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RCRA Facility Investigation – Remedial Investigation/ Corrective Measures Study – Feasibility Study Report for the Rocky Flats Environmental Technology Site Appendix A – Comprehensive Risk Assessment

Volume 14 of 15

Risk Assessment for the Industrial Area Exposure Unit

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ACRONYMS AND ABBREVIATIONS

µg/kg	microgram per kilogram
AEU	Aquatic Exposure Unit
BAF	bioaccumulation factor
bgs	below ground surface
BZ	Buffer Zone
CAD/ROD	Corrective Action Decision/Record of Decision
CERCLA	Comprehensive Environmental response, Compensation and Liability Act
CD	compact disc
CDPHE	Colorado Department of Public Health and Environment
CMS	Corrective Measures Study
COC	contaminant of concern
CRA	Comprehensive Risk Assessment
CSF	cancer slope factors
DOE	U.S. Department of Energy
DQA	data quality assessment
DQO	data quality objective
DRI	dietary reference intake
ECOI	ecological contaminant of interest
ECOPC	ecological contaminant of potential concern
EcoSSL	ecological soil screening level
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERA	Ecological Risk Assessment

ESL	ecological screening level
EU	Exposure Unit
HHRA	Human Health Risk Assessment
HI	hazard index
HQ	hazard quotient
HRR	Historical Release Report
IA	Industrial Area
IAEU	Industrial Area Exposure Unit
IAOU	Industrial Area Operable Unit
IAG	Interagency Agreement
IDEU	Inter-Drainage Exposure Unit
IHSS	Individual Hazardous Substance Site
LOAEL	lowest observed adverse effect level
LOEC	lowest effects concentration
MDC	maximum detected concentration
mg	milligram
mg/day	milligram per day
mg/kg/BW/day	milligram per kilogram receptor body weight per day
N/A	not applicable or not available
NFA	No Further Action
NFAA	No Further Accelerated Action
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
OU	Operable Unit
PAC	Potential Area of Concern

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PAH	polynuclear aromatic hydrocarbons
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyl
PCOC	potential contaminant of concern
PMJM	Preble's meadow jumping mouse
PRG	preliminary remediation goal
QAPjP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RDA	recommended daily allowance
RDI	recommended daily intake
RFCA	Rocky Flats Cleanup Agreement
RfD	reference doses
RFETS	Rocky Flats Environmental Technology Site
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
SCM	site conceptual model
SID	South Interceptor Ditch
tESL	threshold ESL
TRV	toxicity reference value
UBC	Under Building Contamination
UCL	upper confidence limit
UL	upper limit daily intake
UT	uncertain toxicity
UTL	upper tolerance limit

UWNEU	Upper Walnut Creek Exposure Unit
UWOEU	Upper Woman Drainage Exposure Unit
WBEU	Wind Blown Exposure Unit
WRV	wildlife refuge visitor
WRW	wildlife refuge worker

EXECUTIVE SUMMARY

This report presents the Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) for the 428-acre Industrial Area Exposure Unit (EU) (IAEU) at the Rocky Flats Environmental Technology Site (RFETS). The purpose of this report is to assess potential risks to human health and ecological receptors posed by exposure to contaminants of concern (COCs) and ecological contaminants of potential concern (ECOPCs) remaining at the IAEU after completion of accelerated actions at RFETS.

Arsenic and benzo(a)pyrene were selected as COCs for surface soil/surface sediment. No COCs were selected for subsurface soil/subsurface sediment. Results of the risk characterization for the HHRA indicate that estimated non-cancer hazard indices (HIs) for the wildlife refuge worker (WRW) and the wildlife refuge visitor (WRV) in the IAEU are less than 1. In addition, the results of the risk characterization for the HHRA indicate that excess lifetime cancer risks for the WRW and the WRV, 3E-06, in the IAEU are within the U.S. Environmental Protection Agency (EPA) acceptable risk range (i.e., 1E-04 to 1E-06). The estimated excess lifetime cancer risk for arsenic in surface soil/surface sediment, 2E-06, is essentially equivalent to the cancer risks for potential exposure to background levels of arsenic in surface soil/surface sediment. In addition, benzo(a)pyrene, has not been directly associated with historical IHSSs, but is most likely associated with traffic, pavement degradation, or pavement operations. The estimated cancer risks are within EPA's acceptable risk range, and the estimated HIs are well below 1, indicating that significant noncancer health effects are unlikely.

ECOPCs in surface soil were identified for non-Preble's meadow jumping mouse (PMJM) receptors. Only small portions of PMJM habitat are currently located in the IAEU. These habitat patches are evaluated in the Upper Walnut Drainage EU (UWNEU), Appendix A, Volume 7 of the Resource Conservation and Recovery Act (RCRA) Facility Investigation-Remedial Investigation (RI)/Corrective Measures Study (CMS)-Feasibility Study (FS) Report (hereafter referred to as the RI/FS Report). ECOPCs for selected populations of non-PMJM receptors included antimony, chromium, copper, molybdenum, tin, bis(e-ethylhexyl)phthalate, di-n-butylphthalate, total dioxin, and total polychlorinated biphenyls (PCBs). No ECOPCs were identified in subsurface soil. The ECOPC/receptor pairs were evaluated in the risk characterization using a range of exposure point concentrations (EPCs), exposure scenarios, and toxicity reference values (TRVs) to give a range of risk estimates. Overall, no significant risks to survival, growth, and reproduction are predicted for the ecological receptors evaluated in the IAEU.

1.0 INDUSTRIAL AREA EXPOSURE UNIT

This volume of the Comprehensive Risk Assessment (CRA) presents the Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) for the Industrial Area Exposure Unit (EU) (IAEU) at the Rocky Flats Environmental Technology Site (RFETS) (Figure 1.1).

The HHRA and ERA methods and selection of receptors are described in detail in the Final CRA Work Plan and Methodology (DOE 2005a), hereafter referred to as the CRA Methodology. A summary of the risk assessment methods, including updates made in consultation with the regulatory agencies, are summarized in Appendix A, Volume 2, Section 2.0 of the Resource Conservation and Recovery Act (RCRA) Facility Investigation-Remedial Investigation/Corrective Measures Study (CMS)-Feasibility Study (RI/FS) Report (hereafter referred to as the RI/FS Report). The anticipated future land use of RFETS is a wildlife refuge. Two human receptors, a wildlife refuge worker (WRW) and a wildlife refuge visitor (WRV), are evaluated in this risk assessment consistent with this land use. A variety of representative terrestrial and aquatic receptors are evaluated in the ERA, with the exception of the Preble's meadow jumping mouse (PMJM), a federally listed threatened species present at RFETS. The limited habitat within the IAEU boundary is assessed with the more extensive habitat that occurs in the Upper Walnut Creek EU (UWNEU) and is presented in Appendix A, Volume 7 of the RI/FS Report (DOE 2005a). An evaluation will be conducted during the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) 5-year review and if habitat has been established in the IAEU, it will be assessed. The HHRA and ERA methods and selection of receptors are described in detail, as appropriate, in the CRA Methodology.

1.1 Industrial Area Exposure Unit Description

This section provides a brief description of the IAEU, including its location at RFETS, historical activities in the area, topography, surface water features, vegetation, and ecological resources. A more detailed description of these features and additional information regarding the geology, hydrology, and soil types at RFETS are included in Site Physical Characteristics, Section 2.0 of the RI/FS Report. This information is also summarized in Appendix A, Volume 2 of the RI/FS Report.

The Historical Release Report (HRR) (DOE 1992) and annual updates to the HRR provide descriptions of known or suspected spills that have occurred since the inception of the Rocky Flats Plant. The original HRR organized these known or suspected sources of contamination as Individual Hazardous Substance Sites (IHSSs), Potential Areas of Concern (PACs), or Under Building Contamination (UBC) sites (hereafter collectively referred to as IHSSs). Individual IHSSs and groups of IHSSs were also designated as Operable Units (OUs). Over the course of cleanup under the 1991 Interagency Agreement (IAG) and the 1996 Rocky Flats Cleanup Agreement (RFCA), the U.S. Department of Energy (DOE) has thoroughly investigated and characterized the contamination associated with these IHSSs. IHSSs have been dispositioned through

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appropriate remedial actions or by determining that No Further Accelerated Actions (NFAAs) are required, pursuant to the applicable IAG and RFCA requirements. Some OUs have also been dispositioned in accordance with an OU-specific Corrective Action Decision/Record of Decision (CAD/ROD).

Many historical IHSSs exist at RFETS within the IA (Figure 1.2). In 1999, the Industrial Area Characterization and Remediation Strategy (IA Strategy) was developed by DOE to provide a roadmap for final closure of RFETS and ensure integration of remediation activities, including facility decommissioning, characterization, remediation, and regulatory agency and stakeholder participation. As noted in Table 1.1, all historical IHSSs that had not been previously dispositioned through a CAD/ROD were sorted into IHSS Groups for characterization, and accelerated action if warranted. The characterization data indicated that most historical IHSSs did not require accelerated action. All accelerated actions have been completed, and all historical IHSSs have been dispositioned as No Further Accelerated Action (NFAA).

The disposition of the historical IHSSs within the IAEU is described in the 2005 Annual Update to the HRR and regulatory agency approval letters are on file. A more detailed description of the OU and IHSS history at RFETS is included in Site Background, Section 1.0 of the RI/FS Report. This information is also briefly summarized in Appendix A, Volume 2 of the RI/FS Report.

1.1.1 Exposure Unit Characteristics and Location

The IAEU comprises 428 acres in the northeastern portion of RFETS (Figure 1.1) and contains several distinguishing features:

- The IA OU includes the approximately 300-acre former industrialized portion of RFETS. It generally coincides with the Industrial Area Operable Unit (IAOU) and is surrounded by the Buffer Zone (BZ) OU.
- The EU contains more than 250 historical IHSSs (Table 1.1) and was the center of historical industrial activity at RFETS. As described in Table 1.1, each of the 250 historical IHSSs has been dispositioned.
- The IAEU is immediately upstream of North and South Walnut Creeks. No Name Gulch, which empties into Walnut Creek, is north of and hydrologically isolated from the IAEU. The South Interceptor Ditch (SID) is to the south of the IAEU and receives runoff from it.
- The IAEU is bound by the Inter-Drainage EU (IDEU) to the west, UWNEU to the north and east, Wind Blown Area EU (WBEU) to the east and south, and Upper Woman Drainage EU (UWOEU) to the south (Figure 1.1).

1.1.2 Topography and Surface Water Hydrology

The IAEU is located in the central portion of RFETS in the eastern part of a broad, relatively flat pediment that slopes eastward from the foothills. The pediment is capped by unconsolidated surficial deposits. The pediment surface in the IAEU is dissected by the north and south branches of Walnut Creek that trend generally from west to east. (Figures 1.2 and 1.3).

Accelerated remedial actions at the site resulted in removal of all buildings to at least 3 feet below ground surface (bgs) in the IAEU except the former east and west vehicle inspection sheds. Other site activities resulted in some surface recontouring and revegetation of the former IA, after removal of parking lots and other surface infrastructure features, as necessary. In addition, ditches and stormwater conveyances have been eliminated or reconfigured to meet objectives for slope stability and stormwater flow, and pavement has been removed. This work was generally guided by the land configuration drawings and the Environmental Assessment, Pond and Land Configuration DOE/EA – 1492 (DOE 2004a).

The removal of buildings and pavement from the IA significantly reduces the volumes and peak discharge rates of runoff from the IAEU. With accelerated actions complete, it is anticipated that flows in North and South Walnut Creek will be significantly diminished compared with the historic configuration of the site when buildings and pavement generated additional runoff.

1.1.3 Flora and Fauna

The IAEU contained more than 400 buildings and support structures, roads, parking lots, and utilities when RFETS was in operation (Figure 1.1). Wildlife species observed near human structures in the IAEU have included small mammals such as house mice (*Mus musculus*) and deer mice (*Peromyscus maniculatus*); seed eating and insectivorous birds such as starlings (*Sturnus vulgaris*), house finches (*Carpodacus mexicanus*), English house sparrows (*Passer domesticus*), and barn swallows (*Hirundo rustica*); and carnivorous birds such as American kestrels (*Falco sparverius*). Upper South Walnut Creek is the only drainage capable of supporting aquatic life and is an intermittent stream.

All surface structures and infrastructure have been removed with the completion of accelerated actions (Figure 1.4). The disturbed areas within the IAEU have been stabilized using standard erosion control measures and have been revegetated with a native seed mixture to ensure soil stability and reduce erosion. Waterways have been re-engineered to create wetlands and ensure that water is transported off the IAEU into North and South Walnut Creeks while minimizing erosion. All disturbed areas within the IAEU have been revegetated with a mixture of native grasses and forbs as a final reclamation process. With the establishment of native grassland vegetation, the plant and animal communities within the IAEU will be similar to those grassland communities currently found within the BZ.

1.1.4 Preble's Meadow Jumping Mouse Habitat within Industrial Area Exposure Unit

The PMJM is a federally listed threatened species found at RFETS. The preferred habitat for the PMJM at RFETS is the riparian corridors bordering streams, ponds, and wetlands, with an adjacent thin band of upland grasslands. PMJM habitat occurs along Upper Walnut Creek above the A-1 and B-1 ponds, north and east of the IAEU. Two small portions of PMJM habitat cross into the IAEU from the UWNEU (Figure 1.5). No PMJM have ever been observed or captured within the boundaries of IAEU. The assessment of risk to the PMJM will be addressed in the UWNEU because habitat for PMJM within the IAEU is a small subset of the larger PMJM habitat areas in the UWNEU. An evaluation will be conducted during the CERCLA 5-year review and, if habitat has been established in the IAEU area, it will be assessed as appropriate.

More detail on the species that use RFETS habitats and the methodology of creating site-wide PMJM habitat patches can be found in Appendix A, Volume 2, Section 3.2 of the RI/FS Report.

1.1.5 Data Description

Data have been collected at RFETS under regulatory agency-approved Work Plans, Sampling and Analysis Plans (SAPs), and Quality Assurance Project Plans (QAPjPs) to meet data quality objectives (DQOs) and appropriate U.S. Environmental Protection Agency (EPA) and Colorado Department of Public Health and Environment (CDPHE) guidance. Surface soil, subsurface soil, surface sediment, subsurface sediment, and groundwater samples were collected from the IAEU. Surface soil/surface sediment, subsurface soil/subsurface sediment, surface soil, and subsurface soil are the media evaluated in the HHRA and ERA (Table 1.2). The sampling locations for these media are shown in Figures 1.6 and 1.7, and data summaries for detected analytes in each medium are provided in Tables 1.3 through 1.6. Toxicity equivalence concentrations for 2,3,7,8-tetrochlorodibenzo-p-dioxin (TCDD) in surface soil/surface sediment, surface soil, and subsurface soil are presented in Tables 1.7 and 1.8. Potential contaminants of concern (PCOCs) and ecological contaminants of interest (ECOIs) that were analyzed for but not detected, or were detected in less than 5 percent of the samples, are presented in Attachment 1. Detection limits are compared to preliminary remediation goals (PRGs) and ecological screening levels (ESLs) and discussed in Attachment 1 (Tables A1.1 through A1.4). Only data from June 1991 to the present are used in the CRA because these data meet the approved analytical quality assurance/quality control (QA/QC) requirements.

In accordance with the CRA Methodology, only data collected on or after June 28, 1991, and data for subsurface soil and subsurface sediment samples with a starting depth less than or equal to 8 feet bgs are used in the CRA. Subsurface soil and subsurface sediment data are limited to this depth because it is not anticipated that the WRW or burrowing animals will dig to deeper depths. A detailed description of data storage and processing methods is provided in Appendix A, Volume 2 of the RI/FS Report. The CRA analytical data set for the IAEU is provided on a compact disc (CD) presented in Attachment 6. The

CD in Attachment 6 includes the data used in the CRA as well as data not considered useable based on criteria presented in Appendix A, Volume 2 of the RI/FS Report.

The sampling data used for the IAEU HHRA and ERA are as follows:

- Combined surface soil/surface sediment data (HHRA);
- Combined subsurface soil/subsurface sediment data (HHRA);
- Surface soil data (ERA); and,
- Subsurface soil data (ERA).

These data for these media are briefly described below.

In addition, because ECOPCs were identified for soil in this EU, surface water data were used in the ERA as part of the overall intake of ECOPCs by ecological receptor. The surface water data used in the ERA are summarized in Table 8.5. Surface water and sediment are assessed for ecological receptors on an Aquatic Exposure Unit (AEU) basis in Appendix A, Volume 15B of the RI/FS Report. An assessment of the surface water, groundwater-to-surface water, and volatilization pathways for human health are presented in Appendix A, Volume 2 of the RI/FS Report.

Surface Soil/Surface Sediment

The combined surface soil/surface sediment data set for IAEU consists of up to 1,831 samples for various analyte groups. The sediment samples were collected to depths less than 0.5 feet from the sediment surface. The surface soil/surface sediment sample locations are shown in Figure 1.6. The surface soil/surface sediment samples were collected in the IAEU over several months from June 1991 through February 1996, and then again in February 1998 and April 1999 through August 2005. The samples collected in 2004 were located on a 30-acre grid, as described in CRA SAP Addendum #04-01 (DOE 2004b). For the grid sampling, five individual samples were collected from each 30-acre cell, one from each quadrant and one in the center, as described in the Addendum (DOE 2004b). No surface soil/surface sediment samples were collected in the IAEU during the 30-acre sampling for the CRA due to the density of previous sampling (DOE 2004b).

The IAEU surface soil/surface sediment samples were analyzed for inorganics (1,831 samples), organics (1,566 samples), and radionuclides (1,286 samples) (Table 1.2). Detected analytes included many inorganics and organics, as well as several radionuclides (Table 1.3). A summary of analytes that were not detected or detected in less than 5 percent of samples in surface soil/surface sediment in the IAEU is presented and discussed in Attachment 1.

Subsurface Soil/Subsurface Sediment

The combined subsurface soil/subsurface sediment data set for IAEU consists of up to 3,332 samples for various analyte groups. The subsurface sediment samples have a starting depth of less than or equal to 8 feet bgs and an ending depth greater than 0.5 feet.

The subsurface soil/subsurface sediment sample locations are shown in Figure 1.7. The samples were collected in the IAEU over several months from August 1991 through December 1993, and then again from February 1995 through July 2005.

The IAEU subsurface soil/subsurface sediment samples were analyzed for inorganics (2,649 samples), organics (3,332 samples), and radionuclides (1,013 samples) (Table 1.2). Detected analytes included many inorganics and organics, as well as several radionuclides (Table 1.4). A summary of analytes that were not detected or detected in less than 5 percent of samples in surface soil/surface sediment in the IAEU is presented and discussed in Attachment 1.

Surface Soil

The surface soil data set for IAEU consists of up to 1,725 samples for various analyte groups. The samples were collected in the IAEU over several months from June 1991 through October 1995, and then again in February 1998 and June 1999 through August 2005. Sample locations are shown in Figure 1.6. The samples collected in 2004 were located on a 30-acre grid, as described in CRA SAP Addendum #04-01 (DOE 2004b). For the grid sampling, five individual samples were collected from each 30-acre cell, one from each quadrant and one in the center, as described in the Addendum (DOE 2004b). No surface soil samples were collected in the IAEU during the 30-acre sampling for the CRA due to the density of previous sampling (DOE 2004b).

The IAEU surface soil samples were analyzed for inorganics (1,725 samples), organics (1,461 samples), and radionuclides (1,156 samples) (Table 1.2). Detected analytes included many inorganics, organics, and several radionuclides (Table 1.5). A summary of analytes that were not detected or detected in less than 5 percent of samples in surface soil in the IAEU is presented and discussed in Attachment 1.

Subsurface Soil

The subsurface soil data set for IAEU consists of up to 3,312 samples for various analyte groups. The samples were collected in the IAEU over several months from August 1991 through December 1993, and then again in February 1995 through July 2005. Sample locations are shown in Figure 1.7. Subsurface soil samples to be used in the CRA are defined in the CRA Methodology as soil samples with a starting depth less than or equal to 8 feet bgs and an ending depth greater than 0.5 feet.

The IAEU subsurface soil samples were analyzed for inorganics (2,640 samples), organics (3,312 samples), and radionuclides (1,004 samples) (Table 1.2). Detected analytes included many inorganics and organics, and several radionuclides (Table 1.6). A summary of analytes that were not detected or were detected in less than 5 percent of samples in subsurface soil in the IAEU is presented and discussed in Attachment 1.

1.2 Data Adequacy Assessment

A data adequacy assessment was performed to determine whether the available data set discussed in the previous section is adequate for risk assessment purposes. The data adequacy assessment rules are presented in the CRA Methodology, and a detailed data adequacy assessment for the data used in the CRA is presented in Appendix A, Volume 2 of the RI/FS Report. The adequacy of the data was assessed by examining the number of available samples for each analyte group in each medium for use in the CRA, the spatial and temporal representativeness of the data, as well as information on potential historical sources of contamination, migration pathways, and the concentration levels in the media. The assessment concludes that the data are adequate for the purposes of the CRA.

1.3 Data Quality Assessment

A data quality assessment (DQA) of the IAEU data was conducted to determine whether the data were of sufficient quality for risk assessment use. The DQA is presented in Attachment 2, and an evaluation of the entire RFETS data set is presented in Appendix A, Volume 2 of the RI/FS Report. The quality of the laboratory results were evaluated for compliance with the CRA Methodology data quality objectives (DQOs) through an overall review of precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters. This review concluded that the data are of sufficient quality for use in the CRA, and the CRA DQOs have been met.

2.0 SELECTION OF HUMAN HEALTH CONTAMINANTS OF CONCERN

The human health contaminant of concern (COC) screening process is described in Section 4.4 of the CRA Methodology and summarized in Appendix A, Volume 2 of the RI/FS Report (Section 2.2).

The human health COC selection process was conducted for surface soil/surface sediment and subsurface soil/subsurface sediment in the IAEU. Results of the COC selection process are summarized below.

2.1 Contaminant of Concern Selection for Surface Soil/Surface Sediment

Detected PCOCs in surface soil/surface sediment samples (Table 1.3) are screened in accordance with the CRA Methodology to identify the COCs.

2.1.1 Surface Soil/Surface Sediment Cation/Anion and Essential Nutrient Screen

The major cations and anions that do not have toxicity criteria are eliminated from assessments in surface soil/surface sediment in accordance with the CRA Methodology.

The essential nutrient screen for analytes detected in surface soil/surface sediment is presented in Table 2.1. The screen includes PCOCs that are essential for human health and do not have toxicity criteria available. Table 2.1 shows the maximum detected concentrations (MDCs) for essential nutrients, daily intake estimates based on the MDCs, and dietary reference intakes (DRIs). The DRIs are identified in the table as recommended daily allowances (RDAs), recommended daily intakes (RDIs), adequate intakes, and upper limit daily intakes (ULs). The estimated daily maximum intakes based on the nutrients' MDCs and a surface soil/surface sediment ingestion rate of

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100 milligrams per day (mg/day) are less than the DRIs. Therefore, these PCOCs were not further evaluated as COCs for surface soil/surface sediment.

2.1.2 Surface Soil/Surface Sediment Preliminary Remediation Goals Screen

Table 2.2 compares the MDCs and upper confidence limits (UCLs) to the WRW PRGs for each PCOC. If the MDC and the UCL are greater than the PRG, the PCOC is retained for further screening; otherwise, it not further evaluated. Arsenic, benzo(a)pyrene, and radium-228 in surface soil/surface sediment had MDCs and UCLs that exceeded the PRGs and were retained as PCOCs.

PRGs were not available for several PCOCs in surface soil/surface sediment. Analytes without PRGs are listed in Table 2.2 and their effect on the conclusions of the risk assessment results is discussed in the uncertainty section (Section 6.0).

2.1.3 Surface Soil/Surface Sediment Detection Frequency Screen

Arsenic and benzo(a)pyrene were detected in more than 5 percent of surface soil/surface sediment samples and, therefore, were retained for further evaluation in the COC screen (Table 1.3).

The detection frequency screen was not performed for radium-228 in surface soil/surface sediment because all reported values for radionuclides are considered detects.

2.1.4 Surface Soil/Surface Sediment Background Analysis

Results of the background statistical comparison for arsenic and radium-228 are presented in Table 2.3 and discussed in Attachment 3. Boxplots for arsenic and radium-228 (both IAEU and background) are provided in Attachment 3. Arsenic is the only PCOC that was statistically greater than background at the 0.1 significance level and is evaluated further in the professional judgment section.

Following the CRA Methodology, a statistical comparison to background is not performed for organics; therefore, benzo(a)pyrene is carried forward into the professional judgment evaluation.

2.1.5 Surface Soil/Surface Sediment Professional Judgment Evaluation

Based on the weight of available evidence evaluated by professional judgment, PCOCs will either be included for further evaluation as COCs or excluded as COCs. The professional judgment evaluation takes into account process knowledge, spatial trends, and pattern recognition. As discussed in Section 1.2 and Attachment 2, the sample results are adequate for use in the professional judgment because they are of sufficient quality for use in the CRA.

Based on the weight-of-evidence evaluation described in Attachment 3, arsenic and benzo(a)pyrene are considered COCs in surface soil/surface sediment and are further evaluated in Sections 3.0 through 5.0.

2.2 Contaminant of Concern Selection for Subsurface Soil/Subsurface Sediment

Detected PCOCs in subsurface soil/subsurface sediment samples (Table 1.4) are screened in accordance with the CRA Methodology to identify the COCs.

2.2.1 Subsurface Soil/Subsurface Sediment Cation/Anion and Essential Nutrient Screen

The major cations and anions that do not have toxicity criteria were eliminated from assessments in subsurface soil/subsurface sediment in accordance with the CRA Methodology.

Essential nutrients without toxicity criteria that were detected in subsurface soil/subsurface sediment at the IAEU were compared to DRIs in Table 2.4. The estimated daily maximum intakes for these PCOCs, based on the nutrient's MDCs and a subsurface soil/subsurface sediment ingestion rate of 100 mg/day, are less than the DRIs. Therefore, these PCOCs were not further evaluated as COCs for subsurface soil/subsurface sediment.

2.2.2 Subsurface Soil/Subsurface Sediment Preliminary Remediation Goal Screen

The PRG screen for detected analytes in subsurface soil/subsurface sediment is presented in Table 2.5. The MDC and UCL for radium-228 in subsurface soil/subsurface sediment were greater than the PRG and, therefore, radium-228 was retained as a PCOC.

PRGs were not available for several PCOCs in subsurface soil/subsurface sediment. Analytes without PRGs are listed in Table 2.5 and their effect on the conclusions of the risk assessment results is discussed in the uncertainty section (Section 6.0).

2.2.3 Subsurface Soil/Subsurface Sediment Detection Frequency Screen

The detection frequency screen was not performed for radium-228 in subsurface soil/subsurface sediment because all reported values for radionuclides are considered detects.

2.2.4 Subsurface Soil/Subsurface Sediment Background Analysis

Analyses were conducted to asses whether radium-228 concentrations in IAEU subsurface soil/subsurface sediment are statistically higher than those in background subsurface soil/subsurface sediment at the 0.1 level of significance (1-p less than or equal to 0.1). The subsurface soil/subsurface sediment background data are described in detail in Appendix A, Volume 2 of the RI/FS Report.

The results of the statistical comparisons of the IAEU data to the background data indicate site concentrations for radium-228 are not statistically greater than background at the 0.1 significance level. The results are summarized in Table 2.3 and in Attachment 3. Boxplots for radium-228 (both IAEU and background) are provided in Attachment 3. Radium-228 in subsurface soil/subsurface sediment is not further evaluated in the COC screen process.

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2.2.5 Subsurface Soil/Subsurface Sediment Professional Judgment Evaluation

The professional judgment evaluation was not performed for subsurface soil/subsurface sediment in the IAEU because no PCOCs were statistically greater than background at the 0.1 significance level.

2.3 Contaminant of Concern Selection Summary

A summary of the results of the COC screening process is presented in Table 2.6. Arsenic and benzo(a)pyrene were the only analytes in surface soil/surface sediment selected as COCs in the IAEU and are further evaluated quantitatively. No analytes were selected as COCs in subsurface soil/subsurface sediment in the IAEU.

3.0 HUMAN HEALTH EXPOSURE ASSESSMENT

The site conceptual model (SCM), presented in Figure 2.1 of the CRA Methodology and is discussed in Appendix A, Volume 2 of the RI/FS Report, provides an overview of potential human exposures at RFETS for reasonably anticipated land use. Two types of receptors, the WRW and WRV, were selected for quantitative evaluation based on the SCM. Exposure point concentrations (EPCs) were calculated for the COCs identified, and chemical intakes were estimated using the EPCs for the WRW and WRV receptors.

Tier 1 and Tier 2 exposure point concentrations (EPCs) were calculated for the two COCs, arsenic and benzo(a)pyrene, in surface soil/surface sediment for the IAEU. Tier 1 EPCs are based on the UCLs of the mean concentration for the EU data set, and Tier 2 EPCs are calculated using a spatially weighted averaging approach. The methodology for these calculations is provided in Appendix A, Volume 2 of the RI/FS Report. Figure 3.1 shows the 30-acre grid used to calculate the Tier 2 EPCs. Table 3.1 presents the Tier 1 and Tier 2 EPCs for the IAEU.

Chemical intakes for WRW and WRV exposure pathways were quantified for arsenic and benzo(a)pyrene using the exposure factors listed in Tables 3.2 and 3.3, respectively. Additional information on the estimation of chemical intake is presented in Appendix A, Volume 2 of the RI/FS Report and in the CRA Methodology.

4.0 HUMAN HEALTH TOXICITY ASSESSMENT

Toxicity criteria are used in the risk calculations in Section 5.0. Tables 4.1 and 4.2 present the toxicity criteria (cancer slope factors [CSFs], reference doses [RfDs], and dermal absorption factors) for COCs at the IAEU. Toxicity criteria are presented for the oral, inhalation, and dermal exposure pathways. Additional information on the human health toxicity assessment is presented in Appendix A, Volume 2 of the RI/FS Report and in the CRA Methodology.

5.0 HUMAN HEALTH RISK CHARACTERIZATION

Information from the exposure assessment and the toxicity assessment is integrated in this section to characterize risk to the WRW and WRV receptors. Quantitative risks for cancer and noncancer effects were estimated using the toxicity factors presented in the Toxicity Assessment (Section 4.0) and pathway-specific intakes defined in the Exposure Assessment (Section 3.0). Details of the risk characterization methods are provided in the CRA Methodology and summarized in Volume 2, Appendix A of the RI/FS Report.

5.1 Wildlife Refuge Worker

This section presents the risk characterization for exposure to COCs at the IAEU. The WRW receptor was evaluated for exposure to arsenic and benzo(a)pyrene in surface soil/surface sediment. The risk estimates for exposure to arsenic and benzo(a)pyrene are summarized in Table 5.1, while Attachment 4 contains the risk calculation tables.

5.1.1 Surface Soil/Surface Sediment

The WRW is evaluated for exposure to arsenic and benzo(a)pyrene in surface soil/surface sediment by ingestion, inhalation, and dermal exposure (for organic COCs only). Radionuclides were not selected as COCs for surface soil/surface sediment. Therefore, radiation cancer risks and doses were not calculated. The estimated excess lifetime cancer and noncancer hazards for Tier 1 and Tier 2 EPCs are calculated and summarized in Tables 5.1 and 5.3. The noncancer hazards for benzo(a)pyrene were not calculated because noncancer toxicity values are not available for benzo(a)pyrene.

Risk Characterization Results Based on Tier 1 EPCs

The total chemical cancer risk for potential exposure to surface soil/surface sediment by the WRW, based on the Tier 1 EPC, is 3E-06 (Table 5.1). The primary risk driver is arsenic, which comprises 60 percent of the total chemical cancer risk. The risk is predominantly from the ingestion exposure route.

The total chemical noncancer hazard for potential exposure to surface soil/surface sediment by the WRW, based on the Tier 1 EPC, is 0.01 (Table 5.1). The primary hazard driver is arsenic, which comprises 100 percent of the total chemical noncancer hazard. The noncancer hazard is from the ingestion exposure route.

Risk Characterization Results Based on Tier 2 EPCs

The total chemical cancer risk for potential exposure to surface soil/surface sediment by the WRW, based on the Tier 2 EPC, is 3E-06 (Table 5.1). The primary risk driver is arsenic, which comprises 64 percent of the total chemical cancer risk. The risk is predominantly from the ingestion exposure route.

The total chemical noncancer hazard for potential exposure to surface soil/surface sediment by the WRW, base on the Tier 2 EPC, is 0.01 (Table 5.1). The primary hazard driver is arsenic, which comprises 100 percent of the total chemical noncancer hazard. The noncancer hazard is from the ingestion exposure route.

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5.1.2 Subsurface Soil/Subsurface Sediment

No COCs were selected in subsurface soil/subsurface sediment. Therefore, it is not necessary to perform a risk characterization for subsurface soil/subsurface sediment in the IAEU.

5.1.3 Wildlife Refuge Worker Total Risk and Hazards

Risk estimates are summed across media to develop an estimate for the total risk to a receptor. This approach is followed only if the COCs in different media exhibit comparable health effects. For the IAEU, arsenic and benzo(a)pyrene were selected as COCs for surface soil/surface sediment only. Total risk and hazards are summarized in Table 5.3. The surface soil/surface sediment risk estimates for the WRW results in an estimated total cancer risk of 3E-06, based on a Tier 1 EPC, and 3E-06, based on a Tier 2 EPC. The surface soil/surface sediment noncancer hazard estimates for the WRW results in an estimated total noncancer hazard of 0.01, based on a Tier 1 EPC, and 0.01, based on a Tier 2 EPC. Because arsenic and benzo(a)pyrene were selected as COCs in only one medium, cumulative risks from exposure to multimedia are not calculated for the IAEU.

5.2 Wildlife Refuge Visitor

This section presents the results of the risk characterization for exposure of the WRV receptor to arsenic and benzo(a)pyrene in surface soil/surface sediment at the IAEU. Exposure to subsurface soil/subsurface sediment is not evaluated for WRV. The risk estimates for exposure to arsenic and benzo(a)pyrene are summarized in Table 5.2. Attachment 4 contains the risk calculation tables.

5.2.1 Surface Soil/Surface Sediment

The WRV is evaluated for exposure to arsenic and benzo(a)pyrene in surface soil/surface sediment by ingestion, inhalation, and dermal exposure (for organic COCs only). Radionuclides were not selected as COCs for surface soil/surface sediment. Therefore, radiation cancer risks and doses were not calculated. The estimated excess lifetime cancer risks and noncancer hazards for Tier 1 and Tier 2 EPCs are calculated and summarized in Table 5.2 and 5.3. The noncancer hazards for benzo(a)pyrene were not calculated because noncancer toxicity values are not available for benzo(a)pyrene.

Risk Characterization Results Based on Tier 1 EPCs

The total cancer risk for potential exposure to surface soil/surface sediment by the WRV, based on the Tier 1 EPC, is 3E-06 (Table 5.2). The primary risk driver is arsenic, which comprises 55 percent of the total chemical cancer risk. The risk is predominantly from the ingestion exposure route.

The total chemical noncancer hazard for potential exposure to surface soil/surface sediment by the WRV, based on the Tier 1 EPC, is 0.01 (Table 5.2). The primary hazard driver is arsenic, which comprises 100 percent of the total chemical noncancer hazard. The noncancer hazard is from the ingestion exposure route.

Risk Characterization Results Based on Tier 2 EPCs

The total chemical cancer risk for potential exposure to surface soil/surface sediment by the WRV, based on the Tier 2 EPC, is 3E-06 (Table 5.2). The primary risk driver is arsenic, which comprises 59 percent of the total chemical cancer risk. The risk is predominantly from the ingestion exposure route.

The total chemical noncancer hazard for potential exposure to surface soil/surface sediment by the WRV, base on the Tier 2 EPC, is 0.01 (Table 5.2). The primary hazard driver is arsenic, which comprises 100 percent of the total chemical noncancer hazard. The noncancer hazard is from the ingestion exposure route.

5.3 Summary

Risks to the WRW and WRV were evaluated for potential exposure to arsenic and benzo(a)pyrene in surface soil/surface sediment at the IAEU. A summary of the cancer risks and noncancer hazards is presented in Table 5.3.

The results of the Tier 1 and Tier 2 risk characterizations indicate that estimated risks for the WRW and WRV are at the low end or are below the target risk range for COCs exhibiting carcinogenic effects (i.e., 1×10^{-6} to $1\mathrm{x}\ 10^{-4}$) (Table 5.3). In addition, the results of the risk characterizations indicate that the estimated HI is below one (Table 5.3), which indicates that concentrations of arsenic in surface soil/surface sediment are protective of the WRW and WRV.

6.0 UNCERTAINTIES ASSOCIATED WITH THE HUMAN HEALTH RISK ASSESSMENT

There are various types of uncertainties associated with steps of an HHRA. General uncertainties common to the EUs are discussed in Appendix A, Volume 2 of the RI/FS Report. Uncertainties specific to the EU are described below.

6.1 Uncertainties Associated with the Data

Data adequacy for this CRA is evaluated and discussed in Appendix A, Volume 2 of the RI/FS Report. Although there are some uncertainties associated with the sampling and analyses conducted for surface soil/surface sediment and subsurface soil/subsurface sediment at the IAEU, data are considered adequate for the characterization of risk at the EU. The environmental samples for the IAEU were collected from 1991 through 2005. The CRA sampling and analysis requirements for the BZ (DOE 2004b, 2005a) specify that the minimum sampling density requirement for surface soil/surface sediment is one five-sample composite for every 30-acre grid cell. In surface soil/surface sediment, there are up to 1,831 samples in the IAEU. In subsurface soil/subsurface sediment, there are up to 3,332 samples in the IAEU.

Another source of uncertainty in the data is the relationship of detection limits to the PRGs for analytes eliminated as COCs because they were either not detected or had a low

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detection frequency (i.e., less than 5 percent). The detection limits were appropriate for the analytical methods used, and this is examined in greater detail in Attachment 1.

6.2 Uncertainties Associated with Screening Values

The COC screening analyses used RFETS-specific PRGs based on a WRW scenario. The assumptions used in the development of these values were conservative. For example, it is assumed that a future WRW will consume 100 milligrams (mg) of surface soil/surface sediment for 230 days per year for a period of 18.7 years. In addition, a WRW is assumed to be dermally exposed and to inhale surface soil and surface sediment particles in the air. These assumptions are likely to overestimate actual exposures to surface soil for WRWs in the IAEU because a WRW will not spend 100 percent of his or her time in this area. Exposure to subsurface soil and subsurface sediment is assumed to occur 20 days per year. The WRW PRGs for subsurface soil/subsurface sediment are also expected to conservatively estimate potential exposures because it is unlikely a WRW will excavate extensively in the IAEU.

6.2.1 Uncertainties Associated with Potential Contaminants of Concern without Preliminary Remediation Goals

PCOCs for the IAEU for which PRGs are not available are listed in Table 6.1.

Uncertainties associated with the lack of PRGs for analytes listed in Table 6.1 are considered small. The listed inorganics and organics are not usually included in HHRAs because they are not expected to result in significant human health impacts. Radionuclide PRGs are available for all detected individual radionuclides. Therefore, the lack of PRGs for the gross alpha and gross beta activities is not expected to affect the results of the HHRA.

6.3 Uncertainties Associated with Eliminating Potential Contaminants of Concern Based on Professional Judgment

No PCOCs in surface soil/surface sediment or subsurface soil/subsurface sediment in the IAEU were eliminated from the COC screen based on professional judgment. Therefore, there is no uncertainty associated with eliminating COCs based on professional judgment.

6.4 Uncertainties Associated with Calculation of Risk

The Tier 1 UCL for the IAEU surface soil/surface sediment arsenic data is 4.68 mg/kg, and the excess lifetime cancer risk is estimated to be 1.8E-06 (Table 5.1). The background UCL for surface soil/surface sediment arsenic data is 4.03 mg/kg (Appendix A, Volume 2, Attachment 9 of the RI/FS), which results in a background excess lifetime cancer risk of 1.5E-06. Therefore, the incremental risk to the WRW due to exposure to arsenic in the IAEU is 0.3E-06 or 3E-07. The risks to the WRW in the IAEU due to arsenic are within the range of expected background risk.

Benzo(a)pyrene is a common semi-volatile chemical observed within the IAEU (47 percent detection frequency). However, no direct association exists with any IHSS as a result of a release to the environment such as dumping, spilling, or burying. However, many IHSSs may have contributed to the detections of benzo(a)pyrene in soil due to the effects of automobile traffic and asphalt. These areas include Central Avenue (IHSS 172); the Central Avenue Ditch (IHSS 190); the Building 444 parking lot (IHSS 160); the ditches, storm drains, roadways and parking areas adjacent to and north of Building 444/460 (IHSS 157.2, PACs 400-803, 400-804 etc); and waste storage pads such as the 904 Pad (IHSS 213), 750 Pad (IHSS 214), and RCRA Unit 1 PAC (500-903). During the peak traffic years (1990-2004), Geographic Information System (GIS) coverage shows approximately 6,720,800 square feet of asphalt surface area (plantwide). As a result, the detections of benzo(a)pyrene in the IAEU are likely to be a result of traffic, pavement degradation, and/or paving operations. The Tier 1 and Tier 2 risks to the WRW and the WRV in the IAEU due to benzo(a)pyrene (1E-06 for Tier 1 and 1E-06 for Tier 2) are at the low end of the target risk range for COCs exhibiting carcinogenic effects.

6.5 Uncertainties Evaluation Summary

Evaluation of the uncertainties associated with the data and the COC screening processes indicates there is reasonable confidence in the conclusions of the IAEU risk characterization.

7.0 IDENTIFICATION OF ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN

The ECOPC identification process streamlines the ecological risk characterization for each EU by focusing the assessment on ECOIs that are present in the IAEU. ECOIs are defined as any chemical detected in the IAEU and are assessed for surface soils and subsurface soils. ECOIs for sediments and surface water are assessed in Appendix A, Volume 15 of the RI/FS Report. The ECOPC process is described in the CRA Methodology and additional details are provided in Appendix A, Volume 2 of the RI/FS Report.

The process is based on the SCM presented in the CRA Methodology and described in detail in Appendix A, Volume 2 of the RI/FS Report. The SCM presents the pathways of potential exposure from documented historical source areas (IHSSs and PACs) to the receptors of concern. Generally, the most significant exposure pathways for wildlife at the IAEU are the ingestion of plant, invertebrate, or animal tissue that could have accumulated ECOIs from the source areas through direct uptake or dietary routes, as well as the direct ingestion of potentially contaminated media. For terrestrial plants and invertebrates, the most significant exposure pathway is direct contact with potentially contaminated soils.

The receptors of concern that were selected for assessment are listed in Table 7.1, and discussed in detail in Appendix A, Volume 2 of the RI/FS Report, and include representative birds and mammals in addition to the general plant and terrestrial invertebrate communities. The receptors were selected based on several criteria, including their potential to be found in the various habitats present within RFETS, their

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potential to come into contact with ECOIs, and the amount of life history and behavioral information available.

The ECOPC process consists of two separate evaluations, one for the PMJM receptor and one for non-PMJM receptors. The ECOPC identification process for the PMJM is conducted separately from non-PMJM receptors because the PMJM is a federally listed threatened species under the Endangered Species Act (63 FR 26517). No screening for PMJM receptors was conducted in the IAEU due to a lack of habitat.

7.1 Data Used in the Ecological Risk Assessment

The following IAEU data are used in the CRA:

- A total of 1,725 surface soil samples were collected and analyzed for inorganics (1,725 samples), organics (1,461 samples), and radionuclides (1,156 samples) (Table 1.2).
- A total of 3,312 subsurface soil samples were collected and analyzed for inorganics (2,640 samples), organics (3,312 samples), and radionuclides (1,004 samples) (Table 1.2).

A data summary is provided in Table 1.5 for surface soil and Table 1.6 for subsurface soil.

Sediment and surface water data for the IAEU also were collected (Section 1.2) and these data are evaluated for the ERA in Appendix A, Volume 15 of the RI/FS Report.

7.2 Identification of Surface Soil Ecological Contaminants of Potential Concern

ECOPCs for surface soil were identified for non-PMJM receptors in accordance with the sequence presented in the CRA Methodology.

7.2.1 Comparison with No Observed Adverse Effect Level Ecological Screening Levels

In the first step of the ECOPC identification process, the MDCs of ECOIs in surface soil were compared to receptor-specific no observed adverse effect level (NOAEL) ESLs. NOAEL ESLs for surface soil were developed in the CRA Methodology for three receptor groups: terrestrial vertebrates, terrestrial invertebrates, and terrestrial plants.

Non-PMJM Receptors

The NOAEL ESLs for non-PMJM receptors are compared to MDCs in surface soil in Table 7.1. The results of the NOAEL ESL screening analyses for all receptor types are presented in Table 7.2. Analytes with a "Yes" in any of the "Exceedance" columns in Table 7.2 are evaluated further.

NOAEL ESLs were not available for several ECOI/receptor pairs (Tables 7.1 and 7.2). These ECOI/receptor pairs are discussed as ECOIs with uncertain toxicity (UT) in Section 10 along with the potential impacts to the risk assessment.

PMJM Receptors

No screening for PMJM receptors was conducted in the IAEU.

7.2.2 Surface Soil Frequency of Detection Evaluation

The ECOPC identification process for non-PMJM receptors involves an evaluation of detection frequency for each ECOI retained after the NOAEL screening step. If the detection frequency is less than 5 percent, population-level risks are considered highly unlikely and the ECOI is further evaluated to determine if there is adequate evidence to remove it from further consideration as an ECOPC. The detection frequencies for inorganics in surface soil are presented in Table 1.5. The ECOIs 2,4,6-trichlorophenol, 4,4'-DDT, dieldrin, endrin, endrin aldehyde, hexachlorobenzene, and pentachlorophenol were all detected in less than 5 percent of the surface soil samples in the IAEU.

The analytes 2,4,6-trichlorophenol and 4,4'-DDT were each detected once in 915 and 204 IAEU surface soil samples, respectively. Neither ECOI was carried forward in the ECOPC identification process. Population-level risk from one detection within the entire IAEU is highly unlikely given the biased nature of the sampling within the IAEU.

Endrin and endrin aldehyde were detected in three of 204 and two of 60 samples, respectively. The sampling locations and detections are presented in Figures 7.1 and 7.2, respectively. Neither ECOI was carried forward in the ECOPC identification process due to the low number of detections. Population-level risk from a few detections in an area as large as the IAEU is highly unlikely. The detections of each ECOI are closely bounded by sample locations where the ECOI was not detected, indicating the ECOI is only present in a very small location. MDCs of endrin and endrin aldehyde are also very low (17 and 9.2 micrograms per kilogram [μg/kg], respectively). Only the lowest ESL for the mourning dove (insectivore) and the American kestrel NOAEL ESL is exceeded. Both ESLs are driven by a highly conservative soil-to-earthworm bioaccumulation factor (BAF), and both receptors are birds that would range over areas much larger than the isolated detection areas shown in Figures 7.1 and 7.2. Therefore, both endrin and endrin aldehyde were eliminated from further consideration as ECOIs based on the small percentage of detections.

Hexachlorobenzene was detected in four of 918 IAEU surface soil samples. The sampling locations and detections are shown in Figure 7.3. All four detections are located within the 0.1-acre area of IHSS 120.1, the Fiberglassing Area north of Building 664. While these detections are grouped, the area of the IHSS in which they were found is much smaller than the home ranges of the mourning dove (insectivore) and American kestrel, whose ESLs are lower than the detections in that area. No other ESLs are exceeded by these four detections. Hexachlorobenzene was eliminated as an ECOI because of the low number of detections and the very isolated area in which it was detected in relation to the receptors whose ESLs were exceeded.

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Dieldrin was detected in eight of 204 surface soil samples in the IAEU. Figure 7.4 shows the sampling locations and detections. The detections are located in three separate groupings within the IAEU. All are bounded by nondetected results, and the total area with detections is less than 1 acre. Dieldrin was, therefore, eliminated from further consideration in the ECOPC identification process based on the low percentage of detection and the very small total area in which detections were found. It is highly unlikely that population-level risks would be predicted in the IAEU based on the detections of dieldrin.

Pentachlorophenol was detected in 11 of 915 surface soil samples in the IAEU. Figure 7.5 shows the sampling locations and detections. Pentachlorophenol was detected more than once only in IHSS 700-7 (three detections). In that IHSS, the lowest ESLs were exceeded by two of the three detections; however, the total area of the IHSS is less than 0.10 acre. The minimum ESL was also exceeded in six other locations throughout the IAEU; however, each detection was isolated with no other detection nearby. Pentachlorophenol is, therefore, eliminated from further consideration in the ECOPC identification process based on the low percentage of detections and the very small total area where detections were found. It is highly unlikely that population-level risks would be predicted in the IAEU based on the detections of pentachlorophenol.

7.2.3 Surface Soil Background Comparisons

The ECOIs retained after the NOAEL ESL screening and the detection frequency evaluation were then compared to site-specific background concentrations where available. The background comparison is presented in Table 7.3 and discussed in Attachment 3. The statistical methods used for the background comparison are summarized in Appendix A, Volume 15 of the RI/FS Report .

Non-PMJM Receptors

The results of the background comparisons for the non-PMJM receptors are presented in Table 7.3. The analytes listed as being retained as an ECOI in Table 7.3 are evaluated further using upper-bound EPCs in the following section.

PMJM Receptors

No background analysis was conducted for PMJM receptors.

7.2.4 Exposure Point Concentration Comparisons to Threshold Ecological Screening Levels

The ECOIs retained after completion of all previous evaluations for non-PMJM receptors were then compared to threshold ESLs (tESLs) using EPCs specific to small and large home-range receptors. The calculation of EPCs is described in Appendix A, Volume 15 of the RI/FS Report .

Statistical concentrations for each ECOI retained for the tESL screen are presented in Table 7.4. The EPC used for the small home-range receptors is the 95 percent UCL of the 90th percentile (upper tolerance limit [UTL]), or the MDC in the event that the UTL is greater than the MDC. The EPC for large home-range receptors is the UCL, or the MDC in the event that the UCL is greater than the MDC.

Small home-range receptors include terrestrial plants, terrestrial invertebrates, mourning dove, American kestrel, deer mouse, and black-tailed prairie dog. These receptors are evaluated by comparing the small home-range EPC (UTL) for each ECOI to the limiting (or lowest) small home-range receptor tESL (if available). In the event that tESLs are not available, the limiting NOAEL ESL is used in accordance with the CRA Methodology.

Large home-range receptors, such as coyote and mule deer, are evaluated by comparing the large home-range EPC (UCL) for each ECOI to the limiting large home-range receptor tESL (if available). In the event that tESLs are not available, the limiting NOAEL ESL is used in accordance with the CRA Methodology.

The EPC comparison to limiting tESLs for small and large home-range receptors is presented in Table 7.5. No EPCs were greater than the limiting large home-range receptor tESLs; therefore, no further evaluation is necessary for large home-range receptors in the IAEU.

Analytes exceeding the limiting tESLs for small home-range receptors are compared to receptor-specific tESLs in Table 7.6.

Chemicals that exceed any tESLs (if available) are assessed in the professional judgment evaluation. Any analyte/receptor pairs that are retained through professional judgment are identified as ECOPCs and are carried forward in the risk characterization.

7.2.5 Surface Soil Professional Judgment Evaluation

Based on the weight-of-evidence, professional judgment described in Attachment 3, boron in surface soil at the IAEU is not considered an ECOPC for non-PMJM receptors and is not further evaluated quantitatively.

Antimony, chromium, copper, molybdenum, tin, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, total dioxins, and total PCBs were identified as ECOPCs for non-PMJM receptors and retained for further evaluation in the risk characterization.

7.2.6 Summary of Surface Soil Ecological Contaminants of Potential Concern

The ECOPC screening process for surface soil is summarized below for non-PMJM receptors and PMJM receptors.

Non-PMJM Receptors

Inorganic, organic, and radionuclide surface soil ECOIs for non-PMJM receptors in the IAEU were eliminated from further consideration as ECOPCs based on one of the following: 1) the MDC of the ECOI was less than the lowest ESL; 2) no ESLs were available (these ECOIs are discussed in Section 10.0); 3) the concentration of the ECOI in IAEU surface soils was not statistically greater than background surface soils; 4) the upper-bound EPC did not exceed the limiting tESL; or 5) the weight-of-evidence,

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professional judgment evaluation indicated that the ECOI was not a site-related contaminant of potential concern. Chemicals that were retained are identified as ECOPCs

Antimony, chromium, copper, molybdenum, tin, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, total dioxin, and total PCBs were identified as ECOPCs for IAEU surface soils for at least one non-PMJM receptor. The ECOPC/receptor pairs are evaluated further in Section 8.0 (Ecological Exposure Assessment), Section 9.0 (Ecological Toxicity Assessment), and Section 10.0 (Ecological Risk Characterization). The results of the surface soil ECOPC identification process for non-PMJM receptors are summarized in Table 7.7.

PMJM Receptors

No ECOPC identification for PMJM receptors was conducted in the IAEU.

7.3 Identification of Subsurface Soil Ecological Contaminants of Potential Concern

Subsurface soil sampling locations for soil collected at a starting depth of 0.5 to 8 feet bgs in the IAEU are identified on Figure 1.7. A data summary for subsurface soil less than 8 feet bgs is presented in Table 1.6.

7.3.1 Comparison to No Observed Adverse Effect Level Ecological Screening Levels

The CRA Methodology indicates subsurface soil must be evaluated for those ECOIs that have greater concentrations in the subsurface than in surface soil. As a conservative screening step, subsurface soil is evaluated for all EUs regardless of the presence/absence of a change in concentrations from surface soil and subsurface soil. The MDCs of ECOIs in subsurface soil ECOIs were compared to NOAEL ESLs for burrowing receptors (Table 7.8). ECOIs with MDCs greater than the NOAEL ESL for the prairie dog are further evaluated in the ECOPC identification process.

NOAEL ESLs are not available for some analytes, and these are identified as "N/A" in Table 7.8. These constituents are considered ECOIs with UT and are discussed in the uncertainty analysis (Section 10.0).

7.3.2 Subsurface Soil Detection Frequency Evaluation

The ECOPC identification process for burrowing receptors involves an evaluation of detection frequency for each ECOI retained after the NOAEL ESL screening step. If the detection frequency is less than 5 percent, population-level risks are considered highly unlikely and the ECOI is not further evaluated. The detection frequencies for chemicals in subsurface soil are presented in Table 1.6. None of the chemicals in subsurface soil at the IAEU that were retained after the NOAEL ESL screening step had a detection frequency of less than 5 percent. Therefore, no ECOIs were eliminated from further evaluation based on low detection frequencies for subsurface soil in the IAEU.

7.3.3 Subsurface Soil Background Comparison

The ECOIs retained after the ESL screening and detection frequency evaluation were compared to site-specific background concentrations where available. The background comparison was conducted in the same manner as for surface soil non-PMJM receptors using statistical comparisons.

Analyses were conducted to assess whether the remaining inorganic ECOIs in IAEU subsurface soil are statistically greater than those in sitewide background surface soil at the 0.1 level of significance.

The results of the statistical comparisons of the IAEU data to background data indicate that site concentrations for all ECOIs for which comparisons could be made in IAEU subsurface soil are not statistically greater than background concentrations. The results are summarized in Table 7.9.

Background data were not available to conduct statistical evaluations for antimony, cadmium, selenium, tin, and uranium. These ECOIs were carried forward into the next ECOPC identification step.

7.3.4 Exposure Point Concentration Comparisons to Threshold Ecological Screening Levels

ECOIs retained after all previous evaluations for burrowing receptors are compared to tESLs using EPCs specific to small home-range receptors. The calculation of EPCs is discussed in the CRA Methodology.

Statistical concentrations for the remaining ECOIs are presented in Table 7.10. The EPC comparison to tESLs for burrowing receptors is presented in Table 7.11. No ECOIs had UTL concentrations in the IAEU subsurface soils that were greater than the tESLs for burrowing receptors. Therefore, all ECOIs were eliminated from further consideration as ECOPCs in the IAEU subsurface soils.

7.3.5 Subsurface Soil Professional Judgment

ECOIs with subsurface soil concentrations that exceed NOAEL ESLs, which have been detected in more than 5 percent of samples, that have slightly elevated concentrations compared to the background data, and which exceed tESLs, are subject to a professional judgment evaluation. However, no ECOIs had subsurface soil concentrations that exceeded tESLs; therefore, no weight-of-evidence, professional judgment evaluation was needed for subsurface soil in the IAEU.

7.3.6 Summary of Subsurface Ecological Contaminants of Potential Concern

All subsurface soil ECOIs for burrowing receptors in the IAEU were eliminated from further consideration as ECOPCs based on one of the following: 1) the MDC of the ECOI was less than the NOAEL ESL for the burrowing receptor; 2) no ESLs were available (these ECOIs are discussed in Section 10.0); 3) the concentration of the ECOI in IAEU subsurface soils was not statistically greater than background subsurface soils; or 4) the upper-bound EPC was less than the tESL. The results of the subsurface soil ECOPC identification process for burrowing receptors are summarized in Table 7.12.

7.4 Summary of Ecological Contaminants of Potential Concern

ECOIs in surface and subsurface soil in the IAEU were evaluated in the ECOPC identification process for non-PMJM receptors and burrowing receptors. Antimony, chromium, copper, molybdenum, tin, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, total dioxin, and total PCBs in surface soil were identified as ECOPCs for selected non-PMJM receptors. No chemicals were identified as ECOPCs for burrowing receptors. No other ECOIs were retained past the professional judgment step of the ECOPC identification process for any other receptor group (non-PMJM receptors, PMJM receptors, or burrowing receptors).

8.0 ECOLOGICAL EXPOSURE ASSESSMENT

The ECOPC identification process defined the steps necessary to identify those chemicals that could not reliably be removed from further consideration in the ERA process. The list of ECOPC/receptor pairs of potential concern (Table 8.1) represents those media, chemicals and receptors in the IAEU that require further assessment. The characterization of risk defines a range of potential exposures to site receptors from the ECOPCs and a parallel evaluation of the potential toxicity of each of the ECOPCs as well as the uncertainties associated with the risk characterization. This section provides the estimation of potential exposure to surface soil ECOPCs for the receptors identified in Section 7.0 and Table 8.1. Details of the two exposure models, concentration-based exposure and dosage-based exposure, are presented in Appendix A, Volume 2 of the RI/FS Report.

8.1 Exposure Point Concentrations

Surface soil EPCs for all non-PMJM receptors were calculated using both Tier 1 and Tier 2 methods, as described in the CRA Methodology. The 30-acre grid used for the Tier 2 calculations is shown in Figure 8.1. The Tier 1 and Tier 2 UTLs and UCLs for surface soil are presented in Table 8.2. The methodology for the calculation of Tier 2 EPC statistics is provided in Appendix A, Attachment 2 of the RI/FS.

Surface water EPCs consisted of values that corresponded to the soil EPCs (only for the soil ECOPCs) being used and are used to estimate the total exposure via the surface water ingestion pathway. For example, if the soil EPC statistic was the UCL, then the UCL concentration in surface water (total values only) was selected as the EPC. Surface water EPCs for all soil ECOPCs were calculated as described for soils and are presented in Table 8.3. All surface water data are provided on CD in Attachment 6.

8.2 Receptor-Specific Exposure Parameters

Receptor-specific exposure factors are needed to estimate exposure to ECOPCs for each representative species. These include body weight; food, water, and media ingestion rates; and diet composition and respective proportion of each dietary component. Daily rates for intake of forage, prey, water, and incidental ingestion of soils were developed in the CRA Methodology and are presented in Table 8.4 for the receptors of potential concern carried forward in the ERA for the IAEU.

8.3 Bioaccumulation Factors

The measurement or estimation of concentrations of ECOPCs in wildlife food is necessary to evaluate how much of a receptor's exposure is via food versus direct uptake of contaminated media. Conservative BAFs were identified in the CRA Methodology. These BAFs are either simple ratios between chemical concentrations in biota and soil or are based on quantitative relationships such as linear, logarithmic, or exponential equations. The values reported in the CRA Methodology are used as the BAFs for purposes of risk estimation.

8.4 Intake and Exposure Estimates

Intake and exposure estimates were completed for each ECOPC/receptor pair identified in Table 8.1. The estimates use the default exposure parameters and BAFs presented in Appendix B of the CRA Methodology and described in the previous subsection. These intake calculations represent conservative estimates of food tissue concentrations calculated from the range of upper-bound EPCs including the Tier 1 and Tier 2 UTLs and UCLs where appropriate.

Non-PMJM Receptors

The intake and exposure estimates for ECOPC/non-PMJM receptors are presented in Attachment 4. A summary of the exposure estimates is presented in Table 8.5.

- Antimony – Default exposure estimates for deer mouse (insectivore);
- Chromium – Default exposure estimates for the American kestrel, mourning dove (herbivore and insectivore), and deer mouse (insectivore);
- Copper – Default exposure estimates for the mourning dove (herbivore and insectivore);
- Molybdenum – Default exposure estimates for deer mouse (insectivore);
- Tin – Default exposure estimates for the mourning dove (insectivore) and deer mouse (insectivore);
- Bis(2-ethylhexyl)phthalate – Default exposure estimates for the American kestrel and mourning dove (insectivore);

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- Di-n-butylphthalate – Default exposure estimates for the American kestrel and mourning dove (insectivore);
- Total Dioxin – Default exposure estimates for the mourning dove (insectivore) and deer mouse (insectivore); and
- Total PCBs – Default exposure estimates for the American kestrel and mourning dove (insectivore).

9.0 ECOLOGICAL TOXICITY ASSESSMENT

Exposure to wildlife receptors was estimated for representative species of functional groups based on taxonomy and feeding behavior in Section 8.0 in the form of a daily rate of intake for each ECOPC/receptor pair. To estimate risk, soil concentrations (plants and invertebrate exposure) and calculated intakes (birds and mammals) must then be compared to the toxicological properties of each ECOPC. The laboratory-based toxicity benchmarks are termed toxicity reference values (TRVs) and are of several basic types. The NOAEL and no observed effect concentration (NOEC) TRVs are intake rates or soil concentrations below which no ecologically significant effects are expected. The NOAEL and NOEC TRVs were used to calculate the NOAEL ESLs employed in screening steps of the ECOPC identification process to eliminate chemicals that have no potential to cause risk to the representative receptors. The lowest observed adverse effects level (LOAEL) TRV is a concentration above which the potential for some ecologically significant adverse effect could be elevated. The threshold TRVs represent the hypothetical dose at which the response for a group of exposed organisms may first begin to be significantly greater than the response for unexposed receptors and is calculated as the geometric mean of the NOAEL and LOAEL. Threshold TRVs were calculated based on specific data quality rules for use in the ECOPC identification process for a small subset of ECOIs in the CRA Methodology.

TRVs for ECOPCs identified for IAEU were obtained from the CRA Methodology. The pertinent TRVs for the IAEU are presented for terrestrial plants and invertebrates in Table 9.1 and for birds and mammals in Table 9.2.

10.0 ECOLOGICAL RISK CHARACTERIZATION

Risk characterization includes risk estimation and risk description. Details of these components are described in the CRA Methodology and Appendix A, Volume 2 of the RI/FS Report. Predicted risks should be viewed in terms of the potential for the assumptions used in the risk characterization to occur in nature, the uncertainties associated with the assumptions, and in the potential for effects on the population of receptors that could inhabit the IAEU in the future.

Potential risks to terrestrial plants, invertebrates, birds, and mammals are evaluated using a hazard quotient (HQ) approach. An HQ is the ratio of the estimated exposure of a receptor to a TRV that is associated with a known level of toxicity, either a no effect level (NOAEL or NOEC) or an effect level (LOAEL or LOEC):

$$HQ = Exposure / TRV$$

As described in Section 8.0, the units used for exposure and TRV depend upon the type of receptor evaluated. For plants and invertebrates, exposures and TRVs are expressed as concentrations milligrams per kilogram [mg/kg] soil). For birds and mammals, exposures and TRVs are expressed as ingested doses (mg/kg/receptor body weight [BW]/day). In general, if the NOAEL-based HQ is less than 1, then no adverse effects are predicted. If the LOAEL-based HQ is less than 1 but the NOAEL-based HQ is above 1, then some adverse effects are possible, but it is expected that the magnitude and frequency of the effects will usually be low (assuming the magnitude and severity of the response at the LOAEL are not large and the endpoint of the LOAEL accurately reflects the assessment endpoints for that receptor). If the LOAEL-based HQ is greater than or equal to 1, the risk of an adverse effect is of potential concern, with the probability and/or severity of effect tending to increase as the value of the HQ increases.

When interpreting HQ results for non-PMJM ecological receptors, it is important to remember that the assessment endpoint to non-PMJM receptors is based on the sustainability of exposed populations, and risks to some individuals in a population may be acceptable if the population is expected to remain healthy and stable. For threatened and endangered species, such as the PMJM, the interpretation of HQ results is based on potential risks to individuals rather than to populations.

HQs were calculated for each ECOPC/receptor pair based on the exposures estimated and TRVs presented in the preceding sections. Risks are discussed and presented to put the assumptions of the risk predictions into a context that can be used to make risk management decisions.

10.1 Risk Estimation

Chemical risk characterization uses quantitative methods to evaluate potential risks to ecological receptors. In this risk assessment, the quantitative method used to characterize chemical risk is the HQ approach. As noted above, HQs are usually interpreted as follows:

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HQ Values		Interpretation of HQ Results
NOAEL-based	**LOAEL-based**	
≤ 1	≤ 1	Minimal or no risk
> 1	≤ 1	Low level risk[a]
> 1	> 1	Potentially significant risk

[a] Assuming magnitude and severity of response at LOAEL are relatively small and based on endpoints appropriate for the assessment endpoint of the receptor considered.

One potential limitation of the HQ approach is that calculated HQ values may sometimes be uncertain due to simplifications and assumptions in the underlying exposure and toxicity data used to derive the HQs. Where possible, this risk assessment provides information on three potential sources of uncertainty, described below.

- **EPCs.** Because surface soil sampling programs in the EU sometimes tended to focus on areas of potential contamination (IHSS/PAC/UBCs), EPCs calculated using the Tier 1 approach (which assumes that all samples are randomly spread across the EU and are weighted equally) may tend to yield an EPC that is biased high. For this reason, a Tier 2 area-weighting approach was used to derive additional EPCs that help compensate for this potential bias. HQs were always calculated based on both Tier 1 and Tier 2 EPCs for non-PMJM receptors.

- **BAFs.** For wildlife receptors, concentrations of contaminants in dietary items were estimated from surface soil using uptake equations. When the uptake equation was based on a simple linear model (e.g., $C_{tissue} = BAF * C_{soil}$), the default exposure scenario used a high-end estimate of the BAF (the 90th percentile BAF). However, the use of high-end BAFs may tend to overestimate tissue concentrations in some dietary items. To estimate more typical tissue concentrations, where necessary, an alternative exposure scenario calculated total chemical intake using a 50th percentile (median) BAF, and HQs were calculated. The use of the median BAF is consistent with the approach used in the ecological soil screening level (EcoSSL) guidance (EPA 2005).

- **TRVs.** The CRA Methodology used an established hierarchy to identify the most appropriate default TRVs for use in the ECOPC selection. However, in some instances, the default TRV selected may be overly conservative with regard to characterizing population-level risks. The determination of whether the default TRVs are thought to yield overly conservative estimates of risk is addressed in the uncertainty sections below on a chemical-by-chemical basis. When an alternative TRV is identified, the chemical-specific uncertainty sections provide a discussion of why the alternative TRV is thought to be appropriate to provide an alternative estimate of toxicity (e.g., endpoint relevance, species relevance, data quality, chemical form, etc.), and HQs were calculated using both default and alternative TRVs where necessary.

The influences of each of these uncertainties on the calculated HQs were evaluated both alone and in concert in the risk description for each chemical. Uncertainties related to the BAFs, TRVs, and background risk are presented for each chemical in Attachment 5. Where uncertainties were deemed to be high, Attachment 5 provided alternative BAFs and/or TRVs as appropriate based on the results of the uncertainty assessment.

HQs calculated using the default BAFs and HQs with the Tier 1 and Tier 2 EPCs are provided in Tables 10.1 and 10.2 for each ECOPC/receptor pair. Where no LOAEL HQs exceed 1 using the default exposure and toxicity values, no further HQs were calculated regardless of the results of the uncertainty analysis. Because the default HQs are generally the most conservative risk estimations, if low risk is estimated using these values then further reductions of conservatism would only serve to reduce risk estimates further.

Where LOAEL HQs greater than 1 are calculated using default assumptions, and the uncertainty analysis indicated that alternative BAFs and/or TRVs would be beneficial to reduce uncertainty and conservatism, alternative HQs are presented in Table 10.1 as appropriate.

The selection of which EPC (e.g., UTL or UCL) is of primary importance will depend upon the type of receptor and the relative home-range size. Only the UTL EPC is provided in Table 10.1 for small home-range receptors, and only the UCL is provided for large home-range receptors.

All calculated exposure estimates and HQ values are also provided in Attachment 4. These include the default and alternative HQs and are calculated using a range of EPCs. The results for each ECOPC are discussed in more detail below.

The risk description incorporates results of the risk estimates along with the uncertainties associated with the risk estimations and other lines of evidence to evaluate potential chemical effects on ecological receptors in the IAEU following accelerated actions. Information considered in the risk description includes receptor groups potentially affected; type of TRV exceeded (e.g., NOAEL versus LOAEL); relation of EU concentrations to other criteria such as EPA EcoSSLs; and risk above background conditions. In addition, other site-specific and regional factors are considered such as the use of a given ECOPC within the EU related to historical RFETS activities; comparison of ECOPC concentrations within the IAEU to the rest of the RFETS site as it relates to background; and/or comparison to regional background concentrations.

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10.1.1 Antimony

Antimony HQs for the deer mouse (insectivore) receptor are presented in Table 10.1. Figure 10.1 shows the spatial distribution of antimony in relation to the lowest ESL and also presents the data used in the calculation of the Tier 2 EPCs.

HQs Calculated to Characterize Uncertainty

Uncertainties related to the default HQ calculations provided in Table 10.1 are discussed in detail in Attachment 5. Uncertainties related to BAFs, TRVs, and background risks are presented.

For non-PMJM receptors, no receptors had LOAEL HQs greater than 1 using the default exposure assumptions, and no alternative HQs were calculated.

However, care should be taken to review the chemical specific uncertainties discussed in Attachment 5 when reviewing the results of all receptors regardless of whether alternative HQs are provided.

Antimony – Risk Description

Antimony was identified as an ECOPC for the deer mouse (insectivore). Information on the historical use and a summary of site data and background data are provided in Attachment 3.

NOAEL HQs calculated using Tier 1 EPCs were greater than 1 for the deer mouse (insectivore). The Tier 1 HQ equaled 2 while the Tier 2 HQ equaled 3.

All LOAEL HQs were less than 1, indicating that risks to populations of receptors from exposure to antimony in IAEU surface soils are, therefore, likely to be low.

Table 10.2 presents a summary of HQs calculated using the arithmetic mean concentration used as cell-specific EPCs for surface soil samples within each of the Tier 2 30-acre grid cells. Default NOAEL and LOAEL TRVs were used in the HQ calculations. Antimony samples were available from 24 grid cells (Figure 10.1). NOAEL HQs greater than 1 were calculated in 63 percent of the grid cells, while no LOAEL HQs greater than 1 were calculated in any grid cell for the most sensitive receptor (deer mouse [insectivore]). The results of the grid-cell analysis indicate that the average exposure to sub-populations of small home-range receptors results in low risk from exposure to antimony.

10.1.2 Chromium

Chromium HQs for the terrestrial plants, terrestrial invertebrates, American kestrel, mourning dove (herbivore and insectivore), and deer mouse (insectivore) are presented in Table 10.1. Figure 10.2 shows the spatial distribution of chromium in relation to the lowest ESL and also presents the data used in the calculation of the Tier 2 EPCs.

HQs Calculated to Characterize Uncertainty

Uncertainties related to the default HQ calculations provided in Table 10.1 are discussed in detail in Attachment 5. Uncertainties related to BAFs, TRVs, and background risks are presented.

For non-PMJM receptors, because only the terrestrial plant, terrestrial invertebrate, and mourning dove (insectivore) receptors had LOAEL HQs greater than 1 using the default exposure assumptions, alternative HQs were only calculated for those receptors. Those alternative HQs are presented in Table 10.1

However, care should be taken to review the chemical-specific uncertainties discussed in Attachment 5 when reviewing the results of all receptors regardless of whether alternative HQs are provided.

Chromium Risk Description

Chromium was identified as an ECOPC for terrestrial plants, terrestrial invertebrates, American kestrel, mourning dove (herbivore and insectivore), and deer mouse (insectivore) receptors. Alternative HQs were calculated for the terrestrial plant, terrestrial invertebrate, and mourning dove (insectivore) receptors using alternative TRVs for plants and invertebrates and a median soil-to-invertebrate BAF for the mourning dove (insectivore). Information on the historical use and a summary of site data and background data are provided in Attachment 3.

Terrestrial Plants and Invertebrates

For terrestrial plants, HQs were greater than 1 using the default ESL. The UTL HQ equaled 26, indicating that risks could not be considered to be minimal. Because no default LOEC value was available, it is uncertain whether risks have the potential to be significant based on the default HQ calculations.

The uncertainty assessment discussed the low confidence placed in the chromium ESL for terrestrial plants and provided an alternative NOEC and LOEC value. The alternative NOEC had an HQ greater than 1, while no HQs greater than 1 were calculated using the alternative LOEC. As discussed in the uncertainty analysis, the alternative LOEC is representative of a concentration at which soybean roots had a 30 percent reduction in shoot weight.

The default ESL is less than all site-specific background concentrations and HQs greater than 1 were calculated using UTL background concentration (HQ = 17). Because risks are not generally expected in background areas, risks to terrestrial plants may be somewhat over-predicted using the default ESL. Attachment 3 of this document indicates that the background concentrations of chromium in Colorado and bordering states range from 3 to 500 mg/kg, with an average concentration of 48.2 mg/kg. The site-specific background MDC is equal to 16.9 and does not appear to be elevated above what would be expected in the area around RFETS.

The low confidence placed in the ESL and the lack of exceedance of any effects-based TRVs, and the conservatisms noted in the default ESL, all indicate that the potential for

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risk to terrestrial plant populations in the IAEU from exposure to chromium in surface soils is likely to be low.

For terrestrial invertebrates, HQs greater than 1 were calculated using the default ESL, indicating that risks could not be considered to be minimal. Because no default LOEC value was available, it is uncertain whether risks have the potential to be significant based on the default HQ calculations.

The uncertainty assessment indicated that the default ESL is less than all site-specific background concentrations. HQs greater than 1 were calculated using UTL background concentration (HQ = 42). Because risks are not generally expected in background areas, the chromium ESL for terrestrial invertebrates may be over-predicted. As discussed above, site-specific background concentrations do not appear to be elevated above what would be expected in the vicinity of the site.

The maximum HQ calculated using the alternative LOEC, identified in the uncertainty analysis, equaled 0.8. The alternative LOEC is representative of a concentration at which soybean roots had a 30 percent reduction in earthworm growth.

The low confidence placed in the ESL and the lack of exceedance of any effects-based TRVs indicates that the potential for risk to terrestrial invertebrate populations in the IAEU from exposure to chromium in surface soils is likely to be low.

Non-PMJM Receptors – Small Home-Range

NOAEL HQs using default risk models were greater than 1 for the mourning dove (insectivore), American kestrel, and deer mouse (insectivore) (chromium VI TRV only). NOAEL HQs were less than or equal to 1 for the mourning dove (herbivore). All LOAEL HQs were less than 1 for all receptors except the mourning dove (insectivore). Risks to populations of the mourning dove (herbivore), American kestrel, and deer mouse (insectivore) from exposure to chromium are likely to be low. Risks to the mourning dove (insectivore) using the default HQ calculations may potentially be significant and require further evaluation.

Table 10.2 presents a summary of HQs calculated using the arithmetic mean concentration used as cell-specific EPCs for surface soil samples within each of the Tier 2 30-acre grid cells. Default NOAEL and LOAEL TRVs were used in the HQ calculations. Chromium samples were available from 24 grid cells (Figure 10.2). NOAEL and LOAEL HQs greater than 1 were calculated in 100 percent of the grid cells, while no LOAEL HQs greater than 5 were calculated in any grid cell for the most sensitive receptor (mourning dove [insectivore]). The results of the grid-cell analysis indicate that the average exposure to sub-populations of mourning dove (insectivore) results in low to moderate risk from exposure to chromium.

The uncertainty analysis indicated that exposure to the mourning dove (insectivore) may be overestimated based on the use of upper-bound BAFs. Table 10.1 presents HQs calculated using the identical model and TRVs as used in the default but with a median BAF rather than the conservative 90th percentile BAF. The mourning dove (insectivore) had a NOAEL HQ greater than 1 (HQ = 2) and a LOAEL HQ less than 1. These results provide a less conservative measure of potential intake and support the conclusions reached using the default HQ calculation. The results also indicate that risks to the mourning dove (insectivore) may be over-predicted using the default HQ calculations. In addition, background risk evaluations also indicated similar HQs for the mourning dove (insectivore) using the default HQ calculations. The combined lines of evidence suggest the overestimation of risk using the default HQ calculations. Risks are, therefore, expected to be low to populations of the mourning dove (insectivore).

10.1.3 Copper

Copper HQs for the mourning dove (herbivore and insectivore) are presented in Table 10.1. Copper was not identified as an ECOPC in the IAEU for any other receptors. Figure 10.3 shows the spatial distribution of copper in relation to the lowest ESL and also presents the data used in the calculation of the Tier 2 EPCs.

HQs Calculated to Characterize Uncertainty

Uncertainties related to the default HQ calculations provided in Table 10.1 are discussed in detail in Attachment 5. Uncertainties related to BAFs, TRVs, and background risks are presented.

No receptors had LOAEL HQs greater than 1 using the default exposure assumptions and no alternative HQs were calculated.

However, care should be taken to review the chemical-specific uncertainties discussed in Attachment 5 when reviewing the results of all receptors regardless of whether alternative HQs are provided.

Copper Risk Description

Copper was identified as an ECOPC for the mourning dove (herbivore and insectivore) receptors only. Information on the historical use and a summary of site data and background data are provided in Attachment 3.

Non-PMJM Receptors – Small Home-Range

NOAEL HQs calculated using Tier 1 EPCs were equal to 1 for the mourning dove (herbivore). NOAEL HQs for the mourning dove (insectivore) were greater than 1 for both the Tier 1 and Tier 2 UTLs (HQ = 2).

All LOAEL HQs were less than 1 for both receptors. Risks to populations of receptors from exposure to copper in IAEU surface soils are, therefore, likely to be low.

Table 10.2 presents a summary of HQs calculated using the arithmetic mean concentration used as cell-specific EPCs for surface soil samples within each of the Tier 2 30-acre grid cells. Default NOAEL, threshold, and LOAEL TRVs were used in the HQ calculations. Copper samples were available from 24 grid cells (Figure 10.3). NOAEL HQs greater than 1 were calculated in 100 percent of the grid cells while no LOAEL HQs greater than 1 were calculated in any grid cell for the most sensitive receptor (mourning dove [insectivore]). The results of the grid-cell analysis indicate that the average

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exposure to sub-populations of small home-range receptors results in low risk from exposure to copper.

10.1.4 Molybdenum

Molybdenum HQs for the terrestrial plant and deer mouse (insectivore) receptor are presented in Table 10.1. Figure 10.4 shows the spatial distribution of antimony in relation to the lowest ESL and also presents the data used in the calculation of the Tier 2 EPCs.

HQs Calculated to Characterize Uncertainty

Uncertainties related to the default HQ calculations provided in Table 10.1 are discussed in detail in Attachment 5. Uncertainties related to BAFs, TRVs, and background risks are presented.

For non-PMJM receptors, because no LOAEL HQs greater than 1 were calculated for even the NOEC ESL, no alternative HQs are calculated.

However, care should be taken to review the chemical-specific uncertainties discussed in Attachment 5 when reviewing the results of all receptors regardless of whether alternative HQs are provided.

Molybdenum Risk Description

Molybdenum was identified as an ECOPC for terrestrial plant and deer mouse (insectivore) receptors only. Information on the historical use and a summary of site data and background data are provided in Attachment 3.

Terrestrial Plants and Invertebrates

For terrestrial plants, an HQ equal to 1 was calculated using the ESL and the Tier 1 UTL. The Tier 2 UTL resulted in an HQ less than 1 (HQ = 0.6). No LOEC value was available, so it is not possible to estimate at which point effects begin. However, the lack of an HQ greater than 1 using either the Tier 1 or Tier 2 UTL and the NOEC ESL, risks to terrestrial plants are likely to be low.

Non-PMJM Receptors – Small Home-Range

For the deer mouse (insectivore) using Tier 1 UTL, the NOAEL HQ was equal to 1. the NOAEL HQ calculated using the Tier 2 EPC was less than 1. In addition, all LOAEL HQs were less than 1 using all EPCs. Because no HQs greater than 1 were calculated using any effects-based TRV, risks to non-PMJM small home-range receptors are likely low from exposure to molybdenum.

Table 10.2 presents a summary of HQs calculated using the arithmetic mean concentration used as cell-specific EPCs for surface soil samples within each of the Tier 2 30-acre grid cells. Default NOAEL and LOAEL TRVs were used in the HQ calculations. Molybdenum samples were available from 24 grid cells (Figure 10.4). NOAEL HQs greater than 1 were calculated in 8 percent of the grid cells while no LOAEL HQs greater than 1 were calculated in any grid cell for the most sensitive receptor (deer mouse [insectivore]). The results of the grid-cell analysis indicate that the average exposure to sub-populations of small home-range receptors results in low risk from exposure to molybdenum.

The uncertainty analysis indicated that risks have the potential to be over-predicted for the deer mouse (insectivore) due to the use of a conservative (upper bound) soil-to-invertebrate BAF. HQs calculated using the median BAF value from the same source were less than or equal to 1 in all cases. These results support the prediction of low risks to non-PMJM receptors.

10.1.5 Tin

Tin HQs for the mourning dove (insectivore), and deer mouse (insectivore) are presented in Table 10.1. Figure 10.5 shows the spatial distribution of tin in relation to the lowest ESL and also presents the data used in the calculation of the Tier 2 EPCs.

HQs Calculated to Characterize Uncertainty

Uncertainties related to the default HQ calculations provided in Table 10.1 are discussed in detail in Attachment 5. Uncertainties related to BAFs, TRVs, and background risks are presented.

No alternative BAFs or TRVs were recommended in the uncertainty analysis. Therefore, no HQs based on alternative assumptions are provided in Table 10.1.

However, care should be taken to review the chemical-specific uncertainties discussed in Attachment 5 when reviewing the results of all receptors regardless of whether alternative HQs are provided.

Tin – Risk Description

Tin was identified as an ECOPC for the mourning dove (insectivore) and deer mouse (insectivore) receptors. Information on the historical use and a summary of site data and background data are provided in Attachment 3.

Non-PMJM Receptors – Small Home-Range

For the non-PMJM receptors, potential risks from exposure to tin were evaluated using a range of EPCs, default exposure scenarios, and default TRVs. NOAEL HQs were greater than 1 for the mourning dove (insectivore) and deer mouse (insectivore) using Tier 2 UTLs only. All LOAEL HQs for both receptors were less than 1. The lack of HQs calculated when using effects-based TRVs indicates that risk to non-PMJM small home-range receptors is likely to be low.

Table 10.2 presents a summary of HQs calculated using the arithmetic mean concentration used as cell-specific EPCs for surface soil samples within each of the Tier 2 30-acre grid cells. Default NOAEL and LOAEL TRVs were used in the HQ calculations. Tin samples were available from 24 grid cells (Figure 10.5). NOAEL HQs greater than 1 were calculated in 42 percent of the grid cells while no LOAEL HQs greater than 1 were calculated in any grid cell for the most sensitive receptor (mourning dove [insectivore]). The results of the grid-cell analysis indicate that the average

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exposure to sub-populations of small home-range receptors result in low risk from exposure to tin.

The uncertainty section discussed the uncertainties and likely conservatisms in the BAFs used to estimate tissue concentrations. Because no HQs greater than 1 were calculated using the LOAEL TRV, risks to non-PMJM receptor populations in the IAEU are likely to be low.

10.1.6 Dioxin (total)

Dioxin (total) HQs for the mourning dove (insectivore) and deer mouse (insectivore) are presented in Table 10.1. Figure 10.6 shows the spatial distribution of dioxins in relation to the lowest ESL and also presents the data used in the calculation of the Tier 2 EPCs.

HQs Calculated to Characterize Uncertainty

Uncertainties related to the default HQ calculations provided in Table 10.1 are discussed in detail in Attachment 5. Uncertainties related to BAFs, TRVs, and background risks are presented.

No receptors had LOAEL HQs greater than 1 using the default exposure assumptions and no alternative HQs were calculated.

However, care should be taken to review the chemical-specific uncertainties discussed in Attachment 5 when reviewing the results of all receptors regardless of whether alternative HQs are provided.

Non-PMJM Receptors – Small Home-Range

NOAEL HQs calculated using Tier 1 and Tier 2 UTLs were greater than 1 for the mourning dove (insectivore) and deer mouse (insectivore) receptors. All LOAEL HQs were less than 1 for both receptors. Risks to populations of receptors from exposure to dioxins in IAEU surface soils are, therefore, likely to be low.

Table 10.2 presents a summary of HQs calculated using the arithmetic mean concentration used as cell-specific EPCs for surface soil samples within each of the Tier 2 30-acre grid cells. Default NOAEL and LOAEL TRVs were used in the HQ calculations. Dioxin samples were available from 4 grid cells (Figure 10.6). NOAEL HQs greater than 1 were calculated in all of the grid cells with dioxin data while no LOAEL HQs greater than 1 were calculated in any grid cell for the most sensitive receptor (deer mouse [insectivore]). The results of the grid-cell analysis indicate that the average exposure to sub-populations of small home-range receptors results in low risk from exposure to dioxins.

10.1.7 Bis(2-ethylhexyl)phthalate

Bis(2-ehtylhexylphthalate) HQs for the American kestrel and mourning dove (insectivore) are presented in Table 10.1. Figure 10.7 shows the spatial distribution of bis(2-ethlyhexyl)phthalate in relation to the lowest ESL and also presents the data used in the calculation of the Tier 2 EPCs.

HQs Calculated to Characterize Uncertainty

Uncertainties related to the default HQ calculations provided in Table 10.1 are discussed in detail in Attachment 5. Uncertainties related to BAFs, TRVs, and background risks are presented.

No LOAEL HQs greater than 1 were calculated for any non-PMJM receptor. Therefore, no alternative HQ calculations are provided.

However, care should be taken to review the chemical-specific uncertainties discussed in Attachment 5 when reviewing the results of all receptors regardless of whether alternative HQs are provided.

Bis(2-ethylhexyl)phthalate – Risk Description

There is no identified source in the IAEU of bis(2-ethylhexyl)phthalate, which was identified as an ECOPC for the American kestrel and mourning dove (insectivore) receptors. Information on the historical use and a summary of site data and background data are provided in Attachment 3.

Non-PMJM Receptors – Small Home-Range

Potential risks to receptors of concern were estimated using a range of EPCs. NOAEL HQs were greater than 1 for the mourning dove (insectivore) receptor. NOAEL HQs were equal to 1 for the American kestrel (Table 10.1). All LOAEL HQs were less than 1 for both species. Because no effects-based TRVs resulted in HQs greater than 1, risks to non-PMJM receptors are likely to be low.

Table 10.2 presents a summary of HQs calculated using the arithmetic mean concentration used as cell-specific EPCs for surface soil samples within each of the Tier 2 30-acre grid cells. Default NOAEL and LOAEL TRVs were used in the HQ calculations. Bis(2-ethylhexyl)phthalate samples were available from 22 grid cells (Figure 10.7). NOAEL HQs greater than 1 were calculated in all of the grid cells, while no grids had LOAEL HQs greater than 1 for the most sensitive receptor (mourning dove [insectivore]). The results of the grid-cell analysis indicate that the average exposure to sub-populations of small home-range receptors results in low risk from exposure to bis(2-ethylhexyl)phthalate.

These lines of evidence along with the uncertainty analysis indicated that risks to non-PMJM receptors is likely low.

10.1.8 Di-n-butylphthalate

Di-n-butylphthalate HQs for American kestrel and mourning dove (insectivore) are presented in Table 10.1. Figure 10.8 shows the spatial distribution of di-n-butylphthalate in relation to the lowest ESL and also presents the data used in the calculation of the Tier 2 EPCs.

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HQs Calculated to Characterize Uncertainty

Uncertainties related to the default HQ calculations provided in Table 10.1 are discussed in detail in Attachment 5. Uncertainties related to BAFs, TRVs, and background risks are presented.

LOAEL HQs greater than 1 were calculated for the mourning dove (insectivore) receptor. However, as discussed in the uncertainty analysis, no alternative calculations are available.

However, care should be taken to review the chemical-specific uncertainties discussed in Attachment 5 when reviewing the results of all receptors regardless of whether alternative HQs are provided.

Di-n-butylphthalate – Risk Description

There is no identified source in the IAEU of di-n-butylphthalate, which was identified as an ECOPC for the American kestrel and mourning dove (insectivore) receptors. Information on the historical use and a summary of site data and background data are provided in Attachment 3.

Non-PMJM Receptors – Small Home-Range

Potential risks to receptors of concern were estimated using a range of EPC TRVs. NOAEL HQs were greater than 1 for the mourning dove (insectivore) and American kestrel (Table 10.1). LOAEL HQs were also greater than or equal to 1 for the mourning dove (insectivore) but were less than 1 for the American kestrel. Risks to the American kestrel are, therefore, likely to be low from exposure to di-n-butylphthalate. Risks to the mourning dove (insectivore) have the potential to be significant and further evaluation is required.

Table 10.2 presents a summary of HQs calculated using the arithmetic mean concentration used as cell-specific EPCs for surface soil samples within each of the Tier 2 30-acre grid cells. Default NOAEL and LOAEL TRVs were used in the HQ calculations. Di-n-butylphthalate samples were available from 22 grid cells (Figure 10.8). NOAEL and LOAEL HQs greater than 1 were calculated in 100 percent of the grid cells. All LOAEL HQs were between 1 and 5 for the most sensitive receptor (mourning dove [insectivore]). The results of the grid-cell analysis indicate that the average exposure to sub-populations of small home-range receptors requires further evaluation.

The uncertainty analysis discussed the uncertainty in the BAFs used in the exposure models and the potential for overestimation of invertebrate and small mammal tissue concentrations. It is, therefore, likely that risks are somewhat overestimated. In addition, di-n-butylphthalate is a common laboratory contaminant. Given that the highest LOAEL HQ calculated equaled 2, other lines of evidence indicate a possibility for overestimation of risk, and there is no known source, risks to the mourning dove (insectivore) receptor are likely low.

10.1.9 Total Polychlorinated Biphenyl

Total PCB HQs for the American kestrel and mourning dove (insectivore) are presented in Table 10.1. Figure 10.9 shows the spatial distribution of total PCB in relation to the lowest ESL and also presents the data used in the calculation of the Tier 2 EPCs.

HQs Calculated to Characterize Uncertainty

Uncertainties related to the default HQ calculations provided in Table 10.1 are discussed in detail in Attachment 5. Uncertainties related to BAFs, TRVs, and background risks are presented.

No LOAEL HQs greater than 1 were calculated for any non-PMJM receptor. Therefore, no alternative HQ calculations are provided.

However, care should be taken to review the chemical-specific uncertainties discussed in Attachment 5 when reviewing the results of all receptors regardless of whether alternative HQs are provided.

Total PCBs – Risk Description

Total PCBs were identified as an ECOPC for the mourning dove (insectivore) and American kestrel receptors.

Non-PMJM Receptors – Small Home-Range

Potential risks to receptors of concern were estimated using a range of EPCs. NOAEL HQs were greater than 1 for the mourning dove (insectivore) and American kestrel receptors (Table 10.1). All LOAEL HQs were less than 1 for both species. Because no effects-based TRVs resulted in HQs greater than 1, risks to non-PMJM receptors are likely to be low.

Table 10.2 presents a summary of HQs calculated using the arithmetic mean concentration used as cell-specific EPCs for surface soil samples within each of the Tier 2 30-acre grid cells. Default NOAEL and LOAEL TRVs were used in the HQ calculations. Total PCB samples were available from 21 grid cells (Figure 10.9). NOAEL HQs greater than 1 were calculated in 90 percent of the grid cells, while only 5 percent of the grids had LOAEL HQs greater than 1 for the most sensitive receptor (mourning dove [insectivore]). The results of the grid-cell analysis indicate that the average exposure to sub-populations of small home-range receptors results in low risk from exposure to total PCBs.

These lines of evidence along with the uncertainty analysis indicated that risks non-PMJM receptors is likely low.

10.2 Ecosystem Characterization

The IAEU has historically been the center of industrial processes at RFETS. As such, very little ecological habitat has historically been present in the IAEU.

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10.3 General Uncertainty Analysis

Quantitative evaluation of ecological risks is limited by uncertainties regarding the assumptions used to predict risk and the data available for quantifying risk. These limitations are usually addressed by making estimates based on the data available or by making assumptions based on professional judgment when data are limited. Because of these assumptions and estimates, the results of the risk calculations themselves are uncertain, and it is important for risk managers and the public to view the results of the risk assessment with this in mind. Chemical-specific uncertainties are presented in Attachment 5 of this document and were discussed in terms of their potential effects on the risk characterization in the risk description section for each ECOPC. A full discussion of categories of general uncertainty that are not specific to the IAEU is presented in Appendix A, Volume 2 of the RI/FS Report. The following sections are potential sources of general uncertainty that are specific to the IAEU ERA.

10.3.1 Uncertainties Associated with Data Adequacy and Quality

Sections 1.2 and 1.3 summarize the general data adequacy and data quality for the IAEU, respectively. A more detailed discussion is presented in Attachment 2 and Appendix A, Volume 2 of the RI/FS. The data adequacy assessment indicates that the data are adequate for the CRA. Data of sufficient quality for ERA purposes were collected in surface and subsurface soils.

10.3.2 Uncertainties Associated with the Lack of Toxicity Data for Ecological Contaminant of Interest Detected at the Industrial Area Exposure Unit

Several ECOIs detected in the IAEU do not have adequate toxicity data for the derivation of ESLs (CRA Methodology). These ECOIs are listed in Tables 7.1, 7.2, and 7.8 with a "UT" designation. Appendix B of the CRA Methodology outlines a detailed search process that was intended to provide high-quality toxicological information for a large proportion of the chemicals detected at RFETS. Although the toxicity is uncertain for those ECOIs that do not have ESLs calculated due to a lack of identified toxicity data, the overall effect on the risk assessment is small because the primary chemicals historically used at RFETS have adequate toxicity data for use in the CRA. Therefore, while the potential for risk from these ECOPCs is uncertain and will tend to underestimate the overall risk calculated, the magnitude of underestimation is likely to be low.

ESLs and/or TRVs were not available for several of the ECOPC/receptor pairs identified in Section 7. These include antimony (birds), molybdenum (invertebrates), tin (invertebrates), bis(2-ethylhexyl)phthalate (plants and invertebrates), di-n-butylphthalate (invertebrates), dioxin (total) (plants and invertebrates), and total PCB (invertebrates). The risks to these ECOPC/receptor pairs are uncertain. However, because risks to all of the ECOPCs mentioned above are considered to be low for those receptors where toxicity information is available, this source of uncertainty is not expected to be significant.

10.3.3 Uncertainties Associated with Eliminating Ecological Contaminants of Interest Based on Professional Judgment

Boron in surface soil was the only anlayte eliminated as an ECOI based on professional judgment. As discussed in Attachment 3, it is unlikely that boron is related to activities conducted at RFETS. There is little uncertainty associated with the professional judgment analysis.

10.4 Summary of Significant Sources of Uncertainty

The preceding discussion outlined the significant sources of uncertainty in the CRA process for assessing ecological risk. While some of the general sources of uncertainty discussed tend to underestimate risk, an equal or greater number of uncertainties discussed for each ECOPC and in RI/FS Appendix A, Volume 2 indicate that risk estimations may be somewhat biased toward the overestimation of risk to a generally unknown degree.

11.0 SUMMARY AND CONCLUSIONS

A summary of the results of this CRA for human health and ecological receptors in the IAEU is presented below.

11.1 Human Health

The COC screening analyses compared MDCs and UCLs of chemicals and radionuclides in IAEU media to PRGs for the WRW receptor. PCOCs with UCLs greater than the PRGs were statistically compared to the background concentration data set. Inorganic analytes that were statistically greater than background at the 0.1 significance level, and organics with UCL concentrations greater than the PRG were carried forward to professional judgment evaluation. Based on the COC selection process, arsenic and benzo(a)pyrene were retained as COCs for surface soil/surface sediment. No COCs were identified for subsurface soil/subsurface sediment. The estimated Tier 1 total excess lifetime cancer risk for potential exposure of the WRW to surface soil/surface sediment at the IAEU is 3E-06, and the Tier 2 risk is 3E-06. The estimated total Tier 1 cancer risk for potential exposure of the WRV to surface soil/surface sediment based on the Tier 1 EPC is 3E-06, and the Tier 2 risk is 3E-06. The estimated Tier 1 total noncancer hazard for potential exposure of the WRW to surface soil/surface sediment at the IAEU is 0.01, and the Tier 2 risk is 0.01. The estimated total Tier 1 noncancer hazard for potential exposure of the WRV to surface soil/surface sediment, based on the Tier 1 EPC, is 0.01, and the Tier 2 risk is 0.01.

Although selected as a COC for the HHRA, benzo(a)pyrene has not been directly associated with historical IHSSs, but could be associated with traffic, pavement degradation, or pavement operations within parts of the IAEU. In addition, polynuclear aromatic hydrocarbons (PAHs) are ubiquitous in the environment and typical concentrations in urban soil range from 165 to 220 μg/kg (ATSDR 1995). Therefore, under similar exposure conditions as those evaluated for the IAEU, background risks

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from benzo(a)pyrene in urban soils would be 30 to 40 percent of that estimated for the IAEU, or approximately 3E-07 to 4E-07.

The risk characterization for exposure of the WRW and WRV to surface soil/surface sediment indicated that the estimated cancer risks for both receptor populations were at the lower end or below the 10^{-6} to 10^{-4} risk range. In addition, the results of the risk characterizations indicate that the estimated HI is below one, which indicates that concentrations of arsenic in surface soil/surface sediment are protective of the WRW and WRV.

11.2 Ecological Risk

The overall conclusion of the ERA suggests that no significant risks to survival, growth, and reproduction are predicted for the ecological receptors evaluated in the IAEU (see Table 11.1). ECOPCs in surface soil were identified for non-PMJM only. ECOPCs for selected populations of non-PMJM receptors included antimony, chromium, copper, molybdenum, tin, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, total dioxins, and total PCBs. No ECOPCs were identified in subsurface soil. The ECOPC/receptor pairs were evaluated in the risk characterization using a range of EPCs, exposure scenarios, and TRVs to give a range of risk estimates. Overall, no significant risks to survival, growth, and reproduction are predicted for ecological receptors that may use the IAEU in the future.

12.0 REFERENCES

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TABLES

Table 1.1
IAEU IHSSs

IHSS Group	Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft^2)	Brief Description
000-2	IA	Original Process Waste Lines (OPWL)	000-121		Underground network pipes/tanks; multiple breaks and leaks
	IA	Valve Vault West of Building 707	700-123.2	2,476	Process waste migration along containment pipe and into ditch
	IA	Building 123 Process Waste Line Break	100-602	14,514	Line, valve vault, bedding material (conduit) between Buildings 123 and 443
	IA	Tank 29 – OPWL	000-121		Aboveground waste process tank; possible leaks
	IA	Tank 31 – OPWL	000-121		Below-grade, open-top sewage tank
	IA	Low-Level Radioactive Waste Leak	700-127	2,500	Multiple line breaks and leaks
	IA	Process Waste Line Leaks	700-147.1	16,427	Multiple line breaks and leaks; diverse release paths
	IA	Radioactive Site 700 Area	700-162	141,294	Residual hot spots along 8th Street
000-3	IA	Sanitary Sewer System	000-500		Routine and incidental waste discharges to sinks, sumps, lines
	IA	Storm Drains	000-505		
	IA	Old Outfall – Building 771	700-143	6,167	Contaminated waste water outfall area; one hot spot in nearby culvert
	IA	Central Avenue Ditch Caustic Leak	000-190	186,016	Caustic release to Central Ave. Ditch, Walnut Creek, and B-1
000-4	IA	New Process Waste Lines (NPWL)	000-504		
100-1	IA	UBC 122 – Medical Facility	UBC 122	9,768	Drum leaks and possible line leaks
	IA	Tank 1 – OPWL – Underground Stainless Steel Waste Storage Tank	000-121		Overflows and leaks from underground tank
100-2	IA	UBC 125 – Standards Laboratory	UBC 125	17,736	Possible spills from calibration lab (mercury)
100-3	IA	Building 111 Transformer polychlorinated biphenyl (PCB) Leak	100-607	356	Transformer leak
100-4	IA	UBC 123 – Health Physics Laboratory	UBC 123	18,885	Disposal out windows and waste line leaks
	IA	Waste Leaks	100-148	14,143	Unlocated waste spills, OPWL leaks
	IA	Building 123 Bioassay Waste Spill	100-603	356	OPWL leaks
	IA	Building 123 Scrubber Solution Spill	100-611	294	Process waste leak
100-5	IA	Building 121 Security Incinerator	100-609	599	Incinerator; accepted PCB-laden paper
300-1	IA	Oil Burn Pit #1	300-128	914	Burn and airborne contamination area
	IA	Lithium Metal Site	300-134(N)	7,126	Burn area
	IA	Solvent Burning Grounds	300-171	11,412	Burn area
300-2	IA	UBC 331 – Maintenance	UBC 331	4,986	Possible spills from maintenance activities
	IA	Lithium Metal Destruction Site	300-134(S)	23,728	Lithium burn areas (two)
300-3	IA	UBC 371 – Plutonium Recovery	UBC 371	114,147	Known spills of wastewater and process solutions
300-4	IA	UBC 374 – Waste Treatment Facility	UBC 374	27,131	Multiple spills and potential leaks from waste lines
300-5	IA	Inactive D-836 Hazardous Waste Tank	300-206	627	Condensate water spill from line to tank
300-6	IA	Pesticide Shed	300-702	4,380	Herbicide/pesticide spills/leaks in shed and surrounding area
400-1	IA	UBC 439 – Radiological Survey	UBC 439	5,107	Possible spills from machining operations
400-2	IA	UBC 440 – Modification Center	UBC 440	40,166	Possible spills from machining operations
400-3	IA	UBC 444 – Fabrication Facility	UBC 444	123,113	Overflows and leaks of process solutions
	IA	UBC 447 – Fabrication Facility	UBC 447	19,182	Possible spills and leaks from ongoing processes
	IA	West Loading Dock Building 447	400-116.1	2,009	Spills and leaks impacting soil and groundwater beneath dock
	IA	Cooling Tower Pond West of Building 444	400-136.1	7,654	Evaporation holding pond
	IA	Cooling Tower Pond East of Building 444	400-136.2	7,097	Cooling tower blowdown pond
	IA	Buildings 444/453 Drum Storage	400-182	3,465	Leaking drums and oil spills
	IA	Inactive Building 444 Acid Dumpster	400-207	1,288	Known spills to containment berm (possible leakage)
	IA	Inactive Buildings 444/447 Waste Storage Site	400-208	864	Possible leakage from drum storage
	IA	Transformer, Roof of Building 447	400-801	1,597	Transformer leakage via downspouts possibly to storm drain
	IA	Beryllium Fire – Building 444	400-810	15,073	Drainage, holding basin, and airborne contamination from fire
	IA	Tank 4 – OPWL Process Waste Pits	000-121		Potential leaks and overflows
	IA	Tank 5 – OPWL Process Waste Tanks	000-121		Potential leaks and overflows
	IA	Tank 6 – OPWL Process Waste Floor Sump and Foundation Drain Floor	000-121		Potential leaks and overflows
	IA	South Loading Dock Building 444	400-116.2	1,113	Windblown, drum leakage, dumping

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Table 1.1
IAEU IHSSs

IHSS Group	Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft²)	Brief Description
400-4	IA	Miscellaneous Dumping, Building 460 Storm Drain	400-803	18,932	Dumping to storm drain, extending along open ditch
	IA	Road North of Building 460	400-804	1,393	Hot spots covered w/asphalt from falling ingots
400-5	IA	Sump #3 Acid Site (Southeast of Building 460)	400-205	1,693	Leakage from container overflows in berm area
	IA	RCRA Tank Leak in Building 460	400-813	356	Pipe leakage beneath building
	IA	RCRA Tank Leak in Building 460	400-815	356	Possible leakage from spills to secondary containment
400-6	IA	Radioactive Site South Area	400-157.2	438,409	Dumping, surface runoff, air releases, open surface storage
400-7	IA	UBC 442 – Filter Test Facility	UBC 442	2,583	Leaking barrels, discharges
	IA	Radioactive Site North Area	400-157.1	51,169	Leaking drums, drainage to ditches
	IA	Building 443 Oil Leak	400-129	6,434	Leaks and spills from underground tanks (six)
	IA	Sulfuric Acid Spill Building 443	400-187	20,206	Multiple leaks and sprays from storage tank
400-8	IA	UBC 441 – Office Building	UBC 441		
	IA	Underground Concrete Tank	400-122		Overflows and leaking from tanks
	IA	Tank 2 – Concrete Waste Storage Tank	000-121		Potential leaks and overflows
	IA	Tank 3 – Concrete Waste and Steel Waste Storage Tanks	000-121		Potential leaks and overflows
400-10	IA	Sandblasting Area	400-807	9,583	Open air sandblasting
	IA	Fiberglass Area West of Building 664	600-120.2	5,449	Multiple spills around work area (resin and solvents)
	IA	Radioactive Site West of Building 664	600-161	53,346	Punctured and leaking drums, hydraulic leaks
500-1	IA	Valve Vaults 11, 12, 13	300-186	48,345	Leaks and discharges from transfer pipes and vaults
	IA	Scrap Metal Storage Site	500-197	89,320	Residual contamination from removal of process and building scrap
	IA	North Site Chemical Storage Site	500-117.1	115,489	Surface storage of contaminated material, uranium chips
500-2	IA	Radioactive Site Building 551	500-158	62,166	Wastebox leakage, exterior contaminated drums transferred
500-3	IA	UBC 559 – Service Analytical Laboratory	UBC 559	34,544	Plutonium waste line leaks and breaks
	IA	UBC 528 – Temporary Waste Holding Building	UBC 528	432	OPWL leaks/valve vault overflows
	IA	Radioactive Site Building 559	500-159	5,363	Broken process waste lines
	IA	Tank 7 – OPWL - Active Process Waste Pit	000-121		Potential leaks and overflows
	IA	Tank 33 – OPWL - Process Waste Tank	000-121		Potential leaks and overflows
	IA	Tank 34 – OPWL - Process Waste Tank	000-121		Potential leaks and overflows
	IA	Tank 35 – OPWL - Building 561 Concrete Floor Sump	000-121		Potential leaks and overflows
500-4	IA	Middle Site Chemical Storage	500-117.2	91,616	Minor leaks and spills, partial asphalt cover
500-5	IA	Transformer Leak - 558-1	500-904	356	PCB-oil leaks to concrete pad
500-6	IA	Asphalt Surface Near Building 559	500-906	356	1-gallon F001 spill from liquid hose transfer
500-7	IA	Tanker Truck Release of Hazardous Waste from Tank 231B	500-907	859	Liquid and solid sludge release to soil
600-1	IA	Temporary Waste Storage - Building 663	600-1001	42,803	Leaking, punctured, and spilled drums (concrete pad)
600-2	IA	Storage Shed South of Building 334	400-802	63,641	Leaking and spilled drums to concrete pad
600-3	IA	Fiberglass Area North of Building 664	600-120.1	4,650	Multiple spills around work area
600-4	IA	Radioactive Site Building 444 Parking Lot	600-160	143,752	Releases from drums and boxes stored on ground
600-5	IA	Central Avenue Ditch Cleaning	600-1004	14,885	Soil spreading from ditch to area around tanks
600-6	IA	Former Pesticide Storage Area	600-1005	356	Pesticide spills to dirt floor
700-1	IA	Identification of Diesel Fuel in Subsurface Soil	700-1115		Subsurface fuel leak
700-2	IA	UBC 707 – Plutonium Fabrication and Assembly	UBC 707	107,710	Process line leaks/breaks
	IA	UBC 731 – Building 707 Process Waste	UBC 731	4,000	Process spills/OPWL leaks and breaks
	IA	Tank 11 – OPWL - Building 731	000-121		Potential leaks and overflows
	IA	Tank 30 – OPWL - Building 731	000-121		Potential leaks and overflows

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Table 1.1
IAEU IHSSs

IHSS Group	Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft²)	Brief Description
700-3	IA	UBC 776 – Original Plutonium Foundry	UBC 776	142,889	Airborne/tracked contamination fires and explosions/liquid waste spills
	IA	UBC 777 – General Plutonium Research and Development	UBC 777		Process spills/OPWL leaks/fire contamination
	IA	UBC 778 – Plant Laundry Facility	UBC 778	26,609	Laundry water spills/OPWL leaks and breaks
	IA	UBC 701 – Waste Treatment Research and Development	UBC 701	5,645	Possible spills from Research and Development (R&D) laboratory
	IA	Solvent Spills West of Building 730	700-118.1	246	Carbon tetrachloride overflows and line leaks
	IA	Radioactive Site 700 Area No.1	700-131	7,072	Fire and explosion resulting in soil contamination
	IA	Radioactive Site West of Buildings 771/776	700-150.2(S)	27,113	Airborne and tracked contamination from fire, cleanup, and rain
	IA	Radioactive Site South of Building 776	700-150.7	18,589	Airborne and tracked contamination from fire, cleanup, and rain
	IA	French Drain North of Buildings 776/777	700-1100	1,567	Possible pathway for contamination from explosion and fire
	IA	Tank 9 – OPWL – Two 22,500-Gallon Concrete Laundry Tanks	000-121		Potential leaks and overflows
	IA	Tank 10 – OPWL – Two 4,500-Gallon Process Waste Tanks	000-121		Potential leaks and overflows
	IA	Tank 18 – OPWL – Concrete Laundry Waste Lift Sump	000-121		Potential leaks and overflows
	IA	Solvent Spills North of Building 707	700-118.2	633	Tank leaks and rupture
	IA	Sewer Line Overflow	700-144(N)	1,710	Pressurized sewer line breaks and overflows
	IA	Sewer Line Overflow	700-144(S)	2,330	Pressurized sewer line breaks and overflows
	IA	Transformer Leak South of Building 776	700-1116	356	Dielectric fluid leak to pad, gravel, and soil
	IA	Radioactive Site Northwest of Building 750	700-150.4	394	Leaks and backups of stored decontamination fluid
700-4	IA	UBC 771 – Plutonium and Americium Recovery Operations	UBC 771	97,553	Fire, sewer line breaks, process waste line leaks
	IA	UBC 774 – Liquid Process Waste Treatment	UBC 774	15,776	Tank overflows, drain breaks
	IA	Radioactive Site West of Buildings 771/776	700-150.2(N)	27,113	Fire, explosion, tank overflows
	IA	Radioactive Site 700 North of Building 774 (Area 3) Wash Area	700-163.1	18,613	Contaminated equipment wash area
	IA	Radioactive Site 700 Area 3 Americium Slab	700-163.2	2,270	Buried contaminated Americium slab 8'x8'x10"
	IA	Abandoned Sump Near Building 774 Unit 55.13 T-40	700-215	960	Mixed waste storage tank
	IA	Hydroxide Tank, KOH, NaOH Condensate	700-139(N)(b)	342	Overflows/spills from aboveground KOH/NaOH tanks
	IA	30,000-Gallon Tank (68)	700-124.1	1,133	Overflows/leaks from tank
	IA	14,000-Gallon Tank (66)	700-124.2		Overflows/leaks from tank
	IA	14,000-Gallon Tank (67)	700-124.3		Overflows/leaks from tank
	IA	Holding Tank	700-125		Tank overflows
	IA	Westernmost Out-of-Service Process Waste Tank	700-126.1	383	Below-grade leaks/overflows
	IA	Easternmost Out-of-Service Process Waste Tank	700-126.2	370	Below-grade leaks/overflows
	IA	Tank 8 – OPWL – East and West Process Tanks	000-121		Potential leaks and overflows
	IA	Tank 12 – OPWL – Two Abandoned 20,000-Gallon Underground Concrete Tanks	000-121		Potential leaks and overflows
	IA	Tank 13 – OPWL – Abandoned Sump - 600 Gallons	000-121		Potential leaks and overflows
	IA	Tank 14 – OPWL – 30,000-Gallon Concrete Underground Storage Tank (68)	000-121		Potential leaks and overflows
	IA	Tank 15 – OPWL – Two 7,500-Gallon Process Waste Tanks (34W, 34E)	000-121		Potential leaks and overflows
	IA	Tank 16 – OPWL – Two 30,000-Gallon Concrete Underground Storage Tanks (66, 67)	000-121		Potential leaks and overflows
	IA	Tank 17 – OPWL – Four Concrete Process Waste Tanks (30, 31, 32, 33)	000-121		Potential leaks and overflows
	IA	Tank 36 – OPWL – Steel Carbon Tetrachloride Sump	000-121		Potential leaks and overflows
	IA	Tank 37 – OPWL – Steel-Lined Concrete Sump	000-121		Potential leaks and overflows
	IA	Caustic/Acid Spills Hydrofluoric Tank	700-139.2	918	Spills and leaks infiltrating surrounding soil
	IA	Concrete Process 7,500-Gallon Waste Tank (31)	700-146.1	1,507	Frequent tank overflows and leakage
	IA	Concrete Process 7,500-Gallon Waste Tank (32)	700-146.2		Frequent tank overflows and leakage
	IA	Concrete Process 7,500-Gallon Waste Tank (34W)	700-146.3		Frequent tank overflows and leakage

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Table 1.1
IAEU IHSSs

IHSS Group	Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft^2)	Brief Description
	IA	Concrete Process 7,500-Gallon Waste Tank (34E)	700-146.4		Frequent tank overflows and leakage
	IA	Concrete Process 7,500-Gallon Waste Tank (30)	700-146.5		Frequent tank overflows and leakage
	IA	Concrete Process 7,500-Gallon Waste Tank (33)	700-146.6		Frequent tank overflows and leakage
	IA	Radioactive Site North of Building 771	700-150.1	24,779	Airborne, leaking drums, tracked contamination
	IA	Radioactive Site Between Buildings 771 and 774	700-150.3	5,037	Broken process waste line
700-5	IA	UBC 770 – Waste Storage Facility	UBC 770	3,111	Possible leakage from stored waste containers
700-6	IA	Buildings 712/713 Cooling Tower Blowdown	700-137	14,962	Ground placement of tower sludge/blowdown water leaks
	IA	Caustic/Acid Spills Hydroxide Tank Area	700-139.1(S)	923	Multiple spills and leaks
700-7	IA	UBC 779 – Main Plutonium Components Production Facility	UBC 779	43,360	Building over original Solar Pond/water spills and leaks
	IA	Building 779 Cooling Tower Blowdown	700-138	14,962	Underground cooling tower water line break
	IA	Radioactive Site South of Building 779	700-150.6	4,435	Tracked contamination
	IA	Radioactive Site Northeast of Building B779	700-150.8	13,054	Tracked contamination
	IA	Transformer Leak - 779-1/779-2	700-1105	712	PCB oil released from transformer
	IA	Tank 19 – OPWL - Two 1,000-Gallon Concrete Sumps	000-121		Potential leaks and overflows
	IA	Tank 20 – OPWL - Two 8,000-Gallon Concrete Sumps	000-121		Potential leaks and overflows
	IA	Tank 38 – OPWL - 1,000-Gallon Steel Tanks	000-121		Potential leaks and overflows
700-8	IA	750 Pad – Pondcrete/Saltcrete Storage	700-214	139,658	Pondcrete/saltcrete spills/pad runoff not contained
700-10	IA	Laundry Tank Overflow – Building 732	700-1101	1,856	Wastewater tank overflow
700-11	IA	Bowman's Pond	700-1108	4,741	Tanks/process line leaks/footing drain accumulation area
	IA	Hydroxide Tank, KOH, NaOH Condensate	700-139.1(N)(a)	2,520	Multiple spills and leaks
700-12	IA	Process Waste Spill – Portal 1	700-1106	356	Valve vault water spilled onto street
800-1	IA	UBC 865 – Materials Process Building	UBC 865	41,558	OPWL leaks/spills from coating ops and R&D activities
	IA	Building 866 Spills	800-1204	2,623	Vent pipe and tank overflows
	IA	Building 866 Sump Spill	800-1212	364	Leak from sump pump
	IA	Tank 23 – OPWL	000-121		Potential leaks and overflows
800-2	IA	UBC 881 – Laboratory and Office	UBC 881	79,222	Multiple leaks/broken waste lines
	IA	Building 881, East Dock	800-1205	2,426	Possible unknown contamination/condensate spill
	IA	Tank 24 – OPWL – Seven 2,700-Gallon Steel Process Waste Tanks	000-121		Potential leaks and overflows
	IA	Tank 32 – OPWL – 131,160-Gallon Underground Concrete Secondary Containment Sump	000-121		Potential leaks and overflows
	IA	Tank 39 – OPWL – Four 250-Gallon Steel Process Waste Tanks	000-121		Potential leaks and overflows
800-3	IA	UBC 883 - Roll and Form Building	UBC 883	49,325	Process waste water leaks and overflows
	IA	Valve Vault 2	800-1200	4,541	Transfer line leak
	IA	Tank 25 – OPWL – 750-Gallon Steel Tanks (18, 19)	000-121		Potential leaks and overflows
	IA	Tank 26 – OPWL – 750-Gallon Steel Tanks (24, 25, 26)	000-121		Potential leaks and overflows
	IA	Radioactive Site South of Building 883	800-1201	1,500	Multiple areas of contamination from Plant operations

Table 1.1
IAEU IHSSs

IHSS Group	Operable Unit	Description	IHSS/PAC/UBC Site	Area (ft^2)	Brief Description
800-4	IA	UBC 886 – Critical Mass Laboratory	UBC 886	13,517	Leaks and spills from criticality experiments
	IA	Tank 21 – OPWL – 250-Gallon Concrete Sump	000-121		Potential leaks and overflows
	IA	Tank 22 – OPWL – Two 250-Gallon Steel Tanks	000-121		Potential leaks and overflows
	IA	Tank 27 – OPWL – 500-Gallon Portable Steel Tank	000-121	31,400	Potential leaks and overflows
	IA	Radioactive Site #2 800 Area, Building 886 Spill	800-164.2	31,400	Tank leak
800-5	IA	UBC 887 – Process and Sanitary Waste Tanks	UBC 887	378	Leaks and breaks in process waste lines
	IA	Building 885 Drum Storage	800-177	1,064	Possible releases from waste storage
800-6	IA	UBC 889 – Decontamination and Waste Reduction	UBC 889	2,603	Radiological car wash area/OPWL leaks/waste tank breaches
	IA	Radioactive Site 800 Area Site #2 Building 889 Storage Pad	800-164.3	28,944	Leaks/spills/rainwater transport from storage area
	IA	Tank 28 – Two 1,000-Gallon Concrete Sumps	000-121		Potential leaks and overflows
	IA	Tank 40 – Two 400-Gallon Underground Concrete Tanks	000-121		Potential leaks and overflows
900-1	IA	UBC 991 – Weapons Assembly and R&D	UBC 991	59,849	Potential line leaks/valve vault breaches and overflows
	IA	Radioactive Site Building 991	900-173	5,970	Small spills and equipment wash area
	IA	Radioactive Site 991 Steam Cleaning Area	900-184	4,125	Equipment cleaning area
	IA	Building 991 Enclosed Area	900-1301	3,939	Possible leaks from waste containers/material storage

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Table 1.2
Number of Samples Collected in Each Medium by Analyte Suite

Analyte Suite	Surface Soil/Surface Sediment[a]	Subsurface Soil/Subsurface Sediment[a]	Surface Soil[b]	Subsurface Soil[b]
Inorganic	1,831	2,649	1,725	2,640
Organic	1,566	3,332	1,461	3,312
Radionuclide	1,286	1,013	1,156	1,004

[a] Used in the HHRA.

[b] Used in the ERA.

Note: The total number of results (samples) in Tables 1.3 through 1.7 may differ from the total number of samples presented in Table 1.2 because not all analyses are necessarily preformed for each sample.

