Human Health Risk Assessment

Smelter/Tailings Soils Investigation Unit
Hurley, New Mexico

Volume I
Text, Tables, Figure, Appendices A - D

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List of Abbreviations

µm	Micrometer
ABS	Oral Absorption Fraction
ACGIH	American Council of Governmental Industrial Hygienists
AEC	Acceptable Exposure Concentration
AEL	Acceptable Exposure Level
AF	Adherence Factor
Al	Aluminum
AOC	Administrative Order on Consent
As	Arsenic
AT	Averaging Time
ATSDR	Agency for Toxic Substances and Disease Registry
Ba	Barium
bgs	Below Ground Surface
BW	Body Weight
Cd	Cadmium
CMC	Chino Mines Company
COC	Chemical of Concern
COPC	Chemical of Potential Concern
Cr	Chromium
CSF	cancer slope factor
CT	Central Tendency
Cu	Copper
DA	Dermal Absorption Fraction
DRIs	Dietary Reference Intakes
ED	Exposure Duration
EF	Exposure Frequency
ELCR	Excess Lifetime Cancer Risk
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
Fe	Iron
GI	Gastrointestinal
GSD	Geometric Standard Deviation
HEAST	(US EPA's) Health Effects Assessment Summary Table
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IOM	Institute of Medicine
IR	Ingestion Rate
IRIS	(US EPA's) Integrated Risk Information System
IU	Investigation Unit
LOAEL	Lowest Observed Adverse Effect Level
Mo	Molybdenum
MSLs	Medium-Specific Screening Levels
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan

NCRP	National Council on Radiation Protection & Measurements
NHANES	National Health and Nutrition Examination Survey
NIOSH	National Institute of Occupational Safety and Health
NMED	New Mexico Environment Department
NOAEL	No Observed Adverse Effect Level
NRC	National Research Council
PRG	Preliminary Remediation Goal
RAC	Remedial Action Criteria
RBC	Risk-Based Concentration
RDA	Recommended Daily Allowance
RfC	Reference Concentration
RfD	Reference Dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
S/TSIU	Smelter /Tailings Soils Investigation Unit
Sb	Antimony
TAL	Target Analyte List
THI	Target Hazard Index
Tl	Thallium
TLV	Threshold Limit Value
UCL	Upper Confidence Limit on the Mean
UF	Uncertainty Factor
UL	Tolerable Upper Intake Level
UR_{inhal}	Inhalation Unit Risk
UR	Unit Risk
USDA	US Dairy Association
US EPA	United States Environmental Protection Agency
USGS	US Geological Survey
V	Vanadium
WEM	Wind Erosion Model
WRCC	Western Regional Climate Center
XRF	X-Ray Fluorescence

1 Introduction

This Human Health Risk Assessment (HHRa) for the Smelter/Tailings Soils Investigation Unit presents an assessment of human health risks posed by current and potential future exposures to chemical compounds found in soil, air, surface water, sediment, and locally-produced beef, chicken, eggs, and vegetables at the Smelter/Tailings Soils Investigation Unit (S/TSIU).

The S/TSIU includes the Chino smelter and the tailings piles located south of the smelter. As specified in the Administrative Order on Consent (AOC) (NMED, 1994), the objective of the HHRA is to determine the actual or potential risk to public health at the site. The results of the HHRA will be used in the development of Remedial Action Criteria (RAC) for the site.

This risk assessment is organized into four major sections. In the first section, Data Collection and Evaluation (Section 2), metals found in site-related media that may pose a threat to human health are identified and the amount of each compound that individuals may be exposed to is quantified. In the next two sections, Exposure Assessment (Section 3) and Toxicity Assessment (Section 4), the two variable components of risk (*i.e.*, exposure and toxicity) are quantified to the extent possible. In the Risk Characterization section (Section 5), exposure and toxicity information are combined to estimate the potential health risks posed by metals at the site. Section 6 presents the risk based concentrations (RBCs) developed for soil at the site. Section 7 presents the conclusions of the HHRA.

2 Data Collection and Evaluation

In this chapter we provide background information for the S/TSIU (Section 2.1), summarize data collection efforts (Section 2.2), evaluate the usability (Section 2.3) and adequacy (Section 2.4) of the data in the context of preparing a human health risk assessment, and identify chemicals of concern (COCs) that will be evaluated for this risk assessment (Section 2.5).

2.1 Site Background

The Chino Mines Company (Chino) currently owns and operates the Santa Rita mine, located approximately 4 miles northeast of the town of Bayard, New Mexico; Chino also owns a copper smelter near the eastern edge of the town of Hurley, New Mexico. Both Bayard and Hurley are located in Grant County, along US Highway 180 between Deming and Silver City. An AOC between Chino and the New Mexico Environment Department (NMED) requires an environmental and human health evaluation of areas affected by historic mining and smelting operations (NMED, 1994). The AOC originally designated six investigation units (IUs), including a Smelter IU and a Tailings Soils IU, comprising an area of approximately 31,700 acres (CMC, 1995). The Smelter and Tailings Soils IUs were subsequently combined and extended eastward to form the current Smelter/Tailings Soils IU (S/TSIU). Figure 1 shows the boundary of the original AOC investigation area and the current S/TSIU. In this section we provide a description of the S/TSIU (Section 2.1.1), a brief history (Section 2.1.2), and the physical setting and characteristics of the S/TSIU (Section 2.1.3).

Much of the information on the site description, history, and physical characteristics that follows is summarized from information provided in the Background Report (CMC, 1995), as well as the Remedial Investigation (RI) Report for the S/TSIU prepared by SRK, Inc. (SRK, 2006).

2.1.1 Site Description

The S/TSIU extends from just north of the town of Bayard to south of the tailings impoundments, spanning US 180 to the west and extending eastward to the Lampbright Draw (Figure 1). This area encompasses the copper smelter and the tailings impoundments, as well as soils potentially affected by the smelter or tailings impoundments. The S/TSIU does not include the towns of Hurley or North

Hurley, which were investigated previously as part of the Hurley Soils IU HHRA, or the Whitewater Creek Corridor, which is investigated as part of the Hanover/Whitewater Creek IU.

Current land use for the S/TSIU is primarily for cattle grazing. In the future, this area may be developed for residential uses, such as for a retirement community. There is also a shelter in this area used by skeet shooters, and a cemetery for the town of Hurley. There are three newly constructed homes located south of the town of Hurley and east of US 180. There are several primitive shelters located in the area between the tailings impoundments and US 180, which are used occasionally for horses and their owners. There are several stock ponds in the S/TSIU, which are used primarily as a source of drinking water for cattle. Several of these stock ponds are large enough to be used for swimming. The James River Canyon reservoir, located in the S/TSIU, could also be considered desirable for swimming.

For the purposes of the HHRA, the S/TSIU was divided into five exposure areas based on physical characteristics, the potential for exposure to impacted media, anticipated differences in soil COC concentrations from past mining and smelter operations, and anticipated land use activities (*e.g.*, residential, ranching, recreating, trespassing). In addition, the area occupied by the Chino Mines smelter facility is evaluated as a separate, industrial use exposure area because access is limited to the employees of CMC. These exposure areas are shown in Figure 1.

2.1.2 Site History

The Chino Copper Company began open pit mining at the Santa Rita mine and built a mill in the current Hurley smelter area in 1911 (see Figure 1). In conjunction with the mill, the Hurley Concentrator, also located in the current Hurley smelter area, operated from 1911 to 1982. Between 1911 and 1982, ore was transported from the Santa Rita mine to the Hurley Concentrator by open-topped rail car. In 1982, the Ivanhoe Concentrator was built at the Santa Rita pit and began operation, replacing the Hurley Concentrator. Since then, concentrate from the Ivanhoe Concentrator has been transported to the Hurley Smelter through slurry lines. The Hurley Concentrator and ore reduction facility were demolished in 1991 (CMC, 1995).

In 1939, the original mill was replaced by the Hurley Smelter, which is still in operation today. Following construction of the Hurley Smelter, copper concentrate from the Hurley Concentrator was stored in underground bins west of the smelter building. When the capacity of the underground storage

bins was exceeded, concentrate was stockpiled on the northwest side of the smelter. In addition, copper precipitate from the Precipitation Plant near the Santa Rita Mine was blended with copper concentrate prior to smelting. This precipitate was dried in an area adjacent to the concentrate stockpile to the west of the smelter (CMC, 1995; SRK, 2006). Figure 2-1 in the RI Report for the S/TSIU (SRK, 2006) shows a general layout of the smelter area.

The Hurley smelter has undergone several improvements over the years. For example, a new stack for exhaust gas from the converters in the smelter was constructed in 1967. A major modernization of the smelter facility, including replacement of a reverberatory furnace with a new INCO flash furnace, was completed in 1984, at which time the newer stack became the primary emission point for smelter operations (CMC, 1995).

does this reduce emissions

Tailings generated by the Hurley Concentrator, and later by the Ivanhoe Concentrator, have been deposited in tailings impoundments stretching 5.3 miles to the south of the smelter area (southeast of the town of Hurley) since 1911 (SRK, 2006). As of March 1993, the surface area of the tailings impoundments was 3.9 square miles (2,477 acres). Tailings Pond 7, which receives tailings generated by the Ivanhoe Concentrator, is the only active tailings area. The other tailings areas, including the Tailings Ponds (1, 2, B, C, 4, 6E and 6W) and Lake One, are currently inactive and dry. Lake One was previously used in the ore-flotation process and other reduction operations by the Hurley Concentrator, and was filled with tailings from the Hurley Concentrator in the early 1980s. Chino recently regraded the exterior and covered side-slopes of several of the inactive tailings impoundments, including the lower benches of Tailings Pond 7. In March 2003, Chino began excavating tailings material from Lake One to the Santa Rita Mine (SRK, 2006).

2.1.3 Physical Setting and Characteristics

The S/TSIU is an area of approximately 45,000 acres located in Grant County, New Mexico. This area is primarily within the San Vicente Basin, a broad lowland semi-arid region of southwest New Mexico characterized by several sandy bottom dry washes and gullies. Topographically, the S/TSIU is relatively flat with an approximate elevation of 5,700 feet above sea level. Increasing topographic relief is observed northeast and east of the S/TSIU, rising to an elevation of approximately 6,400 feet above sea level. Soils are generally rocky and thin with little organic material. The primary surficial geology is comprised of alluvial deposits and Gila Conglomerate, which consists predominantly of poorly sorted,

unconsolidated to highly consolidated sand, gravel and silty gravel, deposited as coalescing alluvial fans. Alluvial deposits, associated with drainages and stream channels, are similar in composition to the Gila Conglomerate (SRK, 2006).

The climate at the S/TSIU is characterized by low relative humidity and a wide range in daily and annual temperatures. Average monthly temperatures for Silver City (about 10 miles from the site) ranged from a low of 21.0° F in January to a high of 87.7° F in July, for the period 1961 – 1990 (WRCC, 2004). The average annual precipitation is 17.5 inches (WRCC, 2004), with most of the rainfall occurring in July through September as brief thunderstorms, occasionally of high intensity. The prevailing wind direction is from the west-northwest with an average wind speed of approximately 8 miles per hour. Thus, based on the prevailing wind direction and the impact of windblown dust, COC concentrations in soil are expected to be higher along the eastern portions of the S/TSIU, especially east of the tailings ponds.

There are two aquifers in the Hurley area – the Gila Aquifer and the Limestone Aquifer. Groundwater flow in the Gila Aquifer is generally to the south-southeast, at a depth of 140 to greater than 190 feet below ground surface (bgs). A low-permeability volcanic sequence, the Volcanic Aquitard, separates the Gila Aquifer from the deeper Limestone Aquifer, in the underlying Paleozoic limestone/sandstone sedimentary unit (Arcadis, 2001; CMC, 1995; Golder, 1998). Whitewater Creek is the main surface water feature in the S/TSIU, running along the eastern side of the smelter facilities and tailings impoundments. According to field observations, surface water flow from most rainfall events typically infiltrates into the streambed before reaching the S/TSIU, such that surface water flow in the S/TSIU portion of Whitewater Creek occurs ephemerally only after significant rainfall events (SRK, 2006).

2.2 Data Collection

In this section, we have summarized all of the available environmental data collected within the S/TSIU area. Our primary source of data was the most recent Remedial Investigation for the S/TSIU (SRK, 2006) (summarized in Section 2.2.1); this was supplemented with suitable data from previous investigations, including the Chino Mines Site Remedial Investigation Background Report (CMC, 1995), the Phase I Remedial Investigation Report (Golder, 1998), the Phase II Ecological RI Report of the

Ecological IU (Arcadis, 2001) (summarized in Section 2.2.2). The samples that were considered useable for the HHRA are listed in Appendix A, along with the data source for each sample.

2.2.1 Summary of SRK Remedial Investigation for the S/TSIU

SRK conducted a remedial investigation in 2004, and performed additional sampling in 2006, to characterize the nature and extent of contamination in the S/TSIU. The results of both investigations are presented in the SRK Revised Remedial Investigation Report (SRK, 2006). The RI field sampling was conducted in October and November 2004, and July 2006. RI activities included sampling of surface soil (0 to 1 inch bgs) in currently undeveloped areas, shallow soil (0 to 6 inches bgs) in areas east and west of the tailings impoundments, sediment in wash areas, and surface water at existing stock tanks/ponds. In addition, during the 2006 supplemental sampling activities, soil, sediment, and surface water samples from drainages in the uplands in Exposure Area 5 were also collected. Figure 1 shows the locations of samples collected during the RI. The RI included collection of the following samples:[1]

- Surface Soil (0-1 inch):
  - 130 composite surface soil samples within the S/TSIU (61 sample locations from S/TSIU Exposure Area 4, and 69 sample locations from Exposure Areas 1, 2, 3, and 5). Each composite sample was comprised of 6 sub-samples and representative of an approximate 0.25-acre area.
  - 5 surface soil samples just inside the western fence of the smelter operational area
  - 8 surface soil samples along a transect that parallels the railroad tracks running north-south between Hurley and Bayard
- Shallow Soil (0-6 inches):
  - 17 composite shallow soil samples within the S/TSIU
  - 8 shallow soil samples between the tailings ponds and US 180, west of the ponds, along the western boundary of the tailings impoundments
  - 9 additional shallow soil samples (SS118D, SS119D, SS124D, SS125D, SS129D, SS131D located east of the trailing impoundments, and ERA159D, ERA160D, and ERA161D located west of US 180)
- Sediment:
  - 8 composite surface sediment samples from drainage transects from Lower Bolton Draw and James Canyon spillway

[1] Sample counts do not include the quality control samples.

- 19 sediment samples from areas with permanent surface water sources (including stock ponds and perennial reaches of Bolton Draw and Lampbright Draw, Rustler, Lampbright, and Martin Canyons – upper, middle, and lower sections of each)
- 9 composite samples from test pits in three drainages (C Drainage, Bolton Draw, and A Drainage)

- Surface Water:
  - 6 samples from permanent stock ponds that serve as a water supply for local ranchers in the vicinity of Bolton Draw
  - 1 sample from pooled water in an upper tributary of Bolton Draw (Drainage BD4), where water occurred as standing water in seasonal rock pools
  - 1 sample from a permanent grotto within C Drainage, from a small seep exposed within the drainage channel
  - 3 samples from Lucky Bill Canyon
  - 3 samples from Rustler Canyon
  - 3 samples from Martin Canyon
  - 1 sample from James River Canyon Reservoir

2.2.2 Summary of Previous Data Collection Efforts at the S/TSIU

Reports and data from previous investigations were evaluated for inclusion in the HHRA database for the S/TSIU. These reports include the following:

- Chino Mines Site Remedial Investigation Background Report (CMC, 1995);
- Phase I Remedial Investigation Report (Golder, 1998); and
- Phase II Ecological RI Report of the Ecological IU (Arcadis, 2001).

We evaluated data from each of these investigations as to its suitability for use in the HHRA. The following criteria were used for evaluation:

- Samples were collected from within the S/TSIU;
- Sample results were validated; and
- Samples were collected from an appropriate depth (0-1, 0-6, and 3-6 inches).

All suitable data from previous investigations were combined with the data from the 2006 RI, to create the HHRA database for the Smelter/Tailings Soils IU. The following sections describe the available data from each of these prior investigations. The samples included in the HHRA database are listed in Appendix A.

2.2.2.1 Chino Mines Site Remedial Investigation Background Report

The Chino Mines Site RI Background Report (CMC, 1995) presents a preliminary assessment of environmental media affected by historic operations associated with the Santa Rita mine, facilities in the Hurley Smelter area, and the tailings impoundments. The data collected for the RI Background Report (CMC, 1995) were used to assess whether soil in the original AOC investigation area was affected by historic mineral processing activities. Soil samples were collected from several locations throughout the S/TSIU. Due to prevailing wind patterns, the distribution of soil samples emphasized areas east of the smelter and tailings impoundments. Samples were collected up to a distance of approximately 5.5 miles to the east of the smelter and approximately 1.5 miles to the west of the smelter. In addition, samples representative of areas unaffected by historic mineral processing activities (reference samples) were also collected for the RI Background Report. The RI Background Report did not provide information regarding whether soil samples were sieved; therefore, we assumed that all soil samples collected for the RI Background Report were unsieved.

The RI Background Report presents detailed discussions of data collection efforts for the Smelter IU, the Hurley Soils IU, and the Tailings Area Soil IU. In the following sections, we describe the samples from the RI Background Report that we evaluated and included in the S/TSIU HHRA from each of the investigation units. The locations of these samples are shown in Figure 1.

Smelter IU

Sampling for the original Smelter IU included collection of 30 surface soil samples (0-1 inch), as follows:

- 19 east of the smelter
- 9 west of the smelter
- 2 north of the smelter

In addition, two co-located surface soil (0-1 inch) and shallow soil samples (3-6 inches), were collected within 1.5 miles of the Hurley smelter. Samples collected for the original Smelter IU were assigned sample identification numbers in the U04 series in the RI Background Report.

Of the 30 surface soil samples collected in the Smelter IU, 21 (excluding two duplicates) were located within the S/TSIU. The two additional surface soil samples co-located with the shallow soil samples were also located within the S/TSIU. Therefore, a total of 25 samples from the original Smelter IU were retained for use in the S/TSIU HHRA.

Hurley Soils IU

Only 1 sample for total metals

Sampling for the original Hurley Soils IU included collection of residential, recreational, and vacant lot soil samples in the town of Hurley as well as reference samples east of the town of Bayard. All Hurley Soils IU samples were assigned sample identification numbers in the U05 series in the RI Background Report.

For samples analyzed for total metals, we assessed whether the samples were located within the S/TSIU. Only two samples within the S/TSIU were analyzed for total metals (U05-4031 and U05-4083). However, only U05-4031 had total metals data with a data validation report in the RI Background Report, and was thus the only sample from the original Hurley Soils IU that was retained for use in the S/TSIU HHRA.

Tailings Area Soils IU

Sampling for the original Tailings Area Soils IU included collection of 18 surface soil samples in the areas near the tailings impoundments, as well as reference samples collected near the airport. All Tailings Area Soils IU samples were assigned sample identification numbers in the U06 series in the RI Background Report. In this group of samples, 11 samples were located within the S/TSIU, and were retained for use in the HHRA. Nine of these samples were collected at the surface (0 to 1 inch depth) and two co-located samples were collected at depths of 1 to 6 inches.

2.2.2.2 Phase I Remedial Investigation Report (Golder, 1998)

All data from the 1998 Phase I RI report were collected within the towns of Hurley or North Hurley, and thus were not retained for use in the S/TSIU HHRA.

2.2.2.3 Phase II Ecological RI Report of the Ecological IU (Arcadis, 2001)

The data collected for the Phase II Ecological RI Report included 34 soil sampling locations (Arcadis, 2001). These data were collected to assess ecological impacts of mining operations, as part of an ecological risk assessment (ERa). A total of 22 of the 34 shallow soils at depths of 0 to 6 inches were located within the S/TSIU and were retained for use in the HHRA. Figure 1 shows the location of the ERA samples that are within the S/TSIU. All samples collected for the Phase II Ecological RI investigation were sieved to 2,000 μm.

Although some of the surface water samples collected as part of the Phase II Ecological RI were located within the S/TSIU, they were not retained for use in the HHRA because they were collected from streams, which are not evaluated as part of the HHRA for the S/TSIU.

2.2.3 Summary of Overall Trends

The conceptual site model for the S/TSIU remedial investigation indicated that historic smelter stack and fugitive dust emissions from historical mineral processing activities and the tailings areas may have affected soil in the S/TSIU. The S/TSIU RI data confirm a pattern of decreasing constituent concentrations in surface soil with increasing distance from the smelter (SRK, 2006). This finding is consistent with previous investigations, such as the RI Background Report and the Phase I RI Report for the Hurley Soils IU (CMC, 1995; Golder, 1998), which found a significant correlation between copper concentration and distance from the smelter operational area. Evidence of historical wind and surface water erosion of tailings material is observed along the eastern boundary of the tailings impoundments (SRK, 2006).

2.2.4 Reference Samples

Many elements occur naturally in soils, at various concentrations throughout the US. Mining operations tend to be located in areas with elevated levels of naturally-occurring metals; these areas tend to have metals concentrations at the higher end of the observed range of background levels. In this section, we consider the appropriateness of the sampling locations for the reference samples, based on historical activities in the area and the distance from the Hurley smelter and tailings impoundments

(Section 2.2.4.1). In addition, to provide perspective on whether the reference samples truly represent naturally occurring levels, we have summarized relevant background concentrations of metals from published sources and compared the reference area concentrations to these published values (Section 2.2.4.2).

2.2.4.1 Appropriateness of Reference Samples

As part of the RI Background Report (CMC, 1995), 15 soil samples were collected from locations southwest of the town of Hurley near the Silver City/Grant County airport, and two samples were collected west of the town of Bayard. Only 7 of the 15 samples near the airport were submitted for laboratory confirmation analysis. Thus we used a total of nine reference samples in the HHRA (Figure 1). Among the seven reference samples near the airport, the sampling location nearest the S/TSIU is approximately 0.75 miles west of the S/TSIU, just south of the airport, and about 2 miles west of the tailings pond area; the sampling location farthest away from the S/TSIU is approximately 4.2 miles west of the S/TSIU border, northwest of the airport. The samples collected near Bayard are approximately 2 miles west of the town. Copper concentrations in surface soils (0-1") for these reference samples ranged from 43 mg/kg to 216 mg/kg, with an average concentration of 136 mg/kg. Copper concentrations for individual reference samples are summarized in Table 2-4.

Table 2-4
Copper Concentrations in Reference Area
Surface Soil Samples (0-1")

Location	Sample ID (Location ID)	Copper Concentration (mg/kg)
Bayard	U05-4001 (HR-01)	212
Bayard	U05-4004 (HR-02)	216
Airport	U06-3015 (R-05)	137
Airport	U06-3016 (R-01)	72
Airport	U06-3024 (R-07)	207
Airport	U06-3026 (R-03)	149
Airport	U06-3028 (R-08)	114
Airport	U06-3030 (R-12)	73
Airport	U06-3027 (R-14)	43

Wind speed and directional data are available from a meteorological station at a golf course in Hurley; these data are considered to be representative of typical wind conditions for the S/TSIU area (CMC, 1995). The dominant wind direction at this station is west-northwest (330 and 280 degrees). The smelter area is immediately east of the town of Hurley, the tailings impoundments extend approximately 5 miles to the southeast of the town, and the mine operations are located approximately 2 miles north of the S/TSIU (Figure 2-1). Because all of the reference samples are located upwind and at distances of several miles from the Hurley smelter and tailings impoundments, it is unlikely that they were affected by historical emissions from the smelter and tailings impoundments, or releases due to other site operations. There is little development in the vicinity of the reference samples, and no historical mining or other industrial operations are noted in the areas where reference samples were collected. In the absence of undisclosed human activities that might have impacted the reference soils, it appears reasonable to use data obtained from these samples as representative background values.

2.2.4.2 Comparison of Background Levels to Published Values

In this section we compare concentrations for the airport/Bayard reference soil samples with published background concentrations as reported in two data sets: Shacklette and Boerngen (1984) – "Background" Metal Concentrations in US Soils; and Kabata-Pendias and Pendias (1992) – "Trace Elements in Soils and Plants." Table 2-5 lists the metal concentrations in the reference soil samples in comparison with the three "background" data sets. The purpose of this comparison was to verify whether the range of background concentrations in the reference area fall within the range for other published sources of background values. Overall, this comparison indicates that the airport/Bayard reference samples can be considered an appropriate background data set for the S/TSIU.

It is generally recognized that definition of a unique set of background values for trace metals in soils is extremely difficult due to the spatial heterogeneity of soils. Without knowing the criteria used for selection of the samples represented by a particular data set, interpretations and comparisons must be qualified accordingly. Nonetheless, with these considerations in mind, comparison of the airport/Bayard reference soil data (CMC, 1995) to the two "background" data sets suggests that the reference samples are adequately representative of unimpacted soil conditions in the vicinity of the S/TSIU. Only four (of 21) elements (Sb, Cu, Cd, Tl) in the reference soil samples are reported at concentrations higher than "background" levels defined by the two comparison data sets. Of these four elements, two (Sb, Cd, and Tl) are reported only in the Kabata-Pendias and Pendias data, and the reference soil concentrations of Cu,

Cd, and Tl are of approximately the same order of magnitude as the Kabata-Pendias and Pendias data. Additional details regarding the comparison of the airport/Bayard reference soil data to the two "background" data sets are provided below.

Shacklette and Boerngen (1984) – "Background" Metal Concentrations in US Soils. Shacklette and Boerngen have compiled ranges of metal concentrations found in typical western US soils; their report is commonly used by scientists as a general baseline for trace metal studies in soil. For each of the elements listed in Table 2-5, approximately 400 to 500 samples of western US soils were analyzed. Comparison of Shacklette and Boerngen's background values to the airport/Bayard reference concentrations for the S/TSIU are complicated somewhat by the large ranges reported by Shacklette and Boerngen for many metals. In addition, the relevance of a "typical western US" soil to the S/TSIU is somewhat uncertain. With these considerations in mind, reference concentrations for 6 of 21 metals (Al, As, Ba, B, Cr, Mo) are below the values reported by Shacklette and Boerngen, as shown in Table 2-5.

Kabata-Pendias and Pendias (1992) – "Trace Elements in Soils and Plants." Data found in this reference are culled from a compilation of information about trace element distributions in a variety of soil types. We compiled data for US soils and, where possible, specifically for silty soils in the US. For some elements, the data not specifically identified as "silty [US] soils" are for "various [US] soils." We note that "US soil" is an extremely broad term and obviously gives no information on soil type, sample location, number of samples represented, mineralogy, or other details that would enable a more rigorous comparison. Nevertheless, these data are included as another set of values considered typical ranges of background concentrations. Only 5 of 21 metal concentrations for the S/TSIU reference samples (Sb, Cd, Cu, Tl, and V) are greater than the range reported by Kabata-Pendias and Pendias.

Table 2-5
Comparison of Reference Soil Samples for the Smelter/Tailings Soils IU to Background Metal Concentrations of US Soils (concentrations in mg/kg, unless otherwise specified)

	S/TSIU Reference		Shacklette and Boerngen (1984)		Kabata-Pendias and Pendias (1992)	
Element	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**
Aluminum	21,500	15,200-28,400	74,000	5,000-100,000	---	0.43-10%
Antimony	3.0	0.9-5.3	---	---	---	0.25-0.6
Arsenic	2.12	0.70-3.06	5.5	<0.10-97	7	<1-93
Barium	118	62-183	580	70-50,000	675	200-1,500
Beryllium	0.69	0.38-0.93	0.68	<1-15	0.54	0.04-2.54
Boron	6.6	1.3-9	23	<20-300	40	<20-70
Cadmium	0.58	0.34-0.83	---	---	---	0.41-0.57
Chromium	32.3	15.7-48.4	41	3-2,000	55	10-100
Cobalt	12.3	8.7-17.7	7.1	<3-50	11	3-30
Copper	136	43-216	21	2-300	25	7-100
Iron	36,600	22,700-47,300	2.1%	0.1->10%	---	1.4-10%
Lead	22.4	17.5-28.3	17	<10-700	19	10-30
Manganese	537	425-686	380	30-5,000	525	50-1,500
Mercury	0.05	0.05-0.05	0.046	<0.01-4.6	0.17	0.02-1.50
Molybdenum	0.3	0.3-0.3	0.85	<3-7	2.5	0.75-6.40
Nickel	15.5	11.8-18.8	15	<5-700	17	5-30
Selenium	0.7	0.1-1.3	0.23	<0.1-4.3	0.31	<0.1-4.0
Silver	0.1	0.1-0.1	---	---	0.7	0.01-8.0
Thallium	7.3	5.9-8.6	---	---	---	0.02-2.8
Vanadium	101.3	49.3-147	70	7-500		0.7-98
Zinc	69.3	59.2-81.7	55	10-2,100	73.5	13-300

U = Not detected.

2.3 Data Usability in Context of Data Quality/Data Validation

To determine the level of confidence associated with risk assessment decisions, the US Environmental Protection Agency (US EPa) recommends that environmental data for risk assessments be assessed and interpreted based on six data usability criteria (US EPA, 1992a): Reports to Risk Assessor, Documentation, Data Sources, Analytical Method and Detection Limit, Data Review, and Data Quality Indicators. Gradient reviewed data validation reports, as well as data quality assessment reports (if available) with respect to these usability criteria, for the data sets discussed above that were considered for use in the HHRA for the S/TSIU. In the context of data quality/data validation, Gradient determined that the majority of the data (analyzed by laboratory methods, as opposed to field methods) were usable for the risk assessment, including results qualified as estimated (J or UJ), with the caution that bias or imprecision might affect the accuracy and precision of the estimated results. In the context of risk assessment, we determined that the data were of sufficient quality to meet project objectives, with the exception of results that were rejected (qualified R) and those that were analyzed using a field x-ray fluorescence method. (These results were therefore not included in the S/TSIU HHRA.) Based on Gradient's review of the available data validation and data quality assessment reports, there are no data validation or data quality issues that would seriously limit use of the data for the HHRA. A detailed discussion of the data validation and data quality issues is provided in Appendix B.

2.4 Data Usability in the Context of Risk Assessment Decisions

This section discusses the adequacy of the available data for conducting an HHRA, and provides a rationale for the data selected for the risk assessment. As described by US EPA, there are "four fundamental risk assessment decisions" to be made from RI data (US EPA, 1992a):

- "What contamination is present and at what levels?"
- "Are site concentrations sufficiently different from background?"
- "Are all exposure pathways and exposure areas identified and examined?"
- "Are all exposure areas fully characterized?"

In the following subsections (2.4.1 through 2.4.4), we evaluate the adequacy of the available data in the context of these four decisions. Section 2.4.5 provides a detailed discussion of the rationale used in selecting the data for each exposure area.

2.4.1 Adequacy of Data to Determine Nature and Magnitude of Contamination

In evaluating human health risks for the S/TSIU, it is important that all site-related metals have been identified, and that the levels of those metals have been accurately characterized. Determination of whether a constituent is present depends on, among other things, the selection of investigation constituents to be analyzed for, and the detection limits for those substances. The samples collected in the S/TSIU were analyzed for the appropriate list of constituents to determine the nature and extent of contamination potentially related to the Hurley smelter and the tailings impoundments. All samples were analyzed at least for the 11 metals that were identified as smelter-related constituents for the Hurley soils. The detection limits for the sample analysis were adequate to detect the presence of site-related contamination. We conclude that the available data for the S/TSIU are adequate to determine the presence and magnitude of contamination related to the smelter and the tailings impoundments.

2.4.2 Adequacy of Data to Determine Whether Site Concentrations Are Sufficiently Different from Background

In the HHRA, constituents were not eliminated from the risk assessment based on a comparison to background concentrations. Therefore, the comparison to background does not have a direct bearing on the risks estimated for the site. Nevertheless, it is important from a risk management standpoint to understand how site concentrations relate to background. Site concentrations are compared to background concentrations using statistical tests (either a Student's t-test or a Wilcoxon rank sum test, depending on the distribution for each data set) to determine whether the difference in means (or medians) is statistically significant at a given level of confidence. The confidence level (generally 95%) is the probability that we correctly conclude the means are not different when in fact they are not. The statistical "power" of the test is the probability that we correctly conclude the means are different when in fact they are. Once the confidence level is set, the power of the test to detect a statistically significant difference in the means depends on the number of samples in each data set, the size of the difference we are trying to detect, and the standard deviation of the data distribution. In most cases, the S/TSIU data were found to be sufficient to determine whether concentrations are different from background.

However, in a few cases (5 out of a total of 36 comparisons) the power of the test to detect a difference is low, either due to small sample size or large variability in the data. The results of the comparison tests are presented in Section 5.3.

2.4.3 Adequacy of Data to Support Evaluation of All Exposure Pathways

The possible exposure pathways in the S/TSIU include exposure to soil, particulates in air, surface water, and sediment. The receptors, exposure media, and exposure routes for each exposure area are described in detail in Section 3 of the HHRA. In general, samples have been collected from each medium to be evaluated. Thus, there are data available to evaluate each of the receptors and exposure pathways proposed in the work plan. Exposure to metals in air is evaluated using wind dispersion modeling of soil concentrations. Exposure to locally-produced food (chicken, eggs, beef, and vegetables) is evaluated by modeling the metal uptake from soil to each type of food. We conclude that there are sufficient data to evaluate all potential exposure pathways.

2.4.4 Adequacy of Data to Determine Whether All Exposure Areas Are Fully Characterized

The sample locations deemed appropriate for use in the HHRA are shown in Figure 1. The number and areal extent of samples in each exposure area is sufficient to conclude that the extent of site-related contamination has been fully characterized in each exposure area.

It should be noted that EA 5 covers an area of approximately 25 square miles (16,000 acres), and the northern portion includes some rough, hilly terrain. Because of this, it was not feasible during the RI to collect samples at regularly spaced intervals in the northern third of EA 5; thus, there are some portions of this area that are lacking sample coverage (Figure 1). However, the samples that were collected in EA 5 were biased towards areas of potentially higher concentrations along the northern boundary of EA 5, and areas east of the smelter. In addition, the distribution of concentrations in EA 5 is relatively uniform and low; thus, we are fairly confident that the unsampled areas of EA 5 would not have concentrations appreciably different from, or higher than, the rest of EA 5. Therefore, the metals concentrations in EA 5 are considered sufficiently characterized to support the risk assessment.

2.4.5 Soil Data Adequacy by Exposure Area and Pathway

This section discusses the soil sample selection criteria, the soil data available for each exposure area, and whether there are adequate data of the appropriate type to evaluate the receptors and exposure pathways proposed in the risk assessment. All of the samples considered useable for the HHRA are shown in Figure 1.

First, we examined the set of available data for each exposure area, which included samples collected during the 2004 RI, the 2006 supplemental RI sampling, and samples collected during previous investigations. Next, we evaluated samples for inclusion in the risk assessment based on their depth and the type of sieving they had received. The sieve and depth criteria used to guide sample selection for each receptor are listed in Table 2-6, and discussed below.

Table 2-6
Soil Sample Selection Criteria by Pathway and Receptor

Pathway	Receptor	Sieve	Depth (inches)
Soil Ingestion/Dermal Contact	Current Resident	250 µm	0-1
	Future Resident	250 µm	0-1
	Construction Worker	250 µm	0-1
	Rancher	250 µm	0-1
	Recreator	250 µm	0-1
	Trespasser	250 µm	0-1
	Industrial Worker	250 µm	0-1
Soil Inhalation	All Receptors	All data	0-1 & 0-6
Consumption of locally produced vegetables	Current Resident Future Resident	unsieved or 2,000 µm	0-6
Consumption of locally produced chicken/eggs/beef	Current Resident Future Resident	unsieved or 2,000 µm	0-1

For all receptors, direct contact with soil was evaluated using soil that was sieved to <250 µm-sized particles, as this finer fraction best represents the fraction that adheres to the hands. For the indirect soil pathways (*e.g.*, ingestion of vegetables, chicken, eggs, and beef), we used unsieved soil, as exposure *via* these pathways would not be dominated by a specific particle-size fraction. Samples sieved to <2,000 µm sized particles were also considered useable for the food ingestion pathways, as a 2,000 µm is a relatively coarse sieve.

Soil from a depth of 0-1 inch was used to evaluate receptors who would have casual contact with soil at the ground surface, including current and future residents, ranchers, recreators, trespassers, and smelter workers. Construction workers are typically exposed to subsurface soil during construction activities; therefore, they could be exposed to soil depths of 0-6 inches, as well as 0-1 inch. (They could be exposed to even deeper soil as well, but the database largely contains soil collected in the top 6 inches.) From a statistical standpoint, it would not be appropriate to combine the 0-1 inch 250 μm data with the 0-6 inch 2,000 μm data, because the data come from different distributions (essentially the data do not come from the same "population"). Since the finer fraction soil (soils sieved to 250 μm) are a better representation of the soil that sticks to the hand, and often have higher concentrations, we selected the 0-1 inch 250 μm data set for evaluation of the construction worker, to be conservative. The use of the 0-6 inch data set would have resulted in lower exposure point concentrations (EPCs) (and slightly lower risks) for the construction worker. Soil from a depth of 0-6 inches was used for evaluating uptake into vegetables, because often roots extend down at least 6 inches. Soil from 0-1 inch was used for evaluating uptake into chicken and beef, because these animals are expected to contact only soil at the ground surface when grazing or feeding.

Table 2-7 summarizes the soil samples that were included in each data set for the risk assessment. Sample locations included in the risk assessment are shown in Figure 1. The data adequacy for the risk assessment is discussed below by exposure area and pathway. As discussed below, the number of samples in most of the exposure areas is adequate for evaluation of the soil direct contact pathway. However, in some cases the number of samples available to evaluate the indirect food pathways is inadequate and results in risk estimates with high uncertainty.

Table 2-7
Soil Samples Used for Each Exposure Pathway

Exposure Area	Pathway	Receptor	Sample Depth (inches)	Sieve	No. Samples
1	Ingestion Dermal Contact Inhalation	Rancher Recreator Future Resident Construction Worker	0-1	250 µm	11
	Vegetable Ingestion	Future Resident	*0-1*	unsieved	1
	Chicken/Eggs/Beef Ingestion	Future Resident	0-1	unsieved	1
2	Ingestion Dermal Contact Inhalation	Current Residents Future Resident Construction Worker Rancher Recreator	0-1	250 µm	11
	Vegetable Ingestion	Current Residents Future Resident	0-6	2,000 µm	10
	Chicken/Eggs/Beef Ingestion	Current Residents Future Resident	0-1	unsieved	2
3	Ingestion Dermal Contact Inhalation	Future Resident Construction Worker Trespasser	0-1	250 µm	22
	Vegetable Ingestion	Future Resident	0-6 1-6	2,000 µm unsieved	22 2
	Chicken/Eggs/Beef Ingestion	Future Resident	0-1"	unsieved	9
4	Ingestion Dermal Contact Inhalation	Future Resident Construction Worker Trespasser	0-1	250 µm	54
	Vegetable Ingestion	Future Resident	0-6 3-6	2,000 µm unsieved	5 2
	Chicken/Eggs/Beef Ingestion	Future Resident	0-1	unsieved	9
5	Ingestion Dermal Contact Inhalation	Future Resident Construction Worker Rancher Recreator	0-1	250 µm	30
	Vegetable Ingestion	Future Resident	0-6	2,000 µm	18
	Chicken/Eggs/Beef Ingestion	Future Resident	0-1	unsieved	12
Smelter (SM)	Ingestion Dermal Contact Inhalation	Industrial Worker	0-1	250 µm	5

[1] *The inhalation pathway is listed here for completeness; however, this table does not specify the soil samples used in the air modeling. The air modeling is discussed in Appendix C.*
[2] *Samples in italics do not meet specified criteria, but were included as necessary, in absence of data to meet specified criteria.*

Exposure Area 1

For evaluation of the soil direct contact pathway for all receptors, we used 11 soil samples from a depth of 0-1 inch that were sieved to 250 μm. For evaluation of uptake into vegetables, chicken, eggs, and beef, there is only one unsieved soil sample from 0-1 inch. The one sample is inadequate for risk assessment because it does not provide adequate spatial coverage of the exposure area. Risks for the food pathways were calculated using the one available unsieved sample, but the risk estimate is highly uncertain.

Exposure Area 2

For evaluation of the soil direct contact pathway for all receptors, we used 11 soil samples from a depth of 0-1 inch that were sieved to 250 μm. For evaluation of uptake into vegetables, we used 10 samples from 0-6 inches, sieved to 2,000 μm. These data sets are adequate for risk assessment. For evaluation of uptake into chicken, eggs, and beef, there are only two unsieved samples from 0-1 inch. These two samples are inadequate for the risk assessment because they do not provide adequate spatial coverage of the exposure area. Risks for the food pathways were calculated using these two samples, but the risk estimate is highly uncertain.

Exposure Area 3

For evaluation of direct contact with soil for all receptors, we used 22 soil samples from a depth of 0-1 inch that were sieved to 250 μm. For vegetable uptake, we used 22 samples from 0-6 inches (sieved to 2,000 μm), and two unsieved samples from 1-6 inches, for a total of 24 samples. This data set should be adequate for assessing vegetable uptake. For uptake into chicken, eggs, and beef, we used nine unsieved samples collected at a depth of 0-1 inch. This data set is considered marginally adequate for estimating EPCs.

Exposure Area 4

For evaluation of direct contact with soil for all receptors, we used 54 soil samples from a depth of 0-1 inch that were sieved to 250 μm. These data are considered adequate for risk assessment as they characterize the entire exposure area. For vegetable uptake, we used five samples from 0-6 inches (sieved to 2,000 μm) and two unsieved samples from 3-6 inches, for a total of seven samples. These data are marginally adequate to estimate EPCs. For uptake into chicken, eggs, and beef, we used 9 unsieved samples from 0-1 inch. These data are considered marginally adequate to estimate EPCs.

Exposure Area 5

For evaluation of direct contact with soil for all receptors, we used 30 soil samples from a depth of 0-1 inch that were sieved to 250 μm. For vegetable uptake, we used 18 samples from 0-6 inches that were sieved to 2,000 μm. For uptake into chicken, eggs, and beef, we used 12 unsieved samples from 0-1 inch. These data sets are considered adequate for risk assessment.

Smelter

For evaluation of exposures to soil at the Hurley smelter, we used five samples from 0-1 inch that were sieved to 250 μm. The sieve and depth are appropriate; however, this data set is too small give an EPC that is representative of the entire smelter area. These data were used, but the estimated risks for the smelter are highly uncertain.

2.4.6 Data Adequacy for Surface Water and Sediment

Table 2-8 lists the available surface water and sediment data from stock ponds and the James River Canyon reservoir. In EA 4, surface water and sediment samples were collected from two stock ponds and the James River Canyon reservoir. In EA 5, 10 surface water samples were collected from 10 stock ponds, and 5 sediment samples were collected from 5 stock ponds. These data are considered adequate for risk assessment.

Table 2-8
Surface Water and Sediment Samples

Exposure Area	Receptor	Surface Water Samples	Sediment Samples
4	Trespasser	3	3
5	Recreator	10	5

2.5 Summary Statistics and Chemicals of Concern

2.5.1 Summary Statistics for Final Data Sets

Summary statistics for soil, sediment, and surface water are presented in Tables 2-10, 2-11, and 2-12, respectively, for all data selected as useable for the risk assessment (*i.e.*, the data included in the HHRA database). For the purposes of these summary tables, the data for all exposure areas are

combined, and the soil summary statistics include all samples collected at depths between 0 and 6 inches, regardless of sieve size (as noted above, for individual receptors/exposure pathways, only certain soil depths and sieve sizes from each Exposure Area were used). The tables summarize the number of samples, geometric mean, arithmetic mean, standard deviation, minimum and maximum detected concentration, and percentage of nondetect values. All data qualified as "U" or "J" have been used in calculating summary statistics. For those samples qualified as "nondetect," a value equal to one-half the detection limit was used in calculating summary statistics. Data qualified as "R" (rejected) were excluded from the analysis.

2.5.2 Identification of Chemicals of Concern

COCs were identified for soil by comparing concentrations of each of the constituents on the target analyte list (TAL) to risk-based screening criteria. The soil risk-based screening criteria were based on the lower of either the US EPA Region 6 "RCRA Human Health Medium-Specific Screening Levels" (MSLs) for residential soil (US EPA Region 6, 2004), or the US EPA Region 9 Preliminary Remediation Goals (PRGs) for residential soil (US EPA Region 9, 2004). COCs for soil were selected on a site-wide basis. Once COCs were identified for soil, these COCs were also used for sediment and water, to keep the list of COCs consistent across all media. No constituents were eliminated as COCs based on comparison to background concentrations. Constituents without published toxicity factors were not retained as COCs. Chemicals eliminated as COCs were not carried through the risk assessment. The implication of eliminating chemicals without published toxicity factors is discussed qualitatively in the uncertainty section (Section 5.5).

The data set in Table 2-9 includes all soil samples in the top 6 inches that were considered useable for the HHRA. However, not all of these samples were used in the HHRA, because subsets of the data (based on sample depth and sieve size) were used for different exposure scenarios. Based on the comparison to screening criteria, six analytes were identified as COCs in soil (Table 2-9):

- Arsenic
- Cadmium
- Copper
- Iron
- Thallium

- Vanadium

Note that even though concentrations of some elements are higher in the smelter area as compared with Exposure Areas 1-5, the same analytes are identified as COCs whether we include or exclude the smelter area soil samples. This is evident in Table 2-13, which presents the maximum soil concentration by exposure area. As noted above, these six analytes were also retained as COCs for sediment and water. However, for sediment, only arsenic exceeds the soil screening criteria (Table 2-10), and in surface water, no analytes exceeded their respective screening criteria (Table 2-11). (The water screening criteria are for tap water and were obtained from either the Region 9 PRGs or the Region 6 MSLs.)

3 Exposure Assessment

An exposure assessment is used to quantify the magnitude of potential human exposure to COCs. Section 3 describes the land use and potential receptors in the S/TSIU, describes the potential exposure media and exposure pathways, identifies the complete exposure pathways, and presents the conceptual site model (CSM). This section also presents the calculation of EPCs and the equations used to calculate chemical exposures for each potential exposure route (*e.g.*, incidental ingestion, inhalation, *etc.*).

3.1 Characterization of Land Use and Potential Receptors

Current land use in the S/TSIU is primarily cattle grazing. In the future, this area may be developed for residential uses, such as a retirement community. There is also a shelter in this area used by skeet shooters, and a cemetery for the town of Hurley. There are three newly constructed homes located south of the town of Hurley and east of US 180. There are several primitive shelters located in the area between the tailings ponds and US 180, which are used occasionally for horses and their owners. There are several stock ponds in the S/TSIU, which are used primarily as a source of drinking water for cattle. At least one of these stock ponds is large enough that it could be used for swimming by a recreator or trespasser. The James River Canyon reservoir, which is located in the southeast portion of EA 4 in the S/TSIU, could also be considered desirable for swimming by a recreator. Although most of the land in the S/TSIU is privately owned, the adolescent recreator is considered a "recreator" in Exposure Areas 1 and 5, but a "trespasser" in Exposure Areas 3 and 4, simply because the land is considered more accessible in EA 1 and 5.

Land directly to the east of the smelter unit would be the area most heavily impacted by smelter operations, based on prevailing wind directions. Currently, this land is not used for any specific purpose, nor is it readily accessible. Similarly, land directly to the east of the tailings ponds is impacted by windblown dust from the tailings ponds. Because a fence limits access to the area east of the smelter and tailings ponds, there is minimal potential for current exposure. However, it would be feasible for a trespasser to scale the fence and gain access to this area. The elevation increases to the east of Whitewater Creek, thus this area may be considered desirable for future residential use, on account of the views afforded by the elevation.

The Hurley smelter facility is also located within the S/TSIU. Access to this area is limited to Chino employees. The facility is surrounded by a fence topped with barbed wire, and the entrance to the facility is *via* a gate manned by a security guard.

Based on the aforementioned current and future land use activities, the HHRA evaluated exposures for the following receptors:

- Current Residents (Child and Adult)
- Future Residents (Child and Adult)
- Construction Workers (Adult)
- Ranchers (Adult)
- Recreators (including skeet shooting, swimming, hiking, *etc.*) (Adolescents)
- Trespassers (including swimming, hiking, *etc.*) (Adolescents)
- Industrial Workers (Adult)

Note that we conservatively assessed adolescent recreators and trespassers; if the recreator or trespasser is an adult, then his exposure (and risk) would be less than that for the adolescent.

3.3 Potential Exposure Media and Pathways

To characterize the potential exposure media, it is important to understand the source of possible COCs and the potential mechanisms for release or transport of COCs to other environmental media. Each of the potential exposure media at the S/TSIU are discussed below.

3.3.1 Surface Soil

Surface soils within the S/TSIU have been impacted with COCs from former smelter emissions and COCs in windblown dust from the tailings ponds. Thus, there is potential for direct human exposure to COCs in surface soils *via* incidental ingestion, dermal contact, and inhalation for current and future residents, construction workers, industrial workers, ranchers, recreators, and trespassers.

Soil samples collected at a depth of 0-1 inch were used to assess direct contact exposures for the resident, rancher, recreator, trespasser, and construction worker scenarios. Even though some of the

receptors could contact deeper soils (*e.g.*, a construction worker), exposure to subsurface soils (*e.g.*, 3 feet or more below grade) was not assessed in the HHRA because COC concentrations are likely lower in subsurface compared to surface soils. There are several reasons supporting this assumption. First, as described above, COCs were deposited in soil at the S/TSIU *via* deposition from smelter emissions and windblown dust. Second, all of the COCs are metals, which in general are not very mobile in most soils, such that transport of metals to subsurface soils would be limited (Kuo *et al.*, 1983; US EPA, 1992b). In addition, surface soils at the S/TSIU tend to be rocky and hard, thereby minimizing exposure to soil at depths greater than one inch. Table 2-7 in Section 2 lists the soil data used to evaluate each receptor.

An analysis of copper concentrations in soil as a function of depth confirmed that concentrations are higher in the 0-1 inch interval. Using data from the five exposure areas (but excluding data from the Reference Area), the mean copper concentrations are 1145 mg/kg in the 0-1 inch unsieved soil (N = 33), and 565 mg/kg in the 0-6 inches soil sieved to 2,000 μm (N = 55). A t-test shows that this difference in mean copper concentration is statistically significant (p=0.004) (Table 3-1). For this comparison, we used unsieved soil in the 0-1 inch data set, and soil sieved to 2,000 μm in the 0-6" data set, because these particle sizes (unsieved *vs.* sieved to 2,000 μm) are considered similar enough to be comparable, and these two data sets yield the largest data sets for comparison. Therefore, the use of soil data from a depth of 0-1 inch to evaluate direct contact pathways is conservative, because concentrations of copper in soil are higher in the 0-1 inch interval than in the 0-6 inch interval.

Table 3-1
Comparison of Copper Concentrations at 0-1" and 0-6"
(Excludes samples from Reference Area)

Samples	N	Mean	SD
0-1" unsieved	33	1,145	1,130
0-6" sieved 2000μm	55	565	504

t-Test: Two-Sample Assuming Unequal Variances

	0-1"	0-6"
Mean	1,144.7	564.8
Variance	12,77781	253,817
Observations	33	55
Hypothesized Mean Difference	0.0	
df	40	
t Stat	2.79	
P(T<=t) one-tail	**0.0041**	
t Critical one-tail	1.68	

Bold value: p-value of test is <0.05, therefore test is significant.

3.3.2 Air

Air is considered a potential exposure medium for the HHRA, based on the potential for resuspension of soil impacted by the smelter and tailings ponds. Therefore, the risk assessment evaluated potential inhalation exposure to resuspended soil. A US EPA-recommended wind erosion model (WEM) was used to estimate emission rates for PM_{10} soil particles. Airborne concentrations of respirable PM_{10} soil particles were estimated using the estimated particulate emissions rates in US EPA's AERMOD air dispersion model. A description of the air modeling performed to estimate EPCs in air is provided in Section 3.6.2 and Appendix D. Since all of the COCs are metals, there was no need to consider direct volatilization.

3.3.3 Groundwater

Currently, domestic water is supplied to residents within the S/TSIU by the community water system of the town of Hurley, which derives its water from wells several miles south of the town of Hurley (CMC, 1995). Tap water samples analyzed for the town of Hurley indicate that this water is in compliance with the Safe Drinking Water Act (SDWa) [NMED, 1995, as cited in the Background Report (CMC, 1995)]. Exposure to groundwater was not evaluated in the HHRA due to the low potential for groundwater to be used as a source of drinking water, and due to the lack of available groundwater data in the S/TSIU. As noted in the RI report (SRK, 2006), previous work conducted for the Phase I RI Report for the HSIU (Golder, 1998) indicates that constituent concentrations in surface soil have little or no potential to impact groundwater. Synthetic Precipitation Leach Potential (SPLP) tests were conducted on sediment in the S/TSIU to assess the potential for leachate migration into groundwater. The results support the conclusion that potential leachate migration to groundwater is negligible (SRK, 2006).

3.3.4 Surface Water and Sediment

Surface water and sediment were considered as potential exposure media for this HHRA, due to the presence of stock ponds in the S/TSIU. The stock ponds are primarily used as a source of drinking water for cattle. However, several of the stock ponds (in Exposure Areas 4 and 5) may be large enough that they could be used for swimming. In addition, the James River Canyon reservoir, located in EA 4 of the S/TSIU, could also be used for swimming. For the HHRA, we evaluated incidental ingestion and

dermal contact with surface water and sediment in the stock ponds and the reservoir, for an adolescent trespasser in EA 4, and an adolescent recreator in EA 5. Consumption of water from the stock ponds by cattle was also considered when modeling potential COC concentrations in locally raised beef.

3.3.5 Homegrown Vegetables

Due to the potential for plant uptake of COCs in soil, COCs may be present at elevated concentrations in vegetables grown on land affected by mining and smelter operations. Although we have no indication that current residents have vegetable gardens, future residents may grow their own vegetables. Therefore, indirect exposure to COCs in homegrown vegetables was assessed for future child and adult residents. Based on root growth, soil samples collected at a depth of 0-6 inches (when available) were used to estimate plant uptake from soil into homegrown vegetables.

3.3.6 Locally-Raised Chicken and Eggs

Locally-raised chicken and eggs may also contain elevated levels of the COCs in chicken meat and eggs if chickens are raised on land affected by the smelter or tailings ponds. Although we have no indication that current residents raise chickens or eggs, future residents may raise chickens or eggs. Therefore, future residents were evaluated for indirect exposure to COCs in locally-raised chicken and eggs.

3.3.7 Locally-Raised Cattle

Locally-raised cattle may have elevated levels of the COCs in their tissues if they graze on land affected by the smelter or tailings ponds, and/or drink water from affected stock ponds. Although cattle do currently graze on the site, they are auctioned about 60 miles away, and it is unlikely that the beef from these cows is eaten locally, or consistently eaten by any one individual. Therefore, only future residents were evaluated for indirect exposure to COCs from consumption of locally-raised beef.

3.4 Complete Exposure Pathways – the Conceptual Site Model

For exposure and potential risks to occur, a complete exposure pathway must exist. A complete pathway requires the following elements (US EPA, 1989):

- A source and mechanism for release of COCs;
- A transport or retention medium;
- A point of potential human contact (exposure point) with the affected medium; and
- An exposure route at the exposure point.

If any one of these elements is missing, the pathway is not considered complete. For example, if human activity patterns and/or the location of potentially exposed individuals relative to the location of affected media prevent human contact, then that exposure pathway is not complete.

As described above, we have considered the source, potential release mechanisms, likely exposure media, potential receptors, and possible intake mechanisms for the S/TSIU. The potential receptors evaluated in the HHRA include current and future residents, ranchers, construction workers, recreators, trespassers, and industrial workers. The potential exposure routes that were evaluated for soil include incidental ingestion, dermal contact, and inhalation of resuspended soil. For sediment and surface water, the potential exposure routes include ingestion and dermal contact. Indirect exposure to COCs in soil were assessed *via* ingestion of homegrown vegetables as well as locally-raised chicken, eggs, and beef. Indirect exposure to COCs in surface water were assessed *via* ingestion of locally-raised beef. When combined, the potential receptors and exposure routes form the CSM, which integrates the complete exposure pathways at a site.

The CSM for the S/TSIU is presented in Table 3-2. For each exposure medium, the potential exposure pathways are indicated with an X. For each of the receptors (listed above in Section 3.2), the potential exposure media are also indicated with an X. For example, soil is the only exposure medium for which there is a potentially complete exposure pathway for the current resident, rancher, construction worker, and industrial worker. Future residents could be exposed to site-related contaminants in soil, and through ingestion of locally-raised vegetables, chicken, eggs, and beef. Both the recreator and the trespasser could be exposed to site-related contaminants in soil, sediment, and surface water.

Table 3-2
Conceptual Site Model for the Smelter/Tailings Soils Investigation Unit

		Exposure Medium					
		Soil	Sediment	Surface Water	Vegetables	Chicken/ Eggs	Beef
Exposure Pathway	Ingestion	X	X	X	X	X	X
	Dermal Contact	X	X	X	--	--	--
	Inhalation	X	--	--	--	--	--
Receptor	Current Resident	X	--	--	--	--	--
	Future Resident	X	--	--	X	X	X
	Construction Worker	X	--	--	--	--	--
	Rancher	X	--	--	--	--	--
	Recreator	X	X	X	--	--	--
	Trespasser	X	X	X	--	--	--
	Industrial Worker	X	--	--	--	--	--

Notes:
X = Pathway was evaluated.
-- = Pathway was not evaluated; exposure pathway is not complete.

3.5 Exposure Areas

The S/TSIU has been divided into five distinct exposure areas based on physical characteristics, the potential for exposure to impacted media, anticipated differences in soil COC concentrations from past mining and smelter operations, and anticipated land use activities (*e.g.*, residential, ranching, recreating, and trespassing). The five exposure areas are shown in Figure 1. In addition, the Chino Mines smelter facility was evaluated as a separate exposure area. The receptors and media evaluated in each exposure area are described below and summarized in Table 3-3.

Table 3-3
Summary of Exposure Areas, Pathways, and Receptors

Exposure Area	Media	Exposure Pathways	Receptors
1	Soil	Ingestion Dermal Contact Inhalation	Rancher Recreator 1 Future Resident (Child & Adult) Construction Worker
	Local Beef, Chicken, Eggs & Vegetables	Ingestion	Future Resident (Child & Adult)
2	Soil	Ingestion Dermal Contact Inhalation	Rancher Current and Future Resident (Child & Adult) Construction Worker
	Local Beef, Chicken, Eggs & Vegetables	Ingestion	Future Resident (Child & Adult)
3	Soil	Ingestion Dermal Contact Inhalation	Trespasser 1 Future Resident (Child & Adult)
	Local Beef, Chicken, Eggs & Vegetables	Ingestion	Future Resident (Child & Adult)
4	Soil	Ingestion Dermal Contact Inhalation	Trespasser 1 Future Resident (Child & Adult)
	Surface Water and Sediment	Ingestion Dermal Contact	Trespasser 2
	Local Beef, Chicken, Eggs & Vegetables	Ingestion	Future Resident (Child & Adult)
5	Soil	Ingestion Dermal Contact Inhalation	Rancher Recreator 1 Future Resident (Child & Adult)
	Surface Water and Sediment	Ingestion Dermal Contact	Recreator 2
	Local Beef, Chicken, Eggs & Vegetables	Ingestion	Future Resident (Child & Adult)
Smelter	Soil	Ingestion Dermal Contact Inhalation	Industrial Worker

Exposure Area 1. This exposure area is defined by Whitewater Creek to the east, by the borders of the original Smelter Investigation Unit to the north and west, and by Exposure Area 4 to the south. The primary source of contamination in this area is deposition from the smelter/milling operations. This

exposure area includes a picnic area and a shelter for skeet shooting, as well as grazing land for cattle. This area also includes a railroad track (running north and south) located between US 180 and the access road to the towns of Hurley and North Hurley, which was used in the past to transport ore between the mines and the smelter. Potential future receptors include construction workers exposed to soil, and residents exposed to soil and locally-produced vegetables, chicken, eggs, and beef.

Exposure Area 2. This exposure area is defined by the edge of the tailings ponds to the east, Exposure Area 4 to the north, and by the borders of the original Tailings Soils Investigation Unit to the west and south. The primary source of contamination in this area is windblown dust from the tailings ponds. This area includes grazing land for cattle, several primitive shelters for horse owners, and existing houses. Therefore, receptors evaluated in this area include ranchers and construction workers exposed to soil, and current/future residents exposed to soil and locally-produced food items.

Exposure Area 3. This exposure area comprises the fenced-off area of the tailings ponds, and has been heavily impacted by windblown dust from the tailings ponds (due to the prevailing northwest winds). Because the fence limits access to this area, there is minimal potential for current exposures. However, because it would be feasible for a trespasser to scale the fence, exposure to soil was evaluated for a trespasser. In the future, this area may be developed for residential use; therefore, a potential future resident was evaluated for exposure to soil and locally-produced food items.

Exposure Area 4. This area is defined by the borders of the original Tailings Soils Investigation Unit to the west, east, and south. EA 4 extends north to approximately the same latitude as the town of North Hurley. This exposure area is primarily impacted by deposition from the smelter. Although the elevation increases to the east of the creek with a fairly steep grade, this area could be accessible to a trespasser. In addition, it may be both technically feasible and desirable to construct houses on the hillside. There is also at least one stock pond in this area, used as a source of drinking water for grazing cattle, as well as the James River Canyon Reservoir. Both the stock pond and the reservoir may be considered desirable for swimming. Receptors evaluated in this area include trespassers exposed to soil, surface water, and sediment, and future residents exposed to soil and locally-produced beef, chicken, eggs, and vegetables. Because exposure to soil (*e.g.*, a trespasser hiking in the area) is considered to occur at different times than exposure to surface water and sediment (*e.g.*, a trespasser swimming in the stock pond or reservoir), separate trespassers were evaluated for these different exposure media. Trespasser 1 was evaluated for exposure to soil, and Trespasser 2 was evaluated for exposure to surface water and sediment while

swimming. Risks for the two trespassers were not combined. These two pathways were evaluated separately so that risks, and the need for any remediation, could be identified for the two media separately.

Exposure Area 5. This area is defined as the area to the east of Whitewater Creek and the eastern boundaries of Exposure Areas 3 and 4, extending eastward to the Lampbright Draw. The northern portion of this exposure area is primarily impacted by deposition from the smelter, while the southern portion is primarily impacted by windblown dust from the tailings ponds. This area is currently used for cattle grazing, and in the future could be developed for residential use. There are several stock ponds in this area, at least one of which is large enough to be used for swimming by a recreator. Receptors evaluated in this area include a rancher, a recreator, and a future resident. The rancher could be exposed to soil. Two separate recreators were evaluated: Recreator 1 is exposed to soil through casual contact, and outdoor air; and Recreator 2 is exposed to sediment and surface water while swimming in a stock pond. These two pathways were evaluated separately so that risks, and the need for any remediation, could be identified for the two media separately. The risks for the two recreators were not combined. The future resident was evaluated for exposure to soil and locally-produced food items.

Smelter Area. The Hurley smelter facility is not paved and the area outside the buildings is largely composed of unvegetated soil and gravel. Industrial workers at the Hurley Smelter may be exposed to soil inside the facility boundary during the course of their work day. Thus, soil exposure for an Industrial Worker was evaluated for the smelter facility.

3.6 Calculation of EPCs

An exposure point concentration (EPC) represents a conservative estimate of the average concentration of a COC in an environmental medium that a receptor would contact over time. The data sets used to calculate EPCs for each of the exposure areas are described in Section 2. Consistent with US EPA guidance (US EPA, 1992a), data without qualifiers, and data qualified as "U" (analyte not detected above detection limit) or "J" (analyte was positively identified, but concentration was estimated), were included in the EPC calculations. Data flagged as "R" (rejected), and duplicate samples (*i.e.*, field or laboratory duplicates) were not used to calculate EPCs. A value equal to one-half the reported detection limit was used to calculate EPCs for COC concentrations reported as "U" or "non-detect." Soil EPCs

were used to evaluate direct exposures *via* incidental ingestion, dermal contact, and inhalation, and by indirect exposure to COCs in locally-produced beef, chicken, eggs, and vegetables.

3.6.1 Calculation of EPCs in Soil

US EPA considers the arithmetic average or mean concentration of a COC to be a reasonable estimate of the average concentration that is contacted over time at a site (US EPA, 1989). However, because of limitations and uncertainties inherent in all soil sampling plans, it is not possible to know the true mean concentration of a COC at a site. Therefore, the 95% upper confidence limit on the mean concentration (95% UCL) is used because it represents a conservative estimate of the average exposure concentration (US EPA, 1992b). The 95% UCL "equals or exceeds the true mean 95% of the time," and is appropriate to use when it is assumed that an individual has an equal probability of contacting any location within the exposure area (US EPA, 1992b). US EPA guidance notes that an average exposure concentration should be used to evaluate both Reasonable Maximum Exposure (RME) and Central Tendency (CT) exposure scenarios (US EPA, 1992b). Therefore, the 95% UCL was used to assess both RME and CT estimates of exposure. UCL concentrations were calculated according to current US EPA guidance (US EPA, 2002a), using US EPA's "ProUCL" software program (US EPA, 2004b). For COCs with few data points and considerable variability among the data points, the 95% UCL can be greater than the maximum concentration detected at the site. In these instances, the maximum concentration was used as the EPC. EPCs for direct contact with soil are presented in Table 3-4, by exposure area and receptor. EPC calculations are presented in Appendix C.

Table 3-4
Soil Exposure Point Concentrations
for Direct Contact with Soil

	Exposure Point Concentration (mg/kg)					
COC	**EA 1**	**EA 2**	**EA 3**	**EA 4**	**EA 5**	**Smelter**
Arsenic	2.9	2.9	6.2	4.9	2.1	24
Cadmium	1.5	1.3	28	4.1	0.53	7.2
Copper	746	1,520	1,910	4,860	448	25,900
Iron	25,100	25,200	57,200	23,200	26,600	58,800
Thallium	0.41	**0.58**	0.66	0.54	0.32	0.74
Vanadium	55	45	32	29	60	23

Notes:
1. *EPCs are 95% UCL for all COCs except bold values.*
2. *Bold values indicate that EPC is the maximum concentration rather than the 95% UCL.*

The EPCs presented in Table 3-4 for the direct soil contact pathways (*e.g.*, soil ingestion and dermal contact with soil) were calculated for soil sieved to a particle size of <250 μm. This was done to more accurately reflect the particle size fraction typically ingested, and which typically predominates for the dermal contact pathway for dry soil conditions. For the soil ingestion pathway, results from a study by Stanek *et al.* (1999) suggest that ingested soil primarily consists of <250 μm-sized particles. For the dermal contact pathway, results from a study by Kissel *et al.* (1996a) indicate that under dry soil conditions soil adherence is greater for particles less than 250 μm in size, whereas under wet soil conditions soil adherence is greater for particles greater than 250 μm in size. EPCs for the indirect soil pathways (*e.g.*, ingestion of produce, chicken, eggs, and cattle) were calculated using unsieved soil data, as these pathways would not be dominated by a specific particle size fraction.

Hotspots

Hotspots are defined as "areas of high contamination relative to other areas of the site" (US EPA, 1989). The COCs present in soil at the S/TSIU have been deposited over time, primarily by deposition of airborne dust attributable to historic smelter operations and from the mine tailings area. The RI data indicate that soil concentrations generally decrease with increasing distance from the Smelter/Tailings Soils areas. Due to the deposition mechanism and the pattern of contamination, distinct hotspots are unlikely in the S/TSIU.

To determine if hotspots exist, we used a quantitative definition of a hotspot based on US EPA's concept of a hotspot in Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual, Part A (US EPA, 1989). Under this quantitative definition, if the mean concentration of a COC in a discrete subarea is more than 100 times the mean concentration in the immediate surrounding area, then the subarea is considered a hotspot. If there is a discrete subarea where the mean concentration of a COC is greater than 10 times but less than 100 times the mean concentration in the immediate surrounding area, this subarea is a hotspot only if there is reason to believe that there is a greater potential for exposure to this elevated area. For each soil data set in each exposure area, we compared the maximum concentration to the mean concentration. In Exposure Area 3, the maximum concentration of cadmium and thallium were 13 and 11 times the mean concentration, respectively. However, these exceedances are small and there is no preferential exposure to the location of the maximum

concentration. Therefore, our evaluation determined that no hotspots were present in any of the exposure areas.

3.6.2 Calculation of EPCs in Air

We evaluated potential inhalation exposure to resuspended soil using an atmospheric dispersion model to estimate airborne concentrations of COCs attributable to resuspension of soils. Fugitive dust emission rates were calculated for each COC, and these emission rates were used in an air dispersion model to estimate EPCs in air for each exposure area (presented in Table 3-5). We conservatively used the maximum modeled annual average air concentration as the air EPC for each COC in each exposure area. Appendix D presents a detailed description of the air modeling.

Table 3-5
Air Exposure Point Concentrations

	Exposure Point Concentration (mg/m^3) [1]					
COC	**EA 1**	**EA 2**	**EA 3**	**EA 4**	**EA 5**	**Smelter** [2]
Arsenic	1.10E-06	5.50E-07	1.40E-06	2.64E-06	1.16E-06	2.64E-06
Cadmium	6.40E-07	3.60E-07	2.16E-06	2.37E-06	6.80E-07	2.37E-06
Copper	8.24E-04	3.39E-04	1.04E-03	2.46E-03	8.38E-04	2.46E-03
Iron	6.19E-03	7.49E-03	8.41E-03	1.08E-02	9.85E-03	1.08E-02
Thallium	3.90E-07	9.40E-07	4.20E-07	3.50E-07	3.00E-07	3.50E-07
Vanadium	1.08E-05	1.84E-05	9.35E-06	9.39E-06	1.49E-05	9.39E-06

Notes:
1. *The air EPC is the maximum annual average air concentration for the exposure area, based on modeling results presented in Appendix C.*
2. *Air modeling was not performed for the Smelter exposure area, because that area is too small. The Smelter Area air EPCs are the same as those for EA 4.*

Gradient used the latest version of the US EPA-recommended AERMOD model to estimate the long-term COC air concentrations attributable to windblown resuspension of affected soils within the five exposure areas. Specifically, windblown dust emissions of individual compounds were calculated for a number of smaller emission area sources, each 1 km by 1 km in size, using all available soil measurements. These emission rates were then used as inputs into the AERMOD air dispersion model to predict the EPCs for each COC.

Local meteorological data and terrain information, as well as the windblown dust emission calculations for the 1 km by 1 km area sources, were used in the AERMOD dispersion model calculations. One year of meteorological data measured at the Hurley golf course in 1996 was used to predict annual average air concentrations for each chemical.

The air modeling results predicted annual average air concentrations due to windblown resuspension of soil at 726 receptor locations within the five exposure areas. To evaluate the risks from inhalation, we conservatively used the maximum predicted air concentration estimate in each exposure area for each of the COCs as the exposure point concentration. The air EPCs are summarized in Table 3-5.

