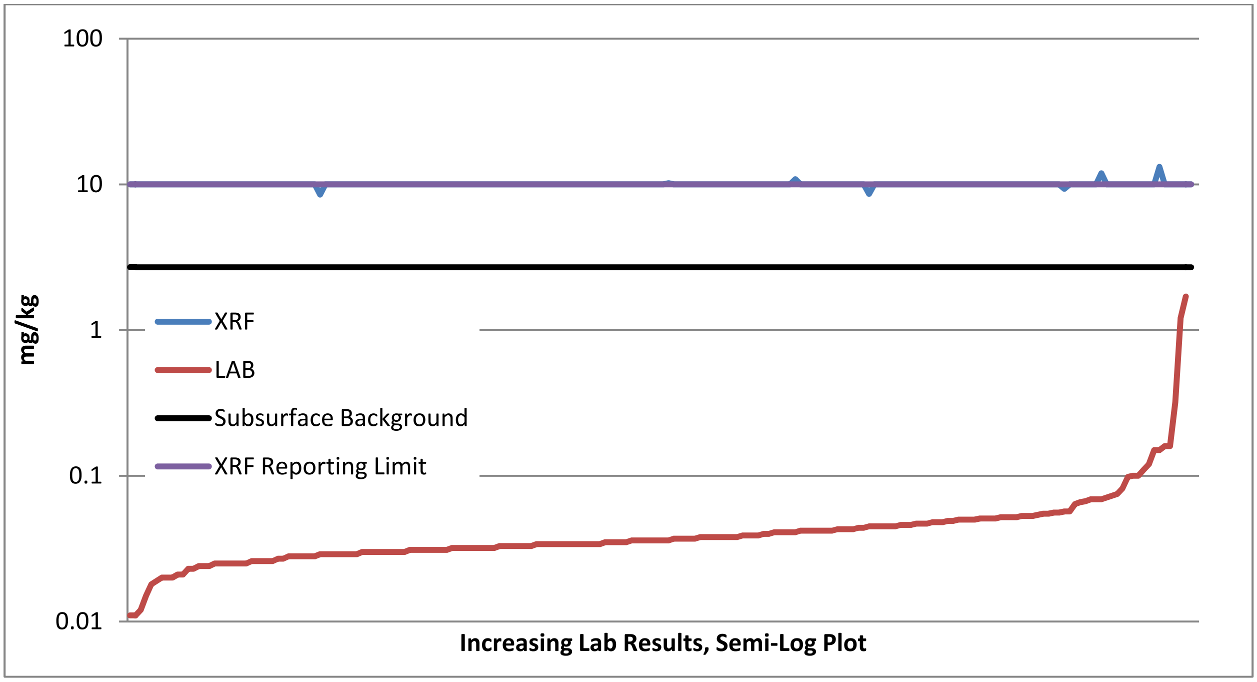
Silver—Subsurface

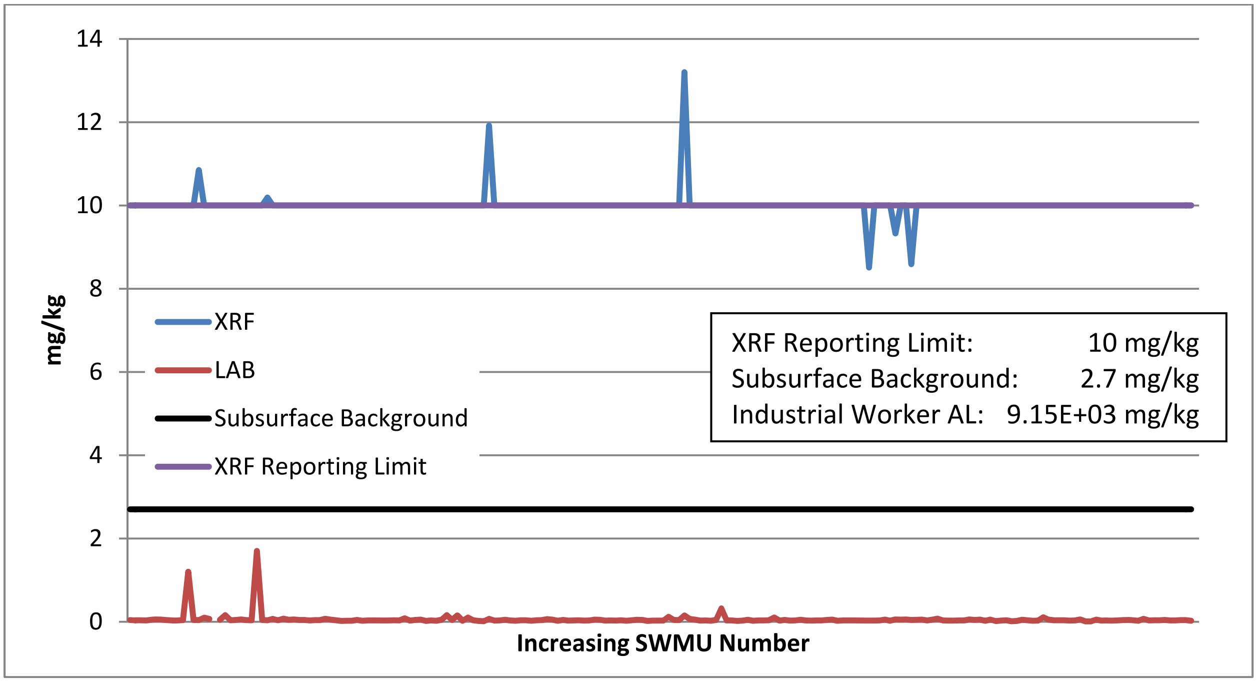
Results for subsurface silver do not correlate very well between the XRF and the fixed-base laboratory. The XRF screening results are acceptable for use in determining risk associated with silver in subsurface soils. Since the XRF results are consistently reported higher than the fixed-base laboratory data, the uncertainty of overestimating risk should be acknowledged.





Silver—Subsurface (Continued)

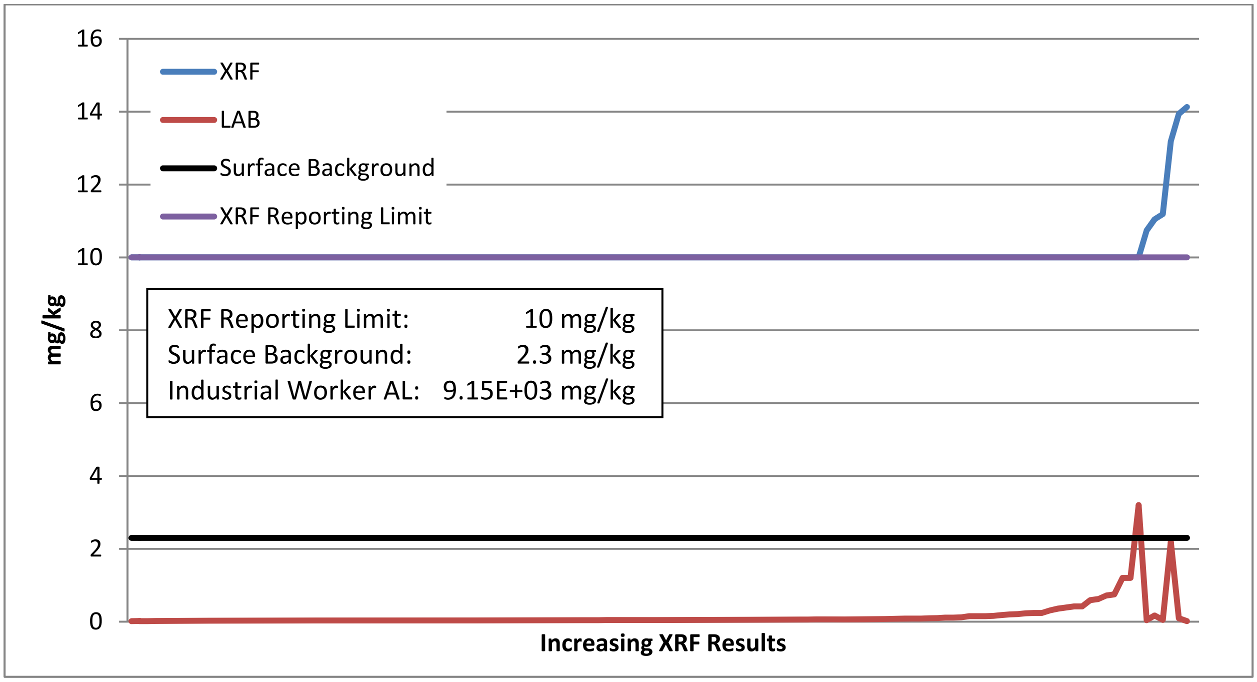


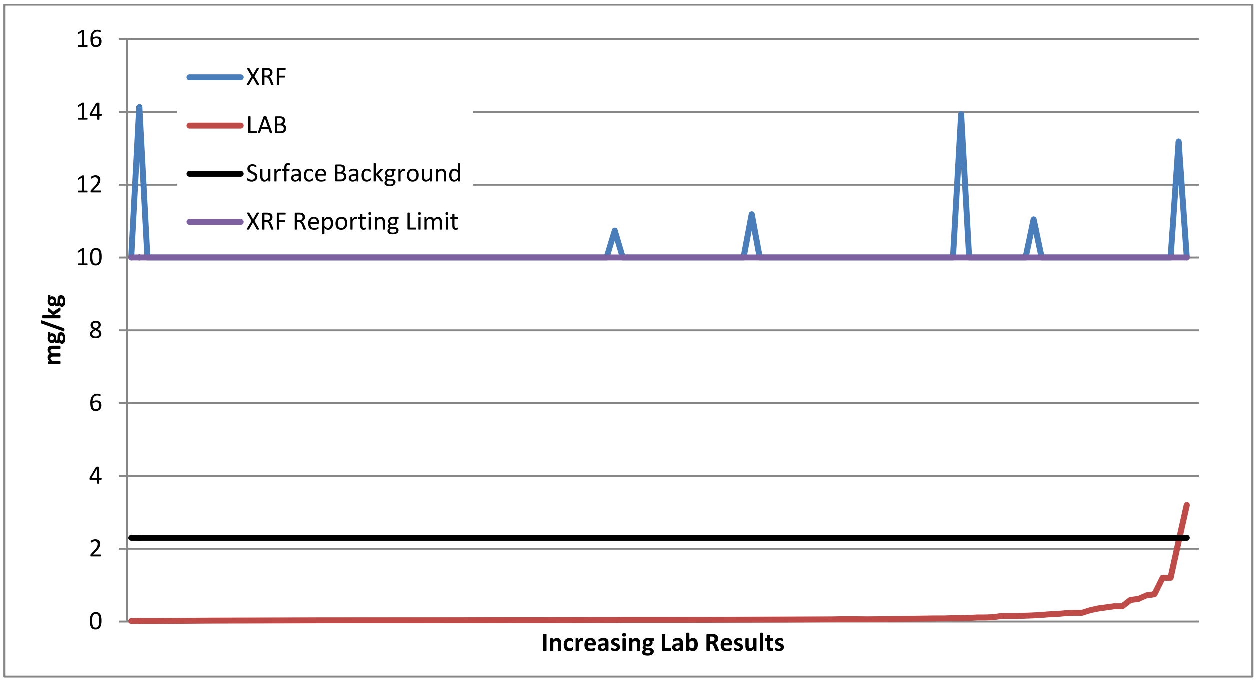


*The value 22.2 mg/kg (analyzed by the fixed-base laboratory in sample SOU014085SA004) was removed as an outlier from the graphs.

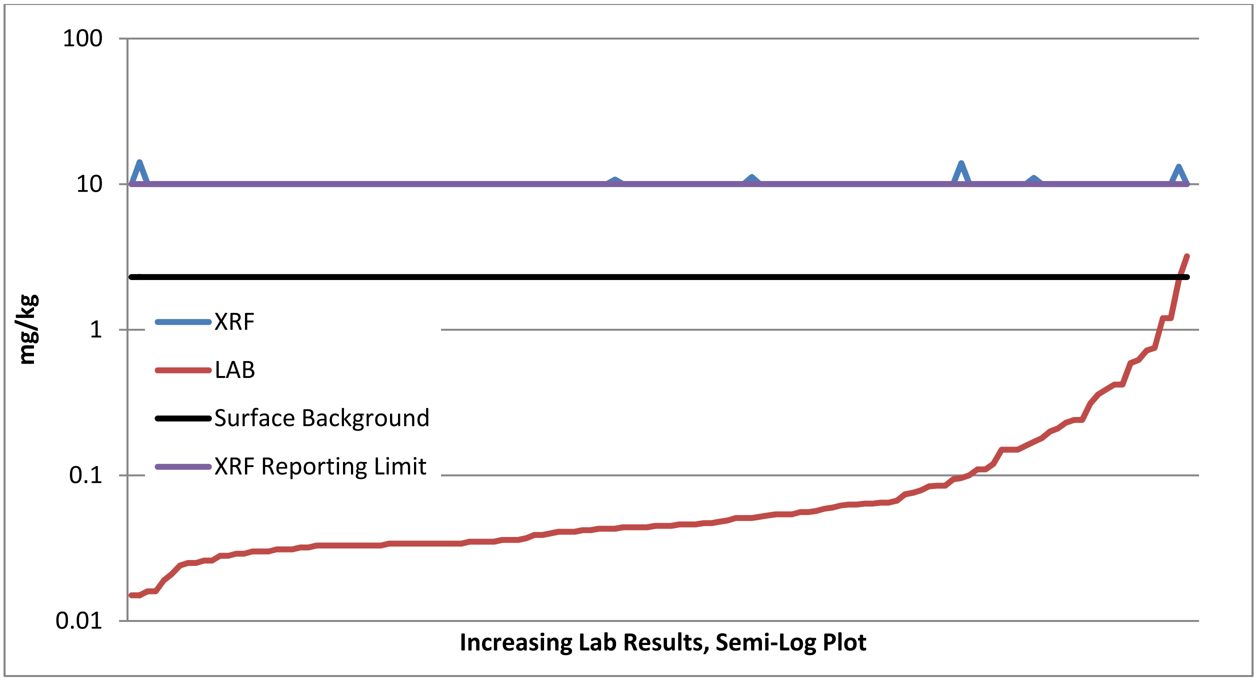
Silver—Surface

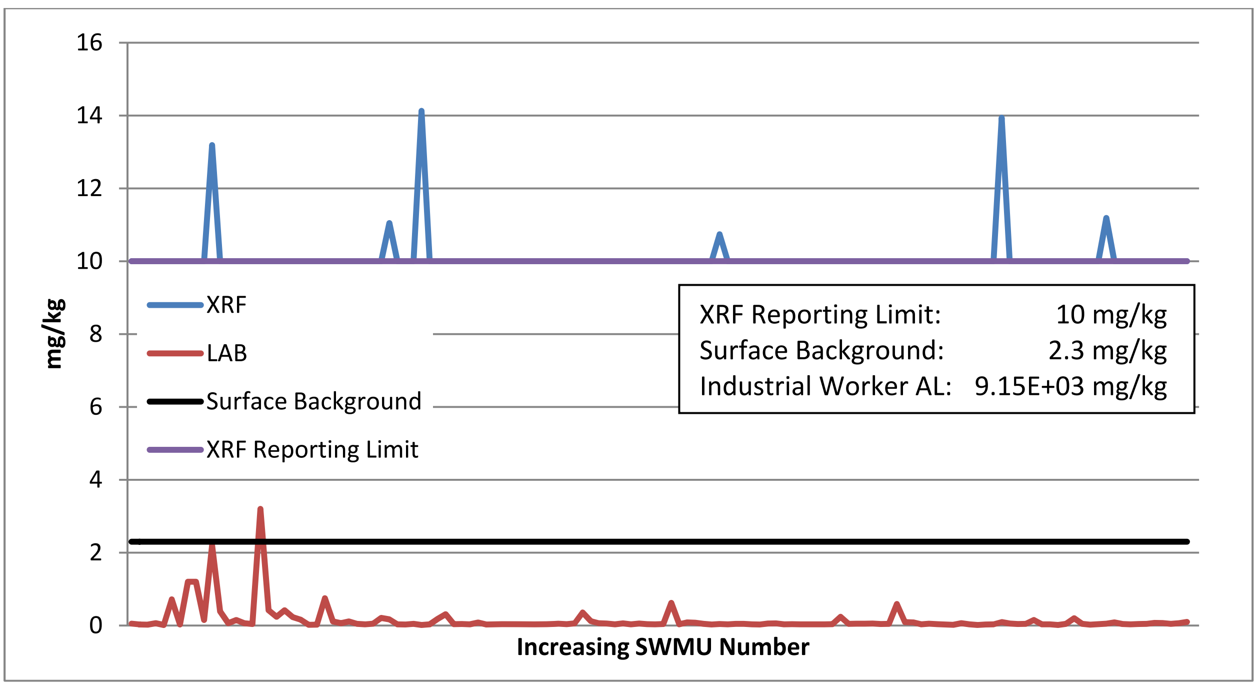
Results for surface silver do not correlate well between the XRF and the fixed-base laboratory. Since all XRF results are reported higher than the fixed-base laboratory results, the XRF screening results are acceptable for use in determining risk associated with silver in surface soils. The uncertainty of overestimating risk should be acknowledged.





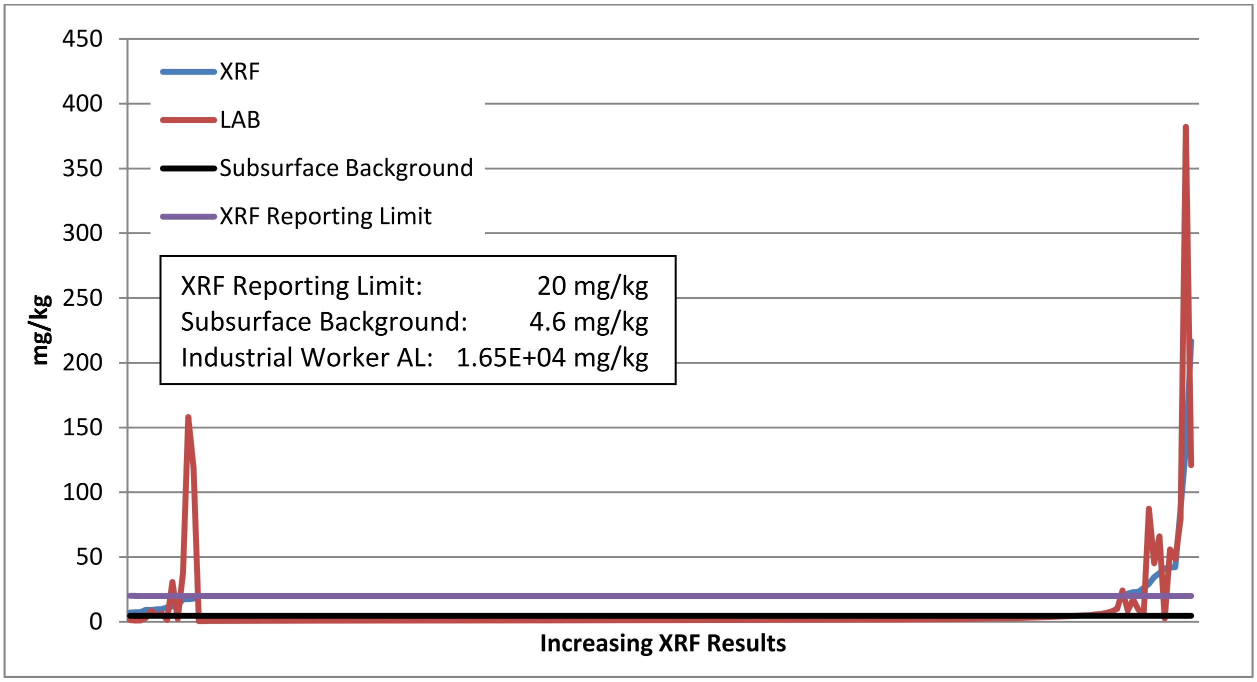
Silver—Surface (Continued)

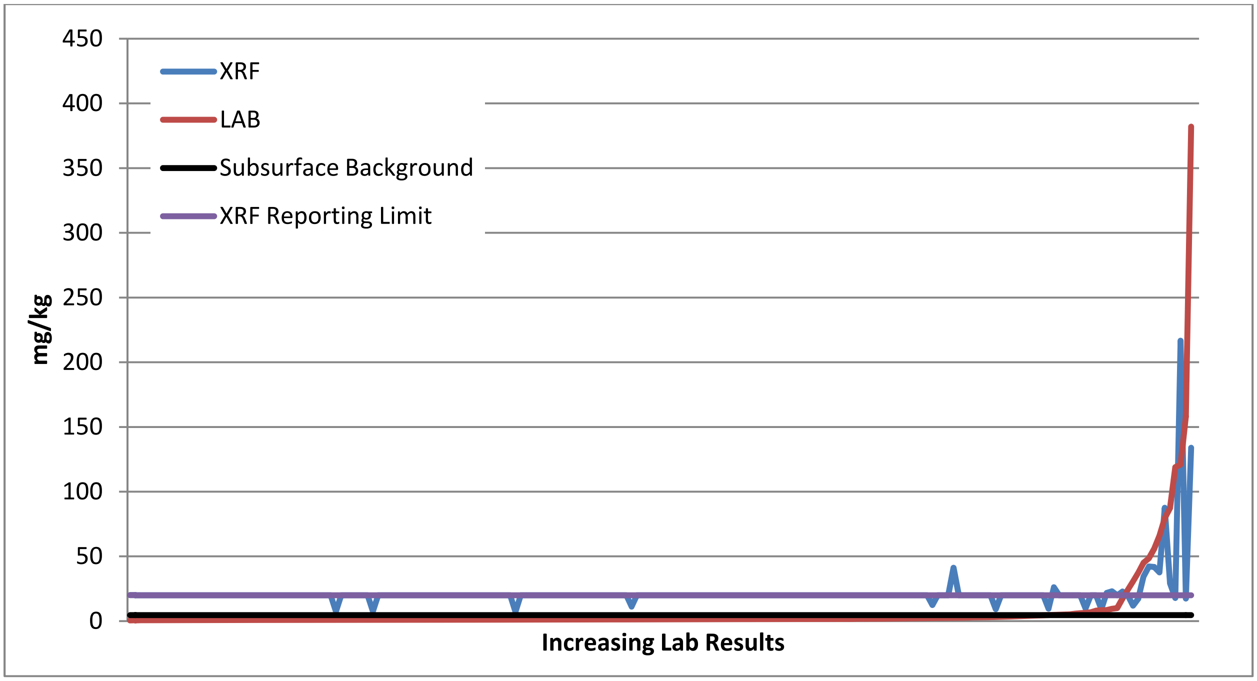




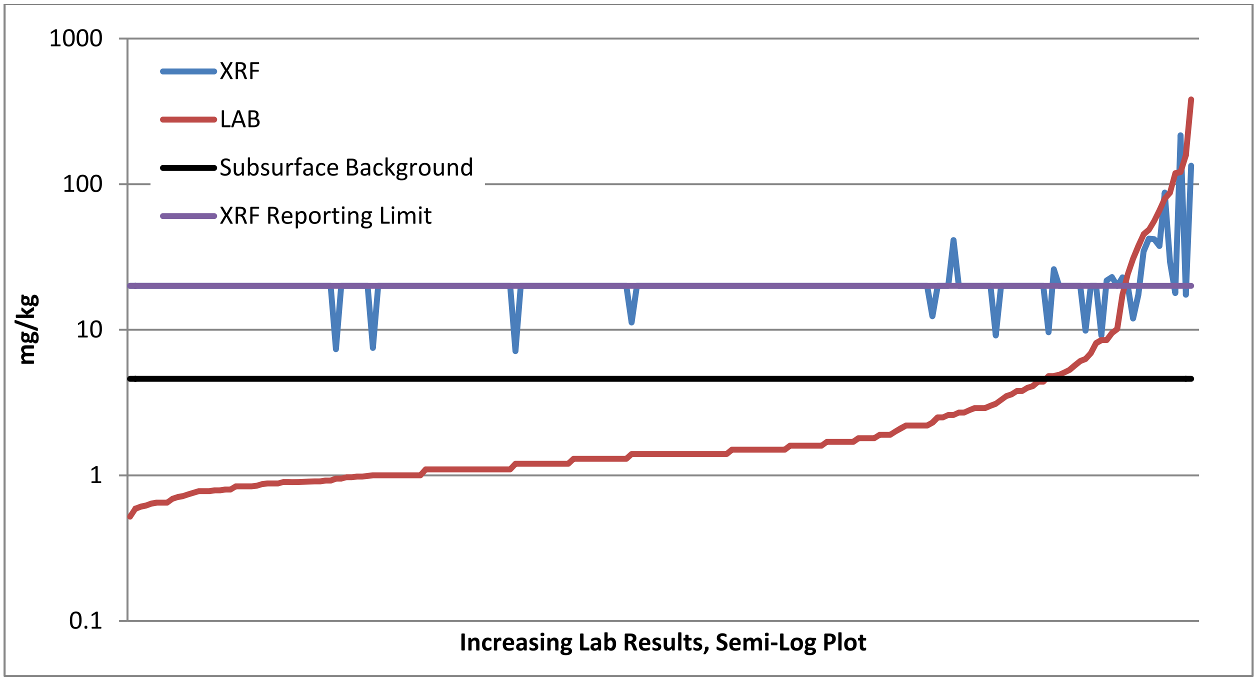
Uranium—Subsurface

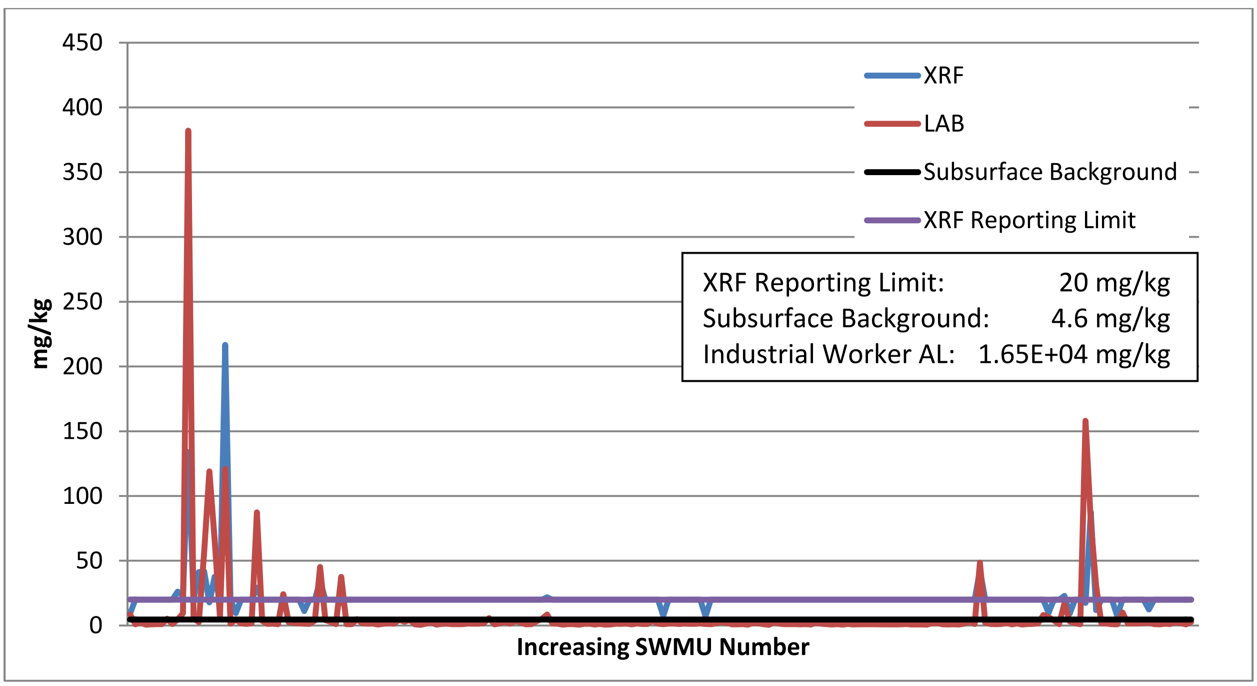
Results for subsurface uranium correlate moderately well between the XRF and the fixed-base laboratory. Since the majority of XRF results are reported higher than the fixed-base laboratory results, the XRF screening results are acceptable for use in determining risk associated with uranium in subsurface soils.





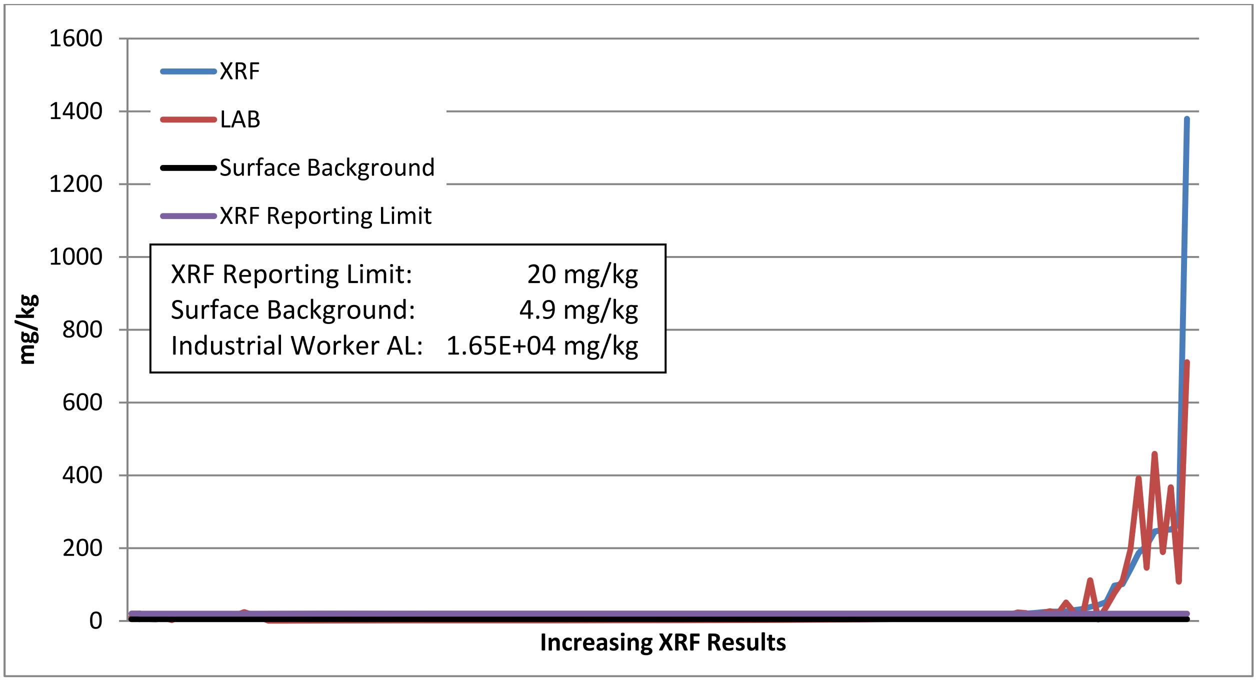
Uranium—Subsurface (Continued)

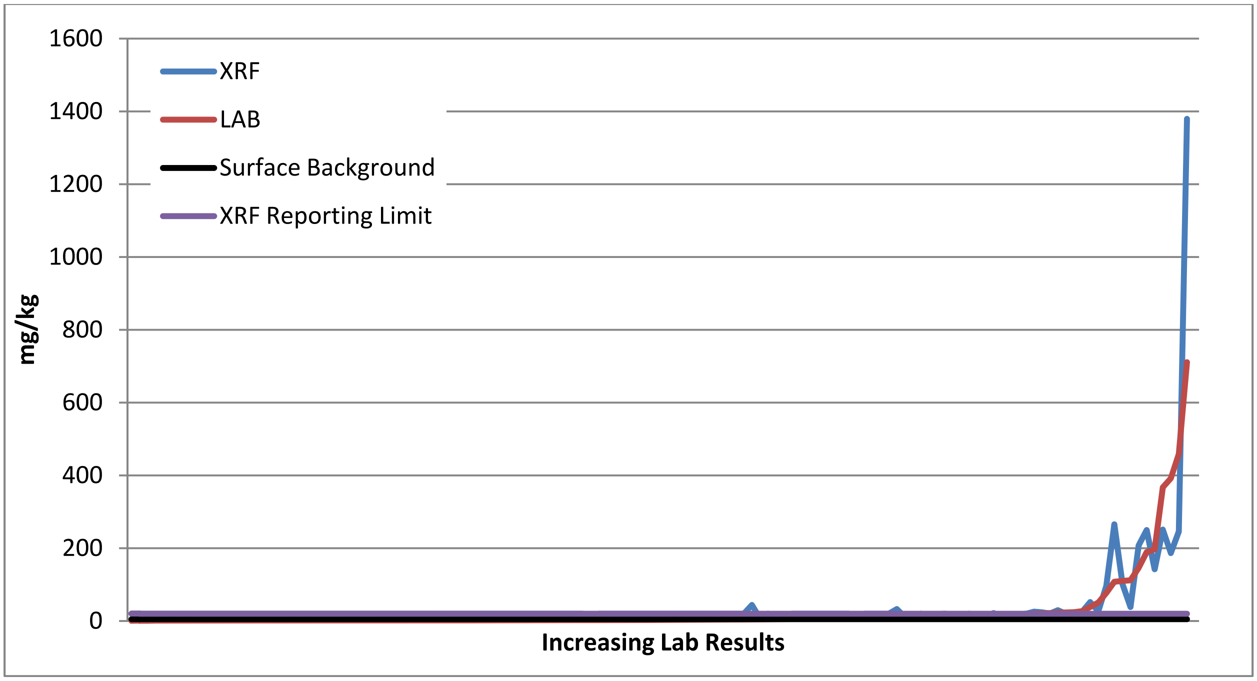




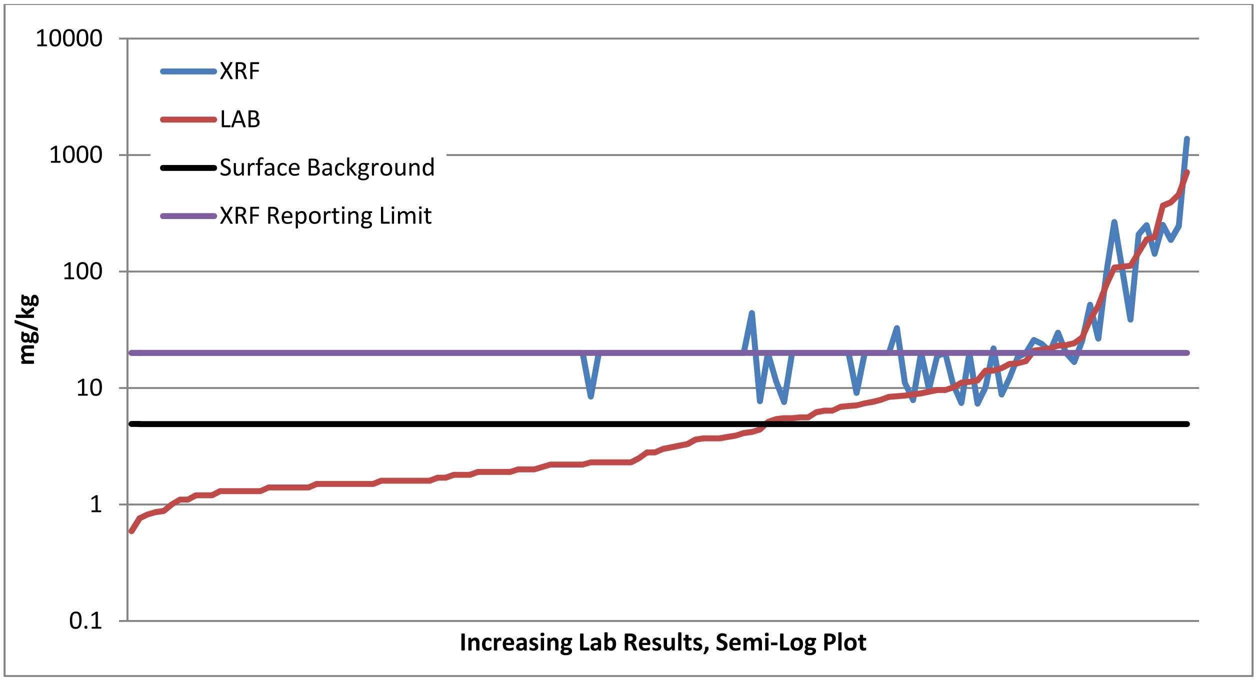
Uranium—Surface

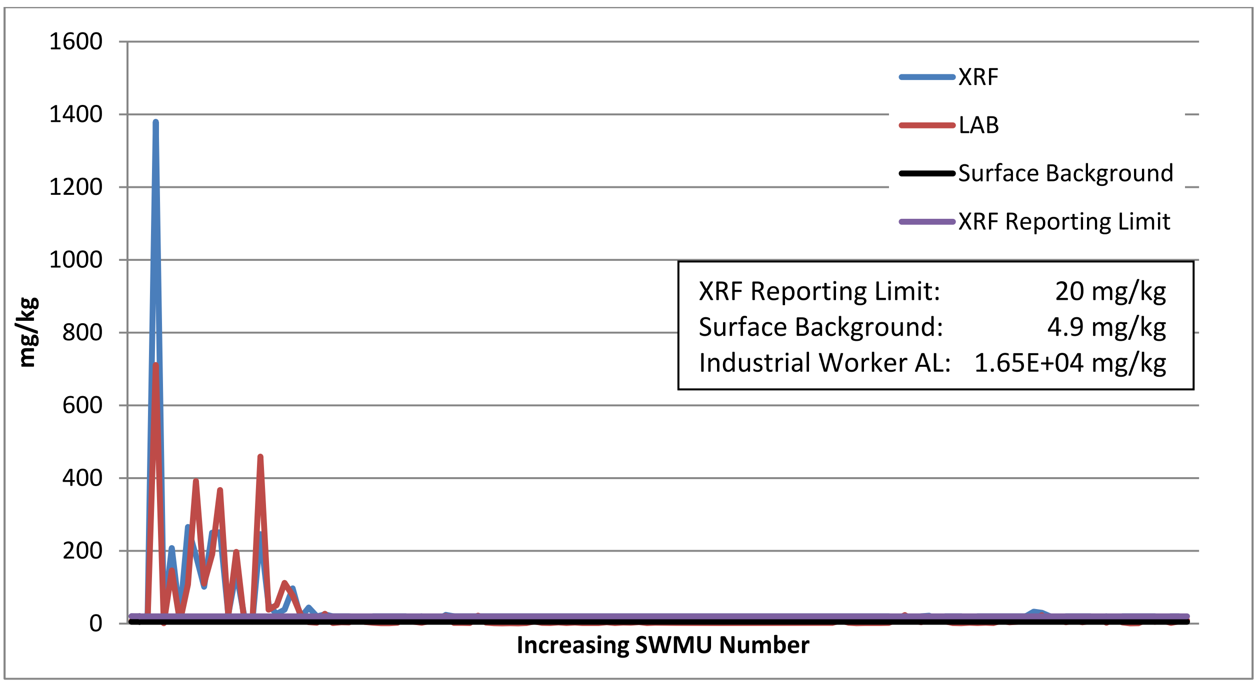
Results for surface uranium correlate reasonably well between the XRF and the fixed-base laboratory (correlation coefficient of 0.86). The XRF screening results are acceptable for use in determining risk associated with uranium in surface soil.





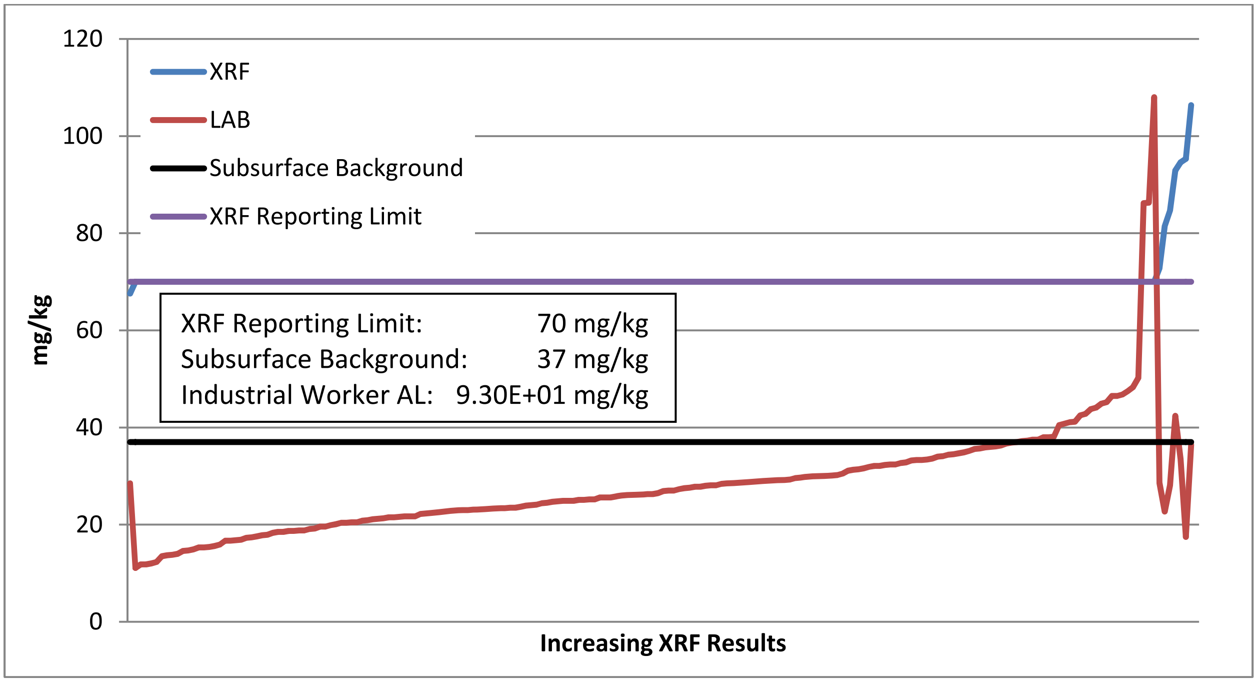
Uranium—Surface (Continued)

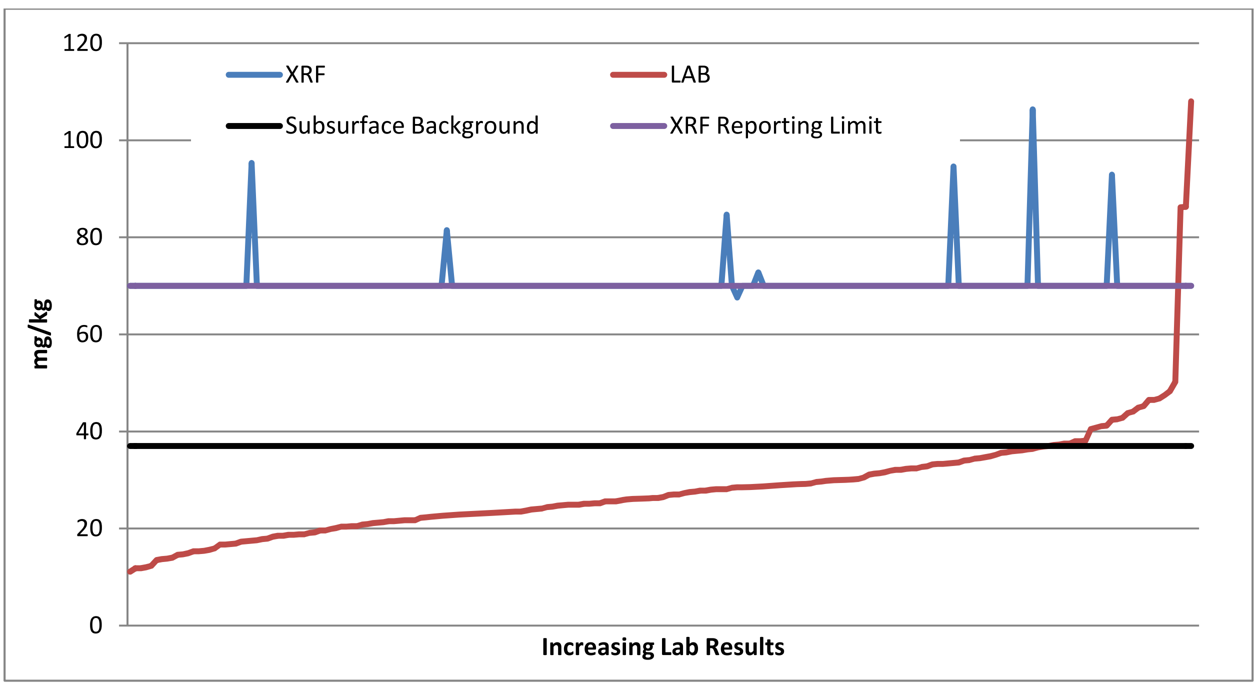




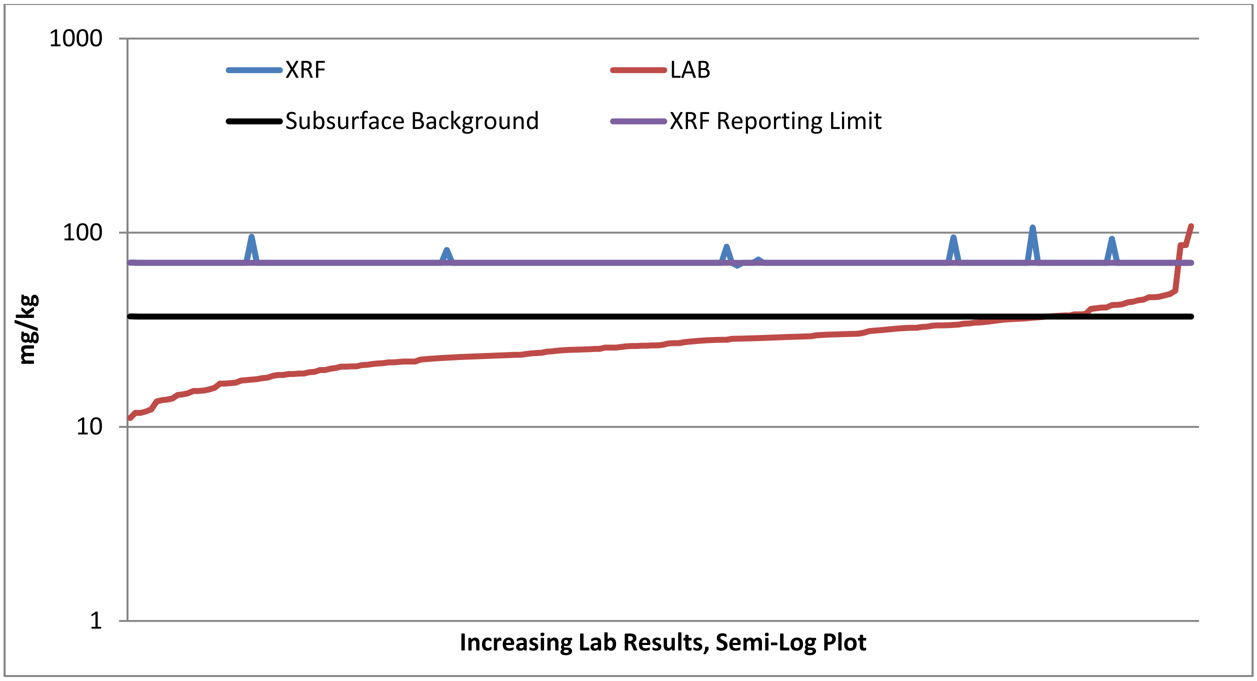
Vanadium—Subsurface

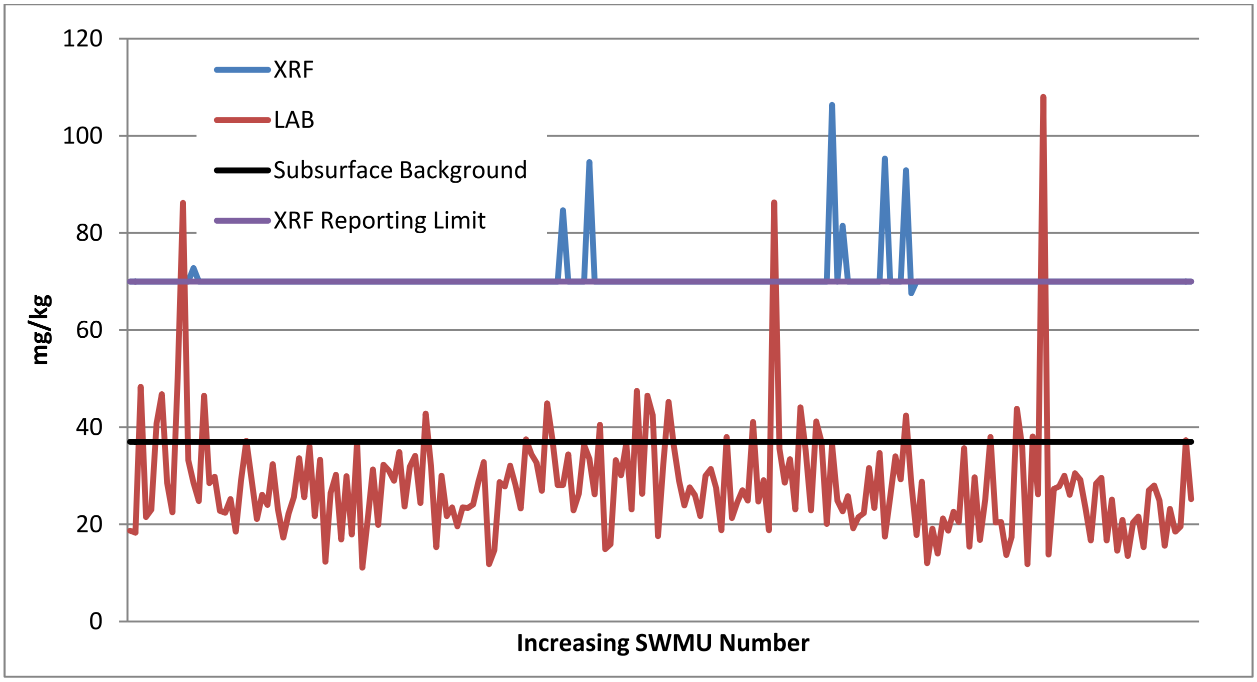
Results for subsurface vanadium correlate poorly between the XRF and the fixed-base laboratory.





Vanadium—Subsurface (Continued)

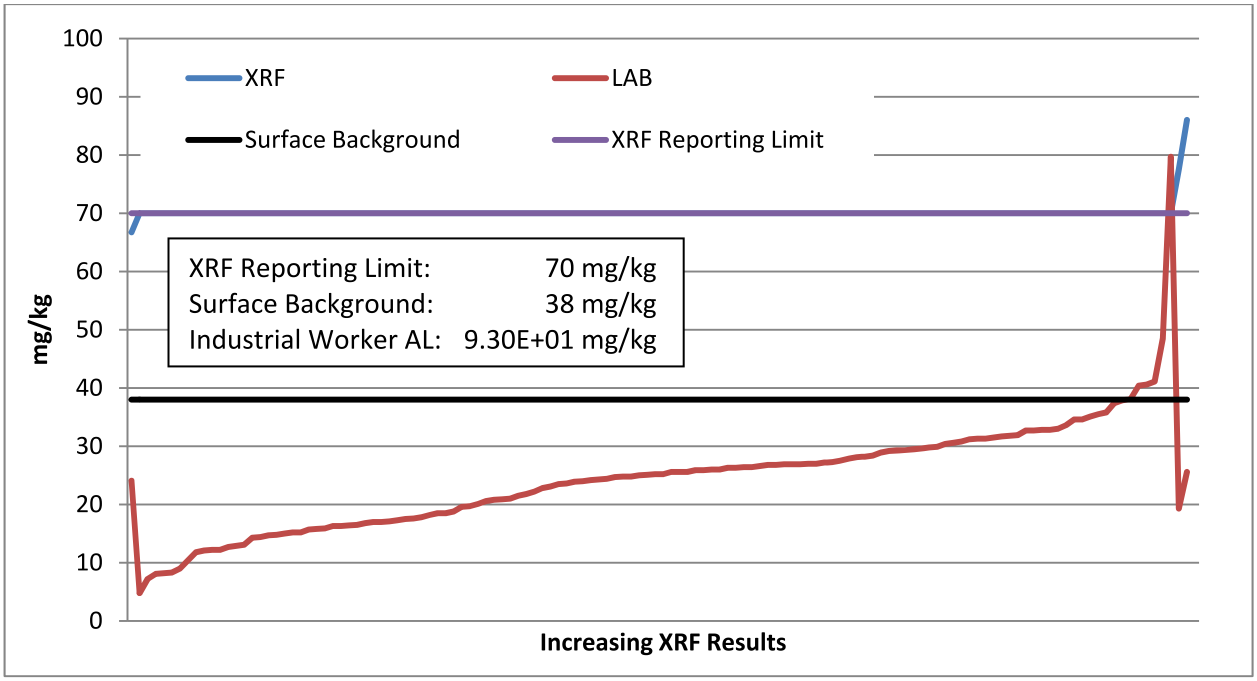


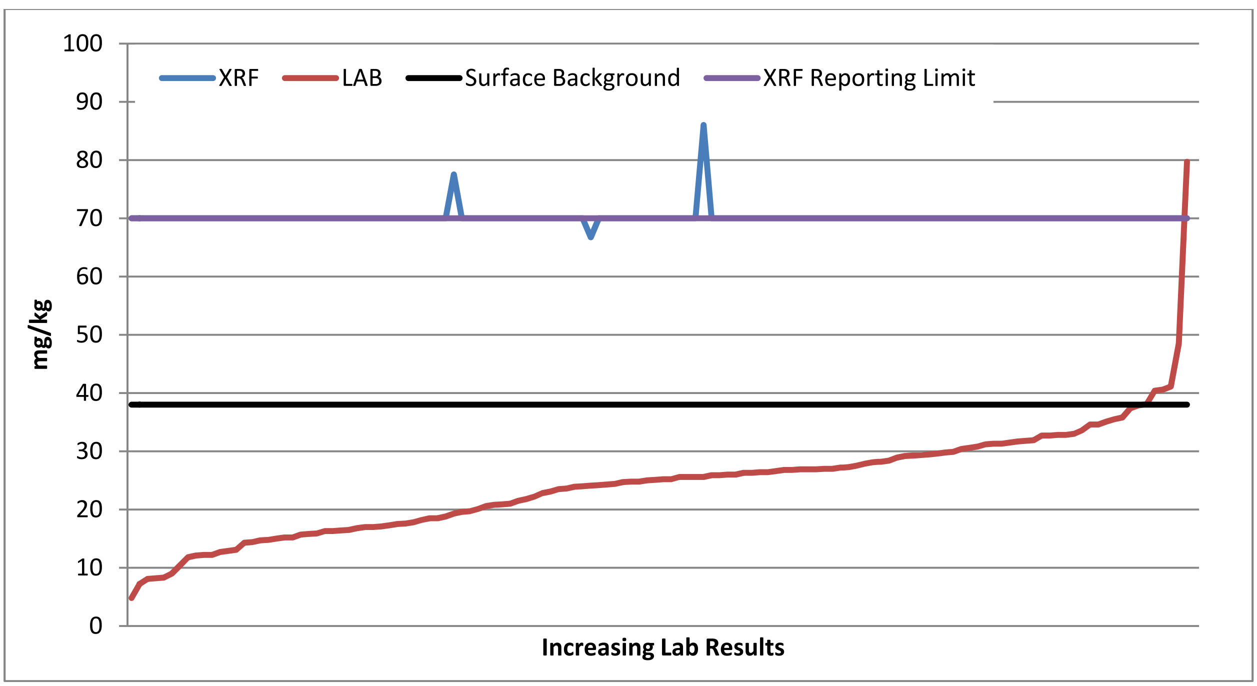


XRF Reporting Limit:	70 mg/kg
Subsurface Background:	37 mg/kg
Industrial Worker AL:	9.30E+01 mg/kg

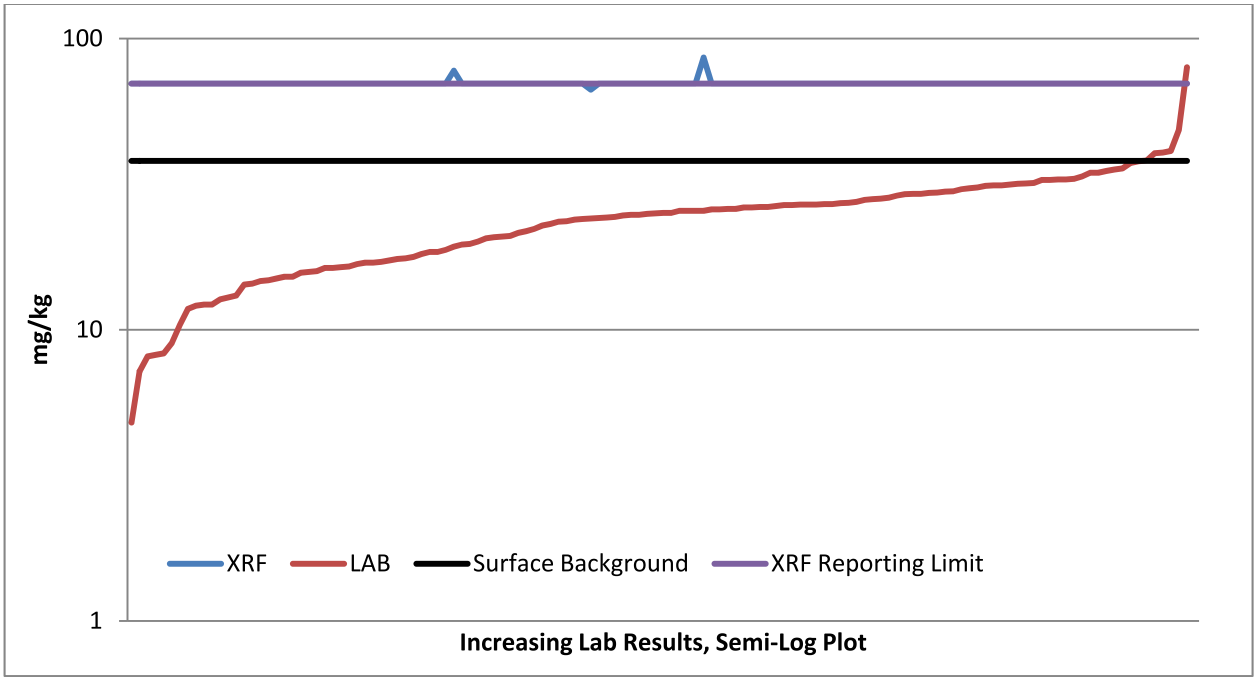
Vanadium—Surface

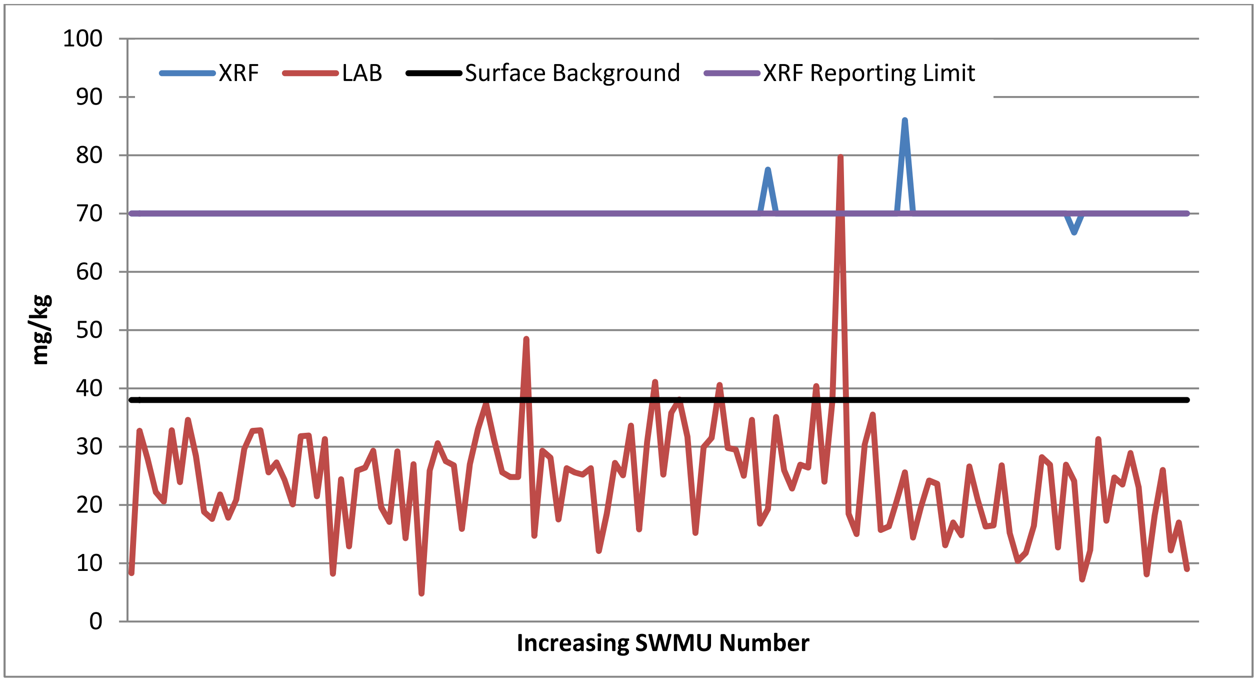
Results for surface vanadium correlate well between the XRF and the fixed-base laboratory for those XRF results detected above the reporting limit. The majority of XRF results were not detected above the reporting limit, and most fixed-base laboratory results were detected below that limit.





Vanadium—Surface (Continued)

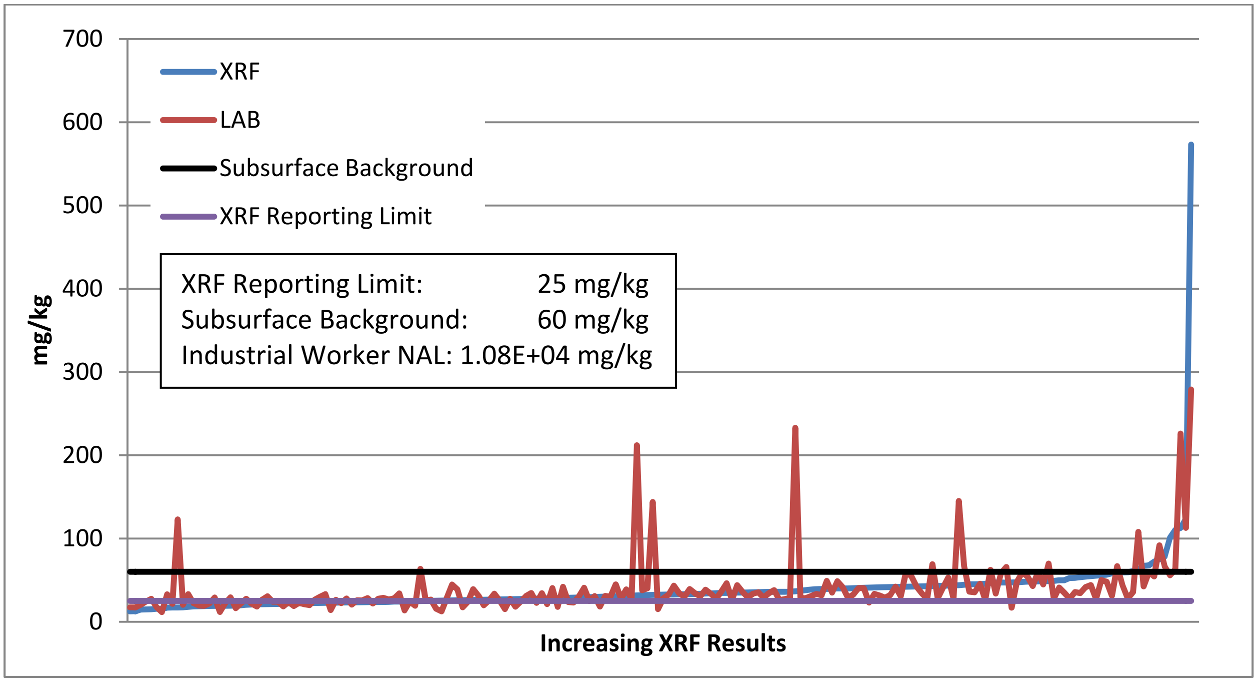


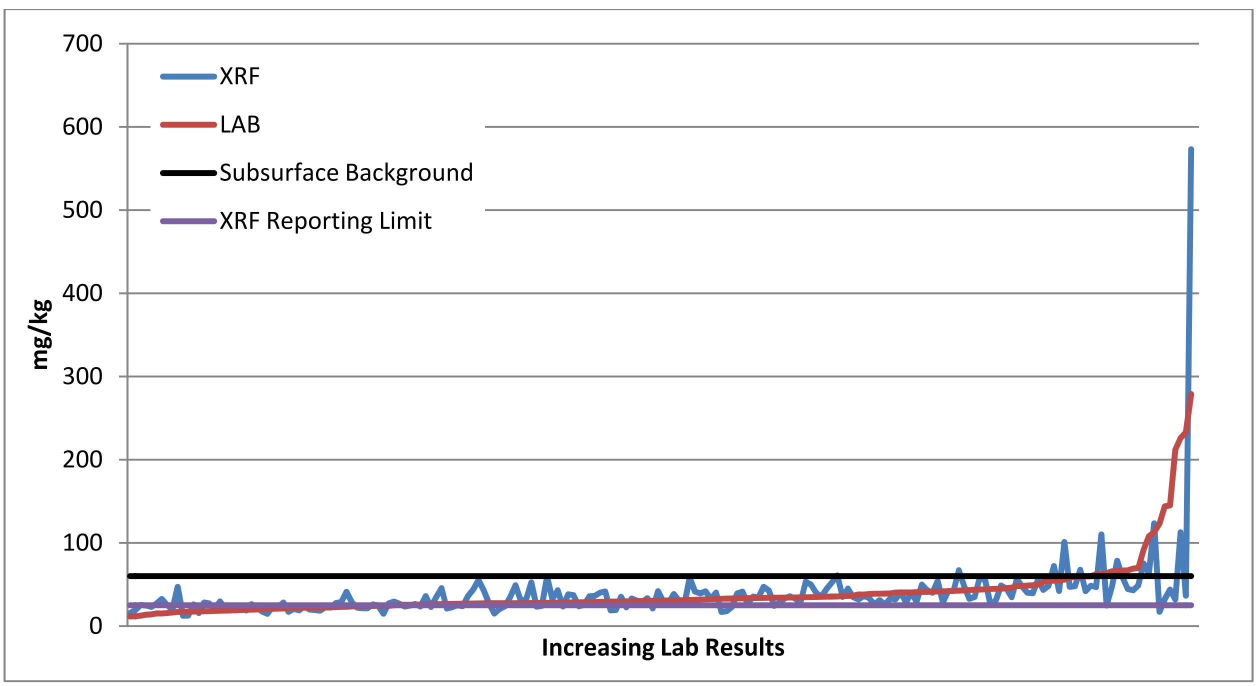


XRF Reporting Limit:	70 mg/kg
Surface Background:	37 mg/kg
Industrial Worker AL:	9.30E+01 mg/kg

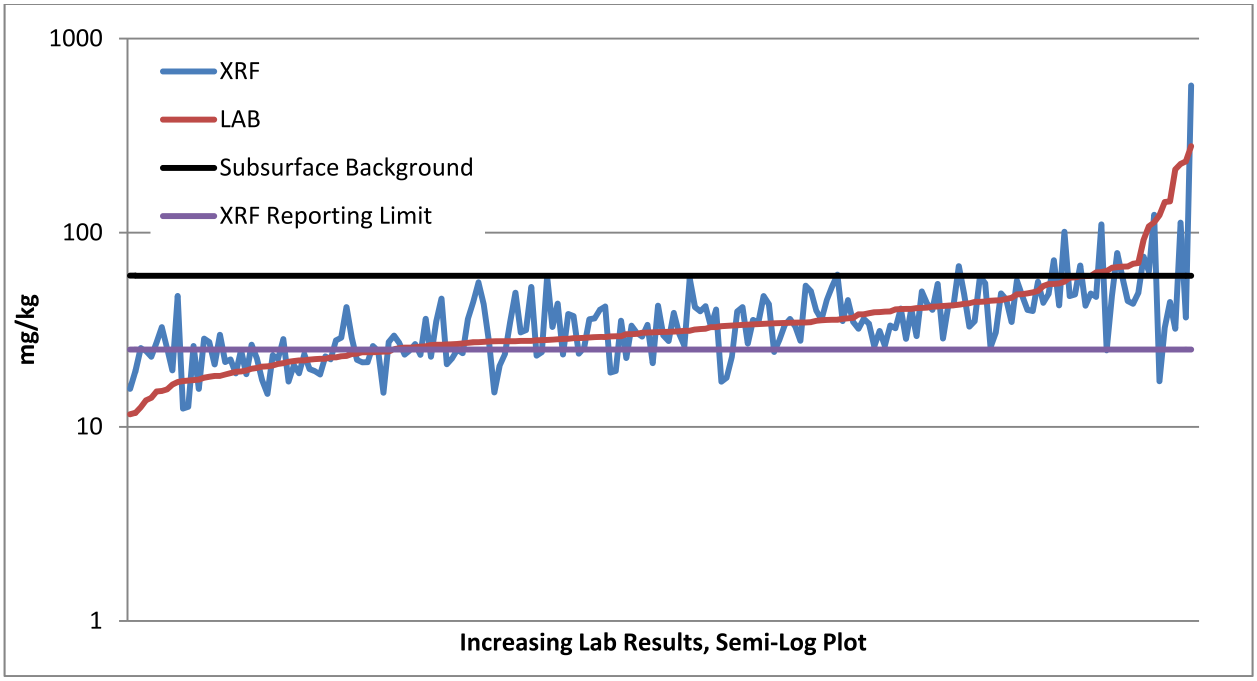
Zinc—Subsurface

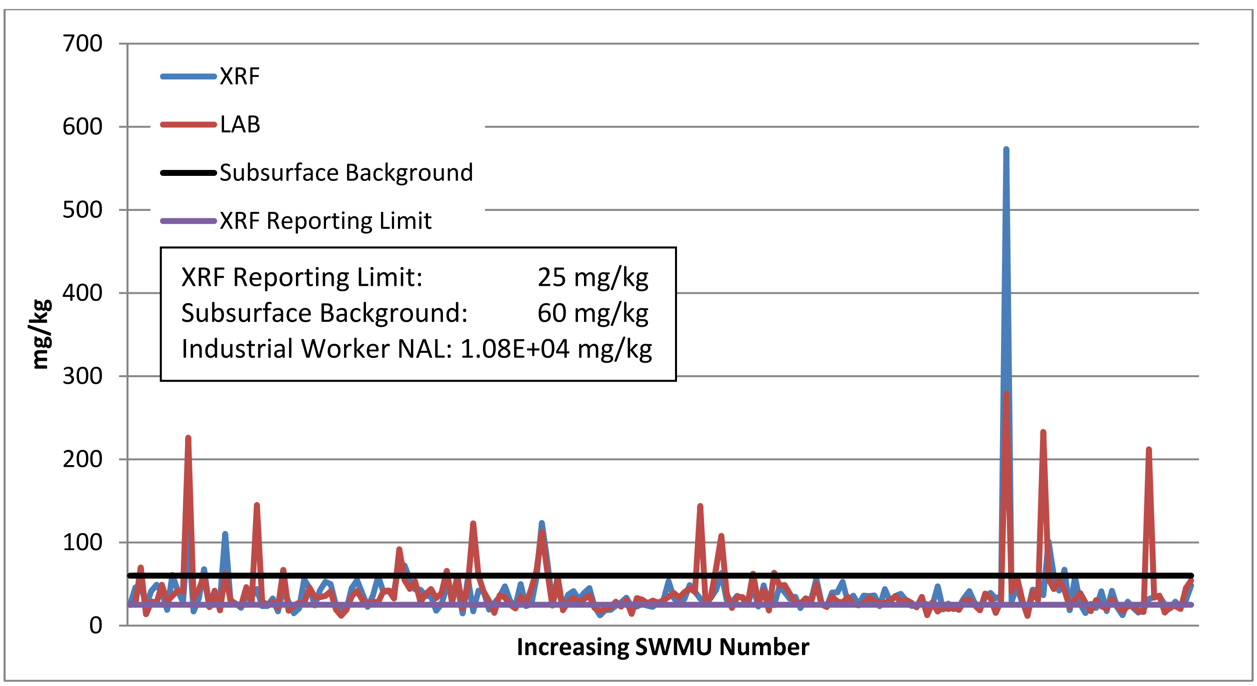
Results for subsurface zinc correlate moderately well between the XRF and the fixed-base laboratory (correlation coefficient of 0.6). The XRF screening results are acceptable for use in determining risk associated with zinc in subsurface soils.





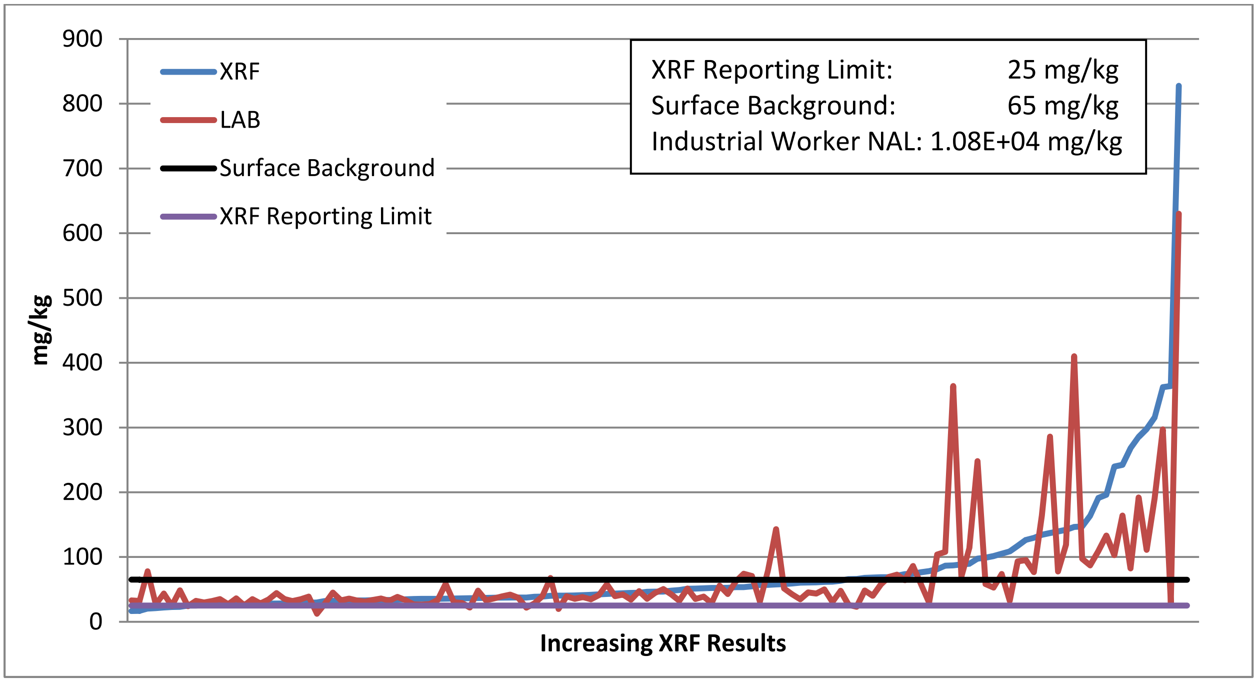
Zinc—Subsurface (Continued)

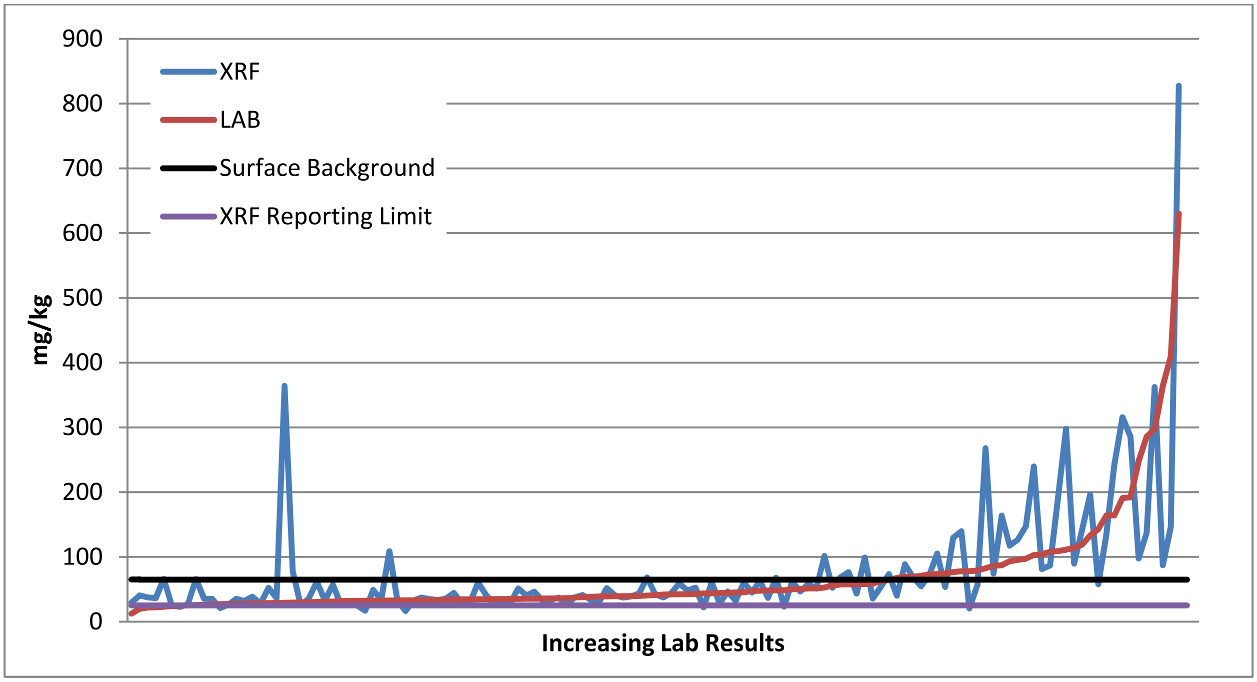




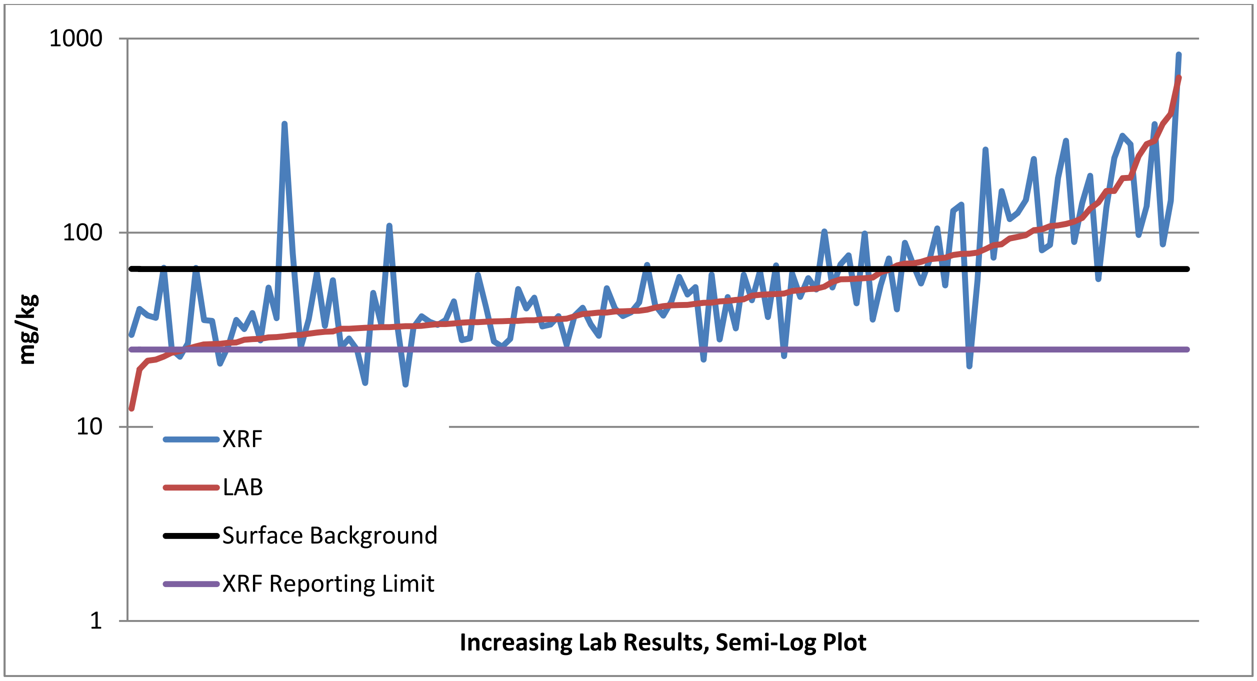
Zinc—Surface

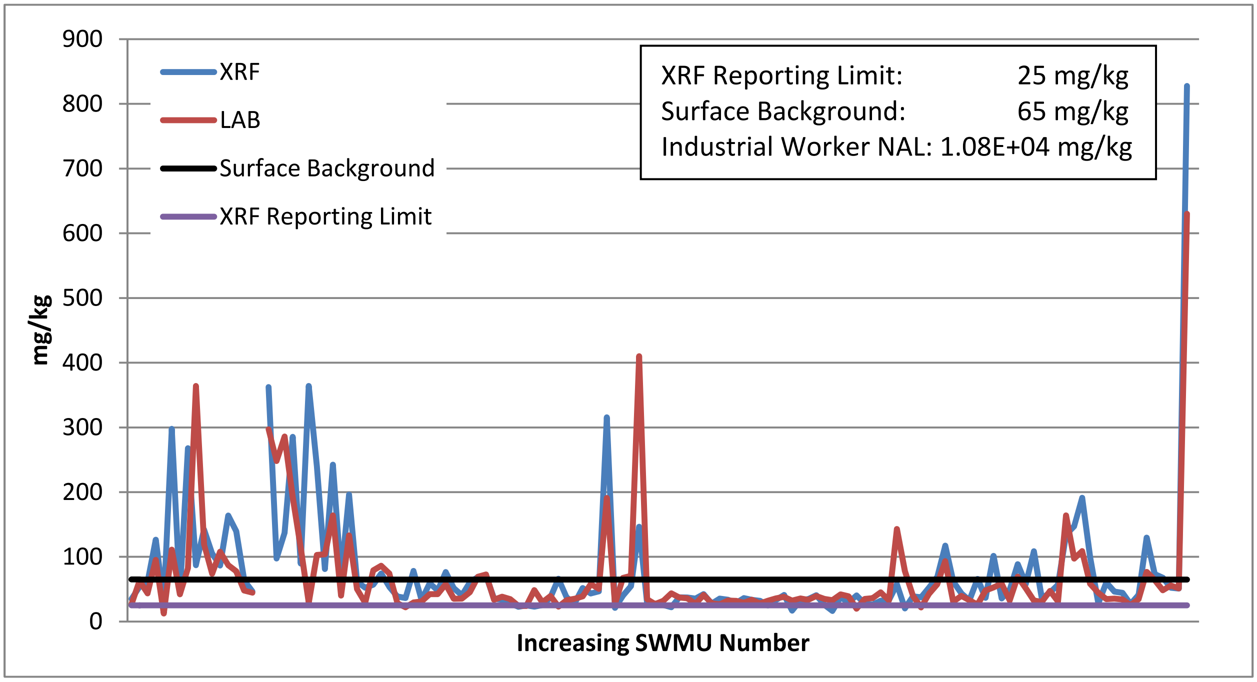
Results for surface zinc correlate reasonably well between the XRF and the fixed-base laboratory (correlation coefficient of 0.75). The XRF screening results are acceptable for use in determining risk associated with zinc in surface soils.





Zinc—Surface (Continued)





The 1,830 value mg/kg (analyzed by the fixed-base laboratory in sample SOU015033SA001) and the corresponding value 1384.86 mg/kg (analyzed by the field-base XRF) were removed as outliers from the graphs.

ATTACHMENT B4

URANIUM COMPARISON

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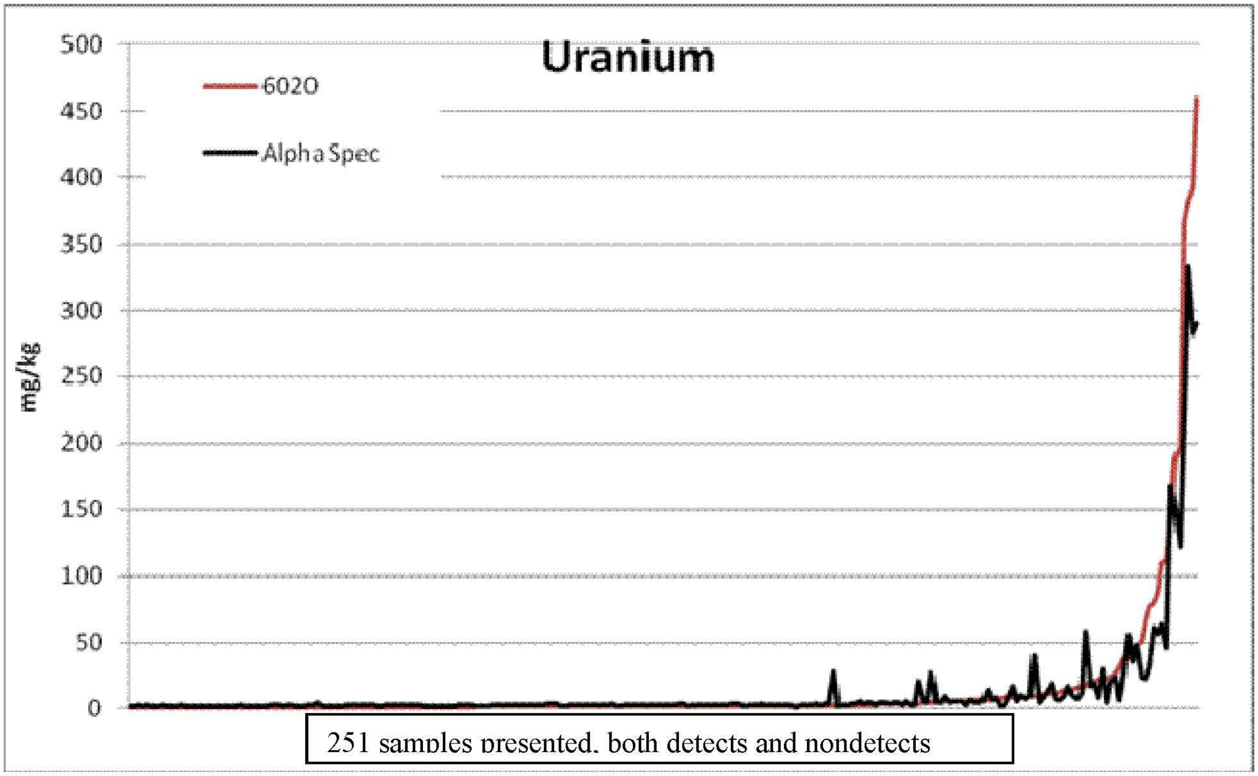
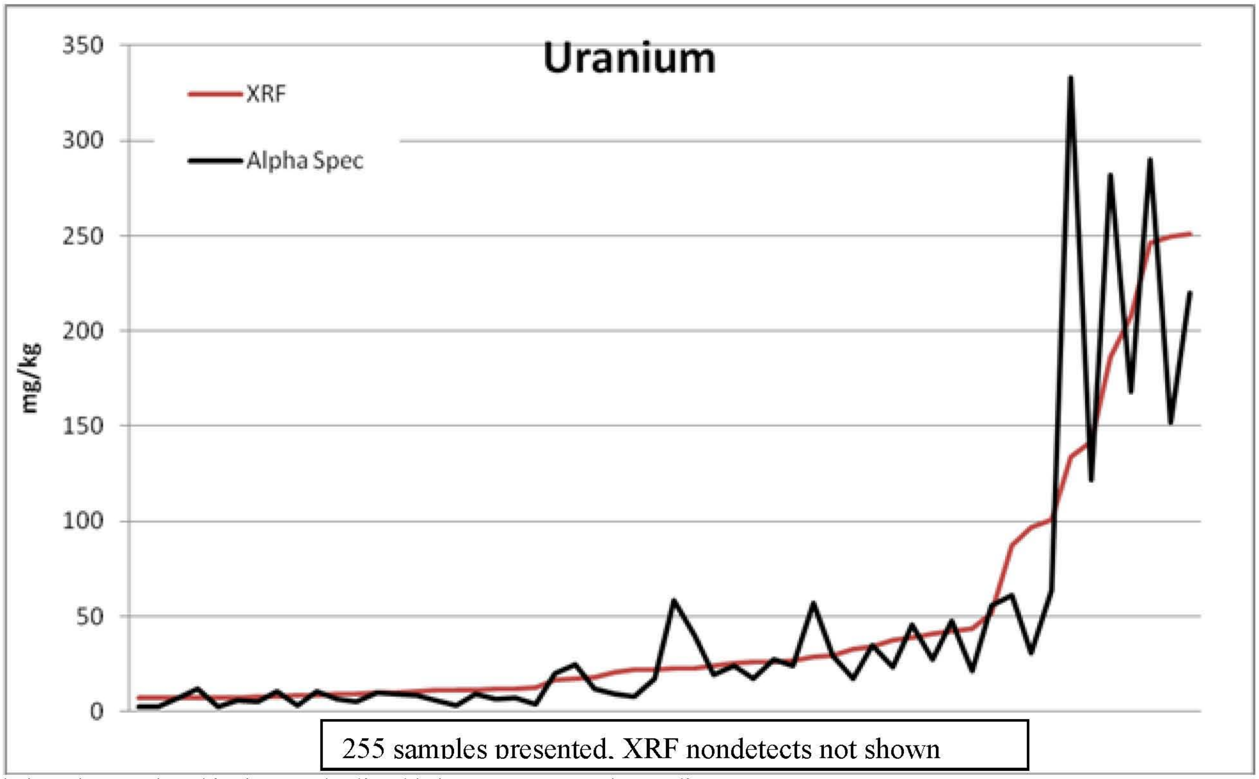


*The values analyzed in the samples listed below were removed as outliers.

Sample	Units	Alpha Spectroscopy	SW846-6020	XRF
SOU012015SA001	mg/kg	348	711	1379.58
SOU014070SA004	mg/kg	77.7	119	17.86
SOU012013SA004	mg/kg	142	539	
SOU014036SA001	mg/kg	506	108	265.72

Figure B4.1. Uranium Fixed-Base Lab Comparison of Methods SW846-6020 and Alpha Spectroscopy

B4.2 compares the XRF result to the alpha spec value with the results sorted by increasing XRF values.



*The values analyzed in the samples listed below were removed as outliers.

Sample	Units	Alpha Spectroscopy	SW846-6020	XRF
SOU012015SA001	mg/kg	348	711	1379.58
SOU014070SA004	mg/kg	77.7	119	17.86
SOU014036SA001	mg/kg	506	108	265.72

Figure B4.2. Comparison of Uranium by Detected XRF Method and Alpha Spectroscopy

Table B4.1 Uranium Comparison

Sample End Level (ft)	Sample ID	Units	XRF RESULTS	XRF Qualifier	Lab RESULTS	Lab Qualifier	RPD
1	SOU226006SA001	mg/kg	7.35		0.95		38.55%
1	SOU531006SA001	mg/kg	7.44		11.1		-9.87%
10	SOU012002SA010	mg/kg	7.7		4.4		13.64%
4	SOU224001DSA004	mg/kg	7.88		8.8		-2.76%
1	SOU158006SA001	mg/kg	8.79		14.8		-12.74%
1	SOU520047SA001	mg/kg	9.09		7.1		6.15%
4	SOU489001SA004	mg/kg	9.14		3.1		24.67%
4	SOU047001SA004	mg/kg	9.14		8.5		1.81%
1	SOU012001HSA001	mg/kg	9.87		6.3		11.04%
4	SOU169003SA004	mg/kg	10.66		10.1		1.35%
1	SOU158008SA001	mg/kg	11.07		8.6		6.28%
4	SOU226011SA004	mg/kg	12.38		2.3		34.33%
4	SOU194131SA004	mg/kg	17.39		37.5		-18.32%
1	SOU195193SA001	mg/kg	17.43		158		-40.06%
1	SOU216001SA001	mg/kg	18.36		16.3		2.97%
1	SOU200013SA001	mg/kg	18.87		9.6		16.28%
1	SOU015002SA001	mg/kg	20.53		21.9		-1.61%
4	SOU015003SA004	mg/kg	21.81		8.5		21.96%
1	SOU227011SA001	mg/kg	23.87		21.3		2.84%
1	SOU229001SA001	mg/kg	25.47		27.1		-1.55%
1	SOU015111SA001	mg/kg	29.8		23.1		6.33%
5	SOU015P04SA005	mg/kg	32.69		8.5		29.36%
4	SOU194192SA004	mg/kg	41.88		55.8		-7.13%
1	SOU194291SA001	mg/kg	87.6		79.6		2.39%
4	SOU217007SA004	mg/kg	216.68		121		14.17%
4	SOU228003SA004	mg/kg	7.13		1.2	E	35.59%
1	SOU081001SA001	mg/kg	7.35		11.6	E	-11.21%
1	SOU488001SA001	mg/kg	7.51		1	E	38.25%
4	SOU222001BSA004	mg/kg	8.43		2.3	E	28.56%
1	SOU080002SA001	mg/kg	9.75		9.3	E	1.18%
1	SOU169004SA001	mg/kg	10.13		14.1	E	-8.19%
1	SOU224001SA001	mg/kg	11.44		5.4	E	17.93%
7	SOU014055SA007	mg/kg	12.29		16.1	E	-6.71%
10	SOU194040SA010	mg/kg	22.92		17.4	E	6.85%
4	SOU015072SA004	mg/kg	29.17		87.3	E	-24.95%
5	SOU015P14SA005	mg/kg	34.55		45.2	E	-6.68%
1	SOU194279SA001	mg/kg	51.89		38.6	E	7.34%
4	SOU217012SA004	mg/kg	245.93		459	E	-15.11%
4	SOU219001SA004	mg/kg	1379.58		711	E	15.99%
1	SOU156007SA001	mg/kg	7.59		5.5	N	7.98%
4	SOU226011CSA004	mg/kg	9.62		4.8	N	16.71%
1	SOU224001MSA001	mg/kg	11.94		30.7	N	-22.00%
7	SOU194095SA007	mg/kg	23		9.5	N	20.77%
4	SOU015052SA004	mg/kg	25.87		20.9	N	5.31%
4	SOU015060SA004	mg/kg	26.08		4.8	N	34.46%
1	SOU076001SA001	mg/kg	37.62		66	N	-13.69%
1	SOU194375SA001	mg/kg	142		197	N	-8.11%
4	SOU194375SA004	mg/kg	186.61		392	N	-17.75%
1	SOU217004SA001	mg/kg	207.66		146	N	8.72%
1	SOU217015SA001	mg/kg	249.89		189	N	6.94%
9	SOU217P07SA009	mg/kg	251.16		367	N	-9.37%
1	SOU047001SA001	mg/kg	11.21		1.4	NE	38.90%
7	SOU014097SA007	mg/kg	16.72		24.2	NE	-9.14%
4	SOU194078SA004	mg/kg	17.86		119	NE	-36.95%

Table B4.1 Uranium Comparison (Continued)

Sample End Level (ft)	Sample ID	Units	XRF RESULTS	XRF Qualifier	Lab RESULTS	Lab Qualifier	RPD
4	SOU015006SA004	mg/kg	21.86		14.1	NE	10.79%
4	SOU015068SA004	mg/kg	26.52		50.9	NE	-15.75%
4	SOU076001SA004	mg/kg	38.62		112	NE	-24.36%
1	SOU194176SA001	mg/kg	41.28		2.6	NE	44.07%
1	SOU194222SA001	mg/kg	42.2		48.5	NE	-3.47%
4	SOU194249SA004	mg/kg	43.96		4.2	NE	41.28%
4	SOU194304SA004	mg/kg	96.76		77.1	NE	5.65%
4	SOU194347SA004	mg/kg	101.14		110	NE	-2.10%
1	SOU194362SA001	mg/kg	133.91		382	NE	-24.04%
1	SOU219001SA001	mg/kg	265.72		108	NE	21.10%
1	SOU212001SA001	mg/kg	20	U	0.52		47.47%
1	SOU154019SA001	mg/kg	20	U	0.59		47.13%
1	SOU229015SA001	mg/kg	20	U	0.59	E	47.13%
0.5	SOU222001SA001	mg/kg	20	U	0.61		47.04%
4	SOU015025SA004	mg/kg	20	U	0.62	E	46.99%
2	SOU026P09SA002	mg/kg	20	U	0.64		46.90%
1	SOU015044SA001	mg/kg	20	U	0.65		46.85%
1	SOU015033SA001	mg/kg	20	U	0.65		46.85%
1	SOU012015SA001	mg/kg	20	U	0.65	E	46.85%
1	SOU015007SA001	mg/kg	20	U	0.69		46.67%
4	SOU014105SA004	mg/kg	20	U	0.71	E	46.57%
4	SOU227004SA004	mg/kg	20	U	0.72		46.53%
4	SOU014019SA004	mg/kg	20	U	0.74		46.43%
1	SOU014111SA001	mg/kg	20	U	0.76		46.34%
4	SOU014015SA004	mg/kg	20	U	0.76	E	46.34%
4	SOU014085SA004	mg/kg	20	U	0.78		46.25%
1	SOU014118SA001	mg/kg	20	U	0.78	E	46.25%
1	SOU014053SA001	mg/kg	20	U	0.78	NE	46.25%
1	SOU014017SA001	mg/kg	20	U	0.79		46.20%
1	SOU014079SA001	mg/kg	20	U	0.79	E	46.20%
1	SOU014105SA001	mg/kg	20	U	0.8		46.15%
4	SOU015110SA004	mg/kg	20	U	0.8	E	46.15%
1	SOU015089SA001	mg/kg	20	U	0.82	E	46.06%
4	SOU014070SA004	mg/kg	20	U	0.84	E	45.97%
1	SOU211001SA001	mg/kg	20	U	0.84	E	45.97%
1	SOU015053SA001	mg/kg	20	U	0.84	E	45.97%
1	SOU015067SA001	mg/kg	20	U	0.84	E	45.97%
4	SOU014046SA004	mg/kg	20	U	0.85	E	45.92%
4	SOU211001SA004	mg/kg	20	U	0.86	E	45.88%
1	SOU015093SA001	mg/kg	20	U	0.87		45.83%
1	SOU015081SA001	mg/kg	20	U	0.88		45.79%
1	SOU014074SA001	mg/kg	20	U	0.88	E	45.79%
4	SOU014027SA004	mg/kg	20	U	0.88	E	45.79%
1	SOU014036SA001	mg/kg	20	U	0.88	E	45.79%
1	SOU012001GSA001	mg/kg	20	U	0.9		45.69%
10	SOU012004ASA010	mg/kg	20	U	0.9		45.69%
10	SOU012005BSA010	mg/kg	20	U	0.9	E	45.69%
10	SOU012006ASA010	mg/kg	20	U	0.9	E	45.69%
1	SOU012010ASA001	mg/kg	20	U	0.9	NE	45.69%
10	SOU012011BSA010	mg/kg	20	U	0.91		45.65%
10	SOU012012ASA010	mg/kg	20	U	0.91		45.65%
10	SOU012015ASA010	mg/kg	20	U	0.91		45.65%
4	SOU012015DSA004	mg/kg	20	U	0.92	E	45.60%

Table B4.1 Uranium Comparison (Continued)

Sample End Level (ft)	Sample ID	Units	XRF RESULTS	XRF Qualifier	Lab RESULTS	Lab Qualifier	RPD
10	SOU014001SA010	mg/kg	20	U	0.92	NE	45.60%
7	SOU015063SA007	mg/kg	20	U	0.95	E	45.47%
7	SOU015105SA007	mg/kg	20	U	0.97		45.37%
7	SOU047002SA007	mg/kg	20	U	0.97	E	45.37%
7	SOU047003SA007	mg/kg	20	U	0.98		45.33%
4	SOU079001GSA004	mg/kg	20	U	0.98	E	45.33%
1	SOU079001SA001	mg/kg	20	U	0.99	E	45.28%
4	SOU081001CSA004	mg/kg	20	U	1		45.24%
4	SOU081001HSA004	mg/kg	20	U	1		45.24%
10	SOU081001HSA010	mg/kg	20	U	1		45.24%
4	SOU081005ASA004	mg/kg	20	U	1		45.24%
4	SOU081007SA004	mg/kg	20	U	1		45.24%
4	SOU099049CSA004	mg/kg	20	U	1	E	45.24%
4	SOU099051BSA004	mg/kg	20	U	1	E	45.24%
4	SOU099051FSA004	mg/kg	20	U	1	E	45.24%
10	SOU099051GSA010	mg/kg	20	U	1	E	45.24%
10	SOU099051SA010	mg/kg	20	U	1	N	45.24%
4	SOU138003CSA004	mg/kg	20	U	1.1		44.79%
10	SOU138008FSA010	mg/kg	20	U	1.1		44.79%
4	SOU138012SA004	mg/kg	20	U	1.1		44.79%
4	SOU138017SA004	mg/kg	20	U	1.1		44.79%
4	SOU153007SA004	mg/kg	20	U	1.1		44.79%
1	SOU154019CSA001	mg/kg	20	U	1.1		44.79%
1	SOU155015SA001	mg/kg	20	U	1.1		44.79%
4	SOU156008SA004	mg/kg	20	U	1.1		44.79%
4	SOU156P01SA004	mg/kg	20	U	1.1		44.79%
4	SOU158008ASA004	mg/kg	20	U	1.1		44.79%
4	SOU158013SA004	mg/kg	20	U	1.1		44.79%
4	SOU158014ASA004	mg/kg	20	U	1.1	E	44.79%
1	SOU158014BSA001	mg/kg	20	U	1.1	E	44.79%
4	SOU158020SA004	mg/kg	20	U	1.1	E	44.79%
4	SOU158023SA004	mg/kg	20	U	1.1	E	44.79%
1	SOU163002SA001	mg/kg	20	U	1.1	E	44.79%
7	SOU163008SA007	mg/kg	20	U	1.1	E	44.79%
7	SOU163016SA007	mg/kg	20	U	1.1	E	44.79%
4	SOU169002BSA004	mg/kg	20	U	1.1	NE	44.79%
4	SOU169002DSA004	mg/kg	20	U	1.2		44.34%
1	SOU169005ASA001	mg/kg	20	U	1.2		44.34%
10	SOU169005SA010	mg/kg	20	U	1.2		44.34%
4	SOU176018SA004	mg/kg	20	U	1.2		44.34%
	SOU176P06SA010	mg/kg	20	U	1.2		44.34%
4	SOU177010SA004	mg/kg	20	U	1.2		44.34%
4	SOU177016SA004	mg/kg	20	U	1.2	E	44.34%
	SOU177P03SA005	mg/kg	20	U	1.2	E	44.34%
7	SOU180004SA007	mg/kg	20	U	1.2	E	44.34%
4	SOU180005SA004	mg/kg	20	U	1.2	E	44.34%
4	SOU180011SA004	mg/kg	20	U	1.2	E	44.34%
1	SOU180020ASA001	mg/kg	20	U	1.2	E	44.34%
4	SOU180029SA004	mg/kg	20	U	1.2	NE	44.34%
4	SOU180043SA004	mg/kg	20	U	1.3		43.90%
4	SOU194015ASA004	mg/kg	20	U	1.3		43.90%
1	SOU194017SA001	mg/kg	20	U	1.3		43.90%
4	SOU194038SA004	mg/kg	20	U	1.3		43.90%
4	SOU194048SA004	mg/kg	20	U	1.3		43.90%
4	SOU194061SA004	mg/kg	20	U	1.3		43.90%

Table B4.1 Uranium Comparison (Continued)

Sample End Level (ft)	Sample ID	Units	XRF RESULTS	XRF Qualifier	Lab RESULTS	Lab Qualifier	RPD
1	SOU194069SA001	mg/kg	20	U	1.3	E	43.90%
1	SOU194117SA001	mg/kg	20	U	1.3	E	43.90%
1	SOU194120SA001	mg/kg	20	U	1.3	E	43.90%
4	SOU194126SA004	mg/kg	20	U	1.3	E	43.90%
1	SOU194161SA001	mg/kg	20	U	1.3	E	43.90%
1	SOU194184SA001	mg/kg	20	U	1.3	E	43.90%
1	SOU194220SA001	mg/kg	20	U	1.3	E	43.90%
10	SOU194231SA010	mg/kg	20	U	1.3	E	43.90%
10	SOU194293SA010	mg/kg	20	U	1.3	N	43.90%
7	SOU194312SA007	mg/kg	20	U	1.3	NE	43.90%
1	SOU194358SA001	mg/kg	20	U	1.3	NE	43.90%
4	SOU194358SA004	mg/kg	20	U	1.4		43.46%
1	SOU194393SA001	mg/kg	20	U	1.4		43.46%
7	SOU195006SA007	mg/kg	20	U	1.4		43.46%
4	SOU195014ASA004	mg/kg	20	U	1.4		43.46%
10	SOU195014CSA010	mg/kg	20	U	1.4		43.46%
7	SOU195193SA007	mg/kg	20	U	1.4		43.46%
4	SOU195195ASA004	mg/kg	20	U	1.4		43.46%
4	SOU200004BSA004	mg/kg	20	U	1.4		43.46%
4	SOU200008ASA004	mg/kg	20	U	1.4		43.46%
4	SOU200011DSA004	mg/kg	20	U	1.4		43.46%
4	SOU200011KSA004	mg/kg	20	U	1.4		43.46%
1	SOU211001ASA001	mg/kg	20	U	1.4		43.46%
7	SOU211002SA007	mg/kg	20	U	1.4	E	43.46%
1	SOU214001SA001	mg/kg	20	U	1.4	E	43.46%
1	SOU215001DSA001	mg/kg	20	U	1.4	E	43.46%
4	SOU215001HSA004	mg/kg	20	U	1.4	E	43.46%
1	SOU217014ASA001	mg/kg	20	U	1.4	E	43.46%
1	SOU217014BSA001	mg/kg	20	U	1.4	E	43.46%
7	SOU221003CSA007	mg/kg	20	U	1.4	E	43.46%
4	SOU221004DSA004	mg/kg	20	U	1.4	E	43.46%
4	SOU221005ASA004	mg/kg	20	U	1.4	N	43.46%
1	SOU222001GSA001	mg/kg	20	U	1.4	NE	43.46%
4	SOU222001ISA004	mg/kg	20	U	1.4	NE	43.46%
4	SOU222001LSA004	mg/kg	20	U	1.4	NE	43.46%
4	SOU224001MSA004	mg/kg	20	U	1.5		43.02%
10	SOU226008SA010	mg/kg	20	U	1.5		43.02%
4	SOU227027CSA004	mg/kg	20	U	1.5		43.02%
7	SOU228002SA007	mg/kg	20	U	1.5		43.02%
1	SOU228004SA001	mg/kg	20	U	1.5		43.02%
1	SOU483001SA001	mg/kg	20	U	1.5		43.02%
4	SOU483004DSA004	mg/kg	20	U	1.5		43.02%
4	SOU483004SA004	mg/kg	20	U	1.5	E	43.02%
4	SOU488001SA004	mg/kg	20	U	1.5	E	43.02%
1	SOU489001SA001	mg/kg	20	U	1.5	E	43.02%
1	SOU517001SA001	mg/kg	20	U	1.5	E	43.02%
4	SOU517001SA004	mg/kg	20	U	1.5	E	43.02%
1	SOU196001SA001	mg/kg	20	U	1.5	E	43.02%
4	SOU196001SA004	mg/kg	20	U	1.5	E	43.02%
4	SOU520013SA004	mg/kg	20	U	1.5	E	43.02%
4	SOU520017SA004	mg/kg	20	U	1.5	E	43.02%
1	SOU520025SA001	mg/kg	20	U	1.5	E	43.02%
4	SOU520049SA004	mg/kg	20	U	1.5	N	43.02%
10	SOU520056SA010	mg/kg	20	U	1.5	NE	43.02%
1	SOU520064SA001	mg/kg	20	U	1.6		42.59%

Table B4.1 Uranium Comparison (Continued)

Sample End Level (ft)	Sample ID	Units	XRF RESULTS	XRF Qualifier	Lab RESULTS	Lab Qualifier	RPD
4	SOU531001SA004	mg/kg	20	U	1.6		42.59%
7	SOU015017SA007	mg/kg	20	U	1.6		42.59%
4	SOU015028SA004	mg/kg	20	U	1.6		42.59%
4	SOU015046SA004	mg/kg	20	U	1.6	E	42.59%
2	SOU026P19SA002	mg/kg	20	U	1.6	E	42.59%
2	SOU026P30SA002	mg/kg	20	U	1.6	E	42.59%
2	SOU026P40SA002	mg/kg	20	U	1.6	E	42.59%
1	SOU075002SA001	mg/kg	20	U	1.6	E	42.59%
1	SOU138001ASA001	mg/kg	20	U	1.6	E	42.59%
10	SOU138001CSA010	mg/kg	20	U	1.6	N	42.59%
10	SOU138006SA010	mg/kg	20	U	1.6	N	42.59%
1	SOU138012SA001	mg/kg	20	U	1.6	NE	42.59%
10	SOU138013SA010	mg/kg	20	U	1.6	NE	42.59%
1	SOU138017SA001	mg/kg	20	U	1.7		42.17%
4	SOU138018BSA004	mg/kg	20	U	1.7		42.17%
7	SOU138021SA007	mg/kg	20	U	1.7		42.17%
4	SOU138024DSA004	mg/kg	20	U	1.7	E	42.17%
1	SOU153001SA001	mg/kg	20	U	1.7	E	42.17%
4	SOU160001SA004	mg/kg	20	U	1.7	E	42.17%
1	SOU160002SA001	mg/kg	20	U	1.7	NE	42.17%
1	SOU180001SA001	mg/kg	20	U	1.8		41.74%
1	SOU180011SA001	mg/kg	20	U	1.8		41.74%
10	SOU180025ASA010	mg/kg	20	U	1.8		41.74%
1	SOU180028SA001	mg/kg	20	U	1.8		41.74%
1	SOU180039SA001	mg/kg	20	U	1.8	E	41.74%
4	SOU194006SA004	mg/kg	20	U	1.8	E	41.74%
1	SOU194027SA001	mg/kg	20	U	1.8	NE	41.74%
4	SOU194030SA004	mg/kg	20	U	1.9		41.32%
1	SOU194034SA001	mg/kg	20	U	1.9		41.32%
4	SOU194054SA004	mg/kg	20	U	1.9	E	41.32%
4	SOU194056SA004	mg/kg	20	U	1.9	E	41.32%
1	SOU194073SA001	mg/kg	20	U	1.9	E	41.32%
1	SOU194080SA001	mg/kg	20	U	1.9	E	41.32%
4	SOU194092SA004	mg/kg	20	U	1.9	E	41.32%
4	SOU194104SA004	mg/kg	20	U	1.9	NE	41.32%
4	SOU194116SA004	mg/kg	20	U	2	E	40.91%
4	SOU194120SA004	mg/kg	20	U	2	E	40.91%
4	SOU194121SA004	mg/kg	20	U	2	E	40.91%
1	SOU194136SA001	mg/kg	20	U	2	NE	40.91%
4	SOU194136SA004	mg/kg	20	U	2.1		40.50%
4	SOU194161SA004	mg/kg	20	U	2.1	NE	40.50%
4	SOU194168SA004	mg/kg	20	U	2.2		40.09%
1	SOU194182SA001	mg/kg	20	U	2.2		40.09%
4	SOU194197SA004	mg/kg	20	U	2.2		40.09%
4	SOU194202SA004	mg/kg	20	U	2.2		40.09%
4	SOU194216SA004	mg/kg	20	U	2.2	E	40.09%
1	SOU194243SA001	mg/kg	20	U	2.2	E	40.09%
1	SOU194255SA001	mg/kg	20	U	2.2	E	40.09%
4	SOU194259SA004	mg/kg	20	U	2.2	E	40.09%
4	SOU194282SA004	mg/kg	20	U	2.2	NE	40.09%
1	SOU194285SA001	mg/kg	20	U	2.2	NE	40.09%
1	SOU194302SA001	mg/kg	20	U	2.3		39.69%
4	SOU194302SA004	mg/kg	20	U	2.3		39.69%
1	SOU194314SA001	mg/kg	20	U	2.3	E	39.69%
1	SOU194325SA001	mg/kg	20	U	2.3	E	39.69%

Table B4.1 Uranium Comparison (Continued)

Sample End Level (ft)	Sample ID	Units	XRF RESULTS	XRF Qualifier	Lab RESULTS	Lab Qualifier	RPD
4	SOU194326SA004	mg/kg	20	U	2.3	NE	39.69%
4	SOU194338SA004	mg/kg	20	U	2.5		38.89%
1	SOU194342SA001	mg/kg	20	U	2.5	E	38.89%
4	SOU194354SA004	mg/kg	20	U	2.5	E	38.89%
1	SOU194367SA001	mg/kg	20	U	2.6	E	38.50%
4	SOU194388SA004	mg/kg	20	U	2.7	E	38.11%
1	SOU195007SA001	mg/kg	20	U	2.7	NE	38.11%
4	SOU195010SA004	mg/kg	20	U	2.8	E	37.72%
1	SOU195012SA001	mg/kg	20	U	2.8	E	37.72%
4	SOU195028SA004	mg/kg	20	U	2.8	E	37.72%
4	SOU195031SA004	mg/kg	20	U	2.9		37.34%
1	SOU195032SA001	mg/kg	20	U	2.9		37.34%
4	SOU195036SA004	mg/kg	20	U	2.9		37.34%
1	SOU195043SA001	mg/kg	20	U	3		36.96%
4	SOU195051SA004	mg/kg	20	U	3		36.96%
4	SOU195056SA004	mg/kg	20	U	3.1		36.58%
1	SOU195061SA001	mg/kg	20	U	3.2		36.21%
4	SOU195061SA004	mg/kg	20	U	3.3		35.84%
1	SOU195068SA001	mg/kg	20	U	3.3		35.84%
1	SOU195073SA001	mg/kg	20	U	3.5		35.11%
1	SOU195079SA001	mg/kg	20	U	3.6		34.75%
4	SOU195085SA004	mg/kg	20	U	3.6	E	34.75%
4	SOU195098SA004	mg/kg	20	U	3.7		34.39%
4	SOU195104SA004	mg/kg	20	U	3.7	N	34.39%
1	SOU195105SA001	mg/kg	20	U	3.7	NE	34.39%
4	SOU195107SA004	mg/kg	20	U	3.8		34.03%
4	SOU195112SA004	mg/kg	20	U	3.8	E	34.03%
1	SOU195115SA001	mg/kg	20	U	3.8	NE	34.03%
4	SOU195118SA004	mg/kg	20	U	3.9	NE	33.68%
1	SOU195121SA001	mg/kg	20	U	4		33.33%
1	SOU195125SA001	mg/kg	20	U	4.1		32.99%
1	SOU195154SA001	mg/kg	20	U	4.1	E	32.99%
4	SOU195155SA004	mg/kg	20	U	4.4		31.97%
1	SOU195158SA001	mg/kg	20	U	4.4		31.97%
4	SOU195160SA004	mg/kg	20	U	4.9	NE	30.32%
1	SOU195162SA001	mg/kg	20	U	5.1		29.68%
4	SOU195173SA004	mg/kg	20	U	5.1		29.68%
1	SOU195177SA001	mg/kg	20	U	5.3		29.05%
4	SOU195178SA004	mg/kg	20	U	5.5	N	28.43%
4	SOU195199SA004	mg/kg	20	U	5.6	E	28.13%
4	SOU200005SA004	mg/kg	20	U	5.6	E	28.13%
4	SOU212001SA004	mg/kg	20	U	5.7		27.82%
2	SOU212P05SA002	mg/kg	20	U	6.1	N	26.63%
1	SOU213001SA001	mg/kg	20	U	6.2	E	26.34%
0.5	SOU215001SA001	mg/kg	20	U	6.4		25.76%
1	SOU221001SA001	mg/kg	20	U	6.4		25.76%
1	SOU225001SA001	mg/kg	20	U	6.9	N	24.35%
1	SOU227023SA001	mg/kg	20	U	6.9	N	24.35%
4	SOU227023SA004	mg/kg	20	U	7		24.07%
4	SOU229004SA004	mg/kg	20	U	7.4	N	22.99%
4	SOU229018SA004	mg/kg	20	U	7.6		22.46%
1	SOU493001SA001	mg/kg	20	U	7.9	NE	21.68%
4	SOU493001SA004	mg/kg	20	U	8.1		21.17%
1	SOU520022SA001	mg/kg	20	U	8.4	E	20.42%
4	SOU520022SA004	mg/kg	20	U	9	E	18.97%

Table B4.1 Uranium Comparison (Continued)

Sample End Level (ft)	Sample ID	Units	XRF RESULTS	XRF Qualifier	Lab RESULTS	Lab Qualifier	RPD
1	SOU520057SA001	mg/kg	20	U	9.6		17.57%
1	SOU014013SA001	mg/kg	20	U	10.1	E	16.45%
1	SOU014033SA001	mg/kg	20	U	11.3	E	13.90%
4	SOU014044SA004	mg/kg	20	U	17		4.05%
4	SOU014096SA004	mg/kg	20	U	23.3		-3.81%
4	SOU014101SA004	mg/kg	20	U	24.1		-4.65%

RPD = relative percent difference
XRF = X-ray fluorescence

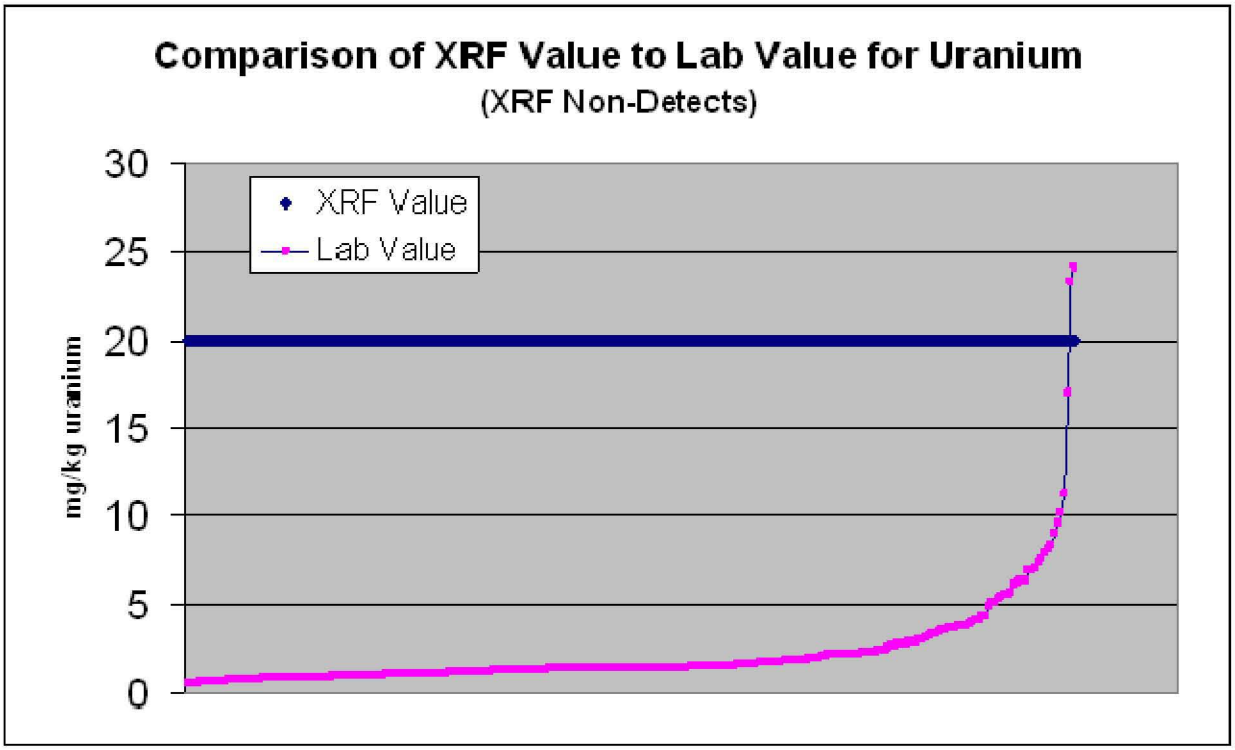


Figure B4.3. Comparison of XRF Nondetect Uranium and Laboratory Uranium Results

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APPENDIX C

FATE AND TRANSPORT MODELING

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CONTENTS

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C.1. INTRODUCTION

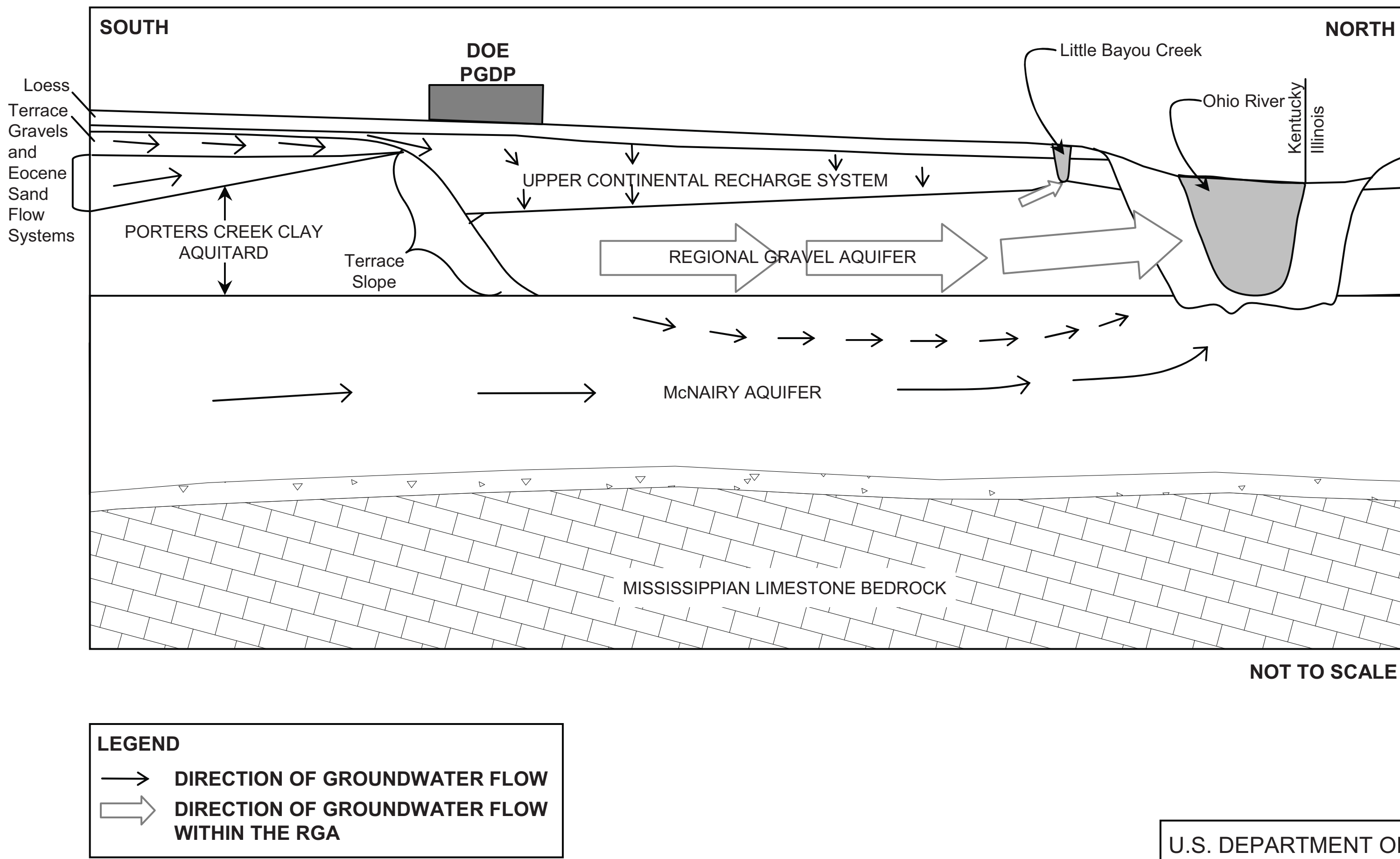
Seasonal Soil Compartment Model (SESOIL) and Analytical Transient 1-, 2-, 3-Dimensional Model (AT123D) groundwater and transport modeling were conducted as part of the Soils Operable Unit (OU) Remedial Investigation (RI) to evaluate the potential Regional Gravel Aquifer (RGA) groundwater impacts from residual soil contamination at the solid waste management unit (SWMU)/areas of concern (AOCs) boundary, the U.S. Department of Energy (DOE) property boundary, and the surface water discharge location. This modeling evaluated migration of metals, radionuclides, and Total PCBs because other modeling determined that residual volatile organic compound (VOC) contamination found at Soils OU SWMUs/AOCs and not addressed by other actions (e.g., VOC contamination at SWMU 1) would not impact adversely the RGA groundwater. Figure C.1 illustrates the relationship of the RGA and the UCRS at the Paducah Gaseous Diffusion Plant (PGDP).

The contents of this report are as follows:

- Section 2 discusses the technical approach used for determining the impacts of soil constituent concentrations on RGA groundwater.
- Section 3 compiles and presents Soils OU SWMU/AOC-specific soil sample results and soil and groundwater flow and contaminant transport parameters. SESOIL and AT123D model input data also are presented.
- Section 4 presents SESOIL and AT123D modeling results.
- Section 5 provides a summary of the modeling effort.
- Section 6 provides references used in the report.
- Attachment C1 to Appendix C provides a discussion of the screening used to identify which SWMU/AOCs soil constituent combinations were subjected to modeling.
- Attachment C2 to Appendix C provides an evaluation of the dilution attenuation factor (DAF), including a sensitivity analysis of how the screening results would vary in response to a change in the target DAF used in screening.
- Attachment C3 of Appendix C provides modeling inputs.
- Attachments C4, C5, and C6 of Appendix C provide Spatial Analysis and Decision Assistance (SADA) (UT 2002) analysis.

C.2. TECHNICAL APPROACH

The first step in this modeling effort was to evaluate SWMU/AOC-specific soil constituent concentration data and determine which SWMUs/AOCs and soil constituents posed a potential threat to RGA groundwater quality. The screening process followed Risk Methods Document (DOE 2011a) procedures and is documented in the Fate and Transport Section of this report, as supplemented by Attachments C1, C2, and C3. After the screening process, flow paths from the SWMUs/AOCs of concern to the surface



Source: PRS 2009

U.S. DEPARTMENT OF ENERGY
DOE PORTSMOUTH/PADUCAH PROJECT OFFICE
PADUCAH GASEOUS DIFFUSION PLANT

LATA Environmental Services of Kentucky, LLC

Figure C.1. Water-Bearing Zones near PGDP

water discharge location were determined using MODPATH (Pollack 1994) and PGDP MODFLOW2000 (Harbaugh et al. 2000) groundwater flow model (PRS 2008). In addition, the average hydraulic conductivity and horizontal hydraulic gradient were determined for each flow paths. Next, the individual SWMU/AOC average soil constituent concentration was determined for 0 ft to 5 ft, 5 ft to 10 ft, and 10 ft to 15 ft depths, and these concentrations were used as input values for the SESOIL modeling. SESOIL predicted UCRS temporal groundwater contaminant concentrations that then were used as input to AT123D to predict downgradient RGA contaminant concentrations at the SWMU/AOC boundary, at DOE property boundary, and the surface water discharge location.

C.3. DATA EVALUATION AND COMPILATION

This section compiles and presents Soils OU SWMU/AOC-specific soil sample results and soil and groundwater flow and contaminant transport parameters. SESOIL and AT123D model input data also are presented.

C.3.1 SOIL CONTAMINANT SCREENING

Soil contaminant screening (described in Attachment C1) determined that the SWMUs/AOCs and soil contaminants listed in Table C.3.1 could potentially impact RGA groundwater quality. These constituents were subjected to groundwater modeling to bound the potential for impacts to RGA groundwater.

Table C.3.1. SWMUs/AOCs and Associated Soil Constituents Subjected to Modeling

SWMU/AOC	Contaminant
1	Trichloroethene*
1	*cis*-Dichloroethene*
1	Vinyl Chloride*
14	Chromium (+3/+6)
14	Nickel
14	Technetium-99
81	Uranium
81	Total PCBs
165	Arsenic
541	Total PCBs
564	Arsenic

* Trichloroethene, *cis*-1,2-dichloroethene, and vinyl chloride were modeled for *Record of Decision for Solid Waste Management Units 1, 211-A, 211-B, and Part of 102 Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2012).

C.3.2 AVERAGE UCRS SOIL CONTAMINANT CONCENTRATIONS AND DISTRIBUTIONS

The PGDP soils database was evaluated to determine how many samples (Table C.3.2) had been collected at each SWMU/AOC previously identified as potentially problematic (Table C.3.1). The soil samples were further evaluated to determine if duplicate samples were present and the number of those samples having detections. With the exceptions of SWMU 14 [Chromium (Cr)], SWMU 14 [nickel (Ni)], SWMU 81 [Total polychlorinated biphenyls (Total PCBs)], and AOC 541 (Total PCBs), the total number of samples collected is less than 10 in each SWMU/AOC data set with even a fewer number of detections

Table C.3.2. Soil Sample Summary[1]

SWMU/AOC	Size (acres)	Contaminant	Depth, ft below ground surface (bgs)	Number of Samples	Number of Analytical Detects
14	5.75	Technetium-99	0 to 5	22	22
			5 to 10	1	1
			10 to 15	1	1
14	5.75	Chromium*	0 to 5	239	101
			5 to 10	16	9
			10 to 15	17	14
14	5.75	Nickel	0 to 5	239	162
			5 to 10	16	14
			10 to 15	17	5
81	0.26	Total PCBs	0 to 5	51	32
			5 to 10	9	2
			10 to 15	3	0
81	0.26	Uranium	0 to 5	59	23
			5 to 10	8	1
			10 to 15	0	0
165	0.49	Arsenic	0 to 5	7	6
			5 to 10	1	1
			10 to 15	1	1
541	2.00	Total PCBs	0 to 5	434	92
			5 to 10	0	0
			10 to 15	0	0
564	0.50	Arsenic	0 to 5	3	3
			5 to 10	0	0
			10 to 15	0	0

* The total mass of chromium was modeled using the K_ds for both trivalent and hexavalent forms.
[1] Table C.3.2 counts only one duplicate soil sample result under the column labeled number of samples, so the actual number of soil samples in the database is greater than what is reported in the tally.

above the analytical detection limit. As per the Risk Methods Document (DOE 2011a), the higher-concentration sample of the duplicate was retained in the data set and used in modeling. Given the small sample sizes, geostatistical evaluation was not used. Rather, soil concentration averages for the detections were calculated for 0 ft to 5 ft, 5 ft to 10 ft, and 10 ft to 15 ft depths below ground surface (Table C.3.3). While there were enough sample results to use geostatistical evaluation for some SWMU/AOC contaminant combinations (e.g., SWMU 14 chromium and nickel, SWMU 81 and AOC 541 PCB data), average soil constituent concentrations also were calculated for these SWMUs/AOCs constituent combinations for consistency.

The area affected by soil contamination was determined by assuming that the area impacted was proportional to the ratio of the number of detects verses the total number of samples collected in a depth interval at the SWMU/AOC. The ratio then was converted to a proportion, and the SWMU/AOC area was multiplied by the proportion to determine the impacted area (Table C.3.4). For example, at SWMU 14, at a depth interval of between 10 and 15 ft bgs, 5 of 17 soil samples had a detectable level of chromium soil contamination. Based on the ratio, equal to a proportion of 0.294 (i.e., 5/17), the area affected by chromium contamination was assumed to be 1.69 acres of the total SWMU size of 5.75 acres.

Table C.3.3. Average Soil Constituent Concentrations

SWMU/AOC	Contaminant	0 ft to 5 ft bgs Average Concentration, µg/g	5 ft to 10 ft bgs Average Concentration, µg/g	10 ft to15 ft bgs Average Concentration, µg/g
14	Technetium-99	3.50×10^{-3} (59.5 pCi/g)	5.77×10^{-5} (0.981 pCi/g)	9.94×10^{-5} (1.70 pCi/g)
14	Chromium*	50.90	44.84	41.49
14	Nickel	401.18	199.34	46.64
81	Uranium	2,502	0.79	0
81	Total PCBs	14.13	5.24	0
165	Arsenic	31.7	4.5	5.0
541	Total PCBs	29.51	0	0
564	Arsenic	25.38	0	0

* The total mass of chromium was modeled using K_ds for both trivalent and hexavalent forms.

Table C.3.4. Area of Soil Contamination

SWMU/AOC	SWMU/AOC Area (acres)	0 ft to 5 ft bgs contaminated area (acres)	5 ft to 10 ft bgs contaminated area (acres)	10 ft to15 ft bgs contaminated area (acres)
14 (Cr)*	5.75	2.43	3.23	4.74
14 (Ni)	5.75	3.89	5.03	1.69
14 (Tc-99)	5.75	5.75	5.75	5.75
81 (U)	0.26	0.10	0.03	0
81 (Total PCBs)	0.26	0.16	0.06	0
165 (As)	0.49	0.42	0.07	0.07
541 (Total PCBs)	2.00	0.42	0	0
564 (As)	0.50	0.50	0	0

* The total mass of chromium was modeled using K_ds for both trivalent and hexavalent forms.

C.3.3 TCE HALF-LIFE ASSESSMENT

When modeling organic solvents, such as trichloroethene (TCE), the degradation rate of the organic solvent in the environment is important to the model results. With the exception of SWMU 1, where organic solvent contaminant is being addressed by another action (DOE 2012), the Soils OU SWMUs/AOCs do not have organic solvent contamination requiring modeling; therefore, an evaluation of TCE degradation (i.e., half-life assessment) is not included in this RI.

C.3.4 PARTICLE TRACE EVALUATIONS

Potential RGA groundwater flow paths from the SWMUs/AOCs listed in Table C.3.1 were determined using particle traces. Particle traces were created by placing a particle representing a water molecule in the middle of the SWMU/AOC and allowing the particle to migrate with the modeled groundwater flow field. To ensure correspondence with likely long-term RGA groundwater flow conditions, the simulation assumed that there was no anthropogenic recharge, and the extraction well field for the Northwest and Northeast TCE Plumes was not operational (i.e., the PGDP has been decommissioned). Of interest were the difference in groundwater elevations at the start and end of the flow path, the length of the flow path from the SWMU/AOC to the downgradient edge of the SWMU/AOC, to the DOE property boundary, and to the discharge location; and the average RGA hydraulic conductivity along the flow path. Table C.3.5 summarizes the results of the particle trace evaluation.

C.3.5 SESOIL AND AT123D INPUTS

The following section summarizes the input parameters used with the SESOIL and AT123D models. The units presented with the input data are those used with SESOIL and AT123D.

Table C.3.5. Summary of Particle Trace Results

SWMU/AOC	Head Difference along RGA Flow Path (ft)	Distance to SWMU/AOC Boundary (ft)	Distance to DOE Property Boundary (ft)	Distance to Surface Water Discharge Location (ft)	Discharge Location	Average RGA Hydraulic Conductivity (ft/d)	Average RGA Horizontal Hydraulic Gradient (ft/ft)
14	28.43	276	2,419	18,829	Ohio River	1,753	1.50E-3
81	15.12	102	7,409	18,220	Ohio River	1,705	3.64E-4
165	16.55	72	8,501	20,490	Ohio River	1,719	8.02E-4
564	1.36	23	2,588	3,732	Little Bayou Creek	2,117	8.30E-4

Note: Values are not included for AOC 541 as modeled constituents in this SWMU do not reach the RGA.

Table C.3.6 presents the UCRS properties used in the SESOIL model. It previously was agreed upon in the Soils OU Work Plan that the Soils OU would limit the soil depths used in the modeling to 15 ft below ground surface or less. Thus, Soils OU SWMU-specific input at depths greater than 15 ft were not available for the SESOIL and AT123D simulations. To overcome this limitation, SWMU 1 SESOIL and AT123D general input parameters were assumed representative of all the modeled sites for those depths greater than 15 ft. As noted in Attachment C1, except for AOC 541 (where the lithology is unknown), the lithology of all modeled SWMUs is similar enough to SWMU 1 so that this assumption is reasonable.

Table C.3.6. General SESOIL Input Parameters

Input Parameter	Value	Source
Soil type	Silty clay	PGDP site-specific
Bulk density (g/cm^3)	1.46	Laboratory analysis
Annual Percolation rate (cm/year)	10.5	SESOIL Climate Data
Intrinsic permeability (cm^2)	1.65E-10	Calibrated
Disconnectedness index	10	Calibrated
Porosity	0.45	Laboratory analysis
Depth to RGA potentiometric surface (m)	16.76	Typical based on field observation
Organic carbon content ($f_{oc)}$ (%)	0.08	Laboratory analysis
Frendlich equation exponent	1	SESOIL default value

Chemical-specific parameters for the soil constituents are listed in Table C.3.7.

SESOIL uses the same contaminated soil area as an input parameter for all depth intervals in a given SWMU; however, as shown in Table C.3.4, the contaminated soil area in the Soils OU SWMUs varies with depth. To adjust the evaluation to allow the modeling to meet the SESOIL requirement of constant contaminated soil areas, the estimated soil concentrations were adjusted by multiplying the concentrations by the ratio of the depth-specific soil contamination area to the largest soil contamination area for that SWMU. Doing so yields a result that adjusts the contaminant mass loading used in the uniform SESOIL areas to match the actual contaminant mass loading. Table C.3.8 lists the area-adjusted soil contaminant concentrations used in the SESOIL modeling.

Table C.3.7. Chemical-Specific Parameters of the Site-Related Soil Constituents Used in SESOIL Modeling

Soil Constituent	Mol. Wt. (MW) (g/gmol)	Solubility in water (mg/L)	Diffusion in air (cm^2/s)	Diffusion in water (m^2/hr)	Henry's Constant ($atm.m^3/mol$)	K_{oc} (L/kg)	K_d (L/kg)	Degradation Half Life (years)
Arsenic	75	1.00E+7	NA	3.60E-7	NA	NA	29	Assumed infinite
Chromium +3	52	1.20E+04	NA	2.14E-06	NA	NA	1.80E+06	Assumed infinite
Chromium +6	52	1.20E+04	NA	2.14E-06	NA	NA	19	Assumed infinite
Nickel	59	4.22E+05	NA	1.76E-05	2.44E-02	NA	65	Assumed infinite
Technetium-99	99	7.18E+03*	NA	3.60E-07	NA	NA	0.2	2.13E+05
Total PCBs	292	2.77E-01	1.75E-02	2.88E-06	3.42E-04	NA	156	Assumed infinite[1]
Uranium	238	1.00E+7	NA	3.60E-7	NA	NA	66.8	4.47E+9

[1] For purposes of the modeling, no degradation of PCBs was assumed; thus, the concentrations of PCBs that are predicted to reach the RGA are an upper bound.

* Technetium-99 solubility is derived from the geochemical database 'thermo.com.V8.R6.230,' which was prepared by Lawrence Livermore National Laboratory. The exact database used here is 'llnl.dat 4023 2010-02-09 21:02:42Z,' which was converted to PHREEQC format by Greg Anderson and David Parkhurst of the U.S. Geological Survey.

Table C.3.8. Adjusted SESOIL Areas and Soil Constituent Concentrations

SWMU/ AOC	Soil Constituent	Contaminated Area (cm^2)	0 to 152.4 cm bgs Average Concentration (µg/g)	152.4 to 304.8 cm bgs Average Concentration (µg/g)	308.4 to 457.2 cm bgs Average Concentration (µg/g)
14	Technetium-99	2.33×10^8	3.50×10^{-3} (59.5 pCi/g)	5.77×10^{-5} (0.981 pCi/g)	9.94×10^{-5} (1.70 pCi/g)
14	Chromium +3/+6	1.92×10^8	26.12	30.63	41.49
14	Nickel	2.04×10^8	310.78	199.34	15.68
81	Total PCBs	6.64×10^6	14.13	1.86	0
81	Uranium	4.12×10^6	2,502	0.25	0
165	Arsenic	1.69×10^7	31.7	0.75	5.0
541	Total PCBs	1.71×10^7	29.51	0	0
564	Arsenic	2.02×10^7	25.38	0	0

Note: The contaminated area presented is the maximum area of the three soil intervals at each contaminated site (see Table C.3.4).

General AT123D input parameters are listed in Table C.3.9 and SWMU/AOC-specific input parameters are listed in Table C.3.10. The groundwater contaminant transport conceptual model assumes saturated flow through the 30-ft thick RGA with the RGA hydraulic conductivities listed in Table C.3.10.

Table C.3.9. General AT123D Input Parameters

Input Parameter	Value	Source
Bulk density (kg/m^3)	1,670	Laboratory analysis
Effective porosity	0.3	PGDP sitewide model calibrated value
TCE biological half-life, years	10	RGA Biodegradation study (KCREE 2008)
Hydraulic conductivity (m/hour)	See Table C.3.11 for SWMU/AOC-specific values	
Hydraulic gradient	See Table C.3.11 for SWMU/AOC-specific values	
RGA aquifer thickness	9.14 m	Site average
Longitudinal dispersivity (m)	1.5	
Density of water (kg/m^3)	1,000	Default
Fraction of organic carbon (%)	0.02	Laboratory analysis
Well screen length (m)	3	Assumed a 10 ft well screen mixing zone

Table C.3.10. SWMU/AOC-Specific AT123D Inputs

SWMU/AOC	Distance to SWMU/AOC Boundary Observation Location (m)	Distance to DOE Property Boundary Observation Location (m)	Distance to Surface Water Discharge Observation Location (m)	Average HU4/RGA Hydraulic Conductivity (m/hr)	Average RGA Horizontal Hydraulic Gradient (ft/ft)
14	84	737	5,741	22.26	1.50E-03
81	31	2,258	5,553	44.55	3.64E-4
165	22	2,591	6,245	26.69	8.02E-4
564	7	789	1,137	20.05	8.30E-4

Note: Values are not included for AOC 541 because modeled constituents in this SWMU do not reach the RGA.

C.4. SESOIL AND AT123D RESULTS

SESOIL and AT123D simulation results are summarized in Table C.4.1. Because migration of uranium, arsenic, nickel, chromium, and Total PCBs are retarded in the UCRS, these constituents do not reach the RGA in the 1,000-year simulation period. The distribution coefficient (K_d) of trivalent chromium is 1.8E6 L/kg and 19 L/kg for hexavalent chromium. Although it is anticipated that the chromium is present in its trivalent form at the site, it also was modeled as if the total chromium mass were in its hexavalent form (i.e., with a lower K_d) to provide a conservative estimate of its mobility. Neither form of chromium reached the RGA during the 1,000-year simulation period.

Based on the modeling results, technetium-99 (Tc-99) present in soil at SWMU 14 has the potential to impact the RGA groundwater at the SWMU boundary at concentrations (1,700 pCi/L) that exceed 900 pCi/L [the value derived by U.S. Environmental Protection Agency from the 4 mrem/yr MCL for technetium-99 (EPA 2002)]. A review of the monitoring well and extraction well data does not show incremental impacts to the RGA plume from SWMU 14 (see also Attachment C1). The Tc-99 plume is sourced from the vicinity of C-400 without measured change as it passes by SWMU 14.

SWMU 14 is located just upgradient of the Northwest Plume extraction wells. Tc-99 concentrations from the extraction wells have not exceeded 900 pCi/L since 1998.

Table C.4.1. SESOIL and AT123D Maximum Predicted Groundwater Concentrations

SWMU/ AOC	Groundwater Constituent	RGA Groundwater Concentration at SWMU/AOC Boundary (µg/L)	Time to Reach SWMU/AOC Boundary (years)	RGA Groundwater Concentration at DOE Property Boundary (µg/L)	Time to Reach DOE Property Boundary (years)	RGA Groundwater Concentration at Discharge Location (µg/L)	Time to Reach Discharge Location[a] (years)	UCRS Groundwater Concentrations at the UCRS/RGA interface (µg/L)
14	Technetium-99	0.100 (1,700 pCi/L)	38	0.060 (1,020 pCi/L)	38	0.020 (339 pCi/L)	45	3.33 (56,500 pCi/L)
14	Chromium	Uranium, arsenic, Total PCBs, chromium (+3 or +6), and nickel do not reach the RGA in the 1,000-year SESOIL modeling period.						
14	Nickel							
81	Total PCBs							
81	Uranium							
165	Arsenic							
541	Total PCBs							
564	Arsenic							

[a] The discharge location is the location to which RGA groundwater discharges to surface water.

C.5. REFERENCES

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ATTACHMENT C1

SCREENING FOR GROUNDWATER MODELING

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C1. SCREENING FOR GROUNDWATER MODELING

Attachment C1 to Appendix C presents a summary of the multistage decision process established to identify which soil constituents were evaluated using modeling to estimate the potential for impacts to the Regional Gravel Aquifer (RGA) groundwater from contaminants in the Soils Operable Unit (OU) solid waste management units (SWMUs)/areas of concern (AOCs). The decision process is described further in the Methodology section and involves the following:

1. Screening of Soils OU SWMU/AOC-specific soil sampling results against the Paducah project-specific remedial guide soil screening levels (RG SSLs);

2. Review of the site-related soil constituents that are not screened from further modeling to identify which SWMU/AOC soil constituent combinations were subjected to modeling; and

3. Identification of certain process-related soil constituents for detailed modeling even though they were not detected above RG SSLs for groundwater protection to ensure appropriate dilution attenuation factor (DAF) was used.

The RG SSLs were back-calculated from MCLs (or risk-based values, if an MCL was not available) using the DAF. The DAF for the Soils OU SWMUs/AOCs was identified from a deterministic calculation and set at 58 (see Attachment C2 to Appendix C, Soils Operable Unit Dilution Attenuation Factor). Attachment C2 includes additional information including a sensitivity analysis of the results of the screening against RG SSLs derived using a DAF of 20. The attachment also relates, where possible, the DAF to the lithology found at the Soils OU SWMUs/AOCs.

C1.1. METHODOLOGY

C1.1.1 SCREENING PROCESS

Analytical results for the Soils OU SWMUs/AOCs were first screened against SSL values to identify which SWMU/AOC soil constituent combinations required groundwater modeling. The screening steps are listed below.

1. Soils OU RG SSLs were calculated based on the MCL or residential groundwater-use no action level (NAL) as adjusted by multiplying a DAF of 1, 20, and 58.

2. The average concentration of each soil constituent at each SWMU/AOC was compared to the SSL and background. Using that comparison:

   a. If the average concentration of each soil constituent at each SWMU/AOC did not exceed the SSL and background, the screening did not indicate the need for groundwater modeling due to the *overall* potential for impacts.

   b. If the average soil constituent concentration did exceed both the SSL and background, modeling was further evaluated if that soil constituent is included in the list of contaminants of concern (COCs) identified for groundwater (Table C1.1).

Table C1.1. Chemicals Identified in the GWOU FS as Contaminants of Concern for the RGA Residential Use of Groundwater (DOE 2001d)

Aluminum	1,1,1-Trichloroethane	Americium-241
Antimony	1,1,2-Trichloroethane	Cesium-137
Arsenic	1,1-Dichloroethene	Neptunium-237
Beryllium	1,2-Dichloroethane	Radium-226
Boron	*cis*-1,2-Dichloroethene	Radon-222
Cadmium	*trans*-1,2-Dichloroethene	Technetium-99
Chromium	2-Butanone	Uranium-234
Fluoride	4-Methyl-2-pentanone	Uranium-235
Iron	Acetone	Uranium-238
Lead	Acrylonitrile	
Lithium	Benzene	
Manganese	Bis(2-ethylhexyl)phthalate	
Molybdenum	Bromomethane	
Nickel	Carbazole	
Silver	Carbon tetrachloride	
Vanadium	Chlorobenzene	
	Chloroform	
	Chloromethane	
	Ethylbenzene	
	Methylene chloride	
	Aroclor-1254	
	Polychlorinated biphenyls	
	Tetrachloroethene	
	Trichloroethene	
	Vinyl chloride	
	Xylenes	

3. Information on the presence of a contaminant in RGA groundwater and whether the results modeling yielded groundwater concentrations of the contaminant consistent with background were considered when determining if detailed modeling of the residual soil contaminant was performed.

4. The individual soil constituent concentrations were compared to the SSL/background; if at least three sample results from one SWMU/AOC exceeded the SSL/background concentrations, groundwater modeling of the SWMU/AOC soil constituent combination was considered. Some of these SWMU/AOC soil constituent combinations were further evaluated using SADA to identify if the exceedances are indicative of hot spots and whether any of these SWMU/AOC soil constituent combinations needed to be subjected to modeling.

For those SWMU/AOC soil constituent combinations whose average concentration at that SWMU/AOC exceeded the screening levels, the next step was to review those combinations against the groundwater COC list (Table C1.1), the groundwater data, and the other site-specific considerations (e.g., location of the SWMU/AOC relative to the groundwater data) to support a determination of those constituents that were then subjected to modeling. The determination of which soil constituent SWMU/AOC combinations to subject to modeling considered the nature of the soil constituents (naturally occurring compounds?) and whether there was an identified groundwater impact of that soil constituent in the vicinity of the SWMU/AOC in question.

A decision was made to model uranium at SWMU 81, Total PCBs at SWMU 81 and AOC 541, Tc-99 at SWMU 14, and arsenic at SWMU 165 and AOC 564 to bound the potential for impacts to RGA groundwater resulting from migration from the Soils OU. These constituents were modeled in accordance with the RMD, Section 3.3.3.2 (DOE 2011a), even though the screening process did not necessarily identify a groundwater impact attributable to any Soils OU SWMU/AOC.

C1.1.2 RG SSL DETERMINATION

The RG SSLs were determined using the U.S. Environmental Protection Agency (EPA)-established formulas listed below. These formulas and inputs are consistent with those used in the Risk Methods Document (DOE 2011). If a maximum contaminant level (MCL) is established for the chemical, then the RG SSLs are based on the MCL; if not, then they are based on the residential NAL for groundwater use.

For inorganic compounds,

$$C_t = C_w\left(K_d + \frac{\theta_w + \theta_a H'}{\rho_b}\right)$$

Where:
C_t = screening level in soil (mg/kg)
C_w = target soil leachate concentration (mg/L) (MCL or residential NAL x 58 DAF)
K_d = soil-water partition coefficient (L/kg) (chemical-specific, see Table C1.1)
θ_w = water-filled soil porosity (L_{water}/L_{soil}) (0.3) (EPA 1996)
θ_a = air-filled soil porosity (L_{air}/L_{soil}) (0.13) (EPA 1996)
ρ_b = dry soil bulk density (kg/L) (1.5) (EPA 1996)
H' = dimensionless Henry's law constant [chemical-specific x 41 (conversion factor)] (value taken from EPA Web site http://www.epa.gov/safewater/consumer/pdf/mcl.pdf)

For organic compounds,

$$C_t = C_w\left((K_{oc}\, f_{oc}) + \frac{\theta_w + \theta_a H'}{\rho_b}\right)$$

Where:
C_t = screening level in soil (mg/kg)
C_w = target soil leachate concentration (mg/L) (MCL or residential NAL x 58 DAF)
K_{oc} = soil organic carbon-water partition coefficient (L/kg) (chemical-specific, taken from EPA Web site)
f_{oc} = organic carbon content of soil (kg/kg) (0.002) (EPA 1996)
θ_w = water-filled soil porosity (L_{water}/L_{soil}) (0.3) (EPA 1996)
θ_a = air-filled soil porosity (L_{air}/L_{soil}) (0.13) (EPA 1996)
ρ_b = dry soil bulk density (kg/L) (1.5) (EPA 1996)
H' = dimensionless Henry's law constant [chemical-specific x 41 (conversion factor)] (value taken from EPA Web site http://www.epa.gov/safewater/consumer/pdf/mcl.pdf)

C1.2. SCREENING, EVALUATION, AND RESULTS

C1.2.1 INITIAL SCREENING

Initial screening of the maximum detected value (only laboratory and validation qualifiers were considered in determining whether a result was detected) of soil constituents from each SWMU/AOC included determining if any of the results from that SWMU/AOC included a detected value greater than the RG SSL or subsurface background value. Only laboratory and validation qualifiers were considered in determining whether a result was detected. Chapter 4 and Appendix B of this Remedial Investigation Report give additional information regarding data quality and the use of data qualifiers for this project. A list of screening values is presented in Table C1.2.

Table C1.2. Soils OU Soil Screening Levels for Groundwater Modeling

Chemical	Target Conc. (mg/L or pCi/L)[a]	Target Ref.[b]	Subsurface Background Conc.[a]	K_d[c] (L/kg)	SSL (DAF 1)	RG SSL (DAF 20)	RG SSL (DAF 58)	UNITS
Metals								
Aluminum	1.04E+00	NAL	1.20E+04	1.50E+03	1.56E+03	3.12E+04	9.05E+04	mg/kg
Antimony	6.00E-03	MCL	2.10E-01	4.50E+01	2.71E-01	5.42E+00	1.57E+01	mg/kg
Arsenic	1.00E-02	MCL	7.90E+00	2.90E+01	2.92E-01	5.84E+00	1.69E+01	mg/kg
Barium	2.00E+00	MCL	1.70E+02	4.10E+01	8.24E+01	1.65E+03	4.78E+03	mg/kg
Beryllium	4.00E-03	MCL	6.90E-01	7.90E+02	3.16E+00	6.32E+01	1.83E+02	mg/kg
Boron	2.08E-01	NAL	n/a	3.00E+00	6.66E-01	1.33E+01	3.86E+01	mg/kg
Cadmium	5.00E-03	MCL	2.10E-01	7.50E+01	3.76E-01	7.52E+00	2.18E+01	mg/kg
Chromium	1.00E-01	MCL	4.30E+01	1.80E+06	1.80E+05	3.60E+06	1.04E+07	mg/kg
Cobalt	3.13E-04	NAL	1.30E+01	4.50E+01	1.41E-02	2.82E-01	8.18E-01	mg/kg
Copper	1.30E+00	MCL	2.50E+01	3.50E+01	4.58E+01	9.16E+02	2.66E+03	mg/kg
Iron	7.29E-01	NAL	2.80E+04	2.50E+01	1.84E+01	3.68E+02	1.07E+03	mg/kg
Lead	1.50E-02	MCL	2.30E+01	9.00E+02	1.35E+01	2.70E+02	7.83E+02	mg/kg
Manganese	2.45E-02	NAL	8.20E+02	6.50E+01	1.60E+00	3.20E+01	9.28E+01	mg/kg
Mercury	2.00E-03	MCL	1.30E-01	5.20E+01	1.04E-01	2.08E+00	6.03E+00	mg/kg
Molybdenum	5.21E-03	NAL	n/a	2.00E+01	1.05E-01	2.10E+00	6.09E+00	mg/kg
Nickel	2.08E-02	NAL	2.20E+01	6.50E+01	1.36E+00	2.72E+01	7.89E+01	mg/kg
Selenium	5.00E-02	MCL	7.00E-01	5.00E+00	2.60E-01	5.20E+00	1.51E+01	mg/kg
Silver	5.15E-03	NAL	2.70E+00	8.30E+00	4.38E-02	8.76E-01	2.54E+00	mg/kg
Thallium	2.00E-03	MCL	3.40E-01	7.10E+01	1.42E-01	2.84E+00	8.24E+00	mg/kg
Uranium[e]	3.00E-02	MCL	4.60E+00	4.50E+02	1.35E+01	2.70E+02	7.83E+02	mg/kg
Vanadium	7.06E-05	NAL	3.70E+01	1.00E+03	7.06E-02	1.41E+00	4.09E+00	mg/kg
Zinc	3.13E-01	NAL	6.00E+01	6.20E+01	1.95E+01	3.90E+02	1.13E+03	mg/kg

Table C1.2. Soils OU Soil Screening Values for Groundwater Modeling (Continued)

Chemical	Target Conc.[a]	Target Ref.[b]	Sub-surface Bckgd[a]	K_d[c] (L/kg)	SSL (DAF 1)	RG SSL (DAF 20)	RG SSL (DAF 58)	UNITS
Radionuclides								
Americium-241	1.50E+01	MCL	n/a	8.20E+00	1.29E-01	2.58E+00	7.48E+00	pCi/g
Cesium-137	2.00E+02	MCL	2.80E-01	1.00E+01	2.83E+00	5.66E+01	1.64E+02	pCi/g
Cobalt-60	1.00E+02	MCL	n/a	1.00E-01	1.21E-01	2.41E+00	6.99E+00	pCi/g
Neptunium-237	1.50E+01	MCL	n/a	1.00E-01	4.50E-03	9.00E-02	2.61E-01	pCi/g
Plutonium-238	1.50E+01	MCL	n/a	5.00E+00	8.75E-02	1.75E+00	5.08E+00	pCi/g
Plutonium-239	1.50E+01	MCL	n/a	5.00E+00	7.80E-02	1.56E+00	4.52E+00	pCi/g
Plutonium-239/240	1.50E+01	MCL	n/a	5.00E+00	7.80E-02	1.56E+00	4.52E+00	pCi/g
Technetium-99[f]	9.00E+02	MCL[f]	2.80E+00	2.00E-01	3.66E-01	7.32E+00	2.12E+01	pCi/g
Thorium-230	1.50E+01	MCL	1.40E+00	2.00E+01	3.03E-01	6.06E+00	1.76E+01	pCi/g
Uranium-233/234[e]	2.89E+05	PRG[e]	1.20E+00	4.50E+02	1.30E+05	2.60E+06	7.55E+06	pCi/g
Uranium-234[e]	1.87E+05	PRG[e]	1.20E+00	4.50E+02	8.41E+04	1.68E+06	4.88E+06	pCi/g
Uranium-235/236[e]	6.48E+01	PRG[e]	6.00E-02	4.50E+02	2.92E+01	5.84E+02	1.69E+03	pCi/g
Uranium-235[e]	6.48E+01	PRG[e]	6.00E-02	4.50E+02	8.73E+02	1.75E+04	5.07E+04	pCi/g
Uranium-238[e]	1.01E+01	PRG[e]	1.20E+00	4.50E+02	4.55E+00	9.10E+01	2.64E+02	pCi/g
Organics (PCBs)								
PCB, Total	5.00E-04	MCL	n/a	1.56E+02	7.82E-02	1.56E+00	4.54E+00	mg/kg
Organics (Semivolatile)								
Acenaphthene	1.38E-02	NAL	n/a	1.01E+01	1.42E-01	2.84E+00	8.24E+00	mg/kg
Anthracene	6.39E-02	NAL	n/a	3.27E+01	2.10E+00	4.20E+01	1.22E+02	mg/kg
Bis(2-ethylhexyl) phthalate	6.00E-03	MCL	n/a	2.39E+02	1.44E+00	2.88E+01	8.35E+01	mg/kg
Fluoranthene	1.44E-02	NAL	n/a	1.11E+02	1.60E+00	3.20E+01	9.28E+01	mg/kg
Fluorene	8.91E-03	NAL	n/a	1.83E+01	1.65E-01	3.30E+00	9.57E+00	mg/kg
Hexachlorobenzene	1.00E-03	MCL	n/a	1.24E+01	1.26E-02	2.52E-01	7.31E-01	mg/kg
Naphthalene	1.76E-04	NAL	n/a	3.09E+00	5.79E-04	1.16E-02	3.36E-02	mg/kg
Nitroaniline, 2-	1.02E-02	NAL	n/a	5.51E-01	1.02E+01	2.04E+02	5.92E+02	mg/kg
Nitroso-di-N-propylamine, N-	8.03E-06	NAL	n/a	5.26E+00	8.03E-03	1.61E-01	4.66E-01	mg/kg
Pentachlorophenol	1.00E-03	MCL	n/a	9.92E+00	1.01E-02	2.02E-01	5.86E-01	mg/kg
Pyrene	5.81E-03	NAL	n/a	1.09E+02	6.33E-01	1.27E+01	3.67E+01	mg/kg
Total PAH [Benz(a)anthracene][d]	1.22E-05	NAL	n/a	3.54E+02	4.32E-03	8.64E-02	2.51E-01	mg/kg
Organics (Volatile)								
Benzene	5.00E-03	MCL	n/a	2.92E-01	2.56E-03	5.12E-02	1.48E-01	mg/kg
Carbon Tetrachloride	5.00E-03	MCL	n/a	8.78E-02	1.94E-03	3.89E-02	1.13E-01	mg/kg
Chloroform	8.00E-02	MCL	n/a	6.36E-02	2.22E-02	4.43E-01	1.28E+00	mg/kg
Chlorobenzene	1.00E-01	MCL	n/a	4.68E-01	6.79E-02	1.36E+00	3.94E+00	mg/kg
Dibromochloromethane	8.00E-02	MCL	n/a	6.36E-02	2.13E-02	4.26E-01	1.24E+00	mg/kg
Dichlorobenzene, 1,2-	6.00E-01	MCL	n/a	7.66E-01	5.84E-01	1.17E+01	3.39E+01	mg/kg
Dichlorobenzene, 1,4-	7.50E-02	MCL	n/a	7.51E-01	7.19E-02	1.44E+00	4.17E+00	mg/kg

Table C1.2. Soils OU Soil Screening Values for Groundwater Modeling (Continued)

Chemical	Target Conc.[a]	Target Ref.[b]	Sub-surface Bckgd[a]	K_d[c] (L/kg)	SSL (DAF 1)	RG SSL (DAF 20)	RG SSL (DAF 58)	UNITS
Dichloroethane, 1,2-	5.00E-03	MCL	n/a	7.92E-02	1.42E-03	2.84E-02	8.24E-02	mg/kg
Dichloroethene, 1,1-	7.00E-03	MCL	n/a	6.36E-02	2.51E-03	5.02E-02	1.46E-01	mg/kg
Dichloroethene, 1,2-	2.24E-03	NAL	n/a	7.92E-02	6.58E-04	1.32E-02	3.82E-02	mg/kg
Dichloroethene, 1,2-*cis*-	7.00E-02	MCL	n/a	7.92E-02	2.06E-02	4.12E-01	1.19E+00	mg/kg
Dichloroethene, 1,2-*trans*-	1.00E-01	MCL	n/a	7.92E-02	2.94E-02	5.88E-01	1.71E+00	mg/kg
Ethylbenzene	7.00E-01	MCL	n/a	8.92E-01	7.85E-01	1.57E+01	4.55E+01	mg/kg
Methylene chloride	5.00E-03	MCL	n/a	4.35E-02	1.27E-03	2.54E-02	7.37E-02	mg/kg
Styrene	1.00E-01	MCL	n/a	8.92E-01	1.10E-01	2.20E+00	6.38E+00	mg/kg
Tetrachloroethene	5.00E-03	MCL	n/a	1.90E-01	2.26E-03	4.52E-02	1.31E-01	mg/kg
Toluene	1.00E+00	MCL	n/a	4.68E-01	6.91E-01	1.38E+01	4.01E+01	mg/kg
Trichlorobenzene, 1,2,4-	7.00E-02	MCL	n/a	2.71E+00	2.04E-01	4.08E+00	1.18E+01	mg/kg
Trichloroethane, 1,1,1-	2.00E-01	NAL	n/a	8.78E-02	6.97E-02	1.39E+00	4.04E+00	mg/kg
Trichloroethane, 1,1,2-	5.00E-03	MCL	n/a	1.21E-01	1.62E-03	3.24E-02	9.40E-02	mg/kg
Trichloroethene	5.00E-03	MCL	n/a	1.21E-01	1.78E-03	3.56E-02	1.03E-01	mg/kg
Vinyl Chloride	2.00E-03	MCL	n/a	4.35E-02	6.84E-04	1.37E-02	3.97E-02	mg/kg
Xylene, Mixture	1.00E+01	MCL	n/a	7.66E-01	9.84E+00	1.97E+02	5.71E+02	mg/kg
Xylene, m,p-	1.00E+01	MCL	n/a	7.51E-01	4.71E-02	9.42E-01	2.73E+00	mg/kg
Xylene, o-	4.85E-02	NAL	n/a	7.66E-01	4.77E-02	9.54E-01	2.77E+00	mg/kg

n/a = not available or not applicable; not used in this screening.
Conc. = Concentration. Concentration units as noted in the units column.
Ref. = Reference
Bckgd. = Background

[a] Target concentrations for soil constituents without an MCL and subsurface background values are taken from the Risk Methods Document (DOE 2011).

[b] MCLs are taken from the EPA Web site: http://www.epa.gov/safewater/consumer/pdf/mcl.pdf

[c] K_d values are taken from the EPA Web site http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search, consistent with the Risk Methods Document, except for Tc-99 and uranium. The Tc-99 and uranium Kd values are set at levels consistent with the Burial Grounds Operable Unit to reflect the PGDP site. The model input parameters are found in Table B.2 and Table B.3 of the *Remedial Investigation for the Burial Grounds Operable unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0030&D2/R1, February 2010.

[d] SSL (DAF 1, 20, 58) calculated as noted above, consistent with EPA Web site. SSL for uranium and Tc-99 calculated in similar manner, but based on Kd value of 450 for uranium and 0.2 for Tc-99. The SSL calculations for Tc-99 and uranium were adjusted for model input parameters to be consistent with the BGOU modeling.

[e] Uranium radionuclide values from EPA guidance, Preliminary Remediation Goals (PRGs) for Radionuclides, (http://epa-prgs.ornl.gov/radionuclides/download.html).

[f] 900 pCi/L is the value derived by EPA from the 4 mrem/yr MCL for technetium-99 (EPA 2002).

The overall average value of the soil constituent for each SWMU/AOC was calculated using both detected values and nondetected values (nondetected values at one-half the reported value). These values were used as reported and not segregated into grid values. If the overall average value of the soil constituent for the SWMU/AOC was below the background value and the RG SSL, then the soil constituent was screened out from consideration for modeling for general fate and transport. The fate and transport modeling utilizes a weighted average value of the concentration of the chemical as the source term value (see Appendix C, Attachment C3); thus, the modeled value for the RGA concentration at the SWMU/AOC boundary is expected to be below the target (MCL or risk-based) concentration if the average soil concentration is below the SSL.

If the average soil constituent concentration was found to be above both the background value and the RG SSL, then the soil constituent was subsequently evaluated against the groundwater COCs and against the information available about RGA groundwater impacts (see Section C1.3). For example, this evaluation resulted in screening out those constituents that are not RGA groundwater COCs (as presented in C1.2 (e.g., cobalt)) or those soil constituents that are not typically detected in RGA groundwater (e.g., silver; see additional discussion in Section C1.3.3). Similarly, the soils results were evaluated against any patterns of detection in RGA groundwater to identify whether a given SWMU/AOC might have been a source of the RGA exceedances. The additional information for this screening and the results of this screening are presented in the following sections.

C1.2.2 HOT SPOT SCREENING

To determine if hot spots exist within the SWMU/AOC that might pose a localized threat to groundwater, the detected results of the constituents were screened against the RG SSLs (presented in Table C1.2) and the subsurface background value, if available (DOE 2011) for each SWMU/AOC. The results of this screening returned a suspected hot spot if at least three locations in a given SWMU/AOC had a soil constituent whose concentration exceeded the higher of the background or RG SSL. Following this initial screen, the results were evaluated and soil constituents and SWMUs/AOCs were selected for further evaluation.

For the selected soil constituents, the results of this evaluation were graphically summarized. These graphs are presented in attachments to Appendix C. The selected SWMU/AOC soil constituent combinations were evaluated using SADA and plotted by depth and spatially to support an evaluation of whether a hot spot exists and whether it may present a potential risk to RGA groundwater.

C1.2.3 SCREENING SUMMARY, OVERALL AVERAGE

Table C1.3 provides the results of the screening where the overall average concentration of a soil constituent exceeds both the respective SSL and the background level.

The results of the screening are summarized in Table C1.3 to find a total of 109 SWMU/AOC soil constituent combinations that exceeded screening values, as follows:

- 2 exceeded for arsenic;
- 23 exceeded for Total PAHs or benz(a)anthracene (3 exceeded the average [calculated using half the detection limit] but the maximum detected value did not exceed the screening level);
- 2 exceeded for cobalt;
- 23 exceeded for molybdenum (18 exceeded average without maximum value exceedance);
- 8 exceeded for naphthalene;
- 4 exceeded for neptunium-237;
- 2 exceeded for nickel;
- 3 exceeded for PCB, Total;
- 2 exceeded for pentachlorophenol (1 exceeded average without maximum value exceedance);
- 30 exceeded for silver (9 exceeded average without maximum value exceedance);

Table C1.3. SWMU/AOC Soil Constituent Combinations That Survive Screening and Are Considered for Modeling Based on Overall Average Concentration

#	SWMU/ AOC	Soil Constituent	Concen-tration Units	# of Samples	Average Concentration[a]	Maximum Concentration[a]	Subsurface Background[b] Concentration	RG SSL[c] Concentration (DAF 58)	Screening Value (Higher of SSL or Background)
1	1	Benz(a)anthracene	mg/kg	108	3.02E-01	6.40E-02	0.00E+00	2.51E-01	2.51E-01
2	1	*cis*-1,2-Dichloroethene	mg/kg	138	1.79E+01	2.40E+03	0.00E+00	1.19E+00	1.19E+00
3	1	Naphthalene	mg/kg	109	1.25E+00	5.78E-04	0.00E+00	3.36E-02	3.36E-02
4	1	Pentachlorophenol	mg/kg	107	9.33E-01	1.10E-01	0.00E+00	5.86E-01	5.86E-01
5	1	Trichloroethene	mg/kg	183	1.79E+00	8.70E+01	0.00E+00	1.03E-01	1.03E-01
6	1	Vinyl chloride	mg/kg	172	4.48E-01	4.80E+00	0.00E+00	3.97E-02	3.97E-02
7	14	Molybdenum	mg/kg	307	7.16E+00	2.87E+01	0.00E+00	6.09E+00	6.09E+00
8	14	Neptunium-237	pCi/g	24	1.47E+00	1.60E+01	0.00E+00	2.61E-01	2.61E-01
9	14	Nickel	mg/kg	307	2.44E+02	2.67E+03	2.20E+01	7.89E+01	7.89E+01
10	14	Silver	mg/kg	307	5.13E+00	2.22E+01	2.70E+00	2.54E+00	2.70E+00
11	14	Technetium-99	pCi/g	24	5.44E+01	4.06E+02	2.80E+00	2.12E+01	2.12E+01
12	19	Benz(a)anthracene	mg/kg	27	4.45E-01	3.70E+00	0.00E+00	2.51E-01	2.51E-01
13	19	Naphthalene	mg/kg	27	1.89E-01	1.10E+00	0.00E+00	3.36E-02	3.36E-02
14	19	Total PAH	mg/kg	27	5.94E-01	5.23E+00	0.00E+00	2.51E-01	2.51E-01
15	76	Benz(a)anthracene	mg/kg	2	9.40E-01	1.70E+00	0.00E+00	2.51E-01	2.51E-01
16	76	Silver	mg/kg	5	3.02E+00	6.30E-02	2.70E+00	2.54E+00	2.70E+00
17	76	Total PAH	mg/kg	2	1.01E+00	1.76E+00	0.00E+00	2.51E-01	2.51E-01
18	81	Molybdenum	mg/kg	57	6.70E+00	2.20E+00	0.00E+00	6.09E+00	6.09E+00
19	81	Naphthalene	mg/kg	12	2.21E-01	3.90E-01	0.00E+00	3.36E-02	3.36E-02
20	81	PCB, Total	mg/kg	81	6.31E+00	3.70E+02	0.00E+00	4.54E+00	4.54E+00
21	81	Silver	mg/kg	60	4.29E+00	2.70E+00	2.70E+00	2.54E+00	2.70E+00
22	81	Uranium	mg/kg	78	9.14E+02	6.50E+03	4.60E+00	7.83E+02	7.83E+02
23	99	Molybdenum	mg/kg	66	7.09E+00	1.60E+01	0.00E+00	6.09E+00	6.09E+00
24	99	Silver	mg/kg	72	4.44E+00	1.03E+01	2.70E+00	2.54E+00	2.70E+00
25	138	Benz(a)anthracene	mg/kg	6	5.24E-01	4.80E-02	0.00E+00	2.51E-01	2.51E-01
26	138	Molybdenum	mg/kg	149	6.90E+00	1.10E+00	0.00E+00	6.09E+00	6.09E+00

Table C1.3. SWMU/COPC Combinations That Survive Screening and Are Considered for Modeling Based on Overall Average Concentration (Continued)

#	SWMU/ AOC	Analyte	Concen-tration Units	# of Samples	Average Concentration[a]	Maximum Concentration[a]	Subsurface Background[b] Concentration	RG SSL[c] Concentration (DAF 58)	Screening Value Higher of SSL or Background
27	138	Silver	mg/kg	162	4.84E+00	1.65E+01	2.70E+00	2.54E+00	2.70E+00
28	138	Total PAH	mg/kg	6	4.45E-01	9.74E-02	0.00E+00	2.51E-01	2.51E-01
29	153	Molybdenum	mg/kg	15	6.65E+00	1.20E+00	0.00E+00	6.09E+00	6.09E+00
30	153	Silver	mg/kg	15	5.37E+00	1.32E+01	2.70E+00	2.54E+00	2.70E+00
31	156	Molybdenum	mg/kg	27	6.73E+00	7.40E-01	0.00E+00	6.09E+00	6.09E+00
32	156	Silver	mg/kg	27	4.71E+00	1.19E+01	2.70E+00	2.54E+00	2.70E+00
33	158	Benz(a)anthracene	mg/kg	7	3.67E-01	4.30E-01	0.00E+00	2.51E-01	2.51E-01
34	158	Molybdenum	mg/kg	63	6.77E+00	1.20E+00	0.00E+00	6.09E+00	6.09E+00
35	158	Silver	mg/kg	65	4.47E+00	1.47E+01	2.70E+00	2.54E+00	2.70E+00
36	158	Total PAH	mg/kg	7	3.31E-01	4.78E-01	0.00E+00	2.51E-01	2.51E-01
37	160	Silver	mg/kg	7	4.48E+00	1.13E+01	2.70E+00	2.54E+00	2.70E+00
38	163	Molybdenum	mg/kg	31	6.90E+00	1.60E+00	0.00E+00	6.09E+00	6.09E+00
39	163	Silver	mg/kg	33	4.53E+00	1.05E+01	2.70E+00	2.54E+00	2.70E+00
40	165	Arsenic	mg/kg	25	2.72E+01	1.30E+02	7.90E+00	1.69E+01	1.69E+01
41	165	Benz(a)anthracene	mg/kg	17	3.36E-01	1.50E+00	0.00E+00	2.51E-01	2.51E-01
42	165	Naphthalene	mg/kg	17	5.84E-01	4.70E+00	0.00E+00	3.36E-02	3.36E-02
43	165	Neptunium-237	pCi/g	6	3.66E-01	5.60E-01	0.00E+00	2.61E-01	2.61E-01
44	165	Pentachlorophenol	mg/kg	13	1.10E+00	2.10E+00	0.00E+00	5.86E-01	5.86E-01
45	165	Silver	mg/kg	25	1.14E+01	8.33E+01	2.70E+00	2.54E+00	2.70E+00
46	165	Total PAH	mg/kg	31	3.00E+00	1.87E+00	0.00E+00	2.51E-01	2.51E-01
47	169	Benz(a)anthracene	mg/kg	2	7.50E-01	1.30E+00	0.00E+00	2.51E-01	2.51E-01
48	169	Molybdenum	mg/kg	44	6.59E+00	6.27E+00	0.00E+00	6.09E+00	6.09E+00
49	169	Silver	mg/kg	64	3.09E+00	7.90E-02	2.70E+00	2.54E+00	2.70E+00
50	169	Total PAH	mg/kg	2	2.30E+00	4.59E+00	0.00E+00	2.51E-01	2.51E-01
51	180	Molybdenum	mg/kg	144	6.98E+00	1.40E+00	0.00E+00	6.09E+00	6.09E+00
52	180	Silver	mg/kg	144	4.90E+00	1.17E+01	2.70E+00	2.54E+00	2.70E+00
53	194	Molybdenum	mg/kg	803	6.94E+00	1.96E+01	0.00E+00	6.09E+00	6.09E+00
54	194	Naphthalene	mg/kg	73	1.98E-01	4.80E-02	0.00E+00	3.36E-02	3.36E-02
55	194	Silver	mg/kg	811	4.97E+00	1.70E+01	2.70E+00	2.54E+00	2.70E+00
56	195	Molybdenum	mg/kg	529	6.97E+00	5.60E+00	0.00E+00	6.09E+00	6.09E+00
57	195	Silver	mg/kg	529	4.77E+00	1.31E+01	2.70E+00	2.54E+00	2.70E+00

Table C1.3. SWMU/COPC Combinations That Survive Screening and Are Considered for Modeling Based on Overall Average Concentration (Continued)

#	SWMU /AOC	Analyte	Concen-tration Units	# of Samples	Average Concentration[a]	Maximum Concentration[a]	Subsurface Background[b] Concentration	RG SSL[c] Concentration (DAF 58)	Screening Value Higher of SSL or Background
58	196	Benz(a)anthracene	mg/kg	33	1.24E+00	6.90E+00	0.00E+00	2.51E-01	2.51E-01
59	196	Naphthalene	mg/kg	33	1.78E-01	1.10E+00	0.00E+00	3.36E-02	3.36E-02
60	196	Total PAH	mg/kg	42	1.08E+00	9.04E+00	0.00E+00	2.51E-01	2.51E-01
61	200	Molybdenum	mg/kg	69	6.90E+00	7.30E-01	0.00E+00	6.09E+00	6.09E+00
62	200	Silver	mg/kg	69	4.63E+00	9.47E+00	2.70E+00	2.54E+00	2.70E+00
63	212	Neptunium-237	pCi/g	4	1.73E+00	4.00E+00	0.00E+00	2.61E-01	2.61E-01
64	212	Silver	mg/kg	21	4.24E+00	1.55E+01	2.70E+00	2.54E+00	2.70E+00
65	212	Thorium-230	pCi/g	4	6.64E+01	2.60E+02	1.40E+00	1.76E+01	1.76E+01
66	213	Molybdenum	mg/kg	20	7.16E+00	6.10E-01	0.00E+00	6.09E+00	6.09E+00
67	213	Silver	mg/kg	20	6.12E+00	1.32E+01	2.70E+00	2.54E+00	2.70E+00
68	214	Silver	mg/kg	3	3.34E+00	2.10E-02	2.70E+00	2.54E+00	2.70E+00
69	215	Molybdenum	mg/kg	23	6.63E+00	1.00E+00	0.00E+00	6.09E+00	6.09E+00
70	215	Silver	mg/kg	23	4.55E+00	9.51E+00	2.70E+00	2.54E+00	2.70E+00
71	215	Total PAH	mg/kg	11	4.04E-01	5.00E-01	0.00E+00	2.51E-01	2.51E-01
72	217	Cobalt	mg/kg	32	1.38E+01	1.90E+02	1.30E+01	8.18E-01	1.30E+01
73	217	Molybdenum	mg/kg	78	6.88E+00	5.89E+00	0.00E+00	6.09E+00	6.09E+00
74	217	Silver	mg/kg	102	4.14E+00	1.61E+01	2.70E+00	2.54E+00	2.70E+00
75	219	Silver	mg/kg	5	3.02E+00	5.60E-02	2.70E+00	2.54E+00	2.70E+00
76	221	Benz(a)anthracene	mg/kg	1	6.10E-01	6.10E-01	0.00E+00	2.51E-01	2.51E-01
77	221	Cobalt	mg/kg	4	4.05E+01	1.44E+02	1.30E+01	8.18E-01	1.30E+01
78	221	Molybdenum	mg/kg	36	6.83E+00	4.00E+00	0.00E+00	6.09E+00	6.09E+00
79	221	Silver	mg/kg	36	4.58E+00	9.74E+00	2.70E+00	2.54E+00	2.70E+00
80	221	Total PAH	mg/kg	1	1.02E+00	1.02E+00	0.00E+00	2.51E-01	2.51E-01
81	221	Vanadium	mg/kg	4	4.57E+01	1.08E+02	3.70E+01	4.09E+00	3.70E+01
82	222	Molybdenum	mg/kg	37	6.62E+00	1.20E+00	0.00E+00	6.09E+00	6.09E+00
83	222	Silver	mg/kg	42	3.84E+00	5.00E-02	2.70E+00	2.54E+00	2.70E+00
84	227	Molybdenum	mg/kg	67	6.51E+00	5.21E+00	0.00E+00	6.09E+00	6.09E+00
85	227	Silver	mg/kg	75	4.09E+00	1.01E+01	2.70E+00	2.54E+00	2.70E+00
86	228	Molybdenum	mg/kg	31	6.23E+00	1.20E+00	0.00E+00	6.09E+00	6.09E+00
87	228	Silver	mg/kg	31	4.58E+00	1.16E+01	2.70E+00	2.54E+00	2.70E+00
88	488	Silver	mg/kg	9	3.91E+00	8.50E-02	2.70E+00	2.54E+00	2.70E+00
89	489	Silver	mg/kg	5	3.01E+00	4.10E-02	2.70E+00	2.54E+00	2.70E+00

Table C1.3. SWMU/COPC Combinations That Survive Screening and Are Considered for Modeling Based on Overall Average Concentration (Continued)

#	SWMU /AOC	Analyte	Concen-tration Units	# of Samples	Average Concentration[a]	Maximum Concentration[a]	Subsurface Background[b] Concentration	RG SSL[c] Concentration (DAF 58)	Screening Value Higher of SSL or Background
90	492	PCB, Total	mg/kg	19	4.77E+00	4.41E+01	0.00E+00	4.54E+00	4.54E+00
91	493	Total PAH	mg/kg	13	4.86E-01	5.00E-01	0.00E+00	2.51E-01	2.51E-01
92	517	Neptunium-237	pCi/g	4	3.04E-01	1.07E+00	0.00E+00	2.61E-01	2.61E-01
93	517	Technetium-99	pCi/g	4	2.43E+01	8.32E+01	2.80E+00	2.12E+01	2.12E+01
94	518	Benz(a)anthracene	mg/kg	27	7.92E+00	1.10E+02	0.00E+00	2.51E-01	2.51E-01
95	518	Total PAH	mg/kg	27	1.88E+00	1.27E+01	0.00E+00	2.51E-01	2.51E-01
96	520	Molybdenum	mg/kg	145	6.99E+00	1.30E+00	0.00E+00	6.09E+00	6.09E+00
97	520	Nickel	mg/kg	164	7.91E+01	8.10E+02	2.20E+01	7.89E+01	7.89E+01
98	520	Silver	mg/kg	164	4.54E+00	1.40E+01	2.70E+00	2.54E+00	2.70E+00
99	531	Molybdenum	mg/kg	16	6.66E+00	1.10E+00	0.00E+00	6.09E+00	6.09E+00
100	531	Silver	mg/kg	16	4.38E+00	1.00E-01	2.70E+00	2.54E+00	2.70E+00
101	541	Benz(a)anthracene	mg/kg	64	6.29E-01	6.40E+00	0.00E+00	2.51E-01	2.51E-01
102	541	Naphthalene	mg/kg	64	2.71E-01	1.80E+00	0.00E+00	3.36E-02	3.36E-02
103	541	PCB, Total	mg/kg	482	1.39E+01	9.40E+01	0.00E+00	4.54E+00	4.54E+00
104	541	Uranium-238	pCi/g	67	2.83E+02	4.54E+03	1.20E+00	2.64E+02	2.64E+02
105	561	Naphthalene	mg/kg	150	2.05E-01	5.50E-01	0.00E+00	3.36E-02	3.36E-02
106	562	Benz(a)anthracene	mg/kg	27	2.55E-01	5.20E-01	0.00E+00	2.51E-01	2.51E-01
107	564	Arsenic	mg/kg	4	2.54E+01	4.30E+01	7.90E+00	1.69E+01	1.69E+01
108	564	Molybdenum	mg/kg	3	6.88E+00	7.84E+00	0.00E+00	6.09E+00	6.09E+00
109	564	Vanadium	mg/kg	4	6.87E+01	8.06E+01	3.70E+01	4.09E+00	3.70E+01

RG SSL= Remedial Guide Soil Screening Level

[a] Concentration units as noted in the units column.

[b] Subsurface background concentration values are taken from the Risk Methods Document (DOE 2011).

[c] Subsurface RG SSL (DAF 58) calculated as noted above, consistent with EPA Web site: http://www.epa.gov/safewater/consumer/pdf/mcl.pdf. RG SSL for uranium and Tc-99 calculated in similar manner but based on Kd value of 450 for uranium and 0.2 for Tc-99 to be consistent with the BGOU RI modeling, DOE/LX/07-0030&D2/R1.

- 2 exceeded for Tc-99;
- 1 exceeded for thorium-230;
- 1 exceeded for uranium;
- 1 exceeded for uranium-238*;*
- 2 exceeded for vanadium;
- 3 exceeded for VOCs (1 VOC each; all at SWMU 1).

These exceedances were noted at 41 of 49 SWMUs. Although widely distributed, the frequency of exceedance for each soil constituent and the distribution of the exceedances do not indicate impacts to the RGA from soils in these SWMUs for the reasons discussed below. Nevertheless, each of the soil constituents was further evaluated against the RGA groundwater data (see Section C1.3) to identify which SWMU/AOC soil constituent combinations were subjected to fate and transport modeling.

C1.2.4 ADDITIONAL SCREENING

The screenings were extended by reviewing the soil constituents and site-specific information including an evaluation based in part upon the presence of these soil constituents in PGDP RGA groundwater as COCs (see Table C1.1). The discussion of this screening is presented below. Based on this screening, these soil constituents were selected for additional modeling.

- Detailed modeling was completed for Tc-99, uranium, Total PCBs, and arsenic at one SWMU/AOC (the SWMU/AOC with the greatest average concentration of the residual soil contaminant). This modeling was performed to bound the potential for these soil constituents to migrate to the RGA groundwater from the Soil OU SWMUs/AOCs. Arsenic was modeled at two SWMUs/AOCs to determine if modeling the differing locations would yield substantially different results with regard to impacts on RGA groundwater.

- Detailed modeling was completed for nickel at the SWMU/AOC with the greatest average nickel concentration in soil. This modeling was completed because nickel is a site-related contaminant, and nickel concentrations in soil exceed screening values at one or more locations.

- Detailed modeling was completed for chromium at the SWMU/AOC with the greatest average chromium concentration in soil. This modeling was completed because chromium is a site-related contaminant. No chromium concentrations in soil exceeded screening values; however, chromium is a COC for PGDP groundwater.

No groundwater modeling was conducted for benz(a)anthracene, beryllium, cadmium, cobalt-60/cobalt, iron, lead, manganese, molybdenum, naphthalene, neptunium-237, pentachlorophenol, silver, thorium-230, Total PAHs, uranium-238, or vanadium because the soil constituent did not fail screening, the soil constituent is not a problem for PGDP groundwater, or the concentration of the soil constituent in groundwater is controlled by other factors as discussed in Section C1.3, below.

The results of the modeling are presented in Appendix C. Additional evaluation of hot spot candidates is presented below and also in Appendix C, Attachment C2.

C1.3. REVIEW OF SOIL CONSTITUENTS AGAINST RGA GROUNDWATER DATA

Naturally-occurring metals and other soil constituents exceed screening criteria at one or more SWMUs. This section of the document summarizes the evaluation of these soil constituents against the RGA groundwater data to determine whether the Soils OU SWMUs are apparent sources of RGA contamination or whether the found RGA concentrations are consistent with groundwater background. This section also discusses the presence of non-naturally-occurring constituents (e.g., TCE, Tc-99, Total PCBs, Total PAHs, and neptunium-237, etc.) in RGA groundwater and the potential for individual SWMUs to be sources of these soil constituents in groundwater.

The Soils OU SWMUs are shown on Figure C1.1. Even though these SWMUs are located in disperse locations around the PGDP and many have soil constituents present above screening levels, only two soil constituents have defined plumes in the RGA at PGDP (TCE and Tc-99); these plumes are presented in Figures C1.2 and C1.3. A review of these plumes indicates that the principal source(s) of both TCE and Tc-99 at PGDP are located in the C-400 area. The highest concentration portions of these plumes are co-located and migrate through the RGA from C-400 toward the northwest corner of the PGDP limited area.

In addition, there may be secondary source areas of Tc-99 but these are not significant enough to cause above-MCL impacts to RGA Tc-99 concentrations. In contrast, there are apparent secondary source area(s) of TCE that are significant enough to cause an exceedance of the MCL; the SWMUs with the largest secondary impacts on RGA groundwater are SWMUs 1 and 4. The TCE emanating from these SWMUs is being addressed outside the Soils OU evaluation. Thus, based on a review of the groundwater data there is no indication that any of the Soils OU SWMUs/AOCs have an impact on RGA groundwater that is attributable to a particular SWMU/AOC. The relative locations of the plumes to each of the soil constituents and the nature of the soil constituents that affects their ability to migrate to the RGA are discussed below.

The other soil constituents do not have concentrations in the RGA that are consistent or persistent enough to provide a plume. Each of these is discussed with respect to the potential for an individual SWMU/AOC to be a source of these in groundwater in the soil constituent-specific sections and/or SWMU/AOC-specific sections below. In general, none of the other soil constituents appear to have a significant Soils OU source; nevertheless, some of those soil constituents with a potential to impact the RGA groundwater were subjected to modeling.

C1.3.1 TCE

A review of Figure C1.2 indicates that there may be secondary sources of TCE that could contribute enough TCE to result in above-MCL concentrations of TCE in the RGA; however, these impacts are masked (in whole or in part) by the C-400 and Southwest Plumes. SWMU 217, located along the edge of the Southwest Plume, has the highest concentration of TCE of the Soils OU SWMUs addressed in this RI. The maximum TCE concentration detected in soil in this SWMU is 0.014 mg/kg—well below the screening value of 0.103 mg/kg used to identify the potential of the soils causing an exceedance of the MCL for TCE in the RGA. Not surprisingly, the TCE in this SWMU does not result in an apparent SWMU 217-sourced TCE RGA plume. Because the highest TCE in soils concentration is below RG SSL, no other modeling of TCE was performed as part of this RI. NOTE: TCE and its daughter products have been modeled for SWMU 1 under the Southwest Plume project (DOE 2012).

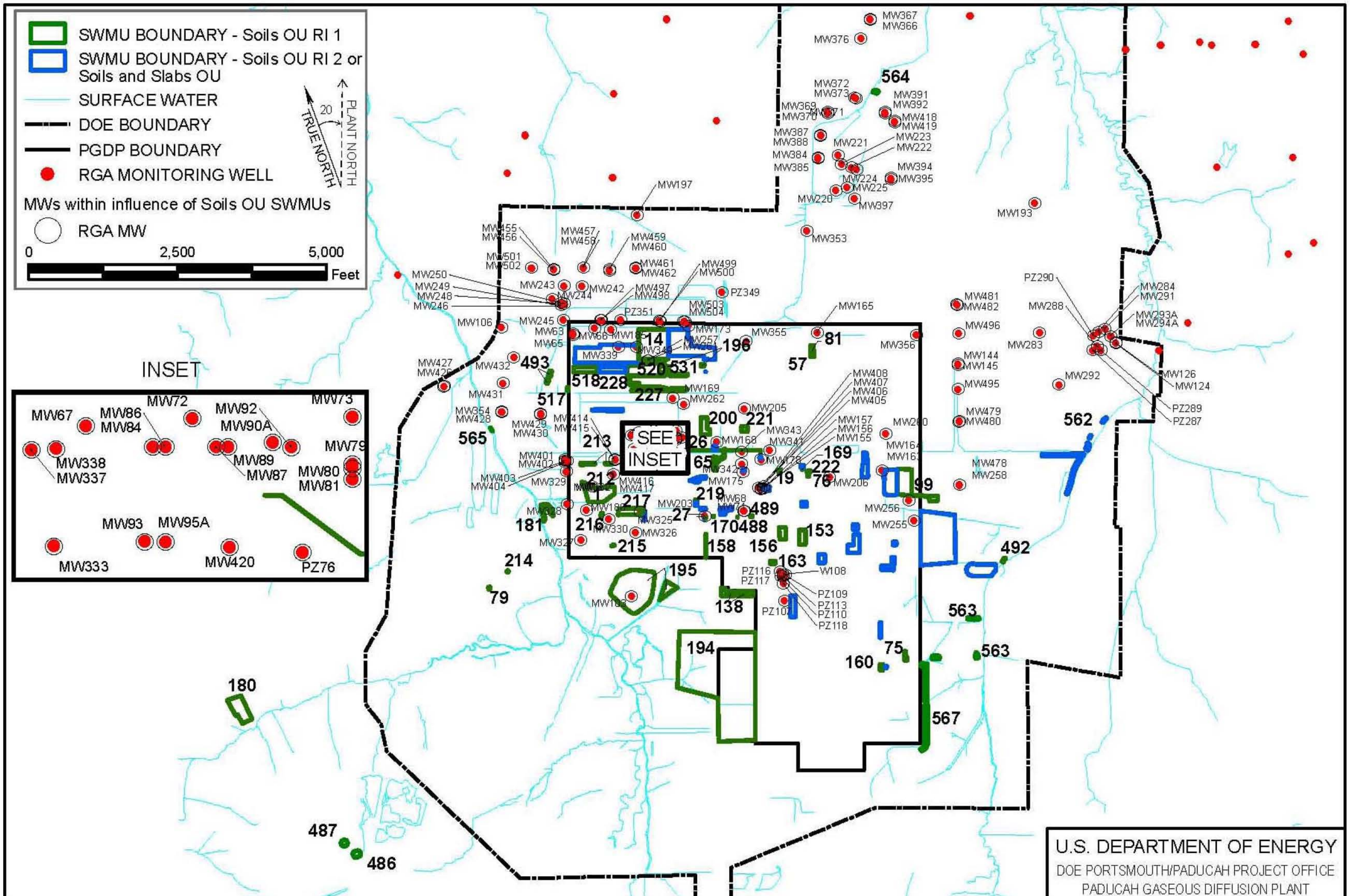

Figure C1.1. PGDP Site with Soils OU SWMU Locations and Monitoring Wells Identified

4/20/2012 SoilsOU\RI Report\RI D2\03-08MWs.mxd

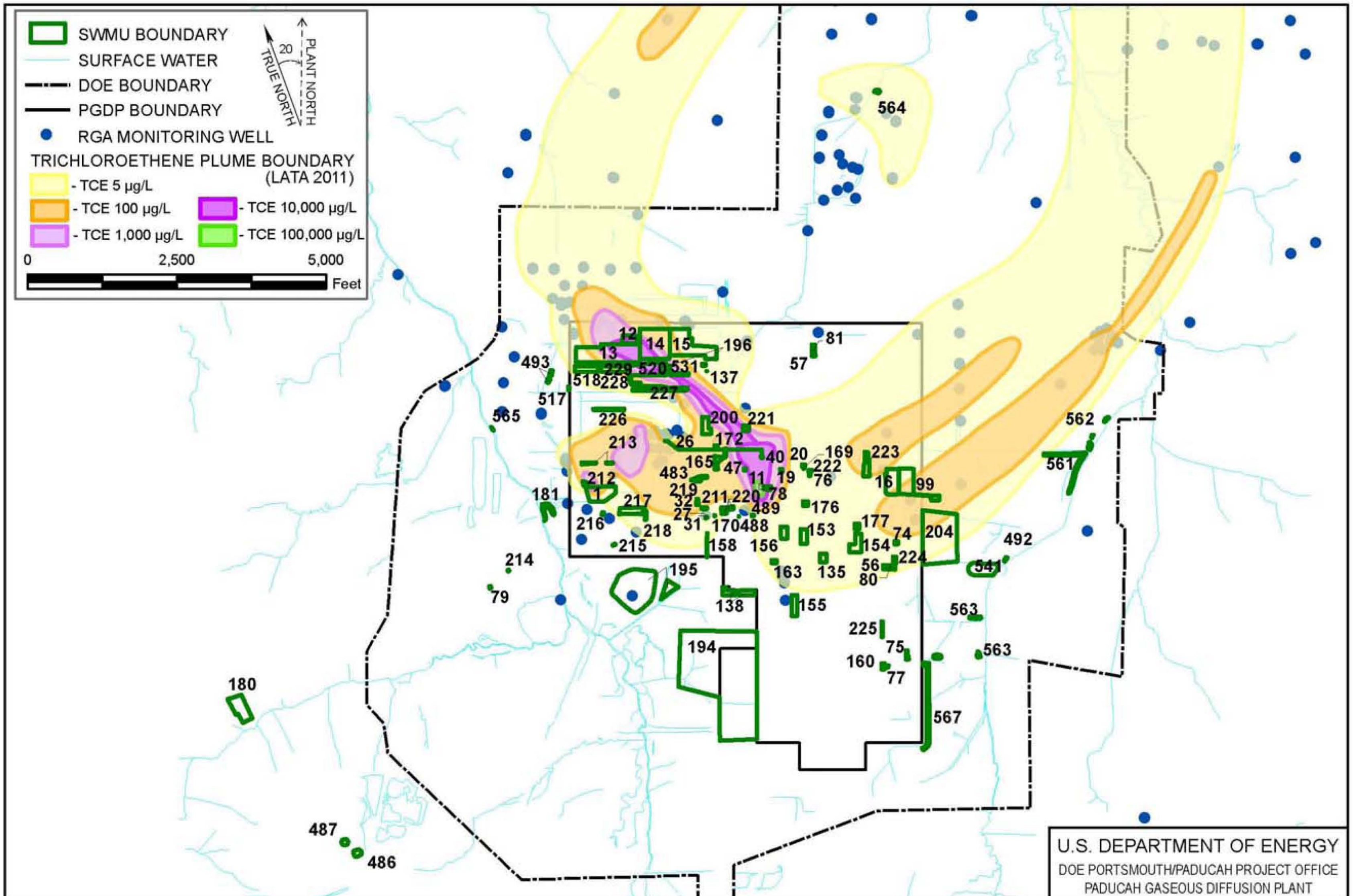

Figure C1.2. PGDP Site RGA TCE Plume Relative to Soils OU SWMUs

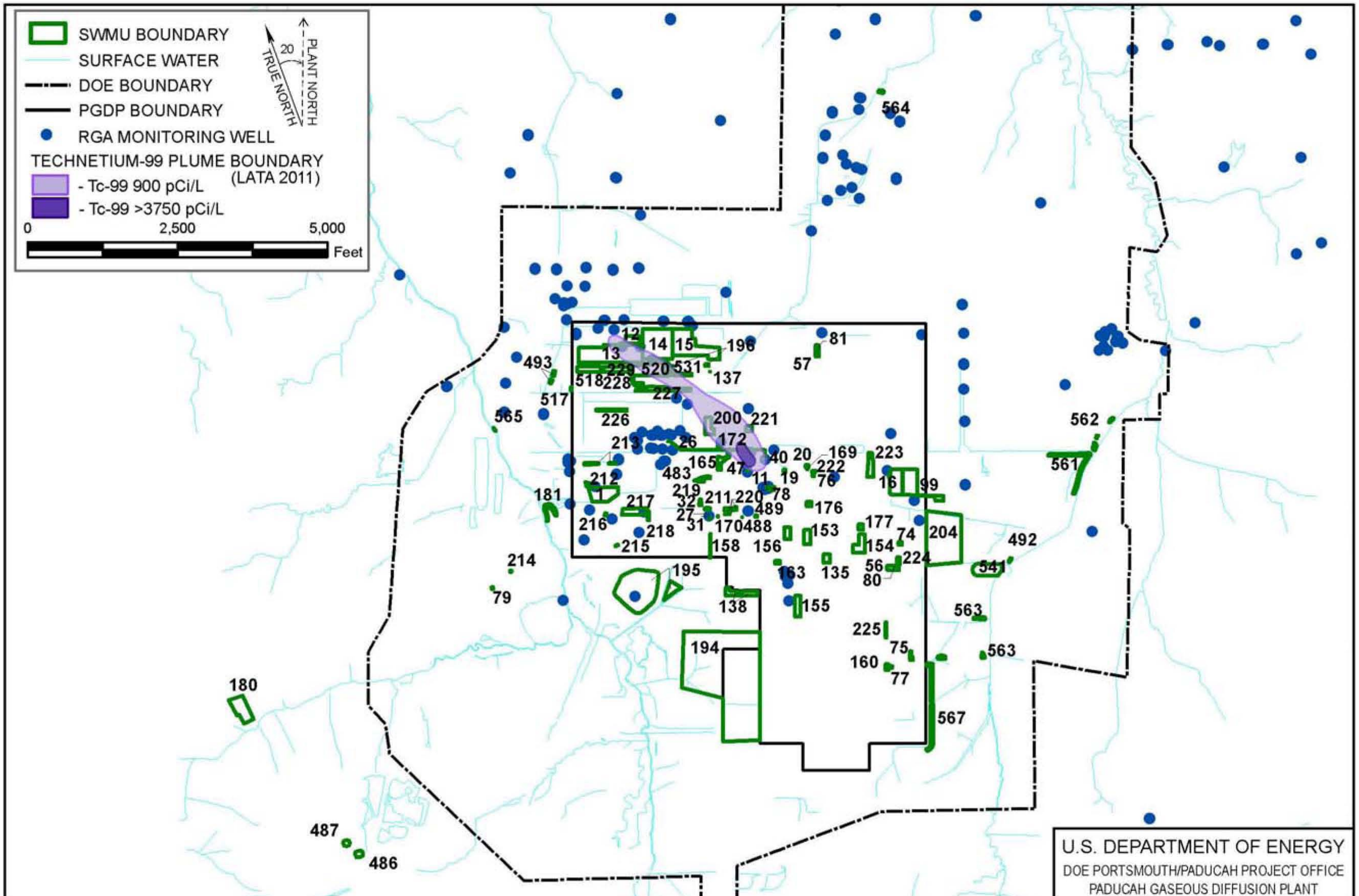

Figure C1.3. PGDP Site RGA Tc-99 Plume Relative to Soils OU SWMUs

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C1.3.2 TECHNETIUM-99

A review of Figure C1.3 indicates only C-400 as a source that causes above-MCL impacts on RGA groundwater. However, SWMU 14 has an average soil concentration that exceeds the RG SSL and soil background and this SWMU is located (at least in part) at a location that is near the RGA Tc-99 plume. Thus, it is possible that this SWMU could be a secondary source of Tc-99. SWMU 517 also had an average concentration that exceeds the RG SSL and soil background, but this SWMU is not located near an above-MCL RGA plume of Tc-99 and the soil concentrations at this SWMU are less than those at SWMU 14. Based on these observations, SWMU 14 was subjected to modeling to bound any impacts of Tc-99 migration to RGA groundwater.

C1.3.3 OTHER DISSOLVED PHASE CONSTITUENTS

As part of the Dissolved-Phase OU review conducted in 2010 (meeting materials from the August 17, 2010, Paducah Gaseous Diffusion Plant Dissolved-Phase Plume Project Scoping Meeting), the percentage frequency of detection of site soil constituents and the percentage frequency of those detections that exceed MCLs were evaluated. This information is summarized in Figure C1.4. This figure reinforces the site understanding that only TCE (and its daughter products) and Tc-99 have widespread impacts to RGA groundwater. The figure also indicates that although other soil constituents may have localized or hot-spot-related concerns (PCBs, chromium, arsenic), the remaining soil constituents do not appear to have consistent nor persistent impacts to RGA groundwater. Thus, the detections of these constituents (e.g., iron, manganese, uranium, molybdenum, silver, nickel) in RGA groundwater are generally consistent with background concentrations of soil constituents in soils and RGA groundwater (as discussed on a soil constituent by soil constituent basis below).

The following sections discuss each soil constituent in the context of the PGDP RGA groundwater. Additional information is presented in Attachments C1-C6.

C1.3.4 ANTIMONY

A review of the PGDP RGA groundwater database shows the following:

- 1,719 antimony analytical results;
- 0 results that detected antimony to a detection limit as low as 0.005 mg/L.

Although antimony has been identified as a groundwater COC, there are no measured impacts on RGA groundwater and thus, antimony was not subjected to modeling to estimate the impacts on the groundwater from migration from the Soils OU.

C1.3.5 ARSENIC

A review of the PGDP RGA groundwater database shows the following:

- 1,955 arsenic analytical results;

- 29 results exceeded the arsenic MCL of 0.010 mg/L (1.5% of samples); and

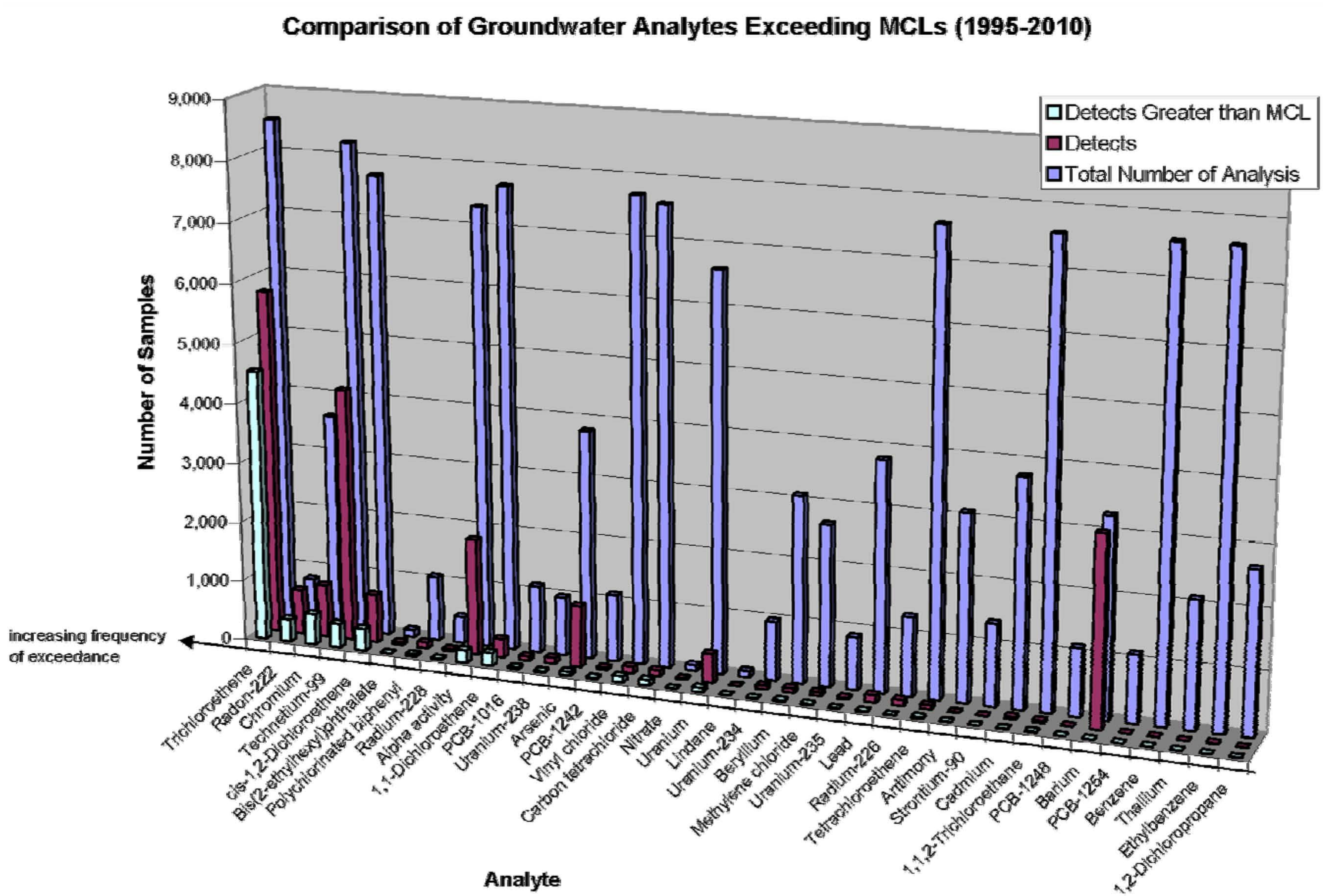

Figure C1.4. Summary of Evaluation of RGA Analytes that Exceed their Respective MCLs (Dissolved Phase Plume Analysis, 2010)

- Only one well (MW67) has had greater-than-MCL concentrations since 2005 (maximum of 0.0156 mg/L).

MW-67 is located immediately north of SWMUs 2 and 3. Based on the infrequent exceedance of the arsenic MCL across the site and the presence of MW67 immediately downgradient of two SWMUs in the Burial Grounds Operable Unit (and not immediately downgradient of any Soils OU SWMUs), and the fact that the results are just above the MCL, and the partial dependence of arsenic concentrations on localized redox conditions, it is unlikely that arsenic in the Soils OU is contributing to RGA groundwater exceedances. Nevertheless, the SWMU/AOC soil constituent combinations with arsenic exceedances (SWMUs 165 and 564) were subjected to modeling to bound the range of potential impacts to RGA groundwater from arsenic in soils at the Soils OU.

C1.3.6 BERYLLIUM

A review of the RGA groundwater database shows the following:

- 1,719 beryllium analytical results;
- 2 results (in 2003) that exceeded the beryllium MCL of 0.004 mg/L (0.12% of samples); and
- A maximum concentration of 0.00527 mg/L—just over the MCL—in MW206. (The other exceedance was in MW366). Both of these wells have had several samples collected since 2003 with reported concentrations below detectable levels.

Based on these results, combined with the fact that none of the SWMU/AOC soil constituent combinations exceed the screening levels, beryllium was not subjected to modeling.

C1.3.7 CADMIUM

A review of the RGA groundwater database shows the following:

- 1,982 cadmium analytical results;
- 2 results (both prior to 2004) that exceed the cadmium MCL of 0.005 mg/L (0.12% of samples);
- The maximum result (0.00861 mg/L) is just above the MCL; and
- The two wells with above-MCL results have had several sample results since 2003 with concentrations below detectable levels.

In addition, none of the SWMU/AOC soil constituent combinations exceeds the Soils OU SWMUs/AOCs RG SSL and soil background for cadmium; thus, cadmium was not subjected to modeling.

C1.3.8 CHROMIUM

A review of the RGA groundwater database shows the following:

- 2,020 chromium analytical results; and
- 172 results that exceeded the chromium (total) MCL of 0.100 mg/L (8.5% of samples).

None of the SWMU/AOC soil constituent combinations exceeds the Soils OU screening levels; however, there is some suspicion of potential chromium sources at PGDP (not likely associated with soils). Thus, even though none of the SWMU/AOC soil constituent combination results exceed the screening levels, the SWMU/AOC with the highest chromium concentration (SWMU 14) was subjected to modeling to bound the potential contribution to chromium concentrations that may result from the Soils OU.

C1.3.9 COBALT/COBALT-60

A review of the RGA groundwater database shows the following:

- 1,719 cobalt analytical results; and

- 3 results (all from 2003 or earlier) that exceed the NAL for cobalt of 0.000313 mg/L (0.17% of samples).

- 132 cobalt-60 analytical results; and

- 0 results that were reported above the minimum detectable activity for cobalt-60 (0.0% of samples).

Neither cobalt nor cobalt-60 is listed as a groundwater COC, and they have not been found in RGA groundwater for many years. Thus, no groundwater modeling was conducted on cobalt or cobalt-60.

C1.3.10 IRON

Iron is a ubiquitous naturally occurring soil constituent. A review of the PGDP RGA groundwater database shows the following:

- 2,039 iron analytical results;

- 789 results exceeded the iron NAL of 0.729 mg/L (38.7% of samples); and

- Iron concentrations in groundwater are known to be controlled by the redox chemistry of the unit and not necessarily related to any hot spots.

Wells that have had concentrations that exceed the NAL are located all across the site. Some of the Soils OU SWMUs have concentrations that exceed screening levels. These are discussed further in the SWMU/AOC-specific sections below. Due to RGA concentrations being largely controlled by redox chemistry and the observation that RGA NAL exceedances do not appear to be SWMU/AOC-related, no modeling was conducted for iron.

C1.3.11 LEAD

A review of the PGDP RGA groundwater database shows the following:

- 1,999 lead analytical results;

- 4 results (all collected in 2003 and earlier) exceed the lead action level of 0.015 mg/L (0.2% of samples);

- The maximum concentration was 0.0201 mg/L—just above the action level;

- All four wells with exceedances have had subsequent samples analyzed to yield results below the action level.

Lead is a COC for groundwater, but is not a current RGA issue at PGDP. In addition, no lead concentrations in Soils OU SWMUs exceed screening levels so lead was not subjected to groundwater modeling.

C1.3.12 MANGANESE

Manganese, like iron, is a naturally-occurring soil constituent whose concentration in groundwater is largely controlled by the redox chemistry of the groundwater and the associated matrix. A review of the PGDP RGA groundwater database shows the following:

- 2,632 manganese results;
- 1,150 results exceeded the manganese NAL of 0.0245 mg/L (43.7% of samples); and
- Above-NAL manganese concentrations are found in wells located across the site.

Manganese is a COC for groundwater. Although there are Soils OU SWMUs that have manganese concentrations that exceed screening levels, the well-dispersed presence of manganese in RGA groundwater, the ubiquitous nature of manganese, and its concentration dependence on local redox conditions obviate the need for modeling of the fate and transport of manganese from these units. Manganese was not subjected to modeling.

C1.3.13 MERCURY

A review of the PGDP RGA groundwater database shows the following:

- 2,265 mercury analytical results; and
- 0 results exceeded the mercury MCL of 0.002 mg/L (0% of samples).

Mercury is not a groundwater COC for the RGA (residential use of groundwater) and thus was not subjected to modeling as part of this Soils OU RI.

C1.3.14 MOLYBDENUM

A review of the PGDP RGA groundwater database shows the following:

- 1,992 molybdenum analytical results;
- 105 results exceeded the molybdenum NAL of 0.00521 mg/L (5.27% of samples); and
- Molybdenum concentrations in water are affected by redox chemistry.

Molybdenum is a groundwater COC; however, molybdenum is present in natural waters. Wells that have had concentrations that exceed the NAL are located all across the site. The Soils OU SWMUs have some locations where concentrations exceed screening levels. These are discussed further in the SWMU/AOC-specific sections below; however, molybdenum was not subjected to modeling because the presence of molybdenum in RGA groundwater does not appear to result from migration from the Soils OU.

C1.3.15 NEPTUNIUM-237

A review of the PGDP RGA groundwater database shows the following:

- 261 Np-237 results;
- 5 Np-237 detections; but
- 0 results exceeded the Np-237 MCL of 15 pCi/L (0.0% of samples).

Neptunium-237 is a groundwater COC. Although some SWMUs had exceedances of screening levels for Np-237 in soils, the lack of impact on groundwater resulted in none of these SWMU/AOC soil constituent combinations being subjected to modeling. Many neptunium ions dissolve in water; thus, the lack of MCL exceedances of Np-237 in PGDP RGA groundwater indicates no above-MCL migration to RGA groundwater from soils at PGDP.

C1.3.16 NICKEL

A review of the PGDP RGA groundwater database shows the following:

- 1,780 nickel analytical results; and
- 323 results exceeded the nickel NAL of 0.0208 mg/L (18.1% of samples).

Nickel is a groundwater COC. Wells that have had concentrations that exceed the NAL are located all across the site. In addition, some of the Soils OU SWMUs have concentrations that exceed screening levels. The SWMU/AOC with the highest average concentration of nickel (SWMU 14) was subjected to fate and transport modeling.

C1.3.17 PLUTONIUM 239/240

A review of the PGDP RGA groundwater database shows the following:

- 256 plutonium 239/240 analytical results; and

- 1 result was reported above the minimum detectable activity for plutonium (0.4% of samples); however, this result was a split/duplicate sample and the other split/duplicate did not have plutonium reported above the minimum detectable activity.

Plutonium-239/240 is not a groundwater COC; thus, plutonium 239/240 was not subjected to modeling for fate and transport to groundwater.

C1.3.18 SILVER

A review of the PGDP RGA groundwater database shows:

- 1,719 silver analytical results; and
- 0 results exceeded the silver NAL of 0.00515 mg/L (0.0% of samples)

Silver is a groundwater COC. Some of the Soils OU SWMUs have silver concentrations that exceed screening levels. However, in RGA monitoring well data, silver has been detected only three times, once in three different wells. These detections range 0.00146 to 0.00208 mg/L, which are below the residential NAL. Based on this information, silver was not subjected to modeling for fate and transport to groundwater.

C1.3.19 TOTAL PAHS, NAPHTHALENE, OTHER PAHS (INCLUDING PENTACHLOROPHENOL AND BENZ(A)ANTHRACENE)

None of these constituents are groundwater COCs; thus, no modeling was conducted.

C1.3.20 TOTAL PCBs

Although PCBs are groundwater COCs, they are not considered mobile in the environment at PGDP; however, SWMU 81 and AOC 541 were subjected to groundwater modeling to bound the potential for PCBs to migrate to the RGA groundwater from the Soils OU.

C1.3.21 URANIUM

Uranium is a naturally occurring soil constituent. A review of the PGDP RGA groundwater database shows the following:

- 5,618 uranium analytical results;

- 7 results exceeded the uranium MCL of 0.030 mg/L (0.12% of samples; exceedances in six different wells; most recent exceedance was in 2002); and

- Every one of these exceedances was a split or duplicate sample whose split/duplicate did not exceed the MCL (some of these split/duplicate samples were analyzed using different methods).

Uranium is not a groundwater COC; thus, additional fate and transport modeling was not needed for uranium. To bound the potential for migration of uranium to RGA groundwater, however, the SWMU/AOC with the highest average uranium concentration (SWMU 81) was subjected to groundwater fate and transport modeling.

C1.3.22 URANIUM-238

Uranium-238 is a naturally occurring soil constituent. A review of the PGDP RGA groundwater database shows the following:

- 626 U-238 results;
- 9 results exceeded the U-238 PRG of 10.1 pCi/L (1.4% of samples; exceedances in eight different wells; only one exceedance after 2002); and
- Every one of these wells had either a duplicate or subsequent result that was below the MCL.

U-238 is a groundwater COC; however, no modeling was conducted for U-238 because the groundwater information does not show any U-238 impacts. The fate and transport of U-238 in the environment will be essentially identical to that for the uranium (and uranium was subjected to the modeling).

C1.3.23 VANADIUM

A review of the PGDP RGA groundwater database shows the following:

- 1,316 vanadium results;
- 32 results (2.4%) had detectable vanadium at a minimum detection limit as low as 0.025 mg/L (a value above the NAL of 7.065E-05 mg/L); and
- Only three of those detections did not have more recent samples that did not have detectable vanadium. MW-90 and MW-95 are two of those wells and both have been properly abandoned and replaced with other wells that do not show detectable vanadium. MW-406PRT5 has had only one detection of vanadium and other ports in the same well do not have detectable vanadium.

Vanadium is a groundwater COC. No modeling was conducted for vanadium because the groundwater information does not show any vanadium impacts attributable to the Soils OU.

In addition, the vanadium NAL is based on vanadium metal (instead of the more common forms of vanadium compounds) and the toxicity criteria for vanadium metal are lower than the detection limit. Thus, there may be exceedances of the NAL that were not identified by the sampling; however, these exceedances do not appear to indicate a real risk/hazard because the NAL developed for vanadium metal does not apply to the vanadium present at PGDP. With few detections in groundwater and no apparent Soils OU sources, coupled with the uncertainty of the toxicity values, no modeling of vanadium was performed.

C1.3.24 ZINC

A review of the PGDP RGA groundwater database shows the following:

- 1,763 zinc results; and
- 2 results (0.11%) had detectable zinc concentrations that exceed the NAL of 0.313 mg/L but both of those wells had more recent results with concentrations below the NAL.

Zinc is not a groundwater COC. No modeling was conducted for zinc because the groundwater information does not show any zinc impacts attributable to the Soils OU.

C1.4. SUMMARY OF EVALUATION THAT IDENTIFIED SWMU/AOC SOIL CONSTITUENTS TO BE SUBJECTED TO MODELING

Based upon the screening evaluation:

- The SWMU/AOC soil constituent combination whose average most exceeded the Tc-99 screening values (SWMU 14) was subjected to modeling;

- The SWMU/AOC soil constituent combinations with the highest average concentrations of Total PCBs (SWMUs 541 and 81) were subjected to modeling;

- The SWMU/AOC soil constituent combination with the highest average concentration of uranium (SWMU 81) was subjected to modeling;

- The SWMU/AOC soil constituent combinations with the highest average concentrations of arsenic (SWMUs 165 and 564) were subjected to modeling; and

- The SWMU/AOC soil constituent combination with the highest average concentration of nickel (SWMU 14) was subjected to modeling.

Even though the screening did not identify any SWMU/AOC soil constituent combinations that exceeded screening values:

- The SWMU/AOC soil constituent combination with the highest overall concentration of chromium (SWMU 14) was subjected to modeling.

No groundwater modeling was conducted for benz(a)anthracene, beryllium, cadmium, cobalt-60/cobalt, iron, lead, manganese, molybdenum, naphthalene, neptunium-237, pentachlorophenol, silver, thorium-230, Total PAHs, uranium-238, or vanadium because the soil constituent did not fail screening, the soil constituent is not a problem for PGDP groundwater, or the concentration of the soil constituent in groundwater is controlled by other factors.

C1.5. SCREENING SUMMARY, HOT SPOT IDENTIFICATION

Table C1.5 provides the results of the screening process that identifies SWMU/AOC soil constituent combinations that have at least three results that exceed both the respective RG SSL and background. This screening was performed to identify hot spots that may pose a threat to groundwater. To support this hot spot evaluation, some of the SWMUs with exceedances were subjected to additional graphical or SADA evaluation, presented in Attachments C1-C6.

The results of the screening were reviewed to find a total of 123 SWMU/AOC soil constituent combinations exceeded hot spot screening values, as follows (soil constituents in italics did not have an exceedance using average values):

- *1 exceeded SSLs/background for antimony;*
- 6 exceeded for arsenic;
- 18 exceeded for Total PAHs or benz(a)anthracene;

- 7 exceeded for cobalt;
- *5 exceeded for iron;*
- *12 exceeded for manganese;*
- *9 exceeded for mercury;*
- 2 exceeded for molybdenum;
- 1 exceeded for naphthalene;
- 2 exceeded for Np-237;
- 16 exceeded for nickel;
- *1 exceeded for pyrene;*
- 11 exceeded for silver;
- 4 exceeded for Tc-99;
- 8 exceeded for Total PCBs;
- 4 exceeded for uranium;
- 3 exceeded for uranium-238*;*
- 7 exceeded for vanadium;
- *1 exceeded for zinc; and*
- 4 exceeded for VOCs (all at SWMU 1).