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Table 1.3
Summary of Detected Analytes in Surface Soil/Surface Sediment

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)							
Aluminum	0.0014 - 200	1,757	99.9	763	61,000	10,432	6,796
Ammonia	0.3 - 0.3	8	100	1.11	2.82	2.00	0.718
Antimony	3.6E-04 - 60	1,690	19.8	0.270	29	1.11	2.04
Arsenic	2.2E-04 - 10	1,747	98.1	0.440	56.2	4.34	3.26
Barium	7.1E-04 - 200	1,759	99.8	0.640	1,500	76.7	56.2
Beryllium	2.9E-05 - 5	1,753	84.4	0.0710	26.8	0.597	0.798
Boron	0.0036 - 1.7	1,038	83.3	0.350	28	3.29	2.53
Cadmium	2.5E-05 - 5	1,751	36.0	0.0600	270	0.759	6.85
Calcium	0.031 - 5,000	1,757	99.9	270	210,000	8,773	14,664
Cesium	2 - 1,000	629	23.5	1.10	18.8	9.75	16.9
Chloride	25 - 25	27	70.4	13	394	87.3	102
Chromium	1.0E-04 - 10	1,759	99.3	1.20	210	16.0	15.2
Chromium (VI)	0.005 - 0.6	44	29.5	0.00500	0.850	0.0734	0.161
Cobalt	2.9E-04 - 50	1,757	97.7	1.10	137	6.23	6.09
Copper	3.6E-04 - 25	1,757	99.0	1.70	1,860	23.9	64.0
Cyanide	0.14 - 2.5	134	5.22	0.170	0.290	0.265	0.161
Fluoride	1 - 2.5	44	61.4	0.831	16.7	2.90	3.05
Iron	0.012 - 100	1,757	99.9	1,680	130,000	13,033	5,985
Lead	2.9E-05 - 4	1,748	100	2.30	590	19.5	30.1
Lithium	9.5E-04 - 100	1,779	96.3	0.990	50	8.39	4.18
Magnesium	0.016 - 5,000	1,768	99.9	180	30,000	2,602	1,872
Manganese	2.2E-04 - 15	1,752	99.9	15	1,750	199	122
Mercury	0 - 0.3	1,700	54.3	0.00140	48	0.0752	1.17
Molybdenum	9.9E-04 - 200	1,757	51.6	0.140	12.6	0.928	1.03
Nickel	3.4E-04 - 40	1,756	97.4	1.90	280	11.9	13.0
Nitrate / Nitrite	0.1 - 31.7	190	77.4	0.157	765	24.8	90.6
Nitrite	0.24 - 2.5	38	28.9	1.20	5.61	1.23	0.973
Potassium	0.029 - 5,000	1,757	99.7	270	8,310	1,765	746
Selenium	5.4E-04 - 5	1,747	6.81	0.300	2.70	0.368	0.184
Silica	0.0063 - 7	998	100	59.3	1,880	634	218
Silicon	0 - 100	109	99.1	79.2	11,300	1,658	2,131
Silver	9.4E-06 - 10	1,753	28.6	0.0580	364	1.05	9.36
Sodium	0.033 - 5,000	1,757	58.2	24.6	6,600	322	520
Strontium	7.2E-04 - 200	1,757	99.9	2.40	526	30.5	32.2
Sulfate	25 - 25	27	37.0	3.81	95.9	17.4	19.5
Thallium	1.6E-04 - 10	1,739	12.2	0.100	5.80	0.457	0.396
Tin	7.8E-04 - 200	1,757	7.80	0.750	161	2.25	6.30
Titanium	2.2E-04 - 0.25	1,038	100	28	1,730	268	180
Uranium	6.3E-04 - 16.8	1,052	9.51	0.430	370	1.80	13.8
Vanadium	6.3E-04 - 50	1,757	99.5	2.30	184	27.0	13.2
Zinc	5.6E-04 - 20	1,757	99.7	4.20	11,900	93.3	317
Organics (µg/kg)							
1,1,1-Trichloroethane	0.12 - 590	659	1.52	1.10	47.7	2.52	13.7
1,1,2,2-Tetrachloroethane	0.089 - 590	659	0.152	2	2	2.35	13.5
1,1,2-Trichloro-1,2,2-trifluoroethane	0.12 - 590	492	0.203	1.83	1.83	1.26	3.31
1,1-Dichloroethene	0.31 - 590	659	0.303	2	7.90	2.51	13.5
1,2,3-Trichlorobenzene	0.22 - 590	492	1.02	0.960	2	1.06	3.04
1,2,4-Trichlorobenzene	0.17 - 2,700	1,284	0.389	0.870	150	157	213
1,2,4-Trimethylbenzene	0.12 - 590	492	8.94	0.680	1,300	5.61	67.7
1,2-Dichloroethene	5 - 28	152	0.658	16	16	6.92	27.3
1,2-Dichloropropane	0.1 - 590	659	0.303	18	140	2.54	14.5
1,3,5-Trimethylbenzene	0.13 - 590	492	6.91	0.610	490	2.80	26.1
1,4-Dichlorobenzene	0.15 - 78,000	1,058	0.0945	110	110	106	148
1,2,3,4,6,7,8-HpCDF	0 - 0.00108	12	100	7.20E-04	0.0200	0.00662	0.00579
1,2,3,4,7,8,9-HpCDF	0 - 0.00108	12	41.7	3.40E-04	0.00350	6.86E-04	0.00102
1,2,3,4,7,8-HxCDD	0 - 0.00108	12	58.3	2.20E-04	0.00170	4.66E-04	5.32E-04
1,2,3,4,7,8-HxCDF	0 - 0.00108	12	83.3	4.50E-04	0.0168	0.00305	0.00561
1,2,3,6,7,8-HxCDD	0 - 0.00108	12	91.7	3.90E-04	0.00510	0.00155	0.00159
1,2,3,6,7,8-HxCDF	0 - 0.00108	12	91.7	1.70E-04	0.00627	0.00137	0.00201
1,2,3,7,8,9-HxCDD	0 - 0.00108	12	75	4.50E-04	0.00360	0.00108	0.00109
1,2,3,7,8,9-HxCDF	0 - 0.00108	12	25	1.60E-04	2.91E-04	1.22E-04	7.06E-05
1,2,3,7,8-PeCDF	0 - 0.00108	12	50	7.90E-04	0.0111	0.00175	0.00320
2,4,5-T	1 - 100	10	10	1.80	1.80	19.7	17.4
2,4,5-Trichlorophenol	27 - 6,800	984	0.102	1,100	1,100	524	637
2,4,6-Trichlorophenol	39 - 2,700	984	0.102	950	950	275	232
2,4,6-Trinitrotoluene	0.22 - 30	8	12.5	56	56	69.5	62.0
2,4-Dimethylphenol	36 - 2,700	984	0.305	47	88	273	231
2,3,4,6,7,8-HxCDF	0 - 0.00108	12	75	3.10E-04	0.00259	6.61E-04	7.82E-04
2,3,4,7,8-PeCDF	0 - 0.00108	12	75	3.00E-04	0.0179	0.00246	0.00520
2,3,7,8-TCDD	0 - 4.32E-04	12	66.7	0.00160	0.00680	0.00264	0.00253
2,3,7,8-TCDF	0 - 4.32E-04	12	83.3	7.60E-04	0.0496	0.00788	0.0140
2-Butanone	1.7 - 12,000	657	2.44	3	155	10.9	36.7
2-Hexanone	0.61 - 5,900	651	0.768	14.7	20	7.28	30.3
2-Methylnaphthalene	31 - 2,700	986	8.62	34	2,600	265	234
2-Methylphenol	40 - 2,700	984	0.102	200	200	274	231
4,4'-DDD	0.3 - 190	264	0.758	3.50	10	8.47	10.8
4,4'-DDE	0.34 - 190	264	1.52	0.600	7.20	8.55	10.9

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Table 1.3
Summary of Detected Analytes in Surface Soil/Surface Sediment

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
4,4'-DDT	0.35 - 190	264	1.14	4.10	18	8.39	9.68
4-Chloro-3-methylphenol	33 - 2,700	984	0.102	60	60	421	458
4-Isopropyltoluene	0.26 - 590	492	3.05	1	100	1.45	5.90
4-Methyl-2-pentanone	0.78 - 5,900	656	2.13	8.37	73	10.3	64.3
4-Methylphenol	54 - 2,700	984	0.610	47	270	273	231
4-Nitroaniline	60 - 6,800	986	0.406	62	820	1,299	1,158
4-Nitrophenol	95 - 6,800	984	0.203	53	320	1,298	1,158
Acenaphthene	30 - 2,700	987	25.4	21	11,000	234	427
Acenaphthylene	27 - 2,700	987	0.304	110	200	197	145
Acetone	1.5 - 12,000	659	18.4	1.70	1,280	24.2	90.2
Aldrin[b]	0.41 - 95	263	1.14	0.590	2.50	4.54	5.52
alpha-BHC	0.39 - 95	264	0.379	7.90	7.90	4.51	5.51
Anthracene	23 - 2,700	987	29.8	19	7,300	247	376
Aroclor-1016	1.9 - 4,500	518	1.16	13	95	57.4	171
Aroclor-1242	2.9 - 4,500	558	0.358	23	350	59.0	166
Aroclor-1248	3.6 - 4,500	558	0.896	17	66	58.6	166
Aroclor-1254	4.4 - 9,000	555	20.2	6.90	8,900	207	730
Aroclor-1260	1.4 - 9,000	549	20.4	6.50	7,800	197	707
Benzene	0.1 - 590	659	0.455	1	11	2.27	13.4
Benzo(a)anthracene	24 - 2,700	987	55.5	25	8,900	374	552
Benzo(a)pyrene	39 - 2,700	986	46.9	23	3,200	383	471
Benzo(b)fluoranthene	28 - 2,700	986	47.9	25	8,800	423	654
Benzo(g,h,i)perylene	26 - 2,700	986	35.5	15	3,200	316	348
Benzo(k)fluoranthene	31 - 2,700	979	41.2	23	4,200	342	407
Benzoic Acid	280 - 5,200	909	4.51	39	1,400	1,324	1,202
Benzyl Alcohol	77 - 2,100	887	0.789	140	2,800	441	471
beta-BHC[b]	0.36 - 95	264	0.379	28	28	4.61	5.70
beta-Chlordane[b]	1.8 - 950	218	0.459	2.60	2.60	39.2	45.4
bis(2-ethylhexyl)phthalate	69 - 2,700	987	31.8	1	75,000	452	2,528
Bromochloromethane	0.1 - 590	492	0.203	7	7	1.07	2.95
Bromomethane	0.52 - 590	655	0.916	2	5	2.81	5.87
Butylbenzylphthalate	34 - 2,700	986	11.2	21	7,100	299	361
Carbazole	340 - 2,700	76	46.1	25	700	204	121
Carbon Disulfide	0.15 - 590	659	0.152	4	4	2.89	14.0
Carbon Tetrachloride	0.18 - 590	659	3.19	0.340	103	2.86	15.1
Chlorobenzene	0.078 - 590	659	0.152	2	2	2.39	13.6
Chloroform	0.089 - 590	659	1.82	1	7	2.29	13.5
Chloromethane[b]	0.35 - 590	658	0.456	1.50	1.70	3.73	27.9
Chrysene	27 - 2,700	987	58.0	22	7,700	395	568
cis-1,2-Dichloroethene	0.21 - 590	492	1.83	1.10	15	1.90	13.4
Dibenz(a,h)anthracene	24 - 2,700	985	17.1	21	930	260	235
Dibenzofuran	35 - 2,700	987	12.7	20	4,600	269	279
Dicamba	1.9 - 100	10	50	2.30	150	40.3	42.3
Dichloroprop	2.3 - 650	10	10	10	10	68.4	90.8
Dieldrin	0.39 - 190	264	3.03	1.80	92	9.35	12.9
Diesel Range Organics	960 - 48,000	13	84.6	4,900	8.80E+06	1.80E+06	3.33E+06
Diethylphthalate	30 - 2,700	984	0.711	33	420	316	226
Dimethylphthalate	39 - 2,700	987	2.23	69	490	271	231
Di-n-butylphthalate	20 - 2,700	987	10.6	28	10,000	272	390
Di-n-octylphthalate	36 - 2,700	986	5.78	21	11,000	318	652
Endosulfan I	0.4 - 95	264	0.758	3.90	7.40	4.52	5.51
Endosulfan II	0.4 - 180	263	1.14	0.700	9.90	8.17	9.43
Endosulfan sulfate	0.3 - 190	264	0.758	5.50	11	8.49	10.8
Endrin	0.4 - 190	264	1.14	2.40	17	8.81	11.2
Endrin aldehyde	0.51 - 38	99	2.02	8.70	9.20	3.42	3.35
Ethylbenzene	0.1 - 590	659	7.28	0.709	173	3.17	15.7
Fluoranthene	22 - 2,700	988	61.6	33	20,000	728	1,373
Fluorene	33 - 2,700	987	21.6	21	4,900	277	326
gamma-BHC (Lindane)	0.44 - 95	264	0.379	8.30	8.30	4.52	5.51
Gasoline	100 - 100	32	6.25	720	2,000	355	321
Heptachlor epoxide	0.38 - 95	264	0.758	7.20	33	6.12	8.81
Heptachlorodibenzo-p-dioxin	0 - 0.00108	12	100	0.00280	0.0950	0.0278	0.0272
Hexachlorobenzene	35 - 2,700	987	0.405	110	380	273	230
Hexachlorobutadiene	0.32 - 2,700	1,284	0.156	2	2.20	157	213
HMX	60 - 60	5	20	230	230	146	47.0
Indeno(1,2,3-cd)pyrene	22 - 2,700	986	40.0	23	2,500	308	333
Isophorone	33 - 2,700	987	0.507	240	850	274	231
Isopropylbenzene	0.11 - 590	492	2.03	0.540	27	1.09	2.89
MCPA	210 - 100,000	10	10	1,100	1,100	12,800	18,855
Methoxychlor	0.18 - 950	264	1.52	0.280	12	40.7	54.7
Methylene Chloride	0.35 - 590	659	12.4	0.790	56	4.36	43.1
Naphthalene	0.39 - 2,700	1,284	16.6	0.850	7,100	167	312
n-Butylbenzene	0.17 - 590	492	1.42	3.70	350	2.01	16.8
n-Propylbenzene	0.25 - 590	492	2.44	1.72	190	1.39	8.87
OCDD	0 - 0.00216	12	91.7	0.0180	0.630	0.190	0.182
OCDF	0 - 0.00216	12	100	0.00200	0.0360	0.0105	0.00940
Pentachlorodibenzo-p-dioxin	0 - 0.00108	12	66.7	3.60E-04	8.20E-04	4.82E-04	2.61E-04
Pentachlorophenol	64 - 6,800	984	1.52	39	39,000	1,310	1,595

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Table 1.3
Summary of Detected Analytes in Surface Soil/Surface Sediment

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[a]	Standard Deviation[a]
Phenanthrene	34 - 2,700	988	60.3	22	22,000	615	1,298
Phenol	34 - 2,700	984	0.407	22	130	273	231
Pyrene	40 - 2,700	988	59.1	20	14,000	699	1,301
sec-Butylbenzene	0.16 - 590	492	1.02	2	42.6	1.07	3.19
Styrene	0.078 - 590	659	0.152	7.80	7.80	2.31	13.4
tert-Butylbenzene	0.21 - 590	492	0.203	1.60	1.60	0.968	2.53
Tetrachloroethene	0.19 - 590	659	6.68	0.790	29,000	48.0	1,130
Toluene	0.089 - 590	659	8.65	0.0990	990	7.82	58.8
Total Petroleum Hydrocarbons	0.25-77.59	21.0	95.2	0.50	2,400	316	557
Trichloroethene	0.15 - 590	659	3.79	0.170	200	2.73	15.6
Trichlorofluoromethane	0.23 - 590	492	7.93	0.660	31.9	1.37	3.45
Xylene[c]	0.033 - 1,200	659	10.3	0.600	933	8.83	49.7
Radionuclides (pCi/g)[d]							
Americium-241	0 - 0.6	1,059	N/A	-0.0480	51.2	0.503	2.43
Cesium-134	0.0166 - 0.3	124	N/A	-0.239	0.200	0.0436	0.0811
Cesium-137	0 - 0.75	142	N/A	-0.0366	0.959	0.140	0.167
Curium-242	0.0178	1	N/A	0	0	0	N/A
Curium-244	0.0362	1	N/A	-0.00290	-0.00290	-0.00290	N/A
Curium-245/246	0.02	1	N/A	0.126	0.126	0.126	N/A
Gross Alpha	0.8 - 56	798	N/A	2.69	160	19.5	10.1
Gross Beta	1 - 21	832	N/A	-1.30	125	32.6	10.1
Neptunium-237	0.00202 - 0.00634	11	N/A	7.79E-04	0.0187	0.0101	0.00719
Plutonium-238	0.00258 - 0.091	54	N/A	-0.0190	1.17	0.0585	0.184
Plutonium-239/240	0 - 0.373	1,257	N/A	-0.0459	183	1.19	6.49
Radium-226	0 - 1.1	118	N/A	-9.84	2.08	0.566	1.33
Radium-228	0 - 2.9	99	N/A	0.490	3.15	1.64	0.564
Strontium-89/90	0.0170 - 1.18	131	N/A	-0.160	1.50	0.177	0.273
Uranium-233/234	0 - 2.39	1,092	N/A	0.0817	34.5	1.23	1.45
Uranium-235	0 - 2.55	1,092	N/A	-0.138	1.69	0.0709	0.0943
Uranium-238	0 - 1.9	1,092	N/A	0.182	59	1.48	3.14

[a] For inorganics and organics, statistics are computed using one-half the reported value for nondetects.

[b] All detections are "J" qualified, signifying that the reported result is below the detection limit, but above the instrument detection limit.

[c] The value for total xylene is used.

[d] All radionuclide values are considered detects.

N/A = Not applicable.

Table 1.4
Summary of Detected Analytes in Subsurface Soil/Subsurface Sediment

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[a]	Standard Deviation[a]
Inorganics (mg/kg)							
Aluminum	0.0014 - 200	2,484	100	870	110,000	16,286	10,332
Antimony	3.6E-04 - 60	2,389	21.6	0.180	19.3	0.855	2.07
Arsenic	2.2E-04 - 10	2,484	98.9	0.480	69.7	5.83	4.35
Barium	7.1E-04 - 200	2,484	100.0	8.60	1,150	84.8	67.0
Beryllium	2.9E-05 - 5	2,464	85.1	0.0520	15	0.876	0.751
Boron	0.0036 - 9.7	2,004	76.2	0.420	33	3.13	2.55
Cadmium	2.5E-05 - 5	2,477	32.1	0.0400	547	1.33	17.8
Calcium	0.031 - 5,000	2,484	100	180	412,000	14,438	32,742
Cesium[b]	9.1 - 1,000	276	6.52	0.950	10.9	25.7	25.2
Chloride	0.284 - 0.327	41	90.2	0.0800	184	31.7	51.4
Chromium	1.0E-04 - 10	2,484	99.8	1.20	11,000	22.7	221
Chromium (VI)[b]	0.52	1	100	0.590	0.590	0.590	N/A
Cobalt	2.9E-04 - 50	2,484	98.6	0.470	120	6.30	5.51
Copper	3.6E-04 - 25	2,484	99.5	0.700	1,190	17.0	44.7
Cyanide	0.15 - 0.61	135	16.3	0.180	43	1.03	4.77
Fluoride	0.159 - 0.183	41	100	0.150	17.6	4.12	4.59
Iron	0.012 - 100	2,484	100	1,060	290,000	14,588	8,376
Lead	2.9E-05 - 3	2,489	99.9	0.990	1,500	13.5	40.8
Lithium	9.5E-04 - 100	2,465	96.7	0.400	79.9	10.9	6.68
Magnesium	0.016 - 5,000	2,484	100	160	17,000	2,583	1,411
Manganese	2.2E-04 - 15	2,484	99.9	8.80	3,140	177	177
Mercury	0 - 0.67	2,420	78.5	0.00190	16	0.0820	0.407
Molybdenum	9.9E-04 - 200	2,481	61.2	0.140	4,100	2.61	82.4
Nickel	3.4E-04 - 40	2,484	99.4	0.720	670	15.4	19.4
Nitrate / Nitrite	0.001 - 478	255	83.5	0	6,100	203	709
Nitrite[b]	0.103 - 0.34	14	35.7	0.111	2.49	2.14	1.04
Potassium	0.029 - 5,000	2,484	99.6	139	21,100	1,707	1,057
Selenium	5.4E-04 - 7.7	2,484	10.7	0.0600	4.30	0.415	0.268
Silica	0.0063 - 22	1,920	100	104	5,110	662	283
Silicon	0 - 200	104	100	72	14,000	2,320	2,534
Silver	9.4E-06 - 10	2,478	24.1	0.0620	110	0.429	3.72
Sodium	0.033 - 5,000	2,484	41.8	40.9	11,000	306	686
Strontium	7.2E-04 - 400	2,483	99.8	2.30	487	37.4	43.6
Sulfate	0.705 - 0.81	19	100	11.6	180	57.1	39.4
Sulfide	4.63 - 200	86	12.8	6.54	18.6	16.6	28.8
Tantalum[b]	66.5 - 66.5	2	50	15.7	15.7	11.9	5.44
Thallium	1.6E-04 - 10	2,478	14.1	0.100	9.30	0.536	0.489
Tin	7.8E-04 - 200	2,462	9.95	0.470	392	2.33	9.94
Titanium	2.2E-04 - 0.5	2,011	100	14	1,420	189	124
Uranium	6.3E-04 - 31	2,060	10.9	0.540	1,600	2.73	37.5
Vanadium	6.3E-04 - 50	2,484	100.0	3	740	33.2	21.9
Zinc	5.6E-04 - 43	2,481	99.6	2.20	1,800	39.9	71.2
Organics (µg/kg)							
1,1,1-Trichloroethane	0.11 - 27,900	3,033	2.27	0.200	2,100	8.33	96.1
1,1,2,2-Tetrachloroethane	0.086 - 27,900	3,027	0.0991	3	1,000	8.49	90.7
1,1,2-Trichloro-1,2,2-trifluoroethane	0.12 - 27,900	2,657	0.226	1	390	5.28	91.3
1,1,2-Trichloroethane	0.2 - 27,900	3,034	0.0659	0.840	3.20	7.15	83.8
1,1-Dichloroethane	0.11 - 27,900	3,034	0.330	0.180	239	7.28	84.1
1,1-Dichloroethene	0.3 - 27,900	3,034	0.824	0.470	23.8	7.62	86.8
1,2,3-Trichlorobenzene	0.22 - 27,900	2,646	1.74	0.490	530	4.20	57.3
1,2,3-Trichloropropane[b]	0.29 - 27,900	2,654	0.0377	4	4	4.33	70.6
1,2,3-Trimethylbenzene	N/R	1	100	700	700	700	N/A
1,2,4-Trichlorobenzene	0.17 - 27,900	2,868	1.36	0.450	2,000	23.9	96.7
1,2,4-Trimethylbenzene	0.12 - 27,900	2,647	4.80	0.150	72,300	35.6	1,420
1,2-Dibromo-3-chloropropane[b]	0.26 - 27,900	2,654	0.0377	3	3	5.67	87.3
1,2-Dichlorobenzene	0.097 - 70,000	2,860	0.175	0.110	270	20.9	78.4
1,2-Dichloroethane	0.13 - 27,900	3,018	0.663	0.440	35	7.21	84.4
1,2-Dichloroethene	5 - 1,200	349	0.860	3	1,200	11.7	73.5
1,2-Dichloropropane	0.097 - 27,900	3,034	0.198	1	13	7.11	83.8
1,3,5-Trimethylbenzene	0.13 - 27,900	2,647	2.49	0.380	20,600	13.2	412
1,3-Dichlorobenzene	0.14 - 27,900	2,885	0.104	2.10	70	24.4	86.1
1,4-Dichlorobenzene	0.14 - 70,000	2,860	0.210	0.240	170	21.6	88.9
1,2,3,4,6,7,8-HpCDF	0 - 0.0011	17	76.5	1.20E-04	0.0240	0.00278	0.00608
1,2,3,4,7,8,9-HpCDF	0 - 0.0011	17	29.4	1.40E-04	0.00140	3.34E-04	3.68E-04
1,2,3,4,7,8-HxCDD	0 - 0.0011	17	11.8	1.00E-04	2.20E-04	1.71E-04	1.53E-04
1,2,3,4,7,8-HxCDF	0 - 0.0011	17	52.9	7.00E-05	0.00310	5.22E-04	9.74E-04
1,2,3,6,7,8-HxCDD	0 - 0.0011	17	29.4	1.40E-04	0.00380	4.86E-04	9.23E-04
1,2,3,6,7,8-HxCDF	0 - 0.0011	17	23.5	1.10E-04	0.00130	2.46E-04	3.69E-04
1,2,3,7,8,9-HxCDD	0 - 0.0011	17	35.3	1.10E-04	0.00120	2.87E-04	3.11E-04

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Table 1.4
Summary of Detected Analytes in Subsurface Soil/Subsurface Sediment

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[a]	Standard Deviation[a]
1,2,3,7,8,9-HxCDF[b]	0 - 0.0011	17	5.88	2.50E-04	2.50E-04	1.51E-04	1.59E-04
1,2,3,7,8-PeCDF	0 - 0.0011	17	17.6	3.50E-04	0.00327	3.30E-04	7.78E-04
1-Iodooctane	N/R	1	100	2,000	2,000	2,000	N/A
2,3-Dimethyl-1-butene	N/R	1	100	1,000	1,000	1,000	N/A
2,3-Dimethylhexane	N/R	1	100	900	900	900	N/A
2,3-Epoxy-2,3-dimethylbutane	N/R	2	100	1,000	4,000	2,500	2,121
2,4-Dimethylphenol	10 - 2,000	886	0.226	81	89	308	114
2,4-Dinitrophenol	51 - 8,740	886	0.113	470	470	1,480	594
2,4-Dinitrotoluene	10 - 3,500	891	0.112	43	43	310	124
2,6-Dimethylundecane	N/R	1	100	1,000	1,000	1,000	N/A
2,7,10-Trimethyldodecane	N/R	2	100	600	1,000	800	283
2,3,4,6,7,8-HxCDF[b]	0 - 0.0011	17	35.3	1.30E-04	5.90E-04	2.04E-04	1.84E-04
2,3,4,7,8-PeCDF	0 - 0.0011	17	29.4	1.50E-04	0.00247	3.36E-04	6.54E-04
2,3,7,8-TCDD	0 - 4.39E-04	17	5.88	5.90E-04	5.90E-04	1.62E-04	1.24E-04
2,3,7,8-TCDF	0 - 4.39E-04	17	29.4	1.50E-04	0.0102	9.60E-04	0.00252
2-Bromooctane	N/R	1	100	2,000	2,000	2,000	N/A
2-Butanone	1.6 - 558,000	2,923	5.88	1	500	60.9	1,309
2-Chlorophenol	10 - 20,00	886	0.339	8.50	77	308	115
2-Chlorotoluene	0.14 - 27,900	2,646	0.0756	11	80	3.93	53.3
2-Hexanone	0.59 - 279,000	3,009	0.665	2	1,760	33.1	500
2-Methylnaphthalene	10 - 2,000	889	7.42	35	1,400	300	140
2-Methylphenol	10 - 2,000	887	0.113	93	93	309	114
3,3'-Dichlorobenzidine[b]	20 - 3,440	889	0.112	160	160	676	198
4,4'-DDD	0.3 - 21	160	1.25	4.20	7.60	6.78	6.51
4,4'-DDE	0.32 - 21	160	2.50	0.460	4.80	6.88	6.60
4,4'-DDT	0.34 - 21	160	1.88	0.790	19	6.88	6.58
4-Chloro-3-methylphenol[b]	10 - 3,440	886	0.113	54	54	513	290
4-Chlorotoluene	0.16 - 27,900	2,646	0.0756	6.20	90	4.34	72.9
4-Hydroxy-4-methyl-2-pentanone	N/R	7	100	10,000	100,000	77,143	36,839
4-Isopropyltoluene	0.26 - 27,900	2,644	1.59	0.470	3,000	5.26	82.5
4-Methyl-2-pentanone	0.76 - 279,000	3,022	0.993	1	850	31.7	475
4-Methylphenol	10 - 2,000	870	0.460	95	460	307	113
4-Nitroaniline	51 - 8,740	872	0.115	230	230	1,477	605
Acenaphthene	10 - 2,000	891	16.2	25	7,900	247	408
Acenaphthylene	10 - 2,000	889	0.225	85	94	209	77.3
Acetone	1.4 - 558,000	2,981	26.5	1	17,000	102	2,043
Aldrin	0.41 - 11	160	0.625	4.40	4.40	3.87	3.37
alpha-BHC	0.39 - 11	160	1.25	3	6.80	3.78	3.31
Anthracene	10 - 2,000	891	18.1	30	13,000	274	653
Aroclor-1016	1.9 - 3,100	674	0.890	2.60	150	74.4	276
Aroclor-1248	3.6 - 3,000	674	2.37	44	5,900	116	470
Aroclor-1254	4.3 - 2,100	674	20.8	4.90	12,000	310	1,276
Aroclor-1260	1.4 - 570	674	15.7	6.60	15,000	250	1,200
Benzene	0.097 - 27,900	3,035	0.659	0.610	240	7.17	83.8
Benzo(a)anthracene	10 - 2,000	888	27.7	21	33,000	439	1,456
Benzo(a)pyrene	10 - 2,000	887	21.9	5.70	35,000	447	1,474
Benzo(b)fluoranthene	10 - 2,000	888	21.7	8.10	29,000	428	1,324
Benzo(g,h,i)perylene	10 - 2,000	888	17.3	13.2	22,000	387	961
Benzo(k)fluoranthene	10 - 2,000	888	19.8	11.9	29,000	404	1,210
Benzoic Acid	51 - 8,740	843	2.97	85	930	1,490	609
Benzyl Alcohol	10 - 3,440	838	0.239	260	1,600	526	291
bis(2-ethylhexyl)phthalate	10 - 2,000	888	14.9	16.8	48,000	346	1,609
bis(2-hydroxyethyl)lauramide	N/R	8	100	1,000	8,000	5,125	2,031
Bromochloromethane	0.097 - 27,900	2,658	0.0376	7	7	3.73	51.3
Bromoform[b]	0.097 - 27,900	3,033	0.0330	1	1	7.35	85.6
Bromomethane	0.33 - 27,900	2,991	0.0334	7,450	7,450	12.9	169
Butylbenzylphthalate	10 - 2,000	888	3.04	16.5	6,000	314	230
Carbazole	330 - 810	42	9.52	20	1,300	262	185
Carbon Disulfide	0.14 - 27,900	3,033	0.528	1	290	8.56	94.6
Carbon Tetrachloride	0.17 - 27,900	3,033	1.48	0.310	370	7.84	91.3
Chlorobenzene	0.076 - 27,900	3,026	0.0330	3	3	7.18	84.0
Chloroethane	0.23 - 27,900	2,993	0.100	3.79	48.2	11.9	112
Chloroform	0.086 - 27,900	3,034	1.52	0.0950	670	7.57	86.4
Chloromethane	0.22 - 27,900	3,032	0.0660	1.80	86	10.7	105
Chrysene	10 - 2,000	889	29.1	24	36,000	460	1,598
cis-1,2-Dichloroethene	0.11 - 27,900	2,649	1.40	0.910	181	5.58	51.8
Decane	N/R	1	100	2,000	2,000	2,000	N/A
delta-BHC	0.11 - 11	160	0.625	42	42	4.04	4.49
Dibenz(a,h)anthracene	10 - 2,000	888	8.56	13.6	10,000	324	398
Dibenzofuran	10 - 2,000	885	7.68	15	3,300	310	200

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Table 1.4
Summary of Detected Analytes in Subsurface Soil/Subsurface Sediment

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[a]	Standard Deviation
Dichlorodifluoromethane	0.21 - 27,900	2,600	0.231	2	26	6.25	113
Dieldrin	0.32 - 21	160	2.50	1.40	6.70	6.82	6.50
Diesel Range Organics	1,700 - 4.9E07	25	80	910	560,000	26,546	111,234
Diethylphthalate	10 - 2,000	888	1.13	20	330	351	94.7
Dimethylphthalate	10 - 2,000	888	0.225	89	460	309	114
Di-n-butylphthalate	10 - 2,000	888	5.86	19	3,600	302	163
Di-n-octylphthalate	10 - 2,000	888	0.563	20.9	6,000	315	223
Dodecane	N/R	5	100	300	2,000	1,260	733
Endosulfan I	0.33 - 11	160	0.625	3.60	3.60	3.75	3.31
Endosulfan II	0.35 - 21	159	1.89	0.910	12	7.26	7.99
Endosulfan sulfate	0.3 - 21	160	1.25	0.870	5.30	6.76	6.52
Endrin	0.39 - 21	160	2.50	2.80	12	6.94	6.61
Endrin aldehyde	0.43 - 21	94	3.19	5.40	21	2.35	2.97
Endrin ketone[b]	0.36 - 38	92	1.09	62	62	11.0	8.32
ethyl acetate	N/R	1	100	1,000	1,000	1,000	N/A
Ethylbenzene	0.097 - 27,900	3,033	3.40	0.180	15,500	12.8	294
Fluoranthene	10 - 2,000	889	33.1	5.80	66,000	752	3,409
Fluorene	10 - 2,000	890	11.7	21	6,300	328	369
gamma-BHC (Lindane)[b]	0.43 - 11	160	0.625	10	10	3.84	3.36
Gasoline	500	1	100	4,800	4,800	4,800	N/A
Gasoline Range Organics	108,000 - 610,000	22	13.6	40,700	1.33E+06	115,509	271,314
Heptachlor epoxide	0.33 - 11	160	1.25	4.20	14	5.93	6.75
Heptachlorodibenzo-p-dioxin	0 - 0.0011	17	82.4	2.20E-04	0.0290	0.00631	0.00864
Hexachlorobenzene	10 - 2,000	889	0.337	170	260	308	114
Hexachlorobutadiene	0.32 - 27,900	2,876	0.278	0.500	7	22.9	86.0
Hexadecane	N/R	2	100	400	1,000	700	424
Hexamethylcyclotrisiloxane	N/R	1	100	1,000	1,000	1,000	N/A
Indeno(1,2,3-cd)pyrene	10 - 2,000	890	18.0	9.40	20,000	370	849
Isophorone	10 - 2,000	888	0.113	840	840	309	115
Isopropylbenzene	0.11 - 27,900	2,650	0.792	0.270	2,500	4.71	71.0
Methoxychlor	0.18 - 110	160	3.13	0.260	22	31.5	33.7
Methylene Chloride	0.33 - 27,900	3,030	16.5	0.570	620	7.82	84.8
Naphthalene	0.38 - 27,900	2,869	18.0	0.350	350,000	180	6,557
n-Butylbenzene	0.16 - 27,900	2,646	1.28	0.290	6,350	6.45	137
n-Hexyl Ether	N/R	1	100	900	900	900	N/A
N-Nitroso-di-n-propylamine	10 - 2,000	888	0.113	700	700	309	114
N-nitrosodiphenylamine	10 - 2,000	871	0.344	67	250	306	113
n-Pentadecane	N/R	6	100	300	2,000	1,350	748
n-Propylbenzene	0.24 - 27,900	2,645	1.10	0.290	10,900	8.06	219
n-Tetradecane	N/R	4	100	2,000	3,000	2,750	500
n-Tetradecanoic Acid	N/R	1	100	900	900	900	N/A
n-Tridecane	N/R	1	100	4,000	4,000	4,000	N/A
OCDD	0 - 0.0022	17	88.2	0.00140	0.420	0.0511	0.102
OCDF	0 - 0.0022	17	64.7	1.90E-04	0.0260	0.00373	0.00688
Octamethylcyclotetrasiloxane	N/R	6	100	400	2,000	1,567	698
Octanol	N/R	1	100	600	600	600	N/A
Octylcyclohexane	N/R	1	100	300	300	300	N/A
Pentachlorodibenzo-p-dioxin[b]	0 - 0.0011	17	5.88	2.00E-04	2.00E-04	1.43E-04	1.53E-04
Pentachlorophenol	51 - 8,740	886	0.564	120	660	1,473	599
Phenanthrene	10 - 2,000	889	32.5	25	62,000	688	3,223
Phenol	10 - 2,000	885	0.791	59	160	308	115
Pyrene	10 - 2,900	888	31.3	17	67,000	722	3,303
sec-Butylbenzene	0.15 - 27,900	2,646	1.10	0.280	2,000	4.48	67.2
Styrene	0.076 - 27,900	3,026	0.231	0.100	25.7	7.25	84.8
tert-Butylbenzene	0.2 - 27,900	2,646	0.0756	2.20	5.02	3.95	58.4
Tetrachloroethene	0.18 - 27,900	3,034	8.47	0.250	197,000	336	6,231
Toluene	0.086 - 27,900	3,035	16.0	0.0910	20,000	26.3	380
Total Petroleum Hydrocarbons	0.25 - 7,090	139	53.2	4.10	467,000	9,098	54,609
trans-1,2-Dichloroethene	0.11 - 27,900	2,687	0.0372	90	90	5.59	59.4
trans-2-pentenal	N/R	2	100	200	600	400	283
Trichloroethene	0.14 - 27,900	3,032	4.29	0.340	11,600	18.4	269
Trichlorofluoromethane	0.23 - 27,900	2,648	1.59	0.570	15	4.96	85.0
Undecane	N/R	3	100	1,000	2,000	1,667	577
Vinyl Chloride	0.23 - 27,900	3,034	0.0659	2.80	7.67	11.5	108
Xylene[c]	0.032 - 55,800	3,018	5.80	0.110	115,000	48.8	2,096
Radionuclides (pCi/g)[d]							
Americium-241	0 - 3.1	941	N/A	-0.0726	75.5	0.794	4.01
Cesium-134	0.011 - 0.21	104	N/A	-0.0396	0.150	0.0392	0.0472
Cesium-137	0.011 - 0.47	143	N/A	-0.0504	0.443	0.0310	0.0779
Curium-244	0.0102 - 0.0489	16	N/A	0.0114	0.462	0.0554	0.109

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Table 1.4
Summary of Detected Analytes in Subsurface Soil/Subsurface Sediment

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Gross Alpha	1.1 - 23.5	268	N/A	-0.498	117	18.9	13.6
Gross Beta	1.5 - 10.11	286	N/A	8.09	55	26.3	8.10
Neptunium-237	0.00483 - 0.00528	2	N/A	9.22E-04	0.00308	0.00200	0.00152
Plutonium-238	0.00278 - 0.0388	27	N/A	-0.00177	0.197	0.0132	0.0392
Plutonium-239/240	0 - 2.84	969	N/A	-0.0953	527	2.25	19.3
Plutonium-242	0.0073 - 0.2419	16	N/A	-0.0110	0.0812	0.0193	0.0253
Radium-226	0 - 0.94	111	N/A	0.330	9.28	1.41	1.51
Radium-228	0 - 2.6	128	N/A	0	3.90	1.60	0.577
Strontium-89/90	0.02 - 1	185	N/A	-0.258	1.31	0.238	0.249
Uranium-232	0.0206 - 0.0644	16	N/A	-0.0375	0.0562	0.0108	0.0202
Uranium-233/234	0 - 1.55	992	N/A	0.0447	28.9	1.36	2.35
Uranium-234	0.0148 - 0.0148	1	N/A	0.600	0.600	0.600	N/A
Uranium-235	0 - 1.85	993	N/A	-0.129	4.88	0.105	0.261
Uranium-238	0 - 3.18	993	N/A	-0.0751	174	1.76	8.63

[a] For inorganics and organics, statistics are computed using one-half the reported value for nondetects.

[b] All detections are "J" qualified, signifying that the reported result is below the detection limit, but above the instrument detection limit.

[c] The value for total xylene is used.

[d] All radionuclide values are considered detects.

N/A = Not applicable.

N/R = Not reported.

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Table 1.5
Summary of Detected Analytes in Surface Soil

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration*	Standard Deviation*
Inorganics (mg/kg)							
Aluminum	0.0014 - 200	1,656	99.9	1,450	61,000	10,678	6,814
Ammonia	0.3 - 0.3	8	100	1.11	2.82	2.00	0.718
Antimony	3.6E-04 - 60	1,591	19.5	0.270	29	1.06	2.02
Arsenic	2.2E-04 - 10	1,647	98.4	0.440	56.2	4.39	3.28
Barium	7.1E-04 - 200	1,658	99.9	0.640	1,500	77.6	56.9
Beryllium	2.9E-05 - 5	1,652	84.7	0.0710	26.8	0.607	0.816
Boron	0.0036 - 1.7	1,027	83.4	0.350	28	3.30	2.54
Cadmium	2.5E-05 - 5	1,651	35.6	0.0600	270	0.766	7.06
Calcium	0.031 - 5,000	1,656	99.9	270	210,000	8,706	14,457
Cesium	9.1 - 1,000	564	25.4	1.10	18.8	9.59	17.1
Chromium	1.0E-04 - 10	1,658	99.6	1.20	210	16.2	15.5
Chromium (VI)	0.53 - 0.6	9	11.1	0.850	0.850	0.342	0.191
Cobalt	2.9E-04 - 50	1,656	98.7	1.10	137	6.37	6.22
Copper	3.6E-04 - 25	1,656	99.3	1.70	1,860	24.1	65.3
Cyanide	0.14 - 2.5	129	4.65	0.170	0.290	0.269	0.163
Fluoride	1 - 1	9	100	1.87	3.61	2.42	0.497
Iron	0.012 - 100	1,656	99.9	2,700	130,000	13,211	6,014
Lead	2.9E-05 - 3	1,647	100	2.30	590	19.1	30.2
Lithium	9.5E-04 - 100	1,678	97.1	0.990	50	8.58	4.14
Magnesium	0.016 - 5,000	1,667	99.9	180	30,000	2,631	1,838
Manganese	2.2E-04 - 15	1,651	99.9	15	1,240	199	118
Mercury	0 - 0.3	1,622	55.9	0.00140	48	0.0761	1.19
Molybdenum	9.9E-04 - 200	1,656	53.3	0.140	12.6	0.907	1.02
Nickel	3.4E-04 - 40	1,655	97.6	1.90	280	11.9	12.3
Nitrate / Nitrite	0.1 - 31.7	150	87.3	0.216	765	30.1	101
Nitrite	0.24 - 0.26	11	90.9	1.20	2	1.69	0.405
Potassium	0.029 - 5,000	1,656	99.8	270	8,310	1,800	735
Selenium	5.4E-04 - 5	1,647	6.13	0.300	2	0.363	0.164
Silica	0.0063 - 7	987	100	59.3	1,880	635	219
Silicon	0 - 100	67	98.5	95.7	11,300	2,347	2,466
Silver	9.4E-06 - 10	1,656	29.3	0.0580	364	1.02	9.55
Sodium	0.033 - 5,000	1,656	56.5	24.6	6,600	311	522
Strontium	7.2E-04 - 200	1,656	99.9	2.40	413	30.5	30.4
Thallium	1.6E-04 - 10	1,638	12.2	0.100	5.80	0.461	0.404
Tin	7.8E-04 - 200	1,656	7.67	0.750	161	2.23	6.47
Titanium	2.2E-04 - 0.25	1,027	100	28	1,730	269	181
Uranium	6.3E-04 - 16.8	1,018	9.82	0.430	370	1.83	14.0
Vanadium	6.3E-04 - 50	1,656	99.9	4.40	184	27.5	13.1
Zinc	5.6E-04 - 20	1,656	99.7	4.20	11,900	87.4	321
Organics (µg/kg)							
1,1,1-Trichloroethane	0.12 - 590	578	1.73	1.10	47.7	2.26	14.6
1,1,2-Trichloro-1,2,2-trifluoroethane	0.12 - 590	468	0.214	1.83	1.83	1.20	3.37
1,1-Dichloroethene	0.31 - 590	578	0.173	7.90	7.90	2.25	14.4
1,2,3-Trichlorobenzene	0.22 - 590	468	0.855	0.960	1.70	0.992	3.09
1,2,4-Trichlorobenzene	0.17 - 2,100	1,197	0.334	0.870	150	153	214
1,2,4-Trimethylbenzene	0.12 - 590	468	9.40	0.680	1,300	5.78	69.4
1,2-Dichloroethene	5 - 28	95	1.05	16	16	7.93	34.5
1,2-Dichloropropane	0.1 - 590	578	0.346	18	140	2.28	15.5
1,3,5-Trimethylbenzene	0.13 - 590	468	7.26	0.610	490	2.82	26.8
1,4-Dichlorobenzene	0.15 - 78,000	985	0.102	110	110	101	144
1,2,3,4,6,7,8-HpCDF	0 - 0.00108	12	100	7.20E-04	0.0200	0.00662	0.00579
1,2,3,4,7,8,9-HpCDF	0 - 0.00108	12	41.7	3.40E-04	0.00350	6.86E-04	0.00102
1,2,3,4,7,8-HxCDD	0 - 0.00108	12	58.3	2.20E-04	0.00170	4.66E-04	5.32E-04
1,2,3,4,7,8-HxCDF	0 - 0.00108	12	83.3	4.50E-04	0.0168	0.00305	0.00561
1,2,3,6,7,8-HxCDD	0 - 0.00108	12	91.7	3.90E-04	0.00510	0.00155	0.00159
1,2,3,6,7,8-HxCDF	0 - 0.00108	12	91.7	1.70E-04	0.00627	0.00137	0.00201
1,2,3,7,8,9-HxCDD	0 - 0.00108	12	75	4.50E-04	0.00360	0.00108	0.00109
1,2,3,7,8,9-HxCDF	0 - 0.00108	12	25	1.60E-04	2.91E-04	1.22E-04	7.06E-05
1,2,3,7,8-PeCDF	0 - 0.00108	12	50	7.90E-04	0.0111	0.00175	0.00320
2,4,5-T	1 - 100	9	11.1	1.80	1.80	18.5	18.1
2,4,5-Trichlorophenol	27 - 5,200	915	0.109	1,100	1,100	514	649
2,4,6-Trichlorophenol	39 - 2,100	915	0.109	950	950	275	236
2,4,6-Trinitrotoluene	0.22 - 30	8	12.5	56	56	69.5	62.0
2,4-Dimethylphenol	36 - 2,100	915	0.328	47	88	272	235
2,3,4,6,7,8-HxCDF	0 - 0.00108	12	75	3.10E-04	0.00259	6.61E-04	7.82E-04
2,3,4,7,8-PeCDF	0 - 0.00108	12	75	3.00E-04	0.0179	0.00246	0.00520
2,3,7,8-TCDD	0 - 4.32E-04	12	66.7	0.00160	0.00680	0.00264	0.00253
2,3,7,8-TCDF	0 - 4.32E-04	12	83.3	7.60E-04	0.0496	0.00788	0.0140
2-Butanone	1.7 - 12,000	576	2.60	3	155	11.6	39.1

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Table 1.5
Summary of Detected Analytes in Surface Soil

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[a]	Standard Deviation[a]
2-Hexanone	0.61 - 5,900	575	0.870	14.7	20	7.43	32.2
2-Methylnaphthalene	31 - 2,100	917	8.62	34	2,600	262	230
4,4'-DDD	0.3 - 190	204	0.980	3.50	10	8.55	8.89
4,4'-DDE	0.34 - 190	204	1.96	0.600	7.20	8.66	8.99
4,4'-DDT	0.35 - 190	204	0.490	9.10	9.10	8.80	8.98
4-Chloro-3-methylphenol	33 - 2,100	915	0.109	60	60	425	468
4-Isopropyltoluene	0.26 - 590	468	3.21	1	100	1.40	6.04
4-Methyl-2-pentanone	0.78 - 5,900	575	2.43	8.37	73	10.9	68.6
4-Methylphenol	54 - 2,100	915	0.546	64	270	272	235
4-Nitroaniline	60 - 6,600	918	0.436	62	820	1,321	1,180
4-Nitrophenol	95 - 5,200	915	0.219	53	320	1,320	1,181
Acenaphthene	30 - 2,100	918	24.9	21	11,000	237	441
Acenaphthylene	27 - 2,100	918	0.327	110	200	194	144
Acetone	1.5 - 12,000	578	20.2	1.70	1,280	26.4	96.1
Aldrin[b]	0.41 - 95	204	1.47	0.590	2.50	4.66	4.58
alpha-BHC	0.39 - 95	204	0.490	7.90	7.90	4.64	4.59
Anthracene	23 - 2,100	918	28.2	31	7,300	251	387
Aroclor-1016	1.9 - 4,500	443	1.35	13	95	59.5	182
Aroclor-1242	2.9 - 4,500	483	0.414	23	350	61.2	176
Aroclor-1248	3.6 - 4,500	483	1.04	17	66	60.7	176
Aroclor-1254	4.4 - 9,000	480	19.2	6.90	8,900	219	777
Aroclor-1260	1.4 - 9,000	476	22.5	6.50	7,800	210	751
Benzene	0.1 - 590	578	0.519	1	11	1.97	14.3
Benzo(a)anthracene	24 - 2,100	918	53.9	37	8,900	382	566
Benzo(a)pyrene	39 - 2,100	917	45.6	36	3,200	390	482
Benzo(b)fluoranthene	28 - 2,100	917	46.1	38	8,800	431	671
Benzo(g,h,i)perylene	26 - 2,100	917	34.4	15	3,200	320	357
Benzo(k)fluoranthene	31 - 2,100	910	39.9	23	4,200	349	417
Benzoic Acid	280 - 5,200	879	4.55	39	1,100	1,322	1,213
Benzyl Alcohol	77 - 2,100	857	0.817	140	2,800	438	474
beta-Chlordane[b]	1.8 - 950	167	0.599	2.60	2.60	46.1	48.3
bis(2-ethylhexyl)phthalate	69 - 2,100	918	29.2	29	75,000	447	2,601
Bromochloromethane	0.1 - 590	468	0.214	7	7	1.00	2.99
Butylbenzylphthalate	34 - 2,100	917	10.9	35	7,100	301	368
Carbazole	340 - 400	37	54.1	41	700	212	130
Carbon Disulfide	0.15 - 590	578	0.173	4	4	2.67	14.9
Carbon Tetrachloride	0.18 - 590	578	3.63	0.340	103	2.64	16.1
Chlorobenzene	0.078 - 590	578	0.173	2	2	2.11	14.5
Chloroform	0.089 - 590	578	1.21	1.30	7	2.01	14.3
Chloromethane[b]	0.35 - 590	578	0.519	1.50	1.70	3.51	29.8
Chrysene	27 - 2,100	918	56.0	36	7,700	402	582
cis-1,2-Dichloroethene	0.21 - 590	468	1.92	1.10	15	1.88	13.8
Dibenz(a,h)anthracene	24 - 2,100	916	16.5	28	930	262	241
Dibenzofuran	35 - 2,100	918	12.9	41	4,600	269	285
Dicamba	1.9 - 100	9	55.6	2.30	150	39.5	44.8
Dichloroprop	2.3 - 100	9	11.1	10	10	39.9	11.5
Dieldrin	0.39 - 190	204	3.92	1.80	92	9.69	11.9
Diesel Range Organics	960 - 48,000	13	84.6	4,900	8.80E+06	1.80E+06	3.33E+06
Diethylphthalate	30 - 2,100	915	0.656	33	420	319	229
Dimethylphthalate	39 - 2,100	918	1.96	69	460	271	235
Di-n-butylphthalate	20 - 2,100	918	7.73	35	10,000	276	400
Di-n-octylphthalate	36 - 2,100	917	4.69	38	11,000	299	568
Endosulfan I	0.4 - 95	204	0.980	3.90	7.40	4.65	4.58
Endosulfan II	0.4 - 170	203	1.48	0.700	9.90	8.16	6.48
Endosulfan sulfate	0.3 - 190	204	0.980	5.50	11	8.58	8.88
Endrin	0.4 - 190	204	1.47	2.40	17	9.00	9.47
Endrin aldehyde	0.51 - 38	60	3.33	8.70	9.20	3.71	3.73
Ethylbenzene	0.1 - 590	578	7.96	0.709	173	2.98	16.7
Fluoranthene	22 - 2,100	919	59.7	37	20,000	743	1,411
Fluorene	33 - 2,100	918	21.2	27	4,900	280	336
gamma-BHC (Lindane)	0.44 - 95	204	0.490	8.30	8.30	4.64	4.59
Gasoline	100 - 100	30	6.67	720	2,000	344	324
Heptachlor epoxide	0.38 - 95	204	0.490	7.20	7.20	6.58	8.79
Heptachlorodibenzo-p-dioxin	0 - 0.00108	12	100	0.00280	0.0950	0.0278	0.0272
Hexachlorobenzene	35 - 2,100	918	0.436	110	380	273	234
Hexachlorobutadiene	0.32 - 2,100	1,197	0.0835	2.20	2.20	153	213
HMX	60 - 60	5	20	230	230	146	47.0
Indeno(1,2,3-cd)pyrene	22 - 2,100	917	38.7	24	2,500	313	341
Isophorone	33 - 2,100	918	0.545	240	850	273	235

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Table 1.5
Summary of Detected Analytes in Surface Soil

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[a]	Standard Deviation[a]
Isopropylbenzene	0.11 - 590	468	2.14	0.540	27	1.02	2.94
MCPA	210 - 100,000	9	11.1	1,100	1,100	9,000	15,411
Methoxychlor	0.18 - 950	204	1.96	0.280	12	40.7	45.3
Methylene Chloride	0.35 - 590	578	11.1	0.790	45	3.68	45.8
Naphthalene	0.39 - 2,100	1,197	17.0	0.850	7,100	165	318
n-Butylbenzene	0.17 - 590	468	1.50	3.70	350	1.99	17.2
n-Propylbenzene	0.25 - 590	468	2.56	1.72	190	1.33	9.09
OCDD	0 - 0.00216	12	91.7	0.0180	0.630	0.190	0.182
OCDF	0 - 0.00216	12	100	0.00200	0.0360	0.0105	0.00940
Pentachlorodibenzo-p-dioxin	0 - 0.00108	12	66.7	3.60E-04	8.20E-04	4.82E-04	2.61E-04
Pentachlorophenol	64 - 5,200	915	1.20	42	39,000	1,337	1,638
Phenanthrene	34 - 2,100	919	58.5	22	22,000	632	1,336
Phenol	34 - 2,100	915	0.328	33	130	272	235
Pyrene	40 - 2,100	919	57.2	35	14,000	717	1,338
sec-Butylbenzene	0.16 - 590	468	1.07	2	42.6	1.00	3.25
Styrene	0.078 - 590	578	0.173	7.80	7.80	2.02	14.3
tert-Butylbenzene	0.21 - 590	468	0.214	1.60	1.60	0.895	2.56
Tetrachloroethene	0.19 - 590	578	6.92	0.790	29,000	54.1	1,206
Toluene	0.089 - 590	578	8.48	0.0990	990	7.74	62.4
Total Petroleum Hydrocarbons	0.25 - 77.6	21	95.2	0.500	2,400	316	557
Trichloroethene	0.15 - 590	578	3.81	0.170	200	2.48	16.7
Trichlorofluoromethane	0.23 - 590	468	5.77	0.660	31.9	1.33	3.52
Xylene[c]	0.033 - 1,200	578	11.2	0.600	933	9.31	53.0
Radionuclides (pCi/g)[d]							
Americium-241	0 - 0.6	932	N/A	-0.0480	51.2	0.543	2.59
Cesium-134	0.0166 - 0.3	69	N/A	-0.239	0.150	0.00916	0.0614
Cesium-137	0 - 0.75	84	N/A	-0.0366	0.790	0.148	0.185
Curium-242	0.0178	1	N/A	0	0	0	N/A
Curium-244	0.0362	1	N/A	-0.00290	-0.00290	-0.00290	N/A
Curium-245/246	0.02	1	N/A	0.126	0.126	0.126	N/A
Gross Alpha	0.8 - 6.87	732	N/A	2.69	67.6	19.5	8.73
Gross Beta	1 - 10	766	N/A	-1.30	81.9	32.7	9.51
Neptunium-237	0.00202 - 0.00634	11	N/A	7.79E-04	0.0187	0.0101	0.00719
Plutonium-238	0.00258 - 0.091	54	N/A	-0.0190	1.17	0.0585	0.184
Plutonium-239/240	0 - 0.373	1,127	N/A	-0.0459	183	1.26	6.83
Radium-226	0 - 1.1	67	N/A	-7.39	2.08	0.785	1.11
Radium-228	0 - 2.9	79	N/A	0.490	3.15	1.73	0.573
Strontium-89/90	0.0170 - 0.44	73	N/A	-0.160	1.50	0.268	0.309
Uranium-233/234	0 - 2.39	995	N/A	0.0817	34.5	1.24	1.48
Uranium-235	0 - 2.55	995	N/A	-0.138	1.69	0.0722	0.0946
Uranium-238	0 - 1.9	995	N/A	0.182	49.8	1.44	2.71

[a] For inorganics and organics, statistics are computed using one-half the reported value for nondetects.

[b] All detections are "J" qualified, signifying that the reported result is below the detection limit, but above the instrument detection limit.

[c] The value for total xylene is used.

[d] All radionuclide values are considered detects.

N/A = Not applicable.

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Table 1.6
Summary of Detected Analytes in Subsurface Soil

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation[a]
Inorganics (mg/kg)							
Aluminum	0.0014 - 200	2,475	100	870	110,000	16,317	10,335
Antimony	3.6E-04 - 60	2,380	21.6	0.180	19.3	0.852	2.07
Arsenic	2.2E-04 - 10	2,475	98.9	0.480	69.7	5.84	4.35
Barium	7.1E-04 - 200	2,475	100.0	8.60	1,150	84.8	67.0
Beryllium	2.9E-05 - 5	2,455	85.1	0.0520	15	0.877	0.752
Boron	0.0036 - 9.7	2,002	76.2	0.420	33	3.13	2.55
Cadmium	2.5E-05 - 5	2,468	31.9	0.0400	547	1.33	17.8
Calcium	0.031 - 5,000	2,475	100	180	412,000	14,426	32,758
Cesium[b]	9.1 - 1,000	274	6.57	0.950	10.9	25.8	25.3
Chloride	0.284 - 0.327	41	90.2	0.0800	184	31.7	51.4
Chromium	1.0E-04 - 10	2,475	99.8	1.20	11,000	22.7	222
Chromium (VI)[b]	0.52	1	100	0.590	0.590	0.590	
Cobalt	2.9E-04 - 50	2,475	98.5	0.470	120	6.30	5.52
Copper	3.6E-04 - 25	2,475	99.5	0.700	1,190	17.0	44.8
Cyanide	0.15 - 0.61	135	16.3	0.180	43	1.03	4.77
Fluoride	0.159 - 0.183	41	100	0.150	17.6	4.12	4.59
Iron	0.012 - 100	2,475	100	1,060	290,000	14,600	8,386
Lead	2.9E-05 - 3	2,480	99.9	0.990	1,500	13.5	40.8
Lithium	9.5E-04 - 100	2,456	96.8	0.400	79.9	10.9	6.69
Magnesium	0.016 - 5,000	2,475	100	160	17,000	2,583	1,412
Manganese	2.2E-04 - 15	2,475	99.9	8.80	3,140	176	177
Mercury	0 - 0.67	2,416	78.5	0.00190	16	0.0820	0.408
Molybdenum	9.9E-04 - 200	2,472	61.2	0.140	4,100	2.62	82.5
Nickel	3.4E-04 - 40	2,475	99.4	0.720	670	15.4	19.5
Nitrate / Nitrite	0.001 - 478	253	83.4	0	6,100	205	711
Nitrite[b]	0.103 - 0.34	14	35.7	0.111	2.49	2.14	1.04
Potassium	0.029 - 5,000	2,475	99.6	139	21,100	1,708	1,058
Selenium	5.4E-04 - 7.7	2,475	10.6	0.0600	4.30	0.415	0.268
Silica	0.0063 - 22	1,918	100	104	5,110	662	283
Silicon	0 - 200	104	100	72	14,000	2,320	2,534
Silver	9.4E-06 - 10	2,469	24.0	0.0620	110	0.429	3.72
Sodium	0.033 - 5,000	2,475	41.7	40.9	11,000	306	687
Strontium	7.2E-04 - 400	2,474	99.8	2.30	487	37.3	43.6
Sulfate	0.705 - 0.81	19	100	11.6	180	57.1	39.4
Sulfide	4.63 - 200	86	12.8	6.54	18.6	16.6	28.8
Tantalum[b]	66.5 - 66.5	2	50	15.7	15.7	11.9	5.44
Thallium	1.6E-04 - 10	2,469	14.1	0.100	9.30	0.537	0.490
Tin	7.8E-04 - 200	2,453	9.95	0.470	392	2.33	9.95
Titanium	2.2E-04 - 0.5	2,009	100	14	1,420	189	124
Uranium	6.3E-04 - 31	2,053	10.9	0.540	1,600	2.73	37.5
Vanadium	6.3E-04 - 50	2,475	100.0	3	740	33.3	21.9
Zinc	5.6E-04 - 20	2,472	99.6	2.20	1,800	39.8	71.3
Organics (µg/kg)							
1,1,1-Trichloroethane	0.11 - 27,900	3,019	2.29	0.200	2,100	8.35	96.3
1,1,2,2-Tetrachloroethane	0.086 - 27,900	3,013	0.0996	3	1,000	8.52	90.9
1,1,2-Trichloro-1,2,2-trifluoroethane	0.12 - 27,900	2,650	0.226	1	390	5.29	91.4
1,1,2-Trichloroethane	0.2 - 27,900	3,020	0.0662	0.840	3.20	7.17	84.0
1,1-Dichloroethane	0.11 - 27,900	3,020	0.331	0.180	239	7.30	84.3
1,1-Dichloroethene	0.3 - 27,900	3,020	0.828	0.470	23.8	7.64	87.0
1,2,3-Trichlorobenzene	0.22 - 27,900	2,639	1.74	0.490	530	4.21	57.3
1,2,3-Trichloropropane[b]	0.29 - 27,900	2,647	0.0378	4	4	4.34	70.7
1,2,3-Trimethylbenzene	N/R	1	100	700	700	700	N/A
1,2,4-Trichlorobenzene	0.17 - 27,900	2,854	1.37	0.450	2,000	23.6	96.5
1,2,4-Trimethylbenzene	0.12 - 27,900	2,640	4.81	0.150	72,300	35.7	1,422
1,2-Dibromo-3-chloropropane[b]	0.26 - 27,900	2,647	0.0378	3	3	5.68	87.4
1,2-Dichlorobenzene	0.097 - 70,000	2,846	0.176	0.110	270	20.5	78.1
1,2-Dichloroethane	0.13 - 27,900	3,008	0.632	0.440	35	7.23	84.5
1,2-Dichloroethene	5 - 1,200	342	0.585	32	1,200	11.8	74.3
1,2-Dichloropropane	0.097 - 27,900	3,020	0.199	1	13	7.13	84.0
1,3,5-Trimethylbenzene	0.13 - 27,900	2,640	2.50	0.380	20,600	13.3	413
1,3-Dichlorobenzene	0.14 - 27,900	2,871	0.104	2.10	70	24.0	85.9
1,4-Dichlorobenzene	0.14 - 70,000	2,846	0.211	0.240	170	21.2	88.7
1,2,3,4,6,7,8-HpCDF	0 - 0.0011	17	76.5	1.20E-04	0.0240	0.00278	0.00608
1,2,3,4,7,8,9-HpCDF	0 - 0.0011	17	29.4	1.40E-04	0.00140	3.34E-04	3.68E-04
1,2,3,4,7,8-HxCDD	0 - 0.0011	17	11.8	1.00E-04	2.20E-04	1.71E-04	1.53E-04
1,2,3,4,7,8-HxCDF	0 - 0.0011	17	52.9	7.00E-05	0.00310	5.22E-04	9.74E-04
1,2,3,6,7,8-HxCDD	0 - 0.0011	17	29.4	1.40E-04	0.00380	4.86E-04	9.23E-04
1,2,3,6,7,8-HxCDF	0 - 0.0011	17	23.5	1.10E-04	0.00130	2.46E-04	3.69E-04

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Table 1.6
Summary of Detected Analytes in Subsurface Soil

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[a]	Standard Deviation[a]
Inorganics (mg/kg)							
1,2,3,7,8,9-HxCDD	0 - 0.0011	17	35.3	1.10E-04	0.00120	2.87E-04	3.11E-04
1,2,3,7,8,9-HxCDF[b]	0 - 0.0011	17	5.88	2.50E-04	2.50E-04	1.51E-04	1.59E-04
1,2,3,7,8-PeCDF	0 - 0.0011	17	17.6	3.50E-04	0.00327	3.30E-04	7.78E-04
1-Iodooctane	N/R	1	100	2,000	2,000	2,000	N/A
2,3-Dimethyl-1-butene	N/R	1	100	1,000	1,000	1,000	N/A
2,3-Dimethylhexane	N/R	1	100	900	900	900	N/A
2,3-Epoxy-2,3-dimethylbutane	N/R	2	100	1,000	4,000	2,500	2,121
2,4-Dimethylphenol	10 - 2,000	873	0.229	81	89	308	114
2,4-Dinitrophenol	51 - 8,740	873	0.115	470	470	1,482	589
2,4-Dinitrotoluene	10 - 3,500	878	0.114	43	43	310	124
2,6-Dimethylundecane	N/R	1	100	1,000	1,000	1,000	N/A
2,7,10-Trimethyldodecane	N/R	2	100	600	1,000	800	283
2,3,4,6,7,8-HxCDF[b]	0 - 0.0011	17	35.3	1.30E-04	5.90E-04	2.04E-04	1.84E-04
2,3,4,7,8-PeCDF	0 - 0.0011	17	29.4	1.50E-04	0.00247	3.36E-04	6.54E-04
2,3,7,8-TCDD	0 - 4.39E-04	17	5.88	5.90E-04	5.90E-04	1.62E-04	1.24E-04
2,3,7,8-TCDF	0 - 4.39E-04	17	29.4	1.50E-04	0.0102	9.60E-04	0.00252
2-Bromooctane	N/R	1	100	2,000	2,000	2,000	N/A
2-Butanone	1.6 - 558,000	2,909	5.88	1	500	61.2	1,312
2-Chlorophenol	10 - 2,000	873	0.344	8.50	77	308	114
2-Chlorotoluene	0.14 - 27,900	2,639	0.0758	11	80	3.94	53.4
2-Hexanone	0.59 - 279,000	2,995	0.668	2	1,760	33.2	501
2-Methylnaphthalene	10 - 2,000	876	7.31	35	1,400	300	140
2-Methylphenol	10 - 2,000	874	0.114	93	93	309	114
3,3'-Dichlorobenzidine[b]	20 - 3,440	876	0.114	160	160	678	195
4,4'-DDD	0.3 - 21	153	1.31	4.20	7.60	6.78	6.63
4,4'-DDE	0.32 - 21	153	2.61	0.460	4.80	6.89	6.72
4,4'-DDT	0.34 - 21	153	1.96	0.790	19	6.89	6.70
4-Chloro-3-methylphenol[b]	10 - 3,440	873	0.115	54	54	513	289
4-Chlorotoluene	0.16 - 27,900	2,639	0.0758	6.20	90	4.35	73.0
4-Hydroxy-4-methyl-2-pentanone	N/R	7	100	10,000	100,000	77,143	36,839
4-Isopropyltoluene	0.26 - 27,900	2,637	1.55	0.470	3,000	5.25	82.6
4-Methyl-2-pentanone	0.76 - 279,000	3,008	0.997	1	850	31.8	477
4-Methylphenol	10 - 2,000	857	0.467	95	460	306	113
4-Nitroaniline	51 - 8,740	859	0.116	230	230	1,478	601
Acenaphthene	10 - 2,000	878	15.6	25	7,900	248	410
Acenaphthylene	10 - 2,000	876	0.228	85	94	209	77.8
Acetone	1.4 - 558,000	2,967	26.5	1	17,000	103	2,048
Aldrin	0.41 - 11	153	0.654	4.40	4.40	3.90	3.43
alpha-BHC	0.39 - 11	153	1.31	3	6.80	3.81	3.37
Anthracene	10 - 2,000	878	17.2	36	13,000	276	658
Aroclor-1016	1.9 - 3,100	661	0.908	2.60	150	75.1	279
Aroclor-1248	3.6 - 3,000	661	2.42	44	5,900	118	474
Aroclor-1254	4.3 - 2,100	661	20.4	4.90	12,000	315	1,288
Aroclor-1260	1.4 - 570	661	16.0	6.60	15,000	254	1,211
Benzene	0.097 - 27,900	3,021	0.662	0.610	240	7.19	84.0
Benzo(a)anthracene	10 - 2,000	875	26.7	21	33,000	441	1,466
Benzo(a)pyrene	10 - 2,000	874	21.4	5.70	35,000	449	1,484
Benzo(b)fluoranthene	10 - 2,000	875	21.3	8.10	29,000	430	1,334
Benzo(g,h,i)perylene	10 - 2,000	875	16.9	13.2	22,000	389	968
Benzo(k)fluoranthene	10 - 2,000	875	19.3	11.9	29,000	405	1,219
Benzoic Acid	51 - 8,740	835	2.87	85	930	1,487	607
Benzyl Alcohol	10 - 3,440	830	0.241	260	1,600	525	290
bis(2-ethylhexyl)phthalate	10 - 2,000	875	15.0	16.8	48,000	347	1,621
bis(2-hydroxyethyl)lauramide	N/R	8	100	1,000	8,000	5,125	2,031
Bromochloromethane	0.097 - 27,900	2,651	0.0377	7	7	3.74	51.4
Bromoform[b]	0.097 - 27,900	3,019	0.0331	1	1	7.37	85.8
Bromomethane	0.33 - 27,900	2,977	0.0336	7,450	7,450	12.9	170
Butylbenzylphthalate	10 - 2,000	875	3.09	16.5	6,000	314	231
Carbazole	330 - 810	37	5.41	410	1,300	274	193
Carbon Disulfide	0.14 - 27,900	3,019	0.530	1	290	8.59	94.8
Carbon Tetrachloride	0.17 - 27,900	3,019	1.49	0.310	370	7.87	91.5
Chlorobenzene	0.076 - 27,900	3,012	0.0332	3	3	7.20	84.2
Chloroethane	0.23 - 27,900	2,979	0.101	3.79	48.2	12.0	112
Chloroform	0.086 - 27,900	3,020	1.52	0.0950	670	7.59	86.6
Chloromethane	0.22 - 27,900	3,018	0.0663	1.80	86	10.7	105
Chrysene	10 - 2,000	876	28.2	24	36,000	462	1,609
cis-1,2-Dichloroethene	0.11 - 27,900	2,642	1.40	0.910	181	5.59	51.8
Decane	N/R	1	100	2,000	2,000	2,000	N/A

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Table 1.6
Summary of Detected Analytes in Subsurface Soil

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[a]	Standard Deviation[a]
Inorganics (mg/kg)							
delta-BHC	0.11 - 11	153	0.654	42	42	4.08	4.58
Dibenz(a,h)anthracene	10 - 2,000	875	8.57	13.6	10,000	324	401
Dibenzofuran	10 - 2,000	872	7.57	15	3,300	310	201
Dichlorodifluoromethane	0.21 - 27,900	2,593	0.231	2	26	6.26	113
Dieldrin	0.32 - 21	153	2.61	1.40	6.70	6.82	6.61
Diesel Range Organics	1,700 - 4.9E07	25	80	910	560,000	26,546	111,234
Diethylphthalate	10 - 2,000	875	1.03	20	330	352	93.5
Dimethylphthalate	10 - 2,000	875	0.229	89	460	309	114
Di-n-butylphthalate	10 - 2,000	875	5.94	19	3,600	301	163
Di-n-octylphthalate	10 - 2,000	875	0.571	20.9	6,000	315	224
Dodecane	N/R	5	100	300	2,000	1,260	733
Endosulfan I	0.33 - 11	153	0.654	3.60	3.60	3.77	3.37
Endosulfan II	0.35 - 21	152	1.97	0.910	12	7.29	8.14
Endosulfan sulfate	0.3 - 21	153	1.31	0.870	5.30	6.77	6.64
Endrin	0.39 - 21	153	2.61	2.80	12	6.95	6.73
Endrin aldehyde	0.43 - 18	89	3.37	5.40	21	2.18	2.90
Endrin ketone[b]	0.36 - 38	90	1.11	62	62	11.0	8.41
ethyl acetate	N/R	1	100	1,000	1,000	1,000	N/A
Ethylbenzene	0.097 - 27,900	3,019	3.41	0.180	15,500	12.9	295
Fluoranthene	10 - 2,000	876	32.2	5.80	66,000	754	3,434
Fluorene	10 - 2,000	877	11.4	21	6,300	328	371
gamma-BHC (Lindane)[b]	0.43 - 11	153	0.654	10	10	3.87	3.42
Gasoline	500	1	100	4,800	4,800	4,800	N/A
Gasoline Range Organics	108,000 - 610,000	22	13.6	40,700	1.33E+06	115,509	271,314
Heptachlor epoxide	0.33 - 11	153	1.31	4.20	14	6.05	6.87
Heptachlorodibenzo-p-dioxin	0 - 0.0011	17	82.4	2.20E-04	0.0290	0.00631	0.00864
Hexachlorobenzene	10 - 2,000	876	0.342	170	260	308	114
Hexachlorobutadiene	0.32 - 27,900	2,862	0.280	0.500	7	22.5	85.7
Hexadecane	N/R	2	100	400	1,000	700	424
Hexamethylcyclotrisiloxane	N/R	1	100	1,000	1,000	1,000	N/A
Indeno(1,2,3-cd)pyrene	10 - 2,000	877	17.6	9.40	20,000	372	855
Isophorone	10 - 2,000	875	0.114	840	840	309	115
Isopropylbenzene	0.11 - 27,900	2,643	0.795	0.270	2,500	4.72	71.1
Methoxychlor	0.18 - 110	153	3.27	0.260	22	31.4	34.3
Methylene Chloride	0.33 - 27,900	3,016	16.4	0.570	620	7.83	85.0
Naphthalene	0.38 - 27,900	2,855	17.9	0.350	350,000	180	6,573
n-Butylbenzene	0.16 - 27,900	2,639	1.29	0.290	6,350	6.46	137
n-Hexyl Ether	N/R	1	100	900	900	900	N/A
N-Nitroso-di-n-propylamine	10 - 2,000	875	0.114	700	700	309	114
N-nitrosodiphenylamine	10 - 2,000	858	0.350	67	250	306	113
n-Pentadecane	N/R	6	100	300	2,000	1,350	748
n-Propylbenzene	0.24 - 27,900	2,638	1.10	0.290	10,900	8.08	220
n-Tetradecane	N/R	4	100	2,000	3,000	2,750	500
n-Tetradecanoic Acid	N/R	1	100	900	900	900	N/A
n-Tridecane	N/R	1	100	4,000	4,000	4,000	N/A
OCDD	0 - 0.0022	17	88.2	0.00140	0.420	0.0511	0.102
OCDF	0 - 0.0022	17	64.7	1.90E-04	0.0260	0.00373	0.00688
Octamethylcyclotetrasiloxane	N/R	6	100	400	2,000	1,567	698
Octanol	N/R	1	100	600	600	600	N/A
Octylcyclohexane	N/R	1	100	300	300	300	N/A
Pentachlorodibenzo-p-dioxin[b]	0 - 0.0011	17	5.88	2.00E-04	2.00E-04	1.43E-04	1.53E-04
Pentachlorophenol	51 - 8,740	873	0.573	120	660	1,474	594
Phenanthrene	10 - 2,000	876	31.6	25	62,000	691	3,246
Phenol	10 - 2,000	872	0.803	59	160	307	115
Pyrene	10 - 2,900	875	30.4	17	67,000	723	3,327
sec-Butylbenzene	0.15 - 27,900	2,639	1.10	0.280	2,000	4.49	67.3
Styrene	0.076 - 27,900	3,012	0.232	0.100	25.7	7.27	85.0
tert-Butylbenzene	0.2 - 27,900	2,639	0.0758	2.20	5.02	3.95	58.5
Tetrachloroethene	0.18 - 27,900	3,020	8.51	0.250	197,000	338	6,246
Toluene	0.086 - 27,900	3,021	16.1	0.0910	20,000	26.4	381
Total Petroleum Hydrocarbons	0.25 - 7,090	139	53.2	4.10	467,000	9,098	54,609
trans-1,2-Dichloroethene	0.11 - 27,900	2,680	0.0373	90	90	5.60	59.5
trans-2-pentenal	N/R	2	100	200	600	400	283
Trichloroethene	0.14 - 27,900	3,018	4.31	0.340	11,600	18.5	270
Trichlorofluoromethane	0.23 - 27,900	2,641	1.59	0.570	15	4.97	85.1
Undecane	N/R	3	100	1,000	2,000	1,667	577
Vinyl Chloride	0.23 - 27,900	3,020	0.0662	2.80	7.67	11.5	108
Xylene[c]	0.032 - 55,800	3,004	5.83	0.110	115,000	49.0	2,101

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Table 1.6
Summary of Detected Analytes in Subsurface Soil

Analyte	Range of Reported Detection Limits	Total Number of Results	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration[a]	Standard Deviation[a]
Inorganics (mg/kg)							
Radionuclides (pCi/g)[d]							
Americium-241	0 - 3.1	932	N/A	-0.0726	75.5	0.800	4.03
Cesium-134	0.011 - 0.21	103	N/A	-0.0396	0.150	0.0396	0.0474
Cesium-137	0.011 - 0.47	141	N/A	-0.0504	0.420	0.0260	0.0654
Curium-244	0.0102 - 0.0489	16	N/A	0.0114	0.462	0.0554	0.109
Gross Alpha	1.1 - 23.5	266	N/A	-0.498	117	19.0	13.6
Gross Beta	1.5 - 10.11	284	N/A	8.09	55	26.3	8.12
Neptunium-237	0.00483 - 0.00528	2	N/A	9.22E-04	0.00308	0.00200	0.00152
Plutonium-238	0.00278 - 0.0388	27	N/A	-0.00177	0.197	0.0132	0.0392
Plutonium-239/240	0 - 2.84	960	N/A	-0.0953	527	2.27	19.4
Plutonium-242	0.0073 - 0.2419	16	N/A	-0.0110	0.0812	0.0193	0.0253
Radium-226	0 - 0.94	111	N/A	0.330	9.28	1.41	1.51
Radium-228	0 - 2.6	127	N/A	0	3.90	1.60	0.580
Strontium-89/90	0.02 - 1	184	N/A	-0.258	1.31	0.238	0.249
Uranium-232	0.0206 - 0.0644	16	N/A	-0.0375	0.0562	0.0108	0.0202
Uranium-233/234	0 - 1.55	983	N/A	0.0447	28.9	1.36	2.36
Uranium-234	0.0148	1	N/A	0.600	0.600	0.600	N/A
Uranium-235	0 - 1.85	984	N/A	-0.129	4.88	0.105	0.262
Uranium-238	0 - 3.18	984	N/A	-0.0751	174	1.77	8.67

[a] For inorganics and organics, statistics are computed using one-half the reported value for nondetects.

[b] All detections are "J" qualified, signifying that the reported result is below the detection limit, but above the instrument detection limit.

[c] The value for total xylene is used.

[d] All radionuclide values are considered detects.

N/A = Not applicable.

N/R = Not reported.

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Table 1.7

Toxicity Equivalency Calculations for Dioxins/Furans - Human Health Receptors

Sampling Location	Sample Number	Analyte	Result	Detect?	Validation Qualifier	TEF[a]	TEQ Concentration[b]
Surface Soil/Surface Sediment (µg/kg)							
BT38-001	02E0015-005	1,2,3,4,6,7,8-HpCDF	0.0057	Yes	V	0.01	5.70E-05
BT38-001	02E0015-005	1,2,3,4,7,8,9-HpCDF	3.30E-04	No	V	0.01	0
BT38-001	02E0015-005	1,2,3,4,7,8-HxCDD	3.00E-04	No	V	0.1	0
BT38-001	02E0015-005	1,2,3,4,7,8-HxCDF	5.40E-04	Yes	JB	0.1	5.40E-05
BT38-001	02E0015-005	1,2,3,6,7,8-HxCDD	9.70E-04	Yes	V	0.1	9.70E-05
BT38-001	02E0015-005	1,2,3,6,7,8-HxCDF	4.30E-04	Yes	JB	0.1	4.30E-05
BT38-001	02E0015-005	1,2,3,7,8,9-HxCDD	2.80E-04	No	V	0.1	0
BT38-001	02E0015-005	1,2,3,7,8,9-HxCDF	1.60E-04	No	V	0.1	0
BT38-001	02E0015-005	1,2,3,7,8-PeCDF	0.0012	Yes	V	0.05	6.00E-05
BT38-001	02E0015-005	2,3,4,6,7,8-HxCDF	4.30E-04	Yes	V	0.1	4.30E-05
BT38-001	02E0015-005	2,3,4,7,8-PeCDF	6.50E-04	Yes	V	0.5	3.25E-04
BT38-001	02E0015-005	2,3,7,8-TCDD	0.0056	Yes	V	1	0.0056
BT38-001	02E0015-005	2,3,7,8-TCDF	0.0038	Yes	V	0.1	3.80E-04
BT38-001	02E0015-005	Heptachlorodibenzo-p-dioxin	0.023	Yes	V	0.01	2.30E-04
BT38-001	02E0015-005	OCDD	0.18	Yes	V	0.0001	1.80E-05
BT38-001	02E0015-005	OCDF	0.0089	Yes	V	0.0001	8.90E-07
BT38-001	02E0015-005	Pentachlorodibenzo-p-dioxin	6.50E-04	Yes	V	1	6.50E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-005:							0.008
BT38-002	02E0015-006	1,2,3,4,6,7,8-HpCDF	0.0035	Yes	V	0.01	3.50E-05
BT38-002	02E0015-006	1,2,3,4,7,8,9-HpCDF	5.10E-04	No	V	0.01	0
BT38-002	02E0015-006	1,2,3,4,7,8-HxCDD	3.80E-04	No	V	0.1	0
BT38-002	02E0015-006	1,2,3,4,7,8-HxCDF	5.30E-04	Yes	JB	0.1	5.30E-05
BT38-002	02E0015-006	1,2,3,6,7,8-HxCDD	8.40E-04	Yes	V	0.1	8.40E-05
BT38-002	02E0015-006	1,2,3,6,7,8-HxCDF	5.30E-04	Yes	V	0.1	5.30E-05
BT38-002	02E0015-006	1,2,3,7,8,9-HxCDD	6.30E-04	Yes	V	0.1	6.30E-05
BT38-002	02E0015-006	1,2,3,7,8,9-HxCDF	2.60E-04	No	V	0.1	0
BT38-002	02E0015-006	1,2,3,7,8-PeCDF	3.00E-04	No	V	0.05	0
BT38-002	02E0015-006	2,3,4,6,7,8-HxCDF	2.30E-04	No	V	0.1	0
BT38-002	02E0015-006	2,3,4,7,8-PeCDF	4.20E-04	Yes	V	0.5	2.10E-04
BT38-002	02E0015-006	2,3,7,8-TCDD	0.0035	Yes	V	1	0.0035
BT38-002	02E0015-006	2,3,7,8-TCDF	0.0026	Yes	V	0.1	2.60E-04
BT38-002	02E0015-006	Heptachlorodibenzo-p-dioxin	0.013	Yes	V	0.01	1.30E-04
BT38-002	02E0015-006	OCDD	0.088	Yes	V	0.0001	8.80E-06
BT38-002	02E0015-006	OCDF	0.016	Yes	V	0.0001	1.60E-06
BT38-002	02E0015-006	Pentachlorodibenzo-p-dioxin	6.30E-04	Yes	V	1	6.30E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-006:							0.005
BT38-002	02E0015-007	1,2,3,4,6,7,8-HpCDF	0.0034	Yes	V	0.01	3.40E-05
BT38-002	02E0015-007	1,2,3,4,7,8,9-HpCDF	3.20E-04	No	V	0.01	0
BT38-002	02E0015-007	1,2,3,4,7,8-HxCDD	2.60E-04	No	V	0.1	0
BT38-002	02E0015-007	1,2,3,4,7,8-HxCDF	6.70E-04	Yes	JB	0.1	6.70E-05
BT38-002	02E0015-007	1,2,3,6,7,8-HxCDD	6.70E-04	Yes	V	0.1	6.70E-05
BT38-002	02E0015-007	1,2,3,6,7,8-HxCDF	5.50E-04	Yes	JB	0.1	5.50E-05
BT38-002	02E0015-007	1,2,3,7,8,9-HxCDD	6.70E-04	Yes	V	0.1	6.70E-05
BT38-002	02E0015-007	1,2,3,7,8,9-HxCDF	1.80E-04	No	V	0.1	0
BT38-002	02E0015-007	1,2,3,7,8-PeCDF	8.90E-04	Yes	V	0.05	4.45E-05
BT38-002	02E0015-007	2,3,4,6,7,8-HxCDF	4.40E-04	Yes	V	0.1	4.40E-05
BT38-002	02E0015-007	2,3,4,7,8-PeCDF	4.40E-04	Yes	V	0.5	2.20E-04
BT38-002	02E0015-007	2,3,7,8-TCDD	0.0068	Yes	V	1	0.0068
BT38-002	02E0015-007	2,3,7,8-TCDF	0.0042	Yes	V	0.1	4.20E-04
BT38-002	02E0015-007	Heptachlorodibenzo-p-dioxin	0.0085	Yes	V	0.01	8.50E-05
BT38-002	02E0015-007	OCDD	0.057	Yes	V	0.0001	5.70E-06
BT38-002	02E0015-007	OCDF	0.0037	Yes	JB	0.0001	3.70E-07
BT38-002	02E0015-007	Pentachlorodibenzo-p-dioxin	6.70E-04	Yes	V	1	6.70E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-007:							0.009
BT39-001	02E0015-001	1,2,3,4,6,7,8-HpCDF	0.0062	Yes	V	0.01	0.000062
BT39-001	02E0015-001	1,2,3,4,7,8,9-HpCDF	1.50E-04	No	V	0.01	0
BT39-001	02E0015-001	1,2,3,4,7,8-HxCDD	2.30E-04	Yes	JB	0.1	0.000023
BT39-001	02E0015-001	1,2,3,4,7,8-HxCDF	6.80E-04	Yes	JB	0.1	0.000068
BT39-001	02E0015-001	1,2,3,6,7,8-HxCDD	5.60E-04	Yes	V	0.1	0.000056
BT39-001	02E0015-001	1,2,3,6,7,8-HxCDF	9.00E-04	Yes	JB	0.1	0.00009
BT39-001	02E0015-001	1,2,3,7,8,9-HxCDD	4.50E-04	Yes	V	0.1	0.000045
BT39-001	02E0015-001	1,2,3,7,8,9-HxCDF	9.50E-05	No	V	0.1	0
BT39-001	02E0015-001	1,2,3,7,8-PeCDF	7.90E-04	Yes	V	0.05	0.0000395
BT39-001	02E0015-001	2,3,4,6,7,8-HxCDF	3.40E-04	Yes	V	0.1	0.000034
BT39-001	02E0015-001	2,3,4,7,8-PeCDF	5.60E-04	Yes	V	0.5	0.00028
BT39-001	02E0015-001	2,3,7,8-TCDD	0.0035	Yes	V	1	0.0035

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Table 1.7

Toxicity Equivalency Calculations for Dioxins/Furans - Human Health Receptors

Sampling Location	Sample Number	Analyte	Result	Detect?	Validation Qualifier	TEF a	TEQ Concentration b
BT39-001	02E0015-001	2,3,7,8-TCDF	0.0036	Yes	V	0.1	3.60E-04
BT39-001	02E0015-001	Heptachlorodibenzo-p-dioxin	0.011	Yes	V	0.01	1.10E-04
BT39-001	02E0015-001	OCDD	0.084	Yes	V	0.0001	8.40E-06
BT39-001	02E0015-001	OCDF	0.0051	Yes	JB	0.0001	5.10E-07
BT39-001	02E0015-001	Pentachlorodibenzo-p-dioxin	5.60E-04	Yes	V	1	5.60E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-001:							**0.005**
BT39-002	02E0015-002	1,2,3,4,6,7,8-HpCDF	0.0038	Yes	V	0.01	0.000038
BT39-002	02E0015-002	1,2,3,4,7,8,9-HpCDF	3.40E-04	Yes	JB	0.01	0.0000034
BT39-002	02E0015-002	1,2,3,4,7,8-HxCDD	2.20E-04	Yes	JB	0.1	0.000022
BT39-002	02E0015-002	1,2,3,4,7,8-HxCDF	4.50E-04	Yes	JB	0.1	0.000045
BT39-002	02E0015-002	1,2,3,6,7,8-HxCDD	5.60E-04	Yes	V	0.1	0.000056
BT39-002	02E0015-002	1,2,3,6,7,8-HxCDF	6.70E-04	Yes	JB	0.1	0.000067
BT39-002	02E0015-002	1,2,3,7,8,9-HxCDD	7.90E-04	Yes	V	0.1	0.000079
BT39-002	02E0015-002	1,2,3,7,8,9-HxCDF	2.20E-04	Yes	JB	0.1	0.000022
BT39-002	02E0015-002	1,2,3,7,8-PeCDF	1.40E-04	No	V	0.05	0
BT39-002	02E0015-002	2,3,4,6,7,8-HxCDF	3.40E-04	Yes	V	0.1	0.000034
BT39-002	02E0015-002	2,3,4,7,8-PeCDF	1.40E-04	No	V	0.5	0
BT39-002	02E0015-002	2,3,7,8-TCDD	0.0016	Yes	V	1	0.0016
BT39-002	02E0015-002	2,3,7,8-TCDF	7.90E-04	Yes	V	0.1	7.90E-05
BT39-002	02E0015-002	Heptachlorodibenzo-p-dioxin	0.014	Yes	V	0.01	1.40E-04
BT39-002	02E0015-002	OCDD	0.076	Yes	V	0.0001	7.60E-06
BT39-002	02E0015-002	OCDF	0.0055	Yes	JB	0.0001	5.50E-07
BT39-002	02E0015-002	Pentachlorodibenzo-p-dioxin	4.50E-04	Yes	V	1	4.50E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-002:							**0.003**
BT39-003	02E0015-003	1,2,3,4,6,7,8-HpCDF	0.0087	Yes	V	0.01	8.70E-05
BT39-003	02E0015-003	1,2,3,4,7,8,9-HpCDF	2.70E-04	No	V	0.01	0
BT39-003	02E0015-003	1,2,3,4,7,8-HxCDD	4.70E-04	Yes	JB	0.1	4.70E-05
BT39-003	02E0015-003	1,2,3,4,7,8-HxCDF	0.0015	Yes	JB	0.1	1.50E-04
BT39-003	02E0015-003	1,2,3,6,7,8-HxCDD	0.0012	Yes	V	0.1	1.20E-04
BT39-003	02E0015-003	1,2,3,6,7,8-HxCDF	0.0012	Yes	JB	0.1	1.20E-04
BT39-003	02E0015-003	1,2,3,7,8,9-HxCDD	0.0011	Yes	V	0.1	1.10E-04
BT39-003	02E0015-003	1,2,3,7,8,9-HxCDF	1.50E-04	No	V	0.1	0
BT39-003	02E0015-003	1,2,3,7,8-PeCDF	0.0043	Yes	V	0.05	2.15E-04
BT39-003	02E0015-003	2,3,4,6,7,8-HxCDF	8.20E-04	Yes	V	0.1	8.20E-05
BT39-003	02E0015-003	2,3,4,7,8-PeCDF	0.0019	Yes	V	0.5	9.50E-04
BT39-003	02E0015-003	2,3,7,8-TCDD	0.0066	Yes	V	1	0.0066
BT39-003	02E0015-003	2,3,7,8-TCDF	0.012	Yes	V	0.1	0.0012
BT39-003	02E0015-003	Heptachlorodibenzo-p-dioxin	0.033	Yes	V	0.01	3.30E-04
BT39-003	02E0015-003	OCDD	0.29	Yes	V	0.0001	2.90E-05
BT39-003	02E0015-003	OCDF	0.011	Yes	V	0.0001	1.10E-06
BT39-003	02E0015-003	Pentachlorodibenzo-p-dioxin	8.20E-04	Yes	V	1	8.20E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-003:							**0.011**
BT39-004	02E0015-004	1,2,3,4,6,7,8-HpCDF	0.0014	Yes	JB	0.01	1.40E-05
BT39-004	02E0015-004	1,2,3,4,7,8,9-HpCDF	3.50E-04	No	V	0.01	0
BT39-004	02E0015-004	1,2,3,4,7,8-HxCDD	2.50E-04	No	V	0.1	0
BT39-004	02E0015-004	1,2,3,4,7,8-HxCDF	1.20E-04	No	V	0.1	0
BT39-004	02E0015-004	1,2,3,6,7,8-HxCDD	2.30E-04	No	V	0.1	0
BT39-004	02E0015-004	1,2,3,6,7,8-HxCDF	1.10E-04	No	V	0.1	0
BT39-004	02E0015-004	1,2,3,7,8,9-HxCDD	2.40E-04	No	V	0.1	0
BT39-004	02E0015-004	1,2,3,7,8,9-HxCDF	1.40E-04	No	V	0.1	0
BT39-004	02E0015-004	1,2,3,7,8-PeCDF	2.30E-04	No	V	0.05	0
BT39-004	02E0015-004	2,3,4,6,7,8-HxCDF	1.30E-04	No	V	0.1	0
BT39-004	02E0015-004	2,3,4,7,8-PeCDF	2.20E-04	No	V	0.5	0
BT39-004	02E0015-004	2,3,7,8-TCDD	0.0016	Yes	V	1	0.0016
BT39-004	02E0015-004	2,3,7,8-TCDF	7.60E-04	Yes	V	0.1	7.60E-05
BT39-004	02E0015-004	Heptachlorodibenzo-p-dioxin	0.0028	Yes	V	0.01	2.80E-05
BT39-004	02E0015-004	OCDD	0.018	Yes	V	0.0001	1.80E-06
BT39-004	02E0015-004	OCDF	0.002	Yes	JB	0.0001	2.00E-07
BT39-004	02E0015-004	Pentachlorodibenzo-p-dioxin	2.50E-04	No	V	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-004:							**0.002**
CB43-034	04F1620-005	1,2,3,4,6,7,8-HpCDF	0.02	Yes	V1	0.01	0.0002
CB43-034	04F1620-005	1,2,3,4,7,8,9-HpCDF	0.0035	Yes	JB1	0.01	3.50E-05
CB43-034	04F1620-005	1,2,3,4,7,8-HxCDD	0.0017	Yes	JB1	0.1	1.70E-04
CB43-034	04F1620-005	1,2,3,4,7,8-HxCDF	0.013	Yes	V1	0.1	0.0013
CB43-034	04F1620-005	1,2,3,6,7,8-HxCDD	0.0051	Yes	JB1	0.1	5.10E-04
CB43-034	04F1620-005	1,2,3,6,7,8-HxCDF	0.0049	Yes	V1	0.1	4.90E-04
CB43-034	04F1620-005	1,2,3,7,8,9-HxCDD	0.0036	Yes	JB1	0.1	3.60E-04

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Table 1.7

Toxicity Equivalency Calculations for Dioxins/Furans - Human Health Receptors

Sampling Location	Sample Number	Analyte	Result	Detect?	Validation Qualifier	TEF[a]	TEQ Concentration[b]
CB43-034	04F1620-005	1,2,3,7,8,9-HxCDF	1.60E-04	Yes	JB1	0.1	1.60E-05
CB43-034	04F1620-005	1,2,3,7,8-PeCDF	0.0021	Yes	JB1	0.05	1.05E-04
CB43-034	04F1620-005	2,3,4,6,7,8-HxCDF	0.0019	Yes	JB1	0.1	1.90E-04
CB43-034	04F1620-005	2,3,4,7,8-PeCDF	0.0067	Yes	V1	0.5	0.00335
CB43-034	04F1620-005	2,3,7,8-TCDD	0.0019	Yes	V1	1	0.0019
CB43-034	04F1620-005	2,3,7,8-TCDF	0.016	Yes	V1	0.1	0.0016
CB43-034	04F1620-005	Heptachlorodibenzo-p-dioxin	0.095	Yes	V1	0.01	9.50E-04
CB43-034	04F1620-005	OCDD	0.63	Yes	V1	0.0001	6.30E-05
CB43-034	04F1620-005	OCDF	0.036	Yes	V1	0.0001	3.60E-06
CB43-034	04F1620-005	Pentachlorodibenzo-p-dioxin	7.90E-04	Yes	JB1	1	7.90E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1620-005:							**0.012**
CB43-038	04F0770-013	1,2,3,4,6,7,8-HpCDF	0.0159	Yes	V	0.01	1.59E-04
CB43-038	04F0770-013	1,2,3,4,7,8,9-HpCDF	0.00186	Yes	V	0.01	1.86E-05
CB43-038	04F0770-013	1,2,3,4,7,8-HxCDD	0.00143	Yes	V	0.1	1.43E-04
CB43-038	04F0770-013	1,2,3,4,7,8-HxCDF	0.0168	Yes	V	0.1	0.00168
CB43-038	04F0770-013	1,2,3,6,7,8-HxCDD	0.00431	Yes	V	0.1	4.31E-04
CB43-038	04F0770-013	1,2,3,6,7,8-HxCDF	0.00627	Yes	V	0.1	6.27E-04
CB43-038	04F0770-013	1,2,3,7,8,9-HxCDD	0.00285	Yes	V	0.1	2.85E-04
CB43-038	04F0770-013	1,2,3,7,8,9-HxCDF	2.91E-04	Yes	V	0.1	2.91E-05
CB43-038	04F0770-013	1,2,3,7,8-PeCDF	0.0111	Yes	V	0.05	5.55E-04
CB43-038	04F0770-013	2,3,4,6,7,8-HxCDF	0.00259	Yes	V	0.1	2.59E-04
CB43-038	04F0770-013	2,3,4,7,8-PeCDF	0.0179	Yes	V	0.5	0.00895
CB43-038	04F0770-013	2,3,7,8-TCDD	4.32E-04	No	V	1	0
CB43-038	04F0770-013	2,3,7,8-TCDF	0.0496	Yes	V	0.1	0.00496
CB43-038	04F0770-013	Heptachlorodibenzo-p-dioxin	0.0646	Yes	V	0.01	6.46E-04
CB43-038	04F0770-013	OCDD	0.408	Yes	V	0.0001	4.08E-05
CB43-038	04F0770-013	OCDF	0.0173	Yes	V	0.0001	1.73E-06
CB43-038	04F0770-013	Pentachlorodibenzo-p-dioxin	0.00108	No	V	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F0770-013:							**0.019**
CB44-013	04F1558-010	1,2,3,4,6,7,8-HpCDF	0.0064	Yes	JB1	0.01	6.40E-05
CB44-013	04F1558-010	1,2,3,4,7,8,9-HpCDF	5.10E-04	Yes	JB1	0.01	5.10E-06
CB44-013	04F1558-010	1,2,3,4,7,8-HxCDD	4.10E-04	Yes	JB1	0.1	4.10E-05
CB44-013	04F1558-010	1,2,3,4,7,8-HxCDF	0.0013	Yes	JB1	0.1	1.30E-04
CB44-013	04F1558-010	1,2,3,6,7,8-HxCDD	0.0021	Yes	JB1	0.1	2.10E-04
CB44-013	04F1558-010	1,2,3,6,7,8-HxCDF	4.80E-04	Yes	JB1	0.1	4.80E-05
CB44-013	04F1558-010	1,2,3,7,8,9-HxCDD	0.0013	Yes	JB1	0.1	1.30E-04
CB44-013	04F1558-010	1,2,3,7,8,9-HxCDF	1.80E-04	No	V1	0.1	0
CB44-013	04F1558-010	1,2,3,7,8-PeCDF	1.60E-04	No	V1	0.05	0
CB44-013	04F1558-010	2,3,4,6,7,8-HxCDF	3.10E-04	Yes	JB1	0.1	3.10E-05
CB44-013	04F1558-010	2,3,4,7,8-PeCDF	3.90E-04	Yes	JB1	0.5	1.95E-04
CB44-013	04F1558-010	2,3,7,8-TCDD	3.00E-04	No	V1	1	0
CB44-013	04F1558-010	2,3,7,8-TCDF	9.50E-04	Yes	V1	0.1	9.50E-05
CB44-013	04F1558-010	Heptachlorodibenzo-p-dioxin	0.033	Yes	V1	0.01	3.30E-04
CB44-013	04F1558-010	OCDD	0.22	Yes	V1	0.0001	2.20E-05
CB44-013	04F1558-010	OCDF	0.011	Yes	V1	0.0001	1.10E-06
CB44-013	04F1558-010	Pentachlorodibenzo-p-dioxin	3.60E-04	Yes	JB1	1	3.60E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1558-010:							**0.002**
CB44-017	04F1556-001	1,2,3,4,6,7,8-HpCDF	0.0037	Yes	JB	0.01	3.70E-05
CB44-017	04F1556-001	1,2,3,4,7,8,9-HpCDF	2.60E-04	No	V	0.01	0
CB44-017	04F1556-001	1,2,3,4,7,8-HxCDD	4.40E-04	Yes	JB	0.1	4.40E-05
CB44-017	04F1556-001	1,2,3,4,7,8-HxCDF	0.001	Yes	JB	0.1	1.00E-04
CB44-017	04F1556-001	1,2,3,6,7,8-HxCDD	0.0018	Yes	JB	0.1	1.80E-04
CB44-017	04F1556-001	1,2,3,6,7,8-HxCDF	3.10E-04	Yes	JB	0.1	3.10E-05
CB44-017	04F1556-001	1,2,3,7,8,9-HxCDD	0.0012	Yes	JB	0.1	1.20E-04
CB44-017	04F1556-001	1,2,3,7,8,9-HxCDF	1.90E-04	No	V	0.1	0
CB44-017	04F1556-001	1,2,3,7,8-PeCDF	1.70E-04	No	V	0.05	0
CB44-017	04F1556-001	2,3,4,6,7,8-HxCDF	5.00E-04	Yes	JB	0.1	5.00E-05
CB44-017	04F1556-001	2,3,4,7,8-PeCDF	3.00E-04	Yes	JB	0.5	1.50E-04
CB44-017	04F1556-001	2,3,7,8-TCDD	2.80E-04	No	V	1	0
CB44-017	04F1556-001	2,3,7,8-TCDF	3.20E-04	No	V	0.1	0
CB44-017	04F1556-001	Heptachlorodibenzo-p-dioxin	0.03	Yes	V	0.01	3.00E-04
CB44-017	04F1556-001	OCDD	0.21	Yes	J	0.0001	2.10E-05
CB44-017	04F1556-001	OCDF	0.0051	Yes	JB	0.0001	5.10E-07
CB44-017	04F1556-001	Pentachlorodibenzo-p-dioxin	2.00E-04	No	V	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1556-001:							**0.001**
CC44-005	04F1372-008	1,2,3,4,6,7,8-HpCDF	7.20E-04	Yes	JB	0.01	7.20E-06
CC44-005	04F1372-008	1,2,3,4,7,8,9-HpCDF	9.30E-04	Yes	JB	0.01	9.30E-06

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Table 1.7
Toxicity Equivalency Calculations for Dioxins/Furans - Human Health Receptors

Sampling Location	Sample Number	Analyte	Result	Detect?	Validation Qualifier	TEF[a]	TEQ Concentration[b]
CC44-005	04F1372-008	1,2,3,4,7,8-HxCDD	2.00E-04	No	V	0.1	0
CC44-005	04F1372-008	1,2,3,4,7,8-HxCDF	1.50E-04	No	V	0.1	0
CC44-005	04F1372-008	1,2,3,6,7,8-HxCDD	3.90E-04	Yes	V	0.1	3.90E-05
CC44-005	04F1372-008	1,2,3,6,7,8-HxCDF	1.70E-04	Yes	JB	0.1	1.70E-05
CC44-005	04F1372-008	1,2,3,7,8,9-HxCDD	2.00E-04	No	V	0.1	0
CC44-005	04F1372-008	1,2,3,7,8,9-HxCDF	2.20E-04	No	V	0.1	0
CC44-005	04F1372-008	1,2,3,7,8-PeCDF	1.30E-04	No	V	0.05	0
CC44-005	04F1372-008	2,3,4,6,7,8-HxCDF	1.60E-04	No	V	0.1	0
CC44-005	04F1372-008	2,3,4,7,8-PeCDF	1.30E-04	No	V	0.5	0
CC44-005	04F1372-008	2,3,7,8-TCDD	2.50E-04	No	V	1	0
CC44-005	04F1372-008	2,3,7,8-TCDF	2.70E-04	No	V	0.1	0
CC44-005	04F1372-008	Heptachlorodibenzo-p-dioxin	0.0051	Yes	V	0.01	5.10E-05
CC44-005	04F1372-008	OCDD	0.042	No	UJ	0.0001	0
CC44-005	04F1372-008	OCDF	0.0041	Yes	JB	0.0001	4.10E-07
CC44-005	04F1372-008	Pentachlorodibenzo-p-dioxin	1.70E-04	No	V	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1372-008:							**1.24E-04**
2,3,7,8-TCDD TEQ Concentration used in Surface Soil/Surface Sediment PRG Screenc:							**0.019**

[a] Toxicity Equivalency Factor (WHO, 1997).

[b] TEQ (Toxicity Equivalence) Concentration = Soil Concentration x TEF. For non-detects, the TEQ Concentration equals zero.

[c] The TEQ concentration used in the PRG screen is the maximum of all sampling locations for the medium.

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Table 1.8
Toxicity Equivalency Calculations for Dioxins/Furans - Ecological Receptors

Sampling Location	Sample Number	Congener	Result	Detect?	Validation Qualifier	Mammals TEF[a]	Mammals TEQ Concentration[b]	Birds TEF[a]	Birds TEQ Concentration[b]
Surface Soil (µg/kg)									
BT38-001	02E0015-005	1,2,3,4,6,7,8-HpCDF	0.0057	Yes	V	0.01	5.70E-05	0.01	5.70E-05
BT38-001	02E0015-005	1,2,3,4,7,8,9-HpCDF	3.30E-04	No	V	0.01	0	0.01	0
BT38-001	02E0015-005	1,2,3,4,7,8-HxCDD	3.00E-04	No	V	0.1	0	0.05	0
BT38-001	02E0015-005	1,2,3,4,7,8-HxCDF	5.40E-04	Yes	JB	0.1	5.40E-05	0.1	5.40E-05
BT38-001	02E0015-005	1,2,3,6,7,8-HxCDD	9.70E-04	Yes	V	0.1	9.70E-05	0.01	9.70E-06
BT38-001	02E0015-005	1,2,3,6,7,8-HxCDF	4.30E-04	Yes	JB	0.1	4.30E-05	0.1	4.30E-05
BT38-001	02E0015-005	1,2,3,7,8,9-HxCDD	2.80E-04	No	V	0.1	0	0.1	0
BT38-001	02E0015-005	1,2,3,7,8,9-HxCDF	1.60E-04	No	V	0.1	0	0.1	0
BT38-001	02E0015-005	1,2,3,7,8-PeCDF	0.0012	Yes	V	0.05	6.00E-05	0.1	1.20E-04
BT38-001	02E0015-005	2,3,4,6,7,8-HxCDF	4.30E-04	Yes	V	0.1	4.30E-05	0.1	4.30E-05
BT38-001	02E0015-005	2,3,4,7,8-PeCDF	6.50E-04	Yes	V	0.5	3.25E-04	1	6.50E-04
BT38-001	02E0015-005	2,3,7,8-TCDD	0.0056	Yes	V	1	0.0056	1	0.0056
BT38-001	02E0015-005	2,3,7,8-TCDF	0.0038	Yes	V	0.1	3.80E-04	1	0.0038
BT38-001	02E0015-005	Heptachlorodibenzo-p-dioxin	0.023	Yes	V	0.01	2.30E-04	0.001	2.30E-05
BT38-001	02E0015-005	OCDD	0.18	Yes	V	0.0001	1.80E-05	0.0001	1.80E-05
BT38-001	02E0015-005	OCDF	0.0089	Yes	V	0.0001	8.90E-07	0.0001	8.90E-07
BT38-001	02E0015-005	Pentachlorodibenzo-p-dioxin	6.50E-04	Yes	V	1	6.50E-04	1	6.50E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-005:[c]							0.008		0.011
BT38-002	02E0015-006	1,2,3,4,6,7,8-HpCDF	0.0035	Yes	V	0.01	3.50E-05	0.01	3.50E-05
BT38-002	02E0015-006	1,2,3,4,7,8,9-HpCDF	5.10E-04	No	V	0.01	0	0.01	0
BT38-002	02E0015-006	1,2,3,4,7,8-HxCDD	3.80E-04	No	V	0.1	0	0.05	0
BT38-002	02E0015-006	1,2,3,4,7,8-HxCDF	5.30E-04	Yes	JB	0.1	5.30E-05	0.1	5.30E-05
BT38-002	02E0015-006	1,2,3,6,7,8-HxCDD	8.40E-04	Yes	V	0.1	8.40E-05	0.01	8.40E-06
BT38-002	02E0015-006	1,2,3,6,7,8-HxCDF	5.30E-04	Yes	V	0.1	5.30E-05	0.1	5.30E-05
BT38-002	02E0015-006	1,2,3,7,8,9-HxCDD	6.30E-04	Yes	V	0.1	6.30E-05	0.1	6.30E-05
BT38-002	02E0015-006	1,2,3,7,8,9-HxCDF	2.60E-04	No	V	0.1	0	0.1	0
BT38-002	02E0015-006	1,2,3,7,8-PeCDF	3.00E-04	No	V	0.05	0	0.1	0
BT38-002	02E0015-006	2,3,4,6,7,8-HxCDF	2.30E-04	No	V	0.1	0	0.1	0
BT38-002	02E0015-006	2,3,4,7,8-PeCDF	4.20E-04	Yes	V	0.5	2.10E-04	1	4.20E-04
BT38-002	02E0015-006	2,3,7,8-TCDD	0.0035	Yes	V	1	0.0035	1	0.0035
BT38-002	02E0015-006	2,3,7,8-TCDF	0.0026	Yes	V	0.1	2.60E-04	1	0.0026
BT38-002	02E0015-006	Heptachlorodibenzo-p-dioxin	0.013	Yes	V	0.01	1.30E-04	0.001	1.30E-05
BT38-002	02E0015-006	OCDD	0.088	Yes	V	0.0001	8.80E-06	0.0001	8.80E-06
BT38-002	02E0015-006	OCDF	0.016	Yes	V	0.0001	1.60E-06	0.0001	1.60E-06
BT38-002	02E0015-006	Pentachlorodibenzo-p-dioxin	6.30E-04	Yes	V	1	6.30E-04	1	6.30E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-006:[c]							0.005		0.007
BT38-002	02E0015-007	1,2,3,4,6,7,8-HpCDF	0.0034	Yes	V	0.01	3.40E-05	0.01	3.40E-05
BT38-002	02E0015-007	1,2,3,4,7,8,9-HpCDF	3.20E-04	No	V	0.01	0	0.01	0
BT38-002	02E0015-007	1,2,3,4,7,8-HxCDD	2.60E-04	No	V	0.1	0	0.05	0
BT38-002	02E0015-007	1,2,3,4,7,8-HxCDF	6.70E-04	Yes	JB	0.1	6.70E-05	0.1	6.70E-05
BT38-002	02E0015-007	1,2,3,6,7,8-HxCDD	6.70E-04	Yes	V	0.1	6.70E-05	0.01	6.70E-06
BT38-002	02E0015-007	1,2,3,6,7,8-HxCDF	5.50E-04	Yes	JB	0.1	5.50E-05	0.1	5.50E-05
BT38-002	02E0015-007	1,2,3,7,8,9-HxCDD	6.70E-04	Yes	V	0.1	6.70E-05	0.1	6.70E-05
BT38-002	02E0015-007	1,2,3,7,8,9-HxCDF	1.80E-04	No	V	0.1	0	0.1	0
BT38-002	02E0015-007	1,2,3,7,8-PeCDF	8.90E-04	Yes	V	0.05	4.45E-05	0.1	8.90E-05
BT38-002	02E0015-007	2,3,4,6,7,8-HxCDF	4.40E-04	Yes	V	0.1	4.40E-05	0.1	4.40E-05
BT38-002	02E0015-007	2,3,4,7,8-PeCDF	4.40E-04	Yes	V	0.5	2.20E-04	1	4.40E-04
BT38-002	02E0015-007	2,3,7,8-TCDD	0.0068	Yes	V	1	0.0068	1	0.0068
BT38-002	02E0015-007	2,3,7,8-TCDF	0.0042	Yes	V	0.1	4.20E-04	1	0.0042
BT38-002	02E0015-007	Heptachlorodibenzo-p-dioxin	0.0085	Yes	V	0.01	8.50E-05	0.001	8.50E-06
BT38-002	02E0015-007	OCDD	0.057	Yes	V	0.0001	5.70E-06	0.0001	5.70E-06
BT38-002	02E0015-007	OCDF	0.0037	Yes	JB	0.0001	3.70E-07	0.0001	3.70E-07
BT38-002	02E0015-007	Pentachlorodibenzo-p-dioxin	6.70E-04	Yes	V	1	6.70E-04	1	6.70E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-007:[c]							0.009		0.012
BT39-001	02E0015-001	1,2,3,4,6,7,8-HpCDF	0.0062	Yes	V	0.01	6.20E-05	0.01	6.20E-05
BT39-001	02E0015-001	1,2,3,4,7,8,9-HpCDF	1.50E-04	No	V	0.01	0	0.01	0
BT39-001	02E0015-001	1,2,3,4,7,8-HxCDD	2.30E-04	Yes	JB	0.1	2.30E-05	0.05	1.15E-05
BT39-001	02E0015-001	1,2,3,4,7,8-HxCDF	6.80E-04	Yes	JB	0.1	6.80E-05	0.1	6.80E-05
BT39-001	02E0015-001	1,2,3,6,7,8-HxCDD	5.60E-04	Yes	V	0.1	5.60E-05	0.01	5.60E-06
BT39-001	02E0015-001	1,2,3,6,7,8-HxCDF	9.00E-04	Yes	JB	0.1	9.00E-05	0.1	9.00E-05
BT39-001	02E0015-001	1,2,3,7,8,9-HxCDD	4.50E-04	Yes	V	0.1	4.50E-05	0.1	4.50E-05
BT39-001	02E0015-001	1,2,3,7,8,9-HxCDF	9.50E-05	No	V	0.1	0	0.1	0
BT39-001	02E0015-001	1,2,3,7,8-PeCDF	7.90E-04	Yes	V	0.05	3.95E-05	0.1	7.90E-05
BT39-001	02E0015-001	2,3,4,6,7,8-HxCDF	3.40E-04	Yes	V	0.1	3.40E-05	0.1	3.40E-05
BT39-001	02E0015-001	2,3,4,7,8-PeCDF	5.60E-04	Yes	V	0.5	2.80E-04	1	5.60E-04
BT39-001	02E0015-001	2,3,7,8-TCDD	0.0035	Yes	V	1	0.0035	1	0.0035
BT39-001	02E0015-001	2,3,7,8-TCDF	0.0036	Yes	V	0.1	3.60E-04	1	0.0036
BT39-001	02E0015-001	Heptachlorodibenzo-p-dioxin	0.011	Yes	V	0.01	1.10E-04	0.001	1.10E-05
BT39-001	02E0015-001	OCDD	0.084	Yes	V	0.0001	8.40E-06	0.0001	8.40E-06
BT39-001	02E0015-001	OCDF	0.0051	Yes	JB	0.0001	5.10E-07	0.0001	5.10E-07
BT39-001	02E0015-001	Pentachlorodibenzo-p-dioxin	5.60E-04	Yes	V	1	5.60E-04	1	5.60E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-001:[c]							0.005		0.009
BT39-002	02E0015-002	1,2,3,4,6,7,8-HpCDF	0.0038	Yes	V	0.01	3.80E-05	0.01	3.80E-05
BT39-002	02E0015-002	1,2,3,4,7,8,9-HpCDF	3.40E-04	Yes	JB	0.01	3.40E-06	0.01	3.40E-06
BT39-002	02E0015-002	1,2,3,4,7,8-HxCDD	2.20E-04	Yes	JB	0.1	2.20E-05	0.05	1.10E-05
BT39-002	02E0015-002	1,2,3,4,7,8-HxCDF	4.50E-04	Yes	JB	0.1	4.50E-05	0.1	4.50E-05

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Table 1.8
Toxicity Equivalency Calculations for Dioxins/Furans - Ecological Receptors

Sampling Location	Sample Number	Congener	Result	Detect?	Validation Qualifier	Mammals TEF[a]	Mammals TEQ Concentration[b]	Birds TEF[a]	Birds TEQ Concentration[b]
BT39-002	02E0015-002	1,2,3,6,7,8-HxCDD	5.60E-04	Yes	V	0.1	5.60E-05	0.01	5.60E-06
BT39-002	02E0015-002	1,2,3,6,7,8-HxCDF	6.70E-04	Yes	JB	0.1	6.70E-05	0.1	6.70E-05
BT39-002	02E0015-002	1,2,3,7,8,9-HxCDD	7.90E-04	Yes	V	0.1	7.90E-05	0.1	7.90E-05
BT39-002	02E0015-002	1,2,3,7,8,9-HxCDF	2.20E-04	Yes	JB	0.1	2.20E-05	0.1	2.20E-05
BT39-002	02E0015-002	1,2,3,7,8-PeCDF	1.40E-04	No	V	0.05	0	0.1	0
BT39-002	02E0015-002	2,3,4,6,7,8-HxCDF	3.40E-04	Yes	V	0.1	3.40E-05	0.1	3.40E-05
BT39-002	02E0015-002	2,3,4,7,8-PeCDF	1.40E-04	No	V	0.5	0	1	0
BT39-002	02E0015-002	2,3,7,8-TCDD	0.0016	Yes	V	1	0.0016	1	0.0016
BT39-002	02E0015-002	2,3,7,8-TCDF	7.90E-04	Yes	V	0.1	7.90E-05	1	7.90E-04
BT39-002	02E0015-002	Heptachlorodibenzo-p-dioxin	0.014	Yes	V	0.01	1.40E-04	0.001	1.40E-05
BT39-002	02E0015-002	OCDD	0.076	Yes	V	0.0001	7.60E-06	0.0001	7.60E-06
BT39-002	02E0015-002	OCDF	0.0055	Yes	JB	0.0001	5.50E-07	0.0001	5.50E-07
BT39-002	02E0015-002	Pentachlorodibenzo-p-dioxin	4.50E-04	Yes	V	1	4.50E-04	1	4.50E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-002:[c]							**0.003**		**0.003**
BT39-003	02E0015-003	1,2,3,4,6,7,8-HpCDF	0.0087	Yes	V	0.01	8.70E-05	0.01	8.70E-05
BT39-003	02E0015-003	1,2,3,4,7,8,9-HpCDF	2.70E-04	No	V	0.01	0	0.01	0
BT39-003	02E0015-003	1,2,3,4,7,8-HxCDD	4.70E-04	Yes	JB	0.1	4.70E-05	0.05	2.35E-05
BT39-003	02E0015-003	1,2,3,4,7,8-HxCDF	0.0015	Yes	JB	0.1	1.50E-04	0.1	1.50E-04
BT39-003	02E0015-003	1,2,3,6,7,8-HxCDD	0.0012	Yes	V	0.1	1.20E-04	0.01	1.20E-05
BT39-003	02E0015-003	1,2,3,6,7,8-HxCDF	0.0012	Yes	JB	0.1	1.20E-04	0.1	1.20E-04
BT39-003	02E0015-003	1,2,3,7,8,9-HxCDD	0.0011	Yes	V	0.1	1.10E-04	0.1	1.10E-04
BT39-003	02E0015-003	1,2,3,7,8,9-HxCDF	1.50E-04	No	V	0.1	0	0.1	0
BT39-003	02E0015-003	1,2,3,7,8-PeCDF	0.0043	Yes	V	0.05	2.15E-04	0.1	4.30E-04
BT39-003	02E0015-003	2,3,4,6,7,8-HxCDF	8.20E-04	Yes	V	0.1	8.20E-05	0.1	8.20E-05
BT39-003	02E0015-003	2,3,4,7,8-PeCDF	0.0019	Yes	V	0.5	9.50E-04	1	0.0019
BT39-003	02E0015-003	2,3,7,8-TCDD	0.0066	Yes	V	1	0.0066	1	0.0066
BT39-003	02E0015-003	2,3,7,8-TCDF	0.012	Yes	V	0.1	0.0012	1	0.012
BT39-003	02E0015-003	Heptachlorodibenzo-p-dioxin	0.033	Yes	V	0.01	3.30E-04	0.001	3.30E-05
BT39-003	02E0015-003	OCDD	0.29	Yes	V	0.0001	2.90E-05	0.0001	2.90E-05
BT39-003	02E0015-003	OCDF	0.011	Yes	V	0.0001	1.10E-06	0.0001	1.10E-06
BT39-003	02E0015-003	Pentachlorodibenzo-p-dioxin	8.20E-04	Yes	V	1	8.20E-04	1	8.20E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-003:[c]							**0.011**		**0.022**
BT39-004	02E0015-004	1,2,3,4,6,7,8-HpCDF	0.0014	Yes	JB	0.01	1.40E-05	0.01	1.40E-05
BT39-004	02E0015-004	1,2,3,4,7,8,9-HpCDF	3.50E-04	No	V	0.01	0	0.01	0
BT39-004	02E0015-004	1,2,3,4,7,8-HxCDD	2.50E-04	No	V	0.1	0	0.05	0
BT39-004	02E0015-004	1,2,3,4,7,8-HxCDF	1.20E-04	No	V	0.1	0	0.1	0
BT39-004	02E0015-004	1,2,3,6,7,8-HxCDD	2.30E-04	No	V	0.1	0	0.01	0
BT39-004	02E0015-004	1,2,3,6,7,8-HxCDF	1.10E-04	No	V	0.1	0	0.1	0
BT39-004	02E0015-004	1,2,3,7,8,9-HxCDD	2.40E-04	No	V	0.1	0	0.1	0
BT39-004	02E0015-004	1,2,3,7,8,9-HxCDF	1.40E-04	No	V	0.1	0	0.1	0
BT39-004	02E0015-004	1,2,3,7,8-PeCDF	2.30E-04	No	V	0.05	0	0.1	0
BT39-004	02E0015-004	2,3,4,6,7,8-HxCDF	1.30E-04	No	V	0.1	0	0.1	0
BT39-004	02E0015-004	2,3,4,7,8-PeCDF	2.20E-04	No	V	0.5	0	1	0
BT39-004	02E0015-004	2,3,7,8-TCDD	0.0016	Yes	V	1	0.0016	1	0.0016
BT39-004	02E0015-004	2,3,7,8-TCDF	7.60E-04	Yes	V	0.1	7.60E-05	1	7.60E-04
BT39-004	02E0015-004	Heptachlorodibenzo-p-dioxin	0.0028	Yes	V	0.01	2.80E-05	0.001	2.80E-06
BT39-004	02E0015-004	OCDD	0.018	Yes	V	0.0001	1.80E-06	0.0001	1.80E-06
BT39-004	02E0015-004	OCDF	0.002	Yes	JB	0.0001	2.00E-07	0.0001	2.00E-07
BT39-004	02E0015-004	Pentachlorodibenzo-p-dioxin	2.50E-04	No	V	1	0	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 02E0015-004:[c]							**0.002**		**0.002**
CB43-034	04F1620-005	1,2,3,4,6,7,8-HpCDF	0.02	Yes	V1	0.01	2.00E-04	0.01	2.00E-04
CB43-034	04F1620-005	1,2,3,4,7,8,9-HpCDF	0.0035	Yes	JB1	0.01	3.50E-05	0.01	3.50E-05
CB43-034	04F1620-005	1,2,3,4,7,8-HxCDD	0.0017	Yes	JB1	0.1	1.70E-04	0.05	8.50E-05
CB43-034	04F1620-005	1,2,3,4,7,8-HxCDF	0.013	Yes	V1	0.1	0.0013	0.1	0.0013
CB43-034	04F1620-005	1,2,3,6,7,8-HxCDD	0.0051	Yes	JB1	0.1	5.10E-04	0.01	5.10E-05
CB43-034	04F1620-005	1,2,3,6,7,8-HxCDF	0.0049	Yes	V1	0.1	4.90E-04	0.1	4.90E-04
CB43-034	04F1620-005	1,2,3,7,8,9-HxCDD	0.0036	Yes	JB1	0.1	3.60E-04	0.1	3.60E-04
CB43-034	04F1620-005	1,2,3,7,8,9-HxCDF	1.60E-04	Yes	JB1	0.1	1.60E-05	0.1	1.60E-05
CB43-034	04F1620-005	1,2,3,7,8-PeCDF	0.0021	Yes	JB1	0.05	1.05E-04	0.1	2.10E-04
CB43-034	04F1620-005	2,3,4,6,7,8-HxCDF	0.0019	Yes	JB1	0.1	1.90E-04	0.1	1.90E-04
CB43-034	04F1620-005	2,3,4,7,8-PeCDF	0.0067	Yes	V1	0.5	0.00335	1	0.0067
CB43-034	04F1620-005	2,3,7,8-TCDD	0.0019	Yes	V1	1	0.0019	1	0.0019
CB43-034	04F1620-005	2,3,7,8-TCDF	0.016	Yes	V1	0.1	0.0016	1	0.016
CB43-034	04F1620-005	Heptachlorodibenzo-p-dioxin	0.095	Yes	V1	0.01	9.50E-04	0.001	9.50E-05
CB43-034	04F1620-005	OCDD	0.63	Yes	V1	0.0001	6.30E-05	0.0001	6.30E-05
CB43-034	04F1620-005	OCDF	0.036	Yes	V1	0.0001	3.60E-06	0.0001	3.60E-06
CB43-034	04F1620-005	Pentachlorodibenzo-p-dioxin	7.90E-04	Yes	JB1	1	7.90E-04	1	7.90E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1620-005:[c]							**0.012**		**0.028**
CB43-038	04F0770-013	1,2,3,4,6,7,8-HpCDF	0.0159	Yes	V	0.01	1.59E-04	0.01	1.59E-04
CB43-038	04F0770-013	1,2,3,4,7,8,9-HpCDF	0.00186	Yes	V	0.01	1.86E-05	0.01	1.86E-05
CB43-038	04F0770-013	1,2,3,4,7,8-HxCDD	0.00143	Yes	V	0.1	1.43E-04	0.05	7.15E-05
CB43-038	04F0770-013	1,2,3,4,7,8-HxCDF	0.0168	Yes	V	0.1	0.00168	0.1	0.00168
CB43-038	04F0770-013	1,2,3,6,7,8-HxCDD	0.00431	Yes	V	0.1	4.31E-04	0.01	4.31E-05
CB43-038	04F0770-013	1,2,3,6,7,8-HxCDF	0.00627	Yes	V	0.1	6.27E-04	0.1	6.27E-04
CB43-038	04F0770-013	1,2,3,7,8,9-HxCDD	0.00285	Yes	V	0.1	2.85E-04	0.1	2.85E-04
CB43-038	04F0770-013	1,2,3,7,8,9-HxCDF	2.91E-04	Yes	V	0.1	2.91E-05	0.1	2.91E-05
CB43-038	04F0770-013	1,2,3,7,8-PeCDF	0.0111	Yes	V	0.05	5.55E-04	0.1	0.00111