The modeled annual average air concentrations due to windblown resuspension of soil for three of the COCs were compared to the annual average air concentrations measured at the Hurley Elementary School (Golder Associates, 1998) (Table 3-6). The predicted air concentrations due to windblown soil in Exposure Area 4, (where the town of Hurley is located) showed satisfactory agreement with the measured concentrations, within a factor of two for arsenic and cadmium, and within a factor of six for copper.

Table 3-6
Comparison of Measured and Modeled Air Concentrations

Element	Average Modeled Conc. (µg/m³) (a)	Average Measured Conc. (µg/m³) (b)
Arsenic	9.2×10^{-4}	1.4×10^{-3}
Cadmium	6.9×10^{-4}	1.4×10^{-3}
Copper	7.8×10^{-1}	1.3×10^{-1}

(a) Average annual average modeled concentration from Exposure Area 4
(b) Average measured concentration at the Hurley Elementary School

3.6.3 Calculation of EPCs in Surface Water and Sediment

EPCs for sediment and surface water are presented in Tables 3-7 and 3-8, respectively. EPC calculations are presented in Appendix C. The COCs used for sediment and surface water are the same as those in soil, in order to maintain a consistent COC list for all media in the HHRA. However, copper risks were not evaluated for exposure to surface water and sediment. Also, it should be noted that only arsenic exceeds the screening criteria in sediment (Table 2-10), and no analytes exceed screening criteria in surface water (Table 2-11). There are two water bodies in EA 4: a stock pond located west of the highway, and the James River Canyon reservoir. EPCs for both media in EA 4 are the maximum concentration from either water body. The EA 5 data are from 10 stock ponds in EA 5. The EPCs for both media in EA 5 are based on the 95% UCL of all the samples from the different stock ponds within EA 5.

Table 3-7
Sediment Exposure Point Concentrations

	Exposure Point Concentration (mg/kg)				
COC	EA 1	EA 2	EA 3	EA 4	EA 5
Arsenic	NA	NA	NA	2.10E+00	1.77E+00
Cadmium	NA	NA	NA	5.80E-01	2.08E-01
Iron	NA	NA	NA	2.74E+04	1.44E+04
Thallium	NA	NA	NA	3.70E-01	3.70E-01
Vanadium	NA	NA	NA	4.49E+01	2.39E+01

Notes:
EA 4: EPC based on the maximum of two samples, one from the James River Canyon Reservoir and one from a stock pond.
EA 5: 95% UCL from all stockponds used as EPC.
NA: Not applicable; no samples collected from these exposure areas.

Table 3-8
Surface Water Exposure Point Concentrations

COC	Exposure Point Concentration (mg/L)				
	EA 1	EA 2	EA 3	EA 4	EA 5
Arsenic	NA	NA	NA	7.80E-03	4.87E-03
Cadmium	NA	NA	NA	7.00E-04	1.45E-04
Iron	NA	NA	NA	6.38E+00	1.15E+01
Thallium	NA	NA	NA	5.90E-04	5.75E-04
Vanadium	NA	NA	NA	1.42E-02	1.43E-02

Notes:
EA 4: EPC based on the maximum of two samples, one from the James Canyon Reservoir and one from a stock pond.
EA 5: 95% UCL from all stock ponds used as EPC.
NA: Not applicable; no samples collected from these exposure areas.

3.6.4 Calculation of EPCs in Homegrown Vegetables

The soil EPCs used to estimate the EPCs in homegrown vegetables are presented in Table 3-9. To the extent possible, soil samples collected from depths of 0-6 inches, and sieved to 2,000 μm, were used for evaluating plant uptake from soil into homegrown vegetables. However, in EA 1, we used unsieved soil samples from a depth of 0-1 inch, due to lack of data from 0-6 inches. Table 2-8 in Section 2 lists the soil samples used to calculate the soil EPCs used for estimating the EPCs in vegetables.

Table 3-9
Soil EPCs Used for Calculating Vegetable EPCs

COC	Exposure Point Concentration (mg/kg)				
	EA 1	EA 2	EA 3	EA 4	EA 5
Arsenic	2.0	**2.0**	1.7	3.2	1.7
Cadmium	0.96	**1.1**	1.1	**4.2**	1.2
Iron	24,000	**14,000**	24,000	33,000	17,000
Thallium	2.0	**0.92**	5.9	**0.18**	0.32
Vanadium	61	**17**	22	44	22

[b] Bold values indicate that EPCs are the maximum concentration rather than the 95% UCL.

We modeled uptake from soil into plants using an empirical model developed by Bechtel/Jacobs (1998). The Bechtel/Jacobs model is based on measured data from numerous studies, which included a wide range of metal concentrations in soil and their corresponding concentrations in plants. For certain

metals, the Bechtel/Jacobs model predicts uptake as occurring in a non-linear, concentration-dependent manner, according to the following equation:

$$\ln(\textit{plant concentration}) = B_0 + B_1\ [\ln(\textit{soil concentration})]$$

where:

B_0, B_1 = Chemical-specific non-linear uptake factors

Vegetable EPCs for arsenic and cadmium were calculated as follows:

$$EPC_{veg} = \exp[B_O + B_1 \times \ln(EPC_{soil})]$$

Vegetable EPCs for iron, thallium, and vanadium were estimated using chemical-specific soil-to-plant transfer coefficients. These transfer coefficients are linear uptake factors that were obtained from either Bechtel/Jacobs (1998) or Baes *et al.* (1984). EPCs in plants for iron, thallium, and vanadium were calculated as follows:

$$EPC_{veg} = EPC_{soil} \times P$$

where:

EPC_{veg} = EPC of chemical vegetables (mg/kg)

P = Chemical-specific, linear plant uptake factor (kg chemical in soil/kg chemical in plant)

Table 3-10 presents plant uptake factors (non-linear for arsenic and cadmium, and linear for iron, thallium, and vanadium) for COCs at the S/TSIU. The resulting modeled vegetable EPCs are presented in Table 3-11. EPC calculations are presented in Appendix C.

Table 3-10
Plant Uptake Factors for Smelter/Tailings Soils Investigation Unit

COC	Non-Linear Uptake Factors [a]		Linear Uptake Factor (P)
	B_0	B_1	
Arsenic	-1.99	0.56	NA
Cadmium	-0.48	0.55	NA
Iron	NA	NA	0.00425 [a]
Thallium	NA	NA	0.0004 [b]
Vanadium	NA	NA	0.00485 [a]

Notes:
[a] Bechtel/Jacobs, 1998. Table 7 for non-linear factors and Table D-1 for linear factors.
[b] Baes et al., 1984. Value for root vegetables, Figure 2.2, p. 11.
[c] NA = Not available

Table 3-11
Vegetable Exposure Point Concentrations

COC	Exposure Point Concentration (mg/kg)				
	EA 1	EA 2	EA 3	EA 4	EA 5
Arsenic	1.99E-01	**2.01E-01**	1.83E-01	2.60E-01	1.84E-01
Cadmium	6.05E-01	**6.54E-01**	6.41E-01	**1.36E+00**	6.72E-01
Iron	1.02E+02	**6.03E+01**	1.04E+02	1.40E+02	7.29E+01
Thallium	8.00E-04	**3.67E-04**	2.36E-03	**7.00E-05**	1.28E-04
Vanadium	2.96E-01	**8.48E-02**	1.08E-01	2.16E-01	1.08E-01

Notes:
1. Bold values indicate that EPCs are the maximum concentration rather than the 95% UCL.

3.6.5 Calculation of EPCs in Locally-Raised Chicken

The soil EPCs used to estimate the EPCs in locally-raised chicken are presented in Table 3-12, and EPCs for chicken are presented in Table 3-13. EPC calculations are presented in Appendix C. Soil EPCs for modeling chicken were based on unsieved soil from a depth of 0-1 inch, thus they differ from those used for evaluating uptake into vegetables or direct contact with soil. EPCs in chicken were estimated using contaminant-specific soil-chicken transfer factors and soil ingestion rates for chickens, according to the following equation (Neptune, 2005):

$$EPC_{chicken} = EPC_{soil} \times TF_{s-ch} \times \left(IR_{feed} \times F_{s,f}\right)$$

where:

EPC_{soil} = Exposure point concentration of chemical in soil (mg/kg)
$TF_{s\text{-}ch}$ = Soil-chicken transfer factor (mg/kg meat per mg/day)
IR_{feed} = Feed ingestion rate for chicken (kg/day)
$F_{s,f}$ = Fraction of soil in chicken feed (unitless)

Values for the transfer factors for calculating EPCs in chicken were obtained from four references, depending on the COC: Ng, *et al.* (1982); Kennedy and Strenge (1992); Staven *et al.* (2003); and US EPA (2005a). The value for the chicken feed ingestion rate was obtained from Ng, *et al.* (1982). The value for the fraction of soil in chicken feed was based on Beyer et al. (1994), using the value for wild turkey as a surrogate for chicken. The values and reference used for each parameter are detailed on the EPC calculation sheet (Appendix C).

Table 3-12
Soil EPCs Used for Calculating Chicken, Egg, and Beef EPCs

COC	Exposure Point Concentration (mg/kg)				
	EA 1	EA 2	EA 3	EA 4	EA 5
Arsenic	2.0E+00	**3.3E+00**	3.2E+00	4.0E+00	2.9E+00
Cadmium	9.6E-01	**8.5E-01**	2.4E+01	3.1E+00	8.7E-01
Iron	2.4E+04	**1.9E+04**	5.7E+04	2.3E+04	2.7E+04
Thallium	2.0E+00	**6.2E+00**	6.6E-01	5.4E-01	3.2E-01
Vanadium	6.1E+01	**3.3E+01**	3.2E+01	2.9E+01	6.0E+01

Table 3-13
Chicken Exposure Point Concentrations

	Exposure Point Concentration (mg/kg)				
COC	EA 1	EA 2	EA 3	EA 4	EA 5
Arsenic	1.51E-02	**2.55E-02**	2.50E-02	3.11E-02	2.24E-02
Cadmium	9.82E-04	**9.21E-04**	2.42E-02	3.15E-03	8.88E-04
Iron	3.35E+02	**2.66E+02**	7.98E+02	3.23E+02	3.71E+02
Thallium	5.58E-03	**1.73E-02**	1.84E-03	1.51E-03	8.93E-04
Vanadium	4.55E-01	**2.42E-01**	2.35E-01	2.17E-01	4.43E-01

Notes:
Bolded values indicate that EPCs were calculated from the maximum soil concentration.
Shaded values: Soil data for the 0-1" interval (unsieved) were not available for these analytes in these exposure areas. Therefore, the soil EPCs used for this pathway were the same as those used for the direct contact pathway (0-1" depth, sieved to 250 μm).

3.6.6 Calculation of EPCs in Locally-Raised Eggs

The soil EPCs used to estimate the EPCs in locally-raised eggs are presented in Table 3-12, and EPCs for eggs are presented in Table 3-14. EPC calculations are presented in Appendix C. EPCs in eggs were estimated using contaminant-specific soil-egg transfer factors and soil ingestion rates for chickens, as follows:

$$EPC_{eggs} = EPC_{soil} \times TF_{s-egg} \times \left(IR_{feed} \times F_{s,f}\right)$$

where:

EPC_{soil}	=	Exposure point concentration of chemical in the soil (mg/kg)
TF_{s-egg}	=	Soil-egg transfer factor (mg/kg egg per mg/day)
IR_{feed}	=	Feed ingestion rate for chicken (kg/day)
$F_{s,f}$	=	Fraction of soil in chicken feed (unitless)

Soil EPCs for modeling uptake into eggs were based on unsieved soil from a depth of 0-1 inch, thus they differ from those used for evaluating uptake into vegetables or direct contact with soil. Values for the transfer factors for calculating EPCs in eggs were obtained from four references, depending on the COC: Ng, *et al.* (1982); Kennedy and Strenge (1992); Staven *et al.* (2003); and US EPA (2005a). The value for the chicken feed ingestion rate was obtained from Ng, *et al.* (1982). The value for the fraction of soil in chicken feed was based on Beyer et al. (1994), using the value for wild turkey as a surrogate for chicken.

Table 3-14
Egg Exposure Point Concentrations

	Exposure Point Concentration (mg/kg)				
COC	**EA 1**	**EA 2**	**EA 3**	**EA 4**	**EA 5**
Arsenic	1.46E-02	**2.46E-02**	2.41E-02	3.00E-02	2.16E-02
Cadmium	2.23E-05	**2.09E-05**	5.49E-04	7.15E-05	2.02E-05
Iron	2.90E+02	**2.31E+02**	6.92E+02	2.80E+02	3.22E+02
Thallium	3.72E-05	**1.15E-04**	1.23E-05	1.01E-05	5.95E-06
Vanadium	5.68E-01	**3.02E-01**	2.94E-01	2.71E-01	5.54E-01

Notes:
Bolded values indicate that EPCs were calculated from the maximum soil concentration.
Shaded values: Soil data for the 0-1" interval (unsieved) were not available for these analytes in these exposure areas. Therefore, the soil EPCs used for this pathway were the same as those used for the direct contact pathway (0-1" depth, sieved to 250 μm).

3.6.7 Calculation of EPCs in Locally-Raised Beef

The soil EPCs used to estimate the EPCs in locally-raised beef are presented in Table 3-12, and EPCs for beef are presented in Table 3-15. EPC calculations are presented in Appendix C. EPCs in beef were estimated using contaminant-specific soil-cattle and water-cattle transfer factors, grass-soil concentration ratios, and ingestion rates of grass, soil and water for cattle, using the following equation:

$$EPC_{beef} = [EPC_{soil} \times TF_{ib} \times ((IR_g \times K_{gs} \times CF_{dw}) + IR_{sc})] + [EPC_w \times TF_{wc} \times IR_w]$$

where:

EPC_{beef}	=	Beef Exposure Point Concentration (mg/kg)
EPC_{soil}	=	Soil Exposure Point Concentration (mg/kg)
TF_{ib}	=	Ingestion-beef transfer factor (mg/kg meat per mg/day intake); (used for intakes from soil and grass)
IR_g	=	Ingestion rate of (wet) grass for cattle (kg/day)
K_{gs}	=	Grass-soil concentration ratio (mg/kg grass)/(mg/kg soil)
CF_{dw}	=	Dry-to-wet weight conversion factor for grass (kg dry grass/kg wet grass)
IR_{sc}	=	Soil Ingestion rate for cattle
EPC_w	=	Exposure point concentration of chemical in surface water (mg/L) (using data from stock ponds)
TF_{wc}	=	Water-cattle transfer factor (mg/kg meat per mg/day intake) (calculated as $TF_{ib} \times Rb$)
IR_w	=	Water Ingestion rate for cattle (L/day)
RB	=	Soil relative bioavailability

Soil EPCs for modeling uptake into beef were based on unsieved soil from a depth of 0-1 inch, thus they differ from the soil EPCs for evaluating uptake into vegetables or direct contact with soil. The ingestion-beef transfer factors were obtained from Baes *et al.* (1984) (for As, Fe, Tl, V) and US EPA (2005a) (for Cd). The grass ingestion rate for cattle (50 kg/day) was obtained from Baes *et al.* (1984). The grass to soil concentration ratios were obtained from US EPA (1995) (As, Cd, Tl, V) and Wang *et al.* (1993) (Fe). The conversion factor for dry/wet grass (0.182) was obtained from Wang *et al.* 1993. The soil ingestion rate for cattle (0.5 kg/day) was obtained from US EPA (2005a). The water-cattle transfer factor was calculated as (TF_{ib} × soil relative bioavailability). The water ingestion rate for cattle (53 L/day) was obtained from US EPA (1999).

Table 3-15
Beef Exposure Point Concentrations

	Exposure Point Concentration (mg/kg)				
COC	**EA 1**	**EA 2**	**EA 3**	**EA 4**	**EA 5**
Arsenic	4.10E-03	6.90E-03	6.78E-03	1.01E-02	7.11E-03
Cadmium	2.04E-04	**1.92E-04**	5.03E-03	6.59E-04	1.86E-04
Iron	2.53E+02	**2.01E+02**	6.03E+02	2.44E+02	2.81E+02
Thallium	4.29E-02	**1.33E-01**	1.41E-02	1.16E-02	6.86E-03
Vanadium	8.40E-02	**4.47E-02**	4.35E-02	4.01E-02	8.20E-02

Notes:
Bolded values indicate that EPC is the maximum values rather than the 95% UCL.
Shaded values: Soil data for the 0-1" interval (unsieved) were not available for these analytes in these exposure areas. Therefore, the soil EPCs used for this pathway were the same as those used for the direct contact pathway (0-1" depth, sieved to 250 μm).

3.7 Quantification of Exposure

This section describes the process for estimating exposures. Exposures occurring *via* ingestion or dermal contact were estimated by an intake, which represents the daily dose of a chemical taken into the body, averaged over the appropriate exposure period, expressed in mg chemical per kg body weight per day. Exposures occurring *via* inhalation are estimated by an exposure concentration in air, which represents an average exposure concentration taking into account daily exposure time (*i.e.*, hours/day) and yearly exposure frequency (*i.e.*, days/year). In general, quantitative exposure estimates involve the following:

- Identification of applicable human exposure models and input parameters;
- Determination of EPCs (the concentration of each COC in environmental media at the point of human exposure); and
- Estimation of human intakes using exposure algorithms.

For each potentially complete exposure pathway identified in Section 3.5, both CT and RME estimates were calculated. According to US EPA guidance (1995a), CT estimates are intended to reflect central estimates of exposure or dose, while RME estimates are intended to reflect exposure for persons at the upper end ("above about the 90th percentile") of the distribution of exposures. RME exposure estimates should be within the range of possible exposures, and not beyond it.

The primary source for the exposure algorithms used in the HHRA is US EPA's Risk Assessment Guidance for Superfund (RAGS) (US EPA, 1989). Exposure algorithms for the different exposure media and pathways are outlined below.

3.7.1 Ingestion of Soil/Sediment

Intake for the soil and sediment ingestion pathways is calculated as:

$$Intake\left(\frac{mg}{kg-day}\right)=\frac{EPC_{soil}\times IR_{soil}\times B\times FS\times EF\times ED\times 10^{-6}\,kg/mg}{BW\times AT}$$

where:

EPC_{soil}	=	Exposure point concentration of chemical in soil/sediment (mg/kg)
IR_{soil}	=	Soil/sediment ingestion rate (mg/day)
B	=	Oral bioavailability of chemical in soil/sediment (unitless)
FS	=	Fraction of soil or sediment from the site (unitless)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

3.7.2 Dermal Contact with Soil/Sediment

Absorbed doses are used for the soil and sediment dermal contact pathways. Dermal intake, an estimate of the amount of chemical absorbed into the body, is calculated as:

$$Intake\left(\frac{mg}{kg-day}\right)=\frac{EPC_{soil}\times SA\times AF\times DA\times EF\times ED\times 10^{-6}\,kg/mg}{BW\times AT}$$

where:

EPC_{soil}	=	Exposure point concentration of chemical in soil/sediment (mg/kg)
SA	=	Skin surface area exposed to soil/sediment (cm^2/day)
AF	=	Soil/sediment skin adherence factor (mg/cm^2)
DA	=	Dermal absorption fraction of chemical in soil/sediment (unitless)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

Note that since absorbed doses are used for the dermal pathway, the toxicity criteria must be adjusted so they apply to absorbed doses. This adjustment is discussed in more detail in the toxicity section (Section 4).

3.7.3 Inhalation of Resuspended Soil

For the inhalation pathway, an effective exposure concentration in air is calculated as:

$$EC_{air} = \frac{EPC_{air} \times ET \times EF \times ED}{AT}$$

where:

EC_{air}	=	Effective exposure concentration of chemical in air (mg/m^3)
EPC_{air}	=	Concentration of chemical in air (mg/m^3)
ET	=	Exposure time (hours/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
AT	=	Averaging time (hours)

The effective exposure concentration represents the average concentration that an individual would be exposed to, if his or her actual exposure concentration was averaged over 24 hours per day and 365 days per year.

3.7.4 Ingestion of Surface Water

Intake for the water ingestion pathway is calculated as:

$$Intake\left(\frac{mg}{kg-day}\right) = \frac{EPC_{water} \times IR_{water} \times EF \times ED}{BW \times AT}$$

where:

EPC_{water}	=	Exposure point concentration of chemical in surface water (mg/L)
IR_{water}	=	Surface water ingestion rate (L/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)

BW = Body weight (kg)
AT = Averaging time (days)

3.7.5 Dermal Contact with Surface Water

Intake for the surface water dermal contact pathways is based on an absorbed dose, which is calculated as:

$$Intake\left(\frac{mg}{kg-day}\right)=\frac{EPC_{water}\times SA\times K_p\times ET\times EF\times ED\times 10^{-3}\,L/cm^3}{BW\times AT}$$

where:

EPC_{water} = Exposure point concentration of chemical in groundwater (mg/L)
SA = Skin surface area exposed to groundwater (cm^2/day)
K_p = Dermal permeability coefficient of chemical (cm/hr)
ET = Exposure time (hours)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

3.7.6 Ingestion of Homegrown Vegetables

Intake *via* ingestion of homegrown vegetables was estimated using EPCs for vegetables (calculated as described above in Section 3.6.5). Whereas ingestion rates for homegrown vegetables are based on wet weights, EPCs in vegetables are based on dry weights. Therefore, it is necessary to convert ingestion rates in terms of wet weight to ingestion rates in terms of dry weight. Homegrown vegetables were assumed to contain an average of 85% moisture. This is a general value based on those presented for individual produce items in US EPA's Exposure Factors Handbook (US EPA, 1997).[2] Fresh weight intake rates ($IR_{veg\text{-}fw}$) were converted to dry weight intake rates ($IR_{veg\text{-}dw}$) using the following equation, where W is the percent moisture content:

$$IR_{veg\text{-}dw} = IR_{veg\text{-}fw} * [(100-W)/100]$$

[2] U.S. Environmental Protection Agency (US EPA). 1997. "Exposure Factors Handbook, Volume II. Table 9-27: Mean Moisture Content of Selected Fruits and Vegetables Expressed as Percentages of Edible Portions."

Intake due to ingestion of homegrown vegetables was calculated as follows (Neptune, 2005):

$$Intake\left(\frac{mg}{kg \cdot day}\right) = \frac{EPC_{veg} \times IR_{veg-dw} \times FS \times EF \times ED \times 0.001 kg/g}{AT}$$

where:

EPC_{veg}	=	Exposure point concentration of chemical in vegetables (mg/kg)
IR_{veg-dw}	=	Dry weight vegetable ingestion rate(g/kg-day)
FS	=	Fraction of vegetables from the site (unitless)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
AT	=	Averaging time (days)

3.7.7 Ingestion of Locally-Raised Chicken

Intake due to ingestion of locally-raised chicken was estimated based on EPC concentrations in chickens (calculated as described above in Section 3.6.6) as follows (Neptune, 2005):

$$Intake\left(\frac{mg}{kg \cdot day}\right) = \frac{EPC_{chicken} \times IR_{chicken} \times EF \times ED \times 0.001 kg/g}{AT}$$

where:

$EPC_{chicken}$	=	Exposure point concentration of chemical in chicken (mg/kg)
$IR_{chicken}$	=	Chicken ingestion rate (g/kg-day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
AT	=	Averaging time (days)

3.7.8 Ingestion of Locally-Raised Eggs

Intake due to ingestion of locally-raised eggs was estimated based on EPC concentrations in eggs (calculated as described above in Section 3.6.7) as follows (Neptune, 2005):

$$Intake\left(\frac{mg}{kg \cdot day}\right) = \frac{EPC_{eggs} \times IR_{egg} \times EF \times ED \times 0.001 kg/g}{AT}$$

where:

EPC_{eggs}	=	Exposure point concentration of chemical in eggs (mg/kg)
IR_{egg}	=	Egg ingestion rate (g/kg-day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
AT	=	Averaging time (days)

3.7.9 Ingestion of Locally-Raised Beef

Intake due to ingestion of locally-raised beef was estimated based on EPC concentrations in beef (calculated as described above in Section 3.6.8) as follows (Neptune, 2005):

$$Intake\left(\frac{mg}{kg-d}\right) = \frac{EPC_{beef} \times IR_{beef} \times EF \times ED \times 0.001 kg/g}{AT}$$

where:

EPC_{beef}	=	Exposure point concentration of chemical in beef (mg/kg)
IR_{beef}	=	Beef ingestion rate (g/kg-day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
AT	=	Averaging time (days)

3.8 Recommended Exposure Parameters

Exposure parameters (*e.g.*, contact rate, exposure frequency, exposure duration, body weight) describe the exposure of a receptor for a given exposure scenario. These values are the input parameters for the exposure algorithms used to estimate chemical intake (described above) (US EPA, 1989; 1991; 1997). The RME and CT values for each of the relevant exposure parameters are presented in Tables 3-16(a-i) and 3-17(a-i), respectively. In addition, distributions were developed for the Monte Carlo analysis for the soil pathway (discussed in Section 3.8.2). Exposure parameters were based on current US EPA guidance, recent scientific literature, or best professional judgment. RME values are generally 90th or 95th percentile values, depending on the data available for each parameter. A combination of RME and CT exposure parameters were used to estimate exposures for the RME scenarios. The basis for each value is described below.

3.8.1 Exposure Parameters for Deterministic Risk Assessment

Soil Ingestion Rate (IR_{soil}). Consistent with US EPA guidance (US EPA, 1997; US EPA, 1991), the following soil and dust ingestion rates were used for residential scenarios: 100 mg/day as a mean soil ingestion rate for children under 6 years of age, 200 mg/day as a high end estimate of mean childhood soil ingestion, 50 mg/day as a mean adult soil ingestion rate, and 100 mg/day to represent the upper range of values reported in adult soil ingestion studies. Note that while US EPA describes 200 mg/day as a "conservative estimate of the mean" for soil and dust ingestion for children (US EPA, 1997), recent studies indicate that 200 mg/day is approximately the 95th percentile soil and dust ingestion rate for children (Stanek and Calabrese, 1995). An RME ingestion rate of 100 mg/day, and a CT ingestion rate of 50 mg/day were used for the construction worker, industrial worker, and adolescent recreator.

Soil and Dust Percentages. Soil ingestion estimates represent total intake of outdoor soil as well as indoor dust. For both RME and CT exposures, we assumed that 100% of a person's total soil and dust intake is derived from outdoor soil.

Fraction of Soil From the Site (FS). For soil ingestion in the RME and CT residential scenarios, we conservatively assumed that 100% of an individual's daily soil ingestion is from the site (*i.e.*, from the individual's residential yard). The fraction from site is 50% for the industrial worker RME and CT scenarios, and 100% for the adolescent recreator, construction worker, and rancher RME and CT

scenarios. The industrial worker is assumed to spend half of the work day outdoors. We assumed that on days spent recreating or at work for a construction worker or a rancher, an individual's entire daily intake of soil and dust is from their exposure area. This approach is conservative because in reality, only a portion of an individual's daily intake would be expected to come from his or her recreational or work area, and a portion would be from home or other areas where he or she spends time.

Relative Oral Bioavailability (b). In evaluating chronic toxicity, it is important to consider the amount of a chemical that is absorbed into the bloodstream. Following ingestion, a chemical may not be completely absorbed into the bloodstream; some fraction of the dose may pass through the gastrointestinal tract unabsorbed. A relative bioavailability estimate for a specific compound represents the absorption fraction from soil (the exposure route of concern) relative to the absorption fraction from food or water (in most toxicity studies, chemical doses are administered in food or water). Specifically, we used chemical-specific bioavailability estimates of 50% for arsenic, and 100% for all other metals; the basis for these values is discussed in more detail in the toxicity section (Section 4).

Dermal Absorption Fraction (Da). The dermal absorption fraction represents the amount of a chemical in contact with skin that is absorbed through the skin and into the bloodstream (US EPA, 2004a). The dermal absorption fractions were obtained from US EPA's dermal risk assessment guidance (US EPA, 2004a). For arsenic and cadmium, we used dermal absorption fractions of 3% and 0.1%, respectively. For the other COCs, metal-specific dermal absorption values were not provided; therefore, we conservatively assumed a dermal absorption fraction of 1%, consistent with US EPA Region 6 guidance (US EPA Region 6, 1995). The same dermal absorption fraction was used for all scenarios, and for CT and RME exposures.

Soil/Skin Adherence Factor (AF). The soil/skin adherence factor describes the amount of soil that adheres to the skin per unit of surface area (US EPA, 2004a). Adherence factors vary depending on the properties of the soil, the part of the body, and the type of activity. The US EPA has recommended default body part-weighted soil adherence factors for residential scenarios, based on exposure scenarios that best represent typical residential exposures to soil (US EPA, 2004a, Tables 3.3 and 3.5). The studies considered by US EPA in deriving these default values evaluated a range of different types of activities and individuals, and included Kissel (1996a); Kissel *et al.* (1996b); Kissel *et al.* (1998); Holmes *et al.* (1999); and (US EPA, 2004a).

For adult residents, the default soil/skin adherence factor is based on exposure to the face, hands, forearms, and lower legs (assuming short-sleeved shirts, shorts, and shoes are worn) (US EPA, 2004a). The recommended weighted soil/skin adherence factor for these body parts is 0.01 mg/cm^2 for CT exposure and risk calculations, based on the 50th percentile weighted adherence factor for groundskeepers. For high end exposure and risk calculations, the recommended weighted soil/skin adherence factor is 0.07 mg/cm^2, based on the 50th percentile weighted adherence factor for gardeners, a reasonable, high end soil contact activity. These values were used for both residential and recreational scenarios.

For child residents (<1 to <6 years old), the default soil/skin adherence factor is based on exposure to the face, hands, forearms, lower legs, and feet (assuming that short-sleeved shirts and shorts are worn, and that shoes are not worn) (US EPA, 2004a). The recommended weighted soil/skin adherence factor for these body parts is 0.02 mg/cm^2 for CT exposure and risk calculations, based on the 50th percentile weighted adherence factor for children playing at a day care center (a CT soil contact activity). For high end exposure and risk calculations, the recommended weighted soil/skin adherence factor is 0.2 mg/cm^2, based on the 95th percentile weighted adherence factor for children playing at a day care center, and the 50th percentile weighted adherence factor for children playing in wet soil (a high end soil contact activity).

For the adolescent recreator, we used the CT and RME values for the adult resident, 0.01 and 0.07 mg/cm^2, respectively. For the construction worker, rancher, and industrial worker, we used 0.02 and 0.2 mg/cm^2 for the CT and RME scenarios, respectively. A value of 0.02 mg/cm^2 is the default CT value for industrial workers; the value of 0.2 mg/cm^2 is the default RME value for outdoor workers (US EPA Region 6, 2006). For the recreator exposed to sediment, we used a CT value of 0.04 mg/cm^2, based on the geometric mean value for adolescents playing soccer in moist conditions (US EPA, 2004a), and an RME value of 0.3 mg/cm^2, based on the 95% upper bound value for adolescents playing soccer in moist conditions (US EPA, 2004a).

Skin Surface Area Exposed (Sa). This parameter reflects the amount of skin that is exposed to soil. For residential scenarios, adults are assumed to wear short-sleeved shirts, shorts, and shoes. Therefore, the US EPA-recommended SA for adults is 5,700 cm^2, based on the 50th percentile value for the head, hands, forearms, and lower legs for male and female adults (US EPA, 2004a). Children (<1 to <6 years old) are assumed to wear short-sleeved shirts, shorts, and no shoes. Therefore, the US EPA-

recommended SA for children is 2,800 cm^2, based on the 50th percentile value for the head, hands, forearms, lower legs, and feet for male and female children (<1 to <6 years old) (US EPA, 2004a). These assumptions are consistent with the activities and scenarios on which the default soil/skin adherence factors are based. These skin surface areas were used for both CT and RME exposure calculations. These surface area assumptions are conservative and may overestimate exposure, since residents may wear long pants and long-sleeved shirts during the cooler months, and children are unlikely to be barefoot all the time. Clothing is expected to limit the extent of the skin exposed to soil (US EPA, 2004a).

For the adolescent recreator, we used CT and RME values of 3790 cm^2, assuming exposure of forearms, hands, and lower legs. For the construction worker, industrial worker, and rancher, we used CT and RME values of 3,300 cm^2, assuming exposure of forearms, hands, and lower legs. For the recreator exposed to sediment, we used CT and RME values of 4980 cm^2, assuming exposure of forearms, hands, lower legs, and feet.

Home-grown vegetable ingestion rate (IR_{veg}). The US Department of Agriculture conducts a Nationwide Food Consumption Survey every ten years to analyze the food consumption behavior of Americans (US EPA, 1997). Survey data is collected for all seasons and all geographic regions of the US. Based on a US EPA analysis of this data, the 50th percentile seasonally adjusted consumer intake of homegrown vegetables for the western US (including Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming) is 0.49 g vegetables (wet weight) per kg body weight per day, and the 75th percentile is 1.46 g vegetables (wet weight) per kg body weight per day (US EPA, 1997, Table 13-33).

These intake rates were derived based on "household food consumption," or the amount of food brought into a household that has been used up in some manner, and therefore includes vegetables that may have spoiled as well as parts of vegetables that are discarded during preparation. On average, there is an 18% weight loss of vegetables during cooking preparation (including paring trimming, slicing, chopping, *etc.*) (US EPA, 1997, Table 13-7, average for all types of vegetables). Therefore, as recommended by US EPA, the intake rates were corrected to reflect the amount of vegetables actually eaten, by multiplying the ingestion rates by 0.82 (US EPA, 1997). The resulting 50th and 75th percentile, seasonally adjusted, homegrown vegetable consumption rates for the western US are 0.4 and 1.2 g vegetables (wet weight) per kg body weight per day, respectively.

Because the modeled vegetable concentrations are expressed on a dry weight basis, the wet weight homegrown vegetable consumption rates must be converted to reflect dry weight consumption rates for consistency (US EPA, 1997). The water content of different vegetables varies, but is typically greater than 85%, particularly for those vegetables commonly grown in home vegetable gardens (US EPA, 1997). Therefore, the wet weight intake rates are multiplied by 0.15 to convert the values to a dry weight basis, yielding 50th and 95th percentile homegrown vegetable consumption rates for the western US, adjusted for seasonal changes and preparation losses, of 0.06 and 0.18 g vegetables (dry weight) per kg body weight per day, respectively.

These intake rates are expressed in units of g vegetable per kg body weight per day because they were based on the distribution of results from the entire study population, which included children as well as adults. Converting these intake rates into units of g/day by multiplying by body weight is not recommended. Therefore, since body weight is already factored into these values, an additional body weight factor is not required in the denominator when calculating average daily exposures from homegrown vegetables (US EPA, 1997). Furthermore, the same ingestion rate is used for both children and adults.

These intake rates are for consumers of homegrown vegetables only. Many individuals may not eat *any* homegrown vegetables. Out of 552 residences in the town of Hurley (US Bureau of Census, 1991), only 30 active vegetable gardens were identified in the town of Hurley during the Phase I RI (Golder, 1998).

Inhalation Rate (IR_{air}). US EPA recommends a general population average inhalation rate of 11.3 m^3/day for women, and 15.2 m^3/day for men (US EPA, 1997).[3] An upper percentile is not recommended. Averaging the male and female inhalation rate yields an overall average adult inhalation rate of 13.25 m^3/day. For children aged 1-12, US EPA now recommends an average daily inhalation rate of 8.7 m^3/day (US EPA, 1997). The same values were used in both central estimate and high end exposure calculations.

Body Weight (BW). We used a mean body weight for children aged 1 to 6 of 16 kg (US EPA, 1997). We used an adult body weight of 70 kg because this weight is consistent with that used to

[3] The previous EPA default adult inhalation rate was 20 m^3/day.

develop the toxicity factors (US EPA, 1991a). We used a body weight of 53 kg for the adolescent recreator and trespasser (US EPA, 1997).

Exposure Frequency (EF). Consistent with US EPA guidance, the adult and child resident CT and RME scenarios used an exposure frequency of 350 days/year, based on the assumption that an individual spends two weeks each year away from his or her residence (US EPA Region 6, 2006).

For ingestion of soil, we used CT and RME values of 50 days/year for the adolescent recreator, and CT and RME values of 10 days/year for the trespasser. These values are based on professional judgment.

For ingestion of sediment, we used CT and RME values of 24 days/year for the adolescent recreator, and 12 days/year for the trespasser. The recreator is assumed to swim for 2 days/week for 12 weeks during the summer. The trespasser is assumed to swim for 1 day/week for 12 weeks during the summer.

For the construction worker and industrial worker, the CT and RME values are 219 days/year and 225 days/year, respectively. The 219 days/year is based on US EPA guidance for an industrial scenario; the 225 days/year is based on an estimate for outdoor workers from US EPA Region 6 (2006).

For the rancher, the CT and RME values are 250 days/year and 350 days/year, respectively. The CT value of 250 days/year assumes that the rancher works at the site 5 days/week for 50 weeks/year; the RME value of 350 days/year assumes that the rancher lives on the site.

Exposure Duration (ED). The exposure duration for soil ingestion in residential scenarios was assumed to be 6 years for children aged 1 to 6 for both CT and high end exposure calculations, 9 years for adults for CT exposure calculations (based on the average duration at a single residence), and 24 years for adults for high end exposure calculations (based on the 95th percentile total duration of 30 yrs at one residence, assuming 6 years as a child and 24 years as an adult) (US EPA, 1997). For the adolescent recreator and trespasser, an exposure duration of 6 years was used, based on an age range of 12-18 years. An RME exposure duration of 25 years was used for the industrial worker, construction worker, and adult rancher. A CT exposure duration of 9 years was used for the industrial worker, construction worker, and adult rancher (US EPA Region 6, 2006).

Averaging Time (AT). For noncarcinogens, an average daily dose is calculated using an averaging time equal to the exposure duration multiplied by 365 days/year. For carcinogens, a lifetime average daily dose is calculated using an averaging time of 70 years (lifetime) multiplied by 365 days/year.

3.8.2 Monte Carlo Input Distributions

We conducted a Monte Carlo simulation for ingestion of surface soil to characterize population exposure and risk variability associated with the soil ingestion pathway. The Monte Carlo simulations were implemented using Crystal Ball®. Monte Carlo simulation is a probabilistic technique used to quantitatively characterize uncertainty and variability in population exposure and risk. Recognizing the importance of quantitatively characterizing uncertainty and variability, US EPA recently released guidance on the use of Monte Carlo simulation in risk assessment (US EPA, 2001a). Monte Carlo simulations estimate the range and relative likelihood of exposure and risk by replacing input parameter point estimate values with probability distributions. The simulation randomly selects a value from each parameter's distribution and calculates the corresponding exposure and risk, repeating this process many times. The collection of computed risks approximates the exposure or risk distribution for the population of interest.

We performed a Monte Carlo simulation for the residential soil ingestion pathway to characterize population exposure and risk variability associated with this pathway. The Monte Carlo simulations were run with 10,000 iterations. We ran the cancer risks for arsenic in EA 3, and the noncancer risks for iron in EA 3, because EA3 had the highest EPCs for these two COCs (6.2 mg/kg for arsenic, and 57,200 mg/kg for iron).

We used distribution inputs for four exposure parameters: soil ingestion rate, exposure duration, exposure frequency, and body weight. The simulation replaced point estimates for these parameters with distributions. For all other parameters, we used the point estimate values used for the deterministic risk assessment. Table 3-18 presents the input values used for the Monte Carlo simulation. The soil exposure point concentration has a large effect on predicted risk. However, US EPA guidance (2001) states that the EPC should be a point estimate rather than an input distribution, therefore the soil EPC

was the same as that used in the deterministic risk assessment. The basis for the distribution input parameters is described below.

Table 3-18
Distributions for Exposure Parameters for Monte Carlo Assessment

Parameter	Assumed Distribution	Distribution Parameters	Source
Exposure frequency	Uniform	Range = 270-350 days/year	Professional judgment
Exposure duration	Lognormal	Range = 1-48 yr GM = 6.5 yr GSD = 3.2 yr	Literature values.
Soil ingestion rate	Lognormal	Child: Range = 1-200 50th% = 45 95th% = 124	Literature values.
		Adult: Range = 1-200 50th% = 23 95th% = 100	Used half the child value for 50th percentile, and EPA value for 95th percentile.
Body weight	Normal	Child: Range = 11-19 Mean = 15 Stdev = 2	EPA Exposure Factors Handbook
		Adult: Range = 34-216 Mean = 70 Std Dev = 4	

Soil Ingestion Rate: Recent studies of soil ingestion rates are discussed below. The results of these studies indicate that child soil ingestion rates can be described by a geometric mean ingestion rate of 45 mg/day, and a 95th percentile rate of 124 mg/day, as discussed below.

Stanek and Calabrese (1995) performed a re-analysis of a previous soil ingestion study of 64 children (ages 1-4) in Amherst, Massachusetts (Calabrese *et al.*, 1989). The Amherst study is one of the most comprehensive and detailed studies of children's incidental soil ingestion to date (Calabrese *et al.*, 1989). In this study, incidental soil ingestion rates were estimated using a mass balance approach. In the re-analysis, the Amherst data were used to develop distributions of potential daily soil ingestion rates, including estimates for various percentiles of the study population. Using this approach, the authors

estimated a mean soil ingestion rate for the 50th percentile child (ages 1-4 years) of 45 mg/day (Stanek and Calabrese, 1995). This re-analysis differs from earlier interpretations of the Amherst study (including evaluations conducted by the study researchers) and reflects a more robust approach that takes into account a greater degree of the information reflected in the study data.

Stanek and Calabrese (2000) performed a soil ingestion study of 64 children (ages 1-4 years) living on a Superfund site in Anaconda, Montana. Stanek and Calabrese derived a seven-day average soil ingestion rate for the 50th percentile child of 17 mg/day. (The comparable value based on the 1989 Amherst population was 45 mg/day.) The seven-day average soil ingestion rate for the 95th percentile child was 141 mg/day (compared to 208 mg/day for the Amherst population.) Stanek and Calabrese (2000) also estimate average soil ingestion rates over longer time periods, based on the seven-day study period. They estimate that the 95th percentile child will have a 365 day average soil ingestion rate of 106 mg/day for the Anaconda population and 124 mg/day for the Amherst population. These estimates are based on an analysis of uncertainty in the daily soil ingestion estimates, using standard statistical techniques.

Exposure Duration: Cohen *et al.* (1996) describe the derivation of an exposure duration distribution using residential duration rate data published by Israeli and Nelson (1992). Specifically, Israeli and Nelson "report the fraction of individuals who have lived in their current residence for at least t years, where t takes on 14 values ranging from 1 year to 48 years" (Cohen *et al.*, 1996, p. 956). The best fit lognormal distribution for rural households (Table 9 in Cohen *et al.*, 1996) has a geometric mean of 6.5 years, and a geometric standard deviation of 3.2.

Exposure Frequency: The deterministic risk assessment assumed a residential exposure frequency of 350 days/year. For the Monte Carlo assessment, we assumed the exposure frequency was a uniform distribution that ranged between 270 and 350 days/year. This is because people may have less contact with soil during the winter months.

Body Weight: The distributions for child and adult body weight were obtained from the US EPA Exposure Factors Handbook (US EPA, 1997). The child body weight is a normal distribution with a mean of 15 kg, a standard deviation of 2 kg, and a range of 11-19 kg. The adult body weight is a normal distribution with a mean of 70 kg, a standard deviation of 4, and a range of 34 to 216 kg.

4 Toxicity Assessment

4.1 Overview of Toxicity Values

We have evaluated potential cancer and noncancer risks posed by site-related metals using dose-response relationships for carcinogenicity (oral and inhalation Cancer Slope Factors, CSFs) and systemic toxicity (oral and inhalation Reference Doses, RfDs).

The primary source of toxicity values was US EPA's Integrated Risk Information System (IRIS) (US EPA, 2007). Toxicity values in IRIS undergo a rigorous peer review process and are generally considered to be of high quality. As a secondary source, we used US EPA Region 3 RBCs (US EPA Region 3, 2007) and Region 9 PRGs (US EPA Region 9, 2004). For cadmium and copper, toxicity values were not available from either IRIS, Region 3 or Region 9; thus, alternate values were used. The basis for these alternate values is discussed on a chemical-specific basis in the appropriate sections below.

4.1.1 Oral Reference Doses (RfD_{oral})

An RfD is an estimate of daily exposure, averaged over a lifetime, that a sensitive population can experience with a negligible risk of systemic health effects. US EPA derives RfDs by first identifying the highest oral dose level that does not cause observable adverse effects (the no-observed-adverse-effect-level, or NOAEL). If a NOAEL is not identified, a lowest-observed-adverse-effect-level, or LOAEL, may be used. This dose level is then divided by uncertainty factors to calculate an RfD. An uncertainty factor of 100 is often used, to account for interspecies variability (if animal studies are used) and sensitive human subpopulations. Additional uncertainty factors may be used, depending on the quality of the data.

The RfD_{oral} values used to evaluate systemic toxicity *via* oral exposures are tabulated in Table 4-1. For each metal, the following information is also summarized: the reference for the study on which the RfD_{oral} is based, the reported NOAEL, the reported LOAEL, the species tested, the health effects observed, and the uncertainty factors used to calculate the RfD_{oral}. The scientific basis for each toxicity value is also described in more detail in Section 4.2.

For the COCs evaluated for the S/TSIU, there is a US EPA-recommended RfD_{oral} for arsenic, cadmium, iron, thallium and vanadium. There is no RFD_{oral} for copper; instead, we evaluated copper toxicity using a probabilistic analysis to estimate the number of nausea episodes that an individual might experience on an annual basis. This is because, unlike most chemicals, for which toxicity following chronic exposure occurs at lower concentrations than toxicity following acute exposure, copper toxicity from acute exposure can occur at lower concentrations than toxicity from chronic exposure.

4.1.2 Oral Cancer Slope Factors (CSF_{oral})

The CSF is an upper bound estimate of carcinogenic potency used to calculate risk from exposure to carcinogens, by relating estimates of lifetime average chemical intake to the incremental risk of an individual developing cancer over a lifetime. The CSFs approved by USEPA are conservative upper bound estimates, which means that US EPA is reasonably confident that the "true" cancer risk does not exceed the estimated risk calculated from the CSF, and may be as low as zero at low dose levels (US EPA, 1986a; 2004c).

For oral carcinogenicity, the oral CSF, the study reference, the species tested, the types of tumors observed, the modeling approach, and the weight of evidence for carcinogenicity have been summarized in Table 4-2. Of all the COCs identified for the S/TSIU, only arsenic is quantitatively evaluated for oral carcinogenicity.

4.1.3 Inhalation Reference Concentrations (RfC)

To evaluate systemic toxicity *via* inhalation exposure, inhalation Reference Concentrations (RfCs) were used. The RfC values used to evaluate systemic toxicity *via* inhalation exposures are tabulated in Table 4-3. For each COC, the following information is also summarized: the reference for the study on which the RfC is based, the reported NOAEL, the reported LOAEL, the species tested, the health effects observed, and the uncertainty factors used to calculate the RfC. For the COCs identified for the S/TSIU, an RfC value is available only for cadmium. For copper and iron, Gradient derived surrogate RfC values, which we termed an Acceptable Exposure Level (AEL_{inhal}). For the remaining metals for which RfC values are not available, systemic toxicity *via* inhalation exposure is not evaluated quantitatively.

4.1.4 Inhalation Unit Risks (UR_{inhal})

For inhalation carcinogenicity, the inhalation Unit Risk (UR_{inhal}), the study reference, the species tested, the types of tumors observed, the modeling approach, and the weight of evidence for carcinogenicity are summarized in Table 4-4. UR_{inhal} values are available only for arsenic and cadmium.

4.1.5 Dermal Reference Doses (RfD_{dermal})

There are no US EPA-derived toxicity criteria based specifically on toxicity studies involving dermal exposures. In the absence of dermal-specific RfDs, oral toxicity factors are used, assuming that once a chemical is absorbed into the bloodstream, the health effects are similar regardless of whether the route of exposure is oral or dermal. However, since oral toxicity criteria are based on the amount of a chemical *administered* per unit time and body weight (chemical intake), they need to be adjusted to be applicable to *absorbed* doses (dermal exposures are expressed as absorbed intake levels) (US EPA, 1989; 1992b; 2004c).

Since most RfDs are based on studies where a chemical is administered in food or water, this adjustment is made using the oral absorption efficiency for that chemical. If oral absorption is very high (almost 100%), then the absorbed dose is virtually the same as the administered dose, and no adjustment of the toxicity factor is necessary. If oral absorption is very low (*e.g.*, 5%), the absorbed dose is much smaller that the administered dose, and an adjustment of the toxicity criteria is necessary. For any given chemical, US EPA recommends adjusting the oral toxicity factor for use in evaluating dermal risks only when the oral absorption for that chemical is less than 50%, because "this cutoff level obviates the need to make comparatively small adjustments in the toxicity value that would otherwise impart on the process a level of accuracy that is not supported by the scientific literature" (US EPA, 2004c).

For noncancer, this adjustment is made by multiplying the oral RfD (for applied doses) by the oral absorption efficiency (*i.e.*, $RfD_{oral} \times Abs_{oral} = RfD_{dermal}$). For each metal, we used chemical-specific oral absorption values recommended by USEPA, if available (US EPA, 2004c). The oral absorption rates and absorbed toxicity values (RfD_{dermal}) used to evaluate dermal noncancer risks are summarized in Table 4-5. The US EPA dermal guidance does not provide an oral absorption value for iron. Although US EPA recommends a default oral absorption value of 100% (US EPA, 2004c), this approach is anti-conservative, and can result in a significant underestimate of risk, particularly for those metals that are

actually poorly absorbed. Because iron in soil would be present as nonheme iron, we conservatively used an oral absorption of 1%, the low end of the range of absorption for nonheme iron, as discussed in Section 4.2.4.2 (US EPA, 1984).

4.1.6 Dermal Cancer Slope Factors (CSF_{dermal})

There are no US EPA-derived toxicity criteria based specifically on cancer studies involving dermal exposures. In the absence of dermal-specific CSFs, oral CSFs are used, assuming that once a chemical is absorbed into the bloodstream, the carcinogenicity is similar regardless of whether the route of exposure is oral or dermal. However, as with RfDs, since oral CSFs are based on the amount of a chemical *administered* per unit time and body weight (chemical intake), they need to be adjusted to be applicable to *absorbed* doses (dermal exposures are expressed as absorbed intake levels) (US EPA, 1989; 1992b; 2004c). For any given chemical, US EPA recommends adjusting the oral CSF for use in evaluating dermal risks only when the oral absorption for that chemical is less than 50%, because "this cutoff level obviates the need to make comparatively small adjustments in the toxicity value that would otherwise impart on the process a level of accuracy that is not supported by the scientific literature" (US EPA, 2004c).

For cancer, this adjustment is made by dividing the oral CSF (for applied doses) by the oral absorption efficiency (*i.e.*, CSF_{oral} / Abs_{oral} = CSF_{dermal}). For each metal, we used chemical-specific oral absorption rates recommended by US EPA, if available (US EPA, 2004c). The oral absorption rates and absorbed CSFs (CSF_{dermal}) used to evaluate dermal cancer risks are summarized in Table 4-5.

4.2 Toxicity Values for COCs

The basis for the toxicity values for each of the seven metals identified as COCs for the S/TSIU is described in this section. For copper and iron, toxicity values were not available from either IRIS, Region 3, or Region 9, and alternate values were used. The basis for these alternate values is discussed on a chemical-specific basis below.

In addition, this section provides a more detailed qualitative discussion of issues relating to the toxicity of the COCs in the HHRA. Where important, the relevance of the form of each metal studied in toxicity studies compared to the forms likely to be present in environmental media in the S/TSIU is

discussed. We have also considered typical dietary intake rates for each COC, and recommended dietary intakes for metals that are essential elements. Recommended dietary intakes for adults and children, as specified by the Institute of Medicine (IOM, 2001) and the National Research Council (NRC, 1989), have been summarized in Tables 4-6 and 4-7. While these values are not factored into quantitative risk estimates, understanding the relationship between toxic levels of essential metals, intake levels required to maintain health, and typical dietary intake rates allows the significance of site exposures to be put into perspective.

4.2.1 Arsenic

In IRIS, US EPA currently has the following toxicity criteria available for arsenic: RfD_{oral}, CSF_{oral}, and UR_{inhal} (US EPA, 2007). The derivation of each of these values, and some of the scientific uncertainties concerning arsenic toxicity, are discussed below. A reference concentration for chronic arsenic exposure *via* inhalation (*i.e.*, an RfC) is not currently available from US EPA. For perspective on the significance of exposures in the S/TSIU, the estimated daily intake of inorganic arsenic from food averages about 3 µg/day for children and adults (Schoof *et al.*, 1999; Yost *et al.*, 2004). There are no studies that determine the nutritional importance of arsenic for humans. However, there is evidence that arsenic has a beneficial role in some physiological processes in some species (IOM, 2001). The possible essentiality of arsenic in humans is based on evidence for requirement of arsenic in lab animals (NRC, 1989).

4.2.1.1 Arsenic RfD_{oral} and RfC

US EPA cites an RfD_{oral} for arsenic of 0.0003 mg/kg-day (US EPA, 2007). The arsenic RfD_{oral} is based on increased incidence of hyperpigmentation, keratosis, and possible vascular complications in a study of a large population (over 40,000 people) in Taiwan with chronic exposure to high levels of arsenic in drinking water and food (Tseng, 1977; Tseng *et al.*, 1968). US EPA characterized an NOAEL of 0.0008 mg/kg-day for skin lesions in the Tseng study, based on the drinking water concentration in the NOAEL group (0.009 mg/L), an assumed drinking water ingestion rate of 4.5 L, daily arsenic intake from sweet potatoes and rice of 0.002 mg/day, and an average Taiwanese body weight of 55 kg ((0.009 mg/L × 4.5 L/day) + 0.002 mg/day / 55 kg) (Abernathy *et al.*, 1989). An uncertainty factor of 3 (based on the lack of reproductive toxicity data and uncertainty regarding toxicity in sensitive individuals) was applied to the NOAEL to derive an RfD of 0.0003 mg/kg-day (0.0008/3). Overall, US EPA has "medium"

confidence in the study, "medium" confidence in the database (due to poor characterization of the dose levels in the Tseng and other supporting studies), and "medium" confidence in the RfD_{oral} for arsenic. It is noted in the arsenic IRIS file that a clear consensus does not exist among US EPA scientists regarding arsenic systemic toxicity (US EPA, 2007). Solid scientific arguments can be made for values within a factor of 2 or 3 of the current recommended RfD_{oral} value, *i.e.*, 0.1 to 0.8 μg/kg/day.

In the HHRA, the RfD_{oral} for inorganic arsenic is also used to evaluate exposures to arsenic in homegrown vegetables. However, it should be noted that some arsenic present in vegetables may be in the form of organic arsenic. Organic arsenicals are commonly believed to be less toxic than inorganic forms of arsenic (ATSDR, 2005).

There are no toxicity criteria (*e.g.*, an RfC) available for evaluating inhalation exposures to arsenic; therefore, inhalation of arsenic is not quantitatively evaluated for noncancer effects in this risk assessment.

4.2.1.2 Arsenic CSF_{oral} and UR_{inhal}

US EPA classifies arsenic as a "human carcinogen," with a weight-of-evidence classification for carcinogenicity of "A" (US EPA, 2007). This classification is based on sufficient evidence of carcinogenicity in human populations. Lung cancer has been associated with inhalation of arsenic, and skin, bladder, and possibly other internal cancers have been associated with ingestion of arsenic in drinking water.

In IRIS, US EPA recommends a CSF_{oral} value for arsenic of 1.5 $(mg/kg\text{-}day)^{-1}$ (US EPA, 2007). This value is based on skin cancer incidence rates in the same Taiwanese study used as the basis for the RfD_{oral} value (Tseng, 1977; Tseng *et al.*, 1968). US EPA calculated this value using a multistage model, assuming a drinking water ingestion rate of 3.5 L/day for Taiwanese males and 2 L/day for Taiwanese females, an average Taiwanese body weight of 55 kg, and an average US body weight of 70 kg.

The current inhalation unit risk (UR_{inhal}) for arsenic in IRIS is 4.3×10^{-3} $(\mu g/m^3)^{-1}$ (US EPA, 2007). This value is based on relative risk estimates for lung cancer among workers at the Anaconda (Montana) and ASARCO (Tacoma, Wa) smelters (Brown and Chu, 1983a,b,c; Lee-Feldstein, 1983; Higgins, 1982; Enterline and Marsh, 1982).

4.2.1.3 Arsenic RfD_{dermal} and CSF_{dermal}

In general, for dermal exposures (expressed as absorbed intake levels), the RfD_{oral} and CSF_{oral} are adjusted to be applicable to absorbed doses (US EPA, 1989; 1992b). As noted above, this adjustment is made assuming that once a chemical is absorbed into the bloodstream, the health effects are similar regardless of whether the route of exposure is oral or dermal. However, since oral absorption of arsenic is about 95% (US EPA, 2004c), and the US EPA recommends adjusting dermal toxicity factors only when oral absorption is less than 50%, no adjustment was made for arsenic. Therefore, the RfD_{dermal} and CSF_{dermal} for arsenic have the same values as the RfD_{oral} and CSF_{oral}, respectively (*i.e.*, 3×10^{-4} mg/kg-day and 1.5 $(mg/kg\text{-}day)^{-1}$).

4.2.2 Cadmium

In IRIS, US EPA currently has the following toxicity criteria available for cadmium: RfD_{oral}, and CSF_{inhal} (US EPA, 2007). In the absence of an RfC for cadmium in IRIS, we used an RfC recommended in a 1999 US EPA review of cadmium toxicity (US EPA, 1999).

For perspective on the significance of exposures in the S/TSIU, the estimated daily intake of cadmium from food is approximately 30 μg/day, of which about 1-3 μg/day are absorbed (ATSDR, 1999). About the same amount of cadmium (1-3 μg/day) is absorbed from smoking a pack of cigarettes (ATSDR, 1999). There is weak evidence for cadmium essentiality in animal studies, but even if nutritional requirements do exist, they would be easily met by natural levels of cadmium in food, water, and air (NRC, 1989).

4.2.2.1 Cadmium RfD_{oral} and RfC

US EPA cites an RfD_{oral} of 0.001 mg/kg-day for cadmium in food (US EPA, 2007). This value is based on a NOAEL of 0.01 mg/kg-day for significant proteinurea in chronic human studies. Cadmium levels in the kidney of 200 μg/g are not associated with significant proteinurea. The NOAEL value was estimated using a toxicokinetic model to determine the level of human exposure that results in a cadmium concentration of 200 μg/g in the kidney, assuming 2.5% absorption of cadmium from food. An uncertainty factor of 10 (to account for intrahuman variability in the absence of specific data on sensitive

individuals) was applied to the NOAEL to yield an RfD_{oral} of 0.001 mg/kg-day for food (0.01 mg/kg-day/10). Overall, US EPA has "high" confidence in the database and "high" confidence in the RfD_{oral} for cadmium, because the RfD reflects the results from many animal and human cadmium toxicity studies.

A 1999 US EPA review of cadmium toxicity recommends an RfC of 7.0×10^{-4} mg/m^3 (US EPA, 1999b). The RfC was calculated based on a urinary cadmium level of 2.7 µg/day (reflective of exposures from both oral and inhalation routes) (Buchet *et al.*, 1990 as cited in US EPA, 1999b), using the modified toxicokinetic model of Oberdorster et al. (1990, as cited in US EPA, 1999b), and a whole-body half-life of 20 years (US EPA, 1999b).

4.2.2.2 Cadmium CSF_{oral} and UR_{inhal}

US EPA classifies cadmium as a "probable human carcinogen," with a weight-of-evidence classification of "B1," based on limited evidence from human epidemiology studies of cadmium inhalation exposures, and sufficient evidence of carcinogenicity in rats and mice by inhalation and injection (US EPA, 2007). There is no evidence that cadmium is carcinogenic *via* oral routes of exposure. Therefore, cadmium is not evaluated for oral carcinogenicity in the HHRA.

For carcinogenic effects resulting from inhalation exposures, US EPA recommends an inhalation unit risk of 1.8×10^{-3} (µg/m^3)$^{-1}$ for cadmium (US EPA, 2007). This value is based on increased risk of lung cancer in a cadmium smelter (Thun *et al.*, 1985, as cited in US EPA, 2007). Exposure concentrations in the workplace were adjusted to reflect continuous, 24-hour equivalent concentrations (8/24 and 240/365).

4.2.2.3 Cadmium RfD_{dermal}

For dermal exposures to cadmium (expressed as absorbed intake levels), the RfD_{oral} is adjusted to be applicable to absorbed doses (US EPA, 1989; 1992b). This adjustment is made assuming that once a chemical is absorbed into the bloodstream, the health effects are similar regardless of whether the route of exposure is oral or dermal. For noncancer effects, this adjustment is made by multiplying the RfD_{oral} (for applied doses) by the absorption rate for cadmium in food (*i.e.*, $RfD_{oral} \times Abs_{oral} = RfD_{dermal}$). US EPA assumes 2.5% absorption of cadmium from food (US EPA, 2004c). Using 2.5% absorption, we calculated an RfD_{dermal} of 2.5×10^{-5} mg/kg-day (*i.e.*, 0.001 mg/kg-day × 0.025).

4.2.3 Copper

As noted above, we evaluated copper toxicity from oral exposure using a probabilistic analysis, to estimate the number of nausea episodes that an individual might experience on an annual basis. This is because unlike most chemicals, for which toxicity following chronic exposure occurs at lower concentrations than toxicity following acute exposure, copper toxicity from acute exposure can occur at lower concentrations than toxicity from chronic exposure. For inhalation exposure to copper, we developed a surrogate RfC; we have termed this Gradient-derived toxicity value an Acceptable Exposure Level (AEL_{inhal}). Below we review the toxicity of copper and the derivation of the copper AEL_{inhal}. Our probabilistic analysis to evaluate nausea is summarized in Section 5.4, and detailed in Appendix F.

4.2.3.1 Toxicity of Copper from Oral Exposure

In contrast to most chemicals, for which the chronic health effects typically occur at lower doses or exposure concentrations than the acute effects, the toxicity of copper is unusual in that acute effects following oral exposure can occur at lower exposure concentrations than chronic effects. Acute effects of copper ingestion consist predominantly of gastrointestinal (GI) symptoms, including nausea, abdominal pain, and vomiting. As discussed in Olivares *et al.* (2001), copper interacts with mucosal cells and triggers a vagal response (*i.e.*, stimulation of the vagus nerve, resulting in acute symptoms such as a decrease in heart rate, decrease in blood pressure, light-headedness, and nausea).

Several controlled studies have examined the incidence of gastrointestinal symptoms in humans following ingestion of water containing copper at defined concentrations (Pizarro *et al.*, 1999; Olivares *et al.*, 2001; Araya *et al.*, 2001; 2003). These studies indicate that the most sensitive endpoint for copper toxicity in humans is gastrointestinal symptoms (primarily nausea), and is a function of the copper concentration in the stomach at any given time. These effects generally occurred directly following exposure, and were readily reversible once exposure ceased. At the levels of copper intake that caused gastrointestinal symptoms, there was no evidence of systemic copper toxicity, such as effects on the liver or the kidney. This is in part because the acute toxic response to copper occurs prior to its absorption and distribution throughout the body. Using the dose-response data from the Araya *et al.* (2001; 2003) and Olivares *et al.* (2001) studies, we generated a distribution of exposure concentrations at which there is no appreciable risk of experiencing nausea, ranging from 1.4 (based on the lowest NOAEL of 2 mg/L from

the drinking water studies, adjusted for a gastric juice volume of 80 mL) to 50 mg/L, with a most likely value of approximately 6.5 mg/L (this analysis is detailed in Appendix D). This distribution of Acceptable Exposure Concentrations (AEC) was used in our probabilistic analysis of copper exposure and nausea episodes (Section 5.4).

The reversibility and lack of systemic toxicity associated with acute copper exposure is further supported by case studies of repeated exposures to high levels of copper in water. For example, Spitalny *et al.* (1984) reported on three family members (two children and their father) who experienced recurrent acute symptoms (vomiting, nausea, and abdominal pain) after drinking juice, coffee, or water in the morning. These symptoms subsided when the family members stopped consuming copper-containing water. There were no other reports of permanent, systemic health effects. Knobeloch *et al.* (1994) similarly reported five case studies in which consumption of copper-containing drinking water was suspected of causing vomiting, diarrhea, abdominal pain, *etc.* These symptoms subsided when consumption of copper-containing water was discontinued, with no reports of permanent systemic effects, even with relatively long-term exposures to copper in drinking water (up to five years).

Although some studies have reported diarrhea following ingestion of copper, results from controlled human exposure studies indicate that diarrhea is not associated with copper, and suggest that copper appears to target the stomach rather than the intestine (Araya *et al.*, 2001; 2003; Olivares *et al.*, 2001; Pizarro *et al.*, 1999). Results from animal studies further support the suggestion that the primary site of copper action is the stomach. Several studies suggest that the primary mechanism by which high doses of copper induce vomiting in ferrets and dogs is through activation of peripheral neural receptors in the stomach, which in turn signal abdominal visceral neural pathways *via* the vagal and splanchnic nerves (Bhandari and Andrews, 1991; Fukui *et al.*, 1994; Makale and King, 1992; Wang and Borison, 1951). Makale and King presented further evidence that the primary site of copper action is the stomach, since seven out of nine ferrets vomited following infusion of a high dose of copper into the stomach, while only one of nine ferrets vomited following infusion of copper directly into the duodenum of the small intestine. Because vagal innervation in the stomach of the ferret is similar to humans (MacKay and Andrews, 1983), the relative sensitivity of the stomach *vs.* the small intestine is likely also similar in ferrets and humans.

More severe effects are observed only at much higher doses of copper. In acute poisoning cases (doses of at least 1 g copper, or approximately 14 mg/kg), copper sulfate caused gastrointestinal

symptoms, jaundice, hypotension, coma, and in some cases, death (Chuttani *et al.*, 1965). The gastrointestinal symptoms observed were believed to be due to damage to the gastrointestinal lining, as Chuttani *et al.* (1965) observed ulcerations in stomach and intestinal mucosa.

The liver is the primary target organ for chronic exposure to copper. Studies in laboratory animals indicate that liver effects typically occur at lower doses than effects in other organ systems, such as the kidney, the hematopoietic, cardiovascular, or central nervous systems (ATSDR, 2002). Liver effects observed in rats following exposures of 13–15 weeks include increased activity of liver enzymes, inflammation, regeneration of parenchymal tissue, and chronic hepatitis. However, as noted above, there is no evidence of liver or other systemic effects at the doses that cause gastrointestinal symptoms. There is little evidence of liver toxicity in humans due to chronic exposure to copper, except for individuals with pre-existing liver diseases, such as Wilson's disease[4] (discussed in ATSDR, 2002 and NRC, 2000).

It is also important to consider that copper is an essential nutrient for humans and animals; copper intake is necessary for good health. Copper is required for a variety of functions, including infant growth, bone strength, red and white blood cell maturation, cholesterol and glucose metabolism, and brain development (Olivares and Uauy, 1996). The Institute of Medicine has a Recommended Dietary Intake value of 0.9 mg/day based on the estimated average requirement to cover the needs of 97 – 98% of adults (IOM, 2001). The daily allowance recommended in the IOM report was 0.34 mg/day for 1-3 year old children, 0.44 mg/day for 4-8 year old children, 0.7 mg/day for 9-13 year old children, and 0.89 mg/day for 14-18 year old adolescents (IOM, 2001). Based on the US FDA Total Diet Study, daily intake levels of copper from food are somewhat greater than the RDA; the reported dietary intake is 1-1.1 mg/day for women, and 1.2-1.6 mg/day for men (IOM, 2001). Copper deficiency in humans is rare, but can result in anemia, bone abnormalities, connective tissue defects, and central nervous system disorders (ATSDR, 2004; Olivares and Uauy, 1996; IOM, 2001).

4.2.3.2 Copper AEL_{inhal}

Since an RfC for copper is not available on IRIS, we reviewed the available literature on inhaled copper toxicity to derive an Acceptable Exposure Level (AEL_{inhal}) for copper in air. A few investigators have examined toxicity associated with inhalation of respirable copper dust. However, most of these

[4] Wilson's disease is a genetic disorder associated with a defect in biliary excretion of copper, which results in accumulation of copper in the liver and brain (NRC, 2000).

studies were limited in that they did not provide data necessary to calculate an acceptable level of exposure to airborne copper dust (*i.e.*, air concentration measurements, or copper exposure in the form of inhalable dust (not fume or ultra-fine dust)). In one of the studies, confounding variables (*i.e.*, exposure to other metals) could not be ruled out. Considering the limitations of the available studies, we selected a no-effect level for occupational exposure to airborne copper dust, and then adjusted this value to reflect residential exposures. The American Council of Governmental Industrial Hygienists (ACGIH) chose the same exposure concentration in deriving their Threshold Limit Value (TLV) for occupational exposure to copper dust. The remainder of this section first describes the available studies on copper dust and discusses their limitations, and then presents the basis for our AEL_{inhal} derivation.

The National Institute of Occupational Safety and Health (NIOSH) conducted a Health Hazard Evaluation of workplace copper exposures at the General Electric Company in response to a request received from a union representative (NIOSH, 1981). Workers were exposed to copper dust from a number of operations (milling, annealing, brazing, sanding, and filling) involved in the formation of copper components for use in turbine generators. Copper air concentrations during the sanding process were found to be 0.683 mg/m^3. The same general procedure had been followed for approximately 45 years without modifications, although improved ventilation was implemented 20 years prior. Worker exposure duration was not reported. The most common complaint was green skin discoloration, and the authors concluded that chronic copper exposure resulted in dermatologic toxicity. There was no evidence of systemic copper absorption suggesting that the skin effects observed were a result of direct dermal contact and not inhalation exposure. Therefore, copper air concentrations determined in this study are not appropriate to use for deriving an AEL_{inhal}.

Suciu *et al.* (1981) examined workers exposed chronically to copper dust (99.9 % pure) from the grinding and sieving of copper dust from 1970 to 1973 (a period of 4 years). During this time, air concentrations ranged from 464 mg/m^3 (in 1971) to 111 mg/m^3 (in 1973) and were believed to drop to 7-22 mg/m^3 after this time. Effects in workers attributed to chronic copper dust exposure included neurological changes, digestive disorders, and pulmonary complications. However, this study is limited in that: (1) no control group was used; (2) no statistics were used to measure the significance of the data; and (3) a concentration in which there was no response was not reported.

In another report, respiratory effects (*i.e.*, mucosal irritation) were observed in workers exposed to copper dust (Askergren and Mellgren, 1975). Although a control group was used, this study is limited in that airborne copper concentrations were not measured.

Finelli *et al.* (1981) reported decreased hemoglobin and erythrocyte levels in workers exposed to 0.64-1.05 mg/m^3 of copper dust. The major limitation of this study is that workers were also exposed to iron, lead, and cadmium, as shown by hair analyses. Overall, none of the available studies are adequate to calculate permissible levels of exposure to airborne copper dust.