Table C1.5. PGDP Soils OU RI 1—Groundwater Screening (Potential Hot Spots)

#	SWMU/ AOC	Analysis	Unit	No. of Samples	Average (Avg.)	Maximum (Max.)	Subsurface Bckgrd. Conc.	RG SSL (DAF 58)	Ave. > Screen?[1]	Max.> Screen[1]?	How Many?
1	1	*cis*-1,2-Dichloroethene	mg/kg	138	1.79E+01	2.40E+03	0.00E+00	1.19E+00	YES	YES	5
2	1	Cobalt	mg/kg	102	5.77E+00	1.54E+01	1.30E+01	8.18E-01	No	YES	4
3	1	Manganese	mg/kg	102	4.47E+02	2.16E+03	8.20E+02	9.28E+01	No	YES	9
4	1	Silver	mg/kg	105	1.68E+00	7.39E+01	2.70E+00	2.54E+00	No	YES	4
5	1	*trans*-1,2-Dichloroethene	mg/kg	136	8.69E-01	1.60E+01	0.00E+00	1.71E+00	No	YES	5
6	1	Trichloroethene	mg/kg	183	1.79E+00	8.70E+01	0.00E+00	1.03E-01	YES	YES	27
7	1	Vanadium	mg/kg	102	2.18E+01	5.33E+01	3.70E+01	4.09E+00	No	YES	4
8	1	Vinyl chloride	mg/kg	172	4.48E-01	4.80E+00	0.00E+00	3.97E-02	YES	YES	6
9	14	Arsenic	mg/kg	307	7.45E+00	4.48E+01	7.90E+00	1.69E+01	No	YES	6
10	14	Cobalt	mg/kg	25	8.72E+00	1.93E+01	1.30E+01	8.18E-01	No	YES	4
11	14	Iron	mg/kg	307	1.82E+04	9.27E+04	2.80E+04	1.07E+03	No	YES	43
12	14	Manganese	mg/kg	307	4.71E+02	2.67E+03	8.20E+02	9.28E+01	No	YES	37
13	14	Mercury	mg/kg	307	4.87E+00	4.37E+01	1.30E-01	6.03E+00	No	YES	12
14	14	Molybdenum	mg/kg	307	7.16E+00	2.87E+01	0.00E+00	6.09E+00	YES	YES	9
15	14	Neptunium-237	pCi/g	24	1.47E+00	1.60E+01	0.00E+00	2.61E-01	YES	YES	12
16	14	Nickel	mg/kg	307	2.44E+02	2.67E+03	2.20E+01	7.89E+01	YES	YES	163
17	14	PCB, Total	mg/kg	306	2.71E+00	1.00E+01	0.00E+00	4.54E+00	No	YES	22
18	14	Silver	mg/kg	307	5.13E+00	2.22E+01	2.70E+00	2.54E+00	YES	YES	21
19	14	Technetium-99	pCi/g	24	5.44E+01	4.06E+02	2.80E+00	2.12E+01	YES	YES	11
20	14	Total PAH	mg/kg	22	1.04E-01	4.87E-01	0.00E+00	2.51E-01	No	YES	4
21	14	Uranium	mg/kg	328	1.22E+02	4.60E+03	4.60E+00	7.83E+02	No	YES	4
22	14	Vanadium	mg/kg	25	2.74E+01	8.62E+01	3.70E+01	4.09E+00	No	YES	3
23	19	Benz(a)anthracene	mg/kg	27	4.45E-01	3.70E+00	0.00E+00	2.51E-01	YES	YES	6
24	19	Total PAH	mg/kg	27	5.94E-01	5.23E+00	0.00E+00	2.51E-01	YES	YES	6

Table C1.5. PGDP Soils OU RI 1—Groundwater Screening (Potential Hot Spots) (Continued)

#	SWMU/ AOC	Analysis	Unit	No. of Samples	Average (Avg.)	Maximum (Max.)	Subsurface Bckgrd. Conc.	RG SSL (DAF 58)	Ave. > Screen?[1]	Max.> Screen?[1]	How Many?
25	81	Manganese	mg/kg	60	5.87E+02	3.65E+03	8.20E+02	9.28E+01	No	YES	9
26	81	PCB, Total	mg/kg	81	6.31E+00	3.70E+02	0.00E+00	4.54E+00	YES	YES	8
27	81	Uranium	mg/kg	78	9.14E+02	6.50E+03	4.60E+00	7.83E+02	YES	YES	17
28	99	Nickel	mg/kg	72	3.45E+01	9.05E+01	2.20E+01	7.89E+01	No	YES	3
29	138	Manganese	mg/kg	149	3.62E+02	1.23E+03	8.20E+02	9.28E+01	No	YES	4
30	138	Mercury	mg/kg	162	4.89E+00	2.13E+01	1.30E-01	6.03E+00	No	YES	9
31	138	Nickel	mg/kg	162	3.56E+01	1.13E+02	2.20E+01	7.89E+01	No	YES	8
32	138	Silver	mg/kg	162	4.84E+00	1.65E+01	2.70E+00	2.54E+00	YES	YES	10
33	153	Nickel	mg/kg	15	4.18E+01	9.92E+01	2.20E+01	7.89E+01	No	YES	3
34	158	Manganese	mg/kg	65	4.11E+02	1.86E+03	8.20E+02	9.28E+01	No	YES	6
35	158	Mercury	mg/kg	65	4.49E+00	1.05E+01	1.30E-01	6.03E+00	No	YES	3
36	158	Nickel	mg/kg	65	3.58E+01	1.32E+02	2.20E+01	7.89E+01	No	YES	4
37	165	Arsenic	mg/kg	25	2.72E+01	1.30E+02	7.90E+00	1.69E+01	YES	YES	12
38	165	Benz(a)anthracene	mg/kg	17	3.36E-01	1.50E+00	0.00E+00	2.51E-01	YES	YES	5
39	165	Naphthalene	mg/kg	17	5.84E-01	4.70E+00	0.00E+00	3.36E-02	YES	YES	4
40	165	Neptunium-237	pCi/g	6	3.66E-01	5.60E-01	0.00E+00	2.61E-01	YES	YES	4
41	165	PCB, Total	mg/kg	226	1.17E+00	5.10E+01	0.00E+00	4.54E+00	No	YES	8
42	165	Silver	mg/kg	25	1.14E+01	8.33E+01	2.70E+00	2.54E+00	YES	YES	6
43	165	Technetium-99	pCi/g	11	1.67E+01	6.00E+01	2.80E+00	2.12E+01	No	YES	5
44	165	Total PAH	mg/kg	31	3.00E+00	1.87E+00	0.00E+00	2.51E-01	YES	YES	4
45	169	Nickel	mg/kg	64	6.61E+01	8.04E+02	2.20E+01	7.89E+01	No	YES	14
46	169	PCB, Total	mg/kg	34	1.68E+00	1.00E+01	0.00E+00	4.54E+00	No	YES	3
47	169	Vanadium	mg/kg	26	2.43E+01	4.49E+01	3.70E+01	4.09E+00	No	YES	3
48	180	Arsenic	mg/kg	144	8.23E+00	1.38E+02	7.90E+00	1.69E+01	No	YES	6
49	180	Manganese	mg/kg	144	3.40E+02	1.99E+03	8.20E+02	9.28E+01	No	YES	8
50	180	Mercury	mg/kg	144	4.69E+00	8.28E+00	1.30E-01	6.03E+00	No	YES	4
51	180	Nickel	mg/kg	144	3.97E+01	1.08E+02	2.20E+01	7.89E+01	No	YES	8

Table C1.5. PGDP Soils OU RI 1—Groundwater Screening (Potential Hot Spots) (Continued)

#	SWMU/ AOC	Analysis	Unit	No. of Samples	Average (Avg.)	Maximum (Max.)	Subsurface Bckgrd. Conc.	RG SSL (DAF 58)	Ave. > Screen?[1]	Max.> Screen?[1]	How Many?
52	180	Silver	mg/kg	144	4.90E+00	1.17E+01	2.70E+00	2.54E+00	YES	YES	7
53	194	Arsenic	mg/kg	811	6.75E+00	3.52E+01	7.90E+00	1.69E+01	No	YES	5
54	194	Benz(a)anthracene	mg/kg	73	2.13E-01	8.90E-01	0.00E+00	2.51E-01	No	YES	4
55	194	Cobalt	mg/kg	76	8.35E+00	8.31E+01	1.30E+01	8.18E-01	No	YES	6
56	194	Iron	mg/kg	810	1.22E+04	4.73E+04	2.80E+04	1.07E+03	No	YES	5
57	194	Manganese	mg/kg	810	4.08E+02	3.11E+04	8.20E+02	9.28E+01	No	YES	51
58	194	Mercury	mg/kg	811	4.58E+00	8.94E+00	1.30E-01	6.03E+00	No	YES	15
59	194	Nickel	mg/kg	811	3.55E+01	1.08E+02	2.20E+01	7.89E+01	No	YES	21
60	194	Silver	mg/kg	811	4.97E+00	1.70E+01	2.70E+00	2.54E+00	YES	YES	55
61	194	Total PAH	mg/kg	73	6.67E-02	8.91E-01	0.00E+00	2.51E-01	No	YES	6
62	194	Vanadium	mg/kg	77	2.88E+01	8.63E+01	3.70E+01	4.09E+00	No	YES	12
63	195	Cobalt	mg/kg	40	6.86E+00	2.77E+01	1.30E+01	8.18E-01	No	YES	3
64	195	Manganese	mg/kg	529	2.19E+02	1.42E+03	8.20E+02	9.28E+01	No	YES	8
65	195	Mercury	mg/kg	529	4.64E+00	8.43E+00	1.30E-01	6.03E+00	No	YES	4
66	195	Nickel	mg/kg	529	3.58E+01	1.02E+02	2.20E+01	7.89E+01	No	YES	24
67	195	Silver	mg/kg	529	4.77E+00	1.31E+01	2.70E+00	2.54E+00	YES	YES	16
68	195	Vanadium	mg/kg	40	2.66E+01	7.97E+01	3.70E+01	4.09E+00	No	YES	4
69	196	Antimony	mg/kg	74	7.81E+00	1.21E+02	2.10E-01	1.57E+01	No	YES	9
70	196	Benz(a)anthracene	mg/kg	33	1.24E+00	6.90E+00	0.00E+00	2.51E-01	YES	YES	4
71	196	Cobalt	mg/kg	72	6.50E+00	1.12E+02	1.30E+01	8.18E-01	No	YES	3
72	196	Nickel	mg/kg	76	3.91E+01	5.87E+02	2.20E+01	7.89E+01	No	YES	7
73	196	Total PAH	mg/kg	42	1.08E+00	9.04E+00	0.00E+00	2.51E-01	YES	YES	6
74	200	Nickel	mg/kg	69	5.00E+01	2.60E+02	2.20E+01	7.89E+01	No	YES	9
75	212	Iron	mg/kg	21	1.93E+04	4.14E+04	2.80E+04	1.07E+03	No	YES	5
76	212	Silver	mg/kg	21	4.24E+00	1.55E+01	2.70E+00	2.54E+00	YES	YES	3
77	213	Silver	mg/kg	20	6.12E+00	1.32E+01	2.70E+00	2.54E+00	YES	YES	4
78	215	Total PAH	mg/kg	11	4.04E-01	5.00E-01	0.00E+00	2.51E-01	YES	YES	9

Table C1.5. PGDP Soils OU RI 1—Groundwater Screening (Potential Hot Spots) (Continued)

#	SWMU/ AOC	Analysis	Unit	No. of Samples	Average (Avg.)	Maximum (Max.)	Subsurface Bckgrd. Conc.	RG SSL (DAF 58)	Ave. > Screen?[1]	Max.> Screen?[1]	How Many?
79	217	Cobalt	mg/kg	32	1.38E+01	1.90E+02	1.30E+01	8.18E-01	YES	YES	7
80	217	Iron	mg/kg	102	1.57E+04	6.04E+04	2.80E+04	1.07E+03	No	YES	8
81	217	Manganese	mg/kg	102	3.59E+02	2.05E+03	8.20E+02	9.28E+01	No	YES	8
82	217	Mercury	mg/kg	102	3.60E+00	9.20E+00	1.30E-01	6.03E+00	No	YES	4
83	217	Nickel	mg/kg	102	3.53E+01	1.31E+02	2.20E+01	7.89E+01	No	YES	8
84	217	Silver	mg/kg	102	4.14E+00	1.61E+01	2.70E+00	2.54E+00	YES	YES	9
85	221	Mercury	mg/kg	36	4.80E+00	1.23E+01	1.30E-01	6.03E+00	No	YES	3
86	221	Nickel	mg/kg	36	3.84E+01	1.39E+02	2.20E+01	7.89E+01	No	YES	4
87	227	Manganese	mg/kg	75	3.66E+02	2.39E+03	8.20E+02	9.28E+01	No	YES	4
88	227	Nickel	mg/kg	75	6.37E+01	6.53E+02	2.20E+01	7.89E+01	No	YES	20
89	227	PCB, Total	mg/kg	146	1.93E+00	1.26E+01	0.00E+00	4.54E+00	No	YES	4
90	227	Technetium-99	pCi/g	17	1.65E+01	1.52E+02	2.80E+00	2.12E+01	No	YES	3
91	492	PCB, Total	mg/kg	19	4.77E+00	4.41E+01	0.00E+00	4.54E+00	YES	YES	3
92	493	Total PAH	mg/kg	13	4.86E-01	5.00E-01	0.00E+00	2.51E-01	YES	YES	13
93	518	Benz(a)anthracene	mg/kg	27	7.92E+00	1.10E+02	0.00E+00	2.51E-01	YES	YES	12
94	518	Pyrene	mg/kg	27	1.19E+01	1.50E+02	0.00E+00	3.67E+01	No	YES	4
95	520	Benz(a)anthracene	mg/kg	23	2.25E-01	3.80E-01	0.00E+00	2.51E-01	No	YES	3
96	520	Iron	mg/kg	164	1.08E+04	3.26E+04	2.80E+04	1.07E+03	No	YES	3
97	520	Manganese	mg/kg	164	2.99E+02	1.76E+03	8.20E+02	9.28E+01	No	YES	5
98	520	Mercury	mg/kg	164	4.25E+00	1.19E+01	1.30E-01	6.03E+00	No	YES	6
99	520	Nickel	mg/kg	164	7.91E+01	8.10E+02	2.20E+01	7.89E+01	YES	YES	40
100	520	Silver	mg/kg	164	4.54E+00	1.40E+01	2.70E+00	2.54E+00	YES	YES	7
101	520	Total PAH	mg/kg	23	2.13E-01	5.52E-01	0.00E+00	2.51E-01	No	YES	3
102	531	Nickel	mg/kg	16	5.37E+01	1.62E+02	2.20E+01	7.89E+01	No	YES	4
103	531	Zinc	mg/kg	16	7.78E+02	2.45E+03	6.00E+01	1.13E+03	No	YES	6
104	541	Benz(a)anthracene	mg/kg	64	6.29E-01	6.40E+00	0.00E+00	2.51E-01	YES	YES	12
105	541	PCB, Total	mg/kg	482	1.39E+01	9.40E+01	0.00E+00	4.54E+00	YES	YES	72

Table C1.5. PGDP Soils OU RI 1—Groundwater Screening (Potential Hot Spots) (Continued)

#	SWMU/ AOC	Analysis	Unit	No. of Samples	Average (Avg.)	Maximum (Max.)	Subsurface Bckgrd. Conc.	RG SSL (DAF 58)	Ave. > Screen?[1]	Max.> Screen?[1]	How Many?
106	541	Technetium-99	pCi/g	65	3.45E+00	3.65E+01	2.80E+00	2.12E+01	No	YES	3
107	541	Total PAH	mg/kg	477	1.67E-01	7.63E+00	0.00E+00	2.51E-01	No	YES	42
108	541	Uranium	mg/kg	478	7.22E+02	2.02E+04	4.60E+00	7.83E+02	No	YES	105
109	541	Uranium-238	pCi/g	67	2.83E+02	4.54E+03	1.20E+00	2.64E+02	YES	YES	14
110	541	Vanadium	mg/kg	67	2.66E+01	5.17E+01	3.70E+01	4.09E+00	No	YES	7
111	561	Arsenic	mg/kg	162	9.00E+00	3.96E+01	7.90E+00	1.69E+01	No	YES	18
112	561	Benz(a)anthracene	mg/kg	149	2.17E-01	1.90E+00	0.00E+00	2.51E-01	No	YES	4
113	561	Cobalt	mg/kg	162	6.85E+00	3.10E+01	1.30E+01	8.18E-01	No	YES	6
114	561	Manganese	mg/kg	162	5.90E+02	5.23E+03	8.20E+02	9.28E+01	No	YES	25
115	561	PCB, Total	mg/kg	839	1.07E+00	7.90E+01	0.00E+00	4.54E+00	No	YES	13
116	561	Total PAH	mg/kg	151	2.18E-01	2.63E+00	0.00E+00	2.51E-01	No	YES	3
117	561	Uranium	mg/kg	839	6.17E+01	6.41E+03	4.60E+00	7.83E+02	No	YES	10
118	561	Uranium-238	pCi/g	174	5.73E+01	1.34E+03	1.20E+00	2.64E+02	No	YES	11
119	561	Vanadium	mg/kg	162	2.53E+01	8.69E+01	3.70E+01	4.09E+00	No	YES	10
120	562	Uranium-238	pCi/g	37	8.57E+01	5.81E+02	1.20E+00	2.64E+02	No	YES	7
121	564	Arsenic	mg/kg	4	2.54E+01	4.30E+01	7.90E+00	1.69E+01	YES	YES	4
122	564	Molybdenum	mg/kg	3	6.88E+00	7.84E+00	0.00E+00	6.09E+00	YES	YES	3
123	564	Vanadium	mg/kg	4	6.87E+01	8.06E+01	3.70E+01	4.09E+00	YES	YES	4

[1] Screening value is the higher of the Subsurface Background concentration or the RG SSL concentration. Average result can be higher than maximum concentration due to averaging of half the ND value.

Concentration values in units shown in units column.

Of the hot spot exceedances, most of the same soil constituents were identified as exceedances of the overall average against the RG SSLs. Thus, the potential for impacts to RGA groundwater were captured and included in the above evaluation against the average because the SWMUs with the highest average concentrations would present the greatest risk to RGA groundwater. Thus, the decisions to subject soil constituents to modeling are sufficient for those soil constituents on both lists.

The soil constituents marked in italics above (antimony, cadmium, iron, manganese, mercury, pyrene, and zinc) were not identified as exceedances against the overall average. However, their potential to affect RGA groundwater is discussed above in the soil constituent-specific section. These soil constituents were not subjected to modeling because the soil constituent is either not a groundwater COC or there are no impacts on RGA groundwater from the respective soil constituent's presence in the Soils OU. However, these soil constituents were subjected to further hot spot analysis (as identified in Table C1.4) as summarized in the attachments to Appendix C.

Table C1.4. SWMU/AOC Soil Constituent Combinations Subjected to Modeling

#	SWMU/AOC	Soil Constituent	Location
1	14	Tc-99	NW corner of PGDP; lithology consistent with DAF of 58
2	81	Total PCBs	NE portion of PGDP, near MW165; lithology consistent w/DAF of 58
3	541	Total PCBs	E of PGDP; no monitoring well nearby; local lithology unknown
4	81	Uranium	NE portion of PGDP, near MW165; lithology consistent w/DAF of 58
5	165	Arsenic	Central portion of PGDP, near MW168; lithology consistent w/DAF of 58
6	14	Nickel	NW corner of PGDP; lithology consistent with DAF of 58
7	14	Chromium	NW corner of PGDP; lithology consistent with DAF of 58
8	564	Arsenic	North of PGDP, near U-Landfill; lithology consistent with DAF of 58

C1.6. REFERENCES

DOE 2001 *Feasibility Study for the Groundwater Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume 1. Main Text,* DOE/OR/07-1857&D2, U.S. Department of Energy, Paducah, KY, August.

DOE 2010. *Remedial Investigation Report for the Burial Grounds Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/LX/07-0030&D2/R1, U.S. Department of Energy, Paducah, KY, February.

DOE 2011. *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume 1. Human Health,* DOE/LX/07-0107/V1&D2/R1, U.S. Department of Energy, Paducah, KY, February.

DOE 2012. *Record of Decision for Solid Waste Management Unit 1, 211-A, 211-B, and Part 102 Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, U.S. Department of Energy, Paducah, KY, March.

EPA 1996. *Soil Screening Guidance: Technical Background Document*, EPA/540/R-95/128, Office of Emergency and Remedial Response, Washington, DC, May.

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ATTACHMENT C2

DILUTION ATTENUATION FACTOR EVALUATION

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C2. DILUTION ATTENUATION FACTOR EVALUATION

The maximum Upper Continental Recharge System (UCRS) soil concentrations that are protective of Regional Gravel Aquifer (RGA) groundwater quality are determined by combining the dilution attenuation factor (DAF) (unitless) calculations with contaminant-specific distribution coefficients (K_d) (units of volume/mass). The DAF is a measure of how much the UCRS concentration of a soil constituent is diluted or attenuated by the migration through the UCRS, coupled with the migration through the RGA.

The DAF was calculated by comparing the volume of contaminated groundwater passing vertically through a UCRS solid waste management unit (SWMU)/area of concern (AOC) with the volume of "clean" RGA groundwater flowing beneath the SWMU/AOC and mixing with the UCRS water. RGA groundwater flows are much higher relative to UCRS groundwater flows; thus, mixing the two waters will result in much lower RGA groundwater contaminant concentrations relative to the initial UCRS groundwater contaminant concentrations. The reduction in groundwater concentrations in the RGA is proportional to the ratio of the volume of "clean" RGA groundwater to contaminated UCRS groundwater. The DAF calculates the impact on the concentration from the relative rates of vertical migration of contaminated UCRS water and the horizontal rate of migration of "clean" RGA groundwater to yield a concentration of the blended diluted/attenuated water.

To complete the evaluation, the K_d of the constituent must be factored into the analysis. K_d represents the ratio of contamination adhered to soil particles relative to that dissolved in groundwater.

Starting with a target-acceptable RGA groundwater contaminant concentration below the source area [i.e., maximum contaminant levels (MCLs) or site-specific risk based concentrations, etc.], the maximum-acceptable UCRS groundwater contaminant concentration can be calculated. When this result is combined with the K_d, this calculation will yield the maximum-acceptable UCRS soil contaminant concentration that is protective of RGA groundwater quality at the target concentration.

Once calculated, the maximum UCRS soil contaminant concentrations were used as site-specific remedial guide soil screening levels to screen the site-specific soil contamination data to identify those constituents that may pose a threat to groundwater. Soil contaminants found at concentrations below the levels identified as protective were screened from further evaluation of impacts to groundwater. Sites having soil contamination above the identified protective levels then were subjected to additional evaluation to estimate the potential for impacts to groundwater. This evaluation is summarized elsewhere in Appendix C and included the following:

- Comparing the nature of the constituent against the constituents found to have had an impact on the RGA groundwater at Paducah Gaseous Diffusion Plant (PGDP) (see Attachment C1) to identify whether there is evidence of these soil concentrations having had an impact on the RGA groundwater;

- Evaluating the horizontal and vertical spatial distribution of soil constituent concentrations to identify hot spots that may need to be addressed;

- Evaluating the locations of the constituents and comparing them to the RGA groundwater impacts; and

- Performing numerical modeling using the spatial distribution of soil contamination as an input into the Seasonal Soil Compartment Model (SESOIL) and Analytical Transient 1-,2-,3- Dimensional (AT123D) modeling to predict downgradient RGA temporal groundwater concentrations.

This attachment discusses the derivation of the DAF and the finding that the deterministic DAF for these soils is calculated at 58. This attachment also provides a sensitivity analysis of the screening of Soils Operable Unit (OU) concentrations against values calculated using a DAF of 58 and a DAF of 20. The effects on the decision to model groundwater impacts from individual SWMU/AOC soil constituent combinations are also discussed.

C2.1. METHODOLOGY

The DAF calculation recognizes that vertical mixing of UCRS and RGA groundwater does not immediately occur throughout the entire RGA thickness and mixing primarily occurs in the upper portions of the RGA immediately below the source area, deemed the mixing depth. The DAF (unitless) for the Soils OU is calculated using the following equation:

$$DAF = 1 + \frac{Kid}{IL} \qquad \text{(EPA 1996)}$$

Where:

i = horizontal hydraulic gradient (m/m)
d = mixing zone depth (m)
I = infiltration rate (m/yr)
L = length of source area parallel to groundwater flow (m)
K = aquifer hydraulic conductivity (m/yr)

The equation for calculating the aquifer mixing zone depth, d:

$$d = \left(0.0112\, L^2\right)^{0.5} + d_a \left\{1 - e^{\left[\frac{(-L\, I)}{(K\, i\, d_a)}\right]}\right\}$$

Where:

d_a = aquifer thickness (m)

The first term in the equation predicts the depth of the mixing due to vertical dispersivity along the length of the groundwater flow path:

$$\left(0.0112\, L^2\right)^{0.5}$$

The second term in the equation estimates the depth of mixing due to the downward velocity of infiltrating water:

$$d_a \left\{ 1 - e^{\left[\frac{(-L\ I)}{(K\ i\ d_a)} \right]} \right\}$$

Most important is the presence of L (length of source area parallel to groundwater flow) in d (mixing zone depth) in the DAF equation. Incorporation of L in d, results in L being in both the numerator and denominator of the DAF equation. NOTE: These equations indicate that as long as hydraulic conductivity (K), hydraulic gradient (i) and the infiltration rate (I) remain constant, the DAF will be constant regardless of the size of the source area undergoing evaluation. While mathematically true, the DAF is ultimately based on plume center-line concentrations which remain the same regardless of source area size. What does differ is the plume footprint, smaller source areas will generate smaller plume widths and lengths relative to larger source areas; however, the plume center-line concentrations will be the calculated to be the same regardless of source area size.

C2.2. DAF CALCULATIONS

Assuming an L of 1 m and using the input parameters provided in Table C2.1, the DAF result is 58 for all Soils OU SWMUs/AOCs. With the exception of aquifer thickness, Table C2.1 values are exactly the same as those used for the Southwest Plume Site Investigation (DOE 2007) DAF evaluation. The aquifer thickness differs (9.14 m verses 10.54 m) slightly because the previous efforts did not include the Hydrogeologic Unit (HU) 4 stratigraphic thickness in the total RGA aquifer thickness despite the HU4 being considered part of the RGA flow system as evidenced by the unit being included in determining a representative RGA/HU4 hydraulic conductivity value.

Table C2.1. DAF Input Parameter Values

Parameter	Description	Value	Source
K	Horizontal Hydraulic Conductivity	0.45 cm/s; 1,286 ft/d This value represents the arithmetic averaged hydraulic conductivity for the RGA/HU4 stratigraphic sequence <u>RGA</u> K, 0.53 cm/s; thickness, 9.14 m K, 1,502 ft/d; thickness, 30 ft <u>HU4</u> K, 0.001 cm/s; thickness, 1.5 m K, 2.8 ft/d; thickness, 5 ft	Southwest Plume Site-Investigation Report (DOE 2007)
I	Horizontal Hydraulic Gradient	4.00E-04 m/m, 4.00E-04 ft/ft	Southwest Plume Site-Investigation Report (DOE 2007)

Table C2.1. DAF Input Parameter Values (Continued)

Parameter	Description	Value	Source
I	Infiltration Rate	0.1054 m/yr, 4.1 inches/yr	SESOIL predicted net recharge rate to groundwater, Southwest Plume Remedial Investigation Report (DOE 2007)
d_a	Aquifer Thickness (HU4 +RGA)	10.54 m, 35 ft	Southwest Plume Site-Investigation Report (DOE 2007)

As noted previously, the DAF is independent of waste area size, but is dependent on K, i, and I. Given that the 50 Soils OU SWMUs/AOCs are widely distributed within the PGDP and the vicinity, it is expected that site-specific K, i, and I will vary somewhat.

An evaluation of RGA horizontal hydraulic gradients shows i is expected to range between 1.84×10^{-4} and 2.98×10^{-3} ft/ft and have average and median values of 7.81×10^{-4} and 4.4×10^{-4} ft/ft, respectively (DOE 2010). Because of the inclusion in the data set of some localized, relatively high horizontal hydraulic gradients associated with PGDP anthropogenic influences, the median horizontal hydraulic gradient is more representative than the average horizontal hydraulic gradient.

With respect to K variability, six RGA pumping tests have been conducted and have produced hydraulic conductivity estimates ranging between approximately 100 and 3,600 ft/day (CH2M HILL 1992; LMES 1996a; LMES 1996b; LMES 1997; Terran 1990; Terran 1992). The lowest measured RGA hydraulic conductivity is beneath PGDP. The highest measured value is between PGDP and the Ohio River. A previous evaluation assumed that RGA hydraulic conductivity ranged between 75 ft/d and 1,500 ft/d, with a likeliest value of 350 ft/d (DOE 2007). The evaluation was based on the 1997 PGDP groundwater flow model (DOE 1997), which has since undergone recalibration. The current calibrated PGDP RGA groundwater flow model (DOE 2010) contains K values that range over the values characterized by the RGA pumping tests.

Minimal HU4 K measurements have been collected so the value presented in Table C2.1 is assumed to be representative. In addition, the thicker (and thus higher weighted) and higher RGA K values dominate the arithmetic averaged calculations, thus fixing the HU4 K in the analysis will have minimal impact on the evaluation.

Thornthwaite analysis (Thornthwaite and Mather 1957), which is based on monthly precipitation and potential evaporation rates, was used to estimate I at PGDP (DOE 2010). The calculations estimate that I ranges from 2.64 to 7.64 inches/yr. In addition to I from precipitation, anthropogenic I from man-made sources could be as high as 48 inches/yr (DOE 2010). Note that the higher anthropogenic I values are believed to be associated with features such as the cooling towers, the C-616 Lagoons, and building drainage systems; thus, the anthropogenic I values are expected to have only limited impacts on the migration of constituents from the Soils OU SWMUs/AOCs. It is assumed that the calculated range associated with precipitation I is most appropriate for an evaluation of the Soils OU SWMUs/AOCs.

For this analysis, it was assumed that the HU4 and RGA thickness reported in Table C2.1 are “typical.”

Table C2.2. Minimum and Maximum DAF Input Parameter Values

Parameter	Description	Minimum Value	Maximum Value
K	Horizontal Hydraulic Conductivity	0.03 cm/s, 85 ft/d This value represents the arithmetic averaged hydraulic conductivity for the RGA/HU4 stratigraphic sequence RGA K, 0.035 cm/s; thickness, 9.14 m K, 100 ft/d; thickness, 30 ft HU4 K, 0.001 cm/s; thickness, 1.5 m K, 2.8 ft/d; thickness, 5 ft	1.09 cm/s; 3,087 ft/d This value represents the arithmetic averaged hydraulic conductivity for the RGA/HU4 stratigraphic sequence RGA K, 1.27 cm/s; thickness, 9.14 m K, 3,600 ft/d; thickness, 30 ft HU4 K, 0.001 cm/s; thickness, 1.5 m K, 2.8 ft/d; thickness, 5 ft
i	Horizontal Hydraulic Gradient	1.84E-04 m/m, 1.84E-04 ft/ft	2.98E-03 m/m, 2.98E-04 ft/ft
I	Infiltration Rate	0.0679 m/yr, 2.64 inches/yr	0.1964 m/yr, 7.64 inches/yr
d_a	Aquifer Thickness (HU4 +RGA)	10.54 m, 35 ft	10.54 m, 35 ft

Based on expected minimum and maximum K, i, and I values (Table C2.2), DAF values for the Soils OU are expected to range between 5 and 139. If the maximum hydraulic conductivity value is limited to 1,500 ft/d, to reflect the lower hydraulic conductivity values found beneath the PGDP, then the maximum DAF is 68.

The previous calculations provide an indication of the potential DAF range based on sitewide input parameter variability; however, the evaluation does not characterize the DAF distribution between the potential minimum and maximum DAF values. To develop a better understanding of the potential DAF distribution, probabilistic evaluation was performed using the parameter value distributions listed in Table C2.3.

Table C2.3. Parameter Distributions

Parameter	Most Likely Value	Minimum Value	Maximum Value	Standard Deviation	Coefficient of Variation	Distribution Type
Hydraulic Conductivity, ft/d	350	75	1,500	350	100	Log Normal
Horizontal Hydraulic Gradient, ft/ft	1.01E-03	1.00E-04	4.00E-03	1.12E-03	1.11E+02	Normal
Infiltration, inches/yr	4.1	2.64	7.64	--	--	Uniform
Aquifer Thickness, ft	38.71	10	63.5	11.84	30.59	Normal

The parameter distributions, with the exception of I, were developed for probabilistic evaluation of soil cleanup RGs for SWMU 1 and the C-720 Building (DOE 2007; DOE 2011). For the soil RG probabilistic evaluation, I was held constant. For this probabilistic evaluation, I, as discussed previously, was assumed to range linearly between 2.64 inches/yr and 7.64 inches/yr.

Crystal Ball® (Decisioneering, Inc. 2000) was used to generate 10,000 individual K, horizontal i, I, and d_a values which were used as input to the DAF calculation. The evaluation predicted mean, median, minimum, and maximum DAF values of 52, 33, 3, and 366, respectively. Note that the probabilistic mean (52) DAF value is similar to the deterministic mean DAF value of 58. Additionally, the probabilistic minimum DAF (3) is similar to the minimum DAF (5) calculated using minimum parameter inputs (Table C2.2). The maximum probabilistic DAF (366), while larger than the deterministic maximum DAF (139), is within the same order of magnitude. Evaluation of the probabilistic DAF distribution (Figure C2.1) shows that lower DAF values occur more frequently than higher DAF values with the most frequently occurring DAF being between 11 and 20.

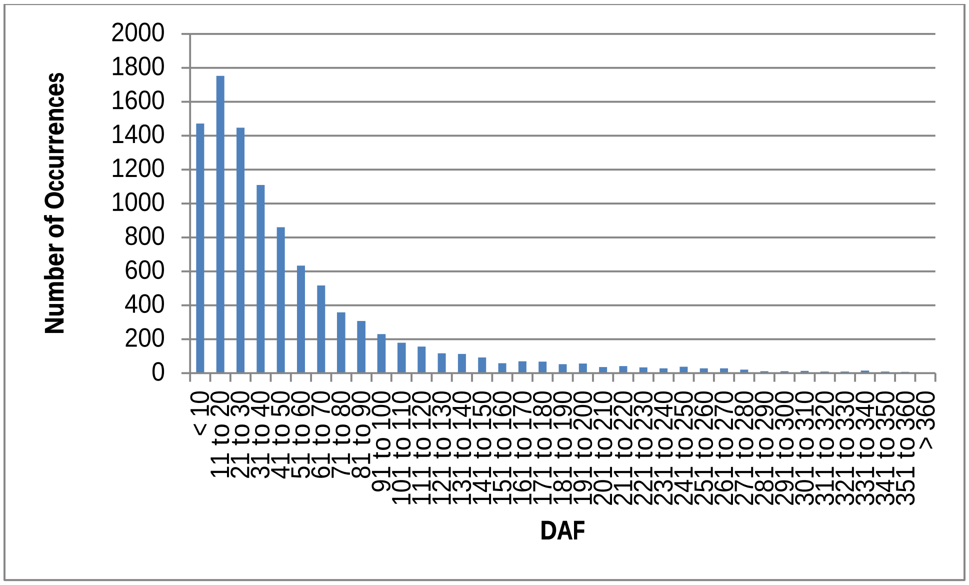

Figure C2.1. Probabilistic DAF Distribution

C2.3. SUMMARY

Deterministic evaluation of PGDP site conditions predicts a DAF of 58 for the Soils OU. Minimum and maximum deterministic predicted DAF values are 5 and 139, respectively. Probabilistic evaluation predicts average, median, minimum, and maximum DAF values of 52, 33, 3, and 366, respectively. Frequency evaluation shows that lower value DAF values are more common than higher DAF values, with the most frequently occurring DAF being between 11 and 20.

The DAF of 58 determined in this calculation was used to support screening of the Soils OU results to identify those SWMUs/AOCs where constituents might present an impact to groundwater. The results of this screening are summarized in Attachment C1 to Appendix C.

Section C2.4 presents a sensitivity analysis of this same screening using a DAF of 20. The DAF of 20 was used because it is a value that EPA uses as a default value for screening in their derivation of soil screening values and also because it is a lower value than the median value calculated for PGDP of 33. A value of 20 is recognized as a reasonable value for general soil conditions (including sandy soils); however, the UCRS at PGDP has much more silt and clay than the typical sandy soil condition; thus, a DAF greater than 20 (33 or 58) is expected to better estimate the actual potential for migration to groundwater at the PGDP. The DAF of 58 is similar to that calculated for the Southwest Plume and is considered typical of that found at PGDP where most locations have a majority of the URCS composed of silt and clay.

C2.4. SENSITIVITY ANALYSIS

The screening identified in Attachment C1 of Appendix C was carried out using a DAF of 58 to yield the results summarized in Tables C1.3 and C1.4. This screening identified 109 SWMU/AOC soil constituent combinations that exceeded the screening values based on the overall average concentration, as follows:

- Thirty exceeded for silver (9 exceeded average without maximum value exceedance);
- Twenty-three exceeded for Total polycyclic aromatic hydrocarbons (PAHs) or benz(a)anthracene [3 exceeded the average (calculated using half the detection limit) but the maximum detected value did not exceed the screening level];
- Twenty-three exceeded for molybdenum (18 exceeded average without maximum value exceedance);
- Two exceeded for nickel;
- Four exceeded for neptunium-237;
- Two exceeded for technetium-99;
- Eight exceeded for naphthalene;
- One exceeded for thorium-230;
- Two exceeded for cobalt;
- One exceeded for uranium-238;
- One exceeded for uranium;
- Two exceeded for vanadium;
- Three exceeded for Total polychlorinated biphenyl (PCBs);
- Two exceeded for pentachlorophenol (1 exceeded average without maximum value exceedance);
- Two exceeded for arsenic; and
- Three exceeded for volatile organic compounds (VOCs) (1 VOC each; all at SWMU 1).

Based upon the additional evaluation presented in Attachment C1 to Appendix C, 8 SWMU/AOC soil constituent combinations were subjected to fate and transport modeling as summarized in Appendix C.

This same screening approach was performed using values derived from a DAF of 20 in order to evaluate the sensitivity of this screening to the DAF. Screening against DAF 20 values identified 280

SWMU/AOC soil constituent combinations that exceeded the screening values based on the average concentrations, as follows, and shown in Table C2.4, sorted by analyte.

- Two exceeded soil screening levels/background for antimony
- Seven exceeded for arsenic
- Fifty-four exceeded for Total PAHs or benz(a)anthracene
- Two exceeded for cobalt
- Twenty-nine exceeded for mercury
- Thirty-three exceeded for molybdenum
- Eight exceeded for naphthalene
- Nine exceeded for neptunium-237
- Twenty-nine exceeded for nickel
- Two exceeded for pentachlorophenol
- Three exceeded for plutonium 239/240
- Thirty exceeded for selenium
- Thirty exceeded for silver
- Five exceeded for Tc-99
- Five exceeded for thallium
- Two exceeded for thorium-230
- Sixteen exceeded for Total PCBs
- Three exceeded for uranium
- Three exceeded for uranium-238
- Two exceeded for vanadium
- One exceeded for zinc
- Six exceeded for VOCs

Table C2.4. SWMU/AOC Soil Constituent Combinations That Survive Screening and Are Considered for Modeling Based on Overall Average Concentration Using a DAF of 20

#	SWMU/ AOC	Analysis	Units	Average Conc.	Maximum Conc.	Subsurface Background Conc.	RG SSL Conc. (DAF 20)
1	99	Antimony	mg/kg	5.47E+00	5.30E-01	**2.10E-01**	**5.42E+00**
2	196	Antimony	mg/kg	7.81E+00	1.21E+02	**2.10E-01**	**5.42E+00**
1	76	Arsenic	mg/kg	8.10E+00	1.31E+01	**7.90E+00**	**5.84E+00**
2	81	Arsenic	mg/kg	8.18E+00	1.37E+01	**7.90E+00**	**5.84E+00**
3	165	Arsenic	mg/kg	2.72E+01	1.30E+02	**7.90E+00**	**5.84E+00**
4	180	Arsenic	mg/kg	8.23E+00	1.38E+02	**7.90E+00**	**5.84E+00**
5	531	Arsenic	mg/kg	9.97E+00	4.68E+01	**7.90E+00**	**5.84E+00**
6	561	Arsenic	mg/kg	9.00E+00	3.96E+01	**7.90E+00**	**5.84E+00**
7	564	Arsenic	mg/kg	2.54E+01	4.30E+01	**7.90E+00**	**5.84E+00**
1	1	Benz(a)anthracene	mg/kg	3.02E-01	6.40E-02	**0.00E+00**	**8.64E-02**
2	19	Benz(a)anthracene	mg/kg	4.45E-01	3.70E+00	**0.00E+00**	**8.64E-02**
3	76	Benz(a)anthracene	mg/kg	9.40E-01	1.70E+00	**0.00E+00**	**8.64E-02**
4	81	Benz(a)anthracene	mg/kg	2.43E-01	6.50E-01	**0.00E+00**	**8.64E-02**
5	138	Benz(a)anthracene	mg/kg	5.24E-01	4.80E-02	**0.00E+00**	**8.64E-02**
6	153	Benz(a)anthracene	mg/kg	1.32E-01	5.80E-02	**0.00E+00**	**8.64E-02**

Table C2.4. SWMU/COPC Combinations That Survive Screening and Are Considered for Modeling Based on Overall Average Concentration Using a DAF of 20 (Continued)

#	SWMU/ AOC	Analysis	Units	Average Conc.	Maximum Conc.	Subsurface Background Conc.	RG SSL Conc. (DAF 20)
7	156	Benz(a)anthracene	mg/kg	1.55E-01	6.60E-02	**0.00E+00**	**8.64E-02**
8	158	Benz(a)anthracene	mg/kg	3.67E-01	4.30E-01	**0.00E+00**	**8.64E-02**
9	163	Benz(a)anthracene	mg/kg	1.97E-01	1.60E-01	**0.00E+00**	**8.64E-02**
10	165	Benz(a)anthracene	mg/kg	3.36E-01	1.50E+00	**0.00E+00**	**8.64E-02**
11	169	Benz(a)anthracene	mg/kg	7.50E-01	1.30E+00	**0.00E+00**	**8.64E-02**
12	180	Benz(a)anthracene	mg/kg	1.84E-01	4.80E-02	**0.00E+00**	**8.64E-02**
13	194	Benz(a)anthracene	mg/kg	2.13E-01	8.90E-01	**0.00E+00**	**8.64E-02**
14	195	Benz(a)anthracene	mg/kg	2.05E-01	1.90E-01	**0.00E+00**	**8.64E-02**
15	196	Benz(a)anthracene	mg/kg	1.24E+00	6.90E+00	**0.00E+00**	**8.64E-02**
16	213	Benz(a)anthracene	mg/kg	1.10E-01	1.10E-01	**0.00E+00**	**8.64E-02**
17	215	Benz(a)anthracene	mg/kg	2.25E-01	8.00E-02	**0.00E+00**	**8.64E-02**
18	217	Benz(a)anthracene	mg/kg	2.08E-01	3.80E-01	**0.00E+00**	**8.64E-02**
19	221	Benz(a)anthracene	mg/kg	6.10E-01	6.10E-01	**0.00E+00**	**8.64E-02**
20	222	Benz(a)anthracene	mg/kg	1.20E-01	1.20E-01	**0.00E+00**	**8.64E-02**
21	227	Benz(a)anthracene	mg/kg	2.11E-01	1.18E-01	**0.00E+00**	**8.64E-02**
22	228	Benz(a)anthracene	mg/kg	1.18E-01	4.00E-02	**0.00E+00**	**8.64E-02**
23	488	Benz(a)anthracene	mg/kg	1.93E-01	1.90E-01	**0.00E+00**	**8.64E-02**
24	489	Benz(a)anthracene	mg/kg	1.36E-01	7.60E-02	**0.00E+00**	**8.64E-02**
25	518	Benz(a)anthracene	mg/kg	7.92E+00	1.10E+02	**0.00E+00**	**8.64E-02**
26	520	Benz(a)anthracene	mg/kg	2.25E-01	3.80E-01	**0.00E+00**	**8.64E-02**
27	531	Benz(a)anthracene	mg/kg	1.17E-01	3.90E-02	**0.00E+00**	**8.64E-02**
28	541	Benz(a)anthracene	mg/kg	6.29E-01	6.40E+00	**0.00E+00**	**8.64E-02**
29	561	Benz(a)anthracene	mg/kg	2.17E-01	1.90E+00	**0.00E+00**	**8.64E-02**
30	562	Benz(a)anthracene	mg/kg	2.55E-01	5.20E-01	**0.00E+00**	**8.64E-02**
1	1	*cis*-1,2-Dichloroethene	mg/kg	1.79E+01	2.40E+03	**0.00E+00**	**4.12E-01**
1	217	Cobalt	mg/kg	1.38E+01	1.90E+02	**1.30E+01**	**2.82E-01**
2	221	Cobalt	mg/kg	4.05E+01	1.44E+02	**1.30E+01**	**2.82E-01**
1	14	Mercury	mg/kg	4.87E+00	4.37E+01	**1.30E-01**	**2.08E+00**
2	76	Mercury	mg/kg	3.50E+00	7.45E+00	**1.30E-01**	**2.08E+00**
3	81	Mercury	mg/kg	4.27E+00	8.33E+00	**1.30E-01**	**2.08E+00**
4	99	Mercury	mg/kg	4.20E+00	9.53E+00	**1.30E-01**	**2.08E+00**
5	138	Mercury	mg/kg	4.89E+00	2.13E+01	**1.30E-01**	**2.08E+00**
6	153	Mercury	mg/kg	4.34E+00	1.99E-02	**1.30E-01**	**2.08E+00**
7	156	Mercury	mg/kg	4.70E+00	9.87E+00	**1.30E-01**	**2.08E+00**
8	158	Mercury	mg/kg	4.49E+00	1.05E+01	**1.30E-01**	**2.08E+00**
9	163	Mercury	mg/kg	4.33E+00	7.53E+00	**1.30E-01**	**2.08E+00**
10	169	Mercury	mg/kg	3.02E+00	7.87E+00	**1.30E-01**	**2.08E+00**
11	180	Mercury	mg/kg	4.69E+00	8.28E+00	**1.30E-01**	**2.08E+00**
12	194	Mercury	mg/kg	4.58E+00	8.94E+00	**1.30E-01**	**2.08E+00**

Table C2.4. SWMU/COPC Combinations That Survive Screening and Are Considered for Modeling Based on Overall Average Concentration Using a DAF of 20 (Continued)

#	SWMU/ AOC	Analysis	Units	Average Conc.	Maximum Conc.	Subsurface Background Conc.	RG SSL Conc. (DAF 20)
13	195	Mercury	mg/kg	4.64E+00	8.43E+00	**1.30E-01**	**2.08E+00**
14	200	Mercury	mg/kg	4.62E+00	6.93E+00	**1.30E-01**	**2.08E+00**
15	212	Mercury	mg/kg	3.20E+00	6.94E+00	**1.30E-01**	**2.08E+00**
16	213	Mercury	mg/kg	4.75E+00	3.75E-02	**1.30E-01**	**2.08E+00**
17	214	Mercury	mg/kg	3.35E+00	4.16E-02	**1.30E-01**	**2.08E+00**
18	215	Mercury	mg/kg	4.35E+00	2.83E-02	**1.30E-01**	**2.08E+00**
19	216	Mercury	mg/kg	2.52E+00	3.49E-02	**1.30E-01**	**2.08E+00**
20	217	Mercury	mg/kg	3.60E+00	9.20E+00	**1.30E-01**	**2.08E+00**
21	219	Mercury	mg/kg	3.01E+00	2.59E-02	**1.30E-01**	**2.08E+00**
22	221	Mercury	mg/kg	4.80E+00	1.23E+01	**1.30E-01**	**2.08E+00**
23	222	Mercury	mg/kg	3.81E+00	2.77E-02	**1.30E-01**	**2.08E+00**
24	227	Mercury	mg/kg	3.83E+00	8.41E+00	**1.30E-01**	**2.08E+00**
25	228	Mercury	mg/kg	4.18E+00	9.37E+00	**1.30E-01**	**2.08E+00**
26	488	Mercury	mg/kg	3.90E+00	5.03E-02	**1.30E-01**	**2.08E+00**
27	489	Mercury	mg/kg	3.01E+00	3.39E-02	**1.30E-01**	**2.08E+00**
28	520	Mercury	mg/kg	4.25E+00	1.19E+01	**1.30E-01**	**2.08E+00**
29	531	Mercury	mg/kg	4.38E+00	3.65E-02	**1.30E-01**	**2.08E+00**
1	165	Methylene chloride	mg/kg	4.67E-02	6.80E-02	**0.00E+00**	**2.54E-02**
1	1	Molybdenum	mg/kg	4.31E+00	1.42E+01	**0.00E+00**	**2.10E+00**
2	14	Molybdenum	mg/kg	7.16E+00	2.87E+01	**0.00E+00**	**2.10E+00**
3	81	Molybdenum	mg/kg	6.70E+00	2.20E+00	**0.00E+00**	**2.10E+00**
4	99	Molybdenum	mg/kg	7.09E+00	1.60E+01	**0.00E+00**	**2.10E+00**
5	138	Molybdenum	mg/kg	6.90E+00	1.10E+00	**0.00E+00**	**2.10E+00**
6	153	Molybdenum	mg/kg	6.65E+00	1.20E+00	**0.00E+00**	**2.10E+00**
7	156	Molybdenum	mg/kg	6.73E+00	7.40E-01	**0.00E+00**	**2.10E+00**
8	158	Molybdenum	mg/kg	6.77E+00	1.20E+00	**0.00E+00**	**2.10E+00**
9	160	Molybdenum	mg/kg	5.54E+00	7.70E-01	**0.00E+00**	**2.10E+00**
10	163	Molybdenum	mg/kg	6.90E+00	1.60E+00	**0.00E+00**	**2.10E+00**
11	169	Molybdenum	mg/kg	6.59E+00	6.27E+00	**0.00E+00**	**2.10E+00**
12	180	Molybdenum	mg/kg	6.98E+00	1.40E+00	**0.00E+00**	**2.10E+00**
13	194	Molybdenum	mg/kg	6.94E+00	1.96E+01	**0.00E+00**	**2.10E+00**
14	195	Molybdenum	mg/kg	6.97E+00	5.60E+00	**0.00E+00**	**2.10E+00**
15	196	Molybdenum	mg/kg	4.14E+00	1.30E+00	**0.00E+00**	**2.10E+00**
16	200	Molybdenum	mg/kg	6.90E+00	7.30E-01	**0.00E+00**	**2.10E+00**
17	212	Molybdenum	mg/kg	6.06E+00	1.30E+00	**0.00E+00**	**2.10E+00**
18	213	Molybdenum	mg/kg	7.16E+00	6.10E-01	**0.00E+00**	**2.10E+00**
19	214	Molybdenum	mg/kg	5.15E+00	4.50E-01	**0.00E+00**	**2.10E+00**
20	215	Molybdenum	mg/kg	6.63E+00	1.00E+00	**0.00E+00**	**2.10E+00**
21	216	Molybdenum	mg/kg	4.11E+00	7.10E-01	**0.00E+00**	**2.10E+00**

Table C2.4. SWMU/COPC Combinations That Survive Screening and Are Considered for Modeling Based on Overall Average Concentration Using a DAF of 20 (Continued)

#	SWMU/ AOC	Analysis	Units	Average Conc.	Maximum Conc.	Subsurface Background Conc.	RG SSL Conc. (DAF 20)
22	217	Molybdenum	mg/kg	6.88E+00	5.89E+00	**0.00E+00**	**2.10E+00**
23	219	Molybdenum	mg/kg	4.63E+00	3.40E-01	**0.00E+00**	**2.10E+00**
24	221	Molybdenum	mg/kg	6.83E+00	4.00E+00	**0.00E+00**	**2.10E+00**
25	222	Molybdenum	mg/kg	6.62E+00	1.20E+00	**0.00E+00**	**2.10E+00**
26	227	Molybdenum	mg/kg	6.51E+00	5.21E+00	**0.00E+00**	**2.10E+00**
27	228	Molybdenum	mg/kg	6.23E+00	1.20E+00	**0.00E+00**	**2.10E+00**
28	488	Molybdenum	mg/kg	5.92E+00	5.50E-01	**0.00E+00**	**2.10E+00**
29	489	Molybdenum	mg/kg	4.75E+00	7.40E-01	**0.00E+00**	**2.10E+00**
30	520	Molybdenum	mg/kg	6.99E+00	1.30E+00	**0.00E+00**	**2.10E+00**
31	531	Molybdenum	mg/kg	6.66E+00	1.10E+00	**0.00E+00**	**2.10E+00**
32	541	Molybdenum	mg/kg	2.42E+00	5.62E+00	**0.00E+00**	**2.10E+00**
33	564	Molybdenum	mg/kg	6.88E+00	7.84E+00	**0.00E+00**	**2.10E+00**
1	1	Naphthalene	mg/kg	1.25E+00	5.78E-04	**0.00E+00**	**1.16E-02**
2	19	Naphthalene	mg/kg	1.89E-01	1.10E+00	**0.00E+00**	**1.16E-02**
3	81	Naphthalene	mg/kg	2.21E-01	3.90E-01	**0.00E+00**	**1.16E-02**
4	165	Naphthalene	mg/kg	5.84E-01	4.70E+00	**0.00E+00**	**1.16E-02**
5	194	Naphthalene	mg/kg	1.98E-01	4.80E-02	**0.00E+00**	**1.16E-02**
6	196	Naphthalene	mg/kg	1.78E-01	1.10E+00	**0.00E+00**	**1.16E-02**
7	541	Naphthalene	mg/kg	2.71E-01	1.80E+00	**0.00E+00**	**1.16E-02**
8	561	Naphthalene	mg/kg	2.05E-01	5.50E-01	**0.00E+00**	**1.16E-02**
1	1	Neptunium-237	pCi/g	1.14E-01	6.63E-01	**0.00E+00**	**9.00E-02**
2	14	Neptunium-237	pCi/g	1.47E+00	1.60E+01	**0.00E+00**	**9.00E-02**
3	165	Neptunium-237	pCi/g	3.66E-01	5.60E-01	**0.00E+00**	**9.00E-02**
4	196	Neptunium-237	pCi/g	1.33E-01	3.11E-01	**0.00E+00**	**9.00E-02**
5	212	Neptunium-237	pCi/g	1.73E+00	4.00E+00	**0.00E+00**	**9.00E-02**
6	227	Neptunium-237	pCi/g	2.15E-01	2.53E+00	**0.00E+00**	**9.00E-02**
7	228	Neptunium-237	pCi/g	1.47E-01	8.00E-01	**0.00E+00**	**9.00E-02**
8	517	Neptunium-237	pCi/g	3.04E-01	1.07E+00	**0.00E+00**	**9.00E-02**
9	520	Neptunium-237	pCi/g	1.20E-01	1.10E+00	**0.00E+00**	**9.00E-02**
1	14	Nickel	mg/kg	2.44E+02	2.67E+03	**2.20E+01**	**2.72E+01**
2	19	Nickel	mg/kg	4.26E+01	4.38E+02	**2.20E+01**	**2.72E+01**
3	81	Nickel	mg/kg	3.31E+01	1.14E+02	**2.20E+01**	**2.72E+01**
4	99	Nickel	mg/kg	3.45E+01	9.05E+01	**2.20E+01**	**2.72E+01**
5	138	Nickel	mg/kg	3.56E+01	1.13E+02	**2.20E+01**	**2.72E+01**
6	153	Nickel	mg/kg	4.18E+01	9.92E+01	**2.20E+01**	**2.72E+01**
7	156	Nickel	mg/kg	3.13E+01	6.16E+01	**2.20E+01**	**2.72E+01**
8	158	Nickel	mg/kg	3.58E+01	1.32E+02	**2.20E+01**	**2.72E+01**
9	163	Nickel	mg/kg	3.70E+01	7.81E+01	**2.20E+01**	**2.72E+01**
10	169	Nickel	mg/kg	6.61E+01	8.04E+02	**2.20E+01**	**2.72E+01**

Table C2.4. SWMU/COPC Combinations That Survive Screening and Are Considered for Modeling Based on Overall Average Concentration Using a DAF of 20 (Continued)

#	SWMU/ AOC	Analysis	Units	Average Conc.	Maximum Conc.	Subsurface Background Conc.	RG SSL Conc. (DAF 20)
11	180	Nickel	mg/kg	3.97E+01	1.08E+02	**2.20E+01**	**2.72E+01**
12	194	Nickel	mg/kg	3.55E+01	1.08E+02	**2.20E+01**	**2.72E+01**
13	195	Nickel	mg/kg	3.58E+01	1.02E+02	**2.20E+01**	**2.72E+01**
14	196	Nickel	mg/kg	3.91E+01	5.87E+02	**2.20E+01**	**2.72E+01**
15	200	Nickel	mg/kg	5.00E+01	2.60E+02	**2.20E+01**	**2.72E+01**
16	212	Nickel	mg/kg	2.91E+01	8.69E+01	**2.20E+01**	**2.72E+01**
17	213	Nickel	mg/kg	3.98E+01	9.10E+01	**2.20E+01**	**2.72E+01**
18	215	Nickel	mg/kg	3.26E+01	7.32E+01	**2.20E+01**	**2.72E+01**
19	217	Nickel	mg/kg	3.53E+01	1.31E+02	**2.20E+01**	**2.72E+01**
20	219	Nickel	mg/kg	3.08E+01	6.71E+01	**2.20E+01**	**2.72E+01**
21	221	Nickel	mg/kg	3.84E+01	1.39E+02	**2.20E+01**	**2.72E+01**
22	222	Nickel	mg/kg	3.66E+01	9.19E+01	**2.20E+01**	**2.72E+01**
23	227	Nickel	mg/kg	6.37E+01	6.53E+02	**2.20E+01**	**2.72E+01**
24	228	Nickel	mg/kg	3.58E+01	7.92E+01	**2.20E+01**	**2.72E+01**
25	489	Nickel	mg/kg	3.77E+01	7.88E+01	**2.20E+01**	**2.72E+01**
26	517	Nickel	mg/kg	5.65E+01	1.72E+02	**2.20E+01**	**2.72E+01**
27	520	Nickel	mg/kg	7.91E+01	8.10E+02	**2.20E+01**	**2.72E+01**
28	531	Nickel	mg/kg	5.37E+01	1.62E+02	**2.20E+01**	**2.72E+01**
1	14	PCB, Total	mg/kg	2.71E+00	1.00E+01	**0.00E+00**	**1.56E+00**
2	76	PCB, Total	mg/kg	1.57E+00	2.60E-01	**0.00E+00**	**1.56E+00**
3	81	PCB, Total	mg/kg	6.31E+00	3.70E+02	**0.00E+00**	**1.56E+00**
4	138	PCB, Total	mg/kg	1.93E+00	5.00E-01	**0.00E+00**	**1.56E+00**
5	153	PCB, Total	mg/kg	2.09E+00	6.00E-01	**0.00E+00**	**1.56E+00**
6	156	PCB, Total	mg/kg	2.33E+00	3.00E-01	**0.00E+00**	**1.56E+00**
7	169	PCB, Total	mg/kg	1.68E+00	1.00E+01	**0.00E+00**	**1.56E+00**
8	194	PCB, Total	mg/kg	2.29E+00	1.80E+01	**0.00E+00**	**1.56E+00**
9	195	PCB, Total	mg/kg	2.32E+00	7.40E-01	**0.00E+00**	**1.56E+00**
10	200	PCB, Total	mg/kg	2.35E+00	2.60E+00	**0.00E+00**	**1.56E+00**
11	213	PCB, Total	mg/kg	2.38E+00	7.30E-02	**0.00E+00**	**1.56E+00**
12	221	PCB, Total	mg/kg	2.23E+00	5.00E-01	**0.00E+00**	**1.56E+00**
13	227	PCB, Total	mg/kg	1.93E+00	1.26E+01	**0.00E+00**	**1.56E+00**
14	488	PCB, Total	mg/kg	2.81E+00	1.03E+01	**0.00E+00**	**1.56E+00**
15	492	PCB, Total	mg/kg	4.77E+00	4.41E+01	**0.00E+00**	**1.56E+00**
16	541	PCB, Total	mg/kg	1.39E+01	9.40E+01	**0.00E+00**	**1.56E+00**
1	1	Pentachlorophenol	mg/kg	9.33E-01	1.10E-01	**0.00E+00**	**2.02E-01**
2	165	Pentachlorophenol	mg/kg	1.10E+00	2.10E+00	**0.00E+00**	**2.02E-01**
1	1	Plutonium-239/240	pCi/g	2.20E+00	9.05E+00	**0.00E+00**	**1.56E+00**
2	165	Plutonium-239/240	pCi/g	2.93E+00	7.78E+00	**0.00E+00**	**1.56E+00**
3	212	Plutonium-239/240	pCi/g	3.32E+00	6.71E+00	**0.00E+00**	**1.56E+00**

Table C2.4. SWMU/COPC Combinations That Survive Screening and Are Considered for Modeling Based on Overall Average Concentration Using a DAF of 20 (Continued)

#	SWMU/ AOC	Analysis	Units	Average Conc.	Maximum Conc.	Subsurface Background Conc.	RG SSL Conc. (DAF 20)
1	14	Selenium	mg/kg	9.30E+00	3.07E+01	**7.00E-01**	**5.20E+00**
2	76	Selenium	mg/kg	6.49E+00	1.50E+00	**7.00E-01**	**5.20E+00**
3	81	Selenium	mg/kg	8.48E+00	1.40E+00	**7.00E-01**	**5.20E+00**
4	99	Selenium	mg/kg	9.06E+00	1.30E+00	**7.00E-01**	**5.20E+00**
5	138	Selenium	mg/kg	8.54E+00	4.72E+00	**7.00E-01**	**5.20E+00**
6	153	Selenium	mg/kg	8.85E+00	1.70E+00	**7.00E-01**	**5.20E+00**
7	156	Selenium	mg/kg	9.04E+00	1.50E+00	**7.00E-01**	**5.20E+00**
8	158	Selenium	mg/kg	8.69E+00	4.15E+00	**7.00E-01**	**5.20E+00**
9	160	Selenium	mg/kg	7.44E+00	1.30E+00	**7.00E-01**	**5.20E+00**
10	163	Selenium	mg/kg	8.79E+00	2.00E+00	**7.00E-01**	**5.20E+00**
11	169	Selenium	mg/kg	6.14E+00	1.70E+00	**7.00E-01**	**5.20E+00**
12	180	Selenium	mg/kg	9.29E+00	3.82E+00	**7.00E-01**	**5.20E+00**
13	194	Selenium	mg/kg	9.15E+00	4.03E+00	**7.00E-01**	**5.20E+00**
14	195	Selenium	mg/kg	9.29E+00	3.06E+00	**7.00E-01**	**5.20E+00**
15	200	Selenium	mg/kg	8.99E+00	5.84E+00	**7.00E-01**	**5.20E+00**
16	212	Selenium	mg/kg	6.80E+00	1.60E+00	**7.00E-01**	**5.20E+00**
17	213	Selenium	mg/kg	9.54E+00	7.70E-01	**7.00E-01**	**5.20E+00**
18	214	Selenium	mg/kg	6.89E+00	6.70E-01	**7.00E-01**	**5.20E+00**
19	215	Selenium	mg/kg	8.81E+00	1.10E+00	**7.00E-01**	**5.20E+00**
20	216	Selenium	mg/kg	5.65E+00	1.30E+00	**7.00E-01**	**5.20E+00**
21	217	Selenium	mg/kg	7.63E+00	1.67E+00	**7.00E-01**	**5.20E+00**
22	219	Selenium	mg/kg	6.46E+00	1.20E+00	**7.00E-01**	**5.20E+00**
23	221	Selenium	mg/kg	9.26E+00	9.80E+00	**7.00E-01**	**5.20E+00**
24	222	Selenium	mg/kg	7.75E+00	1.40E+00	**7.00E-01**	**5.20E+00**
25	227	Selenium	mg/kg	8.27E+00	2.20E+00	**7.00E-01**	**5.20E+00**
26	228	Selenium	mg/kg	7.99E+00	3.97E+00	**7.00E-01**	**5.20E+00**
27	488	Selenium	mg/kg	8.09E+00	1.60E+00	**7.00E-01**	**5.20E+00**
28	489	Selenium	mg/kg	6.52E+00	1.40E+00	**7.00E-01**	**5.20E+00**
29	520	Selenium	mg/kg	8.24E+00	4.55E+00	**7.00E-01**	**5.20E+00**
30	531	Selenium	mg/kg	8.85E+00	1.10E+00	**7.00E-01**	**5.20E+00**
1	14	Silver	mg/kg	5.13E+00	2.22E+01	**2.70E+00**	**8.76E-01**
2	76	Silver	mg/kg	3.02E+00	6.30E-02	**2.70E+00**	**8.76E-01**
3	81	Silver	mg/kg	4.29E+00	2.70E+00	**2.70E+00**	**8.76E-01**
4	99	Silver	mg/kg	4.44E+00	1.03E+01	**2.70E+00**	**8.76E-01**
5	138	Silver	mg/kg	4.84E+00	1.65E+01	**2.70E+00**	**8.76E-01**
6	153	Silver	mg/kg	5.37E+00	1.32E+01	**2.70E+00**	**8.76E-01**
7	156	Silver	mg/kg	4.71E+00	1.19E+01	**2.70E+00**	**8.76E-01**
8	158	Silver	mg/kg	4.47E+00	1.47E+01	**2.70E+00**	**8.76E-01**
9	160	Silver	mg/kg	4.48E+00	1.13E+01	**2.70E+00**	**8.76E-01**

Table C2.4. SWMU/COPC Combinations That Survive Screening and Are Considered for Modeling Based on Overall Average Concentration Using a DAF of 20 (Continued)

#	SWMU/ AOC	Analysis	Units	Average Conc.	Maximum Conc.	Subsurface Background Conc.	RG SSL Conc. (DAF 20)
10	163	Silver	mg/kg	4.53E+00	1.05E+01	**2.70E+00**	**8.76E-01**
11	165	Silver	mg/kg	1.14E+01	8.33E+01	**2.70E+00**	**8.76E-01**
12	169	Silver	mg/kg	3.09E+00	7.90E-02	**2.70E+00**	**8.76E-01**
13	180	Silver	mg/kg	4.90E+00	1.17E+01	**2.70E+00**	**8.76E-01**
14	194	Silver	mg/kg	4.97E+00	1.70E+01	**2.70E+00**	**8.76E-01**
15	195	Silver	mg/kg	4.77E+00	1.31E+01	**2.70E+00**	**8.76E-01**
16	200	Silver	mg/kg	4.63E+00	9.47E+00	**2.70E+00**	**8.76E-01**
17	212	Silver	mg/kg	4.24E+00	1.55E+01	**2.70E+00**	**8.76E-01**
18	213	Silver	mg/kg	6.12E+00	1.32E+01	**2.70E+00**	**8.76E-01**
19	214	Silver	mg/kg	3.34E+00	2.10E-02	**2.70E+00**	**8.76E-01**
20	215	Silver	mg/kg	4.55E+00	9.51E+00	**2.70E+00**	**8.76E-01**
21	217	Silver	mg/kg	4.14E+00	1.61E+01	**2.70E+00**	**8.76E-01**
22	219	Silver	mg/kg	3.02E+00	5.60E-02	**2.70E+00**	**8.76E-01**
23	221	Silver	mg/kg	4.58E+00	9.74E+00	**2.70E+00**	**8.76E-01**
24	222	Silver	mg/kg	3.84E+00	5.00E-02	**2.70E+00**	**8.76E-01**
25	227	Silver	mg/kg	4.09E+00	1.01E+01	**2.70E+00**	**8.76E-01**
26	228	Silver	mg/kg	4.58E+00	1.16E+01	**2.70E+00**	**8.76E-01**
27	488	Silver	mg/kg	3.91E+00	8.50E-02	**2.70E+00**	**8.76E-01**
28	489	Silver	mg/kg	3.01E+00	4.10E-02	**2.70E+00**	**8.76E-01**
29	520	Silver	mg/kg	4.54E+00	1.40E+01	**2.70E+00**	**8.76E-01**
30	531	Silver	mg/kg	4.38E+00	1.00E-01	**2.70E+00**	**8.76E-01**
1	14	Technetium-99	pCi/g	5.44E+01	4.06E+02	**2.80E+00**	**7.32E+00**
2	19	Technetium-99	pCi/g	1.01E+01	3.70E+01	**2.80E+00**	**7.32E+00**
3	165	Technetium-99	pCi/g	1.67E+01	6.00E+01	**2.80E+00**	**7.32E+00**
4	227	Technetium-99	pCi/g	1.65E+01	1.52E+02	**2.80E+00**	**7.32E+00**
5	517	Technetium-99	pCi/g	2.43E+01	8.32E+01	**2.80E+00**	**7.32E+00**
1	99	Thallium	mg/kg	5.03E+00	2.50E-01	**3.40E-01**	**2.84E+00**
2	163	Thallium	mg/kg	3.13E+00	3.50E-01	**3.40E-01**	**2.84E+00**
3	181	Thallium	mg/kg	3.06E+00	3.50E+00	**3.40E-01**	**2.84E+00**
4	227	Thallium	mg/kg	5.69E+00	5.10E-01	**3.40E-01**	**2.84E+00**
5	520	Thallium	mg/kg	4.66E+00	3.40E-01	**3.40E-01**	**2.84E+00**
1	1	Thorium-230	pCi/g	1.56E+01	6.50E+01	**1.40E+00**	**6.06E+00**
2	212	Thorium-230	pCi/g	6.64E+01	2.60E+02	**1.40E+00**	**6.06E+00**
1	14	Total PAH	mg/kg	1.04E-01	4.87E-01	**0.00E+00**	**8.64E-02**
2	19	Total PAH	mg/kg	5.94E-01	5.23E+00	**0.00E+00**	**8.64E-02**
3	76	Total PAH	mg/kg	1.01E+00	1.76E+00	**0.00E+00**	**8.64E-02**
4	81	Total PAH	mg/kg	2.39E-01	7.79E-01	**0.00E+00**	**8.64E-02**
5	138	Total PAH	mg/kg	4.45E-01	9.74E-02	**0.00E+00**	**8.64E-02**
6	158	Total PAH	mg/kg	3.31E-01	4.78E-01	**0.00E+00**	**8.64E-02**

Table C2.4. SWMU/COPC Combinations That Survive Screening and Are Considered for Modeling Based on Overall Average Concentration Using a DAF of 20 (Continued)

#	SWMU/ AOC	Analysis	Units	Average Conc.	Maximum Conc.	Subsurface Background Conc.	RG SSL Conc. (DAF 20)
7	163	Total PAH	mg/kg	1.08E-01	2.85E-01	**0.00E+00**	**8.64E-02**
8	165	Total PAH	mg/kg	3.00E+00	1.87E+00	**0.00E+00**	**8.64E-02**
9	169	Total PAH	mg/kg	2.30E+00	4.59E+00	**0.00E+00**	**8.64E-02**
10	196	Total PAH	mg/kg	1.08E+00	9.04E+00	**0.00E+00**	**8.64E-02**
11	212	Total PAH	mg/kg	1.14E-01	0.00E+00	**0.00E+00**	**8.64E-02**
12	213	Total PAH	mg/kg	1.72E-01	1.72E-01	**0.00E+00**	**8.64E-02**
13	215	Total PAH	mg/kg	4.04E-01	5.00E-01	**0.00E+00**	**8.64E-02**
14	216	Total PAH	mg/kg	1.49E-01	1.49E-01	**0.00E+00**	**8.64E-02**
15	217	Total PAH	mg/kg	1.76E-01	7.37E-01	**0.00E+00**	**8.64E-02**
16	221	Total PAH	mg/kg	1.02E+00	1.02E+00	**0.00E+00**	**8.64E-02**
17	222	Total PAH	mg/kg	1.77E-01	1.77E-01	**0.00E+00**	**8.64E-02**
18	227	Total PAH	mg/kg	1.80E-01	3.38E-01	**0.00E+00**	**8.64E-02**
19	488	Total PAH	mg/kg	1.27E-01	2.50E-01	**0.00E+00**	**8.64E-02**
20	493	Total PAH	mg/kg	4.86E-01	5.00E-01	**0.00E+00**	**8.64E-02**
21	518	Total PAH	mg/kg	1.88E+00	1.27E+01	**0.00E+00**	**8.64E-02**
22	520	Total PAH	mg/kg	2.13E-01	5.52E-01	**0.00E+00**	**8.64E-02**
23	541	Total PAH	mg/kg	1.67E-01	7.63E+00	**0.00E+00**	**8.64E-02**
24	561	Total PAH	mg/kg	2.18E-01	2.63E+00	**0.00E+00**	**8.64E-02**
1	1	*trans*-1,2-Dichloroethene	mg/kg	8.69E-01	1.60E+01	**0.00E+00**	**5.88E-01**
1	1	Trichloroethene	mg/kg	1.79E+00	8.70E+01	**0.00E+00**	**3.56E-02**
2	165	Trichloroethene	mg/kg	3.56E-02	6.00E-03	**0.00E+00**	**3.56E-02**
1	81	Uranium	mg/kg	9.14E+02	6.50E+03	**4.60E+00**	**2.70E+02**
2	518	Uranium	mg/kg	3.05E+02	2.17E+02	**4.60E+00**	**2.70E+02**
3	541	Uranium	mg/kg	7.22E+02	2.02E+04	**4.60E+00**	**2.70E+02**
1	14	Uranium-238	pCi/g	9.74E+01	1.54E+03	**1.20E+00**	**9.09E+01**
2	492	Uranium-238	pCi/g	1.39E+02	3.83E+02	**1.20E+00**	**9.09E+01**
3	541	Uranium-238	pCi/g	2.83E+02	4.54E+03	**1.20E+00**	**9.09E+01**
1	221	Vanadium	mg/kg	4.57E+01	1.08E+02	**3.70E+01**	**1.41E+00**
2	564	Vanadium	mg/kg	6.87E+01	8.06E+01	**3.70E+01**	**1.41E+00**
1	1	Vinyl chloride	mg/kg	4.48E-01	4.80E+00	**0.00E+00**	**1.37E-02**
1	531	Zinc	mg/kg	7.78E+02	2.45E+03	**6.00E+01**	**3.90E+02**

A review of this table indicates that the principal impact of using a DAF of 20 is to increase the number of SWMU/AOC soil constituent combinations that fail the screening; however, there is no impact on the SWMU/AOC soil constituent combinations subjected to modeling because of the following:

- Where a SWMU/AOC soil constituent was going to be modeled because of screening against a DAF of 58, that same SWMU/AOC soil constituent will be modeled if screened against a DAF of 20 because it is the SWMU/AOC with the highest average concentration of that soil constituent. Thus, the additional SWMU/AOC soil constituent combinations will have impacts that are lower than those already subjected to modeling;

- Where a SWMU/AOC soil constituent was not going to be modeled because it is not found in groundwater, is not a groundwater COC, or where its concentration is controlled by other factors, it will not be modeled based on screening against either a DAF of 20 or DAF of 58; and

- All of those additional soil constituents that are not screened out using a DAF of 20, but are screened out using a DAF of 58, are also constituents that are not groundwater COCs, or the concentration is controlled by other factors, or the constituent is not found in groundwater.

This rationale is summarized in Table C2.5.

Based on this sensitivity analysis, no additional SWMU/AOC soil constituent combinations were subjected to modeling.

Table C2.5. Comparison of Soil Constituents Exceeding RG SSLs and Background Derived From DAF of 58 Versus Values Derived from DAF of 20

Soil Constituent (Modeled?)	DAF 58: # of SWMUs/AOCs with Soil Constituent Exceedance	DAF 20: # SWMUs/AOCs with Soil Constituent Exceedance	Comments on Impact of Screening Using DAF of 20 Values
Silver (No)	30	30	No impact on modeling. Silver not detected in RGA groundwater.
Total PAHs or benz(a)anthracene (No)	23	54	No impact on modeling. Not a groundwater COC.
Molybdenum (No)	23	33	No impact on modeling. Not major RGA issue; concentrations controlled by redox chemistry.
Nickel (Yes)	2	28	No impact on modeling. SWMU/AOC with highest average nickel concentration will be modeled.
Np-237 (No)	4	9	No impact on modeling. No above-MCL detections of Np-237 in RGA groundwater.
Tc-99 (Yes)	2	5	No impact on modeling. SWMU/AOC with highest average Tc-99 concentration will be modeled.
Naphthalene (No)	8	8	No impact on modeling. Not RGA COC.
Thorium-230 (No)	1	2	No impact on modeling. Not RGA COC.
Cobalt (No)	2	2	No impact on modeling. Not RGA COC.
U-238 (No)	1	3	No impact on modeling. No RGA impacts from Soils OU.
Uranium (Yes)	1	3	No impact on modeling. SWMU/AOC with highest avg. uranium concentration will be modeled.
Vanadium (No)	2	2	No impact on modeling. Not major RGA issue.
Arsenic (Yes)	2	7	No impact. SWMU/AOC with highest average arsenic concentration will be modeled.
VOCs (Yes/No)	3	6	No impact on modeling. Mostly in SWMU 1—modeled separately.
Antimony (No)	0	2	No impact. No RGA detects in 2,063 samples.
Chromium (Yes)	0	0	No impact. SWMU/AOC with highest concentration subjected to modeling.

Table C2.5. Comparison of Soil Constituents Exceeding RG SSLs and Background Derived From DAF of 58 Versus Values Derived from DAF of 20 (Continued)

Soil Constituent (Modeled?)	DAF 58: # of SWMUs/AOCs with Soil Constituent Exceedance	DAF 20: # SWMUs/AOCs with Soil Constituent Exceedance	Comments on Impact of Screening Using DAF of 20 Values
Manganese (No)	0	0	No impact on modeling. Concentrations controlled by redox chemistry.
Mercury (No)	0	29	No impact. Not a groundwater COC. RGA concentrations < MCL for all 2,265 samples.
PCB, Total (Yes)	3	16	No impact on modeling. SWMU/AOC with highest total PCB concentration will be modeled.
Pentachlorophenol (No)	2	2	No impact on modeling. Not RGA COC. No detects out of 436 RGA samples.
Plutonium-239/240 (No)	0	3	No impact. Not RGA COC. 1 detect out of 256 samples. Detect not near Soils OU SWMU/AOC.
Selenium (No)	0	30	No impact on modeling. Not RGA COC. No RGA results > MCL out of 2,426 samples.
Thallium (No)	0	5	No impact on modeling. Not RGA COC. 1 split detect (not near Soils OU SWMU/AOC) of 1,283 samples.
Zinc (No)	0	1	No impact on modeling. Not RGA COC. 2 exceed NAL (not near Soils OU SWMU/AOC) of 1,763.

VOCs = volatile organic compounds

C2.5. REFERENCES

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ATTACHMENT C3

CALCULATION PACKAGE

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C3.1. CALCULATIONS SUMMARY

This attachment provides an example of the calculations used in performing the groundwater modeling. Seasonal Soil Compartment Model (SESOIL) and Analytical Transient 1-, 2-, 3-Dimensional Model (AT123D) groundwater and transport modeling were conducted as part of the Soils Operable Unit (SOU) Remedial Investigation (RI) to determine potential Regional Gravel Aquifer (RGA) groundwater concentrations of technetium-99 (Tc-99), chromium (Cr), and nickel (Ni) emanating from solid waste management unit (SWMU) 14 as well as total polychlorinated biphenyls (Total PCBs) emanating from SWMU 81 and AOC 541 at four points of exposure:

- SWMU boundary
- Paducah Gaseous Diffusion Plant (PGDP) Boundary Fence
- Department of Energy (DOE) Fence and
- The Ohio River

The input files were developed in the graphic user interface SEVIEW v 7.1.7. It previously was agreed upon in the SOU Work Plan that the Soils Project would be limited to soil depths of 15 ft below ground surface or less. Thus, site-specific input at depths greater than 15 ft was not available for the SESOIL and AT123D simulations. To overcome this limitation, SWMU 1 SESOIL and AT123D general input parameters were assumed representative of SWMU 14 and other SWMUs at the PGDP as described in "Appendix C Fate and Transport Modeling" prepared by Las Alamos Technical Associates (LATA) as part of the SOU RI Report (Appendix C). These input parameters are shown in Table C3.1.

Additional input parameters were provided in Appendix C; the Remedial Investigation Report for Waste Area Grouping 27 at the PGDP, Paducah, KY June, 1999, prepared by CH2M HILL; and the Remedial Investigation Report for the Burial Grounds Operable Unit at PGDP, Paducah, KY, Feb. 2010, prepared by Paducah Remediation Services. The remainder of data (flow path from source to points of exposure, source area size) was provided in ArcGIS files depicting particle tracking and flow paths. Particle tracking and the flow path from the center of SWMU 14 to the Ohio River were determined using MODPATH (Pollack 1994) and the Paducah Gaseous Diffusion Plant (PGDP) MODFLOW2000 (Harbaugh et al. 2000) groundwater flow model (PRS 2008). In addition, the horizontal hydraulic gradient was determined from the flow path and modeled groundwater elevations at the center of SWMU and adjacent to the Ohio River.

Input concentrations are summarized in Tables C3.2-C3.6. Table C3.1 lists reported average concentrations that were calculated using samples having detected concentrations. Table C.3.8 (Appendix C main text) presents the calculated adjusted soil contaminated area for each contaminant, which is the maximum area (of the three intervals) as listed in Table C.3.4 (Appendix C main text). Adjusted interval concentrations (Table C.3.8, Appendix C main text) were calculated using the ratio of SWMU total area to maximum impacted soil area as well as the ratio of number of detects to the total number of samples. That ratio was then applied to the Table C.3.3 (Appendix C main text) average concentration for each interval. For example, the calculation of SWMU 14 nickel at a depth of between 0 cm to 152.4 cm below ground surface is as follows:

$$401.18\ \mu g/g \times \frac{5.75\ \text{acres (total area)}}{5.03\ \text{acres (max interval area)}} \times \frac{162\ \text{samples with Ni detection}}{239\ \text{total Ni samples}} = 310.78\ \mu g/g$$

Tc-99 concentrations were reported in units of activity (pCi/g) as well as on a mass basis. The activity was converted from mass concentration (µg/g) using the following formulas:

$$\lambda = \ln(2)/t_{1/2}$$

Where:

λ is the Tc-99 decay constant = 1.03 x 10^{-13}
$t_{1/2}$ is the half-life of Tc-99 = 6.71 x 10^{12} s

$$SA = N_A(\lambda)/M$$

Where:

SA is the specific activity in disintegrations per second per gram (dps/g) = 6.27 x 10^{8} dps/g
N_A is Avogadro's number = 6.02 x 10^{23} mol^{-1}
M is atomic mass (Tc-99 = 98.9 g/mol)

The unit conversion of dps to Curies (Ci) is 3.7 x 10^{10} dps/Ci, which equals SA of 0.017 Ci/g or 1.7 x 10^{4} pCi/µg. Activity concentrations can then be calculated by multiplying the mass concentration (µg/g) by the SA (1.7 x 10^{4} pCi/µg).

C3.2. REFERENCES

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PRS (Paducah Remediation Services, LLC) 2010. *2008 Update of the Paducah Gaseous Diffusion Plant Sitewide Groundwater Flow Model*, PRS-ENR-0028.

Table C3.1. SEVIEW Input Parameters

Parameter (Units)	Value	Source
SESOIL Parameters		
Temperature (Celsius) [Oct–Sept]	15.28 8.39 3.33 2.06 3.67 8.11 14.72 19.39 23.89 25.56 24.94 21.17	Template input files
Cloud Cover (fraction) [Oct–Sept]	0.45 0.55 0.65 0.70 0.65 0.65 0.60 0.60 0.55 0.50 0.45 0.45	Template input files
Relative Humidity (fraction) [Oct–Sept]	0.70 0.70 0.75 0.75 0.70 0.65 0.65 0.70 0.70 0.70 0.70 0.70	Template input files
Short Wave Albedo (fraction) [Oct–Sept]	0.17 0.18 0.20 0.22 0.20 0.19 0.17 0.17 0.17 0.17 0.17 0.17	Template input files
Evapotranspiration (cm/day) [Oct–Sept]	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	Template input files
Precip (cm/month) [Oct–Sept]	9.98 10.67 15.19 16.08 12.19 15.32 13.72 10.26 12.85 10.54 7.39 11.38	Template input files
Storm Length (days) [Oct–Sept]	0.32 0.45 0.49 0.47 0.41 0.40 0.37 0.30 0.25 0.25 0.23 0.27	Template input files
# of Storms (storms/month) [Oct-Sep]	4.50 5.00 5.62 5.29 5.84 6.65 6.82 7.38 5.85 6.15 5.28 4.60	Template input files
Rainy Season (days) [Oct-Sep]	30.40 30.40 30.40 30.40 30.40 30.40 30.40 30.40 30.40 30.40 30.40 30.40	Template input files

Table C3.1. SEVIEW Input Parameters (Continued)

Parameter (Units)	Value	Source
Water Solubility (mg/L)	Tc-99 = 7,180	SEVIEW Chemical Database
	Cr = 12,000	SEVIEW Chemical Database
	Ni = 422,000	SEVIEW Chemical Database
	Total PCBs = 0.277	SEVIEW Chemical Database
Henry's Law Constant (m^3-atm/mol)	Tc-99 = 0	Remedial Investigation Report for the Burial Grounds Operable Unit at PGDP, Paducah, KY Feb. 2010
	Cr = 0	SEVIEW Chemical Database
	Ni = 2.44E-2	SEVIEW Chemical Database
	Total PCBs = 3.42E-4	SEVIEW Chemical Database
Koc adsorption-desorption (µg/g)/(µg/ml)	0	Remedial Investigation Report for the Burial Grounds Operable Unit at PGDP, Paducah, KY Feb. 2010 for Tc-99/ SEVIEW Chemical Database for Cr, Ni, and Total PCBs
Kd adsorption (µg/g)/(µg/ml)	Tc-99 = 0.2	Remedial Investigation Report for the Burial Grounds Operable Unit at PGDP, Paducah, KY Feb. 2010
	Cr(+3) = 1.80E6 Cr(+6) = 19	SEVIEW Chemical Database
	Ni = 65	SEVIEW Chemical Database
	Total PCBs = 156	SEVIEW Chemical Database
Kd desorption (µg/g)/(µg/ml)	0	Template input files
chemical valence (g/mole)	0	Template input files
base hydrolysis rate constant (1/day)	0	Template input files
Liquid phase biodegradation rate (1/day)	Tc-99 = 9.50E-9	Remedial Investigation Report for Waste Area Grouping 27 at the PGDP, Paducah, KY June, 1999
	Cr = 0	SESOIL Chemical Library
	Ni = 0	SESOIL Chemical Library
	Total PCBs = 0	SESOIL Chemical Library
Solid phase biodegradation rate (1/day)	Tc-99 = 9.50E-9	Remedial Investigation Report for Waste Area Grouping 27 at the PGDP, Paducah, KY June, 1999
	Cr = 0	SESOIL Chemical Library
	Ni = 0	SESOIL Chemical Library
	Total PCBs = 0	SESOIL Chemical Library
Water diffusion coefficient (cm^2/sec)	Tc-99 = 1.0E-06	Remedial Investigation Report for the Burial Grounds Operable Unit at PGDP, Paducah, KY Feb. 2010
	Cr = 5.94E-06	Domenico and Schwartz, 1997
	Ni = 4.90E-05	Alabama Risk Based Corrective Action Guidance Manual
	Total PCBs = 8.00E-06	SEVIEW Chemical Database
Air diffusion coefficient (cm^2/sec)	Tc-99 = 0	Remedial Investigation Report for the Burial Grounds Operable Unit at PGDP, Paducah, KY Feb. 2010
	Cr = 0	SEVIEW Chemical Database
	Ni = 0	SEVIEW Chemical Database

Table C3.1. SEVIEW Input Parameters (Continued)

Parameter (Units)	Value	Source
	Total PCBs = 1.75E-2	SEVIEW Chemical Database
Molecular weight (g/mole)	Tc-99 = 99	Remedial Investigation Report for the Burial Grounds Operable Unit at PGDP, Paducah, KY Feb. 2010
	Cr = 52	SEVIEW Chemical Database
	Ni = 59	SEVIEW Chemical Database
	Total PCBs = 292	SEVIEW Chemical Database
Neutral hydrolysis rate constant (1/day)	0	Template input files
Acid Hydrolysis rate constant (1/day)	0	Template input files
Ligand dissociation constant (-)	0	Template input files
Moles ligand/mole chemical (-)	0	Template input files
Molecular weight ligand (g/mol)	0	Template input files
Soil bulk density (g/cm^3)	1.46	Template input files
Intrinsic permeability (cm^2)	1.6E-10	Template input files
Soil pore disconnectedness index (-)	10	Template input files
Effective porosity (fraction)	0.45	Template input files
Organic carbon content (percent)	0.08	Template input files
CEC (milliequivalents/100 g dry soil)	0	Template input files
Freundlich Exponent (-)	1	Template input files
Load area (cm^2)	Tc-99 = 2.33E+08	ArcGIS shapefiles
	Cr = 1.92E+08	
	Ni = 2.04E+08	
	Total PCBs (SWMU 81) = 6.64E+06	
	Total PCBs (AOC 541) = 1.71E+07	
Site Latitude (decimal degrees)	37.1	Template input files
Number of Layers	4	Template input files
Upper Soil Layer Thickness (cm)/Number of sublayers	152.4/1	Template input files
Second Soil Layer Thickness (cm)/Number of sublayers	152.4/1	Template input files
Third Soil Layer Thickness (cm)/Number of sublayers	152.4/1	Template input files
Lower Soil Layer Thickness (cm)/Number of sublayers	1219.2/10	Template input files
pH [upper, second, third and lower layer)	7	Template input files
Intrinsic permeability (cm^2) [upper, second, third and lower layer]	0	Template input files
Ratio of liquid phase biodegradation to upper layer (fraction) [upper, second, third and lower layer]	1	Template input files
Ratio of solid phase biodegradation to upper layer (fraction) [upper, second, third and lower layer]	1	Template input files
Organic Carbon ratio to upper layer (fraction) [upper, second, third and lower layer]	1	Template input files

Table C3.1. SEVIEW Input Parameters (Continued)

Parameter (Units)	Value	Source
CEC ratio to upper layer (fraction) [upper, second, third and lower layer]	1	Template input files
Freundlich exponent ratio to upper layer (fraction) [upper, second, third and lower layer]	1	Template input files
Adsorption coefficient ratio to upper layer (fraction) [upper, second, third and lower layer]	1	Template input files
Layer 1-4 all years VOLF1 (fraction) [Oct-Sep]	1	Template input files
Layer 1 all years ISRM (fraction) and ASL1 (fraction) [Oct-Sep]	0	Template input files
Layer 1-4 all years POLIN1, TRANS1, SINK1, LIG1 (µg/cm^2)	0	Template input files
Layer 1, Layer 2, Layer 3, and Layer 4 Adjusted sublayer concentrations (µg/g)	Tc-99 = 0.0035, 5.77E-5, 9.94E-5, 0 Cr(+3/+6) = 26.12, 32.63, 41.49, 0 Ni = 310.78, 199.34, 15.68, 0 Total PCBs (SWMU 81) = 14.13, 1.86, 0, 0 Total PCBs (AOC 541) = 29.51, 0, 0, 0	Concentration average of Tc-99 data collected in SWMU14 from 0-5, 5-10, and 10-15 feet below ground surface (bgs). Assumed concentration between 15 ft bgs and water table is zero. See soil concentration data in Table A.1*
AT123D (Only Tc-99 reached the RGA; therefore, values below are for Tc-99 in SWMU 14 only.)		
Hydraulic conductivity (m/hr)	22.263	Historical sitewide model
Effective porosity (-)	0.3	PGDP sitewide model calibrated value
Soil bulk density (kg/m^3)	1670	Laboratory analysis
Hydraulic gradient (m/m)	0.0015	ArcGIS particle tracking shapefiles
Number of Eigenvalues	1000	Template input files
Longitudinal, transverse, and vertical dispersivity (m)	1.5, 0.15, 0.003	Template input files
Aquifer width (m)	Infinite	Template input files
Aquifer depth (m)	9.14	Site Average
Organic carbon content (%)	0.02	Laboratory analysis
Water diffusion coefficient (m^2/hr)/(cm^2/s)	3.60E-07 / 1.0E-6	Remedial Investigation Report for the Burial Grounds Operable Unit at PGDP, Paducah, KY Feb. 2010
First order decay coefficient (1/hr)/(1/d)	3.96E-10 / 9.50E-9	Remedial Investigation Report for Waste Area Grouping 27 at the PGDP, Paducah, KY June, 1999
Carbon adsorption coefficient, Koc (µg/g)/(µg/ml)	0	Forces model to use Kd
Distribution coefficient, Kd (m^3/kg)	0.0002	Remedial Investigation Report for the Burial Grounds Operable Unit at PGDP, Paducah, KY Feb. 2010
SOL H20	7,180	Remedial Investigation Report for the Burial Grounds Operable Unit at PGDP, Paducah, KY Feb. 2010
Starting time step	1	Desired time interval

Table C3.1. SEVIEW Input Parameters (Continued)

Parameter (Units)	Value	Source
Ending time step	11989	Desired time interval
Print Interval	1	Desired print interval
X-axis coordinates (m)	76.3, 161, 195, 814, 5818	Desired observation coordinates (place holder, SWMU boundary, PGDP fence, DOE fence, Ohio River)
Y-axis coordinates (m)	126.3	Centerline of SWMU 14.
Z-axis coordinates (m)	0, 1.5, 3, 6, 7.5, 9	Desired observation depths
Release Coordinates Start/End X (meters)	0, 152.552	Model space chosen coordinates
Release Coordinates Start/End Y (meters)	50, 202.552	Model space chosen coordinates
Release Coordinates Start/End Z (meters)	0, 0	Model space chosen coordinates
Initial Concentration (mg/L)	0	Assumption: conc.=0 at time = 0
Single Mass Load (kg)	0	Assumption: conc.=0 at time = 0
Model time step (hours)	730	SESOIL default, one month
Continuous release	11988	Number of time steps required for 1,000 year simulation
Load release rate (kg/hr)	Output from SESOIL	SESOIL**

*In keeping with the convention documented in Appendix C to the Soils Operable Unit Remedial Investigation, the average concentrations were assumed to be present across the entire SWMU within the associated depth interval as each sample was reported to have a detection of Tc-99.
**Input for AT123D is derived directly from SESOIL output files.

Table C3.2. Soil Concentration Tc-99 Soil Data

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Activity (pCi/g)	Concentration (μg/g)
Depth Interval 0-5 ft						
DOESS308-99	9/1/1999	-6060.00	946.00	0	406	2.40E-02
SOU014RADSA001	10/13/2010	-5899.37	640.71	0.5	215	1.27E-02
SOU014036SA001	6/23/2010	-6013.72	798.84	1	13	7.69E-04
SOU014053SA001	6/24/2010	-5743.72	753.84	1	101	5.98E-03
SOU014074SA001	6/25/2010	-5788.72	663.84	1	25.1	1.49E-03
SOU014079SA001	6/28/2010	-6058.72	618.84	1	76	4.50E-03
SOU014105SA001	6/29/2010	-5878.72	528.84	1	166	9.82E-03
SOU014111SA001	6/29/2010	-6103.72	483.84	1	30.9	1.83E-03
SOU014017SA001	6/30/2010	-5878.72	888.84	1	48.8	2.89E-03
SOU014033SA001	6/30/2010	-5653.72	843.84	1	1.25	7.40E-05
SOU014118SA001	6/30/2010	-5788.72	483.84	1	56.3	3.33E-03
SOU014013SA001	6/30/2010	-6058.72	888.84	1	0.75	4.44E-05
SOU014046SA004	6/23/2010	-6058.72	753.84	4	23.9	1.41E-03
SOU014044SA004	6/24/2010	-5653.72	798.84	4	1.57	9.29E-05
SOU014085SA004	6/24/2010	-5788.72	618.84	4	7.09	4.20E-04
SOU014027SA004	6/25/2010	-5923.72	843.84	4	93.5	5.53E-03
SOU014070SA004	6/25/2010	-5968.72	663.84	4	5.92	3.50E-04
SOU014105SA004	6/29/2010	-5878.72	528.84	4	1.66	9.82E-05
SOU014101SA004	6/29/2010	-6058.72	528.84	4	0.96	5.68E-05
SOU014096SA004	6/29/2010	-5788.72	573.84	4	12.2	7.22E-04
SOU014015SA004	6/30/2010	-5968.72	888.84	4	6.18	3.66E-04
SOU014019SA004	6/30/2010	-5788.72	888.84	4	9.03	5.34E-04
Depth Interval 5-10 ft						
007008SA010	4/2/2007	-6064.71	934.28	10	0.975	5.77E-05
Depth Interval 10-15 ft						
007008SA015	4/2/2007	-6064.71	934.28	15	1.68	9.94E-05

Note: Concentrations used in the 0-5 ft, 5-10 ft, and 10-15 ft intervals in the SWMU 14 SEVIEW model are simple arithmetic averages of available data within those intervals.

Table C3.3. SADA SWMU 14 Cr (+3/+6) Soil Data

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Cr Concentration (µg/g)
Depth Interval 0-5 ft					
SOU014111SA001	6/29/2010	-6103.72	483.84	1	36.59
SOU014111SA001	6/29/2010	-6103.72	483.84	1	16.8
SOU014100SA001	6/30/2010	-6103.72	528.84	1	85 U
SOU014089SA001	6/29/2010	-6103.72	573.84	1	85 U
SOU014078SA001	6/25/2010	-6103.72	618.84	1	85 U
SOU014067SA001	6/25/2010	-6103.72	663.84	1	85 U
SOU014056SA001	6/30/2010	-6103.72	708.84	1	85 U
SOU014045SA001	6/23/2010	-6103.72	753.84	1	85 U
SOU014034SA001	6/24/2010	-6103.72	798.84	1	85 U
SOU014023SA001	6/30/2010	-6103.72	843.84	1	57.1
SOU014012SA001	6/30/2010	-6103.72	888.84	1	44.41
SOU014001SA001	6/30/2010	-6103.72	933.84	1	85 U
SOU014112SA001	6/29/2010	-6058.72	483.84	1	85 U
SOU014101SA001	6/29/2010	-6058.72	528.84	1	85 U
SOU014090SA001	6/29/2010	-6058.72	573.84	1	38.47
SOU014079SA001	6/28/2010	-6058.72	618.84	1	897.61
SOU014079SA001	6/28/2010	-6058.72	618.84	1	22
SOU014068SA001	6/24/2010	-6058.72	663.84	1	85 U
SOU014057SA001	6/25/2010	-6058.72	708.84	1	85 U
SOU014046SA001	6/23/2010	-6058.72	753.84	1	85 U
SOU014035SA001	6/24/2010	-6058.72	798.84	1	51.32
SOU014024SA001	6/30/2010	-6058.72	843.84	1	42.2
SOU014013SA001	6/30/2010	-6058.72	888.84	1	85 U
SOU014013SA001	6/30/2010	-6058.72	888.84	1	12.7
SOU014002SA001	6/30/2010	-6058.72	933.84	1	85 U
SOU014113SA001	6/29/2010	-6013.72	483.84	1	85 U
SOU014102SA001	6/30/2010	-6013.72	528.84	1	85 U
SOU014102SD001	6/30/2010	-6013.72	528.84	1	46.03
SOU014091SA001	6/30/2010	-6013.72	573.84	1	85 U
SOU014080SA001	6/25/2010	-6013.72	618.84	1	32.91
SOU014069SA001	6/24/2010	-6013.72	663.84	1	85 U
SOU014058SA001	6/25/2010	-6013.72	708.84	1	85 U
SOU014047SA001	6/24/2010	-6013.72	753.84	1	41.59
SOU014036SA001	6/23/2010	-6013.72	798.84	1	37.28
SOU014036SA001	6/23/2010	-6013.72	798.84	1	25.7
SOU014025SA001	6/25/2010	-6013.72	843.84	1	63.58

Table C3.3. SADA SWMU 14 Cr (+3/+6) Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Cr Concentration (µg/g)
SOU014014SA001	7/1/2010	-6013.72	888.84	1	85 U
SOU014003SA001	6/30/2010	-6013.72	933.84	1	43.91
SOU014114SA001	6/29/2010	-5968.72	483.84	1	85 U
SOU014103SA001	6/29/2010	-5968.72	528.84	1	85 U
SOU014092SA001	6/30/2010	-5968.72	573.84	1	32.42
SOU014081SA001	6/28/2010	-5968.72	618.84	1	85 U
SOU014070SA001	6/25/2010	-5968.72	663.84	1	85 U
SOU014059SA001	6/25/2010	-5968.72	708.84	1	85 U
SOU014048SA001	6/24/2010	-5968.72	753.84	1	85 U
SOU014037SA001	6/23/2010	-5968.72	798.84	1	48.55
SOU014026SA001	6/25/2010	-5968.72	843.84	1	85 U
SOU014015SA001	6/30/2010	-5968.72	888.84	1	85 U
SOU014004SA001	6/30/2010	-5968.72	933.84	1	85 U
SOU014115SA001	6/30/2010	-5923.72	483.84	1	36.71
SOU014104SA001	6/29/2010	-5923.72	528.84	1	85 U
SOU014093SA001	6/30/2010	-5923.72	573.84	1	85 U
SOU014082SA001	6/29/2010	-5923.72	618.84	1	46.44
SOU014071SA001	6/25/2010	-5923.72	663.84	1	85 U
SOU014060SA001	6/25/2010	-5923.72	708.84	1	59.55
SOU014049SA001	6/23/2010	-5923.72	753.84	1	54.54
SOU014038SA001	6/23/2010	-5923.72	798.84	1	85 U
SOU014027SA001	6/25/2010	-5923.72	843.84	1	38.74
SOU014016SA001	7/1/2010	-5923.72	888.84	1	36.91
SOU014005SA001	6/30/2010	-5923.72	933.84	1	47.19
SOU014116SA001	6/30/2010	-5878.72	483.84	1	32.69
SOU014105SA001	6/29/2010	-5878.72	528.84	1	85 U
SOU014105SA001	6/29/2010	-5878.72	528.84	1	26.3
SOU014094SA001	6/29/2010	-5878.72	573.84	1	85 U
SOU014083SA001	6/29/2010	-5878.72	618.84	1	85 U
SOU014072SA001	6/25/2010	-5878.72	663.84	1	34.64
SOU014061SD001	6/25/2010	-5878.72	708.84	1	36.37
SOU014061SA001	6/25/2010	-5878.72	708.84	1	33.57
SOU014050SA001	6/24/2010	-5878.72	753.84	1	77.28
SOU014039SA001	6/24/2010	-5878.72	798.84	1	44.56
SOU014028SA001	6/25/2010	-5878.72	843.84	1	54.24
SOU014017SA001	6/30/2010	-5878.72	888.84	1	57.78
SOU014017SA001	6/30/2010	-5878.72	888.84	1	36.2
SOU014006SA001	6/30/2010	-5878.72	933.84	1	54.78
SOU014117SA001	6/30/2010	-5833.72	483.84	1	85 U
SOU014106SA001	6/29/2010	-5833.72	528.84	1	85 U
SOU014106SD001	6/29/2010	-5833.72	528.84	1	85 U

Table C3.3. SADA SWMU 14 Cr (+3/+6) Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Cr Concentration (µg/g)
SOU014095SA001	6/29/2010	-5833.72	573.84	1	32.35
SOU014084SA001	6/29/2010	-5833.72	618.84	1	37.8
SOU014073SA001	6/25/2010	-5833.72	663.84	1	85 U
SOU014062SA001	6/24/2010	-5833.72	708.84	1	85 U
SOU014051SA001	6/23/2010	-5833.72	753.84	1	39
SOU014051SD001	6/23/2010	-5833.72	753.84	1	85 U
SOU014040SA001	6/24/2010	-5833.72	798.84	1	41.72
SOU014029SA001	6/23/2010	-5833.72	843.84	1	85 U
SOU014018SA001	6/30/2010	-5833.72	888.84	1	85 U
SOU014007SA001	6/30/2010	-5833.72	933.84	1	66.54
SOU014118SA001	6/30/2010	-5788.72	483.84	1	39.23
SOU014118SA001	6/30/2010	-5788.72	483.84	1	15.1
SOU014107SA001	6/29/2010	-5788.72	528.84	1	85 U
SOU014096SA001	6/29/2010	-5788.72	573.84	1	35.53
SOU014085SA001	6/25/2010	-5788.72	618.84	1	64.56
SOU014074SA001	6/25/2010	-5788.72	663.84	1	85 U
SOU014074SA001	6/25/2010	-5788.72	663.84	1	18.1
SOU014063SA001	6/24/2010	-5788.72	708.84	1	85 U
SOU014041SA001	6/24/2010	-5788.72	798.84	1	85 U
SOU014030SA001	6/24/2010	-5788.72	843.84	1	65.48
SOU014019SA001	6/30/2010	-5788.72	888.84	1	85 U
SOU014008SA001	6/30/2010	-5788.72	933.84	1	60.92
SOU014108SA001	6/29/2010	-5743.72	528.84	1	41.85
SOU014097SA001	6/25/2010	-5743.72	573.84	1	34.83
SOU014086SA001	6/28/2010	-5743.72	618.84	1	28.16
SOU014075SA001	6/25/2010	-5743.72	663.84	1	85 U
SOU014064SA001	6/24/2010	-5743.72	708.84	1	85 U
SOU014053SA001	6/24/2010	-5743.72	753.84	1	85 U
SOU014053SA001	6/24/2010	-5743.72	753.84	1	44.7
SOU014042SA001	6/24/2010	-5743.72	798.84	1	85 U
SOU014031SA001	6/23/2010	-5743.72	843.84	1	85 U
SOU014020SA001	6/30/2010	-5743.72	888.84	1	85 U
SOU014009SA001	6/30/2010	-5743.72	933.84	1	70.13
SOU014120SA001	6/29/2010	-5698.72	483.84	1	85 U
SOU014109SA001	6/25/2010	-5698.72	528.84	1	34.88
SOU014098SA001	6/25/2010	-5698.72	573.84	1	32.24
SOU014087SA001	6/24/2010	-5698.72	618.84	1	34.44
SOU014076SA001	6/25/2010	-5698.72	663.84	1	36.86
SOU014065SD001	6/24/2010	-5698.72	708.84	1	41.55
SOU014065SA001	6/24/2010	-5698.72	708.84	1	85 U
SOU014054SA001	6/23/2010	-5698.72	753.84	1	85 U

Table C3.3. SADA SWMU 14 Cr (+3/+6) Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Cr Concentration (μg/g)
SOU014043SA001	6/23/2010	-5698.72	798.84	1	46.97
SOU014032SA001	6/24/2010	-5698.72	843.84	1	85 U
SOU014021SA001	7/1/2010	-5698.72	888.84	1	85 U
SOU014010SA001	6/30/2010	-5698.72	933.84	1	85 U
SOU014121SA001	6/29/2010	-5653.72	483.84	1	85 U
SOU014110SA001	6/24/2010	-5653.72	528.84	1	85 U
SOU014099SA001	6/25/2010	-5653.72	573.84	1	85 U
SOU014088SA001	6/25/2010	-5653.72	618.84	1	85 U
SOU014077SA001	6/25/2010	-5653.72	663.84	1	85 U
SOU014066SA001	6/24/2010	-5653.72	708.84	1	35.55
SOU014055SA001	6/23/2010	-5653.72	753.84	1	85 U
SOU014044SA001	6/24/2010	-5653.72	798.84	1	85 U
SOU014033SA001	6/30/2010	-5653.72	843.84	1	85 U
SOU014033SA001	6/30/2010	-5653.72	843.84	1	25
SOU014022SA001	7/1/2010	-5653.72	888.84	1	66.69
SOU014011SA001	6/30/2010	-5653.72	933.84	1	46.91
SOU014111SA004	6/29/2010	-6103.72	483.84	4	48.3
SOU014100SA004	6/30/2010	-6103.72	528.84	4	51.41
SOU014089SA004	6/29/2010	-6103.72	573.84	4	42.41
SOU014089SD004	6/29/2010	-6103.72	573.84	4	85 U
SOU014078SA004	6/25/2010	-6103.72	618.84	4	85 U
SOU014067SA004	6/25/2010	-6103.72	663.84	4	85 U
SOU014067SD004	6/25/2010	-6103.72	663.84	4	85 U
SOU014056SA004	6/30/2010	-6103.72	708.84	4	85 U
SOU014045SA004	6/23/2010	-6103.72	753.84	4	85 U
SOU014034SA004	6/24/2010	-6103.72	798.84	4	34.11
SOU014023SA004	6/30/2010	-6103.72	843.84	4	85 U
SOU014023SD004	6/30/2010	-6103.72	843.84	4	55.12
SOU014012SA004	6/30/2010	-6103.72	888.84	4	85 U
SOU014001SA004	6/30/2010	-6103.72	933.84	4	45.84
SOU014112SA004	6/29/2010	-6058.72	483.84	4	85 U
SOU014101SA004	6/29/2010	-6058.72	528.84	4	85 U
SOU014101SA004	6/29/2010	-6058.72	528.84	4	12.9
SOU014090SA004	6/29/2010	-6058.72	573.84	4	36.14
SOU014079SA004	6/28/2010	-6058.72	618.84	4	40.5
SOU014068SA004	6/24/2010	-6058.72	663.84	4	85 U
SOU014057SA004	6/25/2010	-6058.72	708.84	4	85 U
SOU014046SA004	6/23/2010	-6058.72	753.84	4	85 U
SOU014046SA004	6/23/2010	-6058.72	753.84	4	18.7
SOU014035SA004	6/24/2010	-6058.72	798.84	4	85 U
SOU014024SA004	6/30/2010	-6058.72	843.84	4	51.83

Table C3.3. SADA SWMU 14 Cr (+3/+6) Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Cr Concentration (µg/g)
SOU014024SD004	6/30/2010	-6058.72	843.84	4	40.08
SOU014013SA004	6/30/2010	-6058.72	888.84	4	85 U
SOU014002SA004	6/30/2010	-6058.72	933.84	4	36.74
SOU014113SA004	6/29/2010	-6013.72	483.84	4	85 U
SOU014102SA004	6/30/2010	-6013.72	528.84	4	85 U
SOU014091SA004	6/30/2010	-6013.72	573.84	4	42.47
SOU014080SA004	6/25/2010	-6013.72	618.84	4	61.92
SOU014069SA004	6/24/2010	-6013.72	663.84	4	85 U
SOU014058SA004	6/25/2010	-6013.72	708.84	4	85 U
SOU014047SA004	6/24/2010	-6013.72	753.84	4	39.18
SOU014036SA004	6/23/2010	-6013.72	798.84	4	85 U
SOU014025SA004	6/25/2010	-6013.72	843.84	4	85 U
SOU014014SA004	7/1/2010	-6013.72	888.84	4	85 U
SOU014003SA004	6/30/2010	-6013.72	933.84	4	58.35
SOU014114SA004	6/29/2010	-5968.72	483.84	4	85 U
SOU014103SA004	6/29/2010	-5968.72	528.84	4	85 U
SOU014092SA004	6/30/2010	-5968.72	573.84	4	35.08
SOU014081SA004	6/28/2010	-5968.72	618.84	4	37.59
SOU014070SA004	6/25/2010	-5968.72	663.84	4	85 U
SOU014070SA004	6/25/2010	-5968.72	663.84	4	13.1
SOU014059SA004	6/25/2010	-5968.72	708.84	4	44.01
SOU014048SA004	6/24/2010	-5968.72	753.84	4	85 U
SOU014037SA004	6/23/2010	-5968.72	798.84	4	85 U
SOU014026SA004	6/25/2010	-5968.72	843.84	4	47.25
SOU014015SA004	6/30/2010	-5968.72	888.84	4	85 U
SOU014015SA004	6/30/2010	-5968.72	888.84	4	72.7
SOU014004SA004	6/30/2010	-5968.72	933.84	4	85 U
SOU014115SA004	6/30/2010	-5923.72	483.84	4	33.18
SOU014104SA004	6/29/2010	-5923.72	528.84	4	85 U
SOU014093SA004	6/30/2010	-5923.72	573.84	4	85 U
SOU014082SA004	6/29/2010	-5923.72	618.84	4	85 U
SOU014082SD004	6/29/2010	-5923.72	618.84	4	85 U
SOU014071SA004	6/25/2010	-5923.72	663.84	4	85 U
SOU014060SA004	6/25/2010	-5923.72	708.84	4	85 U
SOU014049SA004	6/23/2010	-5923.72	753.84	4	32.13
SOU014038SA004	6/23/2010	-5923.72	798.84	4	85 U
SOU014027SA004	6/25/2010	-5923.72	843.84	4	85 U
SOU014027SA004	6/25/2010	-5923.72	843.84	4	37
SOU014016SA004	7/1/2010	-5923.72	888.84	4	85 U
SOU014005SA004	6/30/2010	-5923.72	933.84	4	48.97
SOU014116SA004	6/30/2010	-5878.72	483.84	4	85 U

Table C3.3. SADA SWMU 14 Cr (+3/+6) Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Cr Concentration (µg/g)
SOU014105SA004	6/29/2010	-5878.72	528.84	4	33.68
SOU014105SA004	6/29/2010	-5878.72	528.84	4	10.1
SOU014094SA004	6/29/2010	-5878.72	573.84	4	85 U
SOU014083SA004	6/29/2010	-5878.72	618.84	4	33.34
SOU014072SA004	6/25/2010	-5878.72	663.84	4	85 U
SOU014061SA004	6/25/2010	-5878.72	708.84	4	85 U
SOU014050SA004	6/24/2010	-5878.72	753.84	4	85 U
SOU014039SA004	6/24/2010	-5878.72	798.84	4	85 U
SOU014028SA004	6/25/2010	-5878.72	843.84	4	85 U
SOU014017SA004	6/30/2010	-5878.72	888.84	4	66.08
SOU014006SA004	6/30/2010	-5878.72	933.84	4	98.88
SOU014117SA004	6/30/2010	-5833.72	483.84	4	38.54
SOU014106SA004	6/29/2010	-5833.72	528.84	4	85 U
SOU014095SA004	6/29/2010	-5833.72	573.84	4	85 U
SOU014084SA004	6/29/2010	-5833.72	618.84	4	85 U
SOU014073SA004	6/25/2010	-5833.72	663.84	4	85 U
SOU014062SA004	6/24/2010	-5833.72	708.84	4	85 U
SOU014051SA004	6/23/2010	-5833.72	753.84	4	85 U
SOU014040SA004	6/24/2010	-5833.72	798.84	4	85 U
SOU014029SA004	6/23/2010	-5833.72	843.84	4	37.96
SOU014018SA004	6/30/2010	-5833.72	888.84	4	85 U
SOU014007SA004	6/30/2010	-5833.72	933.84	4	85 U
SOU014118SA004	6/30/2010	-5788.72	483.84	4	85 U
SOU014107SA004	6/29/2010	-5788.72	528.84	4	85 U
SOU014096SA004	6/29/2010	-5788.72	573.84	4	85 U
SOU014096SA004	6/29/2010	-5788.72	573.84	4	9.9
SOU014085SA004	6/24/2010	-5788.72	618.84	4	85 U
SOU014085SA004	6/24/2010	-5788.72	618.84	4	15.7
SOU014074SA004	6/25/2010	-5788.72	663.84	4	85 U
SOU014063SA004	6/24/2010	-5788.72	708.84	4	43.02
SOU014041SA004	6/24/2010	-5788.72	798.84	4	85 U
SOU014030SA004	6/24/2010	-5788.72	843.84	4	85 U
SOU014019SA004	6/30/2010	-5788.72	888.84	4	85 U
SOU014019SA004	6/30/2010	-5788.72	888.84	4	31.6
SOU014008SA004	6/30/2010	-5788.72	933.84	4	48.36
SOU014119SA004	6/29/2010	-5743.72	483.84	4	44.72
SOU014108SA004	6/29/2010	-5743.72	528.84	4	85 U
SOU014097SA004	6/25/2010	-5743.72	573.84	4	38.27
SOU014086SA004	6/28/2010	-5743.72	618.84	4	85 U
SOU014075SA004	6/25/2010	-5743.72	663.84	4	85 U
SOU014064SA004	6/24/2010	-5743.72	708.84	4	85 U

Table C3.3. SADA SWMU 14 Cr (+3/+6) Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Cr Concentration (µg/g)
SOU014053SA004	6/24/2010	-5743.72	753.84	4	85 U
SOU014042SA004	6/24/2010	-5743.72	798.84	4	85 U
SOU014031SA004	6/23/2010	-5743.72	843.84	4	85 U
SOU014020SA004	6/30/2010	-5743.72	888.84	4	85 U
SOU014009SA004	6/30/2010	-5743.72	933.84	4	85 U
SOU014120SA004	6/29/2010	-5698.72	483.84	4	85 U
SOU014109SA004	6/25/2010	-5698.72	528.84	4	85 U
SOU014098SA004	6/25/2010	-5698.72	573.84	4	85 U
SOU014087SA004	6/24/2010	-5698.72	618.84	4	85 U
SOU014076SA004	6/25/2010	-5698.72	663.84	4	49.22
SOU014065SA004	6/24/2010	-5698.72	708.84	4	36.3
SOU014054SA004	6/23/2010	-5698.72	753.84	4	85 U
SOU014043SA004	6/23/2010	-5698.72	798.84	4	85 U
SOU014032SA004	6/24/2010	-5698.72	843.84	4	35.22
SOU014021SA004	7/1/2010	-5698.72	888.84	4	85 U
SOU014010SA004	6/30/2010	-5698.72	933.84	4	85 U
SOU014121SA004	6/29/2010	-5653.72	483.84	4	85 U
SOU014110SA004	6/24/2010	-5653.72	528.84	4	85 U
SOU014099SA004	6/25/2010	-5653.72	573.84	4	85 U
SOU014088SA004	6/25/2010	-5653.72	618.84	4	85 U
SOU014077SA004	6/25/2010	-5653.72	663.84	4	85 U
SOU014066SA004	6/24/2010	-5653.72	708.84	4	85 U
SOU014055SA004	6/23/2010	-5653.72	753.84	4	85 U
SOU014044SA004	6/24/2010	-5653.72	798.84	4	85 U
SOU014044SA004	6/24/2010	-5653.72	798.84	4	15.7
SOU014033SA004	6/30/2010	-5653.72	843.84	4	85 U
SOU014022SA004	7/1/2010	-5653.72	888.84	4	85 U
SOU014011SA004	6/30/2010	-5653.72	933.84	4	85 U
Depth Interval 5-10 ft					
SOU014111SA007	7/20/2010	-6103.72	483.84	7	85 U
SOU014078SA007	7/22/2010	-6103.72	618.84	7	85 U
SOU014045SA007	7/22/2010	-6103.72	753.84	7	34.18
SOU014001SA007	7/22/2010	-6103.72	933.84	7	85 U
SOU014091SA007	7/20/2010	-6013.72	573.84	7	85 U
SOU014114SA007	7/20/2010	-5968.72	483.84	7	85 U
SOU014059SA007	7/22/2010	-5968.72	708.84	7	49.98
SOU014039SA007	7/22/2010	-5878.72	798.84	7	75.34
SOU014007SA007	7/23/2010	-5833.72	933.84	7	52.06
SOU014097SA007	7/20/2010	-5743.72	573.84	7	85 U
SOU014097SA007	7/20/2010	-5743.72	573.84	7	13.7
SOU014064SA007	7/20/2010	-5743.72	708.84	7	85 U

Table C3.3. SADA SWMU 14 Cr (+3/+6) Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Cr Concentration (µg/g)
SOU014031SA007	7/19/2010	-5743.72	843.84	7	58.15
SOU014121SA007	7/20/2010	-5653.72	483.84	7	41.11
SOU014088SA007	7/20/2010	-5653.72	618.84	7	43.05
SOU014055SA007	7/20/2010	-5653.72	753.84	7	35.96
SOU014055SA007	7/20/2010	-5653.72	753.84	7	23.5
SOU014011SA007	7/22/2010	-5653.72	933.84	7	85 U
Depth Interval 10-15 ft					
SOU014078SA010	7/22/2010	-6103.72	618.84	10	53.47
SOU014045SA010	7/22/2010	-6103.72	753.84	10	85 U
SOU014001SA010	7/22/2010	-6103.72	933.84	10	44.01
SOU014001SA010	7/22/2010	-6103.72	933.84	10	15.5
007008SA010	4/2/2007	-6064.71	934.28	10	13.1
SOU014091SA010	7/20/2010	-6013.72	573.84	10	39.78
SOU014114SA010	7/20/2010	-5968.72	483.84	10	36.91
SOU014059SA010	7/22/2010	-5968.72	708.84	10	62.95
SOU014059SD010	7/22/2010	-5968.72	708.84	10	85 U
SOU014039SA010	7/22/2010	-5878.72	798.84	10	40.9
SOU014007SA010	7/22/2010	-5833.72	933.84	10	51.44
SOU014097SA010	7/20/2010	-5743.72	573.84	10	85 U
SOU014064SA010	7/20/2010	-5743.72	708.84	10	45.84
SOU014031SA010	7/19/2010	-5743.72	843.84	10	53.94
SOU014121SA010	7/20/2010	-5653.72	483.84	10	36.31
SOU014121SD010	7/20/2010	-5653.72	483.84	10	85 U
SOU014088SA010	7/20/2010	-5653.72	618.84	10	85 U
SOU014055SA010	7/20/2010	-5653.72	753.84	10	46.75
SOU014011SA010	7/23/2010	-5653.72	933.84	10	44.89
007008SA015	4/2/2007	-6064.71	934.28	15	10.5

* Note: "U" indicates that the concentration was below the method detection limit.

Table C3.4. SADA SWMU 14 Ni Soil Data

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Ni Concentration (µg/g)
Depth Interval 0-5 ft					
SOU014111SA001	6/29/2010	-6103.72	483.84	1	529.85
SOU014111SA001	6/29/2010	-6103.72	483.84	1	166
SOU014100SA001	6/30/2010	-6103.72	528.84	1	112.45
SOU014089SA001	6/29/2010	-6103.72	573.84	1	531.79
SOU014078SA001	6/25/2010	-6103.72	618.84	1	1059.09
SOU014067SA001	6/25/2010	-6103.72	663.84	1	1622.96
SOU014056SA001	6/30/2010	-6103.72	708.84	1	344.76
SOU014045SA001	6/23/2010	-6103.72	753.84	1	296.12
SOU014034SA001	6/24/2010	-6103.72	798.84	1	269.83
SOU014023SA001	6/30/2010	-6103.72	843.84	1	65 U
SOU014012SA001	6/30/2010	-6103.72	888.84	1	65 U
SOU014001SA001	6/30/2010	-6103.72	933.84	1	65 U
SOU014112SA001	6/29/2010	-6058.72	483.84	1	480.96
SOU014101SA001	6/29/2010	-6058.72	528.84	1	255.25
SOU014090SA001	6/29/2010	-6058.72	573.84	1	343.76
SOU014079SA001	6/28/2010	-6058.72	618.84	1	1227.64
SOU014079SA001	6/28/2010	-6058.72	618.84	1	355
SOU014068SA001	6/24/2010	-6058.72	663.84	1	546.1
SOU014057SA001	6/25/2010	-6058.72	708.84	1	175.84
SOU014046SA001	6/23/2010	-6058.72	753.84	1	246.11
SOU014035SA001	6/24/2010	-6058.72	798.84	1	805.25
SOU014024SA001	6/30/2010	-6058.72	843.84	1	126.39
SOU014013SA001	6/30/2010	-6058.72	888.84	1	81
SOU014013SA001	6/30/2010	-6058.72	888.84	1	5
SOU014113SA001	6/29/2010	-6013.72	483.84	1	212.7
SOU014102SA001	6/30/2010	-6013.72	528.84	1	256.99
SOU014102SD001	6/30/2010	-6013.72	528.84	1	1299.73
SOU014091SA001	6/30/2010	-6013.72	573.84	1	660.44
SOU014080SA001	6/25/2010	-6013.72	618.84	1	1047.65
SOU014069SA001	6/24/2010	-6013.72	663.84	1	283.94
SOU014058SA001	6/25/2010	-6013.72	708.84	1	897.81
SOU014047SA001	6/24/2010	-6013.72	753.84	1	383.04
SOU014036SA001	6/23/2010	-6013.72	798.84	1	580.71
SOU014036SA001	6/23/2010	-6013.72	798.84	1	102
SOU014025SA001	6/25/2010	-6013.72	843.84	1	303.96
SOU014014SA001	7/1/2010	-6013.72	888.84	1	65 U
SOU014003SA001	6/30/2010	-6013.72	933.84	1	133.3
SOU014114SA001	6/29/2010	-5968.72	483.84	1	334.32

Table C3.4. SADA SWMU 14 Ni Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Ni Concentration (µg/g)
SOU014103SA001	6/29/2010	-5968.72	528.84	1	378.08
SOU014092SA001	6/30/2010	-5968.72	573.84	1	892.12
SOU014081SA001	6/28/2010	-5968.72	618.84	1	516.72
SOU014070SA001	6/25/2010	-5968.72	663.84	1	761.45
SOU014059SA001	6/25/2010	-5968.72	708.84	1	283.63
SOU014048SA001	6/24/2010	-5968.72	753.84	1	454.39
SOU014037SA001	6/23/2010	-5968.72	798.84	1	869.46
SOU014026SA001	6/25/2010	-5968.72	843.84	1	84.46
SOU014015SA001	6/30/2010	-5968.72	888.84	1	80.31
SOU014004SA001	6/30/2010	-5968.72	933.84	1	97.67
SOU014115SA001	6/30/2010	-5923.72	483.84	1	147.32
SOU014104SA001	6/29/2010	-5923.72	528.84	1	232.08
SOU014093SA001	6/30/2010	-5923.72	573.84	1	672.65
SOU014082SA001	6/29/2010	-5923.72	618.84	1	1724.92
SOU014071SA001	6/25/2010	-5923.72	663.84	1	1879.18
SOU014060SA001	6/25/2010	-5923.72	708.84	1	207.13
SOU014049SA001	6/23/2010	-5923.72	753.84	1	499.31
SOU014038SA001	6/23/2010	-5923.72	798.84	1	313.29
SOU014027SA001	6/25/2010	-5923.72	843.84	1	382.38
SOU014016SA001	7/1/2010	-5923.72	888.84	1	273.96
SOU014005SA001	6/30/2010	-5923.72	933.84	1	260.63
SOU014116SA001	6/30/2010	-5878.72	483.84	1	322.15
SOU014105SA001	6/29/2010	-5878.72	528.84	1	338.09
SOU014105SA001	6/29/2010	-5878.72	528.84	1	321
SOU014094SA001	6/29/2010	-5878.72	573.84	1	1340.98
SOU014072SA001	6/25/2010	-5878.72	663.84	1	2668.41
SOU014061SA001	6/25/2010	-5878.72	708.84	1	119.79
SOU014061SD001	6/25/2010	-5878.72	708.84	1	151.18
SOU014050SA001	6/24/2010	-5878.72	753.84	1	1590.5
SOU014039SA001	6/24/2010	-5878.72	798.84	1	877.83
SOU014028SA001	6/25/2010	-5878.72	843.84	1	433.15
SOU014017SA001	6/30/2010	-5878.72	888.84	1	524.64
SOU014017SA001	6/30/2010	-5878.72	888.84	1	352
SOU014006SA001	6/30/2010	-5878.72	933.84	1	1380.97
SOU014106SA001	6/29/2010	-5833.72	528.84	1	275.6
SOU014106SD001	6/29/2010	-5833.72	528.84	1	65 U
SOU014095SA001	6/29/2010	-5833.72	573.84	1	333.28
SOU014084SA001	6/29/2010	-5833.72	618.84	1	585.04
SOU014062SA001	6/24/2010	-5833.72	708.84	1	157.52
SOU014051SA001	6/23/2010	-5833.72	753.84	1	206.68
SOU014051SD001	6/23/2010	-5833.72	753.84	1	211.13

Table C3.4. SADA SWMU 14 Ni Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Ni Concentration (µg/g)
SOU014040SA001	6/24/2010	-5833.72	798.84	1	822.76
SOU014029SA001	6/23/2010	-5833.72	843.84	1	65 U
SOU014018SA001	6/30/2010	-5833.72	888.84	1	72.87
SOU014007SA001	6/30/2010	-5833.72	933.84	1	379.16
SOU014118SA001	6/30/2010	-5788.72	483.84	1	406.3
SOU014118SA001	6/30/2010	-5788.72	483.84	1	218
SOU014107SA001	6/29/2010	-5788.72	528.84	1	447.82
SOU014096SA001	6/29/2010	-5788.72	573.84	1	797.95
SOU014085SA001	6/25/2010	-5788.72	618.84	1	495.4
SOU014074SA001	6/25/2010	-5788.72	663.84	1	840.39
SOU014074SA001	6/25/2010	-5788.72	663.84	1	462
SOU014063SA001	6/24/2010	-5788.72	708.84	1	137.41
SOU014041SA001	6/24/2010	-5788.72	798.84	1	697.12
SOU014030SA001	6/24/2010	-5788.72	843.84	1	757.6
SOU014019SA001	6/30/2010	-5788.72	888.84	1	76.15
SOU014008SA001	6/30/2010	-5788.72	933.84	1	373.54
SOU014108SA001	6/29/2010	-5743.72	528.84	1	873.58
SOU014097SA001	6/25/2010	-5743.72	573.84	1	495.05
SOU014086SA001	6/28/2010	-5743.72	618.84	1	84.54
SOU014075SA001	6/25/2010	-5743.72	663.84	1	121.55
SOU014064SA001	6/24/2010	-5743.72	708.84	1	342.3
SOU014053SA001	6/24/2010	-5743.72	753.84	1	232.75
SOU014053SA001	6/24/2010	-5743.72	753.84	1	531
SOU014042SA001	6/24/2010	-5743.72	798.84	1	668.6
SOU014031SA001	6/23/2010	-5743.72	843.84	1	1198.49
SOU014020SA001	6/30/2010	-5743.72	888.84	1	64.57
SOU014009SA001	6/30/2010	-5743.72	933.84	1	531.58
SOU014120SA001	6/29/2010	-5698.72	483.84	1	65 U
SOU014109SA001	6/25/2010	-5698.72	528.84	1	950.81
SOU014098SA001	6/25/2010	-5698.72	573.84	1	456.88
SOU014076SA001	6/25/2010	-5698.72	663.84	1	258.94
SOU014065SA001	6/24/2010	-5698.72	708.84	1	65 U
SOU014065SD001	6/24/2010	-5698.72	708.84	1	349.59
SOU014054SA001	6/23/2010	-5698.72	753.84	1	392.14
SOU014043SA001	6/23/2010	-5698.72	798.84	1	315.77
SOU014032SA001	6/24/2010	-5698.72	843.84	1	778.4
SOU014021SA001	7/1/2010	-5698.72	888.84	1	198.25
SOU014010SA001	6/30/2010	-5698.72	933.84	1	218.39
SOU014121SA001	6/29/2010	-5653.72	483.84	1	115.82
SOU014110SA001	6/24/2010	-5653.72	528.84	1	125.67
SOU014099SA001	6/25/2010	-5653.72	573.84	1	131.88

Table C3.4. SADA SWMU 14 Ni Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Ni Concentration (μg/g)
SOU014088SA001	6/25/2010	-5653.72	618.84	1	272.78
SOU014077SA001	6/25/2010	-5653.72	663.84	1	378.46
SOU014066SA001	6/24/2010	-5653.72	708.84	1	65 U
SOU014055SA001	6/23/2010	-5653.72	753.84	1	248.77
SOU014044SA001	6/24/2010	-5653.72	798.84	1	228.61
SOU014033SA001	6/30/2010	-5653.72	843.84	1	65 U
SOU014033SA001	6/30/2010	-5653.72	843.84	1	18.2
SOU014022SA001	7/1/2010	-5653.72	888.84	1	278.36
SOU014011SA001	6/30/2010	-5653.72	933.84	1	184.93
SOU014100SA004	6/30/2010	-6103.72	528.84	4	58.88
SOU014089SA004	6/29/2010	-6103.72	573.84	4	65 U
SOU014089SD004	6/29/2010	-6103.72	573.84	4	65 U
SOU014067SA004	6/25/2010	-6103.72	663.84	4	75.66
SOU014067SD004	6/25/2010	-6103.72	663.84	4	65 U
SOU014056SA004	6/30/2010	-6103.72	708.84	4	65 U
SOU014045SA004	6/23/2010	-6103.72	753.84	4	65 U
SOU014023SA004	6/30/2010	-6103.72	843.84	4	65 U
SOU014023SD004	6/30/2010	-6103.72	843.84	4	65 U
SOU014012SA004	6/30/2010	-6103.72	888.84	4	65 U
SOU014001SA004	6/30/2010	-6103.72	933.84	4	117.24
SOU014112SA004	6/29/2010	-6058.72	483.84	4	65 U
SOU014101SA004	6/29/2010	-6058.72	528.84	4	65 U
SOU014101SA004	6/29/2010	-6058.72	528.84	4	11.1
SOU014090SA004	6/29/2010	-6058.72	573.84	4	156.42
SOU014079SA004	6/28/2010	-6058.72	618.84	4	65 U
SOU014068SA004	6/24/2010	-6058.72	663.84	4	122.63
SOU014057SA004	6/25/2010	-6058.72	708.84	4	65 U
SOU014046SA004	6/23/2010	-6058.72	753.84	4	65 U
SOU014046SA004	6/23/2010	-6058.72	753.84	4	16.8
SOU014024SA004	6/30/2010	-6058.72	843.84	4	540.71
SOU014024SD004	6/30/2010	-6058.72	843.84	4	208.51
SOU014013SA004	6/30/2010	-6058.72	888.84	4	93.37
SOU014002SA004	6/30/2010	-6058.72	933.84	4	64.53
SOU014113SA004	6/29/2010	-6013.72	483.84	4	65 U
SOU014102SA004	6/30/2010	-6013.72	528.84	4	167.13
SOU014091SA004	6/30/2010	-6013.72	573.84	4	65 U
SOU014080SA004	6/25/2010	-6013.72	618.84	4	134.52
SOU014069SA004	6/24/2010	-6013.72	663.84	4	65 U
SOU014058SA004	6/25/2010	-6013.72	708.84	4	69.99
SOU014047SA004	6/24/2010	-6013.72	753.84	4	65 U
SOU014036SA004	6/23/2010	-6013.72	798.84	4	65 U

Table C3.4. SADA SWMU 14 Ni Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Ni Concentration (µg/g)
SOU014025SA004	6/25/2010	-6013.72	843.84	4	602.31
SOU014014SA004	7/1/2010	-6013.72	888.84	4	65 U
SOU014003SA004	6/30/2010	-6013.72	933.84	4	87.94
SOU014114SA004	6/29/2010	-5968.72	483.84	4	65 U
SOU014103SA004	6/29/2010	-5968.72	528.84	4	67.33
SOU014092SA004	6/30/2010	-5968.72	573.84	4	65 U
SOU014081SA004	6/28/2010	-5968.72	618.84	4	65 U
SOU014070SA004	6/25/2010	-5968.72	663.84	4	65 U
SOU014070SA004	6/25/2010	-5968.72	663.84	4	11.3
SOU014059SA004	6/25/2010	-5968.72	708.84	4	71.2
SOU014048SA004	6/24/2010	-5968.72	753.84	4	94.07
SOU014037SA004	6/23/2010	-5968.72	798.84	4	122.14
SOU014026SA004	6/25/2010	-5968.72	843.84	4	1293.64
SOU014015SA004	6/30/2010	-5968.72	888.84	4	62.79
SOU014015SA004	6/30/2010	-5968.72	888.84	4	19.1
SOU014004SA004	6/30/2010	-5968.72	933.84	4	84.56
SOU014115SA004	6/30/2010	-5923.72	483.84	4	65 U
SOU014104SA004	6/29/2010	-5923.72	528.84	4	65 U
SOU014082SA004	6/29/2010	-5923.72	618.84	4	65 U
SOU014082SD004	6/29/2010	-5923.72	618.84	4	65 U
SOU014071SA004	6/25/2010	-5923.72	663.84	4	65 U
SOU014060SA004	6/25/2010	-5923.72	708.84	4	65 U
SOU014049SA004	6/23/2010	-5923.72	753.84	4	65 U
SOU014038SA004	6/23/2010	-5923.72	798.84	4	65 U
SOU014027SA004	6/25/2010	-5923.72	843.84	4	201.9
SOU014027SA004	6/25/2010	-5923.72	843.84	4	358
SOU014016SA004	7/1/2010	-5923.72	888.84	4	65 U
SOU014005SA004	6/30/2010	-5923.72	933.84	4	89.12
SOU014116SA004	6/30/2010	-5878.72	483.84	4	65 U
SOU014105SA004	6/29/2010	-5878.72	528.84	4	65 U
SOU014105SA004	6/29/2010	-5878.72	528.84	4	14.3
SOU014094SA004	6/29/2010	-5878.72	573.84	4	59.71
SOU014083SA004	6/29/2010	-5878.72	618.84	4	62.74
SOU014072SA004	6/25/2010	-5878.72	663.84	4	76.63
SOU014061SA004	6/25/2010	-5878.72	708.84	4	65 U
SOU014050SA004	6/24/2010	-5878.72	753.84	4	65 U
SOU014039SA004	6/24/2010	-5878.72	798.84	4	65 U
SOU014028SA004	6/25/2010	-5878.72	843.84	4	65 U
SOU014017SA004	6/30/2010	-5878.72	888.84	4	875.68
SOU014006SA004	6/30/2010	-5878.72	933.84	4	65 U
SOU014117SA004	6/30/2010	-5833.72	483.84	4	65 U

Table C3.4. SADA SWMU 14 Ni Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Ni Concentration (µg/g)
SOU014106SA004	6/29/2010	-5833.72	528.84	4	65 U
SOU014095SA004	6/29/2010	-5833.72	573.84	4	65 U
SOU014084SA004	6/29/2010	-5833.72	618.84	4	68.26
SOU014073SA004	6/25/2010	-5833.72	663.84	4	65 U
SOU014062SA004	6/24/2010	-5833.72	708.84	4	65 U
SOU014051SA004	6/23/2010	-5833.72	753.84	4	67.29
SOU014040SA004	6/24/2010	-5833.72	798.84	4	65 U
SOU014029SA004	6/23/2010	-5833.72	843.84	4	969.77
SOU014018SA004	6/30/2010	-5833.72	888.84	4	315.3
SOU014007SA004	6/30/2010	-5833.72	933.84	4	65 U
SOU014118SA004	6/30/2010	-5788.72	483.84	4	65 U
SOU014107SA004	6/29/2010	-5788.72	528.84	4	65 U
SOU014096SA004	6/29/2010	-5788.72	573.84	4	65 U
SOU014096SA004	6/29/2010	-5788.72	573.84	4	13.4
SOU014085SA004	6/24/2010	-5788.72	618.84	4	65 U
SOU014085SA004	6/24/2010	-5788.72	618.84	4	28.7
SOU014074SA004	6/25/2010	-5788.72	663.84	4	65 U
SOU014063SA004	6/24/2010	-5788.72	708.84	4	65 U
SOU014041SA004	6/24/2010	-5788.72	798.84	4	78.18
SOU014030SA004	6/24/2010	-5788.72	843.84	4	125.7
SOU014019SA004	6/30/2010	-5788.72	888.84	4	65 U
SOU014019SA004	6/30/2010	-5788.72	888.84	4	18.5
SOU014008SA004	6/30/2010	-5788.72	933.84	4	65 U
SOU014119SA004	6/29/2010	-5743.72	483.84	4	91.37
SOU014108SA004	6/29/2010	-5743.72	528.84	4	65 U
SOU014097SA004	6/25/2010	-5743.72	573.84	4	266.79
SOU014086SA004	6/28/2010	-5743.72	618.84	4	65 U
SOU014075SA004	6/25/2010	-5743.72	663.84	4	65 U
SOU014064SA004	6/24/2010	-5743.72	708.84	4	65 U
SOU014053SA004	6/24/2010	-5743.72	753.84	4	65 U
SOU014042SA004	6/24/2010	-5743.72	798.84	4	65 U
SOU014031SA004	6/23/2010	-5743.72	843.84	4	300.2
SOU014020SA004	6/30/2010	-5743.72	888.84	4	65 U
SOU014009SA004	6/30/2010	-5743.72	933.84	4	65 U
SOU014120SA004	6/29/2010	-5698.72	483.84	4	65 U
SOU014109SA004	6/25/2010	-5698.72	528.84	4	65 U
SOU014098SA004	6/25/2010	-5698.72	573.84	4	65 U
SOU014087SA004	6/24/2010	-5698.72	618.84	4	65 U
SOU014076SA004	6/25/2010	-5698.72	663.84	4	65 U
SOU014065SA004	6/24/2010	-5698.72	708.84	4	258.99
SOU014054SA004	6/23/2010	-5698.72	753.84	4	65 U

Table C3.4. SADA SWMU 14 Ni Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Ni Concentration (µg/g)
SOU014043SA004	6/23/2010	-5698.72	798.84	4	65 U
SOU014032SA004	6/24/2010	-5698.72	843.84	4	65 U
SOU014021SA004	7/1/2010	-5698.72	888.84	4	65 U
SOU014010SA004	6/30/2010	-5698.72	933.84	4	65 U
SOU014121SA004	6/29/2010	-5653.72	483.84	4	65 U
SOU014110SA004	6/24/2010	-5653.72	528.84	4	65 U
SOU014099SA004	6/25/2010	-5653.72	573.84	4	65 U
SOU014088SA004	6/25/2010	-5653.72	618.84	4	85.72
SOU014077SA004	6/25/2010	-5653.72	663.84	4	65 U
SOU014066SA004	6/24/2010	-5653.72	708.84	4	123.42
SOU014055SA004	6/23/2010	-5653.72	753.84	4	65 U
SOU014044SA004	6/24/2010	-5653.72	798.84	4	65 U
SOU014044SA004	6/24/2010	-5653.72	798.84	4	11.7
SOU014033SA004	6/30/2010	-5653.72	843.84	4	79.62
SOU014022SA004	7/1/2010	-5653.72	888.84	4	97.21
SOU014011SA004	6/30/2010	-5653.72	933.84	4	65 U
Depth Interval 5-10 ft					
SOU014111SA007	7/20/2010	-6103.72	483.84	7	490.81
SOU014078SA007	7/22/2010	-6103.72	618.84	7	344.5
SOU014045SA007	7/22/2010	-6103.72	753.84	7	92.48
SOU014001SA007	7/22/2010	-6103.72	933.84	7	118.58
SOU014091SA007	7/20/2010	-6013.72	573.84	7	62.71
SOU014114SA007	7/20/2010	-5968.72	483.84	7	115.35
SOU014059SA007	7/22/2010	-5968.72	708.84	7	94.5
SOU014039SA007	7/22/2010	-5878.72	798.84	7	418.94
SOU014007SA007	7/23/2010	-5833.72	933.84	7	74.89
SOU014097SA007	7/20/2010	-5743.72	573.84	7	437.11
SOU014097SA007	7/20/2010	-5743.72	573.84	7	141
SOU014064SA007	7/20/2010	-5743.72	708.84	7	68.14
SOU014031SA007	7/19/2010	-5743.72	843.84	7	271.32
SOU014121SA007	7/20/2010	-5653.72	483.84	7	62.98
SOU014088SA007	7/20/2010	-5653.72	618.84	7	65 U
SOU014055SA007	7/20/2010	-5653.72	753.84	7	138.51
SOU014055SA007	7/20/2010	-5653.72	753.84	7	67.1
SOU014011SA007	7/22/2010	-5653.72	933.84	7	65 U
Depth Interval 10-15 ft					
SOU014078SA010	7/22/2010	-6103.72	618.84	10	97.32
SOU014045SA010	7/22/2010	-6103.72	753.84	10	65 U
SOU014001SA010	7/22/2010	-6103.72	933.84	10	65 U
SOU014001SA010	7/22/2010	-6103.72	933.84	10	12.3
007008SA010	4/2/2007	-6064.71	934.28	10	16.1

Table C3.4. SADA SWMU 14 Ni Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Ni Concentration (µg/g)
SOU014091SA010	7/20/2010	-6013.72	573.84	10	65 U
SOU014059SA010	7/22/2010	-5968.72	708.84	10	65 U
SOU014059SD010	7/22/2010	-5968.72	708.84	10	65 U
SOU014039SA010	7/22/2010	-5878.72	798.84	10	65 U
SOU014007SA010	7/22/2010	-5833.72	933.84	10	65 U
SOU014097SA010	7/20/2010	-5743.72	573.84	10	65 U
SOU014064SA010	7/20/2010	-5743.72	708.84	10	65 U
SOU014121SA010	7/20/2010	-5653.72	483.84	10	65 U
SOU014121SD010	7/20/2010	-5653.72	483.84	10	65 U
SOU014088SA010	7/20/2010	-5653.72	618.84	10	65 U
SOU014055SA010	7/20/2010	-5653.72	753.84	10	99.67
SOU014011SA010	7/23/2010	-5653.72	933.84	10	65 U
007008SA015	4/2/2007	-6064.71	934.28	15	7.79

* Note: "U" indicates that the concentration was below the method detection limit.

Table C3.5. SADA SWMU 81 Total PCB Soil Data

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
Depth Interval 0-5 ft					
057002SA001	1/20/1998	-3226.6	568.8	0	0.1 U
057001SD001	1/20/1998	-3226.3	582.2	0	0.1 U
057001SA001	1/20/1998	-3226.3	582.2	0	0.1 U
057003SA001	1/21/1998	-3202.1	582	0	0.1 U
057004SA001	1/21/1998	-3201.8	569.2	0	0.7
23A5744	2/26/1996	-3315.03	518.46	0.5	0.01
23A5745	2/26/1996	-3315	563	0.5	0.11
23A5746	2/26/1996	-3315	613	0.5	0.34
23A5746D	2/26/1996	-3315	613	0.5	0.42
23A5748	2/26/1996	-3315	713	0.5	0.1
23A5749	2/23/1996	-3315	763	0.5	0.2 U
23A5741	2/26/1996	-3274.95	618.33	0.5	14.76
CH214080-00000	4/3/1991	-3267.99	678.4	0.5	3.5
CH214081-DUP	4/3/1991	-3267.99	678.4	0.5	2.5
23A5742	2/26/1996	-3265	563	0.5	0.26
23A5740	2/26/1996	-3265	663	0.5	0.52
23A5739	2/26/1996	-3265	713	0.5	0.15
23A5738	2/23/1996	-3265	763	0.5	0.2 U
23A5743	2/26/1996	-3264.92	518.46	0.5	0.02
23A5737	2/23/1996	-3215	763	0.5	0.2 U
23A5736	2/26/1996	-3214.01	713.25	0.5	0.33
CH214083-00000	4/3/1991	-3190.55	709.85	0.5	0.37
CH214084-00000	4/3/1991	-3183.84	666.54	0.5	370
23A5730	2/26/1996	-3177.72	501.38	0.5	0.02
23A5731	2/26/1996	-3177.5	475.5	0.5	0.03
23A5729	2/26/1996	-3177.5	525.5	0.5	0.01
23A5728	2/26/1996	-3177.5	550.5	0.5	0.01
23A5727	2/26/1996	-3177.5	575.5	0.5	0.03
23A5722	2/26/1996	-3177.5	700.5	0.5	0.17
23A5721	2/26/1996	-3177.5	725.5	0.5	0.35
23A5721D	2/26/1996	-3177.5	725.5	0.5	0.28
23A5720	2/23/1996	-3177.5	750.5	0.5	0.02
23A5719	2/23/1996	-3177.5	775.5	0.5	0.04
23A5726	2/26/1996	-3177.24	600.93	0.5	0.19
23A5723	2/26/1996	-3176.28	662.57	0.5	15.34
CH214082-00000	4/3/1991	-3174.39	522.64	0.5	1.9

Table C3.5. SADA SWMU 81 Total PCB Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
SOU081006SA001	8/5/2010	-3270.47	528.49	1	5 U
SOU081005SA001	8/5/2010	-3270.47	575.37	1	5 U
SOU081004SA001	8/5/2010	-3270.47	622.29	1	5 U
SOU081003SA001	8/3/2010	-3270.47	669.16	1	5 U
SOU081002SA001	8/3/2010	-3270.47	716.04	1	5 U
CH205053-00000	12/5/1989	-3252.6	606.65	1	17.41
CH205056-00000	12/5/1989	-3252.6	606.65	1	1
SOU081001SA001	8/3/2010	-3224.64	716.04	1	5 U
SOU081001SA001	8/3/2010	-3224.64	716.04	1	0.42
CH205058-00000	12/5/1989	-3181.48	603.53	1	6
SOU081007SA001	8/5/2010	-3177.64	538.76	1	5 U
SOU081006SA004	8/5/2010	-3270.47	528.49	4	5 U
SOU081005SA004	8/5/2010	-3270.47	575.37	4	5 U
SOU081004SA004	8/5/2010	-3270.47	622.29	4	5 U
SOU081003SA004	8/3/2010	-3270.47	669.16	4	5 U
SOU081002SA004	8/3/2010	-3270.47	716.04	4	5 U
CH205054-00000	12/5/1989	-3252.6	606.65	4	9.77
CH205057-00000	12/5/1989	-3252.6	606.65	4	12.49
SOU081001SA004	8/3/2010	-3224.64	716.04	4	5 U
CH205061-00000	12/6/1989	-3181.48	603.53	4	0.74
CH205064-00000	12/6/1989	-3178.41	757.7	4	1.2
SOU081007SA004	8/5/2010	-3177.64	538.76	4	5 U
SOU081007SA004	8/5/2010	-3177.64	538.76	4	0.33 U
Depth Interval 5-10 ft					
23B8141-01	3/23/1996	-3274.95	618.33	5	0.15 U
23B8141-02	3/23/1996	-3274.95	618.33	5	0.15 U
23B8141-03	3/23/1996	-3274.95	618.33	5	0.15 U
CH214065-00000	4/2/1991	-3251.02	612.27	5	0.9 U
23B8150-01	3/23/1996	-3214.09	614.26	5	0.15 U
23B8133-01	3/23/1996	-3208.95	573.47	5	0.15 U
23B8133-02	3/23/1996	-3208.95	573.47	5	0.15 U
23B8133-03	3/23/1996	-3208.95	573.47	5	0.15 U
23B813304-05	3/30/1996	-3208.95	573.47	5	0.15 U
23B8151-01	3/25/1996	-3204.69	606.74	5	0.1 U
23B8123-01	3/25/1996	-3176.28	662.57	5	0.15 U
23B8123-01D	3/25/1996	-3176.28	662.57	5	0.15 U
23B8123-02	3/25/1996	-3176.28	662.57	5	0.15 U
23B8123-03	3/25/1996	-3176.28	662.57	5	0.15 U
CH205055-00000	12/5/1989	-3252.6	606.65	6	9.8
CH205062-00000	12/6/1989	-3181.48	603.53	6	0.89 U

Table C3.5. SADA SWMU 81 Total PCB Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
CH205065-00000	12/6/1989	-3178.41	757.7	6	0.68
Depth Interval 10-15 ft					
CH214066-00000	4/2/1991	-3251.02	612.27	10	0.9 U
23B813304-10	3/30/1996	-3208.95	573.47	10	0.15 U
CH214067-00000	4/2/1991	-3251.02	612.27	15	0.89 U
CH214068-DUP	4/2/1991	-3251.02	612.27	15	0.89 U
23B813304-15	3/30/1996	-3208.95	573.47	15	0.15 U

* Note: "U" indicates that the total PCB concentration was below the method detection limit

Table C3.6. SADA AOC 541 Total PCB Soil Data

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
Depth Interval 0-5 ft					
120801	12/2/2008	-571.75	-3026.54	0	7.2
120802	12/2/2008	-546.38	-3041.85	0	0.14 U
120803	12/2/2008	-540.44	-2995.3	0	0.2
LBCSOBVB2SF-01	3/20/2010	-141.62	-2997.08	0.5	0.1 U
LBCSOBVB3SF-01	3/27/2010	-141.46	-2990.56	0.5	0.1 U
LBCSOOB4SF-01	11/25/2008	-642.27	-3074.43	1	1 U
LBCSOOB2SF-01	11/25/2008	-641.86	-3054.18	1	5 U
LBCSOOB3SF-01	11/25/2008	-641.48	-3063.21	1	1 U
LBCSOOB5SF-01	11/25/2008	-640.66	-3087.61	1	1 U
LBCSOOB1SF-01	11/25/2008	-640.47	-3045.13	1	5 U
LBCSOOB1SF-01	11/25/2008	-640.47	-3045.13	1	6.08
LBCSOOB10SF-01	11/25/2008	-632.29	-3083.66	1	5 U
LBCSOOB9SF-01	11/25/2008	-631.92	-3070.13	1	10 U
LBCSOOB9SF-01	11/25/2008	-631.92	-3070.13	1	12.2
LBCSOOB8SF-01	11/25/2008	-629.93	-3056.45	1	10 U
LBCSOOB7SF-01	11/25/2008	-629.8	-3045.59	1	5 U
LBCSOOB6SF-01	11/25/2008	-627.93	-3033.7	1	1 U
LBCSOOB15SF-01	11/25/2008	-621.38	-3062.46	1	10 U
LBCSOOB14SF-01	11/25/2008	-620.34	-3052.42	1	5 U
LBCSOOB16SF-01	11/25/2008	-620.06	-3073.83	1	5 U
LBCSOOB13SF-01	11/25/2008	-619.94	-3043.47	1	10 U
LBCSOOB17SF-01	11/25/2008	-619.23	-3085.04	1	1 U
LBCSOOB12SF-01	11/25/2008	-618.65	-3034.06	1	10 U
LBCSOOB11SF-01	11/25/2008	-618.53	-3023.94	1	5 U
LBCSOOB25SF-01	11/26/2008	-612.13	-3082.97	1	5 U
LBCSOOB24SF-01	11/26/2008	-611.64	-3071.31	1	5 U
LBCSOOB23SF-01	11/26/2008	-610.58	-3061.54	1	5 U
LBCSOOB22SF-01	11/26/2008	-610.39	-3050.68	1	50
LBCSOOB21SF-01	11/26/2008	-610.06	-3040.64	1	5 U
LBCSOOB21SF-01	11/26/2008	-610.06	-3040.64	1	11
LBCSOOB20SF-01	11/25/2008	-608.72	-3031.89	1	10 U
LBCSOOB19SF-01	11/25/2008	-608.48	-3022.69	1	50 U
LBCSOOB18SF-01	11/25/2008	-607.58	-3011.29	1	50 U
LBCSOOB31SF-01	11/26/2008	-601.21	-3061.56	1	5 U
LBCSOOB32SF-01	11/26/2008	-601.1	-3070.73	1	5 U
LBCSOOB30SF-01	11/26/2008	-600.92	-3051.42	1	50 U
LBCSOOB30SF-01	11/26/2008	-600.92	-3051.42	1	8.26

Table C3.6. SADA AOC 541 Total PCB Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
LBCSOOB29SF-01	11/26/2008	-600.53	-3042.27	1	10 U
LBCSOOB27SF-01	11/26/2008	-600.46	-3021.04	1	5 U
LBCSOOB33SF-01	11/26/2008	-600.38	-3079.85	1	5 U
LBCSOOB28SF-01	11/26/2008	-600.05	-3032.14	1	10 U
LBCSOOB26SF-01	11/16/2008	-598.99	-3009.73	1	50
LBCSOOB40SF-01	12/1/2008	-593.99	-3060.71	1	50 U
LBCSOOB42SF-01	12/1/2008	-593.97	-3079.94	1	5 U
LBCSOOB41SF-01	12/1/2008	-593.97	-3070.78	1	5 U
LBCSOOB39SF-01	12/1/2008	-592.01	-3051.59	1	50 U
LBCSOOB38SF-01	12/1/2008	-591.13	-3040.03	1	5 U
LBCSOOB37SF-01	11/26/2008	-590.71	-3029.77	1	50 U
LBCSOOB36SF-01	11/26/2008	-590.41	-3019.85	1	1 U
LBCSOOB35SF-01	11/26/2008	-589.43	-3010.68	1	50 U
LBCSOOB34SF-01	11/26/2008	-588.85	-2998.45	1	1 U
LBCSOOB49SF-01	12/1/2008	-582.35	-3060.61	1	5 U
LBCSOOB50SF-01	12/1/2008	-582.15	-3071.64	1	5 U
LBCSOOB47SF-01	12/1/2008	-581.05	-3040.78	1	5 U
LBCSOOB48SF-01	12/1/2008	-580.78	-3050.52	1	50 U
LBCSOOB46SF-01	12/1/2008	-580.58	-3031.58	1	1 U
LBCSOOB45SF-01	12/1/2008	-580.28	-3021.36	1	10 U
LBCSOOB44SF-01	12/1/2008	-580.02	-3011.01	1	5 U
LBCSOOB51SF-01	12/1/2008	-579.51	-3077.27	1	50 U
LBCSOOB43SF-01	12/1/2008	-578.97	-2998.83	1	5 U
LBCSOOB56SF-01	12/1/2008	-572.91	-3049.38	1	50
LBCSOOB55SF-01	12/2/2008	-571.75	-3026.54	1	31.1
LBCSOOB57SF-01	12/1/2008	-571.65	-3057.64	1	1 U
LBCSOOB58SF-01	12/1/2008	-570.82	-3066.84	1	1 U
LBCSOOB54SF-01	12/1/2008	-569.98	-3017.38	1	1 U
LBCSOOB53SF-01	12/1/2008	-569.62	-3006.93	1	50 U
LBCSOOB52SF-01	12/1/2008	-568.39	-2996.39	1	50 U
WC02-308D	9/4/2002	-567.91	-3036.16	1	31.5
WC02-308	9/4/2002	-567.91	-3036.16	1	26.3
LBCSOOB63SF-01	12/1/2008	-565.54	-3038.95	1	1 U
WC02-310	9/4/2002	-564.71	-3066.21	1	94
LBCSOOB65SF-01	12/1/2008	-563.86	-3058.56	1	5 U
LBCSOOB64SF-01	12/1/2008	-562.58	-3049.76	1	1 U
WC02-320	9/4/2002	-562.25	-3011.49	1	3
WC02-320D	9/4/2002	-562.25	-3011.49	1	3.3
LBCSOOB62SF-01	12/1/2008	-559.93	-3028.53	1	5 U
LBCSOOB61SF-01	12/1/2008	-559.47	-3016.1	1	1 U
LBCSOOB60SF-01	12/1/2008	-559.39	-3007.31	1	50 U

Table C3.6. SADA AOC 541 Total PCB Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
LBCSOOB59SF-01	12/1/2008	-559.21	-2994.23	1	1 U
WC02-172	3/14/2002	-550.99	-2976.16	1	0.15
LBCSOOB69SF-01	12/1/2008	-550.59	-3031.82	1	50 U
LBCSOOB66SF-01	12/1/2008	-550.22	-2994.12	1	50 U
LBCSOOB67SF-01	12/1/2008	-549.72	-3004.19	1	50
LBCSOOB68SF-01	12/1/2008	-549.13	-3016.11	1	50 U
LBCSOOB71SF-01	12/1/2008	-546.99	-3052.2	1	1 U
LBCSOOB70SF-01	12/2/2008	-546.38	-3041.85	1	0.13 U
LBCSOOB72SF-01	12/2/2008	-540.44	-2995.3	1	7.34
LBCSOOB73SF-01	12/1/2008	-539.63	-3006.53	1	50 U
LBCSOOB74SF-01	12/1/2008	-539.14	-3017.34	1	50
LBCSOOB74SF-01	12/1/2008	-539.14	-3017.34	1	14.1
LBCSOOB77SF-01	12/2/2008	-537.22	-3049.77	1	50 U
LBCSOOB76SF-01	12/2/2008	-536.64	-3038.33	1	50 U
LBCSOOB75SF-01	12/2/2008	-536.12	-3030.7	1	50 U
WC02-309	9/4/2002	-535.86	-3069.68	1	2.3
LBCSOOB82SF-01	12/2/2008	-532.58	-3039.04	1	50 U
LBCSOOB83SF-01	12/2/2008	-530.4	-3050.81	1	50 U
LBCSOOB84SF-01	12/2/2008	-529.98	-3060.3	1	10 U
LBCSOOB101SF-01	12/3/2008	-528.12	-2996.2	1	5 U
LBCSOOB78SF-01	12/2/2008	-527.85	-2994.56	1	5 U
LBCSOOB79SF-01	12/2/2008	-527.55	-3005.38	1	50 U
LBCSOOB85SF-01	12/2/2008	-527.52	-3065.09	1	50 U
LBCSOOB80SF-01	12/2/2008	-527.22	-3018.6	1	50 U
LBCSOOB81SF-01	12/2/2008	-526.96	-3027.57	1	50 U
LBCSOOB86SF-01	12/2/2008	-519.22	-2993.09	1	50 U
LBCSOOB87SF-01	12/2/2008	-518.2	-3005.29	1	50
LBCSOOB92SF-01	12/2/2008	-518.06	-3052.87	1	50 U
LBCSOOB91SF-01	12/2/2008	-517.85	-3046.97	1	50 U
LBCSOOB88SF-01	12/2/2008	-517.38	-3016.7	1	5 U
LBCSOOB90SF-01	12/2/2008	-517.09	-3037.24	1	10 U
LBCSOOB93SF-01	12/2/2008	-516.38	-3056.06	1	50 U
LBCSOOB93SF-01	12/2/2008	-516.38	-3056.06	1	9.09
LBCSOOB89SF-01	12/2/2008	-515.78	-3026.63	1	50 U
LBCSOOB94SF-01	12/2/2008	-510.57	-2994.67	1	5 U
LBCSOOB94SF-01	12/2/2008	-510.57	-2994.67	1	3.25
LBCSOOB95SF-01	12/2/2008	-510.15	-3006.88	1	3.19
LBCSOOB95SF-01	12/2/2008	-510.15	-3006.88	1	50 U
LBCSOOB99SF-01	12/3/2008	-510.12	-3047	1	1 U
LBCSOOB98SF-01	12/3/2008	-509.89	-3038.5	1	50 U
LBCSOOB96SF-01	12/2/2008	-509.69	-3017.49	1	50 U

Table C3.6. SADA AOC 541 Total PCB Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
LBCSOOB100SF-01	12/3/2008	-507.17	-3057.3	1	5 U
WC02-319	9/4/2002	-505.58	-3003.74	1	2.7
WC02-319D	9/4/2002	-505.58	-3003.74	1	3.4
LBCSOOB103SF-01	12/3/2008	-495.02	-3013.18	1	5 U
LBCSOOB102SF-01	12/3/2008	-494.98	-3003.41	1	10 U
WC02-313	9/9/2002	-494.92	-3023.54	1	68
LBCSOOB105SF-01	12/3/2008	-494.81	-3032.36	1	5 U
LBCSOOB107SF-01	12/3/2008	-494.07	-3051.65	1	5 U
LBCSOOB106SF-01	12/3/2008	-493.89	-3041.01	1	10 U
WC02-311	9/4/2002	-492.97	-3033.59	1	20.8
LBCSOOB104SF-01	12/3/2008	-491.35	-3022.68	1	10 U
LBCSOOB108SF-01	12/3/2008	-489.32	-2991.05	1	5 U
LBCSOOB114SF-01	12/3/2008	-489.08	-3050.58	1	1 U
LBCSOOB110SF-01	12/3/2008	-488.79	-3014.06	1	5 U
LBCSOOB109SF-01	12/3/2008	-488.66	-3003.45	1	5 U
LBCSOOB112SF-01	12/3/2008	-487.73	-3034.09	1	5 U
LBCSOOB111SF-01	12/3/2008	-486.6	-3024.54	1	5 U
LBCSOOB113SF-01	12/3/2008	-486.16	-3042.12	1	50 U
LBCSOOB116SF-01	1/8/2009	-484.04	-3002.41	1	5 U
LBCSOOB115SF-01	12/3/2008	-482.84	-2990.03	1	50 U
LBCSOOB119SF-01	12/4/2008	-480.31	-3032.22	1	50 U
LBCSOOB117SF-01	12/3/2008	-480.09	-3014.71	1	50 U
LBCSOOB118SF-01	12/4/2008	-479.5	-3023.05	1	50 U
LBCSOOB120SF-01	12/4/2008	-478.77	-3042.32	1	50 U
LBCSOOB121SF-01	12/4/2008	-478.32	-3051.25	1	50 U
LBCSOOB122SF-01	12/4/2008	-477.61	-3061.89	1	10 U
LBCSOOB126SF-01	12/4/2008	-471.76	-3022.51	1	1 U
LBCSOOB125SF-01	12/4/2008	-471.05	-3011.6	1	50 U
LBCSOOB124SF-01	12/4/2008	-470.18	-3003.56	1	5 U
LBCSOOB128SF-01	12/4/2008	-470	-3045.42	1	50 U
LBCSOOB123SF-01	12/4/2008	-469.85	-2989.12	1	50 U
LBCSOOB127SF-01	12/4/2008	-469.56	-3030.15	1	5 U
LBCSOOB127SF-01	12/4/2008	-469.56	-3030.15	1	2.16
LBCSOOB129SF-01	12/4/2008	-466.38	-3051.35	1	50 U
LBCSOOB134SF-01	12/4/2008	-462.44	-3028.65	1	5 U
LBCSOOB134SF-01	12/4/2008	-462.44	-3028.65	1	0.61
LBCSOOB135SF-01	12/5/2008	-462.28	-3038.69	1	5 U
LBCSOOB130SF-01	12/4/2008	-461.53	-2987.92	1	5 U
LBCSOOB133SF-01	12/4/2008	-461.36	-3020.7	1	5 U
LBCSOOB132SF-01	12/4/2008	-460.95	-3011.97	1	50 U
LBCSOOB136SF-01	12/5/2008	-460.86	-3046.65	1	50

Table C3.6. SADA AOC 541 Total PCB Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
LBCSOOB131SF-01	12/4/2008	-459.48	-3000.18	1	1 U
LBCSOOB139SF-01	12/5/2008	-456.15	-3010.45	1	50
LBCSOOB140SF-01	12/5/2008	-454.92	-3020.5	1	5 U
LBCSOOB142SF-01	12/5/2008	-454.7	-3038.09	1	5 U
LBCSOOB138SF-01	12/5/2008	-454.61	-3002.56	1	5 U
LBCSOOB141SF-01	12/5/2008	-453.37	-3029.02	1	5 U
LBCSOOB141SF-01	12/5/2008	-453.37	-3029.02	1	0.13 U
LBCSOOB137SF-01	12/5/2008	-453.08	-2989.15	1	5 U
LBCSOOB146SF-01	12/5/2008	-442.34	-3018.95	1	50 U
LBCSOOB145SF-01	12/5/2008	-437.97	-3010.06	1	50 U
LBCSOOB143SF-01	12/5/2008	-437.87	-2985.46	1	10 U
LBCSOOB144SF-01	12/5/2008	-435.52	-3001.38	1	50
LBCSOOB149SF-01	12/5/2008	-431.42	-3006.73	1	5 U
LBCSOOB148SF-01	12/5/2008	-431.36	-3001.02	1	50
LBCSOOB147SF-01	12/5/2008	-429.25	-2984.48	1	50
LBCSOOB150SF-01	12/5/2008	-429.18	-3020.17	1	10 U
LBCSOOB151SF-01	12/5/2008	-421.36	-2982.53	1	50 U
LBCSOOB152SF-01	12/5/2008	-420.36	-3000.01	1	50 U
LBCSOOB153SF-01	12/5/2008	-420.26	-3009.29	1	50 U
LBCSOOB154SF-01	12/5/2008	-419.88	-3020.52	1	5 U
LBCSOOB157SF-01	12/5/2008	-413.84	-3011.15	1	50 U
LBCSOOB157SF-01	12/5/2008	-413.84	-3011.15	1	0.13 U
LBCSOOB158SF-01	12/5/2008	-413.34	-3017.61	1	50 U
LBCSOOB165SF-01	12/5/2008	-411.61	-3018.27	1	50
WC02-168	3/28/2002	-411.42	-2976.19	1	0.1 U
LBCSOOB156SF-01	12/5/2008	-411.16	-3003.05	1	50 U
LBCSOOB155SF-01	12/5/2008	-410.27	-2988.53	1	50 U
LBCSOOB155SF-01	12/5/2008	-410.27	-2988.53	1	0.12 U
LBCSOOB162SF-01	12/5/2008	-403.37	-3025.52	1	5 U
LBCSOOB162SF-01	12/5/2008	-403.37	-3025.52	1	12.2
LBCSOOB163SF-01	12/5/2008	-402.98	-3029.12	1	5 U
LBCSOOB159SF-01	12/5/2008	-402.13	-2987.28	1	50 U
LBCSOOB160SF-01	12/5/2008	-401.26	-3000.08	1	50 U
LBCSOOB161SF-01	12/5/2008	-400.16	-3010.08	1	5 U
LBCSOOB167SF-01	12/5/2008	-389.29	-3018.7	1	50 U
LBCSOOB166SF-01	12/5/2008	-389.22	-3009.98	1	5 U
LBCSOOB164SF-01	12/5/2008	-388.97	-2984.43	1	5 U
LBCSOOB171SF-01	12/8/2008	-383.46	-3016.72	1	50 U
LBCSOOB170SF-01	12/5/2008	-380.78	-3006.08	1	50
LBCSOOB169SF-01	12/5/2008	-379.47	-2999.43	1	5 U
LBCSOOB169SF-01	12/5/2008	-379.47	-2999.43	1	29.7

Table C3.6. SADA AOC 541 Total PCB Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
LBCSOOB168SF-01	12/5/2008	-379.43	-2984.3	1	1 U
LBCSOOB175SF-01	12/8/2008	-371.6	-3013.62	1	1 U
LBCSOOB173SF-01	12/8/2008	-367.98	-2999.31	1	5 U
LBCSOOB172SF-01	12/8/2008	-367.46	-2983.76	1	5 U
LBCSOOB179SF-01	12/8/2008	-361.61	-3016.89	1	5 U
LBCSOOB179SF-01	12/8/2008	-361.61	-3016.89	1	0.13 U
LBCSOOB178SF-01	12/8/2008	-360.41	-3007.73	1	10 U
LBCSOOB177SF-01	12/8/2008	-359.88	-3000.52	1	1 U
LBCSOOB176SF-01	12/8/2008	-355.91	-2982.42	1	1 U
LBCSOOB174SF-01	12/8/2008	-352.97	-2988.27	1	50 U
LBCSOOB180SF-01	12/8/2008	-351.84	-2986.83	1	5 U
LBCSOOB183SF-01	12/8/2008	-350.19	-3012.5	1	50 U
LBCSOOB182SF-01	12/8/2008	-349.93	-3010.29	1	50 U
LBCSOOB181SF-01	12/8/2008	-347.8	-2993.58	1	10 U
LBCSOOB185SF-01	12/8/2008	-342.91	-2991.41	1	50
LBCSOOB186SF-01	12/8/2008	-342.57	-3005.72	1	1 U
LBCSOOB188SF-01	12/8/2008	-342.33	-3021.47	1	5 U
LBCSOOB184SF-01	12/8/2008	-341.28	-2981.57	1	50 U
LBCSOOB187SF-01	12/8/2008	-339.98	-3010.42	1	5 U
LBCSOOB189SF-01	12/8/2008	-332.38	-2981.93	1	5 U
LBCSOOB192SF-01	12/8/2008	-332.17	-3013.65	1	50 U
LBCSOOB191SF-01	12/8/2008	-331.77	-3006.67	1	50 U
LBCSOOB190SF-01	12/8/2008	-330.26	-2993.65	1	50 U
LBCSOOB193SF-01	12/8/2008	-324.1	-3023.81	1	5 U
LBCSOOB198SF-01	12/8/2008	-318.6	-3024.53	1	5 U
LBCSOOB195SF-01	12/8/2008	-316.74	-2990.86	1	50 U
LBCSOOB97SF-01	12/2/2008	-316.73	-3009.22	1	50 U
LBCSOOB197SF-01	12/8/2008	-316.73	-3009.22	1	50
LBCSOOB196SF-01	12/8/2008	-316.5	-3000.74	1	50 U
LBCSOOB194SF-01	12/8/2008	-315.94	-2982.99	1	5 U
LBCSOOB201SF-01	12/11/2008	-311.37	-3003.66	1	50 U
LBCSOOB203SF-01	12/11/2008	-311.25	-3023.53	1	1 U
LBCSOOB200SF-01	12/11/2008	-310.37	-2991.38	1	10 U
LBCSOOB202SF-01	12/11/2008	-310.33	-3012.91	1	5 U
LBCSOOB199SF-01	12/11/2008	-308.44	-2983.05	1	10 U
LBCSOOB207SF-01	12/11/2008	-302.21	-3012.12	1	50
LBCSOOB205SF-01	12/11/2008	-300.72	-2993.84	1	5 U
LBCSOOB208SF-01	12/11/2008	-299.99	-3021.24	1	50
LBCSOOB206SF-01	12/11/2008	-299.2	-3000.24	1	50 U
LBCSOOB204SF-01	12/11/2008	-298.21	-2982.73	1	5 U
LBCSOOB211SF-01	12/11/2008	-289.82	-3002.07	1	5 U

Table C3.6. SADA AOC 541 Total PCB Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
LBCSOOB212SF-01	12/11/2008	-289.29	-3009.9	1	5 U
LBCSOOB210SF-01	12/11/2008	-288.94	-2991.66	1	5 U
LBCSOOB213SF-01	12/11/2008	-288.23	-3024.62	1	5 U
LBCSOOB209SF-01	12/11/2008	-287.63	-2982.6	1	5 U
LBCSOOB218SF-01	12/11/2008	-281.43	-3017.63	1	5 U
LBCSOOB216SF-01	12/11/2008	-281.11	-2999.72	1	5 U
LBCSOOB214SF-01	12/11/2008	-280.05	-2983.04	1	5 U
LBCSOOB217SF-01	12/11/2008	-279.77	-3005.16	1	10 U
LBCSOOB215SF-01	12/11/2008	-278.49	-2990.49	1	1 U
LBCSOOB221SF-01	12/11/2008	-269.77	-3007.31	1	5 U
LBCSOOB222SF-01	12/11/2008	-268.98	-3015.92	1	5 U
LBCSOOB220SF-01	12/11/2008	-268.74	-2988.9	1	10 U
LBCSOOB219SF-01	12/11/2008	-266.12	-2983.36	1	10 U
LBCSOOB225SF-01	12/11/2008	-262.81	-3016.27	1	50 U
LBCSOOB223SF-01	12/11/2008	-261.76	-2989.6	1	10 U
LBCSOOB223SF-01	12/11/2008	-261.76	-2989.6	1	3.34
LBCSOOB224SF-01	12/11/2008	-258.97	-3000.52	1	10 U
LBCSOOB229SF-01	12/11/2008	-252.79	-3005.62	1	0.34
LBCSOOB229SF-01	12/11/2008	-252.79	-3005.62	1	50 U
LBCSOOB226SF-01	12/11/2008	-251.34	-2985.29	1	50
LBCSOOB227SF-01	12/11/2008	-250.01	-2992.1	1	50
LBCSOOB228SF-01	1/8/2009	-245.62	-3010.86	1	10 U
LBCSOOB232SF-01R	2/25/2009	-238.27	-3001.94	1	50 U
LBCSOOB230SF-01	12/11/2008	-237.96	-2983.98	1	50 U
LBCSOOB231SF-01R	2/25/2009	-236.46	-2992.69	1	5 U
LBCSOOB235SF-01	12/12/2008	-230.44	-3003.54	1	10 U
LBCSOOB235SF-01	12/12/2008	-230.44	-3003.54	1	13.9
LBCSOOB233SF-01	12/12/2008	-229.93	-2985.88	1	10 U
LBCSOOB233SF-01	12/12/2008	-229.93	-2985.88	1	0.13 U
LBCSOOB234SF-01	12/12/2008	-225.59	-2994.62	1	10 U
LBCSOOB237SF-01	12/12/2008	-219.17	-2994.22	1	10 U
LBCSOOB236SF-01	12/12/2008	-217.97	-2986.08	1	10 U
LBCSOOB239SF-01	12/12/2008	-209.29	-2993.83	1	10 U
LBCSOOB238SF-01	12/12/2008	-209.02	-2985.91	1	10 U
LBCSOOB241SF-01	12/12/2008	-198.74	-2999.58	1	10 U
LBCSOOB242SF-01	12/12/2008	-198.13	-3007.75	1	50 U
LBCSOOB242SF-01	12/12/2008	-198.13	-3007.75	1	3.62
LBCSOOB240SF-01	12/12/2008	-197.7	-2985.11	1	10 U
LBCSOBVB1SF-01	10/16/2008	-146.46	-3003.9	1	1 U
LBCSOBVB1SF-01D	10/16/2008	-146.46	-3003.9	1	1 U
LBCSOBVB1SF-01D	10/16/2008	-146.46	-3003.9	1	0.13 U

Table C3.6. SADA AOC 541 Total PCB Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
LBCSOBVB1SF-01	10/16/2008	-146.46	-3003.9	1	0.13 U
WC02-315	9/9/2002	-567.91	-3036.16	3	9.6
WC02-317	9/9/2002	-564.71	-3066.21	3	4.2
WC02-316	9/9/2002	-535.86	-3069.68	3	2.2
WC02-318	9/9/2002	-492.97	-3033.59	3	23.4
LBCSOOB2SSF-01	11/25/2008	-641.86	-3054.18	4	5 U
LBCSOOB1SSF-01	11/25/2008	-640.47	-3045.13	4	5 U
LBCSOOB1SSF-01	11/25/2008	-640.47	-3045.13	4	2.91
LBCSOOB9SSF-01	11/25/2008	-631.92	-3070.13	4	5 U
LBCSOOB9SSF-01	11/25/2008	-631.92	-3070.13	4	8.8
LBCSOOB8SSF-01	11/25/2008	-629.93	-3056.45	4	10 U
LBCSOOB7SSF-01	11/25/2008	-629.8	-3045.59	4	10 U
LBCSOOB15SSF-01	11/25/2008	-621.38	-3062.46	4	50
LBCSOOB14SSF-01	11/25/2008	-620.34	-3052.42	4	5 U
LBCSOOB16SSF-01	11/25/2008	-620.06	-3073.83	4	5 U
LBCSOOB13SSF-01	11/25/2008	-619.94	-3043.47	4	10 U
LBCSOOB17SSF-01	11/25/2008	-619.23	-3085.04	4	5 U
LBCSOOB12SSF-01	11/25/2008	-618.65	-3034.06	4	5 U
LBCSOOB11SSF-01	11/25/2008	-618.53	-3023.94	4	5 U
LBCSOOB22SSF-01	11/26/2008	-610.39	-3050.68	4	50
LBCSOOB21SSF-01	11/26/2008	-610.06	-3040.64	4	50
LBCSOOB21SSF-01	11/26/2008	-610.06	-3040.64	4	8.37
LBCSOOB20SSF-01	11/25/2008	-608.72	-3031.89	4	50 U
LBCSOOB19SSF-01	11/25/2008	-608.48	-3022.69	4	10 U
LBCSOOB18SSF-01	11/25/2008	-607.58	-3011.29	4	50
LBCSOOB30SSF-01	11/26/2008	-600.92	-3051.42	4	10 U
LBCSOOB30SSF-01	11/26/2008	-600.92	-3051.42	4	5.55
LBCSOOB29SSF-01	11/26/2008	-600.53	-3042.27	4	10 U
LBCSOOB27SSF-01	11/26/2008	-600.46	-3021.04	4	5 U
LBCSOOB28SSF-01	11/26/2008	-600.05	-3032.14	4	50 U
LBCSOOB26SSF-01	11/26/2008	-598.99	-3009.73	4	1 U
LBCSOOB40SSF-01	12/1/2008	-593.99	-3060.71	4	50 U
LBCSOOB39SSF-01	12/1/2008	-592.01	-3051.59	4	50 U
LBCSOOB38SSF-01	12/1/2008	-591.13	-3040.03	4	5 U
LBCSOOB37SSF-01	11/26/2008	-590.71	-3029.77	4	50 U
LBCSOOB36SSF-01	11/26/2008	-590.41	-3019.85	4	50 U
LBCSOOB35SSF-01	11/26/2008	-589.43	-3010.68	4	10 U
LBCSOOB34SSF-01	11/26/2008	-588.85	-2998.45	4	10 U
LBCSOOB49SSF-01	12/1/2008	-582.35	-3060.61	4	5 U
LBCSOOB47SSF-01	12/1/2008	-581.05	-3040.78	4	50 U
LBCSOOB48SSF-01	12/1/2008	-580.78	-3050.52	4	50 U

Table C3.6. SADA AOC 541 Total PCB Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
LBCSOOB46SSF-01	12/1/2008	-580.58	-3031.58	4	50 U
LBCSOOB44SSF-01	12/1/2008	-580.02	-3011.01	4	10 U
LBCSOOB43SSF-01	12/1/2008	-578.97	-2998.83	4	5 U
LBCSOOB56SSF-01	12/1/2008	-572.91	-3049.38	4	50 U
LBCSOOB55SSF-01	12/2/2008	-571.75	-3026.54	4	29.1
LBCSOOB57SSF-01	12/1/2008	-571.65	-3057.64	4	1 U
LBCSOOB53SSF-01	12/1/2008	-569.62	-3006.93	4	50 U
LBCSOOB63SSF-01	12/1/2008	-565.54	-3038.95	4	1 U
LBCSOOB64SSF-01	12/1/2008	-562.58	-3049.76	4	1 U
LBCSOOB62SSF-01	12/1/2008	-559.93	-3028.53	4	5 U
LBCSOOB61SSF-01	12/1/2008	-559.47	-3016.1	4	50
LBCSOOB60SSF-01	12/1/2008	-559.39	-3007.31	4	50 U
LBCSOOB69SSF-01	12/1/2008	-550.59	-3031.82	4	50 U
LBCSOOB66SSF-01	12/1/2008	-550.22	-2994.12	4	10 U
LBCSOOB67SSF-01	12/1/2008	-549.72	-3004.19	4	50 U
LBCSOOB68SSF-01	12/1/2008	-549.13	-3016.11	4	5 U
LBCSOOB70SSF-01	12/2/2008	-546.38	-3041.85	4	0.13 U
LBCSOOB72SSF-01	12/2/2008	-540.44	-2995.3	4	1.35
LBCSOOB73SSF-01	12/1/2008	-539.63	-3006.53	4	50 U
LBCSOOB74SSF-01	12/1/2008	-539.14	-3017.34	4	50 U
LBCSOOB74SSF-01	12/1/2008	-539.14	-3017.34	4	5.16
LBCSOOB77SSF-01	12/2/2008	-537.22	-3049.77	4	50
LBCSOOB76SSF-01	12/2/2008	-536.64	-3038.33	4	10 U
LBCSOOB75SSF-01	12/2/2008	-536.12	-3030.7	4	50 U
LBCSOOB82SSF-01	12/2/2008	-532.58	-3039.04	4	50 U
LBCSOOB83SSF-01	12/2/2008	-530.4	-3050.81	4	5 U
LBCSOOB84SSF-01	12/2/2008	-529.98	-3060.3	4	50
LBCSOOB79SSF-01	12/2/2008	-527.55	-3005.38	4	50 U
LBCSOOB85SSF-01	12/2/2008	-527.52	-3065.09	4	50 U
LBCSOOB81SSF-01	12/2/2008	-526.96	-3027.57	4	50
LBCSOOB87SSF-01	12/2/2008	-518.2	-3005.29	4	50
LBCSOOB92SSF-01	12/2/2008	-518.06	-3052.87	4	10 U
LBCSOOB91SSF-01	12/2/2008	-517.85	-3046.97	4	50 U
LBCSOOB90SSF-01	12/2/2008	-517.09	-3037.24	4	10 U
LBCSOOB93SSF-01	12/2/2008	-516.38	-3056.06	4	50 U
LBCSOOB93SSF-01	12/2/2008	-516.38	-3056.06	4	2.09
LBCSOOB89SSF-01	12/2/2008	-515.78	-3026.63	4	50 U
LBCSOOB94SSF-01	12/2/2008	-510.57	-2994.67	4	50 U
LBCSOOB94SSF-01	12/2/2008	-510.57	-2994.67	4	2.28
LBCSOOB95SSF-01	12/2/2008	-510.15	-3006.88	4	5.58
LBCSOOB95SSF-01	12/2/2008	-510.15	-3006.88	4	50 U

Table C3.6. SADA AOC 541 Total PCB Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
LBCSOOB99SSF-01	12/3/2008	-510.12	-3047	4	1 U
LBCSOOB98SSF-01	12/3/2008	-509.89	-3038.5	4	1 U
LBCSOOB96SSF-01	12/2/2008	-509.69	-3017.49	4	50 U
LBCSOOB100SSF-01	12/3/2008	-507.17	-3057.3	4	5 U
LBCSOOB102SSF-01	12/3/2008	-494.98	-3003.41	4	5 U
LBCSOOB105SSF-01	12/3/2008	-494.81	-3032.36	4	5 U
LBCSOOB107SSF-01	2/25/2009	-494.07	-3051.65	4	5 U
LBCSOOB106SSF-01	12/3/2008	-493.89	-3041.01	4	5 U
LBCSOOB104SSF-01	12/3/2008	-491.35	-3022.68	4	50
LBCSOOB112SSF-01	12/3/2008	-487.73	-3034.09	4	50 U
LBCSOOB111SSF-01	12/3/2008	-486.6	-3024.54	4	1 U
LBCSOOB113SSF-01	12/3/2008	-486.16	-3042.12	4	50
LBCSOOB116SSF-01	1/8/2009	-484.04	-3002.41	4	5 U
LBCSOOB115SSF-01	12/3/2008	-482.84	-2990.03	4	50 U
LBCSOOB119SSF-01	12/4/2008	-480.31	-3032.22	4	50 U
LBCSOOB120SSF-01	12/4/2008	-478.77	-3042.32	4	50 U
LBCSOOB121SSF-01	12/4/2008	-478.32	-3051.25	4	50 U
LBCSOOB125SSF-01	12/4/2008	-471.05	-3011.6	4	5 U
LBCSOOB128SSF-01	12/4/2008	-470	-3045.42	4	50 U
LBCSOOB127SSF-01	12/4/2008	-469.56	-3030.15	4	5 U
LBCSOOB127SSF-01	12/4/2008	-469.56	-3030.15	4	1
LBCSOOB129SSF-01	12/4/2008	-466.38	-3051.35	4	5 U
LBCSOOB134SSF-01	12/4/2008	-462.44	-3028.65	4	5 U
LBCSOOB134SSF-01	12/4/2008	-462.44	-3028.65	4	0.13 U
LBCSOOB135SSF-01	12/5/2008	-462.28	-3038.69	4	1 U
LBCSOOB133SSF-01	12/4/2008	-461.36	-3020.7	4	5 U
LBCSOOB132SSF-01	12/4/2008	-460.95	-3011.97	4	50 U
LBCSOOB136SSF-01	12/5/2008	-460.86	-3046.65	4	50
LBCSOOB131SSF-01	12/4/2008	-459.48	-3000.18	4	5 U
LBCSOOB139SSF-01	12/5/2008	-456.15	-3010.45	4	50
LBCSOOB142SSF-01	12/5/2008	-454.7	-3038.09	4	5 U
LBCSOOB138SSF-01	12/5/2008	-454.61	-3002.56	4	10 U
LBCSOOB145SSF-01	12/5/2008	-437.97	-3010.06	4	10 U
LBCSOOB144SSF-01	12/5/2008	-435.52	-3001.38	4	50 U
LBCSOOB149SSF-01	12/5/2008	-431.42	-3006.73	4	5 U
LBCSOOB148SSF-01	12/5/2008	-431.36	-3001.02	4	50
LBCSOOB150SSF-01	12/5/2008	-429.18	-3020.17	4	10 U
LBCSOOB152SSF-01	12/5/2008	-420.36	-3000.01	4	5 U
LBCSOOB153SSF-01	12/5/2008	-420.26	-3009.29	4	1 U
LBCSOOB154SSF-01	12/5/2008	-419.88	-3020.52	4	5 U
LBCSOOB157SSF-01	12/5/2008	-413.84	-3011.15	4	50 U

Table C3.6. SADA AOC 541 Total PCB Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
LBCSOOB157SSF-01	12/5/2008	-413.84	-3011.15	4	3.28
LBCSOOB158SSF-01	12/5/2008	-413.34	-3017.61	4	50 U
LBCSOOB165SSF-01	12/5/2008	-411.61	-3018.27	4	50
LBCSOOB156SSF-01	12/5/2008	-411.16	-3003.05	4	50 U
LBCSOOB162SSF-01	12/5/2008	-403.37	-3025.52	4	50
LBCSOOB162SSF-01	12/5/2008	-403.37	-3025.52	4	38.2
LBCSOOB160SSF-01	1/8/2009	-401.26	-3000.08	4	10 U
LBCSOOB161SSF-01	12/5/2008	-400.16	-3010.08	4	50 U
LBCSOOB167SSF-01	12/5/2008	-389.29	-3018.7	4	5 U
LBCSOOB166SSF-01	12/5/2008	-389.22	-3009.98	4	50
LBCSOOB171SSF-01	12/8/2008	-383.46	-3016.72	4	50 U
LBCSOOB170SSF-01	12/5/2008	-380.78	-3006.08	4	50
LBCSOOB169SSF-01	12/5/2008	-379.47	-2999.43	4	5 U
LBCSOOB169SSF-01	12/5/2008	-379.47	-2999.43	4	5.47
LBCSOOB173SSF-01	12/8/2008	-367.98	-2999.31	4	1 U
LBCSOOB179SSF-01	12/8/2008	-361.61	-3016.89	4	5 U
LBCSOOB179SSF-01	12/8/2008	-361.61	-3016.89	4	0.51
LBCSOOB178SSF-01	12/8/2008	-360.41	-3007.73	4	5 U
LBCSOOB177SSF-01	12/8/2008	-359.88	-3000.52	4	5 U
LBCSOOB174SSF-01	12/8/2008	-352.97	-2988.27	4	1 U
LBCSOOB183SSF-01	12/8/2008	-350.19	-3012.5	4	50 U
LBCSOOB182SSF-01	12/8/2008	-349.93	-3010.29	4	50
LBCSOOB186SSF-01	12/8/2008	-342.57	-3005.72	4	1 U
LBCSOOB192SSF-01	12/8/2008	-332.17	-3013.65	4	10 U
LBCSOOB191SSF-01	12/8/2008	-331.77	-3006.67	4	50
LBCSOOB190SSF-01	12/8/2008	-330.26	-2993.65	4	50 U
LBCSOOB193SSF-01	12/8/2008	-324.1	-3023.81	4	5 U
LBCSOOB195SSF-01	12/8/2008	-316.74	-2990.86	4	50 U
LBCSOOB97SSF-01	12/2/2008	-316.73	-3009.22	4	50 U
LBCSOOB197SSF-01	12/8/2008	-316.73	-3009.22	4	50
LBCSOOB196SSF-01	12/8/2008	-316.5	-3000.74	4	50
LBCSOOB201SSF-01	12/11/2008	-311.37	-3003.66	4	10 U
LBCSOOB203SSF-01	12/11/2008	-311.25	-3023.53	4	5 U
LBCSOOB200SSF-01	12/11/2008	-310.37	-2991.38	4	5 U
LBCSOOB202SSF-01	12/11/2008	-310.33	-3012.91	4	10 U
LBCSOOB199SSF-01	12/11/2008	-308.44	-2983.05	4	5 U
LBCSOOB207SSF-01	12/11/2008	-302.21	-3012.12	4	50
LBCSOOB208SSF-01	12/11/2008	-299.99	-3021.24	4	50
LBCSOOB206SSF-01	12/11/2008	-299.2	-3000.24	4	50 U
LBCSOOB204SSF-01	12/11/2008	-298.21	-2982.73	4	50 U
LBCSOOB211SSF-01	12/11/2008	-289.82	-3002.07	4	10 U

Table C3.6. SADA AOC 541 Total PCB Soil Data (Continued)

Sample ID	Date	Easting (ft)	Northing (ft)	Depth (ft)	Total PCB Concentration (µg/g)
LBCSOOB212SSF-01	12/11/2008	-289.29	-3009.9	4	50 U
LBCSOOB213SSF-01	12/11/2008	-288.23	-3024.62	4	5 U
LBCSOOB218SSF-01	12/11/2008	-281.43	-3017.63	4	5 U
LBCSOOB216SSF-01	12/11/2008	-281.11	-2999.72	4	50
LBCSOOB214SSF-01	12/11/2008	-280.05	-2983.04	4	5 U
LBCSOOB217SSF-01	12/11/2008	-279.77	-3005.16	4	50 U
LBCSOOB221SSF-01	12/11/2008	-269.77	-3007.31	4	5 U
LBCSOOB222SSF-01	12/11/2008	-268.98	-3015.92	4	5 U
LBCSOOB220SSF-01	12/11/2008	-268.74	-2988.9	4	10 U
LBCSOOB219SSF-01	12/11/2008	-266.12	-2983.36	4	5 U
LBCSOOB225SSF-01	12/11/2008	-262.81	-3016.27	4	5 U
LBCSOOB223SSF-01	12/11/2008	-261.76	-2989.6	4	10 U
LBCSOOB223SSF-01	12/11/2008	-261.76	-2989.6	4	1.18
LBCSOOB224SSF-01	12/11/2008	-258.97	-3000.52	4	10 U
LBCSOOB229SSF-01	12/11/2008	-252.79	-3005.62	4	2.47
LBCSOOB229SSF-01	12/11/2008	-252.79	-3005.62	4	50 U
LBCSOOB226SSF-01	12/11/2008	-251.34	-2985.29	4	5 U
LBCSOOB227SSF-01	12/11/2008	-250.01	-2992.1	4	50 U
LBCSOOB228SSF-01	12/11/2008	-245.62	-3010.86	4	50 U
LBCSOOB232SSF-01R	2/25/2009	-238.27	-3001.94	4	50 U
LBCSOOB230SSF-01R	2/25/2009	-237.96	-2983.98	4	5 U
LBCSOOB231SSF-01R	2/25/2009	-236.46	-2992.69	4	5 U
LBCSOOB235SSF-01	12/12/2008	-230.44	-3003.54	4	10 U
LBCSOOB235SSF-01	12/12/2008	-230.44	-3003.54	4	9.81
LBCSOOB233SSF-01	12/12/2008	-229.93	-2985.88	4	10 U
LBCSOOB233SSF-01	12/12/2008	-229.93	-2985.88	4	0.13 U
LBCSOOB234SSF-01	12/12/2008	-225.59	-2994.62	4	10 U
LBCSOOB237SSF-01	12/12/2008	-219.17	-2994.22	4	10 U
LBCSOOB236SSF-01	12/12/2008	-217.97	-2986.08	4	10 U
LBCSOOB239SSF-01	12/12/2008	-209.29	-2993.83	4	10 U
LBCSOOB238SSF-01	12/12/2008	-209.02	-2985.91	4	10 U
LBCSOOB241SSF-01	12/12/2008	-198.74	-2999.58	4	10 U
LBCSOOB242SSF-01	12/12/2008	-198.13	-3007.75	4	50 U
LBCSOOB242SSF-01	12/12/2008	-198.13	-3007.75	4	1.05
LBCSOOB240SSF-01	12/12/2008	-197.7	-2985.11	4	50 U

* Note: "U" indicates that the total PCB concentration was below the method detection limit.

ATTACHMENT C4

DATA SUMMARY AND EVALUATION, GROUP 1, FORMER FACILITIES

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C4. DATA SUMMARY AND EVALUATION, GROUP 1, FORMER FACILITIES

In this attachment to Appendix C, the solid waste management unit (SWMU)/area of concern (AOC)-specific results are discussed for those soil constituents with exceedances of the Remedial Guide (RG) Soil Screening Level (SSL) or background to identify whether they should be subjected to fate and transport modeling. Although few SWMU/AOC soil constituent combinations were subjected to modeling because they did not exceed the screening criteria, the information presented in this attachment has been developed to support the feasibility study (FS).

C4.1. SWMU 1, C-747-C OIL LANDFARM

Data for SWMU 1 consists entirely of historical data. SWMU 1 exceedances of the RG SSL include the following soil constituents: *cis*-1,2-dichloroethene, cobalt, manganese, silver, *trans*-1,2,-dichloroethene, trichloroethene, vanadium, and vinyl chloride.

Groundwater/vapor modeling for volatile organic compounds (VOCs) was accomplished as part of the Southwest Plume FS (DOE 2011c).[1] Therefore, exceedances of VOCs (i.e., *cis*-1,2-dichloroethene; *trans*-1,2-dichloroethene; and vinyl chloride) of the RG SSL at SWMU 1 will not be further evaluated in the Soils Operable Unit (OU) Remedial Investigation (RI). The remaining exceedances of the RG SSL are discussed in the following sections.

Naphthalene was detected in only 1 of 109 samples. The naphthalene detection was 0.063 mg/kg (which was below the reporting limit of 0.41 mg/kg). Therefore, this analyte will not be considered for groundwater modeling or hot spot analysis.

[1] All references are cited from Chapter 13 of this Soils OU RI.

Cobalt was detected in 101 of 102 samples. The chart illustrating the detections is shown in Figure C4.1.1. The average concentration over SWMU 1 for cobalt is less than the subsurface background value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU nor was a hot spot evaluation performed, because cobalt was not identified as a Regional Gravel Aquifer (RGA) contaminant of concern (COC) in the Groundwater Operable Unit (GWOU) FS (DOE 2001).

Further, Attachment C1 to Appendix C discusses the cobalt concentrations in the RGA groundwater and determines that there is no indication of cobalt migration from the Soils OU to RGA groundwater at Paducah Gaseous Diffusion Plant (PGDP).

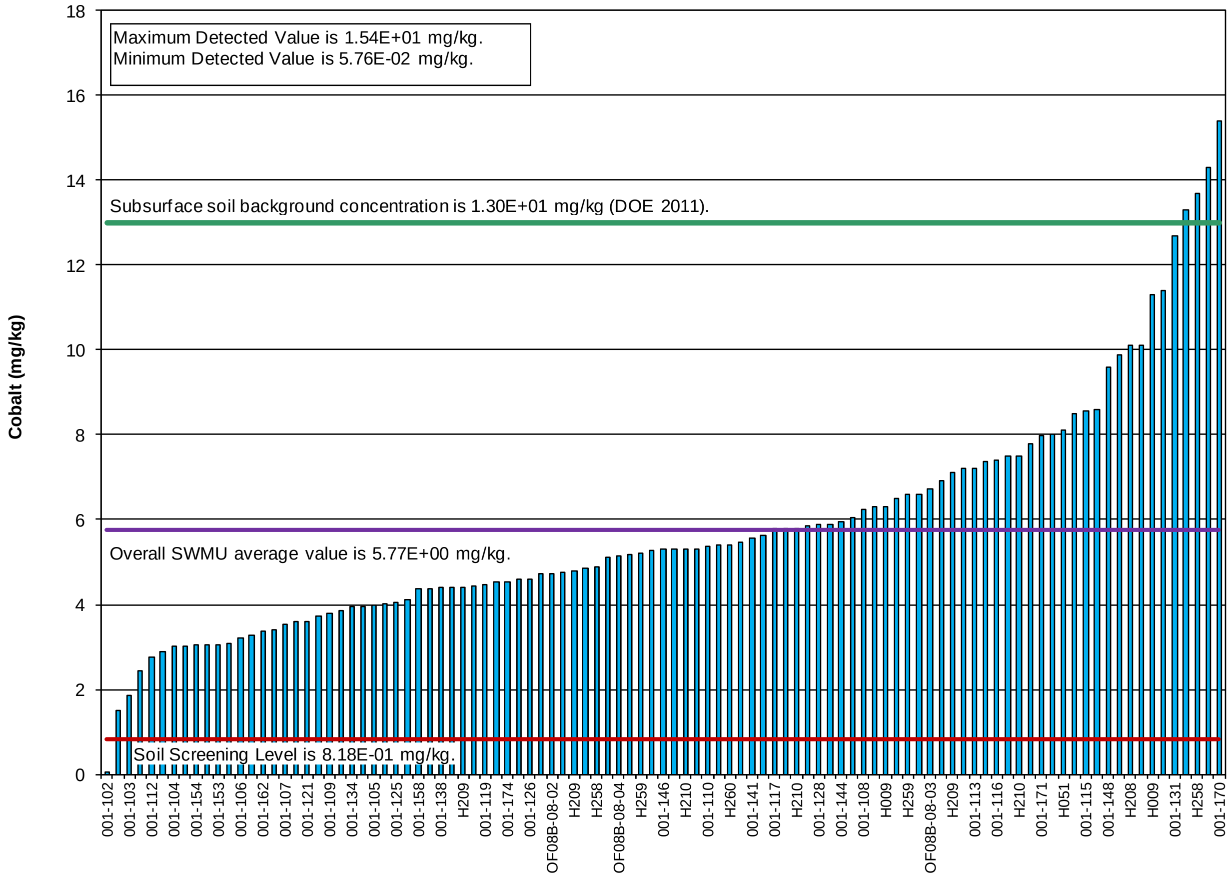

Figure C4.1.1. Cobalt Detections at SWMU 1

Manganese was detected in all 102 samples. The chart illustrating the detections is shown in Figure C4.1.2. The average concentration over SWMU 1 for manganese is less than the subsurface background value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU.

Nine values were detected at concentrations greater than subsurface background; therefore, a hot spot evaluation was performed. A plot of the detected values is shown in Figure C4.1.3. The plot shows manganese detections are not clustered and not indicative of a hot spot.

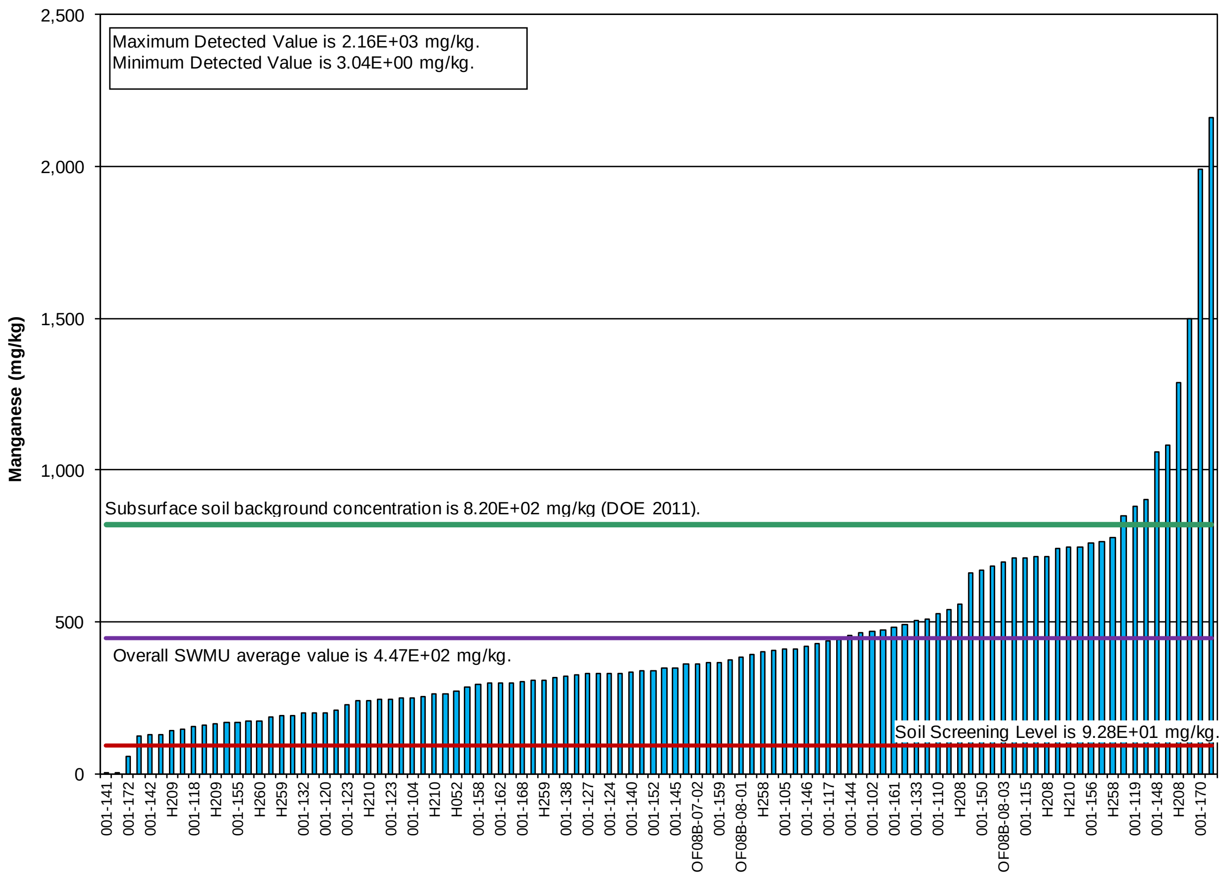

Figure C4.1.2. Manganese Detections at SWMU 1

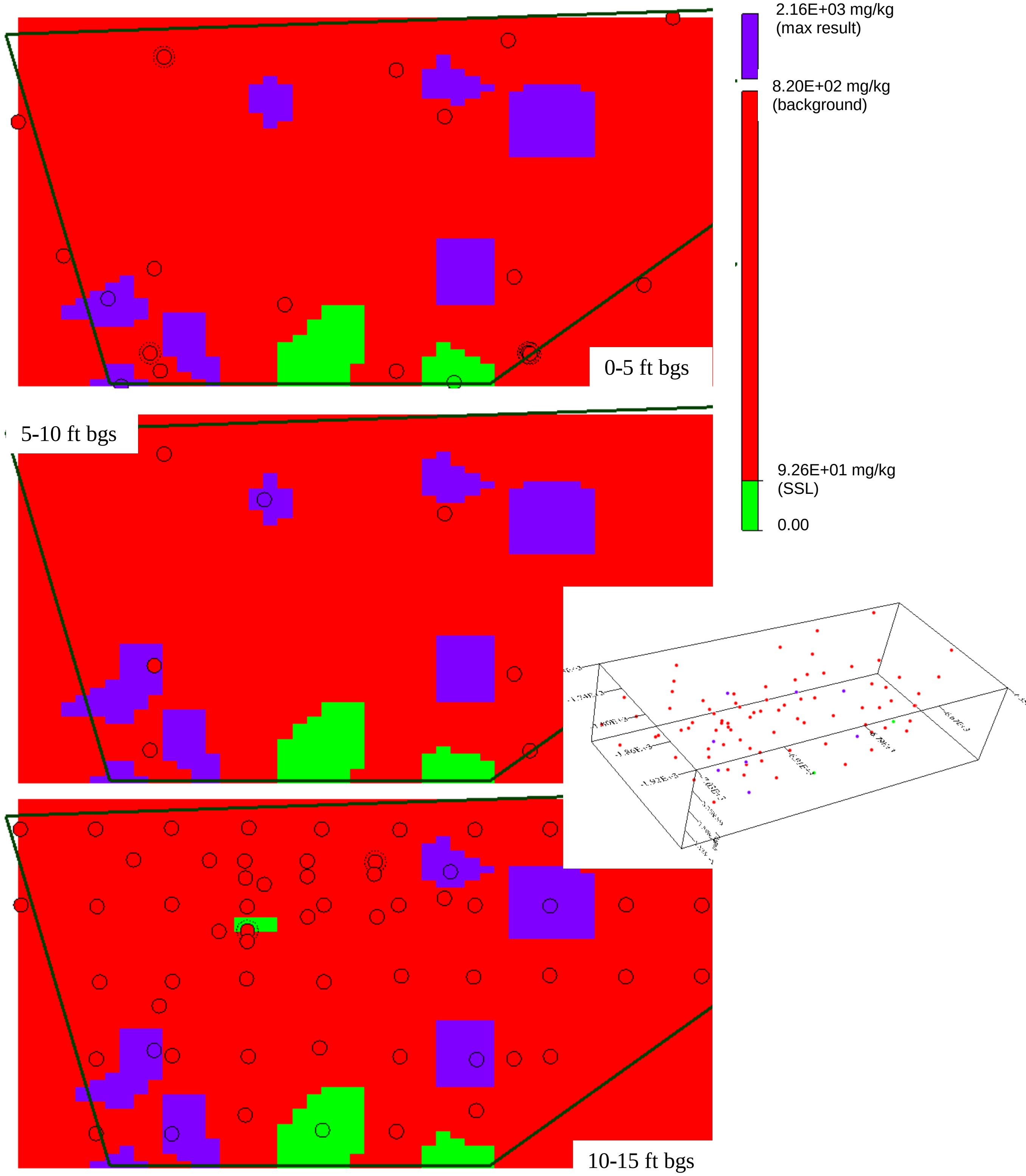

Figure C4.1.3. Distribution of Manganese Detections at SWMU 1

Mercury was detected in 67 of 105 samples. The chart illustrating the detections is shown in Figure C4.1.4. The average over SWMU 1 for mercury is less than both the subsurface background value and the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although one value was detected at a concentration greater than the RG SSL, mercury was not identified as a COC in the GWOU FS (DOE 2001d). One value was detected at a concentration greater than the RG SSL; however, a hot spot evaluation was not performed because the decision rule does not attribute a hot spot to one exceedance. Further, Attachment C1 to Appendix C documents that a review of RGA groundwater data indicates that mercury from the Soils OU is not a source of migration to RGA groundwater.

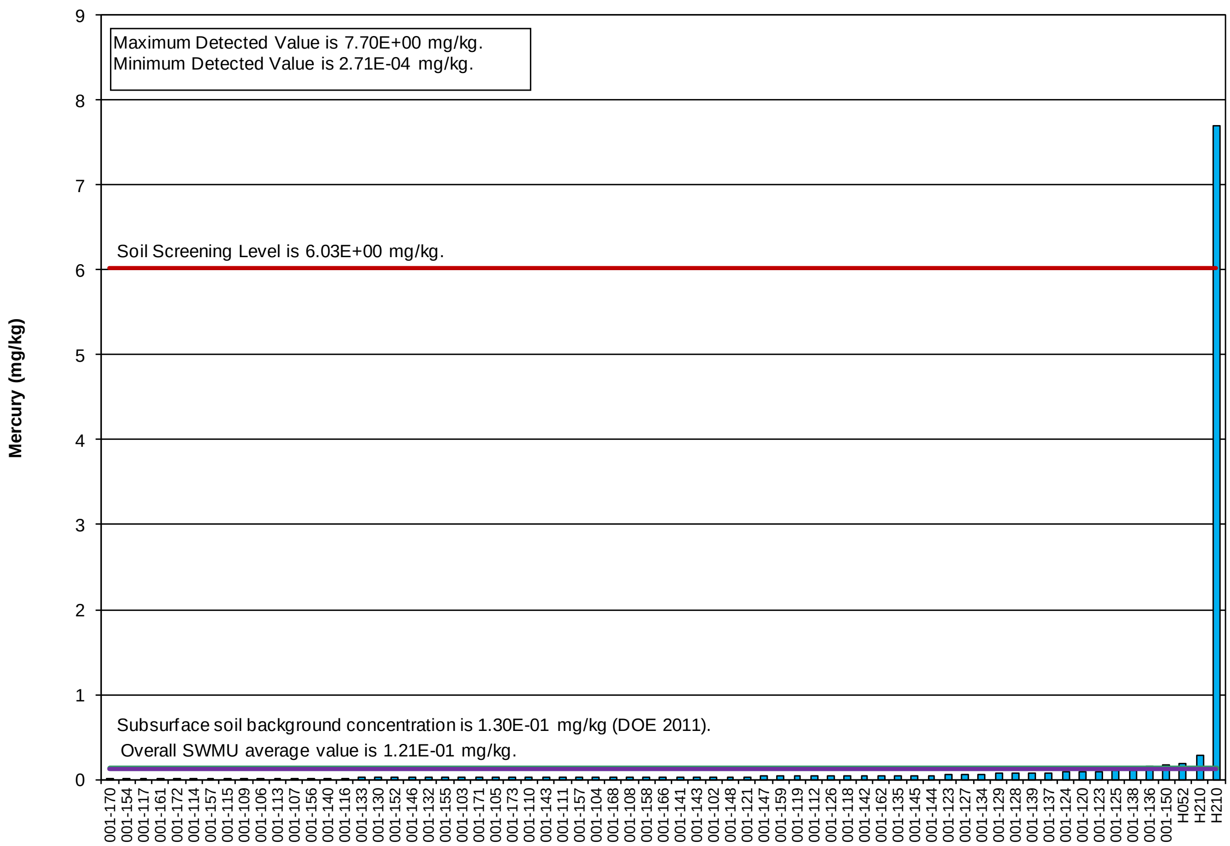

Figure C4.1.4. Mercury Detections at SWMU 1

Molybdenum was detected in one of six samples. All six samples were collected from sediment within the Surface Water OU Site Investigation (DOE 2008); therefore, the single detectable concentration was not considered for groundwater modeling.

Nickel was detected in 101 of 105 samples. The chart illustrating the detections is shown in Figure C4.1.5. The average concentration over SWMU 1 for nickel is less than both the subsurface background value and the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One value was detected at a concentration greater than the RG SSL; however, a hot spot evaluation was not performed, because the decision rule does not attribute a hot spot to 1 exceedance.

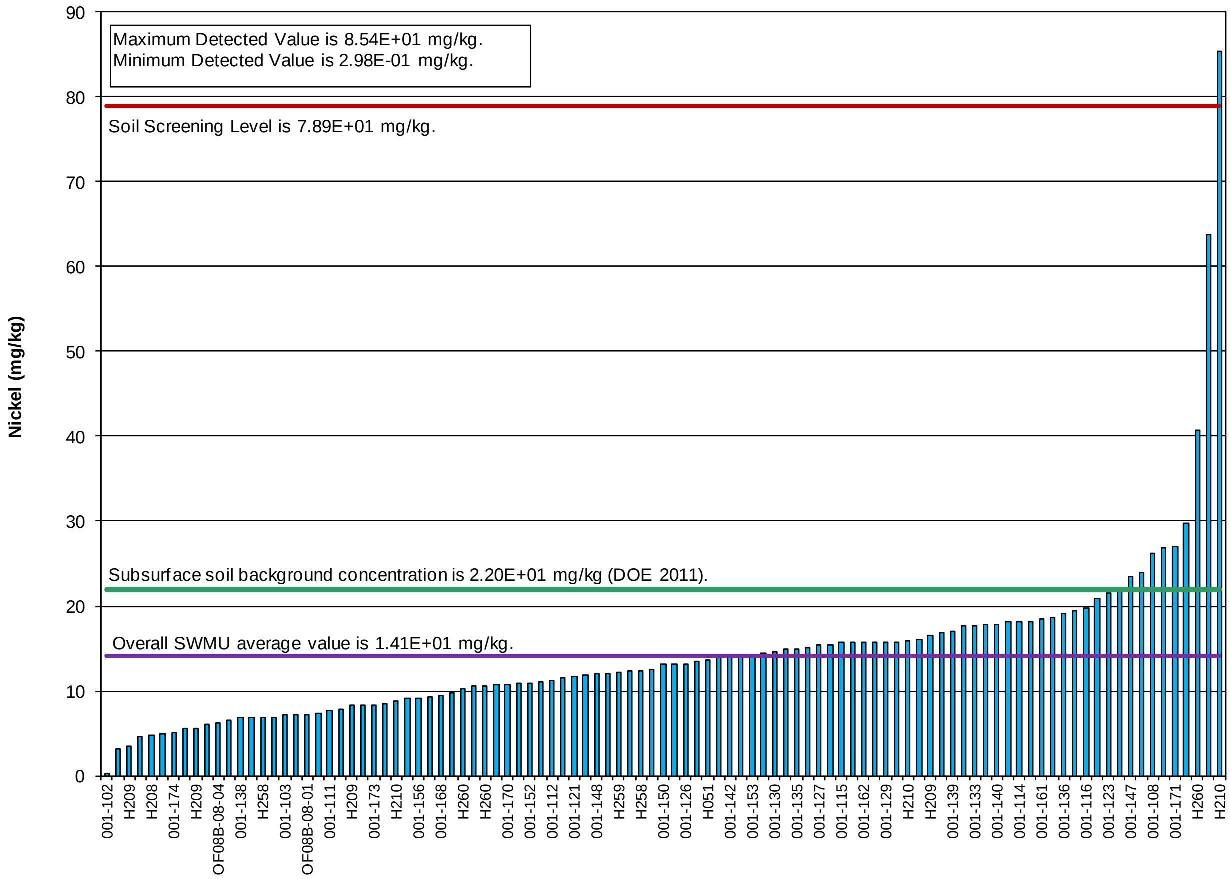

Figure C4.1.5. Nickel Detections at SWMU 1

Silver was detected in 7 of 105 samples. The chart illustrating the detections is shown in Figure C4.1.6. The average concentration over SWMU 1 for silver is less than both the subsurface background value and the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Silver was evaluated as part of the GWOU FS and identified as a COC in the groundwater plumes associated with PGDP (DOE 2001d). There is no evidence of RGA impacts due to silver (see Section C1.3.3); therefore, no hot spot evaluation was performed.

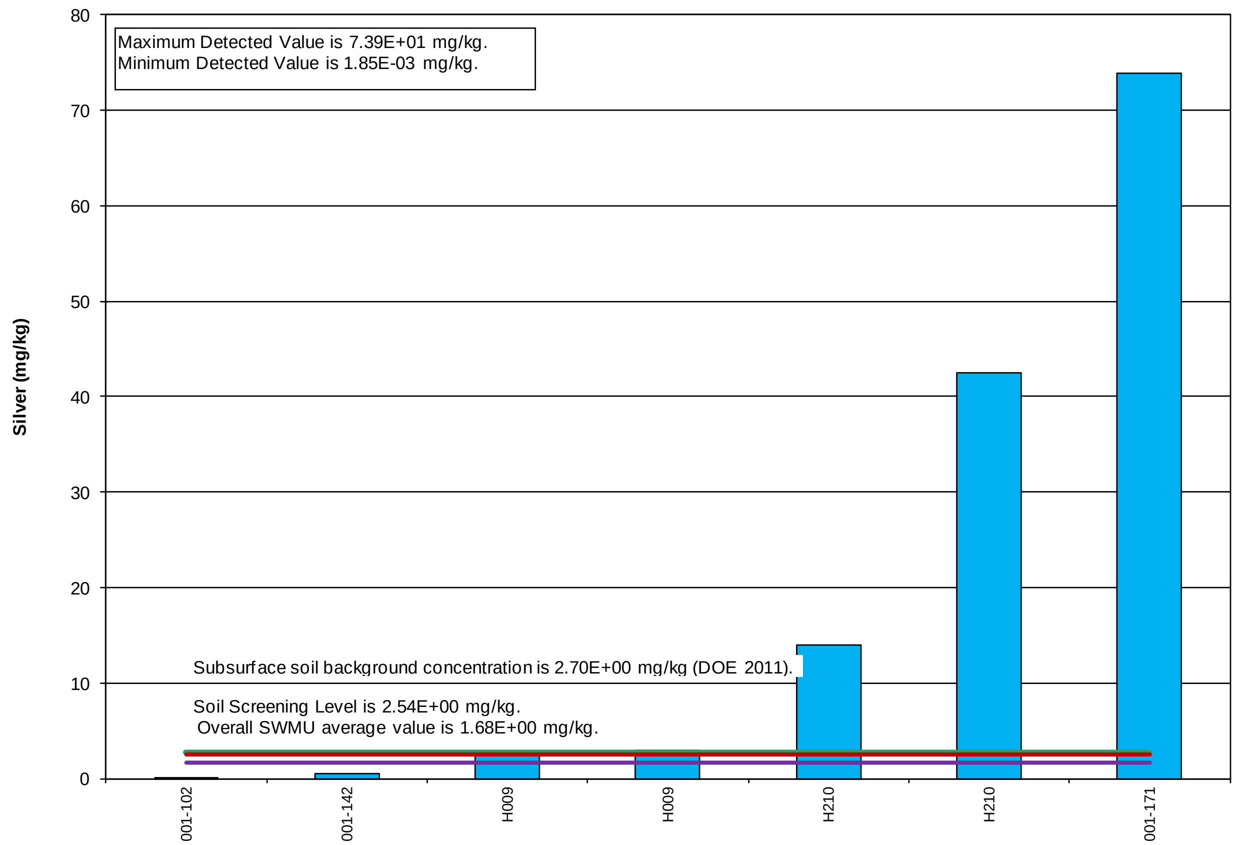

Figure C4.1.6. Silver Detections at SWMU 1

Vanadium was detected in 101 of 102 samples. The chart illustrating the detections is shown in Figure C4.1.7. The average concentration of vanadium in SWMU 1 is less than the subsurface background value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Four values were detected at concentrations greater than subsurface background; therefore, a hot spot evaluation was performed. A plot of the detected values is shown in Figure C4.1.8. The map shows vanadium detections are not clustered or indicative of a hot spot; therefore, hot spot fate and transport modeling was not performed for this chemical at this SWMU.

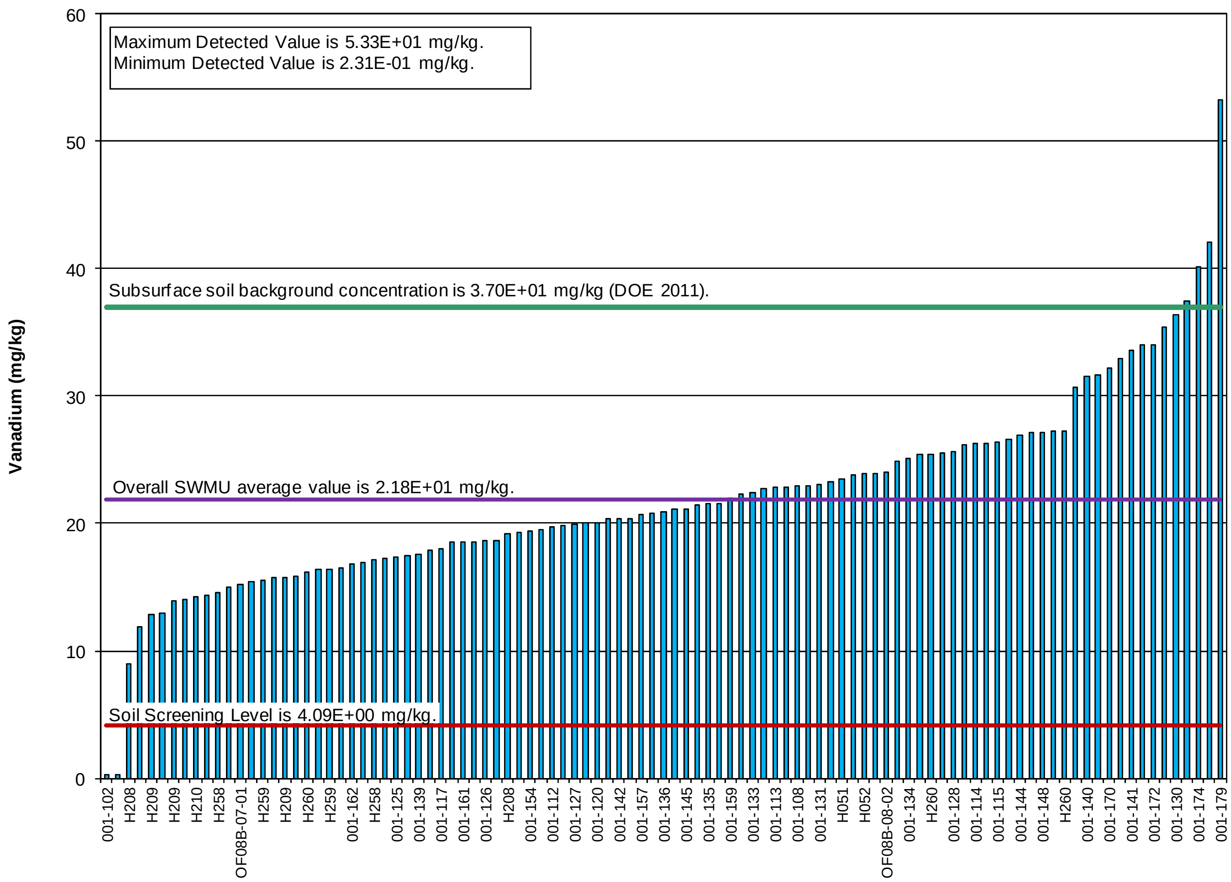

Figure C4.1.7. Vanadium Detections at SWMU 1

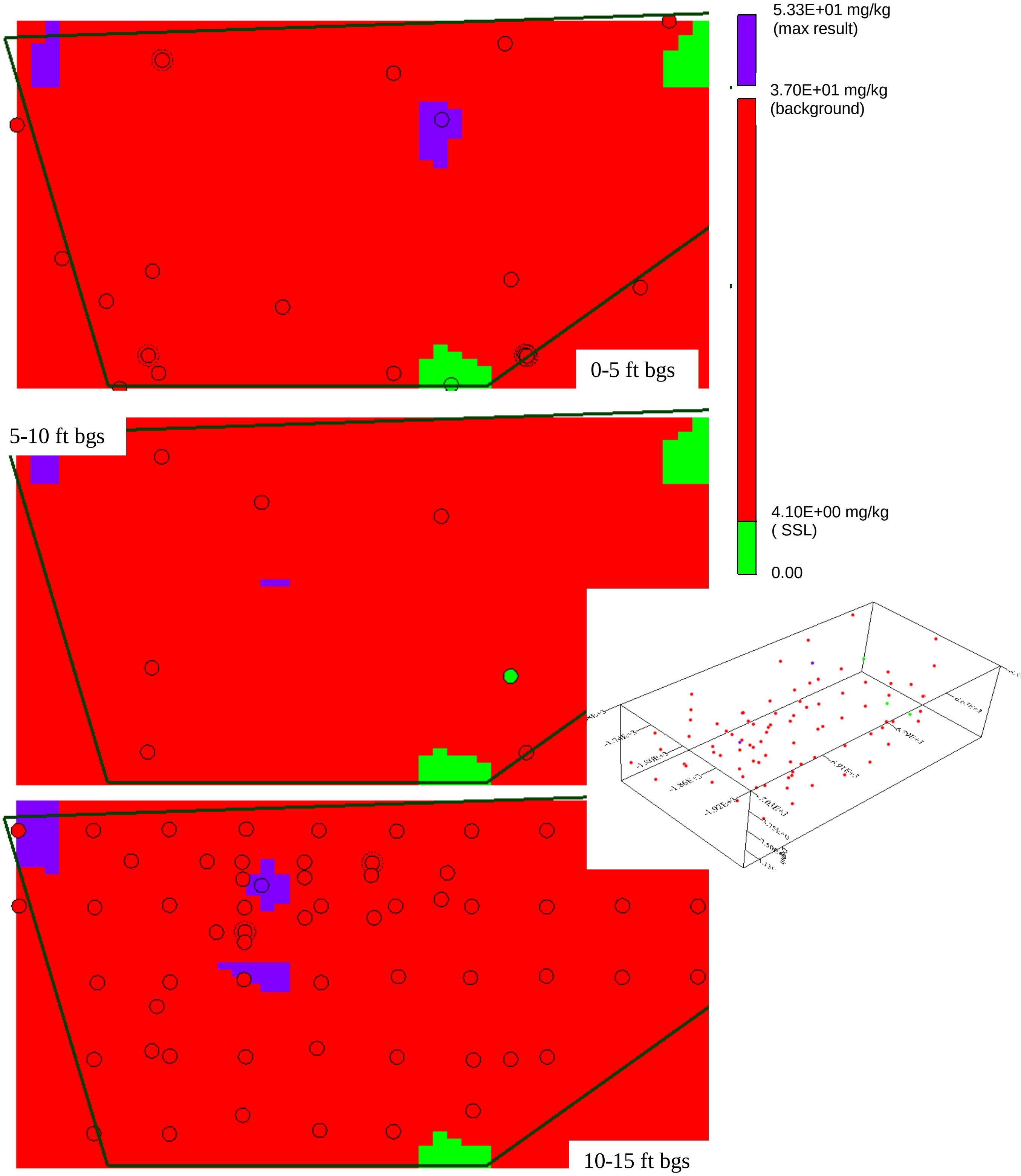

Figure C4.1.8. Distribution of Vanadium Detections at SWMU 1

Total polychlorinated biphenyls (PCBs) were detected in 32 of 288 samples. The chart illustrating the detections is shown in Figure C4.1.9. The average concentration over SWMU 1 for Total PCBs is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Because the two values detected above the RG SSL are both from the location, H210, a map was not generated showing the distribution of Total PCB detections. Two values were detected at a concentration greater than the RG SSL; however, 2 exceedances do not necessitate a hot spot evaluation.

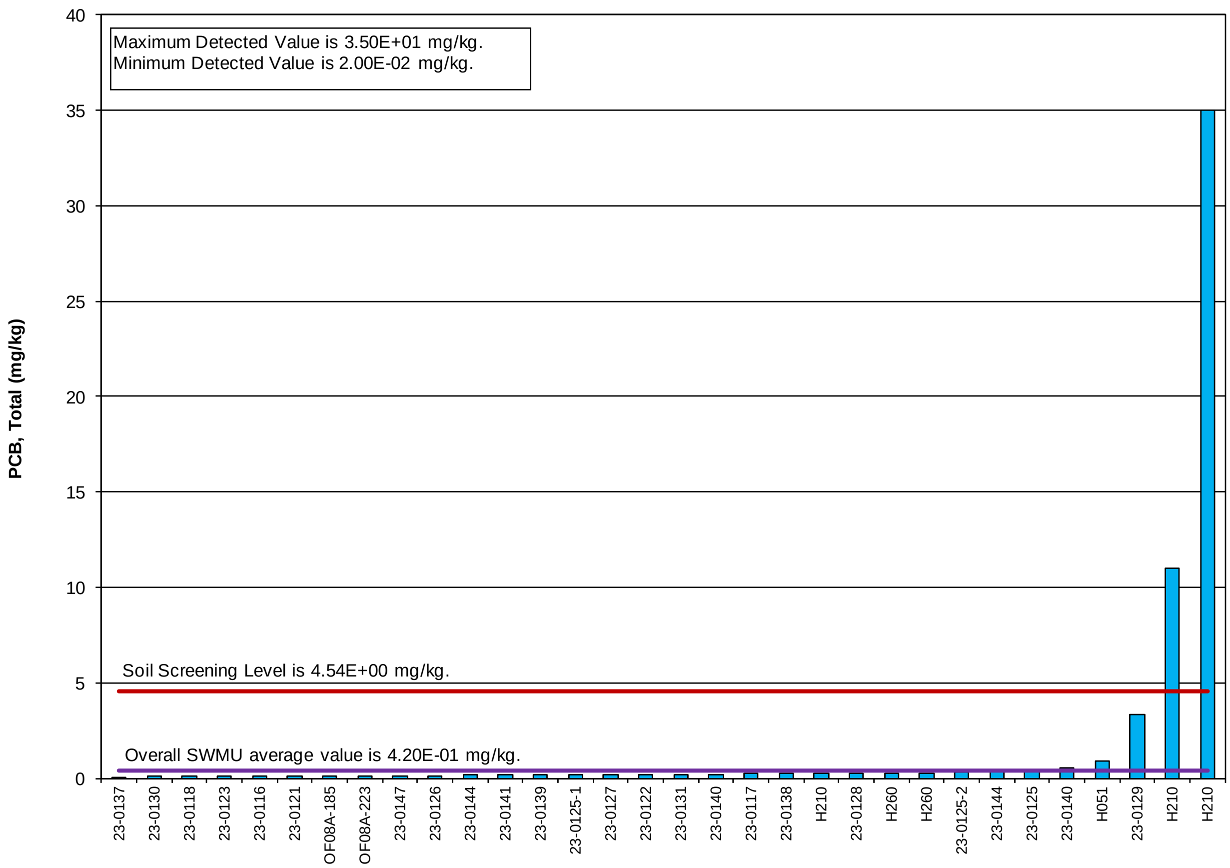

Figure C4.1.9. PCB, Total Detections at SWMU 1

Plutonium-239/240 was detected in six of six samples. The average concentration for SWMU 1 is less than the RG SSL and plutonium 239/240 was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS; therefore, it was not modeled for groundwater fate and transport and a hot spot evaluation was not performed (DOE 2001d). Further, Attachment C1 to Appendix C documents that a review of RGA groundwater data indicates that plutonium 239/240 from the Soils OU is not a source of migration to RGA groundwater.

C4.1.1 SWMU 99B, C-745 KELLOGG BUILDING SITE—SEPTIC SYSTEM

Data for SWMU 99B consisted of both historical and RI-collected data. SWMU 99B exceedances of the RG SSL include manganese, mercury, molybdenum, nickel, and silver. These analyses are shown in the following charts.

Figure C4.1.1.1 is a graph of manganese detections at SWMU 99B. Manganese was detected in 71 of 72 samples. The average concentration of manganese at SWMU 99B is less than the subsurface background value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One value was detected at a concentration greater than subsurface background, but 1 value does not necessitate a hot spot evaluation.

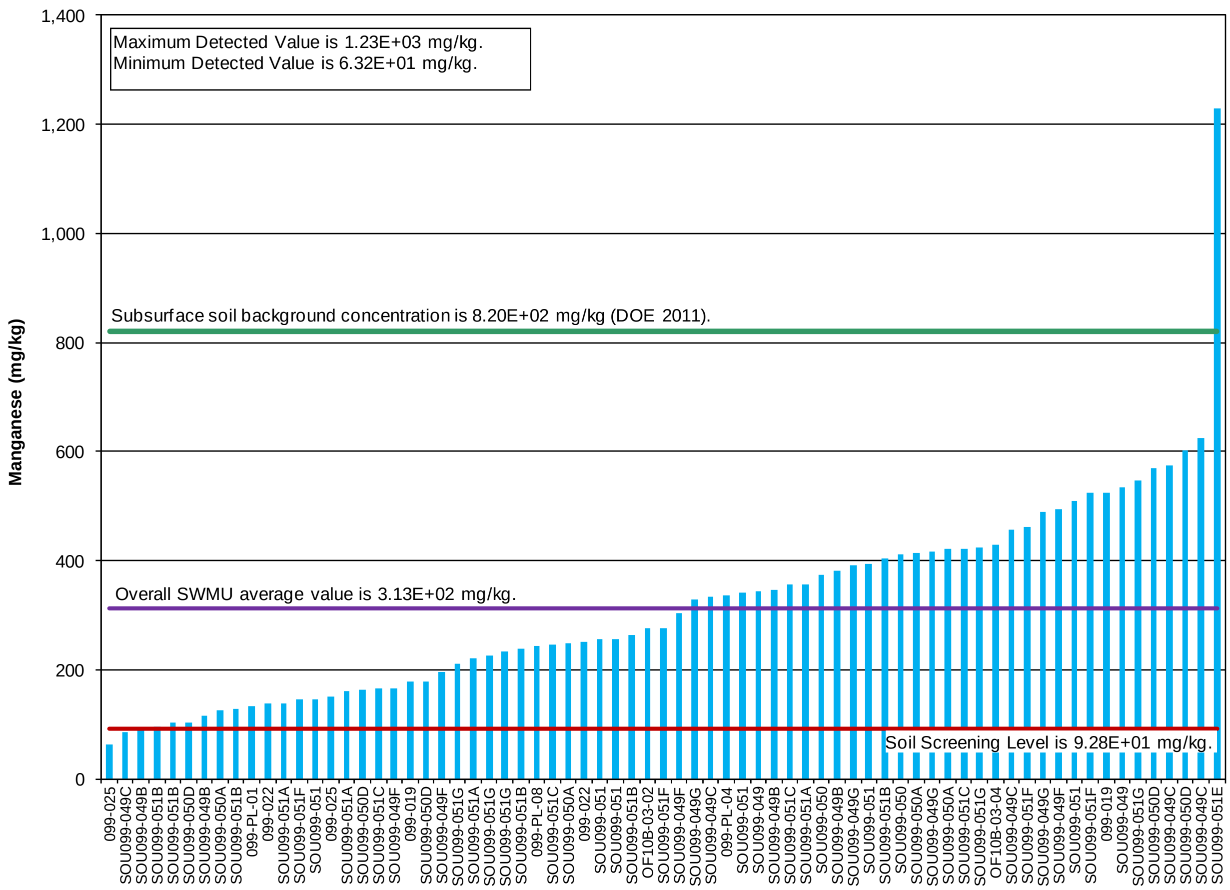

Figure C4.1.1.1. Manganese Detections at SWMU 99B

Figure C4.1.1.2 is a graph of mercury detection at SWMU 99B. Mercury was detected in 6 of 72 samples. The average over SWMU 99B for mercury is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Two values were detected at a concentration greater than the RG SSL; however, 2 exceedances do not necessitate a hot spot evaluation.

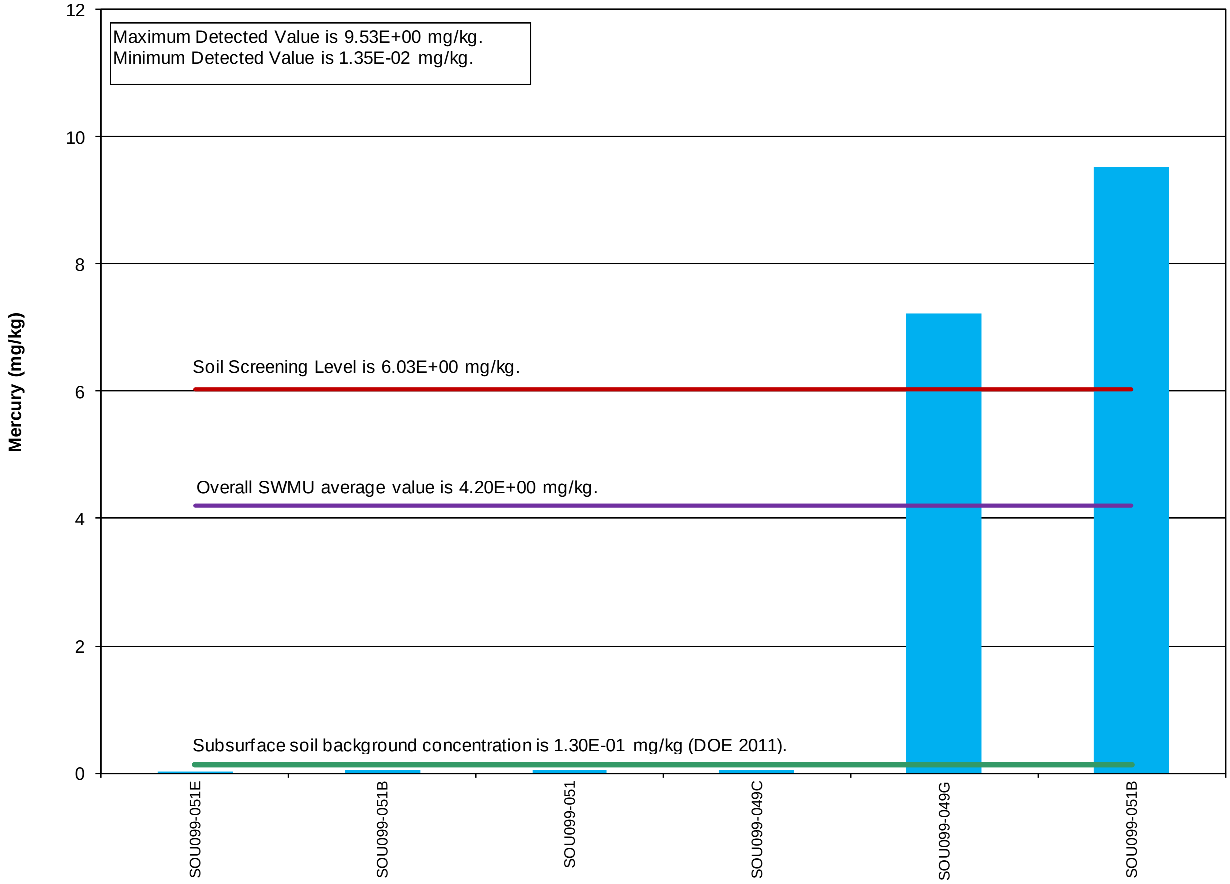

Figure C4.1.1.2. Mercury Detections at SWMU 99B

Molybdenum was detected in 7 of 66 samples. The chart illustrating the detections is shown in Figure C4.1.1.3. The average over SWMU 99B for molybdenum is greater than the RG SSL value. Based on the evaluation presented in Attachment C1 to Appendix C, molybdenum was not subjected to groundwater fate and transport modeling because molybdenum at the Soils OU is not considered to pose a threat to RGA groundwater. Only 1 sample for molybdenum was detected above the RG SSL; therefore, a hot spot evaluation was not performed.