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Table 1.8
Toxicity Equivalency Calculations for Dioxins/Furans - Ecological Receptors

Sampling Location	Sample Number	Congener	Result	Detect?	Validation Qualifier	Mammals TEF	Mammals TEQ Concentration	Birds TEF	Birds TEQ Concentration
CB43-038	04F0770-013	2,3,4,6,7,8-HxCDF	0.00259	Yes	V	0.1	2.59E-04	0.1	2.59E-04
CB43-038	04F0770-013	2,3,4,7,8-PeCDF	0.0179	Yes	V	0.5	0.00895	1	0.0179
CB43-038	04F0770-013	2,3,7,8-TCDD	4.32E-04	No	V	1	0	1	0
CB43-038	04F0770-013	2,3,7,8-TCDF	0.0496	Yes	V	0.1	0.00496	1	0.0496
CB43-038	04F0770-013	Heptachlorodibenzo-p-dioxin	0.0646	Yes	V	0.01	6.46E-04	0.001	6.46E-05
CB43-038	04F0770-013	OCDD	0.408	Yes	V	0.0001	4.08E-05	0.0001	4.08E-05
CB43-038	04F0770-013	OCDF	0.0173	Yes	V	0.0001	1.73E-06	0.0001	1.73E-06
CB43-038	04F0770-013	Pentachlorodibenzo-p-dioxin	0.001	No	V	1	0	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F0770-013:[c]							**0.019**		**0.072**
CB44-013	04F1558-010	1,2,3,4,6,7,8-HpCDF	0.0064	Yes	JB1	0.01	6.40E-05	0.01	6.40E-05
CB44-013	04F1558-010	1,2,3,4,7,8,9-HpCDF	5.10E-04	Yes	JB1	0.01	5.10E-06	0.01	5.10E-06
CB44-013	04F1558-010	1,2,3,4,7,8-HxCDD	4.10E-04	Yes	JB1	0.1	4.10E-05	0.05	2.05E-05
CB44-013	04F1558-010	1,2,3,4,7,8-HxCDF	0.0013	Yes	JB1	0.1	1.30E-04	0.1	1.30E-04
CB44-013	04F1558-010	1,2,3,6,7,8-HxCDD	0.0021	Yes	JB1	0.1	2.10E-04	0.01	2.10E-05
CB44-013	04F1558-010	1,2,3,6,7,8-HxCDF	4.80E-04	Yes	JB1	0.1	4.80E-05	0.1	4.80E-05
CB44-013	04F1558-010	1,2,3,7,8,9-HxCDD	0.0013	Yes	JB1	0.1	1.30E-04	0.1	1.30E-04
CB44-013	04F1558-010	1,2,3,7,8,9-HxCDF	1.80E-04	No	V1	0.1	0	0.1	0
CB44-013	04F1558-010	1,2,3,7,8-PeCDF	1.60E-04	No	V1	0.05	0	0.1	0
CB44-013	04F1558-010	2,3,4,6,7,8-HxCDF	3.10E-04	Yes	JB1	0.1	3.10E-05	0.1	3.10E-05
CB44-013	04F1558-010	2,3,4,7,8-PeCDF	3.90E-04	Yes	JB1	0.5	1.95E-04	1	3.90E-04
CB44-013	04F1558-010	2,3,7,8-TCDD	3.00E-04	No	V1	1	0	1	0
CB44-013	04F1558-010	2,3,7,8-TCDF	9.50E-04	Yes	V1	0.1	9.50E-05	1	9.50E-04
CB44-013	04F1558-010	Heptachlorodibenzo-p-dioxin	0.033	Yes	V1	0.01	3.30E-04	0.001	3.30E-05
CB44-013	04F1558-010	OCDD	0.22	Yes	V1	0.0001	2.20E-05	0.0001	2.20E-05
CB44-013	04F1558-010	OCDF	0.011	Yes	V1	0.0001	1.10E-06	0.0001	1.10E-06
CB44-013	04F1558-010	Pentachlorodibenzo-p-dioxin	3.60E-04	Yes	JB1	1	3.60E-04	1	3.60E-04
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1558-010:[c]							**0.002**		**0.002**
CB44-017	04F1556-001	1,2,3,4,6,7,8-HpCDF	0.0037	Yes	JB	0.01	3.70E-05	0.01	3.70E-05
CB44-017	04F1556-001	1,2,3,4,7,8,9-HpCDF	2.60E-04	No	V	0.01	0	0.01	0
CB44-017	04F1556-001	1,2,3,4,7,8-HxCDD	4.40E-04	Yes	JB	0.1	4.40E-05	0.05	2.20E-05
CB44-017	04F1556-001	1,2,3,4,7,8-HxCDF	0.001	Yes	JB	0.1	1.00E-04	0.1	1.00E-04
CB44-017	04F1556-001	1,2,3,6,7,8-HxCDD	0.0018	Yes	JB	0.1	1.80E-04	0.01	1.80E-05
CB44-017	04F1556-001	1,2,3,6,7,8-HxCDF	3.10E-04	Yes	JB	0.1	3.10E-05	0.1	3.10E-05
CB44-017	04F1556-001	1,2,3,7,8,9-HxCDD	0.0012	Yes	JB	0.1	1.20E-04	0.1	1.20E-04
CB44-017	04F1556-001	1,2,3,7,8,9-HxCDF	1.90E-04	No	V	0.1	0	0.1	0
CB44-017	04F1556-001	1,2,3,7,8-PeCDF	1.70E-04	No	V	0.05	0	0.1	0
CB44-017	04F1556-001	2,3,4,6,7,8-HxCDF	5.00E-04	Yes	JB	0.1	5.00E-05	0.1	5.00E-05
CB44-017	04F1556-001	2,3,4,7,8-PeCDF	3.00E-04	Yes	JB	0.5	1.50E-04	1	3.00E-04
CB44-017	04F1556-001	2,3,7,8-TCDD	2.80E-04	No	V	1	0	1	0
CB44-017	04F1556-001	2,3,7,8-TCDF	3.20E-04	No	V	0.1	0	1	0
CB44-017	04F1556-001	Heptachlorodibenzo-p-dioxin	0.03	Yes	V	0.01	3.00E-04	0.001	3.00E-05
CB44-017	04F1556-001	OCDD	0.21	Yes	J	0.0001	2.10E-05	0.0001	2.10E-05
CB44-017	04F1556-001	OCDF	0.0051	Yes	JB	0.0001	5.10E-07	0.0001	5.10E-07
CB44-017	04F1556-001	Pentachlorodibenzo-p-dioxin	2.00E-04	No	V	1	0	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1556-001:[c]							**0.001**		**7.30E-04**
CC44-005	04F1372-008	1,2,3,4,6,7,8-HpCDF	7.20E-04	Yes	JB	0.01	7.20E-06	0.01	7.20E-06
CC44-005	04F1372-008	1,2,3,4,7,8,9-HpCDF	9.30E-04	Yes	JB	0.01	9.30E-06	0.01	9.30E-06
CC44-005	04F1372-008	1,2,3,4,7,8-HxCDD	2.00E-04	No	V	0.1	0	0.05	0
CC44-005	04F1372-008	1,2,3,4,7,8-HxCDF	1.50E-04	No	V	0.1	0	0.1	0
CC44-005	04F1372-008	1,2,3,6,7,8-HxCDD	3.90E-04	Yes	V	0.1	3.90E-05	0.01	3.90E-06
CC44-005	04F1372-008	1,2,3,6,7,8-HxCDF	1.70E-04	Yes	JB	0.1	1.70E-05	0.1	1.70E-05
CC44-005	04F1372-008	1,2,3,7,8,9-HxCDD	2.00E-04	No	V	0.1	0	0.1	0
CC44-005	04F1372-008	1,2,3,7,8,9-HxCDF	2.20E-04	No	V	0.1	0	0.1	0
CC44-005	04F1372-008	1,2,3,7,8-PeCDF	1.30E-04	No	V	0.05	0	0.1	0
CC44-005	04F1372-008	2,3,4,6,7,8-HxCDF	1.60E-04	No	V	0.1	0	0.1	0
CC44-005	04F1372-008	2,3,4,7,8-PeCDF	1.30E-04	No	V	0.5	0	1	0
CC44-005	04F1372-008	2,3,7,8-TCDD	2.50E-04	No	V	1	0	1	0
CC44-005	04F1372-008	2,3,7,8-TCDF	2.70E-04	No	V	0.1	0	1	0
CC44-005	04F1372-008	Heptachlorodibenzo-p-dioxin	0.0051	Yes	V	0.01	5.10E-05	0.001	5.10E-06
CC44-005	04F1372-008	OCDD	0.042	No	UJ	0.0001	0	0.0001	0
CC44-005	04F1372-008	OCDF	0.0041	Yes	JB	0.0001	4.10E-07	0.0001	4.10E-07
CC44-005	04F1372-008	Pentachlorodibenzo-p-dioxin	1.70E-04	No	V	1	0	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1372-008:[c]							**1.24E-04**		**4.29E-05**
2,3,7,8-TCDD TEQ Concentration used in Surface Soil ESL Screen[c]:							**0.019**		**0.072**
Subsurface Soil (µg/kg)									
CB43-034	04F1620-006	1,2,3,4,6,7,8-HpCDF	0.011	Yes	V1	0.01	1.10E-04	N/A	N/A
CB43-034	04F1620-006	1,2,3,4,7,8,9-HpCDF	0.001	Yes	JB1	0.01	1.00E-05	N/A	N/A
CB43-034	04F1620-006	1,2,3,4,7,8-HxCDD	2.20E-04	Yes	JB1	0.1	2.20E-05	N/A	N/A
CB43-034	04F1620-006	1,2,3,4,7,8-HxCDF	0.0031	Yes	JB1	0.1	3.10E-04	N/A	N/A
CB43-034	04F1620-006	1,2,3,6,7,8-HxCDD	0.0014	Yes	JB1	0.1	1.40E-04	N/A	N/A
CB43-034	04F1620-006	1,2,3,6,7,8-HxCDF	0.0013	Yes	JB1	0.1	1.30E-04	N/A	N/A
CB43-034	04F1620-006	1,2,3,7,8,9-HxCDD	6.10E-04	Yes	JB1	0.1	6.10E-05	N/A	N/A
CB43-034	04F1620-006	1,2,3,7,8,9-HxCDF	7.00E-05	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-006	1,2,3,7,8-PeCDF	3.50E-04	Yes	JB1	0.05	1.75E-05	N/A	N/A
CB43-034	04F1620-006	2,3,4,6,7,8-HxCDF	5.90E-04	Yes	JB1	0.1	5.90E-05	N/A	N/A
CB43-034	04F1620-006	2,3,4,7,8-PeCDF	0.0015	Yes	JB1	0.5	7.50E-04	N/A	N/A

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Table 1.8
Toxicity Equivalency Calculations for Dioxins/Furans - Ecological Receptors

Sampling Location	Sample Number	Congener	Result	Detect?	Validation Qualifier	Mammals		Birds	
						TEF[a]	TEQ Concentration[b]	TEF[a]	TEQ Concentration[b]
CB43-034	04F1620-006	2,3,7,8-TCDD	5.90E-04	Yes	V1	1	5.90E-04	N/A	N/A
CB43-034	04F1620-006	2,3,7,8-TCDF	0.0035	Yes	V1	0.1	3.50E-04	N/A	N/A
CB43-034	04F1620-006	Heptachlorodibenzo-p-dioxin	0.02	Yes	V1	0.01	2.00E-04	N/A	N/A
CB43-034	04F1620-006	OCDD	0.095	Yes	V1	0.0001	9.50E-06	N/A	N/A
CB43-034	04F1620-006	OCDF	0.015	Yes	JB1	0.0001	1.50E-06	N/A	N/A
CB43-034	04F1620-006	Pentachlorodibenzo-p-dioxin	2.00E-04	Yes	JB1	1	2.00E-04	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample04F1620-006:[c]							0.003		N/A
CB43-034	04F1620-007	1,2,3,4,6,7,8-HpCDF	3.90E-04	Yes	JB1	0.01	3.90E-06	N/A	N/A
CB43-034	04F1620-007	1,2,3,4,7,8,9-HpCDF	6.00E-05	No	V1	0.01	0	N/A	N/A
CB43-034	04F1620-007	1,2,3,4,7,8-HxCDD	7.60E-05	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-007	1,2,3,4,7,8-HxCDF	7.70E-05	Yes	JB1	0.1	7.70E-06	N/A	N/A
CB43-034	04F1620-007	1,2,3,6,7,8-HxCDD	7.90E-05	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-007	1,2,3,6,7,8-HxCDF	4.30E-05	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-007	1,2,3,7,8,9-HxCDD	7.20E-05	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-007	1,2,3,7,8,9-HxCDF	5.30E-05	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-007	1,2,3,7,8-PeCDF	5.90E-05	No	V1	0.05	0	N/A	N/A
CB43-034	04F1620-007	2,3,4,6,7,8-HxCDF	4.50E-05	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-007	2,3,4,7,8-PeCDF	4.80E-05	No	V1	0.5	0	N/A	N/A
CB43-034	04F1620-007	2,3,7,8-TCDD	1.40E-04	No	V1	1	0	N/A	N/A
CB43-034	04F1620-007	2,3,7,8-TCDF	1.20E-04	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-007	Heptachlorodibenzo-p-dioxin	8.70E-04	Yes	JB1	0.01	8.70E-06	N/A	N/A
CB43-034	04F1620-007	OCDD	0.0056	Yes	JB1	0.0001	5.60E-07	N/A	N/A
CB43-034	04F1620-007	OCDF	6.20E-04	Yes	JB1	0.0001	6.20E-08	N/A	N/A
CB43-034	04F1620-007	Pentachlorodibenzo-p-dioxin	9.20E-05	No	V1	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1620-007:[c]							2.09E-05		N/A
CB43-034	04F1620-008	1,2,3,4,6,7,8-HpCDF	1.20E-04	Yes	JB1	0.01	1.20E-06	N/A	N/A
CB43-034	04F1620-008	1,2,3,4,7,8,9-HpCDF	5.70E-05	No	V1	0.01	0	N/A	N/A
CB43-034	04F1620-008	1,2,3,4,7,8-HxCDD	6.60E-05	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-008	1,2,3,4,7,8-HxCDF	7.00E-05	Yes	JB1	0.1	7.00E-06	N/A	N/A
CB43-034	04F1620-008	1,2,3,6,7,8-HxCDD	7.10E-05	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-008	1,2,3,6,7,8-HxCDF	3.20E-05	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-008	1,2,3,7,8,9-HxCDD	6.40E-05	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-008	1,2,3,7,8,9-HxCDF	3.90E-05	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-008	1,2,3,7,8-PeCDF	4.70E-05	No	V1	0.05	0	N/A	N/A
CB43-034	04F1620-008	2,3,4,6,7,8-HxCDF	3.40E-05	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-008	2,3,4,7,8-PeCDF	4.00E-05	No	V1	0.5	0	N/A	N/A
CB43-034	04F1620-008	2,3,7,8-TCDD	1.30E-04	No	V1	1	0	N/A	N/A
CB43-034	04F1620-008	2,3,7,8-TCDF	1.10E-04	No	V1	0.1	0	N/A	N/A
CB43-034	04F1620-008	Heptachlorodibenzo-p-dioxin	2.20E-04	Yes	JB1	0.01	2.20E-06	N/A	N/A
CB43-034	04F1620-008	OCDD	0.0021	Yes	JB1	0.0001	2.10E-07	N/A	N/A
CB43-034	04F1620-008	OCDF	1.90E-04	Yes	JB1	0.0001	1.90E-08	N/A	N/A
CB43-034	04F1620-008	Pentachlorodibenzo-p-dioxin	7.00E-05	No	V1	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1620-008:[c]							1.06E-05		N/A
CB43-038	04F0770-014	1,2,3,4,6,7,8-HpCDF	0.00316	Yes	V	0.01	3.16E-05	N/A	N/A
CB43-038	04F0770-014	1,2,3,4,7,8,9-HpCDF	4.52E-04	Yes	V	0.01	4.52E-06	N/A	N/A
CB43-038	04F0770-014	1,2,3,4,7,8-HxCDD	0.0011	No	V	0.1	0	N/A	N/A
CB43-038	04F0770-014	1,2,3,4,7,8-HxCDF	0.003	Yes	V	0.1	3.00E-04	N/A	N/A
CB43-038	04F0770-014	1,2,3,6,7,8-HxCDD	0.0011	No	V	0.1	0	N/A	N/A
CB43-038	04F0770-014	1,2,3,6,7,8-HxCDF	9.61E-04	Yes	V	0.1	9.61E-05	N/A	N/A
CB43-038	04F0770-014	1,2,3,7,8,9-HxCDD	0.0011	No	V	0.1	0	N/A	N/A
CB43-038	04F0770-014	1,2,3,7,8,9-HxCDF	0.0011	No	V	0.1	0	N/A	N/A
CB43-038	04F0770-014	1,2,3,7,8-PeCDF	0.00327	Yes	V	0.05	1.64E-04	N/A	N/A
CB43-038	04F0770-014	2,3,4,6,7,8-HxCDF	0.0011	No	V	0.1	0	N/A	N/A
CB43-038	04F0770-014	2,3,4,7,8-PeCDF	0.00247	Yes	V	0.5	0.001	N/A	N/A
CB43-038	04F0770-014	2,3,7,8-TCDD	4.39E-04	No	V	1	0	N/A	N/A
CB43-038	04F0770-014	2,3,7,8-TCDF	0.0102	Yes	V	0.1	0.00102	N/A	N/A
CB43-038	04F0770-014	Heptachlorodibenzo-p-dioxin	0.0149	Yes	V	0.01	1.49E-04	N/A	N/A
CB43-038	04F0770-014	OCDD	0.0837	Yes	V	0.0001	8.37E-06	N/A	N/A
CB43-038	04F0770-014	OCDF	0.00425	Yes	V	0.0001	4.25E-07	N/A	N/A
CB43-038	04F0770-014	Pentachlorodibenzo-p-dioxin	0.0011	No	V	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F0770-014:[c]							0.003		N/A
CB44-013	04F1558-011	1,2,3,4,6,7,8-HpCDF	0.024	Yes	V1	0.01	2.40E-04	N/A	N/A
CB44-013	04F1558-011	1,2,3,4,7,8,9-HpCDF	0.0014	Yes	JB1	0.01	1.40E-05	N/A	N/A
CB44-013	04F1558-011	1,2,3,4,7,8-HxCDD	2.40E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-011	1,2,3,4,7,8-HxCDF	8.70E-04	Yes	JB1	0.1	8.70E-05	N/A	N/A
CB44-013	04F1558-011	1,2,3,6,7,8-HxCDD	0.0038	Yes	JB1	0.1	3.80E-04	N/A	N/A
CB44-013	04F1558-011	1,2,3,6,7,8-HxCDF	5.00E-04	Yes	JB1	0.1	5.00E-05	N/A	N/A
CB44-013	04F1558-011	1,2,3,7,8,9-HxCDD	0.0012	Yes	JB1	0.1	1.20E-04	N/A	N/A
CB44-013	04F1558-011	1,2,3,7,8,9-HxCDF	1.90E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-011	1,2,3,7,8-PeCDF	1.80E-04	No	V1	0.05	0	N/A	N/A
CB44-013	04F1558-011	2,3,4,6,7,8-HxCDF	3.50E-04	Yes	JB1	0.1	3.50E-05	N/A	N/A
CB44-013	04F1558-011	2,3,4,7,8-PeCDF	1.40E-04	No	V1	0.5	0	N/A	N/A
CB44-013	04F1558-011	2,3,7,8-TCDD	2.90E-04	No	V1	1	0	N/A	N/A
CB44-013	04F1558-011	2,3,7,8-TCDF	5.90E-04	Yes	V1	0.1	5.90E-05	N/A	N/A
CB44-013	04F1558-011	Heptachlorodibenzo-p-dioxin	0.029	Yes	V1	0.01	2.90E-04	N/A	N/A
CB44-013	04F1558-011	OCDD	0.047	Yes	JB1	0.0001	4.70E-06	N/A	N/A
CB44-013	04F1558-011	OCDF	0.026	Yes	V1	0.0001	2.60E-06	N/A	N/A

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Table 1.8
Toxicity Equivalency Calculations for Dioxins/Furans - Ecological Receptors

Sampling Location	Sample Number	Congener	Result	Detect?	Validation Qualifier	Mammals TEF[a]	Mammals TEQ Concentration[b]	Birds TEF[a]	Birds TEQ Concentration[b]
CB44-013	04F1558-011	Pentachlorodibenzo-p-dioxin	2.00E-04	No	V1	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1558-011:[c]							**0.001**		N/A
CB44-013	04F1558-012	1,2,3,4,6,7,8-HpCDF	0.0019	Yes	JB1	0.01	1.90E-05	N/A	N/A
CB44-013	04F1558-012	1,2,3,4,7,8,9-HpCDF	3.30E-04	No	V1	0.01	0	N/A	N/A
CB44-013	04F1558-012	1,2,3,4,7,8-HxCDD	2.90E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-012	1,2,3,4,7,8-HxCDF	1.70E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-012	1,2,3,6,7,8-HxCDD	3.20E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-012	1,2,3,6,7,8-HxCDF	1.70E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-012	1,2,3,7,8,9-HxCDD	2.90E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-012	1,2,3,7,8,9-HxCDF	2.20E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-012	1,2,3,7,8-PeCDF	1.90E-04	No	V1	0.05	0	N/A	N/A
CB44-013	04F1558-012	2,3,4,6,7,8-HxCDF	2.00E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-012	2,3,4,7,8-PeCDF	1.70E-04	No	V1	0.5	0	N/A	N/A
CB44-013	04F1558-012	2,3,7,8-TCDD	3.70E-04	No	V1	1	0	N/A	N/A
CB44-013	04F1558-012	2,3,7,8-TCDF	3.80E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-012	Heptachlorodibenzo-p-dioxin	0.002	Yes	JB1	0.01	2.00E-05	N/A	N/A
CB44-013	04F1558-012	OCDD	0.0047	Yes	JB1	0.0001	4.70E-07	N/A	N/A
CB44-013	04F1558-012	OCDF	0.002	Yes	JB1	0.0001	2.00E-07	N/A	N/A
CB44-013	04F1558-012	Pentachlorodibenzo-p-dioxin	2.40E-04	No	V1	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1558-012:[c]							**3.97E-05**		N/A
CB44-013	04F1558-013	1,2,3,4,6,7,8-HpCDF	3.60E-04	No	V1	0.01	0	N/A	N/A
CB44-013	04F1558-013	1,2,3,4,7,8,9-HpCDF	4.50E-04	No	V1	0.01	0	N/A	N/A
CB44-013	04F1558-013	1,2,3,4,7,8-HxCDD	3.50E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-013	1,2,3,4,7,8-HxCDF	2.00E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-013	1,2,3,6,7,8-HxCDD	3.50E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-013	1,2,3,6,7,8-HxCDF	2.10E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-013	1,2,3,7,8,9-HxCDD	3.40E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-013	1,2,3,7,8,9-HxCDF	2.80E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-013	1,2,3,7,8-PeCDF	2.20E-04	No	V1	0.05	0	N/A	N/A
CB44-013	04F1558-013	2,3,4,6,7,8-HxCDF	2.40E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-013	2,3,4,7,8-PeCDF	1.80E-04	No	V1	0.5	0	N/A	N/A
CB44-013	04F1558-013	2,3,7,8-TCDD	3.60E-04	No	V1	1	0	N/A	N/A
CB44-013	04F1558-013	2,3,7,8-TCDF	3.90E-04	No	V1	0.1	0	N/A	N/A
CB44-013	04F1558-013	Heptachlorodibenzo-p-dioxin	4.00E-04	No	V1	0.01	0	N/A	N/A
CB44-013	04F1558-013	OCDD	8.00E-04	No	V1	0.0001	0	N/A	N/A
CB44-013	04F1558-013	OCDF	6.60E-04	No	V1	0.0001	0	N/A	N/A
CB44-013	04F1558-013	Pentachlorodibenzo-p-dioxin	2.60E-04	No	V1	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1558-013:[c]							**0**		N/A
CB44-017	04F1556-002	1,2,3,4,6,7,8-HpCDF	8.90E-04	Yes	JB	0.01	8.90E-06	N/A	N/A
CB44-017	04F1556-002	1,2,3,4,7,8,9-HpCDF	8.80E-04	No	V	0.01	0	N/A	N/A
CB44-017	04F1556-002	1,2,3,4,7,8-HxCDD	5.00E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-002	1,2,3,4,7,8-HxCDF	2.60E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-002	1,2,3,6,7,8-HxCDD	5.40E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-002	1,2,3,6,7,8-HxCDF	2.50E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-002	1,2,3,7,8,9-HxCDD	5.00E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-002	1,2,3,7,8,9-HxCDF	4.10E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-002	1,2,3,7,8-PeCDF	2.50E-04	No	V	0.05	0	N/A	N/A
CB44-017	04F1556-002	2,3,4,6,7,8-HxCDF	3.00E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-002	2,3,4,7,8-PeCDF	2.10E-04	No	V	0.5	0	N/A	N/A
CB44-017	04F1556-002	2,3,7,8-TCDD	4.00E-04	No	V	1	0	N/A	N/A
CB44-017	04F1556-002	2,3,7,8-TCDF	4.00E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-002	Heptachlorodibenzo-p-dioxin	0.006	Yes	JB	0.01	5.60E-05	N/A	N/A
CB44-017	04F1556-002	OCDD	0.04	Yes	JB	0.0001	4.00E-06	N/A	N/A
CB44-017	04F1556-002	OCDF	0.0019	No	V	0.0001	0	N/A	N/A
CB44-017	04F1556-002	Pentachlorodibenzo-p-dioxin	3.10E-04	No	V	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1556-002:[c]							**6.89E-05**		N/A
CB44-017	04F1556-003	1,2,3,4,6,7,8-HpCDF	2.10E-04	No	V	0.01	0	N/A	N/A
CB44-017	04F1556-003	1,2,3,4,7,8,9-HpCDF	2.70E-04	No	V	0.01	0	N/A	N/A
CB44-017	04F1556-003	1,2,3,4,7,8-HxCDD	2.10E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-003	1,2,3,4,7,8-HxCDF	1.60E-04	Yes	JB	0.1	1.60E-05	N/A	N/A
CB44-017	04F1556-003	1,2,3,6,7,8-HxCDD	2.20E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-003	1,2,3,6,7,8-HxCDF	1.30E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-003	1,2,3,7,8,9-HxCDD	2.10E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-003	1,2,3,7,8,9-HxCDF	1.80E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-003	1,2,3,7,8-PeCDF	1.50E-04	No	V	0.05	0	N/A	N/A
CB44-017	04F1556-003	2,3,4,6,7,8-HxCDF	1.40E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-003	2,3,4,7,8-PeCDF	1.30E-04	No	V	0.5	0	N/A	N/A
CB44-017	04F1556-003	2,3,7,8-TCDD	3.40E-04	No	V	1	0	N/A	N/A
CB44-017	04F1556-003	2,3,7,8-TCDF	3.50E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-003	Heptachlorodibenzo-p-dioxin	0.0013	Yes	JB	0.01	1.30E-05	N/A	N/A
CB44-017	04F1556-003	OCDD	0.0072	Yes	JB	0.0001	7.20E-07	N/A	N/A
CB44-017	04F1556-003	OCDF	4.50E-04	No	V	0.0001	0	N/A	N/A
CB44-017	04F1556-003	Pentachlorodibenzo-p-dioxin	1.90E-04	No	V	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1556-003:[c]							**2.97E-05**		N/A
CB44-017	04F1556-004	1,2,3,4,6,7,8-HpCDF	2.90E-04	No	V	0.01	0	N/A	N/A
CB44-017	04F1556-004	1,2,3,4,7,8,9-HpCDF	3.60E-04	No	V	0.01	0	N/A	N/A
CB44-017	04F1556-004	1,2,3,4,7,8-HxCDD	3.00E-04	No	V	0.1	0	N/A	N/A

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Table 1.8

Toxicity Equivalency Calculations for Dioxins/Furans - Ecological Receptors

Sampling Location	Sample Number	Congener	Result	Detect?	Validation Qualifier	Mammals TEF[a]	Mammals TEQ Concentration[b]	Birds TEF[a]	Birds TEQ Concentration[b]
CB44-017	04F1556-004	1,2,3,4,7,8-HxCDF	1.60E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-004	1,2,3,6,7,8-HxCDD	3.20E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-004	1,2,3,6,7,8-HxCDF	1.60E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-004	1,2,3,7,8,9-HxCDD	3.00E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-004	1,2,3,7,8,9-HxCDF	2.40E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-004	1,2,3,7,8-PeCDF	6.30E-04	Yes	JB	0.05	3.15E-05	N/A	N/A
CB44-017	04F1556-004	2,3,4,6,7,8-HxCDF	1.80E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-004	2,3,4,7,8-PeCDF	1.70E-04	No	V	0.5	0	N/A	N/A
CB44-017	04F1556-004	2,3,7,8-TCDD	3.60E-04	No	V	1	0	N/A	N/A
CB44-017	04F1556-004	2,3,7,8-TCDF	3.70E-04	No	V	0.1	0	N/A	N/A
CB44-017	04F1556-004	Heptachlorodibenzo-p-dioxin	3.40E-04	No	V	0.01	0	N/A	N/A
CB44-017	04F1556-004	OCDD	0.0037	Yes	JB	0.0001	3.70E-07	N/A	N/A
CB44-017	04F1556-004	OCDF	6.20E-04	No	V	0.0001	0	N/A	N/A
CB44-017	04F1556-004	Pentachlorodibenzo-p-dioxin	2.20E-04	No	V	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1556-004:[c]							**3.19E-05**		N/A
CC42-014	04F0815-012	1,2,3,4,6,7,8-HpCDF	0.00319	Yes	V	0.01	3.19E-05	N/A	N/A
CC42-014	04F0815-012	1,2,3,4,7,8,9-HpCDF	0.00102	No	V	0.01	0	N/A	N/A
CC42-014	04F0815-012	1,2,3,4,7,8-HxCDD	0.00102	No	V	0.1	0	N/A	N/A
CC42-014	04F0815-012	1,2,3,4,7,8-HxCDF	0.00102	No	V	0.1	0	N/A	N/A
CC42-014	04F0815-012	1,2,3,6,7,8-HxCDD	8.09E-04	Yes	V	0.1	8.09E-05	N/A	N/A
CC42-014	04F0815-012	1,2,3,6,7,8-HxCDF	0.00102	No	V	0.1	0	N/A	N/A
CC42-014	04F0815-012	1,2,3,7,8,9-HxCDD	7.14E-04	Yes	V	0.1	7.14E-05	N/A	N/A
CC42-014	04F0815-012	1,2,3,7,8,9-HxCDF	0.00102	No	V	0.1	0	N/A	N/A
CC42-014	04F0815-012	1,2,3,7,8-PeCDF	0.00102	No	V	0.05	0	N/A	N/A
CC42-014	04F0815-012	2,3,4,6,7,8-HxCDF	0.00102	No	V	0.1	0	N/A	N/A
CC42-014	04F0815-012	2,3,4,7,8-PeCDF	0.00102	No	V	0.5	0	N/A	N/A
CC42-014	04F0815-012	2,3,7,8-TCDD	4.07E-04	No	V	1	0	N/A	N/A
CC42-014	04F0815-012	2,3,7,8-TCDF	4.07E-04	No	V	0.1	0	N/A	N/A
CC42-014	04F0815-012	Heptachlorodibenzo-p-dioxin	0.0156	Yes	V	0.01	1.56E-04	N/A	N/A
CC42-014	04F0815-012	OCDD	0.11	Yes	V	0.0001	1.10E-05	N/A	N/A
CC42-014	04F0815-012	OCDF	0.00725	Yes	V	0.0001	7.25E-07	N/A	N/A
CC42-014	04F0815-012	Pentachlorodibenzo-p-dioxin	0.00102	No	V	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F0815-012:[c]							**3.52E-04**		N/A
CC42-024	04F1230-011	1,2,3,4,6,7,8-HpCDF	2.20E-04	Yes	V	0.01	2.20E-06	N/A	N/A
CC42-024	04F1230-011	1,2,3,4,7,8,9-HpCDF	9.50E-05	No	V	0.01	0	N/A	N/A
CC42-024	04F1230-011	1,2,3,4,7,8-HxCDD	1.00E-04	Yes	V	0.1	1.00E-05	N/A	N/A
CC42-024	04F1230-011	1,2,3,4,7,8-HxCDF	1.40E-04	Yes	JB	0.1	1.40E-05	N/A	N/A
CC42-024	04F1230-011	1,2,3,6,7,8-HxCDD	1.40E-04	Yes	V	0.1	1.40E-05	N/A	N/A
CC42-024	04F1230-011	1,2,3,6,7,8-HxCDF	1.10E-04	Yes	JB	0.1	1.10E-05	N/A	N/A
CC42-024	04F1230-011	1,2,3,7,8,9-HxCDD	1.60E-04	Yes	V	0.1	1.60E-05	N/A	N/A
CC42-024	04F1230-011	1,2,3,7,8,9-HxCDF	7.60E-05	No	V	0.1	0	N/A	N/A
CC42-024	04F1230-011	1,2,3,7,8-PeCDF	6.50E-05	No	V	0.05	0	N/A	N/A
CC42-024	04F1230-011	2,3,4,6,7,8-HxCDF	1.30E-04	Yes	JB	0.1	1.30E-05	N/A	N/A
CC42-024	04F1230-011	2,3,4,7,8-PeCDF	1.70E-04	Yes	JB	0.5	8.50E-05	N/A	N/A
CC42-024	04F1230-011	2,3,7,8-TCDD	1.00E-04	No	V	1	0	N/A	N/A
CC42-024	04F1230-011	2,3,7,8-TCDF	1.70E-04	Yes	V	0.1	1.70E-05	N/A	N/A
CC42-024	04F1230-011	Heptachlorodibenzo-p-dioxin	0.0058	Yes	V	0.01	5.80E-05	N/A	N/A
CC42-024	04F1230-011	OCDD	0.42	Yes	V	0.0001	4.20E-05	N/A	N/A
CC42-024	04F1230-011	OCDF	4.50E-04	Yes	JB	0.0001	4.50E-08	N/A	N/A
CC42-024	04F1230-011	Pentachlorodibenzo-p-dioxin	7.70E-05	No	V	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1230-011:[c]							**2.82E-04**		N/A
CC43-019	04F1208-005	1,2,3,4,6,7,8-HpCDF	1.30E-04	Yes	V	0.01	1.30E-06	N/A	N/A
CC43-019	04F1208-005	1,2,3,4,7,8,9-HpCDF	8.90E-05	No	V	0.01	0	N/A	N/A
CC43-019	04F1208-005	1,2,3,4,7,8-HxCDD	7.90E-05	No	V	0.1	0	N/A	N/A
CC43-019	04F1208-005	1,2,3,4,7,8-HxCDF	1.50E-04	Yes	JB	0.1	1.50E-05	N/A	N/A
CC43-019	04F1208-005	1,2,3,6,7,8-HxCDD	7.00E-05	No	V	0.1	0	N/A	N/A
CC43-019	04F1208-005	1,2,3,6,7,8-HxCDF	5.60E-05	No	V	0.1	0	N/A	N/A
CC43-019	04F1208-005	1,2,3,7,8,9-HxCDD	1.10E-04	Yes	V	0.1	1.10E-05	N/A	N/A
CC43-019	04F1208-005	1,2,3,7,8,9-HxCDF	7.10E-05	No	V	0.1	0	N/A	N/A
CC43-019	04F1208-005	1,2,3,7,8-PeCDF	6.80E-05	No	V	0.05	0	N/A	N/A
CC43-019	04F1208-005	2,3,4,6,7,8-HxCDF	1.50E-04	Yes	JB	0.1	1.50E-05	N/A	N/A
CC43-019	04F1208-005	2,3,4,7,8-PeCDF	1.90E-04	Yes	JB	0.5	9.50E-05	N/A	N/A
CC43-019	04F1208-005	2,3,7,8-TCDD	1.60E-04	No	V	1	0	N/A	N/A
CC43-019	04F1208-005	2,3,7,8-TCDF	1.50E-04	Yes	V	0.1	1.50E-05	N/A	N/A
CC43-019	04F1208-005	Heptachlorodibenzo-p-dioxin	2.30E-04	Yes	JB	0.01	2.30E-06	N/A	N/A
CC43-019	04F1208-005	OCDD	0.0014	Yes	JB	0.0001	1.40E-07	N/A	N/A
CC43-019	04F1208-005	OCDF	1.60E-04	No	V	0.0001	0	N/A	N/A
CC43-019	04F1208-005	Pentachlorodibenzo-p-dioxin	7.40E-05	No	V	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1208-005:[c]							**1.55E-04**		N/A
CC43-028	04F1545-007	1,2,3,4,6,7,8-HpCDF	1.70E-04	Yes	V1	0.01	1.70E-06	N/A	N/A
CC43-028	04F1545-007	1,2,3,4,7,8,9-HpCDF	1.40E-04	Yes	JB1	0.01	1.40E-06	N/A	N/A
CC43-028	04F1545-007	1,2,3,4,7,8-HxCDD	1.20E-04	No	V1	0.1	0	N/A	N/A
CC43-028	04F1545-007	1,2,3,4,7,8-HxCDF	6.40E-05	No	V1	0.1	0	N/A	N/A
CC43-028	04F1545-007	1,2,3,6,7,8-HxCDD	1.50E-04	Yes	V1	0.1	1.50E-05	N/A	N/A
CC43-028	04F1545-007	1,2,3,6,7,8-HxCDF	6.50E-05	No	V1	0.1	0	N/A	N/A
CC43-028	04F1545-007	1,2,3,7,8,9-HxCDD	1.10E-04	No	V1	0.1	0	N/A	N/A
CC43-028	04F1545-007	1,2,3,7,8,9-HxCDF	8.10E-05	No	V1	0.1	0	N/A	N/A

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Table 1.8
Toxicity Equivalency Calculations for Dioxins/Furans - Ecological Receptors

Sampling Location	Sample Number	Congener	Result	Detect?	Validation Qualifier	Mammals TEF[a]	Mammals TEQ Concentration[b]	Birds TEF[a]	Birds TEQ Concentration[b]
CC43-028	04F1545-007	1,2,3,7,8-PeCDF	8.10E-05	No	V1	0.05	0	N/A	N/A
CC43-028	04F1545-007	2,3,4,6,7,8-HxCDF	1.30E-04	Yes	JB1	0.1	1.30E-05	N/A	N/A
CC43-028	04F1545-007	2,3,4,7,8-PeCDF	1.50E-04	Yes	JB1	0.5	7.50E-05	N/A	N/A
CC43-028	04F1545-007	2,3,7,8-TCDD	1.70E-04	No	V1	1	0	N/A	N/A
CC43-028	04F1545-007	2,3,7,8-TCDF	1.80E-04	No	V1	0.1	0	N/A	N/A
CC43-028	04F1545-007	Heptachlorodibenzo-p-dioxin	2.70E-04	Yes	JB1	0.01	2.70E-06	N/A	N/A
CC43-028	04F1545-007	OCDD	0.0019	Yes	JB1	0.0001	1.90E-07	N/A	N/A
CC43-028	04F1545-007	OCDF	4.90E-04	Yes	JB1	0.0001	4.90E-08	N/A	N/A
CC43-028	04F1545-007	Pentachlorodibenzo-p-dioxin	9.30E-05	No	V1	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1545-007:[c]							**1.09E-04**		N/A
CC44-005	04F1372-009	1,2,3,4,6,7,8-HpCDF	0.0012	Yes	JB	0.01	1.20E-05	N/A	N/A
CC44-005	04F1372-009	1,2,3,4,7,8,9-HpCDF	7.60E-04	No	V	0.01	0	N/A	N/A
CC44-005	04F1372-009	1,2,3,4,7,8-HxCDD	5.10E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-009	1,2,3,4,7,8-HxCDF	3.00E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-009	1,2,3,6,7,8-HxCDD	5.20E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-009	1,2,3,6,7,8-HxCDF	3.00E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-009	1,2,3,7,8,9-HxCDD	4.80E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-009	1,2,3,7,8,9-HxCDF	4.20E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-009	1,2,3,7,8-PeCDF	2.10E-04	No	V	0.05	0	N/A	N/A
CC44-005	04F1372-009	2,3,4,6,7,8-HxCDF	3.60E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-009	2,3,4,7,8-PeCDF	1.90E-04	No	V	0.5	0	N/A	N/A
CC44-005	04F1372-009	2,3,7,8-TCDD	3.30E-04	No	V	1	0	N/A	N/A
CC44-005	04F1372-009	2,3,7,8-TCDF	3.90E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-009	Heptachlorodibenzo-p-dioxin	0.0096	Yes	V	0.01	9.60E-05	N/A	N/A
CC44-005	04F1372-009	OCDD	0.071	No	UJ	0.0001	0	N/A	N/A
CC44-005	04F1372-009	OCDF	0.0036	Yes	JB	0.0001	3.60E-07	N/A	N/A
CC44-005	04F1372-009	Pentachlorodibenzo-p-dioxin	3.00E-04	No	V	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1372-009:[c]							**1.08E-04**		N/A
CC44-005	04F1372-010	1,2,3,4,6,7,8-HpCDF	1.90E-04	No	V	0.01	0	N/A	N/A
CC44-005	04F1372-010	1,2,3,4,7,8,9-HpCDF	2.80E-04	No	V	0.01	0	N/A	N/A
CC44-005	04F1372-010	1,2,3,4,7,8-HxCDD	1.80E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-010	1,2,3,4,7,8-HxCDF	1.10E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-010	1,2,3,6,7,8-HxCDD	2.00E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-010	1,2,3,6,7,8-HxCDF	1.10E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-010	1,2,3,7,8,9-HxCDD	1.80E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-010	1,2,3,7,8,9-HxCDF	1.70E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-010	1,2,3,7,8-PeCDF	8.10E-05	No	V	0.05	0	N/A	N/A
CC44-005	04F1372-010	2,3,4,6,7,8-HxCDF	1.30E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-010	2,3,4,7,8-PeCDF	7.20E-05	No	V	0.5	0	N/A	N/A
CC44-005	04F1372-010	2,3,7,8-TCDD	1.50E-04	No	V	1	0	N/A	N/A
CC44-005	04F1372-010	2,3,7,8-TCDF	1.60E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-010	Heptachlorodibenzo-p-dioxin	3.40E-04	No	V	0.01	0	N/A	N/A
CC44-005	04F1372-010	OCDD	0.0031	Yes	JB	0.0001	3.10E-07	N/A	N/A
CC44-005	04F1372-010	OCDF	4.90E-04	No	V	0.0001	0	N/A	N/A
CC44-005	04F1372-010	Pentachlorodibenzo-p-dioxin	1.20E-04	No	V	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1372-010:[c]							**3.10E-07**		N/A
CC44-005	04F1372-011	1,2,3,4,6,7,8-HpCDF	4.10E-04	Yes	JB	0.01	4.10E-06	N/A	N/A
CC44-005	04F1372-011	1,2,3,4,7,8,9-HpCDF	3.60E-04	Yes	JB	0.01	3.60E-06	N/A	N/A
CC44-005	04F1372-011	1,2,3,4,7,8-HxCDD	1.20E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-011	1,2,3,4,7,8-HxCDF	1.70E-04	Yes	JB	0.1	1.70E-05	N/A	N/A
CC44-005	04F1372-011	1,2,3,6,7,8-HxCDD	1.30E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-011	1,2,3,6,7,8-HxCDF	8.40E-05	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-011	1,2,3,7,8,9-HxCDD	2.70E-04	Yes	JB	0.1	2.70E-05	N/A	N/A
CC44-005	04F1372-011	1,2,3,7,8,9-HxCDF	2.50E-04	Yes	JB	0.1	2.50E-05	N/A	N/A
CC44-005	04F1372-011	1,2,3,7,8-PeCDF	9.70E-05	No	V	0.05	0	N/A	N/A
CC44-005	04F1372-011	2,3,4,6,7,8-HxCDF	2.50E-04	Yes	JB	0.1	2.50E-05	N/A	N/A
CC44-005	04F1372-011	2,3,4,7,8-PeCDF	8.30E-05	No	V	0.5	0	N/A	N/A
CC44-005	04F1372-011	2,3,7,8-TCDD	1.70E-04	No	V	1	0	N/A	N/A
CC44-005	04F1372-011	2,3,7,8-TCDF	1.70E-04	No	V	0.1	0	N/A	N/A
CC44-005	04F1372-011	Heptachlorodibenzo-p-dioxin	0.0013	Yes	JB	0.01	1.30E-05	N/A	N/A
CC44-005	04F1372-011	OCDD	0.0074	Yes	JB	0.0001	7.40E-07	N/A	N/A
CC44-005	04F1372-011	OCDF	0.0014	Yes	JB	0.0001	1.40E-07	N/A	N/A
CC44-005	04F1372-011	Pentachlorodibenzo-p-dioxin	1.10E-04	No	V	1	0	N/A	N/A
Total 2,3,7,8-TCDD TEQ Concentration for Sample 04F1372-011:[c]							**1.16E-04**		N/A
2,3,7,8-TCDD TEQ Concentration used in Subsurface Soil ESL Screen[c]:							**0.003**		N/A

[a] Toxicity Equivalency Factor (WHO, 1997).

[b] TEQ (Toxicity Equivalence) Concentration = Soil Concentration x TEF. For non-detects, the TEQ Concentration equals zero.

[c] The TEQ concentration used in the ESL screen is the maximum of all sampling locations for the medium.

N/A = Not Applicable.

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Table 2.1
Essential Nutrient Screen for Surface Soil/Surface Sediment

Analyte	MDC (mg/kg)	Estimated Maximum Daily Intake[a] (mg/day)	RDA/RDI/AI[b] (mg/day)	UL[b] (mg/day)	Retain for PRG Screen?
Calcium	210,000	21	500-1,200	2,500	No
Magnesium	30,000	3	80-420	65-110	No
Potassium	8,310	0.831	2,000-3,500	N/A	No
Sodium	6,600	0.660	500-2,400	N/A	No

[a] Based on the MDC and a 100 mg/day soil ingestion rate for a WRW.

[b] RDA/RDI/AI/UL taken from NAS 2000, 2002

N/A = Not available.

Table 2.2
PRG Screen for Surface Soil/Surface Sediment

Analyte	PRG[a]	MDC	MDC Exceeds PRG?	UCL[b]	UCL Exceeds PRG?	Retain for Detection Frequency Screen?
Inorganics (mg/kg)						
Aluminum	24,774	61,000	Yes	11,139	No	No
Ammonia	910,997	2.82	No	--	--	No
Antimony	44.4	29	No	--	--	No
Arsenic	**2.41**	**56.2**	**Yes**	**4.68**	**Yes**	**Yes**
Barium	2,872	1,500	No	--	--	No
Beryllium	100	26.8	No	--	--	No
Boron	9,477	28	No	--	--	No
Cadmium	91.4	270	Yes	1.78	No	No
Cesium	N/A	18.8	UT	--	--	UT
Chromium[c]	28.4	210	Yes	17.6	No	No
Chromium (VI)	28.4	0.850	No	--	--	No
Cobalt	122	137	Yes	6.86	No	No
Copper	4,443	1,860	No	--	--	No
Cyanide	2,222	0.290	No	--	--	No
Fluoride	6,665	16.7	No	--	--	No
Iron	33,326	130,000	Yes	13,268	No	No
Lead	1,000	590	No	--	--	No
Lithium	2,222	50	No	--	--	No
Manganese	419	1,750	Yes	211	No	No
Mercury	32.9	48	Yes	0.252	No	No
Molybdenum	555	12.6	No	--	--	No
Nickel	2,222	280	No	--	--	No
Nitrate / Nitrite[d]	177,739	765	No	--	--	No
Nitrite	11,109	5.61	No	--	--	No
Selenium	555	2.70	No	--	--	No
Silica	N/A	1,880	UT	--	--	UT
Silicon	N/A	11,300	UT	--	--	UT
Silver	555	364	No	--	--	No
Strontium	66,652	526	No	--	--	No
Thallium	7.78	5.80	No	--	--	No
Tin	66,652	161	No	--	--	No
Titanium	169,568	1,730	No	--	--	No
Uranium	333	370	Yes	3.65	No	No
Vanadium	111	184	Yes	27.5	No	No
Zinc	33,326	11,900	No	--	--	No
Organics (µg/kg)						
1,1,1-Trichloroethane	9.18E+06	47.7	No	--	--	No
1,1,2,2-Tetrachloroethane	10,483	2	No	--	--	No
1,1,2-Trichloro-1,2,2-trifluoroethane	2.38E+09	1.83	No	--	--	No
1,1-Dichloroethene	17,366	7.90	No	--	--	No
1,2,3-Trichlorobenzene	N/A	2	UT	--	--	UT
1,2,4-Trichlorobenzene	151,360	150	No	--	--	No
1,2,4-Trimethylbenzene	132,620	1,300	No	--	--	No
1,2-Dichloroethene	999,783	16	No	--	--	No
1,2-Dichloropropane	38,427	140	No	--	--	No
1,3,5-Trimethylbenzene	114,340	490	No	--	--	No
1,4-Dichlorobenzene	91,315	110	No	--	--	No
2,4,5-T	801,440	1.80	No	--	--	No
2,4,5-Trichlorophenol	8.01E+06	1,100	No	--	--	No
2,4,6-Trichlorophenol	272,055	950	No	--	--	No
2,4,6-Trinitrotoluene	40,072	56	No	--	--	No

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Table 2.2
PRG Screen for Surface Soil/Surface Sediment

Analyte	PRG[a]	MDC	MDC Exceeds PRG?	UCL[b]	UCL Exceeds PRG?	Retain for Detection Frequency Screen?
2,4-Dimethylphenol	1.60E+06	88	No	--	--	No
2,3,7,8-TCDD (TEQ)[c]	0.0248	0.01880	No	--	--	No
2-Butanone	4.64E+07	155	No	--	--	No
2-Hexanone	N/A	20	UT	--	--	No
2-Methylnaphthalene	320,574	2,600	No	--	--	No
2-Methylphenol	4.01E+06	200	No	--	--	No
4,4'-DDD	15,528	10	No	--	--	No
4,4'-DDE	10,961	7.20	No	--	--	No
4,4'-DDT	10,927	18	No	--	--	No
4-Chloro-3-methylphenol	N/A	60	UT	--	--	UT
4-Isopropyltoluene	N/A	100	UT	--	--	UT
4-Methyl-2-pentanone	8.32E+07	73	No	--	--	No
4-Methylphenol	400,718	270	No	--	--	No
4-Nitroaniline	207,917	820	No	--	--	No
4-Nitrophenol	641,148	320	No	--	--	No
Acenaphthene	4.44E+06	11,000	No	--	--	No
Acenaphthylene	N/A	200	UT	--	--	UT
Acetone	1.00E+08	1,280	No	--	--	No
Aldrin	176	2.50	No	--	--	No
alpha-BHC	570	7.90	No	--	--	No
Anthracene	2.22E+07	7,300	No	--	--	No
Aroclor-1016	1,349	95	No	--	--	No
Aroclor-1242	1,349	350	No	--	--	No
Aroclor-1248	1,349	66	No	--	--	No
Aroclor-1254	1,349	8,900	Yes	400	No	No
Aroclor-1260	1,349	7,800	Yes	386	No	No
Benzene	23,563	11	No	--	--	No
Benzo(a)anthracene	3,793	8,900	Yes	450	No	No
Benzo(a)pyrene	**379**	**3,200**	**Yes**	**449**	**Yes**	**Yes**
Benzo(b)fluoranthene	3,793	8,800	Yes	513	No	No
Benzo(g,h,i)perylene	N/A	3,200	UT	--	--	UT
Benzo(k)fluoranthene	37,927	4,200	No	--	--	No
Benzoic Acid	3.21E+08	1,400	No	--	--	No
Benzyl Alcohol	2.40E+07	2,800	No	--	--	No
beta-BHC	1,995	28	No	--	--	No
beta-Chlordane	10,261	2.60	No	--	--	No
bis(2-ethylhexyl)phthalate	213,750	75,000	No	--	--	No
Bromochloromethane	N/A	7	UT	--	--	UT
Bromomethane	20,959	5	No	--	--	No
Butylbenzylphthalate	1.60E+07	7,100	No	--	--	No
Carbazole	150,001	700	No	--	--	No
Carbon Disulfide	1.64E+06	4	No	--	--	No
Carbon Tetrachloride	8,446	103	No	--	--	No
Chlorobenzene	666,523	2	No	--	--	No
Chloroform	7,850	7	No	--	--	No
Chloromethane	115,077	1.70	No	--	--	No
Chrysene	379,269	7,700	No	--	--	No
cis-1,2-Dichloroethene	1.11E+06	15	No	--	--	No
Dibenz(a,h)anthracene	379	930	Yes	293	No	No
Dibenzofuran	222,174	4,600	No	--	--	No
Dicamba	2.40E+06	150	No	--	--	No
Dichloroprop	N/A	10	UT	--	--	UT

Table 2.2
PRG Screen for Surface Soil/Surface Sediment

Analyte	PRG[a]	MDC	MDC Exceeds PRG?	UCL[b]	UCL Exceeds PRG?	Retain for Detection Frequency Screen?
Dieldrin	187	92	No	--	--	No
Diesel Range Organics	N/A	8.80E+06	UT	--	--	UT
Diethylphthalate	6.41E+07	420	No	--	--	No
Dimethylphthalate	8.01E+08	490	No	--	--	No
Di-n-butylphthalate	8.01E+06	10,000	No	--	--	No
Di-n-octylphthalate	3.21E+06	11,000	No	--	--	No
Endosulfan I	480,861	7.40	No	--	--	No
Endosulfan II	480,861	9.90	No	--	--	No
Endosulfan sulfate	480,861	11	No	--	--	No
Endrin	24,043	17	No	--	--	No
Endrin aldehyde	24,043	9.20	No	--	--	No
Ethylbenzene	5.39E+06	173	No	--	--	No
Fluoranthene	2.96E+06	20,000	No	--	--	No
Fluorene	3.21E+06	4,900	No	--	--	No
gamma-BHC (Lindane)	2,771	8.30	No	--	--	No
Gasoline	N/A	2,000	UT	--	--	UT
Heptachlor epoxide	329	33	No	--	--	No
Hexachlorobenzene	1,870	380	No	--	--	No
Hexachlorobutadiene	22,217	2.20	No	--	--	No
HMX	4.01E+06	230	No	--	--	No
Indeno(1,2,3-cd)pyrene	3,793	2,500	No	--	--	No
Isophorone	3.16E+06	850	No	--	--	No
Isopropylbenzene	32,680	27	No	--	--	No
MCPA	40,072	1,100	No	--	--	No
Methoxychlor	400,718	12	No	--	--	No
Methylene Chloride	271,792	56	No	--	--	No
Naphthalene	1.40E+06	7,100	No	--	--	No
n-Butylbenzene	N/A	350	UT	--	--	UT
n-Propylbenzene	N/A	190	UT	--	--	UT
Pentachlorophenol	17,633	39,000	Yes	1,532	No	No
Phenanthrene	N/A	22,000	UT	--	--	UT
Phenol	2.40E+07	130	No	--	--	No
Pyrene	2.22E+06	14,000	No	--	--	No
sec-Butylbenzene	N/A	42.6	UT	--	--	UT
Styrene	1.38E+07	7.80	No	--	--	No
tert-Butylbenzene	N/A	1.60	UT	--	--	UT
Tetrachloroethene	6,705	29,000	Yes	323	No	No
Toluene	3.09E+06	990	No	--	--	No
Total Petroleum Hydrocarbons	N/A	2,400	UT	--	--	UT
Trichloroethene	1,770	200	No	--	--	No
Trichlorofluoromethane	1.51E+06	31.9	No	--	--	No
Xylene[e]	1.06E+06	933	No	--	--	No
Radionuclides (pCi/g)						
Americium-241	7.69	51.2	Yes	0.828	No	No
Cesium-134	0.0800	0.200	Yes	0.0754	No	No
Cesium-137	0.221	0.959	Yes	0.201	No	No
Curium-242	N/A	0	UT	--	--	No
Curium-244	8.63	-0.00290	No	--	--	No
Curium-245/246	1.80	0.126	No	--	--	No
Gross Alpha	N/A	160	UT	--	--	UT
Gross Beta	N/A	125	UT	--	--	UT
Neptunium-237	5.43	0.0187	No	--	--	No

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Table 2.2
PRG Screen for Surface Soil/Surface Sediment

Analyte	PRG[a]	MDC	MDC Exceeds PRG?	UCL[b]	UCL Exceeds PRG?	Retain for Detection Frequency Screen?
Plutonium-238	5.97	1.17	No	--	--	No
Plutonium-239/240	9.80	183	Yes	1.98	No	No
Radium-226	2.69	2.08	No	--	--	No
Radium-228	**0.111**	**3.15**	**Yes**	**1.73**	**Yes**	**Yes**
Strontium-89/90	13.2	1.50	No	--	--	No
Uranium-233/234	25.3	34.5	Yes	1.42	No	No
Uranium-235	1.05	1.69	Yes	0.0834	No	No
Uranium-238	29.3	59	Yes	1.89	No	No

[a] The value shown is equal to the most stringent of the PRGs based on a risk of 1E-06 or an HQ of 0.1.

[b] UCL = 95% upper confidence limit on the mean, unless the MDC < UCL, then the MDC is used as the UCL.

[c] The PRG for chromium (VI) is used.

[d] The PRG for nitrate is used.

[e] The TEQ for 2,3,7,8-TCDD is calculated in Table 1.7.

N/A = Not available.

UT = Uncertain toxicity; no PRG available (assessed in Section 6.0).

Bold = Analyte retained for further consideration in the next COC selection step.

-- = Screen not performed because analyte was eliminated from further consideration in a previous COC selection step.

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Table 2.3
Statistical Distributions and Background Comparisons for Human Health PCOCs for IAEU[a]

Analyte	Statistical Distribution Testing Results						Background Comparison Test Results		
	Background Data Set			IAEU Data Set					
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Test	1-p	Retain as PCOC?
Surface Soil/Surface Sediment									
Arsenic	**73**	**GAMMA**	**91.8**	**1,747**	**NON-PARAMETRIC**	**98**	**WRS**	**0.00141**	**Yes**
Radium-228	40	GAMMA	100	99	NORMAL	100	WRS	0.169	No
Subsurface Soil/Subsurface Sediment									
Radium-228	31	GAMMA	100	128	NON-PARAMETRIC	100	WRS	0.127	No

[a] EU data for background comparison do not include data from background locations.
Bold = Analyte retained for further consideration in the next COC selection step.
WRS = Wilcoxon Rank Sum.

Table 2.4
Essential Nutrient Screen for Subsurface Soil/Subsurface Sediment

Analyte	MDC (mg/kg)	Estimated Maximum Daily Intake[a] (mg/day)	RDA/RDI/AI[b] (mg/day)	UL[b] (mg/day)	Retain for PRG Screen?
Calcium	412,000	41.2	500-1,200	2,500	No
Magnesium	17,000	1.70	80-420	65-110	No
Potassium	21,100	2.11	2,000-3,500	N/A	No
Sodium	11,000	1.10	500-2,400	N/A	No

[a] Based on the MDC and a 100 mg/day soil ingestion rate for a WRW.

[b] RDA/RDI/AI/UL taken from NAS 2000, 2002

N/A = Not available.

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Table 2.5
PRG Screen for Subsurface Soil/Subsurface Sediment

Analyte	PRG[a]	MDC	MDC Greater Than PRG?	UCL[b]	UCL Greater Than PRG?	Retain for Detection Frequency Screen?
Inorganics (mg/kg)						
Aluminum	284,902	110,000	No	--	--	No
Antimony	511	19.3	No	--	--	No
Arsenic	27.7	69.7	Yes	6.21	No	No
Barium	33,033	1,150	No	--	--	No
Beryllium	1,151	15	No	--	--	No
Boron	108,980	33	No	--	--	No
Cadmium	1,051	547	No	--	--	No
Cesium	N/A	10.9	UT	--	--	UT
Chloride	N/A	184	UT	--	--	UT
Chromium[c]	327	11,000	Yes	42.0	No	No
Chromium (VI)	327	0.590	No	--	--	No
Cobalt	1,401	120	No	--	--	No
Copper	51,100	1,190	No	--	--	No
Cyanide	25,550	43	No	--	--	No
Fluoride	76,650	17.6	No	--	--	No
Iron	383,250	290,000	No	--	--	No
Lead	1,000	1,500	Yes	17.1	No	No
Lithium	25,550	79.9	No	--	--	No
Manganese	4,815	3,140	No	--	--	No
Mercury	379	16	No	--	--	No
Molybdenum	6,388	4,100	No	--	--	No
Nickel	25,550	670	No	--	--	No
Nitrate / Nitrite[d]	2.04E+06	6,100	No	--	--	No
Nitrite	127,750	2.49	No	--	--	No
Selenium	6,388	4.30	No	--	--	No
Silica	N/A	5,110	UT	--	--	UT
Silicon	N/A	14,000	UT	--	--	UT
Silver	6,388	110	No	--	--	No
Strontium	766,500	487	No	--	--	No
Sulfate	N/A	180	UT	--	--	UT
Sulfide	N/A	18.6	UT	--	--	UT
Tantalum	N/A	15.7	UT	--	--	UT
Thallium	89.4	9.30	No	--	--	No
Tin	766,500	392	No	--	--	No
Titanium	1.95E+06	1,420	No	--	--	No
Uranium	3,833	1,600	No	--	--	No
Vanadium	1,278	740	No	--	--	No
Zinc	383,250	1,800	No	--	--	No
Organics (µg/kg)						
1,1,1-Trichloroethane	1.06E+08	2,100	No	--	--	No
1,1,2,2-Tetrachloroethane	120,551	1,000	No	--	--	No
1,1,2-Trichloro-1,2,2-trifluoroethane	2.74E+10	390	No	--	--	No
1,1,2-Trichloroethane	322,253	3.20	No	--	--	No
1,1-Dichloroethane	3.12E+07	239	No	--	--	No
1,1-Dichloroethene	199,706	23.8	No	--	--	No
1,2,3-Trichlorobenzene	N/A	530	UT	--	--	UT
1,2,3-Trichloropropane	23,910	4	No	--	--	No
1,2,3-Trimethylbenzene	N/A	700	UT	--	--	UT
1,2,4-Trichlorobenzene	1.74E+06	2,000	No	--	--	No
1,2,4-Trimethylbenzene	1.53E+06	72,300	No	--	--	No
1,2-Dibromo-3-chloropropane	34,137	3	No	--	--	No
1,2-Dichlorobenzene	3.32E+07	270	No	--	--	No
1,2-Dichloroethane	152,603	35	No	--	--	No
1,2-Dichloroethene	1.15E+07	1,200	No	--	--	No
1,2-Dichloropropane	441,907	13	No	--	--	No
1,3,5-Trimethylbenzene	1.31E+06	20,600	No	--	--	No

VA

Table 2.5
PRG Screen for Subsurface Soil/Subsurface Sediment

Analyte	PRG[a]	MDC	MDC Greater Than PRG?	UCL[b]	UCL Greater Than PRG?	Retain for Detection Frequency Screen?
1,3-Dichlorobenzene	3.83E+07	70	No	--	--	No
1,4-Dichlorobenzene	1.05E+06	170	No	--	--	No
1-Iodooctane	N/A	2,000	UT	--	--	UT
2,3-Dimethyl-1-butene	N/A	1,000	UT	--	--	UT
2,3-Dimethylhexane	N/A	900	UT	--	--	UT
2,3-Epoxy-2,3-dimethylbutane	N/A	4,000	UT	--	--	UT
2,4-Dimethylphenol	1.84E+07	89	No	--	--	No
2,4-Dinitrophenol	1.84E+06	470	No	--	--	No
2,4-Dinitrotoluene	1.84E+06	43	No	--	--	No
2,6-Dimethylundecane	N/A	1,000	UT	--	--	UT
2,7,10-Trimethyldodecane	N/A	1,000	UT	--	--	UT
2,3,7,8-TCDD TEQ[c]	0.285	0.001	No	--	--	No
2-Bromooctane	N/A	2,000	UT	--	--	UT
2-Butanone	5.33E+08	500	No	--	--	No
2-Chlorophenol	6.39E+06	77	No	--	--	No
2-Chlorotoluene	2.56E+07	80	No	--	--	No
2-Hexanone	N/A	1,760	UT	--	--	UT
2-Methylnaphthalene	3.69E+06	1,400	No	--	--	No
2-Methylphenol	4.61E+07	93	No	--	--	No
3,3'-Dichlorobenzidine	76,667	160	No	--	--	No
4,4'-DDD	178,570	7.60	No	--	--	No
4,4'-DDE	126,049	4.80	No	--	--	No
4,4'-DDT	125,658	19	No	--	--	No
4-Chloro-3-methylphenol	N/A	54	UT	--	--	UT
4-Chlorotoluene	N/A	90	UT	--	--	UT
4-Hydroxy-4-methyl-2-pentanone	N/A	100,000	UT	--	--	UT
4-Isopropyltoluene	N/A	3,000	UT	--	--	UT
4-Methyl-2-pentanone	9.57E+08	850	No	--	--	No
4-Methylphenol	4.61E+06	460	No	--	--	No
4-Nitroaniline	2.39E+06	230	No	--	--	No
Acenaphthene	5.10E+07	7,900	No	--	--	No
Acenaphthylene	N/A	94	UT	--	--	UT
Acetone	1.15E+09	17,000	No	--	--	No
Aldrin	2,024	4.40	No	--	--	No
alpha-BHC	6,555	6.80	No	--	--	No
Anthracene	2.55E+08	13,000	No	--	--	No
Aroclor-1016	15,514	150	No	--	--	No
Aroclor-1248	15,514	5,900	No	--	--	No
Aroclor-1254	15,514	12,000	No	--	--	No
Aroclor-1260	15,514	15,000	No	--	--	No
Benzene	270,977	240	No	--	--	No
Benzo(a)anthracene	43,616	33,000	No	--	--	No
Benzo(a)pyrene	4,357	35,000	Yes	663	No	No
Benzo(b)fluoranthene	43,616	29,000	No	--	--	No
Benzo(g,h,i)perylene	N/A	22,000	UT	--	--	UT
Benzo(k)fluoranthene	436,159	29,000	No	--	--	No
Benzoic Acid	3.69E+09	930	No	--	--	No
Benzyl Alcohol	2.76E+08	1,600	No	--	--	No
bis(2-ethylhexyl)phthalate	2.46E+06	48,000	No	--	--	No
bis(2-hydroxyethyl)lauramide	N/A	8,000	UT	--	--	UT
Bromochloromethane	N/A	7	UT	--	--	UT
Bromoform	4.83E+06	1	No	--	--	No
Bromomethane	241,033	7,450	No	--	--	No
Butylbenzylphthalate	1.84E+08	6,000	No	--	--	No
Carbazole	1.73E+06	1,300	No	--	--	No
Carbon Disulfide	1.88E+07	290	No	--	--	No
Carbon Tetrachloride	97,124	370	No	--	--	No

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Table 2.5
PRG Screen for Subsurface Soil/Subsurface Sediment

Analyte	PRG[a]	MDC	MDC Greater Than PRG?	UCL[b]	UCL Greater Than PRG?	Retain for Detection Frequency Screen?
Chlorobenzene	7.67E+06	3	No	--	--	No
Chloroethane	1.65E+07	48.2	No	--	--	No
Chloroform	90,270	670	No	--	--	No
Chloromethane	1.32E+06	86	No	--	--	No
Chrysene	4.36E+06	36,000	No	--	--	No
cis-1,2-Dichloroethene	1.28E+07	181	No	--	--	No
Decane	N/A	2,000	UT	--	--	UT
delta-BHC	6,555	42	No	--	--	No
Dibenz(a,h)anthracene	4,362	10,000	Yes	382	No	No
Dibenzofuran	2.56E+06	3,300	No	--	--	No
Dichlorodifluoromethane	2.64E+06	26	No	--	--	No
Dieldrin	2,151	6.70	No	--	--	No
Diesel Range Organics	N/A	560,000	UT	--	--	UT
Diethylphthalate	7.37E+08	330	No	--	--	No
Dimethylphthalate	9.22E+09	460	No	--	--	No
Di-n-butylphthalate	9.22E+07	3,600	No	--	--	No
Di-n-octylphthalate	3.69E+07	6,000	No	--	--	No
Dodecane	N/A	2,000	UT	--	--	UT
Endosulfan I	5.53E+06	3.60	No	--	--	No
Endosulfan II	5.53E+06	12	No	--	--	No
Endosulfan sulfate	5.53E+06	5.30	No	--	--	No
Endrin	276,495	12	No	--	--	No
Endrin aldehyde	276,495	21	No	--	--	No
Endrin ketone	383,250	62	No	--	--	No
ethyl acetate	1.15E+09	1,000	No	--	--	No
Ethylbenzene	6.19E+07	15,500	No	--	--	No
Fluoranthene	3.40E+07	66,000	No	--	--	No
Fluorene	3.69E+07	6,300	No	--	--	No
gamma-BHC (Lindane)	31,864	10	No	--	--	No
Gasoline	N/A	4,800	UT	--	--	UT
Gasoline Range Organics	N/A	1.33E+06	UT	--	--	UT
Heptachlor epoxide	3,782	14	No	--	--	No
Hexachlorobenzene	21,508	260	No	--	--	No
Hexachlorobutadiene	255,500	7	No	--	--	No
Hexadecane	N/A	1,000	UT	--	--	UT
Hexamethylcyclotrisiloxane	N/A	1,000	UT	--	--	UT
Indeno(1,2,3-cd)pyrene	43,616	20,000	No	--	--	No
Isophorone	3.63E+07	840	No	--	--	No
Isopropylbenzene	375,823	2,500	No	--	--	No
Methoxychlor	4.61E+06	22	No	--	--	No
Methylene Chloride	3.13E+06	620	No	--	--	No
Naphthalene	1.61E+07	350,000	No	--	--	No
n-Butylbenzene	N/A	6,350	UT	--	--	UT
n-Hexyl Ether	N/A	900	UT	--	--	UT
N-Nitroso-di-n-propylamine	4,929	700	No	--	--	No
N-nitrosodiphenylamine	7.04E+06	250	No	--	--	No
n-Pentadecane	N/A	2,000	UT	--	--	UT
n-Propylbenzene	N/A	10,900	UT	--	--	UT
n-Tetradecane	N/A	3,000	UT	--	--	UT
n-Tetradecanoic Acid	N/A	900	UT	--	--	UT
n-Tridecane	N/A	4,000	UT	--	--	UT
Octamethylcyclotetrasiloxane	N/A	2,000	UT	--	--	UT
Octanol	N/A	600	UT	--	--	UT
Octylcyclohexane	N/A	300	UT	--	--	UT
Pentachlorophenol	202,777	660	No	--	--	No
Phenanthrene	N/A	62,000	UT	--	--	UT
Phenol	2.76E+08	160	No	--	--	No

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Table 2.5
PRG Screen for Subsurface Soil/Subsurface Sediment

Analyte	PRG[a]	MDC	MDC Greater Than PRG?	UCL[b]	UCL Greater Than PRG?	Retain for Detection Frequency Screen?
Pyrene	2.55E+07	67,000	No	--	--	No
sec-Butylbenzene	N/A	2,000	UT	--	--	UT
Styrene	1.59E+08	25.7	No	--	--	No
tert-Butylbenzene	N/A	5.02	UT	--	--	UT
Tetrachloroethene	77,111	197,000	Yes	1,043	No	No
Toluene	3.56E+07	20,000	No	--	--	No
Total Petroleum Hydrocarbons	N/A	467,000	UT	--	--	UT
trans-1,2-Dichloroethene	3.30E+06	90	No	--	--	No
trans-2-pentenal	N/A	600	UT	--	--	UT
Trichloroethene	20,354	11,600	No	--	--	No
Trichlorofluoromethane	1.74E+07	15	No	--	--	No
Undecane	N/A	2,000	UT	--	--	UT
Vinyl Chloride	24,948	7.67	No	--	--	No
Xylene[f]	1.22E+07	115,000	No	--	--	No
Radionuclides (pCi/g)						
Americium-241	88.4	75.5	No	--	--	No
Cesium-134	0.910	0.150	No	--	--	No
Cesium-137	2.54	0.443	No	--	--	No
Curium-244	99.3	0.462	No	--	--	No
Gross Alpha	N/A	117	UT	--	--	UT
Gross Beta	N/A	55	UT	--	--	UT
Neptunium-237	62.5	0.00308	No	--	--	No
Plutonium-238	68.7	0.197	No	--	--	No
Plutonium-239/240	112	527	Yes	4.95	No	No
Plutonium-242	71.8	0.0812	No	--	--	No
Radium-226	31	9.28	No	--	--	No
Radium-228	**1.28**	**3.90**	**Yes**	**1.82**	**Yes**	**Yes**
Strontium-89/90	152	1.31	No	--	--	No
Uranium-232	41.5	0.0562	No	--	--	No
Uranium-233/234	291	28.9	No	--	--	No
Uranium-234	291	0.600	No	--	--	No
Uranium-235	12.1	4.88	No	--	--	No
Uranium-238	337	174	No	--	--	No

[a] The value shown is equal to the most stringent of the PRGs based on a risk of 1E-06 or an HQ of 0.1.

[b] UCL = 95% upper confidence limit on the mean, unless the MDC < UCL, then the MDC is used as the UCL.

[c] The PRG for chromium (VI) is used.

[d] The PRG for nitrate is used.

[e] The TEQ for 2,3,7,8-TCDD is calculated in Table 1.7.

[f] The value for total xylene is used.

N/A = Not available.

UT = Uncertain toxicity; no PRG available (assessed in Section 6.0).

Bold = Analyte retained for further consideration in the next COC selection step.

-- = Screen not performed because analyte was eliminated from further consideration in a previous COC selection step.

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Table 2.6
Summary of the COC Selection Process

Analyte	MDC Exceeds PRG?	UCL Exceeds PRG?	Detection Frequency > 5%[a]	Exceeds 30X the PRG?	Exceeds Background?	Professional Judgment-Retain?	Retain as COC?
Surface Soil/Surface Sediment							
Aluminum	Yes	No	--	--	--	--	No
Arsenic	**Yes**	**Yes**	**Yes**	**N/A**	**Yes**	**Yes**	**Yes**
Cadmium	Yes	No	--	--	--	--	No
Chromium	Yes	No	--	--	--	--	No
Cobalt	Yes	No	--	--	--	--	No
Iron	Yes	No	--	--	--	--	No
Manganese	Yes	No	--	--	--	--	No
Mercury	Yes	No	--	--	--	--	No
Uranium	Yes	No	--	--	--	--	No
Vanadium	Yes	No	--	--	--	--	No
Aroclor-1254	Yes	No	--	--	--	--	No
Aroclor-1260	Yes	No	--	--	--	--	No
Benzo(a)anthracene	Yes	No	--	--	--	--	No
Benzo(a)pyrene	**Yes**	**Yes**	**Yes**	**N/A**	**N/A**	**Yes**	**Yes**
Benzo(b)fluoranthene	Yes	No	--	--	--	--	No
Dibenz(a,h)anthracene	Yes	No	--	--	--	--	No
Pentachlorophenol	Yes	No	--	--	--	--	No
Tetrachloroethene	Yes	No	--	--	--	--	No
Americium-241	Yes	No	--	--	--	--	No
Cesium-134	Yes	No	--	--	--	--	No
Cesium-137	Yes	No	--	--	--	--	No
Plutonium-239/240	Yes	No	--	--	--	--	No
Radium-228	Yes	Yes	N/A	N/A	No	--	No
Uranium-233/234	Yes	No	--	--	--	--	No
Uranium-235	Yes	No	--	--	--	--	No
Uranium-238	Yes	No	--	--	--	--	No
Subsurface Soil/Subsurface Sediment							
Arsenic	Yes	No	--	--	--	--	No
Chromium	Yes	No	--	--	--	--	No
Lead	Yes	No	--	--	--	--	No
Benzo(a)pyrene	Yes	No	--	--	--	--	No
Dibenz(a,h)anthracene	Yes	No	--	--	--	--	No
Tetrachloroethene	Yes	No	--	--	--	--	No
Plutonium-239/240	Yes	No	--	--	--	--	No
Radium-228	Yes	Yes	N/A	N/A	No	--	No

-- = Screen not performed because analyte was eliminated from further consideration in a previous COC selection step.

N/A = Not applicable.

[a] All radionuclide values are considered detects.

Bold = Contaminant of concern.

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Table 3.1
Exposure Point Concentrations

Analyte	Unit	MDC[a]	UCL Value[b]	UCL Type	Distribution	EPC[c]
Tier 1						
Surface Soil/Surface Sediment						
Arsenic	mg/kg	56.2	4.68	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	4.68
Benzo(a)pyrene	mg/kg	32	0.449	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.449
Tier 2						
Surface Soil/Surface Sediment						
Arsenic	mg/kg	7.32	4.62	95% Student's-t UCL	NORMAL	4.62
Benzo(a)pyrene	mg/kg	1.35	0.375	95% Student's-t UCL	NORMAL	0.375

[a] The MDC for Tier 1 is the maximum detected concentration of all samples and the MDC for Tier 2 is the maximum of the average concentration of the samples in each of the 30-acre grids in the EU.

[b] UCL = upper confidence limit.

[c] The UCL is used as the EPC, unless the UCL exceeds the MDC, then the MDC is used for the EPC.

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Table 3.2
Chemical Exposure Factors Used in Surface Soil Intake Calculations for the Wildlife Refuge Worker

Exposure Route/Exposure Factor	Abbreviation	Value	Units	Source
Ingestion				
CI = (Cs x IRwss x EFwss x EDw x CF_3) / (BW x [ATc_wss or ATn_wss][b])				
Chemical Intake	CI	chemical-specific	mg/kg-day	calculated
Chemical concentration in soil	Cs	chemical-specific	mg/kg	Tier 1 or 2 EPC
Ingestion Rate of soil/sediment	IRwss	100	mg/day	EPA et al. 2002
Exposure Frequency	EFwss	230	days/year	EPA et al. 2002
Exposure Duration	EDw	18.7	yr	EPA et al. 2002
Conversion Factor	CF_3	1.00E-06	kg/mg	1 kg = 1.0E6 mg
Adult Body Weight	BW	70	kg	EPA 1991
Averaging Time-Carcinogenic	ATc_wss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATnc_wss	6,826	day	calculated
Outdoor Inhalation of Suspended Particulates				
CI = (Cs x IRawss x EFwss x EDw x ETwss x ETFo x MLF) / (BW x [ATc_wss or ATn_wss][b])				
Chemical Intake	CI	chemical-specific	mg/kg-day	calculated
Chemical concentration in soil	Cs	chemical-specific	mg/kg	Tier 1 or 2 EPC
Inhalation Rate	IRawss	1.3	m^3/hr	EPA et al. 2002
Exposure Frequency	EFwss	230	days/year	EPA et al. 2002
Exposure Duration	EDw	18.7	yr	EPA et al. 2002
Exposure Time	ETwss	8	hr/day	EPA et al. 2002
Exposure Time Fraction, outdoor	ETFo	0.5	--	EPA et al. 2002
Mass loading, (PM 10) for inhalation[a]	MLF	6.70E-08	kg/m^3	EPA et al. 2002
Adult Body Weight	BW	70	kg	EPA 1991
Averaging Time-Carcinogenic	ATc_wss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATnc_wss	6,826	day	calculated
Indoor Inhalation of Suspended Particulates				
CI = (Cs x IRawss x EFwss x EDw x ETwss x ETFi x DFi x MLF) / (BW x [ATc_wss or ATn_wss][b])				
Chemical Intake	CI	chemical-specific	mg/kg-day	calculated
Chemical concentration in soil	Cs	chemical-specific	mg/kg	Tier 1 or 2 EPC
Inhalation Rate	IRawss	1.3	m^3/hr	EPA et al. 2002
Exposure Frequency	EFwss	230	days/year	EPA et al. 2002
Exposure Duration	EDw	18.7	yr	EPA et al. 2002
Exposure Time	ETwss	8	hr/day	EPA et al. 2002
Exposure Time Fraction, indoor	ETFi	0.5	--	EPA et al. 2002
Dilution Factor, indoor inhalation	DFi	0.7	--	EPA et al. 2002

Table 3.2
Chemical Exposure Factors Used in Surface Soil Intake Calculations for the Wildlife Refuge Worker

Exposure Route/Exposure Factor	Abbreviation	Value	Units	Source
Mass Loading, (PM 10) for inhalation[a]	MLF	6.70E-08	kg/m^3	EPA et al. 2002
Adult Body Weight	BW	70	kg/m3	EPA 1991
Averaging Time-Carcinogenic	ATc_wss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATnc_wss	6,826	day	calculated
Dermal Contact				
CI = (Cs x SAw x AFw x EFwss x EDw x ABS x EVw x CF_3) / (BW x [Atc_wss or Atn_wss][b])				
Chemical Intake	CI	chemical-specific	mg/kg-day	calculated
Chemical concentration in soil	Cs	chemical-specific	mg/kg	Tier 1 or 2 EPC
Skin Surface Area[c]	SAw	3300	cm^2	EPA 2001
Skin-soil adherence factor	AFw	0.117	mg/cm^2-event	EPA 2001
Exposure Frequency	EFwss	230	days/year	EPA et al. 2002
Exposure Duration	EDw	18.7	yr	EPA et al. 2002
Conversion Factor	CF_3	1.00E-06	kg/mg	1 kg = 1.0E6 mg
Absorption Fraction	ABS	chemical-specific		EPA 2001[c]
Event frequency	EVw	1	events/day	EPA 2001
Adult Body Weight	BW	70	kg	EPA 1991
Averaging Time-Carcinogenic	ATc_wss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATnc_wss	6,826	day	calculated

[a] The mass loading value is the 95th percentile of the estimated mass loading distribution estimated in the RSALs Task 3 Report (EPA et al. 2002).
[b] Carcinogenic or noncarcinogenic averaging times (Atc and Atnc, respectively) are used in equations, depending on whether carcinogenic or noncarcinogenic intakes are being calculated.
[c] The skin surface area value is the EPA default for commercial/industrial exposures and is the average of the 50th percentile for men and women > 18 years old wearing a short-sleeved shirt, long pants, and shoes. The value was recommended by CDPHE for use in the WRW PRGs.

Table 3.3
Chemical Exposure Factors Used in Surface Soil Intake Calculations for the Wildlife Refuge Visitor

Exposure Route/Exposure Factor	Abbreviation	Value	Units	Source
Ingestion				
CI = (Cs x IRagevss x EFvss x CF_3) / [Atc_vss or Atnc][a] where, IRageav = ((IRvss x EDav) / BW) + ((IRcvss x EDcv) / BWc)				
Chemical Intake	CI	chemical-specific	mg/kg-day	calculated
Chemical concentration in soil	Cs	chemical-specific	mg/kg	Tier 1 or 2 EPC
Age-adjusted Soil Ingestion Rate for chemicals	IRagevss	57	mg-yr/kg-day	calculated
Exposure Frequency	EFvss	100	days/year	EPA et al. 2002[b]
Exposure Duration - adult	EDav	24	yr	EPA et al. 2002
Exposure Duration - child	EDcv	6	yr	EPA et al. 2002
Conversion Factor	CF_3	1.00E-06	kg/mg	1 kg = 1.0E6 mg
Soil Ingestion Rate - adult	IRvss	50	mg/day	EPA et al. 2002
Soil Ingestion Rate - child	IRcvss	100	mg/day	EPA et al. 2002
Adult Body Weight	BW	70	kg	EPA 1991
Child Body Weight	BWc	15	kg	EPA 1991
Averaging Time-Carcinogenic	ATc_vss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATn_vss	8,760	day	calculated
Averaging Time-Noncarcinogenic (child)	ATn_c_vss	2,190	day	calculated
Averaging Time-Noncarcinogenic (child+adult)	ATnc	10,950	day	calculated
Outdoor Inhalation of Suspended Particulates				
CI = (Cs x IRa_agevss x EFvss x MLF) / [Atc_vss or Atnc][a] where, IRa_agevss = (((Ira_vss x EDav) / BW) + ((IRa_cvss x EDcv) / BWc)) x ET				
Chemical Intake	NRI	chemical-specific	mg/kg-day	calculated
Chemical concentration in soil	Cs	chemical-specific	mg/kg	EPC
Age-averaged Inhalation Rate for chemicals	IRa_agevss	3.7	m^3-yr/kg-day	EPA et al. 2002[b]
Exposure Frequency	EFvss	100	days/year	EPA et al. 2002[b]
Mass loading, (PM 10) for inhalation	MLF	6.70E-08	kg/m^3	EPA et al. 2002
Exposure Duration - adult	EDav	24	yr	EPA et al. 2002
Exposure Duration - child	EDcv	6	yr	EPA et al. 2002
Adult Body Weight	BW	70	kg	EPA 1991
Child Body Weight	BWc	15	kg	EPA 1991
Air Inhalation Rate - adult	IRavss	2.4	m^3/hr	EPA et al. 2002
Air Inhalation Rate - child	IRa_cvss	1.6	m^3/hr	EPA et al. 2002

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Table 3.3
Chemical Exposure Factors Used in Surface Soil Intake Calculations for the Wildlife Refuge Visitor

Exposure Route/Exposure Factor	Abbreviation	Value	Units	Source
Exposure Time	Etvss	2.5	hr/day	EPA et al. 2002[b]
Averaging Time-Carcinogenic	ATc_vss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATn_vss	8,760	day	calculated
Averaging Time-Noncarcinogenic (child)	ATn_c_vss	2,190	day	calculated
Averaging Time-Noncarcinogenic (child+adult)	ATnc	10,950	day	calculated

Table 3.3
Chemical Exposure Factors Used in Surface Soil Intake Calculations for the Wildlife Refuge Visitor

Exposure Route/Exposure Factor	Abbreviation	Value	Units	Source
Dermal Contact				
CI = (Cs x SFSagav x EFvss x ABS x EVv x CF_3) /[ATc_vss or ATnc][a] **where, SFSagav = ((SAav x AFav xEDav) / BW) + ((SAcv x AFcv x EDcv) / BWc)**				
Chemical Intake	CI	chemical-specific	mg/kg-day	calculated
Chemical concentration in soil	Cs	chemical-specific	mg/kg	Tier 1 or 2 EPC
Exposure Frequency	EFvss	100	days/year	EPA et al. 2002[b]
Exposure Duration - adult	EDav	24	yr	EPA et al. 2002
Exposure Duration - child	EDcv	6	yr	EPA et al. 2002
Adult skin-soil adherence factor	AFav	0.07	mg/cm^2-event	EPA 2001b[c]
Child skin-soil adherence factor	AFcv	0.2	mg/cm^2-event	EPA 2001b[d]
Adult skin surface area (exposed)	SAav	5,700	cm^2	EPA 2001b[e]
Child skin surface area (exposed)	SAcv	2,800	cm^2	EPA 2001b[f]
Age-averaged surface area/adherence factor	SFSagav	361	mg-yr/kg-event	EPA 2001b
Absorption Fraction	ABS	chemical-specific	[--]	EPA 2001b
Event frequency	EVv	1.00	events/day	EPA 2001
Conversion Factor	CF_3	1.00E-06	kg/mg	1 kg = 1.0E6 mg
Adult Body Weight	Bw	70	kg	EPA 1991
Child Body Weight	BWc	15	kg	EPA 1991
Averaging Time-Carcinogenic	ATc_vss	25,550	day	calculated
Averaging Time-Noncarcinogenic	ATn_vss	8,760	day	calculated
Averaging Time-Noncarcinogenic (child)	ATn_c_vss	2,190	day	calculated
Averaging Time-Noncarcinogenic (child+adult)	ATnc	10,950	day	calculated

[a] Carcinogenic or noncarcinogenic averaging times (Atc and Atnc, respectively) are used in equations, depending on whether carcinogenic or noncarcinogenic intakes are being calculated.

[b] Value is the 50th percentile of time spent for open space users (Jefferson County 1996).

[c] The adult skin-soil adherence factor is the EPA residential default and the 50th percentile for gardeners. This is the value recommended by CDPHE for use in the WRW PRGs.

[d] The child skin-soil adherence factor is the EPA residential default and the 95th percentile for children playing in wet soil. This is the value recommended by CDPHE for use in the open space user PRGs.

[e] The adult skin-surface area value is the EPA default for residential exposures and the average of the 50th percentile for males and females > 18 years old wearing short-sleeved shirts, shorts, and shoes. The value was recommended by CDPHE for use in the WRW PRGs.

Table 3.3

Chemical Exposure Factors Used in Surface Soil Intake Calculations for the Wildlife Refuge Visitor

Exposure Route/Exposure Factor	Abbreviation	Value	Units	Source

[f] The child skin-surface area value is the EPA default for residential exposures and the average of the 50th percentiles for males and females from <1 to <6 years old wearing short-sleeved shirts, shorts, and no shoes. The value was recommended by CDPHE for use in the WRW PRGs.

Table 4.1
Chemical Cancer Slope Factors, Weight of Evidence, and Target Organs for COCs

Contaminant of Concern	CAS Number	Oral Slope Factor (mg/kg-day)⁻¹	Source	Dermal Slope Factor (mg/kg-day)⁻¹	Source	Inhalation Slope Factor (mg/kg-day)⁻¹	Source	Weight of Evidence[a]	Dermal Absorption Fraction[b]	Target Organ/Cancer	Source
Arsenic	7440-38-2	1.5	I	1.5	O	15.10	I	A	0.03	Skin, lungs	I
Benzo(a)pyrene	50-32-8	7.3	I	7.3	O	0.31	P	B2	0.13	Tumors	A

[a] See Table 5.1 in the CRA Methodology (DOE 2005) for definitions of Weight of Evidence classifications.

[b] Dermal ABS from EPA 2001.

A = Agency for Toxic Substances and Disease Registry online database, http://www.atsdr.cdc.gov.

I = IRIS (EPA 2004a).

O = Oral slope factor used.

P = EPA-NCEA provisional value (EPA 2004).

Table 4.2
Chemical Non-Cancer Reference Doses, Target Organs, and Effects for COCs

Contaminant of Concern	CAS Number	Oral RfD (mg/kg-day)	Source	Dermal RfD (mg/kg-day)	Source	Inhalation RfD (mg/kg-day)	Source	Dermal Absorption Fraction[a]	Target Organ/Effect	Source
Arsenic	7440-38-2	3.00E-04	I	3.00E-04	N/A	N/A	N/A	0.0300	Hyperpigmentation, keratosis and vascular complications	I
Benzo(a)pyrene	50-32-8	N/A	N/A	N/A	N/A	N/A	N/A	0.130	N/A	N/A

[a] Dermal ABS from EPA 2001
N/A = Not available or not applicable.
I = IRIS (EPA 2004).

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Table 5.1
Summary of Chemical Cancer Risks and Non-Cancer Hazards for the Wildlife Refuge Worker

EPC/Medium/ Contaminant of Concern	Chemical Cancer Risk					Non-Cancer Hazard Quotient				
	Ingestion	Inhalation	Dermal	Exposure Routes Total	Percent Contribution to Risk	Ingestion	Inhalation	Dermal	Exposure Routes Total	Percent Contribution to Hazard Index
Tier 1										
Surface Soil/Surface Sediment										
Arsenic	1.69E-06	1.01E-07	--	1.79E-06	60%	0.0141	NC	NC	0.0141	100%
Benzo(a)pyrene	7.88E-07	1.98E-10	3.95E-07	1.18E-06	40%	NC	NC	NC	NC	NC
Surface Soil/Surface Sediment Total:				**3E-06**	**100%**				**0.01**	**100%**
Tier 1 WRW Total:				**3E-06**					**0.01**	
Tier 2										
Surface Soil/Surface Sediment										
Arsenic	1.67E-06	9.94E-08	--	1.77E-06	64%	0.0139	NC	NC	0.0139	100%
Benzo(a)pyrene	6.58E-07	1.65E-10	3.30E-07	9.88E-07	36%	NC	NC	NC	NC	NC
Surface Soil/Surface Sediment Total:				**3E-06**	**100%**				**0.01**	**100%**
Tier 2 WRW Total:				**3E-06**					**0.01**	

-- = Exposure route is not complete because no COCs identified or exposure route was identified as insignificant in the CRA Methodology.

NC = Not calculated, noncancer toxicity criteria were not available.

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Table 5.2

Summary of Chemical Cancer Risks and Non-Cancer Hazards for the Wildlife Refuge Visitor

EPC/Medium/ Contaminant of Concern	Chemical Cancer Risk					Non-Cancer Hazard Quotient				
	Ingestion	Inhalation	Dermal	Exposure Routes Total	Percent Contribution to Risk	Ingestion	Inhalation	Dermal	Exposure Routes Total	Percent Contribution to Hazard Index
Tier 1										
Surface Soil/Surface Sediment										
Arsenic	1.57E-06	6.78E-08	--	1.64E-06	55%	0.00815	NC	NC	0.00815	100%
Benzo(a)pyrene	7.33E-07	1.33E-10	6.02E-07	1.33E-06	45%	NC	NC	NC	NC	NC
Surface Soil/Surface Sediment Total:				**3E-06**	**100%**				**0.01**	**100%**
Tier 1 WRV Total:				**3E-06**					**0.01**	
Tier 2										
Surface Soil/Surface Sediment										
Arsenic	1.55E-06	6.69E-08	--	1.62E-06	59%	0.00804	NC	NC	0.00804	100%
Benzo(a)pyrene	6.12E-07	1.11E-10	5.02E-07	1.11E-06	41%	NC	NC	NC	NC	NC
Surface Soil/Surface Sediment Total:				**3E-06**	**100%**				**0.01**	**NC**
Tier 2 WRV Total:				**3E-06**					**0.01**	

-- = Exposure route is not complete because no COCs identified or exposure route was identified as insignificant in the CRA Methodology.

NC = Not calculated, noncancer toxicity criteria were not available.

Table 5.3
Summary of Risk Characterization Results

Exposure Scenario/EPC/Medium	Estimated Excess Lifetime Cancer Risk	Major Contributors to Chemical Cancer Risk	Estimated Non-Cancer Hazard Quotient	Major Contributors to Hazard Quotient
Wildlife Refuge Worker (WRW)				
Tier 1 EPC				
Surface Soil/Surface Sediment	2E-06	Arsenic (60%)	0.01	Arsenic (100%)
	1E-06	Benzo(a)pyrene (40%)	NC	N/A
Tier 2 EPC				
Surface Soil/Surface Sediment	2E-06	Arsenic (64%)	0.01	Arsenic (100%)
	1E-06	Benzo(a)pyrene (36%)	NC	N/A
Wildlife Refuge Visitor (WRV)				
Tier 1 EPC				
Surface Soil/Surface Sediment	2E-06	Arsenic (55%)	0.01	Arsenic (100%)
	1E-06	Benzo(a)pyrene (45%)	NC	N/A
Tier 2 EPC				
Surface Soil/Surface Sediment	2E-06	Arsenic (59%)	0.01	Arsenic (100%)
	1E-06	Benzo(a)pyrene (41%)	NC	N/A

NC = Not calculated, noncancer toxicity criteria were not available.
N/A = Not applicable.

Table 6.1

Detected PCOCs without PRGs in Each Medium by Analyte Suite[a]

Analyte	Surface Soil/Surface Sediment	Subsurface Soil/Subsurface Sediment
Cations/Anions		
Chloride	X	X
Sulfate	X	X
Sulfide	N/A	X
Inorganics		
Cesium	X	X[b]
Silica	X	X
Silicon	X	X
Tantalum	N/A	X[b]
Organics		
1,2,3-Trichlorobenzene	X	X
1,2,3-Trimethylbenzene	N/A	X
1-Iodooctane	N/A	X
2,3-Dimethyl-1-butene	N/A	X
2,3-Dimethylhexane	N/A	X
2,3-Epoxy-2,3-dimethylbutane	N/A	X
2,6-Dimethylundecane	N/A	X
2,7,10-Trimethyldodecane	N/A	X
2-Bromooctane	N/A	X
2-Hexanone	X	X
4-Chloro-3-methylphenol	X	X[b]
4-Chlorotoluene	N/A	X
4-Hydroxy-4-methyl-2-pentanone	N/A	X
4-Isopropyltoluene	X	X
Acenaphthylene	X	X
Benzo(g,h,i)perylene	X	X
bis(2-hydroxyethyl)lauramide	N/A	X
Bromochloromethane	X	X
Decane	N/A	X
Dichloroprop	X	N/A
Diesel Range Organics	X	X
Dodecane	N/A	X
Gasoline	X	X
Gasoline Range Organics	N/A	X
Hexadecane	N/A	X
Hexamethylcyclotrisiloxane	N/A	X
n-Butylbenzene	X	X
n-Hexyl Ether	N/A	X
n-Pentadecane	N/A	X
n-Propylbenzene	X	X
n-Tetradecane	N/A	X
n-Tetradecanoic Acid	N/A	X
n-Tridecane	N/A	X
Octamethylcyclotetrasiloxane	N/A	X
Octanol	N/A	X
Octylcyclohexane	N/A	X
Phenanthrene	X	X
sec-Butylbenzene	X	X
tert-Butylbenzene	X	X
Total Petroleum Hydrocarbons	X	X
trans-2-pentenal	N/A	X
Undecane	N/A	X

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Table 6.1

Detected PCOCs without PRGs in Each Medium by Analyte Suite[a]

Analyte	Surface Soil/Surface Sediment	Subsurface Soil/Subsurface Sediment
Radionuclides		
Curium-242	X	N/A
Gross Alpha	X	X
Gross Beta	X	X

[a] Does not include essential nutrients. Essential nutrients without PRGs were evaluated by comparing estimated intakes to recommended intakes. Dioxin and Furan congeners were evaluated by calculating the TCDD Equivalents (TEQ), which are presented in Table 1.7.

[b] All detections are "J" qualified, signifying that the reported result is below the detection limit, but above the instrument detection limit.

X = PRG is unavailable.

N/A = Not applicable. Analyte not detected or not analyzed.

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ECOI	MDC	Terrestrial Plants		Ter Inve	Coyote Insectivore		Terrestrial Receptor[a]		Most Sensitive Receptor	Retain for Further Analysis?
		NOAEL	MDC > ESL?	NOAE	AEL	MDC > ESL?	NOAEL	MDC > ESL?	Results	
Inorganics (mg/kg)										
Aluminum	61,000	50	Yes	N/A	/A	N/A	N/A	N/A	Terrestrial Plants	Yes
Ammonia	2.82	N/A	N/A	N/A	539	No	N/A	N/A	Deer Mouse Insectivore	No
Antimony	29	5	Yes	78	85	Yes	N/A	N/A	Deer Mouse Insectivore	Yes
Arsenic	56.2	10	Yes	60	93	No	N/A	N/A	Deer Mouse Herbivore	Yes
Barium	1,500	500	Yes	330	369	No	N/A	N/A	Morning Dove Herbivore	Yes
Beryllium	26.8	10	Yes	40	).2	No	N/A	N/A	Deer Mouse Insectivore	Yes
Boron	28	0.500	Yes	N/A	316	No	N/A	N/A	Terrestrial Plants	Yes
Cadmium	270	32	Yes	140	75	Yes	N/A	N/A	Morning Dove Insectivore	Yes
Calcium	210,000	N/A	N/A	N/A	/A	N/A	N/A	N/A	N/A	UT
Cesium	18.8	N/A	N/A	N/A	/A	N/A	N/A	N/A	N/A	UT
Chromium[b]	210	1	Yes	0.400	1.5	Yes	N/A	N/A	Terrestrial Invertebrates	Yes
Chromium (VI)	0.850	N/A	N/A	N/A	1.5	No	N/A	N/A	Morning Dove Insectivore	No
Cobalt	137	13	Yes	N/A	519	No	N/A	N/A	Terrestrial Plants	Yes
Copper	1,860	100	Yes	50	541	No	N/A	N/A	Morning Dove Insectivore	Yes
Cyanide	0.290	N/A	N/A	N/A	11	No	N/A	N/A	Deer Mouse Herbivore	No
Fluoride	3.61	N/A	N/A	N/A	1.5	No	N/A	N/A	Morning Dove Insectivore	Yes
Iron	130,000	N/A	N/A	N/A	/A	N/A	N/A	N/A	N/A	UT
Lead	590	110	Yes	1,700	393	No	N/A	N/A	Morning Dove Insectivore	Yes
Lithium	50	2	Yes	N/A	360	No	N/A	N/A	Terrestrial Plants	Yes
Magnesium	30,000	N/A	N/A	N/A	/A	N/A	N/A	N/A	N/A	UT
Manganese	1,240	500	Yes	N/A	115	No	N/A	N/A	Prarie Dog	Yes
Mercury	48	0.300	Yes	0.100	1.3	Yes	N/A	N/A	Morning Dove Insectivore	Yes
Molybdenum	12.6	2	Yes	N/A	18	Yes	N/A	N/A	Deer Mouse Insectivore	Yes
Nickel	280	30	Yes	200	36	Yes	N/A	N/A	Deer Mouse Insectivore	Yes
Nitrate / Nitrite[c]	765	N/A	N/A	N/A	379	No	N/A	N/A	Deer Mouse Herbivore	No
Nitrite	2	N/A	N/A	N/A	/A	N/A	N/A	N/A	N/A	UT
Potassium	8,310	N/A	N/A	N/A	/A	N/A	N/A	N/A	N/A	UT
Selenium	2	1	Yes	70	39	No	N/A	N/A	Deer Mouse Insectivore	Yes
Silica	1,880	N/A	N/A	N/A	/A	N/A	N/A	N/A	N/A	UT
Silicon	11,300	N/A	N/A	N/A	/A	N/A	N/A	N/A	N/A	UT
Silver	364	2	Yes	N/A	/A	N/A	N/A	N/A	Terrestrial Plants	Yes
Sodium	6,600	N/A	N/A	N/A	/A	N/A	N/A	N/A	N/A	UT
Strontium	413	N/A	N/A	N/A	298	No	N/A	N/A	Deer Mouse Herbivore	No
Thallium	5.80	1	Yes	N/A	1.8	No	N/A	N/A	Terrestrial Plants	Yes
Tin	161	50	Yes	N/A	1.2	Yes	N/A	N/A	Morning Dove Insectivore	Yes
Titanium	1,730	N/A	N/A	N/A	/A	N/A	N/A	N/A	N/A	UT
Uranium	370	5	Yes	N/A	72	No	N/A	N/A	Terrestrial Plants	Yes
Vanadium	184	2	Yes	N/A	1	Yes	N/A	N/A	Terrestrial Plants	Yes
Zinc	11,900	50	Yes	200	1	Yes	N/A	N/A	Morning Dove Insectivore	Yes
Organics (µg/kg)										
1,1,1-Trichloroethane	47.7	N/A	N/A	N/A	E+06	No	N/A	N/A	Deer Mouse Insectivore	No
1,1,2-Trichloro-1,2,2-trifluoroethane	1.83	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	UT
1,1-Dichloroethene	7.90	N/A	N/A	N/A	253	No	N/A	N/A	Deer Mouse Insectivore	No
1,2,3-Trichlorobenzene	1.70	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	UT
1,2,4-Trichlorobenzene	150	N/A	N/A	20,000	67	No	N/A	N/A	Deer Mouse Insectivore	No
1,2,4-Trimethylbenzene	1,300	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	UT
1,2-Dichloroethene	16	N/A	N/A	N/A	973	No	N/A	N/A	Deer Mouse Insectivore	No
1,2-Dichloropropane	140	N/A	N/A	700,000	215	No	N/A	N/A	Deer Mouse Insectivore	No
1,3,5-Trimethylbenzene	490	N/A	N/A	N/A	915	No	N/A	N/A	Deer Mouse Insectivore	No
1,4-Dichlorobenzene	110	N/A	N/A	20,000	682	No	N/A	N/A	Terrestrial Invertebrates	No
2,4,5-T	1.80	N/A	N/A	N/A	1	No	N/A	N/A	Deer Mouse Insectivore	No
2,4,5-Trichlorophenol	1,100	4,000	No	9,000	A	N/A	N/A	N/A	Terrestrial Plants	No
2,4,6-Trichlorophenol	950	4,000	No	10,000	5	Yes	N/A	N/A	Deer Mouse Insectivore	Yes
2,4,6-Trinitrotoluene	56	N/A	N/A	N/A	27	No	N/A	N/A	Deer Mouse Insectivore	No
2,4-Dimethylphenol	88	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	UT
2-Butanone	155	N/A	N/A	N/A	E+06	No	N/A	N/A	Deer Mouse Insectivore	No
2-Hexanone	20	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	UT
2-Methylnaphthalene	2,600	N/A	N/A	N/A	96	No	N/A	N/A	Deer Mouse Insectivore	No
4,4'-DDD	10	N/A	N/A	N/A	65	No	N/A	N/A	Deer Mouse Insectivore	No
4,4'-DDE	7.20	N/A	N/A	N/A	40	No	N/A	N/A	Morning Dove Insectivore	No
4,4'-DDT	9.10	N/A	N/A	N/A	44	No	N/A	N/A	Morning Dove Insectivore	Yes
4-Chloro-3-methylphenol	60	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	UT
4-Isopropyltoluene	100	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	UT
4-Methyl-2-pentanone	73	N/A	N/A	N/A	79	No	N/A	N/A	Deer Mouse Insectivore	No
4-Methylphenol	270	N/A	N/A	N/A	A	N/A	N/A	N/A	N/A	UT
4-Nitroaniline	820	N/A	N/A	N/A	328	No	N/A	N/A	Deer Mouse Insectivore	No

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Table 7.1

Comparison of MDCs in Surface Soil to NOAEL ESLs for Terrestrial Plants, Invertebrates and Vertebrates in the IAEU

ECOI	MDC	Terrestrial Plants		Terrestrial Invertebrates		Mourning Dove Herbivore		Mourning Dove Insectivore		American Kestrel		Deer Mouse Herbivore		Deer Mouse Insectivore		Mule Deer		Prairie Dog		Coyote Carnivore		Coyote Generalist		Coyote Insectivore		Terrestrial Receptor		Most Sensitive Receptor	Retain for Further Analysis?
		NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	Results	
4-Nitrophenol	320	N/A	N/A	7,000	No	N/A	N/A	N/A	N/A	N/A	N/A	285,869	No	14,207	No	1.45E+06	No	1.02E+06	No	58,587	No	59,254	No	61,547	No	N/A	N/A	Terrestrial Invertebrates	No
Acenaphthene	11,000	20,000	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Terrestrial Plants	No
Acenaphthylene	200	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Acetone	1,280	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	67,474	No	6,182	No	341,202	No	247,687	No	23,175	No	23,963	No	26,778	No	N/A	N/A	Deer Mouse Insectivore	No
Aldrin	2.50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3,623	No	47.0	No	18,504	No	11,282	No	233	No	225	No	204	No	N/A	N/A	Deer Mouse Insectivore	No
alpha-BHC	7.90	N/A	N/A	N/A	N/A	4,687	No	81.8	No	212	No	726,500	No	18,662	No	3.69E+06	No	2.47E+06	No	84,381	No	83,405	No	80,847	No	N/A	N/A	Morning Dove Insectivore	No
Anthracene	7,300	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Benzene	11	500	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	307,359	No	14,934	No	1.56E+06	No	1.10E+06	No	61,785	No	62,438	No	64,693	No	N/A	N/A	Terrestrial Plants	No
Benzo(a)anthracene	8,900	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Benzo(a)pyrene	3,200	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	336,625	No	631	Yes	2.41E+06	No	502,521	No	3,062	No	2,971	Yes	2,756	Yes	N/A	N/A	Deer Mouse Insectivore	Yes
Benzo(b)fluoranthene	8,800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Benzo(g,h,i)perylene	3,200	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Benzo(k)fluoranthene	4,200	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Benzoic Acid	1,100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Benzyl Alcohol	2,800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	70,007	No	4,403	No	354,317	No	253,015	No	17,529	No	17,877	No	19,073	No	N/A	N/A	Deer Mouse Insectivore	No
beta-Chlordane	2.60	N/A	N/A	N/A	N/A	26,471	No	289	No	793	No	148,809	No	2,205	No	758,988	No	472,808	No	10,725	No	10,398	No	9,553	No	N/A	N/A	Morning Dove Insectivore	No
bis(2-ethylhexyl)phthalate	75,000	N/A	N/A	N/A	N/A	19,547	Yes	137	Yes	398	Yes	960,345	No	8,071	Yes	4.93E+06	No	2.76E+06	No	42,305	Yes	40,167	Yes	34,967	Yes	N/A	N/A	Morning Dove Insectivore	Yes
Bromochloromethane	7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Butylbenzylphthalate	7,100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	999,643	No	24,155	No	5.08E+06	No	3.37E+06	No	110,121	No	108,616	No	104,645	No	N/A	N/A	Deer Mouse Insectivore	No
Carbazole	700	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Carbon Disulfide	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	115,187	No	5,676	No	583,411	No	410,941	No	23,436	No	23,696	No	24,590	No	N/A	N/A	Deer Mouse Insectivore	No
Carbon Tetrachloride	103	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	208,160	No	8,906	No	1.05E+06	No	736,154	No	37,529	No	37,757	No	38,582	No	N/A	N/A	Deer Mouse Insectivore	No
Chlorobenzene	2	N/A	N/A	40,000	No	N/A	N/A	N/A	N/A	N/A	N/A	117,455	No	4,750	No	595,322	No	413,812	No	20,175	No	20,258	No	20,576	No	N/A	N/A	Deer Mouse Insectivore	No
Chloroform	7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	155,938	No	8,655	No	789,511	No	560,030	No	35,115	No	35,654	No	37,496	No	N/A	N/A	Deer Mouse Insectivore	No
Chloromethane	1.70	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Chrysene	7,700	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
cis-1,2-Dichloroethene	15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	37,221	No	1,814	No	188,528	No	132,702	No	7,500	No	7,580	No	7,857	No	N/A	N/A	Deer Mouse Insectivore	No
Dibenz(a,h)anthracene	930	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Dibenzofuran	4,600	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	707,000	No	21,200	No	3.59E+06	No	2.44E+06	No	93,800	No	93,200	No	91,800	No	N/A	N/A	Deer Mouse Insectivore	No
Dicamba	150	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	36,282	No	1,690	No	183,802	No	129,003	No	7,034	No	7,097	No	7,320	No	N/A	N/A	Deer Mouse Insectivore	No
Dichloroprop	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Dieldrin	92	N/A	N/A	N/A	N/A	178	No	9.87	Yes	25.7	Yes	81.4	Yes	7.40	Yes	411	No	301	No	33.6	Yes	33.2	Yes	32.0	Yes	N/A	N/A	Deer Mouse Insectivore	Yes
Diesel Range Organics	8.80E+06	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Diethylphthalate	420	100,000	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.27E+07	No	2.53E+06	No	3.18E+08	No	2.21E+08	No	1.08E+07	No	1.08E+07	No	1.10E+07	No	N/A	N/A	Terrestrial Plants	No
Dimethylphthalate	460	N/A	N/A	200,000	No	N/A	N/A	N/A	N/A	N/A	N/A	3.77E+06	No	200,859	No	1.91E+07	No	1.35E+07	No	819,700	No	831,099	No	870,128	No	N/A	N/A	Terrestrial Invertebrates	No
Di-n-butylphthalate	10,000	200,000	No	N/A	N/A	989	Yes	15.9	Yes	41.5	Yes	1.21E+07	No	281,236	No	6.13E+07	No	4.06E+07	No	1.29E+06	No	1.27E+06	No	1.22E+06	No	N/A	N/A	Morning Dove Insectivore	Yes
Di-n-octylphthalate	11,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.05E+07	No	731;367	No	4.65E+08	No	2.58E+08	No	3.85E+06	No	3.65E+06	No	3.17E+06	No	N/A	N/A	Deer Mouse Insectivore	No
Endosulfan I	7.40	N/A	N/A	N/A	N/A	71,421	No	1,505	No	3,811	No	2,522	No	80.1	No	12,798	No	8,726	No	352	No	350	No	347	No	N/A	N/A	Deer Mouse Insectivore	No
Endosulfan II	9.90	N/A	N/A	N/A	N/A	71,421	No	1,505	No	3,811	No	2,522	No	80.1	No	12,798	No	8,726	No	352	No	350	No	347	No	N/A	N/A	Deer Mouse Insectivore	No
Endosulfan sulfate	11	N/A	N/A	N/A	N/A	71,421	No	1,505	No	3,811	No	2,522	No	80.1	No	12,798	No	8,726	No	352	No	350	No	347	No	N/A	N/A	Deer Mouse Insectivore	No
Endrin	17	N/A	N/A	N/A	N/A	106	No	1.40	Yes	3.74	Yes	2,462	No	45.5	No	12,536	No	8,060	No	215	No	210	No	197	No	N/A	N/A	Morning Dove Insectivore	Yes
Endrin aldehyde	9.20	N/A	N/A	N/A	N/A	106	No	1.40	Yes	3.74	Yes	2,462	No	45.5	No	12,536	No	8,060	No	215	No	210	No	197	No	N/A	N/A	Morning Dove Insectivore	Yes
Ethylbenzene	173	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Fluoranthene	20,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Fluorene	4,900	200,000	No	30,000	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Terrestrial Invertebrates	No
gamma-BHC (Lindane)	8.30	N/A	N/A	N/A	N/A	4,687	No	81.8	No	212	No	1,009	No	25.9	No	5,125	No	3,425	No	117	No	116	No	112	No	N/A	N/A	Deer Mouse Insectivore	No
Gasoline	2,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Heptachlor epoxide	7.20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,710	No	64.0	No	13,772	No	9,121	No	293	No	289	No	277	No	N/A	N/A	Deer Mouse Insectivore	No
Heptachlorodibenzo-p-dioxin	0.0950	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Hexachlorobenzene	380	N/A	N/A	N/A	N/A	646	No	7.73	Yes	21.0	Yes	58,939	No	974	No	300,322	No	190,142	No	4,669	No	4,545	No	4,219	No	N/A	N/A	Morning Dove Insectivore	Yes
Hexachlorobutadiene	2.20	N/A	N/A	N/A	N/A	27,573	No	431	No	1,131	No	45,040	No	1,018	No	228,964	No	150,894	No	4,684	No	4,609	No	4,411	No	N/A	N/A	Morning Dove Insectivore	No
HMX	230	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	236,455	No	16,012	No	1.20E+06	No	857,536	No	63,027	No	64,450	No	69,366	No	N/A	N/A	Deer Mouse Insectivore	No
Indeno(1,2,3-cd)pyrene	2,500	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Isophorone	850	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Isopropylbenzene	27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
MCPA	1,100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Methoxychlor	12	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	70,467	No	1,226	No	358,904	No	228,896	No	5,840	No	5,695	No	5,313	No	N/A	N/A	Deer Mouse Insectivore	No
Methylene Chloride	45	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	58,196	No	3,399	No	294,601	No	209,560	No	13,687	No	13,922	No	14,727	No	N/A	N/A	Deer Mouse Insectivore	No
Naphthalene	7,100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.08E+06	No	27,048	No	5.57E+07	No	1.60E+07	No	104,269	No	107,146	No	117,177	No	N/A	N/A	Deer Mouse Insectivore	No
n-Butylbenzene	350	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
n-Propylbenzene	190	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Pentachlorophenol	39,000	3,000	Yes	6,000	Yes	N/A	N/A	N/A	N/A	N/A	N/A	5,495	Yes	122	Yes	27,940	Yes	18,373	Yes	562	Yes	553	Yes	528	Yes	N/A	N/A	Deer Mouse Insectivore	Yes
Phenanthrene	22,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Phenol	130	70,000	No	30,000	No	N/A	N/A	N/A	N/A	N/A	N/A	414,819	No	23,090	No	2.10E+06	No	1.49E+06	No	93,638	No	95,083	No	100,028	No	N/A	N/A	Deer Mouse Insectivore	No
Pyrene	14,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT

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Table 7.1

Comparison of MDCs in Surface Soil to NOAEL ESLs for Terrestrial Plants, Invertebrates and Vertebrates in the IAEU

ECOI	MDC	Terrestrial Plants		Terrestrial Invertebrates		Mourning Dove Herbivore		Mourning Dove Insectivore		American Kestrel		Deer Mouse Herbivore		Deer Mouse Insectivore		Mule Deer		Prairie Dog		Coyote Carnivore		Coyote Generalist		Coyote Insectivore		Terrestrial Receptor[a]		Most Sensitive Receptor	Retain for Further Analysis?
		NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	NOAEL	MDC > ESL?	Results	
sec-Butylbenzene	42.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Styrene	7.80	300,000	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	435,332	No	16,408	No	2.21E+06	No	1.53E+06	No	70,388	No	70,505	No	71,080	No	N/A	N/A	Deer Mouse Insectivore	No
tert-Butylbenzene	1.60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Tetrachloroethene	29,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20,713	Yes	763	Yes	105,023	No	72,494	No	3,285	Yes	3,288	Yes	3,307	Yes	N/A	N/A	Deer Mouse Insectivore	Yes
Toluene	990	200,000	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	346,579	No	14,416	No	1.76E+06	No	1.22E+06	No	60,990	No	61,301	No	62,452	No	N/A	N/A	Deer Mouse Insectivore	No
Total Dioxin	0.842	N/A	N/A	N/A	N/A	0.194	Yes	0.0134	Yes	0.0775	Yes	0.0375	Yes	0.00425	Yes	0.192	Yes	0.116	No	0.0735	No	0.0339	No	0.0146	No	N/A	N/A	Deer Mouse Insectivore	Yes
Total PCBs	12,300	40,000	No	N/A	N/A	1,141	No	172	No	886	Yes	11,892	No	1,244	No	61,287	No	37,963	No	5,190	No	3,320	No	3,681	No	N/A	N/A	Mourning Dove Insectivore	Yes
Trichloroethene	200	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9,174	No	389	No	46,488	No	32,424	No	1,642	No	1,651	No	1,686	No	N/A	N/A	Deer Mouse Insectivore	No
Trichlorofluoromethane	31.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Xylene[d]	933	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	31,985	No	1,140	No	162,199	No	111,663	No	4,927	No	4,926	No	4,937	No	N/A	N/A	Deer Mouse Insectivore	No
Radionuclides (pCi/g)																													
Americium-241	51.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3,890	No	Terrestrial Receptor	No
Cesium-134	0.150	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Cesium-137	0.790	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20.8	No	Terrestrial Receptor	No
Curium-242	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Curium-244	-0.00290	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Curium-245/246	0.126	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Gross Alpha	67.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Gross Beta	81.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Neptunium-237	0.0187	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Plutonium-238	1.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UT
Plutonium-239/240	183	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6,110	No	Terrestrial Receptor	No
Radium-226	2.08	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	50.6	No	Terrestrial Receptor	No
Radium-228	3.15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	43.9	No	Terrestrial Receptor	No
Strontium-89/90	1.50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	22.5	No	Terrestrial Receptor	No
Uranium-233/234	34.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4,980	No	Terrestrial Receptor	No
Uranium-235	1.69	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,770	No	Terrestrial Receptor	No
Uranium-238	49.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,580	No	Terrestrial Receptor	No

[a] Radionuclide ESLs are not receptor-specific. They are considered protective of all terrestrial ecological species.

[b] The ESLs for chromium were developed using available toxicity data based on chromium (III) (birds) and chromium (VI) (plants, invertebrates, and mammals).

[c] The ESL for nitrate is used

[d] The value for total xylene is used.

N/A = Indicates no ESL was available for that ECOI/receptor pair.

Bold = Analyte retained for further consideration in the next ECOPC selection step.

UT = Uncertain toxicity; no ESL available (assessed in Section 10).