It is difficult to quantify a no-effect level for inhalation of copper dust based on the available literature. ACGIH chose a TLV of 1.0 mg/m^3 for exposure to inhalable copper dust, to reduce the incidence of respiratory irritation observed in industrial workers (ACGIH, 1995a). The ACGIH TLV does not appear to be based on the results of any one study in particular, and the exact derivation is not described in the ACGIH documentation. Based on our independent review of the literature, a "no-effect" level of 1 mg/m^3 copper dust is not inconsistent with the available data. For example, frank effects were seen in workers at concentrations 100 times greater in the Suciu study. Considering the limitations in the available data, we selected a "no-effect" level of 1 mg/m^3 for occupational exposure to airborne copper dust.

In order to determine appropriate Uncertainty Factors (UFs) to apply this occupational value to residential scenarios, we used US EPA's "Methods for Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry" (US EPA, 1994) as a guideline. Since occupational studies are assumed to be composed of average, healthy individuals, a UF of 10 is typically used to account for sensitive individuals within the population. Also, the ACGIH value applies to workers who are exposed for 40 hrs/week, while residents may be exposed for as many as 24 hrs/day or 168 hrs/week. The ratio of residential exposure to worker exposure of 4.2 (*i.e.*, 168/40) is used to account for the difference in exposure time between residents and workers. Applying a UF of 10 for sensitive individuals and an exposure adjustment of 4.2 to the occupational "no-effect" level of 1 mg/m^3 yields an AEL_{inhal} of 24 $\mu g/m^3$. In the absence of a US EPA-derived toxicity criteria for inhaled copper, this AEL_{inhal} value is used in the HHRA to evaluate copper inhalation exposures.

It should be noted that inhalation of copper fume has been associated with metal fume fever in numerous occupational studies (*e.g.*, Gleason, 1968). The symptoms of metal fume fever typically last

for one to two days, and include chills, fever, aching muscles, dry mouth and throat, and headache (ATSDR, 1990). However, these effects are only observed in workers exposed to copper fume or submicron and ultrafine copper particles, and it is unlikely that copper present in the air in Hurley would be present in this form.

4.2.3.3 Copper Carcinogenicity

US EPA has assigned copper a Weight-of-Evidence Classification for human carcinogenicity of "D," because there are no human data, inadequate data from animal cancer assays, and equivocal mutagenicity data (US EPA, 2007). Therefore, copper is not evaluated for carcinogenicity in the HHRA.

4.2.3.4 Copper RfD_{dermal}

There is limited evidence that dermal exposure to copper can result in allergic contact dermatitis and eye irritation in some people (ATSDR, 2004). However, there is no quantitative information available regarding dermal exposure levels required to elicit a dermal response. Since the critical effect for copper ingestion is based on irritation of the gastric mucosa and not systemic absorption, it is not appropriate to evaluate the copper toxicity based on absorption through the skin into the bloodstream. Therefore, dermal copper toxicity is not quantitatively evaluated in the HHRA.

4.2.4 Iron

US EPA does not list any toxicity criteria for iron in IRIS (US EPA, 2007). However, US EPA has derived a provisional RfD_{oral} for iron, which is used by US EPA Region 3 and US EPA Region 9 for developing risk-based screening levels.

Iron is an essential element, critical for generating energy. It is present in food in two different forms, which have different absorption values. Small quantities of iron are present in meats as heme iron, of which 10-25% is absorbed; iron in plants and dairy products is present as nonheme iron, of which 1-10% is absorbed (IOM, 2001; US EPA, 1984). The body has some ability to control the amount of iron absorbed from the GI tract, in response to the amount of iron stored in the body (discussed in US EPA, 1999b). Iron in the body is incorporated into various proteins with diverse functions. In hemoglobin, iron facilitates delivery of oxygen to the tissues in the body; in myoglobin, iron facilitates diffusion of

oxygen from capillary erythrocytes to cytoplasm and mitochondria; and in cytochromes (in the mitochondria), iron serves as an electron carrier (IOM, 2001).

Iron deficiency is far more common than iron toxicity. Iron deficiency causes anemia, which can cause decreased physical work performance, developmental delays, cognitive impairment, adverse pregnancy outcomes, and compromised immunity (IOM, 2001). The IOM recommends 8 mg/day as the RDA for children (boys and girls) ages 9-13 years, for adult men (all ages) and for women ages 51 or older. IOM recommends higher RDAs for 14-18 year old boys and girls (11 mg/day and 15 mg/day, respectively), for women ages 19-50 years (18 mg/day) and for pregnant women (27 mg/day). Dietary intake of iron in the US is approximately 16-18 mg/day for men, and approximately 12 mg/day for women (IOM, 2001).

4.2.4.1 Iron RfD_{oral} and RfC

US EPA's National Center for Environmental Assessment (NCEa) has derived a provisional RfD_{oral} for iron of 0.3 mg/kg-day (US EPA, 1999b). This value is based on an NOAEL of 0.27 mg/kg-day, which is the upper bound value of iron intake from food and supplements, based on data from the second National Health and Nutrition Examination Survey (NHANES II), for the time period 1976-1980. NCEA applied an uncertainty factor of 1 to this NOAEL, based on data regarding iron intake for more than 20,000 individuals, ages 6-17 years, as well as the existence of homeostatic mechanisms that can control the amount of iron in the body under conditions of variable intake. US EPA Region 3 and US EPA Region 9 use this RfD_{oral} for iron in developing risk-based screening levels (US EPA Region 9, 2004; US EPA Region 3, 2007).

There are no toxicity criteria (*e.g.*, an RfC) available for evaluating inhalation exposures to iron; therefore, inhalation of iron is not evaluated in this risk assessment.

4.2.4.2 Iron Carcinogenicity

US EPA has not evaluated the carcinogenicity of iron in IRIS (US EPA, 2007). In a 1984 Health Effects Assessment for Iron (1984), US EPA discussed that although some studies have suggested a possible association between lung cancer and inhalation of iron mining dusts, it was not possible to determine the cause of the excess risk, because the miners had exposure to iron oxide, as well as

additional compounds, including radon and silica. Overall, US EPA classified iron and its compounds as a "possible human carcinogen" (Group C), and concluded that no quantitative estimates of cancer potency could be derived (US EPA, 1984). Therefore, iron is not evaluated for carcinogenicity in this risk assessment.

Note that US EPA also concluded that certain iron-carbohydrate complexes (such as iron dextran, a prescription drug) may be carcinogenic (US EPA, 1984). However, these forms of iron are not relevant to the forms of iron likely to be found at the site.

4.2.4.3 Iron RfD_{dermal}

For dermal exposures to iron (expressed as absorbed intake levels), the RfD_{oral} is adjusted to be applicable to absorbed doses (US EPA, 1989; US EPA, 1992b). This adjustment is made assuming that once a chemical is absorbed into the bloodstream the health effects are similar regardless of whether the route of exposure is oral or dermal. For noncancer effects, this adjustment is made by multiplying the RfD_{oral} (for applied doses) by the absorption rate for iron in food (*i.e.*, $RfD_{oral} \times Abs_{oral} = RfD_{dermal}$). Absorption of non-heme iron is reported to range from 1-10% (US EPA, 1984). Because iron in soil would be present as nonheme iron, we used an oral absorption of 1%, the low end of the range of absorption for nonheme iron, as noted above (US EPA, 1984). (Note that using the low end of the range for oral absorption is a conservative approach; if we had used a higher oral absorption value to derive the RfD_{dermal}, the resulting dermal risks would have been lower.) Using 1% absorption, we calculated an RfD_{dermal} of 3×10^{-3} mg/kg-day (*i.e.*, 0.3 mg/kg-day × 0.01).

4.2.5 Thallium

4.2.5.1 Thallium RfD_{oral}

In IRIS, US EPA currently lists RfD_{oral} values ranging from 8×10^{-5} to 9×10^{-5} mg/kg-day for various thallium salts (*e.g.*, thallium acetate, thallium chloride, thallium nitrate, thallium sulfate) (US EPA, 2007). The RfD_{oral} for thallium sulfate is based on a single subchronic study in rats exposed *via* oral gavage to an aqueous solution of thallium sulfate. There were dose-related increases in alopecia, lacrimination, exophtalmus, and changes in blood chemistry parameters. However, alopecia was the only finding at necropsy that was considered treatment-related, and there were no underlying histopathological

alterations. Therefore, the highest dose tested, 0.25 mg/kg-day, was identified as the NOAEL from this study. A UF of 3,000 was applied to this NOAEL (10 for extrapolation to chronic exposure, 10 each for inter- and intra-species variability, and 3 for lack of reproductive and chronic toxicity data), resulting in the IRIS oral RfD_{oral} for thallium sulfate of 8 x 10^{-5} mg/kg-day. The US EPA RfD_{oral} values for the other thallium salts are based on a same subchronic study of thallium sulfate, adjusted to reflect differences in the molecular weight of each thallium salt.

Both US EPA Region 3 and US EPA Region 9 have adjusted US EPA's RfD_{oral} for thallium sulfate, based on the molecular weight of thallium relative to thallium sulfate, to derive an RfD_{oral} of 6.6 x 10^{-5} mg/kg-day for thallium compounds in general (US EPA Region 9, 2004; US EPA Region 3, 2007). In the environment, thallium is likely to be combined with other elements (*e.g.*, thallium oxide, thallium sulfate), but since we do not know the exact form of thallium present at the S/TSIU, we have used the US EPA Region 3 and Region 9 adjusted RfD_{oral} for thallium compounds in general in this HHRA.

There are no toxicity criteria (*e.g.*, an RfC) available for evaluating inhalation exposures to thallium; therefore, inhalation of thallium is not evaluated in this risk assessment.

For additional perspective on the significance of exposures at the S/TSIU, the estimated intake of thallium for adults is approximately 5 µg/day from food and 2 µg/day from water (ATSDR, 1992a). No recommended dietary intake levels have been published for thallium.

4.2.5.2 Thallium Carcinogenicity

US EPA has classified thallium as a Class D carcinogen - not classifiable as to human carcinogenicity, based on a lack of carcinogenicity data in either animals or humans (US EPA, 2007). Therefore, thallium is not evaluated for carcinogenicity in this risk assessment.

4.2.5.3 Thallium RfD_{dermal}

For dermal exposures to thallium (expressed as absorbed intake levels), the RfD_{oral} is adjusted to be applicable to absorbed doses (US EPA, 1989; 1992b). This adjustment is made assuming that once a chemical is absorbed into the bloodstream the health effects are similar regardless of whether the route of exposure is oral or dermal. For noncancer effects, this adjustment is made by multiplying the RfD_{oral} (for

applied doses) by the absorption rate for thallium (*i.e.*, $RfD_{oral} \times Abs_{oral} = RfD_{dermal}$). However, since oral absorption of thallium is about 85%, and the US EPA recommends adjusting dermal toxicity factors only when oral absorption is less than 50%, no adjustment was made for thallium (US EPA, 2004c). Therefore, the RfD_{dermal} for thallium has the same value as the RfD_{oral}, of 6.6×10^{-5} mg/kg-day.

4.2.6 Vanadium

4.2.6.1 Vanadium RfD_{oral}

US EPA does not have any toxicity criteria applicable to vanadium compounds in general in its IRIS database (US EPA, 2007). US EPA (2007) does present an RfD of 9×10^{-3} for vanadium pentoxide, but this form of vanadium is primarily found in dust at factories that use vanadium for making steel, and is therefore usually encountered only in occupational settings (ATSDR, 1992b).

US EPA Regions 3 and 9 both list an RfD_{oral} of 1×10^{-3} mg/kg-day for vanadium compounds in general, using a value developed by US EPA's Environmental Criteria and Assessment Office (ECAO) (US EPA Region 9, 2004; US EPA Region 3, 2007). This value is derived from a study by Domingo *et al.* (1985) in which rats were exposed to sodium metavanadate in water for three months, at concentrations of 0, 5, 10, and 50 ppm (US EPA, 1987). Rats exposed to a drinking water concentration of 50 ppm exhibited signs of impaired kidney function, as evidenced by increased blood urea nitrogen and uric acid. At all concentrations, treated rats had mild histological lesions in the lungs, kidneys, and spleen. A concentration of 10 ppm, corresponding to a vanadium dose of 0.55 mg/kg-day, and a sodium metavanadate dose of 1.0 mg/kg-day, was designated as a NOAEL. A total UF of 1,000, including factors of 10 each for inter- and intra-species variability, and a factor of 10 for extrapolation from a subchronic to chronic exposure, was applied to the NOAEL of 1.0 mg/kg-day for sodium metavanadate, resulting in a RfD_{oral} of 0.001 mg/kg-day. Note that the RfD_{oral} listed by the US EPA regional offices for vanadium is actually the RfD_{oral} for sodium metavanadate, most likely because this is the lowest chronic RfD_{oral} derived by US EPA (1987b) for the various vanadium compounds (*i.e.*, vanadium sulfate, vanadium pentoxide).

Since vanadium can exist in the environment in over 50 different mineral ores (ATSDR, 1992), and we do not know the specific form of vanadium present at the S/TSIU, we used the US EPA Region 3 and Region 9 RfD in this risk assessment. Note that this is a conservative approach; use of the US EPA

Region 3 and Region 9 RfD (a lower value) will result in higher calculated risks than if we had used the US EPA RfD for vanadium pentoxide (a higher value).

For additional perspective on the significance of exposures at the S/TSIU, human exposure to vanadium in food is approximately 10-20 µg/day (ATSDR, 1992b). There is weak evidence for vanadium essentiality in animal studies, but even if nutritional requirements do exist, they would be easily met by natural levels of vanadium in food, water, and air (NRC, 1989). The IOM reports a tolerable intake value, the highest level of daily nutrient intake that poses no risk of adverse health effects for most individuals, of 1.8 mg/day for adults. This value is based on an LOAEL of 7.7 mg/kg-day from an animal study observing the presence of kidney lesions from vanadium exposure (IOM, 2001). No values were presented for infants and children.

4.2.6.2 Vanadium RfC

There are no toxicity criteria available for evaluating inhalation exposure to vanadium. Human chronic occupational exposure studies reveal that the respiratory system is the target for inhalation exposure (US EPA, 1987). Subjects in these studies exhibited symptoms of mild respiratory distress, including cough, wheezing, chest pain, runny nose, and sore throat. However, these studies had various shortcomings that precluded their use for quantifying an RfC, including insufficient quantification of exposures, lack of evaluation of clinical symptoms, or absence of a well-defined NOAEL.

4.2.6.3 Vanadium Carcinogenicity

Available data are inadequate for determination of vanadium carcinogenicity in humans or animals, after oral, inhalation, or dermal exposure (US EPA, 1987).

4.2.6.4 Vanadium RfD_{dermal}

For dermal exposures to vanadium (expressed as absorbed intake levels), the RfD_{oral} is adjusted to be applicable to absorbed doses (US EPA, 1989; 1992b). This adjustment is made assuming that once a chemical is absorbed into the bloodstream the health effects are similar regardless of whether the route of exposure is oral or dermal. For noncancer effects, this adjustment is made by multiplying the RfD_{oral} (for applied doses) by the absorption rate in food (*i.e.*, $RfD_{oral} \times Abs_{oral} = RfD_{dermal}$). US EPA assumes an

oral absorption of 2.6% (US EPA, 2004a). Using 2.6% absorption, we calculated an RfD_{dermal} of 2.6×10^{-5} mg/kg-day (*i.e.*, 0.001 mg/kg-day × 0.026).

4.3 Possible Synergistic and Antagonistic Interactions

An important issue to consider is possible synergistic and antagonistic interactions between metals. Positive interactions are synergistic, where one metal enhances the bioavailability or toxicity of another, while negative interactions are antagonistic, where one metal decreases the bioavailability or toxicity of another. Therefore, a metal can either enhance or decrease the toxicity potential of another metal. Metal interactions have been summarized by various authors (Miller and Groziak, 1997; Gochfeld, 1997; Peraza *et al.*, 1998). Interactions can affect absorption and excretion of metals, transport of metals in the body, binding of metals to target proteins, metabolism and sequestration of metals, and secondary mechanisms of toxicity such as oxidative stress (Peraza *et al.*, 1998). In general, those metals with similar orbitals and coordination numbers antagonize each other directly by competing for the same binding site. Synergistic and antagonistic interactions may also involve other mechanisms, such as competition for binding with proteins in blood and tissues, or the formation of metal complexes.

For the HHRA, we have focused on summarizing known interactions between copper and other metals, since copper is the primary metal of concern, and copper is known to have synergistic and antagonistic interactions with a number of different metals, including lead, zinc, cadmium, selenium, molybdenum, and silver. As summarized by Miller and Groziak (1997), copper and cadmium have similar orbitals, configurations, and coordination numbers; therefore, they are expected to interact directly. Research conducted on the interactions of these minerals has focused on the negative effect of cadmium on copper metabolism. Studies indicate that cadmium interferes with copper utilization, perhaps by decreasing copper absorption. Research conducted on animals has shown that diets high in cadmium decrease plasma and tissue copper levels during pregnancy in both the maternal and fetal organisms.

Some researchers have suggested that intake of adequate levels of essential elements (such as copper and iron) may offer protection against the toxicity of other non-essential metals (such as arsenic, cadmium, and lead), and that conversely, a deficiency of certain essential elements may predispose individuals to toxicity from non-essential metals (Peraza *et al.*, 1998; Chowdhury and Chandra, 1987).

Overall, interactions between metals may be both synergistic and antagonistic, depending on a variety of factors. However, while some mixture research has provided evidence suggesting that simultaneous exposure to toxic doses of several chemicals can result in enhanced toxicity, combined exposure to a mixture of chemicals, each present at their individual no-effect level, does not result in a clearly increased risk of adverse health effects (Jonker *et al.*, 1990; Simmons *et al.*, 1994).

4.4 Bioavailability

In evaluating chronic toxicity, it is important to consider the amount of a chemical that is absorbed into the bloodstream. Following ingestion, a chemical may not be completely absorbed into the bloodstream; some fraction of the dose may pass through the gastrointestinal tract unabsorbed, particularly if the chemical is bound to soil particles. A relative bioavailability estimate for a specific compound represents the absorption fraction from soil (the exposure route of concern) relative to the absorption fraction from food or water (in most toxicity studies, chemical doses are administered in food or water).

It is widely recognized that bioavailability from soil tends to be considerably lower than bioavailability from food or water (see, for example, Ruby *et al.*, 1999). Bioavailability from soil is dependent on a number of factors, including chemical form, solubility, size of the ingested soil particle, soil type, and nutritional status of the individual. As a result, bioavailability estimates for a given compound can vary significantly from one site to another.

The bioavailability of arsenic has been reasonably well characterized in published scientific studies. A large number of published *in vitro* and animal *in vivo* studies, using a wide range of soil types and arsenic concentrations, have demonstrated that only a fraction of soil arsenic is bioavailable, with the relative bioavailability of arsenic in soil generally ranging between 3 and 50% (*e.g.*, Freeman *et al.*, 1993; 1995; Groen *et al.*, 1994; Valberg *et al.*, 1997; Rodriguez *et al.*, 1998; 1999; Ruby *et al.*, 1999; NEPI, 2000; Ellickson *et al.*, 2001; Roberts *et al.*, 2002; 2007; Palumbo-Roe *et al.*, 2005; Carrizales *et al.*, 2006; Rieuwerts *et al.*, 2006). (Although one study did show higher relative bioavailability estimates, the soil arsenic concentrations were considered too low to produce reliable bioavailability estimates (Ruby *et al.*, 1999)). Therefore, for both central tendency and high-end soil ingestion calculations in the HHRA, a default relative bioavailability of 50% was assumed for arsenic, corresponding to the maximum relative bioavailability for arsenic reported in published *in vivo* studies.

(For comparison, note that gastrointestinal absorption of soluble forms of arsenic, such as the forms typically present in food and water, is about 95%.)

Although the general principles discussed above are likely to reduce the bioavailability of other metals in soil as well, published bioavailability studies have been almost exclusively limited to arsenic and lead (Ruby *et al.*, 1999). The Phase II mineralogical analysis only characterized the mineral phases in which lead was found (Golder, 2000); the results do not provide sufficient information to predict the likely bioavailability or form of other metals present in Hurley soil. For example, although some of the lead phases analyzed contained copper (*e.g.*, chalcopyrite), there is no overall accounting of the phases in which the copper was found. The presence of even a small fraction of a very soluble form of a metal could have a large impact on the overall bioavailability. Therefore, we conservatively assumed a relative bioavailability of 100% for all other metals. This assumption is likely to overestimate systemic absorption.

Table 4-1
Summary of Oral Toxicity Factors

Chemicals of Concern	Chronic Oral RfD (mg/kg-d)	Referenced Study	Species Tested	Observed Health Effects	NOAEL (mg/kg-d)	LOAEL (mg/kg-d)	Uncertainty Factors	Oral RfD Comment	Oral RfD Source
Arsenic	3.0E-04	Tseng, 1977; Tseng et al., 1968	Humans	Hyperpigmentation, keratosis and possible vascular complications	0.0008	0.014	3	NC	IRIS
Cadmium	1.0E-03	US EPA, 1985	Humans	Significant proteinuria	0.01	NA	10	food	IRIS
Copper [a]	NA	NA	Humans	Gastrointestinal effects	NA	NA	NA	NC	NA
Iron	3.0E-01	NHANES II, 1976-1980	Humans	No effects, iron from food and supplements	0.27	NA	1	US EPA-NCEA (1999) value	Region 3, Region 9
Thallium	6.6E-05	US EPA, 1986b	Rats	Increased alopecia, lacrimation, and exophthalmos (considered a no-effect level)	0.25	NA	3000	Modified from Thallium Sulfate IRIS value, based on molecular weight	Region 3, Region 9
Vanadium	1.0E-03	Domingo *et al.*, 1985	Rats	Impaired kidney function, as evidenced by increased blood urea nitrogen an uric acid	1.0	NA	1000	US EPA-ECAO value (1987), based on sodium metavanadate	Region 3, Region 9

Notes: NA: Indicates information not available; NC indicates no comment.
[a] A review of the literature on copper toxicity is presented in Section 4.2.3.
References:
US EPA. 2007. "Integrated Risk Assessment System (IRIS)." Accessed on April 9, 2007 at http://www.epa.gov/iris.
US EPA Region 3. 2007. "Risk Based Concentration (RBC) Table." Accessed on April 11, 2007 at http://www.epa.gov/reg3hwmd/risk/human/index.htm.
US EPA Region 9. 2004. "Preliminary Remediation Goals (PRG) Table." Accessed on April 11, 2007 at http://www.epa.gov/region09/waste/sfund/prg/index.html.
US EPA. 1987. "Health Effects Assessment for Vanadium and Compounds." US EPA Environmental Criteria and Assessment Office. National Technical Information Service (NTIS) EPA/600/8-88/061 ; NTIS PB88-176383. July.US EPA, National Center for Environmental Assessment. 1999c. "Risk assessment issue paper for: Derivation of a provisional RfD for iron (CASRN 7439-89-6)." 13p., January .
U.S. EPA. 1986. Subchronic (90-day) toxicity of thallium sulfate in Sprague- Dawley rats. Office of Solid Waste, Washington, DC. cited in EPA IRIS document for Thallium(I) sulfate. Accessed at http://www.epa.gov/iris/subst/0116.htm

Table 4-2

Summary of Inhalation Toxicity Factors

Chemicals of Concern	Chronic RfC (mg/m^3)	Referenced Study	Species Tested	Observed Health Effects	NOAEL (mg/m^3)	LOAEL (mg/m^3)	Uncertainty Factors	Chronic RfC Comment	Chronic RfC Source
Arsenic	NA	NA	NA	NA	NA	NA	NA	NC	NA
Cadmium	7.0E-04	NA	NA	NA	NA	NA	NA	NC	US EPA, 1999b
Copper[a]	2.4E-02	NA	NA	NA	NA	NA	NA	NC	ACGIH, 1995b [b]
Iron	NA	NA	NA	NA	NA	NA	NA	NC	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NC	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NC	NA

Notes: NA: Indicates information not available; NC indicates no comment.
[a] Acceptable Exposure Level (AEL) value used in the absence of a chronic inhalation RfC.
[b] See text for derivation of acceptable exposure levels of inhaled copper dust.

References:

US EPA. 1999." Toxicological Review: Cadmium and Compounds." In Support of Summary Information on Integrated Risk Information System (IRIS). Office of Research and Development, Washington, D.C. March 4.
ACGIH, 1995b. "Threshold Limit Value (TLV) Documentation for Copper and Inorganic Compounds." April 20.

Table 4-3
Summary of Oral Carcinogenicity Factors

Chemicals of Concern	Oral Slope Factor (kg-d/mg)	Referenced Study	Species Tested	Tumors Observed	Modeling Approach	Source	Weight of Evidence (W-O-E) [a]	W-O-E Source
Arsenic	1.5	Tseng, 1977; Tseng *et al.*, 1968	Humans	Skin, liver, kidney, lung cancer	Multistage Model	IRIS	A	IRIS
Cadmium	NA	NA	NA	NA	NA	NA	B1	IRIS
Copper	NA	NA	NA	NA	NA	NA	D	IRIS
Iron	NA	NA	NA	NA	NA	NA	C	US EPA, 1984
Thallium	NA	NA	NA	NA	NA	NA	D	IRIS
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA

Notes: *NA: Indicates information not available; NC indicates no comment.*
[a] W-O-E is a US EPA classification and is not specific to route of exposure. Route specific carcinogenicity is discussed in more detail in the risk assessment.

References:

US EPA, Environmental Criteria and Assessment Office. September 1984. "Health Effects Assessment for Iron (and Compounds) (Draft)." Report to US EPA, Office of Emergency and Remedial Response. ECAO-CIN-H054. 35p.
US EPA. 2007. "Integrated Risk Assessment System (IRIS)." Accessed on April 9, 2007 at http://www.epa.gov/iris.

Table 4-4
Summary of Inhalation Carcinogenicity Factors

Chemicals of Concern	Inhalation Unit Risk ($m^3/\mu g$)	Referenced Study	Species Tested	Tumors Observed	Modeling Approach	Unit Risk Comment	Unit Risk Source	Weight of Evidence (W-O-E) [a]	W-O-E Source
Arsenic	4.3E-03	Brown and Chu, 1983a; Lee-Feldstein, 1983; Higgins *et al.*, 1982; Enterline and Marsh, 1982	Human, male	Lung Cancer	Absolute-risk linear Model	NC	IRIS	A	IRIS
Cadmium	1.8E-03	Thun et al., 1985	Human, male	Lung, trachea, bronchus cancer	Two stage extrapolation	NC	IRIS	B1	IRIS
Copper	NA	NA	NA	NA	NA	NC	NA	D	IRIS
Iron	NA	NA	NA	NA	NA	NC	NA	C	US EPA, 1984
Thallium	NA	NA	NA	NA	NA	NC	NA	D	IRIS
Vanadium	NA	NA	NA	NA	NA	NC	NA	NA	NA

Notes: NA: Indicates information not available; NC indicates no comment.
[a] W-O-E is a US EPA classification and is not specific to route of exposure. Route specific carcinogenicity is discussed in more detail in the risk assessment.

References:
US EPA, Environmental Criteria and Assessment Office. 1984. "Health Effects Assessment for Iron (and Compounds) (Draft)." Report to US EPA, Office of Emergency and Remedial Response. ECAO-CIN-H054. 35p., September.
US EPA. 2007. "Integrated Risk Assessment System (IRIS)." Accessed on April 9, 2007 at http://www.epa.gov/iris.

Table 4-5
Summary of Dermal Toxicity and Carcinogenicity Factors

Chemicals of Concern	Oral Absorption (%) [a]	Oral RfD (mg/kg-d)	Oral CSF (kg-d/mg)	Dermal RfD (mg/kg-d)	Dermal CSF (kg-d/mg)
Arsenic [b]	0.95	3.0E-04	1.5	3.0E-04	1.5
Cadmium	0.025	1.0E-03	NA	2.5E-05	NA
Copper [c]	0.57	NA	NA	NA	NA
Iron	0.01	3.0E-01	NA	3.0E-03	NA
Thallium [b]	0.85	6.6E-05	NA	6.6E-05	NA
Vanadium	0.026	1.0E-03	NA	2.6E-05	NA

Notes: NA: Indicates information not available; NC indicates no comment.
Dermal RfD and CSF were derived by multiplying the oral RfDs and CSFs by the percent oral absorption.
[a] Metal-specific oral absorption values were taken from US EPA Part E, Supplemental Guidance for Dermal Risk Assessment when available. The value for iron is a conservative assumption and discussed in Section 4.2.4.2.
[b] US EPA recommends adjusting dermal toxicity factors only when oral absorption is <50%. Since the oral absorption for arsenic is 95%, the RfD and CSF were not adjusted.
[c] Copper RfD_{oral} cannot be extrapolated to RfD_{derm} since it is based on local irritation, not systemic effects.

Table 4-6
Recommended or Safe Dietary Intake Levels for Adults

Chemicals of Concern	Recommended or Safe Dietary Intake Levels (mg/day) [a]			
	Men		Women	
Arsenic [b]	NS	Essentiality in humans possible based on evidence for requirement in lab animals.	NS	Essentiality in humans possible based on evidence for requirement in lab animals.
Cadmium [b]	NS	Evidence for essentiality weak. If nutritional requirements exist, they are low and easily met by natural levels in foods, water, and air.	NS	Evidence for essentiality weak. If nutritional requirements exist, they are low and easily met by natural levels in foods, water, and air.
Copper	0.9	Values based on the estimated average requirement to cover the needs of 97 – 98% of individuals in this age group.	0.9	Values based on the estimated average requirement to cover the needs of 97 – 98% of individuals in this age group
Iron	8	Recommended Dietary Allowance modeled based on iron requirements and iron absorption.	8 - 18	Recommended Dietary Allowance modeled based on iron requirements and iron absorption. Requirement values adjusted for iron during menstrual losses..
Thallium	NA		NA	
Vanadium [c]	1.8	Tolerable Uptake Value based on a LOAEL of 7.7 mg/kg-d from an animal study observing the presence of kidney lesions from vanadium exposure.	1.8	Tolerable Uptake Value based on a LOAEL of 7.7 mg/kg-d. from an animal study observing the presence of kidney lesions from vanadium exposure.

Notes

[a] Reference unless otherwise noted: IOM. 2001. "Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc." National Academy Press (Washington, DC) 650p.

[b] Reference: National Research Council, Subcommittee on the Tenth Edition of the RDAs. 1989. "Recommended Dietary Allowances (Tenth Edition)." National Academy Press (Washington, DC), 285 pp.

[c] In cases where an Recommended or Safety Dietary Intake Level is not available, a Tolerable Uptake Level, highest level of daily nutrient intake that poses no risk of adverse health effects for most individuals, was used.

NA – Not available

NS – Not specified

Table 4-7
Recommended or Safe Dietary Intake Levels for Infants and Children

Chemicals of Concern	Recommended or Safe Dietary Intake Levels (mg/day) [a]						
	Infants (years)		Children (years)				Comments
	0-0.5	0.5-1	1-3	4-6	7-10	11+	
Arsenic [b]	NS	NS	NS	NS	NS	NS	Essentiality in humans possible based on evidence for requirement in lab animals.
Cadmium [b]	NS	NS	NS	NS	NS	NS	Evidence for essentiality weak. If nutritional requirements exist, they are low and easily met by natural levels in foods, water, and air.
Copper [c]	0.2	0.22	0.34	0.44	0.44 – 0.7	0.7 – 0.89	Values based on the estimated average requirement to cover the needs of 97 – 98% of individuals in each age group.
Iron [c]	0.27	11	7	10	8-10	8-15	Recommended Dietary Allowance modeled based on iron requirements and iron absorption.
Thallium	NA	NA	NA	NA	NA	NA	
Vanadium [d]	NA	NA	NA	NA	NA	NA	Tolerable Uptake Levels not possible to establish. Source of intake should be from food and/or formula only.

Notes

[a] Reference unless otherwise noted: IOM. 2001. "Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc." National Academy Press (Washington, DC) 650p.

[b] Reference: National Research Council, Subcommittee on the Tenth Edition of the RDAs. 1989. "Recommended Dietary Allowances (Tenth Edition)." National Academy Press (Washington, DC), 285 pp.

[c] In the absence of Recommended or Safe Dietary Intake Levels, Adequate Intake values (mean intake of infants principally fed human milk) were used for infants 0 - 1 years

[d] In cases where an Recommended or Safety Dietary Intake Level is not available, a Tolerable Uptake Level, highest level of daily nutrient intake that poses no risk of adverse health effects for most individuals, was used.

NA – Not available

NS – Not specified

5 Risk Characterization

In this section, we calculate risk estimates for both cancer and noncancer health effects, combining the information from Sections 2 through 4. Calculations of cancer and noncancer risks are presented in Sections 5.1 and 5.2, respectively. Section 5.3 presents a comparison of site concentrations to background concentrations, and a comparison of site-related intake levels to dietary reference intakes. Section 5.4 discusses the risks from exposure to copper. Section 5.5 provides a qualitative discussion of the most significant sources of uncertainty in the risk estimates.

5.1 Cancer Risks

5.1.1 Calculation of Cancer Risks

Cancer risks are characterized as the incremental probability that an individual will develop cancer during his or her lifetime due to chemical exposure to contaminants at the site under the specific exposure scenarios evaluated. The term "incremental" implies the risk above the background cancer risk experienced by all individuals in the course of daily life. According to Greenlee *et al.* (2001), the lifetime probability of developing cancer (*i.e.*, background cancer risk) is approximately 0.435 in men, and 0.383 in women. The incremental risk tells us the additional cancer risks estimated to be due to a specific exposure; this incremental risk is termed the "excess lifetime cancer risk" (ELCR). Cancer risks are expressed as a unitless probability (*e.g.*, one in a million, or 10^{-6}) of an individual developing cancer over a lifetime, above background risk, as a result of site-related exposures.

Excess (incremental) cancer risks for all of the exposure pathways (oral, dermal, and inhalation) are calculated using intake estimates (lifetime average daily doses, calculated in Section 3 as part of the exposure assessment) and cancer slope factors (CSFs) (summarized as part of the toxicity assessment in Section 4) as follows (US EPA, 1989):

$$Cancer\,Risk = Intake\left(\frac{mg}{kg \cdot day}\right) \times SF\left(\frac{mg}{kg \cdot day}\right)^{-1}$$

For ingestion pathways, oral intake estimates (expressed as applied or administered dose levels) are multiplied by the oral CSF (applicable to applied/administered doses). Ingestion pathways include soil, water and sediment, and homegrown food products (beef, chicken, eggs, and vegetables). For inhalation pathways, the inhalation intake concentration (usually expressed in mg/m^3) is divided by the inhalation Unit Risk (UR) (applicable to intake concentrations). For dermal exposures to soil, dermal intake estimates (expressed as an absorbed dose level) are multiplied by an adjusted oral CSF (adjusted to apply to absorbed doses) (US EPA, 2004a). For dermal exposures to water, dermal intake estimates (expressed as an absorbed dose level adjusted by a dermal permeability coefficient) are also multiplied by an adjusted oral CSF (adjusted to apply to absorbed doses) (US EPA, 1999).

The total cancer risk for each receptor is the sum of the risks over all chemicals, all exposure routes, and all exposure periods (child and adult). Total cancer risks are additive, therefore, for residential exposures, cancer risks for adults and children are summed to yield a total excess lifetime cancer risk. The RME and CT total excess lifetime cancer risk estimates for each receptor are summarized in Table 5-1 (RME) and Table 5-2 (CT). The total cancer risk estimates are rounded to one significant figure; the cancer risk estimates for individual pathways are rounded to two significant figures. The risks are discussed below by receptor. The risk calculation sheets for each receptor and exposure pathway are provided in Appendix E.1 (RME cancer risks) and Appendix E.2 (CT cancer risks).

5.1.2 Discussion of Cancer Risks

The excess lifetime cancer risk posed by site-related constituents that is deemed unacceptable is determined by the risk manager, which for the S/TSIU is NMED. NMED intends to be consistent with the National Contingency Plan, which generally considers a target risk range of 10^{-6} to 10^{-4} (one in 1 million to one hundred in 1 million).

Cancer risks for each receptor are discussed below. Overall, arsenic is the primary contributor to cancer risk for all of the exposure scenarios. The RME resident scenarios are the only cases with cancer risks exceeding the target risk range. However, if risks associated with ingestion of homegrown foods (which are highly uncertain) are excluded, then the total excess cancer risks for all receptors, including RME residents, are all within or below the target risk range of 10^{-6} to 10^{-4}.

Residents

The RME total excess lifetime cancer risks for residents in EA1 through EA5 range from $2x10^{-4}$ to $3x10^{-4}$. These values exceed the target risk range of 10^{-6} to 10^{-4} (Table 5-1a). The CT total excess lifetime cancer risks for residents in EA1 through EA5 range from $3x10^{-5}$ to $5x10^{-5}$. These values are within the target risk range of 10^{-6} to 10^{-4} (Table 5-2a). For all RME and CT cases, the exposure pathways with the greatest contribution to cancer risk are ingestion of homegrown beef, chicken, eggs, and vegetables. The combined food pathways contribute between 87% and 97% of the overall total excess lifetime cancer risks. For both the RME and CT scenarios, nearly all of the total lifetime excess cancer risk is contributed by arsenic. As discussed in Section 5.5, however, there is considerable uncertainty associated with both cancer risk estimates from arsenic, and cancer risk estimates for food pathways (for example, due to uncertainty in estimating the uptake of contaminants into the plants or animals, and uncertainty in the rate of consumption of homegrown produce). In addition, a portion of the risk in all areas is contributed by background levels of metals in soil.

Due to the considerable uncertainty in cancer risk estimates for food pathways (see Section 5.5), we also calculated the total ELCR excluding consumption of homegrown foods. The RME non-food ELCR for residents in EA1 through EA5 ranged from $5x10^{-6}$ to $1x10^{-5}$ (Table 5-1a). The CT non-food total ELCR for residents in EA1 through EA5 ranged from $2x10^{-6}$ to $6x10^{-6}$ (Table 5-2a). Excluding risks associated with ingestion of homegrown foods, the RME and CT total lifetime excess cancer risks are all within the target risk range of 10^{-6} to 10^{-4}.

Adolescent Recreators

The Adolescent Recreator 1 is exposed to soil *via* ingestion, dermal contact, and inhalation of particulates. The Adolescent Recreator 2 is exposed to surface water and sediment *via* swimming in the stock ponds. The RME total excess lifetime cancer risks for Adolescent Recreator 1 receptors in EA1 and EA5 are $7x10^{-8}$ and $5x10^{-8}$, respectively. These values are well below the target risk range of 10^{-6} to 10^{-4} (Table 5-1b). The CT total excess lifetime cancer risks for Adolescent Recreator 1 in EA1 and EA5 are $4x10^{-8}$ and $3x10^{-8}$, respectively. These values are also well below the target risk range of 10^{-6} to 10^{-4} (Table 5-2b). For both RME and CT cases, the exposure pathway with the greatest contribution to cancer risk is ingestion of soil. For both the RME and CT cases, the COC with the greatest contribution to total cancer risk is arsenic.

The RME and CT total excess lifetime cancer risks for the Adolescent Recreator 2 in EA5 are $8x10^{-8}$ and $5x10^{-8}$, respectively (Tables 5-1b and 5-2b). Both values are also well below the target risk range of 10^{-6} to 10^{-4}. For both RME and CT cases, the exposure pathway with the greatest contribution to cancer risk is ingestion of surface water. For both the RME and CT cases, arsenic is the major contributor to cancer risk.

Adolescent Trespassers

The Adolescent Trespasser 1 is exposed to soil *via* ingestion, dermal contact, and inhalation of particulates. The Adolescent Trespasser 2 is exposed to surface water and sediment *via* swimming in the stock ponds. The RME total excess lifetime cancer risks for the Adolescent Trespasser 1 in EA3 and EA4 are both $2x10^{-8}$ (Table 5-1b). The CT total cancer risks for Adolescent Trespasser 1 in EA3 and EA4 are $9x10^{-9}$ and $1x10^{-8}$, respectively (Table 5-2b). All RME and CT cancer risks are well below the target risk range of 10^{-6} to 10^{-4}. For both RME and CT cases, the exposure pathway with the greatest contribution to cancer risk is ingestion of soil. For both the RME and CT cases, the COC with the greatest contribution to total cancer risk is arsenic.

The RME and CT total excess lifetime cancer risks for the Adolescent Trespasser 2 in EA 4 are $6x10^{-8}$ and $4x10^{-8}$, respectively (Tables 5-1b and 5-2b). These risks are also well below the target risk range. For both RME and CT cases, the exposure pathway with the greatest contribution to cancer risk is

ingestion of surface water. For both the RME and CT cases, arsenic is the major contributor to cancer risk.

Ranchers

The RME total excess lifetime cancer risks for the rancher in EA 1, 2, and 5 are all $2x10^{-6}$ (Table 5-1c). The CT total cancer risks for the rancher scenarios in EA 1, 2, and 5 range from $3x10^{-7}$ to $4x10^{-7}$ (Table 5-2c). The RME and CT cancer risks for all cancer scenarios are below the target risk range of 10^{-6} to 10^{-4}. For both RME and CT cases, the exposure pathway with the greatest contribution to cancer risk is ingestion of soil, and the COC with the greatest contribution to total cancer risk is arsenic.

Construction Workers

The RME total excess lifetime cancer risks for the construction worker in EA1 and EA2 are $2x10^{-6}$ and $1x10^{-6}$, respectively (Table 5-1c). The CT total excess lifetime cancer risk for the construction worker in EA1 and EA2 are $3x10^{-7}$ and $2x10^{-7}$, respectively (Table 5-2c). All RME and CT cancer risks are below the target risk range. For both RME and CT cases, the exposure pathway with the greatest contribution to cancer risk is ingestion of soil. For both the RME and CT cases, the COC with the greatest contribution to total cancer risk is arsenic.

Industrial Workers

The RME and CT total lifetime excess cancer risk for the industrial worker receptor in the smelter area are $5x10^{-6}$ and $6x10^{-7}$, respectively (Tables 5-1c and 5-2c). While the RME cancer risk is within the target risk range (10^{-6} to 10^{-4}), the CT cancer risk is below the range. For both RME and CT scenarios, the exposure pathways with the greatest contribution to cancer risk are ingestion of and dermal contact with soil. For both the RME and CT scenarios, the COC with the greatest contribution to total cancer risk is arsenic.

5.2 Noncancer Risks

5.2.1 Calculation of Noncancer Risks

Risks from noncarcinogenic effects are expressed as hazard quotients rather than as probabilities. A hazard quotient compares the calculated exposure (average daily doses, calculated as part of the exposure assessment in Section 3) to reference exposures derived by US EPA (RfDs and RfCs) (summarized as part of the toxicity assessment in Section 4). For example, the hazard quotient for oral intakes is calculated based on the RfD as (US EPA, 1989):

$$HazardQuotient = \frac{Intake\left(\frac{mg}{kg \cdot day}\right)}{RfD\left(\frac{mg}{kg \cdot day}\right)}$$

Hazard quotients are calculated for each receptor, for each exposure pathway, and for each COC according to US EPA guidance (US EPA, 1989). For each exposure route, hazard quotients are summed across all COCs to calculate a hazard index. For each receptor, the percent contribution of each exposure route to the total noncancer risk is also shown. Because a hazard quotient is simply a ratio of site exposures to reference exposure levels (RfDs, RfCs, *etc.*), hazard indices do not represent the probability that an adverse health effect would occur. Therefore, unlike cancer risks, noncancer hazard indices are not additive across different age groups for a given receptor.[5] Typically, since child exposures are higher than adult exposures, the hazard index for a child will represent the greatest hazard index experienced by that receptor during his or her lifetime.

For ingestion pathways, oral intake estimates (expressed as applied or administered dose levels) are divided by the oral RfD (applicable to applied/administered doses). Ingestion pathways include soil, water, sediment, and homegrown food products (beef, chicken, eggs, and vegetables). For inhalation pathways, the inhalation intake concentration (usually expressed in mg/m^3) is divided by the inhalation RfC. For dermal exposures to soil, dermal intake estimates (expressed as an absorbed dose level) are divided by an adjusted oral RfD (adjusted to apply to absorbed doses) (US EPA, 2004c). For dermal

[5] As an example, if a total hazard index was 0.8 for a child resident and 0.5 for an adult resident, adding hazard indices would inappropriately yield a value greater than one, even though the daily exposures for that receptor never exceeded US EPA reference exposure levels.

exposures to water, dermal intake estimates (expressed as an absorbed dose level adjusted by a dermal permeability coefficient) are divided by an adjusted oral RfD (adjusted to apply to absorbed doses) (US EPA, 2004a).

The total noncancer risks for each receptor are summarized in Table 5-3 (for RME) and Table 5-4 (for CT). For each receptor, we list the percent contribution of each exposure route to the total noncancer risk, and the total contribution of the four food pathways to the total noncancer risk. The total hazard index (HI) for each receptor is the sum of the HI for each exposure route. As noted above, noncancer hazard indices are not added across different age groups for a given receptor (*i.e.*, child and adult risks for the resident are not added). The total hazard indices are rounded to one significant figure; hazard indices for the individual exposure pathways are rounded to two significant figures. The noncancer risks are discussed below by receptor. The risk calculation sheets for each receptor and exposure pathway are provided in Appendix E.3 (RME noncancer risks) and Appendix E.4 (CT noncancer risks).

5.2.2 Discussion of Noncancer Risks

If a hazard index is greater than 1, there may be concern for potential noncancer effects. It is the responsibility of the risk manager (NMED) to determine the value of the hazard index which represents an unacceptable risk. As discussed below in Section 5.5, there are several limitations to the hazard index approach which may overestimate the noncancer risk.

Noncancer risks for each receptor are discussed below. (Copper risks are evaluated separately, in Section 5.4). Overall, the target hazard index of 1 is exceeded only for certain resident scenarios and the RME industrial worker. For residents, food pathways have the greatest contribution to noncancer risk. However, even if food pathways are excluded, the hazard index still exceeds 1 for certain child resident scenarios. Iron and vanadium are the primary contributors to noncancer risk for all of the exposure scenarios.

Residents

The RME total hazard indices for the child resident range from 14 to 24 in EA 1 to 5 (Table 5-3a), which exceed the target hazard index of 1. The CT total hazard indices for the child resident range from 5 to 10 in EA 1 to 5 (Table 5-4a), which also exceed the target hazard index of 1. For both the RME and CT cases, the combined food pathways have the greatest contribution to noncancer risk. The combined food ingestion pathways contribute 55% to 65% of the overall noncancer risk for the RME child, and 90% to 93% of the risk for the RME adult (Table 5-4a). For both the RME and CT cases, the COCs with the greatest contribution to noncancer risk are iron and vanadium.

There is a fair amount of uncertainty in the risk associated with the food pathways, due to uncertainty in estimating the uptake of contaminants into the plants or animals, and uncertainty in the rate of consumption of homegrown produce (see Section 5.5). Due to this uncertainty, we also calculated the total HI excluding consumption of homegrown foods. The RME non-food total HI for the child range from 5 to 11, which still exceed the target hazard index of 1 (Table 5-3a). The CT non-food total HI for the child range from 1 to 3; only EA2 and EA3 exceed the target hazard index of 1 (Table 5-4a). Excluding the food pathways, the exposure pathways with the greatest contribution to noncancer risk are ingestion of and dermal contact with soil.

The RME total HI for the adult resident range from 9 to 15 (Table 5-3a). The CT total HI for the adult resident range from 4 to 7 (Table 5-4a). For both the RME and CT cases, the exposure pathways with the greatest contribution to noncancer risk are ingestion of homegrown foods. For RME adults, the combined food pathways contribute 90% to 93% of the overall risk (Table 5-3a). The RME and CT non-food total HI are all less than or equal to the target hazard index of 1 (Tables 5-3a and 5-3b). Excluding the food pathways, the exposure pathways with the greatest contribution to noncancer risk are ingestion of and dermal contact with soil. For both the RME and CT cases, the COCs with the greatest contribution to noncancer risk are iron and vanadium.

Summing hazard quotients for different chemicals is conservative; this approach assumes that the resulting toxic effects are additive. In fact, it is known that the metals present at the site do not all affect the same organ systems. For example, the most sensitive health endpoint for iron, the primary contributor to risk, is gastrointestinal effects (IOM, 2001). The estimated levels of iron intake from soil, however, are below published levels at which gastrointestinal effects are likely to occur in all populations

(IOM, 2001). It is unlikely that the other COCs would affect the gastrointestinal tract at the estimated levels of exposure. While some research has provided evidence suggesting that simultaneous exposure to toxic doses of several chemicals can result in enhanced toxicity, combined exposure to a mixture of chemicals, each present at their individual no-effect level, does not result in a clearly increased risk of adverse health effects (discussed in more detail in Section 5.5).

Adolescent Recreators

The RME total HI for the Adolescent Recreator 1 is 0.1 for both EA 1 and 5 (Table 5-3b). The CT total HI for the Adolescent Recreator 1 are 0.03 and 0.01 for EA 1 and 5, respectively (Table 5-4b). All RME and CT total HI for the Adolescent Recreator 1 in EA 1 and 5 are below the target HI of 1. For all RME and CT cases, the exposure pathways with the greatest contribution to noncancer risk are ingestion of and dermal contact with soil. Iron has the greatest contribution to noncancer risk.

The RME and CT total HI for the Adolescent Recreator 2 in EA 5 are 0.2 and 0.07, respectively (Tables 5-3b and 5-4b). For both RME and CT cases, the exposure pathways with the greatest contribution to noncancer risk are dermal contact with surface water and sediment. For both the RME and CT cases, iron has the greatest contribution to noncancer risk.

Adolescent Trespassers

The RME total HI for the Adolescent Trespasser 1 are 0.04 and 0.02 for EA 3 and 4, respectively (Table 5-3b). The CT total HI for the Adolescent Trespasser 1 is 0.008 in EA 3 and 0.003 in EA 4. All RME and CT total HI for the Adolescent Trespasser 1 in EA 3 and 4 are below the target HI of 1 (Tables 5-3b and 5-4b). For all RME and CT cases, the exposure pathways with the greatest contribution to noncancer risk are ingestion of and dermal contact with soil. Iron has the greatest contribution to noncancer risk.

The RME and CT total HI for the Adolescent Trespasser 2 are 0.14 and 0.03, respectively (Tables 5-3b and 5-4b), below the target hazard index of 1. For both RME and CT cases, the exposure pathways with the greatest contribution to noncancer risk are ingestion of and dermal contact with sediment and dermal contact with surface water. Iron has the greatest contribution to noncancer risk.

Ranchers

The RME total HI for the rancher in EA 1, 2 and 5 range from 0.4 (EA 5) to 1 (EA 1) (Table 5-3c). The CT total HI for the rancher in EA 1, 2 and 5 range from 0.1 (EA 1 and 2) to 0.2 (EA 5) (Table 5-4c). The total HI for all the RME and CT rancher scenarios are below the target hazard index of 1. For all RME and CT cases, the exposure pathways with the greatest contribution to noncancer risk are ingestion of and dermal contact with soil. Iron has the greatest contribution to noncancer risk.

Construction Workers

The RME total HI for construction workers in both EA 1 and 2 is 0.7 (Table 5-3c). The CT total HI for the construction worker is 0.2 in EA 1 and 0.1 in EA 2 (Table 5-4c). The total HI for all RME and CT construction worker scenarios are below the target HI of 1. For all RME and CT cases, the exposure pathways with the greatest contribution to noncancer risk are ingestion of and dermal contact with soil. Iron has the greatest contribution to noncancer risk.

Industrial Workers

The RME and CT total hazard indices for the industrial worker in the smelter area are 1 and 0.2, respectively (Tables 5-3c and 5-4c). For both RME and CT cases, the exposure pathways with the greatest contribution to noncancer risk are ingestion of and dermal contact with soil. For both the RME and CT cases, the COCs with the greatest contribution to noncancer risk are arsenic, iron, and vanadium.

5.3 Comparison of Site Concentrations to Background Levels and Dietary Intakes

In the following sections, we compare site concentrations to background (Section 5.3.1), present risks due to background levels in soil (Section 5.3.2) and compare estimated daily intakes from soil ingestion to published dietary intake levels (Section 5.3.3).

5.3.1 Comparison to Background Soil in Reference Area

All of the COCs evaluated in this risk assessment are inorganic elements and occur naturally in soil. Naturally-occurring concentrations in soil are termed "background" levels. In the HHRA, constituents were not eliminated from the risk assessment based on a comparison to background concentrations. Nevertheless, it is important from a risk management standpoint to understand how site concentrations relate to background. If site concentrations for a COC in an exposure area are consistent with background levels, then risks may be due to background levels of metals in soil rather than impacts from historic mining and smelting operations.

For the Chino S/TSIU, we used nine background soil samples collected from a "Reference" area located southwest of the S/TSIU, in the vicinity of the airport and in the town of Bayard (Figure 1). As discussed in Section 2.2.4.1, the soil in the Reference area is presumed not to have been influenced by emissions from the smelter or windblown dust from the tailings piles.

We performed a statistical comparison of site and background concentrations, in order to evaluate which COCs are likely to be related to past smelter operations and which are likely to be present at background levels. We compared the mean (arithmetic average) concentrations in each of the S/TSIU exposure areas to the mean background concentrations in the Reference Area, using nine reference soil samples collected as part of the RI Background Report (CMC, 1995). For data sets that were normal, the comparison was conducted using Student's t-test assuming unequal variances, at a 95% confidence level. For datasets that were lognormal (as determined by ProUCL), the t-test was run on the log-transformed data. (For datasets that were non-parametric or followed a gamma distribution, we ran the Wilcoxon rank sum test (a nonparametric test) to compare medians instead of means.) The test was run as a one-sided test, thus it tested only whether the mean (or median) site concentration was greater than the mean (or median) reference area concentration. It should be noted that the characteristics of the site and reference area datasets are not exactly the same; the samples from the Reference Area are 0-1 inch and unsieved, while the data from the exposure areas are 0-1 inch and sieved to 250 μm. Nonetheless, since sieved soil samples are more likely to have higher metal concentrations, the use of sieved data from the Exposure Areas makes it more likely to conclude that site concentrations exceed background, and thus our use of sieved data for this analysis is conservative.

The mean concentrations in the S/TSIU exposure areas and the Reference Area are presented in Table 5-5. The results of the statistical comparisons are reported in Table 5-6. For each analyte in each exposure area, Table 5-6 reports the *p*-value for the statistical test. *P*-values less than 0.05 are statistically significant, indicating that the mean (or median) concentration in the exposure area is significantly greater than the mean (or median) concentration in the reference area. For arsenic, the mean concentrations in EA 3, EA 4, and the Smelter area are significantly greater than background. For cadmium, the mean concentrations in EA 2, EA 4, and the Smelter area are significantly greater than background. For copper, the mean concentrations in all exposure areas and the Smelter area are significantly greater than background. In all exposure areas, the results of the t-test indicate that mean concentrations of iron, thallium, and vanadium in the S/TSIU exposure areas are not significantly greater than background (Table 5-6). It is not clear why the concentrations of thallium and vanadium are higher in the Reference Area than in the S/TSIU exposure areas.

Statistical power can be determined for comparisons run using a t-test. For most of the comparisons, the power of the test was adequate to detect a significant difference. However, there were four comparisons run by t-test, where the mean site concentration was higher than the mean background concentration, but the t-test did not allow us to conclude that the difference was statistically significant (Table 5-7). In each case, the power of the test to detect a significant difference is low (less than 35%), due to either small sample size or large standard deviation, therefore, the results of the test should be interpreted as inconclusive. Although a larger sample size might increase the power for these comparisons, we can not predict whether a larger sample size would result in a statistically significant difference in the mean concentrations.

Table 5-5
Mean Concentrations (mg/kg)
in S/TSIU Exposure Areas *vs.* Reference Area

	EA1	EA2	EA3	EA4	EA5	Smelter	Reference
Arsenic	2.41	2.50	3.51	4.38	1.93	18.30	2.12
Cadmium	0.96	0.99	4.56	3.40	0.47	5.94	0.58
Copper	638	1058	1297	4306	370	18700	136
Iron	21527	22491	45209	21014	22471	43140	36600
Thallium	0.34	0.37	0.35	0.48	0.27	0.48	7.28
Vanadium	44.3	36.3	28.5	25.7	47.2	22.0	101.3

Table 5-6
Statistical Comparison of Mean Concentrations in S/TSIU Exposure Areas *vs.* Reference Area (*p*-values of comparison test)

	EA1	EA2	EA3	EA4	EA5	Smelter
Arsenic	0.249	0.169	*0.067*	**0.000**	0.712	**0.002**
Cadmium	0.1372	**0.025**	*0.728*	**0.000**	0.958	**0.000**
Copper	**0.000**	**0.002**	**0.003**	**0.000**	**0.000**	**0.003**
Iron	1.000	1.000	0.123	*1.000*	1.000	0.219
Thallium	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
Vanadium	1.000	1.000	1.000	*1.000*	1.000	1.000

Notes:
Bold: p-value is less than 0.05 and result is significant.
Underlined: p-value is from test run on log-transformed data.
Italics: p-value is from the Wilcoxon rank sum test instead of the t-test.
P-values listed as 0.000 are output from the statistical software as 0.0000, and signify a p-value less than 0.0001.

Table 5-7
Statistical Power of t-test to Detect Significant Difference in Means

	N	Mean (mg/kg)	CV	% Difference in means	p-value	Result	Power of test
Arsenic in EA1	11	2.41	0.39	14%	0.249	NS	17%
Arsenic in EA2	11	2.5	0.30	18%	0.169	NS	26%
Iron in EA3	22	45209	0.70	24%	0.123	NS	32%
Iron at Smelter	5	43140	0.38	18%	0.219	NS	21%

Notes:
CV: Coefficient of variation = Std Dev / Mean
% Difference in means = (Mean in EA – Mean in Ref Area)/(Mean in Ref Area)
NS: Not significant

5.3.2 Risks Due to Background Soils

As discussed above in Section 5.3.1, the COCs in this risk assessment also occur naturally in background soils. Therefore, a portion of the risk is due to naturally occurring background metals in soil. In order to obtain a general idea of the magnitude of background risks, we calculated the RME cancer and noncancer risks associated with exposure to these metals in background soil, for a child and adult resident. The background soil data were obtained from the samples collected in the Reference Area, located southwest of the S/TSIU, near the Silver City airport (Figure 1). Although background samples were analyzed by both x-ray fluorescence (XRF) and fixed laboratory, we used only the data generated by the fixed laboratory, as this data met the data quality objectives of the risk assessment. Although the

fixed-lab data set (9 samples) for the reference area is somewhat limited, the data are sufficient to get a general idea of the magnitude of background risks.

We evaluated risks for an adult and child resident, *via* ingestion, dermal contact, inhalation, and consumption of locally-produced beef, chicken, eggs, and vegetables. The soil EPCs are the 95%UCL concentrations for the Reference Area soil samples. The background soil EPCs were used to calculate EPCs for locally-produced beef, chicken, eggs, and vegetables. We did not perform air modeling to determine the air concentrations due to resuspended background soils. Therefore, the air concentration used for the inhalation pathway was same as the air EPC for EA 2, because EA 2 is the closest exposure area to the Reference Area.

The soil EPCs used to calculate risk in the reference area are presented in Table 5-8. We compared the soil EPCs in the reference area to the EPCs in the S/TSIU exposure areas. The EPCs for thallium and vanadium in the Reference Area are higher than in all five Exposure Areas and the Smelter area. For arsenic, the primary contributor to cancer risk, the EPCs in EAs 1, 2, and 5 (2.92, 2.91, and 2.13 mg/kg, respectively), are similar to the arsenic EPC in the Reference Area (2.7 mg/kg). As a result, the inclusion of these metals in the site-related risk calculations is conservative and may overestimate site-related risks.

Table 5-8
Soil EPCs (mg/kg) in Reference Area and S/TSIU Exposure Areas

	Reference Area	EA1	EA2	EA3	EA4	EA5	Smelter
Arsenic	2.7	2.92	2.91	6.18	4.94	2.13	24.1
Cadmium	0.67	1.48	1.32	28.40	4.07	0.53	7.24
Copper	177	746	1519	1907	4861	448	25926
Iron	41194	25137	25167	57203	23163	26629	58842
Thallium	7.9	0.41	0.58	0.66	0.54	0.32	0.74
Vanadium	120	55.30	44.80	31.60	29.20	59.60	23

The estimated RME cancer risks for the child and adult resident, due to background, are summarized in Table 5-9. The cancer risk calculations for each pathway are in Appendix E.5. The total excess lifetime cancer risk (ELCR) for a resident in the Reference Area is $2x10^{-4}$. This value is above the

target risk range. Arsenic contributes nearly all of the cancer risk. The combined food pathways comprise 98% of the total ELCR in the reference area.

The estimated RME noncancer hazard indices for the child and adult resident, due to background, are summarized in Table 5-10. The noncancer risk calculations for each pathway are in Appendix E.5. The total HI for a child resident in the Reference Area is 26; the total HI for adults is 20. These values are above the target hazard index of 1. Iron, thallium, and vanadium contribute the majority of the noncancer risk. The combined food pathways comprise 71% and 95% of the total HI, for children and adults, respectively.

The RME cancer risk for a resident in the Reference Area ($2x10^{-4}$) is the same as the RME cancer risk for EA 1, 2, 3, and 5. The cancer risk for a resident in EA 4 ($3x10^{-4}$) slightly exceeds that of the Reference Area. The RME noncancer risks in the Reference Area (26 for the child and 20 for the adult) are higher than the RME and CT noncancer risks for resident adults and children in all exposure areas.

We compared the risks from the combined food pathways in the Reference Area to those in the five S/TSIU exposure areas. The RME noncancer risk from the food pathway in the Reference Area is higher than that in each of the five exposure areas. The RME cancer risk from the food pathway in the Reference Area ($2x10^{-4}$) is the same as the food pathway cancer risk in Exposure Areas 1, 2, 4, and 5. The food pathway cancer risk in EA 3 ($3x10^{-4}$) is slightly higher than the food pathway cancer risk in the Reference Area ($2x10^{-4}$). Thus, with one exception, the combined food pathway risks in the Reference Area are similar to or greater than the food pathway risks calculated for the S/TSIU exposure areas. Thus it is important to note that much of the total risk from the food pathways may be due to background concentrations in soil.

5.3.3 Comparison to Dietary Intake Levels

The largest contributors to noncancer risk in children and adults are iron and vanadium, and the largest contributor to cancer risk in children and adults is arsenic. Iron, however, is an essential nutrient, and vanadium and arsenic are naturally occurring in soil and living organisms. We compared the amount of these elements that one might take in *via* incidental ingestion of soil to the levels recommended in a healthy diet or found in ambient intake. We determined metal intakes from soil using the RME soil ingestion rates (100 mg/day for adults and 200 mg/day for children) and the highest residential EPC. For

iron and vanadium, we compared these daily intakes to the Recommended Dietary Allowance (RDa) and the Tolerable Upper Intake Level (UL) (IOM, 2001), if available. The RDA is the average daily dietary nutrient intake level sufficient to meet the nutrient requirement of nearly all healthy individuals (IOM, 2001). The Tolerable Upper Intake Level (UL) is the highest level of daily intake that is likely to pose no risk of adverse health effects (IOM, 2001). Since there is no RDA for arsenic, we compared site intakes to published levels of dietary inorganic arsenic intake for children and adults in the US (Yost *et al.*, 1998; Schoof *et al.*, 1999; Yost *et al.*, 2004). Yost *et al.* (1998) estimated that dietary inorganic arsenic intake ranges from 8 to 14 μg/day in the US, and Schoof *et al.* (1999) estimated that dietary inorganic arsenic intake ranges from 1-20 μg/day for adults in the US, with a mean intake of 3.2 μg/day. Yost *et al.* (2004) estimated a dietary intake for inorganic arsenic of 3.2 μg/day (range of 1.6-6.2 μg/day for the 10th-95th percentile) for 1-6-year-old children, based on concentrations of inorganic arsenic in 38 foods and water, along with food consumption data from the USDA. (The arsenic dietary intakes were converted to mg/day in Table 5-11 below). The results of these comparisons are presented in Table 5-11.

The highest arsenic EPC is 6.18 mg/kg, in EA 3. Daily intakes of arsenic from soil were calculated as 0.001 mg/day for both children and adults. This estimated arsenic intake is lower than the estimated range of dietary intakes for arsenic, for both children and adults.

For adults, the estimated intake of iron from site soil (6 mg/day) is lower than both the RDA (8 and 18 mg/day for males and females, respectively) and UL values (45 mg/day). For children, the estimated intake of iron from soil (11 mg/day) exceeds the RDA (8 mg/day for both males and females) but does not exceed the UL for iron (40 mg/day). We assumed that in addition to iron intake from soil, receptors will consume iron as part of their normal diet. When we added the iron intake from soil to the RDA, we found that the total iron intake from both sources was below the UL for both children and adults. Since vanadium does not have a published RDA, we compared the daily intake to an estimated range of daily dietary intake; this range was reported by Jones (1987, as cited in IOM, 2001). The estimated daily intake of vanadium from soil does not exceed the range for children or adults, nor does it exceed the UL. It is therefore unlikely that iron and vanadium intake in children and adult residents will result in adverse noncancer effects.

Copper intakes from soil were also compared to copper dietary reference levels. Copper is an essential nutrient for humans and animals; copper intake is necessary for good health. Copper is required for a variety of functions, including infant growth, bone strength, red and white blood cell maturation,

cholesterol and glucose metabolism, and brain development (Olivares and Uauy, 1996). We compared the copper intake *via* incidental ingestion of soil to the levels recommended in a healthy diet. We determined copper intakes from soil using the RME soil ingestion rates (100 mg/day for adults and 200 mg/day for children) and the highest residential copper EPC (4,860 mg/kg in EA 4). We compared these intakes to published Dietary Reference Intakes (IOM, 2001) (Table 5-11). For children, the estimated intake of copper from soil (1 mg/day) slightly exceeded the Recommended Daily Allowance (RDa) (0.7 mg/day for children ages 9-13 years) but did not exceed the Tolerable Upper Intake Level (UL) for copper (5 mg/day for children ages 9-13 years). For adults, the estimated intake of copper from soil (0.5 mg/day) did not exceed either the RDA (0.9 mg/day) or the UL for copper (10 mg/day). We also assumed that in addition to copper intake from soil, receptors will consume copper as part of their diet. When we added estimated copper intake from site soil to the RDA, we found that total copper intake from both sources was below the UL for children and adults.

Table 5-11
Comparison of Estimated Daily Intake to Dietary Reference Levels

Analyte	Soil Concentration (mg/kg)		Estimated Daily Intake (mg/day)[1]		RDA (mg/day)		UL (mg/day)	
			Child	Adult	Child[2]	Adult	Child	Adult
Arsenic	6.18	EA3	0.001	0.001	0.0016-0.0062[3]	0.001-0.020[3]	NA	NA
Copper	4860	EA4	1	0.5	0.7	0.7	5	10
Iron	57,200	EA3	11	6	8.0	8 (males) 18 (females)	40	45
Vanadium	59.6	EA5	0.01	0.006	0.0065-0.011 [3]	0.006-0.018 [3]	1.8[4]	1.8

Notes:
1. Estimated Daily Intake = EPC x RME soil ingestion rate (200 mg/day for children and 100 mg/day for adults)/(1x10^6).
2. RDA for children ages 9-13 years (IOM, 2001).
3. RDA not available. Estimated daily intake range was used (Jones, 1987, as cited in IOM, 2001).
4. Child-specific UL for vanadium not available; value is for adults 19 years and older.
NA: Not available.

5.4 Evaluating Toxicity from Oral Exposure to Copper

As discussed in Section 4, the toxicity of copper is unusual in that acute effects following oral exposure, consisting predominantly of gastrointestinal symptoms, can occur at lower exposure doses than chronic effects. Therefore, instead of the standard RfD approach used for the other site COCs, we developed an innovative approach to evaluate acute toxicity from oral exposure to copper.

Several controlled studies have examined the incidence of gastrointestinal symptoms in humans following ingestion of water containing copper at defined concentrations (Pizarro *et al.*, 1999; Olivares *et al.*, 2001; Araya *et al.*, 2001; 2003). These studies indicate that the concentration of soluble copper in the stomach contents is an important determinant of the gastrointestinal effects of copper, and that the majority of symptoms occur within the first 15 minutes following ingestion of copper, and subside within an hour. Thus, the most sensitive endpoint for copper toxicity in humans (acute, reversible GI symptoms) is a function of the copper concentration in the stomach ($C_{stomach}$) at any given time, and the relevant timeframe for evaluating the copper concentration in the stomach is one hour. Because nausea is the primary GI symptom associated with ingestion of copper, we evaluated copper toxicity in terms of the occurrence of nausea. Copper risks are expressed as the estimated number of episodes of nausea per year.

Our aim in this analysis was to estimate the number of nausea episodes that an individual might experience on an annual basis, at a given EPC for copper, and only a 5% probability of exceeding that number of nausea episodes. This analysis was based on the remedial action criterion (RAC) analysis for copper in soil in the Hurley Soils IU (Gradient Corporation, 2004), which was conducted using a Monte Carlo simulation. The RAC analysis used child input parameters because a child is expected to be the most sensitive receptor due to higher soil ingestion rate and smaller stomach volume. We did not re-calculate the Monte Carlo distribution based on distributions for adult input parameters, because we do not have a set of reliable input distributions that describe inputs for adults. We therefore used the Monte Carlo distribution developed for the RAC analysis, to estimate copper risks for the S/TSIU. As such, the copper risks estimated for adult and adolescent receptors are conservative overestimates, because they are based on a Monte Carlo distribution developed with child inputs.

To evaluate the potential for nausea associated with ingestion of copper in soil, we first used a Monte Carlo analysis to generate a distribution of soil copper concentrations at which nausea is not likely to occur in any given hour (Hourly C_{soil}), according to the following basic equation:

$$Hourly\,C_{soil}\,(mg/kg) = \left[\frac{AEC\,(mg/L)}{C_{stomach}\,(mg/L)}\right] \times \left[\frac{10^6\,mg}{kg}\right] \qquad \text{(Eq. 1)}$$

In this equation, AEC is the Acceptable Exposure Concentration at which there is no appreciable risk of experiencing nausea, which we identified based on the studies by Pizarro *et al.* (1999), Olivares *et al.* (2001) and Araya *et al.* (2001; 2003). The copper concentration in the stomach ($C_{stomach}$) depends on the amount of copper-containing soil ingested ($Soil_{ing}$), the solubility or bioaccessibility (b) of copper in the stomach contents, and the volume of food and liquid in the stomach ($V_{stomach}$), as shown in the following equation:

$$C_{stomach}\,(mg/L) = \frac{Soil_{ing}\,(mg) \times B\ (unitless)}{V_{stomach}\,(L)} \qquad \text{(Eq. 2)}$$

Combining equations 1 and 2 results in the following equation for calculating Hourly C_{soil}:

$$Hourly\ C_{soil}(mg/kg) = \left[\frac{(AEC\,(mg/L))}{\left(\dfrac{Soil_{ing}\,(mg) \times B\,(unitless)}{V_{stomach}\,(L)}\right)}\right] \times \left[10^6\,\frac{mg}{kg}\right] \qquad \text{(Eq. 3)}$$

Because soil ingestion rates are higher for children than for adults, children would be more likely to develop nausea at any given copper soil concentration. Thus we generated a distribution of Hourly C_{soil} values that would minimize the occurrence of nausea in children (ages 1 to 6 years).