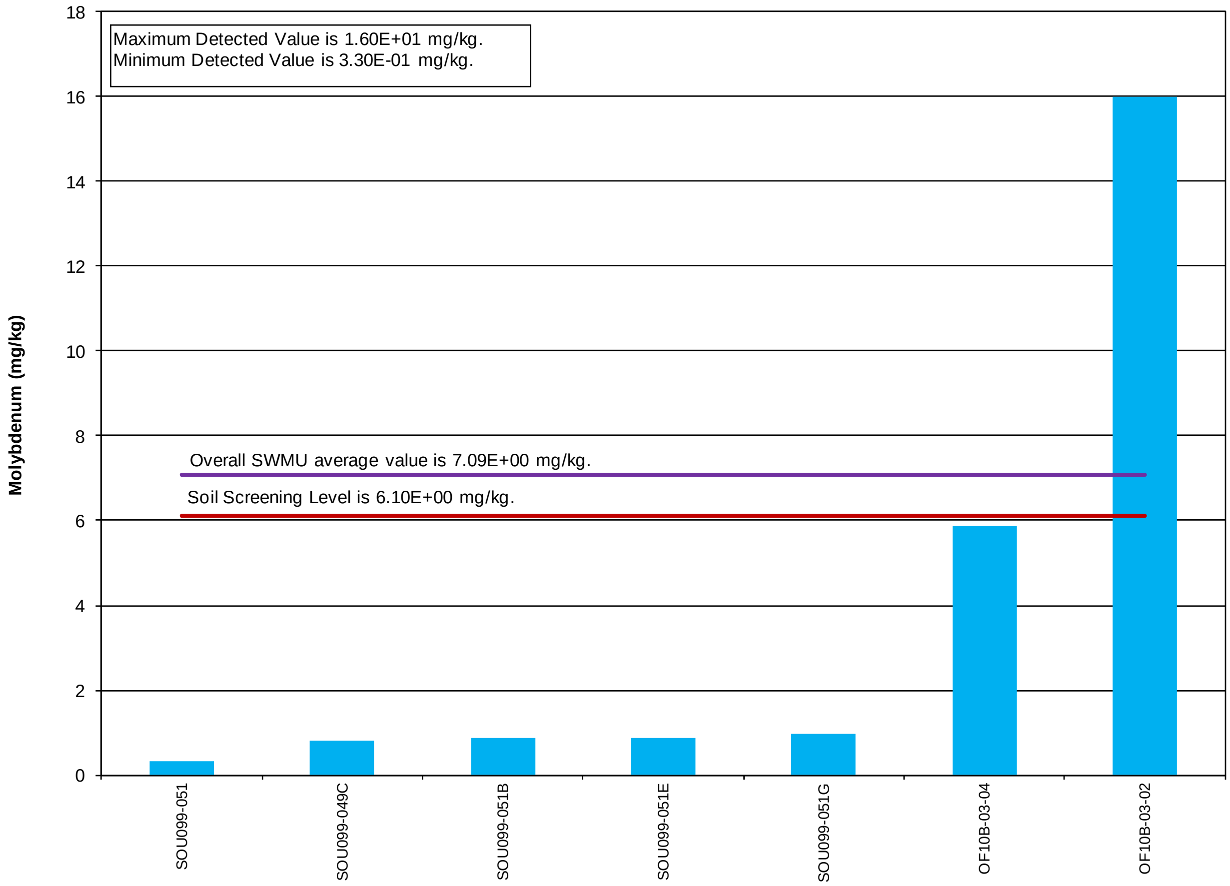

Figure C4.1.1.3. Molybdenum Detections at SWMU 99B

Nickel was detected in 23 of 72 samples. The chart illustrating the detections is shown in Figure C4.1.1.4. The average over SWMU 99B for nickel is lower than the RG SSL value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Three samples were detected at a concentration greater than the RG SSL; therefore, a hot spot evaluation was conducted.

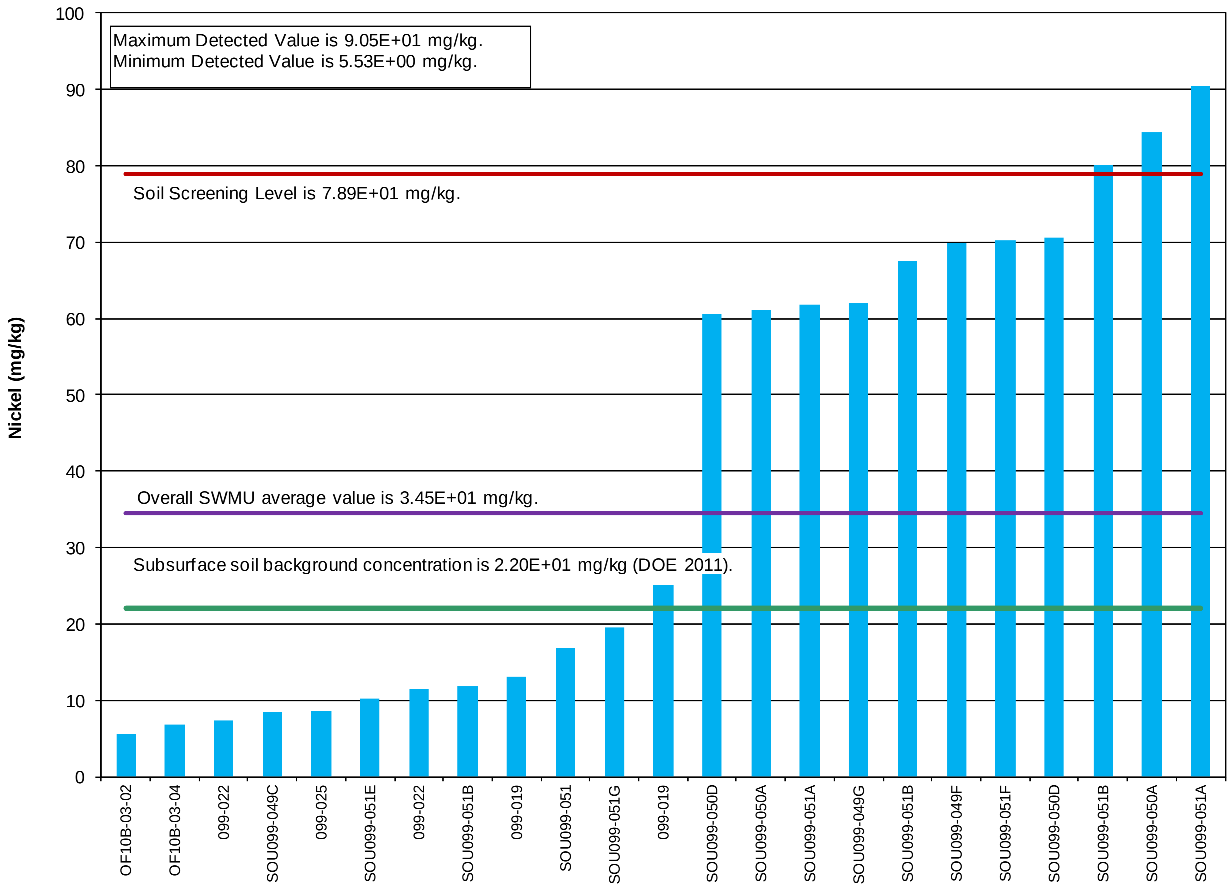

Figure C4.1.1.4. Nickel Detections at SWMU 99B

A map of the distribution of nickel detections is shown in Figure C4.1.1.5. The map shows that detections are not clustered and not indicative of a hot spot; therefore, hot spot fate and transport modeling was not performed for this chemical at this SWMU.

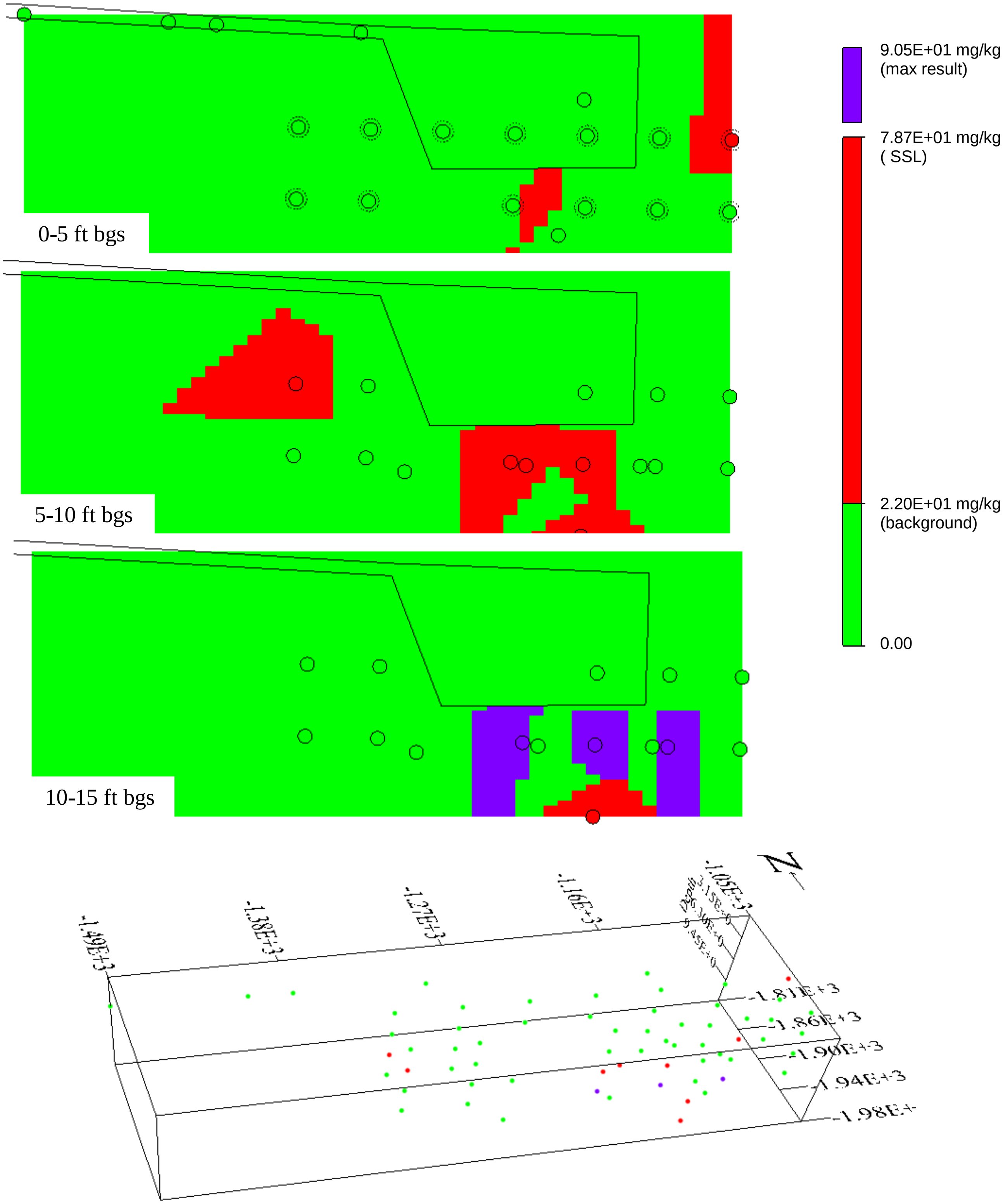

Figure C4.1.1.5. Distribution of Nickel Detections at SWMU 99B

Silver was detected in 7 of 72 samples. The chart illustrating the detections is shown in Figure C4.1.1.6. The average over SWMU 99B for silver is greater than background and the RG SSL value.

As discussed in Section C2.1.3, silver has not been detected in RGA groundwater at levels above the residential no action level (NAL); therefore, soil concentrations of silver will not be modeled for fate and transport to groundwater. Two values were detected at a concentration greater than the RG SSL; however, two exceedances do not necessitate a hot spot evaluation.

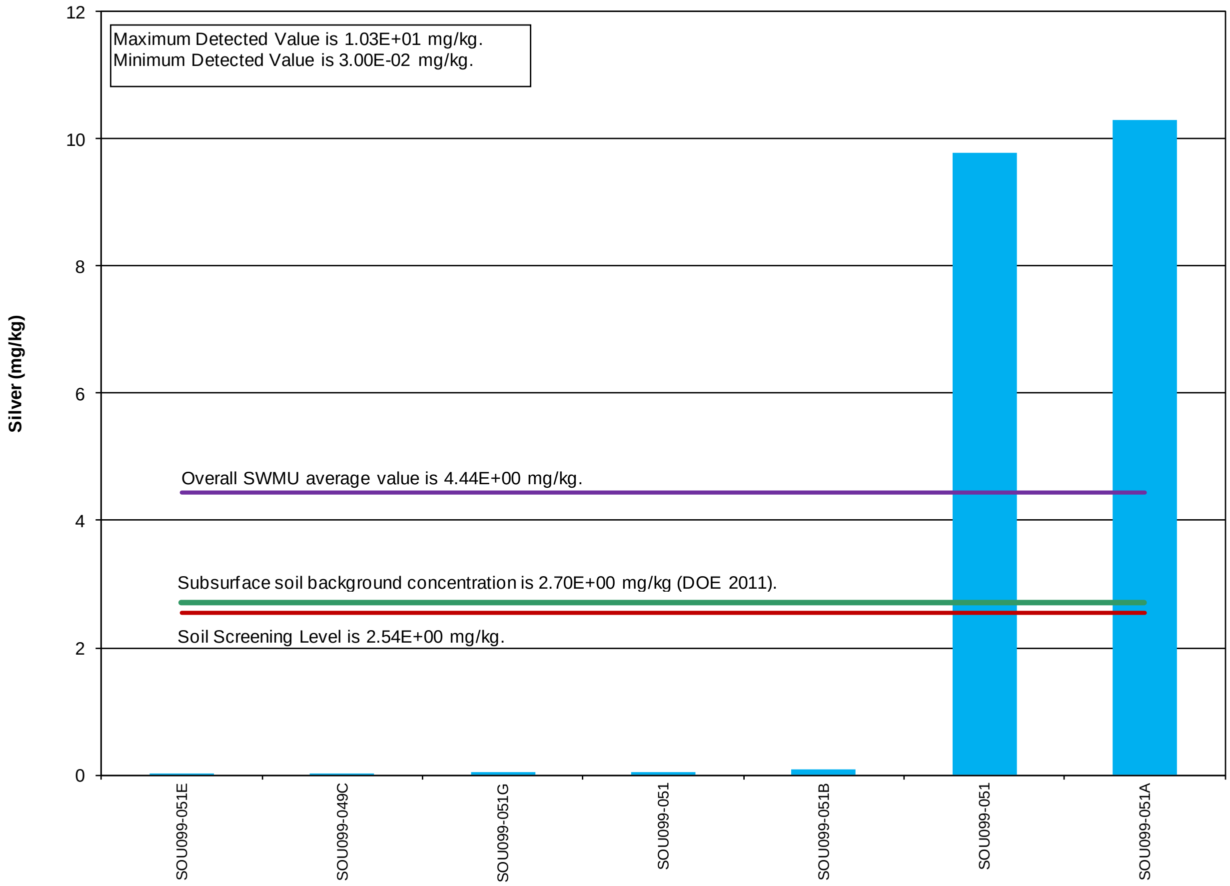

Figure C4.1.1.6. Silver Detections at SWMU 99B

C4.1.2 SWMU 194, DUF_6 FACILITY, MCGRAW CONSTRUCTION FACILITIES (SOUTH SIDE)

Data for SWMU 194 consisted of both historical and RI-collected data. SWMU 194 exceedances of the RG SSL include the following: naphthalene, Total PCB, arsenic, cobalt, iron, manganese, mercury, molybdenum, nickel, silver, and vanadium.

Naphthalene was detected in only 1 of 73 samples. The naphthalene detection was 0.048 mg/kg (which was below the detection limit of 0.37 mg/kg); therefore, this analysis was not subjected to groundwater modeling. The remaining analyses are shown in the following charts.

Total PCBs were detected in 2 of 803 samples. The chart illustrating the detections is shown in Figure C4.1.2.1. The average of Total PCBs over SWMU 194 is less than the RG SSL value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. The sparse occurrence of PCBs at SWMU 194, 2 samples of 803, resulted in no hot spot evaluation being performed.

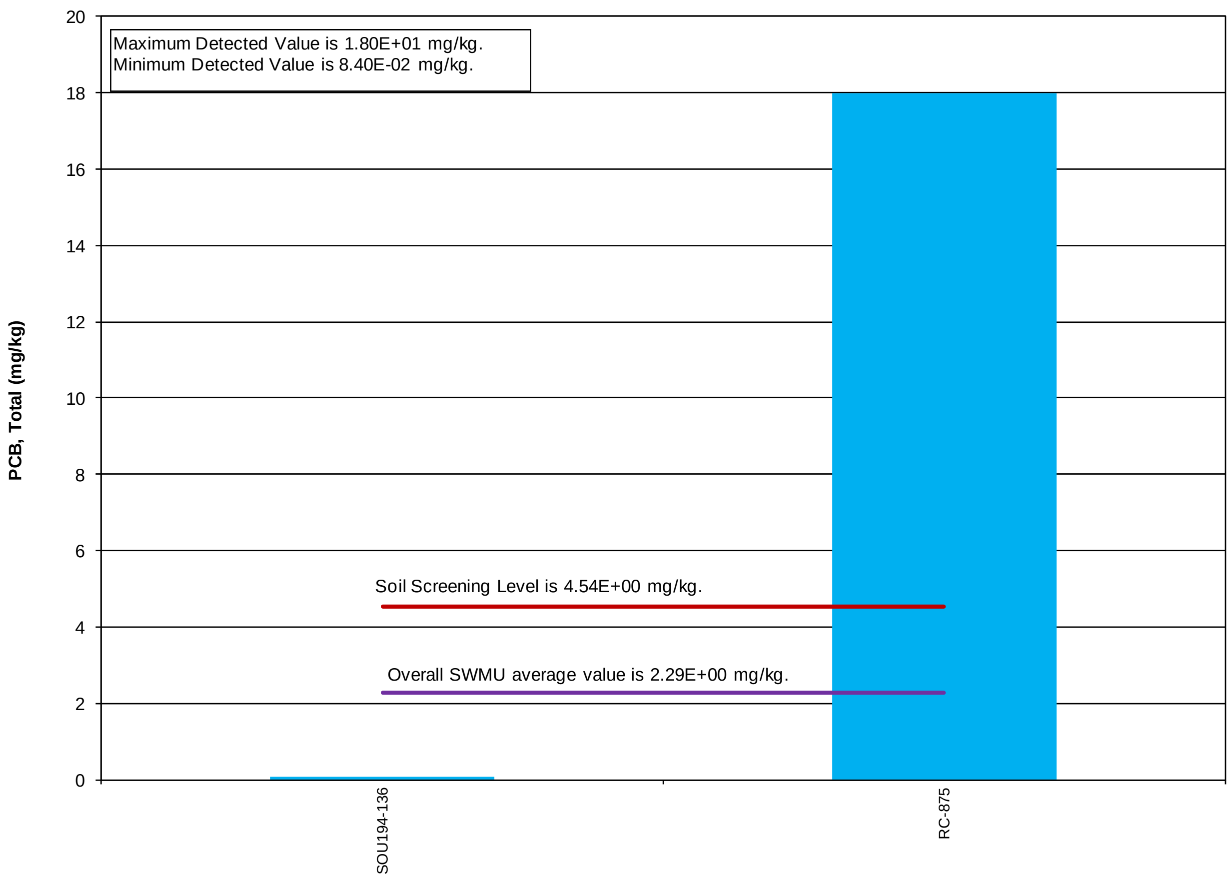

Figure C4.1.2.1. Total PCB Detections at SWMU 194

Arsenic was detected in 373 of 811 samples. A plot of the detected samples is shown in Figure C4.1.2.2. The average over SWMU 194 for arsenic is less than the RG SSL value; therefore groundwater fate and transport modeling was not performed for this chemical at this SWMU. One hundred sixty-three samples were detected at a concentration greater than subsurface background and 5 greater than the RG SSL. Because of the low frequency of detection, a hot spot map was not generated.

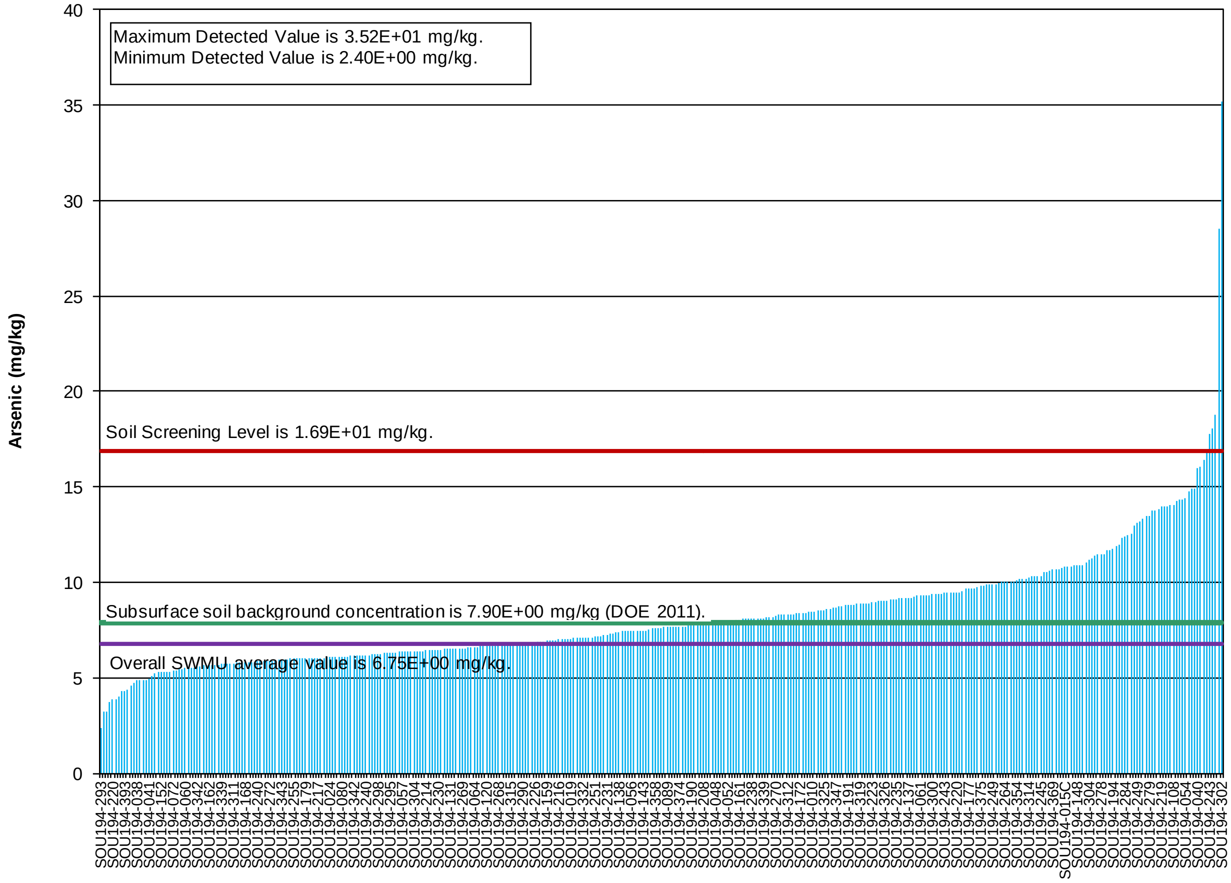

Figure C4.1.2.2. Arsenic Detections at SWMU 194

Cobalt was detected in 76 of 76 samples. A plot of the detected samples is shown in Figure C4.1.2.3. The average over SWMU 194 for cobalt is less than the subsurface background value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although 6 samples had a concentration greater than the RG SSL, cobalt was not identified as a COC for the RGA in the GWOU FS; therefore, a hot spot evaluation was not performed (DOE 2001d).

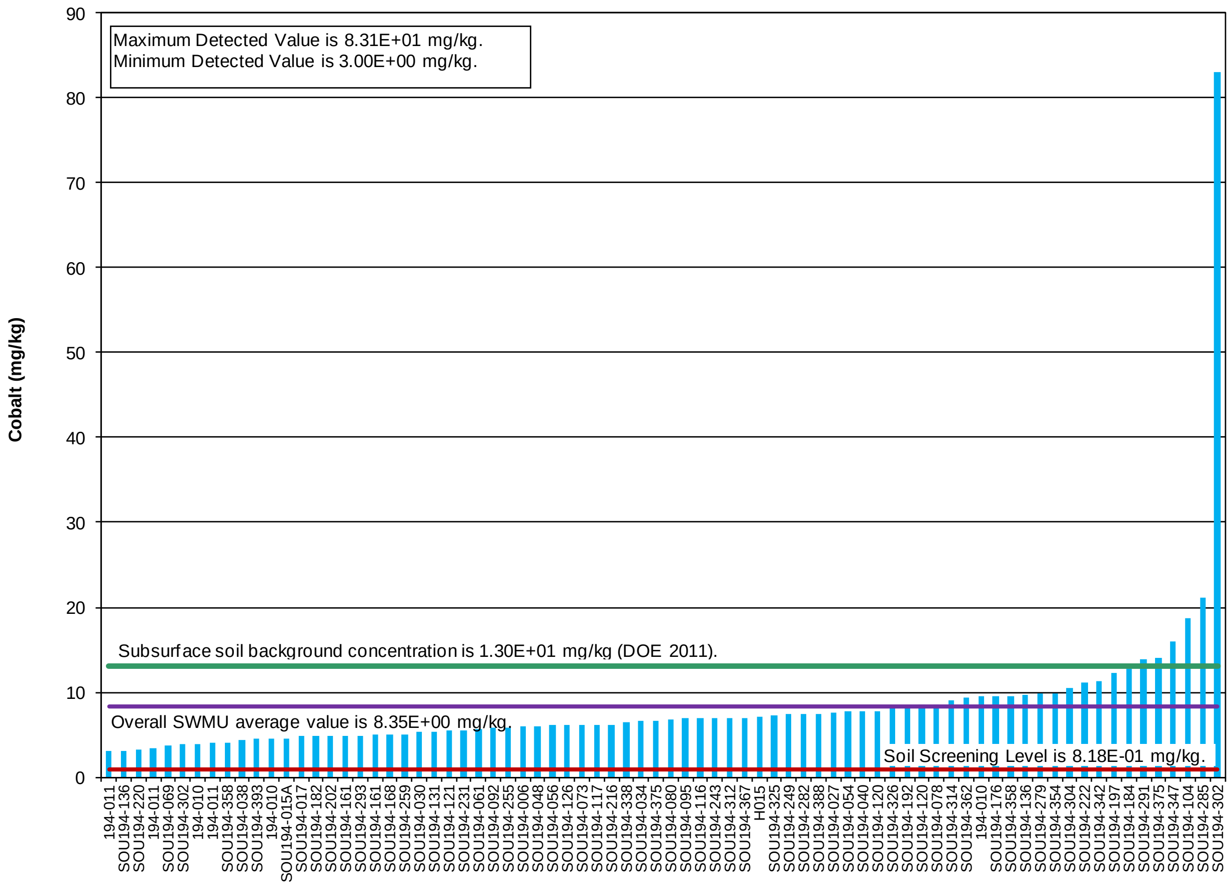

Figure C4.1.2.3. Cobalt Detections at SWMU 194

Iron was detected in 810 of 810 samples. A plot of the detected samples is shown in Figure C4.1.2.4. The average over SWMU 194 for iron is less than the subsurface background value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although 5 samples were detected at a concentration greater than subsurface background, no hot spot analysis was performed, because of the low frequency of detection and the fact that iron is ubiquitous.

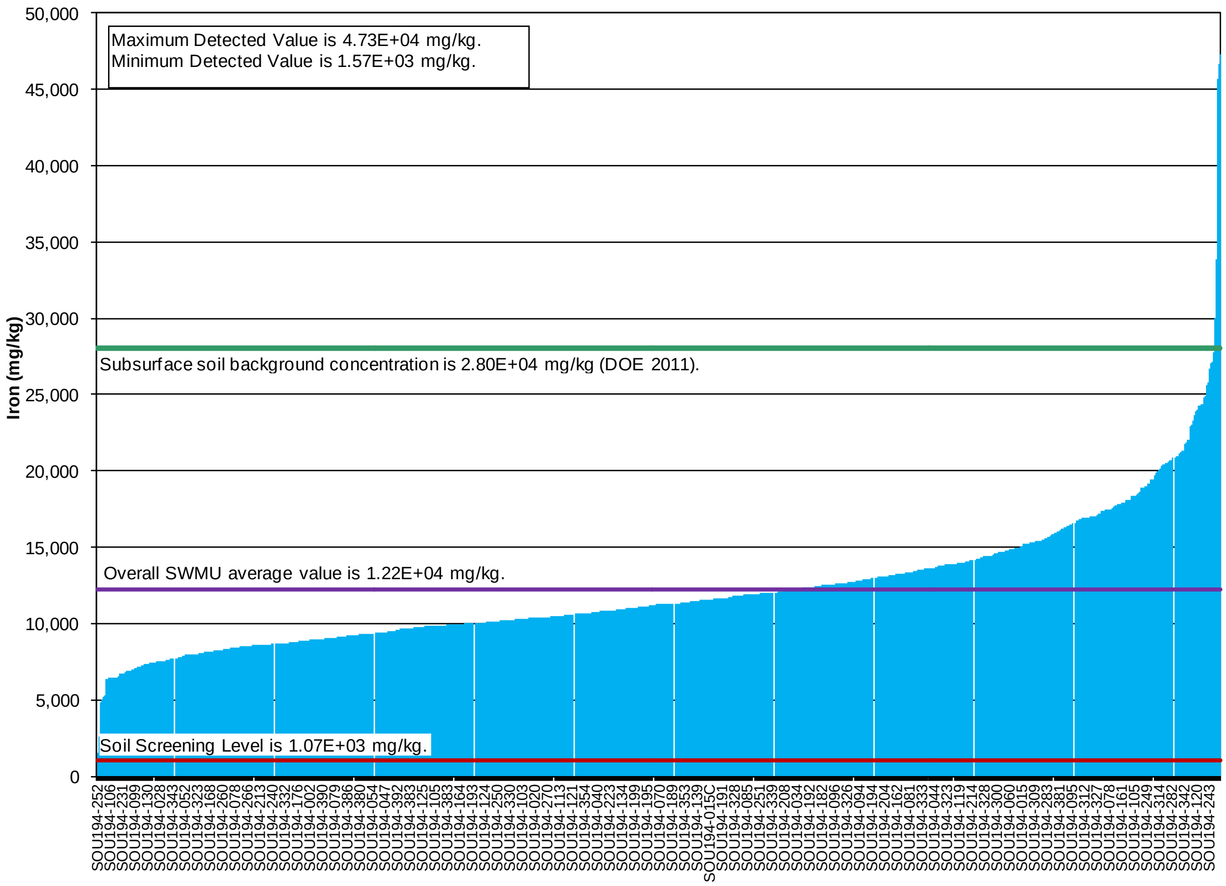

Figure C4.1.2.4. Iron Detections at SWMU 194

Manganese was detected in 802 of 810 samples. A plot of the detected samples is shown in Figure C4.1.2.5. The average over SWMU 194 for manganese is less than the subsurface background value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Fifty-one samples were detected at a concentration greater than subsurface background. A hot spot evaluation was not performed because manganese is ubiquitous, concentrations are controlled by site soil geochemistry, and the soils do not appear to yield an RGA impact.

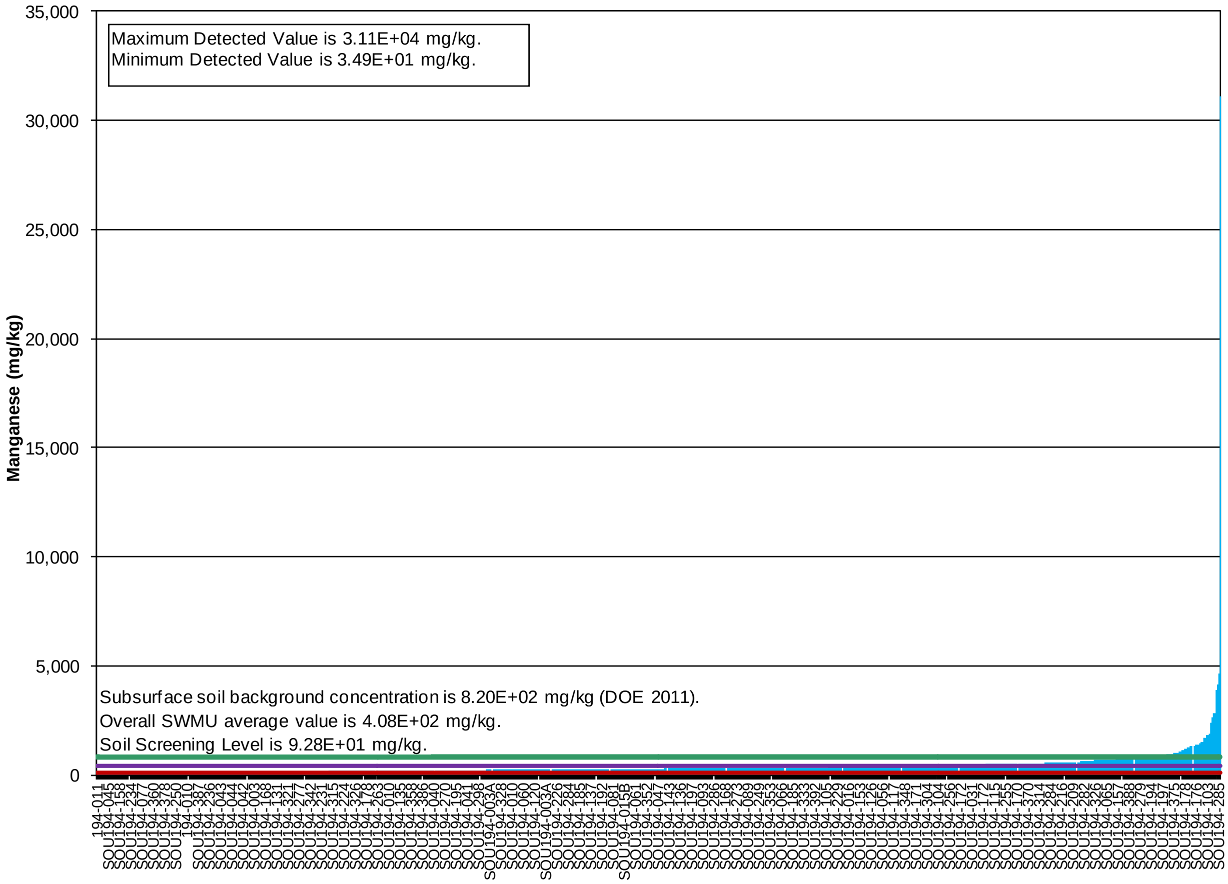

Figure C4.1.2.5. Manganese Detections at SWMU 194

Mercury was detected in 81 of 811 samples. A plot of the detected samples is shown in Figure C4.1.2.6. The average over SWMU 194 for mercury is less than the RG SSL value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Mercury was evaluated as part of the GWOU FS and was not identified as a COC in the groundwater plumes associated with PGDP; therefore, a hot spot evaluation was not performed (DOE 2001d).

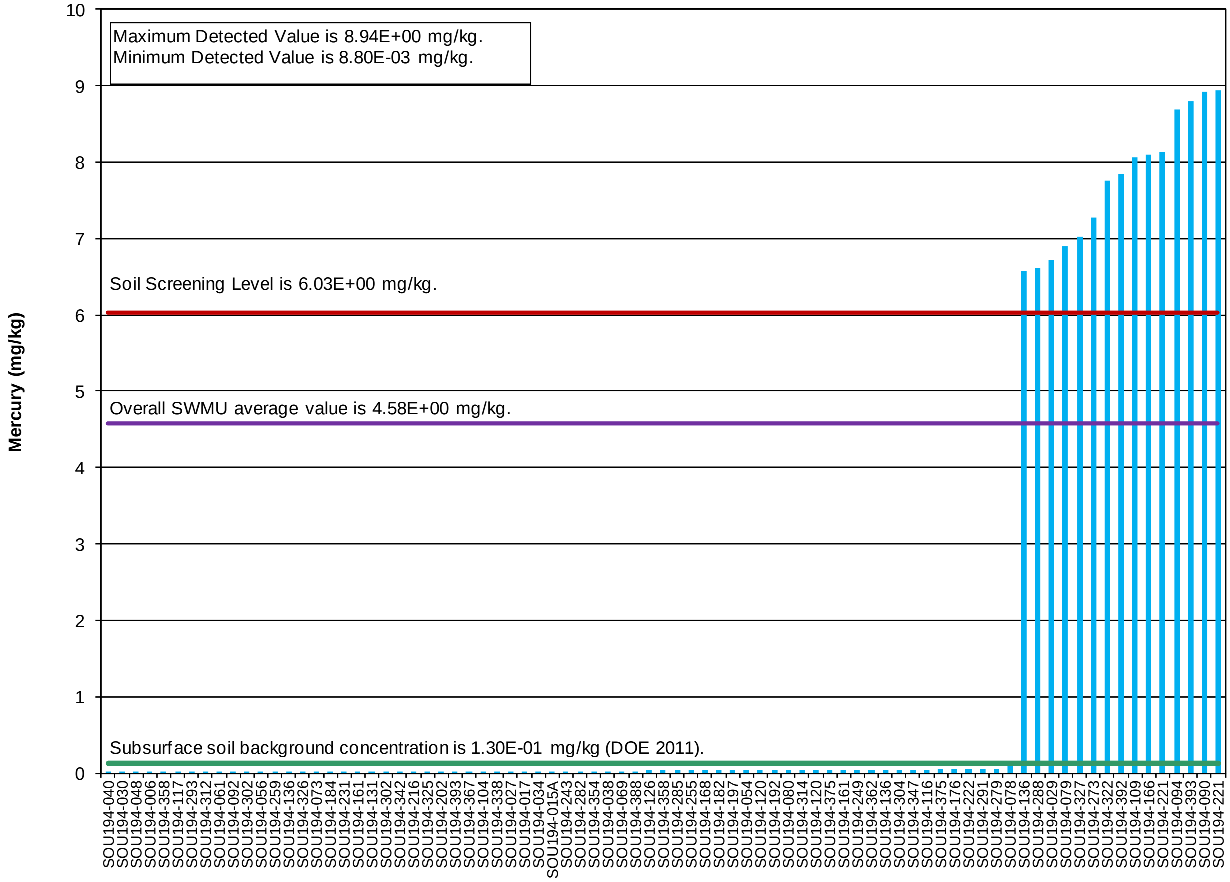

Figure C4.1.2.6. Mercury Detections at SWMU 194

Molybdenum was detected in 70 of 803 samples. A plot of the detected samples is shown in Figure C4.1.2.7. The average over SWMU 194 for molybdenum is greater than the RG SSL value. Molybdenum was evaluated as part of the GWOU FS and is a COC in the groundwater plumes associated with PGDP (DOE 2001d). The evaluation summarized in Attachment C1 to Appendix C did not identify molybdenum from the Soils OU as contributing to RGA groundwater contamination; therefore, no groundwater fate and transport modeling was performed. One value was detected at a concentration greater than subsurface background, but 1 exceedance does not require a hot spot evaluation.

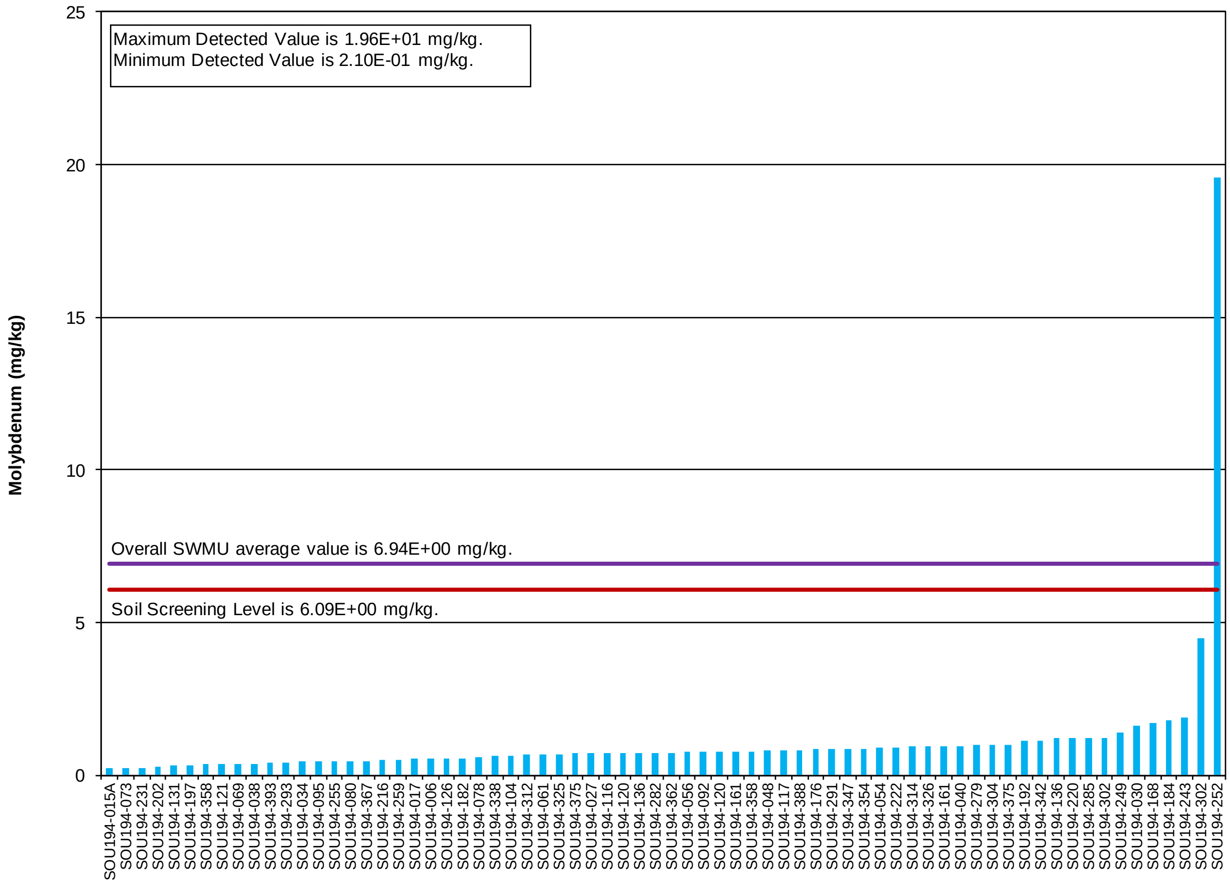

Figure C4.1.2.7. Molybdenum Detections at SWMU 194

Nickel was detected in 179 of 811 samples. A plot of the detected samples is shown in Figure C4.1.2.8. The average over SWMU 194 for nickel is less than the RG SSL value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Several samples were detected at a concentration greater than the RG SSL; however, a hot spot evaluation was not performed because nickel is being modeled at SWMU 14—the location with the highest average concentration of nickel in any SWMU. Nickel exceeded the RG SSL in Exposure Unit 11, which includes sampling locations SOU194-064, SOU194-111, SOU194-135, SOU194-137, SOU194-138, and SOU194-163.

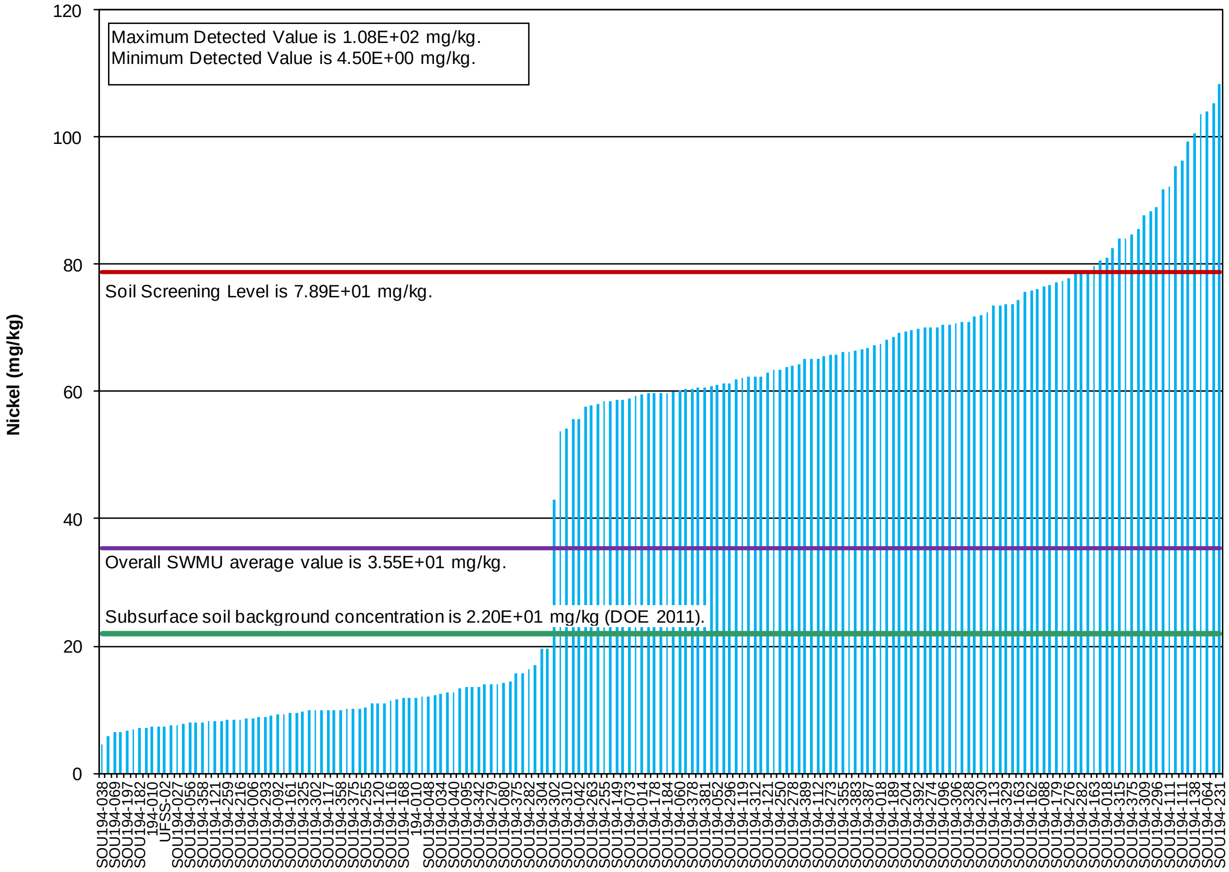

Figure C4.1.2.8. Nickel Detections at SWMU 194

Silver was detected in 124 of 811 samples. A plot of the detected samples is shown in Figure C4.1.2.9. The average over SWMU 194 for silver is greater than the subsurface background and the RG SSL value. Silver was evaluated as part of the GWOU FS and identified as a COC in the groundwater plumes associated with PGDP (DOE 2001d). There is no evidence of RGA impacts due to silver; therefore, no hot spot evaluation was performed. As discussed in Attachment C1 to Appendix C, silver has not been detected above the residential NAL in RGA groundwater; therefore, soil concentrations of silver were not modeled for fate and transport to groundwater.

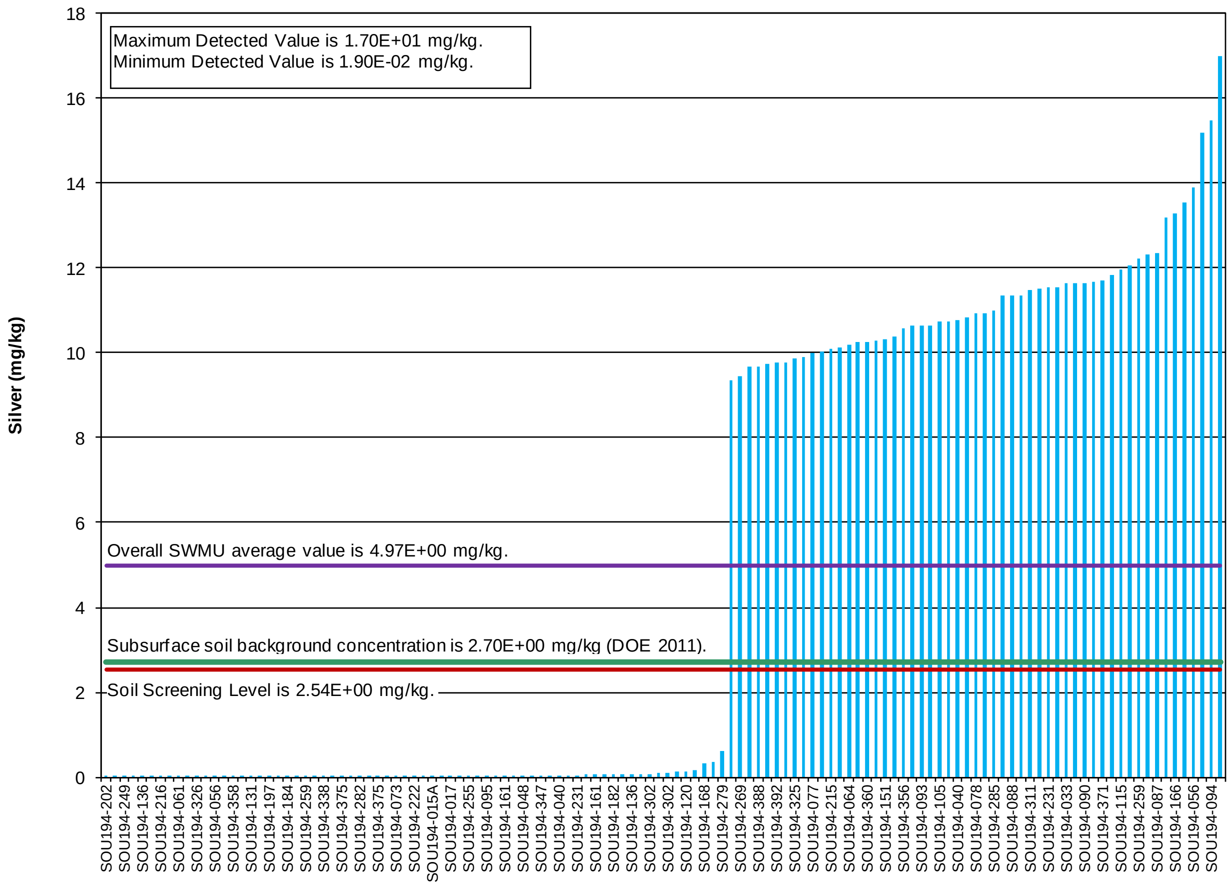

Figure C4.1.2.9. Silver Detections at SWMU 194

Vanadium was detected in 77 of 77 samples. A plot of the detected samples is shown in Figure C4.1.2.10. The average over SWMU 194 for vanadium is less than background; therefore groundwater fate and transport modeling was not performed for this chemical at this SWMU. Several samples were detected at a concentration greater than subsurface background. A hot spot evaluation was not performed because vanadium in soils does not impact RGA groundwater.

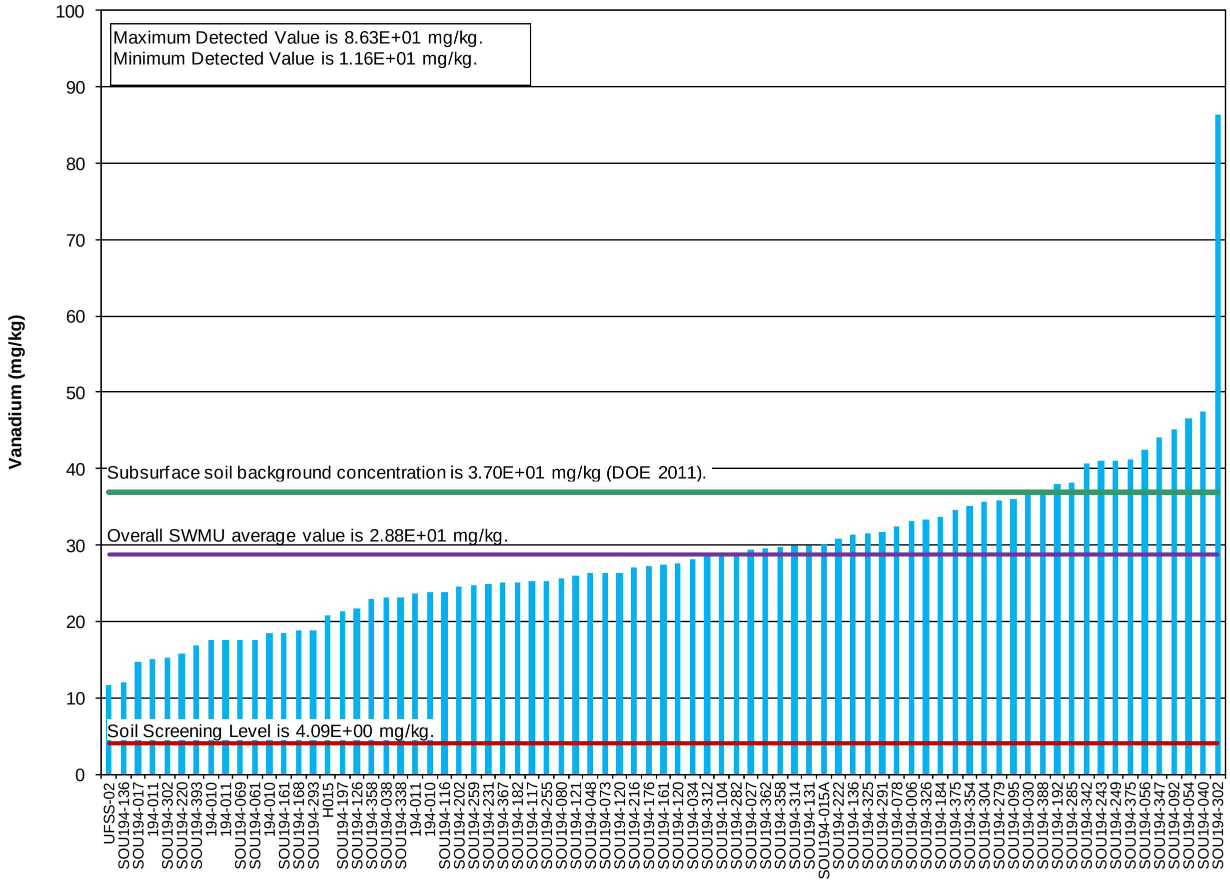

Figure C4.1.2.10. Vanadium Detections at SWMU 194

C4.1.3 SWMU 196, C-746-A SEPTIC SYSTEM

Data for SWMU 196 consisted of both historical and RI-collected data. SWMU 196 exceedances of the RG SSL include the following soil constituents: naphthalene, antimony, cadmium, cobalt, iron, manganese, nickel, selenium, silver, thallium, vanadium, and zinc. These analyses are summarized in the following charts.

Figure C4.1.3.1 is a graph of naphthalene detection at SWMU 196. Naphthalene was detected in 2 of 33 samples. Although the average over SWMU 196 for naphthalene is greater than the RG SSL value, the low frequency of occurrence of naphthalene at SWMU 196 does not lend itself to groundwater fate and transport modeling. Furthermore, naphthalene was evaluated as part of the GWOU FS and was not identified as a COC for groundwater in the RGA at PGDP (DOE 2001d).

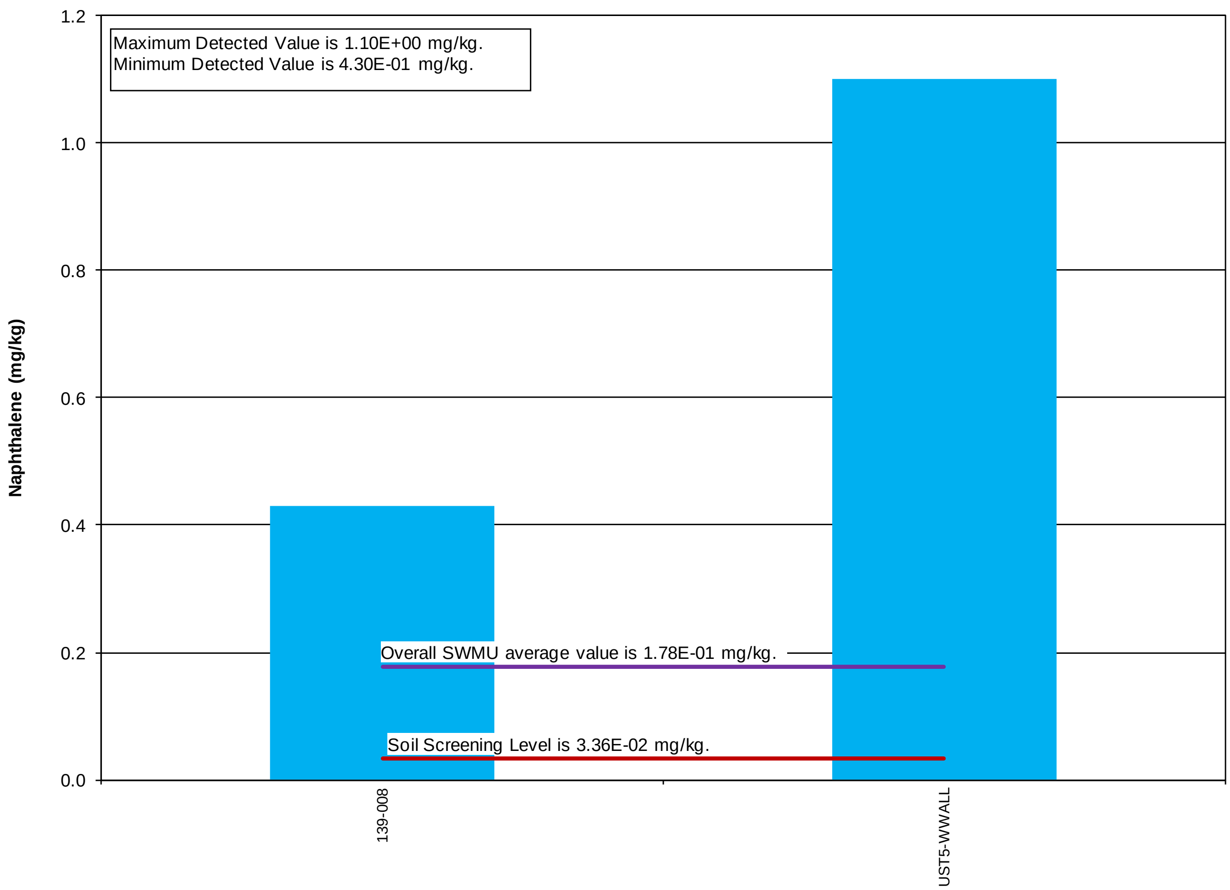

Figure C4.1.3.1. Naphthalene Detections at SWMU 196

Antimony was detected in 30 of 74 samples. A plot of the detected samples is shown in Figure C4.1.3.2. The average over SWMU 194 for antimony is less than the RG SSL value; therefore groundwater fate and transport modeling was not performed for this chemical at this SWMU. Nine samples were detected at a concentration greater than the RG SSL. A hot spot evaluation was not performed due to the low frequency of occurrence and the finding that antimony in soils does not contribute to an RGA groundwater problem (see Section C1.3.4).

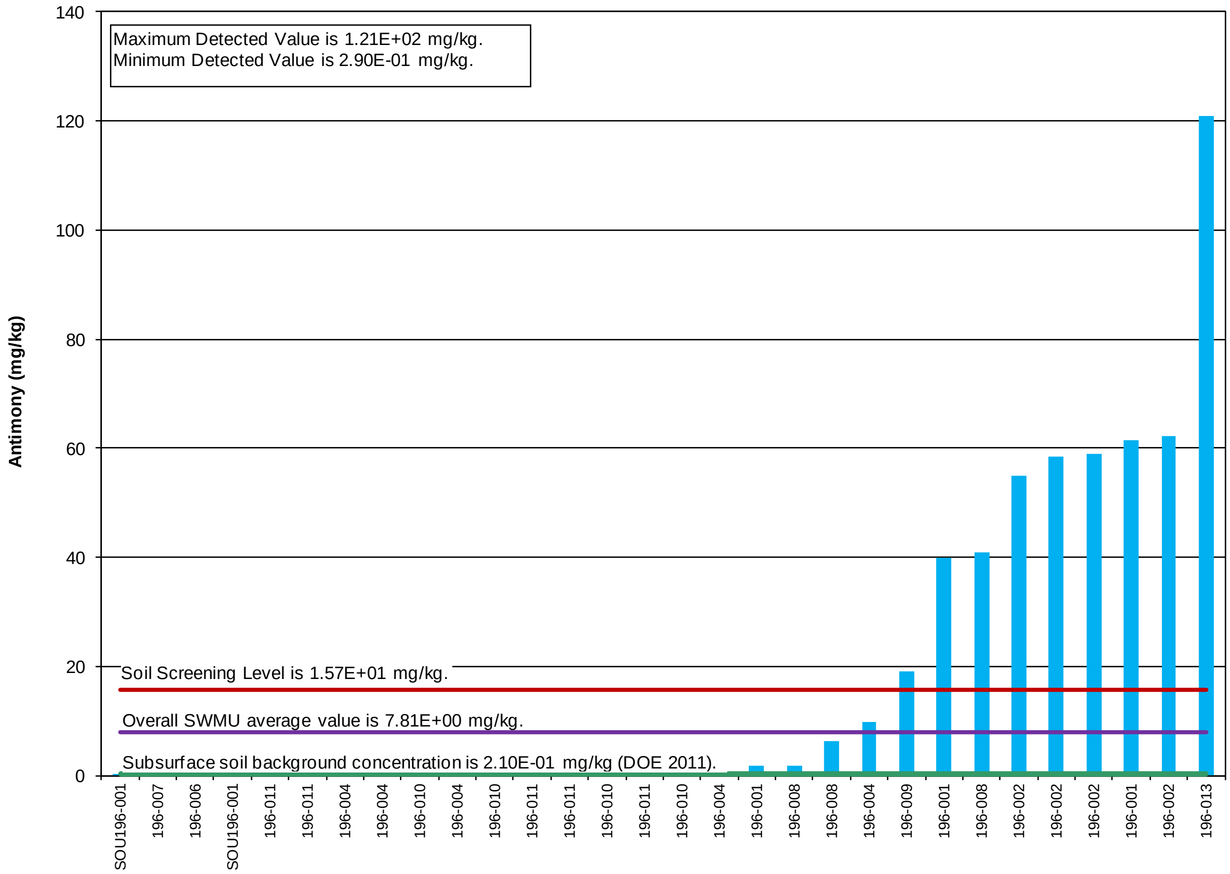

Figure C4.1.3.2. Antimony Detections at SWMU 196

Cadmium was detected in 40 of 80 samples. A plot of the detected samples is shown in Figure C4.1.3.3. The average over SWMU 196 for cadmium is less than the RG SSL value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only 1 sample was detected at a concentration greater than the RG SSL; therefore, a hot spot evaluation was not performed.

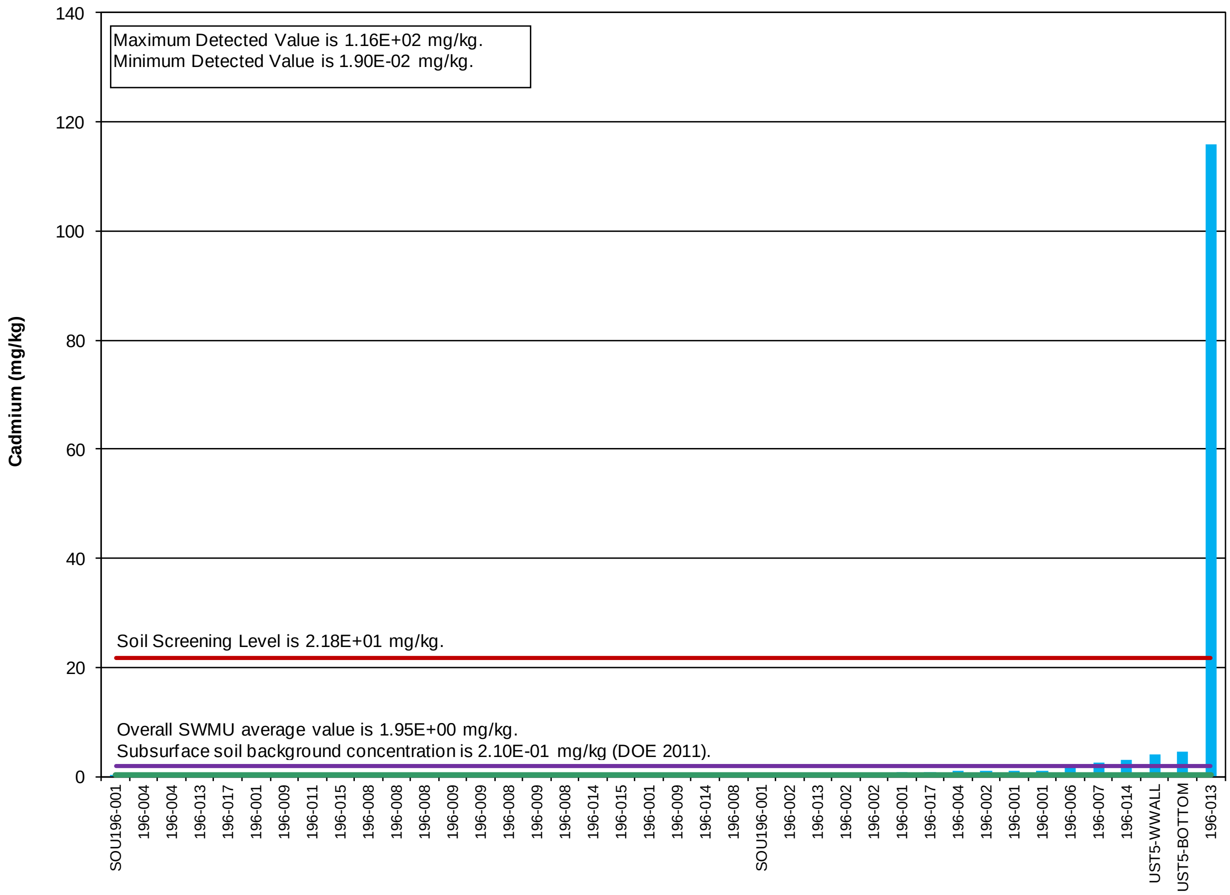

Figure C4.1.3.3. Cadmium Detections at SWMU 196

Cobalt was detected in 72 of 72 samples. A plot of the detected samples is shown in Figure C4.1.3.4. The average over SWMU 196 for cobalt is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Cobalt was evaluated as part of the GWOU FS and was not identified as a COC in the groundwater plumes associated with PGDP; therefore, a hot spot evaluation was not performed (DOE 2001d).

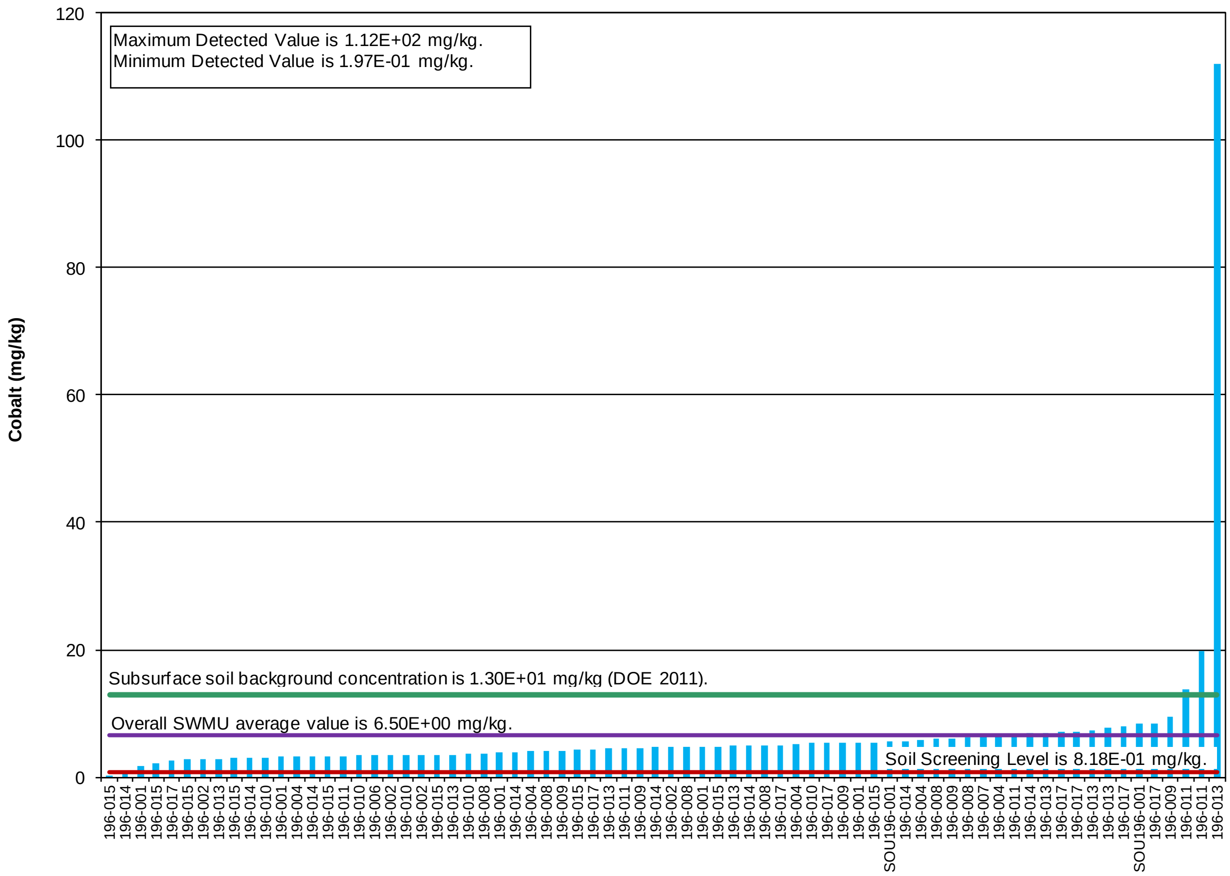

Figure C4.1.3.4. Cobalt Detections at SWMU 196

Iron was detected in 74 of 74 samples. A plot of the detected samples is shown in Figure C4.1.3.5. The average over SWMU 196 for iron is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only 1 sample was detected at a concentration greater than subsurface background; therefore, a hot spot evaluation was not performed.

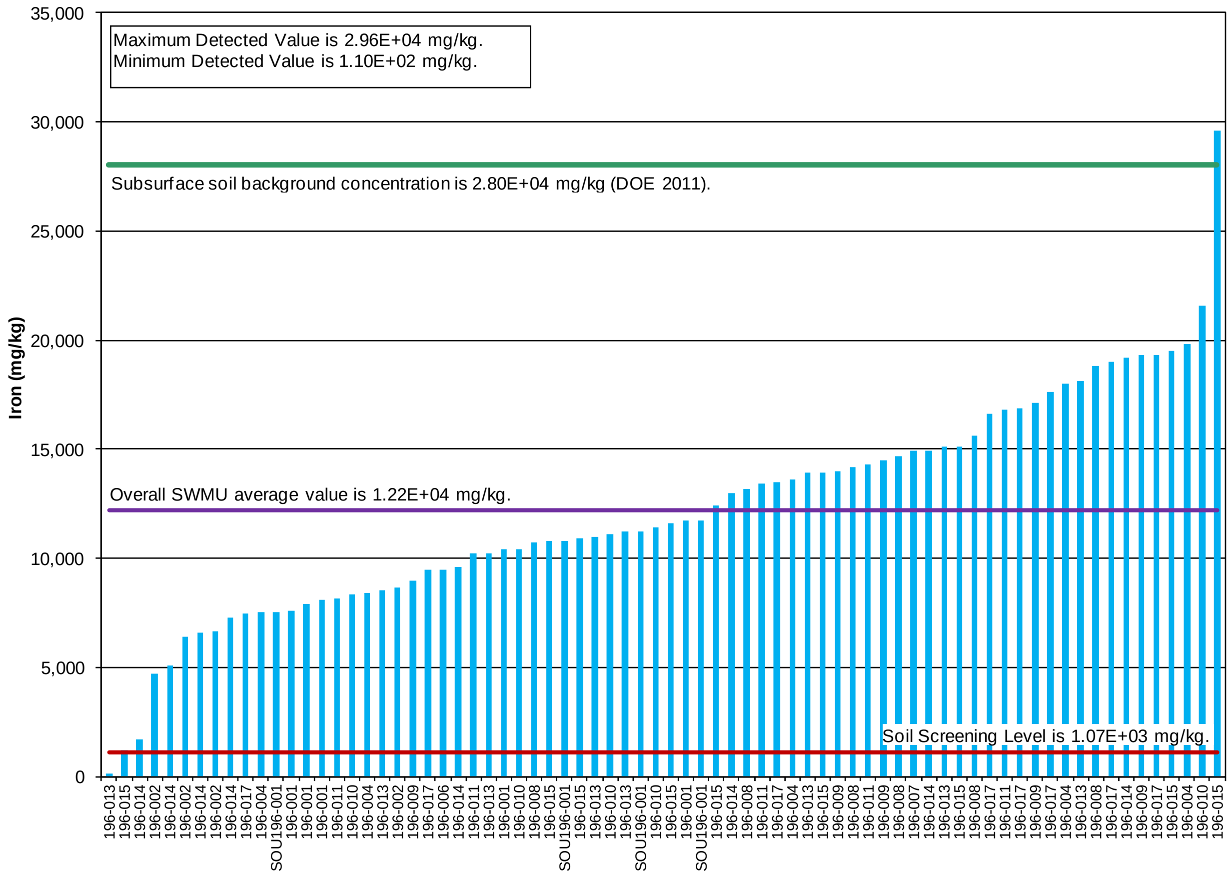

Figure C4.1.3.5. Iron Detections at SWMU 196

Manganese was detected in 74 of 74 samples. A plot of the detected samples is shown in Figure C4.1.3.6. The average over SWMU 196 for manganese is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Two samples were detected at a concentration greater than subsurface background, but 2 samples do not necessitate a hot spot evaluation.

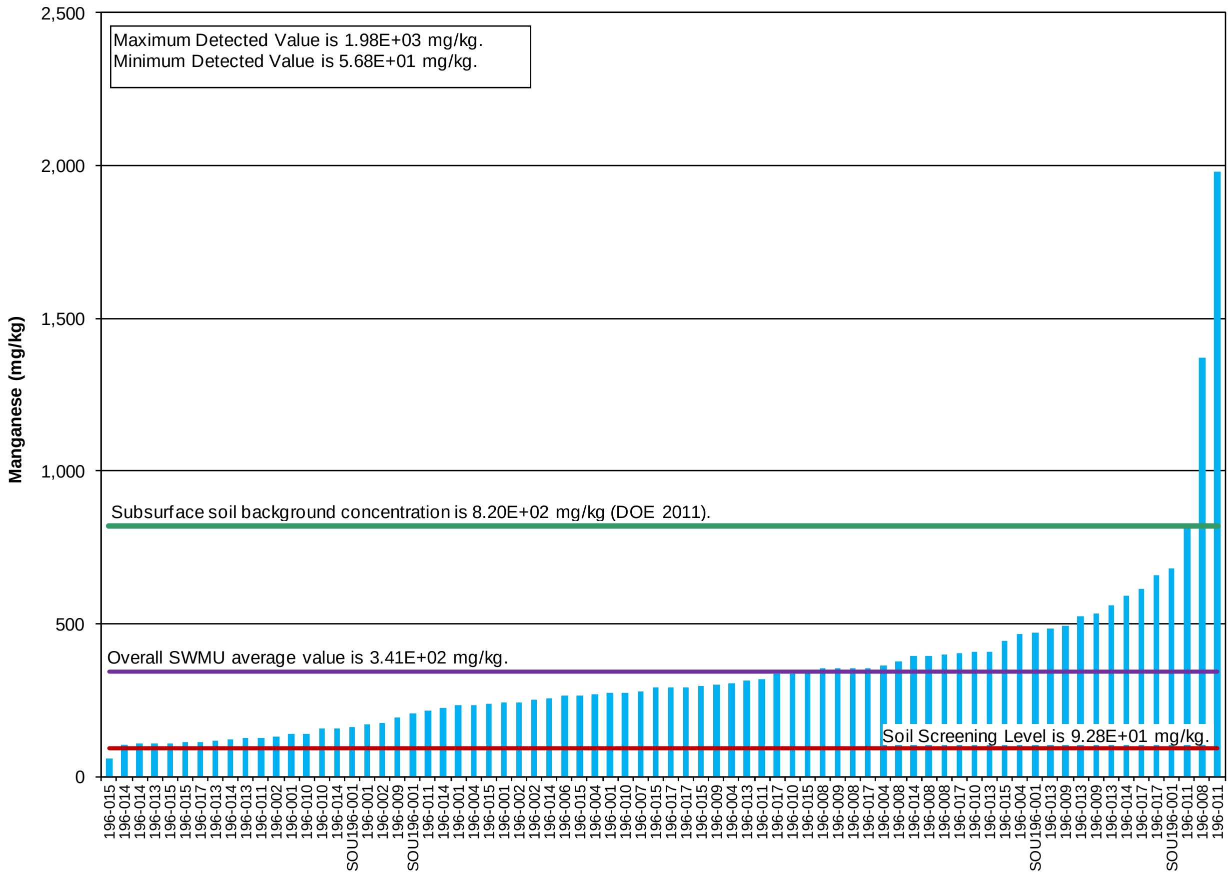

Figure C4.1.3.6. Manganese Detections at SWMU 196

Nickel was detected in 75 of 76 samples. A plot of the detected samples is shown in Figure C4.1.3.7. The average over SWMU 196 for nickel is less than the RG SSL value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Six samples were detected at a concentration greater than the RG SSL; however, a hot spot evaluation was not performed because nickel is being modeled at SWMU 14—the location with the highest average concentration of nickel in any SWMU.

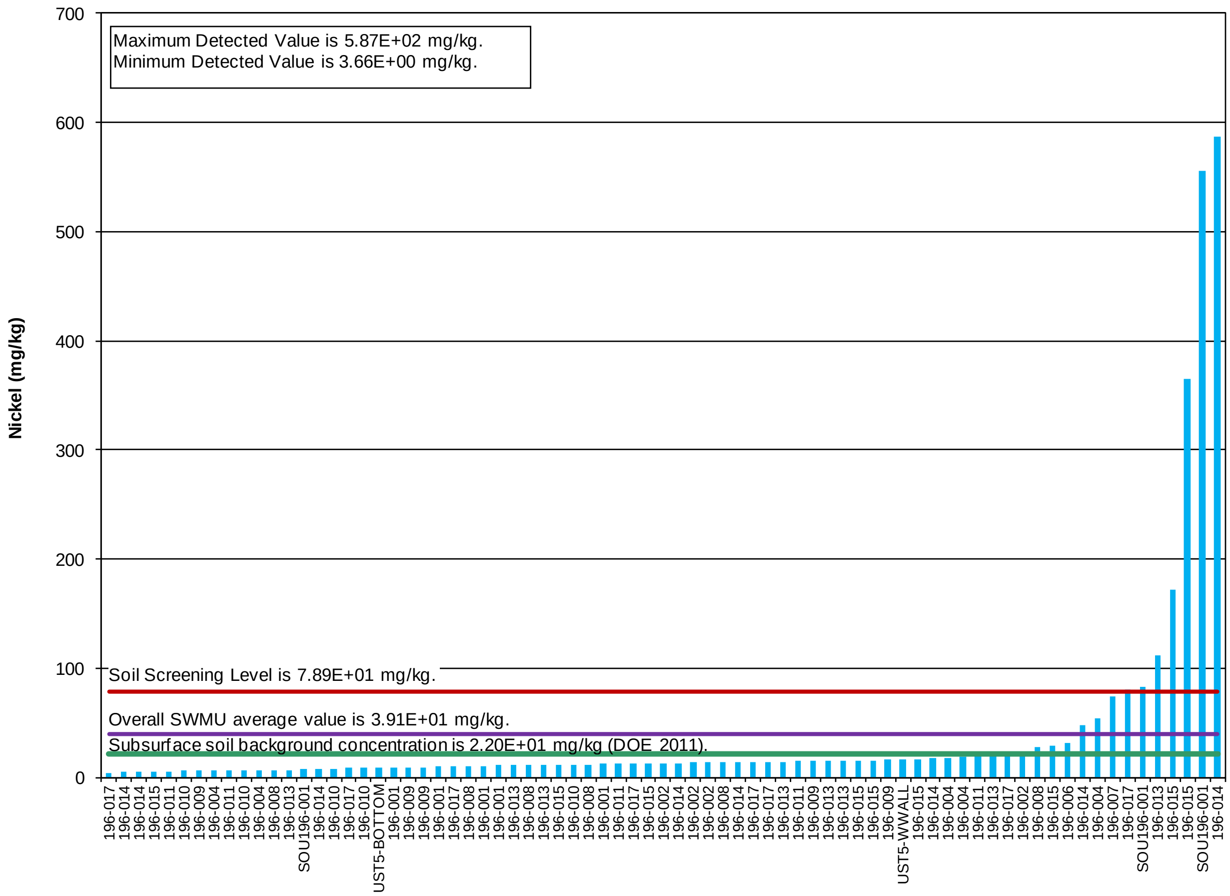

Figure C4.1.3.7. Nickel Detections at SWMU 196

Selenium was detected in 50 of 82 samples. A plot of the detected samples is shown in Figure C4.1.3.8. The average over SWMU 196 for selenium is less than the RG SSL value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only 1 sample was detected at a concentration greater than the RG SSL; therefore, a hot spot evaluation was not performed.

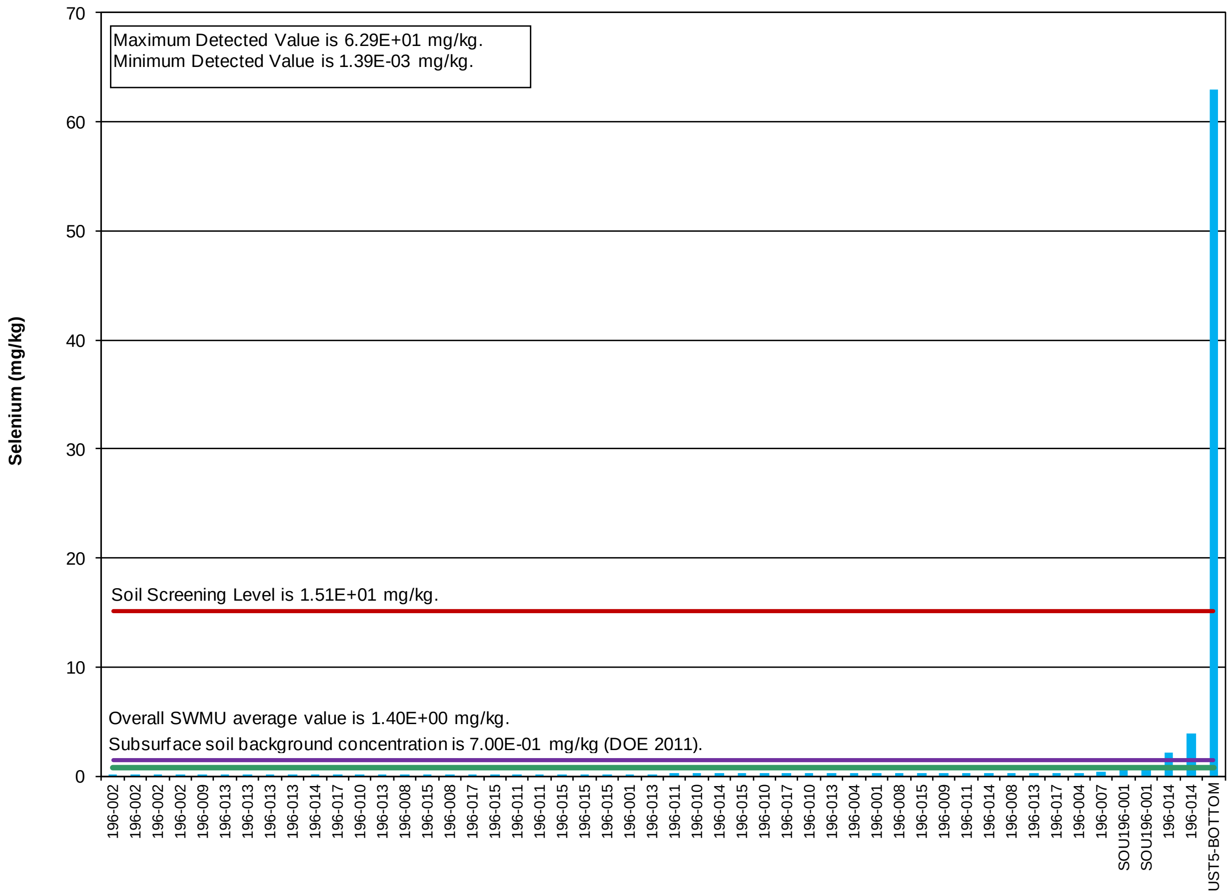

Figure C4.1.3.8. Selenium Detections at SWMU 196

Silver was detected in 18 of 82 samples. A plot of the detected samples is shown in Figure C4.1.3.9. The average over SWMU 196 for silver is less than background and the RG SSL value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One value was detected at a concentration greater than subsurface background, but 1 exceedance does not necessitate a hot spot evaluation.

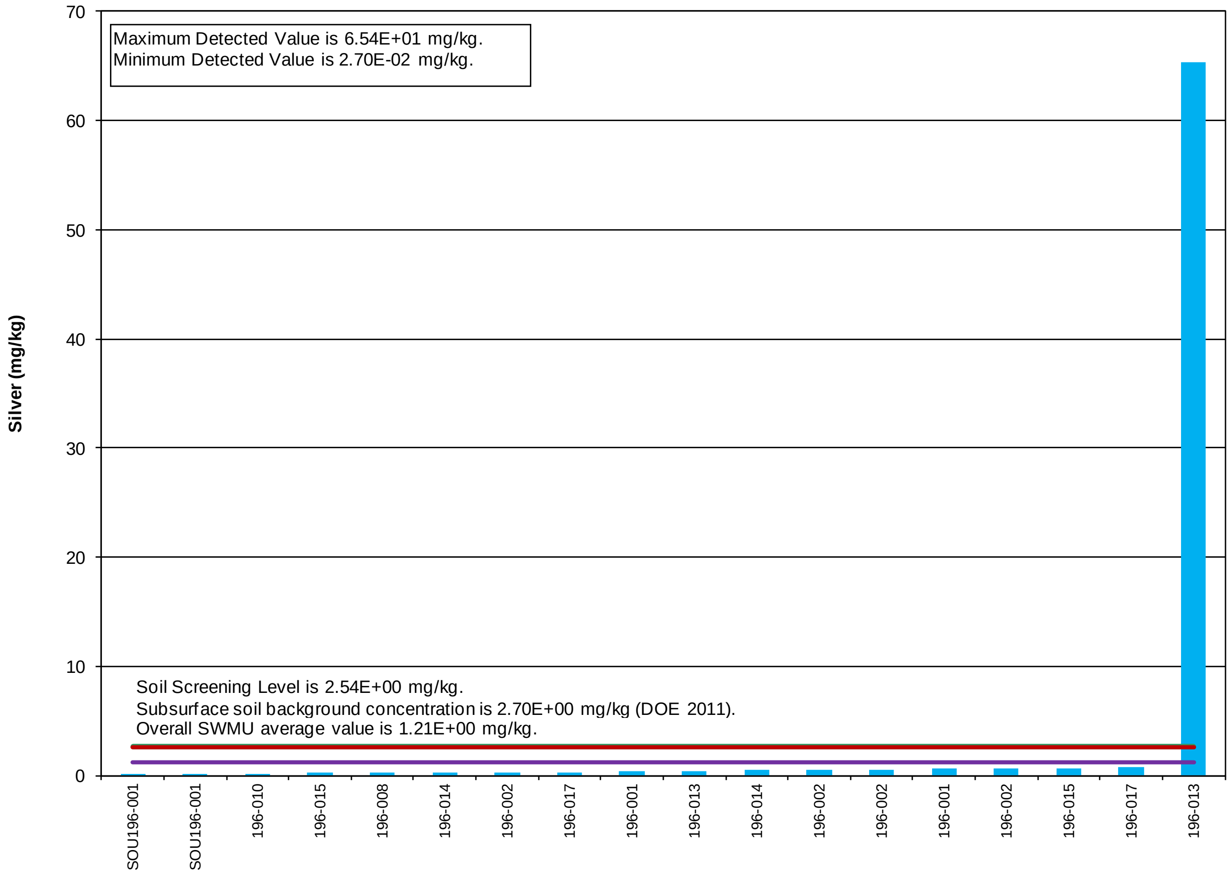

Figure C4.1.3.9. Silver Detections at SWMU 196

Thallium was detected in 10 of 72 samples. A plot of the detected samples is shown in Figure C4.1.3.10. The average over SWMU 196 for thallium is less than the RG SSL value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although 1 value was detected at a concentration greater than subsurface background, 1 exceedance does not necessitate a hot spot evaluation.

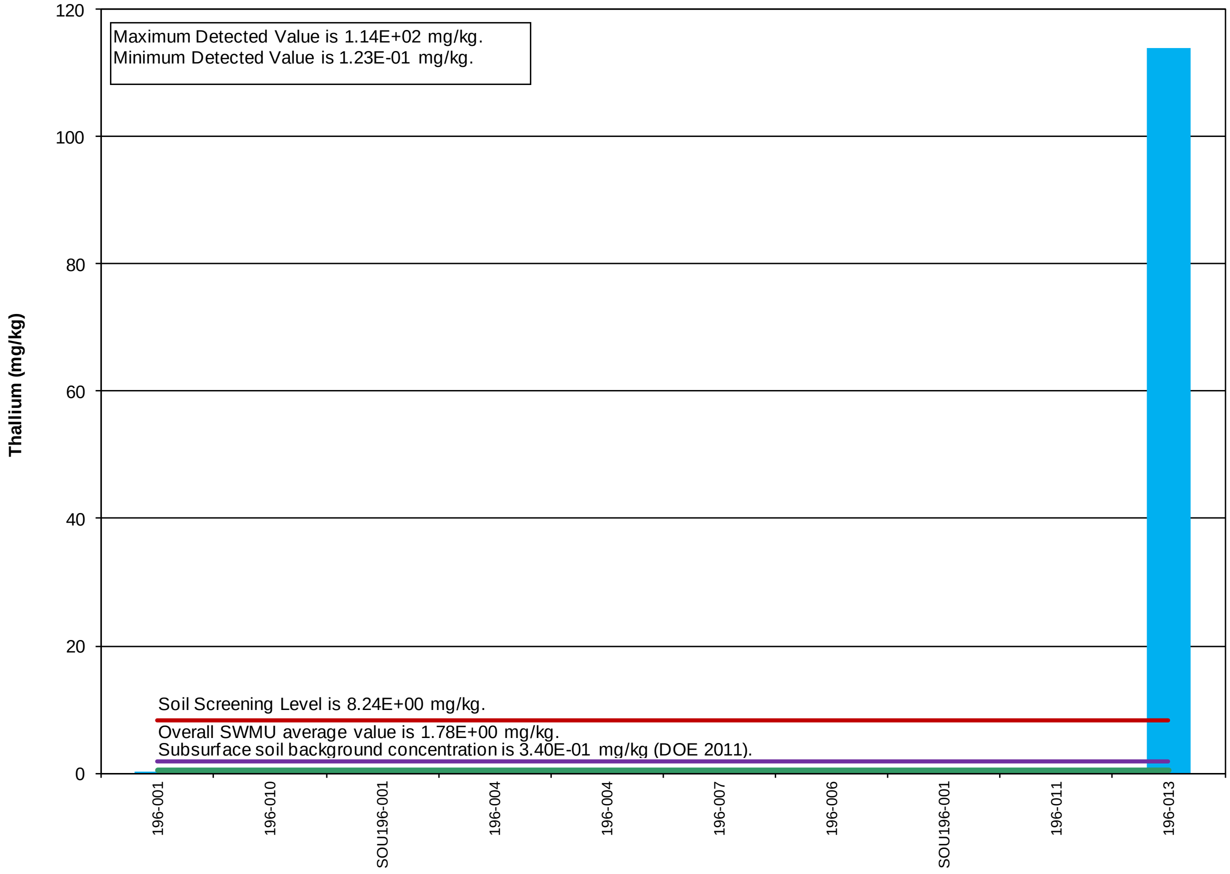

Figure C4.1.3.10. Thallium Detections at SWMU 196

Vanadium was detected in 72 of 72 samples. A plot of the detected samples is shown in Figure C4.1.3.11. The average over SWMU 196 for vanadium is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although 2 samples were detected at a concentration greater than subsurface background, 2 exceedances do not require a hot spot evaluation.

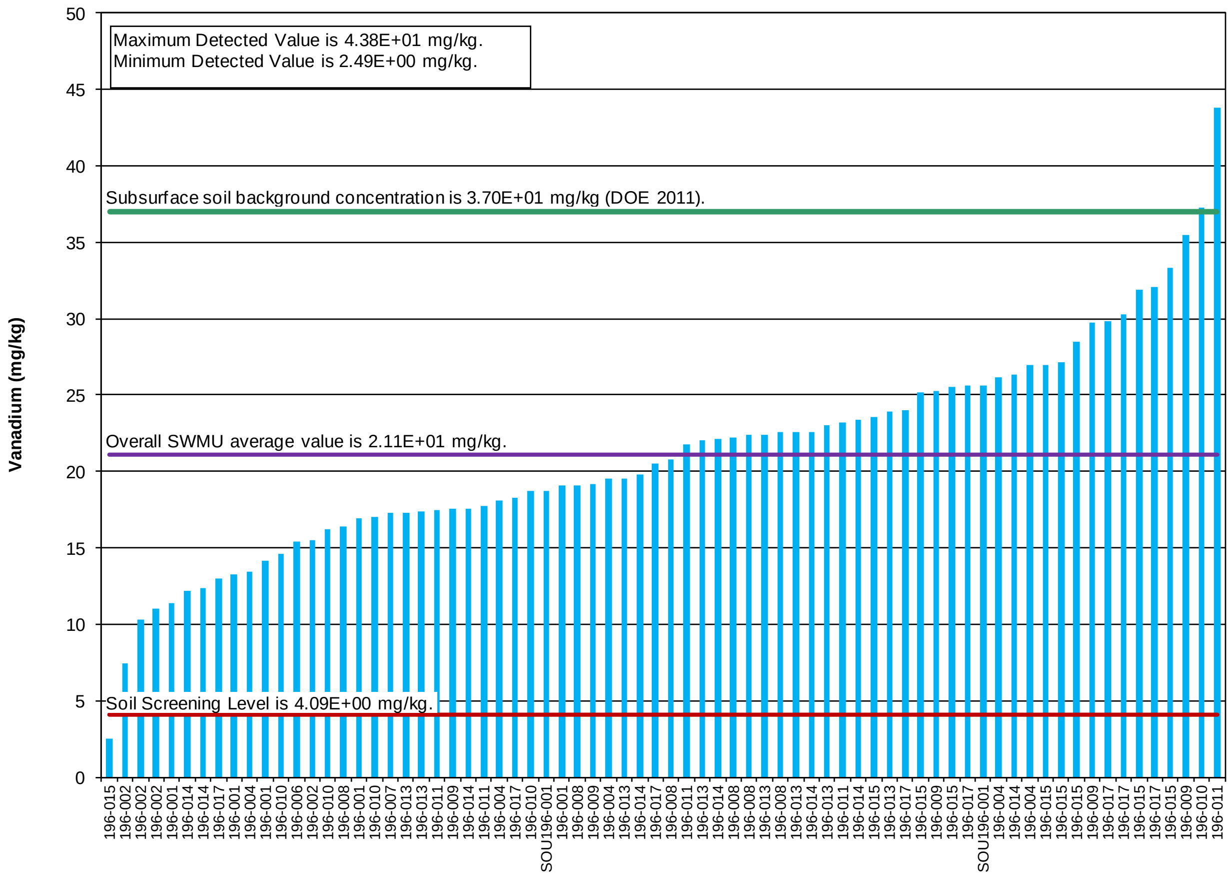

Figure C4.1.3.11. Vanadium Detections at SWMU 196

Zinc was detected in 76 of 76 samples. A plot of the detected samples is shown in Figure C4.1.3.12. The average over SWMU 196 for zinc is less than the RG SSL value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only 1 sample was detected at a concentration greater than the RG SSL; therefore, a hot spot evaluation was not performed.

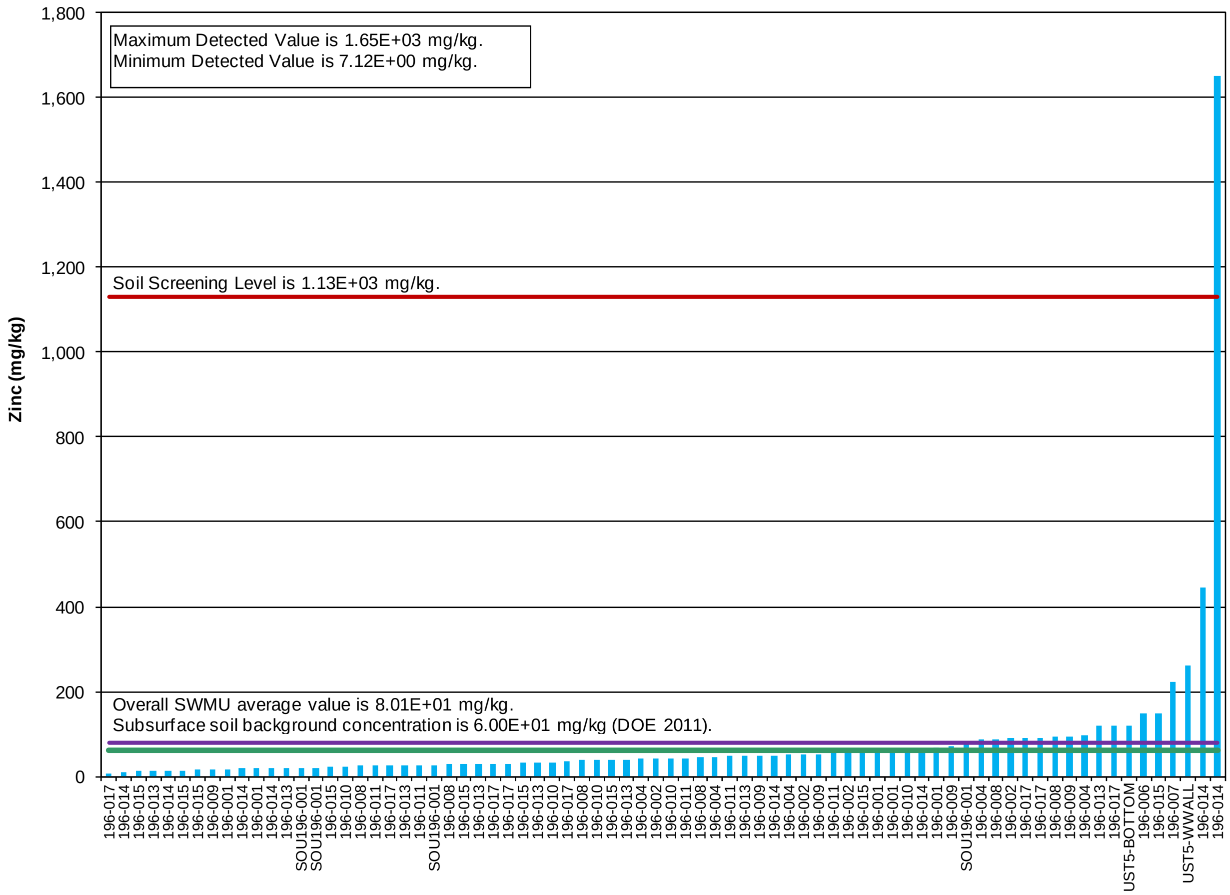

Figure C4.1.3.12. Zinc Detections at SWMU 196

C4.1.4 SWMU 489, C-710 NORTH SEPTIC TANK, NORTH OF C-710

Data for SWMU 489 consisted of both historical and RI-collected data. SWMU 489 exceedances of the RG SSL include cobalt, iron, manganese, nickel, and vanadium; however, only nickel had an average concentration that exceeded the background levels. This analysis is summarized in the following chart.

Nickel was detected in four of five samples. A plot of the detected samples is shown in Figure C4.1.4.1. The average over SWMU 489 for nickel is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only one sample was detected at a concentration greater than the RG SSL, but one exceedance does not require a hot spot evaluation.

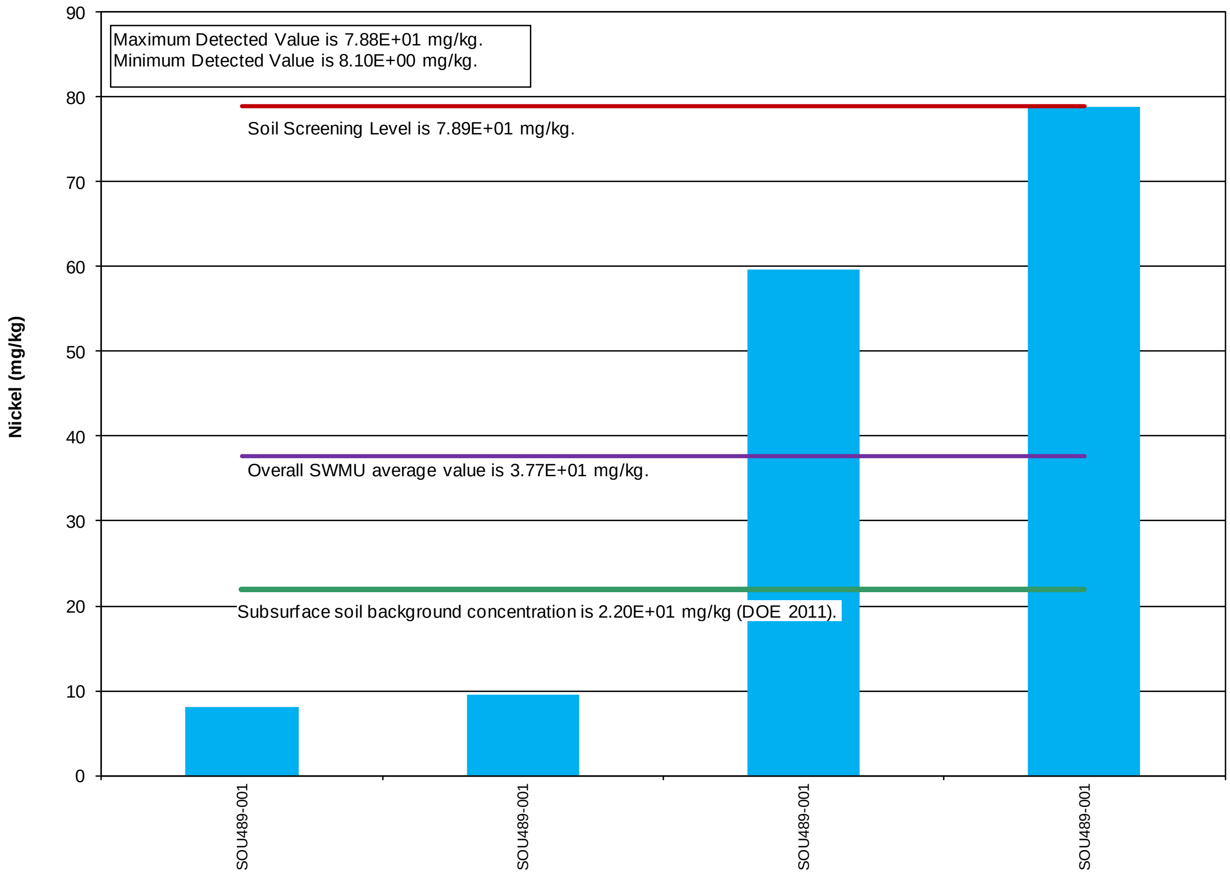

Figure C4.1.4.1. Nickel Detections at SWMU 489

C4.1.5 SWMU 531, C-746-A SOUTH ALUMINUM SLAG REACTING AREA

Data for SWMU 531 consisted of both historical and RI-collected data. SWMU 531 exceedances of the RG SSL include arsenic, iron, manganese, nickel, vanadium, zinc; however, cobalt and vanadium concentrations are below background. The data analyses are summarized in the following charts.

Arsenic was detected in 9 of 16 samples. A plot of the detected samples is shown in Figure C4.1.5.1. The average over SWMU 531 for arsenic is less than the RG SSL value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only 2 samples were detected at a concentration greater than the RG SSL; therefore, hot spot evaluation was not performed.

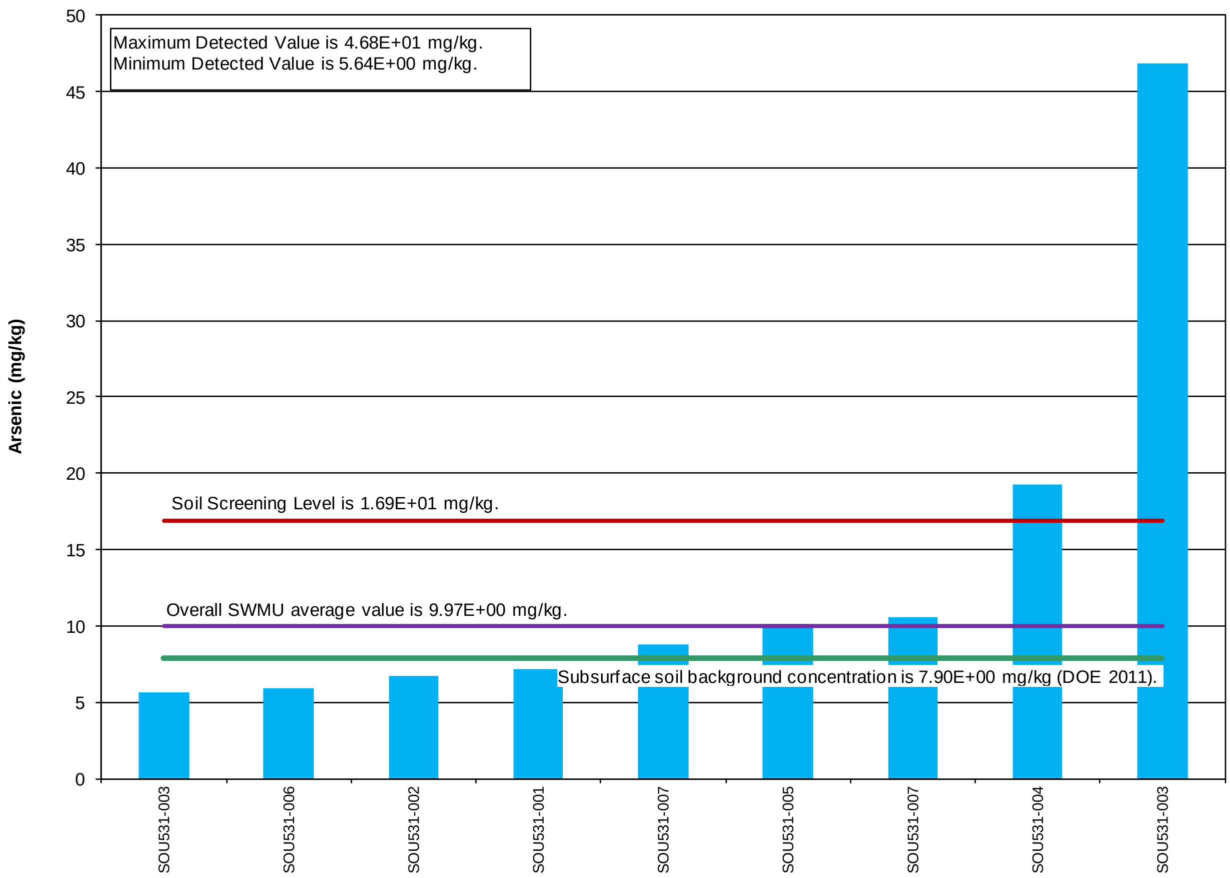

Figure C4.1.5.1. Arsenic Detections at SWMU 531

Iron was detected in 16 of 16 samples. A plot of the detected samples is shown in Figure C4.1.5.2. The average over SWMU 531 for iron is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although 1 sample was detected at a concentration greater than background, 1 exceedance does not require a hot spot evaluation.

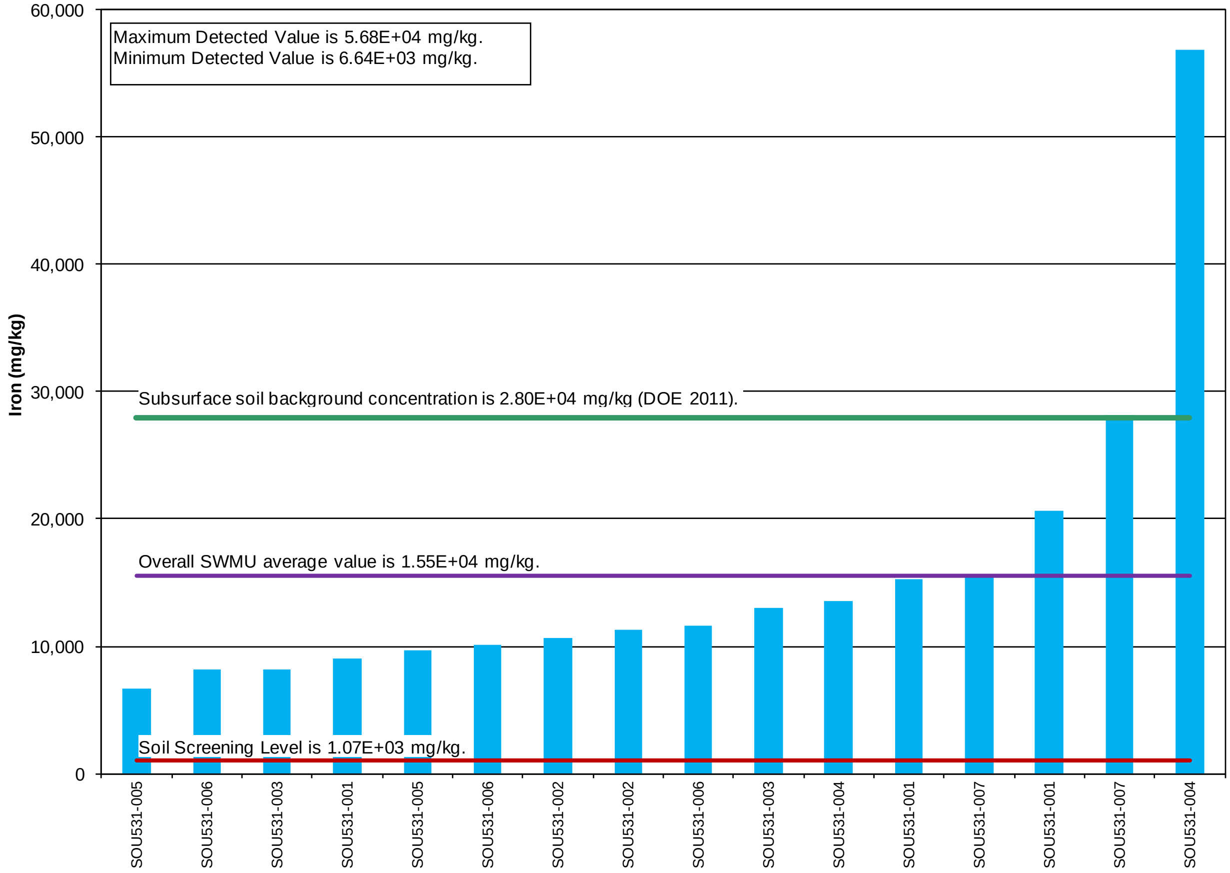

Figure C4.1.5.2. Iron Detections at SWMU 531

Manganese was detected in 16 of 16 samples. A plot of the detected samples is shown in Figure C4.1.5.3. The average over SWMU 531 for manganese is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although 1 sample was detected at a concentration greater than background, 1 exceedance does not require a hot spot evaluation.

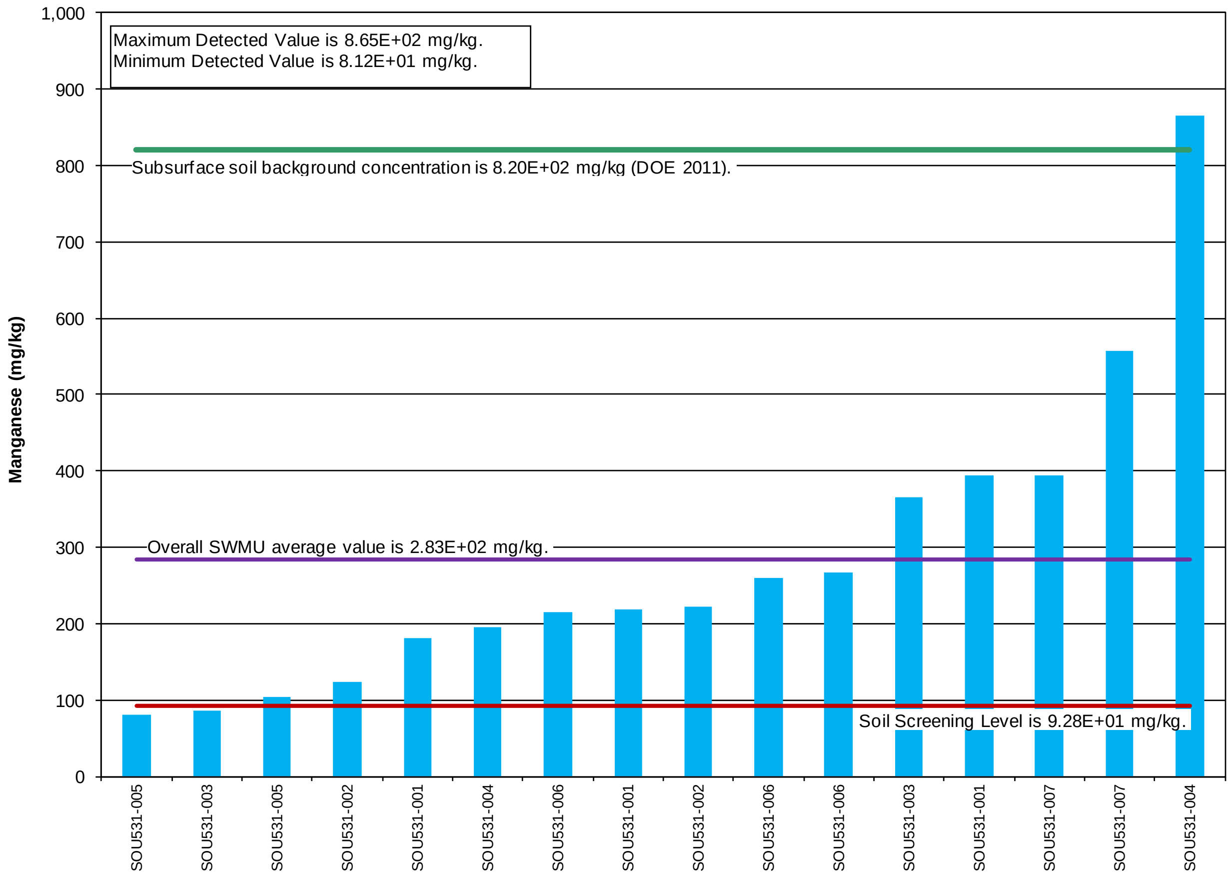

Figure C4.1.5.3. Manganese Detections at SWMU 531

Nickel was detected in 8 of 16 samples. A plot of the detected samples is shown in Figure C4.1.5.4. The average over SWMU 531 for nickel is less than the RG SSL value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Four samples were detected at a concentration greater than the RG SSL; however, a hot spot evaluation was not performed because nickel is being modeled at SWMU 14—the location with the highest average concentration of nickel in any SWMU.

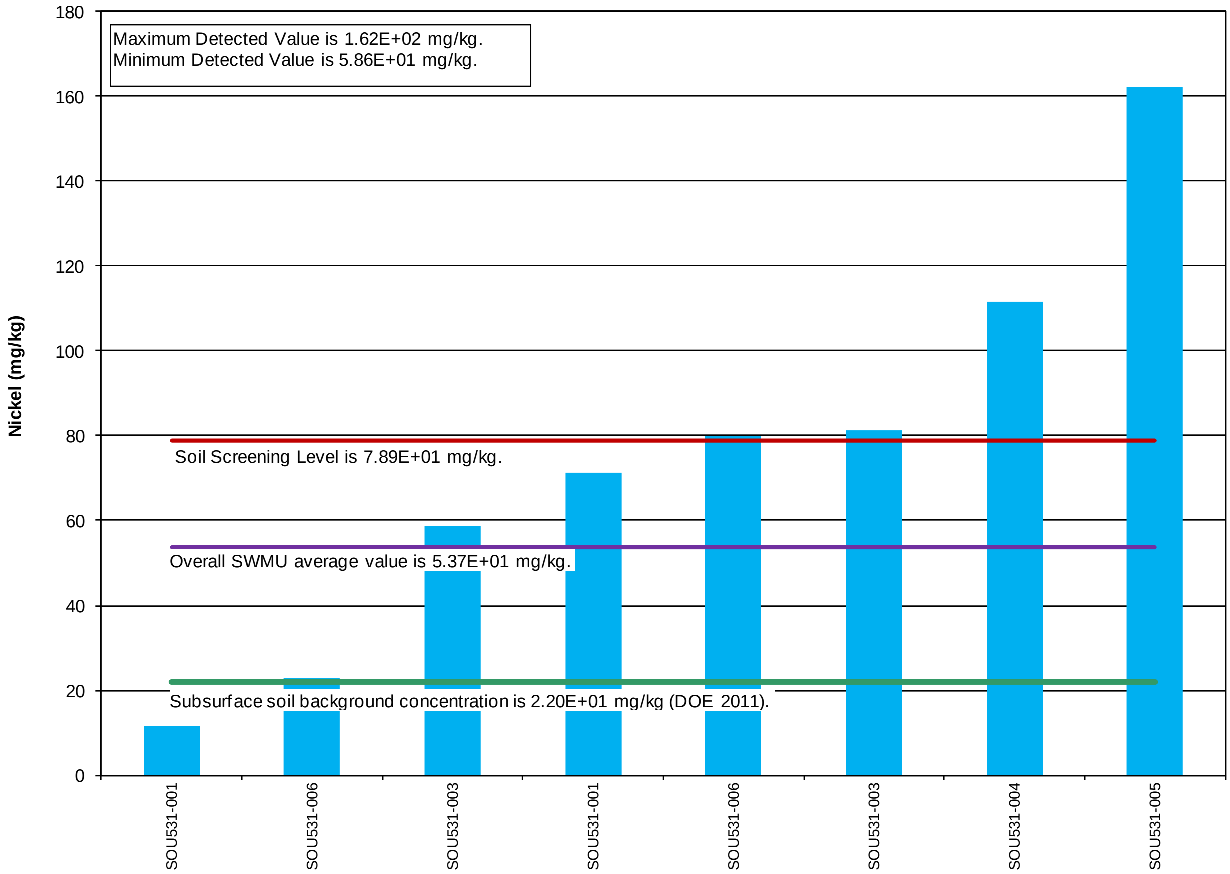

Figure C4.1.5.4. Nickel Detections at SWMU 531

Zinc was detected in 16 of 16 samples. A plot of the detected samples is shown in Figure C4.1.5.5. The average over SWMU 531 for zinc is less than the RG SSL value; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although 6 samples were detected at a concentration greater than the RG SSL, zinc was not identified as a COC in the groundwater plumes associated with PGDP; therefore, hot spot evaluation was not performed.

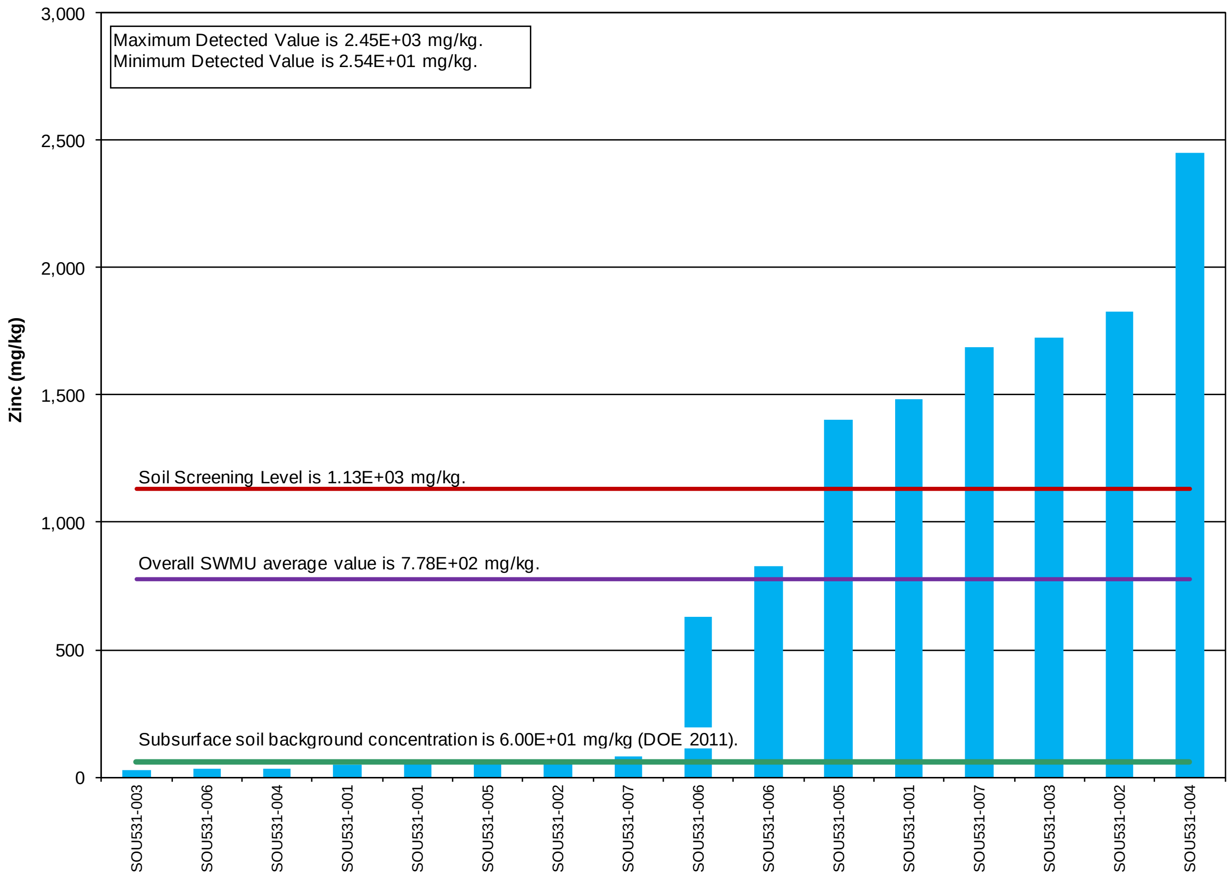

Figure C4.1.5.5. Zinc Detections at SWMU 531

C4.2. GROUP 1, STORAGE AREAS

C4.2.1 SWMU 200, CENTRAL PGDP SOIL CONTAMINATION SOUTH OF TSCA WASTE STORAGE FACILITY

Data for SWMU 200 consisted of both historical and RI data. SWMU 200 exceedances of the RG SSL include cobalt, iron, manganese, mercury, nickel, silver, and vanadium; however, cobalt, iron, and vanadium are below background. The data analysis summaries are shown in the following charts.

Manganese was detected in 69 of 69 samples. A plot of the detected samples is shown in Figure C4.1.1-1. The average over SWMU 200 for manganese is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One sample was detected at a concentration greater than subsurface background, but 1 exceedance does not necessitate a hot spot evaluation.

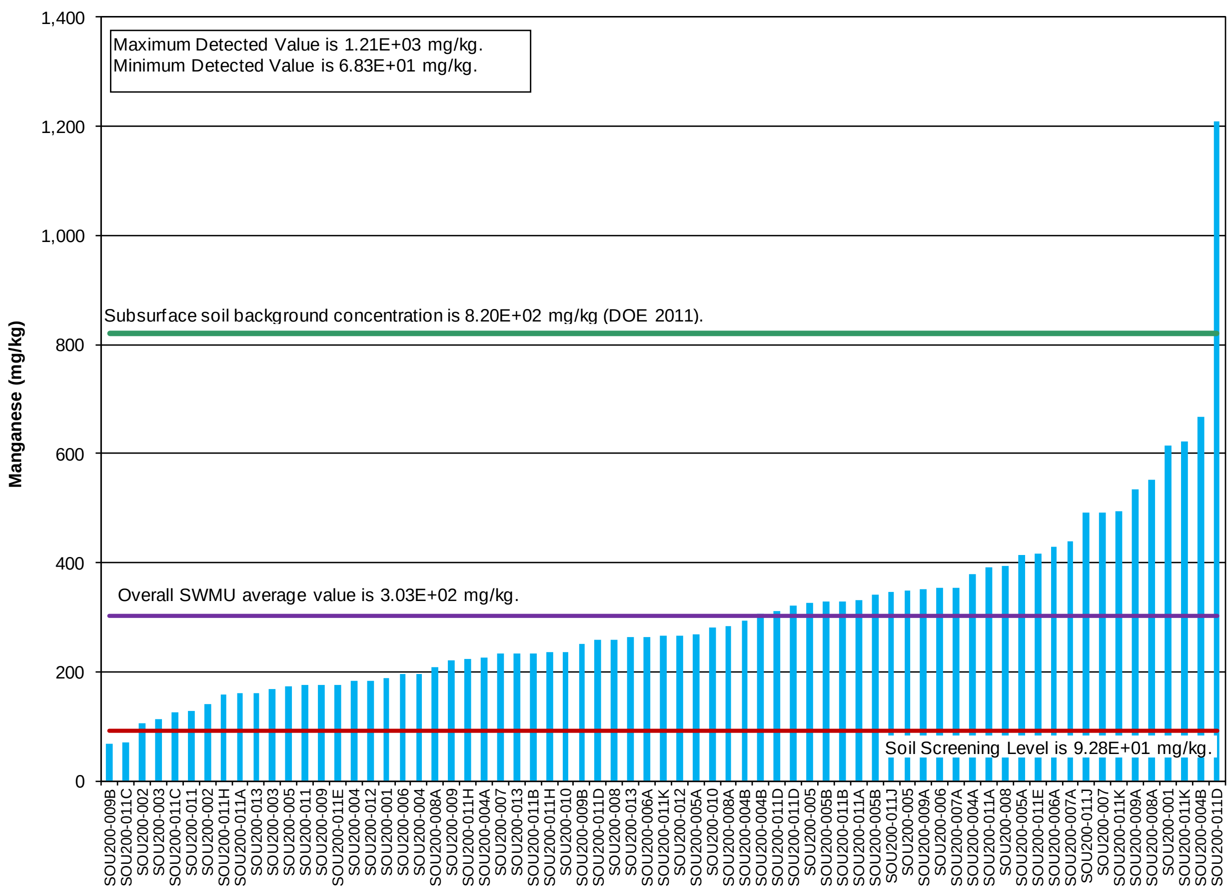

Figure C4.2.1.1. Manganese Detections at SWMU 200

Mercury was detected in 8 of 69 samples. A plot of the detected samples is shown in Figure C4.2.1.2. The average over SWMU 200 for mercury is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Two samples were detected at a concentration greater than the RG SSL, but 2 samples do not necessitate a hot spot evaluation.

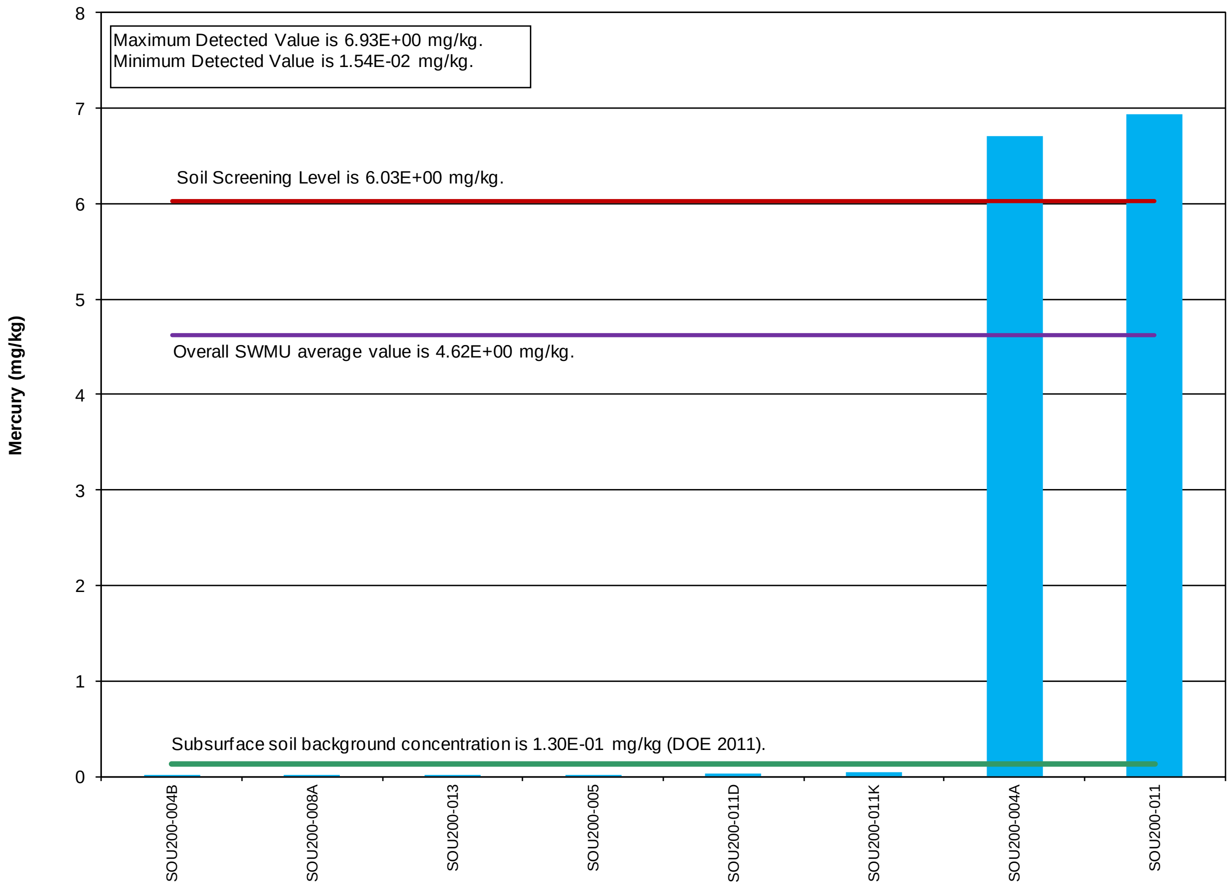

Figure C4.2.1.2. Mercury Detections at SWMU 200

Nickel was detected in 25 of 69 samples. A plot of the detected samples is shown in Figure C4.2.1.3. The average over SWMU 200 for nickel is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Nine samples were detected at a concentration greater than the RG SSL; however, a hot spot evaluation was not performed because nickel is being modeled at SWMU 14—the location with the highest average concentration of nickel in any SWMU.

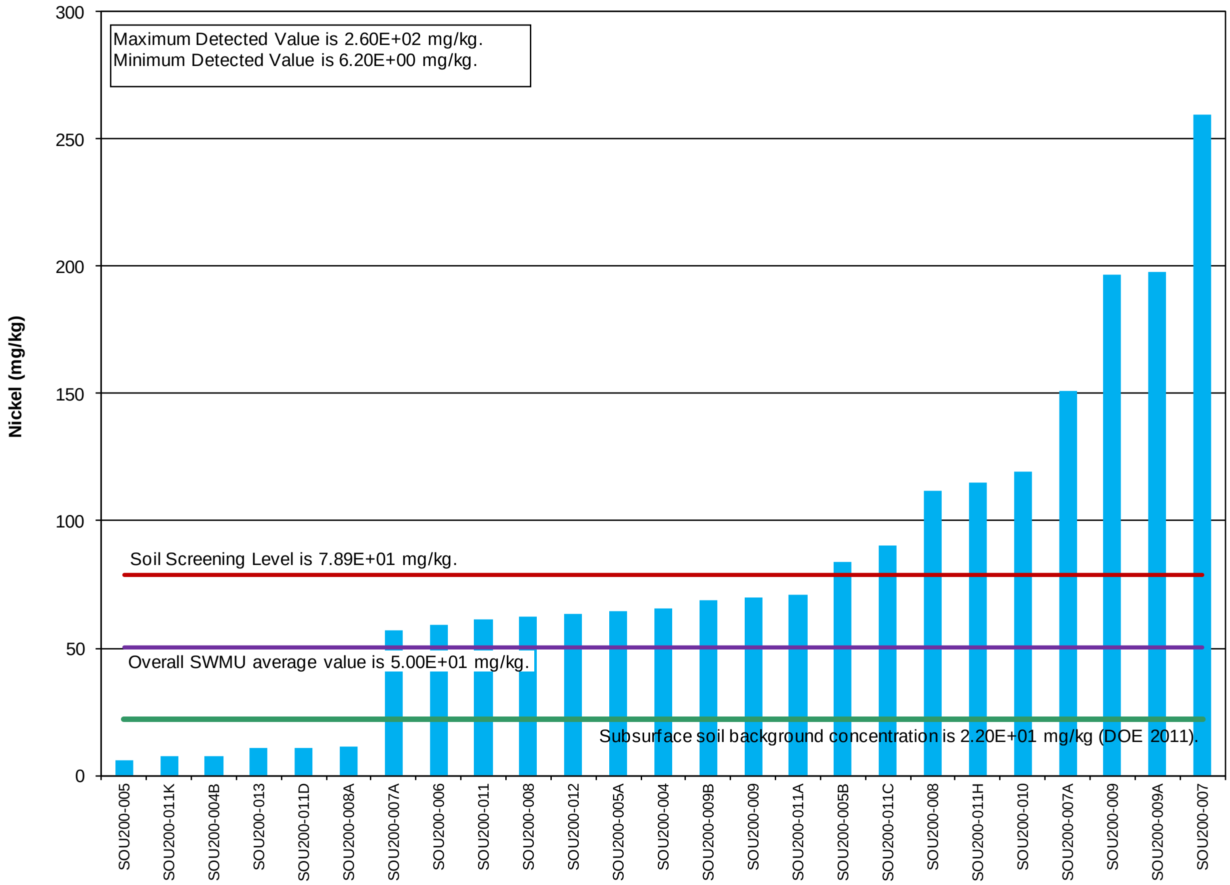

Figure C4.2.1.3. Nickel Detections at SWMU 200

Silver was detected in 7 of 69 samples. A plot of the detected samples is shown in Figure C4.2.1.4. The average over SWMU 200 for silver is greater than the RG SSL and background. Silver was evaluated as part of the GWOU FS and identified as a COC in the groundwater plumes associated with PGDP (DOE 2001d). There is no evidence of RGA impacts due to silver; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One sample was detected at a concentration greater than subsurface background but 1 exceedance does not necessitate a hot spot evaluation.

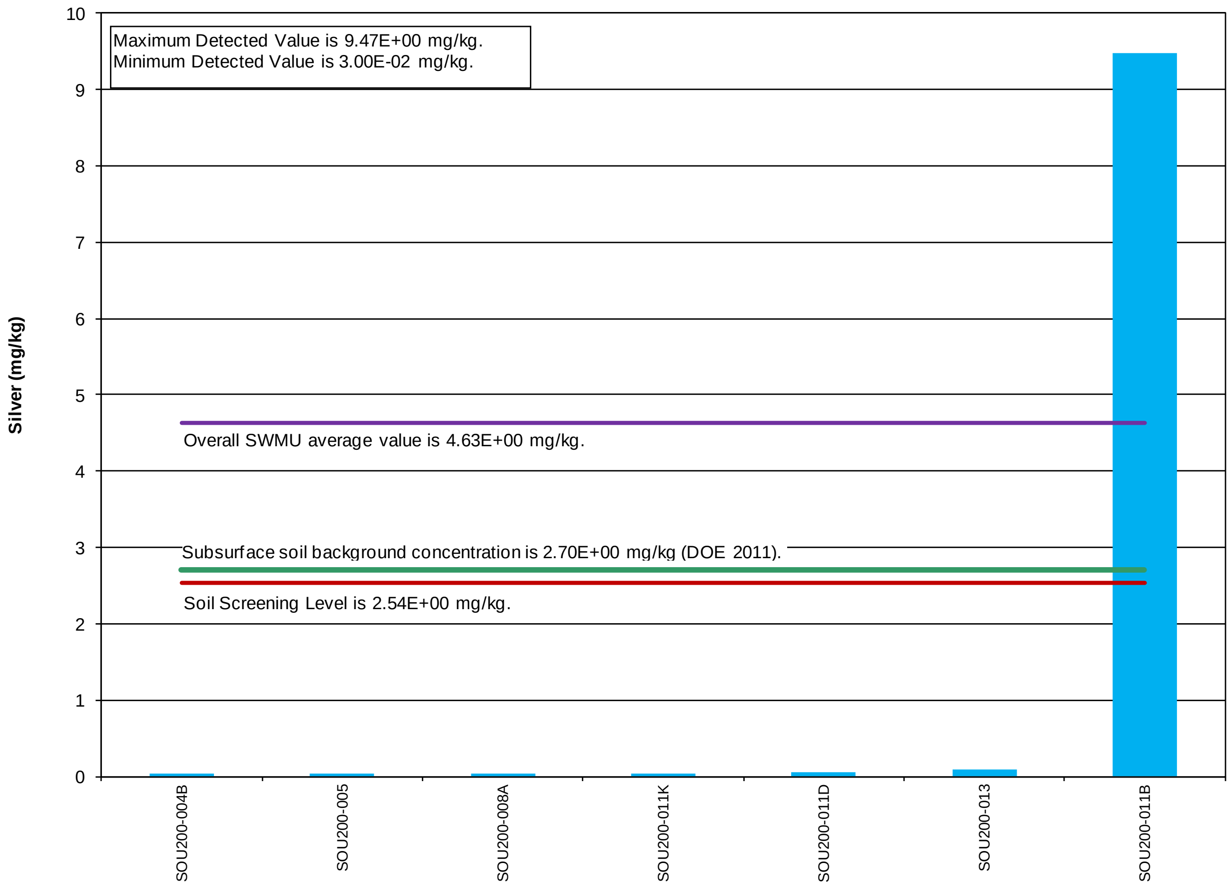

Figure C4.2.1.4. Silver Detections at SWMU 200

C4.2.2 SWMU 212, C-745-A RADIOLOGICAL CONTAMINATION AREA

Data for SWMU 212 consisted of both historical and RI data. SWMU 212 exceedances of the RG SSL include cobalt, iron, manganese, mercury, nickel, silver, vanadium, and plutonium 239/240. The data analysis summaries are shown in the following charts.

Cobalt was detected in eight of eight samples. A plot of the detected samples is shown in Figure C4.2.2.1. The average over SWMU 212 for cobalt is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One sample was detected at a concentration greater than background, but one exceedance does not require a hot spot evaluation.

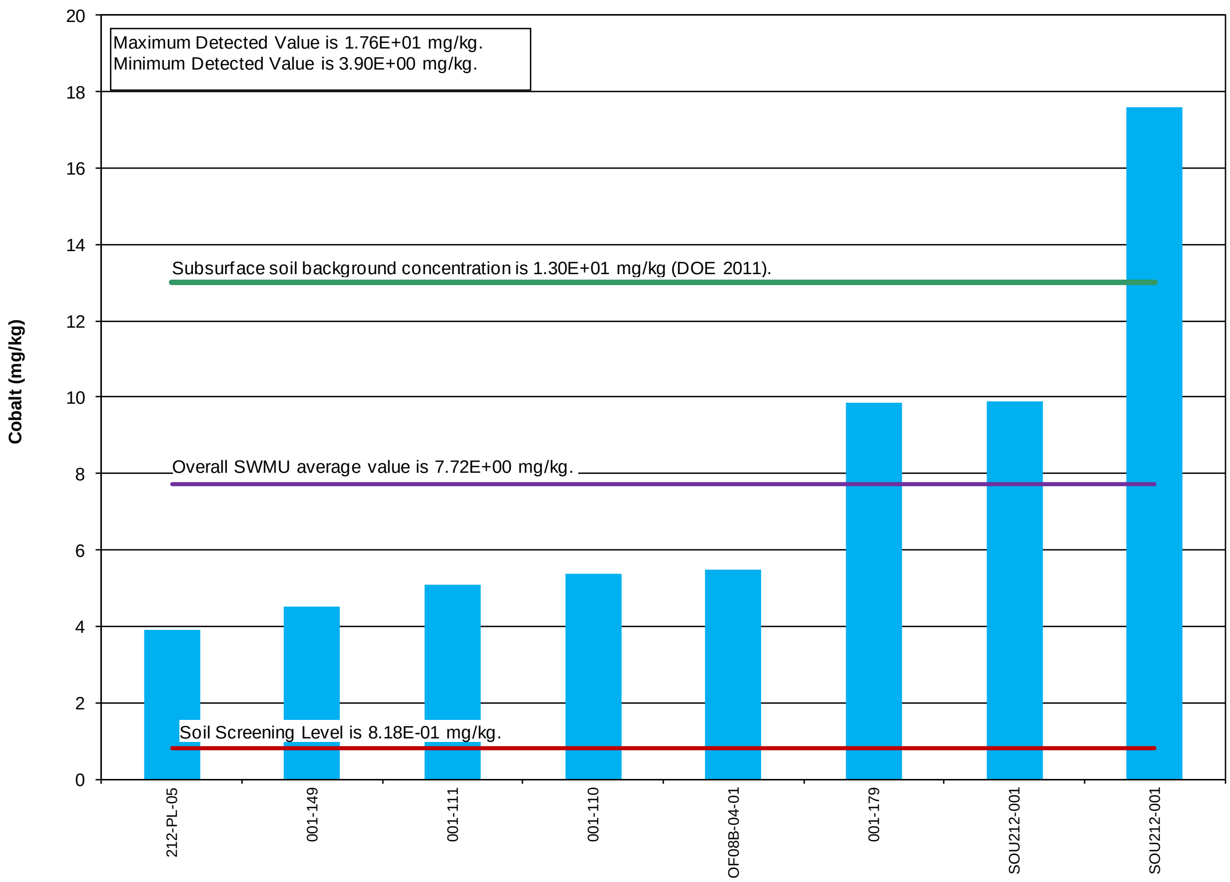

Figure C4.2.2.1. Cobalt Detections at SWMU 212

Iron was detected in 21 of 21 samples. A plot of the detected samples is shown in Figure C4.2.2.2. The average over SWMU 212 for iron is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Five samples were detected at a concentration greater than subsurface background. Iron is ubiquitous, and the concentrations in the RGA are controlled by geochemical factors; therefore, a hot spot evaluation was not performed.

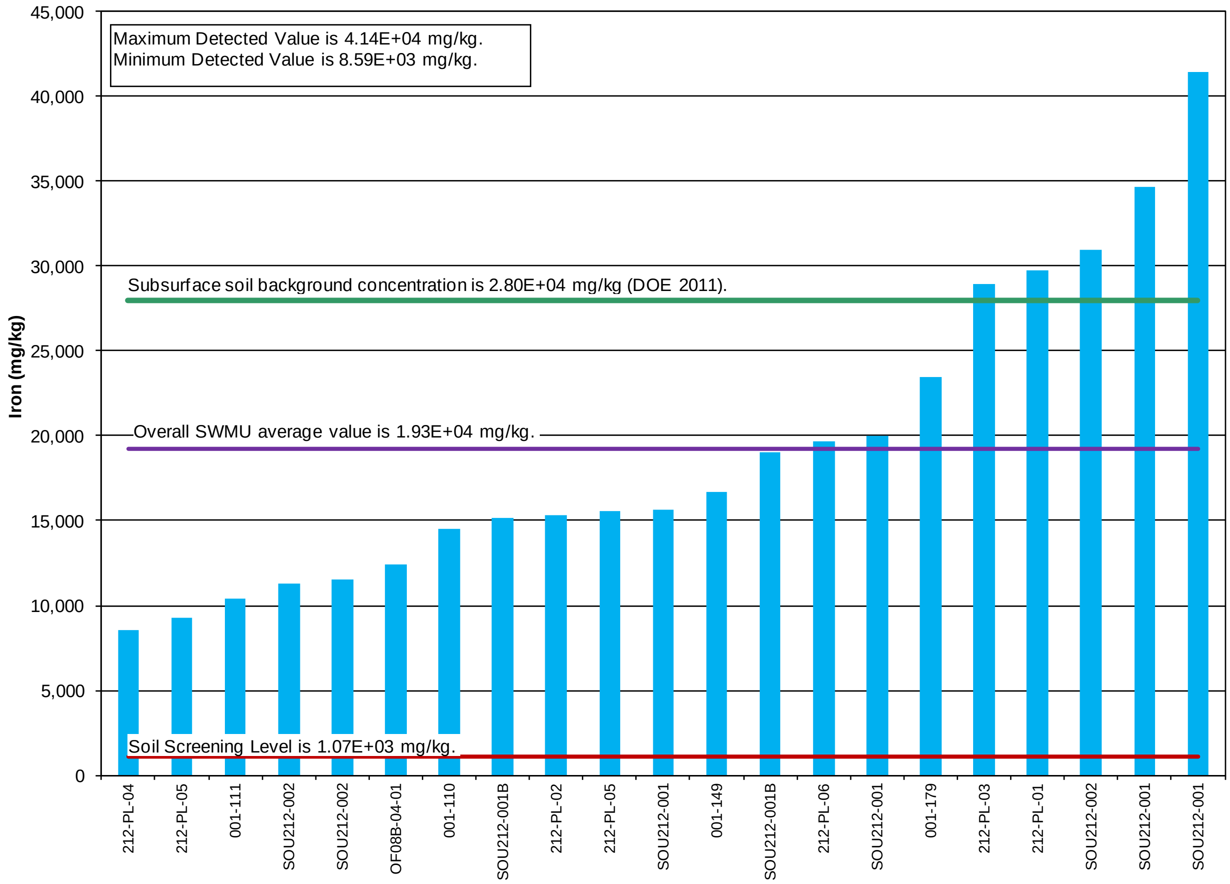

Figure C4.2.2.2. Iron Detections at SWMU 212

Manganese was detected in 21 of 21 samples. A plot of the detected samples is shown in Figure C4.2.2.3. The average over SWMU 212 for manganese is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One sample was detected at a concentration greater than background, but 1 exceedance does not require a hot spot evaluation.

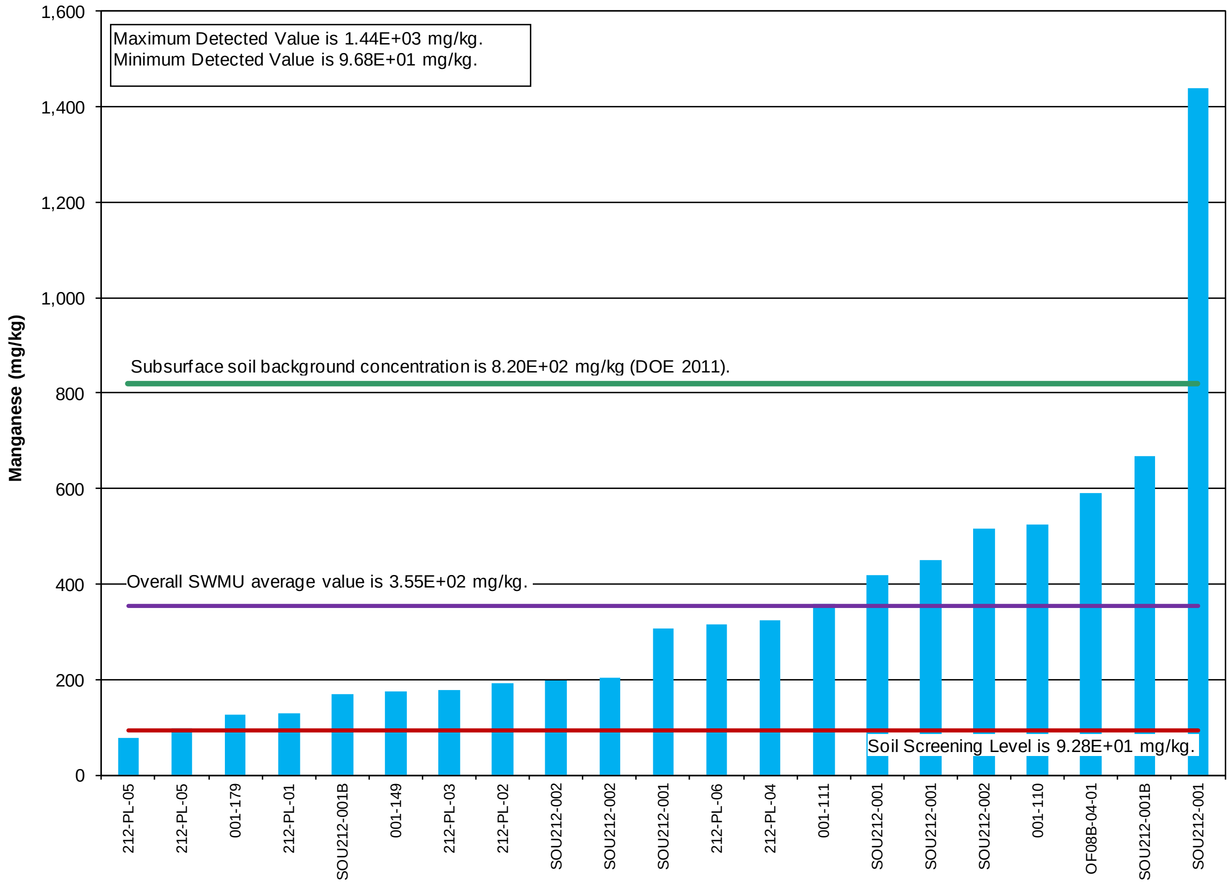

Figure C4.2.2.3. Manganese Detections at SWMU 212

Mercury was detected in 6 of 21 samples. A plot of the detected samples is shown in Figure C4.2.2.4. The average over SWMU 212 for mercury is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One sample was detected at a concentration greater than the RG SSL, but 1 exceedance does not require a hot spot evaluation.

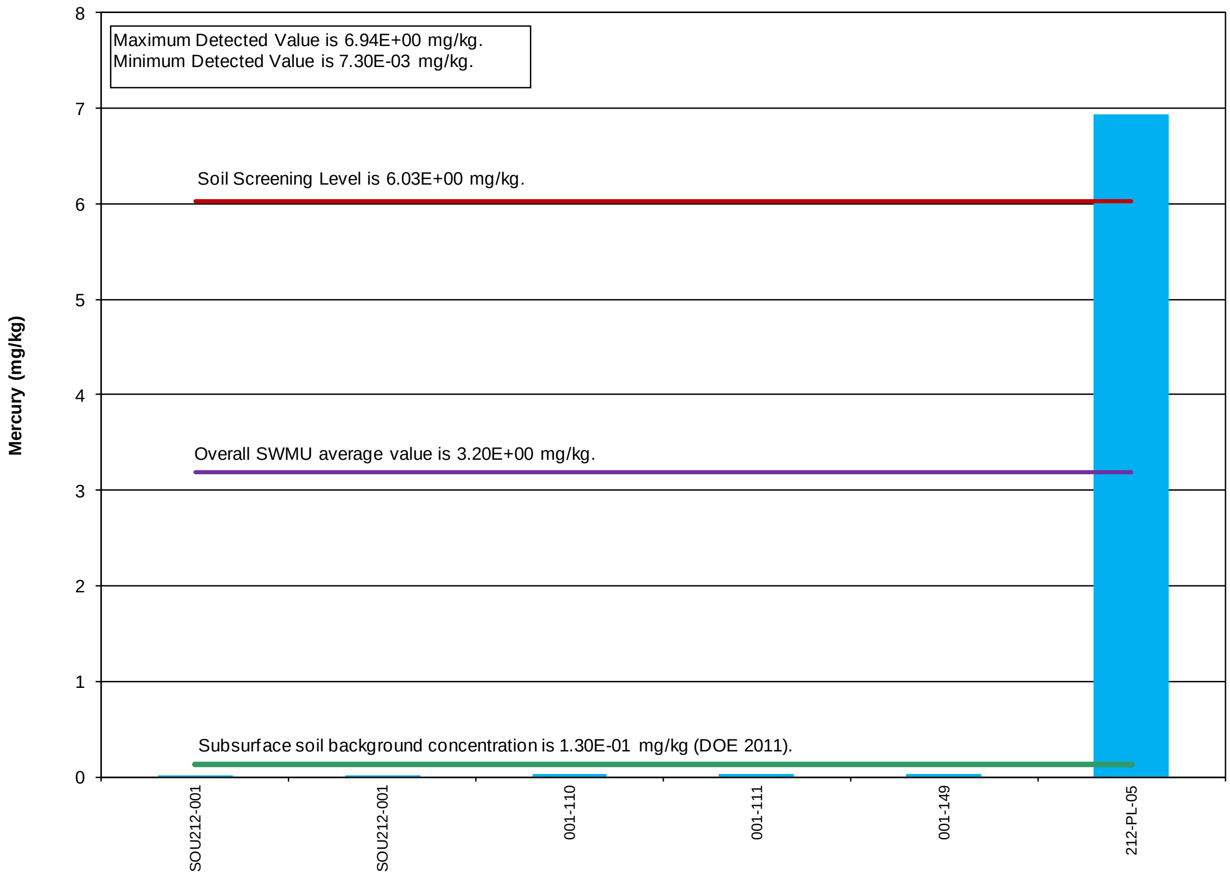

Figure C4.2.2.4. Mercury Detections at SWMU 212

Nickel was detected in 10 of 21 samples. A plot of the detected samples is shown in Figure C4.2.2.5. The average over SWMU 212 for nickel is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only 1 sample was detected at a concentration greater than the RG SSL; therefore, a hot spot evaluation was not performed.

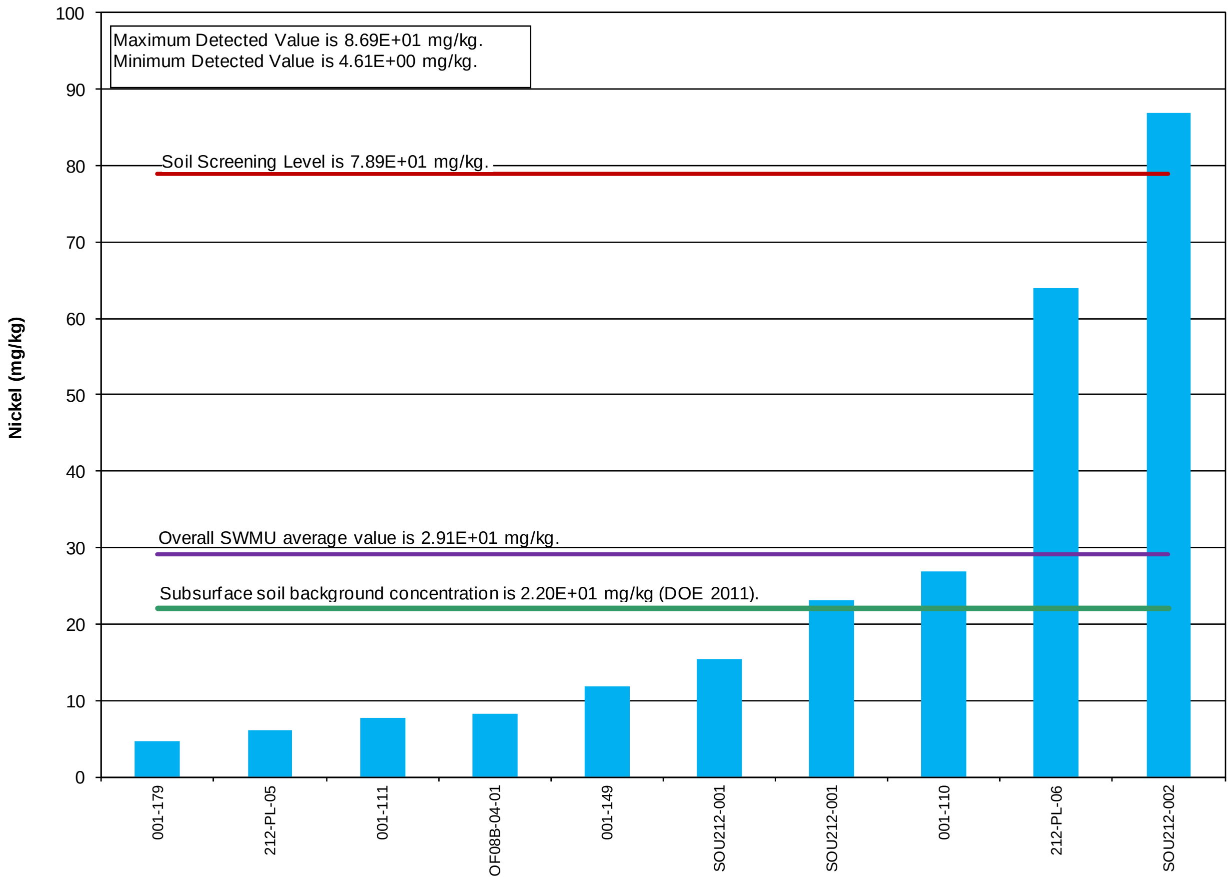

Figure C4.2.2.5. Nickel Detections at SWMU 212

Silver was detected in 6 of 21 samples. A plot of the detected samples is shown in Figure C4.2.2.6. The average over SWMU 212 for silver is greater than the RG SSL and background. Silver was evaluated as part of the GWOU FS and is a COC in the groundwater plumes associated with PGDP (DOE 2001d). There is no evidence of RGA impacts due to silver; therefore, no hot spot evaluation was performed.

An examination of the individual samples revealed that the three highest concentrations were all from pipeline samples collected from 2 ft bgs from grids 1 and 1A and were analyzed using X-ray fluorescence (XRF). Two of the three samples with the highest concentrations were from grid 1, 212-PL-02 and 212-PL-03. Another pipeline sample collected from grid 1, 212-PL-01, did not have detectable silver. A composite sample from gird 1 collected from 1–4 ft bgs was analyzed using both XRF and SW846-6020. The composite sample analyzed using XRF did not have detectable silver, and the sample analyzed using SW846-6020 had a concentration of 0.051 mg/kg. Because of the discrepancy between the pipeline samples and the composite samples, the results of the pipeline samples from grid 1 were eliminated from the calculation of the average value for the SWMU. Those two samples had reported concentrations of 15.52 mg/kg and 11.16 mg/kg. Without the two highest concentrations, the average for the SWMU is 3.28 mg/kg, which is still slightly higher than both background and the RG SSL. There is no indication of RGA silver impacts; thus, groundwater fate and transport evaluations were not performed.

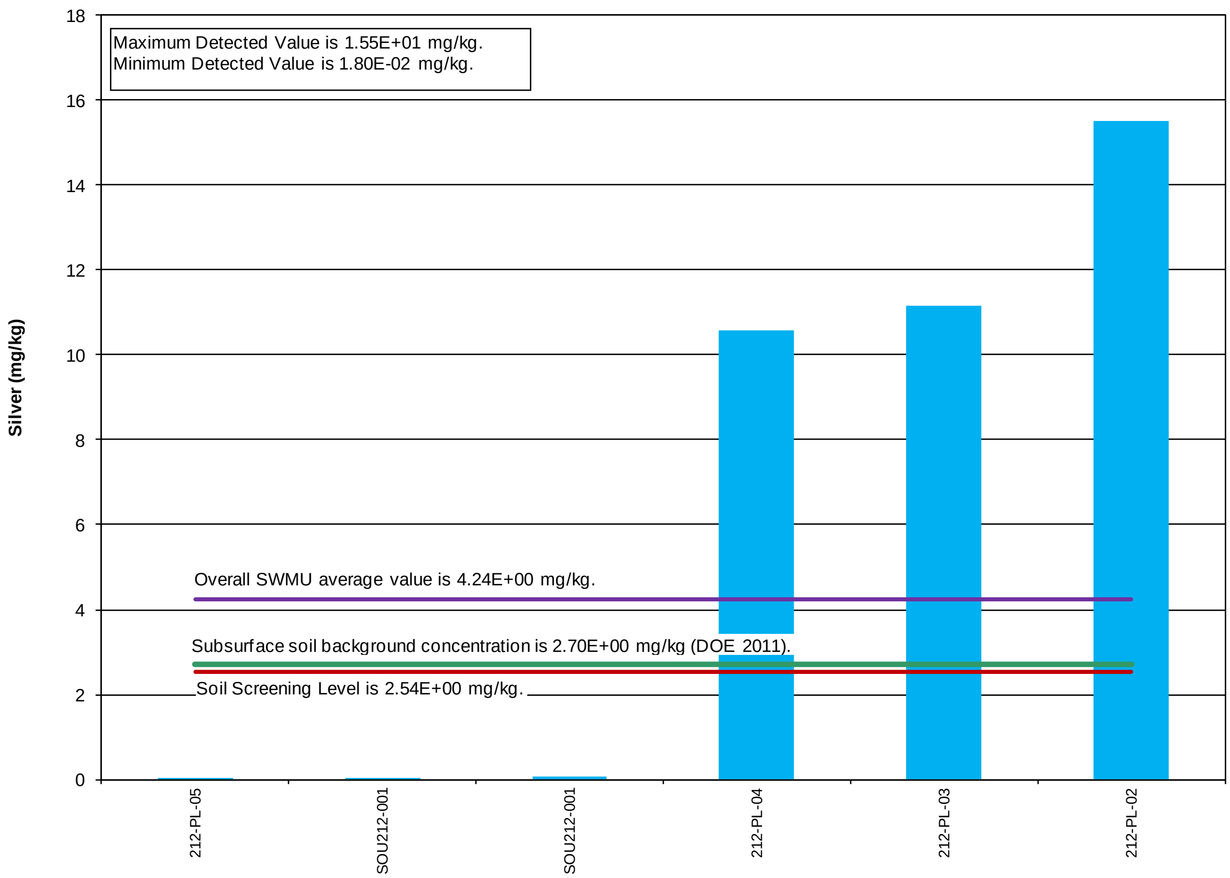

Figure C4.2.2.6. Silver Detections at SWMU 212

Vanadium was detected in eight of eight samples. A plot of the detected samples is shown in Figure C4.2.2.7. The average over SWMU 212 for vanadium is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Two samples were detected at a concentration greater than background, but two exceedances do not necessitate a hot spot evaluation.

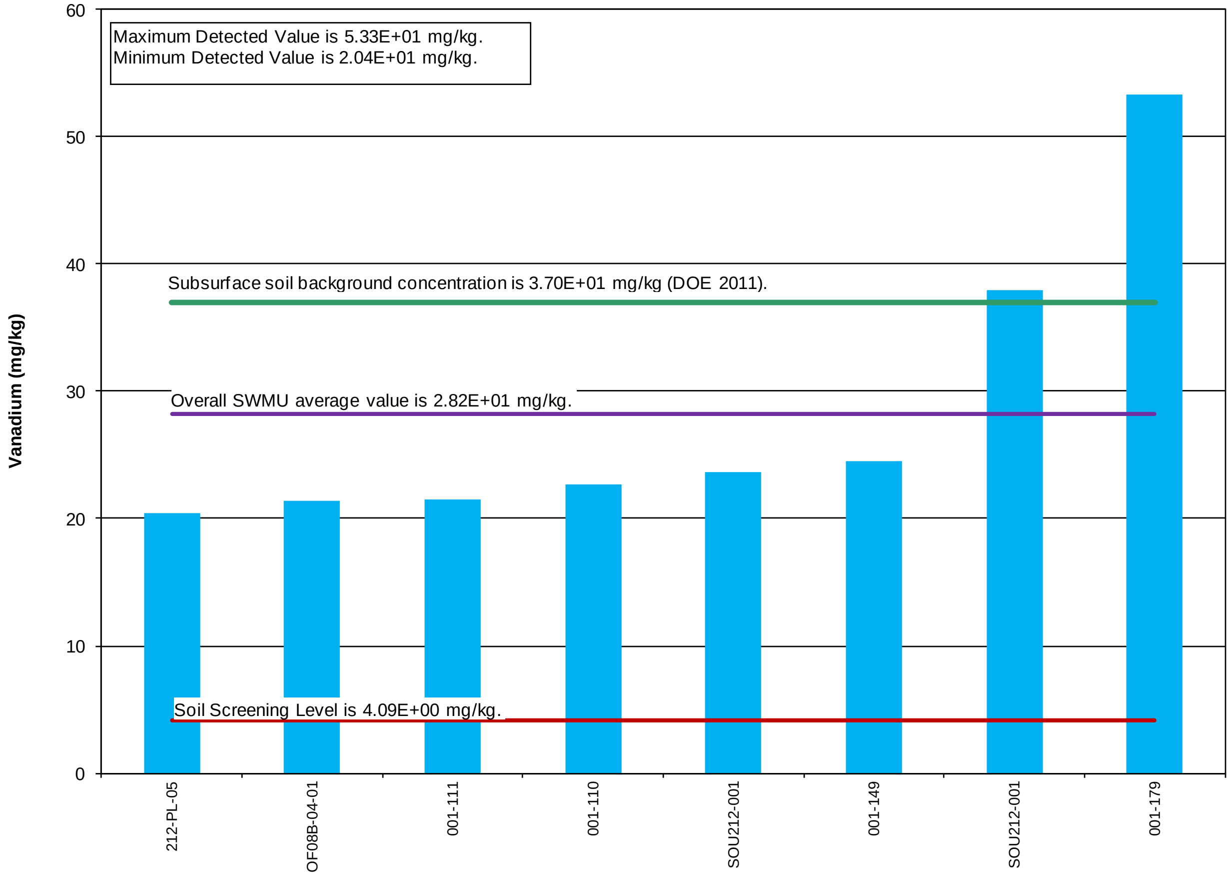

Figure C4.2.2.7. Vanadium Detections at SWMU 212

Plutonium-239/240 was detected in four of four samples. A plot of the detected samples is shown in Figure C4.2.2.8. Although the average over SWMU 212 for plutonium-239/240 is greater than the RG SSL, plutonium-239/240 was evaluated as part of the GWOU FS and was not identified as a COC in the groundwater plumes associated with PGDP (DOE 2001d). Groundwater fate and transport modeling was not performed for this chemical at this SWMU. Two samples were detected at a concentration greater than the RG SSL, but two exceedances do not necessitate a hot spot evaluation.

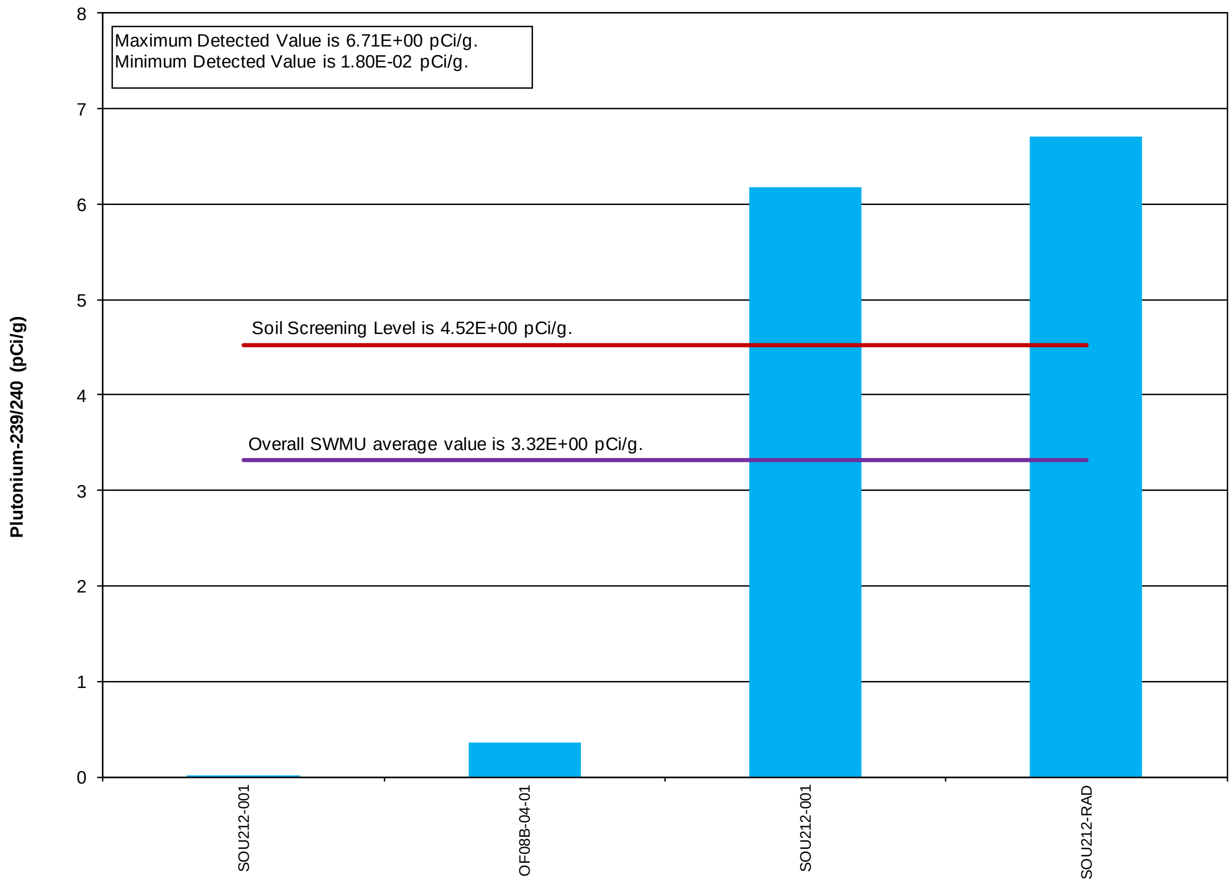

Figure C4.2.2.8. Plutonium-239/240 Detections at SWMU 212

C4.2.3 SWMU 213, C-745-A, OS-02

Data for SWMU 213 consisted of both historical and RI data. SWMU 213 exceedances of the RG SSL include cobalt, iron, manganese, nickel, silver, and vanadium. Cobalt, iron, and vanadium were below background. The data analysis summaries are shown in the following charts.

Manganese was detected in 19 of 20 samples. A plot of the detected samples is shown in Figure C4.2.3.1. The average over SWMU 213 for manganese is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Two samples were detected at a concentration greater than subsurface background, but 2 exceedances do not necessitate a hot spot evaluation.

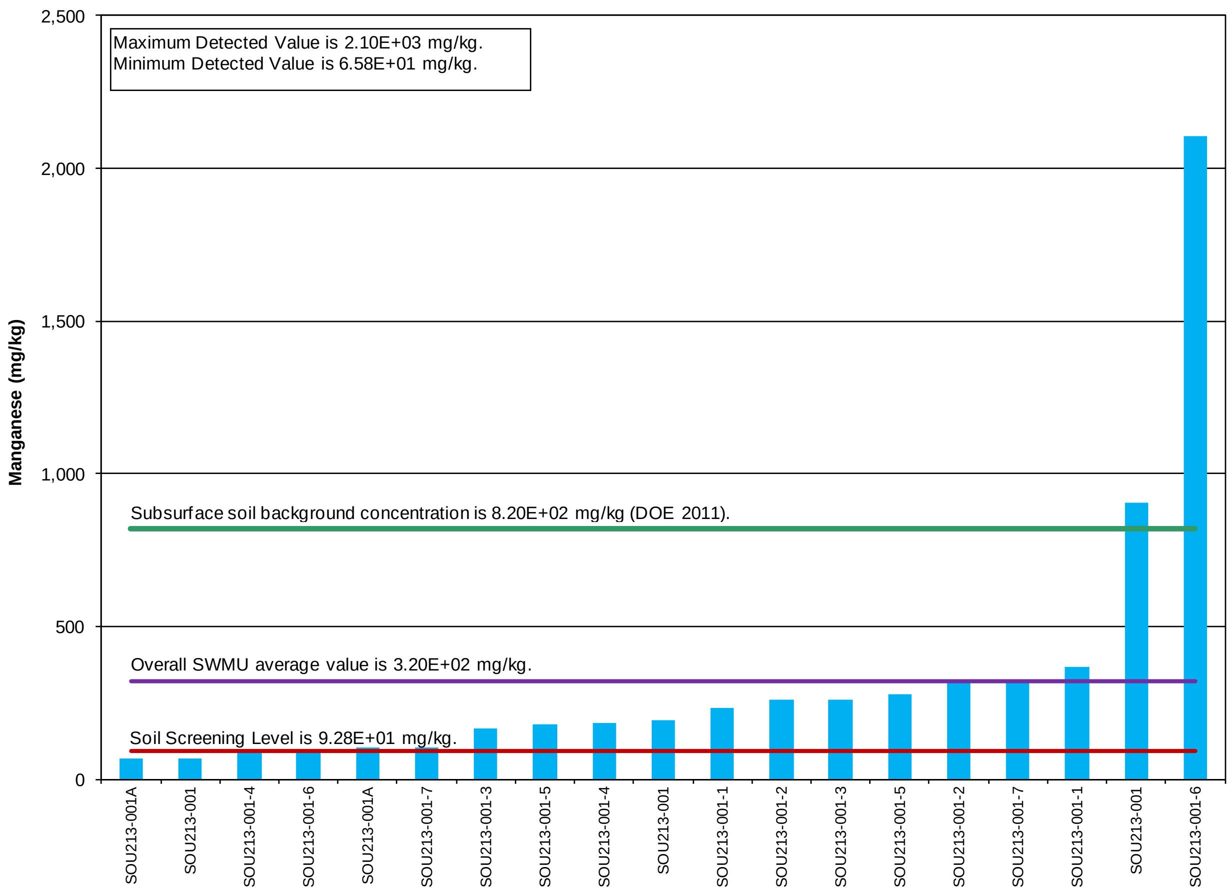

Figure C4.2.3.1. Manganese Detections at SWMU 213

Nickel was detected in 5 of 20 samples. A plot of the detected samples is shown in Figure C4.2.3.2. The average over SWMU 213 for nickel is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only 1 sample was detected at a concentration greater than the RG SSL; therefore, a hot spot evaluation was not performed.

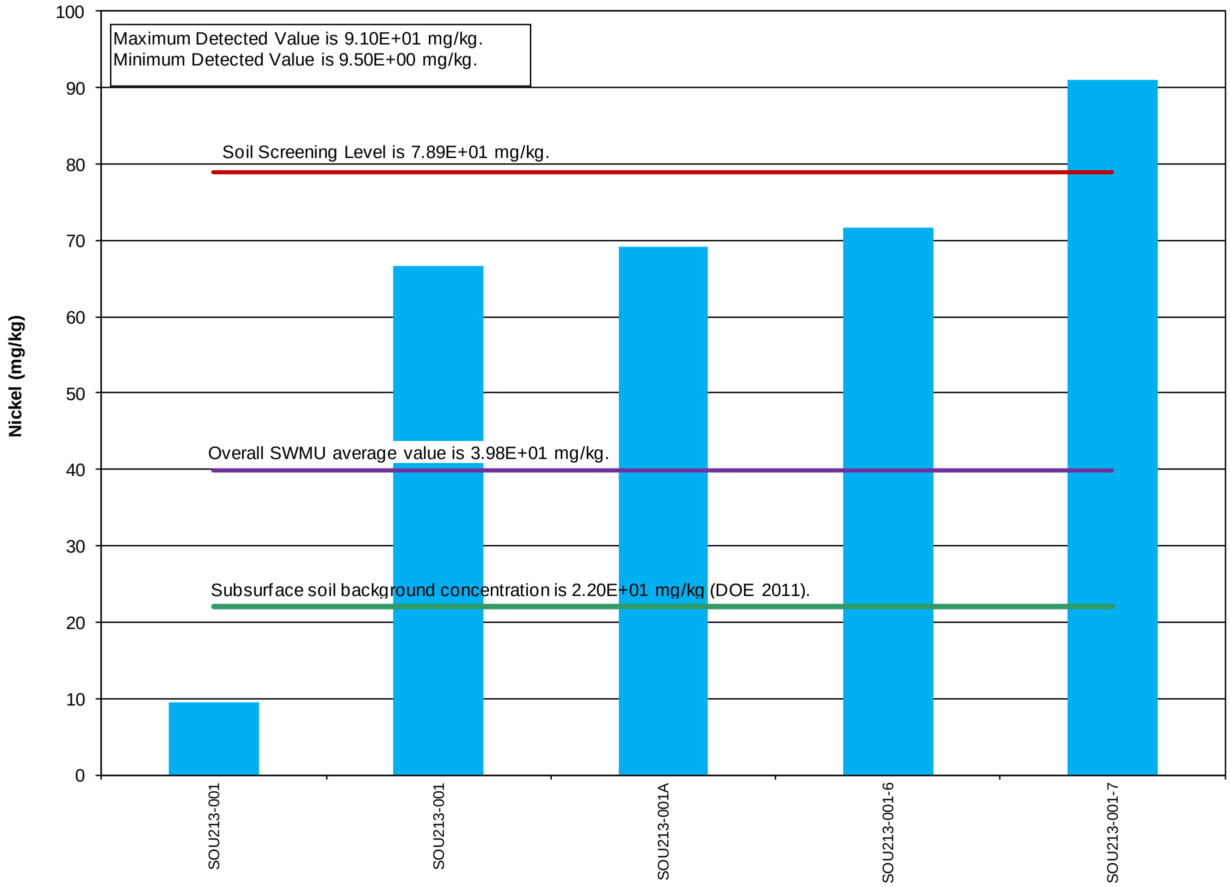

Figure C4.2.3.2. Nickel Detections at SWMU 213

Silver was detected in 5 of 20 samples. A plot of the detected samples is shown in Figure C4.2.3.3. The average over SWMU 213 for silver is greater than the RG SSL and background. Silver was evaluated as part of the GWOU FS and identified as a COC in the groundwater plumes associated with PGDP (DOE 2001d). The evaluation presented in Attachment C1 to Appendix C did not identify any RGA silver impacts; therefore, neither fate and transport modeling nor hot spot evaluation were performed for this chemical at this SWMU.

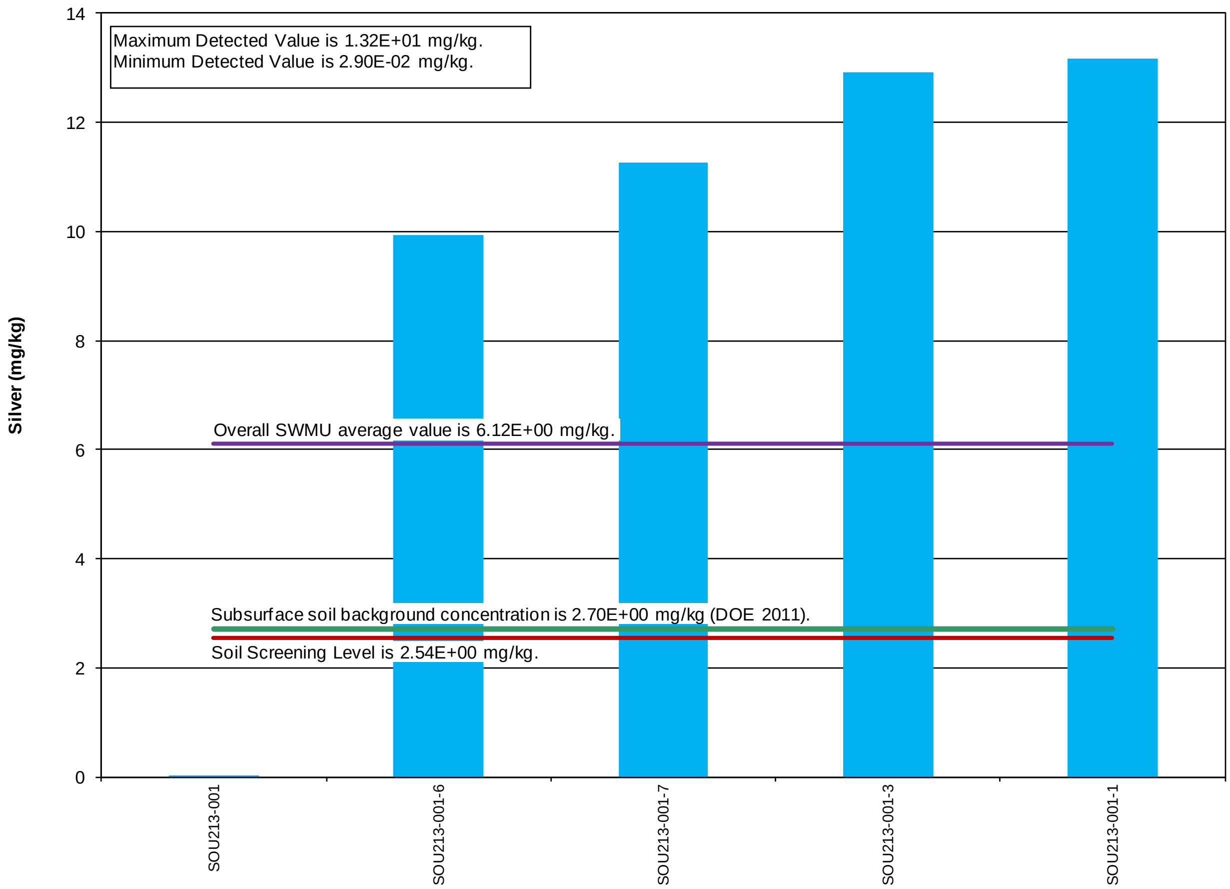

Figure C4.2.3.3. Silver Detections at SWMU 213

C4.2.4 SWMU 214, C-611, OS-03

Data for SWMU 214 consisted of both historical and RI data. SWMU 214 exceedances of the RG SSL include cobalt, iron, manganese, and vanadium, but all of these constituents were below background. Since no results exceed background screening levels, groundwater modeling was not performed.

C4.2.5 SWMU 215, C-743, OS-04

Data for SWMU 215 consisted of both historical and RI data. SWMU 215 exceedances of the RG SSL include cobalt, iron, manganese, silver, and vanadium. Cobalt, manganese, and vanadium are present at below-background levels. The data analysis summaries for the other soil constituents are shown in the following charts.

Iron was detected in 23 of 23 samples. A plot of the detected samples is shown in Figure C4.2.5.1. The average over SWMU 215 for iron is less than background; therefore, groundwater fate and transport was not performed for this chemical at this SWMU. One sample was detected at a concentration greater than subsurface background, but 1 exceedance does not necessitate a hot spot evaluation.

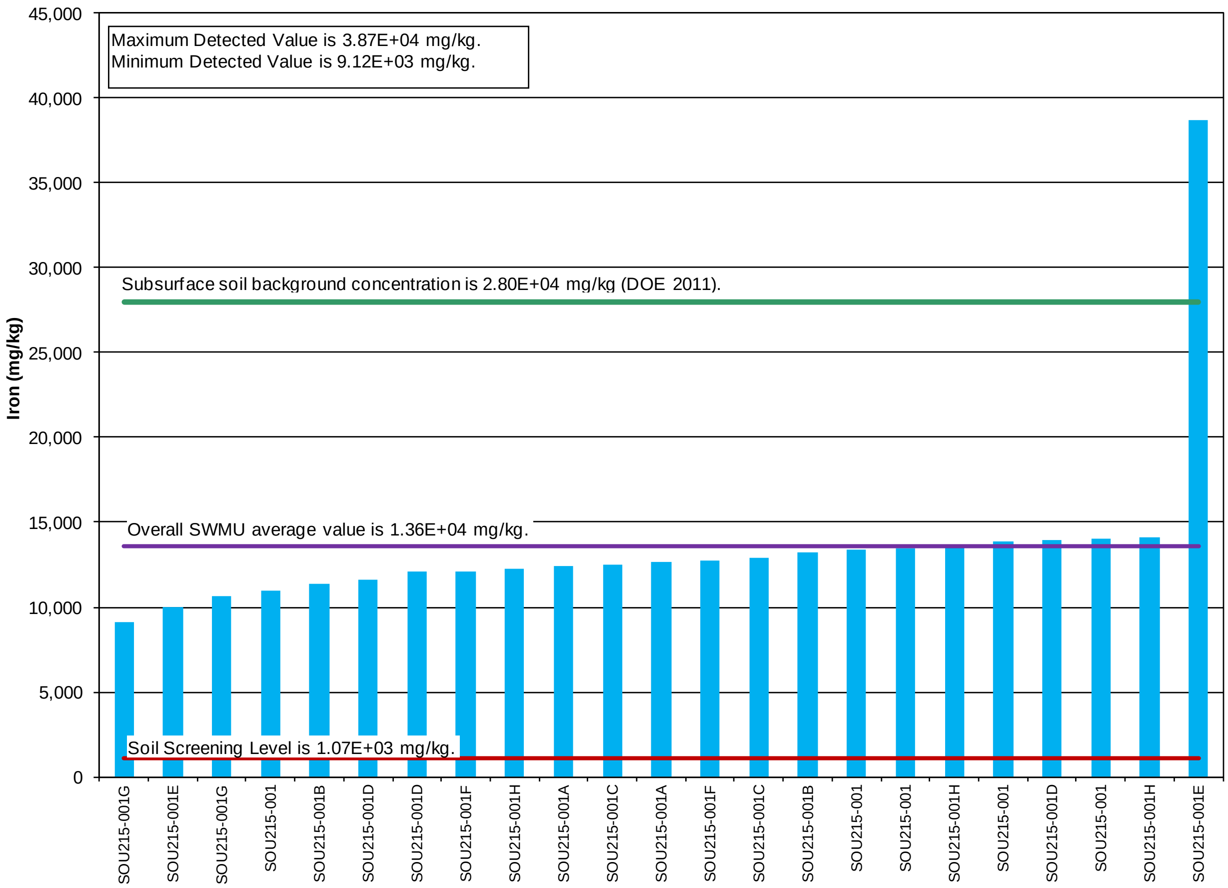

Figure C4.2.5.1. Iron Detections at SWMU 215

Silver was detected in 4 of 23 samples. A plot of the detected samples is shown in Figure C4.2.5.2. The average over SWMU 215 for silver is greater than the RG SSL and background. Silver was evaluated as part of the GWOU FS and identified as a COC in the groundwater plumes associated with PGDP (DOE 2001d). The highest detected value from SOU215-001F was analyzed using XRF, and a concentration of 9.51 mg/kg was reported. This is lower than the detection limit of the method, XRF, which is 10 mg/kg. This is the only XRF analysis that reported a detectable concentration. Whenever a concentration is reported below the detection level it is considered a non-detect. Even without using the highest detected value in calculating the average over the SWMU, the average is 4.32 mg/kg, which remains higher than either background or the RG SSL. Nevertheless, silver was not modeled for fate and transport to RGA groundwater, because there are no silver impacts to RGA groundwater from migration from soils. One sample was detected at a concentration greater than subsurface background, but 1 exceedance does not necessitate a hot spot evaluation.

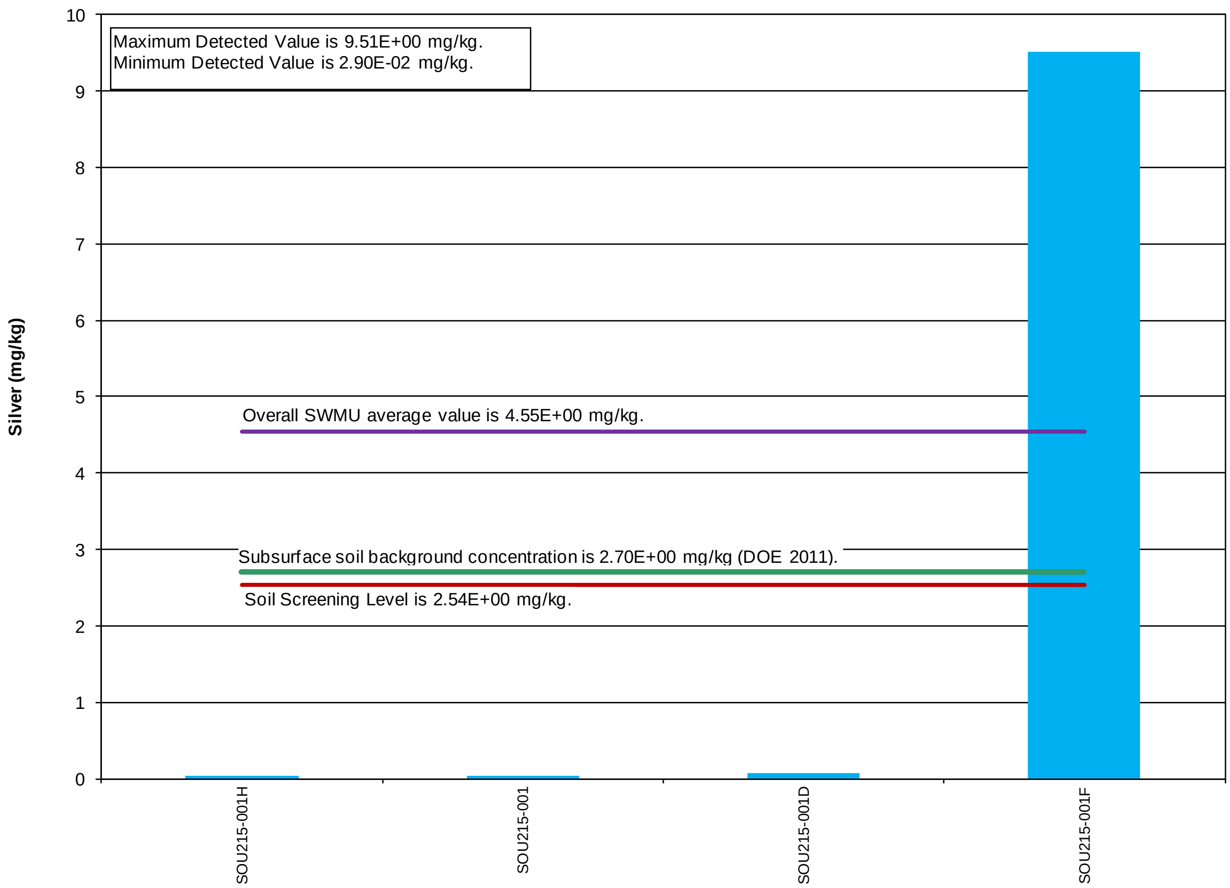

Figure C4.2.5.2. Silver Detections at SWMU 215

C4.2.6 SWMU 216, C-206, OS-05

Data for SWMU 216 consisted of both historical and RI data. SWMU 216 exceedances of the RG SSL include cobalt, iron, manganese, and vanadium, but all of these soil constituents are present at below background concentrations. Since no results exceed background screening levels, groundwater modeling was not performed.

C4.2.7 SWMU 217, C-740, OS-06

Data for SWMU 217 consisted of both historical and RI data. SWMU 217 exceedances of the RG SSL include arsenic, cobalt, iron, manganese, mercury, nickel, silver, and vanadium. The data analysis summaries for these soil constituents are shown in the following charts.

Arsenic was detected in 52 of 97 samples. A plot of the detected samples is shown in Figure C4.2.7.1. The average over SWMU 217 for arsenic is less than the RG SSL and background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only 1 sample was detected at a concentration greater than the RG SSL; therefore, a hot spot evaluation was not performed.

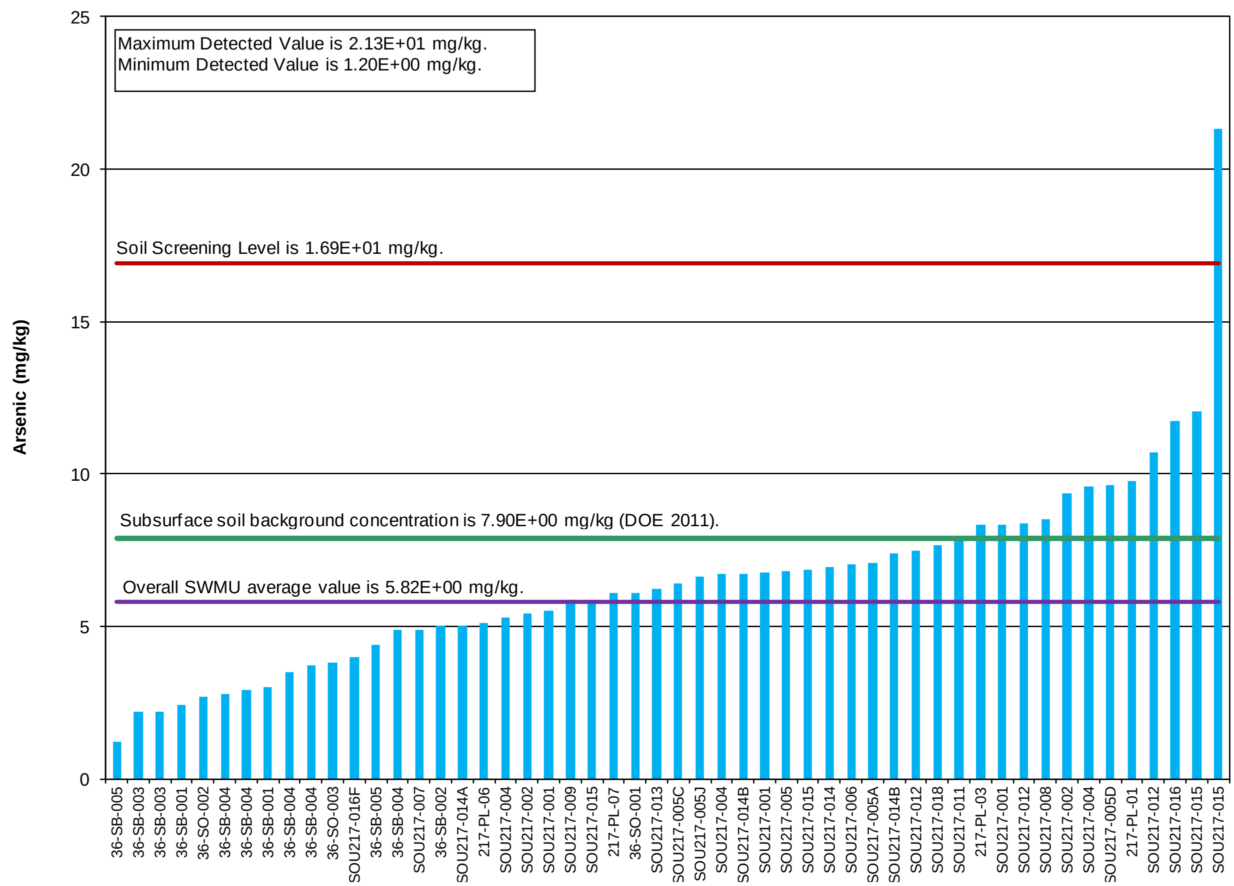

Figure C4.2.7.1. Arsenic Detections at SWMU 217

Cobalt was detected in 31 of 32 samples. A plot of the detected samples is shown in Figure C4.622.7-2. Although the average over SWMU 217 for cobalt is greater than the RG SSL and background, cobalt was evaluated as part of the GWOU FS and was not identified as a COC in the groundwater plumes associated with PGDP (DOE 2001d). Groundwater fate and transport modeling was not performed for this chemical at this SWMU, nor is a hot spot evaluation required.

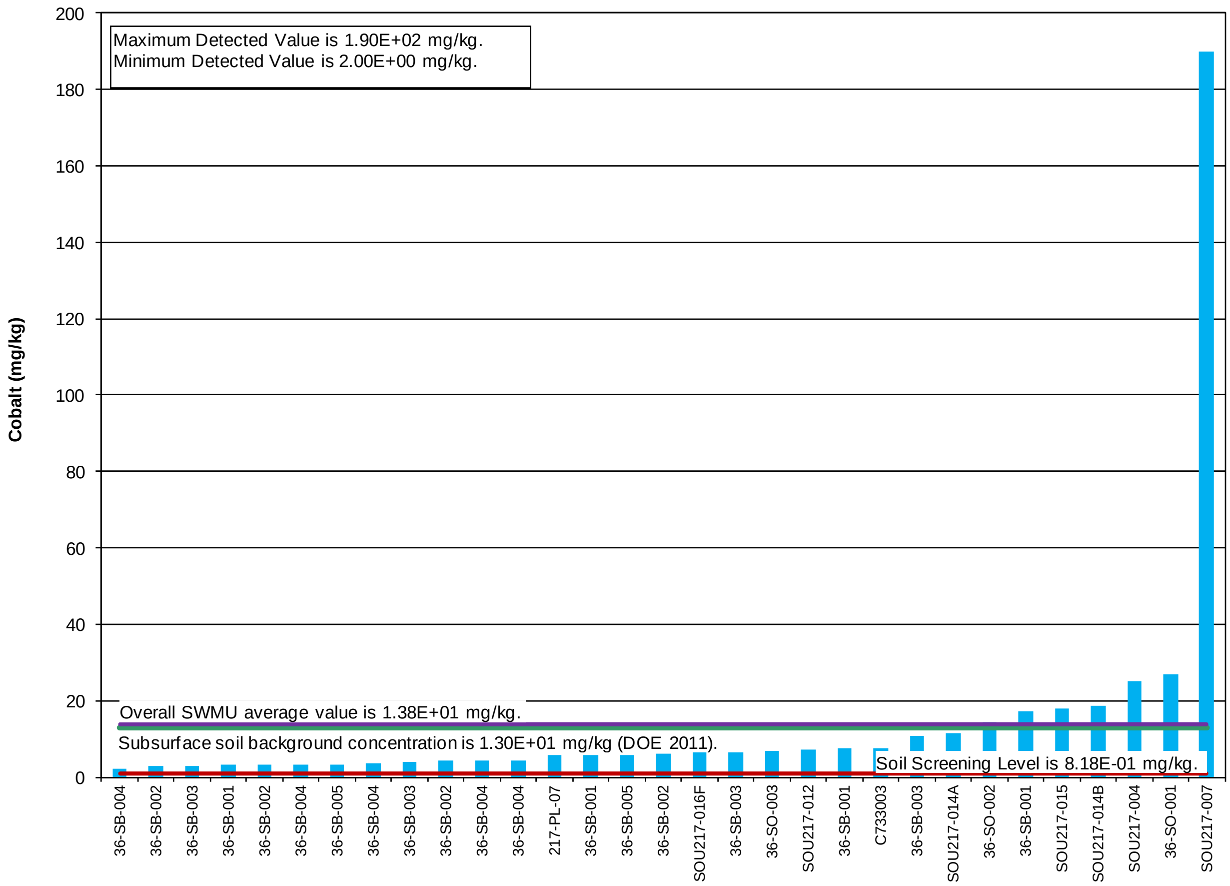

Figure C4.2.7.2. Cobalt Detections at SWMU 217

Iron was detected in 102 of 102 samples. A plot of the detected samples is shown in Figure C4.2.7.3. The average over SWMU 217 for iron is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Several samples were detected at a concentration greater than subsurface background. Iron is ubiquitous, and the concentrations in the RGA are controlled by geochemical factors; therefore, a hot spot evaluation was not performed

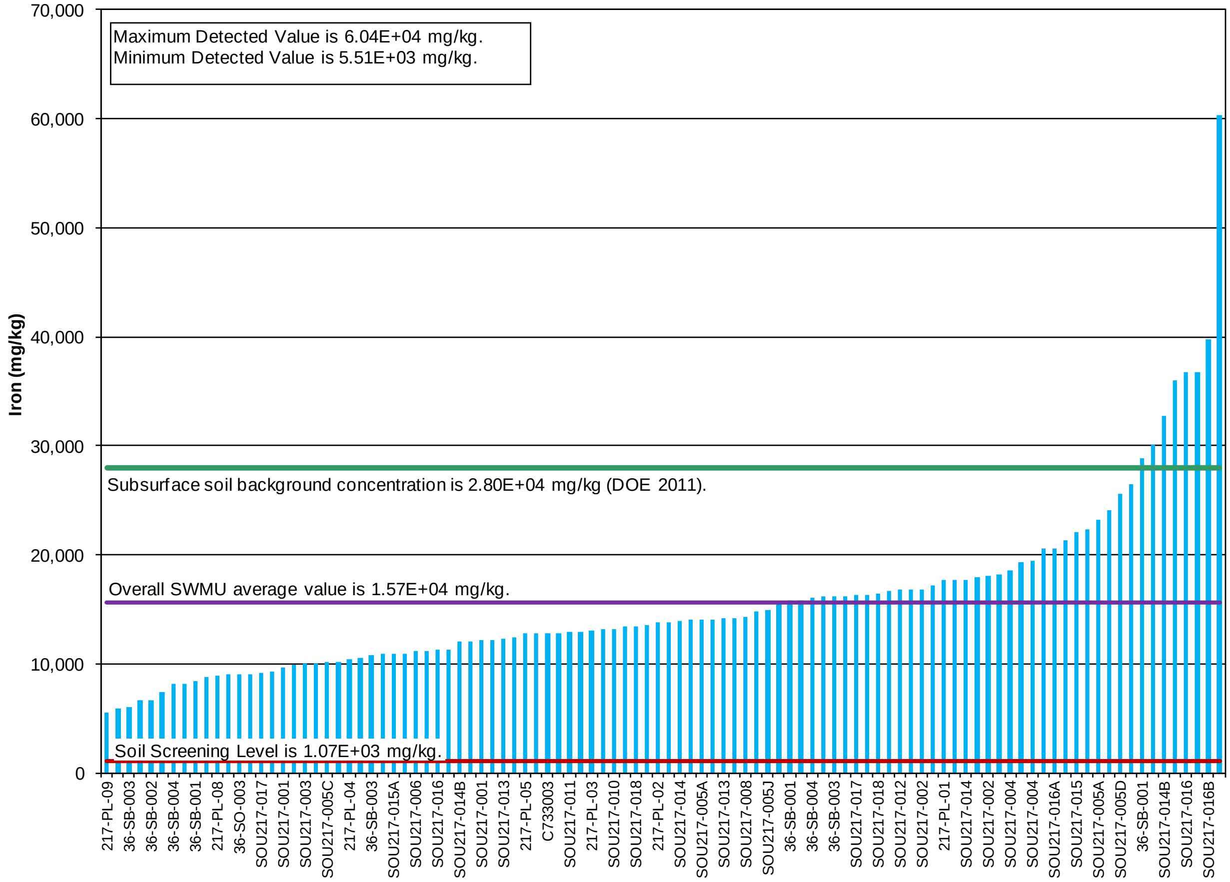

Figure C4.2.7.3. Iron Detections at SWMU 217

Manganese was detected in 99 of 102 samples. A plot of the detected samples is shown in Figure C4.2.7.4. The average over SWMU 217 for manganese is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Several samples were detected at a concentration greater than subsurface background. A hot spot evaluation was not performed, because manganese is ubiquitous, the concentrations in the RGA are controlled by geochemical factors, and the fact that impacts on the RGA groundwater are not expected from the soils, as described in Attachment C1 to Appendix C.

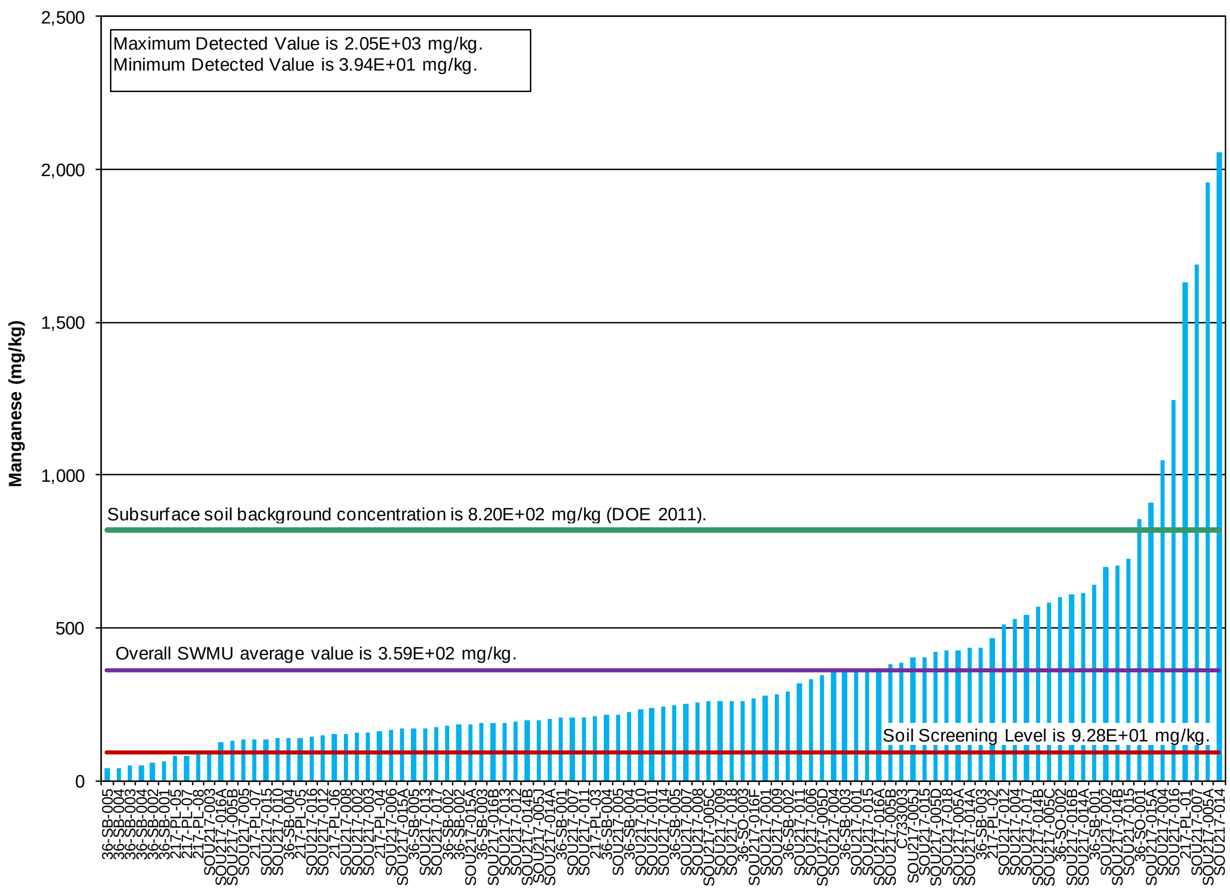

Figure C4.2.7.4. Manganese Detections at SWMU 217

Mercury was detected in 15 of 102 samples. A plot of the detected samples is shown in Figure C4.2.7.5. The average over SWMU 217 for mercury is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although 4 samples were detected at a concentration greater than subsurface background, mercury was evaluated as part of the GWOU FS, and it was not identified as a COC in the groundwater plumes associated with PGDP; therefore, a hot spot evaluation was not performed (DOE 2001d).

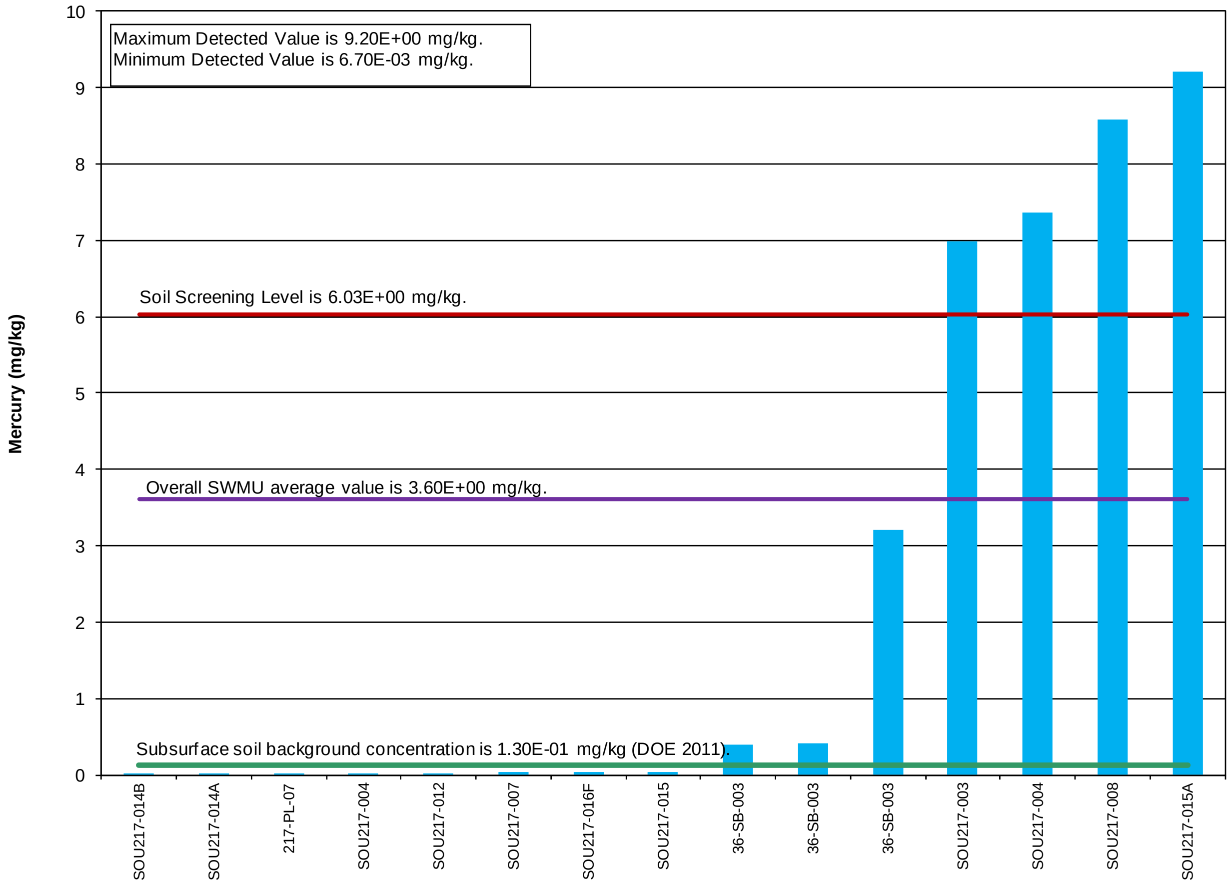

Figure C4.2.7.5. Mercury Detections at SWMU 217

Nickel was detected in 51 of 102 samples. A plot of the detected samples is shown in Figure C4.2.7.6. The average over SWMU 217 for nickel is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Several samples were detected at a concentration greater than the RG SSL; however, a hot spot evaluation was not performed because nickel is being modeled at SWMU 14—the location with the highest average concentration of nickel in any SWMU and concentrations in SWMU 14 are higher than those in SWMU 217.

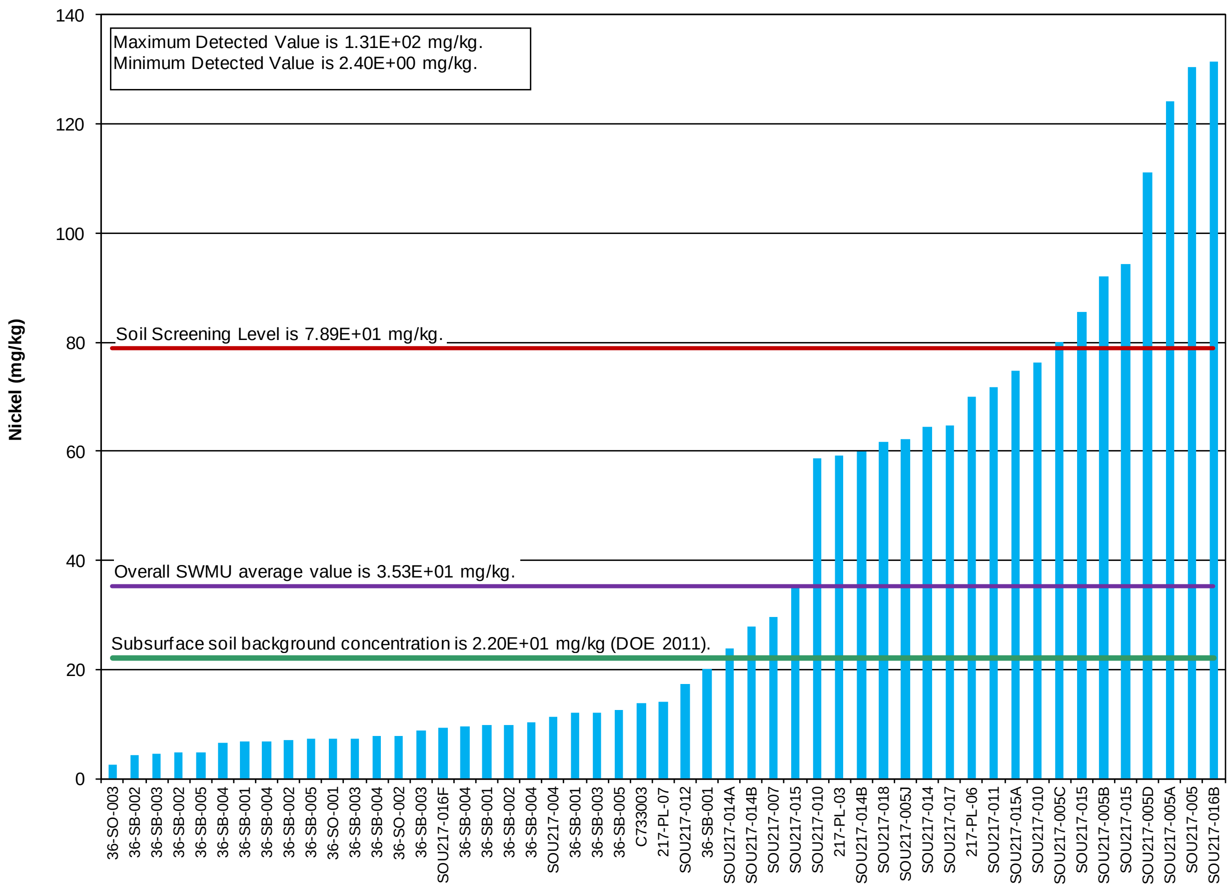

Figure C4.2.7.6. Nickel Detections at SWMU 217

Silver was detected in 17 of 102 samples. A plot of the detected samples is shown in Figure C4.2.7.7. The average over SWMU 217 for silver is greater than the RG SSL and background. Silver was evaluated as part of the GWOU FS and identified as a COC in the groundwater plumes associated with PGDP (2001d). As noted in Attachment C1 to Appendix C, silver impacts to the RGA have not been seen; therefore, neither groundwater fate and transport modeling nor hot spot evaluation were performed for this chemical at this SWMU.

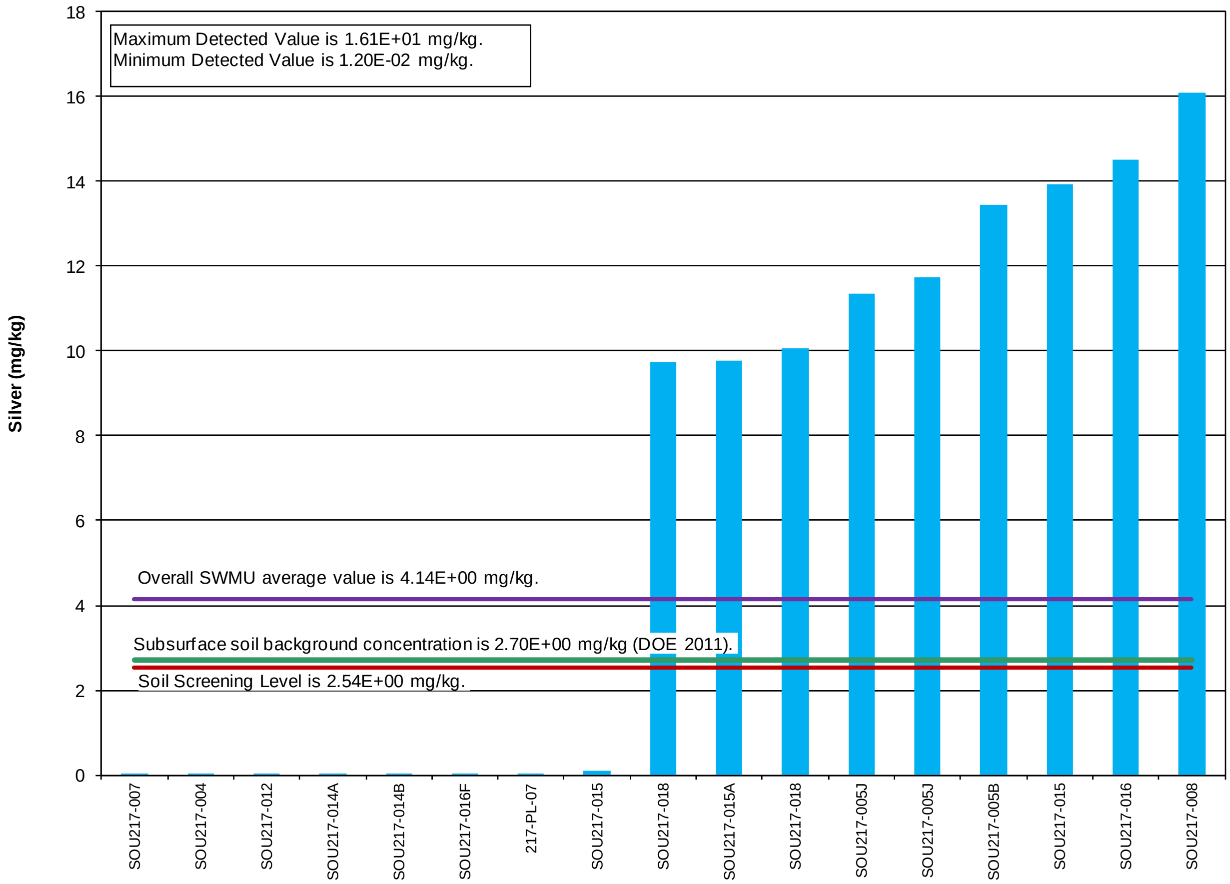

Figure C4.2.7.7. Silver Detections at SWMU 217

Vanadium was detected in 31 of 32 samples. A plot of the detected samples is shown in Figure C4.2.7.8. The average over SWMU 217 for vanadium is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only 2 samples were detected at a concentration greater than subsurface background; therefore, a hot spot evaluation was not performed.

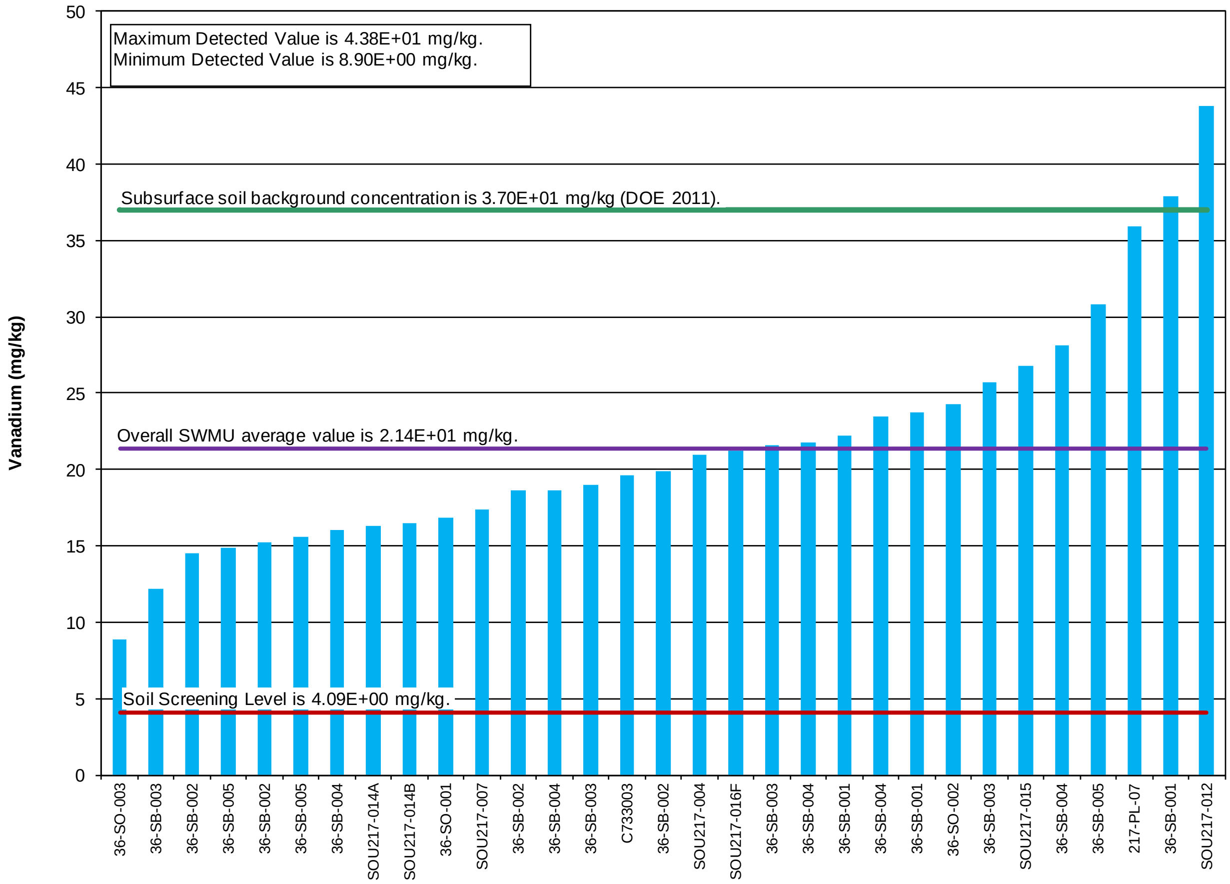

Figure C4.2.7.8. Vanadium Detections at SWMU 217

C4.2.8 SWMU 221, C-635, OS-10

Data for SWMU 221 consisted of both historical and RI data. SWMU 221 exceedances of the RG SSL include arsenic, cobalt, iron, manganese, mercury, nickel, silver, and vanadium. The data analysis summaries are shown in the following charts.

Arsenic was detected in 19 of 36 samples. A plot of the detected samples is shown in Figure C4.2.8.1. The average over SWMU 221 for arsenic is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only 1 sample was detected at a concentration greater than the RG SSL; therefore, a hot spot evaluation was not performed.

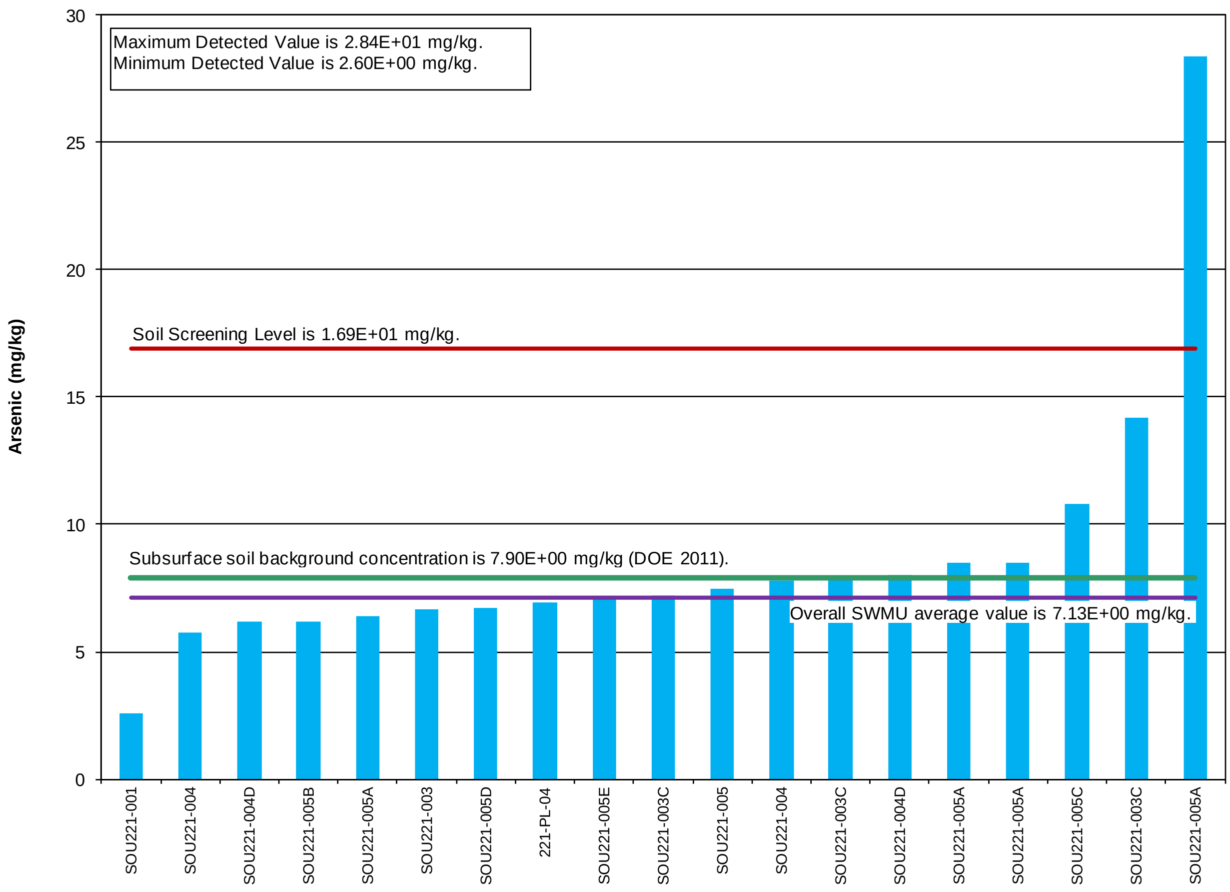

Figure C4.2.8.1. Arsenic Detections at SWMU 221

Cobalt was detected in four of four samples. A plot of the detected samples is shown in Figure C4.2.8.2. The average over SWMU 221 for cobalt is greater than the RG SSL and background, but cobalt was evaluated as part of the GWOU FS and was not identified as a COC in the groundwater plumes associated with PGDP; therefore, groundwater fate and transport was not performed for this chemical at this SWMU (DOE 2001d). One sample was detected at a concentration greater than subsurface background, but one exceedance does not necessitate a hot spot evaluation.

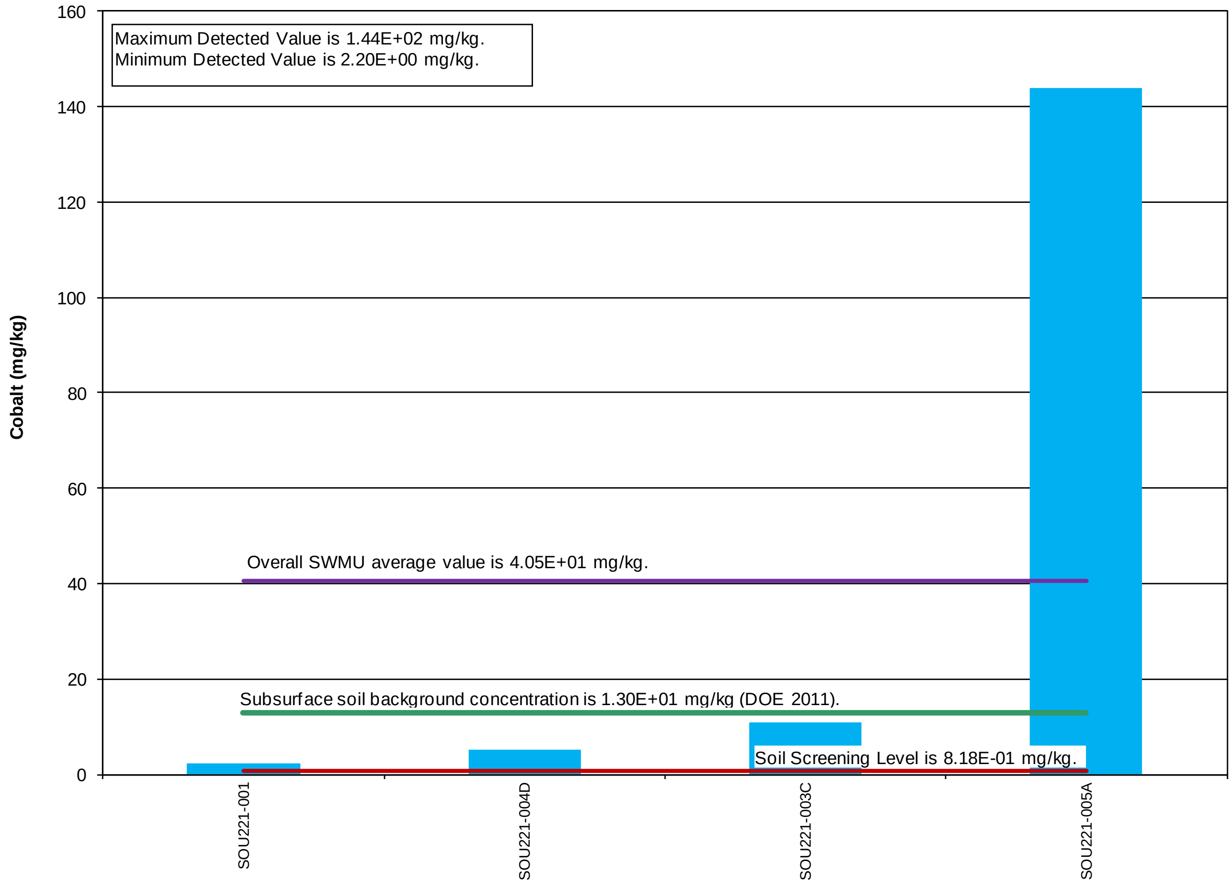

Figure C4.2.8.2. Cobalt Detections at SWMU 221

Iron was detected in 36 of 36 samples. A plot of the detected samples is shown in Figure C4.2.8.3. The average over SWMU 221 for iron is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Two samples were detected at a concentration greater than subsurface background, but 2 exceedances do not necessitate a hot spot evaluation.