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Table 7.2
Summary of Non-PMJM NOAEL ESL Screening Results for Surface Soil in the IAEU

Analyte	Terrestrial Plant Exceedance?	Terrestrial Invertebrate Exceedance?	Terrestrial Vertebrate Exceedance?
Inorganics			
Aluminum	Yes	UT	No
Ammonia	UT	UT	No
Antimony	Yes	No	Yes
Arsenic	Yes	No	Yes
Barium	Yes	Yes	Yes
Beryllium	Yes	No	Yes
Boron	Yes	UT	No
Cadmium	Yes	Yes	Yes
Calcium	UT	UT	UT
Cesium	UT	UT	UT
Chromium	Yes	Yes	Yes
Chromium (VI)	UT	UT	No
Cobalt	Yes	UT	Yes
Copper	Yes	Yes	Yes
Cyanide	UT	UT	No
Fluoride	UT	UT	No
Iron	UT	UT	UT
Lead	Yes	No	Yes
Lithium	Yes	UT	No
Magnesium	UT	UT	UT
Manganese	Yes	UT	Yes
Mercury	Yes	Yes	Yes
Molybdenum	Yes	UT	Yes
Nickel	Yes	Yes	Yes
Nitrate / Nitrite	UT	UT	No
Nitrite	UT	UT	UT
Potassium	UT	UT	UT
Selenium	Yes	No	Yes
Silica	UT	UT	UT
Silicon	UT	UT	UT
Silver	Yes	UT	UT
Sodium	UT	UT	UT
Strontium	UT	UT	No
Thallium	Yes	UT	No
Tin	Yes	UT	Yes
Titanium	UT	UT	UT
Uranium	Yes	UT	No
Vanadium	Yes	UT	Yes
Zinc	Yes	Yes	Yes
Organics			
1,1,1-Trichloroethane	UT	UT	No
1,1,2-Trichloro-1,2,2-trifluoroethane	UT	UT	UT
1,1-Dichloroethene	UT	UT	No
1,2,3-Trichlorobenzene	UT	UT	UT
1,2,4-Trichlorobenzene	UT	No	No

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Table 7.2
Summary of Non-PMJM NOAEL ESL Screening Results for Surface Soil in the IAEU

Analyte	Terrestrial Plant Exceedance?	Terrestrial Invertebrate Exceedance?	Terrestrial Vertebrate Exceedance?
1,2,4-Trimethylbenzene	UT	UT	UT
1,2-Dichloroethene	UT	UT	No
1,2-Dichloropropane	UT	No	No
1,3,5-Trimethylbenzene	UT	UT	No
1,4-Dichlorobenzene	UT	No	No
2,4,5-T	UT	UT	No
2,4,5-Trichlorophenol	No	No	UT
2,4,6-Trichlorophenol	No	No	**Yes**
2,4,6-Trinitrotoluene	UT	UT	No
2,4-Dimethylphenol	UT	UT	UT
2-Butanone	UT	UT	No
2-Hexanone	UT	UT	UT
2-Methylnaphthalene	UT	UT	No
2-Methylphenol	UT	UT	No
4,4'-DDD	UT	UT	No
4,4'-DDE	UT	UT	No
4,4'-DDT	UT	UT	**Yes**
4-Chloro-3-methylphenol	UT	UT	UT
4-Isopropyltoluene	UT	UT	UT
4-Methyl-2-pentanone	UT	UT	No
4-Methylphenol	UT	UT	UT
4-Nitroaniline	UT	UT	No
4-Nitrophenol	UT	No	No
Acenaphthene	No	UT	UT
Acenaphthylene	UT	UT	UT
Acetone	UT	UT	No
Aldrin	UT	UT	No
alpha-BHC	UT	UT	No
Anthracene	UT	UT	UT
Benzene	No	UT	No
Benzo(a)anthracene	UT	UT	UT
Benzo(a)pyrene	UT	UT	**Yes**
Benzo(b)fluoranthene	UT	UT	UT
Benzo(g,h,i)perylene	UT	UT	UT
Benzo(k)fluoranthene	UT	UT	UT
Benzoic Acid	UT	UT	UT
Benzyl Alcohol	UT	UT	No
beta-Chlordane	UT	UT	No
bis(2-ethylhexyl)phthalate	UT	UT	**Yes**
Bromochloromethane	UT	UT	UT
Butylbenzylphthalate	UT	UT	No
Carbazole	UT	UT	UT
Carbon Disulfide	UT	UT	No
Carbon Tetrachloride	UT	UT	No
Chlorobenzene	UT	No	No
Chloroform	UT	UT	No

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Table 7.2
Summary of Non-PMJM NOAEL ESL Screening Results for Surface Soil in the IAEU

Analyte	Terrestrial Plant Exceedance?	Terrestrial Invertebrate Exceedance?	Terrestrial Vertebrate Exceedance?
Chloromethane	UT	UT	UT
Chrysene	UT	UT	UT
cis-1,2-Dichloroethene	UT	UT	No
Dibenz(a,h)anthracene	UT	UT	UT
Dibenzofuran	UT	UT	No
Dicamba	UT	UT	No
Dichloroprop	UT	UT	UT
Dieldrin	UT	UT	**Yes**
Diesel Range Organics	UT	UT	UT
Diethylphthalate	No	UT	No
Dimethylphthalate	UT	No	No
Di-n-butylphthalate	No	UT	**Yes**
Di-n-octylphthalate	UT	UT	No
Endosulfan I	UT	UT	No
Endosulfan II	UT	UT	No
Endosulfan sulfate	UT	UT	No
Endrin	UT	UT	**Yes**
Endrin aldehyde	UT	UT	**Yes**
Ethylbenzene	UT	UT	UT
Fluoranthene	UT	UT	UT
Fluorene	No	No	UT
gamma-BHC (Lindane)	UT	UT	No
Gasoline	UT	UT	UT
Heptachlor epoxide	UT	UT	No
Heptachlorodibenzo-p-dioxin	UT	UT	UT
Hexachlorobenzene	UT	UT	**Yes**
Hexachlorobutadiene	UT	UT	No
HMX	UT	UT	No
Indeno(1,2,3-cd)pyrene	UT	UT	UT
Isophorone	UT	UT	UT
Isopropylbenzene	UT	UT	UT
MCPA	UT	UT	UT
Methoxychlor	UT	UT	No
Methylene Chloride	UT	UT	No
Naphthalene	UT	UT	No
n-Butylbenzene	UT	UT	UT
n-Propylbenzene	UT	UT	UT
Pentachlorodibenzo-p-dioxin	UT	UT	UT
Pentachlorophenol	**Yes**	**Yes**	**Yes**
Phenanthrene	UT	UT	UT
Phenol	No	No	No
Pyrene	UT	UT	UT
sec-Butylbenzene	UT	UT	UT
Styrene	No	UT	No
tert-Butylbenzene	UT	UT	UT
Tetrachloroethene	UT	UT	**Yes**

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Table 7.2

Summary of Non-PMJM NOAEL ESL Screening Results for Surface Soil in the IAEU

Analyte	Terrestrial Plant Exceedance?	Terrestrial Invertebrate Exceedance?	Terrestrial Vertebrate Exceedance?
Toluene	No	UT	No
Total Dioxin	UT	UT	**Yes**
Total PCBs	No	UT	**Yes**
Total Petroleum Hydrocarbons	UT	UT	UT
Trichloroethene	UT	UT	No
Trichlorofluoromethane	UT	UT	UT
Xylene	UT	UT	No
Radionuclides			
Americium-241	UT	UT	No
Cesium-134	UT	UT	UT
Cesium-137	UT	UT	No
Curium-242	UT	UT	UT
Curium-244	UT	UT	UT
Curium-245/246	UT	UT	UT
Gross Alpha	UT	UT	UT
Gross Beta	UT	UT	UT
Neptunium-237	UT	UT	UT
Plutonium-238	UT	UT	UT
Plutonium-239/240	UT	UT	No
Radium-226	UT	UT	No
Radium-228	UT	UT	No
Strontium-89/90	UT	UT	No
Uranium-233/234	UT	UT	No
Uranium-235	UT	UT	No
Uranium-238	UT	UT	No

UT = Uncertain toxicity; no ESL available (assessed in Section 10.0).

Bold = Analyte retained for further consideration in the next ECOPC selection step.

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Table 7.3
Statistical Distribution and Comparison to Background for Surface Soil in the IAEU

Analyte	Statistical Distribution Testing Results						Background Comparison Test Results		
	Background Data Set			IAEU Data Set					
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Test	1 - p	Retain as ECOI?
Inorganics									
Aluminum	20	NORMAL	100	1,656	NONPARAMETRIC	99.9	WRS	0.802	No
Antimony	**20**	**NONPARAMETRIC**	**0**	**1,591**	**NONPARAMETRIC**	**19.5**	**N/A**	**N/A**	**Yes[a]**
Arsenic	20	NORMAL	100	1,647	NONPARAMETRIC	98.4	WRS	1.000	No
Barium	20	NORMAL	100	1,658	NONPARAMETRIC	99.9	WRS	1.000	No
Beryllium	20	NORMAL	100	1,652	NONPARAMETRIC	84.7	WRS	0.992	No
Boron	**N/A**	**N/A**	**N/A**	**1,027**	**GAMMA**	**83.4**	**N/A**	**N/A**	**Yes[a]**
Cadmium	20	NONPARAMETRIC	65	1,651	NONPARAMETRIC	35.6	WRS	1.000	No
Chromium	**20**	**NORMAL**	**100**	**1,658**	**NONPARAMETRIC**	**99.6**	**WRS**	**0.0386**	**Yes**
Cobalt	20	NORMAL	100	1,656	NONPARAMETRIC	98.7	WRS	1.000	No
Copper	**20**	**NONPARAMETRIC**	**100**	**1,656**	**NONPARAMETRIC**	**99.3**	**WRS**	**0.0365**	**Yes**
Lead	20	NORMAL	100	1,647	NONPARAMETRIC	100	WRS	1.000	No
Lithium	20	NORMAL	100	1,678	NONPARAMETRIC	97.1	WRS	0.255	No
Manganese	20	NORMAL	100	1,651	NONPARAMETRIC	99.9	WRS	0.999	No
Mercury	20	NONPARAMETRIC	40	1,622	NONPARAMETRIC	55.9	WRS	1.000	No
Molybdenum	**20**	**NORMAL**	**0**	**1,656**	**NONPARAMETRIC**	**53.3**	**N/A**	**N/A**	**Yes[a]**
Nickel	20	NORMAL	100	1,655	NONPARAMETRIC	97.6	WRS	0.297	No
Selenium	**20**	**NONPARAMETRIC**	**60**	**1,647**	**NONPARAMETRIC**	**6.13**	**N/A**	**N/A**	**Yes[a]**
Silver	**20**	**NORMAL**	**0**	**1,656**	**NONPARAMETRIC**	**29.3**	**N/A**	**N/A**	**Yes[a]**
Thallium	**14**	**NORMAL**	**0**	**1,638**	**NONPARAMETRIC**	**12.2**	**N/A**	**N/A**	**Yes[a]**
Tin	**20**	**NORMAL**	**0**	**1,656**	**NONPARAMETRIC**	**7.67**	**N/A**	**N/A**	**Yes[a]**
Uranium	**N/A**	**N/A**	**N/A**	**1,018**	**NONPARAMETRIC**	**9.82**	**N/A**	**N/A**	**Yes**
Vanadium	20	NORMAL	100	1,656	NONPARAMETRIC	99.9	WRS	0.802	No
Zinc	20	NORMAL	100	1,656	NONPARAMETRIC	99.7	WRS	0.735	No

[a] Statistical comparisons to background cannot be performed. The analyte is retained as an ECOI for further evaluation.
-- = Screen not performed because analyte was eliminated from further consideration by a previous ECOPC screening step.
N/A = Not applicable. Site and/or background detection frequency less than 20 percent
Bold = Analyte retained for further consideration in the next ECOPC selection step.
WRS = Wilcoxon Rank Sum.

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Table 7.4
Statistical Concentrations in Surface Soil in the IAEU

Analyte	UCL Recommeded by ProUCL	Distribution Recommened by ProUCL	Total Samples	Mean Detected Concentration	Median Detected Concentration	75th percentile	95th percentile	UCL[a]	UTL[b]	Maximum[c]
Inorganics (mg/kg)										
Antimony	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	1,591	1.06	0.300	1.30	5.45	1.37	2.10	29
Boron	95% Approximate Gamma UCL	GAMMA	1,027	3.30	2.70	4.30	8.30	3.43	6.90	28
Chromium	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	1,658	16.2	12.9	17.7	34	17.8	26	210
Copper	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	1,656	24.1	15	20.9	59.9	31.1	39	1,860
Molybdenum	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	1,656	0.907	0.640	1	2.50	1.02	2.10	12.6
Selenium	95% Student's-t UCL	NONPARAMETRIC	1,647	0.363	0.385	0.405	0.594	0.369	0.460	2
Silver	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	1,656	1.02	0.150	0.563	2	2.49	1.40	364
Thallium	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	1,638	0.461	0.435	0.470	1.10	0.505	0.930	5.80
Tin	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	1,656	2.23	1.05	1.35	9.64	2.93	3.90	161
Uranium	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	1,018	1.83	0.700	0.750	2.90	3.74	1.70	370
Organics (µg/kg)										
Benzo(a)pyrene	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	917	390	210	370	1,500	460	970	3,500
bis(2-ethylhexyl)phthalate	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	918	447	195	355	540	821	405	75,000
Di-n-butylphthalate	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	918	276	190	355	400	333	380	10,000
Dioxins (Total Bird TEQ)[d]	95% Approximate Gamma UCL	GAMMA	12	0.0142	0.00801	0.0150	0.0480	0.0329	0.0719	0.0719
Dioxins (Total Mammal TEQ)[d]	95% Student's-t UCL	NORMAL	12	0.00627	0.00513	0.00915	0.0151	0.00916	0.0186	0.0188
Tetrachloroethene	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	578	54.1	0.728	2.50	6	367	5.50	29,000
Total PCBs	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	483	425	95.5	190	2,116	794	1,090	12,300

[a] UCL = 95% upper confidence limit on the mean, unless the MDC<UCL, then the MDC is used as the UCL.

[b] UTL = 95% upper confidence limit on the 90th percentile value, unless the MDC<UTL, then the MDC is used as the UTL.

[c] Maximum = maximum proxy result; may not be a detect.

[d] The TEQ for Dioxins (Total Bird TEQ) and Dioxins (Total Mammal TEQ) are calculated in Table 1.8.

Table 7.5

Upper-Bound Exposure Point Concentration Comparison to Limiting ESLs in the IAEU Surface Soil (Non-PMJM)

Analyte	Small Home Range Receptors			Large Home Range Receptors		
	EPC (UTL)	Limiting ESL[a]	EPC>ESL?	EPC (UCL)	Limiting ESL[b]	EPC>ESL?
Inorganics (mg/kg)						
Antimony	2.10	0.905	**Yes**	1.37	3.85	No
Boron	6.90	0.500	**Yes**	3.43	314	No
Chromium[c]	26	0.400	**Yes**	17.8	68.5	No
Copper	39.2	8.25	**Yes**	31.1	3,000	No
Molybdenum	2.10	1.90	**Yes**	1.02	8.18	No
Selenium	0.460	0.754	No	0.369	3.82	No
Silver	1.40	2	No	2.49	N/A	N/A
Thallium	0.930	1	No	0.505	53.3	No
Tin	3.90	2.90	**Yes**	2.93	16.2	No
Uranium	1.70	5	No	3.74	2,770	No
Organics (µg/kg)						
Benzo(a)pyrene	970	3,160	No	460	13,800	No
Bis(2-ethylhexyl)phthalate	405	137	**Yes**	821	35,000	No
Di-n-butylphthalate	380	15.9	**Yes**	333	122,000	No
Dioxin (Bird TEQ)[d]	0.0720	0.00775	**Yes**	N/A	N/A	N/A
Dioxin (Mammal TEQ)[d]	0.0190	0.00425	**Yes**	0.00900	0.0146	No
Tetrachloroethene	5.50	767	No	367	3,285	No
Total PCBs	1,100	42.3	**Yes**	794	1,180	No

[a]Lowest ESL (threshold if available) for the plant, invertebrate, deer mouse, prairie dog, dove, or kestrel receptors.

[b]Lowest ESL (threshold if available) for the coyote and mule deer receptors.

[c]The ESLs for chromium were developed using available toxicity data based on chromium (III) (birds) and chromium (VI) (plants, invertebrates, and mammals).

[d]The TEQ for Dioxins (Total Bird TEQ) and Dioxins (Total Mammal TEQ) are calculated in Table 1.8.

N/A = Not applicable; ESL not available (assessed in Section 10).

Bold = Analyte retained for further consideration in the next ECOPC selection step.

Table 7.6
Upper-Bound Exposure Point Concentration Comparison to Receptor-Specific ESLs for Small Home Range Receptors in the IAEU Surface Soil (Non-PMJM)

Analyte	Small Home Range Receptor UTL	Receptor-Specific ESLs[a]							
		Terrestrial Plant	Terrestrial Invertebrate	American Kestrel	Mourning Dove (herbivore)	Mourning Dove (insectivore)	Deer Mouse (herbivore)	Deer Mouse (insectivore)	Prairie Dog
Inorganics (mg/kg)									
Antimony	2.10	5	78	N/A	N/A	N/A	9.89	**0.905**	18.7
Boron	6.90	**0.500**	N/A	167	30.3	115	62.1	422	237
Chromium	26	**1**	**0.400**	**14.2**	**24.6**	**1.34**	281	**15.9**	703
Copper	39	100	50	164	**28.8**	**8.25**	295	605	838
Molybdenum	2.10	**2**	N/A	76.1	44.1	6.97	8.68	**1.90**	27.1
Tin	3.90	50	N/A	19	26.1	**2.90**	45	**3.77**	80.6
Organics (µg/kg)									
Bis(2-ethylhexyl)phthalate	405	200,000	N/A	**398**	19,500	**137**	96,200	8,070	27,600
Di-n-butylpthalate	380	N/A	N/A	**41.5**	989	**15.9**	1.21E+06	281,000	4.06E+06
Dioxin (Bird TEQ)[b]	0.0720	N/A	N/A	0.0775	0.194	**0.0135**	N/A	N/A	N/A
Dioxin (Mammal TEQ)[b]	0.0190	N/A	N/A	N/A	N/A	N/A	0.0375	**0.00425**	0.116
Total PCBs	1,100	40,000	N/A	**886**	1,140	**172**	17,000	16,100	53,200

[a]Threshold ESL (if available) for that receptor.

[b] The TEQ for Dioxins (Total Bird TEQ) and Dioxins (Total Mammal TEQ) are calculated in Table 1.8.

N/A = Not applicable; ESL not available (assessed in Section 10).

Bold = Receptors of potential concern.

Table 7.7
Summary of ECOPC Screening Steps for Surface Soil in the IAEU for Non-PMJM Receptors

Analyte	Exceed Any NOAEL ESL?	Detection Frequency >5%?	Exceed Background?[a]	Upper-Bound EPC > Limiting tESL?	Professional Judgment - Retain?	ECOPC?	Receptor(s) of Potential Concern
Inorganics							
Aluminum	Yes	Yes	No	--	--	No	--
Ammonia	No	--	--	--	--	No	--
Antimony	**Yes**	**Yes**	**N/A**	**Yes**	**Yes**	**Yes**	**deer mouse (insectivore)**
Arsenic	Yes	Yes	No	--	--	No	--
Barium	Yes	Yes	No	--	--	No	--
Beryllium	Yes	Yes	No	--	--	No	--
Boron	Yes	Yes	N/A	Yes	No	No	--
Cadmium	Yes	Yes	No	--	--	No	--
Calcium	UT	--	--	--	--	--	--
Cesium	UT	--	--	--	--	--	--
Chromium	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**terrestrial plant terrestrial invertebrate American kestrel mourning dove (insectivore) mourning dove (herbivore) deer mouse (insectivore)**
Chromium (VI)	No	--	--	--	--	No	--
Cobalt	Yes	Yes	No	--	--	No	--
Copper	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**mourning dove (insectivore) mourning dove (herbivore)**
Cyanide	No	--	--	--	--	No	--
Fluoride	No	--	--	--	--	No	--
Iron	UT	--	--	--	--	No	--
Lead	Yes	Yes	No	--	--	No	--
Lithium	Yes	Yes	No	--	--	No	--
Magnesium	UT	--	--	--	--	No	--
Manganese	Yes	Yes	No	--	--	No	--
Mercury	Yes	Yes	No	--	--	No	--
Molybdenum	**Yes**	**Yes**	**N/A**	**Yes**	**Yes**	**Yes**	**terrestrial plant deer mouse (insectivore)**
Nickel	Yes	Yes	No	--	--	No	--
Nitrate / Nitrite	No	--	--	--	--	No	--
Nitrite	UT	--	--	--	--	No	--
Potassium	UT	--	--	--	--	No	--
Selenium	Yes	Yes	N/A	No	--	No	--
Silica	UT	--	--	--	--	No	--
Silicon	UT	--	--	--	--	No	
Silver	Yes	Yes	N/A	No	--	No	--
Sodium	UT	--	--	--	--	No	--

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Table 7.7
Summary of ECOPC Screening Steps for Surface Soil in the IAEU for Non-PMJM Receptors

Analyte	Exceed Any NOAEL ESL?	Detection Frequency >5%?	Exceed Background?[a]	Upper-Bound EPC > Limiting tESL?	Professional Judgment - Retain?	ECOPC?	Receptor(s) of Potential Concern
Strontium	No	--	--	--	--	No	
Thallium	Yes	Yes	N/A	No	--	No	--
Tin	**Yes**	**Yes**	**N/A**	**Yes**	**Yes**	**Yes**	**mourning dove (insectivore)** **deer mouse (insectivore)**
Titanium	UT	--	--	--	--	No	--
Uranium	Yes	Yes	N/A	No	--	No	--
Vanadium	Yes	Yes	No	--	--	No	--
Zinc	Yes	Yes	No	--	--	No	--
Organics							
1,1,1-Trichloroethane	No	--	--	--	--	No	--
1,1,2-Trichloro-1,2,2-trifluoroethane	UT	--	--	--	--	No	--
1,1-Dichloroethene	No	--	--	--	--	No	--
1,2,3-Trichlorobenzene	UT	--	--	--	--	No	--
1,2,4-Trichlorobenzene	No	--	--	--	--	No	--
1,2,4-Trimethylbenzene	UT	--	--	--	--	No	--
1,2-Dichloroethene	No	--	--	--	--	No	--
1,2-Dichloropropane	No	--	--	--	--	No	--
1,3,5-Trimethylbenzene	No	--	--	--	--	No	--
1,4-Dichlorobenzene	No	--	--	--	--	No	--
2,3,7,8-TCDD TEQ (birds)	**Yes**	**Yes**	**N/A**	**Yes**	**Yes**	**Yes**	**mourning dove (insectivore)**
2,3,7,8-TCDD TEQ (mammals)	**Yes**	**Yes**	**N/A**	**Yes**	**Yes**	**Yes**	**deer mouse (insectivore)**
2,4,5-T	No	--	--	--	--	No	--
2,4,5-Trichlorophenol	No	--	--	--	--	No	--
2,4,6-Trichlorophenol	Yes	No	--	--	--	No	--
2,4,6-Trinitrotoluene	No	--	--	--	--	No	--
2,4-Dimethylphenol	UT	--	--	--	--	No	--
2-Butanone	No	--	--	--	--	No	--
2-Hexanone	UT	--	--	--	--	No	--
2-Methylnaphthalene	No	--	--	--	--	No	--
2-Methylphenol	No	--	--	--	--	No	--
4,4'-DDD	No	--	--	--	--	No	--
4,4'-DDE	No	--	--	--	--	No	--
4,4'-DDT	Yes	No	--	--	--	No	--
4-Chloro-3-methylphenol	UT	--	--	--	--	No	--
4-Isopropyltoluene	UT	--	--	--	--	No	--
4-Methyl-2-pentanone	No	--	--	--	--	No	--
4-Methylphenol	UT	--	--	--	--	No	--
4-Nitroaniline	No	--	--	--	--	No	--
4-Nitrophenol	No	--	--	--	--	No	--
Acenaphthene	No	--	--	--	--	No	--

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Table 7.7
Summary of ECOPC Screening Steps for Surface Soil in the IAEU for Non-PMJM Receptors

Analyte	Exceed Any NOAEL ESL?	Detection Frequency >5%?	Exceed Background?	Upper-Bound EPC > Limiting tESL?	Professional Judgment - Retain?	ECOPC?	Receptor(s) of Potential Concern
Acenaphthylene	UT	--	--	--	--	No	--
Acetone	No	--	--	--	--	No	--
Aldrin	No	--	--	--	--	No	--
alpha-BHC	No	--	--	--	--	No	--
Anthracene	UT	--	--	--	--	No	--
Benzene	No	--	--	--	--	No	--
Benzo(a)anthracene	UT	--	--	--	--	No	--
Benzo(a)pyrene	Yes	Yes	N/A	No	--	No	--
Benzo(b)fluoranthene	UT	--	--	--	--	No	--
Benzo(g,h,i)perylene	UT	--	--	--	--	No	--
Benzo(k)fluoranthene	UT	--	--	--	--	No	--
Benzoic Acid	UT	--	--	--	--	No	--
Benzyl Alcohol	No	--	--	--	--	No	--
beta-Chlordane	No	--	--	--	--	No	--
bis(2-ethylhexyl)phthalate	**Yes**	**Yes**	**N/A**	**Yes**	**Yes**	**Yes**	**American kestrel mourning dove (insectivore)**
Bromochloromethane	UT	--	--	--	--	No	--
Butylbenzylphthalate	No	--	--	--	--	No	--
Carbazole	UT	--	--	--	--	No	--
Carbon Disulfide	No	--	--	--	--	No	--
Carbon Tetrachloride	No	--	--	--	--	No	--
Chlorobenzene	No	--	--	--	--	No	--
Chloroform	No	--	--	--	--	No	--
Chloromethane	UT	--	--	--	--	No	--
Chrysene	UT	--	--	--	--	No	--
cis-1,2-Dichloroethene	No	--	--	--	--	No	--
Dibenz(a,h)anthracene	UT	--	--	--	--	No	--
Dibenzofuran	No	--	--	--	--	No	--
Dicamba	No	--	--	--	--	No	--
Dichloroprop	UT	--	--	--	--	No	--
Dieldrin	Yes	No	--	--	--	No	--
Diesel Range Organics	UT	--	--	--	--	No	--
Diethylphthalate	No	--	--	--	--	No	--
Dimethylphthalate	No	--	--	--	--	No	--
Di-n-butylphthalate	**Yes**	**Yes**	**N/A**	**Yes**	**Yes**	**Yes**	**American kestrel mourning dove (insectivore)**
Di-n-octylphthalate	No	--	--	--	--	No	--
Endosulfan I	No	--	--	--	--	No	--
Endosulfan II	No	--	--	--	--	No	--
Endosulfan sulfate	No	--	--	--	--	No	--

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Table 7.7
Summary of ECOPC Screening Steps for Surface Soil in the IAEU for Non-PMJM Receptors

Analyte	Exceed Any NOAEL ESL?	Detection Frequency >5%?	Exceed Background?	Upper Bound EPC > Limiting ESL?	Professional Judgment - Retain?	ECOPC?	Receptor(s) of Potential Concern
Endrin	Yes	No	--	--	--	No	--
Endrin aldehyde	Yes	No	--	--	--	No	--
Ethylbenzene	UT	--	--	--	--	No	--
Fluoranthene	UT	--	--	--	--	No	--
Fluorene	No	--	--	--	--	No	--
gamma-BHC (Lindane)	No	--	--	--	--	No	--
Gasoline	UT	--	--	--	--	No	--
Heptachlor epoxide	No	--	--	--	--	No	--
Heptachlorodibenzo-p-dioxin	UT	--	--	--	--	No	--
Hexachlorobenzene	Yes	No	--	--	--	No	--
Hexachlorobutadiene	No	--	--	--	--	No	--
HMX	No	--	--	--	--	No	--
Indeno(1,2,3-cd)pyrene	UT	--	--	--	--	No	--
Isophorone	UT	--	--	--	--	No	--
Isopropylbenzene	UT	--	--	--	--	No	--
MCPA	UT	--	--	--	--	No	--
Methoxychlor	No	--	--	--	--	No	--
Methylene Chloride	No	--	--	--	--	No	--
Naphthalene	No	--	--	--	--	No	--
n-Butylbenzene	UT	--	--	--	--	No	--
n-Propylbenzene	UT	--	--	--	--	No	--
Pentachlorophenol	Yes	No	--	--	--	No	--
Phenanthrene	UT	--	--	--	--	No	--
Phenol	No	--	--	--	--	No	--
Pyrene	UT	--	--	--	--	No	--
sec-Butylbenzene	UT	--	--	--	--	No	--
Styrene	No	--	--	--	--	No	--
tert-Butylbenzene	UT	--	--	--	--	No	--
Tetrachloroethene	Yes	Yes	N/A	No	--	No	--
Toluene	No	--	--	--	--	No	--
Total PCBs	**Yes**	**Yes**	**N/A**	**Yes**	**Yes**	**Yes**	**American kestrel mourning dove (insectivore)**
Total Petroleum Hydrocarbons	UT	--	--	--	--	No	--
Trichloroethene	No	--	--	--	--	No	--
Trichlorofluoromethane	UT	--	--	--	--	No	--
Xylene	No	--	--	--	--	No	--
Radionuclides							
Americium-241	No	--	--	--	--	No	--
Cesium-134	UT	--	--	--	--	No	--
Cesium-137	No	--	--	--	--	No	--

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Table 7.7
Summary of ECOPC Screening Steps for Surface Soil in the IAEU for Non-PMJM Receptors

Analyte	Exceed Any NOAEL ESL?	Detection Frequency >5%?	Exceed Background?[a]	Upper-Bound EPC > Limiting tESL?	Professional Judgment - Retain?	ECOPC?	Receptor(s) of Potential Concern
Curium-242	UT	--	--	--	--	No	--
Curium-244	UT	--	--	--	--	No	--
Curium-245/246	UT	--	--	--	--	No	--
Gross Alpha	UT	--	--	--	--	No	--
Gross Beta	UT	--	--	--	--	No	--
Neptunium-237	UT	--	--	--	--	No	--
Plutonium-238	UT	--	--	--	--	No	--
Plutonium-239/240	No	--	--	--	--	No	--
Radium-226	No	--	--	--	--	No	--
Radium-228	No	--	--	--	--	No	--
Strontium-89/90	No	--	--	--	--	No	--
Uranium-233/234	No	--	--	--	--	No	--
Uranium-235	No	--	--	--	--	No	--
Uranium-238	No	--	--	--	--	No	--

[a] Based on results of statistical analysis at the 0.1 level of significance.
-- = Screen not performed because analyte was eliminated from further consideration in a previous ECOPC screening step.
N/A = Not applicable; background comparison could not be conducted.
Bold = Analyte retained as an ECOPC for risk characterization.

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Table 7.8
Comparison of MDCs in IAEU Subsurface Soil to NOAEL ESLs for Burrowing Receptors

ECOI	MDC	Prairie Dog NOAEL ESL	EPC> NOAEL ESL?
Inorganics (mg/kg)			
Aluminum	110,000	N/A	UT
Antimony	**19.3**	**18.7**	**Yes**
Arsenic	**69.7**	**9.35**	**Yes**
Barium	1,150	3,220	No
Beryllium	15	211	No
Boron	33	237	No
Cadmium	**547**	**198**	**Yes**
Calcium	412,000	N/A	UT
Cesium	10.9	N/A	UT
Chloride	184	N/A	UT
Chromium[a]	**11,000**	**703**	**Yes**
Chromium (VI)	0.59	703	No
Cobalt	120	2,460	No
Copper	**1,190**	**838**	**Yes**
Cyanide	43	2,200	No
Fluoride	17.6	867	No
Iron	290,000	N/A	UT
Lead	1,500	1,850	No
Lithium	79.9	3,180	No
Magnesium	17,000	N/A	UT
Manganese	**3,140**	**1,519**	**Yes**
Mercury	**16**	**3.15**	**Yes**
Molybdenum	**4,100**	**27.1**	**Yes**
Nickel	**670**	**38.3**	**Yes**
Nitrate / Nitrite[b]	6,100	16,200	No
Nitrite	2.49	N/A	UT
Potassium	21,100	N/A	UT
Selenium	**4.3**	**2.80**	**Yes**
Silica	5,110	N/A	UT
Silicon	14,000	N/A	UT
Silver	110	N/A	UT
Sodium	11,000	N/A	UT
Strontium	487	3,520	No
Sulfate	180	N/A	UT
Sulfide	18.6	N/A	UT
Tantalum	15.7	N/A	UT
Thallium	9.3	204	No
Tin	**392**	**80.6**	**Yes**
Titanium	1,420	N/A	UT

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Table 7.8
Comparison of MDCs in IAEU Subsurface Soil to NOAEL ESLs for Burrowing Receptors

ECOI	MDC	Prairie Dog NOAEL ESL	EPC> NOAEL ESL?
Total Petroleum Hydrocarbons	467,000	N/A	UT
Uranium	**1,600**	**1,230**	**Yes**
Vanadium	**740**	**83.5**	**Yes**
Zinc	**1,800**	**1,170**	**Yes**
Organics (µg/kg)			
1,1,1-Trichloroethane	2,100	4.85E+07	No
1,1,2,2-Tetrachloroethane	1,000	4.70E+06	No
1,1,2-Trichloro-1,2,2-trifluoroethane	390	N/A	UT
1,1,2-Trichloroethane	3.20	N/A	UT
1,1-Dichloroethane	239	215,000	No
1,1-Dichloroethene	23.8	1.28E+06	No
1,2,3-Trichlorobenzene	530	N/A	UT
1,2,3-Trichloropropane	4	1.17E+06	No
1,2,3-Trimethylbenzene	700	N/A	UT
1,2,4-Trichlorobenzene	2,000	94,500	No
1,2,4-Trimethylbenzene	72,300	N/A	UT
1,2-Dibromo-3-chloropropane	3	N/A	UT
1,2-Dichlorobenzene	270	N/A	UT
1,2-Dichloroethane	35	2.00E+06	No
1,2-Dichloroethene	1,200	1.87E+06	No
1,2-Dichloropropane	13	3.92E+06	No
1,3,5-Trimethylbenzene	20,600	856,000	No
1,3-Dichlorobenzene	70	N/A	UT
1,4-Dichlorobenzene	170	5.93E+06	No
1-Iodooctane	2,000	N/A	UT
2,3-Dimethyl-1-butene	1,000	N/A	UT
2,3-Dimethylhexane	900	N/A	UT
2,3-Epoxy-2,3-dimethylbutane	4,000	N/A	UT
2,4-Dimethylphenol	89	N/A	UT
2,4-Dinitrophenol	470	4.90E+06	No
2,4-Dinitrotoluene	43	2,470	No
2,6-Dimethylundecane	1,000	N/A	UT
2,7,10-Trimethyldodecane	1,000	N/A	UT
2-Bromooctane	2,000	N/A	UT
2-Butanone	500	4.94E+07	No
2-Chlorophenol	77	21,600	No
2-Chlorotoluene	80	N/A	UT
2-Hexanone	1,760	N/A	UT
2-Methylnaphthalene	1,400	319,000	No

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Table 7.8
Comparison of MDCs in IAEU Subsurface Soil to NOAEL ESLs for Burrowing Receptors

ECOI	MDC	Prairie Dog NOAEL ESL	EPC> NOAEL ESL?
2-Methylphenol	93	9.26E+06	No
3,3'-Dichlorobenzidine	160	N/A	UT
4,4'-DDD	7.6	6.19E+06	No
4,4'-DDE	4.8	54,400	No
4,4'-DDT	19	176,000	No
4-Chloro-3-methylphenol	54	N/A	UT
4-Chlorotoluene	90	N/A	UT
4-Hydroxy-4-methyl-2-pentanone	100,000	N/A	UT
4-Isopropyltoluene	3,000	N/A	UT
4-Methyl-2-pentanone	850	859,000	No
4-Methylphenol	460	N/A	UT
4-Nitroaniline	230	2.62E+06	No
Acenaphthene	7,900	N/A	UT
Acenaphthylene	94	N/A	UT
Acetone	17,000	248,000	No
Aldrin	4.4	11,300	No
alpha-BHC	6.8	2.47E+06	No
Anthracene	13,000	N/A	UT
Benzene	240	1.10E+06	No
Benzo(a)anthracene	33,000	N/A	UT
Benzo(a)pyrene	35,000	503,000	No
Benzo(b)fluoranthene	29,000	N/A	UT
Benzo(g,h,i)perylene	22,000	N/A	UT
Benzo(k)fluoranthene	29,000	N/A	UT
Benzoic Acid	930	N/A	UT
Benzyl Alcohol	1,600	253,000	No
bis(2-ethylhexyl)phthalate	48,000	2.76E+06	No
bis(2-hydroxyethyl)lauramide	8,000	N/A	UT
Bromochloromethane	7	N/A	UT
Bromoform	1	199,000	No
Bromomethane	7,450	N/A	UT
Butylbenzylphthalate	6,000	3.37E+06	No
Carbazole	1,300	N/A	UT
Carbon Disulfide	290	411,000	No
Carbon Tetrachloride	370	736,000	No
Chlorobenzene	3	414,000	No
Chloroethane	48.2	N/A	UT
Chloroform	670	560,000	No
Chloromethane	86	N/A	UT
Chrysene	36,000	N/A	UT

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Table 7.8
Comparison of MDCs in IAEU Subsurface Soil to NOAEL ESLs for Burrowing Receptors

ECOI	MDC	Prairie Dog NOAEL ESL	EPC> NOAEL ESL?
cis-1,2-Dichloroethene	181	133,000	No
Decane	2,000	N/A	UT
delta-BHC	42	3,420	No
Dibenz(a,h)anthracene	10,000	N/A	UT
Dibenzofuran	3,300	2.44E+06	No
Dichlorodifluoromethane	26	60,000	No
Dieldrin	6.7	301	No
Diesel Range Organics	560,000	N/A	UT
Diethylphthalate	330	2.21E+08	No
Dimethylphthalate	460	1.35E+07	No
Di-n-butylphthalate	3,600	4.06E+07	No
Di-n-octylphthalate	6,000	2.58E+08	No
Dodecane	2,000	N/A	UT
Endosulfan I	3.6	8,730	No
Endosulfan II	12	8,730	No
Endosulfan sulfate	5.3	8,730	No
Endrin	12	8,060	No
Endrin aldehyde	21	8,060	No
Endrin ketone	62	8,060	No
Ethyl acetate	1,000	3.14E+06	No
Ethylbenzene	15,500	N/A	UT
Fluoranthene	66,000	N/A	UT
Fluorene	6,300	N/A	UT
gamma-BHC (Lindane)	10	3,420	No
Gasoline	4,800	N/A	UT
Gasoline Range Organics	1.33E+06	N/A	UT
Heptachlor epoxide	14	9,120	No
Hexachlorobenzene	260	190,000	No
Hexachlorobutadiene	7	151,000	No
Hexadecane	1,000	N/A	UT
Hexamethylcyclotrisiloxane	1,000	N/A	UT
Indeno(1,2,3-cd)pyrene	20,000	N/A	UT
Isophorone	840	N/A	UT
Isopropylbenzene	2,500	N/A	UT
Methoxychlor	22	229,000	No
Methylene Chloride	620	210,000	No
Naphthalene	350,000	1.60E+07	No
n-Butylbenzene	6,350	N/A	UT
n-Hexyl Ether	900	N/A	UT
N-Nitroso-di-n-propylamine	700	N/A	UT

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Table 7.8
Comparison of MDCs in IAEU Subsurface Soil to NOAEL ESLs for Burrowing Receptors

ECOI	MDC	Prairie Dog NOAEL ESL	EPC>NOAEL ESL?
N-nitrosodiphenylamine	250	2.15E+06	No
n-Pentadecane	2,000	N/A	UT
n-Propylbenzene	10,900	N/A	UT
n-Tetradecane	3,000	N/A	UT
n-Tetradecanoic Acid	900	N/A	UT
n-Tridecane	4,000	N/A	UT
Octamethylcyclotetrasiloxane	2,000	N/A	UT
Octanol	600	N/A	UT
Octylcyclohexane	300	N/A	UT
Pentachlorophenol	660	18,400	No
Phenanthrene	62,000	N/A	UT
Phenol	160	1.49E+06	No
Pyrene	67,000	N/A	UT
sec-Butylbenzene	2,000	N/A	UT
Styrene	25.7	1.53E+06	No
tert-Butylbenzene	5.02	N/A	UT
Tetrachloroethene	**197,000**	**72,500**	**Yes**
Toluene	20,000	1.22E+06	No
Total Dioxins	**0.428**	**0.116**	**Yes**
Total PCB	23,000	38,000	No
trans-1,2-Dichloroethene	90	1.87E+06	No
trans-2-pentenal	600	N/A	UT
Trichloroethene	11,600	32,400	No
Trichlorofluoromethane	15	N/A	UT
Undecane	2,000	N/A	UT
Vinyl Chloride	7.67	6,490	No
Xylene[c]	**115,000**	**112,000**	**Yes**
Radionuclides (pCi/g)			
Americium-241	75.5	3,890	No
Cesium-134	0.15	N/A	UT
Cesium-137	0.42	20.8	No
Curium-244	0.4618	N/A	UT
Gross Alpha	116.7	N/A	UT
Gross Beta	55	N/A	UT
Neptunium-237	0.003078	N/A	UT
Plutonium-238	0.1973	N/A	UT
Plutonium-239/240	527	6,110	No
Plutonium-242	0.0812	N/A	UT
Radium-226	9.28	50.6	No
Radium-228	3.9	43.9	No

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Table 7.8
Comparison of MDCs in IAEU Subsurface Soil to NOAEL ESLs for Burrowing Receptors

ECOI	MDC	Prairie Dog NOAEL ESL	EPC> NOAEL ESL?
Strontium-89/90	1.31	22.5	No
Uranium-232	0.0562	N/A	UT
Uranium-233/234	28.9	4,980	No
Uranium-234	0.6	4,980	No
Uranium-235	4.88	2,770	No
Uranium-238	174	1,580	No

[a] The ESLs for chromium were developed using available toxicity data based on chromium (III) (birds) and chromium (VI) (plants, invertebrates, and mammals).

[b] The ESL for nitrate is used.

[c] The value for total xylene is used.

N/A = Indicates no ESL was available for that ECOI/receptor pair.

UT = Uncertain toxicity; no ESL available (assessed in Section 10).

Bold = Analyte retained for further consideration in the next ECOPC selection step.

Table 7.9

Statistical Distribution and Comparison to Background for Subsurface Soil in the IAEU

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background Data Set			IAEU Data Set (excluding background samples)					
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Test	1 - p	Retain as ECOI?
Antimony	28	NONPARAMETRIC	7.14	2,380	NONPARAMETRIC	21.6	N/A	N/A	Yes[a]
Arsenic	45	NONPARAMETRIC	93.3	2,475	NONPARAMETRIC	98.9	WRS	0.0948	Yes
Cadmium	37	NONPARAMETRIC	5.41	2,468	NONPARAMETRIC	31.9	N/A	N/A	Yes[a]
Chromium	45	GAMMA	100	2,475	NONPARAMETRIC	99.8	WRS	0.612	No
Copper	45	NORMAL	95.6	2,475	NONPARAMETRIC	99.5	WRS	0.227	No
Manganese	45	GAMMA	100	2,475	NONPARAMETRIC	99.9	WRS	0.176	No
Mercury	41	NONPARAMETRIC	29.3	2,416	NONPARAMETRIC	78.5	WRS	1.000	No
Molybdenum	45	NONPARAMETRIC	66.7	2,472	NONPARAMETRIC	61.2	WRS	1	No
Nickel	44	GAMMA	100	2,475	NONPARAMETRIC	99.4	WRS	1.000	No
Selenium	38	LOGNORMAL	0	2,475	NONPARAMETRIC	10.6	N/A	N/A	Yes[a]
Tin	41	NONPARAMETRIC	36.6	2,453	NONPARAMETRIC	9.95	N/A	N/A	Yes[a]
Uranium	N/A	N/A	N/A	2,053	NONPARAMETRIC	10.9	N/A	N/A	Yes[a]
Vanadium	45	NORMAL	97.8	2,475	NONPARAMETRIC	100.0	WRS	0.765	No
Zinc	44	NORMAL	100	2,472	NONPARAMETRIC	99.6	WRS	0.911	No

[a] Statistical comparisons to background cannot be performed. The analyte is retained as an ECOI for further evaluation.

-- = Screen not performed because analye was eliminated from further consideration by a previous ECOPC screening step.

N/A = Not applicable. Site and/or background detection frequency less than 20 percent

Bold = Analyte retained for further consideration in the next ECOPC selection step.

WRS = Wolcoxon Rank Sum.

Table 7.10
Statistical Concentrations in Subsurface Soil in the IAEU

Analyte	UCL Recommeded by ProUCL	Distribution Recommened by ProUCL	Total Samples	Mean Detected Concentration	Median Detected Concentration	75^{th} percentile	95^{th} percentile	UCL[a]	UTL[b]	Maximum[c]
Inorganics (mg/kg)										
Antimony	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	2,380	0.852	0.165	0.380	5.65	1.12	2.40	19.3
Arsenic	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	2,475	5.84	5	7.20	13	6.22	11	69.7
Cadmium	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	2,468	1.33	0.0375	0.245	0.957	3.57	0.600	547
Selenium	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	2,475	0.415	0.405	0.435	0.866	0.438	0.500	4.30
Tin	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	2,453	2.33	1	1.50	9.90	3.21	3.30	392
Uranium	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	2,053	2.73	0.750	0.800	6.72	6.34	3.30	1,600
Organics (µg/kg)										
2,3,7,8-TCDD TEQ (mammal)	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	17	5.04E-04	1.08E-04	2.82E-04	0.00297	0.00154	0.00301	0.00301
Tetrachloroethene	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	3,020	338	0.770	2.80	7	1,047	3.20	197,000
Xylene[d]	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	3,004	49.0	1.46	2.80	7.97	216	3.50	115,000

[a] UCL = 95% upper confidence limit on the mean, unless the MDC<UCL, then the MDC is used as the UCL.

[b] UTL = 95% upper confidence limit on the 90th percentile value, unless the MDC<UTL, then the MDC is used as the UTL.

[c] Maximum = maximum proxy result; may not be a detect.

[d] The value for total xylene is used.

Table 7.11
Upper-Bound Exposure Point Concentration Comparison to tESLs in the IAEU

Analyte	Burrowing Receptors		
	EPC (UTL)	tESL[a]	EPC>ESL?
Inorganics (mg/kg)			
Antimony	2.40	18.7	No
Arsenic	11	35.9	No
Cadmium	0.600	198	No
Selenium	0.500	2.80	No
Tin	3.30	80.6	No
Uranium	3.30	1,230	No
Organics (µg/kg)			
2,3,7,8-TCDD TEQ (mammal)	0.00301	0.116	No
Tetrachloroethene	3.20	72,500	No
Xylene	3.50	112,000	No

[a]Threshold ESL (if available) for the prairie dog receptor.

Bold = Analyte retained for further consideration in the next ECOPC selection step.

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Table 7.12
Summary of ECOPC Screening Steps for Subsurface Soil in the IAEU

Analyte	Exceed Any NOAEL ESL	Frequency of Detection >5%	Exceeds Background?[a]	Upper Bound EPC > Limiting ESL?	Professional Judgment - Retain?	Retain as ECOPC?
Inorganics						
Aluminum	UT	--	--	--	--	No
Antimony	Yes	Yes	N/A	No	--	No
Arsenic	Yes	Yes	Yes	No	--	No
Barium	No	--	--	--	--	No
Beryllium	No	--	--	--	--	No
Boron	No	--	--	--	--	No
Cadmium	Yes	Yes	N/A	No	--	No
Calcium	UT	--	--	--	--	No
Cesium	UT	--	--	--	--	No
Chloride	UT	--	--	--	--	No
Chromium	Yes	Yes	No	--	--	No
Chromium (VI)	No	--	--	--	--	No
Cobalt	No	--	--	--	--	No
Copper	Yes	Yes	No	--	--	No
Cyanide	No	--	--	--	--	No
Fluoride	No	--	--	--	--	No
Iron	UT	--	--	--	--	No
Lead	No	--	--	--	--	No
Lithium	No	--	--	--	--	No
Magnesium	UT	--	--	--	--	No
Manganese	Yes	Yes	No	--	--	No
Mercury	Yes	Yes	No	--	--	No
Molybdenum	Yes	Yes	No	--	--	No
Nickel	Yes	Yes	No	--	--	No
Nitrate / Nitrite	No	--	--	--	--	No
Nitrite	UT	--	--	--	--	No
Potassium	UT	--	--	--	--	No
Selenium	Yes	Yes	N/A	No	--	No
Silica	UT	--	--	--	--	No
Silicon	UT	--	--	--	--	No
Silver	UT	--	--	--	--	No
Sodium	UT	--	--	--	--	No
Strontium	No	--	--	--	--	No
Sulfate	UT	--	--	--	--	No
Sulfide	UT	--	--	--	--	No
Tantalum	UT	--	--	--	--	No
Thallium	No	--	--	--	--	No
Tin	Yes	Yes	N/A	No	--	No
Titanium	UT	--	--	--	--	No

Table 7.12
Summary of ECOPC Screening Steps for Subsurface Soil in the IAEU

Analyte	Exceed Any NOAEL ESL	Frequency of Detection >5%	Exceeds Background?[a]	Upper Bound EPC > Limiting ESL?	Professional Judgment - Retain?	Retain as ECOPC?
Uranium	Yes	Yes	N/A	No	--	No
Vanadium	Yes	Yes	No	--	--	No
Zinc	Yes	Yes	No	--	--	No
Organics						
1,1,1-Trichloroethane	No	--	--	--	--	No
1,1,2,2-Tetrachloroethane	No	--	--	--	--	No
1,1,2-Trichloro-1,2,2-trifluoroethane	UT	--	--	--	--	No
1,1,2-Trichloroethane	UT	--	--	--	--	No
1,1-Dichloroethane	No	--	--	--	--	No
1,1-Dichloroethene	No	--	--	--	--	No
1,2,3-Trichlorobenzene	UT	--	--	--	--	No
1,2,3-Trichloropropane	No	--	--	--	--	No
1,2,3-Trimethylbenzene	UT	--	--	--	--	No
1,2,4-Trichlorobenzene	No	--	--	--	--	No
1,2,4-Trimethylbenzene	UT	--	--	--	--	No
1,2-Dibromo-3-chloropropane	UT	--	--	--	--	No
1,2-Dichlorobenzene	UT	--	--	--	--	No
1,2-Dichloroethane	No	--	--	--	--	No
1,2-Dichloroethene	No	--	--	--	--	No
1,2-Dichloropropane	No	--	--	--	--	No
1,3,5-Trimethylbenzene	No	--	--	--	--	No
1,3-Dichlorobenzene	UT	--	--	--	--	No
1,4-Dichlorobenzene	No	--	--	--	--	No
1-Iodooctane	UT	--	--	--	--	No
2,3-Dimethyl-1-butene	UT	--	--	--	--	No
2,3-Dimethylhexane	UT	--	--	--	--	No
2,3-Epoxy-2,3-dimethylbutane	UT	--	--	--	--	No
2,3,7,8-TCDD TEQ (mammal)	Yes	Yes	N/A	No	--	No
2,4-Dimethylphenol	UT	--	--	--	--	No
2,4-Dinitrophenol	No	--	--	--	--	No
2,4-Dinitrotoluene	No	--	--	--	--	No
2,6-Dimethylundecane	UT	--	--	--	--	No
2,7,10-Trimethyldodecane	UT	--	--	--	--	No
2-Bromooctane	UT	--	--	--	--	No
2-Butanone	No	--	--	--	--	No
2-Chlorophenol	No	--	--	--	--	No
2-Chlorotoluene	UT	--	--	--	--	No
2-Hexanone	UT	--	--	--	--	No
2-Methylnaphthalene	No	--	--	--	--	No

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Table 7.12
Summary of ECOPC Screening Steps for Subsurface Soil in the IAEU

Analyte	Exceed Any NOAEL ESL	Frequency of Detection >5%	Exceeds Background?*	Upper Bound EPC > Limiting ESL?	Professional Judgment - Retain?	Retain as ECOPC?
2-Methylphenol	No	--	--	--	--	No
3,3'-Dichlorobenzidine	UT	--	--	--	--	No
4,4'-DDD	No	--	--	--	--	No
4,4'-DDE	No	--	--	--	--	No
4,4'-DDT	No	--	--	--	--	No
4-Bromophenyl-phenylether	UT	--	--	--	--	No
4-Chloro-3-methylphenol	UT	--	--	--	--	No
4-Chlorotoluene	UT	--	--	--	--	No
4-Hydroxy-4-methyl-2-pentanone	UT	--	--	--	--	No
4-Isopropyltoluene	UT	--	--	--	--	No
4-Methyl-2-pentanone	No	--	--	--	--	No
4-Methylphenol	UT	--	--	--	--	No
4-Nitroaniline	No	--	--	--	--	No
Acenaphthene	UT	--	--	--	--	No
Acenaphthylene	UT	--	--	--	--	No
Acetone	No	--	--	--	--	No
Aldrin	No	--	--	--	--	No
alpha-BHC	No	--	--	--	--	No
Anthracene	UT	--	--	--	--	No
Benzene	No	--	--	--	--	No
Benzo(a)anthracene	UT	--	--	--	--	No
Benzo(a)pyrene	No	--	--	--	--	No
Benzo(b)fluoranthene	UT	--	--	--	--	No
Benzo(g,h,i)perylene	UT	--	--	--	--	No
Benzo(k)fluoranthene	UT	--	--	--	--	No
Benzoic Acid	UT	--	--	--	--	No
Benzyl Alcohol	No	--	--	--	--	No
bis(2-ethylhexyl)phthalate	No	--	--	--	--	No
bis(2-hydroxyethyl)lauramide	UT	--	--	--	--	No
Bromochloromethane	UT	--	--	--	--	No
Bromodichloromethane	No	--	--	--	--	No
Bromoform	No	--	--	--	--	No
Bromomethane	UT	--	--	--	--	No
Butylbenzylphthalate	No	--	--	--	--	No
Carbazole	UT	--	--	--	--	No
Carbon Disulfide	No	--	--	--	--	No
Carbon Tetrachloride	No	--	--	--	--	No
Chlorobenzene	No	--	--	--	--	No
Chloroethane	UT	--	--	--	--	No
Chloroform	No	--	--	--	--	No

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Table 7.12
Summary of ECOPC Screening Steps for Subsurface Soil in the IAEU

Analyte	Exceed Any NOAEL ESL	Frequency of Detection >5%	Exceeds Background?[a]	Upper Bound EPC > Limiting ESL?	Professional Judgment - Retain?	Retain as ECOPC?
Chloromethane	UT	--	--	--	--	No
Chrysene	UT	--	--	--	--	No
cis-1,2-Dichloroethene	No	--	--	--	--	No
Decane	UT	--	--	--	--	No
delta-BHC	No	--	--	--	--	No
Dibenz(a,h)anthracene	UT	--	--	--	--	No
Dibenzofuran	No	--	--	--	--	No
Dichlorodifluoromethane	No	--	--	--	--	No
Dieldrin	No	--	--	--	--	No
Diesel Range Organics	UT	--	--	--	--	No
Diethylphthalate	No	--	--	--	--	No
Dimethylphthalate	No	--	--	--	--	No
Di-n-butylphthalate	No	--	--	--	--	No
Di-n-octylphthalate	No	--	--	--	--	No
Dodecane	UT	--	--	--	--	No
Endosulfan I	No	--	--	--	--	No
Endosulfan II	No	--	--	--	--	No
Endosulfan sulfate	No	--	--	--	--	No
Endrin	No	--	--	--	--	No
Endrin aldehyde	No	--	--	--	--	No
Endrin ketone	No	--	--	--	--	No
ethyl acetate	No	--	--	--	--	No
Ethylbenzene	UT	--	--	--	--	No
Fluoranthene	UT	--	--	--	--	No
Fluorene	UT	--	--	--	--	No
gamma-BHC (Lindane)	No	--	--	--	--	No
Gasoline	UT	--	--	--	--	No
Gasoline Range Organics	UT	--	--	--	--	No
Heptachlor epoxide	No	--	--	--	--	No
Hexachlorobenzene	No	--	--	--	--	No
Hexachlorobutadiene	No	--	--	--	--	No
Hexadecane	UT	--	--	--	--	No
Hexamethylcyclotrisiloxane	UT	--	--	--	--	No
Indeno(1,2,3-cd)pyrene	UT	--	--	--	--	No
Isophorone	UT	--	--	--	--	No
Isopropylbenzene	UT	--	--	--	--	No
Methoxychlor	No	--	--	--	--	No
Methylene Chloride	No	--	--	--	--	No
Naphthalene	No	--	--	--	--	No
n-Butylbenzene	UT	--	--	--	--	No

Table 7.12
Summary of ECOPC Screening Steps for Subsurface Soil in the IAEU

Analyte	Exceed Any NOAEL ESL	Frequency of Detection >5%	Exceeds Background?[a]	Upper Bound EPC > Limiting ESL?	Professional Judgment - Retain?	Retain as ECOPC?
n-Hexyl Ether	UT	--	--	--	--	No
N-Nitroso-di-n-propylamine	UT	--	--	--	--	No
N-nitrosodiphenylamine	No	--	--	--	--	No
n-Pentadecane	UT	--	--	--	--	No
n-Propylbenzene	UT	--	--	--	--	No
n-Tetradecane	UT	--	--	--	--	No
n-Tetradecanoic Acid	UT	--	--	--	--	No
n-Tridecane	UT	--	--	--	--	No
Octamethylcyclotetrasiloxane	UT	--	--	--	--	No
Octanol	UT	--	--	--	--	No
Octylcyclohexane	UT	--	--	--	--	No
Pentachlorophenol	No	--	--	--	--	No
Phenanthrene	UT	--	--	--	--	No
Phenol	No	--	--	--	--	No
Pyrene	UT	--	--	--	--	No
sec-Butylbenzene	UT	--	--	--	--	No
Styrene	No	--	--	--	--	No
tert-Butylbenzene	UT	--	--	--	--	No
Tetrachloroethene	Yes	Yes	N/A	No	--	No
Toluene	No	--	--	--	--	No
Total PCB	No	--	--	--	--	No
Total Petroleum Hydrocarbons	UT	--	--	--	--	No
trans-1,2-Dichloroethene	No	--	--	--	--	No
trans-2-pentenal	UT	--	--	--	--	No
Trichloroethene	No	--	--	--	--	No
Trichlorofluoromethane	UT	--	--	--	--	No
Undecane	UT	--	--	--	--	No
Vinyl Chloride	No	--	--	--	--	No
Xylene	Yes	Yes	N/A	No	--	No
Radionuclides						No
Americium-241	No	--	--	--	--	No
Cesium-134	UT	--	--	--	--	No
Cesium-137	No	--	--	--	--	No
Curium-244	UT	--	--	--	--	No
Gross Alpha	UT	--	--	--	--	No
Gross Beta	UT	--	--	--	--	No
Neptunium-237	UT	--	--	--	--	No
Plutonium-238	UT	--	--	--	--	No
Plutonium-239/240	No	--	--	--	--	No
Plutonium-242	UT	--	--	--	--	No

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Table 7.12
Summary of ECOPC Screening Steps for Subsurface Soil in the IAEU

Analyte	Exceed Any NOAEL ESL	Frequency of Detection >5%	Exceeds Background?[a]	Upper Bound EPC > Limiting ESL?	Professional Judgment - Retain?	Retain as ECOPC?
Radium-226	No	--	--	--	--	No
Radium-228	No	--	--	--	--	No
Strontium-89/90	No	--	--	--	--	No
Uranium-232	UT	--	--	--	--	No
Uranium-233/234	No	--	--	--	--	No
Uranium-234	No	--	--	--	--	No
Uranium-235	No	--	--	--	--	No
Uranium-238	No	--	--	--	--	No

[a] Based on results of statistical analysis at the 0.1 level of significance.

-- - Screen not performed because analyte was eliminated from further consideration in a previous ECOPC screening step.

UT = Uncertain toxicity; ESL not available (assessed in Section 10)

N/A = Not applicable; background comparison could not be conducted.

Table 8.1
Summary of ECOPC/Receptor Pairs

ECOPC	Receptors of Potential Concern
Surface Soil	
Antimony	Deer mouse (insectivore)
Chromium	Terrestrial plant Terrestrial invertebrate American kestrel Mourning dove (insectivore) Mourning dove (herbivore) Deer mouse (insectivore)
Copper	Mourning dove (insectivore) Mourning dove (herbivore)
Molybdenum	Terrestrial plant Deer mouse (insectivore)
Tin	Mourning dove (insectivore) Deer mouse (insectivore)
bis(2-ethylhexyl)phthalate	American kestrel Mourning dove (insectivore)
Di-n-butylphthalate	American kestrel Mourning dove (insectivore)
2,3,7,8-TCDD TEQ (bird)	Mourning dove (insectivore)
2,3,7,8-TCDD TEQ (mammal)	Deer mouse (insectivore)
Total PCBs	American kestrel Mourning dove (insectivore)
Surface Soil PMJM	
N/A	
Subsurface Soil	
None	None

N/A = Not applicable.

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Table 8.2
Surface Soil Exposure Point Concentrations for Non-PMJM Receptors

ECOPC	Tier I Exposure Point Concentrations (mg/kg)		Tier II Exposure Point Concentrations (mg/kg)	
	UTL	UCL	UTL	UCL
Inorganics				
Antimony	2.1	1.37	2.53	1.91
Chromium	26	17.8	17	15.7
Copper	39	31.1	31	25.5
Molybdenum	2.1	1.02	1.09	0.956
Tin	3.9	2.93	5.63	3.99
Organics				
bis(2-ethylhexyl)phthalate	0.405	0.821	0.524	0.413
Di-n-butylphthalate	0.38	0.333	0.294	0.274
2,3,7,8-TCDD TEQ (bird)	7.19E-05	3.29E-05	2.50E-05	1.70E-05
2,3,7,8-TCDD TEQ (mammal)	1.86E-05	9.16E-06	1.00E-05	7.90E-06
Total PCBs	1.09	0.794	0.469	0.38

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Table 8.3
Surface Water Exposure Point Concentrations

ECOPC	MDC	UTL	UCL	Mean
Inorganics (mg/L)				
Antimony	0.604	0.023	0.018	0.013
Chromium	0.434	0.014	0.008	0.006
Copper	0.623	0.034	0.017	0.013
Molybdenum	0.606	0.008	0.006	0.004
Tin	0.315	0.013	0.007	0.005
Organics (ug/L)				
bis(2-ethylhexyl)phthalate	140	26	18.4	8.27
Di-n-butylphthalate	11	5.25	3.84	3.14
2,3,7,8-TCDD TEQ (bird)	N/A	N/A	N/A	N/A
2,3,7,8-TCDD TEQ (mammal)	N/A	N/A	N/A	N/A
Total PCBs	24	1.1	2.33	0.853

N/A = Not available.

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Table 8.4
Receptor-Specific Input Parameters

			Percentage of Diet									
Receptor	Body Weight (kg)	Body Weight Reference	Plant Tissue	Invertebrate Tissue	Bird or Mammal Tissue	Dietary Reference	Food Ingestion Rate (kg/kg BW day^{-1})	Ingestion Rate Reference	Water Ingestion Rate (l/kg BW day^{-1})	Ingestion Rate Reference	Percentage of Diet as Soil	Soil Ingestion Reference
Vertebrate Receptors												
Deer Mouse - Insectivore	0.0187	Flake (1973)	0	100	0	Generalized Diet	0.065	Cronin and Bradley (1988)	0.19	Ross (1930); Dice (1922) as cited in USEPA 1993.	2	Beyer et al. (1994)
Mourning Dove - Herbivore	0.113	Average of adult values from CalEPA (2004) Online Database	100	0	0	Cowan (1952)	0.23	EPA (2003a)	0.12	EPA (1993) - Estimated using model for all birds - Calder and Braun (1983)	9.3	Beyer et al (1994) - Wild turkey used as a surrogate.
Mourning Dove - Insectivore	0.113	Average of adult values from CalEPA (2004) Online Database	0	100	0	Generalized Diet	0.23	EPA (2003a)	0.12	EPA (1993) - Estimated using model for all birds - Calder and Braun (1983)	9.3	Beyer et al (1994) - Wild turkey used as a surrogate.
American Kestrel	0.116	Brown and Amadon (1968) - Average value	0	20	80	Generalized Diet from several studies presented in the Watershed ERA DOE (1996)	0.092	Kolpin et al. (1980)	0.12	EPA (1993) - Estimated using model for all birds - Calder and Braun (1983)	5	Assumed value based on conservative estimates for carnivores
Non-Wildlife Terrestrial Receptors												
Terrestrial Invertebrates: N/A												
Terrestrial Plants: N/A												

Receptor parameters for all receptors with the exception of the Prairie Dog and the Mourning Dove were taken from the Watershed Risk Assessment (DOE, 1996b) and referenced to the original source.

All receptor parameters are estimates of central tendency except where noted.

All values are presented in a dry weight basis.

N/A = Not applicable

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Table 8.5
Receptor-Specific Intake Estimates

Intake Estimates (mg/kg BW day)						
	Plant Tissue	Invertebrate Tissue	Mammal Tissue	Soil	Surface Water	Total
Default Exposure Estimates						
Antimony						
Deer Mouse - Insectivore						
Tier 1 UTL	N/A	0.137	N/A	0.00273	0.00342	0.143
Tier 2 UTL	N/A	0.164	N/A	0.00329	0.00342	0.171
Chromium						
Mourning Dove - Herbivore						
Tier 1 UTL	0.502	N/A	N/A	0.556	0.00168	1.06
Tier 2 UTL	0.328	N/A	N/A	0.364	0.00168	0.694
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	18.9	N/A	0.556	0.00168	19.5
Tier 2 UTL	N/A	12.4	N/A	0.364	0.00168	12.7
American Kestrel						
Tier 1 UTL	N/A	1.51	0.180	0.120	0.00168	1.81
Tier 2 UTL	N/A	0.989	0.132	0.0782	0.00168	1.20
Deer Mouse - Insectivore						
Tier 1 UTL	N/A	5.34	N/A	0.0338	0.00266	5.38
Tier 2 UTL	N/A	3.49	N/A	0.0221	0.00266	3.52
Copper						
Mourning Dove - Herbivore						
Tier 1 UTL	1.90	N/A	N/A	0.834	0.00408	2.74
Tier 2 UTL	1.74	N/A	N/A	0.663	0.00408	2.40
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	3.23	N/A	0.834	0.00408	4.07
Tier 2 UTL	N/A	3.04	N/A	0.663	0.00408	3.71
Molybdenum						
Deer Mouse - Insectivore						
Tier 1 UTL	N/A	0.285	N/A	0.003	0.002	0.29
Tier 2 UTL	N/A	0.148	N/A	0.001	0.002	0.15
Tin						
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	0.897	N/A	0.0834	0.00156	0.982
Tier 2 UTL	N/A	1.29	N/A	0.120	0.00156	1.42
Deer Mouse - Insectivore						
Tier 1 UTL	N/A	0.254	N/A	0.00507	0.00247	0.261
Tier 2 UTL	N/A	0.366	N/A	0.00732	0.00247	0.376
Bis(2-ethylhexyl)phthalate						
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	3.25	N/A	0.00866	0.00312	3.26
Tier 2 UTL	N/A	4.21	N/A	0.0112	0.00312	4.22

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Table 8.5
Receptor-Specific Intake Estimates

	Intake Estimates (mg/kg BW-day)					
	Plant Tissue	Invertebrate Tissue	Mammal Tissue	Soil	Surface Water	Total
American Kestrel						
Tier 1 UTL	N/A	0.260	0.859	0.00186	0.00312	1.12
Tier 2 UTL	N/A	0.336	1.11	0.00241	0.00312	1.45
Di-n-butylphthalate						
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	2.63	N/A	0.00813	6.30E-04	2.64
Tier 2 UTL	N/A	2.04	N/A	0.00629	6.30E-04	2.04
American Kestrel						
Tier 1 UTL	N/A	0.210	0.795	0.00175	6.30E-04	1.01
Tier 2 UTL	N/A	0.163	0.615	0.00135	6.30E-04	0.780
2,3,7,8-TCDD TEQ (bird)						
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	8.37E-05	N/A	1.54E-06	N/A	8.53E-05
Tier 2 UTL	N/A	2.36E-05	N/A	5.35E-07	N/A	2.41E-05
2,3,7,8-TCDD TEQ (mammal)						
Deer Mouse - Insectivore						
Tier 1 UTL	NA	4.67E-06	NA	2.42E-08	N/A	4.69E-06
Tier 2 UTL	NA	2.22E-06	NA	1.30E-08	N/A	2.23E-06
Total PCBs						
Mourning Dove - Insectivore						
Tier 1 UTL	NA	1.06	NA	0.0233	0.00132	1.08
Tier 2 UTL	NA	0.689	NA	0.0170	0.00132	0.708
American Kestrel						
Tier 1 UTL	NA	0.0847	0.128	0.00501	0.00132	0.219
Tier 2 UTL	NA	0.0552	0.121	0.00366	0.00132	0.181
Alterative Exposure Estimates						
Chromium						
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	1.83	N/A	0.556	0.00168	2.39
Tier 2 UTL	N/A	1.20	N/A	0.364	0.00168	1.56

N/A = Not applicable.

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Table 9.1
TRVs for Terrestrial Plant and Invertebrate Receptors

ECOPC	Soil Concentration (mg/kg)	Endpoint	Effect Measured/Observed	Reference	Notes
Terrestrial Plants					
Chromium	1	Screening ESL	Value was not based on any specific study.	Efroymsom et al. 1997a	Low confidence in value.
Molybdenum	2	Screening ESL	Unspecified effects to plants grown in surface soil with 2 mg/kg Mo added.	Kabata-Pendias and Pendias 1993 in Efroymson et al. 1997a	Low confidence in value.
Terrestrial Invertebrates					
Chromium	0.4	Screening ESL	Value based on lowest concentration tested and then adjusted by an uncertainty factor of 5.	Efroymsom et al. 1997b	Low confidence in value.

Table 9.2
TRVs for Terrestrial Vertebrate Receptors

ECOPC	NOAEL (mg/kg day)	NOAEL Endpoint	Lowest Bounded LOAEL (mg/kg day)	LOAEL Endpoint	TRV Source	Uncertainty Factor	Final NOAEL (mg/kg day)	Threshold (mg/kg day)	Rationale For Calculation	TRV Confidence
Birds										
Antimony	*No Values Available*									N/A
Chromium (III)	1	No effect on black duckling survival	5	Reduction in black duckling survival	Sample et al. (1996)	1	1	N/A	No threshold TRV available	High
Chromium (VI)	*No Values Available*									N/A
Copper	2.3	No effects noted	52.3	Increase in chicken gizzard erosion	PRC (1994)	1	2.3	11	The nature of the effect is not likely to cause a significant effect on growth, reproduction, or survival. Thus, the data satisfy the requirements described in the text for calculating a threshold.	High
Tin (Butyltins)	0.73	No change in Japanese quail growth and reproduction	18.34	Decrease in Japanese quail reproduction	PRC (1994)	1	0.73	N/A	No threshold TRV available	High
bis(2-ethylhexyl)phthalate	1.1	No reproductive effects in ringed doves	214	Increase in European starling body weight.	Sample et al. (1996)/O'Shea and Stafford (1980)	1	1.1	N/A	No threshold TRV available	Low
Di-n-butylphthalate[1]	0.11	NOAEL estimated from LOAEL	1.1	Reduction in eggshell thickness and water permeability in ringed doves	Sample et al. (1996)	1	0.11	N/A	NOAEL was estimated from the LOAEL.	High
2,3,7,8-TCDD TEQ (bird)	1.40E-05	No effect on pheasant egg production and hatchability	1.40E-04	Decrease in egg production and hatchability	Sample et al. (1996)	1	1.40E-05	N/A	No threshold TRV available	High
Total PCBs	0.09	NOAEL was estimated from LOAEL	1.27	Decrease in egg hatchability	PRC (1994)	1	0.09	NA	NOAEL was estimated from LOAEL	High
Mammals										
Antimony	0.06	No change to rat progeny weight	0.59	Decrease in rat progeny weight	EPA (2003)	1	0.06	N/A	No threshold TRV available	Very high
Chromium III	2,737	No effects on rat reproduction and life span	NA	No effects at the highest study dose	Sample et al. (1996)	1	2,737	N/A	No LOAEL was presented.	High

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Table 9.2
TRVs for Terrestrial Vertebrate Receptors

ECOPC	NOAEL (mg/kg day)	NOAEL Endpoint	Lowest Bounded LOAEL (mg/kg day)	LOAEL Endpoint	TRV Source	Uncertainty Factor	Final NOAEL (mg/kg day)	Threshold (mg/kg day)	Rationale For Calculation	TRV Confidence
Chromium VI	3.28	No effects on rat body weight or food consumption	13.14	Increased mortality in rats	Sample et al. (1996)	1	3.28	N/A	No threshold TRV available	High
Molybdenum	0.26	NOAEL estimated from LOAEL	2.6	Increased incidence in runts in mice litters	Sample et al. (1996)	1	0.26	N/A	No threshold TRV available	High
Tin (Butyltins)	0.25	No systemic effects	15	Midrange of effects less than mortality	PRC (1994)	1	0.25	N/A	No threshold TRV available	High
2,3,7,8-TCDD TEQ (mammal)	1.00E-06	No reproductive effects in rats.	1.00E-05	Decreased fertility and neonatal survival in rats	Sample et al. (1996)	1	1.00E-06	N/A	No threshold TRV available	High

Threshold TRVs were independently calculated using the procedures outline in the CRA Methodology, Section 3.1.4.

TRV Confidence:

N/A = No TRV has been identified or the TRV has been deemed unacceptable for use in ECOPC selection.
Low = TRVs that have data for only one species looking at one endpoint (non-mortality) and from one primary literature source.
Moderate = TRVs that have multiple primary literature sources looking at one endpoint (non-mortality or mortality) but with only one species evaluated.
Good = For TRVs that have either multiple species with one endpoint from multiple studies or those TRVs with multiple species and multiple endpoints from only one study.
High = For TRVs that have multiple study sources looking at multiple endpoints and more than one species.
Very High = All EcoSSLs (EPA 2003a) will be assigned this level of confidence by default.

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Table 10.1
Hazard Quotient Summary For Non-PMJM Receptors

ECOPC	Receptor	BAF	EPC	Hazard Quotients (HQs)	
				Based on Default TRVs	Based on Alternate TRVs (Uncertainty Analysis)
Antimony	Deer Mouse (Insectivore)	Default	Tier 1	*NOAEL* UTL = 2 *LOAEL* UTL = 0.2	Not Calculated
			Tier 2	*NOAEL* UTL = 3 *LOAEL* UTL = 0.3	Not Calculated
		Alternate	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated

Table 10.1
Hazard Quotient Summary For Non-PMJM Receptors

ECOPC	Receptor	BAF	EPC	Hazard Quotients (HQs) Based on Default TRVs	Hazard Quotients (HQs) Based on Alternate TRVs (Uncertainty Analysis)
	Terrestrial Plants	N/A	Tier 1	*ESL* UTL = 26	*NOEC* UTL = 3 *LOEC* UTL = 0.9
			Tier 2	*ESL* UTL = 17	*NOEC* UTL = 2 *LOEC* UTL = 0.6
	Terrestrial Invertebrates	N/A	Tier 1	*ESL* UTL = 65	*LOEC* UTL = 0.8
			Tier 2	*ESL* UTL = 45	*LOEC* UTL = 0.5
	American kestrel	Default	Tier 1	*NOAEL* UTL = 2 *LOAEL* UTL = 0.4	Not Calculated
			Tier 2	*NOAEL* UTL = 1 *LOAEL* UTL = 0.2	Not Calculated
		Alternate	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated
	Mourning Dove (Herbivore)	Default	Tier 1	*NOAEL* UTL = 1 *LOAEL* UTL = 0.2	Not Calculated
			Tier 2	*NOAEL* UTL = 0.7 *LOAEL* UTL = 0.1	Not Calculated
		Alternate (Uncertainty Analysis)	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated

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Table 10.1
Hazard Quotient Summary For Non-PMJM Receptors

ECOPC	Receptor	BAF	EPC	Hazard Quotients (HQs)	
				Based on Default TRVs	Based on Alternate TRVs (Uncertainty Analysis)
Chromium	Mourning Dove (Insectivore)	Default	Tier 1	*NOAEL* UTL = 19 *LOAEL* UTL = 4	Not Calculated
			Tier 2	*NOAEL* UTL = 13 *LOAEL* UTL = 3	Not Calculated
		Alternate	Tier 1	*NOAEL* UTL = 2 *LOAEL* UTL = 0.5	Not Calculated
			Tier 2	*NOAEL* UTL = 2 *LOAEL* UTL = 0.3	Not Calculated
	Deer Mouse (Insectivore)	Default	Tier 1	**Chromium VI** *NOAEL* UTL = 2 *LOAEL* UTL = 0.4 **Chromium III** *NOAEL* UTL = 0.002	Not Calculated
			Tier 2	**Chromium VI** *NOAEL* UTL = 1 *LOAEL* UTL = 0.3 **Chromium III** *NOAEL* UTL = 0.001	Not Calculated
		Alternate	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated

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Table 10.1
Hazard Quotient Summary For Non-PMJM Receptors

ECOPC	Receptor	BAF	EPC	Hazard Quotients (HQs) Based on Default TRVs	Hazard Quotients (HQs) Based on Alternate TRVs (Uncertainty Analysis)
Copper	Mourning Dove (Herbivore)	Default	Tier 1	*NOAEL* UTL = 1 *Threshold* UTL = 0.2 *LOAEL* UTL = 0.05	Not Calculated
			Tier 2	*NOAEL* UTL = 1 *Threshold* UTL = 0.2 *LOAEL* UTL = 0.05	Not Calculated
		Alternate (Uncertainty Analysis)	Tier 1	Not Calcualted	Not Calculated
			Tier 2	Not Calcualted	Not Calculated
	Mourning Dove (Insectivore)	Default	Tier 1	*NOAEL* UTL = 2 *Threshold* UTL = 0.4 *LOAEL* UTL = 0.1	Not Calculated
			Tier 2	*NOAEL* UTL = 2 *Threshold* UTL = 0.3 *LOAEL* UTL = 0.1	Not Calculated
		Alternate	Tier 1	Not Calcualted	Not Calculated
			Tier 2	Not Calcualted	Not Calculated

Table 10.1
Hazard Quotient Summary For Non-PMJM Receptors

ECOPC	Receptor	BAF	EPC	Hazard Quotients (HQs)	
				Based on Default TRVs	Based on Alternate TRVs (Uncertainty Analysis)
Molybdenum	Terrestrial Plants	N/A	Tier 1	*ESL* UTL = 1	Not Calculated
			Tier 2	*ESL* UTL = 0.6	Not Calculated
	Deer Mouse (Insectivore)	Default	Tier 1	*NOAEL* UTL = 1 *LOAEL* UTL = 0.1	Not Calculated
			Tier 2	*NOAEL* UTL = 0.6 *LOAEL* UTL = 0.1	Not Calculated
		Alternate	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated

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Table 10.1
Hazard Quotient Summary For Non-PMJM Receptors

ECOPC	Receptor	BAF	EPC	Hazard Quotients (HQs) Based on Default TRVs	Hazard Quotients (HQs) Based on Alternate TRVs (Uncertainty Analysis)
Tin	Mourning Dove (Insectivore)	Default	Tier 1	*NOAEL* UTL = 1 *LOAEL* UTL = 0.05	Not Calculated
			Tier 2	*NOAEL* UTL = 2 *LOAEL* UTL = 0.1	Not Calculated
		Alternate	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated
	Deer Mouse (Insectivore)	Default	Tier 1	*NOAEL* UTL = 1 *LOAEL* UTL = 0.02	Not Calculated
			Tier 2	*NOAEL* UTL = 2 *LOAEL* UTL = 0.03	Not Calculated
		Alternate	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated

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Table 10.1
Hazard Quotient Summary For Non-PMJM Receptors

ECOPC	Receptor	BAF	EPC	Hazard Quotients (HQs)	
				Based on Default TRVs	Based on Alternate TRVs (Uncertainty Analysis)
Bis(2-ethylhexyl)phthalate	American Kestrel	Default	Tier 1	*NOAEL* UTL = 1 *LOAEL* UTL = 0.01	Not Calculated
			Tier 2	*NOAEL* UTL = 1 *LOAEL* UTL = 0.01	Not Calculated
		Alternate	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated
	Mourning Dove (Insectivore)	Default	Tier 1	*NOAEL* UTL = 3 *LOAEL* UTL = 0.02	Not Calculated
			Tier 2	*NOAEL* UTL = 4 *LOAEL* UTL = 0.02	Not Calculated
		Alternate (Uncertainty Analysis)	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated

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Table 10.1
Hazard Quotient Summary For Non-PMJM Receptors

ECOPC	Receptor	BAF	EPC	Hazard Quotients (HQs)	
				Based on Default TRVs	Based on Alternate TRVs (Uncertainty Analysis)
Di-n-butylphthalate	American Kestrel	Default	Tier 1	*NOAEL* UTL = 9 *LOAEL* UTL = 0.9	Not Calculated
			Tier 2	*NOAEL* UTL = 7 *LOAEL* UTL = 0.7	Not Calculated
		Alternate	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated
	Mourning Dove (Insectivore)	Default	Tier 1	*NOAEL* UTL = 24 *LOAEL* UTL = 2	Not Calculated
			Tier 2	*NOAEL* UTL = 19 *LOAEL* UTL = 2	Not Calculated
		Alternate (Uncertainty Analysis)	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated

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Table 10.1
Hazard Quotient Summary For Non-PMJM Receptors

ECOPC	Receptor	BAF	EPC	Hazard Quotients (HQs)	
				Based on Default TRVs	Based on Alternate TRVs (Uncertainty Analysis)
2,3,7,8-TCDD TEQ (bird)	Mourning Dove (Insectivore)	Default	Tier 1	*NOAEL* UTL = 6 *LOAEL* UTL = 0.6	Not Calculated
			Tier 2	*NOAEL* UTL = 2 *LOAEL* UTL = 0.2	Not Calculated
		Alternate (Uncertainty Analysis)	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated
2,3,7,8-TCDD TEQ (mammal)	Deer Mouse (Insectivore)	Default	Tier 1	*NOAEL* UTL = 5 *LOAEL* UTL = 0.5	Not Calculated
			Tier 2	*NOAEL* UTL = 2 *LOAEL* UTL = 0.2	Not Calculated
		Alternate	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated

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Table 10.1
Hazard Quotient Summary For Non-PMJM Receptors

ECOPC	Receptor	BAF	EPC	Hazard Quotients (HQs)	
				Based on Default TRVs	Based on Alternate TRVs (Uncertainty Analysis)
Total PCBs	American Kestrel	Default	Tier 1	*NOAEL* UTL = 2 *LOAEL* UTL = 0.2	Not Calculated
			Tier 2	*NOAEL* UTL = 2 *LOAEL* UTL = 0.1	Not Calculated
		Alternate (Uncertainty Analysis)	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated
	Mourning Dove (Insectivore)	Default	Tier 1	*NOAEL* UTL = 12 *LOAEL* UTL = 0.9	Not Calculated
			Tier 2	*NOAEL* UTL = 4 *LOAEL* UTL = 0.3	Not Calculated
		Alternate (Uncertainty Analysis)	Tier 1	Not Calculated	Not Calculated
			Tier 2	Not Calculated	Not Calculated

Shaded cells represent default HQ calculations based on exposure and toxicity models specifically identified in the CRA Methodology.

All HQ Calculations are provided in Attachment 4.
Discussion of the chemical-specific uncertainties are provided in Attachment 5.

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Table 10.2
Tier 2 Grid Cell Hazard Quotients for Surface Soil in IAEU

ECOPC	Most Sensitive Receptor	Number of Grid Cells	Percent of Tier 2 Grid Means											
			NOAEL TRV				Threshold TRV				LOAEL TRV			
			HQ < 1	HQ > 1 < 5	HQ > 5 < 10	HQ > 10	HQ < 1	HQ > 1 < 5	HQ > 5 < 10	HQ > 10	HQ < 1	HQ > 1 < 5	HQ > 5 < 10	HQ > 10
Inorganics														
Antimony	Deer Mouse - Insectivore	24	38	38	17	8	N/A	N/A	N/A	N/A	100	0	0	0
Chromium	Mourning Dove - Insectivore	24	0	0	38	63	N/A	N/A	N/A	N/A	0	100	0	0
Copper	Mourning Dove - Insectivore	24	0	92	8	0	100	0	0	0	100	0	0	0
Molybdenum	Terrestrial Plants	24	92	8	0	0	N/A	N/A	N/A	N/A	100	0	0	0
Tin	Mourning Dove - Insectivore	24	58	33	4	4	N/A	N/A	N/A	N/A	100	0	0	0
Organics														
Bis(2-ethylhexyl)phthalate	Mourning Dove - Insectivore	22	0	91	0	9	N/A	N/A	N/A	N/A	100	0	0	0
Di-n-Butylphthalate	Mourning Dove - Insectivore	22	0	0	0	100	N/A	N/A	N/A	N/A	0	100	0	0
Total Dioxins	Deer Mouse - Insectivore	4	0	100	0	0	N/A	N/A	N/A	N/A	100	0	0	0
Total PCBs	Mourning Dove - Insectivore	21	10	67	24	0	N/A	N/A	N/A	N/A	95	5	0	0

N/A = No value available.
The limiting receptor is chosen as the receptor with the lowest ESL.

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Table 11.1
Summary of Risk Characterization Results for the IAEU

Analyte	Ecological Receptors	Result of Risk Characterization	Risk Description Conclusion
Surface Soil Non-PMJM Receptors			
Antimony	Terrestrial plants	Not an ECOPC.	Not an ECOPC
	Terrestrial invertebrate	Not an ECOPC.	Not an ECOPC
	American kestrel	Not an ECOPC[a].	ECOPC of Uncertain Risk
	Mourning dove (herbivore)	Not an ECOPC[a].	ECOPC of Uncertain Risk
	Mourning dove (insectivore)	Not an ECOPC.	Not an ECOPC
	Deer mouse (herbivore)	Not an ECOPC.	Not an ECOPC
	Deer mouse (insectivore)	NOAEL HQs > 1 for default exposure and TRVs LOAEL HQs < 1 for all exposures.	Low risk.
	Prairie dog	Not an ECOPC.	Not an ECOPC
	Coyote (carnivore)	Not an ECOPC.	Not an ECOPC
	Coyote (generalist)	Not an ECOPC.	Not an ECOPC
	Coyote (insectivore)	Not an ECOPC.	Not an ECOPC
	Mule Deer	Not an ECOPC.	Not an ECOPC
Chromium	Terrestrial plants	Screening ESL HQs>1 for all exposures. Alternate NOEC HQs >1 for all exposures. Alternate LOEC HQs <1 for all exposures.	Low risk.
	Terrestrial invertebrate	Screening ESL HQs>1 for all EPCs. Alternate LOEC HQs <1 for all EPCs.	Low risk.
	American kestrel	NOAEL HQs >= 1 for default exposures and TRVs. LOAEL HQs <1 for default exposures and TRVs.	Low risk.
	Mourning dove (herbivore)	NOAEL HQs >= 1 for default exposures and TRVs. LOAEL HQs <1 for default exposures and TRVs.	Low risk.
	Mourning dove (insectivore)	NOAEL HQs > 1 for default exposures and TRVs. LOAEL HQs >1 for default exposures and TRVs. NOAEL HQs >=1 for alternative exposures and default TRVs. LOAEL HQs < 1 for alternative exposures and default TRVs.	Low risk.
	Deer mouse (herbivore)	Not an ECOPC.	Not an ECOPC
	Deer mouse (Insectivore)	NOAEL HQs >= 1 for default exposures and Cr VI TRV. LOAEL HQs <1 for default exposures and Cr VI TRV. All HQs <1 for default exposures and Cr III TRV	Low risk.
	Prairie dog	Not an ECOPC.	Not an ECOPC
	Coyote (carnivore)	Not an ECOPC.	Not an ECOPC
	Coyote (generalist)	Not an ECOPC.	Not an ECOPC
	Coyote (insectivore)	Not an ECOPC.	Not an ECOPC
	Mule Deer	Not an ECOPC.	Not an ECOPC

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Table 11.1
Summary of Risk Characterization Results for the IAEU

Analyte	Ecological Receptors	Result of Risk Characterization	Risk Description Conclusion
Copper	Terrestrial plants	Not an ECOPC.	Not an ECOPC
	Terrestrial invertebrate	Not an ECOPC.	Not an ECOPC
	American kestrel	Not an ECOPC.	Not an ECOPC
	Mourning dove (herbivore)	NOAEL HQs <= 1 for default exposures and TRVs. Threshold HQs <1 for all default exposures and TRVs. LOAEL HQs <1 for all default exposure and TRVs.	Low risk.
	Mourning dove (insectivore)	NOAEL HQs >= 1 for default exposure scenarios. Threshold HQs <1 for all default exposure scenarios. LOAEL HQs <1 for all default exposure scenarios.	Low risk.
	Deer mouse (herbivore)	Not an ECOPC.	Not an ECOPC
	Deer mouse (Insectivore)	Not an ECOPC.	Not an ECOPC
	Prairie dog	Not an ECOPC.	Not an ECOPC
	Coyote (carnivore)	Not an ECOPC.	Not an ECOPC
	Coyote (generalist)	Not an ECOPC.	Not an ECOPC
	Coyote (insectivore)	Not an ECOPC.	Not an ECOPC
	Mule Deer	Not an ECOPC.	Not an ECOPC

Table 11.1
Summary of Risk Characterization Results for the IAEU

Analyte	Ecological Receptors	Result of Risk Characterization	Risk Description Conclusion
Molybdenum	Terrestrial plants	Tier 1 UTL HQ = 1 with screening ESL Tier 2 UTL HQ < 1 with screening ESL.	Low risk.
	Terrestrial invertebrate	Not an ECOPC[a].	ECOPC of Uncertain Risk
	American kestrel	Not an ECOPC.	Not an ECOPC
	Mourning dove (herbivore)	Not an ECOPC.	Not an ECOPC
	Mourning dove (insectivore)	Not an ECOPC.	Not an ECOPC
	Deer mouse (herbivore)	Not an ECOPC.	Not an ECOPC
	Deer mouse (Insectivore)	NOAEL HQs >= 1 for default exposures and TRVs. LOAEL HQs <1 for default exposures and TRVs.	Low risk.
	Prairie dog	Not an ECOPC.	Not an ECOPC
	Coyote (carnivore)	Not an ECOPC.	Not an ECOPC
	Coyote (generalist)	Not an ECOPC.	Not an ECOPC
	Coyote (insectivore)	Not an ECOPC.	Not an ECOPC
	Mule Deer	Not an ECOPC.	Not an ECOPC
Tin	Terrestrial plants	Not an ECOPC.	Not an ECOPC
	Terrestrial invertebrate	Not an ECOPC[a].	ECOPC of Uncertain Risk
	American kestrel	Not an ECOPC.	Not an ECOPC
	Mourning dove (herbivore)	Not an ECOPC.	Not an ECOPC
	Mourning dove (insectivore)	NOAEL HQs >= 1 for default exposures and TRVs. LOAEL HQs <1 for default exposures and TRVs.	Low risk.
	Deer mouse (herbivore)	Not an ECOPC.	Not an ECOPC
	Deer mouse (insectivore)	NOAEL HQs => 1 for default exposures and TRVs. LOAEL HQs <1 for default exposures and TRVs	Low risk.
	Prairie dog	Not an ECOPC.	Not an ECOPC
	Coyote (carnivore)	Not an ECOPC.	Not an ECOPC
	Coyote (generalist)	Not an ECOPC.	Not an ECOPC
	Coyote (insectivore)	Not an ECOPC.	Not an ECOPC
	Mule Deer	Not an ECOPC.	Not an ECOPC
Bis(2-ethylhexyl)phthalate	Terrestrial plants	Not an ECOPC[a].	ECOPC of Uncertain Risk
	Terrestrial invertebrate	Not an ECOPC[a].	ECOPC of Uncertain Risk
	American kestrel	NOAEL HQs >= 1 for default exposure and TRVs. LOAEL HQs < 1 for default exposure and TRVs.	Low risk.
	Mourning dove (herbivore)	Not an ECOPC.	Not an ECOPC
	Mourning dove (insectivore)	NOAEL HQs > 1 for default exposure and TRVs. LOAEL HQs < 1 for default exposure and TRVs.	Low risk.
	Deer mouse (herbivore)	Not an ECOPC.	Not an ECOPC
	Deer mouse (Insectivore)	Not an ECOPC.	Not an ECOPC
	Prairie dog	Not an ECOPC.	Not an ECOPC

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Table 11.1
Summary of Risk Characterization Results for the IAEU

Analyte	Ecological Receptors	Result of Risk Characterization	Risk Description Conclusion
	Coyote (carnivore)	Not an ECOPC.	Not an ECOPC
	Coyote (generalist)	Not an ECOPC.	Not an ECOPC
	Coyote (insectivore)	Not an ECOPC.	Not an ECOPC
	Mule Deer	Not an ECOPC.	Not an ECOPC

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Table 11.1
Summary of Risk Characterization Results for the IAEU

Analyte	Ecological Receptors	Result of Risk Characterization	Risk Description Conclusion
Di-n-butylpthalate	Terrestrial plants	Not an ECOPC.	Not an ECOPC
	Terrestrial invertebrate	Not an ECOPC[a].	ECOPC of Uncertain Risk
	American kestrel	NOAEL HQs > 1 for default exposure and TRVs. LOAEL HQs < 1 for default exposure and TRVs.	Low risk.
	Mourning dove (herbivore)	Not an ECOPC.	Not an ECOPC
	Mourning dove (insectivore)	NOAEL HQs > 1 for default exposure and TRVs. LOAEL HQs > 1 for default exposure and TRVs. All HQs = 2.	Low Risk
	Deer mouse (herbivore)	Not an ECOPC.	Not an ECOPC
	Deer mouse (Insectivore)	Not an ECOPC.	Not an ECOPC
	Prairie dog	Not an ECOPC.	Not an ECOPC
	Coyote (carnivore)	Not an ECOPC.	Not an ECOPC
	Coyote (generalist)	Not an ECOPC.	Not an ECOPC
	Coyote (insectivore)	Not an ECOPC.	Not an ECOPC
	Mule Deer	Not an ECOPC.	Not an ECOPC
Dioxin	Terrestrial plants	Not an ECOPC[a].	ECOPC of Uncertain Risk
	Terrestrial invertebrate	Not an ECOPC[a].	ECOPC of Uncertain Risk
	American kestrel	Not an ECOPC.	Not an ECOPC
	Mourning dove (herbivore)	Not an ECOPC.	Not an ECOPC
	Mourning dove (insectivore)	NOAEL HQs >= 1 for default exposure and TRVs. LOAEL HQs < 1 for default exposure and TRVs.	Low risk.
	Deer mouse (herbivore)	Not an ECOPC.	Not an ECOPC
	Deer mouse (Insectivore)	NOAEL HQs > 1 for default exposure and TRVs. LOAEL HQs < 1 for default exposure and TRVs.	Low risk.
	Prairie dog	Not an ECOPC.	Not an ECOPC
	Coyote (carnivore)	Not an ECOPC.	Not an ECOPC
	Coyote (generalist)	Not an ECOPC.	Not an ECOPC
	Coyote (insectivore)	Not an ECOPC.	Not an ECOPC
	Mule Deer	Not an ECOPC.	Not an ECOPC
PCB (total)	Terrestrial plants	Not an ECOPC.	Not an ECOPC
	Terrestrial invertebrate	Not an ECOPC[a].	ECOPC of Uncertain Risk
	American kestrel	NOAEL HQs > 1 for default exposures and TRVs. LOAEL HQs < 1 for default exposures and TRVs.	Low risk.
	Mourning dove (herbivore)	Not an ECOPC.	Not an ECOPC
	Mourning dove (insectivore)	NOAEL HQs > 1 for default exposure and TRVs. LOAEL HQs < 1 for default exposure and TRVs.	Low risk.
	Deer mouse (herbivore)	Not an ECOPC.	Not an ECOPC
	Deer mouse (Insectivore)	Not an ECOPC.	Not an ECOPC
	Prairie dog	Not an ECOPC.	Not an ECOPC

Table 11.1
Summary of Risk Characterization Results for the IAEU

Analyte	Ecological Receptors	Result of Risk Characterization	Risk Description Conclusion
	Coyote (carnivore)	Not an ECOPC.	Not an ECOPC
	Coyote (generalist)	Not an ECOPC.	Not an ECOPC
	Coyote (insectivore)	Not an ECOPC.	Not an ECOPC
	Mule Deer	Not an ECOPC.	Not an ECOPC
Surface Soil - PMJM Receptors			
	The small piece of PMJM habitat located within the IAEU will be evaluated in the UWNEU.		
Subsurface Soil			
None	Prairie dog	No ECOPCs.	No

[a] No ESL was available for the receptor. Risks to this receptor are uncertain and discussed in Section 10.

FIGURES

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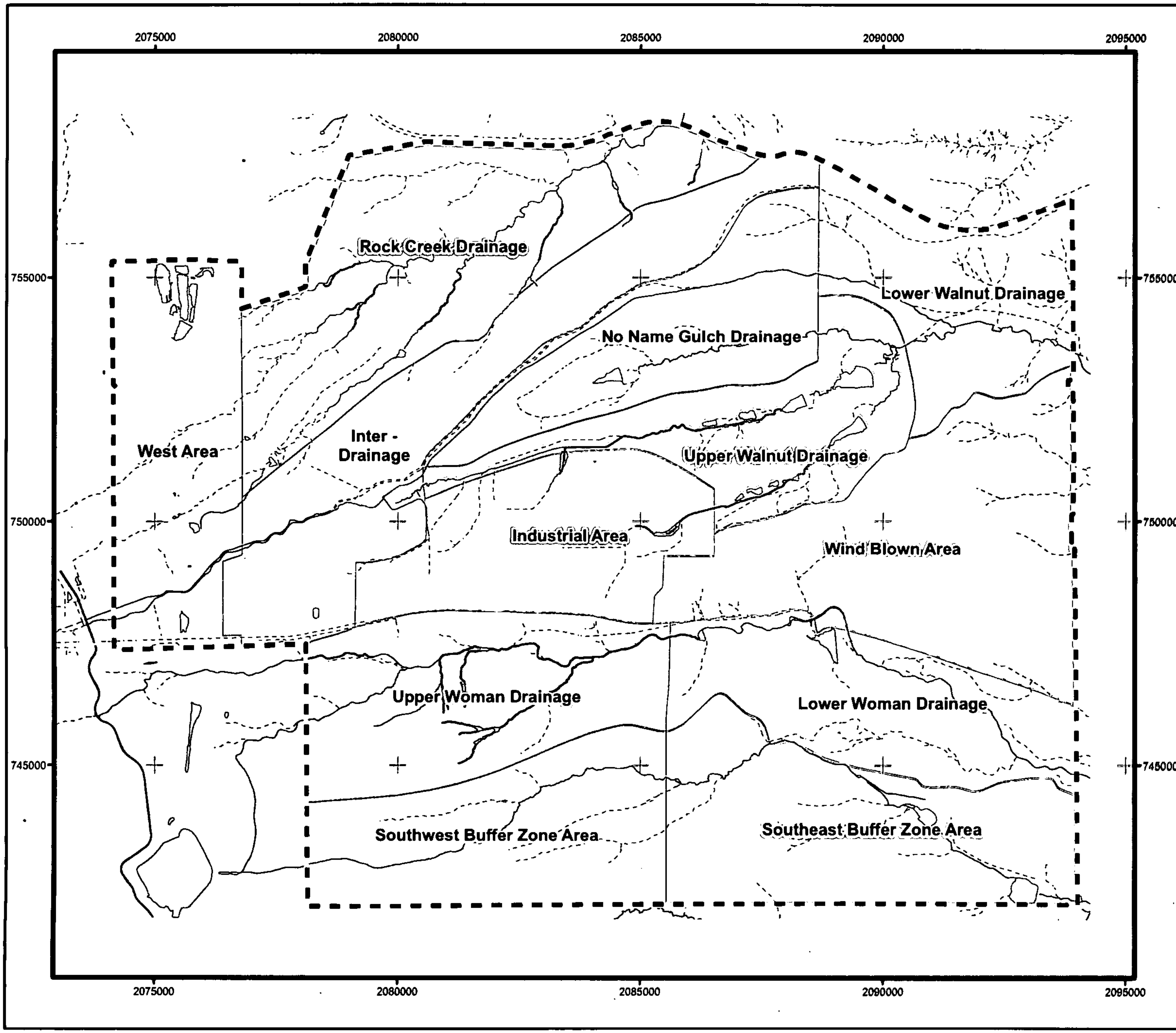

Figure 1.1
Rocky Flats Environmental Technology Site
Exposure Units

KEY
- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 1,500 3,000 Feet

Scale 1:36,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

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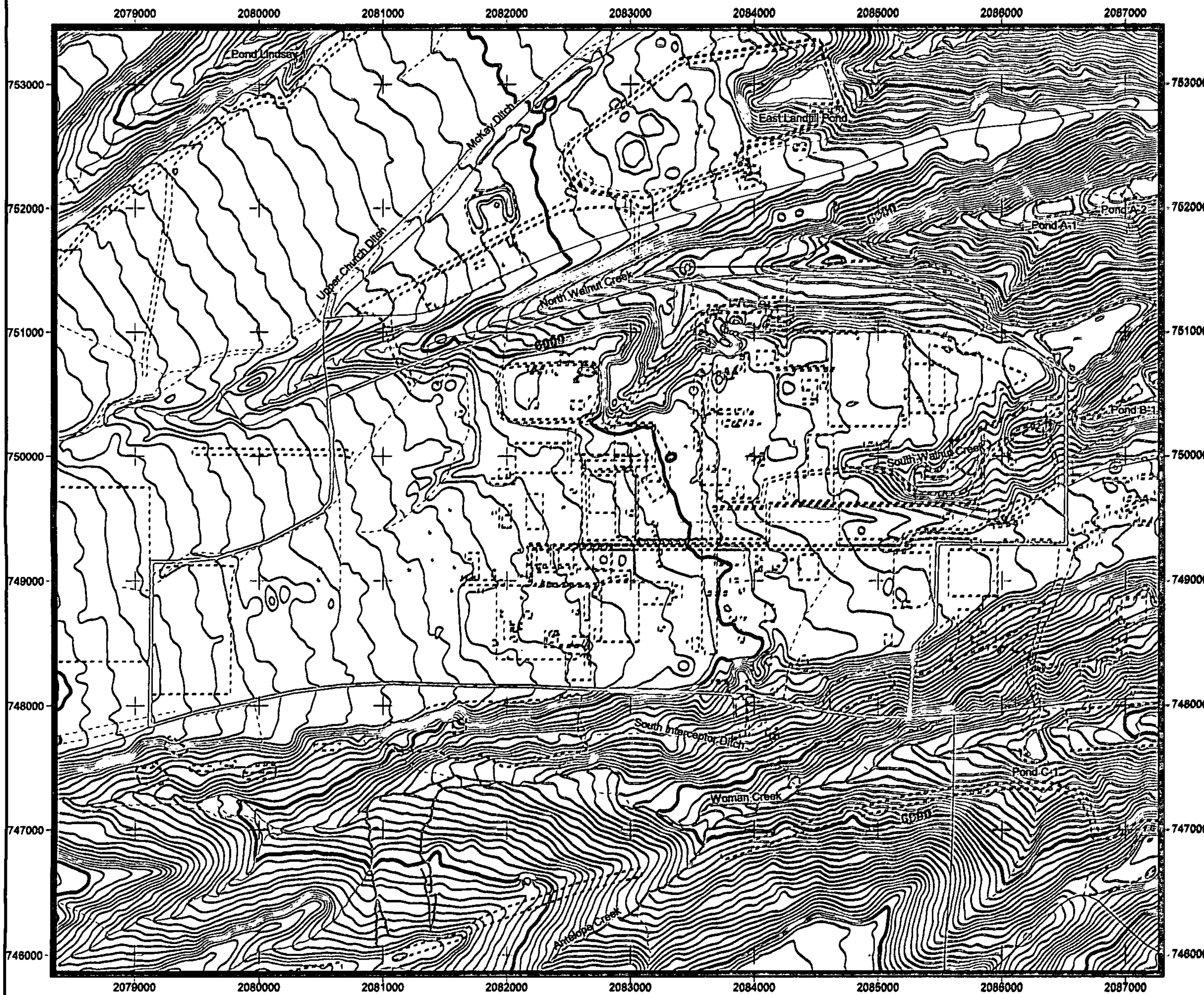


Figure 1.2
Topography and Historical IHSS Locations in the Industrial Area Exposure Unit

KEY

- Industrial Area EU
- Historical IHSS/PAC
- Topographic contour interval = 5 ft.

Standard Map Features

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 600 1200 Feet

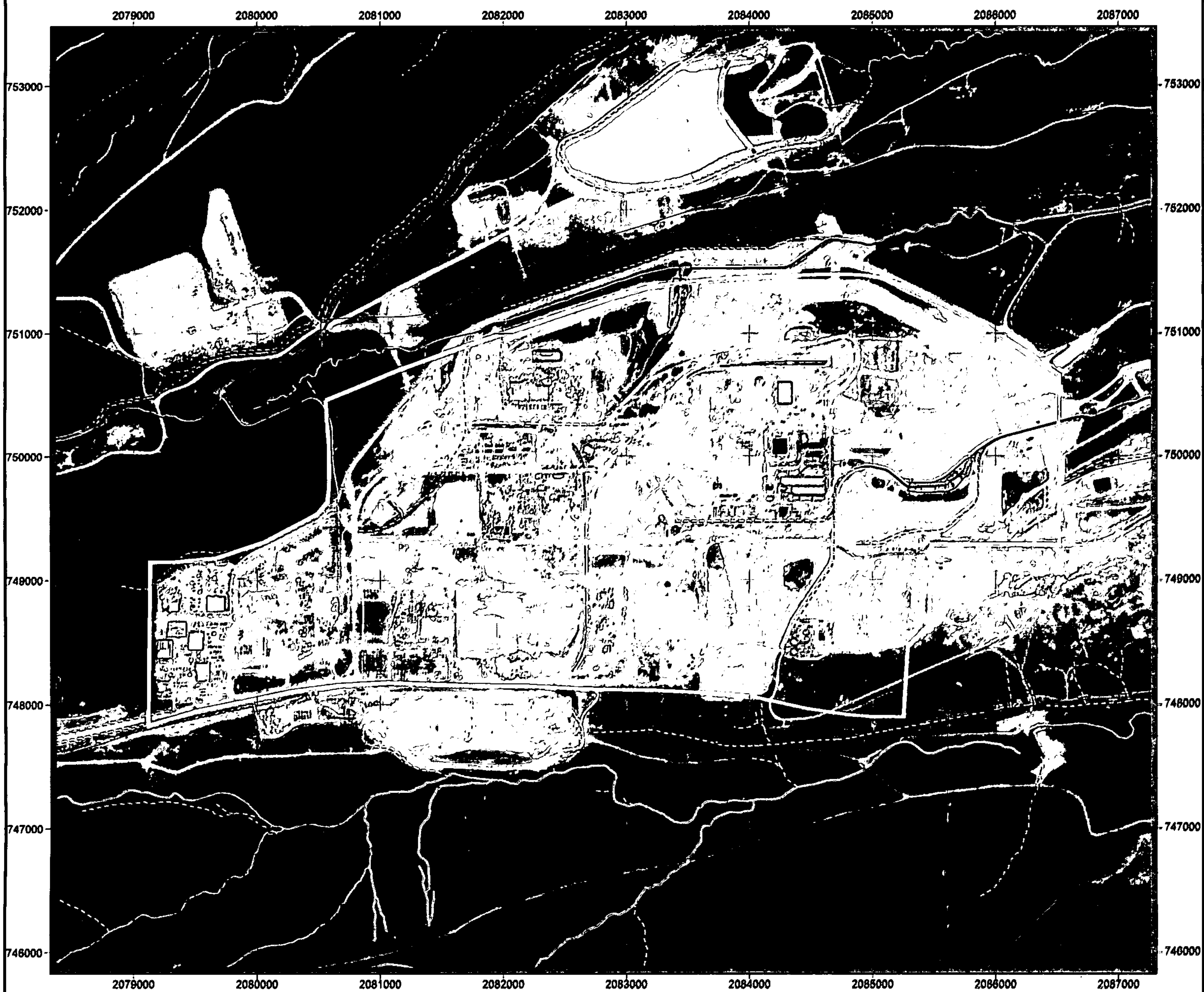
Scale 1:14400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

File: W:\Projects\Fy2005\CRA\GIS_Final\ArcView\Section1\IndustrialArea.apr

Figure 1.3
Aerial Photograph of the
Industrial Area Exposure Unit
July 2005



KEY

Industrial Area EU

Standard Map Features

Exposure unit boundary
Pond
Site boundary
Perennial stream
Intermittent stream
Ephemeral stream

N
W E
S

0 600 1200 Feet

Scale 1:14400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental
Technology Site

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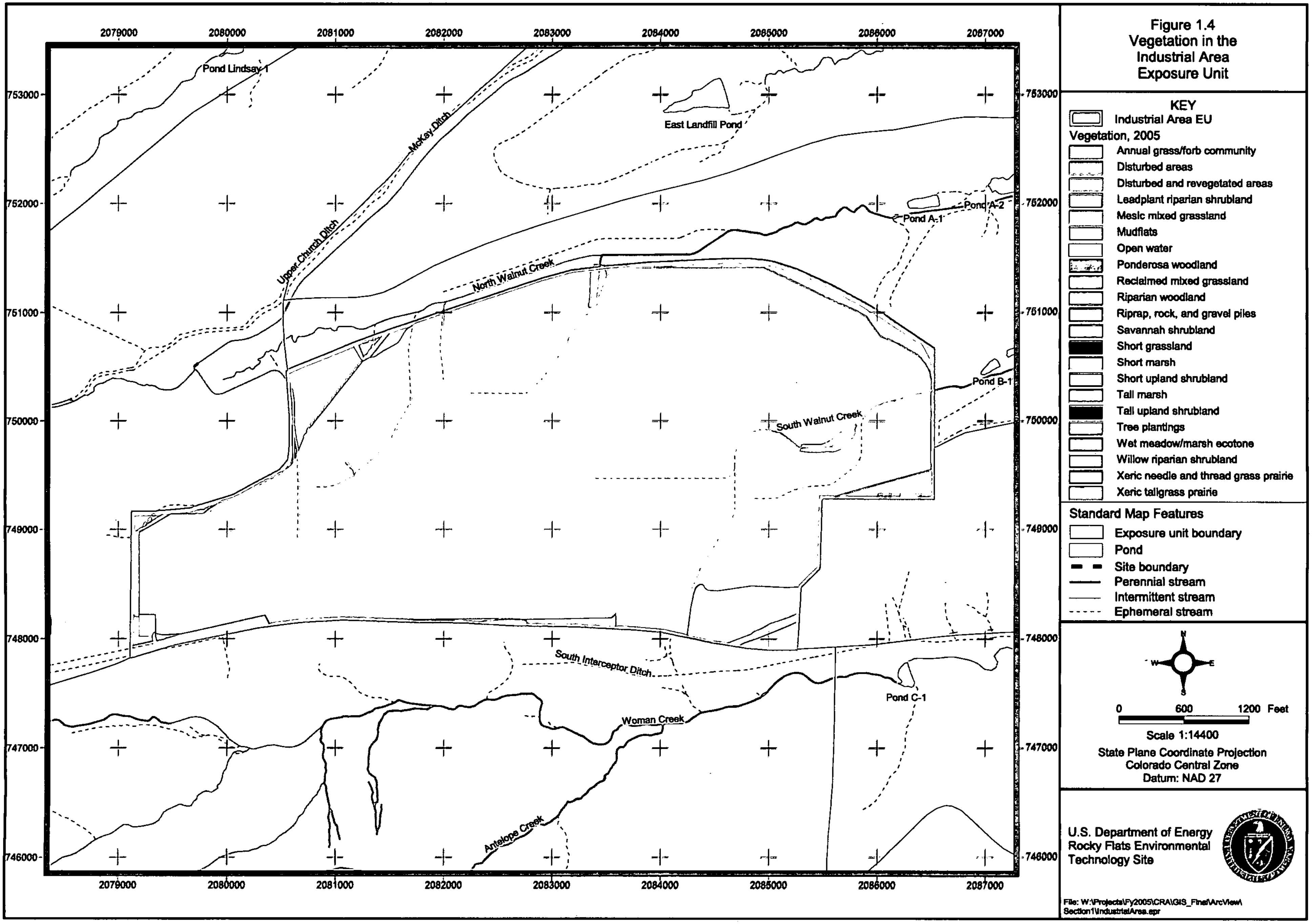

Figure 1.4 Vegetation in the Industrial Area Exposure Unit

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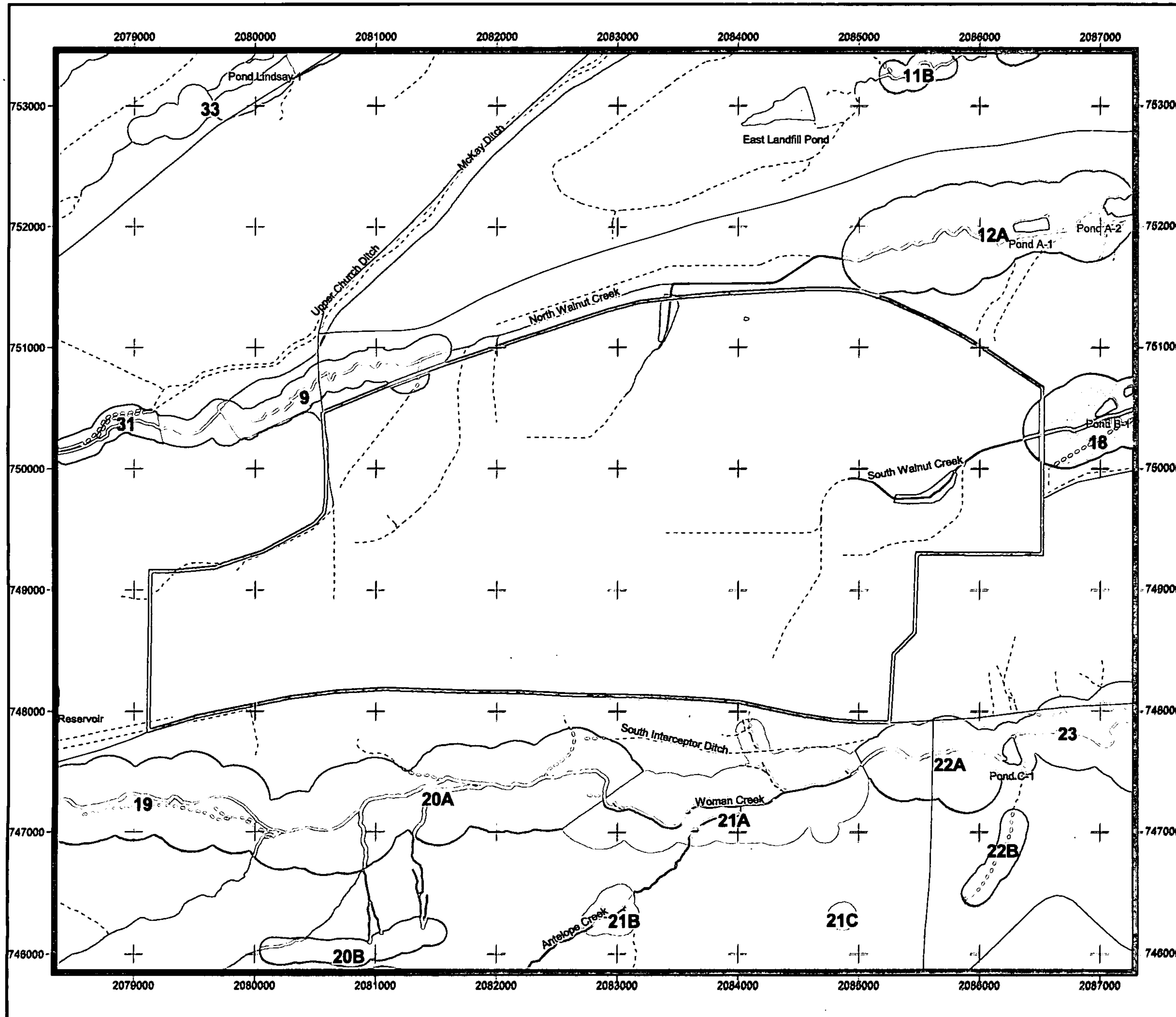

Figure 1.5
Preble's Meadow Jumping Mouse Habitat and Surface Soil Sample Locations in the Industrial Area Exposure Unit

KEY

- △ Surface soil sample location
- Industrial Area EU
- PMJM habitat patch
- 1 PMJM habitat patch ID

Note: Not all analyte groups were analyzed at every sample location.