As noted above, the distribution of Hourly C_{soil} values for copper was determined by Monte Carlo analysis, which involves using a distribution of values, rather than a single value, as input for the parameters in Equation 3. The distributions for the input parameters used to generate the distribution for

Hourly C_{soil} values are presented in Appendix F. The Monte Carlo analysis then calculates many different Hourly C_{soil} values (*e.g.*, on the order of tens of thousands of values), by randomly selecting values from the distribution of values for each of the input parameters. Thus, each Hourly C_{soil} value, which constitutes a different combination of values selected from the distributions for the input parameters in the Hourly C_{soil} equation, represents a soil concentration at which there is a negligible risk of experiencing nausea. In the distribution of Hourly C_{soil} values, an Hourly C_{soil} corresponding to the 5th percentile of the distribution means that there is a 5% probability that an individual would experience nausea at the selected Hourly C_{soil}, and a 95% probability that an individual would not experience nausea at the selected Hourly C_{soil}.

5.4.1 Determining the Probability of Experiencing Nausea in a Year

Based on the distribution of hourly C_{soil} values, we can identify the probability of experiencing nausea in an hour for any given copper EPC (based on corresponding percentile in the distribution of hourly C_{soil} values). However, even if the probability of experiencing nausea in an hour is very low, the probability of experiencing nausea over the course of a longer period, such as a year, can be relatively high. Therefore, we would like to determine the number of nausea episodes that an individual might experience in a longer time period, such as a year. To accomplish this, we generated a distribution of copper concentrations in soil at which nausea is not likely to occur on any given day (daily C_{soil}), based on a distribution of the minimum hourly C_{soil} values for each day. For each copper EPC, we can identify the daily probability of experiencing nausea on a given day, π_{nausea}, as the corresponding percentile in the distribution of daily C_{soil} values. The number of days on which an individual might experience nausea can then be determined by solving for r, in the following equation:

$$P_{nausea,total}(r) = \sum_{i=r}^{N} P_{nausea}(i)$$

with: (Eq. 3)

$$P_{nausea}(i) = \frac{N!}{i!(N-i)!}\pi_{nausea}{}^{i}\left(1-\pi_{nausea}\right)^{N-i}$$

where $P_{nausea,total}(r)$ is the probability of experiencing r or more episodes of nausea in N days, and π_{nausea} is the daily probability of experiencing nausea (corresponding with a percentile in the distribution of daily C_{soil} values). This process is described in detail in Appendix F.

For this analysis we are only evaluating the probability of nausea due to ingestion of copper directly from soil. For ingestion of copper *via* the food pathways, it is not likely that nausea will occur. This is because the copper will be complexed with the food, which will limit the ability of copper to interact with the stomach lining and elicit nausea. In fact, copper is present in many grains, fruits and vegetables, with highest levels found in avocado (2.2 mg/kg), whole wheat bread (2.3 mg/kg), raw mushrooms (2.4 mg/kg), raisins (3.3 mg/kg), and raisin bran cereal (4.4 mg/kg) (ATSDR, 2004). Nausea has not been reported to occur following ingestion of these common copper-containing foods; this provides good evidence that copper in food would not elicit nausea.

5.4.2 Summary of Copper Risks

For this analysis, we considered the probability that an individual would experience a certain number of nausea episodes per year as a result of ingestion of copper in soil. We analyzed each receptor based on the copper EPC for soil ingestion and his or her exposure frequency. Copper risks are expressed as the estimated number of episodes of nausea per year (Table 5-12), but were calculated such that an individual is likely to experience less than this number of nausea events per year.

Residents

Copper risks for a child resident ranged from 1 to 12 episodes of nausea per year, and were highest in EA 4. Copper risks for an adult resident would be lower than those for the child resident, but were not specifically evaluated.

Recreators

Copper risks for soil ingestion by the Adolescent Recreator 1 are estimated as 1 episode of nausea per year. Copper risks for sediment ingestion by the Adolescent Recreator 2 are estimated as less than 1 episode of nausea per year.

Trespassers

Copper risks from soil ingestion by the Adolescent Trespasser 1 are estimated as 1 to 2 episodes of nausea per year. Copper risks for sediment ingestion by the Adolescent Trespasser 2 are estimated as less than 1 episode of nausea per year.

Construction Workers

Copper risks from soil ingestion by construction workers are estimated as 1 to 2 episodes of nausea per year. It should be noted that this risk is an overestimate for an adult worker because the Monte Carlo simulation was done using child inputs.

Industrial Workers

Copper risks from soil ingestion by an industrial worker in the smelter area are estimated as 65 episodes of nausea per year. It should be noted that this risk is an overestimate for an adult worker because the Monte Carlo simulation was done using child inputs. In fact, these estimates are clearly an overestimate because we are unaware of any such routine complaints of nausea from current smelter workers.

Table 5-12
Copper Risks *via* Soil Ingestion

Exposure Area	Media	Copper EPC (mg/kg)	Receptor	Exposure Frequency (days)	Estimated Episodes of Nausea per year
1	Soil	746	Resident	350	1
			Recreator 1	270	1
			Rancher	350	1
			Construction Worker	225	1
2	Soil	1,520	Resident	350	3
			Rancher	350	3
			Construction Worker	225	2
3	Soil	1,910	Resident	350	4
			Trespasser 1	10	1
4	Soil	4,860	Resident	350	12
			Trespasser 1	10	2
	Sediment	87	Trespasser 2	12	<1
5	Soil	448	Resident	350	1
			Recreator 1	50	1
			Rancher	350	1
	Sediment	111	Recreator 2	24	<1
Smelter	Soil	25,900	Industrial Worker	225	65
Reference	Soil	177	Resident	350	<1

Notes:
1. Episodes of Nausea based on 95% probability of nausea, on a yearly basis, at the given concentration.
2. For sediment, the copper concentrations were too low to calculate an exact value; therefore, Episodes of Nausea are given as <1 per year.

5.5 Uncertainty Assessment

The process of evaluating human health risks involves multiple steps. Inherent in each step of the process are uncertainties that ultimately affect the final risk estimates. Uncertainties may exist in numerous areas, including environmental sampling data, derivation of toxicity values, and estimation of potential site exposures, which may result in either an over- or under-estimation of risks. However, for this risk assessment, where uncertainties existed, parameters or approaches were deliberately chosen to be conservative and overestimate potential exposures and risks. In this section, we present a qualitative discussion of all the significant sources of uncertainty and the choices made in each of the four risk assessment steps (Data Collection and Evaluation, Exposure Assessment, Toxicity Assessment, and Risk

Characterization). We also present the results of a probabilistic uncertainty analysis that examined some of the key sources of uncertainty and variability in the risk calculations. Overall, despite the inherent uncertainties, the risk estimates calculated in this assessment are conservative, and are likely to overpredict actual site risks.

5.5.1 Uncertainties in Data Collection and Evaluation

Data Adequacy

Analytical data collected during the RI were used to identify chemicals of concern and characterize the exposure areas for the site. Consequently, any data gaps in the RI would result in uncertainty in the identification of investigative constituents and potentially affect the exposure concentration estimates. However, as discussed in Sections 2.3 and 2.4, overall, the RI is believed to be adequate to fully define the nature and extent of contamination at the site. There are no data validation or data quality issues that would seriously limit use of the data for the HHRA (see Appendix b). The samples collected in the S/TSIU were analyzed for an appropriate list of constituents, and the detection limits for the sample analysis were adequate to detect the presence of site-related contamination.

Analytical data were available to evaluate each of the receptors and exposure pathways, and in many cases, were adequate for risk assessment. However, as noted in Section 2.4.4, for some of the exposure areas, fewer than 10 samples were available for evaluating specific receptors or exposure pathways. Datasets with an inadequate number of samples included the following:

- EA 1 had only 1 sample for assessing uptake into vegetables, chicken, eggs, and beef
- EA 2 had only 2 samples for assessing uptake into vegetables, chicken, eggs, and beef
- EA 3 had only 9 samples for assessing uptake into vegetables, chicken, eggs, and beef
- EA 4 had only 7 samples for assessing uptake into vegetables, and 9 samples for assessing uptake into chicken, eggs, and beef
- The Smelter exposure area had only 5 samples for assessing direct contact with soil.

Overall, the use of small sample sizes and/or samples that are not evenly distributed across the exposure area introduces uncertainty, increasing the possibility that the data may not adequately represent the entire exposure area. For these small datasets, in particular those with less than 5 samples,

it is not possible to determine whether the EPC over- or under-estimates the average exposure concentration, and the resulting risk estimates are highly uncertain.

Selection of COCs

Six metals, whose maximum detected soil concentration exceeded risk-based screening criteria, were identified as soil COCs for Exposure Areas 1 through 5 and the Smelter area (Section 2.5). Additional metals were detected in site soil, but because their maximum detected soil concentration did not exceed conservative risk-based screening criteria, they were eliminated as COCs. Although these chemicals were not carried through the risk assessment, the comparison to conservative screening criteria indicates that they would not be expected to contribute significantly to site risks.

Note that the screening criteria used to select the COCs (the Region 9 PRGs) were based only on exposure pathways involving direct contact with residential surface soil (incidental ingestion, dermal contact), and did not consider exposures *via* food pathways. This type of screening approach is conservative, and widely used in conducting environmental risk assessments. However, it is possible that the COC screening process may have eliminated chemicals of potential concern that correspond to unacceptable calculated risks for one or more food pathways.

The site samples were analyzed for total metals. Based on the site history, there is no reason to suspect that any other chemicals, for which chemical analyses were not performed, might be present at the site at levels that would significantly impact site risks.

Assumptions for Non-Detects

There is significant uncertainty associated with the use of half the detection limit for metals not detected above the detection limit. This approach is highly conservative; actual concentrations may be significantly lower. ?

Groundwater

Groundwater was not quantitatively evaluated in the risk assessment because we do not have groundwater data from the S/TSIU at the present time. Although domestic water is currently supplied to

residents within the Smelter/Tailings Soils IU by the community water system of the town of Hurley (and is in compliance with the Safe Drinking Water Act), groundwater could be used in the future as a source of drinking water. The lack of quantitative risk estimates for potential future exposure to groundwater could result in an underestimate of total risks for future residents.

5.5.2 Uncertainties in Exposure Assessment

Exposure Point Concentrations (EPCs)

An exposure point concentration is intended to represent the average concentration of a chemical to which an individual is exposed. Although some uncertainty is associated with estimating the true average concentration at a site (based on the number of samples collected, *etc.*), our use of an upper confidence limit on the arithmetic mean (95%UCL) for most EPCs (Section 3.6) provides statistical confidence that the true site average will not be underestimated (US EPA, 1992c; 2004c). In some cases with small sample sizes, the 95%UCL could not be calculated, therefore, the maximum concentration is used as the EPC. This approach may overestimate the actual average concentrations that an individual would be exposed to, and therefore overestimate risks for these pathways.

Many of the data uncertainties discussed in Section 5.5.1 have a direct impact on the EPCs used in the risk assessment. For example, the use of one-half the detection limit to represent exposure point concentrations for non-detected chemicals may overestimate actual exposures. The fact that the available datasets for some of the exposure areas were relatively small and that samples were not distributed evenly across some of the exposure areas also introduces some uncertainty. Hotspots of contamination may not have been detected. However, as discussed in Section 3.6.1, based on the deposition mechanism and the pattern of contamination, hotspots are not anticipated in the S/TSIU. In addition, our comparison of maximum to mean concentrations, by exposure area, further indicated that no hotspots were present in any of the exposure areas. Moreover, given the conservative methods used to calculate exposure point concentrations, use of a small sample size is more likely to result in unrealistically high EPC estimates (*i.e.*, likely to be much greater than actual exposure concentrations) and overestimated potential human health risks.

Air Modeling

We used a US EPA-recommended wind erosion model (WEM) and the AERMOD air dispersion model to determine the air quality impact of resuspension of soil impacted by the smelter and tailings ponds. While there are uncertainties associated with any model used to predict the transport and fate of chemicals in the environment, the AERMOD model has been validated and is recommended by the US EPA. We incorporated as much site-specific information that we could into the model; however, when site-specific data were not available, standard US EPA defaults or best estimates were used.

Soil vs. Dust Concentrations

Soil ingestion estimates represent total intake of outdoor soil plus indoor dust. Typically, outdoor soil is a major component of indoor house dust. The HHRA assumed that 100% of a person's total soil and dust intake is derived from outdoor soil; this approach is conservative and likely to overestimate exposures, because some of the individual's intake is from indoor dust, and indoor dust concentrations may be lower than those in outdoor soil.

Soil Ingestion Rate

In this risk assessment, we used US EPA-recommended soil ingestion values: 100 mg/day as a mean soil ingestion rate for children under 6 years of age, 200 mg/day as a high end estimate of mean childhood soil ingestion, 50 mg/day as a mean adult soil ingestion rate, and 100 mg/day to represent the upper range of values reported in adult soil ingestion studies. These values are conservative, and likely to overestimate actual daily soil and dust ingestion rates.

Recently published scientific studies (discussed in Section 3.8.2) indicate that the US EPA-recommended soil ingestion rates overstate empirical values. For childhood soil ingestion, Stanek and Calabrese (1995) estimated a geometric mean soil ingestion rate of 45 mg/day; and Stanek and Calabrese (2000) estimated a 95th percentile soil ingestion rate of 124 mg/day. These literature values are lower than those used for the deterministic risks in the HHRA.

Stanek *et al.* (1997) also conducted a study involving 10 adults as part of a larger soil ingestion study with children. Based on a carefully controlled study that used the most reliable tracer elements and

280 subject-days of data, which according to the study authors is the largest amount of data available regarding soil ingestion rates in adults, Stanek *et al.* (1997) estimated an "average" soil ingestion rate of 10 mg/day for adults (Stanek *et al.*, 1997). These results suggest that average soil ingestion for adults is actually much lower than what we assumed in the HHRA.

Fraction from Site

For residential scenarios, all of an individual's daily soil and dust ingestion was assumed to occur at home (*i.e.,* at the site). This assumption is conservative; it is likely that throughout the year, at least some amount of an individual's soil and dust ingestion occurs at other locations (*i.e.,* at work, at other recreational areas outside of town, *etc.*) Similarly, for the adolescent recreator, construction worker, and rancher, we assumed that on days spent recreating or at work, an individual's entire daily intake of soil and dust was from his or her exposure area. This approach is conservative because in reality, only a portion of an individual's daily intake would be expected to come from his or her recreational or work area, and a portion would be from his or her home.

Relative Bioavailability

A large number of published *in vitro* and animal *in vivo* studies, using a wide range of soil types and arsenic concentrations, have demonstrated that only a fraction of soil arsenic is bioavailable, with the bioavailability of arsenic in soil generally ranging between 3% and 50% (*e.g.*, Freeman *et al.*, 1993; 1995; Groen *et al.*, 1994; Valberg *et al.*, 1997; Rodriguez *et al.*, 1998; 1999; Ruby *et al.*, 1999; NEPI, 2000; Ellickson *et al.*, 2001; Roberts *et al.*, 2002; 2007; Palumbo-Roe *et al.*, 2005; Carrizales *et al.*, 2006; Rieuwerts *et al.*, 2006). We used 50%, the high end of the range, to estimate relative bioavailability for arsenic in soil. *In vivo* bioavailability studies are somewhat uncertain since the animal models used may have anatomical and physiological differences compared to humans (Ruby *et al.*, 1999). Furthermore, the degree to which the bioavailability estimates reported in the scientific literature reflect site-specific bioavailability is somewhat uncertain; site-specific bioavailability data is not available. Nonetheless, the relative bioavailability estimate used for arsenic is likely to overestimate the amount of arsenic absorbed into the body, since the high end of the range reported in the literature was used.

For all other metals, a relative bioavailability of 100% was conservatively assumed, which is likely to overestimate systemic absorption.

Soil/Skin Adherence Factor

This factor represents the amount of soil that adheres to skin and is available for dermal exposure. Because this value is likely to vary based on one's activity, the values used for this parameter, which are estimates from single activities, are somewhat uncertain. Soil/skin adherence can vary significantly based on one's activity, the parts of the body exposed, soil particle size, soil moisture content, *etc.* However, the adherence factor of 0.2 mg/cm^2 that we used for children (RME) in this risk assessment is conservative and likely to overestimate actual average skin adherence. This US EPA-recommended reasonable maximum adherence factor is based on studies of young children playing at a day care center and children playing in wet soil. The default soil/skin adherence values may also overestimate average exposure on a yearly basis, because while residents may engage in similar activities for some period of time, it is unlikely that they would have such direct contact with soil every day. For example, residents may have little to no direct contact with soil on days with inclement weather.

Skin Surface Area Exposed

Default surface areas for exposed skin are based on the assumption that adults and children are wearing short-sleeved shirts and shorts, and that children are barefoot. However, clothing is expected to limit the extent of the skin exposed to soil (US EPA, 2004c). Residents are likely to wear long pants and long-sleeved shirts during cooler months, and children are unlikely to be barefoot year-round. There is a four-fold difference between the surface area for an adult wearing a long-sleeved shirt and long pants *versus* an adult wearing a short-sleeved shirt and shorts (US EPA, 2004a). Therefore, the default surface area assumptions are conservative and may overestimate exposure.

Dermal Absorption Values

The dermal absorption rates used in this risk assessment were based on either published values from peer-reviewed literature, or on federal or regional US EPA recommendations. However, because various factors affect the efficiency of dermal absorption, there is considerable uncertainty associated with these values. For example, some of the dermal absorption values used are based on studies of dermal absorption of metals in aqueous solutions; dermal uptake of metals in soil is likely to be lower. Also, many compounds are only absorbed through the skin after a long exposure duration (*i.e.*, >24

hours). Since most individuals bathe at least once each day, washing may remove any soil residues adhering to the skin before absorption can occur. Therefore, dermal absorption rates based on studies with long exposure durations may overestimate actual absorption. Soil loading rates have also been shown to affect dermal absorption rates; the percentage of dermal absorption may increase as soil loading rates decrease. Most experimental studies of dermal absorption rates have used soil loading rates that are much greater than would be experienced following typical human contact with soil. The use of various testing methods also introduces uncertainties; *in vivo* animal studies introduce uncertainties regarding animal-to-human extrapolation, while *in vitro* studies using human skin introduce uncertainties regarding *in vitro* to *in vivo* extrapolations. Lastly, dermal absorption rates may vary due to the speciation of the metal in soil. Overall, considering these uncertainties, the dermal absorption values used in this risk assessment are likely to overestimate exposure and risk.

For example, for arsenic, we used the US EPA-recommended dermal absorption fraction of 3%, which is based on a study which tested dermal absorption of soluble arsenic freshly mixed with soil. This value is likely to overestimate absorption of arsenic from aged, environmental soil samples (as is the case at the site). More recent studies using more relevant testing conditions have demonstrated lower absorption rates. Using a cadaver skin *in vitro* model, dermal absorption of arsenic from soil was estimated to be <1%; using an *in vivo* monkey model, dermal absorption of arsenic from aged soil was shown to range from 0.01-0.24% (Lowney *et al.*, 2005). Dermal application of arsenic in aged soil caused no detectable increase in urinary arsenic excretion, indicating that percutaneous absorption of arsenic from aged environmental soil samples is negligible (Lowney *et al.*, 2005). Therefore, the arsenic dermal absorption rate used in this risk assessment is likely to overestimate dermal exposure and risk.

Exposure Frequency

A default residential exposure frequency of 350 days/year was used in the risk assessment. However, for dermal exposures, this assumption is likely to overestimate exposures and risks. It is unlikely that an individual would have direct contact with soil every day. For example, residents may have little to no direct contact with soil on days with inclement weather.

Exposure Duration

We assumed an upper bound residential exposure duration of 30 years. Some residents may live in the area for longer than 30 years. If we had used a longer exposure duration, cancer risks would have increased proportionately. For example, if an exposure duration of 60 years was used, cancer risks would be higher by a factor of 2.

5.5.3 Uncertainties in Food Pathways

In this risk assessment, we assessed ingestion of locally produced beef, chicken, eggs, and vegetables. Together, these food exposure pathways contribute 34 to 76% of the total noncancer risk (child residents, RME), and 94 to 97% of the total residential cancer risk (RME), with the greatest contribution from ingestion of locally-grown vegetables. However, it is important to recognize that there is even greater uncertainty associated with these food exposure pathways than with some of the other exposure pathways (*e.g.*, soil ingestion), because estimating these exposures involves a greater number of steps and input assumptions, each of which is uncertain. When conservative assumptions are made for each input parameter, the conservatisms become compounded, making the resulting exposures and risks even more likely to be overestimated.

Exposure Point Concentrations (EPCs)

Because direct measurements of metal uptake by produce and forage crops were not conducted for the site, EPCs for locally-grown vegetables were estimated by modeling uptake from soil into plants (using an empirical model developed by Bechtel/Jacobs). Uptake of metals from soil into plants (vegetables) can vary significantly, depending on the soil type, the form of the metal, the magnitude of the soil concentration, pH, clay content, organic matter, and other soil properties. Published soil-to-plant uptake factors can vary by several orders of magnitude (for example, Baes and Sharp, 1984; Bechtel/Jacobs, 1998; IAEA, 1994; NCRP, 1996; Wang *et al.*, 1993). In addition, uptake models are often based on the availability of metals in soil recently spiked with such metals. However, the availability of metals in soil is considerably reduced by aging, due to the formation of strong bonds to soil particles (*e.g.*, clay) and/or incorporation into resistant secondary minerals of low bioavailability (*e.g.*, iron oxides) (Samse-Petersen *et al.*, 2002; Mahony *et al.*, 1996; Ankley *et al.*, 1996). The presence of iron in soil often forms insoluble iron complexes with other metals, including arsenic, to further

restrict their bioavailability. Although the soil-to-plant uptake model used to calculate vegetable EPCs was based on comprehensive literature reviews and careful analyses, soil-to-plant uptake remains a significant source of uncertainty. The EPCs for vegetables may under- or over-estimate actual concentrations in vegetables grown locally.

EPCs for the other food pathways were also modeled, based on a number of different input parameters. For example, exposure point concentrations in chicken and eggs were estimated based on chemical concentrations in soil, the feed ingestion rate for chickens, an estimate of the fraction of soil in chicken feed, and contaminant-specific soil-chicken or soil-egg transfer factors. In particular, there is a paucity of information regarding the amount of grit or soil consumed by chickens while pecking at grain/feed found on soil. Exposure point concentrations in beef were estimated using an even greater number of input assumptions, including contaminant-specific soil-cattle and water-cattle transfer factors, grass-soil concentration ratios, ingestion rates of grass, soil, and water for cattle, and chemical concentrations in soil and surface water. Each of these values is uncertain, and when conservative assumptions are made for each input, the conservatisms become compounded and the resulting exposures and risks are likely to be overestimated.

Food Pathway Ingestion Rates

The exposure estimates for each of the food pathways are based on the modeled exposure point concentrations (a considerable source of uncertainty), together with assumptions about ingestion rates for locally-grown vegetables and locally-raised chicken, eggs, and beef (also a considerable source of uncertainty), further compounding the conservatisms and increasing the likelihood that exposures and risks for these pathways have been overestimated.

The ingestion rates for locally-grown vegetables and locally-raised chicken, eggs, and beef used in the risk assessment were US EPA-recommended values for the western US (the 75th percentiles), based on a USDA nationwide food consumption survey. Although the USDA survey on which the consumption rates are based is the largest publicly available source of information on food consumption habits in the US, there are considerable uncertainties associated with these values. First, the survey was conducted in 1987-1988, and may not accurately reflect current or future food consumption patterns. Also, the USDA survey had a fairly low response rate (38% for the household surveys and 31% for the individual surveys) (US EPA, 1997). Another source of uncertainty is that the USDA survey was based

on short-term dietary recall (a one-week survey period). Short term dietary data may not accurately reflect long-term intake patterns, particularly with respect to the extremes (*e.g.*, the 95th percentile) of the distributions. The assumptions used in the analytical methods developed by the US EPA to adjust the homegrown vegetable consumption rates to reflect seasonal variability are uncertain, and as a result, US EPA assigns these values a "low" confidence rating (US EPA, 1997).

Additional assumptions and adjustments made to the consumption rates add further uncertainties. The original data was based on estimates of the amount of food brought into each household. Although the US EPA provided estimates of the percentage of each type of food lost during preparation and cooking (*e.g.*, trimming, dripping and volatile losses during cooking), these adjustments are variable and uncertain. Furthermore, use of these adjustments does not account for losses from food that spoils and is thrown away, or food fed to pets, which could lead to an overestimate of the resulting ingestion rates. Also, the US EPA calculation methods assumed that all family members consumed an equal portion of the homegrown food brought into the household; as a result, this method may not have captured high- or low-end consumers within households.

Another uncertainty is that these consumption estimates are based on data for "consumers" (*i.e.*, the subset of the population who grow and eat these types of homegrown or home-raised foods); the estimates are not overall averages for the general population. The consumers-only distribution corresponds to the upper tail of the distribution for the overall population. Even among "consumers," using the 75th percentile consumption rates (as was done for the risk assessment) would overestimate intake for 75% of consumers, but underestimate intake for the 25% of consumers with the greatest intake of homegrown foods. More importantly though, it is likely that many people would not eat any homegrown or home-raised foods at all. This is supported by the fact that none of the current residents have vegetable gardens or regularly consume home-raised chickens, eggs, or beef, and it is uncertain whether any future residents would do so either. *(**NMED should check this assumption.)* Although the cattle that currently graze on-site are beef cows, they are sent to auction about 60 miles away, and the final destination of the beef is uncertain. The beef from these cows is not likely to be consumed locally, nor are these cows likely to be the primary source of beef for any individuals. Furthermore, even if a future resident were to regularly consume one of these types of locally raised foods, it is unlikely that he or she would consume all four types of locally raised foods (vegetables, chicken, eggs, and beef), as was assumed in the risk assessment.

Regarding gardening, while an estimated 37% of households in the west have gardens based on a National Gardening Association survey (US EPA, 1997), only 30 of the 552 residences in Hurley, or 5.4%, had active vegetable gardens when surveyed as part of the Hurley RI (Golder, 1998). This suggests that gardening may not be as popular in the Hurley area as in other parts of the country. Even among gardeners, it is possible that they consume fewer homegrown vegetables as a fraction of their total vegetable intake compared to the USDA survey results. Given the limited types of vegetables typically grown in the area, it is likely that even if future residents did grow their own vegetables, they would also purchase other types of vegetables to supplement their diets. As a result, the USDA survey results for the western region of the country may overestimate homegrown vegetable consumption rates for Hurley.

5.5.5 Uncertainties in Toxicity Assessment

In general, US EPA uses conservative approaches to develop toxicity criteria. US EPA uses uncertainty factors of up to 10,000 in deriving reference doses. Cancer slope factors are typically derived using conservative dose-response models. These approaches are likely to overestimate cancer and noncancer risks.

Dermal Risks

The approach used to evaluate dermal risks addresses systemic cancer and noncancer effects, assuming that once a chemical is absorbed into the blood stream, the health effects are similar regardless of whether the route of exposure is oral or dermal. However, there are uncertainties associated with this approach, due to the fact that dermally-absorbed chemicals may have different patterns of distribution, metabolism, and excretion than orally-absorbed chemicals (US EPA, 2004a). Use of oral toxicity values to evaluate dermal exposures may over- or under-estimate risks, depending on the chemical. Furthermore, this approach does not address potential dermal toxicity associated with direct contact (portal-of-entry effects), such as allergic contact dermatitis, chemical irritation, and skin cancer. Although chemical-specific toxicity factors specific to the dermal exposure route, considering both systemic effects as well as portal-of-entry effects, would be ideal, such values are not currently available (US EPA, 2004a).

Oral Absorption Rates

As discussed in Sections 4.1.5 and 4.1.6, dermal toxicity values are developed by adjusting oral toxicity factors using oral absorption rates. Therefore, uncertainty in the oral absorption rates introduces uncertainty into dermal risk calculations. If actual oral absorption rates are lower than we have assumed, calculated risks could have been underestimated.

Copper

The calculated noncancer risks for copper are somewhat uncertain. Because the most sensitive health endpoint for copper is acute, reversible gastrointestinal disturbances, we have evaluated copper toxicity in terms of occurrence of nausea, based on the copper concentration in the stomach. The copper concentration in the stomach depends on numerous parameters, including the amount of copper-containing soil ingested, the solubility or bioaccessibility of copper in the stomach contents, and the volume of food and liquid in the stomach. There are uncertainties and/or inter-individual variability associated with each of these parameters. Lastly, although the copper LOAEL toxicity criteria are already believed to represent more sensitive segments of the population (*i.e.*, children), it is possible that risks for more sensitive subpopulations are underestimated. It should be noted that the copper risk calculations are based on a Monte Carlo distribution that was developed for the RAC calculations using child input parameters. Therefore, the copper risks for all adult receptors are overestimates, because adults have lower soil ingestion rates, and higher stomach volumes, than children.

Although chronic exposure to higher doses of copper can result in liver damage (IOM, 2001), our approach of evaluating risks based on the acute, gastrointestinal effects of copper (which occur at lower doses) is conservative, and the daily doses calculated for the site would not be expected to result in any liver effects. This is supported by the fact that the daily doses calculated for the site (0.9 mg/day for children and 0.5 mg/day for adults) are similar to the recommended daily allowances (RDa) for copper (0.7 mg/day for children and adults), and considerably less than the Tolerable Upper Intake Level (UL) for copper developed by the Food and Nutrition Board of the Institute of Medicine (5 mg/day for children and 10 mg/day for adults) (Table 5-11; IOM, 2001).

Iron

Although iron contributed to the noncancer risks calculated for the site, the presence of iron in the environment is generally not associated with toxicity. There are very few studies linking exposure to iron with toxic effects. This is possibly because the chemical characteristics of iron restrict its availability and hence toxicity to living organisms, despite the vast amounts of iron present in the earth (Huebers, 1991). Also, iron is an essential microelement, a necessary component of numerous proteins and enzymes in the human body (IOM, 2001). As with copper, the daily doses calculated for the site (11 mg/day for children and 5.5 mg/day for adults) are similar to the recommended daily allowances (RDa) for iron (8 mg/day for children and male adults and 18 mg/day for female adults), and considerably less than the Tolerable Upper Intake Level (UL) for iron developed by the Food and Nutrition Board of the Institute of Medicine for the prevention of gastrointestinal distress (40 mg/day for children and 45 mg/day for adults) (Table 5-11; IOM, 2001). In fact, based on US EPA risk assessment guidance, iron does not necessarily need to be evaluated in quantitative risk assessments:

> "Chemicals that are (1) essential human nutrients, (2) present at low concentrations (*i.e.*, only slightly elevated above naturally occurring levels), and (3) toxic only at very high doses (*i.e.*, much higher than those that could be associated with contact at the site) need not be considered further in the quantitative risk assessment. Examples of such chemicals are **iron**, magnesium, calcium, potassium, and sodium" (US EPA, 1989, pg. 5-23).

Based on these considerations, the calculated noncancer risks for iron are likely to be overestimated.

Arsenic

Arsenic was the primary contributor to cancer risks at the site, but the calculated cancer risks for arsenic are likely to be overestimated. Long term human exposure to high levels of arsenic has been shown to cause certain types of cancer and noncancer health effects, but these effects have been observed only in populations outside of the US with relatively high concentrations of arsenic in drinking water, often in populations suffering from nutritional deficiencies that may increase susceptibility (Guha Mazumder *et al.*, 1998; Hsueh *et al.*, 1997; Mitra *et al.*, 2004). The current US EPA cancer slope factor for arsenic is based on skin cancer in a Taiwanese population exposed to high levels of arsenic in drinking water, assuming a linear dose-response relationship. However, the oral cancer potency of inorganic arsenic as well as the assumption of linearity has been a source of substantial scientific debate,

giving rise to several different evaluations of arsenic's carcinogenic potency. Recent analyses by US government agencies have suggested CSFs for arsenic ranging from 0.4 to 23 $(mg/kg\text{-}d)^{-1}$, an almost 60-fold range (NRC, 2001; US EPA, 2001b; US EPA, 2005b). (Note, however, that the US EPA has not yet published an updated arsenic CSF value on IRIS.) Nonetheless, although the various evaluations of the arsenic CSF use different assumptions to arrive at different quantitative estimates of arsenic's potency, all of the analyses contain certain conservative elements and are thus likely to overestimate arsenic cancer risk for US and other Western populations with generally low to modest levels of arsenic exposure. Particularly important is that convincing human and mechanistic data support a non-linear dose-response relationship for arsenic (*e.g.*, Lamm *et al.*, 2003; 2006; Schoen *et al.*, 2004; Rossman, 2003). Overall, the arsenic cancer slope factor is likely to overestimate cancer risk at low levels of exposure.

It is useful to also compare site-related arsenic intake with daily arsenic intake in food, to provide additional perspective. Because arsenic is a naturally occurring element, low levels of inorganic arsenic are present in many types of foods. The diet represents the major source of exposure to inorganic arsenic in the general population (ATSDR, 2005; Schoof *et al.*, 1999). Dietary intake of inorganic arsenic averages about 3 µg/day for children and adults (Schoof *et al.*, 1999; Yost *et al.*, 2004). Therefore, naturally occurring arsenic present in the diet may have a greater influence on total arsenic dose than any site-related arsenic exposures. The daily arsenic doses from soil ingestion calculated for EA 3 (0.001 mg/day for children and adults) are much lower than the ranges of typical dietary intake.

Chemicals Lacking Toxicity Criteria

Chemicals for which published toxicity criteria have not been developed are not quantitatively evaluated in the risk assessment, which could potentially result in an underestimate of total risks. Specifically, calcium, magnesium, potassium, and sodium were not included as COCs, because no toxicity factors or screening values were available for these elements. However, as noted above for iron, US EPA guidance indicates that because these metals are essential human nutrients, and toxic only at very high doses (*i.e.*, much higher than those that could be associated with contact at the site), they do not necessarily need to be evaluated in quantitative risk assessments (US EPA, 1989). Thus, even though these metals were not quantitatively evaluated in the risk assessment, they would not be expected to contribute to estimates of total risk.

Interactions Between Metals

There is uncertainty regarding possible interactions between metals. In general, chemical interactions may be either additive (the toxic effects produced by exposure to multiple chemicals in combination equal the sum of their individual effects, *e.g.*, 2 + 3 = 5), synergistic (the toxic effects produced by exposure to multiple chemicals equal more than the sum of their individual effects, because interactions enhance the toxicity of each chemical, *e.g.*, 2 + 3 = 15), or antagonistic (the toxic effects produced by exposure to multiple chemicals equal less than the sum of their individual effects, because interactions diminish the toxicity of each chemical, *e.g.*, 2 + 3 = 1). Types of chemical interactions that can affect the toxicity of a mixture include alterations in absorption, metabolism, disposition, or excretion of one chemical by another; and interactions at the site of toxicity (*e.g.*, competitive inhibition of an enzyme).

At low doses or exposure concentrations, US EPA considers the likelihood of significant interactions between chemicals to be low (US EPA, 2000). Nonetheless, in the absence of specific information regarding the type of interaction, US EPA recommends assuming that chemicals interact in an additive manner. Consistent with this US EPA guidance, the toxic effects of each COC were assumed to be additive in this risk assessment. However, mixture studies suggest that combined exposure to a mixture of chemicals, each present at their individual no-effect level, does not result in a clearly increased risk of adverse health effects (Jonker *et al.*, 1990; Simmons *et al.*, 1994; Borgert *et al.*, 2004). In other words, at relatively low exposure levels, assuming additivity may overestimate actual toxicity. For example, based on studies of animals exposed to mixtures of chemicals with different target organs, and also studies involving exposure to mixtures of nephrotoxic chemicals with different modes of action, Feron and Jonker and their coworkers concluded that exposure to such mixtures at doses around or below the NOAEL did not constitute an increased hazard (Feron *et al.*, 1995; Jonker *et al.*, 1996). Feron *et al.* stated that "since in practice the levels of (combinations of) chemicals to which humans are exposed, generally are much lower than the experimentally obtained NOAELs, the chance of increased health hazard due to additive action or potentiating interaction seems to be very small" (Feron *et al.*, 1995).

With regard to metals specifically, the types of interactions can vary widely depending on the particular metals in question, the dose levels, the species of animal or type of cell line being tested, among other things. For example, in a subchronic oral toxicity test in rats fed various combinations of eight different minerals, iron was found to offer protection against cadmium accumulation and toxicity

(an antagonistic interaction) (Groten *et al.*, 1991). In an *in vitro* assay of gene expression, there was no evidence of synergistic activity following treatment of a human hepatoma cell line with a mixture of cadmium, chromium (III), and lead (Mumtaz *et al.*, 2002). Bae *et al.* (2001) tested the cytotoxicity of arsenic, cadmium, chromium, and lead in four different human keratinocyte cell lines. The nature of the metal interactions varied as a function of both the cell line and the dose levels. At the lowest mixture concentrations, growth was stimulated (a hormetic effect), and as the mixture concentrations increased, the cytotoxic effects became additive, and then synergistic. At the highest concentrations tested, the interactions became antagonistic, which the authors suggested may be a result of enhanced cellular defense mechanisms (Bae *et al.*, 2001). Overall, metal interactions can be complex and difficult to predict.

5.5.6 Uncertainties in Risk Characterization

Each of the uncertainties associated with the first three steps of a risk assessment (Data Collection and Evaluation, Exposure Assessment, and Toxicity Assessment) become incorporated into the risk estimates in the Risk Characterization step. Nevertheless, although there are numerous uncertainties associated with this risk assessment, the incorporation of a large number of conservative assumptions has yielded risk estimates likely to overestimate actual site risks.

The approach of summing hazard quotients to generate a total hazard index is likely to overestimate actual noncancer risks. Summing hazard quotients for different chemicals is conservative because it assumes that all chemicals affect the same target organs *via* the same mechanisms, and that the resulting toxic effects are additive. In fact, it is known that the metals present at the site do not all affect the same organ systems.

5.5.7 Monte Carlo Assessment for Surface Soil Ingestion

To quantitatively characterize uncertainty and variability in population exposure and risk associated with the soil ingestion pathway, we performed a Monte Carlo simulation for ingestion of arsenic (the greatest contributor to cancer risks) and iron (the highest contributor to noncancer risk) in outdoor soil in Exposure Area 3 (the area with highest soil EPCs). Monte Carlo simulations estimate the range and relative likelihood of exposure and risk by replacing input parameter point estimate values with probability distributions. The simulation randomly selects a value from each parameter's

distribution and calculates the corresponding exposure and risk, repeating this process many times. The collection of computed risks approximates the exposure or risk distribution for the population of interest. The Monte Carlo simulations were implemented using Crystal Ball ® (using 10,000 iterations). The simulation replaced point estimates for the following four parameters with distributions: soil ingestion rate, exposure frequency, exposure duration[6], and body weight. For all other parameters, we used the point estimate values detailed in Section 3. The detailed output of the Monte Carlo simulation is provided in Appendix G.

The risk estimate distributions produced by the Monte Carlo simulation (distributions of hazard quotient values in the case of iron and distributions of lifetime cancer risk in the case of arsenic) can be compared to the point estimates produced by the deterministic calculations. Specifically, we compare the deterministic results (central tendency and high end) to the 50th percentile and 95th percentile risk estimates produced by the Monte Carlo simulation. These benchmarks characterize the extent to which risk estimates are influenced by the assumed value for each of the parameters treated as random quantities in the simulation. Tables 5-13 and 5-14 detail these comparisons.

Table 5-13
Comparison of Deterministic and Probabilistic Risk Assessment Results
Excess Lifetime Cancer Risks Posed by Arsenic, Exposure Area 3
for Child and Adult Resident Combined

Deterministic Risk Assessment		Probabilistic Risk Assessment		
Scenario	**Cancer Risk**	**Percentile**	**Cancer Risk**	**Ratio: Deterministic/ Probabilistic**
Central Tendency (CT)	2.90E-06	50th Percentile	1.20E-06	2.4
Reasonable Maximum Exposure (RME)	7.30E-06	95th Percentile	3.20E-06	2.3

[6] Exposure duration was not changed for noncancer risks, because it cancels with the averaging time.

Table 5-14
Comparison of Deterministic and Probabilistic Risk Assessment Results
Noncancer Risks Posed by Iron, Exposure Area 3
for Child Resident

Deterministic Risk Assessment		Probabilistic Risk Assessment		
Scenario	**Hazard Quotient**	**Percentile**	**Hazard Quotient**	**Ratio: Deterministic/ Probabilistic**
Central Tendency (CT)	1.2	50th Percentile	0.5	2.4
Reasonable Maximum Exposure (RME)	2.4	95th Percentile	1.3	1.8

The comparison of the deterministic and probabilistic (Monte Carlo) estimates for arsenic cancer risk shows that the central tendency (CT) and reasonable maximum exposure (RME) deterministic estimates are quite close to the 50th and 95th percentile Monte Carlo estimates. The central tendency and high end deterministic estimates are each approximately a factor of 2 to 3 greater than the 50th and 95th percentile Monte Carlo estimates, respectively. This represents good agreement between the deterministic and Monte Carlo risk estimates, suggesting that the deterministic estimates are adequately reflecting the risks expected in the population.

A comparison of the deterministic and Monte Carlo estimates for iron noncancer risk show a similar level of agreement to that observed for the cancer risks, with the deterministic risk estimates once again a factor of 2 to 3 greater than the comparable Monte Carlo risk estimates. Again, this represents good agreement between the deterministic and Monte Carlo risk estimates, and indicates that the deterministic estimates are adequately reflecting the risks expected in the population.

In summary, the results of the deterministic and Monte Carlo risk calculations are quite similar, and give confidence that the deterministic estimates are providing a conservative representation of the risks incurred by the population, given what is known about the various exposure parameters involved in the calculation.

6 Risk-Based Concentrations for Soil

6.1 Calculation of RBCs

This section presents the calculation of site-specific risk-based concentrations (RBCs) for soil. RBCs are concentrations of a metal in soil that are calculated to correspond to a given target risk level, for a specified exposure scenario. For this assessment, RBCs were calculated based on exposures to soil *via* incidental ingestion and dermal contact. RBCs based on food pathways (*i.e.*, ingestion of locally-grown produce and ingestion of locally-raised chicken, eggs, and beef) were not calculated due to the substantial uncertainty associated with these exposure pathways. RBCs based on inhalation were not calculated because the modeled air concentrations are very low and have a minor contribution to overall risk. For perspective, RBCs were calculated for several different target risk levels: a target cancer risk level of either 1×10^{-4}, 1×10^{-5}, or 1×10^{-6}; a target noncancer Hazard Quotient (HQ) of either 1, 2, or 5.

The equations and exposure assumptions used to calculate the RBCs are presented below. The RBCs were calculated using the same exposure assumptions and toxicity values that were used in the risk calculations. In the RBC calculations, we combined the exposure and risk equations, and rearranged them to solve for a soil concentration based on a specified exposure scenario and target risk level (as opposed to calculating risk levels based on a specified exposure scenario and soil concentration).

Specifically, for noncancer health endpoints, RBCs were calculated for a RME child resident, as:

$$RBC_{nc}\left(\frac{mg}{kg}\right) = \frac{THQ}{\dfrac{AF \times SA \times DA \times EF \times ED \times 10^{-6}\,kg/mg}{AT_{nc} \times BW \times RfD \times ABS_{oral}} + \dfrac{IR \times B \times EF \times ED \times 10^{-6}\,kg/mg}{AT_{nc} \times BW \times RfD}}$$

where:

RBC_{nc}	=	Risk-based soil concentration, based on noncancer health endpoints (mg/kg)
THQ	=	Target Hazard Quotient (unitless)
AF	=	Soil skin adherence factor (mg/cm^2)
SA	=	Skin surface area exposed to soil (cm^2/day)
DA	=	Dermal absorption fraction of chemical in soil (unitless)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
AT	=	Averaging time, noncancer (days)
BW	=	Body weight (kg)

RfD = Reference Dose (mg/kg-day)
ABS_{oral} = Oral absorption fraction (unitless)
IR = Soil ingestion rate (mg/day)
B = Oral bioavailability of chemical in soil (unitless)

For cancer, RBCs were calculated considering both an RME child and adult resident, as:

$$RBC_{canc}\left(\frac{mg}{kg}\right)=\frac{TCR}{\left(\left(\frac{CSF}{ABS_{oral}}\right)\times\left(\frac{AF\times SA\times DA\times EF\times ED\times 10^{-6}kg/mg}{AT_{canc}\times BW}\right)\right)+\left(\frac{CSF\times IR\times B\times EF\times ED\times 10^{-6}kg/mg}{AT_{canc}\times BW}\right)}$$

where:

RBC_{canc} = Risk-based soil concentration, based on cancer health endpoints (mg/kg)
TCR = Target cancer risk (unitless)
AF = Soil skin adherence factor (mg/cm^2)
SA = Skin surface area exposed to soil (cm^2/day)
DA = Dermal absorption fraction of chemical in soil (unitless)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
AT = Averaging time, cancer (days)
BW = Body weight (kg)
CSF = Cancer slope factor $(mg/kg\text{-}day)^{-1}$
ABS_{oral} = Oral absorption fraction (unitless)
IR = Soil ingestion rate (mg/day)
B = Oral bioavailability of chemical in soil (unitless)

The resulting RBCs, based on RME exposures to soil *via* incidental ingestion and dermal contact, are summarized in Table 6-1 below. The soil RBCs for arsenic based on cancer risk range from 0.7 to 72 mg/kg. The soil RBCs for arsenic based on noncancer risk range from 40 to 201 mg/kg. Arsenic was the only carcinogenic analyte evaluated in the risk assessment. The RBCs for the other analytes were developed based on noncancer risk only. For comparison, the Region 9 PRGs for residential soil, which are based on a target cancer risk of 1×10^{-6} and a target noncancer hazard quotient of 1, are also presented. Note that while our RBC calculations considered soil ingestion and dermal contact, the Region 9 PRGs considered soil ingestion, dermal contact, and inhalation pathways. Another difference is that we used the US EPA RfD for cadmium in food in this assessment. In contrast, Region 9 choose to use the (more conservative) US EPA RfD for cadmium in water in deriving the PRG screening values, although they did comment that "reasonable arguments could be made for applying an RfD for food (instead of the oral RfD for water) for some media such as soils" (US EPA Region 9, 2004).

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Lastly, US EPA Region 9 assumed that ingested arsenic in soil is 100% bioavailable, while we used an arsenic bioavailability of 50% based on literature values.

For copper, we used an RfD of 0.04 mg/kg-day, the value used by US EPA Region 9 in deriving its PRG for copper. It is interesting to note that the resulting copper RBC is 3,129 mg/kg, which is quite similar to the health-based value of 3,100 mg/kg that we developed for the Hurley Soils IU based on our probabilistic model of copper concentrations in the stomach.

Table 6-1
Risk Based Concentrations (RBCs) for Soil
Based on Ingestion and Dermal Contact

	Basis	Cancer Risk			
	Target Risk Level	$1x10^{-6}$	$1x10^{-5}$	$1x10^{-4}$	
Receptor	COPC	RBC (mg/kg)	RBC (mg/kg)	RBC (mg/kg)	Region 9 PRG
Resident (adult & child)	Arsenic	0.7	7	72	0.4

	Basis	Noncancer Risk			
	Target Risk Level	HQ = 1	HQ = 2	HQ = 5	
Receptor	COPC	RBC (mg/kg)	RBC (mg/kg)	RBC (mg/kg)	Region 9 PRG
Resident (child)	Arsenic	40	80	201	0.4
Resident (child)	Cadmium	70	141	352	37
Resident (child)	Copper	3,129	6,257	15,643	2905*
Resident (child)	Iron	23,464	46,929	117,321	23,463
Resident (child)	Thallium	5	10	26	5
Resident (child)	Vanadium	78	156	391	78

Notes:
** The PRG for copper is the Medium Specific Screening Level from US EPA Region 6.*
Arsenic RBC calculation assumes a bioavailability of 50%.

6.2 The Use of Cancer Risk Targets in Risk Management Decisions

This section discusses the issue of significant risk in the regulation of chemical exposures. It is included to provide some perspective on the estimated cancer risks in the S/TSIU, which arise primarily from exposure to arsenic in soil. The definition of an acceptable cancer risk in the federal government is not a single precise value, but rather a range of values that allows the selection of an acceptable risk within this range based on a number of considerations. The US EPA has established an "acceptable cancer risk range" of 1×10^{-6} to 1×10^{-4} and exposures to chemicals are regulated so that estimated risks are within this acceptable range.

The 1990 National Contingency Plan (NCP), a US EPA environmental guidance document, contains language indicating that remediation of hazardous waste sites should be managed so that concentrations of chemicals remaining in soil are associated with cancer risks within a range of 1×10^{-6} to 1×10^{-4} (US EPA, 1990). The NCP states that risks within this range are "generally acceptable" and that risks greater than 1×10^{-4} may be permitted depending on site-specific considerations. This risk range soon became policy for the Agency, as evidenced in an April 1991 memo from the Assistant Administrator to the Directors of the Waste Management, Emergency and Remedial Response, and Hazardous Waste Divisions in several regional offices (US EPA, 1991b). The memo states that cumulative cancer risks up to 1×10^{-4} can be used to develop remedial alternatives for Superfund sites and in risk management decisions, that remediation would not typically be required at a site if risks associated with reasonable maximum exposure (RME) parameters were 1×10^{-4} or less, and that in certain cases the Agency "may consider risk estimates slightly greater than 1×10^{-4} to be protective" (US EPA, 1991b).

7 Conclusions

A Human Health Risk Assessment (HHRa) was performed for the Smelter Tailings Soils Investigation Unit (S/TSIU). Risk was evaluated in five exposure areas in the S/TSIU, plus the Smelter Area. The risk assessment evaluated exposures to soil, windblown dust in air, sediment, surface water, and locally-produced food items, including beef, chicken, eggs, and vegetables. The HHRA evaluated risks for several types of human receptors, including residents (children and adults), adolescent recreators, adolescent trespassers, ranchers, construction workers, and industrial workers. Risks were evaluated for six COPCs, including arsenic, cadmium, iron, thallium, vanadium, and copper (copper was evaluated separately). Exposure pathways evaluated included inhalation of particulates in air; ingestion of and dermal contact with soil; ingestion of locally-grown foods (beef, chicken, eggs, and vegetables); ingestion of and dermal contact with sediment; and ingestion of and dermal contact with surface water. For each receptor, we evaluated exposure pathways relevant for that individual, but not all exposure pathways were evaluated for each receptor. We evaluated both RME and CT risks. Values used for exposure parameters were conservative so as to overestimate risks.

Cancer risks were evaluated for arsenic and cadmium. Total excess lifetime cancer risks (ELCR) ranged from $9x10^{-9}$ to $3x10^{-4}$. Nearly all (> 90%) of the total ELCR can be attributed to arsenic. Some of these risks exceed US EPA's target risk range of 1×10^{-6} to 1×10^{-4}. The RME ELCR for residents exceeds the target risk range in EAs 1 to 5, with the highest ELCR for a resident ($3x10^{-4}$) in EA 4. The CT ELCR for residents falls within the target risk range. For residential cancer risks, over 90% of the risk is due to consumption of locally-grown foods (beef, chicken, eggs, and vegetables). In all exposure areas, if we exclude the food pathways, the residential cancer risk falls within the target risk range of 1×10^{-6} to 1×10^{-4}. For adolescent recreators and trespassers, all RME and CT cancer risks are below the target risk range. For all ranchers, construction workers, and industrial workers, all RME ELCR fall within the target risk range; the CT risks for all worker receptors are below the target risk range.

Noncancer risks were evaluated for arsenic, cadmium, iron, thallium, and vanadium. Total Hazard Indices (HI) ranged from 0.003 to 25. Iron and vanadium were the two largest contributors to total noncancer risk, with smaller contributions from arsenic, thallium, and cadmium. For adult and child residents, total RME and CT HI ranged from 4 to 24; these values exceed the target HI of 1. Consumption of locally-grown foods accounted for nearly two-thirds of the noncancer risk for children, and over 90% of the noncancer risk for adults. However, RME and CT noncancer risks for residents still

exceeded an HI of 1 even excluding the food pathways. For adolescent recreators and trespassers, all RME and CT noncancer risks were below a total HI of 1. Ranchers in EA 1, EA 2, and EA 5 had RME noncancer risks at or below a total of HI of 1. Construction workers in EAs 1 and 2 had RME noncancer risks below a total HI of 1. Industrial workers in the smelter area had an RME noncancer risk of 1. The CT noncancer risks for ranchers, construction workers, and smelter workers were below 1 in all exposure areas.

The Reference Area represents a background area, unaffected by the smelter or tailings piles. Residential RME risks were calculated for the Reference Area, to provide an understanding of risks due to background. The ELCR for residents in the Reference Area was $2x10^{-4}$; consumption of locally-grown foods contributed 98% of this risk, and nearly all the cancer risk was contributed by arsenic. The RME ELCR for residents in EAs 1, 2, 3, and 5 were approximately the same as the ELCR for the Reference Area ($2x10^{-4}$); only the ELCR in EA 4 was higher than the ELCR in the Reference Area. Because the Reference Area is not affected by the smelter, most of the ELCR in the S/TSIU is likely due to naturally-occurring background levels of metals in soil. In the Reference Area, total RME HI were 26 and 20 for children and adults, respectively; and consumption of locally-grown foods contributed more than 75% of the noncancer risk. The total RME noncancer risks in the Reference Area were higher than the RME HI in all five S/TSIU exposure areas. This again indicates that most of the noncancer risk in the S/TSIU exposure areas is due to naturally occurring background levels of metals in soil.

Overall, our analysis indicated that site exposures could result in unacceptable cancer risks for residents of all five exposure areas. However, these cancer risks are largely driven by the consumption of locally grown foods, exposure pathways containing considerable uncertainties. Furthermore, comparison of these risks to those in the Reference Area indicated that risks are similar in areas outside of the S/TSIU that are not affected by the smelter. Only EA 4 had a higher total cancer risk than that in the Reference Area. No recreators or trespassers had unacceptable cancer risks, for either RME or CT scenarios. All ranchers, construction workers, and smelter workers had unacceptable RME cancer risks, but acceptable CT cancer risks.

This analysis also indicated that site exposures could result in unacceptable noncancer risks for residents in all five exposure areas. However, these cancer risks are largely driven by the consumption of locally grown foods, exposure pathways fraught with considerable uncertainties. Furthermore, all residential noncancer risks in the S/TSIU were lower than residential RME noncancer risks calculated for

the Reference Area. There were no site exposures that could result in unacceptable noncancer risks, either RME or CT, for recreators or trespassers. Industrial workers in the smelter area, and ranchers in EAs 1 and 2, had unacceptable RME noncancer risks. All construction workers and ranchers in EA 5 had acceptable RME noncancer risks. All ranchers, construction workers, and industrial workers had acceptable CT noncancer risks.

Copper risks were evaluated separately using a probabilistic method, only for ingestion of soil. The most sensitive endpoint for copper toxicity is nausea; therefore, copper risks were based on estimating the annual number of nausea episodes that an individual might experience, at a given soil concentration of copper. It is important to note that this method was developed using child-specific exposure factors, therefore, using it to assess copper risks for adult or adolescent receptors is extremely conservative. The industrial worker in the smelter area had the highest copper risk, with an estimated 65 nausea events per year. Copper risks for residents ranged from 1 to 12 nausea events per year (the highest risk was in EA 4). Copper risks for ranchers and construction workers ranged from 1 to 2 nausea events per year in all exposure areas. We compared estimated copper intake from soil to dietary reference intakes, and noted that estimated daily intakes for child and adult residents were below tolerable upper limits (UL) for copper, defined as a daily intake level that is likely to pose no risk of adverse health effects. In the Reference Area, copper risks for all receptors were less than 1 nausea event per year.

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Tables

Table 2-9
Summary Statistics (mg/kg) for Soil in EA 1 to 5, Including Smelter Area

Analyte [1]	N [2]	Percent Nondetects	Geometric Mean	Arithmetic Mean	Standard Deviation	Min	Max	Screen	Basis [3]	COC
Aluminum	192	0%	9,609	10,196	3,710	2,810	26,700	76,142	PRG	--
Antimony	148	81%	0.48	0.8	1	0.03	6	31	PRG	--
Arsenic	225	9%	2.2	3.1	3.1	0.02	**25.4**	**0.4**	PRG	Yes
Barium	225	0%	139	153	88	46	985	5,375	PRG	--
Beryllium	170	12%	0.55	0.6	0.3	0.1	2.1	154.4	PRG	--
Boron	192	88%	1.1	1.4	1.3	0.5	7.1	15,622	MSL	--
Cadmium	225	0%	0.9	2.1	4.5	0.04	**51.6**	**37**	PRG	Yes
Chromium	217	0%	11.9	13.6	9.1	3.5	92.2	117,294	PRG	--
Cobalt	179	0%	9.5	11.3	9.7	3.4	103.0	903	PRG	--
Copper	225	0%	878	2,019	3,422	29.6	**30,500**	**2,905**	MSL	Yes
Iron	192	0%	20,597	23,807	16,250	7,170	**141,000**	**23,463**	PRG	Yes
Lead	225	1%	28	40.1	41	4.3	314	400	PRG	--
Manganese	200	0%	321	359.6	188	95.3	1,290	1,762	PRG	--
Mercury	217	40%	0.037	0.1	0.2	0.01	2.8	23.5	PRG	--
Molybdenum	204	2%	10.3	19.8	27.9	0.3	201.0	391	PRG	--
Nickel	192	0%	10.1	12.4	8.7	0.8	58.5	1,564	PRG	--
Selenium	224	44%	0.6	1.1	1.4	0.02	8.3	391	PRG	--
Silver	203	65%	0.13	0.5	1.1	0.03	8.1	391	PRG	--
Thallium	192	68%	0.32	0.5	1.0	0.04	**10.3**	**5.2**	PRG	Yes
Vanadium	192	0%	25	29.1	22	4.2	**210**	**78**	PRG	Yes
Zinc	200	0%	65	101.9	157	14.3	1,490	23,463	PRG	--

1. Analytes that do not have screening values: calcium, magnesium, potassium, sodium, and sulfate.

2. Sample counts lower than 225, which is the total possible sample count, indicate either that results were rejected after data validation, or samples were not analyzed for that constituent.

3. The basis of the screening values is either the EPA Region 9 Preliminary Remediation Goal (PRG), or the Medium-Specific Screening Level (MSL) from EPA Region 6, as indicated.

4. Samples depths include all samples in the top 6", if they were considered useable for the HHRA. Not all samples were used in the HHRA, because subsets of the data (based on sample depth and sieve size) were used for different exposure scenarios.

Table 2-10
Summary Statistics (mg/kg) for Sediment in EA 4 and 5

Analyte [1]	N	Percent Nondetects	Geometric Mean	Arithmetic Mean	Standard Deviation	Min	Max	Screening Value
Aluminum	8	0%	6767.8	7890.0	5389.1	3980.0	19500.0	76142
Antimony	8	100%	0.4	0.4	0.0	0.3	0.4	31
Arsenic	8	0%	1.3	1.4	0.5	0.9	**2.1**	**0.39**
Barium	8	0%	94.7	110.6	62.0	40.4	212.0	5375
Beryllium	8	63%	0.3	0.4	0.4	0.1	1.4	154
Boron	8	100%	0.8	0.8	0.0	0.8	0.9	15622
Cadmium	8	0%	0.2	0.3	0.2	0.1	0.6	37
Chromium	8	0%	7.5	9.0	5.3	2.5	16.4	117294
Cobalt	8	0%	4.7	5.5	3.1	1.3	9.6	903
Copper	8	0%	101.8	143.9	137.3	42.5	423.0	2905
Iron	8	0%	10732.1	12396.3	7337.5	4820.0	27400.0	23463
Lead	8	0%	11.8	13.1	6.0	4.9	20.8	400
Manganese	8	0%	320.3	361.6	193.1	145.0	760.0	1762
Mercury	8	88%	0.0	0.0	0.0	0.0	0.1	23
Molybdenum	8	38%	1.2	1.6	1.2	0.4	3.4	391
Nickel	8	0%	9.4	11.2	6.8	3.2	24.8	1564
Selenium	8	63%	0.2	0.4	0.8	0.1	2.3	391
Silver	8	100%	0.0	0.0	0.0	0.0	0.0	391
Thallium	8	100%	0.3	0.3	0.1	0.2	0.4	5
Vanadium	8	0%	20.9	23.5	11.5	9.2	44.9	78
Zinc	8	0%	25.6	32.9	22.5	10.0	65.4	23463

1. Analytes that do not have screening values: calcium, magnesium, potassium, sodium, and sulfate.

2. The basis of the screening values is either a Preliminary Remediation Goal (PRG) from EPA Region 9 or a Medium-Specific Screening Level (MSL) from EPA Region 6, as indicated.

Table 2-11
Summary Statistics (mg/L) for Surface Water in Stock Ponds and James River Canyon Reservoir

Analyte [1]	N	NDs	Percent Nondetects	Arithmetic Mean	Standard Deviation	Geometric Mean	Min	Max	Screening Value	Basis [2]	Exceed
Aluminum	13	0	0%	11	10	5	0.101	31.1	36000	PRG	No
Antimony	13	13	100%	0.0020	0.0006	0.0019	0.00125	0.00275	15	PRG	No
Arsenic	13	11	85%	0.0036	0.0023	0.0032	0.00225	0.0097	0.045	PRG	No
Barium	13	0	0%	0.079	0.034	0.072	0.0326	0.154	2600	PRG	No
Beryllium	13	7	54%	0.00045	0.00051	0.00025	0.00005	0.0017	73	PRG	No
Boron	13	10	77%	0.011	0.006	0.009	0.00385	0.0223	7300	PRG	No
Cadmium	13	7	54%	0.00018	0.00017	0.00015	0.00005	0.0007	18	PRG	No
Chromium	13	3	23%	0.0055	0.0050	0.0027	0.00015	0.0157	55000	PRG	No
Cobalt	13	2	15%	0.0025	0.0013	0.0019	0.0001	0.0045	730	PRG	No
Copper	13	0	0%	0.29	0.28	0.20	0.0262	1.14	1400	MSL	No
Iron	13	0	0%	6.9	5.7	3.8	0.0815	17.7	11000	PRG	No
Lead	13	3	23%	0.008	0.005	0.005	0.0009	0.0166	15	MSL	No
Manganese	13	0	0%	0.244	0.206	0.180	0.035	0.699	880	PRG	No
Mercury	7	7	100%	0.00005	0.00000	0.00005	0.00005	0.00005	11	PRG	No
Molybdenum	13	1	8%	0.0091	0.0046	0.0076	0.0017	0.016	180	PRG	No
Nickel	13	3	23%	0.0075	0.0068	0.0047	0.00085	0.0244	730	PRG	No
Selenium	13	6	46%	0.0022	0.0013	0.0018	0.00059	0.0036	180	PRG	No
Silver	13	13	100%	0.00038	0.00026	0.00031	0.00015	0.0008	180	PRG	No
Thallium	13	6	46%	0.00032	0.00020	0.00023	0.00001	0.00064	2.4	PRG	No
Vanadium	13	1	8%	0.0091	0.0073	0.0057	0.00035	0.0235	36	PRG	No
Zinc	13	2	15%	0.025	0.019	0.016	0.00245	0.0552	11000	PRG	No

1. *Analytes that do not have screening values: calcium, magnesium, potassium, sodium, and sulfate.*
2. *The screening values are for tap water, and are either a Preliminary Remediation Goal (PRG) from EPA Region 9 or a Medium-Specific Screening Level (MSL) from EPA Region 6, as indicated.*

Table 2-12
Maximum Soil Concentrations by Exposure Area (mg/kg)

Exposure Area	EA 1	EA 2	EA 3	EA 4	EA 5	Smelter	Screening Value	COC
Analyte								
Aluminum	17100	15000	16800	26700	22000	7940	76142	--
Antimony	0.9	2	4.6	5.9	3.6	1.2	31	--
Arsenic	**4.1**	**4.2**	**15.1**	**13.3**	**4.19**	**25.4**	**0.4**	Yes
Barium	213	985	216	432	297	353	5375	--
Beryllium	1	1.2	0.82	2.1	1.3	0.72	154	--
Boron	1.3	3.5	5.8	7.1	6.6	2.25	15622	--
Cadmium	2.4	2.1	**51.6**	20.2	2.9	7.8	**37**	Yes
Chromium	23.1	33.5	22.4	44.1	92.2	14.5	117294	--
Cobalt	12.3	14.5	32.5	28.9	27.8	103	903	--
Copper	899	2570	**7880**	**12100**	1790	**30500**	**2905**	Yes
Iron	**30200**	**30800**	**141000**	**57500**	**55000**	**62400**	**23463**	Yes
Lead	162	61.6	314	217	203	116	400	--
Manganese	1290	593	508	1160	988	817	1762	--
Mercury	0.06	0.09	0.09	1.5	0.05	2.8	23	--
Molybdenum	23.1	22.6	87.4	201	15.5	161	391	--
Nickel	11.4	32	25.4	41.6	58.5	40	1564	--
Selenium	0.6	2.5	5.6	8	2.05	8.3	391	--
Silver	0.28	0.69	1.8	4.1	0.27	8.1	391	--
Thallium	2	**6.2**	**10.3**	1.2	0.66	0.93	5.2	Yes
Vanadium	**80.1**	73.8	52.2	**116**	**210**	23	**78**	Yes
Zinc	853	128	473	1490	1070	503	23463	--

Bold: Concentration exceeds screening value.

COC: Constituent of concern

Table 3-16a
Summary of Exposure Factors – RME Scenario – Child Resident

Child Resident – RME Scenario Exposure Pathway/Exposure Factor	Value	Comment
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/day)	200	RME Child soil ingestion rate, US EPA, 2002b (Table 5-19); US EPA Region 6, 2006.
Fraction Surface Soil from Contaminated Source	1	Assumes all of soil intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.2	RME value for child resident, US EPA, 2004a (Exhibit 3-5); US EPA Region 6, 2006.
Surface Area Exposed to Surface Soil (cm^2/event)	2,800	Average exposed surface area for children, US EPA, 2004a; US EPA Region 6, 2006.
Exposure Frequency (events/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	24	Assumes continuous exposure.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day* 365 days/year.
Averaging Time - Noncancer (hours)	52,560	6-year exposure duration * 24 hours/day * 365 days/year.
Ingestion of Vegetables		
Vegetable Ingestion Rate (g/kg-day)	1.2	75th percentile of seasonally adjusted consumer intake of homegrown vegetables for the Western US, with an 18% food preparation loss. US EPA, 1997, Table 13-33.
Fraction of Vegetables from Contaminated Source	1	Assumes all of home-produced vegetable intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).

Child Resident – RME Scenario Exposure Pathway/Exposure Factor	Value	Comment
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Ingestion of Chicken		
Chicken Ingestion Rate (g/kg-day)	1.3	75th percentile annual average home-produced poultry intake for Western US, with a 31% food preparation loss. US EPA, 1997, Table 13-55.
Fraction of Chicken from Contaminated Source	1	Assumes all of home-produced chicken intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Ingestion of Eggs		
Egg Ingestion Rate (g/kg-day)	1.05	75th percentile of home-produced egg intake for Western US US EPA, 1997, Table 13-43.
Fraction of Eggs from Contaminated Source	1	Assumes all of home-produced egg intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Ingestion of Beef		
Beef Ingestion Rate (g/kg-day)	2.2	75th percentile annual-average home-produced beef intake for Western US, with a 24% food preparation loss. US EPA, 1997, Table 13-36.
Fraction of Beef from Contaminated Source	1	Assumes all of home-produced beef intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.

Table 3-16b
Summary of Exposure Factors – RME Scenario – Adult Resident

Adult Resident – RME Scenario Exposure Pathway/Exposure Factor	Value	Comment
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/day)	100	Upper bound soil ingestion from Calabrese 1990 as cited in US EPA, 1997.
Fraction Surface Soil from Contaminated Source	1	Assumes all of soil intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	24	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	8,760	24-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.07	RME value for adult resident, US EPA, 2004a.
Surface Area Exposed to Surface Soil (cm^2/event)	5,700	Average exposed surface for adults, US EPA, 2004a.
Exposure Frequency (events/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	24	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/yr.
Averaging Time - Noncancer (days)	8,760	24-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	24	Assumes continuous exposure.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (year)	24	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day* 365 days/year.
Averaging Time - Noncancer (hours)	210,240	24-year exposure duration * 24 hours/day * 365 days/year.

Adult Resident – RME Scenario Exposure Pathway/Exposure Factor	Value	Comment
Ingestion of Vegetables		
Vegetable Ingestion Rate (g/kg-day)	1.2	75th percentile of seasonally adjusted consumer intake of homegrown vegetables for the Western US, with an 18% food preparation loss. US EPA, 1997, Table 13-33.
Fraction of Vegetables from Contaminated Source	1	Assumes all of home-produced vegetable intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	24	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	8,760	24-year exposure duration * 365 days/year.
Ingestion of Chicken		
Chicken Ingestion Rate (g/kg-day)	1.3	75th percentile annual average home-produced poultry intake for Western US, with a 31% food preparation loss. US EPA, 1997, Table 13-55.
Fraction of Chicken from Contaminated Source	1	Assumes all of home-produced chicken intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	24	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	8,760	24-year exposure duration * 365 days/year.
Ingestion of Eggs		
Egg Ingestion Rate (g/kg-day)	1.05	75th percentile of home-produced egg intake for Western US US EPA, 1997, Table 13-43.
Fraction of Eggs from Contaminated Source	1	Assumes all of home-produced eggs intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	24	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	8,760	24-year exposure duration * 365 days/year.
Ingestion of Beef		
Beef Ingestion Rate (g/kg-day)	2.2	75th percentile annual-average home-produced beef intake for Western US, with a 24% food preparation loss. US EPA, 1997, Table 13-36.
Fraction of Beef from Contaminated Source	1	Assumes all of home-produced beef intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	24	90th percentile for time at one residence; 24 years as adult, 6 years as child.

Adult Resident – RME Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	8,760	24-year exposure duration * 365 days/year.

Table 3-16c
Summary of Exposure Factors – RME Scenario – Adult Construction Worker

Adult Construction Worker – RME Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/day)	100	Screening level default for outdoor workers, US EPA Region 6, 2006.
Fraction Surface Soil from Contaminated Source	1	Assumes all of soil intake from site.
Exposure Frequency (days/year)	225	Screening level default for outdoor workers, US EPA Region 6, 2006.
Exposure Duration (years)	25	Screening level default for outdoor workers, US EPA Region 6, 2006.
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	9,125	25-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.2	RME default value for outdoor workers, US EPA Region 6, 2006.
Surface Area Exposed to Surface Soil (cm^2/event)	3,300	Default value for outdoor workers, US EPA Region 6, 2006.
Exposure Frequency (events/year)	225	Screening level default for outdoor workers, US EPA Region 6, 2006.
Exposure Duration (years)	25	Screening level default for outdoor workers, US EPA Region 6, 2006.
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	9,125	25-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	10	Assumes continuous exposure during 10-hour work day.
Exposure Frequency (days/year)	225	Screening level default for outdoor workers, US EPA Region 6, 2006.
Exposure Duration (years)	25	Screening level default for outdoor workers, US EPA Region 6, 2006.
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day* 365 days/year.
Averaging Time - Noncancer (hours)	219,000	25-year exposure duration * 24 hours/day * 365 days/year.