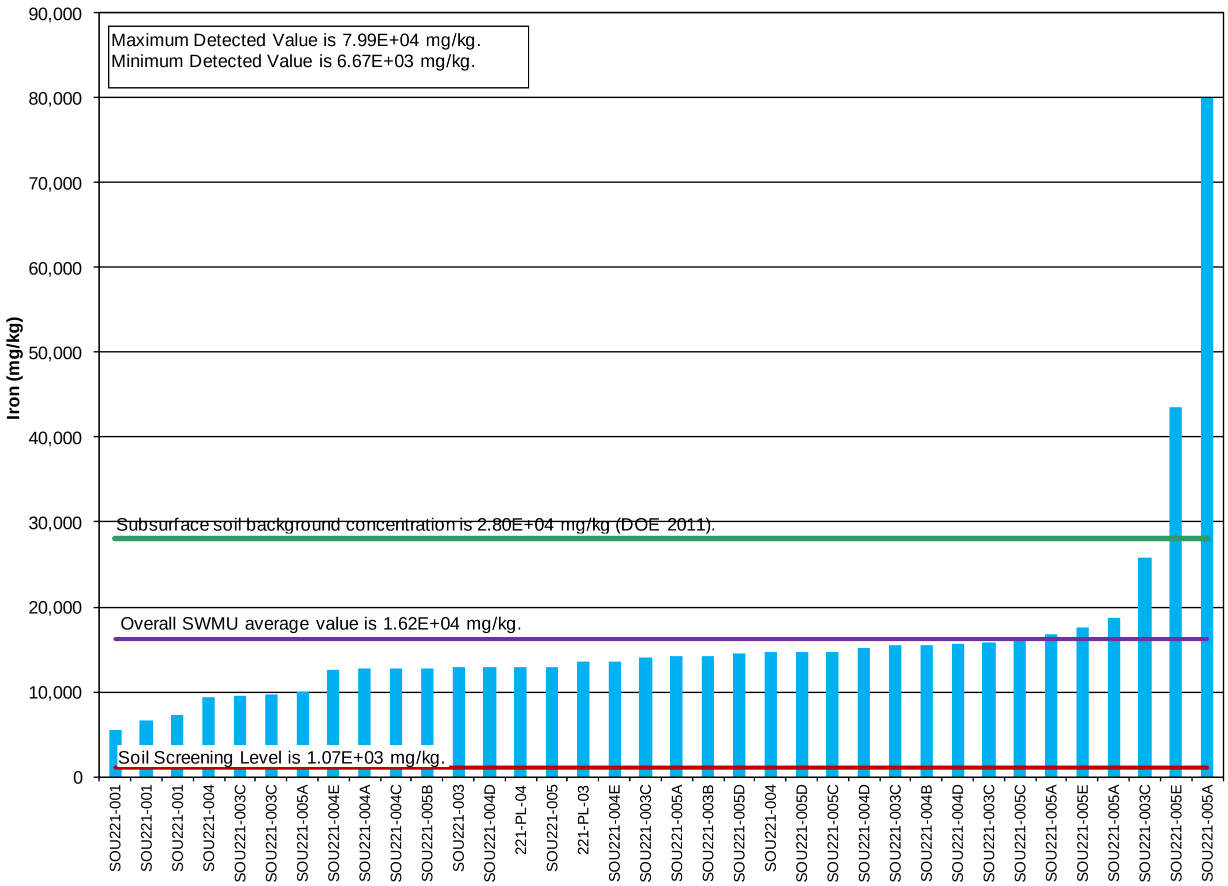

Figure C4.2.8.3. Iron Detections at SWMU 221

Manganese was detected in 36 of 36 samples. A plot of the detected samples is shown in Figure C4.2.8.4. The average over SWMU 221 for manganese is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One sample was detected at a concentration greater than subsurface background, but 1 exceedance does not necessitate a hot spot evaluation.

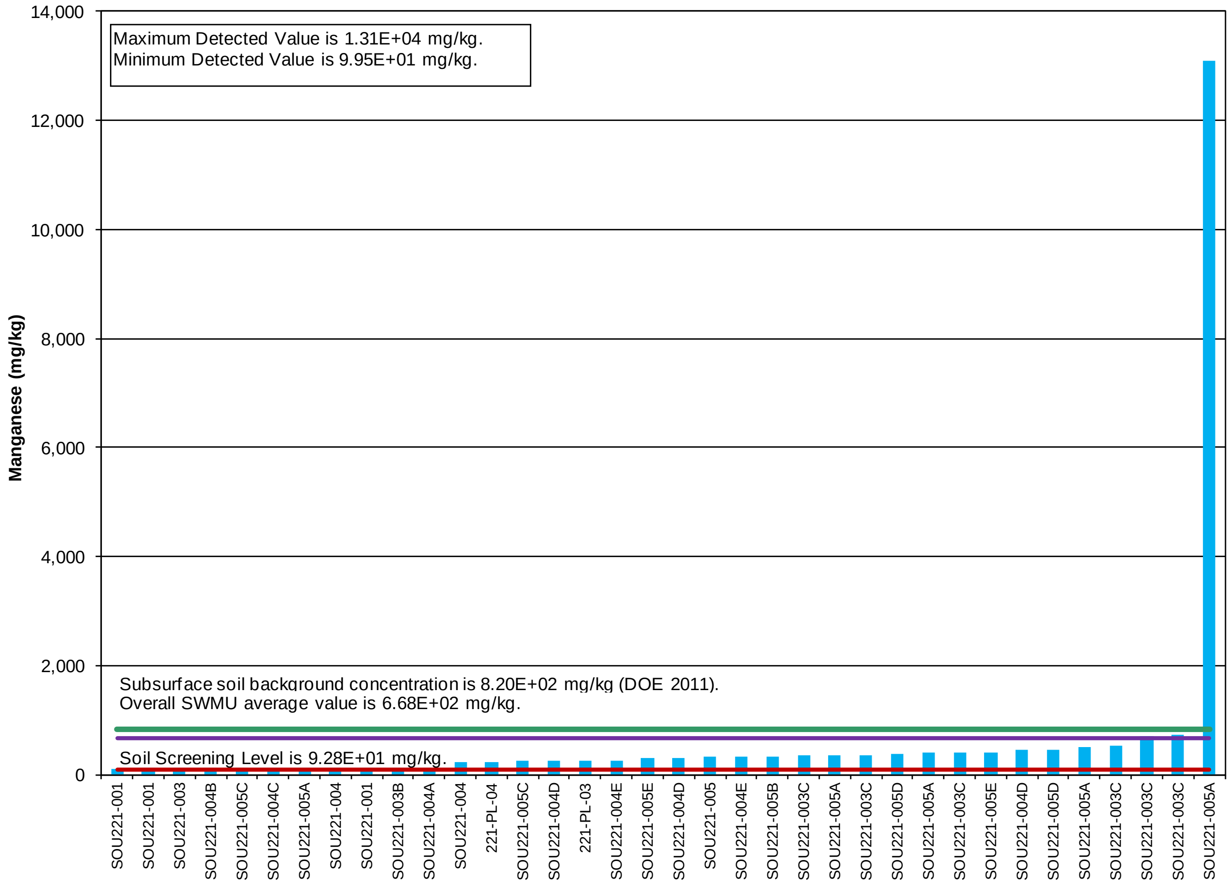

Figure C4.2.8.4. Manganese Detections at SWMU 221

Mercury was detected in 6 of 36 samples. A plot of the detected samples is shown in Figure C4.2.8.5. The average over SWMU 221 for mercury is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Mercury was evaluated as part of the GWOU FS and was not identified as a COC in the groundwater plumes associated with PGDP; therefore, a hot spot evaluation was not performed (DOE 2001d).

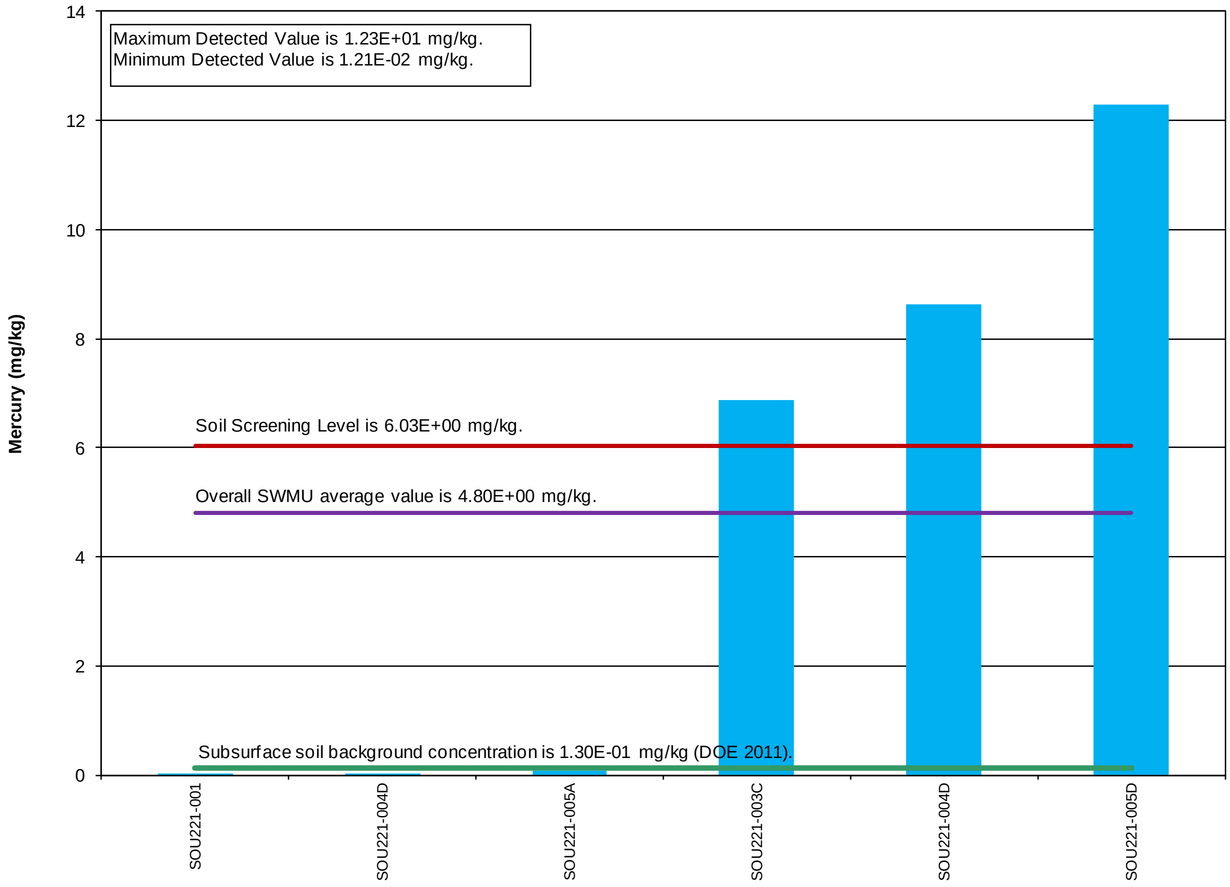

Figure C4.2.8.5. Mercury Detections at SWMU 221

Nickel was detected in 8 of 36 samples. A plot of the detected samples is shown in Figure C4.2.8.6. The average over SWMU 221 for nickel is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only 1 sample was detected at a concentration greater than the RG SSL; therefore, a hot spot evaluation was not performed.

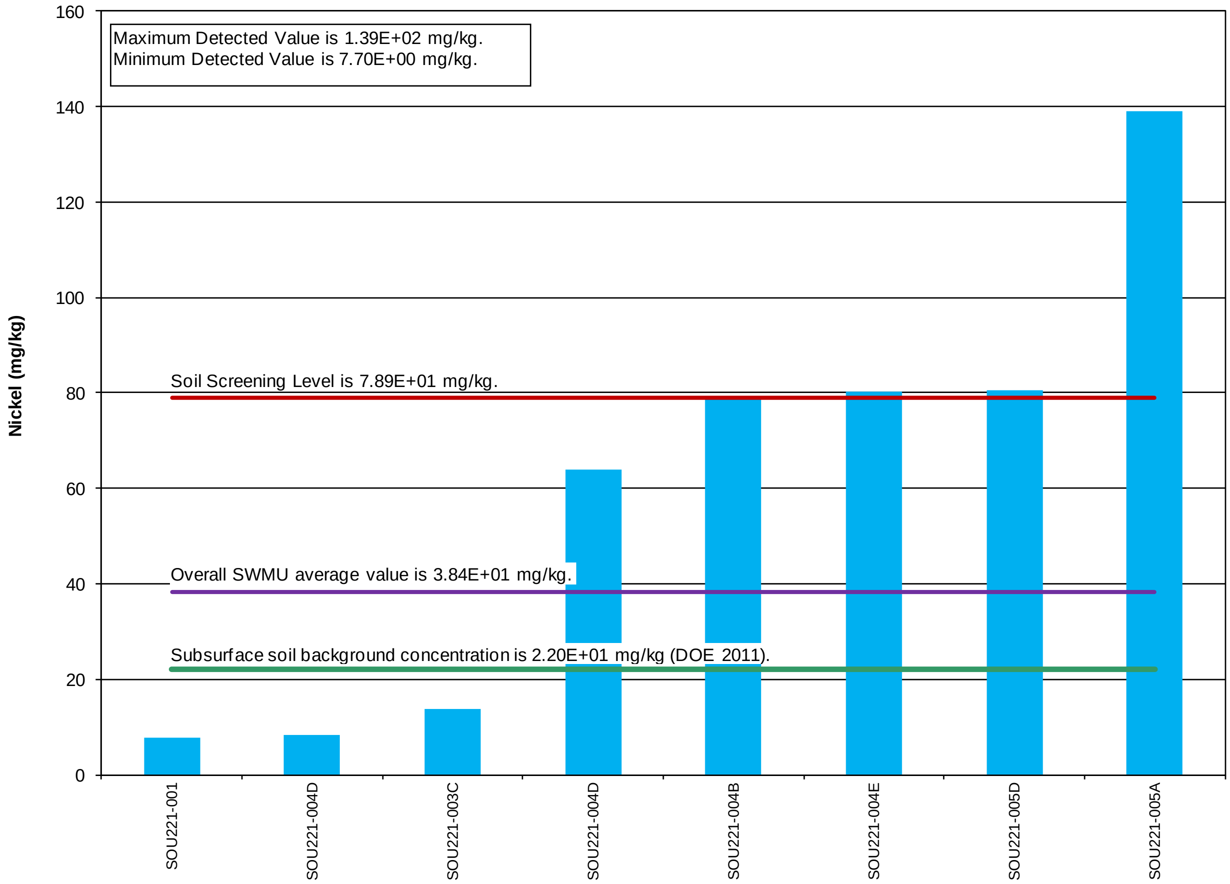

Figure C4.2.8.6. Nickel Detections at SWMU 221

Silver was detected in 5 of 36 samples. A plot of the detected samples is shown in Figure C4.2.8.7. The average over SWMU 221 for silver is greater than background and the RG SSL. Silver was evaluated as part of the GWOU FS and is a COC in the groundwater plumes associated with PGDP (DOE 2001d). The highest detected value, 9.74 mg/kg from sample 221-PL-04, was the result of an XRF analysis with a detection limit of 10 mg/kg. Even without this value, the average for the SWMU remains higher than background and the RG SSL; however, groundwater fate and transport modeling was not performed for silver because silver impacts to the RGA from the soils have not been observed. Only 1 sample was detected at a concentration greater than the RG SSL; therefore, a hot spot evaluation was not performed.

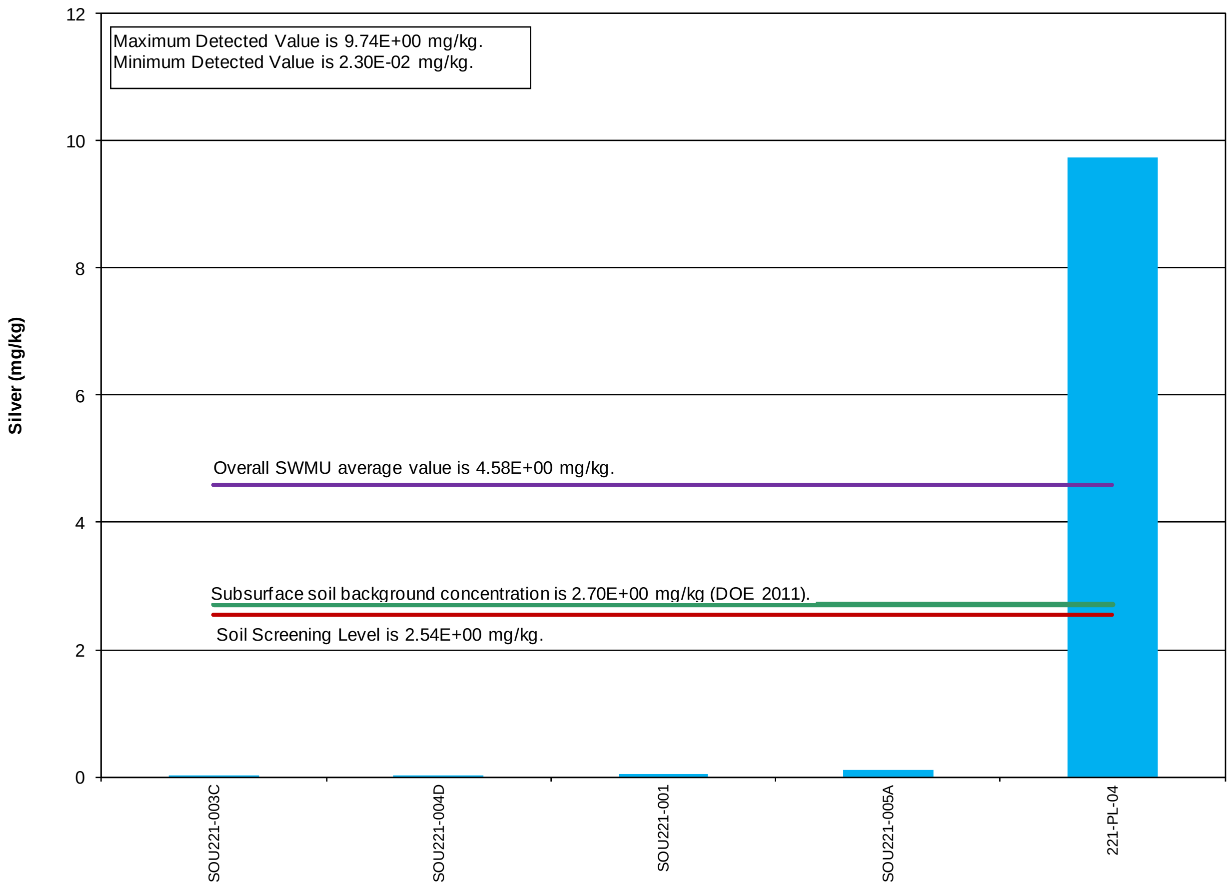

Figure C4.2.8.7. Silver Detections at SWMU 221

Vanadium was detected in four of four samples. A plot of the detected samples is shown in Figure C4.2.8.8. The average over SWMU 221 for vanadium is greater than background and the RG SSL and background. Vanadium was evaluated as part of the GWOU FS and is a COC in the groundwater plumes associated with PGDP (DOE 2001d). Vanadium impacts to the RGA have not been identified; therefore, groundwater fate and transport modeling has not been performed for this chemical at this SWMU. Two samples were detected at a concentration greater than subsurface background, but two exceedances do not necessitate a hot spot evaluation.

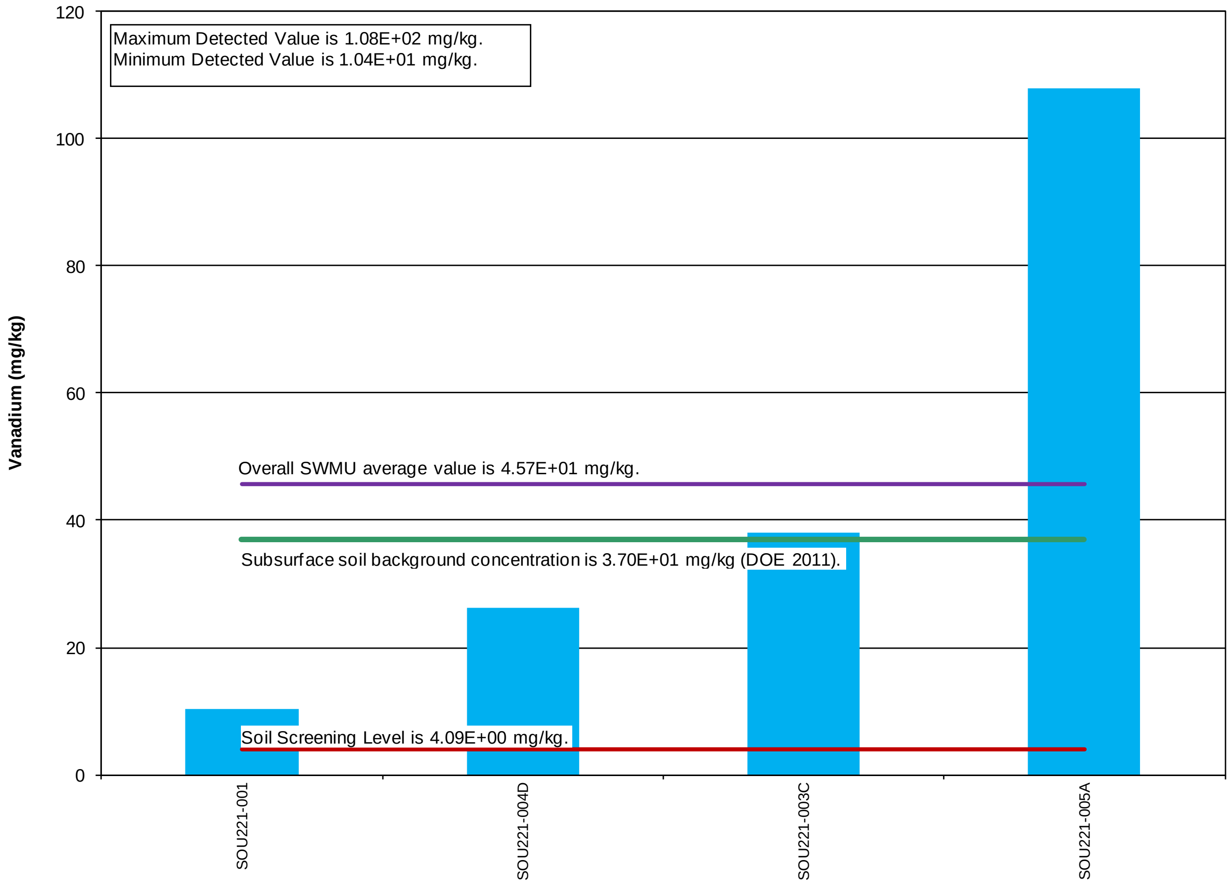

Figure C4.2.8.8. Vanadium Detections at SWMU 221

C4.2.9 SWMU 222, C-410, OS-11

Data for SWMU 222 consisted of both historical and RI data. SWMU 222 exceedances of the RG SSL include cobalt, iron, manganese, nickel, and vanadium; however, cobalt, iron, and vanadium are below background. The data analysis summaries are shown in the following charts.

Manganese was detected in 42 of 42 samples. A plot of the detected samples is shown in Figure C4.2.9.1. The average over SWMU 222 for manganese is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Two samples were detected at a concentration greater than subsurface background, but 2 exceedances do not necessitate a hot spot evaluation.

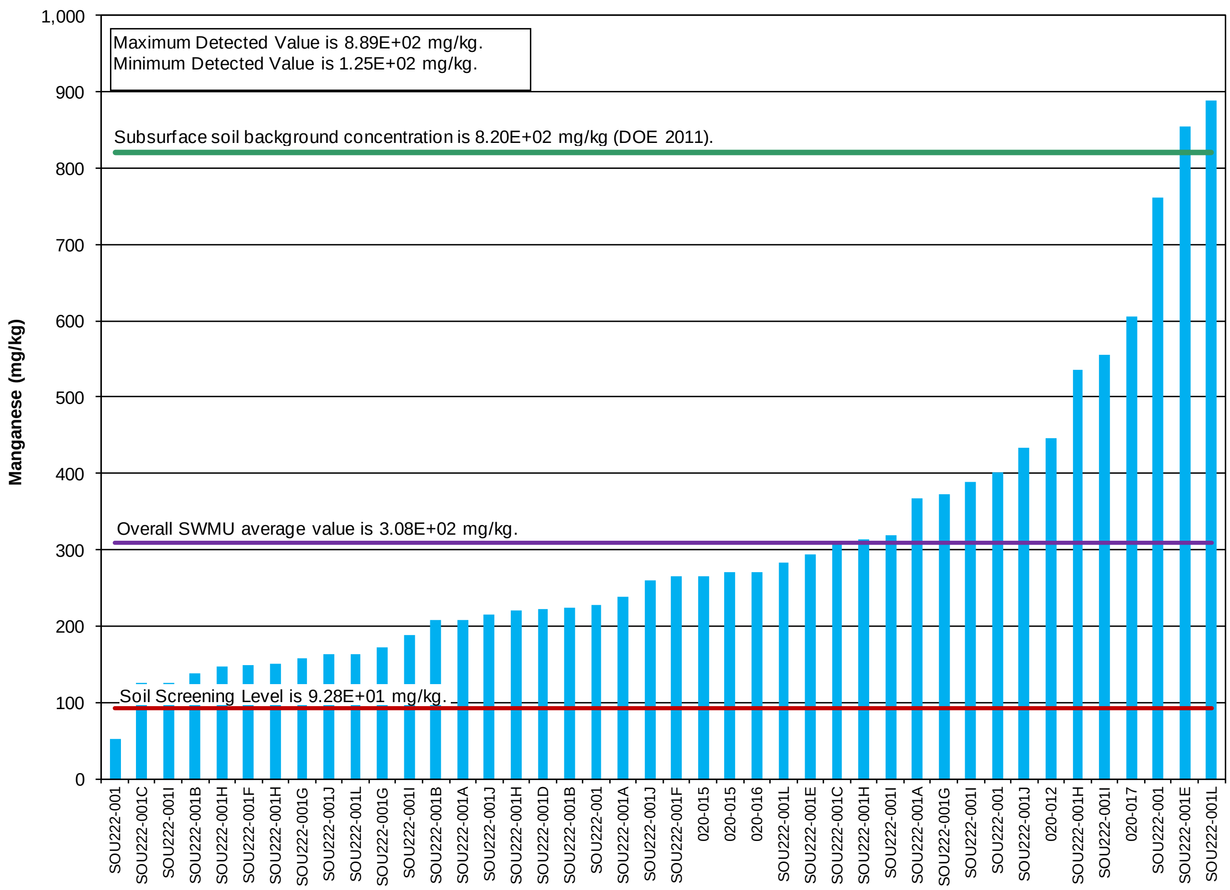

Figure C4.2.9.1. Manganese Detections at SWMU 222

Nickel was detected in 19 of 42 samples. A plot of the detected samples is shown in Figure C4.2.9.2. The average over SWMU 222 for nickel is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. 2 two samples were detected at a concentration greater than the RG SSL; therefore, a hot spot evaluation was not performed.

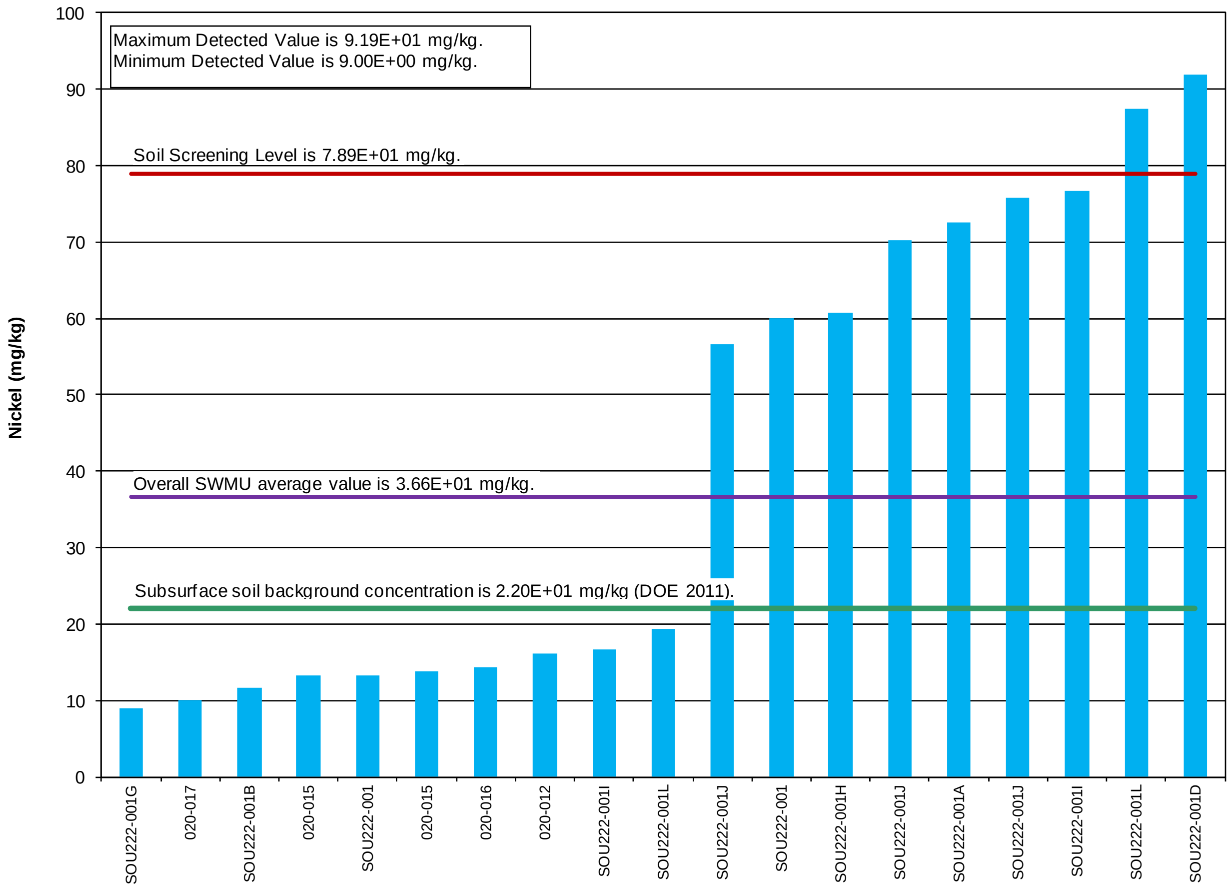

Figure C4.2.9.2. Nickel Detections at SWMU 222

C4.2.10 SWMU 227, C-746-B, OS-16

Data for SWMU 227 consisted of both historical and RI data. SWMU 227 exceedances of the RG SSL include Total PCBs, cobalt, iron, manganese, mercury, nickel, silver, vanadium, and technetium-99. The data analysis summaries are shown in the following charts.

Total PCBs were detected in 54 of 146 samples. A plot of the detected samples is shown in Figure C4.2.10.1. The average over SWMU 227 for Total PCBs is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Because 4 samples were detected with a concentration greater than the RG SSL, a hot spot evaluation was performed. A map of the distribution of detection of Total PCBs is shown in Figure C4.80.

The plot shows that PCBs is not clustered and not indicative of a hot spot; therefore, hot spot fate and transport modeling was not performed for this chemical at this SWMU.

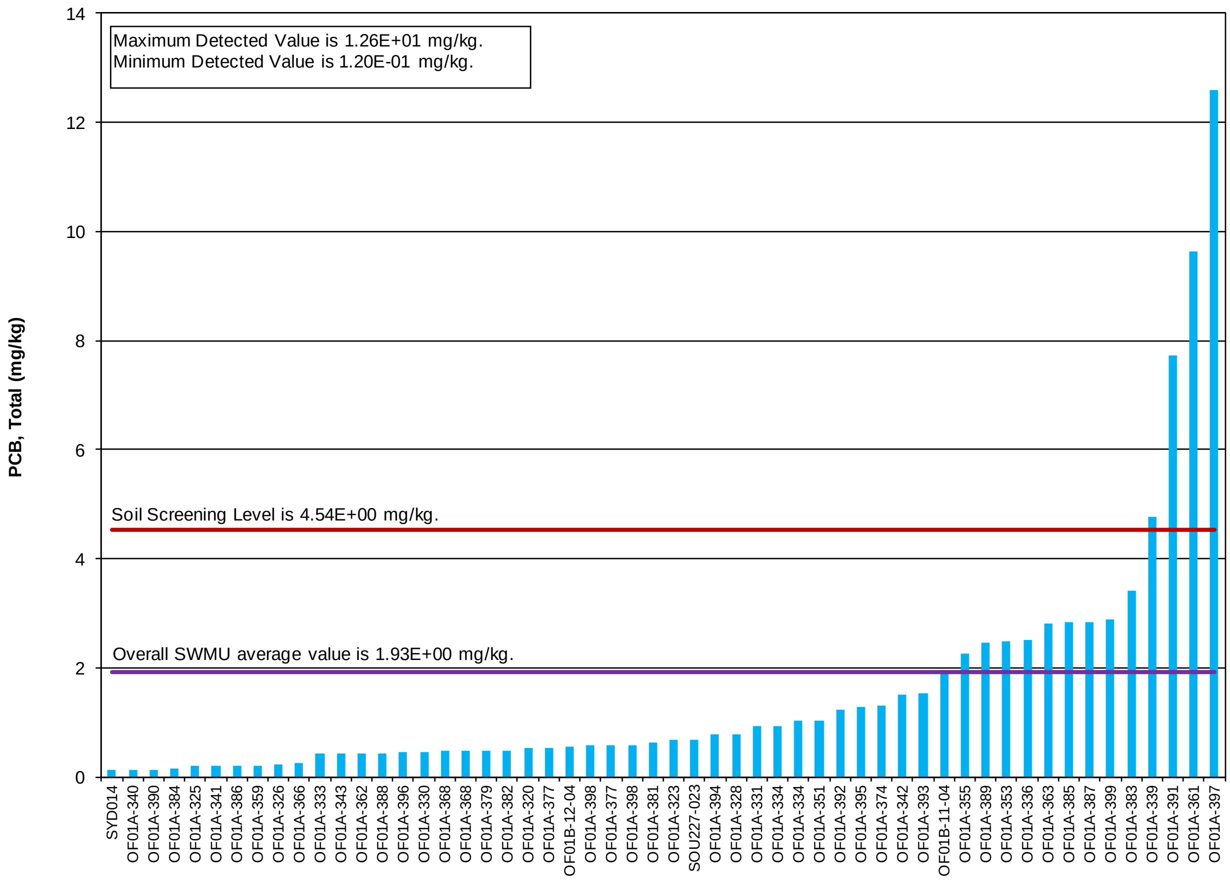

Figure C4.2.10.1. Total PCB Detections at SWMU 227

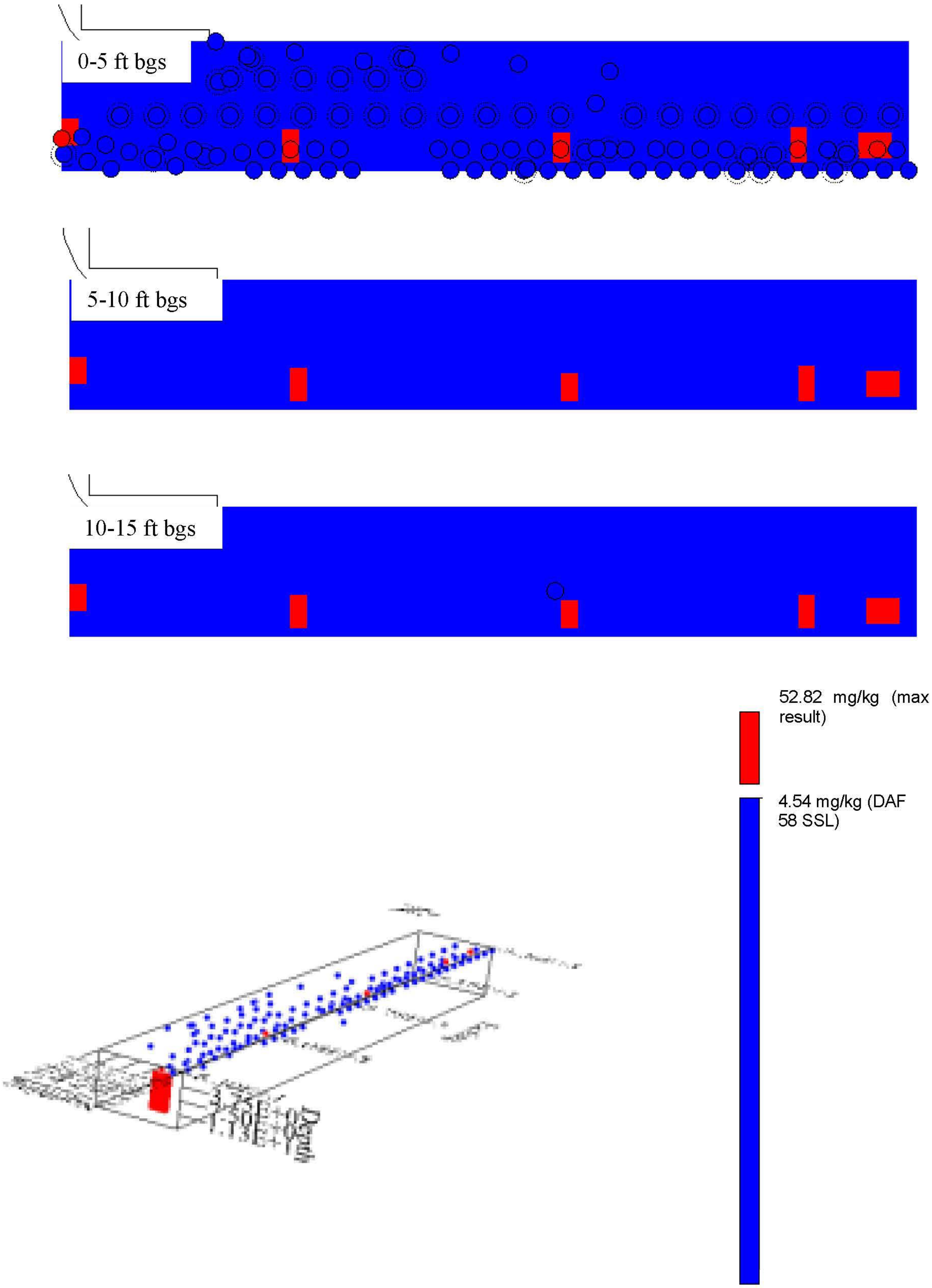

Figure C4.2.10.2. Distribution of Total PCBs Detections at SWMU 227

Cobalt was detected in 19 of 20 samples. A plot of the detected samples is shown in Figure C4.2.10.3. The average over SWMU 227 for cobalt is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Two samples were detected above background, but 2 samples do not necessitate a hot spot analysis.

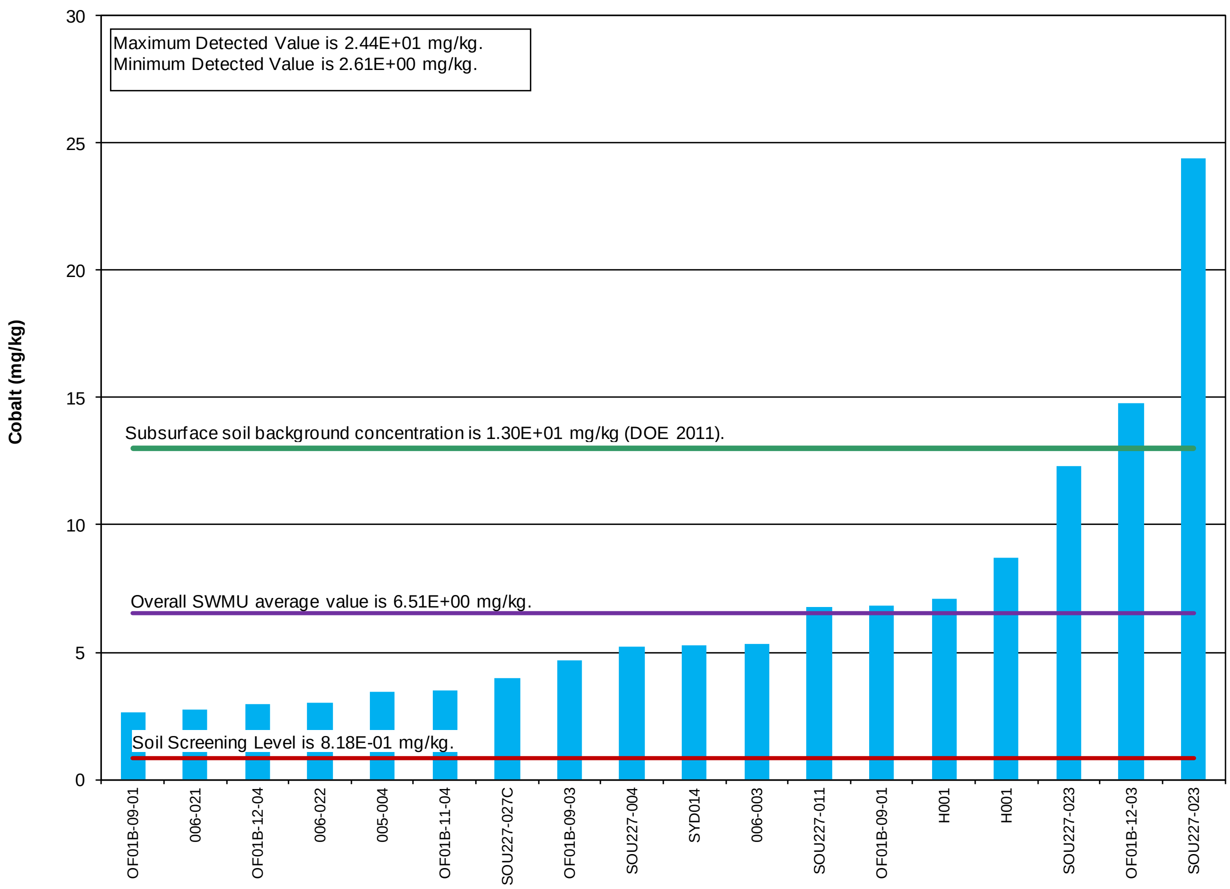

Figure C4.2.10.3. Cobalt Detections at SWMU 227

Manganese was detected in 76 of 76 samples. A plot of the detected samples is shown in Figure C4.2.10.4. The average over SWMU 227 for manganese is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although 4 samples were detected above background, a hot spot evaluation was not performed for manganese because it is ubiquitous, the concentrations in the RGA are controlled by geochemical factors, and it has a low frequency of occurrence.

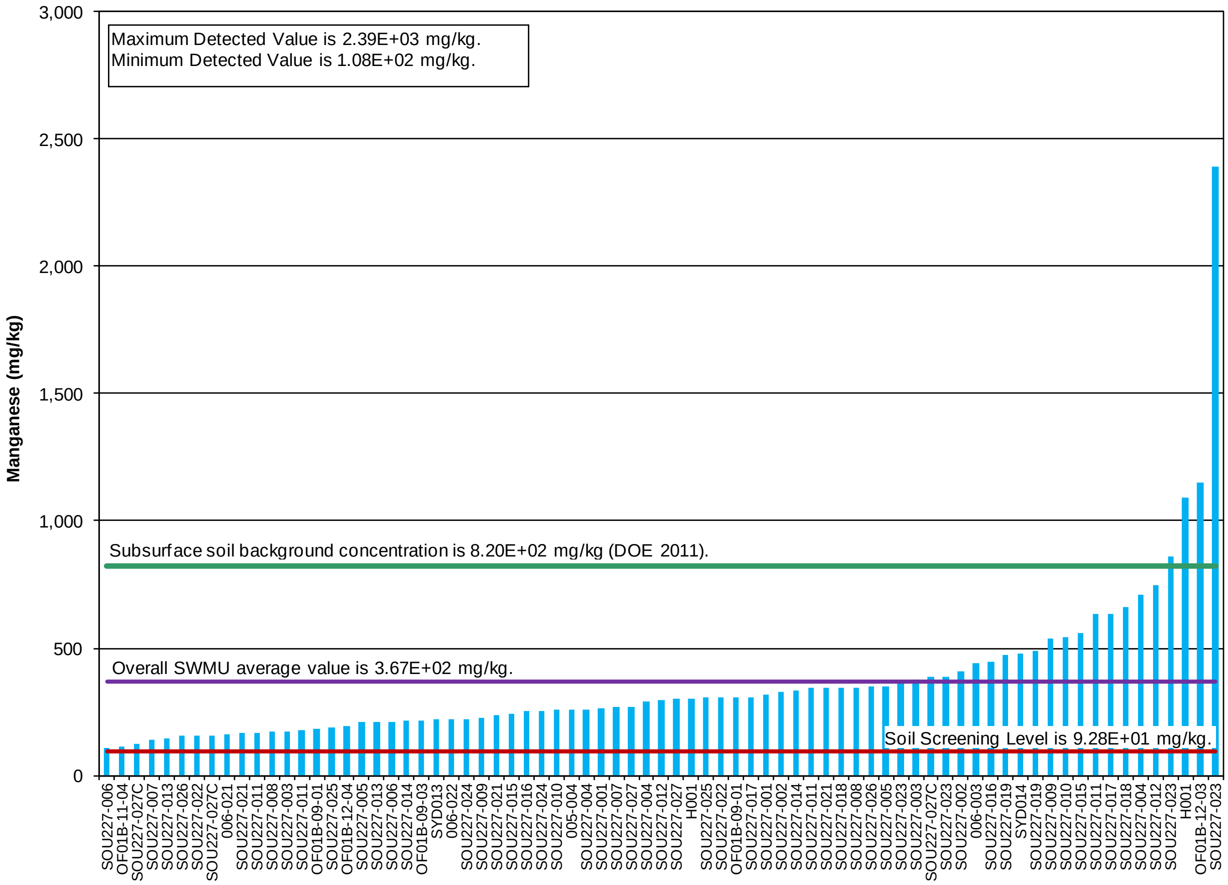

Figure C4.2.10.4. Manganese Detections at SWMU 227

Mercury was detected in 6 of 76 samples. A plot of the detected samples is shown in Figure C4.2.10.5. The average over SWMU 227 for mercury is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Because only 2 samples were detected above the RG SSL, a hot spot evaluation was not performed.

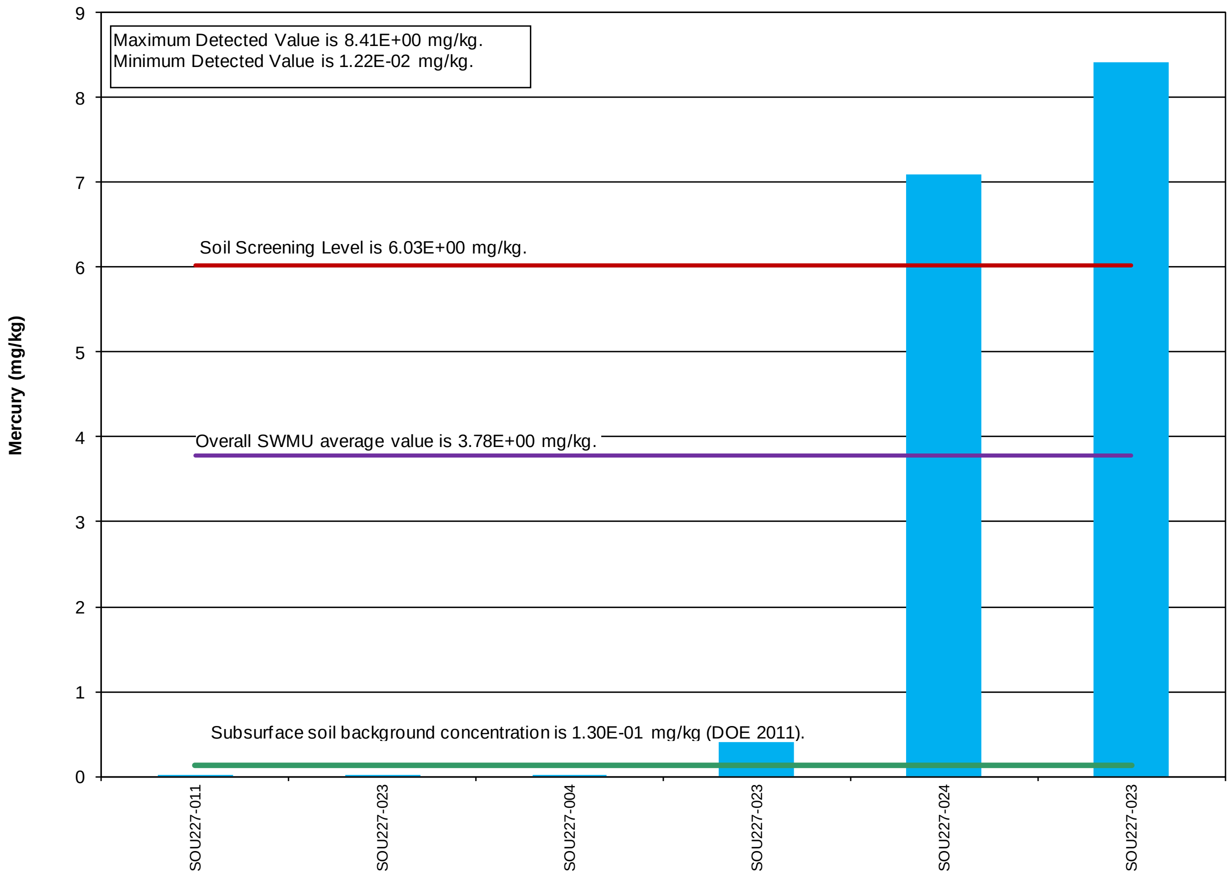

Figure C4.2.10.5. Mercury Detections at SWMU 227

Nickel was detected in 42 of 76 samples. A plot of the detected samples is shown in Figure C4.2.10.6. The average over SWMU 227 for nickel is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Because several samples were detected above the RG SSL, a hot spot evaluation was performed.

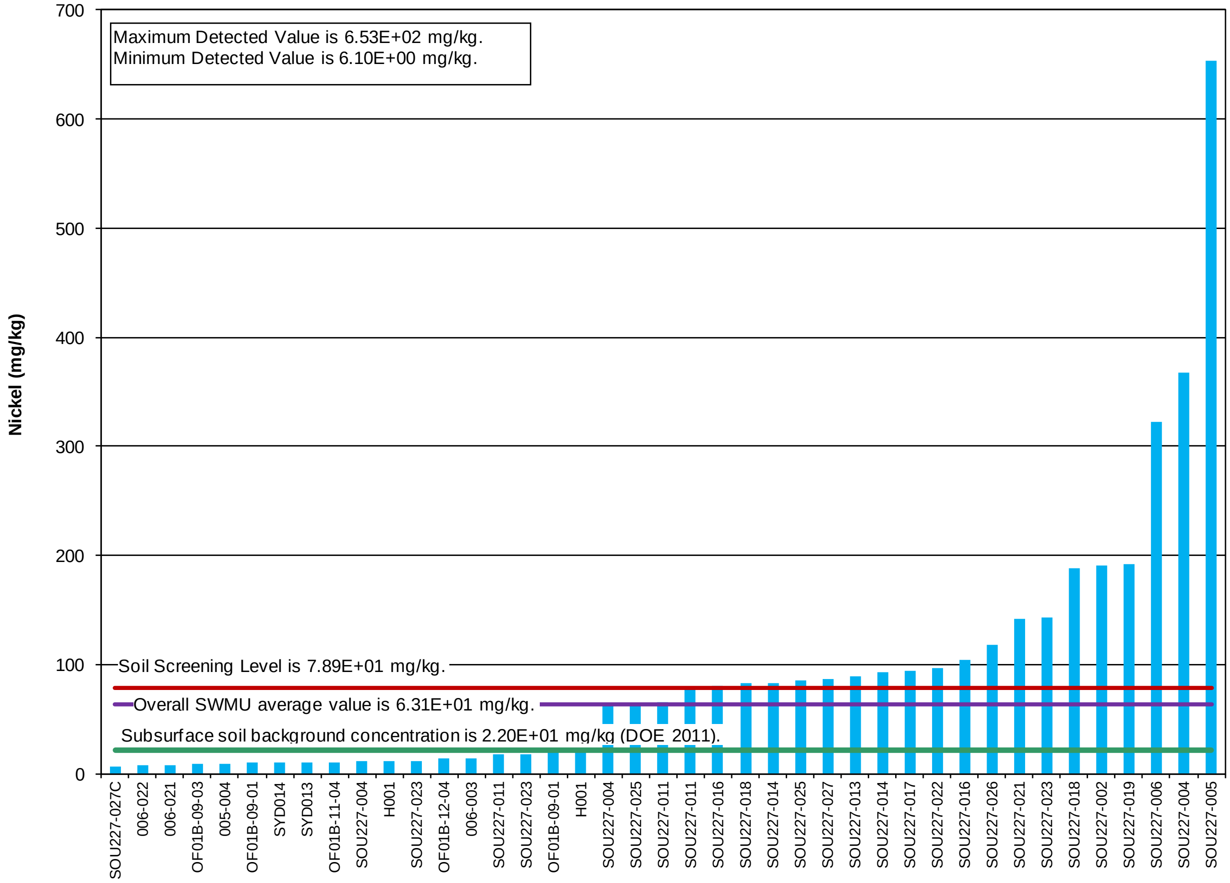

Figure C4.2.10.6. Nickel Detections at SWMU 227

A map of the distribution of detection of nickel is shown in Figure C4.2.10.7. The plot shows that nickel may be clustered indicative of a hot spot; however, fate and transport modeling was not performed, because nickel is being modeled at SWMU 14—the location with the highest average concentration of nickel in any SWMU.

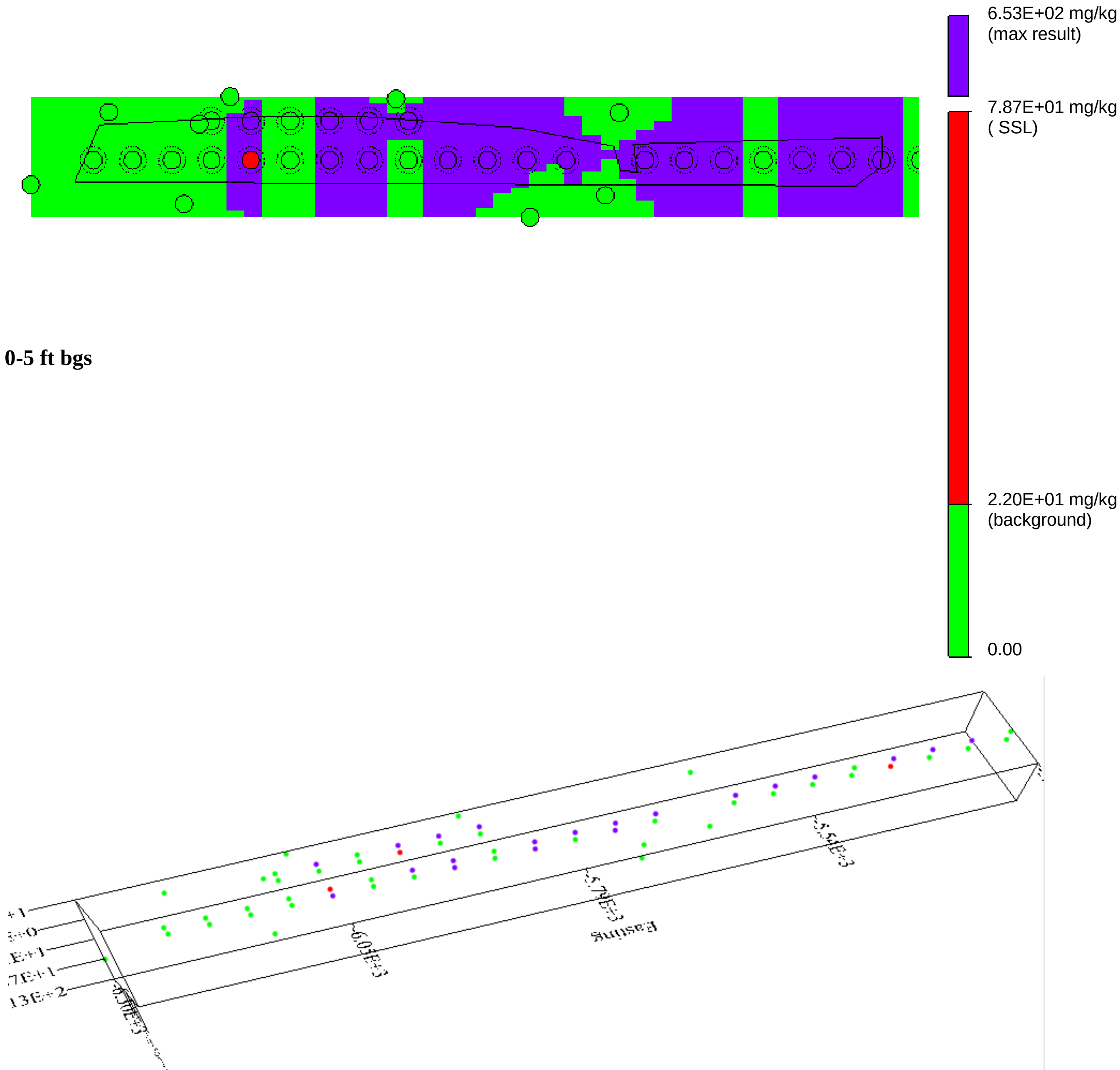

Figure C4.2.10.7. Distribution of Nickel Detections at SWMU 227

Silver was detected in 6 of 76 samples. A plot of the detected samples is shown in Figure C4.2.10.8. The average over SWMU 227 for silver is greater than background and the RG SSL. Silver was evaluated as part of the GWOU FS and is a COC in the groundwater plumes associated with PGDP (DOE 2001d). Silver impacts to RGA groundwater have not been seen; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One sample was detected at a concentration greater than subsurface background, but 1 exceedance does not necessitate a hot spot evaluation.

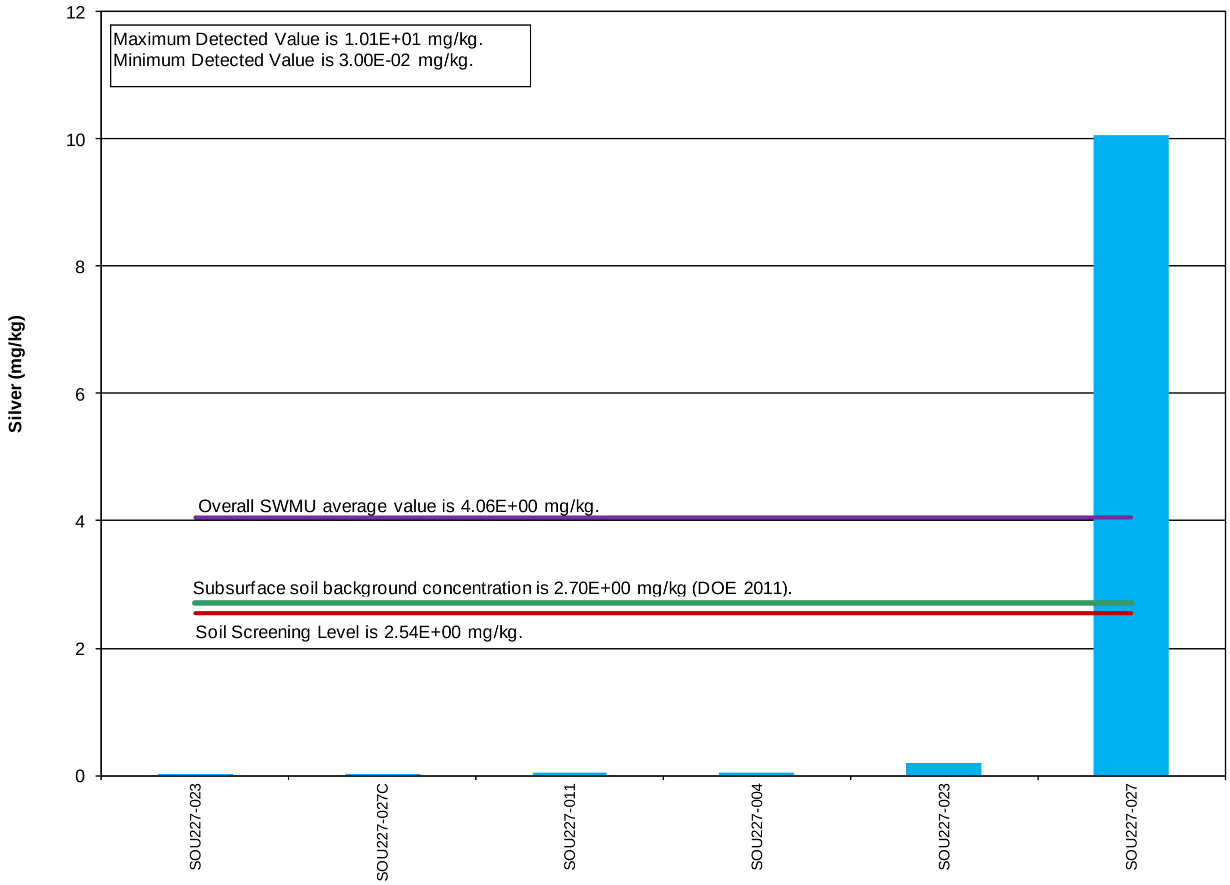

Figure C4.2.10.8. Silver Detections at SWMU 227

Vanadium was detected in 20 of 20 samples. A plot of the detected samples is shown in Figure C4.2.10.9. The average over SWMU 227 for vanadium is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One sample was detected above background, but 1 sample does not necessitate a hot spot evaluation.

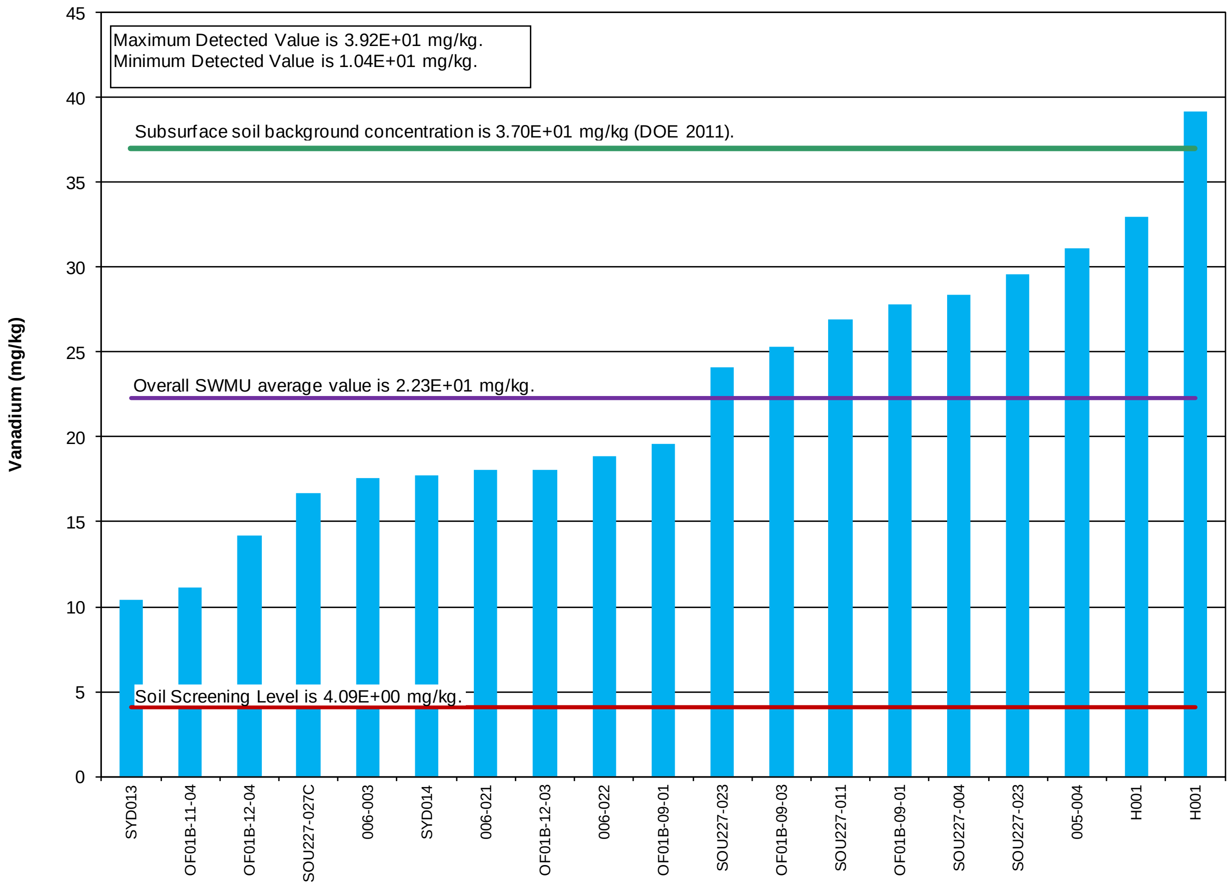

Figure C4.2.10.9. Vanadium Detections at SWMU 227

Technetium-99 was detected in 18 of 18 samples. A plot of the detected samples is shown in Figure C4.2.10.10. The average over SWMU 227 for technetium-99 is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Three samples were detected above the RG SSL, but a hot spot evaluation was not performed.

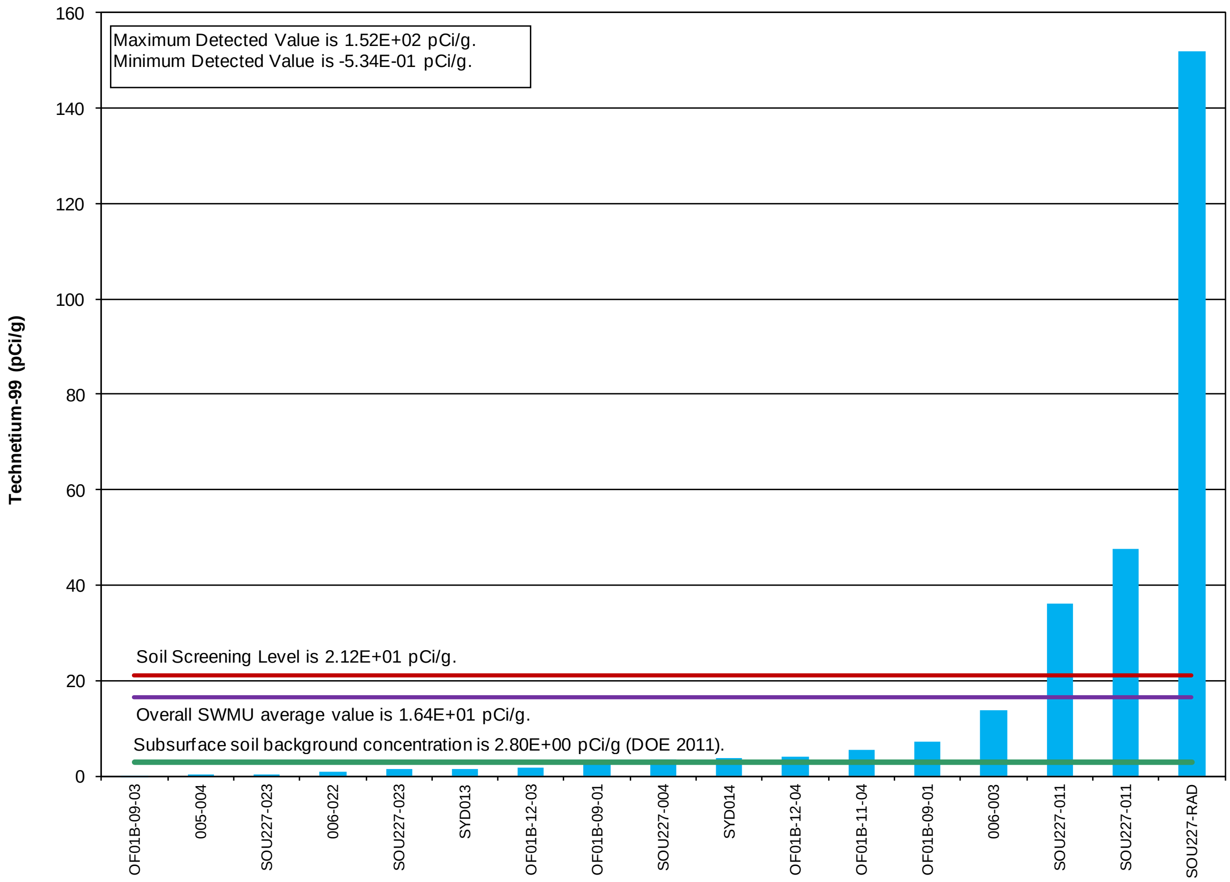

Figure C4.2.10.10. Technetium-99 Detections at SWMU 227

C4.2.11 SWMU 228, C-747-B, OS-17

Data for SWMU 228 consisted of both historical and RI data. SWMU 228 exceedances of the RG SSL include arsenic, cobalt, iron, manganese, mercury, nickel, silver, vanadium, and plutonium 239/240; however, cobalt and vanadium are below background. The data analysis summaries are shown in the following charts.

Arsenic was detected in 12 of 31 samples. A plot of the detected samples is shown in Figure C4.2.11.1. The average over SWMU 228 for arsenic is less than the RG SSL and background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Because only 1 sample was detected above background, a hot spot evaluation was not performed.

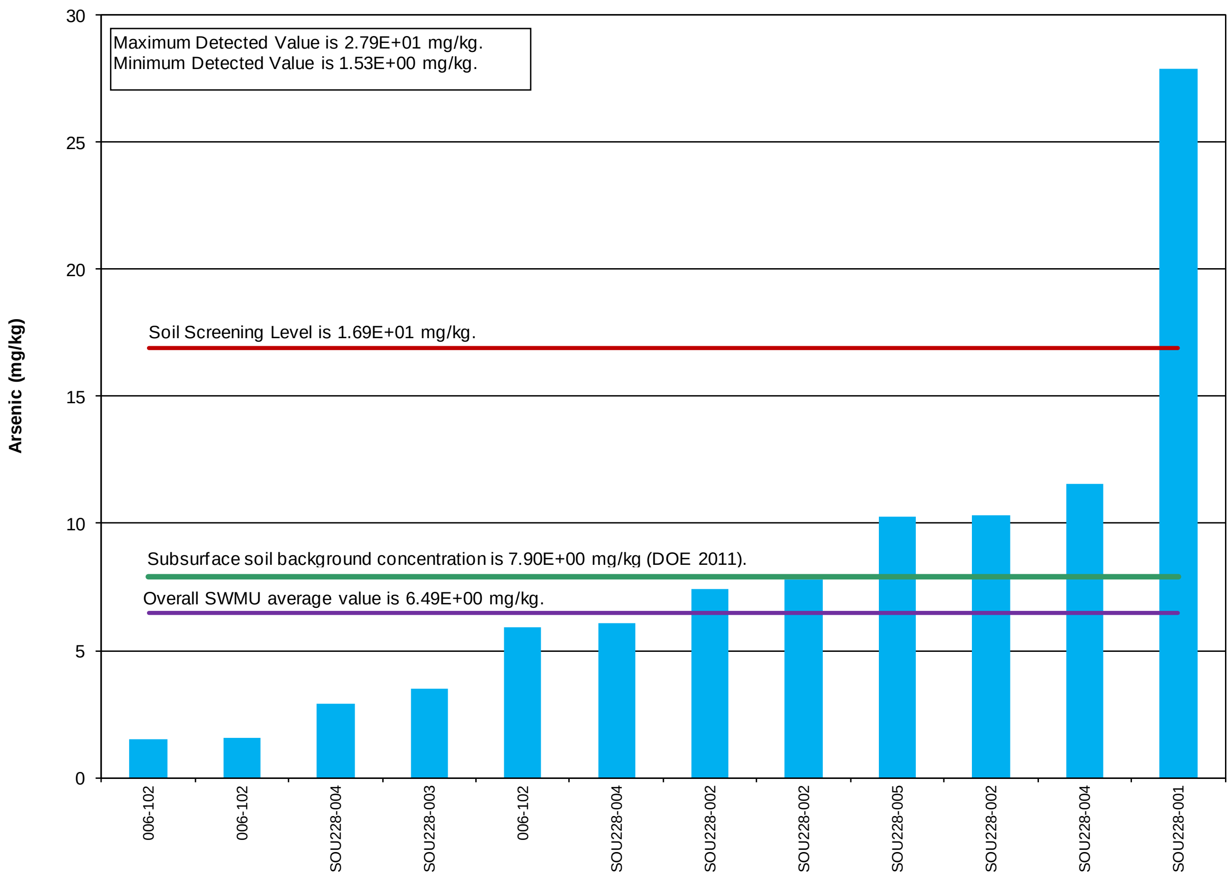

Figure C4.2.11.1. Arsenic Detections at SWMU 228

Iron was detected in 31 of 31 samples. A plot of the detected samples is shown in Figure C4.2.11.2. The average over SWMU 228 for iron is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One sample was detected above background, but 1 sample does not necessitate a hot spot evaluation.

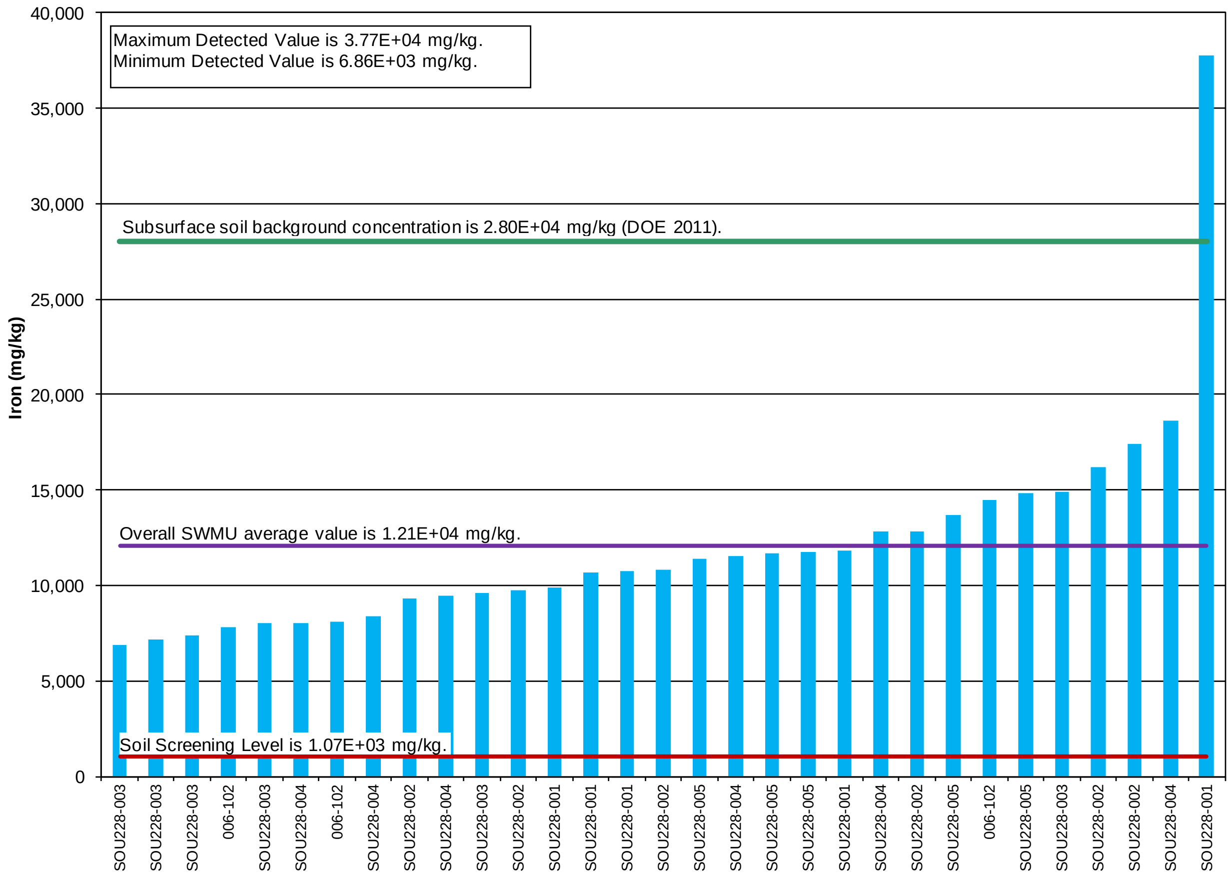

Figure C4.2.11.2. Iron Detections at SWMU 228

Manganese was detected in 31 of 31 samples. A plot of the detected samples is shown in Figure C4.2.11.3. The average over SWMU 228 for manganese is less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One sample was detected above background, but 1 sample does not necessitate a hot spot evaluation.

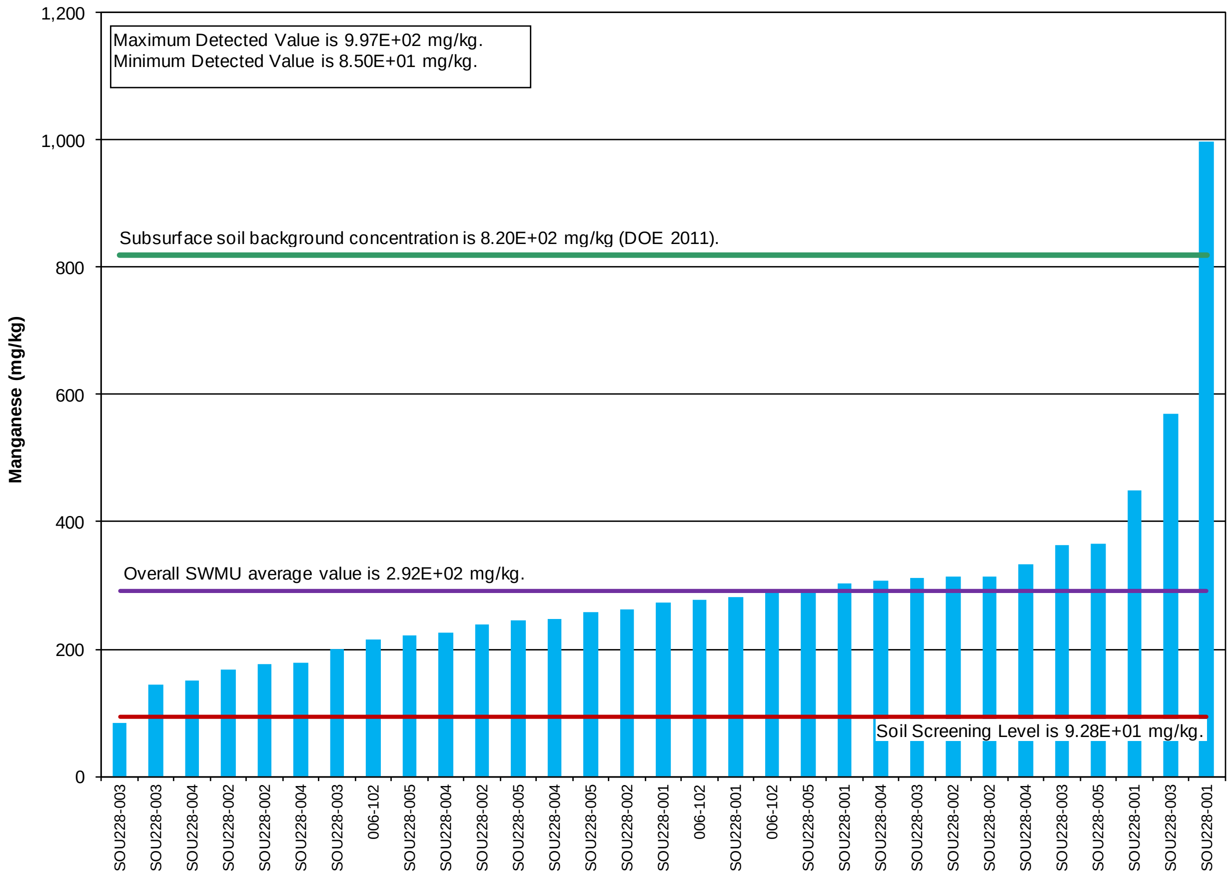

Figure C4.2.11.3. Manganese Detections at SWMU 228

Mercury was detected in 4 of 31 samples. A plot of the detected samples is shown in Figure C4.2.11.4. The average over SWMU 228 for mercury is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One sample was detected above the RG SSL, but 1 sample does not necessitate a hot spot evaluation.

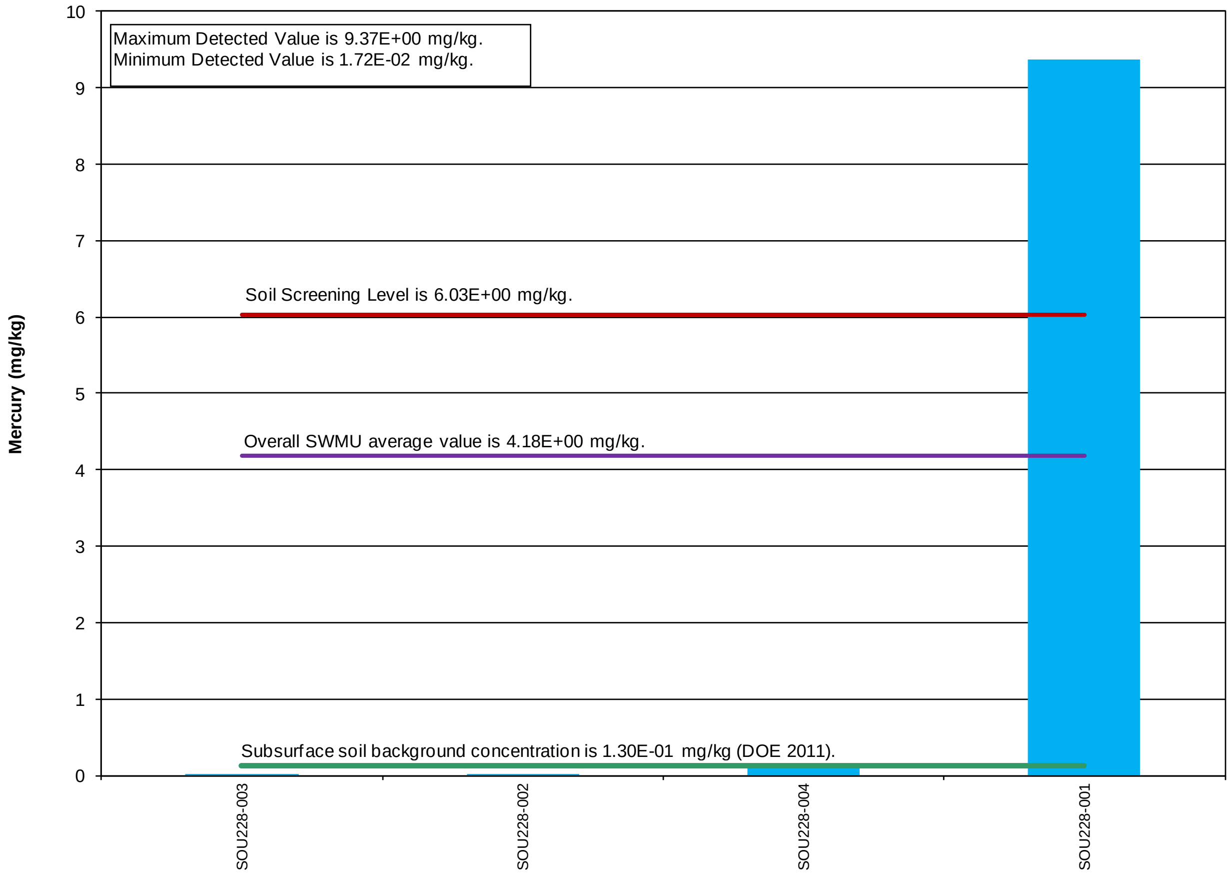

Figure C4.2.11.4. Mercury Detections at SWMU 228

Nickel was detected in 13 of 31 samples. A plot of the detected samples is shown in Figure C4.2.11.5. The average over SWMU 228 for nickel is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Because only 1 sample was detected above the RG SSL, a hot spot evaluation was not performed.

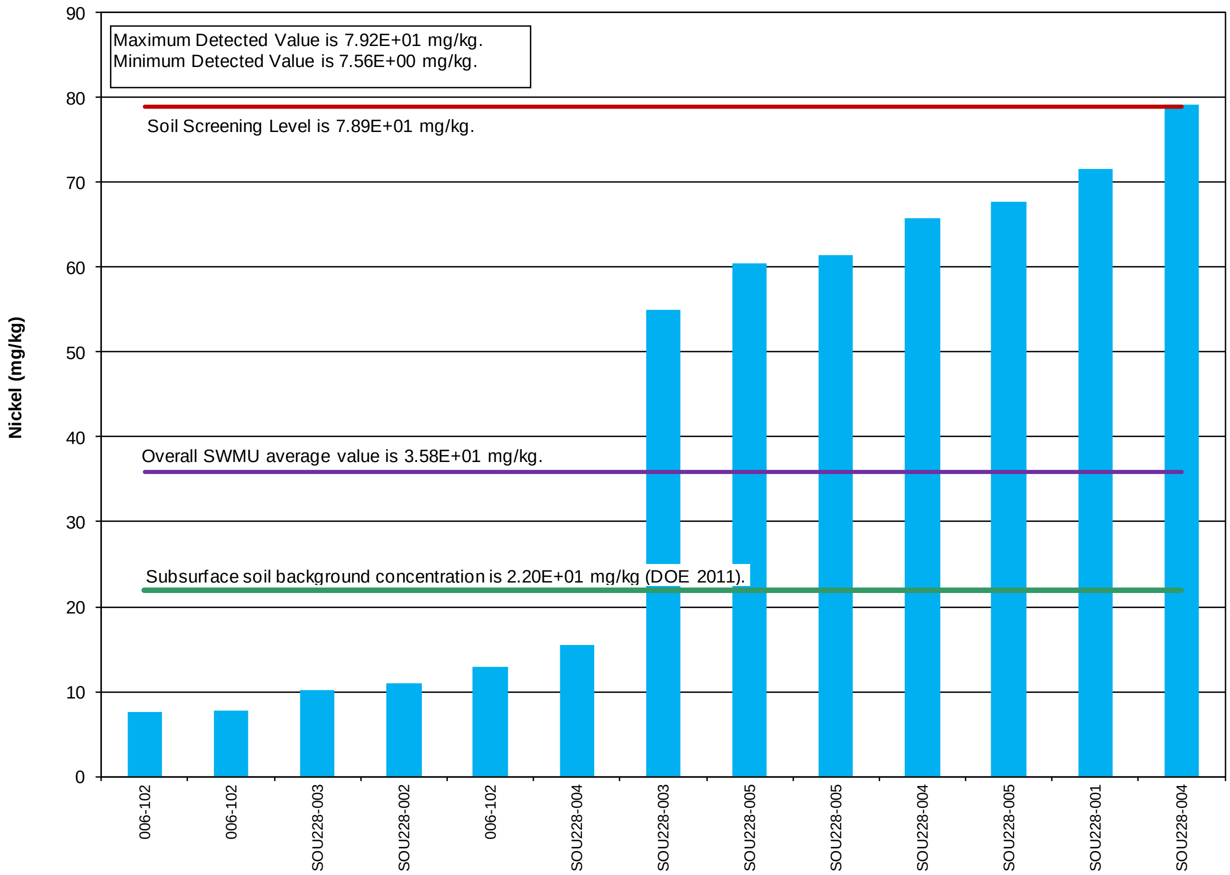

Figure C4.2.11.5. Nickel Detections at SWMU 228

Silver was detected in 5 of 31 samples. A plot of the detected samples is shown in Figure C4.2.11.6. The average over SWMU 228 for silver is greater than background and the RG SSL. Silver was evaluated as part of the GWOU FS and is a COC in the groundwater plumes associated with PGDP (DOE 2001d). Silver impacts on the RGA groundwater have not been noted; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Two samples were detected at a concentration greater than subsurface background, but 2 exceedances do not necessitate a hot spot evaluation.

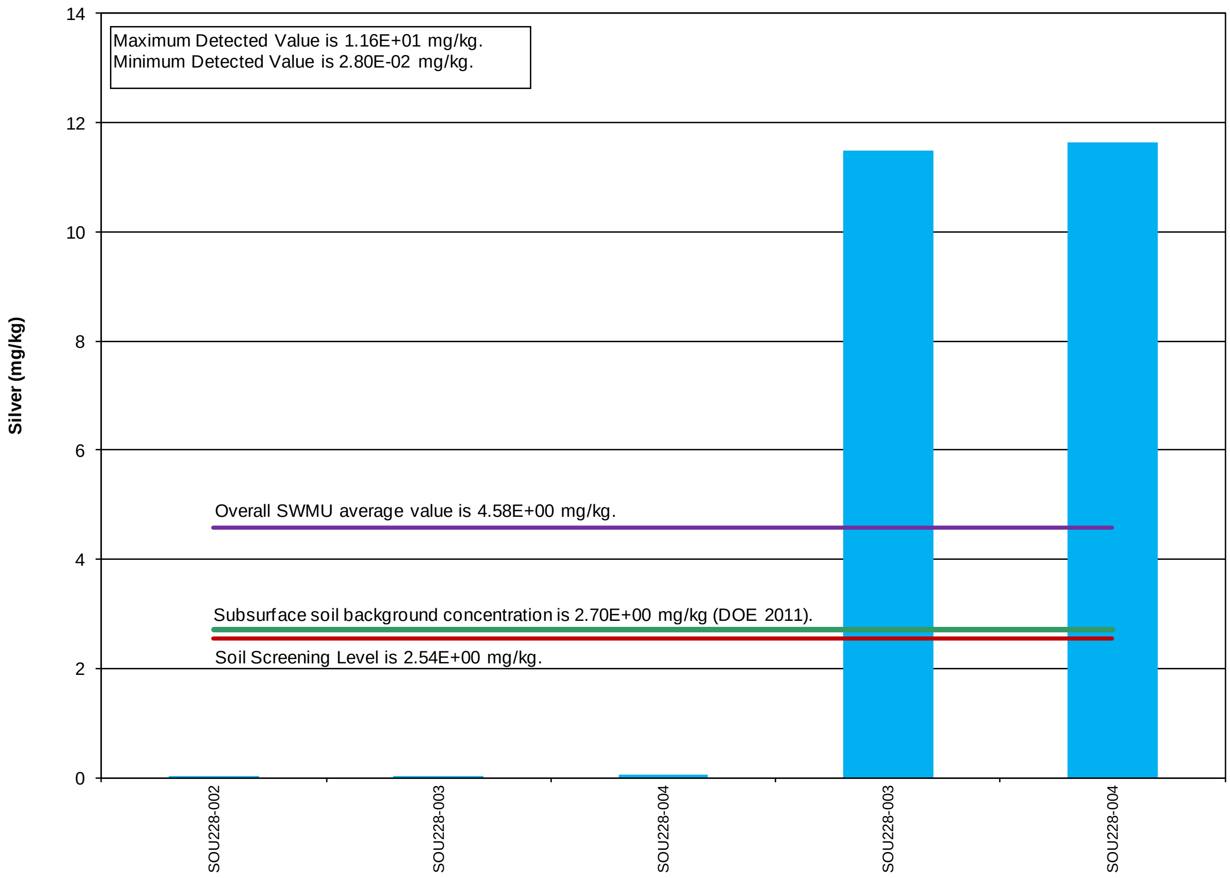

Figure C4.2.11.6. Silver Detections at SWMU 228

Plutonium-239/240 was detected in six of six samples. A plot of the detected samples is shown in Figure C4.2.11.7. The average over SWMU 228 for plutonium-239/240 is less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. No samples were detected above the RG SSL; therefore, a hot spot evaluation was not performed.

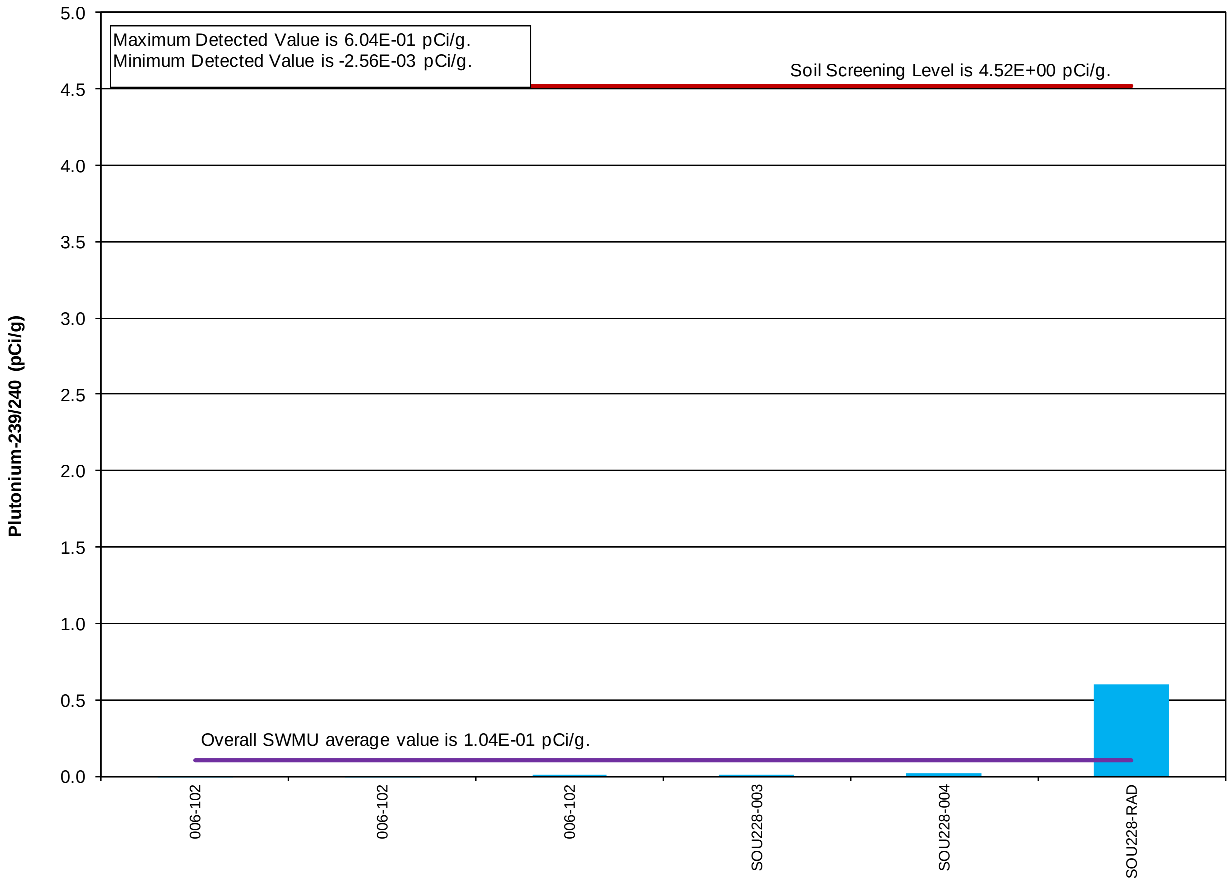

Figure C4.2.11.7. Plutonium-239/240 Detections at SWMU 228

ATTACHMENT C5

DATA SUMMARY AND EVALUATION, GROUP 2, UNDERGROUND TANKS

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C5. DATA SUMMARY AND EVALUATION, GROUP 2, UNDERGROUND TANKS

C5.1.1 SWMU 27 (C-722 ACID NEUTRALIZATION TANK)

Data for SWMU 27 consisted entirely of historical data. SWMU 27 exceedances of the RG SSL include cobalt, iron, manganese, and vanadium; however, all of these constituents are present below background. Because the maximum results of all detected chemicals at SWMU 27 were below background, no chemicals were modeled for groundwater fate and transport or hot spot evaluations.

C5.1.2 SWMU 76 (C-632-B SULFURIC ACID STORAGE TANK)

Data for SWMU 76 consisted entirely of RI data. SWMU 76 exceedances of the RG SSL include cobalt, iron, manganese, mercury, and vanadium. Cobalt, iron, manganese, and vanadium were not detected above background values; therefore, they were not considered for groundwater transport modeling or hot spot evaluations.

Mercury was detected in three of five samples. The chart illustrating the detections is shown in Figure C5.1.2.1. The average over SWMU 76 for mercury was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Because only 1 value was detected at concentrations greater than RG SSL, a hot spot evaluation was not necessary.

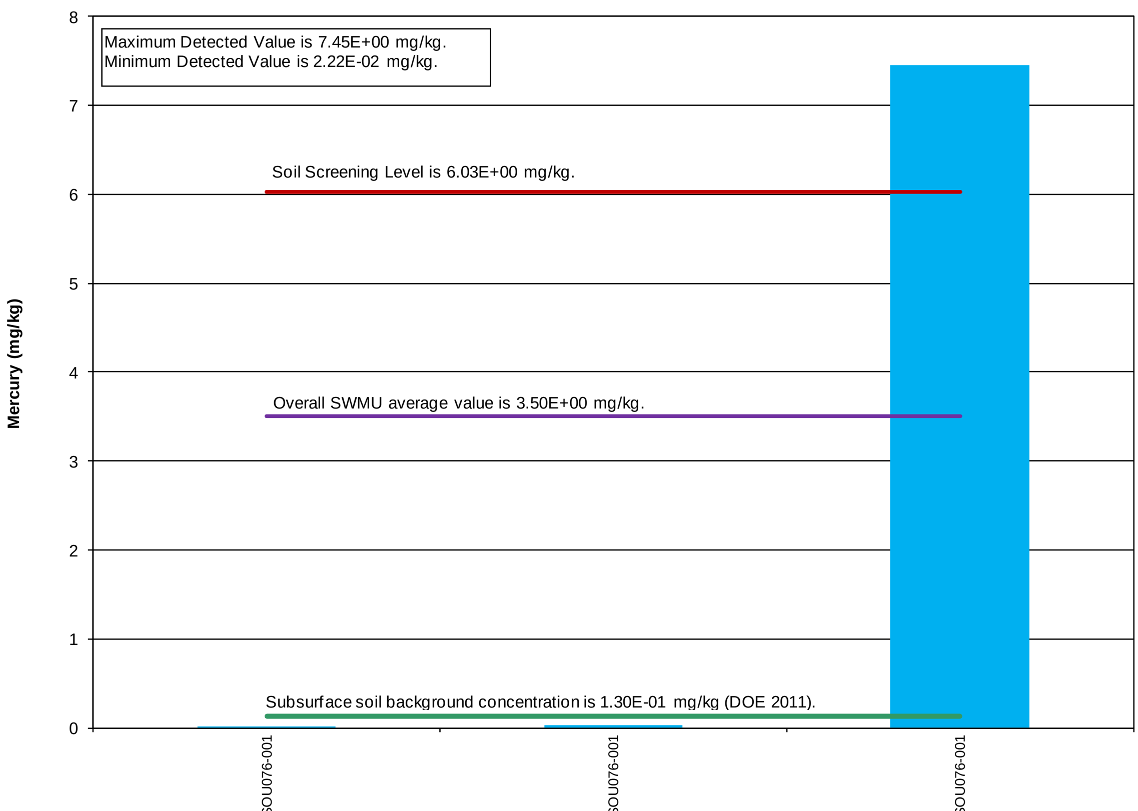

Figure C5.1.2.1. Mercury Detections at SWMU 76

C5.1.3.1 SWMU 165 (C-616-L PIPELINE AND VAULT SOIL CONTAMINATION)

Data for SWMU 165 consisted of both historical data and RI data. SWMU 165 exceedances of the RG SSL include naphthalene, pentachlorophenol, Total PCBs, arsenic, cobalt, iron, manganese, silver, vanadium, plutonium-239, plutonium-239/240, and technetium-99. Iron, manganese, and vanadium were not detected above background values; therefore, they were not considered for groundwater transport modeling or hot spot evaluations.

Naphthalene was reported in 4 of 17 samples. The chart illustrating the reported results is shown in Figure C5.1.3.1. Although the average over SWMU 165 for naphthalene was greater than the RG SSL, it was evaluated in the GWOU FS and was not identified as a contaminant of concern (COC) in the PGDP groundwater plumes (DOE 2001d). Naphthalene was not modeled for groundwater fate and transport, nor was a hot spot evaluation necessary.

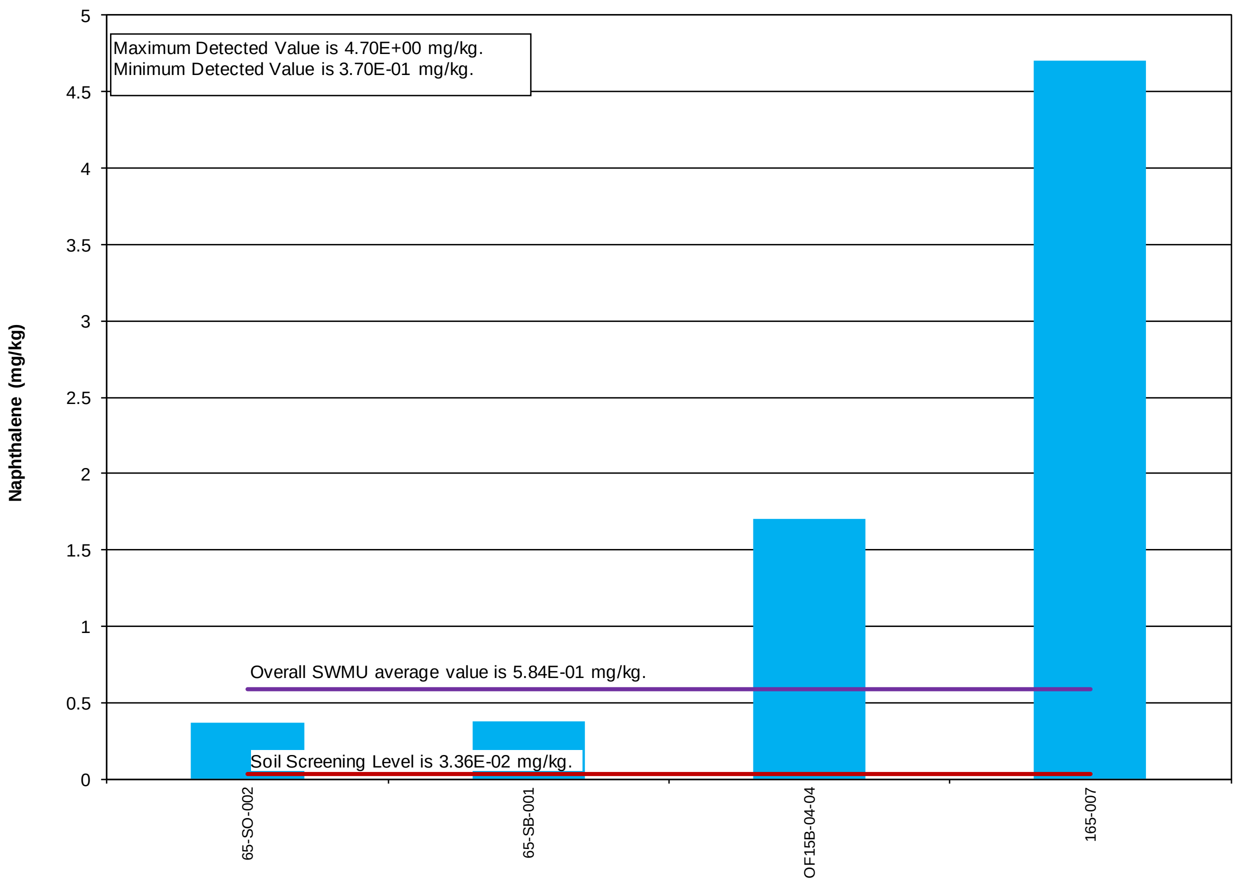

Figure C5.1.3.1. Naphthalene Detections at SWMU 165

Pentachlorophenol was detected in 1 of 13 samples. The chart illustrating the detections is shown in Figure C5.1.3.2. Although the detected result is greater than the RG SSL, pentachlorophenol evaluated in the GWOU FS and was not identified as a COC in the groundwater plumes at PGDP; therefore, this analyte was not modeled for fate and transport (DOE 2001d). This single result does not necessitate a hot spot evaluation.

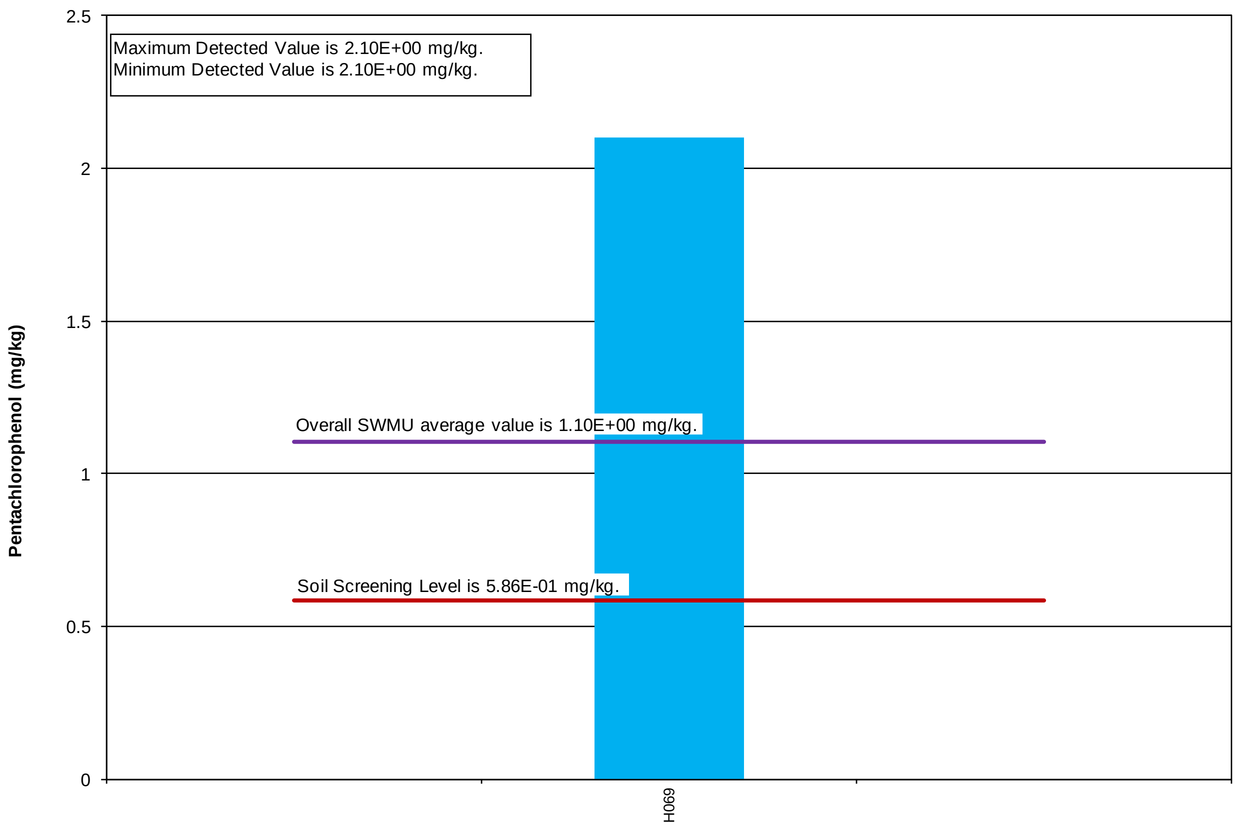

Figure C5.1.3.2. Pentachlorophenol Detections at SWMU 165

Total PCBs were detected in 35 of 226 samples. The chart illustrating the detections is shown in Figure C5.1.3.3. The average of Total PCBs over SWMU 165 is less than the RG SSL; therefore, this analyte was not modeled for fate and transport. Six results were detected above the RG SSL; therefore, a hot spot evaluation was performed. A plot showing the distribution of PCB detections at SWMU 165 is shown in Figure C5.1.3.4.

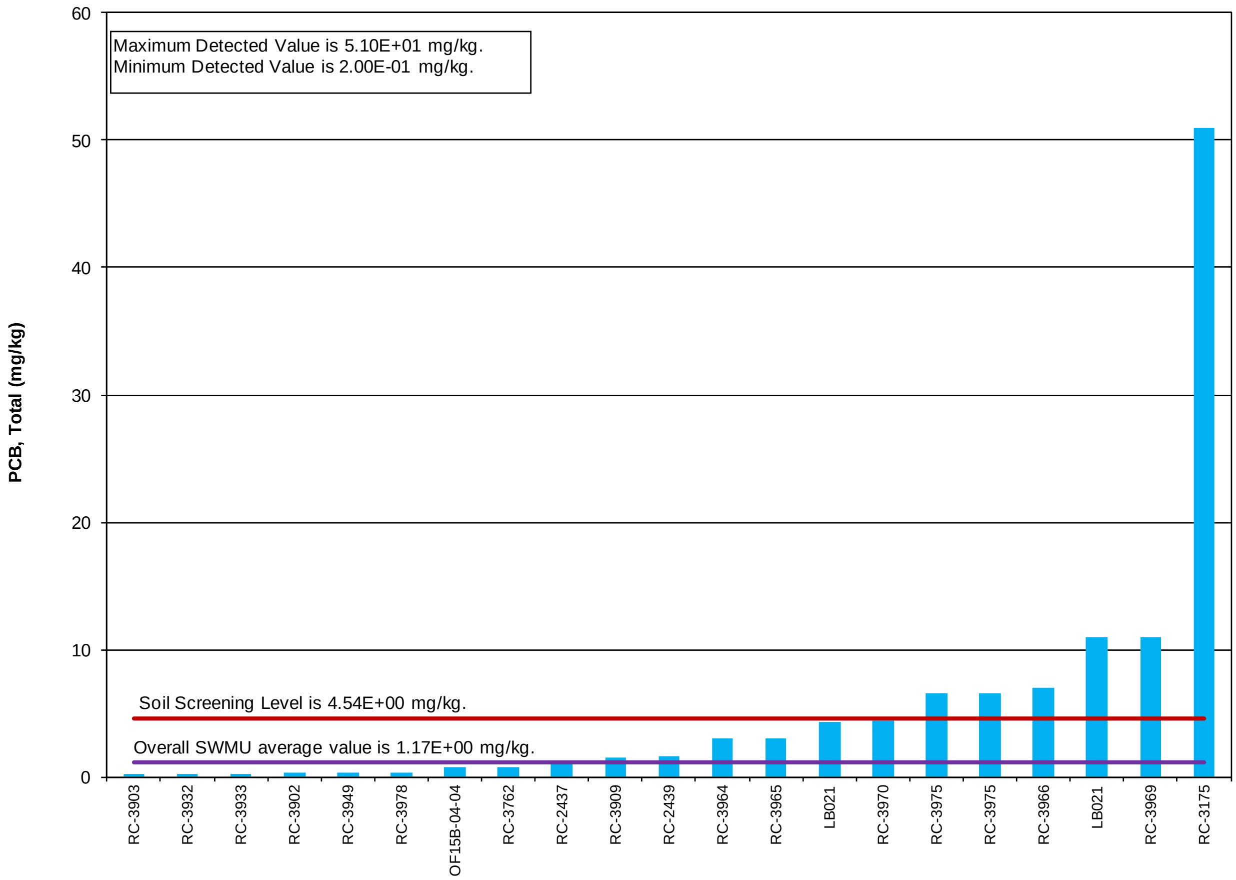

Figure C5.1.3.3. Total PCB Detections at SWMU 165

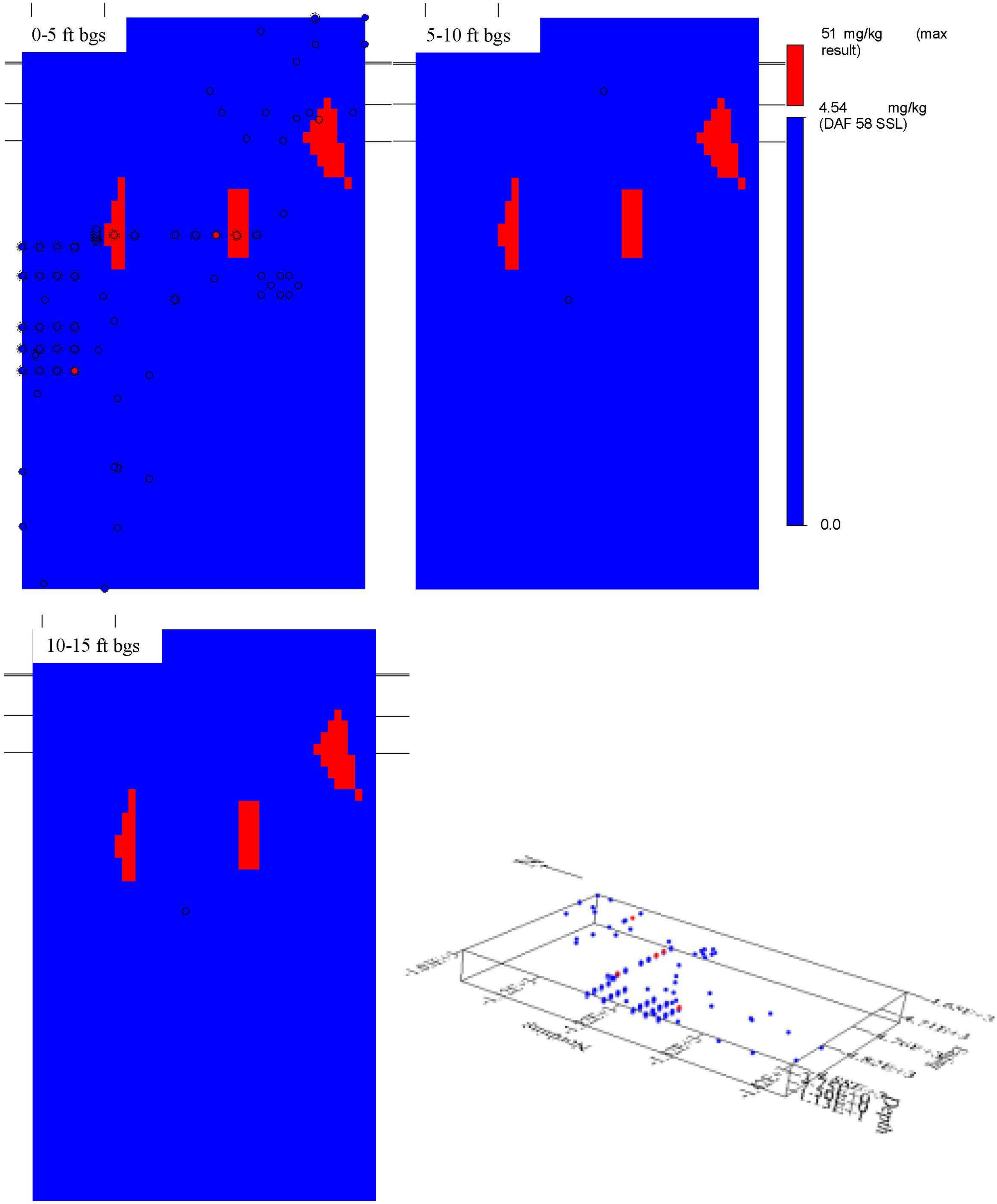

Figure C5.1.3.4. Distribution of Total PCB Detections at SWMU 165

Arsenic was detected in 24 of 25 samples. The chart illustrating the detections is shown in Figure C5.1.3.5. The average of arsenic over SWMU 165 is greater than the RG SSL and background. This analyte was evaluated for fate and transport as part of the GWOU FS and is a COC in the groundwater plumes at PGDP; therefore, arsenic was subjected to fate and transport modeling (DOE 2001d).

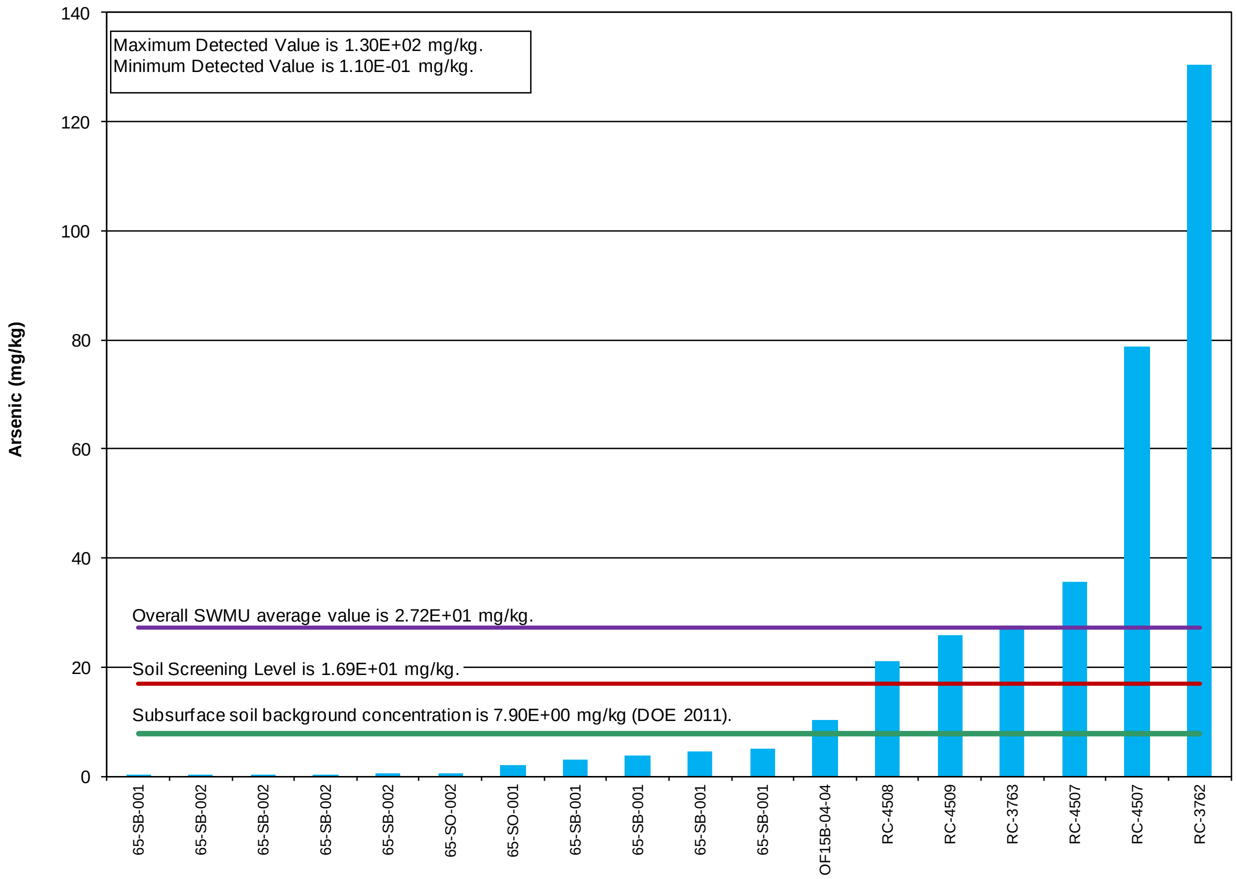

Figure C5.1.3.5. Arsenic Detections at SWMU 165

Cobalt was detected in 12 of 12 samples. The chart illustrating the detections is shown in Figure C5.1.3.6. The average of cobalt over SWMU 165 is lower than background; therefore, it was not modeled for fate and transport. Because only 1 result was detected above background, a hotspot evaluation was not necessary.

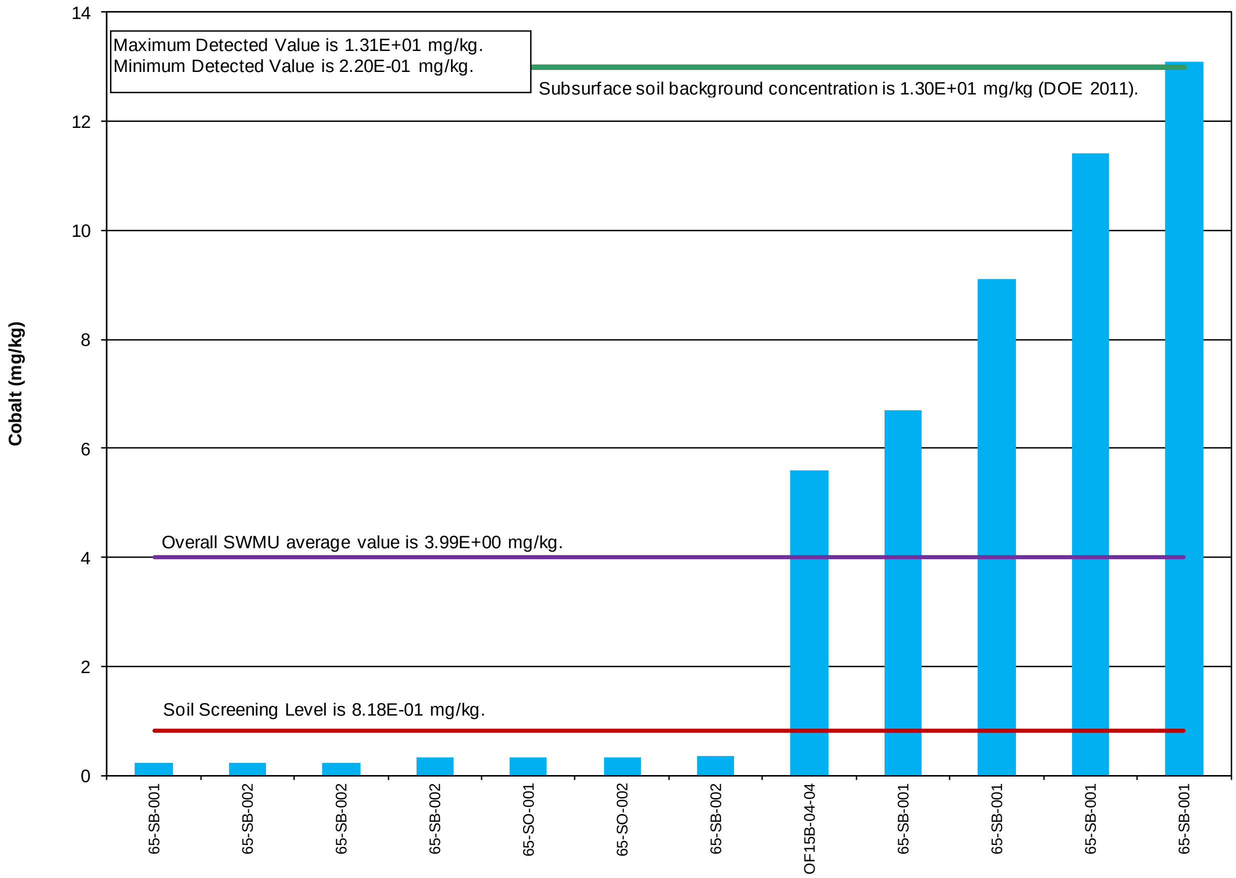

Figure C5.1.3.6. Cobalt Detections at SWMU 165

Silver was detected in 7 of 25 samples. The chart illustrating the detections is shown in Figure C5.1.3.7. The average of silver over SWMU 165 is greater than the RG SSL and background. This analyte was evaluated as part of the GWOU FS and is a COC in the groundwater plumes at PGDP (DOE 2001d). The evaluation presented in Attachment C1 to Appendix C did not identify any RGA silver impacts; therefore, neither fate and transport modeling nor hot spot evaluation was performed for this chemical at this SWMU.

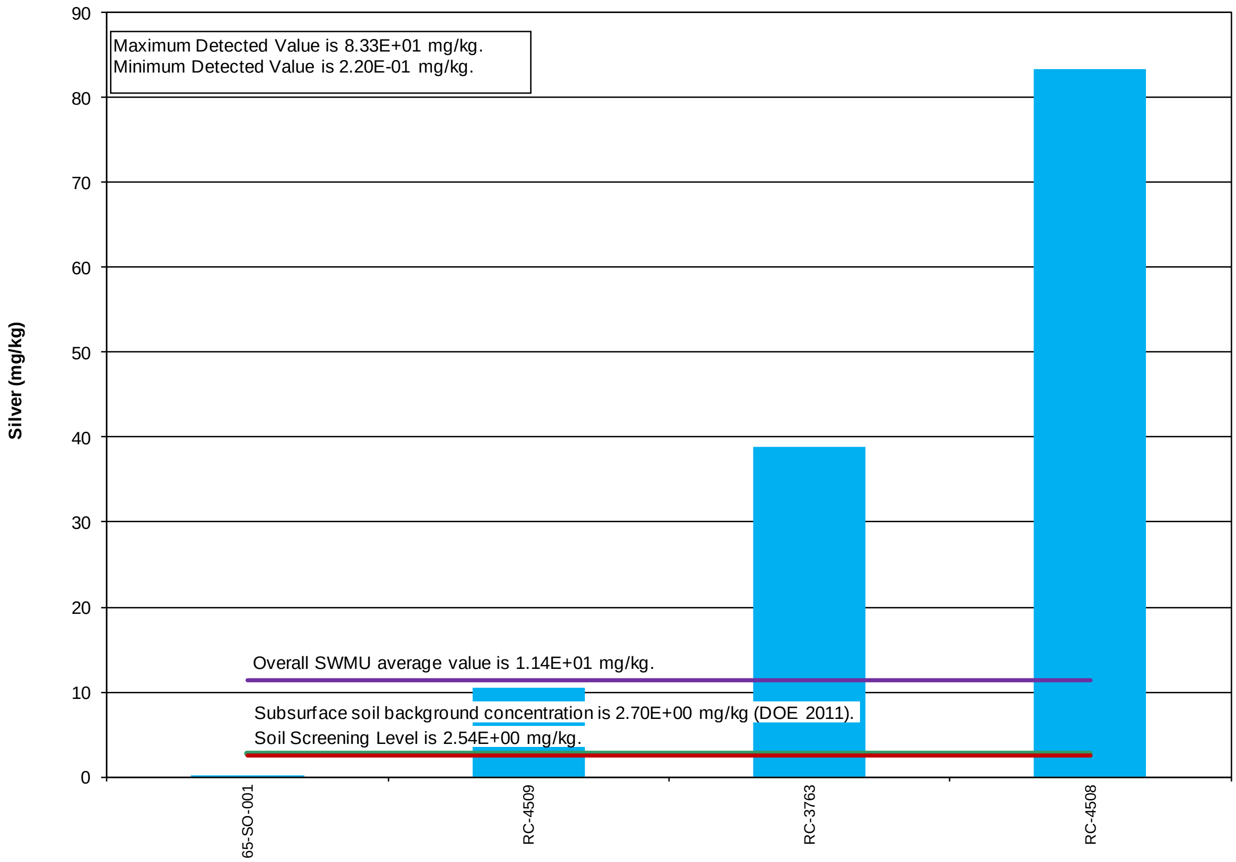

Figure C5.1.3.7. Silver Detections at SWMU 165

Plutonium-239 was detected in two of two samples. The chart illustrating the detections is shown in Figure C5.1.3.8. The average for the 2 results is less than the RG SSL; therefore, this analyte was not modeled for fate and transport. There were no results above the RG SSL and it does not necessitate a hot spot evaluation.

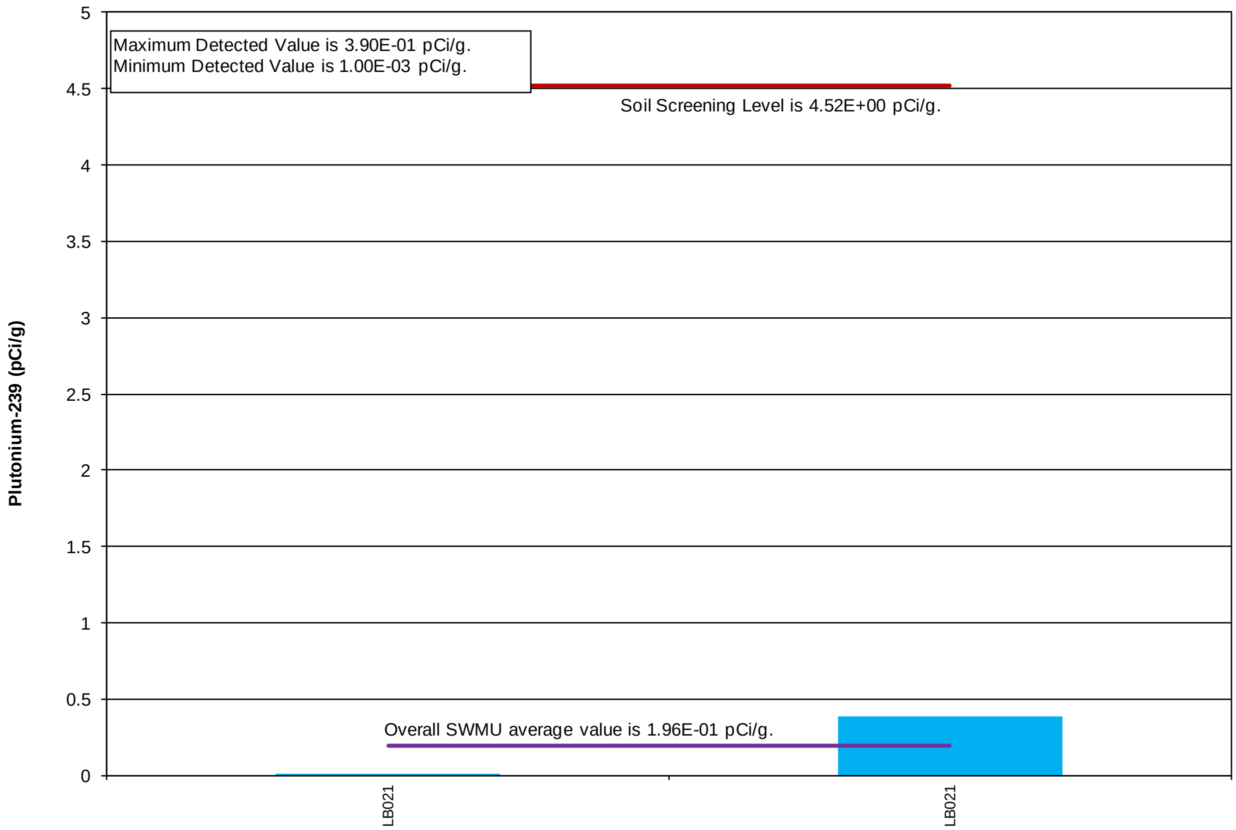

Figure C5.1.3.8. Plutonium-239 Detections at SWMU 165

Plutonium-239/240 was detected in three of three samples. The chart illustrating the detections is shown in Figure C5.1.3.9. Although the average over SWMU 165 for plutonium-239/240 was greater than the RG SSL, it was assessed during the GWOU FS and was not identified as a COC in the plumes associated with PGDP; therefore, plutonium-239/240 was not modeled for groundwater fate and transport (DOE 2001d). A hot spot evaluation was not conducted because only 1 sample had a detected result greater than the RG SSL.

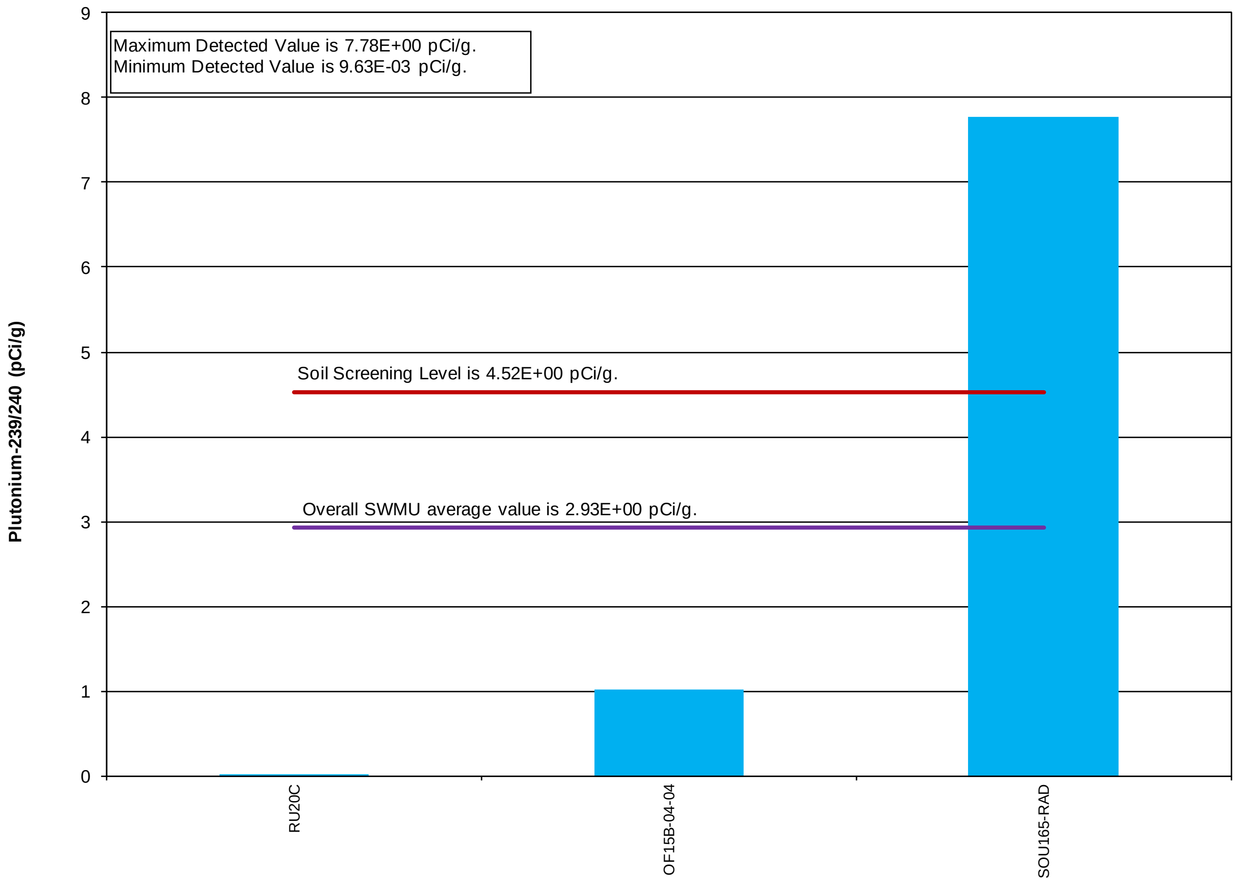

Figure C5.1.3.9. Plutonium-239/240 Detections at SWMU 165

Technetium-99 was reported in 11 of 11 samples. The chart illustrating the reported results is shown in Figure C5.1.3.10. The average over SWMU 165 for technetium-99 was less than the RG SSL value; therefore, technetium-99 was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted. Five samples had a detection result greater than the RG SSL.

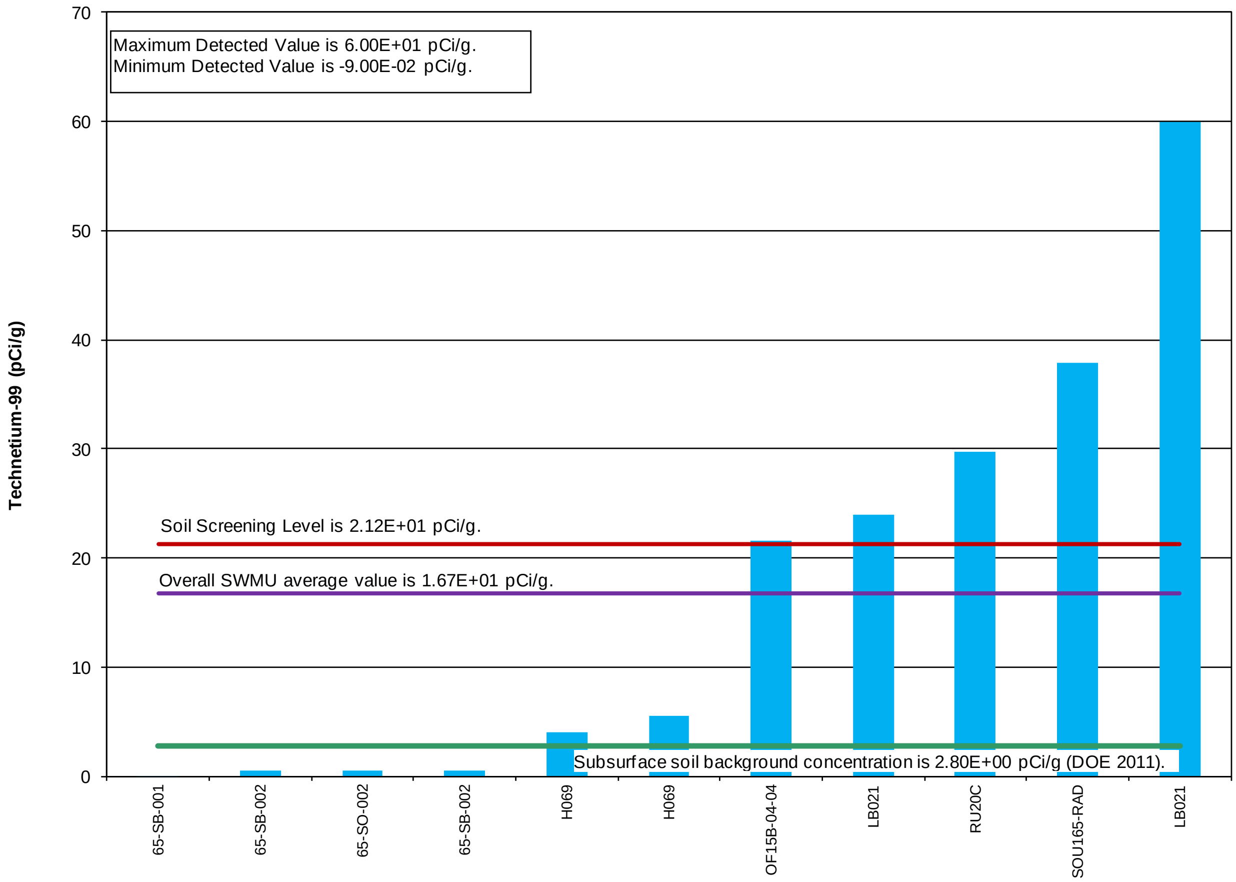

Figure C5.1.3.10. Technetium-99 Detections at SWMU 165

C5.1.4 SWMU 170 (C-729 ACETYLENE BUILDING DRAIN PITS)

Data for SWMU 170 consisted of both historical data and RI data. SWMU 170 had no exceedances of the RG SSL.

C5.2. GROUP 2, CHROMIUM AREAS

C5.2.1 SWMU 158 (CHILLED WATER SYSTEM LEAK SITE)

Data for SWMU 158 consisted of both historical data and RI data. SWMU 158 exceedances of the RG SSL include cobalt, iron, manganese, mercury, nickel, silver, and vanadium. Iron and vanadium were not detected above background values; therefore, they were not considered for groundwater transport modeling or hot spot evaluations.

Cobalt was reported in 10 of 10 samples. The chart illustrating the reported results is shown in Figure C5.2.1. The average over SWMU 158 for cobalt was less than background; therefore, cobalt was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

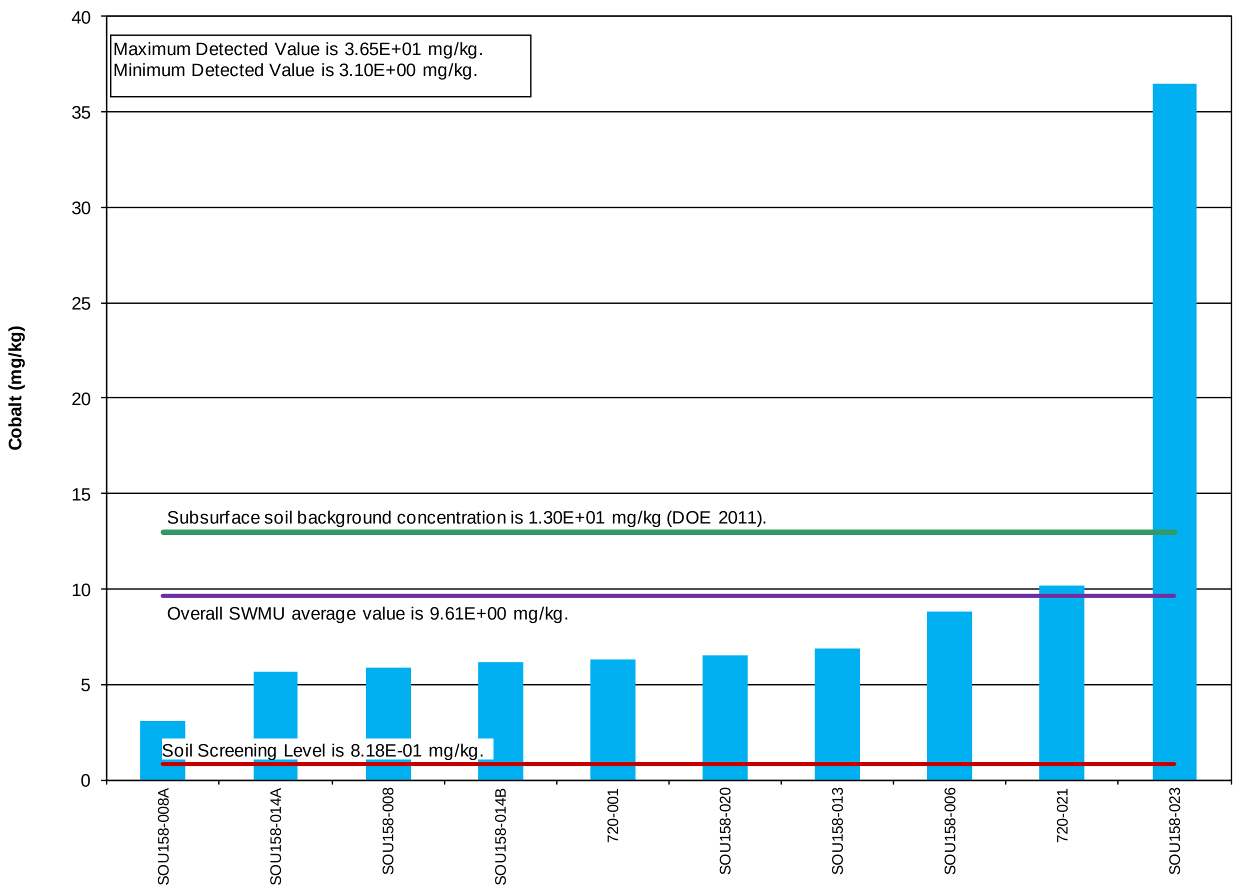

Figure C5.2.1. Cobalt Detections at SWMU 158

Manganese was reported in 68 of 70 samples. The chart illustrating the reported results is shown in Figure C5.2.2. The average over SWMU 158 for manganese was less than the background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted even though several samples had a detected result greater than background because manganese is ubiquitous, concentrations are controlled by site soil geochemistry, and there are no soils-related impacts on RGA groundwater.

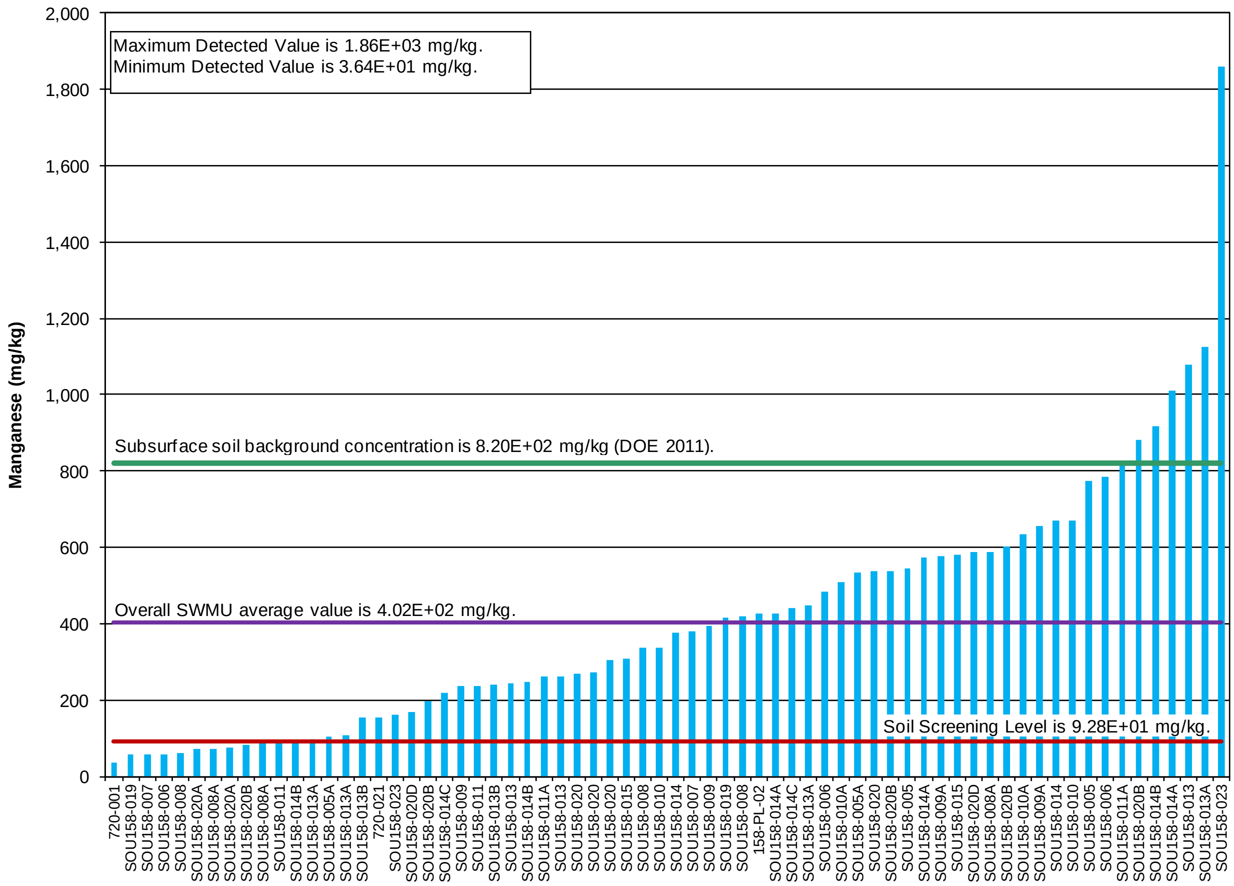

Figure C5.2.2. Manganese Detections at SWMU 158

Mercury was reported in 10 of 70 samples. The chart illustrating the reported results is shown in Figure C5.2.3. The average over SWMU 158 for mercury was less than the RG SSL; therefore, mercury was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because mercury was assessed for nature and extent during the GWOU FS, and was not identified as a COC in the groundwater plumes associated with PGDP (DOE 2001d).

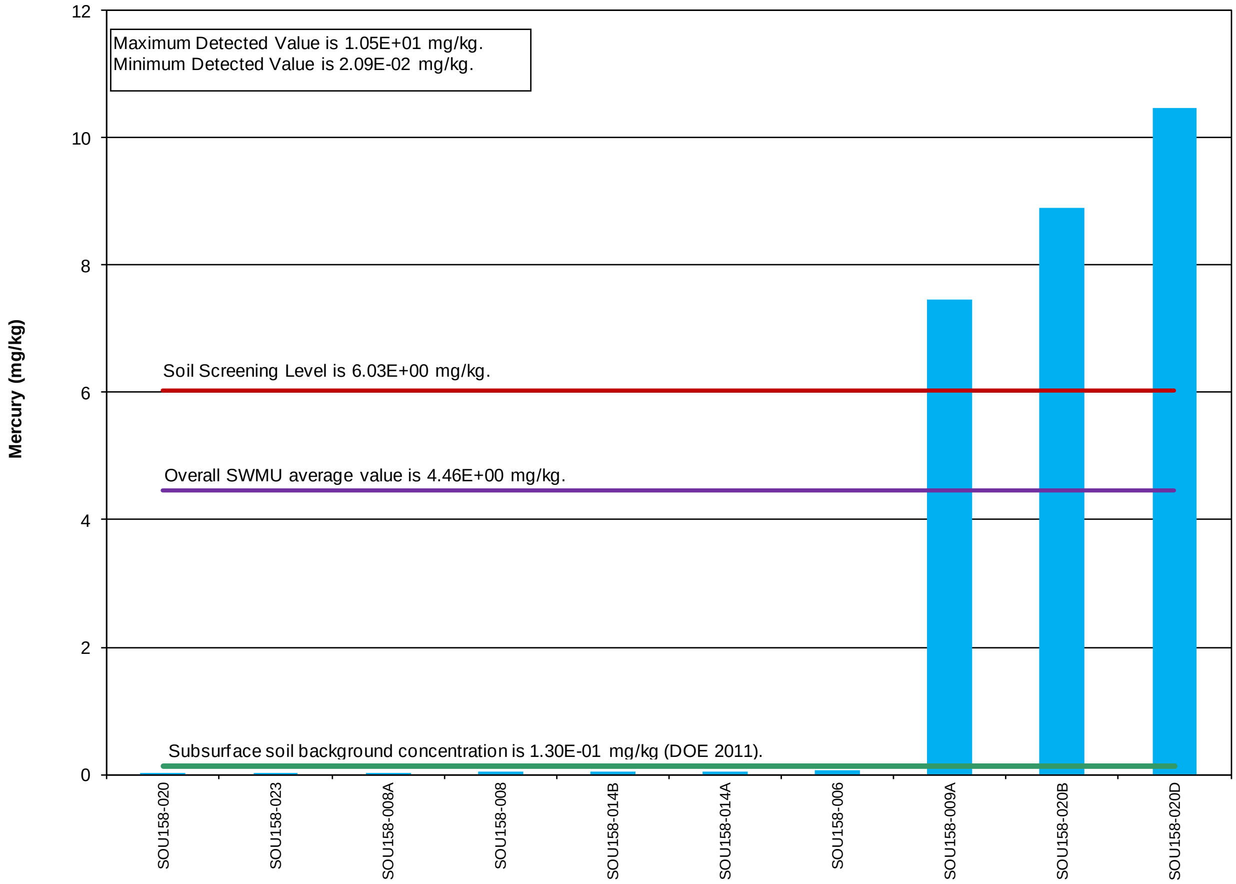

Figure C5.2.3. Mercury Detections at SWMU 158

Nickel was reported in 19 of 70 samples. The chart illustrating the reported results is shown in Figure C5.2.4. The average over SWMU 158 for nickel was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. Several samples were detected at a concentration greater than the RG SSL; however, a hot spot evaluation was not performed because nickel is being modeled at SWMU 14—the location with the highest average concentration of nickel in any SWMU.

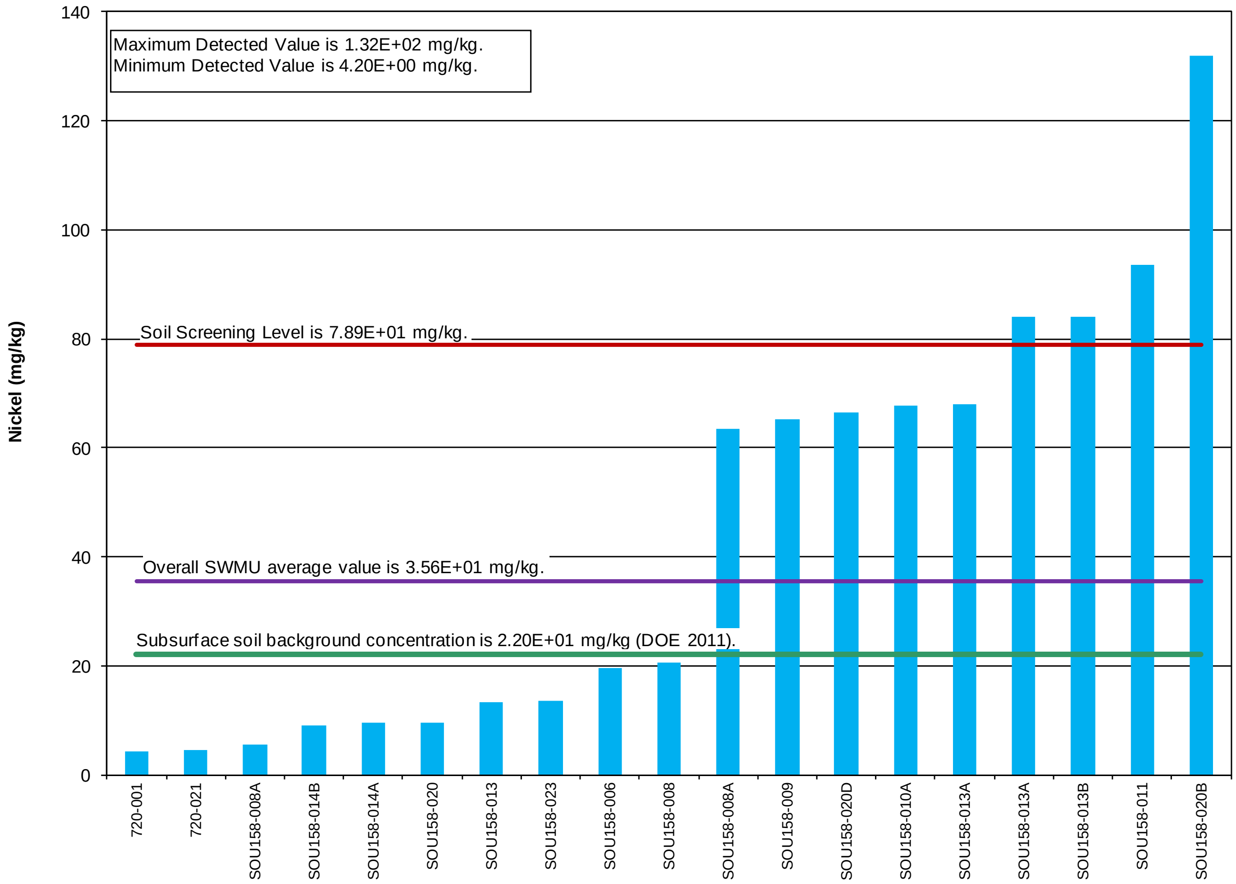

Figure C5.2.4. Nickel Detections at SWMU 158

Silver was detected in 10 of 70 samples. The chart illustrating the detections is shown in Figure C5.2.5. The average of silver over SWMU 158 is greater than the RG SSL and background. This analyte was evaluated for fate and transport as part of the GWOU FS and is a COC in the groundwater plumes at PGDP. The evaluation presented in Attachment C1 to Appendix C did not identify any RGA silver impacts; therefore, neither fate nor transport modeling was performed for this chemical at this SWMU (DOE 2001d). A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

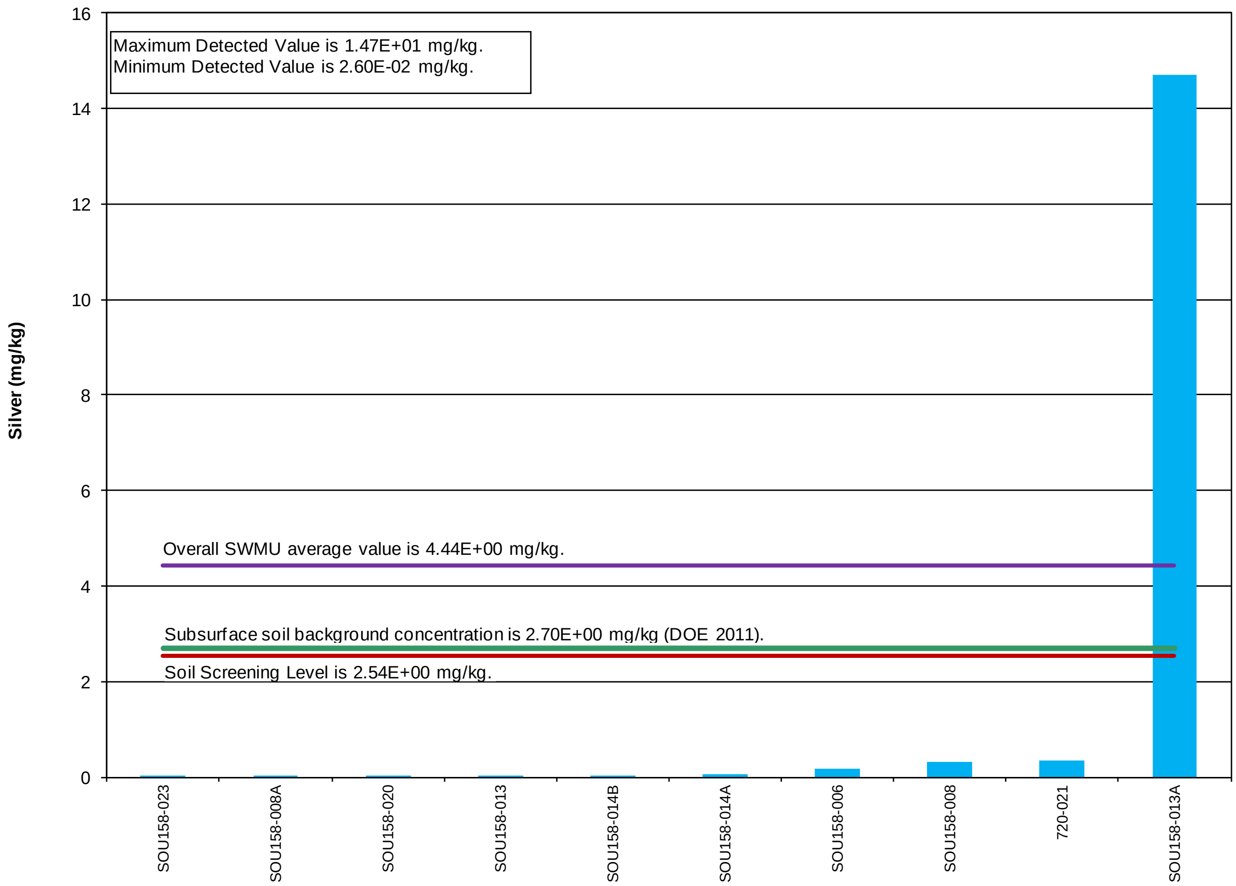

Figure C5.2.5. Silver Detections at SWMU 158

C5.2.2 SWMU 169 (C-410-E HF VENT SURGE PROTECTION TANK)

Data for SWMU 169 consisted of both historical data and RI data. SWMU 169 exceedances of the RG SSL include Total PCBs, arsenic, cobalt, iron, manganese, mercury, molybdenum, nickel, and vanadium.

Total PCBs were reported in 21 of 34 samples. The chart illustrating the reported results is shown in Figure C5.2.2.1. The average over SWMU 169 for Total PCBs was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was conducted because 3 samples had a detected result greater than the RG SSL. A plot showing the distribution of Total PCBs detections at SWMU 165 is shown in Figure C5.2.2.2. SWMU 169 did not have hot spot fate and transport modeling performed due to SWMUs 81 and 541 being modeled—the locations with the highest average concentration of Total PCBs.

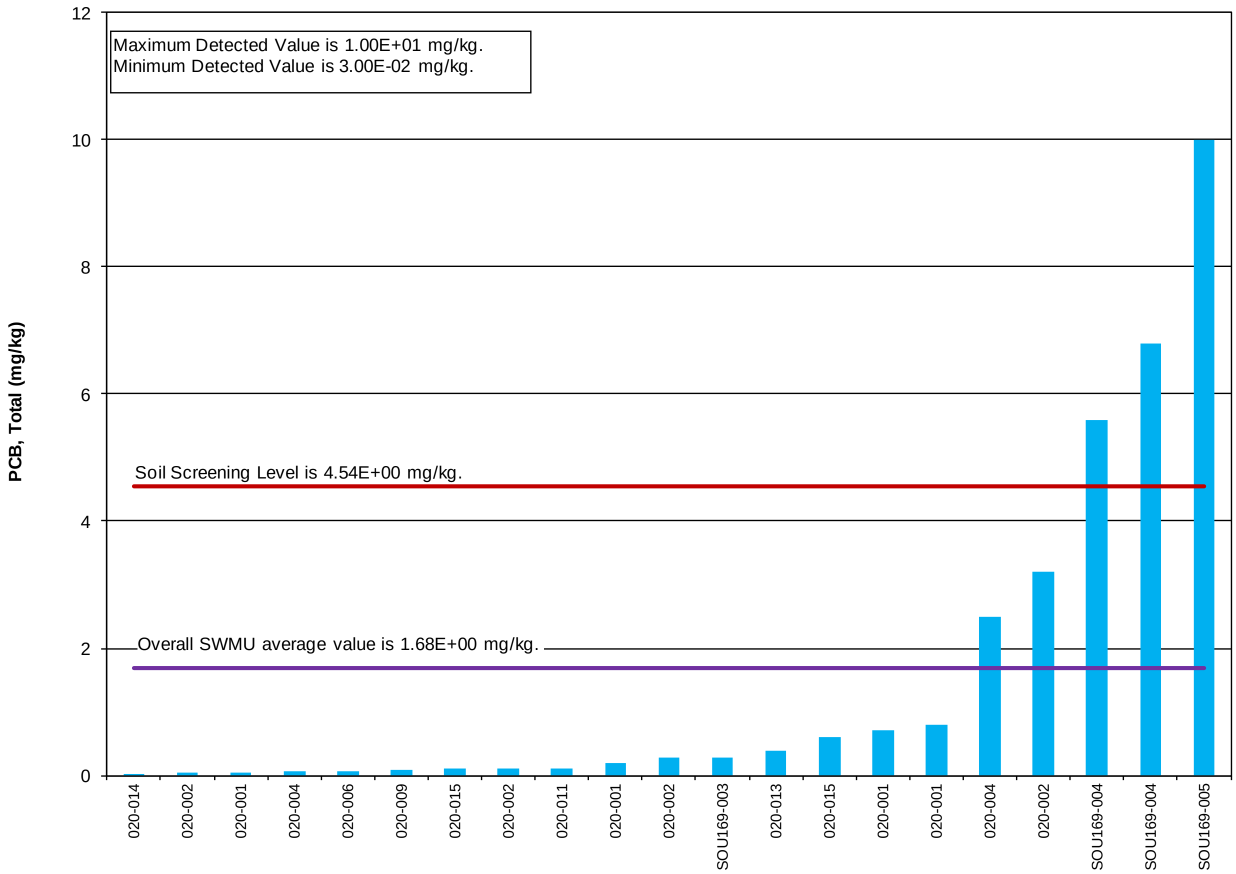

Figure C5.2.2.1. Total PCB Detections at SWMU 169

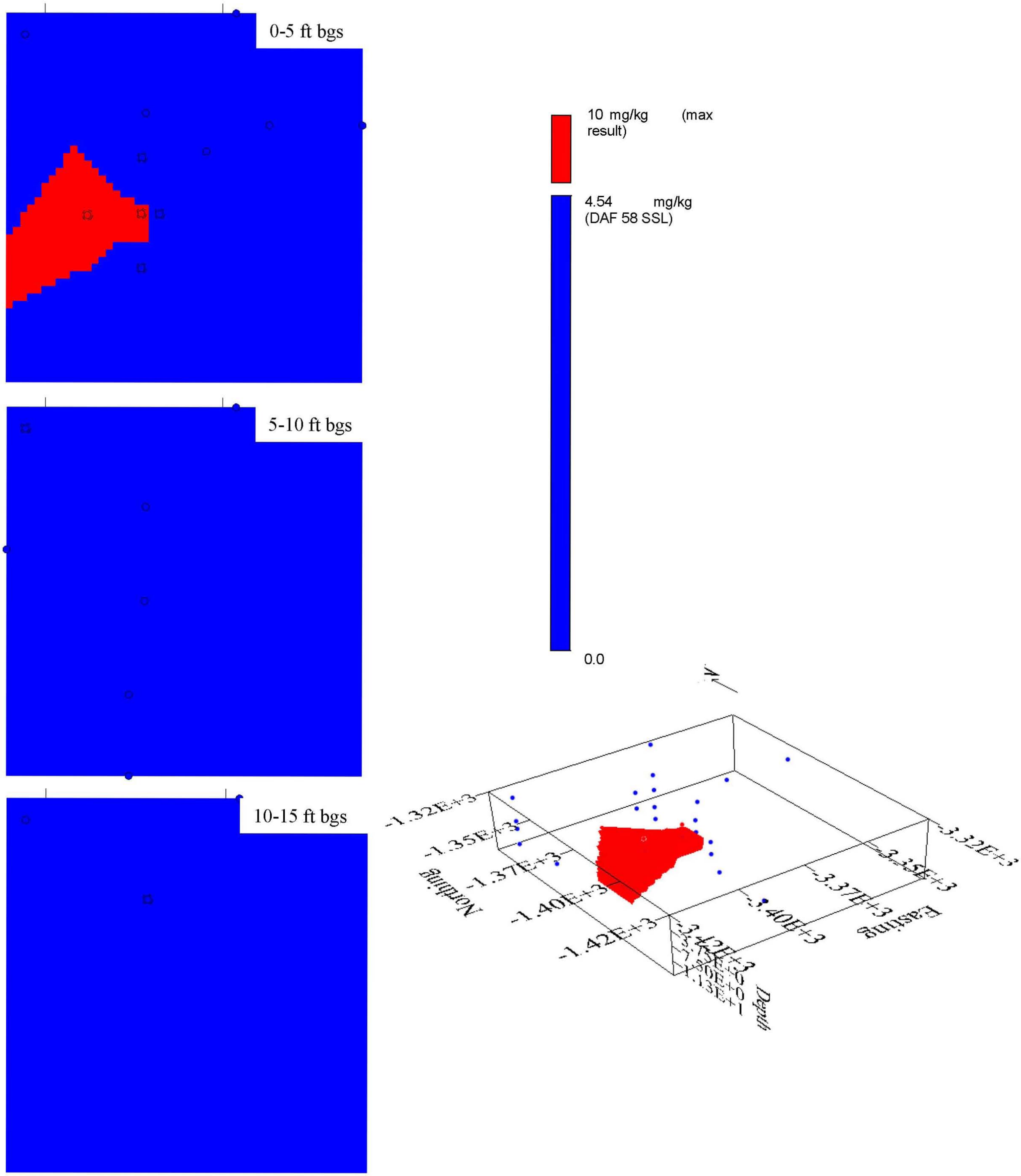

Figure C5.2.2.2. Distribution of Total PCB Detections at SWMU 169

Arsenic was reported in 49 of 64 samples. The chart illustrating the reported results is shown in Figure C5.2.2.3. The average over SWMU 169 for arsenic was less than the RG SSL and background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than the RG SSL.

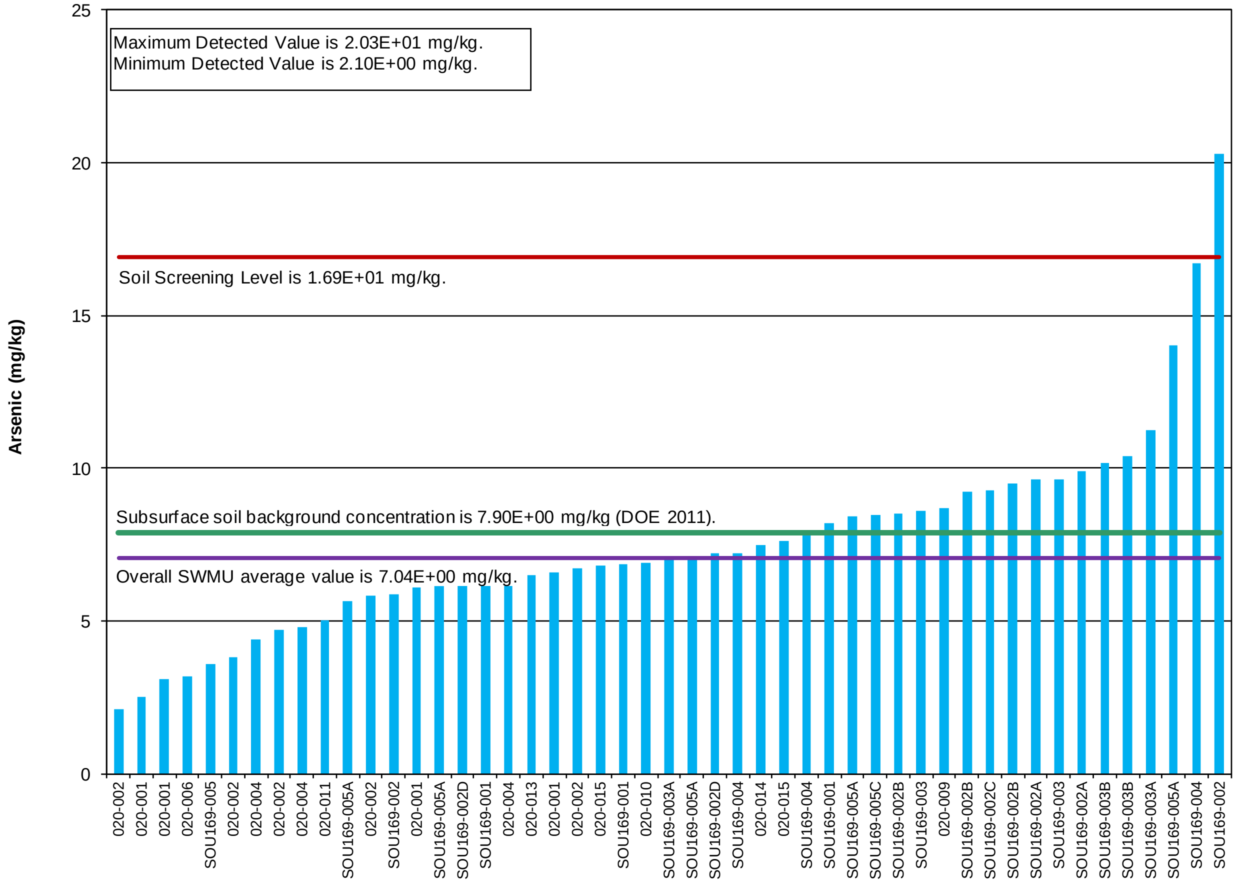

Figure C5.2.2.3. Arsenic Detections at SWMU 169

Cobalt was reported in 22 of 26 samples. The chart illustrating the reported results is shown in Figure C5.2.2.4. The average over SWMU 169 for cobalt was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

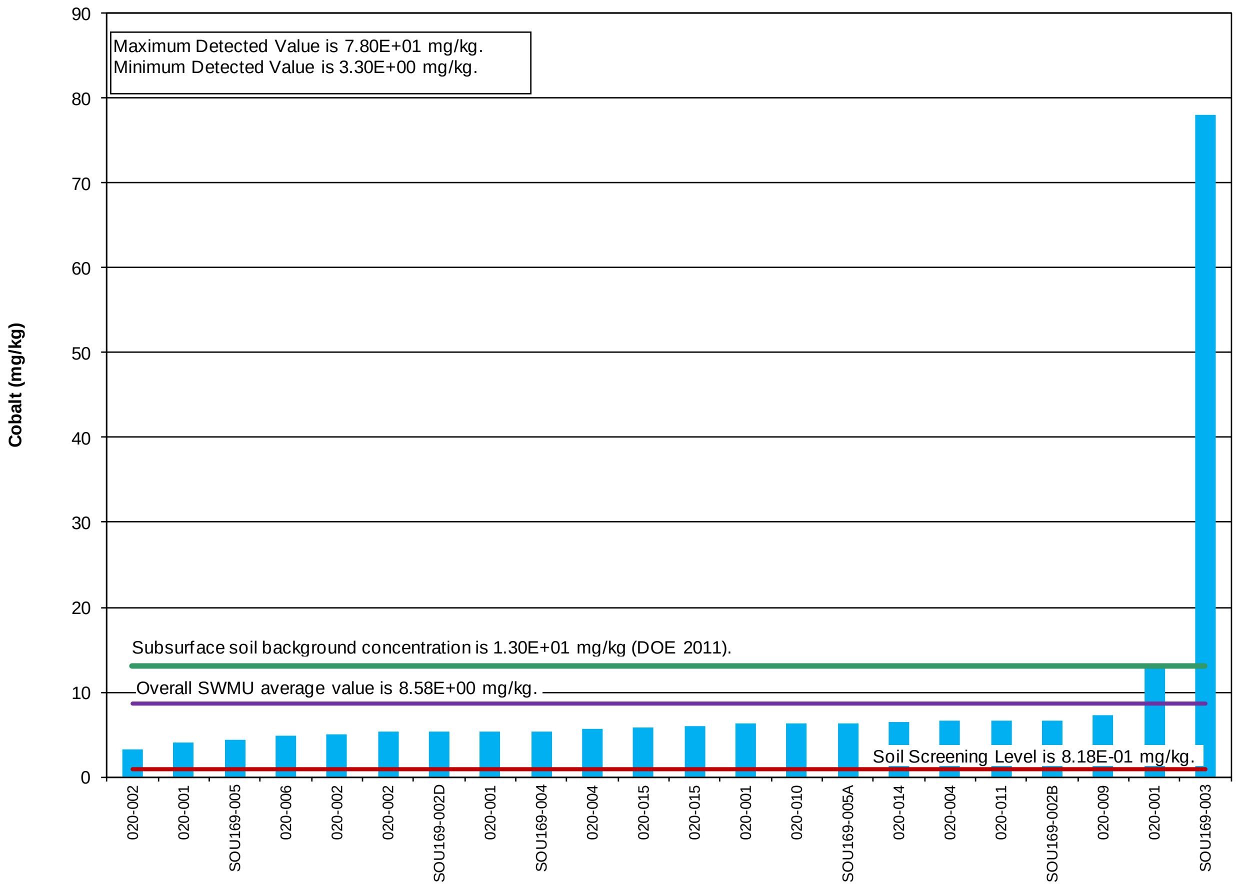

Figure C5.2.2.4. Cobalt Detections at SWMU 169

Iron was reported in 64 of 64 samples. The chart illustrating the reported results is shown in Figure C5.2.2.5. The average over SWMU 169 for iron was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

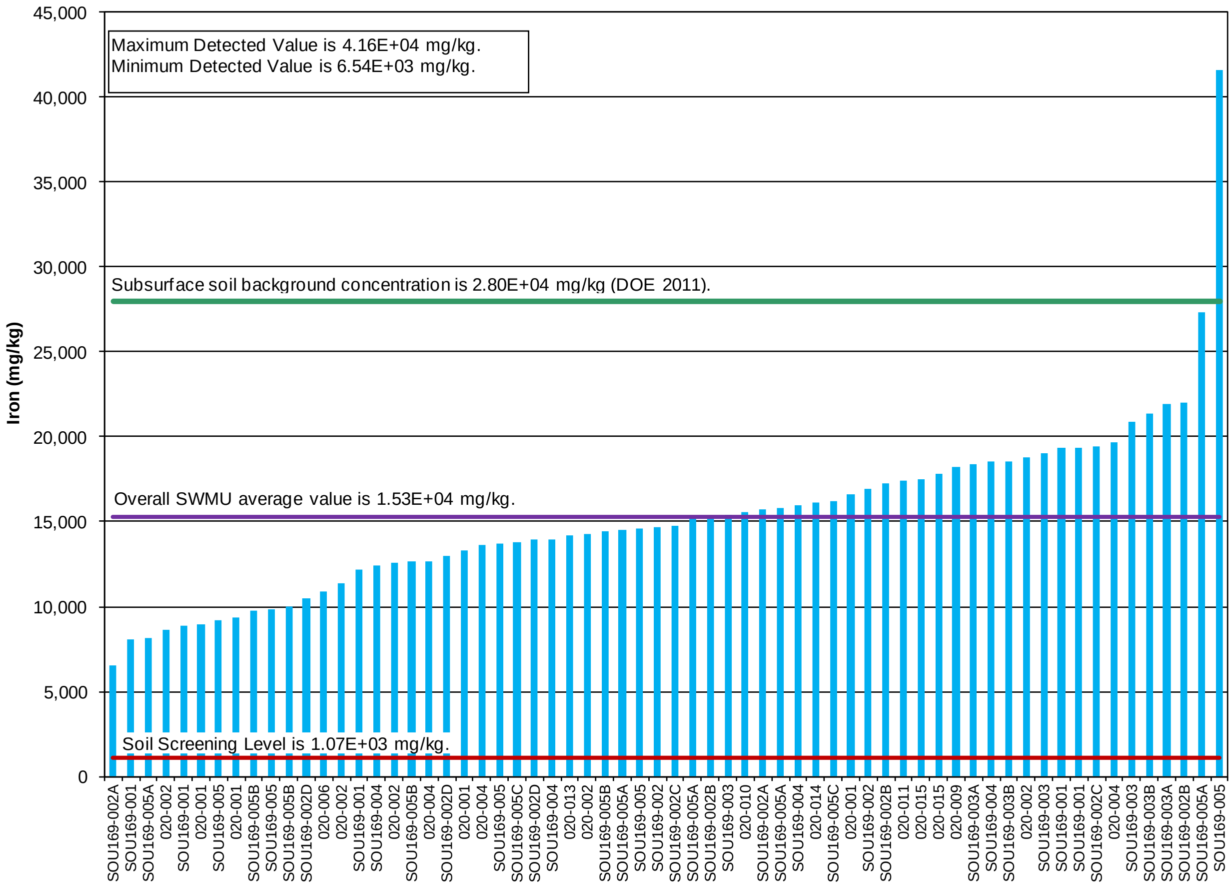

Figure C5.2.2.5. Iron Detections at SWMU 169

Manganese was reported in 62 of 64 samples. The chart illustrating the reported results is shown in Figure C5.2.2.6. The average over SWMU 169 for manganese was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 2 samples had a detected result greater than background.

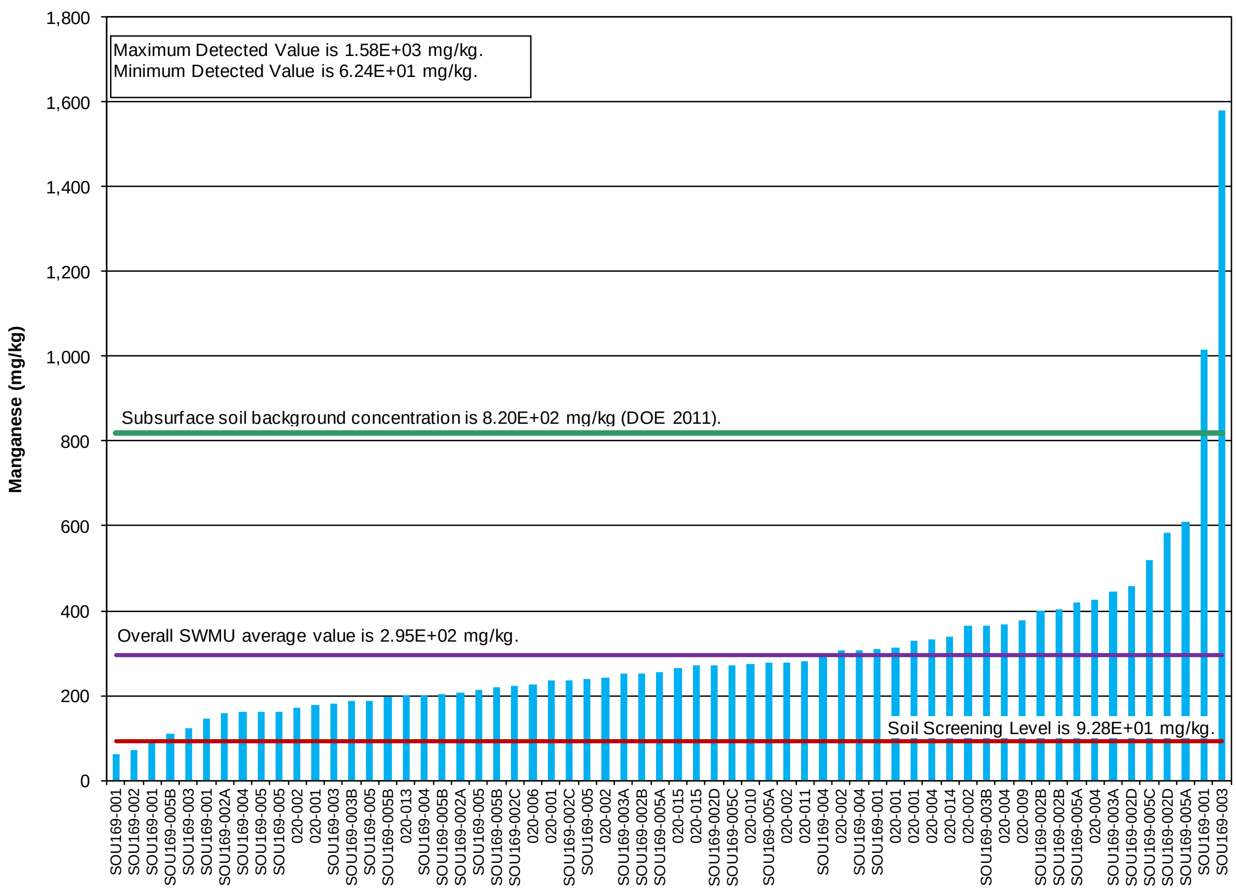

Figure C5.2.2.6. Manganese Detections at SWMU 169

Mercury was reported in 7 of 64 samples. The chart illustrating the reported results is shown in Figure C5.2.2.7. The average over SWMU 169 for mercury was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than the RG SSL.

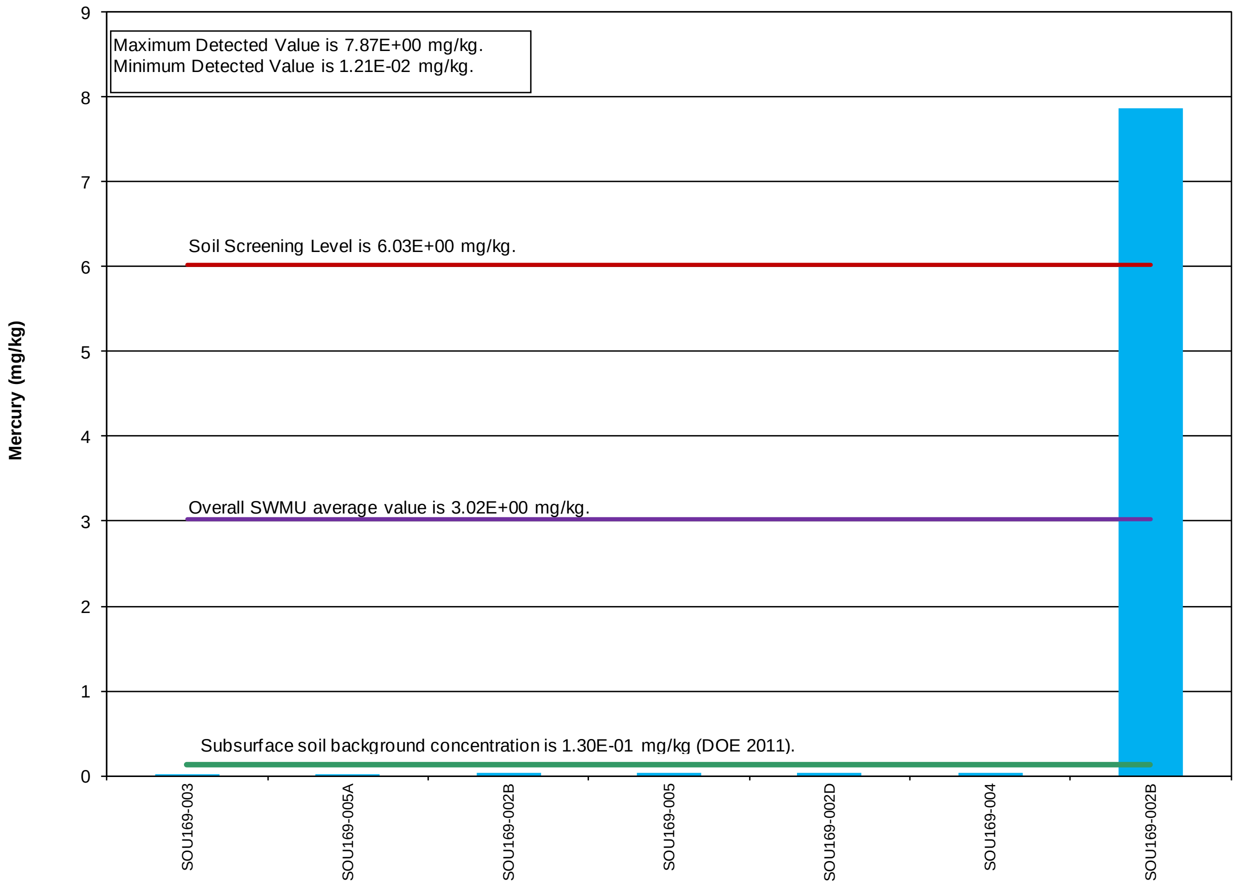

Figure C5.2.2.7. Mercury Detections at SWMU 169

Molybdenum was reported in 7 of 44 samples. The chart illustrating the reported results is shown in Figure C5.2.2.8. The average over SWMU 169 for molybdenum was greater than the RG SSL. It was evaluated in the GWOU FS and is a COC; however, there are no molybdenum impacts on the RGA groundwater (DOE 2001d). Fate and transport modeling was not performed for this chemical on this SWMU. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than the RG SSL.

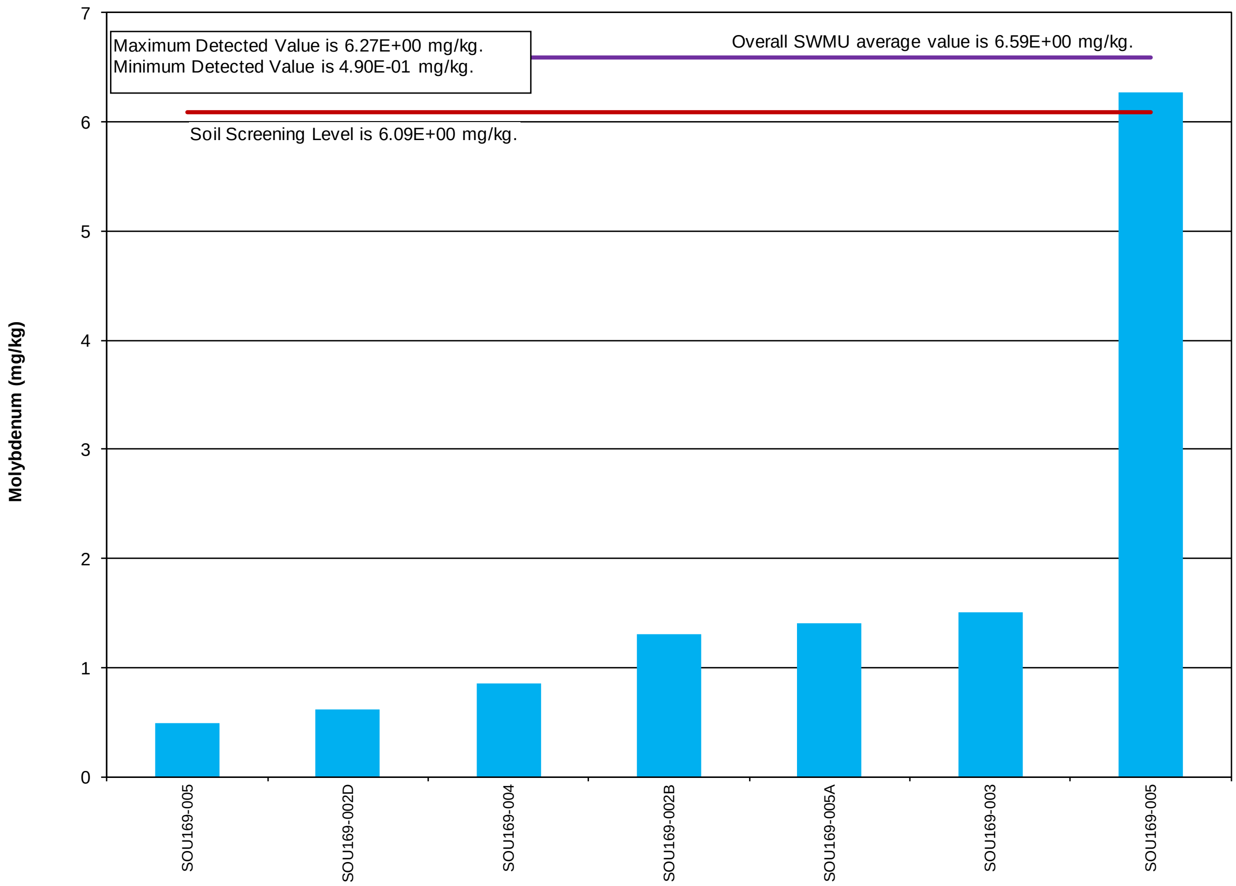

Figure C5.2.2.8. Molybdenum Detections at SWMU 169

Nickel was reported in 45 of 64 samples. The chart illustrating the reported results is shown in Figure C5.2.2.9. The average over SWMU 169 for nickel was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. Several samples were detected at a concentration greater than the RG SSL; however, a hot spot evaluation was not performed, because nickel is being modeled at SWMU 14—the location with the highest average concentration of nickel in any SWMU.

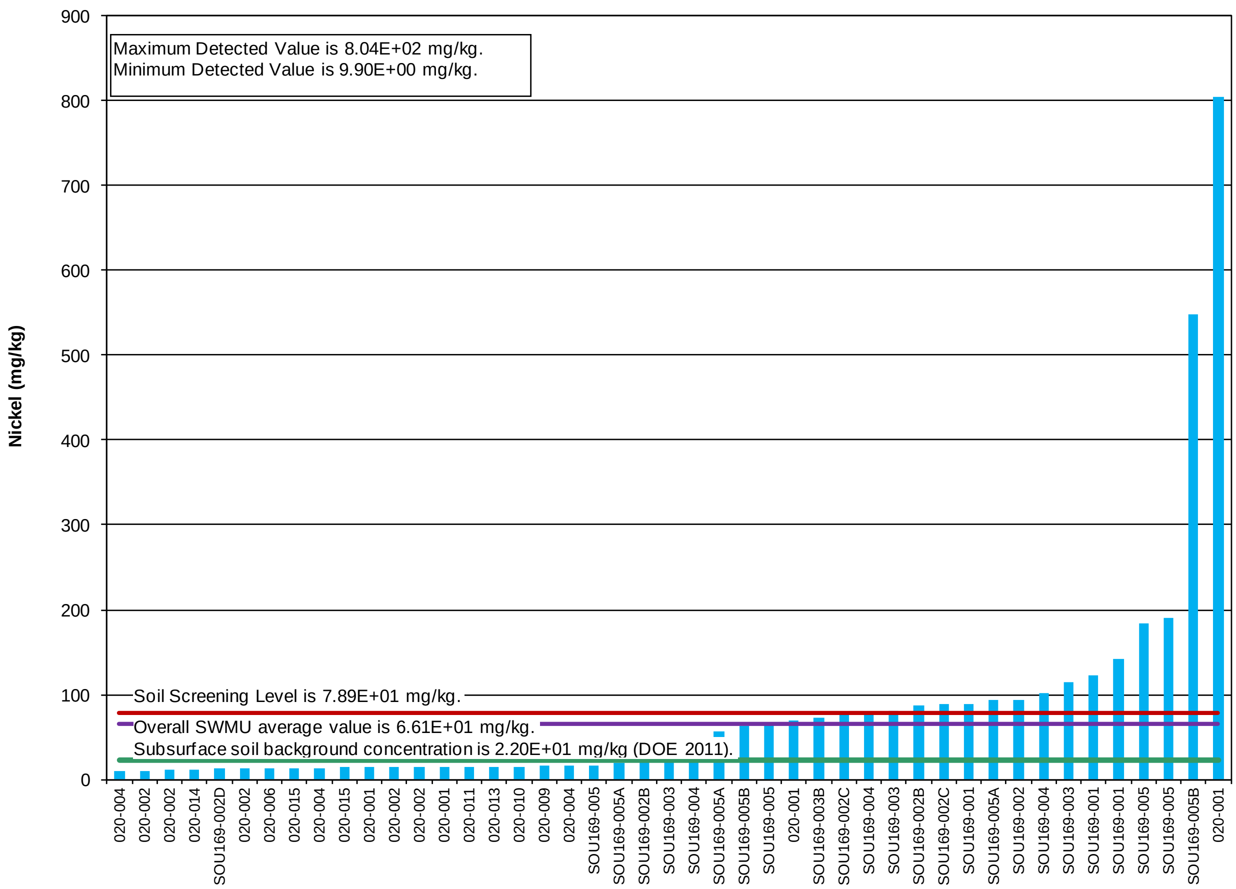

Figure C5.2.2.9. Nickel Detections at SWMU 169

Vanadium was reported in 26 of 26 samples. The chart illustrating the reported results is shown in Figure C5.2.2.10. The average over SWMU 169 for vanadium was less than background; therefore, it was not modeled for groundwater fate and transport. Even though 3 samples had a detected result greater than background, no vanadium impacts to RGA groundwater result from soils; therefore, no hot spot evaluation was performed.

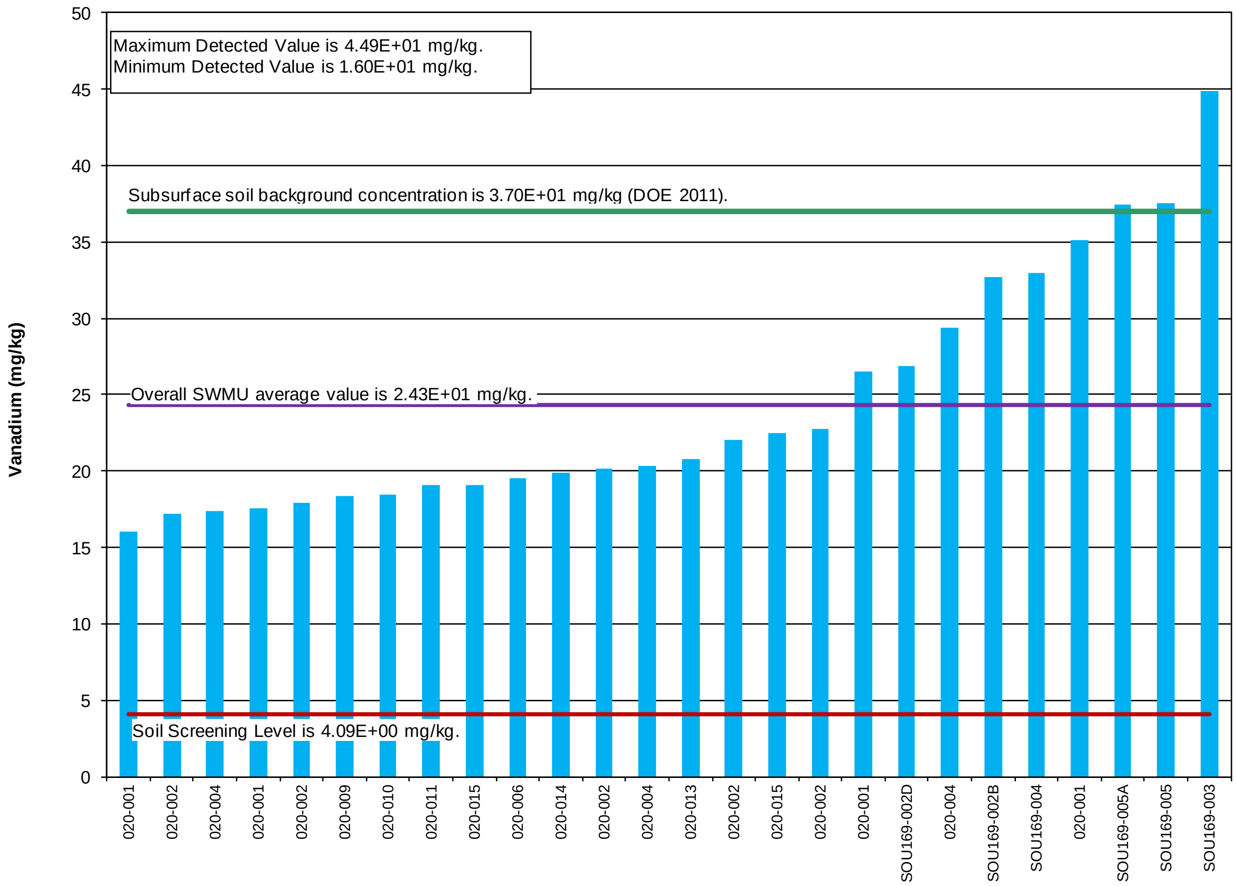

Figure C5.2.2.10. Vanadium Detections at SWMU 169

C5.3. GROUP 2, SOIL/RUBBLE PILES

C5.3.1 SWMU 19 (C-410-B HF EMERGENCY LAGOON)

Data for SWMU 19 consisted entirely of historical data. SWMU 19 exceedances of the RG SSL include naphthalene, cobalt, iron, manganese, nickel, and vanadium. Iron and manganese were not detected above background values; therefore, they were not considered for groundwater transport modeling or hot spot evaluations.

Naphthalene was reported in 1 of 27 samples. The chart illustrating the reported results is shown in Figure C5.3.1.1. Although the average over SWMU 19 for naphthalene was greater than the RG SSL, it was evaluated in the GWOU FS and was not identified as a COC in the groundwater plumes associated with PGDP (DOE 2001d). It was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because of the single detected result.

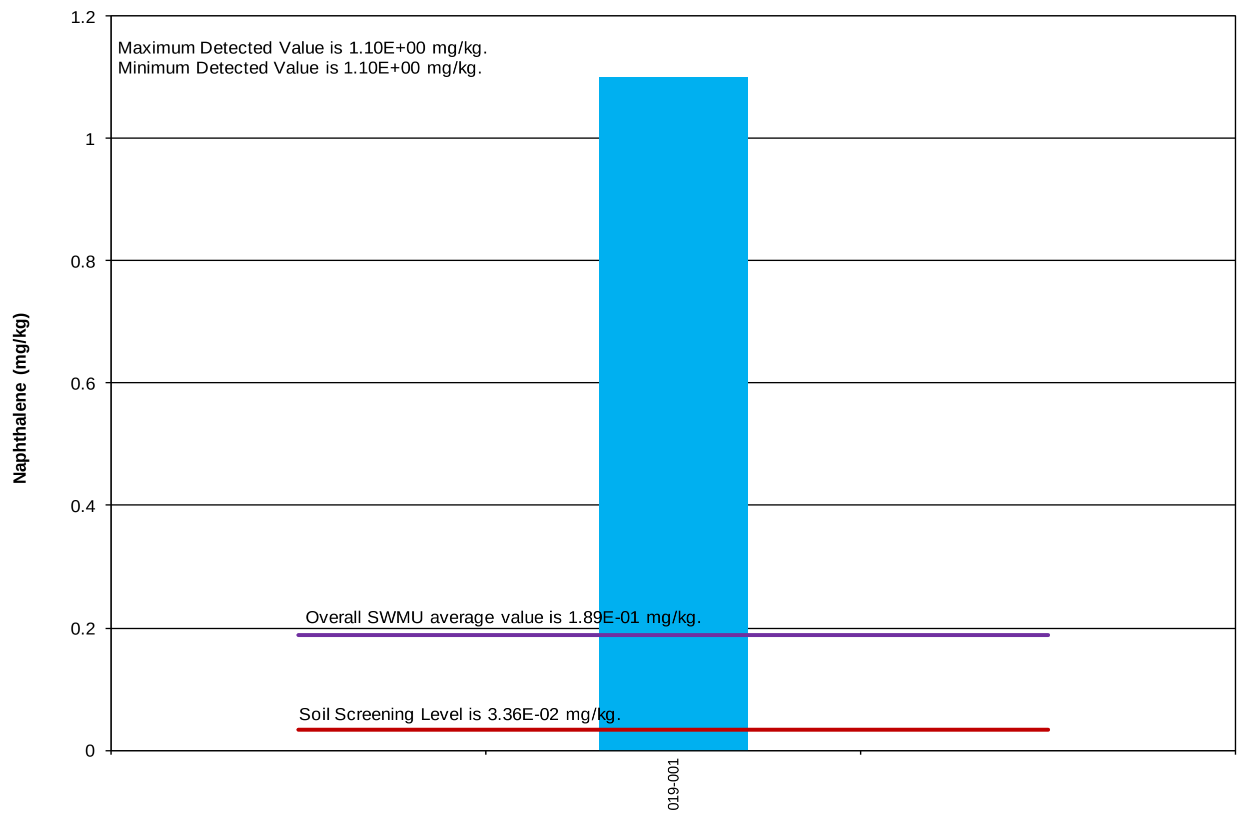

Figure C5.3.1.1. Naphthalene Detections at SWMU 19

Cobalt was reported in 22 of 27 samples. The chart illustrating the reported results is shown in Figure C5.3.1.2. The average over SWMU 19 for cobalt was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

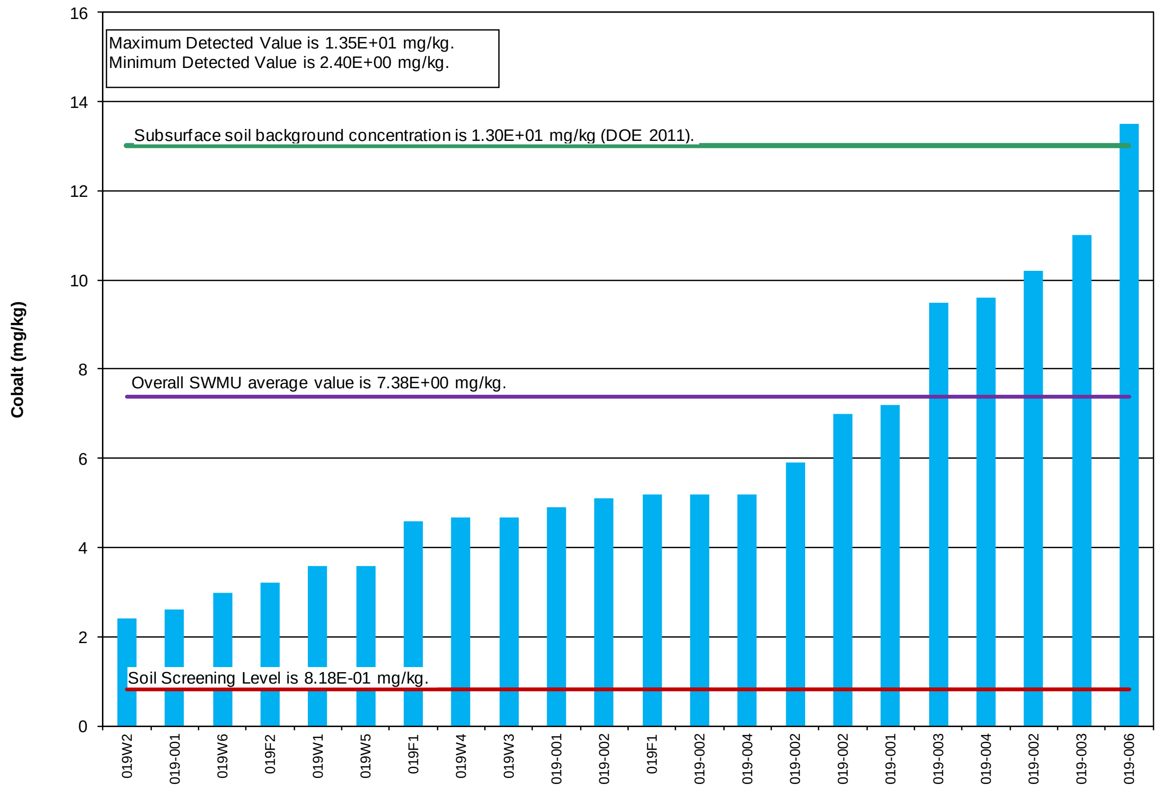

Figure C5.3.1.2. Cobalt Detections at SWMU 19

Nickel was reported in 24 of 27 samples. The chart illustrating the reported results is shown in Figure C5.3.1.3. The average over SWMU 19 for nickel was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 2 samples had a detected result greater than background.

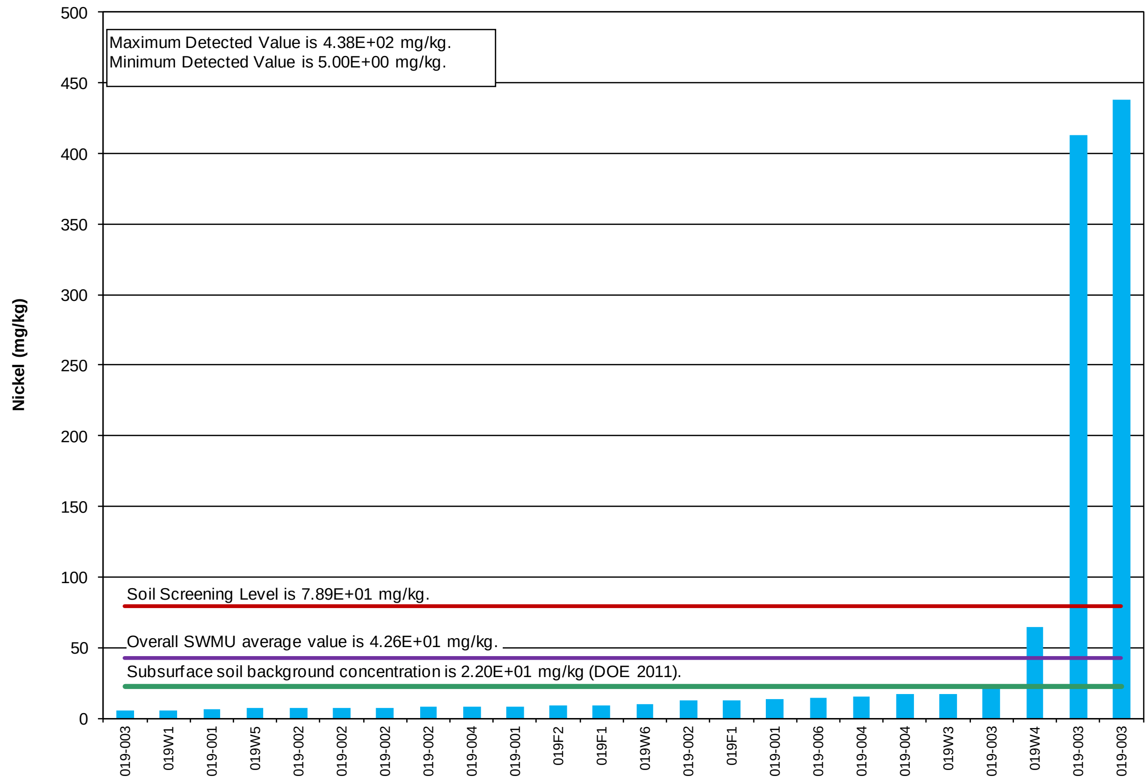

Figure C5.3.1.3. Nickel Detections at SWMU 19

Vanadium was reported in 27 of 27 samples. The chart illustrating the reported results is shown in Figure C5.3.1.4. The average over SWMU 19 for vanadium was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

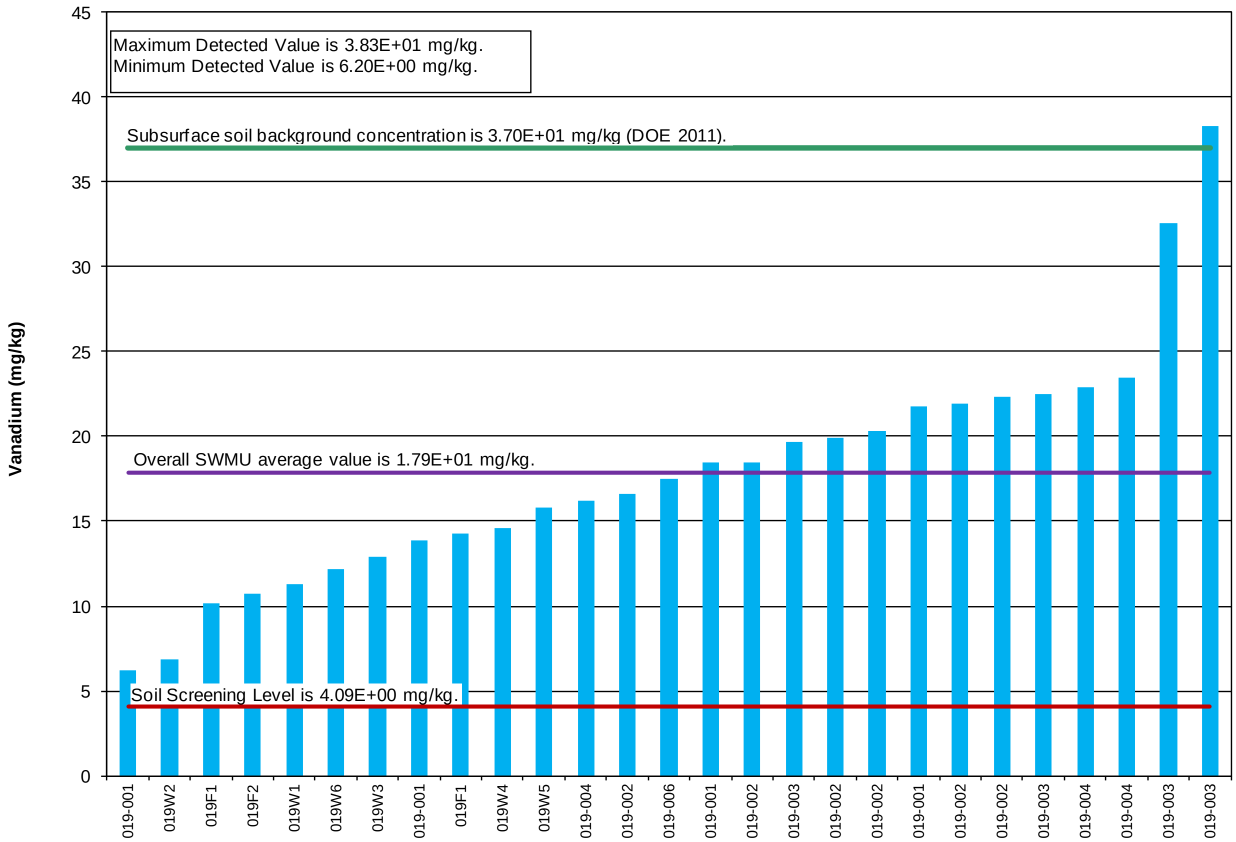

Figure C5.3.1.4. Vanadium Detections at SWMU 19

C5.3.2 SWMU 138 (C-100 SOUTHSIDE BERM)

Data for SWMU 138 consisted of both historical data and RI data. SWMU 138 exceedances of the RG SSL include cobalt, iron, manganese, mercury, nickel, silver, and vanadium.

Cobalt was reported in 13 of 13 samples. The chart illustrating the reported results is shown in Figure C5.3.2.1. The average over SWMU 138 for cobalt was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

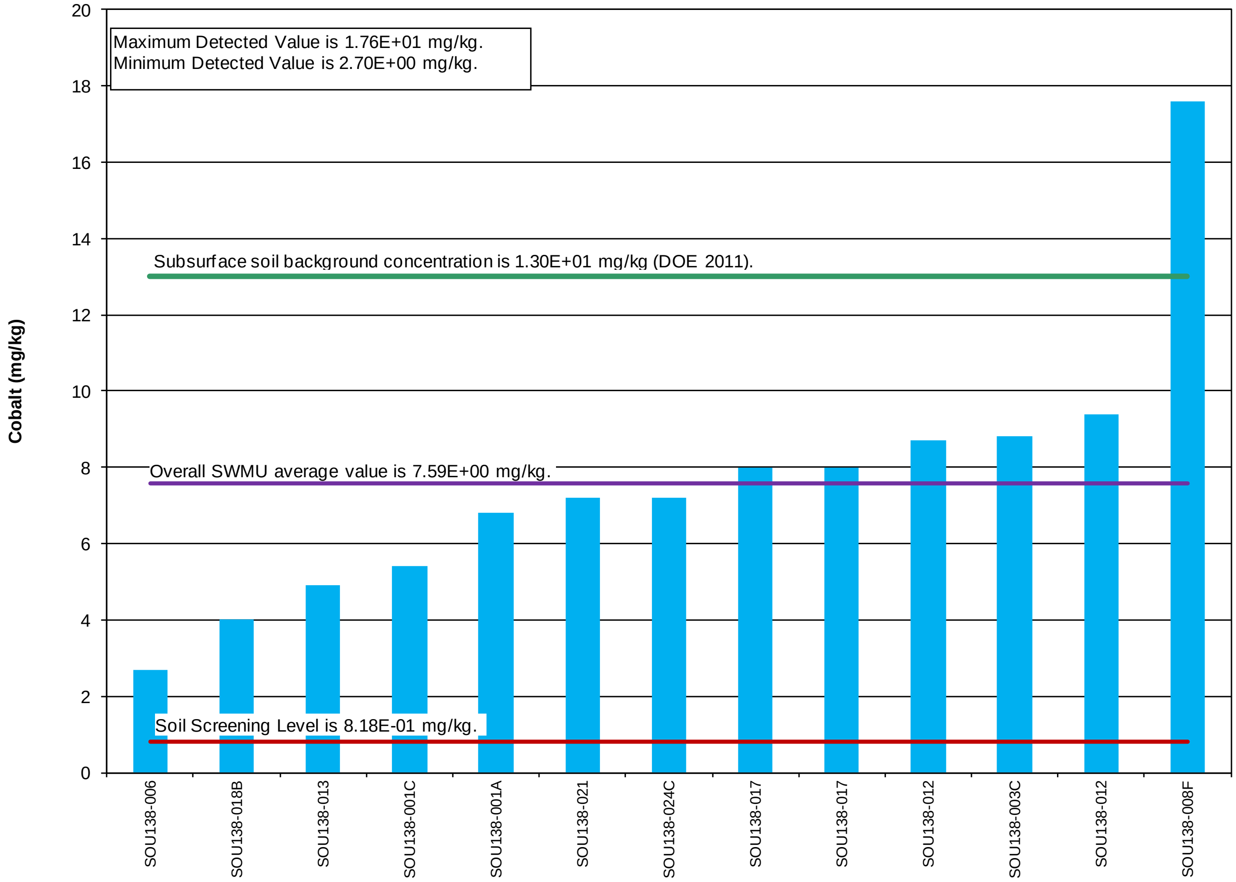

Figure C5.3.2.1. Cobalt Detections at SWMU 138

Iron was reported in 147 of 147 samples. The chart illustrating the reported results is shown in Figure C5.3.2.2. The average over SWMU 138 for iron was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 2 samples had a detected result greater than background.

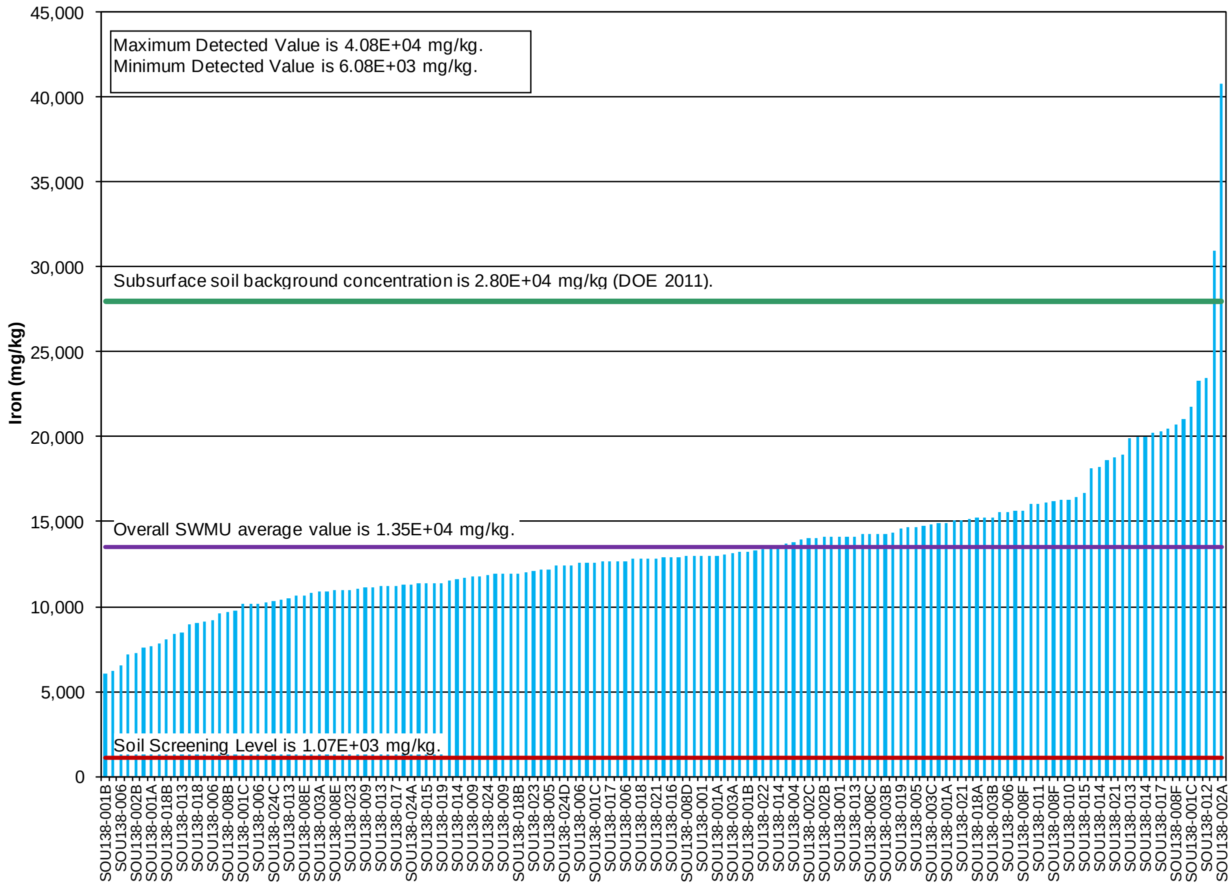

Figure C5.3.2.2. Iron Detections at SWMU 138

Manganese was reported in 145 of 147 samples. The chart illustrating the reported results is shown in Figure C5.3.2.3. The average over SWMU 138 for manganese was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted even though several samples had a detected result greater than background, as manganese is ubiquitous, concentrations are controlled by site soil geochemistry, and there are no soils-related impacts on RGA groundwater.

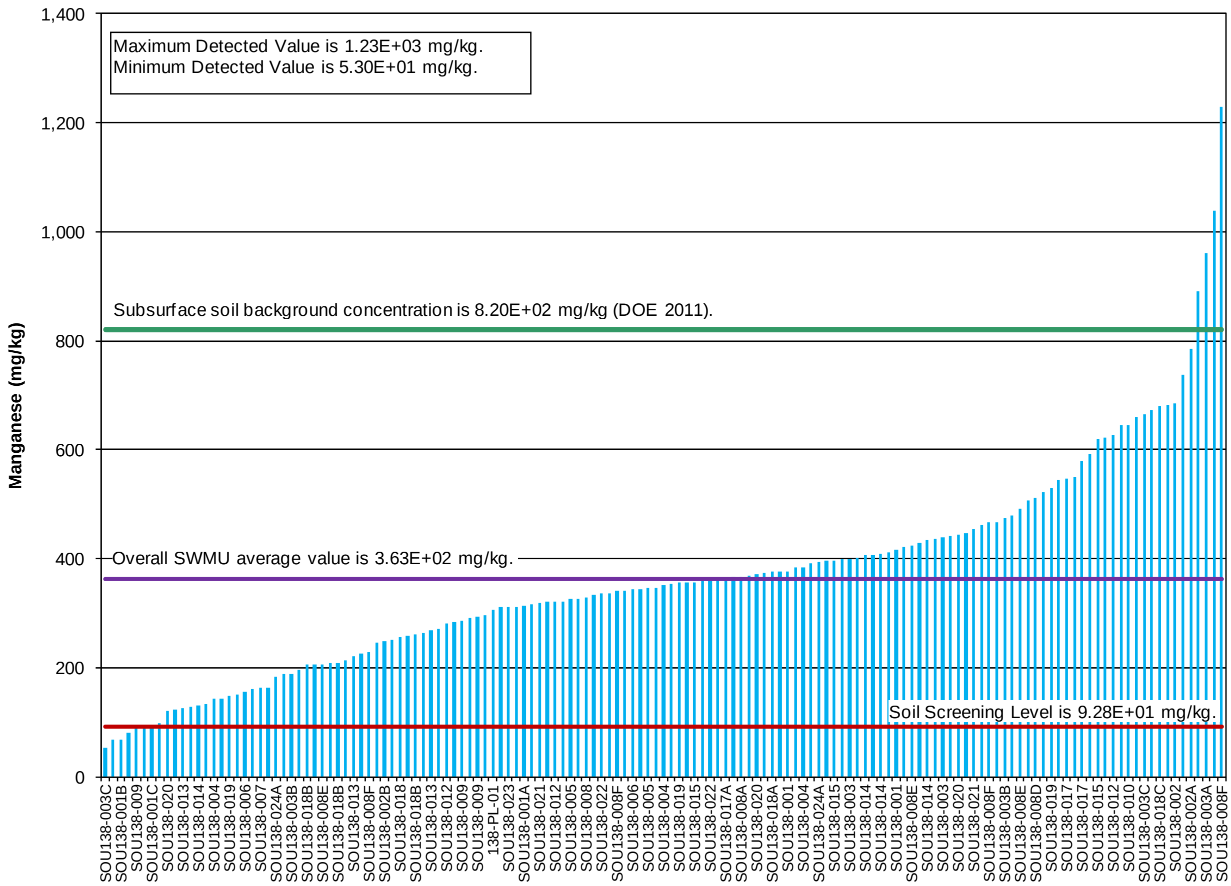

Figure C5.3.2.3. Manganese Detections at SWMU 138

Mercury was reported in 28 of 160 samples. The chart illustrating the reported results is shown in Figure C5.3.2.4. The average over SWMU 138 for mercury was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. Because it has not been identified as a COC in the groundwater plumes associated with PGDP, a hot spot evaluation was not conducted.

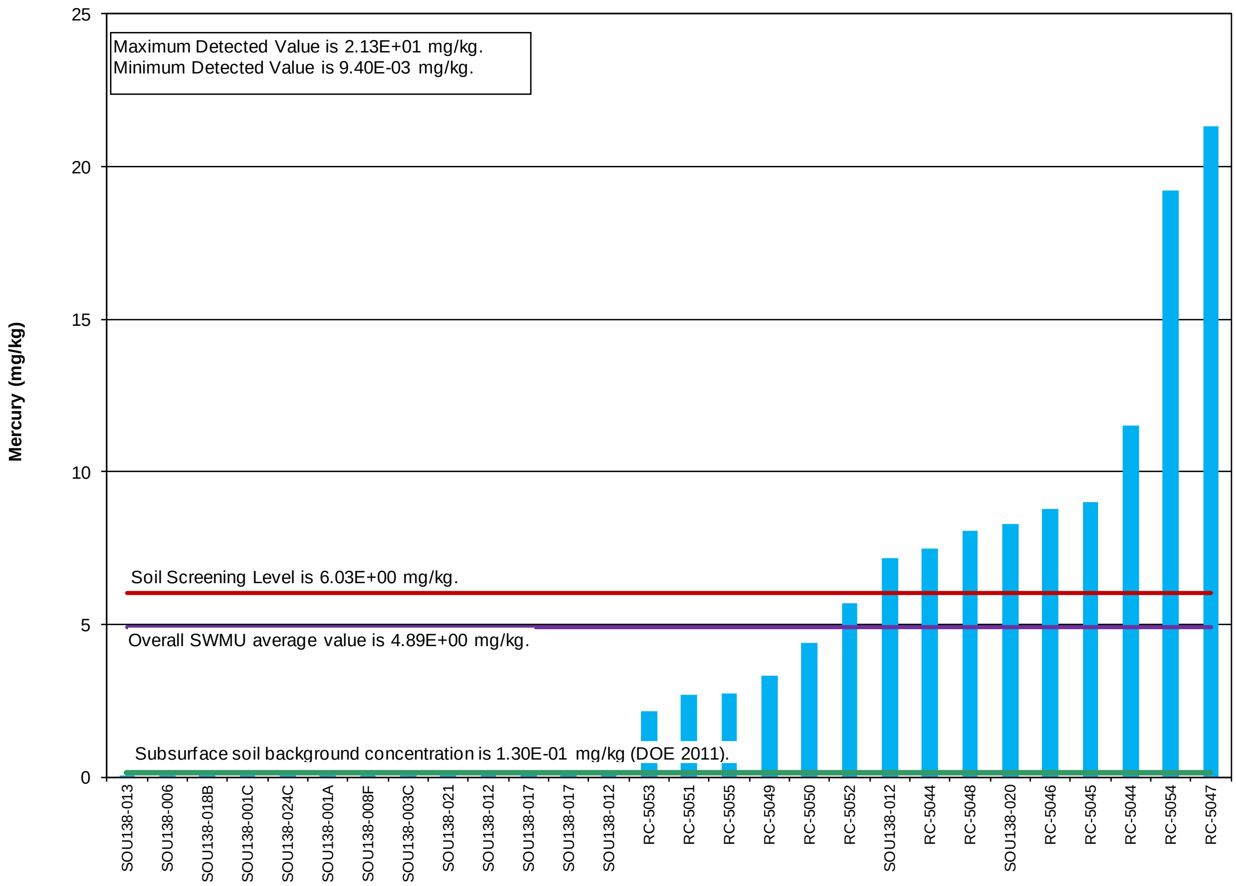

Figure C5.3.2.4. Mercury Detections at SWMU 138

Nickel was reported in 44 of 160 samples. The chart illustrating the reported results is shown in Figure C5.3.2.5. The average over SWMU 138 for nickel was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. Several samples were detected at a concentration greater than the RG SSL; however, a hot spot evaluation was not performed, because nickel is being modeled at SWMU 14—the location with the highest average concentration of nickel in any SWMU.

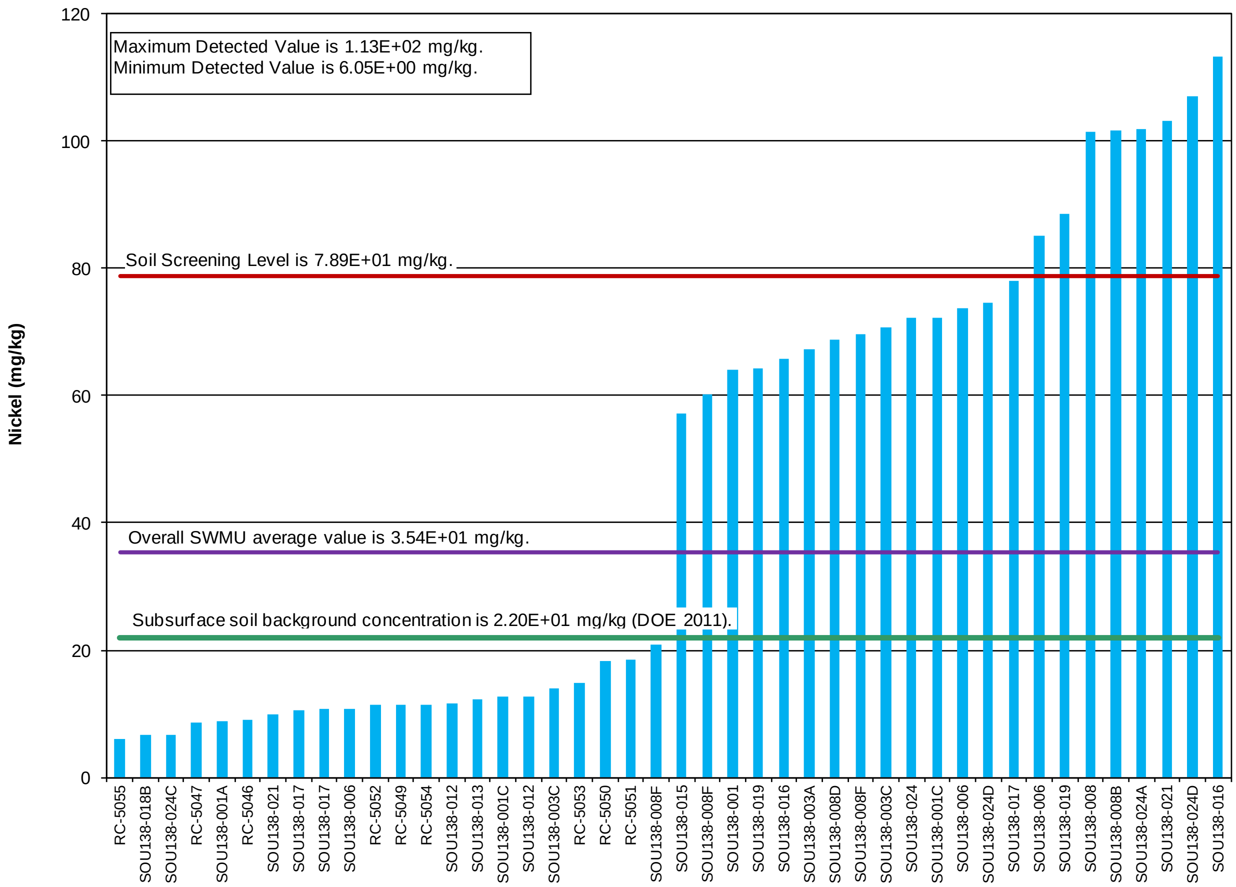

Figure C5.3.2.5. Nickel Detections at SWMU 138

Silver was reported in 22 of 160 samples. The chart illustrating the reported results is shown in Figure C5.3.2.6. The average over SWMU 138 for silver was greater than the RG SSL. SWMU 138 was evaluated in the GWOU FS and is a COC in the groundwater plumes associated with PGDP. The evaluation presented in Attachment C1 to Appendix C did not identify any RGA silver impacts; therefore, neither fate and transport modeling nor hot spot evaluation was performed for this chemical at this SWMU.

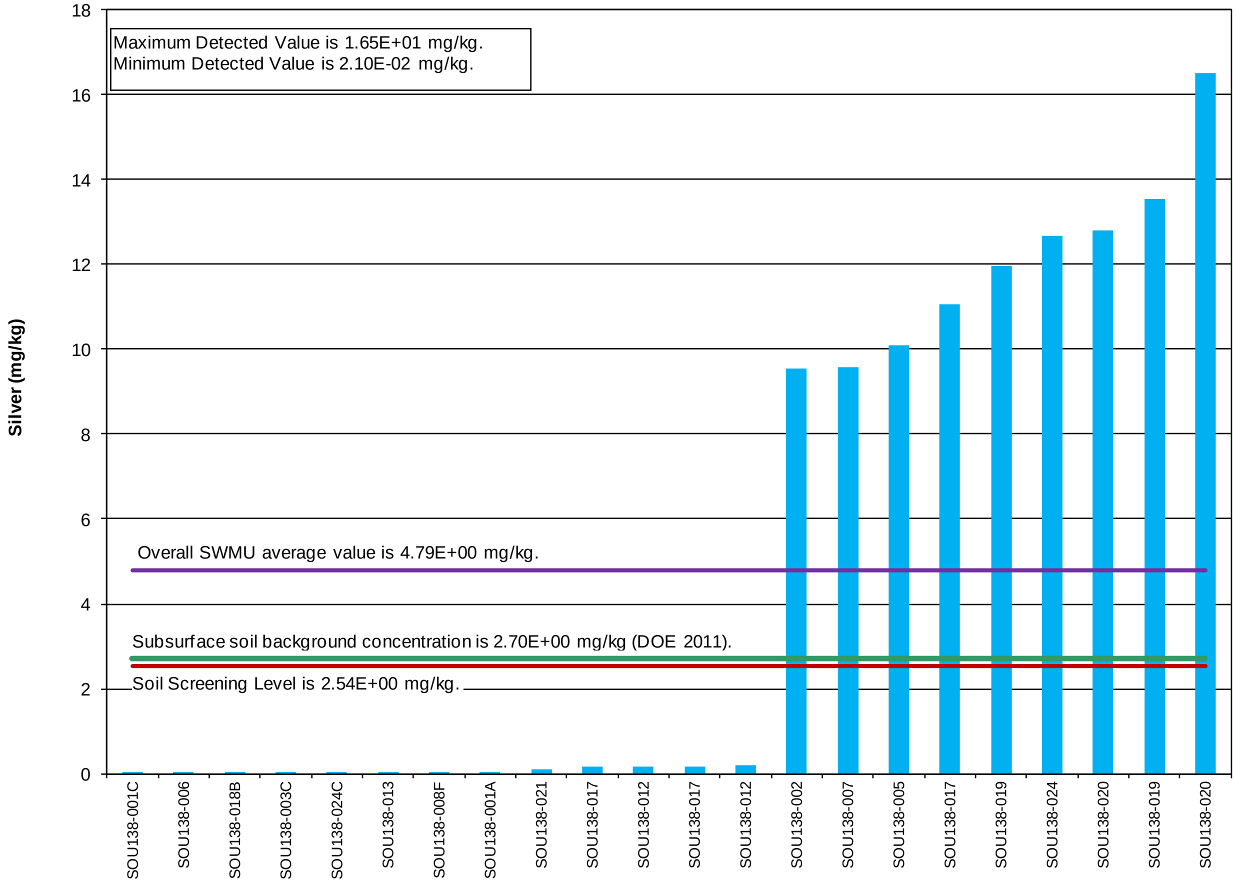

Figure C5.3.2.6. Silver Detections at SWMU 138

Vanadium was reported in 13 of 13 samples. The chart illustrating the reported results is shown in Figure C5.3.2.7. The average over SWMU 138 for vanadium was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

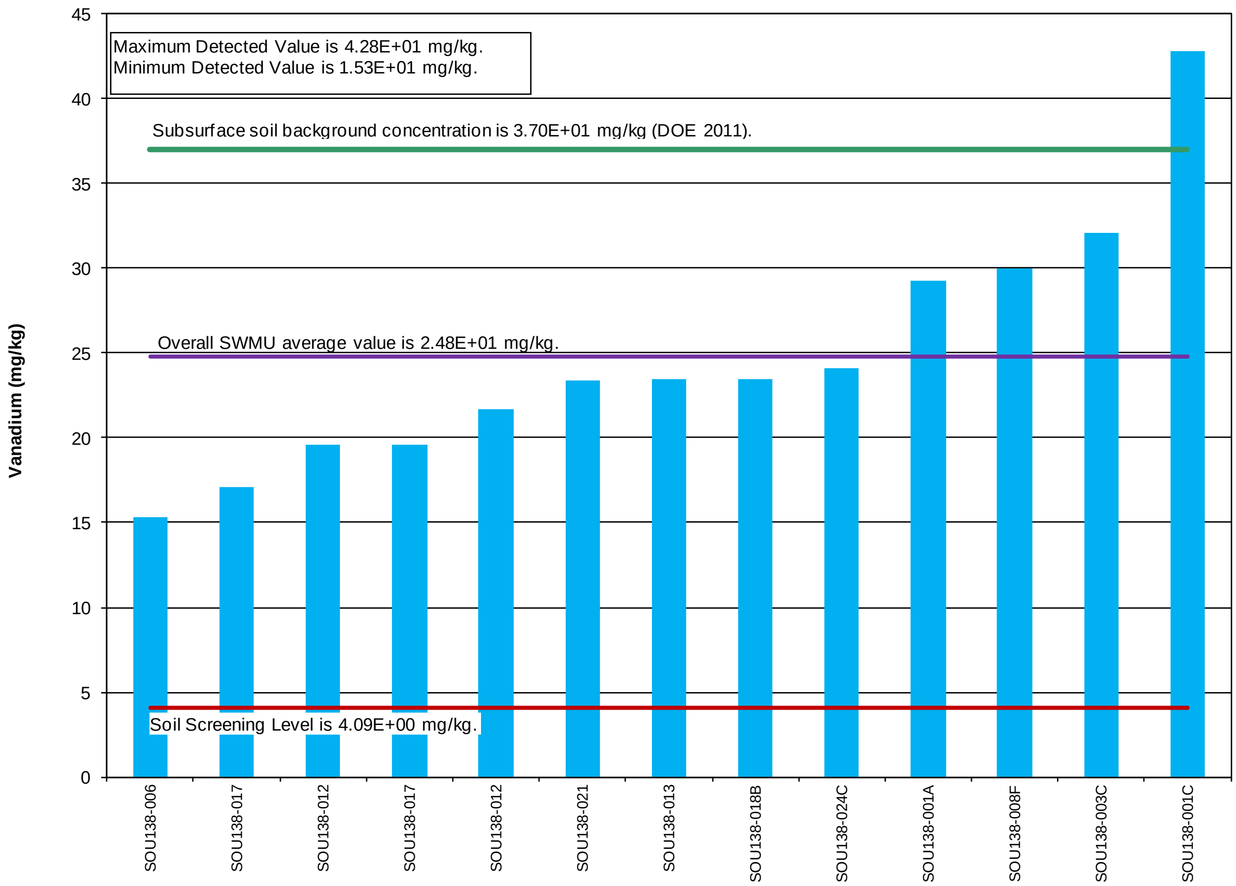

Figure C5.3.2.7. Vanadium Detections at SWMU 138

C5.3.3 SWMU 180 (OUTDOOR FIRING RANGE WKWMA)

Data for SWMU 180 consisted entirely of RI data. SWMU 180 exceedances of the RG SSL include arsenic, cobalt, iron, lead, manganese, mercury, nickel, silver, and vanadium.