Standard Map Features

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 600 1200 Feet

Scale 1:14400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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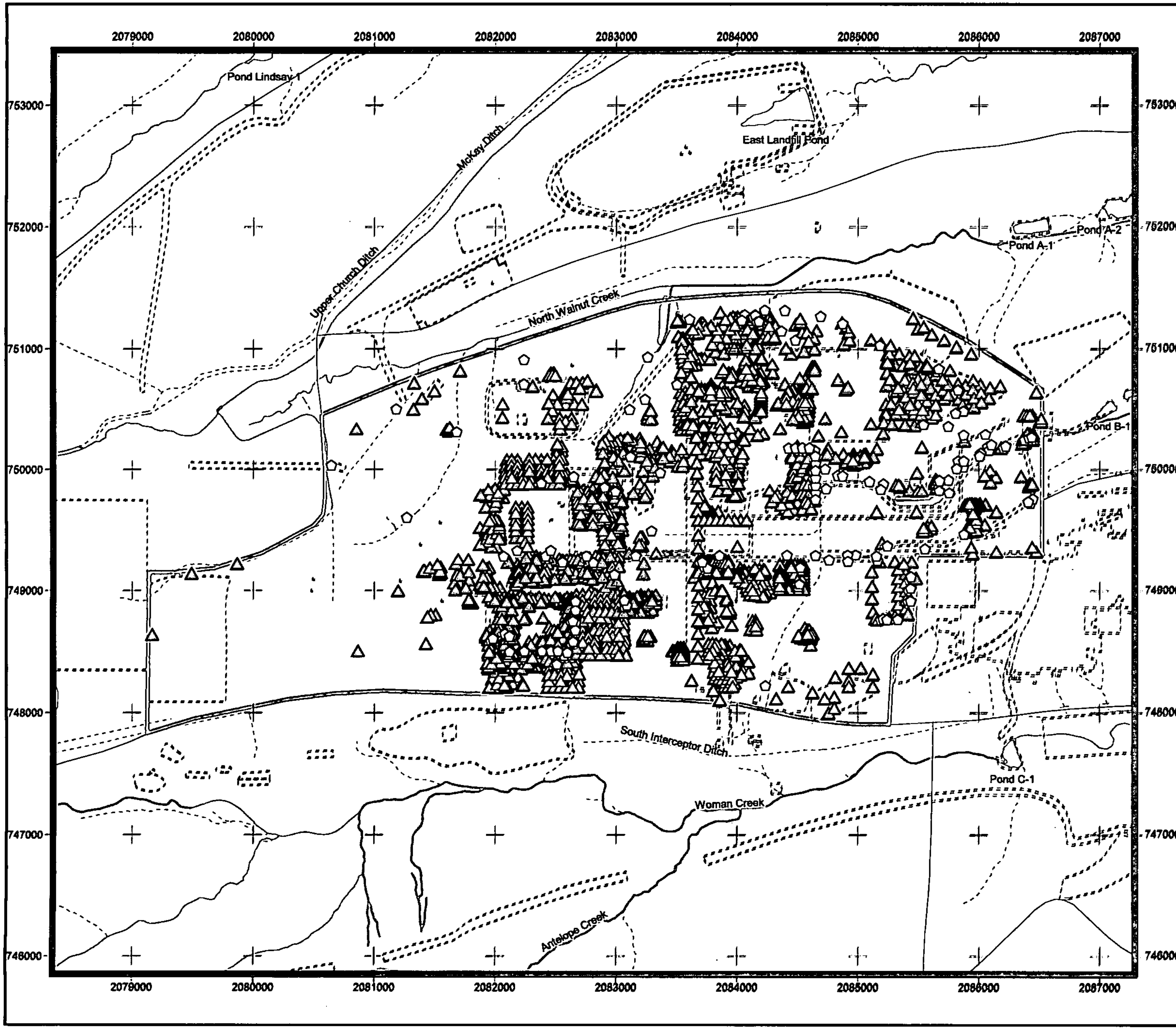

Figure 1.6
Industrial Area Exposure Unit Surface Soil and Surface Sediment Sample Locations

KEY

Sample location
- Surface sediment sample location
- Surface soil sample location

(Background locations shown in red)
- Surface sediment sample location
- Surface soil sample location
- Industrial Area EU
- Historical IHSS/PAC

Standard Map Features
- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N S E W

0 600 1200 Feet

Scale 1:14400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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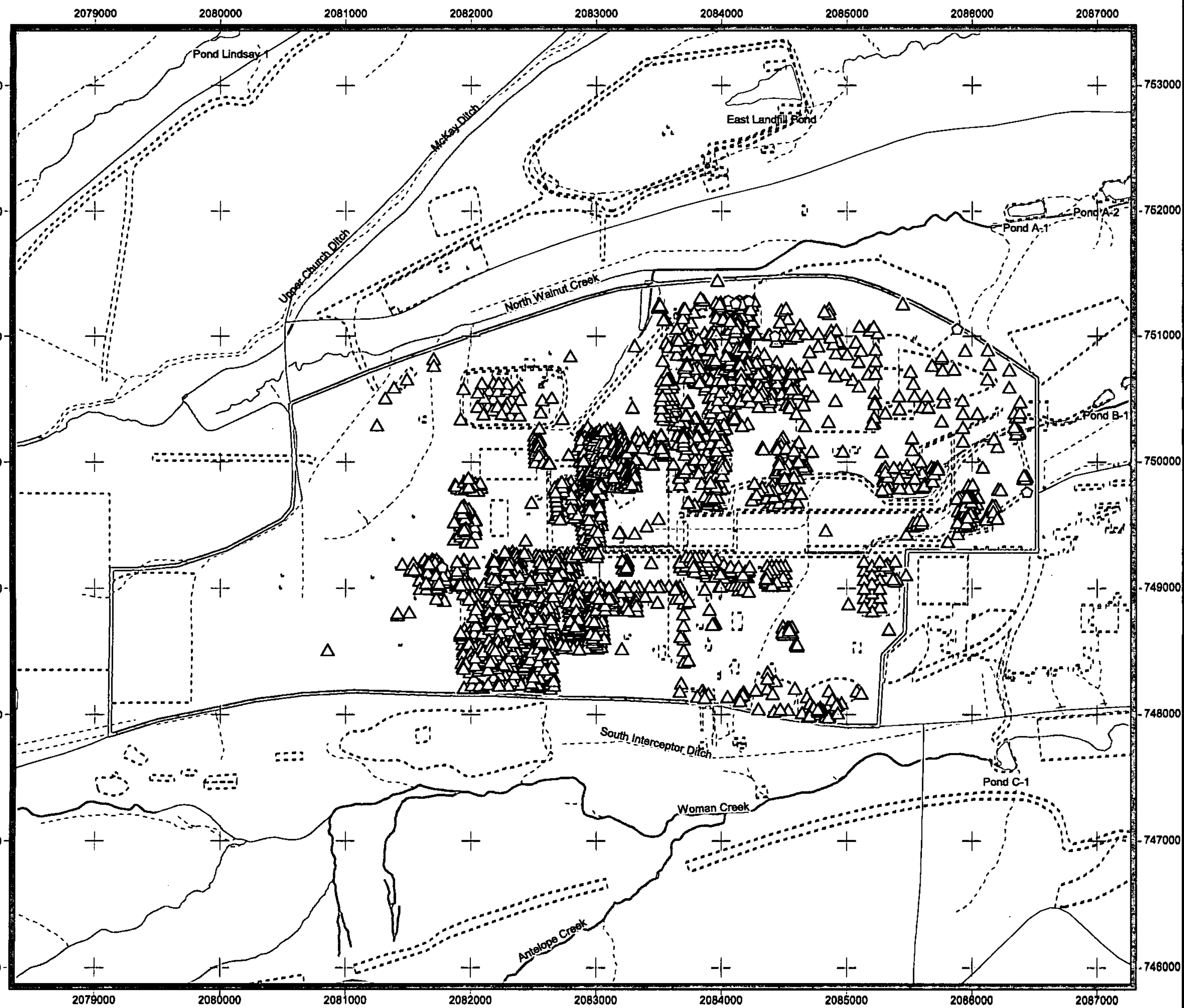

Figure 1.7
Industrial Area Exposure Unit Subsurface Soil and Subsurface Sediment Sample Locations

KEY

Sample location

- Subsurface sediment sample location
- Subsurface soil sample location

(Background locations shown in red)

- Subsurface sediment sample location
- Subsurface soil sample location
- Industrial Area EU
- Historical IHSS/PAC

Standard Map Features

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N W E S

0 600 1200 Feet

Scale 1:14400

State Plane Coordinate Projection
Colorado Central Zone
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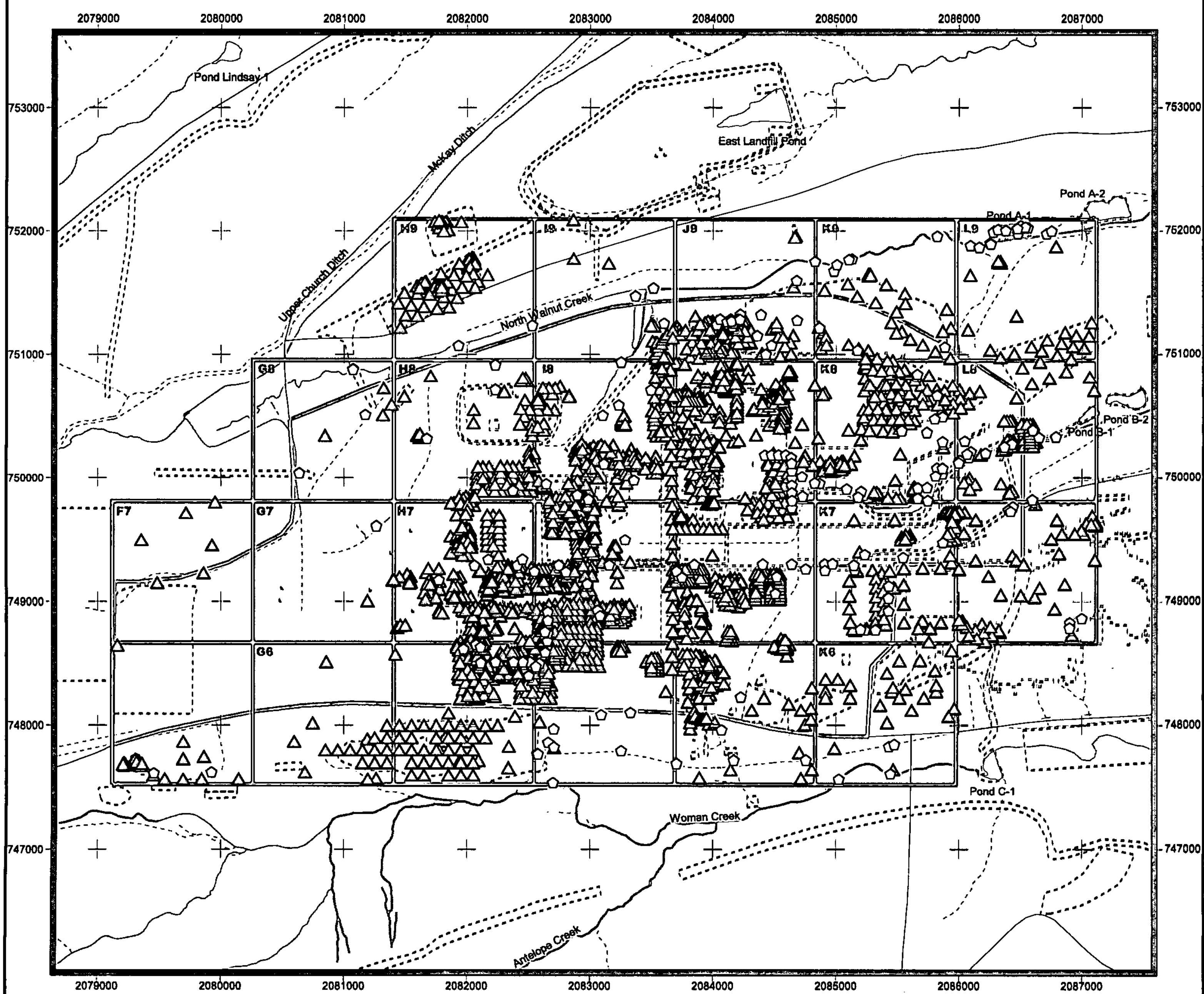
Figure 3.1
Tier 2 EPC 30-acre Grids with Surface Soil and Surface Sediment Sample Locations



KEY

- Surface sediment sample location
- Surface soil sample location
- Industrial Area EU
- 30-acre grid
- Historical IHSS/PAC
- A1 Grid cell ID

Standard Map Features

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N W E S

0 600 1200 Feet

Scale 1:14400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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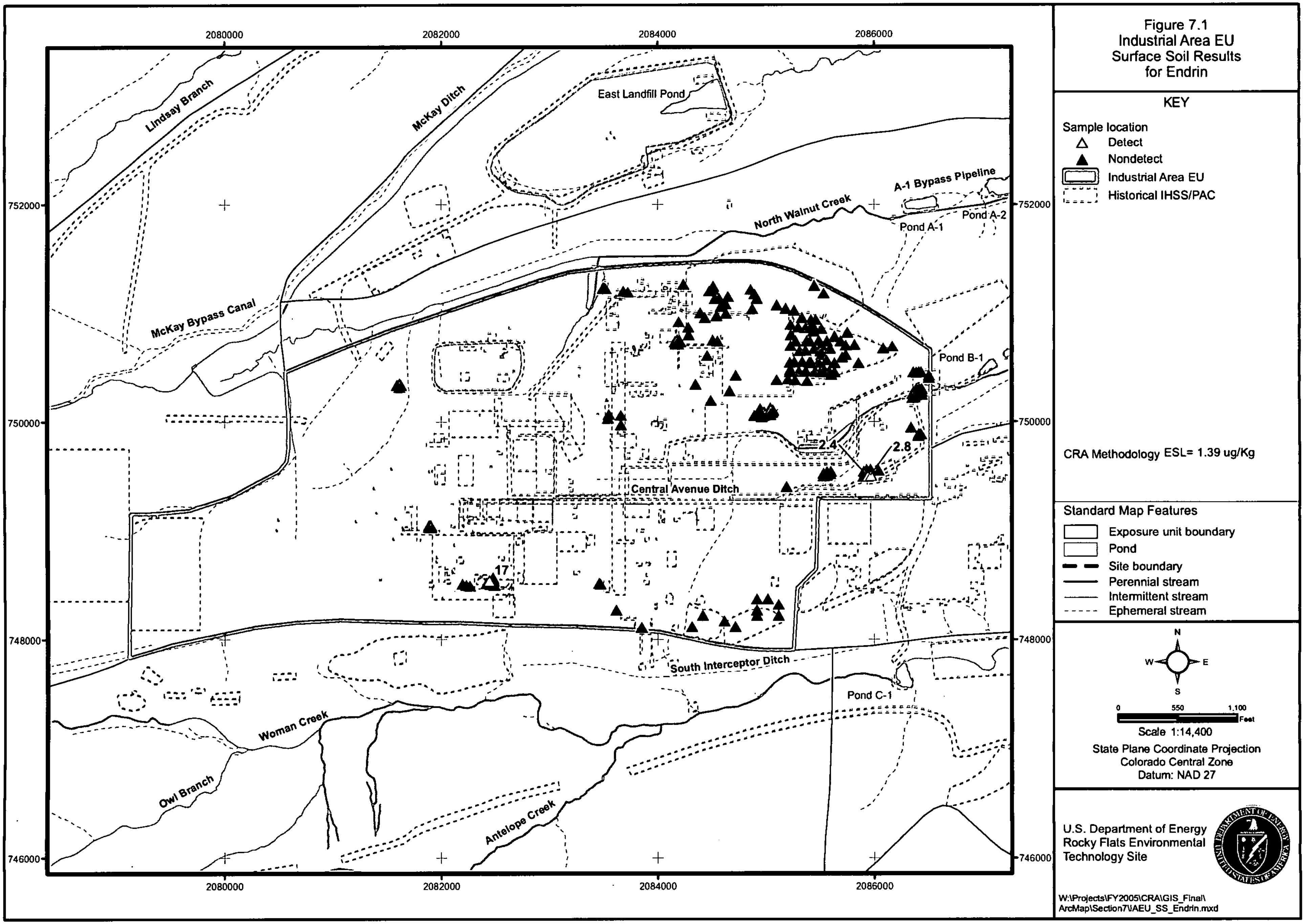

Figure 7.1
Industrial Area EU
Surface Soil Results
for Endrin

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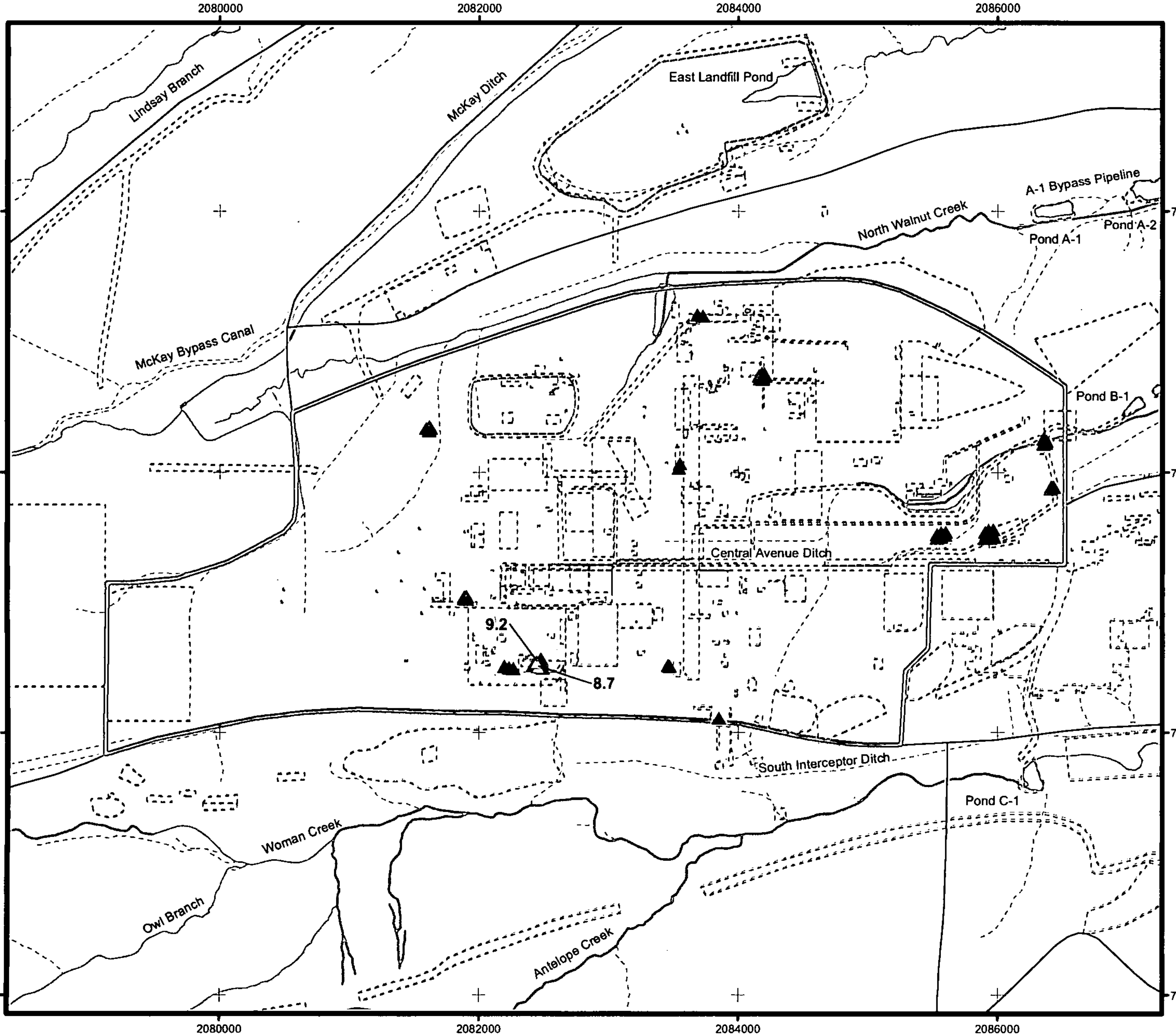

Figure 7.2
Industrial Area EU Surface Soil Results for Endrin Aldehyde

KEY

Sample location
- Detect
- Nondetect
- Industrial Area EU
- Historical IHSS/PAC

CRA Methodology ESL= 1.39 ug/Kg

Standard Map Features
- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
W E
S

0 550 1,100 Feet

Scale 1:14,400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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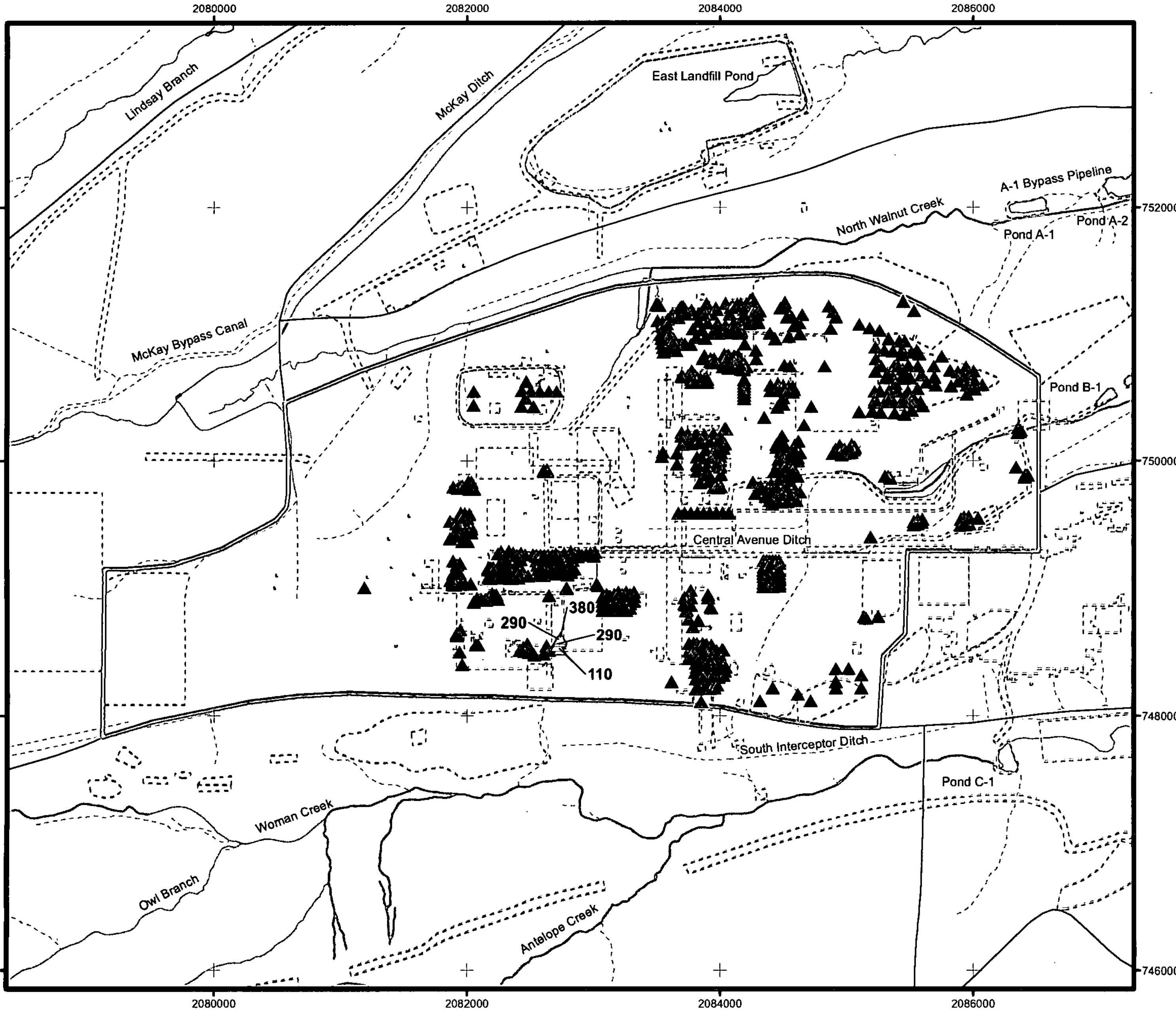

Figure 7.3
Industrial Area EU
Surface Soil Results
for Hexachlorobenzene

KEY

Sample location
- Detect
- Nondetect
- Industrial Area EU
- Historical IHSS/PAC

CRA Methodology ESL= 7.72 ug/Kg

Standard Map Features
- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N S W E

0 550 1,100 Feet

Scale 1:14,400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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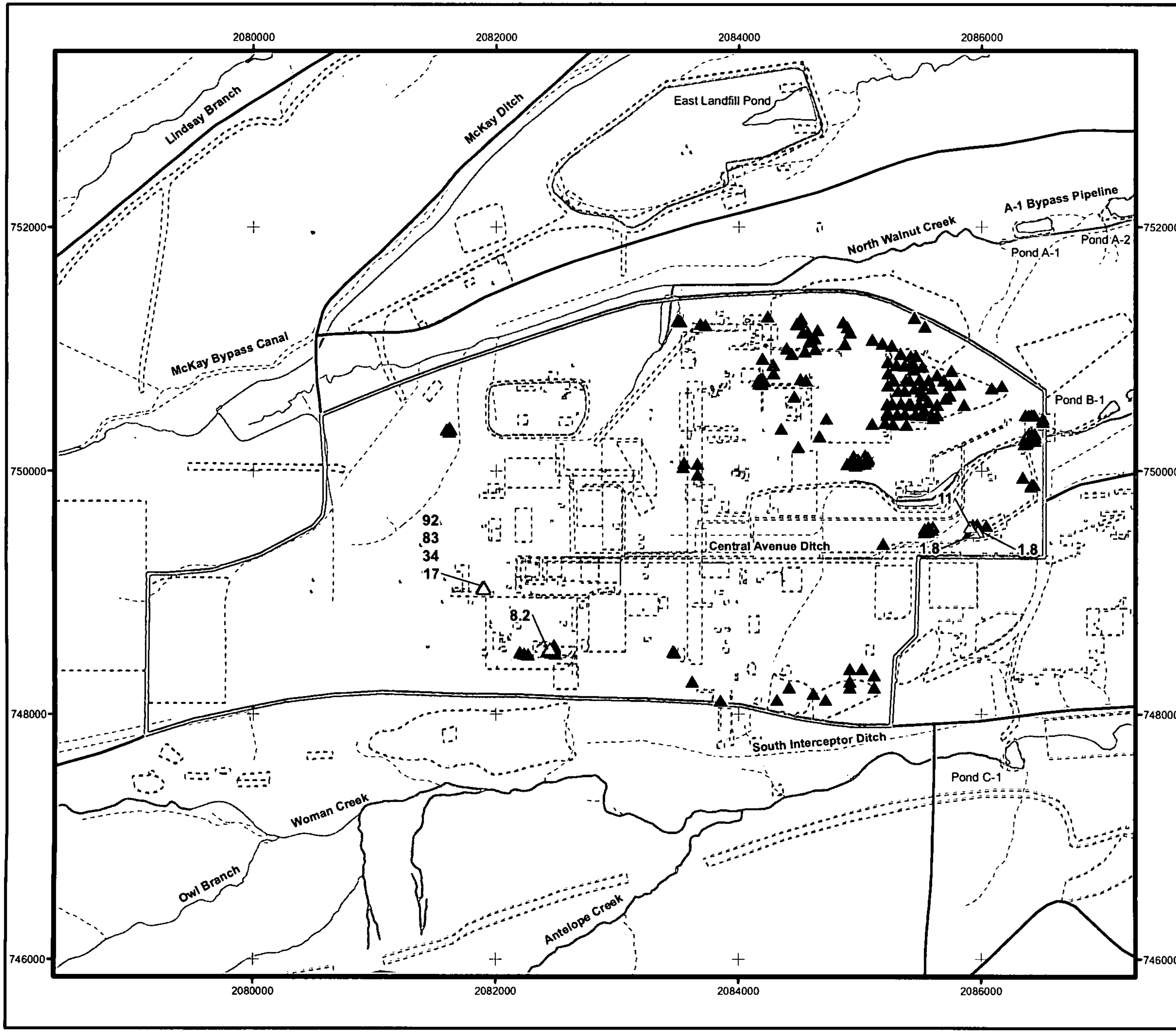

Figure 7.4
Industrial Area EU
Surface Soil Results
for Dieldrin

KEY

Sample location
△ Detect
▲ Nondetect
Industrial Area EU
Historical IHSS/PAC

CRA Methodology ESL= 7.4 ug/Kg

Standard Map Features
Exposure unit boundary
Pond
Site boundary
Perennial stream
Intermittent stream
Ephemeral stream

N
W E
S

0 550 1,100 Feet

Scale 1:14,400

State Plane Coordinate Projection
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Datum: NAD 27

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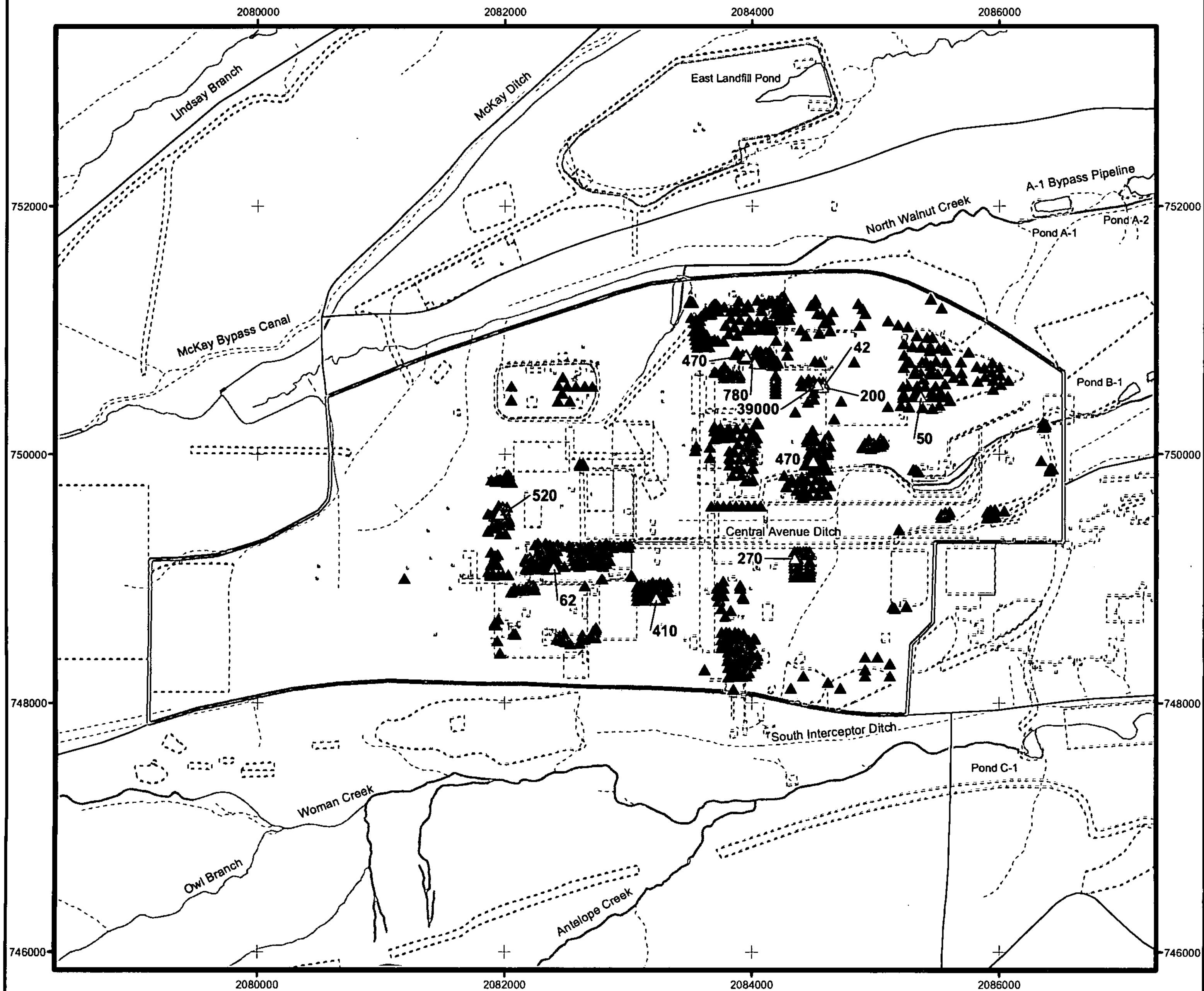

Figure 7.5
Industrial Area EU
Surface Soil Results
for Pentachlorophenol

KEY

Sample location
Detect
Nondetect
Industrial Area EU
Historical IHSS/PAC

CRA Methodology ESL= 121.86 ug/Kg

Standard Map Features
Exposure unit boundary
Pond
Site boundary
Perennial stream
Intermittent stream
Ephemeral stream

N
W E
S

0 550 1,100 Feet
Scale 1:14,400
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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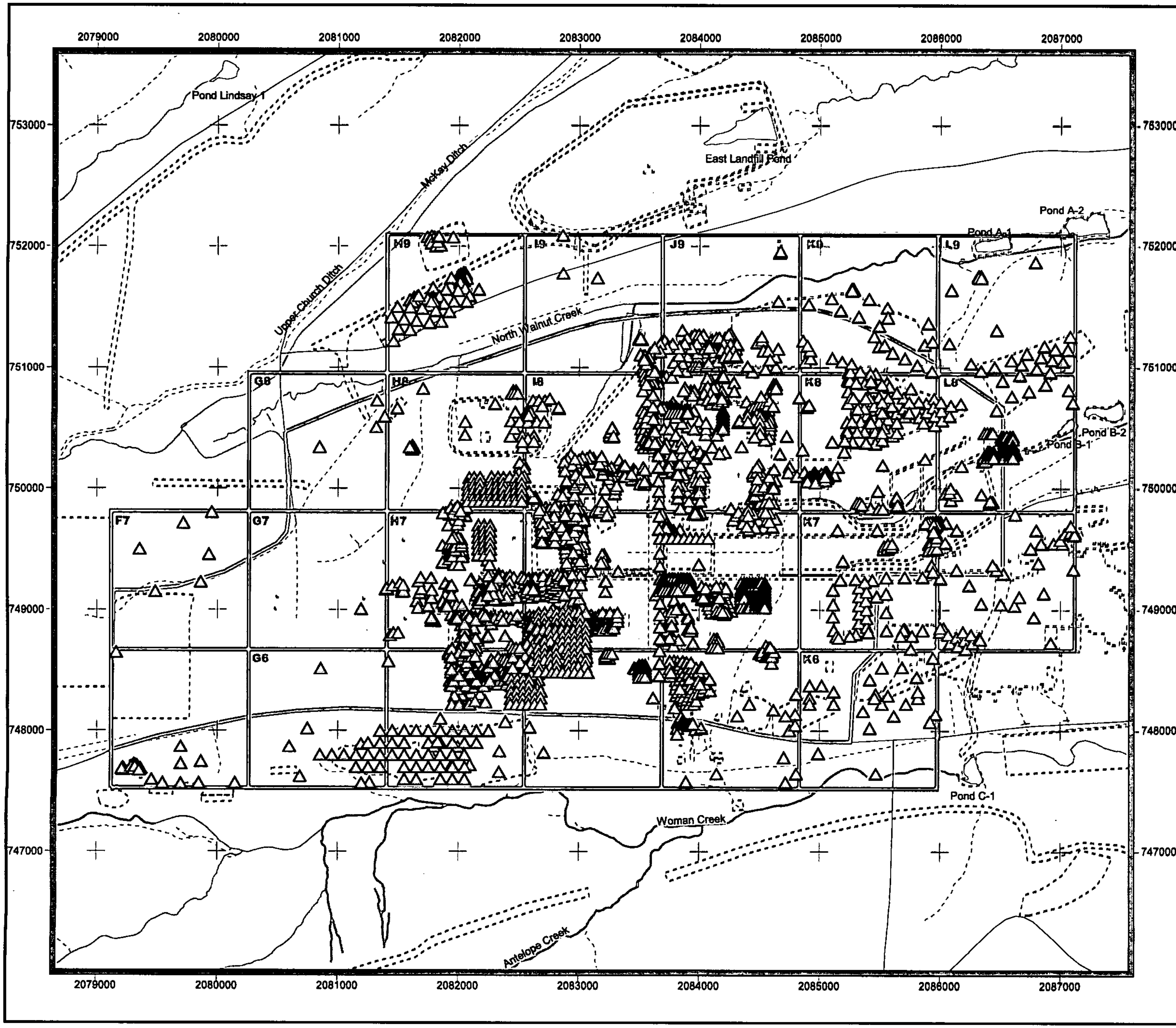

Figure 8.1
Tier 2 EPC 30-acre Grids with Surface Soil Sample Locations

KEY

- Surface soil sample location
- Industrial Area EU
- 30-acre grid
- Historical IHSS/PAC
- A1 Grid cell ID

Standard Map Features

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N E S W

0 600 1200 Feet

Scale 1:14400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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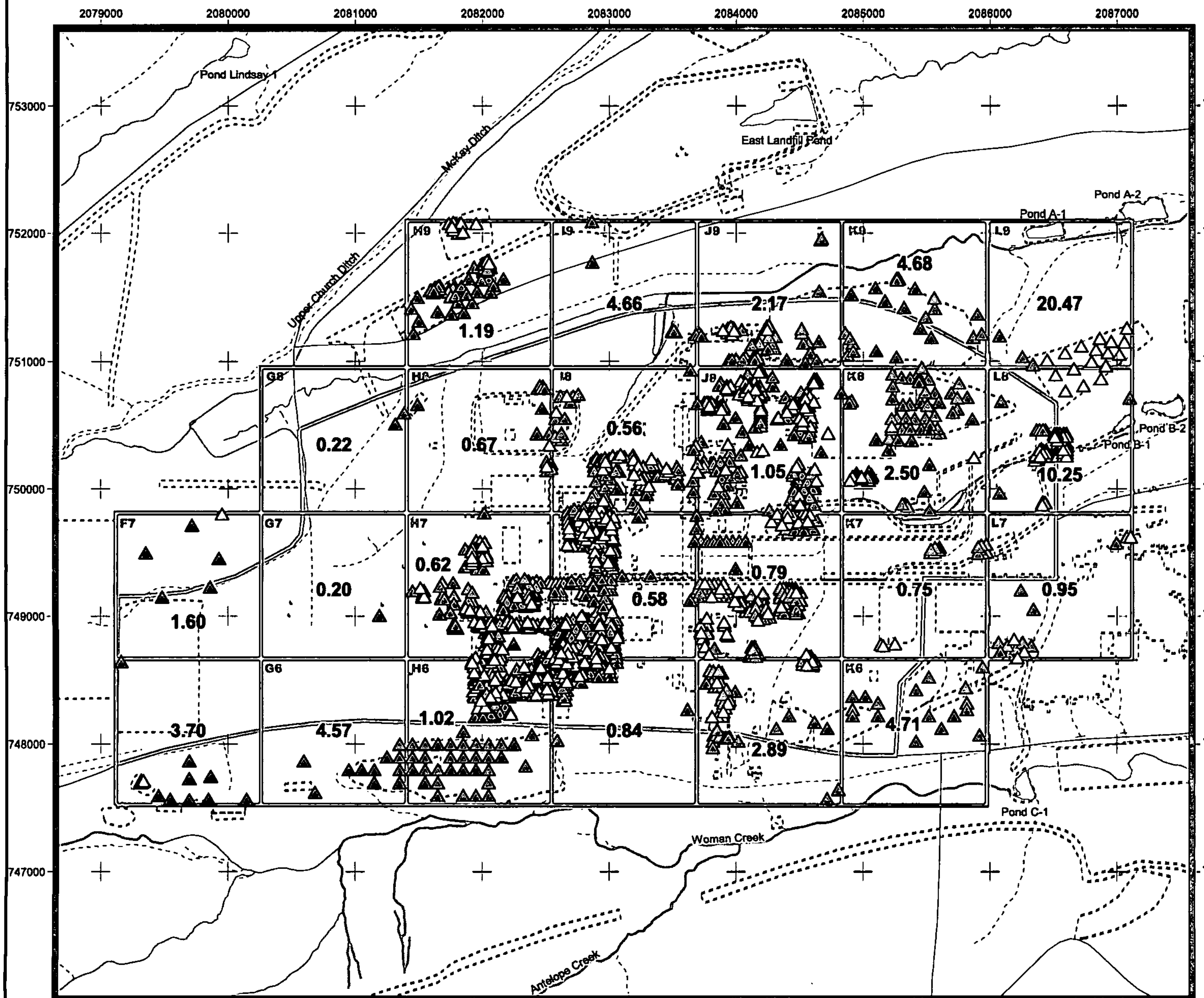

Figure 10.1
Industrial Area Exposure Unit
Sample-by-Sample
Comparison to the Limiting ESL -
Antimony

KEY

Surface soil sample location
- Detect >= 10 x ESL
- Detect >= ESL < 10 x ESL
- Detect < ESL
- Nondetect
- Industrial Area EU
- 30-acre grid
- Historical IHSS/PAC
- A1 Grid cell ID

ESL: 0.905 mg/kg
Receptor: Deer Mouse - Insectivore
95th UCL background: 0.309 mg/kg
Maximum background concentration: N/A

Standard Map Features
- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N S E W

0 600 1200 Feet

Scale 1:14400

State Plane Coordinate Projection
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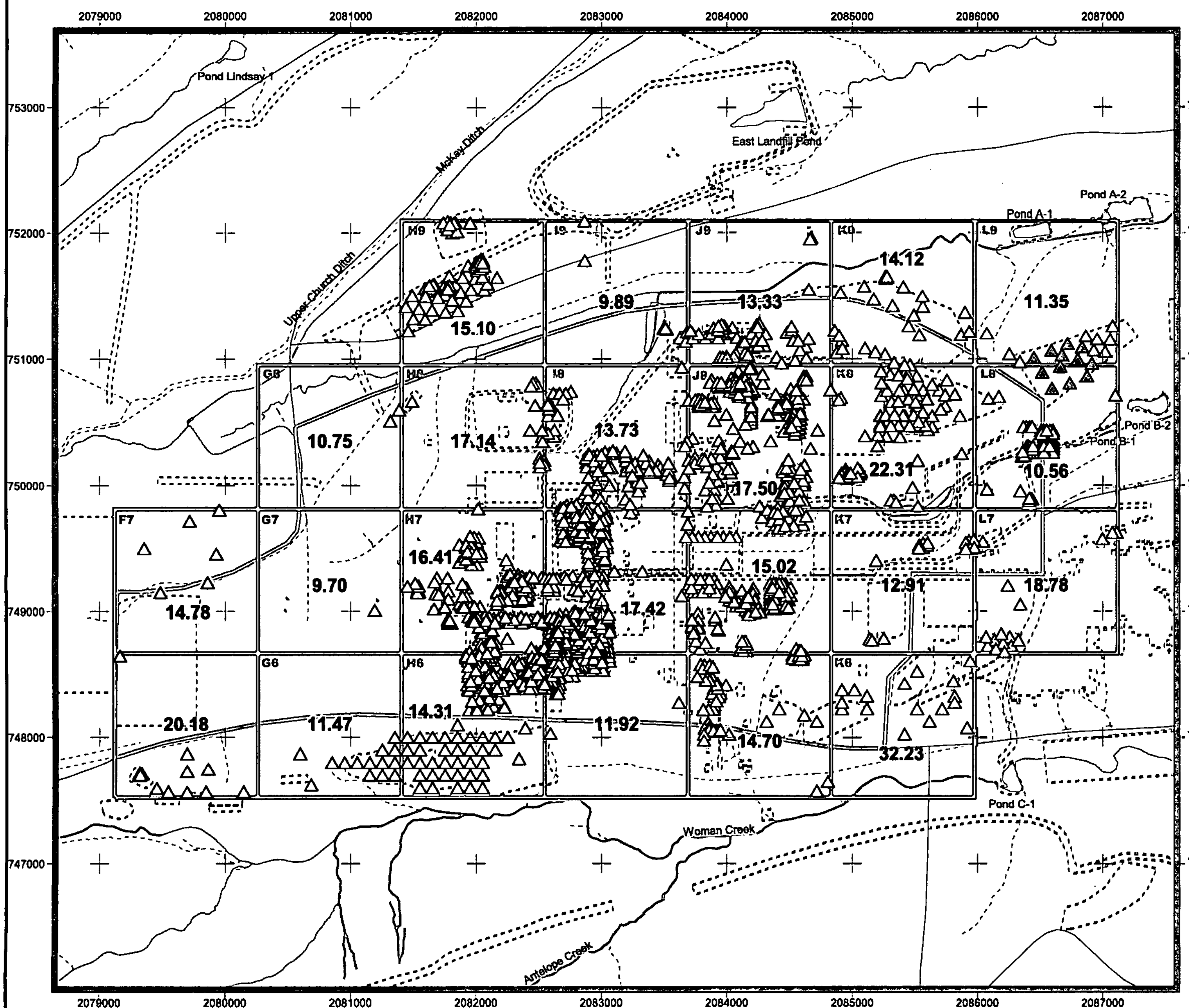
Figure 10.2
Industrial Area Exposure Unit
Sample-by-Sample
Comparison to the Limiting ESL -
Chromium



KEY

Surface soil sample location

- Detect >= 10 x ESL
- Detect >= ESL < 10 x ESL
- Detect < ESL
- Nondetect
- Industrial Area EU
- 30-acre grid
- Historical IHSS/PAC
- A1 Grid cell ID

ESL: 1.34 mg/kg
Receptor: Mourning Dove - Insectivore
95th UCL background: 12.3 mg/kg
Maximum background concentration: 16.9 mg/kg

Standard Map Features

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N E S W

0 600 1200 Feet

Scale 1:14400

State Plane Coordinate Projection
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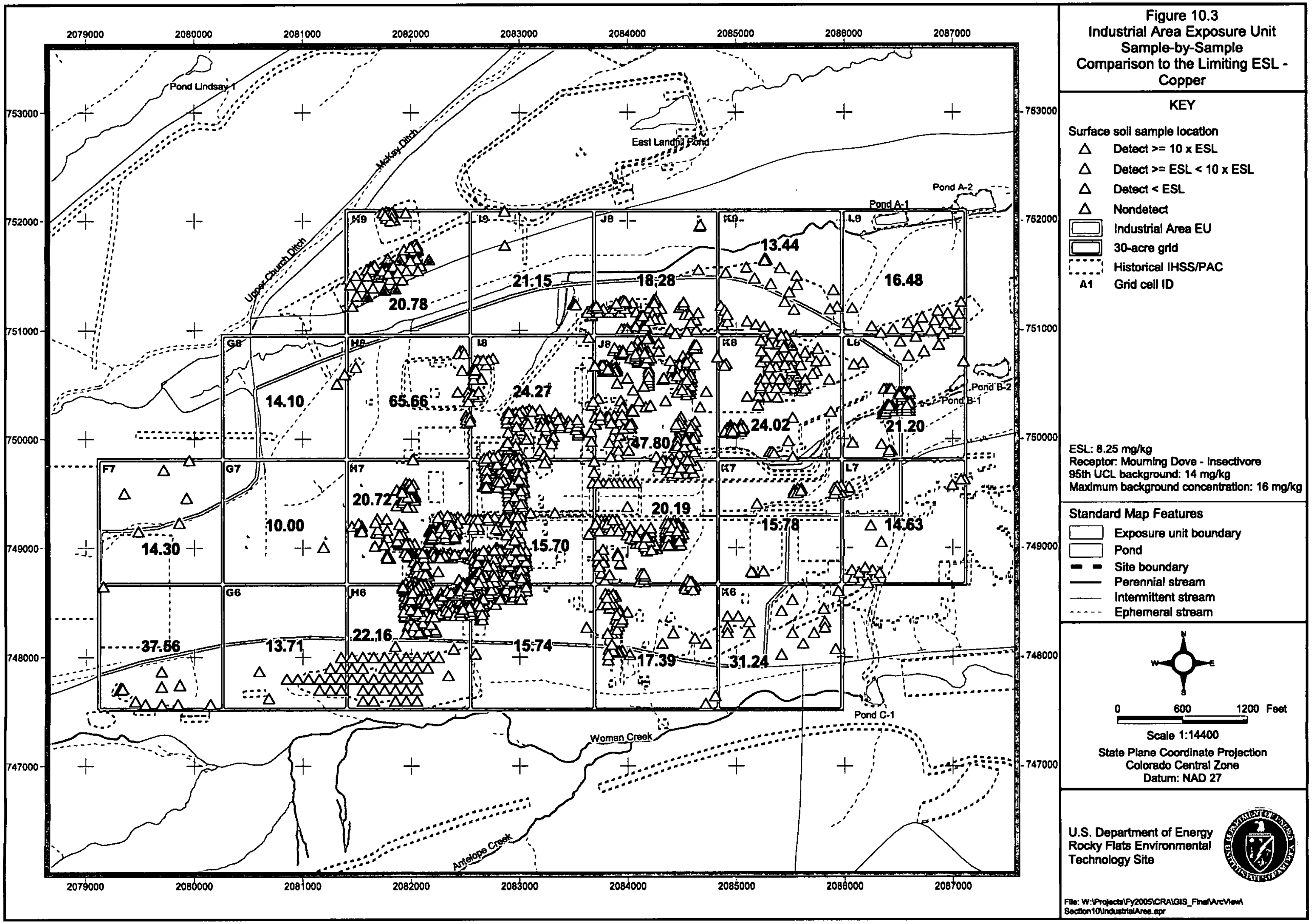

Figure 10.3
Industrial Area Exposure Unit
Sample-by-Sample
Comparison to the Limiting ESL -
Copper
KEY
Surface soil sample location
Detect >= 10 x ESL
Detect >= ESL < 10 x ESL
Detect < ESL
Nondetect
Industrial Area EU
30-acre grid
Historical IHSS/PAC
A1 Grid cell ID
ESL: 8.25 mg/kg
Receptor: Mourning Dove - Insectivore
95th UCL background: 14 mg/kg
Maximum background concentration: 16 mg/kg
Standard Map Features
Exposure unit boundary
Pond
Site boundary
Perennial stream
Intermittent stream
Ephemeral stream
0 600 1200 Feet
Scale 1:14400
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
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Rocky Flats Environmental
Technology Site
File: W:\Projects\Fy2005\CRA\GIS_Final\ArcView\Section10\IndustrialArea.apr
Pond Lindsay 1
East Landfill Pond
McKay Ditch
Upper Church Ditch
Pond A-2
Pond A-1
Pond B-2
Pond B-1
Pond C-1
Woman Creek
Antelope Creek
H9 I9 J9 K9 L9
G8 H8 I8 J8 K8 L8
F7 G7 H7 I7 J7 K7 L7
F6 G6 H6 I6 J6 K6
20.78 21.15 18.28 13.44 16.48
14.10 65.66 24.27 47.80 24.02 21.20
14.30 10.00 20.72 15.70 20.19 15.78 14.63
37.56 13.71 22.16 15.74 17.39 31.24
2079000 2080000 2081000 2082000 2083000 2084000 2085000 2086000 2087000
753000 752000 751000 750000 749000 748000 747000

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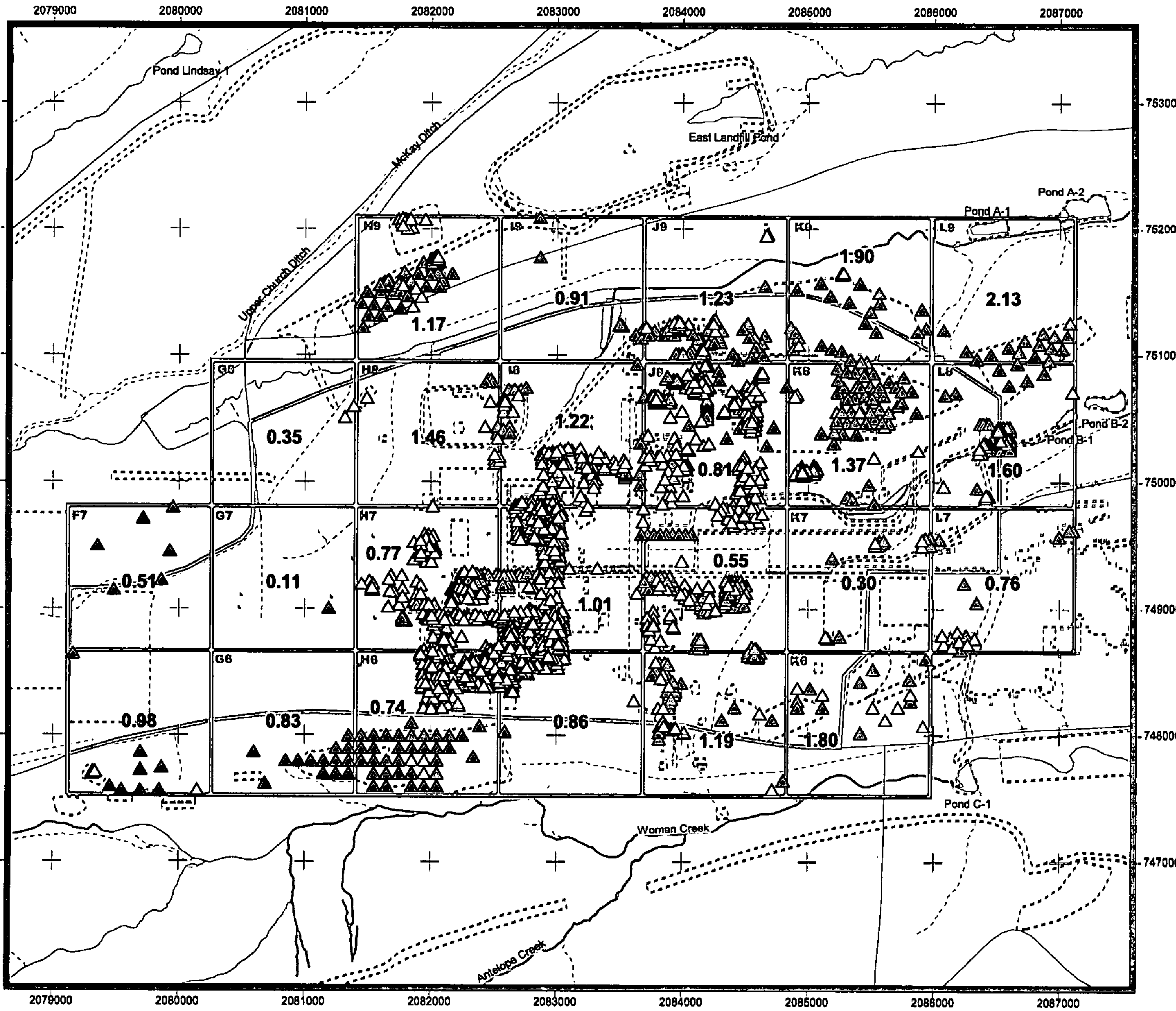

Figure 10.4
Industrial Area Exposure Unit
Sample-by-Sample
Comparison to the Limiting ESL -
Molybdenum

KEY

Surface soil sample location

- Detect >= 10 x ESL
- Detect >= ESL < 10 x ESL
- Detect < ESL
- Nondetect
- Industrial Area EU
- 30-acre grid
- Historical IHSS/PAC
- A1 Grid cell ID

ESL: 1.90 mg/kg
Receptor: Deer Mouse - Insectivore
95th UCL background: 0.644 mg/kg
Maximum background concentration: N/A

Standard Map Features

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N E S W

0 600 1200 Feet

Scale 1:14400

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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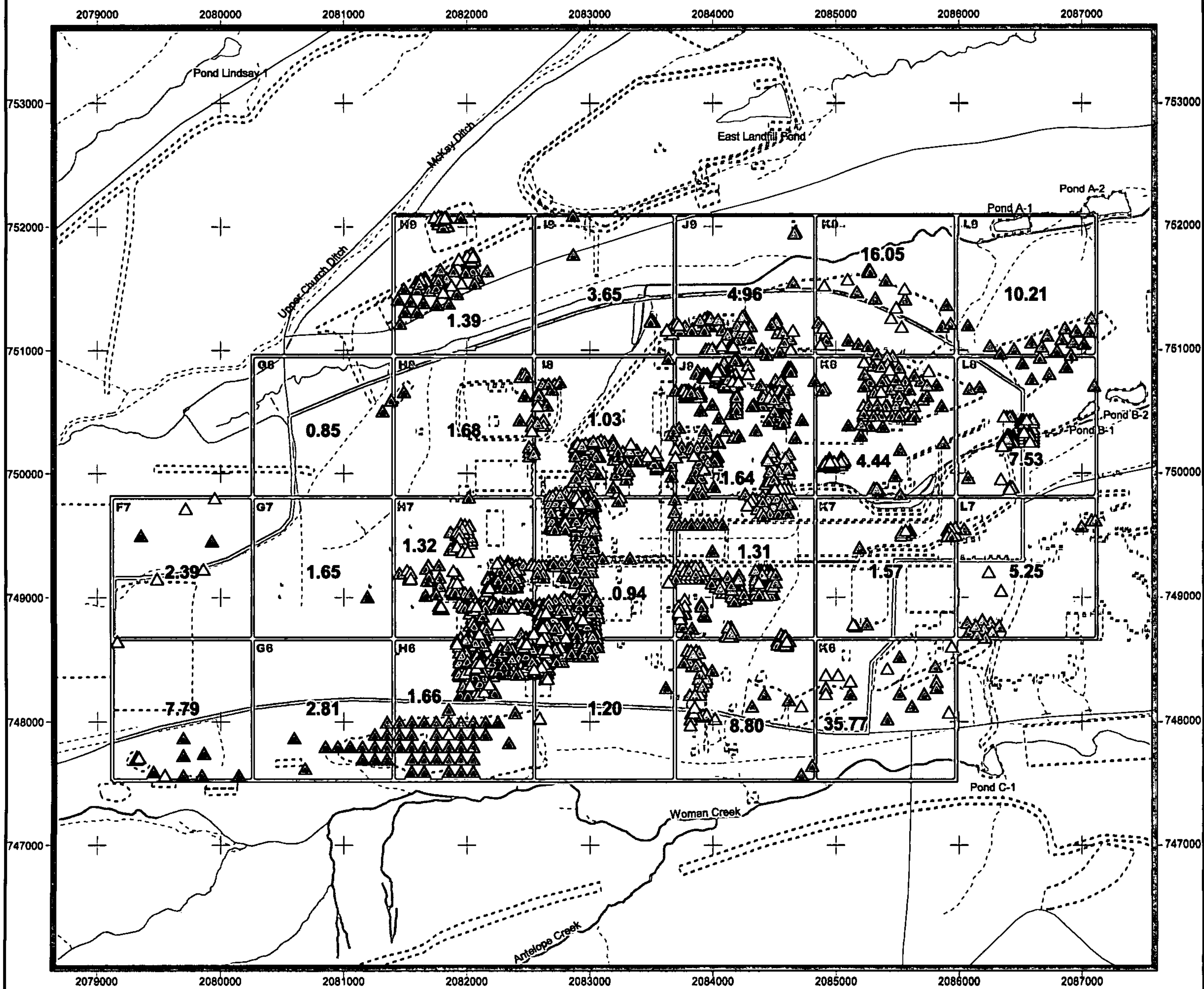

Figure 10.5
Industrial Area Exposure Unit Sample-by-Sample Comparison to the Limiting ESL - Tin

KEY

Surface soil sample location
- Detect >= 10 x ESL
- Detect >= ESL < 10 x ESL
- Detect < ESL
- Nondetect
- Industrial Area EU
- 30-acre grid
- Historical IHSS/PAC
- A1 Grid cell ID

ESL: 2.9 mg/kg
Receptor: Mourning Dove - Insectivore
95th UCL background: 2.22 mg/kg
Maximum background concentration: N/A

Standard Map Features
- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

0 600 1200 Feet

Scale 1:14400

State Plane Coordinate Projection
Colorado Central Zone
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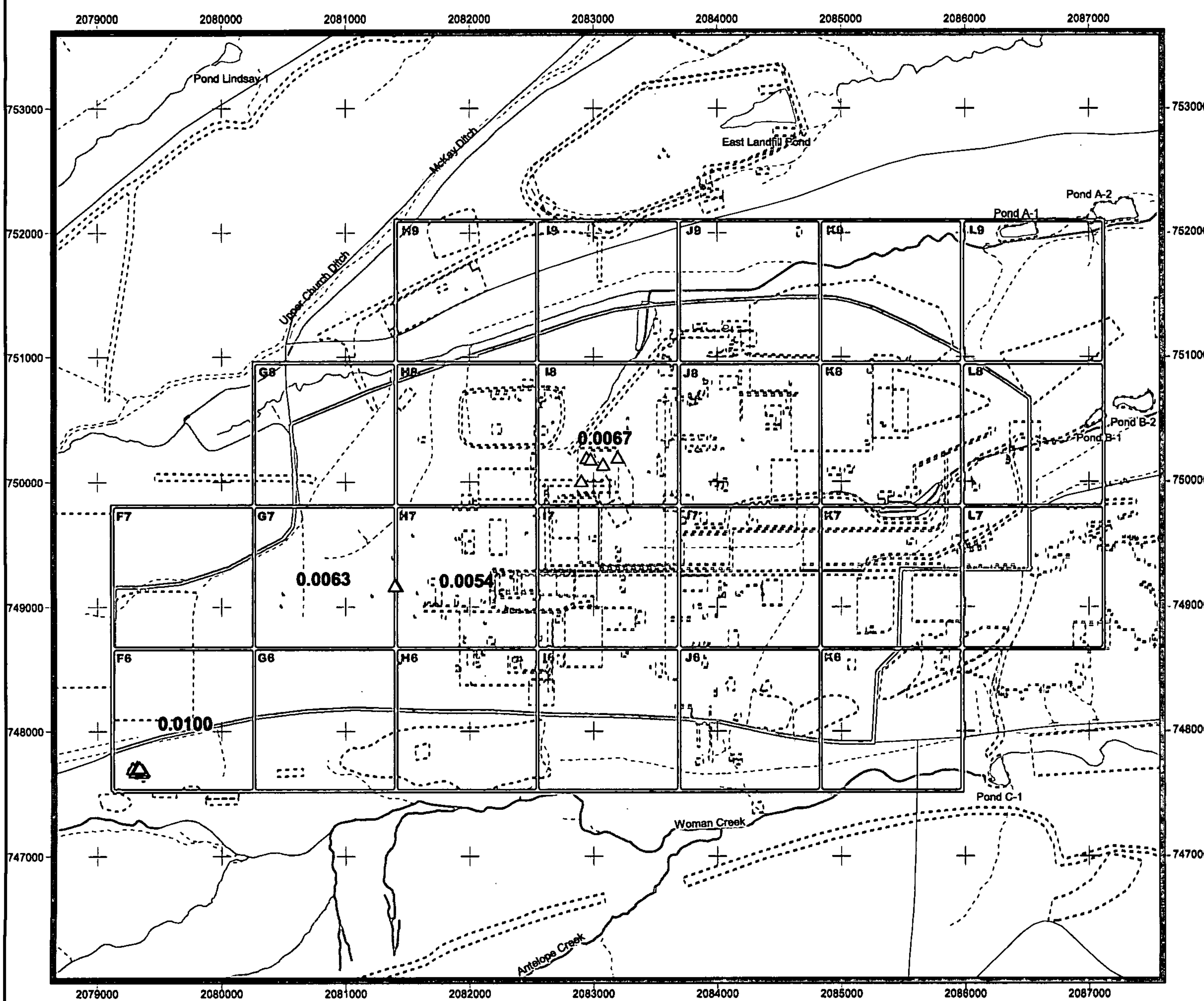
Figure 10.6
Industrial Area Exposure Unit
Sample-by-Sample
Comparison to the Limiting ESL -
Total Dioxins



KEY

Surface soil sample location

- △ Detect >= 10 x ESL
- △ Detect >= ESL < 10 x ESL
- △ Detect < ESL
- Industrial Area EU
- 30-acre grid
- Historical IHSS/PAC
- A1 Grid cell ID

ESL: 0.0042 mg/kg
Receptor: Deer Mouse - Insectivore
95th UCL background: N/A
Maximum background concentration: N/A

Standard Map Features

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N
E
S
W

0 600 1200 Feet

Scale 1:14400

State Plane Coordinate Projection
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Datum: NAD 27

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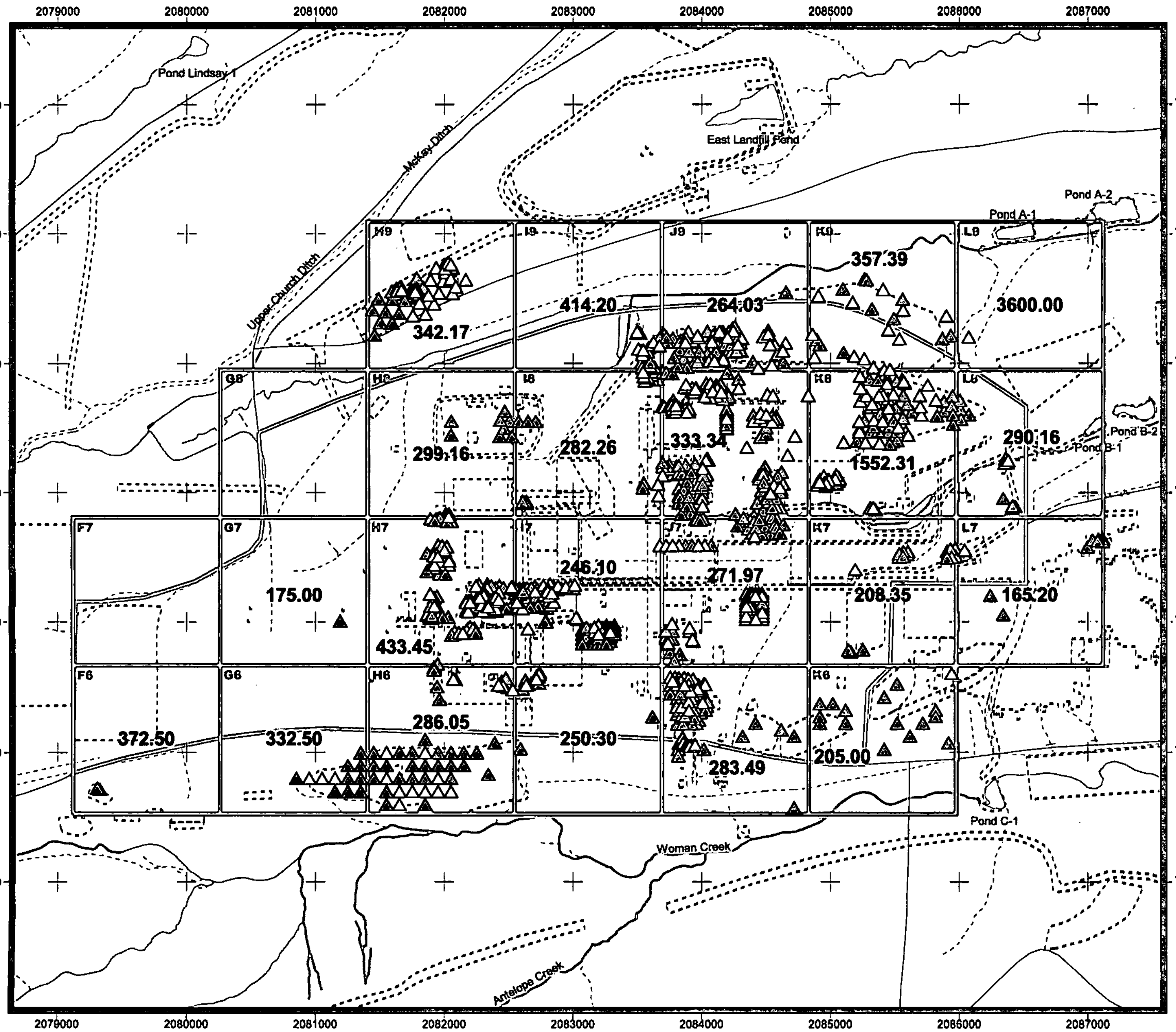
Figure 10.7
Industrial Area Exposure Unit Sample-by-Sample Comparison to the Limiting ESL - Bis(2-ethylhexyl)phthalate



KEY

Surface soil sample location
- Detect >= 10 x ESL
- Detect >= ESL < 10 x ESL
- Detect < ESL
- Nondetect
- Industrial Area EU
- 30-acre grid
- Historical IHSS/PAC
- A1 Grid cell ID

ESL: 136.8 ug/kg
Receptor: Mourning Dove - Insectivore
95th UCL background: N/A
Maximum background concentration: N/A

Standard Map Features
- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N E S W

0 600 1200 Feet

Scale 1:14400

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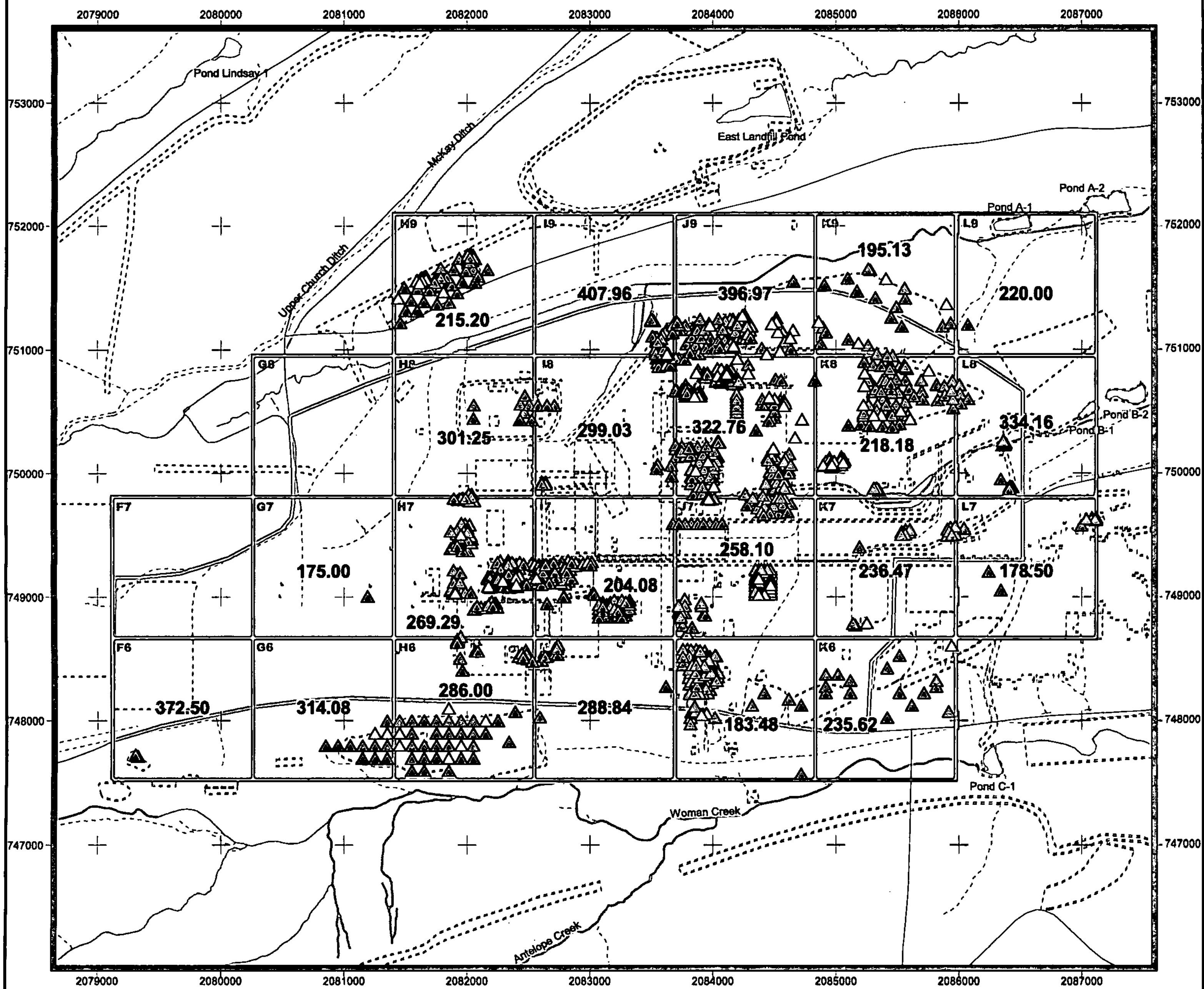

Figure 10.8
Industrial Area Exposure Unit Sample-by-Sample Comparison to the Limiting ESL - Di-n-butylphthalate

KEY

Surface soil sample location

- Detect >= 10 x ESL
- Detect >= ESL < 10 x ESL
- Detect < ESL
- Nondetect
- Industrial Area EU
- 30-acre grid
- Historical IHSS/PAC
- A1 Grid cell ID

ESL: 15.86 ug/kg
Receptor: Mourning Dove - Insectivore
95th UCL background: N/A
Maximum background concentration: N/A

Standard Map Features

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N W E S

0 600 1200 Feet

Scale 1:14400

State Plane Coordinate Projection
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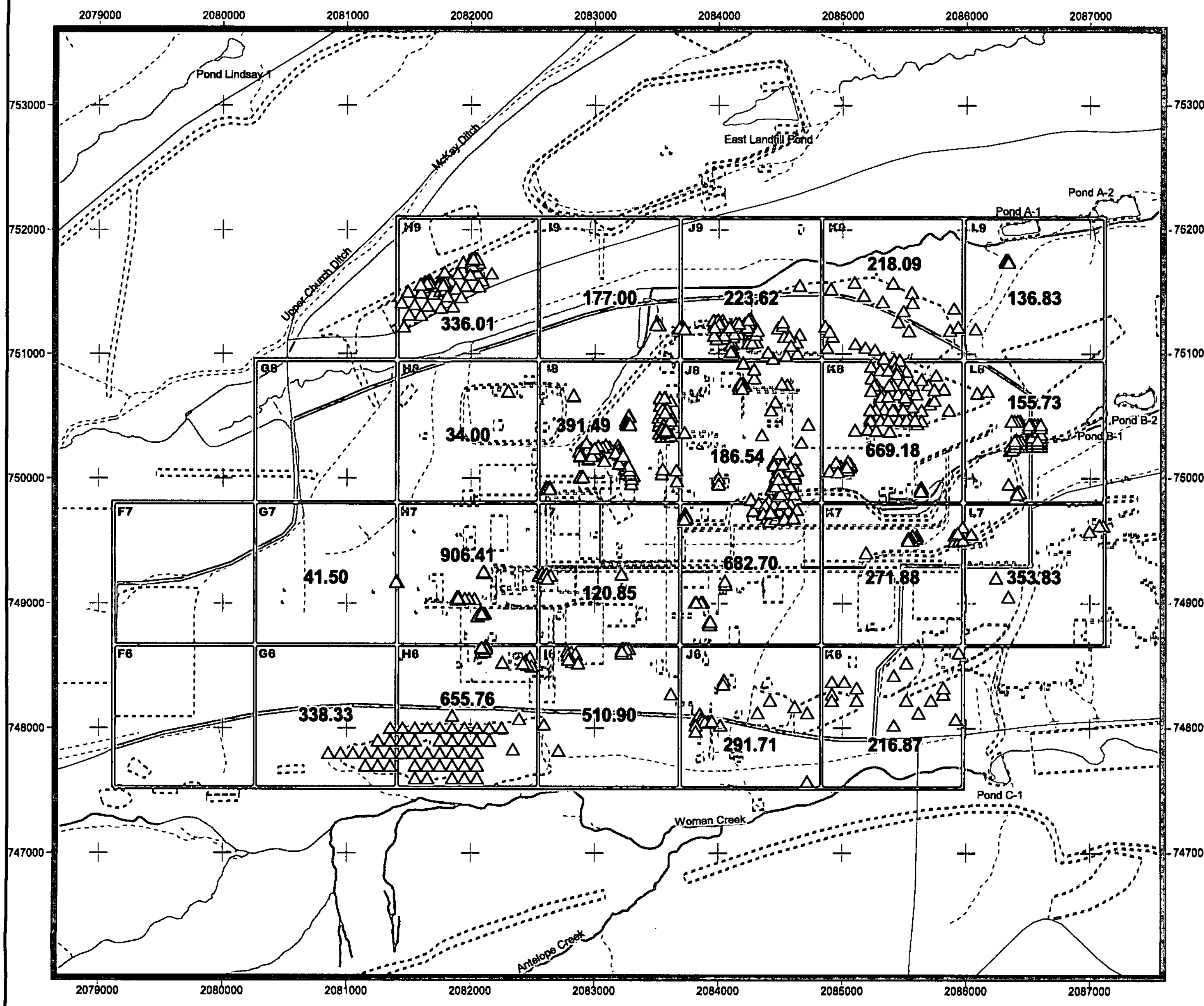
Figure 10.9
Industrial Area Exposure Unit Sample-by-Sample Comparison to the Limiting ESL - Total PCBs



KEY

Surface soil sample location

- Detect >= 10 x ESL
- Detect >= ESL < 10 x ESL
- Detect < ESL
- Industrial Area EU
- 30-acre grid
- Historical IHSS/PAC
- A1 Grid cell ID

ESL: 42.3 ug/kg
Receptor: Mourning Dove - Insectivore
95th UCL background: N/A
Maximum background concentration: N/A

Standard Map Features

- Exposure unit boundary
- Pond
- Site boundary
- Perennial stream
- Intermittent stream
- Ephemeral stream

N E S W

0 600 1200 Feet

Scale 1:14400

State Plane Coordinate Projection
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COMPREHENSIVE RISK ASSESSMENT

INDUSTRIAL AREA EXPOSURE UNIT

VOLUME 14: ATTACHMENT 1

Detection Limit Screen

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ACRONYMS AND ABBREVIATIONS

ERA	Ecological Risk Assessment
ESL	ecological screening level
EU	Exposure Unit
HHRA	Human Health Risk Assessment
IAEU	Industrial Area Exposure Unit
NOAEL	no observed adverse effect level
PRG	preliminary remediation goal
WRW	wildlife refuge worker

1.0 EVALUATION OF DETECTION LIMITS FOR NONDETECTED ANALYTES AND ANALYTES DETECTED IN LESS THAN 5 PERCENT OF SAMPLES IN THE INDUSTRIAL AREA EXPOSURE UNIT

The detection limits for analytes that are either not detected or are detected in less than 5 percent of the samples collected from the media used in the Human Health Risk Assessment (HHRA) or the Ecological Risk Assessment (ERA) are reviewed in this attachment. The detection limits for surface soil/surface sediment and subsurface soil/subsurface sediment samples are compared to human health preliminary remediation goals (PRGs) for the wildlife refuge worker (WRW). The detection limits for media evaluated in the ERA are compared to the minimum ecological screening level (ESL) for a variety of ecological receptors (surface soil) and the prairie dog no observed effect level (NOAEL) ESL (subsurface soil). The results of these comparisons are presented in Tables A1.1 through A1.4.

Nondetects, analytes detected in less than 5 percent of samples, and the reported detection limits (referred to as "reported result" in the following sections of this attachment) are listed in these tables for each medium in the Industrial Area Exposure Unit (EU) (IAEU) and compared to medium-specific human health PRGs for the WRW and ESLs for a variety of ecological receptors. Maximum reported results that exceed the respective PRGs and ESLs are noted and discussed.

Analytes that were not detected in any samples collected in each medium are referred to as nondetected analytes. The nondetected chemicals are reported in this attachment at the lowest level at which the chemical may be accurately and reproducibly quantified, taking into account the sample characteristics, sample collection, sample preparation, and analytical adjustments.

1.1 Comparison of Maximum Reported Results for Nondetected Analytes and Analytes Detected in Less than 5 percent of Samples to Preliminary Remediation Goals

1.1.1 Surface Soil/Surface Sediment

The maximum reported results for eight nondetected analytes (1,2-dibromoethane, 3,3'-dichlorobenzidine, 4,6-dinitro-2-methylphenol, bis[2-chloroethyl]ether, MCPP, n-nitroso-di-n-propylamine, PCB-1221, and PCB-1232) and six analytes detected in less than 5 percent of samples (dieldrin, hexachlorobenzene, PCB-1016, PCB-1242, PCB-1248, and pentachlorophenol) in surface soil/surface sediment are greater than the PRG (Table A1.1). Therefore, there is some uncertainty associated with the reported results for these analytes in the IAEU.

The minimum reported results for all 14 analytes were below their respective PRGs. The maximum reported result for 13 of the 14 analytes were less than five times the PRGs. The maximum reported result for n-nitroso-di-n-propylamine is approximately 16 times

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the PRG. The slight exceedance of the PRG by the maximum reported results for these 14 analytes is not expected to have significant impacts on the results of the risk assessment.

PRGs were not available for several nondetected analytes and analytes detected in less than 5 percent of samples in surface soil/surface sediment (Table A1.1). Because PRGs were available for most of the nondetected analytes and analytes detected in less than 5 percent of samples in surface soil/surface sediment, and the maximum reported results for these analytes were much lower than the PRGs, the lack of PRGs for less than half of the organics is unlikely to have a significant effect on the results of the risk assessment. In addition, the fact that no identified source exists for these analytes in the surface soil/surface sediment at the IAEU suggests there is an acceptable level of uncertainty associated with the reported results for these analytes.

1.1.2 Subsurface Soil/Subsurface Sediment

The maximum reported results for four nondetected analytes (1,2-dibromoethane, benzidine, n-nitrosodiethylamine, and n-nitrosodimethylamine) in subsurface soil/subsurface sediment are greater than the PRG (Table A1.2). Therefore, there is some uncertainty associated with the reported results for these analytes in the IAEU.

The minimum reported result for all 1,2-dibromoethane was below the PRG. The maximum reported result for all four analytes were less than 10 times the PRGs. The slight exceedance of the PRG by the maximum reported results for these four analytes is not expected to have significant impacts on the results of the risk assessment.

PRGs were not available for several nondetected analytes and analytes detected in less than 5 percent of samples in subsurface soil/subsurface sediment (Table A1.2). Because PRGs were available for most of the nondetected analytes and analytes detected in less than 5 percent of samples in subsurface soil/subsurface sediment, and the maximum reported results for these analytes were much lower than the PRGs, the lack of PRGs for less than half of the analytes is unlikely to have a significant effect on the results of the risk assessment. In addition, the fact that no identified source exists for these analytes in the subsurface soil/subsurface sediment at the IAEU suggests there is an acceptable level of uncertainty associated with the reported results for these nondetected analytes and analytes detected in less than 5 percent of samples.

1.2 Comparison of Maximum Reported Results for Nondetected Analytes and Analytes Detected in Less than 5 percent of Samples to Ecological Screening Levels

1.2.1 Surface Soil

In surface soil in the IAEU, the maximum reported results for 18 nondetected analytes and 25 analytes detected in less than 5 percent of samples exceeded their respective ESLs (Table A1.3). For three of these 43 analytes, the minimum reported results also exceeded the ESL. Therefore, there is some uncertainty associated with the reported results for nondetected analytes and analytes detected in less than 5 percent of samples in surface soil in the IAEU.

For 2,4-dinitrotoluene, 4,4'-DDT, endrin, endrin ketone, hexachlorobenzene, and pentachlorophenol, the maximum reported result was two orders of magnitude greater than the PRG. For 2,4,6-trichlorophenol, 2-chlorophenol, 4,4'-DDE, 4,6-dinitro-2-methylphenol, 4-chloroaniline, dieldrin, dimethoate, endrin aldehyde, hexachlorobutadiene, hexachloroethane, PCB-1016, PCB-1221, PCB-1232, PCB-1242, PCB-1248, and vinyl chloride, the maximum reported result was between one order of magnitude greater than the PRG. The remaining 21 analytes had maximum reported result that were less than 10 times the PRG.

ESLs were unavailable for several of the nondetected analytes and analytes detected in less than 5 percent of samples in surface soil (Table A1.3). Because ESLs were available for most of the nondetected analytes and analytes detected in less than 5 percent of samples in surface soil and the maximum reported results for these analytes were much lower than the ESLs, the lack of ESLs for these analytes is unlikely to have a significant effect on the results of the risk assessment.

1.2.2 Subsurface Soil

In subsurface soil in the IAEU, the maximum reported results for two analytes (2,4-dinitrotoluene and vinyl chloride) detected in less than 5 percent of samples exceeded their respective ESLs (Table A1.4). Therefore, there is some uncertainty associated with the reported results for analytes detected in less than 5 percent of samples in subsurface soil in the IAEU.

For 2,4-dinitrotoluene and vinyl chloride, the minimum reported results were below their respective ESLs. For both of these analytes, the maximum reported results were below two times the ESLs. The slight exceedance of the ESL by the maximum reported results for these two analytes is not expected to have significant impacts on the results of the risk assessment.

ESLs were unavailable for several nondetected analytes and analytes detected in less than 5 percent of samples in subsurface soil (Table A1.4). Because ESLs were available for most of the nondetected analytes and analytes detected in less than 5 percent of samples in subsurface soil and the maximum reported results for these analytes were much lower than the ESLs, the lack of ESLs for several of the analytes is unlikely to have a significant effect on the results of the risk assessment.

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TABLES

Table A1.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Soil/Surface Sediment

Analyte	Range of Reported Results	Total Number of Results	PRG	Maximum Reported Result[a] > PRG?
Inorganics (mg/kg)				
Tantalum	13.6 - 19.9	11	N/A	UT
Organics (µg/kg)				
1,1,1,2-Tetrachloroethane	0.502 - 131	492	91,018	No
1,1,1-Trichloroethane[b]	0.587 - 680	649	9.18E+06	No
1,1,2,2-Tetrachloroethane[b]	0.527 - 680	658	10,483	No
1,1,2-Trichloro-1,2,2-trifluoroethane[b]	0.587 - 108.6	491	2.38E+09	No
1,1,2-Trichloroethane	0.502 - 680	659	28,022	No
1,1-Dichloroethane	0.512 - 680	659	2.72E+06	No
1,1-Dichloroethene[b]	0.61 - 680	657	17,366	No
1,1-Dichloropropene	0.424 - 79.41	492	N/A	UT
1,2,3-Trichlorobenzene[b]	0.641 - 97.8	487	N/A	UT
1,2,3-Trichloropropane	0.525 - 129	492	2,079	No
1,2,4-Trichlorobenzene[b]	0.621 - 7,000	1,279	151,360	No
1,2-Dibromo-3-chloropropane	1.368 - 589	492	2,968	No
1,2-Dibromoethane	**0.502 - 138**	**492**	**35.1**	**Yes**
1,2-Dichlorobenzene	0.502 - 6,900	1,058	2.89E+06	No
1,2-Dichloroethane	0.522 - 680	656	13,270	No
1,2-Dichloroethene[b]	5 - 680	151	999,783	No
1,2-Dichloropropane[b]	0.413 - 680	657	38,427	No
1,3,5-Trinitrobenzene	250 - 250	5	N/A	UT
1,3-Dichlorobenzene	0.505 - 7,000	1,284	3.33E+06	No
1,3-Dichloropropane	0.492 - 85.5	492	N/A	UT
1,3-Dinitrobenzene	250 - 250	5	N/A	UT
1,4-Dichlorobenzene[b]	0.649 - 6,900	1,057	91,315	No
2,2-Dichloropropane	0.466 - 114	492	N/A	UT
2,4,5-TP (Silvex)	14.8 - 100	12	169,369	No
2,4,5-Trichlorophenol[b]	330 - 34,000	983	8.01E+06	No
2,4,6-Trichlorophenol[b]	330 - 7,000	983	272,055	No
2,4-D	83 - 180	12	801,435	No
2,4-DB	83 - 1,400	10	641,148	No
2,4-Dichlorophenol	330 - 7,000	984	240,431	No
2,4-Dimethylphenol[b]	330 - 7,000	981	1.60E+06	No
2,4-Dinitrophenol	850 - 35,000	979	160,287	No
2,4-Dinitrotoluene	250 - 7,000	992	160,287	No
2,6-Dinitrotoluene	250 - 7,000	992	80,144	No
2-Amino-4,6-dinitrotoluene	250 - 250	5	N/A	UT
2-Butanone[b]	2.72 - 1,400	641	4.64E+07	No
2-Chloroethyl vinyl ether	10 - 11	15	N/A	UT
2-Chloronaphthalene	330 - 7,000	987	6.41E+06	No
2-Chlorophenol	330 - 7,000	984	555,435	No
2-Chlorotoluene	0.475 - 118	492	2.22E+06	No
2-Hexanone[b]	1.54 - 1,400	646	N/A	UT
2-Methylphenol[b]	330 - 7,000	983	4.01E+06	No
2-Nitroaniline	370 - 35,000	987	192,137	No
2-Nitrophenol	330 - 7,000	984	N/A	UT
2-Nitrotoluene	250 - 250	5	N/A	UT
3,3'-Dichlorobenzidine	**340 - 14,000**	**972**	**6,667**	**Yes**
3-Nitroaniline	850 - 35,000	975	N/A	UT
3-Nitrotoluene	250 - 250	5	N/A	UT
4,4'-DDD[b]	1.8 - 190	262	15,528	No

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Table A1.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Soil/Surface Sediment

Analyte	Range of Reported Results	Total Number of Results	PRG	Maximum Reported Result[a] > PRG?
4,4'-DDE[b]	1.8 - 190	260	10,961	No
4,4'-DDT[b]	1.8 - 190	261	10,927	No
4,6-Dinitro-2-methylphenol	**850 - 35,000**	**979**	**8,014**	**Yes**
4-Amino-2,6-dinitrotoluene	250 - 250	5	N/A	UT
4-Bromophenyl-phenylether	330 - 7,000	987	N/A	UT
4-Chloro-3-methylphenol[b]	330 - 14,000	983	N/A	UT
4-Chloroaniline	330 - 14,000	986	320,574	No
4-Chlorophenyl-phenyl ether	330 - 7,000	987	N/A	UT
4-Chlorotoluene	0.622 - 96.9	492	N/A	UT
4-Isopropyltoluene[b]	0.431 - 70.18	477	N/A	UT
4-Methyl-2-pentanone[b]	1.94 - 2,960	642	8.32E+07	No
4-Methylphenol[b]	330 - 7,000	978	400,718	No
4-Nitroaniline[b]	850 - 35,000	982	207,917	No
4-Nitrophenol[b]	850 - 35,000	982	641,148	No
4-Nitrotoluene	250 - 250	5	244,608	No
Acenaphthylene[b]	330 - 6,900	984	N/A	UT
Aldrin[b]	1.8 - 95	260	176	No
alpha-BHC[b]	1.8 - 95	263	570	No
alpha-Chlordane	1.8 - 950	234	10,261	No
Aroclor-1016[b]	**33 - 4,500**	**512**	**1,349**	**Yes**
Aroclor-1221	**33 - 4,500**	**558**	**1,349**	**Yes**
Aroclor-1232	**33 - 4,500**	**558**	**1,349**	**Yes**
Aroclor-1242[b]	**33 - 4,500**	**556**	**1,349**	**Yes**
Aroclor-1248[b]	**33 - 4,500**	**553**	**1,349**	**Yes**
Azinphos-methyl	86 - 890	7	N/A	UT
Benzene[b]	0.502 - 680	656	23,563	No
Benzoic Acid[b]	370 - 35,000	868	3.21E+08	No
Benzyl Alcohol[b]	330 - 14,000	880	2.40E+07	No
beta-BHC[b]	1.8 - 95	263	1,995	No
beta-Chlordane[b]	1.8 - 950	217	10,261	No
bis(2-Chloroethoxy) methane	330 - 7,000	987	N/A	UT
bis(2-Chloroethyl) ether	**330 - 7,000**	**987**	**3,767**	**Yes**
bis(2-Chloroisopropyl) ether	330 - 7,000	986	59,301	No
Bromobenzene	0.502 - 121	492	N/A	UT
Bromochloromethane[b]	0.502 - 106	491	N/A	UT
Bromodichloromethane	0.502 - 680	659	67,070	No
Bromoform	0.525 - 680	659	419,858	No
Bromomethane[b]	0.972 - 221	649	20,959	No
Carbon Disulfide[b]	0.535 - 680	658	1.64E+06	No
Carbon Tetrachloride[b]	0.575 - 680	638	8,446	No
Chlordane	18 - 220	30	10,261	No
Chlorobenzene[b]	0.484 - 680	658	666,523	No
Chloroethane	0.862 - 1,400	656	1.43E+06	No
Chloroform[b]	0.543 - 680	647	7,850	No
Chloromethane[b]	0.992 - 1,400	655	115,077	No
Chlorpyriphos	8.6 - 89	7	240,431	No
cis-1,2-Dichloroethene[b]	0.502 - 590	483	1.11E+06	No
cis-1,3-Dichloropropene	0.502 - 680	659	19,432	No
Coumaphos	18 - 180	7	N/A	UT
Dalapon	42 - 2,300	10	2.40E+06	No

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Table A1.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Soil/Surface Sediment

Analyte	Range of Reported Results	Total Number of Results	PRG	Maximum Reported Result[a] > PRG?
delta-BHC	1.8 - 95	264	570	No
Demeton	8.6 - 89	7	3,206	No
Diazinon	8.6 - 89	7	N/A	UT
Dibromochloromethane	0.502 -.680	659	49,504	No
Dibromomethane	0.502 - 141	492	N/A	UT
Dichlorodifluoromethane	1.73 - 398	479	229,820	No
Dichlorovos	18 - 180	7	N/A	UT
Dieldrin[b]	**1.8 - 190**	**256**	**187**	**Yes**
Diesel fuel	25,000 - 29,000	28	N/A	UT
Diethylphthalate[b]	330 - 7,000	977	6.41E+07	No
Dimethoate	18 - 180	7	16,029	No
Dimethylphthalate[b]	330 - 7,000	965	8.01E+08	No
Dinoseb	12 - 100	10	80,144	No
Disulfoton	8.6 - 89	7	N/A	UT
Endosulfan I[b]	1.8 - 95	262	480,861	No
Endosulfan II[b]	1.8 - 180	260	480,861	No
Endosulfan sulfate[b]	1.8 - 190	262	480,861	No
Endrin[b]	1.8 - 190	261	24,043	No
Endrin aldehyde[b]	1.8 - 38	97	24,043	No
Endrin ketone	1.8 - 190	233	33,326	No
Ethoprop	8.6 - 89	7	N/A	UT
Famphur	34 - 350	7	N/A	UT
Fensulfothion	31 - 320	7	N/A	UT
Fenthion	8.6 - 89	7	N/A	UT
gamma-BHC (Lindane)[b]	1.8 - 95	263	2,771	No
gamma-Chlordane	2 - 910	16	10,261	No
Heptachlor	1.8 - 95	264	665	No
Heptachlor epoxide[b]	1.8 - 95	262	329	No
Hexachlorobenzene[b]	**330 - 7,000**	**983**	**1,870**	**Yes**
Hexachlorobutadiene[b]	0.508 - 7,000	1,282	22,217	No
Hexachlorocyclopentadiene	330 - 7,000	981	380,452	No
Hexachloroethane	330 - 7,000	987	111,087	No
Isophorone[b]	330 - 7,000	982	3.16E+06	No
Isopropylbenzene[b]	0.361 - 94.4	482	32,680	No
Malathion	21 - 210	7	N/A	UT
MCPP	**8,300 - 140,000**	**10**	**80,144**	**Yes**
Merphos	8.6 - 89	7	N/A	UT
Methoxychlor[b]	3.5 - 950	260	400,718	No
Methyl parathion	8.6 - 89	7	N/A	UT
Mevinphos	31 - 320	7	N/A	UT
Naled	260 - 2,700	7	N/A	UT
n-Butylbenzene[b]	0.471 - 93.9	485	N/A	UT
Nitrobenzene	250 - 7,000	992	43,246	No
Nitroglycerin	5,000 - 5,000	5	N/A	UT
N-Nitroso-di-n-propylamine	**330 - 7,000**	**987**	**429**	**Yes**
N-nitrosodiphenylamine	330 - 7,000	987	612,250	No
n-Propylbenzene[b]	0.537 - 89.5	480	N/A	UT
O,O,O-Triethyl phosphorothioate	8.6 - 89	7	N/A	UT
Parathion	8.6 - 89	7	480,861	No
Pentachlorophenol[b]	**850 - 35,000**	**969**	**17,633**	**Yes**
PETN	4,000 - 4,000	5	N/A	UT
Phenol[b]	330 - 7,000	980	2.40E+07	No

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Table A1.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Soil/Surface Sediment

Analyte	Range of Reported Results	Total Number of Results	PRG	Maximum Reported Result[a] > PRG?
Phorate	8.6 - 89	7	N/A	UT
Prothiophos	8.6 - 89	7	N/A	UT
Pyridine	370 - 7,000	387	N/A	UT
RDX	250 - 250	5	N/A	UT
Ronnel	8.6 - 89	7	N/A	UT
sec-Butylbenzene[b]	0.549 - 93	487	N/A	UT
Styrene[b]	0.55 - 680	658	1.38E+07	No
Sulprofos	18 - 180	7	N/A	UT
tert-Butylbenzene[b]	0.702 - 92.1	491	N/A	UT
Tetrachlorvinphos	8.6 - 89	7	N/A	UT
Tetraethyl dithiopyrophosphate	8.6 - 89	7	40,070	No
Tetryl	500 - 500	5	N/A	UT
Thionazine	8.6 - 89	7	N/A	UT
Toxaphene	85 - 2,200	264	2,720	No
trans-1,2-Dichloroethene	0.738 - 93.3	507	287,340	No
trans-1,3-Dichloropropene	0.502 - 680	659	20,820	No
Tributyl phosphate	350 - 350	1	N/A	UT
Trichloroethene[b]	0.5 - 680	634	1,770	No
Trichloronate	8.6 - 89	7	N/A	UT
Vinyl acetate	10 - 1,400	96	2.65E+06	No
Vinyl Chloride	0.748 - 1,400	659	2,169	No

[a] Value is the maximum reported result for nondetected analytes.

[b] Analyte has a detection frequency of less than 5 percent.

N/A = Not Available.

UT = Uncertain toxicity.

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Table A1.2
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Subsurface Soil/Subsurface Sediment

Analyte	Range of Reported Results	Total Number of Results	PRG	Maximum Reported Result > PRG?
Inorganics (mg/kg)				
Ammonia	0.331 - 0.338	3	1.05E+07	No
Bromide	0.04 - 1	40	N/A	UT
Ortho-phosphate	0.458 - 0.481	2	N/A	UT
Organics (µg/kg)				
1,1,1,2-Tetrachloroethane	0.483 - 3,090	2,656	1.05E+06	No
1,1,1-Trichloroethane[b]	0.589 - 7,000	2,964	1.06E+08	No
1,1,2,2-Tetrachloroethane[b]	0.507 - 7,000	3,024	120,551	No
1,1,2-Trichloro-1,2,2-trifluoroethane[b]	0.589 - 8,185	2,651	2.74E+10	No
1,1,2-Trichloroethane[b]	0.483 - 7,000	3,032	322,253	No
1,1-Dichloroethane[b]	0.493 - 7,000	3,024	3.12E+07	No
1,1-Dichloroethene[b]	0.611 - 7,000	3,009	199,706	No
1,1-Dichloropropene	0.425 - 5,685	2,658	N/A	UT
1,2,3-Trichlorobenzene[b]	0.614 - 3,716	2,600	N/A	UT
1,2,3-Trichloropropane[b]	0.534 - 5,702	2,653	23,910	No
1,2,4,5-Tetrachlorobenzene	380 - 400	4	276,495	No
1,2,4-Trichlorobenzene[b]	0.632 - 4,224	2,829	1.74E+06	No
1,2,4-Trimethylbenzene[b]	0.533 - 3,286	2,520	1.53E+06	No
1,2-Dibromo-3-chloropropane[b]	1.318 - 7,610	2,653	34,137	No
1,2-Dibromoethane	**0.483 - 3,090**	**2,658**	**403**	**Yes**
1,2-Dichlorobenzene[b]	0.483 - 3,090	2,855	3.32E+07	No
1,2-Dichloroethane[b]	0.502 - 7,000	2,998	152,603	No
1,2-Dichloroethene[b]	5 - 620	346	1.15E+07	No
1,2-Dichloropropane[b]	0.419 - 7,000	3,028	441,907	No
1,2-Diphenylhydrazine	380 - 400	4	43,021	No
1,3,5-Trimethylbenzene[b]	0.519 - 3,090	2,581	1.31E+06	No
1,3,5-Trinitrobenzene	250	1	N/A	UT
1,3-Dichlorobenzene[b]	0.486 - 3,090	2,882	3.83E+07	No
1,3-Dichloropropane	0.483 - 3,090	2,658	N/A	UT
1,3-Dinitrobenzene	250	1	N/A	UT
1,4-Dichlorobenzene[b]	0.66 - 5,189	2,854	1.05E+06	No
2,2-Dichloropropane	0.467 - 4,040	2,658	N/A	UT
2,4,5-TP (Silvex)	14 - 15	3	1.95E+06	No
2,4,5-Trichlorophenol	51 - 5,000	886	9.22E+07	No
2,4,6-Trichlorophenol	10 - 3,100	886	3.13E+06	No
2,4,6-Trinitrotoluene	0.2 - 250	10	460,825	No
2,4-D	84 - 90	3	9.22E+06	No
2,4-Dichlorophenol	10 - 3,100	886	2.76E+06	No
2,4-Dimethylphenol[b]	10 - 3,100	884	1.84E+07	No
2,4-Dinitrophenol[b]	51 - 15,000	885	1.84E+06	No
2,4-Dinitrotoluene[b]	10 - 3,500	890	1.84E+06	No
2,6-Dinitrotoluene	10 - 3,100	890	921,651	No
2-Amino-4,6-dinitrotoluene	250	1	N/A	UT
2-Chloroethyl vinyl ether	11 - 12	4	N/A	UT
2-Chloronaphthalene	10 - 3,100	889	7.37E+07	No

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Table A1.2
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Subsurface Soil/Subsurface Sediment

Analyte	Range of Reported Results	Total Number of Results	PRG	Maximum Reported Result[a] > PRG?
2-Chlorophenol[b]	10 - 3,100	883	6.39E+06	No
2-Chlorotoluene[b]	0.476 - 3,090	2,644	2.56E+07	No
2-Hexanone[b]	1.54 - 40,520	2,989	N/A	UT
2-Methylphenol[b]	10 - 3,100	886	4.61E+07	No
2-Nitroaniline	51 - 15,000	889	2.21E+06	No
2-Nitrophenol	10 - 3,100	885	N/A	UT
2-Nitrotoluene	250	1	N/A	UT
3 & 4-methyl phenol	754 - 1,740	17	N/A	UT
3,3'-Dichlorobenzidine[b]	20 - 6,000	888	76,667	No
3-Nitroaniline	51 - 15,000	870	N/A	UT
3-Nitrotoluene	250	1	N/A	UT
4,4'-DDD[b]	1.8 - 40	158	178,570	No
4,4'-DDE[b]	1.8 - 42	156	126,049	No
4,4'-DDT[b]	1.8 - 40	157	125,658	No
4,6-Dinitro-2-methylphenol	51 - 15,000	885	92,165	No
4-Amino-2,6-dinitrotoluene	250	1	N/A	UT
4-Bromophenyl-phenylether	10 - 3,100	889	N/A	UT
4-Chloro-3-methylphenol[b]	10 - 6,000	885	N/A	UT
4-Chloroaniline	10 - 6,000	881	3.69E+06	No
4-Chlorophenyl-phenyl ether	10 - 3,100	889	N/A	UT
4-Chlorotoluene[b]	0.624 - 5,998	2,644	N/A	UT
4-Isopropyltoluene[b]	0.438 - 3,420	2,602	N/A	UT
4-Methyl-2-pentanone[b]	1.95 - 37,300	2,992	9.57E+08	No
4-Methylphenol[b]	10 - 3,100	866	4.61E+06	No
4-Nitroaniline[b]	51 - 15,000	871	2.39E+06	No
4-Nitrophenol	51 - 15,000	885	7.37E+06	No
4-Nitrotoluene	250	1	2.81E+06	No
Acenaphthylene[b]	10 - 2,000	887	N/A	UT
Acetophenone	1,000	1	N/A	UT
Aldrin[b]	1.8 - 23	159	2,024	No
alpha-BHC[b]	1.8 - 22	158	6,555	No
alpha-Chlordane	1.8 - 200	97	117,997	No
Aroclor-1016[b]	33 - 7,300	668	15,514	No
Aroclor-1221	33 - 7,300	674	15,514	No
Aroclor-1232	33 - 7,300	674	15,514	No
Aroclor-1242	33 - 7,300	674	15,514	No
Aroclor-1248[b]	33 - 7,300	658	15,514	No
Benzene[b]	0.43 - 7,000	3,015	270,977	No
Benzidine	**360**	**1**	**150**	**Yes**
Benzoic Acid[b]	51 - 15,000	818	3.69E+09	No
Benzyl Alcohol[b]	10 - 6,000	836	2.76E+08	No
beta-BHC	1.8 - 22	160	22,942	No
beta-Chlordane	1.8 - 200	79	117,997	No
bis(2-Chloroethoxy) methane	10 - 3,100	888	N/A	UT
bis(2-Chloroethyl) ether	10 - 3,100	888	43,315	No

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Table A1.2
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Subsurface Soil/Subsurface Sediment

Analyte	Range of Reported Results	Total Number of Results	PRG	Maximum Reported Result[a] > PRG?
bis(2-Chloroisopropyl) ether	10 - 3,100	886	681,967	No
Bromobenzene	0.483 - 3,090	2,646	N/A	UT
Bromochloromethane[b]	0.483 - 3,090	2,657	N/A	UT
Bromodichloromethane	0.483 - 7,000	3,033	771,304	No
Bromoform[b]	0.494 - 7,000	3,032	4.83E+06	No
Bromomethane[b]	0.936 - 7,000	2,990	241,033	No
Butylbenzylphthalate[b]	10 - 3,100	861	1.84E+08	No
Carbon Disulfide[b]	0.544 - 7,000	3,017	1.88E+07	No
Carbon Tetrachloride[b]	0.577 - 7,000	2,988	97,124	No
Chlordane	18 - 220	63	117,997	No
Chlorobenzene[b]	0.483 - 7,000	3,025	7.67E+06	No
Chloroethane[b]	0.847 - 7,000	2,990	1.65E+07	No
Chloroform[b]	0.539 - 7,000	2,988	90,270	No
Chloromethane[b]	0.934 - 7,000	3,030	1.32E+06	No
cis-1,2-Dichloroethene[b]	0.483 - 3,090	2,612	1.28E+07	No
cis-1,3-Dichloropropene	0.483 - 7,000	3,034	223,462	No
delta-BHC[b]	1.8 - 22	159	6,555	No
Dibromochloromethane	0.483 - 7,000	3,034	569,296	No
Dibromomethane	0.483 - 3,090	2,658	N/A	UT
Dichlorodifluoromethane[b]	1.658 - 10,520	2,594	2.64E+06	No
Dieldrin[b]	1.8 - 40	156	2,151	No
Diesel fuel	25,000	1	N/A	UT
Diethylphthalate[b]	10 - 3,100	878	7.37E+08	No
Dimethylphthalate[b]	10 - 3,100	886	9.22E+09	No
Di-n-octylphthalate[b]	10 - 3,100	883	3.69E+07	No
Diphenylamine	754 - 1,740	17	N/A	UT
Endosulfan I[b]	1.8 - 22	159	5.53E+06	No
Endosulfan II[b]	1.8 - 130	156	5.53E+06	No
Endosulfan sulfate[b]	1.8 - 40	158	5.53E+06	No
Endrin[b]	1.8 - 43	156	276,495	No
Endrin aldehyde[b]	1.8 - 21	91	276,495	No
Endrin ketone[b]	1.8 - 40	91	383,250	No
Ethylbenzene[b]	0.46 - 7,000	2,930	6.19E+07	No
gamma-BHC (Lindane)[b]	1.8 - 22	159	31,864	No
gamma-Chlordane	1.9 - 10	18	117,997	No
Heptachlor	1.8 - 22	160	7,647	No
Heptachlor epoxide[b]	1.8 - 88	158	3,782	No
Hexachlorobenzene[b]	10 - 3,100	886	21,508	No
Hexachlorobutadiene[b]	0.516 - 3,588	2,868	255,500	No
Hexachlorocyclopentadiene	10 - 3,100	888	4.38E+06	No
Hexachloroethane	10 - 3,100	889	1.28E+06	No

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Table A1.2
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Subsurface Soil/Subsurface Sediment

Analyte	Range of Reported Results	Total Number of Results	PRG	Maximum Reported Result[a] > PRG?
HMX	250	1	4.61E+07	No
Isophorone[b]	10 - 3,100	887	3.63E+07	No
Isopropylbenzene[b]	0.339 - 3,090	2,629	375,823	No
m,p-Xylene	6 - 63	13	1.22E+07	No
Methoxychlor[b]	3.4 - 200	155	4.61E+06	No
n-Butylbenzene[b]	0.479 - 3,956	2,612	N/A	UT
Nitrobenzene	10 - 3,100	890	497,333	No
Nitroglycerin	5,000	1	N/A	UT
N-Nitrosodiethylamine	**760 - 790**	**4**	**229**	**Yes**
N-Nitrosodimethylamine	**760 - 790**	**4**	**675**	**Yes**
N-Nitrosodi-n-butylamine	380 - 400	4	5,977	No
N-Nitroso-di-n-propylamine[b]	10 - 3,100	887	4,929	No
N-nitrosodiphenylamine[b]	10 - 3,100	868	7.04E+06	No
n-Propylbenzene[b]	0.546 - 3,727	2,616	N/A	UT
o-Xylene	6 - 620	30	1.22E+07	No
Pentachlorobenzene	380 - 400	4	737,321	No
Pentachlorophenol[b]	51 - 15,000	881	202,777	No
PETN	4,000	1	N/A	UT
Phenol[b]	10 - 3,100	878	2.76E+08	No
Pyridine	350 - 3,100	483	N/A	UT
RDX	250	1	N/A	UT
sec-Butylbenzene[b]	0.551 - 3,443	2,617	N/A	UT
Styrene[b]	0.53 - 7,000	3,019	1.59E+08	No
tert-Butylbenzene[b]	0.689 - 3,978	2,644	N/A	UT
Tetryl	500	1	N/A	UT
Toxaphene	170 - 2,200	160	31,284	No
trans-1,2-Dichloroethene[b]	0.711 - 4,106	2,686	3.30E+06	No
trans-1,3-Dichloropropene	0.483 - 7,000	3,031	239,434	No
Tributyl phosphate	350 - 8,740	21	N/A	UT
Trichloroethene[b]	0.501 - 4,804	2,902	20,354	No
Trichlorofluoromethane[b]	0.602 - 7,421	2,606	1.74E+07	No
Vinyl acetate	10 - 65	266	3.04E+07	No
Vinyl Chloride[b]	0.704 - 7,000	3,032	24,948	No

[a] Value is the maximum reported result for nondetected analytes.

[b] Analyte has a detection frequency of less than 5 percent.

N/A = Not Available.

UT = Uncertain toxicity.

Table A1.3
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Soil

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Inorganics (mg/kg)				
Cyanide[b]	0.18 - 2.5	123	607	No
Tantalum	13.6 - 19.9	11	N/A	UT
Organics (µg/kg)				
1,1,1,2-Tetrachloroethane	0.502 - 131	468	N/A	UT
1,1,1-Trichloroethane[b]	0.587 - 680	568	551,453	No
1,1,2,2-Tetrachloroethane	0.527 - 680	578	60,701	No
1,1,2-Trichloro-1,2,2-trifluoroethane[b]	0.587 - 108.6	467	N/A	UT
1,1,2-Trichloroethane	0.502 - 680	578	N/A	UT
1,1-Dichloroethane	0.512 - 680	578	3,121	No
1,1-Dichloroethene[b]	0.61 - 680	577	16,909	No
1,1-Dichloropropene	0.424 - 79.41	468	N/A	UT
1,2,3-Trichlorobenzene[b]	0.641 - 97.8	464	N/A	UT
1,2,3-Trichloropropane	0.525 - 129	468	13,883	No
1,2,4-Trichlorobenzene[b]	**0.621 - 7,000**	**1,193**	**777**	**Yes**
1,2-Dibromo-3-chloropropane	1.368 - 589	468	N/A	UT
1,2-Dibromoethane	0.502 - 138	468	N/A	UT
1,2-Dichlorobenzene	0.502 - 6,900	985	N/A	UT
1,2-Dichloroethane	0.522 - 680	575	2,764	No
1,2-Dichloroethene[b]	5 - 680	94	25,617	No
1,2-Dichloropropane[b]	0.413 - 680	576	49,910	No
1,3,5-Trinitrobenzene	250 - 250	5	N/A	UT
1,3-Dichlorobenzene	0.505 - 7,000	1,197	N/A	UT
1,3-Dichloropropane	0.492 - 85.5	468	N/A	UT
1,3-Dinitrobenzene	250 - 250	5	N/A	UT
1,4-Dichlorobenzene[b]	0.649 - 6,900	984	20,000	No
2,2-Dichloropropane	0.466 - 114	468	N/A	UT
2,4,5-TP (Silvex)	14.8 - 100	11	N/A	UT
2,4,5-Trichlorophenol[b]	**330 - 34,000**	**914**	**4,000**	**Yes**
2,4,6-Trichlorophenol[b]	**330 - 7,000**	**914**	**161**	**Yes**
2,4-D	83 - 100	11	N/A	UT
2,4-DB	83 - 100	9	426	No
2,4-Dichlorophenol	**330 - 7,000**	**915**	**2,744**	**Yes**
2,4-Dimethylphenol[b]	330 - 7,000	912	N/A	UT
2,4-Dinitrophenol	**850 - 35,000**	**911**	**20,000**	**Yes**
2,4-Dinitrotoluene	**250 - 7,000**	**923**	**32.1**	**Yes**
2,6-Dinitrotoluene	**250 - 7,000**	**923**	**6,186**	**Yes**
2-Amino-4,6-dinitrotoluene	250 - 250	5	N/A	UT
2-Butanone[b]	2.72 - 1,400	561	1.07E+06	No
2-Chloroethyl vinyl ether	10 - 11	15	N/A	UT
2-Chloronaphthalene	330 - 7,000	918	N/A	UT
2-Chlorophenol	**330 - 7,000**	**915**	**281**	**Yes**
2-Chlorotoluene	0.475 - 118	468	N/A	UT

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Table A1.3

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Soil

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
2-Hexanone[b]	1.54 - 1,400	570	N/A	UT
2-Methylphenol	330 - 7,000	915	123,842	No
2-Nitroaniline	**370 - 35,000**	**918**	**5,659**	**Yes**
2-Nitrophenol	330 - 7,000	915	N/A	UT
2-Nitrotoluene	250 - 250	5	N/A	UT
3,3'-Dichlorobenzidine	340 - 14,000	904	N/A	UT
3-Nitroaniline	850 - 35,000	906	N/A	UT
3-Nitrotoluene	250 - 250	5	N/A	UT
4,4'-DDD[b]	1.8 - 190	202	13,726	No
4,4'-DDE[b]	**1.8 - 190**	**200**	**7.95**	**Yes**
4,4'-DDT[b]	**1.8 - 190**	**203**	**1.20**	**Yes**
4,6-Dinitro-2-methylphenol	**850 - 35,000**	**911**	**560**	**Yes**
4-Amino-2,6-dinitrotoluene	250 - 250	5	N/A	UT
4-Bromophenyl-phenylether	330 - 7,000	918	N/A	UT
4-Chloro-3-methylphenol[b]	330 - 14,000	914	N/A	UT
4-Chloroaniline	**330 - 14,000**	**917**	**716**	**Yes**
4-Chlorophenyl-phenyl ether	330 - 7,000	918	N/A	UT
4-Chlorotoluene	0.622 - 96.9	468	N/A	UT
4-Isopropyltoluene[b]	0.431 - 70.18	453	N/A	UT
4-Methyl-2-pentanone[b]	1.94 - 2,960	561	14,630	No
4-Methylphenol[b]	330 - 7,000	910	N/A	UT
4-Nitroaniline[b]	850 - 35,000	914	41,050	No
4-Nitrophenol[b]	**850 - 35,000**	**913**	**7,000**	**Yes**
4-Nitrotoluene	250 - 250	5	61,422	No
Acenaphthylene[b]	330 - 6,900	915	N/A	UT
Aldrin[b]	**1.8 - 95**	**201**	**47.0**	**Yes**
alpha-BHC[b]	1.8 - 95	203	18,662	No
alpha-Chlordane	**1.8 - 950**	**174**	**289**	**Yes**
Aroclor-1016[b]	**33 - 4,500**	**437**	**172**	**Yes**
Aroclor-1221	**33 - 4,500**	**483**	**172**	**Yes**
Aroclor-1232	**33 - 4,500**	**483**	**172**	**Yes**
Aroclor-1242[b]	**33 - 4,500**	**481**	**172**	**Yes**
Aroclor-1248[b]	**33 - 4,500**	**478**	**172**	**Yes**
Azinphos-methyl	86 - 890	7	N/A	UT
Benzene[b]	**0.502 - 680**	**575**	**500**	**Yes**
Benzoic Acid[b]	1,000 - 35,000	839	N/A	UT
Benzyl Alcohol[b]	**330 - 14,000**	**850**	**4,403**	**Yes**
beta-BHC	1.8 - 95	204	207	No
beta-Chlordane[b]	**1.8 - 950**	**166**	**289**	**Yes**
bis(2-Chloroethoxy) methane	330 - 7,000	918	N/A	UT
bis(2-Chloroethyl) ether	330 - 7,000	918	N/A	UT
bis(2-Chloroisopropyl) ether	330 - 7,000	918	N/A	UT
Bromobenzene	0.502 - 121	468	N/A	UT

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Table A1.3
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Soil

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Bromochloromethane[b]	0.502 - 106	467	N/A	UT
Bromodichloromethane	0.502 - 680	578	5,750	No
Bromoform	0.525 - 680	578	2,855	No
Bromomethane	0.972 - 221	574	N/A	UT
Carbon Disulfide[b]	0.535 - 680	577	5,676	No
Carbon Tetrachloride[b]	0.575 - 680	557	8,906	No
Chlordane	18 - 220	30	289	No
Chlorobenzene[b]	0.484 - 680	577	4,750	No
Chloroethane	0.862 - 1,400	575	N/A	UT
Chloroform[b]	0.543 - 680	571	8,655	No
Chloromethane[b]	0.992 - 1,400	575	N/A	UT
Chlorpyriphos	8.6 - 89	7	N/A	UT
cis-1,2-Dichloroethene[b]	0.502 - 590	459	1,814	No
cis-1,3-Dichloropropene	0.502 - 680	578	2,800	No
Coumaphos	18 - 180	7	N/A	UT
Dalapon	42 - 100	9	N/A	UT
delta-BHC	**1.8 - 95**	**204**	**25.9**	**Yes**
Demeton	8.6 - 89	7	N/A	UT
Diazinon	8.6 - 89	7	N/A	UT
Dibromochloromethane	0.502 - 680	578	5,730	No
Dibromomethane	0.502 - 141	468	N/A	UT
Dichlorodifluoromethane	1.73 - 398	455	855	No
Dichlorovos	18 - 180	7	N/A	UT
Dieldrin[b]	**1.8 - 190**	**196**	**7.40**	**Yes**
Diesel fuel	25,000 - 29,000	28	N/A	UT
Diethylphthalate[b]	330 - 7,000	909	100,000	No
Dimethoate	**18 - 180**	**7**	**13.7**	**Yes**
Dimethylphthalate[b]	330 - 7,000	900	200,000	No
Di-n-octylphthalate[b]	330 - 7,000	874	731,367	No
Dinoseb	12 - 100	9	N/A	UT
Disulfoton	8.6 - 89	7	N/A	UT
Endosulfan I[b]	**1.8 - 95**	**202**	**80.1**	**Yes**
Endosulfan II[b]	**1.8 - 170**	**200**	**80.1**	**Yes**
Endosulfan sulfate[b]	**1.8 - 190**	**202**	**80.1**	**Yes**
Endrin[b]	**1.8 - 190**	**201**	**1.40**	**Yes**
Endrin aldehyde[b]	**1.8 - 38**	**58**	**1.40**	**Yes**
Endrin ketone	**1.8 - 190**	**177**	**1.40**	**Yes**
Ethoprop	8.6 - 89	7	N/A	UT
Famphur	34 - 350	7	N/A	UT
Fensulfothion	31 - 320	7	N/A	UT
Fenthion	8.6 - 89	7	N/A	UT
gamma-BHC (Lindane)[b]	**1.8 - 95**	**203**	**25.9**	**Yes**
gamma-Chlordane	2 - 4.4	7	289	No
Heptachlor	**1.8 - 95**	**204**	**63.3**	**Yes**

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Table A1.3

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Soil

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Heptachlor epoxide[b]	**1.8 - 95**	**203**	**64.0**	**Yes**
Hexachlorobenzene[b]	**330 - 7,000**	**914**	**7.73**	**Yes**
Hexachlorobutadiene[b]	**0.508 - 7,000**	**1,196**	**431**	**Yes**
Hexachlorocyclopentadiene	**330 - 7,000**	**913**	**5,518**	**Yes**
Hexachloroethane	**330 - 7,000**	**918**	**366**	**Yes**
Isophorone[b]	330 - 7,000	913	N/A	UT
Isopropylbenzene[b]	0.361 - 94.4	458	N/A	UT
Malathion	21 - 210	7	N/A	UT
MCPP	8,300 - 100,000	9	N/A	UT
Merphos	8.6 - 89	7	N/A	UT
Methoxychlor[b]	3.5 - 950	200	1,226	No
Methyl parathion	8.6 - 89	7	N/A	UT
Mevinphos	31 - 320	7	N/A	UT
Naled	260 - 2,700	7	N/A	UT
n-Butylbenzene[b]	0.471 - 93.9	461	N/A	UT
Nitrobenzene	250 - 7,000	923	40,000	No
Nitroglycerin	5,000 - 5,000	5	N/A	UT
N-Nitroso-di-n-propylamine	330 - 7,000	918	N/A	UT
N-nitrosodiphenylamine	330 - 7,000	918	20,000	No
n-Propylbenzene[b]	0.537 - 89.5	456	N/A	UT
O,O,O-Triethyl phosphorothioate	8.6 - 89	7	N/A	UT
Parathion	8.6 - 89	7	N/A	UT
Pentachlorophenol[b]	**850 - 35,000**	**904**	**122**	**Yes**
PETN	4,000 - 4,000	5	N/A	UT
Phenol[b]	330 - 7,000	912	23,090	No
Phorate	8.6 - 89	7	N/A	UT
Prothiophos	8.6 - 89	7	N/A	UT
Pyridine	660 - 7,000	367	N/A	UT
RDX	250 - 250	5	N/A	UT
Ronnel	8.6 - 89	7	N/A	UT
sec-Butylbenzene[b]	0.549 - 93	463	N/A	UT
Styrene[b]	0.55 - 680	577	16,408	No
Sulprofos	18 - 180	7	N/A	UT
tert-Butylbenzene[b]	0.702 - 92.1	467	N/A	UT
Tetrachlorvinphos	8.6 - 89	7	N/A	UT
Tetraethyl dithiopyrophosphate	8.6 - 89	7	N/A	UT
Tetryl	500 - 500	5	N/A	UT
Thionazine	8.6 - 89	7	N/A	UT
Toxaphene	86 - 2,200	204	3,756	No
trans-1,2-Dichloroethene	0.738 - 93.3	483	25,617	No
trans-1,3-Dichloropropene	0.502 - 680	578	2,800	No
Tributyl phosphate	350 - 350	1	N/A	UT
Trichloroethene[b]	**0.5 - 680**	**556**	**389**	**Yes**
Trichloronate	8.6 - 89	7	N/A	UT
Vinyl acetate	10 - 1,400	74	13,986	No
Vinyl Chloride	**0.748 - 1,400**	**578**	**97.7**	**Yes**

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Table A1.3

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Soil

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?

[a] Value is the maximum reported result for nondetected analytes.

[b] Analyte has a detection frequency of less than 5 percent.

N/A = Not Available.

UT = Uncertain toxicity.

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Table A1.4

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Subsurface Soil

Analyte	Range of Reported Results	Total Number of Results	Prairie Dog NOAEL ESL	Maximum Reported Result[a] > ESL?
Inorganics (mg/kg)				
Ammonia	0.331 - 0.338	3	26,723	No
Bromide	0.04 - 1	40	N/A	UT
Ortho-phosphate	0.458 - 0.481	2	N/A	UT
Organics (µg/kg)				
1,1,1,2-Tetrachloroethane	0.483 - 3,090	2,649	N/A	UT
1,1,1-Trichloroethane[b]	0.589 - 7,000	2,950	4.85E+07	No
1,1,2,2-Tetrachloroethane[b]	0.507 - 7,000	3,010	4.70E+06	No
1,1,2-Trichloro-1,2,2-trifluoroethane[b]	0.589 - 8,185	2,644	N/A	UT
1,1,2-Trichloroethane[b]	0.483 - 7,000	3,018	N/A	UT
1,1-Dichloroethane[b]	0.493 - 7,000	3,010	215,360	No
1,1-Dichloroethene[b]	0.611 - 7,000	2,995	1.28E+06	No
1,1-Dichloropropene	0.425 - 5,685	2,651	N/A	UT
1,2,3-Trichlorobenzene[b]	0.614 - 3,716	2,593	N/A	UT
1,2,3-Trichloropropane[b]	0.534 - 5,702	2,646	1.17E+06	No
1,2,4,5-Tetrachlorobenzene	380 - 400	4	N/A	UT
1,2,4-Trichlorobenzene[b]	0.632 - 4,224	2,815	94,484	No
1,2,4-Trimethylbenzene[b]	0.533 - 3,286	2,513	N/A	UT
1,2-Dibromo-3-chloropropane[b]	1.318 - 7,610	2,646	N/A	UT
1,2-Dibromoethane	0.483 - 3,090	2,651	N/A	UT
1,2-Dichlorobenzene[b]	0.483 - 3,090	2,841	N/A	UT
1,2-Dichloroethane[b]	0.502 - 7,000	2,989	2.00E+06	No
1,2-Dichloroethene[b]	5 - 620	340	1.87E+06	No
1,2-Dichloropropane[b]	0.419 - 7,000	3,014	3.92E+06	No
1,2-Diphenylhydrazine	380 - 400	4	N/A	UT
1,3,5-Trimethylbenzene[b]	0.519 - 3,090	2,574	855,709	No
1,3,5-Trinitrobenzene	250	1	N/A	UT
1,3-Dichlorobenzene[b]	0.486 - 3,090	2,868	N/A	UT
1,3-Dichloropropane	0.483 - 3,090	2,651	N/A	UT
1,3-Dinitrobenzene	250	1	N/A	UT
1,4-Dichlorobenzene[b]	0.66 - 5,189	2,840	5.93E+06	No
2,2-Dichloropropane	0.467 - 4,040	2,651	N/A	UT
2,4,5-TP (Silvex)	14 - 15	3	N/A	UT
2,4,5-Trichlorophenol	51 - 5,000	873	N/A	UT
2,4,6-Trichlorophenol	10 - 3,100	873	17,263	No
2,4,6-Trinitrotoluene	0.2 - 250	10	20,782	No
2,4-D	84 - 90	3	N/A	UT
2,4-Dichlorophenol	10 - 3,100	873	249,324	No
2,4-Dimethylphenol[b]	10 - 3,100	871	N/A	UT
2,4-Dinitrophenol[b]	51 - 15,000	872	4.90E+06	No
2,4-Dinitrotoluene[b]	**10 - 3,500**	**877**	**2,473**	**Yes**
2,6-Dinitrotoluene	10 - 3,100	877	477,309	No
2-Amino-4,6-dinitrotoluene	250	1	N/A	UT
2-Chloroethyl vinyl ether	11 - 12	4	N/A	UT

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Table A1.4

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Subsurface Soil

Analyte	Range of Reported Results	Total Number of Results	Prairie Dog NOAEL ESL	Maximum Reported Result[a] > ESL?
2-Chloronaphthalene	10 - 3,100	876	N/A	UT
2-Chlorophenol[b]	10 - 3,100	870	21,598	No
2-Chlorotoluene[b]	0.476 - 3090	2,637	N/A	UT
2-Hexanone[b]	1.54 - 40,520	2,975	N/A	UT
2-Methylphenol[b]	10 - 3,100	873	9.26E+06	No
2-Nitroaniline	51 - 15,000	876	418,475	No
2-Nitrophenol	10 - 3,100	872	N/A	UT
2-Nitrotoluene	250	1	N/A	UT
3 & 4-methyl phenol	754 - 1,740	17	N/A	UT
3,3'-Dichlorobenzidine[b]	20 - 6,000	875	N/A	UT
3-Nitroaniline	51 - 15,000	857	N/A	UT
3-Nitrotoluene	250	1	N/A	UT
4,4'-DDD[b]	1.8 - 40	151	6.19E+06	No
4,4'-DDE[b]	1.8 - 42	149	54,420	No
4,4'-DDT[b]	1.8 - 40	150	175,708	No
4,6-Dinitro-2-methylphenol	51 - 15,000	872	44,283	No
4-Amino-2,6-dinitrotoluene	250	1	N/A	UT
4-Bromophenyl-phenylether	10 - 3,100	876	N/A	UT
4-Chloro-3-methylphenol[b]	10 - 6,000	872	N/A	UT
4-Chloroaniline	10 - 6,000	868	48,856	No
4-Chlorophenyl-phenyl ether	10 - 3,100	876	N/A	UT
4-Chlorotoluene[b]	0.624 - 5,998	2,637	N/A	UT
4-Isopropyltoluene[b]	0.438 - 3,420	2,596	N/A	UT
4-Methyl-2-pentanone[b]	1.95 - 37,300	2,978	859,131	No
4-Methylphenol[b]	10 - 3,100	853	N/A	UT
4-Nitroaniline[b]	51 - 15,000	858	2.62E+06	No
4-Nitrophenol	51 - 15,000	872	1.02E+06	No
4-Nitrotoluene	250	1	4.97E+06	No
Acenaphthylene[b]	10 - 2,000	874	N/A	UT
Acetophenone	1,000	1	N/A	UT
Aldrin[b]	1.8 - 23	152	11,282	No
alpha-BHC[b]	1.8 - 22	151	2.47E+06	No
alpha-Chlordane	1.8 - 200	90	472,808	No
Aroclor-1016[b]	33 - 7,300	655	37,963	No
Aroclor-1221	33 - 7,300	661	37,963	No
Aroclor-1232	33 - 7,300	661	37,963	No
Aroclor-1242	33 - 7,300	661	37,963	No
Aroclor-1248[b]	33 - 7300	645	37,963	No
Benzene[b]	0.43 - 7,000	3,001	1.10E+06	No
Benzidine	360	1	N/A	UT
Benzoic Acid[b]	51 - 15,000	811	N/A	UT
Benzyl Alcohol[b]	10 - 6,000	828	253,015	No
beta-BHC	1.8 - 22	153	27,399	No
beta-Chlordane	1.8 - 200	77	472,808	No
bis(2-Chloroethoxy) methane	10 - 3,100	875	N/A	UT

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Table A1.4

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Subsurface Soil

Analyte	Range of Reported Results	Total Number of Results	Prairie Dog NOAEL ESL	Maximum Reported Result[a] > ESL?
bis(2-Chloroethyl) ether	10 - 3,100	875	N/A	UT
bis(2-Chloroisopropyl) ether	10 - 3,100	873	N/A	UT
Bromobenzene	0.483 - 3,090	2,639	N/A	UT
Bromochloromethane[b]	0.483 - 3,090	2,650	N/A	UT
Bromodichloromethane	0.483 - 7,000	3,019	381,135	No
Bromoform[b]	0.494 - 7,000	3,018	198,571	No
Bromomethane[b]	0.936 - 7,000	2,976	N/A	UT
Butylbenzylphthalate[b]	10 - 3,100	848	3.37E+06	No
Carbon Disulfide[b]	0.544 - 7,000	3,003	410,941	No
Carbon Tetrachloride[b]	0.577 - 7,000	2,974	736,154	No
Chlordane	18 - 220	63	472,808	No
Chlorobenzene[b]	0.483 - 7,000	3,011	413,812	No
Chloroethane[b]	0.847 - 7,000	2,976	N/A	UT
Chloroform[b]	0.539 - 7,000	2,974	560,030	No
Chloromethane[b]	0.934 - 7,000	3,016	N/A	UT
cis-1,2-Dichloroethene[b]	0.483 - 3,090	2,605	132,702	No
cis-1,3-Dichloropropene	0.483 - 7,000	3,020	222,413	No
delta-BHC[b]	1.8 - 22	152	3,425	No
Dibromochloromethane	0.483 - 7,000	3,020	389,064	No
Dibromomethane	0.483 - 3,090	2,651	N/A	UT
Dichlorodifluoromethane[b]	1.658 - 10,520	2,587	59,980	No
Dieldrin[b]	1.8 - 40	149	301	No
Diesel fuel	25,000	1	N/A	UT
Diethylphthalate[b]	10 - 3,100	866	2.21E+08	No
Dimethylphthalate[b]	10 - 3,100	873	1.35E+07	No
Di-n-octylphthalate[b]	10 - 3,100	870	2.58E+08	No
Diphenylamine	754 - 1,740	17	N/A	UT
Endosulfan I[b]	1.8 - 22	152	8,726	No
Endosulfan II[b]	1.8 - 130	149	8,726	No
Endosulfan sulfate[b]	1.8 - 40	151	8,726	No
Endrin[b]	1.8 - 43	149	8,060	No
Endrin aldehyde[b]	1.8 - 20	86	8,060	No
Endrin ketone[b]	1.8 - 40	89	8,060	No
Ethylbenzene[b]	0.46 - 7,000	2,916	N/A	UT
gamma-BHC (Lindane)[b]	1.8 - 22	152	3,425	No
gamma-Chlordane	1.9 - 4.4	13	472,808	No
Heptachlor	1.8 - 22	153	12,359	No
Heptachlor epoxide[b]	1.8 - 88	151	9,121	No
Hexachlorobenzene[b]	10 - 3,100	873	190,142	No
Hexachlorobutadiene[b]	0.516 - 3,588	2,854	150,894	No
Hexachlorocyclopentadiene	10 - 3,100	875	799,679	No
Hexachloroethane	10 - 3,100	876	45,656	No
HMX	250	1	857,536	No
Isophorone[b]	10 - 3,100	874	N/A	UT

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Table A1.4

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Subsurface Soil

Analyte	Range of Reported Results	Total Number of Results	Prairie Dog NOAEL ESL	Maximum Reported Result[a] > ESL?
Isopropylbenzene[b]	0.339 - 3,090	2,622	N/A	UT
m,p-Xylene	6 - 63	13	111,663	No
Methoxychlor[b]	3.4 - 200	148	228,896	No
n-Butylbenzene[b]	0.479 - 3,956	2,605	N/A	UT
Nitrobenzene	10 - 3,100	877	N/A	UT
Nitroglycerin	5,000	1	N/A	UT
N-Nitrosodiethylamine	760 - 790	4	N/A	UT
N-Nitrosodimethylamine	760 - 790	4	N/A	UT
N-Nitrosodi-n-butylamine	380 - 400	4	N/A	UT
N-Nitroso-di-n-propylamine[b]	10 - 3,100	874	N/A	UT
N-nitrosodiphenylamine[b]	10 - 3,100	855	2.15E+06	No
n-Propylbenzene[b]	0.546 - 3,727	2,609	N/A	UT
o-Xylene	6 - 620	30	111,663	No
Pentachlorobenzene	380 - 400	4	68,375	No
Pentachlorophenol[b]	51 - 15,000	868	18,373	No
PETN	4,000	1	N/A	UT
Phenol[b]	10 - 3,100	865	1.49E+06	No
Pyridine	350 - 3,100	477	N/A	UT
RDX	250	1	N/A	UT
sec-Butylbenzene[b]	0.551 - 3,443	2,610	N/A	UT
Styrene[b]	0.53 - 7,000	3,005	1.53E+06	No
tert-Butylbenzene[b]	0.689 - 3,978	2,637	N/A	UT
Tetryl	500	1	N/A	UT
Toxaphene	170 - 2,200	153	909,313	No
trans-1,2-Dichloroethene[b]	0.711 - 4,106	2,679	1.87E+06	No
trans-1,3-Dichloropropene	0.483 - 7,000	3,017	222,413	No
Tributyl phosphate	350 - 8,740	21	N/A	UT
Trichloroethene[b]	0.501 - 4,804	2,888	32,424	No
Trichlorofluoromethane[b]	0.602 - 7,421	2,599	N/A	UT
Vinyl acetate	10 - 65	264	730,903	No
Vinyl Chloride[b]	**0.704 - 7,000**	**3,018**	**6,494**	**Yes**

[a] Value is the maximum reported result for nondetected analytes.