Table 3-16d
Summary of Exposure Factors – RME Scenario – Adult Industrial Worker

Adult Industrial Worker – RME Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/day)	100	Screening level default for outdoor workers, US EPA Region 6, 2006.
Fraction Surface Soil from Contaminated Source	0.5	Assumes half of daily soil intake is from the site.
Exposure Frequency (days/year)	225	Screening level default for outdoor workers, US EPA Region 6, 2006.
Exposure Duration (years)	25	Screening level default for outdoor workers, US EPA Region 6, 2006.
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	9,125	25-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.2	RME default value for outdoor workers, US EPA Region 6, 2006.
Surface Area Exposed to Surface Soil (cm^2/event)	3,300	Default value for outdoor workers, US EPA Region 6, 2006.
Exposure Frequency (events/year)	225	Screening level default for outdoor workers, US EPA Region 6, 2006.
Exposure Duration (years)	25	Screening level default for outdoor workers, US EPA Region 6, 2006.
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	9,125	25-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	2	Assumes worker is outside for 2 hours/day.
Exposure Frequency (days/year)	225	Screening level default for outdoor workers, US EPA Region 6, 2006.
Exposure Duration (years)	25	Screening level default for outdoor workers, US EPA Region 6, 2006.
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day* 365 days/year.
Averaging Time - Noncancer (hours)	219,000	25-year exposure duration * 24 hours/day * 365 days/year.

Table 3-16e
Summary of Exposure Factors – RME Scenario – Adult Rancher

Adult Rancher – RME Scenario Exposure Pathway/Exposure Factor	Value	Comment
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/d)	100	Screening level default for outdoor workers, US EPA Region 6, 2006.
Fraction Surface Soil from Contaminated Source	1	Assumes all of soil intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes residence at on-site ranch).
Exposure Duration (years)	25	Screening level default for outdoor workers, US EPA Region 6, 2006.
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	9,125	25-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.2	Default value for outdoor workers, US EPA Region 6, 2006.
Surface Area Exposed to Surface Soil (cm^2/event)	3,300	Default value for outdoor workers, US EPA Region 6, 2006.
Exposure Frequency (events/year)	350	US EPA Region 6, 2006 (assumes residence at on-site ranch).
Exposure Duration (years)	25	Screening level default for outdoor workers, US EPA Region 6, 2006.
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	9,125	25-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	10	Assumes continuous exposure during 10-hour work day.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes residence at on-site ranch).
Exposure Duration (years)	25	Screening level default for outdoor workers, US EPA Region 6, 2006.
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day* 365 days/year.
Averaging Time - Noncancer (hours)	219,000	25-year exposure duration * 24 hours/day * 365 days/year.

Table 3-16f
Summary of Exposure Factors – RME Scenario – Adolescent Recreator 1
Soil Exposures

Adolescent Recreator 1 (12-18 years old) – RME Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/day)	100	Upper bound soil ingestion from Calabrese, 1990, as cited in US EPA, 1997.
Fraction Surface Soil from Contaminated Source	1	Assumes all of soil intake from site.
Exposure Frequency (days/year)	50	Professional judgment for adolescent frequency at the site.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.07	RME value for adult residents, US EPA, 2004a (Exhibit 3-5).
Surface Area Exposed to Surface Soil (cm^2/event)	3,790	Assumes exposure of forearms, hands, and lower legs, US EPA, 1997.
Exposure Frequency (events/year)	50	Professional judgment for adolescent frequency at the site.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	4	Professional judgment for time spent recreating at the site.
Inhalation Exposure Frequency (days/year)	50	Professional judgment for adolescent frequency at the site.
Inhalation Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day* 365 days/year.
Averaging Time - Noncancer (hours)	52,560	6-year exposure duration * 24 hours/day * 365 days/year.

Table 3-16g
Summary of Exposure Factors – RME Scenario – Adolescent Recreator 2
Surface Water and Sediment Exposure

Adolescent Recreator 2 (12-18 years old) – RME Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Ingestion of Sediment		
Sediment Ingestion Rate (mg/day)	100	Upper bound soil ingestion rate from Calabrese, 1990, as cited in US EPA, 1997.
Fraction Sediment from Contaminated Source	1	Assumes all sediment intake from site.
Exposure Frequency (days/year)	24	Professional judgment: swimming 2 days/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Dermal Contact with Sediment		
Sediment/Skin Adherence Factor (mg/cm^2)	0.3	95% upper bound value for adolescents playing soccer in moist conditions, US EPA, 2004a (Exhibit 3-3).
Surface Area Exposed to Sediment (cm^2/event)	4,980	Assumes exposure of forearms, hands, lower legs, and feet, US EPA, 1997.
Exposure Frequency (events/year)	24	Professional judgment: swimming 2 days/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Ingestion of Surface Water		
Surface Water Ingestion Rate (L/day)	0.05	Default value for ingestion of water during 1 hr of swimming, US EPA, 1989.
Exposure Frequency (days/year)	24	Professional judgment: swimming 2 days/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.

Adolescent Recreator 2 (12-18 years old) – RME Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Dermal Contact with Surface Water		
Surface Area Exposed to Surface Water (cm^2/event)	15,800	Calculated from Exposure Factors Handbook, US EPA, 1997 (Table 6-6).
Surface Water Dermal Exposure Time (hours)	1	Professional judgment.
Dermal Exposure Frequency (events/year)	24	Professional judgment: swimming 2 days/week for 12 weeks during summer.
Dermal Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.

Note: The appropriateness of each exposure parameter will be reviewed and documented in more detail for the HHRA; some values may be revised after further review, or based on site-specific information

Table 3-16h
Summary of Exposure Factors – RME Scenario – Adolescent Trespasser 1
Soil Exposure

Adolescent Trespasser 1 (12-18 years old) – RME Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/day)	100	Upper bound soil ingestion rate from Calabrese, 1990, as cited in US EPA, 1997.
Fraction Surface Soil from Contaminated Source	0.5	Assumes all of soil-sediment intake from site, 50% as soil.
Exposure Frequency (days/year)	10	Professional judgment for adolescent trespasser frequency at the site.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.07	RME value for soil for adult residents, US EPA, 2004a (Exhibit 3-5).
Surface Area Exposed to Surface Soil (cm^2/event)	3,790	Assumes exposure of forearms, hands, and lower legs, US EPA, 1997.
Exposure Frequency (events/year)	10	Professional judgment for adolescent trespasser frequency at the site.
Exposure Duration (years)	6	Assumes all adolescent years are spent at one residence.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	4	Professional judgment for time spent trespassing at the site.
Exposure Frequency (days/year)	10	Professional judgment for adolescent trespasser frequency at the site.
Exposure Duration (years)	6	Assumes all adolescent years are spent at one residence.
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day * 365 days/year.
Averaging Time - Noncancer (hours)	52,560	6-year exposure duration * 24 hours/day * 365 days/year.

Note: The appropriateness of each exposure parameter will be reviewed and documented in more detail for the HHRA; some values may be revised after further review, or based on site-specific information.

Table 3-16i
Summary of Exposure Factors – RME Scenario – Adolescent Trespasser 2
Surface Water and Sediment Exposure

Adolescent Trespasser 2 (12-18 years old) – RME Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Ingestion of Sediment		
Sediment Ingestion Rate (mg/day)	100	Upper bound soil ingestion rate from Calabrese, 1990, as cited in US EPA, 1997.
Fraction Sediment from Contaminated Source	1	Assumes all sediment intake from site.
Exposure Frequency (days/year)	12	Professional judgment: swimming 1 day/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Dermal Contact with Sediment		
Sediment/Skin Adherence Factor (mg/cm^2)	0.3	95% upper bound value for adolescents playing soccer in moist conditions, US EPA, 2004a (Exhibit 3-3).
Surface Area Exposed to Sediment (cm^2/event)	4,980	Assumes exposure of forearms, hands, lower legs, and feet, US EPA, 1997.
Exposure Frequency (events/year)	12	Professional judgment: swimming 1 days/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Ingestion of Surface Water		
Surface Water Ingestion Rate (L/day)	0.05	Default value for ingestion of water during 1 hr of swimming, US EPA, 1989.
Exposure Frequency (days/year)	12	Professional judgment: swimming 1 day/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.

Adolescent Trespasser 2 (12-18 years old) – RME Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Dermal Contact with Surface Water		
Surface Area Exposed to Surface Water (cm^2/event)	15,800	Calculated from Exposure Factors Handbook, US EPA, 1997 (Table 6-6).
Surface Water Dermal Exposure Time (hours)	1	Professional judgment.
Dermal Exposure Frequency (events/year)	12	Professional judgment: swimming 1 day/week for 12 weeks during summer.
Dermal Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.

Note: The appropriateness of each exposure parameter will be reviewed and documented in more detail for the HHRA; some values may be revised after further review, or based on site-specific information

Table 3-17a
Summary of Exposure Factors – CT Scenario – Child Resident

Child Resident – CT Scenario Exposure Pathway/Exposure Factor	Value	Comment
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/day)	100	CT Child soil ingestion rate, US EPA, 2002b (Table 5-19).
Fraction Surface Soil from Contaminated Source	1	Assumes all of soil intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.02	CT value for child resident, US EPA, 2004a (Exhibit 3-5).
Surface Area Exposed to Surface Soil (cm^2/event)	2,800	Average exposed surface area for children, US EPA, 2004a (Exhibit 3-5).
Exposure Frequency (events/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	24	Assumes continuous exposure.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day* 365 days/year.
Averaging Time - Noncancer (hours)	52,560	6-year exposure duration * 24 hours/day * 365 days/year.

Child Resident – CT Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Ingestion of Groundwater		
Groundwater Ingestion Rate (L/day)	0.30	50th percentile for children (1-10 years old), US EPA, 2002b (Table 4-12).
Fraction Groundwater from Contaminated Source	1	Assumes all of groundwater intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Dermal Contact with Groundwater		
Surface Area Exposed to Groundwater (cm^2/event)	6,600	Average child surface area for bathing, US EPA, 2004a (Exhibit 3-2).
Groundwater Dermal Exposure Time (hours)	0.33	CT exposure time for children bathing, US EPA, 2004a (Exhibit 3-2).
Exposure Frequency (events/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Ingestion of Vegetables		
Vegetable Ingestion Rate (g/kg-day)	0.4	50th percentile of seasonally adjusted consumer intake of homegrown vegetables for the Western US, with an 18% food preparation loss. US EPA, 1997, Table 13-33.
Fraction of Vegetables from Contaminated Source	1	Assumes all of home-produced vegetable intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.

Child Resident – CT Scenario Exposure Pathway/Exposure Factor	Value	Comment
Ingestion of Chicken		
Chicken Ingestion Rate (g/kg-day)	0.7	50th percentile annual-average home-produced poultry intake for Western US, with a 31% food preparation loss. US EPA, 1997, Table 13-55.
Fraction of Chicken from Contaminated Source	1	Assumes all of home-produced chicken intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Ingestion of Eggs		
Egg Ingestion Rate (g/kg-day)	0.67	50th percentile of home-produced egg intake for Western US US EPA, 1997, Table 13-43.
Fraction of Eggs from Contaminated Source	1	Assumes all of home-produced egg intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Ingestion of Beef		
Beef Ingestion Rate (g/kg-day)	1.2	50th percentile annual-average home-produced beef intake for Western US, with a 24% food preparation loss. US EPA, 1997, Table 13-36
Fraction of Beef from Contaminated Source	1	Assumes all of home-produced beef intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	6	90th percentile for time at one residence; 24 years as adult, 6 years as child.
Body Weight (kg)	15	US EPA Region 6, 2006 (average child body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.

Table 3-17b
Summary of Exposure Factors – CT Scenario – Adult Resident

Adult Resident – CT Scenario Exposure Pathway/Exposure Factor	Value	Comment
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/day)	50	CT soil ingestion rate for adults, US EPA, 1997 (Table 4-23).
Fraction Surface Soil from Contaminated Source	1	Assumes all of soil intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	9	CT exposure duration, US EPA 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.01	CT value for adult resident, US EPA, 2004a (Exhibit 3-5).
Surface Area Exposed to Surface Soil (cm^2/event)	5,700	Average exposed surface area for adults, US EPA, 2004a (Exhibit 3-5).
Exposure Frequency (events/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	9	CT exposure duration, US EPA 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/yr.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	24	Assumes continuous exposure.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (year)	9	CT exposure duration, US EPA 2004a (Exhibit 3-5).
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day* 365 days/year.
Averaging Time - Noncancer (hours)	78,840	9-year exposure duration * 24 hours/day * 365 days/year.

Adult Resident – CT Scenario Exposure Pathway/Exposure Factor	Value	Comment
Ingestion of Groundwater		
Groundwater Ingestion Rate (liters/day)	1.3	50th percentile for adults, US EPA, 1997 (Table 3-30).
Fraction Groundwater from Contaminated Source	1	Assumes all of groundwater intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	9	CT exposure duration, US EPA 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/yr.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.
Dermal Contact with Groundwater		
Surface Area Exposed to Groundwater (cm^2/event)	18,000	Average adult surface area for bathing, US EPA 2004a (Exhibit 3-2).
Groundwater Dermal Exposure Time (hours)	0.25	CT exposure time for adults bathing, US EPA, 2004a (Exhibit 3-2).
Exposure Frequency (events/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	9	CT exposure duration, US EPA 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.
Ingestion of Vegetables		
Vegetable Ingestion Rate (g/kg-day)	0.4	50th percentile of seasonally adjusted consumer intake of homegrown vegetables for the Western US, with an 18% food preparation loss. US EPA, 1997, Table 13-33.
Fraction of Vegetables from Contaminated Source	1	Assumes all of home-produced vegetable intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	9	CT exposure duration, US EPA 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.

Adult Resident – CT Scenario Exposure Pathway/Exposure Factor	Value	Comment
Ingestion of Chicken		
Chicken Ingestion Rate (g/kg-day)	0.7	50th percentile annual-average home-produced poultry intake for Western US, with a 31% food preparation loss. US EPA, 1997, Table 13-55.
Fraction of Chicken from Contaminated Source	1	Assumes all of home-produced chicken intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	9	CT exposure duration, US EPA 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.
Ingestion of Eggs		
Egg Ingestion Rate (g/kg-day)	0.67	50th percentile of home-produced egg intake for Western US US EPA, 1997, Table 13-43.
Fraction of Eggs from Contaminated Source	1	Assumes all of home-produced eggs intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	9	CT exposure duration, US EPA 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.
Ingestion of Beef		
Beef Ingestion Rate (g/kg-day)	1.2	50th percentile annual-average home-produced beef intake for Western US, with a 24% food preparation loss. US EPA, 1997, Table 13-36.
Fraction of Beef from Contaminated Source	1	Assumes all of home-produced beef intake from site.
Exposure Frequency (days/year)	350	US EPA Region 6, 2006 (assumes 2 weeks/year spent away from the residence, US EPA, 1991).
Exposure Duration (years)	9	CT exposure duration, US EPA 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.

Table 3-17c
Summary of Exposure Factors – CT Scenario – Adult Construction Worker

Adult Construction Worker – CT Scenario Exposure Pathway/Exposure Factor	Value	Comment
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/day)	50	CT soil ingestion rate for adults, US EPA, 1997 (Table 4-23).
Fraction Surface Soil from Contaminated Source	1	Assumes all of soil intake from site.
Exposure Frequency (days/year)	219	CT exposure frequency for industrial scenario, US EPA, 2004a (Exhibit 3-5).
Exposure Duration (years)	9	CT exposure duration for industrial scenario, US EPA, 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.02	CT default value for industrial workers, US EPA, 2004a (Exhibit 3-5).
Surface Area Exposed to Surface Soil (cm^2/event)	3,300	CT default value for industrial workers, US EPA, 2004a (Exhibit 3-5).
Exposure Frequency (events/year)	219	CT exposure frequency for industrial scenario, US EPA, 2004a (Exhibit 3-5).
Exposure Duration (years)	9	CT exposure duration for industrial scenario, US EPA, 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	10	Assumes continuous exposure during 10-hour work day.
Exposure Frequency (days/year)	219	CT exposure frequency for industrial scenario, US EPA, 2004a (Exhibit 3-5).
Exposure Duration (years)	9	CT exposure duration for industrial scenario, US EPA, 2004a (Exhibit 3-5).
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day* 365 days/year.
Averaging Time - Noncancer (hours)	78,840	9-year exposure duration * 24 hours/day * 365 days/year.

Note: The appropriateness of each exposure parameter will be reviewed and documented in more detail for the HHRA; some values may be revised after further review; or based on site-specific information.

Table 3-17d
Summary of Exposure Factors – CT Scenario – Adult Industrial Worker

Adult Industrial Worker – CT Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/day)	50	CT soil ingestion rate for adults, US EPA, 1997 (Table 4-23).
Fraction Surface Soil from Contaminated Source	0.5	Assumes half of daily soil intake is from site.
Exposure Frequency (days/year)	219	CT exposure frequency for industrial scenario, US EPA, 2004a (Exhibit 3-5).
Exposure Duration (years)	9	CT exposure duration for industrial scenario, US EPA, 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.02	CT default value for industrial workers, US EPA, 2004a (Exhibit 3-5).
Surface Area Exposed to Surface Soil (cm^2/event)	3,300	CT default value for industrial workers, US EPA, 2004a (Exhibit 3-5).
Exposure Frequency (events/year)	219	CT exposure frequency for industrial scenario, US EPA, 2004a (Exhibit 3-5).
Exposure Duration (years)	9	CT exposure duration for industrial scenario, US EPA, 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	2	Assumes worker is outside for 2 hr/day.
Exposure Frequency (days/year)	219	CT exposure frequency for industrial scenario, US EPA, 2004a (Exhibit 3-5).
Exposure Duration (years)	9	CT exposure duration for industrial scenario, US EPA, 2004a (Exhibit 3-5).
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day* 365 days/year.
Averaging Time - Noncancer (hours)	78,840	9-year exposure duration * 24 hours/day * 365 days/year.

Table 3-17e
Summary of Exposure Factors – CT Scenario – Adult Rancher

Adult Rancher – CT Scenario Exposure Pathway/Exposure Factor	Value	Comment
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/d)	50	CT soil ingestion rate for adults, US EPA 1997a (Table 4-23).
Fraction Surface Soil from Contaminated Source	1	Assumes all of soil intake from site.
Exposure Frequency (days/year)	250	Professional judgment (assumes working 5 d/wk * 50 wk/yr at on-site ranch).
Exposure Duration (years)	9	CT exposure duration for outdoor worker, US EPA, 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.02	Default value for adults, US EPA, 2004a (Exhibit 3-5)
Surface Area Exposed to Surface Soil (cm^2/event)	3,300	US EPA, 2004a. (Exhibit 3-5)
Exposure Frequency (events/year)	250	Professional judgment (assumes working 5 d/wk * 50 wk/yr at on-site ranch).
Exposure Duration (years)	9	CT exposure duration for outdoor worker, US EPA, 2004a (Exhibit 3-5).
Body Weight (kg)	70	US EPA Region 6, 2006 (average adult body weight, US EPA, 1991).
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	3,285	9-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	10	Assumes continuous exposure during 10-hour work day.
Exposure Frequency (days/year)	250	Professional judgment (assumes working 5 d/wk * 50 wk/yr at on-site ranch).
Exposure Duration (years)	9	CT exposure duration for outdoor worker, US EPA, 2004a (Exhibit 3-5).
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day* 365 days/year.
Averaging Time - Noncancer (hours)	78,840	9-year exposure duration * 24 hours/day * 365 days/year.

Table 3-17f
Summary of Exposure Factors – CT Scenario – Adolescent Recreator 1
Soil Exposure

Adolescent Recreator 1 (12-18 years old) – CT Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/day)	50	CT adult soil ingestion rate, US EPA, 1997 (Table 4-23).
Fraction Surface Soil from Contaminated Source	1	Assumes all of soil intake from site.
Exposure Frequency (days/year)	50	Professional judgment for adolescent frequency at the site.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.01	CT value for adult residents, US EPA, 2004a (Exhibit 3-5).
Surface Area Exposed to Surface Soil (cm^2/event)	3,790	Assumes exposure of forearms, hands, and lower legs, US EPA, 1997.
Exposure Frequency (events/year)	50	Professional judgment for adolescent frequency at the site.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	4	Professional judgment for time spent recreating at the site.
Exposure Frequency (days/year)	50	Professional judgment for adolescent frequency at the site.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day* 365 days/year.
Averaging Time - Noncancer (hours)	52,560	6-year exposure duration * 24 hours/day * 365 days/year.

Table 3-17g
Summary of Exposure Factors – CT Scenario – Adolescent Recreator 2
Surface Water and Sediment Exposure

Adolescent Recreator 2 (12-18 years old) – CT Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Ingestion of Sediment		
Sediment Ingestion Rate (mg/day)	50	Upper bound soil and dust ingestion, US EPA, 1997.
Fraction Sediment from Contaminated Source	1	Assumes all sediment intake from site.
Exposure Frequency (days/year)	24	Professional judgment: swimming 2 days/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Dermal Contact with Sediment		
Sediment/Skin Adherence Factor (mg/cm^2)	0.04	Geomean value for adolescents playing soccer in moist conditions, US EPA, 2004a (Exhibit 3-5).
Surface Area Exposed to Sediment (cm^2/event)	4,980	Assumes exposure of forearms, hands, lower legs, and feet, US EPA, 1997.
Exposure Frequency (events/year)	24	Professional judgment: swimming 2 days/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Ingestion of Surface Water		
Surface Water Ingestion Rate (L/day)	0.05	Default value for ingestion of water during 1 hr of swimming, US EPA, 1989.
Exposure Frequency (days/year)	24	Professional judgment: swimming 2 days/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.

Adolescent Recreator 2 (12-18 years old) – CT Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Dermal Contact with Surface Water		
Surface Area Exposed to Surface Water (cm^2/event)	15,800	Calculated from Exposure Factors Handbook, US EPA, 1997 (Table 6-6).
Surface Water Dermal Exposure Time (hours)	0.5	Professional judgment.
Exposure Frequency (events/year)	24	Professional judgment: swimming 2 days/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.

Table 3-17h
Summary of Exposure Factors – CT Scenario – Adolescent Trespasser 1
Soil Exposure

Adolescent Trespasser 1 (12-18 years old) – CT Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Ingestion of Surface Soil		
Surface Soil Ingestion Rate (mg/day)	50	CT adult soil ingestion rate, US EPA, 1997 (Table 4-23).
Fraction Surface Soil from Contaminated Source	0.5	Assumes all of soil-sediment intake from site, 50% as soil.
Exposure Frequency (days/year)	10	Professional judgment for adolescent frequency at the site.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Dermal Contact with Surface Soil		
Soil/Skin Adherence Factor (mg/cm^2)	0.01	CT value for soil for adult residents, US EPA, 2004a (Exhibit 3-5).
Surface Area Exposed to Surface Soil (cm^2/event)	3,790	Assumes exposure of forearms, hands, and lower legs, US EPA, 1997.
Exposure Frequency (events/year)	10	Professional judgment for adolescent frequency at the site.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Inhalation of Soil Dust in Air		
Inhalation Exposure Time (hours/day)	4	Professional judgment for time spent recreating at the site.
Exposure Frequency (days/year)	10	Professional judgment for adolescent frequency at the site.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Averaging Time - Cancer (hours)	613,200	70-year lifetime exposure duration * 24 hours/day* 365 days/year.
Averaging Time - Noncancer (hours)	52,560	6-year exposure duration * 24 hours/day * 365 days/year.

Table 3-17i
Summary of Exposure Factors – CT Scenario – Adolescent Trespasser 2
Surface Water and Sediment Exposure

Adolescent Trespasser 2 (12-18 years old) – CT Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Ingestion of Sediment		
Sediment Ingestion Rate (mg/day)	50	Upper bound soil and dust ingestion, US EPA, 1997.
Fraction Sediment from Contaminated Source	1	Assumes all sediment intake from site.
Exposure Frequency (days/year)	12	Professional judgment: swimming 1 day/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Dermal Contact with Sediment		
Sediment/Skin Adherence Factor (mg/cm^2)	0.04	Geomean value for adolescents playing soccer in moist conditions, US EPA, 2004a (Exhibit 3-5).
Surface Area Exposed to Sediment (cm^2/event)	4,980	Assumes exposure of forearms, hands, lower legs, and feet US EPA, 1997.
Exposure Frequency (events/year)	12	Professional judgment: swimming 1 day/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.
Ingestion of Surface Water		
Surface Water Ingestion Rate (L/day)	0.05	Default value for ingestion of water during 1 hr of swimming, US EPA, 1989.
Exposure Frequency (days/year)	12	Professional judgment: swimming 1 day/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.

Adolescent Trespasser 2 (12-18 years old) – CT Scenario		
Exposure Pathway/Exposure Factor	**Value**	**Comment**
Dermal Contact with Surface Water		
Surface Area Exposed to Surface Water (cm^2/event)	15,800	Calculated from Exposure Factors Handbook, US EPA, 1997 (Table 6-6).
Surface Water Dermal Exposure Time (hours)	0.5	Professional judgment.
Exposure Frequency (events/year)	12	Professional judgment: swimming 1 day/week for 12 weeks during summer.
Exposure Duration (years)	6	Assumes all adolescent years are spent near the site.
Body Weight (kg)	53	Average adolescent body weight, US EPA, 1997.
Averaging Time - Cancer (days)	25,550	70-year lifetime exposure duration * 365 days/year.
Averaging Time - Noncancer (days)	2,190	6-year exposure duration * 365 days/year.

Table 5-1a
Summary of Total Excess Lifetime Cancer Risk for Exposure Area Residents
Reasonable Maximum Exposure

EA	Exposure Pathway	Cancer Risk Child Resident	Cancer Risk Adult Resident	Total Excess Lifetime Cancer Risk	Percent Contribution	Food Total
1	Inhalation of Outdoor Air	4.8E-07	1.9E-06	2.4E-06	1%	
1	Ingestion of Soil	2.4E-06	1.0E-06	3.4E-06	2%	
1	Dermal Contact with Soil	4.0E-07	2.5E-07	6.5E-07	0%	
1	Ingestion of Locally-Grown Beef	1.1E-06	4.4E-06	5.6E-06	3%	
1	Ingestion of Locally-Grown Chicken	2.4E-06	9.7E-06	1.2E-05	7%	
1	Ingestion of Locally-Grown Eggs	1.9E-06	7.6E-06	9.5E-06	5%	
1	Ingestion of Locally-Grown Vegetables	2.9E-05	1.2E-04	1.5E-04	81%	96%
Total Cancer Risk Excluding Food Pathways:		3E-06	3E-06	**6E-06**		
	Total Cancer Risk:	4E-05	1E-04	**2E-04**		

EA	Exposure Pathway	Cancer Risk Child Resident	Cancer Risk Adult Resident	Total Excess Lifetime Cancer Risk	Percent Contribution	Food Total
2	Inhalation of Outdoor Air	2.5E-07	9.9E-07	1.2E-06	1%	
2	Ingestion of Soil	2.4E-06	1.0E-06	3.4E-06	2%	
2	Dermal Contact with Soil	4.0E-07	2.5E-07	6.5E-07	0%	
2	Ingestion of Locally-Grown Beef	1.9E-06	7.5E-06	9.4E-06	5%	
2	Ingestion of Locally-Grown Chicken	4.1E-06	1.6E-05	2.0E-05	10%	
2	Ingestion of Locally-Grown Eggs	3.2E-06	1.3E-05	1.6E-05	8%	
2	Ingestion of Locally-Grown Vegetables	3.0E-05	1.2E-04	1.5E-04	74%	97%
Total Cancer Risk Excluding Food Pathways:		3E-06	2E-06	**5E-06**		
	Total Cancer Risk:	4E-05	2E-04	**2E-04**		

EA	Exposure Pathway	Cancer Risk Child Resident	Cancer Risk Adult Resident	Total Excess Lifetime Cancer Risk	Percent Contribution	Food Total
3	Inhalation of Outdoor Air	8.1E-07	3.3E-06	4.1E-06	2%	
3	Ingestion of Soil	5.1E-06	2.2E-06	7.3E-06	4%	
3	Dermal Contact with Soil	8.5E-07	5.2E-07	1.4E-06	1%	
3	Ingestion of Locally-Grown Beef	1.8E-06	7.4E-06	9.2E-06	5%	
3	Ingestion of Locally-Grown Chicken	4.0E-06	1.6E-05	2.0E-05	10%	
3	Ingestion of Locally-Grown Eggs	3.1E-06	1.2E-05	1.6E-05	8%	
3	Ingestion of Locally-Grown Vegetables	2.7E-05	1.1E-04	1.4E-04	70%	93%
Total Cancer Risk Excluding Food Pathways:		7E-06	6E-06	**1E-05**		
	Total Cancer Risk:	4E-05	2E-04	**2E-04**		

Table 5-1a
Summary of Total Excess Lifetime Cancer Risk for Exposure Area Residents
Reasonable Maximum Exposure

EA	Exposure Pathway	Cancer Risk Child Resident	Cancer Risk Adult Resident	Total Excess Lifetime Cancer Risk	Percent Contribution	Food Total
4	Inhalation of Outdoor Air	1.3E-06	5.1E-06	6.4E-06	2%	
4	Ingestion of Soil	4.1E-06	1.7E-06	5.8E-06	2%	
4	Dermal Contact with Soil	6.8E-07	4.2E-07	1.1E-06	0%	
4	Ingestion of Locally-Grown Beef	2.7E-06	1.1E-05	1.4E-05	5%	
4	Ingestion of Locally-Grown Chicken	5.0E-06	2.0E-05	2.5E-05	9%	
4	Ingestion of Locally-Grown Eggs	3.9E-06	1.6E-05	1.9E-05	7%	
4	Ingestion of Locally-Grown Vegetables	3.8E-05	1.5E-04	1.9E-04	73%	95%
Total Cancer Risk Excluding Food Pathways:		6E-06	7E-06	**1E-05**		
	Total Cancer Risk:	6E-05	2E-04	**3E-04**		

EA	Exposure Pathway	Cancer Risk Child Resident	Cancer Risk Adult Resident	Total Excess Lifetime Cancer Risk	Percent Contribution	Food Total
5	Inhalation of Outdoor Air	5.1E-07	2.0E-06	2.6E-06	1%	
5	Ingestion of Soil	1.8E-06	7.5E-07	2.5E-06	1%	
5	Dermal Contact with Soil	2.9E-07	1.8E-07	4.7E-07	0%	
5	Ingestion of Locally-Grown Beef	1.9E-06	7.7E-06	9.6E-06	5%	
5	Ingestion of Locally-Grown Chicken	3.6E-06	1.4E-05	1.8E-05	10%	
5	Ingestion of Locally-Grown Eggs	2.8E-06	1.1E-05	1.4E-05	8%	
5	Ingestion of Locally-Grown Vegetables	2.7E-05	1.1E-04	1.4E-04	74%	97%
Total Cancer Risk Excluding Food Pathways:		3E-06	3E-06	**6E-06**		
	Total Cancer Risk:	4E-05	1E-04	**2E-04**		

Table 5-1b
Summary of Total Excess Lifetime Cancer Risk for Adolescent Recreators and Trespassers
Reasonable Maximum Exposure

Adolescent Recreator 1

EA	Exposure Pathway	Cancer Risk	Percent Contribution
1	Inhalation of Outdoor Air	1.2E-08	17%
1	Ingestion of Soil	4.9E-08	72%
1	Dermal Contact with Soil	7.7E-09	11%
	Total Cancer Risk:	**7E-08**	

EA	Exposure Pathway	Cancer Risk	Percent Contribution
5	Inhalation of Outdoor Air	1.2E-08	23%
5	Ingestion of Soil	3.5E-08	67%
5	Dermal Contact with Soil	5.6E-09	11%
	Total Cancer Risk:	**5E-08**	

Adolescent Recreator 2

EA	Exposure Pathway	Cancer Risk	Percent Contribution
5	Ingestion of Surface Water	3.9E-08	50%
5	Dermal Contact with Surface Water	1.2E-08	16%
5	Ingestion of Sediment	1.4E-08	18%
5	Dermal Contact with Sediment	1.3E-08	16%
	Total Cancer Risk:	**8E-08**	

Adolescent Trespasser 1

EA	Exposure Pathway	Cancer Risk	Percent Contribution
3	Inhalation of Outdoor Air	3.9E-09	22%
3	Ingestion of Soil	1.0E-08	59%
3	Dermal Contact with Soil	3.3E-09	19%
	Total Cancer Risk:	**2E-08**	

EA	Exposure Pathway	Cancer Risk	Percent Contribution
4	Inhalation of Outdoor Air	6.1E-09	36%
4	Ingestion of Soil	8.2E-09	48%
4	Dermal Contact with Soil	2.6E-09	15%
	Total Cancer Risk:	**2E-08**	

Adolescent Trespasser 2

EA	Exposure Pathway	Cancer Risk	Percent Contribution
4	Ingestion of Surface Water	3.1E-08	55%
4	Dermal Contact with Surface Water	9.8E-09	17%
4	Ingestion of Sediment	8.4E-09	15%
4	Dermal Contact with Sediment	7.5E-09	13%
	Total Cancer Risk:	**6E-08**	

Table 5-1c
Summary of Total Excess Lifetime Cancer Risks for Workers
Reasonable Maximum Exposure

Rancher

EA	Exposure Pathway	Cancer Risk	Percent Contribution
1	Inhalation of Outdoor Air	8.4E-07	36%
1	Ingestion of Soil	1.1E-06	46%
1	Dermal Contact with Soil	4.2E-07	18%
	Total Cancer Risk:	**2E-06**	

EA	Exposure Pathway	Cancer Risk	Percent Contribution
2	Inhalation of Outdoor Air	4.3E-07	22%
2	Ingestion of Soil	1.1E-06	56%
2	Dermal Contact with Soil	4.2E-07	22%
	Total Cancer Risk:	**2E-06**	

EA	Exposure Pathway	Cancer Risk	Percent Contribution
5	Inhalation of Outdoor Air	8.9E-07	45%
5	Ingestion of Soil	7.8E-07	40%
5	Dermal Contact with Soil	3.1E-07	16%
	Total Cancer Risk:	**2E-06**	

Construction Worker

EA	Exposure Pathway	Cancer Risk	Percent Contribution
1	Inhalation of Outdoor Air	5.4E-07	36%
1	Ingestion of Soil	6.9E-07	46%
1	Dermal Contact with Soil	2.7E-07	18%
	Total Cancer Risk:	**2E-06**	

EA	Exposure Pathway	Cancer Risk	Percent Contribution
2	Inhalation of Outdoor Air	2.8E-07	22%
2	Ingestion of Soil	6.9E-07	56%
2	Dermal Contact with Soil	2.7E-07	22%
	Total Cancer Risk:	**1E-06**	

Industrial Worker

EA	Exposure Pathway	Cancer Risk	Percent Contribution
Smelter Area	Inhalation of Outdoor Air	2.9E-07	5%
Smelter Area	Ingestion of Soil	2.8E-06	53%
Smelter Area	Dermal Contact with Soil	2.3E-06	42%
	Total Cancer Risk:	**5E-06**	

Table 5-2a
Summary of Total Excess Lifetime Cancer Risk for Residents
Central Tendency

EA	Exposure Pathway	Cancer Risk Child Resident	Cancer Risk Adult Resident	Total Excess Lifetime Cancer Risk	Percent Contribution	Food Total
1	Inhalation of Outdoor Air	4.8E-07	7.3E-07	1.2E-06	3%	
1	Ingestion of Soil	1.2E-06	1.9E-07	1.4E-06	4%	
1	Dermal Contact with Soil	4.0E-08	1.3E-08	5.4E-08	0.2%	
1	Ingestion of Locally-Grown Beef	6E-07	9.1E-07	1.5E-06	4%	
1	Ingestion of Locally-Grown Chicken	1.3E-06	2.0E-06	3.3E-06	9%	
1	Ingestion of Locally-Grown Eggs	1.2E-06	1.8E-06	3.0E-06	9%	
1	Ingestion of Locally-Grown Vegetables	9.8E-06	1.5E-05	2.5E-05	70%	92%
Total Cancer Risk Excluding Food Pathways:		2E-06	9E-07	**3E-06**		
Total Cancer Risk:		1E-05	2E-05	**3E-05**		

EA	Exposure Pathway	Cancer Risk Child Resident	Cancer Risk Adult Resident	Total Excess Lifetime Cancer Risk	Percent Contribution	Food Total
2	Inhalation of Outdoor Air	2.5E-07	3.7E-07	6.2E-07	2%	
2	Ingestion of Soil	1.2E-06	1.9E-07	1.4E-06	3%	
2	Dermal Contact with Soil	4.0E-08	1.3E-08	5.3E-08	0%	
2	Ingestion of Locally-Grown Beef	1.0E-06	1.5E-06	2.6E-06	6%	
2	Ingestion of Locally-Grown Chicken	2.2E-06	3.3E-06	5.5E-06	14%	
2	Ingestion of Locally-Grown Eggs	2.0E-06	3.0E-06	5.1E-06	13%	
2	Ingestion of Locally-Grown Vegetables	9.9E-06	1.5E-05	2.5E-05	62%	95%
Total Cancer Risk Excluding Food Pathways:		1E-06	6E-07	**2E-06**		
Total Cancer Risk:		2E-05	2E-05	**4E-05**		

EA	Exposure Pathway	Cancer Risk Child Resident	Cancer Risk Adult Resident	Total Excess Lifetime Cancer Risk	Percent Contribution	Food Total
3	Inhalation of Outdoor Air	8.1E-07	1.2E-06	2.0E-06	5%	
3	Ingestion of Soil	2.5E-06	4.1E-07	2.9E-06	7%	
3	Dermal Contact with Soil	8.5E-08	2.8E-08	1.1E-07	0%	
3	Ingestion of Locally-Grown Beef	1.0E-06	1.5E-06	2.5E-06	6%	
3	Ingestion of Locally-Grown Chicken	2.2E-06	3.2E-06	5.4E-06	13%	
3	Ingestion of Locally-Grown Eggs	2.0E-06	3.0E-06	5.0E-06	12%	
3	Ingestion of Locally-Grown Vegetables	9.0E-06	1.4E-05	2.3E-05	56%	87%
Total Cancer Risk Excluding Food Pathways:		3E-06	2E-06	**5E-06**		
Total Cancer Risk:		2E-05	2E-05	**4E-05**		

Table 5-2a
Summary of Total Excess Lifetime Cancer Risk for Residents
Central Tendency

EA	Exposure Pathway	Cancer Risk Child Resident	Cancer Risk Adult Resident	Total Excess Lifetime Cancer Risk	Percent Contribution	Food Total
4	Inhalation of Outdoor Air	1.3E-06	1.9E-06	3.2E-06	6%	
4	Ingestion of Soil	2.0E-06	3.3E-07	2.4E-06	4%	
4	Dermal Contact with Soil	6.8E-08	2.2E-08	9.1E-08	0%	
4	Ingestion of Locally-Grown Beef	1.5E-06	2.2E-06	3.7E-06	7%	
4	Ingestion of Locally-Grown Chicken	2.7E-06	4.0E-06	6.7E-06	12%	
4	Ingestion of Locally-Grown Eggs	2.5E-06	3.7E-06	6.2E-06	11%	
4	Ingestion of Locally-Grown Vegetables	1.3E-05	1.9E-05	3.2E-05	59%	90%
Total Cancer Risk Excluding Food Pathways:		3E-06	2E-06	**6E-06**		
	Total Cancer Risk:	2E-05	3E-05	**5E-05**		

EA	Exposure Pathway	Cancer Risk Child Resident	Cancer Risk Adult Resident	Total Excess Lifetime Cancer Risk	Percent Contribution	Food Total
5	Inhalation of Outdoor Air	5.1E-07	7.7E-07	1.3E-06	3%	
5	Ingestion of Soil	8.8E-07	1.4E-07	1.0E-06	3%	
5	Dermal Contact with Soil	2.9E-08	9.6E-09	3.9E-08	0%	
5	Ingestion of Locally-Grown Beef	1.1E-06	1.6E-06	2.6E-06	7%	
5	Ingestion of Locally-Grown Chicken	1.9E-06	2.9E-06	4.8E-06	13%	
5	Ingestion of Locally-Grown Eggs	1.8E-06	2.7E-06	4.5E-06	12%	
5	Ingestion of Locally-Grown Vegetables	9.1E-06	1.4E-05	2.3E-05	61%	94%
Total Cancer Risk Excluding Food Pathways:		1E-06	9E-07	**2E-06**		
	Total Cancer Risk:	2E-05	2E-05	**4E-05**		

Table 5-2b
Summary of Total Excess Lifetime Cancer Risk for Adolescent Recreators and Trespassers
Central Tendency

Adolescent Recreator 1

EA	Exposure Pathway	Cancer Risk	Percent Contribution
1	Inhalation of Outdoor Air	1.2E-08	31%
1	Ingestion of Soil	2.4E-08	66%
1	Dermal Contact with Soil	1.1E-09	3%
	Total Cancer Risk	**4E-08**	

EA	Exposure Pathway	Cancer Risk	Percent Contribution
5	Inhalation of Outdoor Air	1.2E-08	40%
5	Ingestion of Soil	1.8E-08	58%
5	Dermal Contact with Soil	8.0E-10	3%
	Total Cancer Risk	**3E-08**	

Adolescent Recreator 2

EA	Exposure Pathway	Cancer Risk	Percent Contribution
5	Ingestion of Surface Water	3.9E-08	72%
5	Dermal Contact with Surface Water	6.1E-09	11%
5	Ingestion of Sediment	7.1E-09	13%
5	Dermal Contact with Sediment	1.7E-09	3%
	Total Cancer Risk	**5E-08**	

Adolescent Trespasser 1

EA	Exposure Pathway	Cancer Risk	Percent Contribution
3	Inhalation of Outdoor Air	3.9E-09	41%
3	Ingestion of Soil	5.1E-09	54%
3	Dermal Contact with Soil	4.7E-10	5%
	Total Cancer Risk	**9E-09**	

EA	Exposure Pathway	Cancer Risk	Percent Contribution
4	Inhalation of Outdoor Air	6.1E-09	58%
4	Ingestion of Soil	4.1E-09	39%
4	Dermal Contact with Soil	3.7E-10	4%
	Total Cancer Risk	**1E-08**	

Adolescent Trespasser 2

EA	Exposure Pathway	Cancer Risk	Percent Contribution
4	Ingestion of Surface Water	3.1E-08	75%
4	Dermal Contact with Surface Water	4.9E-09	12%
4	Ingestion of Sediment	4.2E-09	10%
4	Dermal Contact with Sediment	1.0E-09	2%
	Total Cancer Risk	**4E-08**	

Table 5-2c
Summary of Total Excess Lifetime Cancer Risk for Workers
Central Tendency

Adult Rancher

EA	Exposure Pathway	Cancer Risk	Percent Contribution
1	Inhalation of Outdoor Air	2.2E-07	59%
1	Ingestion of Soil	1.4E-07	38%
1	Dermal Contact with Soil	1.1E-08	3%
	Total Cancer Risk	**4E-07**	

EA	Exposure Pathway	Cancer Risk	Percent Contribution
2	Inhalation of Outdoor Air	1.1E-07	43%
2	Ingestion of Soil	1.4E-07	53%
2	Dermal Contact with Soil	1.1E-08	4%
	Total Cancer Risk	**3E-07**	

EA	Exposure Pathway	Cancer Risk	Percent Contribution
5	Inhalation of Outdoor Air	2.3E-07	68%
5	Ingestion of Soil	1.0E-07	30%
5	Dermal Contact with Soil	8.0E-09	2%
	Total Cancer Risk	**3E-07**	

Adult Construction Worker

EA	Exposure Pathway	Cancer Risk	Percent Contribution
1	Inhalation of Outdoor Air	1.9E-07	59%
1	Ingestion of Soil	1.2E-07	38%
1	Dermal Contact with Soil	9.6E-09	3%
	Total Cancer Risk	**3E-07**	

EA	Exposure Pathway	Cancer Risk	Percent Contribution
2	Inhalation of Outdoor Air	9.7E-08	43%
2	Ingestion of Soil	1.2E-07	53%
2	Dermal Contact with Soil	9.5E-09	4%
	Total Cancer Risk	**2E-07**	

Adult Industrial Worker

EA	Exposure Pathway	Cancer Risk	Percent Contribution
Smelter Area	Inhalation of Outdoor Air	1.0E-07	15%
Smelter Area	Ingestion of Soil	5.0E-07	74%
Smelter Area	Dermal Contact with Soil	7.9E-08	12%
	Total Cancer Risk	**7E-07**	

Table 5-3a
Summary of Total Noncancer Risk for Residents
Reasonable Maximum Exposure

EA	Exposure Pathway	Noncancer Risk Child Resident	Percent Contribution	Noncancer Risk Adult Resident	Percent Contribution	Food Child	Food Adult
1	Inhalation of Outdoor Air	8.8E-04	0.01%	8.8E-04	0.01%		
1	Ingestion of Soil	1.9E+00	14%	2.1E-01	2%		
1	Dermal Contact with Soil	3.0E+00	21%	5.8E-01	6%		
1	Ingestion of Locally-Grown Beef	3.4E+00	24%	3.4E+00	33%		
1	Ingestion of Locally-Grown Chicken	2.1E+00	15%	2.1E+00	21%		
1	Ingestion of Locally-Grown Eggs	1.6E+00	11%	1.6E+00	16%		
1	Ingestion of Locally-Grown Vegetables	2.2E+00	15%	2.2E+00	22%	65%	92%
	Total HI Excluding Food Pathways:	**5**		**0.8**			
	Total Hazard Index:	**14**		**10**			

EA	Exposure Pathway	Noncancer Risk Child Resident	Percent Contribution	Noncancer Risk Adult Resident	Percent Contribution	Food Child	Food Adult
2	Inhalation of Outdoor Air	2.2E+00	12.02%	4.9E-04	0.00%		
2	Ingestion of Soil	1.8E+00	10%	2.0E-01	2%		
2	Dermal Contact with Soil	3.6E+00	20%	5.6E-01	5%		
2	Ingestion of Locally-Grown Beef	5.8E+00	32%	5.8E+00	51%		
2	Ingestion of Locally-Grown Chicken	1.8E+00	10%	1.8E+00	16%		
2	Ingestion of Locally-Grown Eggs	1.2E+00	6%	1.2E+00	10%		
2	Ingestion of Locally-Grown Vegetables	1.9E+00	10%	1.9E+00	16%	58%	93%
	Total HI Excluding Food Pathways:	**8**		**0.8**			
	Total Hazard Index:	**18**		**11**			

EA	Exposure Pathway	Noncancer Risk Child Resident	Percent Contribution	Noncancer Risk Adult Resident	Percent Contribution	Food Child	Food Adult
3	Inhalation of Outdoor Air	3.0E-03	0.0%	3.0E-03	0.0%		
3	Ingestion of Soil	3.8E+00	15%	3.7E-01	3%		
3	Dermal Contact with Soil	7.3E+00	30%	1.1E+00	8%		
3	Ingestion of Locally-Grown Beef	4.8E+00	19.8%	4.8E+00	33%		
3	Ingestion of Locally-Grown Chicken	3.8E+00	15.5%	3.8E+00	25%		
3	Ingestion of Locally-Grown Eggs	2.7E+00	11.1%	2.7E+00	18.2%		
3	Ingestion of Locally-Grown Vegetables	2.0E+00	8%	2.0E+00	14%	55%	90%
	Total HI Excluding Food Pathways:	**11**		**1**			
	Total Hazard Index:	**24**		**15**			

Table 5-3a
Summary of Total Noncancer Risk for Residents
Reasonable Maximum Exposure

EA	Exposure Pathway	Noncancer Risk Child Resident	Percent Contribution	Noncancer Risk Adult Resident	Percent Contribution	Food Child	Food Adult
4		3.2E-03	0.0%	3.2E-03	0.0%		
4	Ingestion of Soil	2.0E+00	14%	1.7E-01	2%		
4	Dermal Contact with Soil	3.2E+00	23%	4.9E-01	5%		
4	Ingestion of Locally-Grown Beef	2.2E+00	16.2%	2.2E+00	24%		
4	Ingestion of Locally-Grown Chicken	1.8E+00	12.8%	1.8E+00	19%		
4	Ingestion of Locally-Grown Eggs	1.3E+00	9.5%	1.3E+00	14.1%		
4	Ingestion of Locally-Grown Vegetables	3.3E+00	24%	3.3E+00	36%	63%	93%
	Total HI Excluding Food Pathways:	**5**		**0.7**			
	Total Hazard Index:	**14**		**9**			

EA	Exposure Pathway	Noncancer Risk Child Resident	Percent Contribution	Noncancer Risk Adult Resident	Percent Contribution	Food Child	Food Adult
5	Inhalation of Outdoor Air	9.3E-04	0.01%	9.3E-04	0.01%		
5	Ingestion of Soil	2.0E+00	14%	2.2E-01	2%		
5	Dermal Contact with Soil	4.0E+00	28%	6.1E-01	7%		
5	Ingestion of Locally-Grown Beef	2.4E+00	17.0%	2.4E+00	26.7%		
5	Ingestion of Locally-Grown Chicken	2.2E+00	15.5%	2.2E+00	24.4%		
5	Ingestion of Locally-Grown Eggs	1.7E+00	12.0%	1.7E+00	18.9%		
5	Ingestion of Locally-Grown Vegetables	1.9E+00	13%	1.9E+00	21%	58%	91%
	Total HI Excluding Food Pathways:	**6**		**0.8**			
	Total Hazard Index:	**14**		**9**			

Table 5-3b
Summary of Total Noncancer Risk for Adolescent Recreators and Trespassers
Reasonable Maximum Exposure

Adolescent Recreator 1

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
1	Inhalation of Outdoor Air	2.1E-05	0.02%
1	Ingestion of Soil	3.9E-02	35%
1	Dermal Contact with Soil	7.2E-02	65%
	Total Hazard Index:	**0.1**	

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
5	Inhalation of Outdoor Air	2.2E-05	0.02%
5	Ingestion of Soil	4.1E-02	35%
5	Dermal Contact with Soil	7.7E-02	65%
	Total Hazard Index:	**0.1**	

Percent Contribution

Adolescent Recreator 2

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
5	Ingestion of Surface Water	4.8E-03	2%
5	Dermal Contact with Surface Water	8.7E-02	42%
5	Ingestion of Sediment	1.0E-02	5%
5	Dermal Contact with Sediment	1.1E-01	51%
	Total Hazard Index:	**0.2**	

Adolescent Trespasser 1

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
3	Inhalation of Outdoor Air	1.4E-05	0.04%
3	Ingestion of Soil	7.0E-03	20%
3	Dermal Contact with Soil	2.8E-02	80%
	Total Hazard Index:	**0.04**	

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
4	Inhalation of Outdoor Air	1.5E-05	0.1%
4	Ingestion of Soil	3.3E-03	21%
4	Dermal Contact with Soil	1.2E-02	79%
	Total Hazard Index:	**0.02**	

Adolescent Trespasser 2

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
4	Ingestion of Surface Water	2.2E-03	1.6%
4	Dermal Contact with Surface Water	2.7E-02	19%
4	Ingestion of Sediment	9.1E-03	7%
4	Dermal Contact with Sediment	1.0E-01	73%
	Total Hazard Index:	**0.14**	

Table 5-3c
Summary of Total Noncancer Risk for Workers
Reasonable Maximum Exposure

Adult Rancher

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
1	Inhalation of Outdoor Air	3.7E-04	0.03%
1	Ingestion of Soil	2.1E-01	18%
1	Dermal Contact with Soil	9.5E-01	82%
	Total Hazard Index:	**1**	

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
2	Inhalation of Outdoor Air	2.1E-04	0.02%
2	Ingestion of Soil	2.0E-01	18%
2	Dermal Contact with Soil	9.2E-01	82%
	Total Hazard Index:	**1**	**Percent Contribution**

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
5	Inhalation of Outdoor Air	3.9E-04	0.09%
5	Ingestion of Soil	2.2E-01	50%
5	Dermal Contact with Soil	2.2E-01	50%
	Total Hazard Index:	**0.4**	

Adult Construction Worker

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
1	Inhalation of Outdoor Air	2.3E-05	0.003%
1	Ingestion of Soil	1.3E-01	18%
1	Dermal Contact with Soil	6.1E-01	82%
	Total Hazard Index:	**0.7**	

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
2	Inhalation of Outdoor Air	1.3E-04	0.02%
2	Ingestion of Soil	1.3E-01	18%
2	Dermal Contact with Soil	5.9E-01	82%
	Total Hazard Index:	**0.7**	

Adult Industrial Worker

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
Smelter Area	Inhalation of Outdoor Air	1.7E-04	0.013%
Smelter Area	Ingestion of Soil	1.2E-01	9%
Smelter Area	Dermal Contact with Soil	1.2E+00	91%
	Total Hazard Index:	**1.3**	

Table 5-4a
Summary of Total Noncancer Risk for Residents
Central Tendency

EA	Exposure Pathway	Noncancer Risk Child Resident	Percent Contribution	Noncancer Risk Adult Resident	Percent Contribution	Food Child	Food Adult
1	Inhalation of Outdoor Air	8.8E-04	0.01%	8.8E-04	0.02%		
1	Ingestion of Soil	9.7E-01	16%	1.0E-01	2%		
1	Dermal Contact with Soil	3.0E-01	5%	8.2E-02	2%		
1	Ingestion of Locally-Grown Beef	1.8E+00	31%	1.8E+00	37%		
1	Ingestion of Locally-Grown Chicken	1.1E+00	19%	1.1E+00	23%		
1	Ingestion of Locally-Grown Eggs	1.0E+00	17%	1.0E+00	21%		
1	Ingestion of Locally-Grown Vegetables	7.4E-01	12%	7.4E-01	15%	79%	96%
	Total HI Excluding Food Pathways:	**1**		**0.2**			
	Total Hazard Index:	**6**		**5**			

EA	Exposure Pathway	Noncancer Risk Child Resident	Percent Contribution	Noncancer Risk Adult Resident	Percent Contribution	Food Child	Food Adult
2	Inhalation of Outdoor Air	7.4E-01	9.75%	4.9E-04	0.01%		
2	Ingestion of Soil	9.2E-01	12%	9.8E-02	2%		
2	Dermal Contact with Soil	3.6E-01	5%	7.9E-02	1%		
2	Ingestion of Locally-Grown Beef	3.2E+00	42%	3.2E+00	56%		
2	Ingestion of Locally-Grown Chicken	9.9E-01	13%	9.9E-01	17%		
2	Ingestion of Locally-Grown Eggs	7.4E-01	10%	7.4E-01	13%		
2	Ingestion of Locally-Grown Vegetables	6.2E-01	8%	6.2E-01	11%	73%	97%
	Total HI Excluding Food Pathways:	**2**		**0.2**			
	Total Hazard Index:	**8**		**6**			

EA	Exposure Pathway	Noncancer Risk Child Resident	Percent Contribution	Noncancer Risk Adult Resident	Percent Contribution	Food Child	Food Adult
3	Inhalation of Outdoor Air	3.0E-03	0.0%	3.0E-03	0.0%		
3	Ingestion of Soil	1.9E+00	19%	1.9E-01	3%		
3	Dermal Contact with Soil	7.3E-01	8%	1.6E-01	2%		
3	Ingestion of Locally-Grown Beef	2.6E+00	27.3%	2.6E+00	36%		
3	Ingestion of Locally-Grown Chicken	2.0E+00	21.0%	2.0E+00	27%		
3	Ingestion of Locally-Grown Eggs	1.7E+00	17.8%	1.7E+00	23.2%		
3	Ingestion of Locally-Grown Vegetables	6.7E-01	7%	6.7E-01	9%	73%	95%
	Total HI Excluding Food Pathways:	**3**		**0.3**			
	Total Hazard Index:	**10**		**7**			

Table 5-4a
Summary of Total Noncancer Risk for Residents
Central Tendency

EA	Exposure Pathway	Noncancer Risk Child Resident	Percent Contribution	Noncancer Risk Adult Resident	Percent Contribution	Food Child	Food Adult
4	Inhalation of Outdoor Air	3.2E-03	0.1%	3.2E-03	0.1%		
4	Ingestion of Soil	9.8E-01	18%	8.7E-02	1%		
4	Dermal Contact with Soil	3.2E-01	6%	7.0E-02	1%		
4	Ingestion of Locally-Grown Beef	1.2E+00	22.5%	1.2E+00	20%		
4	Ingestion of Locally-Grown Chicken	9.6E-01	17.6%	9.6E-01	15%		
4	Ingestion of Locally-Grown Eggs	8.4E-01	15.4%	5.0E-01	8.1%		
4	Ingestion of Locally-Grown Vegetables	1.1E+00	21%	3.3E+00	54%	76%	97%
	Total HI Excluding Food Pathways:	**1**		**0.2**			
	Total Hazard Index:	**5**		**6**			

EA	Exposure Pathway	Noncancer Risk Child Resident	Percent Contribution	Noncancer Risk Adult Resident	Percent Contribution	Food Child	Food Adult
5	Inhalation of Outdoor Air	9.3E-04	0.02%	9.3E-04	0.0%		
5	Ingestion of Soil	1.0E+00	18%	1.1E-01	2%		
5	Dermal Contact with Soil	4.0E-01	7%	8.7E-02	2%		
5	Ingestion of Locally-Grown Beef	1.3E+00	23.4%	1.3E+00	29.8%		
5	Ingestion of Locally-Grown Chicken	1.2E+00	21.1%	1.2E+00	26.8%		
5	Ingestion of Locally-Grown Eggs	1.1E+00	19.4%	1.1E+00	24.7%		
5	Ingestion of Locally-Grown Vegetables	6.3E-01	11%	6.3E-01	14%	75%	96%
	Total HI Excluding Food Pathways:	**1**		**0.2**			
	Total Hazard Index:	**6**		**4**			

Table 5-4b
Summary of Total Noncancer Risk for Adolescent Recreators and Trespassers
Central Tendency

Adolescent Recreator 1

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
1	Inhalation of Outdoor Air	2.1E-05	0.07%
1	Ingestion of Soil	2.0E-02	65%
1	Dermal Contact with Soil	1.0E-02	35%
	Total Hazard Index:	**0.03**	

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
5	Inhalation of Outdoor Air	2.2E-05	0.20%
5	Ingestion of Soil	0.0E+00	0%
5	Dermal Contact with Soil	1.1E-02	100%
	Total Hazard Index:	**0.01**	

Adolescent Recreator 2

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
5	Ingestion of Surface Water	4.8E-03	7%
5	Dermal Contact with Surface Water	4.3E-02	64%
5	Ingestion of Sediment	5.0E-03	7%
5	Dermal Contact with Sediment	1.4E-02	21%
	Total Hazard Index:	**0.07**	

Adolescent Trespasser 1

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
3	Inhalation of Outdoor Air	1.4E-05	0.2%
3	Ingestion of Soil	3.5E-03	47%
3	Dermal Contact with Soil	4.0E-03	53%
	Total Hazard Index:	**0.008**	

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
4	Inhalation of Outdoor Air	1.5E-05	0.5%
4	Ingestion of Soil	1.6E-03	48%
4	Dermal Contact with Soil	1.7E-03	51%
	Total Hazard Index:	**0.003**	

Adolescent Trespasser 2

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
4	Ingestion of Surface Water	2.2E-03	7%
4	Dermal Contact with Surface Water	1.3E-02	40%
4	Ingestion of Sediment	4.5E-03	13%
4	Dermal Contact with Sediment	1.3E-02	40%
	Total Hazard Index:	**0.03**	

Table 5-4c
Summary of Total Noncancer Risk for Workers
Central Tendency

Adult Rancher

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
1	Inhalation of Outdoor Air	2.6E-04	0.2%
1	Ingestion of Soil	7.4E-02	52%
1	Dermal Contact with Soil	6.8E-02	48%
	Total Hazard Index:	**0.1**	

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
2	Inhalation of Outdoor Air	1.5E-04	0.11%
2	Ingestion of Soil	7.0E-02	52%
2	Dermal Contact with Soil	6.6E-02	48%
	Total Hazard Index:	**0.1**	

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
5	Inhalation of Outdoor Air	2.8E-04	0.2%
5	Ingestion of Soil	7.7E-02	50%
5	Dermal Contact with Soil	7.7E-02	50%
	Total Hazard Index:	**0.2**	

Adult Construction Worker

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
1	Inhalation of Outdoor Air	2.3E-05	0.01%
1	Ingestion of Soil	6.5E-02	42%
1	Dermal Contact with Soil	9.0E-02	58%
	Total Hazard Index:	**0.2**	

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
2	Inhalation of Outdoor Air	1.3E-04	0.09%
2	Ingestion of Soil	6.2E-02	42%
2	Dermal Contact with Soil	8.6E-02	58%
	Total Hazard Index:	**0.1**	

Adult Industrial Worker

EA	Exposure Pathway	Noncancer Risk	Percent Contribution
Smelter Area	Inhalation of Outdoor Air	1.7E-04	0.10%
Smelter Area	Ingestion of Soil	6.0E-02	34%
Smelter Area	Dermal Contact with Soil	1.2E-01	66%
	Total Hazard Index:	**0.2**	

Table 5-9
Summary of Reference Area Cancer Risks (RME)

Exposure Pathway	Cancer Risk Child Resident	Cancer Risk Adult Resident	Total Excess Lifetime Cancer Risk	Percent Contribution	Food Total
Inhalation of Outdoor Air	2.5E-07	9.9E-07	1.2E-06	1%	
Ingestion of Soil	2.2E-06	9.5E-07	3.2E-06	1%	
Dermal Contact with Soil	3.7E-07	2.3E-07	6.0E-07	0.3%	
Ingestion of Locally-Grown Beef	1.5E-06	6.1E-06	7.7E-06	4%	
Ingestion of Locally-Grown Chicken	3.3E-06	1.3E-05	1.7E-05	8%	
Ingestion of Locally-Grown Eggs	2.6E-06	1.0E-05	1.3E-05	6%	
Ingestion of Locally-Grown Vegetables	3.5E-05	1.4E-04	1.8E-04	81%	98%
Total Cancer Risk Excluding Food Pathways:	3.E-06	2.E-06	**5E-06**		
Total Cancer Risk:	5E-05	2E-04	**2E-04**		

Table 5-10
Summary of Reference Area Noncancer Risks (RME)

Exposure Pathway	Noncancer Risk Child Resident	Percent Contribution	Noncancer Risk Adult Resident	Percent Contribution	Food Child	Food Adult
Inhalation of Outdoor Air	0.00049	0.002%	0.00049	0.0%		
Ingestion of Soil	4.9	19%	0.5	3%		
Dermal Contact with Soil	2.7	10%	0.4	2%		
Ingestion of Locally-Grown Beef	8.9	34%	8.9	45%		
Ingestion of Locally-Grown Chicken	4.0	15%	4.0	20%		
Ingestion of Locally-Grown Eggs	2.9	11%	2.9	15%		
Ingestion of Locally-Grown Vegetables	2.9	11%	2.9	15%	71%	95%
Total HI Excluding Food Pathways:	**8**		**1**			
Total Hazard Index:	**26**		**20**			

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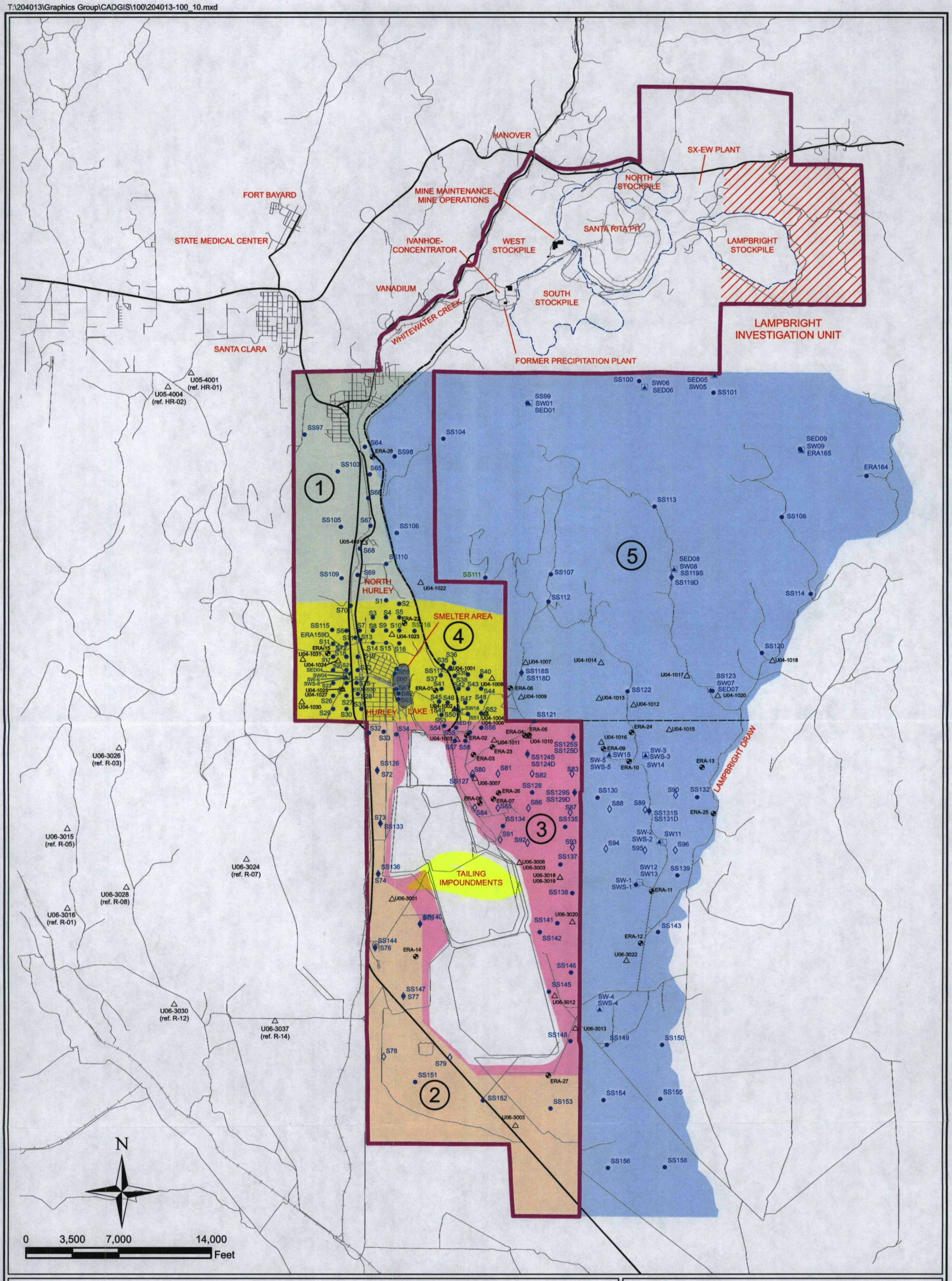

LEGEND

- LAMPBRIGHT INVESTIGATION UNIT
- AOC INVESTIGATION AREA BOUNDARY
- PIPELINE
- HIGHWAY
- ROAD
- RAILROAD
- Exposure Area 1
- Exposure Area 2
- Exposure Area 3
- Exposure Area 4
- Exposure Area 5
- (1) Exposure Area

SAMPLE LOCATIONS

S/TSIU RI (SRK, 2006)

- SURFACE SOIL (0-1")
- SHALLOW SOIL (0-6")
- SURFACE WATER
- SEDIMENT

PREVIOUS DATA COLLECTION

- SURFACE SOIL (0-1") RI BACKGROUND REPORT (CMC, 1995)
- SURFACE SOIL (1-6") RI BACKGROUND REPORT (CMC, 1995)
- SURFACE SOIL (3-6") RI BACKGROUND REPORT (CMC, 1995)
- SHALLOW SOIL (0-6") ECOLOGIC RI REPORT (ARCADIS, 2001)

Gradient CORPORATION
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FIGURE 1

All 1995-2006 Sample Locations Used for Risk Assessment

Smelter/Tailings Soils Investigation Unit
Hurley, New Mexico

Drawing By:	RF	Checked By:	RLM	Project No.:	204013
Date:	06/11/07	Date:	06/11/07	File:	204013-100_10.mxd

Appendix A

Samples Used in HHRA

Appendix A
Samples Used in the HHRA Database

Medium	Exposure Area	Location ID	AOC Sample	Sample Depth (inches)	Sieve (µm)	Year Sampled	Report Source
soil	1	S64	U04-1098	0-1	250	2004	SRK, 2006
soil	1	S65	U04-1099	0-1	250	2004	SRK, 2006
soil	1	S66	U04-1100	0-1	250	2004	SRK, 2006
soil	1	S67	U04-1101	0-1	250	2004	SRK, 2006
soil	1	S68	U04-1102	0-1	250	2004	SRK, 2006
soil	1	S69	U04-1103	0-1	250	2004	SRK, 2006
soil	1	SS103	U04-1173	0-1	250	2006	SRK, 2006
soil	1	SS105	U04-1175	0-1	250	2006	SRK, 2006
soil	1	SS109	U04-1179	0-1	250	2006	SRK, 2006
soil	1	SS110	U04-1180	0-1	250	2006	SRK, 2006
soil	1	SS97	U04-1167	0-1	250	2006	SRK, 2006
soil	1	U05-4031	U05-4031	0-1	unsieved	1995	CMC, 1995
soil	2	S32	U04-1066	0-1	250	2004	SRK, 2006
soil	2	S33	U04-1067	0-1	250	2004	SRK, 2006
soil	2	S72	U04-1106	0-6	2000	2004	SRK, 2006
soil	2	S73	U04-1107	0-6	2000	2004	SRK, 2006
soil	2	S74	U04-1108	0-6	2000	2004	SRK, 2006
soil	2	S75	U04-1109	0-6	2000	2004	SRK, 2006
soil	2	S76	U04-1110	0-6	2000	2004	SRK, 2006
soil	2	S77	U04-1111	0-6	2000	2004	SRK, 2006
soil	2	S78	U04-1112	0-6	2000	2004	SRK, 2006
soil	2	S79	U04-1113	0-6	2000	2004	SRK, 2006
soil	2	SS126	U04-1200	0-1	250	2006	SRK, 2006
soil	2	SS133	U04-1209	0-1	250	2006	SRK, 2006
soil	2	SS136	U04-1212	0-1	250	2006	SRK, 2006
soil	2	SS140	U04-1216	0-1	250	2006	SRK, 2006
soil	2	SS144	U04-1220	0-1	250	2006	SRK, 2006
soil	2	SS147	U04-1223	0-1	250	2006	SRK, 2006
soil	2	SS151	U04-1227	0-1	250	2006	SRK, 2006
soil	2	SS152	U04-1228	0-1	250	2006	SRK, 2006
soil	2	SS153	U04-1229	0-1	250	2006	SRK, 2006
soil	2	U06-3001	U06-3001	0-1	unsieved	1995	CMC, 1995
soil	2	U06-3003	U06-3003	0-1	unsieved	1995	CMC, 1995
soil	2	ERA-14	U07-0194	0-6	2000	1999	Arcadis, 2001
soil	2	ERA-27	U07-0359	0-6	2000	1999	Arcadis, 2001
soil	3	S34	U04-1068	0-1	250	2004	SRK, 2006
soil	3	S53	U04-1087	0-1	250	2004	SRK, 2006
soil	3	S54	U04-1088	0-1	250	2004	SRK, 2006
soil	3	S55	U04-1089	0-1	250	2004	SRK, 2006
soil	3	S56	U04-1090	0-1	250	2004	SRK, 2006
soil	3	S57	U04-1091	0-1	250	2004	SRK, 2006
soil	3	S58	U04-1092	0-1	250	2004	SRK, 2006
soil	3	S80	U04-1114	0-6	2000	2004	SRK, 2006
soil	3	S81	U04-1115	0-6	2000	2004	SRK, 2006
soil	3	S82	U04-1116	0-6	2000	2004	SRK, 2006
soil	3	S83	U04-1117	0-6	2000	2004	SRK, 2006
soil	3	S84	U04-1118	0-6	2000	2004	SRK, 2006
soil	3	S85	U04-1119	0-6	2000	2004	SRK, 2006
soil	3	S86	U04-1120	0-6	2000	2004	SRK, 2006
soil	3	S87	U04-1121	0-6	2000	2004	SRK, 2006