Arsenic was reported in 66 of 140 samples. The chart illustrating the reported results is shown in Figure C5.3.3.1. The average over SWMU 180 for arsenic was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted even though several samples had a detected result greater than background, because arsenic was modeled for fate and transport at SWMUs 564 and 165.

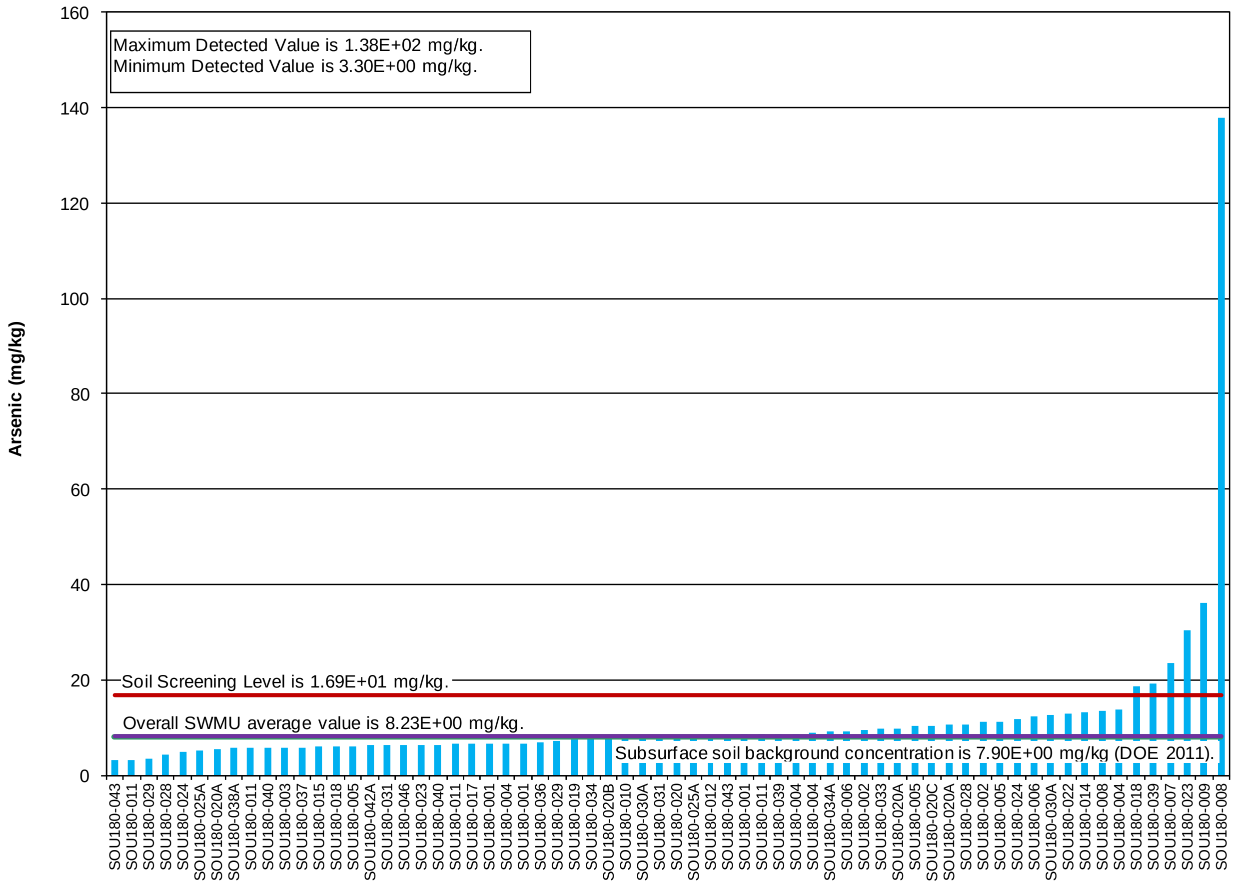

Figure C5.3.3.1. Arsenic Detections at SWMU 180

Cobalt was reported in 11 of 11 samples. The chart illustrating the reported results is shown in Figure C5.3.3.2. The average over SWMU 180 for cobalt was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 2 samples had a detected result greater than background.

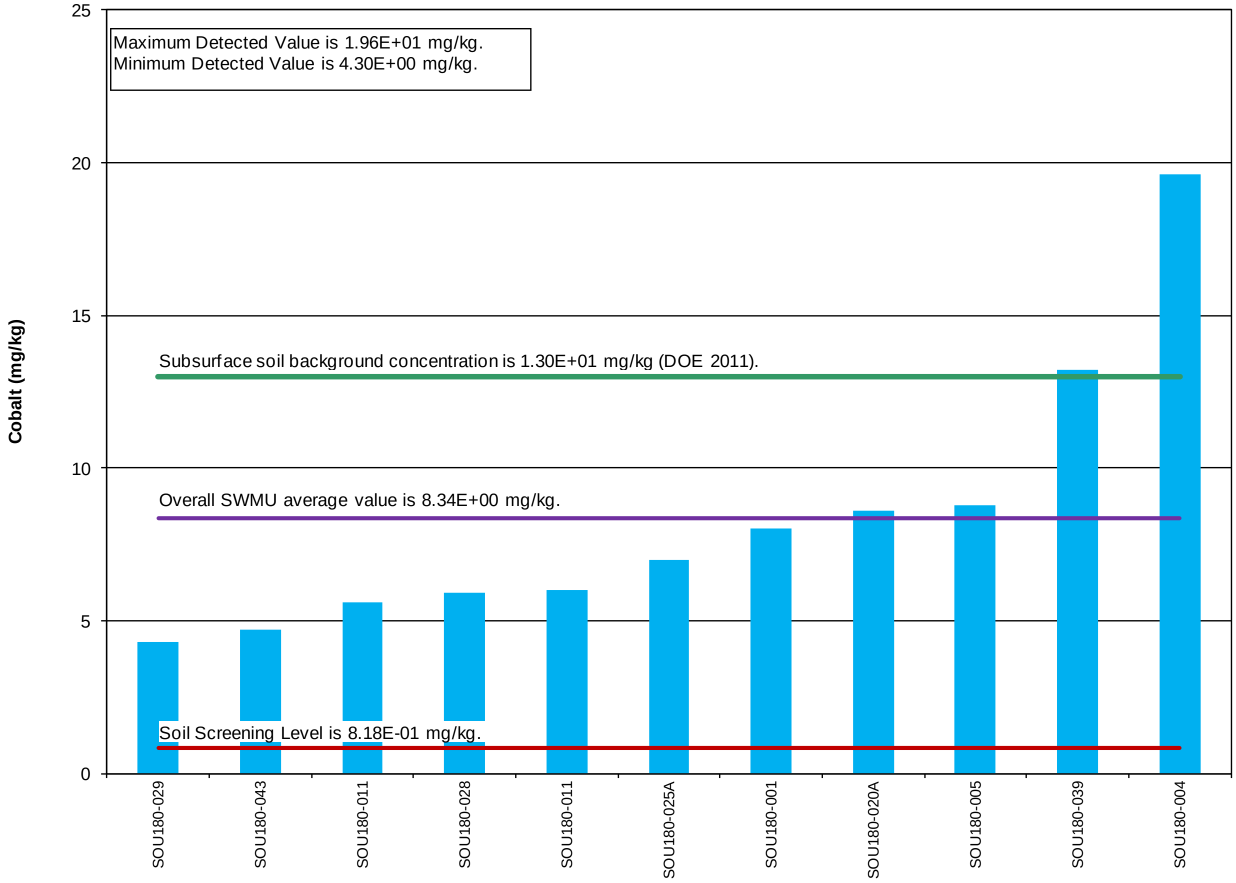

Figure C5.3.3.2. Cobalt Detections at SWMU 180

Iron was reported in 140 of 140 samples. The chart illustrating the reported results is shown in Figure C5.3.3.3. The average over SWMU 180 for iron was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

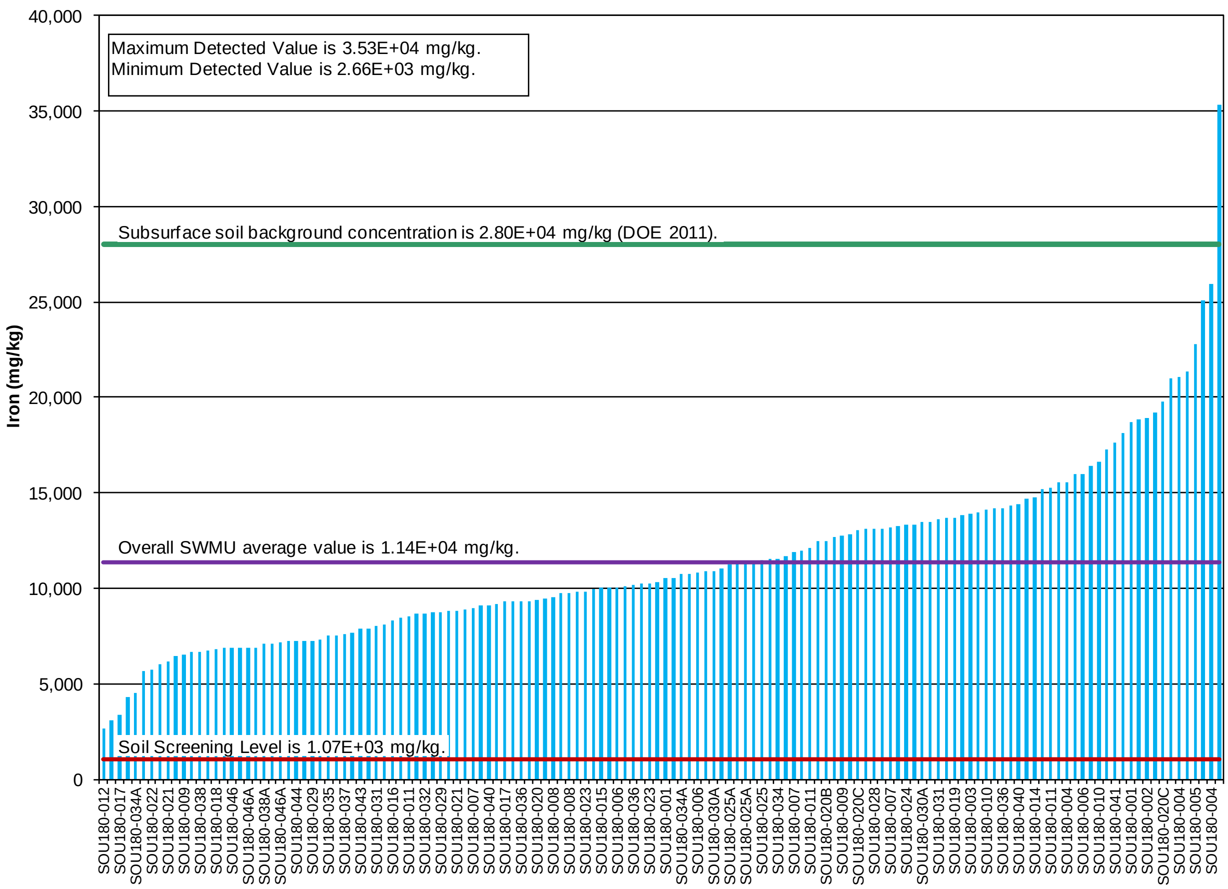

Figure C5.3.3.3. Iron Detections at SWMU 180

Lead was reported in 131 of 140 samples. The chart illustrating the reported results is shown in Figure C5.3.3.4. The average over SWMU 180 for lead was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than the RG SSL.

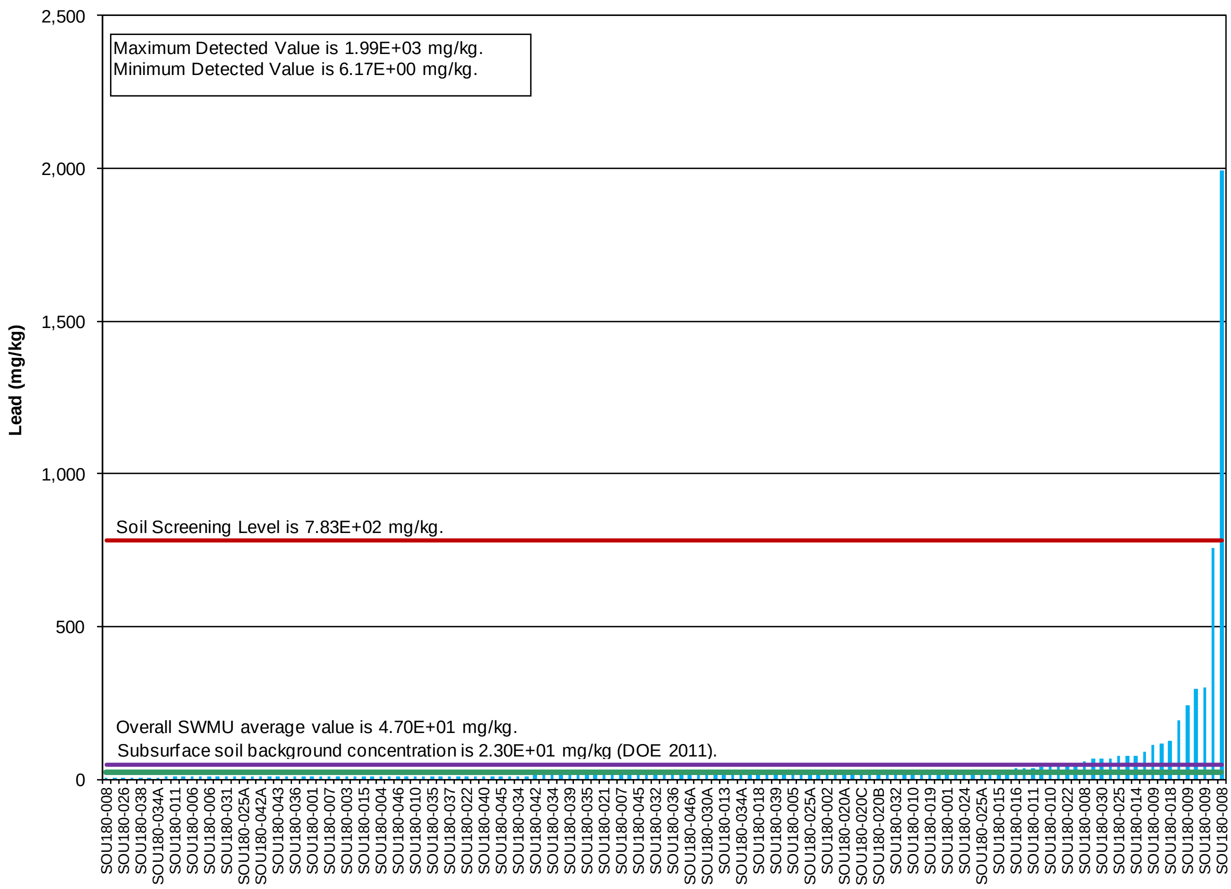

Figure C5.3.3.4. Lead Detections at SWMU 180

Manganese was reported in 135 of 140 samples. The chart illustrating the reported results is shown in Figure C5.3.3.5. The average over SWMU 180 for manganese was less than background; therefore, it was not modeled for groundwater fate and transport. Even though several samples had a detected result greater than background, no hot spot evaluation was conducted, as manganese is ubiquitous, concentrations are controlled by site soil geochemistry, and the fact that there are no soils-related impacts on RGA groundwater.

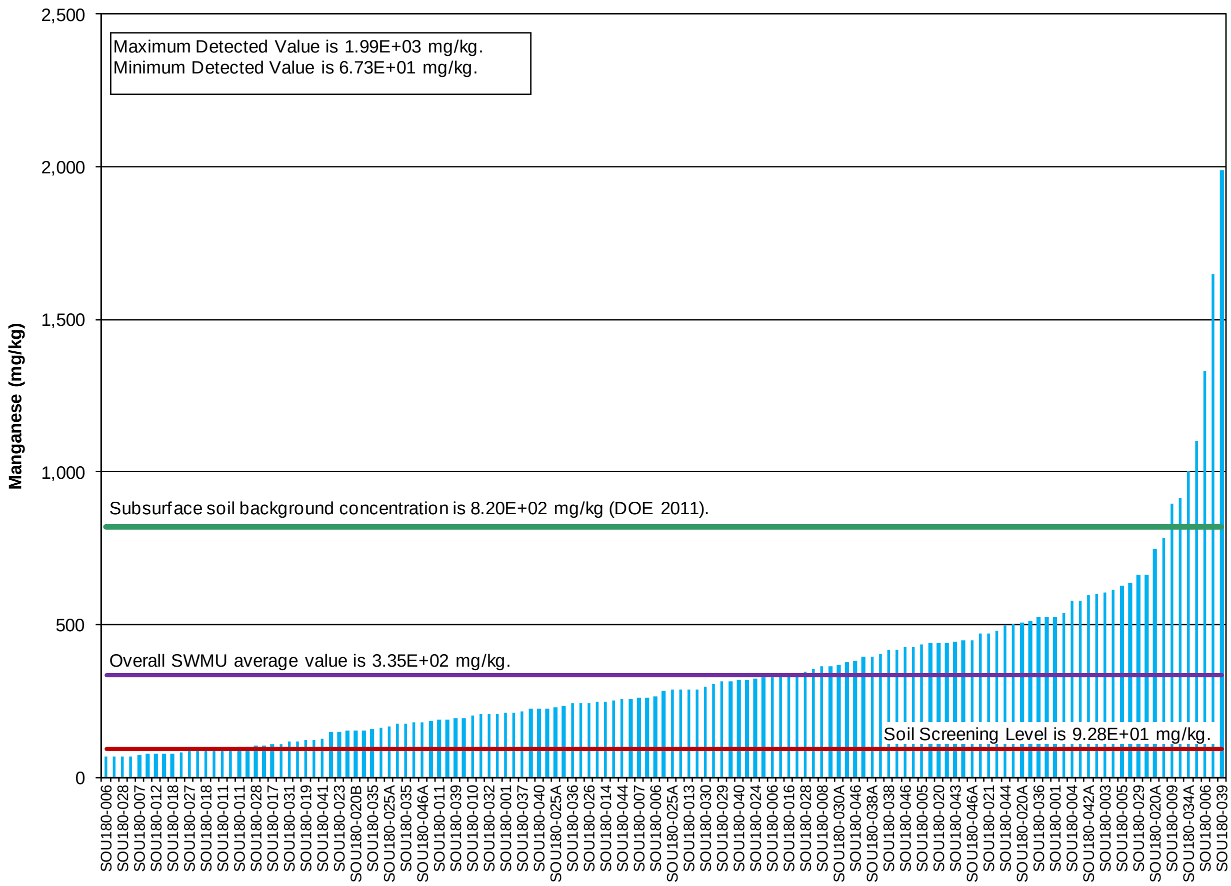

Figure C5.3.3.5. Manganese Detections at SWMU 180

Mercury was reported in 15 of 140 samples. The chart illustrating the reported results is shown in Figure C5.3.3.6. The average over SWMU 180 for mercury was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted, because mercury was evaluated as part of the GWOU FS and was not identified as part of the groundwater plumes associated with PGDP (DOE 2001d).

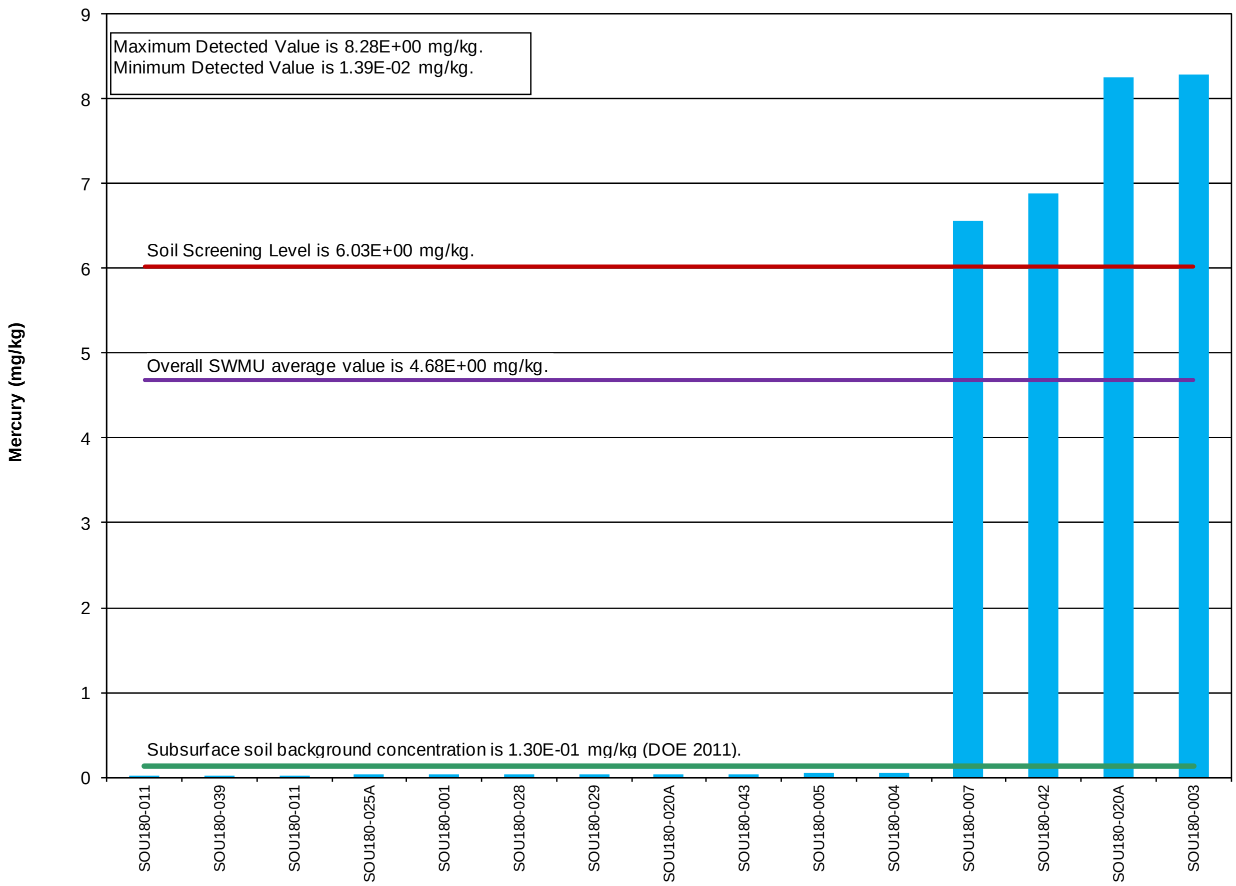

Figure C5.3.3.6. Mercury Detections at SWMU 180

Nickel was reported in 44 of 140 samples. The chart illustrating the reported results is shown in Figure C5.3.3.7. The average over SWMU 180 for nickel was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. Several samples were detected at a concentration greater than the RG SSL; however, a hot spot evaluation was not performed, because nickel is being modeled at SWMU 14—the location with the highest average concentration of nickel in any SWMU.

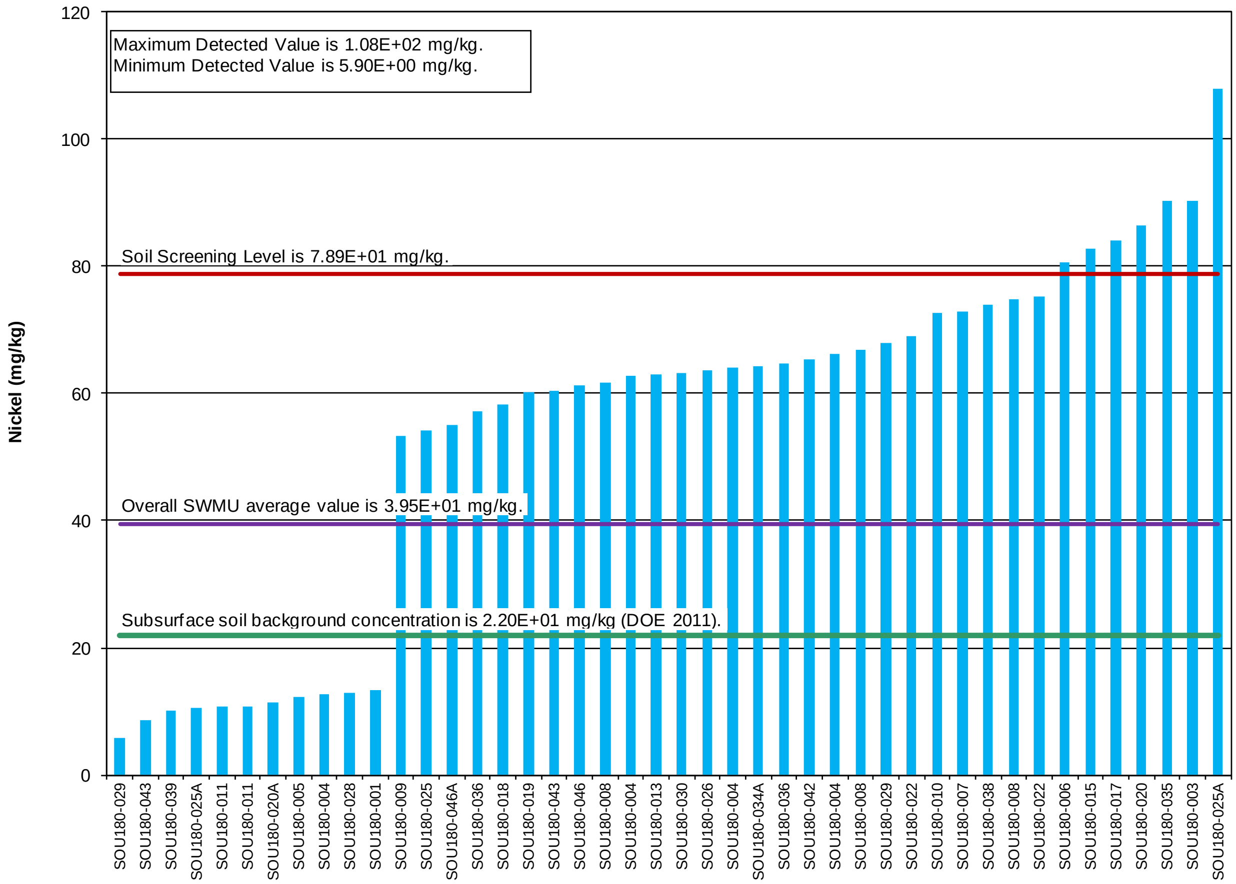

Figure C5.3.3.7. Nickel Detections at SWMU 180

Silver was reported in 18 of 140 samples. The chart illustrating the reported results is shown in Figure C5.3.3.8. The average over SWMU 180 for silver was greater than the RG SSL and background. Silver was evaluated as part of the GWOU FS and is a COC in the groundwater plumes associated with PGDP (DOE 2001d). The evaluation presented in Attachment C1 to Appendix C did not identify any RGA silver impacts; therefore, neither fate and transport modeling nor hot spot evaluation was performed for this chemical at this SWMU.

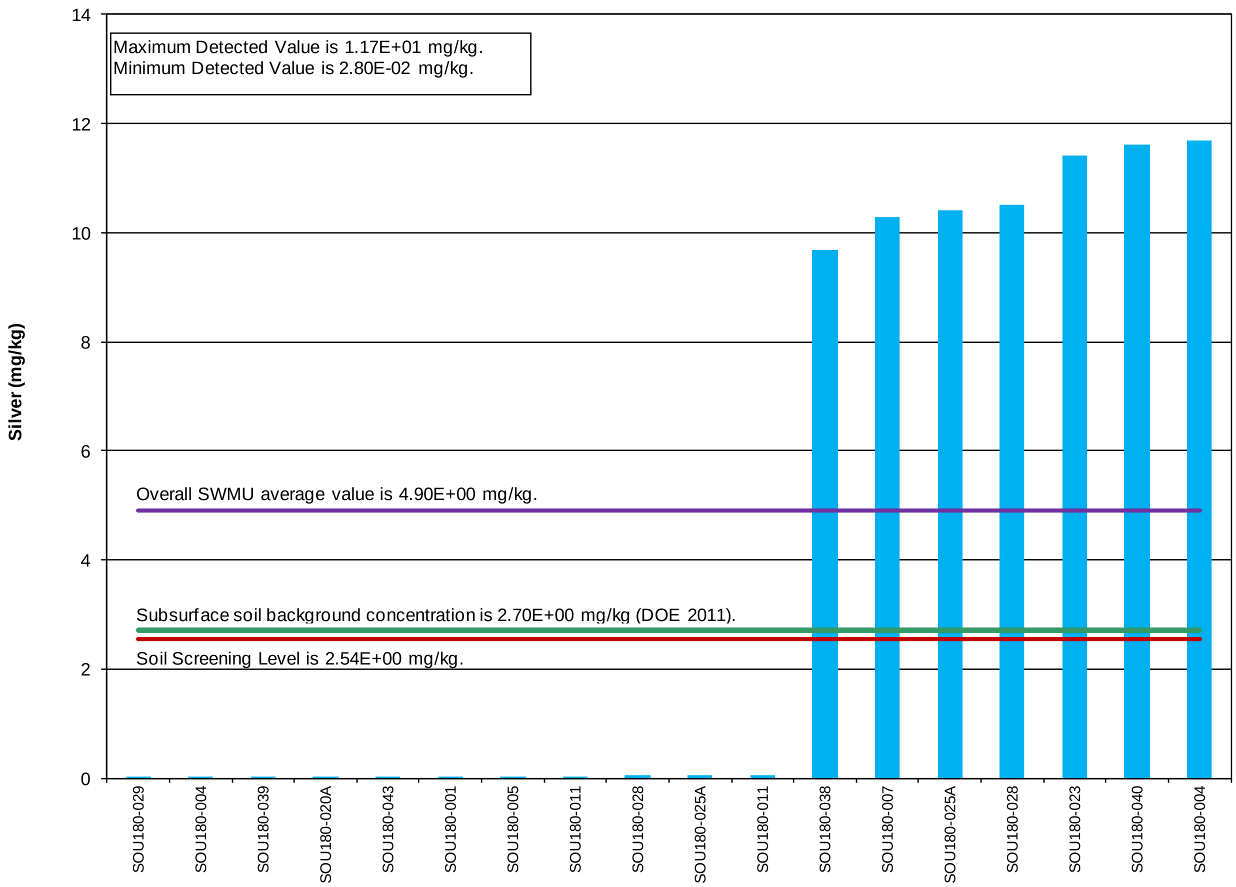

Figure C5.3.3.8. Silver Detections at SWMU 180

Vanadium was reported in 11 of 11 samples. The chart illustrating the reported results is shown in Figure C5.3.3.9. The average over SWMU 180 for vanadium was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 2 samples had a detected result greater than the background.

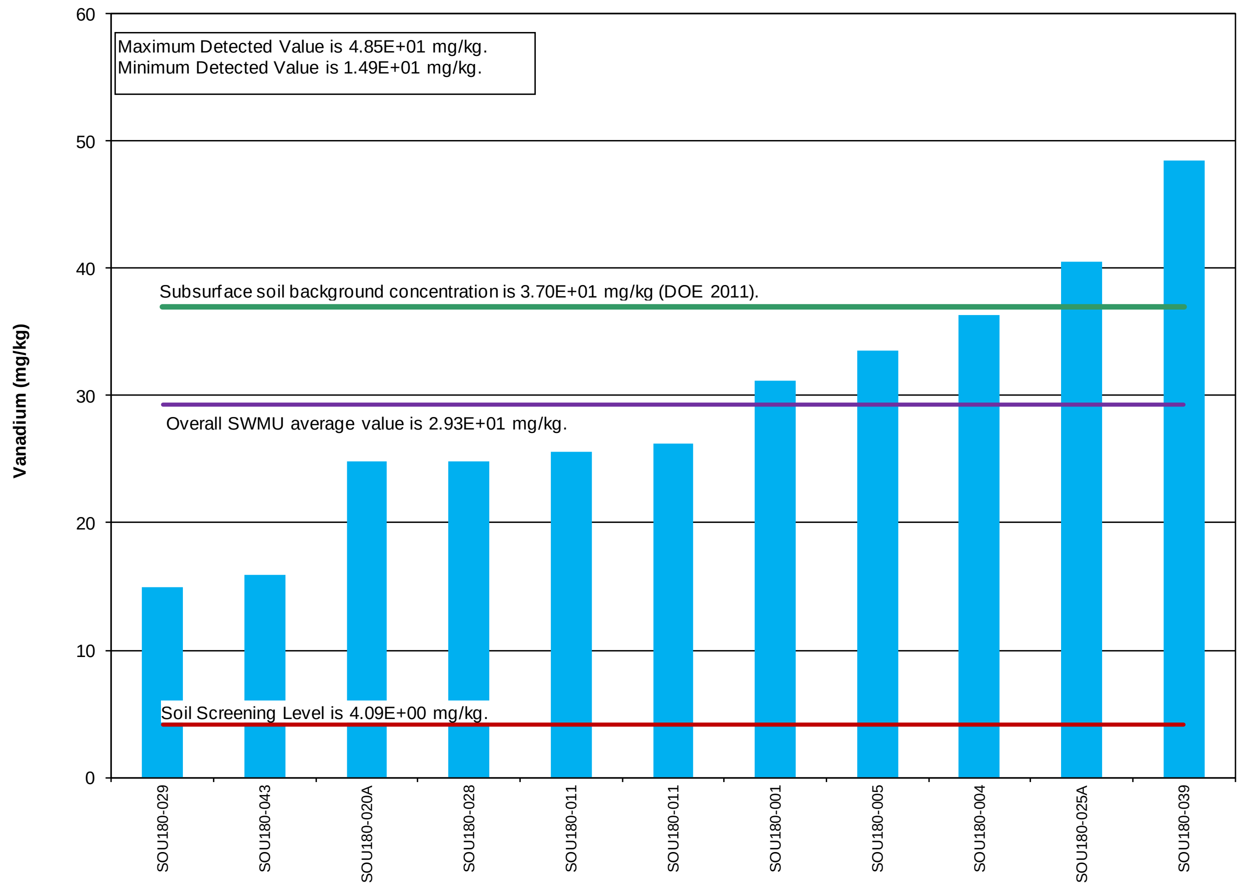

Figure C5.3.3.9. Vanadium Detections at SWMU 180

C5.3.4 SWMU 181 (OUTDOOR FIRING RANGE PGDP)

Data for SWMU 181 consisted of entirely of historical data, with the exception of one biased radiological sample collected during the RI. SWMU 181 exceedances of the RG SSL include cobalt, iron, manganese, and vanadium. Since no chemicals exceeding RG SSLs were detected above background values, none were considered for groundwater transport modeling or hot spot evaluations.

C5.3.5 SWMU 195 (CURLEE ROAD CONTAMINATED SOIL MOUNDS)

Data for SWMU 195 consisted entirely of RI data. SWMU 195 exceedances of the RG SSL include arsenic, cobalt, iron, manganese, mercury, nickel, silver, and vanadium.

Arsenic was reported in 143 of 529 samples. The chart illustrating the reported results is shown in Figure C5.3.5.1. The average over SWMU 195 for arsenic was less than background and the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than the RG SSL.

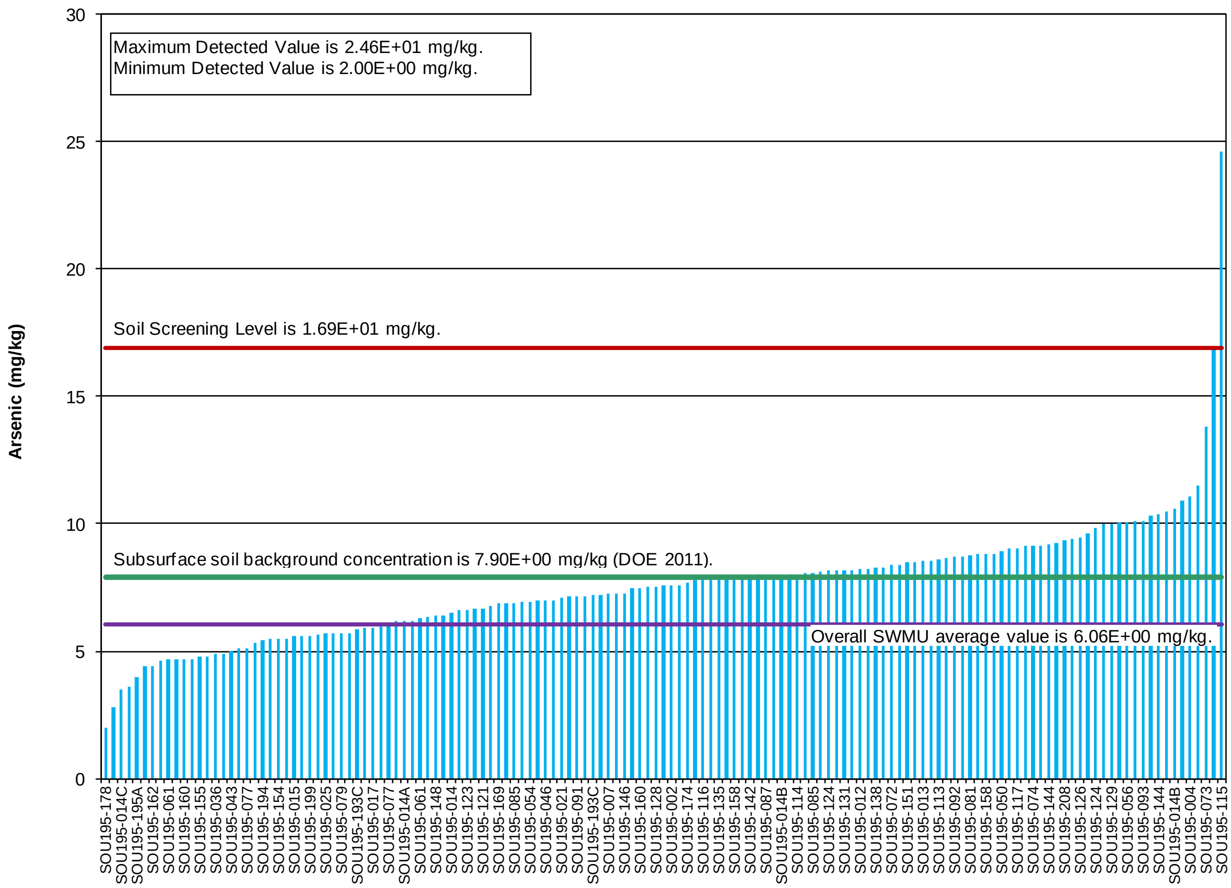

Figure C5.3.5.1. Arsenic Detections at SWMU 195

Cobalt was reported in 40 of 40 samples. The chart illustrating the reported results is shown in Figure C5.3.5.2. The average over SWMU 195 for cobalt was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted, because cobalt was evaluated in the GWOU FS and was not identified as a COC in the groundwater plumes associated with PGDP (DOE 2001d).

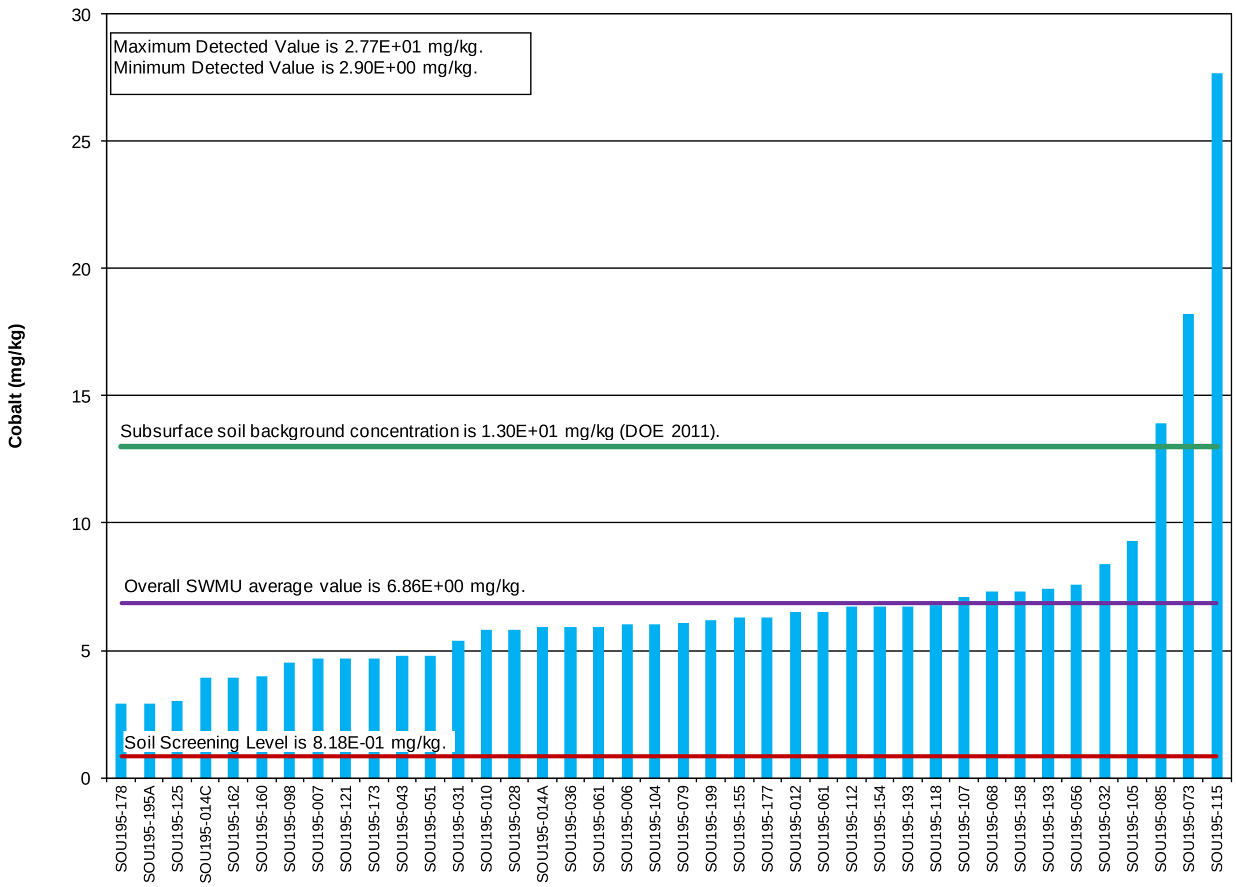

Figure C5.3.5.2. Cobalt Detections at SWMU 195

Iron was reported in 529 of 529 samples. The chart illustrating the reported results is shown in Figure C5.3.5.3. The average over SWMU 195 for iron was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

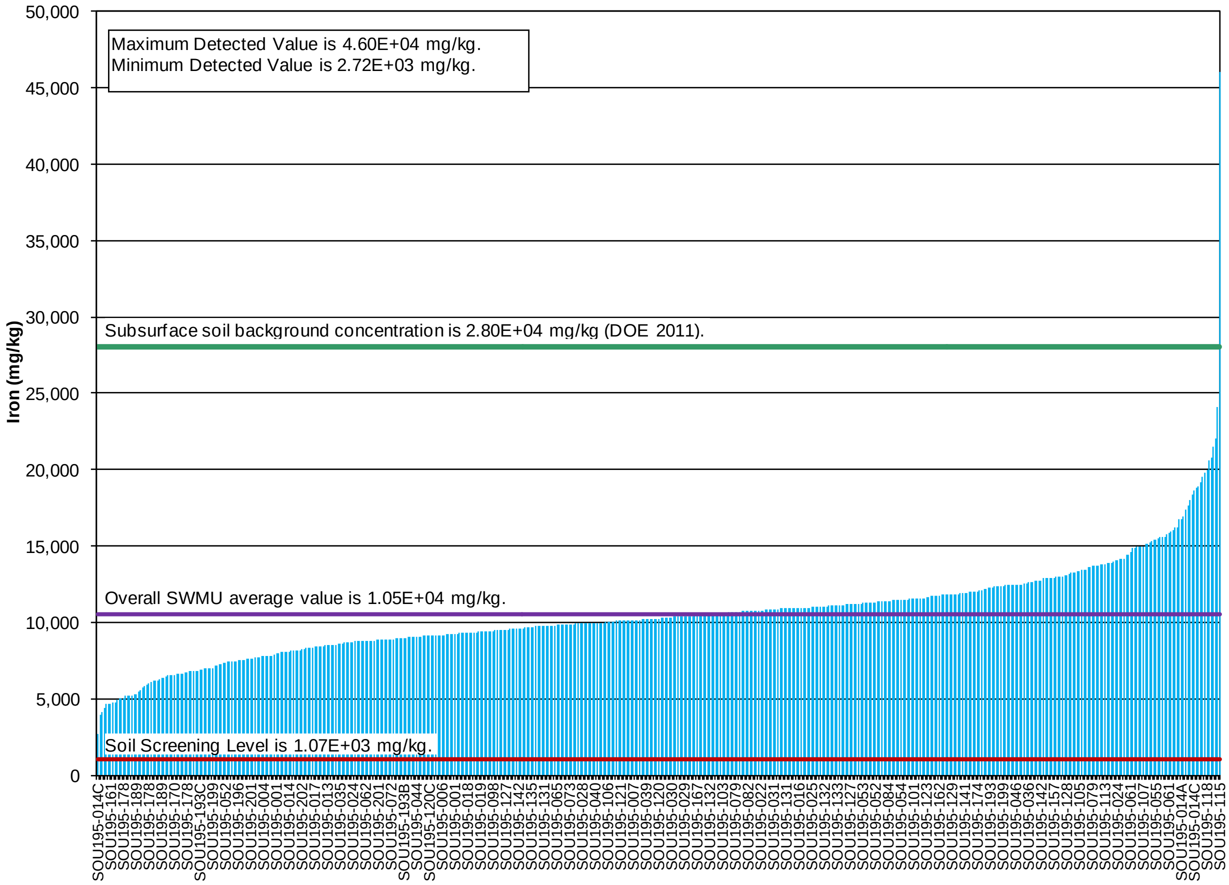

Figure C5.3.5.3. Iron Detections at SWMU 195

Manganese was reported in 518 of 529 samples. The chart illustrating the reported results is shown in Figure C5.3.5.4. The average over SWMU 195 for manganese was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted even though several samples had a detected result greater than background. Manganese is ubiquitous, concentrations are controlled by site soil geochemistry, and there are no soils-related impacts on RGA groundwater.

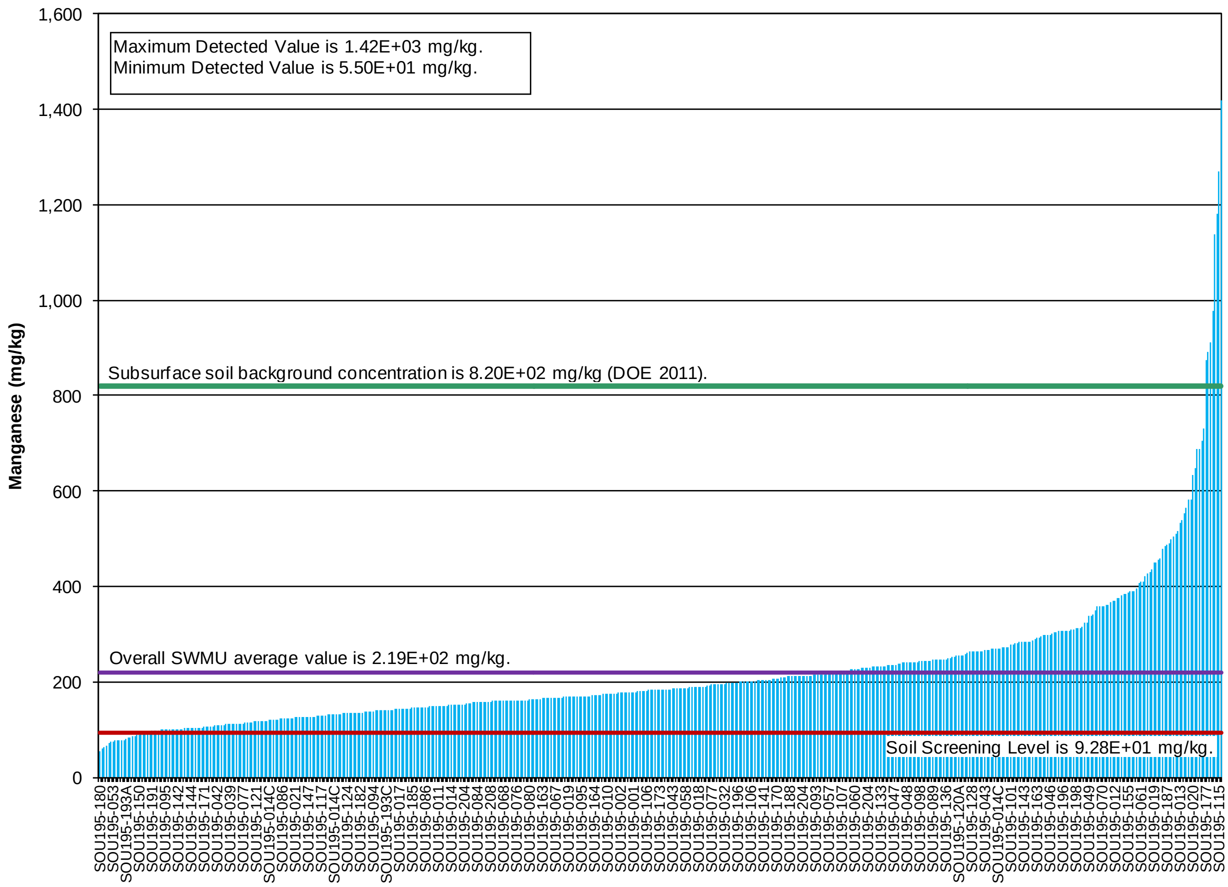

Figure C5.3.5.4. Manganese Detections at SWMU 195

Mercury was reported in 44 of 529 samples. The chart illustrating the reported results is shown in Figure C5.3.5.5. The average over SWMU 195 for mercury was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted, because it was evaluated in the GWOU FS and was not identified as a COC in the groundwater plumes associated with PGDP (DOE 2001d).

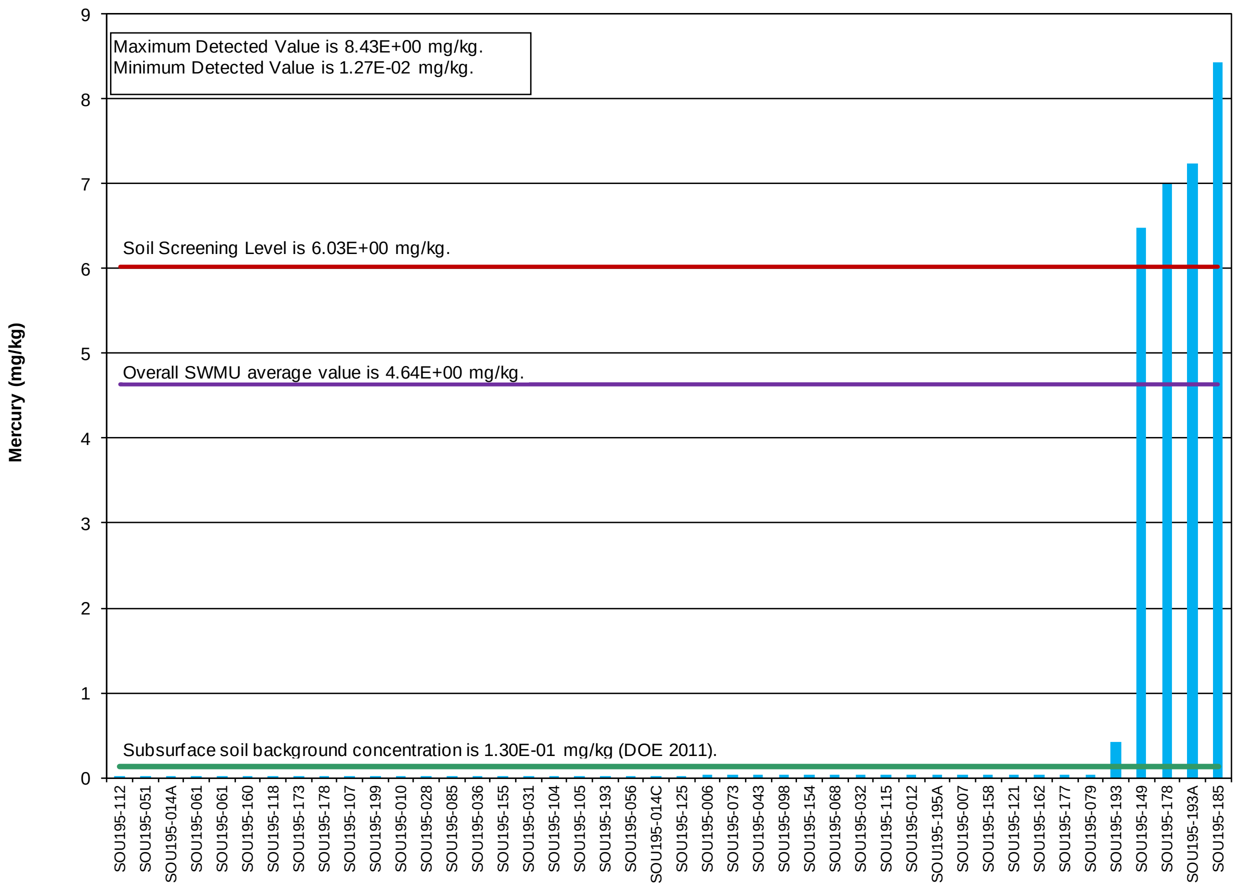

Figure C5.3.5.5. Mercury Detections at SWMU 195

Nickel was reported in 100 of 529 samples. The chart illustrating the reported results is shown in Figure C5.3.5.6. The average over SWMU 195 for nickel was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. Several samples were detected at a concentration greater than the RG SSL; however, a hot spot evaluation was not performed, because nickel is being modeled at SWMU 14—the location with the highest average concentration of nickel in any SWMU.

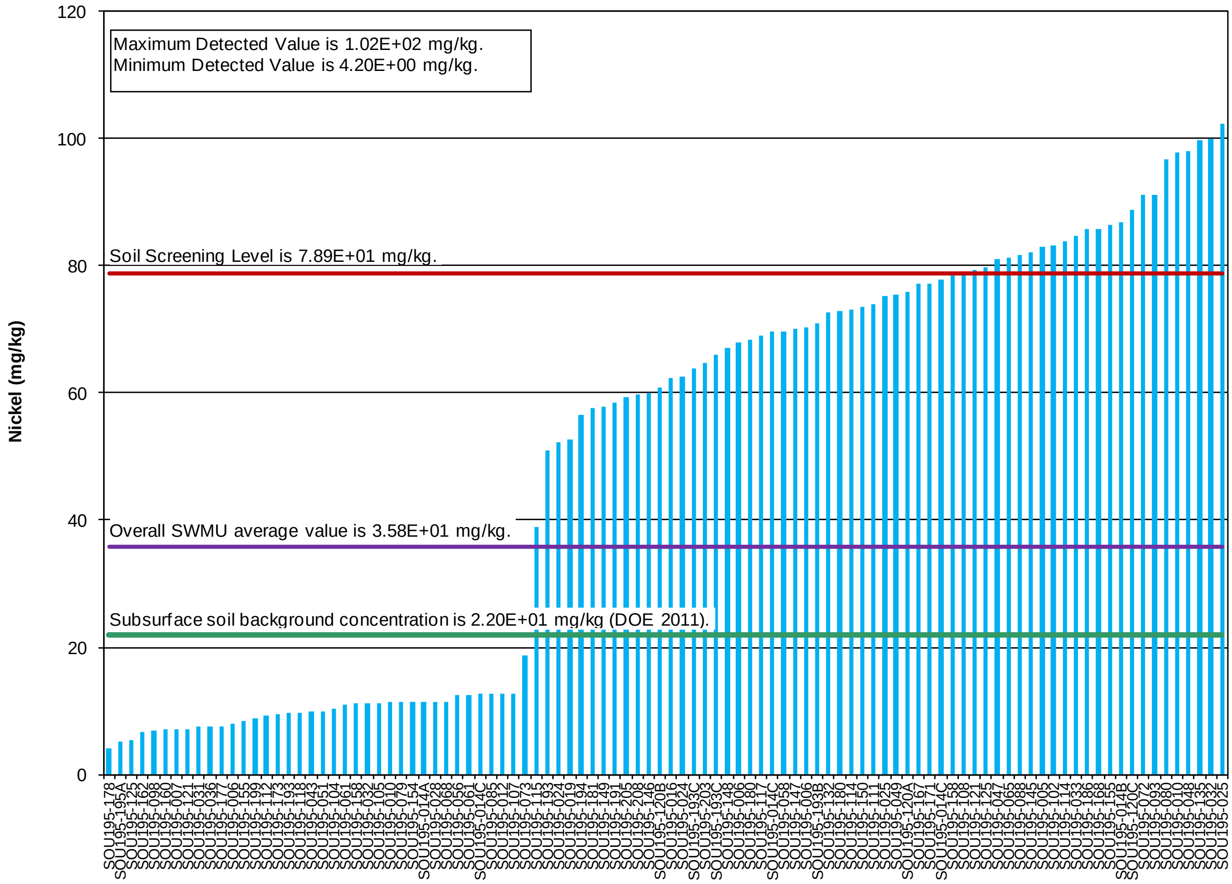

Figure C5.3.5.6. Nickel Detections at SWMU 195

Silver was reported in 56 of 529 samples. The chart illustrating the reported results is shown in Figure C5.3.5.7. The average over SWMU 195 for silver was greater than the RG SSL and background. SWMU 195 was evaluated during the GWOU FS and is a COC in the groundwater plumes associated with PGDP (DOE 2001d). The evaluation presented in Attachment C1 to Appendix C did not identify any RGA silver impacts; therefore, neither fate and transport modeling nor hot spot evaluation was performed for this chemical at this SWMU.

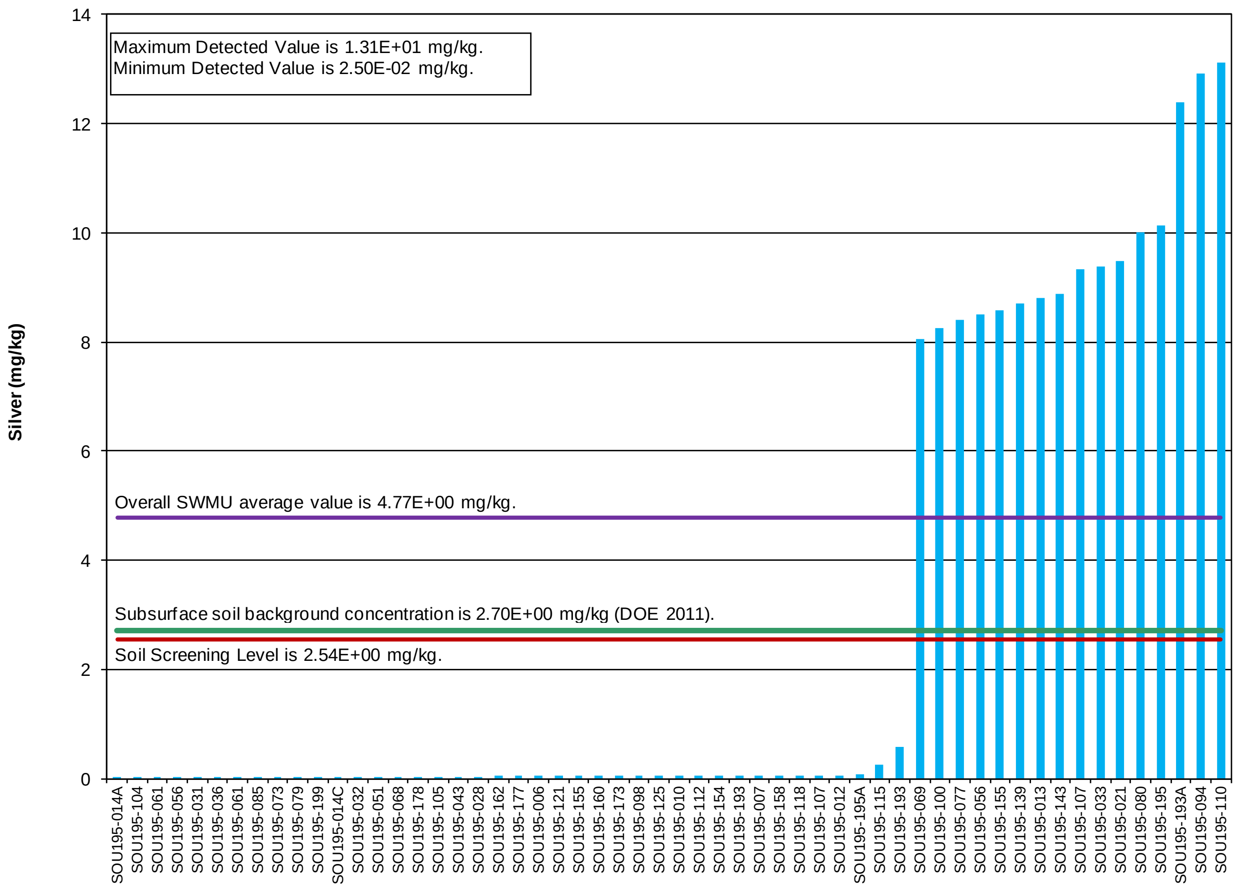

Figure C5.3.5.7. Silver Detections at SWMU 195

Vanadium was reported in 40 of 40 samples. The chart illustrating the reported results is shown in Figure C5.3.5.8. The average over SWMU 195 for vanadium was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted even though four samples had a detected result greater than background because of the infrequency of detection and the lack of vanadium RGA impacts.

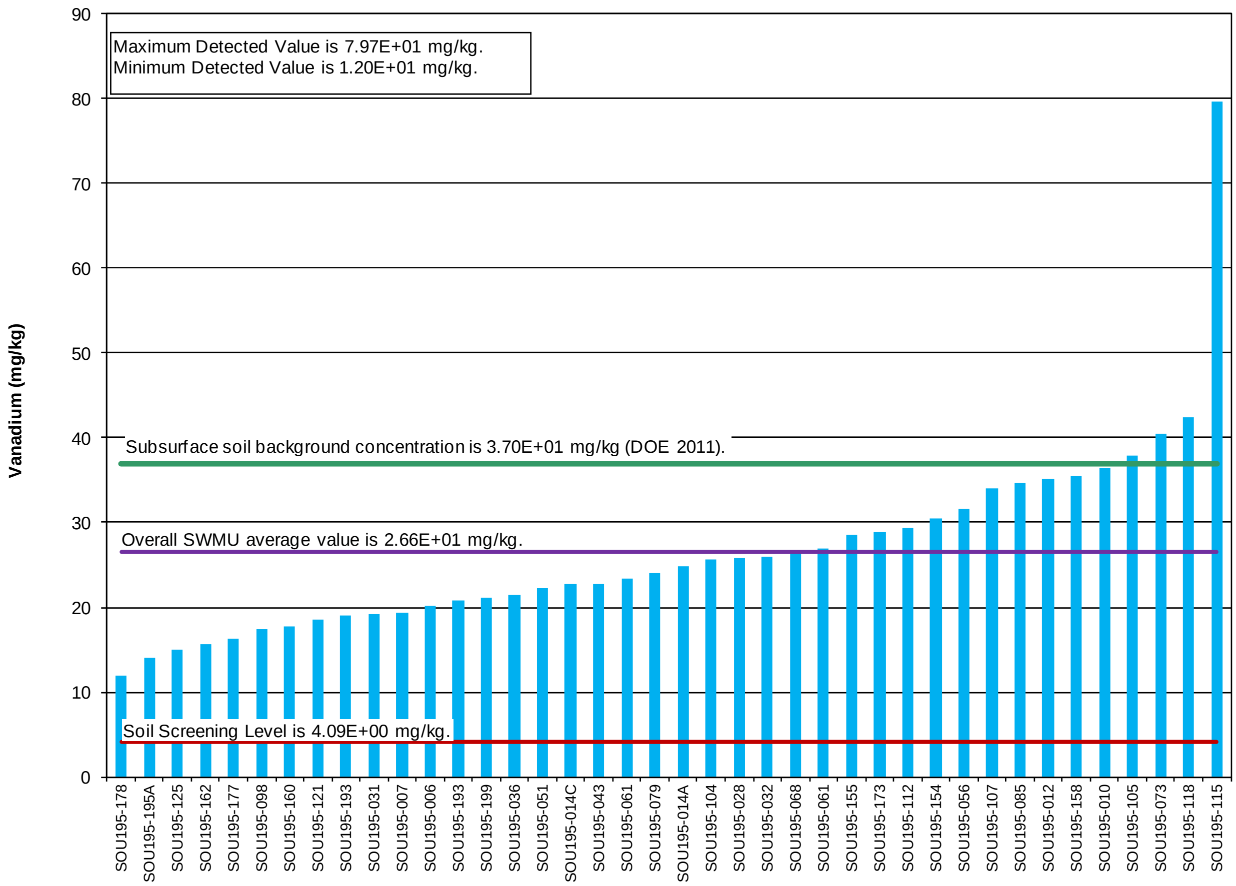

Figure C5.3.5.8. Vanadium Detections at SWMU 195

C5.3.6 SWMU 486 (RUBBLE PILE WKWMA)

Data for SWMU 486 consisted of only one radiological sample collected during the RI. SWMU 486 had no exceedances of the RG SSL.

C5.3.7 SWMU 487 (RUBBLE PILE WKWMA)

Data for SWMU 487 consisted of only one radiological sample collected during the RI. SWMU 487 had no exceedances of the SSL.

C5.3.8 AOC 492 (CONTAMINATED SOIL AREA, NORTH OF OUTFALL 10)

Data for AOC 492 consisted of historical data and one radiological sample collected during the RI. AOC 492 exceedances of the RG SSL include Total PCBs, cobalt, iron, manganese, uranium, and vanadium. Cobalt, iron, and manganese were not detected above background values; therefore, they were not considered for groundwater transport modeling or hot spot evaluations.

Total PCBs was reported in 3 of 19 samples. The chart illustrating the reported results is shown in Figure C5.3.8.1. The average over AOC 492 for Total PCBs was greater than the RG SSL. AOC 492 was evaluated in the GWOU FS and is a COC in the groundwater plumes associated with PGDP (DOE 2001d). Average concentrations were higher in SWMUs 81 and 541; therefore, AOC 492 was not modeled for groundwater fate and transport. Because 3 samples exceeded the RG SSL, a hot spot analysis was conducted, as shown in Figure C5.3.8.2. The 3 samples were all in shallow soils indicating a potential surface soil hot spot.

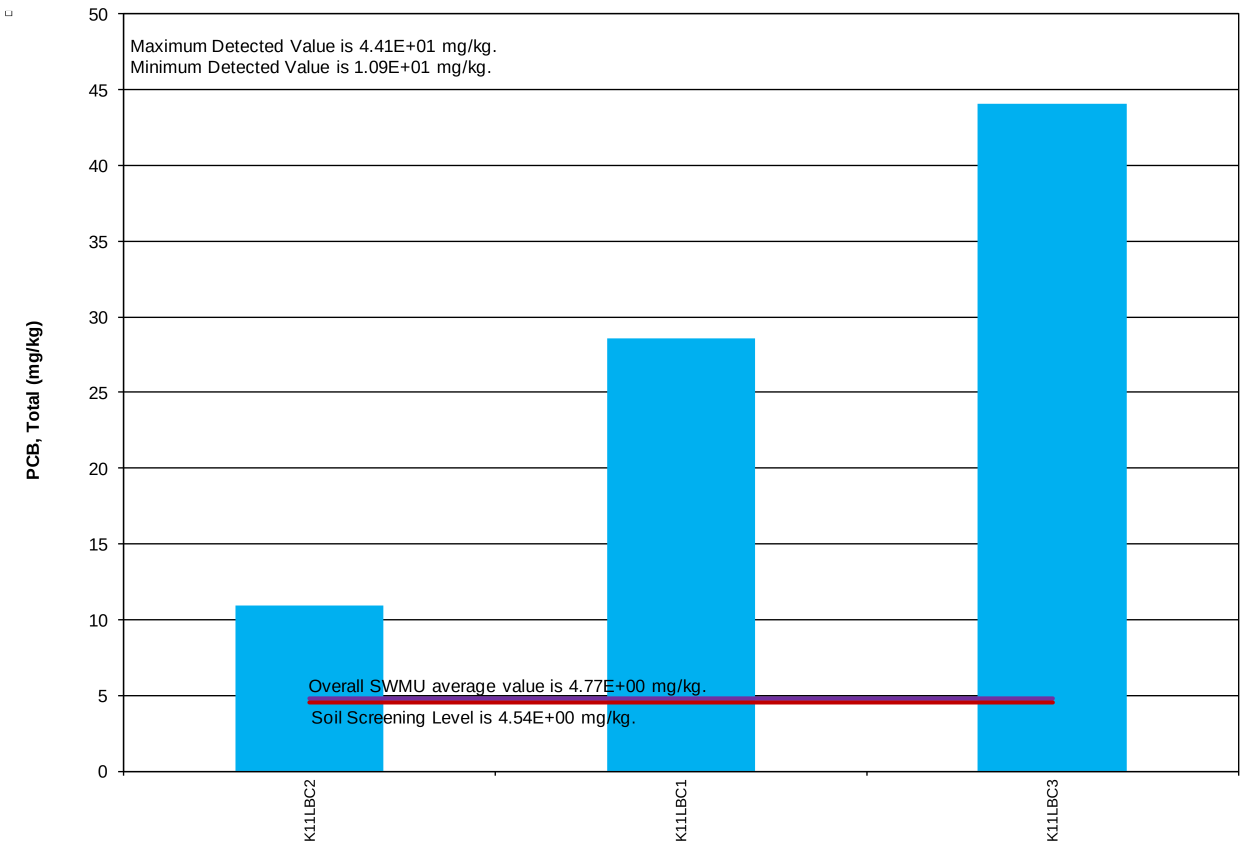

Figure C5.3.8.1. Total PCB Detections at AOC 492

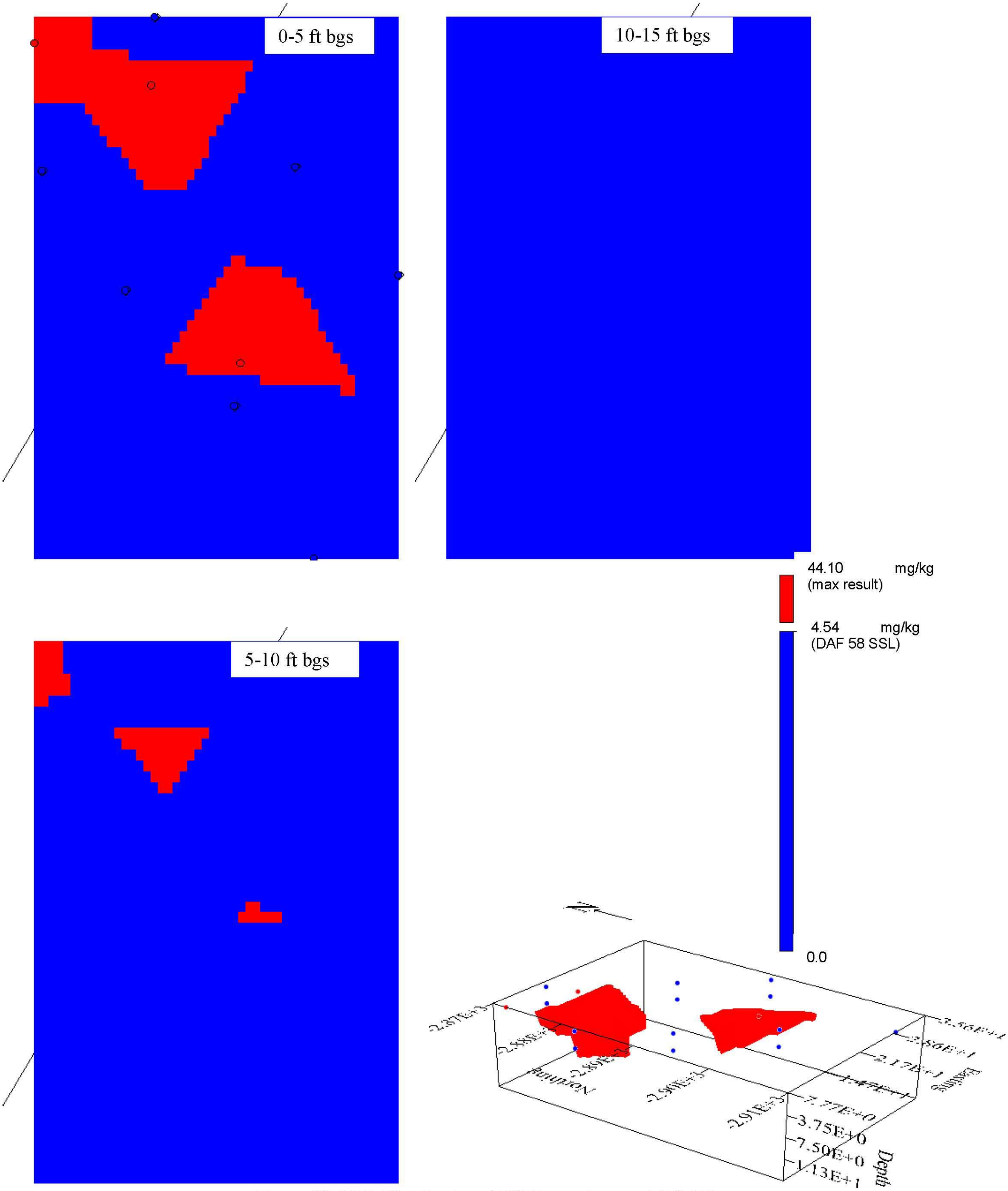

Figure C5.3.8.2. Distribution of PCB Detections at AOC 492

Uranium was reported in 6 of 18 samples. The chart illustrating the reported results is shown in Figure C5.3.8.3. The average over AOC 492 for uranium was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 2 samples had a detected result greater than the RG SSL.

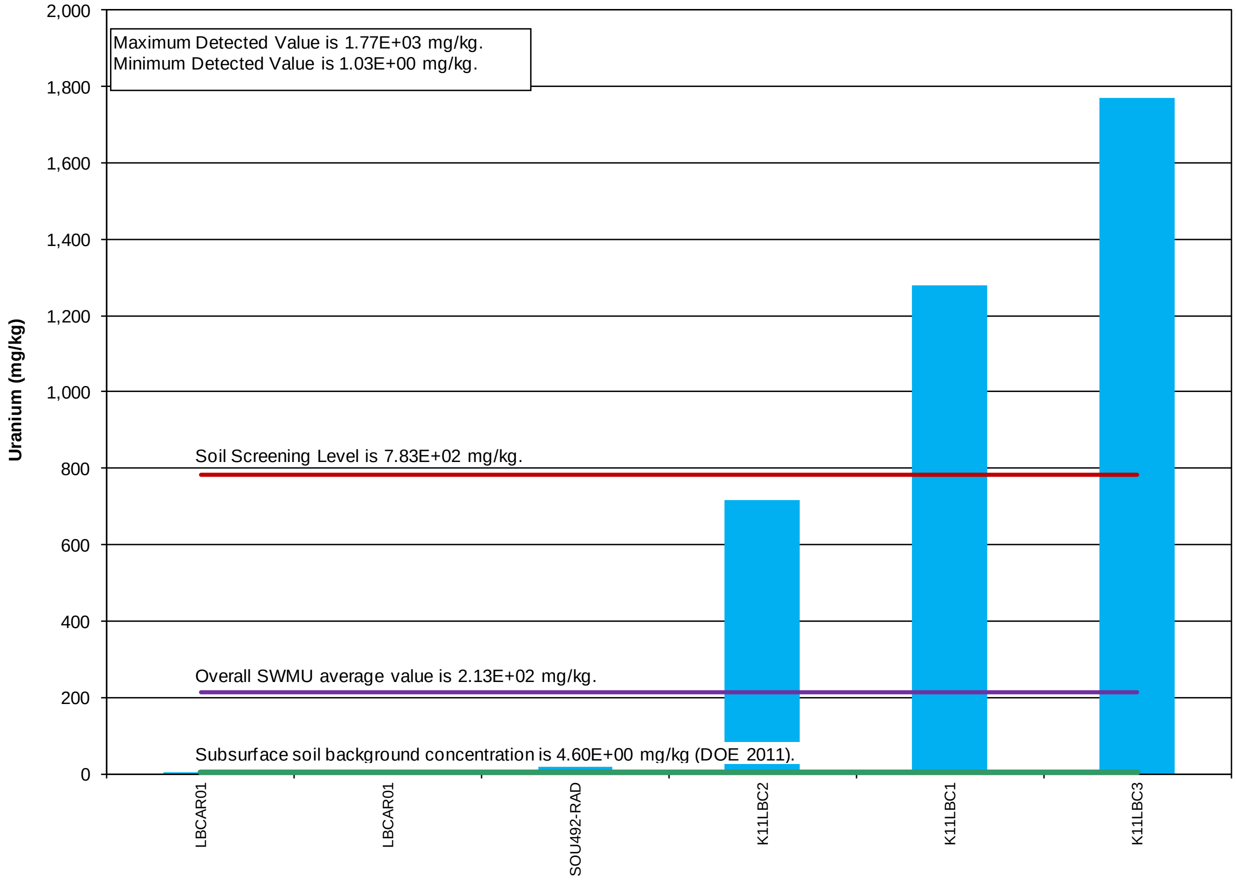

Figure C5.3.8.3. Uranium Detections at AOC 492

Vanadium was reported in seven of seven samples. The chart illustrating the reported results is shown in Figure C5.3.8.4. The average over AOC 492 for vanadium was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

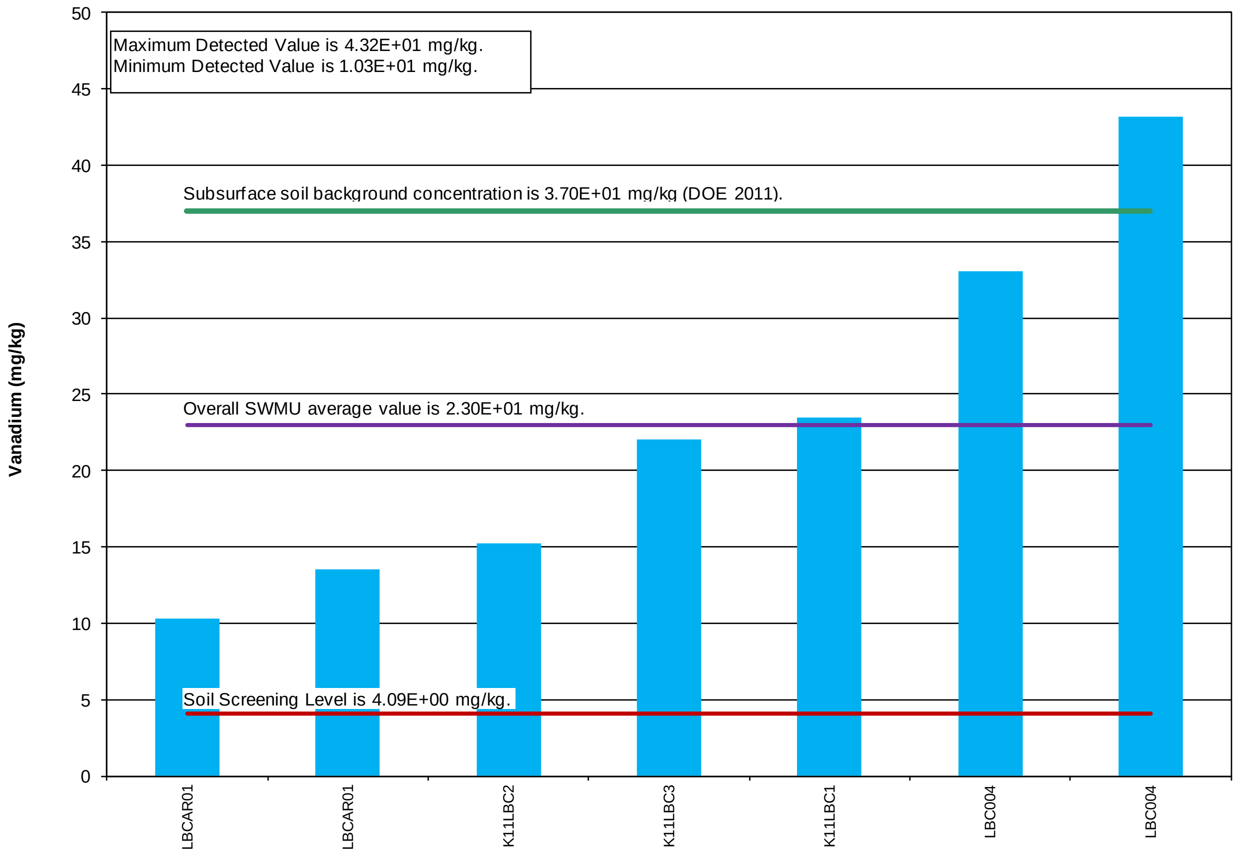

Figure C5.3.8.4. Vanadium Detections at AOC 492

C5.3.9 SWMU 493 (CONCRETE RUBBLE PILES NEAR OUTFALL 001)

Data for SWMU 493 consisted of both historical data and RI data. SWMU 493 exceedances of the RG SSL include cobalt, iron, manganese, nickel, vanadium, and technetium-99. Iron was not detected above background values; therefore, it was not considered for groundwater transport modeling or hot spot evaluation.

Cobalt was reported in 21 of 22 samples. The chart illustrating the reported results is shown in Figure C5.3.9.1. The average over SWMU 493 for cobalt was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

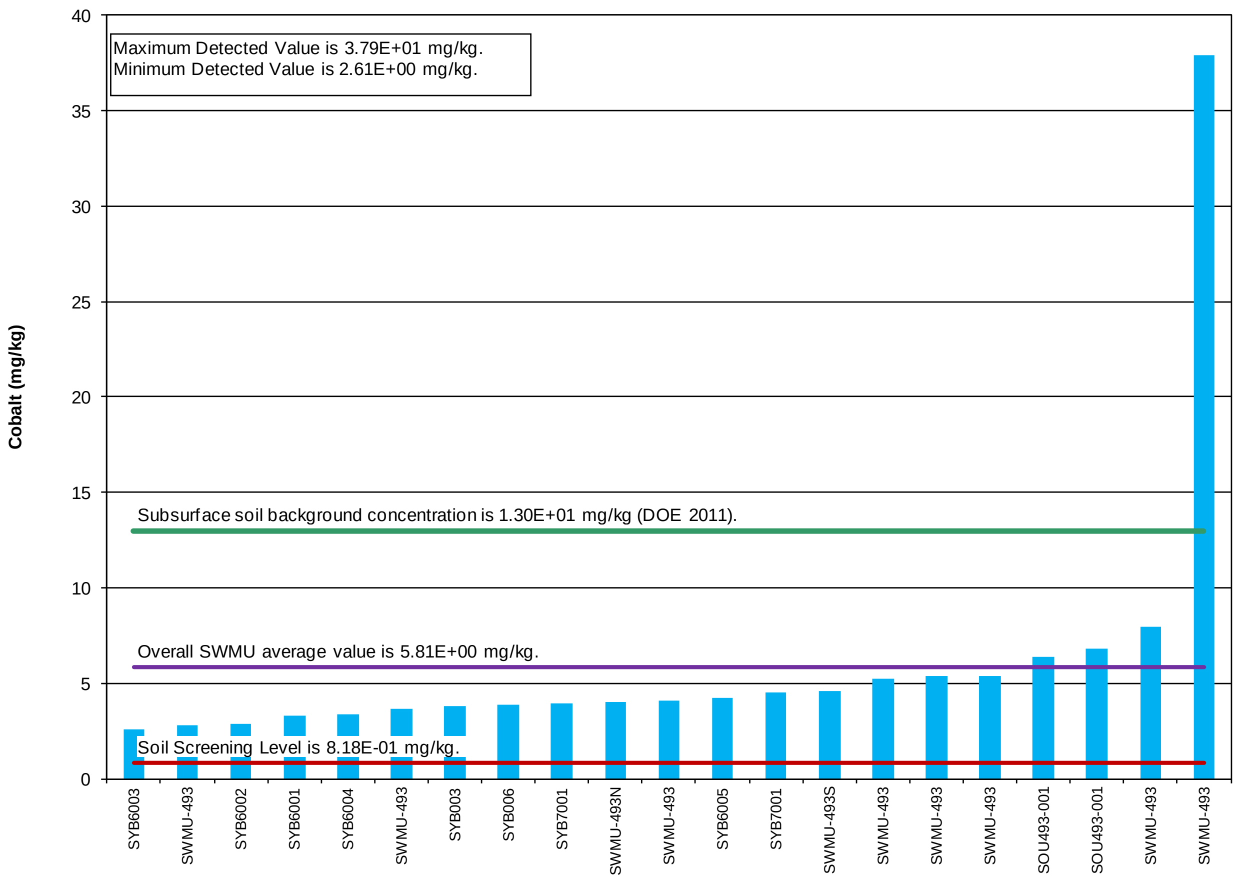

Figure C5.3.9.1. Cobalt Detections at SWMU 493

Manganese was reported in 26 of 26 samples. The chart illustrating the reported results is shown in Figure C5.3.9.2. The average over SWMU 493 for manganese was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

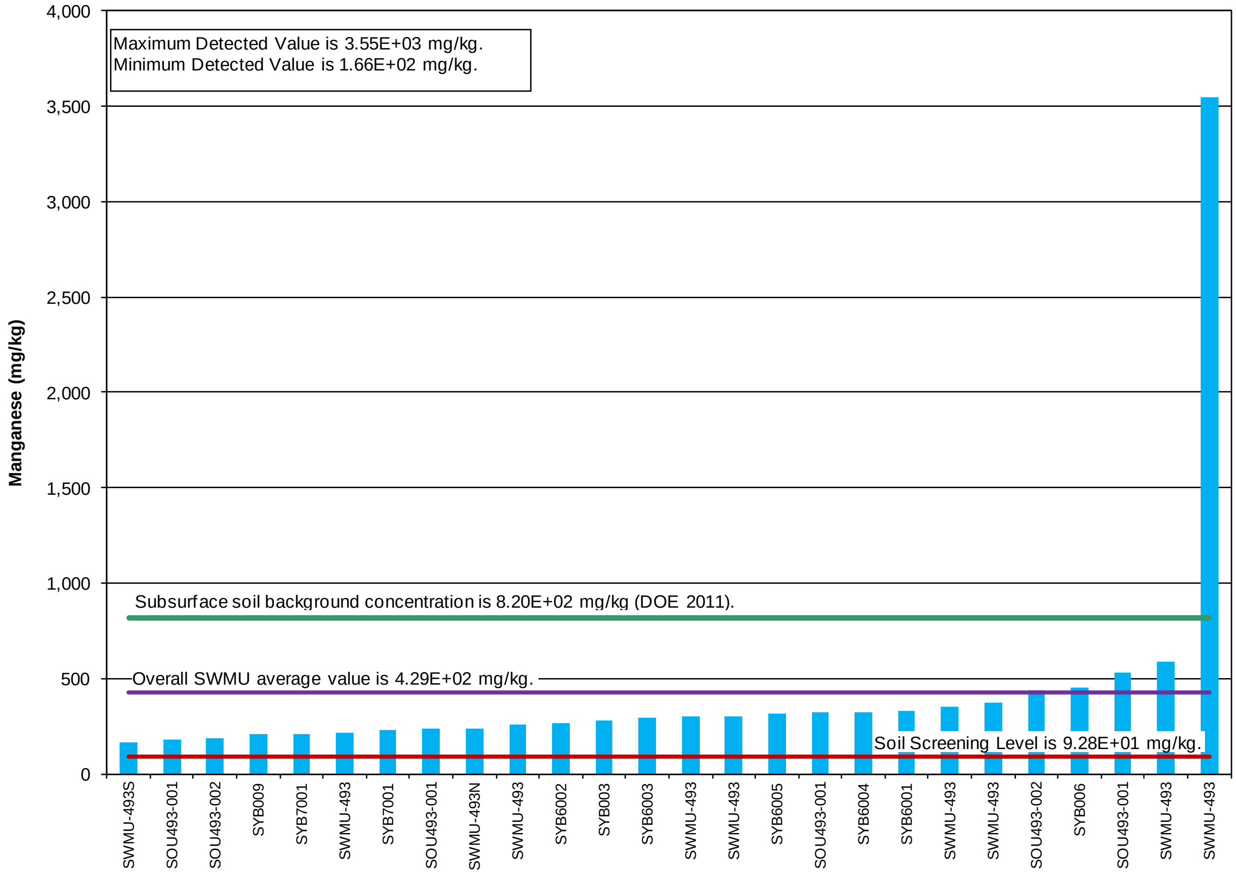

Figure C5.3.9.2. Manganese Detections at SWMU 493

Nickel was reported in 22 of 26 samples. The chart illustrating the reported results is shown in Figure C5.3.9.3. The average over SWMU 493 for nickel was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than the RG SSL.

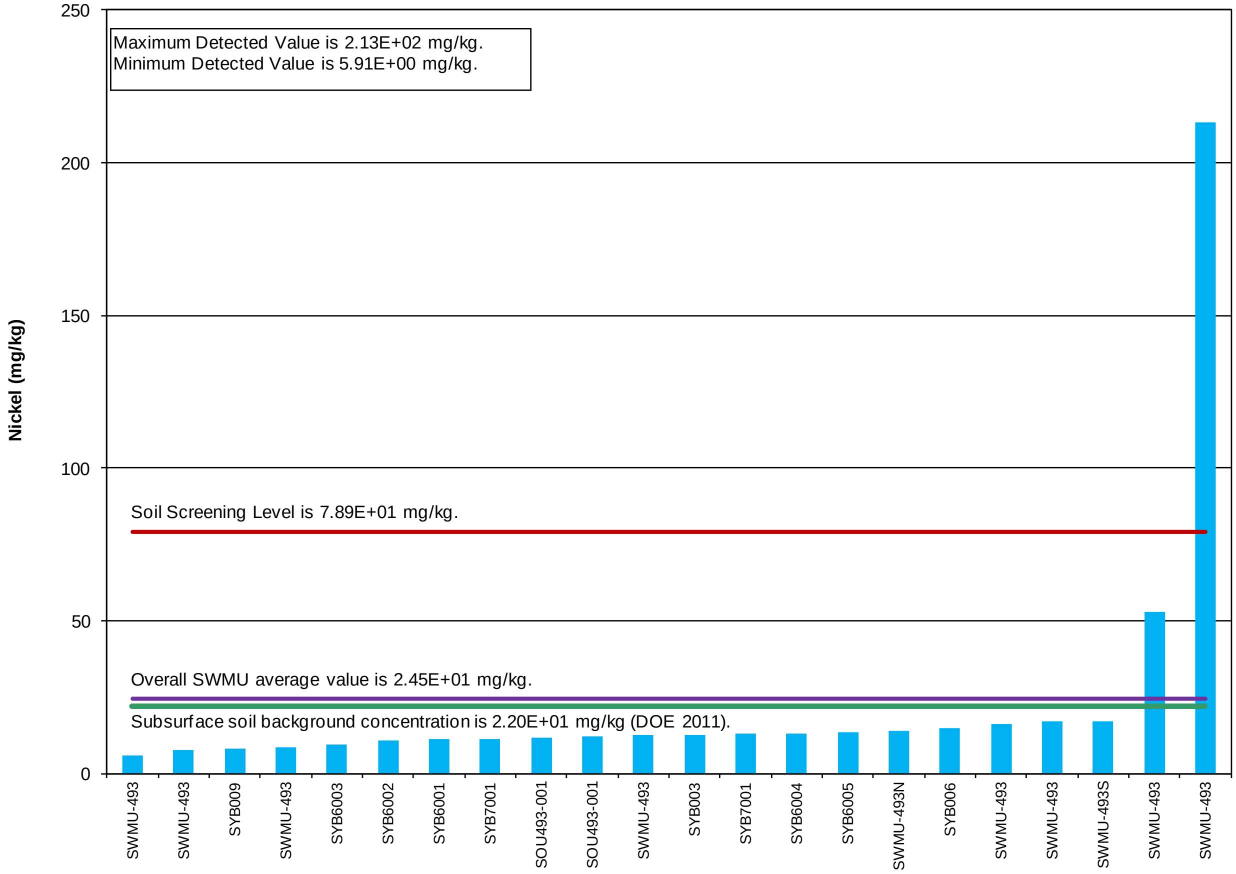

Figure C5.3.9.3. Nickel Detections at SWMU 493

Vanadium was reported in 22 of 22 samples. The chart illustrating the reported results is shown in Figure C5.3.9.4. The average over SWMU 493 for vanadium was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

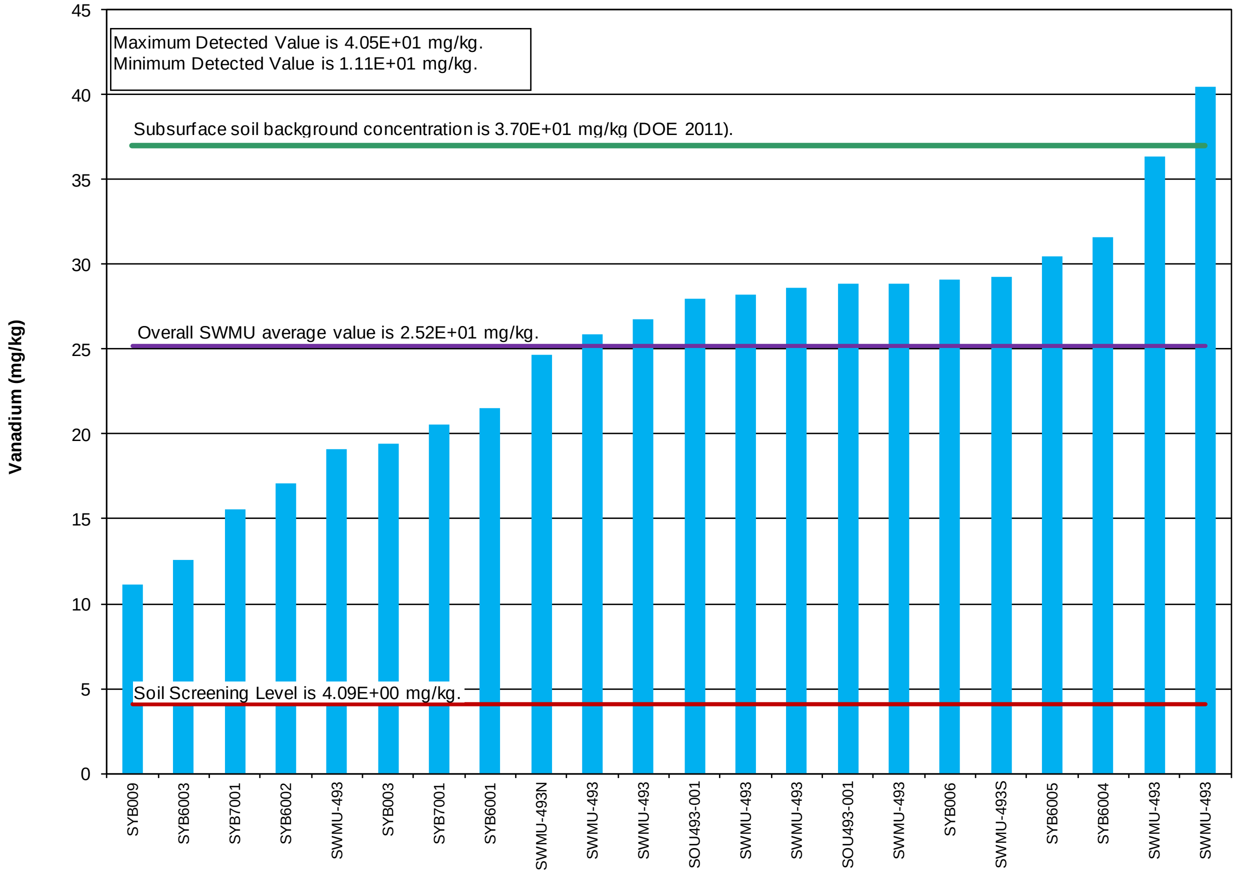

Figure C5.3.9.4. Vanadium Detections at SWMU 493

Technetium-99 was reported in 13 of 13 samples. The chart illustrating the reported results is shown in Figure C5.3.9.5. The average over SWMU 493 for technetium-99 was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted, because only 1 sample had a detected result equal to or greater than the RG SSL, and none were higher than the RG SSL.

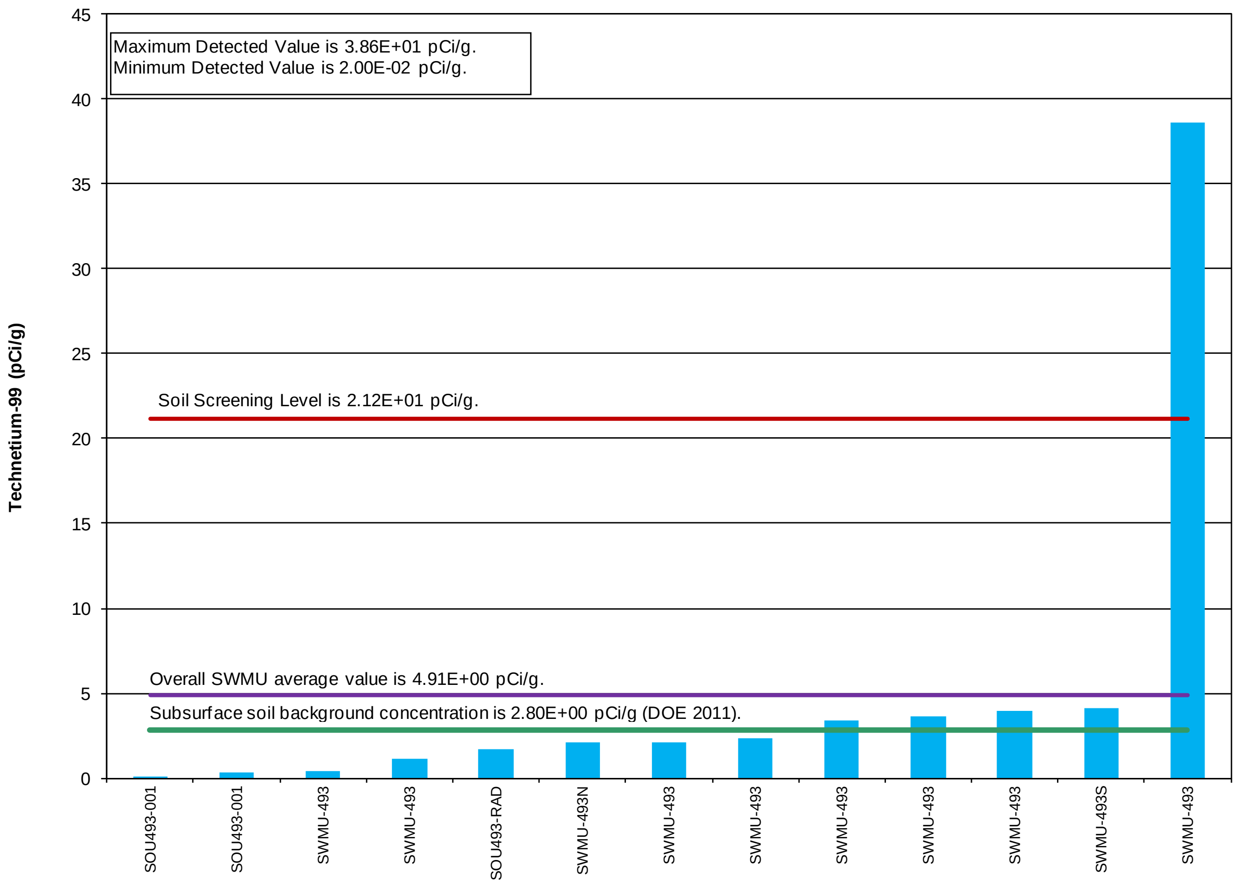

Figure C5.3.9.5. Technetium-99 Detections at SWMU 493

C5.3.10 SWMU 517 (RUBBLE AND DEBRIS EROSION CONTROL FILL AREA)

Data for SWMU 517 consisted of both historical data and RI data. SWMU 517 exceedances of the RG SSL include cobalt, iron, manganese, nickel, vanadium, zinc, and technetium-99. Cobalt, iron, manganese, and vanadium were not detected above background values; therefore, they were not considered for groundwater transport modeling or hot spot evaluations.

Nickel was reported in six of nine samples. The chart illustrating the reported results is shown in Figure C5.3.10.1. The average over SWMU 517 for nickel was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than the RG SSL.

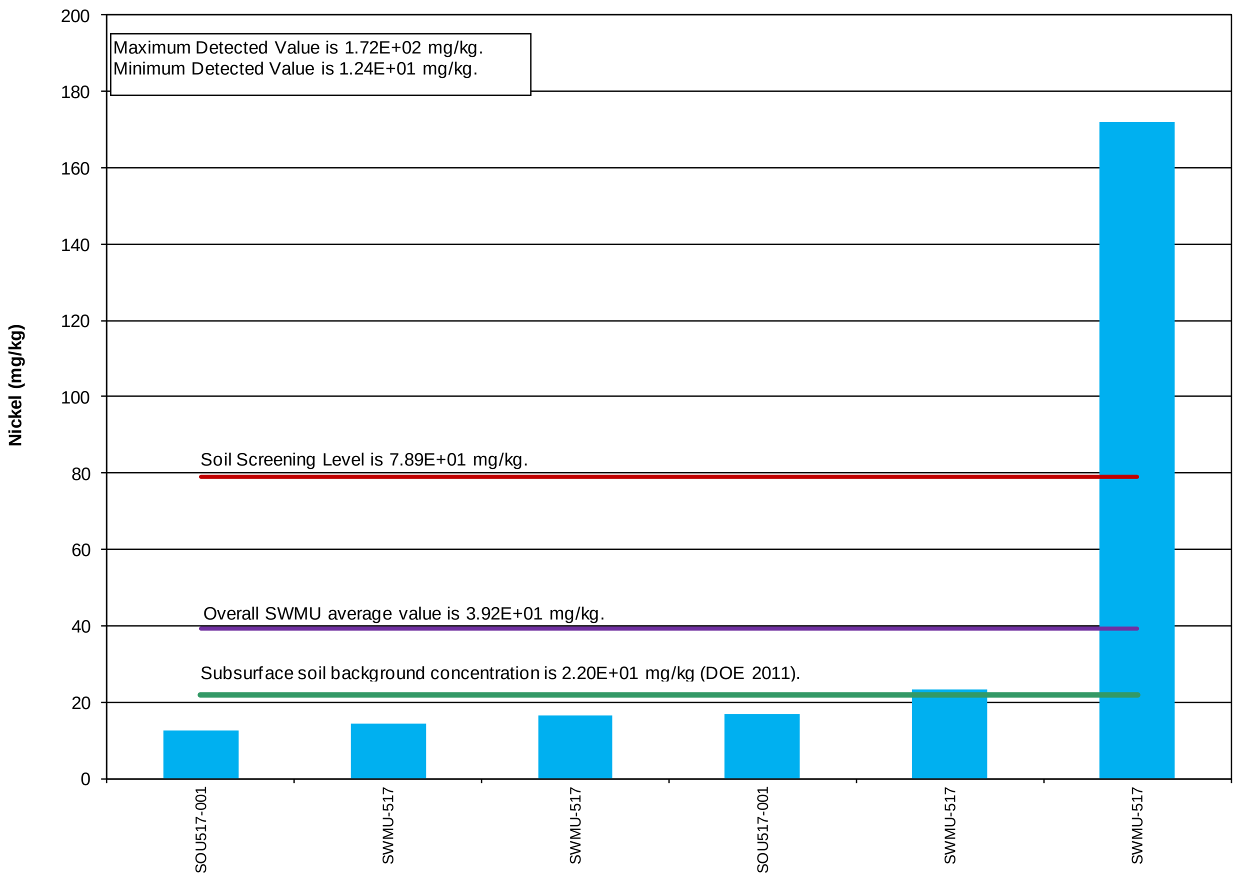

Figure C5.3.10.1. Nickel Detections at SWMU 517

Zinc was reported in nine of nine samples. The chart illustrating the reported results is shown in Figure C5.3.10.2. The average over SWMU 517 for zinc was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than the RG SSL.

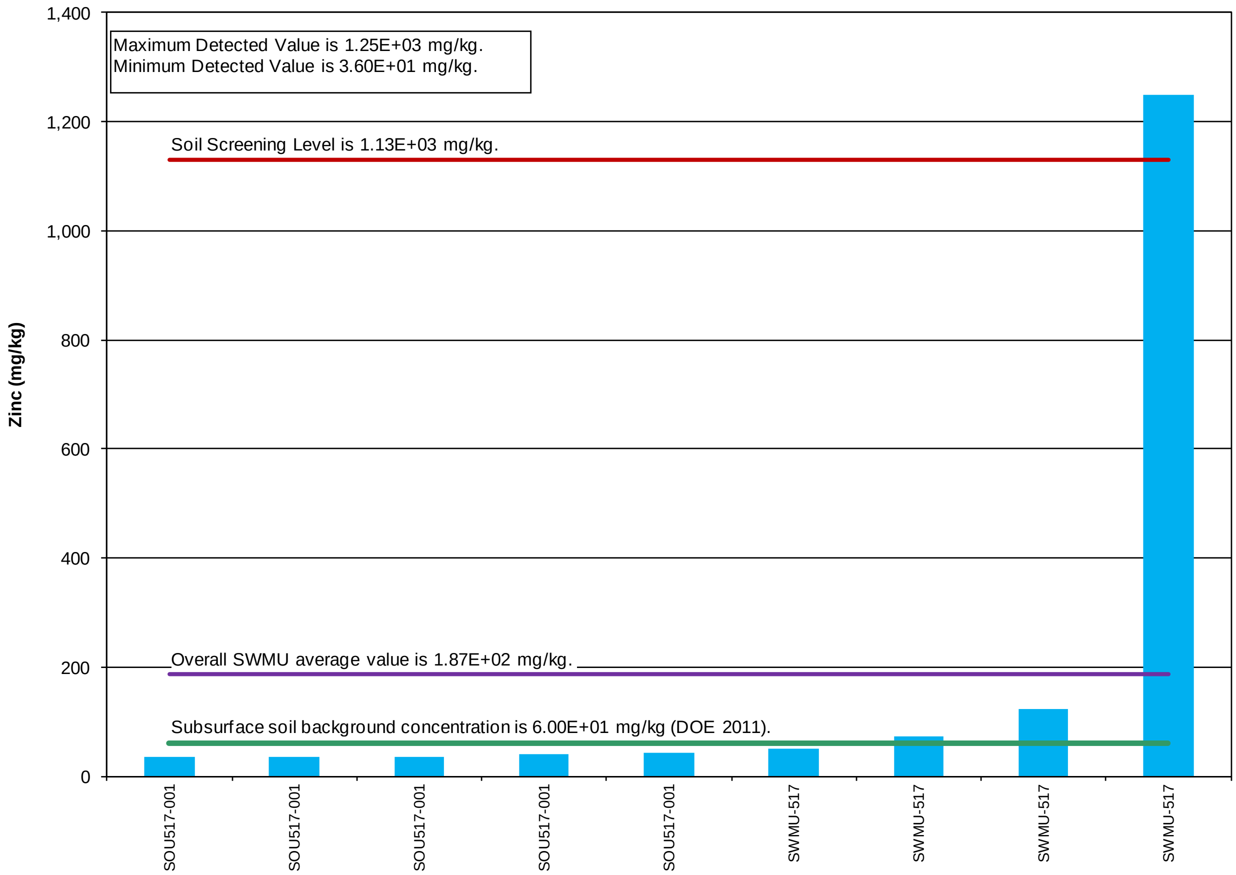

Figure C5.3.10.2. Zinc Detections at SWMU 517

Technetium-99 was reported in seven of seven samples. The chart illustrating the reported results is shown in Figure C5.3.10.3. The average over SWMU 517 for technetium-99 was less than the RG SSL; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than the RG SSL.

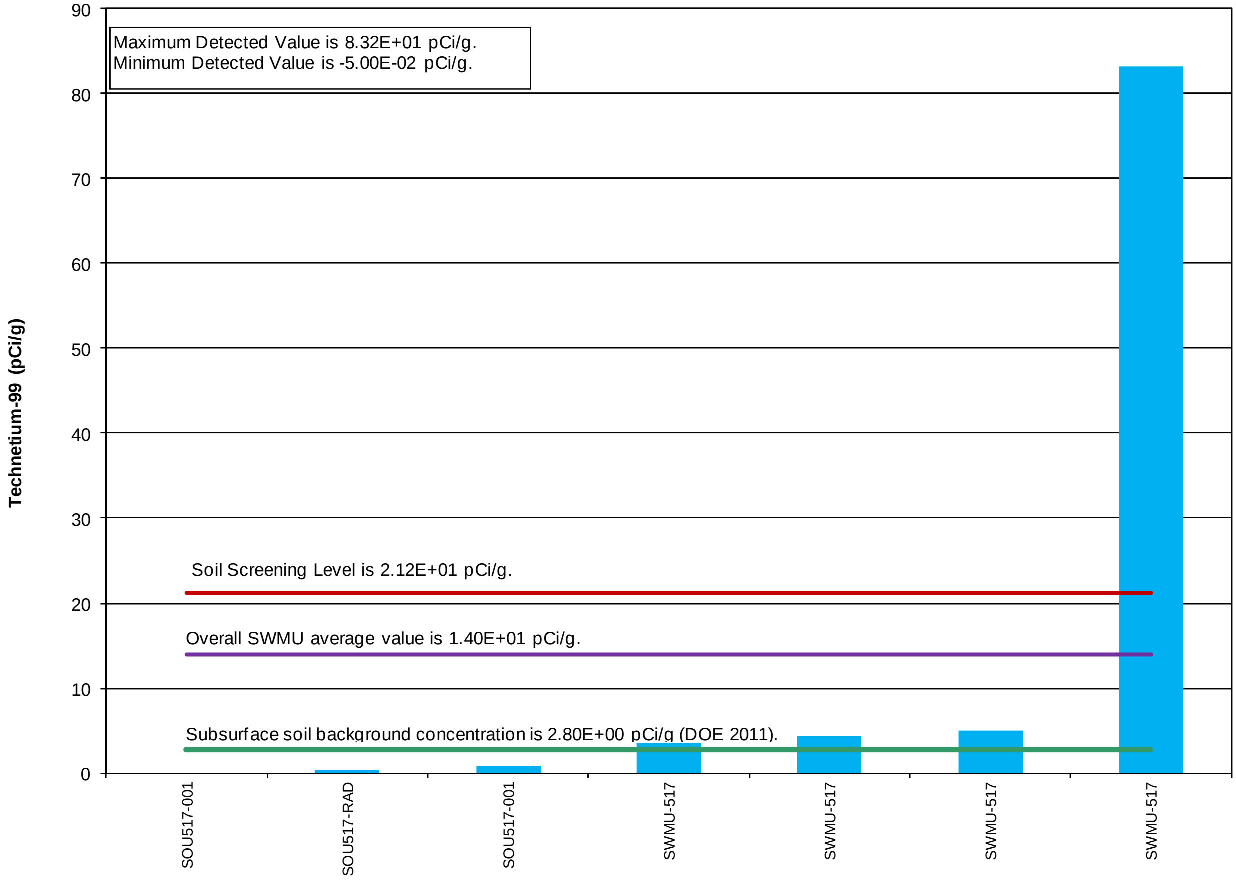

Figure C5.3.10.3. Technetium-99 Detections at SWMU 517

C5.3.11 AOC 563 (SOIL PILES 20, CC, AND BW IN SUBUNIT 4)

Data for AOC 563 consisted of historical data and one radiological sample collected during the RI. AOC 563 exceedances of the RG SSL include cobalt, iron, manganese, and vanadium. Since no chemicals exceeding RG SSLs were detected above background values, none were considered for groundwater transport modeling or hot spot evaluations.

C5.4.1 AOC 564 (SOIL PILE AT IN SUBUNIT 5)

Data for AOC 564 consisted of historical data and one radiological sample collected during the RI. AOC 564 exceedances of the RG SSL include arsenic, cobalt, iron, manganese, molybdenum, and vanadium. Cobalt and manganese were not detected above background values; therefore, they were not considered for groundwater transport modeling or hot spot evaluations.

Arsenic was reported in four of four samples. The chart illustrating the reported results is shown in Figure C5.4.2.1. The average over AOC 564 for arsenic was greater than background and the RG SSL. AOC 564 was evaluated during the GWOU FS and is a COC in the groundwater plumes associated with PGDP (DOE 2001d). The sample with the highest detected level was a surface soil sample collected from the same location as a shallow surface soil sample. The concentration detected deeper in the boring was less than half of that seen in the surface soil sample. If the highest detected value is eliminated from the data set, the average for the SWMU drops to 19.5 mg/kg, which is higher than both the RG SSL and background; therefore, the entire data set was used to model for groundwater fate and transport.

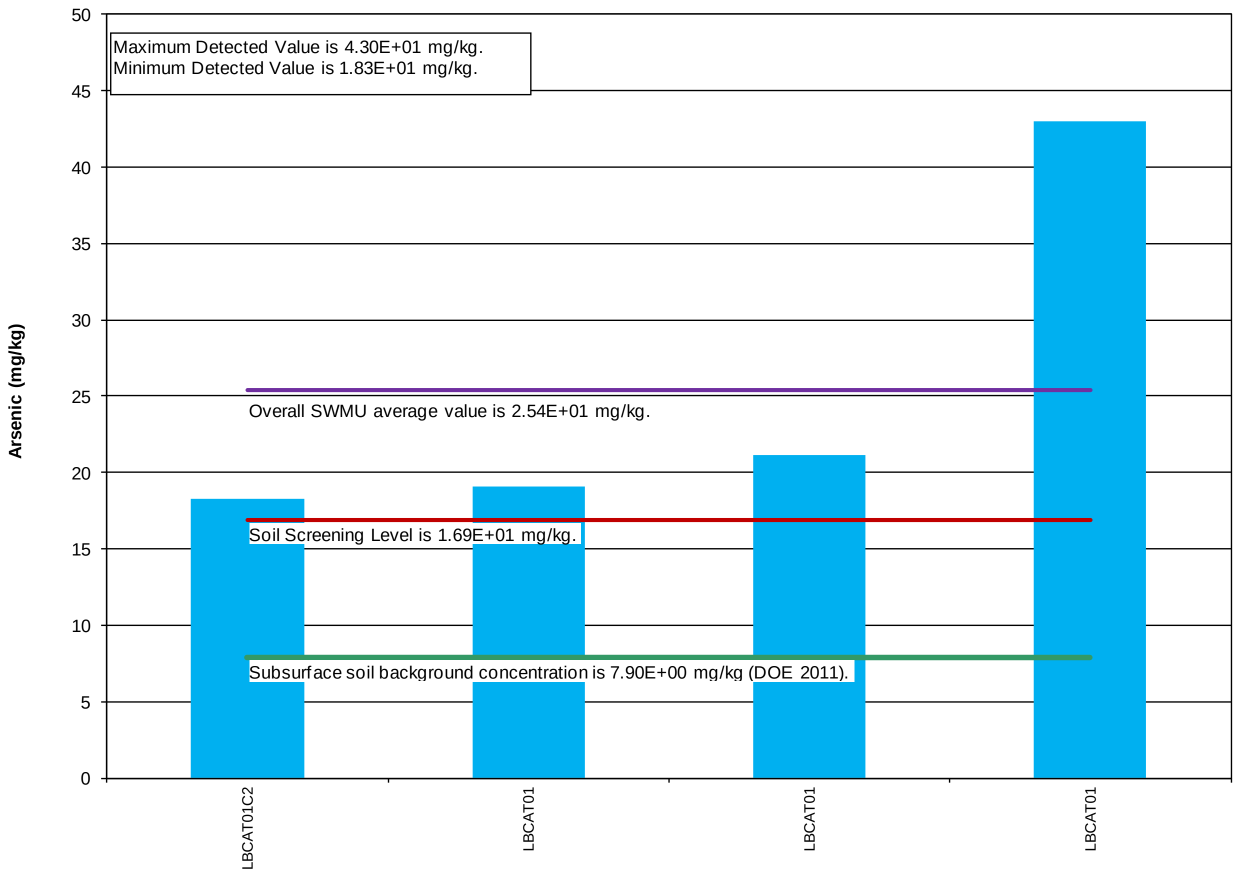

Figure C5.4.2.1. Arsenic Detections at AOC 564

Iron was reported in four of four samples. The chart illustrating the reported results is shown in Figure C5.4.2.3. The average over AOC 564 for iron was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

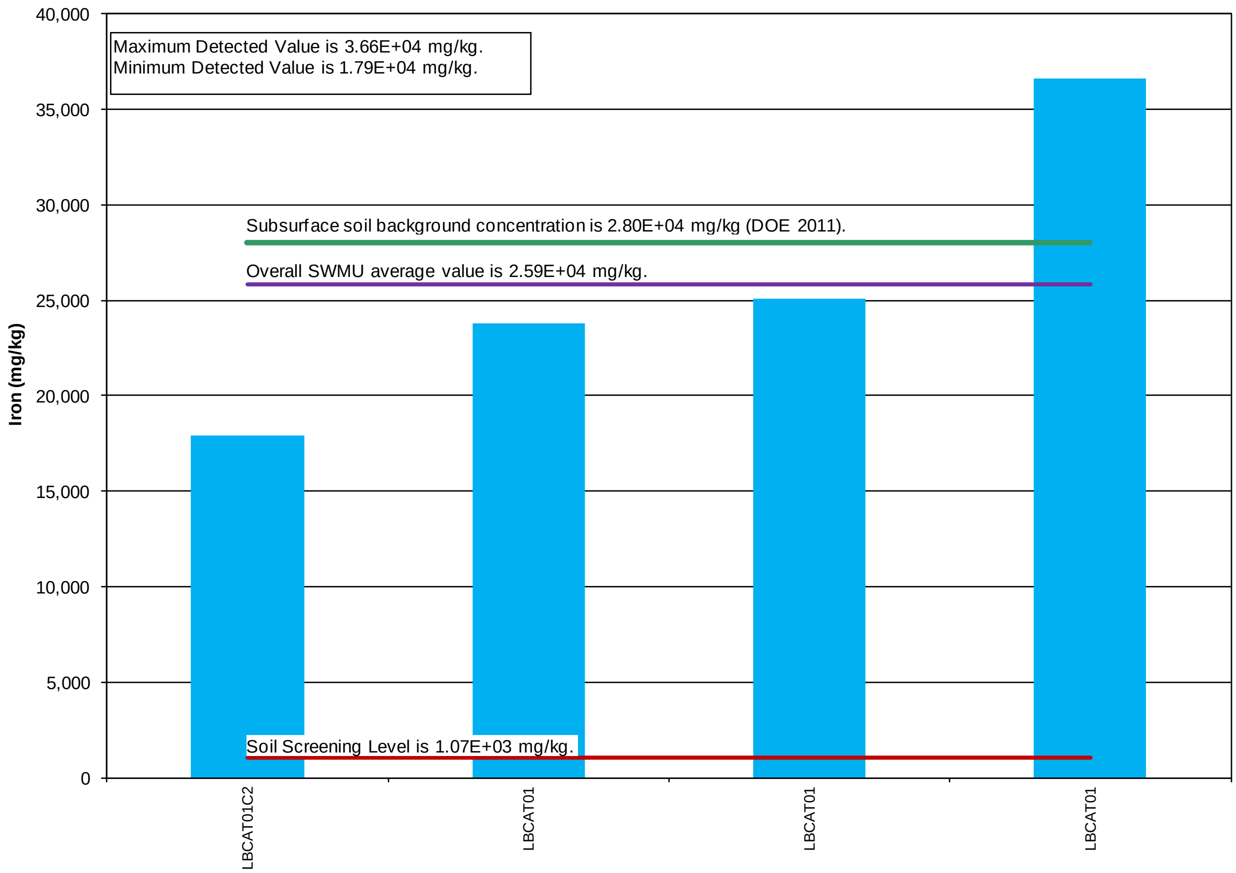

Figure C5.4.2.3. Iron Detections at AOC 564

Molybdenum was reported in three of three samples. The chart illustrating the reported results is shown in Figure C5.4.2.4. The average over AOC 564 for molybdenum was greater than the RG SSL. AOC 564 was evaluated as part of the GWOU FS (DOE1991) and is a COC in the groundwater plumes associated with PGDP. It was not modeled for groundwater fate and transport due to the lack of impacts on RGA groundwater from soil molybdenum. A hot spot evaluation was not conducted even though several samples had a detected result greater than RG SSL. Molybdenum is ubiquitous, concentrations are controlled by site soil geochemistry, and there are no soils-related impacts on RGA groundwater.

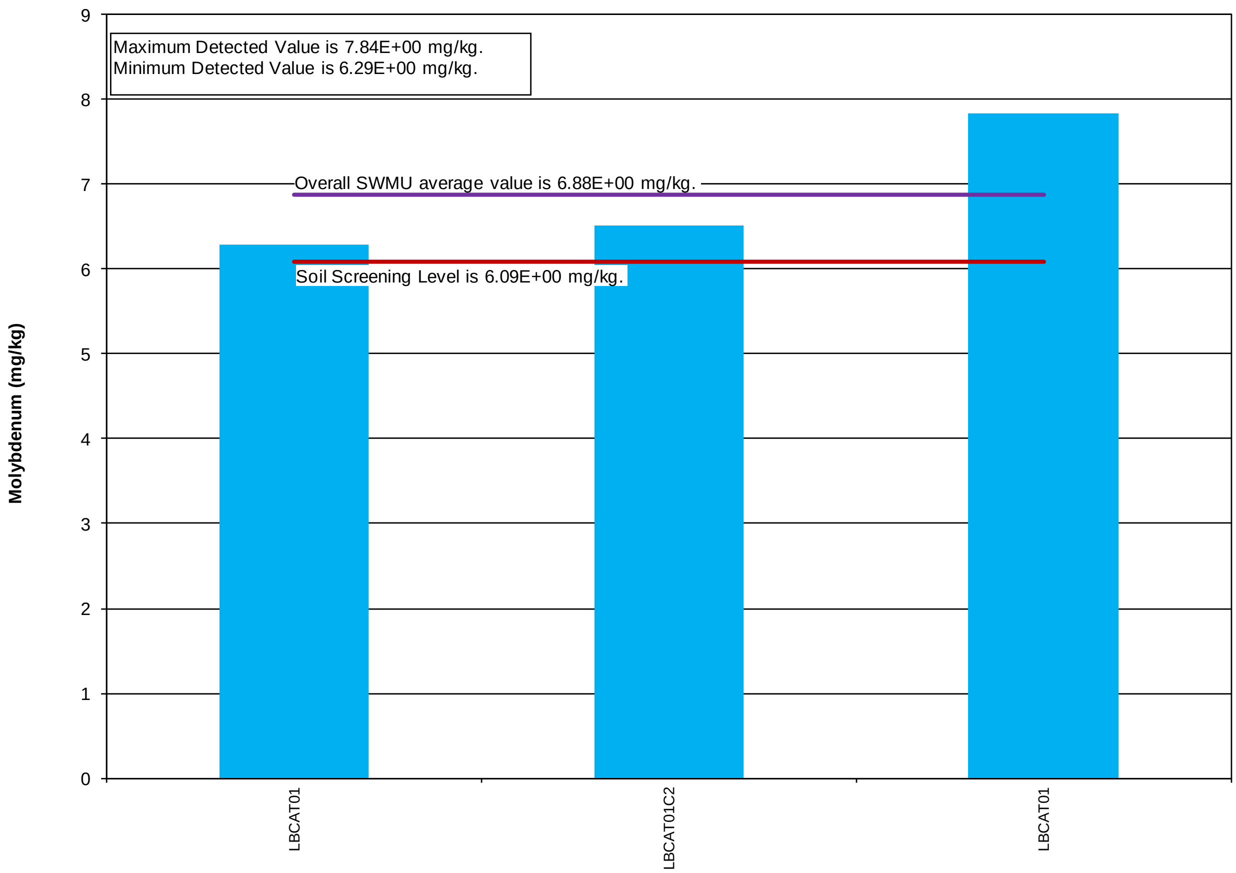

Figure C5.4.2.4. Molybdenum Detections at AOC 564

Vanadium was reported in four of four samples. The chart illustrating the reported results is shown in Figure C5.4.2.5. The average over AOC 564 for vanadium was greater than the RG SSL and background. AOC 564 was evaluated as part of the GWOU FS (DOE1991) and identified as a COC in the groundwater plumes associated with PGDP. It was not modeled for groundwater fate and transport, because there are no vanadium impacts on RGA groundwater from soils. Several samples were detected at a concentration greater than subsurface background; however, a hot spot evaluation was not performed, because vanadium in soils does not impact RGA groundwater.

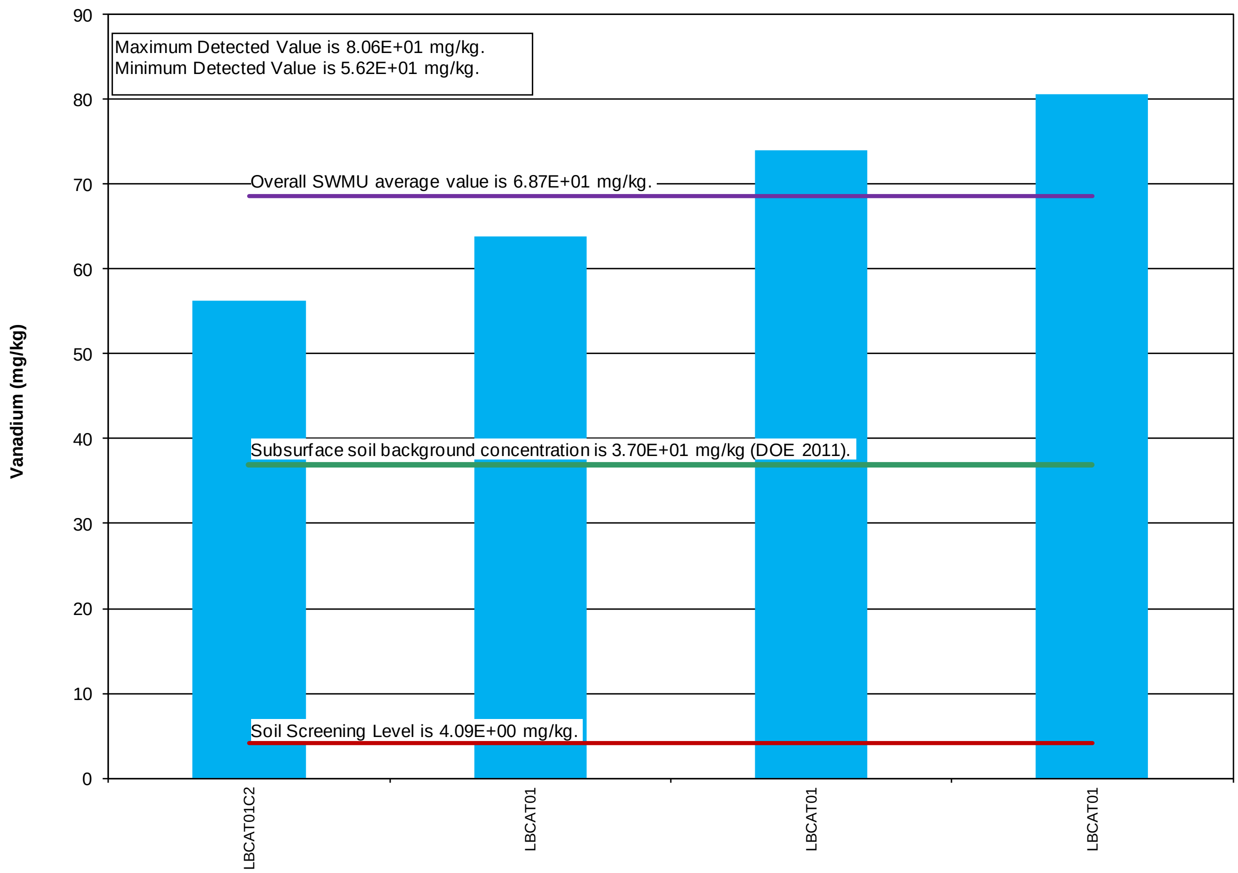

Figure C5.4.2.5. Vanadium Detections at AOC 564

C5.4.2 AOC 567 (CONTAMINATED SOIL AREA K013)

Data for AOC 567 consisted of historical data and one radiological sample collected during the RI. AOC 567 exceedances of the RG SSL include cobalt, iron, manganese, and vanadium. Cobalt, iron, and vanadium were not detected above background values; therefore, they were not considered for groundwater transport modeling or hot spot evaluations.

Manganese was reported in 11 of 11 samples. The chart illustrating the reported results is shown in Figure C5.4.3.1. The average over AOC 567 for manganese was less than background; therefore, it was not modeled for groundwater fate and transport. A hot spot evaluation was not conducted because only 1 sample had a detected result greater than background.

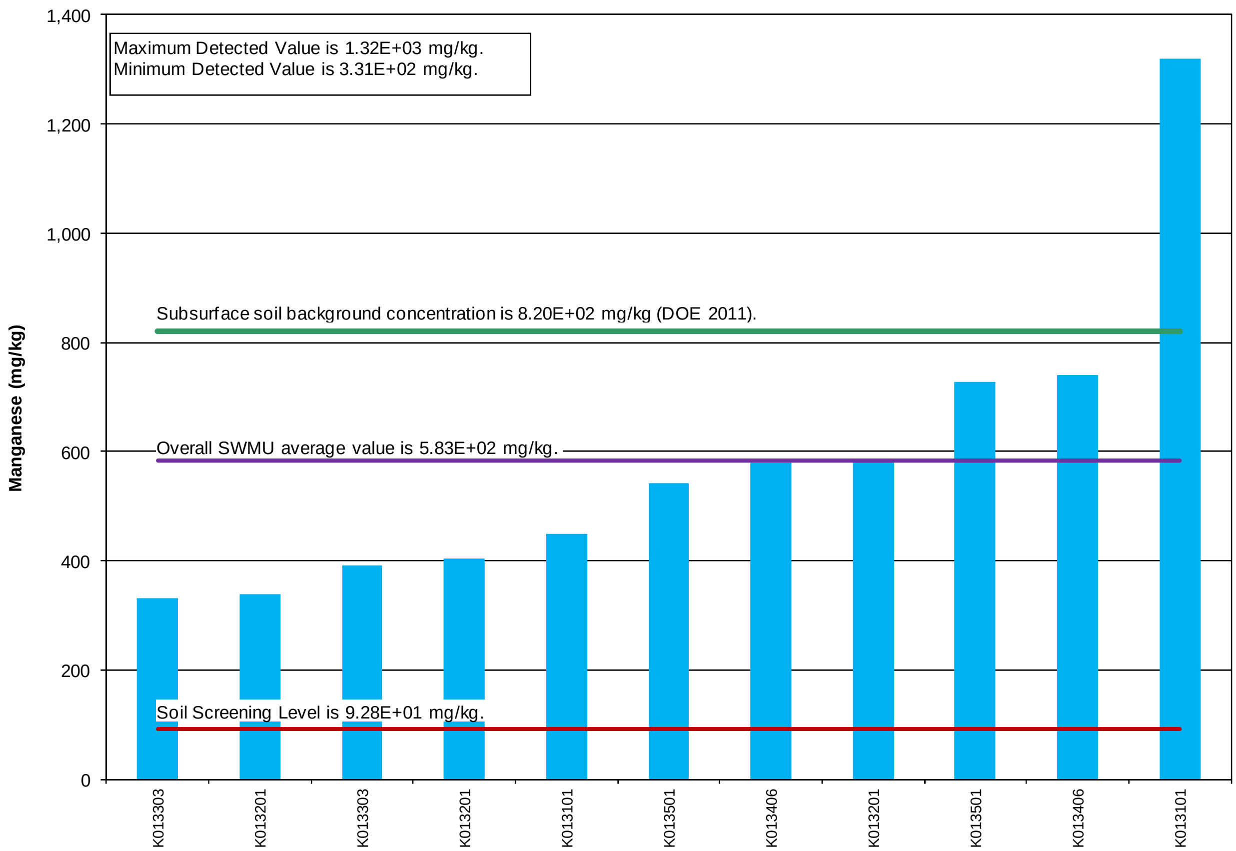

Figure C5.4.3.1. Manganese Detections at AOC 567

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ATTACHMENT C6

DATA SUMMARY AND EVALUATION, GROUP 3, SCRAP YARDS AND PCBS

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C6.1 GROUP 3, SCRAP YARDS

C6.1.1. SWMU 14, C-746-E SCRAP YARD

Data for Solid Waste Management Unit (SWMU) 14 consisted of both historical data and Remedial Investigation (RI) data. SWMU 14 exceedances of the remediation goal (RG) soil screening level (SSL) include Total polychlorinated biphenyls (Total PCBs), arsenic, cobalt, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, uranium, vanadium, plutonium-239/240, technetium-99, uranium-234, and uranium-238. The data analysis summaries are presented below.

Total PCBs were detected in 36 of 306 samples. The chart illustrating the detections is shown in Figure C6.1.1.1. The average for Total PCBs over SWMU 14 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Several samples had a concentration of Total PCBs above the RG SSL so a hot spot assessment was required. A plot showing the distribution of Total PCBs detection at SWMU 14 is show as Figure C6.1.1.2. Hot spot fate and transport modeling was not performed due to the fact that Total PCBs was subjected to fate and transport modeling at SWMUs 541 and 81 with higher average concentrations. The spatial distribution of total PCB results will be incorporated into the decision making in the feasibility study (FS).

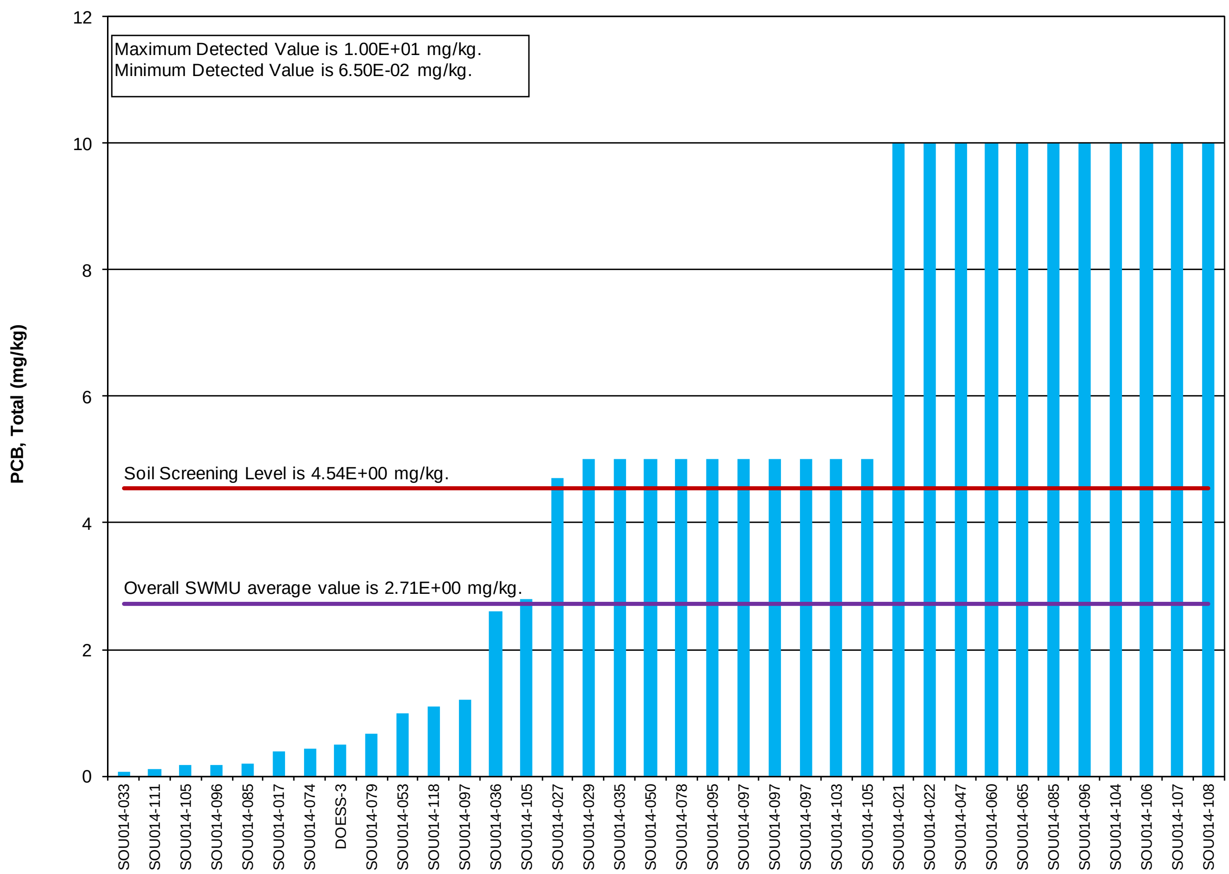

Figure C6.1.1.1. Total PCB Detections at SWMU 14

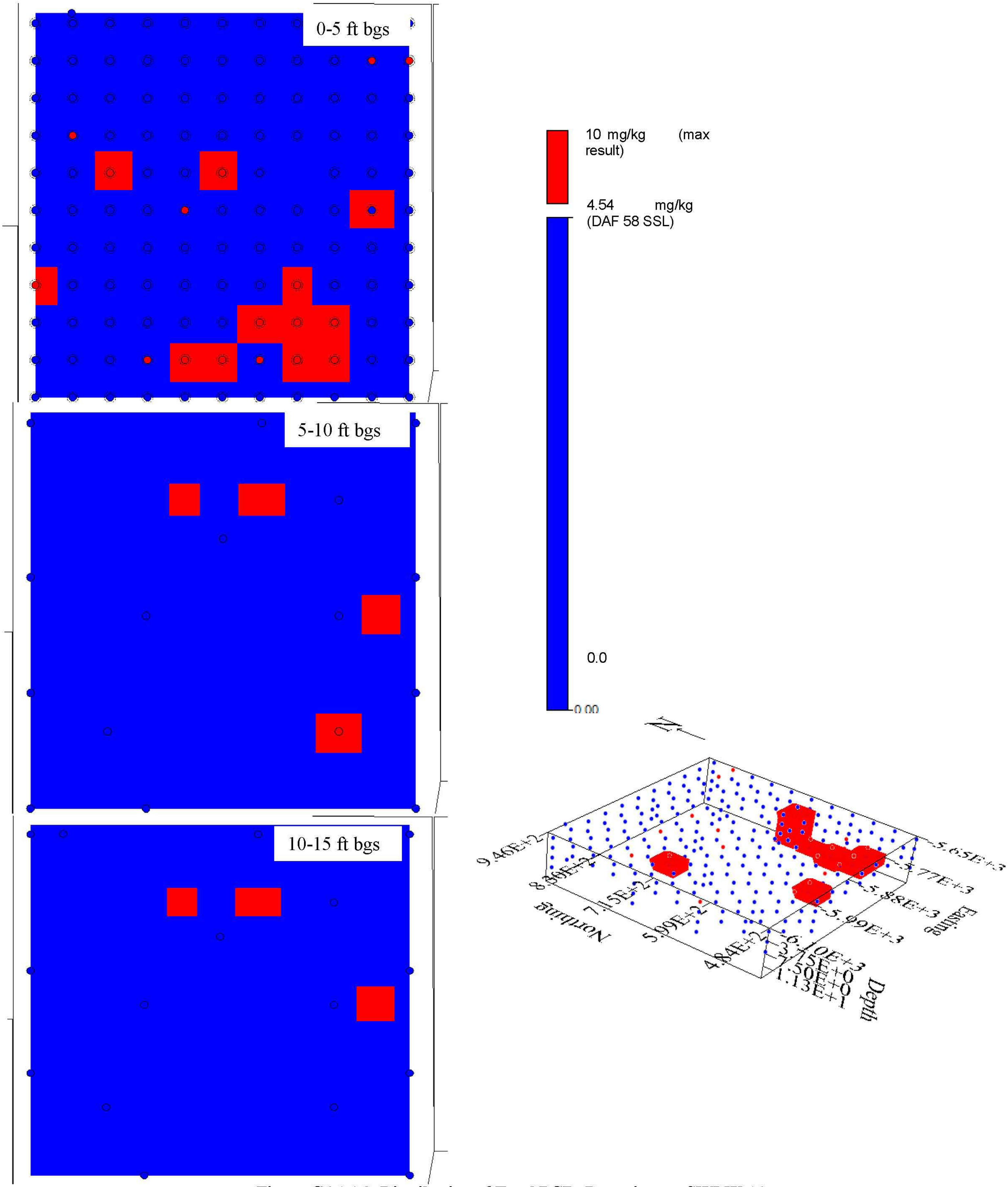

Figure C6.1.1.2. Distribution of Total PCBs Detections at SWMU 14

Arsenic was detected in 150 of 307 samples. The chart illustrating the detections is shown in Figure C6.1.1.3. The average for arsenic over SWMU 14 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Several samples had a concentration of arsenic above the RG SSL; however, a hot spot assessment was not performed because arsenic is subjected to fate and transport modeling for SWMUs 165 and 564. The spatial distribution of arsenic results will be incorporated into the decision making in the FS.

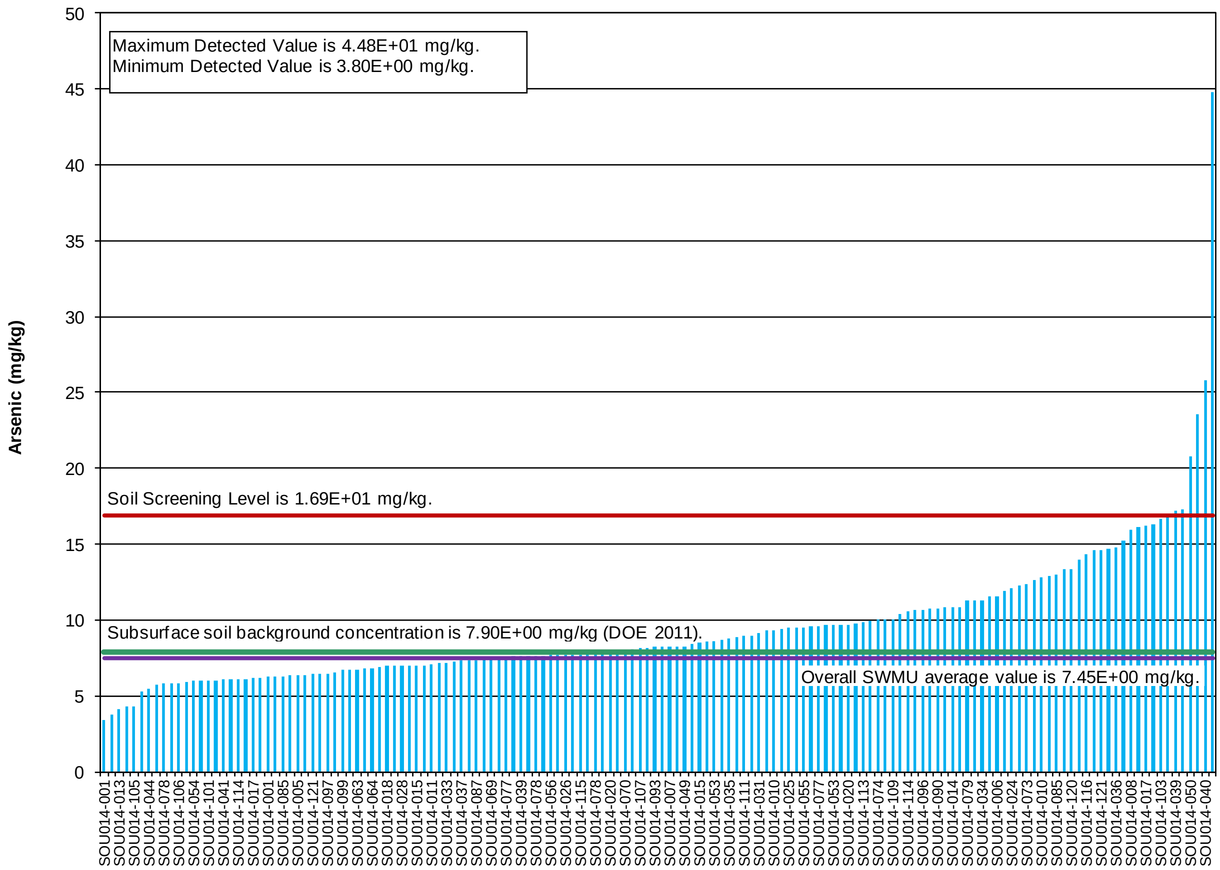

Figure C6.1.1.3. Arsenic Detections at SWMU 14

Cobalt was detected in 24 of 25 samples. The chart illustrating the detections is shown in Figure C6.1.1.4. The average for cobalt over SWMU 14 was less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although four samples had a concentration of cobalt above background, cobalt was not identified as a contaminant of concern (COC) in the groundwater plumes associated with PGDP; therefore, a hot spot assessment was not performed (DOE 2001d).

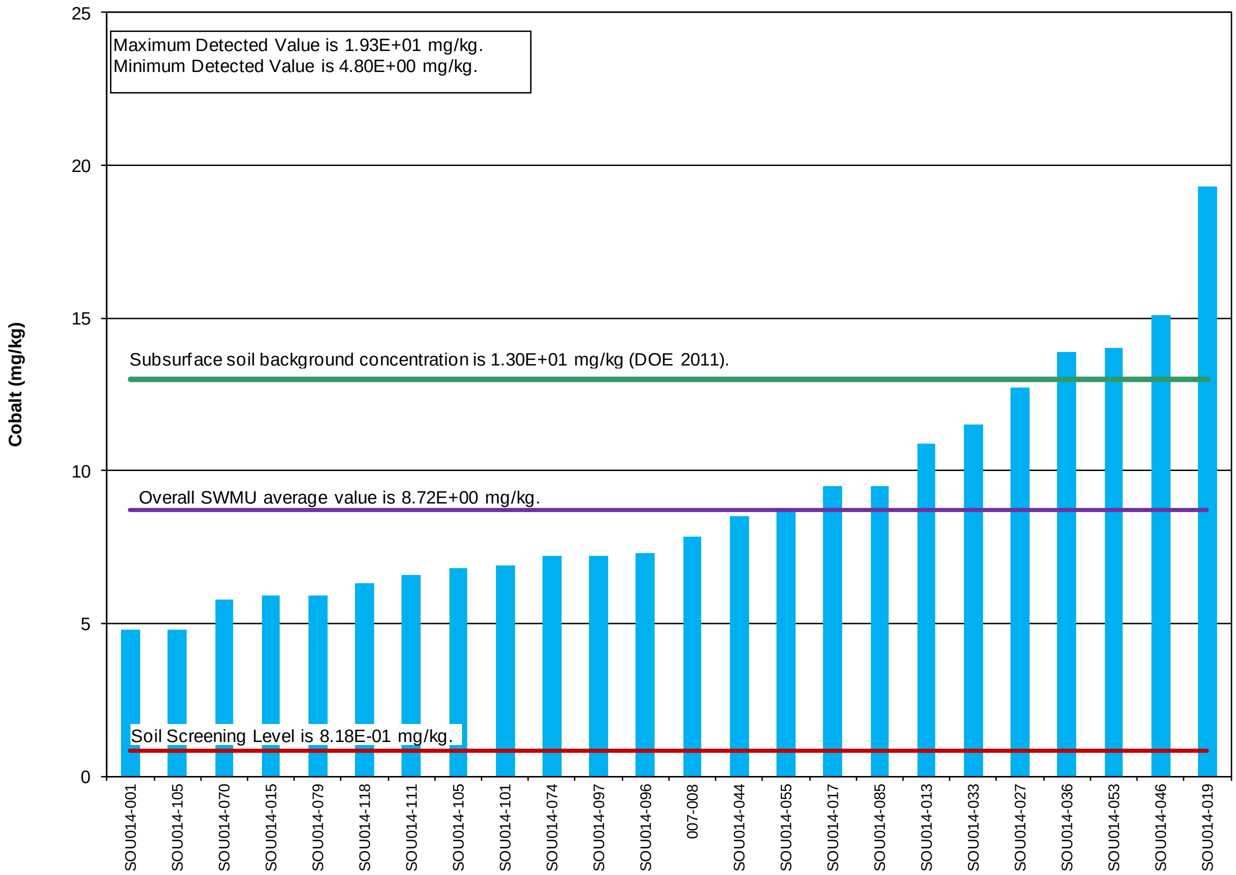

Figure C6.1.1.4. Cobalt Detections at SWMU 14

Iron was detected in 307 of 307 samples. The chart illustrating the detections is shown in Figure C6.1.1.5. The average for iron over SWMU 14 was less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Several samples had a concentration of iron above background. A hot spot assessment was not performed because of the ubiquitous nature of iron and the lack of impacts on RGA groundwater from soil concentrations.

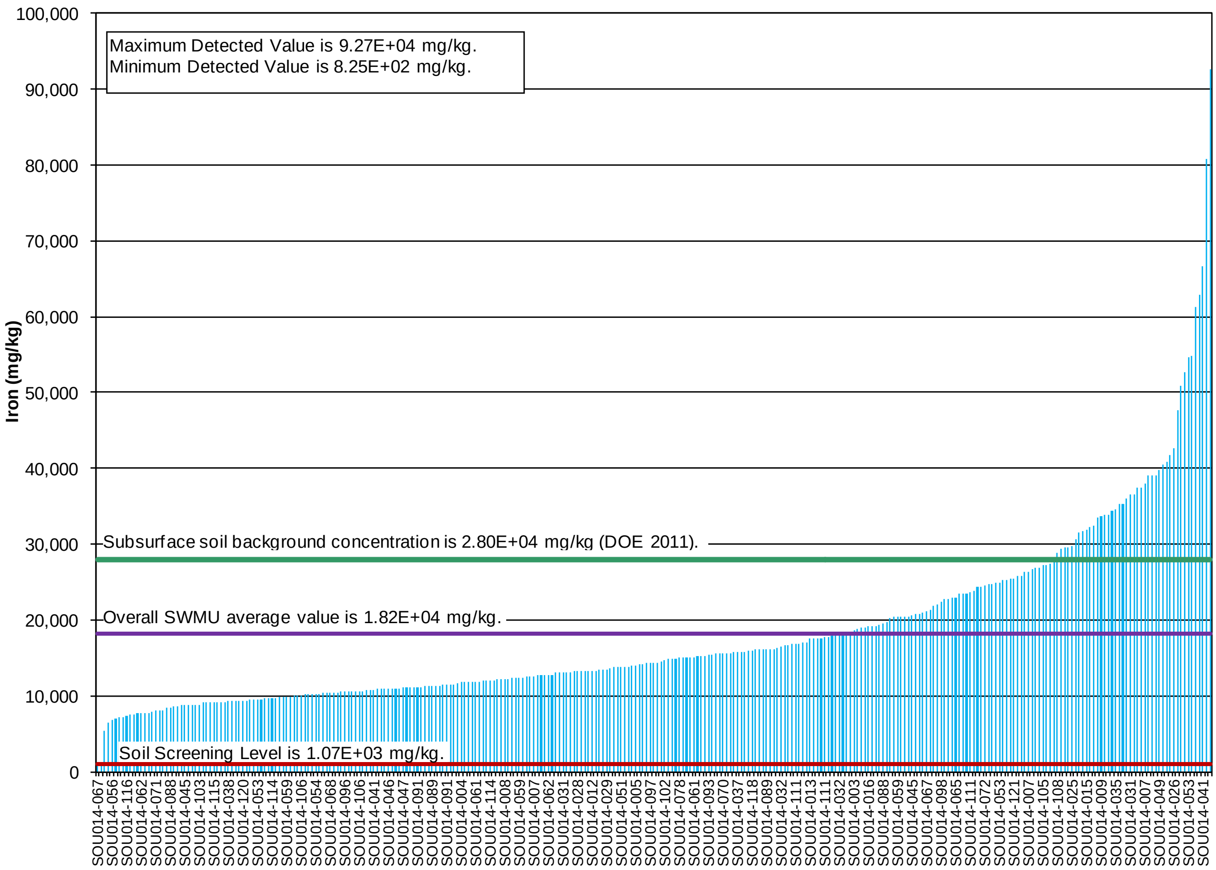

Figure C6.1.1.5 Iron Detections at SWMU 14

Lead was detected in 297 of 307 samples. The chart illustrating the detections is shown in Figure C6.1.1.6. The average for lead over SWMU 14 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only one sample had a concentration of lead above the RG SSL so a hot spot assessment was not performed.

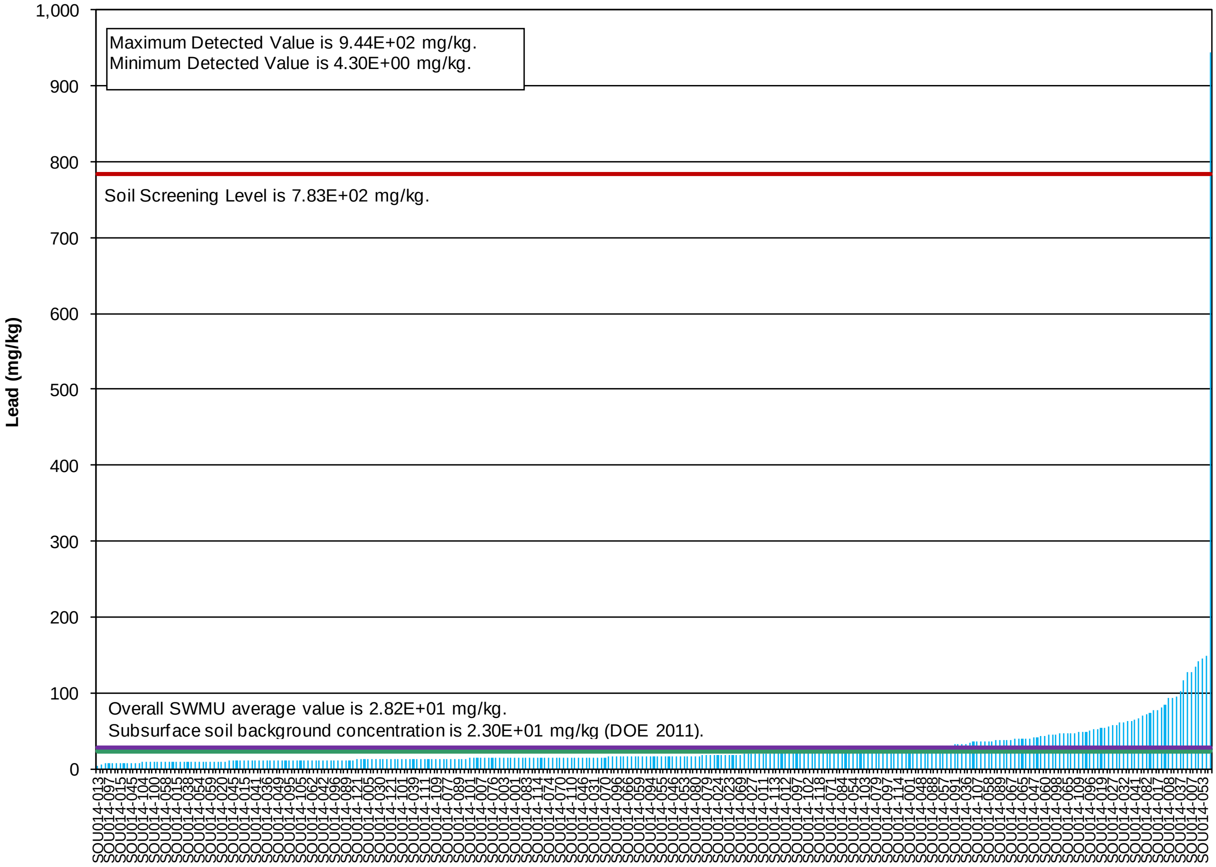

Figure C6.1.1.6. Lead Detections at SWMU 14

Manganese was detected in 304 of 307 samples. The chart illustrating the detections is shown in Figure C6.1.1.7. The average for manganese over SWMU 14 was less than background so groundwater fate and transport modeling was not performed for this chemical at this SWMU. Several samples had a concentration of manganese above background; however, a hot spot assessment was not performed due to the ubiquitous nature of manganese and the lack of impacts to RGA groundwater from manganese concentrations in soils.

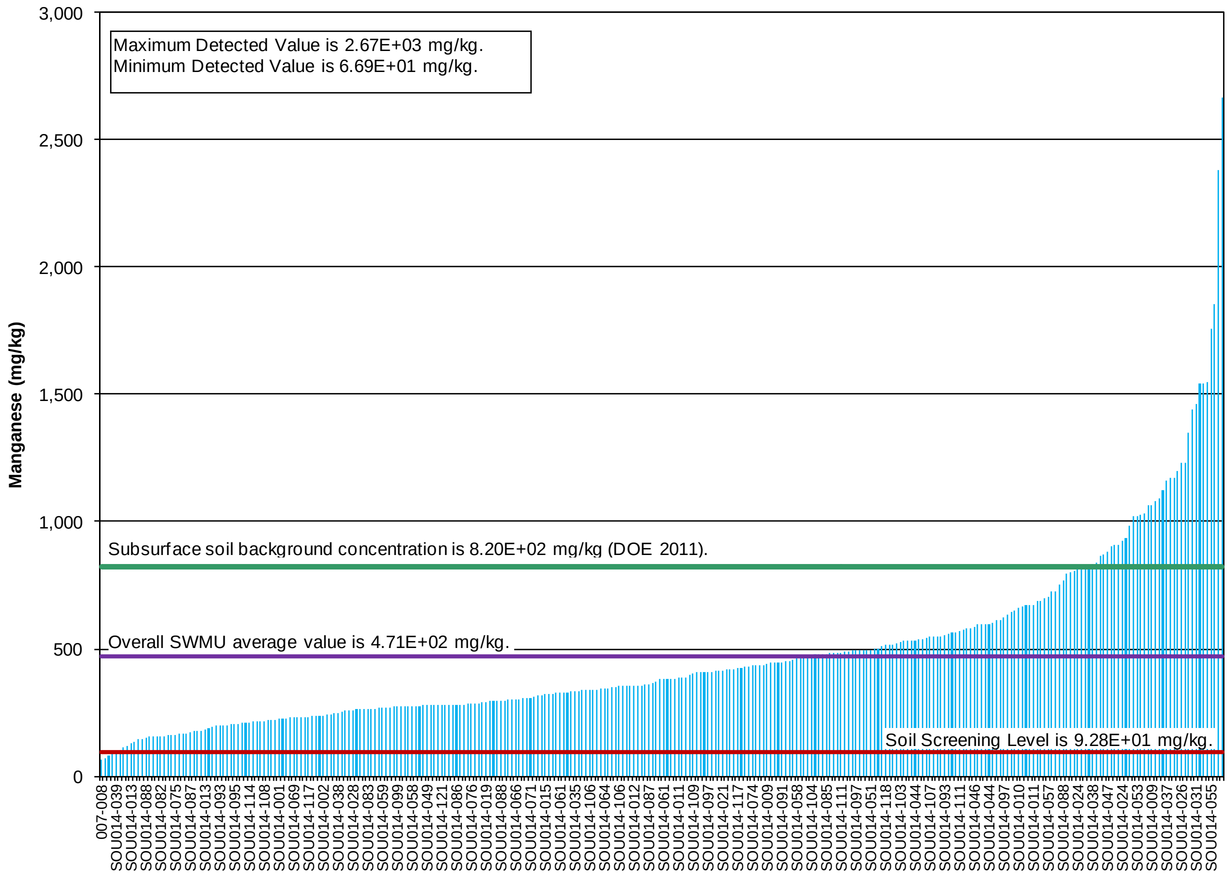

Figure C6.1.1.7. Manganese Detections at SWMU 14

Mercury was detected in 35 of 307 samples. The chart illustrating the detections is shown in Figure C6.1.1.12. The average for mercury over SWMU 14 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although several samples had a concentration of mercury above the RG SSL, mercury was not identified as a COC in the GWOU FS; therefore, a hot spot assessment was not performed (DOE 2001d).

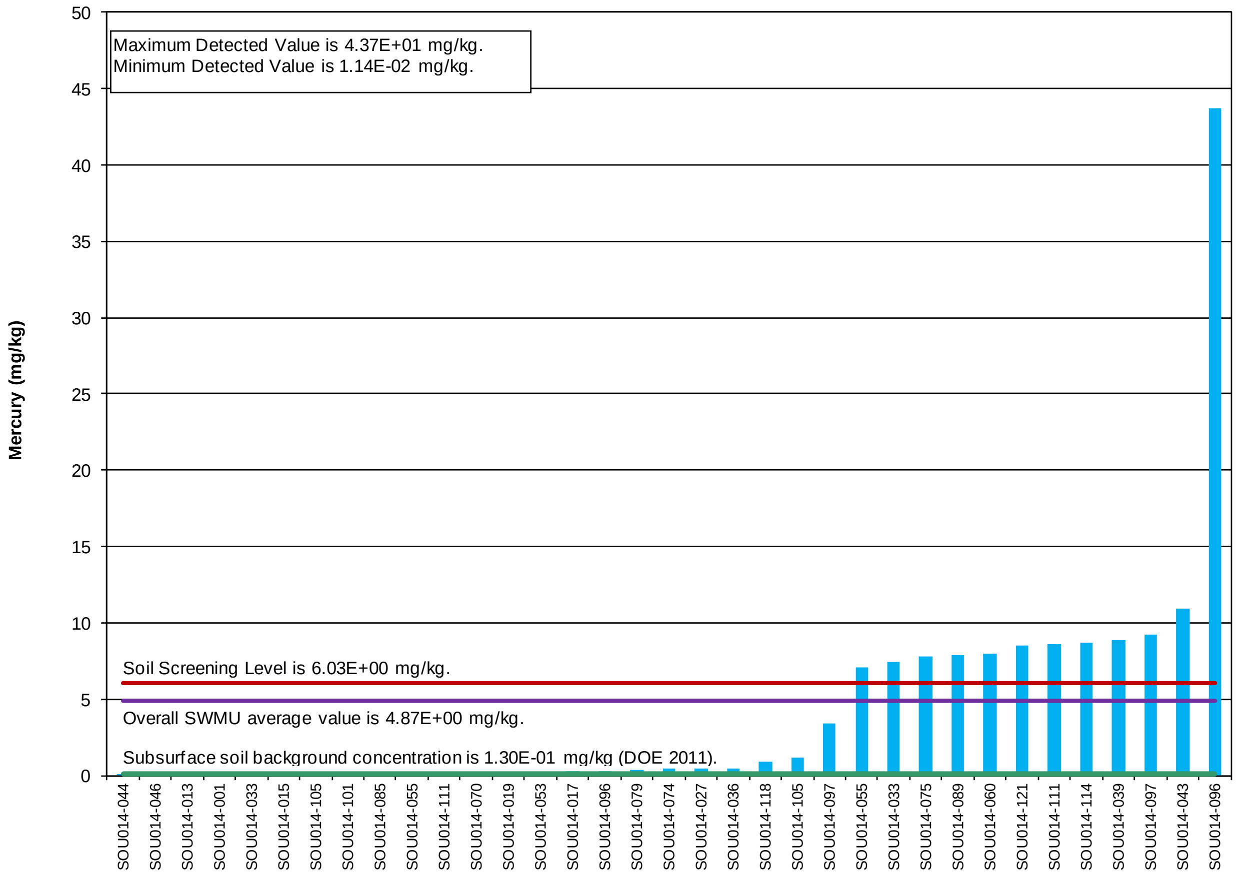

Figure C6.1.1.8. Mercury Detections at SWMU 14

Molybdenum was detected in 32 of 307 samples. The chart illustrating the detections is shown in Figure C6.1.1.9. The average for molybdenum over SWMU 14 was greater than the RG SSL. Groundwater fate and transport modeling was not performed for this chemical at this SWMU because of the infrequency of detection and the understanding that RGA groundwater impacts are not noted from soil molybdenum concentrations.

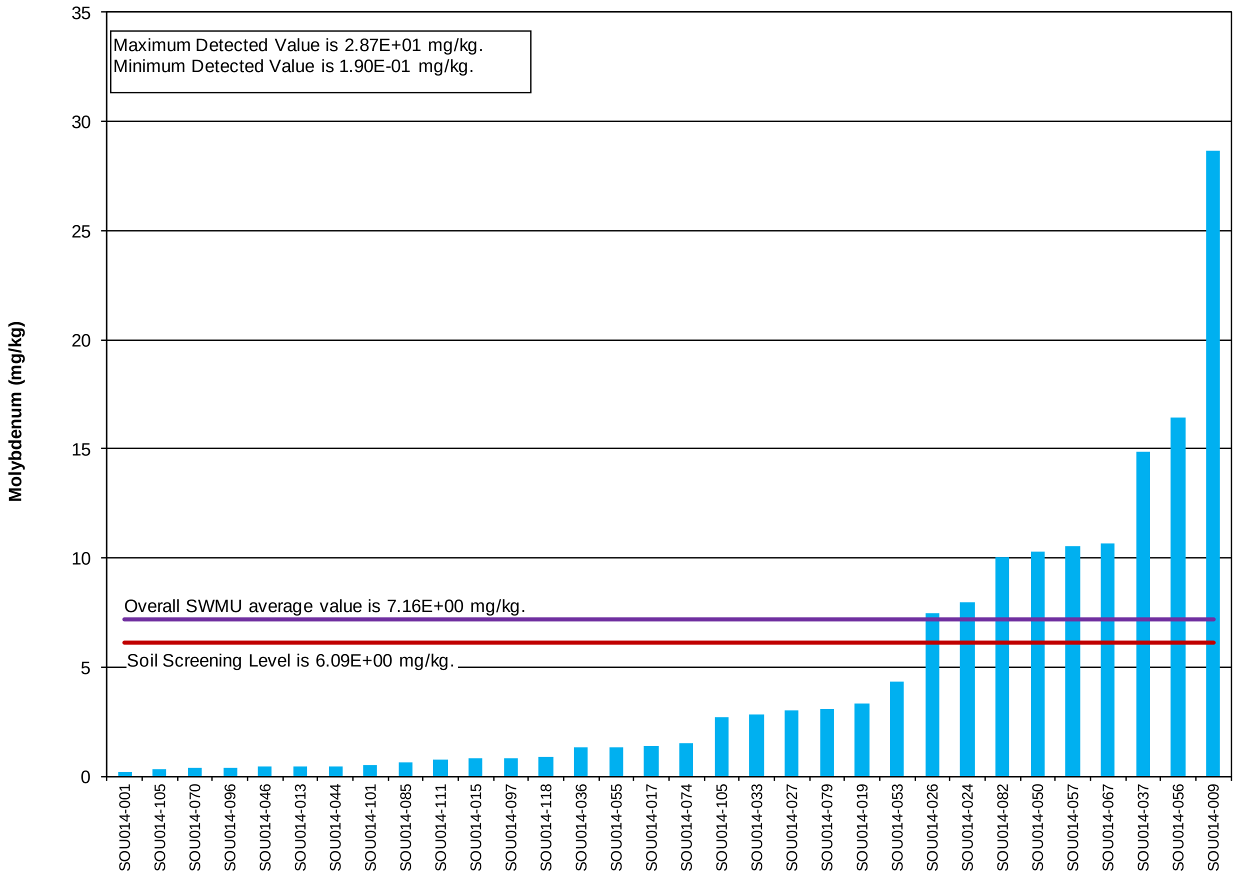

Figure C6.1.1.9. Molybdenum Detections at SWMU 14

Nickel was detected in 198 of 307 samples. The chart illustrating the detections is shown in Figure C6.1.1.10. The average for nickel over SWMU 14 was greater than the RG SSL; therefore, groundwater fate and transport modeling was performed for this chemical at this SWMU.

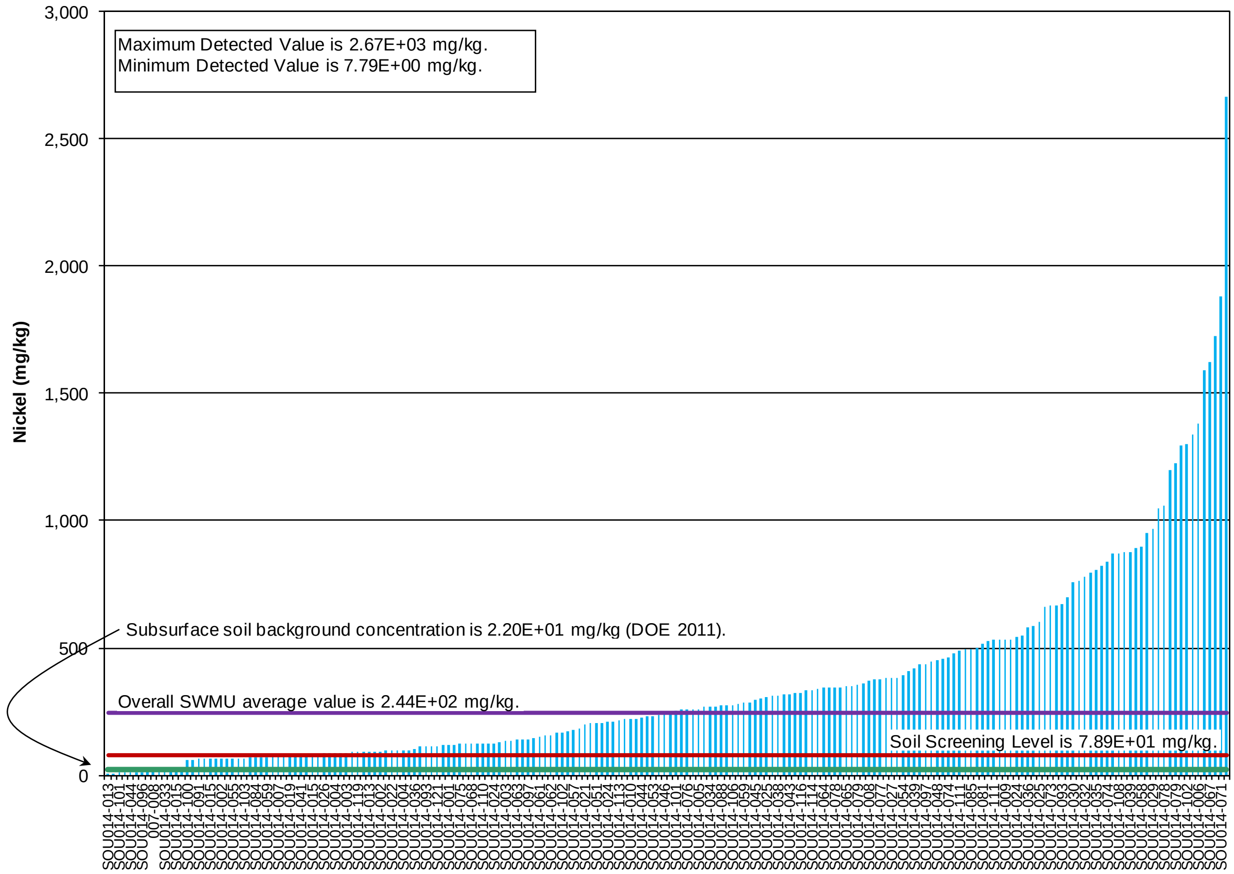

Figure C6.1.1.10. Nickel Detections at SWMU 14

Selenium was detected in 27 of 307 samples. The chart illustrating the detections is shown in Figure C6.1.1.11. The average for selenium over SWMU 14 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only one sample had a concentration of selenium above the RG SSL, and selenium was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS; therefore, a hot spot assessment was not performed (DOE 2001d).

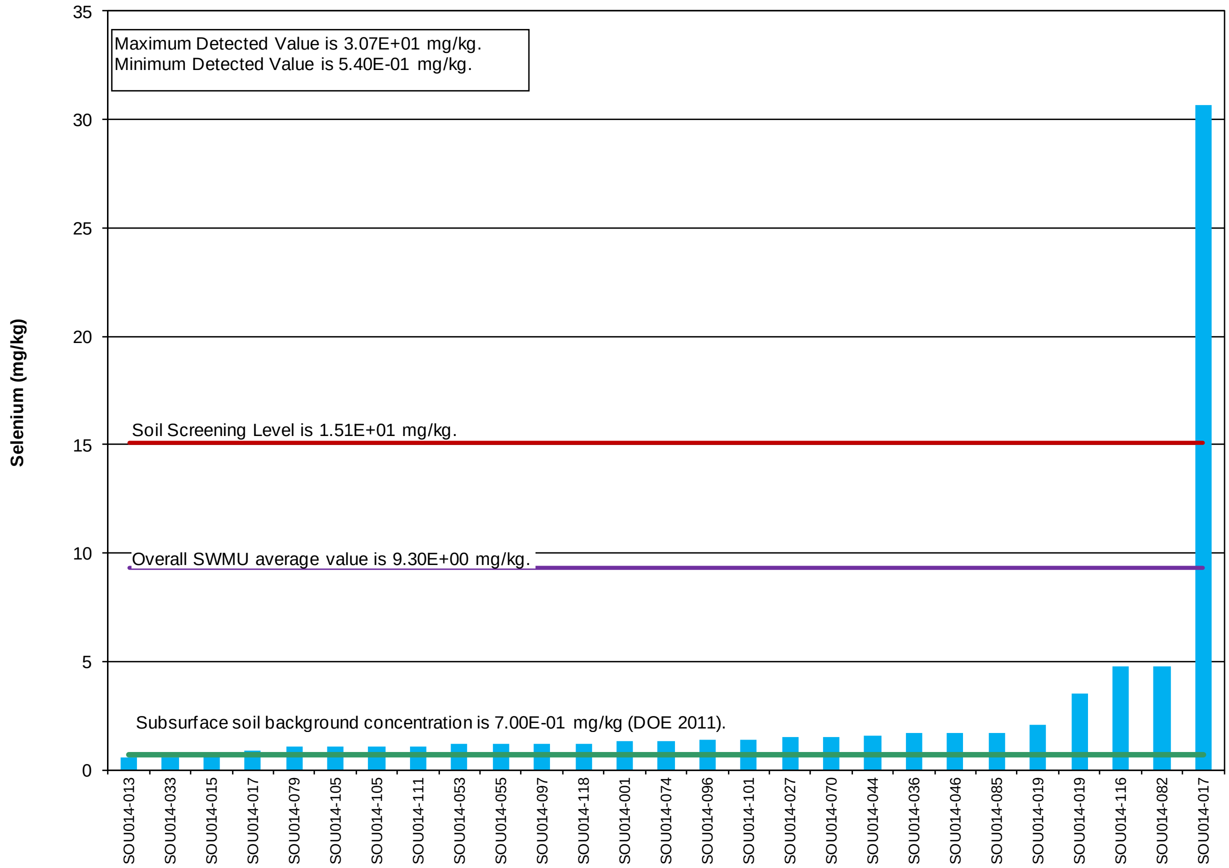

Figure C6.1.1.11. Selenium Detections at SWMU 14

Silver was detected in 198 of 307 samples. The chart illustrating the detections is shown in Figure C6.1.1.12. The average for silver over SWMU 14 was greater than the RG SSL and background. Silver was assessed for nature and extent of during the GWOU FS and silver is a COC in the plumes associated with PGDP; however, the evaluation presented in Attachment C1 to Appendix C did not identify any RGA silver impacts (DOE 2001d). As a result, neither fate and transport modeling nor hot spot evaluation was performed for this chemical at this SWMU.

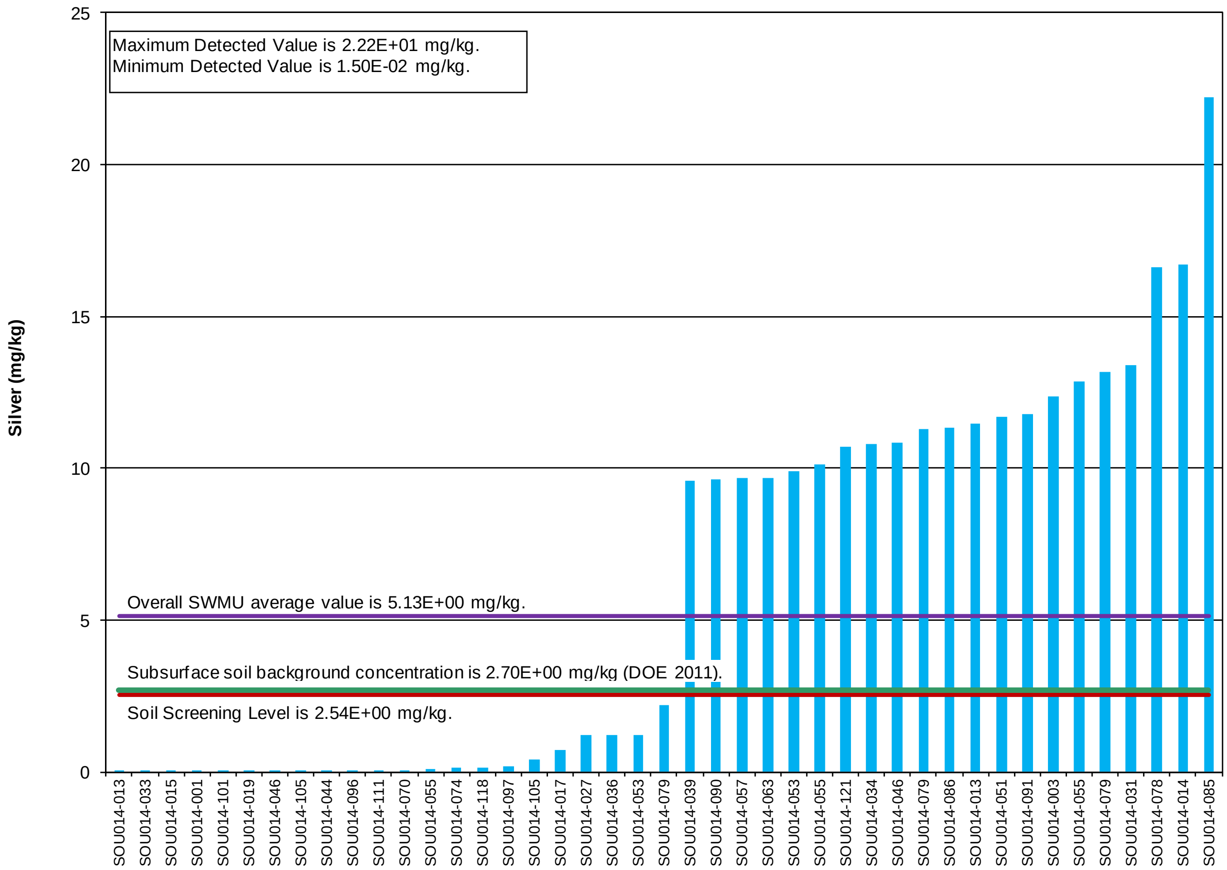

Figure C6.1.1.12. Silver Detections at SWMU 14

Uranium was detected in 257 of 328 samples. The chart illustrating the detections is shown in Figure C6.1.1.13. The average for uranium over SWMU 14 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although several samples had a concentration of uranium above the RG SSL, uranium was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS; therefore, a hot spot assessment was not performed (DOE 2001d).

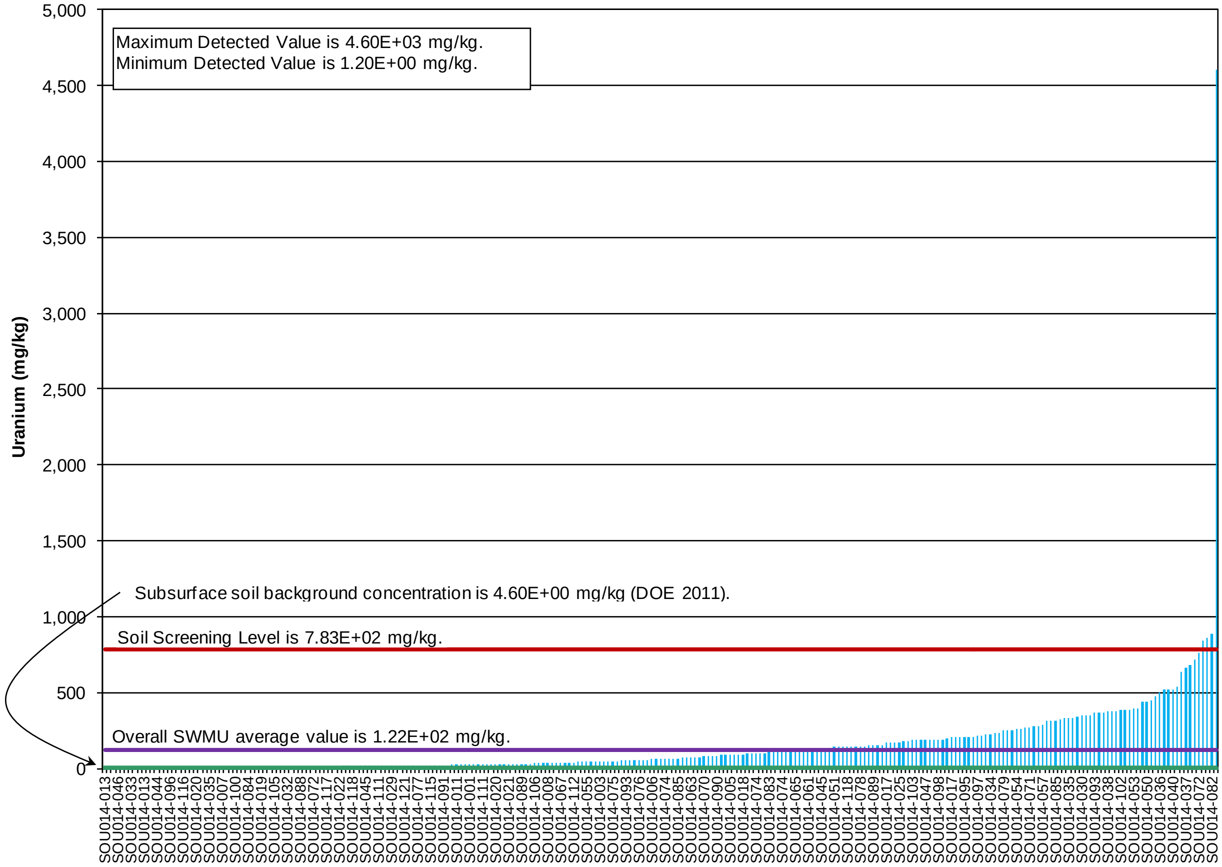

Figure C6.1.1.13. Uranium Detections at SWMU 14

Vanadium was detected in 24 of 25 samples. The chart illustrating the detections is shown in Figure C6.1.1.14. The average for vanadium over SWMU 14 was less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Three samples had a concentration of vanadium above background; however, a hot spot assessment was not performed because there are no vanadium impacts to the RGA from soils.

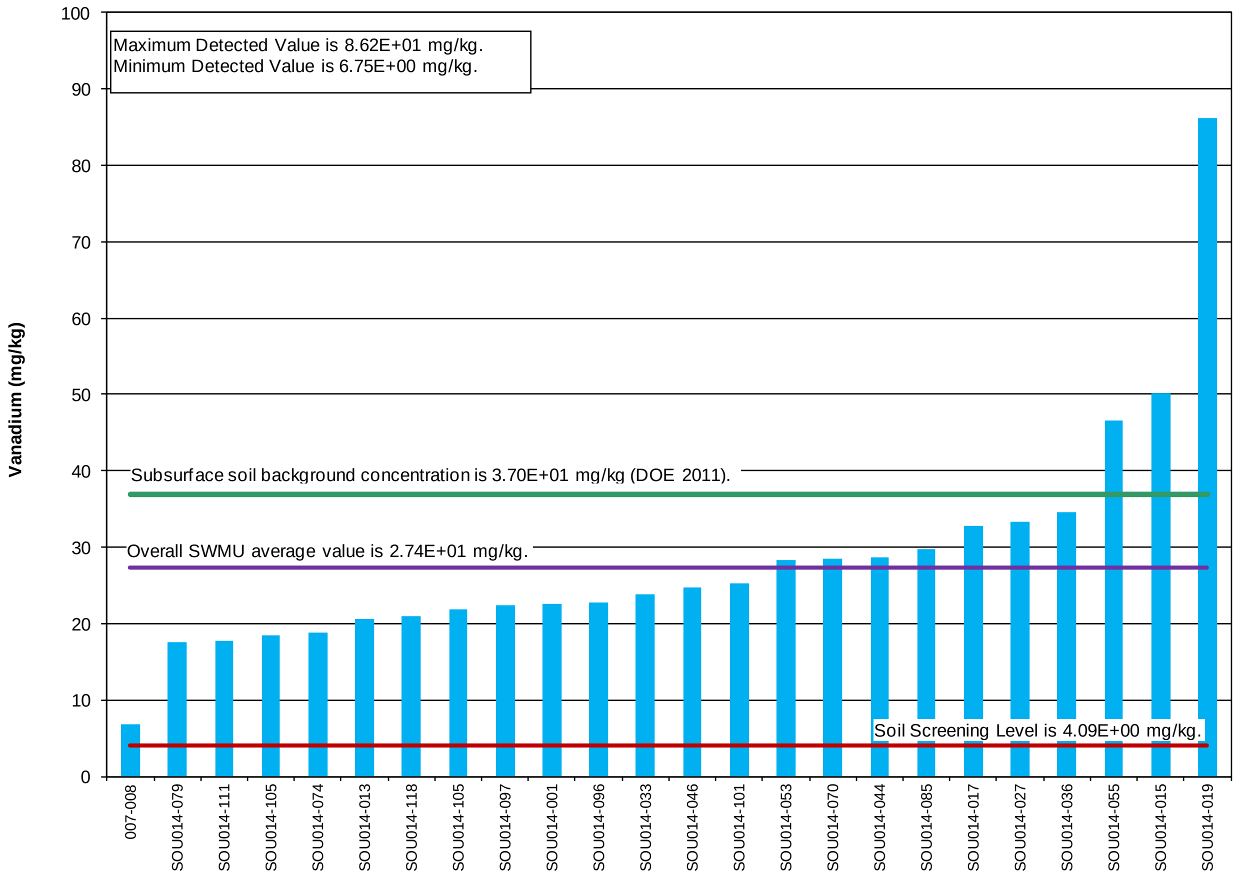

Figure C6.1.1.14. Vanadium Detections at SWMU 14

Plutonium-239/240 was detected in 24 of 24 samples. The chart illustrating the detections is shown in Figure C6.1.1.15. The average for plutonium-239/240 over SWMU 14 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. No samples had a concentration of plutonium-239/240 above the RG SSL, plutonium-239/240 was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS; therefore, a hot spot assessment was not performed (DOE 2001d).

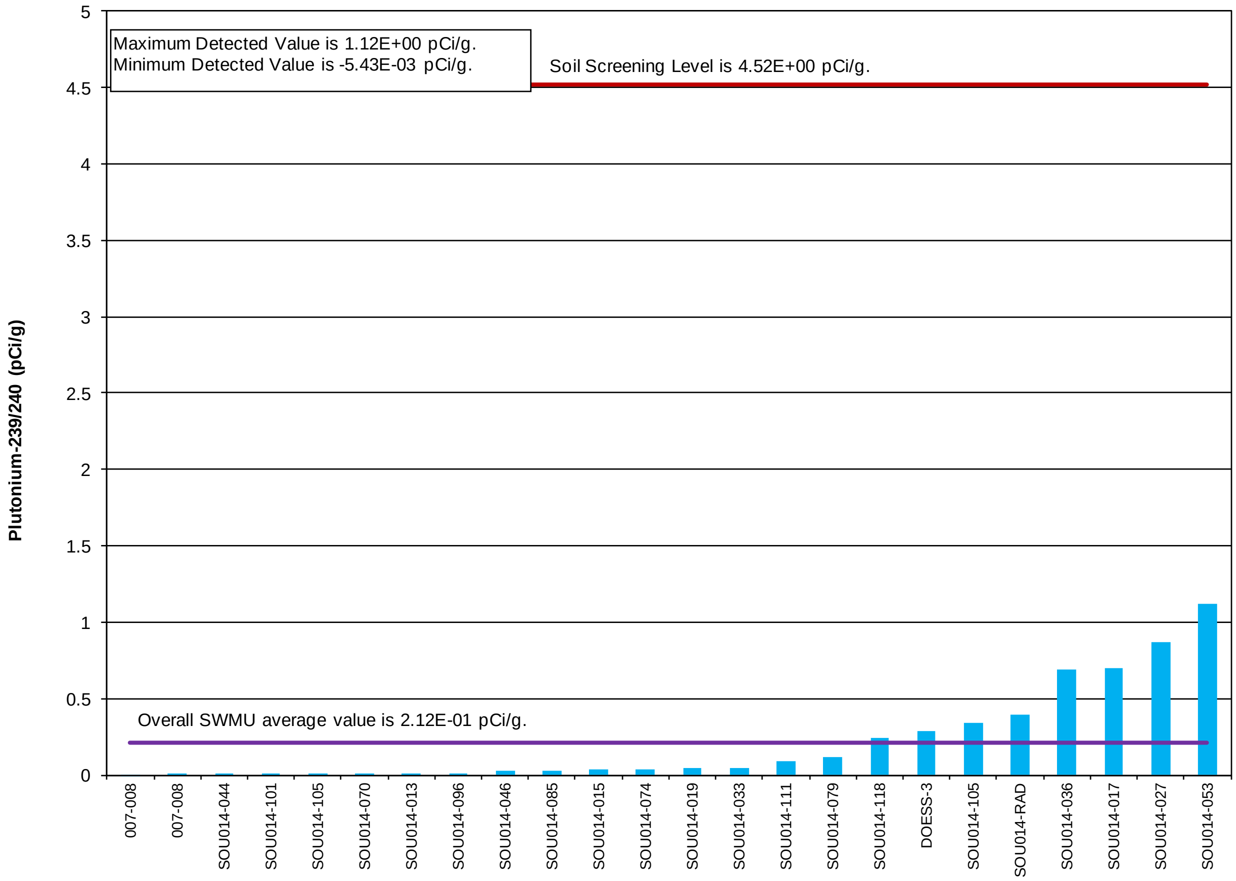

Figure C6.1.1.15. Plutonium-239/240 Detections at SWMU 14

Technetium-99 was detected in 24 of 24 samples. The chart illustrating the detections is shown in Figure C6.1.1.16. The average for technetium-99 over SWMU 14 was greater than background and the RG SSL; therefore, groundwater fate and transport modeling was performed for this chemical at this SWMU.

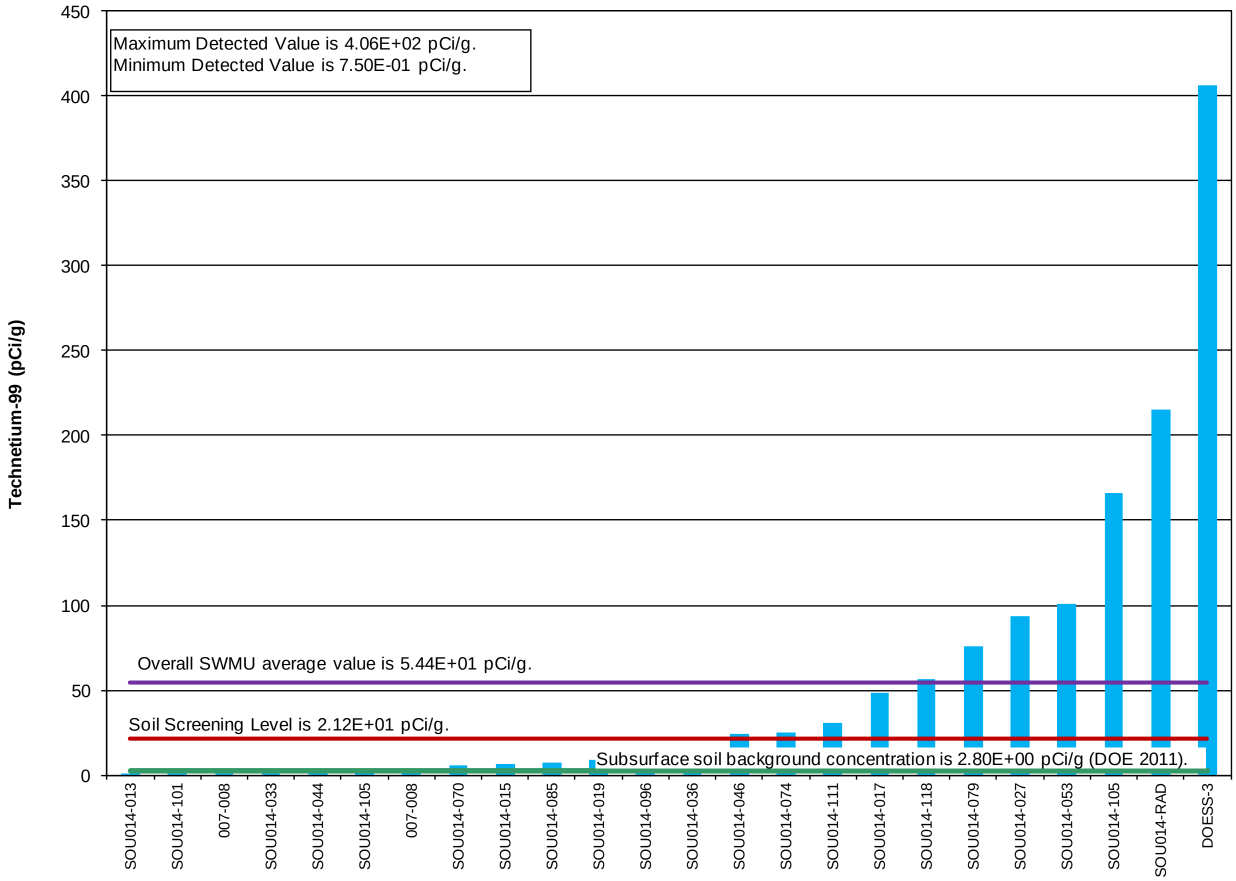

Figure C6.1.1.16. Technetium-99 Detections at SWMU 14

Uranium-234 was detected in 23 of 23 samples. The chart illustrating the detections is shown in Figure C6.1.1.17. The average for uranium-234 over SWMU 14 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. No samples had a concentration of uranium-234 above the RG SSL; therefore, a hot spot assessment was not performed.

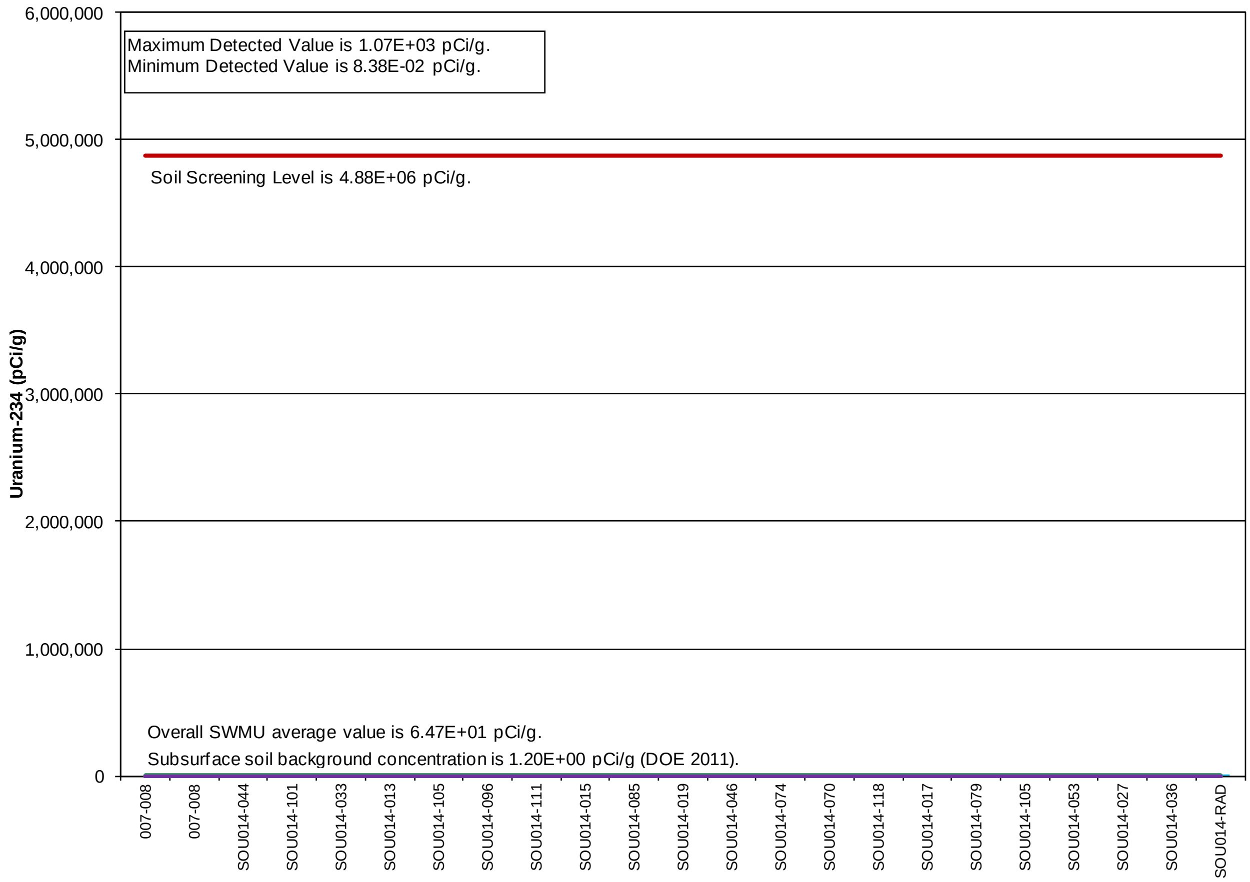

Figure C6.1.1.17. Uranium-234 Detections at SWMU 14

Uranium-238 was detected in 23 of 23 samples. The chart illustrating the detections is shown in Figure C6.1.1.18. The average for uranium-238 over SWMU 14 was less than the RG SSL. Groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only one sample had a concentration of uranium-238 above the RG SSL; therefore, a hot spot assessment was not performed.

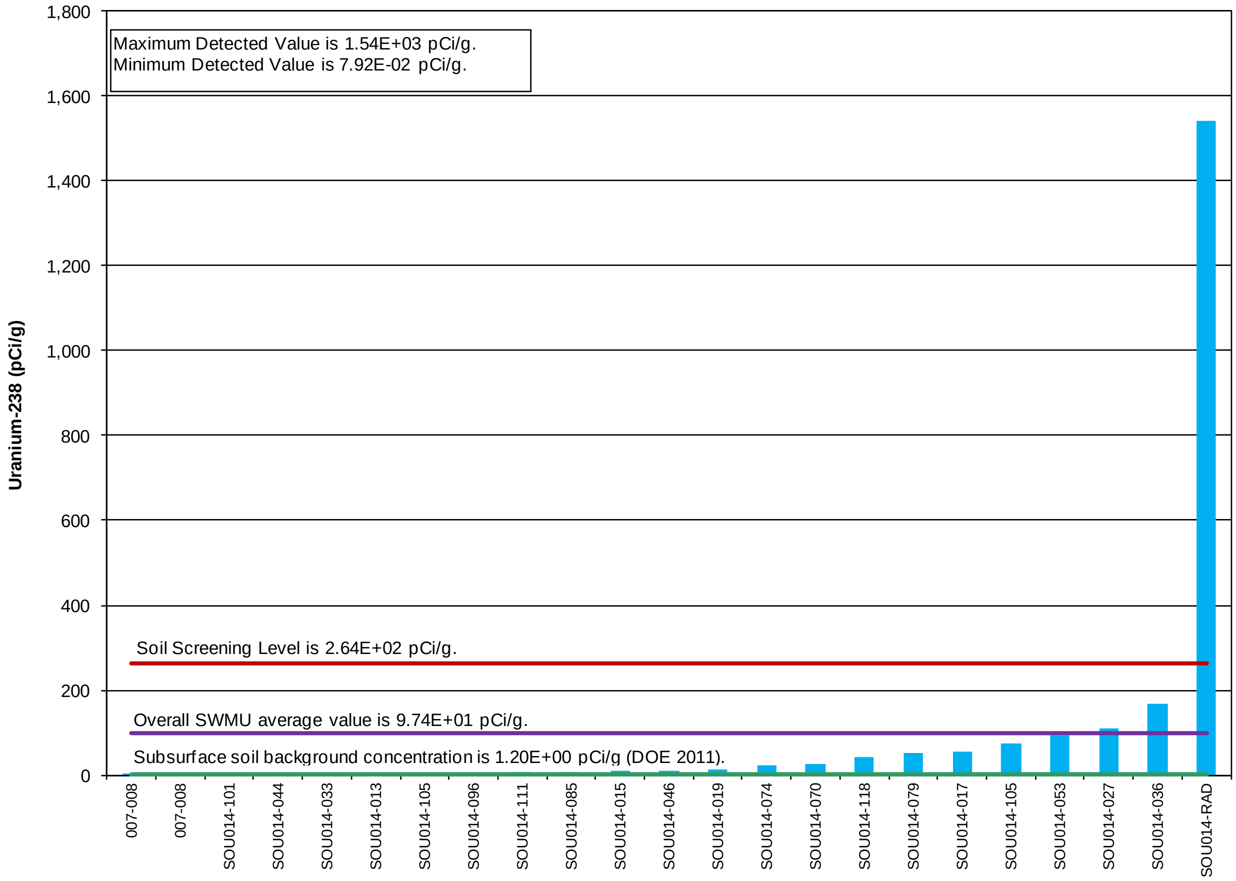

Figure C6.1.1.18. Uranium-238 Detections at SWMU 14

C6.1.2 SWMU 518, FIELD SOUTH OF P1 YARD

Data for SWMU 518 consisted of both historical data and RI data. SWMU 518 exceedances of the RG SSL include acenaphthene, fluorine, pyrene, cobalt, iron, manganese, and vanadium. The maximum results for iron, manganese, and vanadium were detected below subsurface background, so these analyses will not be considered for fate and transport modeling or hot spot analysis.

Acenaphthene was detected in 7 of 27 samples. The chart illustrating the detections is shown in Figure C6.1.2.1. The average for acenaphthene over SWMU 518 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. One sample had a concentration of acenaphthene above the RG SSL. Acenaphthene was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS; therefore, a hot spot assessment was not performed (DOE 2001d).

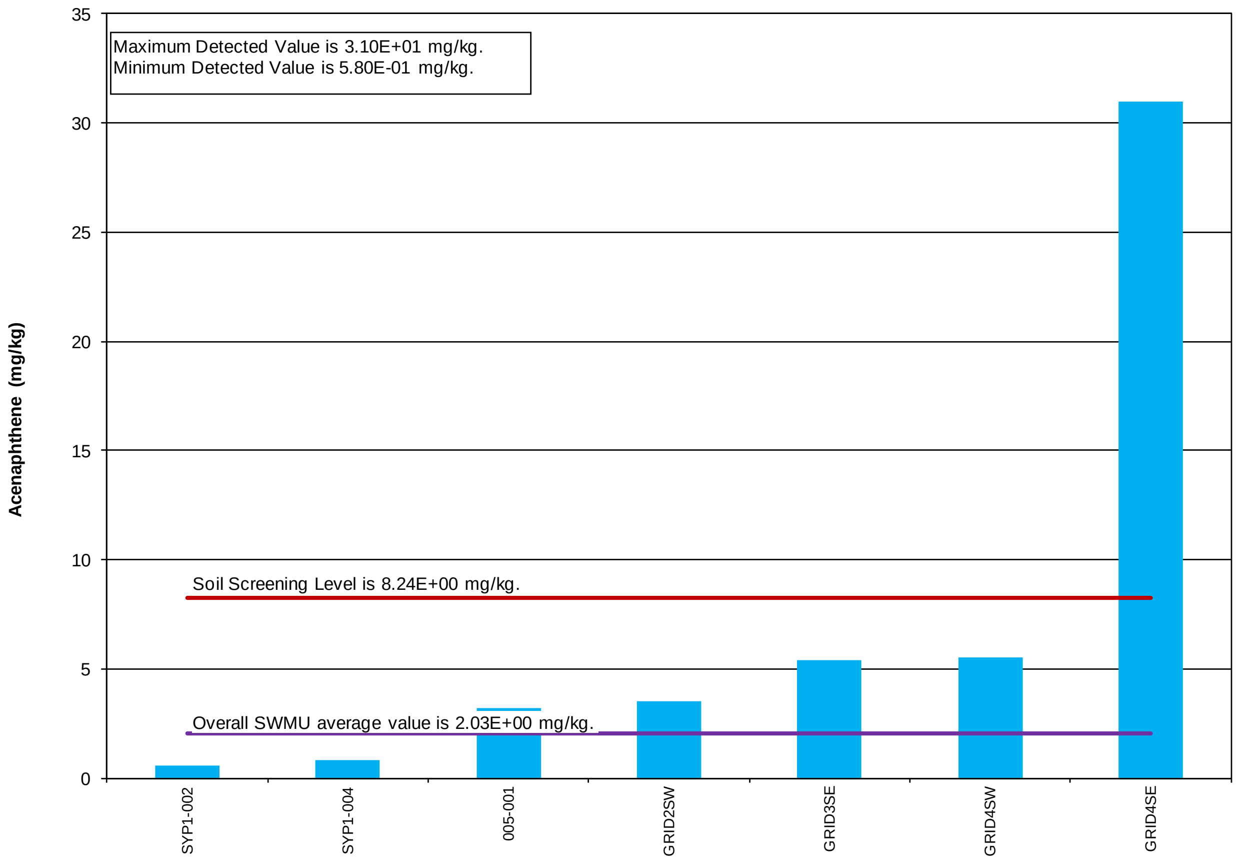

Figure C6.1.2.1. Acenaphthene Detections at SWMU 518

Fluorene was detected in 6 of 27 samples. The chart illustrating the detections is shown in Figure C6.1.2.2. The average for fluorene over SWMU 518 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only one sample had a concentration of fluorene above the RG SSL, and fluorene was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS; therefore, a hot spot assessment was not performed (DOE 2001d).

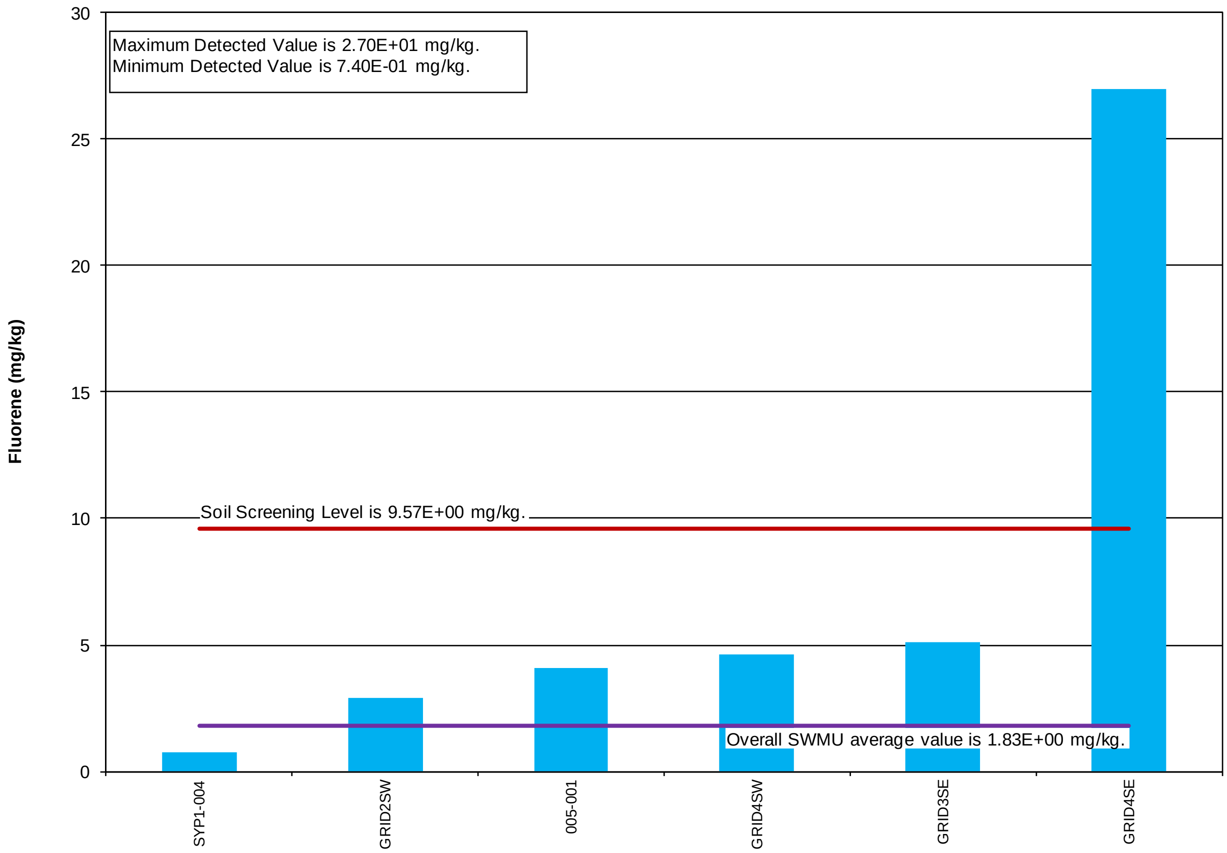

Figure C6.1.2.2. Fluorene Detections at SWMU 518

Pyrene was detected in 17 of 27 samples. The chart illustrating the detections is shown in Figure C6.1.2.3. The average for pyrene over SWMU 518 was less than the RG SSL, so groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although four samples had a concentration of pyrene above the RG SSL, pyrene was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS; therefore, a hot spot assessment was not performed (DOE 2001d).

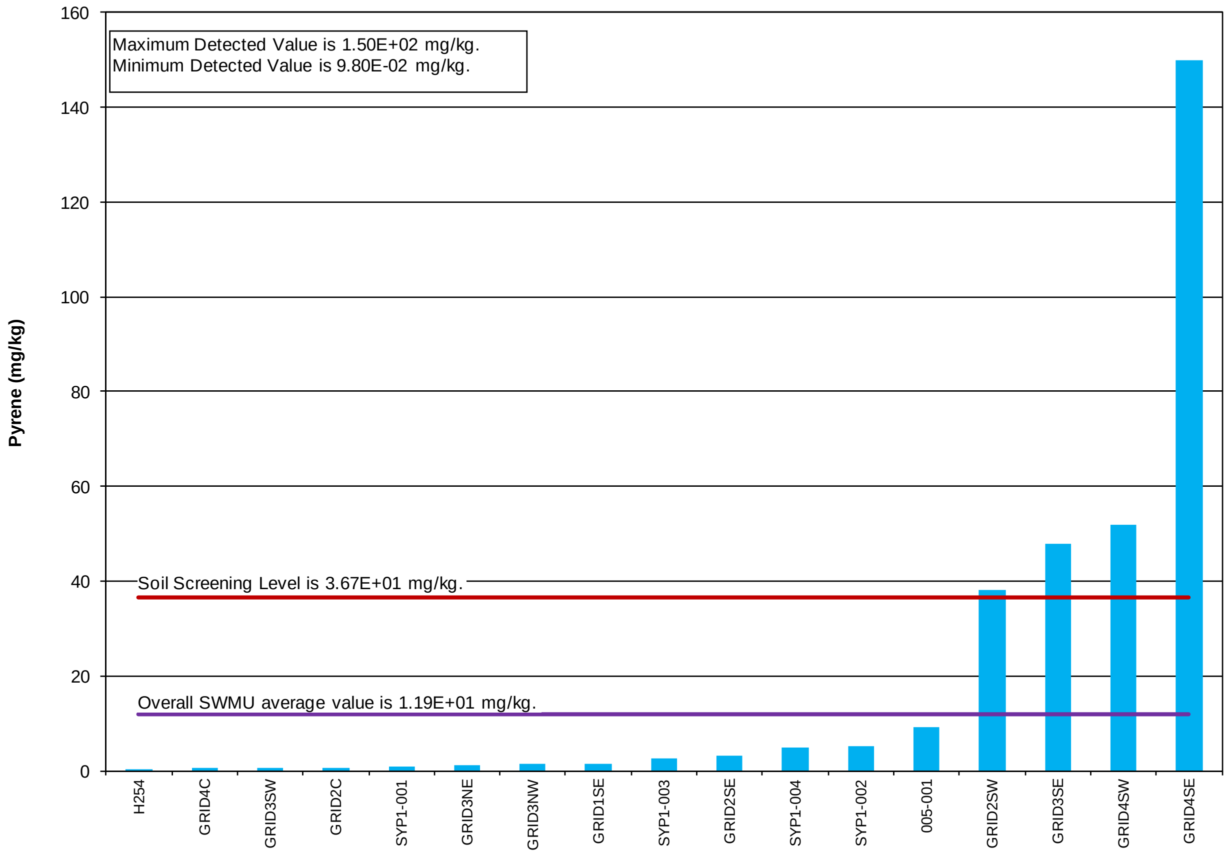

Figure C6.1.2.3. Pyrene Detections at SWMU 518

Cobalt was detected in 11 of 11 samples. The chart illustrating the detections is shown in Figure C6.1.2.4. The average for cobalt over SWMU 518 was less than background, so groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only one sample had a concentration of cobalt above background and cobalt was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS; therefore, a hot spot assessment was not performed (DOE 2001d).

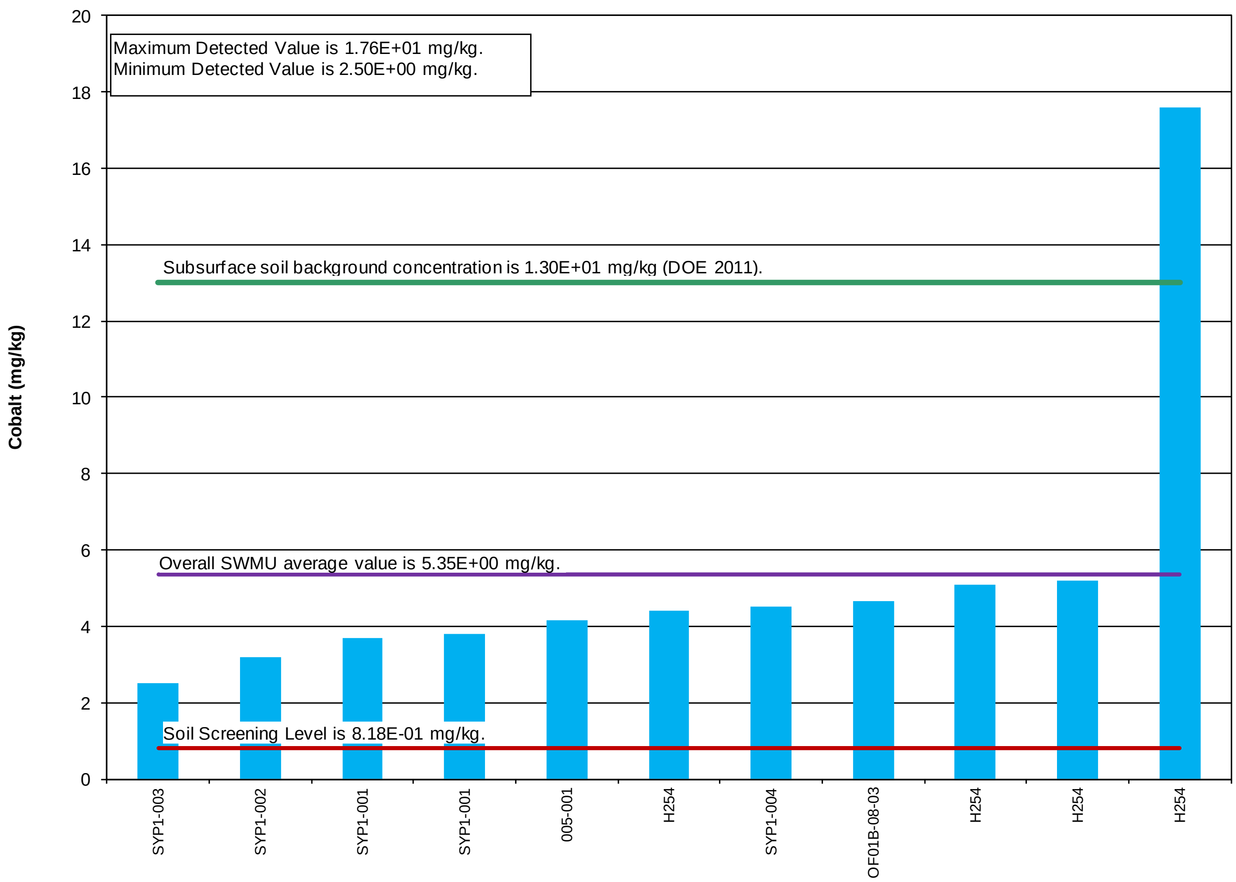

Figure C6.1.2.4. Cobalt Detections at SWMU 518

C6.1.3. SWMU 520 C-746-A SCRAP MATERIAL

Data for SWMU 520 consisted of both historical data and RI data. SWMU 520 exceedances of the RG SSL include cobalt, iron, manganese, mercury, nickel, silver, vanadium, and plutonium-239/240. The data analysis summaries are presented in the following charts.

Cobalt was detected in 31 of 31 samples. The chart illustrating the detections is shown in Figure C6.1.3.1. The average for cobalt over SWMU 520 was less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only one sample had a concentration of cobalt above background, and cobalt was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS; therefore, a hot spot assessment was not performed (DOE 2001d).

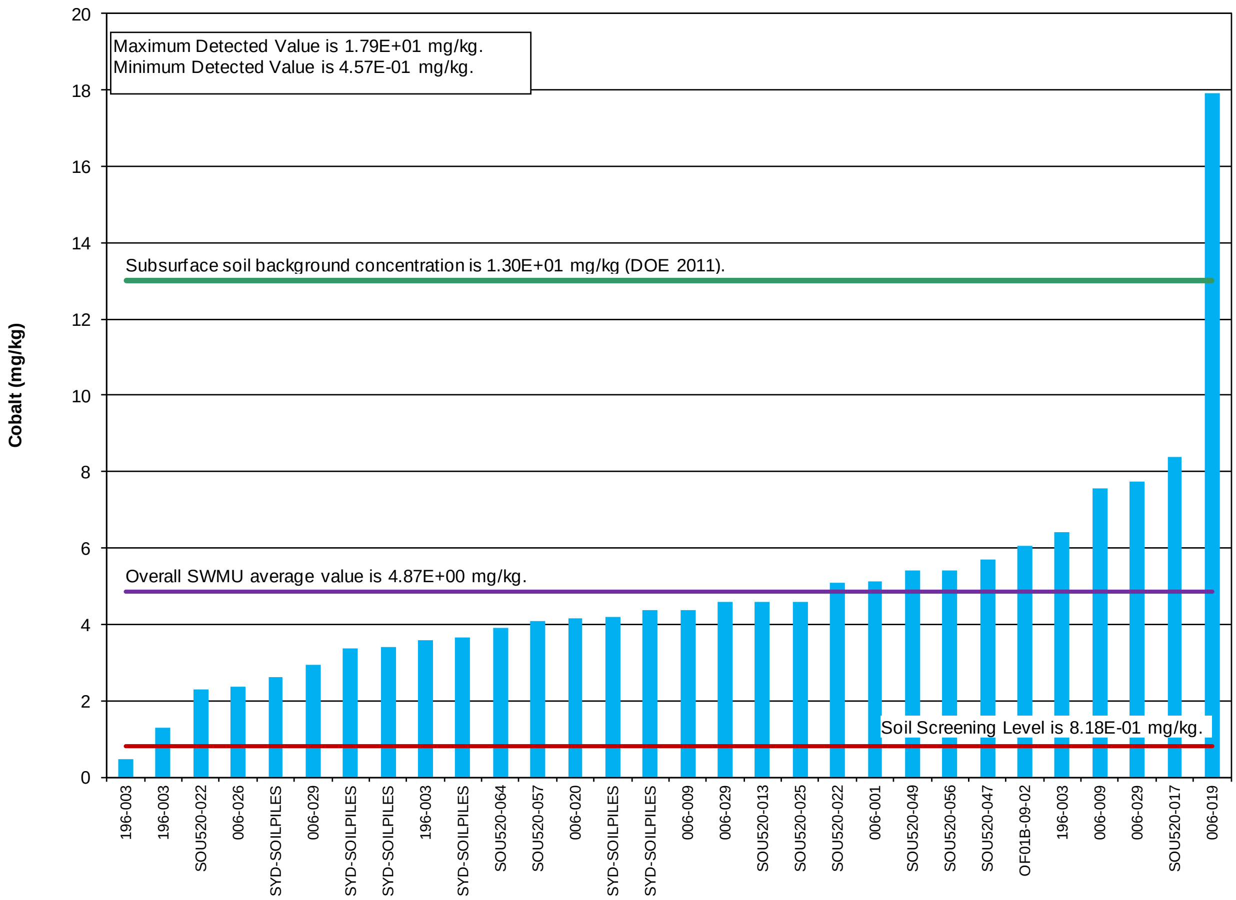

Figure C6.1.3.1. Cobalt Detections at SWMU 520

Iron was detected in 165 of 165 samples. The chart illustrating the detections is shown in Figure C6.1.3.2. The average for iron over SWMU 520 was less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Three samples had a concentration of iron above background; however, a hot spot assessment was not performed due to the ubiquitous nature of iron and the lack of RGA impacts attributed to migration from soils.

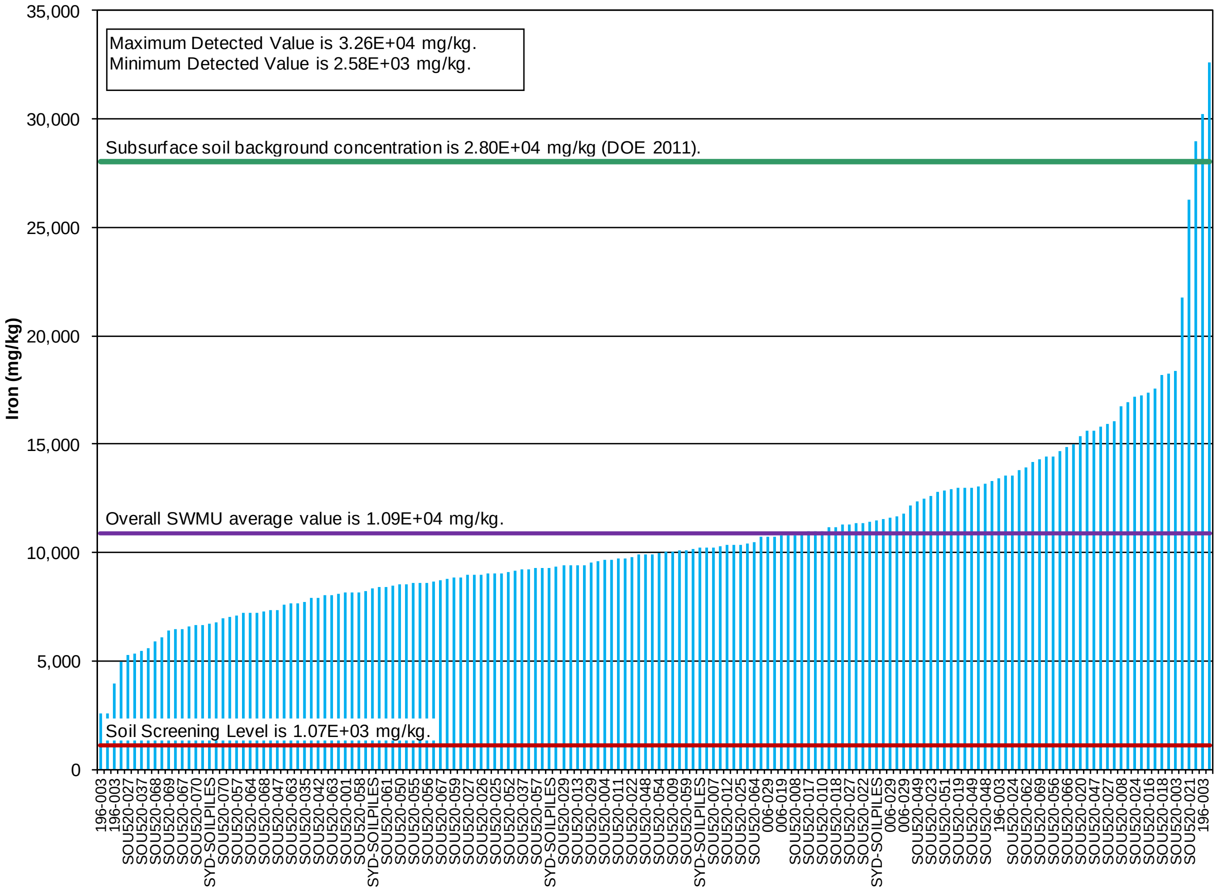

Figure C6.1.3.2. Iron Detections at SWMU 520

Manganese was detected in 164 of 165 samples. The chart illustrating the detections is shown in Figure C6.1.3.3. The average for manganese over SWMU 520 was less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Five samples had a concentration of manganese above background and manganese is a COC in the groundwater plumes associated with PGDP in the GWOU FS (DOE 2001d). A hot spot assessment was not performed due to the low frequency of detection above the RG SSL, the ubiquitous nature of manganese, and the lack of RGA impacts attributable to migration from soils.

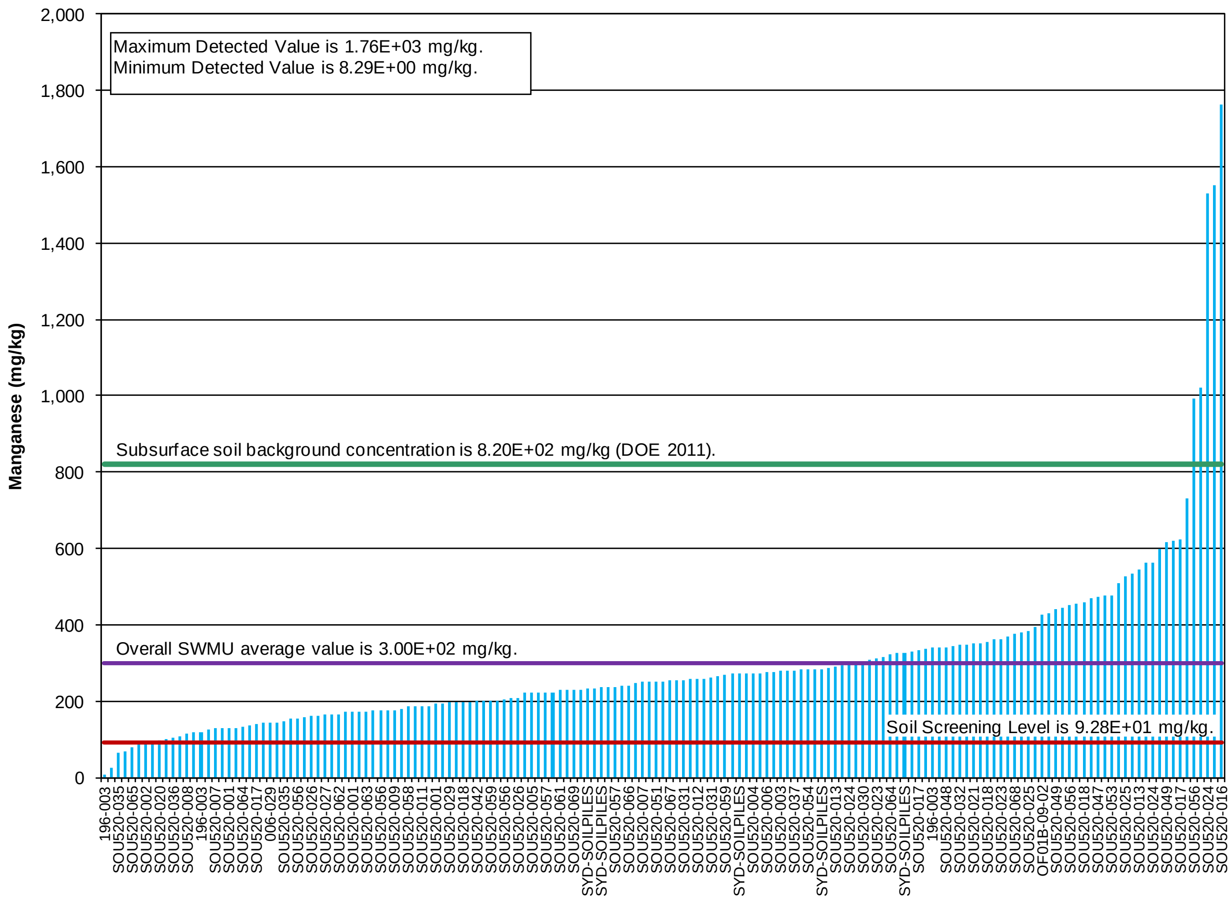

Figure C6.1.3.3. Manganese Detections at SWMU 520

Mercury was detected in 18 of 165 samples. The chart illustrating the detections is shown in Figure C6.1.3.4. The average for mercury over SWMU 520 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although six samples had a concentration of manganese above the RG SSL, mercury was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS; therefore, a hot spot assessment was not performed (DOE 2001d).