[b] Analyte has a detection frequency of less than 5 percent.

N/A = Not Available.

UT = Uncertain toxicity.

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COMPREHENSIVE RISK ASSESSMENT

INDUSTRIAL AREA EXPOSURE UNIT

VOLUME 14: ATTACHMENT 2

Data Quality Assessment

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ACRONYMS AND ABBREVIATIONS

ASD	Analytical Services Division
CRA	Comprehensive Risk Assessment
DER	duplicate error ratio
DQA	Data Quality Assessment
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
IAEU	Industrial Area Exposure Unit
IDL	instrument detection limit
LCS	laboratory control sample
MDA	minimum detectable activity
MS	matrix spike
MSD	matrix spike duplicate
PARCC	precision, accuracy, representativeness, completeness, and comparability
QC	quality control
RFETS	Rocky Flats Environmental Technology Site
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit
RPD	relative percent difference
SWD	Soil Water Database
V&V	verification and validation

EXECUTIVE SUMMARY

This document provides an assessment of the quality of the data used in the Industrial Area Exposure Unit (IAEU) Comprehensive Risk Assessment (CRA). This Data Quality Assessment (DQA) focuses on all elements of quality control (QC) including both laboratory and sample-specific QC data.

Depending on the matrix and analyte group, anywhere from 69 to 100 percent of the IAEU data have been verified and/or validated by a validator from the Analytical Services Division (ASD) at the Rocky Flats Environmental Technology Site (RFETS) (or from an outside subcontractor) using verification and validation (V&V) guidelines for each analytical method developed for RFETS. V&V data are identified in the RFETS Soil Water Database (SWD) by a data qualifier flag and reason code(s) that provide an explanation for the qualifier flag. All rejected data have been removed from the dataset used in the CRA because the validator has determined the data are unusable. The remaining V&V data have associated qualifier flags indicating that the data are valid, estimated, or undetected, and are used in the CRA. Of the IAEU V&V data, approximately 13 percent was qualified as estimated and/or undetected. Approximately less than 4 percent of the data reported as detected by the laboratory were qualified as undetected due to blank contamination. Data qualified as estimated or undetected are a result of various minor laboratory noncompliance issues that are insufficient to render the data unusable.

A review of the IAEU V&V data indicates that the data meet the data quality objectives (DQOs) outlined in the Final CRA Work Plan and Methodology (K-H 2004) (hereafter referred to as the CRA Methodology). A review of the most common observations found in the V&V data determined that a minimal amount, less than 1 percent, of the non-V&V data may have been qualified if a review had been performed. Based on this DQA, data for the IAEU are of sufficient quality for use in the CRA.

1.0 INTRODUCTION

The Industrial Area Exposure Unit (IAEU) Comprehensive Risk Assessment (CRA) for the Rocky Flats Environmental Technology Site (RFETS) has been prepared in accordance with the CRA Methodology. The CRA Methodology was developed jointly with the regulatory agencies using the consultative process, and was approved by the agencies on September 28, 2004. Consistent with the CRA Methodology, data quality was assessed using a standard precision, accuracy, representativeness, completeness, and comparability (PARCC) parameter analysis (EPA 2002). Both laboratory and field quality control (QC) were evaluated for the IAEU data set.

Although many of the elements of QC that are reviewed in this document affect more than one PARCC parameter, their major impact on data quality is described below:

- Precision, as a measure of agreement among replicate measurements, is determined quantitatively based on the results of replicate laboratory measurements. Precision of the laboratory data was verified through review of:
  - Relative percent differences (RPDs) for laboratory control samples (LCSs) and LCS duplicates compared to the acceptable ranges (analytical precision);
  - RPDs (nonradionuclides) and duplicate error ratios (DERs) (radionuclides) for field sample and field duplicates compared to the acceptable ranges[1] (field precision);
  - RPDs for matrix spike (MS) and matrix spike duplicates (MSDs) compared to acceptable control ranges (matrix precision); and
  - RPDs for primary- and secondary-column analyses (analytical precision).
- Accuracy, as a measure of the distortion of a measurement process that causes error in measuring the true value, is determined quantitatively based on the analysis of samples with a known concentration. Accuracy of the laboratory data was verified through review of:
  - LCS data, calibration verification data, internal standard data, and instrument tune parameters (laboratory accuracy); and
  - Surrogate recoveries, MSs, and sample preparation (sample-specific accuracy).
- Representativeness of the data was verified through review of:

[1] The CRA Methodology states that the overall precision of the data is considered adequate if the RPD between the target and duplicate, at concentrations five times the reporting limit (RL), is less than 35 percent for solids and 20 percent for liquids. The precision adequacy requirement for radiological contaminants is a DER less than 1.96.

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- Laboratory blank data;
- Sample preservation/storage;
- Adherence to sample holding times;
- Documentation issues;
- Contract noncompliance issues; and
- Laboratory activities affecting ability to properly identify compounds.

- Completeness is a data adequacy criterion and is addressed in Appendix A, Volume 2 of the Remedial Investigation/Feasibility Study (RI/FS) Report. It refers to the spatial and temporal distribution of the data, and their adequacy for estimating exposure point concentrations (EPCs) for the CRA.

- Comparability of the data was verified through evaluation of:
  - Analytical procedures, and whether they were standard U.S. Environmental Protection Agency (EPA)- and RFETS-approved procedures;
  - Instrument types and maintenance, sample preparation techniques, and standard units for reporting; and
  - MS and surrogate samples, ensuring accuracy within acceptable ranges.

2.0 ANALYTICAL DATA

Approximately 963,000 specific analytical records exist in the IAEU CRA data set, some 91 percent of which (879,311 records) have undergone verification and validation (V&V). The fraction of the data that was verified and/or validated is shown in Table A2.1 by analyte group and matrix. These data were reviewed by validators and their observations and comments are captured in the Soil Water Database (SWD). All of the data that have been flagged due to V&V findings (except "R"-flagged data) and data that have no flags as a result of V&V are used in the IAEU CRA. The small amount of data that has not undergone V&V is used as provided by the laboratories. The most common errors found during V&V such as transcription errors, calculation errors, and excluded records that were later added by the validator were reviewed to determine the possible effect on non-V&V data. Assuming that the percentage of data qualified as a result of these issues are representative of similar observations in the non-V&V data, less than 1 percent of the entire IAEU dataset is at risk for such unacknowledged and, therefore, uncorrected errors.

Data V&V involves an in-depth review of the data packages from the laboratory to assess compliance with contract requirements. In general, data validation includes all of the activities of verification, as well as additional QC checks and review of some raw laboratory instrument data and calculations. After V&V, a data qualifier flag and/or reason code(s) are assigned to the data record (Tables A2.2 and A2.3). The reason codes provide an explanation for the qualifier flag, thereby making it possible to determine which of the PARCC parameters is affected by the observation (Table A2.4). Qualifier flags are discussed in this Data Quality Assessment (DQA) as those V&V flags that note issues in the data. V&V flags "V," "V1," and "1" represent data that were reviewed by validators, but no issues were observed. Eighty-six percent of the V&V data fall into this category. Additional qualifier flags such as "A," "E," and "Z" were also applied. These validation qualifiers are notations that do not indicate estimation or a change in the status of detection. The data are valid and useable as reported by the laboratory. Only 1 percent of the V&V data are represented by these additional qualifier flags. The specific definitions of these additional V&V flags are presented in Table A2.2. Data with noted issues are presented in Table A2.5 and discussed in detail in Section 3.0.

V&V qualifier flags are not specifically addressed in this data assessment, but rather the reason codes associated with the qualifier flags for each analytical record are summarized and evaluated. This approach was chosen because the validator's specific observations (reason codes), and not the qualifier flags, provide the best descriptors of the data quality.

V&V data records contain a field with V&V reason codes (5, 18/52, 200, 99/101/701, and so forth), or the field is null. These reason codes represent observations related to assessment of precision, accuracy, and representativeness. For example, the reason code 110 definition (see Table A2.3) is "LCS recovery criteria were not met," which is an observation related to data accuracy.

Multiple reason codes were routinely applied to a specific sample method/matrix/analyte combination. Therefore, it was necessary to parse out the individual codes to create a table that included a unique record identifier and the associated parsed data V&V reason code (5, 18, 52, 200, 99, 101, 701, and so forth). With this information and the data V&V reason code definitions, the data validator's observations related to this data set can be re-created for each analytical record.

To summarize the reason codes in a logical manner for presentation, it was first necessary to group the reason codes that have slightly different definitions but convey the same meaning. A standardized definition was then applied to the individual reason codes within the group. The grouped reason codes were also assigned a QC category (for example, blanks, calibration, and holding time), and the affected PARCC parameter (Table A2.4). The reason codes were then summarized for each medium and analyte group within each QC category, applying the standardized definition to the summarized codes. The summary is presented in Table A2.5.

Rejected data (data qualifier flag "R"), consisting of approximately 1 percent of all V&V data, have been removed from the data used in the IAEU CRA because the validator has determined the data to be unusable. The fraction of the data that was rejected during validation and/or verification is shown in Table A2.6 by analyte group and matrix.

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Finally, evaluating the RPD (DER for radionuclides) between a target sample and the associated field duplicate is not a QC parameter performed during V&V, but is still an important analysis when determining data precision. Because this analysis was not performed during V&V, the target sample/field duplicate RPD and DER calculations were performed separately and are presented in Table A2.7 as the number of exceedances per analyte group/matrix combination. Only those analyte group/matrix combinations having records that met the criteria for calculating an RPD or DER are presented. RPDs and DERs for target sample/field duplicate analyte pairs where one or both of the results are less than five times the RL are not calculated as outlined in the CRA Methodology.

3.0 FINDINGS

V&V observations affecting the CRA data set are summarized by analyte group/matrix/QC category/V&V observation in Table A2.5. The detected and nondetected results are summarized separately to give the reader a better idea of the impact on data usability. Only those issues observed in notable percentages (generally greater than 5 percent) of the data are discussed below in further detail. RPDs (DERs for radionuclides) presented in Table A2.7 are only discussed below when RPD (DER for radionuclides) exceedances of control criteria are greater than 10 percent for any give analyte group/matrix combination. Instances of elevated rates (greater than 10 percent) of rejected data are also discussed below.

3.1 Dioxins and Furans – Soil

Blank, calibration, confirmation, and internal standard issues resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low, with the exception of those records qualified due to blank contamination and issues with result confirmation. While the importance of these QC parameters should not be overlooked, it is also important to note that the associated data were qualified as usable, although estimated. Finally, although almost 47 percent of the target sample/field duplicate analyte pairs exceeded RPD criteria, it is important to note that all exceedances were noted at only four locations. This is more indicative of matrix interference than an overall precision issue.

3.2 Herbicides – Soil

Calibration, documentation, holding time, internal standard, LCS, matrix, sample preparation, surrogate, and other issues resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.3 Herbicides – Water

Calibration, documentation, holding time, internal standard, matrix, samples preparation, surrogate, and other issues resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low, with the exception of those records qualified due to omissions and/or errors in the data package. The usability of the data is not impacted, however, as all observations were noted in portions of the data package not required for validation.

3.4 Metals – Soil

Blank, calculation error, calibration, documentation, holding time, instrument setup, LCS, matrix, sample preparations, sensitivity, and other observations resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low, with the exception of those records qualified due to pre-digestion MS recoveries and expired instrument detection limit (IDL) studies. While the importance of these QC parameters should not be overlooked, it is also important to note that the associated data were qualified as usable, although estimated. Finally, although almost 15 percent of the target sample/field duplicate analyte pairs exceeded RPD criteria, it is important to note the majority of exceedances were noted in a limited number of locations within the IAEU. This is more indicative of matrix interference than an overall precision issue.

3.5 Metals – Water

Blank, calculation error, calibration, documentation, holding time, instrument setup, LCS, matrix, sample preparation, sensitivity, and other observations resulted in V&V qualifications associated with this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.6 Polychlorinated Biphenyls – Soil

Calculation error, calibration, confirmation, documentation, holding time, matrix, sample preparation, surrogate, and other issues resulted in data V&V observations related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.7 Polychlorinated Biphenyls – Water

Calibration, documentation, holding time, LCS, surrogate, and other issues resulted in data V&V observations related to this analyte group/matrix combination. The percentage of observations is low, with the exception of those records qualified due to transcription errors, holding time exceedances, and low surrogate recoveries. Transcription errors have no impact on data usability because all issues have previously been evaluated and corrected. While the importance of QC parameters such as sample holding times and surrogate analyses should not be overlooked, it is also important to note that the associated data were qualified as usable, although estimated.

3.8 Pesticides – Soil

Blank, calibration, confirmation, documentation, holding time, internal standard, LCS, matrix, sample preparation, surrogate, and other issues resulted in data V&V observations related to this analyte group/matrix combination. The percentage of observations is low, with the exception of those records qualified due to omissions and/or errors in the data package. The usability of the data is not impacted, however, as all observations were noted in portions of the data package not required for validation.

3.9 Pesticides – Water

Calibration, documentation, holding time, internal standard, matrix, sample preparation, surrogate, and other issues resulted in V&V qualification related to this analyte group/matrix combination. The percentage of observations is low, with the exception of those records qualified due to low surrogate recoveries. While the importance of surrogate analyses should not be overlooked, it is also important to note that the data were qualified as usable, although estimated.

3.10 Radionuclides – Soil

Blank, calculation error, calibration, documentation, holding time, instrument setup, LCS, matrix, sensitivity, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low, with one exception. Validator-calculated minimum detectable activities (MDAs) have no effect on data quality as all issues have previously been evaluated and corrected.

3.11 Radionuclides – Water

Blank, calculation error, calibration, documentation, holding time, instrument setup, LCS, matrix, sample preparation, sensitivity, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low, with few exceptions. Insufficient documentation indicates that a complete V&V evaluation may not have been performed, but it is important to note that the data were qualified as usable, although estimated. Validator-calculated MDAs have no effect on data quality because all issues have previously been evaluated and corrected. While the importance of continuing calibration verifications should not be overlooked, it is also important to note that the data were qualified as usable, although estimated.

3.12 Semi-Volatile Organic Compounds – Soil

Blank, calibration, documentation, holding time, internal standard, LCS, matrix, sample preparation, surrogate, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.13 Semi-Volatile Organic Compounds – Water

Blank, calibration, confirmation, documentation, holding time, instrument setup, internal standard, LCS, matrix, sample preparation, surrogate, and other issues resulted in V&V observations related to this analyte group/matrix combination. The percentage of observations is low, with the exception of those records qualified due to holding time exceedances and omissions or errors in the data package. The omissions or errors noted in the data package do not impact data quality because the omitted data were not required for V&V. While the importance of observing the allowed sample holding time should not be overlooked, it is also important to note that the data were qualified as usable.

3.14 Volatile Organic Compounds – Soil

Blank, calculation error, calibration, documentation, holding time, instrument setup, internal standard, LCS, matrix, sample preparation, surrogate, and other issues resulted in V&V observations related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.15 Volatile Organic Compounds – Water

Blank, calculation error, calibration, confirmation, documentation, holding time, instrument setup, internal standard, LCS, matrix, sample preparation, sensitivity, surrogate, and other issues resulted in V&V observations related to this analyte group/matrix combination. The percentage of observations is low, with few exceptions. The omissions or errors noted in the data package do not impact data quality as the omitted data were not required for V&V. While the importance of observing allowed sample holding times should not be overlooked, it is also important to note that the data were qualified as usable, although estimated.

3.16 Wet Chemistry Parameters – Soil

Blank, calculation error, documentation, holding time, LCS, matrix, sample preparations, and other issues resulted in V&V observations related to this analyte group/matrix combination. While the percentage of several of the observations is high, it is important to note that this analyte group contains numerous general chemistry parameters having little or no impact on site characterization.

3.17 Wet Chemistry Parameters – Water

Blank, calculation error, calibration, documentation, holding time, LCS, matrix, sample preparation, and other issues resulted in V&V observations related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

4.0 CONCLUSIONS

The quality of the laboratory results were evaluated for compliance with the CRA Methodology data quality objectives (DQOs) through an overall review of PARCC parameters.

Of the data used in the IAEU CRA, approximately 91 percent underwent the V&V process. Of that 91 percent, 86 percent was qualified as having no QC issues, and approximately 13 percent was qualified as estimated or undetected (Table A2.8). The remaining 1 percent of the V&V data are made up of records qualified with additional flags indicating acceptable data such as "A," "E," or "P." Less than 4 percent of the data reported as detected by the laboratory were flagged as undetected by the validators due to blank contamination (Table A2.9). Data qualified as estimated or undetected indicate some issues with PARCC parameters, but not to a degree sufficient to mark the data unusable. Approximately 1 percent of the entire data set was rejected during the V&V process (Table A2.6).

Although many of the elements of QC that are reviewed in this document affect more than one PARCC parameter, the general discussion below summarizes the data quality per the validation reason codes affecting each specific PARCC parameter. Several V&V reason codes have no real impact on data quality because they represent issues that were noted but corrected, or represent observations related to missing documentation that was not required for data assessment. Approximately 11 percent of the IAEU V&V data were flagged with these "Other" V&V observations.

- Precision, as a measure of agreement among replicate measurements, is determined quantitatively based on the results of replicate laboratory measurements.

  Of the V&V data, approximately 2 percent was noted for observations related to precision. Of that 2 percent, 99 percent was qualified for issues related to sample matrices. Result confirmation and instrument setup observations make up the other 1 percent. No LCS or instrument sensitivity issues related to precision were noted.

  RPDs and DERs for target sample/field duplicate pairs were found to be acceptable for all analyte group/matrix combinations. Overall, the method precision was found to be generally acceptable.

- Accuracy is a measure of the distortion of a measurement process that causes error in the true value.

  Of the V&V data, 34 percent was noted for accuracy-related observations. Of that 34 percent, 76 percent was noted for laboratory practice-related observations, while sample-specific accuracy observations make up the other 24 percent. Although the percentage of data with noted accuracy issues is slightly elevated, it is important to note that most of the data flagged with these accuracy related observations are also flagged as estimated and the CRA is performed with this uncertainty in mind.

Accuracy was generally acceptable with infrequent performance outside QC limits.

- Representativeness of the data was verified.

  Of the V&V data, approximately 24 percent was noted for observations related to representativeness. Of that 24 percent, 57 percent was qualified for blank observations, 30 percent for failure to observe allowed holding times, 3 percent for documentation issues, 1 percent for instrument sensitivity issues, and approximately 8 percent for sample preparation observations. Instrument setup, LCS, matrix and other observations make up the other 1 percent of the data qualified for observations related to sample representativeness.

  Reportable levels of target analytes were not routinely detected in the laboratory blanks greater than the laboratory RLs except for relatively isolated incidences. Samples were generally stored and preserved properly. Overall, these elements of QC exceedances are indicative of normal laboratory operations and have little impact on the sample data as reported.

  Sample data are representative of the site conditions at the time of sample collection.

- Comparability of the data was reviewed and no systematic errors were noted.

  - The use of standard EPA- and RFETS-approved analytical procedures;
  - Instrument types and maintenance, sample preparation techniques, and standard units for reporting; and
  - Evaluation of MS and surrogate samples, ensuring accuracy within acceptable ranges.

  Examination of these parameters did not show any systematic issues with comparability.

- Completeness, as defined in the CRA Methodology, is addressed in Appendix A, Volume 2 of the RI/FS Report.

  Another indication of completeness that is sometimes used is a measure of the number of valid measurements obtained in relation to the total number of measurements planned.

  Because only approximately 1 percent of the overall data were rejected, the use of non-V&V data for the IAEU CRA does not contribute to any completeness issues.

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This review concludes that the PARCC of the data are generally acceptable and the CRA objectives have been met.

5.0 REFERENCES

K-H, 2004. Final Comprehensive Risk Assessment Work Plan and Methodology, Environmental Restoration, Rocky Flats Environmental Technology Site, Golden, Colorado. September.

EPA, 2002. Guidance for Quality Assurance Project Plans. EPA QA/G-5, EPA/240/R-02/009. Office of Environmental Information, Washington, D.C. December.

TABLES

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Table A2.1
CRA Data V&V Summary

Analyte Group	Matrix	Total No. of V&V Records	Total No. of CRA Records	Percent V&V (%)
Dioxins and Furans	SOIL	493	493	100
Dioxins and Furans	WATER	98	98	100
Explosive	SOIL	24	24	100
Herbicide	SOIL	1,914	2,014	95.0
Herbicide	WATER	277	384	72.1
Metal	SOIL	123,592	124,491	99.3
Metal	WATER	130,905	146,363	89.4
PCB	SOIL	7,931	8,572	92.5
PCB	WATER	1,801	2,121	84.9
Pesticide	SOIL	9,405	10,382	90.6
Pesticide	WATER	4,218	5,276	79.9
Radionuclide	SOIL	13,060	14,095	92.7
Radionuclide	WATER	26,340	38,316	68.7
SVOC	SOIL	111,721	117,513	95.1
SVOC	WATER	23,366	30,225	77.3
VOC	SOIL	208,750	215,261	97.0
VOC	WATER	197,783	224,845	88.0
Wet Chem	SOIL	3,927	4,182	93.9
Wet Chem	WATER	13,706	18,001	76.1
	Total	**879,311**	**962,656**	**91.3**

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Table A2.2
V&V Qualifier Flag Definitions

Validation Qualifier Code	Description
I	QC data from a data package – Verification
A	Data acceptable with qualifications
B	Compound was found in BLK and sample
C	Calibration
E	Associated value exceeds calibration range; dilute and reanalyze
J	Estimated quantity – Validation
J1	Estimated quantity – Verification
JB	Organic method blank contamination – Validation
JB1	Organic method blank contamination – Verification
N	Historical – Validators asked not to validate this
NJ	Associated value is presumptively estimated
NJ1	Value presumptively estimated – Verification
P	Systematic error
R	Data unusable – Validation
R1	Data unusable – Verification
S	Matrix spike
U	Analyzed, not detected at/above method detection limit
U1	Analyzed, not detect at/above method detection limit – Verification
UJ	Associated value is considered estimated at an elevated detection
UJ1	Estimated at elevated level – Verification
V	No problems with the data – Validation
V1	No problems with the data – Verification
Y	Analytical results in validation process
Z	Validation was not requested or could not be performed

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Table A2.3
V&V Reason Code Definitions

Validation Reason Code	Description
***	Unknown code from RFEDS
1	Holding times were exceeded
2	Holding times were grossly exceeded
3	Initial calibration correlation coefficient <0.995
4	Calibration verification criteria were not met
5	CRDL check sample recovery criteria were not met
6	Incorrect calibration of instrument
7	Analyte values > IDL were found in the blanks
8	Negative bias was indicated in the blanks
9	Interference indicated in the ICP interference check sample
10	Laboratory control sample recovery criteria were not met
11	Duplicate sample precision criteria were not met
12	Predigestion matrix spike criteria were not met (+/- 25 percent)
13	Predigestion matrix spike criteria were not met (<30 percent)
14	Post-digestion matrix spike recovery criteria were not met
15	MSA was required but not performed
16	MSA calibration correlation coefficient <0.995
17	Serial dilution criteria not met
18	Documentation was not provided
19	Calibration verification criteria not met
20	AA duplicate injection precision criteria were not met
21	Reagent blanks exceeded MDA
22	Tracer contamination
23	Improper aliquot size
24	Sample aliquot not taken quantitatively
25	Primary standard had exceeded expiration date
26	No raw data submitted by the laboratory
27	Recovery criteria were not met
28	Duplicate analysis was not performed
29	Verification criteria were not met
30	Replicate precision criteria were not met
31	Replicate analysis was not performed
32	Laboratory control samples >+/- 3 sigma
33	Laboratory control samples >+/- 2 sigma and <+/- 3 sigma
35	Transformed spectral index external ST criteria were not met
36	MDA exceeded the RDL
37	Sample exceeded efficiency curve weight limit
38	Excessive solids on planchet
39	Tune criteria not met
40	Organics initial calibration criteria were not met
41	Organics continuing calibration criteria were not met
42	Surrogates were outside criteria

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Table A2.3
V&V Reason Code Definitions

Validation Reason Code	Description
43	Internal standards outside criteria
44	No mass spectra were provided
45	Results were not confirmed
47	Percent breakdown exceeded 20 percent
48	Linear range of instrument was exceeded
49	Method blank contamination
51	Nonverifiable laboratory results and/or unsubmitted data
52	Transcription error
53	Calculation error
54	Incorrect reported activity or MDA
55	Result exceeds linear range; serial dilution value reported
56	IDL changed due to significant figure discrepancy
57	Percent solids < 30 percent
58	Percent solids < 10 percent
59	Blank activity exceeded RDL
60	Blank recovery criteria were not met
61	Replicate recovery criteria were not met
62	LCS relative percent error criteria not met
63	LCS expected value not submitted/verifiable
64	Nontraceable/noncertified standard was used
67	Sample results not submitted/verifiable
68	Frequency of quality control samples not met
69	Samples not distilled
70	Resolution criteria not met
71	Unit conversion of results
72	Calibration counting statistics not met
73	Daily instrument performance assessment not performed
74	LCS data not submitted
75	Blank data not submitted
76	Instrument gain and/or efficiency not submitted
77	Detector efficiency criteria not met
78	MDAs were calculated by reviewer
79	Result obtained through dilution
80	Spurious counts of unknown origin
81	Repeat count outside of 3 sigma counting error
82	Sample results were not corrected for decay
83	Sample results were not included on Data Summary Table
84	Key fields wrong
85	Record added by QLI
86	Results considered qualitative not quantitative
87	Laboratory did no analysis for this record
88	Blank corrected results

Table A2.3
V&V Reason Code Definitions

Validation Reason Code	Description
89	Sample analysis was not requested
90	Sample result was not validated due to reanalysis
91	Unit conversion; QC sample activity/uncertainty/MDA
99	See hard copy for further explanation
101	Holding times were exceeded (attributed to laboratory problem)
102	Holding times were grossly exceeded (attribute to laboratory problem)
103	Calibration correlation coefficient does not meet requirement
104	Calibration verification recovery criteria were not met
105	Low-level check sample recovery criteria were not met
106	Calibration did not contain minimum number of standards
107	Analyte detected but < RDL in calibration blank verification
109	Interference indicated in the ICP interference check sample
110	Laboratory control sample recovery criteria were not met
111	Laboratory duplicate sample precision criteria were not met
112	Predigestion matrix spike criteria were not met (+/- 25 percent)
113	Predigestion matrix spike recovery is <30 percent
114	Post-digestion matrix spike criteria were not met
115	MSA was required but not performed
116	MSA calibration correlation coefficient <0.995
117	Serial dilution percent D criteria not met
123	Improper aliquot size
128	Laboratory duplicate was not analyzed
129	Verification criteria for frequency or sequence were not met
130	Replicate precision criteria were not met
131	Confirmation percent difference criteria not met
132	Laboratory control samples >+/- 3 sigma
136	MDA exceeded the RDL
139	Tune criteria not met
140	Requirements for independent calibration verification were not met
141	Continuing calibration verification criteria were not met
142	Surrogates were outside criteria
143	Internal standards outside criteria
145	Results were not confirmed
147	Percent breakdown exceeded 20 percent
148	Linear range of measurement system was exceeded
149	Method, preparation, or reagent blank contamination > RDL
150	Unknown carrier volume
152	Reported data do not agree with raw data
153	Calculation error
155	Original result exceeds linear range; serial dilution value reported
159	Magnitude of calibration verification blank result exceeded the RDL
164	Standard traceability or certification requirements not met

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Table A2.3
V&V Reason Code Definitions

Validation Reason Code	Description
166	Carrier aliquot nonverifiable
168	QC sample frequency does not meet requirements
170	Resolution criteria not met
172	Calibration counting statistics not met
174	LCS data not submitted
175	Blank data not submitted
177	Detector efficiency criteria not met
188	Blank corrected results
199	See hard copy for further explanation
201	Preservation requirements not met by the laboratory
205	Unobtainable omissions or errors on SDP (required for databases)
206	Analyses were not requested according to the SOW
207	Sample pretreatment or sample preparation method is incorrect
211	Poor cleanup recovery
212	Instrument detection limit was not provided
213	Instrument detection limit is > the associated RDL
214	IDL is older than 3 months from date of analysis
215	Blank results were not reported to the IDL/MDL
216	Post-digestion spike recoveries outside of 85-115 percent criteria
217	Post-digestion spike recoveries were < 10 percent
218	Sample COC was not verifiable (attributed to laboratory)
219	Standards have expired or are not valid
220	TCLP sample percent solids < 0.5 percent
222	TCLP particle size was not performed
224	Incomplete TCLP extraction data
225	Insufficient TCLP extraction time
226	TIC misidentification
227	No documentation regarding deviations from methods or SOW
228	Calibration recoveries affecting data quality have not been met
229	Element not analyzed in ICP interference check sample
230	QC sample/analyte (e.g., spike, duplicate, LCS) not analyzed
231	MS/MSD criteria not met
232	Control limits not assigned correctly
233	Sample matrix QC does not represent samples analyzed
234	QC sample does not meet method requirement
235	Duplicate sample control limits do not pass
236	LCS control limits do not pass
237	Preparation blank control limits do not pass
238	Blank correction was not performed
239	Winsorized mean plus standard deviation of the same not calculated or calculated wrong
240	Sample preparations for soil/sludge/sediment were not homog/aliq properly
241	No micro PPT or electroplating data available

Table A2.3
V&V Reason Code Definitions

Validation Reason Code	Description
242	Tracer requirements were not met
243	Standard values were not calculated correctly (LCS, tracer, standards)
244	Standard or tracer is not NIST traceable
245	Energy calibration criteria not met
246	Background calibration criteria were not met
247	Sample or control analysis not chemically separated from each other
248	Single combined TCLP result was not repeated for sample with both mis+nonm
249	Result qualified due to blank contamination
250	Incorrect analysis sequence
251	Misidentified target compounds
252	Result is suspect DU
701	Holding times were exceeded (not attributed to laboratory)
702	Holding times were grossly exceeded (not attributed to laboratory)
703	Samples were not preserved properly in the field (not attributed to laboratory)
801	Missing deliverables (required for data assessment)
802	Missing deliverables (not required for data assessment)
803	Omissions or errors on SDP deliverables (required for data assessment)
804	Omissions or errors on SDP deliverables (not required for data assessment
805	Information missing from case narrative
806	Site samples not used for sample matrix QC
807	Original documentation not provided
808	Incorrect or incomplete DRC
809	Non-site samples reported with site samples
810	EDD does not match hard copy; EDD may be resubmitted

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Table A2.4
Standardized V&V Reason Code Definitions, QC Categories, and Affected PARCC Parameters

Validation Reason Codes	Standardized Description	QC Category	Affected PARCC Parameter
188, 88	Blank corrected results	Blanks	Representativeness
238	Blank correction was not performed	Blanks	Representativeness
175, 75	Blank data not submitted	Blanks	Representativeness
60	Blank recovery criteria were not met	Blanks	Representativeness
215	Blank results were not reported to the IDL/MDL	Blanks	Representativeness
107, 159	Calibration verification blank contamination	Blanks	Representativeness
149, 21, 237, 249, 49, 59, 7	Method, preparation, or reagent blank contamination	Blanks	Representativeness
8	Negative bias indicated in the blanks	Blanks	Representativeness
153, 53	Calculation error	Calculation Errors	Other
232	Control limits not assigned correctly	Calculation Errors	Other
246	Background calibration criteria were not met	Calibration	Accuracy
103, 3	Calibration correlation coefficient did not meet requirements	Calibration	Accuracy
172, 72	Calibration counting statistics did not meet criteria	Calibration	Accuracy
106	Calibration did not contain minimum number of standards	Calibration	Accuracy
228	Calibration requirements affecting data quality have not been met	Calibration	Accuracy
104, 141, 19, 29, 4, 40, 41	Continuing calibration verification criteria were not met	Calibration	Accuracy
245	Energy calibration criteria not met	Calibration	Accuracy
6	Incorrect calibration of instrument	Calibration	Accuracy
148, 48	Result exceeded linear range of measurement system	Calibration	Accuracy
155, 55	Original result exceeded linear range, serial dilution value reported	Calibration	Accuracy
140	Requirements for independent calibration verification were not met	Calibration	Accuracy
129	Frequency or sequencing verification criteria not met	Calibration	Accuracy
131	Confirmation percent difference criteria not met	Confirmation	Precision
145, 45	Results were not confirmed	Confirmation	Precision
18	Sufficient documentation not provided by the laboratory	Documentation issues	Representativeness
705	Electronic qualifiers were applied from validation report by hand	Documentation issues	Other
805	Information missing from case narrative	Documentation issues	Other
84	Key data field incorrect	Documentation issues	Other
802	Missing deliverables (not required for validation)	Documentation issues	Other
801	Missing deliverables (required for validation)	Documentation issues	Representativeness
227	No documentation regarding deviations from methods or SOW	Documentation issues	Other
44	No mass spectra were provided	Documentation issues	Representativeness
241	No micro pipette or electroplating data available	Documentation issues	Other

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Table A2.4
Standardized V&V Reason Code Definitions, QC Categories, and Affected PARCC Parameters

Validation Reason Codes	Standardized Description	QC Category	Affected PARCC Parameter
26	No raw data submitted by the laboratory	Documentation issues	Representativeness
804	Omissions or errors in SDP (not required for validation)	Documentation issues	Other
803	Omissions or errors in SDP (required for validation)	Documentation issues	Representativeness
807	Original documentation not provided	Documentation issues	Other
85	Record added by the validator	Documentation issues	Other
152	Reported data do not agree with raw data	Documentation issues	Other
89	Sample analysis was not requested	Documentation issues	Other
218	Sample COC was not verifiable (attributed to laboratory)	Documentation issues	Representativeness
704	Sample COC was not verifiable (not attributed to laboratory)	Documentation issues	Representativeness
83	Sample results were not included on Data Summary Table	Documentation issues	Other
52	Transcription error	Documentation issues	Other
205	Unobtainable omissions or errors on SDP (required for data assessment)	Documentation issues	Representativeness
1, 101, 701	Holding times were exceeded	Holding times	Representativeness
2, 102, 702	Holding times were grossly exceeded	Holding times	Representativeness
251	Misidentified target compounds	Identification errors	Representativeness
70	Resolution criteria not met	Identification errors	Representativeness
226	TIC misidentification	Identification errors	Representativeness
143, 43	Internal standards did not meet criteria	Internal standards	Accuracy
5	CRDL check sample recovery criteria were not met	LCS	Accuracy
33	LCS > ± 2 sigma and < ± 3 sigma	LCS	Accuracy
10, 110, 236	LCS recovery criteria were not met	LCS	Accuracy
132, 32	Laboratory control samples > ± 3 sigma	LCS	Accuracy
174, 74	LCS data not submitted	LCS	Representativeness
63	Expected LCS value not submitted/verifiable	LCS	Representativeness
62	LCS relative percent error criteria not met	LCS	Accuracy
105	Low-level check sample recovery criteria were not met	LCS	Accuracy
230	QC sample/analyte (e.g., spike, duplicate, LCS) not analyzed	LCS	Representativeness
28	Duplicate analysis was not performed	Matrices	Precision
11, 235	Duplicate sample precision criteria were not met	Matrices	Precision
111	LCS/LCSD precision criteria were not met	Matrices	Precision
128	Laboratory duplicate was not analyzed	Matrices	Precision
231	MS/MSD criteria not met	Matrices	Precision
116, 16	MSA calibration correlation coefficient <0.995	Matrices	Accuracy
115, 15	MSA was required but not performed	Matrices	Representativeness
58	Sample contained < 10 percent solid material	Matrices	Representativeness
57	Sample contained < 30 percent solid material	Matrices	Representativeness
217	Post-digestion spike recoveries were < 10%	Matrices	Accuracy

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Table A2.4

Standardized V&V Reason Code Definitions, QC Categories, and Affected PARCC Parameters

Validation Reason Codes	Standardized Description	QC Category	Affected PARCC Parameter
14, 114, 216	Post-digestion matrix spike criteria were not met	Matrices	Accuracy
113, 13	Predigestion matrix spike recovery is <30%	Matrices	Accuracy
112, 12	Predigestion matrix spike recovery criteria were not met	Matrices	Accuracy
27	Recovery criteria were not met	Matrices	Accuracy
31	Replicate analysis was not performed	Matrices	Precision
130, 30	Replicate precision criteria were not met	Matrices	Precision
61	Replicate recovery criteria were not met	Matrices	Accuracy
233	Sample matrix QC does not represent samples analyzed	Matrices	Representativeness
117, 17	Serial dilution criteria not met	Matrices	Accuracy
806	Site samples not used for sample matrix QC	Matrices	Representativeness
810	EDD does not match hard copy; EDD may be resubmitted	Other	Other
214	IDL is older than 3 months from date of analysis	Other	Accuracy
250	Incorrect analysis sequence	Other	Representativeness
808	Incorrect or incomplete DRC	Other	Representativeness
212	Instrument detection limit was not provided	Other	Other
87	Laboratory did no analysis for this record	Other	Other
809	Nonsite samples reported with Site samples	Other	Other
64	Nontraceable/noncertified standard was used	Other	Accuracy
51	Nonverifiable laboratory results and/or unsubmitted data	Other	Representativeness
211	Poor cleanup recovery	Other	Accuracy
25	Primary standard had exceeded expiration date	Other	Accuracy
234	QC sample does not meet method requirement	Other	Representativeness
168, 68	QC sample frequency does not meet requirements	Other	Representativeness
252	Result is suspect due to dilution	Other	Other
79	Result obtained through dilution	Other	Other
37	Sample exceeded efficiency curve weight limit	Other	Accuracy
247	Sample or control analyses not chemically separated from each other	Other	Representativeness
90	Sample result was not validated due to re-analysis	Other	Other
67	Sample results not submitted/verifiable	Other	Representativeness
199, 99	See hard copy for further explanation	Other	Other
248	Single combined TCLP results was not reported for sample with both mis+nonm	Other	Accuracy
80	Spurious counts of unknown origin	Other	Representativeness
244	Standard or tracer is not NIST traceable	Other	Accuracy
164	Standard traceability or certification requirements not met	Other	Accuracy
219	Standards have expired or are not valid	Other	Accuracy
243	Standard values were not calculated correctly (LCS, tracer, standards)	Other	Other

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Table A2.4
Standardized V&V Reason Code Definitions, QC Categories, and Affected PARCC Parameters

Validation Reason Codes	Standardized Description	QC Category	Affected PARCC Parameter
22	Tracer contamination	Other	Accuracy
242	Tracer requirements were not met	Other	Accuracy
71	Unit conversion of results	Other	Other
239	Winsorized mean+standard deviation of the same not calculated or calculated wrong	Other	Other
38	Excessive solids on planchet	Sample preparation	Accuracy
123, 23	Improper aliquot size	Sample preparation	Accuracy
224	Incomplete TCLP extraction data	Sample preparation	Representativeness
225	Insufficient TCLP extraction time	Sample preparation	Representativeness
201	Preservation requirements not met by the laboratory	Sample preparation	Representativeness
24	Sample aliquot not taken quantitatively	Sample preparation	Accuracy
240	Sample preparation for soil/sludge/ sediment were not homog/aliq properly	Sample preparation	Representativeness
207	Sample pretreatment or preparation method is incorrect	Sample preparation	Representativeness
69	Samples not distilled	Sample preparation	Representativeness
703	Samples were not preserved properly in the field	Sample preparation	Representativeness
222	TCLP particle size was not performed	Sample preparation	Representativeness
220	TCLP sample percent solids < 0.5 percent	Sample preparation	Representativeness
56	IDL changed due to significant figure discrepancy	Sensitivity	Representativeness
54	Incorrect reported activity or MDA	Sensitivity	Other
213	Instrument detection limit > the associated RDL	Sensitivity	Representativeness
136, 36	MDA exceeded the RDL	Sensitivity	Representativeness
78	MDA was calculated by reviewer	Sensitivity	Other
81	Repeat count outside of 3 sigma counting error	Sensitivity	Precision
86	Results considered qualitative not quantitative	Sensitivity	Accuracy
82	Sample results were not corrected for decay	Sensitivity	Other
91	Unit conversion, QC sample activity uncertainty/MDA	Sensitivity	Representativeness
142, 42	Surrogates were outside criteria	Surrogate	Accuracy
20	AA duplicate injection precision criteria were not met	Instrument Set-up	Precision
73	Daily instrument performance assessment not performed	Instrument Set-up	Accuracy
177, 77	Detector efficiency criteria not met	Instrument Set-up	Accuracy
229	Element not analyzed in ICP interference check sample	Instrument Set-up	Representativeness
76	Instrument gain and/or efficiency not submitted	Instrument Set-up	Representativeness
109, 9	Interference indicated in the ICP interference check sample	Instrument Set-up	Accuracy
147, 47	Percent breakdown exceeded 20 percent	Instrument Set-up	Representativeness
170	Resolution criteria not met	Instrument Set-up	Representativeness
35	Transformed spectral index external site criteria were not met	Instrument Set-up	Representativeness

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Table A2.4
Standardized V&V Reason Code Definitions, QC Categories, and Affected PARCC Parameters

Validation Reason Codes	Standardized Description	QC Category	Affected PARCC Parameter
139, 39	Tune criteria not met	Instrument Set-up	Accuracy
206	Analysis was not requested according to SOW	Unknown	Other
166	Carrier aliquot nonverifiable	Unknown	Representativeness
150	Unknown carrier volume	Unknown	Representativeness

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Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Dioxins and Furans	SOIL	Blanks	Calibration verification blank contamination	Yes	21	493	4.26
Dioxins and Furans	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	99	493	20.1
Dioxins and Furans	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	4	493	0.811
Dioxins and Furans	SOIL	Confirmation	Confirmation percent difference criteria not met	Yes	26	493	5.27
Dioxins and Furans	SOIL	Internal Standards	Internal standards did not meet criteria	No	2	493	0.406
Dioxins and Furans	SOIL	Internal Standards	Internal standards did not meet criteria	Yes	1	493	0.203
Herbicide	SOIL	Calibration	Continuing calibration verification criteria were not met	No	70	1,914	3.66
Herbicide	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	5	1,914	0.261
Herbicide	SOIL	Documentation Issues	Missing deliverables (required for validation)	No	1	1,914	0.0522
Herbicide	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	57	1,914	2.98
Herbicide	SOIL	Documentation Issues	Transcription error	No	23	1,914	1.20
Herbicide	SOIL	Holding Times	Holding times were exceeded	No	29	1,914	1.52
Herbicide	SOIL	Internal Standards	Internal standards did not meet criteria	No	2	1,914	0.104
Herbicide	SOIL	LCS	LCS recovery criteria were not met	No	2	1,914	0.104
Herbicide	SOIL	Matrices	MS/MSD precision criteria were not met	No	20	1,914	1.04
Herbicide	SOIL	Other	Sample results were not validated due to re-analysis	No	30	1,914	1.57
Herbicide	SOIL	Other	See hard copy for further explanation	No	2	1,914	0.104
Herbicide	SOIL	Sample Preparation	Samples were not properly preserved in the field	No	16	1,914	0.836
Herbicide	SOIL	Surrogates	Surrogate recovery criteria were not met	No	17	1,914	0.888
Herbicide	WATER	Calibration	Continuing calibration verification criteria were not met	No	1	277	0.361
Herbicide	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	2	277	0.722
Herbicide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	19	277	6.86
Herbicide	WATER	Documentation Issues	Transcription error	No	3	277	1.08
Herbicide	WATER	Holding Times	Holding times were exceeded	No	9	277	3.25
Herbicide	WATER	Internal Standards	Internal standards did not meet criteria	No	1	277	0.361
Herbicide	WATER	Matrices	Site samples were not used for sample matrix QC	No	3	277	1.08
Herbicide	WATER	Other	Sample results were not validated due to re-analysis	No	1	277	0.361
Herbicide	WATER	Other	See hard copy for further explanation	No	4	277	1.44
Herbicide	WATER	Sample Preparation	Samples were not properly preserved in the field	No	1	277	0.361
Herbicide	WATER	Surrogates	Surrogate recovery criteria were not met	No	1	277	0.361
Metal	SOIL	Blanks	Calibration verification blank contamination	No	6,412	123,592	5.19
Metal	SOIL	Blanks	Calibration verification blank contamination	Yes	926	123,592	0.749
Metal	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	1,600	123,592	1.29
Metal	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	79	123,592	0.0639
Metal	SOIL	Blanks	Negative bias indicated in the blanks	No	201	123,592	0.163
Metal	SOIL	Blanks	Negative bias indicated in the blanks	Yes	235	123,592	0.190
Metal	SOIL	Calculation Errors	Calculation error	Yes	13	123,592	0.0105
Metal	SOIL	Calculation Errors	Control limits not assigned correctly	No	764	123,592	0.618
Metal	SOIL	Calculation Errors	Control limits not assigned correctly	Yes	2,468	123,592	2.00
Metal	SOIL	Calibration	Calibration correlation coefficient did not meet requirements	No	7	123,592	0.00566
Metal	SOIL	Calibration	Calibration correlation coefficient did not meet requirements	Yes	23	123,592	0.0186

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Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	11	123,592	0.00890
Metal	SOIL	Calibration	Frequency or sequencing verification criteria not met	No	16	123,592	0.0129
Metal	SOIL	Calibration	Frequency or sequencing verification criteria not met	Yes	35	123,592	0.0283
Metal	SOIL	Calibration	Original result exceeded linear range, serial dilution value reported	Yes	1	123,592	8.09E-04
Metal	SOIL	Documentation Issues	Information missing from case narrative	No	6	123,592	0.00485
Metal	SOIL	Documentation Issues	Information missing from case narrative	Yes	21	123,592	0.0170
Metal	SOIL	Documentation Issues	Key data fields incorrect	No	12	123,592	0.00971
Metal	SOIL	Documentation Issues	Key data fields incorrect	Yes	14	123,592	0.0113
Metal	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	45	123,592	0.0364
Metal	SOIL	Documentation Issues	Missing deliverables (not required for validation)	Yes	187	123,592	0.151
Metal	SOIL	Documentation Issues	Missing deliverables (required for validation)	No	4	123,592	0.00324
Metal	SOIL	Documentation Issues	Missing deliverables (required for validation)	Yes	2	123,592	0.00162
Metal	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	818	123,592	0.662
Metal	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	2,779	123,592	2.25
Metal	SOIL	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	3	123,592	0.00243
Metal	SOIL	Documentation Issues	Transcription error	No	1,124	123,592	0.909
Metal	SOIL	Documentation Issues	Transcription error	Yes	4,993	123,592	4.04
Metal	SOIL	Holding Times	Holding times were exceeded	No	8	123,592	0.00647
Metal	SOIL	Holding Times	Holding times were exceeded	Yes	30	123,592	0.0243
Metal	SOIL	Holding Times	Holding times were grossly exceeded	No	1	123,592	8.09E-04
Metal	SOIL	Holding Times	Holding times were grossly exceeded	Yes	20	123,592	0.0162
Metal	SOIL	Instrument Set-up	Interference was indicated in the interference check sample	No	305	123,592	0.247
Metal	SOIL	Instrument Set-up	Interference was indicated in the interference check sample	Yes	452	123,592	0.366
Metal	SOIL	LCS	CRDL check sample recovery criteria were not met	No	192	123,592	0.155
Metal	SOIL	LCS	CRDL check sample recovery criteria were not met	Yes	308	123,592	0.249
Metal	SOIL	LCS	LCS recovery criteria were not met	No	1,132	123,592	0.916
Metal	SOIL	LCS	LCS recovery criteria were not met	Yes	1,808	123,592	1.46
Metal	SOIL	LCS	Low level check sample recovery criteria were not met	No	3,713	123,592	3.00
Metal	SOIL	LCS	Low level check sample recovery criteria were not met	Yes	3,871	123,592	3.13
Metal	SOIL	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	No	115	123,592	0.0930
Metal	SOIL	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	419	123,592	0.339
Metal	SOIL	Matrices	Duplicate sample precision criteria were not met	No	22	123,592	0.0178
Metal	SOIL	Matrices	Duplicate sample precision criteria were not met	Yes	703	123,592	0.569
Metal	SOIL	Matrices	LCS/LCSD precision criteria were not met	No	91	123,592	0.0736
Metal	SOIL	Matrices	LCS/LCSD precision criteria were not met	Yes	1,555	123,592	1.26
Metal	SOIL	Matrices	MSA calibration correlation coefficient < 0.995	Yes	4	123,592	0.00324
Metal	SOIL	Matrices	MSA was required, but not performed	Yes	3	123,592	0.00243
Metal	SOIL	Matrices	Post-digestion MS did not meet control criteria	No	141	123,592	0.114
Metal	SOIL	Matrices	Post-digestion MS did not meet control criteria	Yes	87	123,592	0.0704
Metal	SOIL	Matrices	Predigestion MS recovery criteria were not met	No	3,616	123,592	2.93
Metal	SOIL	Matrices	Predigestion MS recovery criteria were not met	Yes	10,407	123,592	8.42
Metal	SOIL	Matrices	Predigestion MS recovery was < 30 percent	No	44	123,592	0.0356

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Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	SOIL	Matrices	Predigestion MS recovery was < 30 percent	Yes	695	123,592	0.562
Metal	SOIL	Matrices	Serial dilution criteria were not met	No	68	123,592	0.0550
Metal	SOIL	Matrices	Serial dilution criteria were not met	Yes	2,551	123,592	2.06
Metal	SOIL	Other	IDL is older than 3 months from date of analysis	No	13,228	123,592	10.7
Metal	SOIL	Other	IDL is older than 3 months from date of analysis	Yes	41,882	123,592	33.9
Metal	SOIL	Other	Primary standard exceeded the expiration date	Yes	1	123,592	8.09E-04
Metal	SOIL	Other	Result obtained through dilution	Yes	17	123,592	0.0138
Metal	SOIL	Other	See hard copy for further explanation	No	70	123,592	0.0566
Metal	SOIL	Other	See hard copy for further explanation	Yes	198	123,592	0.160
Metal	SOIL	Sample Preparation	Samples were not properly preserved in the field	No	32	123,592	0.0259
Metal	SOIL	Sample Preparation	Samples were not properly preserved in the field	Yes	130	123,592	0.105
Metal	SOIL	Sensitivity	IDL changed due to a significant figure discrepancy	No	45	123,592	0.0364
Metal	SOIL	Sensitivity	IDL changed due to a significant figure discrepancy	Yes	1	123,592	8.09E-04
Metal	WATER	Blanks	Calibration verification blank contamination	No	5,126	130,905	3.92
Metal	WATER	Blanks	Calibration verification blank contamination	Yes	815	130,905	0.623
Metal	WATER	Blanks	Method, preparation, or reagent blank contamination	No	6,115	130,905	4.67
Metal	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	938	130,905	0.717
Metal	WATER	Blanks	Negative bias indicated in the blanks	No	1,296	130,905	0.990
Metal	WATER	Blanks	Negative bias indicated in the blanks	Yes	729	130,905	0.557
Metal	WATER	Calculation Errors	Calculation error	No	3	130,905	0.00229
Metal	WATER	Calculation Errors	Control limits not assigned correctly	No	308	130,905	0.235
Metal	WATER	Calculation Errors	Control limits not assigned correctly	Yes	285	130,905	0.218
Metal	WATER	Calibration	Calibration correlation coefficient did not meet requirements	No	433	130,905	0.331
Metal	WATER	Calibration	Calibration correlation coefficient did not meet requirements	Yes	90	130,905	0.0688
Metal	WATER	Calibration	Continuing calibration verification criteria were not met	No	101	130,905	0.0772
Metal	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	96	130,905	0.0733
Metal	WATER	Calibration	Frequency or sequencing verification criteria not met	No	32	130,905	0.0244
Metal	WATER	Calibration	Frequency or sequencing verification criteria not met	Yes	105	130,905	0.0802
Metal	WATER	Calibration	Result exceeded linear range of measurement system	Yes	2	130,905	0.00153
Metal	WATER	Documentation Issues	Electronic qualifiers were applied from validation report by hand	No	19	130,905	0.0145
Metal	WATER	Documentation Issues	Electronic qualifiers were applied from validation report by hand	Yes	10	130,905	0.00764
Metal	WATER	Documentation Issues	Information missing from case narrative	No	1	130,905	7.64E-04
Metal	WATER	Documentation Issues	Information missing from case narrative	Yes	1	130,905	7.64E-04
Metal	WATER	Documentation Issues	Key data fields incorrect	No	51	130,905	0.0390
Metal	WATER	Documentation Issues	Key data fields incorrect	Yes	290	130,905	0.222
Metal	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	473	130,905	0.361
Metal	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	499	130,905	0.381
Metal	WATER	Documentation Issues	Missing deliverables (required for validation)	No	867	130,905	0.662
Metal	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	947	130,905	0.723
Metal	WATER	Documentation Issues	No raw data submitted by the laboratory	No	2	130,905	0.00153
Metal	WATER	Documentation Issues	No raw data submitted by the laboratory	Yes	1	130,905	7.64E-04
Metal	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	3,358	130,905	2.57
Metal	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	5,197	130,905	3.97
Metal	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	42	130,905	0.0321

Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	34	130,905	0.0260
Metal	WATER	Documentation Issues	Record added by the validator	No	39	130,905	0.0298
Metal	WATER	Documentation Issues	Record added by the validator	Yes	38	130,905	0.0290
Metal	WATER	Documentation Issues	Transcription error	No	1,514	130,905	1.16
Metal	WATER	Documentation Issues	Transcription error	Yes	1,103	130,905	0.843
Metal	WATER	Holding Times	Holding times were exceeded	No	197	130,905	0.150
Metal	WATER	Holding Times	Holding times were exceeded	Yes	158	130,905	0.121
Metal	WATER	Holding Times	Holding times were grossly exceeded	No	2	130,905	0.00153
Metal	WATER	Holding Times	Holding times were grossly exceeded	Yes	4	130,905	0.00306
Metal	WATER	Instrument Set-up	AA duplicate injection precision criteria were not met	No	6	130,905	0.00458
Metal	WATER	Instrument Set-up	AA duplicate injection precision criteria were not met	Yes	1	130,905	7.64E-04
Metal	WATER	Instrument Set-up	Element not analyzed in the interference check sample	Yes	1	130,905	7.64E-04
Metal	WATER	Instrument Set-up	Interference was indicated in the interference check sample	No	463	130,905	0.354
Metal	WATER	Instrument Set-up	Interference was indicated in the interference check sample	Yes	771	130,905	0.589
Metal	WATER	LCS	CRDL check sample recovery criteria were not met	No	431	130,905	0.329
Metal	WATER	LCS	CRDL check sample recovery criteria were not met	Yes	460	130,905	0.351
Metal	WATER	LCS	LCS data not submitted by the laboratory	No	1	130,905	7.64E-04
Metal	WATER	LCS	LCS recovery criteria were not met	No	101	130,905	0.0772
Metal	WATER	LCS	LCS recovery criteria were not met	Yes	280	130,905	0.214
Metal	WATER	LCS	Low level check sample recovery criteria were not met	No	1,475	130,905	1.13
Metal	WATER	LCS	Low level check sample recovery criteria were not met	Yes	1,267	130,905	0.968
Metal	WATER	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	No	101	130,905	0.0772
Metal	WATER	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	100	130,905	0.0764
Metal	WATER	Matrices	Duplicate analysis was not performed	No	167	130,905	0.128
Metal	WATER	Matrices	Duplicate analysis was not performed	Yes	69	130,905	0.0527
Metal	WATER	Matrices	Duplicate sample precision criteria were not met	No	170	130,905	0.130
Metal	WATER	Matrices	Duplicate sample precision criteria were not met	Yes	570	130,905	0.435
Metal	WATER	Matrices	LCS/LCSD precision criteria were not met	No	214	130,905	0.163
Metal	WATER	Matrices	LCS/LCSD precision criteria were not met	Yes	292	130,905	0.223
Metal	WATER	Matrices	MSA calibration correlation coefficient < 0.995	No	4	130,905	0.00306
Metal	WATER	Matrices	MSA calibration correlation coefficient < 0.995	Yes	23	130,905	0.0176
Metal	WATER	Matrices	MSA was required, but not performed	Yes	5	130,905	0.00382
Metal	WATER	Matrices	Post-digestion MS did not meet control criteria	No	1,119	130,905	0.855
Metal	WATER	Matrices	Post-digestion MS did not meet control criteria	Yes	389	130,905	0.297
Metal	WATER	Matrices	Predigestion MS recovery criteria were not met	No	1,461	130,905	1.12
Metal	WATER	Matrices	Predigestion MS recovery criteria were not met	Yes	1,893	130,905	1.45
Metal	WATER	Matrices	Predigestion MS recovery was < 30 percent	No	11	130,905	0.00840
Metal	WATER	Matrices	Predigestion MS recovery was < 30 percent	Yes	84	130,905	0.0642
Metal	WATER	Matrices	Serial dilution criteria were not met	No	139	130,905	0.106
Metal	WATER	Matrices	Serial dilution criteria were not met	Yes	2,630	130,905	2.01
Metal	WATER	Matrices	Site samples were not used for sample matrix QC	No	7	130,905	0.00535
Metal	WATER	Matrices	Site samples were not used for sample matrix QC	Yes	21	130,905	0.0160
Metal	WATER	Other	Analysis was not requested according to the statement of work	No	4	130,905	0.00306
Metal	WATER	Other	IDL is older than 3 months from date of analysis	No	1,939	130,905	1.48

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Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	WATER	Other	IDL is older than 3 months from date of analysis	Yes	3,099	130,905	2.37
Metal	WATER	Other	Incorrect analysis sequence	No	20	130,905	0.0153
Metal	WATER	Other	Incorrect analysis sequence	Yes	26	130,905	0.0199
Metal	WATER	Other	Lab results not verified due to unsubmitted data	Yes	4	130,905	0.00306
Metal	WATER	Other	QC sample frequency does not meet method requirements	No	177	130,905	0.135
Metal	WATER	Other	QC sample frequency does not meet method requirements	Yes	211	130,905	0.161
Metal	WATER	Other	Result obtained through dilution	No	44	130,905	0.0336
Metal	WATER	Other	Result obtained through dilution	Yes	41	130,905	0.0313
Metal	WATER	Other	See hard copy for further explanation	No	250	130,905	0.191
Metal	WATER	Other	See hard copy for further explanation	Yes	276	130,905	0.211
Metal	WATER	Sample Preparation	Preservation requirements were not met by the laboratory	No	1	130,905	7.64E-04
Metal	WATER	Sample Preparation	Samples were not properly preserved in the field	No	1,746	130,905	1.33
Metal	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	3,248	130,905	2.48
Metal	WATER	Sensitivity	IDL changed due to a significant figure discrepancy	No	200	130,905	0.153
Metal	WATER	Sensitivity	Instrument detection limit > the associated RDL	Yes	1	130,905	7.64E-04
PCB	SOIL	Calculation Errors	Calculation error	Yes	2	7,931	0.0252
PCB	SOIL	Calibration	Continuing calibration verification criteria were not met	No	58	7,931	0.731
PCB	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	8	7,931	0.101
PCB	SOIL	Calibration	Independent calibration verification criteria not met	Yes	3	7,931	0.0378
PCB	SOIL	Confirmation	Confirmation percent difference criteria not met	Yes	36	7,931	0.454
PCB	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	62	7,931	0.782
PCB	SOIL	Documentation Issues	Missing deliverables (not required for validation)	Yes	1	7,931	0.0126
PCB	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	208	7,931	2.62
PCB	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	2	7,931	0.0252
PCB	SOIL	Documentation Issues	Record added by the validator	No	37	7,931	0.467
PCB	SOIL	Documentation Issues	Record added by the validator	Yes	6	7,931	0.0757
PCB	SOIL	Documentation Issues	Transcription error	No	34	7,931	0.429
PCB	SOIL	Documentation Issues	Transcription error	Yes	3	7,931	0.0378
PCB	SOIL	Holding Times	Holding times were exceeded	No	242	7,931	3.05
PCB	SOIL	Holding Times	Holding times were exceeded	Yes	32	7,931	0.403
PCB	SOIL	Matrices	MS/MSD precision criteria were not met	No	40	7,931	0.504
PCB	SOIL	Matrices	MS/MSD precision criteria were not met	Yes	1	7,931	0.0126
PCB	SOIL	Other	QC sample frequency does not meet method requirements	Yes	1	7,931	0.0126
PCB	SOIL	Other	Sample results were not validated due to re-analysis	No	14	7,931	0.177
PCB	SOIL	Other	See hard copy for further explanation	No	3	7,931	0.0378
PCB	SOIL	Other	See hard copy for further explanation	Yes	12	7,931	0.151
PCB	SOIL	Sample Preparation	Samples were not properly preserved in the field	No	124	7,931	1.56
PCB	SOIL	Sample Preparation	Samples were not properly preserved in the field	Yes	2	7,931	0.0252
PCB	SOIL	Surrogates	Surrogate recovery criteria were not met	No	334	7,931	4.21
PCB	SOIL	Surrogates	Surrogate recovery criteria were not met	Yes	92	7,931	1.16
PCB	WATER	Calibration	Continuing calibration verification criteria were not met	No	24	1,801	1.33
PCB	WATER	Documentation Issues	Key data fields incorrect	No	14	1,801	0.777
PCB	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	14	1,801	0.777
PCB	WATER	Documentation Issues	Missing deliverables (required for validation)	No	28	1,801	1.55

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Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
PCB	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	70	1,801	3.89
PCB	WATER	Documentation Issues	Transcription error	No	185	1,801	10.3
PCB	WATER	Holding Times	Holding times were exceeded	No	98	1,801	5.44
PCB	WATER	LCS	LCS recovery criteria were not met	No	12	1,801	0.666
PCB	WATER	LCS	LCS recovery criteria were not met	Yes	2	1,801	0.111
PCB	WATER	Other	Sample results were not validated due to re-analysis	No	5	1,801	0.278
PCB	WATER	Other	See hard copy for further explanation	No	14	1,801	0.777
PCB	WATER	Surrogates	Surrogate recovery criteria were not met	No	235	1,801	13.0
PCB	WATER	Surrogates	Surrogate recovery criteria were not met	Yes	3	1,801	0.167
Pesticide	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	3	9,405	0.0319
Pesticide	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	1	9,405	0.0106
Pesticide	SOIL	Calibration	Continuing calibration verification criteria were not met	No	237	9,405	2.52
Pesticide	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	1	9,405	0.0106
Pesticide	SOIL	Calibration	Independent calibration verification criteria not met	No	19	9,405	0.202
Pesticide	SOIL	Confirmation	Confirmation percent difference criteria not met	Yes	18	9,405	0.191
Pesticide	SOIL	Confirmation	Results were not confirmed	No	2	9,405	0.0213
Pesticide	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	185	9,405	1.97
Pesticide	SOIL	Documentation Issues	Missing deliverables (required for validation)	No	1	9,405	0.0106
Pesticide	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	555	9,405	5.90
Pesticide	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	2	9,405	0.0213
Pesticide	SOIL	Documentation Issues	Transcription error	No	156	9,405	1.66
Pesticide	SOIL	Documentation Issues	Transcription error	Yes	1	9,405	0.0106
Pesticide	SOIL	Holding Times	Holding times were exceeded	No	110	9,405	1.17
Pesticide	SOIL	Internal Standards	Internal standards did not meet criteria	No	3	9,405	0.0319
Pesticide	SOIL	LCS	LCS recovery criteria were not met	No	10	9,405	0.106
Pesticide	SOIL	Matrices	MS/MSD precision criteria were not met	No	91	9,405	0.968
Pesticide	SOIL	Other	Sample results were not validated due to re-analysis	No	66	9,405	0.702
Pesticide	SOIL	Other	Sample results were not validated due to re-analysis	Yes	9	9,405	0.0957
Pesticide	SOIL	Other	See hard copy for further explanation	No	18	9,405	0.191
Pesticide	SOIL	Other	See hard copy for further explanation	Yes	2	9,405	0.0213
Pesticide	SOIL	Sample Preparation	Samples were not properly preserved in the field	No	256	9,405	2.72
Pesticide	SOIL	Surrogates	Surrogate recovery criteria were not met	No	432	9,405	4.59
Pesticide	SOIL	Surrogates	Surrogate recovery criteria were not met	Yes	10	9,405	0.106
Pesticide	WATER	Calibration	Continuing calibration verification criteria were not met	No	78	4,218	1.85
Pesticide	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	1	4,218	0.0237
Pesticide	WATER	Calibration	Independent calibration verification criteria not met	No	4	4,218	0.0948
Pesticide	WATER	Documentation Issues	Key data fields incorrect	No	40	4,218	0.948
Pesticide	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	2	4,218	0.0474
Pesticide	WATER	Documentation Issues	Missing deliverables (required for validation)	No	38	4,218	0.901
Pesticide	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	2	4,218	0.0474
Pesticide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	136	4,218	3.22
Pesticide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	2	4,218	0.0474
Pesticide	WATER	Documentation Issues	Transcription error	No	212	4,218	5.03
Pesticide	WATER	Holding Times	Holding times were exceeded	No	210	4,218	4.98

Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Pesticide	WATER	Internal Standards	Internal standards did not meet criteria	No	1	4,218	0.0237
Pesticide	WATER	Matrices	Site samples were not used for sample matrix QC	No	6	4,218	0.142
Pesticide	WATER	Other	Sample results were not validated due to re-analysis	No	7	4,218	0.166
Pesticide	WATER	Other	See hard copy for further explanation	No	42	4,218	0.996
Pesticide	WATER	Sample Preparation	Samples were not properly preserved in the field	No	1	4,218	0.0237
Pesticide	WATER	Surrogates	Surrogate recovery criteria were not met	No	647	4,218	15.3
Pesticide	WATER	Surrogates	Surrogate recovery criteria were not met	Yes	3	4,218	0.0711
Radionuclide	SOIL	Blanks	Blank recovery criteria were not met	No	6	13,060	0.0459
Radionuclide	SOIL	Blanks	Blank recovery criteria were not met	Yes	74	13,060	0.567
Radionuclide	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	12	13,060	0.0919
Radionuclide	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	341	13,060	2.61
Radionuclide	SOIL	Calculation Errors	Calculation error	No	43	13,060	0.329
Radionuclide	SOIL	Calculation Errors	Calculation error	Yes	53	13,060	0.406
Radionuclide	SOIL	Calibration	Background calibration criteria were not met	No	19	13,060	0.145
Radionuclide	SOIL	Calibration	Background calibration criteria were not met	Yes	16	13,060	0.123
Radionuclide	SOIL	Calibration	Continuing calibration verification criteria were not met	No	3	13,060	0.0230
Radionuclide	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	1,118	13,060	8.56
Radionuclide	SOIL	Documentation Issues	Information missing from case narrative	No	61	13,060	0.467
Radionuclide	SOIL	Documentation Issues	Information missing from case narrative	Yes	50	13,060	0.383
Radionuclide	SOIL	Documentation Issues	Key data fields incorrect	Yes	110	13,060	0.842
Radionuclide	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	121	13,060	0.926
Radionuclide	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	167	13,060	1.28
Radionuclide	SOIL	Documentation Issues	Omissions or errors in data package (required for validation)	No	2	13,060	0.0153
Radionuclide	SOIL	Documentation Issues	Record added by the validator	Yes	67	13,060	0.513
Radionuclide	SOIL	Documentation Issues	Results were not included on Data Summary Table	No	4	13,060	0.0306
Radionuclide	SOIL	Documentation Issues	Sample analysis was not requested	Yes	2	13,060	0.0153
Radionuclide	SOIL	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	656	13,060	5.02
Radionuclide	SOIL	Documentation Issues	Transcription error	No	32	13,060	0.245
Radionuclide	SOIL	Documentation Issues	Transcription error	Yes	576	13,060	4.41
Radionuclide	SOIL	Holding Times	Holding times were grossly exceeded	Yes	6	13,060	0.0459
Radionuclide	SOIL	Instrument Set-up	Detector efficiency did not meet requirements	No	1	13,060	0.00766
Radionuclide	SOIL	Instrument Set-up	Detector efficiency did not meet requirements	Yes	29	13,060	0.222
Radionuclide	SOIL	Instrument Set-up	Resolution criteria were not met	No	4	13,060	0.0306
Radionuclide	SOIL	Instrument Set-up	Resolution criteria were not met	Yes	34	13,060	0.260
Radionuclide	SOIL	LCS	LCS data not submitted by the laboratory	Yes	28	13,060	0.214
Radionuclide	SOIL	LCS	LCS recovery > +/- 3 sigma	No	14	13,060	0.107
Radionuclide	SOIL	LCS	LCS recovery > +/- 3 sigma	Yes	268	13,060	2.05
Radionuclide	SOIL	LCS	LCS recovery criteria were not met	No	7	13,060	0.0536
Radionuclide	SOIL	LCS	LCS recovery criteria were not met	Yes	71	13,060	0.544
Radionuclide	SOIL	LCS	LCS relative percent error criteria not met	No	12	13,060	0.0919
Radionuclide	SOIL	LCS	LCS relative percent error criteria not met	Yes	384	13,060	2.94
Radionuclide	SOIL	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	1	13,060	0.00766
Radionuclide	SOIL	Matrices	Duplicate sample precision criteria were not met	No	1	13,060	0.00766
Radionuclide	SOIL	Matrices	Duplicate sample precision criteria were not met	Yes	5	13,060	0.0383
Radionuclide	SOIL	Matrices	Recovery criteria were not met	No	7	13,060	0.0536
Radionuclide	SOIL	Matrices	Recovery criteria were not met	Yes	92	13,060	0.704

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Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Radionuclide	SOIL	Matrices	Replicate analysis was not performed	Yes	23	13,060	0.176
Radionuclide	SOIL	Matrices	Replicate precision criteria were not met	No	3	13,060	0.0230
Radionuclide	SOIL	Matrices	Replicate precision criteria were not met	Yes	290	13,060	2.22
Radionuclide	SOIL	Matrices	Replicate recovery criteria were not met	No	16	13,060	0.123
Radionuclide	SOIL	Matrices	Replicate recovery criteria were not met	Yes	130	13,060	0.995
Radionuclide	SOIL	Other	Lab results not verified due to unsubmitted data	No	1	13,060	0.00766
Radionuclide	SOIL	Other	Lab results not verified due to unsubmitted data	Yes	14	13,060	0.107
Radionuclide	SOIL	Other	QC sample does not meet method requirements	No	219	13,060	1.68
Radionuclide	SOIL	Other	QC sample does not meet method requirements	Yes	345	13,060	2.64
Radionuclide	SOIL	Other	Sample exceeded efficiency curve weight limit	Yes	2	13,060	0.0153
Radionuclide	SOIL	Other	Sample or control analyses not chemically separated	Yes	1	13,060	0.00766
Radionuclide	SOIL	Other	See hard copy for further explanation	No	17	13,060	0.130
Radionuclide	SOIL	Other	See hard copy for further explanation	Yes	120	13,060	0.919
Radionuclide	SOIL	Other	Standard values were not calculated correctly (LCS, tracer, standards)	No	1	13,060	0.00766
Radionuclide	SOIL	Other	Standard values were not calculated correctly (LCS, tracer, standards)	Yes	2	13,060	0.0153
Radionuclide	SOIL	Other	Tracer requirements were not met	No	110	13,060	0.842
Radionuclide	SOIL	Other	Tracer requirements were not met	Yes	150	13,060	1.15
Radionuclide	SOIL	Sensitivity	Incorrect reported activity or MDA	No	4	13,060	0.0306
Radionuclide	SOIL	Sensitivity	Incorrect reported activity or MDA	Yes	47	13,060	0.360
Radionuclide	SOIL	Sensitivity	MDA exceeded the RDL	No	23	13,060	0.176
Radionuclide	SOIL	Sensitivity	MDA exceeded the RDL	Yes	50	13,060	0.383
Radionuclide	SOIL	Sensitivity	MDA was calculated by reviewer	No	2	13,060	0.0153
Radionuclide	SOIL	Sensitivity	MDA was calculated by reviewer	Yes	1,348	13,060	10.3
Radionuclide	SOIL	Sensitivity	Results considered qualitative not quantitative	Yes	27	13,060	0.207
Radionuclide	WATER	Blanks	Blank data not submitted	Yes	4	26,340	0.0152
Radionuclide	WATER	Blanks	Blank recovery criteria were not met	No	24	26,340	0.0911
Radionuclide	WATER	Blanks	Blank recovery criteria were not met	Yes	177	26,340	0.672
Radionuclide	WATER	Blanks	Method, preparation, or reagent blank contamination	No	206	26,340	0.782
Radionuclide	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	1,050	26,340	3.99
Radionuclide	WATER	Calculation Errors	Calculation error	No	136	26,340	0.516
Radionuclide	WATER	Calculation Errors	Calculation error	Yes	84	26,340	0.319
Radionuclide	WATER	Calibration	Calibration counting statistics did not meet criteria	No	56	26,340	0.213
Radionuclide	WATER	Calibration	Calibration counting statistics did not meet criteria	Yes	15	26,340	0.0569
Radionuclide	WATER	Calibration	Calibration requirements affecting data quality have not been met	Yes	1	26,340	0.00380
Radionuclide	WATER	Calibration	Continuing calibration verification criteria were not met	No	248	26,340	0.942
Radionuclide	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	1,755	26,340	6.66
Radionuclide	WATER	Documentation Issues	Information missing from case narrative	No	30	26,340	0.114
Radionuclide	WATER	Documentation Issues	Information missing from case narrative	Yes	61	26,340	0.232
Radionuclide	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	2	26,340	0.00759
Radionuclide	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	20	26,340	0.0759
Radionuclide	WATER	Documentation Issues	Missing deliverables (required for validation)	No	34	26,340	0.129
Radionuclide	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	49	26,340	0.186
Radionuclide	WATER	Documentation Issues	No raw data submitted by the laboratory	Yes	3	26,340	0.0114
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	192	26,340	0.729
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	448	26,340	1.70

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Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	43	26,340	0.163
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	42	26,340	0.159
Radionuclide	WATER	Documentation Issues	Record added by the validator	Yes	75	26,340	0.285
Radionuclide	WATER	Documentation Issues	Sample analysis was not requested	No	9	26,340	0.0342
Radionuclide	WATER	Documentation Issues	Sufficient documentation not provided by the laboratory	No	40	26,340	0.152
Radionuclide	WATER	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	1,792	26,340	6.80
Radionuclide	WATER	Documentation Issues	Transcription error	No	561	26,340	2.13
Radionuclide	WATER	Documentation Issues	Transcription error	Yes	790	26,340	3.00
Radionuclide	WATER	Holding Times	Holding times were exceeded	No	35	26,340	0.133
Radionuclide	WATER	Holding Times	Holding times were exceeded	Yes	146	26,340	0.554
Radionuclide	WATER	Holding Times	Holding times were grossly exceeded	No	4	26,340	0.0152
Radionuclide	WATER	Holding Times	Holding times were grossly exceeded	Yes	23	26,340	0.0873
Radionuclide	WATER	Instrument Set-up	Resolution criteria were not met	No	12	26,340	0.0456
Radionuclide	WATER	Instrument Set-up	Resolution criteria were not met	Yes	108	26,340	0.410
Radionuclide	WATER	Instrument Set-up	Transformed spectral index external site criteria were not met	No	21	26,340	0.0797
Radionuclide	WATER	Instrument Set-up	Transformed spectral index external site criteria were not met	Yes	11	26,340	0.0418
Radionuclide	WATER	LCS	Expected LCS value not submitted/verifiable	No	4	26,340	0.0152
Radionuclide	WATER	LCS	Expected LCS value not submitted/verifiable	Yes	78	26,340	0.296
Radionuclide	WATER	LCS	LCS data not submitted by the laboratory	Yes	2	26,340	0.00759
Radionuclide	WATER	LCS	LCS recovery > +/- 3 sigma	No	390	26,340	1.48
Radionuclide	WATER	LCS	LCS recovery > +/- 3 sigma	Yes	489	26,340	1.86
Radionuclide	WATER	LCS	LCS recovery criteria were not met	No	29	26,340	0.110
Radionuclide	WATER	LCS	LCS recovery criteria were not met	Yes	91	26,340	0.345
Radionuclide	WATER	LCS	LCS relative percent error criteria not met	No	69	26,340	0.262
Radionuclide	WATER	LCS	LCS relative percent error criteria not met	Yes	505	26,340	1.92
Radionuclide	WATER	Matrices	Duplicate analysis was not performed	No	1	26,340	0.00380
Radionuclide	WATER	Matrices	Duplicate analysis was not performed	Yes	5	26,340	0.0190
Radionuclide	WATER	Matrices	Duplicate sample precision criteria were not met	No	17	26,340	0.0645
Radionuclide	WATER	Matrices	Duplicate sample precision criteria were not met	Yes	36	26,340	0.137
Radionuclide	WATER	Matrices	Laboratory duplicate was not analyzed	No	7	26,340	0.0266
Radionuclide	WATER	Matrices	Laboratory duplicate was not analyzed	Yes	15	26,340	0.0569
Radionuclide	WATER	Matrices	Recovery criteria were not met	No	31	26,340	0.118
Radionuclide	WATER	Matrices	Recovery criteria were not met	Yes	147	26,340	0.558
Radionuclide	WATER	Matrices	Replicate analysis was not performed	No	28	26,340	0.106
Radionuclide	WATER	Matrices	Replicate analysis was not performed	Yes	290	26,340	1.10
Radionuclide	WATER	Matrices	Replicate precision criteria were not met	No	151	26,340	0.573
Radionuclide	WATER	Matrices	Replicate precision criteria were not met	Yes	647	26,340	2.46
Radionuclide	WATER	Matrices	Replicate recovery criteria were not met	No	11	26,340	0.0418
Radionuclide	WATER	Matrices	Replicate recovery criteria were not met	Yes	121	26,340	0.459
Radionuclide	WATER	Other	Lab results not verified due to unsubmitted data	Yes	26	26,340	0.0987
Radionuclide	WATER	Other	QC sample does not meet method requirements	No	180	26,340	0.683
Radionuclide	WATER	Other	QC sample does not meet method requirements	Yes	183	26,340	0.695
Radionuclide	WATER	Other	QC sample frequency does not meet method requirements	Yes	2	26,340	0.00759
Radionuclide	WATER	Other	Sample exceeded efficiency curve weight limit	No	4	26,340	0.0152
Radionuclide	WATER	Other	Sample exceeded efficiency curve weight limit	Yes	23	26,340	0.0873
Radionuclide	WATER	Other	Sample or control analyses not chemically separated	Yes	3	26,340	0.0114

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Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Radionuclide	WATER	Other	Sample results were not validated due to re-analysis	No	1	26,340	0.00380
Radionuclide	WATER	Other	Sample results were not validated due to re-analysis	Yes	5	26,340	0.0190
Radionuclide	WATER	Other	See hard copy for further explanation	No	95	26,340	0.361
Radionuclide	WATER	Other	See hard copy for further explanation	Yes	689	26,340	2.62
Radionuclide	WATER	Other	Tracer requirements were not met	No	117	26,340	0.444
Radionuclide	WATER	Other	Tracer requirements were not met	Yes	191	26,340	0.725
Radionuclide	WATER	Other	Unit conversion of results	Yes	4	26,340	0.0152
Radionuclide	WATER	Sample Preparation	Excessive solids on planchet	Yes	2	26,340	0.00759
Radionuclide	WATER	Sample Preparation	Improper aliquot size	Yes	3	26,340	0.0114
Radionuclide	WATER	Sample Preparation	Preservation requirements were not met by the laboratory	Yes	2	26,340	0.00759
Radionuclide	WATER	Sample Preparation	Samples were not properly preserved in the field	No	26	26,340	0.0987
Radionuclide	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	41	26,340	0.156
Radionuclide	WATER	Sensitivity	Incorrect reported activity or MDA	No	2	26,340	0.00759
Radionuclide	WATER	Sensitivity	Incorrect reported activity or MDA	Yes	26	26,340	0.0987
Radionuclide	WATER	Sensitivity	MDA exceeded the RDL	No	101	26,340	0.383
Radionuclide	WATER	Sensitivity	MDA exceeded the RDL	Yes	753	26,340	2.86
Radionuclide	WATER	Sensitivity	MDA was calculated by reviewer	No	30	26,340	0.114
Radionuclide	WATER	Sensitivity	MDA was calculated by reviewer	Yes	3,102	26,340	11.8
SVOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	227	111,721	0.203
SVOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	254	111,721	0.227
SVOC	SOIL	Calibration	Continuing calibration verification criteria were not met	No	670	111,721	0.600
SVOC	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	117	111,721	0.105
SVOC	SOIL	Calibration	Independent calibration verification criteria not met	No	175	111,721	0.157
SVOC	SOIL	Calibration	Independent calibration verification criteria not met	Yes	1	111,721	8.95E-04
SVOC	SOIL	Confirmation	Confirmation percent difference criteria not met	Yes	3	111,721	0.00269
SVOC	SOIL	Confirmation	Results were not confirmed	No	1	111,721	8.95E-04
SVOC	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	323	111,721	0.289
SVOC	SOIL	Documentation Issues	Missing deliverables (not required for validation)	Yes	61	111,721	0.0546
SVOC	SOIL	Documentation Issues	Missing deliverables (required for validation)	No	67	111,721	0.0600
SVOC	SOIL	Documentation Issues	Missing deliverables (required for validation)	Yes	1	111,721	8.95E-04
SVOC	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	2,682	111,721	2.40
SVOC	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	270	111,721	0.242
SVOC	SOIL	Documentation Issues	Omissions or errors in data package (required for validation)	No	24	111,721	0.0215
SVOC	SOIL	Documentation Issues	Record added by the validator	Yes	5	111,721	0.00448
SVOC	SOIL	Documentation Issues	Transcription error	No	743	111,721	0.665
SVOC	SOIL	Documentation Issues	Transcription error	Yes	375	111,721	0.336
SVOC	SOIL	Holding Times	Holding times were exceeded	No	1,178	111,721	1.05
SVOC	SOIL	Holding Times	Holding times were exceeded	Yes	90	111,721	0.0806
SVOC	SOIL	Holding Times	Holding times were grossly exceeded	Yes	71	111,721	0.0636
SVOC	SOIL	Instrument Set-up	Instrument tune criteria were not met	No	3	111,721	0.00269
SVOC	SOIL	Internal Standards	Internal standards did not meet criteria	No	344	111,721	0.308
SVOC	SOIL	Internal Standards	Internal standards did not meet criteria	Yes	153	111,721	0.137
SVOC	SOIL	LCS	LCS recovery criteria were not met	No	17	111,721	0.0152
SVOC	SOIL	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	No	2	111,721	0.00179
SVOC	SOIL	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	1	111,721	8.95E-04

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Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
SVOC	SOIL	Matrices	MS/MSD precision criteria were not met	No	924	111,721	0.827
SVOC	SOIL	Matrices	MS/MSD precision criteria were not met	Yes	66	111,721	0.0591
SVOC	SOIL	Other	Sample results were not validated due to re-analysis	No	1,555	111,721	1.39
SVOC	SOIL	Other	Sample results were not validated due to re-analysis	Yes	475	111,721	0.425
SVOC	SOIL	Other	See hard copy for further explanation	No	91	111,721	0.0815
SVOC	SOIL	Other	See hard copy for further explanation	Yes	92	111,721	0.0823
SVOC	SOIL	Sample Preparation	Samples were not properly preserved in the field	No	990	111,721	0.886
SVOC	SOIL	Sample Preparation	Samples were not properly preserved in the field	Yes	48	111,721	0.0430
SVOC	SOIL	Surrogates	Surrogate recovery criteria were not met	No	540	111,721	0.483
SVOC	SOIL	Surrogates	Surrogate recovery criteria were not met	Yes	119	111,721	0.107
SVOC	WATER	Blanks	Method, preparation, or reagent blank contamination	No	95	23,366	0.407
SVOC	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	19	23,366	0.0813
SVOC	WATER	Calibration	Continuing calibration verification criteria were not met	No	477	23,366	2.04
SVOC	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	17	23,366	0.0728
SVOC	WATER	Calibration	Independent calibration verification criteria not met	No	112	23,366	0.479
SVOC	WATER	Calibration	Independent calibration verification criteria not met	Yes	1	23,366	0.00428
SVOC	WATER	Confirmation	Results were not confirmed	Yes	1	23,366	0.00428
SVOC	WATER	Documentation Issues	Information missing from case narrative	No	16	23,366	0.0685
SVOC	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	298	23,366	1.28
SVOC	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	10	23,366	0.0428
SVOC	WATER	Documentation Issues	Missing deliverables (required for validation)	No	21	23,366	0.0899
SVOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	2,370	23,366	10.1
SVOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	32	23,366	0.137
SVOC	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	12	23,366	0.0514
SVOC	WATER	Documentation Issues	Original documentation not provided	No	12	23,366	0.0514
SVOC	WATER	Documentation Issues	Transcription error	No	459	23,366	1.96
SVOC	WATER	Documentation Issues	Transcription error	Yes	33	23,366	0.141
SVOC	WATER	Holding Times	Holding times were exceeded	No	1,778	23,366	7.61
SVOC	WATER	Holding Times	Holding times were exceeded	Yes	22	23,366	0.0942
SVOC	WATER	Instrument Set-up	Instrument tune criteria were not met	No	433	23,366	1.85
SVOC	WATER	Instrument Set-up	Instrument tune criteria were not met	Yes	18	23,366	0.0770
SVOC	WATER	Internal Standards	Internal standards did not meet criteria	No	64	23,366	0.274
SVOC	WATER	Internal Standards	Internal standards did not meet criteria	Yes	4	23,366	0.0171
SVOC	WATER	LCS	LCS recovery criteria were not met	No	202	23,366	0.865
SVOC	WATER	LCS	LCS recovery criteria were not met	Yes	5	23,366	0.0214
SVOC	WATER	Matrices	MS/MSD precision criteria were not met	No	15	23,366	0.0642
SVOC	WATER	Matrices	Site samples were not used for sample matrix QC	No	287	23,366	1.23
SVOC	WATER	Matrices	Site samples were not used for sample matrix QC	Yes	1	23,366	0.00428
SVOC	WATER	Other	QC sample frequency does not meet method requirements	No	5	23,366	0.0214
SVOC	WATER	Other	QC sample frequency does not meet method requirements	Yes	1	23,366	0.00428
SVOC	WATER	Other	Sample results were not validated due to re-analysis	No	52	23,366	0.223
SVOC	WATER	Other	Sample results were not validated due to re-analysis	Yes	10	23,366	0.0428
SVOC	WATER	Other	See hard copy for further explanation	No	285	23,366	1.22
SVOC	WATER	Other	See hard copy for further explanation	Yes	3	23,366	0.0128
SVOC	WATER	Sample Preparation	Samples were not properly preserved in the field	No	442	23,366	1.89
SVOC	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	2	23,366	0.00856

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Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
SVOC	WATER	Surrogates	Surrogate recovery criteria were not met	No	217	23,366	0.929
SVOC	WATER	Surrogates	Surrogate recovery criteria were not met	Yes	13	23,366	0.0556
VOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	459	208,750	0.220
VOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	656	208,750	0.314
VOC	SOIL	Calculation Errors	Calculation error	No	37	208,750	0.0177
VOC	SOIL	Calculation Errors	Calculation error	Yes	3	208,750	0.00144
VOC	SOIL	Calibration	Continuing calibration verification criteria were not met	No	5,282	208,750	2.53
VOC	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	373	208,750	0.179
VOC	SOIL	Calibration	Independent calibration verification criteria not met	No	997	208,750	0.478
VOC	SOIL	Calibration	Independent calibration verification criteria not met	Yes	69	208,750	0.0331
VOC	SOIL	Calibration	Original result exceeded linear range, serial dilution value reported	Yes	2	208,750	9.58E-04
VOC	SOIL	Calibration	Result exceeded linear range of measurement system	Yes	7	208,750	0.00335
VOC	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	2,013	208,750	0.964
VOC	SOIL	Documentation Issues	Missing deliverables (not required for validation)	Yes	54	208,750	0.0259
VOC	SOIL	Documentation Issues	Missing deliverables (required for validation)	No	242	208,750	0.116
VOC	SOIL	Documentation Issues	Missing deliverables (required for validation)	Yes	4	208,750	0.00192
VOC	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	4,243	208,750	2.03
VOC	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	116	208,750	0.0556
VOC	SOIL	Documentation Issues	Omissions or errors in data package (required for validation)	No	466	208,750	0.223
VOC	SOIL	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	14	208,750	0.00671
VOC	SOIL	Documentation Issues	Transcription error	No	810	208,750	0.388
VOC	SOIL	Documentation Issues	Transcription error	Yes	36	208,750	0.0172
VOC	SOIL	Holding Times	Holding times were exceeded	No	1,874	208,750	0.898
VOC	SOIL	Holding Times	Holding times were exceeded	Yes	38	208,750	0.0182
VOC	SOIL	Holding Times	Holding times were grossly exceeded	Yes	3	208,750	0.00144
VOC	SOIL	Instrument Set-up	Instrument tune criteria were not met	No	60	208,750	0.0287
VOC	SOIL	Instrument Set-up	Instrument tune criteria were not met	Yes	1	208,750	4.79E-04
VOC	SOIL	Internal Standards	Internal standards did not meet criteria	No	934	208,750	0.447
VOC	SOIL	Internal Standards	Internal standards did not meet criteria	Yes	45	208,750	0.0216
VOC	SOIL	LCS	LCS recovery criteria were not met	No	73	208,750	0.0350
VOC	SOIL	LCS	LCS recovery criteria were not met	Yes	1	208,750	4.79E-04
VOC	SOIL	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	No	59	208,750	0.0283
VOC	SOIL	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	2	208,750	9.58E-04
VOC	SOIL	Matrices	MS/MSD precision criteria were not met	No	4,860	208,750	2.33
VOC	SOIL	Matrices	MS/MSD precision criteria were not met	Yes	96	208,750	0.0460
VOC	SOIL	Other	Sample results were not validated due to re-analysis	No	250	208,750	0.120
VOC	SOIL	Other	Sample results were not validated due to re-analysis	Yes	9	208,750	0.00431
VOC	SOIL	Other	See hard copy for further explanation	No	9	208,750	0.00431
VOC	SOIL	Sample Preparation	Samples were not properly preserved in the field	No	1,875	208,750	0.898
VOC	SOIL	Sample Preparation	Samples were not properly preserved in the field	Yes	42	208,750	0.0201
VOC	SOIL	Surrogates	Surrogate recovery criteria were not met	No	616	208,750	0.295
VOC	SOIL	Surrogates	Surrogate recovery criteria were not met	Yes	148	208,750	0.0709
VOC	WATER	Blanks	Method, preparation, or reagent blank contamination	No	410	197,783	0.207
VOC	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	339	197,783	0.171

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Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
VOC	WATER	Calculation Errors	Calculation error	Yes	1	197,783	5.06E-04
VOC	WATER	Calibration	Continuing calibration verification criteria were not met	No	3,640	197,783	1.84
VOC	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	241	197,783	0.122
VOC	WATER	Calibration	Independent calibration verification criteria not met	No	382	197,783	0.193
VOC	WATER	Calibration	Independent calibration verification criteria not met	Yes	64	197,783	0.0324
VOC	WATER	Calibration	Original result exceeded linear range, serial dilution value reported	No	1	197,783	5.06E-04
VOC	WATER	Calibration	Original result exceeded linear range, serial dilution value reported	Yes	137	197,783	0.0693
VOC	WATER	Calibration	Result exceeded linear range of measurement system	Yes	70	197,783	0.0354
VOC	WATER	Confirmation	Results were not confirmed	No	18	197,783	0.00910
VOC	WATER	Confirmation	Results were not confirmed	Yes	2	197,783	0.00101
VOC	WATER	Documentation Issues	Information missing from case narrative	No	303	197,783	0.153
VOC	WATER	Documentation Issues	Information missing from case narrative	Yes	10	197,783	0.00506
VOC	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	3,473	197,783	1.76
VOC	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	245	197,783	0.124
VOC	WATER	Documentation Issues	Missing deliverables (required for validation)	No	424	197,783	0.214
VOC	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	18	197,783	0.00910
VOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	15,986	197,783	8.08
VOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	1,377	197,783	0.696
VOC	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	288	197,783	0.146
VOC	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	13	197,783	0.00657
VOC	WATER	Documentation Issues	Original documentation not provided	No	234	197,783	0.118
VOC	WATER	Documentation Issues	Original documentation not provided	Yes	10	197,783	0.00506
VOC	WATER	Documentation Issues	Record added by the validator	No	346	197,783	0.175
VOC	WATER	Documentation Issues	Record added by the validator	Yes	14	197,783	0.00708
VOC	WATER	Documentation Issues	Transcription error	No	8,388	197,783	4.24
VOC	WATER	Documentation Issues	Transcription error	Yes	1,347	197,783	0.681
VOC	WATER	Holding Times	Holding times were exceeded	No	14,117	197,783	7.14
VOC	WATER	Holding Times	Holding times were exceeded	Yes	181	197,783	0.0915
VOC	WATER	Holding Times	Holding times were grossly exceeded	Yes	4	197,783	0.00202
VOC	WATER	Instrument Set-up	Instrument tune criteria were not met	No	7,501	197,783	3.79
VOC	WATER	Instrument Set-up	Instrument tune criteria were not met	Yes	619	197,783	0.313
VOC	WATER	Internal Standards	Internal standards did not meet criteria	No	299	197,783	0.151
VOC	WATER	Internal Standards	Internal standards did not meet criteria	Yes	29	197,783	0.0147
VOC	WATER	LCS	LCS recovery criteria were not met	No	2,562	197,783	1.30
VOC	WATER	LCS	LCS recovery criteria were not met	Yes	311	197,783	0.157
VOC	WATER	Matrices	MS/MSD precision criteria were not met	No	250	197,783	0.126
VOC	WATER	Matrices	MS/MSD precision criteria were not met	Yes	34	197,783	0.0172
VOC	WATER	Matrices	Site samples were not used for sample matrix QC	No	4	197,783	0.00202
VOC	WATER	Matrices	Site samples were not used for sample matrix QC	Yes	2	197,783	0.00101
VOC	WATER	Other	Lab results not verified due to unsubmitted data	Yes	1	197,783	5.06E-04
VOC	WATER	Other	QC sample frequency does not meet method requirements	No	103	197,783	0.0521
VOC	WATER	Other	QC sample frequency does not meet method requirements	Yes	5	197,783	0.00253
VOC	WATER	Other	Sample results were not validated due to re-analysis	No	685	197,783	0.346

Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
VOC	WATER	Other	Sample results were not validated due to re-analysis	Yes	264	197,783	0.133
VOC	WATER	Other	See hard copy for further explanation	No	1,123	197,783	0.568
VOC	WATER	Other	See hard copy for further explanation	Yes	221	197,783	0.112
VOC	WATER	Sample Preparation	Samples were not properly preserved in the field	No	6,805	197,783	3.44
VOC	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	555	197,783	0.281
VOC	WATER	Sensitivity	Incorrect reported activity or MDA	Yes	1	197,783	5.06E-04
VOC	WATER	Sensitivity	Instrument detection limit > the associated RDL	No	17	197,783	0.00860
VOC	WATER	Surrogates	Surrogate recovery criteria were not met	No	2,045	197,783	1.03
VOC	WATER	Surrogates	Surrogate recovery criteria were not met	Yes	270	197,783	0.137
Wet Chem	SOIL	Blanks	Calibration verification blank contamination	No	71	3,927	1.81
Wet Chem	SOIL	Blanks	Calibration verification blank contamination	Yes	142	3,927	3.62
Wet Chem	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	6	3,927	0.153
Wet Chem	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	2	3,927	0.0509
Wet Chem	SOIL	Calculation Errors	Control limits not assigned correctly	No	1	3,927	0.0255
Wet Chem	SOIL	Calculation Errors	Control limits not assigned correctly	Yes	121	3,927	3.08
Wet Chem	SOIL	Calibration	Calibration did not contain minimum number of standards	No	1	3,927	0.0255
Wet Chem	SOIL	Calibration	Calibration did not contain minimum number of standards	Yes	1	3,927	0.0255
Wet Chem	SOIL	Documentation Issues	Key data fields incorrect	Yes	4	3,927	0.102
Wet Chem	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	1	3,927	0.0255
Wet Chem	SOIL	Documentation Issues	Missing deliverables (not required for validation)	Yes	21	3,927	0.535
Wet Chem	SOIL	Documentation Issues	Missing deliverables (required for validation)	No	25	3,927	0.637
Wet Chem	SOIL	Documentation Issues	Missing deliverables (required for validation)	Yes	58	3,927	1.48
Wet Chem	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	2	3,927	0.0509
Wet Chem	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	77	3,927	1.96
Wet Chem	SOIL	Documentation Issues	Record added by the validator	No	3	3,927	0.0764
Wet Chem	SOIL	Documentation Issues	Record added by the validator	Yes	2	3,927	0.0509
Wet Chem	SOIL	Documentation Issues	Transcription error	Yes	32	3,927	0.815
Wet Chem	SOIL	Holding Times	Holding times were exceeded	No	18	3,927	0.458
Wet Chem	SOIL	Holding Times	Holding times were exceeded	Yes	60	3,927	1.53
Wet Chem	SOIL	Holding Times	Holding times were grossly exceeded	No	41	3,927	1.04
Wet Chem	SOIL	Holding Times	Holding times were grossly exceeded	Yes	96	3,927	2.44
Wet Chem	SOIL	LCS	LCS recovery criteria were not met	No	7	3,927	0.178
Wet Chem	SOIL	LCS	LCS recovery criteria were not met	Yes	197	3,927	5.02
Wet Chem	SOIL	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	18	3,927	0.458
Wet Chem	SOIL	Matrices	LCS/LCSD precision criteria were not met	No	2	3,927	0.0509
Wet Chem	SOIL	Matrices	LCS/LCSD precision criteria were not met	Yes	8	3,927	0.204
Wet Chem	SOIL	Matrices	Predigestion MS recovery criteria were not met	No	24	3,927	0.611
Wet Chem	SOIL	Matrices	Predigestion MS recovery criteria were not met	Yes	759	3,927	19.3
Wet Chem	SOIL	Matrices	Predigestion MS recovery was < 30 percent	Yes	1,872	3,927	47.7
Wet Chem	SOIL	Matrices	Serial dilution criteria were not met	Yes	134	3,927	3.41
Wet Chem	SOIL	Other	IDL is older than 3 months from date of analysis	Yes	1,825	3,927	46.5
Wet Chem	SOIL	Other	Lab results not verified due to unsubmitted data	Yes	2	3,927	0.0509
Wet Chem	SOIL	Other	Result obtained through dilution	Yes	3	3,927	0.0764
Wet Chem	SOIL	Sample Preparation	Samples were not properly preserved in the field	No	1	3,927	0.0255
Wet Chem	SOIL	Sample Preparation	Samples were not properly preserved in the field	Yes	7	3,927	0.178
Wet Chem	WATER	Blanks	Calibration verification blank contamination	No	21	13,706	0.153
Wet Chem	WATER	Blanks	Calibration verification blank contamination	Yes	7	13,706	0.0511
Wet Chem	WATER	Blanks	Method, preparation, or reagent blank contamination	No	101	13,706	0.737

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Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Wet Chem	WATER	Blanks	Negative bias indicated in the blanks	No	32	13,706	0.233
Wet Chem	WATER	Blanks	Negative bias indicated in the blanks	Yes	31	13,706	0.226
Wet Chem	WATER	Calculation Errors	Calculation error	Yes	3	13,706	0.0219
Wet Chem	WATER	Calculation Errors	Control limits not assigned correctly	No	2	13,706	0.0146
Wet Chem	WATER	Calculation Errors	Control limits not assigned correctly	Yes	100	13,706	0.730
Wet Chem	WATER	Calibration	Calibration correlation coefficient did not meet requirements	Yes	24	13,706	0.175
Wet Chem	WATER	Calibration	Continuing calibration verification criteria were not met	No	2	13,706	0.0146
Wet Chem	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	76	13,706	0.555
Wet Chem	WATER	Calibration	Result exceeded linear range of measurement system	Yes	15	13,706	0.109
Wet Chem	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	1	13,706	0.00730
Wet Chem	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	18	13,706	0.131
Wet Chem	WATER	Documentation Issues	Missing deliverables (required for validation)	No	3	13,706	0.0219
Wet Chem	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	33	13,706	0.241
Wet Chem	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	14	13,706	0.102
Wet Chem	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	246	13,706	1.79
Wet Chem	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	13	13,706	0.0948
Wet Chem	WATER	Documentation Issues	Record added by the validator	Yes	1	13,706	0.00730
Wet Chem	WATER	Documentation Issues	Reported data does not agree with raw data	Yes	1	13,706	0.00730
Wet Chem	WATER	Documentation Issues	Transcription error	No	121	13,706	0.883
Wet Chem	WATER	Documentation Issues	Transcription error	Yes	405	13,706	2.95
Wet Chem	WATER	Holding Times	Holding times were exceeded	No	85	13,706	0.620
Wet Chem	WATER	Holding Times	Holding times were exceeded	Yes	157	13,706	1.15
Wet Chem	WATER	Holding Times	Holding times were grossly exceeded	No	39	13,706	0.285
Wet Chem	WATER	Holding Times	Holding times were grossly exceeded	Yes	46	13,706	0.336
Wet Chem	WATER	LCS	LCS recovery criteria were not met	Yes	12	13,706	0.0876
Wet Chem	WATER	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	No	5	13,706	0.0365
Wet Chem	WATER	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	6	13,706	0.0438
Wet Chem	WATER	Matrices	Duplicate sample precision criteria were not met	No	2	13,706	0.0146
Wet Chem	WATER	Matrices	Duplicate sample precision criteria were not met	Yes	5	13,706	0.0365
Wet Chem	WATER	Matrices	LCS/LCSD precision criteria were not met	Yes	8	13,706	0.0584
Wet Chem	WATER	Matrices	Predigestion MS recovery criteria were not met	No	70	13,706	0.511
Wet Chem	WATER	Matrices	Predigestion MS recovery criteria were not met	Yes	388	13,706	2.83
Wet Chem	WATER	Matrices	Predigestion MS recovery was < 30 percent	Yes	15	13,706	0.109
Wet Chem	WATER	Matrices	Serial dilution criteria were not met	Yes	3	13,706	0.0219
Wet Chem	WATER	Matrices	Site samples were not used for sample matrix QC	No	2	13,706	0.0146
Wet Chem	WATER	Matrices	Site samples were not used for sample matrix QC	Yes	52	13,706	0.379
Wet Chem	WATER	Other	IDL is older than 3 months from date of analysis	Yes	1	13,706	0.00730
Wet Chem	WATER	Other	Lab results not verified due to unsubmitted data	No	3	13,706	0.0219
Wet Chem	WATER	Other	Lab results not verified due to unsubmitted data	Yes	58	13,706	0.423
Wet Chem	WATER	Other	Result obtained through dilution	Yes	29	13,706	0.212
Wet Chem	WATER	Other	See hard copy for further explanation	No	2	13,706	0.0146
Wet Chem	WATER	Other	See hard copy for further explanation	Yes	6	13,706	0.0438
Wet Chem	WATER	Sample Preparation	Preservation requirements were not met by the laboratory	No	2	13,706	0.0146

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Table A2.5
Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Wet Chem	WATER	Sample Preparation	Preservation requirements were not met by the laboratory	Yes	75	13,706	0.547
Wet Chem	WATER	Sample Preparation	Sample pretreatment or preparation method was incorrect	Yes	2	13,706	0.0146
Wet Chem	WATER	Sample Preparation	Samples were not properly preserved in the field	No	17	13,706	0.124
Wet Chem	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	215	13,706	1.57

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Table A2.6
Summary of Data Rejected During V&V

Analyte Group	Matrix	Total No. of Rejected Records	Total No. of Records	Percent Rejected (%)
Dioxins and Furans	SOIL	0	615	0
Dioxins and Furans	WATER	0	100	0
Explosive	SOIL	0	24	0
Herbicide	SOIL	23	2,743	0.838
Herbicide	WATER	6	359	1.67
Metal	SOIL	957	169,529	0.565
Metal	WATER	2,033	154,038	1.32
PCB	SOIL	88	10,605	0.830
PCB	WATER	7	2,156	0.325
Pesticide	SOIL	96	13,081	0.734
Pesticide	WATER	28	5,367	0.522
Radionuclide	SOIL	834	149,093	0.559
Radionuclide	WATER	2,311	33,675	6.86
SVOC	SOIL	1,068	149,364	0.715
SVOC	WATER	398	26,999	1.47
VOC	SOIL	2,403	310,061	0.775
VOC	WATER	5,195	232,363	2.24
Wet Chem	SOIL	204	5,568	3.66
Wet Chem	WATER	347	17,319	2.00
	Total	**15,998**	**1,283,059**	**1.25**

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Table A2.7
Summary of RPDs/DERs of Field Duplicate Analyte Pairs

Analyte Group	Matrix	No. of Duplicates Failing RPD/DER Criteria	Total No. of Duplicate Pairs	Percent Failure (%)	Field Duplicate Frequency (%)
Dioxins and Furans	SOIL	111	238	46.6	48.3
Explosive	SOIL	0	4	0	16.7
Herbicide	SOIL	0	234	0	11.6
Herbicide	WATER	0	25	0	6.51
Metal	SOIL	1,654	11,362	14.6	9.13
Metal	WATER	362	7,048	5.14	4.82
PCB	SOIL	36	949	3.79	11.1
PCB	WATER	0	147	0	6.93
Pesticide	SOIL	6	1,296	0.463	12.5
Pesticide	WATER	0	371	0	7.03
Radionuclide	SOIL	60	2,089	2.87	14.8
Radionuclide	WATER	28	1,843	1.52	4.81
SVOC	SOIL	125	12,918	0.968	11.0
SVOC	WATER	1	1,698	0.0589	5.62
VOC	SOIL	9	22,837	0.0394	10.6
VOC	WATER	115	11,875	0.968	5.28
Wet Chem	SOIL	17	356	4.78	8.51
Wet Chem	WATER	19	697	2.73	3.87

Table A2.8
Summary of Data Estimated or Undetected Due to V&V Determinations

Analyte Group	Matrix	No. of CRA Data Records Qualified	Total No. of V&V CRA Records	Detect?	Percent Qualified (%)
Dioxins and Furans	SOIL	2	493	No	0.406
Dioxins and Furans	SOIL	121	493	Yes	24.5
Herbicide	SOIL	110	1,914	No	5.75
Herbicide	WATER	16	277	No	5.78
Metal	SOIL	14,851	123,592	No	12.0
Metal	SOIL	21,338	123,592	Yes	17.3
Metal	WATER	17,111	130,905	No	13.1
Metal	WATER	10,186	130,905	Yes	7.78
PCB	SOIL	345	7,931	No	4.35
PCB	SOIL	67	7,931	Yes	0.845
PCB	WATER	346	1,801	No	19.2
PCB	WATER	2	1,801	Yes	0.111
Pesticide	SOIL	505	9,405	No	5.37
Pesticide	SOIL	31	9,405	Yes	0.330
Pesticide	WATER	916	4,218	No	21.7
Radionuclide	SOIL	52	13,060	No	0.398
Radionuclide	SOIL	83	13,060	Yes	0.636
Radionuclide	WATER	170	26,340	No	0.645
Radionuclide	WATER	347	26,340	Yes	1.32
SVOC	SOIL	2,889	111,721	No	2.59
SVOC	SOIL	514	111,721	Yes	0.460
SVOC	WATER	2,940	23,366	No	12.6
SVOC	WATER	53	23,366	Yes	0.227
VOC	SOIL	9,514	208,750	No	4.56
VOC	SOIL	1,074	208,750	Yes	0.514
VOC	WATER	22,175	197,783	No	11.2
VOC	WATER	1,254	197,783	Yes	0.634
Wet Chem	SOIL	119	3,927	No	3.03
Wet Chem	SOIL	2,856	3,927	Yes	72.7
Wet Chem	WATER	339	13,706	No	2.47
Wet Chem	WATER	868	13,706	Yes	6.33
	Total	**111,194**	**879,311**		**12.6**

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Table A2.9
Summary of Data Qualified as Undetected Due to Blank Contamination

Analyte Group	Matrix	No. of CRA Records Qualified as Undetected	Total No. of CRA Records with Detected Results[a]	Percent Qualified as Undetected
Dioxins and Furans	SOIL	2	259	0.77
Metal	SOIL	4,849	92,657	5.23
Metal	WATER	3,024	67,169	4.50
Pesticide	WATER	1	11	9.09
Radionuclide	SOIL	6	10,173	0.06
Radionuclide	WATER	3	17,943	0.02
SVOC	SOIL	18	9,949	0.18
SVOC	WATER	3	285	1.05
VOC	SOIL	85	3,958	2.15
VOC	WATER	88	11,591	0.76
Wet Chem	SOIL	61	3,467	1.76
Wet Chem	WATER	17	11,780	0.14
	Total	**8,157**	**229,242**	**3.56%**

[a] As determined by the laboratory prior to V&V.

COMPREHENSIVE RISK ASSESSMENT

INDUSTRIAL AREA EXPOSURE UNIT

VOLUME 14: ATTACHMENT 3

Statistical Analyses and Professional Judgment

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ACRONYMS AND ABBREVIATIONS

µg/kg	micrograms per kilogram
AL	action level
CDH	Colorado Department of Health
CDPHE	Colorado Department of Public Health and Environment
CMS	Corrective Measures Study
COC	contaminant of concern
CRA	Comprehensive Risk Assessment
DOE	U.S. Department of Energy
DQA	Data Quality Assessment
ECOI	ecological contaminant of interest
ECOPC	ecological contaminant of potential concern
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERA	Ecological Risk Assessment
ESL	ecological screening level
EU	Exposure Unit
GIS	Geographical Information System
HHRA	Human Health Risk Assessment
IAEU	Industrial Area Exposure Unit
IDEU	Inter-Drainage Exposure Unit
IHSS	Individual Hazardous Substance Site
LWNEU	Lower Walnut Drainage Exposure Unit

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LWOEU	Lower Woman Exposure Unit
MDC	maximum detected concentration
mg/kg	milligram per kilogram
NNEU	No Name Gulch Exposure Drainage Unit
NOAEL	no observed adverse effect level
OU	Operable Unit
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
PCOC	potential contaminant of concern
PMJM	Preble's meadow jumping mouse
PRG	preliminary remediation goal
RCRA	Resource Conservation and Recovery Act
RFETS	Rocky Flats Environmental Technology Site
RI/FS	Remedial Investigation/Feasibility Study
tESL	threshold ESL
UCL	upper confidence limit
UTL	upper tolerance limit
UWNEU	Upper Walnut Drainage Exposure Unit
UWOEU	Upper Woman Exposure Unit
WBEU	Wind Blown Exposure Unit
WRW	wildlife refuge worker

1.0 INTRODUCTION

This attachment presents the results for the statistical analyses and professional judgment evaluation used to select human health contaminants of concern (COCs) as part of the Human Health Risk Assessment (HHRA) and ecological contaminants of potential concern (ECOPCs) as part of the Ecological Risk Assessment (ERA) for the Industrial Area Exposure Unit (IAEU) at the Rocky Flats Environmental Technology Site (RFETS). The methods used to perform the statistical analysis and to develop the professional judgment sections are described in Appendix A, Volume 2, Section 2 of the Resource Conservation and Recovery Act (RCRA) Facility Investigation—Remedial Investigation (RI)/Corrective Measures Study (CMS)—Feasibility Study (FS) Report (hereafter referred to as the RI/FS Report), following the Comprehensive Risk Assessment (CRA) Methodology (DOE 2005).

2.0 RESULTS OF STATISTICAL COMPARISONS TO BACKGROUND FOR THE INDUSTRIAL AREA EXPOSURE UNIT

The results of the statistical background comparisons for inorganic and radionuclide potential contaminants of concern (PCOCs) and ecological contaminants of interest (ECOIs) in surface soil/surface sediment, subsurface soil/subsurface sediment, surface soil, and subsurface soil samples collected from the IAEU are presented in this section. Box plots are provided for analytes that were carried forward into the statistical comparison step and are presented in Figures A3.2.1 to A3.2.18.[1] The box plots display several reference points: 1) the line inside the box is the median; 2) the lower edge of the box is the 25th percentile; 3) the upper edge of the box is the 75th percentile; 4) the upper lines (called whiskers) are drawn to the greatest value that is less than or equal to 1.5 times the inter-quartile range (the inter-quartile range is between the 75th and 25th percentiles); 5) the lower whiskers are drawn to the lowest value that is greater than or equal to 1.5 times the inter-quartile range; and 6) solid circles are data points greater than or less than the whiskers.

PCOCs with concentrations in the IAEU that are statistically greater than background (or those where background comparisons were not performed) are carried through to the professional judgment step of the COC/ECOPC selection processes. ECOIs (for non-PMJM receptors) with concentrations in the IAEU that are statistically greater than background (or those where background comparisons were not performed) are carried

[1] Statistical background comparisons are not performed for analytes if: 1) the background concentrations are non-detections; 2) background data are unavailable; 3) the analyte has low detection frequency in the IAEU or background data set (less than 20 percent); or 4) the analyte is an organic compound. Box plots are not provided for these analytes. However, these analytes are carried forward into the professional judgment evaluation.

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through to the upper-bound exposure point concentration (EPC) – threshold ecological screening level (tESL) comparison step of the ECOPC selection processes.

PCOCs and ECOIs with concentrations that are not statistically greater than background are not identified as COCs/ECOPCs and are not further evaluated.

2.1 Surface Soil/Surface Sediment Data Used in the HHRA

For the IAEU surface soil/surface sediment data set, the maximum detected concentrations (MDCs) for aluminum, cadmium, cobalt, iron, manganese, mercury, uranium, vanadium, benzo(a)anthracene, benzo(a)fluoranthene, dibenz(a,h)anthracene, PCB-1254, PCB-1260, pentachlorophenol, tetrachloroethene, americium-241, cesium-134, cesium-137, plutonium-239/240, radium-228, uranium-233/234, uranium-235 and uranium-238 exceed the wildlife refuge worker (WRW) preliminary remediation goals (PRGs), but the upper confidence limit (UCL) on the mean concentrations for the site data set do not exceed the PRGs. Therefore, these analytes are not further evaluated.

The MDCs and UCLs for arsenic, benzo(a)pyrene and radium-228 exceed the PRGs for the IAEU data set; these analytes were carried forward into the statistical background comparison step. The results of the statistical comparison of the IAEU surface soil/surface sediment data to background data for these PCOCs are presented in Table A3.2.1 and the summary statistics for background and IAEU surface soil/surface sediment data are shown in Table A3.2.2.

The results of the statistical comparisons of the IAEU surface soil/surface sediment data to background data indicate the following:

Analytes Statistically Greater than Background at the 0.1 Significance Level

- Arsenic

Analytes Not Statistically Greater than Background at the 0.1 Significance Level

- Radium-228

Background Comparison Not Performed[1]

- Benzo(a)pyrene

2.2 Subsurface Soil/Subsurface Sediment Data Used in the HHRA

For the IAEU subsurface soil/subsurface sediment data set, the MDCs for arsenic, chromium, lead, benzo(a)pyrene, dibenz(a,h)anthracene, tetrachloroethene and plutonium-239/240 exceed the WRW PRGs, but the UCL on the mean concentrations for the site data set do not exceed the PRGs. Therefore, these analytes are not further evaluated.

The MDC and UCL for radium-228 exceed the PRG for the IAEU subsurface soil/subsurface sediment data set and were carried forward into the statistical background comparison step. The results of the statistical comparison of the IAEU subsurface soil/subsurface sediment data to the background data are presented in Table A3.2.3, and the summary statistics for the IAEU subsurface soil/subsurface sediment data to background data are presented in Table A3.2.4.

The results of the statistical comparisons of the IAEU subsurface soil/subsurface data to background data indicate the following:

Analytes Statistically Greater than Background at the 0.1 Significance Level

- None

Analytes Not Statistically Greater than Background at the 0.1 Significance Level

- Radium-228

Background Comparison not Performed[1]

- None

2.3 Surface Soil Data Used in the ERA (Non-PMJM)

For the surface soil data set, the MDCs for aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, tin, uranium, vanadium, and zinc exceed a non-PMJM ecological screening level (ESL); these analytes were carried forward into the statistical background comparison step. The results of the statistical comparison of the IAEU surface soil data to background data are presented in Table A3.2.5, and the summary statistics for background and IAEU surface soil data are shown in Table A3.2.6.

The MDCs for benzo(a)pyrene, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, total dioxin, total polychlorinated biphenyls (PCBs), and tetrachloroethene also exceed a non-PMJM ESL and were carried forward into the upper-bound exposure point concentration step (Section 3.0).

The MDCs for 2,4,6-trichlorophenol, 4,4'-DDT, dieldrin, endrin, endrin aldehyde, hexachlorobenzene and pentachlorophenol also exceeded an ESL. However, these analytes had detection frequency of less than 5 percent and were not further evaluated.

The results of the statistical comparisons of the IAEU surface soil (non-PMJM) to background data indicate the following:

Analytes Statistically Greater than Background at the 0.1 Significance Level

- Chromium
- Copper

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Analytes Not Statistically Greater than Background at the 0.1 Significance Level

- Aluminum
- Arsenic
- Barium
- Beryllium
- Cadmium
- Cobalt
- Lead
- Lithium
- Manganese
- Mercury
- Nickel
- Vanadium
- Zinc

***Background Comparison not Performed*[1]**

- Antimony
- Boron
- Molybdenum
- Selenium
- Silver
- Thallium
- Tin
- Uranium
- Benzo(a)pyrene
- Bis(2 ethylhexyl)phthalate

- di-n-butylphthalate
- 2,3,7,8-TCDD (TEQ) (mammals and birds)
- Total PCBs
- Tetrachloroethene

2.4 Surface Soil Data Used in the ERA (PMJM)

There are no PMJM habitats within IAEU and, therefore, no ECOIs were evaluated for PMJM receptors in surface soil.

2.5 Subsurface Soil Data Used in the ERA

For the subsurface soil data set, the MDCs for antimony, arsenic, cadmium, chromium, copper, manganese, mercury, molybdenum, nickel, selenium, tin, uranium, vanadium and zinc exceed the prairie dog ESL and were carried forward into the statistical background comparison step. The results of the statistical comparison of the IAEU subsurface soil data to background data are presented in Table A3.2.7 and the summary statistics for background and IAEU subsurface soil data are shown in Table A3.2.8.

The MDCs for total dioxin, tetrachloroethene, and xylene also exceed the ESL and were carried forward into the upper-bound EPC comparison step (Section 3.0).

The results of the statistical comparisons of the surface soil data to background data indicate the following:

Analytes Statistically Greater than Background at the 0.1 Significance Level

- Arsenic

Analytes Not Statistically Greater than Background at the 0.1 Significance Level

- Chromium
- Copper
- Manganese
- Mercury
- Molybdenum
- Nickel
- Vanadium
- Zinc

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***Background Comparison not Performed*[1]**

- Antimony
- Cadmium
- Selenium
- Tin
- Uranium
- 2,3,7,8-TCDD (TEQ) (mammals and birds)
- Tetrachloroethene
- Xylene

3.0 UPPER-BOUND EXPOSURE POINT CONCENTRATION COMPARISON TO LIMITING ECOLOGICAL SCREENING LEVELS

ECOIs in surface soil and subsurface soil with concentrations that are statistically greater than background, or background comparisons were not performed, are evaluated further by comparing the EU EPCs to the tESLs. The EPCs are the 95 percent UCLs of the 90th percentile (upper tolerance limit [UTL]) for small home-range receptors, the UCL for large home-range receptors, or the MDC in the event that the UCL or UTL is greater than the MDC.