Medium	Exposure Area	Location ID	AOC Sample	Sample Depth (inches)	Sieve (µm)	Year Sampled	Report Source
soil	3	S91	U04-1125	0-6	2000	2004	SRK, 2006
soil	3	S92	U04-1126	0-6	2000	2004	SRK, 2006
soil	3	S93	U04-1127	0-6	2000	2004	SRK, 2006
soil	3	SS121	U04-1193	0-1	250	2006	SRK, 2006
soil	3	SS124D	U04-1196	0-6	2000	2006	SRK, 2006
soil	3	SS124S	U04-1197	0-1	250	2006	SRK, 2006
soil	3	SS125D	U04-1198	0-6	2000	2006	SRK, 2006
soil	3	SS125S	U04-1199	0-1	250	2006	SRK, 2006
soil	3	SS127	U04-1201	0-1	250	2006	SRK, 2006
soil	3	SS128	U04-1202	0-1	250	2006	SRK, 2006
soil	3	SS129D	U04-1203	0-6	2000	2006	SRK, 2006
soil	3	SS129S	U04-1204	0-1	250	2006	SRK, 2006
soil	3	SS134	U04-1210	0-1	250	2006	SRK, 2006
soil	3	SS135	U04-1211	0-1	250	2006	SRK, 2006
soil	3	SS137	U04-1213	0-1	250	2006	SRK, 2006
soil	3	SS138	U04-1214	0-1	250	2006	SRK, 2006
soil	3	SS141	U04-1217	0-1	250	2006	SRK, 2006
soil	3	SS142	U04-1218	0-1	250	2006	SRK, 2006
soil	3	SS145	U04-1221	0-1	250	2006	SRK, 2006
soil	3	SS146	U04-1222	0-1	250	2006	SRK, 2006
soil	3	SS148	U04-1224	0-1	250	2006	SRK, 2006
soil	3	U04-1003	U04-1003	0-1	unsieved	1995	CMC, 1995
soil	3	U04-1010	U04-1010	0-1	unsieved	1995	CMC, 1995
soil	3	U04-1011	U04-1011	0-1	unsieved	1995	CMC, 1995
soil	3	U06-3007	U06-3007	0-1	unsieved	1995	CMC, 1995
soil	3	U06-3008	U06-3008	0-1	unsieved	1995	CMC, 1995
soil	3	U06-3009	U06-3009	1-6	unsieved	1995	CMC, 1995
soil	3	U06-3012	U06-3012	0-1	unsieved	1995	CMC, 1995
soil	3	U06-3013	U06-3013	0-1	unsieved	1995	CMC, 1995
soil	3	U06-3018	U06-3018	0-1	unsieved	1995	CMC, 1995
soil	3	U06-3019	U06-3019	1-6	unsieved	1995	CMC, 1995
soil	3	U06-3020	U06-3020	0-1	unsieved	1995	CMC, 1995
soil	3	ERA-02	U07-0041	0-6	2000	1999	Arcadis, 2001
soil	3	ERA-03	U07-0053	0-6	2000	1999	Arcadis, 2001
soil	3	ERA-04	U07-0066	0-6	2000	1999	Arcadis, 2001
soil	3	ERA-05	U07-0078	0-6	2000	1999	Arcadis, 2001
soil	3	ERA-07	U07-0104	0-6	2000	1999	Arcadis, 2001
soil	3	ERA-08	U07-0116	0-6	2000	1999	Arcadis, 2001
soil	3	ERA-23	U07-0307	0-6	2000	1999	Arcadis, 2001
soil	3	ERA-26	U07-0346	0-6	2000	1999	Arcadis, 2001
soil	4	ERA159D	U04-1235	0-6	2000	2006	SRK, 2006
soil	4	ERA160D	U04-1236	0-6	2000	2006	SRK, 2006
soil	4	S1	U04-1035	0-1	250	2004	SRK, 2006
soil	4	S10	U04-1044	0-1	250	2004	SRK, 2006
soil	4	S11	U04-1045	0-1	250	2004	SRK, 2006
soil	4	S12	U04-1046	0-1	250	2004	SRK, 2006
soil	4	S13	U04-1047	0-1	250	2004	SRK, 2006
soil	4	S14	U04-1048	0-1	250	2004	SRK, 2006
soil	4	S15	U04-1049	0-1	250	2004	SRK, 2006
soil	4	S16	U04-1050	0-1	250	2004	SRK, 2006
soil	4	S17	U04-1051	0-1	250	2004	SRK, 2006
soil	4	S18	U04-1052	0-1	250	2004	SRK, 2006
soil	4	S19	U04-1053	0-1	250	2004	SRK, 2006
soil	4	S2	U04-1036	0-1	250	2004	SRK, 2006

Medium	Exposure Area	Location ID	AOC Sample	Sample Depth (inches)	Sieve (µm)	Year Sampled	Report Source
soil	4	S20	U04-1054	0-1	250	2004	SRK, 2006
soil	4	S21	U04-1055	0-1	250	2004	SRK, 2006
soil	4	S22	U04-1056	0-1	250	2004	SRK, 2006
soil	4	S23	U04-1057	0-1	250	2004	SRK, 2006
soil	4	S24	U04-1058	0-1	250	2004	SRK, 2006
soil	4	S25	U04-1059	0-1	250	2004	SRK, 2006
soil	4	S26	U04-1060	0-1	250	2004	SRK, 2006
soil	4	S27	U04-1061	0-1	250	2004	SRK, 2006
soil	4	S28	U04-1062	0-1	250	2004	SRK, 2006
soil	4	S29	U04-1063	0-1	250	2004	SRK, 2006
soil	4	S3	U04-1037	0-1	250	2004	SRK, 2006
soil	4	S30	U04-1064	0-1	250	2004	SRK, 2006
soil	4	S31	U04-1065	0-1	250	2004	SRK, 2006
soil	4	S35	U04-1069	0-1	250	2004	SRK, 2006
soil	4	S36	U04-1070	0-1	250	2004	SRK, 2006
soil	4	S37	U04-1071	0-1	250	2004	SRK, 2006
soil	4	S38	U04-1072	0-1	250	2004	SRK, 2006
soil	4	S39	U04-1073	0-1	250	2004	SRK, 2006
soil	4	S4	U04-1038	0-1	250	2004	SRK, 2006
soil	4	S40	U04-1074	0-1	250	2004	SRK, 2006
soil	4	S41	U04-1075	0-1	250	2004	SRK, 2006
soil	4	S42	U04-1076	0-1	250	2004	SRK, 2006
soil	4	S43	U04-1077	0-1	250	2004	SRK, 2006
soil	4	S44	U04-1078	0-1	250	2004	SRK, 2006
soil	4	S45	U04-1079	0-1	250	2004	SRK, 2006
soil	4	S46	U04-1080	0-1	250	2004	SRK, 2006
soil	4	S47	U04-1081	0-1	250	2004	SRK, 2006
soil	4	S48	U04-1082	0-1	250	2004	SRK, 2006
soil	4	S49	U04-1083	0-1	250	2004	SRK, 2006
soil	4	S5	U04-1039	0-1	250	2004	SRK, 2006
soil	4	S50	U04-1084	0-1	250	2004	SRK, 2006
soil	4	S51	U04-1085	0-1	250	2004	SRK, 2006
soil	4	S52	U04-1086	0-1	250	2004	SRK, 2006
soil	4	S6	U04-1040	0-1	250	2004	SRK, 2006
soil	4	S7	U04-1041	0-1	250	2004	SRK, 2006
soil	4	S70	U04-1104	0-1	250	2004	SRK, 2006
soil	4	S71	U04-1105	0-1	250	2004	SRK, 2006
soil	4	S8	U04-1042	0-1	250	2004	SRK, 2006
soil	4	S9	U04-1043	0-1	250	2004	SRK, 2006
soil	4	SS115	U04-1185	0-1	250	2006	SRK, 2006
soil	4	SS116	U04-1186	0-1	250	2006	SRK, 2006
soil	4	SS117	U04-1187	0-1	250	2006	SRK, 2006
soil	4	U04-1001	U04-1001	0-1	unsieved	1995	CMC, 1995
soil	4	U04-1002	U04-1002	0-1	unsieved	1995	CMC, 1995
soil	4	U04-1004	U04-1004	0-1	unsieved	1995	CMC, 1995
soil	4	U04-1006	U04-1006	3-6	unsieved	1995	CMC, 1995
soil	4	U04-1008	U04-1008	0-1	unsieved	1995	CMC, 1995
soil	4	U04-1023	U04-1023	0-1	unsieved	1995	CMC, 1995
soil	4	U04-1024	U04-1024	0-1	unsieved	1995	CMC, 1995
soil	4	U04-1025	U04-1025	0-1	unsieved	1995	CMC, 1995
soil	4	U04-1027	U04-1027	3-6	unsieved	1995	CMC, 1995
soil	4	U04-1030	U04-1030	0-1	unsieved	1995	CMC, 1995
soil	4	U04-1031	U04-1031	0-1	unsieved	1995	CMC, 1995
soil	4	ERA-01	U07-0028	0-6	2000	1999	Arcadis, 2001

Medium	Exposure Area	Location ID	AOC Sample	Sample Depth (inches)	Sieve (µm)	Year Sampled	Report Source
soil	4	ERA-15	U07-0207	0-6	2000	1999	Arcadis, 2001
soil	4	ERA-22	U07-0294	0-6	2000	1999	Arcadis, 2001
soil	5	ERA164	U04-1240	0-1	250	2006	SRK, 2006
soil	5	ERA165	U04-1241	0-1	250	2006	SRK, 2006
soil	5	SS100	U04-1170	0-1	250	2006	SRK, 2006
soil	5	SS101	U04-1171	0-1	250	2006	SRK, 2006
soil	5	SS104	U04-1174	0-1	250	2006	SRK, 2006
soil	5	SS106	U04-1176	0-1	250	2006	SRK, 2006
soil	5	SS107	U04-1177	0-1	250	2006	SRK, 2006
soil	5	SS108	U04-1178	0-1	250	2006	SRK, 2006
soil	5	SS111	U04-1181	0-1	250	2006	SRK, 2006
soil	5	SS112	U04-1182	0-1	250	2006	SRK, 2006
soil	5	SS113	U04-1183	0-1	250	2006	SRK, 2006
soil	5	SS114	U04-1184	0-1	250	2006	SRK, 2006
soil	5	SS118D	U04-1188	0-6	2000	2006	SRK, 2006
soil	5	SS118S	U04-1189	0-1	250	2006	SRK, 2006
soil	5	SS119D	U04-1190	0-6	2000	2006	SRK, 2006
soil	5	SS119S	U04-1191	0-1	250	2006	SRK, 2006
soil	5	SS120	U04-1192	0-1	250	2006	SRK, 2006
soil	5	SS122	U04-1194	0-1	250	2006	SRK, 2006
soil	5	SS123	U04-1195	0-1	250	2006	SRK, 2006
soil	5	SS98	U04-1168	0-1	250	2006	SRK, 2006
soil	5	SS99	U04-1169	0-1	250	2006	SRK, 2006
soil	5	U04-1007	U04-1007	0-1	unsieved	1995	CMC, 1995
soil	5	U04-1009	U04-1009	0-1	unsieved	1995	CMC, 1995
soil	5	U04-1012	U04-1012	0-1	unsieved	1995	CMC, 1995
soil	5	U04-1013	U04-1013	0-1	unsieved	1995	CMC, 1995
soil	5	U04-1014	U04-1014	0-1	unsieved	1995	CMC, 1995
soil	5	U04-1017	U04-1017	0-1	unsieved	1995	CMC, 1995
soil	5	U04-1018	U04-1018	0-1	unsieved	1995	CMC, 1995
soil	5	U04-1020	U04-1020	0-1	unsieved	1995	CMC, 1995
soil	5	U04-1022	U04-1022	0-1	unsieved	1995	CMC, 1995
soil	5	ERA-06	U07-0091	0-6	2000	1999	Arcadis, 2001
soil	5	ERA-28	U07-0372	0-6	2000	1999	Arcadis, 2001
soil	5	S88	U04-1122	0-6	2000	2004	SRK, 2006
soil	5	S89	U04-1123	0-6	2000	2004	SRK, 2006
soil	5	S90	U04-1124	0-6	2000	2004	SRK, 2006
soil	5	S94	U04-1128	0-6	2000	2004	SRK, 2006
soil	5	S95	U04-1129	0-6	2000	2004	SRK, 2006
soil	5	S96	U04-1130	0-6	2000	2004	SRK, 2006
soil	5	SS130	U04-1205	0-1	250	2006	SRK, 2006
soil	5	SS131D	U04-1206	0-6	2000	2006	SRK, 2006
soil	5	SS131S	U04-1207	0-1	250	2006	SRK, 2006
soil	5	SS132	U04-1208	0-1	250	2006	SRK, 2006
soil	5	SS139	U04-1215	0-1	250	2006	SRK, 2006
soil	5	SS143	U04-1219	0-1	250	2006	SRK, 2006
soil	5	SS149	U04-1225	0-1	250	2006	SRK, 2006
soil	5	SS150	U04-1226	0-1	250	2006	SRK, 2006
soil	5	SS154	U04-1230	0-1	250	2006	SRK, 2006
soil	5	SS155	U04-1231	0-1	250	2006	SRK, 2006
soil	5	SS156	U04-1232	0-1	250	2006	SRK, 2006
soil	5	SS158	U04-1234	0-1	250	2006	SRK, 2006
soil	5	U04-1015	U04-1015	0-1	unsieved	1995	CMC, 1995
soil	5	U04-1016	U04-1016	0-1	unsieved	1995	CMC, 1995

Medium	Exposure Area	Location ID	AOC Sample	Sample Depth (inches)	Sieve (µm)	Year Sampled	Report Source
soil	5	U06-3022	U06-3022	0-1	unsieved	1995	CMC, 1995
soil	5	ERA-09	U07-0129	0-6	2000	1999	Arcadis, 2001
soil	5	ERA-10	U07-0142	0-6	2000	1999	Arcadis, 2001
soil	5	ERA-11	U07-0155	0-6	2000	1999	Arcadis, 2001
soil	5	ERA-12	U07-0168	0-6	2000	1999	Arcadis, 2001
soil	5	ERA-13	U07-0181	0-6	2000	1999	Arcadis, 2001
soil	5	ERA-24	U07-0320	0-6	2000	1999	Arcadis, 2001
soil	5	ERA-25	U07-0333	0-6	2000	1999	Arcadis, 2001
soil	REF	HR-01	U05-4001	0-1	unsieved	1995	CMC, 1995
soil	REF	HR-02	U05-4004	0-1	unsieved	1995	CMC, 1995
soil	REF	R-01	U06-3016	0-1	unsieved	1995	CMC, 1995
soil	REF	R-03	U06-3026	0-1	unsieved	1995	CMC, 1995
soil	REF	R-05	U06-3015	0-1	unsieved	1995	CMC, 1995
soil	REF	R-07	U06-3024	0-1	unsieved	1995	CMC, 1995
soil	REF	R-08	U06-3028	0-1	unsieved	1995	CMC, 1995
soil	REF	R-12	U06-3030	0-1	unsieved	1995	CMC, 1995
soil	REF	R-14	U06-3037	0-1	unsieved	1995	CMC, 1995
soil	Smelter	S59	U04-1093	0-1	250	2004	SRK, 2006
soil	Smelter	S60	U04-1094	0-1	250	2004	SRK, 2006
soil	Smelter	S61	U04-1095	0-1	250	2004	SRK, 2006
soil	Smelter	S62	U04-1096	0-1	250	2004	SRK, 2006
soil	Smelter	S63	U04-1097	0-1	250	2004	SRK, 2006
sediment	4	SED04	U04-1245	0-6	2000	2006	SRK, 2006
sediment	4	SED11	U04-1252	0-6	2000	2006	SRK, 2006
sediment	4	SWS-6	U04-1154	0-3	2000	2004	SRK, 2006
sediment	5	SED01	U04-1242	0-6	2000	2006	SRK, 2006
sediment	5	SED05	U04-1246	0-6	2000	2006	SRK, 2006
sediment	5	SED06	U04-1247	0-6	2000	2006	SRK, 2006
sediment	5	SED07	U04-1248	0-6	2000	2006	SRK, 2006
sediment	5	SED08	U04-1249	0-6	2000	2006	SRK, 2006
sediment	5	SED09	U04-1250	0-6	2000	2006	SRK, 2006
sediment	5	SWS-1	U04-1149	0-3	2000	2004	SRK, 2006
sediment	5	SWS-2	U04-1150	0-3	2000	2004	SRK, 2006
sediment	5	SWS-3	U04-1151	0-3	2000	2004	SRK, 2006
sediment	5	SWS-4	U04-1152	0-3	2000	2004	SRK, 2006
sediment	5	SWS-5	U04-1153	0-3	2000	2004	SRK, 2006

Medium	Exposure Area	Location ID	AOC Sample	Sample Depth (inches)	Sieve (µm)	Year Sampled	Report Source
water	4	SW04	U04-1256			2006	SRK, 2006
water	4	SW16	U04-1268			2006	SRK, 2006
water	4	SW-6	U04-1148			2004	SRK, 2006
water	5	SW01	U04-1253			2006	SRK, 2006
water	5	SW05	U04-1257			2006	SRK, 2006
water	5	SW06	U04-1258			2006	SRK, 2006
water	5	SW07	U04-1259			2006	SRK, 2006
water	5	SW08	U04-1260			2006	SRK, 2006
water	5	SW09	U04-1261			2006	SRK, 2006
water	5	SW-1	U04-1143			2004	SRK, 2006
water	5	SW11	U04-1263			2006	SRK, 2006
water	5	SW12	U04-1264			2006	SRK, 2006
water	5	SW13	U04-1265			2006	SRK, 2006
water	5	SW14	U04-1266			2006	SRK, 2006
water	5	SW15	U04-1267			2006	SRK, 2006
water	5	SW-2	U04-1144			2004	SRK, 2006
water	5	SW-3	U04-1145			2004	SRK, 2006
water	5	SW-4	U04-1146			2004	SRK, 2006
water	5	SW-5	U04-1147			2004	SRK, 2006

Appendix B

Evaluation of Data Usability

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B.1 Evaluation of the Usability of the 1995 U04 (Smelter), U05 (Hurley Soils), and U06 (Tailings) Data For Risk Assessment B-1

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B.4 Evaluation of the Usability of the Supplemental Sampling Data (SRK, 2006) for Risk Assessment B-14

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B.1 Evaluation of the Usability of the 1995 U04 (Smelter), U05 (Hurley Soils), and U06 (Tailings) Data For Risk Assessment

To determine the level of confidence associated with risk assessment decisions, the U.S. Environmental Protection Agency (US EPA) recommends that environmental data for risk assessments be assessed and interpreted based on six data usability criteria (US EPA, 1992): Reports to Risk Assessor, Documentation, Data Sources, Analytical Method and Detection Limit, Data Review, and Data Quality Indicators.

Golder Associates Inc. performed validation of the data consisting of a systematic review of the analytical results, associated quality control (QC) methods and results, and supporting data. Gradient evaluated the 1995 background data based only on a review of the available data validation reports, which were contained in Volume II of CMC's 1995 *Administrative Order in Consent, Investigation Area, RI Background Report, Chino Mine Investigation Area*: Appendix B-3, Data Validation, Smelter Investigation Unit; Appendix B-4, Data Validation, Hurley Soils Investigation Unit (two samples only; the majority of the Hurley soils unit was evaluated in a subsequent report); and Appendix B-5, Data Validation, Tailing Area Soils Investigation Unit (CMC, 1995). A data usability assessment was not formally performed for these data, although US EPA's general data usability criteria were evaluated by Golder during the validation process. Based on our review of the validation reports, overall, the U04, U05, and U06 data results may be considered usable for use in the risk assessment. Minor QC exceedances were noted during data validation as summarized in Table B-1.

Table B-1
Summary of Potential Biases and Imprecision Identified in the Chino Smelter/Tailings 1995 Background Report Data[1]

Parameter		Matrix	Analyte / Issue / Bias	Samples Affected	Reason	Data Used as Reported?
Smelter (U04)	IU	Soils	chromium / precision	(J) U04-1001 through U04-1016	Laboratory duplicate imprecision	Yes[2]
			copper / precision	(J) U04-1017, U04-1018, U04-1020, U04-1022; U04-1023 through U04-1027; U04-1030, U04-1031	Laboratory duplicate imprecision	Yes[2]
			arsenic / precision	(J) U04-1017, U04-1018, U04-1020, U04-1022; U04-1023 through U04-1027; U04-1030, U04-1031	Field duplicate imprecision	Yes[2]
Hurley (U05)	IU	Soil	arsenic / precision	(J) U05-4031, U05-4083 (background)	Laboratory duplicate imprecision	Yes[2]
			arsenic / accuracy / ~70% low bias	(J) U05-4031, U05-4083 (background)	Low matrix spike recovery	Yes[2]
			silver / accuracy / ~70% low bias	(UJ) U05-4031, U05-4083 (background)	Low matrix spike recovery	Yes[2]
			selenium / accuracy / ~67% low bias	(UJ) U05-4031, U05-4083 (background)	Low matrix spike recovery	Yes[2]
Tailings (U06)	IU	Soil	antimony / accuracy / ~39% high bias	(J) positive results	High matrix spike recovery	Yes[2]
			mercury / accuracy / low bias	(UJ) all results	Holding time exceedance	Yes[2]

Notes:
1) Information in table from Golder Associate's Data Validation Reports contained in Volume II of II (Appendices), Administrative Order in Consent, Investigation Area, RI Background Report, Chino Mine Investigation Area: Appendix B-3, Data Validation, Smelter Unit; Appendix B-4, Data Validation, Hurley Soils Investigation Unit; Appendix B-5, Data Validation, Tailing Area Soils Investigation Unit (CMC, 1995)
2) Magnitude of bias or imprecision does not affect data usability.

Based on the qualifiers applied during validation, results were considered usable or unusable for project decisions. Rejected results (qualified R) during data validation are considered to be unusable for project decisions; of the 618 results validated, 0 results (0%) were rejected (qualified R). Results that were estimated (qualified J or UJ) were considered usable for project decisions, with the caution that bias or imprecision might affect the accuracy and precision of the estimated results. All 1995 U04 (Smelter), U05 (Hurley Soils), and U06 (Tailings) data reported for are considered usable for the risk assessment, including 54 results (9%) qualified as estimated (J or UJ). Project completeness, calculated as

$$\frac{\text{total number of results} - \text{unusable results -}}{\text{total number of results}} \times 100$$

easily met the defined project criterion of 80% for the background data sets (URS, 2000b); completeness was 100%.

B.2 Evaluation of the Usability of the 1999 Ecological Risk Assessment (ERA) Soil Data for Risk Assessment

Data Usability in Context of Data Quality/Data Validation

US EPA's (1992) recommended data usability criteria (Reports to Risk Assessor, Documentation, Data Sources, Analytical Method and Detection Limit, Data Review, and Data Quality Indicators) were evaluated by URS in the Chino Mines Smelter/Tailings Data Validation and Data Quality Assessment reports for the 1999 Ecological Risk Assessment (ERA) soil samples (URS, 2000).

URS performed an in-depth data validation consisting of a systematic review of the analytical results, associated quality control (QC) methods and results, and supporting data. Data were reviewed according to procedures defined in US EPA's National Functional Guidelines for Inorganic Data Review (US EPA, 1994). During validation, URS evaluated laboratory performance criteria on a minimum of 10% of the data set per analysis type. This included a review of the following QC parameters/laboratory QC check samples: initial and continuing calibration procedures and results, Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) recovery results, Contract Required Detection Limit (CRDL) standard results, laboratory control sample (LCS) results, and sample result quantitation/verification. One (1) Sample Delivery Group (SDG) was selected from a total of the four (4) SDGs reported and were reviewed for the indicated laboratory performance parameters.[2]

The data validation also incorporated a sample-specific QC criteria evaluation for 100% of the samples in all SDGs, including the following items/parameters: Chain-of-Custody (COC) and sample receipt documentation, sample holding times, method and calibration blank contamination, matrix interferences, laboratory duplicate sample analyses, matrix spike/matrix spike duplicate (MS/MSD)

[2] Gradient recommends that the Laboratory Performance Evaluation be performed for <u>each</u> SDG validated, especially if significant laboratory-derived exceedances are identified. If an in-depth validation is not feasible, this evaluation can be performed by solely reviewing reporting forms that summarize the quality control (QC) sample results, such as initial and continuing calibration verifications (ICV and CCV results), LCS, CRDL standards, ICS results, *etc.* It is not essential that the raw data for these QC samples be reviewed, but a more in-depth review should be performed if gross exceedances are observed, as indicated in the Quality Assurance Project Plan (QAPP). Such a review is important because not all sample analyses may have been performed within the same batch or on the same day, and it is possible that instrument or analytical variances may occur from one day (and occasionally from one analysis) to the next. The effort to review and qualify samples based upon laboratory performance should not increase the data validation effort significantly.

recoveries, serial dilution results, post-digestion spike results, and Method of Standard Addition (MSA) results. Data results were flagged with the appropriate validation qualifiers if Quality Assurance/Quality Control (QA/QC) exceedances were identified during the data validation review.

When the validation of all data was complete, the qualified ERA sample results were collectively assessed by URS in the context of use in the risk assessment for overall precision, accuracy, representativeness, comparability, completeness, and reporting limits/sensitivity. The results of this evaluation were summarized in URS' Data Quality Assessment Report (URS, 2000). Based on the qualifiers applied during validation, results were considered usable or unusable for project decisions. Results that were estimated (qualified J or UJ) were considered usable for project decisions, with the caution that bias or imprecision might affect the accuracy and precision of the estimated results. Of the 398 results validated and evaluated for use in the risk assessment, only 20 results (5%) were rejected (qualified R) and considered unusable for project objectives due to very low matrix spike recoveries. All other metals data reported are considered usable for the risk assessment, including 76 results (19%) qualified as estimated (J or UJ). Project completeness easily met the defined project criterion of 80% for both the ecological and human health risk assessment data sets (URS, 2000b); completeness was 95% for the ERA data evaluation.

Usability of Data in Context of Risk Assessment

In the remainder of this section, we present the key findings from URS' Data Quality Assessment Report (URS, 2000) with respect to the usability of the data for risk assessment purposes. During the data quality assessment, URS evaluated and summarized the various data validation exceedances in terms of bias and precision, and the potential affect of the bias/imprecision on the use of the data in the risk assessment. As stated previously, overall, the data may be used in the risk assessment as reported. With the exception of the rejected antimony results (discussed below), the data were found to be of sufficient quality to meet project objectives. There were no data validation or data quality issues that would seriously limit the RA.

Rejected Antimony Results

A total of 20 of the 22 antimony results (91%) considered for use in the RA were rejected (qualified R) and considered unusable during data validation due to very low MS/MSD recoveries. The results will not be used to calculate exposure point concentrations for Smelter/Tailing Soils IU (S/TSIU) Human Health Risk Assessment (HHRA).

Antimony Reporting Limit

According to URS, the ERA soil sample antimony reporting limit of 0.05 mg/kg exceeded the required reporting limit (RL) of 0.01 mg/kg. Most of the antimony results were rejected due to very low MS recoveries. However, one (1) usable nondetected ERA soil result satisfies human health screening criteria because the reporting limit that was achieved is below the screening criterion of 31.3 mg/kg. Therefore, the elevated reporting limit for antimony does not affect the usability of the data for comparison to screening criteria.

Arsenic Reporting Limit

According to URS, the ERA soil sample arsenic reporting limit of 0.30 mg/kg exceeded the required reporting limit (RL) of 0.05 mg/kg. The majority of the nondetected ERA soil results satisfy screening criteria because the reporting limit that was achieved is below the human health screening criterion (Region 9 PRG) of 0.39 mg/kg. However, numerous arsenic results that were qualified (U) due to blank contamination (ERA-01, ERA-02, ERA-03, ERA-05, ERA-06, ERA-07, ERA-08, ERA-11, ERA-12, ERA-15, ERA-23, ERA-26), and the raised detection limits for several samples, exceed the arsenic PRG of 0.39 mg/kg. The elevated reporting limit for arsenic does not affect the usability of the data for risk assessment, and the data are considered useable.

Summary of Bias and Imprecision

Table B-2 summarizes the various QA/QC exceedances and associated potential bias/imprecision identified by URS in the Data Quality Assessment report (URS, 2000). Overall, the reported bias/imprecision does not affect the usability of the data, and the results may be used "as-is" in the risk assessment.

Table B-2
Summary of Potential Biases and Imprecision Identified in the 1999 Chino Smelter/Tailings Ecological Risk Assessment (ERA) Data Usability Assessment[1]

Parameter	Matrix	Analyte / Issue / Bias	Sample Qualified	Reason for Result Qualification	Data Used as Reported?
Ecological Risk Assessment (ERA) Evaluation	Soil	arsenic / accuracy / ~40% low bias	(J, UJ) all except ERA-13, ERA-14, ERA-25, ERA-27, ERA-28	Low MS/post digestion spike recoveries	Yes[3]
		arsenic / accuracy / high bias	(U) ERA-01 through ERA-04; ERA-06 through ERA-12; ERA-15, ERA-23, ERA-25, ERA-26	Blank contamination	Yes, but some nondetected results exceed screening criterion of 0.39 mg/Kg; conflicting low/high bias
		arsenic / unknown bias[2]	(J) ERA-05[2]	Unknown[2]	Yes[2]
		selenium / accuracy / 34% low bias	(J, UJ) all except ERA-13, ERA-14, ERA-25, ERA-27, ERA-28	Low MS recovery and post-digestion spike recovery exceedances	Yes[3]
		lead / accuracy / 44% high bias	(J) ERA-27, ERA-28	High MS recovery	Yes[3]
		vanadium /accuracy /low bias	(J) ERA-27, ERA-28	Matrix suppression evident in serial dilution results	Yes[3]
		boron / accuracy / low bias	(J) ERA-01, ERA-02, ERA-03, ERA-06, ERA-07, ERA-08, ERA-09, ERA-11, ERA-12, ERA-14, ERA-15, ERA-22, ERA-24, ERA-26	Matrix suppression evident in Interference Check Sample results	Yes[3]

Notes:
1) Information in table derived from URS' Final Data Validation Report for Soil and Resultant SPLP Leachate Samples, December 7, 2000 (URS, 2000). Refer to the validation report for specific details regarding validation actions applied.
2) Duplicate arsenic results were present in the database for ERA-05. Gradient therefore chose to use the maximum arsenic concentration (1.1 J) in lieu of the validated result (0.73 UJ) reported by URS in their data validation report (2000).
3) Magnitude of bias does not affect data usability.

B.3 Evaluation of the Usability of the RI Data (SRK, 2005) for Risk Assessment

Overall, as discussed in more detail below, Gradient has determined that the RI data from SRK (2005) are usable for the purpose of the Smelter/Tailing Soils IU HHRA.

Data Usability in Context of Data Quality/Data Validation

Data usability criteria were evaluated by URS as described in Section B.2.1 and were summarized in the Chino Mines Smelter/Tailings Data Validation and Data Quality Assessment reports for soil, sediment, and surface water samples (URS, 2005a,b).

As with the 1999 data set, URS evaluated laboratory performance criteria on a minimum of 10% of the data set per analysis type. Three (3) Sample Delivery Groups (SDGs) (one each of soil, sediment, and surface water) were selected from a total of the 14 SDGs reported and were reviewed for the indicated laboratory performance parameters.[3] URS' data validation procedures also incorporated a sample-specific QC criteria evaluation for 100% of the samples in all SDGs. Data results were flagged with the appropriate validation qualifiers if Quality Assurance/Quality Control (QA/QC) exceedances were identified during the data validation review.

When the validation of all data was complete, the qualified sample results were collectively assessed by URS in the context of use in the risk assessment for overall precision, accuracy, representativeness, comparability, completeness, and reporting limits/sensitivity. The results of this evaluation were summarized in URS' Data Quality Assessment Report (URS, 2005b). Based on the qualifiers applied during validation, results were considered usable or unusable for project decisions. Only results that were rejected (qualified R) during data validation were considered unusable. Results that were estimated (qualified J or UJ) were considered usable for project decisions, with the caution that bias or imprecision might affect the accuracy and precision of the estimated results. Of the 3,806 results

[3] Gradient recommends that the Laboratory Performance Evaluation be performed for <u>each</u> SDG validated, especially if significant laboratory-derived exceedances are identified. If an in-depth validation is not feasible, this evaluation can be performed by solely reviewing reporting forms that summarize the quality control (QC) sample results, such as initial and continuing calibration verifications (ICV and CCV results), LCS, CRDL standards, ICS results, *etc.* It is not essential that the raw data for these QC samples be reviewed, but a more in-depth review should be performed if gross exceedances are observed, as indicated in the QAPP. Such a review is important because not all sample analyses may be performed within the same batch or on the same day, and it is possible that instrument or analytical variances may occur from one day (and occasionally from one analysis) to the next. The effort to review and qualify samples based upon laboratory performance should not increase the data validation effort significantly.

validated, only 69 results (2%) were rejected (qualified R) and considered unusable for project objectives due to very low MS/MSD recoveries. Of the 1050 human health soil and sediment results validated, 16 results (2%) were rejected (qualified R) and considered unusable. Of the 2,325 ecological soil and sediment results validated, only 53 results (2%) were rejected (qualified R) and considered unusable for project objectives due to very low MS/MSD recoveries. All other metals data reported are considered usable for the risk assessment. Project completeness met the defined project criterion of 80% for both the ecological and human health risk assessment data sets (URS, 2005b); completeness was 98% for the overall Smelter/Tailings program. By program, completeness was 98% for the human health data evaluation, and 98% for the ecological data evaluation.

It should be noted that metals results for one sample were missing from the project database (sediment sample "D Drainage #2"), and another sample should have been excluded from the database due to a sampling error (sediment sample "A Drainage"); the project database was accordingly revised by Gradient. In addition, Gradient revised numerous data validation qualifiers in the database based on a review of the data validation reports against the project database. The revisions performed by Gradient are summarized in Table B-3, below.

Table B-3
Chino Smelter/Tailings RI Data Results Requiring Database Revision based on Gradient's Review[1]

SVL Analytical Data Package Number[2]	Laboratory ID	Sample ID	Analyte	Qualifier change	Reason for Qualifier Change
114732	S429377	D DRAINAGE #2	All	Not applicable	Sample appears to be missing from database. Added to database based on communication with SRK.
114556	S42756	S72	Sodium	UJ	Not qualified (J) on Form I but should have been qualified (J) due to serial dilution exceedance code (SD-I) annotated on lab Form I ; all other affected sodium results were estimated in this SDG.
114558	S427658	A DRAINAGE	All	Not applicable	Sample removed from database; not to be included in risk assessment as per SRK.
114561	S427685	S37	Silver	U	Validation report page 5-43 lists this sample result as being qualified (U) although no hand-annotation was made on lab Form I.
114563	S427719	S58	Sodium	UJ	According to validation report page 6-2, all human health soil sodium results except S60 and S62 should be qualified (U) due to rinsate blank contamination.
114565	S427744	S81	Arsenic	J/UJ	All arsenic results reported in data package 114565 should be estimated (J/UJ) due to low MS recoveries based on validation code MS-L (low MS recovery) per page 5-21 of the validation report; result not hand-annotated (J) on lab Form I however.
114733	S429391	SWS-3	Manganese	J	Coded MS-L due to low MS recoveries; and hand-annotated (J) on Form I.
114733	S429397	SWS-4	Sodium	UJ	Sodium result should also be qualified (U) according to validation report text on page 5-15; result was not hand-annotated (U) on lab Form I.
114724	W429252	SW-6	Silver	U	Coded U-MB due to Method Blank contamination; result was hand-annotated (U) on lab Form I. Result should be qualified (U).

Notes:
1) Information in Table B-3 derived from URS (2005a,b).
2) SVL Analytical laboratory performed the analyses of the RI data.

Usability of Data in Context of Risk Assessment

The key findings from URS' RI data quality assessment report (URS, 2005b) with respect to the usability of the data for risk assessment purposes are described below. During the data quality assessment, URS evaluated and summarized the various data validation exceedances in terms of bias and precision, and the potential affect of the bias/imprecision on the use of the data in the risk assessment. As stated previously, overall, the data may be used in the risk assessment as reported. With the exception of the rejected antimony results (discussed below), the data were found to be of sufficient quality to meet project objectives. There were no data validation or data quality issues that seriously limit the use of the data for risk assessment.

Rejected Antimony Results

A total of 69 antimony soil and sediment results (of a total of 135 reported antimony results) were rejected (qualified R) and considered unusable during data validation due to very low MS/MSD recoveries. The results will not be used to calculate exposure point concentrations for the S/TSIU HHRA. However, as summarized in the Data Quality Assessment Report (URS, 2005), the valid antimony results were considered sufficient to characterize the site for assessment of potential human health risk, although the validators indicate that there is an approximate 70% low bias imposed on the data set due to the low matrix spike recoveries. Because the useable antimony results were at least a factor of 15 times lower than the residential screening criterion, the magnitude of the potential low bias in the antimony results does not affect the usability of the results for comparison to screening criteria (the US EPA Region 9 PRG). Since all usable antimony results were significantly less than the soil screening criteria, and the sample locations for the rejected samples were not in areas predicted to have the highest concentrations from smelter emissions deposition, the rejected results do not result in a critical data gap.

Antimony Reporting Limit

According to URS, the soil and sediment sample antimony reporting limit of 0.76 mg/kg exceeded the required reporting limit (RL) of 0.30 mg/kg. However, all usable nondetected human health soil results satisfy the human health screening criteria specified because the reporting limit that was achieved is below the human health criteria (31.3 mg/kg) for soil contact pathways. Nondetected human health sediment results also satisfy the human health screening criteria (31.3 mg/kg) because the reporting limit achieved is below the screening criterion. Therefore, the elevated reporting limit for antimony does not affect the usability of the data for comparing to the human health decision criteria for the evaluated pathways.

Selenium Reporting Limit

According to URS' evaluation, the soil and sediment selenium reporting limit of 0.160 mg/kg exceeded the required reporting limit of 0.01 mg/kg. Although selenium was nondetected in many of the human health soil and sediment samples, the human health selenium soil results reported as nondetect at an elevated reporting limit satisfy the human health screening criteria as the reporting limit achieved was below the criteria (EPA Region 9 PRG for selenium for residential soil is 391 mg/kg). The human health selenium sediment results reported as nondetect at an elevated reporting limit also satisfy the human health screening criteria as the reporting limit achieved was below the associated criterion (391 mg/kg).

Therefore, the elevated reporting limit for selenium does not affect the usability of the data for comparing to the human health decision criteria for the pathways evaluated.

Summary of Bias and Imprecision

Table B-4 summarizes the various QA/QC exceedances and associated potential bias/imprecision identified by URS in the Data Quality Assessment report (URS, 2005b). Overall, the reported bias/imprecision does not affect the usability of the data, and the results may be used "as-is" in the risk assessment.

Table B-4
Summary of Potential Biases and Imprecision Identified in the 2005 Chino Smelter/Tailings RI Data Usability Assessment[1]

Parameter	Matrix	Analyte / Issue / Bias	Samples Qualified	Reason for Result Qualification	Data Used as Reported?
Ecological Evaluation	Soils	arsenic / accuracy / 48% low bias	(J, UJ) S78, S77, S75, S289, S94, S284	Low matrix spike/post digestion spike recoveries	Yes[2]
		cadmium / accuracy / 39% low bias	(J, UJ) all Ecological Soils	Low matrix spike recovery and post-digestion spike recovery exceedances	Yes[2]
		manganese / accuracy / 13% high bias	(J) all ecological soils	High matrix spike recovery	Yes[2]
		antimony / accuracy / 70% low bias	(J, UJ) all ecological soils	Low matrix spike recoveries	Yes[2]
		sodium / accuracy / ±20% bias	(J) all ecological soils	High/low serial dilution analysis results	Yes[2]
		molybdenum / accuracy / up to 41% high bias	(J) all ecological soils	High serial dilution analysis results	Yes[2]
		lead / accuracy / up to 232% high bias	(J) all ecological soils	High Contract Required Detection Limit standard recovery	Yes[2]
	Sediment	antimony / accuracy / 33% low bias	(J) all ecological sediments	Low matrix spike recoveries	Yes[2]
		manganese / accuracy & precision / 55% low bias; 58% imprecision	(J, UJ) all ecological sediments	Low matrix spike/lab dup imprecision	Yes[2]
		sodium / accuracy / 11% high bias	(J) all ecological sediments	Serial dilution results	Yes[2]
		selenium / accuracy / 10% high bias	(J) associated sediment samples	Post-digestion spike recoveries	Yes[2]
Human Health Evaluation	Soils	arsenic / accuracy / 24% low bias	(J, UJ) S29, S68, S66, S4	Post-digestion spike recoveries and low matrix spike recovery	Yes[2]
		selenium / accuracy / up to 26% low bias	(J, UJ) all human health soils	Low post-digestion spike and matrix spike recoveries	Yes[2]
		antimony / accuracy / 69% low bias	(J, UJ) all human health Soils	Low matrix spike recoveries	Yes[2]
		sodium / accuracy / 21% low bias	(J, UJ) all human health Soils	Serial dilution results	Yes[2]
		molybdenum / accuracy / 14% low bias	(J, UJ) all human health Soils	Serial dilution results	Yes[2]
		nickel / accuracy / low and high bias	(J, UJ) S53, S4, S49 (low bias); (J) S245, S44 (high bias)	Interference check sample results	Yes[2]
		thallium / accuracy / low bias	(J, UJ) S53, S4, S59, S49, S60	Interference check sample results	Yes[2]
		silver / accuracy / low bias	(J, UJ) S53, S4, S49	Interference check sample results	Yes[2]

Parameter	Matrix	Analyte / Issue / Bias	Samples Qualified	Reason for Result Qualification	Data Used as Reported?
	Sediments	arsenic / accuracy / 49% low bias	(J, UJ) all human health sediments	Low matrix spike recovery	Yes[2]
		selenium / precision / ± 44% uncertainty	(J, UJ) all human health sediments	Post-digestion spike recoveries	Yes[2]
		copper / accuracy / 26.5% high bias	(J) all human health sediments	High matrix spike recovery	Yes[2]
		molybdenum / accuracy / 33% low bias	(J, UJ) all human health sediments	Low matrix spike recovery	Yes[2]
Water Samples	Water Samples	thallium / accuracy / 9% low bias	(J, UJ) all water samples	Low post-digestion spike recovery	Yes[2]
		vanadium / low bias	(J, UJ) CDW-1, SW-3, BD4W-1, SW-5(DIS), CDW-1 (DIS), SW-3 (DIS), BD4W-1 (DIS), SW-1 (DIS), SW-4 (DIS), SW-2 (DIS), SW-204 (DIS)	Negative blank concentrations indicative of a low bias of up to 0.5 µg/L	Yes, however if Gradient performed validation, we would have considered these results estimated (J and UJ) due to the negative blank concentrations. Magnitude of low bias does not affect usability since there is no criterion for vanadium.
		selenium / accuracy / low bias	(J, UJ) SW-1, SW-4, SW-2, SW-204, SW-5(DIS), CDW-1, SW-3(DIS), BD4W-1(DIS), SW-6(DIS), SW-1(DIS), SW-4(DIS), SW-2(DIS), SW-204(DIS)	Negative blank concentrations indicative of a low bias of up to 10.3µg/L	Yes, however, if Gradient performed validation, we would have considered these results estimated (J and UJ) due to the negative blank concentrations. Magnitude of low bias does not affect usability.

Notes: *1) Information in Table B-4 derived from "Data Quality Assessment Report for the Smelter/Tailing Soils Investigation, Prepared by URS, Denver, Colorado". May 18, 2005*
2) Magnitude of bias or imprecision does not affected data usability.

B.4 Evaluation of the Usability of the Supplemental Sampling Data (SRK, 2006) for Risk Assessment

Data Usability in Context of Data Quality/Data Validation

Overall, as discussed in more detail below, Gradient has determined that the Supplemental Sampling data from SRK (2006) are usable for the purpose of the Smelter/Tailing Soils IU HHRA.

Data usability criteria were evaluated by URS as described in Section B.2.1 and were summarized in the Chino Mines Smelter/Tailings Data Validation and Data Quality Assessment reports for soil, sediment, and surface water samples (URS, 2006a,b).

As with the 1999 and 2005 data sets, URS evaluated laboratory performance criteria on a minimum of 10% of the data set per analysis type. Two (2) SDGs (one each of soil and sediment) were selected from a total of the 13 SDGs reported and were reviewed for the indicated laboratory performance parameters.[3] URS' data validation procedures also incorporated a sample-specific QC criteria evaluation for 100% of the samples in all SDGs. Data results were flagged with the appropriate validation qualifiers if QA/QC exceedances were identified during the data validation review.

When the validation of all data was complete, the qualified sample results were collectively assessed by URS in the context of use in the risk assessment for overall precision, accuracy, representativeness, comparability, completeness, and reporting limits/sensitivity. The results of this evaluation were summarized in URS' Data Quality Assessment Report (URS, 2006b). Based on the qualifiers applied during validation, results were considered usable or unusable for project decisions. Only results that were rejected (qualified R) during data validation were considered unusable. Results that were estimated (qualified J or UJ) were considered usable for project decisions, with the caution that bias or imprecision might affect the accuracy and precision of the estimated results.

[3] Gradient recommends that the Laboratory Performance Evaluation be performed for each SDG validated, especially if significant laboratory-derived exceedances are identified. If an in-depth validation is not feasible, this evaluation can be performed by solely reviewing reporting forms that summarize the quality control (QC) sample results, such as initial and continuing calibration verifications (ICV and CCV results), LCS, CRDL standards, ICS results, *etc.* It is not essential that the raw data for these QC samples be reviewed, but a more in-depth review should be performed if gross exceedances are observed, as indicated in the QAPP. Such a review is important because not all sample analyses may be performed within the same batch or on the same day, and it is possible that instrument or analytical variances may occur from one day (and occasionally from one analysis) to the next. The effort to review and qualify samples based upon laboratory performance should not increase the data validation effort significantly.

Of the 3,875 soil, sediment, and surface water results validated, only 1 soil result (0.026%) was rejected (qualified R) and considered unusable for project objectives. All other metals data reported are considered usable for the risk assessment. Therefore, overall completeness was 99.98% for the Supplemental Sampling Smelter/Tailings program, easily meeting the defined project criterion of 80% for the ecological and human health risk assessment data sets (URS, 2006b). By program, 1,890 human health soil and sediment results were validated; 1 soil sample result (0.05%) was rejected and considered unusable. Of the 648 ecological soil and sediment results validated, no results were rejected and considered unusable. Of the 1,337 human health and ecological surface water results validated, no results were rejected. By program, completeness was 99.95% for the human health data soil and sediment evaluation, 100% for the soil and sediment ecological data evaluation, and 100% for the human health and ecological surface water program.

It should be noted twelve (12) rinsate blanks were collected during the Supplemental Sampling program that were inadvertently evaluated as surface water samples during data validation and assessment. Thus, the surface water data usability summary statistics presented in URS' data usability report (URS, 2006b) erroneously include rinsate blank data and qualifiers (rinsate blanks are typically not validated and are usually excluded from usability evaluations). In addition, metals concentrations and ranges reported for these rinsate blanks were incorrectly considered and compared to water criteria in the data usability report. Since overall data usability is not affected, no actions were taken except to note this.

Usability of Data in Context of Risk Assessment

The key findings from the URS RI data quality assessment report (URS, 2006b) with respect to the usability of the data for risk assessment purposes are described below. During the data quality assessment, URS evaluated and summarized the various data validation exceedances in terms of bias and precision, and the potential affect of the bias/imprecision on the use of the data in the risk assessment. As stated previously, overall, the data may be used in the risk assessment as reported. With the exception of the single rejected selenium result (discussed below), the data were found to be of sufficient quality to meet project objectives. There were no data validation or data quality issues that seriously limit the use of the data for risk assessment.

Rejected Selenium Result

A single selenium result was rejected in soil sample SS136 due to very low MS recoveries. The result will not be used to calculate exposure point concentrations for the Smelter Tailings Soils HHRA.

Antimony Reporting Limit

According to URS, the antimony reporting limit of 0.58 mg/kg exceeded the project-required reporting limit of 0.30 mg/kg. This does not affect data usability, since the Human Health Medium-Specific Screening Level is 31 mg/kg.

Selenium Reporting Limit

According to URS, the selenium reporting limit of 0.02 mg/kg exceeded the project-required reporting limit of 0.01 mg/kg. Selenium was reported as detected in 77 of the soil and sediment samples so the elevated reporting limit does not affect the usability of the data for those samples. Selenium for 19 of the soil and sediment samples was reported as nondetected; since the Human Health Medium-Specific Screening Level is 391 mg/kg, selenium usability is not affected in these samples.

Molybdenum Reporting Limit

According to URS, molybdenum reporting limit of 0.09 mg/kg exceeded the project-required reporting limit of 0.01 mg/kg. Since molybdenum was reported detected in all soil and sediment samples, the elevated reporting limit does not affect overall usability for molybdenum.

Summary of Bias and Imprecision

Table B-5 summarizes the various QA/QC exceedances and associated potential bias/imprecision identified by URS in the Data Quality Assessment report (URS, 2006b). Overall, the reported bias/imprecision does not affect the usability of the data, and the results may be used "as-is" in the risk assessment.

Table B-5
Summary of Potential Biases and Imprecision Identified in the 2006 Supplemental Sampling Smelter/Tailings RI Data Usability Assessment[1]

Parameter	Matrix	Analyte / Issue / Bias	Samples Qualified	Reason for Result Qualification	Data Used as Reported?
Ecological Evaluation	Soils and Sediments	antimony / accuracy / up to 55% low bias	(J, UJ) associated samples	Low matrix spike recoveries	Yes[2]
		arsenic / accuracy / ±35% conflicting bias	(J, UJ) associated samples	Low/high matrix spike recoveries	Yes[2]
		cadmium / accuracy / conflicting 30% high bias, low bias	(J) associated samples	High matrix spike recoveries (high bias); serial dilution results (low bias)	Yes[2]
		calcium / accuracy / conflicting 30% high bias, low bias	(J, UJ) associated samples	High matrix spike recoveries (high bias); serial dilution results (low bias)	Yes[2]
		chromium, cobalt, nickel, zinc / accuracy / low bias	(J, UJ) associated samples	Serial dilution analysis results	Yes[2]
		copper / accuracy / up to 42% high bias	(J) associated samples	High matrix spike recoveries	Yes[2]
		magnesium / accuracy / up to 42% high bias	(J) associated samples	High matrix spike recoveries	Yes[2]
		selenium/ accuracy / conflicting high/low bias	(J, UJ) associated samples	High matrix spike recoveries, high post-digestion spike recovery (high bias); negative blank concentrations (low bias)	Yes[2]
Human Health Evaluation	Soils and Sediments	antimony / accuracy / up to 55% low bias	(J, UJ) associated samples	Interference check results and low matrix spike recovery	Yes[2]
		aluminum, cobalt, chromium, copper, iron, lead, molybdenum, nickel, vanadium, zinc / accuracy / low bias	(J, UJ) associated samples	Serial dilution results	Yes[2]
		barium / accuracy / up to 33.5% high bias	(J) associated samples	High matrix spike recoveries	Yes[2]
		calcium / accuracy / up to 44% high bias	(J) associated samples	High matrix spike recoveries	Yes[2]
		magnesium/ accuracy / up to 39% high bias	(J) associated samples	High matrix spike recoveries	Yes[2]
		potassium/ accuracy /conflicting high and low bias	(J, UJ) associated samples	High matrix spike recoveries (high bias); serial dilution results (low bias)	Yes[2]
		selenium/ accuracy / up to 44% low bias	(J, UJ) associated samples	Low matrix spike recoveries; low post-digestion spike recoveries; negative blank concentrations	Yes[2]

Parameter	Matrix	Analyte / Issue / Bias	Samples Qualified	Reason for Result Qualification	Data Used as Reported?
		silver, thallium / accuracy / low bias	(J, UJ) associated samples	Interference check sample results	Yes[2]
Human Health/Ecological	Surface Waters	aluminum, boron, cobalt, manganese, potassium/ accuracy / low bias	(J, UJ) associated samples	Negative blank concentrations	Yes[2]
		arsenic / accuracy/ 81% low bias	(UJ) associated nondetects	Low CRDL standard recovery	Yes[2]

Notes: 1) Information in Table B-5 derived from "Data Quality Assessment Report for the Supplemental Sampling Smelter/Tailing RI, Prepared by URS, Denver, Colorado". December 8, 2006.
2) Magnitude of bias or imprecision does not affected data usability.

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Appendix C

EPC Calculations

EPC Summary

Exposure Area	Pathway	Receptor	Sample Depth	Sieve (µm)	N*	Exposure Point Concentration (mg/kg) Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
1	Ingestion Dermal Contact Inhalation	Rancher Recreator Future Resident Construction Worker	0-1"	250 µm	11	2.9	1.5	746	25137	0.4	55.3
1	Vegetable Ingestion	Future Resident	0-1"	Unsieved	1	**2.0**	**1.0**	**254**	**24000**	**2.0**	**61.1**
1	Chicken/Eggs/Beef Ingestion	Future Resident	0-1"	Unsieved	1	**2.0**	**1.0**	**254**	**24000**	**2.0**	**61.1**
2	Ingestion Dermal Contact Inhalation	Current Residents Future Resident Construction Worker Rancher Recreator	0-1"	250 µm	11	2.9	1.3	1519	25167	**0.6**	44.8
2	Vegetable Ingestion	Current Residents Future Resident	0-6"	2000 µm	10	2.0	1.1	906	14180	0.9	17.5
2	Chicken/Eggs/Beef Ingestion	Current Residents Future Residents	0-1"	Unsieved	2	**3.3**	**0.9**	**709**	**19100**	**6.2**	**32.5**
3	Ingestion Dermal Contact Inhalation	Future Resident Construction Worker Trespasser	0-1"	250 µm	22	6.2	28.4	1907	57203	0.7	31.6
3	Vegetable Ingestion	Future Resident	0-6" 1-6"	2000 µm Unsieved	24	1.7	1.1	699	24462	5.9	22.4
3	Chicken/Eggs/Beef Ingestion	Future Resident	0-1"	Unsieved	9	3.2	23.6	1213	57203	0.7	31.6
4	Ingestion Dermal Contact Inhalation	Future Resident Construction Worker Trespasser	0-1"	250 µm	54	4.9	4.1	4861	23163	0.5	29.2
4	Vegetable Ingestion		0-6" 3-6"	2000 µm Unsieved	7	3.2	**4.2**	2718	32872	**0.2**	44.5
4	Chicken/Eggs/Beef Ingestion	Chicken/Eggs/Beef Uptake	0-1"	Unsieved	9	4.0	3.1	3274	23163	0.5	29.2
5	Ingestion Dermal Contact Inhalation	Future Resident Construction Worker Rancher Recreator	0-1"	250 µm	30	2.1	0.5	448	26629	0.3	59.6
5	Vegetable Ingestion	Vegetable Uptake	0-6"	2000 µm	18	1.7	1.2	495	17142	0.3	22.3
5	Chicken/Eggs/Beef Ingestion	Chicken/Eggs/Beef Uptake	0-1"	Unsieved	12	2.9	0.9	891	26629	0.3	59.6
SM	Ingestion Dermal Contact Inhalation	Industrial Worker	0-1"	250 µm	4	24.1	7.2	25926	58842	0.7	**23.0**

1. Bold: EPC is maximum concentration, instead of 95% UCL.

2. Shaded values: This dataset was not analyzed for this constituent. Soil EPCs are the same as those used for the Ingestion pathway from the same exposure area.

EPC Calculation Groups

EPC Scenario	Exposure Area	Pathway	Receptor	Sample Depth	Sieve (µm)
A	1	Ingestion Dermal Contact Inhalation	Rancher Recreator Future Resident Construction Worker	0-1"	250 um
B	1	Vegetable Ingestion	Future Resident	0-1"	Unsieved
C	1	Chicken/Eggs/Beef Ingestion	Future Resident	0-1"	Unsieved
D	2	Ingestion Dermal Contact Inhalation	Current Residents Future Resident Construction Worker Rancher Recreator	0-1"	250 um
E	2	Vegetable Ingestion	Current Residents Future Resident	0-6"	2000 um
F	2	Chicken/Eggs/Beef Ingestion	Current Residents Future Residents	0-1"	Unsieved
G	3	Ingestion Dermal Contact Inhalation	Future Resident Construction Worker Trespasser	0-1"	250 um
H	3	Vegetable Ingestion	Future Resident	0-6" 1-6"	2000 um Unsieved
I	3	Chicken/Eggs/Beef Ingestion	Future Resident	0-1"	Unsieved
J	4	Ingestion Dermal Contact Inhalation	Future Resident Construction Worker Trespasser	0-1"	250 um
K	4	Vegetable Ingestion		0-6" 3-6"	2000 um Unsieved
L	4	Chicken/Eggs/Beef Ingestion	Chicken/Eggs/Beef Uptake	0-1"	Unsieved
M	5	Ingestion Dermal Contact Inhalation	Future Resident Construction Worker Rancher Recreator	0-1"	250 um
O	5	Vegetable Ingestion	Vegetable Uptake	0-6"	2000 um
P	5	Chicken/Eggs/Beef Ingestion	Chicken/Eggs/Beef Uptake	0-1"	Unsieved
Q	SM	Ingestion Dermal Contact Inhalation	Industrial Worker	0-1"	250 um

Data Set for Direct Contact with Soil Pathway, Exposure Area 1

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
1	soil	0-1	Inches	250	S64	U04-1098	mg/kg	4.1	2.4	689	25100	0.37	33.2
1	soil	0-1	Inches	250	S65	U04-1099	mg/kg	2.3	0.65	660	16200	0.37	25.8
1	soil	0-1	Inches	250	S66	U04-1100	mg/kg	1.2	0.63	789	20400	0.37	43
1	soil	0-1	Inches	250	S67	U04-1101	mg/kg	2.4	2.1	899	27400	0.37	59.3
1	soil	0-1	Inches	250	S68	U04-1102	mg/kg	1.2	0.74	846	14700	0.37	27.1
1	soil	0-1	Inches	250	S69	U04-1103	mg/kg	2.2	0.64	710	12800	0.37	25.7
1	soil	0-1	Inches	250	SS103	U04-1173	mg/Kg	2.4	0.37	497	12300	0.175	22.8
1	soil	0-1	Inches	250	SS105	U04-1175	mg/Kg	2	0.39	226	30200	0.175	80.1
1	soil	0-1	Inches	250	SS109	U04-1179	mg/Kg	1.9	0.76	597	23600	0.51	59
1	soil	0-1	Inches	250	SS110	U04-1180	mg/Kg	2.9	1.1	692	24700	0.51	40.4
1	soil	0-1	Inches	250	SS97	U04-1167	mg/Kg	3.9	0.8	412	29400	0.175	71.1

UCL Calculation of Arsenic, Direct Contact with Soil Pathway, Exposure Area 1

Data File | **Variable: Arsenic**

Raw Statistics	
Number of Valid Samples	11
Number of Unique Samples	9
Minimum	1.2
Maximum	4.1
Mean	2.4090909
Median	2.3
Standard Deviation	0.934296
Variance	0.8729091
Coefficient of Variation	0.387821
Skewness	0.677523

Gamma Statistics	
k hat	7.3699288
k star (bias corrected)	5.4205543
Theta hat	0.3268812
Theta star	0.4444363
nu hat	162.13843
nu star	119.25219
Approx.Chi Square Value (.05)	95.031768
Adjusted Level of Significance	0.02783
Adjusted Chi Square Value	91.511054

Log-transformed Statistics	
Minimum of log data	0.1823216
Maximum of log data	1.410987
Mean of log data	0.8098748
Standard Deviation of log data	0.3961171
Variance of log data	0.1569087

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9086982
Shapiro-Wilk 5% Critical Value	0.85
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**2.9196627**

Gamma Distribution Test	
A-D Test Statistic	0.3698606
A-D 5% Critical Value	0.7304431
K-S Test Statistic	0.1823114
K-S 5% Critical Value	0.2557061
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	3.0230878
Adjusted Gamma UCL	3.1393954

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.927802
Shapiro-Wilk 5% Critical Value	0.85
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	3.1440407
95% Chebyshev (MVUE) UCL	3.6861795
97.5% Chebyshev (MVUE) UCL	4.2371814
99% Chebyshev (MVUE) UCL	5.3195181

95% Non-parametric UCLs	
CLT UCL	2.8724476
Adj-CLT UCL (Adjusted for skewness)	2.9339364
Mod-t UCL (Adjusted for skewness)	2.9292538
Jackknife UCL	2.9196627
Standard Bootstrap UCL	2.8503453
Bootstrap-t UCL	3.0607291
Hall's Bootstrap UCL	3.352813
Percentile Bootstrap UCL	2.8727273
BCA Bootstrap UCL	2.8909091
95% Chebyshev (Mean, Sd) UCL	3.6369965
97.5% Chebyshev (Mean, Sd) UCL	4.1683122
99% Chebyshev (Mean, Sd) UCL	5.211979

UCL Calculation of Cadmium, Direct Contact with Soil Pathway, Exposure Area 1

Data File

Variable: Cadmium

Raw Statistics	
Number of Valid Samples	11
Number of Unique Samples	11
Minimum	0.37
Maximum	2.4
Mean	0.9618182
Median	0.74
Standard Deviation	0.6698629
Variance	0.4487164
Coefficient of Variation	0.6964549
Skewness	1.59965

Gamma Statistics	
k hat	3.002068
k star (bias corrected)	2.2439282
Theta hat	0.3203852
Theta star	0.4286314
nu hat	66.045496
nu star	49.366421
Approx.Chi Square Value (.05)	34.232956
Adjusted Level of Significance	0.02783
Adjusted Chi Square Value	32.188751

Log-transformed Statistics	
Minimum of log data	-0.994252
Maximum of log data	0.8754687
Mean of log data	-0.214631
Standard Deviation of log data	0.5923202
Variance of log data	0.3508432

RECOMMENDATION

Data are lognormal (0.05)

Use H-UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.7549975
Shapiro-Wilk 5% Critical Value	0.85
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	1.3278833

Gamma Distribution Test	
A-D Test Statistic	0.7724876
A-D 5% Critical Value	0.7335181
K-S Test Statistic	0.272368
K-S 5% Critical Value	0.2569889
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	1.387012
Adjusted Gamma UCL	1.4750968

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8970436
Shapiro-Wilk 5% Critical Value	0.85
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	**1.4816353**
95% Chebyshev (MVUE) UCL	1.7002418
97.5% Chebyshev (MVUE) UCL	2.0272985
99% Chebyshev (MVUE) UCL	2.6697381

95% Non-parametric UCLs	
CLT UCL	1.2940314
Adj-CLT UCL (Adjusted for skewness)	1.3981189
Mod-t UCL (Adjusted for skewness)	1.3441188
Jackknife UCL	1.3278833
Standard Bootstrap UCL	1.2777181
Bootstrap-t UCL	1.948527
Hall's Bootstrap UCL	3.3760262
Percentile Bootstrap UCL	1.2972727
BCA Bootstrap UCL	1.3763636
95% Chebyshev (Mean, Sd) UCL	1.8421906
97.5% Chebyshev (Mean, Sd) UCL	2.2231284
99% Chebyshev (Mean, Sd) UCL	2.971407

UCL Calculation of Copper, Direct Contact with Soil Pathway, Exposure Area 1

Data File

Variable: Copper

Raw Statistics	
Number of Valid Samples	11
Number of Unique Samples	11
Minimum	226
Maximum	899
Mean	637.90909
Median	689
Standard Deviation	196.91443
Variance	38775.291
Coefficient of Variation	0.3086873
Skewness	-0.853967

Gamma Statistics	
k hat	8.5835244
k star (bias corrected)	6.3031692
Theta hat	74.317852
Theta star	101.2045
nu hat	188.83754
nu star	138.66972
Approx.Chi Square Value (.05)	112.45518
Adjusted Level of Significance	0.02783
Adjusted Chi Square Value	108.60963

Log-transformed Statistics	
Minimum of log data	5.420535
Maximum of log data	6.801283
Mean of log data	6.3988151
Standard Deviation of log data	0.395418
Variance of log data	0.1563554

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9445326
Shapiro-Wilk 5% Critical Value	0.85
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**745.51841**

Gamma Distribution Test	
A-D Test Statistic	0.5591542
A-D 5% Critical Value	0.7299479
K-S Test Statistic	0.2211157
K-S 5% Critical Value	0.2555556
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	786.61274
Adjusted Gamma UCL	814.4644

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8375882
Shapiro-Wilk 5% Critical Value	0.85
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	840.18338
95% Chebyshev (MVUE) UCL	985.01525
97.5% Chebyshev (MVUE) UCL	1132.0787
99% Chebyshev (MVUE) UCL	1420.9563

95% Non-parametric UCLs	
CLT UCL	735.56723
Adj-CLT UCL (Adjusted for skewness)	719.23272
Mod-t UCL (Adjusted for skewness)	742.97056
Jackknife UCL	745.51841
Standard Bootstrap UCL	731.20713
Bootstrap-t UCL	728.81549
Hall's Bootstrap UCL	722.60999
Percentile Bootstrap UCL	725.72727
BCA Bootstrap UCL	718
95% Chebyshev (Mean, Sd) UCL	896.70535
97.5% Chebyshev (Mean, Sd) UCL	1008.6867
99% Chebyshev (Mean, Sd) UCL	1228.6524

UCL Calculation of Iron, Direct Contact with Soil Pathway, Exposure Area 1

Data File

Variable: Iron

Raw Statistics	
Number of Valid Samples	11
Number of Unique Samples	11
Minimum	12300
Maximum	30200
Mean	21527.273
Median	23600
Standard Deviation	6605.9202
Variance	43638182
Coefficient of Variation	0.3068628
Skewness	-0.20857

Gamma Statistics	
k hat	10.644309
k star (bias corrected)	7.8019217
Theta hat	2022.4209
Theta star	2759.227
nu hat	234.1748
nu star	171.64228
Approx.Chi Square Value (.05)	142.33932
Adjusted Level of Significance	0.02783
Adjusted Chi Square Value	137.99038

Log-transformed Statistics	
Minimum of log data	9.4173545
Maximum of log data	10.315597
Mean of log data	9.9293676
Standard Deviation of log data	0.3329598
Variance of log data	0.1108622

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9138395
Shapiro-Wilk 5% Critical Value	0.85
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**25137.26**

Gamma Distribution Test	
A-D Test Statistic	0.4874862
A-D 5% Critical Value	0.7293268
K-S Test Statistic	0.2031503
K-S 5% Critical Value	0.2553574
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	25959.026
Adjusted Gamma UCL	26777.158

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8936627
Shapiro-Wilk 5% Critical Value	0.85
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	26737.115
95% Chebyshev (MVUE) UCL	31118.148
97.5% Chebyshev (MVUE) UCL	35245.053
99% Chebyshev (MVUE) UCL	43351.56

95% Non-parametric UCLs	
CLT UCL	24803.426
Adj-CLT UCL (Adjusted for skewness)	24669.59
Mod-t UCL (Adjusted for skewness)	25116.384
Jackknife UCL	25137.26
Standard Bootstrap UCL	24651.903
Bootstrap-t UCL	25087.881
Hall's Bootstrap UCL	24435.697
Percentile Bootstrap UCL	24572.727
BCA Bootstrap UCL	24554.545
95% Chebyshev (Mean, Sd) UCL	30209.153
97.5% Chebyshev (Mean, Sd) UCL	33965.809
99% Chebyshev (Mean, Sd) UCL	41345.033

UCL Calculation of Thallium, Direct Contact with Soil Pathway, Exposure Area 1

Data File

Variable: Thallium

Raw Statistics	
Number of Valid Samples	11
Number of Unique Samples	3
Minimum	0.175
Maximum	0.51
Mean	0.3422727
Median	0.37
Standard Deviation	0.1203404
Variance	0.0144818
Coefficient of Variation	0.3515922
Skewness	-0.313903

Gamma Statistics	
k hat	7.52074
k star (bias corrected)	5.5302352
Theta hat	0.0455105
Theta star	0.0618912
nu hat	165.45628
nu star	121.66517
Approx.Chi Square Value (.05)	97.188495
Adjusted Level of Significance	0.02783
Adjusted Chi Square Value	93.626048

Log-transformed Statistics	
Minimum of log data	-1.742969
Maximum of log data	-0.673345
Mean of log data	-1.140101
Standard Deviation of log data	0.4066577
Variance of log data	0.1653705

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8112357
Shapiro-Wilk 5% Critical Value	0.85
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	0.4080361

Gamma Distribution Test	
A-D Test Statistic	1.2734891
A-D 5% Critical Value	0.7303815
K-S Test Statistic	0.3594226
K-S 5% Critical Value	0.2556874
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.4284733
Adjusted Gamma UCL	0.4447766

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.7624555
Shapiro-Wilk 5% Critical Value	0.85
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.4530081
95% Chebyshev (MVUE) UCL	0.5314229
97.5% Chebyshev (MVUE) UCL	0.6122652
99% Chebyshev (MVUE) UCL	0.7710643

95% Non-parametric UCLs	
CLT UCL	0.4019546
Adj-CLT UCL (Adjusted for skewness)	0.3982852
Mod-t UCL (Adjusted for skewness)	**0.4074637**
Jackknife UCL	0.4080361
Standard Bootstrap UCL	N/R
Bootstrap-t UCL	N/R
Hall's Bootstrap UCL	N/R
Percentile Bootstrap UCL	N/R
BCA Bootstrap UCL	N/R
95% Chebyshev (Mean, Sd) UCL	0.500431
97.5% Chebyshev (Mean, Sd) UCL	0.5688663
99% Chebyshev (Mean, Sd) UCL	0.703294