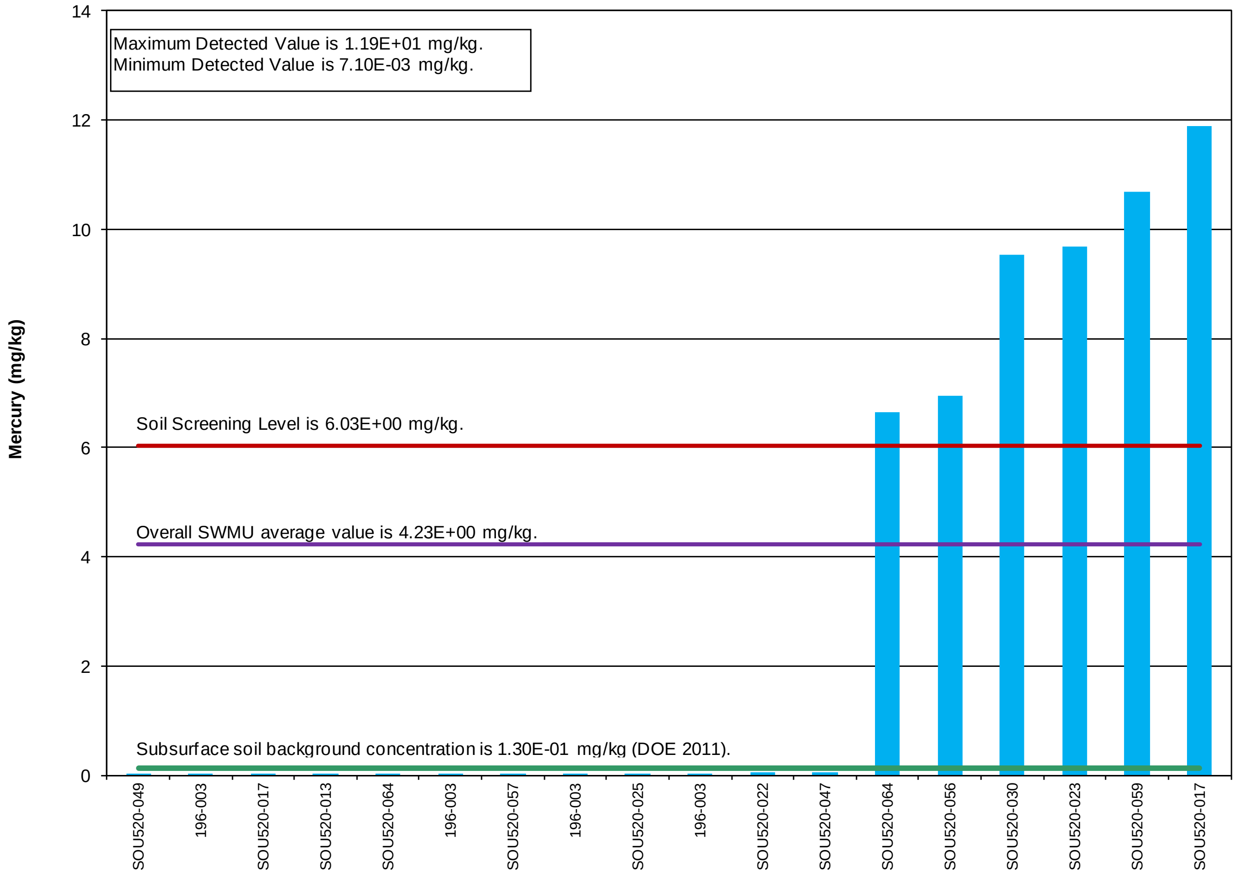

Figure C6.1.3.4. Mercury Detections at SWMU 520

Nickel was detected in 87 of 165 samples. The chart illustrating the detections is shown in Figure C6.1.3.5. The average for nickel over SWMU 520 was greater than background and the RG SSL; however, nickel is being modeled at SWMU 14–the location with the highest average concentration of nickel in any SWMU. Groundwater fate and transport modeling and hot spot evaluation were not performed for this chemical at this SWMU.

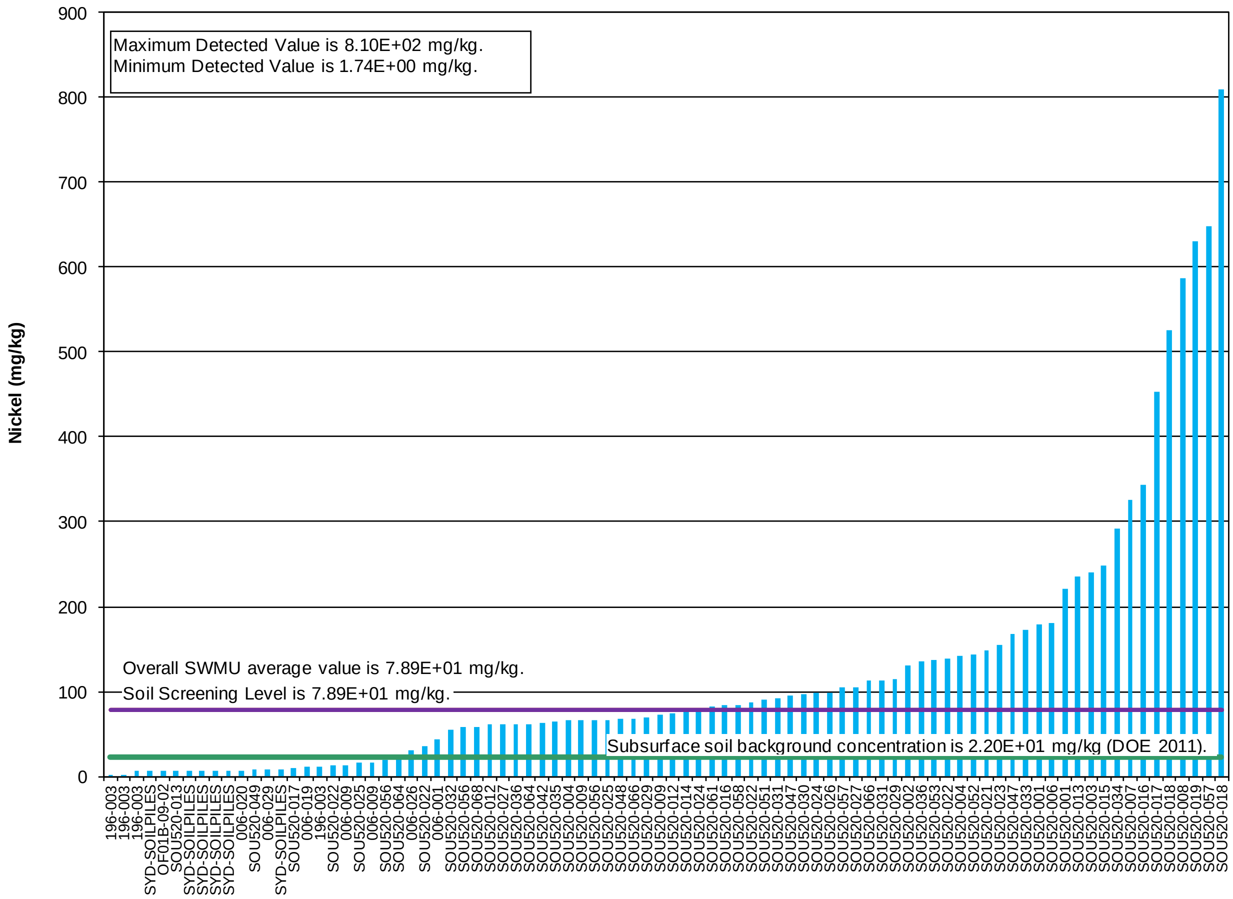

Figure C6.1.3.5. Nickel Detections at SWMU 520

Silver was detected in 17 of 165 samples. The chart illustrating the detections is shown in Figure C6.1.3.6. The average for silver over SWMU 520 was greater than background and the RG SSL. Silver was assessed for nature and extent of during the GWOU FS, and silver is a COC in the plumes associated with PGDP (DOE 2001d). The evaluation presented in Attachment C1 to Appendix C did not identify any RGA silver impacts; therefore, neither fate and transport modeling nor hot spot evaluation was performed for this chemical at this SWMU.

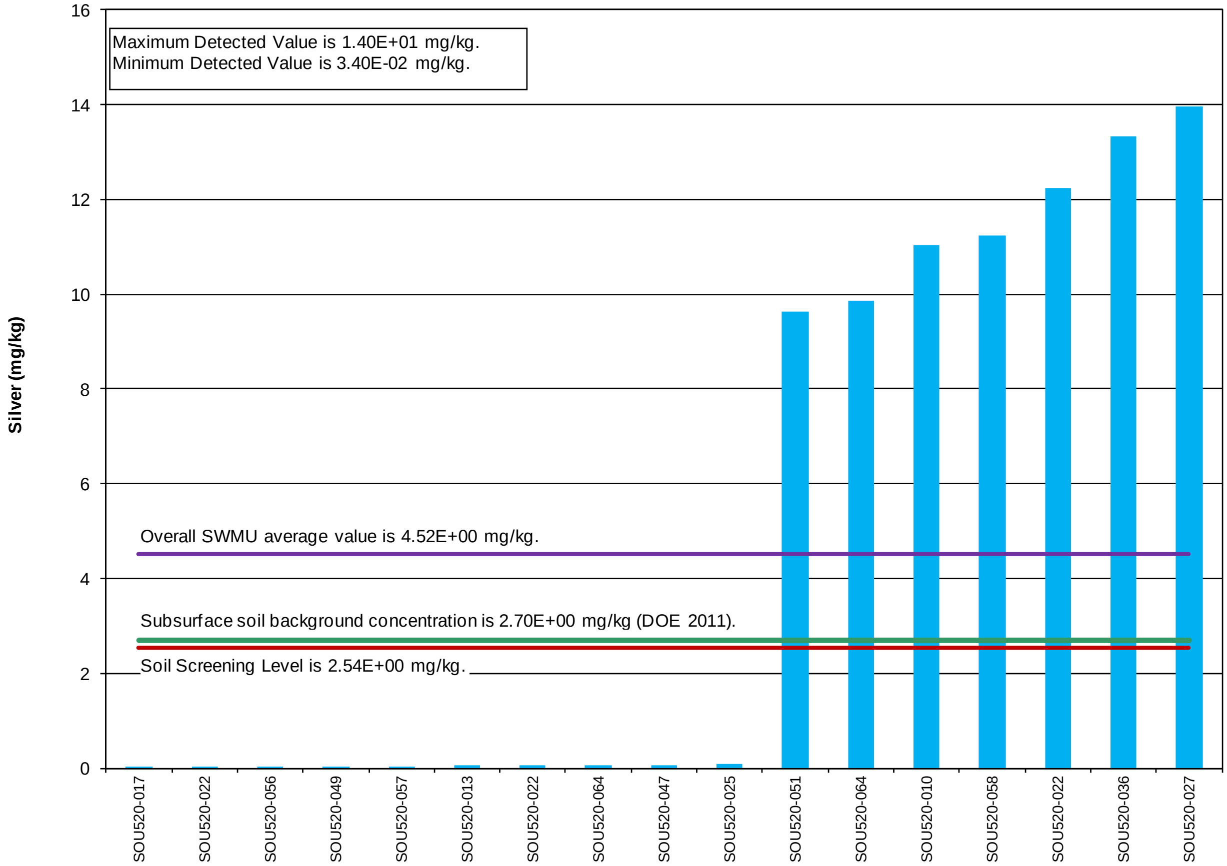

Figure C6.1.3.6. Silver Detections at SWMU 520

Vanadium was detected in 31 of 31 samples. The chart illustrating the detections is shown in Figure C6.1.3.7. The average for vanadium over SWMU 520 was less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only two samples had a concentration of vanadium above background; therefore, a hot spot assessment was not performed.

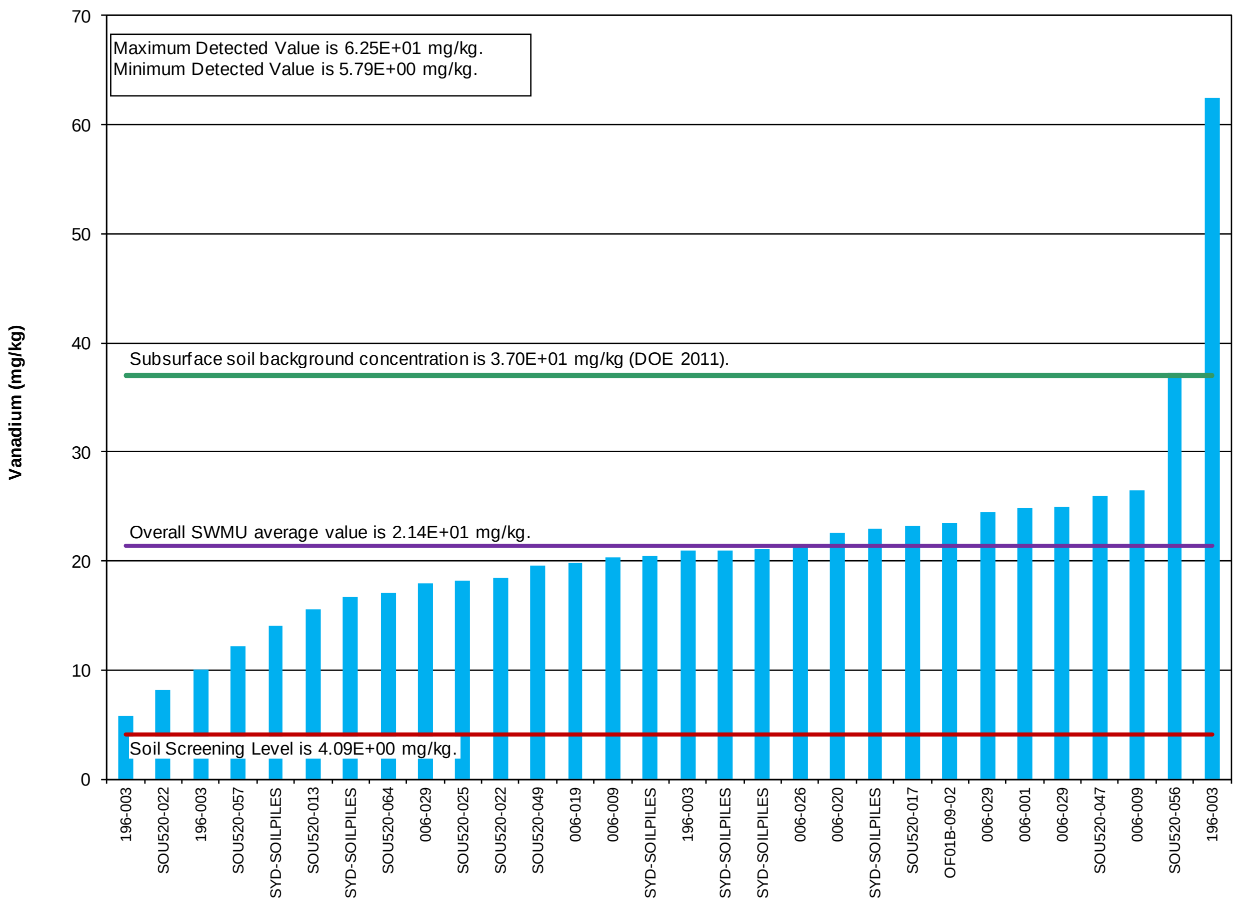

Figure C6.1.3.7. Vanadium Detections at SWMU 520

Plutonium-239/240 was detected in 19 of 19 samples. The chart illustrating the detections is shown in Figure C6.1.3.8. The average for plutonium-239/240 over SWMU 520 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. No samples had a concentration of plutonium-239/240 above the RG SSL. Plutonium-239/240 was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS; therefore, a hot spot assessment was not performed (DOE 2001d).

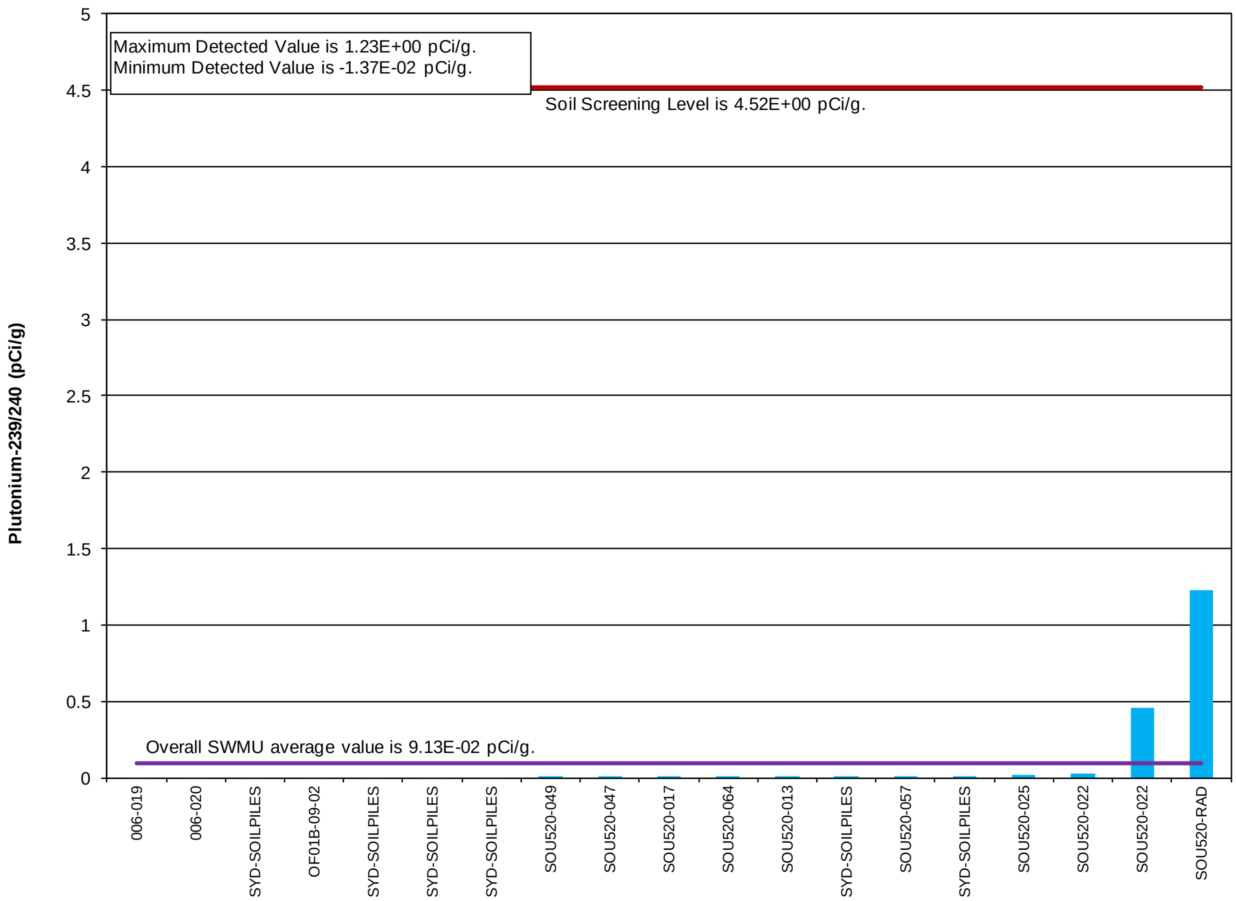

Figure C6.1.3.8. Plutonium-239/240 Detections at SWMU 520

C6.2 GROUP 3, PCB AREAS

C6.2.1 SWMU 81, C-541 PCB SPILL SITE

Data for SWMU 81 consisted of both historical data and RI data. SWMU 81 exceedances of the RG SSL include naphthalene, Total PCBs, cobalt, iron, manganese, mercury, nickel, silver, uranium, and vanadium. The maximum results for iron and vanadium were detected below subsurface background; therefore, these analyses did not have fate and transport modeling or hot spot evaluations performed.

Naphthalene was detected in 1 of 12 samples. The chart illustrating the detections is shown in Figure C6.2.1.1. The average for naphthalene over SWMU 81 was greater than the RG SSL; however, naphthalene was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS (DOE 2001d). Because of this, groundwater fate and transport modeling was not performed for this chemical at this SWMU, nor is a hot spot assessment required.

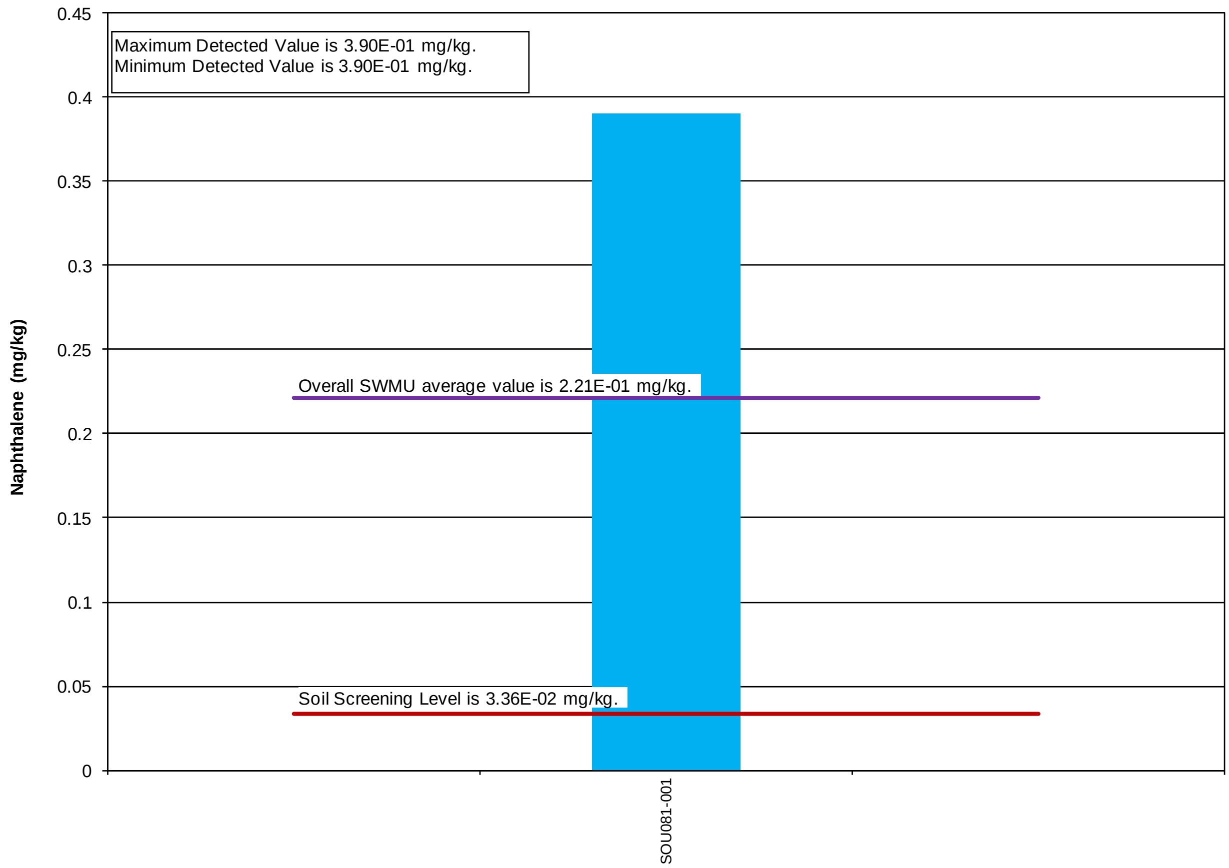

Figure C6.2.1.1. Naphthalene Detections at SWMU 81

Total PCBs were detected in 39 of 81 samples. The chart illustrating the detections is shown in Figure C6.2.1.2. The average for Total PCBs over SWMU 81 was greater than the RG SSL; therefore, groundwater fate and transport modeling was performed for this chemical at this SWMU.

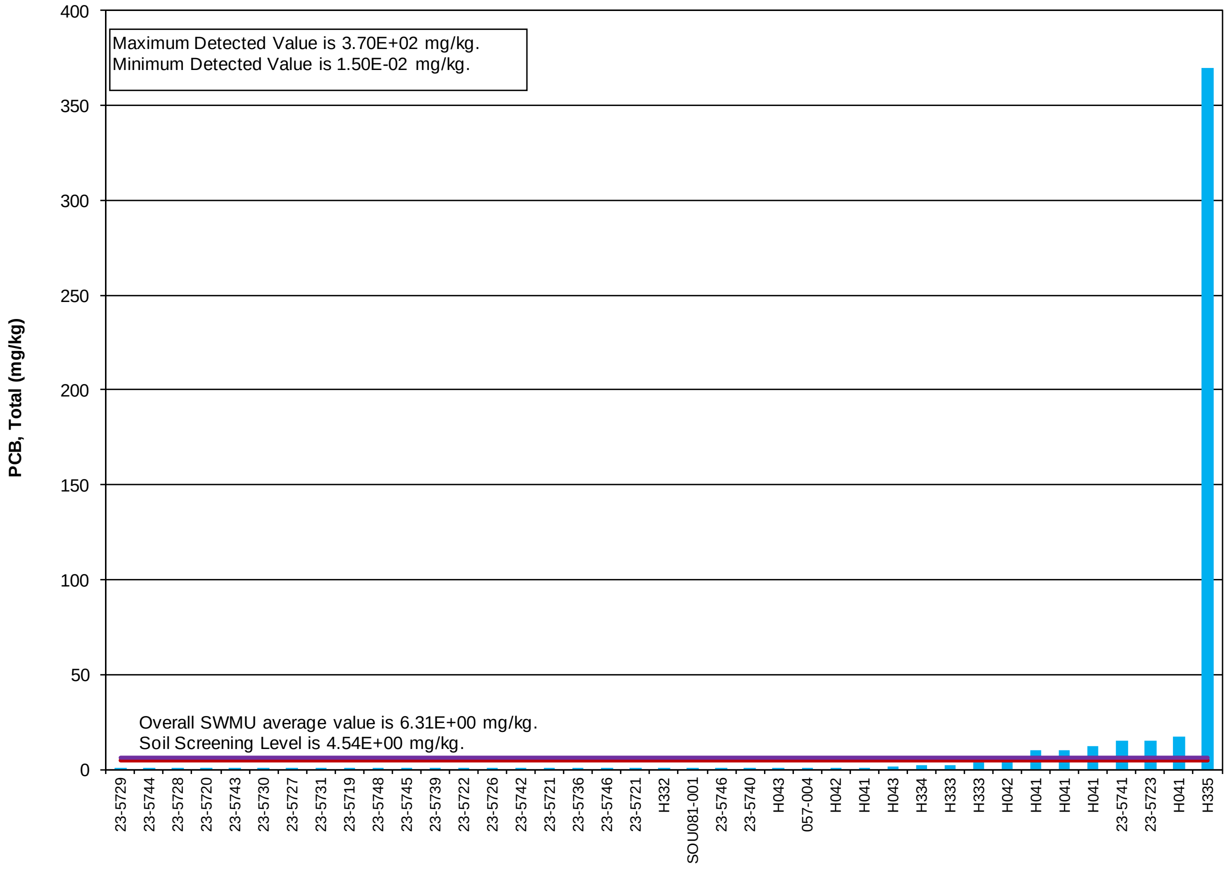

Figure C6.2.1.2. Total PCB Detections at SWMU 81

Cobalt was detected in 10 of 10 samples. The chart illustrating the detections is shown in Figure C6.2.1.3. The average for cobalt over SWMU 81 was less than background, and cobalt was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS (DOE 2001d). Because of this, groundwater fate and transport modeling was not performed for this chemical at this SWMU, nor is a hot spot assessment required.

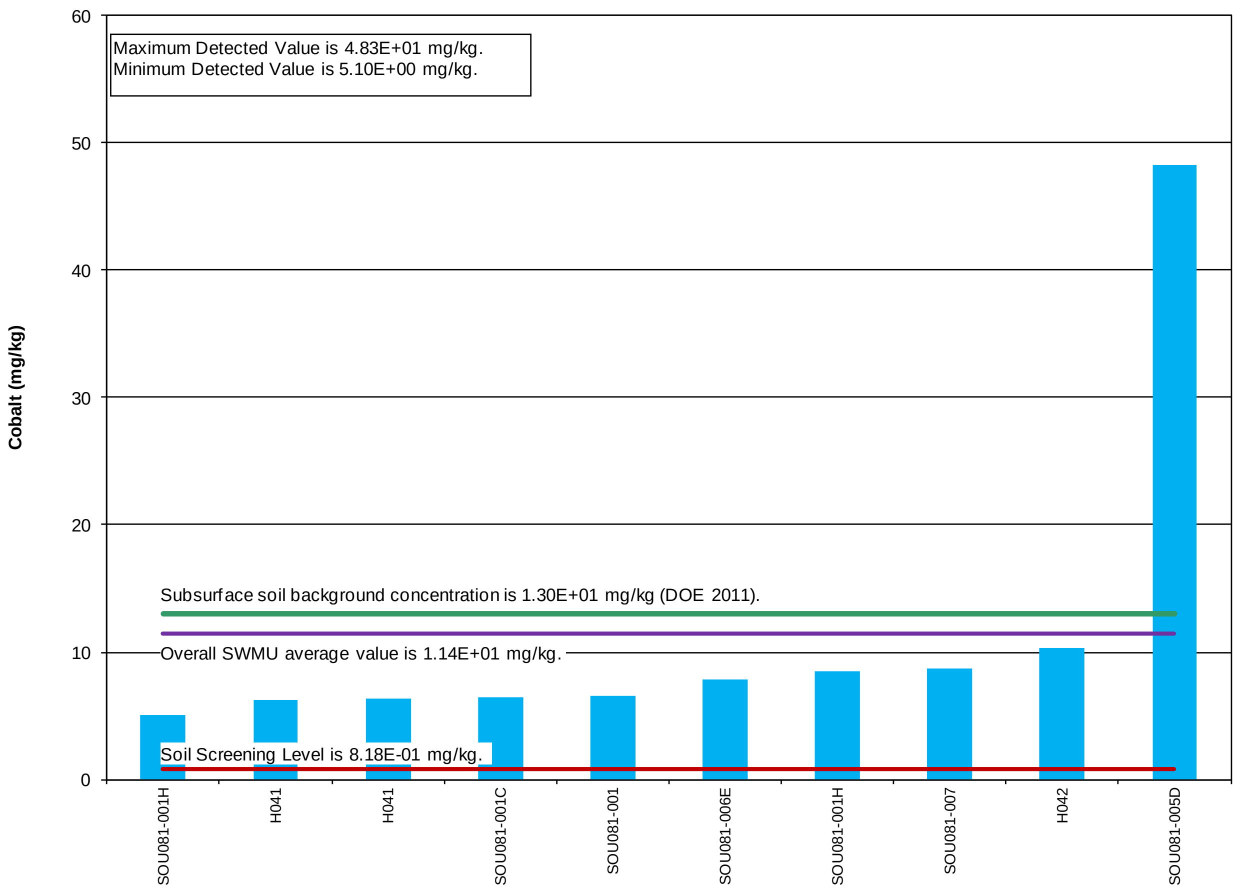

Figure C6.2.1.3. Cobalt Detections at SWMU 81

Manganese was detected in 59 of 60 samples. The chart illustrating the detections is shown in Figure C6.2.1.4. The average for manganese over SWMU 81 was less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Although several samples had concentrations greater than background, a hot spot evaluation was not performed due to the ubiquitous nature of manganese and the lack of RGA impacts due to soil manganese concentrations.

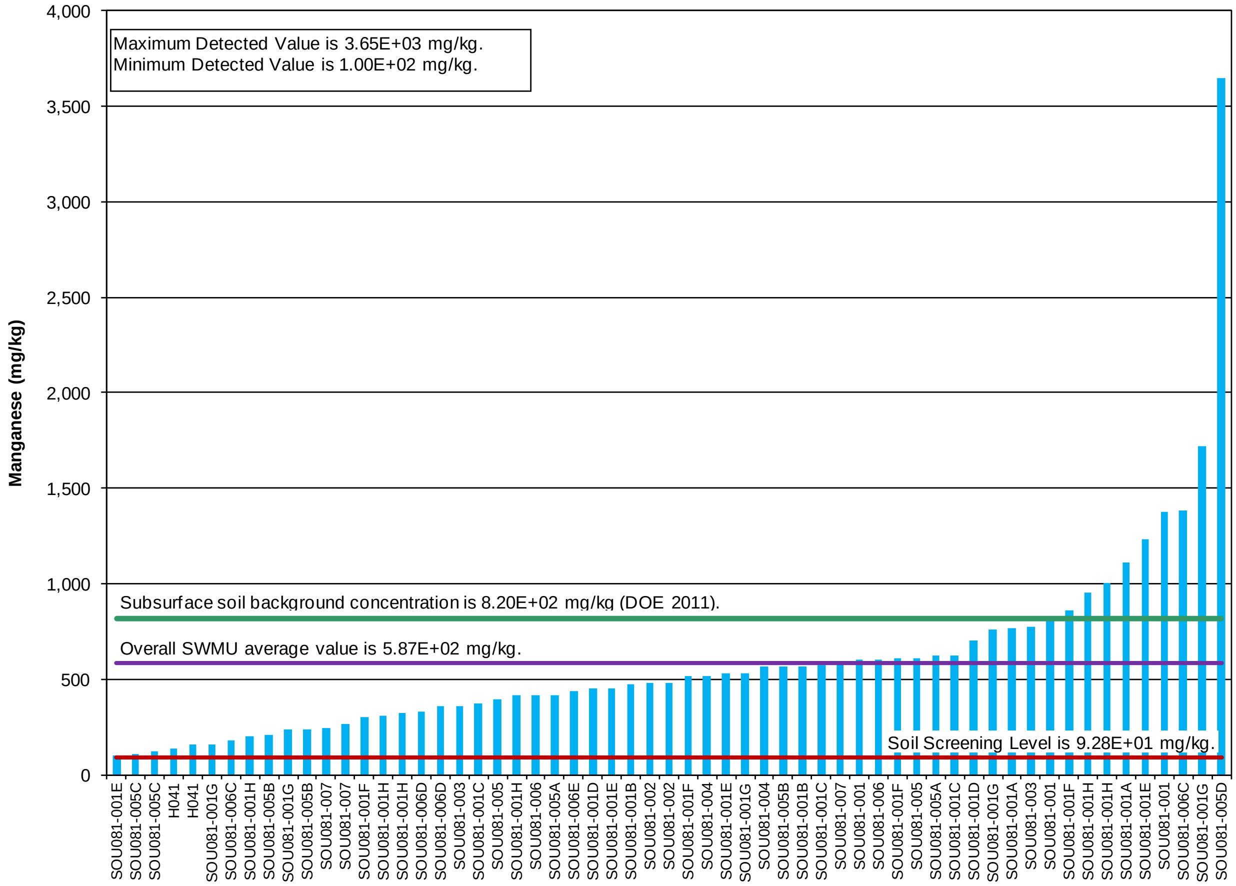

Figure C6.2.1.4. Manganese Detections at SWMU 81

Mercury was detected in 9 of 60 samples. The chart illustrating the detections is shown in Figure C6.2.1.5. The average for mercury over SWMU 81 was less than the RG SSL, and mercury was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS (DOE 2001d). Because of this, groundwater fate and transport modeling was not performed for this chemical at this SWMU, nor is a hot spot assessment required.

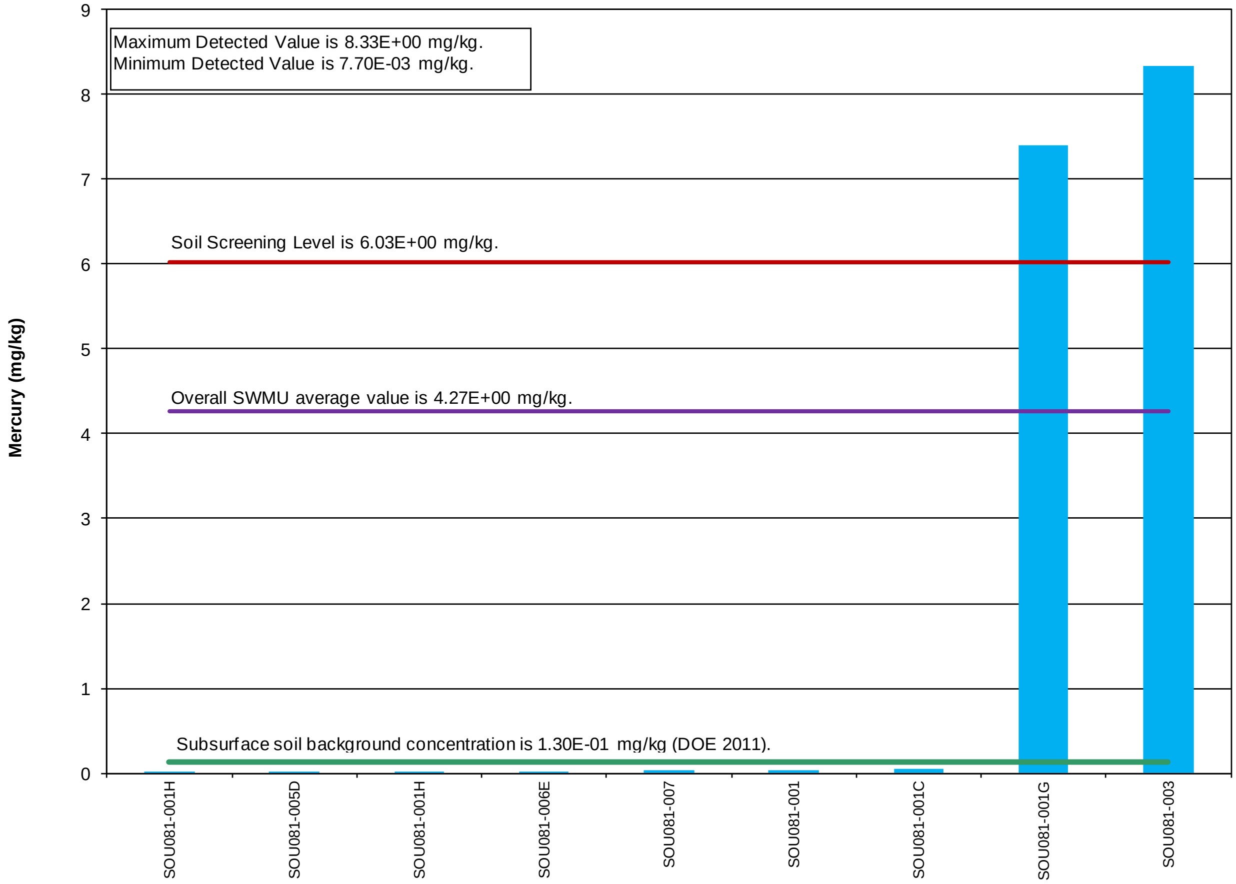

Figure C6.2.1.5. Mercury Detections at SWMU 81

Nickel was detected in 15 of 60 samples. The chart illustrating the detections is shown in Figure C6.2.1.6. The average for nickel over SWMU 81 was less than the RG SSL so groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only two samples had a concentration above the RG SSL; therefore, a hot spot assessment was not performed.

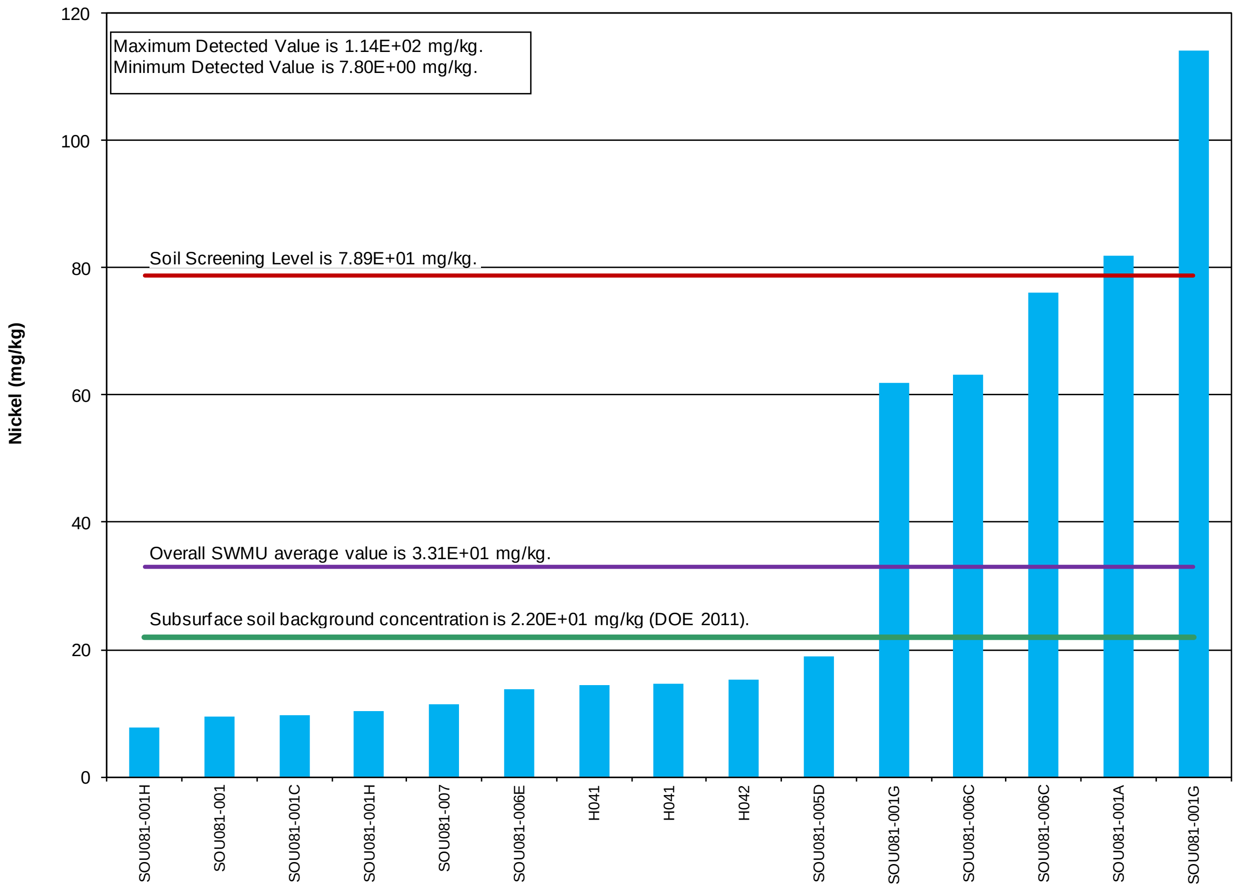

Figure C6.2.1.6. Nickel Detections at SWMU 81

Silver was detected in 10 of 60 samples. The chart illustrating the detections is shown in Figure C6.2.1.7. The average for silver over SWMU 81 was greater than the RG SSL and background only because the detection limit was high. The average over SWMU 81 is greater than the maximum detected value because there were 50 samples that had a nondetected result with a detection limit of 10 mg/kg. Using half of the detection limit as the concentration for undetected results, then averaging for all results, detected and undetected, produces an average greater than the maximum detected result. Since there were no detected samples at levels above the subsurface soil background, groundwater fate and transport modeling was not performed for this chemical at this SWMU. No results were over background; therefore, a hot spot evaluation was not performed.

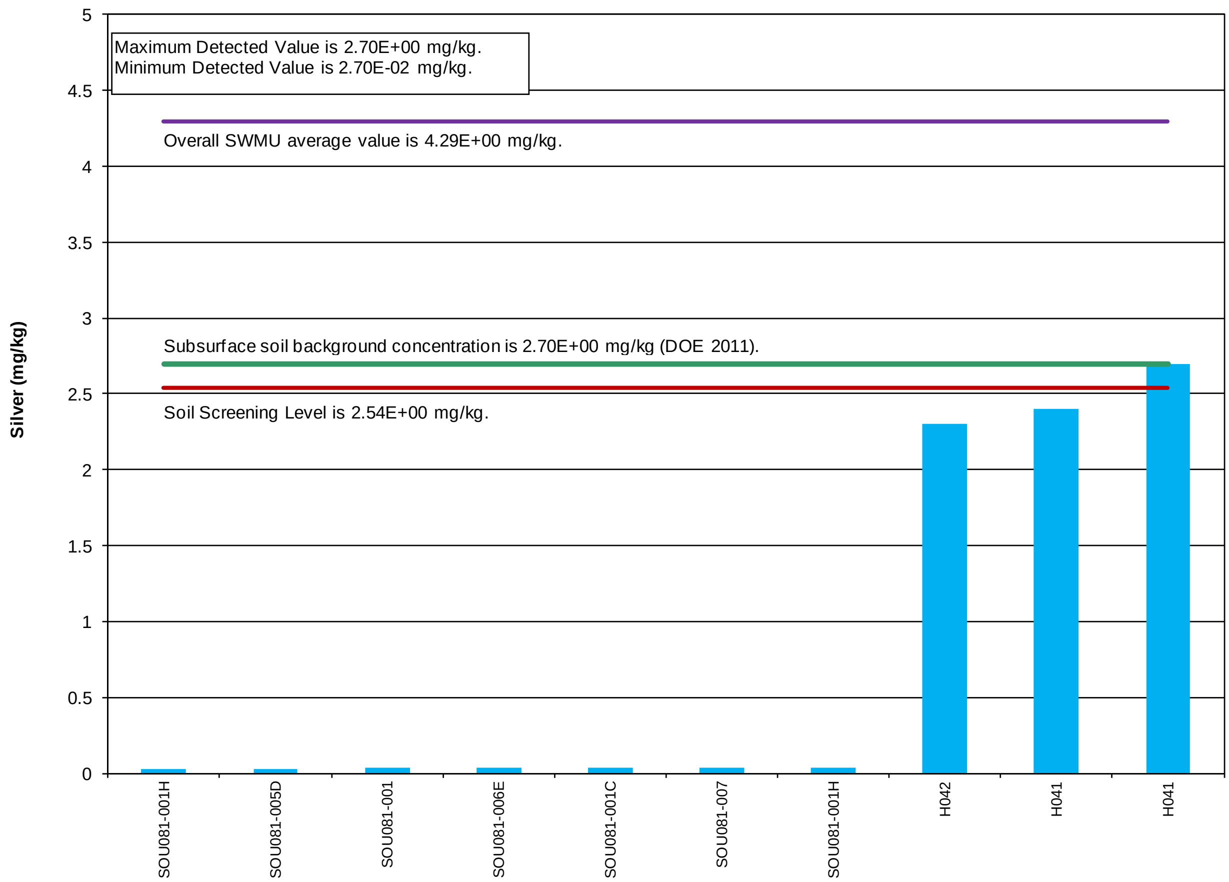

Figure C6.2.1.7. Silver Detections at SWMU 81

Uranium was detected in 32 of 78 samples. The chart illustrating the detections is shown in Figure C6.2.1.8. Although the average for uranium over SWMU 81 was greater than background and the RG SSL, uranium was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS (DOE 2001d). Nevertheless, groundwater fate and transport modeling was performed for this chemical at this SWMU.

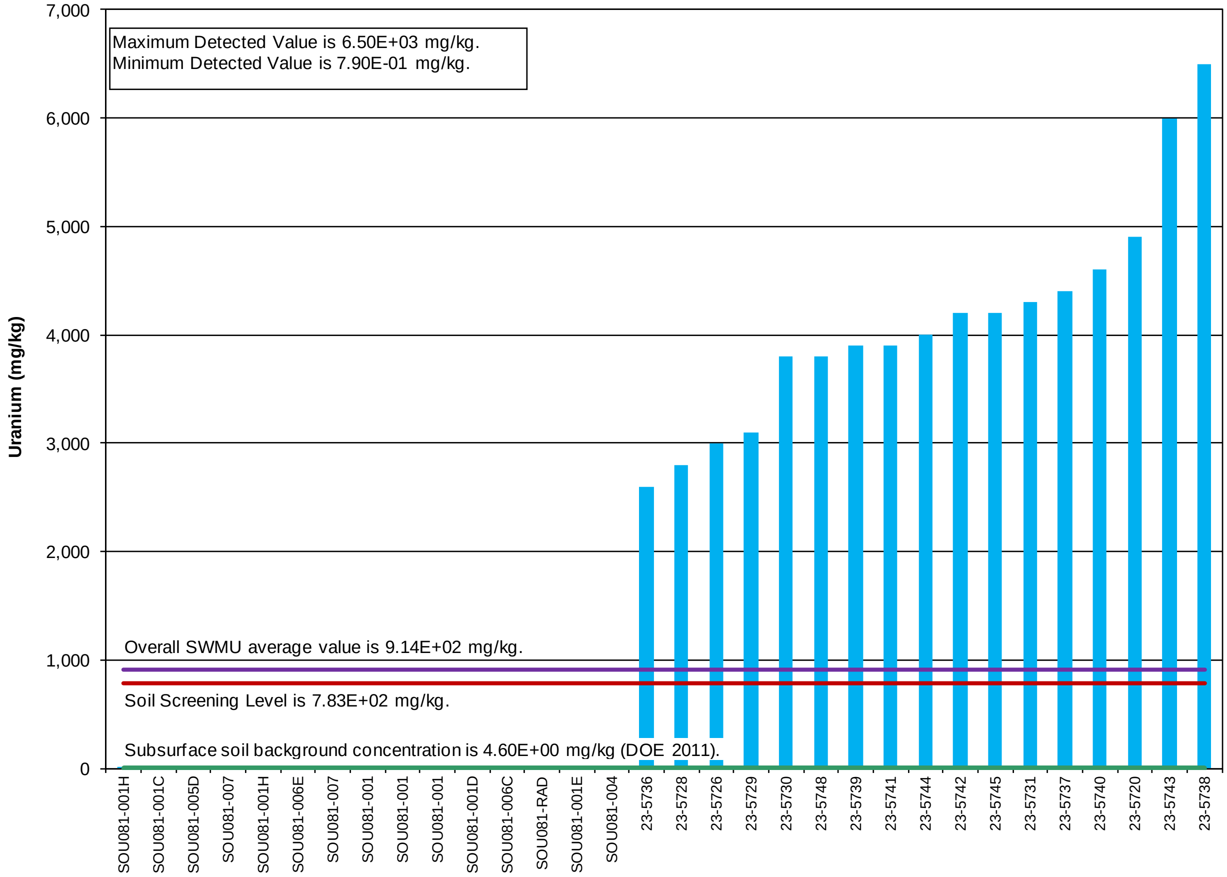

Figure C6.2.1.8. Uranium Detections at SWMU 81

C6.2.2 SWMU 153, C-331 PCB SOIL CONTAMINATION (WEST)

Data for SWMU 153 consisted of both historical data and RI data. SWMU 153 exceedances of the RG SSL include cobalt, iron, manganese, nickel, silver, and vanadium. The maximum results for cobalt, iron, and vanadium were detected below subsurface background; therefore, these analytes will not be considered for groundwater modeling or hot spot evaluations.

Manganese was detected in 15 of 15 samples. The chart illustrating the detections is shown in Figure C6.2.2.1. The average for manganese over SWMU 153 was less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only one sample had a concentration above background; therefore, a hot spot assessment was not performed.

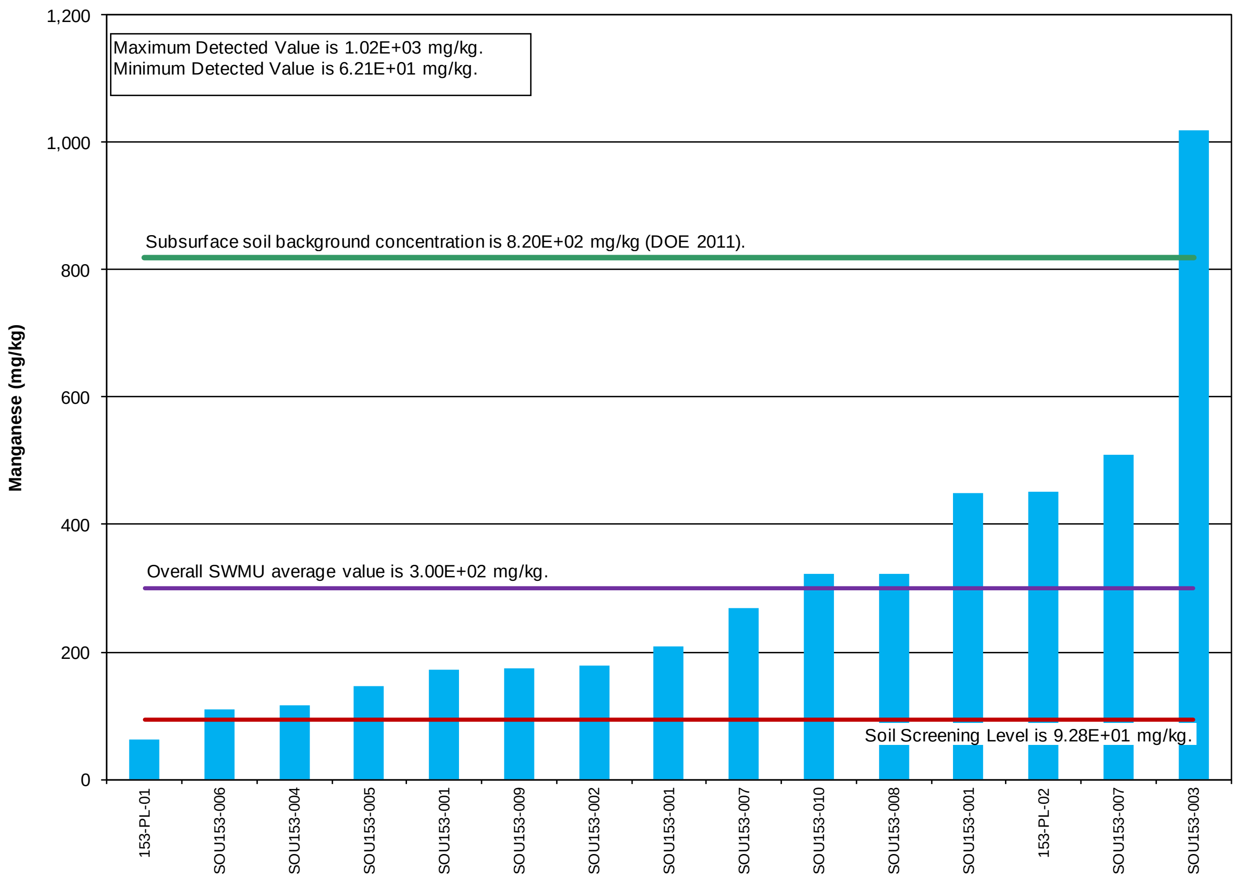

Figure C6.2.2.1. Manganese Detections at SWMU 153

Nickel was detected in 5 of 15 samples. The chart illustrating the detections is shown in Figure C6.2.2.2. The average for nickel over SWMU 153 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Three samples had a concentration above the RG SSL; however, a hot spot evaluation was not performed because nickel is being modeled at SWMU 14–the location with the highest average concentration of nickel in any SWMU.

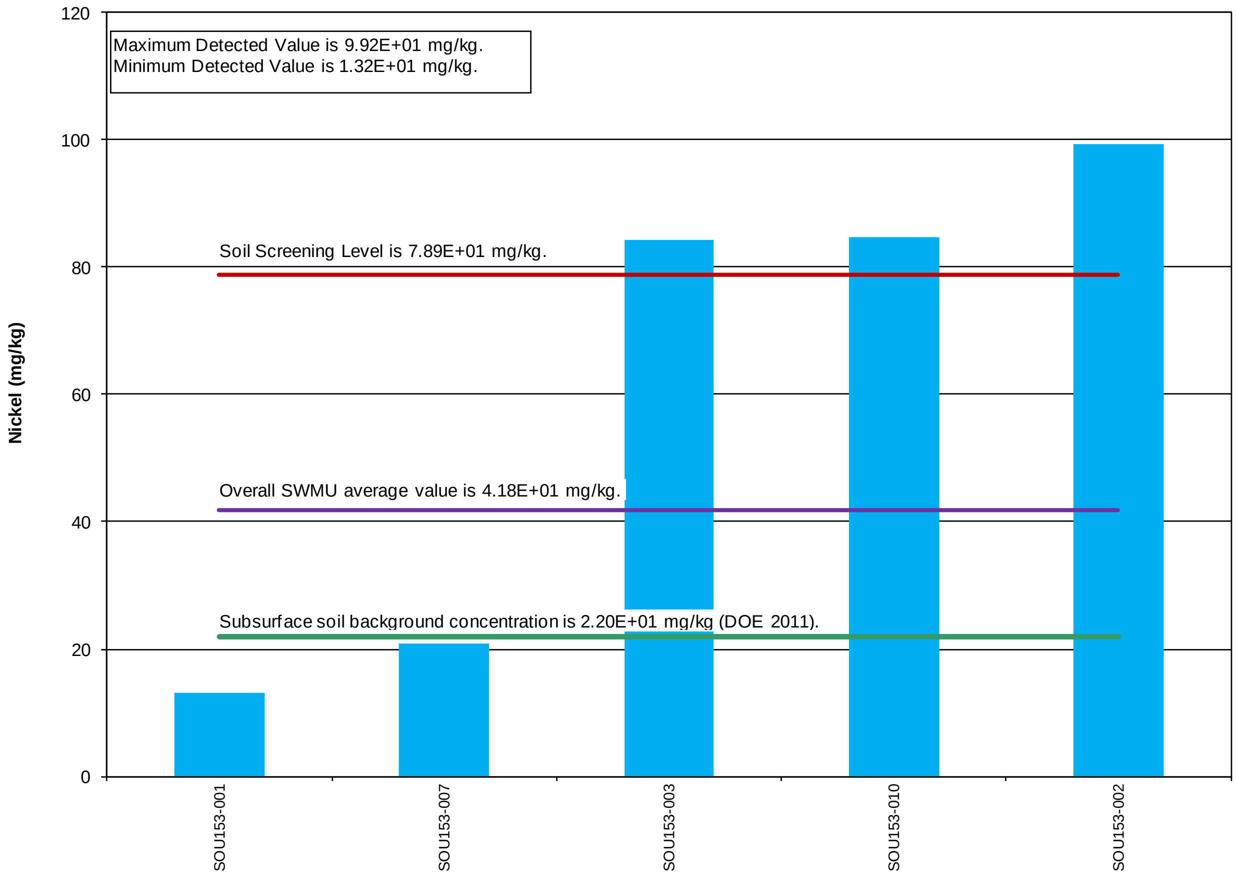

Figure C6.2.2.2. Nickel Detections at SWMU 153

Silver was detected in 4 of 15 samples. The chart illustrating the detections is shown in Figure C6.2.2.3. The average for silver over SWMU 153 was greater than background and the RG SSL; however, it was not modeled for groundwater fate and transport. Silver was assessed for nature and extent during the GWOU FS, and silver is considered is a COC in the plumes associated with PGDP (DOE 2001d). The evaluation presented in Attachment C1 to Appendix C did not identify any RGA silver impacts. Fate and transport modeling was performed for this chemical at this SWMU; however, because only two samples had concentrations greater than background, a hot spot evaluation was not performed.

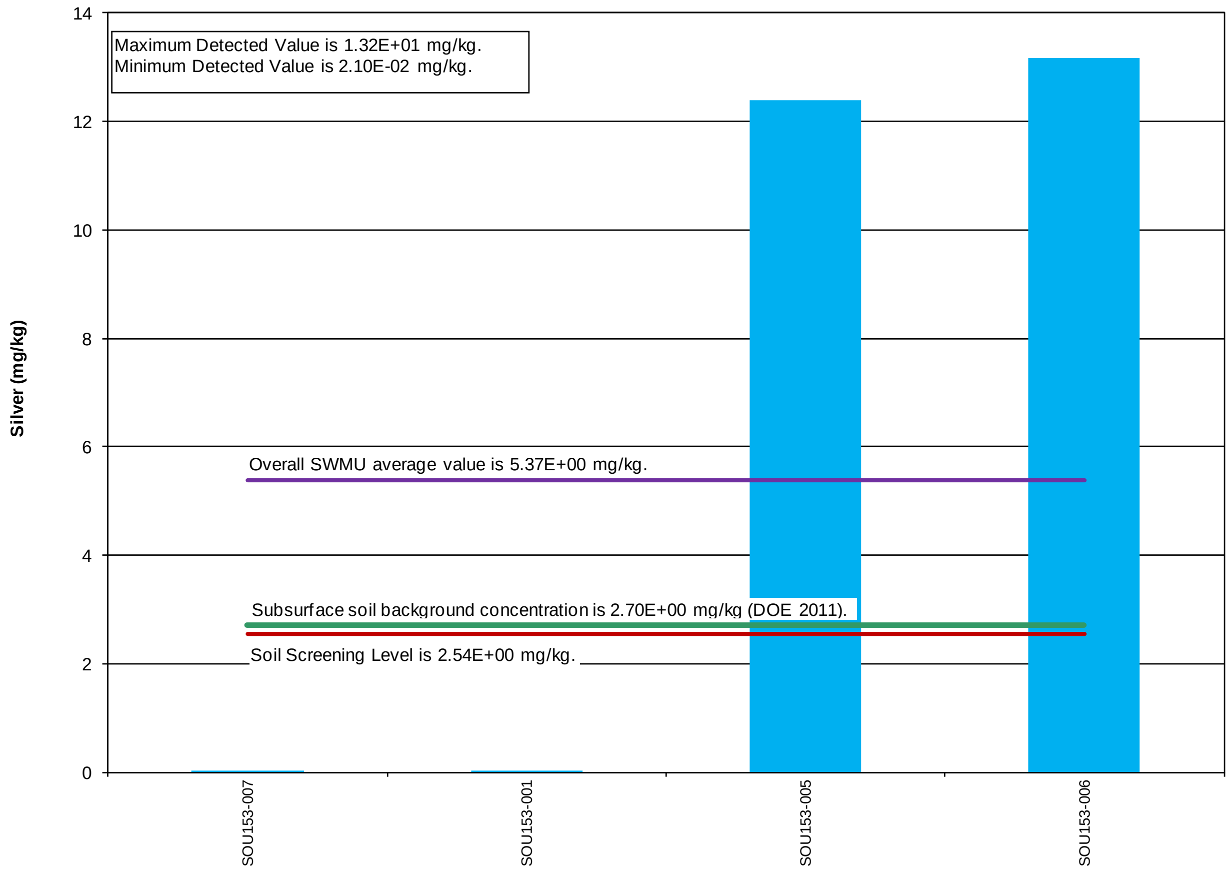

Figure C6.2.2.3. Silver Detections at SWMU 153

C6.2.3 SWMU 156, C-310 PCB SOIL CONTAMINATION (WEST)

Data for SWMU 156 consisted of both historical data and RI data. SWMU 156 exceedances of the RG SSL include cobalt, iron, manganese, mercury, silver, and vanadium.

Cobalt was detected in 3 of 3 samples. The chart illustrating the detections is shown in Figure C6.2.3.1. The average for cobalt over SWMU 156 was less than background and the RG SSL, and cobalt was not identified as a COC in the groundwater plumes associated with PGDP in the GWOU FS (DOE 2001d). Because of this, groundwater fate and transport modeling was not performed for this chemical at this SWMU, nor is a hot spot assessment required.

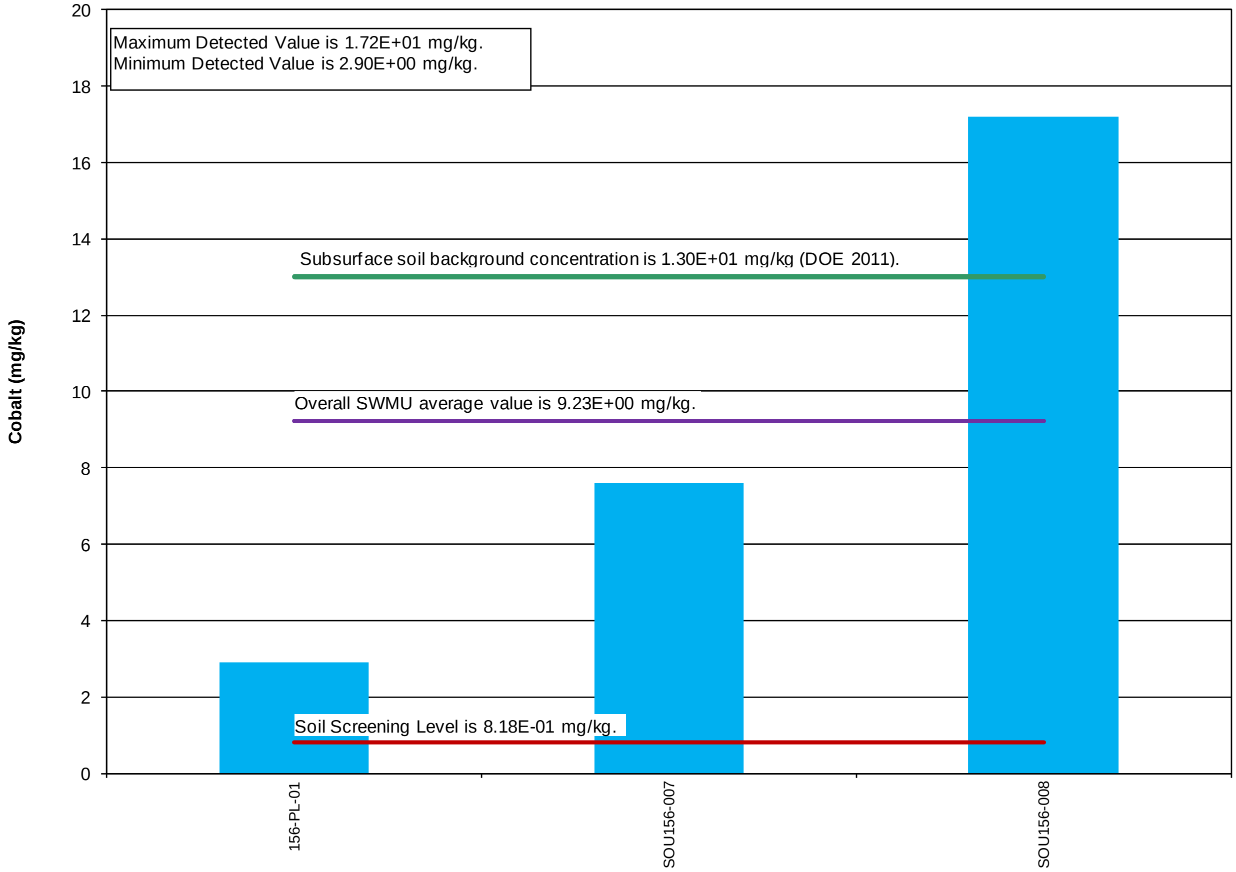

Figure C6.2.3.1. Cobalt Detections at SWMU 156

Manganese was detected in 27 of 27 samples. The chart illustrating the detections is shown in Figure C6.2.3.2. The average for manganese over SWMU 156 was less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Only one sample had a concentration greater than background; therefore, a hot spot evaluation was not necessary.

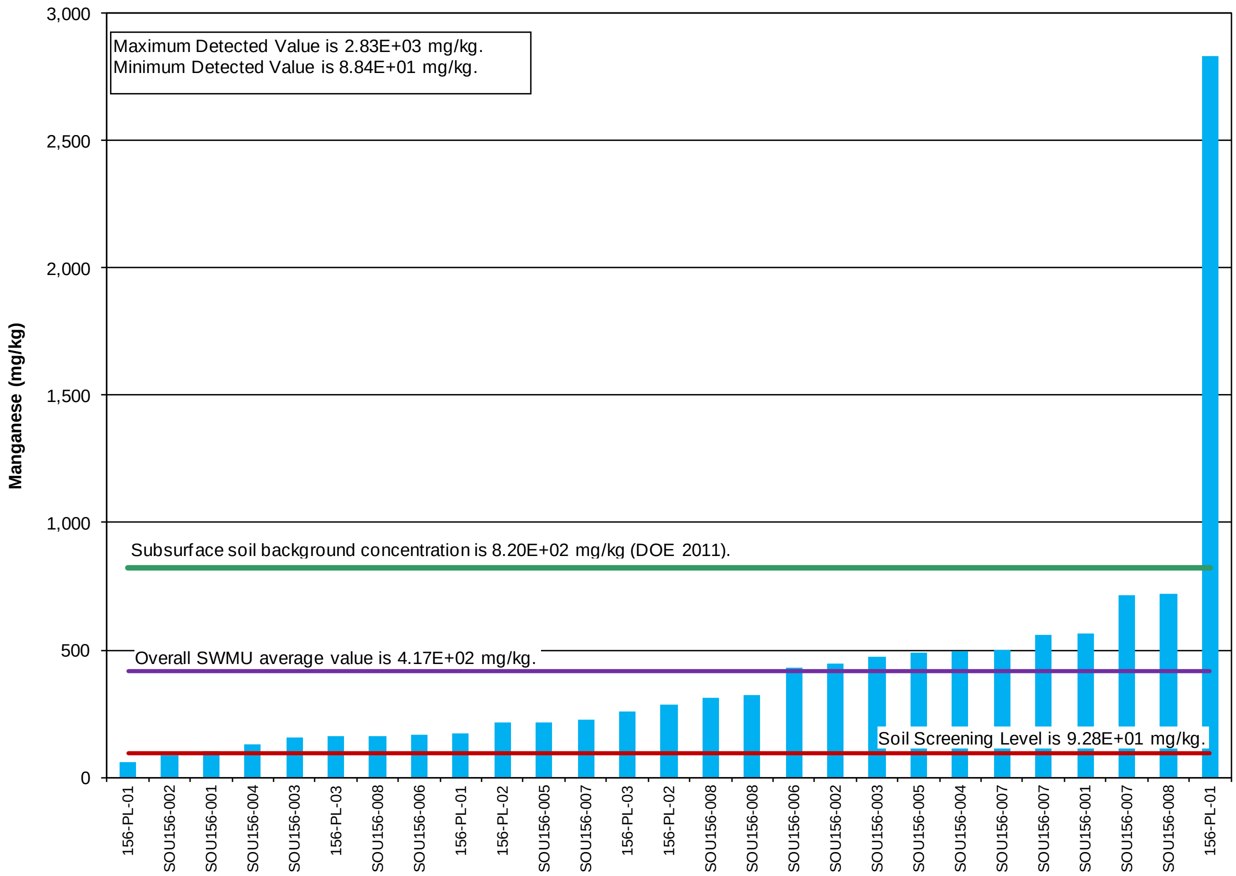

Figure C6.2.3.2. Manganese Detections at SWMU 156

Mercury was detected in 4 of 27 samples. The chart illustrating the detections is shown in Figure C6.2.3.3. The average for mercury over SWMU 156 was less than the RG SSL, and mercury was not identified as a COC in the groundwater plumes associated with PGDP; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU (DOE 2001d). Only two samples had a concentration greater than background; therefore, a hot spot evaluation was not necessary.

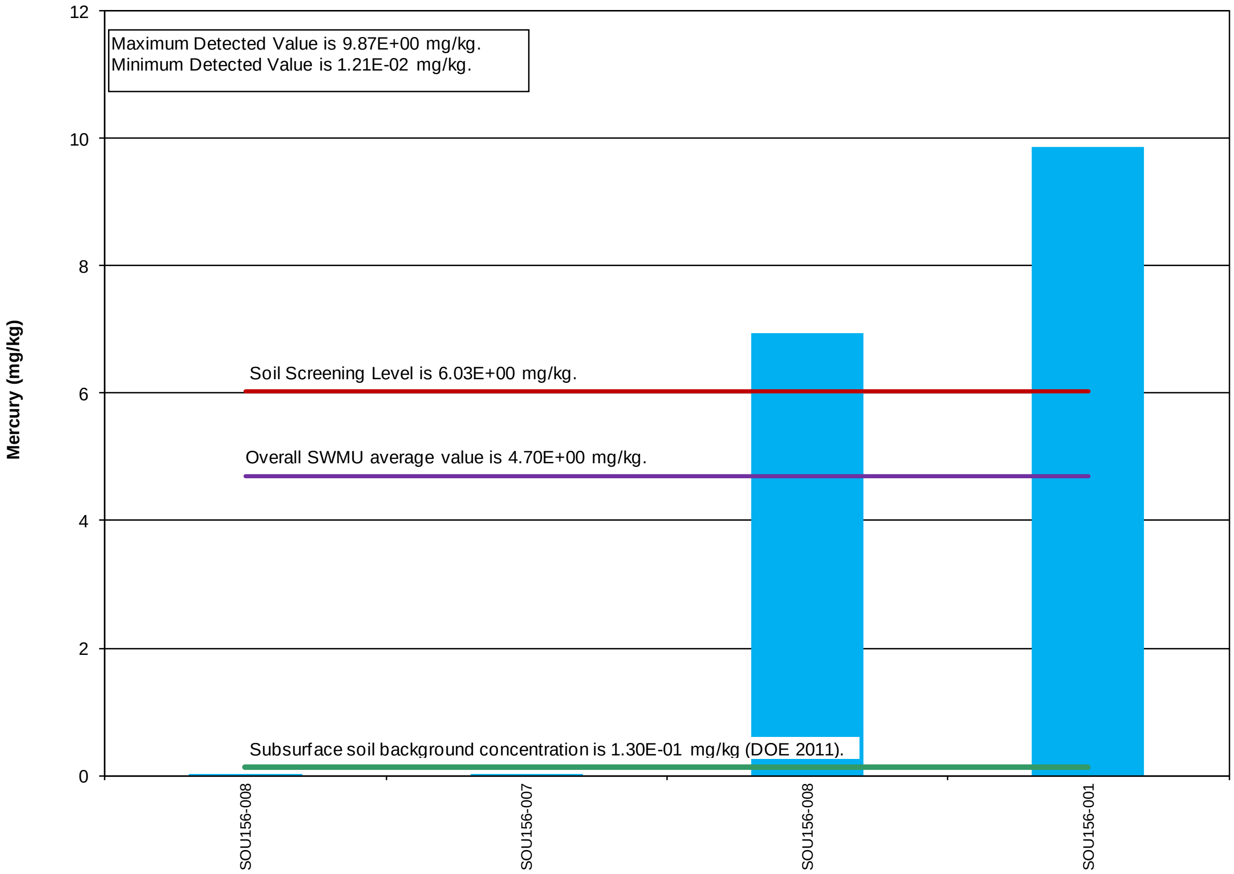

Figure C6.2.3.3. Mercury Detections at SWMU 156

Silver was detected in 4 of 27 samples. The chart illustrating the detections is shown in Figure C6.2.3.4. The average for silver over SWMU 156 was greater than the RG SSL and background; however, it was not modeled for groundwater fate and transport because silver was assessed for nature and extent of during the GWOU FS, and silver is a COC in the plumes associated with PGDP (DOE 2001d). The evaluation presented in Attachment C1 to Appendix C did not identify any RGA silver impacts; therefore, neither fate and transport modeling nor hot spot evaluation was performed for this chemical at this SWMU.

The sample with the highest detected value, 11.92 mg/kg from location 156-PL-01, was analyzed using XRF and was duplicated by another sample from the same depth and location using SW846-6020. The two analyses are not similar; the analysis using SW846-6020 had a result of 0.069 mg/kg. However, even if these tow samples are eliminated from the data set, the average for the entire SWMU remains higher than background because the of detection limit of XRF analyses, 10 mg/kg. Using 5 mg/kg or half of the detection limit for 23 of the 27 samples results in an overall average that is higher than background, however, a large majority of samples did not have detectable concentrations of silver.

Because only one sample had a concentration greater than the RG SSL, a hot spot evaluation was not performed.

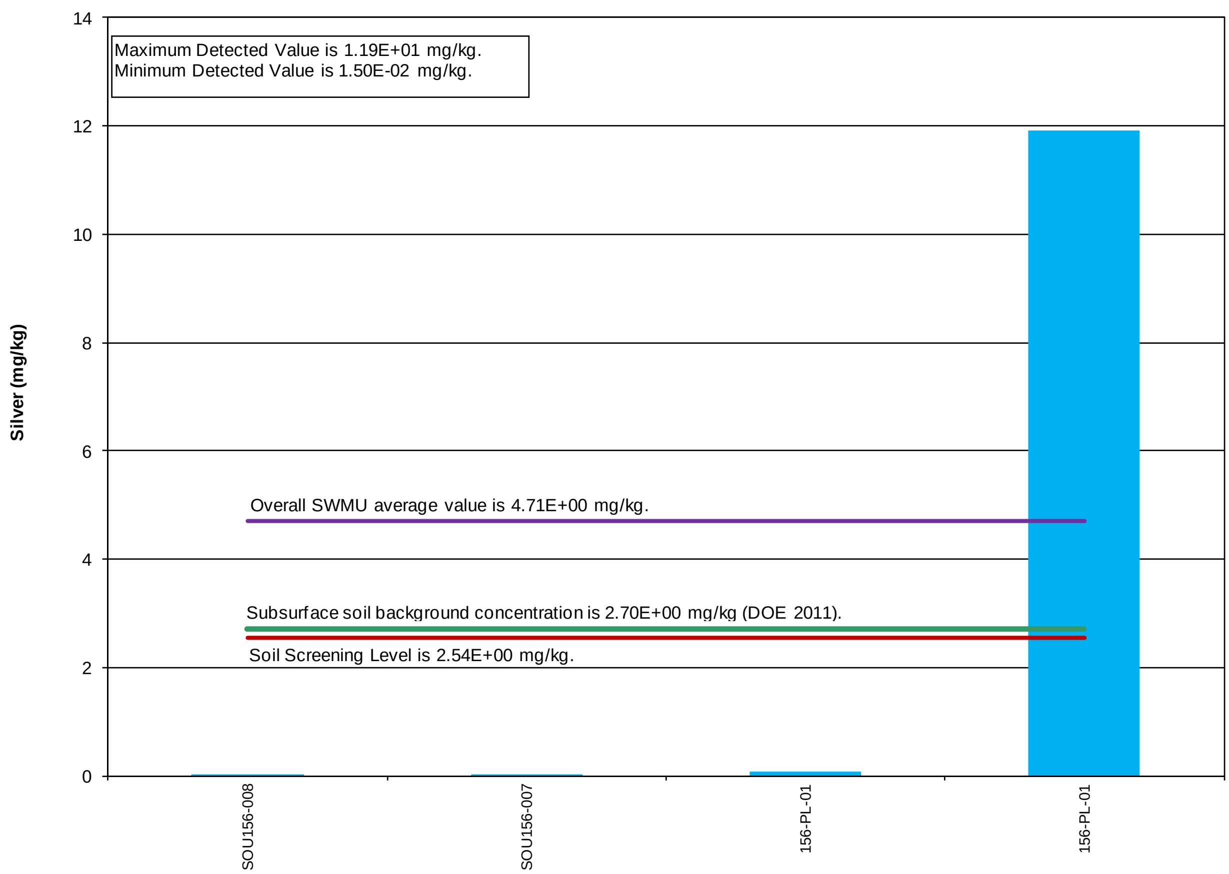

Figure C6.2.3.4. Silver Detections at SWMU 156

C6.2.4 SWMU 160, C-745 CYLINDER YARD (PCB SOILS) SPOILS

Data for SWMU 160 consisted of both historical data and RI data.

Silver was detected in 3 of 7 samples. The chart illustrating the detections is shown in Figure C6.2.4.1. The average for silver over SWMU 160 was greater than the RG SSL and background; therefore, silver was assessed for nature and extent of during the GWOU FS, and silver is a COC in the plumes associated with PGDP (DOE 2001d). The evaluation presented in Attachment C1 to Appendix C did not identify any RGA silver impacts; therefore, fate and transport modeling was performed for this chemical at this SWMU. Because only one sample had a concentration greater than the RG SSL, a hot spot evaluation was not performed.

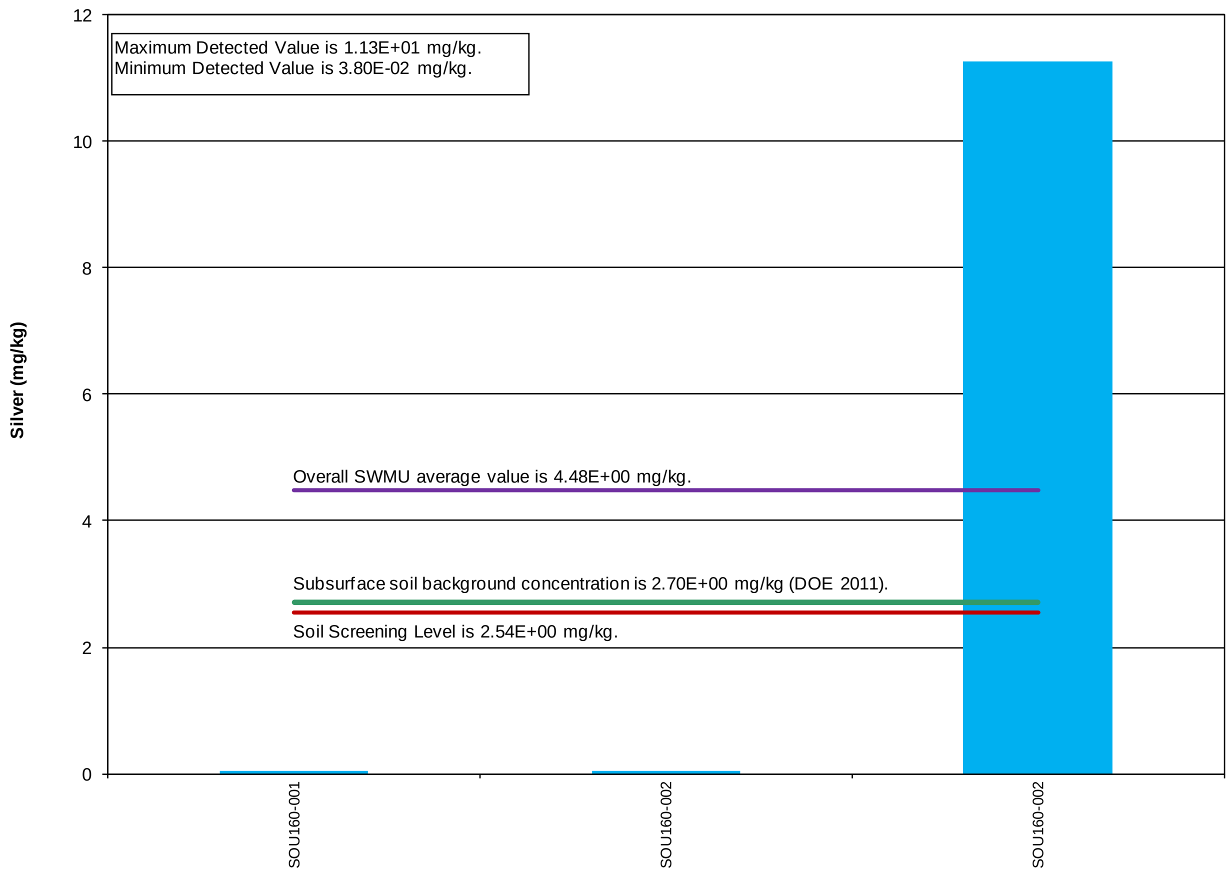

Figure C6.2.4.1. Silver Detections at SWMU 160

C6.2.5 SWMU 163, C-304 HVAC PIPING SYSTEM (SOIL BACKFILL FROM C-611)

Data for SWMU 163 consisted of both historical data and RI data. SWMU 163 exceedances of the RG SSL include cobalt, iron, manganese, mercury, silver, and vanadium. Because the maximum concentration of cobalt, iron, and manganese was less than the RG SSL, no additional evaluation was performed.

Mercury was detected in 3 of 33 samples. The chart illustrating the detections is shown in Figure C6.2.5.1. The average for mercury over SWMU 163 was less than the RG SSL, and mercury was not identified as a COC in the groundwater plumes associated with PGDP; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU (DOE 2001d). Only one sample had a concentration greater than the RG SSL so a hot spot evaluation was not necessary.

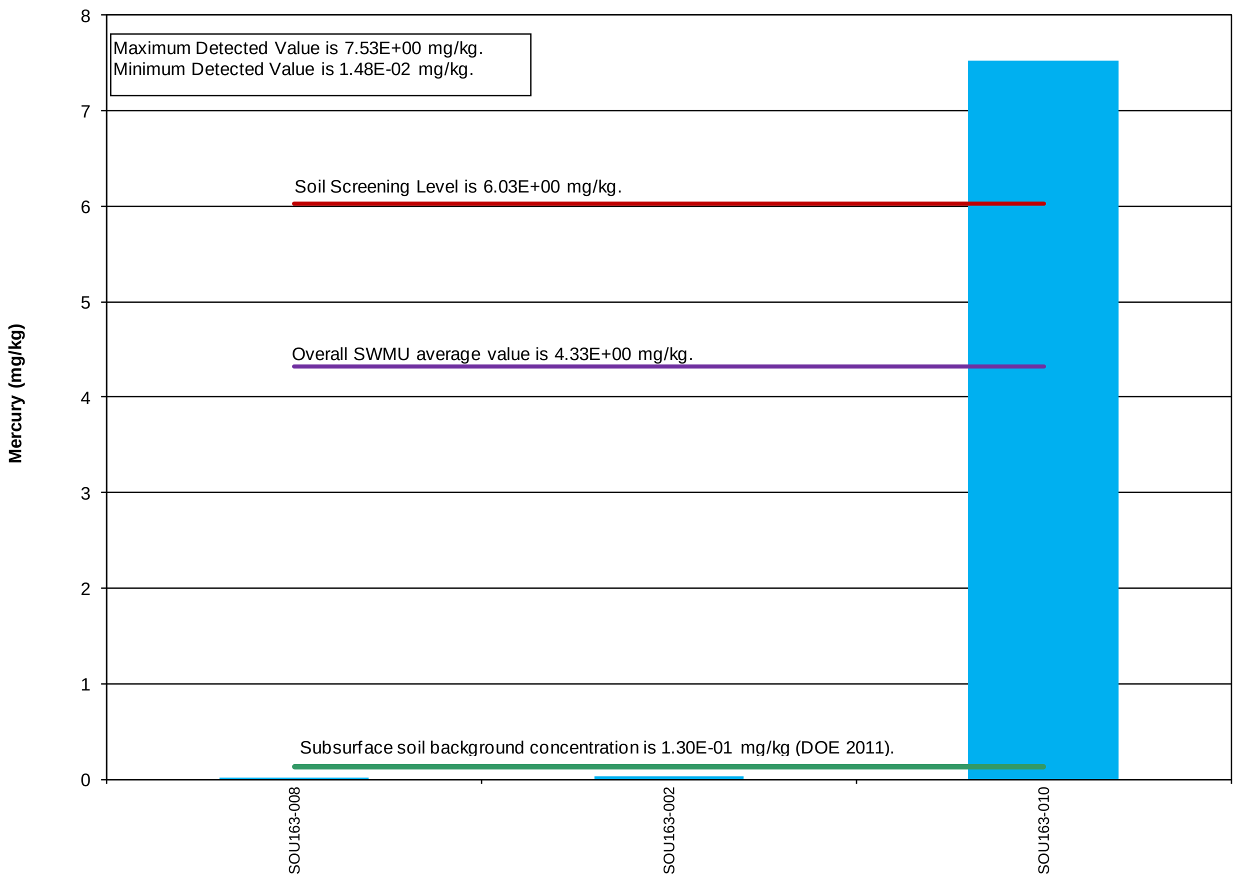

Figure C6.2.5.1. Mercury Detections at SWMU 163

Silver was detected in 4 of 33 samples. The chart illustrating the detections is shown in Figure C6.2.5.2. The average for silver over SWMU 163 was greater than the RG SSL and background; however, it was not modeled for groundwater fate and transport because silver was assessed for nature and extent of during the GWOU FS, and silver is a COC in the plumes associated with PGDP (DOE 2001d). The evaluation presented in Attachment C1 to Appendix C did not identify any RGA silver impacts; therefore, neither fate and transport modeling nor hot spot evaluation was performed for this chemical at this SWMU.

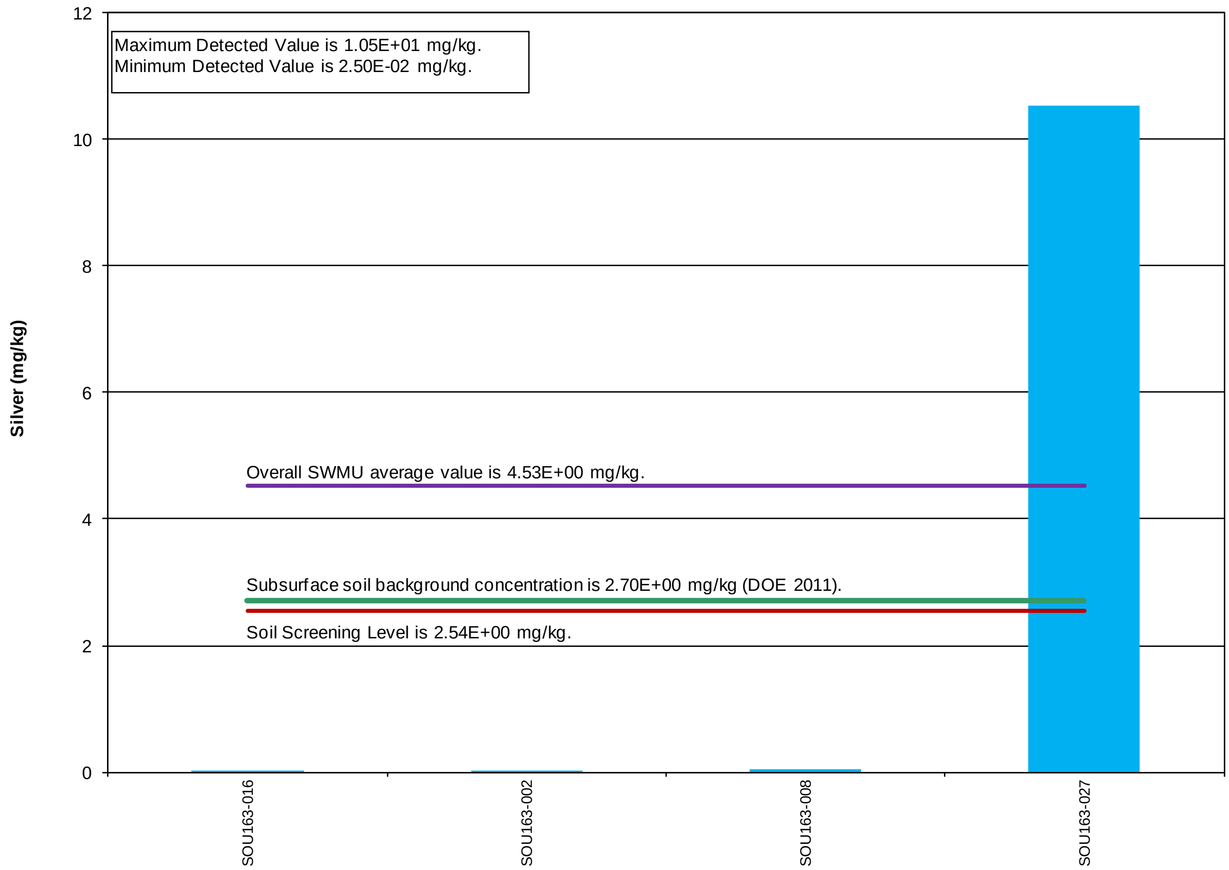

Figure C6.2.5.2. Silver Detections at SWMU 163

Vanadium was detected in 5 of 5 samples. The chart illustrating the detections is shown in Figure C6.2.5.3. The average for vanadium over SWMU 163 was less than background; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Because only one sample had a concentration greater than background, a hot spot evaluation was not performed.

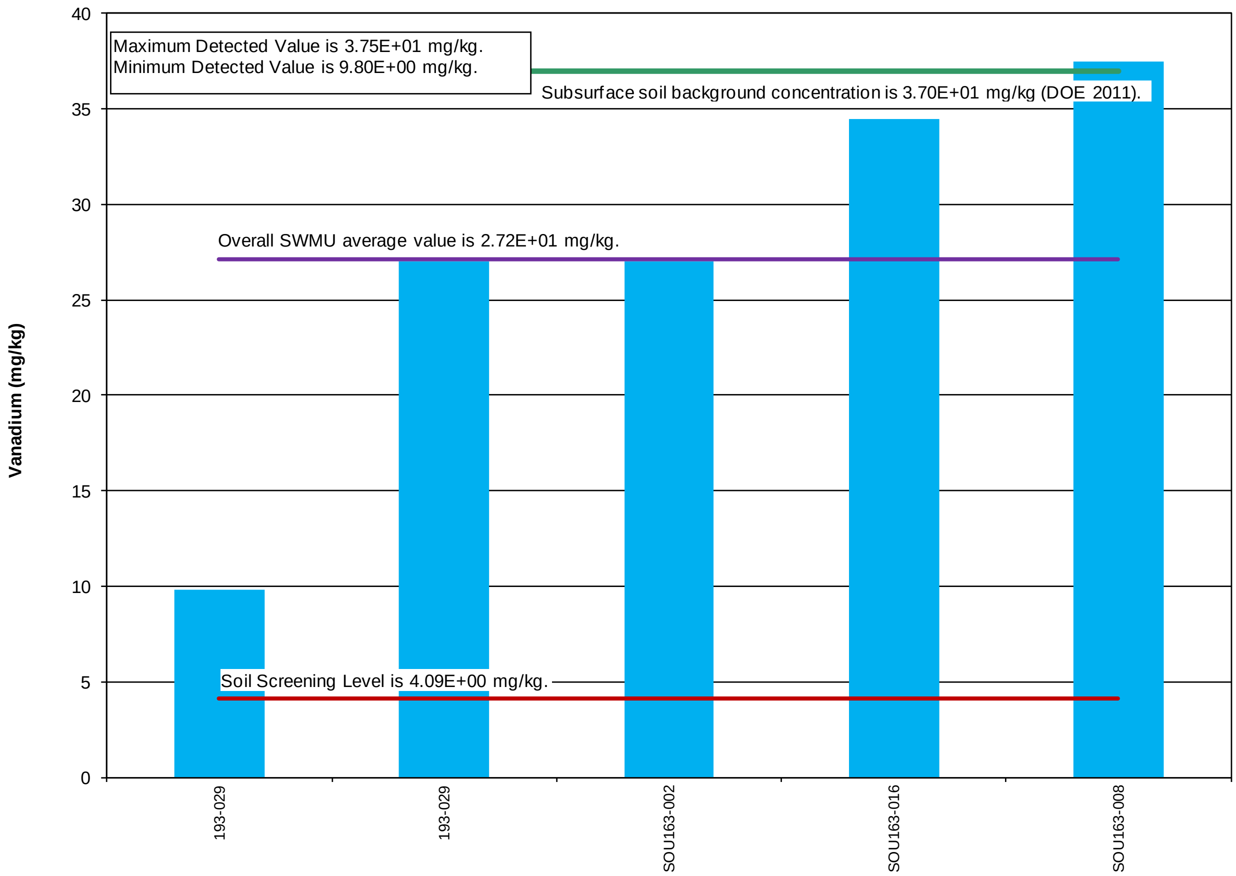

Figure C6.2.5.3. Vanadium Detections at SWMU 163

C6.2.6 SWMU 219, C-728 DMSA OS-08, EMPTY FIBERGLASS TANK

Data for SWMU 219 consisted entirely of RI data. SWMU 219 exceedances of the RG SSL include cobalt, iron, manganese, and vanadium. The maximum concentrations of each of these chemicals of potential concern did not exceed the RG SSL; therefore, no additional evaluation was performed for these chemicals at this SWMU.

C6.2.7 SWMU 488, C-410 TRAILERS, PCB CONTAMINATION AREA

Data for SWMU 488 consisted of both historical data and RI data. SWMU 488 exceedances of the RG SSL include Total PCBs, cobalt, iron, manganese, and vanadium; however, only Total PCBs had detected values that exceeded the RG SSL.

Total PCBs were detected in 1 of 10 samples. The chart illustrating the detections is shown in Figure C6.2.7.1. The average for Total PCBs over SWMU 488 was less than the RG SSL; therefore, groundwater fate and transport modeling was not performed for this chemical at this SWMU. Because only one sample had a concentration greater than the RG SSL, a hot spot evaluation was not performed.

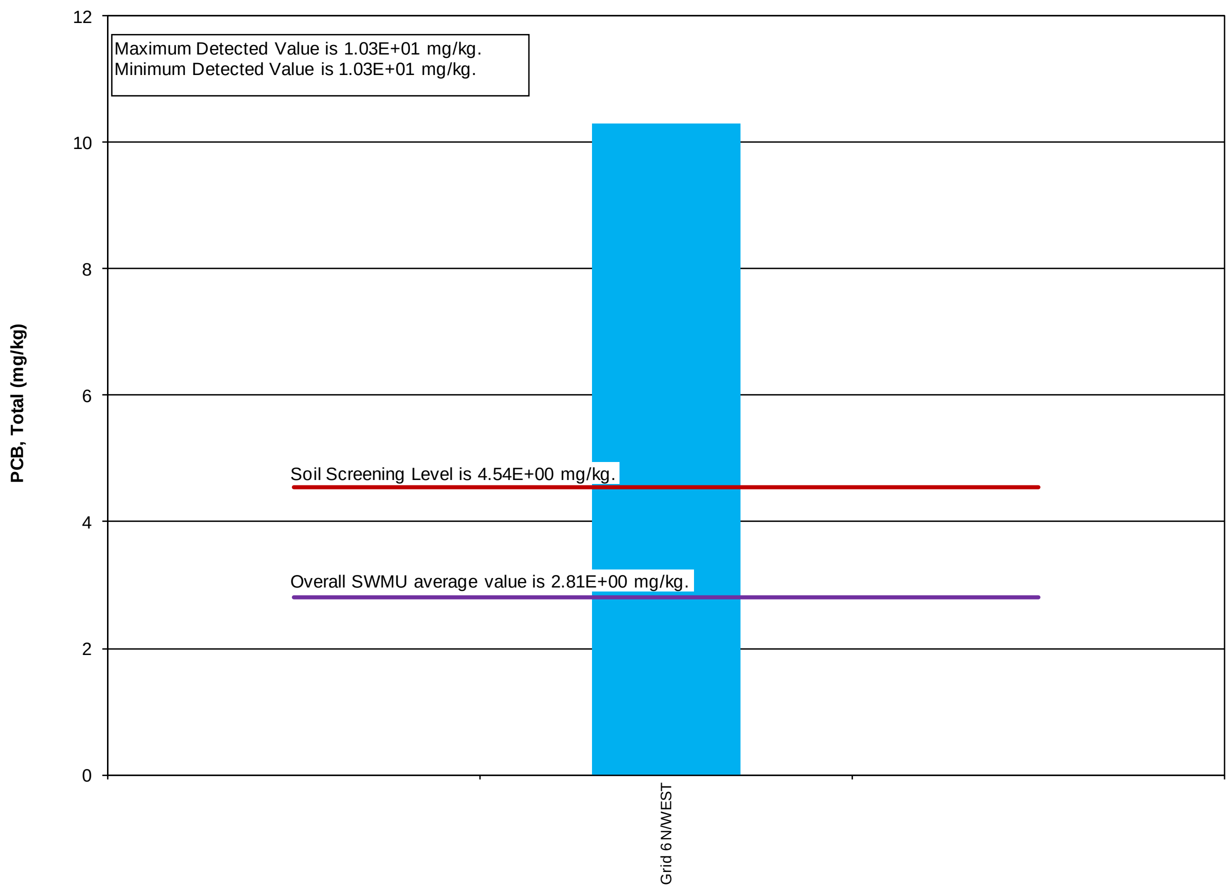

Figure C6.2.7.1. Total PCB Detections at SWMU 488

APPENDIX D

BASELINE HUMAN HEALTH RISK ASSESSMENT

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CONTENTS

FIGURES

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TABLES

EXHIBITS

ACRONYMS

ABS	dermal absorption factor
AOC	Area of Concern
AT	average ton
BAF	bioaccumulation factor
BERA	baseline ecological risk assessment
BGOU	Burial Grounds Operable Unit
bgs	below ground surface
BHHRA	Baseline Human Health Risk Assessment
BRA	baseline risk assessment
BW	body weight
CAS	Chemical Abstract Service
CDI	chronic daily intake
COC	contaminant of concern
COPC	chemical of potential concern
CSM	conceptual site model
D&D	decontamination and decommissioning
DCE	dichloroethene
DMSA	U.S. Department of Energy Material Storage Area
DOE	U.S. Department of Energy
DQA	data quality analysis
ED	exposure duration
EF	exposure frequency
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EU	exposure unit
FI/CR	Final Inventory and Characterization Report
FS	feasibility study
GDP	gaseous diffusion plant
GI	gastrointestinal tract
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HP	health physics
HQ	hazard quotient
HVAC	heating, ventilation, and air-conditioning
IRIS	Integrated Risk Information System
KDEP	Kentucky Department for Environmental Protection
KDWM	Kentucky Division of Waste Management
KPDES	Kentucky Pollutant Discharge Elimination System
LBC	Little Bayou Creek
LLW	low-level waste
NAL	no action level
NCEA	National Center for Environmental Assessment
NFA	no further action
NSDD	North-South Diversion Ditch
OREIS	Oak Ridge Environmental Information System
ORPS	Occurrence Reporting and Processing System
OU	operable unit

PAH	polycyclic aromatic hydrocarbon
PbB	blood lead
PCB	polychlorinated biphenyl
PGDP	Paducah Gaseous Diffusion Plant
POC	pathway of concern
POE	point of exposure
PSS	plant shift superintendent
RAGS	Risk Assessment Guidance for Superfund
RAIS	Risk Assessment Information System
RAO	remedial action objective
RAR	remedial action report
RCRA	Resource Conservation and Recovery Act
RCW	recirculating cooling water
RfD	reference dose
RGA	Regional Gravel Aquifer
RGO	remedial goal option
RI	remedial investigation
RME	reasonable maximum exposure
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SAR	Solid Waste Management Unit Assessment Report
SE	site evaluation
SESOIL	Seasonal Soil Compartment Model
SF	slope factor
SI	site investigation
SQL	sample quantitation limit
SSL	soil screening level
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TCE	trichloroethene
TEF	toxicity equivalence factor
TSCA	Toxic Substances Control Act
UCL	upper confidence limit
UCL95	95% upper confidence limit of the mean
USEC	United States Enrichment Corporation
VOA	volatile organic analyte
VOC	volatile organic compound
WAG	waste area grouping
WKWMA	West Kentucky Wildlife Management Area
XRF	X-ray fluorescence

BASELINE HUMAN HEALTH RISK ASSESSMENT

This baseline human health risk assessment (BHHRA) utilizes information on 50 solid waste management units (SWMUs) collected during the recently completed remedial investigation (RI) of 86 Soils Operable Unit (OU) SWMUs, in addition to information collected during previous investigations (listed in Section D.1), to characterize the baseline risks posed to human health from contact with contaminants in soil at these SWMUs/areas of concern (AOCs) and at locations to which contaminants may migrate. A summary of the data is presented Sections 5-11.

Part of Goal 3 for the Soils OU RI, as presented in the Soils OU Work Plan (DOE 2010a), was to determine if contaminants at the Soils OU units are present at levels sufficiently high to pose a risk to human health or the environment. Risk assessments for potential residential, industrial, excavation, and recreational scenarios are presented here. The sampling information collected during the RI and in earlier investigations, the analyses of these data presented in Chapters 5—11 of the RI Report, and the results of this BHHRA will be used to determine if response actions are appropriate for the SWMUs/AOCs and to screen among response action alternatives. This risk assessment also includes modeled concentrations of contaminants in the Regional Gravel Aquifer (RGA) to support the refinement of an assessment of risks to human health and the environment through groundwater for those SWMUs/AOCs that had contaminant concentrations exceeding the respective soil screening levels (SSLs) for the RGA (see Appendix C).

The methods and presentations used in this BHHRA are consistent with those presented in *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant* (DOE 2011a). The Risk Methods Document integrates the human health risk assessment guidance from the U.S. Environmental Protection Agency (EPA) and the Kentucky Department for Environmental Protection (KDEP) and incorporates instructions contained in regulatory agency comments on earlier risk assessments performed for Paducah Gaseous Diffusion Plant (PGDP).

Consistent with the 2011 revision to the Risk Methods Document, the Soils OU RI BHHRA is presented in nine sections, as described below.

- The first section (D.1) reviews the results of previous risk assessments that are useful in understanding the potential risks posed to human health by contaminants at or migrating from the source areas.

- The second section (D.2) includes identification of chemicals of potential concern (COPCs).

- The third section (D.3) documents the exposure assessment for the sources, including the following:

  — The characterization of the exposure setting,

  — Identification of exposure pathways,

  — Consideration of land use,

  — Determination of potential receptors,

  — Delineation of exposure points and routes [including development of the conceptual site model (CSM)], and

  — Calculation of chronic daily intakes (CDIs).

- The fourth section (D.4) presents the following:
    - The toxicity assessment, including information on the noncarcinogenic (i.e., systemic toxicity or hazard) and carcinogenic effects of the COPCs, and
    - The uncertainties in the toxicity information.
- The fifth section (D.5) reports the following:
    - The results of the risk characterization for current and future land uses; and
    - Identifies contaminants, pathways, and land use scenarios of concern.
- The sixth section (D.6) contains qualitative and quantitative analyses of the uncertainties affecting the results of the BHHRA.
- The seventh section (D.7) summarizes the methods used in the BHHRA and presents the BHHRA's conclusions and observations.
- The eighth section (D.8) uses the results of the BHHRA to develop site-specific risk-based remedial goal options (RGOs).
- The ninth section (D.9) contains references.

The overall risk assessment process is presented in Figure D.1, which graphically displays the steps identified in the preceding section.

D.1. RESULTS OF PREVIOUS STUDIES

Several previous reports contain risk assessment results for one or more of the SWMUs/AOCs considered in this RI. The results of these assessments are summarized here for each SWMU/AOC. This RI includes new soil data (DOE 2010a) and up-to-date toxicity and exposure parameters (DOE 2011a); therefore, a comparison with historical cancer risk and non-cancer hazard index data was not considered further. Reports containing previous assessments and the year the assessment was completed are included in the references to this section. Methodologies used in previous risk assessment are likely different than those used in this BHHRA and, therefore, results may differ between the two risk assessments. A comprehensive list of historical projects from which data were collected is presented in Appendix B.

D.1.1 GROUP 1, FORMER FACILITY AREAS

Group 1 includes former facility areas and storage areas. This chapter includes a discussion of the SWMU/AOC in the former facility areas subgroup.

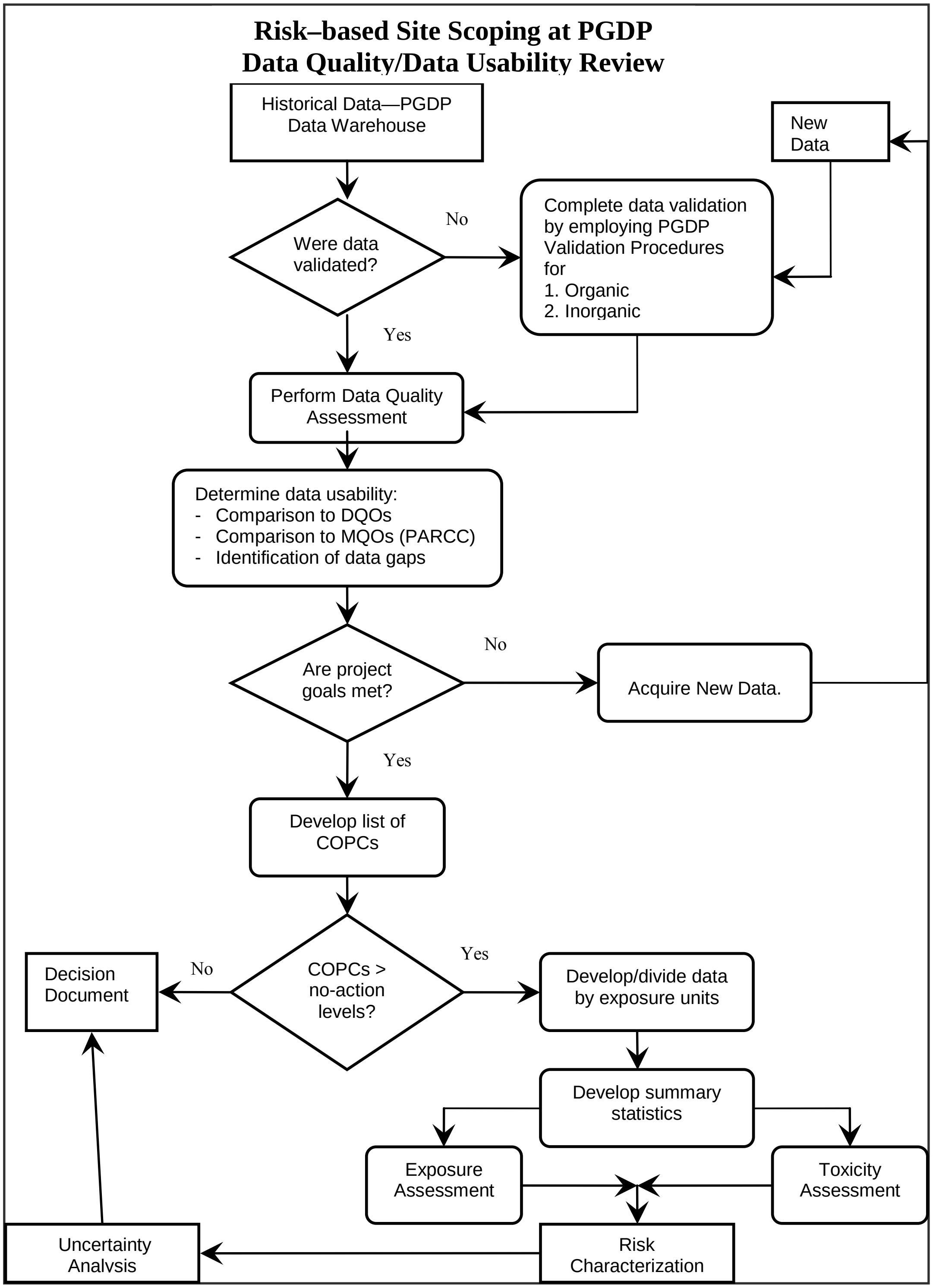


Figure D.1. BHHRA Flow Chart

D.1.1.1 SWMU 1, C-747-C Oil Landfarm

Investigations that have collected data on SWMU 1 include the Phase I and Phase II Site Investigation (SI) (CH2M HILL 1991, 1992). Additional sampling was performed to support the Waste Area Group (WAG) 23 FS (DOE 1996a), the WAG 23 Proposed Remedial Action Plan (DOE 1998a), the WAG 27 RI (DOE 1999a), and the Southwest Plume SI (DOE 2004a). These investigations and actions identified solvents, polychlorinated biphenyls (PCBs), dioxins, semivolatile organic compounds (SVOCs), heavy metals, and radionuclides as potential contaminants of concern (COCs) (DOE 1999a).

A summary of conclusions from the WAG 23 effort is as follows:

> Following the removal action at WAG 23 sites, the residual polychlorinated biphenyl (PCB) ELCR based on a 250 day/year exposure scenario is … below *de minimis* [i.e., a cumulative human health excess lifetime cancer risk (ELCR) of 1×10^{-6} or a cumulative hazard index (HI) of 1]. These risk levels are well within the EPA's acceptable risk range of 1×10^{-4} to 1×10^{-6}, as required by the NCP [National Oil and Hazardous Substances Pollution Contingency Plan].

The WAG 27 RI found trichloroethene (TCE) in SWMU 1 soils. The areal extent of TCE contamination in the vadose zone (vadose zone is defined as extending from the top of the ground surface to the water table) soils on the north side of the site is approximately 175 ft x 115 ft. The TCE-impacted soil was found to extend from 5 ft bgs to the top of the water table at 50 ft bgs. Metals also were detected in the subsurface soils at concentrations that were 27 times (silver) background levels. The metals are widely dispersed throughout the SWMU, but the highest metal concentrations generally are restricted to the upper 20 ft of vadose soil.

The primary COCs indentified in WAG 27 RI were beryllium and lead for surface and subsurface soils. Scenarios that were assessed in the WAG 27 baseline risk assessment (BRA) are the following:

- Current on-site industrial worker,
- Future on-site industrial worker,
- Future on-site excavation worker,
- Future on-site recreational user,
- Future off-site recreational user,
- Future on-site rural resident, and
- Future off-site rural resident.

The following is an excerpt on land use scenarios from WAG 27 RI (where scenarios of concern were considered for an ELCR $\geq 1 \times 10^{-6}$ and/or an HI ≥ 1):

"At SWMU 1 and SWMU 91, all scenarios assessed are a land use scenario of concern for both systemic toxicity and ELCR."

D.1.1.2 SWMU 99B, C-745 Kellogg Building Site—Septic System/Leach Field

SWMU 99 (A and B) was investigated during the Phase II SI (CH2M HILL 1992). Volatile organic compounds (VOCs) (primarily TCE), metals, and radionuclides were reported in the groundwater samples collected.

The WAG 28 RI/Feasibility Study (FS) (DOE 2000b) conducted in 1999 focused on potential metals contamination in soils of SWMU 99 (A and B) based on previous studies and the process knowledge of the activities conducted in this area at the Kellogg Building Site. These studies noted the sporadic presence of some metals in soil at slightly above background levels for subsurface soils. These metals include antimony, barium, beryllium, cadmium, chromium, iron, lead, manganese, and vanadium.

The data from WAG 28 RI/FS was assessed for risk. The results are documented in *Remedial Investigation Report for Waste Area Grouping 28 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2000a). The SWMU was divided into two sections—99A (Kellogg Building Site) and 99B (septic system/leach field)—in the risk assessment.

SWMU 99B

Land use scenarios evaluated for 99b were the following:

- Future on-site industrial worker,
- Future on-site excavation worker,
- Future on-site rural resident, and
- Future off-site rural resident.

COCs for 99B were identified as beryllium, TCE, lead, radon-222, and chromium.

SWMU 99 (both 99A and 99B)

Significant results of the BHHRA and baseline ecological risk assessment (BERA) pertinent to this investigation were as follows:

- Scenarios for which human health risk exceeds *de minimis* levels were as follows:

  (1) Future industrial worker exposure to RGA groundwater and McNairy groundwater;
  (2) Future on-site resident exposure to soil, RGA groundwater, and McNairy groundwater;
  (3) Current off-site resident exposure to groundwater;
  (4) Future excavation worker exposure to soil;
  (5) Current industrial worker exposure to soil;
  (6) Future industrial worker exposure to soil;
  (7) Future on-site resident exposure to soil; and
  (8) Future recreational user exposure to soil.

Significant results of the ecological risk assessment pertinent to this investigation are as follows:

- Although chromium and zinc exceed benchmarks for plants and soil invertebrates and barium exceeds benchmarks for plants, potential risks to plant and soil invertebrate communities from future exposure to surface soil at this site appear low.

- Estimated doses from exposure to radionuclides in soil are below recommended dose rate limits for wildlife, but dose rates for plants and soil invertebrates are higher than the recommended dose rate limit of 1 rad/day. Technetium-99 was the radionuclide of concern based on its occurrence in a single sample.

D.1.1.3 SWMU 194, DUF_6 Facility McGraw Construction Facilities (Southside)

The Northeast Plume Investigation (DOE 1995a) was conducted in 1995 to identify possible sources of contamination associated with various buildings and operations within SWMU 194. The results of this investigation indicated potential metal contamination. The WAG 28 RI conducted in 1999 focused on potential metals contamination of SWMU 194 based on the previous study and the process knowledge of the activities conducted in this area by the McGraw Construction Facilities. This study noted the sporadic presence of some metals that were slightly above background levels. These metals included aluminum, beryllium, cadmium, calcium, iron, lead, magnesium, sodium, vanadium, and zinc (DOE 2000a).

Additional site characterization was conducted in 2000 in support of the depleted uranium hexafluoride (DUF_6) conversion project. The results of this investigation are documented in *DUF_6 Conversion Facility Site Characterization Report, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (BJC 2001).

The data contained in the aforementioned studies have been assessed for risk. The results are documented in *Baseline Human Health Risk Assessment and Screening Ecological Risk Assessment for the Proposed Site of the UF_6 Conversion Facility, Including the Eastern Portion of SWMU 194, McGraw Construction Facilities (South Side), at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2001a).

Significant results of the BHHRA and Screening Ecological Risk Assessment were that the soil at the present location of the uranium hexafluoride (UF_6) Conversion Facility [operated by B&W Conversion Services (BWCS)] and that portion of SWMU 194 overlain by BWCS have been well characterized, the risks to the health of the BWCS employees from exposure to soil fall within the acceptable risk range, and adverse impacts from contamination in soil to ecological receptors are not expected.

The risk assessment supported a no further action (NFA) recommendation for the proposed site of the UF_6 Conversion Facility if the site is developed and maintained as an industrial area.

D.1.1.4 SWMU 196, C-746-A Septic System

Subsurface soil samples and groundwater samples were obtained during the WAG 27 RI/FS. The COCs (i.e., contaminants whose chemical-specific HI was greater than 1 or whose ELCR was greater than 1×10^{-6}) from WAG 27 RI Report were lead, antimony, beryllium, and iron (DOE 1999a).

The area impacted by metals at the northeast septic system is approximately 70 ft x 60 ft (includes septic tank and leach field) and extends to approximately 10 ft bgs. The area impacted by the metals contamination along the northwest drain lines is more extensive and is approximately 100 ft x 10 ft along the line extending north-south to the west of the building and 180 ft x 10 ft along the line extending east-west to the west of the septic tank. The contamination extends to approximately 10 ft bgs along both of these lines.

Scenarios that were assessed in the WAG 27 RI Report are the following:

- Current on-site industrial worker,
- Future on-site industrial worker,
- Future on-site excavation worker,
- Future on-site recreational user,
- Future off-site recreational user,
- Future on-site rural resident, and
- Future off-site rural resident.

An excerpt on land use scenarios from WAG 27 RI Report follows:

> At SWMU 196 for all scenarios assessed, including lead as a COPC, only the future recreational user exposure to soil for both systemic toxicity and ELCR is not of concern.

Possible exceptions at SWMU 196 are the current and future industrial worker exposure to soil which has a total hazard index which falls below 1 if contribution from lead is not considered.

D.1.1.5 SWMU 489, C-710 North Septic Tank, North of C-710

In May 2001, radiological surveys of this area and materials were performed. Results of this survey indicated no radiological contamination was present. Additionally, a sample of the sand showed no results above background.

D.1.1.6 SWMU 531, C-746-A South Aluminum Slag Reacting Area

From analyses of samples collected from SWMUs 139 and 196A, which are located near SWMU 531, some elevated concentrations of metals (aluminum, calcium, iron, and magnesium) in soils were noted as presented in the 2002 SWMU Assessment Report (SAR) (DOE 2002a).

D.1.2 GROUP 1, STORAGE AREAS

Group 1 includes former facility areas and storage areas. This chapter includes a discussion of the SWMUs in the storage area subgroup.

D.1.2.1 SWMU 200, Central PGDP Soil Contamination South of TSCA Waste Storage Facility

Site characterization sampling was performed prior to construction of a Toxic Substances Control Act (TSCA) waste storage facility. The surface sampling showed elevated levels of PCBs and radiological contaminants to be present.

D.1.2.2 SWMU 212, C-745-A Radiological Contamination Area

Subsurface soil samples were obtained in support of the C-745-A Cylinder Storage Yard construction project. Results of the sampling effort indicated the following were detected contaminants: technetium-99, thorium-230, plutonium-239/240, americium-241, cesium-137, neptunium-237, uranium-234, uranium-235, and uranium-238.

D.1.2.3 SWMU 213, C-745-A, OS-02

The Final Inventory and Characterization Report (FI/CR) was submitted September 16, 2002, to the Kentucky Division of Waste Management and approved on July 21, 2005 (DOE 2002b). Resource Conservation and Recovery Act (RCRA) closure was not required for this SWMU because no hazardous wastes were stored in this unit; therefore, no risk assessments have been performed for this SWMU to date.

D.1.2.4 SWMU 214, C-611, OS-03

There have been no known spills or releases of materials from this facility to the environment. A certified RCRA Closure Report was approved by KDEP on February 13, 2007, for this U.S. Department of Energy (DOE) Material Storage Area (DMSA) (DOE 2002c). The Division of Waste Management "determined that the characterization, removal and disposal of hazardous waste meets the applicable requirements of the approved Agreed Order Closure Plan for DMSAs, dated December 23, 2005" (Webb 2007). The closure report documented that no sign of spill or release was found. There have been no known spills or releases of materials from this SWMU to the environment. There are no prior risk assessments for this SWMU.

D.1.2.5 SWMU 215, C-743, OS-04

The history of this railcar could not be ascertained definitively. It likely was brought on-site to deliver an acid compound. Subsequent uses may have included water storage for fire fighting, spill control (storage), and/or fire training. In August of 2005, as part of the DMSA characterization and remediation project, the railcar was removed.

The railcar, valve, and ground beneath the rail car were surveyed for radiological contamination in April 1999. Results indicated contamination on randomly selected rock from beneath the valve. In addition, results from sampling the liner of the railcar in February 2006 indicated uranium contamination. This DMSA now qualifies as a Phase 3 DMSA because it has been characterized fully and contains no fissionable material (DOE 2002d). As part of the DMSA characterization, soil samples were collected based on the radiological survey in April and December 2002. Eight samples were collected from six sampling locations. Two of the locations were identified as hot spots on a health physics (HP) survey. Radiological results indicated that the highest alpha reading was 5,376 disintegrations per minute (dpm)/100 cm^2 and the highest beta/gamma reading was 506,500 dpm/cm^2. Two samples at two separate depths were collected at these two hot spots. The other four locations were chosen to verify the HP survey results. There is no prior risk assessment for this SWMU.

D.1.2.6 SWMU 216, C-206, OS-05

No evidence of a release was found and process knowledge indicates none has occurred. Vegetation in the area is flourishing. A certified RCRA Closure Report was approved by KDEP on February 13, 2007, for this DMSA (DOE 2002e). The Division of Waste Management "determined that the characterization, removal and disposal of hazardous waste meets the applicable requirements of the approved Agreed Order Closure Plan for DMSAs, dated December 23, 2005" (Webb 2007). The closure report documented that no sign of spill or release was found. There have been no known spills or releases of materials from this SWMU to the environment. No prior risk assessments have been performed for this SWMU.

D.1.2.7 SWMU 217, C-740, OS-06

There are no known releases associated with this SWMU. A certified RCRA Closure Report was approved by KDEP on February 13, 2007, for this DMSA (DOE 2004b). The Division of Waste Management "determined that the characterization, removal and disposal of hazardous waste meets the applicable requirements of the approved Agreed Order Closure Plan for DMSAs, dated December 23, 2005" (Webb 2007). The closure report documented that no sign of spill or release was found. There have been no known spills or releases of materials from this SWMU to the environment. No prior risk assessments have been performed for this SWMU.

The area is a Radiological Material Area and has a posted Contamination Area inside.

D.1.2.8 SWMU 221, C-635, OS-10

This DMSA has been fully characterized and contains no fissionable material. There have been no known spills or releases of materials from this SWMU to the environment. A radiological survey of the area did not find anything above background levels (DOE 2002g). The closure report documented that no sign of a spill or release was found. The FI/CR was submitted September 18, 2002, to the Kentucky Division of Waste Management (KDWM). KDWM approved the FI/CR on April 15, 2004. RCRA closure was not required for this SWMU, because no hazardous wastes were stored in this unit. The area currently is empty. No prior risk assessments have been performed for this SWMU.

D.1.2.9 SWMU 222, C-410, OS-11

A certified RCRA Closure Report was approved by KDEP on February 13, 2007, for this DMSA. The Division of Waste Management "determined that the characterization, removal and disposal of hazardous waste meets the applicable requirements of the approved Agreed Order Closure Plan for DMSAs, dated December 23, 2005" (Webb 2007). No prior risk assessments have been performed for this SWMU.

D.1.2.10 SWMU 227, C-746-B, OS-16

A certified RCRA Closure Report was approved by Kentucky on February 13, 2007, for this DMSA (DOE 2004f). The Division of Waste Management "determined that the characterization, removal and disposal of hazardous waste meets the applicable requirements of the approved Agreed Order Closure Plan for DMSAs, dated December 23, 2005" (Webb 2007). No prior risk assessments have been performed for this SWMU.

D.1.2.11 SWMU 228, C-747-B, OS-17

This DMSA has been fully characterized and contains no fissionable material (DOE 2004g). No prior risk assessments have been performed for this SWMU.

D.1.3 GROUP 2, UNDERGROUND TANKS

The SWMUs/AOCs in Group 2 consist of underground tanks, chromium areas, and soil and rubble piles. This chapter summarizes the historical investigations at the underground tanks.

D.1.3.1 SWMU 27, C-722 Acid Neutralization Tank

A sludge sample from 1989 indicated a high level of mercury. The area soils were sampled as part of the Site Evaluation (SE) for WAGs 9 and 11 (DOE 1999c), and it was determined that contamination present at SWMU 27 does not present risks that exceed *de minimis* levels to industrial workers, potential residential groundwater users, or nonhuman receptors. Direct contact risks are *de minimis* because contaminated media are not available for direct contact at SWMU 27. Risks from use of groundwater contaminated by the migration from soil are *de minimis* because the concentrations of all contaminants in soil were below the groundwater protection screening criteria.

D.1.3.2 SWMU 76, C-632-B Sulfuric Acid Storage Tank

No previous samples have been taken at this location. No prior risk assessments have been performed for this SWMU.

D.1.3.3 SWMU 165, C-616-L Pipeline and Vault Soil Contamination

In order to address potential risks to workers who were exposed to contaminated sediments from the North-South Diversion Ditch (NSDD), a removal action was implemented, as described in the *Record of Decision for Interim Action Source Control at the North-South Diversion Ditch* (DOE 1994b). The removal action, which was completed in 1995, consisted of several components. The component pertinent to SWMU 165 included removing runoff from the C-600 Steam Plant ash pile by constructing settling lagoons then pumping the supernatant in the lagoons into the piping that replaced the southern part of the NSDD channel. The vault and lift station collect runoff and sediment from C-600 coal pile and pump it around the southern reaches of the NSDD to a point just north of the C-616-C Lift Station inlet. Water from the fly ash settling basins enters the station through underground piping from the basins. Coal pile runoff is routed into the west side of the lift station by a trench. This lift station is under the control and operation of United States Enrichment Corporation (USEC).

Past sampling events occurred in 1989, 1990, 1991, 1994, and 1995. Analysis of soil samples detected low-levels of PCBs and radionuclides. Subsurface soil samples also were obtained and analyzed as part of the SE for WAGs 9 and 11 (DOE 1999c). Characterization of the area has identified elevated levels of PCBs, uranium, and technetium-99.

Summary excerpts from the SE are as follows:

> It is concluded that the contamination present at SWMU 165 does not present risks to industrial workers, potential residential groundwater users, or non-human receptors that exceed *de minimis* levels. Direct contact risks are regarded acceptably low even though a confirmatory sample determined that PAHs may be present at SWMU 165 at concentrations that exceed *de minimis* levels.
>
> None of the PAHs was detected at a concentration that exceeds the systemic toxicity RBC calculated using a hazard index (HI) or the KDEP soil screening value. However, six PAHs were detected at a concentration that exceeds the cancer risk RBC calculated using a excess lifetime cancer risk (ELCR) of 1×10^{-7}, and five of these six PAHs were detected at a concentration that exceeds the KDEP soil screening value. Significantly, two PAHs, benzo(a)pyrene and dibenz(a,h)anthracene, were detected at concentrations that were greater than l00X the cancer risk RBC, or at a concentration that may result in risks to an unrestricted worker that approach 1×10^{-4}. However, of these two PAHs, one, benzo(a)pyene, was reported detected at the detection limit.

D.1.3.4 SWMU 170, C-729 Acetylene Building Drain Pits

A sludge sample was obtained and analyzed from each of the pits in 1993. Results indicated a high pH, volatiles, and uranium contamination. Surface and subsurface sampling results from the WAGs 9 and 11 SE (DOE 1999c) showed no VOCs present.

An excerpt from the SE is as follows:

> From the SE for SWMU 170, it is concluded that the contamination present does not present risks to industrial workers, potential residential groundwater users, and non-human receptors that exceed *de minimis* levels. Direct contact risks are *de minimis* because contaminated media are not available for direct contact at SWMU 170. Risks from the use of groundwater where contamination has migrated from soil also are regarded acceptably low, though two detections of uranium-238 exceed background. These exceedances are deemed to be of little significance because the magnitude of the exceedance is minor (i.e., 1.40 and 2.55 pCi/g verses a background of 1.20 pCi/g) and because previous work has determined that uranium has limited mobility in the subsurface at PGDP.

D.1.4 GROUP 2, CHROMIUM AREAS

The SWMUs/AOCs in Group 2 consist of underground tanks, chromium areas, and soil and rubble piles. This chapter summarizes the investigation at the chromium areas.

D.1.4.1 SWMU 158, C-720 Chilled Water System Leak Site

The primary function of the system was to provide cooling water for computer systems and heating ventilation, and air-conditioning (HVAC) systems in various plant buildings. The site is an area where approximately 3,500 gal of chromated water from the chilled water system leaked into an adjacent electrical vault and spilled over to another connected vault. Suspected contamination is hexavalent chromium due to process knowledge.

No previous investigation results are available.

D.1.4.2 SWMU 169, C-410-E HF Vent Surge Protection Tank

The 1992 SAR indicates that sampling of the aboveground tank found chromium present. No previous investigations are available.

D.1.5 GROUP 2, SOIL/RUBBLE AREAS

The SWMUs/AOCs in Group 2 consist of underground tanks, chromium areas, and soil and rubble piles. This chapter summarizes the investigation at the soil/rubble piles.

D.1.5.1 SWMU 19, C-410-B HF Neutralization Lagoon

The C-410-B HF Emergency Lagoon (SWMU 19) is a below-grade impoundment with an earth/clay floor and wire-reinforced concrete walls. SWMU 19 is located north of the C-410 Building in the central portion of the plant site. SWMU 19 is approximately 1,900 ft^2 (38 ft x 51 ft) and 7-ft deep. This SWMU was excavated as described in the *Action Memorandum for the Soils Operable Unit Inactive Facilities* (DOE 2009b).

SWMU 19 was part of the Soils OU Inactive Facilities Removal Action; therefore, no additional samples were required during this investigation. Eight samples were collected at SWMU 19 after the removal action. These samples were evaluated and indicated the following:

- Total uranium concentrations ranged from less than the detection limit (of 0.896 mg/kg) to 164 mg/kg. Seven of the eight samples contained total uranium at concentrations less than 27.1 mg/kg.

- Uranium-238 levels ranged between 0.536 pCi/g and 30.6 pCi/g. All other radioactive analytes, included americium-241, cesium-237, neptunium-237, plutonium-238, plutonium-239/240, technetium-99, thorium-228, thorium-230, thorium-232, uranium-234, and uranium-235 were present in amounts less than background or less than a 1×10^{-5} risk-based SSLs for direct contact for the industrial worker (DOE 2001a).

- None of the samples had concentrations of polychlorinated biphenyls above the detection limit of 100 µg/kg.

- Detected lead and arsenic concentrations were below background.

- Polycyclic aromatic hydrocarbons, including benzo(b)fluoranthene, fluoranthene, phenanthrene, and pyrene, were detected in both floor samples and two of the six wall samples at concentrations ranging from less than the detection limit to 1,400 µg/kg. These detections were less than a 1×10^{-5} risk-based soil screening levels for direct contact for the industrial worker (DOE 2001a).

Based on the sampling results, the remedial action objectives (RAOs) for this removal action were achieved by reducing the risk to current and future workers and excavation workers from direct contact by removing known sources of contamination (DOE 2010b).

D.1.5.2 SWMU 138, C-100 Southside Berm

Characterization was performed on preliminary soil samples collected in September and October 1991 for WAG 13, and a draft screening assessment was prepared showing that the primary COCs for this SWMU were PCBs, radionuclides, mercury, and lead (Jacobs EM Team 1994).

D.1.5.3 SWMU 180, WKWMA Outdoor Firing Range (WKWMA)

The Outdoor Firing Range West Kentucky Wildlife Management Area (WKWMA) (SWMU 180) is located in the WKWMA; southwest of the plant site. The Outdoor Firing Range is controlled by the WKWMA. It is used by the Kentucky State Police as a firing range. Lead bullets are present in the berm. The unit is not used by PGDP. No sampling data are available.

D.1.5.4 SWMU 181, West Side Outdoor Firing Range (PGDP)

The Firing Range (SWMU 181) is located west of the plant site. This SWMU is included in the *Action Memorandum for the Soils Operable Unit Inactive Facilities* (DOE 2009b). Contaminated soil on the berm face has been excavated in accordance with the *Removal Action Work Plan* (RAWP) (DOE 2009d). The results of verification sampling are included here and in the *Removal Action Report* (DOE 2010b) and are summarized in the "fieldwork summary" section below.

Excavation of lead-contaminated soils began on November 30, 2009, and was completed on December 23, 2009, including demobilization. A total of 1,478 yd^3 of soil was removed and dispositioned. Confirmation sampling was performed as described in the RAWP.

The action limit and cleanup level of 800 ppm total lead, based on the industrial scenario, was achieved in all excavated areas. Based on the sampling results, the RAOs for this removal action were achieved. The removal action also successfully achieved cleanup to below 400 ppm total lead, the value for a residential scenario.

D.1.5.5 SWMU 195, Curlee Road Contaminated Soil Mounds

The Curlee Road Contaminated Soil Mounds (SWMU 195) is located in the southwest portion of the plant site. The site consists of two mounds of soil approximately 10–15 ft in height and covers 370,000 ft^2 in area. Historical knowledge indicates that potential COCs for SWMU 195 are radionuclides.

The area was created during original construction of the plant. The soil was unusable for fill due to its characteristics and was placed in this location. Some soil also came from excavation of drainage ditches and cleaning of the ditches.

No previous investigations are available.

D.1.5.6 SWMU 486, West of PGDP Rubble Pile WKWMA

The history of this site is unknown, but may have been used as a disposal area for waste material or a storage location for equipment during plant construction. In April of 2001, a radiological survey of the area and materials was performed. Results of the survey indicate no radiological contamination is present. No sampling data are available in Paducah Oak Ridge Environmental Information System (OREIS).

D.1.5.7 SWMU 487, West of PGDP Rubble Pile WKWMA

In April of 2001, a radiological survey of the area and materials was performed. Results of the survey indicate no radiological contamination is present. No sampling data are available in Paducah OREIS.

D.1.5.8 AOC 492, Contaminated Soil Area, North Of Outfall 10

An area with elevated radiological readings was detected on July 30, 2001. This area was sampled (surface) and analytical results received on August 29, 2001, indicated the presence of elevated levels of PCBs and radiological constituents. Data from three locations sampled in the AOC were evaluated. Analytical results indicated the presence of metals (chromium); PCBs; and radionuclides (uranium-238). The area also was sampled in 2008 by the Kentucky Research Consortium for Energy and Environment and as part of the *Addendum I-B to the Sampling and Analysis Plan for Soil Piles at the Paducah Gaseous Diffusion Plant,* DOE/LX/07-0015/B (DOE 2009c).

During the Addendum I-B SE, AOC 492 was sampled using a systematic approach using a grid spacing of 10 ft. This approach was designed to ensure sampling results were sufficient to determine the concentration and distribution of constituents throughout the study area. Findings for AOC 492 from the Addendum I-B sampling were similar to the findings from a 2002 soil sampling effort to assess initial site conditions. The results of the initial sampling effort indicated detections of PCBs and uranium above background.

Also of note is that Kentucky Research Consortium for Energy and Environment performed a real-time demonstration of *in situ* analysis and field testing at AOC 492 during 2008 that included removal of approximately 18 yd^3 of soil. This is described in *Real Time Technology Application Demonstration Project Final Report* (KRCEE 2008).

D.1.5.9 SWMU 493, Concrete Rubble Piles Near Outfall 001

After being surveyed by HP, the concrete debris and soil near the concrete debris were found to be clean. In order for construction of the Scrap Yard Infrastructure Storm Water Collection Basin to continue, the concrete was relocated to SWMU 474. Per a request from KDEP, the first foot of soil under the concrete was excavated, relocated to SWMU 474, and placed on plastic. After removal of the concrete, excavation and relocation of the first foot of soil began; the excavated soil was surveyed routinely throughout the excavation. Pieces of metal shavings and filings, such as that from a machine shop, and other pieces of scrap metal, along with a few gaskets and litter, were discovered in the relocated soil. Some fixed radiological activity was present on these materials, but was below release limits. These items were surveyed, packaged, and placed into proper storage. As a result of this discovery, the excavation of the area was discontinued and the site inspected visually. Minute amounts of metal shavings, filings, and litter were observed on the ground. In addition, a valve cap was discovered at this location during this inspection. Fixed radiological contamination was detected on the valve cap. The valve cap was removed from the area, packaged, and placed into proper storage. The area was radiologically posted.

Data obtained during a preliminary soil sampling event from locations near the SWMU did not indicate that the soil has contamination from either hazardous or radiological constituents. After discovery of the concrete rubble piles, the piles were radiologically scanned and determined to be clean prior to removal to SWMU 474. Other materials found were radiologically surveyed, removed, and placed in appropriate storage.

D.1.5.10 SWMU 517, Rubble and Debris Erosion Control Fill Area

Data obtained during a preliminary soil sampling event from locations near the SWMU did not indicate the presence of any contamination of hazardous or radiological constituents. Additional surface sampling of the excavated soils occurred on February 9, 2002. The sampling analyses from this event indicated four COCs (nickel, zinc, neptunium-237, and uranium-238) greater than twice background that may pose some risk.

D.1.5.11 AOC 541, Contaminated Area by Outfall 011

This area was sampled in September 2002. Analytical results indicate the presence of metals (chromium); PCBs; SVOCs; and radionuclides (uranium-238). The area also was sampled during the winter of 2008, with findings presented in *Site Evaluation Report for Addendum 1-B Soil Piles* (DOE 2009f). Findings that were summarized in the SAR are follows.

During 2002, the area was surveyed upon initial discovery. Fixed beta/gamma measurements ranging from approximately 26,000 dpm/100 cm^2 to over 300,000 dpm/100 cm^2 were recorded. Highest readings were obtained in a significantly small, localized area (approximately 1 acre) in which several small mounds of soil were located. Analytical results indicate the presence of metals, PCBs, SVOCs, and radionuclides. No metals results exceeded the RCRA Metals levels (401 *KAR* 31:030 § 4 incorporating 40 *CFR* § 261.24). All samples had detectable PCBs; some sampling points exceeded 50 ppm. Significant levels of uranium (greater than 1,000 pCi/g) were measured at five sampling points. All other sampling points showed uranium greater than background. There were some points with detectable technetium-99, plutonium-239/240, and radium-226. There were no RCRA issues identified with the semivolatile results.

In December 2008, 242 soil samples were collected for field screening, with 24 samples being sent to a fixed-base laboratory for analysis. As a result of the 2008 sampling event, additional areas within the AOC were determined to have levels of PCBs and uranium that were similar to the original five sample results collected in 2002. The highest concentration of Total PCBs was 38.2 mg/kg from the subsurface sample at location LBCSOOB162. The surface soil sample with the highest concentration of Total PCBs (31.1 mg/kg) was from location LBCSOOB55. The highest concentration of uranium in a surface soil sample (3,600 mg/kg as a metal and 1,020 pCi/g as uranium-238) was from location LBCSOOB169 and the highest concentration of uranium in a subsurface soil sample (3,430 mg/kg as a metal and 1,660 pCi/g as uranium-238) was from location LBCSOOB162.

D.1.5.12 SWMU 561, Soil Pile I

A key potential source of contaminants in the surface water drainage system on the east side of PGDP is the C-340 facility. Historical leaks and spills at C-340 likely resulted in releases that traveled from floor drains through the storm sewer system, into Outfall 011, and discharged to Little Bayou Creek (LBC). Recorded spills and releases from C-340 included COPCs such as PCB oil, as documented in Occurrence Reporting and Processing System (ORPS) reports, plant shift superintendent (PSS) logs, and Annual Site Environmental Reports.

The following are the primary chemicals employed at C-340 during active operations: UF_6, hydrogen, magnesium fluoride, magnesium, and TCE. PCBs were used in electrical and hydraulic systems.

Outfall 010 is likely a primary source of historical releases to LBC and may have contributed to observed conditions at Soil Pile I. Its associated ditches drain several PGDP facilities including the following: C-331 Process Building, C-531 Complex, and C-617-B Lagoon. In general, COPCs carried through internal ditches to Outfall 010 mirror those transported throughout the PGDP surface water management system. Key COPCs include radionuclides, VOCs, SVOCs, and heavy metals. The soil piles along LBC contained uranium and PCBs.

On November 2, 2006, radiological control technicians observed and completed a gamma radiological survey on Soil Pile I. Field radioactivity measurements greater than twice area background were observed in several of the soil piles, ranging from twice to more than seven times area background.

Similarly in 2006, following the discovery of the soil piles and subsequent completion of a gamma walkover survey, biased surface samples were acquired from Soil Pile I. The samples were collected from the five locations exhibiting the highest field radioactivity measurements. Initial sampling was completed in this way, to provide a "worst-case" picture of conditions at Soil Pile I.

The following are the results from the 2007 evaluation (DOE 2008b).

Distribution of constituents that can be attributed directly to PGDP processes, including the majority of the radionuclides and PCBs, is found along LBC and primarily is confined to the soil pile itself. Uranium and uranium daughters show more widespread distribution, with elevated levels along LBC. Levels at or above no action levels (NALs) for recreational users are generally confined to the northern half of the soil pile along LBC. Similarly, PCBs exceeding the "high-occupancy without restriction" TSCA limit of 1 ppm total PCBs (40 *CFR* § 761.61(a)(4)(I)(A) are confined to the northern half of the soil pile along LBC, with two results at the high occupancy limit in the southern third of the LBC soil pile.

At locations where COPCs were measured at levels of concern in surface samples, levels generally decrease with depth, decreasing to *de minimis* levels below the 4 ft interval in most cases. Elevated concentrations of plant-related COPCs diminished to the 1–4 ft interval and below regulatory and/or risk-based action/NALs beyond the upper 4 ft of Soil Pile I.

D.1.5.13 AOC 562, Soil Piles C, D, E, F, G, H, J, K, and P in Subunit 1

Historical research was performed to attempt to determine the origin of the piles. The origin of the Addendum 1-B Soil Piles, however, remains unknown, although, the location and shape indicates that many of the PGDP-related soil piles are likely to have originated from excavations associated with the creation, periodic dredging, and cleanout of the outfalls, ditches, and creeks that comprise the PGDP surface water management system. Management of the surface water system at PGDP no longer allows piling soil along the ditch or creek banks outside the SWMU boundaries.

This AOC has been characterized and the summary of the findings is presented in the *Site Evaluation Report for Addendum 1-B Soil Piles at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0225&D1 (DOE 2009f). The COPCs at AOC 562 are uranium-238 at piles H, J, and K and PCBs at D, H, and J. The remaining chemicals were not recommended COPCs either because the concentrations were similar to background or because the chemicals are considered ubiquitous (e.g., PAHs). None of these COPCs exceed action levels for the teen recreational user.

D.1.5.14 AOC 563, Soil Piles 20, BW, and CC in Subunit 4

Sampling, field reconnaissance, and field radioactivity measurements at AOC 563 were completed in December 2006 as part of the Addendum 1B effort. An investigation of all soils in Addendum 1B was completed in December 2008, which included AOC 563. Soil Pile 20 consists of one conical-shaped small pile approximately 25 ft by 25 ft by 6-ft high. Soil Pile BW consists of one rectangular-shaped pile approximately 150 ft by 25 ft generally uniform in height, approximately 5 ft, with an irregular surface. Soil Pile CC is a large soil pile approximately 75 ft by 25 ft by 3-ft high.

Historical research was performed to attempt to determine the origin of the piles. The origin of the Addendum 1-B Soil Piles, however, remains unknown, although the location and shape indicates that many of the PGDP-related soil piles are likely to have originated from excavations associated with the creation, periodic dredging, and cleanout of the outfalls, ditches, and creeks that comprise the PGDP surface water management system. Management of the surface water system at PGDP no longer allows piling soil along the ditch or creek banks outside the SWMU boundaries.

The COPC at AOC 563, chromium, was found in pile 20 and PCBs at BW. The remaining chemicals were not recommended COPCs either because the concentrations were similar to background or because the chemicals are considered ubiquitous (e.g., PAHs). None of these COPCs exceed action levels for the teen recreational user.

D.1.5.15 AOC 564, Soil Pile AT in Subunit 5

This AOC has been characterized and the summary of the findings is presented in the *Site Evaluation Report for Addendum 1-B Soil Piles at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0225&D1 (DOE 2009f). Limited sampling, field reconnaissance, and field radioactivity measurements at AOC 564 were completed in December 2006 as part of the Addendum 1B effort. An investigation of all soils, in Addendum 1B was completed in December 2008, which included AOC 564.

Historical research was performed to attempt to determine the origin of the piles. Origin of the Addendum 1-B Soil Piles remains unknown, although the location and shape indicates that many of the PGDP-related soil piles are likely to have originated from excavations associated with the creation, periodic dredging, and cleanout of the outfalls, ditches, and creeks that comprise the PGDP surface water management system. Management of the surface water system at PGDP no longer allows piling soil along the ditch or creek banks outside the SWMU boundaries.

The COPCs at AOC 564, arsenic, beryllium, vanadium, uranium-238, and PCBs, were found in pile AT. The remaining chemicals were not recommended COPCs due to levels similar to background or the chemicals are considered ubiquitous (e.g., PAHs). None of these COPCs exceed action levels for the PGDP teen recreational user.

D.1.5.16 AOC 567, Contaminated Soil Area K013

This area was discovered in June 2008, during work to implement a sampling and analysis plan (SAP) for other soil piles in the area. The area contained soil piles that likely were generated as a result of past construction activities at PGDP. This AOC has been characterized, and the summary of the findings is presented in the SE Report for Addendum 1-B Soil Piles (DOE 2009f).

As a result of the December 2008 sampling event, risk screening determined uranium-238 to be a COPC in the soil piles (DOE 2009f).

D.1.6 GROUP 3, SCRAP YARDS

The SWMUs/AOCs in Group 3 consist of scrap yards and PCB Areas. This chapter summarizes the investigation at the scrap yards.

D.1.6.1 SWMU 14, C-746-E Contaminated Scrap Yard

The storage yard was emptied as specified by the Action Memorandum for Scrap Metal Disposition (DOE 2001d) and documented in the Removal Action Report for the Scrap Metal Removal Action (DOE 2008a).

The Phase II SI (CH2M HILL 1992) sampled surface and shallow soils in the area. Contaminants of concern include metals and radionuclides.

D.1.6.2 SWMU 518, C-746-P1 Field South of C-746-P1 Clean Scrap Yard

Analytical results from precharacterization sampling, performed by collecting subsurface composite samples within four grid areas, indicated the presence of PAHs in three of the grids. A second round of sampling was conducted by collecting grab samples within the previously discussed grids. The presence of PAHs was confirmed.

A radiological walkover survey performed in the area indicated results ranging from 15,000 to 35,000 cpm.

D.1.6.3 SWMU 520, C-746-A Scrap Material West of C-746-A

Annual surveys of the perimeter of this area are performed. The area currently is posted as a radioactive materials area, although no known releases have occurred. There have been no prior risk assessments for this SWMU.

D.1.7 GROUP 3, PCBS

The SWMUs/AOCs in Group 3 consist of scrap yards and PCB areas. This chapter summarizes the investigations at the PCB areas.

D.1.7.1 SWMU 57, C-541-A PCB Waste Staging Area

Soil boring samples were obtained during the Phase I and Phase II SIs (CH2M HILL 1991, 1992) and during the WAG 23 RI (DOE 1994a). Results of these investigations indicate the presence of PCBs.

In 1997, as part of the WAG 23 (DOE 1998f) non-time-critical removal action, 23 yd^3 of soil contaminated with dioxins and 32 yd^3 of soil contaminated with PCBs were excavated for SWMUs 57 and 81. A summary of conclusions from the WAG 23 RAR, based on the future use scenario of unrestricted industrial, is as follows:

> Following the removal action at WAG 23 sites, the residual PCB ELCR based on a 250 day/year exposure scenario is 2×10^{-6} at SWMUs 56 and 80 and below *de minimis* (i.e., 1×10^{-6}) at SWMUs 57 and 81. These risk levels are well within the EPA's acceptable risk range of 1×10^{-4} to 1×10^{-6}, as required by the NCP.

D.1.7.2 SWMU 81, C-541 PCB Spill Site

Soil boring samples were obtained during the Phase I and Phase II SIs (CH2M HILL 1991, 1992) and during the WAG 23 RI (DOE 1994a). Results of these investigations indicate the presence of PCBs.

In 1997, as part of the WAG 23 (DOE 1998b) non-time-critical removal action, 23 yd^3 of soil contaminated with dioxins and 32 yd^3 of soil contaminated with PCBs were excavated for SWMUs 57 and 81. A summary of conclusions from the WAG 23 RAR, based on the future use scenario of unrestricted industrial, is as follows:

> Following the removal action at WAG 23 sites, the residual PCB ELCR based on a 250 day/year exposure scenario is 2×10^{-6} at SWMUs 56 and 80 and below *de minimis* (i.e., 1×10^{-6}) at SWMUs 57 and 81. In addition, the PCB ELCR at SWMU 1 also is below *de minimis*. These risk levels are well within the EPA's acceptable risk range of 1×10^{-4} to 1×10^{-6}, as required by the NCP.

D.1.7.3 SWMU 153, C-331 PCB Soil Contamination (West)

SWMU 153 was part of WAGs 16 and 19. Information obtained in the scoping information package for WAGs 16 and 19 projects identified surface sampling that detected PCBs at a maximum concentration of 0.6 mg/kg. Uranium also was detected (DOE 1997a).

D.1.7.4 SWMU 156, C-310 PCB Soil Contamination (West Side)

SWMU 156 was part of WAGs 16 and 19. Information obtained in the scoping information package for WAGs 16 and 19 projects identified surface samples with PCBs detected at a maximum concentration of 0.3 mg/kg. Uranium also was detected (DOE 1997a).

D.1.7.5 SWMU 160, C-745 Cylinder Yard Spoils (PCB Soils)

Surface samples detected PCBs at a maximum concentration of 4 mg/kg. Uranium, arsenic, barium, chromium, lead, selenium, cadmium, thallium, and nickel also were detected (DOE 1997a).

D.1.7.6 SWMU 163, C-304 Building/HVAC Piping System (Soil Backfill)

The C-304 Building/HVAC Piping System (Soil Backfill) (SWMU 163) is located in the central portion of the plant site. SWMU 163 is approximately 100-ft wide by 200-ft long.

Soils from the C-611-V Lagoon borrow area were used for fill material for C-304 construction activities. The fill material was used as a base for the HVAC piping system and as a heat sink; it is located approximately 6 ft bgs.

The borrow area itself has not been characterized, but the lagoon was sampled, resulting in the identification of PCBs to a maximum of 8.4 mg/kg, as noted in the 1998 *Sampling and Analysis, Quality Assurance, and Data Management Plan for the Site Evaluation of Waste Area Groupings 16 and 19* (DOE 1998d) and the SAR.

D.1.7.7 SWMU 219, C-728 OS-08

PCB spill documentation indicates this tank was used to store PCB-contaminated rainwater that had collected in a pit in the C-537 Switchyard. Two transformer spills in 1989 resulted in rainwater collecting in the C-537 pit that would have been subject to TSCA rules. This rainwater would have been transferred to SWMU 219. The SWMU 219 tank was documented as leaking inside the present location, a diked area covered with Hypalon®, in November 1991. The water from the diked area was sampled with results of PCBs at < 0.1 mg/L. The tank was drained and cleaned according to TSCA requirements. Additionally, personnel recall this tank possibly was used to cleanup a RCW spill in C-333. The spill would have been subject to TSCA regulations because it came into contact with PCB troughing and gaskets.

No previous investigations are available. No prior risk assessments have been performed on this SWMU.

D.1.7.8 SWMU 488, C-410 Trailers PCB Contamination Area by C-410 Trailer Complex

The contamination area was discovered as a result of a surface soil sampling and characterization event for the placement of the support trailers for the DMSA characterization/disposition activities in the field north of the C-710 Laboratory. In May 2001, radiological surveys of this area were performed. Results of this survey indicated no radiological contamination was present. Soil samples were obtained as part of site characterization. The only contaminant above background detected in the soil was PCBs.

D.2. IDENTIFICATION OF COPCS

This subsection describes the process used to determine the list of COPCs used in the BHHRA. Specifically, this subsection describes the sources of data, the procedures used to screen the data, and the methods used to derive exposure point concentrations (EPCs) under both current and future conditions. Additionally, this section describes the site characterization data used in the exposure assessment performed in Section D.3.

The SWMU/AOC evaluations in the Nature and Extent sections of the main text focused on summarizing the representative analytical results for surface and subsurface soils. The process for highlighting chemicals of greatest potential interest, consistent with the work plan, considered background concentrations, action levels and NALs (for industrial worker on-site and teen recreator off-site), and groundwater protection SSLs for the UCRS and RGA. This screening was independent of COPC identification for this BHHRA.

D.2.1 SOURCES OF DATA

Data used in the BHHRA describing current contaminant concentrations in surface and subsurface soil and groundwater at all SWMUs/AOCs that were sampled during the summer of 2010 were derived from the recently completed Soils OU RI sampling (DOE 2010a), as well as historical data acquired from the Paducah OREIS database. The nature and extent of contamination in surface and subsurface soils are described in Sections 5 through 11 of this RI.

D.2.2 GENERAL DATA EVALUATION CONSIDERATIONS

This section describes the data evaluation steps that were used to ensure that the soil data were appropriate for use in BHHRAs. A general description of the eight steps used and their outcome in relation to the Soils OU RI BHHRA data set is provided in this section. A graphical presentation of this process is shown in Figure D.2.

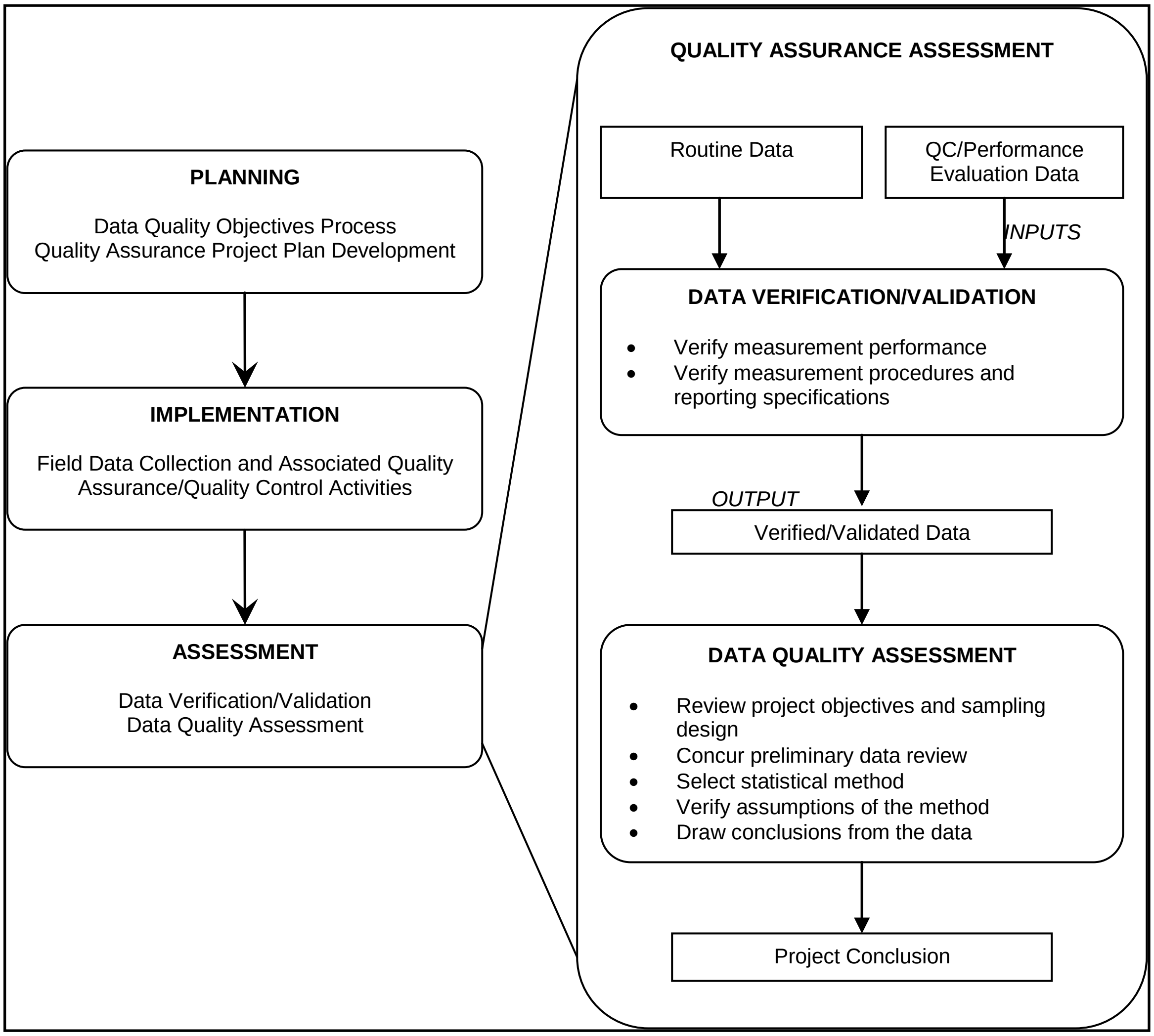


Figure D.2. Data Evaluation Steps

D.2.2.1 Evaluation of Sampling

Data were examined to ensure that sampling methods were adequate for determining the nature and extent of contamination and were representative of site conditions. It was determined that samples of the Soils OU RI and those selected from the Paducah OREIS database were collected using appropriate methods that were consistent with each project's work plan.

D.2.2.2 Evaluation of Analytical Methods

Methods used to collect and analyze the selected surface soil and subsurface soil samples were evaluated to determine if they were those approved by EPA. As described in work plans and project reports (see Sections 5-11 and Appendix B), the analytical methods used for surface and subsurface soil samples meet these requirements.

The data evaluation and COPC identification steps include a comprehensive evaluation of the analytical data collected during the nature and extent definition for a site. The data collection and evaluation by media were included as part of the nature and extent discussion section for each SWMU/AOC. The data quality analysis (DQA) section (Appendix B) identifies the quality assurance/quality control-related issues to determine which data are useable for evaluations performed in the RI. The data used for the COPC selection were validated in accordance with the DQE.

The Soils OU RI data include field screening such as X-ray fluorescence (XRF) data. The primary use of such data is for site characterization, but this survey-type data [called field data in the RI WP (DOE 2010a)] also can play a role in risk-based decision making. Survey-type data assist in determining the distribution of COPCs and can be used to identify which sets of laboratory data should be combined to develop site average contaminant concentrations. The XRF data were evaluated to determine if some or all could be combined with laboratory data for use in the risk assessment to determine the average concentrations for contaminants, by evaluating whether the laboratory and XRF data possess similar detection limits and analytical uncertainty. This analysis was conducted in Appendix B and indicated that a subset of XRF data qualified for use in the risk assessment in conjunction with the laboratory data. Similarly, use of XRF data was applied to historical data. The Risk Methods Document (DOE 2011a) allows for use of this type of data after the DQA is performed. Any uncertainties associated with the results that impact potential decisions are highlighted in the Uncertainties section.

D.2.2.3 Evaluation of Sample Quantitation Limits

The sample quantitation limits (SQLs) used in the analyses of the selected soil samples were examined to determine if these limits were below the concentration at which the contaminant may pose a risk to human health. Generally, the SQLs for each analyte met this goal. Table D.1 presents a comparison between each undetected analyte’s maximum SQLs for soil for the RI Soils OU data set and the analyte’s residential use no action screening value. Appendix B presents a comparison between each undetected analyte’s maximum SQL for soil and the historical data set and the analytes residential use no action screening value. The implications of this finding upon risk characterization (presented in this BHHRA) are discussed in Section D.6, Uncertainty in the Risk Assessment.

Consistent with the Risk Methods Document (DOE 2011a), if the maximum SQL for an analyte over all samples within a medium exceeded the no action screening value, then the data for that analyte was deemed of uncertain quality, and a qualitative assessment for that analyte was performed. In developing the qualitative assessment for such chemicals, the maximum SQL for the chemical is used in the qualitative assessment if historical or process knowledge indicated that the chemical potentially could be present. If historical or process knowledge indicates that the chemical is not expected to be present, one-half of the SQL is used in the qualitative assessment (EPA 1991). The qualitative analysis is presented in Section D.6, Uncertainty in the Risk Assessment.

D.2.2.4 Evaluation of Data Qualifiers and Codes

The soil data used in the BHHRA were tagged with various qualifiers and codes. Tagged data were evaluated following rules in Exhibits 5-4 and 5-5 of the Risk Assessment Guidance for Superfund (RAGS) (EPA 1998). Generally, this resulted in the retention of all results for which the identity of the analyte was certain even if there was substantial uncertainty in the analyte concentration within an individual sample. The qualifiers and codes attached to the soil data used in the BHHRA are defined in Table D.2. (Note: Consistent with the Risk Methods Document, radionuclides with negative activity values[1] were used in the calculation of EPCs in this BHHRA.)

Data rejected by validation were not used in the human health and ecological risk assessments. The majority of the RI data rejected by validation was VOC analyses. Acetone (2 rejected of 6 data points), acrolein (6 rejected of 6 data points), acrylonitrile (6 rejected of 6 data points), 2-butanone (6 rejected of

[1] Negative results may be reported due to a statistical determination of the counts seen by a detector, minus a background count.

Table D.1. Comparison between Undetected Analyte's Maximum SQLs and Site-Specific Soil Screening Levels[a]

Analyte	Frequency of Detection[b]	Maximum SQL	No Action Screening Value[c]	Screening Value Exceeded?	Units
Inorganic Compounds					
Antimony	320/342	2.6	0.552	No	mg/kg
Arsenic	1620/3614	11	0.238	Yes	mg/kg
Cadmium	330/341	0.32	0.811	No	mg/kg
Chromium	1676/3614	85	15.6	No	mg/kg
Copper	885/3614	35	184	No	mg/kg
Lead	3331/3614	13	400	Yes	mg/kg
Manganese	3562/3614	85	419	No	mg/kg
Mercury	403/3614	10	0.213	Yes	mg/kg
Molybdenum	364/3614	15	23	No	mg/kg
Nickel	1195/3614	65	10.4	Yes	mg/kg
Selenium	368/3614	20	23	No	mg/kg
Silver	540/3614	10	2.61	Yes	mg/kg
Sodium	340/341	130	n/a	n/a	mg/kg
Thallium	293/341	1.3	0.368	No	mg/kg
Uranium	1352/3930	20	13.8	Yes	mg/kg
Zinc	3603/3614	69.7	1380	No	mg/kg
PCBs					
PCB, Total	102/3035	67	0.0648	Yes	mg/kg
Organics					
1,2,4-Trichlorobenzene	0/272	0.49	n/a	n/a	mg/kg
1,2-Dichlorobenzene	0/272	0.49	n/a	n/a	mg/kg
1,3-Dichlorobenzene	0/272	0.49	n/a	n/a	mg/kg
1,4-Dichlorobenzene	0/272	0.49	n/a	n/a	mg/kg
2,4,5-Trichlorophenol	0/272	0.49	n/a	n/a	mg/kg
2,4,6-Trichlorophenol	0/272	0.49	n/a	n/a	mg/kg
2,4-Dichlorophenol	0/272	0.49	n/a	n/a	mg/kg
2,4-Dimethylphenol	0/272	0.49	n/a	n/a	mg/kg
2,4-Dinitrophenol	0/272	2.4	n/a	n/a	mg/kg
2,4-Dinitrotoluene	0/272	0.49	n/a	n/a	mg/kg
2,6-Dinitrotoluene	0/272	0.49	n/a	n/a	mg/kg
2-Chloronaphthalene	0/272	0.49	n/a	n/a	mg/kg
2-Chlorophenol	0/272	0.49	n/a	n/a	mg/kg
2-Methyl-4,6-dinitrophenol	0/272	2.4	n/a	n/a	mg/kg
2-Methylnaphthalene	5/272	0.49	n/a	n/a	mg/kg
2-Methylphenol	0/272	0.49	n/a	n/a	mg/kg
2-Nitrobenzenamine	0/272	2.4	0.296	Yes	mg/kg
2-Nitrophenol	0/272	0.49	n/a	n/a	mg/kg
3,3'-Dichlorobenzidine	0/272	2.4	n/a	n/a	mg/kg
3-Nitrobenzenamine	0/272	2.4	n/a	n/a	mg/kg
4-Bromophenyl phenyl ether	0/272	0.49	n/a	n/a	mg/kg
4-Chloro-3-methylphenol	0/272	0.49	n/a	n/a	mg/kg

Table D.1. Comparison between Undetected Analyte's Maximum SQLs and Site-Specific Soil Screening Levels[a] (Continued)

Analyte	Frequency of Detection[b]	Maximum SQL	No Action Screening Value[c]	Screening Value Exceeded?	Units
4-Chlorobenzenamine	0/272	0.49	n/a	n/a	mg/kg
4-Chlorophenyl phenyl ether	0/272	0.49	n/a	n/a	mg/kg
4-Nitrophenol	0/272	2.4	n/a	n/a	mg/kg
Acenaphthene	21/272	0.49	117	No	mg/kg
Acenaphthylene	5/272	0.49	n/a	n/a	mg/kg
Anthracene	32/272	0.49	747	No	mg/kg
Benzenemethanol	3/272	0.49	n/a	n/a	mg/kg
Benzo(ghi)perylene	60/272	0.49	n/a	n/a	mg/kg
Benzoic acid	9/272	2.4	n/a	n/a	mg/kg
Bis(2-chloroethoxy)methane	0/272	0.49	n/a	n/a	mg/kg
Bis(2-chloroethyl) ether	0/272	0.0097	n/a	n/a	mg/kg
Bis(2-chloroisopropyl) ether	0/272	0.49	n/a	n/a	mg/kg
Bis(2-ethylhexyl)phthalate	50/273	2.1	n/a	n/a	mg/kg
Butyl benzyl phthalate	3/272	0.49	n/a	n/a	mg/kg
Dibenzofuran	11/272	0.49	n/a	n/a	mg/kg
Diethyl phthalate	0/272	0.49	n/a	n/a	mg/kg
Dimethyl phthalate	0/272	0.49	n/a	n/a	mg/kg
Di-n-butyl phthalate	5/272	0.49	n/a	n/a	mg/kg
Di-n-octylphthalate	1/272	0.49	n/a	n/a	mg/kg
Fluoranthene	95/272	0.49	109	No	mg/kg
Fluorine	18/272	0.49	91.5	No	mg/kg
Hexachlorobenzene	0/272	0.49	0.0492	Yes	mg/kg
Hexachlorobutadiene	0/272	0.49	n/a	n/a	mg/kg
Hexachlorocyclopentadiene	0/272	2.4	n/a	n/a	mg/kg
Hexachloroethane	0/272	0.49	n/a	n/a	mg/kg
Isophorone	0/272	0.49	n/a	n/a	mg/kg
m,p-Cresol	0/272	0.97	n/a	n/a	mg/kg
Naphthalene	7/272	0.49	1.15	No	mg/kg
Nitrobenzene	0/272	2.4	n/a	n/a	mg/kg
N-Nitroso-di-n-propylamine	0/272	0.0097	0.0189	No	mg/kg
N-Nitrosodiphenylamine	0/272	0.49	n/a	n/a	mg/kg
Pentachlorophenol	0/272	2.4	n/a	n/a	mg/kg
Phenanthrene	64/272	0.49	n/a	n/a	mg/kg
Phenol	1/272	0.49	n/a	n/a	mg/kg
p-Nitroaniline	0/272	2.4	n/a	n/a	mg/kg
Pyrene	88/272	0.49	81.2	No	mg/kg
Pyridine	0/272	0.97	n/a	n/a	mg/kg
Total PAH	167/274	0.49	0.0197	Yes	mg/kg
1,1,1,2-Tetrachloroethane	0/14	0.49	n/a	n/a	mg/kg
1,1,1-Trichloroethane	0/14	0.49	n/a	n/a	mg/kg
1,1,2,2-Tetrachloroethane	0/14	0.49	n/a	n/a	mg/kg
1,1,2-Trichloroethane	0/14	0.49	n/a	n/a	mg/kg
1,1-Dichloroethane	0/14	0.49	n/a	n/a	mg/kg
1,1-Dichloroethene	0/14	0.49	0.0237	Yes	mg/kg
1,2,3-Trichloropropane	0/14	0.49	n/a	n/a	mg/kg
1,2-Dibromoethane	0/14	2.4	n/a	n/a	mg/kg
1,2-Dichloroethane	0/14	0.49	n/a	n/a	mg/kg
1,2-Dichloropropane	0/14	0.49	n/a	n/a	mg/kg

Table D.1. Comparison between Undetected Analyte's Maximum SQLs and Site-Specific Soil Screening Levels[a] (Continued)

Analyte	Frequency of Detection[b]	Maximum SQL	No Action Screening Value[c]	Screening Value Exceeded?	Units
1,2-Dimethylbenzene	0/14	0.49	53.5	No	mg/kg
2-Butanone	1/8	0.49	n/a	n/a	mg/kg
2-Chloroethyl vinyl ether	0/8	2.4	n/a	n/a	mg/kg
2-Hexanone	0/14	0.49	n/a	n/a	mg/kg
4-Methyl-2-pentanone	0/14	0.49	n/a	n/a	mg/kg
Acetone	5/12	2.4	n/a	n/a	mg/kg
Acrolein	0/8	0.49	n/a	n/a	mg/kg
Acrylonitrile	0/8	2.4	0.0743	Yes	mg/kg
Benzene	0/14	2.4	0.333	Yes	mg/kg
Bromodichloromethane	0/14	0.49	n/a	n/a	mg/kg
Bromoform	0/14	0.49	n/a	n/a	mg/kg
Bromomethane	1/14	0.49	n/a	n/a	mg/kg
Carbon disulfide	0/14	0.49	n/a	n/a	mg/kg
Carbon tetrachloride	0/14	2.4	0.239	Yes	mg/kg
Chlorobenzene	0/14	0.49	n/a	n/a	mg/kg
Chloroethane	0/14	0.49	n/a	n/a	mg/kg
Chloroform	1/14	0.49	0.122	Yes	mg/kg
Chloromethane	0/14	0.49	n/a	n/a	mg/kg
cis-1,2-Dichloroethene	1/14	0.49	1.05	No	mg/kg
cis-1,3-Dichloropropene	0/14	2.4	n/a	n/a	mg/kg
Dibromochloromethane	0/14	0.49	n/a	n/a	mg/kg
Dibromomethane	0/14	0.0097	n/a	n/a	mg/kg
Dichlorodifluoromethane	0/14	0.49	n/a	n/a	mg/kg
Ethyl methacrylate	0/14	2.1	n/a	n/a	mg/kg
Ethylbenzene	0/14	0.49	1.58	No	mg/kg
Iodomethane	0/14	0.49	n/a	n/a	mg/kg
m,p-Xylene	0/14	0.49	7.96	No	mg/kg
Methylene chloride	13/14	0.49	n/a	n/a	mg/kg
Styrene	0/14	0.49	n/a	n/a	mg/kg
Tetrachloroethene	0/14	0.49	0.113	Yes	mg/kg
Toluene	3/14	0.49	n/a	n/a	mg/kg
trans-1,2-Dichloroethene	0/14	0.49	2.43	No	mg/kg
trans-1,3-Dichloropropene	0/14	0.49	n/a	n/a	mg/kg
trans-1,4-Dichloro-2-butene	0/14	0.49	n/a	n/a	mg/kg
Trichloroethene	0/14	2.4	0.0234	Yes	mg/kg
Trichlorofluoromethane	0/14	0.49	n/a	n/a	mg/kg
Vinyl acetate	0/14	0.49	n/a	n/a	mg/kg
Vinyl chloride	0/14	0.97	0.0824	Yes	mg/kg

SQL = sample quantitation limit
PCBs = polychlorinated biphenyls
[a] Results shown are over all soil samples collected within SWMUs/AOCs investigated for the Soils OU RI in summer 2010. Comparison for historical data is shown in Appendix B.
[b] Number of detected results over total number of samples collected within SWMUs/AOCs investigated for the Soils OU RI in summer 2010.
[c] Risk-based screening values are taken from Appendix A of the Risk Methods Document (DOE 2011). The screening values are the lesser of the HI and ELCR no action levels used for the child resident of 0.1 and 1×10^{-6}, respectively.
n/a = no screening level available

Table D.2. Definitions of Qualifiers and Codes Present in the OREIS Data Set Used for the BHHRA of the Soils Operable Unit Remedial Investigation

Qualifier	Definition	Data Used?
Field = VALIDATION (Validation Qualifier)		
=	Validated result that is detected and unqualified.	Yes
D	Detected above the reported detection limit, the reported detection limit is approximated due to quality deficiency	Yes
E	E = ?	Yes
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.	Yes
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification."	Yes
R	Result rejected due to quality deficiency.	No
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.	Yes
X	Not validated; refer to RSLTQUAL field for more information.	Yes
XV	Not validated; refer to RSLTQUAL field for more information.	Yes
?	Not validated; refer to RSLTQUAL field for more information.	Yes
Field = RSLTQUAL (Result Qualifier)		
Blank	Result not qualified.	Yes
*	Duplicate analysis is not within control limits.	Yes
+	METAL: Correlation coefficient for MSA (Method of Standard Additions) < 0.995	Yes
<	Numerical value reported was less than the requested reporting limit (e.g., MDL, MDA, RRL, IDL).	Yes
>	Actual value was greater than the reported result.	Yes
A	SVOA/VOA: TIC (Tentatively Identified Compound) was suspected aldol condensation product; PPCB/SVOA/VOA: Suspected aldol-condensation product (pre-05/30/03 definition); RADS: Analyzed but not detected at the analyte quantitation limit.	Yes
B	Inorganic: The result is less than the project contract required detection limit, but greater than the instrument detection limit.	Yes
C	PPCB: Pesticide confirmed by GC/MS(Gas Chromatography/Mass Spectrometry); METAL: Possible contamination	Yes
D	Identified at secondary dilution.	Yes
E	Inorganic: Estimated value; matrix interference.	Yes
	Organic: Concentration exceeds calibration range of gas chromatograph/mass spectrometer.	Yes
G	BIOTOX: Male	Yes
J	Estimated value, tentatively identified compound, or less than specified detection limit.	Yes
K	RADS: Missing one or more lines in spectrum	Yes
M	METAL: Duplicate injection precision not met; RADS: Matrix Spike recovery is < 80% or > 120% (pre-05/30/03 definition).	Yes
N	Inorganic: Spike recovery not within control limits.	Yes
	Organic: Applied to TIC results, except generic characteristics.	Yes
P	HERB/PPCB: > 25% difference between two columns for Pesticides/Aroclors	Yes
S	METAL/TCLPMET: Determined by Method of Standard Additions; DI FURA: Signal-to-noise ratio of the confirmation ion does not meet 2.5 S/N requirement but peak was determined to be positive in the judgment of the GC/MS analyst	Yes
T	Tracer recovery is less than 20% or greater than 105%.	Yes
U	ALL ANALYSIS TYPES EXCEPT RADS: Not detected; RADS: Value reported is < MDA and/or TPU.	Yes
V	Incomplete sample (e.g., sample is a partial filet)	Yes
W	METAL: Post-digestion spike for atomic absorption out of control limit.	Yes
X	Flag one; defined in COMMENTS field.	Yes
Y	Chemical yield exceeds acceptance limits; Organic: matrix spike, matrix spike duplicate recovery, and/or relative percent difference failed acceptance criteria.	Yes

6 data points), and 2-chloroethyl vinyl ether (6 rejected of 6 data points) were rejected due to the initial and continuing calibration relative response factors being less than 0.05. Also rejected by validation was neptunium-237 (12 rejected of 26 data points). This analysis was rejected due to failed relative bias and recovery for the laboratory control sample. Most of the rejected neptunium-237 analyses were reported below the minimum detectable activity (MDA) (9 rejected of 12 data points below MDA). The risk assessment does not identify any of the rejected VOC analyses as a COPC for the Soils OU RI; thus, the rejection of these data points has little importance. In contrast, neptunium-237 is a COPC at several Soils OU SWMUs/AOCs. Only two of the 12 data points, a sample and its duplicate, were above both the Child Resident NAL and PGDP background value; therefore, the rejected data should have minimal impact to human health and ecological risk assessment.

D.2.2.5 Elimination of Chemicals Not Detected

Consistent with the Risk Methods Document (DOE 2011a), any analyte passing the earlier screens and not detected in at least one sample using an appropriate SQL was eliminated from the data set. These data are not considered further in this BHHRA.

D.2.2.6 Examination of Toxicity of Detected Analytes

Each analyte's maximum detected concentration in the data set was compared to that analyte's residential use no action human health risk-based screening value for soil in the Risk Methods Document (DOE 2011a). Consistent with this Risk Methods Document, this screen was not applied to those analytes known to accumulate significantly in biota (i.e., not used for analytes with a bioaccumulation factor for fish greater than 100).

D.2.2.7 Examination of Analyte Maximum Concentrations for Essential Human Nutrients Detected in Site Samples to Recommended Dietary Allowances for Children

Seven analytes known to be essential nutrients and known to be toxic only at extremely high concentrations were removed from the data set. These analytes were calcium, chloride, iodine, magnesium, phosphorus, potassium, and sodium. Consistent with the Risk Methods Document, no other analytes were removed from the data set based upon the essential nutrient screen.

D.2.2.8 Comparison of Analyte Maximum Concentrations and Activities Detected in Site Samples to Analyte Concentrations and Activities Detected in Background Samples

Consistent with the 2011 revision to the Risk Methods Document, a background screen was used to develop the BHHRA data set. Table D.3 shows the current PGDP background concentration for surface and subsurface soils used in the screening process.

D.2.2.9 RI Analytes

For this project, both historical and RI data were combined into one dataset; however, only those analytes listed in the approved Soils OU RI Work Plan (DOE 2010a) were evaluated for this BHHRA. The RI Work Plan states that data were downloaded from the Paducah OREIS database in March 2008. Data from within a study boundary (typically 50 ft) outside the SWMU/AOC were downloaded. All historical data were used for the approved work plan regardless of data quality. Appendix B addresses data quality and applicability of the historical data. The potential for undetermined risk from historical data not evaluated during this BHHRA is addressed in the Uncertainties section, D.6.

Table D.3. Provisional Background Concentrations for Surface and Subsurface Soil at PGDP

Analyte	Background Value[b]	
	Surface	Subsurface
Inorganic Chemicals (mg/kg)[a]		
Aluminum	13,000	12,000
Antimony	0.21	0.21
Arsenic	12	7.9
Barium	200	170
Beryllium	0.67	0.69
Cadmium	0.21	0.21
Calcium	200,000	6,100
Chromium (III)	16	43
Chromium (VI)	---	---
Cobalt	14	13
Copper	19	25
Cyanide (CN^-)[c]	---	---
Iron	28,000	28,000
Lead	36	23
Magnesium	7,700	2,100
Manganese	1,500	820
Mercury	0.2	0.13
Nickel	21	22
Potassium	1,300	950
Selenium	0.8	0.7
Silver	2.3	2.7
Sodium	320	340
Sulfide[d]	---	---
Thallium	0.21	0.34
Tin[d]	---	---
Uranium	4.9	4.6
Vanadium	38	37
Zinc	65	60
Radionuclide (pCi/g)		
Cesium-137	0.49	0.28
Neptunium-237[e]	0.1	---
Plutonium-238[e]	0.073	---
Plutonium-239[e]	0.025	---
Potassium-40	16	16
Radium-226	1.5	1.5
Strontium-90[e]	4.7	---
Technetium-99	2.5	2.8
Thorium-228	1.6	1.6
Thorium-230	1.5	1.4
Thorium-232	1.5	1.5
Uranium-234	1.2[f]	1.2[f]
Uranium-235	0.06[f]	0.06[f]
Uranium-238	1.2	1.2

Notes: Cells with "---" indicated data are not available or not applicable.
Values contained in this table have not been approved for all uses by the PGDP Risk Assessment Working Group; therefore, the values presented here are provisional values and subject to change.
[a] Includes inorganic chemicals found on Target Analyte List as defined by EPA in 1988 CLP Statement of Work and RCRA Appendix IX list of constituents.
[b] Risk Methods Document (DOE 2011)
[c] Cyanide is not expected to be naturally occurring in soil at PGDP; background values were not derived.
[d] Data are not adequate to calculate a background concentration in soil for this analyte.
[e] Concentrations for these radionuclides in subsurface soil were not derived.
[f] The values listed for uranium-234 and uranium-235 are not from the 1996 background study, but are derived from the natural isotopic abundance ratio and the uranium-238 values. The values for these radionuclides that appeared in the 2001 version of the Risk Methods Document (DOE 2001) were the UTLs of measured values for the individual isotopes as reported in the PGDP background study (DOE 1997).

D.2.3 RISK ASSESSMENT SPECIFIC DATA EVALUATION

This section discusses details associated with the surface soil data set, the subsurface soil data set, and groundwater modeling data set used to examine potential current and future ELCRs and HIs to human health presented in this BHHRA.

D.2.3.1 Current Conditions

The specific processes used to evaluate data and calculate EPCs under current conditions are described in this section. The analyte's names were checked to ensure that names and Chemical Abstract Services (CAS) numbers were uniform. This activity was performed so that the analyte names and CAS numbers in the data set matched those used in the PGDP toxicity database presented in the Risk Methods Document (DOE 2011a).

D.2.3.2 Evaluation of Concentrations for Soil

The following describes the processes that were used in the surface and subsurface COPC selection. For this screening and the subsequent BHHRA, surface soil was defined as 0–1 ft bgs and subsurface soil was defined as 0–16 ft bgs. All surface soil samples at the sites were evaluated together as soil whether the sample came from the SWMU/AOC surface area or the surrounding ditches. SWMUs/AOCs were divided into exposure units (EUs) consistent with the Risk Methods Document (DOE 2011a). EUs are areas within a site that, because of similar levels of contamination or because of expected human activity patterns, can be assessed reasonably using one EPC for each COPC. EUs typically are one-half acre in size.

- *Convert units of measure to a consistent basis.* The units of measure used for analyte classes (i.e., inorganic chemicals, organic compounds, and radionuclides) were assigned consistent units of measure. The units of measure used were mg/kg for inorganic chemicals and organic compounds and pCi/g for radionuclides. This activity was performed so that the units of measure in the data set matched those found in the equations that are used to calculate CDIs as part of the BHHRA.

- *Categorize all sample results as detects or nondetects.* Each result was coded either detected or nondetected based upon the data qualifier codes present in the data set. Any data assigned a "U" or "UJ" qualifier was considered to be nondetected. All radiological data were considered detects for this project and used at the reported value. This coding subsequently was used to calculate the frequency of detection statistics and to assign surrogate values to results listed as nondetects.

- *Analyze duplicate samples.* Duplicate samples were available for some sample analyses. In cases where the value from the original sample and its duplicate both were detected values, the greater of the results from the original sample and its duplicate was retained in the data set. In cases where one value was a detected value and the other was a nondetect, the detected value was retained in the data set. Finally, when both values were listed as nondetects, the lesser of the two detection limits was retained in the data set.

- *Compare maximum detected concentrations to human health screening values.* The maximum detected result for each analyte within a SWMU/AOC or EU (for SWMUs/AOCs large enough to contain more than one EU) was compared to NAL screening values for soil use as part of the toxicity screen. Analytes with a maximum detected value less than the analyte's NAL were not retained as COPCs. The values used to screen surface and subsurface soil were the direct contact residential child NAL values taken from Appendix A of the 2011 Risk Methods Document. For analytes that did not have an NAL listed in the 2011 Risk Methods Document, one was calculated following the same protocols. The residential child NAL values are listed in Attachment D1. The EPA residential screening levels for lead in soil (400 mg/kg) were used to screen lead to determine if it is a COPC. For all scenarios, PCBs and PAHs were screened and evaluated in the BHHRA using the Total PCB values and Total PAH values calculated following the Risk Methods Document (DOE 2011a).

- *Compare maximum detected concentrations to PGDP background soil levels for metals and radionuclides.* The maximum detected result for each analyte within a SWMU/AOC or EU (for SWMUs/AOCs large enough to contain more than one EU) was compared to the background levels of metals and radionuclides [reported in the Risk Methods Document (DOE 2011a)] that have been negotiated with EPA and KDEP. [Surface soil background levels were used for all but the outdoor worker (exposed to surface and subsurface soil) and the excavation worker where subsurface soil background levels were used for screening.] Analytes with a maximum detected value less than the analyte's associated background value are not retained as COPCs. The background concentrations used for screening are shown above in Table D.3.

- *Remove essential nutrients from the data sets.* Results for the seven essential nutrients listed earlier were removed from the data sets.

- *Remove protactinium-234m (Pa-234m), potassium-40 (K-40), and thorium-234 (Th-234) from the data sets.* All results for Pa-234m were removed to prevent double-counting its contribution to cancer risk through use of a toxicity value for U-238 that includes its short-lived progeny. All K-40 and Th-234 results were removed to be consistent with the Risk Methods Document and earlier BHHRAs prepared for PGDP (DOE 2011a).

Analytes retained as surface soil COPCs under current conditions are presented for each SWMU/AOC in Table D.4 (located on CD). Analytes retained as subsurface soil COPCs under current conditions are presented for each SWMU/AOC in Table D.5 (located on CD). Tables D.4 and D.5 include a listing of all detected analytes in soil samples. In addition to the analyte's name, human health risk-based screening value, and background value, each table also contains the analyte's frequency of detection, whether it was chosen as a COPC, and the COPC's EPCs for use in the risk and hazard calculations.

EPCs were calculated for each EU for those constituents that are retained as COPCs. For each COPC, data were summarized within each sampling grid before calculating the EPC for the EU. This was necessary to ensure that each sampling grid was represented equally (i.e., received equal weight) in the EU EPC calculation. Section 4 of the main text further illustrates this implementation. Tables D.6 and D.7 (located on CD) present the Soils OU data set for surface and subsurface soils, respectively, with the assigned grid values and the EPC.

The representative sampling design for the SWMUs was gridding. In some instances (such as SWMUs/AOCs not grid sampled in summer 2010), when a grid was applied to the SWMUs/AOCs, a grid lacking a sample result resulted. In order to fill a grid lacking a sample result, the average of the grids within the EU with sampling results was used. Attachment D2 presents an uncertainty evaluation in determining EPC values using these averages against EPC values calculated without using the averages or the maximum value, as applicable. An example for determining the EPC through averaging is illustrated below.

If the SWMU/EU combination had less than 10 grids, the maximum grid result was used as the EPC. If the SWMU/EU combination had 10 or more grids, the grid values were used to determine the 95% upper confidence level of the mean (UCL95). Grid values were determined following guidance in the work plan. Basically, the maximum detected result from within the grid applies to the grid. If not detected, the minimum detection limit applies to the grid.

If a grid had no result (detect or nondetect) for the COPC, an average of the results for the grids with results was used. See below for example illustrating this average.

Exhibit D.1.

NO RESULT	RESULT = 9	NO RESULT	RESULT = 2
RESULT = 7	NO RESULT	RESULT = 3	NO RESULT
RESULT = 3	NO RESULT	RESULT = 5	RESULT = 5

For grids with "NO RESULT," the average of the grids with results was used [i.e., (9+2+7+3+3+5+5)/7= 4.86]. The UCL95 would be calculated from the following:

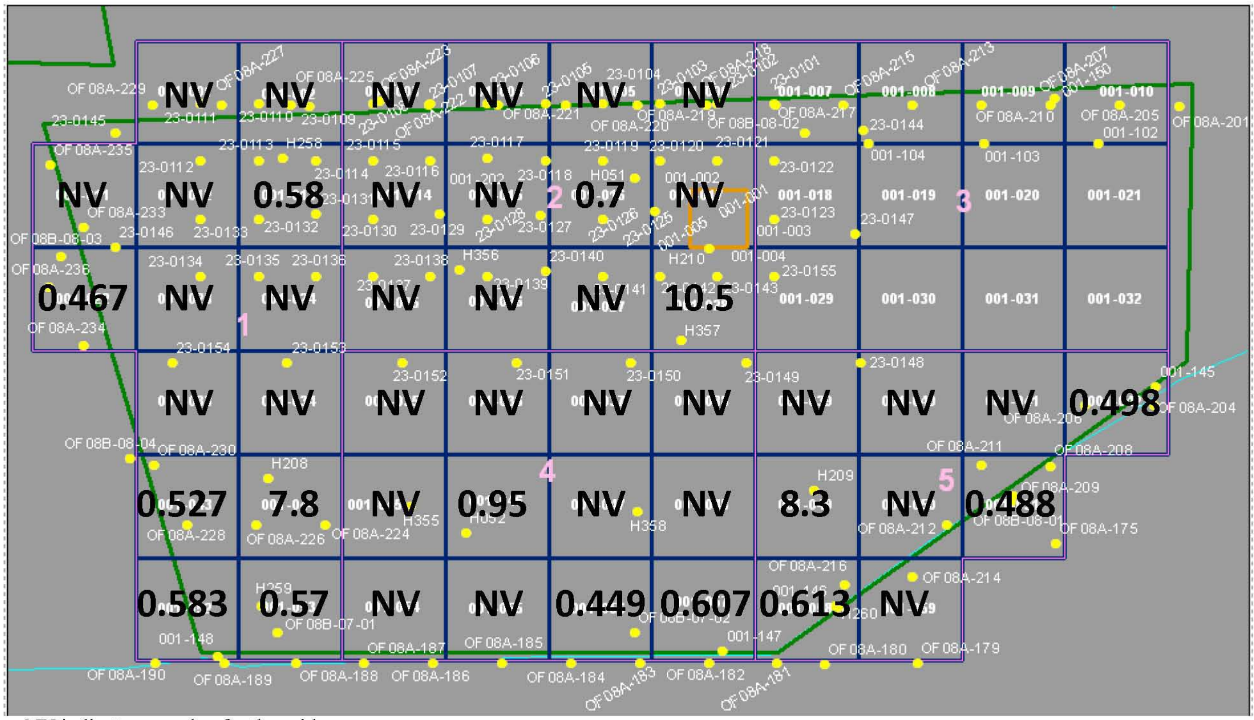
4.86
9
4.86
2
7
4.86
3
4.86
3
4.86
5
5

The UCL95 is calculated using the recommended result from ProUCL, an EPA-provided software (available at www.epa.gov/nerlesd1/tsc/software.htm) (EPA 2009b), as specified in the Risk Methods Document (DOE 2011a).

In some instances, ProUCL will calculate the UCL95 as greater than the maximum value. In these cases, the lesser of the maximum **detected** value for the EU and the UCL95 was used at the EPC.

A representative calculation using beryllium results for SWMU 1 is shown below as an example. For SWMU 1, beryllium is a COPC for EUs 1, 2, 4, and 5. Grid concentrations are listed on the illustration below. (For EU 3, beryllium is not a COPC, because all detected values are below background.)

Exhibit D.2.



NV indicates no value for the grid.

Exhibit D.3. Values for Calculating UCL95 of Beryllium in Surface Soil at SWMU 1

EU 1		EU 2		EU 4		EU 5
1.75*	1.75*	5.6*	0.7	0.669*	0.669*	2.47*
1.75*	1.75*	5.6*	5.6*	0.669*	0.669*	2.47*
1.75*	1.75*	5.6*	5.6*	0.669*	0.669*	2.47*
1.75*	0.527	5.6*	5.6*	0.669*	0.669*	0.498
0.58	7.8	5.6*	5.6*	0.669*	0.449	8.3
0.467	0.583	5.6*	10.5	0.95	0.607	2.47*
1.75*	0.57					0.488
						0.613
						2.47*
EPC =	3.89	EPC =	8.23	EPC =	0.725	EPC = 8.3

* Indicates average of actual values used for calculation. For EU 1, 1.75 is the average of actual values 0.58, 0.467, 0.527, 7.8, 0.583, and 0.57. For EU 2, 5.6 is the average of actual values 0.7 and 10.5. For EU 4, 0.669 is the average of actual values 0.95, 0.449, and 0.607. For EU 5, 2.47 is the average of actual values 0.498, 8.3, 0.488, and 0.613.

The EPC is determined consistent with the Risk Methods Document (DOE 2011a). If results from ten or more samples are available, then a distribution check was performed, and the EPC will be the lesser of the maximum detected concentration and the 95% upper confidence limit (UCL) on the mean of the appropriate distribution. The latest version of EPA's ProUCL software (available at www.epa.gov/nerlesd1/tsc/software.htm) incorporates a number of different distributional tests to calculate the most appropriate UCL (EPA 2009b). Attachment D3 presents the output from the ProUCL software.

D.2.3.3 Evaluation of Modeled Concentrations for Groundwater

Groundwater modeling was done in a similar manner as the process described above for surface/subsurface soil. SSLs are risk-based soil concentrations considered to be protective of groundwater (DOE 2011a). These SSLs were derived as described in Appendix C and used to screen soil sampling results to select COPCs for RGA groundwater. Analytes retained as COPCs are presented for each SWMU/AOC in Appendix C. Selected analytes then were modeled as described in Appendix C. SWMU 1 was not considered for groundwater modeling under this OU, since it has been extensively modeled under other OUs.

As presented in Appendix C, technetium-99 present in soil at SWMU 14 has the potential to impact the RGA groundwater at the SWMU/AOC boundary.

D.3. EXPOSURE ASSESSMENT

This section describes the exposure assessment used to determine the pathways of exposure that were considered for the surface and subsurface soil at the source units that are part of the Soils OU RI. Specifically, the exposure assessment process is delineated, the exposure settings of the Soils OU are described, the routes of exposure are outlined, and the daily intakes and doses are derived. The ultimate products presented in this section are the CSM for the Soils OU and the CDIs used when calculating ELCR and HI in Section 5.

D.3.1 DESCRIPTION OF THE EXPOSURE ASSESSMENT PROCESS

Exposure is the contact of an organism with a chemical or physical agent. The magnitude of exposure (i.e., dose) is determined by measuring or estimating the amount of an agent available at exchange boundaries (e.g., gut, skin, etc.) during a specified period. Exposure assessment is a process that uses information about the exposure setting and human activities to develop CSMs under current and potential future conditions.

The first step in the exposure assessment is to characterize the exposure setting. This includes describing the activities of the human population (on or near a site) that may affect the extent of exposure and the physical characteristics of the site. During this process, sensitive subpopulations that may be present at the site or that may be exposed to contamination migrating from the site also are considered. Generally, site characterization results in a qualitative evaluation of the site and the surrounding population.

The second step in the exposure assessment is to identify exposure pathways. Exposure pathways describe the path a contaminant travels from its source to an individual. A complete exposure pathway includes all links between the source and the exposed population; therefore, a complete pathway consists of a source of release, a mechanism of release, a transport medium, a point of potential human contact, and an exposure route.

The third step in the exposure assessment is to calculate dose by quantifying the magnitude, frequency, and duration of exposure for the populations for the exposure pathways selected for quantitative evaluation. This step involves using the EPCs developed for each COPC to quantify the pathway-specific CDIs for that COPC.

D.3.2 CHARACTERIZATION OF THE EXPOSURE SETTING

The first step in evaluating exposure is to characterize surface features, meteorology, geology, demography and land use, ecology, hydrology, and hydrogeology of the area inhabited by potential receptors. These aspects are discussed in Chapter 3 of this RI report. Physical descriptions of the SWMUs/AOCs are summarized within this exposure assessment to support later discussions of the conceptual model and its uncertainties.

D.3.2.1 Group 1, Former Facility Areas

D.3.2.1.1 SWMU 1, C-747-C Oil Landfarm

The C-747-C Oil Landfarm (SWMU 1) is located in the extreme west-central portion of the plant. SWMU 1 was used from 1975 to 1979 for the biodegradation of waste oils contaminated with TCE, PCBs, 1,1,1-trichloroethane, and uranium. It is estimated that approximately 5,000 gal of waste oil were applied to the landfarm during its period of operation (DOE 1999a). These waste oils were believed to have been derived from a variety of plant processes. The landfarm consisted of two 1,125 ft^2 plots that were plowed to 1 ft to 2 ft depth. Waste oils were spread on the surface every 3 to 4 months, then limed and fertilized. The area now is mowed regularly as part of PGDP maintenance operations.

D.3.2.1.2 SWMU 99B, C-745 Kellogg Building Site—Septic System/Leach Field

The C-745 Kellogg Building Site, septic system/leach field (SWMU 99B) is located in the east-central portion of the plant site. Included in the SWMU are a former septic tank, leach field, and clay piping southeast of the former building location (concrete pad) and the gravel covered parking area (SWMU 99A). SWMU 99B totals approximately 0.34 acres.

The C-745 Kellogg Building Site was constructed in 1951 as facilities for pipe fabrication and pipe cleaning activities during construction of the plant. The building was demolished in 1955, but the remaining concrete pads are used to store UF_6 cylinders and waste at the C-745-E Cylinder Storage Yard and the C-746-D Scrap Yard (SWMU 16), respectively.

The tank and associated leach field were connected to the Kellogg Building Site by a vitreous clay drain line. The tank and the leaching field are believed to have been designed to receive sanitary waste from the buildings' operations; however, the actual configuration of the drainage system is unknown. No records exist as to what was done with the residual contents of the tank after the buildings were demolished or whether any closure or removal actions were taken. The lateral lines for the leach field were found intact when they were uncovered during construction activities in late 1994.

D.3.2.1.3 SWMU 194, DUF_6 Facility McGraw Construction Facilities (south side)

The McGraw Construction Facilities (south side) (SWMU 194) is an open field located southwest of the plant site. SWMU 194 is approximately 540,000 ft^2 (600 ft x 900 ft). The McGraw Construction Facility was constructed in 1951 as buildings for support of original plant construction. Buildings located in this area included an administration building, a cafeteria, a boiler house, guard headquarters, a hospital, and a purchasing building. The facilities were demolished following completion of PGDP construction. The area was graded and has been maintained as a grassy area since that time. A portion of the site east of Hobbs Road and south of the C-100 Parking Lot is the location of the DUF_6 Conversion Facility. Concrete footers and debris may remain below grade, although no known disposal of hazardous constituents have occurred.

D.3.2.1.4 SWMU 196, C-746-A Septic System

The C-746-A Septic System (SWMU 196) is located in the northwest portion of the plant site. The C-746-A Septic System consists of two systems: System 1, on the northwest corner of C-746-A, is a 500-gal tank, and System 2, on the northeast corner of C-746-A, is a 950-gal concrete tank and a 60 ft by 20 ft drainage field.

Both systems were used to process the sanitary waste coming from C-746-A. The systems were abandoned in place in 1980. The contents of the septic tanks were removed. The empty tanks were backfilled with clean sand and the site was graded to the surface.

D.3.2.1.5 SWMU 489, C-710 North Septic Tank, North of C-710

The Septic Tank, North of C-710 (SWMU 489), is constructed of cement blocks and located in the central portion of the plant site. SWMU 489 is approximately 200 ft^3 (8 ft x 5 ft x 5 ft). The tank is below a doublewide trailer.

Due to the construction materials and the manner in which it was constructed, it is believed that the septic tank was associated with the original construction activities of the PGDP in the early 1950s. SWMU 489 was discovered on June 1, 2001, as a result of a construction project for the DMSA trailers in the field north of the C-710 Laboratory. During excavation, what appeared to be an abandoned septic tank was discovered. The tank appeared to have had the top and contents removed, and backfilled with sand prior to burial in place. When the septic tank was uncovered, water was present in the interior of the tank from past rainfall events. A sample of the sand was obtained from the interior of the tank. The septic tank has been backfilled, compacted, and graded, and also has 9–10 inches of dense grade aggregate on top of the tank area.

D.3.2.1.6 SWMU 531, C-746-A South Aluminum Slag Reacting Area

The Aluminum Slag Reacting Area (SWMU 531) is a concrete pad located adjacent to the south side of C-746-A, Hazardous and Mixed Waste Storage Facility, which is located in the northwestern portion of PGDP. SWMU 531 is approximately 9,000 ft^2 (30 ft x 300 ft).

The Aluminum Slag Reacting Area was used for treatment of stored aluminum slag from the aluminum smelter. Aluminum slag was brought from a sweat furnace in the west end of C-746-A smelter. Water was slowly added to dumpsters and possibly drums to react with the aluminum slag. Slag was allowed to react with no agitation for several days. Hydrogen that was produced from the reaction escaped to the atmosphere. The slag was dewatered, and the resulting waste was placed in the C-746-F Landfill. It is unknown how long this operation was in practice.

D.3.2.2 Group 1, Storage Areas

D.3.2.2.1 SWMU 200, Central PGDP Soil Contamination South of TSCA Waste Storage Facility

The Soil Contamination South of TSCA Waste Storage Facility (SWMU 200) is located in the central portion of the plant site. This area is approximately 282-ft wide by 304-ft long. This SWMU was used in the past for placement of dredged material from the NSDD.

D.3.2.2.2 SWMU 212, C-745-A Radiological Contamination Area

The C-745-A Radiological Contamination Area (SWMU 212) is located in the west-central portion of the plant site. The area is approximately 2,500 ft^2. While the exact history is unknown, supposition is that the area may have been used as an unloading site near railroad tracks, and a release of radiological contaminants may have occurred.

D.3.2.2.3 SWMU 213, C-745-A OS-02

DMSA OS-02 (SWMU 213) is located north of C-745-A in the west-central portion of the plant site. SWMU 213 is approximately 7,000 ft^2. SWMU 213 was used to store excess or unused material. Items formerly stored at this location included a spill storage tank; an old "drop test" cylinder with over pack, metal parts from forklifts, cranes, cylinder slings and carts; and wood to make cylinder saddles. The spill tank has three closed valves located near the bottom. The tank was used extensively during a 1979 No. 2 fuel oil spill to "decant" the water from the fuel oil/water mixture and possibly utilized to contain other spills.

D.3.2.2.4 SWMU 214, C-611 OS-03

DMSA OS-03 (SWMU 214) is located at the C-611 Water Treatment Plant west of the plant site. SWMU 214 is 384 ft^2 (16 ft x 24 ft). This DMSA was created by PGDP utilities operations for storage of DOE materials upon transition from DOE to USEC operations. Prior to 1994, the area was a gravel and grass covered area. The material stored is covered by a 16 ft x 24 ft aluminum carport type shed without walls. All RCRA-regulated items and other waste have been dispositioned properly (DOE 2002c).

D.3.2.2.5 SWMU 215, C-743 OS-04

DMSA OS-04 (SWMU 215) included a rail tank car located west of the C-743 Trailer Complex in the west-central portion of the plant site. The roped area defining SWMU 215 is approximately 480 ft^2 (40 ft x 12 ft). The SWMU currently is empty and the waste was dispositioned properly.

The history of this railcar could not be ascertained definitively. It was likely brought on-site to deliver an acid compound. Subsequent uses may have included water storage for fire fighting, spill control (storage), and/or fire training. In August of 2005, as part of the DMSA characterization and remediation project, the railcar was removed.

D.3.2.2.6 SWMU 216, C-206 OS-05

DMSA OS-05 (SWMU 216) is located north of C-206 in the west-central portion of the plant site. SWMU 216 is approximately 7,000 ft^2. This area was controlled by fire services and used to store excess material and supplies, primarily fire extinguishers. The initiation of this area as a storage area for fire extinguishers is unknown; however, in 1997 or 1998, the majority of the fire extinguishers were placed in a covered metal bin located next to the roped portion of the DMSA.

D.3.2.2.7 SWMU 217, C-740 OS-06

DMSA OS-06 (SWMU 217) is located at C-740 in the west-central portion of the plant site. SWMU 217 is approximately 57,600 ft^2.

Beginning in the late 1970s, this area originally was used as an excess material and/or staging area for C-720. Over time, DMSA OS-06 became a storage area for excess materials from various areas within the plant. All RCRA-regulated items and other waste have been dispositioned properly (DOE 2004b). DMSA OS-06 currently is used as a hot shop and loading area. It is set up for size reducing large equipment and loading and staging shipping containers.

D.3.2.2.8 SWMU 221, C-635 OS-10

DMSA OS-10 (SWMU 221) is a 750 ft^2 area located east of the C-635 RCW Pump House in the central portion of the plant site.

This DMSA initially was classified as a Phase I DMSA (expected to have no fissionable material, but not fully characterized). The area contained approximately 414 ft^3 of scrap metal and an empty sulfuric acid tank. The items were characterized and dispositioned properly. This DMSA now qualifies as a Phase 3 DMSA because it has been fully characterized and contains no fissionable material. There have been no known spills or releases of materials from this SWMU to the environment. A radiological survey of the area did not find anything above background levels (DOE 2002g).

D.3.2.2.9 SWMU 222, C-410 OS-11

DMSA OS-11 consists of both SWMU 76 and SWMU 222 at the south and north ends, respectively. SWMU 222 is located east of the C-410 facility and west of the C-651 Pump House and Cooling Tower near the central portion of the plant site. SWMU 222 is approximately 1,738 ft^2.

This area is believed to have been created around 1993 during the USEC/DOE transition. Miscellaneous materials were placed in this area, the majority of which were radiologically surveyed and sent to the scrap yards around 1998. In 2001, DOE began characterization and remediation of the materials in the DMSAs. All materials previously located in SWMU 222 either have been disposed of properly or currently are located in permitted storage (DOE 2002h).

D.3.2.2.10 SWMU 227, C-746-B OS-16

DMSA OS-16 (SWMU 227) is located south of the C-746-B Warehouse, in the northwest portion of the plant site. SWMU 227 is approximately 37,000 ft^2.

This area was used as a storage area for miscellaneous excess process equipment and UF_6 cylinders since the 1970s. In 2001, DOE began characterization and remediation of the materials in the DMSAs. All RCRA-regulated items and other waste have been dispositioned properly (DOE 2004f).

D.3.2.2.11 SWMU 228, C-747-B OS-17

DMSA OS-17 (SWMU 228) is located west of C-747-B in the northwest portion of the plant site. SWMU 228 is approximately 10,800 ft^2. SWMU 228 has been used for the storage of excess mobile industrial equipment, which originally was slated for auction. Equipment at this location includes forklifts, tow motors and miniature pump trucks, and concrete culverts. The equipment has remained in storage at this location since the termination of off-site property sales around 1985. The exact operational dates for this site are unknown, although the last equipment probably was placed in this area in 1996. This DMSA now qualifies as a Phase 3 DMSA because it has been fully characterized and contains no fissionable material (DOE 2004g).

D.3.2.3 Group 2, Underground Tanks

D.3.2.3.1 SWMU 27, C-722 Acid Neutralization Tank

The C-722 Acid Neutralization Tank (SWMU 27) is an underground concrete tank lined with an acid-resistant membrane and acid brick. SWMU 27 is located at the northeast corner of the C-720 Building in the central portion of the plant site. The tank is approximately 180 ft^2.

The C-722 Acid Neutralization Tank was designed as a holdup tank for instrument shop effluent from the 1950s. All lines were capped from the instrument shop. All sludge and water were removed after the lines were capped. Discharge to the tank was stopped in 1992.

D.3.2.3.2 SWMU 76, C-632-B Sulfuric Acid Storage Tank

The C-632-B Sulfuric Acid Storage Tank (SWMU 76) is located in the central portion of the plant site. The tank itself is empty, but the unit includes a diked area surrounding the tank. This SWMU is located on the south end of DMSA OS-11, SWMU 222.

The tank was used for the storage of sulfuric acid. Spills of sulfuric acid inside the diked area are known to have occurred.

D.3.2.3.3 SWMU 165, C-616-L Pipeline and Vault Soil Contamination

The C-616-L Pipeline and Vault Soil Contamination (SWMU 165) is located in the central portion of the plant site. The C-616-L Vault and Lift Station is located on the south side of Virginia Avenue and north of the C-600 Steam Plant. The SWMU dimensions consist of two areas: area 1 is 105-ft wide by 210-ft long; and area 2 is 30-ft wide by 130-ft long.

The C-616-L Vault historically served as an effluent collection system. The area collects runoff from the C-600 Coal Pile. This runoff was transferred to the NSDD causing the ditch to overflow onto an adjacent stretch of 10th Street at PGDP during heavy rains. In order to address risks to workers that were exposed to contaminated sediments from the NSDD, a removal action was implemented as described in the *Record of Decision for Interim Action Source Control at the North-South Diversion Ditch* (DOE 1994b). The removal action, which was completed in 1995, consisted of several components. The component pertinent to SWMU 165 included removing fly ash from the C-600 Steam Plant ash pile runoff by constructing settling lagoons, then pumping the supernatant in the lagoons into the piping that replaced the southern part of the NSDD channel. The vault and lift station collect runoff and sediment from C-600 coal pile and pumps it around the southern reaches of the NSDD to a point just north of the C-616-C Lift Station inlet. Water from the fly ash settling basins enters the station through underground piping from the basins. Coal pile runoff is routed into the west side of the lift station by a trench. This lift station is under the control and operation of USEC.

D.3.2.3.4 SWMU 170, C-729 Acetylene Building Drain Pits

The C-729 Acetylene Building Drain Pits (SWMU 170) is located in the central portion of the plant site. The two pits are approximately 16-ft long by 8-ft wide by 3-ft deep.

The two pits were operational from 1954 to the mid 1970s. Acetylene was generated for maintenance activities by combining calcium carbide and water. The residual from the operation drained to two outside concrete pits. Standpipes in the pits allowed sediments to settle out with the effluent draining to the storm sewer system.

D.3.2.4 Group 2, Chromium Areas

D.3.2.4.1 SWMU 158, C-720 Chilled Water System Leak Site

The Chilled Water System Leak Site (SWMU 158) is located in the central portion of the plant site, southeast of the C-720 Building. The SWMU consists of chilled waterlines located under the concrete pad near the C-720 truck alley. The SWMU 158 area is approximately 10-ft wide by 30-ft long.

The primary function of the system was to provide cooling water for computer systems and HVAC systems in various plant buildings. The site is an area where approximately 3,500 gal of chromated water from the chilled water system leaked into an adjacent electrical vault and spilled over to another connected vault. Suspected contamination is hexavalent chromium due to process knowledge.

D.3.2.4.2 SWMU 169, C-410-EHF Vent Surge Protection Tank

The C-410-E HF Vent Surge Protection Tank (SWMU 169) is located in the east-central portion of the plant site. The tank has an approximate volume of 150 gal and was operated from 1952 to 1977.

The tank is an aboveground tank that was used for surge protection. It is part of a system that produced hydrogen fluoride for the feed facility. Visual observation of staining on the ground indicated probable release of materials from the tank.

D.3.2.5 Group 2, Soil/Rubble Areas

D.3.2.5.1 SWMU 19, C-410-B Hydrogen Fluoride Neutralization Lagoon

The C-410-B hydrogen fluoride (HF) Emergency Lagoon (SWMU 19) is a below grade impoundment with an earth/clay floor and wire-reinforced concrete walls. SWMU 19 is located north of the C-410 Building in the central portion of the plant site. SWMU 19 is approximately 1,900 ft^2 (38 ft x 51 ft) and 7-ft deep. This SWMU was excavated in 2010 and backfilled with clean soil.

D.3.2.5.2 SWMU 138, C-100 Southside Berm

The C-100 Southside Berm (SWMU 138) is located south of the C-100 Building, south of the plant site. SWMU 138 consists of two soil berms, each approximately 10,000 ft^2 (200 ft x 50 ft), which were constructed in 1979. Berm construction used sludge dredged from the C-611 Lagoon, the potable drinking water treatment plant, and the C-615 Sewage Treatment Plant.

D.3.2.5.3 SWMU 180, WKWMA Outdoor Firing Range (WKWMA)

The WKWMA Outdoor Firing Range (SWMU 180) is located in the WKWMA, southwest of the plant site. The Outdoor Firing Range is controlled by the WKWMA. It is used by the Kentucky State Police as a firing range. Lead bullets are present in the berm. The unit is not used by PGDP.

D.3.2.5.4 SWMU 181, West Side Outdoor Firing Range (PGDP)

The Firing Range (SWMU 181) is located west of the plant site. This SWMU is included in the *Action Memorandum for the Soils Operable Unit Inactive Facilities* (DOE 2009b). Contaminated soil on the berm face has been excavated in accordance with the Removal Action Work Plan (DOE 2009d). The results of verification sampling are included in the Work Plan (DOE 2010b).

The action limit and cleanup level of 800 ppm total lead, based on the industrial scenario, was achieved in all excavated areas. Based on the sampling results, the RAOs for this removal action were achieved. The removal action also successfully achieved cleanup to below 400 ppm total lead, the value for a residential scenario.

D.3.2.5.5 SWMU 195, SW PGDP Curlee Road Contaminated Soil Mounds

The Curlee Road Contaminated Soil Mounds (SWMU 195) is located in the southwest portion of the plant site. The site consists of two mounds of soil approximately 10–15 ft in height and covers 370,000 ft^2 in area. Historical knowledge indicates that potential COCs for SWMU 195 are radionuclides.

The area was created during original construction of the plant. The soil was unusable for fill due to its characteristics and was placed in this location. Some soil also came from excavation of drainage ditches and cleaning of the ditches.

D.3.2.5.6 SWMU 486, West of PGDP Rubble Pile WKWMA

The rubble pile is on the west side of Rice Springs Road, approximately 116 ft off the roadside. It is in the vicinity of the former locations of the C-611-M Water Tower in the Kentucky Ordnance Works area. It is approximately 55 ft by 55 ft.

The history of this site is unknown, but may have been used as a disposal area for waste material or a storage location for equipment during plant construction.

D.3.2.5.7 SWMU 487, West of PGDP Rubble Pile WKWMA

The rubble pile is on the west side of Rice Springs Road and is approximately 483 ft off the roadside. The pile is in the vicinity of the former location of the C-611-M Water Tower and is in the Kentucky Ordnance Works. The pile is approximately 80 ft by 80 ft.

The history of this site is unknown, but may have been used as a disposal area for waste material or a storage location for equipment during plant construction.

D.3.2.5.8 AOC 492, Outfall 011 Contaminated Soil Area, North of Outfall 10

The contaminated soil area, north of Outfall 10 (AOC 492) is located east of the plant site. AOC 492 is approximately 450 ft^2 (15 ft x 30 ft).

AOC 492 was discovered during routine radiological surveys in support of sampling activities. This area likely was generated from past plant maintenance activities.

D.3.2.5.9 SWMU 493, Outfall 001 Concrete Rubble Piles Near Outfall 001

The concrete rubble piles near Outfall 001 (SWMU 493) are two concrete rubble piles located west of the plant site. The two piles making up SWMU 493 are approximately 450 ft^2 and 270 ft^2, respectively.

Two concrete rubble piles were found during a site inspection for the construction of the Scrap Yard Infrastructure Storm Water Collection Basin in November 2001. The concrete rubble piles appear to have been placed along the bank for erosion control. It is unknown where the concrete originated, but it is assumed to be from the PGDP.

D.3.2.5.10 SWMU 517, West of PGDP, Rubble and Debris Erosion Control Fill Area

The rubble and debris erosion control fill area (SWMU 517) is a rubble pile located west of the plant site. SWMU 517 is approximately 653 ft^2. The fill area is believed to have resulted from placing rubble and debris in the area for erosion control.

Prior to the beginning of construction of the Scrap Yard Infrastructure Storm Water Collection Basin, a magnetometer survey was performed via a metal detector, which resulted in the discovery of several anomalies at the construction site. A drainage pipe was to have been excavated at the location of one of the anomalies, now identified as SWMU 517. During the excavation, concrete rubble was found. The concrete rubble was surveyed by HP and was determined to be uncontaminated. In accordance with a request by DOE that was approved by KDEP, the concrete was to be excavated, relocated to SWMU 474, and placed on plastic. After removal of the concrete, excavation of the area continued. During removal of the first bucket of the second truckload, additional concrete debris was discovered. The soil and debris were surveyed by HP and were found to be contaminated. Small pieces of radiologically contaminated concrete and soil were removed from the SWMU by HP personnel and placed in appropriate storage. The remaining soil and debris in the bucket were placed back in the SWMU. The excavation was discontinued. The area was backfilled with gravel and graded before being posted as a contamination area and covered with plastic.

D.3.2.5.11 AOC 541, Outfall 011 Contaminated area by Outfall 011

The Contaminated Soil Area South of Outfall 011 (AOC 541) is located in an area of heavy undergrowth, approximately 75 ft from the south bank of Outfall 011. AOC 541 is located east of PGDP, is outside of the limited area, and is approximately 100,800 ft^2 (480 ft x 210 ft).

AOC 541 was discovered during routine radiological surveys in support of sampling activities. The area contained soil piles that likely were generated as a result of past maintenance activities.

D.3.2.5.12 SWMU 561, Near Outfall 2 Soil Pile I

This SWMU was identified on November 2, 2006, as noted in the SWMU notification letter dated February 16, 2007. This SWMU is located east of the PGDP fence and is adjacent to LBC between McCaw Road and Outfall 002 Ditch. The area of this SWMU is approximately 7 acres. The footprint of the soil piles within the 7 acre area is approximately 30-ft wide x 700-ft long by an average of 8-ft tall along Outfall Ditch 002 and 30-ft wide x 700-ft long by an average of 8-ft tall along LBC for an estimated total volume of ~ 12,000 yd^3.

There appears to be no function for the soil piles within the SWMU; however, the piles most likely were dredged material produced as a result of maintenance activities performed within/along the ditch and creek.

Outfall 010 likely is a primary source of historical releases to LBC and may have contributed to observed conditions at Soil Pile I. Its associated ditches drain several PGDP facilities including the following: C-331 Process Building, C-531 Complex, and C-617-B Lagoon. In general, COPCs carried through is internal ditches to Outfall 010 mirror those transported throughout the PGDP surface water management system. Key COPCs include radionuclides, VOCs, SVOCs, and heavy metals. The soil piles along LBC contained uranium and PCBs.

A key potential source of contaminants in the surface water drainage system on the east side of PGDP is the C-340 facility. Historical leaks and spills at C-340 likely resulted in releases that traveled from floor drains through the storm sewer system, into Outfall 011, and discharged to LBC. Recorded spills and releases from C-340 include COPCs such as PCB oil, as documented in ORPS reports, PSS logs, and Annual Site Environmental Reports.

Primary processes in the C-340 Reduction and Metals Facility were the reduction of UF_6 to UF_4 and the conversion of UF_4 to metallic uranium. The facility became operational in 1956 and continued operating until 1977, when shutdown of primary processes began. After shutdown, C-340 was used as a training school, a valve test facility, a pilot plant for the study of liquid/gas scrubber systems, and a waste pilot plant for the stabilization of uranium chips. A uranium metal remolding project was conducted in the mid-1980s at C-340. The building was closed in 1991.

D.3.2.5.13 AOC 562, North of Soil Pile I, West of LBC Soil Piles C, D, E, F, G, H, J, K, and P in Subunit 1

Limited sampling, field reconnaissance, and field radioactivity measurements at AOC 562 were completed in December 2006 as part of the Addendum 1B effort. An investigation of all soils, in Addendum 1B was completed in December 2008, which included AOC 562.

Historical research was performed to attempt to determine the origin of the piles. Origin of the Addendum 1-B Soil Piles remains unknown, although, the location and shape indicates that many of the PGDP-related soil piles are likely to have originated from excavations associated with the creation, periodic dredging, and cleanout of the outfalls, ditches, and creeks that comprise the PGDP surface water management system. Management of the surface water system at PGDP no longer allows piling soil along the ditch or creek banks outside the SWMU boundaries.

D.3.2.5.14 AOC 563, North of Outfall 12, West of LBC Soil Piles 20, BW, and CC in Subunit 4

Limited sampling, field reconnaissance, and field radioactivity measurements at AOC 563 were completed in December 2006 as part of the Addendum 1B effort. An investigation of all soils, in Addendum 1B was completed in December 2008, which included AOC 563.

Historical research was performed to attempt to determine the origin of the piles; however, the origin of the Addendum 1-B Soil Piles remains unknown, although the location and shape indicates that many of the PGDP-related soil piles are likely to have originated from excavations associated with the creation, periodic dredging, and cleanout of the outfalls, ditches, and creeks that comprise the PGDP surface water management system. Management of the surface water system at PGDP no longer allows piling soil along the ditch or creek banks outside the SWMU boundaries.

D.3.2.5.15 AOC 564, East of NSDD, North of P, S, and T Landfill Soils Pile AT in Subunit 5

Limited sampling, field reconnaissance, and field radioactivity measurements at AOC 564 were completed in December 2006 as part of the Addendum 1B effort. An investigation of all soils in Addendum 1B was completed in December 2008, which included AOC 564.

Historical research was performed to attempt to determine the origin of the piles Origin of the Addendum 1-B Soil Piles remains unknown, although the location and shape indicates that many of the PGDP-related soil piles are likely to have originated from excavations associated with the creation, periodic dredging, and cleanout of the outfalls, ditches, and creeks that comprise the PGDP surface water management system. Management of the surface water system at PGDP no longer allows piling soil along the ditch or creek banks outside the SWMU boundaries.

D.3.2.5.16 AOC 567, Near Outfall 013 and West of LBC Contaminated Soil Area K013

This SWMU/AOC encompasses five individual soil piles located near Outfall 013. The soil piles vary in size and are approximately 3-ft high.

This area was discovered in June 2008, during work to implement a SAP for other soil piles in the area. The area contained soil piles that likely were generated as a result of past construction activities at PGDP. This area was characterized with the other soil piles in the area in October 2008 during the Soil Pile Addendum 1-B Site Evaluation. The K013 soil piles are not in close proximity to other piles.

D.3.2.6 Group 3, Scrap Yards

D.3.2.6.1 SWMU 14, C-746-E Contaminated Scrap Yard

The C-746-E Contaminated Scrap Yard (SWMU 14) is located in the northwest corner of the plant site. SWMU 14 is approximately 265,000 ft^2.

C-746-E was used for the storage of uranium-contaminated scrap metal, including ferrous alloys, copper and copper alloys, nickel-plated steel, Monel®, and aluminum from the 1950s through 2005. In addition, Burial Pit E is located under the northeastern section of C-746-E. Burial Pit E was investigated under the BGOU in conjunction with SWMU 7.

The storage yard was emptied as specified by the *Action Memorandum for Scrap Metal Disposition* (DOE 2001d) and documented in the *Removal Action Report for the Scrap Metal Removal Action* (DOE 2008a).

D.3.2.6.2 SWMU 518, C-746-P1 Field South of C-746—P1 Clean Scrap Yard

The field south of the C-746-P1 Clean Scrap Yard (SWMU 518) is in the northwestern portion of the plant. SWMU 518 is approximately 35,000 ft^2. It is believed to have been used as a temporary storage area for heavy equipment.

D.3.2.6.3 SWMU 520, C-746-A Scrap Material West of C-746-A

The scrap material west of C-746-A (SWMU 520) is located in the northwestern portion of PGDP. SWMU 520 is approximately 152,000 ft^2. This SWMU has been used as a storage area for old equipment and materials since the 1970s. Material stored in this area include old pallets, old equipment (such as tow motors, forklifts, welding rigs and fixtures, vehicles, and vehicle trailers), and wooden saddles from the cylinder yards.

Annual surveys of the perimeter of this area are performed. The area currently is posted as a radioactive materials area, although no known releases have occurred.

D.3.2.7 Group 3, PCBs

D.3.2.7.1 SWMU 57, C-541-A PCB Waste Staging Area

The C-541-A PCB Waste Staging Area (SWMU 57) is located in the northeast portion of the plant site. SWMU 57 is made up of leaks and spills of oils containing PCBs as a result of past operations that contaminated the soils.

D.3.2.7.2 SWMU 81, C-541 PCB Spill Site

The C-541 PCB Spill Site (SWMU 81) is located in the northeast portion of the plant site. SWMU 81 is made up of leaks and spills of oils containing PCBs as a result of past operations that contaminated the soils.

D.3.2.7.3 SWMU 153, C-331 PCB Soil Contamination (west)

The C-331 PCB soil contamination (west) (SWMU 153) is located west of the C-331 Building in the west-central portion of the plant site and was a dust palliative area used to reduce the amount of dust taken in by the ventilation system. The area is approximately 100-ft wide by 420-ft long.

D.3.2.7.4 SWMU 156, C-310 PCB Soil Contamination (west side)

The C-310 PCB soil contamination (west side) (SWMU 156) is located in the central portion of the plant site. The approximate dimension of SWMU 156 is 100-ft wide by 160-ft long. The area historically was used as a dust palliative area to reduce the amount of dust taken in by the C-331 Building ventilation systems.

D.3.2.7.5 SWMU 160, C-745 Cylinder Yard Spoils (PCB soils)

The C-745 Cylinder Yard Spoils (PCB Soils) (SWMU 160) is located in the southeast portion of the plant site. SWMU 160 is approximately 300-ft wide by 500-ft long. Historically, this area was used as storage of excavated soils and soils for fill from other projects at PGDP.

D.3.2.7.6 SWMU 163, C-304 Building/HVAC Piping System (soil backfill)

The C-304 Building/HVAC Piping System (Soil Backfill) (SWMU 163) is located in the central portion of the plant site. SWMU 163 is approximately 100-ft wide by 200-ft long.

Soils from the C-611-V Lagoon borrow area were used for fill material for C-304 construction activities. The fill material was used as a base for the HVAC piping system and as a heat sink; it is located approximately 6 ft bgs.

D.3.2.7.7 SWMU 219, C-728 OS-08

DMSA OS-08 (SWMU 219) is located east of C-728 in the central portion of the plant site. SWMU 219 is an empty 4,722 ft^3 fiberglass tank that was used to store PCB-contaminated water prior to treatment, as appropriate, and disposal.

PCB spill documentation indicates this tank was used to store PCB-contaminated rainwater that had collected in a pit in the C-537 Switchyard. Two transformer spills in 1989 resulted in rainwater collecting in the C-537 pit that would have been subject to TSCA rules. This rainwater would have been transferred to SWMU 219. The SWMU 219 tank was documented as leaking inside the present location, a diked area covered with Hypalon®, in November 1991. The water from the diked area was sampled with results of PCBs at < 0.1 mg/L. The tank was drained and cleaned according to TSCA requirements. Additionally, personnel recall this tank possibly was used to clean up an RCW spill in C-333. The spill would have been subject to TSCA regulations because it came into contact with PCB troughing and gaskets.

D.3.2.7.8 SWMU 488, C-410 Trailers PCB Contamination Area by C-410 Trailer Complex

The PCB Contamination Area by the C-410 Trailer Complex (SWMU 488) is a PCB soil contamination area located in a grassy drainage swale in the central portion of the plant site. SWMU 488 is approximately 25 ft^2. It is unknown how this area experienced a PCB spill.

The contamination area was discovered as a result of a surface soil sampling and characterization event for the placement of the support trailers for the DMSA characterization/disposition activities in the field north of the C-710 Laboratory. In May 2001, radiological surveys of this area were performed. Results of this survey indicated no radiological contamination was present. Soil samples were obtained as part of site characterization. The only contaminant above background detected in the soil was PCBs.

D.3.3 DEMOGRAPHY AND LAND USE

As shown in the physical descriptions presented above, current land use of all sources investigated during the Soils OU RI is either industrial or recreational. Under current use, because of access restrictions, only plant workers and authorized visitors are allowed access to the areas located inside the limited area. The areas outside the limited area either have industrial restricted access or are part of the WKWMA. The sources that are in the WKWMA have a land use of recreational and that of the outdoor worker. As discussed in the PGDP Site Management Plan (DOE 2011b), foreseeable future land use of the PGDP industrial area is expected to be industrial as well. The land use of the WKWMA also is not expected to change; it will remain recreational and available to the outdoor worker.

At present, both recreational and residential land uses occur in areas surrounding PGDP. Recreational use occurs in the WKWMA. The WKWMA is used primarily for hunting and fishing, but other activities include horseback riding, field trials, hiking, and bird watching. An estimated 5,000 fishermen visit the area annually, according to the Kentucky Department of Fish and Wildlife Resources manager of the WKWMA. Residential use near the plant and in areas to which the groundwater from the PGDP may migrate is rural residential and includes agricultural activities. No SWMUs/AOCs located outside the limited area and evaluated in this RI are currently in residential areas. Response actions have eliminated exposure of these rural residents to contaminated groundwater. More urban residential use occurs in the villages of Heath, Grahamville, and Kevil, which are within 3 miles of U.S. Department of Energy (DOE) property boundaries, but outside of the area that may be impacted by the Soils OU. The closest major urban area is the municipality of Paducah, Kentucky, which has a population of approximately 26,000 and is approximately 10 miles from PGDP. Other municipalities in the region near PGDP are Cape Girardeau, Missouri, which is approximately 40 miles west of the plant; and the cities of Metropolis and Joppa, Illinois, which are across the Ohio River from PGDP. Total population within a 50-mile radius of the plant is approximately 732,000 people, with about 88,500 people living within 10 miles. The population of McCracken County, in which PGDP lies, is estimated at 65,000 people.

In the area near PGDP and in western Kentucky, in general, the economy has been based on agriculture; however, industry has increased in recent years. PGDP is a major employer with approximately 1,400 workers. Another major employer near PGDP is the Tennessee Valley Authority Shawnee Fossil Plant, which employs approximately 260 individuals.

D.3.4 IDENTIFICATION OF EXPOSURE PATHWAYS

The general principles of the exposure assessment as addressed in the Risk Methods Document (DOE 2011a) provide the basis for the evaluations provided in this assessment. This subsection describes the potential exposure scenarios and receptors. Only the receptors potentially exposed to each media and location were evaluated. The exposure scenarios evaluated represent potential future scenarios, because most of the exposure assumptions are based on conservative input factors for the administered or absorbed dose estimations. Thus, most, if not all, exposure scenarios represent future hypothetical exposure assumptions, because current exposures are minimal or are not occurring at the site. As a result, the exposure assumptions are either the available default values or are conservatively selected based on assumed receptor behavior.

The current on-site land use is industrial, and this can be expected to continue in the foreseeable future. However, the expected exposure frequencies and durations may be higher in the future than duration and frequency of the current exposure. Additionally, use of groundwater drawn from the RGA at these SWMUs/AOCs is not expected; however, uses of areas surrounding PGDP indicate that it would be prudent to examine a range of land uses to provide decision makers with estimates of the risk that may be posed to humans under alternate uses. In order to provide consideration of a range of land uses, the BHHRA reports the hazards and risks for current and several hypothetical future uses, consistent with regulatory guidance.

The exposure scenarios and receptors evaluated in this BHHRA are pertinent to the activities conducted at the Soils OU. Default land use scenarios (e.g., current and future industrial and hypothetical future residential) and additional scenarios (e.g., recreational, excavation, and outdoor worker) were evaluated for each of the EUs.