3.1 ECOIs in Surface Soil

Selenium, silver, thallium, uranium, benzo(a)pyrene, and tetrachloroethene in surface soil (non-PMJM) were eliminated from further consideration because the upper-bound EPCs are not greater than the tESLs.

Antimony, boron, chromium, copper, molybdenum, and tin along with four organics, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, 2,3,7,8-TCDD (TEQ), and total PCB, have upper-bound EPCs greater than the tESLs and are evaluated in the professional judgment evaluation screening step (Section 4.0).

3.2 ECOIs in Subsurface Soil

Antimony, arsenic, cadmium, selenium, tin, uranium, dioxins (total), tetrachloroethene, and xylene in surface soil (non-PMJM) were eliminated from further consideration because the upper-bound EPCs are not greater than the tESLs. Therefore, no ECOIs in subsurface soil at the IAEU were carried forward into professional judgment for subsurface soils.

4.0 PROFESSIONAL JUDGMENT

This section presents the results of the professional judgment step of the COC and ECOPC selection processes for the HHRA and ERA, respectively. Based on the weight of evidence evaluated in the professional judgment step, PCOCs and ECOIs are either included for further evaluation as COCs/ECOPCs in the risk characterization step, or excluded from further evaluation.

The professional judgment evaluation takes into account the following lines of evidence: process knowledge, spatial trends, pattern recognition[2], comparison to RFETS background and regional background datasets (see Table A3.4.1 for a summary of regional background data)[3], and risk potential. For PCOCs or ECOIs where the process knowledge and/or spatial trends indicate that the presence of the analyte in the EU may be a result of historical site-related activities, the professional judgment discussion includes only two of the lines of evidence listed above, and it is concluded that these analytes are COCs/ECOPCs and are carried forward into risk characterization. For the other PCOCs and ECOIs that are evaluated in the professional judgment step, each of the lines of evidence listed above are included in the discussion.

For metals, Appendix A, Volume 2, Attachment 8, of the RI/FS Report provides the details of the process knowledge and spatial trend evaluations. The conclusions from these evaluations are noted in this attachment.

The following PCOCs/ECOIs are evaluated further in the professional judgment step for IAEU:

- Surface soil/surface sediment (HHRA)

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[2] The pattern recognition evaluation includes the use of probability plots. If two or more distinct populations are evident in the probability plot, this suggests that one or more local releases may have occurred. Conversely, if only one distinct low-concentration population is defined, likely representing a background population, a local release may or may not have occurred. Similar to all statistical methods, the probability plot has limitations in cases where there is inadequate sampling and the magnitude of the release is relatively small. Thus, the absence of two clear populations in the probability plots is consistent with, but not definitive proof of, the hypothesis that no releases have occurred. However, if a release has occurred within the sampled area and has been included in the samples, then the elemental concentrations associated with that release are either within the background concentration range or the entire sampled population represents a release, a highly unlikely probability.

[3] The regional background data set for Colorado and the bordering states was extracted from data for the western United States (Shacklette and Boerngen 1984), and is composed of data from Colorado as well as Arizona, Kansas, Nebraska, New Mexico, Oklahoma, Utah, and Wyoming. Although the Colorado and bordering states background data set is not specific to Colorado's Front Range, it is useful for the professional judgment evaluation in the absence of a robust data set for the Front Range. Colorado's Front Range has highly variable terrain that changes elevation over short distances. Consequently, numerous soil types and geologic materials are present at RFETS, and the data set for Colorado and bordering states may be more representative of these variable soil types.

  - Arsenic
  - Benzo(a)pyrene
- Subsurface soil/subsurface sediment (HHRA)
  - None
- Surface soil for non-PMJM receptors (ERA)
  - Antimony
  - Boron
  - Chromium
  - Copper
  - Molybdenum
  - Tin
  - bis(2-Ethylhexyl)phthalate
  - Di-n-butylphthalate
  - 2,3,7,8-TCDD (TEQ) (mammals and birds)
  - Total PCBs
- Subsurface soil (ERA)
  None

The following sections provide the professional judgment evaluations, by analyte and by medium, for the PCOCs/ECOIs listed above.

4.1 Antimony

Antimony has an EPC in surface soil (for non-PMJM receptors) greater than the tESL. Therefore, antimony in surface soil (non-PMJM receptor) was carried forward to the professional judgment step. The lines of evidence used to determine if antimony should be retained for risk characterization are summarized below.

4.1.1 Summary of Process Knowledge

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, process knowledge indicates antimony is unlikely to be present in RFETS soil as a result of historical site-related activities.

4.1.2 Evaluation of Spatial Trends

Surface Soil (Non-PMJM)

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, the spatial trend analysis indicates that the antimony EPCs for the Inter-Drainage Exposure Unit (IDEU), No Name Exposure Unit (NNEU), Upper Woman Exposure Unit (UWOEU), Lower Woman Exposure Unit (LWOEU), Upper Walnut Exposure Unit (UWNEU), Lower Walnut Exposure Unit (LWNEU), and IAEU are greater than the tESL. Therefore, at these locations antimony cannot be eliminated as an ECOPC in surface soil (non-PMJM) and is carried into risk characterization.

4.1.3 Conclusion

Antimony in surface soil (non-PMJM) is being carried forward into the ecological non-PMJM risk characterization because elevated concentrations that are greater than 10 times the ESL are found in surface soil near or within historical Individual Hazardous Substance Sites (IHSSs). Antimony was used in limited quantities during historical RFETS operations, which would indicate it is unlikely to be a site-related contaminant. Nevertheless, as a conservative measure, antimony is carried forward into the risk characterization recognizing that its classification as an ECOPC is uncertain.

4.2 Arsenic

Arsenic has concentrations statistically greater than background in surface soil/surface sediment and, therefore, was carried forward to the professional judgment step. The lines of evidence used to determine if arsenic should be retained as a COC for risk characterization are summarized below.

4.2.1 Summary of Process Knowledge

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, process knowledge indicates that arsenic may be present in RFETS soil as a result of historical site-related activities at IAEU.

4.2.2 Evaluation of Spatial Trends

Surface Soil/Surface Sediment

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, the spatial trend analysis indicates that arsenic concentrations at several surface soil/surface sediment locations within the IAEU exceed three times the background MDC and these locations are near historical IHSSs. Therefore, arsenic in surface soil/surface sediment cannot be eliminated as a COC for the IAEU and will be evaluated in the risk characterization.

4.2.3 Conclusion

The weight of evidence presented above shows that arsenic concentrations in IAEU surface soil/surface sediment may be a result of historical site-related activities. Therefore, arsenic in surface soil/surface sediment in the IAEU is carried into risk characterization.

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4.3 Benzo(a)pyrene

Benzo(a)pyrene had a UCL in surface soil/surface sediment greater than the PRG and, therefore, was carried forward to the professional judgment step. A decision could not be made whether concentrations in samples collected from EU are significantly elevated versus background, because the background comparison is not performed for organics. The lines of evidence used to determine if benzo(a)pyrene should be retained as a COC are summarized below.

4.3.1 Summary of Process Knowledge

Polynuclear aromatic hydrocarbons (PAHs), including benzo(a)pyrene, are ubiquitous in the environment and typical concentrations in urban soil range from 165 to 220 micrograms per kilogram (µg/kg) (ATSDR 1995). Benzo(a)pyrene has not been directly associated with historical IHSSs within the IAEU, but could be associated with traffic, pavement degradation, or pavement operations in the IAEU. During the peak traffic years (1990–2004), Geographic Information System (GIS) coverage shows approximately 6,720,800 square feet of asphalt surface area (plantwide, but primarily in the IAEU).

4.3.2 Summary of Spatial Trends

Surface Soil/Surface Sediment

Benzo(a)pyrene was detected in 47 percent of the 986 surface soil/surface sediment samples collected at IAEU. Benzo(a)pyrene concentrations in surface soil/surface sediment at the IAEU range from 23.0 to 3,200 µg /kg with several locations with concentrations that are greater than three times the PRG. These elevated concentrations are located near various historical IHSSs within the IAEU (Figure A3.4.1).

4.3.3 Conclusion

Because elevated concentrations of benzo(a)pyrene in samples collected within the IAEU are greater than three times the PRG at several sampling points located near historical IHSSs, benzo(a)pyrene was identified as a COC and carried forward into risk characterization.

4.4 Bis(2-ethylhexyl)phthalate

Bis(2-ethylhexyl)phthalate had an upper-bound EPC in surface soil (for non-PMJM receptors) greater than the tESL and, therefore, was carried forward to the professional judgment step. A decision could not be made whether concentrations in samples collected from EU are significantly elevated versus background because the background comparison is not performed for organics. The lines of evidence used to determine if bis(2-ethylhexyl)phthalate should be retained for risk characterization are summarized below.

4.4.1 Summary of Process Knowledge

There are no documented operations or activities that occurred in IAEU involving the use of bis(2-ethylhexyl)phthalate (CDH 1992; DOE 1995; DOE 1992). However, because the IAEU is the Exposure Unit (EU) where facility operations were conducted, bis(2-ethylhexyl)phthalate may be present in IAEU surface soil as a result of historical site-related activities.

4.4.2 Evaluation of Spatial Trends

Surface Soil (Non-PMJM)

Bis(2-ethylhexyl)phthalate was detected in 29 percent of the 918 surface soil samples collected within the IAEU. The bis(2-ethylhexyl)phthalate detected concentrations range from 29.0 to 75,000 μg/kg with a mean concentration of 447 μg/kg. As shown in Figure A3.4.2, elevated concentrations of bis(2-ethylhexyl)phthalate that are more than three times the ESL of 136 μg/kg occur at several locations near historical IHSSs within the IAEU.

4.4.3 Conclusion

Bis(2-ethylhexyl)phthalate in surface soil concentrations at the IAEU is carried forward into the ecological non-PMJM risk characterization as an ECOPC due to the presence of elevated concentrations (greater than three times the ESL) in surface soil at several locations near historical IHSSs.

4.5 Boron

Boron has an EPC in surface soil (for non-PMJM receptors) greater than the limiting tESL and, therefore, was carried forward to the professional judgment step. The lines of evidence used to determine if boron should be retained for risk characterization are summarized below.

4.5.1 Summary of Process Knowledge

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, process knowledge indicates boron is unlikely to be present in RFETS soil as a result of historical site-related activities.

4.5.2 Evaluation of Spatial Trends

Surface Soil (Non-PMJM)

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, the spatial trend analysis indicates that boron concentrations in IAEU surface soil reflect variations in naturally occurring boron.

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4.5.3 Pattern Recognition

Surface Soil (Non-PMJM)

The probability plot for the natural logarithm of all boron analytical results in the surface soil of the IAEU is shown in Figure A3.4.3a. The boron data represent a single unique background population but with a severe number of detection limit stair-steps in the lower half of the concentration range. Figure A3.4.3b includes the last major stair- step of the lower half of the population and shows the actual upper part of the boron background population. Figure A3.4.3c shows three discrete stair-steps formed by detection limits in this lower half of the population range.

4.5.4 Comparison to RFETS Background and Other Background Data Sets

Surface Soil (Non-PMJM)

The reported range for boron in surface soil within Colorado and the bordering states is 20 to 150 milligrams per kilogram (mg/kg), with a mean concentration of 27.9 mg/kg and a standard deviation of 19.7 mg/kg (Table A3.4.1). Boron concentrations reported in surface soil samples at the IAEU is 0.350 to 28.0 mg/kg, with a mean concentration of 3.3 mg/kg and a standard deviation of 2.53 mg/kg, (Table A3.2.6). The range of concentrations of boron in surface soil within IAEU is well within the range for boron in soils of Colorado and the bordering states (Table A3.4.1).

4.5.5 Risk Potential for Plants and Wildlife

Surface Soil (Non-PMJM)

The MDC for boron in the IAEU (28.0 mg/kg) exceeds the no observed adverse effect level (NOAEL) ESL for only one receptor group, terrestrial plants (0.5 mg/kg). All other NOAEL ESLs were greater than the MDC and ranged from 30 to 6,070 mg/kg. Site-specific background data for boron were not available, but the IAEU boron MDC slightly exceeds the low end (20 mg/kg) of the background range presented in Shacklette and Boerngen (1984). This indicates the terrestrial plant NOAEL ESL (0.5 mg/kg) is well below expected background concentrations, and MDCs above the NOAEL ESL are not likely to be indicative of site-related risk to the terrestrial plant community in the IAEU. Kabata-Pendias and Pendias (1992) indicate soil with boron concentrations equal to 0.3 mg/kg is critically deficient in boron, and effects on plant reproduction would be expected. Additionally, the summary of boron toxicity in Efroymson et al. (1997) notes that the source of the 0.5 mg/kg NOAEL ESL indicates boron was toxic when added at 0.5 mg/kg to soil, but gives no indication of the boron concentration in the baseline soil before addition. The confidence placed by Efroymson et al. (1997) was low. Because no NOAEL ESLs other than the terrestrial plant NOAEL ESL are exceeded by the MDC, boron is unlikely to present a risk to terrestrial receptor populations in the IAEU.

4.5.6 Conclusion

The weight of evidence presented above shows that boron concentrations in IAEU surface soil (non-PMJM receptors) are not likely to be a result of historical site-related activities based on process knowledge; a spatial distribution that suggests boron is naturally occurring; and a probability plot that suggests the presence of a single population, which is also indicative of background conditions. In addition, the boron concentrations in surface soil within IAEU are well within regional background levels and IAEU concentrations that are unlikely to result in risk concerns for wildlife populations. Boron is not considered an ECOPC in surface soil for the IAEU and, therefore, is not further evaluated quantitatively.

4.6 Chromium

Chromium has an EPC in surface soil (for non-PMJM receptors) greater than the limiting tESL and, therefore, was carried forward to the professional judgment step. The lines of evidence used to determine if chromium should be retained for risk characterization are summarized below.

4.6.1 Summary of Process Knowledge

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, process knowledge indicates a potential for chromium to have been released into RFETS soil because of the moderate chromium metal inventory and presence of chromium in waste generated during former operations. Spills of chromium-contaminated wastes have also occurred at RFETS. Based on process knowledge, chromium may be present in RFETS soil, especially at IAEU, as a result of historical site-related activities.

4.6.2 Evaluation of Spatial Trends

Surface Soil (Non-PMJM)

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, the spatial trend analysis shows the concentrations of chromium at levels three times the background MDC at several locations in the IAEU, UWOEU, and WBEU that are near historical IHSSs. Therefore, the elevated concentrations of chromium in surface soil within IAEU suggest that chromium may be from historical site-related activities.

4.6.3 Conclusion

The weight of evidence presented above shows that chromium concentrations in IAEU surface soil (non-PMJM) may be a result of historical site-related activities based on process knowledge and the spatial distribution analysis that indicate the presence of elevated chromium concentrations within IAEU may be from historical site-related activities. Therefore, chromium is retained as an ECOPC and carried into risk characterization.

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4.7 Copper

Copper has an EPC in surface soil (for non-PMJM receptors) greater than the limiting tESL and, therefore, was carried forward to the professional judgment step. The lines of evidence used to determine if copper should be retained for risk characterization are summarized below.

4.7.1 Summary of Process Knowledge

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, process knowledge indicates a potential for copper to have been released into RFETS soil because of the moderate copper metal inventory and presence of copper in waste generated during former operations. Therefore, copper may be present in IAEU soil as a result of historical site-related activities.

4.7.2 Evaluation of Spatial Trends

Surface Soil (Non-PMJM)

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, the spatial trend analysis indicates that copper was detected above three times background in the IAEU at locations near historical IHSSs. Therefore, based on this line of evidence, copper in surface soil cannot be eliminated as an ECOPC in surface soils within the IAEU and will be evaluated in the risk characterization.

4.7.3 Conclusion

Based on the weight of evidence, copper may be present in the IAEU soil as a result of historical site-related activities. Because elevated concentrations of copper (greater than 10 times the ESL) were detected at various sampling locations within or near historical IHSSs at IAEU, copper is being carried forward into the ecological non-PMJM risk characterization.

4.8 Di-n-butylphthalate

Di-n-butylphthalate has an EPC in surface soil (for non-PMJM receptors) greater than the tESL and, therefore, was carried forward to the professional judgment step. The lines of evidence used to determine if di-n-butylphthalate should be retained risk characterization are summarized below.

4.8.1 Summary of Process Knowledge

There are no documented operations or activities that occurred in IAEU involving the use of di-n-butylphthalate (CDH 1992; DOE 1995; DOE 1992). Therefore, the potential for di-n-butylphthalate to be present in IAEU surface soil as a result of historical site-related activities is unlikely. However, because the IAEU was the place where facility operations were conducted, the use of di-n-butylphthalate in former buildings located within the IAEU cannot be discarded.

4.8.2 Evaluation of Spatial Trends

Surface Soil (Non-PMJM)

Di-n-butylphthalate was detected in only 8 percent of the 918 surface soil samples collected within IAEU. The di-n-butylphthalate concentrations in surface soils within IAEU range from 35.0 to 10,000 µg/kg, with a mean of 276 µg/kg and a standard deviation of 400 µg/kg. Therefore, all the detected concentrations (73 detected concentrations out of the total 918 samples) exceed the ESL of 16 µg/kg. As shown in Figure A3.4.4, the locations of the detections are near historical IHSS at IAEU. Thus it appears that di-n-butylphthalate concentrations in IAEU surface soil may show a pattern of release.

4.8.3 Conclusion

Di-n-butylphthalate in surface soil concentrations is being carried forward into the ecological non-PMJM risk characterization as an ECOPC because elevated concentrations in surface soil samples (greater than 3 times the ESL) were detected at several locations near historical IHSSs within the IAEU.

4.9 2,3,7,8-TCDD (TEQ)

2,3,7,8-TCDD (TEQ) has an EPC in surface soil (for non-PMJM receptors) greater than the limiting tESL and, therefore, was carried forward to the professional judgment step. The lines of evidence used to determine if 2,3,7,8-TCDD (TEQ) should be retained in the risk characterization are summarized below.

4.9.1 Summary of Process Knowledge

There are no documented operations or activities that occurred in the IAEU that involved the direct use of dioxins (CDM 1992; DOE 1995; DOE 1992). However, the IAEU was the location where operations occurred and dioxins are sometimes formed as by-products of incineration. Therefore, there is a potential for dioxins to be present in the IAEU surface soil as a result of historical site-related activities.

4.9.2 Evaluation of Spatial Trends

Surface Soil (Non-PMJM)

2,3,7,8-TCDD (TEQ) is not a naturally occurring compound and a background comparison cannot be performed. 2,3,7,8-TCDD (TEQ) was detected in all 12 surface soil samples collected at the IAEU. The concentrations in surface soil at the IAEU range from 0.028 to 0.842 µg/kg, with a mean of 0.259 µg/kg and a standard deviation of 0.248 µg/kg. The two locations where 2,3,7,8-TCDD (TEQ) concentrations were greater than three times the ESL are shown in Figure A3.4.5 for mammals. As shown in

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Figure A3.4.6, there is one location with concentrations greater than three times the ESL for 2,3,7,8-TCDD (TEQ) (birds). Based on this line of evidence, 2,3,7,8-TCDD (TEQ) cannot be eliminated as an ECOPC.

4.9.3 Conclusion

Because total dioxin was detected at all twelve sampling locations and some elevated concentrations exceed the ESL, total dioxin is retained as an ECOPC and carried forward into risk characterization.

4.10 Molybdenum

Molybdenum had an EPC in surface soil (for non-PMJM receptors) greater than the limiting tESL and, therefore, was carried forward to the professional judgment step. The lines of evidence used to determine if molybdenum should be retained for risk characterization are summarized below.

4.10.1 Summary of Process Knowledge

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, process knowledge indicates that molybdenum is unlikely to be present in RFETS soil as a result of historical site-related activities.

4.10.2 Evaluation of Spatial Trends

Surface Soil (Non-PMJM)

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, the spatial trend analysis indicates that molybdenum concentrations at the IAEU were detected above the background MDC based on the surface soil background data set for Colorado and bordering states. These locations are also near an historical IHSS. Therefore, based on this line of evidence, molybdenum in surface soil cannot be eliminated as an ECOPC in surface soil within IAEU and will be evaluated in the risk characterization.

4.10.3 Conclusion

Molybdenum in surface soil is being carried forward into the ecological non-PMJM risk characterization because elevated concentrations (greater than 10 times the ESL) were detected in surface soil samples located near historical IHSSs located within IAEU.

4.11 Total PCBs

Total PCBs has an EPC in surface soil (for non-PMJM receptors) greater than the tESL and, therefore, was carried forward to the professional judgment step. A decision could not be made whether concentrations in samples collected from EU are significantly elevated versus background because the background comparison is not performed for organics. The lines of evidence used to determine if total PCB should be retained in the risk characterization are summarized below.

4.11.1 Summary of Process Knowledge

There are no documented operations or activities that occurred in IAEU involving the use of total PCBs (CDH 1992; DOE 1995; DOE 1992). However, the IAEU was the location where facility operations were conducted. Therefore, there is a potential for total PCB to be present in IAEU surface soil as a result of historical site-related activities.

4.11.2 Evaluation of Spatial Trends

Surface Soil (Non-PMJM)

Total PCB was detected in 38 percent of the 483 surface samples collected from the IAEU with a concentration range of 24.0 to 12.300 µg/kg, with a mean concentration of 425 µg/kg and a standard deviation 1,298 µg/kg. Samples with total PCB concentrations three times the ESL of 42 µg/kg are located near historical IHSSs (Figure A3.4.6).

4.11.3 Conclusion

Total PCBs in surface soil is being carried forward into the ecological non-PMJM risk characterization as an ECOPC because the presence of elevated concentrations (greater than three times the ESL) in surface soil samples collected near historical IHSSs within the IAEU.

4.12 Tin

Tin has an EPC in surface soil (for non-PMJM receptors) greater than the tESL and, therefore, was carried forward to the professional judgment step. The lines of evidence used to determine if tin should be retained for risk characterization are summarized below.

4.12.1 Summary of Process Knowledge

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, process knowledge indicates a potential for tin to have been released into RFETS soil because of the moderate tin metal inventory during former operations. Based on process knowledge, tin may be present in RFETS soil as a result of historical site-related activities.

4.12.2 Evaluation of Spatial Trends

Surface Soil (Non-PMJM)

As discussed in Appendix A, Volume 2, Attachment 8 of the RI/FS Report, the spatial trend analysis indicates that tin MDCs and EPCs exceed the minimum ESL for the IAEU. Within the IAEU, there are several locations near historical IHSSs where tin concentrations are greater than three times background. Therefore, based on this line of evidence, tin in surface soil cannot be eliminated as an ECOPC for the IAEU.

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4.12.3 Conclusion

Tin in surface soil is being carried forward into the ecological non-PMJM risk characterization because of the presence of elevated tin concentrations (greater than 10 times the ESL) within or near historical IHSSs at the IAEU.

5.0 REFERENCES

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TABLES

Table A3.2.1

Statistical Distributions and Comparison to Background For IAEU Surface Soil/Surface Sediment

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background Data Set			IAEU Data Set (excluding background samples)					
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Test	1 - p	Statistically Greater than Background?
Inorganics									
Arsenic	**73**	**GAMMA**	**92**	**1,758**	**NONPARAMETRIC**	**98**	**WRS**	**0.00133**	**Yes**
Radionuclides									
Radium-228	40	GAMMA	100	99	NORMAL	100	WRS	0.169	No

WRS = Wilcoxon Rank Sum.

Bold = Analyte retained for further consideration in the next COC selection step.

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Table A3.2.2
Summary Statistics For Background and IAEU Surface Soil/Surface Sediment[a]

Analyte	Background					IAEU (excluding background samples)				
	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation
Inorganics (mg/kg)										
Arsenic	73	0.270	9.60	3.42	2.55	1,747	0.440	56.2	4.35	3.26
Organics (µg/kg)										
Benzo(a)pyrene	N/A	N/A	N/A	N/A	N/A	986	23	3,200	383	471
Radionuclides (pCi/g)										
Radium-228	40	0.200	4.10	1.60	0.80	99	0.490	3.15	1.64	0.56

[a] For inorganics and organics, statistics are computed using one-half the reported value for nondetects.

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Table A3.2.3

Statistical Distributions and Comparison to Background For IAEU Subsurface Soil/Subsurface Sediment

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background Data Set			IAEU Data Set (excluding background samples)			Test	1 - p	Statistically Greater than Background?
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Radionuclides									
Radium-228	31	GAMMA	100	128	NONPARAMETRIC	100	WRS	0.127	No

WRS = Wilcoxon Rank Sum.

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Table A3.2.4
Summary Statistics For Background and IAEU Subsurface Soil/Subsurface Sediment

Analyte	Background					IAEU (excluding background samples)				
	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation
Radionuclides (pCi/g)										
Radium-228	31	1.00	2.10	1.45	0.320	128	0	3.90	1.60	0.577

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Table A3.2.5

Statistical Distributions and Comparison to Background For IAEU Surface Soil (Non-PMJM Receptor)

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background Data Set			IAEU Data Set (excluding background samples)			Test	1 - p	Statistically Greater than Background?
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Inorganics									
Aluminum	20	NORMAL	100	1,667	NONPARAMETRIC	100	WRS	0.799	No
Antimony	**20**	**NONPARAMETRIC**	**0**	**1,602**	**NONPARAMETRIC**	**19**	**N/A**	**N/A**	**N/A**
Arsenic	20	NORMAL	100	1,658	NONPARAMETRIC	98	WRS	1.000	No
Barium	20	NORMAL	100	1,669	NONPARAMETRIC	100	WRS	1.000	No
Beryllium	20	NORMAL	100	1,663	NONPARAMETRIC	85	WRS	0.991	No
Boron	**N/A**	**N/A**	**N/A**	**1,029**	**GAMMA**	**84**	**N/A**	**N/A**	**N/A**
Cadmium	20	NONPARAMETRIC	65	1,662	NONPARAMETRIC	36	WRS	1.000	No
Chromium	**20**	**NORMAL**	**100**	**1,669**	**NONPARAMETRIC**	**100**	**WRS**	**0.0386**	**Yes**
Cobalt	20	NORMAL	100	1,667	NONPARAMETRIC	99	WRS	1.000	No
Copper	**20**	**NONPARAMETRIC**	**100**	**1,667**	**NONPARAMETRIC**	**99**	**WRS**	**0.0341**	**Yes**
Lead	20	NORMAL	100	1,658	NONPARAMETRIC	100	WRS	1.000	No
Lithium	20	NORMAL	100	1,689	NONPARAMETRIC	97	WRS	0.253	No
Manganese	20	NORMAL	100	1,662	NONPARAMETRIC	100	WRS	0.999	No
Mercury	20	NONPARAMETRIC	40	1,633	NONPARAMETRIC	56	WRS	1.000	No
Molybdenum	**20**	**NORMAL**	**0**	**1,667**	**NONPARAMETRIC**	**53**	**N/A**	**N/A**	**N/A**
Nickel	20	NORMAL	100	1,666	NONPARAMETRIC	98	WRS	0.290	No
Selenium	**20**	**NONPARAMETRIC**	**60**	**1,658**	**NONPARAMETRIC**	**6**	**N/A**	**N/A**	**N/A**
Silver	**20**	**NORMAL**	**0**	**1,667**	**NONPARAMETRIC**	**29**	**N/A**	**N/A**	**N/A**
Thallium	**14**	**NORMAL**	**0**	**1,649**	**NONPARAMETRIC**	**12**	**N/A**	**N/A**	**N/A**
Tin	**20**	**NORMAL**	**0**	**1,667**	**NONPARAMETRIC**	**8**	**N/A**	**N/A**	**N/A**
Uranium	**N/A**	**N/A**	**N/A**	**1,019**	**NONPARAMETRIC**	**10**	**N/A**	**N/A**	**N/A**
Vanadium	20	NORMAL	100	1,667	NONPARAMETRIC	100	WRS	0.797	No
Zinc	20	NORMAL	100	1,667	NONPARAMETRIC	100	WRS	0.731	No

WRS = Wilcoxon Rank Sum.

N/A = not applicable; site and/or background detection frequency less than 20%.

Bold = indicate ECOIs retained for further consideration in the upper-bound EPC comparison step.

-- = Screen not performed because analyte was eliminated from further consideration in a previous ECOPC screening step.

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Table A3.2.6

Summary Statistics For Background and IAEU Surface Soil (Non-PMJM)[a]

Analyte	Background					IAEU (excluding background samples)				
	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation
Inorganics (mg/kg)										
Aluminum	20	4,050	17,100	10,200	3,260	1,667	1,450	61,000	10,700	6,800
Antimony	20	ND	ND	0.279	0.078	1,602	0.270	29.0	1.05	2.02
Arsenic	20	2.30	9.60	6.09	2.00	1,658	0.440	56.2	4.39	3.28
Barium	20	45.7	134	102	19.4	1,669	0.640	1,500	77.7	56.9
Beryllium	20	0.240	0.900	0.660	0.152	1,663	0.071	26.8	0.610	0.818
Boron	N/A	N/A	N/A	N/A	N/A	1,029	0.350	28.0	3.31	2.53
Cadmium	20	0.670	2.30	0.708	0.455	1,662	0.060	270	0.840	7.23
Chromium	20	5.50	16.9	11.2	2.78	1,669	1.20	210	16.2	15.5
Cobalt	20	3.40	11.2	7.27	1.79	1,667	1.10	137	6.38	6.22
Copper	20	5.20	16.0	13.0	2.58	1,667	1.70	1,860	24.2	65.1
Lead	20	8.60	53.3	33.5	10.5	1,658	2.30	590	19.1	30.1
Lithium	20	4.80	11.6	7.66	1.89	1,689	0.990	50.0	8.60	4.16
Manganese	20	129	357	237	63.9	1,662	15.0	1,240	199	117
Mercury	20	0.090	0.120	0.072	0.031	1,633	0.001	48.0	0.077	1.19
Molybdenum	20	ND	ND	0.573	0.184	1,667	0.140	12.6	0.905	1.01
Nickel	20	3.80	14.0	9.60	2.59	1,666	1.90	280	12.0	12.2
Selenium	20	0.680	1.40	0.628	0.305	1,658	0.300	2.00	0.363	0.165
Silver	20	ND	ND	0.207	0.007	1,667	0.058	364	1.02	9.52
Thallium	14	ND	ND	0.414	0.015	1,649	0.100	5.80	0.460	0.403
Tin	20	ND	ND	2.06	0.410	1,667	0.750	161	2.23	6.45
Uranium	N/A	N/A	N/A	N/A	N/A	1,019	0.430	370	1.82	14.0
Vanadium	20	10.8	45.8	27.7	7.68	1,667	4.40	184	27.5	13.1
Zinc	20	21.1	75.9	49.8	12.2	1,667	4.20	11,900	88.5	323
Organics (µg/kg)										
2,4,6-Trichlorophenol	N/A	N/A	N/A	N/A	N/A	915	950	950	275	236
4,4'-DDT	N/A	N/A	N/A	N/A	N/A	204	9.10	9.10	8.80	8.98
Benzo(a)pyrene	N/A	N/A	N/A	N/A	N/A	917	36	3,200	390	482
bis(2-ethylhexyl)phthalate	N/A	N/A	N/A	N/A	N/A	918	29	75,000	447	2,601
Di-n-butylphthalate	N/A	N/A	N/A	N/A	N/A	918	35	10,000	276	400
2,3,7,8-TCDD TEQ (bird)	N/A	N/A	N/A	N/A	N/A	12	4.29E-05	0.0719	0.0142	0.0202
2,3,7,8-TCDD TEQ (mammal)	N/A	N/A	N/A	N/A	N/A	12	1.24E-04	0.0188	0.00627	0.00557
Total PCBs	N/A	N/A	N/A	N/A	N/A	483	24	12,300	425	1,298
Tetrachloroethene	N/A	N/A	N/A	N/A	N/A	578	0.790	29,000	54.1	1,206

[a] For inorganics and organics, statistics are computed using one-half the reported value for nondetects.

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Table A3.2.7

Statistical Distributions and Comparison to Background for IAEU Subsurface Soil

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background			IAEU (excluding background samples)			Test	1 - p	Statistically Greater than Background?
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Inorganics									
Antimony	**28**	**NONPARAMETRIC**	**7**	**2,380**	**NONPARAMETRIC**	**22**	**N/A**	**N/A**	**N/A**
Arsenic	**45**	**NONPARAMETRIC**	**93**	**2,519**	**NONPARAMETRIC**	**99**	**WRS**	**0.101**	**Yes**
Cadmium	**37**	**NONPARAMETRIC**	**5**	**2,512**	**NONPARAMETRIC**	**31**	**N/A**	**N/A**	**N/A**
Chromium	45	GAMMA	100	2,519	NONPARAMETRIC	100	WRS	0.586	No
Copper	45	NORMAL	96	2,519	NONPARAMETRIC	99	WRS	0.196	No
Manganese	45	GAMMA	100	2,519	NONPARAMETRIC	100	WRS	0.164	No
Mercury	41	NONPARAMETRIC	29	2,460	NONPARAMETRIC	78	WRS	1.000	No
Molybdenum	45	NONPARAMETRIC	67	2,516	NONPARAMETRIC	61	WRS	1	No
Nickel	44	GAMMA	100	2,519	NONPARAMETRIC	99	WRS	1.000	No
Selenium	**38**	**LOGNORMAL**	**0**	**2,519**	**NONPARAMETRIC**	**11**	**N/A**	**N/A**	**N/A**
Tin	**41**	**NONPARAMETRIC**	**37**	**2,497**	**NONPARAMETRIC**	**10**	**N/A**	**N/A**	**N/A**
Uranium	**N/A**	**N/A**	**N/A**	**2,097**	**NONPARAMETRIC**	**11**	**N/A**	**N/A**	**N/A**
Vanadium	45	NORMAL	98	2,519	NONPARAMETRIC	100	WRS	0.769	No
Zinc	44	NORMAL	100	2,516	NONPARAMETRIC	100	WRS	0.906	No

WRS = Wilcoxon Rank Sum.

N/A = Not applicable; site and/or background detection frequency less than 20%.

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Table A3.2.8

Summary Statistics for Background and IAEU Subsurface Soil[a]

Analyte	Background					IAEU (excluding background samples)				
	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Concentration	Standard Deviation
Inorganics (mg/kg)										
Antimony	28	2.90	8.20	4.21	2.78	2,424	0.180	19.3	0.840	2.05
Arsenic	45	1.70	41.8	5.48	6.02	2,519	0.480	69.7	5.82	4.34
Cadmium	37	1.40	1.50	0.569	0.254	2,512	0.040	547	1.31	17.7
Chromium	45	5.80	69.6	18.4	11.9	2,519	1.20	11,000	22.7	220
Copper	45	2.20	31.6	11.6	6.09	2,519	0.700	1,190	17.2	44.5
Manganese	45	16.0	747	171	158	2,519	8.80	3,140	177	176
Mercury	41	0.190	0.640	0.155	0.166	2,460	0.002	16.0	0.081	0.404
Molybdenum	45	3.50	41.0	13.5	7.80	2,516	0.140	4,100	2.58	81.8
Nickel	44	4.30	54.2	20.9	11.1	2,519	0.720	670	15.4	19.3
Selenium	38	ND	ND	0.592	0.543	2,519	0.060	4.30	0.414	0.266
Tin	41	25.7	441	86.0	134	2,497	0.470	392	2.30	9.87
Uranium	N/A	N/A	N/A	N/A	N/A	2,097	0.540	1,600	2.68	37.1
Vanadium	45	11.4	70.0	33.8	14.8	2,519	3.00	740	33.2	21.8
Zinc	44	0.520	79.8	36.2	21.0	2,516	2.20	1,800	39.8	70.7
Organics (µg/kg)										
2,3,7,8-TCDD TEQ (bird)	N/A	N/A	N/A	N/A	N/A	17	3.10E-07	0.0135	0.00133	0.00350
2,3,7,8-TCDD TEQ (mammal)	N/A	N/A	N/A	N/A	N/A	17	3.10E-07	0.00301	5.04E-04	9.81E-04
Tetrachloroethene	N/A	N/A	N/A	N/A	N/A	3,020	0.250	197,000	338	6,246
Xylene	N/A	N/A	N/A	N/A	N/A	3,004	0.110	115,000	49.0	2,101

[a] For inorganics and organics, statistics are computed using one-half the reported value for nondetects.

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Table A3.4.1
Summary of Element Concentrations in Colorado and Bordering States Surface Soil[a]

Analyte	Total Number of Results	Detection Frequency (%)	Range of Detected Values (mg/kg)	Average (mg/kg)[b]	Standard Deviation (mg/kg)[b]
Aluminum	303	100	5,000 - 100,000	50,800	23,500
Antimony	84	15.0	1.038 - 2.531	0.647	0.378
Arsenic	307	99.0	1.224 - 97	6.9	7.64
Barium	342	100	100 - 3,000	642	330
Beryllium	342	36.0	1 - 7	0.991	0.876
Boron	342	67.0	20 - 150	27.9	19.7
Bromine	85	51.0	0.5038 - 3.522	0.681	0.599
Calcium	342	100	0.055 - 32	3.09	4.13
Carbon	85	100	0.3 - 10	2.18	1.92
Cerium	291	16.0	150 - 300	90	38.4
Chromium	342	100	3 - 500	48.2	41
Cobalt	342	88.6	3 - 30	8.09	5.03
Copper	342	100	2 - 200	23.1	17.7
Fluorine	264	97.3	10 - 1,900	394	261
Gallium	340	99.1	5 - 50	18.3	8.9
Germanium	85	100	0.5777 - 2.146	1.18	0.316
Iodine	85	78.8	0.516 - 3.487	1.07	0.708
Iron	342	100	3,000 - 100,000	21,100	13,500
Lanthanum	341	66.3	30 - 200	39.8	28.8
Lead	342	92.7	10 - 700	24.8	41.5
Lithium	307	100	5 - 130	25.3	14.4
Magnesium	341	100	300 - 50,000	8,630	6,400
Manganese	342	100	70 - 2,000	414	272
Mercury	309	99.0	0.01 - 4.6	0.0768	0.276
Molybdenum	340	3.50	3 - 7	1.59	0.522
Neodymium	256	22.7	70 - 300	47.1	31.7
Nickel	342	96.5	5 - 700	18.8	39.8
Niobium	335	63.3	10 - 100	11.4	8.68
Phosphorus	249	100	40 - 4,497	399	397
Potassium	341	100	1,900 - 63,000	18,900	6,980
Rubidium	85	100	35 - 140	75.8	25
Scandium	342	85.1	5 - 30	8.64	4.69
Selenium	309	80.6	0.1023 - 4.3183	0.349	0.415
Silicon	85	100	149,340 - 413,260	302,000	61,500
Sodium	335	100	500 - 70,000	10,400	6,260
Strontium	342	100	10 - 2,000	243	212
Sulfur	85	16.5	816 - 47,760	1,250	5,300
Thallium	76	100	2.45 - 20.79	9.71	3.54

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Table A3.4.1
Summary of Element Concentrations in Colorado and Bordering States Surface Soil[a]

Analyte	Total Number of Results	Detection Frequency (%)	Range of Detected Values (mg/kg)	Average (mg/kg)[b]	Standard Deviation (mg/kg)[b]
Tin	85	96.5	0.117 - 5.001	1.15	0.772
Titanium	342	100	500 - 7,000	2,290	1,350
Uranium	85	100	1.11 - 5.98	2.87	0.883
Vanadium	342	100	7 - 300	73	41.7
Ytterbium	330	99.1	1 - 20	3.33	2.06
Yttrium	342	98.0	10 - 150	26.9	18.1
Zinc	330	100	10 - 2,080	72.4	159
Zirconium	342	100	30 - 1,500	220	157

[a] Based on data from Shacklette and Boerngen 1984 for the states of Colorado, Arizona, Kansas, Nebraska, New Mexico, Oklahoma, Utah, and Wyoming.
[b] One-half the detection limit used as proxy value for nondetects in computation of the mean and standard deviation.

FIGURES

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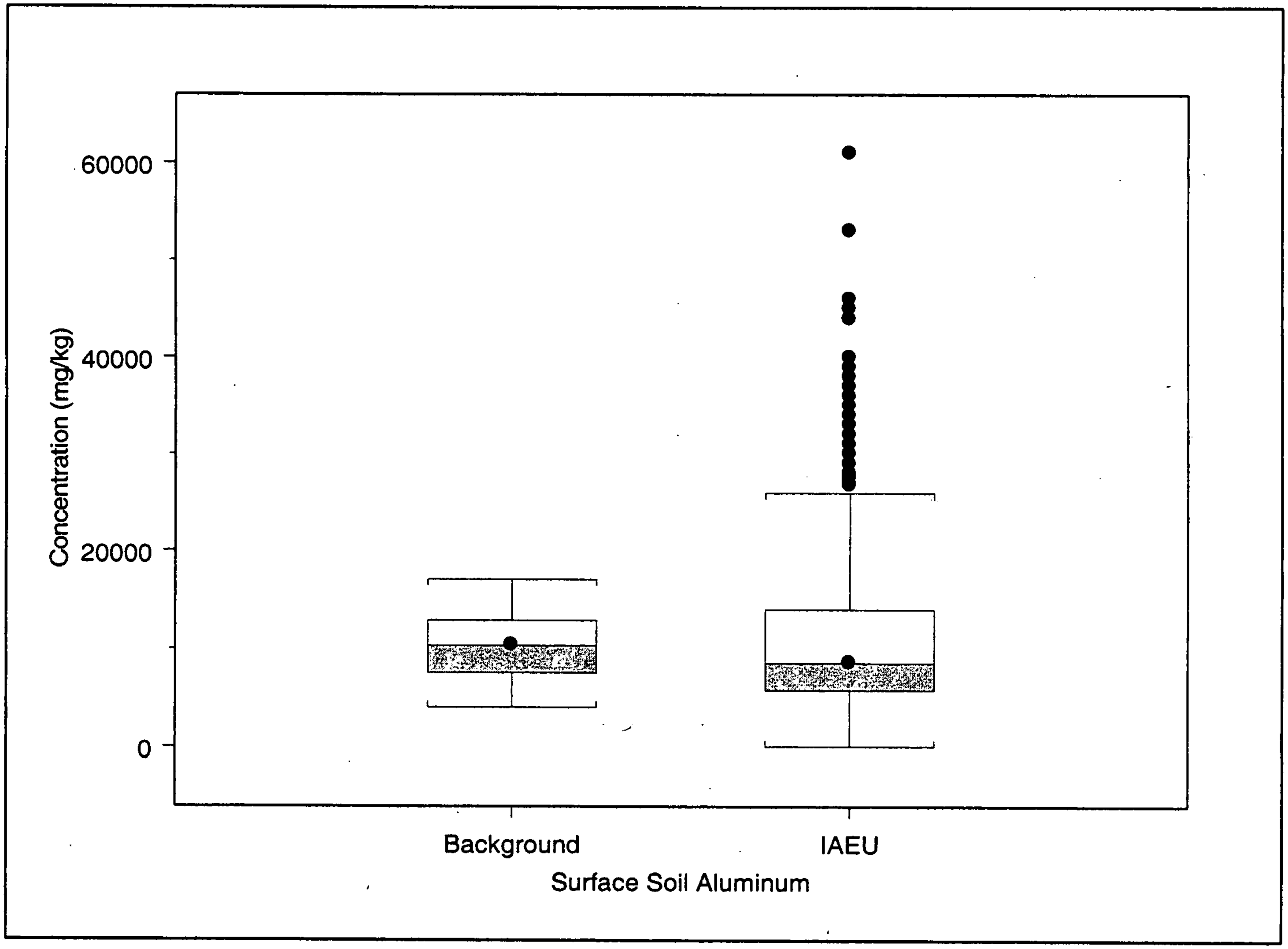
Figure A3.2.1
IAEU Surface Soil Box Plots for Aluminum



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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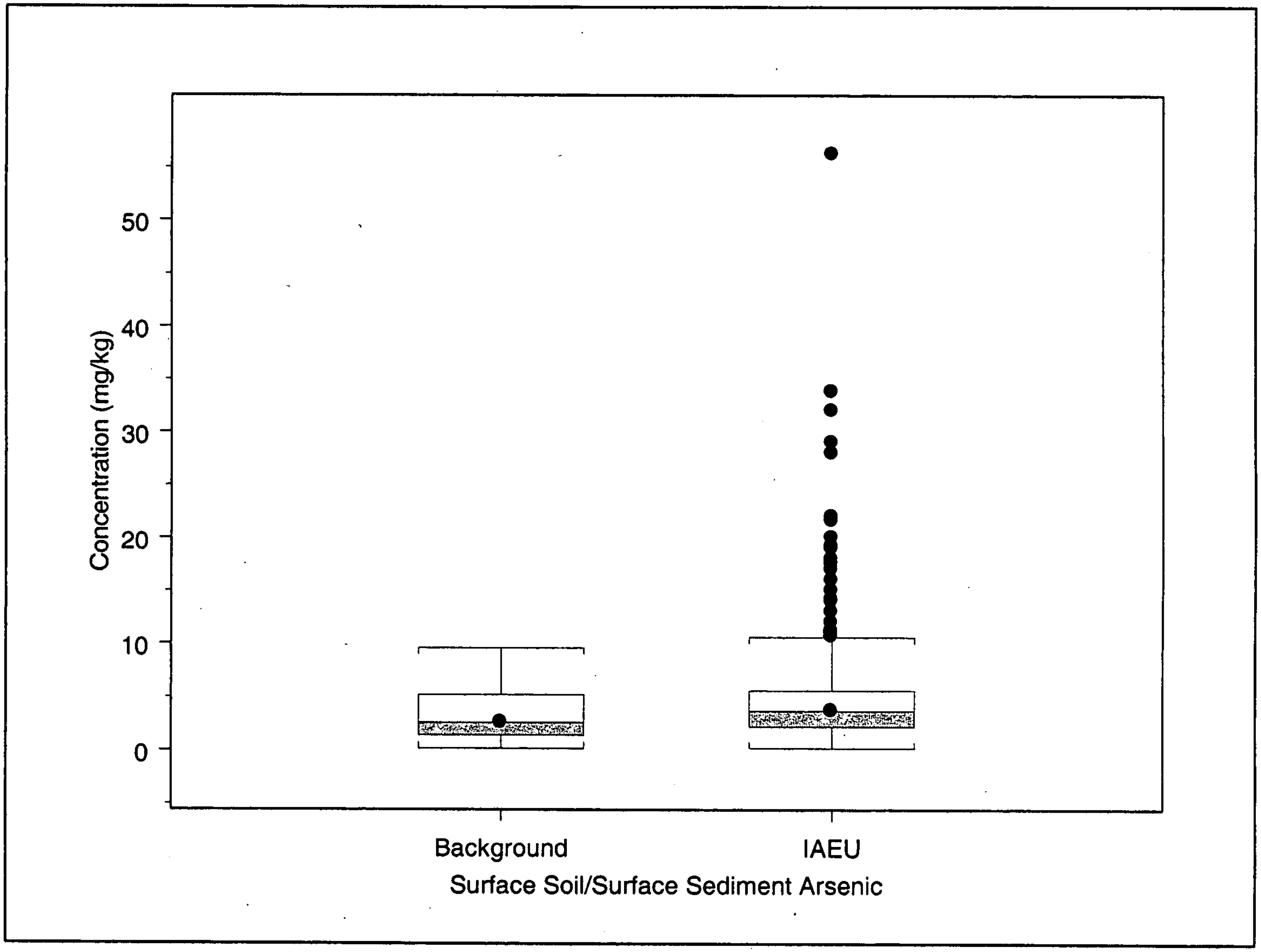
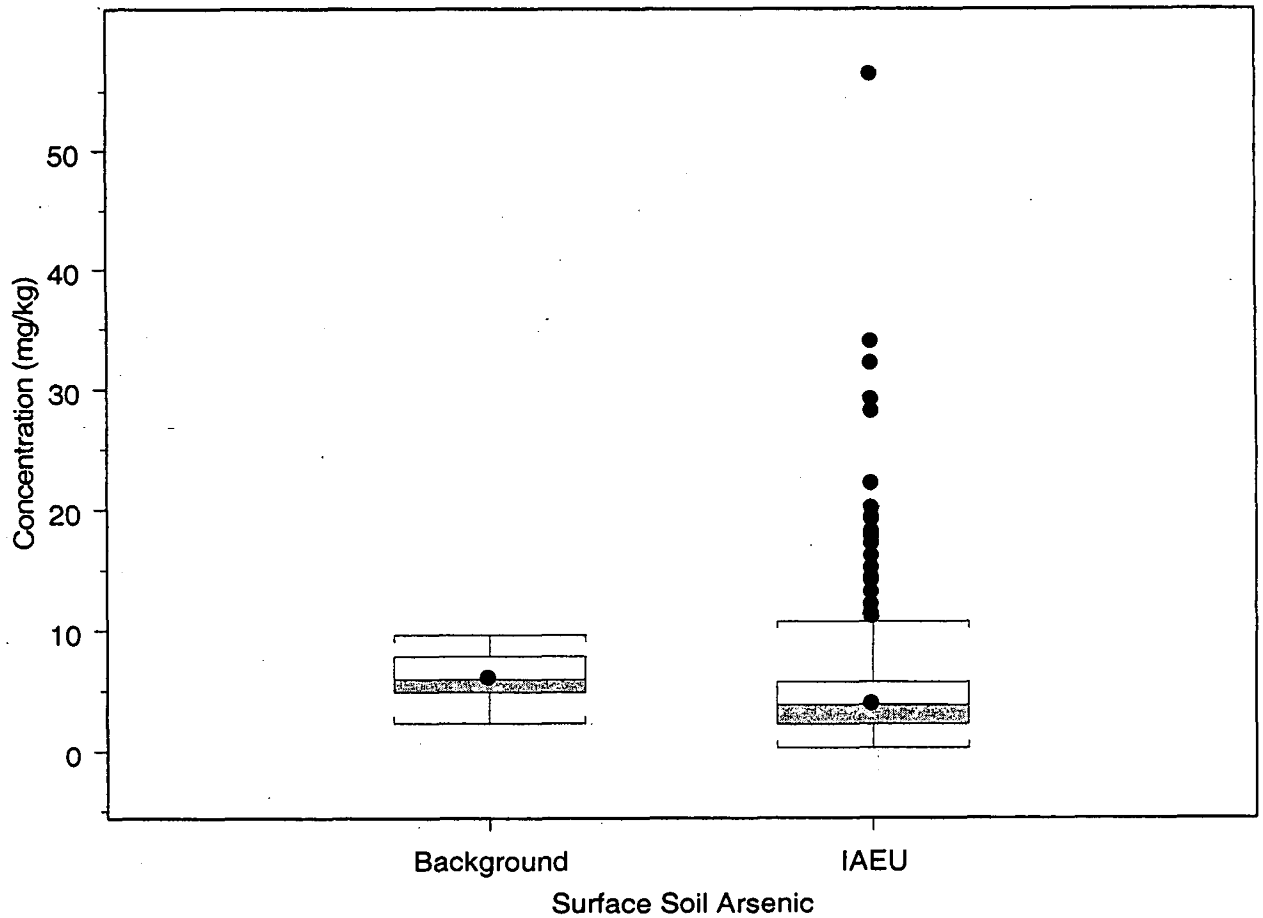
Figure A3.2.2
IAEU Surface Soil/Surface Sediment Box Plots for Arsenic



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.3
IAEU Surface Soil Box Plots for Arsenic



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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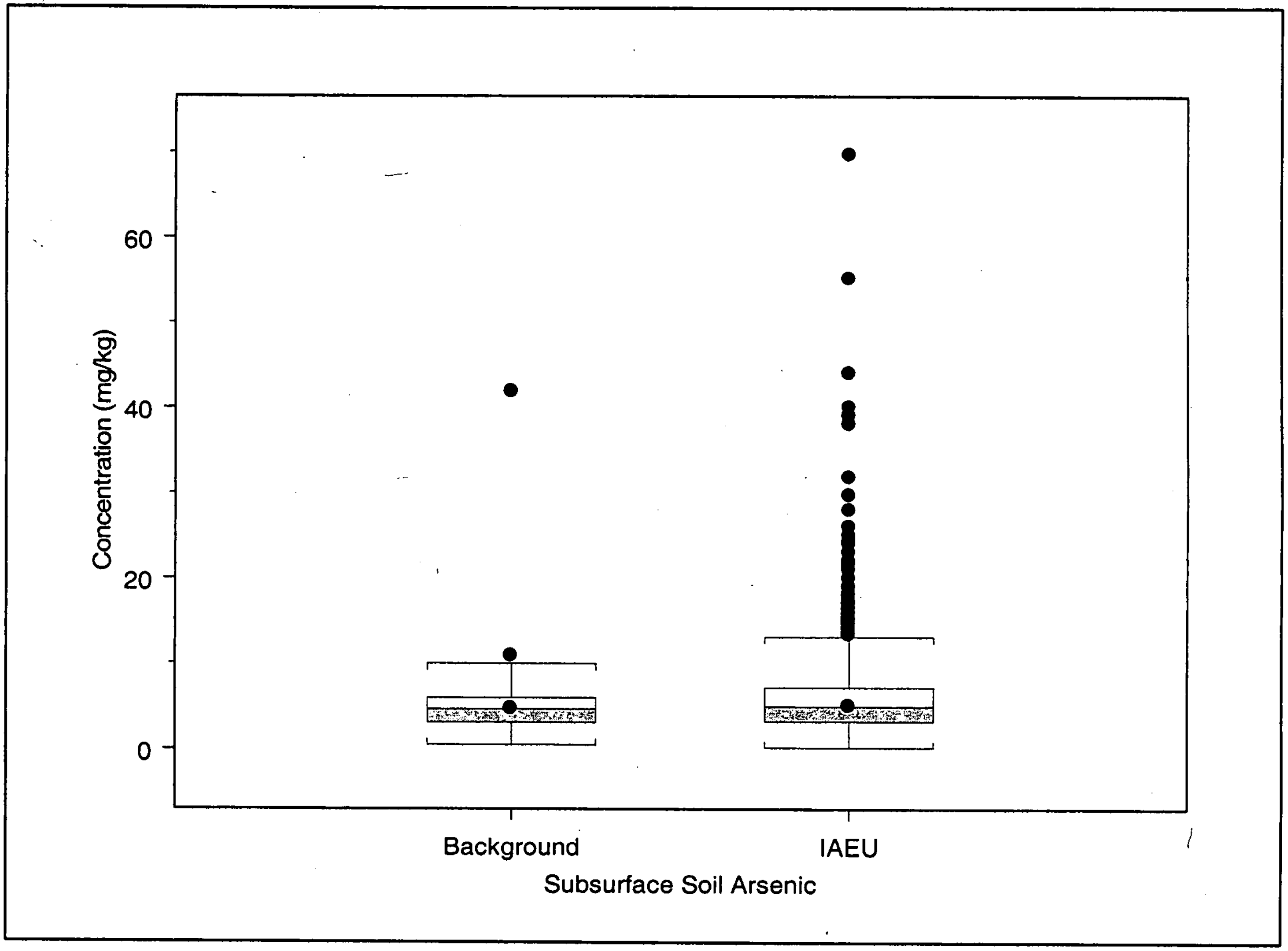
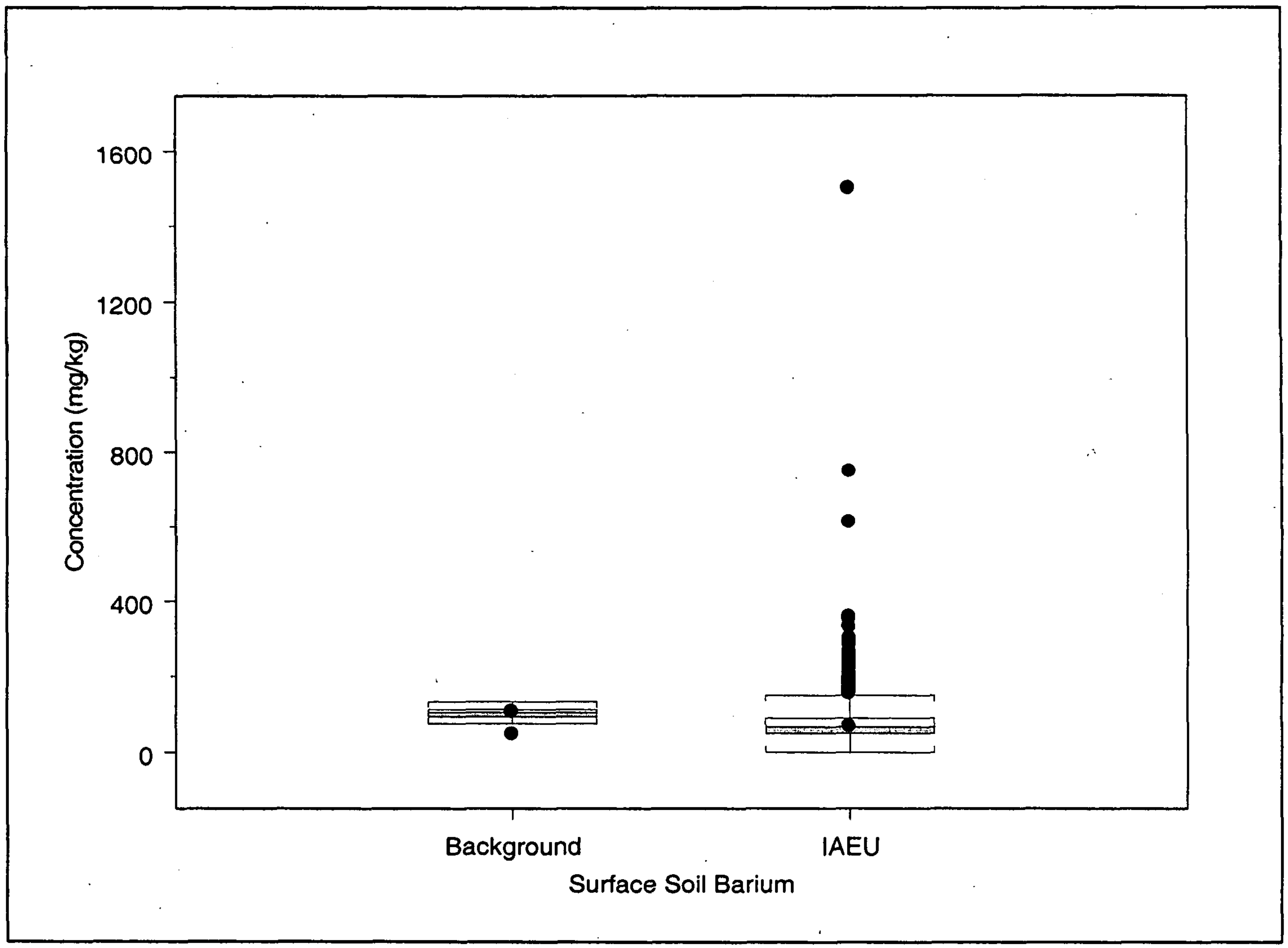
Figure A3.2.4
IAEU Subsurface Soil Box Plots for Arsenic



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

192

Figure A3.2.5
IAEU Surface Soil Box Plots for Barium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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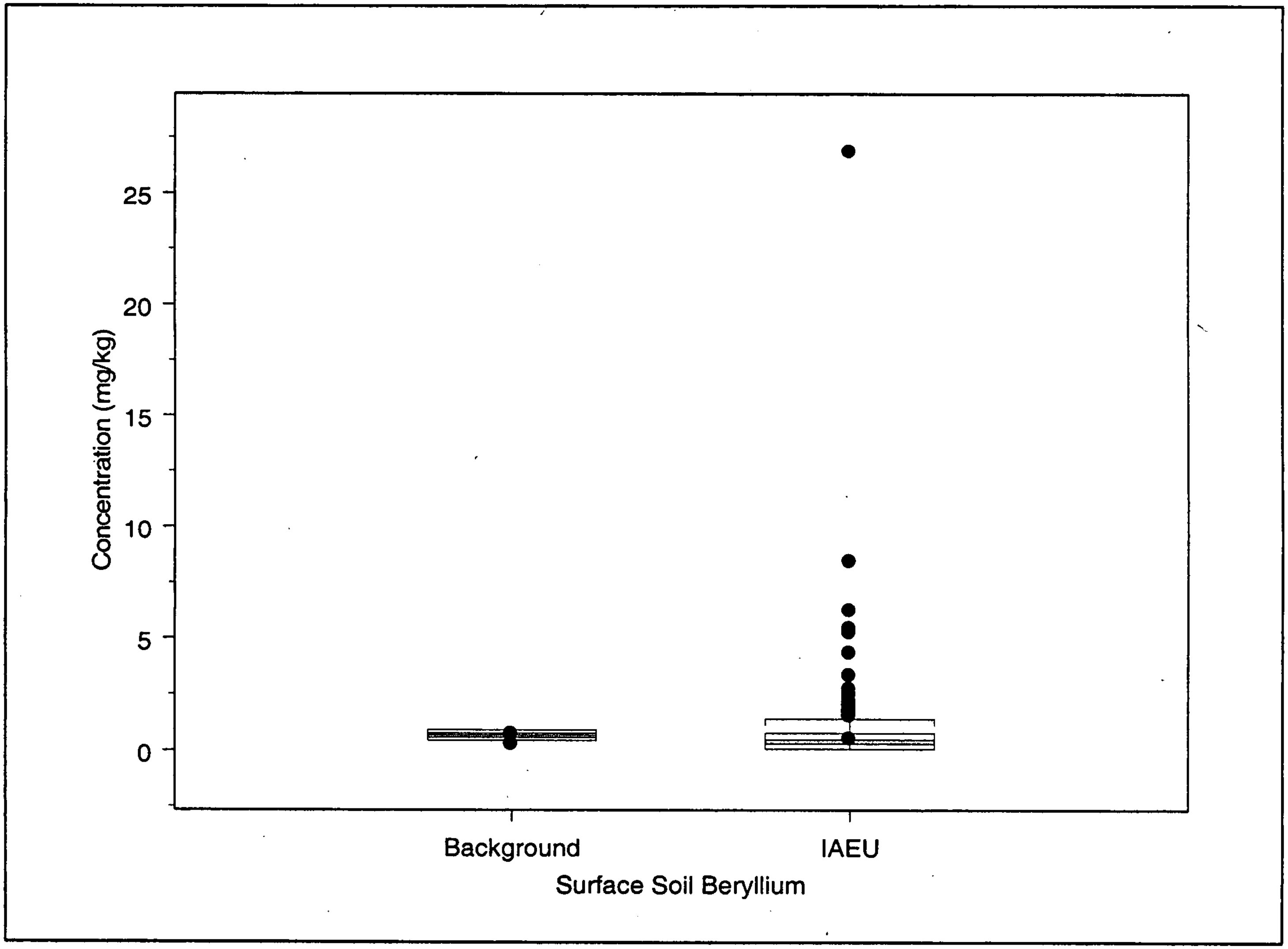
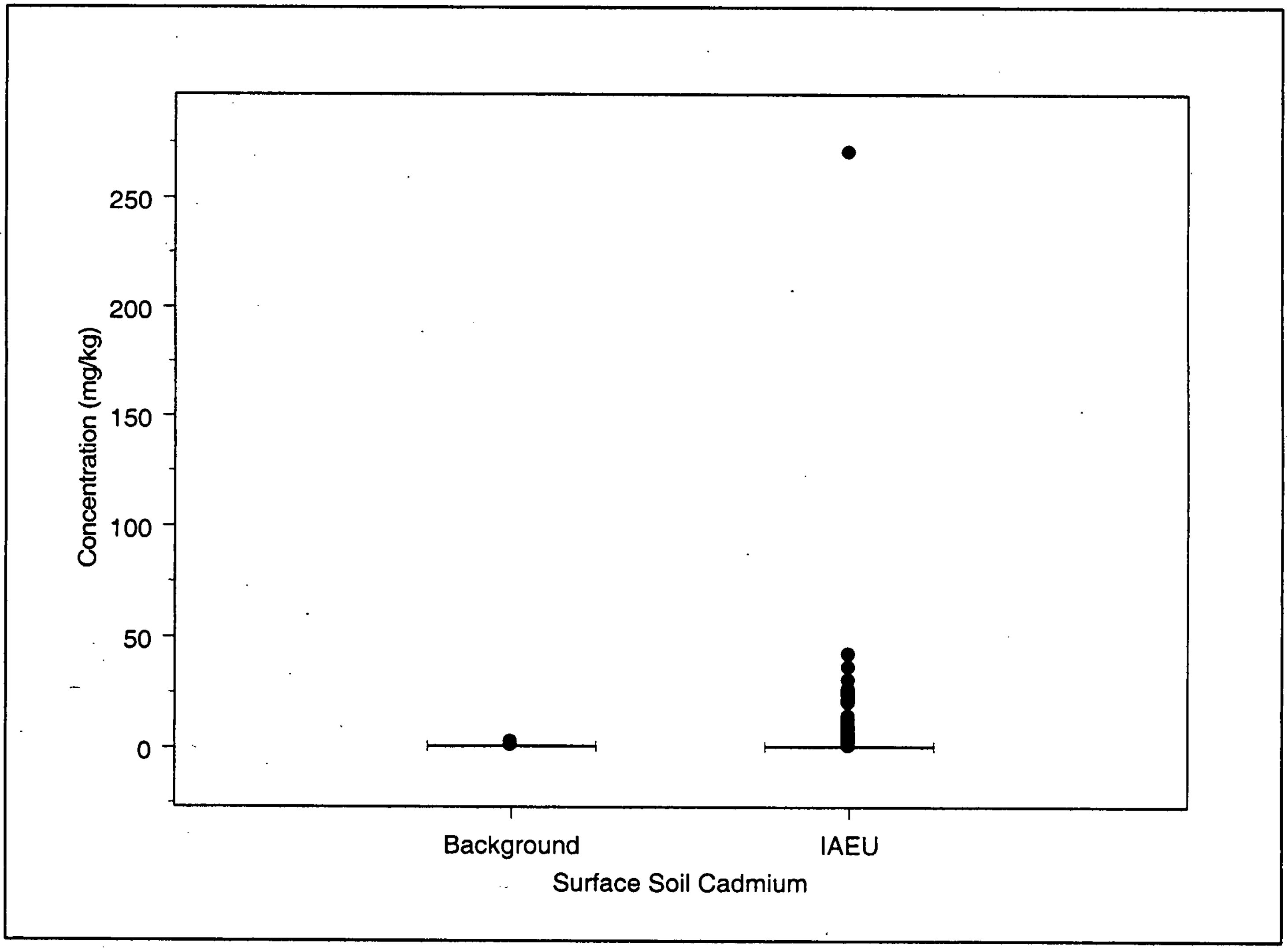
Figure A5.2.6
IAEU Surface Soil Box Plots for Beryllium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

263

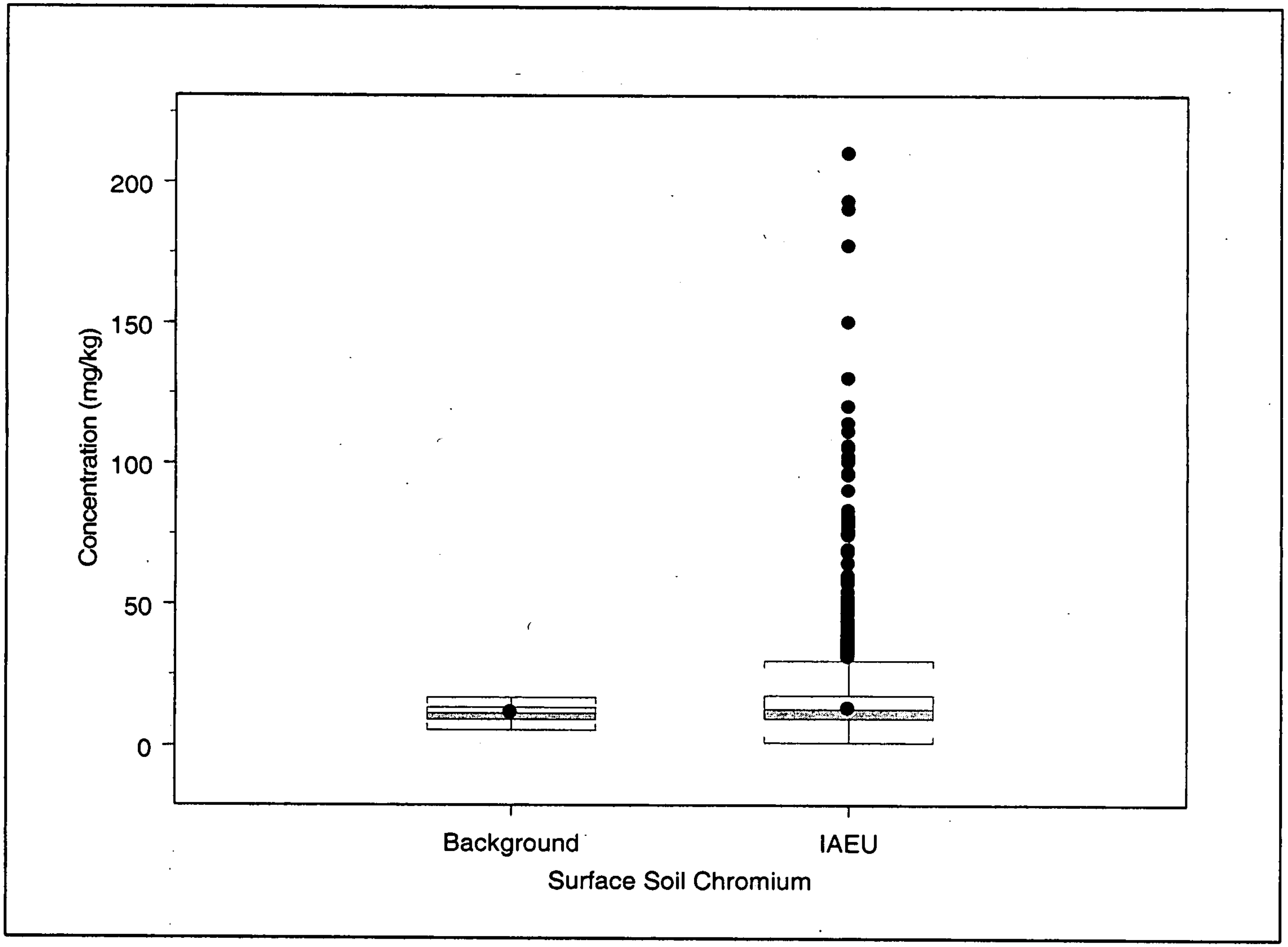
Figure [illegible]3.2.7
IAEU Surface Soil Box Plots for Cadmium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

264

Figure A3.2.8
IAEU Surface Soil Box Plots for Chromium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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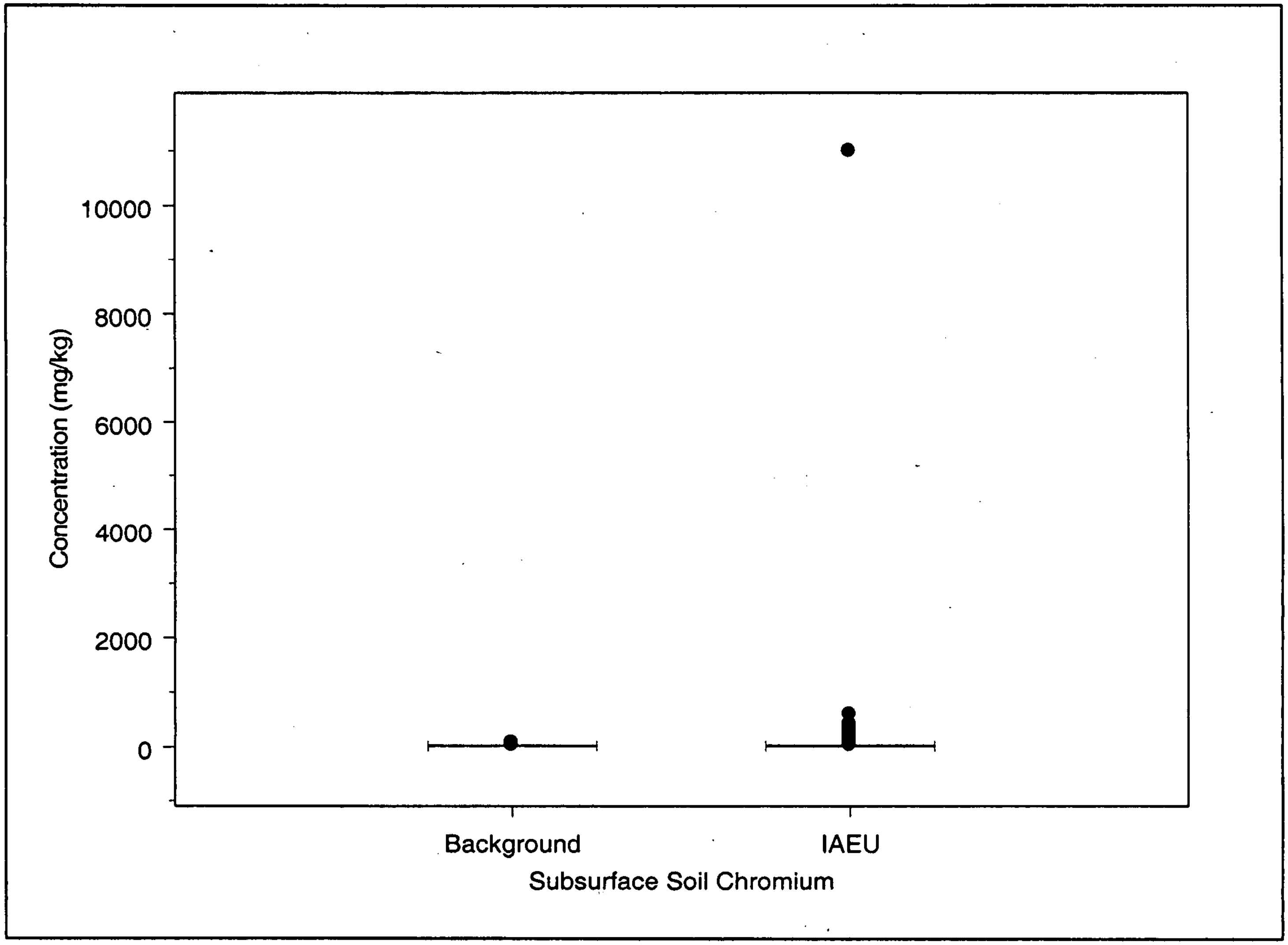
Figure A3.2.9
IAEU Subsurface Soil Box Plots for Chromium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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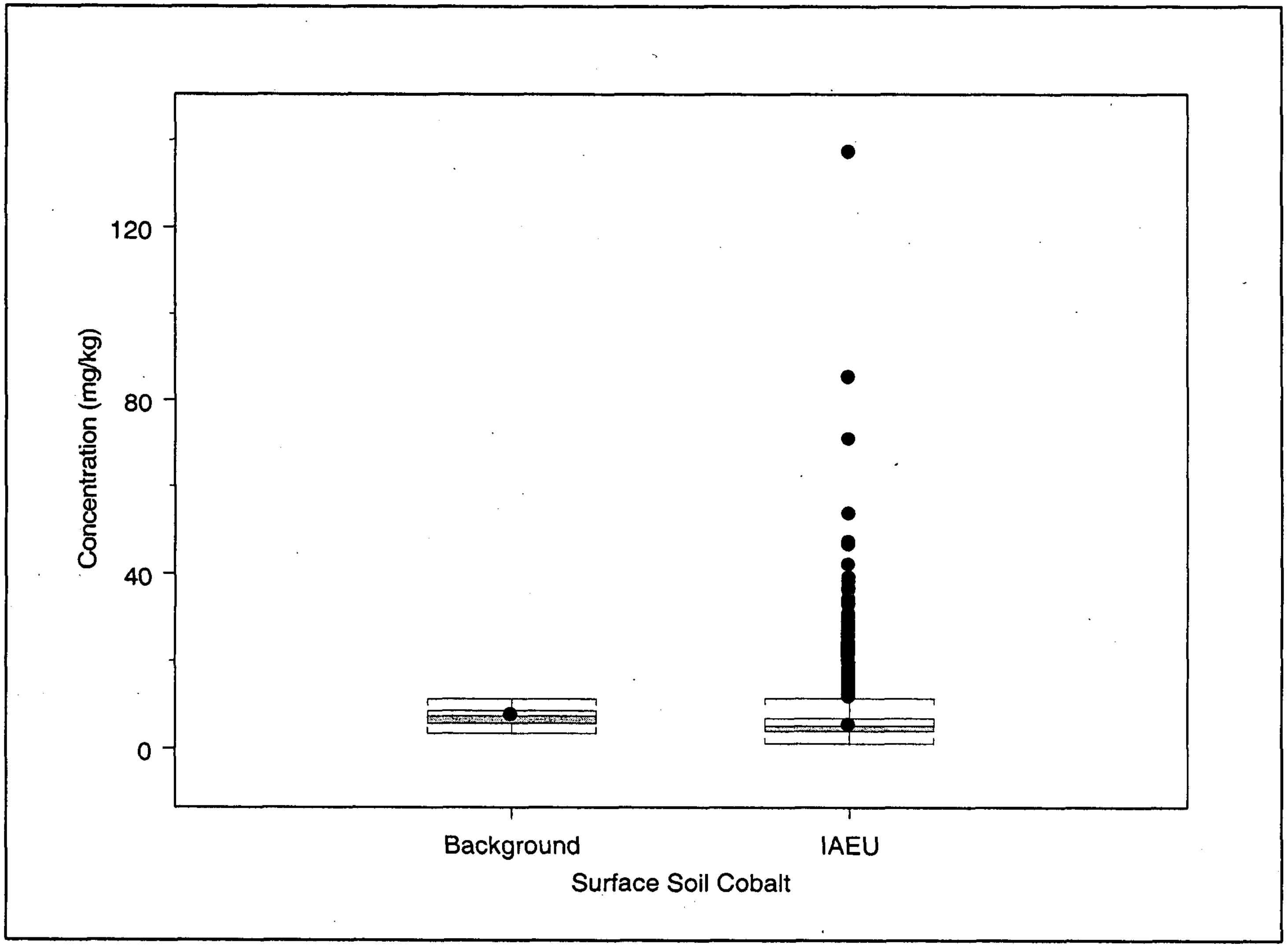
Figure A8.2.10
IAEU Surface Soil Box Plots for Cobalt



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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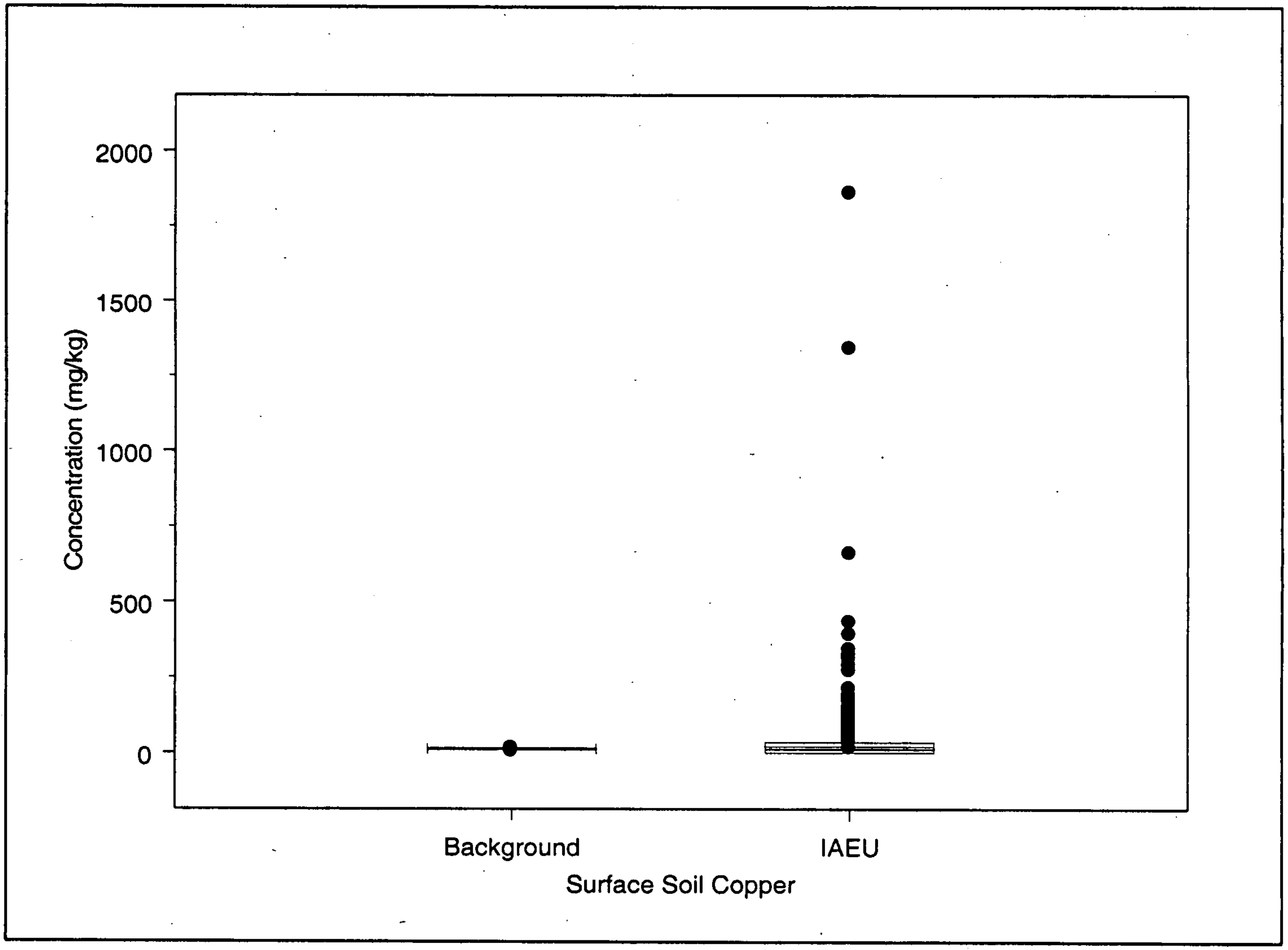
Figure A3.2.11
IAEU Surface Soil Box Plots for Copper



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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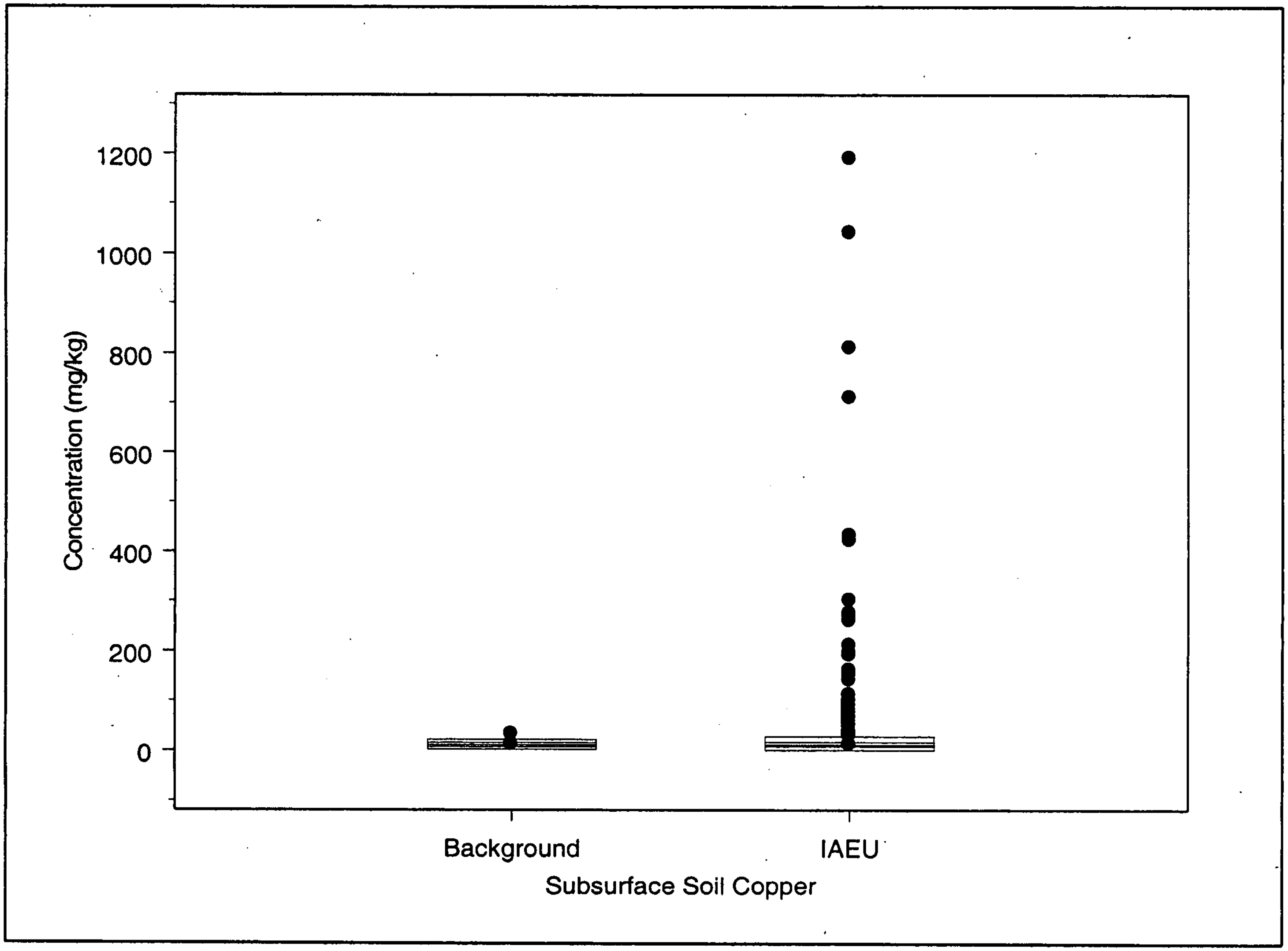
Figure [illegible].2.12
IAEU Subsurface Soil Box Plots for Copper



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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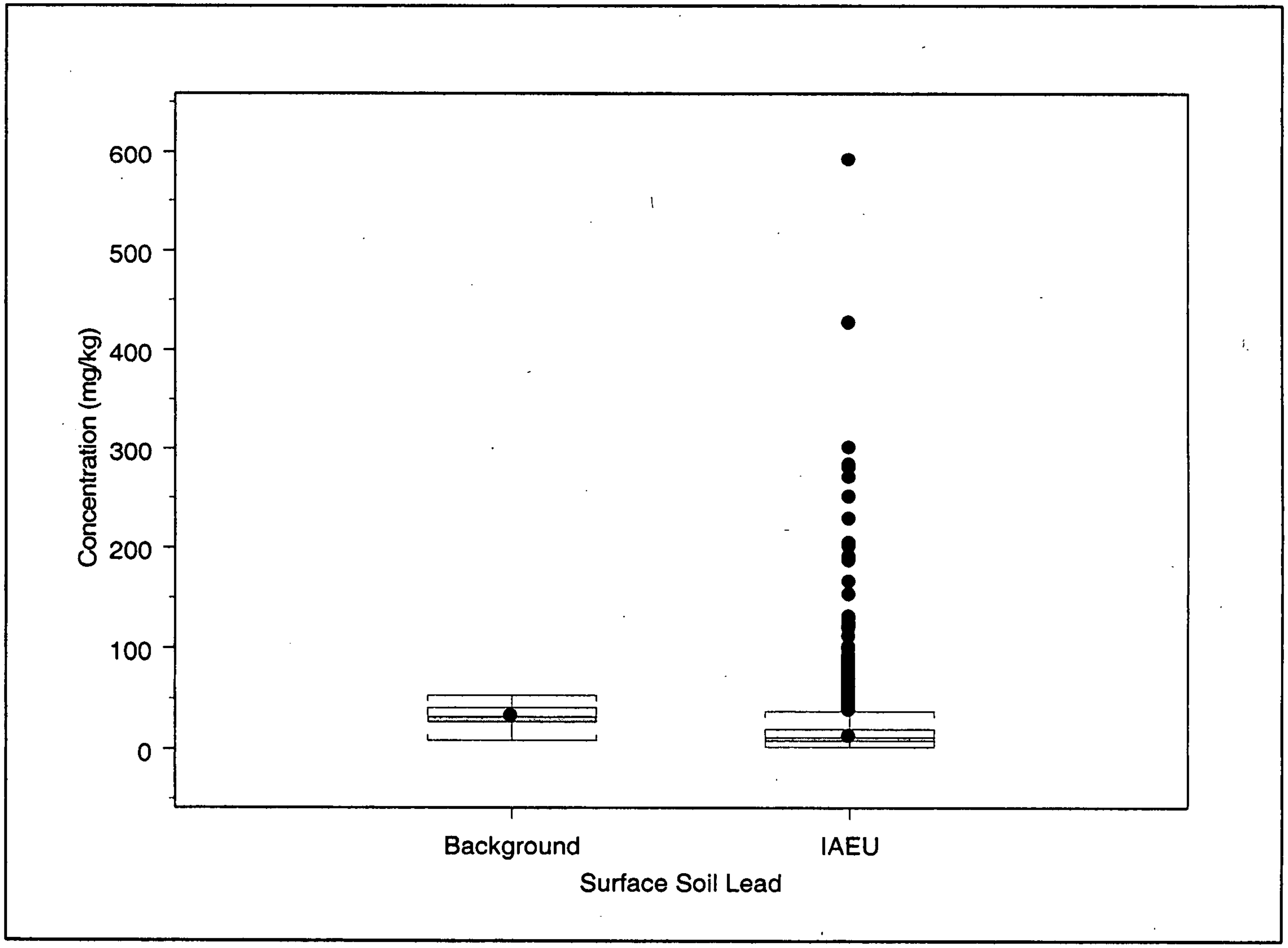
Figure A3.2.13
IAEU Surface Soil Box Plots for Lead



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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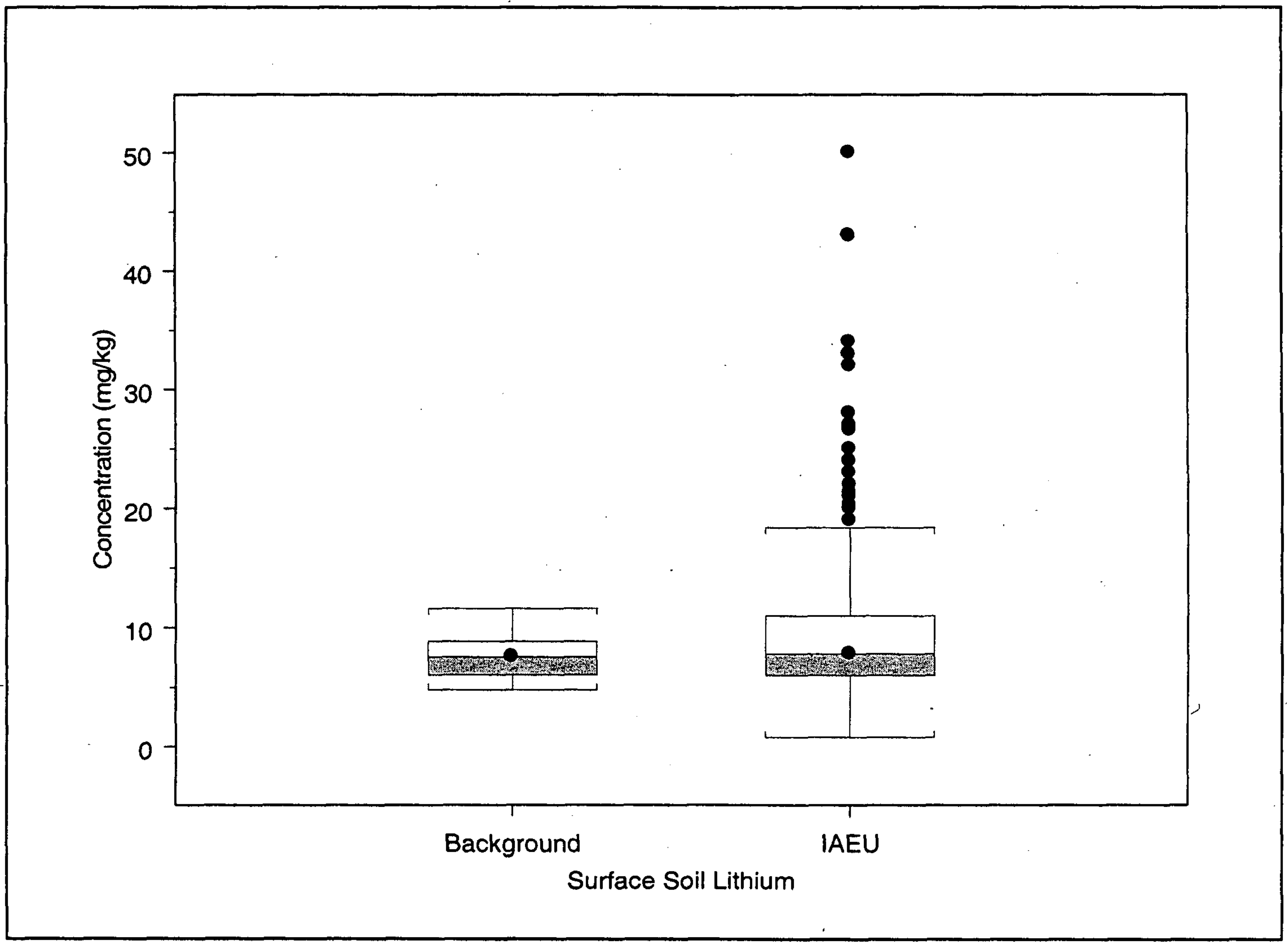
Figure A3.2.14
IAEU Surface Soil Box Plots for Lithium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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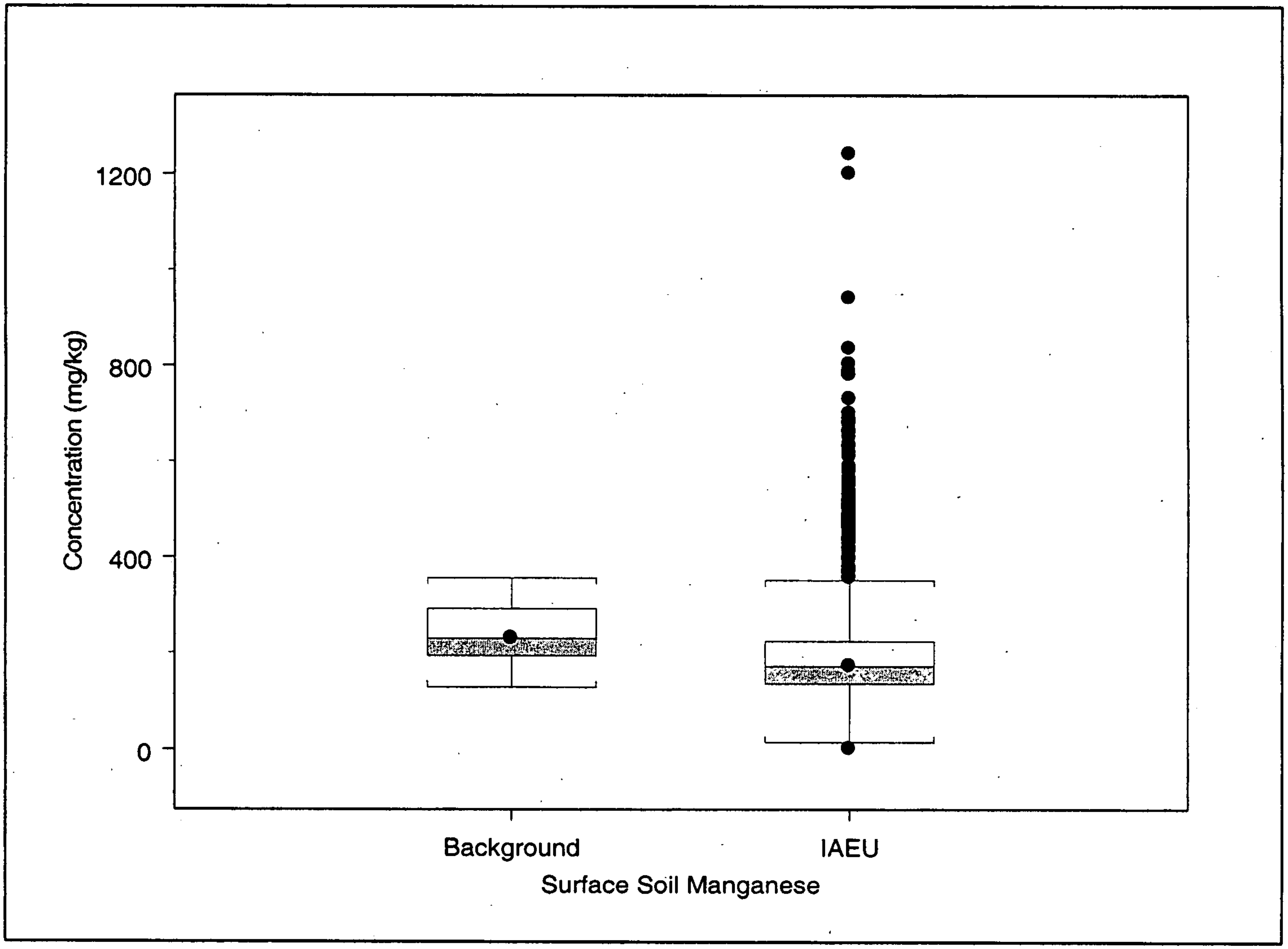
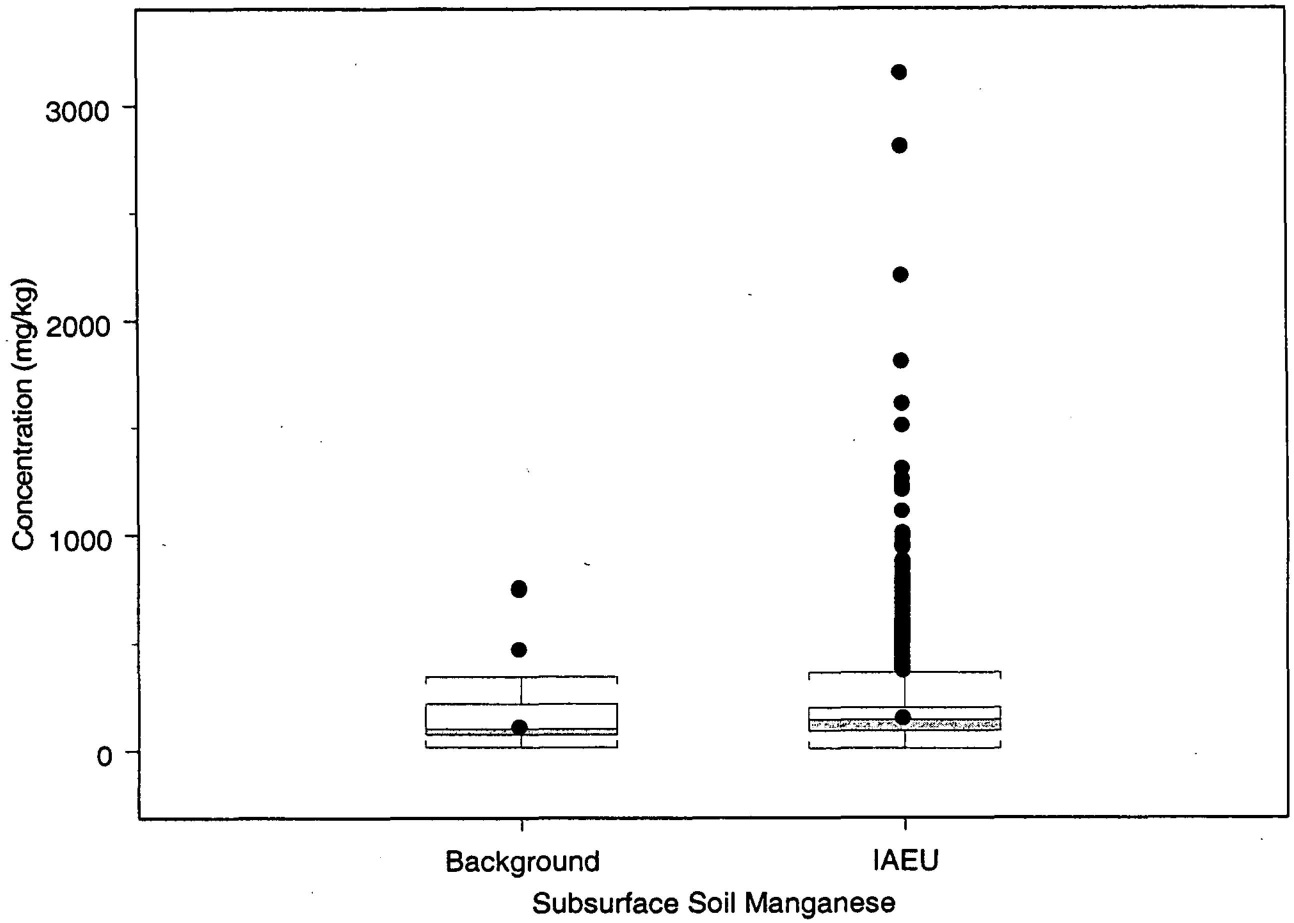
Figure A6.2.15
IAEU Surface Soil Box Plots for Manganese



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

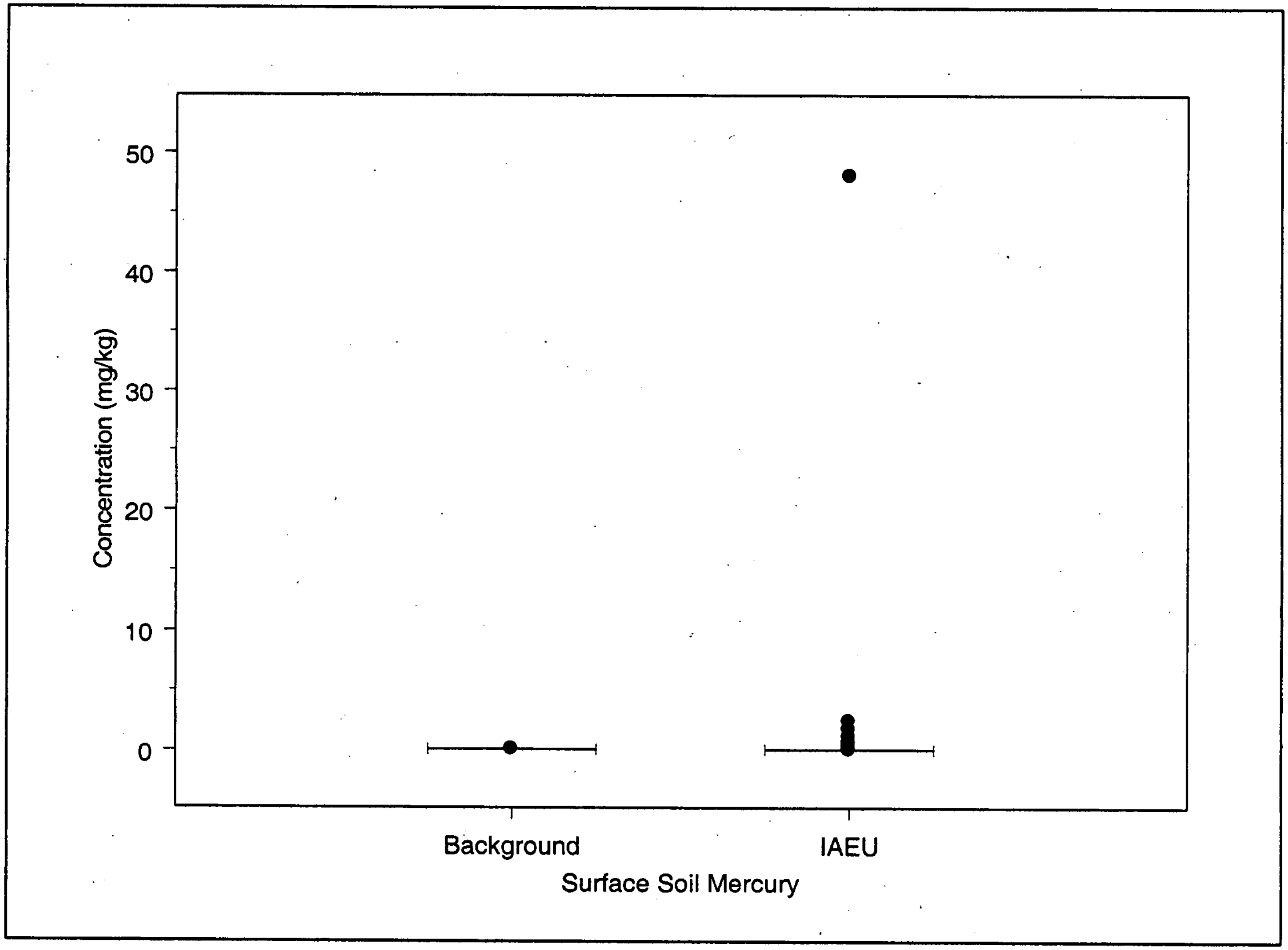
Figure A5.2.16
IAEU Subsurface Soil Box Plots for Manganese



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

273

Figur[illegible].2.17
IAEU Surface Soil Box Plots for Mercury



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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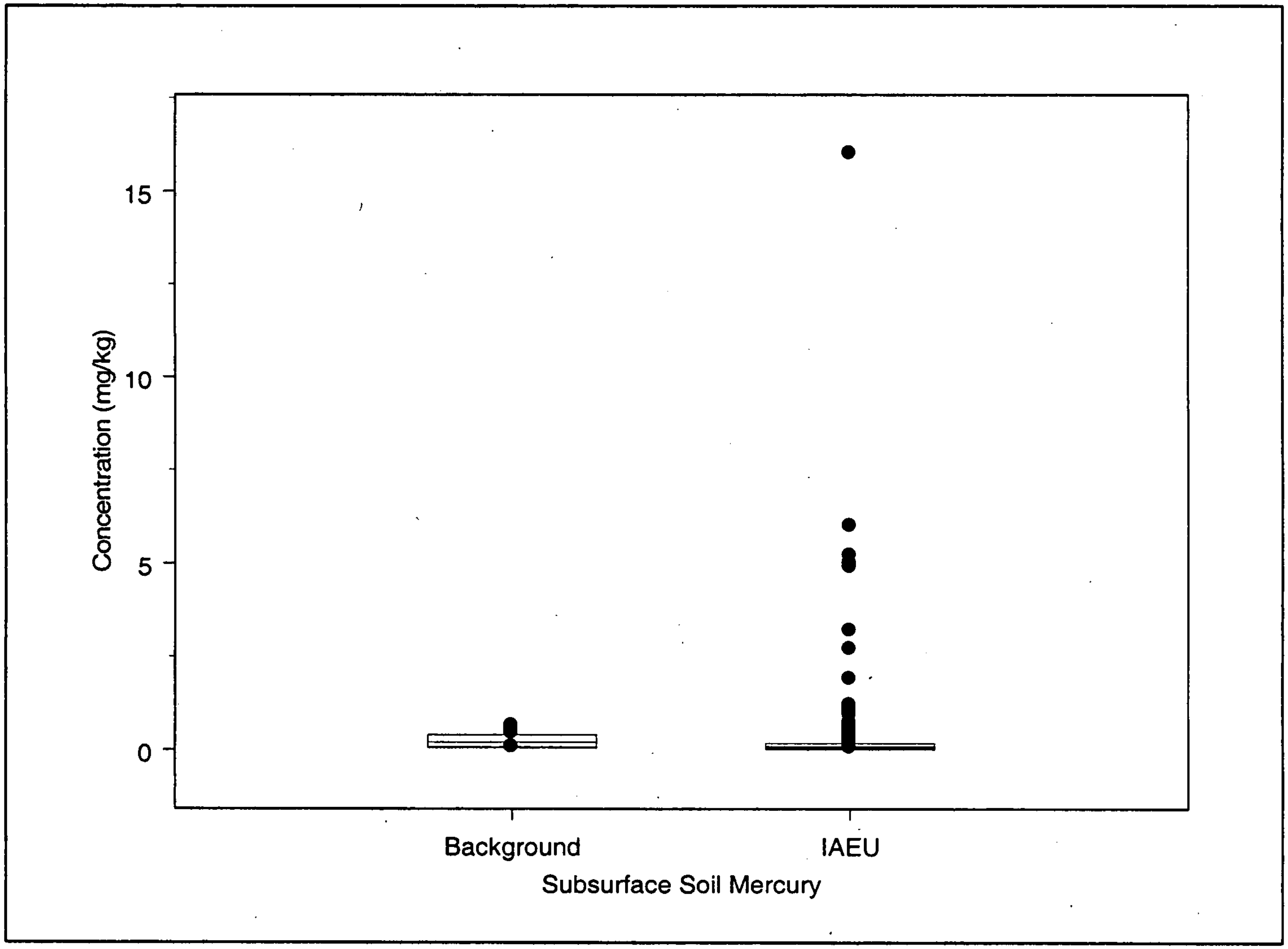
Figure A3.2.18
IAEU Subsurface Soil Box Plots for Mercury



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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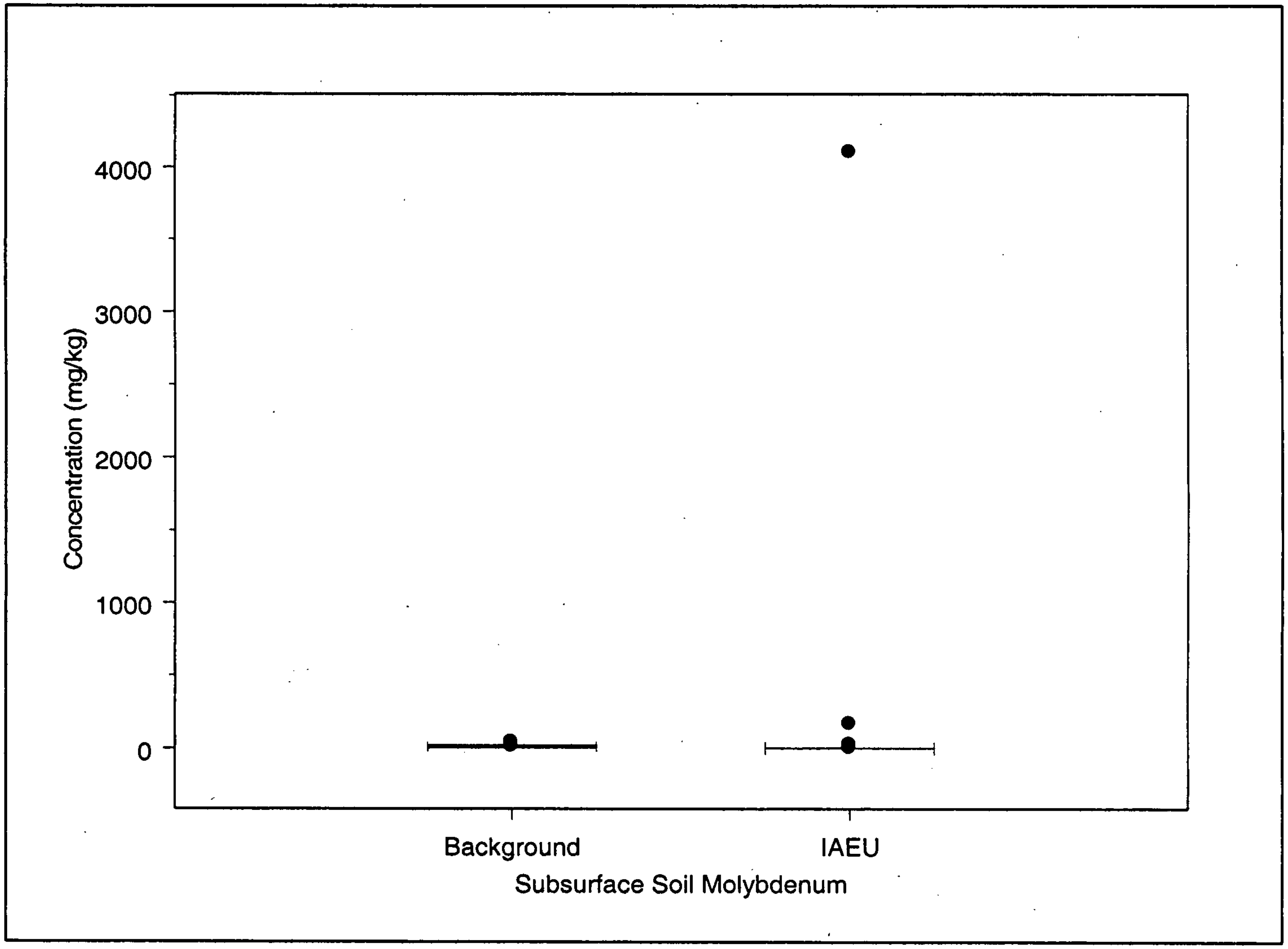
Figure A3.2.19
IAEU Subsurface Soil Box Plots for Molybdenum



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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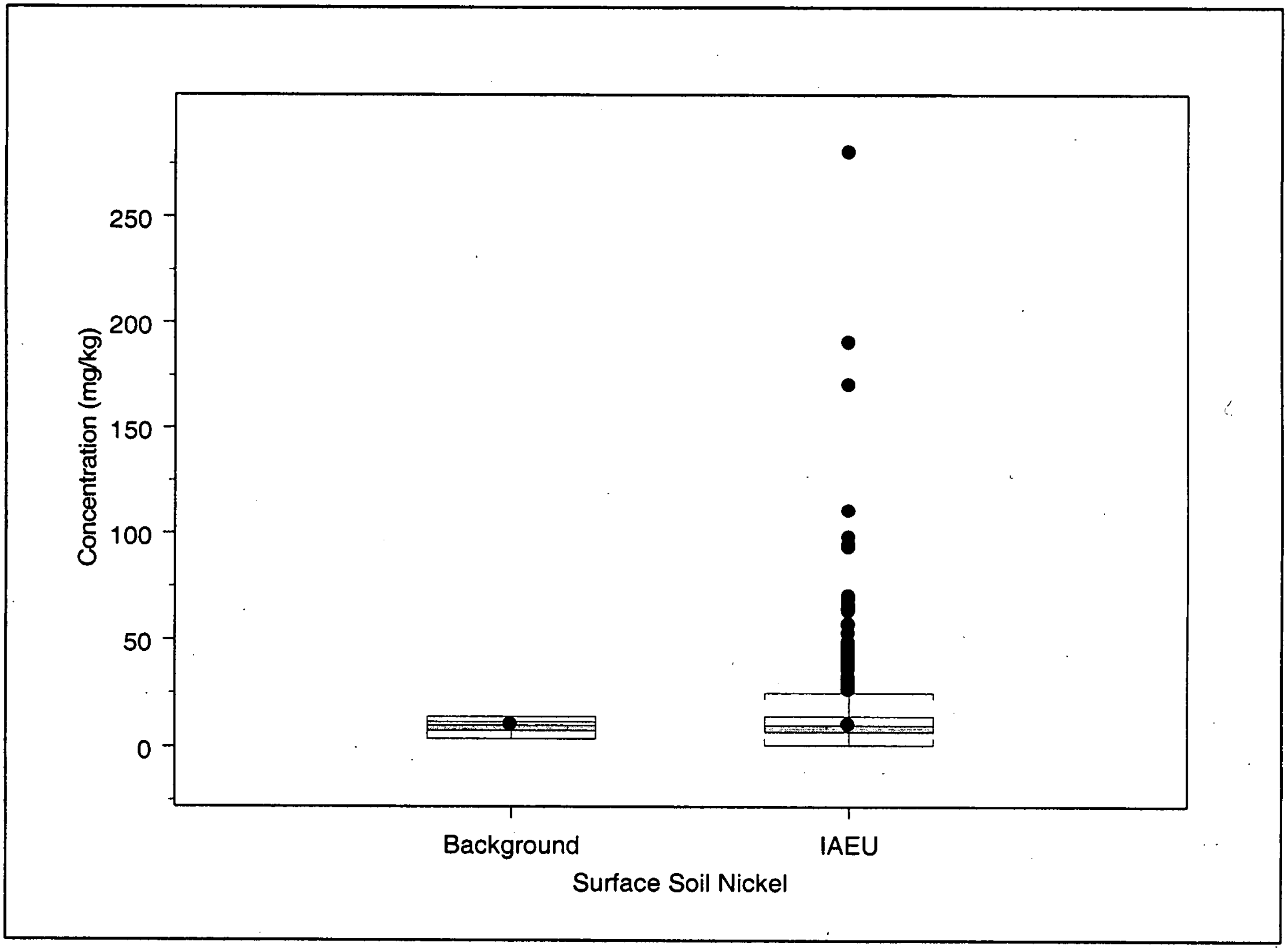
Figure A6.2.20
IAEU Surface Soil Box Plots for Nickel



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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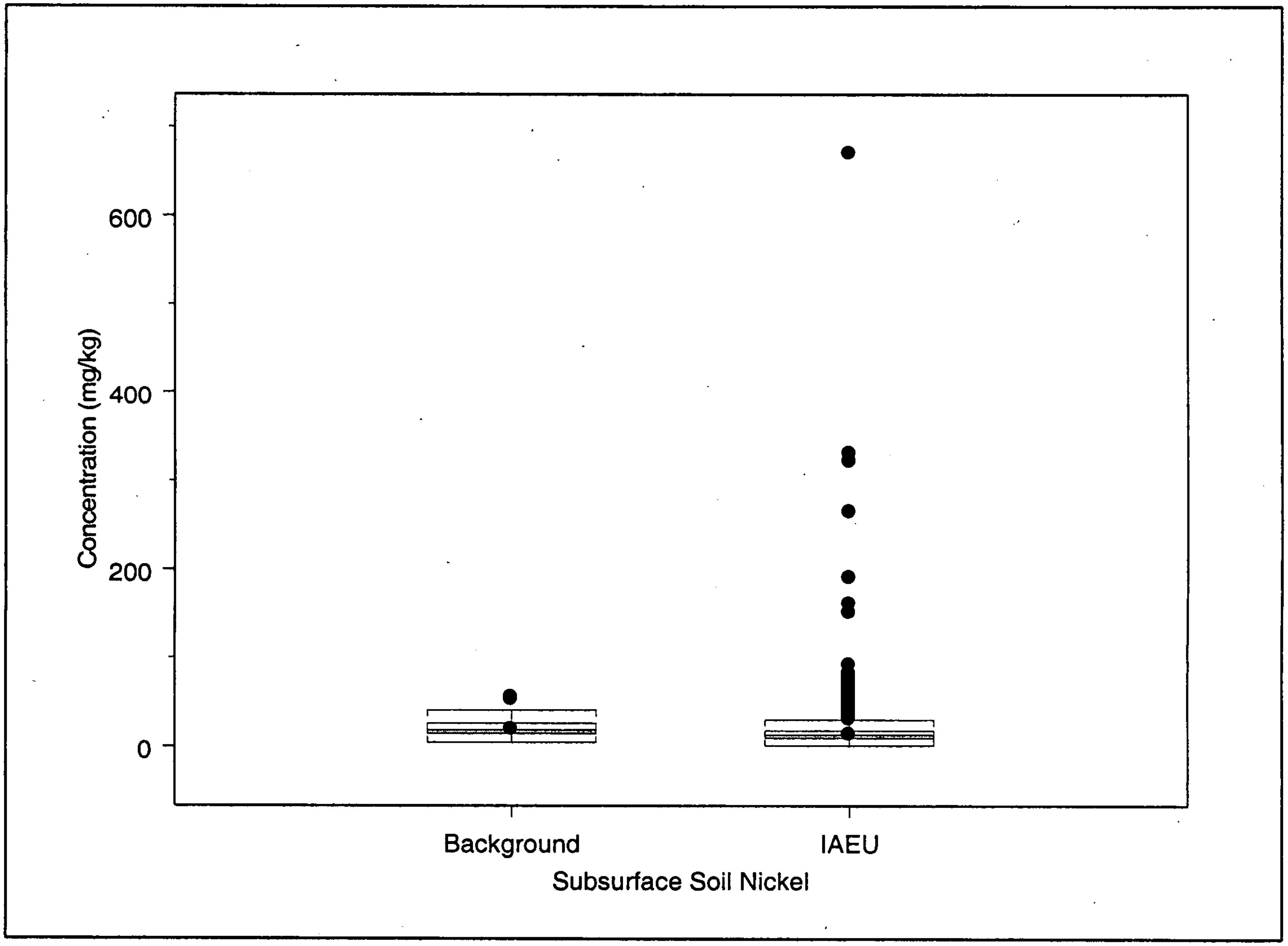
Figure A5.2.21
IAEU Subsurface Soil Box Plots for Nickel