RECOMMENDATION

Data are Non-parametric (0.05)

Use Student's-t UCL
or Modified-t UCL

UCL Calculation of Vanadium, Direct Contact with Soil Pathway, Exposure Area 1

Data File

Variable: Vanadium

Raw Statistics	
Number of Valid Samples	11
Number of Unique Samples	11
Minimum	22.8
Maximum	80.1
Mean	44.318182
Median	40.4
Standard Deviation	20.068324
Variance	402.73764
Coefficient of Variation	0.4528237
Skewness	0.6387787

Gamma Statistics	
k hat	5.59562
k star (bias corrected)	4.1301479
Theta hat	7.9201557
Theta star	10.73041
nu hat	123.10364
nu star	90.863254
Approx.Chi Square Value (.05)	69.879408
Adjusted Level of Significance	0.02783
Adjusted Chi Square Value	66.885474

Log-transformed Statistics	
Minimum of log data	3.1267605
Maximum of log data	4.3832759
Mean of log data	3.6993863
Standard Deviation of log data	0.4487231
Variance of log data	0.2013524

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8925252
Shapiro-Wilk 5% Critical Value	0.85
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**55.285071**

Gamma Distribution Test	
A-D Test Statistic	0.4514146
A-D 5% Critical Value	0.731167
K-S Test Statistic	0.1871624
K-S 5% Critical Value	0.2559261
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	57.626335
Adjusted Gamma UCL	60.205811

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9163546
Shapiro-Wilk 5% Critical Value	0.85
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	60.353131
95% Chebyshev (MVUE) UCL	70.823857
97.5% Chebyshev (MVUE) UCL	82.315326
99% Chebyshev (MVUE) UCL	104.88809

95% Non-parametric UCLs	
CLT UCL	54.270907
Adj-CLT UCL (Adjusted for skewness)	55.516136
Mod-t UCL (Adjusted for skewness)	55.479302
Jackknife UCL	55.285071
Standard Bootstrap UCL	53.811805
Bootstrap-t UCL	57.282859
Hall's Bootstrap UCL	54.516477
Percentile Bootstrap UCL	54.272727
BCA Bootstrap UCL	55
95% Chebyshev (Mean, Sd) UCL	70.693127
97.5% Chebyshev (Mean, Sd) UCL	82.105587
99% Chebyshev (Mean, Sd) UCL	104.52315

Data Set Used to Calculate Soil EPCs for the Locally-Grown Vegetable Pathway, Exposure Area 1

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
1	soil	0-1	Inches		U05-4031	U05-4031	mg/kg	1.96	0.96	254	24000	2	61.1

Data Set Used to Calculate Soil EPCs for the Locally-Grown Beef, Chicken, and Eggs Pathways, Exposure Area 1

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
1	soil	0-1	Inches		U05-4031	U05-4031	mg/kg	1.96	0.96	254	24000	2	61.1

Data Set for Direct Contact with Soil Pathway, Exposure Area 2

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
2	soil	0-1	Inches	250	S32	U04-1066	mg/kg	2.7	2	2440	15300	0.37	20
2	soil	0-1	Inches	250	S33	U04-1067	mg/kg	2.6	2.1	2570	14500	0.37	20.4
2	soil	0-1	Inches	250	SS126	U04-1200	mg/Kg	2	1.2	1400	19000	0.55	24.6
2	soil	0-1	Inches	250	SS133	U04-1209	mg/Kg	2.5	1.3	1500	23300	0.175	27
2	soil	0-1	Inches	250	SS136	U04-1212	mg/Kg	2.3	0.91	783	25200	0.175	39.9
2	soil	0-1	Inches	250	SS140	U04-1216	mg/Kg	3.2	0.83	1180	26600	0.45	30.2
2	soil	0-1	Inches	250	SS144	U04-1220	mg/Kg	4.2	0.58	449	30800	0.55	73.8
2	soil	0-1	Inches	250	SS147	U04-1223	mg/Kg	2	0.5	379	24700	0.175	45
2	soil	0-1	Inches	250	SS151	U04-1227	mg/Kg	2.3	0.36	259	19700	0.175	40.2
2	soil	0-1	Inches	250	SS152	U04-1228	mg/Kg	1.2	0.43	237	24100	0.58	46.5
2	soil	0-1	Inches	250	SS153	U04-1229	mg/Kg	2.5	0.68	438	24200	0.55	32

UCL Calculation of Arsenic, Direct Contact with Soil Pathway, Exposure Area 2

Data File

Variable: Arsenic

Raw Statistics	
Number of Valid Samples	11
Number of Unique Samples	8
Minimum	1.2
Maximum	4.2
Mean	2.5
Median	2.5
Standard Deviation	0.7549834
Variance	0.57
Coefficient of Variation	0.3019934
Skewness	0.7958038

Gamma Statistics	
k hat	11.987551
k star (bias corrected)	8.7788247
Theta hat	0.2085497
Theta star	0.2847762
nu hat	263.72611
nu star	193.13414
Approx.Chi Square Value (.05)	161.97672
Adjusted Level of Significance	0.02783
Adjusted Chi Square Value	157.32537

Log-transformed Statistics	
Minimum of log data	0.1823216
Maximum of log data	1.4350845
Mean of log data	0.8740013
Standard Deviation of log data	0.3114607
Variance of log data	0.0970078

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.922486
Shapiro-Wilk 5% Critical Value	0.85
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**2.9125815**

Gamma Distribution Test	
A-D Test Statistic	0.4159904
A-D 5% Critical Value	0.7292368
K-S Test Statistic	0.1754522
K-S 5% Critical Value	0.2553104
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	2.9808936
Adjusted Gamma UCL	3.0690241

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9276317
Shapiro-Wilk 5% Critical Value	0.85
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	3.0522407
95% Chebyshev (MVUE) UCL	3.5381336
97.5% Chebyshev (MVUE) UCL	3.9855546
99% Chebyshev (MVUE) UCL	4.8644266

95% Non-parametric UCLs	
CLT UCL	2.874428
Adj-CLT UCL (Adjusted for skewness)	2.9327902
Mod-t UCL (Adjusted for skewness)	2.9216848
Jackknife UCL	2.9125815
Standard Bootstrap UCL	2.8581473
Bootstrap-t UCL	3.0106062
Hall's Bootstrap UCL	3.3914238
Percentile Bootstrap UCL	2.8727273
BCA Bootstrap UCL	2.9090909
95% Chebyshev (Mean, Sd) UCL	3.4922426
97.5% Chebyshev (Mean, Sd) UCL	3.9215868
99% Chebyshev (Mean, Sd) UCL	4.7649503

UCL Calculation of Cadmium, Direct Contact with Soil Pathway, Exposure Area 2

Data File

Variable: Cadmium

Raw Statistics	
Number of Valid Samples	11
Number of Unique Samples	11
Minimum	0.36
Maximum	2.1
Mean	0.99
Median	0.83
Standard Deviation	0.6032578
Variance	0.36392
Coefficient of Variation	0.6093513
Skewness	0.996735

Gamma Statistics	
k hat	3.247961
k star (bias corrected)	2.4227595
Theta hat	0.3048066
Theta star	0.408625
nu hat	71.455143
nu star	53.30071
Approx.Chi Square Value (.05)	37.525554
Adjusted Level of Significance	0.02783
Adjusted Chi Square Value	35.377419

Log-transformed Statistics	
Minimum of log data	-1.021651
Maximum of log data	0.7419373
Mean of log data	-0.171821
Standard Deviation of log data	0.5944611
Variance of log data	0.353384

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.871034
Shapiro-Wilk 5% Critical Value	0.85
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**1.3196669**

Gamma Distribution Test	
A-D Test Statistic	0.2993811
A-D 5% Critical Value	0.7332944
K-S Test Statistic	0.1280333
K-S 5% Critical Value	0.2568635
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	1.4061805
Adjusted Gamma UCL	1.4915645

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9553769
Shapiro-Wilk 5% Critical Value	0.85
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	1.5517398
95% Chebyshev (MVUE) UCL	1.7795936
97.5% Chebyshev (MVUE) UCL	2.1226319
99% Chebyshev (MVUE) UCL	2.7964644

95% Non-parametric UCLs	
CLT UCL	1.2891809
Adj-CLT UCL (Adjusted for skewness)	1.3475886
Mod-t UCL (Adjusted for skewness)	1.3287773
Jackknife UCL	1.3196669
Standard Bootstrap UCL	1.2760891
Bootstrap-t UCL	1.4761549
Hall's Bootstrap UCL	1.4923171
Percentile Bootstrap UCL	1.2845455
BCA Bootstrap UCL	1.3254545
95% Chebyshev (Mean, Sd) UCL	1.7828361
97.5% Chebyshev (Mean, Sd) UCL	2.1258969
99% Chebyshev (Mean, Sd) UCL	2.7997735

UCL Calculation of Copper, Direct Contact with Soil Pathway, Exposure Area 2

Data File

Variable: Copper

Raw Statistics	
Number of Valid Samples	11
Number of Unique Samples	11
Minimum	237
Maximum	2570
Mean	1057.7273
Median	783
Standard Deviation	844.25519
Variance	712766.82
Coefficient of Variation	0.7981785
Skewness	0.887313

Gamma Statistics	
k hat	1.7166516
k star (bias corrected)	1.3090799
Theta hat	616.15723
Theta star	807.99289
nu hat	37.766335
nu star	28.799758
Approx.Chi Square Value (.05)	17.549978
Adjusted Level of Significance	0.02783
Adjusted Chi Square Value	16.132413

Log-transformed Statistics	
Minimum of log data	5.4680601
Maximum of log data	7.8516612
Mean of log data	6.6451755
Standard Deviation of log data	0.8634104
Variance of log data	0.7454774

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8568717
Shapiro-Wilk 5% Critical Value	0.85
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**1519.0938**

Gamma Distribution Test	
A-D Test Statistic	0.4128391
A-D 5% Critical Value	0.7407744
K-S Test Statistic	0.2164012
K-S 5% Critical Value	0.25919
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	1735.7452
Adjusted Gamma UCL	1888.2662

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9227008
Shapiro-Wilk 5% Critical Value	0.85
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	2367.2327
95% Chebyshev (MVUE) UCL	2343.8123
97.5% Chebyshev (MVUE) UCL	2895.1689
99% Chebyshev (MVUE) UCL	3978.2022

95% Non-parametric UCLs	
CLT UCL	1476.4289
Adj-CLT UCL (Adjusted for skewness)	1549.1966
Mod-t UCL (Adjusted for skewness)	1530.4441
Jackknife UCL	1519.0938
Standard Bootstrap UCL	1454.4076
Bootstrap-t UCL	1670.3286
Hall's Bootstrap UCL	1638.2235
Percentile Bootstrap UCL	1469.1818
BCA Bootstrap UCL	1514
95% Chebyshev (Mean, Sd) UCL	2167.296
97.5% Chebyshev (Mean, Sd) UCL	2647.4072
99% Chebyshev (Mean, Sd) UCL	3590.4928

UCL Calculation of Iron, Direct Contact with Soil Pathway, Exposure Area 2

Data File

Variable: Iron

Raw Statistics	
Number of Valid Samples	11
Number of Unique Samples	11
Minimum	14500
Maximum	30800
Mean	22490.909
Median	24100
Standard Deviation	4897.439
Variance	23984909
Coefficient of Variation	0.2177519
Skewness	-0.273625

Gamma Statistics	
k hat	21.477148
k star (bias corrected)	15.68035
Theta hat	1047.2018
Theta star	1434.3372
nu hat	472.49726
nu star	344.9677
Approx.Chi Square Value (.05)	302.92088
Adjusted Level of Significance	0.02783
Adjusted Chi Square Value	296.49258

Log-transformed Statistics	
Minimum of log data	9.5819039
Maximum of log data	10.33527
Mean of log data	9.9974053
Standard Deviation of log data	0.2326306
Variance of log data	0.054117

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9448349
Shapiro-Wilk 5% Critical Value	0.85
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**25167.25**

Gamma Distribution Test	
A-D Test Statistic	0.4647786
A-D 5% Critical Value	0.7286852
K-S Test Statistic	0.2298613
K-S 5% Critical Value	0.2550113
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	25612.752
Adjusted Gamma UCL	26168.065

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9160273
Shapiro-Wilk 5% Critical Value	0.85
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	25938.08
95% Chebyshev (MVUE) UCL	29433.516
97.5% Chebyshev (MVUE) UCL	32427.001
99% Chebyshev (MVUE) UCL	38307.123

95% Non-parametric UCLs	
CLT UCL	24919.755
Adj-CLT UCL (Adjusted for skewness)	24789.585
Mod-t UCL (Adjusted for skewness)	25146.946
Jackknife UCL	25167.25
Standard Bootstrap UCL	24811.849
Bootstrap-t UCL	24984.951
Hall's Bootstrap UCL	24801.494
Percentile Bootstrap UCL	24736.364
BCA Bootstrap UCL	24709.091
95% Chebyshev (Mean, Sd) UCL	28927.405
97.5% Chebyshev (Mean, Sd) UCL	31712.482
99% Chebyshev (Mean, Sd) UCL	37183.226

UCL Calculation of Thallium, Direct Contact with Soil Pathway, Exposure Area 2

Data File

Variable: Thallium

Raw Statistics	
Number of Valid Samples	11
Number of Unique Samples	5
Minimum	0.175
Maximum	**0.58**
Mean	0.3745455
Median	0.37
Standard Deviation	0.1730817
Variance	0.0299573
Coefficient of Variation	0.4621113
Skewness	-0.152667

Gamma Statistics	
k hat	4.4080217
k star (bias corrected)	3.26644
Theta hat	0.0849691
Theta star	0.1146647
nu hat	96.976477
nu star	71.86168
Approx.Chi Square Value (.05)	53.339553
Adjusted Level of Significance	0.02783
Adjusted Chi Square Value	50.745754

Log-transformed Statistics	
Minimum of log data	-1.742969
Maximum of log data	-0.544727
Mean of log data	-1.099739
Standard Deviation of log data	0.5321401
Variance of log data	0.2831731

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8180818
Shapiro-Wilk 5% Critical Value	0.85
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	0.4691307

Gamma Distribution Test	
A-D Test Statistic	1.0228175
A-D 5% Critical Value	0.7321204
K-S Test Statistic	0.2580662
K-S 5% Critical Value	0.2562841
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.5046061
Adjusted Gamma UCL	0.5303984

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.780634
Shapiro-Wilk 5% Critical Value	0.85
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.5576637
95% Chebyshev (MVUE) UCL	0.6488732
97.5% Chebyshev (MVUE) UCL	0.7660001
99% Chebyshev (MVUE) UCL	0.9960734

95% Non-parametric UCLs	
CLT UCL	0.4603839
Adj-CLT UCL (Adjusted for skewness)	0.4578172
Mod-t UCL (Adjusted for skewness)	0.4687304
Jackknife UCL	0.4691307
Standard Bootstrap UCL	0.4569585
Bootstrap-t UCL	0.4640068
Hall's Bootstrap UCL	0.4476382
Percentile Bootstrap UCL	0.4554545
BCA Bootstrap UCL	0.4559091
95% Chebyshev (Mean, Sd) UCL	0.6020194
97.5% Chebyshev (Mean, Sd) UCL	0.7004475
99% Chebyshev (Mean, Sd) UCL	0.8937905

RECOMMENDATION

Data are Non-parametric (0.05)

Use 95% Chebyshev (Mean, Sd) UCL

Recommended UCL exceeds the maximum observation

UCL Calculation of Vanadium, Direct Contact with Soil Pathway, Exposure Area 2

Data File

Variable: Vanadium

Raw Statistics	
Number of Valid Samples	11
Number of Unique Samples	11
Minimum	20
Maximum	73.8
Mean	36.327273
Median	32
Standard Deviation	15.529719
Variance	241.17218
Coefficient of Variation	0.4274948
Skewness	1.4130118

Gamma Statistics	
k hat	6.97688
k star (bias corrected)	5.1347006
Theta hat	5.2068078
Theta star	7.0748571
nu hat	153.49136
nu star	112.96341
Approx.Chi Square Value (.05)	89.423339
Adjusted Level of Significance	0.02783
Adjusted Chi Square Value	86.013409

Log-transformed Statistics	
Minimum of log data	2.9957323
Maximum of log data	4.3013587
Mean of log data	3.519195
Standard Deviation of log data	0.393499
Variance of log data	0.1548415

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8757175
Shapiro-Wilk 5% Critical Value	0.85
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**44.813916**

Gamma Distribution Test	
A-D Test Statistic	0.2744186
A-D 5% Critical Value	0.7306034
K-S Test Statistic	0.1247919
K-S 5% Critical Value	0.2557549
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	45.890175
Adjusted Gamma UCL	47.709453

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9567264
Shapiro-Wilk 5% Critical Value	0.85
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	47.074402
95% Chebyshev (MVUE) UCL	55.182131
97.5% Chebyshev (MVUE) UCL	63.393975
99% Chebyshev (MVUE) UCL	79.524552

95% Non-parametric UCLs	
CLT UCL	44.029113
Adj-CLT UCL (Adjusted for skewness)	46.160671
Mod-t UCL (Adjusted for skewness)	45.146396
Jackknife UCL	44.813916
Standard Bootstrap UCL	43.626216
Bootstrap-t UCL	48.177752
Hall's Bootstrap UCL	53.836916
Percentile Bootstrap UCL	44.218182
BCA Bootstrap UCL	45.754545
95% Chebyshev (Mean, Sd) UCL	56.737323
97.5% Chebyshev (Mean, Sd) UCL	65.568767
99% Chebyshev (Mean, Sd) UCL	82.916431

Data Set Used to Calculate Soil EPCs for the Locally-Grown Vegetable Pathway, Exposure Area 2

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
2	soil	0-6	Inches	2000	S72	U04-1106	mg/kg	2.3	1.7	1160	9670	1.3	12.7
2	soil	0-6	Inches	2000	S73	U04-1107	mg/kg	2.1	1.4	1290	12900	0.37	12.8
2	soil	0-6	Inches	2000	S74	U04-1108	mg/kg	1.6	0.72	529	9780	0.6	13.1
2	soil	0-6	Inches	2000	S75	U04-1109	mg/kg	1.7	0.89	940	15800	0.37	16.7
2	soil	0-6	Inches	2000	S76	U04-1110	mg/kg	2.6	0.91	278	11700	0.39	22.8
2	soil	0-6	Inches	2000	S77	U04-1111	mg/kg	1.3	0.52	267	9710	0.37	14.1
2	soil	0-6	Inches	2000	S78	U04-1112	mg/kg	1.5	0.5	207	10900	0.37	17.7
2	soil	0-6	Inches	2000	S79	U04-1113	mg/kg	1.4	0.37	157	11100	1.1	17
2	soil	0-6	Inches	2000	U07-0194	U07-0194	mg/kg	1.4	0.73	100	15900	0.12	12.6
2	soil	0-6	Inches	2000	U07-0359	U07-0359	mg/kg	0.15	0.92	346	17500	0.09	16.6

Soil EPCs for Arsenic Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Arsenic

Raw Statistics	
Number of Valid Samples	10
Number of Unique Samples	9
Minimum	0.15
Maximum	2.6
Mean	1.605
Median	1.55
Standard Deviation	0.6693488
Variance	0.4480278
Coefficient of Variation	0.4170397
Skewness	-0.779975

Gamma Statistics	
k hat	3.002739
k star (bias corrected)	2.168584
Theta hat	0.534512
Theta star	0.7401143
nu hat	60.05478
nu star	43.371679
Approx.Chi Square Value (.05)	29.267787
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	27.267615

Log-transformed Statistics	
Minimum of log data	-1.89712
Maximum of log data	0.9555114
Mean of log data	0.2974644
Standard Deviation of log data	0.805092
Variance of log data	0.6481731

RECOMMENDATION

Data are normal (0.0.5)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9196988
Shapiro-Wilk 5% Critical Value	0.842
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**1.9930089**

Gamma Distribution Test	
A-D Test Statistic	1.088789
A-D 5% Critical Value	0.7321724
K-S Test Statistic	0.3379859
K-S 5% Critical Value	0.2684483
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	2.3784355
Adjusted Gamma UCL	2.5529019

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.6438616
Shapiro-Wilk 5% Critical Value	0.842
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	3.8626378
95% Chebyshev (MVUE) UCL	3.8499582
97.5% Chebyshev (MVUE) UCL	4.7415957
99% Chebyshev (MVUE) UCL	6.493045

95% Non-parametric UCLs	
CLT UCL	1.9531607
Adj-CLT UCL (Adjusted for skewness)	1.8973762
Mod-t UCL (Adjusted for skewness)	1.9843076
Jackknife UCL	1.9930089
Standard Bootstrap UCL	1.9314884
Bootstrap-t UCL	1.955379
Hall's Bootstrap UCL	1.9525904
Percentile Bootstrap UCL	1.925
BCA Bootstrap UCL	1.9
95% Chebyshev (Mean, Sd) UCL	2.5276336
97.5% Chebyshev (Mean, Sd) UCL	2.9268579
99% Chebyshev (Mean, Sd) UCL	3.7110567

Soil EPCs for Cadmium Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Cadmium

Raw Statistics	
Number of Valid Samples	10
Number of Unique Samples	10
Minimum	0.37
Maximum	1.7
Mean	0.866
Median	0.81
Standard Deviation	0.4117227
Variance	0.1695156
Coefficient of Variation	0.4754303
Skewness	1.0238996

Gamma Statistics	
k hat	5.2999801
k star (bias corrected)	3.7766528
Theta hat	0.1633968
Theta star	0.2293036
nu hat	105.9996
nu star	75.533055
Approx.Chi Square Value (.05)	56.511852
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	53.66122

Log-transformed Statistics	
Minimum of log data	-0.994252
Maximum of log data	0.5306283
Mean of log data	-0.241167
Standard Deviation of log data	0.4650163
Variance of log data	0.2162402

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9045738
Shapiro-Wilk 5% Critical Value	0.842
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**1.1046679**

Gamma Distribution Test	
A-D Test Statistic	0.2775227
A-D 5% Critical Value	0.7291866
K-S Test Statistic	0.187692
K-S 5% Critical Value	0.267382
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	1.1574851
Adjusted Gamma UCL	1.2189739

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9682202
Shapiro-Wilk 5% Critical Value	0.842
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	1.2258408
95% Chebyshev (MVUE) UCL	1.4286537
97.5% Chebyshev (MVUE) UCL	1.6724261
99% Chebyshev (MVUE) UCL	2.1512698

95% Non-parametric UCLs	
CLT UCL	1.0801569
Adj-CLT UCL (Adjusted for skewness)	1.1252015
Mod-t UCL (Adjusted for skewness)	1.1116939
Jackknife UCL	1.1046679
Standard Bootstrap UCL	1.0703742
Bootstrap-t UCL	1.2304892
Hall's Bootstrap UCL	1.5614135
Percentile Bootstrap UCL	1.08
BCA Bootstrap UCL	1.109
95% Chebyshev (Mean, Sd) UCL	1.4335205
97.5% Chebyshev (Mean, Sd) UCL	1.6790871
99% Chebyshev (Mean, Sd) UCL	2.1614551

Soil EPCs for Copper Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Copper

Raw Statistics	
Number of Valid Samples	10
Number of Unique Samples	10
Minimum	100
Maximum	1290
Mean	527.4
Median	312
Standard Deviation	439.37081
Variance	193046.71
Coefficient of Variation	0.8330884
Skewness	0.9267629

Gamma Statistics	
k hat	1.6675518
k star (bias corrected)	1.233953
Theta hat	316.27203
Theta star	427.4069
nu hat	33.351037
nu star	24.679059
Approx.Chi Square Value (.05)	14.36447
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	13.014987

Log-transformed Statistics	
Minimum of log data	4.6051702
Maximum of log data	7.1623975
Mean of log data	5.9390884
Standard Deviation of log data	0.8713091
Variance of log data	0.7591796

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8353833
Shapiro-Wilk 5% Critical Value	0.842
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	782.09499

Gamma Distribution Test	
A-D Test Statistic	0.4159044
A-D 5% Critical Value	0.7380069
K-S Test Statistic	0.1949631
K-S 5% Critical Value	0.270681
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**906.1062**
Adjusted Gamma UCL	1000.0575

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9458407
Shapiro-Wilk 5% Critical Value	0.842
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	1267.8903
95% Chebyshev (MVUE) UCL	1190.6254
97.5% Chebyshev (MVUE) UCL	1476.956
99% Chebyshev (MVUE) UCL	2039.3971

95% Non-parametric UCLs	
CLT UCL	755.93802
Adj-CLT UCL (Adjusted for skewness)	799.44713
Mod-t UCL (Adjusted for skewness)	788.88153
Jackknife UCL	782.09499
Standard Bootstrap UCL	743.7324
Bootstrap-t UCL	873.2959
Hall's Bootstrap UCL	750.119
Percentile Bootstrap UCL	754.7
BCA Bootstrap UCL	785.2
95% Chebyshev (Mean, Sd) UCL	1133.0309
97.5% Chebyshev (Mean, Sd) UCL	1395.0878
99% Chebyshev (Mean, Sd) UCL	1909.848

Soil EPCs for Iron Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Iron

Raw Statistics	
Number of Valid Samples	10
Number of Unique Samples	10
Minimum	9670
Maximum	17500
Mean	12496
Median	11400
Standard Deviation	2905.1915
Variance	8440137.8
Coefficient of Variation	0.2324897
Skewness	0.7327177

Gamma Statistics	
k hat	21.856604
k star (bias corrected)	15.366289
Theta hat	571.72651
Theta star	813.20868
nu hat	437.13208
nu star	307.32579
Approx.Chi Square Value (.05)	267.70649
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	261.27429

Log-transformed Statistics	
Minimum of log data	9.1767836
Maximum of log data	9.7699562
Mean of log data	9.4101131
Standard Deviation of log data	0.2232743
Variance of log data	0.0498514

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8612553
Shapiro-Wilk 5% Critical Value	0.842
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**14180.085**

Gamma Distribution Test	
A-D Test Statistic	0.5835651
A-D 5% Critical Value	0.7245401
K-S Test Statistic	0.1919697
K-S 5% Critical Value	0.2661508
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	14345.349
Adjusted Gamma UCL	14698.511

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8794122
Shapiro-Wilk 5% Critical Value	0.842
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	14423.032
95% Chebyshev (MVUE) UCL	16346.227
97.5% Chebyshev (MVUE) UCL	18015.807
99% Chebyshev (MVUE) UCL	21295.376

95% Non-parametric UCLs	
CLT UCL	14007.131
Adj-CLT UCL (Adjusted for skewness)	14234.584
Mod-t UCL (Adjusted for skewness)	14215.563
Jackknife UCL	14180.085
Standard Bootstrap UCL	13938.21
Bootstrap-t UCL	14579.373
Hall's Bootstrap UCL	13883.109
Percentile Bootstrap UCL	14010
BCA Bootstrap UCL	14111
95% Chebyshev (Mean, Sd) UCL	16500.53
97.5% Chebyshev (Mean, Sd) UCL	18233.294
99% Chebyshev (Mean, Sd) UCL	21636.972

Soil EPCs for Thallium Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Thallium

Raw Statistics	
Number of Valid Samples	10
Number of Unique Samples	7
Minimum	0.09
Maximum	1.3
Mean	0.508
Median	0.37
Standard Deviation	0.394625
Variance	0.1557289
Coefficient of Variation	0.7768209
Skewness	1.2688821

Gamma Statistics	
k hat	1.9184105
k star (bias corrected)	1.409554
Theta hat	0.2648026
Theta star	0.3603977
nu hat	38.36821
nu star	28.191081
Approx.Chi Square Value (.05)	17.074954
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	15.588417

Log-transformed Statistics	
Minimum of log data	-2.407946
Maximum of log data	0.2623643
Mean of log data	-0.959998
Standard Deviation of log data	0.8338266
Variance of log data	0.6952667

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.814782
Shapiro-Wilk 5% Critical Value	0.842
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	0.7367567

Gamma Distribution Test	
A-D Test Statistic	0.5877221
A-D 5% Critical Value	0.7361756
K-S Test Statistic	0.2410706
K-S 5% Critical Value	0.2700238
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.8387179
Adjusted Gamma UCL	**0.9186994**

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8988394
Shapiro-Wilk 5% Critical Value	0.842
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	1.1717225
95% Chebyshev (MVUE) UCL	1.1394839
97.5% Chebyshev (MVUE) UCL	1.4078885
99% Chebyshev (MVUE) UCL	1.9351172

95% Non-parametric UCLs	
CLT UCL	0.7132636
Adj-CLT UCL (Adjusted for skewness)	0.7667676
Mod-t UCL (Adjusted for skewness)	0.7451022
Jackknife UCL	0.7367567
Standard Bootstrap UCL	0.7019256
Bootstrap-t UCL	0.9756091
Hall's Bootstrap UCL	2.2441039
Percentile Bootstrap UCL	0.719
BCA Bootstrap UCL	0.765
95% Chebyshev (Mean, Sd) UCL	1.051953
97.5% Chebyshev (Mean, Sd) UCL	1.2873219
99% Chebyshev (Mean, Sd) UCL	1.7496586

Soil EPCs for Vanadium Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Vanadium

Raw Statistics	
Number of Valid Samples	10
Number of Unique Samples	10
Minimum	12.6
Maximum	22.8
Mean	15.61
Median	15.35
Standard Deviation	3.2346904
Variance	10.463222
Coefficient of Variation	0.2072191
Skewness	1.1999781

Gamma Statistics	
k hat	28.376582
k star (bias corrected)	19.930274
Theta hat	0.5501015
Theta star	0.7832306
nu hat	567.53163
nu star	398.60547
Approx.Chi Square Value (.05)	353.31835
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	345.89898

Log-transformed Statistics	
Minimum of log data	2.5336968
Maximum of log data	3.1267605
Mean of log data	2.7301881
Standard Deviation of log data	0.1945674
Variance of log data	0.0378565

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8485144
Shapiro-Wilk 5% Critical Value	0.842
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**17.485089**

Gamma Distribution Test	
A-D Test Statistic	0.5741678
A-D 5% Critical Value	0.7245053
K-S Test Statistic	0.2006105
K-S 5% Critical Value	0.2660834
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	17.610836
Adjusted Gamma UCL	17.98858

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8768942
Shapiro-Wilk 5% Critical Value	0.842
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	17.651194
95% Chebyshev (MVUE) UCL	19.795044
97.5% Chebyshev (MVUE) UCL	21.610741
99% Chebyshev (MVUE) UCL	25.177325

95% Non-parametric UCLs	
CLT UCL	17.292519
Adj-CLT UCL (Adjusted for skewness)	17.707269
Mod-t UCL (Adjusted for skewness)	17.549782
Jackknife UCL	17.485089
Standard Bootstrap UCL	17.217467
Bootstrap-t UCL	18.088375
Hall's Bootstrap UCL	18.128057
Percentile Bootstrap UCL	17.27
BCA Bootstrap UCL	17.62
95% Chebyshev (Mean, Sd) UCL	20.068713
97.5% Chebyshev (Mean, Sd) UCL	21.998002
99% Chebyshev (Mean, Sd) UCL	25.787716

Data Set Used to Calculate Soil EPCs for the Locally-Grown Beef, Chicken, and Eggs Pathways, Exposure Area 2

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
2	soil	0-1	Inches		U06-3001	U06-3001	mg/kg	2.92	0.85	709			
2	soil	0-1	Inches		U06-3003	U06-3003	mg/Kg	3.27	0.53	135	19100	6.2	32.5

Soil EPCs Used for Calculation of EPCs for Locally-Grown Beef, Chicken, and Eggs
95%UCL values were not calculated due to the fact that there are only two samples.
The EPCs were based on the maximum of the two samples.

COC	Soil EPC for Beef/Chicken/Egg pathway (mg/kg)
Arsenic	3.27
Cadmium	0.85
Copper	709
Iron	19100
Thallium	6.2
Vanadium	32.5

Data Set for Direct Contact with Soil Pathways, Exposure Area 3

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
3	soil	0-1	Inches	250	S34	U04-1068	mg/kg	2.8	2.5	4340	17900	0.37	20.8
3	soil	0-1	Inches	250	S53	U04-1087	mg/kg	15.1	51.6	7880	45700	0.37	21
3	soil	0-1	Inches	250	S54	U04-1088	mg/kg	7.3	16.7	2220	34800	1.6	24
3	soil	0-1	Inches	250	S55	U04-1089	mg/kg	4.5	6.1	1740	24200	0.37	21.5
3	soil	0-1	Inches	250	S56	U04-1090	mg/kg	3.1	3.8	1490	18600	0.91	19.3
3	soil	0-1	Inches	250	S57	U04-1091	mg/kg	3.5	7.2	1300	34600	0.37	19.3
3	soil	0-1	Inches	250	S58	U04-1092	mg/kg	3.9	7.4	1590	32700	0.37	20.9
3	soil	0-1	Inches	250	SS121	U04-1193	mg/Kg	3.2	0.93	896	21400	0.175	24.6
3	soil	0-1	Inches	250	SS124S	U04-1197	mg/Kg	2.7	1.4	1150	26700	0.55	41.2
3	soil	0-1	Inches	250	SS125S	U04-1199	mg/Kg	1.3	0.42	398	12300	0.175	18
3	soil	0-1	Inches	250	SS127	U04-1201	mg/Kg	1.9	0.5	1020	27700	0.175	20.8
3	soil	0-1	Inches	250	SS128	U04-1202	mg/Kg	1.8	0.2	454	31800	0.36	27.2
3	soil	0-1	Inches	250	SS129S	U04-1204	mg/Kg	2.1	0.15	315	26000	0.175	28.4
3	soil	0-1	Inches	250	SS134	U04-1210	mg/Kg	2.2	0.15	334	47200	0.175	40.5
3	soil	0-1	Inches	250	SS135	U04-1211	mg/Kg	2.1	0.15	325	36400	0.175	33.4
3	soil	0-1	Inches	250	SS137	U04-1213	mg/Kg	2.3	0.12	309	62000	0.175	34.7
3	soil	0-1	Inches	250	SS138	U04-1214	mg/Kg	2.4	0.16	297	57200	0.175	37.4
3	soil	0-1	Inches	250	SS141	U04-1217	mg/Kg	1.9	0.1	320	55600	0.175	35.9
3	soil	0-1	Inches	250	SS142	U04-1218	mg/Kg	3.2	0.14	392	53500	0.175	33.9
3	soil	0-1	Inches	250	SS145	U04-1221	mg/Kg	3.4	0.07	413	141000	0.175	38.8
3	soil	0-1	Inches	250	SS146	U04-1222	mg/Kg	2.7	0.35	710	64300	0.175	35.6
3	soil	0-1	Inches	250	SS148	U04-1224	mg/Kg	3.8	0.2	632	123000	0.39	29.1

Data File **Variable: Arsenic**

Raw Statistics	
Number of Valid Samples	22
Number of Unique Samples	18
Minimum	1.3
Maximum	15.1
Mean	3.5090909
Median	2.75
Standard Deviation	2.8741722
Variance	8.2608658
Coefficient of Variation	0.8190646
Skewness	3.4772118

Gamma Statistics	
k hat	3.1703638
k star (bias corrected)	2.7683445
Theta hat	1.1068417
Theta star	1.2675774
nu hat	139.49601
nu star	121.80716
Approx.Chi Square Value (.05)	97.31548
Adjusted Level of Significance	0.0386
Adjusted Chi Square Value	95.682208

Log-transformed Statistics	
Minimum of log data	0.2623643
Maximum of log data	2.7146947
Mean of log data	1.0894344
Standard Deviation of log data	0.5170475
Variance of log data	0.2673381

RECOMMENDATION

Data are Non-parametric (0.05)

Use 95% Chebyshev (Mean, Sd) UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.5705721
Shapiro-Wilk 5% Critical Value	0.911
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	4.56352

Gamma Distribution Test	
A-D Test Statistic	1.4626385
A-D 5% Critical Value	0.7489396
K-S Test Statistic	0.2162697
K-S 5% Critical Value	0.1866097
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	4.3922343
Adjusted Gamma UCL	4.4672087

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8803159
Shapiro-Wilk 5% Critical Value	0.911
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	4.2569698
95% Chebyshev (MVUE) UCL	5.0630185
97.5% Chebyshev (MVUE) UCL	5.793522
99% Chebyshev (MVUE) UCL	7.2284545

95% Non-parametric UCLs	
CLT UCL	4.517017
Adj-CLT UCL (Adjusted for skewness)	5.0024191
Mod-t UCL (Adjusted for skewness)	4.6392329
Jackknife UCL	4.56352
Standard Bootstrap UCL	4.489782
Bootstrap-t UCL	6.4884441
Hall's Bootstrap UCL	9.1801083
Percentile Bootstrap UCL	4.5909091
BCA Bootstrap UCL	5.2090909
95% Chebyshev (Mean, Sd) UCL	**6.1801177**
97.5% Chebyshev (Mean, Sd) UCL	7.3358731
99% Chebyshev (Mean, Sd) UCL	9.6061309

Data File **Variable: Cadmium**

Raw Statistics	
Number of Valid Samples	22
Number of Unique Samples	19
Minimum	0.07
Maximum	51.6
Mean	4.5609091
Median	0.385
Standard Deviation	11.237489
Variance	126.28115
Coefficient of Variation	2.4638703
Skewness	3.8666174

Gamma Statistics	
k hat	0.3613406
k star (bias corrected)	0.3423699
Theta hat	12.622188
Theta star	13.321582
nu hat	15.898987
nu star	15.064277
Approx.Chi Square Value (.05)	7.3050861
Adjusted Level of Significance	0.0386
Adjusted Chi Square Value	6.9035503

Log-transformed Statistics	
Minimum of log data	-2.65926
Maximum of log data	3.9435217
Mean of log data	-0.333797
Standard Deviation of log data	1.919148
Variance of log data	3.6831289

RECOMMENDATION

Data are Non-parametric (0.05)

Use 99% Chebyshev (Mean, Sd) UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.4431176
Shapiro-Wilk 5% Critical Value	0.911
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	8.6835342

Gamma Distribution Test	
A-D Test Statistic	1.7813478
A-D 5% Critical Value	0.8343044
K-S Test Statistic	0.2446651
K-S 5% Critical Value	0.1995237
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	9.405337
Adjusted Gamma UCL	9.9523859

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8928686
Shapiro-Wilk 5% Critical Value	0.911
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	23.832328
95% Chebyshev (MVUE) UCL	12.008774
97.5% Chebyshev (MVUE) UCL	15.601306
99% Chebyshev (MVUE) UCL	22.658139

95% Non-parametric UCLs	
CLT UCL	8.5017162
Adj-CLT UCL (Adjusted for skewness)	10.612084
Mod-t UCL (Adjusted for skewness)	9.0127089
Jackknife UCL	8.6835342
Standard Bootstrap UCL	8.3820573
Bootstrap-t UCL	19.41729
Hall's Bootstrap UCL	23.007291
Percentile Bootstrap UCL	8.9540909
BCA Bootstrap UCL	11.785455
95% Chebyshev (Mean, Sd) UCL	15.004136
97.5% Chebyshev (Mean, Sd) UCL	19.522929
99% Chebyshev (Mean, Sd) UCL	**28.399222**

Data File **Variable: Copper**

Raw Statistics	
Number of Valid Samples	22
Number of Unique Samples	22
Minimum	297
Maximum	7880
Mean	1296.5909
Median	671
Standard Deviation	1741.639
Variance	3033306.3
Coefficient of Variation	1.3432448
Skewness	3.0285148

Gamma Statistics	
k hat	1.1478277
k star (bias corrected)	1.0216088
Theta hat	1129.6041
Theta star	1269.1658
nu hat	50.50442
nu star	44.950787
Approx.Chi Square Value (.05)	30.569066
Adjusted Level of Significance	0.0386
Adjusted Chi Square Value	29.683596

Log-transformed Statistics	
Minimum of log data	5.6937321
Maximum of log data	8.9720832
Mean of log data	6.672369
Standard Deviation of log data	0.9264816
Variance of log data	0.8583682

RECOMMENDATION

Assuming gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.5957538
Shapiro-Wilk 5% Critical Value	0.911
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	1935.5348

Gamma Distribution Test	
A-D Test Statistic	1.2818974
A-D 5% Critical Value	0.7672167
K-S Test Statistic	0.1884749
K-S 5% Critical Value	0.1900966
Data follow approximate gamma distibution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**1906.5934**
Adjusted Gamma UCL	1963.4677

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8923943
Shapiro-Wilk 5% Critical Value	0.911
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	1993.4208
95% Chebyshev (MVUE) UCL	2314.5981
97.5% Chebyshev (MVUE) UCL	2804.6302
99% Chebyshev (MVUE) UCL	3767.2034

95% Non-parametric UCLs	
CLT UCL	1907.3558
Adj-CLT UCL (Adjusted for skewness)	2163.536
Mod-t UCL (Adjusted for skewness)	1975.4937
Jackknife UCL	1935.5348
Standard Bootstrap UCL	1896.7817
Bootstrap-t UCL	2913.7635
Hall's Bootstrap UCL	4704.0815
Percentile Bootstrap UCL	1935.2273
BCA Bootstrap UCL	2280.2727
95% Chebyshev (Mean, Sd) UCL	2915.1315
97.5% Chebyshev (Mean, Sd) UCL	3615.4753
99% Chebyshev (Mean, Sd) UCL	4991.1651

Data File **Variable: Iron**

Raw Statistics	
Number of Valid Samples	22
Number of Unique Samples	22
Minimum	12300
Maximum	141000
Mean	45209.091
Median	34700
Standard Deviation	31919.869
Variance	1.019E+09
Coefficient of Variation	0.7060498
Skewness	1.9988318

Gamma Statistics	
k hat	2.8993164
k star (bias corrected)	2.5342581
Theta hat	15593.017
Theta star	17839.182
nu hat	127.56992
nu star	111.50736
Approx.Chi Square Value (.05)	88.127497
Adjusted Level of Significance	0.0386
Adjusted Chi Square Value	86.576637

Log-transformed Statistics	
Minimum of log data	9.4173545
Maximum of log data	11.856515
Mean of log data	10.536797
Standard Deviation of log data	0.5955264
Variance of log data	0.3546517

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.77207
Shapiro-Wilk 5% Critical Value	0.911
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	56919.328

Gamma Distribution Test	
A-D Test Statistic	0.5610472
A-D 5% Critical Value	0.7500966
K-S Test Statistic	0.1528265
K-S 5% Critical Value	0.1868178
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**57202.875**
Adjusted Gamma UCL	58227.559

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9701563
Shapiro-Wilk 5% Critical Value	0.911
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	58895.564
95% Chebyshev (MVUE) UCL	70550.986
97.5% Chebyshev (MVUE) UCL	81792.535
99% Chebyshev (MVUE) UCL	103874.38

95% Non-parametric UCLs	
CLT UCL	56402.877
Adj-CLT UCL (Adjusted for skewness)	59501.688
Mod-t UCL (Adjusted for skewness)	57402.679
Jackknife UCL	56919.328
Standard Bootstrap UCL	56331.274
Bootstrap-t UCL	65235.404
Hall's Bootstrap UCL	118515.05
Percentile Bootstrap UCL	56604.545
BCA Bootstrap UCL	60413.636
95% Chebyshev (Mean, Sd) UCL	74872.875
97.5% Chebyshev (Mean, Sd) UCL	87708.418
99% Chebyshev (Mean, Sd) UCL	112921.36

Data File

Variable: Thallium

Raw Statistics	
Number of Valid Samples	22
Number of Unique Samples	7
Minimum	0.175
Maximum	1.6
Mean	0.3527273
Median	0.175
Standard Deviation	0.3300171
Variance	0.1089113
Coefficient of Variation	0.9356154
Skewness	2.9931374

Gamma Statistics	
k hat	2.2899852
k star (bias corrected)	2.0080175
Theta hat	0.1540304
Theta star	0.1756595
nu hat	100.75935
nu star	88.352772
Approx.Chi Square Value (.05)	67.678238
Adjusted Level of Significance	0.0386
Adjusted Chi Square Value	66.327782

Log-transformed Statistics	
Minimum of log data	-1.742969
Maximum of log data	0.4700036
Mean of log data	-1.276013
Standard Deviation of log data	0.620866
Variance of log data	0.3854746

RECOMMENDATION

Data are Non-parametric (0.05)

Use 95% Chebyshev (Mean, Sd) UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.5774413
Shapiro-Wilk 5% Critical Value	0.911
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	0.4737985

Gamma Distribution Test	
A-D Test Statistic	2.4392391
A-D 5% Critical Value	0.7541913
K-S Test Statistic	0.3089405
K-S 5% Critical Value	0.1875307
Data do not follow gamma distribution at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.4604794
Adjusted Gamma UCL	0.4698549

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.751241
Shapiro-Wilk 5% Critical Value	0.911
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.4497952
95% Chebyshev (MVUE) UCL	0.539454
97.5% Chebyshev (MVUE) UCL	0.6279005
99% Chebyshev (MVUE) UCL	0.8016364

95% Non-parametric UCLs	
CLT UCL	0.468459
Adj-CLT UCL (Adjusted for skewness)	0.5164346
Mod-t UCL (Adjusted for skewness)	0.4812817
Jackknife UCL	0.4737985
Standard Bootstrap UCL	0.4671814
Bootstrap-t UCL	0.637433
Hall's Bootstrap UCL	1.0043945
Percentile Bootstrap UCL	0.4784091
BCA Bootstrap UCL	0.5372727
95% Chebyshev (Mean, Sd) UCL	**0.6594188**
97.5% Chebyshev (Mean, Sd) UCL	0.7921245
99% Chebyshev (Mean, Sd) UCL	1.0527992

Data File **Variable: Vanadium**

Raw Statistics	
Number of Valid Samples	22
Number of Unique Samples	20
Minimum	18
Maximum	41.2
Mean	28.468182
Median	27.8
Standard Deviation	7.82544
Variance	61.237511
Coefficient of Variation	0.2748837
Skewness	0.2174183

Gamma Statistics	
k hat	13.78295
k star (bias corrected)	11.93376
Theta hat	2.0654636
Theta star	2.3855165
nu hat	606.44982
nu star	525.08545
Approx.Chi Square Value (.05)	472.93196
Adjusted Level of Significance	0.0386
Adjusted Chi Square Value	469.24453

Log-transformed Statistics	
Minimum of log data	2.8903718
Maximum of log data	3.7184383
Mean of log data	3.3120719
Standard Deviation of log data	0.2785838
Variance of log data	0.0776089

RECOMMENDATION
Assuming gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9042505
Shapiro-Wilk 5% Critical Value	0.911
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	31.339051

Gamma Distribution Test	
A-D Test Statistic	0.8242507
A-D 5% Critical Value	0.742363
K-S Test Statistic	0.1805758
K-S 5% Critical Value	0.1851511
Data follow approximate gamma distibution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**31.607566**
Adjusted Gamma UCL	31.855946

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9081206
Shapiro-Wilk 5% Critical Value	0.911
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	31.855403
95% Chebyshev (MVUE) UCL	35.940798
97.5% Chebyshev (MVUE) UCL	39.170927
99% Chebyshev (MVUE) UCL	45.51589

95% Non-parametric UCLs	
CLT UCL	31.212438
Adj-CLT UCL (Adjusted for skewness)	31.295073
Mod-t UCL (Adjusted for skewness)	31.35194
Jackknife UCL	31.339051
Standard Bootstrap UCL	31.157789
Bootstrap-t UCL	31.419205
Hall's Bootstrap UCL	31.099437
Percentile Bootstrap UCL	31.081818
BCA Bootstrap UCL	31.172727
95% Chebyshev (Mean, Sd) UCL	35.740523
97.5% Chebyshev (Mean, Sd) UCL	38.88727
99% Chebyshev (Mean, Sd) UCL	45.068447

Data Set Used to Calculate Soil EPCs for the Locally-Grown Vegetable Pathway, Exposure Area 3

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
3	soil	0-6	Inches	2000	S80	U04-1114	mg/kg	1.1	0.58	1440	17200	0.37	16
3	soil	0-6	Inches	2000	S81	U04-1115	mg/kg	2.5	0.21	875	20300	0.37	30.4
3	soil	0-6	Inches	2000	S82	U04-1116	mg/kg	2.2	0.23	455	12600	0.37	17.6
3	soil	0-6	Inches	2000	S83	U04-1117	mg/kg	1.9	0.14	358	11400	0.37	18.2
3	soil	0-6	Inches	2000	S84	U04-1118	mg/kg	0.45	0.14	362	14600	0.37	8.4
3	soil	0-6	Inches	2000	S85	U04-1119	mg/kg	1.4	0.17	451	18500	0.37	22.6
3	soil	0-6	Inches	2000	S86	U04-1120	mg/kg	2.4	0.26	513	16200	0.37	20.8
3	soil	0-6	Inches	2000	S87	U04-1121	mg/kg	1.4	0.3	309	9290	0.37	17.2
3	soil	0-6	Inches	2000	S91	U04-1125	mg/kg	1.8	0.25	926	36300	0.37	16.5
3	soil	0-6	Inches	2000	S92	U04-1126	mg/kg	2.2	0.33	581	15300	0.37	22.1
3	soil	0-6	Inches	2000	S93	U04-1127	mg/kg	2.5	0.16	308	18500	0.37	25.7
3	soil	0-6	Inches	2000	SS124D	U04-1196	mg/Kg	3.2	1	523	23600	0.175	52.2
3	soil	0-6	Inches	2000	SS125D	U04-1198	mg/Kg	0.96	0.25	166	9610	0.175	16.9
3	soil	0-6	Inches	2000	SS129D	U04-1203	mg/Kg	1.9	0.1	337	19000	0.175	28.5
3	soil	0-6	Inches	2000	U07-0041	U07-0041	mg/kg	1	4.7	974	33300	0.18	14.1
3	soil	0-6	Inches	2000	U07-0053	U07-0053	mg/kg	0.34	1.1	817	22400	0.09	12.4
3	soil	0-6	Inches	2000	U07-0066	U07-0066	mg/kg	0.155	1.5	423	15900	0.09	12.3
3	soil	0-6	Inches	2000	U07-0078	U07-0078	mg/kg	1.1	1	624	13900	0.09	9.1
3	soil	0-6	Inches	2000	U07-0104	U07-0104	mg/kg	0.55	1	744	25200	0.13	16.7
3	soil	0-6	Inches	2000	U07-0116	U07-0116	mg/kg	0.39	0.52	730	26600	0.07	4.2
3	soil	0-6	Inches	2000	U07-0307	U07-0307	mg/kg	0.5	1.2	1100	20700	0.11	12.8
3	soil	0-6	Inches	2000	U07-0346	U07-0346	mg/kg	0.33	0.78	599	19800	0.08	9.2
3	soil	1-6	Inches		U06-3009	U06-3009	mg/Kg	1.76	0.34	250	56500	7.1	24.7
3	soil	1-6	Inches		U06-3019	U06-3019	mg/Kg	1.37	0.36	309	25800	10.3	20.4

Data File **Variable: Arsenic**

Raw Statistics	
Number of Valid Samples	24
Number of Unique Samples	19
Minimum	0.155
Maximum	3.2
Mean	1.391875
Median	1.385
Standard Deviation	0.8479166
Variance	0.7189626
Coefficient of Variation	0.6091902
Skewness	0.2724602

Gamma Statistics	
k hat	2.1531679
k star (bias corrected)	1.9117997
Theta hat	0.6464312
Theta star	0.7280444
nu hat	103.35206
nu star	91.766386
Approx.Chi Square Value (.05)	70.672319
Adjusted Level of Significance	0.0392
Adjusted Chi Square Value	69.370733

Log-transformed Statistics	
Minimum of log data	-1.86433
Maximum of log data	1.1631508
Mean of log data	0.0808156
Standard Deviation of log data	0.8062342
Variance of log data	0.6500135

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9506695
Shapiro-Wilk 5% Critical Value	0.916
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**1.6885123**

Gamma Distribution Test	
A-D Test Statistic	0.5549753
A-D 5% Critical Value	0.754455
K-S Test Statistic	0.1367463
K-S 5% Critical Value	0.1800468
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	1.8073178
Adjusted Gamma UCL	1.841228

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9148539
Shapiro-Wilk 5% Critical Value	0.916
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	2.2024576
95% Chebyshev (MVUE) UCL	2.6326292
97.5% Chebyshev (MVUE) UCL	3.1336277
99% Chebyshev (MVUE) UCL	4.1177423

95% Non-parametric UCLs	
CLT UCL	1.6765667
Adj-CLT UCL (Adjusted for skewness)	1.6868522
Mod-t UCL (Adjusted for skewness)	1.6901166
Jackknife UCL	1.6885123
Standard Bootstrap UCL	1.6685387
Bootstrap-t UCL	1.7019139
Hall's Bootstrap UCL	1.6818732
Percentile Bootstrap UCL	1.6758333
BCA Bootstrap UCL	1.68375
95% Chebyshev (Mean, Sd) UCL	2.1463144
97.5% Chebyshev (Mean, Sd) UCL	2.4727609
99% Chebyshev (Mean, Sd) UCL	3.1140018

Data File **Variable: Copper**

Raw Statistics	
Number of Valid Samples	24
Number of Unique Samples	23
Minimum	166
Maximum	1440
Mean	590.58333
Median	518
Standard Deviation	309.19417
Variance	95601.036
Coefficient of Variation	0.5235403
Skewness	1.0355136

Gamma Statistics	
k hat	4.0599616
k star (bias corrected)	3.5802442
Theta hat	145.46525
Theta star	164.95616
nu hat	194.87816
nu star	171.85172
Approx.Chi Square Value (.05)	142.53015
Adjusted Level of Significance	0.0392
Adjusted Chi Square Value	140.65407

Log-transformed Statistics	
Minimum of log data	5.1119878
Maximum of log data	7.2723984
Mean of log data	6.2529311
Standard Deviation of log data	0.5235916
Variance of log data	0.2741482

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9238487
Shapiro-Wilk 5% Critical Value	0.916
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**698.7526**

Gamma Distribution Test	
A-D Test Statistic	0.2161833
A-D 5% Critical Value	0.7485577
K-S Test Statistic	0.1036094
K-S 5% Critical Value	0.178686
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	712.07927
Adjusted Gamma UCL	721.57717

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9873926
Shapiro-Wilk 5% Critical Value	0.916
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	740.56349
95% Chebyshev (MVUE) UCL	879.98877
97.5% Chebyshev (MVUE) UCL	1004.5747
99% Chebyshev (MVUE) UCL	1249.2995

95% Non-parametric UCLs	
CLT UCL	694.39662
Adj-CLT UCL (Adjusted for skewness)	708.65126
Mod-t UCL (Adjusted for skewness)	700.97603
Jackknife UCL	698.7526
Standard Bootstrap UCL	691.51366
Bootstrap-t UCL	716.20396
Hall's Bootstrap UCL	716.64347
Percentile Bootstrap UCL	697.875
BCA Bootstrap UCL	704.95833
95% Chebyshev (Mean, Sd) UCL	865.69086
97.5% Chebyshev (Mean, Sd) UCL	984.73011
99% Chebyshev (Mean, Sd) UCL	1218.5597

Data File **Variable: Cadmium**

Raw Statistics	
Number of Valid Samples	24
Number of Unique Samples	20
Minimum	0.1
Maximum	4.7
Mean	0.6925
Median	0.335
Standard Deviation	0.9448545
Variance	0.89275
Coefficient of Variation	1.3644108
Skewness	3.5803639

Gamma Statistics	
k hat	1.1550988
k star (bias corrected)	1.0384892
Theta hat	0.5995158
Theta star	0.6668341
nu hat	55.44474
nu star	49.847481
Approx.Chi Square Value (.05)	34.634203
Adjusted Level of Significance	0.0392
Adjusted Chi Square Value	33.742067

Log-transformed Statistics	
Minimum of log data	-2.302585
Maximum of log data	1.5475625
Mean of log data	-0.85912
Standard Deviation of log data	0.9405138
Variance of log data	0.8845662

RECOMMENDATION

Data are lognormal (0.05)

Use H-UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.5695842
Shapiro-Wilk 5% Critical Value	0.916
Data not normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t UCL	1.0230503

Gamma Distribution Test	
A-D Test Statistic	1.0070472
A-D 5% Critical Value	0.7686519
K-S Test Statistic	0.2041711
K-S 5% Critical Value	0.1824423
Data do not follow gamma distribution	
at 5% significance level	
95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.9966847
Adjusted Gamma UCL	1.0230369

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9460715
Shapiro-Wilk 5% Critical Value	0.916
Data are lognormal at 5% significance level	
95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	**1.0648243**
95% Chebyshev (MVUE) UCL	1.2456525
97.5% Chebyshev (MVUE) UCL	1.5065754
99% Chebyshev (MVUE) UCL	2.019108

95% Non-parametric UCLs	
CLT UCL	1.009739
Adj-CLT UCL (Adjusted for skewness)	1.1603516
Mod-t UCL (Adjusted for skewness)	1.0465428
Jackknife UCL	1.0230503
Standard Bootstrap UCL	1.0073081
Bootstrap-t UCL	1.393141
Hall's Bootstrap UCL	2.247635
Percentile Bootstrap UCL	1.04
BCA Bootstrap UCL	1.21125
95% Chebyshev (Mean, Sd) UCL	1.5331904
97.5% Chebyshev (Mean, Sd) UCL	1.8969579
99% Chebyshev (Mean, Sd) UCL	2.6115085

Data File **Variable: Iron**

Raw Statistics	
Number of Valid Samples	24
Number of Unique Samples	23
Minimum	9290
Maximum	56500
Mean	20937.5
Median	18750
Standard Deviation	10133.334
Variance	102684454
Coefficient of Variation	0.4839801
Skewness	2.0648791

Gamma Statistics	
k hat	5.7835189
k star (bias corrected)	5.0883569
Theta hat	3620.2008
Theta star	4114.7861
nu hat	277.60891
nu star	244.24113
Approx.Chi Square Value (.05)	209.05207
Adjusted Level of Significance	0.0392
Adjusted Chi Square Value	206.76578

Log-transformed Statistics	
Minimum of log data	9.1366938
Maximum of log data	10.941996
Mean of log data	9.8603605
Standard Deviation of log data	0.4161308
Variance of log data	0.1731648

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8222954
Shapiro-Wilk 5% Critical Value	0.916
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	24482.571

Gamma Distribution Test	
A-D Test Statistic	0.3865374
A-D 5% Critical Value	0.7458817
K-S Test Statistic	0.1221259
K-S 5% Critical Value	0.1782222
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**24461.842**
Adjusted Gamma UCL	24732.326

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.973868
Shapiro-Wilk 5% Critical Value	0.916
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	24637.453
95% Chebyshev (MVUE) UCL	28730.785
97.5% Chebyshev (MVUE) UCL	32159.256
99% Chebyshev (MVUE) UCL	38893.824

95% Non-parametric UCLs	
CLT UCL	24339.811
Adj-CLT UCL (Adjusted for skewness)	25271.382
Mod-t UCL (Adjusted for skewness)	24627.877
Jackknife UCL	24482.571
Standard Bootstrap UCL	24281.974
Bootstrap-t UCL	26130.078
Hall's Bootstrap UCL	30092.949
Percentile Bootstrap UCL	24462.5
BCA Bootstrap UCL	25425
95% Chebyshev (Mean, Sd) UCL	29953.7
97.5% Chebyshev (Mean, Sd) UCL	33855.017
99% Chebyshev (Mean, Sd) UCL	41518.398

Data File **Variable: Thallium**

Raw Statistics	
Number of Valid Samples	24
Number of Unique Samples	10
Minimum	0.07
Maximum	10.3
Mean	0.9514583
Median	0.37
Standard Deviation	2.4358574
Variance	5.933401
Coefficient of Variation	2.5601303
Skewness	3.4163657

Gamma Statistics	
k hat	0.5213767
k star (bias corrected)	0.4839824
Theta hat	1.8248963
Theta star	1.9658946
nu hat	25.02608
nu star	23.231153
Approx.Chi Square Value (.05)	13.263812
Adjusted Level of Significance	0.0392
Adjusted Chi Square Value	12.73444

Log-transformed Statistics	
Minimum of log data	-2.65926
Maximum of log data	2.3321439
Mean of log data	-1.26019
Standard Deviation of log data	1.2153972
Variance of log data	1.4771903

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.3666319
Shapiro-Wilk 5% Critical Value	0.916
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	1.8036248

Gamma Distribution Test	
A-D Test Statistic	4.343257
A-D 5% Critical Value	0.8042907
K-S Test Statistic	0.4582054
K-S 5% Critical Value	0.1878572
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	1.6664497
Adjusted Gamma UCL	1.7357241

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.753909
Shapiro-Wilk 5% Critical Value	0.916
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	1.2119999
95% Chebyshev (MVUE) UCL	1.2835009
97.5% Chebyshev (MVUE) UCL	1.5944451
99% Chebyshev (MVUE) UCL	2.2052348

95% Non-parametric UCLs	
CLT UCL	1.769308
Adj-CLT UCL (Adjusted for skewness)	2.1398056
Mod-t UCL (Adjusted for skewness)	1.8614149
Jackknife UCL	1.8036248
Standard Bootstrap UCL	1.7351848
Bootstrap-t UCL	14.642146
Hall's Bootstrap UCL	9.5950997
Percentile Bootstrap UCL	1.8170833
BCA Bootstrap UCL	2.1970833
95% Chebyshev (Mean, Sd) UCL	3.1187783
97.5% Chebyshev (Mean, Sd) UCL	4.0565794
99% Chebyshev (Mean, Sd) UCL	**5.898708**

RECOMMENDATION

Data are Non-parametric (0.05)

Use 99% Chebyshev (Mean, Sd) UCL

Data File **Variable: Vanadium**

Raw Statistics	
Number of Valid Samples	24
Number of Unique Samples	24
Minimum	4.2
Maximum	52.2
Mean	18.708333
Median	17.05
Standard Deviation	9.6294348
Variance	92.726014
Coefficient of Variation	0.5147137
Skewness	1.8065749

Gamma Statistics	
k hat	4.4274145
k star (bias corrected)	3.9017655
Theta hat	4.2255662
Theta star	4.794838
nu hat	212.5159
nu star	187.28474
Approx.Chi Square Value (.05)	156.62133
Adjusted Level of Significance	0.0392
Adjusted Chi Square Value	154.65146

Log-transformed Statistics	
Minimum of log data	1.4350845
Maximum of log data	3.9550825
Mean of log data	2.8118062
Standard Deviation of log data	0.5080492
Variance of log data	0.258114

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8647467
Shapiro-Wilk 5% Critical Value	0.916
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	22.077119

Gamma Distribution Test	
A-D Test Statistic	0.3066829
A-D 5% Critical Value	0.7476244
K-S Test Statistic	0.10328
K-S 5% Critical Value	0.178539
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**22.371061**
Adjusted Gamma UCL	22.656012

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9636672
Shapiro-Wilk 5% Critical Value	0.916
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	23.344668
95% Chebyshev (MVUE) UCL	27.679281
97.5% Chebyshev (MVUE) UCL	31.513015
99% Chebyshev (MVUE) UCL	39.043643

95% Non-parametric UCLs	
CLT UCL	21.941458
Adj-CLT UCL (Adjusted for skewness)	22.715966
Mod-t UCL (Adjusted for skewness)	22.197926
Jackknife UCL	22.077119
Standard Bootstrap UCL	21.844562
Bootstrap-t UCL	23.173417
Hall's Bootstrap UCL	26.022947
Percentile Bootstrap UCL	22.083333
BCA Bootstrap UCL	22.745833
95% Chebyshev (Mean, Sd) UCL	27.276186
97.5% Chebyshev (Mean, Sd) UCL	30.983502
99% Chebyshev (Mean, Sd) UCL	38.265808

Data Set Used to Calculate Soil EPCs for Chicken, Eggs, and Beef Pathway

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper
3	soil	0-1	Inches		U04-1003	U04-1003	mg/kg	0.05	29.1	1880
3	soil	0-1	Inches		U04-1010	U04-1010	mg/kg	3.02	1.5	1230
3	soil	0-1	Inches		U04-1011	U04-1011	mg/kg	4.78	1.18	990
3	soil	0-1	Inches		U06-3007	U06-3007	mg/kg	2.44	1.15	1330
3	soil	0-1	Inches		U06-3008	U06-3008	mg/kg	2.21	0.89	469
3	soil	0-1	Inches		U06-3012	U06-3012	mg/kg	2.37	0.98	647
3	soil	0-1	Inches		U06-3013	U06-3013	mg/kg	2.95	0.92	624
3	soil	0-1	Inches		U06-3018	U06-3018	mg/kg	1.63	0.83	521
3	soil	0-1	Inches		U06-3020	U06-3020	mg/kg	2.71	0.89	531

This data set in Exposure Area 3 does not have data for Iron, Thallium, or Vanadium

Data File **Variable: Arsenic**

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	9
Minimum	0.05
Maximum	4.78
Mean	2.4622222
Median	2.44
Standard Deviation	1.2533234
Variance	1.5708194
Coefficient of Variation	0.5090212
Skewness	-0.15293

Gamma Statistics	
k hat	1.5001563
k star (bias corrected)	1.0741783
Theta hat	1.6413105
Theta star	2.2921915
nu hat	27.002813
nu star	19.335209
Approx.Chi Square Value (.05)	10.361108
Adjusted Level of Significance	0.02308
Adjusted Chi Square Value	9.0082235

Log-transformed Statistics	
Minimum of log data	-2.995732
Maximum of log data	1.5644405
Mean of log data	0.532131
Standard Deviation of log data	1.354022
Variance of log data	1.8333755

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.92769
Shapiro-Wilk 5% Critical Value	0.829
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**3.2390939**

Gamma Distribution Test	
A-D Test Statistic	1.2678378
A-D 5% Critical Value	0.7343586
K-S Test Statistic	0.3362983
K-S 5% Critical Value	0.2839795
Data do not follow gamma distribution at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	4.5948349
Adjusted Gamma UCL	5.2849022

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.595289
Shapiro-Wilk 5% Critical Value	0.829
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	31.199248
95% Chebyshev (MVUE) UCL	11.050269
97.5% Chebyshev (MVUE) UCL	14.259184
99% Chebyshev (MVUE) UCL	20.562475

95% Non-parametric UCLs	
CLT UCL	3.1494
Adj-CLT UCL (Adjusted for skewness)	3.1266441
Mod-t UCL (Adjusted for skewness)	3.2355444
Jackknife UCL	3.2390939
Standard Bootstrap UCL	3.1103013
Bootstrap-t UCL	3.1875386
Hall's Bootstrap UCL	3.3341511
Percentile Bootstrap UCL	3.11
BCA Bootstrap UCL	3.1
95% Chebyshev (Mean, Sd) UCL	4.2832588
97.5% Chebyshev (Mean, Sd) UCL	5.0712228
99% Chebyshev (Mean, Sd) UCL	6.6190255

Data File **Variable: Cadmium**

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	8
Minimum	0.83
Maximum	29.1
Mean	4.16
Median	0.98
Standard Deviation	9.354841
Variance	87.51305
Coefficient of Variation	2.2487599
Skewness	2.997121

Gamma Statistics	
k hat	0.5998311
k star (bias corrected)	0.4739615
Theta hat	6.9352859
Theta star	8.777085
nu hat	10.796959
nu star	8.5313063
Approx.Chi Square Value (.05)	3.0456971
Adjusted Level of Significance	0.02308
Adjusted Chi Square Value	2.397545

Log-transformed Statistics	
Minimum of log data	-0.18633
Maximum of log data	3.3707382
Mean of log data	0.3953887
Standard Deviation of log data	1.1311198
Variance of log data	1.279432

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.4090329
Shapiro-Wilk 5% Critical Value	0.829
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	9.958592

Gamma Distribution Test	
A-D Test Statistic	2.4328949
A-D 5% Critical Value	0.763011
K-S Test Statistic	0.476104
K-S 5% Critical Value	0.2921632
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	11.652581
Adjusted Gamma UCL	14.80274

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.5352394
Shapiro-Wilk 5% Critical Value	0.829
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	11.92715
95% Chebyshev (MVUE) UCL	6.8952687
97.5% Chebyshev (MVUE) UCL	8.7764279
99% Chebyshev (MVUE) UCL	12.471601

95% Non-parametric UCLs	
CLT UCL	9.2891147
Adj-CLT UCL (Adjusted for skewness)	12.617845
Mod-t UCL (Adjusted for skewness)	10.477807
Jackknife UCL	9.958592
Standard Bootstrap UCL	8.962109
Bootstrap-t UCL	240.84849
Hall's Bootstrap UCL	121.71159
Percentile Bootstrap UCL	10.364444
BCA Bootstrap UCL	13.512222
95% Chebyshev (Mean, Sd) UCL	17.752269
97.5% Chebyshev (Mean, Sd) UCL	**23.633654**
99% Chebyshev (Mean, Sd) UCL	35.186498

RECOMMENDATION

Data are Non-parametric (0.05)

Use 99% Chebyshev (Mean, Sd) UCL

Recommended UCL exceeds the maximum observation

Consider using 95% or 97.5% Chebyshev (Mean, Sd) UCL

Data File **Variable: Copper**

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	9
Minimum	469
Maximum	1880
Mean	913.55556
Median	647
Standard Deviation	483.01064
Variance	233299.28
Coefficient of Variation	0.5287151
Skewness	1.0831765

Gamma Statistics	
k hat	4.562978
k star (bias corrected)	3.1160594
Theta hat	200.21038
Theta star	293.17656
nu hat	82.133603
nu star	56.089069
Approx.Chi Square Value (.05)	39.873479
Adjusted Level of Significance	0.02308
Adjusted Chi Square Value	37.008447

Log-transformed Statistics	
Minimum of log data	6.1506028
Maximum of log data	7.5390271
Mean of log data	6.703783
Standard Deviation of log data	0.4949
Variance of log data	0.244926

RECOMMENDATION
Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8587704
Shapiro-Wilk 5% Critical Value	0.829
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**1212.9494**

Gamma Distribution Test	
A-D Test Statistic	0.4961486
A-D 5% Critical Value	0.7237214
K-S Test Statistic	0.2595982
K-S 5% Critical Value	0.2800978
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	1285.0767
Adjusted Gamma UCL	1384.5617

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9044315
Shapiro-Wilk 5% Critical Value	0.829
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	1376.8628
95% Chebyshev (MVUE) UCL	1570.4607
97.5% Chebyshev (MVUE) UCL	1857.0147
99% Chebyshev (MVUE) UCL	2419.8945

95% Non-parametric UCLs	
CLT UCL	1178.3828
Adj-CLT UCL (Adjusted for skewness)	1240.4974
Mod-t UCL (Adjusted for skewness)	1222.638
Jackknife UCL	1212.9494
Standard Bootstrap UCL	1161.8524
Bootstrap-t UCL	1355.3615
Hall's Bootstrap UCL	1206.4419
Percentile Bootstrap UCL	1174.6667
BCA Bootstrap UCL	1212.6667
95% Chebyshev (Mean, Sd) UCL	1615.3537
97.5% Chebyshev (Mean, Sd) UCL	1919.0224
99% Chebyshev (Mean, Sd) UCL	2515.5206