A future on-site rural resident is not a likely land use scenario because land use controls are in place that prevent residential exposure at the site. More likely future on-site scenarios may include recreational uses (hunting), considering the WKWMA is adjacent to a buffer area that surrounds the industrial areas of the site. Further, although unauthorized access to the area (trespassing) is unlikely under current conditions, evaluation of this scenario could be represented under the assessment of the recreational user. Current and future industrial worker, outdoor worker, and excavation worker are all considered in this assessment.

As discussed in the Risk Methods Document (DOE 2011a), risks from water drawn from the UCRS will not be presented in the main body of the risk assessment.

The exposure factors primarily are based on a reasonable maximum exposure (RME) assumption. The intent of the RME assumption is to estimate the highest exposure level that reasonably could be expected to occur (EPA 1989; EPA 1991). The RME assumptions were developed by EPA to represent an upper-bound estimate for the plausible exposures. In keeping with the EPA guidance (EPA 1991), the variables chosen for a baseline RME scenario for the intake rate, exposure frequency (EF), and exposure duration (ED) are generally upper-bounds. Other variables, such as body weight (BW) and exposed skin surface area are generally central tendency or average values. The conservatism built into the individual variables ensures that the entire estimate for the contact rate is more than sufficiently conservative.

The scenarios described in the following subsections assume that 100% of a receptor's time is spent in contact with the contaminated medium at the site. For all sites, a worker is assumed to spend all of a workday in the area, which is a conservative estimate for the intake from a given site.

The averaging time (AT) for noncancer evaluation is computed as the product of ED (years) multiplied by 365 days per year, to estimate an average daily dose over the entire exposure period (EPA 1989). For the cancer evaluation, AT is computed as the product of 70 years, the assumed human lifetime, multiplied by 365 days per year, to estimate an average daily dose prorated over a lifetime, regardless of the frequency or duration of exposure. This methodology assumes that the risk from a short-term exposure to a high dose of a given carcinogen is equivalent to a long-term exposure to a correspondingly lower dose, provided that the total lifetime doses are equivalent. For example, the current and future exposure scenarios represent exposures mostly under future hypothetical scenarios, because exposed soils are limited at most of these sites and a maintenance worker or a recreational visitor would not spend the amount of time assumed in the exposure assumptions. The more conservative exposure assumptions used are for conservatism in the potential exposure evaluations during site management. Thus, the estimated intake or exposure doses apply mostly to the future hypothetical exposure scenarios. The scenarios are discussed in the following text.

D.3.4.1 Potential Receptor Populations

The receptors and exposure factors are summarized in Table D.8, with an overview presented following.

Values in the table marked as “chemical-specific” are listed in Attachment D4. The dermal absorption (ABS) factors used are from the KDEP values presented in the 2011 Risk Methods Document. Because these factors apply only to COPCs evaluated for dermal toxicity, these ABS factors are presented in Attachment D4 along with the dermal toxicity values.

Current On-site and Off-site Industrial Workers. The current on-site industrial worker exposure scenario was evaluated for direct contact to surface soils (0 ft–1 ft). The current worker differs from the future industrial worker only by a lower EF equivalent to the current maintenance schedule for these areas (14 days for current on-site industrial worker (such as maintenance worker) versus 250 days for future industrial worker default scenario). For workers outside the limited area, the workers also are assumed to have direct contact to surface soils (0 ft–1 ft) under current conditions. This limited frequency reflects the size (roughly ½ acre or less for each EU) and limited activities at these SWMUs/AOCs.

Future Industrial Workers. The future industrial worker exposure scenario 0 ft–1 ft was evaluated using standard default assumptions as outlined in the Risk Methods Document (DOE 2011a) (e.g., 70-kg adult who works 8 hours per day, approximately 5 days per week, year-round on-site, for a total of 250 days per year for 25 years). No ingestion of groundwater assumed for the future industrial worker (only for the resident).

Future Recreational Users. As per the Risk Methods Document (DOE 2011a), recreational uses (child, teen, adult) are primarily focused on sediments, where areas are more attractive for wading. However, a plausible future use on-site and off-site is for recreational use, specifically hunting (deer, rabbits, quail). Hunters are assumed primarily to be teens and adults, and direct contact to soils for these receptors is assumed to be limited because repeated contact with contaminated media at sites less than 0.5 acre would be unlikely for hunting activities. This pathway was evaluated as a basis for SWMU-specific decisions in this assessment only for the teen, which is the more conservative of the two, and is consistent with planning and scoping for the OU.

The equation used for calculating chemical intake from incidental soil/sediment ingestion to the recreational user was taken from the Risk Methods Document (DOE 2011a). This equation erroneously adjusts the ingestion rate to reflect exposure time out of the 24-hour day. More appropriately, the full incidental soil ingestion should have been calculated to occur during the exposure time. This may result in an underestimation of potential risk to the teen recreational user.

Table D.8. Exposure Factors Used for Intake Calculations in BHHRA

Pathway Variable	Units	Current On-site Industrial Worker		Future On-site Industrial Worker		Off-site Outdoor Worker[c]		Adult Resident		Child Resident		Teen Recreational User	
		Value	Source	Value	Source	Value	Source	Value	Source	Value	Source	Value	Source
General Parameters Used in All Intake Models													
Exposure frequency (EF)	days/year	14	b	250	a	185	a	350	a	350	a	140	a
Exposure duration (ED)	Years	25	a	25	a	25	a	24	a	6	a	12	a
Body weight (BW)	Kilograms	70	a	70	a	70	a	70	a	15	a	43	a
Averaging time - noncancer (AT-N)	Days	9,125	a	9,125	a	9,125	a	8,760	a	2,190	a	4,380	a
Averaging time - cancer (AT-C)	Days	25,550	a	25,550	a	25,550	a	25,550	a	25,550	a	25,550	a
Inhalation of VOCs and Resuspended Dust from Soil													
Outdoor inhalation rate (IN)	m^3/hour	2.5	a	2.5	a	2.5	a	0.833	a	0.833	a	2.5	a
Exposure time (ET)	hours/day	8	a	8	a	8	a	24	a	24	a	6	a
Volatilization Factor (VF)	m^3/kg	CSV		CSV		CSV		CSV		CSV		CSV	
Particulate emission factor (PEF)	m^3/kg	6.20E+08	a	6.20E+08	a	6.20E+08	a	9.30E+08	a	9.30E+08	a	9.30E+08	a
Incidental Ingestion of Soil													
Incidental ingestion rate (IR-S)	mg/day	50	a	50	a	480	a	100	a	200	a	100	a
Dermal Contact with Soil													
Body surface area exposed (SA)	m^2/day	0.47	a	0.47	a	0.47	a	0.57	a	0.28	a, e	0.75	a
Soil-to-skin adherence factor (SSAF)	mg/cm^2 – day	1	a	1	a	1	a	1	a	1	a, e	1	a
Dermal absorption factor (DABS)	Unitless	CSV		CSV		CSV		CSV		CSV		CSV	
External Exposure													
Exposure frequency (EF)	day/day	14/365	b	250/365	a	185/365	a	350/365	a	350/365	a	140/365	a
Gamma shielding factor	Unitless	0.2	a	0.2	a	0.2	a	0.2	a	0.2	a	0	a
Gamma exposure time factor	hr/hr	8/24	a	8/24	a	8/24	a	24/24	a	24/24	a	5/24	a
Drinking Water Ingestion													
Drinking water ingestion rate (IR-GW)	L/day	n/a		n/a		n/a		2	a	1.5	a	n/a	
Dermal Contact with RGA Groundwater													
Body surface area exposed (SA)	m^2/day	n/a		n/a		n/a		1.815	a	0.65	a	n/a	
Fraction absorbed water	Unitless	n/a		n/a		n/a		CSV		CSV		n/a	
Permeability coefficient (Kp)	cm/hour	n/a		n/a		n/a		CSV		CSV		n/a	
Lag time (t)	hour/event	n/a		n/a		n/a		CSV		CSV		n/a	
Time to reach steady-state (t*)	Hours	n/a		n/a		n/a		CSV		CSV		n/a	
Ratio of permeability of stratum corneum to epidermis (B)	Unitless	n/a		n/a		n/a		CSV		CSV		n/a	
Event time (t_{event})	hour/event	n/a		n/a		n/a		0.2	a	0.2	a	n/a	
Event frequency (EV)	events/day	n/a		n/a		n/a		1	a	1	a	n/a	

Table D.8. Exposure Factors Used for Intake Calculations in BHHRA (Continued)

Pathway Variable	Units	Current On-site Industrial Worker		Future On-site Industrial Worker		Off-site Outdoor Worker		Adult Resident		Child Resident		Teen Recreational User	
		Value	Source	Value	Source	Value	Source	Value	Source	Value	Source	Value	Source
Inhalation RGA Groundwater (showering)													
Indoor inhalation rate	m^3/hour	n/a		n/a		n/a		0.833	a	0.833	a	n/a	
Exposure frequency (EF)	day/year	n/a		n/a		n/a		350	a	350	a	n/a	
Exposure time (ET)	hours/day	n/a		n/a		n/a		0.2	a	0.2	a	n/a	
Time of shower (t1)	Hour	n/a		n/a		n/a		0.1	a	0.1	a	n/a	
Time after shower (t2)	Hour	n/a		n/a		n/a		0.1	a	0.1	a	n/a	
Fraction volatilized (f)	Unitless	n/a		n/a		n/a		0.75	a	0.75	a	n/a	
Water flow rate (Fw)	L/h	n/a		n/a		n/a		890	a	890	a	n/a	
Bathroom volume (Va)	m^3	n/a		n/a		n/a		11	a	11	a	n/a	
Inhalation RGA Groundwater (household use)													
Indoor inhalation rate	m^3/hour	n/a		n/a		n/a		0.833	a	0.833	a	n/a	
Exposure frequency (EF)	day/year	n/a		n/a		n/a		350	a	350	a	n/a	
Exposure time (ET)	hours/day	n/a		n/a		n/a		24	a	24	a	n/a	
Exchange rate (ER)	changes/day	n/a		n/a		n/a		10	a	10	a	n/a	
Mixing coefficient (MC)	Unitless	n/a		n/a		n/a		0.5	a	0.5	a	n/a	
Fraction volatilized (f)	Unitless	n/a		n/a		n/a		0.5	a	0.5	a	n/a	
Water flow rate (WHF)	L/day	n/a		n/a		n/a		890	a	890	a	n/a	
House volume (HV)	m^3	n/a		n/a		n/a		450	a	450	a	n/a	

Notes:

[a] DOE 2011, *Methods for Conducting Risk Assessment and Risk Evaluation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume 1. Human Health,* DOE/LX/07-0107&D2/R1/V1, February.

[b] Best professional judgment; similar to value used for DOE 2008c, *Surface Water Operable Unit (On-Site) Site Investigation and Baseline Risk Assessment at the Paducah Gaseous Diffusion Plant,* DOE/LX/07-0001&D2/R1, U.S. Department of Energy, Paducah, KY, February.

[c] Excavation worker exposure durations are a ratio of the off-site outdoor worker.

Additional information is available in Sections D.3.5.1 and D.5 and the text box to the side.

n/a = Not available or not applicable

Area	Acres	0.5
	m2	2023.5
	ft2	21780
Depth	feet	15
	m	4.572
Volume	m3	9251.442
Excavation Rate	m3/hr	20
	m3/day	160
Excavation time	days	57.82151
	Weeks	11.5643
	Months	2.891076
	Yrs	0.231286
	Max Workdays/yr	250
Default outdoor worker	days/yr	185
	yrs	25
	Total days	4625
No. of whole years		1
	days/yr	57.82151
Multiplier for ELCR		**0.0125**
Multiplier for HI		**0.313**

Future Hypothetical Rural Resident. The future residential scenario is evaluated using both an adult and a child potentially exposed to site surface soils for SWMUs/AOCs both within and outside the limited area. Although this land use is unlikely, this evaluation provides information on potential for adverse impacts if no land use restrictions were in place. Future residents are assumed to be exposed to RGA groundwater for those SWMUs/AOCs where potential impacts to groundwater are identified from the soils. Appendix C describes the groundwater modeling. Similarly, potential exposure to soil VOCs that have migrated to indoor air through vapor intrusion have been considered only for the sites with releases of VOCs from the soils and potential presence in the shallow groundwater. .

Future Outdoor Worker and Excavation Worker. For evaluation of potential future direct contact issues with subsurface soil, two scenarios were considered: excavation worker and outdoor worker. These each assume contact with both surface and subsurface soils, but differ in that the excavation addresses contact during the excavation/construction process, so for small SWMUs/AOCs, total number of days exposed was limited. Additional detail is provided below. For the outdoor worker, it is assumed that surface and subsurface soils are mixed (brought to the surface) where exposure durations may be extended.

According to the Risk Methods Document (DOE 2011a), 185 days per year and 25 years are recommended for the EF and the ED, respectively, for the outdoor worker. However, the Risk Methods Document provides flexibility in this assumption when applying to an excavation worker. According to the Risk Methods Document (DOE 2011a), "all exposure parameters for the outdoor worker/gardener scenario, except ED, can be used for a construction/excavation worker." When used for the construction/excavation worker scenario, the ED should be reduced to as low as 1 year (based on guidance from the Exposure Factors Handbook) (DOE 2011a). Further, from a practical standpoint, defaulting to outdoor worker exposure assumptions for an excavation scenario will exceed the reasonable assumptions for many SWMUs/AOCs because the excavation scenario typically represents a soil removal action associated with construction of a foundation or excavation of contaminated soil. For nearly all waste sites or foundation construction sites, this is a one-time event of short duration. For example, according to Regulatory Impact Analysis for Radiation Site Cleanup Proposed Rule (EPA 1995) and Means Heavy Construction Cost Data (8th Annual Edition. R.S. Means Company, Inc. Kingston, Massachusetts), a m^3 of soil can be excavated in 0.05 hours with a crew of 1 supervisor, 2 laborers, and 1 heavy equipment operator. Using the size of a ½ acre EU and assuming that the first 15 ft of soil is excavated, and using a 1 m^3/0.05 hr (20 m^3/hr) soil excavation rate, the number of 8-hour work days, with no breaks, required to totally excavate each EU was calculated. In summary, in the BHHRA, the number of days and years to complete the excavation was set to maintain the exposure frequency as close to but not over 185 days per year, and the exposure duration was set to maintain the smallest whole number of years possible based on the size of a SWMU/EU.

D.3.4.2 Delineation of exposure point/exposure routes

As discussed, human health risks are assessed by determining points of exposure (POEs) and exposure routes. POEs are locations where human receptors can contact contaminated media. Exposure routes are the processes by which human receptors contact contaminated media. The exposure routes considered during the exposure assessment for all BHHRAs per the Risk Methods Document (DOE 2011a) are listed in the following paragraphs. This material also presents reasons for selecting or not selecting each exposure route for each of the potentially exposed populations in this BHHRA. The exposure routes evaluated and those that were quantitatively assessed in this BHHRA are described below.

Surface water. Although some SWMUs/AOCs are located near drainageways, significant surface water contamination is not expected as a result of these SWMUs/AOCs (UK 2007). Further, due to the physical cover at the SWMUs that limit the potential for particulate transport through sheet flow and based upon the modeling performed as part of the SI report for the outfalls and their associated internal ditches, no contaminants are migrating in surface water (dissolved or through sediment) from ditches to surrounding creeks at concentrations that may adversely impact human health (DOE 2008c). As a result, human health risks associated with exposure to surface water was not assessed in this BHHRA.

Groundwater. Residential and industrial use of RGA groundwater is common in western Kentucky. There is no current complete pathway for domestic use of RGA groundwater downgradient of the facility; however, a conservative assumption for evaluating impacts to the RGA is based on hypothetical future use of RGA groundwater by a resident. SWMU 14 was identified with soil concentration that could yield potential unacceptable concentrations in groundwater associated with migration from this area; however, as noted in Appendix C, there is no evidence of impact on RGA groundwater from migration from soils in SWMU 14. The potential POEs as completed in the modeling are the SWMU boundary, the property boundary, and a downgradient RGA discharge point. The most stringent assumptions for risk estimates at the SWMU boundary are used for the risk estimates.

For domestic use of groundwater by a hypothetical future resident, the following routes of exposure are evaluated:

- Groundwater ingestion (potable use of RGA groundwater),

- Inhalation of volatile constituents emitted while using groundwater (all household uses), and

- Dermal contact with groundwater while showering.

Vapor Intrusion. Transport of vapors in subsurface soils and shallow groundwater into buildings is considered a potential future exposure pathway. The POE—location where this is complete—is focused at the source areas where volatile compounds were release. These are the primary locations where VOCs may be in the soils or upper groundwater layer where a building may be constructed in the future. Although future residential use is not considered likely, this exposure route was considered in this BHHRA for rural residential scenario. No additional contribution via inhalation of vapors that may be transported into basements is expected.

Soil. A primary consideration for risks associated with contamination in soils is direct contact with these at the SWMUs/AOCs. Therefore, these are the points of exposure either under current conditions where exposure may be to contaminants in the 0 ft–1 ft depth, or possible future contact with contaminants in the subsurface as well. To estimate risks for the receptors described in the previous section, the following routes of exposure are quantified:

- Incidental ingestion of contaminated soil,
- Dermal contact with contaminated soil,
- Inhalation of particulates emitted from contaminated soil,
- Inhalation of volatile constituents emitted from contaminated soil, and
- External exposure to ionizing radiation emitted from contaminated soil.

D.3.5 QUANTIFICATION OF EXPOSURE

D.3.5.1 Calculation of EPCs of COPCs

The EPCs were determined as described in Section D.2.3.2.

Soil—Direct Contact Exposure. In determining the UCL for soil, the data are segregated into depth intervals relevant to receptors. For all scenarios except the excavation worker and the outdoor worker (exposed to surface and subsurface soil), data from samples collected from 0 to 1 ft bgs are used to estimate the exposure point concentration. For the excavation worker and the outdoor worker (exposed to surface and subsurface soil), data collected from 0 to 16 ft bgs are used to estimate the exposure point concentration.

Groundwater—Residential Use. The groundwater COPC concentrations in the RGA groundwater at the SWMU boundary are based on the results of the modeling as presented in the fate and transport discussion.

D.3.5.2 Chronic Daily Intakes

The EPC for each COPC was used to calculate potential chemical intakes. The equations to be used to combine the EPCs and exposure factors to estimate chemical intake followed the general format presented in RAGS, Part A (EPA 1989a) as follows:

$$\text{Chemical Intake}\,[\text{mg/(kg} \times \text{day)}] = \frac{C_s \times CF \times EF \times FI \times ED \times IR}{BW \times AT}$$

Where:

Chemical Intake = the dose

- C_s = average concentration contacted over the exposure period.
- CF = contact rate or amount of contaminated medium contacted per unit time or event.
- EF = exposure frequency
- FI = frequency of ingestion
- ED = exposure duration
- IR = ingestion rate
- BW = average body weight of the receptor over the term of exposure.
- AT = averaging time or period over which exposure is averaged.

and

$$\textbf{Radionuclide Intake (pCi)} = A_s \times CF_{rad} \times EF \times FI \times ED \times IR$$

Where:

Radionuclide Intake = the dose

- A_s = average activity contacted over the exposure period.
- CF_{rad} = conversion factor.
- EF = exposure frequency
- FI = fraction ingested
- ED = exposure duration
- IR = ingestion rate

Calculation of intake, both noncancerous and cancerous are presented in Tables D.9 through D.22 (located on CD) of this BHHRA for the following scenarios:

- Current industrial worker exposure to surface soil
- Future industrial worker exposure to surface soil
- Excavation worker/outdoor worker exposure to surface and subsurface soil
- Outdoor worker exposure to surface soil
- Future hypothetical adult resident exposure to surface soil
- Future hypothetical child resident exposure to surface soil
- Teen recreational user exposure to surface soil

D.3.6 SUMMARY OF EXPOSURE ASSESSMENT

Consistent with the data collected during the RI, the receptors selected for assessment are the outdoor/excavation worker, industrial worker, and rural resident.

D.3.6.1 Development of Conceptual Site Models

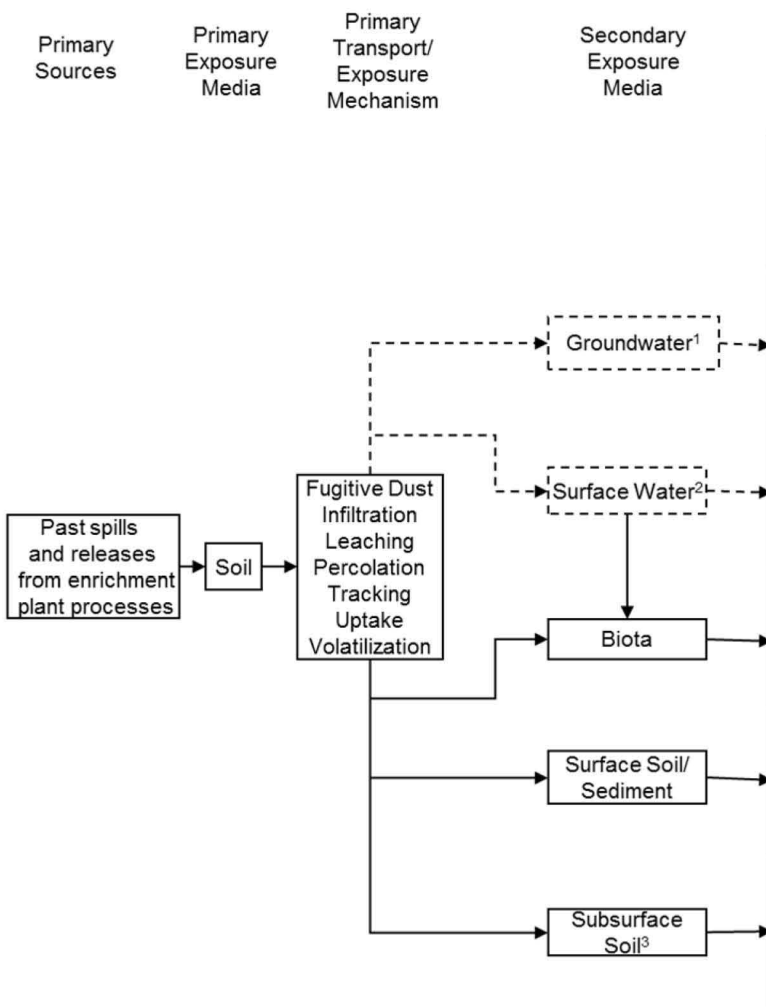
The scope of the sampling in support of the remedial investigation discussed in Section 1 of the RI/FS Work Plan is as follows:

> The objective of this investigation is to determine the nature and extent of contamination in the soils to a depth of 10 ft below ground surface (bgs) or up to 16 ft bgs at infrastructure (e.g., pipelines). For all source units, the initial focus of the investigation will be surface and subsurface soil contamination to a depth of 4 ft bgs. If contamination at the 4 ft bgs is found, then secondary sources from the unit located in the subsurface soil, which extend to a depth of 10 ft bgs, will be investigated. Any contamination that is found to extend past the depths specified in this investigation will be addressed under another OU.

This scope and the uncertainties in site conditions were subsequently used in the baseline risk assessment to develop a generalized conceptual site model that identified the sources of contamination (from both process releases and unspecified releases), release mechanisms, primary and secondary contaminated environmental media, transport mechanisms, potential receptors, and routes of exposure consistent with the remedial investigation. This generalized conceptual site model, which does not consider conditions unique to each SWMU/AOC grouping, is presented in Figure D.3. The impacts of the conditions unique to each SWMU/AOC grouping upon the generalized conceptual site model are discussed below.

Former Facilities. Two of the former facilities include septic systems (SWMU 99B and SWMU 194). For these SWMUs/AOCs, the groundwater pathway was considered a potentially complete pathway and was evaluated through data screening, comparison to SSLs, and, in some cases, groundwater modeling—see Appendix C. This evaluation concluded that the groundwater pathway is incomplete for these SWMUs. Note: SWMU 1 has a complete pathway for groundwater and is addressed under the GWOU (VOC sources for the Southwest Plume project).

Storage Areas. The conditions at storage areas are consistent with the generalized CSM.



Potential Receptor and Exposure Routes

Current Industrial Worker	Future Industrial Worker	Future Excavation Worker	Future Recreational User	Future Rural Resident	Ecological
	· Ingestion · Dermal · Inhalation	· Ingestion · Dermal · Inhalation		· Ingestion · Dermal · Inhalation	· Ingestion · Dermal · Inhalation · External Exposure
· Ingestion · Dermal · Inhalation · External Exposure	· Ingestion · Dermal · Inhalation · External Exposure	· Ingestion · Dermal · Inhalation · External Exposure	· Ingestion · Dermal · Inhalation · External Exposure	· Ingestion · Dermal · Inhalation · External Exposure	· Ingestion · Dermal · Inhalation · External Exposure
			· Ingestion	· Ingestion	· Ingestion
· Ingestion · Dermal · Inhalation · External Exposure	· Ingestion · Dermal · Inhalation · External Exposure	· Ingestion · Dermal · Inhalation · External Exposure	· Ingestion · Dermal · Inhalation · External Exposure	· Ingestion · Dermal · Inhalation · External Exposure	· Ingestion · Dermal · Inhalation · External Exposure
		· Ingestion · Dermal · Inhalation · External Exposure			

- - - - - Incomplete/Potential Pathway
——— Complete Pathway

[1] The groundwater pathway is complete for SWMU 1 and potentially complete for SWMU 14. Information from this RI will be provided to the GWOU.
[2] Contamination currently in sediments in ditches or surface water will be evaluated as part of the SWOU.
[3] For the PCB areas grouping, the pathway impacting subsurface soil is incomplete.

Figure D.3. CSM for the Soils OU

Underground/Tank. For the underground/tank grouping, the groundwater pathway was considered a potentially complete pathway and was evaluated through data screening, comparison to SSLs, and, in some cases, groundwater modeling—see Appendix C. This evaluation concluded that the groundwater pathway is incomplete for this SWMU/AOC grouping. In addition, for underground storage tanks, the biota pathway would be incomplete.

Chromium Areas. The conditions at chromium areas are consistent with the generalized CSM.

Soil/Rubble Piles. The conditions at soil/rubble piles are consistent with the generalized CSM.

Scrap Yards. The conditions at scrap yards are consistent with the generalized CSM. Groundwater modeling (see Appendix C) indicates that the groundwater pathway for SWMU 14 is potentially complete. The uncertainty of this pathway in regard to a potential contaminant source to groundwater will be managed in the FS.

PCB Areas. For the PCB areas grouping, the pathway impacting subsurface soil is incomplete.

Conditions unique to each SWMU/AOC not reflected in the generalized CSM which might affect alternatives development in the FS will be addressed in the FS, as appropriate.

Each grouping of the Soils OU includes the following:

- Former Facility
  - SWMU 1 (2.29 acres): 5 EUs
  - SWMU 99B (0.34 acres): 2 EUs
  - SWMU 194 (41.7 acres): 31 EUs
  - SWMU 196 (0.4156 acres): 2 EUs
  - SWMU 489 (0.02082 acres): 1 EU
  - SWMU 531 (0.21 acres): 1 EU

- Storage Area
  - SWMU 200 (0.81 acres): 1 EU
  - SWMU 212 (0.09 acres): 1 EU
  - SWMU 213 (0.16258 acres): 2 EUs
  - SWMU 214 (0.01355 acres): 1 EU
  - SWMU 215 (0.01 acres): 1 EU
  - SWMU 216 (0.027 acres): 1 EU
  - SWMU 217 (0.98 acres): 2 EUs
  - SWMU 221 (0.21 acres): 1 EU
  - SWMU 222 (0.05279 acres): 1 EU

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- SWMU 227 (1.28 acres): 2 EUs
- SWMU 228 (0.23 acres): 1 EU

- Underground/ Tank
  - SWMU 27 (0.0027 acres): 1 EU
  - SWMU 76 (0.02 acres): 1 EU
  - SWMU 165 (0.49 acres): 1 EU
  - SWMU 170 (0.0029 acres): 1 EU

- Chromium Areas
  - SWMU 158 (0.06 acres): 1 EU
  - SWMU 169 (0.002 acres): 1 EU

- Soil/ Rubble Piles
  - SWMU 19 (0.04419 acres): 1 EU
  - SWMU 138 (0.91754 acres): 2 EUs
  - SWMU 180 (2.21 acres): 4 EUs
  - SWMU 181 (0.50891 acres): 1 EU
  - SWMU 195 (9.70968 acres): 17 EUs
  - SWMU 486 (0.069 acres): 1 EU
  - SWMU 487 (0.22 acres): 1 EU
  - AOC 492 (0.04664 acres): 1 EU
  - SWMU 493 (0.12949 acres): 1 EU
  - SWMU 517 (0.01 acres): 1 EU
  - AOC 541 (2 acres): 1 EU
  - SWMU 561 (9.45 acres): 2 EUs
  - AOC 562 (0.11 acres): 5 EUs
  - AOC 563 (0.100 acres): 2 EUs
  - AOC 564 (0.0012 acres): 1 EU
  - AOC 567 (1.7172 acres): 4 EUs

Scrap Yards
  - SWMU 14 (5.75 acres): 10 EUs
  - SWMU 518 (0.81 acres): 1 EU
  - SWMU 520 (2.89 acres): 5 EUs

- PCB Areas
  - SWMU 81 (0.26 acres): 1 EU
  - SWMU 153 (0.6 acres): 1 EU
  - SWMU 156 (0.46 acres): 1 EU
  - SWMU 160 (0.11 acres): 1 EU
  - SWMU 163 (0.08 acres): 1 EU
  - SWMU 219 (0.038 acres): 1 EU
  - SWMU 488 (0.00106 acres): 1 EU

D.4. TOXICITY ASSESSMENT

This section summarizes the potential toxicological effects of the COPCs on exposed populations. Many of the toxicological summaries were obtained from the *Risk Assessment Information System* (RAIS) prepared by the Toxicology and Risk Analysis Section of Oak Ridge National Laboratory for DOE (DOE 2004b). This site also lists toxicity values taken from the EPA's Integrated Risk Information System (IRIS) database (EPA 2004a), National Center for Environmental Assessment (NCEA), and Health Effects Assessment Summary Tables (HEAST) database (EPA 1998). This list formed the basis of the toxicity values reported in this section. For those chemicals not profiled in RAIS, a brief summary of information drawn from Agency for Toxic Substances and Disease Registry or other library research sources is included in this section. The last paragraph of each profile contains the toxicity values used in this BHHRA.

The toxicity information considered in the assessment of potential carcinogenic risks includes (1) a weight-of-evidence classification and (2) a slope factor (SF). The weight-of-evidence classification qualitatively describes the likelihood that an agent is a human carcinogen, based on the available data from animal and human studies. A chemical may be placed in one of three groups to indicate its potential for carcinogenic effects: Group A, a known human carcinogen; Group B, a probable human carcinogen; and Group C, a possible human carcinogen. Group B is divided into Subgroups B1 and B2. Assignment of a chemical to Subgroup B1 indicates that the judgment that the chemical is a probable human carcinogen is based on limited human data, and assignment of a chemical to Subgroup B2 indicates that the judgment that the chemical is a probable human carcinogen is based on animal data because human data are lacking or inadequate. Chemicals that cannot be classified as human carcinogens because of a lack of data are categorized in Group D, and those for which there is evidence of noncarcinogenicity in humans are categorized in Group E.

The SF for chemicals is defined as a plausible upperbound estimate of the probability of a response (i.e., development of cancer) per unit intake of a chemical over a lifetime (EPA 1989). SFs are specific for each chemical and route of exposure. SFs currently are available for ingestion and inhalation pathways. The SFs used for oral and inhalation routes of exposure for the COPCs considered in this report are shown in Attachment D4. Two changes to the BHHRA were made to SFs between the publication of the D1 version of this document and the current version. Attachment D4 shows that oral and dermal SFs were removed for beryllium and cadmium, as these chemicals no longer are considered cancerous through the oral and dermal pathways.

Toxicity values used in risk calculations also include the chronic reference dose (RfD), which is used to estimate the potential for systemic toxicity or noncarcinogenic risk. The chronic RfD is defined as an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime (EPA 1989). RfD values are specific to the route of exposure. The RfDs used for oral and inhalation routes of exposure for the COPCs considered in this report are presented in Attachment D4. One change to the BHHRA was made to RfDs between the publication of the D1 version of this document and the current version. Attachment D4 shows that the values previously used for "vanadium (metal)" have been updated to those for "vanadium and compounds.".

For the dermal routes of exposure (i.e., dermal exposure to contaminated water while showering or bathing or dermal contact with contaminated soil), it is necessary to consider the absorbed dose received by a receptor. This is reflected by the addition of an absorption coefficient in the equations used to calculate the CDI for these pathways. Because the CDI is expressed as an absorbed dose, it is necessary to use RfDs and SFs that also are expressed in terms of absorbed dose. Currently, EPA has not produced lists of RfDs and slope factors based on absorbed dose, but have produced guidance concerning the estimation of absorbed dose RfDs and SFs from administered dose RfDs and SFs. This guidance is found in *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* (EPA 2004b) and states, "that to convert an administered dose slope factor to an absorbed dose slope factor, the administered dose slope factor is divided by the gastrointestinal (GI) absorption efficiency of the contaminant." Alternatively, to convert an administered dose RfD to an absorbed dose RfD, the administered dose RfD is multiplied by the GI absorption efficiency of the contaminant. The absorbed dose slope factors and RfDs and the information used in their derivation are presented in Attachment D4.

Toxicity profiles for primary COCs identified in this assessment are included in Attachment D5.

D.4.1 CHEMICALS FOR WHICH NO EPA TOXICITY VALUES ARE AVAILABLE

Chemicals for which no EPA toxicity values are available have been evaluated as an uncertainty included in Attachment D1.

D.4.2 UNCERTAINTIES RELATED TO TOXICITY INFORMATION

Standard EPA RfDs and SFs were used to estimate potential noncarcinogenic and carcinogenic health effects from exposure to detected chemical contaminants. Considerable uncertainty is associated with the methodology applied to derive SFs and RfDs. EPA working groups review all relevant human and animal studies for each compound and select the studies pertinent to the derivation of the specific RfD and SF. These studies often involve data from experimental studies in animals, high exposure levels, and exposures under acute or occupational conditions. Extrapolation of these data to humans under low-dose, chronic conditions introduces uncertainties. The magnitude of these uncertainties is addressed by applying uncertainty factors to the dose response data for each applicable uncertainty. These factors are incorporated to provide a margin of safety for use in human health assessments. For TCE, there is currently no IRIS SF, but several draft SFs are available. The oral SF from the EPA draft reassessment is 4.00E-01 $(mg/kg \times day)^{-1}$ and the KDEP oral SF is 3.22E-01 $(mg/kg \times day)^{-1}$. These SFs are significantly higher than the ones used in previous BHHRAs for PGDP. The KDEP oral SF [3.22E-01 $(mg/kg \times day)^{-1}$] was used in this BHHRA, but neither that value nor the EPA value has received final approval.

The dose-response relationship between cancer and ionizing radiation has been evaluated in many reports. Risk factors are extrapolated from the cancer risk established using the Japanese Atomic Bomb Survivors database and a relative risk projection model. EPA's methodology for estimating radionuclide carcinogenic risks currently is being reevaluated.

D.4.2.1 Development of Dermal Toxicity Factors

Dermal RfDs and SFs are derived from the corresponding oral values, using a route-to-route extrapolation based on the absorption efficiency of the chemical though the exposure route (for example, through the gastrointestinal tract), provided that there is no evidence to suggest that dermal exposure induces exposure route-specific effects that are not appropriately modeled by oral exposure data. In the derivation of a dermal RfD, the oral RfD is multiplied by the gastrointestinal absorption factor (ABS_{GI}), expressed as a decimal fraction. The resulting dermal RfD, therefore, is based on absorbed dose. The RfD based on absorbed dose is the appropriate value with which to compare a dermal dose, because dermal doses are expressed as absorbed rather than exposure doses. The dermal SF is derived by dividing the oral SF by the ABS_{GI}. The oral SF is divided, rather than multiplied, by the ABS_{GI} because SFs are expressed as a reciprocal dose.

Dermal contact with soil has been a driving exposure route in previous BHHRAs at PGDP, with most of this risk arising from contact with metals (e.g., beryllium, vanadium). This is a direct result of using dermal absorption factors that exceed GI absorption values and may be overly conservative. In such circumstances, risk estimates from the dermal exposure route may be unrealistic and exceed the real risk posed by this route of exposure. Although chemical-specific ABS values were used when available, default ABS values were used for most chemicals because chemical-specific values are lacking. It should be noted that risk management decisions based on the dermal contact with soil exposure route should be considered carefully because of the uncertainty associated with risk from this exposure route.

In the past it has been assumed that 5% of the inorganic materials will be absorbed through the skin as from the gastrointestinal tract. This was considered conservative because the primary function of the GI tract is to allow absorption of minerals and nutrients, where the function of the skin is to act as a barrier to entry of foreign materials. Therefore, absorption of materials from the GI tract generally is considered to occur more readily than dermal absorption. In addition, once ingested, it will remain in contact with the GI tract for approximately 24 hours or more, while materials on skin most likely will be washed off more frequently.

Two metals, beryllium and vanadium, contributed disproportionately to the risk estimates/hazards when evaluated using the comparisons to residential NALs that include 5% dermal absorption of beryllium and vanadium in the Risk Methods Document (DOE 2011a). The identification of these metals as COPCs was based on assumptions in the Risk Methods Document. Both of these are poorly absorbed through the gastrointestinal tract, and dermal absorption is considered negligible [and not included in the calculation of EPA Regional Screening Levels (RSLs) consistent with RAGS Part E (EPA 2004b)] for these metals. The maximum concentration of beryllium was 113 mg/kg. The EPA RSL (April 2012), calculated under the assumption that dermal absorption is negligible, is 160 mg/kg residential and 2,000 mg/kg industrial. For vanadium, the maximum concentration was 108 mg/kg. The RSLs for vanadium and compounds are 390 and 5,200 mg/kg for residential and industrial, respectively.

D.4.2.2 Lead Toxicity

Although it is known that exposure to lead can result in systemic toxic effects and possibly cancer, the approved toxicity values required to estimate potential for systemic toxicity and carcinogenesis are not available. Thus, the approach to evaluating health risks associated with exposure to lead is different from other chemicals detected at the site. To determine if exposure to lead has occurred, the amount of lead present in the blood can be measured; the level of lead in the blood is measured in micrograms per deciliter (μg/dL). Ten μg/dL is considered the national health criteria that no more than 5% of the population should exceed this level before health effects may be exhibited (EPA 2003b). Based on the target blood lead (PbB) level of 10 μg/dL, EPA has derived a residential screening level of 400 mg/kg lead in soil, which is considered protective for young children exposed routinely under a residential scenario. This residential screening value of 400 mg/kg also is adopted as the NAL for lead in soils at PGDP for identifying lead as a COPC. EPA also has derived an industrial screening level of 800 mg/kg lead in soil.

Lead is unique in that a continuous level of exposure is needed to detect an increase in PbB. According to EPA guidance on intermittent exposures to lead (EPA 2003a), the magnitude and duration of the increase in PbB will vary depending on the temporal pattern of exposure at a site. According to EPA guidance (EPA 2003a; 2003b), an increase in PbB will be greatest if exposure occurs every day in succession over an extended period of time (e.g., summer); in comparison to intermittent exposures (e.g., once every 7 days) would give rise to smaller PbB increases. Infrequent exposures (i.e., less than 1 day per week) over a minimum duration of 90 days would be expected to produce oscillations in blood lead concentrations associated with the absorption and subsequent clearance of lead from the blood between each exposure event. As a result, EPA's Technical Review Workgroup recommends that PbB models for evaluating child and adult exposure to lead be applied to exposure that exceed a minimum frequency of one day per week and a duration of 3 consecutive months (EPA 2003a).

For PGDP, the preliminary risk characterization of lead is conducted for each SWMU/EU by comparing the maximum detected result to the residential screening value of 400 mg/kg. Lead is considered a COPC at each SWMU/EU that exceeds the screening value. Additional analysis was conducted for these SWMU/EUs by comparing the arithmetic average lead concentration to the NAL; this is consistent with EPA guidance for estimating soil lead concentrations for use in lead uptake models (EPA 2003a, 2003b, 2007) which emphasized the importance that the frequency of exposure and the duration of exposure be over a sufficient duration for the blood lead concentration to become nearly constant over time.

Sites with average lead concentrations exceeding the NAL undergo additional risk analysis using the results of EPA's Integrated Exposure Uptake Biokinetic Model (EPA 2004c) for evaluating exposures of children and the EPA Adult Lead Model (EPA 2003a) for evaluating lead exposure to adults. The parameters for use in each of these models are presented in Appendix B of the Risk Methods Document (DOE 2011a).

D.4.2.3 Carcinogenic PAHs

During the development of the list of COPCs, concentrations of total cancerous PAHs were derived based on the methodology in the Risk Methods Document. When deriving total PAHs, the toxicity equivalence factors (TEFs) presented in Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (EPA 2005) will be used. These TEFs are applied to the concentrations of detected PAHs in each sample and then the total PAH concentration in a sample will be the sum of the products of each carcinogenic PAH and its TEF. When calculated the EPC for carcinogenic PAHs, for samples in which PAHs are not detected, the value for the minimum detection limit of the PAHs with TEFs were used.

D.5. RISK CHARACTERIZATION

Risk characterization is the final step in the risk assessment process. In this step, the information from the exposure and toxicity assessments is integrated to quantitatively estimate both carcinogenic health risks and noncarcinogenic hazard potential. For this assessment, risk is defined as both the lifetime probability of excess cancer incidence for carcinogens and the estimate of daily intake exceeding intake that may lead to toxic effects for noncarcinogens.

D.5.1 DETERMINATION OF POTENTIAL FOR NONCANCER EFFECTS

In this BHHRA, the numeric estimate of the potential for noncancer effects posed by a single chemical within one pathway of exposure is derived as the ratio of the CDI of a chemical, from a single pathway to the appropriate RfD. This ratio also is referred to as a hazard quotient (HQ). This value is calculated as shown in the following equation:

$$\mathbf{HQ} = \frac{\mathbf{CDI}}{\mathbf{RfD}}$$

where:

HQ is the hazard quotient, dimensionless
CDI is the chronic daily intake of a particular chemical, mg/(kg × day)
RfD is the chronic reference dose for a particular chemical and pathway, mg/(kg × day)

When performing this calculation, the proper RfD was used for each CDI. For CDIs that reflect ingestion, the RfD used was that for administered dose. For CDIs that reflect absorption, as in dermal contact, the RfD used was that for absorbed dose. Finally, for CDIs that reflect inhalation exposure, the RfD used was that for inhalation. Similarly, the RfD that was appropriate for the duration of exposure was used. For all adult exposures, the period of exposure was greater than seven years; therefore, the chronic RfD was used. For all exposures to children, regardless of duration, the chronic RfD was used (DOE 2011a).

If several chemicals may reach a receptor through a common pathway, guidance (RAGS, DOE 2011a) recommends adding the HQs of all chemicals reaching the receptor through the common pathway to calculate a pathway HI. This can be represented by the following equation:

$$\text{Pathway HI} = HQ_1 + HQ_2 + HQ_3 + \ldots + HQ_n$$

where:

Pathway HI is the sum of the individual chemical HQs, dimensionless
HQ_1 to HQ_n are the individual chemical hazard quotients relevant to the pathway, dimensionless

Similarly, guidance (DOE 2011a) recommends summing the pathway HIs for all pathways relevant to an individual receptor to develop a total HI. The total HI is not an estimate of the systemic toxicity posed by all contaminants that may reach the receptor, but can be used to estimate if a toxic effect may result if all contaminants reaching the receptor have additive effects over all pathways. This can be represented as in the following equation:

$$\text{Total HI} = HI_1 + HI_2 + HI_3 + \ldots + HI_n$$

where:

Total HI is the sum of all pathways relevant to a single receptor, dimensionless
HI_1 to HI_n are the individual pathway HIs

Note that the HQ, the pathway HI, and the total HI do not define a dose-response relationship. That is, the magnitude of the HQ or HI does not represent a statistical probability of incurring an adverse effect. If the HQ is less than 1, the estimated exposure to a substance may be judged to be below a level that could present a toxic effect. If the HQ is greater than 1, a toxic effect may or may not result depending on the assumptions used to develop the CDI and assumptions used in deriving the RfD. Similarly, if the pathway HI is less than 1, then the estimated exposure to multiple chemicals contributing to the pathway HI should not be expected to present a toxic effect. If the pathway HI is greater than 1, then exposure may or may not result in a toxic effect depending on what assumptions were used to develop the pathway and how the chemicals included in the pathway interact. Finally, if the total HI is less than 1, then the estimated exposure to multiple chemicals over multiple pathways should not be expected to result in a toxic effect. If the total HI is greater than 1, then a toxic effect may or may not result depending on the rigor used to develop the CSM for all pathways and the interaction between pathways and individual chemicals.

The hazards associated with the excavation worker have been calculated as a ratio of the future outdoor worker scenario. Based on information presented in Section D.3.5.1, a factor of 0.313 has been applied to the future outdoor worker to obtain hazards to the excavation worker. Independent calculations have not been performed.

D.5.2 DETERMINATION OF EXCESS LIFETIME CANCER RISK

Estimates of the potential for cancer induction are measured by calculating estimates of ELCR. Generally, ELCR can be defined as the incremental increase in the probability that a receptor may develop cancer if the receptor is exposed to chemicals or radionuclides or both. ELCRs are specific to the CSM used to define the routes and magnitude of exposure. The magnitude of the ELCRs could vary markedly if the exposure assumptions used to develop the CSM are varied.

D.5.2.1 Chemical Excess Cancer Risk

The numeric estimate of the ELCR resulting from exposure to a single chemical carcinogen is derived by multiplying the CDI through a particular pathway by the SF appropriate to that pathway. The resulting value is referred to as a chemical-specific ELCR. This value is calculated as shown in the following equation:

$$\mathbf{Chemical-specific\ ELCR = CDI \times SF}$$

where:

Chemical specific ELCR is an estimate of the excess lifetime probability of developing cancer that results because of exposure to the specific chemical, dimensionless

CDI is the chronic daily intake of the chemical [mg/(kg × day)]

SF is the slope factor for the specific chemical $[(mg/(kg \times day)]^{-1}$

As with the calculation used to derive HQs, the proper SF was used for each CDI when performing this calculation. For CDIs that reflect ingestion, the SF was that for an administered dose. For CDIs that reflect absorption, the SF was that for absorbed dose. Finally, for CDIs that reflect inhalation exposure, the SF was that for inhalation.

If several chemicals may reach a receptor through a common pathway, the chemical specific ELCRs of all chemicals reaching the receptor through the common pathway are summed to calculate a pathway ELCR. This can be represented by the following equation:

$$\mathbf{Pathway\ ELCR = ELCR_1 + ELCR_2 + ELCR_3 + ... + ELCR_n}$$

where:

$ELCR_1$ to $ELCR_n$ are the chemical-specific ELCRs relevant to the pathway; dimensionless

Similarly, the pathway ELCRs for all pathways relevant to an individual receptor are summed to develop a total ELCR. The total ELCR is not an actuarial estimate of an individual developing cancer, but can be used to estimate the total ELCR that may result if all contaminants reaching the receptor have additive effects over all pathways. This can be represented as in the following equation:

$$\mathbf{Total\ ELCR = ELCR_{P1} + ELCR_{P2} + ELCR_{P3} + ... + ELCR_{Pn}}$$

where:

Total ELCR is the sum of all pathways relevant to a single receptor, dimensionless
$ELCR_{P1}$ to $ELCR_{P2}$ is the individual pathway ELCRs

Unlike the HQ, the pathway HI and the total HI, the chemical-specific ELCR, the pathway ELCR, and total ELCR define a dose-response relationship. That is, the ELCRs represent a statistical probability of the increased risk of developing cancer that exists in receptors exposed under the assumptions used in the calculation of the CDI.

The risks associated with the excavation worker have been calculated as a ratio of the future outdoor worker scenario. Based on information presented in Section D.3.5.1, a factor of 0.0125 has been applied to the future outdoor worker ELCR to obtain risks to the excavation worker. Independent calculations have not been performed.

D.5.2.2 Radionuclide Excess Cancer Risk

Calculation of cancer risk due to exposure to radionuclides through ingestion or inhalation is conceptually similar to calculation of risks for chemical carcinogens. In performing this calculation, ELCR due to exposure to a particular radionuclide within a specific pathway is calculated by multiplying the intake of the radionuclide by the route-specific cancer slope factor. This can be represented by the following equation:

$$\textbf{Radionuclide} - \textbf{specific ELCR} = \textbf{CDI} \times \textbf{SF}$$

where:

Radionuclide specific ELCR is an estimate of the excess lifetime probability of developing cancer that results because of exposure to the specific radionuclide, dimensionless

CDI is the ingestion and inhalation chronic daily intake of the radionuclide, pCi

SF is the ingestion and inhalation slope factor for the specific radionuclide, risk/pCi

(Note: For external exposure to ionizing radiation, the units for CDI and SF are pCi-year/g and risk-g/pCi-year, respectively.)

As with the calculation used to derive chemical-specific ELCRs, the proper SF was used for each CDI when performing this calculation. For CDIs that reflect ingestion, the SF was that for ingestion. Similarly, for CDIs that reflect inhalation exposure, the SF was that for inhalation.

Both the pathway ELCR for radionuclides and the total ELCR from exposure to multiple radionuclides within a pathway and over multiple pathways, respectively, are calculated as illustrated for chemical carcinogens in the Risk Methods Document. These equations will not be presented in this risk assessment. The uncertainties related to this method of determining ELCR from exposure to radionuclides is discussed in detail in Section D.6.

In this risk assessment, ELCRs from exposure to chemicals and radionuclides were summed within pathways and over all pathways to indicate the potential health risk to a receptor that may be exposed to radionuclides and chemicals over all pathways. The uncertainties associated with combining radionuclide and chemical ELCRs are discussed in detail in Section D.6.

Similar to chemical excess cancer risk, the excavation worker has been calculated as a ratio of the future outdoor worker scenario. Based on information presented in Section D.3.5.1, a unitless factor of 0.0125 has been applied to the future outdoor worker ELCR to obtain risks to the excavation worker(i.e., independent calculations to obtain risks to the excavation worker have not been performed); the factor was applied to the calculation results from the future outdoor worker.

D.5.3 RISK CHARACTERIZATION FOR SOIL

This subsection presents the systemic toxicity (HI) and ELCR for soil exposure at each source area calculated from the COPCs at each unit. Both HI and ELCR are presented for the following receptors:

- Current industrial worker exposure to surface soil
- Future industrial worker exposure to surface soil
- Excavation worker/outdoor worker exposure to surface and subsurface soil
- Outdoor worker exposure to surface soil
- Future hypothetical adult resident exposure to surface soil
- Future hypothetical child resident exposure to surface soil
- Teen recreational user exposure to surface soil

The results of the quantitative risk assessment are presented in Tables D.23 through D.35 (located on CD) and include (1) risks by contaminant for each pathway, (2) risks by contaminant across all pathways (shown in "Total" column), (3) total pathway risks for all contaminants (shown across "Total" row, and d) total risk for all contaminants across all pathways (bold value in "Total" row).

D.5.3.1 Systemic Toxicity (Direct Exposure to Soil)

Tables D.23 through D.29 summarize the computed HIs for soil exposure for each receptor. Total HIs greater than 1 were observed for the following scenarios by SWMU:

- *Industrial Worker (current):* none;

- *Industrial Worker (future):* SWMUs/AOCs 1, 14, 81, 99, 138, 156, 158, 169, 180, 194, 195, 196, 200, 217, 227, 228, 492, 493, 520, 541, 561;

- *Outdoor Worker (exposed to surface and subsurface soil):* SWMUs/AOCs 1, 14, 19, 81, 99, 138, 156, 158, 163, 165, 169, 180, 194, 195, 196, 200, 212, 217, 221, 227, 228, 492, 493, 520, 531, 541, 561, and 564;

- *Outdoor Worker (exposed to surface soil):* SWMUs/AOCs 1, 14, 81, 99, 138, 156, 158, 165, 169, 180, 194, 195, 196, 217, 227, 228, 492, 493, 520, 531, 541, 561, and 564;

- *Future Hypothetical Adult Residential Receptor:* SWMUs/AOCs 1, 14, 81, 99, 138, 156, 158, 165, 169, 180, 194, 195, 196, 200, 217, 227, 228, 492, 493, 520, 531, 541, 561, and 564;

- *Future Hypothetical Child Residential Receptor:* SWMUs/AOCs 1, 14, 81, 99, 138, 156, 158, 165, 169, 180, 194, 195, 196, 200, 212, 213, 215, 217, 221, 222, 227, 228, 492, 493, 517, 518, 520, 531, 541, 561, 562, and 564; and

- *Teen Recreational User:* SWMUs/AOCs 1, 14, 81, 99, 138, 156, 158, 165, 169, 180, 194, 195, 196, 200, 217, 227, 228, 492, 493, 520, 531, 541, and 561.

D.5.3.2 Excess Lifetime Cancer Risk (Direct Exposure to Soil)

Tables D.30 through D.35 summarize the computed lifetime cancer risks for soil exposure for all receptors from all COPCs (including radionuclides). ELCRs greater than 1×10^{-6} were observed at most

SWMUs/AOCs for all receptors. ELCRs greater than 1×10^{-4} were observed for the following scenarios by SWMU:

- *Industrial Worker (current):* none;
- *Industrial Worker (future):* SWMUs/AOCs 1, 14, 81, 165, 169, 492, 518, 541, 561, and 562;
- *Outdoor Worker (exposed to surface and subsurface soil):* SWMUs/AOCs 1, 14, 19, 81, 165, 169, 180, 196, 212, 227, 488, 492, 518, 531, 541, 561, 562, and 564;
- *Outdoor Worker (exposed to surface soil):* SWMUs/AOCs 1, 14, 19, 81, 165, 169, 180, 212, 492, 518, 531, 541, 561, 562, and 564;
- *Future Hypothetical Residential Receptor:* SWMUs/AOCs 1, 14, 19, 81, 165, 169, 180, 194, 212, 222, 227, 486, 488, 492, 518, 531, 541, 561, 562, and 564; and
- *Teen Recreational User:* SWMUs/AOCs 1, 14, 81, 165, 492, 518, 541, 561, and 562.

D.5.4 RISK CHARACTERIZATION FOR RESIDENTIAL USE OF GROUNDWATER DRAWN FROM THE RGA (MODELED FROM SOIL CONCENTRATIONS)

This subsection presents the risk for residential use of groundwater drawn from the RGA. Tables and discussion in this subsection provide the total HI or ELCR for the each source area and list the major exposure routes and COPCs contributing to the total HI or ELCR. Environmental data for each source area was used to model groundwater concentrations at the POEs (see Appendix C for details of the groundwater modeling). The groundwater assessment is conducted only for the residential scenario. Characterization of risks from groundwater at off-site POEs (plant boundary, property boundary, and Ohio River) are discussed in Section D.3.4.2.

D.5.4.1 Systemic Toxicity (Groundwater Use)

Only technetium-99 from SWMU 14 is present in soils at concentrations that may result in migration to the RGA at concentrations that could exceed 900 pCi/L; however, the technetium-99 plume does not indicate contribution from SWMU 14. Technetium-99 does not contribute to hazard; therefore, it is not summarized here.

D.5.4.2 Excess Lifetime Cancer Risk (Groundwater Use)

Tables D.36 and D.37 summarize the ELCRs for the modeled groundwater exposure above each SWMU for the rural resident for the child and the adult. Lifetime exposure to the resident is 9.32E-05. The EPC is taken from the modeled activity at the SWMU boundary (i.e., 1,700 pCi/L, see Appendix C). As shown in these tables, the total ELCR (bold value in "ELCR" column) is greater than 1×10^{-6} for SWMU 14.

Table D.36. ELCR for the Child Residential Receptor Exposed to RGA Groundwater at the SWMU Boundary

SWMU	COPC	EPC (pCi/L)	Ingestion	Dermal	Inhalation through showering	Inhalation through household use	ELCR	Percent
14	Technetium-99	1.70E+03	1.47E-05	n/a	n/a	n/a	1.47E-05	100%
14	**Totals**		**1.47E-05**	**n/a**	**n/a**	**n/a**	**1.47E-05**	
14	**Percent**		**100%**					

n/a = not applicable

Table D.37. ELCR for the Adult Residential Receptor Exposed to RGA Groundwater at the SWMU Boundary

SWMU	COPC	EPC (pCi/L)	Ingestion	Dermal	Inhalation through showering	Inhalation through household use	ELCR	Percent
14	Technetium-99	1.70E+03	7.85E-05	n/a	n/a	n/a	7.85E-05	100%
14	**Totals**		**7.85E-05**	**n/a**	**n/a**	**n/a**	**7.85E-05**	
14	**Percent**		**100%**					

n/a = not applicable

D.5.5 LEAD ASSESSMENT

SWMUs/AOCs for which lead was identified as a COPC were identified as such by comparing the maximum detected result for the grid to the residential screening value of 400 mg/kg. Those SWMUs/AOCs were evaluated for modeling for lead. An average lead concentration was determined for each SWMU, consistent with EPA guidance for estimating soil lead concentration for integrated exposure uptake (EPA 2004c). The average lead concentration did not exceed the NAL (400 mg/kg) at any of these SWMUs/AOCs; therefore, lead is not considered further as a COPC nor as a COC.

D.5.6 DOSE ASSESSMENT

A dose assessment was performed for radionuclides (separate from the ELCR evaluation) selected as COPCs within each SWMU/EU (Section D.2). Calculation of dose was performed using the following equation and screening values provided in the Risk Methods Document:

$$\mathbf{Dose} = \frac{\mathbf{EPC}}{\mathbf{SSL}} \times \mathbf{TargetDose}$$

where:

EPC = exposure point concentration
SSL = soil screening level provided in the Risk Methods Document (DOE 2011a, Table A.8)
Target Dose = The target dose upon which the SSL was based (1 mrem).

Tables D.38 and D.39 (included on the Appendix D CD) provide the results of the dose assessment.

Dose greater than 15 mrem were observed for the following pathways by SWMU:

- *Industrial Worker (future):* SWMUs/AOCs 14 (57.17 mrem at EU 9), 541 (40.19 mrem), 561 (15.95 mrem at EU 2), and 562 (22.44 mrem at EU 2);

- *Outdoor Worker (exposed to surface and subsurface soil):* SWMUs/AOCs 14 (88.56 mrem at EU 9), 212 (17.44 mrem), 492 (19.78 mrem), 541 (59.96 mrem), 561 (19.67 mrem at EU 2), and 562 (29.05 mrem at EU 2);

- *Outdoor Worker (exposed to surface soil):* SWMUs/AOCs 14 (88.56 mrem at EU 9), 212 (17.44 mrem), 492 (19.62 mrem), 541 (54.29 mrem), 561 (20.39 mrem at EU 2), and 562 (28.88 mrem at EU 2);

- *Future Hypothetical Adult Residential Receptor:* SWMUs/AOCs 14 (201.10 at EU 9), 165 (19.69 mrem), 492 (51.55 mrem), 541 (139.34 mrem), 561 (55.49 mrem at EU 2), and 562 (77.58 mrem at EU 2);

- *Future Hypothetical Child Residential Receptor:* SWMUs/AOCs 14 (223.29 mrem at EU 9), 165 (21.44 mrem), 212 (18.75 mrem), 492 (55.94 mrem), 541 (151.73 mrem), 561 (59.91 mrem at EU 2), and 562 (83.91 mrem at EU 2); and

- *Teen Recreational User:* SWMU 14 (19.41 mrem at EU 9).

D.5.7 IDENTIFICATION OF LAND USE SCENARIOS, PATHWAYS, MEDIA, AND COCS

This subsection outlines those chemicals, land use scenarios, exposure pathways, and media for each source area. Section D.8 presents the RGOs for each location and land use scenario.

D.5.7.1 Land Use Scenarios of Concern

To make a determination whether land use scenarios are of concern, quantitative risk and hazard results were compared to risk and hazard benchmarks for each land use scenario. The benchmarks used for this comparison were HI $\geq$ 1 and/or ELCR $\geq 1 \times 10^{-6}$. Land use scenarios with total HIs exceeding the benchmark of 1 are deemed land use scenarios of concern for noncancer hazard. Land use scenarios with a total ELCR exceeding the benchmark of 1×10^{-6} are deemed land use scenarios of concern for cancer risk. The following are land uses of concern for the Soils OU at the SWMUs/AOCs indicated.

- Industrial (based on the default worker):

  - SWMU 1 (HI and ELCR)
  - SWMU 99B (HI and ELCR)
  - SWMU 194 (HI and ELCR)
  - SWMU 196 (HI and ELCR)
  - SWMU 489 (ELCR)
  - SWMU 531 (ELCR)

  - SWMU 200 (HI and ELCR)
  - SWMU 212 (ELCR)
  - SWMU 213 (ELCR)
  - SWMU 215 (ELCR)

- SWMU 216 (ELCR)
- SWMU 217 (HI and ELCR)
- SWMU 221 (ELCR)
- SWMU 222 (ELCR)
- SWMU 227 (HI and ELCR)
- SWMU 228 (HI and ELCR)

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- SWMU 76 (ELCR)
- SWMU 165 (HI and ELCR)
- SWMU 170 (ELCR)

- SWMU 158 (HI and ELCR)
- SWMU 169 (HI and ELCR)

- SWMU 19 (ELCR)
- SWMU 138 (HI and ELCR)
- SWMU 180 (HI and ELCR)
- SWMU 181 (ELCR)
- SWMU 195 (ELCR)
- SWMU 486 (ELCR)
- SWMU 487 (ELCR)
- AOC 492 (HI and ELCR)
- SWMU 493 (HI and ELCR)
- SWMU 517 (ELCR)
- AOC 541 (HI and ELCR)
- SWMU 561 (HI and ELCR)
- AOC 562 (ELCR)
- AOC 563 (ELCR)
- AOC 564 (ELCR)
- AOC 567 (ELCR)

- SWMU 14 (HI and ELCR)
- SWMU 518 (ELCR)
- SWMU 520 (HI and ELCR)

- SWMU 81 (HI and ELCR)
- SWMU 153 (ELCR)
- SWMU 156 (HI and ELCR)
- SWMU 163 (ELCR)
- SWMU 219 (ELCR)
- SWMU 488 (ELCR)

• Outdoor worker (exposed to surface soil):

- SWMU 1 (HI and ELCR)
- SWMU 99B (HI and ELCR)
- SWMU 194 (HI and ELCR)
- SWMU 196 (HI and ELCR)
- SWMU 489 (ELCR)
- SWMU 531 (HI and ELCR)

- SWMU 200 (ELCR)
- SWMU 212 (ELCR)
- SWMU 213 (ELCR)
- SWMU 215 (ELCR)
- SWMU 216 (ELCR)
- SWMU 217 (HI and ELCR)

— SWMU 221 (ELCR)
— SWMU 222 (ELCR)
— SWMU 227 (HI and ELCR)
— SWMU 228 (HI and ELCR)

— SWMU 76 (ELCR)
— SWMU 165 (HI and ELCR)
— SWMU 170 (ELCR)

— SWMU 158 (HI and ELCR)
— SWMU 169 (HI and ELCR)

— SWMU 19 (ELCR)
— SWMU 138 (HI and ELCR)
— SWMU 180 (HI and ELCR)
— SWMU 181 (ELCR)
— SWMU 195 (HI and ELCR)
— SWMU 486 (ELCR)
— SWMU 487 (ELCR)
— AOC 492 (HI and ELCR)
— SWMU 493 (HI and ELCR)
— SWMU 517 (ELCR)
— AOC 541 (HI and ELCR)
— SWMU 561 (HI and ELCR)
— AOC 562 (ELCR)
— AOC 563 (ELCR)
— AOC 564 (HI and ELCR)
— AOC 567 (ELCR)

— SWMU 14 (HI and ELCR)
— SWMU 518 (ELCR)
— SWMU 520 (HI and ELCR)

— SWMU 81 (HI and ELCR)
— SWMU 153 (ELCR)
— SWMU 156 (HI and ELCR)
— SWMU 160 (ELCR)
— SWMU 163 (ELCR)
— SWMU 219 (ELCR)
— SWMU 488 (ELCR)

- Outdoor worker (exposed to surface and subsurface soil):

— SWMU 1 (HI and ELCR)
— SWMU 99B (HI and ELCR)
— SWMU 194 (HI and ELCR)
— SWMU 196 (HI and ELCR)
— SWMU 489 (ELCR)
— SWMU 531 (HI and ELCR)

— SWMU 200 (HI and ELCR)
— SWMU 212 (HI and ELCR)
— SWMU 213 (ELCR)
— SWMU 214 (ELCR)
— SWMU 215 (ELCR)
— SWMU 216 (ELCR)
— SWMU 217 (HI and ELCR)
— SWMU 221 (HI and ELCR)
— SWMU 222 (ELCR)
— SWMU 227 (HI and ELCR)
— SWMU 228 (HI and ELCR)

— SWMU 76 (ELCR)
— SWMU 165 (HI and ELCR)
— SWMU 170 (ELCR)

— SWMU 158 (HI and ELCR)
— SWMU 169 (HI and ELCR)

— SWMU 19 (HI and ELCR)
— SWMU 138 (HI and ELCR)
— SWMU 180 (HI and ELCR)
— SWMU 181 (ELCR)
— SWMU 195 (HI and ELCR)
— SWMU 486 (ELCR)
— SWMU 487 (ELCR)
— AOC 492 (HI and ELCR)
— SWMU 493 (HI and ELCR)
— SWMU 517 (ELCR)
— AOC 541 (HI and ELCR)
— SWMU 561 (HI and ELCR)
— AOC 562 (ELCR)
— AOC 563 (ELCR)
— AOC 564 (HI and ELCR)
— AOC 567 (ELCR)

— SWMU 14 (HI and ELCR)
— SWMU 518 (ELCR)
— SWMU 520 (HI and ELCR)

— SWMU 81 (HI and ELCR)
— SWMU 153 (ELCR)
— SWMU 156 (HI and ELCR)
— SWMU 160 (ELCR)
— SWMU 163 (HI and ELCR)
— SWMU 219 (ELCR)
— SWMU 488 (ELCR)

- Hypothetical future residential (for ELCR, the dose method incorporates age-adjusted values for the 30-year exposure duration; for HI, the child resident exposure assumptions are shown):

- SWMU 1 (HI and ELCR)
- SWMU 99B (HI and ELCR)
- SWMU 194 (HI and ELCR)
- SWMU 196 (HI and ELCR)
- SWMU 489 (ELCR)
- SWMU 531 (HI and ELCR)

- SWMU 200 (HI and ELCR)
- SWMU 212 (HI and ELCR)
- SWMU 213 (HI and ELCR)
- SWMU 215 (HI and ELCR)
- SWMU 216 (ELCR)
- SWMU 217 (HI and ELCR)
- SWMU 221 (HI and ELCR)
- SWMU 222 (HI and ELCR)
- SWMU 227 (HI and ELCR)
- SWMU 228 (HI and ELCR)

- SWMU 76 (ELCR)
- SWMU 165 (HI and ELCR)
- SWMU 170 (ELCR)

- SWMU 158 (HI and ELCR)
- SWMU 169 (HI and ELCR)

- SWMU 19 (ELCR)
- SWMU 138 (HI and ELCR)
- SWMU 180 (HI and ELCR)
- SWMU 181 (ELCR)
- SWMU 195 (HI and ELCR)
- SWMU 486 (ELCR)
- SWMU 487 (ELCR)
- AOC 492 (HI and ELCR)
- SWMU 493 (HI and ELCR)
- SWMU 517 (HI and ELCR)
- AOC 541 (HI and ELCR)
- SWMU 561 (HI and ELCR)
- AOC 562 (HI and ELCR)
- AOC 563 (ELCR)
- AOC 564 (HI and ELCR)
- AOC 567 (ELCR)

- SWMU 14 (HI and ELCR)
- SWMU 518 (HI and ELCR)
- SWMU 520 (HI and ELCR)

- SWMU 81 (HI and ELCR)
- SWMU 153 (ELCR)
- SWMU 156 (HI and ELCR)
- SWMU 160 (ELCR)

- SWMU 163 (ELCR)
- SWMU 219 (ELCR)
- SWMU 488 (ELCR)

- Teen recreational user:

    - SWMU 1 (HI and ELCR)
    - SWMU 99B (HI)
    - SWMU 194 (HI and ELCR)
    - SWMU 196 (HI and ELCR)
    - SWMU 489 (ELCR)
    - SWMU 531 (HI and ELCR)

    - SWMU 200 (HI and ELCR)
    - SWMU 212 (ELCR)
    - SWMU 213 (ELCR)
    - SWMU 215 (ELCR)
    - SWMU 216 (ELCR)
    - SWMU 217 (HI and ELCR)
    - SWMU 221 (ELCR)
    - SWMU 222 (ELCR)
    - SWMU 227 (HI and ELCR)
    - SWMU 228 (HI and ELCR)

    - SWMU 76 (ELCR)
    - SWMU 165 (HI and ELCR)

    - SWMU 158 (HI and ELCR)
    - SWMU 169 (HI and ELCR)

    - SWMU 19 (ELCR)
    - SWMU 138 (HI and ELCR)
    - SWMU 180 (HI and ELCR)
    - SWMU 195 (HI and ELCR)
    - SWMU 486 (ELCR)
    - SWMU 487 (ELCR)
    - AOC 492 (HI and ELCR)
    - SWMU 493 (HI and ELCR)
    - SWMU 517 (ELCR)
    - AOC 541 (HI and ELCR)
    - SWMU 561 (HI and ELCR)
    - AOC 562 (ELCR)
    - AOC 563 (ELCR)
    - AOC 564 (ELCR)

    - SWMU 14 (HI and ELCR)
    - SWMU 518 (ELCR)
    - SWMU 520 (HI and ELCR)

— SWMU 81 (HI and ELCR)
— SWMU 153 (ELCR)
— SWMU 156 (HI and ELCR)
— SWMU 163 (ELCR)
— SWMU 219 (ELCR)
— SWMU 488 (ELCR)

D.5.7.2 Contaminants of Concern

To make a determination about whether contaminants are of concern, quantitative risk and hazard results over all pathways were compared to risk and hazard benchmarks for land use scenarios of concern. The benchmarks used for this comparison were HI $\geq$ 0.1 and/or ELCR $\geq 1 \times 10^{-6}$. COCs based on the toxicity factors listed in Attachment D4 are shown in summary tables in Attachment D6.

Contaminants with chemical-specific HIs or ELCRs exceeding these benchmarks were deemed COCs. Priority COCs are contaminants whose chemical-specific HI is greater than 1 or whose ELCR is greater than 1×10^{-4} for one or more scenarios. These priority COCs can be found in Attachment D6.

D.5.7.3 Contaminants of Concern (Groundwater—Modeled from Soil)

Similarly, no priority COCs were identified (i.e., contaminants whose chemical-specific HI is greater than 1 or whose ELCR is greater than 1×10^{-4}) for domestic use of groundwater for a hypothetical future residential use of the SWMU.

D.5.7.4 Pathways of Concern

To determine whether pathways are of concern, the quantitative risks and hazards for each exposure route are summed over all contaminants and compared to benchmarks for land use scenarios of concern. The benchmarks used for this comparison were HI $\geq$ 0.1 and/or ELCR $\geq 1 \times 10^{-6}$. Exposure routes with HIs and ELCRs exceeding these benchmarks are considered pathways of concern (POCs). Each of the pathways included in the BHHRA is a POC for at least one SWMU.

D.5.7.5 Media of Concern

Media of concern are those media that appear in at least one POC. Because they contribute to at least one POC, soil is a medium of concern for all SWMUs/AOCs.

Though not quantified in this evaluation, UCRS groundwater could pose as a medium of concern under certain exposure scenarios; however, these risks were not quantified due to the high improbability of the UCRS at these SWMUs/AOCs being used as a drinking water aquifer [see Section 3.3.4.3 of the Risk Methods Document (DOE 2011a)].

D.5.7.6 Summary of Risk Characterization

Attachment D6 presents summaries of the risk characterization by location considered in the BHHRA. They present land use scenarios of concern, COCs, and POCs. In addition, each table lists the following:

- Receptor risks for each land use scenario of concern;
- Percent contribution by pathway to the total risk; and
- Percent contribution each COC contributes to the total risk.

D.6. UNCERTAINTY IN THE RISK ASSESSMENT

Uncertainties are associated with each step of the risk assessment process. The potential effect of the uncertainties on the final risk characterization must be considered when interpreting the results of the risk characterization because a number of assumptions are made during the risk assessment. Types of uncertainties to consider are divided into four broad categories: (1) those associated with data, (2) exposure assessment, (3) toxicity assessment, and (4) risk characterization.

Specific uncertainties in each of these categories are discussed in the following sections. Magnitude of the effect of the uncertainty on the risk characterization is categorized as small, moderate, or large. Uncertainties categorized as small are assumed to not affect the risk estimates by more than one order of magnitude; those categorized as moderate are assumed to affect the risk estimates by between one and two orders of magnitude, and uncertainties categorized as large are assumed to affect the risk estimate by more than two orders of magnitude.

In evaluating these uncertainties and their estimated effect on the risk estimates, it should be remembered that the following uncertainties are neither independent nor mutually exclusive; therefore, the total effect of all uncertainties on the risk estimates (i.e., total ELCRs and HIs) is not necessarily the sum of the estimated effects.

D.6.1 UNCERTAINTIES ASSOCIATED WITH DATA AND DATA EVALUATION

The purpose of data evaluation is to determine which constituents, if any, are present at concentrations requiring evaluation in the risk assessment. Uncertainty with respect to data evaluation can arise from many sources, such as the quality of data used to characterize the site and the process used to select data and COPCs used in the risk assessment.

Since many of the detection limits for XRF data are above background concentrations (see Attachment B3) and possibly NALs, the COPCs identified using these data are expected to overstate the presence of these metals. The potential uncertainty associated with this issue is small.

COPCs were selected for each EU for those analytes that were detected above background and where maximum detected value is greater than the no action level [as defined in the Risk Methods Document (DOE 2011a) for the child residential scenario]. For those analytes that never were detected within an EU, even if the detection limit is greater than the no action level, the analyte was not considered a COPC. Uncertainties are associated with this assumption. To assist in evaluating this uncertainty, the maximum detection limit was used as an EPC and hazard and ELCR calculated for the nondetected analyses. These calculations showed no hazard greater than 1 and no ELCR greater than 10^{-6} for the current industrial worker. Attachment D7 presents the results of these calculations. The potential uncertainty associated with this assumption is small.

For determining COPCs, maximum detected values within each EU were screened against background values presented in the Risk Methods Document regardless of analytical method used (DOE 2011a). For uranium-238, this presents an uncertainty with respect to those samples analyzed using nitric extraction. The adjusted background value for uranium-238 is lower that the value used to screen. This uncertainty potentially affects two SWMUs/AOCs: 1 and 567. A quick risk screen for uranium-238 was calculated using a maximum value as an EPC for these SWMUs/AOCs. Only the residential scenario at AOC 567 showed uranium-238 at a risk of over 1×10^{-6}. Since this location already exceeds a risk of over 1×10^{-6}, the potential uncertainty associated with the use of a single background screening value for uranium-238 is small.

The use of historical data in addition to data collected during the RI is an uncertainty. As noted earlier, these data were added to the data set to augment the information collected during the RI. Use of these data is consistent with current EPA guidelines (EPA 1989a). No statistical determination was performed to see if historical data and data collected during the remedial investigation were comparable; however, the estimated effect of this uncertainty on this risk assessment is assumed to be small.

The full range of background was not considered beyond the initial screening against site-specific background. Further, surface soil background levels were used for all but the outdoor worker (exposed to surface and subsurface soil) and the excavation worker, where subsurface soil background levels were used for screening to determine COPCs. If sample data used in determining COPCs for the outdoor worker (exposed to surface and subsurface soil) and the excavation worker actually were collected from the surface, the inappropriate background value was used for comparison. The potential uncertainty associated with this assumption is small.

Some SQLs for the data are above screening levels. Since nondetect results were used at their SQL in determining EPCs, the potential uncertainty for the high SQL is small.

D.6.2 UNCERTAINTIES ASSOCIATED WITH EXPOSURE ASSESSMENT

Uncertainties associated with dermal absorption have been included in Section 6.5.

In accordance with EPA guidance, UCL95 concentrations were used as EPCs if there were a sufficient number of samples and distinct results to calculate a UCL95. This likely will lead to an overestimation of actual exposure because receptors are assumed to be exposed to the UCL95 concentration for the entire exposure duration. As the data indicate, many COPCs were not detected in all samples. Thus, the assumption that all potential exposures are to the UCL95 concentrations likely results in an overestimation of actual exposures and estimates of potential risk. The potential uncertainty for use of the UCL95 is small.

Significant uncertainty exists in the exposure assumptions used to calculate chemical intakes from exposure to various media (e.g., rate of soil ingestion, frequency and duration of exposure, absorption through the skin). Conservative (i.e., health protective) exposure factors are used when information available is limited in the form of using RME exposure assumptions as per the Risk Methods Document (DOE 2011a). This may result in an overestimation of potential risk; this potential uncertainty is moderate.

Many of the SWMUs/AOCs evaluated in this assessment are very small (< 0.1 acre), and the assumptions used for the levels of exposures (duration, frequency) overstate potential chronic exposures in these units. This potential uncertainty is moderate.

D.6.3 UNCERTAINTIES ASSOCIATED WITH TOXICITY ASSESSMENT

Uncertainty is involved in characterizing EPCs for environmental media under future conditions in this BHHRA. In calculating the EPCs at the Soils OU sources, the concentrations of COPCs are kept constant throughout the exposure period. That is, the risk assessment does not consider that concentrations of some COCs may be lower or higher in the future because of processes such as degradation and attenuation.

Because the COCs driving risk at the SWMUs/AOCs are not expected to degrade significantly throughout a lifetime, the effect of this uncertainty is estimated to be small.

A second uncertainty is the potential risk that may develop as COPCs in media at the Soils OU sources migrate to groundwater below the SWMU and are transported off-site. To address this uncertainty, results from a fate and transport model were used to estimate potential contributions from each SWMU to POEs for groundwater exposure away from the source area (see Appendix C). While the modeling estimated contaminant transport though groundwater based on contaminant concentrations in the surrounding soil, uncertainty still exists in the POE at which exposure may occur in the future and the contaminant mass that is present in the source areas contributing to the future groundwater concentrations of contaminants. These uncertainties are discussed in Appendix C. Generally, the estimated effect for most of the modeling uncertainties is moderate to small, indicating that the ELCR and HI estimates generated using the modeled concentrations can be expected to vary by less than an order of magnitude.

Additional information regarding uncertainties associated with toxicity assessment can be found in Section D.4.2.

D.6.4 UNCERTAINTIES ASSOCIATED WITH RISK CHARACTERIZATION

The potential risk of adverse health effects is characterized based on potential exposures to COPCs and potential dose-response relationships for the COPCs. Two important additional sources of uncertainty are introduced in this phase of the BHHRA: the evaluation of potential simultaneous exposure to multiple chemicals and the combination of upper-bound exposure estimates with upper-bound toxicity estimates.

As prescribed by the Risk Methods Document (DOE 2011a), after potential exposures and potential risks from each COPC are calculated, the total potential upper-bound risk and HI associated with each receptor scenario are calculated by combining the estimated potential health risk from each COPC for each scenario. For virtually all combinations of chemicals, little if any evidence of interaction is available, and synergistic/antagonistic effects and magnitude of effects cannot be addressed. Therefore, additivity is assumed. For noncarcinogenic effects, this is equivalent to the assumption of simple similar action. Whether assuming additivity can lead to an underestimation or overestimation of risk is unknown. The general consensus is that the effect of this uncertainty is small to moderate.

Additionally, some uncertainty is associated with adding risks from chemical exposure to those from exposure to radionuclides. Because the Soils OU SWMUs/AOCs have multiple chemicals and radionuclides driving risk and these COCs have differing endpoints, the effect of this uncertainty could be moderate.

Though not quantified in this evaluation, UCRS groundwater could pose as a medium of concern under certain exposure scenarios; however, these risks were not quantified due to the high improbability of the UCRS at these SWMUs/AOCs being used as a drinking water aquifer (DOE 2011).

D.6.5 UNCERTAINTIES ASSOCIATED WITH DERMAL ABSORPTION

Due to the circumstances presented in Section D.4.2.1, Development of Dermal Toxicity Factors, Attachment D8 has been developed. Attachment D8 presents summaries of the risk characterization by location considered in the BHHRA, as an analysis using an alternative approach to that described in the Risk Methods Document to incorporate recent guidance. The alternative approach excludes consideration of dermal absorption for all metals except arsenic and cadmium, consistent with EPA guidance (EPA

2004). According to RAGS Part E, dermal absorption (ABS) values for all metals except arsenic and cadmium, are zero. Because arsenic and cadmium have a non-zero ABS value, their dermal absorption was not excluded. The summaries presented in Attachment D8 are similar to those presented in Attachment D6. They present land use scenarios of concern, COCs, and POCs. In addition, each table lists the following:

- Receptor risks for each land use scenario of concern;
- Percent contribution by pathway to the total risk; and
- Percent contribution each COC contributes to the total risk.

Because the effects of this uncertainty are large, they have been further considered in selection of COCs. This COCs selection is provided in Section D.7.4.2.

D.6.6 SUMMARY OF UNCERTAINTIES

The large number of assumptions used in the risk assessment could introduce a great deal of uncertainty. While it is theoretically possible that this leads to underestimates of potential risk, the use of numerous upper-bound assumptions most likely results in conservative estimates of potential risks. Any individual's potential exposure and subsequent potential risk are influenced by their individual exposure and toxicity parameters and will vary on a case-by-case basis. Despite inevitable uncertainties associated with the steps used to derive potential risks, the use of numerous health-protective assumptions will most likely result in a protective estimate of potential health risks for receptors that could be exposed to site contaminants at EUs evaluated in this Soils OU.

In addition to the uncertainties listed, the error in calculations for the risk to the recreational user receptor, as described in Section D.3.4.1, has a small effect on the risk characterization (i.e., uncertainties categorized as small are assumed not to affect the risk estimates by more than one order of magnitude).The error in calculations will be managed in the FS.

D.7. CONCLUSIONS

This section summarizes the results of the BHHRA and draws conclusions from the results. The primary purpose of this section is to provide a concise summary of each of the BHHRA steps without the use of tables, extensive explanations, or justifications. This section also includes a series of observations in which the results of the BHHRA are combined with the uncertainties in the risk assessment.

D.7.1 CHEMICALS OF POTENTIAL CONCERN

COPCs were selected from soil data collected in the recently completed Soils OU RI and historical data from the OREIS database. This data set was screened to produce final COPCs lists aggregated by location.

Through a series of screening steps, which follow the Risk Methods Document (DOE 2011a) and other regulatory agency approved procedures, the data sets were reduced to lists of COPCs for the entire Soils OU.

D.7.2 EXPOSURE ASSESSMENT

Historical information and newly collected data were used to develop a CSM. After consideration of the available data and scope of the SI, the potential receptor population under current conditions at the source units is industrial workers, and the potential receptor populations under future conditions are industrial workers, excavation workers, and residents.

Industrial Worker

Incidental ingestion of surface soil
Dermal contact with surface soil
Inhalation of vapors emitted by surface soil
External exposure to ionizing radiation in surface soil

Outdoor/Excavation Worker

Incidental ingestion of surface and subsurface soil
Dermal contact with surface and subsurface soil
Inhalation of vapors emitted by surface and subsurface soil
External exposure to ionizing radiation in surface and subsurface soil

Future rural resident

Incidental ingestion of surface soil
Dermal contact with surface soil
Inhalation of vapors emitted by surface soil
External exposure to ionizing radiation in surface soil
Ingestion of groundwater
Dermal contact with groundwater while showering
Inhalation of vapors emitted by groundwater during household use/showering and
Inhalation of vapors indoors from transport from subsurface VOCs

Recreational user (teenage)

Incidental ingestion of surface soil
Dermal contact with surface soil
Inhalation of vapors emitted by surface soil
External exposure to ionizing radiation in surface soil

After selection of the exposure routes, CDIs were calculated using standard exposure models. Most parameters used in models were default values.

D.7.3 TOXICITY ASSESSMENT

The toxicity values used in the risk assessment were taken from the Risk Methods Document (DOE 2011a), except as noted within this BHHRA. After compiling toxicity information, the determination was made that the majority of the COPCs had a toxicity value available for one or more routes of exposure (see Section D.3.5.2).

D.7.4 RISK CHARACTERIZATION

Quantitative risks were computed by integrating the CDIs tabulated from the exposure assessment and toxicity values calculated from the toxicity assessment. The quantitative risks indicate elevated risks associated with exposure to subsurface soil, surface soil, and groundwater exposure. Significant findings are summarized below.

D.7.4.1 Land Use Scenarios of Concern

A list of land uses of concern for Soils OU SWMUs/AOC is shown in Section D.5.7.1. The list shows that each land use has at least one SWMU/AOC, which it is a concern.

D.7.4.2 Contaminants of Concern for Soil

To determine use scenarios of concern, risk characterization results for cumulative systemic toxicity (HI) and cumulative risk (ELCR) are compared to benchmarks of 1.0 and 1×10^{-6}, respectively. Use scenarios with cumulative HI or cumulative ELCR exceeding either of these benchmarks are deemed use scenarios of concern. To make a determination about whether contaminants are of concern, quantitative risk and hazard results over all pathways were compared to risk and hazard benchmarks for land use scenarios of concern, with the alternative evaluation approach described in Section D.6.5 considered. The benchmarks used for this comparison were a) 0.1 for a chemical-specific HQ and b) 1×10^{-6} for a chemical-specific ELCR.

In the subsections that follow, all COPCs meeting the benchmarks above in the HI and ELCR calculations (Tables D.23–D.29 and D.30–D.35, respectively) are listed. The alternative evaluation approach for dermal absorption assumptions (see Section D.6.5 and Attachment D8), then are documented for each SWMU. After considering this alternative approach, contaminants with chemical-specific HQs or ELCRs exceeding these benchmarks were deemed COCs.

Priority COCs are identified to highlight those COCs contributing most to cumulative HI and ELCR for each SWMU/AOC. Priority COCs are contaminants deemed COCs whose chemical-specific HQ is greater than 1 or whose chemical-specific ELCR is greater than 1×10^{-4} for one or more scenarios. The priority COCs found in soil at individual SWMUs/AOCs are summarized in the subsections that follow.

The chemical-specific benchmark for ELCR is set at 1.0E-06; however, many of the COPCs listed in Appendix D, Tables D.30 through D.35, correspond to individual risks less than 1.0E-06 for the particular receptor evaluated. Nevertheless, these individual risk values are summed to get the cumulative risk values shown in these tables, as well as in Appendix D Attachment 6; Tables D6.1 through D6.131; and Attachment 8 Tables D8.1 through D8.131.

Once the COPCs with individual risks less than 1.0E-06 are removed in order to derive the final COC list, the corresponding cumulative risk values shown in Exhibits D.5 through D.37 (odd numbered tables only) and Exhibits D.40 through D.100 (even numbered tables only), Table D.40a (Summary of Direct Contact Risks for the Soils OU SWMUs/AOCs) and Table 12.6 (Summary of Direct Contact Total HI, Total ELCR, and Total Doses for the Soils OU SWMUs/AOCs by Grouping) consequently are lower.

D.7.4.2.1 Group 1, Former Facility Areas

SWMU 1, C-747-C Oil Landfarm

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 1 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.4.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None
	Neptunium-237			Neptunium-237	
	Thorium-230			Thorium-230	
	Uranium-238			Uranium-238	
2	Chromium	Beryllium[1]	2	Chromium	None
	PCB, Total	Mercury[1]		PCB, Total	
		Nickel[1]			
		Silver[1]			

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Exhibit D.4. (Continued)

Future Industrial Worker (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
3	PCB, Total	None	3	PCB, Total	None
	Uranium-238			Uranium-238	
4	Chromium	Nickel	4	Chromium	None
	Cobalt-60[2]				
5	PCB, Total	Beryllium[1]	5	PCB, Total	None
	Total PAH			Total PAH	
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None
	Neptunium-237			Neptunium-237	
	PCB, Total			PCB, Total	
	Plutonium-239/240			Plutonium-239/240	
	Thorium-230			Thorium-230	
	Uranium-238			Uranium-238	
2	Chromium	Beryllium[1]	2	Chromium	None
	PCB, Total	Mercury[1]		PCB, Total	
		Nickel[1]			
		Silver[1]			
3	PCB, Total	None	3	PCB, Total	None
	Uranium-238			Uranium-238	
4	Chromium	None	4	Chromium	None
	Thorium-230			Thorium-230	
5	PCB, Total	Beryllium[1]	5	PCB, Total	None
	Total PAH			Total PAH	
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	Arsenic[1]	1	Arsenic	None
	Cesium-137	Cobalt[1]		Cesium-137	
	Neptunium-237			Neptunium-237	
	Plutonium-239/240			Plutonium-239/240	
	Thorium-230			Thorium-230	
	Trichloroethene			Trichloroethene	
	Uranium-238			Uranium-238	
2	Arsenic	Arsenic[1]	2	Arsenic	*cis*-1,2-Dichloroethene
	Chromium	*cis*-1,2-Dichloroethene		Chromium	Trichloroethene
	PCB, Total	Mercury[1]		PCB, Total	
	Trichloroethene	Silver[1]		Trichloroethene	
	Vinyl chloride	Trichloroethene		Vinyl chloride	
3	Arsenic	None	3	Arsenic	None
	PCB, Total			PCB, Total	
	Uranium-238			Uranium-238	
4	Cesium-137	None	4	Cesium-137	None
	Chromium			Chromium	
	Thorium-230			Thorium-230	
	Trichloroethene			Trichloroethene	

Exhibit D.4. (Continued)

Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
5	Arsenic	Arsenic[1]	5	Arsenic	None
	PCB, Total	Beryllium[1]		PCB, Total	
	Total PAH	Cobalt[1]		Total PAH	
		Manganese[1]			
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	PCB, Total	*cis*-1,2-Dichloroethene	2	PCB, Total	*cis*-1,2-Dichloroethene
	Trichloroethene	Mercury[1]		Trichloroethene	Trichloroethene
		Silver[1]			
		Trichloroethene			
3	None	None	3	None	None
4	None	None	4	None	None
5	None	None	5	None	None
Hypothetical Resident (adult)					
Initial COCs			Final COCs		
EU	Cancerous COCs[3]	Noncancerous COCs	EU	Cancerous COCs[3]	Noncancerous COCs
1	Cesium-137	Beryllium[1]	1	Cesium-137	None
	Neptunium-237			Neptunium-237	
	PCB, Total			PCB, Total	
	Plutonium-239/240			Plutonium-239/240	
	Thorium-230			Thorium-230	
	Uranium-235			Uranium-235	
	Uranium-238			Uranium-238	
2	Chromium	Beryllium[1]	2	Chromium	None
	PCB, Total	Mercury[1]		PCB, Total	
		Nickel[1]			
		Silver[1]			
3	PCB, Total	None	3	PCB, Total	None
	Uranium-238			Uranium-238	
4	Chromium	Nickel[1]	4	Chromium	
	Cobalt-60[2]			PCB, Total	
	PCB, Total			Thorium-230	
	Thorium-230				
5	PCB, Total	Beryllium[1]	5	PCB, Total	
	Total PAH	Nickel[1]		Total PAH	
Hypothetical Resident (child)					
Initial COCs			Final COCs		
EU	Cancerous COCs[3]	Noncancerous COCs	EU	Cancerous COCs[3]	Noncancerous COCs
1	Cesium-137	Beryllium[1]	1	Cesium-137	None
	Neptunium-237			Neptunium-237	
	PCB, Total			PCB, Total	
	Plutonium-239/240			Plutonium-239/240	
	Thorium-230			Thorium-230	

Exhibit D.4. (Continued)

Hypothetical Resident (child) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs[3]	Noncancerous COCs	EU	Cancerous COCs[3]	Noncancerous COCs
	Uranium-235			Uranium-235	
	Uranium-238			Uranium-238	
2	Chromium	Beryllium[1]	2	Chromium	None
	PCB, Total	Cadmium[1]		PCB, Total	
		Mercury[1]			
		Nickel[1]			
		Silver[1]			
		Thallium[1]			
3	PCB, Total	None	3	PCB, Total	None
	Uranium-238			Uranium-238	
4	Chromium	Nickel[1]	4	Chromium	None
	Cobalt-60[2]			PCB, Total	
	PCB, Total			Thorium-230	
	Thorium-230				
5	PCB, Total	Beryllium[1]	5	PCB, Total	None
	Total PAH	Nickel[1]		Total PAH	
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	Beryllium[1]	1	Cesium-137	None
2	Chromium	Beryllium[1]	2	Chromium	None
	PCB, Total	Mercury[1]		PCB, Total	
		Nickel[1]			
		Silver[1]			
3	None	None	3	None	None
4	None	Nickel[1]	4	None	None
5	Total PAH	Beryllium[1]	5	Total PAH	None
		Nickel[1]			

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] COC was removed after evaluation as described below.
[3] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

These calculations take into consideration the revised dermal absorption calculations and that evaluation that vanadium does not contribute to cumulative risks/hazards (for the outdoor worker in EU 1 and for the child resident in EU 2); therefore constituents in these two exposure/use scenarios (at those two locations) are not considered to be COCs.

Cobalt-60, though reported in SWMU 1 analyses, was reported with values below the laboratory's MDA. Cobalt-60, therefore, is not considered a COC.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.4 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI of the COCs are as follows:

Exhibit D.5.

Future Industrial Worker				
EU	ELCR		HI	
1	Cesium-137	6.86E-06	None	
	Neptunium-237	1.48E-06		
	Thorium-230	3.20E-06		
	Uranium-238	1.16E-06		
	Cumulative	**1.27E-05**	**Cumulative**	**< 1**
2	Chromium	6.67E-06	None	
	PCB, Total	1.71E-04		
	Cumulative	**1.78E-04**	**Cumulative**	**< 1**
3	PCB, Total	1.16E-06	None	
	Uranium-238	1.02E-06		
	Cumulative	**2.17E-06**	**Cumulative**	**< 1**
4	Chromium	3.08E-06	None	
	Cumulative	3.08E-06	**Cumulative**	**< 1**
5	PCB, Total	1.44E-06	None	
	Total PAH	1.66E-06		
	Cumulative	**3.10E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Cesium-137	5.13E-06	None	
	Neptunium-237	1.23E-06		
	PCB, Total	1.09E-06		
	Plutonium-239/240	3.80E-06		
	Thorium-230	2.00E-05		
	Uranium-238	1.68E-06		
	Cumulative	**3.30E-05**	**Cumulative**	**< 1**
2	Chromium	4.93E-06	None	
	PCB, Total	1.98E-04		
	Cumulative	**2.03E-04**	**Cumulative**	**< 1**
3	PCB, Total	1.34E-06	None	
	Uranium-238	1.48E-06		
	Cumulative	**2.81E-06**	**Cumulative**	**< 1**
4	Chromium	2.28E-06	None	
	Thorium-230	2.29E-06		
	Cumulative	**4.57E-06**	**Cumulative**	**< 1**
5	PCB, Total	1.67E-06	None	
	Total PAH	2.03E-06		
	Cumulative	**3.69E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
1	Arsenic	1.63E-05	None	
	Cesium-137	5.13E-06		
	Neptunium-237	1.23E-06		
	Plutonium-239/240	3.80E-06		
	Thorium-230	2.00E-05		
	Trichloroethene	1.11E-05		
	Uranium-238	1.68E-06		
	Cumulative	**5.93E-05**	**Cumulative**	**< 1**

Exhibit D.5. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)				
EU	ELCR		HI	
2	Arsenic	1.88E-05	*cis*-1,2-Dichloroethene	41.2
	Chromium	3.08E-06	Trichloroethene	3.3
	PCB, Total	1.98E-04		
	Trichloroethene	1.04E-03		
	Vinyl chloride	1.98E-05		
	Cumulative	**1.28-03**	**Cumulative**	**44.5**
3	Arsenic	1.50E-05	None	
	PCB, Total	1.28E-06		
	Uranium-238	1.48E-06		
	Cumulative	**1.78E-05**	**Cumulative**	**< 1**
4	Cesium-137	2.92E-06	None	
	Chromium	1.74E-06		
	Thorium-230	2.29E-06		
	Trichloroethene	3.06E-06		
	Cumulative	**1.00E-05**	**Cumulative**	**< 1**
5	Arsenic	4.02E-05	None	
	PCB, Total	1.67E-06		
	Total PAH	2.03E-06		
	Cumulative	**4.39E-05**	**Cumulative**	**< 1**
Excavation Worker				
EU	ELCR		HI	
1	None	**< 1.00E-06**	None	**< 1**
2	PCB, Total	2.48E-06	*cis*-1,2-Dichloroethene	12.9
	Trichloroethene	1.30E-05	Trichloroethene	1.0
	Cumulative	**1.55E-05**	**Cumulative**	**13.9**
3	None	**< 1.00E-06**	None	**< 1**
4	None	**< 1.00E-06**	None	**< 1**
5	None	**< 1.00E-06**	None	**< 1**
Hypothetical Resident[2]				
EU	ELCR[1]		HI	
1	Cesium-137	3.46E-05	None	
	Neptunium-237	7.45E-06		
	PCB, Total	2.76E-06		
	Plutonium-239/240	2.21E-06		
	Thorium-230	1.23E-05		
	Uranium-235	1.35E-06		
	Uranium-238	5.71E-06		
	Cumulative	**6.64E-05**		**< 1**
2	Chromium	1.29E-05	None	
	PCB, Total	5.03E-04		
	Cumulative	**5.16E-04**		**< 1**
3	PCB, Total	3.40E-06	None	
	Uranium-238	5.00E-06		
	Cumulative	**8.40E-06**		**< 1**
4	Chromium	5.98E-06	None	
	PCB, Total	2.04E-06		
	Thorium-230	1.41E-06		

Exhibit D.5. (Continued)

Hypothetical Resident[2] (Continued)				
EU	ELCR		HI	
	Cumulative	**9.43E-06**		**< 1**
5	PCB, Total	4.23E-06	None	
	Total PAH	5.06E-06		
	Cumulative	**9.29E-06**		**< 1**
Teen Recreational User				
EU	ELCR		HI	
1	Cesium-137	1.44E-06	None	
	Cumulative	**1.44E-06**	**Cumulative**	**< 1**
2	Chromium	1.22E-06	None	
	PCB, Total	1.07E-04		
	Cumulative	**1.09E-04**	**Cumulative**	**< 1**
3	None	**< 1.00E-06**	None	**< 1**
4	None	**< 1.00E-06**	None	**< 1**
5	Total PAH	1.09E-06	None	
	Cumulative	**1.09E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs are located all in EU 2. These include the following:

- *Future Industrial Worker:* Total PCBs (ELCR)
- *Outdoor Worker (exposed to surface soil):* Total PCBs (ELCR)
- *Outdoor Worker (exposed to surface and subsurface soil): cis*-1,2-DCE and trichloroethene (HI) and Total PCBs and trichloroethene (ELCR)
- *Excavation Worker: cis*-1,2-DCE (HI)
- *Future Hypothetical Residential Receptor:* Total PCBs (ELCR)
- *Teen Recreational User:* Total PCBs (ELCR)

SWMU 99B, C-745 Kellogg Building Site—Septic System/Leach Field

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 99B include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

No surface samples are available for the pipeline area of SWMU 99B; therefore, only the outdoor worker (exposed to surface and subsurface soil) and excavation worker have been evaluated for this area.

Exhibit D.6.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	Mercury[1]	1	Chromium	None
		Nickel[1]			
Pipelines	n/a	n/a	Pipelines	n/a	n/a
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	Mercury[1]	1	Chromium	None
		Nickel[1]			
Pipelines	n/a	n/a	Pipelines	n/a	n/a
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	Arsenic[1]	1	Arsenic	None
	Chromium	Mercury[1]		Chromium	
		Nickel[1]			
Pipelines	Chromium	None	Pipelines	Chromium	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Pipelines	None	None	Pipelines	None	None
Hypothetical Resident (adult)					
Initial COCs			Final COCs		
EU	Cancerous COCs[3]	Noncancerous COCs	EU	Cancerous COCs[3]	Noncancerous COCs
1	Chromium[1]	Mercury[1]	1	Uranium-238	None
	Cobalt-60[2]	Nickel[1]			
	Uranium-238	Silver[1]			
Pipelines	n/a	n/a	Pipelines	n/a	n/a
Hypothetical Resident (child)					
Initial COCs			Final COCs		
EU	Cancerous COCs[3]	Noncancerous COCs	EU	Cancerous COCs[3]	Noncancerous COCs
1	Chromium[1]	Mercury[1]	1	Uranium-238	None
	Cobalt-60[2]	Nickel[1]			
	Uranium-238	Silver[1]			
Pipelines	n/a	n/a	Pipelines	n/a	n/a
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	Mercury[1]	1	None	None
		Nickel[1]			

Exhibit D.6. (Continued)

Teen Recreational User (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
		Silver[1]			
Pipelines	n/a	n/a	Pipelines	n/a	n/a

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] COC was removed after evaluation as described below.
[3] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cobalt-60, though reported in SWMU 99B analyses, was reported with values below the laboratory's MDA. Cobalt-60, therefore, is not considered a COC.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.6 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.7.

Future Industrial Worker				
EU	ELCR		HI	
1	Chromium	1.83E-06	None	
	Cumulative	**1.83E-06**	**Cumulative**	**< 1**
Pipelines	n/a	n/a	n/a	n/a
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	1.35E-06	None	
	Cumulative	**1.35E-06**	**Cumulative**	**< 1**
Pipelines	n/a	n/a	n/a	n/a
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.39E-05	None	
	Chromium	1.54E-06		
	Cumulative	**2.55E-05**	**Cumulative**	**< 1**
Pipelines	Chromium	1.12E-06	None	
	Cumulative	**1.12E-06**	**Cumulative**	**< 1**
Excavation Worker				
EU	ELCR		HI	
1	None	< **1.00E-06**	None	**1**
Pipelines	None	< **1.00E-06**	None	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Uranium-238	2.73E-06	None	
	Cumulative	**2.73E-06**	**Cumulative**	**< 1**
Pipelines	n/a	n/a	n/a	n/a
Teen Recreational User				
EU	ELCR		HI	
1	None	< **1.00E-06**	None	**< 1**
Pipelines	n/a	n/a	n/a	n/a

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs at SWMU 99B.

SWMU 194, DUF_6 Facility McGraw Construction Facilities (south side)

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 194 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.8.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	Mercury[1]	1	Chromium	None
		Nickel[1]			
		Silver[1]			
2	Chromium	None	2	Chromium	None
3	Arsenic	None	3	Arsenic	None
	Chromium			Chromium	
4	Chromium	Mercury[1]	4	Chromium	None
	Total PAH	Nickel[1]		Total PAH	
	Uranium-238	Silver[1]		Uranium-238	
5	Chromium	Mercury[1]	5	Chromium	None
		Nickel[1]			
		Silver[1]			
6	Chromium	None	6	Chromium	None
7	Chromium	None	7	Chromium	None
8	Chromium	None	8	Chromium	None
	Total PAH			Total PAH	
9	Arsenic	None	9	Arsenic	None
	Chromium			Chromium	
10	Arsenic	None	10	Arsenic	None
	Cesium-137			Cesium-137	
	Chromium			Chromium	
	Total PAH			Total PAH	
11	Chromium	Mercury[1]	11	Chromium	None
	Total PAH	Nickel[1]		Total PAH	
		Silver[1]			
12	Chromium	None	12	Chromium	None
	Total PAH			Total PAH	
13	Chromium	None	13	Chromium	None
	Total PAH			Total PAH	
14	Chromium	None	14	Chromium	None
15	Chromium	None	15	Chromium	None
16	Arsenic	None	16	Arsenic	None
	Chromium			Chromium	
17	Arsenic	None	17	Arsenic	None
	Chromium			Chromium	
	Total PAH			Total PAH	
18	Arsenic	None	18	Arsenic	None
	Chromium			Chromium	

Exhibit D.8. (Continued)

Future Industrial Worker (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
19	Arsenic	None	19	Arsenic	None
	Chromium			Chromium	
20	Arsenic	Cobalt[1]	20	Arsenic	None
	Chromium	Mercury[1]		Chromium	
		Nickel[1]			
		Silver[1]			
21	Chromium	None	21	Chromium	None
22	Chromium	None	22	Chromium	None
	PCB, Total			PCB, Total	
23	Arsenic	None	23	Arsenic	None
	Chromium			Chromium	
24	Chromium	None	24	Chromium	None
25	Chromium	None	25	Chromium	None
26	Chromium	None	26	Chromium	None
27	Chromium	None	27	Chromium	None
28	Arsenic	None	28	Arsenic	None
	Chromium			Chromium	
29	Chromium	None	29	Chromium	None
30	Chromium	Mercury[1]	30	Chromium	None
		Nickel[1]			
31	Cesium-137	None	31	Cesium-137	None
	Uranium-238			Uranium-238	
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	Chromium	None	2	Chromium	None
	Uranium-238			Uranium-238	
3	Arsenic	None	3	Arsenic	None
	Uranium-238			Uranium-238	
4	Chromium	Mercury[1]	4	Chromium	None
	Total PAH	Nickel[1]		Total PAH	
4	Uranium-238		4	Uranium-238	
5	Chromium	Mercury[1]	5	Chromium	None
	Uranium-238	Nickel[1]		Uranium-238	
6	Uranium-238	None	6	Uranium-238	None
7	Chromium	None	7	Chromium	None
8	Chromium	None	8	Chromium	None
	Total PAH			Total PAH	
	Uranium-238			Uranium-238	
9	Arsenic	None	9	Arsenic	None
	Chromium			Chromium	

Exhibit D.8. (Continued)

Outdoor Worker (exposed to surface soil) (Continued)					
Initial COCs			Final COCs		
10	Arsenic	None	10	Arsenic	None
	Cesium-137			Cesium-137	
	Total PAH			Total PAH	
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Uranium-238			Uranium-238	
11	Total PAH	Mercury[1]	11	Total PAH	None
		Nickel[1]			
12	Chromium	None	12	Chromium	None
	Total PAH			Total PAH	
13	Chromium	None	13	Chromium	None
	Total PAH			Total PAH	
14	Chromium	None	14	Chromium	None
15	Chromium	None	15	Chromium	None
16	Arsenic	None	16	Arsenic	None
	Chromium			Chromium	
17	Arsenic	None	17	Arsenic	None
	Chromium			Chromium	
	Total PAH			Total PAH	
18	Arsenic	None	18	Arsenic	None
	Chromium			Chromium	
19	Arsenic	None	19	Arsenic	None
	Chromium			Chromium	
20	Arsenic	Arsenic[1]	20	Arsenic	None
	Chromium	Cobalt[1]		Chromium	
		Manganese[1]			
		Mercury[1]			
		Nickel[1]			
21	Chromium	None	21	Chromium	None
22	Chromium	None	22	Chromium	None
	PCB, Total			PCB, Total	
23	Arsenic	None	23	Arsenic	None
	Chromium			Chromium	
24	Chromium	None	24	Chromium	None
25	Chromium	None	25	Chromium	None
26	Chromium	None	26	Chromium	None
27	Chromium	None	27	Chromium	None
28	Arsenic	None	28	Arsenic	None
	Chromium			Chromium	
29	Chromium	None	29	Chromium	None
30	Chromium	Mercury[1]	30	Chromium	None
		Nickel[1]			
31	Cesium-137	None	31	Cesium-137	None
	Uranium-238			Uranium-238	

Exhibit D.8. (Continued)

Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	Arsenic[1]	1	Arsenic	None
	Chromium	Mercury[1]		Chromium	
		Nickel[1]			
2	Arsenic	Arsenic[1]	2	Arsenic	None
	Chromium	Mercury[1]		Chromium	
	Uranium-238	Silver[1]		Uranium-238	
3	Arsenic	None	3	Arsenic	None
	Cesium-137[2]			Chromium	
	Chromium				
4	Arsenic	Arsenic[1]	4	Arsenic	None
	Cesium-137[2]	Iron[1]		Chromium	
	Chromium	Mercury[1]			
		Nickel[1]			
5	Arsenic	Arsenic[1]	5	Arsenic	None
	Chromium	Mercury[1]		Chromium	
	Total PAH	Nickel[1]		Total PAH	
6	None	None	6	None	None
7	Arsenic	None	7	Arsenic	None
	Chromium			Chromium	
8	Arsenic	None	8	Arsenic	None
	Cesium-137[2]			Chromium	
	Chromium			Total PAH	
	Total PAH			Uranium-238	
	Uranium-238				
9	Arsenic	None	9	Arsenic	None
	Chromium			Chromium	
10	Arsenic	Arsenic[1]	10	Arsenic	None
	Cesium-137	Mercury[1]		Cesium-137	
	Chromium	Nickel[1]		Chromium	
	Total PAH			Total PAH	
	Uranium-238			Uranium-238	
11	Arsenic	Arsenic[1]	11	Arsenic	None
	Chromium	Mercury[1]		Chromium	
	Total PAH	Nickel[1]		Total PAH	
12	Arsenic	None	12	Arsenic	None
	Chromium			Chromium	
	Total PAH			Total PAH	
13	Arsenic	None	13	Arsenic	None
	Chromium			Chromium	
	Total PAH			Total PAH	
14	Arsenic	Arsenic[1]	14	Arsenic	None
	Chromium	Mercury[1]		Chromium	
		Nickel[1]			

Exhibit D.8. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
15	Arsenic	None	15	Arsenic	None
	Chromium			Chromium	
16	Arsenic	None	16	Arsenic	None
	Chromium			Chromium	
17	Arsenic	None	17	Arsenic	None
	Cesium-137[2]			Chromium	
	Chromium			Total PAH	
	Total PAH				
18	Arsenic	None	18	Arsenic	None
	Chromium			Chromium	
19	Arsenic	None	19	Arsenic	None
	Chromium			Chromium	
20	Arsenic	Arsenic[1]	20	Arsenic	None
	Chromium	Cobalt[1]		Chromium	
		Manganese[1]			
		Mercury[1]			
		Nickel[1]			
21	Arsenic	Arsenic	21	Arsenic	Arsenic
	Chromium	Barium[1]		Chromium	Cobalt
		Cobalt			Iron
		Iron			Manganese
		Manganese			
		Mercury[1]			
		Nickel[1]			
22	Arsenic	None	22	Arsenic	None
	Cesium-137[2]			Chromium	
	Chromium			PCB, Total	
	PCB, Total				
23	Arsenic	Arsenic[1]	23	Arsenic	None
	Cadmium[1]	Iron[1]		Chromium	
	Cesium-137[2]	Mercury[1]			
	Chromium	Nickel[1]			
24	Arsenic	Arsenic[1]	24	Arsenic	None
	Cesium-137[2]	Iron[1]		Chromium	
	Chromium	Mercury[1]			
		Nickel			
25	Arsenic	None	25	Arsenic	None
	Chromium			Chromium	
26	Arsenic	None	26	Arsenic	None
	Chromium			Chromium	
27	Arsenic	None	27	Arsenic	None
	Chromium			Chromium	
28	Arsenic	None	28	Arsenic	None
	Chromium			Chromium	

Exhibit D.8. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
29	Arsenic	Arsenic[1]	29	Arsenic	None
	Chromium	Cobalt[1]		Chromium	
		Manganese[1]			
		Nickel[1]			
30	Arsenic	Arsenic[1]	30	Arsenic	None
	Chromium	Mercury[1]		Chromium	
		Nickel[1]			
31	Cesium-137	None	31	Cesium-137	None
	Uranium-238			Uranium-238	
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1—20	None	None	1—20	None	None
21	Arsenic	Arsenic	21	Arsenic	Arsenic
		Barium[1]			Cobalt
		Cobalt			Manganese
		Iron[1]			
		Manganese			
		Mercury[1]			
22—31	None	None	22—31	None	None
Hypothetical Resident (adult)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	Antimony[1]	1	Chromium	None
		Mercury[1]			
		Nickel[1]			
		Silver[1]			
2	Chromium	None	2	Chromium	None
	Uranium-238			Uranium-238	
3	Arsenic	None	3	Arsenic	None
	Chromium			Chromium	
	Total PAH			Total PAH	
	Uranium-238			Uranium-238	
4	Chromium	Mercury[1]	4	Chromium	None
	Total PAH	Nickel[1]		Total PAH	
	Uranium-238	Silver[1]		Uranium-238	
5	Chromium	Mercury[1]	5	Chromium	None
	Total PAH	Nickel[1]		Total PAH	
	Uranium-238	Silver[1]		Uranium-238	
6	Chromium	None	6	Chromium	None
	Uranium-238			Uranium-238	

Exhibit D.8. (Continued)

Hypothetical Resident (Adult) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
7	Chromium	None	7	Chromium	None
8	Bis(2-ethylhexyl)phthalate	None	8	Bis(2-ethylhexyl)phthalate	None
	Chromium			Chromium	
	Total PAH			Total PAH	
	Uranium-238			Uranium-238	
9	Arsenic	None	9	Arsenic	None
	Chromium			Chromium	
10	Arsenic	None	10	Arsenic	None
	Cesium-137			Cesium-137	
	Chromium			Chromium	
	Total PAH			Total PAH	
	Uranium-238			Uranium-238	
11	Chromium	Mercury[1]	11	Chromium	None
	PCB, Total	Nickel[1]		PCB, Total	
	Total PAH	Silver[1]		Total PAH	
12	Chromium	None	12	Chromium	None
	Total PAH			Total PAH	
13	Chromium	None	13	Chromium	None
	Total PAH			Total PAH	
14	Chromium	Mercury[1]	14	Chromium	None
15	Chromium	None[1]	15	Chromium	None
16	Arsenic	None	16	Arsenic	None
	Chromium			Chromium	
17	Arsenic	None	17	Arsenic	None
	Cadmium			Chromium	
	Chromium			Total PAH	
	Total PAH				
18	Arsenic	None	18	Arsenic	None
	Chromium			Chromium	
19	Arsenic	None	19	Arsenic	None
	Chromium			Chromium	
20	Arsenic	Arsenic[1]	20	Arsenic	None
	Chromium	Cobalt[1]		Chromium	
	Total PAH	Manganese[1]		Total PAH	
		Mercury[1]			
		Nickel[1]			
		Silver[1]			
21	Chromium	Mercury[1]	21	Chromium	None
		Nickel[1]			
22	Chromium	None	22	Chromium	None
	PCB, Total			PCB, Total	
23	Arsenic	None	23	Arsenic	None
	Chromium			Chromium	
24	Chromium	None	24	Chromium	None
	Total PAH			Total PAH	

Exhibit D.8. (Continued)

Hypothetical Resident (Adult) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
25	Chromium	None	25	Chromium	None
	Total PAH			Total PAH	
26	Chromium	None	26	Chromium	None
27	Chromium	None	27	Chromium	None
28	Arsenic	None	28	Arsenic	None
	Chromium			Chromium	
29	Chromium	None	29	Chromium	None
30	Chromium	Mercury[1]	30	Chromium	None
		Nickel[1]			
		Silver[1]			
31	Cesium-137	None	31	Cesium-137	None
	Uranium-238			Uranium-238	
Hypothetical Resident (child)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	Antimony[1]	1	Chromium	None
		Mercury[1]			
		Nickel[1]			
		Silver[1]			
2	Chromium	None	2	Chromium	None
	Uranium-238			Uranium-238	
3	Arsenic	Antimony[1]	3	Arsenic	None
	Chromium	Arsenic[1]		Chromium	
	Total PAH	Nickel[1]		Total PAH	
	Uranium-238			Uranium-238	
4	Chromium	Mercury[1]	4	Chromium	None
	Total PAH	Nickel[1]		Total PAH	
	Uranium-238	Silver[1]		Uranium-238	
5	Chromium	Mercury[1]	5	Chromium	None
	Total PAH	Nickel[1]		Total PAH	
	Uranium-238	Silver[1]		Uranium-238	
6	Chromium	Manganese[1]	6	Chromium	None
	Uranium-238	Nickel[1]		Uranium-238	
		Silver[1]			
7	Chromium	Nickel[1]	7	Chromium	None
		Silver[1]			
8	Bis(2-ethylhexyl)phthalate	None	8	Bis(2-ethylhexyl)phthalate	None
	Chromium			Chromium	
	Total PAH			Total PAH	
	Uranium-238			Uranium-238	
9	Arsenic	None	9	Arsenic	None
	Chromium			Chromium	

Exhibit D.8. (Continued)

Hypothetical Resident (child) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
10	Arsenic	Arsenic[1]	10	Arsenic	None
	Cesium-137	Nickel[1]		Cesium-137	
	Chromium			Chromium	
	Total PAH			Total PAH	
	Uranium-238			Uranium-238	
11	Chromium	Mercury[1]	11	Chromium	None
	PCB, Total	Nickel[1]		PCB, Total	
	Total PAH	Silver[1]		Total PAH	
12	Chromium	Nickel[1]	12	Chromium	None
	Total PAH	Silver[1]		Total PAH	
13	Chromium	None	13	Chromium	None
	Total PAH			Total PAH	
14	Chromium	Mercury[1]	14	Chromium	None
15	Chromium	None	15	Chromium	None
16	Arsenic	Antimony[1]	16	Arsenic	None
	Chromium	Arsenic[1]		Chromium	
		Nickel[1]			
		Thallium[1]			
		Vanadium[1]			
17	Arsenic	None	17	Arsenic	None
	Cadmium[1]			Chromium	
	Chromium			Total PAH	
	Total PAH				
18	Arsenic	Arsenic[1]	18	Arsenic	None
	Chromium	Nickel[1]		Chromium	
19	Arsenic	Arsenic[1]	19	Arsenic	None
	Chromium	Nickel[1]		Chromium	
20	Arsenic	Arsenic	20	Arsenic	Arsenic
	Chromium	Barium[1]		Chromium	Cobalt
	Total PAH	Beryllium[1]		Total PAH	Manganese
		Cobalt			Mercury
		Manganese			
		Mercury			
		Nickel[1]			
		Silver[1]			
		Vanadium[1]			
21	Chromium	Antimony[1]	21	Chromium	None
		Mercury[1]			
		Nickel[1]			
		Thallium[1]			
22	Chromium	None	22	Chromium	None
	PCB, Total			PCB, Total	

Exhibit D.8. (Continued)

Hypothetical Resident (child) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
23	Arsenic	Arsenic	23	Arsenic	Arsenic
	Chromium	Iron		Chromium	Iron
		Nickel[1]			
		Silver[1]			
24	Chromium	None	24	Chromium	None
	Total PAH			Total PAH	
25	Chromium	Barium[1]	25	Chromium	None
	Total PAH	Manganese[1]		Total PAH	
		Nickel[1]			
26	Chromium	None	26	Chromium	None
27	Chromium	Nickel[1]	27	Chromium	None
		Silver[1]			
28	Arsenic	Arsenic	28	Arsenic	Arsenic
	Chromium	Manganese		Chromium	Manganese
		Nickel[1]			Vanadium
		Silver[1]			
		Vanadium			
29	Chromium	Antimony[1]	29	Chromium	None
		Nickel[1]			
		Silver[1]			
30	Chromium	Mercury[1]	30	Chromium	None
		Nickel[1]			
		Silver			
31	Cesium-137	None	31	Cesium-137	None
	Uranium-238			Uranium-238	
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	Mercury[1]	1	None	None
		Nickel[1]			
		Silver[1]			
2	None	None	2	None	None
3	Arsenic	None	3	Arsenic	None
4	None	Mercury[1]	4	None	None
		Nickel[1]			
		Silver[1]			
5	None	Mercury[1]	5	None	None
		Nickel[1]			
		Silver[1]			
6	None	None	6	None	None
7	None	None	7	None	None
8	Total PAH	None	8	Total PAH	None
9	Arsenic	None	9	Arsenic	None

Exhibit D.8. (Continued)

Teen Recreational User (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
10	Cesium-137	None	10	Arsenic	None
	Total PAH			Cesium-137	
	Arsenic			Total PAH	
11	None	Mercury[1]	11	None	None
		Nickel[1]			
		Silver[1]			
12	Total PAH	None	12	Total PAH	None
13	Total PAH	None	13	Total PAH	None
14	None	Mercury[1]	14	None	None
15	None	None	15	None	None
16	Arsenic	None	16	Arsenic	None
17	Total PAH	None	17	Arsenic	None
	Arsenic			Total PAH	
18	Arsenic	None	18	Arsenic	None
19	Arsenic	None	19	Arsenic	None
20	Arsenic	Cobalt[1]	20	Arsenic	None
		Mercury[1]			
		Nickel[1]			
		Silver[1]			
21	None	Mercury[1]	21	None	None
		Nickel[1]			
22	PCB, Total	None	22	PCB, Total	None
23	Arsenic	None	23	Arsenic	None
24	None	None	24	None	None
25	None	None	25	None	None
26	None	None	26	None	None
27	None	None	27	None	None
28	Arsenic	None	28	Arsenic	None
29	None	None	29	None	None
30	None	Mercury[1]	30	None	None
		Nickel[1]			
		Silver[1]			
31	Cesium-137	None	31	Cesium-137	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] COC was removed after evaluation as described below.
[3] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Surface soil background levels were used for all but the outdoor worker (exposed to surface and subsurface soil) and the excavation worker where subsurface soil background levels were used for screening to determine COPCs. If sample data used in determining COPCs for the outdoor worker (exposed to surface and subsurface soil) and the excavation worker were actually collected from the surface, the inappropriate background value was used for comparison. In the case of cesium-137, several surface soil sample results in EUs 3, 4, 8, 17, 22, 23, and 24 are reported above the subsurface background concentration (0.21 pCi/g). These sample results, however, if compared to surface background (0.49 pCi/g) (since they are surface samples) would fall below the background screening. Cesium-137 in these EUs (3, 4, 8, 17, 22, 23, and 24) is not considered a COC.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.8 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.9.

Future Industrial Worker				
EU	ELCR		HI	
1	Chromium	1.28E-06	None	
	Cumulative	**1.28E-06**	**Cumulative**	**< 1**
2	Chromium	1.98E-06		
	Cumulative	**1.98E-06**	**Cumulative**	**< 1**
3	Arsenic	1.47E-05		
	Chromium	1.29E-06		
	Cumulative	**1.60E-05**	**Cumulative**	**< 1**
4	Chromium	1.60E-06		
	Total PAH	1.23E-06		
	Uranium-238	1.02E-06		
	Cumulative	**3.85E-06**	**Cumulative**	**< 1**
5	Chromium	1.52E-06		
	Cumulative	**1.52E-06**	**Cumulative**	**< 1**
6	Chromium	1.23E-06		
	Cumulative	**1.23E-06**	**Cumulative**	**< 1**
7	Chromium	1.76E-06		
	Cumulative	**1.76E-06**	**Cumulative**	**< 1**
8	Chromium	1.78E-06		
	Total PAH	8.19E-06		
	Cumulative	**9.97E-06**	**Cumulative**	**< 1**
9	Arsenic	1.15E-05		
	Chromium	1.71E-06		
	Cumulative	**1.32E-05**	**Cumulative**	**< 1**
10	Arsenic	1.22E-05		
	Cesium-137	6.75E-06		
	Chromium	1.20E-06		
	Total PAH	4.34E-06		
	Cumulative	**2.45E-05**	**Cumulative**	**< 1**
11	Chromium	1.08E-06		
	Total PAH	1.34E-06		
	Cumulative	**2.43E-06**	**Cumulative**	**< 1**
12	Chromium	2.10E-06		
	Total PAH	1.51E-05		
	Cumulative	**1.72E-05**	**Cumulative**	**< 1**

Exhibit D.9. (Continued)

Future Industrial Worker (Continued)				
EU	ELCR		HI	
13	Chromium	1.58E-06		
	Total PAH	1.54E-06		
	Cumulative	**3.12E-06**	**Cumulative**	**< 1**
14	Chromium	1.73E-06		
	Cumulative	**1.73E-06**	**Cumulative**	**< 1**
15	Chromium	1.77E-06		
	Cumulative	**1.77E-06**	**Cumulative**	**< 1**
16	Arsenic	1.16E-05		
	Chromium	1.76E-06		
	Cumulative	**1.33E-05**	**Cumulative**	**< 1**
17	Arsenic	1.16E-05		
	Chromium	1.54E-06		
	Total PAH	2.68E-06		
	Cumulative	**1.58E-05**	**Cumulative**	**< 1**
18	Arsenic	1.06E-05		
	Chromium	2.27E-06		
	Cumulative	**1.29E-05**	**Cumulative**	**< 1**
19	Arsenic	1.07E-05		
	Chromium	1.60E-06		
	Cumulative	**1.23E-05**	**Cumulative**	**< 1**
20	Arsenic	1.19E-05		
	Chromium	1.74E-06		
	Cumulative	**1.36E-05**	**Cumulative**	**< 1**
21	Chromium	1.83E-06		
	Cumulative	**1.83E-06**	**Cumulative**	**< 1**
22	Chromium	1.62E-06		
	PCB, Total	5.82E-05		
	Cumulative	**5.98E-05**	**Cumulative**	**< 1**
23	Arsenic	1.16E-05		
	Chromium	2.19E-06		
	Cumulative	**1.38E-05**	**Cumulative**	**< 1**
24	Chromium	1.66E-06		
	Cumulative	**1.66E-06**	**Cumulative**	**< 1**
25	Chromium	2.03E-06		
	Cumulative	**2.03E-06**	**Cumulative**	**< 1**
26	Chromium	1.39E-06		
	Cumulative	**1.39E-06**	**Cumulative**	**< 1**
27	Chromium	1.73E-06		
	Cumulative	**1.73E-06**	**Cumulative**	**< 1**
28	Arsenic	1.21E-05		
	Chromium	2.01E-06		
	Cumulative	**1.41E-05**	**Cumulative**	**< 1**
29	Chromium	1.68E-06		
	Cumulative	**1.68E-06**	**Cumulative**	**< 1**
30	Chromium	1.87E-06		
	Cumulative	**1.87E-06**	**Cumulative**	**< 1**
31	Cesium-137	6.62E-06		
	Uranium-238	1.01E-06		
	Cumulative	**7.63E-06**	**Cumulative**	**< 1**

Exhibit D.9. (Continued)

Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	None	< 1.00E-06	None	
	Cumulative	**< 1.00E-06**	**Cumulative**	**< 1**
2	Chromium	1.46E-06		
	Uranium-238	1.21E-06		
	Cumulative	**2.67E-06**	**Cumulative**	**< 1**
3	Arsenic	3.53E-05		
	Uranium-238	1.09E-06		
	Cumulative	**3.64E-05**	**Cumulative**	**< 1**
4	Chromium	1.19E-06		
	Total PAH	1.50E-06		
	Uranium-238	1.48E-06		
	Cumulative	**4.17E-06**	**Cumulative**	**< 1**
5	Chromium	1.12E-06		
	Uranium-238	1.18E-06		
	Cumulative	**2.30E-06**	**Cumulative**	**< 1**
6	Uranium-238	1.13E-06		
	Cumulative	**1.13E-06**	**Cumulative**	**< 1**
7	Chromium	1.30E-06		
	Cumulative	**1.30E-06**	**Cumulative**	**< 1**
8	Chromium	1.31E-06		
	Total PAH	1.00E-05		
	Uranium-238	1.19E-06		
	Cumulative	**1.25E-05**	**Cumulative**	**< 1**
9	Arsenic	2.75E-05		
	Chromium	1.27E-06		
	Cumulative	**2.88E-05**	**Cumulative**	**< 1**
10	Arsenic	2.93E-05		
	Cesium-137	5.04E-06		
	Total PAH	5.30E-06		
	Uranium-238	1.27E-06		
	Cumulative	**4.09E-05**	**Cumulative**	**< 1**
11	Total PAH	1.64E-06		
	Cumulative	**1.64E-06**	**Cumulative**	**< 1**
12	Chromium	1.55E-06		
	Total PAH	1.84E-05		
	Cumulative	**1.99E-05**	**Cumulative**	**< 1**
13	Chromium	1.17E-06		
	Total PAH	1.88E-06		
	Cumulative	**3.05E-06**	**Cumulative**	**< 1**
14	Chromium	1.28E-06		
	Cumulative	**1.28E-06**	**Cumulative**	**< 1**
15	Chromium	1.31E-06		
	Cumulative	**1.31E-06**	**Cumulative**	**< 1**
16	Arsenic	2.78E-05		
	Chromium	1.31E-06		
	Cumulative	**2.91E-05**	**Cumulative**	**< 1**

Exhibit D.9. (Continued)

Outdoor Worker (exposed to surface soil) (Continued)				
EU	ELCR		HI	
17	Arsenic	2.78E-05		
	Chromium	1.14E-06		
	Total PAH	3.27E-06		
	Cumulative	**3.22E-05**	**Cumulative**	**< 1**
18	Arsenic	2.55E-05		
	Chromium	1.68E-06		
	Cumulative	**2.72E-05**	**Cumulative**	**< 1**
19	Arsenic	2.58E-05		
	Chromium	1.19E-06		
	Cumulative	**2.69E-05**	**Cumulative**	**< 1**
20	Arsenic	2.85E-05		
	Chromium	1.28E-06		
	Cumulative	**2.98E-05**	**Cumulative**	**< 1**
21	Chromium	1.35E-06		
	Cumulative	**1.35E-06**	**Cumulative**	**< 1**
22	Chromium	1.20E-06		
	PCB, Total	6.73E-05		
	Cumulative	**6.85E-05**	**Cumulative**	**< 1**
23	Arsenic	2.78E-05		
	Chromium	1.62E-06		
	Cumulative	**2.95E-05**	**Cumulative**	**< 1**
24	Chromium	1.23E-06		
	Cumulative	**1.23E-06**	**Cumulative**	**< 1**
25	Chromium	1.50E-06		
	Cumulative	**1.50E-06**	**Cumulative**	**< 1**
26	Chromium	1.03E-06		
	Cumulative	**1.03E-06**	**Cumulative**	**< 1**
27	Chromium	1.28E-06		
	Cumulative	**1.28E-06**	**Cumulative**	**< 1**
28	Arsenic	2.90E-05		
	Chromium	1.49E-06		
	Cumulative	**3.05E-05**	**Cumulative**	**< 1**
29	Chromium	1.24E-06		
	Cumulative	**1.24E-06**	**Cumulative**	**< 1**
30	Chromium	1.39E-06		
	Cumulative	**1.39E-06**	**Cumulative**	**< 1**
31	Cesium-137	4.95E-06		
	Uranium-238	1.47E-06		
	Cumulative	**6.41E-06**	**Cumulative**	**< 1**

Exhibit D.9. (Continued)

Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.46E-05		
	Chromium	1.25E-06		
	Cumulative	**2.58E-05**	**Cumulative**	**< 1**
2	Arsenic	2.46E-05		
	Chromium	1.46E-06		
	Uranium-238	1.05E-06		
	Cumulative	**2.71E-05**	**Cumulative**	**< 1**
3	Arsenic	3.48E-05		
	Cesium-137	2.04E-06		
	Chromium	1.22E-06		
	Cumulative	**3.80E-05**	**Cumulative**	**< 1**
4	Arsenic	2.47E-05		
	Cesium-137	1.25E-06		
	Chromium	1.37E-06		
	Cumulative	**2.73E-05**	**Cumulative**	**< 1**
5	Arsenic	2.34E-05		
	Chromium	1.36E-06		
	Total PAH	9.28E-06		
	Cumulative	**3.40E-05**	**Cumulative**	**< 1**
6	None			
	Cumulative	**< 1.0E-06**	**Cumulative**	**< 1**
7	Arsenic	2.46E-05		
	Chromium	1.30E-06		
	Cumulative	**2.59E-05**	**Cumulative**	**< 1**
8	Arsenic	2.62E-05		
	Cesium-137	2.41E-06		
	Chromium	1.49E-06		
	Total PAH	7.71E-06		
	Uranium-238	1.01E-06		
	Cumulative	**3.88E-05**	**Cumulative**	**< 1**
9	Arsenic	2.36E-05		
	Chromium	1.10E-06		
	Cumulative	**2.47E-05**	**Cumulative**	**< 1**
10	Arsenic	2.66E-05		
	Cesium-137	5.04E-06		
	Chromium	1.23E-06		
	Total PAH	5.30E-06		
	Uranium-238	1.27E-06		
	Cumulative	**3.94E-05**	**Cumulative**	**< 1**
11	Arsenic	2.59E-05		
	Chromium	1.39E-06		
	Total PAH	1.64E-06		
	Cumulative	**2.90E-05**	**Cumulative**	**< 1**
12	Arsenic	2.21E-05		
	Chromium	1.55E-06		
	Total PAH	1.46E-05		
	Cumulative	**3.83E-05**	**Cumulative**	**< 1**

Exhibit D.9. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)				
EU	ELCR		HI	
13	Arsenic	2.39E-05		
	Chromium	1.53E-06		
	Total PAH	1.39E-06		
	Cumulative	**2.68E-05**	**Cumulative**	**< 1**
14	Arsenic	2.61E-05		
	Chromium	1.49E-06		
	Cumulative	**2.76E-05**	**Cumulative**	**< 1**
15	Arsenic	2.16E-05		
	Chromium	1.49E-06		
	Cumulative	**2.31E-05**	**Cumulative**	**< 1**
16	Arsenic	2.63E-05		
	Chromium	1.31E-06		
	Cumulative	**2.76E-05**	**Cumulative**	**< 1**
17	Arsenic	2.69E-05		
	Cesium-137	2.20E-06		
	Chromium	1.34E-06		
	Total PAH	2.14E-06		
	Cumulative	**3.25E-05**	**Cumulative**	**< 1**
18	Arsenic	2.86E-05		
	Chromium	1.68E-06		
	Cumulative	**3.03E-05**	**Cumulative**	**< 1**
19	Arsenic	2.40E-05		
	Chromium	1.19E-06		
	Cumulative	**2.52E-05**	**Cumulative**	**< 1**
20	Arsenic	2.76E-05		
	Chromium	1.74E-06		
	Cumulative	**2.93E-05**	**Cumulative**	**< 1**
21	Arsenic	8.48E-05	Arsenic	0.5
	Chromium	1.35E-06	Cobalt	1.0
			Iron	0.2
			Manganese	1.3
	Cumulative	**8.62E-05**	**Cumulative**	**3.0**
22	Arsenic	2.77E-05		
	Cesium-137	1.41E-06		
	Chromium	1.17E-06		
	PCB, Total	6.41E-05		
	Cumulative	**9.44E-05**	**Cumulative**	**< 1**
23	Arsenic	2.71E-05		
	Cesium-137	2.46E-06		
	Chromium	1.45E-06		
	Cumulative	**3.10E-05**	**Cumulative**	**< 1**
24	Arsenic	2.87E-05		
	Cesium-137	1.85E-06		
	Chromium	1.15E-06		
	Cumulative	**3.17E-05**	**Cumulative**	**< 1**
25	Arsenic	2.53E-05		
	Chromium	1.28E-06		
	Cumulative	**2.66E-05**	**Cumulative**	**< 1**

Exhibit D.9. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)				
EU	ELCR[1]		HI[2]	
26	Arsenic	2.19E-05		
	Chromium	1.18E-06		
	Cumulative	**2.31E-05**	**Cumulative**	**< 1**
27	Arsenic	2.57E-05		
	Chromium	1.27E-06		
	Cumulative	**2.69E-05**	**Cumulative**	**< 1**
28	Arsenic	2.72E-05		
	Chromium	1.56E-06		
	Cumulative	**2.87E-05**	**Cumulative**	**< 1**
29	Arsenic	3.44E-05		
	Chromium	1.41E-06		
	Cumulative	**3.59E-05**	**Cumulative**	**< 1**
30	Arsenic	2.28E-05		
	Chromium	1.40E-06		
	Cumulative	**2.42E-05**	**Cumulative**	**< 1**
31	Cesium-137	4.95E-06		
	Uranium-238	1.47E-06		
	Cumulative	**6.41E-06**	**Cumulative**	**< 1**
Excavation Worker				
EU	ELCR		HI	
21	Arsenic	1.06E-06	Arsenic	0.2
			Cobalt	0.3
			Manganese	0.4
	Cumulative	**1.06E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR		HI	
1	Chromium	2.49E-06	None	
	Cumulative	**2.49E-06**	**Cumulative**	**< 1**
2	Chromium	3.83E-06	None	
	Uranium-238	4.10E-06		
	Cumulative	**7.94E-06**	**Cumulative**	**< 1**
3	Arsenic	6.22E-05	None	
	Chromium	2.51E-06		
	Total PAH	2.02E-06		
	Uranium-238	3.71E-06		
	Cumulative	**7.04E-05**	**Cumulative**	**< 1**
4	Chromium	3.11E-06	None	
	Total PAH	3.75E-06		
	Uranium-238	5.00E-06		
	Cumulative	**1.19E-05**	**Cumulative**	**< 1**
5	Chromium	2.95E-06	None	
	Total PAH	1.22E-06		
	Uranium-238	3.99E-06		
	Cumulative	**8.15E-06**	**Cumulative**	**< 1**
6	Chromium	2.38E-06	None	
	Uranium-238	3.82E-06		
	Cumulative	**6.20E-06**	**Cumulative**	**< 1**
7	Chromium	3.42E-06		
	Cumulative	**3.42E-06**	**Cumulative**	**< 1**

Exhibit D.9. (Continued)

Excavation Worker				
EU	ELCR[1]		HI[2]	
8	Bis(2-ethylhexyl)phthalate	1.21E-06	None	
	Chromium	3.45E-06		
	Total PAH	2.50E-05		
	Uranium-238	4.02E-06		
	Cumulative	**3.36E-05**	**Cumulative**	**< 1**
9	Arsenic	4.85E-05	None	
	Chromium	3.32E-06		
	Cumulative	**5.18E-05**	**Cumulative**	**< 1**
10	Arsenic	5.16E-05	None	
	Cesium-137	3.40E-05		
	Chromium	2.33E-06		
	Total PAH	1.32E-05		
	Uranium-238	4.31E-06		
	Cumulative	**1.06E-04**	**Cumulative**	**< 1**
11	Chromium	2.10E-06	None	
	PCB, Total	1.32E-06		
	Total PAH	4.09E-06		
	Cumulative	**7.51E-06**	**Cumulative**	**< 1**
12	Chromium	4.07E-06	None	
	Total PAH	4.59E-05		
	Cumulative	**4.99E-05**	**Cumulative**	**< 1**
13	Chromium	3.06E-06	None	
	Total PAH	4.70E-06		
	Cumulative	**7.76E-06**	**Cumulative**	**< 1**
14	Chromium	3.35E-06		
	Cumulative	**3.35E-06**	**Cumulative**	**< 1**
15	Chromium	3.43E-06		
	Cumulative	**3.43E-06**	**Cumulative**	**< 1**
16	Arsenic	4.89E-05	None	
	Chromium	3.42E-06		
	Cumulative	**5.23E-05**	**Cumulative**	**< 1**
17	Arsenic	4.90E-05	None	
	Chromium	2.99E-06		
	Total PAH	8.16E-06		
	Cumulative	**6.02E-05**	**Cumulative**	**< 1**
18	Arsenic	4.49E-05	None	
	Chromium	4.40E-06		
	Cumulative	**4.93E-05**	**Cumulative**	**< 1**
19	Arsenic	4.54E-05	None	
	Chromium	3.11E-06		
	Cumulative	**4.85E-05**	**Cumulative**	**< 1**
20	Arsenic	5.03E-05	Arsenic	0.7
	Chromium	3.37E-06	Cobalt	0.9
	Total PAH	1.59E-06	Manganese	0.4
			Mercury	0.3
	Cumulative	**5.52E-05**	**Cumulative**	**2.4**

Exhibit D.9. (Continued)

Hypothetical Resident (Continued)				
EU	ELCR[1]		HI[2]	
21	Chromium	3.54E-06	None	
	Cumulative	**3.54E-06**	**Cumulative**	**< 1**
22	Chromium	3.15E-06	None	
	PCB, Total	1.71E-04		
	Cumulative	**1.74E-04**	**Cumulative**	**< 1**
23	Arsenic	4.90E-05	Arsenic	0.7
	Chromium	4.24E-06	Iron	0.3
	Cumulative	**5.33E-05**	**Cumulative**	**1.0**
24	Chromium	3.23E-06	None	
	Total PAH	1.17E-06		
	Cumulative	**4.40E-06**	**Cumulative**	**< 1**
25	Chromium	3.94E-06	None	
	Total PAH	1.06E-06		
	Cumulative	**5.00E-06**	**Cumulative**	**< 1**
26	Chromium	2.69E-06	None	
	Cumulative	**2.69E-06**	**Cumulative**	**< 1**
27	Chromium	3.36E-06	None	
	Cumulative	**3.36E-06**	**Cumulative**	**< 1**
28	Arsenic	5.11E-05	Arsenic	0.7
	Chromium	3.90E-06	Manganese	0.2
			Vanadium	0.1
	Cumulative	**5.50E-05**	**Cumulative**	**1.0**
29	Chromium	3.25E-06	None	
	Cumulative	**3.25E-06**	**Cumulative**	**< 1**
30	Chromium	3.64E-06	None	
	Cumulative	**3.64E-06**	**Cumulative**	**< 1**
31	Cesium-137	3.34E-05	None	
	Uranium-238	4.97E-06		
	Cumulative	**3.83E-05**	**Cumulative**	**< 1**
Teen Recreational User				
EU	ELCR		HI	
3	Arsenic	8.26E-06	None	
	Cumulative	**8.26E-06**	**Cumulative**	**< 1**
8	Total PAH	5.39E-06	None	
	Cumulative	**5.39E-06**	**Cumulative**	**< 1**
9	Arsenic	6.44E-06	None	
	Cumulative	**6.44E-06**	**Cumulative**	**< 1**
10	Arsenic	6.86E-06	None	
	Cesium-137	1.42E-06		
	Total PAH	2.86E-06		
	Cumulative	**1.11E-05**	**Cumulative**	**< 1**
12	Total PAH	9.91E-06	None	
	Cumulative	**9.91E-06**	**Cumulative**	**< 1**
13	Total PAH	1.02E-06	None	
	Cumulative	**1.02E-06**	**Cumulative**	**< 1**
16	Arsenic	6.50E-06	None	

Exhibit D.9. **(Continued)**

Teen Recreational User (Continued)				
EU	ELCR		HI	
	Cumulative	**6.50E-06**	**Cumulative**	**< 1**
17	Arsenic	6.52E-06	None	
	Total PAH	1.76E-06		
	Cumulative	**8.28E-06**	**Cumulative**	**< 1**
18	Arsenic	5.96E-06	None	
	Cumulative	**5.96E-06**	**Cumulative**	**< 1**
19	Arsenic	6.03E-06	None	
	Cumulative	**6.03E-06**	**Cumulative**	**< 1**
20	Arsenic	6.68E-06	None	
	Cumulative	**6.68E-06**	**Cumulative**	**< 1**
22	PCB, Total	3.65E-05	None	
	Cumulative	**3.65E-05**	**Cumulative**	**< 1**
23	Arsenic	6.52E-06	None	
	Cumulative	**6.52E-06**	**Cumulative**	**< 1**
28	Arsenic	6.79E-06	None	
	Cumulative	**6.79E-06**	**Cumulative**	**< 1**
31	Cesium-137	1.39E-06	None	
	Cumulative	**1.39E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs are found in SWMU 194 as follows:

- *Outdoor Worker (exposed to surface and subsurface soil):* manganese (HI, EU 21)
- *Future Hypothetical Residential Receptor:* Total PCBs (ELCR, EU 22)

SWMU 196, C-746-A Septic System

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 196 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.10.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Neptunium-237	Nickel[1]	1	Neptunium-237	None
2	PCB, Total Total PAH Uranium-238	None	2	PCB, Total Total PAH Uranium-238	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Uranium-238	Nickel[1]	1	Uranium-238	None
2	PCB, Total Total PAH Uranium-238	None	2	PCB, Total Total PAH Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Uranium-238	Antimony Arsenic Beryllium Cadmium Cobalt Iron Manganese[1] Nickel Silver[1] Thallium	1	Arsenic Chromium Uranium-238	Antimony Arsenic Beryllium Cadmium Cobalt Iron Nickel Thallium
2	Arsenic PCB, Total Total PAH Uranium-238	Antimony[1] Arsenic[1] Nickel[1]	2	Arsenic PCB, Total Total PAH Uranium-238	None

Exhibit D.10. (Continued)

Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	Antimony Beryllium[1] Cadmium Cobalt Nickel[1] Silver[1] Thallium	1	None	Antimony Cadmium Cobalt Thallium
2	Total PAH	Antimony[1]	2	Total PAH	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Neptunium-237 Uranium-238	Nickel[1]	1	Chromium Neptunium-237 Uranium-238	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
2	Chromium PCB, Total Total PAH Uranium-238	None	2	Chromium PCB, Total Total PAH Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Neptunium-237 Uranium-238	Antimony[1] Nickel[1] Uranium[1]	1	Chromium Neptunium-237 Uranium-238	None
2	Chromium PCB, Total Total PAH Uranium-238	None	2	Chromium PCB, Total Total PAH Uranium-238	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	Nickel[1]	1	None	None
2	PCB, Total Total PAH	None	2	PCB, Total Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.10 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.11.

EU	ELCR		HI	
Future Industrial Worker				
1	Neptunium-237	1.15E-06	None	
	Cumulative	**1.15E-06**	**Cumulative**	**< 1**
2	PCB, Total	8.05E-06	None	
	Total PAH	1.15E-05		
	Uranium-238	1.30E-06		
	Cumulative	**2.08E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Uranium-238	1.31E-06	None	
	Cumulative	**1.31E-06**	**Cumulative**	**< 1**
2	PCB, Total	9.31E-06	None	
	Total PAH	1.40E-05		
	Uranium-238	1.88E-06		
	Cumulative	**2.52E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	**ELCR**		**HI**	
1	Arsenic	2.53E-05	Antimony	1.1
	Chromium	2.75E-06	Arsenic	0.2
	Uranium-238	1.31E-06	Beryllium	0.2
			Cadmium	0.6
			Cobalt	1.3
			Iron	0.1
			Nickel	0.1
			Thallium	5.0
	Cumulative	**2.94E-05**	**Cumulative**	**8.5**
2	Arsenic	2.27E-05	None	
	PCB, Total	9.31E-06		
	Total PAH	1.86E-04		
	Uranium-238	1.88E-06		
	Cumulative	**2.20E-04**	**Cumulative**	**< 1**
Excavation Worker				
EU	ELCR		HI	
1	None		Antimony	0.3
			Cadmium	0.2
			Cobalt	0.4
			Thallium	1.6
	Cumulative	**< 1.0E-6**	**Cumulative**	**2.5**
2	Total PAH	2.33E-06	None	
	Cumulative	**2.33E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	1.26E-06	None	
	Neptunium-237	5.76E-06		
	Uranium-238	4.45E-06		
	Cumulative	**1.15E-05**	**Cumulative**	**< 1**

Exhibit D.11. (Continued)

Hypothetical Resident					
EU	ELCR[1]		HI[2]		
2	Chromium	1.33E-06	None		
	PCB, Total	2.37E-05			
	Total PAH	3.50E-05			
	Uranium-238	6.39E-06			
	Cumulative	**6.64E-05**	**Cumulative**	**< 1**	
Teen Recreational User					
EU	ELCR		HI		
1	None		None		
	Cumulative	**< 1.0E-6**	**Cumulative**	**< 1**	
2	PCB, Total	5.05E-06	None		
	Total PAH	7.56E-06			
	Cumulative	**1.26E-05**	**Cumulative**	**< 1**	

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs for SWMU 196 include the following:

- *Outdoor Worker (exposed to surface and subsurface soil):* antimony, cobalt, and thallium (HI, EU 1) and Total PAH (ELCR, EU 2)

- *Excavation Worker:* thallium (HI, EU 1)

SWMU 489, C-710 North Septic Tank, North of C-710

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 489 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.12.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH	None	1	Chromium Total PAH	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH Uranium-238	None	1	Chromium Total PAH Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Total PAH Uranium-238	None	1	Arsenic Total PAH Uranium-238	None

Exhibit D.12. (Continued)

Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH Uranium-238	None	1	Chromium Total PAH Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH Uranium-238	None	1	Chromium Total PAH Uranium-238	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.12 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.13.

Future Industrial Worker				
EU	ELCR		HI	
1	Chromium	1.38E-06	None	
	Total PAH	1.39E-06		
	Cumulative	**2.77E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	1.02E-06	None	
	Total PAH	1.69E-06		
	Uranium-238	1.25E-06		
	Cumulative	**3.97E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	**ELCR**		**HI**	
1	Arsenic	2.41E-05	None	
	Total PAH	1.69E-06		
	Uranium-238	1.25E-06		
	Cumulative	**2.70E-05**	**Cumulative**	**< 1**

Exhibit D.13. (Continued)

Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	2.68E-06	None	
	Total PAH	4.23E-06		
	Uranium-238	4.25E-06		
	Cumulative	**1.12E-05**	**Cumulative**	**< 1**
Teen Recreational User				
EU	ELCR[1]		HI	
1	None		None	
	Cumulative	**< 1.0E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 489.

SWMU 531, C-746-A South Aluminum Slag Reacting Area

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 531 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.14.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Uranium-238	Arsenic[1] Iron[1] Nickel[1]	1	Arsenic Chromium Uranium-238	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Total PAH Uranium-238	Arsenic Iron Nickel[1]	1	Arsenic Chromium Total PAH Uranium-238	Arsenic Iron
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Total PAH Uranium-238	Arsenic Iron Nickel[1]	1	Arsenic Chromium Total PAH Uranium-238	Arsenic Iron
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	None	1	Arsenic	None

Exhibit D.14. (Continued)

Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Total PAH Uranium-235 Uranium-238	Arsenic[1] Iron[1] Nickel[1]	1	Arsenic Chromium Total PAH Uranium-235 Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Total PAH Uranium-235 Uranium-238	Antimony[1] Arsenic Iron Nickel Uranium Zinc	1	Arsenic Chromium Total PAH Uranium-235 Uranium-238	Arsenic Iron Nickel Uranium Zinc
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	Arsenic Iron Nickel	1	Arsenic	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.14 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.15.

Future Industrial Worker				
EU	ELCR		HI	
1	Arsenic	4.70E-05	None	
	Chromium	1.67E-06		
	Uranium-238	2.05E-06		
	Cumulative	**5.07E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Arsenic	1.13E-04	Arsenic	0.7
	Chromium	1.24E-06	Iron	0.3
	Total PAH	1.10E-06		
	Uranium-238	2.97E-06		
	Cumulative	**1.18E-04**	**Cumulative**	**1.0**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	**ELCR**		**HI**	
1	Arsenic	1.13E-04	Arsenic	0.7
	Chromium	1.31E-06	Iron	0.3
	Total PAH	1.10E-06		
	Uranium-238	2.97E-06		
	Cumulative	**1.18E-04**	**Cumulative**	**1.0**
Excavation Worker				
EU	**ELCR**		**HI**	
1	Arsenic	1.41E-06	None	
	Cumulative	**1.41E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Arsenic	1.99E-04	Arsenic	2.8
	Chromium	3.24E-06	Iron	1.0
	Total PAH	2.75E-06	Nickel	0.1
	Uranium-235	1.75E-06	Uranium	0.1
	Uranium-238	1.01E-05	Zinc	0.1
	Cumulative	**2.17E-04**	**Cumulative**	**4.2**
Teen Recreational User				
EU	ELCR[1]		HI	
1	Arsenic	2.64E-05	None	
	Cumulative	**< 2.64E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs for SWMU 531 are the following:

- *Outdoor Worker (exposed to surface soil):* arsenic (ELCR)
- *Outdoor Worker (exposed to surface and subsurface soil):* arsenic (ELCR)
- *Future Hypothetical Residential Receptor:* arsenic and iron (HI, child) and arsenic (ELCR)

D.7.4.2.2 Group 1, Storage Areas

SWMU 200, Central PGDP Soil Contamination South of TSCA Waste Storage Facility

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 200 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.16.

Initial COCs			Final COCs		
Future Industrial Worker					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 Chromium PCB, Total Uranium-238	Mercury[1] Nickel[1]	1	Cesium-137 Chromium PCB, Total Uranium-238	None
Outdoor Worker (exposed to surface soil)					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 Chromium PCB, Total Uranium-238	None	1	Cesium-137 Chromium PCB, Total Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium PCB, Total Uranium-238	Arsenic[1] Mercury[1] Nickel[1]	1	Arsenic Cesium-137 Chromium PCB, Total Uranium-238	None
Excavation Worker					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 Chromium PCB, Total Total PAH Uranium-235 Uranium-238	Mercury[1] Nickel[1]	1	Cesium-137 Chromium PCB, Total Total PAH Uranium-235 Uranium-238	None

Exhibit D. 16. (Continued)

Hypothetical Resident (child)[2] (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 Chromium PCB, Total Total PAH Uranium-235 Uranium-238	Antimony[1] Mercury[1] Nickel[1] Uranium[1]	1	Cesium-137 Chromium PCB, Total Total PAH Uranium-235 Uranium-238	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 PCB, Total	Mercury[1] Nickel[1]	1	Cesium-137 PCB, Total	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.16 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.17.

Future Industrial Worker				
EU	ELCR		HI	
1	Cesium-137	6.67E-06	None	
	Chromium	1.91E-06		
	PCB, Total	1.39E-05		
	Uranium-238	2.10E-06		
	Cumulative	**2.45E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Cesium-137	4.98E-06	None	
	Chromium	1.41E-06		
	PCB, Total	1.60E-05		
	Uranium-238	3.05E-06		
	Cumulative	**2.55E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	**ELCR**		**HI**	
1	Arsenic	2.35E-05	None	
	Cesium-137	4.06E-06		
	Chromium	1.52E-06		
	PCB, Total	1.60E-05		
	Uranium-238	2.38E-06		
	Cumulative	**4.74E-05**	**Cumulative**	**< 1**
Excavation Worker				
EU	**ELCR**		**HI**	
1	None		None	
	Cumulative	**< 1.0E-06**	**Cumulative**	**< 1**

Exhibit D.17. (Continued)

Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Cesium-137	3.36E-05		
	Chromium	3.70E-06		
	PCB, Total	4.07E-05		
	Total PAH	1.46E-06		
	Uranium-235	1.82E-06		
	Uranium-238	1.03E-05		
	Cumulative	**9.16E-05**	**Cumulative**	**< 1**
Teen Recreational User				
EU	ELCR		HI	
1	Cesium-137	1.40E-06	None	
	PCB, Total	8.70E-06		
	Cumulative	**1.01E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 200.

SWMU 212, C-745-A Radiological Contamination Area

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 212 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.18.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium Neptunium-237 Thorium-230 Uranium-238	None	1	Arsenic Cesium-137 Chromium Neptunium-237 Thorium-230 Uranium-238	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Neptunium-237 PCB, Total Plutonium-239/240 Thorium-230 Uranium-238	None	1	Arsenic Cesium-137 Neptunium-237 PCB, Total Plutonium-239/240 Thorium-230 Uranium-238	None

Exhibit D.18. (Continued)

Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Plutonium-239/240 Thorium-230 Uranium-238	Arsenic[1] Cobalt[1] Iron[1] Nickel[1]	1	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Plutonium-239/240 Thorium-230 Uranium-238	None

Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Thorium-230	None	1	Thorium-230	None

Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium Cobalt-60[3] Neptunium-237 PCB, Total Plutonium-239/240 Thorium-230 Uranium-235 Uranium-238	None	1	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Plutonium-239/240 Thorium-230 Uranium-235 Uranium-238	None

Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium Cobalt-60[3] Neptunium-237 PCB, Total Plutonium-239/240 Thorium-230 Uranium-235 Uranium-238	Arsenic Iron[1] Nickel Uranium[1]	1	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Plutonium-239/240 Thorium-230 Uranium-235 Uranium-238	Arsenic Iron

Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Neptunium-237 Thorium-230	None	1	Arsenic Cesium-137 Neptunium-237 Thorium-230	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[3] COC was removed after evaluation as described below.

Cobalt-60, though reported in SWMU 212 analyses, was reported with values below the laboratory's MDA. Cobalt-60, therefore, is not considered a COC.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.18 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.19.

Future Industrial Worker				
EU	ELCR		HI	
1	Arsenic	1.45E-05	None	
	Cesium-137	6.98E-06		
	Chromium	1.19E-06		
	Neptunium-237	1.48E-05		
	Thorium-230	1.89E-05		
	Uranium-238	1.86E-06		
	Cumulative	**5.81E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Arsenic	3.48E-05	None	
	Cesium-137	5.22E-06		
	Neptunium-237	1.22E-05		
	PCB, Total	1.11E-06		
	Plutonium-239/240	4.15E-06		
	Thorium-230	1.18E-04		
	Uranium-238	2.70E-06		
	Cumulative	**1.79E-04**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	**ELCR**		**HI**	
1	Arsenic	3.48E-05	None	
	Cesium-137	5.22E-06		
	Chromium	1.63E-06		
	Neptunium-237	1.22E-05		
	PCB, Total	1.11E-06		
	Plutonium-239/240	4.15E-06		
	Thorium-230	1.18E-04		
	Uranium-238	2.70E-06		
	Cumulative	**1.80E-04**	**Cumulative**	**< 1**
Excavation Worker				
EU	**ELCR**		**HI**	
1	Thorium-230	1.48E-06	None	
	Cumulative	**1.48E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	**ELCR**[1]		**HI**[2]	
1	Arsenic	6.12E-05	Arsenic	0.88
	Cesium-137	3.52E-05	Iron	0.76
	Chromium	2.30E-06		
	Neptunium-237	7.41E-05		
	PCB, Total	2.82E-06		
	Plutonium-239/240	2.41E-06		
	Thorium-230	7.27E-05		

Exhibit D.19. (Continued)

EU	ELCR		HI	
	Uranium-235	2.66E-06		
	Uranium-238	9.16E-06		
	Cumulative	**2.63E-04**	**Cumulative**	**1.64**
Teen Recreational User				
EU	ELCR		HI	
1	Arsenic	8.14E-06	None	
	Cesium-137	1.46E-06		
	Neptunium-237	3.08E-06		
	Thorium-230	2.21E-06		
	Cumulative	**1.49E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs for SWMU 212 are the following:

- *Outdoor Worker (exposed to surface soil):* thorium-230 (ELCR)
- *Outdoor Worker (exposed to surface and subsurface soil):* thorium-230 (ELCR)

SWMU 213, C-745-A OS-02

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 213 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.20.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH Uranium-238	None	1	Chromium Total PAH Uranium-238	None
2	Chromium		2	Chromium	
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH Uranium-238	None	1	Chromium Total PAH Uranium-238	None
2	Chromium		2	Chromium	
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Total PAH Uranium-238	None	1	Arsenic Chromium Total PAH Uranium-238	None
2	Chromium		2	Chromium	

Exhibit D.20. (Continued)

Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	None	None	2	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-238	None	1	Chromium PCB, Total Total PAH Uranium-238	None
2	Chromium	None	2	Chromium	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-238	Antimony[1] Nickel[1] Silver[1]	1	Chromium PCB, Total Total PAH Uranium-238	None
2	Chromium	Nickel[1] Silver[1]	2	Chromium	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None
2	None	None	2	None	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.20 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.21.

Future Industrial Worker				
EU	ELCR		HI	
1	Chromium	1.58E-06	None	
	Total PAH	2.90E-06		
	Uranium-238	1.37E-06		
	Cumulative	**5.86E-06**	**Cumulative**	**< 1**
2	Chromium	1.49E-06	None	
	Cumulative	**1.49E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	1.17E-06	None	
	Total PAH	3.54E-06		
	Uranium-238	1.99E-06		
	Cumulative	**6.70E-06**	**Cumulative**	**< 1**

Exhibit D.21. (Continued)

EU	ELCR		HI	
Outdoor Worker (exposed to surface soil) (Continued)				
2	Chromium	1.10E-06	None	
	Cumulative	**1.10E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.22E-05	None	
	Chromium	1.34E-06		
	Total PAH	3.54E-06		
	Uranium-238	1.99E-06		
	Cumulative	**2.91E-05**	**Cumulative**	**< 1**
2	Chromium	1.66E-06	None	
	Cumulative	**1.66E-06**	**Cumulative**	**< 1**
Excavation Worker				
EU	**ELCR**		**HI**	
1	None		None	
	Cumulative	**< 1.0E-06**	**Cumulative**	**< 1**
2	None		None	
	Cumulative	**< 1.0E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	3.07E-06	None	
	PCB, Total	1.14E-06		
	Total PAH	8.84E-06		
	Uranium-238	6.73E-06		
	Cumulative	**1.98E-05**	**Cumulative**	**< 1**
2	Chromium	2.88E-06	None	
	Cumulative	**2.88E-06**	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Total PAH	1.91E-06	None	
	Cumulative	**1.91E-06**	**Cumulative**	**< 1**
2	None		None	
	Cumulative	**< 1.0E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 213.

SWMU 214, C-611 OS-03

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 214 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.22.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	None	1	Arsenic	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.22 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.23.

Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.78E-05	None	
	Cumulative	**2.78E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 214.

SWMU 215, C-743 OS-04

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 215 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.24.

Initial COCs			Final COCs		
Future Industrial Worker					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH	None	1	Chromium Total PAH	None
Outdoor Worker (exposed to surface soil)					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH	None	1	Chromium Total PAH	None
Outdoor Worker (exposed to surface and subsurface soil)					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Total PAH	None	1	Arsenic Chromium Total PAH	None
Excavation Worker					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH	None	1	Chromium Total PAH	None
Hypothetical Resident (child)[2]					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH	Antimony[1] Iron[1] Nickel[1]	1	Chromium Total PAH	None
Teen Recreational User					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.24 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.25.

Future Industrial Worker				
EU	ELCR		HI	
1	Chromium	1.90E-06	None	
	Total PAH	1.37E-06		
	Cumulative	**3.27E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	1.41E-06	None	
	Total PAH	1.67E-06		
	Cumulative	**3.07E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.45E-05	None	
	Chromium	1.41E-06		
	Total PAH	1.03E-05		
	Cumulative	**3.62E-05**	**Cumulative**	**< 1**
Excavation Worker				
EU	**ELCR**		**HI**	
1	None		None	
	Cumulative	**< 1.0E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	3.69E-06	None	
	Total PAH	4.16E-06		
	Cumulative	**7.85E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 215.

SWMU 216, C-206 OS-05

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 216 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.26.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH Uranium-238	None	1	Total PAH Uranium-238	None

Exhibit D.26. (Continued)

Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Total PAH Uranium-238	None	1	Arsenic Chromium Total PAH Uranium-238	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH Uranium-238	None	1	Chromium Total PAH Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH Uranium-238	None	1	Chromium Total PAH Uranium-238	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.26 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.27.

Future Industrial Worker				
EU	ELCR		HI	
1	Total PAH	2.52E-06	None	
	Cumulative	**2.52E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Total PAH	3.08E-06	None	
	Uranium-238	1.13E-06		
	Cumulative	**4.21E-06**	**Cumulative**	**< 1**
1	Arsenic	2.07E-05	None	
	Cesium-137	3.56E-06		
	Total PAH	3.08E-06		
	Uranium-238	1.13E-06		

Exhibit D.27. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)				
EU	ELCR		HI	
	Cumulative	**2.85E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	1.53E-06	None	
	Total PAH	7.68E-06		
	Uranium-238	3.84E-06		
	Cumulative	**1.31E-05**	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Total PAH	1.66E-06	None	
	Cumulative	**1.66E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 216.

SWMU 217, C-740 OS-06

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 217 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.28.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	None	1	Chromium	None
2	Arsenic Chromium Total PAH	Cobalt[1] Iron[1] Mercury[1] Nickel[1] Silver[1]	2	Arsenic Chromium Total PAH	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	None	1	Chromium	None
2	Arsenic Chromium Total PAH	Arsenic[1] Cobalt[1] Iron[1] Mercury[1] Nickel[1] Silver[1]	2	Arsenic Chromium Total PAH	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium	Arsenic[1] Cobalt[1]	1	Arsenic Chromium	None

Exhibit D.28. (Continued)

EU	Initial Cancerous COCs	Initial Noncancerous COCs	EU	Final Cancerous COCs	Final Noncancerous COCs
Outdoor Worker (exposed to surface and subsurface soil) (Continued)					
		Mercury[1] Nickel[1] Silver[1]			
Outdoor Worker (exposed to surface and subsurface soil)					
2	Arsenic Chromium Total PAH	Antimony[1] Arsenic Cobalt Iron Mercury Nickel[1] Silver[1]	2	Arsenic Chromium Total PAH	Arsenic Cobalt Iron Mercury
Excavation Worker					
1	None	None	1	None	None
2	None	Cobalt[1] Mercury[1]	2	None	None
Hypothetical Resident (adult)[2]					
1	Chromium Uranium-238	None	1	Chromium Uranium-238	None
2	Arsenic Chromium Total PAH	Antimony[1] Arsenic[1] Cobalt[1] Iron[1] Mercury[1] Nickel[1] Silver[1]	2	Arsenic Chromium Total PAH	None
Hypothetical Resident (child)[2]					
1	Chromium Uranium-238	Cobalt Manganese Nickel[1] Silver[1]	1	Chromium Uranium-238	Cobalt Manganese
2	Arsenic Chromium Total PAH	Antimony[1] Arsenic Cobalt Iron Manganese Mercury Nickel[1] Silver[1]	2	Arsenic Chromium Total PAH	Arsenic Cobalt Iron Manganese Mercury

Exhibit D.28. (Continued)

Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	Arsenic Total PAH	Cobalt[1] Iron[1] Mercury[1] Nickel[1]	2	Arsenic Total PAH	None

Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
		Silver[1]			

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.28 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.29.

Future Industrial Worker				
EU	ELCR		HI	
1	Chromium	2.84E-06	None	
	Cumulative	**2.84E-06**	**Cumulative**	**< 1**
2	Arsenic	1.12E-05	None	
	Chromium	3.37E-06		
	Total PAH	8.53E-06		
	Cumulative	**2.31E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	2.10E-06	None	
	Cumulative	**2.10E-06**	**Cumulative**	**< 1**
2	Arsenic	2.69E-05	None	
	Chromium	2.49E-06		
	Total PAH	1.04E-05		
	Cumulative	**3.98E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.27E-05	None	
	Chromium	1.60E-06		
	Cumulative	**2.43E-05**	**Cumulative**	**< 1**
2	Arsenic	2.40E-05	Arsenic	0.15
	Chromium	1.62E-06	Cobalt	0.97
	Total PAH	8.37E-06	Iron	0.15
			Mercury	0.11
	Cumulative	**3.40E-05**	**Cumulative**	**1.38**

Exhibit D.29.

Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	5.51E-06	Cobalt	0.85
	Uranium-238	3.34E-06	Manganese	0.14
	Cumulative	**8.85E-06**	**Cumulative**	**0.99**
2	Arsenic	4.74E-05	Arsenic	0.68
	Chromium	6.53E-06	Cobalt	0.76
	Total PAH	2.60E-05	Iron	0.56
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
			Manganese	0.16
			Mercury	0.37
	Cumulative	**7.99E-05**	**Cumulative**	**2.53**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	None		None	
	Cumulative	**< 1.0E-06**	**Cumulative**	**< 1**
2	Arsenic	6.30E-06	None	
	Total PAH	5.62E-06		
	Cumulative	**1.19E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 217.

SWMU 221, C-635 OS-10

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 221 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.30.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-238	None	1	Chromium PCB, Total Total PAH Uranium-238	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH	None	1	Chromium PCB, Total Total PAH	None

Exhibit D.30. (Continued)

Outdoor Worker (exposed to surface soil) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Uranium-238			Uranium-238	
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Total PAH Uranium-238	Aluminum[1] Arsenic Barium[1] Cobalt Iron Manganese	1	Arsenic Chromium PCB, Total Total PAH Uranium-238	Arsenic Cobalt Iron Manganese Mercury
Outdoor Worker (exposed to surface and subsurface soil) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
		Mercury Nickel[1]			
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	Cobalt Mercury	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-238	None	1	Chromium PCB, Total Total PAH Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-238	Barium[1] Iron[1] Nickel[1] Uranium[1]	1	Chromium PCB, Total Total PAH Uranium-238	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH	None	1	PCB, Total Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.30 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.31.

Future Industrial Worker				
EU	ELCR		HI	
1	Chromium	2.32E-06	None	
	PCB, Total	2.66E-06		
	Total PAH	1.73E-05		
	Uranium-238	1.13E-06		
	Cumulative	**2.34E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	1.72E-06	None	
	PCB, Total	3.08E-06		
	Total PAH	2.11E-05		
	Uranium-238	1.65E-06		
	Cumulative	**2.75E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.98E-05	Arsenic	0.19
	Chromium	1.61E-06	Cobalt	0.85
	PCB, Total	3.08E-06	Iron	0.19
	Total PAH	2.11E-05	Manganese	0.18
	Uranium-238	1.65E-06	Mercury	0.14
	Cumulative	**5.72E-05**	**Cumulative**	**1.55**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	4.51E-06	None	
	PCB, Total	7.83E-06		
	Total PAH	5.26E-05		
	Uranium-238	5.58E-06		
	Cumulative	**7.05E-05**	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	PCB, Total	1.67E-06	None	
	Total PAH	1.14E-05		
	Cumulative	**1.30E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 221.

SWMU 222, C-410 OS-11

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 222 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.32.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-235 Uranium-238	None	1	Chromium PCB, Total Total PAH Uranium-235 Uranium-238	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None	1	Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None	1	Arsenic Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None	1	Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Nickel[1] Uranium[1]	1	Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None

Exhibit D.32. (Continued)

Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH Uranium-238	None	1	PCB, Total Total PAH Uranium-238	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.32 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.33.

EU	ELCR		HI	
Future Industrial Worker				
1	Chromium	1.57E-06	None	
	PCB, Total	7.46E-06		
	Total PAH	2.99E-06		
	Uranium-235	1.80E-06		
	Uranium-238	1.15E-05		
	Cumulative	**2.53E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	1.16E-06	None	
	PCB, Total	8.63E-06		
	Total PAH	3.65E-06		
	Uranium-234	3.67E-06		
	Uranium-235	1.56E-06		
	Uranium-238	1.67E-05		
	Cumulative	**3.54E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.45E-05	None	
	Cesium-137	2.59E-06		
	Chromium	1.59E-06		
	PCB, Total	5.96E-06		
	Total PAH	3.65E-06		
	Uranium-234	2.49E-06		
	Uranium-235	1.56E-06		
	Uranium-238	1.31E-05		
	Cumulative	**5.55E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	3.04E-06	None	
	PCB, Total	2.19E-05		
	Total PAH	9.11E-06		
	Uranium-234	2.16E-06		
	Uranium-235	9.02E-06		
	Uranium-238	5.66E-05		
	Cumulative	**1.02E-04**	**Cumulative**	**< 1**

Exhibit D.33. (Continued)

Hypothetical Resident			
EU	ELCR[1]		HI[2]
Teen Recreational User			
EU	**ELCR**		**HI**
1	PCB, Total	4.68E-06	None
	Total PAH	1.97E-06	
	Uranium-238	2.29E-06	
	Cumulative	**8.94E-06**	**Cumulative** **< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 222.

SWMU 227, C-746-B OS-16

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 227 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.34.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 Chromium Neptunium-237 PCB, Total Total PAH Uranium-235 Uranium-238	None	1	Cesium-137 Chromium Neptunium-237 PCB, Total Total PAH Uranium-235 Uranium-238	None
2	Chromium PCB, Total Total PAH	Mercury[1] Nickel[1]	2	Chromium PCB, Total Total PAH	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None	1	Cesium-137 Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
2	Chromium PCB, Total Total PAH Uranium-238	Cobalt[1] Mercury[1] Nickel[1]	2	Chromium PCB, Total Total PAH Uranium-238	None

Exhibit D.34. (Continued)

Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	None	1	Arsenic	None
	Cesium-137			Cesium-137	
	Chromium			Chromium	
	Neptunium-237			Neptunium-237	
	PCB, Total			PCB, Total	
	Total PAH			Total PAH	
	Uranium-234			Uranium-234	
	Uranium-235			Uranium-235	
	Uranium-238			Uranium-238	
2	Arsenic	Arsenic[1]	2	Arsenic	None
	Chromium	Cobalt[1]		Chromium	
	PCB, Total	Mercury[1]		PCB, Total	
	Total PAH	Nickel[1]		Total PAH	
	Uranium-238			Uranium-238	

Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	None	None	1	None	None

Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	Nickel[1]	1	Cesium-137	None
	Chromium	Uranium[1]		Chromium	
	Cobalt-60[3]			Neptunium-237	
	Neptunium-237			PCB, Total	
	PCB, Total			Total PAH	
	Total PAH			Uranium-234	
	Uranium-234			Uranium-235	
	Uranium-235			Uranium-238	
	Uranium-238				
2	Chromium	Cobalt[1]	2	Chromium	None
	Cobalt-60[3]	Mercury[1]		PCB, Total	
	PCB, Total	Nickel[1]		Total PAH	
	Total PAH			Uranium-238	
	Uranium-238				

Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	Nickel[1]	1	Cesium-137	None
	Chromium	Uranium[1]		Chromium	
	Cobalt-60[3]			Neptunium-237	
	Neptunium-237			PCB, Total	
	PCB, Total			Total PAH	
	Total PAH			Uranium-234	
	Uranium-234			Uranium-235	
	Uranium-235			Uranium-238	
	Uranium-238				

Exhibit D.34. (Continued)

Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
2	Chromium Cobalt-60[3] PCB, Total Total PAH Uranium-238	Cobalt[1] Mercury[1] Nickel[1] Uranium[1]	2	Chromium PCB, Total Total PAH Uranium-238	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH Uranium-238	None	1	PCB, Total Total PAH Uranium-238	None
2	PCB, Total Total PAH	Cobalt[1] Mercury[1] Nickel[1]	2	PCB, Total Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[3] COC was removed after evaluation as described below.

Cobalt-60, though reported in SWMU 227 analyses, was reported with values below the laboratory's MDA. Cobalt-60, therefore, is not considered a COC.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.34 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.35.

Future Industrial Worker				
EU	ELCR		HI	
1	Cesium-137	2.21E-06	None	
	Chromium	1.56E-06		
	Neptunium-237	3.34E-06		
	PCB, Total	2.21E-05		
	Total PAH	5.71E-06		
	Uranium-235	3.77E-06		
	Uranium-238	2.72E-05		
	Cumulative	**6.59E-05**	**Cumulative**	**< 1**
2	Chromium	1.87E-06	None	
	PCB, Total	3.10E-05		
	Total PAH	1.95E-06		
	Cumulative	**3.48E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Cesium-137	1.65E-06	None	
	Chromium	1.16E-06		
	Neptunium-237	2.76E-06		
	PCB, Total	2.55E-05		
	Total PAH	6.96E-06		

Exhibit D.35. (Continued)

EU	ELCR		HI	
Outdoor Worker (exposed to surface soil) (Continued)				
	Uranium-234	5.46E-06		
	Uranium-235	3.28E-06		
	Uranium-238	3.95E-05		
	Cumulative	**8.63E-05**	**Cumulative**	**< 1**
2	Chromium	1.38E-06	None	
	PCB, Total	3.59E-05		
	Total PAH	2.38E-06		
	Uranium	1.34E-06		
	Cumulative	**4.10E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.04E-05	None	
	Cesium-137	1.45E-06		
	Chromium	1.31E-06		
	Neptunium-237	2.43E-06		
	PCB, Total	2.43E-05		
	Total PAH	6.96E-06		
	Uranium-234	4.94E-06		
	Uranium-235	2.96E-06		
	Uranium-238	3.56E-05		
	Cumulative	**1.00E-04**	**Cumulative**	**< 1**
2	Arsenic	2.01E-05	None	
	Chromium	1.11E-06		
	PCB, Total	2.93E-05		
	Total PAH	2.38E-06		
	Uranium-238	1.34E-06		
	Cumulative	**5.42E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Cesium-137	1.11E-05	None	
	Chromium	3.03E-06		
	Neptunium-237	1.68E-05		
	PCB, Total	6.49E-05		
	Total PAH	1.74E-05		
	Uranium-234	3.20E-06		
	Uranium-235	1.89E-05		
	Uranium-238	1.34E-04		
	Cumulative	**2.69E-04**	**Cumulative**	**< 1**
2	Chromium	3.62E-06		
	PCB, Total	9.12E-05		
	Total PAH	5.95E-06		
	Uranium-238	4.55E-06		
	Cumulative	**1.05E-04**	**Cumulative**	**< 1**

Exhibit D.35. (Continued)

Hypothetical Resident				
EU	ELCR[1]		HI[2]	
Teen Recreational User				
EU	**ELCR**		**HI**	
1	PCB, Total	1.39E-05	None	
	Total PAH	3.76E-06		
	Uranium-238	5.41E-06		
	Cumulative	**2.30E-05**	**Cumulative**	**< 1**
2	PCB, Total	1.95E-05	None	
	Total PAH	1.29E-06		
	Cumulative	**2.08E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Only one priority COC is found in SWMU 227. It is in EU 1 for the future hypothetical resident:

- *Future Hypothetical Residential Receptor:* uranium-238 (ELCR)

SWMU 228, C-747-B OS-17

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 228 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.36.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Neptunium-237 Total PAH Uranium-238	Mercury[1] Nickel[1] Silver[1]	1	Chromium Neptunium-237 Total PAH Uranium-238	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Neptunium-237 Total PAH Uranium-238	Mercury[1] Nickel[1]	1	Chromium Neptunium-237 Total PAH Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Neptunium-237 Total PAH Uranium-238	Arsenic[1] Iron[1] Mercury[1] Nickel[1]	1	Arsenic Chromium Neptunium-237 Total PAH Uranium-238	None

Exhibit D.36. (Continued)

Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Neptunium-237 Total PAH Uranium-235 Uranium-238	Mercury [1] Nickel[1] Silver[1]	1	Chromium Neptunium-237 Total PAH Uranium-235 Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Neptunium-237 Total PAH Uranium-235 Uranium-238	Antimony [1] Mercury[1] Nickel[1] Silver[1] Uranium[1]	1	Chromium Neptunium-237 Total PAH Uranium-235 Uranium-238	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	Mercury[1] Nickel[1] Silver[1]	1	Chromium	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.36 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.37.

Future Industrial Worker				
EU	ELCR		HI	
1	Chromium	6.26E-06	None	
	Neptunium-237	2.95E-06		
	Total PAH	1.13E-06		
	Uranium-238	2.22E-06		
	Cumulative	**1.26E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	4.63E-06	None	
	Neptunium-237	2.44E-06		
	Total PAH	1.38E-06		
	Uranium-238	3.22E-06		
	Cumulative	**1.17E-05**	**Cumulative**	**< 1**

Exhibit D.37. (Continued)

Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	6.72E-05	None	
	Chromium	4.63E-06		
	Neptunium-237	2.44E-06		
	Total PAH	1.38E-06		
	Uranium-238	3.22E-06		
	Cumulative	**7.89E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	1.21E-05	None	
	Neptunium-237	1.48E-05		
	Total PAH	3.44E-06		
	Uranium-235	2.26E-06		
	Uranium-238	1.09E-05		
	Cumulative	**4.36E-05**	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Chromium	1.14E-06	None	
	Cumulative	**1.14E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 228.

D.7.4.2.3 Group 2, Underground Tanks

SWMU 27, C-722 Acid Neutralization Tank

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 27 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

No surface samples are available for SWMU 27; therefore, only the outdoor worker (exposed to surface and subsurface soil) and excavation worker have been evaluated for this area.

Exhibit D.38.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	n/a	n/a	1	n/a	n/a
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	n/a	n/a	1	n/a	n/a

Exhibit D.38. (Continued)

Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	n/a	n/a	1	n/a	n/a
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	n/a	n/a	1	n/a	n/a
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	n/a	n/a	1	n/a	n/a

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

No COCs are identified for SWMU 27.

SWMU 76, C-632-B Sulfuric Acid Storage Tank

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 76 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.39.

Initial COCs			Final COCs		
Future Industrial Worker					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH	None	1	PCB, Total Total PAH	None
Outdoor Worker (exposed to surface soil)					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH Uranium-238	None	1	PCB, Total Total PAH Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic PCB, Total Total PAH Uranium-238	None	1	Arsenic PCB, Total Total PAH Uranium-238	None
Excavation Worker					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH Uranium-238	None	1	PCB, Total Total PAH Uranium-238	None
Hypothetical Resident (child)[2]					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH Uranium-238	None	1	PCB, Total Total PAH Uranium-238	None
Teen Recreational User					
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.39 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.40.

Future Industrial Worker				
EU	ELCR		HI	
1	PCB, Total	1.39E-06	None	
	Total PAH	2.97E-05		
	Cumulative	**3.11E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	PCB, Total	1.60E-06	None	
	Total PAH	3.62E-05		
	Uranium-238	1.24E-06		
	Cumulative	**3.91E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	3.16E-05	None	
	PCB, Total	1.60E-06		
	Total PAH	3.62E-05		
	Uranium-238	1.24E-06		
	Cumulative	**7.07E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	PCB, Total	4.07E-06	None	
	Total PAH	9.04E-05		
	Uranium-238	4.19E-06		
	Cumulative	**9.87E-05**	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Total PAH	1.96E-05	None	
	Cumulative	**1.96E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 76.

SWMU 165, C-616-L Pipeline and Vault Soil Contamination

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 165 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.41.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	Arsenic[1]	1	Arsenic	None
	Cesium-137	Silver[1]		Cesium-137	
	Chromium	Uranium[1]		Chromium	
	Neptunium-237			Neptunium-237	
	PCB, Total			PCB, Total	
	Total PAH			Total PAH	

Exhibit D.41. (Continued)

Future Industrial Worker (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Uranium-234 Uranium-235 Uranium-238			Uranium-234 Uranium-235 Uranium-238	
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Neptunium-237 PCB, Total Plutonium-239/240 Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Silver[1] Uranium	1	Arsenic Cesium-137 Neptunium-237 PCB, Total Plutonium-239/240 Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Uranium
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Neptunium-237 PCB, Total Pentachlorophenol Plutonium-239/240 Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Cobalt[1] Silver[1] Uranium	1	Arsenic Cesium-137 Neptunium-237 PCB, Total Pentachlorophenol Plutonium-239/240 Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Uranium
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	None	1	Arsenic	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium Naphthalene Neptunium-237 PCB, Total Plutonium-239/240 Thorium-230 Total PAH Uranium-234 Uranium-235	Antimony[1] Arsenic[1] Barium[1] Nickel[1] Silver[1] Uranium[1]	1	Arsenic Cesium-137 Chromium Naphthalene Neptunium-237 PCB, Total Plutonium-239/240 Thorium-230 Total PAH Uranium-234 Uranium-235	None

Exhibit D.41. (Continued)

Hypothetical Resident (adult)[2] (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Uranium-238			Uranium-238	
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	Antimony[1]	1	Arsenic	Arsenic
	Cesium-137	Arsenic		Cesium-137	Uranium
	Chromium	Barium[1]		Chromium	
	Naphthalene	Mercury[1]		Naphthalene	
	Neptunium-237	Nickel[1]		Neptunium-237	
	PCB, Total	Silver[1]		PCB, Total	
	Plutonium-239/240	Uranium		Plutonium-239/240	
	Thorium-230			Thorium-230	
	Total PAH			Total PAH	
	Uranium-234			Uranium-234	
	Uranium-235			Uranium-235	
	Uranium-238			Uranium-238	
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	Antimony[1]	1	Arsenic	None
	Cesium-137	Arsenic[1]		Cesium-137	
	PCB, Total	Barium[1]		PCB, Total	
	Total PAH	Nickel[1]		Total PAH	
	Uranium-235	Silver[1]		Uranium-235	
	Uranium-238	Uranium[1]		Uranium-238	

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.41 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.42.

Future Industrial Worker				
EU	ELCR		HI	
1	Arsenic	6.37E-05	None	
	Cesium-137	4.03E-05		
	Chromium	1.24E-06		
	Neptunium-237	1.57E-06		
	PCB, Total	4.41E-05		
	Total PAH	3.16E-05		
	Uranium-234	3.04E-06		
	Uranium-235	5.18E-06		
	Uranium-238	3.77E-05		
	Cumulative	**2.28E-04**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Arsenic	1.53E-04	Arsenic	0.96

Exhibit D.42. (Continued)

EU	ELCR		HI	
Outdoor Worker (exposed to surface soil) (Continued)				
EU	ELCR		HI	
	Cesium-137	3.01E-05	Uranium	0.12
	Neptunium-237	1.30E-06		
	PCB, Total	5.10E-05		
	Plutonium-239/240	1.73E-06		
	Thorium-230	2.74E-06		
	Total PAH	3.85E-05		
	Uranium-234	2.03E-05		
	Uranium-235	4.50E-06		
	Uranium-238	5.47E-05		
	Cumulative	**3.58E-04**	**Cumulative**	**1.08**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	1.54E-04	Arsenic	0.96
	Cesium-137	3.01E-05	Uranium	0.12
	Neptunium-237	1.30E-06		
	PCB, Total	6.10E-05		
	Pentachlorophenol	1.94E-06		
	Plutonium-239/240	1.73E-06		
	Thorium-230	2.74E-06		
	Total PAH	3.85E-05		
	Uranium-234	2.04E-05		
	Uranium-235	4.53E-06		
	Uranium-238	5.47E-05		
	Cumulative	**3.70E-04**	**Cumulative**	**1.08**
Excavation Worker				
EU	**ELCR**		**HI**	
1	Arsenic	1.92E-06	None	
	Cumulative	**1.92E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Arsenic	2.70E-04	Arsenic	3.86
	Cesium-137	2.03E-04	Uranium	0.46
	Chromium	2.40E-06		
	Naphthalene	1.41E-06		
	Neptunium-237	7.89E-06		
	PCB, Total	1.30E-04		
	Plutonium-239/240	1.01E-06		
	Thorium-230	1.68E-06		
	Total PAH	9.61E-05		
	Uranium-234	1.19E-05		
	Uranium-235	2.60E-05		
	Uranium-238	1.85E-04		
	Cumulative	**9.36E-04**	**Cumulative**	**4.32**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Arsenic	3.58E-05	None	
	Cesium-137	8.46E-06		
	PCB, Total	2.77E-05		
	Total PAH	2.08E-05		

Exhibit D.42. (Continued)

Teen Recreational User (Continued)					
EU		**ELCR**		**HI**	
	Uranium-235	1.08E-06			
	Uranium-238	7.49E-06			
	Cumulative	**1.01E-04**	**Cumulative**		**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs include the following:

- *Outdoor Worker (exposed to surface soil):* arsenic (ELCR)
- *Outdoor Worker (exposed to surface and subsurface soil):* arsenic (ELCR)
- *Future Hypothetical Residential Receptor:* arsenic (HI, child) and arsenic; cesium-137; Total PCBs; and uranium-238 (ELCR)
- *Teen Recreational User:* Total PCBs (ELCR)

SWMU 170, C-729 Acetylene Building Drain Pits

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 170 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.43.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Uranium-238	None	1	Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 Uranium-238	None	1	Cesium-137 Uranium-238	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None

Exhibit D.43. (Continued)

Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Neptunium-237 Uranium-238	None	1	Neptunium-237 Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Neptunium-237 Uranium-238	None	1	Neptunium-237 Uranium-238	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.43 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.44.

Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Uranium-238	1.30E-06	None	
	Cumulative	**1.30E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Cesium-137	2.91E-06	None	
	Uranium-238	2.17E-06		
	Cumulative	**5.08E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Neptunium-237	2.13E-06	None	
	Uranium-238	4.42E-06		
	Cumulative	**6.55E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 170.

D.7.4.2.4 Group 2, Chromium Areas

SWMU 158, C-720 Chilled Water System Leak Site

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 158 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.45.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Total PAH Uranium-238	Cobalt[1] Mercury[1] Nickel[1]	1	Arsenic Chromium Total PAH Uranium-238	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Total PAH Uranium-238	Arsenic[1] Cobalt[1] Mercury[1] Nickel[1]	1	Arsenic Chromium Total PAH Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Total PAH Uranium-238	Arsenic[1] Cobalt[1] Mercury[1]	1	Arsenic Chromium Total PAH Uranium-238	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Total PAH Uranium-235 Uranium-238	Arsenic[1] Cobalt[1] Mercury[1] Nickel[1]	1	Arsenic Chromium Total PAH Uranium-235 Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Total PAH Uranium-235 Uranium-238	Arsenic Barium[1] Cobalt Manganese Mercury Nickel[1] Uranium[1]	1	Arsenic Chromium Total PAH Uranium-235 Uranium-238	Arsenic Cobalt Manganese Mercury
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Total PAH	Cobalt[1] Mercury[1] Nickel[1]	1	Arsenic Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.45 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.46.

EU	ELCR		HI	
Future Industrial Worker				
1	Arsenic	1.01E-05	None	
	Chromium	2.01E-06		
	Total PAH	6.23E-06		
	Uranium-238	2.23E-06		
	Cumulative	**2.06E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Arsenic	2.44E-05	None	
	Chromium	1.49E-06		
	Total PAH	7.61E-06		
	Uranium-238	3.23E-06		
	Cumulative	**3.67E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.29E-05	None	
	Chromium	1.25E-06		
	Total PAH	9.86E-06		
	Uranium-238	2.69E-06		
	Cumulative	**3.67E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Arsenic	4.30E-05	Arsenic	0.62
	Chromium	3.91E-06	Cobalt	0.70
	Total PAH	1.90E-05	Manganese	0.19
	Uranium-235	2.07E-06	Mercury	0.45
	Uranium-238	1.10E-05		
	Cumulative	**7.89E-05**	**Cumulative**	**1.96**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Arsenic	5.71E-06	None	
	Total PAH	4.10E-06		
	Cumulative	**9.81E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 158.

SWMU 169, C-410-E HF Vent Surge Protection Tank

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 169 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.47.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Total PAH Uranium-235 Uranium-238	Arsenic[1] Iron[1] Mercury[1] Nickel[1]	1	Arsenic Chromium PCB, Total Total PAH Uranium-235 Uranium-238	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic[1] Iron[1] Mercury[1] Nickel[1]	1	Arsenic Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Aluminum[1] Arsenic Cobalt Iron Mercury[1] Nickel	1	Arsenic Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Cobalt Iron Nickel
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	Cobalt[1] Mercury[1] Nickel[1]	1	Total PAH	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic[1] Iron[1] Mercury[1] Nickel[1]	1	Arsenic Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total	Aluminum Antimony[1] Arsenic	1	Arsenic Chromium PCB, Total	Aluminum Arsenic Copper

Exhibit D.47. (Continued)

Hypothetical Resident (child)[2] (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Total PAH	Chromium[1]		Total PAH	Iron
	Uranium-234	Copper		Uranium-234	Mercury
	Uranium-235	Iron		Uranium-235	Nickel
	Uranium-238	Mercury		Uranium-238	
		Nickel			
		Thallium[1]			
		Uranium[1]			
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	Arsenic[1]	1	Arsenic	None
	Chromium	Iron[1]		Chromium	
	PCB, Total	Mercury[1]		PCB, Total	
	Total PAH	Nickel[1]		Total PAH	

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.47 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.48.

Future Industrial Worker				
EU	ELCR		HI	
1	Arsenic	2.04E-05	None	
	Chromium	7.12E-06		
	PCB, Total	5.33E-05		
	Total PAH	7.74E-05		
	Uranium-235	1.16E-06		
	Uranium-238	4.78E-06		
	Cumulative	**1.64E-04**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Arsenic	4.89E-05	None	
	Chromium	5.27E-06		
	PCB, Total	6.17E-05		
	Total PAH	9.45E-05		
	Uranium-234	2.31E-06		
	Uranium-235	1.01E-06		
	Uranium-238	6.92E-06		
	Cumulative	**2.21E-04**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	4.89E-05	Arsenic	0.31
	Chromium	5.27E-06	Cobalt	0.91
	PCB, Total	6.17E-05	Iron	0.21
	Total PAH	9.45E-05	Nickel	0.15
	Uranium-234	2.31E-06		
	Uranium-235	1.01E-06		

Exhibit D.48. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)				
EU	ELCR		HI	
	Uranium-238	6.92E-06		
	Cumulative	**2.21E-04**	**Cumulative**	**1.57**
Excavation Worker				
EU	**ELCR**		**HI**	
1	Total PAH	1.18E-06	None	
	Cumulative	**1.18E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Arsenic	8.62E-05	Aluminum	0.20
	Chromium	1.38E-05	Arsenic	1.24
	PCB, Total	1.57E-04	Copper	0.12
	Total PAH	2.36E-04	Iron	0.76
	Uranium-234	1.36E-06	Mercury	0.34
	Uranium-235	5.84E-06	Nickel	0.38
	Uranium-238	2.35E-05	Uranium	0.22
	Cumulative	**5.23E-04**	**Cumulative**	**3.24**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Arsenic	1.15E-05	None	
	Chromium	1.30E-06		
	PCB, Total	3.34E-05		
	Total PAH	5.10E-05		
	Cumulative	**9.72E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs found in SWMU 169 are for the future hypothetical resident:

- *Future Hypothetical Residential Receptor:* arsenic (HI, child), Total PCBs and Total PAH (ELCR)

D.7.4.2.5 Group 2, Soil/Rubble Areas

SWMU 19, C-410-B Hydrogen Fluoride Neutralization Lagoon

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 19 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.49.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic[1] Cobalt[1] Copper[1] Nickel[1] Uranium[1]	1	Arsenic PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.49 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.50.

Future Industrial Worker				
EU	ELCR		HI	
1	Total PAH	8.83E-05	None	
	Cumulative	**8.83E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Total PAH	1.08E-04	None	
	Cumulative	**1.08E-04**	**Cumulative**	**< 1**

Exhibit D.50. (Continued)

Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.43E-05	None	
	Total PAH	1.08E-04		
	Uranium-234	9.79E-06		
	Uranium-235	2.86E-06		
	Uranium-238	2.61E-05		
	Cumulative	**1.71E-04**	**Cumulative**	**< 1**
Excavation Worker				
EU	**ELCR**		**HI**	
1	Total PAH	1.35E-06	None	
	Cumulative	**1.35E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Total PAH	2.69E-04	None	
	Cumulative	2.69E-04	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Total PAH	5.81E-05	None	
	Cumulative	**5.81E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Only one priority COC is found in SWMU 19. It is Total PAH for both the outdoor worker exposed to surface soil and the outdoor worker exposed to surface and subsurface soil:

- *Outdoor Worker (exposed to surface soil):* Total PAH (ELCR)`
- *Outdoor Worker (exposed to surface and subsurface soil):* Total PAH (ELCR)
- *Future Hypothetical Residential Receptor:* Total PAH (ELCR)

SWMU 138, C-100 Southside Berm

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 138 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

SWMU 138 has two EUs; however, a definitive location for some sampling was unable to be determined. Therefore, the two EUs were evaluated for risk separately, but the COCs are listed together. The maximum calculated risk/HI is retained in the evaluation of the whole SWMU.

Exhibit D.51.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1,2	Arsenic Chromium PCB, Total	Antimony[1] Mercury[1] Nickel[1]	1,2	Arsenic Chromium PCB, Total	None
	Total PAH			Total PAH	

Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1,2	Arsenic Chromium PCB, Total Total PAH	Antimony[1] Arsenic[1] Mercury[1] Nickel[1]	1,2	Arsenic Chromium PCB, Total Total PAH	None

Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1,2	Arsenic Chromium PCB, Total Total PAH	Antimony[1] Arsenic[1] Cobalt[1] Iron[1] Mercury[1] Nickel[1] Silver[1]	1,2	Arsenic Chromium PCB, Total Total PAH	None

Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1,2	None	None	1,2	None	None

Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1,2	Arsenic Chromium PCB, Total Total PAH	Antimony[1] Arsenic[1] Mercury[1] Nickel[1] Silver[1]	1,2	Arsenic Chromium PCB, Total Total PAH	None

Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1,2	Arsenic Chromium PCB, Total Total PAH	Antimony Arsenic Cadmium Mercury Nickel[1] Silver[1]	1,2	Arsenic Chromium PCB, Total Total PAH	Antimony Arsenic Cadmium Mercury

Exhibit D.51. (Continued)

Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1,2	Arsenic PCB, Total Total PAH	Antimony[1] Mercury[1] Nickel[1] Silver[1]	1,2	Arsenic PCB, Total Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.51 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.52.

Future Industrial Worker				
EU	ELCR		HI	
1,2	Arsenic	1.07E-05	None	
	Chromium	1.78E-06		
	PCB, Total	2.66E-06		
	Total PAH	1.65E-06		
	Cumulative	**1.68E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1,2	Arsenic	2.56E-05	None	
	Chromium	1.32E-06		
	PCB, Total	3.08E-06		
	Total PAH	2.01E-06		
	Cumulative	**3.20E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1,2	Arsenic	2.60E-05	None	
	Chromium	1.54E-06		
	PCB, Total	3.08E-06		
	Total PAH	2.01E-06		
	Cumulative	**3.26E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1,2	Arsenic	4.51E-05	Antimony	0.17
	Chromium	3.46E-06	Arsenic	0.65
	PCB, Total	7.83E-06	Cadmium	0.11
	Total PAH	5.01E-06	Mercury	0.55
	Cumulative	**6.13E-05**	**Cumulative**	**1.48**
Teen Recreational User				
EU	**ELCR**		**HI**	
1,2	Arsenic	5.99E-06	None	
	PCB, Total	1.67E-06		
	Total PAH	1.08E-06		
	Cumulative	**8.74E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 138.

SWMU 180, WKWMA Outdoor Firing Range (WKWMA)

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 180 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.53.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium	Arsenic[1] Mercury[1] Nickel[1]	1	Arsenic Chromium	None
2	Arsenic Chromium Total PAH	None	2	Arsenic Chromium Total PAH	None
3	Arsenic Chromium	None	3	Arsenic Chromium	None
4	Arsenic Chromium	None	4	Arsenic Chromium	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium	Arsenic Mercury[1] Nickel[1]	1	Arsenic Chromium	Arsenic
2	Arsenic Chromium Total PAH	None	2	Arsenic Chromium Total PAH	None
3	Arsenic Chromium	None	3	Arsenic Chromium	None
4	Arsenic Chromium	None	4	Arsenic Chromium	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium	Arsenic Cobalt Mercury[1] Nickel[1]	1	Arsenic Chromium	Arsenic Cobalt
2	Arsenic Chromium Total PAH	Arsenic[1] Mercury[1] Nickel[1]	2	Arsenic Chromium Total PAH	None
3	Arsenic Chromium	None	3	Arsenic Chromium	None
4	Arsenic Chromium	Arsenic[1] Cobalt[1] Iron[1] Mercury[1] Nickel[1]	4	Arsenic Chromium	None

Exhibit D.53. (Continued)

Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	None	1	Arsenic	None
2	None	None	2	None	None
3	None	None	3	None	None
4	None	None	4	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium	Arsenic[1] Mercury[1] Nickel[1]	1	Arsenic Chromium	None
2	Arsenic Chromium Total PAH	None	2	Arsenic Chromium Total PAH	None
3	Arsenic Chromium	None	3	Arsenic Chromium	None
4	Arsenic Chromium Total PAH	None	4	Arsenic Chromium Total PAH	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium	Antimony[1] Arsenic Mercury Nickel[1]	1	Arsenic Chromium	Arsenic Mercury
2	Arsenic Chromium Total PAH	Arsenic[1] Nickel[1]	2	Arsenic Chromium Total PAH	None
3	Arsenic Chromium	Arsenic[1] Nickel[1] Silver[1]	3	Arsenic Chromium	None
4	Arsenic Chromium Total PAH	Arsenic Barium[1] Beryllium[1] Iron Manganese Nickel[1] Silver[1] Vanadium	4	Arsenic Chromium Total PAH	Arsenic Iron Manganese Vanadium

Exhibit D.53. (Continued)

Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	Arsenic[1] Mercury[1] Nickel[1]	1	Arsenic	None
2	Arsenic Total PAH	None	2	Arsenic Total PAH	None
3	Arsenic	None	3	Arsenic	None
4	Arsenic	None	4	Arsenic	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.53 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.54.

Future Industrial Worker				
EU	ELCR		HI	
1	Arsenic	7.50E-05	None	
	Chromium	1.84E-06		
	Cumulative	**7.69E-05**	**Cumulative**	**< 1**
2	Arsenic	1.27E-05	None	
	Chromium	1.48E-06		
	Total PAH	1.55E-06		
	Cumulative	**1.57E-05**	**Cumulative**	**< 1**
3	Arsenic	1.34E-05	None	
	Chromium	1.56E-06		
	Cumulative	**1.49E-05**	**Cumulative**	**< 1**
4	Arsenic	1.16E-05	None	
	Chromium	1.99E-06		
	Cumulative	**1.36E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Arsenic	1.80E-04	Arsenic	1.13
	Chromium	1.36E-06		
	Cumulative	**1.82E-04**	**Cumulative**	**1.13**
2	Arsenic	3.05E-05	None	
	Chromium	1.09E-06		
	Total PAH	1.89E-06		
	Cumulative	**3.35E-05**	**Cumulative**	**< 1**
3	Arsenic	3.22E-05	None	
	Chromium	1.15E-06		
	Cumulative	**3.33E-05**	**Cumulative**	**< 1**
4	Arsenic	2.78E-05	None	
	Chromium	1.47E-06		
	Cumulative	**2.93E-05**	**Cumulative**	**< 1**

Exhibit D.54. (Continued)

Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	1.82E-04	Arsenic	1.14
	Chromium	1.56E-06	Cobalt	0.16
	Cumulative	**1.84E-04**	**Cumulative**	**1.3**
2	Arsenic	2.81E-05	None	
	Chromium	1.48E-06		
	Total PAH	1.89E-06		
	Cumulative	**3.15E-05**	**Cumulative**	**< 1**
3	Arsenic	3.28E-05	None	
	Chromium	1.33E-06		
	Cumulative	**3.41E-05**	**Cumulative**	**< 1**
4	Arsenic	2.67E-05	None	
	Chromium	1.47E-06		
	Cumulative	**2.82E-05**	**Cumulative**	**< 1**
Excavation Worker				
EU	**ELCR**		**HI**	
1	Arsenic	2.28E-06	None	
	Cumulative	**2.28E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Arsenic	3.18E-04	Arsenic	4.55
	Chromium	3.57E-06	Mercury	0.35
	Cumulative	**3.21E-04**	**Cumulative**	**4.90**
2	Arsenic	5.37E-05	None	
	Chromium	2.87E-06		
	Total PAH	4.73E-06		
	Cumulative	**6.13E-05**	**Cumulative**	**< 1**
3	Arsenic	5.67E-05	None	
	Chromium	3.02E-06		
	Cumulative	**5.97E-05**	**Cumulative**	**< 1**
4	Arsenic	4.90E-05	Arsenic	0.70
	Chromium	3.86E-06	Iron	0.28
	Total PAH	1.11E-06	Manganese	0.13
			Vanadium	0.12
	Cumulative	**5.39E-05**	**Cumulative**	**1.24**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Arsenic	4.22E-05	None	
	Cumulative	**4.22E-05**	**Cumulative**	**< 1**
2	Arsenic	7.14E-06	None	
	Total PAH	1.02E-06		
	Cumulative	**8.16E-06**	**Cumulative**	**< 1**
3	Arsenic	7.53E-06	None	
	Cumulative	**7.53E-06**	**Cumulative**	**< 1**
4	Arsenic	6.51E-06	None	
	Cumulative	**6.51E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs for SWMU 180 are as follows:

- *Outdoor Worker (exposed to surface soil):* arsenic (HI) and arsenic (ELCR)
- *Outdoor Worker (exposed to surface and subsurface soil):* arsenic (HI) and arsenic (ELCR)
- *Future Hypothetical Residential Receptor:* arsenic (HI, child) and arsenic (ELCR)

Additionally, though the average concentration for lead was below the residential NAL (400 mg/kg), it was not considered a COC initially. Due to the nature of the SWMU, however, and the maximum detected value in surface soil (1992.17 mg/kg), lead also should be considered a COC for all scenarios evaluated.

SWMU 181, West Side Outdoor Firing Range (PGDP)

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 181 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.55.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH	None	1	Chromium Total PAH	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH	None	1	Chromium Total PAH	
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.55 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.56.

Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	1.47E-06	None	
	Total PAH	1.76E-06		
	Cumulative	**3.23E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 181.

SWMU 195, SW PGDP Curlee Road Contaminated Soil Mounds

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 195 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.57.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	None	1	Chromium	None
2	Chromium	None	2	Chromium	None
3	Chromium	None	3	Chromium	None
4	Chromium	None	4	Chromium	None
5	Chromium	None	5	Chromium	None
6	Chromium Total PAH	None	6	Chromium Total PAH	None
7	Chromium	None	7	Chromium	None
8	Arsenic Chromium Total PAH	None	8	Arsenic Chromium Total PAH	None
9	Chromium	None	9	Chromium	None
10	Chromium	None	10	Chromium	None
11	Arsenic Chromium	None	11	Arsenic Chromium	None
12	Chromium	None	12	Chromium	None
13	Chromium	None	13	Chromium	None
14	Chromium	None	14	Chromium	None
15	Chromium	None	15	Chromium	None
16	Chromium	None	16	Chromium	None
17	Chromium PCB, Total Total PAH Uranium-238	None	17	Chromium PCB, Total Total PAH Uranium-238	None

Exhibit D.57. (Continued)

Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	None	1	Chromium	None
2	Chromium	None	2	Chromium	None
3	Chromium	None	3	Chromium	None
4	Chromium	None	4	Chromium	None
5	Chromium	None	5	Chromium	None
6	Chromium Total PAH	None	6	Chromium Total PAH	None
7	Chromium	None	7	Chromium	None
8	Arsenic Chromium Total PAH	None	8	Arsenic Chromium Total PAH	None
9	Chromium	None	9	Chromium	None
10	Chromium	None	10	Chromium	None
11	Arsenic Chromium	Aluminum[1] Arsenic[1]	11	Arsenic Chromium	None
Outdoor Worker (exposed to surface soil) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
		Cobalt[1] Iron[1] Nickel[1]			
12	Chromium	None	12	Chromium	None
13	Chromium	None	13	Chromium	None
14	Chromium	None	14	Chromium	None
15	Chromium	None	15	Chromium	None
16	Chromium	None	16	Chromium	None
17	Chromium PCB, Total Total PAH Uranium-238	None	17	Chromium PCB, Total Total PAH Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium	None	1	Arsenic Cesium-137 Chromium	None
2	Chromium	None	2	Chromium	None
3	Arsenic Chromium	None	3	Arsenic Chromium	None
4	Arsenic Chromium	None None	4	Arsenic Chromium	None None
5	Arsenic Cesium-137 Chromium	None	5	Arsenic Cesium-137 Chromium	None
6	Arsenic Cesium-137 Chromium Total PAH	None	6	Arsenic Cesium-137 Chromium Total PAH	None

Exhibit D.57. (Continued)

Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
7	Arsenic Chromium	None	7	Arsenic Chromium	None
8	Arsenic Cesium-137 Chromium Total PAH	None	8	Arsenic Cesium-137 Chromium Total PAH	None
9	Arsenic Chromium	None	9	Arsenic Chromium	None
10	Arsenic Chromium	None	10	Arsenic Chromium	None
11	Arsenic Cesium-137 Chromium	Aluminum[1] Arsenic[1] Cobalt[1] Iron[1] Nickel[1]	11	Arsenic Cesium-137 Chromium	None
12	Arsenic Chromium	None	12	Arsenic Chromium	None
13	Arsenic Chromium	None	13	Arsenic Chromium	None
Outdoor Worker (exposed to surface and subsurface soil) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
14	Arsenic Chromium	None	14	Arsenic Chromium	None
15	Arsenic Cesium-137 Chromium	None	15	Arsenic Cesium-137 Chromium	None
16	Cesium-137 Chromium	None	16	Cesium-137 Chromium	None
17	Arsenic Chromium PCB, Total Total PAH Uranium-238	Arsenic[1] Mercury[1] Nickel[1]	17	Arsenic Chromium PCB, Total Total PAH Uranium-238	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1-17	None	None	1-17	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	None	1	Chromium	None
2	Chromium Total PAH	None	2	Chromium Total PAH	None
3	Chromium Total PAH	None	3	Chromium Total PAH	None
4	Chromium	None	4	Chromium	None
5	Chromium	None	5	Chromium	None

Exhibit D.57. (Continued)

Hypothetical Resident (adult)[2] (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Total PAH			Total PAH	
6	Chromium Total PAH	None	6	Chromium Total PAH	None
7	Chromium	None	7	Chromium	None
8	Arsenic Chromium Total PAH	None	8	Arsenic Chromium Total PAH	None
9	Chromium	None	9	Chromium	None
10	Chromium	None	10	Chromium	None
11	Arsenic Chromium	Aluminum[1] Arsenic[1] Barium[1] Cobalt[1] Iron[1] Nickel[1]	11	Arsenic Chromium	None
12	Chromium	None	12	Chromium	None
13	Chromium	None	13	Chromium	None
14	Chromium	None	14	Chromium	None
15	Chromium	None	15	Chromium	None
16	Chromium	None	16	Chromium	None
17	Chromium PCB, Total	None	17	Chromium PCB, Total	None
Hypothetical Resident (adult)[2] (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Total PAH Uranium-235 Uranium-238			Total PAH Uranium-235 Uranium-238	
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	Nickel[1] Silver[1]	1	Chromium	None
2	Chromium Total PAH	None	2	Chromium Total PAH	None
3	Chromium Total PAH	None	3	Chromium Total PAH	None
4	Chromium	None	4	Chromium	None
5	Chromium Total PAH	None	5	Chromium Total PAH	None
6	Chromium Total PAH	None	6	Chromium Total PAH	None
7	Chromium	None	7	Chromium	None
8	Arsenic Chromium Total PAH	Arsenic Cobalt Nickel[1] Vanadium	8	Arsenic Chromium Total PAH	Arsenic Cobalt Vanadium
9	Chromium	None	9	Chromium	None

Exhibit D.57. (Continued)

Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
10	Chromium	Nickel[1] Silver[1]	10	Chromium	None
11	Arsenic Chromium	Aluminum Arsenic Barium[1] Cobalt Iron Nickel[1] Thallium Vanadium	11	Arsenic Chromium	Aluminum Arsenic Cobalt Iron Thallium Vanadium
12	Chromium	None	12	Chromium	None
13	Chromium	None	13	Chromium	None
14	Chromium	None	14	Chromium	None
15	Chromium	None	15	Chromium	None
16	Chromium	None	16	Chromium	None
17	Chromium PCB, Total Total PAH Uranium-235 Uranium-238	Mercury[1] Nickel[1] Silver[1] Thallium[1]	17	Chromium PCB, Total Total PAH Uranium-235 Uranium-238	None

Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	None	None	2	None	None
3	None	None	3	None	None

Teen Recreational User (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
4	None	None	4	None	None
5	None	None	5	None	None
6	Total PAH	None	6	Total PAH	None
7	None	None	7	None	None
8	Arsenic Total PAH	None	8	Arsenic Total PAH	None
9	None	None	9	None	None
10	None	None	10	None	None
11	Arsenic	Aluminum[1] Barium[1] Cobalt[1] Nickel[1]	11	Arsenic	None
12	None	None	12	None	None
13	None	None	13	None	None
14	None	None	14	None	None
15	None	None	15	None	None
16	None	None	16	None	None
17	PCB, Total Total PAH	None	17	PCB, Total Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.57 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.58.

Future Industrial Worker				
EU	ELCR		HI	
1	Chromium	2.10E-06	None	
	Cumulative	**2.10E-06**	**Cumulative**	**< 1**
2	Chromium	1.50E-06	None	
	Cumulative	**1.50E-06**	**Cumulative**	**< 1**
3	Chromium	1.67E-06	None	
	Cumulative	**1.67E-06**	**Cumulative**	**< 1**
4	Chromium	1.75E-06	None	
	Cumulative	**1.75E-06**	**Cumulative**	**< 1**
5	Chromium	1.90E-06	None	
	Cumulative	**1.90E-06**	**Cumulative**	**< 1**
6	Chromium	1.48E-06	None	
	Total PAH	4.18E-06		
	Cumulative	**5.66E-06**	**Cumulative**	**< 1**
7	Chromium	1.63E-06	None	
	Cumulative	**1.63E-06**	**Cumulative**	**< 1**
8	Arsenic	1.16E-05	None	
	Chromium	2.25E-06		
	Total PAH	3.64E-06		
	Cumulative	**1.75E-05**	**Cumulative**	**< 1**
9	Chromium	2.02E-06	None	
Future Industrial Worker (Continued)				
EU	ELCR		HI	
	Cumulative	**2.02E-06**	**Cumulative**	**< 1**
10	Chromium	1.49E-06	None	
	Cumulative	**1.49E-06**	**Cumulative**	**< 1**
11	Arsenic	1.35E-05	None	
	Chromium	1.67E-06		
	Cumulative	**1.52E-05**	**Cumulative**	**< 1**
12	Chromium	2.33E-06	None	
	Cumulative	**2.33E-06**	**Cumulative**	**< 1**
13	Chromium	2.17E-06	None	
	Cumulative	**2.17E-06**	**Cumulative**	**< 1**
14	Chromium	1.97E-06	None	
	Cumulative	**1.97E-06**	**Cumulative**	**< 1**
15	Chromium	1.60E-06	None	
	Cumulative	**1.60E-06**	**Cumulative**	**< 1**
16	Chromium	1.47E-06	None	
	Cumulative	**1.47E-06**	**Cumulative**	**< 1**
17	Chromium	2.72E-06	None	
	PCB, Total	3.94E-06		
	Total PAH	5.33E-06		
	Uranium-238	1.46E-06		
	Cumulative	**1.35E-05**	**Cumulative**	**< 1**

Exhibit D.58. (Continued)

Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	1.55E-06	None	
	Cumulative	**1.55E-06**	**Cumulative**	**< 1**
2	Chromium	1.11E-06	None	
	Cumulative	**1.11E-06**	**Cumulative**	**< 1**
3	Chromium	1.23E-06	None	
	Cumulative	**1.23E-06**	**Cumulative**	**< 1**
4	Chromium	1.30E-06	None	
	Cumulative	**1.30E-06**	**Cumulative**	**< 1**
5	Chromium	1.41E-06	None	
	Cumulative	**1.41E-06**	**Cumulative**	**< 1**
6	Chromium	1.09E-06	None	
	Total PAH	5.11E-06		
	Cumulative	**6.20E-06**	**Cumulative**	**< 1**
7	Chromium	1.21E-06	None	
	Cumulative	**1.21E-06**	**Cumulative**	**< 1**
8	Arsenic	2.79E-05	None	
	Chromium	1.67E-06		
	Total PAH	4.44E-06		
	Cumulative	**3.40E-05**	**Cumulative**	**< 1**
9	Chromium	1.49E-06	None	
	Cumulative	**1.49E-06**	**Cumulative**	**< 1**
10	Chromium	1.11E-06	None	
	Cumulative	**1.11E-06**	**Cumulative**	**< 1**
11	Arsenic	3.24E-05	None	
	Chromium	1.24E-06		
	Cumulative	**3.37E-05**	**Cumulative**	**< 1**
12	Chromium	1.73E-06	None	
	Cumulative	**1.73E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil) (Continued)				
EU	ELCR		HI	
13	Chromium	1.61E-06	None	
	Cumulative	**1.61E-06**	**Cumulative**	**< 1**
14	Chromium	1.46E-06	None	
	Cumulative	**1.46E-06**	**Cumulative**	**< 1**
15	Chromium	1.18E-06	None	
	Cumulative	**1.18E-06**	**Cumulative**	**< 1**
16	Chromium	1.09E-06	None	
	Cumulative	**1.09E-06**	**Cumulative**	**< 1**
17	Chromium	2.02E-06	None	
	PCB, Total	4.56E-06		
	Total PAH	6.51E-06		
	Uranium-238	2.11E-06		
	Cumulative	**1.52E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.83E-05	None	
	Cesium-137	3.21E-06		
	Chromium	1.44E-06		
	Cumulative	**3.29E-05**	**Cumulative**	**< 1**

Exhibit D.58. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)				
EU	ELCR		HI	
2	Chromium	1.38E-06	None	
	Cumulative	**1.38E-06**	**Cumulative**	**< 1**
3	Arsenic	2.61E-05	None	
	Chromium	1.30E-06		
	Cumulative	**2.74E-05**	**Cumulative**	**< 1**
4	Arsenic	2.43E-05	None	
	Chromium	1.24E-06		
	Cumulative	**2.55E-05**	**Cumulative**	**< 1**
5	Arsenic	2.12E-05	None	
	Cesium-137	2.96E-06		
	Chromium	1.41E-06		
	Cumulative	**2.56E-05**	**Cumulative**	**< 1**
6	Arsenic	2.53E-05	None	
	Cesium-137	1.96E-06		
	Chromium	1.35E-06		
	Total PAH	3.94E-06		
	Cumulative	**3.25E-05**	**Cumulative**	**< 1**
7	Arsenic	2.05E-05	None	
	Chromium	1.16E-06		
	Cumulative	**2.16E-05**	**Cumulative**	**< 1**
8	Arsenic	2.69E-05	None	
	Cesium-137	2.12E-06		
	Chromium	1.28E-06		
	Total PAH	2.93E-06		
	Cumulative	**3.32E-05**	**Cumulative**	**< 1**
9	Arsenic	2.49E-05	None	
	Chromium	1.49E-06		
	Cumulative	**2.64E-05**	**Cumulative**	**< 1**
10	Arsenic	2.37E-05	None	
	Chromium	1.05E-06		
	Cumulative	**2.47E-05**	**Cumulative**	**< 1**
11	Arsenic	3.12E-05	None	
	Cesium-137	1.85E-06		
	Chromium	1.39E-06		
	Cumulative	**3.45E-05**	**Cumulative**	**< 1**
12	Arsenic	2.59E-05	None	
	Chromium	1.58E-06		
	Cumulative	**2.75E-05**	**Cumulative**	**< 1**
13	Arsenic	2.20E-05	None	
	Chromium	1.28E-06		
	Cumulative	**2.33E-05**	**Cumulative**	**< 1**
14	Arsenic	2.46E-05	None	
	Chromium	1.46E-06		
	Cumulative	**2.61E-05**	**Cumulative**	**< 1**
15	Arsenic	2.21E-05	None	
	Cesium-137	2.27E-06		
	Chromium	1.31E-06		
	Cumulative	**2.56E-05**	**Cumulative**	**< 1**

Exhibit D.58. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)				
EU	ELCR		HI	
16	Cesium-137	2.55E-06	None	
	Chromium	1.28E-06		
	Cumulative	**3.83E-06**	**Cumulative**	**< 1**
17	Arsenic	2.26E-05	None	
	Chromium	1.66E-06		
	PCB, Total	4.56E-06		
	Total PAH	4.23E-06		
	Uranium-238	1.49E-06		
	Cumulative	**3.45E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	4.07E-06	None	
	Cumulative	**4.07E-06**	**Cumulative**	**< 1**
2	Chromium	2.91E-06	None	
	Total PAH	1.38E-06		
	Cumulative	**4.29E-06**	**Cumulative**	**< 1**
3	Chromium	3.23E-06	None	
	Total PAH	2.09E-06		
	Cumulative	**5.32E-06**	**Cumulative**	**< 1**
4	Chromium	3.40E-06	None	
	Cumulative	**3.40E-06**	**Cumulative**	**< 1**
5	Chromium	3.69E-06	None	
	Total PAH	1.23E-06		
	Cumulative	**4.93E-06**	**Cumulative**	**< 1**
6	Chromium	2.86E-06	None	
	Total PAH	1.27E-05		
	Cumulative	**1.56E-05**	**Cumulative**	**< 1**
7	Chromium	3.17E-06	None	
	Cumulative	**3.17E-06**	**Cumulative**	**< 1**
8	Arsenic	4.91E-05	Arsenic	0.70
	Chromium	4.37E-06	Cobalt	0.79
	Total PAH	1.11E-05	Vanadium	0.10
	Cumulative	**6.46E-05**	**Cumulative**	**1.60**
Hypothetical Resident (Continued)				
EU	ELCR		HI	
9	Chromium	3.91E-06	None	
	Cumulative	**3.91E-06**	**Cumulative**	**< 1**
10	Chromium	2.90E-06	None	
	Cumulative	**2.90E-06**	**Cumulative**	**< 1**
11	Arsenic	5.72E-05	Aluminum	0.39
	Chromium	3.25E-06	Arsenic	0.82
			Cobalt	1.20
			Iron	0.36
			Thallium	0.11
			Vanadium	0.20
	Cumulative	**6.04E-05**	**Cumulative**	**3.08**
12	Chromium	4.53E-06	None	
	Cumulative	**4.53E-06**	**Cumulative**	**< 1**
13	Chromium	4.21E-06	None	
	Cumulative	**4.21E-06**	**Cumulative**	**< 1**

Exhibit D.58. (Continued)

Hypothetical Resident (Continued)					
EU	ELCR		HI		
14	Chromium	3.82E-06	None		
	Cumulative	**3.82E-06**	**Cumulative**	**< 1**	
15	Chromium	3.10E-06	None		
	Cumulative	**3.10E-06**	**Cumulative**	**< 1**	
16	Chromium	2.86E-06	None		
	Cumulative	**2.86E-06**	**Cumulative**	**< 1**	
17	Chromium	5.28E-06	None		
	PCB, Total	1.16E-05			
	Total PAH	1.63E-05			
	Uranium-235	1.68E-06			
	Uranium-238	7.17E-06			
	Cumulative	**4.20E-05**	**Cumulative**	**< 1**	
Teen Recreational User					
EU	**ELCR**		**HI**		
6	Total PAH	2.75E-06	None		
	Cumulative	**2.75E-06**	**Cumulative**	**< 1**	
8	Arsenic	6.52E-06	None		
	Total PAH	2.40E-06			
	Cumulative	**8.92E-06**	**Cumulative**	**< 1**	
11	Arsenic	7.59E-06	None		
	Cumulative	**7.59E-06**	**Cumulative**	**< 1**	
17	PCB, Total	2.48E-06	None		
	Total PAH	3.51E-06			
	Cumulative	**5.99E-06**	**Cumulative**	**< 1**	

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

The only priority COC for SWMU 195 is the following:

- *Future Hypothetical Residential Receptor:* cobalt (HI, child—EU 11)

SWMU 486, West of PGDP Rubble Pile WKWMA

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 486 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.59.

EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.59 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.60.

Future Industrial Worker				
EU	ELCR		HI	
1	Cesium-137	1.99E-05	None	
	Cumulative	**1.99E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Cesium-137	1.48E-05	None	

Exhibit D.60. (Continued)

Outdoor Worker (exposed to surface soil) (Continued)				
EU	ELCR		HI	
	Cumulative	**1.48E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Cesium-137	1.48E-05	None	
	Cumulative	**1.48E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Cesium-137	1.00E-04	None	
	Cumulative	**1.00E-04**	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Cesium-137	4.17E-06	None	
	Cumulative	**4.17E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

The only priority COC for SWMU 486 is cesium-137 for the residential scenario.

SWMU 487, West of PGDP Rubble Pile WKWMA

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 486 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.61.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.61 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.62.

Future Industrial Worker				
EU	ELCR		HI	
1	Cesium-137	1.60E-05	None	
	Cumulative	**1.60E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Cesium-137	1.20E-05	None	
	Cumulative	**1.20E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Cesium-137	1.20E-05	None	
	Cumulative	**1.20E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Cesium-137	8.07E-05	None	
	Cumulative	**8.07E-05**	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Cesium-137	3.36E-06	None	
	Cumulative	**3.36E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 487.

AOC 492, Outfall 011 Contaminated Soil Area, North of Outfall 10

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for AOC 492 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.63.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Uranium-234 Uranium-235 Uranium-238	Beryllium[1] Chromium[1] Uranium[1]	1	Arsenic Chromium PCB, Total Uranium-234 Uranium-235 Uranium-238	None

Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Uranium-234 Uranium-235 Uranium-238	Arsenic Beryllium[1] Uranium	1	Arsenic Chromium PCB, Total Uranium-234 Uranium-235 Uranium-238	Arsenic Uranium

Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium PCB, Total Uranium-234 Uranium-235 Uranium-238	Arsenic Beryllium[1] Uranium	1	Arsenic Cesium-137 Chromium PCB, Total Uranium-234 Uranium-235 Uranium-238	Arsenic Uranium

Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Uranium-238	Uranium[1]	1	PCB, Total Uranium-238	None

Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Cobalt-60[3] Neptunium-237 PCB, Total Uranium-234 Uranium-235 Uranium-238	Arsenic Beryllium[1] Chromium[1] Uranium	1	Arsenic Chromium Neptunium-237 PCB, Total Uranium-234 Uranium-235 Uranium-238	Arsenic Uranium

Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Cobalt-60[3] Neptunium-237	Arsenic Beryllium[1] Chromium[1] Uranium	1	Arsenic Chromium Neptunium-237	Arsenic Uranium Vanadium

Exhibit D.63. (Continued)

Hypothetical Resident (child)[2] (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	PCB, Total Uranium-234 Uranium-235 Uranium-238	Vanadium		PCB, Total Uranium-234 Uranium-235 Uranium-238	
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Uranium-235 Uranium-238	Arsenic[1] Beryllium[1] Chromium[1] Uranium[1]	1	Arsenic Chromium PCB, Total Uranium-235 Uranium-238	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[3] COC was removed after evaluation as described below.

Cobalt-60, though reported in AOC 492 analyses, was reported with values below the laboratory's MDA. Cobalt-60, therefore, is not considered a COC.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.63 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.64.

Future Industrial Worker				
EU	ELCR		HI	
1	Arsenic	1.47E-05	None	
	Chromium	3.45E-05		
	PCB, Total	2.35E-04		
	Uranium-234	2.85E-06		
	Uranium-235	1.45E-05		
	Uranium-238	2.25E-04		
	Cumulative	**5.27E-04**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Arsenic	3.54E-05	Arsenic	0.22
	Chromium	2.55E-05	Uranium	2.06
	PCB, Total	2.72E-04		
	Uranium-234	1.90E-05		
	Uranium-235	1.26E-05		
	Uranium-238	3.27E-04		
	Cumulative	**6.91E-04**	**Cumulative**	**2.28**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	3.54E-05	Arsenic	0.22
	Cesium-137	3.00E-06	Uranium	2.06
	Chromium	2.55E-05		

Exhibit D.64. (Continued)

EU	ELCR		HI	
Outdoor Worker (exposed to surface and subsurface soil) (Continued)				
	PCB, Total	2.72E-04		
	Uranium-234	1.90E-05		
	Uranium-235	1.26E-05		
	Uranium-238	3.27E-04		
	Cumulative	**6.94E-04**	**Cumulative**	**2.28**
Excavation Worker				
EU	**ELCR**		**HI**	
1	PCB, Total	3.40E-06	None	
	Uranium-238	4.08E-06		
	Cumulative	**7.48E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Arsenic	6.24E-05	Arsenic	0.89
	Chromium	6.69E-05	Uranium	7.57
	Neptunium-237	3.87E-06	Vanadium	0.11
	PCB, Total	6.91E-04		
	Uranium-234	1.12E-05		
	Uranium-235	7.27E-05		
	Uranium-238	1.11E-03		
	Cumulative	**2.02E-03**	**Cumulative**	**8.57**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Arsenic	8.29E-06	None	
	Chromium	6.28E-06		
	PCB, Total	1.48E-04		
	Uranium-235	3.01E-06		
	Uranium-238	4.48E-05		
	Cumulative	**2.10E-04**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs for AOC 492 include the following:

- *Future Industrial Worker:* Total PCBs and uranium-238 (ELCR)
- *Outdoor Worker (exposed to surface soil):* uranium (HI) and Total PCBs and uranium-238 (ELCR)
- *Outdoor Worker (exposed to surface and subsurface soil):* uranium (HI) and Total PCBs and uranium-238 (ELCR)
- *Future Hypothetical Residential Receptor:* uranium (HI, child) and Total PCBs and uranium-238 (ELCR)
- *Teen Recreational User:* Total PCBs (ELCR)

SWMU 493, Outfall 001 Concrete Rubble Piles Near Outfall 001

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 493 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.65.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-238	Cobalt[1] Manganese[1] Nickel[1]	1	Chromium PCB, Total Total PAH Uranium-238	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-238	Cobalt[1] Manganese[1] Nickel[1]	1	Chromium PCB, Total Total PAH Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium PCB, Total Total PAH Uranium-238	Arsenic[1] Cobalt[1] Manganese[1] Nickel[1]	1	Arsenic Cesium-137 Chromium PCB, Total Total PAH Uranium-238	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Cobalt-60[3] Neptunium-237 PCB, Total Total PAH Uranium-235 Uranium-238	Barium[1] Cobalt[1] Manganese[1] Nickel[1]	1	Chromium Neptunium-237 PCB, Total Total PAH Uranium-235 Uranium-238	None

Exhibit D.65. (Continued)

Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	Aluminum	1	Chromium	Aluminum
	Cobalt-60[3]	Barium[1]		Neptunium-237	Cobalt
	Neptunium-237	Cobalt		PCB, Total	Manganese
	PCB, Total	Manganese			Nickel
	Total PAH	Mercury[1]		Total PAH	Vanadium
	Uranium-235	Nickel		Uranium-235	
	Uranium-238	Vanadium		Uranium-238	
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	Cobalt[1]	1	Total PAH	None
		Manganese[1]			
		Nickel[1]			

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[3] COC was removed after evaluation as described below.

Cobalt-60, though reported in SWMU 493 analyses, was reported with values below the laboratory's MDA. Cobalt-60, therefore, is not considered a COC.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.65 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.66.

Future Industrial Worker				
EU	ELCR		HI	
1	Chromium	2.19E-06	None	
	PCB, Total	1.39E-06		
	Total PAH	8.44E-06		
	Uranium-238	3.23E-06		
	Cumulative	**1.53E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	1.62E-06	None	
	PCB, Total	1.60E-06		
	Total PAH	1.03E-05		
	Uranium-238	4.69E-06		
	Cumulative	**1.82E-05**	**Cumulative**	**< 1**

Exhibit D.66. (Continued)

Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.84E-05	None	
	Cesium-137	2.53E-06		
	Chromium	1.62E-06		
	PCB, Total	1.60E-06		
	Total PAH	1.03E-05		
	Uranium-238	4.69E-06		
	Cumulative	**4.92E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	4.25E-06	Aluminum	0.20
	Neptunium-237	2.26E-06	Cobalt	1.65
	PCB, Total	4.07E-06	Manganese	0.67
	Total PAH	2.57E-05	Nickel	0.15
	Uranium-235	2.10E-06	Vanadium	0.10
	Uranium-238	1.59E-05		
	Cumulative	**5.43E-05**	**Cumulative**	**2.76**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Total PAH	5.56E-06	None	
	Cumulative	**5.56E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

The only priority COC for SWMU 493 is the following:

- *Future Hypothetical Residential Receptor:* cobalt (HI, child)

SWMU 517, West of PGDP Rubble and Debris Erosion Control Fill Area

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 517 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.67.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium	None	1	Chromium	None
	Neptunium-237			Neptunium-237	
	PCB, Total			PCB, Total	
	Uranium-238			Uranium-238	

Exhibit D.67. (Continued)

Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Neptunium-237 PCB, Total Uranium-238	None	1	Chromium Neptunium-237 PCB, Total Uranium-238	None

Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Neptunium-237 PCB, Total Uranium-238	None	1	Chromium Neptunium-237 PCB, Total Uranium-238	None

Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None

Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Cobalt-60[3] Neptunium-237 PCB, Total Uranium-235 Uranium-238	None	1	Chromium Neptunium-237 PCB, Total Uranium-235 Uranium-238	None

Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Cobalt-60[3] Neptunium-237 PCB, Total Uranium-235 Uranium-238	Nickel[1]	1	Chromium Neptunium-237 PCB, Total Uranium-235 Uranium-238	None

Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total	None	1	PCB, Total	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[3] COC was removed after evaluation as described below.

Cobalt-60, though reported in SWMU 517 analyses, was reported with values below the laboratory's MDA. Cobalt-60, therefore, is not considered a COC.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.67 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.68.