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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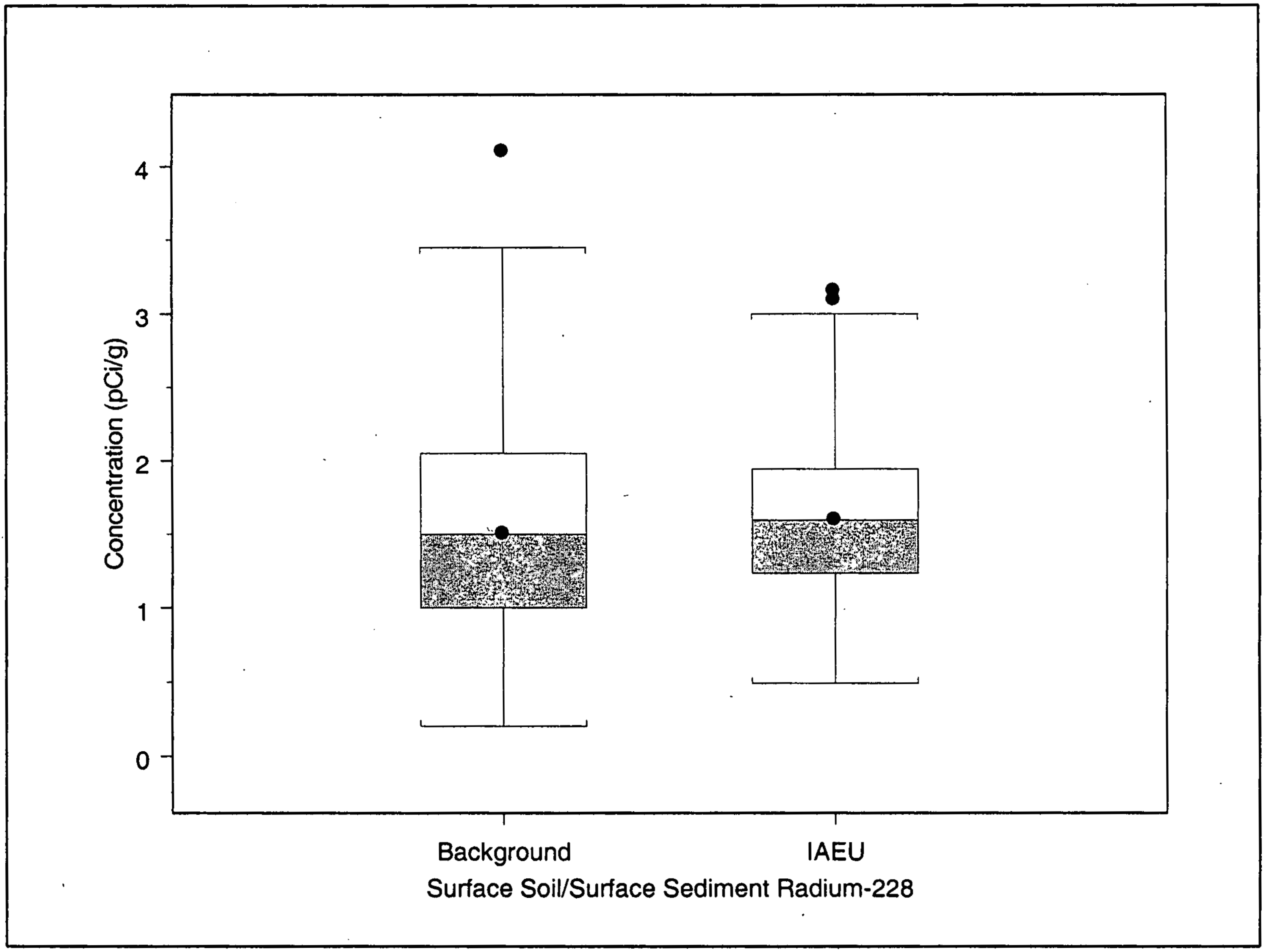
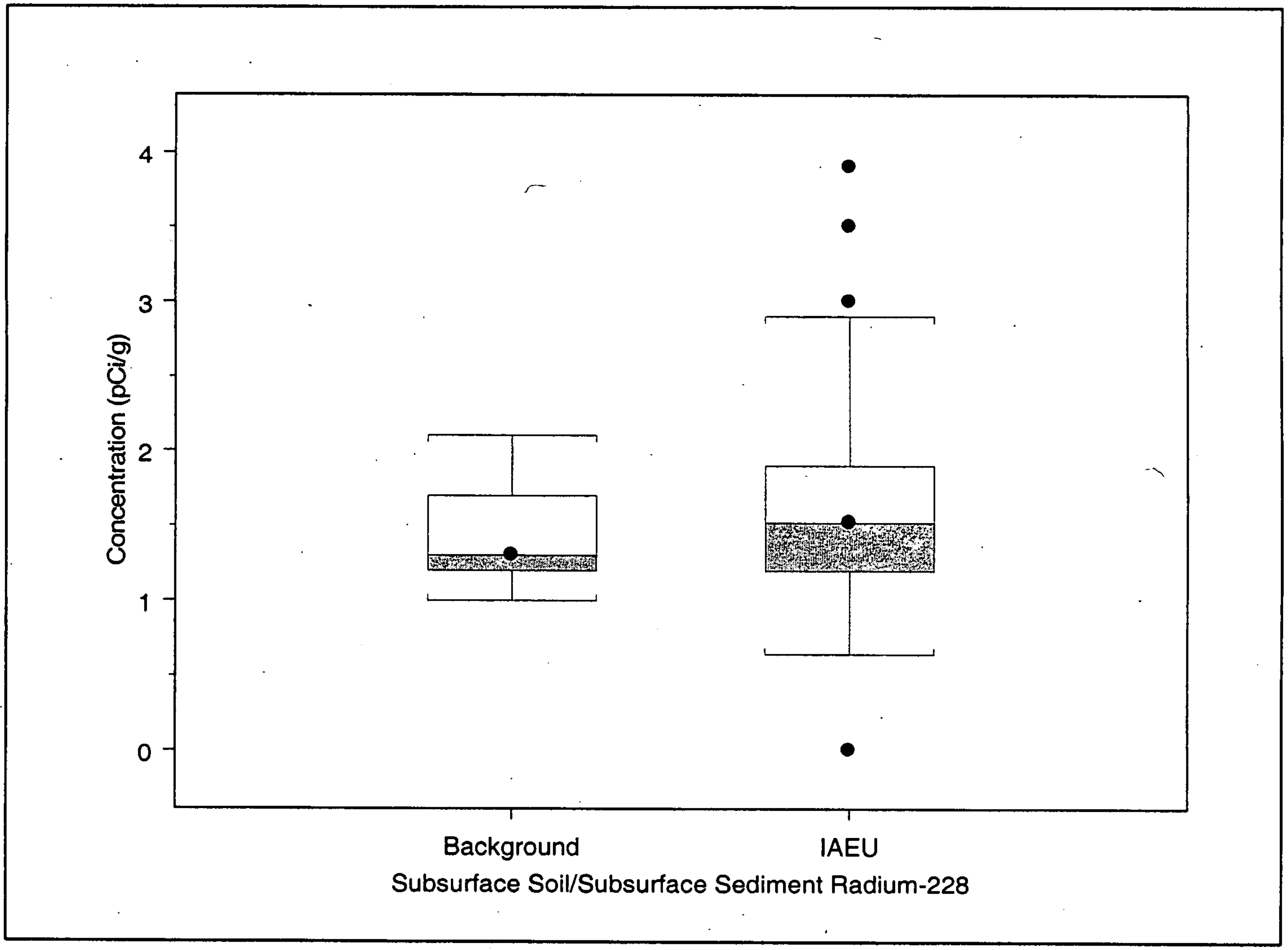
Figure [illegible].2.22
IAEU Surface Soil/Surface Sediment Box Plots for Radium-228



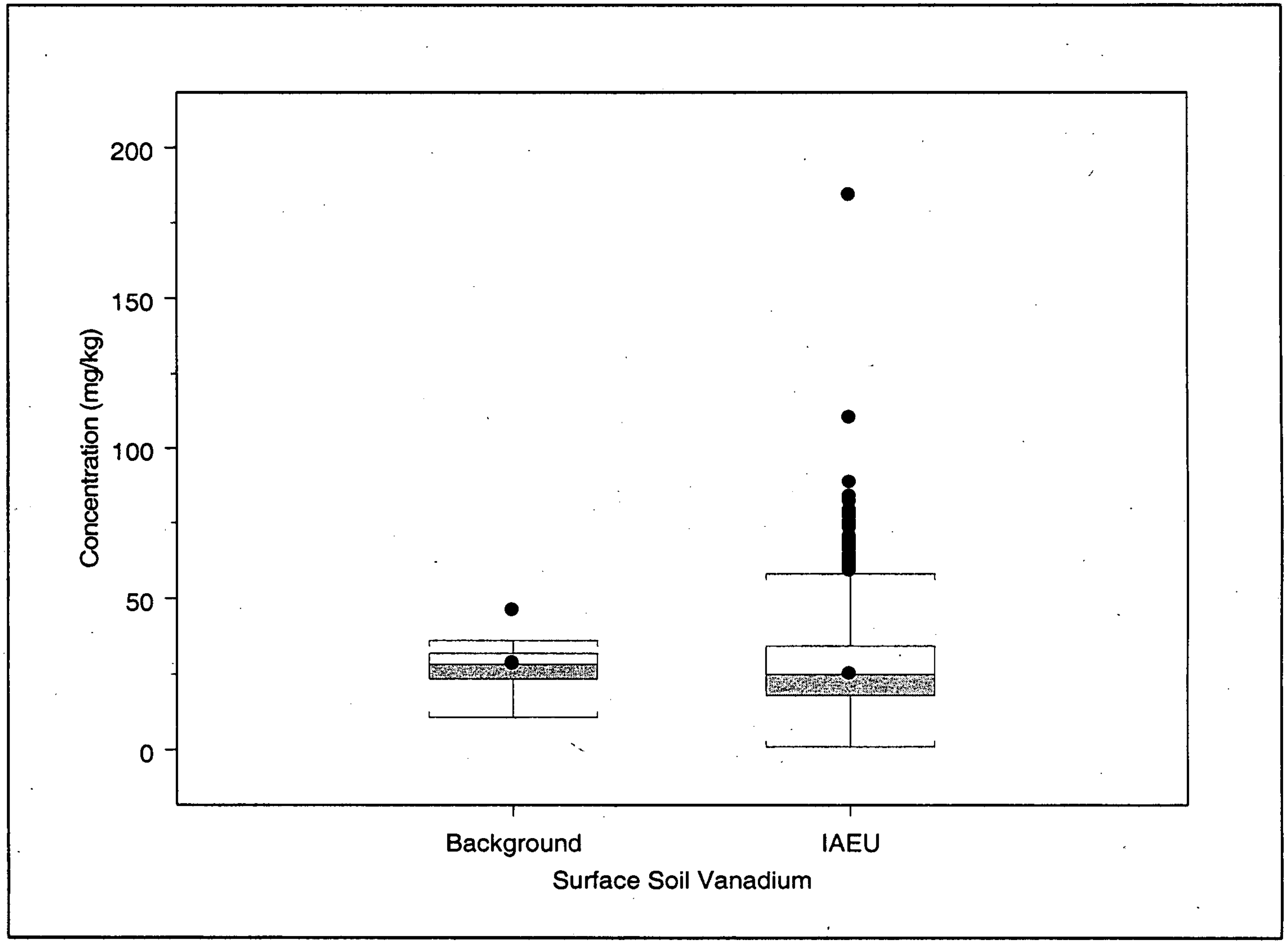
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.23
IAEU Subsurface Soil/Subsurface Sediment Box Plots for Radium-228



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.24
IAEU Surface Soil Box Plots for Vanadium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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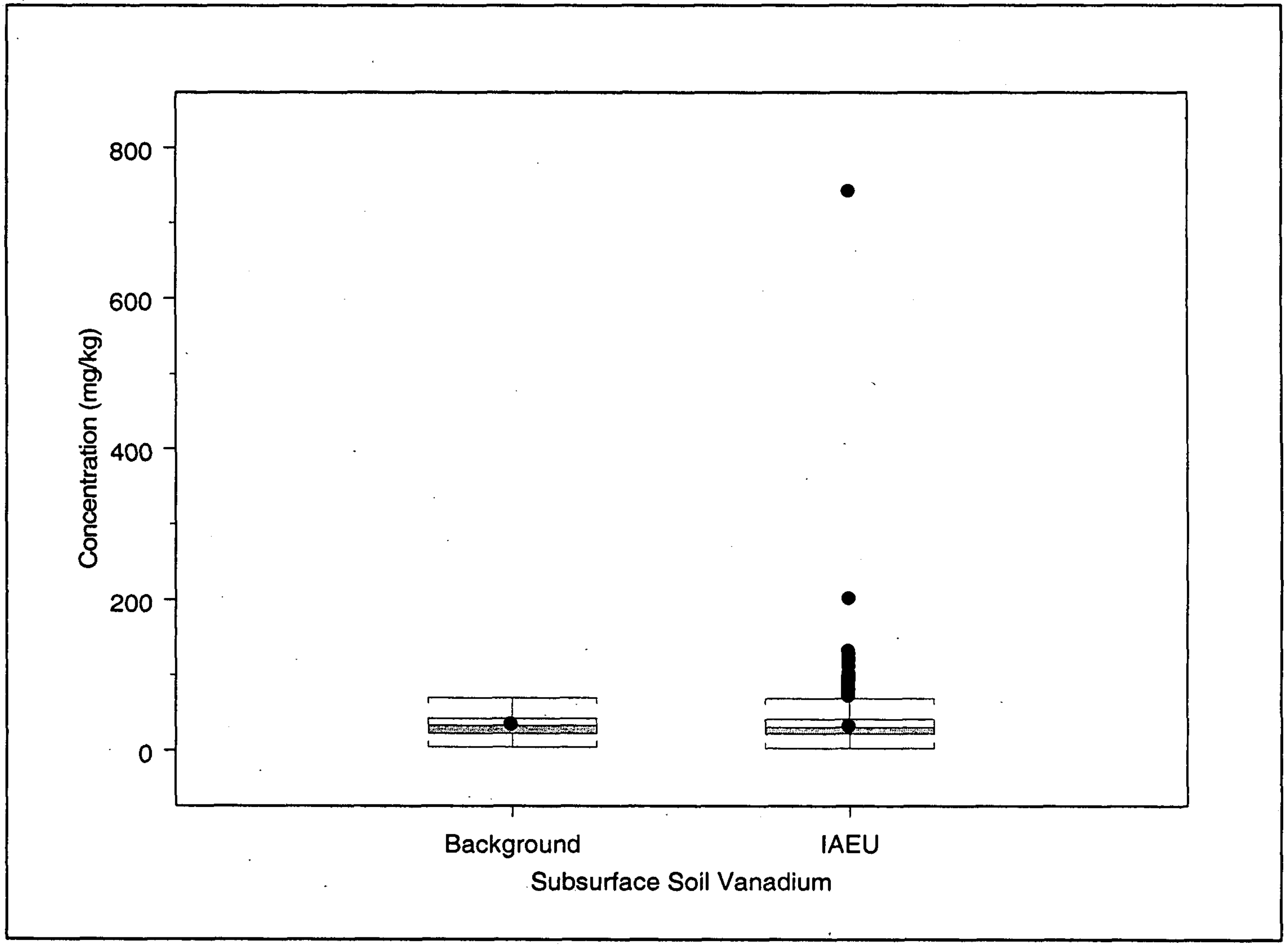
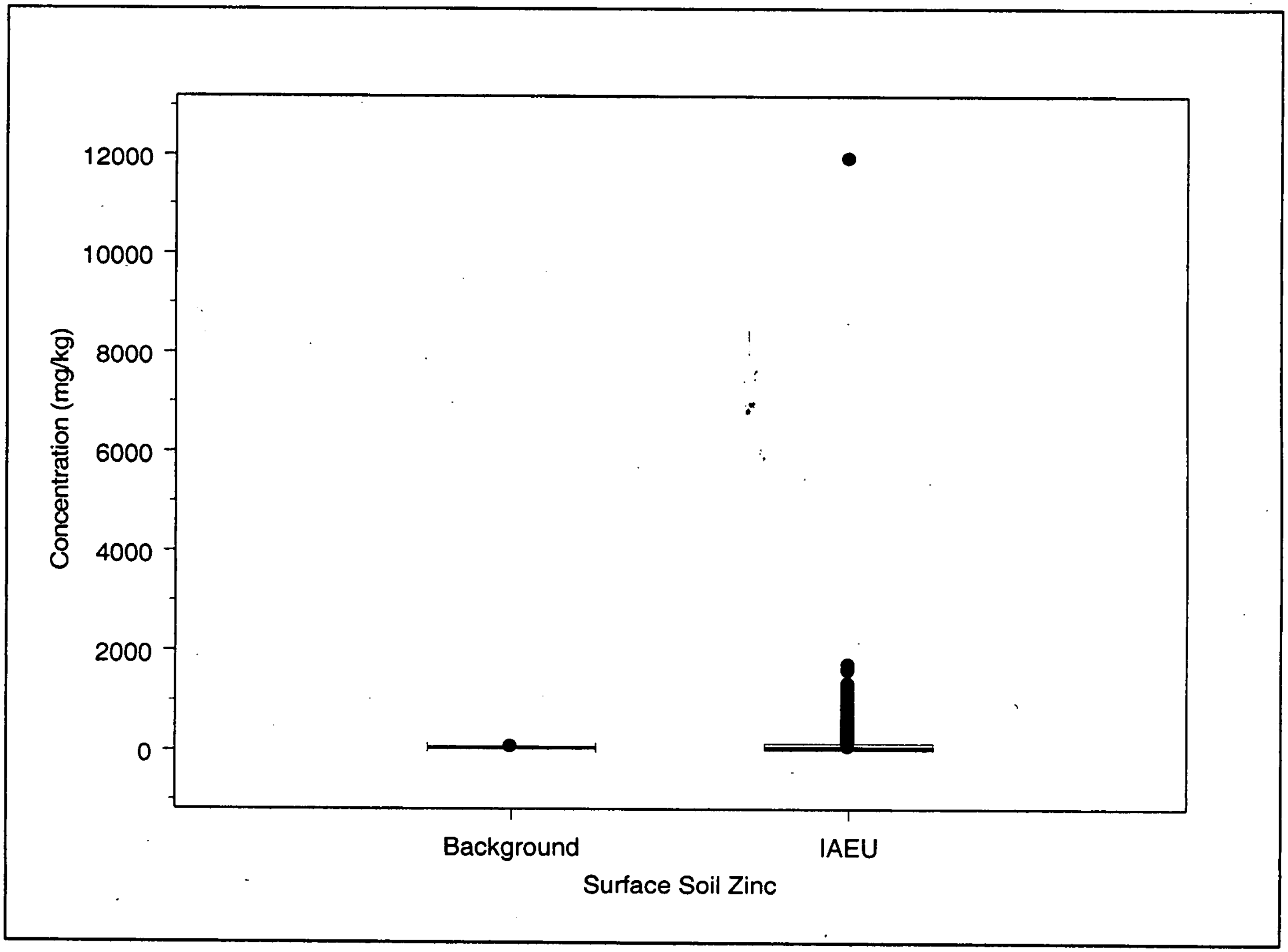
Figure A5.2.25
IAEU Subsurface Soil Box Plots for Vanadium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A[illegible].2.26
IAEU Surface Soil Box Plots for Zinc



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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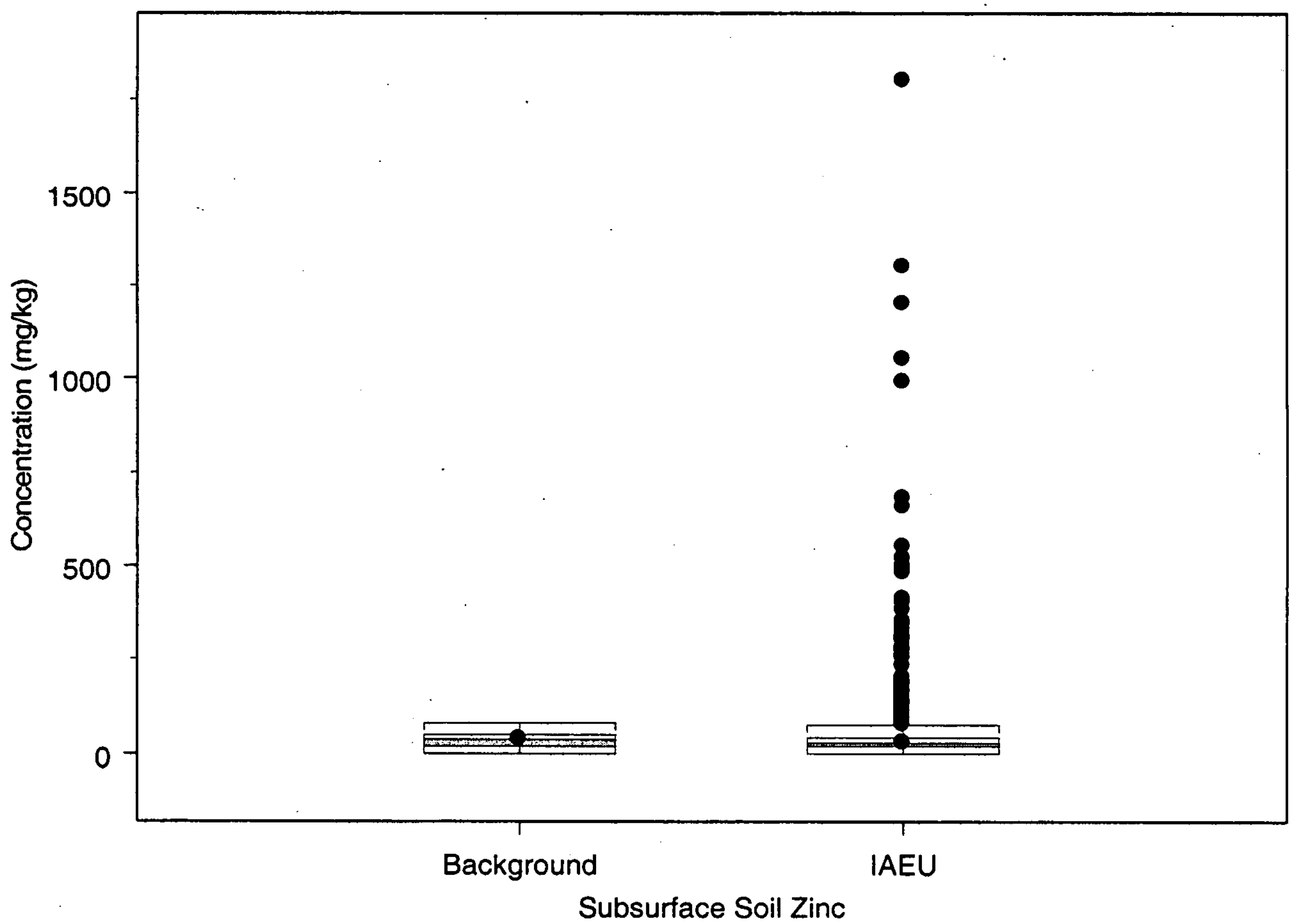
Figure A6.2.27
IAEU Subsurface Soil Box Plots for Zinc



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

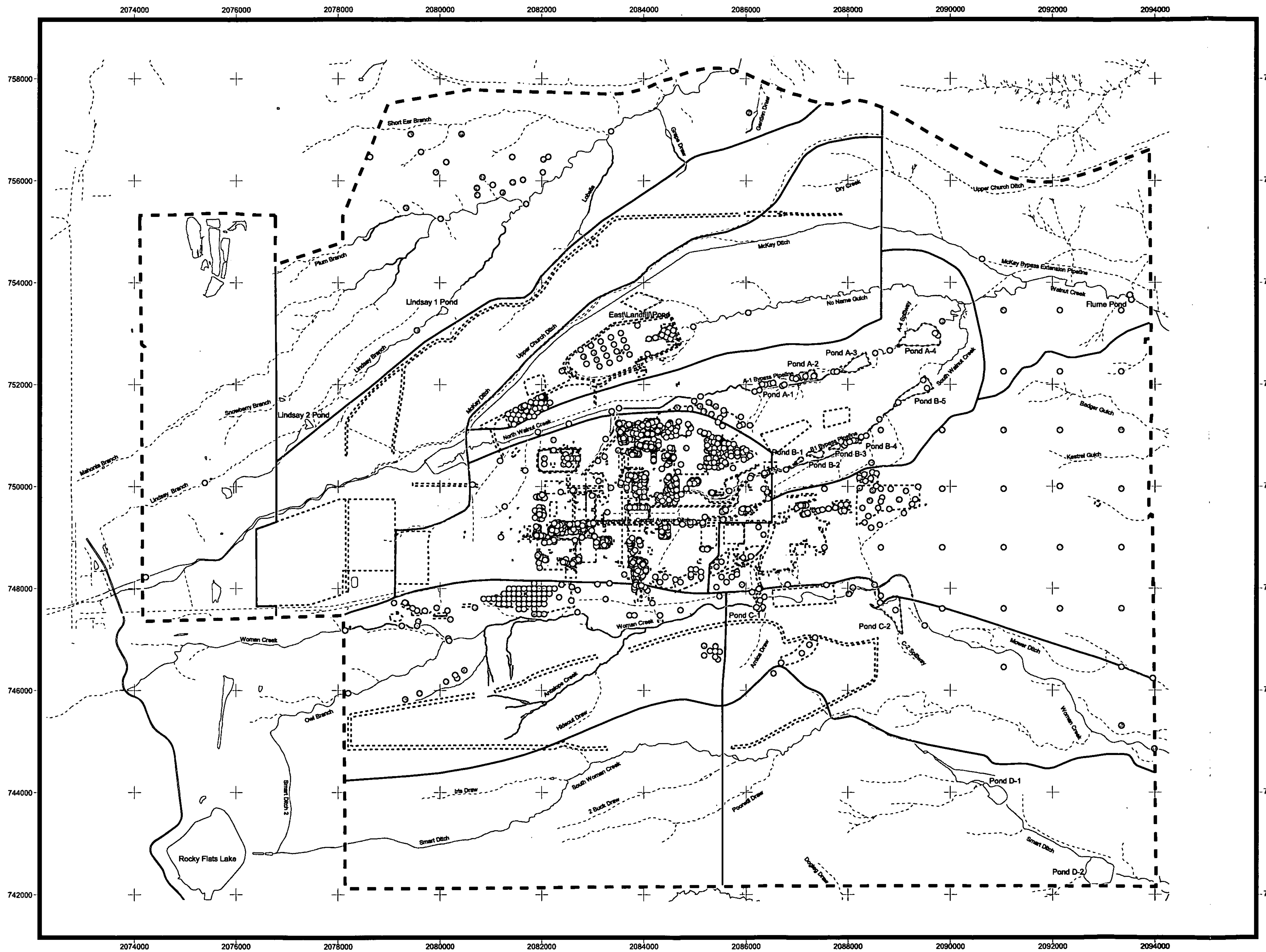


Figure A3.4.1

Benzo(a)pyrene Concentrations in Sitewide Surface Soil/Surface Sediment

KEY

- Concentration > 3x WRW PRG
- Concentration > WRW PRG and <= 3x WRW PRG
- Concentration <= WRW PRG
- Nondetect (ND)

WRW PRG = 379 ug/kg
3 x WRW PRG = 1,137 ug/kg

Standard Map Features

- Industrial Area EU
- Exposure Unit boundaries
- Former building where analyte was used or generated as waste
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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Scale 1:24,000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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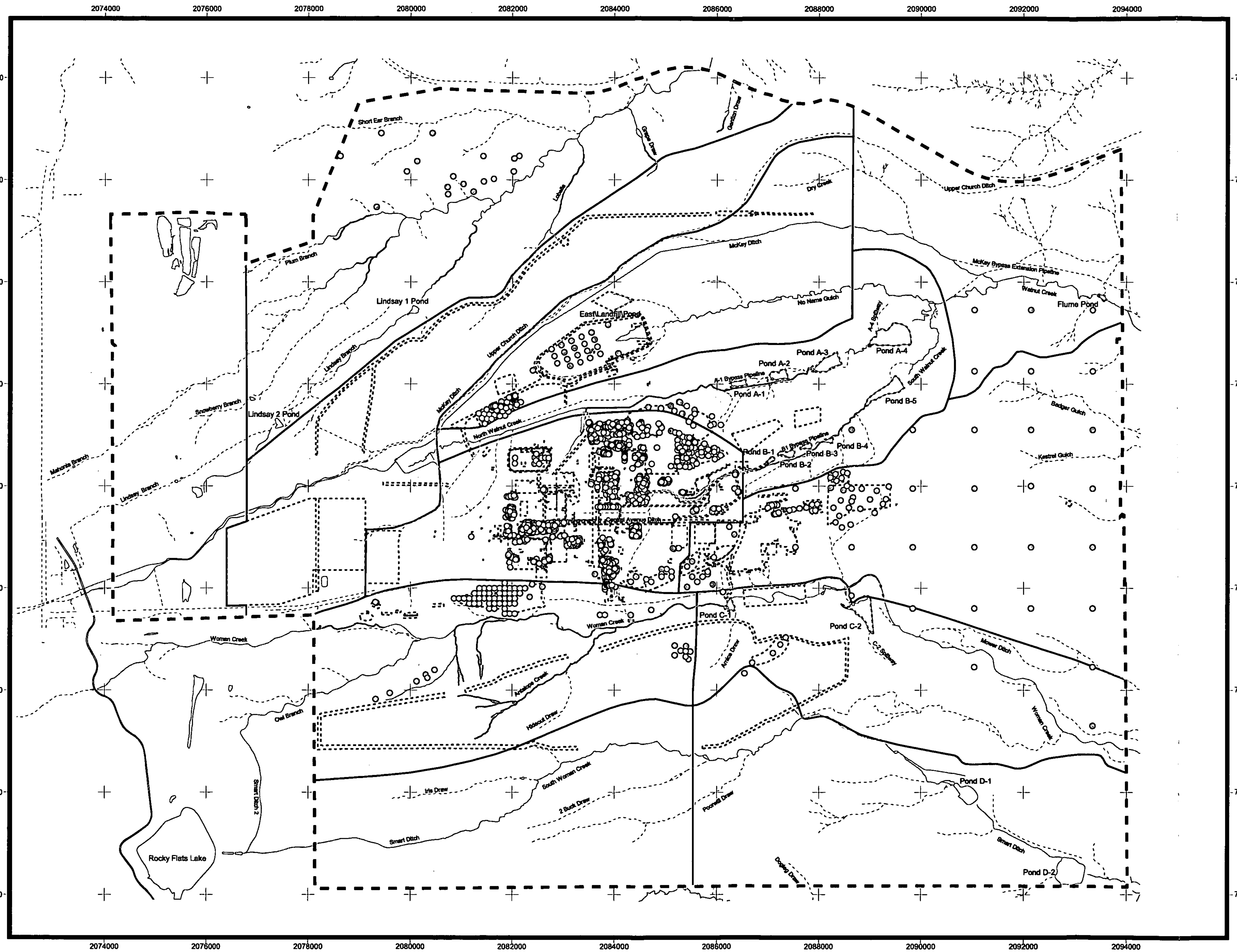

Figure A3.4.2

Bis(2-ethylhexyl)phthalate Concentrations in Sitewide Surface Soil (Non-PMJM)

KEY

- Concentration > 3x ESL
- Concentration > ESL and <= 3x ESL
- Concentration <= ESL
- Nondetect (ND)

Min. Non-PMJM ESL = 137 ug/kg
3 x Min. Non-PMJM ESL = 410 ug/kg

Standard Map Features

- Industrial Area EU
- Exposure Unit boundaries
- Former building where analyte was used or generated as waste
- Historical IHSS/PAC
- Pond
- Ephemeral stream
- Intermittent stream
- Perennial stream
- Site boundary

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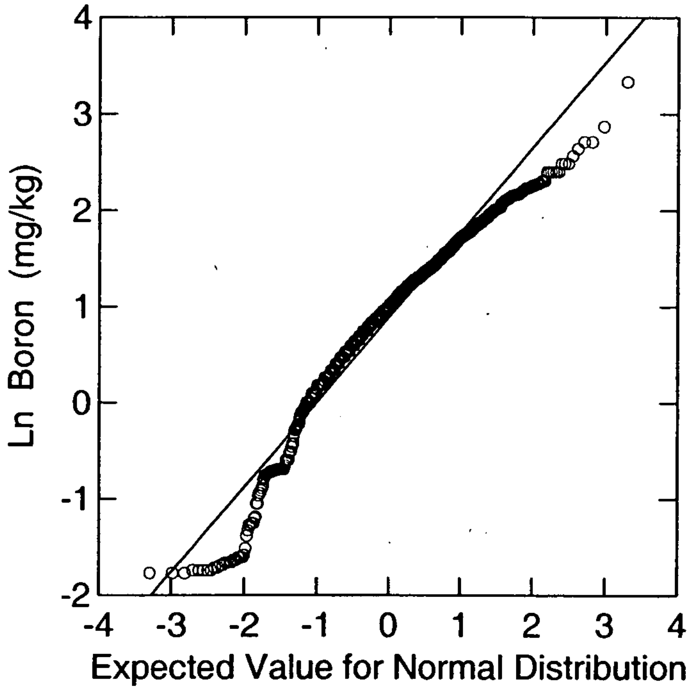

Figure A3.4.3a **Probability Plot for Boron Concentrations (Natural Logarithm) in IAEU Surface Soil**

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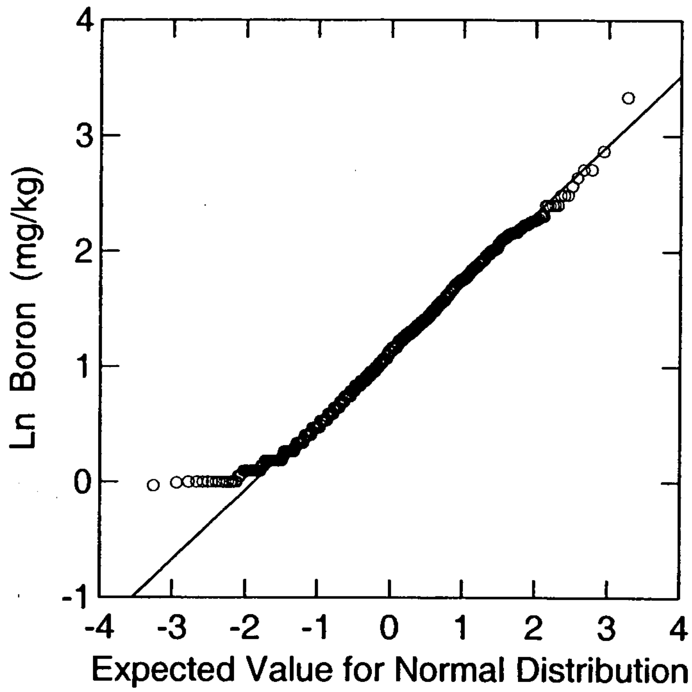

Figure A3.4.3b **Probability Plot for Boron - Concentrations (Natural Logarithm) Above the Highest Detection Limit in IAEU Surface Soil**

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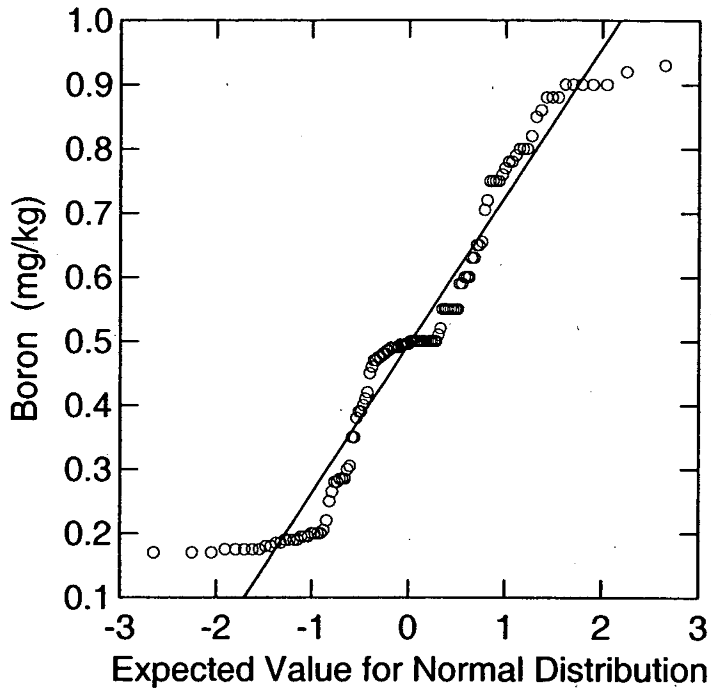

Figure A3.4.3c **Probability Plot for Boron - Detection Limit Concentrations in IAEU Surface Soil**

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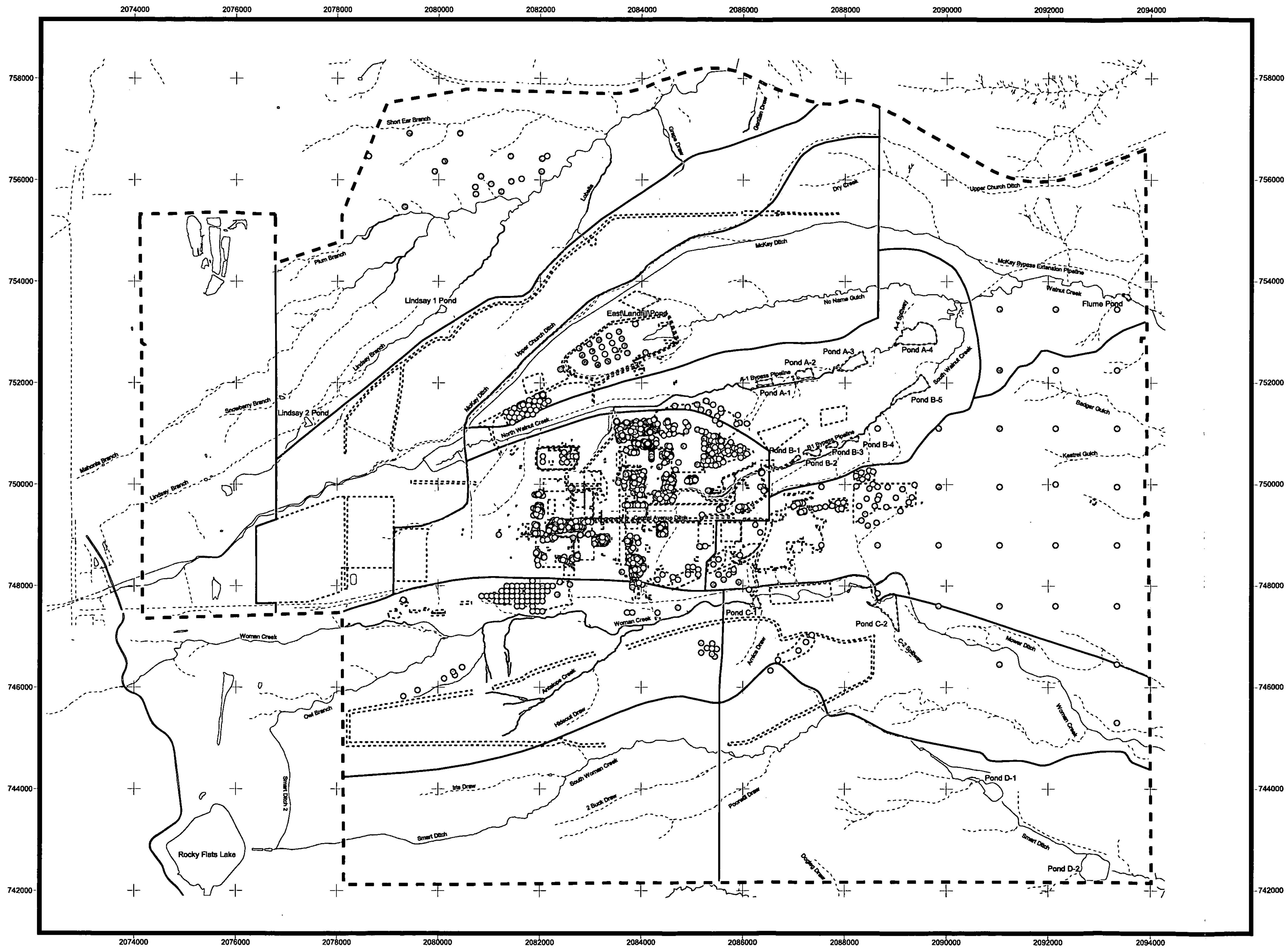
Figure A3.4.4

Di-n-butylphthalate Concentrations in Sitewide Surface Soil (Non-PMJM)



KEY

- Concentration > 3x ESL
- Concentration > ESL and <= 3x ESL
- Concentration <= ESL
- Nondetect (ND)

Min. Non-PMJM ESL = 15.9 ug/kg
3 x Min. Non-PMJM ESL = 47.6 ug/kg

Standard Map Features

- Industrial Area EU
- Exposure Unit boundaries
- Former building where analyte was used or generated as waste
- Historical IHSS/PAC
- Pond
- Ephemeral stream
- Intermittent stream
- Perennial stream
- Site boundary

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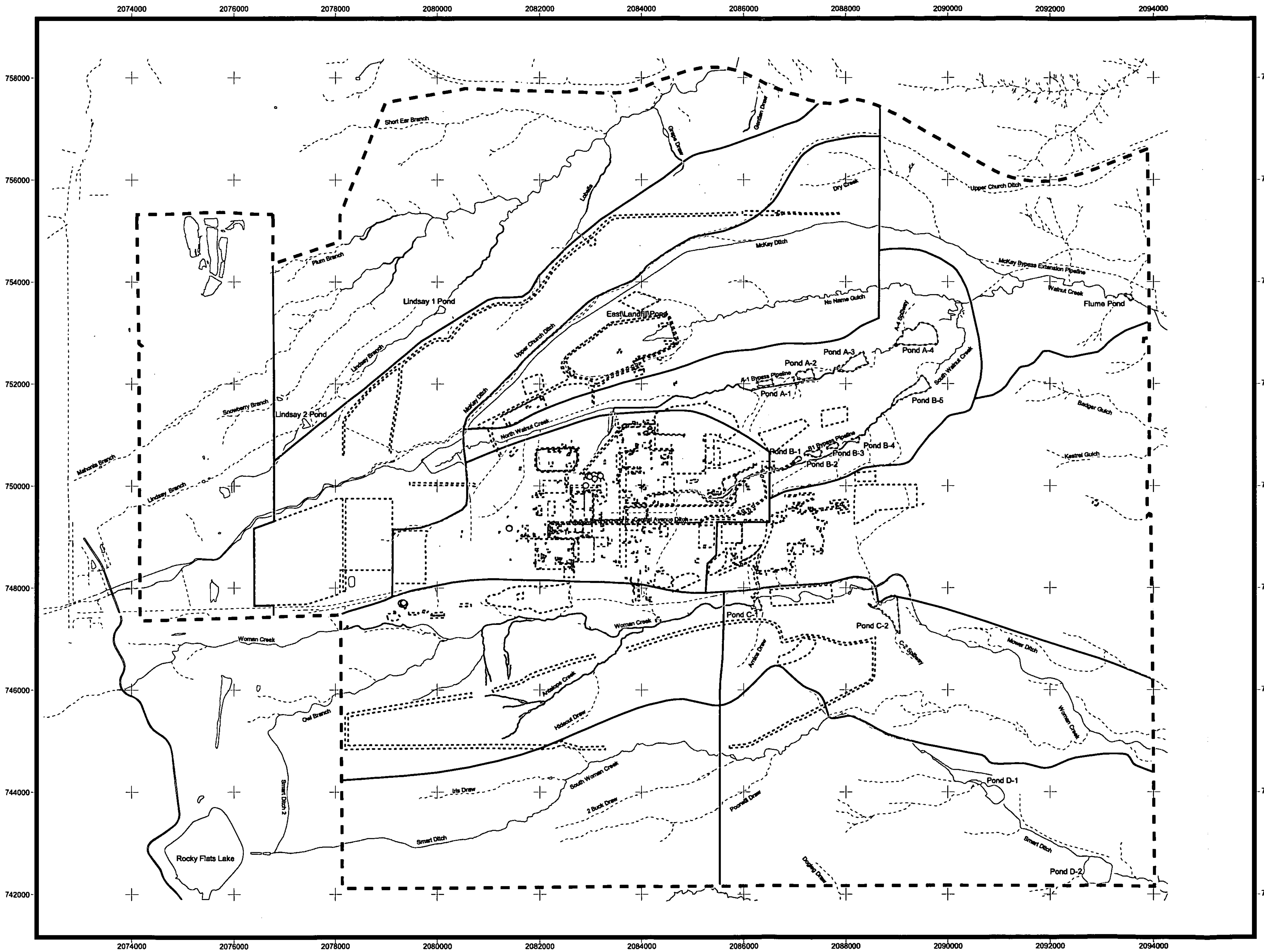

Figure A3.4.5

2,3,7,8-TCDD TEQ (Mammal) Concentrations in Sitewide Surface Soil (Non-PMJM)

KEY

- Concentration > 3x ESL
- Concentration > ESL and <= 3x ESL
- Concentration <= ESL
- Nondetect (ND)

Min. Non-PMJM ESL = 0.004 ug/kg
3 x Min. Non-PMJM ESL = 0.012 ug/kg

Standard Map Features

- Industrial Area EU
- Exposure Unit boundaries
- Former building where analyte was used or generated as waste
- Historical IHSS/PAC
- Pond
- Ephemeral stream
- Intermittent stream
- Perennial stream
- Site boundary

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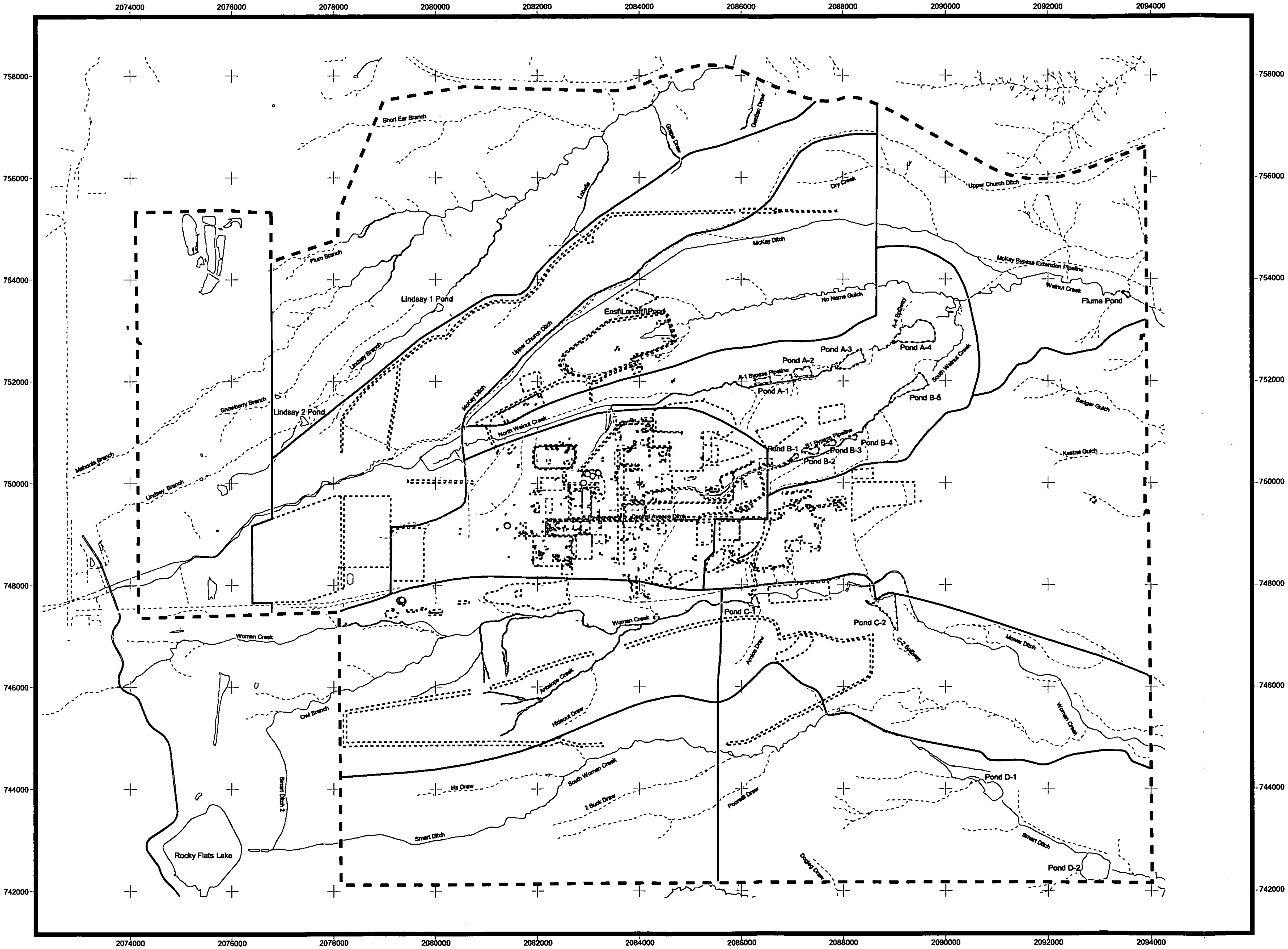

Figure A3.4.6

2,3,7,8-TCDD TEQ (Bird) Concentrations in Sitewide Surface Soil (Non-PMJM)

KEY

- O Concentration > 3x ESL
- O Concentration > ESL and <= 3x ESL
- O Concentration <= ESL
- O Nondetect (ND)

Min. Non-PMJM ESL = 0.013 ug/kg
3 x Min. Non-PMJM ESL = 0.039 ug/kg

Standard Map Features

- Industrial Area EU
- Exposure Unit boundaries
- Former building where analyte was used or generated as waste
- Historical IHSS/PAC
- Pond
- Ephemeral stream
- Intermittent stream
- Perennial stream
- Site boundary

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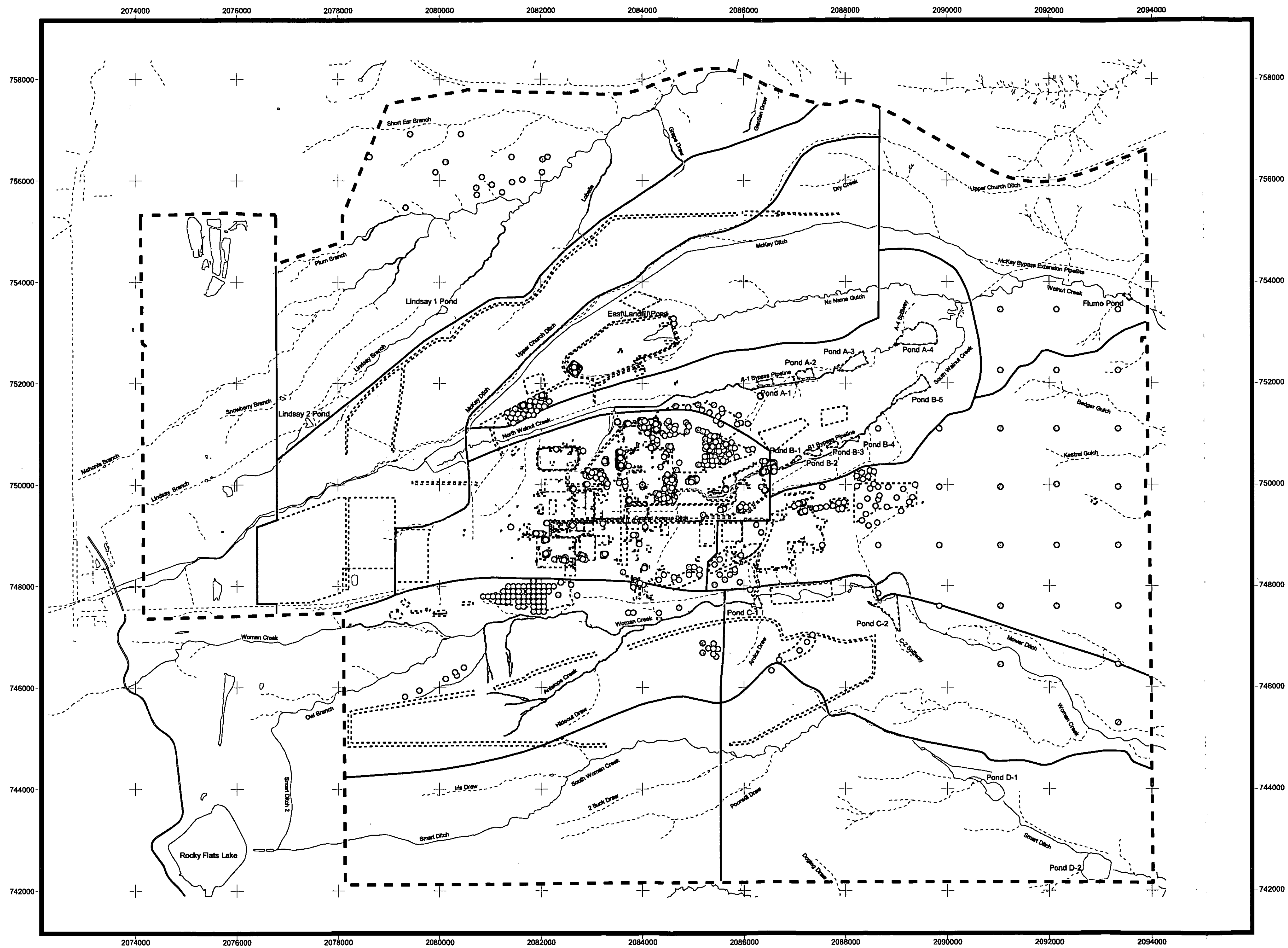

Figure A3.4.7

Total PCB Concentrations in Sitewide Surface Soil (Non-PMJM)

KEY

- Concentration > 3x ESL
- Concentration > ESL and <= 3x ESL
- Concentration <= ESL
- Nondetect (ND)

Min. Non-PMJM ESL = 42.3 ug/kg
3x Min. Non-PMJM ESL = 127 ug/kg

Standard Map Features

- Industrial Area EU
- Exposure Unit boundaries
- Former building where analyte was used or generated as waste
- Historical IHSS/PAC
- Pond
- Perennial stream
- Intermittent stream
- Ephemeral stream
- Site boundary

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<u>COMPREHENSIVE RISK ASSESSMENT</u>

INDUSTRIAL AREA EXPOSURE UNIT

VOLUME 14: ATTACHMENT 4

Risk Assessment Calculations

TABLE OF CONTENTS

1.0 HUMAN HEALTH RISK ASSESSMENT TABLES

2.0 ECOLOGICAL RISK ASSESSMENT TABLES

INDUSTRIAL AREA EXPOSURE UNIT

1.0 Human Health Risk Assessment Tables

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Table A4.1.1
Calculation of Chemical Cancer Risks and Non-Cancer Hazards for the Wildlife Refuge Worker using Tier 1 EPCs

Exposure Route	Contaminant of Concern	Tier 1 EPC (mg/kg)	Cancer Risk Calculations			Non-Cancer Hazard Calculations		
			Intake/Exposure Concentration (mg/kg/day)	CSF (mg/kg/day)⁻¹	Cancer Risk	Intake/Exposure Concentration (mg/kg/day)	RfD (mg/kg/day)	Hazard Quotient
Surface Soil/Surface Sediment								
Ingestion	Arsenic	4.68	1.13E-06	1.50	1.69E-06	4.22E-06	3.00E-04	0.0141
	Benzo(a)pyrene	0.449	1.08E-07	7.30	7.88E-07	4.04E-07	N/A	NC
				Ingestion Total:	**2E-06**		**Ingestion Total:**	**0.01**
Inhalation (indoor + outdoor)	Arsenic	4.68	6.67E-09	15.1	1.01E-07	2.50E-08	N/A	NC
	Benzo(a)pyrene	0.449	6.39E-10	0.310	1.98E-10	2.39E-09	N/A	NC
				Inhalation Total:	**1E-07**		**Inhalation Total:**	**NC**
Dermal	Arsenic	4.68	1.30E-07	1.50	NC	4.88E-07	3.00E-04	NC
	Benzo(a)pyrene	0.449	5.42E-08	7.30	3.95E-07	2.03E-07	N/A	NC
				Dermal Total:	**4E-07**		**Dermal Total:**	**NC**
				Surface Soil/Surface Sediment Total:	**3E-06**		**Surface Soil/Surface Sediment Total:**	**0.01**
				WRW Total:	**3E-06**		**WRW Total:**	**0.01**

N/A = Not applicable or not available.

NC = Not calculated; toxicity factor (CSF or RfD) not available or exposure route was identified as insignificant in the CRA Methodology.

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Table A4.1.2

Calculation of Chemical Cancer Risks and Non-Cancer Hazards for the Wildlife Refuge Worker using Tier 2 EPCs

Exposure Route	Contaminant of Concern	Tier 2 EPC (mg/kg)	Cancer Risk Calculations			Non-Cancer Hazard Calculations		
			Intake/Exposure Concentration (mg/kg/day)	CSF (mg/kg/day)⁻¹	Cancer Risk	Intake/Exposure Concentration (mg/kg/day)	RfD (mg/kg/day)	Hazard Quotient
Surface Soil/Surface Sediment								
Ingestion	Arsenic	4.62	1.11E-06	1.50	1.67E-06	4.16E-06	3.00E-04	0.0139
	Benzo(a)pyrene	0.375	9.01E-08	7.30	6.58E-07	3.37E-07	N/A	NC
				Ingestion Total:	**2E-06**		**Ingestion Total:**	**0.01**
Inhalation (indoor + outdoor)	Arsenic	4.62	6.58E-09	15.1	9.94E-08	2.46E-08	N/A	NC
	Benzo(a)pyrene	0.375	5.34E-10	0.310	1.65E-10	2.00E-09	N/A	NC
				Inhalation Total:	**1E-07**		**Inhalation Total:**	**NC**
Dermal	Arsenic	4.62	1.29E-07	1.50	NC	4.82E-07	3.00E-04	NC
	Benzo(a)pyrene	0.375	4.52E-08	7.30	3.30E-07	1.69E-07	N/A	NC
				Dermal Total:	**3E-07**		**Dermal Total:**	**NC**
				Surface Soil/Surface Sediment Total:	**3E-06**		**Surface Soil/Surface Sediment Total:**	**0.01**
				WRW Total:	**3E-06**		**WRW Total:**	**0.01**

N/A = Not applicable or not available.

NC = Not calculated; toxicity factor (CSF or RfD) not available or exposure route was identified as insignificant in the CRA Methodology.

Table A4.1.3

Calculation of Chemical Cancer Risks and Non-Cancer Hazards for the Wildlife Refuge Visitor using Tier 1 EPCs

Exposure Route	Contaminant of Concern	Tier 1 EPC (mg/kg)	Cancer Risk Calculations: Intake/Exposure Concentration (mg/kg/day)	Cancer Risk Calculations: CSF $(mg/kg/day)^{-1}$	Cancer Risk Calculations: Cancer Risk	Non-Cancer Hazard Calculations: Intake/Exposure Concentration (mg/kg/day)	Non-Cancer Hazard Calculations: RfD (mg/kg/day)	Non-Cancer Hazard Calculations: Hazard Quotient
Surface Soil/Surface Sediment								
Ingestion	Arsenic	4.68	1.05E-06	1.5	1.57E-06	2.44E-06	3.00E-04	0.00815
	Benzo(a)pyrene	0.449	1.00E-07	7.3	7.33E-07	2.34E-07	N/A	NC
				Ingestion Total:	**2E-06**		**Ingestion Total:**	**0.01**
Inhalation (outdoor)	Arsenic	4.68	4.49E-09	15.1	6.78E-08	1.05E-08	N/A	NC
	Benzo(a)pyrene	0.449	4.30E-10	0.3	1.33E-10	1.00E-09	N/A	NC
				Inhalation Total:	**7E-08**		**Inhalation Total:**	**NC**
Dermal	Arsenic	4.68	1.99E-07	1.5	NC	4.63E-07	3.00E-04	NC
	Benzo(a)pyrene	0.449	8.24E-08	7.3	6.02E-07	1.92E-07	N/A	NC
				Dermal Total:	**6E-07**		**Dermal Total:**	**NC**
				Surface Soil/Surface Sediment Total:	**3E-06**		**Surface Soil/Surface Sediment Total:**	**0.01**
				WRV Total:	**3E-06**		**WRV Total:**	**0.01**

N/A = Not applicable or not available.

NC = Not calculated; toxicity factor (CSF or RfD) not available or exposure route was identified as insignificant in the CRA Methodology.

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Table A4.1.4
Calculation of Chemical Cancer Risks and Non-Cancer Hazards for the Wildlife Refuge Visitor using Tier 2 EPCs

Exposure Route	Contaminant of Concern	Tier 2 EPC (mg/kg)	Cancer Risk Calculations			Non-Cancer Hazard Calculations		
			Intake/Exposure Concentration (mg/kg/day)	CSF $(mg/kg/day)^{-1}$	Cancer Risk	Intake/Exposure Concentration (mg/kg/day)	RfD (mg/kg/day)	Hazard Quotient
Surface Soil/Surface Sediment								
Ingestion	Arsenic	4.62	1.03E-06	1.5	1.55E-06	2.41E-06	3.00E-04	0.00804
	Benzo(a)pyrene	0.375	8.38E-08	7.3	6.12E-07	1.96E-07	N/A	NC
				Ingestion Total:	**2E-06**		**Ingestion Total:**	**0.01**
Inhalation (outdoor)	Arsenic	4.62	4.43E-09	15.1	6.69E-08	1.03E-08	N/A	NC
	Benzo(a)pyrene	0.375	3.59E-10	0.3	1.11E-10	8.38E-10	N/A	NC
				Inhalation Total:	**7E-08**		**Inhalation Total:**	**NC**
Dermal	Arsenic	4.62	1.96E-07	1.5	NC	4.57E-07	3.00E-04	NC
	Benzo(a)pyrene	0.375	6.88E-08	7.3	5.02E-07	1.61E-07	N/A	NC
				Dermal Total:	**5E-07**		**Dermal Total:**	**NC**
				Surface Soil/Surface Sediment Total:	**3E-06**		**Surface Soil/Surface Sediment Total:**	**0.01**
				WRV Total:	**3E-06**		**WRV Total:**	**0.01**

N/A = Not applicable or not available.

NC = Not calculated; toxicity factor (CSF or RfD) not available or exposure route was identified as insignificant in the CRA Methodology.

INDUSTRIAL AREA EXPOSURE UNIT

2.0 Ecological Risk Assessment Tables

Table A4.2.1

Intake and Estimates for Antimony in IAEU Surface Soils; Default Exposure Scenario

Bioaccumulation Factors						
Soil to Plant	**Soil to Invertebrate**	**Soil to Small Mammal**				
lnCp = -3.233 + 0.938(lnCs)	1	BAFsm = ((0.5*BAFsp)+(0.5*BAFsi))*0.003*50)				
Media Concentrations (mg/kg)						
Soil Concentration	**Statistic**	**Plant**	**Earthworm**	**Small Mammal**	**Surface Water (mg/L)**	
2.1	Tier 1 UTL	0.08	2.1	0.16	0.018	
1.37	Tier 1UCL	0.05	1.4	0.11	0.023	
2.53	Tier 2 UTL	0.09	2.5	0.20	0.018	
1.91	Tier 2 UCL	0.07	1.9	0.15	0.023	
Intake Parameters						
	$IR_{(food)}$ (kg/kg BW day)	**$IR_{(water)}$ (kg/kg BW day)**	**$IR_{(soil)}$ (kg/kg BW day)**	**P_{plant}**	**P_{invert}**	**P_{mammal}**
Deer Mouse - Insectivore	0.065	0.19	0.001	0	1	0
Intake Estimates (mg/kg BW day)						
	Plant Tissue	**Invertebrate Tissue**	**Mammal Tissue**	**Soil**	**Surface Water**	**Total**
Deer Mouse - Insectivore						
Tier 1 UTL	N/A	0.137	N/A	0.003	0.003	0.143
Tier 1UCL	N/A	0.089	N/A	0.002	0.004	0.095
Tier 2 UTL	N/A	0.164	N/A	0.003	0.003	0.171
Tier 2 UCL	N/A	0.124	N/A	0.002	0.004	0.131

N/A = Not applicable.

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Table A4.2.2
Hazard Quotients for Surface Soils in the IAEU - Antimony

EPC Statistic/Receptor	Total Intake (mg/kg BW day)	TRV (mg/kg BW day)		Hazard Quotients	
		NOAEL	LOAEL	NOAEL	LOAEL
Antimony (Default Exposure)					
Deer Mouse - Insectivore					
Tier 1 UTL	0.143	0.060	0.590	2	0.2
Tier 1 UCL	0.095	0.060	0.590	2	0.2
Tier 2 UTL	0.171	0.060	0.590	3	0.3
Tier 2 UCL	0.131	0.060	0.590	2	0.2

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Table A4.2.3

Intake and Estimates for Chromium in IAEU Surface Soils; Default Exposure Scenario

Bioaccumulation Factors						
Soil to Plant	Soil to Invertebrate	Soil to Small Mammal				
0.084	3.162	lnCm = -1.495 + 0.7326(lnCs)				
Media Concentrations (mg/kg)						
Soil Concentration	Statistic	Plant	Earthworm	Small Mammal	Surface Water (mg/L)	
26	Tier 1 UTL	2.18	82.2	2.44	0.014	
17.8	Tier 1UCL	1.50	56.3	1.85	0.008	
17	Tier 2 UTL	1.43	53.8	1.79	0.014	
15.7	Tier 2 UCL	1.32	49.6	1.69	0.008	
Intake Parameters						
	$IR_{(food)}$ (kg/kg BW day)	$IR_{(water)}$ (kg/kg BW day)	$IR_{(soil)}$ (kg/kg BW day)	P_{plant}	P_{invert}	P_{mammal}
Mourning Dove - Hervibore	0.23	0.12	0.021	1	0	0
Mourning Dove - Insectivore	0.23	0.12	0.021	0	1	0
American Kestrel	0.092	0.12	0.005	0	0.2	0.8
Deer Mouse - Insectivore	0.065	0.19	0.001	0	1	0
Intake Estimates (mg/kg BW day)						
	Plant Tissue	Invertebrate Tissue	Mammal Tissue	Soil	Surface Water	Total
Mourning Dove - Herbivore						
Tier 1 UTL	0.502	N/A	N/A	0.556	0.002	1.06
Tier 1UCL	0.344	N/A	N/A	0.381	9.60E-04	0.726
Tier 2 UTL	0.328	N/A	N/A	0.364	0.002	0.694
Tier 2 UCL	0.303	N/A	N/A	0.336	9.60E-04	0.640
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	18.9	N/A	0.556	0.002	19.5
Tier 1UCL	N/A	12.9	N/A	0.381	9.60E-04	13.3
Tier 2 UTL	N/A	12.4	N/A	0.364	0.002	12.7
Tier 2 UCL	N/A	11.4	N/A	0.336	9.60E-04	11.8
American Kestrel						
Tier 1 UTL	N/A	1.51	0.180	0.120	0.002	1.81
Tier 1UCL	N/A	1.04	0.136	0.082	9.60E-04	1.25
Tier 2 UTL	N/A	0.989	0.132	0.078	0.002	1.20
Tier 2 UCL	N/A	0.913	0.124	0.072	9.60E-04	1.11
Deer Mouse - Insectivore						
Tier 1 UTL	N/A	5.34	N/A	0.034	0.003	5.38
Tier 1UCL	N/A	3.66	N/A	0.023	0.002	3.68
Tier 2 UTL	N/A	3.49	N/A	0.022	0.003	3.52
Tier 2 UCL	N/A	3.23	N/A	0.020	0.002	3.25

N/A = Not applicable.

Table A4.2.4
Intake and Estimates for Chromium in IAEU Surface Soils; Alternative Exposure Scenario; Median BAFs

Bioaccumulation Factors						
Soil to Plant	**Soil to Invertebrate**	**Soil to Small Mammal**				
0.041	0.306	lnCm = -1.495 + 0.7326(lnCs)				
Media Concentrations						
Soil Concentration	**Statistic**	**Plant**	**Earthworm**	**Small Mammal**	**Surface Water (mg/L)**	
26	Tier 1 UTL	1.07	8.0	2.44	0.014	
17.8	Tier 1UCL	0.73	5.4	1.85	0.008	
17	Tier 2 UTL	0.70	5.2	1.79	0.014	
15.7	Tier 2 UCL	0.64	4.8	1.69	0.008	
Intake Parameters						
	$IR_{(food)}$ (kg/kg BW day)	$IR_{(water)}$ (kg/kg BW day)	$IR_{(soil)}$ (kg/kg BW day)	P_{plant}	P_{invert}	P_{mammal}
Mourning Dove - Hervibore	0.23	0.12	0.021	1	0	0
Mourning Dove - Insectivore	0.23	0.12	0.021	0	1	0
American Kestrel	0.092	0.12	0.005	0	0.2	0.8
Deer Mouse - Insectivore	0.065	0.19	0.001	0	1	0
Intake Estimates (mg/kg BW day)						
	Plant Tissue	**Invertebrate Tissue**	**Mammal Tissue**	**Soil**	**Surface Water**	**Total**
Mourning Dove - Herbivore						
Tier 1 UTL	0.245	N/A	N/A	0.556	0.002	0.803
Tier 1UCL	0.168	N/A	N/A	0.381	9.60E-04	0.550
Tier 2 UTL	0.160	N/A	N/A	0.364	0.002	0.526
Tier 2 UCL	0.148	N/A	N/A	0.336	0.001	0.485
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	1.83	N/A	0.556	0.002	2.39
Tier 1UCL	N/A	1.25	N/A	0.381	9.60E-04	1.63
Tier 2 UTL	N/A	1.20	N/A	0.364	0.002	1.56
Tier 2 UCL	N/A	1.10	N/A	0.336	9.60E-04	1.44
American Kestrel	N/A	0.146	0.180	0.120	0.002	0.447
Tier 1 UTL	N/A	0.100	0.136	0.082	9.60E-04	0.319
Tier 1UCL	N/A	0.096	0.132	0.078	0.002	0.307
Tier 2 UTL	N/A	0.088	0.124	0.072	9.60E-04	0.286
Tier 2 UCL						
Deer Mouse - Insectivore	N/A	0.517	N/A	0.034	0.003	0.554
Tier 1 UTL	N/A	0.354	N/A	0.023	0.002	0.379
Tier 1UCL	N/A	0.338	N/A	0.022	0.003	0.363
Tier 2 UTL	N/A	0.312	N/A	0.020	0.002	0.334
Tier 2 UCL						

N/A = Not applicable.

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Table A4.2.5

Hazard Quotients for Surface Soils in the IAEU - Chromium (Terrestrial Plans and Invertebrates)

EPC Statistic	Concentration (mg/kg)	TRV (mg/kg)			Hazard Quotients		
		Screening ESL	Alternate NOEC	Alternate LOEC	Screening ESL	Alternate NOEC	Alternate LOEC
Terrestrial Plant							
Tier 1 UTL	26	1.00	10.0	30.0	**26**	**3**	0.9
Tier 1 UCL	17.8	1.00	10.0	30.0	**18**	**2**	0.6
Tier 2 UTL	17.1	1.00	10.0	30.0	**17**	**2**	0.6
Tier 2 UCL	15.9	1.00	10.0	30.0	**16**	**2**	0.5
Terrestrial Invertebrate							
Tier 1 UTL	26	0.400	N/A	32.6	**65**	N/A	0.8
Tier 1 UCL	17.8	0.400	N/A	32.6	**45**	N/A	0.5
Tier 2 UTL	17.1	0.400	N/A	32.6	**43**	N/A	0.5
Tier 2 UCL	15.9	0.400	N/A	333	**40**	N/A	0.05

Bold = Hazard quotients>1.

N/A = Not applicable.

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Table A4.2.6
Hazard Quotients for Surface Soils in the IAEU - Chromium (Vertebrate Receptors)

		TRV (mg/kg BW/day)				Hazard Quotients			
	Total Intake (mg/kg BW/day)	Chromium VI NOAEL	Chromium VI LOAEL	Chromium III NOAEL	Chromium III LOAEL	Chromium VI NOAEL	Chromium VI LOAEL	Chromium III NOAEL	Chromium III LOAEL
Chromium (Default Exposure)									
Mourning Dove - Herbivore									
Tier 1 UTL	1.06	N/A	N/A	1.00	5.00	N/A	N/A	1	0.2
Tier 1 UCL	0.730	N/A	N/A	1.00	5.00	N/A	N/A	0.7	0.1
Tier 2 UTL	0.694	N/A	N/A	1.00	5.00	N/A	N/A	0.7	0.1
Tier 2 UCL	0.640	N/A	N/A	1.00	5.00	N/A	N/A	0.6	0.1
Mourning Dove - Insectivore									
Tier 1 UTL	19.5	N/A	N/A	1.00	5.00	N/A	N/A	19	4
Tier 1 UCL	13.4	N/A	N/A	1.00	5.00	N/A	N/A	13	3
Tier 2 UTL	12.7	N/A	N/A	1.00	5.00	N/A	N/A	13	3
Tier 2 UCL	11.8	N/A	N/A	1.00	5.00	N/A	N/A	12	2
American Kestrel									
Tier 1 UTL	1.81	N/A	N/A	1.00	5.00	N/A	N/A	2	0.4
Tier 1 UCL	1.26	N/A	N/A	1.00	5.00	N/A	N/A	1	0.3
Tier 2 UTL	1.20	N/A	N/A	1.00	5.00	N/A	N/A	1	0.2
Tier 2 UCL	1.11	N/A	N/A	1.00	5.00	N/A	N/A	1	0.2
Deer Mouse - Insectivore									
Tier 1 UTL	5.38	3.28	13.1	2,737	N/A	2	0.4	0.002	N/A
Tier 1 UCL	3.70	3.28	13.1	2,737	N/A	1	0.3	0.001	N/A
Tier 2 UTL	3.52	3.28	13.1	2,737	N/A	1	0.3	0.001	N/A
Tier 2 UCL	3.25	3.28	13.1	2,737	N/A	1	0.2	0.001	N/A
Chromium (Alternative Exposure Scenario; Median BAFs)									
Mourning Dove - Insectivore									
Tier 1 UTL	2.39	N/A	N/A	1.00	5.00	N/A	N/A	2	0.5
Tier 1 UCL	1.64	N/A	N/A	1.00	5.00	N/A	N/A	2	0.3
Tier 2 UTL	1.56	N/A	N/A	1.00	5.00	N/A	N/A	2	0.3
Tier 2 UCL	1.44	N/A	N/A	1.00	5.00	N/A	N/A	1	0.3

N/A = Not applicable.

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Table A4.2.7

Intake and Estimates for Copper in IAEU Surface Soils; Default Exposure Scenario

Bioaccumulation Factors						
Soil to Plant	**Soil to Invertebrate**	**Soil to Small Mammal**				
lnCp = 0.669 + 0.394(lnCs)	lnCi = 1.675 + 0.264(lnCs)	lnCsm = 2.042 + .1444(lnCs)				
Media Concentrations (mg/kg)						
Soil Concentration	**Statistic**	**Plant**	**Earthworm**	**Small Mammal**	**Surface Water (mg/L)**	
39	Tier 1 UTL	8.27	14.0	13.1	0.0340	
31.1	Tier 1UCL	7.56	13.2	12.7	0.0170	
31	Tier 2 UTL	7.55	13.2	12.7	0.0340	
25.5	Tier 2 UCL	6.99	12.6	12.3	0.0170	
Intake Parameters						
	$IR_{(food)}$ (kg/kg BW day)	**$IR_{(water)}$ (kg/kg BW day)**	**$IR_{(soil)}$ (kg/kg BW day)**	**P_{plant}**	**P_{invert}**	**P_{mammal}**
Mourning Dove - Hervibore	0.23	0.12	0.0214	1	0	0
Mourning Dove - Insectivore	0.23	0.12	0.0214	0	1	0
Intake Estimates (mg/kg BW day)						
	Plant Tissue	**Invertebrate Tissue**	**Mammal Tissue**	**Soil**	**Surface Water**	**Total**
Mourning Dove - Herbivore						
Tier 1 UTL	1.90	N/A	N/A	0.834	0.00408	2.74
Tier 1UCL	1.74	N/A	N/A	0.665	0.00204	2.41
Tier 2 UTL	1.74	N/A	N/A	0.663	0.00408	2.40
Tier 2 UCL	1.61	N/A	N/A	0.545	0.00204	2.16
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	3.23	N/A	0.834	0.00408	4.07
Tier 1UCL	N/A	3.04	N/A	0.665	0.00204	3.71
Tier 2 UTL	N/A	3.04	N/A	0.663	0.00408	3.71
Tier 2 UCL	N/A	2.89	N/A	0.545	0.00204	3.43

N/A = Not applicable.

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Table A4.2.8
Hazard Quotients for Surface Soils in IAEU-Copper

		TRV (mg/kg BW day)			Hazard Quotients		
	Total Intake (mg/kg BW day)	NOAEL	Threshold	LOAEL	NOAEL	Threshold	LOAEL
Copper (Default Exposure)							
Mourning Dove - Herbivore							
Tier 1 UTL	2.74	2.30	11.0	52.3	1.19	0.249	0.0524
Tier 1 UCL	2.41	2.30	11.0	52.3	1.05	0.219	0.0460
Tier 2 UTL	2.40	2.30	11.0	52.3	1.05	0.219	0.0460
Tier 2 UCL	2.16	2.30	11.0	52.3	0.937	0.196	0.0412
Mourning Dove - Insectivore							
Tier 1 UTL	4.07	2.30	11.0	52.3	**1.77**	0.370	0.0778
Tier 1 UCL	3.71	2.30	11.0	52.3	**1.61**	0.337	0.0709
Tier 2 UTL	3.71	2.30	11.0	52.3	**1.61**	0.337	0.0709
Tier 2 UCL	3.43	2.30	11.0	52.3	1.49	0.312	0.0657

Bold = Hazard quotients>1.

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Table A4.2.9

Intake and Estimates for Molybdenum in IAEU Surface Soils; Default Exposure Scenario

Bioaccumulation Factors						
Soil to Plant	Soil to Invertebrate	Soil to Small Mammal				
0.25	2.09	BAFsm = ((0.5*BAFsp)+(0.5*BAFsi))*0.003*50)				
Media Concentrations (mg/kg)						
Soil Concentration	Statistic	Plant	Earthworm	Small Mammal	Surface Water (mg/L)	
2.1	Tier 1 UTL	0.525	4.39	4.30	0.00800	
1.9	Tier 1 UCL	0.475	3.97	3.89	0.00600	
1.09	Tier 2 UTL	0.273	2.28	2.23	0.00800	
0.956	Tier 2 UCL	0.239	2.00	1.96	0.00600	
Intake Parameters						
	$IR_{(food)}$ (kg/kg BW day)	$IR_{(water)}$ (kg/kg BW day)	$IR_{(soil)}$ (kg/kg BW day)	P_{plant}	P_{invert}	P_{mammal}
Deer Mouse - Insectivore	0.0650	0.190	0.00130	0	1	0
Intake Estimates (mg/kg BW day)						
	Plant Tissue	Invertebrate Tissue	Mammal Tissue	Soil	Surface Water	Total
Deer Mouse - Insectivore						
Tier 1 UTL	N/A	0.285	N/A	0.00273	0.00152	0.290
Tier 1 UCL	N/A	0.258	N/A	0.00247	0.00114	0.262
Tier 2 UTL	N/A	0.148	N/A	0.00142	0.00152	0.151
Tier 2 UCL	N/A	0.130	N/A	0.00124	0.00114	0.132

N/A = Not applicable.

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Table A4.2.10

Terrestrial Plant Hazard Quotients for Surface Soils in the IAEU -Molybdenum

EPC Statistic	Concentration (mg/kg)	TRV (mg/kg) Screening ESL	Hazard Quotients Screening ESL
Terrestrial Plant			
Tier 1 UTL	2.1	2.00	1.05
Tier 1 UCL	1.01	2.00	0.505
Tier 2 UTL	1.21	2.00	0.605
Tier 2 UCL	1.1	2.00	0.550

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Table A4.2.11
Hazard Quotients for Surface Soils in the IAEU - Molybdenum

Receptor/ EPC Statistic	Total Intake (mg/kg BW day)	TRV (mg/kg BW day)		Hazard Quotients	
		NOAEL	LOAEL	NOAEL	LOAEL
Molybdenum (Default Exposure)					
Deer Mouse - Insectivore					
Tier 1 UTL	0.151	0.260	2.60	0.6	0.1
Tier 1 UCL	0.132	0.260	2.60	0.5	0.1
Tier 2 UTL	0.151	0.260	2.60	0.6	0.1
Tier 2 UCL	0.132	0.260	2.60	0.5	0.1

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Table A4.2.12

Intake and Estimates for Tin in IAEU Surface Soils; Default Exposure Scenario

Bioaccumulation Factors						
Soil to Plant	**Soil to Invertebrate**	**Soil to Small Mammal**				
0.03	1	0.21				
Media Concentrations (mg/kg)						
Soil Concentration	**Statistic**	**Plant**	**Earthworm**	**Small Mammal**	**Surface Water (mg/L)**	
3.9	Tier 1 UTL	0.117	3.90	0.819	0.0130	
2.93	Tier 1UCL	0.0879	2.93	0.615	0.00700	
5.63	Tier 2 UTL	0.169	5.63	1.18	0.0130	
3.99	Tier 2 UCL	0.120	3.99	0.838	0.00700	
Intake Parameters						
	$IR_{(food)}$ (kg/kg BW day)	**$IR_{(water)}$ (kg/kg BW day)**	**$IR_{(soil)}$ (kg/kg BW day)**	**P_{plant}**	**P_{invert}**	**P_{mammal}**
Mourning Dove - Insectivore	0.230	0.120	0.0214	0	1	0
Deer Mouse - Insectivore	0.0650	0.190	0.00130	0	1	0
Intake Estimates (mg/kg BW day)						
	Plant Tissue	**Invertebrate Tissue**	**Mammal Tissue**	**Soil**	**Surface Water**	**Total**
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	0.897	N/A	0.0834	0.00156	0.982
Tier 1UCL	N/A	0.674	N/A	0.0627	8.40E-04	0.737
Tier 2 UTL	N/A	1.29	N/A	0.120	0.00156	1.42
Tier 2 UCL	N/A	0.918	N/A	0.0853	8.40E-04	1.00
Deer Mouse - Insectivore						
Tier 1 UTL	N/A	0.254	N/A	0.00507	0.00247	0.261
Tier 1UCL	N/A	0.190	N/A	0.00381	0.00133	0.196
Tier 2 UTL	N/A	0.366	N/A	0.00732	0.00247	0.376
Tier 2 UCL	N/A	0.259	N/A	0.00519	0.00133	0.266

N/A = Not applicable.

Table A4.2.13
Hazard Quotients for Surface Soils in the IAEU - Tin

Receptor/ EPC Statistic	Total Intake (mg/kg BW day)	TRV (mg/kg BW day)		Hazard Quotients	
		NOAEL	LOAEL	NOAEL	LOAEL
Tin (Default Exposure)					
Mourning Dove - Insectivore					
Tier 1 UTL	0.982	0.730	18.3	1	0.05
Tier 1 UCL	0.737	0.730	18.3	1	0.04
Tier 2 UTL	1.42	0.730	18.3	**2**	0.1
Tier 2 UCL	1.00	0.730	18.3	1	0.1
Deer Mouse - Insectivore					
Tier 1 UTL	0.261	0.250	15.0	1	0.02
Tier 1 UCL	0.196	0.250	15.0	0.8	0.01
Tier 2 UTL	0.376	0.250	15.0	**2**	0.03
Tier 2 UCL	0.266	0.250	15.0	1	0.02

Bold = Hazard quotients>1.

Table A4.2.14
Intake and Estimates for Bis(2-ethyhexyl)phthalate in IAEU Surface Soils; Default Exposure Scenario

Bioaccumulation Factors						
Soil to Plant	**Soil to Invertebrate**	**Soil to Small Mammal**				
0.15	34.9	28.81				
Media Concentrations (mg/kg)						
Soil Concentration	**Statistic**	**Plant**	**Earthworm**	**Small Mammal**	**Surface Water (mg/L)**	
0.405	Tier 1 UTL	0.0608	14.1	11.7	0.0260	
0.821	Tier 1UCL	0.123	28.7	23.7	0.0184	
0.524	Tier 2 UTL	0.0786	18.3	15.1	0.0260	
0.413	Tier 2 UCL	0.0620	14.4	11.9	0.0184	
Intake Parameters						
	$IR_{(food)}$ (kg/kg BW day)	$IR_{(water)}$ (kg/kg BW day)	$IR_{(soil)}$ (kg/kg BW day)	P_{plant}	P_{invert}	P_{mammal}
Mourning Dove - Insectivore	0.230	0.120	0.0214	0	1	0
American Kestrel	0.0920	0.120	0.00460	0	0.200	0.800
Intake Estimates (mg/kg BW day)						
	Plant Tissue	**Invertebrate Tissue**	**Mammal Tissue**	**Soil**	**Surface Water**	**Total**
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	3.25	N/A	0.00866	0.00312	3.26
Tier 1UCL	N/A	6.59	N/A	0.0176	0.00221	6.61
Tier 2 UTL	N/A	4.21	N/A	0.0112	0.00312	4.22
Tier 2 UCL	N/A	3.32	N/A	0.00883	0.00221	3.33
American Kestrel						
Tier 1 UTL	N/A	0.260	0.859	0.00186	0.00312	1.12
Tier 1UCL	N/A	0.527	1.74	0.00378	0.00221	2.27
Tier 2 UTL	N/A	0.336	1.11	0.00241	0.00312	1.45
Tier 2 UCL	N/A	0.265	0.876	0.00190	0.00221	1.15

N/A = Not applicable

Table A4.2.15
Hazard Quotients for Surface Soils in IAEU - Bis(2-ethylhexyl)pthalate

	Total Intake (mg/kg BW day)	TRV (mg/kg BW day)		Hazard Quotients	
		NOAEL	LOAEL	NOAEL	LOAEL
Bis(2-ethylhexyl)phthalate (Default Exposure)					
Mourning Dove - Insectivore					
Tier 1 UTL	3.26	1.10	214	**3**	0.02
Tier 1 UCL	6.61	1.10	214	**6**	0.03
Tier 2 UTL	4.22	1.10	214	**4**	0.02
Tier 2 UCL	3.33	1.10	214	**3**	0.02
American Kestrel					
Tier 1 UTL	1.12	1.10	214	1	0.01
Tier 1 UCL	2.27	1.10	214	**2**	0.01
Tier 2 UTL	1.45	1.10	214	1	0.01
Tier 2 UCL	1.15	1.10	214	1	0.01

Bold = Hazard quotients>1.

Table A4.2.16

Intake and Estimates for Di-n-butylphthalate in IAEU Surface Soils; Default Exposure Scenario

Bioaccumulation Factors						
Soil to Plant	**Soil to Invertebrate**	**Soil to Small Mammal**				
0.39	30.1	28.43				
Media Concentrations (mg/kg)						
Soil Concentration	**Statistic**	**Plant**	**Earthworm**	**Small Mammal**	**Surface Water (mg/L)**	
0.38	Tier 1 UTL	0.148	11.4	10.8	0.00525	
0.333	Tier 1UCL	0.130	10.0	9.47	0.00384	
0.294	Tier 2 UTL	0.115	8.85	8.36	0.00525	
0.274	Tier 2 UCL	0.107	8.25	7.79	0.00384	
Intake Parameters						
	$IR_{(food)}$ (kg/kg BW day)	$IR_{(water)}$ (kg/kg BW day)	$IR_{(soil)}$ (kg/kg BW day)	P_{plant}	P_{invert}	P_{mammal}
Mourning Dove - Insectivore	0.230	0.120	0.0214	0	1	0
American Kestrel	0.0920	0.120	0.00460	0	0.200	0.800
Intake Estimates (mg/kg BW day)						
	Plant Tissue	**Invertebrate Tissue**	**Mammal Tissue**	**Soil**	**Surface Water**	**Total**
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	2.63	N/A	0.00813	6.30E-04	2.64
Tier 1UCL	N/A	2.31	N/A	0.00712	4.61E-04	2.31
Tier 2 UTL	N/A	2.04	N/A	0.00629	6.30E-04	2.04
Tier 2 UCL	N/A	1.90	N/A	0.00586	4.61E-04	1.90
American Kestrel						
Tier 1 UTL	N/A	0.210	0.795	0.00175	6.30E-04	1.01
Tier 1UCL	N/A	0.184	0.697	0.00153	4.61E-04	0.883
Tier 2 UTL	N/A	0.163	0.615	0.00135	6.30E-04	0.780
Tier 2 UCL	N/A	0.152	0.573	0.00126	4.61E-04	0.727

N/A = Not applicable.

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Table A4.2.17
Hazard Quotients for Surface Soils in IAEU-Di-n-butylphthalate

		TRV (mg/kg BW day)		Hazard Quotients	
	Total Intake (mg/kg BW day)	NOAEL	LOAEL	NOAEL	LOAEL
Di-n-butylphthalate (Default Exposure)					
Mourning Dove - Insectivore					
Tier 1 UTL	2.67	0.110	1.10	**24**	**2**
Tier 1 UCL	2.31	0.110	1.10	**21**	**2**
Tier 2 UTL	2.04	0.110	1.10	**19**	**2**
Tier 2 UCL	1.90	0.110	1.10	**17**	**2**
American Kestrel					
Tier 1 UTL	1.02	0.110	1.10	**9**	0.9
Tier 1 UCL	0.883	0.110	1.10	**8**	0.8
Tier 2 UTL	0.780	0.110	1.10	**7**	0.7
Tier 2 UCL	0.727	0.110	1.10	**7**	0.7

Bold = Hazard quotients>1.

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Table A4.2.18

Intake and Estimates for 2,3,7,8-TCDD TEQ (bird) in IAEU Surface Soils; Default Exposure Scenario

Bioaccumulation Factors						
Soil to Plant	**Soil to Invertebrate**	**Soil to Small Mammal**				
0.22	$\ln Ci = 3.53 + 1.2(\ln Cs)$	$\ln Csm = 0.8113 + .0993(\ln Cs)$				
Media Concentrations (mg/kg)						
Soil Concentration	**Statistic**	**Plant**	**Earthworm**	**Small Mammal**	**Surface Water[a] (mg/L)**	
7.19E-05	Tier 1 UTL	1.58E-05	3.64E-04	6.28E-05	N/A	
3.29E-05	Tier 1UCL	7.24E-06	1.42E-04	2.66E-05	N/A	
2.50E-05	Tier 2 UTL	5.50E-06	1.02E-04	1.96E-05	N/A	
1.70E-05	Tier 2 UCL	3.74E-06	6.45E-05	1.29E-05	N/A	
Intake Parameters						
	$IR_{(food)}$ (kg/kg BW day)	$IR_{(water)}$ (kg/kg BW day)	$IR_{(soil)}$ (kg/kg BW day)	P_{plant}	P_{invert}	P_{mammal}
Mourning Dove - Insectivore	0.230	0.120	0.0214	0	1	0
American Kestrel	0.0920	0.120	0.00460	0	0.200	0.800
Intake Estimates (mg/kg BW day)						
	Plant Tissue	**Invertebrate Tissue**	**Mammal Tissue**	**Soil**	**Surface Water**	**Total**
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	8.37E-05	N/A	1.54E-06	N/A	8.53E-05
Tier 1UCL	N/A	3.28E-05	N/A	7.04E-07	N/A	3.35E-05
Tier 2 UTL	N/A	2.36E-05	N/A	5.35E-07	N/A	2.41E-05
Tier 2 UCL	N/A	1.48E-05	N/A	3.64E-07	N/A	1.52E-05

N/A = Not applicable.

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Table A4.2.19

Intake and Estimates for 2,3,7,8-TCDD TEQ (mammal) in IAEU Surface Soils; Default Exposure Scenario

Bioaccumulation Factors						
Soil to Plant	Soil to Invertebrate	Soil to Small Mammal				
0.22	lnCi = 3.53 + 1.2(lnCs)	lnCsm = 0.8113 + .0993(lnCs)				
Media Concentrations (mg/kg)						
Soil Concentration	**Statistic**	**Plant**	**Earthworm**	**Small Mammal**	**Surface Water (mg/L)**	
1.86E-05	Tier 1 UTL	4.09E-06	7.19E-05	1.42E-05	N/A	
9.16E-06	Tier 1 UCL	2.02E-06	3.07E-05	6.52E-06	N/A	
1.00E-05	Tier 2 UTL	2.20E-06	3.41E-05	7.18E-06	N/A	
7.90E-06	Tier 2 UCL	1.74E-06	2.57E-05	5.54E-06	N/A	
Intake Parameters						
	$IR_{(food)}$ (kg/kg BW day)	$IR_{(water)}$ (kg/kg BW day)	$IR_{(soil)}$ (kg/kg BW day)	P_{plant}	P_{invert}	P_{mammal}
Deer Mouse - Insectivore	0.0650	0.190	0.00130	0	1	0
Intake Estimates (mg/kg BW day)						
	Plant Tissue	**Invertebrate Tissue**	**Mammal Tissue**	**Soil**	**Surface Water**	**Total**
Deer Mouse - Insectivore						
Tier 1 UTL	N/A	4.67E-06	N/A	2.42E-08	N/A	4.69E-06
Tier 1 UCL	N/A	2.00E-06	N/A	1.19E-08	N/A	2.01E-06
Tier 2 UTL	N/A	2.22E-06	N/A	1.30E-08	N/A	2.23E-06
Tier 2 UCL	N/A	1.67E-06	N/A	1.03E-08	N/A	1.68E-06

N/A = Not applicable.

Table A2.4.20
Hazard Quotients for Surface Soils in IAEU-2,3,7,8-TCDD TEQ (bird)

		TRV (mg/kg BW day)		Hazard Quotients	
	Total Intake (mg/kg BW day)	NOAEL	LOAEL	NOAEL	LOAEL
2,3,7,8-TCDD TEQ (bird) (Default Exposure)					
Mourning Dove - Insectivore					
Tier 1 UTL	8.53E-05	1.40E-05	1.40E-04	**6**	0.6
Tier 1UCL	3.35E-05	1.40E-05	1.40E-04	**2**	0.2
Tier 2 UTL	2.41E-05	1.40E-05	1.40E-04	**2**	0.2
Tier 2 UCL	1.52E-05	1.40E-05	1.40E-04	1	0.1

Bold = Hazard quotients>1.

Table A4.2.21
Hazard Quotients for Surface Soils in IAEU-2,3,7,8-TCDD TEQ (mammal)

		TRV (mg/kg BW day)		Hazard Quotients	
	Total Intake (mg/kg BW day)	NOAEL	LOAEL	NOAEL	LOAEL
2,3,7,8-TCDD TEQ (mammal) (Default Exposure)					
Deer Mouse - Insectivore					
Tier 1 UTL	4.69E-06	1.00E-06	1.00E-05	**5**	0.5
Tier 1 UCL	2.01E-06	1.00E-06	1.00E-05	**2**	0.2
Tier 2 UTL	2.23E-06	1.00E-06	1.00E-05	**2**	0.2
Tier 2 UCL	1.68E-06	1.00E-06	1.00E-05	**2**	0.2

Bold = Hazard quotients>1.

Table A4.2.22
Intake and Estimates for Total PCB in IAEU Surface Soils; Default Exposure Scenario

Bioaccumulation Factors						
Soil to Plant	**Soil to Invertebrate**	**Soil to Small Mammal**				
0.250	lnCe = 1.41 + 1.361(lnCs)	log(Csm) = 0.246 * ((0.5*0.25)+(0.5*Cinv/Csoil))				
Media Concentrations (mg/kg)						
Soil Concentration	**Statistic**	**Plant**	**Earthworm**	**Small Mammal**	**Surface Water (mg/L)**	
1.09	Tier 1 UTL	0.273	4.61	1.73	0.0110	
0.794	Tier 1 UCL	0.199	2.99	1.64	0.00230	
0.795	Tier 2 UTL	0.199	3.00	1.64	0.0110	
0.660	Tier 2 UCL	0.165	2.33	1.59	0.00230	
Intake Parameters						
	$IR_{(food)}$ (kg/kg BW day)	$IR_{(water)}$ (kg/kg BW day)	$IR_{(soil)}$ (kg/kg BW day)	P_{plant}	P_{invert}	P_{mammal}
Mourning Dove - Insectivore	0.230	0.120	0.0214	0	1	0
American Kestrel	0.0920	0.120	0.00460	0	0.200	0.800
Intake Estimates (mg/kg BW day)						
	Plant Tissue	**Invertebrate Tissue**	**Mammal Tissue**	**Soil**	**Surface Water**	**Total**
Mourning Dove - Insectivore						
Tier 1 UTL	N/A	1.06	N/A	0.0233	0.00132	1.08
Tier 1 UCL	N/A	0.688	N/A	0.0170	2.76E-04	0.705
Tier 2 UTL	N/A	0.336	N/A	0.0100	0.00132	0.348
Tier 2 UCL	N/A	0.252	N/A	0.00813	2.76E-04	0.261
American Kestrel						
Tier 1 UTL	N/A	0.0847	0.128	0.00501	0.00132	0.219
Tier 1 UCL	N/A	0.0551	0.121	0.00365	2.76E-04	0.180
Tier 2 UTL	N/A	0.0269	0.111	0.00216	0.00132	0.142
Tier 2 UCL	N/A	0.0202	0.108	0.00175	2.76E-04	0.130

N/A = Not applicable.

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Table A4.2.23
Hazard Quotients for Surface Soils in IAEU-Total PCB

	Total Intake (mg/kg BW day)	TRV (mg/kg BW day)		Hazard Quotients	
		NOAEL	LOAEL	NOAEL	LOAEL
Total PCB(Default Exposure)					
Mourning Dove - Insectivore					
Tier 1UTL	1.08	0.090	1.27	**12**	0.9
Tier 1 UCL	0.705	0.090	1.27	**8**	0.6
Tier 2 UTL	0.34	0.090	1.27	**4**	0.3
Tier 2 UCL	0.261	0.090	1.27	**3**	0.2
American Kestrel					
Tier 1UTL	0.22	0.090	1.27	**2**	0.2
Tier 1 UCL	0.18	0.090	1.27	**2**	0.1
Tier 2 UTL	0.14	0.090	1.27	**2**	0.1
Tier 2 UCL	0.13	0.090	1.27	**1**	0.1

Bold = Hazard quotients>1.

COMPREHENSIVE RISK ASSESSMENT

INDUSTRIAL AREA EXPOSURE UNIT

VOLUME 14: ATTACHMENT 5

Chemical-Specific Uncertainty Analysis

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

	Bioaccumulation Factors
BW	body weight
CRA	Comprehensive Risk Assessment
ECOPC	ecological contaminant of potential concern
EcoSSL	Ecological Soil Screening Level
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ESL	ecological screening level
HQ	hazard quotient
LOAEL	lowest observed adverse effect level
LOEC	lowest observed effect concentration
mg/kg	milligrams per kilogram
mg/kg/BW/day	milligram per kilogram per receptor body weight per day
NOAEL	no observed adverse effect level
PMJM	Preble's meadow jumping mouse
PRC	PRC Environmental Management, Inc
RFETS	Rocky Flats Environmental Technology Site
TRV	toxicity reference value
UCL	upper confidence limit
UTL	upper tolerance limit
UWNEU	Upper Walnut Exposure Unit

1.0 INTRODUCTION

One potential limitation of the HQ approach is that calculated HQ values may sometimes be uncertain due to simplifications and assumptions in the underlying exposure and toxicity data used to derive the HQs. Where possible, this risk assessment provides information on two potential sources of uncertainty, described below.

- **Bioaccumulation Factors (BAFs).** For wildlife receptors, concentrations of contaminants in dietary items were estimated from surface soil using uptake equations. When the uptake equation was based on a simple linear model (e.g., $C_{tissue} = BAF * C_{soil}$), the default exposure scenario used a high-end estimate of the BAF (the 90th percentile BAF). However, the use of high-end BAFs may tend to overestimate tissue concentrations in some dietary items. If necessary, in order to estimate more typical tissue concentrations, an alternate exposure scenario calculated total chemical intake using a 50th percentile (median) BAF. The use of the median BAF is consistent with the approach used in the ecological soil screening level (EcoSSL) guidance (EPA 2005).

- **Toxicity Reference Values (TRVs).** The CRA Methodology utilized an established hierarchy to identify the most appropriate default TRVs for use in the ECOPC selection. However, in some instances, the default TRV selected may be overly conservative with regard to characterizing population-level risks. The determination of whether the default TRVs are thought to yield overly conservative estimates of risk is addressed in the uncertainty sections below on a chemical-by-chemical basis. If LOAEL HQs greater than 1 were calculated using the default HQ calculations and an alternate TRV is identified, the chemical-specific uncertainty sections provide a discussion of why the alternate TRV is thought to be appropriate to provide an alternative estimate of toxicity (e.g., endpoint relevance, species relevance, data quality, chemical form, etc.), and HQs were calculated using both default and alternate TRVs.

The influences of each of these uncertainties on the calculated HQs are discussed for each ECOPC in the following subsections.

1.1 Antimony

Bioaccumulation Factors

There are several important uncertainties associated with the intake and HQ calculations for vertebrate receptors. Antimony has two types of BAFs used in the intake calculations. For the soil-to-plant BAF, a regression equation from EPA (2003a) was used to estimate plant tissue concentrations. Confidence placed in this value is high; however, uncertainty is unavoidable when using even high-quality models to predict tissue concentrations. In many cases, regression-based models are the best available predictor of tissue

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concentrations but may still overestimate or underestimate plant tissue concentrations of antimony to an unknown degree.

Considerable uncertainty is placed in the soil-to-invertebrate and soil-to-small mammal BAFs for antimony. No soil-to-invertebrate BAF was identified in the CRA Methodology and, therefore, a default value of 1 was used as the BAF. As a result, all intake calculations assume that antimony concentrations in terrestrial invertebrate tissues are equal to concentrations in surface soils. Because antimony is not typically a bioaccumulative compound, this assumption is likely to overestimate antimony concentrations and subsequent risk estimations to an unknown degree. The soil-to-small mammal BAF utilizes both the soil-to-plant and soil-to-invertebrate BAFs in addition to a food-to-small mammal BAF to estimate small mammal tissue concentrations. Given the uncertainties associated with the soil-to-invertebrate TRV and the added uncertainty of the food-to-small mammal BAF, the total uncertainty related to the soil-to-small mammal BAF is large. However, it is unclear as to whether the BAF overestimates or underestimates the concentration of antimony in small mammal tissues, and the degree of effects that the uncertainty has on the intake calculations is unknown.

Plant Toxicity

Toxicity information on the effects of antimony to plants is extremely limited. The summary of antimony toxicity in Efroymson et al. (1997a) places low confidence in the value because there are no primary reference data showing toxicity to plants and the NOAEL ESL value is based on unspecified toxic effects. No additional TRVs were available in the literature. The uncertainty associated with the lack of toxicity data for terrestrial plants is high. It is unclear whether risks are overestimated or underestimated by using the default toxicity value.

Toxicity Reference Values

For mammalian receptors, review of the toxicity data provided in EPA (2003) indicates that only one bounded LOAEL, used in the risk estimation, is lower than the geometric mean of growth and reproduction NOAEL TRVs. All other bounded LOAEL TRVs for growth, reproduction, and mortality are more than an order of magnitude greater than the NOAEL and LOAEL used as the default TRVs. The default NOAEL and LOAEL TRVs for antimony are based on a decrease in rat progeny weight, and the effect of a predicted decrease in birth weight on the mammalian receptors in the UWNEU is unknown. Given that the geometric mean NOAEL TRV is less than the next lowest, bounded LOAEL TRV and the uncertainty regarding whether the endpoint predicted by the default LOAEL TRV is predictive of population-level effects, the geometric mean NOAEL provides a useful comparison point versus the default TRV.

Background Risk Calculations

Antimony was not detected in background surface soils. Therefore, background risks were not calculated for antimony in Appendix A, Volume 2, Attachment 9 of the RI/FS Report.

1.2 Copper

Bioaccumulation Factors

For the soil-to-plant, soil-to-invertebrate, and soil-to-small mammal BAFs, regression equations were used to estimate plant tissue concentrations. Confidence placed in these values is high; however, uncertainty is unavoidable when using even high-quality models to predict tissue concentrations. In cases without available measurements of tissue concentrations, regression-based models are generally the best available predictor of tissue concentrations. However, the regression-based BAFs may still overestimate or underestimate tissue concentrations of copper to an unknown degree.

Toxicity Reference Values

The NOAEL and LOAEL TRVs for birds were obtained from PRC Environmental Management, Inc. (PRC) (1994). The PRC document reviewed the available effects database for avian effects from copper. The NOAEL TRV represents a dose of copper at which no growth, developmental, reproductive, or mortality effects were noted. The LOAEL TRV represents a dose rate at which an increase in the erosion of chicken gizzards was noted. The CRA Methodology noted that the nature of the effect predicted by the LOAEL TRV is not likely to cause significant effects on growth, reproduction, or survival in birds and, subsequently, calculated a threshold TRV. The threshold TRV represents an estimate of the point between the NOAEL and LOAEL TRVs where effects related to the LOAEL TRV may begin to occur. This point is uncertain and it is impossible to accurately estimate where the threshold for effects lies given the available data. Therefore, the calculation of the threshold TRV may overestimate or underestimate the calculated risks by a degree less than half of the difference between the NOAEL and LOAEL TRVs. In addition, the ability of the LOAEL TRV endpoint to predict effects to populations of avian receptors at RFETS under the assessment endpoints used in this CRA is uncertain. The effect that gizzard erosion in birds has on population-level endpoints is unclear, but risk estimations are likely to be conservative and over-predict risk. However, Sample et al. (1996), a CRA Methodology-approved TRV source, provides avian TRVs for growth and mortality endpoints to neonate chickens that are very similar to the LOAEL TRV from PRC (PRC LOAEL = 52.3 milligrams per kilogram [mg/kg]/BW/day; Sample LOAEL = 61.7 mg/kg/BW/day). Because the two LOAEL values are similar, the uncertainty in the PRC LOAEL is reduced and no alternative TRVs are provided to calculate risk to the mourning dove receptors. The PRC value is considered to be protective of growth and mortality effects in birds. Although it may over-predict risks, the degree is likely to be small.

Background Risks

Copper was detected in RFETS background surface soils. Because risks are generally not expected at naturally occurring background levels, it is important to calculate the risks that would be predicted at naturally occurring concentrations using the same assumptions and models as used in the CRA. This provides information necessary to gauge the predictive ability of the risk assessment models used in the CRA. In addition, risks calculated using background data can provide additional information on the magnitude of potentially site-related risks.

Risks to the mourning dove (herbivore and insectivore) were calculated using both the UCL and UTL of background soils. No HQs greater than 1 were calculated for either receptor using the NOAEL, threshold or LOAEL TRVs. NOAEL HQs equal to 1 were calculated for the mourning dove (insectivore) with both the UCL and UTL EPCs. NOAEL HQs for the mourning dove (herbivore) equaled 0.7 for the UCL and UTL EPCs. These results indicate that HQs calculated in the risk estimation are not overly conservative in terms of predicting risk at natural background concentrations.

1.3 Chromium

Bioaccumulation Factors

There are several important uncertainties associated with the intake and HQ calculations for vertebrate receptors. Chromium has two types of bioaccumulation factors used in the intake calculations. For the soil-to-small mammal BAF, a regression equation was used to estimate tissue concentrations. Confidence placed in this values is high; however, uncertainty is unavoidable when using even high quality models to predict tissue concentrations. In cases without available measurements of tissue concentrations, regression-based models are generally the best available predictor of tissue concentrations. However, the regression-based BAFs may still overestimate or underestimate tissue concentrations of chromium to an unknown degree.

The soil-to-invertebrate and soil-to-plant BAFs used to estimate invertebrate tissue concentrations are both based on screening-level upper-bound (90th percentile) BAFs presented in Sample et al. (1998a) and ORNL (1998). These values provide conservative estimates of uptake from soils to invertebrate and plant tissues. This conservative estimate may serve to overestimate chromium concentrations in tissues. For this reason, the median BAFs presented in the same documents were used as alternative BAFs to estimate invertebrate and plant tissue concentrations as recommended in EPA's updated EcoSSL guidance (EPA 2005). It is unclear whether the use of median BAFs reduces the uncertainty involved in the estimation of invertebrate tissue concentrations, but the likelihood of overestimation of risks is reduced.

Toxicity Reference Values

For terrestrial plants, the summary of chromium toxicity in Efroymson et al. (1997a) places low confidence in the value because there are no primary reference data showing toxicity to plants and the basis for the NOEC ESL is not discussed in the document. The document simply notes that confidence in the values is low due to the small number of studies on which it was based. Efroymson et al. (1997a) also provides plant toxicity values from Turner and Rust (1971) that are based on growth effects on grown in loamy soils. No effects to plant growth were noted at 10 mg/kg while shoot weight was reduced by 30 percent at chromium concentrations equal to 30 mg/kg. Uncertainty is high using the alternative values but reduced from the unspecified and unsupported 1 mg/kg value used as the ESL.

For terrestrial invertebrates, the ESL is based on survival effects to earthworms exposed to hexavalent chromium (chromium VI). Severe effects on survival were noted at 2 mg/kg chromium VI. The 0.4 mg/kg ESL was calculated by Efroymson et al. (1997b) by dividing be a safety factor of 5. There is some uncertainty in the chromium VI TRV since trivalent chromium (chromium III) is the most prevalent form of inorganic chromium found in soils (Kabata-Pendias 2002) and chromium VI was rarely detected when sampled for anywhere at RFETS. This introduces uncertainty into the TRV selection process as chromium VI is regarded as the more toxic form of chromium. Efroymson et al. (1997b) also provide data for a LOEC concentration where growth to earthworms was reduced by 30 percent at 32.6 mg/kg of chromium III. The alternative chromium III LOEC provides a useful alternative estimate of toxicity based on a more applicable estimate of chromium III toxicity.

The NOAEL and LOAEL TRVs for birds were obtained from Sample et al. (1996). The mammalian TRV was based on effects from chromium VI while the bird TRV was based on effects from chromium III.

The NOAEL TRV for chromium VI represents a dose of at which no effects to the survival of ducks were noted. The LOAEL TRV represents a dose rate at which an a decrease in survivability was noted in the same study. No threshold TRV was calculated in the CRA Methodology and one is not identified here. Therefore, the threshold for chromium VI toxicity lies somewhere between the NOAEL and LOAEL but the actual intake rate is uncertain.

There is some uncertainty in the chromium VI TRV since chromium III is the most prevalent form of inorganic chromium found in soils (Kabata-Pendias 2002) and chromium VI was rarely detected when sampled for anywhere at RFETS. This introduces uncertainty into the TRV selection process as chromium VI is regarded as the more toxic form of chromium (IRIS, 2005). The bird TRVs are based on mortality effects in black ducks and are based on chromium II toxicity. These values are based on appropriate endpoints and uncertainty in them is considered low. No alternative TRVs were identified for chromium III and none were available for chromium VI.

NOAEL and LOAEL TRVs for chromium VI were available for estimating risk to mammals. Only a NOAEL TRV was available for assessing risks to mammals from exposure to chromium III. All of the mammalian TRVs were obtained from Sample et al. (1996) and relate to reproduction and mortality endpoints. Both the chromium VI and chromium III TRVs were used in the default analysis. As discussed above for birds, the use of the chromium VI TRV is likely to overestimate risks. The chromium VI NOAEL is less than the chromium III NOAEL by three orders of magnitude for similar endpoints. Care should be taken when reviewing the HQs calculated using the chromium VI TRVs. Uncertainty is also introduced into the risk estimates due to the lack of a LOAEL TRV for chromium. Since both TRVs were based on acceptable endpoints, no alternative TRVs were identified.

Background Risks

Chromium was detected in RFETS background surface soils. Because risks are generally not expected at naturally occurring background levels, it is important to calculate the risks that would be predicted at naturally occurring concentrations using the same assumptions and models as used in the CRA. This provides information necessary to gauge the predictive ability of the risk assessment models used in the CRA. In addition, risks calculated using background data can provide additional information on the magnitude of potentially site-related risks.

Risks to the terrestrial plants, terrestrial invertebrates, mourning dove (herbivore and insectivore), American kestrel, deer mouse (insectivore), and PMJM were calculated using both the UCL and UTL of background soils. NOAEL HQs greater than to 1 were calculated for terrestrial plants, terrestrial invertebrates, and mourning dove (insectivore) with both the UCL and UTL EPCs. NOAEL HQs for terrestrial plants equaled 17 using the UTL while those calculated for terrestrial invertebrates equaled 42. Both NOAEL and LOAEL HQs greater than 1 were calculated for the mourning dove (insectivore). The LOAEL HQ equaled 3 using the UTL EPC. No LOAEL TRVs were available for terrestrial plants or invertebrates. These results indicate that risks calculated using the default exposure model and TRVs may be overly conservative for terrestrial plants and invertebrates as well as for the mourning dove (insectivore) receptors because they predict moderate levels of risk at both the UCL and UTL background concentrations. This conservatism should be accounted for in risk management decisions.

1.4 Molybdenum

Bioaccumulation Factors

The soil-to-invertebrate BAF used to estimate invertebrate tissue concentrations for the deer mouse (insectivore) is based on a screening-level upper bound (90th percentile) BAF presented in Sample et al. (1998a). This value provides a conservative estimate of uptake from soils to invertebrate tissues. This conservative estimate may serve to overestimate molybdenum concentrations in invertebrate tissues. For this reason, the median BAF presented in the same document (Sample et al. 1998b) can be as an alternative BAF to estimate invertebrate tissue concentrations. It is unclear whether the use of median BAFs reduces the uncertainty involved in the estimation of invertebrate tissue concentrations, but the likelihood of overestimation of risks is reduced.

Plant Toxicity

Toxicity information on the effects of molybdenum on plants is extremely limited. The summary of molybdenum toxicity in Efroymson et al. (1997a) places low confidence in the value because there are no primary reference data showing toxicity to plants, and the NOAEL ESL value is based on unspecified toxic effects. No alternative TRVs were available in the literature. The uncertainty associated with the lack of toxicity data for terrestrial plants is high. It is unclear whether risks are overestimated or underestimated by using the default toxicity value, but overestimation is the more likely scenario.

Toxicity Reference Values

The NOAEL and LOAEL TRVs for mammalian receptors were obtained from Sample et al. (1996), a CRA Methodology-approved source of TRVs. The LOAEL TRV represents an intake rate at which an increased incidence of runts in mouse litters was noted. No NOAEL TRV was available, so the NOAEL TRV was estimated from the LOAEL TRV by dividing by a factor of 10. The estimation of the NOAEL TRV from the LOAEL TRV introduces uncertainty into the risk characterization process. It is unknown where the threshold for effects lies at intake rates lower than the LOAEL TRV; therefore, it is unclear at which intake-rate the true NOAEL lies. However, this source of uncertainty is limited because the LOAEL TRV is of sufficient quality to assess risks and the LOAEL TRV endpoint may be predictive of population risks. Risks predicted by the LOAEL TRV may be overestimated or underestimated, but the degree of uncertainty is low.

Background Risk Calculations

Molybdenum was not detected in background surface soils. Therefore, background risks were not calculated for molybdenum in Appendix A, Volume 2, Attachment 9 of the RI/FS Report.

1.5 Tin

Bioaccumulation Factors

The primary source of uncertainty in the risk estimation for tin is in the estimation of tissue concentrations. No high-quality regression models or BAF data were available for any of the three soil-to-tissue pathways. As a result, plant tissue concentrations are estimated using a biotransfer factor from soil-to-plant tissue from Baes et al. (1984). The values presented in Baes et al. (1994) were the lowest tier for data quality in the CRA Methodology and represent the most uncertain BAF available. It is unclear whether the Baes et al. (1984) BAFs overestimate or underestimate uptake into plant tissues, and the magnitude of uncertainty is also unknown but could be high.

No data were available to estimate invertebrate concentrations from soil. As a result, a default value of 1 was used. This value assumes that the concentration in invertebrate tissues is equal to the surface soil concentration. There is a large degree of uncertainty in this assumption. Because tin is not expected to bioaccumulate in the food chain, invertebrate tissue concentrations are likely to be overestimated to an unknown degree using this BAF. The lack of quality soil-to-plant and soil-to-invertebrate BAFs directly affects the quality of the soil-to-small mammal BAF that uses the previous two values in its calculation. Compounding the uncertainty for this BAF is a food-to-tissue BAF, again from Baes et al. (1984). It is unclear to what degree and direction that uncertainty can be estimated for the soil-to-small mammal BAF, but the uncertainty associated with the estimated small mammal tissue concentrations is high.

Toxicity Reference Values

The NOAEL and LOAEL TRVs for mammalian receptors were obtained from PRC (1994). The selected NOAEL TRV is protective of systemic effects in mice. These effects are not associated with the assessment endpoints for mammalian receptors at RFETS and, therefore, are overly conservative for use in the CRA. However, the LOAEL TRV selected by PRC (1994) is from a proper endpoint for use in the CRA and is described by PRC (1994) as predictive of a mid-range of effects less than mortality. Therefore, while the uncertainty related to the NOAEL TRV for mammals is high, the uncertainty for the LOAEL TRV is considerably lower. For this reason, no alternative TRVs are recommended in the uncertainty analysis.

For avian receptors, the TRVs selected for use in the CRA were also obtained from PRC (1994) and represent a paired NOAEL and LOAEL from a study on Japanese quail reproduction. No effects on reproduction were noted at the NOAEL, while reduced reproduction was noted at the LOAEL intake rate. Because the endpoints represented by the TRVs are appropriate for use in the CRA, the uncertainty in the avian TRVs for tin is considered to be low.

Background Risk Calculations

Tin was not detected in background surface soils, therefore, background risks were not calculated for tin in Appendix A, Volume 2, Attachment 9 of the RI/FS Report.

1.6 Bis(2-ehtylhexyl)phthalate

Bioaccumulation Factors

Both invertebrate and small mammal tissue concentrations for bis(2-ethylhexyl)phthalate were estimated using uptake models based on the log K_{ow} of bis(2-ehtylhexyl)phthalate. As cited in the CRA Methodology, if organic ECOIs with no empirically calculated BAFs available in the first two sources, log K_{ow} equations are used (as presented and modified in the EPA EcoSSL [EPA 2003a]). These values are more uncertain than empirically based BAFs and are likely to overestimate tissue concentrations to an unknown degree. This uncertainty is compounded in the soil-to-small mammal BAF that uses both the soil-to-invertebrate and soil-to-plant (also log K_{ow}-based) BAFs to estimate the diet of the small mammal. A second model is then used to estimate the amount of ECOI transferred from prey food to prey tissues. This compounded uncertainty may overestimate the concentrations of bis(2-ethylhexyl) phthalate by an even larger degree than was noted for the soil-to-invertebrate pathway.

Toxicity Reference Values

Appendix B of the CRA Methodology presents only a NOAEL TRV for avian effects from bis(2-ethylhexyl)phthalate. No reproductive effects were noted in ring doves at a dose of 1.1 mg/kg/BW/day. Because no effects were noted at the highest dose level in the study presented in the CRA Methodology, EPA's Ecotox database was searched for an alternative study. The following study was identified as applicable for use in the risk characterization.

European starlings were fed a concentration of 0, 25, and 250-mg/kg bis(2-ethylhexyl)phthalate via capsules daily (O'Shea and Stafford 1980). Significant increases in body weight were noted at the 25-mg/kg level, which was identified as the LOAEL. While the effects of increased body weight on the health of bird populations is questionable, the resulting TRV is used as the LOAEL for the risk characterization. No food ingestion rates or body weight for the animals used in the study were provided in the Ecotox database, so they were estimated. The body weight and ingestion rate for the American robin (EPA 1993) were used as surrogates (body weight = 0.077 kg; food ingestion rate = 1.52 mg/kg/BW/day). Converting the 25-mg/kg concentration to a dose resulted in a LOAEL TRV equal to 214 mg/kg. Given the questionable endpoint used in the LOAEL study, the risks calculated using the LOAEL are likely to be overestimated to an unknown degree. The uncertainty associated with the TRVs used to assess risk to avian receptors from bis(2-ethylhexyl)phthalate is high.

Background Risk Calculations

Bis(2-ethylhexyl)phthalate was not analyzed for in background surface soils. Therefore, background risks were not calculated for bis(2-ethylhexyl)phthalate in Appendix A, Volume 2, Attachment 9 of the RI/FS Report.

1.7 Di-n-butylphthalate

Bioaccumulation Factors

Both invertebrate and small mammal tissue concentrations for di-n-butylphthalate were estimated using uptake models based on its log K_{ow}. As cited in the CRA Methodology, if organic ECOIs with no empirically calculated BAFs available in the first two sources, log K_{ow} equations are used (as presented and modified in the EPA EcoSSL [EPA 2003a]). These values are more uncertain than empirically based BAFs and are likely to overestimate tissue concentrations to an unknown degree. This uncertainty is compounded in the soil-to-small mammal BAF, which uses both the soil-to-invertebrate and soil-to-plant (also log K_{ow}-based) BAFs to estimate the diet of the small mammal. A second model is the used to estimate the amount of ECOI transferred from prey food to prey tissues. This compounded uncertainty may overestimate the concentrations of di-n-butylphthalate by a larger degree than noted for the soil-to-invertebrate pathway.

Toxicity Reference Values

The TRV used was obtained from Sample et al. (1996) from a study of reproductive effects in ring doves. Changes in eggshell thickness were noted at the LOAEL intake rate. No NOAEL TRV was available, so the NOAEL TRV was estimated from the LOAEL TRV by dividing by a factor of 10. The estimation of the NOAEL TRV from the LOAEL

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TRV introduces uncertainty into the risk characterization process. It is unknown where the threshold for effects lies at intake rates lower than the LOAEL TRV; therefore, it is unclear at which intake-rate the true NOAEL lies. However, this source of uncertainty is limited since LOAEL TRV is of sufficient quality to assess risks and the LOAEL TRV endpoint may be predictive of population risks. Risks predicted by the LOAEL TRV may be overestimated or underestimated, but the degree of uncertainty is low.

Background Risk Calculations

Di-n-butylphthalate was not analyzed for in background surface soils. Therefore, background risks were not calculated for di-n-butylphthalate in Appendix A, Volume 2, Attachment 9 of the RI/FS Report.

1.8 Dioxin (Total)

Bioaccumulation Factors

For the soil-to-invertebrate, and soil-to-small mammal BAFs, regression equations were used to estimate tissue concentrations. Confidence placed in these values is high. Uncertainty is unavoidable when using even high-quality models to predict tissue concentrations. However, in cases without available measurements of tissue concentrations, regression-based models are the best available predictor of tissue concentrations. The regression-based BAFs may overestimate or underestimate tissue concentrations of total PCBs to an unknown degree.

Toxicity Reference Values

For avian receptors, dioxin (total) TRVs were obtained from the database of TRVs from Sample et al. (1996). The LOAEL TRV was derived from a study of reproductive effects in pheasants. At the LOAEL intake rate, a significant decrease in egg production and hatchability was noted. The NOAEL TRV is set at an intake rate that showed potential effects on egg hatchability in pheasants. No threshold TRV was calculated due to the limited information provided in Sample et al. (1996), making the threshold for effects between the NOAEL and LOAEL TRV uncertain. Both the NOAEL and LOAEL TRVs are based on appropriate endpoints for use in the risk characterization and the uncertainty related to the TRVs is low. No alternative TRVs are provided.

For mammalian receptors, dioxin (total) TRVs were also obtained from the database of TRVs from Sample et al. (1996). The LOAEL TRV was derived from a study of reproductive effects in rats. At the LOAEL intake rate, a significant decrease in fertility and neonate survival was noted. The NOAEL TRV is set at an intake rate that showed potential effects on rat reproduction. No threshold TRV was calculated due to the limited information provided in Sample et al. (1996), making the threshold for effects between the NOAEL and LOAEL TRV uncertain. Both the NOAEL and LOAEL TRVs are based on appropriate endpoints for use in the risk characterization and the uncertainty related to the TRVs is low. No alternative TRVs are provided.

Background Risk Calculations

Dioxins was not analyzed for in background surface soils. Therefore, background risks were not calculated for PCB in Appendix A, Volume 2, Attachment 9 of the RI/FS Report.

1.9 PCB (Total)

Bioaccumulation Factors

For the soil-to-plant, soil-to-invertebrate, and soil-to-small mammal BAFs, regression equations were used to estimate plant tissue concentrations. Confidence placed in these values is high. Uncertainty is unavoidable when using even high-quality models to predict tissue concentrations. However, in cases without available measurements of tissue concentrations, regression-based models are the best available predictor of tissue concentrations. The regression-based BAFs may overestimate or underestimate tissue concentrations of total PCBs to an unknown degree.

A higher level of uncertainty is associated with the log K_{ow}-based soil-to-small mammal BAF, which uses both the soil-to-invertebrate and soil-to-plant (also log K_{ow}-based) BAFs to estimate the diet of the small mammal. The food-to-tissue model used in the second step of the estimation of total PCB concentrations in small mammals is used to estimate the amount of PCBs transferred from prey food to prey tissues. This compounded uncertainty may overestimate the concentrations of total PCBs by a larger degree than noted for the soil-to-invertebrate pathway.

Toxicity Reference Values

For avian receptors, total PCB TRVs were obtained from the database of TRVs from PRC (1994). The LOAEL TRV was derived from a study of reproductive effects in chickens. At the LOAEL intake rate, a significant decrease in egg hatchability was noted. The NOAEL TRV is set at an intake rate that showed potential effects on egg hatchability in chickens and then reduced by one-tenth to convert the concentration to a NOAEL. Because the NOAEL and LOAEL TRVs came from two different studies with different methods and the NOAEL TRV was estimated from an effect-based TRV, no threshold TRV has been calculated for birds. The estimation of the NOAEL TRV from a LOAEL TRV introduces uncertainty in the NOAEL TRV. However, because the LOAEL TRV is based on endpoints appropriate for use by receptors in the UWNEU, the uncertainty associated with the TRVs is considered low. The TRVs may overestimate or underestimate risk to an unknown degree.

Background Risk Calculations

PCB was not analyzed for in background surface soils. Therefore, background risks were not calculated for PCB in Appendix A, Volume 2, Attachment 9 of the RI/FS Report.

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COMPREHENSIVE RISK ASSESSMENT

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VOLUME 14: ATTACHMENT 6

CRA Analytical Data Set