Future Industrial Worker				
EU	ELCR		HI	
1	Chromium	1.63E-06	None	
	Neptunium-237	3.95E-06		
	PCB, Total	2.66E-06		
	Uranium-238	2.29E-06		
	Cumulative	**1.05E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	1.20E-06	None	
	Neptunium-237	3.27E-06		
	PCB, Total	3.08E-06		
	Uranium-238	3.32E-06		
	Cumulative	**1.09E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Chromium	1.20E-06	None	
	Neptunium-237	3.27E-06		
	PCB, Total	3.08E-06		
	Uranium-238	3.32E-06		
	Cumulative	**1.09E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	3.16E-06	None	
	Neptunium-237	1.98E-05		
	PCB, Total	7.83E-06		
	Uranium-235	2.03E-06		
	Uranium-238	1.12E-05		
	Cumulative	**4.40E-05**	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	PCB, Total	1.67E-06	None	
	Cumulative	**1.67E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 517.

AOC 541, Outfall 011 Contaminated area by Outfall 011

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for AOC 541 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.69.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Americium-241[2] Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Uranium	1	Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Uranium

Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Americium-241[2] Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Iron[1] Uranium	1	Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Uranium

Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Americium-241[2] Arsenic Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Iron[1] Uranium	1	Arsenic Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Uranium

Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Uranium-238	Uranium	1	PCB, Total Uranium-238	Uranium

Hypothetical Resident (adult)[3]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Americium-241[2] Cesium-137 Chromium Cobalt-60[2] Neptunium-237[2] PCB, Total Total PAH Uranium-234	Chromium[1] Iron[1] Uranium	1	Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235	Uranium

Exhibit D.69. (Continued)

Hypothetical Resident (adult)[3] (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Uranium-235 Uranium-238			Uranium-238	
Hypothetical Resident (child)[3]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Americium-241[2] Cesium-137 Chromium Cobalt-60[2] Neptunium-237[2] PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Aluminum Chromium[1] Iron Nickel[1] Uranium Vanadium[1]	1	Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Aluminum Iron Uranium
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 Chromium PCB, Total Total PAH Uranium-235	Chromium[1] Uranium[1]	1	Cesium-137 Chromium PCB, Total Total PAH Uranium-235	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Uranium-238			Uranium-238	

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] COC was removed after evaluation as described below.
[3] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cobalt-60 and neptunium-237, though reported in AOC 541 analyses, were reported with values below the laboratory's MDA. Similarly, americium-241 was reported with values below either the laboratory's MDA or the total propagated uncertainty and qualified by the laboratory with a "U." Cobalt-60, neptunium 237, and americium-241, therefore, are not considered COCs.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.69 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.70.

Future Industrial Worker				
EU	ELCR		HI	
1	Cesium-137	1.11E-05	Uranium	1.06
	Chromium	2.73E-05		
	PCB, Total	3.23E-04		

Exhibit D.70. (Continued)

EU	ELCR		HI	
Future Industrial Worker (Continued)				
	Total PAH	3.93E-05		
	Uranium-234	7.55E-06		
	Uranium-235	4.45E-05		
	Uranium-238	5.89E-04		
	Cumulative	**1.04E-03**	**Cumulative**	**1.06**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Cesium-137	8.31E-06	Uranium	7.41
	Chromium	2.02E-05		
	PCB, Total	3.74E-04		
	Total PAH	4.80E-05		
	Uranium-234	5.05E-05		
	Uranium-235	3.86E-05		
	Uranium-238	8.54E-04		
	Cumulative	**1.39E-03**	**Cumulative**	**7.41**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.19E-05	Arsenic	0.14
	Cesium-137	8.44E-06	Uranium	8.58
	Chromium	2.32E-05		
	PCB, Total	3.81E-04		
	Total PAH	6.50E-05		
	Uranium-234	5.10E-05		
	Uranium-235	4.96E-05		
	Uranium-238	9.47E-04		
	Cumulative	**1.55E-03**	**Cumulative**	**8.72**
Excavation Worker				
EU	**ELCR**		**HI**	
1	PCB, Total	4.76E-06	Uranium	2.69
	Uranium-238	1.18E-05		
	Cumulative	**1.66E-05**	**Cumulative**	**2.69**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Cesium-137	5.61E-05	Aluminum	0.20
	Chromium	5.30E-05	Iron	0.29
	PCB, Total	9.50E-04	Uranium	27.31
	Total PAH	1.20E-04		
	Uranium-234	2.96E-05		
	Uranium-235	2.23E-04		
	Uranium-238	2.89E-03		
	Cumulative	**4.20E-03**	**Cumulative**	**27.79**

Exhibit D.70. (Continued)

Teen Recreational User (Continued)				
EU	ELCR		HI	
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Cesium-137	2.33E-06	None	
	Chromium	4.98E-06		
	PCB, Total	2.03E-04		
	Total PAH	2.59E-05		
	Uranium-235	9.25E-06		
	Uranium-238	1.17E-04		
	Cumulative	**3.62E-04**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs for AOC 541 are the following:

- *Future Industrial Worker:* uranium (HI) and Total PCBs and uranium-238 (ELCR)
- *Outdoor Worker (exposed to surface soil):* uranium (HI) and Total PCBs and uranium-238 (ELCR)
- *Outdoor Worker (exposed to surface and subsurface soil):* uranium (HI) and Total PCBs and uranium-238 (ELCR)
- *Excavation Worker:* uranium (HI)
- *Future Hypothetical Residential Receptor:* uranium (HI) and Total PCBs, Total PAH, uranium-235, and uranium-238 (ELCR)
- *Teen Recreational User:* Total PCBs and uranium-238 (ELCR)

SWMU 561, Near Outfall 2 Soil Pile I

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 561 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.71.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	None	1	Arsenic	None
	Chromium			Chromium	
	Cobalt-60[2]			PCB, Total	
	PCB, Total			Total PAH	
	Total PAH			Uranium-235	
	Uranium-235			Uranium-238	
	Uranium-238				

Exhibit D.71. (Continued)

EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
Future Industrial Worker (Continued)					
2	Arsenic Cesium-137 Chromium Cobalt-60[2] PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Cobalt[1] Uranium[1]	2	Arsenic Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Cobalt-60[2] PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic[1] Cobalt[1] Iron[1] Uranium[1]	1	Arsenic Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
2	Arsenic Cesium-137 Chromium Cobalt-60[2] PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic Cobalt Uranium	2	Arsenic Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Cobalt Uranium
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium Cobalt-60[2]	Arsenic[1] Cobalt[1] Iron[1] Uranium[1]	1	Arsenic Cesium-137 Chromium	None
	PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238			PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	
2	Arsenic Cesium-137 Chromium Cobalt-60[2] PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic Cobalt Uranium	2	Arsenic Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Cobalt Uranium

Exhibit D.71. (Continued)

Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Uranium-238	None	1	Uranium-238	None
2	Uranium-238 PCB, Total	None	2	Uranium-238 PCB, Total	None
Hypothetical Resident (adult)[3]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Cobalt-60[2] PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic[1] Cobalt[1] Iron[1] Uranium[1]	1	Arsenic Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
2	Arsenic Cesium-137 Chromium Cobalt-60[2] PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic[1] Cobalt[1] Uranium[1]	2	Arsenic Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
Hypothetical Resident (child)[3]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Cobalt-60[2] PCB, Total Total PAH Uranium-234	Antimony[1] Arsenic Cobalt Iron Manganese Uranium	1	Arsenic Chromium PCB, Total Total PAH Uranium-234	Arsenic Cobalt Iron Manganese Uranium
Hypothetical Resident (child)[3] (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Uranium-235 Uranium-238	Vanadium[1]		Uranium-235 Uranium-238	
2	Arsenic Cesium-137 Chromium Cobalt-60[2] PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony Arsenic Chromium[1] Cobalt Manganese Thallium[1] Uranium Vanadium[1]	2	Arsenic Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony Arsenic Cobalt Manganese Uranium

Exhibit D.71. (Continued)

Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic PCB, Total Total PAH Uranium-238	None	1	Arsenic PCB, Total Total PAH Uranium-238	None
2	Arsenic Chromium PCB, Total Total PAH Uranium-235 Uranium-238	Antimony[1] Cobalt[1] Uranium[1]	2	Arsenic Chromium PCB, Total Total PAH Uranium-235 Uranium-238	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] COC was removed after evaluation as described below.
[3] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cobalt-60, though reported in SWMU 561 analyses, was reported with values below the laboratory's MDA. Cobalt-60, therefore, is not considered a COC.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.71 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.72.

Future Industrial Worker				
EU	ELCR		HI	
1	Arsenic	1.66E-05	None	
	Chromium	2.84E-06		
	PCB, Total	5.55E-06		
	Total PAH	6.65E-06		
	Uranium-235	3.46E-06		
	Uranium-238	6.26E-05		
	Cumulative	**1.02E-04**	**Cumulative**	**< 1**
2	Arsenic	1.30E-05	None	
	Cesium-137	4.75E-06		
	Chromium	9.55E-06		
	PCB, Total	8.75E-05		
	Total PAH	4.10E-05		
	Uranium-234	2.15E-06		
	Uranium-235	1.80E-05		
	Uranium-238	2.35E-04		
	Cumulative	**4.13E-04**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Arsenic	3.99E-05	None	
	Chromium	2.10E-06		
	PCB, Total	6.43E-06		
	Total PAH	8.12E-06		

Exhibit D.72. (Continued)

Outdoor Worker (exposed to surface soil) (Continued)				
EU	ELCR		HI	
	Uranium-234	2.77E-06		
	Uranium-235	3.00E-06		
	Uranium-238	9.08E-05		
	Cumulative	**1.56E-04**	**Cumulative**	**< 1**
2	Arsenic	3.14E-05	Arsenic	0.20
	Cesium-137	3.55E-06	Cobalt	0.13
	Chromium	7.07E-06	Uranium	1.61
	PCB, Total	1.01E-04		
	Total PAH	5.01E-05		
	Uranium-234	1.44E-05		
	Uranium-235	1.56E-05		
	Uranium-238	3.41E-04		
	Cumulative	**5.65E-04**	**Cumulative**	**1.94**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	3.94E-05	None	
	Cesium-137	2.20E-06		
	Chromium	2.21E-06		
	PCB, Total	6.22E-06		
	Total PAH	1.61E-05		
	Uranium-234	2.99E-06		
	Uranium-235	3.14E-06		
	Uranium-238	9.53E-05		
	Cumulative	**1.70E-04**	**Cumulative**	**< 1**
2	Arsenic	3.06E-05	Arsenic	0.19
	Cesium-137	3.49E-06	Cobalt	0.13
	Chromium	7.52E-06	Uranium	1.63
	PCB, Total	1.03E-04		
	Total PAH	4.74E-05		
	Uranium-234	1.39E-05		
	Uranium-235	1.49E-05		
	Uranium-238	3.29E-04		
	Cumulative	**5.51E-04**	**Cumulative**	**1.95**
Excavation Worker				
EU	**ELCR**		**HI**	
1	Uranium-238	1.19E-06	None	
	Cumulative	**1.19E-06**	**Cumulative**	**< 1**
2	Uranium-238	4.11E-06	None	
	PCB, Total	1.29E-06		
	Cumulative	**5.40E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Arsenic	7.03E-05	Arsenic	1.01
	Chromium	5.52E-06	Cobalt	0.46
	PCB, Total	1.63E-05	Iron	0.37

Exhibit D.72. (Continued)

EU	ELCR		HI	
Hypothetical Resident (Continued)				
	Total PAH	2.03E-05	Manganese	0.30
	Uranium-234	1.63E-06	Uranium	1.13
	Uranium-235	1.74E-05		
	Uranium-238	3.08E-04		
	Cumulative	**4.39E-04**	**Cumulative**	**3.28**
2	Arsenic	5.53E-05	Antimony	0.17
	Cesium-137	2.39E-05	Arsenic	0.79
	Chromium	1.85E-05	Cobalt	0.50
	PCB, Total	2.57E-04	Manganese	0.21
	Total PAH	1.25E-04	Uranium	5.92
	Uranium-234	8.43E-06		
	Uranium-235	9.01E-05		
	Uranium-238	1.16E-03		
	Cumulative	**1.74E-03**	**Cumulative**	**7.58**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Arsenic	9.34E-06	None	
	PCB, Total	3.49E-06		
	Total PAH	4.38E-06		
	Uranium-238	1.24E-05		
	Cumulative	**2.97E-05**	**Cumulative**	**< 1**
2	Arsenic	7.34E-06	None	
	Chromium	1.74E-06		
	PCB, Total	5.49E-05		
	Total PAH	2.70E-05		
	Uranium-235	3.74E-06		
	Uranium-238	4.68E-05		
	Cumulative	**1.42E-04**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs for SWMU 561 are the following:

- *Future Industrial Worker:* uranium-238 (ELCR, EU 2)
- *Outdoor Worker (exposed to surface soil):* uranium (HI, EU 2) and Total PCBs and uranium-238 (ELCR, EU 2)
- *Outdoor Worker (exposed to surface and subsurface soil):* uranium (HI, EU 2) and Total PCBs and uranium-238 (ELCR, EU 2)
- *Future Hypothetical Residential Receptor:* arsenic (HI, child—EU 1) and uranium (HI, child—EU 1 and EU 2) and Total PCBs (ELCR, EU 2); Total PAH (ELCR, EU 2); and uranium-238 (ELCR, EU 1 and EU 2)

AOC 562, North of Soil Pile I, West of LBC Soil Piles C, D, E, F, G, H, J, K, and P in Subunit 1

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for AOC 562 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.73.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Uranium-238	None	1	Uranium-238	None
2	PCB, Total Uranium-234 Uranium-235 Uranium-238	None	2	PCB, Total Uranium-234 Uranium-235 Uranium-238	None
3	Chromium PCB, Total Total PAH Uranium-238	None	3	Chromium PCB, Total Total PAH Uranium-238	None
4	Chromium Uranium-238	None	4	Chromium Uranium-238	None
5	Chromium PCB, Total Total PAH Uranium-235 Uranium-238	None	5	Chromium PCB, Total Total PAH Uranium-235 Uranium-238	None
6	Uranium-234 Uranium-235 Uranium-238	None	6	Uranium-234 Uranium-235 Uranium-238	None

Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Uranium-238	None	1	Uranium-238	None
2	PCB, Total Uranium-234 Uranium-235 Uranium-238	None	2	PCB, Total Uranium-234 Uranium-235 Uranium-238	None
3	PCB, Total Total PAH Uranium-238	None	3	PCB, Total Total PAH Uranium-238	None
4	Chromium Uranium-238	None	4	Chromium Uranium-238	None
5	Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None	5	Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None

Exhibit D.73. (Continued)

Outdoor Worker (exposed to surface soil) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
6	Uranium-234 Uranium-235 Uranium-238	None	6	Uranium-234 Uranium-235 Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium PCB, Total Uranium-235 Uranium-238	None	1	Arsenic Cesium-137 Chromium PCB, Total Uranium-235 Uranium-238	None
2	Cesium-137 PCB, Total Uranium-234 Uranium-235 Uranium-238	None	2	Cesium-137 PCB, Total Uranium-234 Uranium-235 Uranium-238	None
3	PCB, Total Total PAH Uranium-238	None	3	PCB, Total Total PAH Uranium-238	None
4	Cesium-137 Chromium Uranium-238	None	4	Cesium-137 Chromium Uranium-238	None
5	Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None	5	Cesium-137 Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
6	Uranium-234 Uranium-235 Uranium-238	None	6	Uranium-234 Uranium-235 Uranium-238	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	Uranium-238	None	2	Uranium-238	None
3	None	None	3	None	None
4	None	None	4	None	None
5	None	None	5	None	None
6	Uranium-238	None	6	Uranium-238	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Uranium-238	None	1	Uranium-238	None

Exhibit D.73. (Continued)

Hypothetical Resident (adult)[2] (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
2	PCB, Total Uranium-234 Uranium-235 Uranium-238	None	2	PCB, Total Uranium-234 Uranium-235 Uranium-238	None
3	Chromium PCB, Total Total PAH Uranium-235 Uranium-238	None	3	Chromium PCB, Total Total PAH Uranium-235 Uranium-238	None
4	Chromium Uranium-238	None	4	Chromium Uranium-238	None
5	Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None	5	Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
6	Uranium-234 Uranium-235 Uranium-238	None	6	Uranium-234 Uranium-235 Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Uranium-238	None	1	Uranium-238	None
2	PCB, Total Uranium-234 Uranium-235 Uranium-238	None	2	PCB, Total Uranium-234 Uranium-235 Uranium-238	None
3	Chromium PCB, Total Total PAH Uranium-235 Uranium-238	None	3	Chromium PCB, Total Total PAH Uranium-235 Uranium-238	None
4	Chromium Uranium-238	None	4	Chromium Uranium-238	None
5	Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Uranium	5	Chromium PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
6	Uranium-234 Uranium-235 Uranium-238	None	6	Uranium-234 Uranium-235 Uranium-238	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None

Exhibit D.73. (Continued)

Teen Recreational User (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
2	PCB, Total Uranium-235 Uranium-238	None	2	PCB, Total Uranium-235 Uranium-238	None
3	Total PAH Uranium-238	None	3	Total PAH Uranium-238	None
4	None	None	4	None	None
5	PCB, Total Uranium-238	None	5	PCB, Total Uranium-238	None
6	Uranium-235 Uranium-238	None	6	Uranium-235 Uranium-238	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.73 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.74.

Future Industrial Worker				
EU	ELCR		HI	
1	Uranium-238	1.61E-06	None	
	Cumulative	**1.61E-06**	**Cumulative**	**< 1**
2	PCB, Total	8.42E-06	None	
	Uranium-234	2.82E-06		
	Uranium-235	2.27E-05		
	Uranium-238	3.42E-04		
	Cumulative	**3.76E-04**	**Cumulative**	**< 1**
3	Chromium	1.26E-06	None	
	PCB, Total	1.28E-06		
	Total PAH	3.72E-06		
	Uranium-238	6.41E-06		
	Cumulative	**1.27E-05**	**Cumulative**	**< 1**
4	Chromium	1.32E-06	None	
	Uranium-238	5.07E-06		
	Cumulative	**6.39E-06**	**Cumulative**	**< 1**
5	Chromium	5.07E-06	None	
	PCB, Total	5.06E-06		
	Total PAH	1.19E-06		
	Uranium-235	2.41E-06		
	Uranium-238	3.67E-05		
	Cumulative	**5.04E-05**	**Cumulative**	**< 1**
6	Uranium-234	2.12E-06	None	
	Uranium-235	1.72E-05		
	Uranium-238	2.13E-04		
	Cumulative	**2.32E-04**	**Cumulative**	**< 1**

Exhibit D.74. (Continued)

EU	ELCR		HI	
Outdoor Worker (exposed to surface soil)				
1	Uranium-238	2.33E-06	None	
	Cumulative	**2.33E-06**	**Cumulative**	**< 1**
2	PCB, Total	9.74E-06	None	
	Uranium-234	1.89E-05		
	Uranium-235	1.97E-05		
	Uranium-238	4.95E-04		
	Cumulative	**5.43E-04**	**Cumulative**	**< 1**
3	PCB, Total	1.48E-06	None	
	Total PAH	4.54E-06		
	Uranium-238	9.30E-06		
	Cumulative	**1.53E-05**	**Cumulative**	**< 1**
4	Chromium	1.14E-06	None	
	Uranium-238	1.91E-06		
	Cumulative	**3.05E-06**	**Cumulative**	**< 1**
5	Chromium	3.76E-06	None	
	PCB, Total	5.86E-06		
	Total PAH	1.45E-06		
	Uranium-234	3.03E-06		
	Uranium-235	2.09E-06		
	Uranium-238	5.32E-05		
	Cumulative	**6.94E-05**	**Cumulative**	**< 1**
6	Uranium-234	1.42E-05	None	
	Uranium-235	1.50E-05		
	Uranium-238	3.08E-04		
	Cumulative	**3.37E-04**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.84E-05	None	
	Cesium-137	3.92E-06		
	Chromium	7.72E-06		
	PCB, Total	1.24E-05		
	Uranium-235	1.30E-06		
	Uranium-238	3.77E-05		
	Cumulative	**9.15E-05**	**Cumulative**	**< 1**
2	Cesium-137	3.11E-06	None	
	PCB, Total	9.74E-06		
	Uranium-234	1.89E-05		
	Uranium-235	1.97E-05		
	Uranium-238	4.95E-04		
	Cumulative	**5.47E-04**	**Cumulative**	**< 1**
3	PCB, Total	1.48E-06	None	
	Total PAH	4.54E-06		
	Uranium-238	9.30E-06		
	Cumulative	**1.53E-05**	**Cumulative**	**< 1**

Exhibit D.74. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)				
EU	ELCR		HI	
4	Cesium-137	4.26E-06	None	
	Chromium	1.14E-06		
	Uranium-238	2.06E-06		
	Cumulative	**7.47E-06**	**Cumulative**	**< 1**
5	Cesium-137	3.30E-06	None	
	Chromium	3.76E-06		
	PCB, Total	5.86E-06		
	Total PAH	1.45E-06		
	Uranium-234	3.03E-06		
	Uranium-235	2.09E-06		
	Uranium-238	5.32E-05		
	Cumulative	**7.27E-05**	**Cumulative**	**< 1**
6	Uranium-234	1.42E-05	None	
	Uranium-235	1.50E-05		
	Uranium-238	3.08E-04		
	Cumulative	**3.38E-04**	**Cumulative**	**< 1**
Excavation Worker				
EU	**ELCR**		**HI**	
2	Uranium-238	6.19E-06	None	
	Cumulative	**6.19E-06**	**Cumulative**	**< 1**
6	Uranium-238	3.86E-06	None	
	Cumulative	**3.86E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Uranium-238	7.89E-06	None	
	Cumulative	**7.89E-06**	**Cumulative**	**< 1**
2	PCB, Total	2.48E-05	None	
	Uranium-234	1.11E-05		
	Uranium-235	1.14E-04		
	Uranium-238	1.68E-03		
	Cumulative	**1.83E-03**	**Cumulative**	**< 1**
3	Chromium	2.45E-06	None	
	PCB, Total	3.76E-06		
	Total PAH	1.13E-05		
	Uranium-235	2.07E-06		
	Uranium-238	3.15E-05		
	Cumulative	**5.11E-05**	**Cumulative**	**< 1**
4	Chromium	3.00E-06	None	
	Uranium-238	6.47E-06		
	Cumulative	**9.48E-06**	**Cumulative**	**< 1**
5	Chromium	9.85E-06	None	
	PCB, Total	1.49E-05		
	Total PAH	3.63E-06		
	Uranium-234	1.78E-06		
	Uranium-235	1.21E-05		

Exhibit D.74. (Continued)

Hypothetical Resident (Continued)				
EU	ELCR		HI	
	Uranium-238	1.80E-04		
	Cumulative	**2.23E-04**	**Cumulative**	**< 1**
6	Uranium-234	8.32E-06		
	Uranium-235	8.65E-05		
	Uranium-238	1.05E-03		
	Cumulative	**1.14E-03**	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
2	PCB, Total	5.28E-06	None	
	Uranium-235	4.72E-06		
	Uranium-238	6.79E-05		
	Cumulative	**7.79E-05**	**Cumulative**	**< 1**
3	Total PAH	7.34E-06	None	
	Uranium-238	1.74E-06		
	Cumulative	**9.08E-06**	**Cumulative**	**< 1**
5	PCB, Total	3.18E-06	None	
	Uranium-238	7.29E-06		
	Cumulative	**1.05E-05**	**Cumulative**	**< 1**
6	Uranium-235	3.59E-06	None	
	Uranium-238	4.23E-05		
	Cumulative	**4.59E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs for AOC 562 are the following:

- *Future Industrial Worker:* uranium-238 (ELCR, EU 2 and EU 6)
- *Outdoor Worker (exposed to surface soil):* uranium-238 (ELCR, EU 2 and EU 6)
- *Outdoor Worker (exposed to surface and subsurface soil)* uranium-238 (ELCR, EU 2 and EU 6)
- *Future Hypothetical Residential Receptor:* uranium-235 (ELCR, EU 2) and uranium-238 (ELCR, EU 2, EU 5, and EU 6)

AOC 563, North of Outfall 12, West of LBC Soil Piles 20, BW, and CC in Subunit 4

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for AOC 563 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.75.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Uranium-238	None	1	Chromium PCB, Total Uranium-238	None
2	Cesium-137	None	2	Cesium-137	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Uranium-238	None	1	Chromium PCB, Total Uranium-238	None
2	Cesium-137 Uranium-238	None	2	Cesium-137 Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 Chromium PCB, Total Uranium-238	None	1	Cesium-137 Chromium PCB, Total Uranium-238	None
2	Cesium-137 Uranium-238	None	2	Cesium-137 Uranium-238	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	None	None	2	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Uranium-238	None	1	Chromium PCB, Total Uranium-238	None
2	Cesium-137 Uranium-238	None	2	Cesium-137 Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Uranium-238	None	1	Chromium PCB, Total Uranium-238	None
2	Cesium-137	None	2	Cesium-137	None
	Uranium-238			Uranium-238	

Exhibit D.75. (Continued)

Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total	None	1	Chromium PCB, Total	None
2	Cesium-137	None	2	Cesium-137	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.75 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.76.

Future Industrial Worker				
EU	ELCR		HI	
1	Chromium	9.45E-06	None	
	PCB, Total	3.94E-06		
	Uranium-238	1.62E-06		
	Cumulative	**1.50E-05**	**Cumulative**	**< 1**
2	Cesium-137	7.51E-06	None	
	Cumulative	**7.51E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	6.99E-06	None	
	PCB, Total	4.56E-06		
	Uranium-238	2.35E-06		
	Cumulative	**1.39E-05**	**Cumulative**	**< 1**
2	Cesium-137	5.62E-06	None	
	Uranium-238	1.27E-06		
	Cumulative	**6.89E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Cesium-137	2.50E-06	None	
	Chromium	8.19E-06		
	PCB, Total	2.18E-05		
	Uranium-238	2.52E-06		
	Cumulative	**3.50E-05**	**Cumulative**	**< 1**
2	Cesium-137	5.62E-06	None	
	Uranium-238	1.27E-06		
	Cumulative	**6.89E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	1.83E-05	None	
	PCB, Total	1.16E-05		
	Uranium-238	7.98E-06		
	Cumulative	**3.79E-05**	**Cumulative**	**< 1**

Exhibit D.76.

Hypothetical Resident (Continued)					
EU	ELCR		HI		
2	Cesium-137	3.79E-05	None		
	Uranium-238	4.31E-06			
	Cumulative	**4.22E-05**	**Cumulative**	**< 1**	
Teen Recreational User					
EU	**ELCR**		**HI**		
1	Chromium	1.72E-06	None		
	PCB, Total	2.48E-06			
	Cumulative	**4.20E-06**	**Cumulative**	**< 1**	
2	Cesium-137	1.58E-06	None		
	Cumulative	**1.58E-06**	**Cumulative**	**< 1**	

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for AOC 563.

AOC 564, East of NSDD, North of P, S, and T Landfill Soils Pile AT in Subunit 5

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for AOC 564 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.77.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	None	1	Arsenic	None
	Cesium-137			Cesium-137	
	Chromium			Chromium	
	PCB, Total			PCB, Total	
	Uranium-238			Uranium-238	
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	Arsenic	1	Arsenic	Arsenic
	Cesium-137	Iron		Cesium-137	Iron
	Chromium	Thallium		Chromium	Thallium
	PCB, Total	Uranium[1]		PCB, Total	
	Thorium-230			Thorium-230	
	Uranium-234			Uranium-234	
	Uranium-238			Uranium-238	

Exhibit D.77. (Continued)

Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium PCB, Total Thorium-230 Uranium-234 Uranium-238	Arsenic Iron Thallium Uranium[1]	1	Arsenic Cesium-137 Chromium PCB, Total Thorium-230 Uranium-234 Uranium-238	Arsenic Iron Thallium
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic	None	1	Arsenic	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium PCB, Total Thorium-230 Uranium-234 Uranium-235 Uranium-238	Arsenic[1] Iron[1] Thallium[1] Uranium[1]	1	Arsenic Cesium-137 Chromium PCB, Total Thorium-230 Uranium-234 Uranium-235 Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium PCB, Total Thorium-230 Uranium-234 Uranium-235 Uranium-238	Arsenic Beryllium[1] Iron Mercury[1] Nickel[1] Thallium Uranium Vanadium	1	Arsenic Cesium-137 Chromium PCB, Total Thorium-230 Uranium-234 Uranium-235 Uranium-238	Arsenic Iron Thallium Uranium Vanadium
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 PCB, Total	None	1	Arsenic Cesium-137 PCB, Total	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.77 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.78.

EU	ELCR		HI	
Future Industrial Worker				
1	Arsenic	4.31E-05	None	
	Cesium-137	7.20E-06		
	Chromium	2.48E-06		
	PCB, Total	1.03E-05		
	Uranium-238	4.90E-06		
	Cumulative	**6.80E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Arsenic	1.04E-04	Arsenic	0.65
	Cesium-137	5.38E-06	Iron	0.18
	Chromium	1.84E-06	Thallium	0.10
	PCB, Total	1.19E-05		
	Thorium-230	2.28E-06		
	Uranium-234	2.45E-06		
	Uranium-238	7.10E-06		
	Cumulative	**1.35E-04**	**Cumulative**	**0.93**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	1.04E-04	Arsenic	0.65
	Cesium-137	5.38E-06	Iron	0.18
	Chromium	2.04E-06	Thallium	0.10
	PCB, Total	1.19E-05		
	Thorium-230	2.28E-06		
	Uranium-234	2.45E-06		
	Uranium-238	7.28E-06		
	Cumulative	**1.35E-04**	**Cumulative**	**0.93**
Excavation Worker				
EU	**ELCR**		**HI**	
1	Arsenic	1.30E-06	None	
	Cumulative	**1.30E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Arsenic	1.83E-04	Arsenic	2.62
	Cesium-137	3.63E-05	Iron	0.67
	Chromium	4.82E-06	Thallium	0.38
	PCB, Total	3.02E-05	Uranium	0.25
	Thorium-230	1.40E-06	Vanadium	0.21
	Uranium-234	1.44E-06		
	Uranium-235	4.92E-06		
	Uranium-238	2.41E-05		
	Cumulative	**2.86E-04**	**Cumulative**	**4.13**

Exhibit D.78. (Continued)

Recreational User				
EU	ELCR		HI	
1	Arsenic	2.43E-05	None	
	Cesium-137	1.51E-06		
	PCB, Total	6.46E-06		

EU	ELCR		HI	
	Cumulative	**3.22E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs for AOC 564 are as follows:

- *Outdoor Worker (exposed to surface soil):* arsenic (ELCR)
- *Outdoor Worker (exposed to surface and subsurface soil)* arsenic (ELCR)
- *Future Hypothetical Child Residential Receptor:* arsenic (HI, child) and arsenic (ELCR)

AOC 567, Near Outfall 013 and West of LBC Contaminated Soil Area K013

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for AOC 567 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.79.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	None	None	2	None	None
3	Chromium	None	3	Chromium	None
4	None	None	4	None	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	None	None	2	None	None
3	None	None	3	None	None
4	None	None	4	None	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	None	None	2	None	None
3	Chromium Uranium-238	None	3	Chromium Uranium-238	None
4	Arsenic	None	4	Arsenic	None

Exhibit D.79. (Continued)

Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1–4	None	None	1–4	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	None	None	2	None	None
3	Chromium	None	3	Chromium	None
4	Chromium Uranium-238	None	4	Chromium Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	None	None	2	None	None
3	Chromium	None	3	Chromium	None
4	Chromium Uranium-238	None	4	Chromium Uranium-238	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1–4	None	None	1–4	None	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.79 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.80.

Future Industrial Worker				
EU	ELCR		HI	
3	Chromium	1.26E-06	None	
	Cumulative	**1.26E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
3	Chromium	1.28E-06	None	
	Uranium-238	1.47E-06		
	Cumulative	**2.74E-06**	**Cumulative**	**< 1**
4	Arsenic	2.62E-05	None	
	Cumulative	**2.62E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
3	Chromium	2.44E-06	None	
	Cumulative	**2.44E-06**	**Cumulative**	**< 1**
4	Chromium	1.05E-06	None	
	Uranium-238	3.03E-06		
	Cumulative	**4.08E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for AOC 567.

D.7.4.2.6 Group 3, Scrap Yards

SWMU 14, C-746-E Contaminated Scrap Yard

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 14 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.81.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Technetium-99	None	1	Arsenic Chromium PCB, Total Technetium-99	None
2	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Iron[1] Nickel[1] Uranium[1]	2	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
3	Arsenic Chromium PCB, Total	Iron[1] Mercury[1] Nickel[1] Uranium[1]	3	Arsenic Chromium PCB, Total	None
4	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Iron[1] Nickel[1] Silver[1] Uranium[1]	4	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
5	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Cobalt[1] Iron[1] Mercury[1] Nickel[1] Silver[1] Uranium[1]	5	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	None
6	Chromium Neptunium-237 PCB, Total Uranium-234 Uranium-235 Uranium-238	Antimony[1] Nickel[1] Silver[1] Uranium[1]	6	Chromium Neptunium-237 PCB, Total Uranium-234 Uranium-235 Uranium-238	None

Exhibit D.81. (Continued)

Future Industrial Worker (Continued					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
7	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-235 Uranium-238	Mercury[1] Nickel[1] Uranium[1]	7	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-235 Uranium-238	None
8	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-238	Mercury[1] Nickel[1] Uranium[1]	8	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-238	None
9	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Mercury[1] Nickel[1] Uranium[1]	9	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
10	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Iron[1] Mercury[1] Nickel[1] Uranium[1]	10	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Technetium-99 Uranium-238	None	1	Arsenic Chromium PCB, Total Technetium-99 Uranium-238	None
2	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic[1] Iron[1] Nickel[1] Uranium[1]	2	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	None
3	Arsenic Chromium PCB, Total Uranium-238	Arsenic[1] Iron[1] Mercury[1] Nickel[1] Uranium[1]	3	Arsenic Chromium PCB, Total Uranium-238	None

Exhibit D.81. (Continued)

Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
4	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic Iron Nickel Uranium	4	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Iron Nickel Uranium
5	Arsenic Chromium Neptunium-237 PCB, Total Technetium-99 Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Cobalt Iron Mercury Nickel[1] Uranium	5	Arsenic Chromium Neptunium-237 PCB, Total Technetium-99 Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Cobalt Iron Mercury Uranium
6	Chromium Neptunium-237 PCB, Total Uranium-234 Uranium-235 Uranium-238	Antimony[1] Nickel[1] Uranium[1]	6	Chromium Neptunium-237 PCB, Total Uranium-234 Uranium-235 Uranium-238	None
7	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic[1] Mercury[1] Nickel[1] Uranium[1]	7	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
8	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-238	Arsenic[1] Mercury[1] Nickel[1] Uranium[1]	8	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-238	None
9	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Technetium-99 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Mercury[1] Nickel Uranium	9	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Technetium-99 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Nickel Uranium
10	Arsenic Chromium Neptunium-237 PCB, Total	Arsenic Iron Mercury Nickel	10	Arsenic Chromium Neptunium-237 PCB, Total	Arsenic Iron Mercury Nickel

Exhibit D.81. (Continued)

Outdoor Worker (exposed to surface soil) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Total PAH Uranium-234 Uranium-235 Uranium-238	Uranium		Total PAH Uranium-234 Uranium-235 Uranium-238	Uranium
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Cobalt-60[2] PCB, Total Technetium-99 Uranium-238	Arsenic[1] Iron[1] Nickel[1] Silver[1] Uranium[1]	1	Arsenic Chromium PCB, Total Technetium-99 Uranium-238	None
2	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic Iron Mercury Nickel Uranium	2	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Iron Mercury Nickel Uranium
3	Arsenic Chromium PCB, Total Uranium-234 Uranium-238	Arsenic Cobalt Iron Mercury[1] Nickel Silver[1] Uranium	3	Arsenic Chromium PCB, Total Uranium-234 Uranium-238	Arsenic Cobalt Iron Nickel Uranium
4	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic Cobalt Iron Mercury[1] Nickel Uranium	4	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Cobalt Iron Nickel Uranium
5	Arsenic Chromium Neptunium-237 PCB, Total Technetium-99 Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Cobalt Iron Mercury Nickel[1] Uranium	5	Arsenic Chromium Neptunium-237 PCB, Total Technetium-99 Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Cobalt Iron Mercury Uranium

Exhibit D.81. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
6	Arsenic Chromium Neptunium-237 PCB, Total Uranium-234	Arsenic Nickel Silver[1] Uranium	6	Arsenic Chromium Neptunium-237 PCB, Total Uranium-234	Arsenic Nickel Uranium
	Uranium-235 Uranium-238			Uranium-235 Uranium-238	
7	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic[1] Mercury[1] Nickel[1] Silver[1] Uranium[1]	7	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
8	Arsenic Chromium Neptunium-237 PCB, Total Uranium-238	Arsenic[1] Mercury[1] Nickel[1] Uranium[1]	8	Arsenic Chromium Neptunium-237 PCB, Total Uranium-238	None
9	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Technetium-99 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Mercury[1] Nickel Uranium	9	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Technetium-99 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Nickel Uranium
10	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Iron Mercury Nickel Uranium	10	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Iron Mercury Nickel Uranium
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
2	None	Iron[1] Mercury[1] Nickel[1] Uranium[1]	2	None	None
3	None	Iron[1] Mercury[1] Nickel[1] Uranium[1]	3	None	None

Exhibit D.81. (Continued)

Excavation Worker (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
4	Uranium-238	Mercury[1] Nickel[1] Uranium[1]	4	Uranium-238	None
5	None	Mercury[1] Nickel[1] Uranium[1]	5	None	None
6	None	Nickel[1] Uranium[1]	6	None	None
7	None	Mercury[1] Nickel[1] Uranium[1]	7	None	None
8	None	None	8	None	None
9	Uranium-234 Uranium-235 Uranium-238	Nickel[1] Uranium[1]	9	Uranium-234 Uranium-235 Uranium-238	None
D.7.4.	None	Mercury[1] Nickel[1] Uranium[1]	10	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Americium-241 Arsenic Chromium Neptunium-237 PCB, Total Technetium-99 Uranium-238	Arsenic[1] Iron[1] Nickel[1] Silver[1] Uranium[1]	1	Americium-241 Arsenic Chromium Neptunium-237 PCB, Total Technetium-99 Uranium-238	None
2	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic[1] Iron[1] Nickel[1] Uranium[1]	2	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	None
3	Arsenic Chromium PCB, Total Uranium-238	Arsenic[1] Iron[1] Mercury[1] Nickel Uranium	3	Arsenic Chromium PCB, Total Uranium-238	None
4	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic[1] Iron[1] Nickel[1] Silver[1] Uranium[1]	4	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	None

Exhibit D.81. (Continued)

Hypothetical Resident (adult)[2] (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
5	Arsenic Chromium Neptunium-237 PCB, Total Technetium-99 Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic[1] Cobalt[1] Iron[1] Mercury[1] Nickel[1] Silver[1] Uranium[1]	5	Arsenic Chromium Neptunium-237 PCB, Total Technetium-99 Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	None
6	Chromium Neptunium-237 PCB, Total Uranium-234 Uranium-235 Uranium-238	Antimony[1] Nickel[1] Silver[1] Uranium[1]	6	Chromium Neptunium-237 PCB, Total Uranium-234 Uranium-235 Uranium-238	None
7	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic[1] Mercury[1] Nickel[1] Uranium[1]	7	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None
8	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-235 Uranium-238	Arsenic[1] Mercury[1] Nickel[1] Silver[1] Uranium[1]	8	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-235 Uranium-238	None
9	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Technetium-99 Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic[1] Mercury[1] Nickel[1] Uranium[1]	9	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Technetium-99 Total PAH Uranium-234 Uranium-235 Uranium-238	None
10	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic[1] Iron[1] Mercury[1] Nickel[1] Uranium[1]	10	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	None

Exhibit D.81. (Continued)

Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Americium-241 Arsenic Chromium Neptunium-237 PCB, Total	Arsenic Iron Nickel[1] Silver[1] Uranium	1	Americium-241 Arsenic Chromium Neptunium-237 PCB, Total	Arsenic Iron Uranium
	Technetium-99 Uranium-238			Technetium-99 Uranium-238	
2	Arsenic Chromium Neptunium-237 PCB, Total	Antimony Arsenic Iron Manganese	2	Arsenic Chromium Neptunium-237 PCB, Total	Antimony Arsenic Iron Manganese
	Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Mercury[1] Nickel Uranium		Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Nickel Uranium
3	Arsenic Chromium PCB, Total Uranium-238	Arsenic Iron Manganese Mercury Nickel Uranium	3	Arsenic Chromium PCB, Total Uranium-238	Arsenic Iron Manganese Mercury Nickel Uranium
4	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony Arsenic Copper Iron Mercury[1] Nickel Silver[1] Uranium	4	Arsenic Chromium Neptunium-237 PCB, Total Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony Arsenic Copper Iron Nickel Uranium
5	Arsenic Chromium Neptunium-237 PCB, Total Technetium-99 Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic Cobalt Iron Manganese Mercury Nickel Silver[1] Thallium[1] Uranium	5	Arsenic Chromium Neptunium-237 PCB, Total Technetium-99 Thorium-230 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Cobalt Iron Manganese Mercury Nickel Uranium
6	Chromium Neptunium-237 PCB, Total Uranium-234 Uranium-235 Uranium-238	Antimony[1] Chromium[1] Mercury[1] Nickel Silver[1] Uranium	6	Chromium Neptunium-237 PCB, Total Uranium-234 Uranium-235 Uranium-238	Nickel Uranium

Exhibit D.81. (Continued)

Hypothetical Resident (child) (Continued)[2]					
Initial COCs			Initial COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
7	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic Mercury Nickel Uranium	7	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Mercury Nickel Uranium
8	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-235 Uranium-238	Antimony[1] Arsenic Mercury Nickel Silver[1] Uranium	8	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-235 Uranium-238	Arsenic Mercury Nickel Uranium
9	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Technetium-99 Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic Mercury[1] Nickel Uranium	9	Arsenic Cesium-137 Chromium Neptunium-237 PCB, Total Technetium-99 Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Nickel Uranium
10	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Antimony[1] Arsenic Iron Mercury Nickel Uranium	10	Arsenic Chromium Neptunium-237 PCB, Total Total PAH Uranium-234 Uranium-235 Uranium-238	Arsenic Iron Mercury Nickel Uranium

Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic PCB, Total	None	1	Arsenic PCB, Total	None
2	Arsenic PCB, Total Total PAH Uranium-235 Uranium-238	Antimony[1] Arsenic[1] Iron[1] Nickel[1] Uranium[1]	2	Arsenic PCB, Total Total PAH Uranium-235 Uranium-238	None
3	Arsenic PCB, Total	Iron[1] Mercury[1] Nickel[1] Uranium[1]	3	Arsenic PCB, Total	None

Exhibit D.81. (Continued)

Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
4	Arsenic	Antimony[1]	4	Arsenic	None
	Neptunium-237	Iron[1]		Neptunium-237	
	PCB, Total	Nickel[1]		PCB, Total	
	Total PAH	Silver[1]		Total PAH	
	Uranium-235	Uranium[1]		Uranium-235	
	Uranium-238			Uranium-238	
5	Arsenic	Antimony[1]	5	Arsenic	None
	Neptunium-237	Cobalt[1]		Neptunium-237	
	PCB, Total	Iron[1]		PCB, Total	
	Total PAH	Mercury[1]		Total PAH	
	Uranium-235	Nickel[1]		Uranium-235	
	Uranium-238	Silver[1]		Uranium-238	
		Uranium[1]			
6	Chromium	Antimony[1]	6	Chromium	None
	Neptunium-237	Nickel[1]		Neptunium-237	
	PCB, Total	Silver[1]		PCB, Total	
	Uranium-235	Uranium[1]		Uranium-235	
	Uranium-238			Uranium-238	
7	Arsenic	Mercury[1]	7	Arsenic	None
	Neptunium-237	Nickel[1]		Neptunium-237	
	PCB, Total	Uranium[1]		PCB, Total	
	Uranium-238			Uranium-238	
8	Arsenic	Mercury[1]	8	Arsenic	None
	PCB, Total	Nickel[1]		PCB, Total	
		Silver[1]			
		Uranium[1]			
9	Arsenic	Antimony[1]	9	Arsenic	None
	Cesium-137	Arsenic[1]		Cesium-137	
	Neptunium-237	Mercury[1]		Neptunium-237	
	PCB, Total	Nickel[1]		PCB, Total	
	Total PAH	Uranium[1]		Total PAH	
	Uranium-234			Uranium-234	
	Uranium-235			Uranium-235	
	Uranium-238			Uranium-238	
10	Arsenic	Iron[1]	10	Arsenic	None
	Neptunium-237	Mercury[1]		Neptunium-237	
	PCB, Total	Nickel[1]		PCB, Total	
	Total PAH	Uranium[1]		Total PAH	
	Uranium-238			Uranium-238	

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] COC was removed after evaluation as described below.
[3] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cobalt-60, though reported in SWMU 14 analyses, was reported with values below the laboratory's MDA. Cobalt-60, therefore, is not considered a COC.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.81 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.82.

Future Industrial Worker				
EU	ELCR		HI	
1	Arsenic	1.10E-05	None	
	Chromium	2.11E-06		
	PCB, Total	2.66E-06		
	Technetium-99	1.12E-06		
	Cumulative	**1.69E-05**	**Cumulative**	**< 1**
2	Arsenic	1.46E-05	None	
	Chromium	2.21E-06		
	Neptunium-237	2.84E-06		
	PCB, Total	2.08E-06		
	Total PAH	5.71E-06		
	Uranium-234	1.71E-06		
	Uranium-235	5.06E-06		
	Uranium-238	3.30E-05		
	Cumulative	**6.72E-05**	**Cumulative**	**< 1**
3	Arsenic	1.30E-05	None	
	Chromium	2.32E-06		
	PCB, Total	4.61E-05		
	Cumulative	**6.14E-05**	**Cumulative**	**< 1**
4	Arsenic	1.33E-05	None	
	Chromium	2.39E-06		
	Neptunium-237	9.89E-06		
	PCB, Total	3.52E-05		
	Total PAH	4.24E-06		
	Uranium-234	5.97E-06		
	Uranium-235	2.03E-05		
	Uranium-238	9.94E-05		
	Cumulative	**1.91E-04**	**Cumulative**	**< 1**
5	Arsenic	1.31E-05	None	
	Chromium	1.56E-06		
	Neptunium-237	6.42E-06		
	PCB, Total	5.33E-06		
	Thorium-230	1.01E-06		
	Total PAH	2.04E-06		
	Uranium-234	2.76E-06		
	Uranium-235	8.43E-06		
	Uranium-238	5.54E-05		
	Cumulative	**9.61E-05**	**Cumulative**	**< 1**
6	Chromium	1.48E-05	None	
	Neptunium-237	9.78E-06		
	PCB, Total	2.66E-05		
	Uranium-234	1.80E-06		
	Uranium-235	5.75E-06		
	Uranium-238	2.99E-05		
	Cumulative	**8.86E-05**	**Cumulative**	**< 1**

Exhibit D.82. (Continued)

Future Industrial Worker (Continued				
EU	ELCR		HI	
7	Arsenic	1.13E-05	None	
	Chromium	2.14E-06		
	Neptunium-237	5.50E-06		
	PCB, Total	4.05E-05		
	Total PAH	1.07E-06		
	Uranium-235	2.43E-06		
	Uranium-238	1.25E-05		
	Cumulative	**7.55E-05**	**Cumulative**	**< 1**
8	Arsenic	1.14E-05	None	
	Chromium	1.53E-06		
	Neptunium-237	3.25E-06		
	PCB, Total	2.66E-05		
	Total PAH	1.06E-06		
	Uranium-238	3.48E-06		
	Cumulative	**4.74E-05**	**Cumulative**	**< 1**
9	Arsenic	1.41E-05	None	
	Cesium-137	5.26E-06		
	Chromium	1.54E-06		
	Neptunium-237	4.03E-05		
Future Industrial Worker (Continued)				
EU	ELCR		HI	
	PCB, Total	3.65E-05		
	Total PAH	8.23E-06		
	Uranium-234	4.40E-05		
	Uranium-235	1.38E-04		
	Uranium-238	7.06E-04		
	Cumulative	**9.94E-04**	**Cumulative**	**< 1**
10	Arsenic	1.13E-05	None	
	Chromium	1.39E-06		
	Neptunium-237	9.74E-06		
	PCB, Total	5.00E-05		
	Total PAH	4.59E-06		
	Uranium-234	1.28E-06		
	Uranium-235	4.46E-06		
	Uranium-238	2.41E-05		
	Cumulative	**1.07E-04**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Arsenic	2.65E-05	None	
	Chromium	1.56E-06		
	PCB, Total	3.08E-06		
	Technetium-99	7.02E-06		
	Uranium-238	1.44E-06		
	Cumulative	**3.96E-05**	**Cumulative**	**< 1**

Exhibit D.82. (Continued)

Outdoor Worker (exposed to surface soil) (Continued)				
EU	ELCR		HI	
2	Arsenic	3.50E-05	None	
	Chromium	1.63E-06		
	Neptunium-237	2.35E-06		
	PCB, Total	2.41E-06		
	Thorium-230	2.72E-06		
	Total PAH	6.97E-06		
	Uranium-234	1.14E-05		
	Uranium-235	4.40E-06		
	Uranium-238	4.78E-05		
	Cumulative	**1.15E-04**	**Cumulative**	**< 1**
3	Arsenic	3.13E-05	None	
	Chromium	1.72E-06		
	PCB, Total	5.33E-05		
	Uranium-238	1.28E-06		
	Cumulative	**8.76E-05**	**Cumulative**	**< 1**
4	Arsenic	3.20E-05	Arsenic	0.20
	Chromium	1.77E-06	Iron	0.19
	Neptunium-237	8.18E-06	Nickel	0.13
	PCB, Total	4.07E-05	Uranium	0.43
	Thorium-230	3.79E-06		
	Total PAH	5.17E-06		
	Uranium-234	3.99E-05		
	Uranium-235	1.76E-05		
	Uranium-238	1.44E-04		
	Cumulative	**2.93E-04**	**Cumulative**	**0.96**
5	Arsenic	3.15E-05	Arsenic	0.20
	Chromium	1.15E-06	Cobalt	0.16
	Neptunium-237	5.31E-06	Iron	0.19
	PCB, Total	6.17E-06	Mercury	0.13
	Technetium-99	1.75E-06	Uranium	0.30
	Thorium-230	6.33E-06		
	Total PAH	2.49E-06		
	Uranium-234	1.84E-05		
	Uranium-235	7.32E-06		
	Uranium-238	8.03E-05		
	Cumulative	**1.61E-04**	**Cumulative**	**0.99**
6	Chromium	1.09E-05	None	
	Neptunium-237	8.09E-06		
	PCB, Total	3.08E-05		
	Uranium-234	1.20E-05		
	Uranium-235	4.99E-06		
	Uranium-238	4.33E-05		
	Cumulative	**1.10E-04**	**Cumulative**	**< 1**

Exhibit D.82. (Continued)

EU	ELCR		HI	
Outdoor Worker (exposed to surface soil) (Continued)				
7	Arsenic	2.72E-05	None	
	Chromium	1.58E-06		
	Neptunium-237	4.55E-06		
	PCB, Total	4.69E-05		
	Total PAH	1.30E-06		
	Uranium-234	4.52E-06		
	Uranium-235	2.11E-06		
	Uranium-238	1.82E-05		
	Cumulative	**1.06E-04**	**Cumulative**	**< 1**
8	Arsenic	2.74E-05	None	
	Chromium	1.13E-06		
	Neptunium-237	2.69E-06		
	PCB, Total	3.08E-05		
	Total PAH	1.29E-06		
	Uranium-238	5.05E-06		
	Cumulative	**6.84E-05**	**Cumulative**	**< 1**
9	Arsenic	3.38E-05	Arsenic	0.21
	Cesium-137	3.93E-06	Nickel	0.17
	Chromium	1.14E-06	Uranium	1.70
	Neptunium-237	3.34E-05		
	PCB, Total	4.22E-05		
	Technetium-99	3.39E-06		
	Total PAH	1.00E-05		
	Uranium-234	2.94E-04		
	Uranium-235	1.20E-04		
	Uranium-238	1.02E-03		
	Cumulative	**1.57E-03**	**Cumulative**	**2.08**
10	Arsenic	2.71E-05	Arsenic	0.17
	Chromium	1.03E-06	Iron	0.14
	Neptunium-237	8.06E-06	Mercury	0.29
	PCB, Total	5.79E-05	Nickel	0.11
	Total PAH	5.60E-06	Uranium	0.33
	Uranium-234	8.55E-06		
	Uranium-235	3.87E-06		
	Uranium-238	3.49E-05		
	Cumulative	**1.47E-04**	**Cumulative**	**1.04**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.71E-05	None	
	Chromium	1.61E-06		
	PCB, Total	3.08E-06		
	Technetium-99	7.02E-06		
	Uranium-238	5.32E-06		
	Cumulative	**4.41E-05**	**Cumulative**	**< 1**

Exhibit D.82. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)				
EU	ELCR		HI	
	Cumulative	**2.48E-04**	**Cumulative**	**1.12**
2	Arsenic	3.55E-05	Arsenic	0.22
	Chromium	1.77E-06	Iron	0.22
	Neptunium-237	5.18E-06	Mercury	0.10
	PCB, Total	3.08E-05	Nickel	0.15
	Thorium-230	3.51E-06	Uranium	0.42
	Total PAH	4.76E-06		
	Uranium-234	1.70E-05		
	Uranium-235	7.50E-06		
	Uranium-238	7.64E-05		
	Cumulative	**1.82E-04**	**Cumulative**	**1.12**
3	Arsenic	4.59E-05	Arsenic	0.29
	Chromium	1.72E-06	Cobalt	0.19
	PCB, Total	5.40E-05	Iron	0.23
	Uranium-234	1.56E-06	Nickel	0.12
	Uranium-238	9.21E-06	Uranium	0.25
	Cumulative	**1.12E-04**	**Cumulative**	**1.08**
4	Arsenic	3.00E-05	Arsenic	0.19
	Chromium	1.39E-06	Cobalt	0.17
	Neptunium-237	6.20E-06	Iron	0.19
	PCB, Total	5.11E-05	Nickel	0.13
	Thorium-230	2.47E-06	Uranium	0.43
	Total PAH	3.90E-06		
	Uranium-234	3.04E-05		
	Uranium-235	1.34E-05		
	Uranium-238	1.10E-04		
5	Arsenic	3.05E-05	Arsenic	0.19
	Chromium	1.15E-06	Cobalt	0.13
	Neptunium-237	5.31E-06	Iron	0.20
	PCB, Total	4.71E-05	Mercury	0.13
	Technetium-99	1.35E-06	Uranium	0.30
	Thorium-230	4.96E-06		
	Total PAH	1.95E-06		
	Uranium-234	1.42E-05		
	Uranium-235	5.65E-06		
	Uranium-238	6.19E-05		
	Cumulative	**1.74E-04**	**Cumulative**	**0.95**
6	Arsenic	2.53E-05	Arsenic	0.16
	Chromium	1.08E-05	Nickel	0.18
	Neptunium-237	6.22E-06	Uranium	0.67
	PCB, Total	3.08E-05		
	Uranium-234	9.16E-06		
	Uranium-235	3.93E-06		
	Uranium-238	3.51E-05		

Exhibit D.82. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)				
EU	ELCR		HI	
	Cumulative	**1.21E-04**	**Cumulative**	**1.00**
7	Arsenic	2.71E-05	None	
	Chromium	1.58E-06		
	Neptunium-237	3.54E-06		
	PCB, Total	4.69E-05		
	Total PAH	1.01E-06		
	Uranium-234	3.48E-06		
	Uranium-235	1.60E-06		
	Uranium-238	1.37E-05		
	Cumulative	**9.89E-05**	**Cumulative**	**< 1**
8	Arsenic	2.94E-05	None	
	Chromium	1.26E-06		
	Neptunium-237	2.07E-06		
	PCB, Total	3.08E-05		
	Uranium-238	3.38E-06		
	Cumulative	**6.69E-05**	**Cumulative**	**< 1**
9	Arsenic	3.35E-05	Arsenic	0.21
	Cesium-137	3.93E-06	Nickel	0.17
	Chromium	1.14E-06	Uranium	1.70
	Neptunium-237	3.34E-05		
	PCB, Total	4.22E-05		
	Technetium-99	3.39E-06		
	Total PAH	1.00E-05		
	Uranium-234	2.94E-04		
	Uranium-235	1.20E-04		
	Uranium-238	1.02E-03		
	Cumulative	**1.56E-03**	**Cumulative**	**2.08**
10	Arsenic	2.77E-05	Arsenic	0.17
	Chromium	1.10E-06	Iron	0.13
	Neptunium-237	6.24E-06	Mercury	0.29
	PCB, Total	5.75E-05	Nickel	0.11
	Total PAH	4.33E-06	Uranium	0.32
	Uranium-234	6.78E-06		
	Uranium-235	3.07E-06		
	Uranium-238	2.29E-05		
	Cumulative	**1.30E-04**	**Cumulative**	**1.03**
Excavation Worker				
EU	**ELCR**		**HI**	
4	Uranium-238	1.37E-06	None	
	Cumulative	**1.37E-06**	**Cumulative**	**< 1**
9	Uranium-234	3.67E-06	None	
	Uranium-235	1.50E-06		
	Uranium-238	1.28E-05		
	Cumulative	**1.80E-05**	**Cumulative**	**< 1**

Exhibit D.82. (Continued)

Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Americium-241	1.16E-06	Arsenic	0.67
	Arsenic	4.66E-05	Iron	0.34
	Chromium	4.09E-06	Uranium	0.31
	Neptunium-237	3.96E-06		
	PCB, Total	7.83E-06		
	Technetium-99	4.68E-06		
	Uranium-238	4.88E-06		
	Cumulative	**7.32E-05**	**Cumulative**	**1.32**
2	Arsenic	6.17E-05	Antimony	0.12
	Chromium	4.28E-06	Arsenic	0.88
	Neptunium-237	1.43E-05	Iron	0.68
	PCB, Total	6.11E-06	Manganese	0.27
	Thorium-230	1.67E-06	Nickel	0.47
	Total PAH	1.74E-05	Uranium	1.25
	Uranium-234	6.72E-06		
	Uranium-235	2.54E-05		
	Uranium-238	1.62E-04		
	Cumulative	**3.00E-04**	**Cumulative**	**3.68**
3	Arsenic	5.51E-05	Arsenic	0.79
	Chromium	4.51E-06	Iron	0.64
	PCB, Total	1.35E-04	Manganese	0.20
	Uranium-238	4.34E-06	Mercury	0.32
			Nickel	0.40
			Uranium	0.93
	Cumulative	**1.99E-04**	**Cumulative**	**3.27**
4	Arsenic	5.64E-05	Antimony	0.14
	Chromium	4.63E-06	Arsenic	0.81
	Neptunium-237	4.97E-05	Copper	0.11
	PCB, Total	1.04E-04	Iron	0.71
	Thorium-230	2.33E-06	Nickel	0.51
	Total PAH	1.29E-05	Uranium	1.59
	Uranium-234	2.34E-05		
	Uranium-235	1.02E-04		
	Uranium-238	4.88E-04		
	Cumulative	**8.43E-04**	**Cumulative**	**3.86**
5	Arsenic	5.55E-05	Arsenic	0.80
	Chromium	3.02E-06	Cobalt	0.61
	Neptunium-237	3.22E-05	Iron	0.72
	PCB, Total	1.57E-05	Manganese	0.16
	Technetium-99	1.16E-06	Mercury	0.47
	Thorium-230	3.89E-06	Nickel	0.32
	Total PAH	6.22E-06	Uranium	1.12
	Uranium-234	1.08E-05		
	Uranium-235	4.23E-05		
	Uranium-238	2.72E-04		
	Cumulative	**4.43E-04**	**Cumulative**	**4.18**

Exhibit D.82. (Continued)

Hypothetical Resident (Continued)				
EU	ELCR		HI	
6	Chromium	2.87E-05	Nickel	0.67
	Neptunium-237	4.91E-05	Uranium	2.48
	PCB, Total	7.83E-05		
	Uranium-234	7.07E-06		
	Uranium-235	2.88E-05		
	Uranium-238	1.47E-04		
	Cumulative	**3.39E-04**	**Cumulative**	**3.14**
7	Arsenic	4.80E-05	Arsenic	0.69
	Chromium	4.15E-06	Mercury	0.33
	Neptunium-237	2.76E-05	Nickel	0.85
	PCB, Total	1.19E-04	Uranium	1.42
	Total PAH	3.25E-06		
	Uranium-234	2.66E-06		
	Uranium-235	1.22E-05		
	Uranium-238	6.16E-05		
	Cumulative	**2.79E-04**	**Cumulative**	**3.29**
8	Arsenic	4.83E-05	Arsenic	0.69
	Chromium	2.96E-06	Mercury	0.34
	Neptunium-237	1.63E-05	Nickel	0.47
	PCB, Total	7.83E-05	Uranium	1.43
	Total PAH	3.23E-06		
	Uranium-235	3.02E-06		
	Uranium-238	1.71E-05		
	Cumulative	**1.69E-04**	**Cumulative**	**2.93**
9	Arsenic	5.96E-05	Arsenic	0.85
	Cesium-137	2.65E-05	Nickel	0.65
	Chromium	2.99E-06	Uranium	6.26
	Neptunium-237	2.03E-04		
	PCB, Total	1.07E-04		
	Technetium-99	2.26E-06		
	Total PAH	2.51E-05		
	Uranium-234	1.73E-04		
	Uranium-235	6.93E-04		
	Uranium-238	3.47E-03		
	Cumulative	**4.76E-03**	**Cumulative**	**7.77**
10	Arsenic	4.77E-05	Arsenic	0.68
	Chromium	2.69E-06	Iron	0.50
	Neptunium-237	4.89E-05	Mercury	1.07
	PCB, Total	1.47E-04	Nickel	0.42
	Total PAH	1.40E-05	Uranium	1.23
	Uranium-234	5.02E-06		
	Uranium-235	2.24E-05		
	Uranium-238	1.18E-04		
	Cumulative	**4.06E-04**	**Cumulative**	**3.90**

Exhibit D.82. (Continued)

Teen Recreational User				
EU	**ELCR**		**HI**	
1	Arsenic	6.19E-06	None	
	PCB, Total	1.67E-06		**< 1**
	Cumulative	**7.87E-06**	**Cumulative**	**< 1**
2	Arsenic	8.20E-06	None	
	PCB, Total	1.30E-06		
	Total PAH	3.76E-06		
	Uranium-235	1.05E-06		
	Uranium-238	6.56E-06		
	Cumulative	**2.09E-05**	**Cumulative**	**< 1**
3	Arsenic	7.32E-06	None	
	PCB, Total	2.89E-05		
	Cumulative	**3.62E-05**	**Cumulative**	**< 1**
4	Arsenic	7.49E-06	None	
	Neptunium-237	2.06E-06		
	PCB, Total	2.21E-05		
	Total PAH	2.79E-06		
	Uranium-235	4.21E-06		
	Uranium-238	1.98E-05		
	Cumulative	**5.84E-05**	**Cumulative**	**< 1**
5	Arsenic	7.38E-06	None	
	Neptunium-237	1.34E-06		
	PCB, Total	3.34E-06		
	Total PAH	1.35E-06		
	Uranium-235	1.75E-06		
	Uranium-238	1.10E-05		
	Cumulative	**2.62E-05**	**Cumulative**	**< 1**
6	Chromium	2.69E-06	None	
	Neptunium-237	2.04E-06		
	PCB, Total	1.67E-05		
	Uranium-235	1.20E-06		
	Uranium-238	5.94E-06		
	Cumulative	**2.86E-05**	**Cumulative**	**< 1**
7	Arsenic	6.38E-06	None	
	Neptunium-237	1.15E-06		
	PCB, Total	2.54E-05		
	Uranium-238	2.49E-06		
	Cumulative	**3.54E-05**	**Cumulative**	**< 1**
8	Arsenic	6.42E-06	None	
	PCB, Total	1.67E-05		
	Cumulative	**2.31E-05**	**Cumulative**	**< 1**
9	Arsenic	7.92E-06	None	
	Cesium-137	1.10E-06		
	Neptunium-237	8.41E-06		
	PCB, Total	2.29E-05		
	Total PAH	5.42E-06		

Exhibit D.82. (Continued)

Teen Recreational User (Continued)				
EU	ELCR		HI	
	Uranium-234	5.02E-06		
	Uranium-235	2.87E-05		
	Uranium-238	1.40E-04		
	Cumulative	**2.20E-04**	**Cumulative**	**< 1**
10	Arsenic	6.34E-06	None	
	Neptunium-237	2.03E-06		
	PCB, Total	3.14E-05		
	Total PAH	3.02E-06		
	Uranium-238	4.78E-06		
	Cumulative	**4.75E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs for SWMU 14 include the following:

- *Future Industrial Worker:* uranium-235 (ELCR, EU 9) and uranium-238 (ELCR, EU 9)
- *Outdoor Worker (exposed to surface soil):* uranium (HI, EU 9) and uranium-234 (ELCR, EU 9); uranium-235 (ELCR, EU 9); and uranium-238 (ELCR, EU 4 and EU 9)
- *Outdoor Worker (exposed to surface and subsurface soil):* uranium (HI, EU 9) and uranium-234 (ELCR, EU 9); uranium-235 (ELCR, EU 9); and uranium-238 (ELCR, EU 4 and EU 9)
- *Future Hypothetical Residential Receptor:* mercury (HI, child—EU 10), uranium (HI, child—EU 2, EU 4, EU 5, EU 6, EU 7, EU 8, EU 9, EU 10) and neptunium-237 (ELCR, EU 9); Total PCBs (ELCR; EU 3, EU 4, EU 7, EU 9, and EU 10); uranium-234 (ELCR, EU 9); uranium-235 (ELCR, EU 4 and EU 9); and uranium-238 (ELCR; EU 2, EU 4, EU 5, EU 6, EU 9, and EU 10)
- *Teen Recreational User:* uranium-238 (ELCR, EU 9)

Groundwater COCs are identified for SWMU 14 as presented in Section D.7.4.3.

SWMU 518, C-746-P1 Field south of C-746—P1 Clean Scrap Yard

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 518 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.83.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH	None	1	PCB, Total Total PAH	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH Uranium-238	None	1	PCB, Total Total PAH Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic PCB, Total Total PAH Uranium-238	None	1	Arsenic PCB, Total Total PAH Uranium-238	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Carbazole PCB, Total Total PAH Uranium-238	None	1	Carbazole PCB, Total Total PAH Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Carbazole PCB, Total Total PAH Uranium-238	Cobalt Nickel[1] Uranium	1	Carbazole PCB, Total Total PAH Uranium-238	Cobalt Uranium
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH	None	1	PCB, Total Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.83 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.84.

Future Industrial Worker				
EU	ELCR		HI	
1	PCB, Total	3.36E-06	None	
	Total PAH	6.58E-04		
	Cumulative	**6.61E-04**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	PCB, Total	3.89E-06	None	
	Total PAH	8.03E-04		
	Uranium-238	1.29E-06		
	Cumulative	**8.08E-04**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	1.55E-05	None	
	PCB, Total	3.89E-06		
	Total PAH	8.03E-04		
	Uranium-238	1.29E-06		
	Cumulative	**8.24E-04**	**Cumulative**	**< 1**
Excavation Worker				
EU	**ELCR**		**HI**	
4	Total PAH	1.00E-05	None	
	Cumulative	**1.00E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Carbazole	1.35E-06	Cobalt	0.30
	PCB, Total	9.87E-06	Uranium	0.93
	Total PAH	2.00E-03		
	Uranium-238	4.38E-06		
	Cumulative	**2.02E-03**	**Cumulative**	**1.23**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	PCB, Total	2.11E-06	None	
	Total PAH	4.33E-04		**< 1**
	Cumulative	**4.35E-04**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

Priority COCs for SWMU 518 include the following:

- *Future Industrial Worker:* Total PAH (ELCR)
- *Outdoor Worker (exposed to surface soil):* Total PAH (ELCR)
- *Outdoor Worker (exposed to surface and subsurface soil):* Total PAH (ELCR)
- *Future Hypothetical Residential Receptor:* Total PAH (ELCR)
- *Teen Recreational User:* Total PAH (ELCR)

SWMU 520, C-746-A Scrap Material West of C-746-A

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 520 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.85.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 Chromium Neptunium-237 Uranium-238	Mercury[1] Nickel[1] Silver[1]	1	Cesium-137 Chromium Neptunium-237 Uranium-238	None
2	Chromium Total PAH Uranium-238	Mercury[1] Nickel[1]	2	Chromium Total PAH Uranium-238	None
Future Industrial Worker (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
3	Chromium Total PAH	None	3	Chromium Total PAH	None
4	Chromium Neptunium-237 Total PAH Uranium-238	Mercury[1] Nickel[1]	4	Chromium Neptunium-237 Total PAH Uranium-238	None
5	Chromium Total PAH	None	5	Chromium Total PAH	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 Neptunium-237 Thorium-230 Uranium-238	Iron[1] Mercury[1] Nickel[1]	1	Cesium-137 Neptunium-237 Thorium-230 Uranium-238	None
2	Chromium Total PAH Uranium-238	Mercury[1] Nickel[1]	2	Chromium Total PAH Uranium-238	None
3	Total PAH Uranium-238	None	3	Total PAH Uranium-238	None
4	Neptunium-237 Total PAH Uranium-238	Mercury[1] Nickel[1]	4	Neptunium-237 Total PAH Uranium-238	None
5	Total PAH Uranium-238	None	5	Total PAH Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Cesium-137 Chromium Neptunium-237	Arsenic[1] Cobalt[1] Iron[1] Mercury[1]	1	Arsenic Cesium-137 Chromium Neptunium-237	None

Exhibit D.85. (Continued)

Outdoor Worker (exposed to surface and subsurface soil) (Continued)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Thorium-230 Uranium-238	Nickel[1] Silver[1]		Thorium-230 Uranium-238	
2	Arsenic Chromium Radium-226 Total PAH Uranium-238	Arsenic[1] Mercury[1] Nickel[1]	2	Arsenic Chromium Radium-226 Total PAH Uranium-238	None
3	Arsenic Chromium Total PAH Uranium-238	Arsenic[1] Mercury[1] Nickel[1]	3	Arsenic Chromium Total PAH Uranium-238	None
4	Arsenic Chromium Neptunium-237 Total PAH Uranium-238	Arsenic[1] Iron[1] Mercury[1] Nickel[1]	4	Arsenic Chromium Neptunium-237 Total PAH Uranium-238	None
5	Arsenic Chromium Total PAH Uranium-238	Arsenic[1] Iron[1] Mercury[1] Nickel[1]	5	Arsenic Chromium Total PAH Uranium-238	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1–5	None	None	1–5	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 Chromium Neptunium-237 Thorium-230 Total PAH Uranium-235 Uranium-238	Iron[1] Mercury[1] Nickel[1] Silver[1]	1	Cesium-137 Chromium Neptunium-237 Thorium-230 Total PAH Uranium-235 Uranium-238	None
2	Chromium Neptunium-237 Total PAH Uranium-238	Mercury[1] Nickel[1]	2	Chromium Neptunium-237 Total PAH Uranium-238	None
3	Chromium Total PAH Uranium-238	Nickel[1] Silver[1]	3	Chromium Total PAH Uranium-238	None
4	Chromium Neptunium-237 Total PAH Uranium-235 Uranium-238	Mercury[1] Nickel[1] Silver[1]	4	Chromium Neptunium-237 Total PAH Uranium-235 Uranium-238	None
5	Chromium Neptunium-237 Total PAH	None	5	Chromium Neptunium-237 Total PAH	None

Exhibit D.85. (Continued)

Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Uranium-238			Uranium-238	
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137 Chromium Neptunium-237 Thorium-230 Total PAH Uranium-235 Uranium-238	Iron Mercury Nickel Silver[1] Uranium[1]	1	Cesium-137 Chromium Neptunium-237 Thorium-230 Total PAH Uranium-235 Uranium-238	Iron Mercury Nickel
2	Chromium Neptunium-237 Total PAH Uranium-238	Manganese Mercury Nickel Uranium	2	Chromium Neptunium-237 Total PAH Uranium-238	Manganese Mercury Nickel Uranium
3	Chromium Total PAH Uranium-238	Nickel[1] Silver[1] Uranium[1]	3	Chromium Total PAH Uranium-238	None
4	Chromium Neptunium-237 Total PAH Uranium-235 Uranium-238	Mercury[1] Nickel[1] Silver[1] Uranium[1]	4	Chromium Neptunium-237 Total PAH Uranium-235 Uranium-238	None
5	Chromium Neptunium-237 Total PAH Uranium-238	Antimony[1] Nickel[1]	5	Chromium Neptunium-237 Total PAH Uranium-238	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	Mercury[1] Nickel[1] Silver[1]	1	Cesium-137	None
2	Total PAH	Mercury[1] Nickel[1]	2	Total PAH	None
3	Total PAH	Nickel[1] Silver[1]	3	Total PAH	None
4	Total PAH	Mercury[1] Nickel[1] Silver[1]	4	Total PAH	None
5	Total PAH	None	5	Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.85 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.86.

Future Industrial Worker				
EU	ELCR		HI	
1	Cesium-137	1.12E-05	None	
	Chromium	1.05E-06		
	Neptunium-237	2.42E-06		
	Uranium-238	2.31E-06		
	Cumulative	**1.70E-05**	**Cumulative**	**< 1**
2	Chromium	2.21E-06	None	
	Total PAH	5.35E-06		
	Uranium-238	1.05E-06		
	Cumulative	**8.61E-06**	**Cumulative**	**< 1**
3	Chromium	1.32E-06	None	
	Total PAH	1.99E-06		
	Cumulative	**3.31E-06**	**Cumulative**	**< 1**
4	Chromium	1.27E-06	None	
	Neptunium-237	2.73E-06		
	Total PAH	9.33E-06		
	Uranium-238	3.68E-06		
	Cumulative	**1.70E-05**	**Cumulative**	**< 1**
5	Chromium	1.22E-06	None	
	Total PAH	6.54E-06		
	Cumulative	**7.76E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Cesium-137	8.35E-06	None	
	Neptunium-237	2.00E-06		
	Thorium-230	5.16E-06		
	Uranium-238	3.35E-06		
	Cumulative	**1.89E-05**	**Cumulative**	**< 1**
2	Chromium	1.63E-06	None	
	Total PAH	6.53E-06		
	Uranium-238	1.52E-06		
	Cumulative	**9.69E-06**	**Cumulative**	**< 1**
3	Chromium	2.43E-06	None	
	Total PAH	1.34E-06		
	Cumulative	**3.77E-06**	**Cumulative**	**< 1**
4	Neptunium-237	2.26E-06	None	
	Total PAH	1.14E-05		
	Uranium-238	5.34E-06		
	Cumulative	**1.90E-05**	**Cumulative**	**< 1**
5	Total PAH	7.98E-06	None	
	Uranium-238	1.24E-06		
	Cumulative	**9.22E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.13E-05	None	
	Cesium-137	7.40E-06		
	Chromium	1.46E-06		

Exhibit D.86 (Continued)

EU	ELCR		HI	
Outdoor Worker (exposed to surface and subsurface soil)				
	Neptunium-237	1.64E-06		
	Thorium-230	4.65E-06		
	Uranium-238	3.15E-06		
	Cumulative	**3.96E-05**	**Cumulative**	**< 1**
2	Arsenic	2.38E-05	None	
	Chromium	1.63E-06		
	Radium-226	4.73E-05		
	Total PAH	5.22E-06		
	Uranium-238	1.34E-06		
	Cumulative	**7.93E-05**	**Cumulative**	**< 1**
3	Arsenic	2.52E-05	None	
	Chromium	1.61E-06		
	Total PAH	1.53E-06		
	Uranium-238	1.14E-06		
	Cumulative	**2.94E-05**	**Cumulative**	**< 1**
4	Arsenic	2.25E-05	None	
	Chromium	1.62E-06		
	Neptunium-237	2.26E-06		
	Total PAH	1.14E-05		
	Uranium-238	5.34E-06		
	Cumulative	**4.31E-05**	**Cumulative**	**< 1**
5	Arsenic	2.40E-05	None	
	Chromium	1.21E-06		
	Total PAH	7.98E-06		
	Uranium-238	1.24E-06		
	Cumulative	**3.44E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Cesium-137	5.63E-05	Iron	0.28
	Chromium	2.04E-06	Mercury	0.46
	Neptunium-237	1.22E-05	Nickel	0.18
	Thorium-230	3.17E-06		
	Total PAH	1.64E-06		
	Uranium-235	1.60E-06		
	Uranium-238	1.14E-05		
	Cumulative	**8.82E-05**	**Cumulative**	**0.92**
2	Chromium	4.29E-06	Manganese	0.11
	Neptunium-237	1.39E-06	Mercury	0.51
	Total PAH	1.63E-05	Nickel	0.22
	Uranium-238	5.14E-06	Uranium	0.17
	Cumulative	**2.71E-05**	**Cumulative**	**1.01**
3	Chromium	2.55E-06	None	
	Total PAH	6.08E-06		
	Uranium-238	4.54E-06		
	Cumulative	**1.32E-05**	**Cumulative**	**< 1**
4	Chromium	2.46E-06	None	
	Neptunium-237	1.37E-05		

Exhibit D.86 (Continued)

	Total PAH	2.84E-05		
	Uranium-235	3.07E-06		
	Uranium-238	1.81E-05		
	Cumulative	**6.58E-05**	**Cumulative**	**< 1**
5	Chromium	2.37E-06	None	
	Neptunium-237	2.87E-06		
	Total PAH	1.99E-05		
	Uranium-238	4.19E-06		
	Cumulative	**2.94E-05**	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Cesium-137	2.34E-06	None	
	Cumulative	**2.34E-06**	**Cumulative**	**< 1**
2	Total PAH	3.53E-06	None	
	Cumulative	**3.53E-06**	**Cumulative**	**< 1**
3	Total PAH	1.31E-06	None	
	Cumulative	**1.31E-06**	**Cumulative**	**< 1**
4	Total PAH	6.14E-06	None	
	Cumulative	**6.14E-06**	**Cumulative**	**< 1**
5	Total PAH	4.31E-06	None	
	Cumulative	**4.31E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 520.

D.7.4.3.1 Group 3, PCBs

SWMUs 57 and 81, C-541-A PCB Waste Staging Area and C-541 PCB Spill Site

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 81 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.87.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Total PAH Uranium-238	Mercury[1] Nickel[1] Uranium	1	Arsenic Chromium PCB, Total Total PAH Uranium-238	Uranium
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total	Arsenic Mercury[1] Nickel[1]	1	Arsenic Chromium PCB, Total	Arsenic Uranium

Exhibit D.87 (Continued)

EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
	Total PAH Uranium-238	Uranium		Total PAH Uranium-238	
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Total PAH Uranium-238	Arsenic Cobalt Mercury[1] Nickel[1] Uranium	1	Arsenic Chromium PCB, Total Total PAH Uranium-238	Arsenic Cobalt Uranium
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total	Mercury[1] Uranium	1	PCB, Total	Uranium
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Total PAH Uranium-238	Arsenic Mercury[1] Nickel[1] Uranium	1	Arsenic Chromium PCB, Total Total PAH Uranium-238	Arsenic Uranium
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Total PAH Uranium-238	Aluminum Arsenic Mercury Nickel[1] Silver[1] Uranium	1	Arsenic Chromium PCB, Total Total PAH Uranium-238	Aluminum Arsenic Mercury Uranium
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic PCB, Total Total PAH	Mercury[1] Nickel[1] Uranium[1]	1	Arsenic PCB, Total Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.87 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.88.

EU	ELCR		HI	
Future Industrial Worker				
1	Arsenic	1.03E-05	Uranium	1.08
	Chromium	2.86E-06		
	PCB, Total	8.51E-04		
	Total PAH	9.34E-06		
	Uranium-238	1.34E-06		
	Cumulative	**8.75E-04**	**Cumulative**	**1.08**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Arsenic	2.47E-05	Arsenic	0.15
	Chromium	2.11E-06	Uranium	7.55
	PCB, Total	9.85E-04		
	Total PAH	1.14E-05		
	Uranium-238	1.95E-06		
	Cumulative	**1.03E-03**	**Cumulative**	**7.7**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.68E-05	Arsenic	0.17
	Chromium	1.56E-06	Cobalt	0.19
	PCB, Total	9.85E-04	Uranium	7.55
	Total PAH	1.02E-05		
	Uranium-238	1.95E-06		
	Cumulative	**1.03E-03**	**Cumulative**	**7.90**
Excavation Worker				
EU	**ELCR**		**HI**	
1	PCB, Total	1.23E-05	Uranium	2.36
	Cumulative	**1.23E-05**	**Cumulative**	**2.36**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Arsenic	4.35E-05	Aluminum	0.13
	Chromium	5.54E-06	Arsenic	0.62
	PCB, Total	2.50E-03	Mercury	0.36
	Total PAH	2.84E-05	Uranium	27.81
	Uranium-238	6.60E-06		
	Cumulative	**2.59E-03**	**Cumulative**	**28.92**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Arsenic	5.78E-06	None	
	PCB, Total	5.34E-04		
	Total PAH	6.15E-06		
	Cumulative	**5.46E-04**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

As discussed in Chapter 11, an uncertainty exists in using the historical uranium data for SWMUs 57/81. Historical samples were analyzed using a radionuclide method and converted to a concentration for uranium metal. These results appear to show uranium at a higher level than would be expected at this site.

The historical uranium metal results have remained in the BHHRA, but should be noted that these results may overstate the actual risks at this site.

Priority COCs for SWMU 81 include the following:

- *Future Industrial Worker:* uranium (HI) and Total PCBs (ELCR)
- *Outdoor Worker (exposed to surface soil):* uranium (HI) and Total PCBs (ELCR)
- *Outdoor Worker (exposed to surface and subsurface soil):* uranium (HI) and Total PCBs (ELCR)
- *Excavation Worker:* uranium (HI)
- *Future Hypothetical Residential Receptor:* uranium (HI) and Total PCBs (ELCR)
- *Teen Recreational User:* Total PCBs (ELCR)

SWMU 153, C-331 PCB Soil Contamination (West)

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 153 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.89.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH	None	1	PCB, Total Total PAH	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH	None	1	PCB, Total Total PAH	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Total PAH	None	1	Arsenic Chromium PCB, Total Total PAH	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH	None	1	PCB, Total Total PAH	None

Exhibit D.89. (Continued)

Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total Total PAH	None	1	PCB, Total Total PAH	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total	None	1	PCB, Total	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.89 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.90.

Future Industrial Worker				
EU	ELCR		HI	
1	PCB, Total	2.71E-06	None	
	Total PAH	1.47E-06		
	Cumulative	**4.18E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	PCB, Total	3.14E-06	None	
	Total PAH	1.79E-06		
	Cumulative	**4.93E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.39E-05	None	
	Chromium	1.62E-06		
	PCB, Total	3.70E-06		
	Total PAH	1.51E-06		
	Cumulative	**3.07E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	PCB, Total	7.97E-06	None	
	Total PAH	4.47E-06		
	Cumulative	**1.24E-05**	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	PCB, Total	1.70E-06	None	
	Cumulative	**1.70E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 153.

SWMU 156, C-310 PCB Soil Contamination (West Side)

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 156 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.91.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-238	Manganese[1] Mercury[1] Nickel[1]	1	Chromium PCB, Total Total PAH Uranium-238	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-238	Manganese[1] Mercury[1] Nickel[1]	1	Chromium PCB, Total Total PAH Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium PCB, Total Total PAH Uranium-238	Arsenic[1] Cobalt[1] Manganese[1] Mercury[1] Nickel[1]	1	Arsenic Chromium PCB, Total Total PAH Uranium-238	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-238	Manganese[1] Mercury[1] Nickel[1]	1	Chromium PCB, Total Total PAH Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium PCB, Total Total PAH Uranium-238	Manganese Mercury Nickel[1] Uranium[1]	1	Chromium PCB, Total Total PAH Uranium-238	Manganese Mercury
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	PCB, Total	Mercury[1] Nickel[1]	1	PCB, Total	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.91 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.92.

Future Industrial Worker				
EU	ELCR		HI	
1	Chromium	1.62E-06	None	
	PCB, Total	1.60E-06		
	Total PAH	1.40E-06		
	Uranium-238	1.29E-06		
	Cumulative	**5.91E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	1.20E-06	None	
	PCB, Total	1.85E-06		
	Total PAH	1.70E-06		
	Uranium-238	1.87E-06		
	Cumulative	**6.62E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.68E-05	None	
	Chromium	1.55E-06		
	PCB, Total	1.85E-06		
	Total PAH	1.70E-06		
	Uranium-238	1.87E-06		
	Cumulative	**3.37E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	3.15E-06	Manganese	0.53
	PCB, Total	4.70E-06	Mercury	0.42
	Total PAH	4.25E-06		
	Uranium-238	6.33E-06		
	Cumulative	**1.84E-05**	**Cumulative**	**0.95**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	PCB, Total	1.00E-06	None	
	Cumulative	**1.00E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 156.

SWMU 160, C-745 Cylinder Yard Spoils (PCB soils)

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 160 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.93.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Total PAH	None	1	Arsenic Chromium Total PAH	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.93 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.94.

Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Total PAH	1.09E-06	None	
	Cumulative	**1.09E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	1.98E-05	None	
	Chromium	1.13E-06		
	Total PAH	2.11E-06		
	Cumulative	**2.31E-05**	**Cumulative**	**< 1**

Exhibit D.94. (Continued)

Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Total PAH	2.72E-06	None	
	Cumulative	**2.72E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 160.

SWMU 163, C-304 Building/HVAC Piping System (Soil Backfill)

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 163 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.95.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH	None	1	Chromium Total PAH	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH	None	1	Chromium Total PAH	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Arsenic Chromium Total PAH	Arsenic[1] Mercury[1] Nickel[1]	1	Arsenic Chromium Total PAH	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH	None	1	Chromium Total PAH	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Chromium Total PAH	None	1	Chromium Total PAH	None

Exhibit D.95. (Continued)

Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Total PAH	None	1	Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.95 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.96.

EU	ELCR		HI	
Future Industrial Worker				
1	Chromium	1.64E-06	None	
	Total PAH	2.75E-06		
	Cumulative	**4.39E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Chromium	1.21E-06	None	
	Total PAH	3.36E-06		
	Cumulative	**4.57E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.41E-05	None	
	Chromium	1.44E-06		
	Total PAH	2.21E-06		
	Cumulative	**2.77E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Chromium	3.18E-06	None	
	Total PAH	8.39E-06		
	Cumulative	**1.16E-05**	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Total PAH	1.81E-06	None	
	Cumulative	**1.81E-06**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 163.

SWMU 219, C-728 OS-08

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 219 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.97.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Neptunium-237 Total PAH Uranium-238	None	1	Neptunium-237 Total PAH Uranium-238	None
Outdoor Worker (exposed to surface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs

Exhibit D.97 (Continued)

1	Neptunium-237 Total PAH Uranium-238	None	1	Neptunium-237 Total PAH Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Neptunium-237 Total PAH Uranium-238	None	1	Neptunium-237 Total PAH Uranium-238	None
Excavation Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Neptunium-237 Total PAH Uranium-235 Uranium-238	None	1	Neptunium-237 Total PAH Uranium-235 Uranium-238	None
Hypothetical Resident (child)[2]					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Neptunium-237 Total PAH Uranium-235 Uranium-238	None	1	Neptunium-237 Total PAH Uranium-235 Uranium-238	None
Teen Recreational User					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	None	None	1	None	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.97 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.98.

Future Industrial Worker				
EU	ELCR		HI	
1	Neptunium-237	1.22E-06	None	
	Total PAH	1.27E-06		
	Uranium-238	2.59E-06		
	Cumulative	**5.08E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Neptunium-237	1.01E-06	None	
	Total PAH	1.55E-06		
	Uranium-238	3.75E-06		
	Cumulative	**6.31E-06**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Neptunium-237	1.01E-06	None	
	Total PAH	1.55E-06		
	Uranium-238	3.75E-06		
	Cumulative	**6.31E-06**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Neptunium-237	6.13E-06	None	
	Total PAH	3.86E-06		
	Uranium-235	2.44E-06		
	Uranium-238	1.27E-05		
	Cumulative	**2.51E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

There are no priority COCs for SWMU 219.

SWMU 488, C-410 Trailers PCB Contamination Area by C-410 Trailer Complex

As calculated and shown in Attachments D6 and D8, COCs for all exposure scenarios for SWMU 488 include those listed below, as well as the final COC determination and the reason for excluding the initial COC.

Exhibit D.99.

Future Industrial Worker					
Initial COCs			Final COCs		
EU	Cancerous COCs	Noncancerous COCs	EU	Cancerous COCs	Noncancerous COCs
1	Cesium-137	None	1	Cesium-137	None
	PCB, Total			PCB, Total	
	Total PAH			Total PAH	
	Uranium-238			Uranium-238	

Exhibit D.99 (Continued)

EU	Initial Cancerous COCs	Initial Noncancerous COCs	EU	Final Cancerous COCs	Final Noncancerous COCs
Outdoor Worker (exposed to surface soil)					
1	Cesium-137 PCB, Total Total PAH Uranium-238	None	1	Cesium-137 PCB, Total Total PAH Uranium-238	None
Outdoor Worker (exposed to surface and subsurface soil)					
1	Arsenic Cesium-137 Chromium PCB, Total Total PAH Uranium-238	None	1	Arsenic Cesium-137 Chromium PCB, Total Total PAH Uranium-238	None
Excavation Worker					
1	None	None	1	None	None
Hypothetical Resident (adult)[2]					
1	Cesium-137 PCB, Total Total PAH Uranium-235 Uranium-238	None	1	Cesium-137 PCB, Total Total PAH Uranium-235 Uranium-238	None
Hypothetical Resident (child)[2]					
1	Cesium-137 PCB, Total Total PAH Uranium-235 Uranium-238	None	1	Cesium-137 PCB, Total Total PAH Uranium-235 Uranium-238	None
Teen Recreational User					
1	Cesium-137 PCB, Total Total PAH	None	1	Cesium-137 PCB, Total Total PAH	None

[1] COC was removed after alternative evaluation approach for dermal absorption of metals as described in Section D.6.5.
[2] ELCR for hypothetical adult and child resident are the combined lifetime scenario.

Cumulative ELCR/HI. Considering only the COCs determined above in Exhibit D.99 and HQ and ELCR values shown in Attachment D8, cumulative ELCR and HI are as follows:

Exhibit D.100.

EU	ELCR		HI	
Future Industrial Worker				
1	Cesium-137	6.04E-06	None	
	PCB, Total	5.49E-05		
	Total PAH	4.22E-06		
	Uranium-238	2.67E-06		
	Cumulative	**6.78E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface soil)				
EU	ELCR		HI	
1	Cesium-137	4.51E-06	None	
	PCB, Total	6.35E-05		
	Total PAH	5.15E-06		
	Uranium-238	3.87E-06		
	Cumulative	**7.71E-05**	**Cumulative**	**< 1**
Outdoor Worker (exposed to surface and subsurface soil)				
EU	ELCR		HI	
1	Arsenic	2.14E-05	None	
	Cesium-137	4.51E-06		
	Chromium	1.30E-06		
	PCB, Total	6.35E-05		
	Total PAH	5.15E-06		
	Uranium-238	3.87E-06		
	Cumulative	**9.98E-05**	**Cumulative**	**< 1**
Hypothetical Resident				
EU	ELCR[1]		HI[2]	
1	Cesium-137	3.04E-05	None	
	PCB, Total	1.61E-04		
	Total PAH	1.28E-05		
	Uranium-235	1.89E-06		
	Uranium-238	1.31E-05		
	Cumulative	**2.20E-04**	**Cumulative**	**< 1**
Teen Recreational User				
EU	**ELCR**		**HI**	
1	Cesium-137	1.27E-06	None	
	PCB, Total	3.45E-05		
	Total PAH	2.78E-06		
	Cumulative	**3.85E-05**	**Cumulative**	**< 1**

[1] ELCR for hypothetical adult and child resident are the combined lifetime scenario.
[2] HI for hypothetical resident is based on the child resident scenario.

The only priority COC for SWMU 488 is the following:

- *Future Hypothetical Residential Receptor:* Total PCBs (ELCR)

D.7.4.4 Contaminants of Concern for Soils Potentially Contributing to Groundwater Contamination

Similarly for soil potentially contributing to groundwater contamination, to determine whether modeled concentrations of contaminants are of concern, quantitative risk and hazard results over all pathways were compared to risk and hazard benchmarks for land use scenarios of concern. The benchmarks used for this comparison were HI ≥ 0.1 and/or ELCR ≥ 1×10^{-6} for ELCR.

"Priority COCs" are identified in this section as an aid to risk managers during decision making.

There were no priority COCs identified above in this risk assessment are based on the modeled groundwater concentrations at all POEs.

D.7.4.5 Pathways of Concern

Each of the pathways included in the BHHRA is a POC.

D.7.4.6 Media of Concern

Media of concern are those media that appear in at least one POC. Because they contribute to at least one POC, soil is a media of concern at all SWMUs/AOCs.

D.7.5 OBSERVATIONS

Consistent with regulatory guidance and agreements contained in the Risk Methods Document (DOE 2011a), this BHHRA presents ELCRs and HIs for land use scenarios representing current use, as well as several hypothetical future uses. Risk evaluation of surface soil was conducted for all SWMUs/AOCs as part of the evaluation of the scenarios specified in the work plan. The scenarios described in the BHHRA are as follows:

- Current industrial use (site maintenance)—direct contact with surface soil (soil 0 to 1 ft bgs).
- Future on-site industrial use—direct contact with surface soil (soil 0 to 1 ft bgs).
- Future on-site excavation worker—direct contact with surface and subsurface soil (soil 0 to 16 ft bgs).
- Future on-site rural resident—direct contact with surface soil (soil 0 to 1 ft bgs) and use of groundwater drawn from the RGA at source areas.

Specific observations for this BHHRA are presented in Tables D.40a and D.40b.

Table D.40a. Summary of Direct Contact Risks for the Soils OU SWMUs/AOCs

		Direct Contact*		
SWMU	**Scenario**	**Total HI**	**Total ELCR**	**Total Dose (mrem)**
Former Facilities				
1	Industrial Worker (Future)	< 1	***1.8E-04***	1.15
99	Teen Recreational User	< 1	< 1E-06	< 0.1
194	Teen Recreational User	< 1	**3.7E-05**	0.15
196	Industrial Worker (Future)	< 1	**2.2E-05**	0.14
489	Industrial Worker (Future)	< 1	**3.6E-06**	< 0.1
531	Industrial Worker (Future)	< 1	**5.2E-05**	0.15
Storage Areas				
200	Industrial Worker (Future)	< 1	**2.5E-05**	0.51
212	Industrial Worker (Future)	< 1	**6.1E-05**	3.73
213	Industrial Worker (Future)	< 1	**6.3E-06**	< 0.1

Table D.40a. Summary of Direct Contact Risks for the Soils OU SWMUs/AOCs (Continued)

SWMU	Scenario	Direct Contact* Total HI	Total ELCR	Total Dose (mrem)
Storage Areas (Continued)				
214	Industrial Worker (Future)	< 1	<1E-06	n/a[1]
215	Industrial Worker (Future)	< 1	**3.3E-06**	n/a[1]
216	Industrial Worker (Future)	< 1	**4.1E-06**	< 0.1
217	Industrial Worker (Future)	< 1	**2.3E-05**	< 0.1
221	Industrial Worker (Future)	< 1	**2.3E-05**	< 0.1
222	Industrial Worker (Future)	< 1	**2.6E-05**	0.85
227	Industrial Worker (Future)	< 1	**6.8E-05**	2.34
228	Industrial Worker (Future)	< 1	**1.3E-05**	0.37
Underground/Tanks				
27	Industrial Worker (Future)	n/a[2]	n/a[2]	n/a[2]
76	Industrial Worker (Future)	< 1	**3.2E-05**	< 0.1
165	Industrial Worker (Future)	< 1	***2.3E-04***	5.26
170	Industrial Worker (Future)	< 1	1.3E-06	0.08
Chromium Areas				
158	Industrial Worker (Future)	< 1	**2.1E-05**	0.16
169	Industrial Worker (Future)	< 1	***1.6E-04***	0.38
Soils/Rubble Piles				
19	Industrial Worker (Future)	< 1	**8.8E-05**	n/a[1]
138	Industrial Worker (Future)	< 1	**1.7E-05**	n/a[1]
180	Teen Recreational User	< 1	**4.3E-05**	n/a[1]
181	Teen Recreational User	< 1	< 1E-06	n/a[1]
195	Teen Recreational User	< 1	**9.3E-06**	< 0.1
486	Teen Recreational User	< 1	**4.2E-06**	0.37
487	Teen Recreational User	< 1	**3.4E-06**	0.30
492	Teen Recreational User	< 1	***2.1E-04***	5.14
493	Industrial Worker (Future)	< 1	**1.7E-05**	0.29
517	Industrial Worker (Future)	< 1	**1.1E-05**	0.46
541	Teen Recreational User	< 1	***3.6E-04***	13.83
561	Teen Recreational User	< 1	***1.4E-04***	5.51
562	Teen Recreational User	< 1	**7.8E-05**	7.75
563	Teen Recreational User	< 1	**4.5E-06**	0.16
564	Teen Recreational User	< 1	**3.4E-05**	0.27
567	Teen Recreational User	< 1	< 1E-06	< 0.1
Scrap Yards				
14	Industrial Worker (Future)	< 1	***9.9E-04***	19.41
518	Industrial Worker (Future)	< 1	***6.6E-04***	< 0.1
520	Industrial Worker (Future)	< 1	**1.9E-05**	0.34

Table D.40a. Summary of Direct Contact Risks for the Soils OU SWMUs/AOCs (Continued)

SWMU	Scenario	Direct Contact* Total HI	Direct Contact* Total ELCR	Direct Contact* Total Dose (mrem)
PCB Areas				
57/81	Industrial Worker (Future)	**1.17**	***8.8E-04***	< 0.1
153	Industrial Worker (Future)	< 1	**4.2E-06**	n/a[1]
156	Industrial Worker (Future)	< 1	**5.9E-06**	< 0.1
160	Industrial Worker (Future)	< 1	< 1E-06	n/a[1]
163	Industrial Worker (Future)	< 1	**4.4E-06**	n/a[1]
219	Industrial Worker (Future)	< 1	**5.6E-06**	< 0.1
488	Industrial Worker (Future)	< 1	**6.8E-05**	0.18

For each SWMU, the total HI, total ELCR, and total Dose from the EU showing the highest result is presented.
Bold indicates total HI > 1 or total ELCR > 1E-6; ***bold italics*** indicates total ELCR > 1E-4.
n/a[1] = Total dose was not assessed because there were no radiological COPCs for the SWMU.
n/a[2] = SWMU is gravel-covered and no surface soil samples are available to characterize risk for direct contact to the industrial worker
*For direct contact, future industrial worker for SWMUs/AOCs inside the limited area and the teen recreational user for SWMUs/AOCs outside the industrial area are presented. Total HI and Total ELCR represent the cumulative value across all exposure routes assessed within this BHHRA (i.e., incidental ingestion, dermal contact, inhalation, and external exposure).
Only total dose above 0.1 mrem is summarized.

Table D.40b. Summary of RGA Groundwater Risks for the Soils OU SWMUs/AOCs

SWMU	Scenario	RGA Groundwater Exposure* Total HI	RGA Groundwater Exposure* Total ELCR
14	Adult Resident	n/a	**7.85E-05**

For the SWMU, the ELCR for the modeled groundwater concentrations from above the SWMU is presented.
Bold indicates ELCR > 1E-6; ***bold italics*** indicates ELCR > 1E-4.
n/a = no risks/hazards are applicable for the SWMU.
*For RGA groundwater exposure, ingestion, dermal exposure, inhalation through showering, and inhalation through household use is included. The adult resident is presented because it has the greater risk.

D.8. REMEDIAL GOAL OPTIONS

This section presents RGOs for the COCs identified in this BHHRA and the methods used to calculate the RGOs. These RGOs should not be interpreted as being clean-up goals, but as risk-based values that may be used to guide the development of clean-up goals by risk managers. Cleanup goals will be determined in later decision documents.

RGOs were calculated for each COC based on targets presented in the Risk Methods Document (DOE 2011a) and consistent with EPA guidance (EPA 1995). Target risks for the RGOs were 1E-4, 1E-5, and 1E-6. Target hazards were 0.1, 1, and 3. Additionally for dose, RGOs were calculated for 1, 15, and 25 mrem/yr, based on benchmarks presented in the Risk Methods Document (DOE 2011a). When calculating the HI-based RGOs, the more conservative child-based values are reported.

D.8.1 CALCULATION OF RGOS

EPA guidance (EPA 1991) directs that RGOs are to be calculated for all COCs identified in a BHHRA. The COCs identified in this risk assessment and their RGOs are presented in Tables D.41 and D.42. These COCs were calculated using the following equation.

$$\frac{\textbf{Concentration}}{\textbf{Risk}} = \frac{\textbf{RGO}}{\textbf{Target Risk}}$$

where:

Concentration is the exposure concentration for the medium.
Risk is the risk posed by exposure to the contaminated medium.
RGO is the remedial goal option.
Target Risk is one of the values listed in Tables D.41 and D.42.

D.8.2 PRESENTATION OF RGOS

The equation developed in the previous subsection was applied for each soil and groundwater COC. The RGOs developed for all COCs using this equation are presented in Table D.41. Grayed cells in Table D.41 indicate the EPC value is higher than the RGO value or an RGO value is not applicable. RGOs for Dose are presented in Table D.42.

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APPENDIX E

SCREENING ECOLOGICAL RISK ASSESSMENT

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CONTENTS

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FIGURES

TABLES

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ACRONYMS

AOC	area of concern
COPEC	chemical of potential ecological concern
CSM	conceptual site model
DMSA	DOE Material Storage Area
DOE	U.S. Department of Energy
EPC	exposure point concentration
ESV	ecological screening value
GDP	gaseous diffusion plant
HI	hazard index
HQ	hazard quotient
KPDES	Kentucky Pollutant Discharge Elimination System
NFA	no further action
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PGDP	Paducah Gaseous Diffusion Plant
RCW	recirculating water
RI	remedial investigation
SERA	screening ecological risk assessment
SVOC	semivolatile organic compound
SWMU	solid waste management unit
VOC	volatile organic compound
WAG	waste area group
WKWMA	West Kentucky Wildlife Management Area

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E.1. INTRODUCTION

E.1.1 SITE LOCATION

This appendix provides the results of the screening ecological risk assessments (SERAs) completed for Soils Operable Unit (OU) solid waste management units (SWMUs)/areas of concern (AOCs) at the Paducah Gaseous Diffusion Plant (PGDP) (Figure E.1). Some of the area surrounding the PGDP facility is a recreational wildlife area, the West Kentucky Wildlife Management Area (WKWMA), with residential areas lying beyond the WKWMA. Private land in rural residential and agricultural areas also borders the PGDP facility.

E.1.2 SITE HISTORY

All the SWMUs/AOCs considered in the SERAs are described in-depth in Chapters 5-11 of this Remedial Investigation (RI) Report. The Soils OU SWMUs and AOCs were divided into seven divisions, which are, in turn, divided into three groups. Each of the groups and divisions is listed below. These groups are divisions of the SWMUs/AOCs developed with agreement of the regulatory agencies during work plan development. Use of these divisions simplifies the reporting of RI results because the types and locations of contamination found at SWMUs/AOCs within each division are expected to be similar.

- Group 1, Former Facility Areas
- Group 1, Storage Areas
- Group 2, Underground Tanks
- Group 2, Chromium Areas
- Group 2, Soil/Rubble Areas
- Group 3, Scrap Yards
- Group 3, Polychlorinated Biphenyl (PCB) Areas

E.2. PROBLEM FORMULATION

The first step in a SERA includes the problem formulation. This step encompasses development of the preliminary conceptual site model (CSM), determination of potentially complete exposure pathways and potentially contaminated media, selection of exposure endpoints, and selection of screening levels protective of the endpoints and potentially exposed receptors at the site.

E.2.1 PRELIMINARY CONCEPTUAL SITE MODEL

The preliminary CSM includes a description of the environmental setting, known site contaminants, and a figure (Figure E.2) representing the potential exposure pathways. This preliminary CSM is used as the basis for selection of benchmark values used to screen the site for potential ecological risk. Screening values are discussed in Section E.3.

E-10

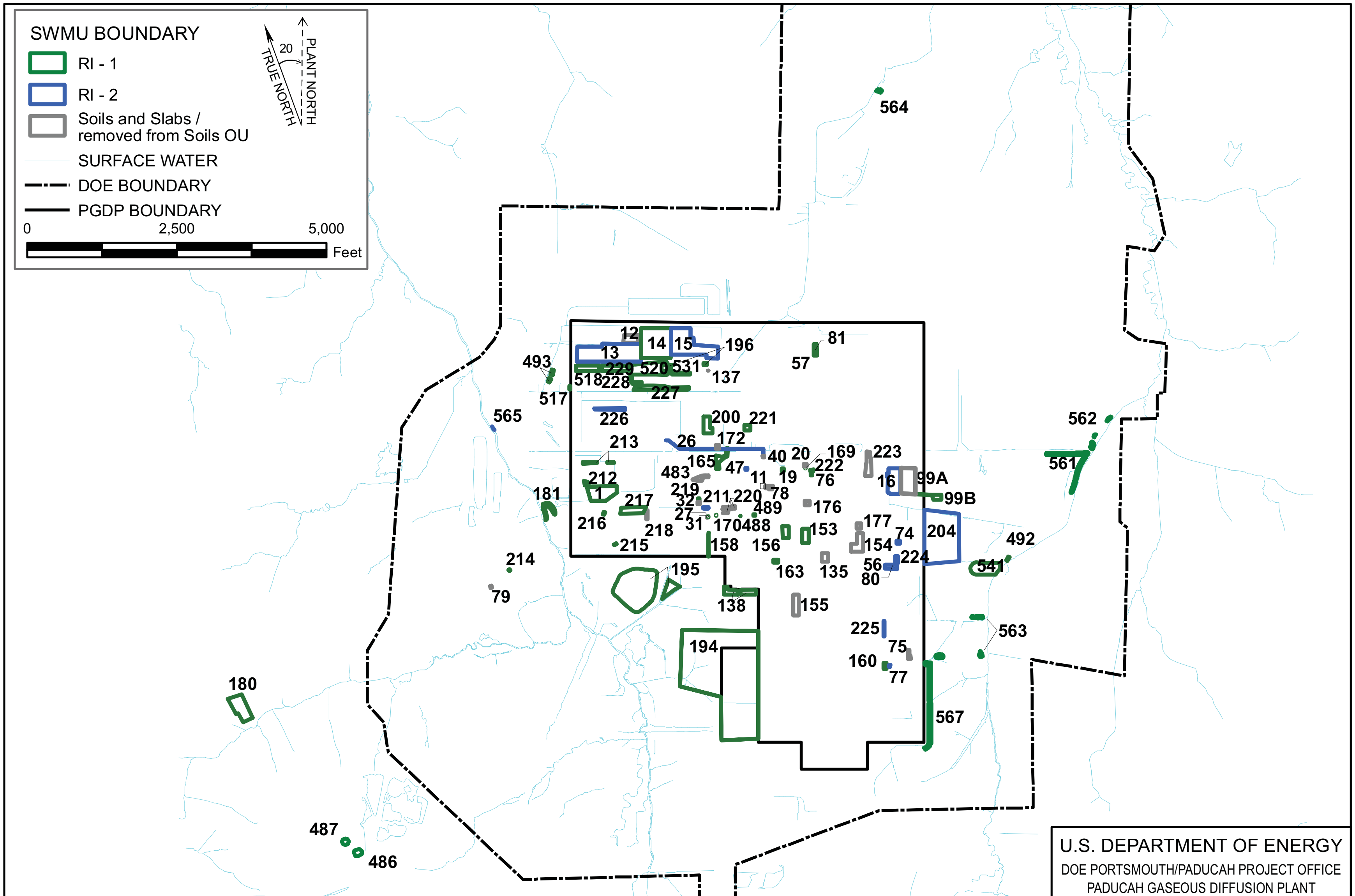

Figure E.1. Location of the Soils OU SWMUs/AOCs

LATA Environmental Services of Kentucky, LLC

6/26/2012 SoilsOU\RI Report\RI D2\01-02AllSWMUsbyRI.mxd

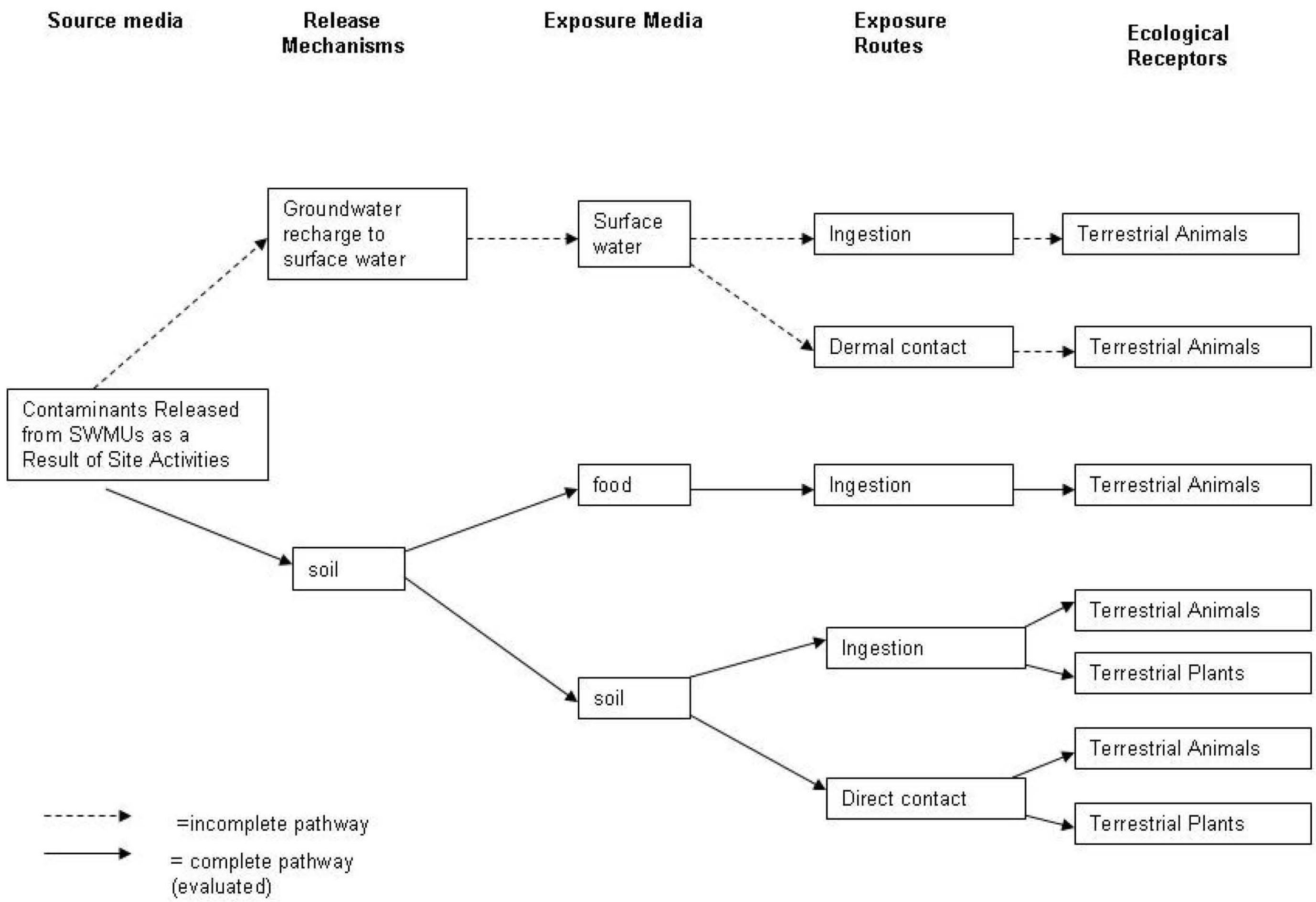

Figure E.2. Preliminary Conceptual Site Model for Soils OU SWMUs

E.2.1.1 Site Environmental Setting and Habitat Descriptions

The SWMUs located inside the limited area are generally similar in topography and process history and the SWMUs/AOCs located outside the limited area also are generally similar in topography and process history. Although there is potential for contamination below the surface to migrate laterally toward surface water, the direction of shallow groundwater flow is primarily downward and represents limited risks to terrestrial receptors near these sites. This section presents a brief summary of the ecosystem relevant to defining the CSM and exposure pathways. Table E.1 and the text below lists the Soils OU SWMU/AOCs along with each ground cover and proximity to surface water/drainageways. Attachment E1 contains photos of the Soils OU SWMUs/AOCs.

The human health and ecological risk assessments utilized acreage for a SWMU based on GPS coordinates and mapping tools. This acreage is reflected in the figures within this document. Of note, the acreage presented in the Background sections of this document may be inconsistent with acreage utilized in the risk assessments due to its being based on historical SAR administrative boundaries, which typically were estimated utilizing a map/figure.

The primary ecosystem in the area outside the industrial area around the SWMUs/AOCs is upland grassland interspersed with developed industrial areas. The vegetation over these SWMUs/AOCs is maintained with routine mowing (see Section 3.1) approximately eight times per year. Most of the SWMUs/AOCs also are surrounded by fencing and/or roads. The buffer area and areas bordering the PGDP facility include forest, thickets, and agricultural land. Much of the PGDP facility is surrounded by the WKWMA, which includes managed native prairie and deciduous forest. Species documented to occur in the area include numerous small mammals, particularly shrews, mice, and voles. Numerous bird species, including doves, turkey, quail, bluebirds and other songbirds, as well as hawks and owls, are found in this area. There also are amphibians, reptiles (primarily lizards and turtles), and bats. Table E.2 lists species observed in the nonindustrial areas of the PGDP and at the adjacent WKWMA.

A number of state and federal listed, threatened, and endangered species may be present on the buffer areas within PGDP and the surrounding WKWMA land, though they are unlikely to be found on the maintained surface within the SWMUs/AOCs (DOE 2008). These species are listed in Table E.2 of this document. As noted in the footnote to Table E.3, none of the species listed in the table have been reported as sighted on the U.S. Department of Energy (DOE) Reservation.

E.2.1.2 Group 1, Former Facility Areas

Group 1 includes former facility areas and storage areas. This section includes a discussion of the SWMU/AOC in the former facility areas subgroup.

E.2.1.2.1 SWMU 1, C-747-C Oil Landfarm

SWMU 1 was used as an oil landfarm for the disposal of waste oil. The SWMU is grass-covered and is approximately 2.29 acres. The SWMU is near a surface water body; its southeast border is a Kentucky Pollutant Discharge Elimination System (KPDES) outfall ditch.

E.2.1.2.2 SWMU 99B, C-745 Kellogg Building Site-Septic System/Leach Field

The Kellogg Building Site was used during construction of the plant and currently is split into SWMU 99A, the location of the former facility, and SWMU 99B, the location of the septic system and leach field associated with the facility. SWMU 99B is mostly gravel with grass over the small eastern section and is approximately 0.34 acres. The SWMU is near a surface water body; west drainage over SWMU 16 is into Outfall 010, and south drainage is into an Outfall 010 tributary.

E.2.1.2.3 SWMU 194, DUF_6 Facility McGraw Construction Facilities (Southside)

SWMU 194 was used as the McGraw construction facilities during construction of PGDP. SWMU 194 is approximately 41.7 acres, grass-covered, or otherwise stabilized; therefore the contaminants are not likely

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Table E.1. Ecological Screening

Group	Group Name	Description	SWMU	Area Acres	Ground Cover	Near a Surface Water Body?	Total HI (max)	Priority COPECs	Background (mg/kg)[a]	Maximum or ½ Detection Limit (mg/kg)	Soil ESV (mg/kg)	HQ (max)
1	Former Facility	Oil Landfarm (disposal of waste oil)	1	2.29	grass	Yes	2008	Cadmium	2.10E-01	6.50E+00	3.60E-01	18
								Lead	3.60E+01	3.23E+02	1.10E+01	29
								Mercury	2.00E-01	7.70E+00	1.00E-01	77
								PCB, Total	n/a	3.50E+01	2.00E-02	1750
								Phenol	n/a	1.80E+00	5.00E-02	36
								Selenium	8.00E-01	9.75E+00	5.20E-01	19
								Silver	2.30E+00	4.25E+01	4.20E+00	10
								Trichloroethene	n/a	1.50E-02	1.00E-03	15
		Kellogg Building Site—Septic System/Leach Field	99B	0.34	mostly gravel with grass over the small eastern section	Yes	127	Mercury	2.00E-01	9.53E+00	1.00E-01	95
								Zinc	6.50E+01	4.72E+02	4.60E+01	10
		McGraw Construction Facilities	194	41.7	wooded area, mix of mostly soil/grass, and concrete/buildings	Yes	1152	Antimony	2.10E-01	1.00E+01	2.70E-01	37
								Lead	3.60E+01	3.58E+02	1.10E+01	33
								Manganese	1.50E+03	4.67E+03	2.20E+02	21
								Mercury	2.00E-01	8.92E+00	1.00E-01	89
								PCB, Total	n/a	1.80E+01	2.00E-02	900
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
								Zinc	6.50E+01	6.40E+02	4.60E+01	14
		Septic System	196	0.4156	grassy	No	186	Nickel	2.10E+01	5.56E+02	3.80E+01	15
								PCB, Total	n/a	2.50E+00	2.00E-02	125
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
		Septic Tank	489	0.02082	gravel	No	29	Selenium	8.00E-01	1.00E+01	5.20E-01	19
		Aluminum Slag Reacting Area	531	0.21	gravel	No	152	Lead	3.60E+01	5.31E+02	1.10E+01	48
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
								Zinc	6.50E+01	2.45E+03	4.60E+01	53

Table E.1. Ecological Screening (Continued)

Group	Group Name	Description	SWMU	Area Acres	Ground Cover	Near a Surface Water Body?	Total HI (max)	Priority COPECs	Background (mg/kg)[a]	Maximum (mg/kg)	Soil ESV (mg/kg)	HQ (max)
1	Storage Area	TSCA Waste Storage Facility	200	0.81	mostly soil/grass with a few patches of gravel	No	251	Mercury	2.00E-01	6.71E+00	1.00E-01	67
								PCB, Total	n/a	2.60E+00	2.00E-02	130
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
		Radiological Contamination Area	212	0.09	grass/soil/gravel mix to all gravel	No	180	Antimony	2.10E-01	4.87E+00	2.70E-01	18
								PCB, Total	n/a	2.50E+00	2.00E-02	125
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
		DMSA OS-02	213	0.16258	grassy	Yes	168	PCB, Total	n/a	2.50E+00	2.00E-02	125
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
		DMSA OS-03	214	0.01355	mostly grassy/ some gravel	Yes	29	Selenium	8.00E-01	1.00E+01	5.20E-01	19
		DMSA OS-04	215	0.01	gravel	No	46	Selenium	8.00E-01	1.00E+01	5.20E-01	19
								Zinc	6.50E+01	5.73E+02	4.60E+01	12
		C-206, OS-05	216	0.027	grassy	No	34	Selenium	8.00E-01	1.00E+01	5.20E-01	19
		DMSA OS-06	217	0.98	mostly gravel	No	218	Antimony	2.10E-01	1.00E+01	2.70E-01	37
								Mercury	2.00E-01	8.59E+00	1.00E-01	86
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
								Uranium	4.90E+00	1.00E+02	5.00E+00	20
								Zinc	6.50E+01	5.89E+02	4.60E+01	13
		DMSA OS-10	221	0.21	mostly gravel to grass/soil mix	No	168	PCB, Total	n/a	2.50E+00	2.00E-02	125
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
		DMSA OS-11	222	0.05279	grassy	No	176	PCB, Total	n/a	2.50E+00	2.00E-02	125
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
								Uranium	4.90E+00	5.86E+01	5.00E+00	12
		DMSA OS-16	227	1.28	mostly gravel	Yes	2887	Mercury	2.00E-01	8.41E+00	1.00E-01	84
								Nickel	2.10E+01	6.53E+02	3.80E+01	17
								PCB, Total	n/a	5.28E+01	2.00E-02	2641
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
								Uranium	4.90E+00	4.38E+02	5.00E+00	88
		DMSA OS-17	228	0.23	mostly gravel with some soil/grass	No	156	Cadmium	2.10E-01	3.90E+00	3.60E-01	11
								Mercury	2.00E-01	9.37E+00	1.00E-01	94
								Selenium	8.00E-01	1.00E+01	5.20E-01	19

Table E.1. Ecological Screening (Continued)

Group	Group Name	Description	SWMU	Area Acres	Ground Cover	Near a Surface Water Body?	Total HI (max)	Priority COPECs	Background (mg/kg)[a]	Maximum (mg/kg)	Soil ESV (mg/kg)	HQ (max)
2	Underground/ Tank	Acid Neutralization Tank	27	0.0027	concrete/gravel	No	n/a	None				
		Sulfuric Acid Storage Tank	76	0.02	mostly gravel	No	155	PCB, Total	n/a	2.50E+00	2.00E-02	125
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
		Pipeline and Vault Soil Contamination	165	0.49	mostly soil/grass with gravel and concrete pavement	Yes	2737	Antimony	2.10E-01	5.00E+00	2.70E-01	19
								PCB, Total	n/a	5.10E+01	2.00E-02	2550
								Selenium	8.00E-01	1.25E+01	5.20E-01	24
								Silver	2.30E+00	8.33E+01	4.20E+00	20
								Toluene	n/a	3.05E-01	1.00E-02	31
								Uranium	4.90E+00	2.68E+02	5.00E+00	54
		Acetylene Building Drain Pits	170	0.0029	mostly concrete	No	n/a	None				
2	Chromium Areas	Chilled Water System Leak Site	158	0.06	soil/grass, soil/gravel mix, and concrete pavement	Yes	167	Mercury	2.00E-01	1.05E+01	1.00E-01	105
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
		Hydrogen Fluoride Vent Surge Protection Tank	169	0.002	mostly soil/grass with a hint of gravel	No	724	Antimony	2.10E-01	1.02E+01	2.70E-01	38
								Copper	1.90E+01	3.74E+02	2.80E+01	13
								Lead	3.60E+01	1.54E+02	1.10E+01	14
								Mercury	2.00E-01	7.87E+00	1.00E-01	79
								Nickel	2.10E+01	5.49E+02	3.80E+01	14
								PCB, Total	n/a	1.00E+01	2.00E-02	500
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
								Uranium	4.90E+00	5.03E+01	5.00E+00	10
								Zinc	6.50E+01	4.73E+02	4.60E+01	10

Table E.1. Ecological Screening (Continued)

Group	Group Name	Description	SWMU	Area Acres	Ground Cover	Near a Surface Water Body?	Total HI (max)	Priority COPECs	Background (mg/kg)[a]	Maximum (mg/kg)	Soil ESV (mg/kg)	HQ (max)
2	Soil/ Rubble Piles	HF Neutralization Lagoon	19	0.04419	soil/grass	No	31	None				
		Southside Berm	138	0.91754	grassy	No	451	Antimony	2.10E-01	7.34E+00	2.70E-01	27
								Cadmium	2.10E-01	7.30E+00	3.60E-01	20
								Lead	3.60E+01	2.81E+02	1.10E+01	26
								Mercury	2.00E-01	2.13E+01	1.00E-01	213
								PCB, Total	n/a	2.50E+00	2.00E-02	125
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
		Outdoor Firing Range	180	2.21	soil/grass mix with gravel/soil	No	322	Lead	3.60E+01	1.99E+03	1.10E+01	181
								Mercury	2.00E-01	8.28E+00	1.00E-01	83
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
		Outdoor Firing Range (PGDP)	181	0.50891	grassy	Yes	39	Antimony	2.10E-01	4.17E+00	2.70E-01	15
		Curlee Road Contaminated Soil Mounds	195	9.70968	grassy	Yes	243	Mercury	2.00E-01	5.00E+00	1.00E-01	50
								PCB, Total	n/a	2.50E+00	2.00E-02	125
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
								Vanadium	3.80E+01	7.97E+01	7.80E+00	10
		Rubble Pile WKWMA	486	0.069	grassy	No	n/a	None				
		Rubble Pile WKWMA	487	0.22	grassy	No	n/a	None				
		Contaminated Soil Area	492	0.04664	grassy	Yes	2641	Chromium	1.60E+01	1.04E+03	2.60E+01	40
								PCB, Total	n/a	4.41E+01	2.00E-02	2205
								Uranium	4.90E+00	1.77E+03	5.00E+00	354
								Zinc	6.50E+01	6.62E+02	4.60E+01	14
		Concrete Rubble Piles	493	0.12949	concrete piles	Yes	67	Manganese	1.50E+03	3.55E+03	2.20E+02	16
								PCB, Total	n/a	2.60E-01	2.00E-02	13
		Rubble and debris, erosion control fill area	517	0.01	concrete rubble with soil	Yes	68	PCB, Total	n/a	5.00E-01	2.00E-02	25
								Zinc	6.50E+01	1.25E+03	4.60E+01	27
		Contaminated Soil Area	541	2	soil/grass mix with trees	Yes	8945	Chromium	1.60E+01	3.35E+03	2.60E+01	129
								HMW PAHs	n/a	1.10E+01	1.10E+00	10
								PCB, Total	n/a	9.40E+01	2.00E-02	4700
								Uranium	4.90E+00	2.02E+04	5.00E+00	4040
								Zinc	6.50E+01	1.09E+03	4.60E+01	24

Table E.1. Ecological Screening (Continued)

Group	Group Name	Description	SWMU	Area Acres	Ground Cover	Near a Surface Water Body?	Total HI (max)	Priority COPECs	Background (mg/kg)[a]	Maximum (mg/kg)	Soil ESV (mg/kg)	HQ (max)
2	Soil/ Rubble Piles	Soil Pile I	561	9.45	soil/grass mix with trees	Yes	5544	Antimony	2.10E-01	2.20E+01	2.70E-01	81
								Boron	n/a	2.34E+01	5.00E-01	47
								Chromium	1.60E+01	1.37E+03	2.60E+01	53
								Lead	3.60E+01	2.25E+02	1.10E+01	20
								Manganese	1.50E+03	5.23E+03	2.20E+02	24
								PCB, Total	n/a	7.90E+01	2.00E-02	3950
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
								Thallium	2.10E-01	1.00E+01	1.00E+00	10
								Uranium	4.90E+00	6.41E+03	5.00E+00	1282
								Vanadium	3.80E+01	8.69E+01	7.80E+00	11
								Zinc	6.50E+01	1.13E+03	4.60E+01	25
		Soil Piles C, D, E, F, G, H, J, K, and P in Subunit 1	562	0.11	soil/grass mix with trees	Yes	182	PCB, Total	n/a	2.50E+00	2.00E-02	125
								Uranium	4.90E+00	2.08E+02	5.00E+00	42
		Soil Piles 20, BW, and CC in Subunit 4	563	0.100	soil/grass mix with trees	Yes	65	Chromium	1.60E+01	2.85E+02	2.60E+01	11
								PCB, Total	n/a	7.40E-01	2.00E-02	37
		Soils Pile AT in Subunit 5	564	0.0012	soil/grass mix with trees	Yes	153	PCB, Total	n/a	1.93E+00	2.00E-02	97
								Uranium	4.90E+00	5.83E+01	5.00E+00	12
								Vanadium	3.80E+01	8.06E+01	7.80E+00	10
		Contaminated Soil Area K013	567	1.7172	soil/grass mix with trees	No	16	None				

Table E.1. Ecological Screening (Continued)

Group	Group Name	Description	SWMU	Area Acres	Ground Cover	Near a Surface Water Body?	Total HI (max)	Priority COPECs	Background (mg/kg)[a]	Maximum (mg/kg)	Soil ESV (mg/kg)	HQ (max)
3	Scrap Yards	E Scrap Yard	14	5.75	gravel with a soil/grass mix	Yes	2123	Antimony	2.10E-01	4.30E+00	2.70E-01	16
								Cadmium	2.10E-01	3.90E+00	3.60E-01	11
								Chromium	1.60E+01	8.98E+02	2.60E+01	35
								Copper	1.90E+01	1.10E+03	2.80E+01	39
								Lead	3.60E+01	1.49E+02	1.10E+01	14
								Manganese	1.50E+03	2.67E+03	2.20E+02	12
								Mercury	2.00E-01	4.37E+01	1.00E-01	437
								Molybdenum	n/a	2.87E+01	2.00E+00	14
								Nickel	2.10E+01	2.67E+03	3.80E+01	70
								PCB, Total	n/a	1.00E+01	2.00E-02	500
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
								Uranium	4.90E+00	4.60E+03	5.00E+00	920
								Zinc	6.50E+01	7.37E+02	4.60E+01	16
		Field south of P1 yard	518	0.81	soil/grass and gravel	No	476	HMW PAHs	n/a	1.70E+02	1.10E+00	155
								PCB, Total	n/a	1.64E+00	2.00E-02	82
								Selenium	8.00E-01	8.85E+00	5.20E-01	17
								Uranium	4.90E+00	1.00E+03	5.00E+00	200
		Scrap Material	520	2.89	mostly gravel and some soil/grass patches	Yes	340	Antimony	2.10E-01	1.00E+01	2.70E-01	37
								Mercury	2.00E-01	1.19E+01	1.00E-01	119
								Nickel	2.10E+01	8.10E+02	3.80E+01	21
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
								Uranium	4.90E+00	5.00E+02	5.00E+00	100

Table E.1. Ecological Screening (Continued)

Group	Group Name	Description	SWMU	Area Acres	Ground Cover	Near a Surface Water Body?	Total HI (max)	Priority COPECs	Background (mg/kg)[a]	Maximum (mg/kg)	Soil ESV (mg/kg)	HQ (max)
3	PCB Areas	PCB Spill Site	81	0.26	gravel/soil/ grass with gravel driveways, and concrete pads	No	19948	Antimony	2.10E-01	6.55E+00	2.70E-01	24
								Mercury	2.00E-01	8.33E+00	1.00E-01	83
								PCB, Total	n/a	3.70E+02	2.00E-02	18500
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
								Uranium	4.90E+00	6.50E+03	5.00E+00	1300
		PCB Soil Contamination	153	0.6	gravel	No	152	PCB, Total	n/a	2.50E+00	2.00E-02	125
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
		PCB Soil Contamination	156	0.46	gravel	No	274	Manganese	1.50E+03	2.83E+03	2.20E+02	13
								Mercury	2.00E-01	9.87E+00	1.00E-01	99
								PCB, Total	n/a	2.50E+00	2.00E-02	125
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
		Cylinder Yard (PCB soils) Spoils	160	0.11	gravel/soil/ grass mix with concrete pads	No	27	Selenium	8.00E-01	1.00E+01	5.20E-01	19
		HVAC Piping System (soil backfill from C-611)	163	0.08	soil/grass mix	No	66	Antimony	2.10E-01	1.00E+01	2.70E-01	37
								Selenium	8.00E-01	1.00E+01	5.20E-01	19
		DMSA OS-08	219	0.038	mostly concrete	No	30	Selenium	8.00E-01	1.00E+01	5.20E-01	19
		PCB Contamination Area	488	0	soil/grass	No	547	PCB, Total	n/a	1.03E+01	2.00E-02	515
								Selenium	8.00E-01	1.00E+01	5.20E-01	19

[a] Background values are for surface soil taken from DOE 2011; ESV = ecological screening value (from DOE 2010); HI = hazard index; HQ = hazard quotient; PAH = polycyclic aromatic hydrocarbon;
PCB = polychlorinated biphenyl; n/a = not applicable
HMW PAHs = high molecular weight PAHs [benz(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(k)fluoranthene; chrysene; benzo(ghi)perylene; dibenz(a,h)anthracene; and indeno(1,2,3-cd)pyrene]

Table E.2. Wildlife Species Present or Potentially Present at the PGDP Site[a]

Common Name	Scientific Name
Fish	
Black buffalo	*Ictiobus niger*
Blackspotted topminnow	*Fundulus olivaceus*
Creek chub	*Semotilus atromaculatus*
Bluegill sunfish	*Lepomis macrochirus*
Green sunfish	*Lepomis cyanellus*
Redspotted sunfish	*Lepomis miniatus*
Largemouth bass	*Micropterus salmoides*
Longear sunfish	*Lepomis megalotis*
Stoneroller	*Campostoma sp.*
Reptiles and Amphibians	
American toad	*Bufo americanus*
Bull frog	*Rana catesbeiana*
Eastern box turtle	*Terrapene carolina*
Leopard frog	*Rana sphenocephala*
Salamanders	Various species
Snakes	Various species
Green treefrog	*Hyla cinerea*
Woodhouse toad	*Bufo woodhousei*
Northern crawfish frog	*Rana areolata circulosa*
Green frog	*Rana clamitans melanota*
Upland chorus frog	*Pseudacris triseriata feriiarum*
Birds	
American robin	*Turdus migratorius*
American woodcock	*Scolopax minor*
Bald eagle	*Haliaeetus leucocephalus*
Barred owl	*Strix varia*
Belted kingfisher	*Ceryle alcyon*
Blue jay	*Cyanocitta cristata*
Blue-winged teal	*Anas discors*
Canada goose	*Branta canadensis*
Coot	*Fulica americana*
American crow	*Corvus brachyrhynchos*
Downy woodpecker	*Picoides pubescens*
Eastern bluebird	*Sialia sialus*
Eastern kingbird	*Tyrannus tyrannus*
Eastern meadowlark	*Sturnella magna*
Eastern phoebe	*Sayornis phoebe*

Table E.2. Wildlife Species Present or Potentially Present at the PGDP Site[a] (Continued)

Common Name	Scientific Name
Bird (Continued)	
Eastern wood pewee	*Contopus virens*
Gadwall duck	*Anas strepera*
Great blue eeron	*Ardea herodias*
Great crested flycatcher	*Myiarchus crinitus*
Great-horned owl	*Bubo virginianus*
Hairy woodpecker	*Picoides villosus*
Hawks	Various species
Herons and egrets	Various species
Killdeer	*Charadrius vociferus*
Loggerhead shrike	*Lanius ludovicianus*
Mallard duck	*Anas platyrhynchus*
Mourning dove	*Zenaida macroura*
Northern bobwhite (aka bobwhite quail)	*Colinus virgianus*
Northern cardinal	*Cardinalis cardinalis*
Northern flicker	*Colaptes auratus*
Pileated woodpecker	*Dryocopus pileatus*
Red-bellied woodpecker	*Melanerpes erythrocephalus*
Red-shouldered hawk	*Buteo lineatus*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Ruby-throated hummingbird	*Archilochus colubris*
Screech owl	*Megascops asio*
Song sparrow	*Melospiza melodia*
Swallows	Various species
Vireos	Various *vireo sp.*
Tufted titmouse	*Baeolophus bicolor*
Turkey vulture	*Cathartes aura*
Warblers	*Various species*
Chuck-will's widow	*Caprimulgus carolinensis*
White-breasted nuthatch	*Sitta carolinensis*
Whip-poor-will	*Caprimulgis vocifierous*
Wild turkey	*Meleagris gallopavo*
Wood cock	*Scolopax minor*
Wood duck	*Aix sponsa*
Wrens	Various species
Yellow-billed cuckoo	*Coccyzus americanus*

Table E.2. Wildlife Species Present or Potentially Present at the PGDP Site (Continued)

Common Name	Scientific Name
Mammals	
American beaver	*Castor canadensis*
American mink (aka mink)	*Mustela vison*
Bobcat	*Lynx rufus*
Common muskrat	*Ondatra zibethicus*
Coyote	*Canis latrans*
Eastern cottontail	*Sylvilagus floridanus*
Eastern grey squirrel and fox squirrel	*Sciurus carolinensis*
Evening bat	*Nycticeceius humeralis*
Groundhog	*Marmota monax*
Indiana bat	*Myotis sodalis*
Mice	Various species
Moles	Various species
Opposum	*Didelphis virginiana*
Raccoon	*Procyon lotor*
Red fox	*Vuples vulpes*
Grey fox	*Urocyon cinereoargenteus*
Shrews	Various species
Skunk	Mephitis mephitis
Southeastern myotis bat	Myotis sodalis
Voles	Various species
White-tailed deer	*Odocoileus virginianus*

[a] The listed species are from the Surface Water Operable Unit Report (DOE 2008) and the WKWMA species information website (http://fw.ky.gov/kfwis/arcims/WmaSpecies.asp?strID=137).

Table E.3. Federally Listed, Proposed, and Candidate Species Potentially Occurring within the Paducah Site Study Area[a]

Common Name	Scientific Name	Animal Type	Endangered Species Act Status
Indiana bat[b]	Myotis sodalist	Mammal	Listed endangered
Interior least tern	Sterna antillarum athalassos	Bird	Listed endangered
Pink mucket	Lampsilis abrupta	Mussel	Listed endangered
Ring pink	Obovaria retusa	Mussel	Listed endangered
Orangefoot pimpleback	Plethobasus cooperianus	Mussel	Listed endangered
Fat pocketbook	Potamilus capax	Mussel	Listed endangered

[a] All of the listed species are discussed in *Environmental Investigations at the Paducah Gaseous Diffusion Plant and Surrounding Area, McCracken County, Kentucky, Volume III,* US. Army Corps of Engineers, Nashville District, May 1994. Note that the area evaluated in the referenced report encompasses 11,719 acres and extends to include the Ohio River, which is over three miles north of the DOE Reservation. None of these species have been reported as sighted on the DOE Reservation, although potential summer habitat exists there for the Indiana bat. No critical habitat for any of these species has been designated anywhere in the area.
[b] Specimens of the Indiana bat were collected from WKWMA property in 1991 and 1999.

to be transported attached to suspended soil particles. The SWMU is near a surface water body; Outfall 017 originates inside SWMU 194.

E.2.1.2.4 SWMU 196, C-746-A Septic System

The C-746-A Septic System (SWMU 196) is located in the northwest portion of the plant site. The C-746-A Septic System consists of two systems: System 1, on the northwest corner of C-746-A, is a 500-gal tank; and System 2, on the northeast corner of C-746-A, is a 950-gal concrete tank and a 60-ft by 20-ft drainage field.

Both systems were used to process the sanitary waste coming from C-746-A. The systems were abandoned in place in 1980. The contents of the septic tanks were removed. The empty tanks were backfilled with clean sand and the site was graded to the surface.

E.2.1.2.5 SWMU 489, C-710 North Septic Tank, North of C-710

The Septic Tank, north of C-710 (SWMU 489), is constructed of cement blocks and located in the central portion of the plant site. SWMU 489 is approximately 200 ft^3 (8 ft x 5 ft x 5 ft). The tank is below a double-wide trailer.

Due to the construction materials and the manner in which it was constructed, it is believed that the septic tank was associated with the original construction activities of the PGDP in the early 1950s. SWMU 489 was discovered on June 1, 2001, as a result of a construction project for the DOE Material Storage Area (DMSA) trailers in the field north of the C-710 Laboratory. During excavation, what appeared to be an abandoned septic tank was discovered. The tank appeared to have had the top and contents removed and was backfilled with sand prior to burial in place. When the septic tank was uncovered, water was present in the interior of the tank from past rainfall events. A sample of the sand was obtained from the interior of the tank. The septic tank has been backfilled, compacted, and graded, and also has 9–10 inches of dense grade aggregate on top of the tank area.

E.2.1.2.6 SWMU 531, C-746-A South Aluminum Slag Reacting Area

SWMU 531 was used as an aluminum slag reacting area. The SWMU is comprised entirely of gravel rail ballast and is approximately 0.21 acres. The SWMU is not near a surface water body.

E.2.1.3 Group 1, Storage Areas

Group 1 includes former facility areas and storage areas. This section includes a discussion of the SWMUs in the storage area subgroup.

E.2.1.3.1 SWMU 200, Central PGDP Soil Contamination South of Toxic Substances Control Act Waste Storage Facility

SWMU 200 is an area of soil contamination. The SWMU is mostly soil/grass with a few patches of gravel and is approximately 0.81 acres. The SWMU is not near a surface water body.

E.2.1.3.2 SWMU 212, C-745-A Radiological Contamination Area

SWMU 212 is an area of radiological soil contamination. The SWMU's ground cover is a grass/soil/gravel mix to all gravel at the southwest corner of the C-745-A depleted uranium cylinder storage yard. SWMU 212 is approximately 0.09 acres. The SWMU is not near a surface water body.

E.2.1.3.3 SWMU 213, C-745-A, OS-02

SWMU 213 is an approximately 0.16 acre grassy area formerly used to store excess or unused material. The western part of this SWMU abuts KPDES Outfall 015.

E.2.1.3.4 SWMU 214, C-611, OS-03

SWMU 214 is located at the C-611 Water Treatment Plant west of the plant site. The SWMU's ground cover is a mix that is mostly grassy with some gravel. SWMU 214 is approximately 0.013 acres. The SWMU is located near the lagoons associated with the water treatment plant.

E.2.1.3.5 SWMU 215, C-743, OS-04

SWMU 215 is a former DMSA. The SWMU is a gravel ballast on the remnants of a railroad bed near the C-746 depleted uranium cylinder storage yard, and is approximately 0.01 acres. The SWMU is not near a surface water body.

E.2.1.3.6 SWMU 216, C-206, OS-05

SWMU 216 is located north of C-206 in the west central portion of the plant site and is approximately 0.027 acres. There is no direct connection from the SWMU to surface water. Vegetation in the area is flourishing.

E.2.1.3.7 SWMU 217, C-740, OS-06

SWMU 217 is a former DMSA. The SWMU is south of a rail spur; southeast of C-745-A depleted uranium cylinder storage yard, mostly of gravel, and is approximately 0.98 acres. The SWMU is not near a surface water body.

E.2.1.3.8 SWMU 221, C-635, OS-10

SWMU 221 is a former DMSA. The SWMU is mostly gravel in the northwest corner, gradually turning to a grass/soil mix in the southeast corner, and is approximately 0.21 acres. The SWMU is not near a surface water body.

E.2.1.3.9 SWMU 222, C-410, OS-11

SWMU 222 is a former DMSA. It is located east of the C-410 facility and west of the C-651 Pump House and Cooling Tower, near the central portion of the plant site. SWMU 222 is approximately 1,738 ft^2.

E.2.1.3.10 SWMU 227, C-746-B, OS-16

SWMU 227 is a former DMSA. The SWMU is mostly gravel and is approximately 1.28 acres. The SWMU is near a surface water body; the south border abuts Outfall 001.

E.2.1.3.11 SWMU 228, C-747-B, OS-17

SWMU 228 is a former DMSA. The SWMU is mostly gravel with some soil/grass cover and is approximately 0.23 acres. The SWMU is not near a surface water body.

E.2.1.4 Group 2, Underground Tanks

The SWMUs/AOCs in Group 2 consist of underground tanks, chromium areas, and soil and rubble piles. This section summarizes the historical investigations at the underground tanks.

E.2.1.4.1 SWMU 27, C-722 Acid Neutralization Tank

The C-722 Acid Neutralization Tank (SWMU 27) is an underground concrete tank lined with an acid-resistant membrane and acid brick. SWMU 27 is located at the northeast corner of the C-720 Building in the central portion of the plant site. The tank is approximately 180 ft^2. There are no surface soil samples in the upper 1 ft of soil for this unit. There are, however, soil samples collected from the range 0–2 ft bgs. These samples were utilized for evaluation in this SERA.

E.2.1.4.2 SWMU 76, C-632-B Sulfuric Acid Storage Tank

SWMU 76 is the site of a former acid storage tank. The SWMU is rectangular, consists of mostly gravel and is approximately 0.02 acres. The SWMU is not near a surface water body.

E.2.1.4.3 SWMU 165, C-616-L Pipeline and Vault Soil Contamination

SWMU 165 is an area of soil contamination. The SWMU is mostly soil/grass with gravel and concrete pavement and is approximately 0.49 acres. The SWMU is near a surface water body; it crosses through Outfall 015.

E.2.1.4.4 SWMU 170, C-729 Acetylene Building Drain Pits

The C-729 Acetylene Building Drain Pits (SWMU 170) is located in the central portion of the plant site. The two pits are concrete and approximately 16-ft long by 8-ft wide by 3-ft deep.

E.2.1.5 Group 2, Chromium Areas

The SWMUs/AOCs in Group 2 consist of underground tanks, chromium areas, and soil and rubble piles. This section summarizes the investigation at the chromium areas.

E.2.1.5.1 SWMU 158, C-720 Chilled Water System Leak Site

SWMU 158 is a chilled water system leak site. The SWMU is soil/grass, soil/gravel mix, and concrete pavement covered and is approximately 0.06 acres. The SWMU is near underground water lines.

E.2.1.5.2 SWMU 169, C-410-E Hydrogen Fluoride Vent Surge Protection Tank

SWMU 169 is the site of a vent surge protection tank. The SWMU is mostly soil/grass with a hint of gravel and is approximately 0.002 acres. The SWMU is not near a surface water body.

E.2.1.6 Group 2, Soil/Rubble Areas

The SWMUs/AOCs in Group 2 consist of underground tanks, chromium areas, and soil and rubble piles. This section summarizes the investigation at the soil/rubble piles.

E.2.1.6.1 SWMU 19, C-410-B Hydrogen Fluoride Neutralization Lagoon

The C-410-B hydrogen fluoride (HF) Emergency Lagoon (SWMU 19) is a below grade impoundment north of the C-410 Building in the central portion of the plant site. SWMU 19 is approximately 1,900 ft^2 (38 ft x 51 ft) and 7-ft deep. This SWMU was excavated, as described in Removal Action Report (DOE 2010a), and backfilled with clean soil.

E.2.1.6.2 SWMU 138, C-100 Southside Berm

The C-100 Southside Berm (SWMU 138) is located south of the C-100 Building, south of the plant site. SWMU 138 consists of two soil berms, each approximately 10,000 ft^2 (200 ft x 50 ft). These berms are grass-covered.

E.2.1.6.3 SWMU 180, WKWMA Outdoor Firing Range (WKWMA)

SWMU 180 is a soil berm formerly used as a firing range. The SWMU is soil/grass mix with gravel/soil driveway and some concrete pads and is approximately 2.21 acres. The SWMU is not near a surface water body.

E.2.1.6.4 SWMU 181, West Side Outdoor Firing Range (PGDP)

SWMU 181 was a soil berm used as a firing range, but was recently removed (see main text for additional information).

E.2.1.6.5 SWMU 195

The Curlee Road Contaminated Soil Mounds (SWMU 195) are located in the southwest portion of the plant site. The site consists of two grass-covered mounds of approximately 9.71 acres. This SWMU is on the banks of KPDES Outfall 009.

E.2.1.6.6 SWMU 486, West of PGDP Rubble Pile WKWMA

SWMU 486 is a rubble pile on the west side of Rice Springs Road, approximately 116 ft off the roadside. It is in the vicinity of the former locations of the C-611-M Water Tower in the Kentucky Ordnance Works area. It is approximately 55 ft by 55 ft.

E.2.1.6.7 SWMU 487, West of PGDP Rubble Pile WKWMA

SWMU 487 is a rubble pile on the west side of Rice Springs Road and is approximately 483 ft off the roadside. The pile is in the vicinity of the former location of the C-611-M Water Tower and is in the Kentucky Ordnance Works. The pile is approximately 80 ft by 80 ft.

E.2.1.6.8 AOC 492, Contaminated Soil Area, North of Outfall 010

AOC 492 is a contaminated soil area, north of Outfall 10 (AOC 492) and east of the plant site. AOC 492 is approximately 450 ft^2 (15 ft x 30 ft).

E.2.1.6.9 SWMU 493, Concrete Rubble Piles near Outfall 001

The concrete rubble piles near Outfall 001 (SWMU 493) are two concrete rubble piles located west of the plant site. The two piles making up SWMU 493 are approximately 450 ft^2 and 270 ft^2.

E.2.1.6.10 SWMU 517, Rubble and Debris Erosion Control Fill Area

SWMU 517 was an area of rubble and debris used to control erosion. The SWMU is concrete rubble with soil and is approximately 0.01 acres. The SWMU is near a surface water body on banks of C-613 sediment basin.

E.2.1.6.11 AOC 541, Contaminated Area by Outfall 011

AOC 541 is a contaminated soil area. The SWMU is covered entirely with a soil/grass mix with trees and is approximately 2 acres. The SWMU is near a surface water body on the banks of Outfall 011 and Little Bayou Creek.

E.2.1.6.12 SWMU 561, Soil Pile I

SWMU 561 is a contaminated soil area. The SWMU is covered entirely with a soil/grass mix with trees and is approximately 9.45 acres. The SWMU is near a surface water body on the banks of Little Bayou Creek and Outfall 002.

E.2.1.6.13 AOC 562, Soil Piles C, D, E, F, G, H, J, K, and P in Subunit 1

AOC 562 is a contaminated soil area. The SWMU is covered entirely with a soil/grass mix with trees. The SWMU is near a surface water body on the banks of Little Bayou Creek.

E.2.1.6.14 AOC 563, Soil Piles 20, BW, and CC in Subunit 4

AOC 563 is a contaminated soil area. The SWMU is covered entirely with a soil/grass mix with trees. The SWMU is near a surface water body along Little Bayou Creek and the north reaches of the North-South Diversion Ditch.

E.2.1.6.15 AOC 564, Soil Pile AT in Subunit 5

AOC 564 is a contaminated soil area. The SWMU is covered entirely with a soil/grass mix with trees. The SWMU is near a surface water body that is near Little Bayou Creek.

E.2.1.6.16 AOC 567, Contaminated Soil Area K013

AOC 567 encompasses five individual soil piles located near Outfall 013. The soil piles vary in size and are approximately 3-ft high.

E.2.1.7 Group 3, Scrap Yards

The SWMUs/AOCs in Group 3 consist of scrap yards and PCB Areas. This section summarizes the investigation at the scrap yards.

E.2.1.7.1 SWMU 14, C-746-E Contaminated Scrap Yard

SWMU 14 is the site of a former scrap yard. The SWMU is gravel with a soil/grass mix, roadways and a former rail spur, and is approximately 5.75 acres. The SWMU is near a surface water body, Outfall 001.

E.2.1.7.2 SWMU 518, C-746-P1 Field South of C-746-P1 Clean Scrap Yard

SWMU 518 is a field south of a former scrap yard. The SWMU is soil/grass covered on the western half and gravel on the eastern half and is approximately 0.81 acres. The SWMU is not near a surface water body.

E.2.1.7.3 SWMU 520, C-746-A Scrap Material West of C-746-A

SWMU 520 is the site of a former scrap yard. The SWMU is mostly covered with gravel and has some soil/grass patches and is approximately 2.89 acres. The SWMU is near a surface water body, a tributary to Outfall 001.

E.2.1.8 Group 3, PCBs

The SWMUs/AOCs in Group 3 consist of Scrap Yards and PCB areas. This section summarizes the investigations at the PCB areas.

E.2.1.8.1 SWMU 57, C-541-A PCB Waste Staging Area

SWMU 57 was a staging area for PCB transformers. SWMU 57 is addressed with SWMU 81.

E.2.1.8.2 SWMU 81, C-541 PCB Spill Site

SWMU 81 is the site of a PCB spill. SWMU 57 is also addressed with this SWMU. The SWMU is gravel/soil/grass covered with gravel driveways and concrete pads and is approximately 0.26 acres. The SWMU is not near a surface water body.

E.2.1.8.3 SWMU 153, C-331 PCB Soil Contamination (West)

SWMU 153 is the site of PCB soil contamination. The SWMU is covered exclusively in gravel and is approximately 0.6 acres. The SWMU is not near a surface water body.

E.2.1.8.4 SWMU 156, C-310 PCB Soil Contamination (West Side)

SWMU 156 is the site of PCB soil contamination. The SWMU is covered exclusively in gravel and is approximately 0.46 acres. The SWMU is not near a surface water body.

E.2.1.8.5 SWMU 160, C-745 Cylinder Yard Spoils (PCB Soils)

SWMU 160 is the site of PCB soil contamination. The SWMU has a gravel/soil/grass mix cover with concrete pads and is approximately 0.11 acres. The SWMU is not near a surface water body.

E.2.1.8.6 SWMU 163, C-304 Building/HVAC Piping System (Soil Backfill)

SWMU 163 is the site of a piping system backfill. The backfill was potentially contaminated with PCBs. The SWMU has a soil/grass mix cover and is approximately 0.08 acres. The SWMU is not near a surface water body.

E.2.1.8.7 SWMU 219, C-728 OS-08

DMSA OS-08 (SWMU 219) is located east of C-728 in the central portion of the plant site. SWMU 219 is an empty 4,722 ft^3 fiberglass tank that was used to store PCB-contaminated water prior to treatment, as appropriate, and disposal.

E.2.1.8.8 SWMU 488, C-410 Trailers PCB Contamination Area by C-410 Trailer Complex

SWMU 488 is the site of PCB soil contamination and is entirely soil/grass. The SWMU is not near a surface water body.

E.2.1.9 Data

The dataset for surface soils used in the SERA is comprised of historical sampling events as well as data collected during the summer of 2010 for this RI (DOE 2010b). Chapters 5-11 describe the data set used for each SWMU/AOC. Chapter 4 describes the use of grids to subdivide data by location. Only maximum results, however, were evaluated for the SERA.

E.2.1.10 Site Contaminants

Only surface soil contaminants at the SWMUs/AOCs were considered in the SERAs. Site contaminants at all SWMUs/AOCs included inorganic chemicals, organic chemicals, and radionuclides.

E.2.1.11 Fate and Transport Mechanisms

Potential migration pathways for contaminants from soil at the Soils OU include transport of contaminated surface soil off-site by surface water, migration of contaminants to the subsurface soil, migration to groundwater, and uptake of soil contaminants through the on-site food chain. In addition, subsurface contaminants may be brought to the surface through bioturbation by burrowing animals or uptake by vegetation on the site. The surface soils at most of the Soils OU SWMUs/AOCs considered here are held in place by vegetation. Transport of surface soil off-site is likely to be minimal. Migration of contaminants to subsurface soil and through subsurface soil to groundwater is not likely to occur at the Soils OU SWMUs/AOCs Contaminants in groundwater may be discharged to surface water at areas away from the Soils OU SWMUs/AOCs. Contaminants in surface soil are likely to be taken up into plants and soil invertebrates at these sites and would enter higher trophic level organisms through the food chain.

E.2.2 POTENTIALLY COMPLETE EXPOSURE PATHWAYS

The potential exposure pathways for ecological receptors are direct contact with and ingestion of soil and ingestion of plants or animals thereby exposed to substances in soil. Significant contaminant transport through runoff directly to surface water is unlikely because most of the sites have vegetated surfaces. The pathways through which receptors could contact contaminants in surface soil include direct ingestion of soil, ingestion of plant or animals from the site as food, external exposure to ionizing radiation, and dermal contact with soil or surface water. A CSM reflective of current site conditions is shown in Figure E.2.

E.2.3 POTENTIALLY CONTAMINATED MEDIA

Soil is the media of concern for all the Soils OU SWMUs/AOCs. The substances detected in surface soils [metals, radionuclides, semivolatile organic compounds (SVOCs) and volatile organic compounds (VOCs)] are capable of causing adverse effects on terrestrial receptors. This SERA evaluates only terrestrial receptors for chemicals of potential ecological concern (COPECs).

Although some SWMUs/AOCs are located near drainageways, significant surface water contamination is not expected as a result of these SWMUs/AOCs (UK 2007). As a result, ecological risks associated with exposure to surface water was assessed in this SERA.

E.3. SCREENING-LEVEL EFFECTS EVALUATION

For the Soils OU SWMUs/AOCs, the maximum detected concentration of the reported values of each potential contaminant was used as the exposure point concentration (EPC) and compared to a single ecological screening level selected from the Ecological Risk Methods Document. Ecological screening values (ESVs) were taken from Tables A.2 and A.3 of the Ecological Risk Methods Document (DOE 2010c). These ESVs are the PGDP no further action (NFA) values for soil.

For each EPC (i.e., the maximum value), a hazard quotient (HQ) was calculated, using a ratio of the EPC with the ESV, as shown below:

$$\mathbf{HQ} = \frac{\mathbf{EPC}}{\mathbf{ESV}}$$

A total hazard index (HI) was further calculated by summing the HQs within each SWMU/AOC. Priority COPECs were selected from the chemicals at each SWMU/AOC showing the HQs greater than 10 calculated with the maximum EPC. Table E.1 summarized these values. Background values from the Risk Methods Document (DOE 2011) also are shown for comparison.

A summary of the results of the site data is provided in Table E.4, which lists the number of COPECs within each analytical suite (i.e., metals, radiological constituents, PCBs, SVOCs, and VOCs) retained for each SWMU/AOC for further consideration. As shown, all Soils OU SWMUs/AOCs had one or more COPECs retained. The entire screening list is provided in Attachment E2.

E.4. UNCERTAINTIES

A number of uncertainties impact the potential usefulness of the results of this SERA. An uncertainty in these screening assessments is that the ecological screening levels are protective of entire suites of receptors, some of which may not be present at these disturbed sites. The grassy areas of these sites would be attractive to ecological receptors, but most of the Soils OU SWMUs/AOCs are relatively small, and the surrounding industrial area may limit the extent to which ecological receptors use these areas.

Table E.4. Summary of Suite of COPECs Retained in Surface Soil

Group	Group Name	SWMU	Media	Number of Metals	Number of Rads	Number of PCBs	Number of SVOCs	Number of VOCs
1	Former Facilities	1	Soil	15	---	1	---	1
		99	Soil	9	---	---	---	---
		194	Soil	16	---	1	---	---
		196	Soil	9	---	1	---	---
		489	Soil	6	---	---	---	---
		531	Soil	11	---	---	---	---
1	Storage Areas	200	Soil	11	---	1	---	---
		212	Soil	9	---	1	---	---
		213	Soil	11	---	1	---	---
		214	Soil	6	---	---	---	---
		215	Soil	9	---	---	---	---
		216	Soil	7	---	---	1	---
		217	Soil	16	---	---	---	1
		221	Soil	11	---	1	1	---
		222	Soil	10	---	1	---	---
		227	Soil	13	---	1	---	---
		228	Soil	12	---	---	---	---
2	Underground/ Tank	27	Soil	---	---	---	---	---
		76	Soil	5	---	1	1	---
		165	Soil	14	---	1	1	1
		170	Soil	---	---	---	---	---
2	Chromium Areas	158	Soil	13	---	---	---	---
		169	Soil	14	---	1	1	---
2	Soil/Rubble Piles	19	Soil	7	---	---	1	---
		138	Soil	13	---	1	---	---
		180	Soil	13	---	---	---	---
		181	Soil	10	---	---	---	---
		195	Soil	16	---	1	---	---
		486	Soil	---	---	---	---	---
		487	Soil	---	---	---	---	---
		492	Soil	10	---	1	---	---
		493	Soil	11	---	1	---	---
		517	Soil	7	---	1	---	---
		541	Soil	10	1	1	1	---
		561	Soil	16	---	1	1	---
		562	Soil	7	---	1	---	---
		563	Soil	7	---	1	---	---
		564	Soil	13	---	1	---	---
		567	Soil	4	---	1	---	---
3	Scrap Yards	14	Soil	16	---	1	---	---
		518	Soil	7	---	1	2	---
		520	Soil	14	---	---	---	---

Table E.4. Summary of Suite of COPECs Retained in Surface Soil (Continued)

Group	Group Name	SWMU	Media	Number of Metals	Number of Rads	Number of PCBs	Number of SVOCs	Number of VOCx
3	PCB Areas	81	Soil	10	---	1	---	---
		153	Soil	5	---	1	---	---
		156	Soil	10	---	1	---	---
		160	Soil	5	---	---	---	---
		163	Soil	7	---	---	---	---
		219	Soil	7	---	---	---	---
		488	Soil	7	---	1	---	---

---: no COPECs
* Radionuclide risk was assessed based on a total dose benchmark for all radionuclides.
COPEC=chemical of potential ecological concern
PCB=polychlorinated biphenyl
SVOC=semivolatile organic compound
SWMU=solid waste management unit
VOC=volatile organic compound

These uncertainties, combined with the results of the SERAs, indicate the need for further evaluation of these sites. Risk managers may determine that sites do not need further evaluation (if exposure pathways are not complete or planned actions will eliminate the exposure pathway) or may recommend additional evaluation of the sites to better define the potential ecological risk indicated by the results. Alternatively, the benchmarks used in the screenings presented here and in the NFA levels in the PGDP Ecological Risk Methods Document (DOE 2010c) may be used as the ecologically based remedial goal options.

E.5. CONCLUSIONS

Each of the sites evaluated in this SERA retained a number of COPECs. Some metals were retained as COPECs at all SWMUs/AOCs except SWMUs/AOCs 27, 170, 486, and 487. Total PCBs were retained as COPECs for 29 SWMUs/AOCs. Radionuclides were retained as COPECs for AOC 541. SVOCs were retained at 10 SWMUs/AOCs and VOCs at 3 SWMUs/AOCs. These COPECs are listed below.

Metals:

- Antimony (SWMUs/AOCs 194, 196, 531, 200, 212, 213, 214, 215, 216, 217, 221, 222, 228, 165, 158, 169, 138, 180, 181, 195, 561, 14, 520, 81, 156, 160, 163, 219, and 488)
- Arsenic (SWMUs/AOCs 194, 531, 217, 165, 169, 180, 195, 561, 564, and 14)
- Barium (SWMUs/AOCs 165, 195, 493, and 561)
- Beryllium (SWMUs/AOCs 1 and 492)
- Boron (SWMU 561)
- Cadmium (SWMUs/AOCs 1, 194, 196, 531, 213, 215, 216, 217, 221, 222, 227, 228, 158, 169, 19, 138, 181, 492, 541, 561, 562, 563, 564, 14, and 520)
- Chromium (SWMUs/AOCs 1, 99B, 194, 489, 531, 200, 212, 213, 215, 217, 221, 222, 227, 228, 165, 158, 169, 138, 180, 181, 195, 492, 493, 517, 541, 561, 562, 563, 564, 567, 14, 520, 81, 156, and 163)

- Cobalt (SWMUs/AOCs 1, 194, 217, 227, 158, 180, 195, 493, 561, 14, and 518)
- Copper (SWMUs/AOCs 1, 194, 200, 217, 221, 227, 228, 165, 158, 169, 19, 138, 180, 181, 195, 492, 493, 517, 541, 561, 564, 14, and 520)
- Lead (SWMUs/AOCs 1, 99B, 194, 196, 489, 531, 200, 212, 213, 214, 215, 216, 217, 221, 222, 227, 228, 76, 165, 158, 169, 19, 138, 180, 181, 195, 492, 493, 517, 541, 561, 562, 563, 564, 567, 14, 518, 520, 81, 153, 156, 160, 163, 219, and 488)
- Lithium (SWMU 520)
- Manganese (SWMUs/AOCs 1, 99B, 194, 196, 489, 531, 200, 212, 213, 214, 215, 216, 217, 221, 222, 227, 228, 76, 165, 158, 169, 19, 138, 180, 181, 195, 492, 493, 517, 541, 561, 562, 563, 564, 567, 14, 518, 520, 81, 153, 156, 160, 163, and 488)
- Mercury (SWMUs/AOCs 1, 99B, 194, 200, 217, 227, 228, 165, 158, 169, 19, 138, 180, 181, 195, 493, 541, 564, 14, 520, 81, and 156)
- Molybdenum (SWMUs/AOCs 1, 99B, 194, 217, 227, 169, 195, 561, 564, and 14)
- Nickel (SWMUs/AOCs 1, 99, 194, 196, 489, 531, 200, 212, 213, 215, 217, 221, 222, 227, 228, 165, 158, 169, 138, 180, 195, 493, 517, 14, 520, 81, 156, and 219)
- Selenium (SWMUs/AOCs 1, 194, 196, 489, 531, 200, 212, 213, 214, 215, 216, 217, 221, 222, 227, 228, 76, 165, 158, 169, 138, 180, 195, 492, 493, 541, 561, 564, 14, 518, 520, 81, 153, 156, 160, 163, 219, and 488)
- Silver (SWMUs/AOCs 1, 99B, 194, 213, 217, 228, 165, 138, 180, 195, 14, and 520)
- Thallium (SWMUs/AOCs 181, 561, and 564)
- Uranium (SWMUs/AOCs 1, 194, 196, 531, 200, 212, 213, 216, 217, 221, 222, 227, 228, 165, 158, 169, 138, 195, 492, 541, 561, 562, 563, 564, 14, 518, 520, 81, 156, 219, and 488)
- Vanadium (SWMUs/AOCs 1, 99B, 194, 196, 489, 531, 200, 212, 213, 214, 215, 216, 217, 221, 222, 227, 76, 165, 158, 169, 19, 138, 180, 181, 195, 492, 493, 517, 541, 561, 562, 563, 564, 567, 14, 518, 520, 81, 153, 156, 160, 163, 219, and 488)
- Zinc (SWMUs/AOCs 1, 99B, 194, 196, 531, 200, 212, 213, 214, 215, 217, 221, 222, 227, 228, 76, 165, 158, 169, 19, 138, 180, 181, 195, 492, 493, 517, 541, 561, 562, 563, 564, 14, 518, 520, 81, 156, 163, 219, and 488)

Total PCBs: (SWMUs/AOCs 1, 194, 196, 200, 212, 213, 221, 222, 227, 76, 165, 169, 138, 195, 492, 493, 517, 541, 561, 562, 563, 564, 567, 14, 518, 81, 153, 156, and 488)

Radionuclides:

- Uranium-238 (AOC 541)

SVOCs:

- Phenol (SWMUs 1 and 216)
- High Molecular Weight PAHs (SWMUs/AOCs 221, 76, 165, 169, 19, 541, 561, and 518)
- Low Molecular Weight PAHs (SWMU 518)

VOCs:

- Toluene (SWMU 165)
- Trichloroethene (SWMUs/AOCs 1 and 217)

Further, some of these COPECs had an HQ, based on EPC, above 10. These COPECs are listed in Table E.1.

E.6. REFERENCES

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ATTACHMENT E1

SWMU/AOC PHOTOGRAPHS

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Figure E1.1. Photograph of SWMU 1

Figure E1.2. Photographs of SWMU 99

Figure E1.2. Photographs of SWMU 99

Figure E1.4. Photographs of SWMU 196

Figure E1.5. Photograph of SWMU 489

Figure E1.6. Photograph of SWMU 531

Figure E1.7. Photograph of SWMU 200

Figure E1.8. Photograph of SWMU 212

Figure E1.9. Photographs of SWMU 213

Figure E1.10. Photographs of SWMU 214

Figure E1.11. Photograph of SWMU 215

Figure E1.12. Photographs of SWMU 216

SWMU 217
DMSA OS-06
February 18, 2004

Figure E1.13. Photographs of SWMU 217

SWMU 221
DMSA OS-10
August 26, 2008

Figure E1.14. Photograph of SWMU 221

Figure E1.15. Photograph of SWMU 222

SWMU 227
DMSA OS-16 (Photo from West looking East)
July 19, 2004

Figure E1.16. Photographs of SWMU 227

East to West View

West to East View

SWMU 228
DMSA OS-17
August 2004

Figure E1.17. Photographs of SWMU 228

Figure E1.18. Photograph of SWMU 27

Figure E1.19. Photograph of SWMU 76

Figure E1.20. Photograph of SWMU 165

Figure E1.21. Photograph of SWMU 170

Figure E1.22. Photograph of SWMU 158

Figure E1.23. Photograph of SWMU 169

Figure E1.24. Photograph of SWMU 19

Figure E1.25. Photograph of SWMU 138

Figure E1.26. Photograph of SWMU 180

C-218 – 1/4/10 (After)

C-218 – 5/17/10 (After)

Figure E1.27. Photographs of SWMU 181

Figure E1.28. Photograph of SWMU 195

Figure E1.29. Photograph of AOC 486

Figure E1.30. Photograph of AOC 487

Figure E1.31. Photograph of AOC 492

Figure E1.32. Photograph of AOC 493

Figure E1.33. Photograph of SWMU 517

AOC 541: April 16, 2009

Figure E1.34. Photograph of AOC 541

Figure E1.35. Photographs of SWMU 561

Soil Pile D: May 19, 2009

Soil Pile D: May 19, 2009

Figure E1.36. Photographs of AOC 562

Soil Pile D: May 19, 2009

Soil Pile H: May 19, 2009

Figure E1.36. Photographs of AOC 562 (Continued)

Soil Pile J: May 19, 2009

Soil Pile J: May 19, 2009

Figure E1.36. Photographs of AOC 562 (Continued)

Soil Pile 20: May 19, 2009

Soil Pile 20: May 19, 2009

Figure E1.37. Photographs of AOC 563

Soil Pile BW: May 19, 2009

Soil Pile BW: May 19, 2009

Figure E1.37. Photographs of AOC 563 (Continued)

Soil Pile AT: May 19, 2009

Soil Pile AT: May 19, 2009

Figure E1.38. Photographs of AOC 564

0 200 400 800 Feet

Figure E1.39. Photograph of AOC 567

Figure E1.40. Photograph of SWMU 14

Figure E1.41. Photographs of SWMU 518

SWMU 520
View Looking West
April 2009

Figure E1.42. Photograph of SWMU 520

Figure E1.43. Photograph of SWMU 81

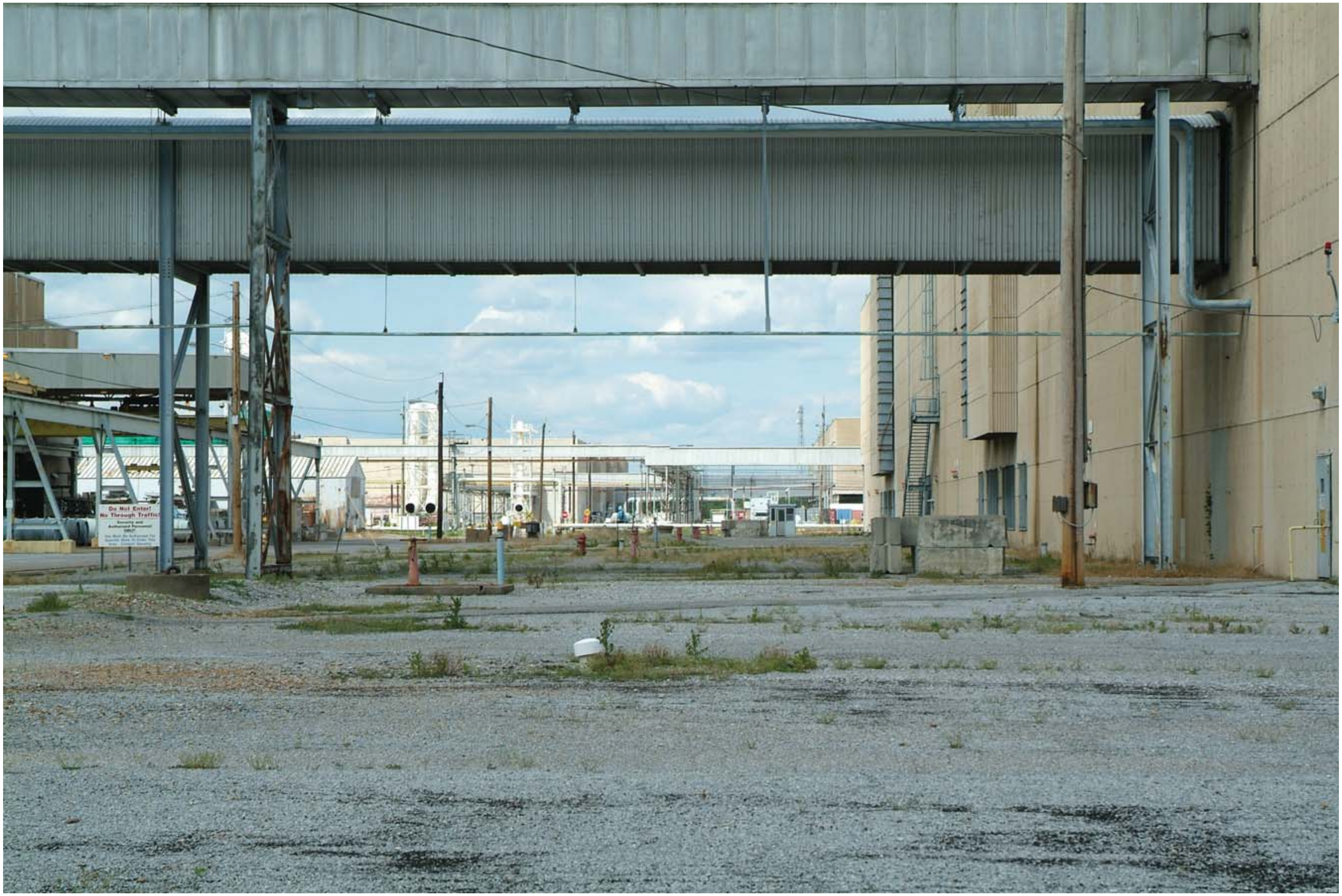

Figure E1.44. Photograph of SWMU 153

Figure E1.45. Photograph of SWMU 156

Figure E1.46. Photograph of SWMU 160

Figure E1.47. Photograph of SWMU 163

Figure E1.48. Photograph of SWMU 219

Figure E1.49. Photograph of SWMU 488

ATTACHMENT E2

SWMU/AOC ECOLOGICAL SCREENING

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Table E2.1. Ecological Screening

SWMU	Analysis	Unit	Bkgd	MaxResult	Soil_NFA	HQ(Max)	Below Bkgd?
1	Beryllium	mg/kg	6.70E-01	1.05E+01	2.50E+00	4.20	No
1	Cadmium	mg/kg	2.10E-01	6.50E+00	3.60E-01	18.06	No
1	Chromium	mg/kg	1.60E+01	2.58E+02	2.60E+01	9.92	No
1	Cobalt	mg/kg	1.40E+01	1.37E+01	1.30E+01	1.05	Yes
1	Copper	mg/kg	1.90E+01	2.31E+02	2.80E+01	8.25	No
1	Lead	mg/kg	3.60E+01	3.23E+02	1.10E+01	29.36	No
1	Manganese	mg/kg	1.50E+03	1.06E+03	2.20E+02	4.82	Yes
1	Mercury	mg/kg	2.00E-01	7.70E+00	1.00E-01	77.00	No
1	Molybdenum	mg/kg		1.42E+01	2.00E+00	7.10	No
1	Nickel	mg/kg	2.10E+01	8.54E+01	3.80E+01	2.25	No
1	PCB, Total	mg/kg		3.50E+01	2.00E-02	1750.00	No
1	Phenol	mg/kg		1.80E+00	5.00E-02	36.00	No
1	Selenium	mg/kg	8.00E-01	9.80E-01	5.20E-01	1.88	No
1	Silver	mg/kg	2.30E+00	4.25E+01	4.20E+00	10.12	No
1	Trichloroethene	mg/kg		1.50E-02	1.00E-03	15.00	No
1	Uranium	mg/kg	4.90E+00	9.86E+00	5.00E+00	1.97	No
1	Vanadium	mg/kg	3.80E+01	4.21E+01	7.80E+00	5.40	No
1	Zinc	mg/kg	6.50E+01	3.90E+02	4.60E+01	8.48	No
1	**Total**					**1990.86**	
99	Chromium	mg/kg	1.60E+01	5.51E+01	2.60E+01	2.12	No
99	Lead	mg/kg	3.60E+01	1.66E+01	1.10E+01	1.51	Yes
99	Manganese	mg/kg	1.50E+03	6.01E+02	2.20E+02	2.73	Yes
99	Mercury	mg/kg	2.00E-01	9.53E+00	1.00E-01	95.30	No
99	Molybdenum	mg/kg		1.60E+01	2.00E+00	8.00	No
99	Nickel	mg/kg	2.10E+01	7.02E+01	3.80E+01	1.85	No
99	Silver	mg/kg	2.30E+00	1.03E+01	4.20E+00	2.45	No
99	Vanadium	mg/kg	3.80E+01	2.36E+01	7.80E+00	3.03	Yes
99	Zinc	mg/kg	6.50E+01	4.72E+02	4.60E+01	10.26	No
99	**Total**					**127.25**	
194	Antimony	mg/kg	2.10E-01	1.50E+00	2.70E-01	5.56	No
194	Arsenic	mg/kg	1.20E+01	2.86E+01	1.80E+01	1.59	No
194	Cadmium	mg/kg	2.10E-01	1.10E+00	3.60E-01	3.06	No
194	Chromium	mg/kg	1.60E+01	7.23E+01	2.60E+01	2.78	No
194	Cobalt	mg/kg	1.40E+01	2.11E+01	1.30E+01	1.62	No
194	Copper	mg/kg	1.90E+01	4.23E+01	2.80E+01	1.51	No
194	Lead	mg/kg	3.60E+01	3.58E+02	1.10E+01	32.51	No
194	Manganese	mg/kg	1.50E+03	4.67E+03	2.20E+02	21.23	No
194	Mercury	mg/kg	2.00E-01	8.92E+00	1.00E-01	89.20	No
194	Molybdenum	mg/kg		1.96E+01	2.00E+00	9.78	No
194	Nickel	mg/kg	2.10E+01	1.01E+02	3.80E+01	2.65	No
194	PCB, Total	mg/kg		1.80E+01	2.00E-02	900.00	No
194	Selenium	mg/kg	8.00E-01	4.03E+00	5.20E-01	7.75	No
194	Silver	mg/kg	2.30E+00	1.55E+01	4.20E+00	3.69	No

Table E2.1. Ecological Screening (Continued)

SWMU	Analysis	Unit	Bkgd	MaxResult	Soil_NFA	HQ(Max)	Below Bkgd?
194	Uranium	mg/kg	4.90E+00	3.36E+01	5.00E+00	6.73	No
194	Vanadium	mg/kg	3.80E+01	4.11E+01	7.80E+00	5.27	No
194	Zinc	mg/kg	6.50E+01	6.40E+02	4.60E+01	13.92	No
194	**Total**					**1108.83**	
196	Antimony	mg/kg	2.10E-01	5.90E-01	2.70E-01	2.19	No
196	Cadmium	mg/kg	2.10E-01	2.53E+00	3.60E-01	7.03	No
196	Lead	mg/kg	3.60E+01	2.75E+01	1.10E+01	2.50	Yes
196	Manganese	mg/kg	1.50E+03	6.80E+02	2.20E+02	3.09	Yes
196	Nickel	mg/kg	2.10E+01	5.56E+02	3.80E+01	14.63	No
196	PCB, Total	mg/kg		1.51E+00	2.00E-02	75.50	No
196	Selenium	mg/kg	8.00E-01	9.30E-01	5.20E-01	1.79	No
196	Uranium	mg/kg	4.90E+00	2.33E+01	5.00E+00	4.66	No
196	Vanadium	mg/kg	3.80E+01	2.56E+01	7.80E+00	3.28	Yes
196	Zinc	mg/kg	6.50E+01	2.22E+02	4.60E+01	4.83	No
196	**Total**					**119.49**	
489	Chromium	mg/kg	1.60E+01	4.16E+01	2.60E+01	1.60	No
489	Lead	mg/kg	3.60E+01	1.39E+01	1.10E+01	1.26	Yes
489	Manganese	mg/kg	1.50E+03	3.83E+02	2.20E+02	1.74	Yes
489	Nickel	mg/kg	2.10E+01	7.88E+01	3.80E+01	2.07	No
489	Selenium	mg/kg	8.00E-01	1.40E+00	5.20E-01	2.69	No
489	Vanadium	mg/kg	3.80E+01	2.35E+01	7.80E+00	3.01	Yes
489	**Total**					**12.39**	
531	Antimony	mg/kg	2.10E-01	1.00E+00	2.70E-01	3.70	No
531	Arsenic	mg/kg	1.20E+01	4.68E+01	1.80E+01	2.60	No
531	Cadmium	mg/kg	2.10E-01	3.10E+00	3.60E-01	8.61	No
531	Chromium	mg/kg	1.60E+01	5.05E+01	2.60E+01	1.94	No
531	Lead	mg/kg	3.60E+01	5.31E+02	1.10E+01	48.29	No
531	Manganese	mg/kg	1.50E+03	8.65E+02	2.20E+02	3.93	Yes
531	Nickel	mg/kg	2.10E+01	1.62E+02	3.80E+01	4.27	No
531	Selenium	mg/kg	8.00E-01	5.60E-01	5.20E-01	1.08	Yes
531	Uranium	mg/kg	4.90E+00	2.41E+01	5.00E+00	4.81	No
531	Vanadium	mg/kg	3.80E+01	9.00E+00	7.80E+00	1.15	Yes
531	Zinc	mg/kg	6.50E+01	2.45E+03	4.60E+01	53.30	No
531	**Total**					**133.69**	
200	Antimony	mg/kg	2.10E-01	5.60E-01	2.70E-01	2.07	No
200	Chromium	mg/kg	1.60E+01	5.75E+01	2.60E+01	2.21	No
200	Copper	mg/kg	1.90E+01	4.42E+01	2.80E+01	1.58	No
200	Lead	mg/kg	3.60E+01	3.20E+01	1.10E+01	2.91	Yes
200	Manganese	mg/kg	1.50E+03	4.39E+02	2.20E+02	1.99	Yes
200	Mercury	mg/kg	2.00E-01	6.71E+00	1.00E-01	67.10	No
200	Nickel	mg/kg	2.10E+01	2.60E+02	3.80E+01	6.83	No
200	PCB, Total	mg/kg		2.60E+00	2.00E-02	130.00	No
200	Selenium	mg/kg	8.00E-01	5.84E+00	5.20E-01	11.23	No

Table E2.1. Ecological Screening (Continued)

SWMU	Analysis	Unit	Bkgd	MaxResult	Soil_NFA	HQ(Max)	Below Bkgd?
200	Uranium	mg/kg	4.90E+00	4.93E+01	5.00E+00	9.85	No
200	Vanadium	mg/kg	3.80E+01	1.44E+01	7.80E+00	1.85	Yes
200	Zinc	mg/kg	6.50E+01	2.48E+02	4.60E+01	5.40	No
200	**Total**					**243.03**	
212	Antimony	mg/kg	2.10E-01	5.20E-01	2.70E-01	1.93	No
212	Chromium	mg/kg	1.60E+01	3.58E+01	2.60E+01	1.38	No
212	Lead	mg/kg	3.60E+01	1.71E+01	1.10E+01	1.55	Yes
212	Manganese	mg/kg	1.50E+03	6.69E+02	2.20E+02	3.04	Yes
212	Nickel	mg/kg	2.10E+01	8.69E+01	3.80E+01	2.29	No
212	PCB, Total	mg/kg		1.80E-01	2.00E-02	9.00	No
212	Selenium	mg/kg	8.00E-01	8.50E-01	5.20E-01	1.63	No
212	Uranium	mg/kg	4.90E+00	2.30E+01	5.00E+00	4.60	No
212	Vanadium	mg/kg	3.80E+01	2.45E+01	7.80E+00	3.14	Yes
212	Zinc	mg/kg	6.50E+01	6.88E+01	4.60E+01	1.50	No
212	**Total**					**30.06**	
213	Antimony	mg/kg	2.10E-01	8.50E-01	2.70E-01	3.15	No
213	Cadmium	mg/kg	2.10E-01	5.10E-01	3.60E-01	1.42	No
213	Chromium	mg/kg	1.60E+01	4.78E+01	2.60E+01	1.84	No
213	Lead	mg/kg	3.60E+01	1.84E+01	1.10E+01	1.67	Yes
213	Manganese	mg/kg	1.50E+03	9.06E+02	2.20E+02	4.12	Yes
213	Nickel	mg/kg	2.10E+01	9.10E+01	3.80E+01	2.39	No
213	PCB, Total	mg/kg		7.30E-02	2.00E-02	3.65	No
213	Selenium	mg/kg	8.00E-01	7.70E-01	5.20E-01	1.48	Yes
213	Silver	mg/kg	2.30E+00	1.32E+01	4.20E+00	3.14	No
213	Uranium	mg/kg	4.90E+00	8.89E+00	5.00E+00	1.78	No
213	Vanadium	mg/kg	3.80E+01	1.31E+01	7.80E+00	1.68	Yes
213	Zinc	mg/kg	6.50E+01	1.17E+02	4.60E+01	2.55	No
213	**Total**					**28.87**	
214	Antimony	mg/kg	2.10E-01	5.70E-01	2.70E-01	2.11	No
214	Lead	mg/kg	3.60E+01	1.49E+01	1.10E+01	1.36	Yes
214	Manganese	mg/kg	1.50E+03	6.12E+02	2.20E+02	2.78	Yes
214	Selenium	mg/kg	8.00E-01	6.70E-01	5.20E-01	1.29	Yes
214	Vanadium	mg/kg	3.80E+01	1.70E+01	7.80E+00	2.18	Yes
214	Zinc	mg/kg	6.50E+01	6.20E+01	4.60E+01	1.35	Yes
214	**Total**					**11.06**	
215	Antimony	mg/kg	2.10E-01	6.80E-01	2.70E-01	2.52	No
215	Cadmium	mg/kg	2.10E-01	3.90E-01	3.60E-01	1.08	No
215	Chromium	mg/kg	1.60E+01	5.73E+01	2.60E+01	2.20	No
215	Lead	mg/kg	3.60E+01	1.96E+01	1.10E+01	1.78	Yes
215	Manganese	mg/kg	1.50E+03	6.72E+02	2.20E+02	3.05	Yes
215	Nickel	mg/kg	2.10E+01	7.32E+01	3.80E+01	1.93	No
215	Selenium	mg/kg	8.00E-01	9.20E-01	5.20E-01	1.77	No
215	Vanadium	mg/kg	3.80E+01	1.48E+01	7.80E+00	1.90	Yes

Table E2.1. Ecological Screening (Continued)

SWMU	Analysis	Unit	Bkgd	MaxResult	Soil_NFA	HQ(Max)	Below Bkgd?
215	Zinc	mg/kg	6.50E+01	5.73E+02	4.60E+01	12.46	No
215	**Total**					**28.70**	
216	Antimony	mg/kg	2.10E-01	3.40E-01	2.70E-01	1.26	No
216	Cadmium	mg/kg	2.10E-01	4.20E-01	3.60E-01	1.17	No
216	Lead	mg/kg	3.60E+01	1.78E+01	1.10E+01	1.62	Yes
216	Manganese	mg/kg	1.50E+03	6.64E+02	2.20E+02	3.02	Yes
216	Phenol	mg/kg		1.30E-01	5.00E-02	2.60	No
216	Selenium	mg/kg	8.00E-01	1.30E+00	5.20E-01	2.50	No
216	Uranium	mg/kg	4.90E+00	8.43E+00	5.00E+00	1.69	No
216	Vanadium	mg/kg	3.80E+01	2.66E+01	7.80E+00	3.41	Yes
216	**Total**					**17.26**	
217	Antimony	mg/kg	2.10E-01	1.70E+00	2.70E-01	6.30	No
217	Arsenic	mg/kg	1.20E+01	2.13E+01	1.80E+01	1.18	No
217	Cadmium	mg/kg	2.10E-01	6.90E-01	3.60E-01	1.92	No
217	Chromium	mg/kg	1.60E+01	1.08E+02	2.60E+01	4.16	No
217	Cobalt	mg/kg	1.40E+01	2.70E+01	1.30E+01	2.08	No
217	Copper	mg/kg	1.90E+01	3.72E+01	2.80E+01	1.33	No
217	Lead	mg/kg	3.60E+01	4.35E+01	1.10E+01	3.96	No
217	Manganese	mg/kg	1.50E+03	2.05E+03	2.20E+02	9.34	No
217	Mercury	mg/kg	2.00E-01	8.59E+00	1.00E-01	85.90	No
217	Molybdenum	mg/kg		5.89E+00	2.00E+00	2.95	No
217	Nickel	mg/kg	2.10E+01	1.31E+02	3.80E+01	3.46	No
217	Selenium	mg/kg	8.00E-01	1.67E+00	5.20E-01	3.21	No
217	Silver	mg/kg	2.30E+00	1.61E+01	4.20E+00	3.83	No
217	Trichloroethene	mg/kg		4.00E-03	1.00E-03	4.00	No
217	Uranium	mg/kg	4.90E+00	7.90E+00	5.00E+00	1.58	No
217	Vanadium	mg/kg	3.80E+01	2.68E+01	7.80E+00	3.44	Yes
217	Zinc	mg/kg	6.50E+01	5.89E+02	4.60E+01	12.81	No
217	**Total**					**151.43**	
221	Antimony	mg/kg	2.10E-01	3.00E-01	2.70E-01	1.11	No
221	Cadmium	mg/kg	2.10E-01	3.90E-01	3.60E-01	1.08	No
221	Chromium	mg/kg	1.60E+01	7.28E+01	2.60E+01	2.80	No
221	Copper	mg/kg	1.90E+01	2.89E+01	2.80E+01	1.03	No
221	HMW PAHs	mg/kg		1.30E+00	1.10E+00	1.18	No
221	Lead	mg/kg	3.60E+01	4.58E+01	1.10E+01	4.16	No
221	Manganese	mg/kg	1.50E+03	4.98E+02	2.20E+02	2.26	Yes
221	Nickel	mg/kg	2.10E+01	8.03E+01	3.80E+01	2.11	No
221	PCB, Total	mg/kg		5.00E-01	2.00E-02	25.00	No
221	Selenium	mg/kg	8.00E-01	7.70E-01	5.20E-01	1.48	Yes
221	Uranium	mg/kg	4.90E+00	1.64E+01	5.00E+00	3.27	No
221	Vanadium	mg/kg	3.80E+01	1.04E+01	7.80E+00	1.33	Yes
221	Zinc	mg/kg	6.50E+01	1.61E+02	4.60E+01	3.51	No
221	**Total**					**50.35**	

Table E2.1. Ecological Screening (Continued)

SWMU	Analysis	Unit	Bkgd	MaxResult	Soil_NFA	HQ(Max)	Below Bkgd?
222	Antimony	mg/kg	2.10E-01	3.90E-01	2.70E-01	1.44	No
222	Cadmium	mg/kg	2.10E-01	5.50E-01	3.60E-01	1.53	No
222	Chromium	mg/kg	1.60E+01	4.73E+01	2.60E+01	1.82	No
222	Lead	mg/kg	3.60E+01	3.25E+01	1.10E+01	2.95	Yes
222	Manganese	mg/kg	1.50E+03	8.55E+02	2.20E+02	3.89	Yes
222	Nickel	mg/kg	2.10E+01	9.19E+01	3.80E+01	2.42	No
222	PCB, Total	mg/kg		1.40E+00	2.00E-02	70.00	No
222	Selenium	mg/kg	8.00E-01	1.40E+00	5.20E-01	2.69	No
222	Uranium	mg/kg	4.90E+00	5.86E+01	5.00E+00	11.72	No
222	Vanadium	mg/kg	3.80E+01	3.00E+01	7.80E+00	3.85	Yes
222	Zinc	mg/kg	6.50E+01	9.45E+01	4.60E+01	2.05	No
222	**Total**					**104.36**	
227	Cadmium	mg/kg	2.10E-01	6.30E-01	3.60E-01	1.75	No
227	Chromium	mg/kg	1.60E+01	5.63E+01	2.60E+01	2.17	No
227	Cobalt	mg/kg	1.40E+01	1.48E+01	1.30E+01	1.14	No
227	Copper	mg/kg	1.90E+01	1.58E+02	2.80E+01	5.64	No
227	Lead	mg/kg	3.60E+01	9.87E+01	1.10E+01	8.97	No
227	Manganese	mg/kg	1.50E+03	1.15E+03	2.20E+02	5.23	Yes
227	Mercury	mg/kg	2.00E-01	8.41E+00	1.00E-01	84.10	No
227	Molybdenum	mg/kg		5.21E+00	2.00E+00	2.61	No
227	Nickel	mg/kg	2.10E+01	6.53E+02	3.80E+01	17.18	No
227	PCB, Total	mg/kg		1.26E+01	2.00E-02	630.00	No
227	Selenium	mg/kg	8.00E-01	1.40E+00	5.20E-01	2.69	No
227	Uranium	mg/kg	4.90E+00	4.38E+02	5.00E+00	87.60	No
227	Vanadium	mg/kg	3.80E+01	3.11E+01	7.80E+00	3.99	Yes
227	Zinc	mg/kg	6.50E+01	1.99E+02	4.60E+01	4.33	No
227	**Total**					**857.39**	
228	Antimony	mg/kg	2.10E-01	6.30E-01	2.70E-01	2.33	No
228	Cadmium	mg/kg	2.10E-01	3.90E+00	3.60E-01	10.83	No
228	Chromium	mg/kg	1.60E+01	1.89E+02	2.60E+01	7.27	No
228	Copper	mg/kg	1.90E+01	9.80E+01	2.80E+01	3.50	No
228	Lead	mg/kg	3.60E+01	6.09E+01	1.10E+01	5.53	No
228	Manganese	mg/kg	1.50E+03	4.49E+02	2.20E+02	2.04	Yes
228	Mercury	mg/kg	2.00E-01	9.37E+00	1.00E-01	93.70	No
228	Nickel	mg/kg	2.10E+01	7.92E+01	3.80E+01	2.08	No
228	Selenium	mg/kg	8.00E-01	3.97E+00	5.20E-01	7.63	No
228	Silver	mg/kg	2.30E+00	1.16E+01	4.20E+00	2.77	No
228	Uranium	mg/kg	4.90E+00	1.51E+01	5.00E+00	3.03	No
228	Zinc	mg/kg	6.50E+01	1.91E+02	4.60E+01	4.15	No
228	**Total**					**144.87**	
76	HMW PAHs	mg/kg		2.30E+00	1.10E+00	2.09	No
76	Lead	mg/kg	3.60E+01	2.21E+01	1.10E+01	2.01	Yes
76	Manganese	mg/kg	1.50E+03	4.37E+02	2.20E+02	1.99	Yes

Table E2.1. Ecological Screening (Continued)

SWMU	Analysis	Unit	Bkgd	MaxResult	Soil_NFA	HQ(Max)	Below Bkgd?
76	PCB, Total	mg/kg		2.60E-01	2.00E-02	13.00	No
76	Selenium	mg/kg	8.00E-01	9.70E-01	5.20E-01	1.87	No
76	Vanadium	mg/kg	3.80E+01	2.44E+01	7.80E+00	3.13	Yes
76	Zinc	mg/kg	6.50E+01	6.83E+01	4.60E+01	1.48	No
76	**Total**					**25.56**	
165	Antimony	mg/kg	2.10E-01	2.20E+00	2.70E-01	8.15	No
165	Arsenic	mg/kg	1.20E+01	1.30E+02	1.80E+01	7.24	No
165	Barium	mg/kg	2.00E+02	1.14E+03	3.30E+02	3.45	No
165	Chromium	mg/kg	1.60E+01	6.66E+01	2.60E+01	2.56	No
165	Copper	mg/kg	1.90E+01	6.60E+01	2.80E+01	2.36	No
165	HMW PAHs	mg/kg		2.40E+00	1.10E+00	2.18	No
165	Lead	mg/kg	3.60E+01	5.15E+01	1.10E+01	4.68	No
165	Manganese	mg/kg	1.50E+03	4.34E+02	2.20E+02	1.97	Yes
165	Mercury	mg/kg	2.00E-01	9.00E-01	1.00E-01	9.00	No
165	Nickel	mg/kg	2.10E+01	3.92E+01	3.80E+01	1.03	No
165	PCB, Total	mg/kg		5.10E+01	2.00E-02	2550.00	No
165	Selenium	mg/kg	8.00E-01	1.25E+01	5.20E-01	24.04	No
165	Silver	mg/kg	2.30E+00	8.33E+01	4.20E+00	19.83	No
165	Toluene	mg/kg		2.10E-01	1.00E-02	21.00	No
165	Uranium	mg/kg	4.90E+00	2.68E+02	5.00E+00	53.60	No
165	Vanadium	mg/kg	3.80E+01	2.47E+01	7.80E+00	3.17	Yes
165	Zinc	mg/kg	6.50E+01	1.22E+02	4.60E+01	2.65	No
165	**Total**					**2716.93**	
158	Antimony	mg/kg	2.10E-01	7.00E-01	2.70E-01	2.59	No
158	Cadmium	mg/kg	2.10E-01	3.90E-01	3.60E-01	1.08	No
158	Chromium	mg/kg	1.60E+01	6.16E+01	2.60E+01	2.37	No
158	Cobalt	mg/kg	1.40E+01	3.65E+01	1.30E+01	2.81	No
158	Copper	mg/kg	1.90E+01	4.34E+01	2.80E+01	1.55	No
158	Lead	mg/kg	3.60E+01	9.43E+01	1.10E+01	8.57	No
158	Manganese	mg/kg	1.50E+03	1.86E+03	2.20E+02	8.45	No
158	Mercury	mg/kg	2.00E-01	1.05E+01	1.00E-01	104.60	No
158	Nickel	mg/kg	2.10E+01	1.32E+02	3.80E+01	3.47	No
158	Selenium	mg/kg	8.00E-01	2.20E+00	5.20E-01	4.23	No
158	Uranium	mg/kg	4.90E+00	3.02E+01	5.00E+00	6.05	No
158	Vanadium	mg/kg	3.80E+01	3.06E+01	7.80E+00	3.92	Yes
158	Zinc	mg/kg	6.50E+01	9.89E+01	4.60E+01	2.15	No
158	**Total**					**151.85**	
169	Antimony	mg/kg	2.10E-01	1.30E+00	2.70E-01	4.81	No
169	Arsenic	mg/kg	1.20E+01	2.03E+01	1.80E+01	1.13	No
169	Cadmium	mg/kg	2.10E-01	6.10E-01	3.60E-01	1.69	No
169	Chromium	mg/kg	1.60E+01	2.15E+02	2.60E+01	8.27	No
169	Copper	mg/kg	1.90E+01	3.74E+02	2.80E+01	13.37	No
169	HMW PAHs	mg/kg		4.30E+00	1.10E+00	3.91	No

Table E2.1. Ecological Screening (Continued)

SWMU	Analysis	Unit	Bkgd	MaxResult	Soil_NFA	HQ(Max)	Below Bkgd?
169	Lead	mg/kg	3.60E+01	1.54E+02	1.10E+01	13.96	No
169	Manganese	mg/kg	1.50E+03	6.08E+02	2.20E+02	2.76	Yes
169	Mercury	mg/kg	2.00E-01	7.87E+00	1.00E-01	78.70	No
169	Molybdenum	mg/kg		6.27E+00	2.00E+00	3.14	No
169	Nickel	mg/kg	2.10E+01	5.49E+02	3.80E+01	14.44	No
169	PCB, Total	mg/kg		1.00E+01	2.00E-02	500.00	No
169	Selenium	mg/kg	8.00E-01	1.50E+00	5.20E-01	2.88	No
169	Uranium	mg/kg	4.90E+00	5.03E+01	5.00E+00	10.06	No
169	Vanadium	mg/kg	3.80E+01	3.74E+01	7.80E+00	4.79	Yes
169	Zinc	mg/kg	6.50E+01	4.73E+02	4.60E+01	10.28	No
169	**Total**					**674.21**	
19	Cadmium	mg/kg	2.10E-01	1.20E+00	3.60E-01	3.33	No
19	Copper	mg/kg	1.90E+01	5.09E+01	2.80E+01	1.82	No
19	HMW PAHs	mg/kg		5.80E+00	1.10E+00	5.27	No
19	Lead	mg/kg	3.60E+01	5.08E+01	1.10E+01	4.62	No
19	Manganese	mg/kg	1.50E+03	7.23E+02	2.20E+02	3.29	Yes
19	Mercury	mg/kg	2.00E-01	1.01E-01	1.00E-01	1.01	Yes
19	Vanadium	mg/kg	3.80E+01	2.25E+01	7.80E+00	2.88	Yes
19	Zinc	mg/kg	6.50E+01	2.03E+02	4.60E+01	4.41	No
19	**Total**					**26.64**	
138	Antimony	mg/kg	2.10E-01	7.34E+00	2.70E-01	27.19	No
138	Cadmium	mg/kg	2.10E-01	7.30E+00	3.60E-01	20.28	No
138	Chromium	mg/kg	1.60E+01	5.39E+01	2.60E+01	2.07	No
138	Copper	mg/kg	1.90E+01	4.13E+01	2.80E+01	1.48	No
138	Lead	mg/kg	3.60E+01	2.81E+02	1.10E+01	25.50	No
138	Manganese	mg/kg	1.50E+03	7.38E+02	2.20E+02	3.36	Yes
138	Mercury	mg/kg	2.00E-01	2.13E+01	1.00E-01	213.00	No
138	Nickel	mg/kg	2.10E+01	1.13E+02	3.80E+01	2.98	No
138	PCB, Total	mg/kg		5.00E-01	2.00E-02	25.00	No
138	Selenium	mg/kg	8.00E-01	1.66E+00	5.20E-01	3.19	No
138	Silver	mg/kg	2.30E+00	1.27E+01	4.20E+00	3.02	No
138	Uranium	mg/kg	4.90E+00	9.09E+00	5.00E+00	1.82	No
138	Vanadium	mg/kg	3.80E+01	2.93E+01	7.80E+00	3.76	Yes
138	Zinc	mg/kg	6.50E+01	9.18E+01	4.60E+01	2.00	No
138	**Total**					**334.62**	
180	Antimony	mg/kg	2.10E-01	5.90E-01	2.70E-01	2.19	No
180	Arsenic	mg/kg	1.20E+01	1.38E+02	1.80E+01	7.67	No
180	Chromium	mg/kg	1.60E+01	6.00E+01	2.60E+01	2.31	No
180	Cobalt	mg/kg	1.40E+01	1.32E+01	1.30E+01	1.02	Yes
180	Copper	mg/kg	1.90E+01	9.42E+01	2.80E+01	3.36	No
180	Lead	mg/kg	3.60E+01	1.99E+03	1.10E+01	181.11	No
180	Manganese	mg/kg	1.50E+03	1.99E+03	2.20E+02	9.05	No
180	Mercury	mg/kg	2.00E-01	8.28E+00	1.00E-01	82.80	No

Table E2.1. Ecological Screening (Continued)

SWMU	Analysis	Unit	Bkgd	MaxResult	Soil_NFA	HQ(Max)	Below Bkgd?
180	Nickel	mg/kg	2.10E+01	9.03E+01	3.80E+01	2.38	No
180	Selenium	mg/kg	8.00E-01	1.80E+00	5.20E-01	3.46	No
180	Silver	mg/kg	2.30E+00	1.14E+01	4.20E+00	2.71	No
180	Vanadium	mg/kg	3.80E+01	4.85E+01	7.80E+00	6.22	No
180	Zinc	mg/kg	6.50E+01	6.86E+01	4.60E+01	1.49	No
180	**Total**					**305.75**	
181	Antimony	mg/kg	2.10E-01	2.80E-01	2.70E-01	1.04	No
181	Cadmium	mg/kg	2.10E-01	6.95E-01	3.60E-01	1.93	No
181	Chromium	mg/kg	1.60E+01	3.12E+01	2.60E+01	1.20	No
181	Copper	mg/kg	1.90E+01	4.47E+01	2.80E+01	1.60	No
181	Lead	mg/kg	3.60E+01	3.50E+01	1.10E+01	3.18	Yes
181	Manganese	mg/kg	1.50E+03	5.12E+02	2.20E+02	2.33	Yes
181	Mercury	mg/kg	2.00E-01	1.30E-01	1.00E-01	1.30	Yes
181	Thallium	mg/kg	2.10E-01	3.50E+00	1.00E+00	3.50	No
181	Vanadium	mg/kg	3.80E+01	2.50E+01	7.80E+00	3.21	Yes
181	Zinc	mg/kg	6.50E+01	8.55E+01	4.60E+01	1.86	No
181	**Total**					**21.14**	
195	Antimony	mg/kg	2.10E-01	5.10E-01	2.70E-01	1.89	No
195	Arsenic	mg/kg	1.20E+01	2.46E+01	1.80E+01	1.37	No
195	Barium	mg/kg	2.00E+02	4.53E+02	3.30E+02	1.37	No
195	Chromium	mg/kg	1.60E+01	1.21E+02	2.60E+01	4.65	No
195	Cobalt	mg/kg	1.40E+01	2.77E+01	1.30E+01	2.13	No
195	Copper	mg/kg	1.90E+01	4.46E+01	2.80E+01	1.59	No
195	Lead	mg/kg	3.60E+01	4.17E+01	1.10E+01	3.79	No
195	Manganese	mg/kg	1.50E+03	1.42E+03	2.20E+02	6.44	Yes
195	Mercury	mg/kg	2.00E-01	4.17E-01	1.00E-01	4.17	No
195	Molybdenum	mg/kg		5.60E+00	2.00E+00	2.80	No
195	Nickel	mg/kg	2.10E+01	9.81E+01	3.80E+01	2.58	No
195	PCB, Total	mg/kg		7.40E-01	2.00E-02	37.00	No
195	Selenium	mg/kg	8.00E-01	1.80E+00	5.20E-01	3.46	No
195	Silver	mg/kg	2.30E+00	1.31E+01	4.20E+00	3.12	No
195	Uranium	mg/kg	4.90E+00	1.16E+01	5.00E+00	2.32	No
195	Vanadium	mg/kg	3.80E+01	7.97E+01	7.80E+00	10.22	No
195	Zinc	mg/kg	6.50E+01	1.43E+02	4.60E+01	3.11	No
195	**Total**					**92.01**	
492	Beryllium	mg/kg	6.70E-01	1.04E+01	2.50E+00	4.16	No
492	Cadmium	mg/kg	2.10E-01	3.14E+00	3.60E-01	8.72	No
492	Chromium	mg/kg	1.60E+01	1.04E+03	2.60E+01	40.00	No
492	Copper	mg/kg	1.90E+01	8.47E+01	2.80E+01	3.03	No
492	Lead	mg/kg	3.60E+01	2.80E+01	1.10E+01	2.55	Yes
492	Manganese	mg/kg	1.50E+03	4.26E+02	2.20E+02	1.94	Yes
492	PCB, Total	mg/kg		4.41E+01	2.00E-02	2205.00	No
492	Selenium	mg/kg	8.00E-01	6.50E-01	5.20E-01	1.25	Yes

Table E2.1. Ecological Screening (Continued)

SWMU	Analysis	Unit	Bkgd	MaxResult	Soil_NFA	HQ(Max)	Below Bkgd?
492	Uranium	mg/kg	4.90E+00	1.77E+03	5.00E+00	354.00	No
492	Vanadium	mg/kg	3.80E+01	4.32E+01	7.80E+00	5.54	No
492	Zinc	mg/kg	6.50E+01	6.62E+02	4.60E+01	14.39	No
492	**Total**					**2640.57**	
493	Barium	mg/kg	2.00E+02	4.04E+02	3.30E+02	1.22	No
493	Chromium	mg/kg	1.60E+01	6.61E+01	2.60E+01	2.54	No
493	Cobalt	mg/kg	1.40E+01	3.79E+01	1.30E+01	2.92	No
493	Copper	mg/kg	1.90E+01	9.87E+01	2.80E+01	3.53	No
493	Lead	mg/kg	3.60E+01	4.79E+01	1.10E+01	4.35	No
493	Manganese	mg/kg	1.50E+03	3.55E+03	2.20E+02	16.14	No
493	Mercury	mg/kg	2.00E-01	2.60E-01	1.00E-01	2.60	No
493	Nickel	mg/kg	2.10E+01	2.13E+02	3.80E+01	5.61	No
493	PCB, Total	mg/kg		2.60E-01	2.00E-02	13.00	No
493	Selenium	mg/kg	8.00E-01	1.31E+00	5.20E-01	2.52	No
493	Vanadium	mg/kg	3.80E+01	4.05E+01	7.80E+00	5.19	No
493	Zinc	mg/kg	6.50E+01	7.59E+01	4.60E+01	1.65	No
493	**Total**					**61.26**	
517	Chromium	mg/kg	1.60E+01	4.91E+01	2.60E+01	1.89	No
517	Copper	mg/kg	1.90E+01	3.37E+01	2.80E+01	1.20	No
517	Lead	mg/kg	3.60E+01	3.22E+01	1.10E+01	2.93	Yes
517	Manganese	mg/kg	1.50E+03	3.42E+02	2.20E+02	1.55	Yes
517	Nickel	mg/kg	2.10E+01	1.72E+02	3.80E+01	4.53	No
517	PCB, Total	mg/kg		5.00E-01	2.00E-02	25.00	No
517	Vanadium	mg/kg	3.80E+01	2.67E+01	7.80E+00	3.42	Yes
517	Zinc	mg/kg	6.50E+01	1.25E+03	4.60E+01	27.17	No
517	**Total**					**67.70**	
541	Cadmium	mg/kg	2.10E-01	2.75E+00	3.60E-01	7.64	No
541	Chromium	mg/kg	1.60E+01	3.35E+03	2.60E+01	128.94	No
541	Copper	mg/kg	1.90E+01	1.61E+02	2.80E+01	5.75	No
541	HMW PAHs	mg/kg		1.10E+01	1.10E+00	10.00	No
541	Lead	mg/kg	3.60E+01	9.43E+01	1.10E+01	8.57	No
541	Manganese	mg/kg	1.50E+03	8.21E+02	2.20E+02	3.73	Yes
541	Mercury	mg/kg	2.00E-01	2.30E-01	1.00E-01	2.30	No
541	PCB, Total	mg/kg		9.40E+01	2.00E-02	4700.00	No
541	Selenium	mg/kg	8.00E-01	2.00E+00	5.20E-01	3.85	No
541	Uranium	mg/kg	4.90E+00	2.02E+04	5.00E+00	4040.00	No
541	Uranium-238	pCi/g	1.20E+00	4.54E+03	1.57E+03	2.89	No
541	Vanadium	mg/kg	3.80E+01	4.97E+01	7.80E+00	6.37	No
541	Zinc	mg/kg	6.50E+01	1.09E+03	4.60E+01	23.70	No
541	**Total**					**8943.74**	
561	Antimony	mg/kg	2.10E-01	2.20E+01	2.70E-01	81.48	No
561	Arsenic	mg/kg	1.20E+01	3.96E+01	1.80E+01	2.20	No
561	Barium	mg/kg	2.00E+02	4.38E+02	3.30E+02	1.33	No

Table E2.1. Ecological Screening (Continued)

SWMU	Analysis	Unit	Bkgd	MaxResult	Soil_NFA	HQ(Max)	Below Bkgd?
561	Boron	mg/kg		7.10E+00	5.00E-01	14.20	No
561	Cadmium	mg/kg	2.10E-01	1.20E+00	3.60E-01	3.33	No
561	Chromium	mg/kg	1.60E+01	1.37E+03	2.60E+01	52.69	No
561	Cobalt	mg/kg	1.40E+01	3.10E+01	1.30E+01	2.38	No
561	Copper	mg/kg	1.90E+01	6.25E+01	2.80E+01	2.23	No
561	HMW PAHs	mg/kg		8.80E+00	1.10E+00	8.00	No
561	Lead	mg/kg	3.60E+01	2.25E+02	1.10E+01	20.50	No
561	Manganese	mg/kg	1.50E+03	5.23E+03	2.20E+02	23.77	No
561	Molybdenum	mg/kg		2.40E+00	2.00E+00	1.20	No
561	PCB, Total	mg/kg		7.90E+01	2.00E-02	3950.00	No
561	Selenium	mg/kg	8.00E-01	1.10E+00	5.20E-01	2.12	No
561	Thallium	mg/kg	2.10E-01	1.20E+00	1.00E+00	1.20	No
561	Uranium	mg/kg	4.90E+00	6.41E+03	5.00E+00	1282.00	No
561	Vanadium	mg/kg	3.80E+01	8.69E+01	7.80E+00	11.14	No
561	Zinc	mg/kg	6.50E+01	1.13E+03	4.60E+01	24.57	No
561	**Total**					**5484.34**	
562	Cadmium	mg/kg	2.10E-01	4.87E-01	3.60E-01	1.35	No
562	Chromium	mg/kg	1.60E+01	1.53E+02	2.60E+01	5.89	No
562	Lead	mg/kg	3.60E+01	2.53E+01	1.10E+01	2.30	Yes
562	Manganese	mg/kg	1.50E+03	4.71E+02	2.20E+02	2.14	Yes
562	PCB, Total	mg/kg		1.58E+00	2.00E-02	79.00	No
562	Uranium	mg/kg	4.90E+00	2.08E+02	5.00E+00	41.60	No
562	Vanadium	mg/kg	3.80E+01	1.79E+01	7.80E+00	2.29	Yes
562	Zinc	mg/kg	6.50E+01	8.36E+01	4.60E+01	1.82	No
562	**Total**					**136.40**	
563	Cadmium	mg/kg	2.10E-01	8.96E-01	3.60E-01	2.49	No
563	Chromium	mg/kg	1.60E+01	2.85E+02	2.60E+01	10.96	No
563	Lead	mg/kg	3.60E+01	2.12E+01	1.10E+01	1.92	Yes
563	Manganese	mg/kg	1.50E+03	5.28E+02	2.20E+02	2.40	Yes
563	PCB, Total	mg/kg		7.40E-01	2.00E-02	37.00	No
563	Uranium	mg/kg	4.90E+00	1.51E+01	5.00E+00	3.02	No
563	Vanadium	mg/kg	3.80E+01	2.53E+01	7.80E+00	3.24	Yes
563	Zinc	mg/kg	6.50E+01	1.98E+02	4.60E+01	4.30	No
563	**Total**					**65.34**	
564	Arsenic	mg/kg	1.20E+01	4.30E+01	1.80E+01	2.39	No
564	Cadmium	mg/kg	2.10E-01	1.96E+00	3.60E-01	5.44	No
564	Chromium	mg/kg	1.60E+01	7.49E+01	2.60E+01	2.88	No
564	Copper	mg/kg	1.90E+01	4.63E+01	2.80E+01	1.65	No
564	Lead	mg/kg	3.60E+01	4.09E+01	1.10E+01	3.72	No
564	Manganese	mg/kg	1.50E+03	4.87E+02	2.20E+02	2.21	Yes
564	Mercury	mg/kg	2.00E-01	2.30E-01	1.00E-01	2.30	No
564	Molybdenum	mg/kg		7.84E+00	2.00E+00	3.92	No
564	PCB, Total	mg/kg		1.93E+00	2.00E-02	96.50	No

Table E2.1. Ecological Screening (Continued)

SWMU	Analysis	Unit	Bkgd	MaxResult	Soil_NFA	HQ(Max)	Below Bkgd?
564	Selenium	mg/kg	8.00E-01	2.82E+00	5.20E-01	5.42	No
564	Thallium	mg/kg	2.10E-01	2.36E+00	1.00E+00	2.36	No
564	Uranium	mg/kg	4.90E+00	5.83E+01	5.00E+00	11.66	No
564	Vanadium	mg/kg	3.80E+01	8.06E+01	7.80E+00	10.33	No
564	Zinc	mg/kg	6.50E+01	1.06E+02	4.60E+01	2.30	No
564	**Total**					**153.10**	
567	Chromium	mg/kg	1.60E+01	3.79E+01	2.60E+01	1.46	No
567	Lead	mg/kg	3.60E+01	1.42E+01	1.10E+01	1.29	Yes
567	Manganese	mg/kg	1.50E+03	1.32E+03	2.20E+02	6.00	Yes
567	PCB, Total	mg/kg		4.60E-02	2.00E-02	2.30	No
567	Vanadium	mg/kg	3.80E+01	2.89E+01	7.80E+00	3.71	Yes
567	**Total**					**14.75**	
14	Antimony	mg/kg	2.10E-01	4.30E+00	2.70E-01	15.93	No
14	Arsenic	mg/kg	1.20E+01	2.58E+01	1.80E+01	1.43	No
14	Cadmium	mg/kg	2.10E-01	3.90E+00	3.60E-01	10.83	No
14	Chromium	mg/kg	1.60E+01	8.98E+02	2.60E+01	34.52	No
14	Cobalt	mg/kg	1.40E+01	1.40E+01	1.30E+01	1.08	No
14	Copper	mg/kg	1.90E+01	1.10E+03	2.80E+01	39.24	No
14	Lead	mg/kg	3.60E+01	1.49E+02	1.10E+01	13.53	No
14	Manganese	mg/kg	1.50E+03	2.67E+03	2.20E+02	12.13	No
14	Mercury	mg/kg	2.00E-01	4.37E+01	1.00E-01	437.10	No
14	Molybdenum	mg/kg		2.87E+01	2.00E+00	14.34	No
14	Nickel	mg/kg	2.10E+01	2.67E+03	3.80E+01	70.22	No
14	PCB, Total	mg/kg		1.00E+01	2.00E-02	500.00	No
14	Selenium	mg/kg	8.00E-01	4.75E+00	5.20E-01	9.13	No
14	Silver	mg/kg	2.30E+00	1.67E+01	4.20E+00	3.97	No
14	Uranium	mg/kg	4.90E+00	4.60E+03	5.00E+00	920.00	No
14	Vanadium	mg/kg	3.80E+01	3.46E+01	7.80E+00	4.44	Yes
14	Zinc	mg/kg	6.50E+01	7.37E+02	4.60E+01	16.03	No
14	**Total**					**2103.92**	
518	Cobalt	mg/kg	1.40E+01	1.76E+01	1.30E+01	1.35	No
518	HMW PAHs	mg/kg		1.70E+02	1.10E+00	154.55	No
518	Lead	mg/kg	3.60E+01	3.19E+01	1.10E+01	2.90	Yes
518	LMW PAHs	mg/kg		1.50E+02	2.90E+01	5.17	No
518	Manganese	mg/kg	1.50E+03	4.93E+02	2.20E+02	2.24	Yes
518	PCB, Total	mg/kg		1.64E+00	2.00E-02	82.00	No
518	Selenium	mg/kg	8.00E-01	1.06E+00	5.20E-01	2.04	No
518	Uranium	mg/kg	4.90E+00	2.17E+02	5.00E+00	43.40	No
518	Vanadium	mg/kg	3.80E+01	2.08E+01	7.80E+00	2.67	Yes
518	Zinc	mg/kg	6.50E+01	7.61E+01	4.60E+01	1.65	No
518	**Total**					**297.97**	
520	Antimony	mg/kg	2.10E-01	9.60E-01	2.70E-01	3.56	No
520	Cadmium	mg/kg	2.10E-01	6.00E-01	3.60E-01	1.67	No

Table E2.1. Ecological Screening (Continued)

SWMU	Analysis	Unit	Bkgd	MaxResult	Soil_NFA	HQ(Max)	Below Bkgd?
520	Chromium	mg/kg	1.60E+01	6.67E+01	2.60E+01	2.56	No
520	Copper	mg/kg	1.90E+01	2.43E+02	2.80E+01	8.67	No
520	Lead	mg/kg	3.60E+01	2.71E+01	1.10E+01	2.46	Yes
520	Lithium	mg/kg		8.08E+00	2.00E+00	4.04	No
520	Manganese	mg/kg	1.50E+03	1.76E+03	2.20E+02	8.01	No
520	Mercury	mg/kg	2.00E-01	1.19E+01	1.00E-01	118.80	No
520	Nickel	mg/kg	2.10E+01	8.10E+02	3.80E+01	21.31	No
520	Selenium	mg/kg	8.00E-01	4.55E+00	5.20E-01	8.75	No
520	Silver	mg/kg	2.30E+00	1.40E+01	4.20E+00	3.32	No
520	Uranium	mg/kg	4.90E+00	1.14E+02	5.00E+00	22.80	No
520	Vanadium	mg/kg	3.80E+01	2.60E+01	7.80E+00	3.33	Yes
520	Zinc	mg/kg	6.50E+01	3.73E+02	4.60E+01	8.10	No
520	**Total**					**217.37**	
81	Antimony	mg/kg	2.10E-01	4.10E-01	2.70E-01	1.52	No
81	Chromium	mg/kg	1.60E+01	1.08E+02	2.60E+01	4.16	No
81	Lead	mg/kg	3.60E+01	2.19E+01	1.10E+01	1.99	Yes
81	Manganese	mg/kg	1.50E+03	1.38E+03	2.20E+02	6.25	Yes
81	Mercury	mg/kg	2.00E-01	8.33E+00	1.00E-01	83.30	No
81	Nickel	mg/kg	2.10E+01	8.19E+01	3.80E+01	2.16	No
81	PCB, Total	mg/kg		3.70E+02	2.00E-02	18500.00	No
81	Selenium	mg/kg	8.00E-01	1.00E+00	5.20E-01	1.92	No
81	Uranium	mg/kg	4.90E+00	6.50E+03	5.00E+00	1300.00	No
81	Vanadium	mg/kg	3.80E+01	2.98E+01	7.80E+00	3.82	Yes
81	Zinc	mg/kg	6.50E+01	1.32E+02	4.60E+01	2.87	No
81	**Total**					**19907.98**	
153	Antimony	mg/kg	2.10E-01	3.00E-01	2.70E-01	1.11	No
153	Lead	mg/kg	3.60E+01	1.20E+01	1.10E+01	1.09	Yes
153	Manganese	mg/kg	1.50E+03	4.49E+02	2.20E+02	2.04	Yes
153	PCB, Total	mg/kg		6.00E-01	2.00E-02	30.00	No
153	Selenium	mg/kg	8.00E-01	1.10E+00	5.20E-01	2.12	No
153	Vanadium	mg/kg	3.80E+01	2.92E+01	7.80E+00	3.74	Yes
153	**Total**					**40.10**	
156	Antimony	mg/kg	2.10E-01	4.30E-01	2.70E-01	1.59	No
156	Chromium	mg/kg	1.60E+01	4.90E+01	2.60E+01	1.89	No
156	Lead	mg/kg	3.60E+01	4.12E+01	1.10E+01	3.75	No
156	Manganese	mg/kg	1.50E+03	2.83E+03	2.20E+02	12.88	No
156	Mercury	mg/kg	2.00E-01	9.87E+00	1.00E-01	98.70	No
156	Nickel	mg/kg	2.10E+01	6.16E+01	3.80E+01	1.62	No
156	PCB, Total	mg/kg		3.00E-01	2.00E-02	15.00	No
156	Selenium	mg/kg	8.00E-01	1.30E+00	5.20E-01	2.50	No
156	Uranium	mg/kg	4.90E+00	2.32E+01	5.00E+00	4.64	No
156	Vanadium	mg/kg	3.80E+01	2.59E+01	7.80E+00	3.32	Yes
156	Zinc	mg/kg	6.50E+01	6.44E+01	4.60E+01	1.40	Yes

Table E2.1. Ecological Screening (Continued)

SWMU	Analysis	Unit	Bkgd	MaxResult	Soil_NFA	HQ(Max)	Below Bkgd?
156	**Total**					**147.28**	
160	Antimony	mg/kg	2.10E-01	6.80E-01	2.70E-01	2.52	No
160	Lead	mg/kg	3.60E+01	1.40E+01	1.10E+01	1.27	Yes
160	Manganese	mg/kg	1.50E+03	3.33E+02	2.20E+02	1.51	Yes
160	Selenium	mg/kg	8.00E-01	8.00E-01	5.20E-01	1.54	No
160	Vanadium	mg/kg	3.80E+01	1.59E+01	7.80E+00	2.04	Yes
160	**Total**					**8.88**	
163	Antimony	mg/kg	2.10E-01	3.40E-01	2.70E-01	1.26	No
163	Chromium	mg/kg	1.60E+01	4.94E+01	2.60E+01	1.90	No
163	Lead	mg/kg	3.60E+01	1.95E+01	1.10E+01	1.77	Yes
163	Manganese	mg/kg	1.50E+03	3.53E+02	2.20E+02	1.60	Yes
163	Selenium	mg/kg	8.00E-01	1.30E+00	5.20E-01	2.50	No
163	Vanadium	mg/kg	3.80E+01	2.70E+01	7.80E+00	3.46	Yes
163	Zinc	mg/kg	6.50E+01	6.07E+01	4.60E+01	1.32	Yes
163	**Total**					**13.82**	
219	Antimony	mg/kg	2.10E-01	3.80E-01	2.70E-01	1.41	No
219	Lead	mg/kg	3.60E+01	1.62E+01	1.10E+01	1.47	Yes
219	Nickel	mg/kg	2.10E+01	6.71E+01	3.80E+01	1.77	No
219	Selenium	mg/kg	8.00E-01	1.10E+00	5.20E-01	2.12	No
219	Uranium	mg/kg	4.90E+00	1.32E+01	5.00E+00	2.64	No
219	Vanadium	mg/kg	3.80E+01	1.52E+01	7.80E+00	1.95	Yes
219	Zinc	mg/kg	6.50E+01	4.90E+01	4.60E+01	1.07	Yes
219	**Total**					**12.41**	
488	Antimony	mg/kg	2.10E-01	3.10E-01	2.70E-01	1.15	No
488	Lead	mg/kg	3.60E+01	2.74E+01	1.10E+01	2.49	Yes
488	Manganese	mg/kg	1.50E+03	3.64E+02	2.20E+02	1.66	Yes
488	PCB, Total	mg/kg		1.03E+01	2.00E-02	515.00	No
488	Selenium	mg/kg	8.00E-01	1.60E+00	5.20E-01	3.08	No
488	Uranium	mg/kg	4.90E+00	1.48E+01	5.00E+00	2.96	No
488	Vanadium	mg/kg	3.80E+01	2.47E+01	7.80E+00	3.17	Yes
488	Zinc	mg/kg	6.50E+01	4.63E+01	4.60E+01	1.01	Yes
488	**Total**					**530.51**	

Bkgd = Background values are for surface soil taken from DOE 2011.
NFA = no further action; These ecological screening values are the PGDP NFA values for soil from DOE 2010
HQ = hazard quotient

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APPENDIX F

POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED GUIDANCE

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ACRONYMS

ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COE	U.S. Army Corps of Engineers
EPA	U.S. Environmental Protection Agency
FR	*Federal Register*
FS	feasibility study
KAR	*Kentucky Administrative Regulations*
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NWP	Nationwide Permit
OSHA	Occupational Safety and Health Association
PGDP	Paducah Gaseous Diffusion Plant
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
TBC	to be considered
U.S.C.A.	United States Code Annotated

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F.1 INTRODUCTION

Congress specified in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 121(d) (42 U.S.C.A. § 9621) that remedial actions for cleanup of hazardous substances must either comply with requirements or standards under federal or more stringent state environmental laws that are applicable or relevant and appropriate to the hazardous substances or particular circumstances at a site, or obtain a waiver [see also 40 *CFR* § 300.430(f)(1)(ii)(B)].

This appendix supplies a preliminary discussion of available federal and state chemical-, location-, and action-specific applicable or relevant and appropriate requirement (ARARs) that may be associated with potential remedial actions at the Soils Operable Unit (SOU) at the Paducah Gaseous Diffusion Plant (PGDP). The process of ARAR identification is an iterative one that is changing continually as the remedial investigation/feasibility study (RI/FS) progresses; therefore, the ARARs that are identified represent a compilation of potential ARARs that are subject to change as site-specific contamination at the SOU is characterized further and alternatives are evaluated further. Site-specific ARARs will be identified further during the remedial action selection for the FS.

The U.S. Environmental Protection Agency (EPA) differentiates ARARs as either "applicable" or "relevant and appropriate" to a site. The terms and conditions of these categories are as follows:

- *Applicable requirements* are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site" (40 *CFR* § 300.5); and

- *Relevant and appropriate requirements* are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (40 *CFR* § 300.5).

The EPA also categorizes ARARs based on whether they are specific to the chemical(s) present at the site (chemical-specific), the remedial action being evaluated (action-specific), or the location of the site (location-specific). The EPA designated these categories to assist in the identification of ARARs; however, they are not necessarily precise [53 *FR* 51437 (1988)]. Some ARARs may fit into more than one category, while others may not definitively fit into any one category. Terms and conditions relevant to this categorization are included in the list that follows:

- *Chemical-specific ARARs* usually are "health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical values" [53 *FR* 51437 (1988)]. These values establish the acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment.

- *Action-specific ARARs* usually are "technology- or activity-based requirements or limitations placed on actions taken with respect to hazardous wastes, or requirements to conduct certain actions to address particular circumstances at a site" [53 *FR* 51437 (1988)]. Selection of a particular remedial action at a site will trigger action-specific ARARs that specify appropriate technologies and performance standards.

- *Location-specific ARARs* “generally are restrictions placed upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations” [53 *FR* 51437 (1988)]. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

Pursuant to CERCLA § 121(e) [42 U.S.C.A. § 9621(e) (1)], response actions, or portions of response actions conducted entirely on-site, as defined in 40 *CFR* § 300.5, must comply with the substantive portions of ARARs, but not the procedural or administrative requirements. Additionally, CERCLA § 121(d) (4) [42 U.S.C.A. § 9621(d)(4)] provides six ARAR waiver options that may be invoked, provided that human health and the environment are protected.

Published unpromulgated information that does not meet the specific definition of an ARAR may be necessary, under certain circumstances, to determine what is protective of human health and the environment or may be useful in developing CERCLA remedies. This type of information is known as to be considered (TBC) guidance. Because ARARs do not exist for every chemical or circumstance that may be found at a CERCLA site it may be necessary, when determining cleanup requirements or designing a remedy, to consult reliable information that otherwise would not be considered a potential ARAR. Criteria or guidance developed by the EPA, other federal agencies, or states may assist in determining, for example, health-based levels for a particular contaminant or the appropriate method for conducting an action for which there are no ARARs. The TBC guidance generally falls within four categories: (1) health effects information; (2) technical information on how to perform or evaluate investigations or response actions; (3) policy; and (4) proposed regulations, if the proposed regulation is noncontroversial and likely to be promulgated as drafted.

The EPA requires compliance with Occupational Safety and Health Association (OSHA) standards through § 300.150 of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), not through the ARARs process. Worker health and safety requirements typically are not addressed as ARARs. The regulations at 29 *CFR* § 1910.120 are designed to protect workers involved in cleanup operations at uncontrolled hazardous waste sites and to provide for worker protection during initial site characterization and analysis, monitoring activities, materials handling activities, training, and emergency response.

As mentioned above, ARAR identification is an iterative process that continually changes as the RI/FS progresses. There are no chemical-specific ARARs for this action. The action-specific ARARs will be identified as part of the FS, based upon remedial alternatives under consideration; therefore, the ARARs discussed are focused on location-specific ARARs. The final set of ARARs will be included as part of the Record of Decision based on the selected remedy.

F.2 CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

There are no chemical-specific ARARs for this action.

F.3 LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

F.3.1 FLOODPLAINS/WETLANDS

Although all ARARs discussed in this section are applicable, relevant and appropriate, or TBC, they will be met by avoidance of the resource to the extent practicable. If impacts become apparent, however, mitigation measures will be addressed and/or initiated during the remedial design and/or remedial action phase to comply with the ARARs.

Construction activities must avoid or minimize adverse impacts on wetlands and act to preserve and enhance their natural and beneficial values (10 *CFR* § 1022). If the action involves the discharge of dredged or fill material into waters of the United States, the response action will comply with the substantive requirements of Nationwide Permit (NWP) 38 (Cleanup of Hazardous and Toxic Waste); however, the specific requirement of notification is not required for CERCLA actions under this NWP. Consequently, although wetlands should be delineated and avoided to the extent possible, the delineation does not have to be sent to the U.S. Army Corps of Engineers (COE), and the COE does not have to be notified for this action [61 *FR* 65905-65906 (1996)].

As provided by 401 *KAR* 4:060, activities or structures exempted by 401 *KAR* 4:020, that includes activities covered by a COE NWP, may be placed within the regulatory floodway limit of a stream only if they are not of such nature as to result in increases in flood elevations.

F.4 ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Action-specific ARARs will be developed, as appropriate, in the FS.

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APPENDIX G

ANALYTICAL DATA (CD)

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APPENDIX G

ANALYTICAL DATA (CD)

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