Data Set for Direct Contact with Soil Pathway, Exposure Area 4

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
4	soil	0-1	Inches	250	S1	U04-1035	mg/kg	3.7	0.72	1240	13100	0.37	22.7
4	soil	0-1	Inches	250	S10	U04-1044	mg/kg	3	4.1	6090	13900	0.37	16.8
4	soil	0-1	Inches	250	S11	U04-1045	mg/kg	3.4	2	3880	17100	0.37	23.1
4	soil	0-1	Inches	250	S12	U04-1046	mg/kg	2.5	2.3	3160	17000	0.37	25.5
4	soil	0-1	Inches	250	S13	U04-1047	mg/kg	6.4	5.9	5920	21000	0.37	29
4	soil	0-1	Inches	250	S14	U04-1048	mg/kg	5.6	5.2	8030	19100	0.37	21.4
4	soil	0-1	Inches	250	S15	U04-1049	mg/kg	6.8	11	12100	24000	0.37	21.3
4	soil	0-1	Inches	250	S16	U04-1050	mg/kg	4.5	5.6	8310	17100	0.37	20.4
4	soil	0-1	Inches	250	S17	U04-1051	mg/kg	3.6	2.7	4650	20100	0.37	25.7
4	soil	0-1	Inches	250	S18	U04-1052	mg/kg	3.6	1.6	3670	16500	0.37	26.2
4	soil	0-1	Inches	250	S19	U04-1053	mg/kg	5	6.7	5660	19300	0.37	30.1
4	soil	0-1	Inches	250	S2	U04-1036	mg/kg	1.8	0.49	625	9630	0.37	18.6
4	soil	0-1	Inches	250	S20	U04-1054	mg/kg	3.5	2.3	4240	18000	0.37	23.5
4	soil	0-1	Inches	250	S21	U04-1055	mg/kg	3.3	3.4	6670	20500	0.37	29.9
4	soil	0-1	Inches	250	S22	U04-1056	mg/kg	6.3	3.5	5210	19800	0.37	29.1
4	soil	0-1	Inches	250	S23	U04-1057	mg/kg	2.6	2.1	3030	17000	0.37	24.9
4	soil	0-1	Inches	250	S24	U04-1058	mg/kg	2.8	2.5	3910	17100	0.37	23.7
4	soil	0-1	Inches	250	S25	U04-1059	mg/kg	3.4	3.7	4630	17900	0.485	26
4	soil	0-1	Inches	250	S26	U04-1060	mg/kg	3.1	1.5	2600	18300	0.37	29.2
4	soil	0-1	Inches	250	S27	U04-1061	mg/kg	2.9	3.2	3150	17900	0.37	25.8
4	soil	0-1	Inches	250	S28	U04-1062	mg/kg	2.9	3.4	5840	16000	0.37	19.1
4	soil	0-1	Inches	250	S29	U04-1063	mg/kg	1.4	0.97	1690	18100	0.37	28.5
4	soil	0-1	Inches	250	S3	U04-1037	mg/kg	3.5	1.1	2110	15300	0.37	27.4
4	soil	0-1	Inches	250	S30	U04-1064	mg/kg	1.1	1.1	2350	14500	0.37	21.6
4	soil	0-1	Inches	250	S31	U04-1065	mg/kg	2.5	2.6	3120	13900	0.37	18.2
4	soil	0-1	Inches	250	S35	U04-1069	mg/kg	4.8	1.4	3270	18200	0.37	16.8
4	soil	0-1	Inches	250	S36	U04-1070	mg/kg	4.7	2.8	3970	21100	1.2	19.6
4	soil	0-1	Inches	250	S37	U04-1071	mg/kg	5.1	1.6	1900	19900	0.37	26.9
4	soil	0-1	Inches	250	S38	U04-1072	mg/kg	5.9	3	4280	19000	0.37	15.8
4	soil	0-1	Inches	250	S39	U04-1073	mg/kg	6.5	1.2	2470	18900	0.37	16.6
4	soil	0-1	Inches	250	S4	U04-1038	mg/kg	1.6	1.3	7990	45500	0.37	116
4	soil	0-1	Inches	250	S40	U04-1074	mg/kg	9.4	1.6	3610	24500	0.37	19.7
4	soil	0-1	Inches	250	S41	U04-1075	mg/kg	3.1	2.7	8170	33600	0.37	26.2
4	soil	0-1	Inches	250	S42	U04-1076	mg/kg	6.3	4.4	5780	25100	0.83	17
4	soil	0-1	Inches	250	S43	U04-1077	mg/kg	3.7	1.2	2230	12800	0.37	16.2
4	soil	0-1	Inches	250	S44	U04-1078	mg/kg	0.98	0.65	908	7170	0.37	10.7
4	soil	0-1	Inches	250	S45	U04-1079	mg/kg	8	5.8	7560	57500	0.97	25
4	soil	0-1	Inches	250	S46	U04-1080	mg/kg	8.2	10.2	9000	39400	1.2	24.3
4	soil	0-1	Inches	250	S47	U04-1081	mg/kg	13.3	7.2	7990	34900	0.91	15.5
4	soil	0-1	Inches	250	S48	U04-1082	mg/kg	7.3	1.4	2520	21000	0.37	15.4
4	soil	0-1	Inches	250	S49	U04-1083	mg/kg	10.3	20.2	5430	41000	1.2	21.8
4	soil	0-1	Inches	250	S5	U04-1039	mg/kg	3.3	0.62	1140	9750	0.37	15.5
4	soil	0-1	Inches	250	S50	U04-1084	mg/kg	1.8	0.7	272	13900	0.75	27.6
4	soil	0-1	Inches	250	S51	U04-1085	mg/kg	5.2	6.2	3790	25500	0.8	16.8
4	soil	0-1	Inches	250	S52	U04-1086	mg/kg	3.7	0.94	1540	14300	0.37	13.1
4	soil	0-1	Inches	250	S6	U04-1040	mg/kg	3.8	2.4	3670	19300	0.37	27.2
4	soil	0-1	Inches	250	S7	U04-1041	mg/kg	3.2	5.2	4760	18500	0.37	28.7
4	soil	0-1	Inches	250	S70	U04-1104	mg/kg	2.2	1.8	2280	19100	1.1	41.4
4	soil	0-1	Inches	250	S71	U04-1105	mg/kg	3.3	4.1	5350	15000	0.37	18.7
4	soil	0-1	Inches	250	S8	U04-1042	mg/kg	4.3	3.6	6100	21200	0.37	39
4	soil	0-1	Inches	250	S9	U04-1043	mg/kg	5	2.5	4950	16800	0.77	25.8
4	soil	0-1	Inches	250	SS115	U04-1185	mg/Kg	3.1	2.8	3800	24200	0.45	40.5
4	soil	0-1	Inches	250	SS116	U04-1186	mg/Kg	3.6	2.6	1460	34400	0.175	47.1
4	soil	0-1	Inches	250	SS117	U04-1187	mg/Kg	5.4	3.6	4450	31100	0.51	33.1

UCL Calculation of Arsenic, Direct Contact with Soil Pathway, Exposure Area 4

Data File

Variable: Arsenic

Raw Statistics	
Number of Valid Samples	54
Number of Unique Samples	39
Minimum	0.98
Maximum	13.3
Mean	4.3755556
Median	3.6
Standard Deviation	2.3703122
Variance	5.6183799
Coefficient of Variation	0.5417169
Skewness	1.4904226

Gamma Statistics	
k hat	3.9080976
k star (bias corrected)	3.7033268
Theta hat	1.1196127
Theta star	1.1815202
nu hat	422.07454
nu star	399.95929
Approx.Chi Square Value (.05)	354.5933
Adjusted Level of Significance	0.0455556
Adjusted Chi Square Value	353.42746

Log-transformed Statistics	
Minimum of log data	-0.020203
Maximum of log data	2.587764
Mean of log data	1.3426725
Standard Deviation of log data	0.5301456
Variance of log data	0.2810544

RECOMMENDATION

Assuming gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Lilliefors Test Statisitic	0.1885195
Lilliefors 5% Critical Value	0.1205693
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	4.9155561

Gamma Distribution Test	
A-D Test Statistic	0.5357135
A-D 5% Critical Value	0.7538842
K-S Test Statistic	0.1340018
K-S 5% Critical Value	0.1215214
Data follow approximate gamma distibution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**4.9353558**
Adjusted Gamma UCL	4.9516358

Lognormal Distribution Test	
Lilliefors Test Statisitic	0.0998972
Lilliefors 5% Critical Value	0.1205693
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	5.0578912
95% Chebyshev (MVUE) UCL	5.8546926
97.5% Chebyshev (MVUE) UCL	6.4867094
99% Chebyshev (MVUE) UCL	7.728184

95% Non-parametric UCLs	
CLT UCL	4.9061173
Adj-CLT UCL (Adjusted for skewness)	4.9760212
Mod-t UCL (Adjusted for skewness)	4.9264597
Jackknife UCL	4.9155561
Standard Bootstrap UCL	4.9032228
Bootstrap-t UCL	5.0104999
Hall's Bootstrap UCL	5.0215131
Percentile Bootstrap UCL	4.9211111
BCA Bootstrap UCL	4.9718519
95% Chebyshev (Mean, Sd) UCL	5.781556
97.5% Chebyshev (Mean, Sd) UCL	6.3899336
99% Chebyshev (Mean, Sd) UCL	7.5849734

UCL Calculation of Cadmium, Direct Contact with Soil Pathway, Exposure Area 4

Data File

Variable: Cadmium

Raw Statistics	
Number of Valid Samples	54
Number of Unique Samples	40
Minimum	0.49
Maximum	20.2
Mean	3.3961111
Median	2.6
Standard Deviation	3.2375074
Variance	10.481454
Coefficient of Variation	0.9532984
Skewness	3.1301618

Gamma Statistics	
k hat	1.7703364
k star (bias corrected)	1.6843301
Theta hat	1.9183422
Theta star	2.0162979
nu hat	191.19633
nu star	181.90765
Approx.Chi Square Value (.05)	151.70523
Adjusted Level of Significance	0.0455556
Adjusted Chi Square Value	150.95111

Log-transformed Statistics	
Minimum of log data	-0.71335
Maximum of log data	3.0056826
Mean of log data	0.9143579
Standard Deviation of log data	0.7808182
Variance of log data	0.609677

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Lilliefors Test Statisitic	0.2033488
Lilliefors 5% Critical Value	0.1205693
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	4.1336746

Gamma Distribution Test	
A-D Test Statistic	0.5640379
A-D 5% Critical Value	0.7651914
K-S Test Statistic	0.0975621
K-S 5% Critical Value	0.122876
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**4.07223**
Adjusted Gamma UCL	4.0925739

Lognormal Distribution Test	
Lilliefors Test Statisitic	0.0695719
Lilliefors 5% Critical Value	0.1205693
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	4.233862
95% Chebyshev (MVUE) UCL	5.0979462
97.5% Chebyshev (MVUE) UCL	5.8499497
99% Chebyshev (MVUE) UCL	7.3271148

95% Non-parametric UCLs	
CLT UCL	4.1207826
Adj-CLT UCL (Adjusted for skewness)	4.3213056
Mod-t UCL (Adjusted for skewness)	4.1649521
Jackknife UCL	4.1336746
Standard Bootstrap UCL	4.1105527
Bootstrap-t UCL	4.4789846
Hall's Bootstrap UCL	5.0239275
Percentile Bootstrap UCL	4.1705556
BCA Bootstrap UCL	4.3685185
95% Chebyshev (Mean, Sd) UCL	5.3165067
97.5% Chebyshev (Mean, Sd) UCL	6.1474634
99% Chebyshev (Mean, Sd) UCL	7.7797169

UCL Calculation of Copper, Direct Contact with Soil Pathway, Exposure Area 4

Data File

Variable: Copper

Raw Statistics	
Number of Valid Samples	54
Number of Unique Samples	52
Minimum	272
Maximum	12100
Mean	4306.0185
Median	3895
Standard Deviation	2438.1857
Variance	5944749.4
Coefficient of Variation	0.5662274
Skewness	0.7759297

Gamma Statistics	
k hat	2.692169
k star (bias corrected)	2.5549497
Theta hat	1599.4607
Theta star	1685.3633
nu hat	290.75425
nu star	275.93457
Approx.Chi Square Value (.05)	238.4562
Adjusted Level of Significance	0.0455556
Adjusted Chi Square Value	237.50458

Log-transformed Statistics	
Minimum of log data	5.6058021
Maximum of log data	9.4009607
Mean of log data	8.1706968
Standard Deviation of log data	0.7118603
Variance of log data	0.506745

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Lilliefors Test Statisitic	0.0918437
Lilliefors 5% Critical Value	0.1205693
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**4861.4819**

Gamma Distribution Test	
A-D Test Statistic	0.2707455
A-D 5% Critical Value	0.7590657
K-S Test Statistic	0.0817559
K-S 5% Critical Value	0.1221445
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	4982.7993
Adjusted Gamma UCL	5002.7641

Lognormal Distribution Test	
Lilliefors Test Statisitic	0.1227474
Lilliefors 5% Critical Value	0.1205693
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	5554.9566
95% Chebyshev (MVUE) UCL	6630.3967
97.5% Chebyshev (MVUE) UCL	7539.6546
99% Chebyshev (MVUE) UCL	9325.7156

95% Non-parametric UCLs	
CLT UCL	4851.7728
Adj-CLT UCL (Adjusted for skewness)	4889.2076
Mod-t UCL (Adjusted for skewness)	4867.321
Jackknife UCL	4861.4819
Standard Bootstrap UCL	4847.8934
Bootstrap-t UCL	4938.7359
Hall's Bootstrap UCL	4906.1273
Percentile Bootstrap UCL	4847.5926
BCA Bootstrap UCL	4901.537
95% Chebyshev (Mean, Sd) UCL	5752.2796
97.5% Chebyshev (Mean, Sd) UCL	6378.0779
99% Chebyshev (Mean, Sd) UCL	7607.3375

UCL Calculation of Iron, Direct Contact with Soil Pathway, Exposure Area 4

Data File

Variable: Iron

Raw Statistics	
Number of Valid Samples	54
Number of Unique Samples	45
Minimum	7170
Maximum	57500
Mean	21013.889
Median	18700
Standard Deviation	9194.3973
Variance	84536941
Coefficient of Variation	0.4375391
Skewness	1.9238617

Gamma Statistics	
k hat	6.8124914
k star (bias corrected)	6.4463654
Theta hat	3084.6114
Theta star	3259.8042
nu hat	735.74908
nu star	696.20746
Approx.Chi Square Value (.05)	635.97493
Adjusted Level of Significance	0.0455556
Adjusted Chi Square Value	634.4052

Log-transformed Statistics	
Minimum of log data	8.8776609
Maximum of log data	10.95954
Mean of log data	9.8777525
Standard Deviation of log data	0.3787948
Variance of log data	0.1434855

Normal Distribution Test	
Lilliefors Test Statisitic	0.2511845
Lilliefors 5% Critical Value	0.1205693
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	23108.541

Gamma Distribution Test	
A-D Test Statistic	1.9725696
A-D 5% Critical Value	0.7523331
K-S Test Statistic	0.1992134
K-S 5% Critical Value	0.1212239
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	23004.092
Adjusted Gamma UCL	23061.013

Lognormal Distribution Test	
Lilliefors Test Statisitic	0.1715072
Lilliefors 5% Critical Value	0.1205693
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	22995.421
95% Chebyshev (MVUE) UCL	25751.113
97.5% Chebyshev (MVUE) UCL	27845.015
99% Chebyshev (MVUE) UCL	31958.081

95% Non-parametric UCLs	
CLT UCL	23071.928
Adj-CLT UCL (Adjusted for skewness)	23421.941
Mod-t UCL (Adjusted for skewness)	**23163.136**
Jackknife UCL	23108.541
Standard Bootstrap UCL	23057.554
Bootstrap-t UCL	23603.227
Hall's Bootstrap UCL	23633.759
Percentile Bootstrap UCL	23124.074
BCA Bootstrap UCL	23417.778
95% Chebyshev (Mean, Sd) UCL	26467.739
97.5% Chebyshev (Mean, Sd) UCL	28827.624
99% Chebyshev (Mean, Sd) UCL	33463.162

RECOMMENDATION

Data are Non-parametric (0.05)

Use Student's-t UCL
or Modified-t UCL

UCL Calculation of Thallium, Direct Contact with Soil Pathway, Exposure Area 4

Data File

Variable: Thallium

Raw Statistics	
Number of Valid Samples	54
Number of Unique Samples	13
Minimum	0.175
Maximum	1.2
Mean	0.4842593
Median	0.37
Standard Deviation	0.2504475
Variance	0.062724
Coefficient of Variation	0.5171766
Skewness	1.9343433

Gamma Statistics	
k hat	5.5697065
k star (bias corrected)	5.272624
Theta hat	0.0869452
Theta star	0.0918441
nu hat	601.5283
nu star	569.44339
Approx.Chi Square Value (.05)	515.08264
Adjusted Level of Significance	0.0455556
Adjusted Chi Square Value	513.67244

Log-transformed Statistics	
Minimum of log data	-1.742969
Maximum of log data	0.1823216
Mean of log data	-0.817584
Standard Deviation of log data	0.3993467
Variance of log data	0.1594778

Normal Distribution Test	
Lilliefors Test Statisitic	0.4351435
Lilliefors 5% Critical Value	0.1205693
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	0.5413158

Gamma Distribution Test	
A-D Test Statistic	10.737446
A-D 5% Critical Value	0.7531593
K-S Test Statistic	0.4376263
K-S 5% Critical Value	0.1213103
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.535367
Adjusted Gamma UCL	0.5368367

Lognormal Distribution Test	
Lilliefors Test Statisitic	0.4301569
Lilliefors 5% Critical Value	0.1205693
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.5280338
95% Chebyshev (MVUE) UCL	0.5942131
97.5% Chebyshev (MVUE) UCL	0.6447649
99% Chebyshev (MVUE) UCL	0.7440641

95% Non-parametric UCLs	
CLT UCL	0.5403185
Adj-CLT UCL (Adjusted for skewness)	0.5499045
Mod-t UCL (Adjusted for skewness)	**0.542811**
Jackknife UCL	0.5413158
Standard Bootstrap UCL	0.5396179
Bootstrap-t UCL	0.5555846
Hall's Bootstrap UCL	0.548113
Percentile Bootstrap UCL	0.5433333
BCA Bootstrap UCL	0.5500926
95% Chebyshev (Mean, Sd) UCL	0.6328175
97.5% Chebyshev (Mean, Sd) UCL	0.6970987
99% Chebyshev (Mean, Sd) UCL	0.8233668

RECOMMENDATION

Data are Non-parametric (0.05)

Use Student's-t UCL
or Modified-t UCL

UCL Calculation of Vanadium, Direct Contact with Soil Pathway, Exposure Area 4

Data File

Variable: Vanadium

Raw Statistics	
Number of Valid Samples	54
Number of Unique Samples	49
Minimum	10.7
Maximum	116
Mean	25.661111
Median	24
Standard Deviation	14.464614
Variance	209.22506
Coefficient of Variation	0.5636784
Skewness	4.7995044

Gamma Statistics	
k hat	6.2377741
k star (bias corrected)	5.9035768
Theta hat	4.113825
Theta star	4.3467057
nu hat	673.67961
nu star	637.5863
Approx.Chi Square Value (.05)	579.99612
Adjusted Level of Significance	0.0455556
Adjusted Chi Square Value	578.49818

Log-transformed Statistics	
Minimum of log data	2.3702437
Maximum of log data	4.7535902
Mean of log data	3.1626836
Standard Deviation of log data	0.3684631
Variance of log data	0.1357651

Normal Distribution Test	
Lilliefors Test Statisitic	0.2683566
Lilliefors 5% Critical Value	0.1205693
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	28.956415

Gamma Distribution Test	
A-D Test Statistic	1.8693388
A-D 5% Critical Value	0.7527151
K-S Test Statistic	0.1829676
K-S 5% Critical Value	0.1212639
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	28.209108
Adjusted Gamma UCL	28.282151

Lognormal Distribution Test	
Lilliefors Test Statisitic	0.1446876
Lilliefors 5% Critical Value	0.1205693
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	27.696045
95% Chebyshev (MVUE) UCL	30.937425
97.5% Chebyshev (MVUE) UCL	33.393981
99% Chebyshev (MVUE) UCL	38.219408

95% Non-parametric UCLs	
CLT UCL	28.898816
Adj-CLT UCL (Adjusted for skewness)	30.272509
Mod-t UCL (Adjusted for skewness)	**29.170684**
Jackknife UCL	28.956415
Standard Bootstrap UCL	28.846568
Bootstrap-t UCL	31.742652
Hall's Bootstrap UCL	43.340753
Percentile Bootstrap UCL	29.190741
BCA Bootstrap UCL	30.788889
95% Chebyshev (Mean, Sd) UCL	34.241101
97.5% Chebyshev (Mean, Sd) UCL	37.953669
99% Chebyshev (Mean, Sd) UCL	45.246291

RECOMMENDATION

Data are Non-parametric (0.05)

Use Student's-t UCL
or Modified-t UCL

Data Set Used to Calculate Soil EPCs for the Locally-Grown Vegetable Pathway, Exposure Area 4

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
4	soil	0-6	Inches	2000	ERA159D	U04-1235	mg/Kg	3.4	0.61	809	30100	0.175	48.6
4	soil	0-6	Inches	2000	ERA160D	U04-1236	mg/Kg	0.95	0.04	34.1	18400	0.175	44.9
4	soil	0-6	Inches	2000	U07-0028	U07-0028	mg/kg	0.65	3.5	3280	29200	0.17	18.1
4	soil	0-6	Inches	2000	U07-0207	U07-0207	mg/kg	1	1.1	584	16400	0.11	14.1
4	soil	0-6	Inches	2000	U07-0294	U07-0294	mg/kg	4.1	4.2	1100	33700	0.12	15.6
4	soil	3-6	Inches		U04-1006	U04-1006	mg/kg	1.22	0.59	427			
4	soil	3-6	Inches		U04-1027	U04-1027	mg/kg	3.3	0.1	112			

Soil EPCs for Arsenic Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Arsenic

Raw Statistics	
Number of Valid Samples	7
Number of Unique Samples	7
Minimum	0.65
Maximum	4.1
Mean	2.0885714
Median	1.22
Standard Deviation	1.4455959
Variance	2.0897476
Coefficient of Variation	0.6921458
Skewness	0.4458947

Gamma Statistics	
k hat	2.3270899
k star (bias corrected)	1.4250038
Theta hat	0.8975035
Theta star	1.4656603
nu hat	32.579259
nu star	19.950053
Approx.Chi Square Value (.05)	10.812837
Adjusted Level of Significance	0.01584
Adjusted Chi Square Value	8.8550284

Log-transformed Statistics	
Minimum of log data	-0.430783
Maximum of log data	1.410987
Mean of log data	0.5064942
Standard Deviation of log data	0.7467656
Variance of log data	0.5576589

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8244676
Shapiro-Wilk 5% Critical Value	0.803
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**3.1502935**

Gamma Distribution Test	
A-D Test Statistic	0.6241642
A-D 5% Critical Value	0.7140169
K-S Test Statistic	0.2714003
K-S 5% Critical Value	0.3146553
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	3.8534854
Adjusted Gamma UCL	4.7054745

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8654756
Shapiro-Wilk 5% Critical Value	0.803
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	5.505131
95% Chebyshev (MVUE) UCL	4.6863157
97.5% Chebyshev (MVUE) UCL	5.8082873
99% Chebyshev (MVUE) UCL	8.0121831

95% Non-parametric UCLs	
CLT UCL	2.987293
Adj-CLT UCL (Adjusted for skewness)	3.0856854
Mod-t UCL (Adjusted for skewness)	3.1656407
Jackknife UCL	3.1502935
Standard Bootstrap UCL	2.9180698
Bootstrap-t UCL	3.3300326
Hall's Bootstrap UCL	2.6387126
Percentile Bootstrap UCL	2.9342857
BCA Bootstrap UCL	3.0071429
95% Chebyshev (Mean, Sd) UCL	4.4702037
97.5% Chebyshev (Mean, Sd) UCL	5.5007378
99% Chebyshev (Mean, Sd) UCL	7.5250227

Soil EPCs for Cadmium Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Cadmium

Raw Statistics	
Number of Valid Samples	7
Number of Unique Samples	7
Minimum	0.04
Maximum	**4.2**
Mean	1.4485714
Median	0.61
Standard Deviation	1.6903296
Variance	2.8572143
Coefficient of Variation	1.1668942
Skewness	1.1087913

Gamma Statistics	
k hat	0.6698907
k star (bias corrected)	0.4780328
Theta hat	2.1623997
Theta star	3.0302764
nu hat	9.3784696
nu star	6.6924588
Approx.Chi Square Value (.05)	2.0028187
Adjusted Level of Significance	0.01584
Adjusted Chi Square Value	1.3217325

Log-transformed Statistics	
Minimum of log data	-3.218876
Maximum of log data	1.4350845
Mean of log data	-0.537176
Standard Deviation of log data	1.7225874
Variance of log data	2.9673075

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.7963716
Shapiro-Wilk 5% Critical Value	0.803
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	2.6900388

Gamma Distribution Test	
A-D Test Statistic	0.2884111
A-D 5% Critical Value	0.7410747
K-S Test Statistic	0.1761115
K-S 5% Critical Value	0.3241276
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**4.8404305**
Adjusted Gamma UCL	7.3346947

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9284527
Shapiro-Wilk 5% Critical Value	0.803
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	160.34894
95% Chebyshev (MVUE) UCL	6.6318976
97.5% Chebyshev (MVUE) UCL	8.7277896
99% Chebyshev (MVUE) UCL	12.844764

95% Non-parametric UCLs	
CLT UCL	2.499443
Adj-CLT UCL (Adjusted for skewness)	2.7855336
Mod-t UCL (Adjusted for skewness)	2.7346632
Jackknife UCL	2.6900388
Standard Bootstrap UCL	2.4213143
Bootstrap-t UCL	5.7235798
Hall's Bootstrap UCL	11.103721
Percentile Bootstrap UCL	2.4585714
BCA Bootstrap UCL	2.6285714
95% Chebyshev (Mean, Sd) UCL	4.2334046
97.5% Chebyshev (Mean, Sd) UCL	5.4384042
99% Chebyshev (Mean, Sd) UCL	7.8053924

Recommended UCL exceeds the maximum observation

Soil EPCs for Copper Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Copper

Raw Statistics	
Number of Valid Samples	7
Number of Unique Samples	7
Minimum	34.1
Maximum	3280
Mean	906.58571
Median	584
Standard Deviation	1111.0572
Variance	1234448.2
Coefficient of Variation	1.2255402
Skewness	2.0527698

Gamma Statistics	
k hat	0.7992114
k star (bias corrected)	0.5519303
Theta hat	1134.3503
Theta star	1642.5728
nu hat	11.188959
nu star	7.7270245
Approx.Chi Square Value (.05)	2.5773209
Adjusted Level of Significance	0.01584
Adjusted Chi Square Value	1.7709123

Log-transformed Statistics	
Minimum of log data	3.5292974
Maximum of log data	8.0955987
Mean of log data	6.066992
Standard Deviation of log data	1.5131128
Variance of log data	2.2895104

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.7622962
Shapiro-Wilk 5% Critical Value	0.803
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	1722.6049

Gamma Distribution Test	
A-D Test Statistic	0.1987747
A-D 5% Critical Value	0.7344393
K-S Test Statistic	0.1479709
K-S 5% Critical Value	0.3220577
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**2718.02**
Adjusted Gamma UCL	3955.7069

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.958247
Shapiro-Wilk 5% Critical Value	0.803
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	34163.186
95% Chebyshev (MVUE) UCL	3585.3612
97.5% Chebyshev (MVUE) UCL	4684.5524
99% Chebyshev (MVUE) UCL	6843.7006

95% Non-parametric UCLs	
CLT UCL	1597.3258
Adj-CLT UCL (Adjusted for skewness)	1945.4699
Mod-t UCL (Adjusted for skewness)	1776.9083
Jackknife UCL	1722.6049
Standard Bootstrap UCL	1548.9412
Bootstrap-t UCL	2826.9494
Hall's Bootstrap UCL	4647.92
Percentile Bootstrap UCL	1636.7143
BCA Bootstrap UCL	1855
95% Chebyshev (Mean, Sd) UCL	2737.0625
97.5% Chebyshev (Mean, Sd) UCL	3529.1112
99% Chebyshev (Mean, Sd) UCL	5084.9376

Soil EPCs for Iron Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Iron

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	5
Minimum	16400
Maximum	33700
Mean	25560
Median	29200
Standard Deviation	7669.6154
Variance	58823000
Coefficient of Variation	0.3000632
Skewness	-0.419741

Gamma Statistics	
k hat	12.70709
k star (bias corrected)	5.2161692
Theta hat	2011.4756
Theta star	4900.1478
nu hat	127.0709
nu star	52.161692
Approx.Chi Square Value (.05)	36.569781
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	30.963944

Log-transformed Statistics	
Minimum of log data	9.7050366
Maximum of log data	10.425253
Mean of log data	10.10892
Standard Deviation of log data	0.3232212
Variance of log data	0.104472

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8716192
Shapiro-Wilk 5% Critical Value	0.762
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**32872.138**

Gamma Distribution Test	
A-D Test Statistic	0.5017342
A-D 5% Critical Value	0.6788286
K-S Test Statistic	0.3183677
K-S 5% Critical Value	0.3574736
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	36457.774
Adjusted Gamma UCL	43058.237

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8540755
Shapiro-Wilk 5% Critical Value	0.762
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	38485.655
95% Chebyshev (MVUE) UCL	41674.682
97.5% Chebyshev (MVUE) UCL	48629.389
99% Chebyshev (MVUE) UCL	62290.563

95% Non-parametric UCLs	
CLT UCL	31201.776
Adj-CLT UCL (Adjusted for skewness)	30513.812
Mod-t UCL (Adjusted for skewness)	32764.83
Jackknife UCL	32872.138
Standard Bootstrap UCL	30619.182
Bootstrap-t UCL	33034.15
Hall's Bootstrap UCL	28613.688
Percentile Bootstrap UCL	30640
BCA Bootstrap UCL	30100
95% Chebyshev (Mean, Sd) UCL	40510.833
97.5% Chebyshev (Mean, Sd) UCL	46980.07
99% Chebyshev (Mean, Sd) UCL	59687.634

Soil EPCs for Thallium Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Thallium

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	4
Minimum	0.11
Maximum	**0.175**
Mean	0.15
Median	0.17
Standard Deviation	0.0322102
Variance	0.0010375
Coefficient of Variation	0.214735
Skewness	-0.645234

Gamma Statistics	
k hat	25.207121
k star (bias corrected)	10.216182
Theta hat	0.0059507
Theta star	0.0146826
nu hat	252.07121
nu star	102.16182
Approx.Chi Square Value (.05)	79.836303
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	71.237945

Log-transformed Statistics	
Minimum of log data	-2.207275
Maximum of log data	-1.742969
Mean of log data	-1.917087
Standard Deviation of log data	0.2275887
Variance of log data	0.0517966

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.7684138
Shapiro-Wilk 5% Critical Value	0.762
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	0.1807089

Gamma Distribution Test	
A-D Test Statistic	0.7134185
A-D 5% Critical Value	0.6786154
K-S Test Statistic	0.360384
K-S 5% Critical Value	0.3571079
Data do not follow gamma distribution at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.1919462
Adjusted Gamma UCL	0.2151139

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.7707794
Shapiro-Wilk 5% Critical Value	0.762
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.194927
95% Chebyshev (MVUE) UCL	0.2165781
97.5% Chebyshev (MVUE) UCL	0.2453423
99% Chebyshev (MVUE) UCL	0.3018439

95% Non-parametric UCLs	
CLT UCL	0.1736939
Adj-CLT UCL (Adjusted for skewness)	0.1692525
Mod-t UCL (Adjusted for skewness)	0.1800162
Jackknife UCL	0.1807089
Standard Bootstrap UCL	N/R
Bootstrap-t UCL	N/R
Hall's Bootstrap UCL	N/R
Percentile Bootstrap UCL	N/R
BCA Bootstrap UCL	N/R
95% Chebyshev (Mean, Sd) UCL	0.2127893
97.5% Chebyshev (Mean, Sd) UCL	0.2399583
99% Chebyshev (Mean, Sd) UCL	0.2933266

Recommended UCL exceeds the maximum observation

Soil EPCs for Vanadium Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Vanadium

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	5
Minimum	14.1
Maximum	48.6
Mean	28.26
Median	18.1
Standard Deviation	16.989791
Variance	288.653
Coefficient of Variation	0.6011957
Skewness	0.6036887

Gamma Statistics	
k hat	3.5836272
k star (bias corrected)	1.5667842
Theta hat	7.8858649
Theta star	18.036944
nu hat	35.836272
nu star	15.667842
Approx.Chi Square Value (.05)	7.7271306
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	5.4649733

Log-transformed Statistics	
Minimum of log data	2.6461748
Maximum of log data	3.8836235
Mean of log data	3.1954838
Standard Deviation of log data	0.5993204
Variance of log data	0.3591849

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.7794198
Shapiro-Wilk 5% Critical Value	0.762
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**44.457905**

Gamma Distribution Test	
A-D Test Statistic	0.6386522
A-D 5% Critical Value	0.6818188
K-S Test Statistic	0.3265257
K-S 5% Critical Value	0.3588539
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	57.301118
Adjusted Gamma UCL	81.020199

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8080881
Shapiro-Wilk 5% Critical Value	0.762
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	78.204126
95% Chebyshev (MVUE) UCL	60.496808
97.5% Chebyshev (MVUE) UCL	74.513672
99% Chebyshev (MVUE) UCL	102.04709

95% Non-parametric UCLs	
CLT UCL	40.757706
Adj-CLT UCL (Adjusted for skewness)	42.949559
Mod-t UCL (Adjusted for skewness)	44.79979
Jackknife UCL	44.457905
Standard Bootstrap UCL	39.337705
Bootstrap-t UCL	144.13684
Hall's Bootstrap UCL	242.94605
Percentile Bootstrap UCL	40.52
BCA Bootstrap UCL	40.52
95% Chebyshev (Mean, Sd) UCL	61.3792
97.5% Chebyshev (Mean, Sd) UCL	75.709904
99% Chebyshev (Mean, Sd) UCL	103.8598

Data Set Used to Calculate Soil EPCs for the Locally-Grown Beef, Chicken, and Eggs Pathways, Exposure Area 4

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper
4	soil	0-1	Inches		U04-1001	U04-1001	mg/kg	3.55	2.03	3560
4	soil	0-1	Inches		U04-1002	U04-1002	mg/kg	5.28	5.11	5240
4	soil	0-1	Inches		U04-1004	U04-1004	mg/kg	1.86	1.92	1090
4	soil	0-1	Inches		U04-1008	U04-1008	mg/kg	2.46	0.79	644
4	soil	0-1	Inches		U04-1023	U04-1023	mg/kg	4.3	2.56	3410
4	soil	0-1	Inches		U04-1024	U04-1024	mg/kg	3.3	2.23	2040
4	soil	0-1	Inches		U04-1025	U04-1025	mg/kg	3.7	1.85	2490
4	soil	0-1	Inches		U04-1030	U04-1030	mg/kg	2.6	1.09	837
4	soil	0-1	Inches		U04-1031	U04-1031	mg/kg	3.5	1.79	1740

Soil EPCs for Arsenic Used for Calculation of EPCs for Locally-Grown Beef, Chicken, and Eggs

Data File

Variable: Arsenic

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	9
Minimum	1.86
Maximum	5.28
Mean	3.3944444
Median	3.5
Standard Deviation	1.022975
Variance	1.0464778
Coefficient of Variation	0.3013674
Skewness	0.3826339

Gamma Statistics	
k hat	12.05317
k star (bias corrected)	8.1095207
Theta hat	0.2816225
Theta star	0.4185752
nu hat	216.95706
nu star	145.97137
Approx.Chi Square Value (.05)	119.0436
Adjusted Level of Significance	0.02308
Adjusted Chi Square Value	113.9171

Log-transformed Statistics	
Minimum of log data	0.6205765
Maximum of log data	1.6639261
Mean of log data	1.180084
Standard Deviation of log data	0.3128473
Variance of log data	0.0978735

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.971327
Shapiro-Wilk 5% Critical Value	0.829
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**4.0285348**

Gamma Distribution Test	
A-D Test Statistic	0.2166441
A-D 5% Critical Value	0.7215899
K-S Test Statistic	0.1662328
K-S 5% Critical Value	0.2792235
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	4.1622708
Adjusted Gamma UCL	4.3495815

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9713979
Shapiro-Wilk 5% Critical Value	0.829
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	4.2837938
95% Chebyshev (MVUE) UCL	4.9531062
97.5% Chebyshev (MVUE) UCL	5.6256947
99% Chebyshev (MVUE) UCL	6.9468646

95% Non-parametric UCLs	
CLT UCL	3.9553258
Adj-CLT UCL (Adjusted for skewness)	4.0017973
Mod-t UCL (Adjusted for skewness)	4.0357834
Jackknife UCL	4.0285348
Standard Bootstrap UCL	3.9235765
Bootstrap-t UCL	4.0887077
Hall's Bootstrap UCL	4.1786391
Percentile Bootstrap UCL	3.93
BCA Bootstrap UCL	3.9566667
95% Chebyshev (Mean, Sd) UCL	4.8807926
97.5% Chebyshev (Mean, Sd) UCL	5.5239366
99% Chebyshev (Mean, Sd) UCL	6.7872686

Soil EPCs for Cadmium Used for Calculation of EPCs for Locally-Grown Beef, Chicken, and Eggs

Data File

Variable: Cadmium

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	9
Minimum	0.79
Maximum	5.11
Mean	2.1522222
Median	1.92
Standard Deviation	1.2347143
Variance	1.5245194
Coefficient of Variation	0.5736928
Skewness	1.8893212

Gamma Statistics	
k hat	4.1877824
k star (bias corrected)	2.865929
Theta hat	0.5139289
Theta star	0.7509684
nu hat	75.380084
nu star	51.586723
Approx.Chi Square Value (.05)	36.08808
Adjusted Level of Significance	0.02308
Adjusted Chi Square Value	33.373803

Log-transformed Statistics	
Minimum of log data	-0.235722
Maximum of log data	1.6311994
Mean of log data	0.6423806
Standard Deviation of log data	0.5221372
Variance of log data	0.2726273

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8004439
Shapiro-Wilk 5% Critical Value	0.829
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	2.9175591

Gamma Distribution Test	
A-D Test Statistic	0.4689585
A-D 5% Critical Value	0.7245469
K-S Test Statistic	0.1985824
K-S 5% Critical Value	0.2803192
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**3.0765308**
Adjusted Gamma UCL	3.3267437

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.935556
Shapiro-Wilk 5% Critical Value	0.829
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	3.3539622
95% Chebyshev (MVUE) UCL	3.7934332
97.5% Chebyshev (MVUE) UCL	4.5076588
99% Chebyshev (MVUE) UCL	5.9106168

95% Non-parametric UCLs	
CLT UCL	2.829197
Adj-CLT UCL (Adjusted for skewness)	3.1061526
Mod-t UCL (Adjusted for skewness)	2.9607586
Jackknife UCL	2.9175591
Standard Bootstrap UCL	2.7949315
Bootstrap-t UCL	3.4299083
Hall's Bootstrap UCL	6.3327472
Percentile Bootstrap UCL	2.8522222
BCA Bootstrap UCL	3.1022222
95% Chebyshev (Mean, Sd) UCL	3.9462205
97.5% Chebyshev (Mean, Sd) UCL	4.722485
99% Chebyshev (Mean, Sd) UCL	6.2473063

Soil EPCs for Copper Used for Calculation of EPCs for Locally-Grown Beef, Chicken, and Eggs

Data File

Variable: Copper

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	9
Minimum	644
Maximum	5240
Mean	2339
Median	2040
Standard Deviation	1508.8786
Variance	2276714.5
Coefficient of Variation	0.6450956
Skewness	0.7961638

Gamma Statistics	
k hat	2.5903765
k star (bias corrected)	1.8009917
Theta hat	902.95756
Theta star	1298.7289
nu hat	46.626776
nu star	32.417851
Approx.Chi Square Value (.05)	20.401568
Adjusted Level of Significance	0.02308
Adjusted Chi Square Value	18.417114

Log-transformed Statistics	
Minimum of log data	6.4676987
Maximum of log data	8.5640768
Mean of log data	7.552211
Standard Deviation of log data	0.7073444
Variance of log data	0.5003361

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9314698
Shapiro-Wilk 5% Critical Value	0.829
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**3274.2774**

Gamma Distribution Test	
A-D Test Statistic	0.192363
A-D 5% Critical Value	0.7280166
K-S Test Statistic	0.141553
K-S 5% Critical Value	0.281807
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	3716.6433
Adjusted Gamma UCL	4117.1137

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9629782
Shapiro-Wilk 5% Critical Value	0.829
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	4770.3851
95% Chebyshev (MVUE) UCL	4861.7084
97.5% Chebyshev (MVUE) UCL	5940.6695
99% Chebyshev (MVUE) UCL	8060.0796

95% Non-parametric UCLs	
CLT UCL	3166.2948
Adj-CLT UCL (Adjusted for skewness)	3308.9195
Mod-t UCL (Adjusted for skewness)	3296.5239
Jackknife UCL	3274.2774
Standard Bootstrap UCL	3121.105
Bootstrap-t UCL	3512.6196
Hall's Bootstrap UCL	3392.5108
Percentile Bootstrap UCL	3142.6667
BCA Bootstrap UCL	3227.1111
95% Chebyshev (Mean, Sd) UCL	4531.3497
97.5% Chebyshev (Mean, Sd) UCL	5479.9812
99% Chebyshev (Mean, Sd) UCL	7343.384

Soil EPCs for Iron, Thallium, and Vanadium Used for Calculation of EPCs for Locally-Grown Beef, Chicken, and Eggs

In the dataset used to calculate soil EPCs for this pathway (locally-grown beef, eggs, and chicken), samples were not analyzed for Fe, Tl, and V. Therefore, soil data from the direct contact with soil pathway (0-1" Sample Depth, 250 µm Sieve) were used as the soil EPCs for calculating the EPCs for the locally-grown beef, chicken, and eggs in EA4.

Data Set for Direct Contact with Soil Pathway, Exposure Area 5

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
5	soil	0-1	Inches	250	ERA164	U04-1240	mg/Kg	1.9	0.32	136	9460	0.43	15.9
5	soil	0-1	Inches	250	ERA165	U04-1241	mg/Kg	1.8	0.48	177	10600	0.5	16.5
5	soil	0-1	Inches	250	SS100	U04-1170	mg/Kg	1.9	0.31	234	20300	0.175	39
5	soil	0-1	Inches	250	SS101	U04-1171	mg/Kg	2.2	0.46	206	55000	0.175	210
5	soil	0-1	Inches	250	SS104	U04-1174	mg/Kg	2.1	0.57	407	10300	0.175	21.5
5	soil	0-1	Inches	250	SS106	U04-1176	mg/Kg	2.1	0.56	531	10500	0.175	17.8
5	soil	0-1	Inches	250	SS107	U04-1177	mg/Kg	0.98	0.32	194	7360	0.175	13.9
5	soil	0-1	Inches	250	SS108	U04-1178	mg/Kg	1.4	0.56	252	32300	0.175	93.8
5	soil	0-1	Inches	250	SS111	U04-1181	mg/Kg	2.3	0.5	551	12100	0.175	21.2
5	soil	0-1	Inches	250	SS112	U04-1182	mg/Kg	2.2	0.72	558	14500	0.175	28.1
5	soil	0-1	Inches	250	SS113	U04-1183	mg/Kg	1.8	0.4	209	14200	0.35	30.6
5	soil	0-1	Inches	250	SS114	U04-1184	mg/Kg	1.8	0.26	119	31800	0.44	98.3
5	soil	0-1	Inches	250	SS118S	U04-1189	mg/Kg	1.6	0.59	640	13600	0.175	23.1
5	soil	0-1	Inches	250	SS119S	U04-1191	mg/Kg	1.7	0.48	338	22100	0.57	46.1
5	soil	0-1	Inches	250	SS120	U04-1192	mg/Kg	1.8	0.14	117	35400	0.175	109
5	soil	0-1	Inches	250	SS122	U04-1194	mg/Kg	0.76	0.27	119	10600	0.175	21.6
5	soil	0-1	Inches	250	SS123	U04-1195	mg/Kg	2	0.5	449	14300	0.41	22.8
5	soil	0-1	Inches	250	SS98	U04-1168	mg/Kg	3.5	0.9	475	38000	0.175	111
5	soil	0-1	Inches	250	SS99	U04-1169	mg/Kg	1.1	0.13	92.5	9610	0.175	17.7
5	soil	0-1	Inches	250	SS130	U04-1205	mg/Kg	1.5	0.08	227	21200	0.175	25
5	soil	0-1	Inches	250	SS131S	U04-1207	mg/Kg	1.8	0.41	454	17500	0.63	25.2
5	soil	0-1	Inches	250	SS132	U04-1208	mg/Kg	2.9	0.69	740	26200	0.175	44.1
5	soil	0-1	Inches	250	SS139	U04-1215	mg/Kg	2.7	0.49	696	40500	0.175	68.5
5	soil	0-1	Inches	250	SS143	U04-1219	mg/Kg	2.2	0.66	738	29200	0.175	41.1
5	soil	0-1	Inches	250	SS149	U04-1225	mg/Kg	2.7	0.48	628	46500	0.175	42.4
5	soil	0-1	Inches	250	SS150	U04-1226	mg/Kg	2.6	0.63	605	24600	0.175	38.3
5	soil	0-1	Inches	250	SS154	U04-1230	mg/Kg	0.02	0.58	372	24400	0.175	40.6
5	soil	0-1	Inches	250	SS155	U04-1231	mg/Kg	1.8	0.8	387	23300	0.43	41.9
5	soil	0-1	Inches	250	SS156	U04-1232	mg/Kg	2.1	0.18	196	28600	0.175	49.8
5	soil	0-1	Inches	250	SS158	U04-1234	mg/Kg	2.5	0.5	247	20100	0.66	40.3

UCL Calculation of Arsenic, Direct Contact with Soil Pathway, Exposure Area 5

Data File

Variable: Arsenic

Raw Statistics	
Number of Valid Samples	30
Number of Unique Samples	19
Minimum	0.02
Maximum	3.5
Mean	1.9253333
Median	1.9
Standard Deviation	0.673415
Variance	0.4534878
Coefficient of Variation	0.3497654
Skewness	-0.459471

Gamma Statistics	
k hat	3.2068581
k star (bias corrected)	2.9083945
Theta hat	0.60038
Theta star	0.6619918
nu hat	192.41149
nu star	174.50367
Approx.Chi Square Value (.05)	144.94735
Adjusted Level of Significance	0.041
Adjusted Chi Square Value	143.39612

Log-transformed Statistics	
Minimum of log data	-3.912023
Maximum of log data	1.252763
Mean of log data	0.4911555
Standard Deviation of log data	0.8895568
Variance of log data	0.7913114

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.962693
Shapiro-Wilk 5% Critical Value	0.927
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**2.1342379**

Gamma Distribution Test	
A-D Test Statistic	2.7394286
A-D 5% Critical Value	0.7518439
K-S Test Statistic	0.260881
K-S 5% Critical Value	0.1610528
Data do not follow gamma distribution at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	2.3179295
Adjusted Gamma UCL	2.3430045

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.4988544
Shapiro-Wilk 5% Critical Value	0.927
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	3.5553461
95% Chebyshev (MVUE) UCL	4.280742
97.5% Chebyshev (MVUE) UCL	5.1011912
99% Chebyshev (MVUE) UCL	6.7128048

95% Non-parametric UCLs	
CLT UCL	2.1275651
Adj-CLT UCL (Adjusted for skewness)	2.1165447
Mod-t UCL (Adjusted for skewness)	2.1325189
Jackknife UCL	2.1342379
Standard Bootstrap UCL	2.1291579
Bootstrap-t UCL	2.1223061
Hall's Bootstrap UCL	2.1299196
Percentile Bootstrap UCL	2.122
BCA Bootstrap UCL	2.1086667
95% Chebyshev (Mean, Sd) UCL	2.4612521
97.5% Chebyshev (Mean, Sd) UCL	2.6931446
99% Chebyshev (Mean, Sd) UCL	3.1486525

UCL Calculation of Cadmium, Direct Contact with Soil Pathway, Exposure Area 5

Data File

Variable: Cadmium

Raw Statistics	
Number of Valid Samples	30
Number of Unique Samples	24
Minimum	0.08
Maximum	0.9
Mean	0.4656667
Median	0.485
Standard Deviation	0.1987839
Variance	0.0395151
Coefficient of Variation	0.4268803
Skewness	-0.067897

Gamma Statistics	
k hat	4.2095645
k star (bias corrected)	3.8108303
Theta hat	0.1106211
Theta star	0.1221956
nu hat	252.57387
nu star	228.64982
Approx.Chi Square Value (.05)	194.64164
Adjusted Level of Significance	0.041
Adjusted Chi Square Value	192.8355

Log-transformed Statistics	
Minimum of log data	-2.525729
Maximum of log data	-0.105361
Mean of log data	-0.887739
Standard Deviation of log data	0.56516
Variance of log data	0.3194058

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9772749
Shapiro-Wilk 5% Critical Value	0.927
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**0.5273328**

Gamma Distribution Test	
A-D Test Statistic	0.8691267
A-D 5% Critical Value	0.748885
K-S Test Statistic	0.1891662
K-S 5% Critical Value	0.1606025
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.5470289
Adjusted Gamma UCL	0.5521525

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8793664
Shapiro-Wilk 5% Critical Value	0.927
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.5948325
95% Chebyshev (MVUE) UCL	0.7077225
97.5% Chebyshev (MVUE) UCL	0.8062893
99% Chebyshev (MVUE) UCL	0.9999047

95% Non-parametric UCLs	
CLT UCL	0.525363
Adj-CLT UCL (Adjusted for skewness)	0.5248823
Mod-t UCL (Adjusted for skewness)	0.5272578
Jackknife UCL	0.5273328
Standard Bootstrap UCL	0.5245291
Bootstrap-t UCL	0.5251663
Hall's Bootstrap UCL	0.5261281
Percentile Bootstrap UCL	0.5246667
BCA Bootstrap UCL	0.525
95% Chebyshev (Mean, Sd) UCL	0.6238634
97.5% Chebyshev (Mean, Sd) UCL	0.6923152
99% Chebyshev (Mean, Sd) UCL	0.8267756

UCL Calculation of Copper, Direct Contact with Soil Pathway, Exposure Area 5

Data File **Variable: Copper**

Raw Statistics	
Number of Valid Samples	30
Number of Unique Samples	29
Minimum	92.5
Maximum	740
Mean	369.81667
Median	355
Standard Deviation	206.39861
Variance	42600.388
Coefficient of Variation	0.5581106
Skewness	0.3665024

Gamma Statistics	
k hat	3.0163106
k star (bias corrected)	2.7369018
Theta hat	122.60563
Theta star	135.12237
nu hat	180.97864
nu star	164.21411
Approx.Chi Square Value (.05)	135.57895
Adjusted Level of Significance	0.041
Adjusted Chi Square Value	134.08044

Log-transformed Statistics	
Minimum of log data	4.5272086
Maximum of log data	6.6066502
Mean of log data	5.7381785
Standard Deviation of log data	0.6294687
Variance of log data	0.3962308

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9157063
Shapiro-Wilk 5% Critical Value	0.927
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	433.84496

Gamma Distribution Test	
A-D Test Statistic	0.6053647
A-D 5% Critical Value	0.7524022
K-S Test Statistic	0.1321816
K-S 5% Critical Value	0.1611423
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**447.92435**
Adjusted Gamma UCL	452.93043

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.931157
Shapiro-Wilk 5% Critical Value	0.927
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	480.6859
95% Chebyshev (MVUE) UCL	576.43555
97.5% Chebyshev (MVUE) UCL	663.33724
99% Chebyshev (MVUE) UCL	834.03877

95% Non-parametric UCLs	
CLT UCL	431.79978
Adj-CLT UCL (Adjusted for skewness)	434.49406
Mod-t UCL (Adjusted for skewness)	434.26521
Jackknife UCL	433.84496
Standard Bootstrap UCL	430.44269
Bootstrap-t UCL	436.35766
Hall's Bootstrap UCL	434.01789
Percentile Bootstrap UCL	432.08333
BCA Bootstrap UCL	434.66667
95% Chebyshev (Mean, Sd) UCL	534.07331
97.5% Chebyshev (Mean, Sd) UCL	605.14729
99% Chebyshev (Mean, Sd) UCL	744.75837

UCL Calculation of Iron, Direct Contact with Soil Pathway, Exposure Area 5

Data File

Variable: Iron

Raw Statistics	
Number of Valid Samples	30
Number of Unique Samples	29
Minimum	7360
Maximum	55000
Mean	22471
Median	20750
Standard Deviation	12057.746
Variance	145389244
Coefficient of Variation	0.5365914
Skewness	0.9315506

Gamma Statistics	
k hat	3.8033833
k star (bias corrected)	3.4452672
Theta hat	5908.1608
Theta star	6522.2808
nu hat	228.203
nu star	206.71603
Approx.Chi Square Value (.05)	174.43969
Adjusted Level of Significance	0.041
Adjusted Chi Square Value	172.73273

Log-transformed Statistics	
Minimum of log data	8.9038152
Maximum of log data	10.915088
Mean of log data	9.8827968
Standard Deviation of log data	0.5374732
Variance of log data	0.2888774

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9173515
Shapiro-Wilk 5% Critical Value	0.927
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	26211.514

Gamma Distribution Test	
A-D Test Statistic	0.3752999
A-D 5% Critical Value	0.7500961
K-S Test Statistic	0.1320125
K-S 5% Critical Value	0.1607724
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**26628.779**
Adjusted Gamma UCL	26891.927

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9649737
Shapiro-Wilk 5% Critical Value	0.927
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	27536.585
95% Chebyshev (MVUE) UCL	32626.118
97.5% Chebyshev (MVUE) UCL	37002.552
99% Chebyshev (MVUE) UCL	45599.207

95% Non-parametric UCLs	
CLT UCL	26092.035
Adj-CLT UCL (Adjusted for skewness)	26492.102
Mod-t UCL (Adjusted for skewness)	26273.916
Jackknife UCL	26211.514
Standard Bootstrap UCL	25999.994
Bootstrap-t UCL	26730.532
Hall's Bootstrap UCL	26565.776
Percentile Bootstrap UCL	26088.667
BCA Bootstrap UCL	26430.667
95% Chebyshev (Mean, Sd) UCL	32066.825
97.5% Chebyshev (Mean, Sd) UCL	36218.946
99% Chebyshev (Mean, Sd) UCL	44374.984

UCL Calculation of Thallium, Direct Contact with Soil Pathway, Exposure Area 5

Data File

Variable: Thallium

Raw Statistics	
Number of Valid Samples	30
Number of Unique Samples	9
Minimum	0.175
Maximum	0.66
Mean	0.2698333
Median	0.175
Standard Deviation	0.1575922
Variance	0.0248353
Coefficient of Variation	0.5840355
Skewness	1.3579864

Gamma Statistics	
k hat	4.018131
k star (bias corrected)	3.6385402
Theta hat	0.0671539
Theta star	0.0741598
nu hat	241.08786
nu star	218.31241
Approx.Chi Square Value (.05)	185.10956
Adjusted Level of Significance	0.041
Adjusted Chi Square Value	183.34955

Log-transformed Statistics	
Minimum of log data	-1.742969
Maximum of log data	-0.415515
Mean of log data	-1.439517
Standard Deviation of log data	0.4845443
Variance of log data	0.2347831

RECOMMENDATION

Data are Non-parametric (0.05)

Use Student's-t UCL
or Modified-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.6463661
Shapiro-Wilk 5% Critical Value	0.927
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	0.3187211

Gamma Distribution Test	
A-D Test Statistic	5.3635641
A-D 5% Critical Value	0.7494651
K-S Test Statistic	0.4379883
K-S 5% Critical Value	0.1606733
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.318233
Adjusted Gamma UCL	0.3212878

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.6370931
Shapiro-Wilk 5% Critical Value	0.927
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.3168989
95% Chebyshev (MVUE) UCL	0.372011
97.5% Chebyshev (MVUE) UCL	0.4181339
99% Chebyshev (MVUE) UCL	0.5087336

95% Non-parametric UCLs	
CLT UCL	0.3171595
Adj-CLT UCL (Adjusted for skewness)	0.3247819
Mod-t UCL (Adjusted for skewness)	**0.31991**
Jackknife UCL	0.3187211
Standard Bootstrap UCL	0.3174388
Bootstrap-t UCL	0.330627
Hall's Bootstrap UCL	0.3193333
Percentile Bootstrap UCL	0.3181667
BCA Bootstrap UCL	0.3248333
95% Chebyshev (Mean, Sd) UCL	0.3952488
97.5% Chebyshev (Mean, Sd) UCL	0.4495161
99% Chebyshev (Mean, Sd) UCL	0.5561139

UCL Calculation of Vanadium, Direct Contact with Soil Pathway, Exposure Area 5

Data File

Variable: Vanadium

Raw Statistics	
Number of Valid Samples	30
Number of Unique Samples	30
Minimum	13.9
Maximum	210
Mean	47.17
Median	38.65
Standard Deviation	41.324787
Variance	1707.738
Coefficient of Variation	0.876082
Skewness	2.5109759

Gamma Statistics	
k hat	2.1632714
k star (bias corrected)	1.9691665
Theta hat	21.804939
Theta star	23.954298
nu hat	129.79628
nu star	118.14999
Approx.Chi Square Value (.05)	94.047479
Adjusted Level of Significance	0.041
Adjusted Chi Square Value	92.808286

Log-transformed Statistics	
Minimum of log data	2.6318888
Maximum of log data	5.3471075
Mean of log data	3.6051677
Standard Deviation of log data	0.6691846
Variance of log data	0.4478081

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.7080065
Shapiro-Wilk 5% Critical Value	0.927
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	59.989638

Gamma Distribution Test	
A-D Test Statistic	1.2478262
A-D 5% Critical Value	0.7574871
K-S Test Statistic	0.1892224
K-S 5% Critical Value	0.1619784
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	59.258738
Adjusted Gamma UCL	60.049971

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9333672
Shapiro-Wilk 5% Critical Value	0.927
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	**59.601016**
95% Chebyshev (MVUE) UCL	71.727601
97.5% Chebyshev (MVUE) UCL	83.028788
99% Chebyshev (MVUE) UCL	105.22778

95% Non-parametric UCLs	
CLT UCL	59.580156
Adj-CLT UCL (Adjusted for skewness)	63.275989
Mod-t UCL (Adjusted for skewness)	60.566113
Jackknife UCL	59.989638
Standard Bootstrap UCL	59.440494
Bootstrap-t UCL	67.461735
Hall's Bootstrap UCL	70.791829
Percentile Bootstrap UCL	60.2
BCA Bootstrap UCL	63.013333
95% Chebyshev (Mean, Sd) UCL	80.057192
97.5% Chebyshev (Mean, Sd) UCL	94.287507
99% Chebyshev (Mean, Sd) UCL	122.2402

RECOMMENDATION

Data are lognormal (0.05)

Use H-UCL

Data Set Used to Calculate Soil EPCs for the Locally-Grown Vegetable Pathway, Exposure Area 5

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
5	soil	0-6	Inches	2000	SS118D	U04-1188	mg/Kg	1.5	0.26	259	14200	0.58	30.3
5	soil	0-6	Inches	2000	SS119D	U04-1190	mg/Kg	1.5	0.29	125	20500	0.175	49
5	soil	0-6	Inches	2000	U07-0091	U07-0091	mg/kg	0.3	1.9	690	20300	0.11	14.8
5	soil	0-6	Inches	2000	U07-0372	U07-0372	mg/kg	2	2.9	1100	26200	0.13	15.1
5	soil	0-6	Inches	2000	S88	U04-1122	mg/kg	1.2	0.38	484	9320	0.37	12.2
5	soil	0-6	Inches	2000	S89	U04-1123	mg/kg	1.8	0.3	399	9890	0.37	13.7
5	soil	0-6	Inches	2000	S90	U04-1124	mg/kg	2.6	0.32	255	14800	0.37	27.6
5	soil	0-6	Inches	2000	S94	U04-1128	mg/kg	1.1	0.15	313	8650	0.37	13.4
5	soil	0-6	Inches	2000	S95	U04-1129	mg/kg	2.6	0.43	494	15800	0.37	24.6
5	soil	0-6	Inches	2000	S96	U04-1130	mg/kg	2.1	0.28	237	11700	0.37	17
5	soil	0-6	Inches	2000	SS131D	U04-1206	mg/Kg	1.6	0.62	444	16600	0.175	26.6
5	soil	0-6	Inches	2000	U07-0129	U07-0129	mg/kg	0.16	1.8	502	18400	0.28	8.8
5	soil	0-6	Inches	2000	U07-0142	U07-0142	mg/kg	0.17	1.1	395	12600	0.22	10.5
5	soil	0-6	Inches	2000	U07-0155	U07-0155	mg/kg	0.295	0.84	210	23300	0.09	10.4
5	soil	0-6	Inches	2000	U07-0168	U07-0168	mg/kg	0.55	0.79	150	17800	0.09	13.4
5	soil	0-6	Inches	2000	U07-0181	U07-0181	mg/kg	0.15	0.87	230	10500	0.12	11.8
5	soil	0-6	Inches	2000	U07-0320	U07-0320	mg/kg	0.15	0.65	29.6	7300	0.11	7.7
5	soil	0-6	Inches	2000	U07-0333	U07-0333	mg/kg	0.19	0.9	49.7	11300	0.04	16.8

Soil EPCs for Arsenic Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Arsenic

Raw Statistics	
Number of Valid Samples	18
Number of Unique Samples	15
Minimum	0.15
Maximum	2.6
Mean	1.1091667
Median	1.15
Standard Deviation	0.8861886
Variance	0.7853301
Coefficient of Variation	0.7989679
Skewness	0.3238263

Gamma Statistics	
k hat	1.203841
k star (bias corrected)	1.0402378
Theta hat	0.9213565
Theta star	1.0662626
nu hat	43.338275
nu star	37.448562
Approx.Chi Square Value (.05)	24.43526
Adjusted Level of Significance	0.03574
Adjusted Chi Square Value	23.427665

Log-transformed Statistics	
Minimum of log data	-1.89712
Maximum of log data	0.9555114
Mean of log data	-0.366091
Standard Deviation of log data	1.114969
Variance of log data	1.243156

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8767011
Shapiro-Wilk 5% Critical Value	0.897
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	1.4725298

Gamma Distribution Test	
A-D Test Statistic	0.9906849
A-D 5% Critical Value	0.7623805
K-S Test Statistic	0.1916962
K-S 5% Critical Value	0.208539
Data follow approximate gamma distibution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**1.6998672**
Adjusted Gamma UCL	1.7729764

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.844185
Shapiro-Wilk 5% Critical Value	0.897
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	2.7734869
95% Chebyshev (MVUE) UCL	2.8101754
97.5% Chebyshev (MVUE) UCL	3.4954939
99% Chebyshev (MVUE) UCL	4.8416694

95% Non-parametric UCLs	
CLT UCL	1.4527382
Adj-CLT UCL (Adjusted for skewness)	1.4697733
Mod-t UCL (Adjusted for skewness)	1.475187
Jackknife UCL	1.4725298
Standard Bootstrap UCL	1.443733
Bootstrap-t UCL	1.4925982
Hall's Bootstrap UCL	1.4484534
Percentile Bootstrap UCL	1.4533333
BCA Bootstrap UCL	1.4538889
95% Chebyshev (Mean, Sd) UCL	2.0196389
97.5% Chebyshev (Mean, Sd) UCL	2.4136009
99% Chebyshev (Mean, Sd) UCL	3.187463

RECOMMENDATION

Assuming gamma distribution (0.05)

Use Approximate Gamma UCL

Soil EPCs for Cadmium Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Cadmium

Raw Statistics	
Number of Valid Samples	18
Number of Unique Samples	18
Minimum	0.15
Maximum	2.9
Mean	0.8211111
Median	0.635
Standard Deviation	0.7199582
Variance	0.5183399
Coefficient of Variation	0.8768098
Skewness	1.7710403

Gamma Statistics	
k hat	1.7741308
k star (bias corrected)	1.5154794
Theta hat	0.4628245
Theta star	0.5418161
nu hat	63.868709
nu star	54.557257
Approx.Chi Square Value (.05)	38.582222
Adjusted Level of Significance	0.03574
Adjusted Chi Square Value	37.2936

Log-transformed Statistics	
Minimum of log data	-1.89712
Maximum of log data	1.0647107
Mean of log data	-0.504658
Standard Deviation of log data	0.7973959
Variance of log data	0.6358402

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.7953138
Shapiro-Wilk 5% Critical Value	0.897
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	1.116315

Gamma Distribution Test	
A-D Test Statistic	0.4967834
A-D 5% Critical Value	0.7542653
K-S Test Statistic	0.1410024
K-S 5% Critical Value	0.2067311
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**1.1610936**
Adjusted Gamma UCL	1.2012134

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9656806
Shapiro-Wilk 5% Critical Value	0.897
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	1.3124759
95% Chebyshev (MVUE) UCL	1.5277801
97.5% Chebyshev (MVUE) UCL	1.837751
99% Chebyshev (MVUE) UCL	2.4466287

95% Non-parametric UCLs	
CLT UCL	1.1002358
Adj-CLT UCL (Adjusted for skewness)	1.1759267
Mod-t UCL (Adjusted for skewness)	1.1281212
Jackknife UCL	1.116315
Standard Bootstrap UCL	1.0950361
Bootstrap-t UCL	1.2694743
Hall's Bootstrap UCL	1.252967
Percentile Bootstrap UCL	1.1066667
BCA Bootstrap UCL	1.1833333
95% Chebyshev (Mean, Sd) UCL	1.5607979
97.5% Chebyshev (Mean, Sd) UCL	1.8808609
99% Chebyshev (Mean, Sd) UCL	2.5095629

Soil EPCs for Copper Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Copper

Raw Statistics	
Number of Valid Samples	18
Number of Unique Samples	18
Minimum	29.6
Maximum	1100
Mean	353.68333
Median	286
Standard Deviation	254.58375
Variance	64812.885
Coefficient of Variation	0.719807
Skewness	1.491979

Gamma Statistics	
k hat	1.8822188
k star (bias corrected)	1.6055527
Theta hat	187.90766
Theta star	220.28759
nu hat	67.759877
nu star	57.799897
Approx.Chi Square Value (.05)	41.319522
Adjusted Level of Significance	0.03574
Adjusted Chi Square Value	39.982852

Log-transformed Statistics	
Minimum of log data	3.3877744
Maximum of log data	7.0030655
Mean of log data	5.5798289
Standard Deviation of log data	0.884659
Variance of log data	0.7826216

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8854851
Shapiro-Wilk 5% Critical Value	0.897
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	458.0701

Gamma Distribution Test	
A-D Test Statistic	0.2817792
A-D 5% Critical Value	0.7534827
K-S Test Statistic	0.1208293
K-S 5% Critical Value	0.2065344
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**494.75065**
Adjusted Gamma UCL	511.2907

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9198776
Shapiro-Wilk 5% Critical Value	0.897
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	668.61635
95% Chebyshev (MVUE) UCL	758.77112
97.5% Chebyshev (MVUE) UCL	922.27746
99% Chebyshev (MVUE) UCL	1243.454

95% Non-parametric UCLs	
CLT UCL	452.38436
Adj-CLT UCL (Adjusted for skewness)	474.93201
Mod-t UCL (Adjusted for skewness)	461.58708
Jackknife UCL	458.0701
Standard Bootstrap UCL	450.68153
Bootstrap-t UCL	491.81979
Hall's Bootstrap UCL	549.7725
Percentile Bootstrap UCL	454.20556
BCA Bootstrap UCL	477.64444
95% Chebyshev (Mean, Sd) UCL	615.24327
97.5% Chebyshev (Mean, Sd) UCL	728.42046
99% Chebyshev (Mean, Sd) UCL	950.73515

Soil EPCs for Iron Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Iron

Raw Statistics	
Number of Valid Samples	18
Number of Unique Samples	18
Minimum	7300
Maximum	26200
Mean	14953.333
Median	14500
Standard Deviation	5338.4719
Variance	28499282
Coefficient of Variation	0.3570088
Skewness	0.5238429

Gamma Statistics	
k hat	8.3737963
k star (bias corrected)	7.0152006
Theta hat	1785.7293
Theta star	2131.5618
nu hat	301.45667
nu star	252.54722
Approx.Chi Square Value (.05)	216.74446
Adjusted Level of Significance	0.03574
Adjusted Chi Square Value	213.56285

Log-transformed Statistics	
Minimum of log data	8.8956296
Maximum of log data	10.173515
Mean of log data	9.5517927
Standard Deviation of log data	0.3620843
Variance of log data	0.131105

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9607646
Shapiro-Wilk 5% Critical Value	0.897
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**17142.263**

Gamma Distribution Test	
A-D Test Statistic	0.1712707
A-D 5% Critical Value	0.7404157
K-S Test Statistic	0.1026388
K-S 5% Critical Value	0.2036582
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	17423.388
Adjusted Gamma UCL	17682.957

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9805394
Shapiro-Wilk 5% Critical Value	0.897
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	17759.149
95% Chebyshev (MVUE) UCL	20637.033
97.5% Chebyshev (MVUE) UCL	23091.107
99% Chebyshev (MVUE) UCL	27911.661

95% Non-parametric UCLs	
CLT UCL	17023.036
Adj-CLT UCL (Adjusted for skewness)	17189.043
Mod-t UCL (Adjusted for skewness)	17168.156
Jackknife UCL	17142.263
Standard Bootstrap UCL	16964.092
Bootstrap-t UCL	17340.592
Hall's Bootstrap UCL	17270.08
Percentile Bootstrap UCL	16996.111
BCA Bootstrap UCL	17128.889
95% Chebyshev (Mean, Sd) UCL	20438.092
97.5% Chebyshev (Mean, Sd) UCL	22811.351
99% Chebyshev (Mean, Sd) UCL	27473.16

Soil EPCs for Thallium Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Thallium

Raw Statistics	
Number of Valid Samples	18
Number of Unique Samples	10
Minimum	0.04
Maximum	0.58
Mean	0.2411111
Median	0.1975
Standard Deviation	0.1480715
Variance	0.0219252
Coefficient of Variation	0.6141213
Skewness	0.5819081

Gamma Statistics	
k hat	2.5300689
k star (bias corrected)	2.1454278
Theta hat	0.0952982
Theta star	0.1123837
nu hat	91.082482
nu star	77.235402
Approx.Chi Square Value (.05)	57.986931
Adjusted Level of Significance	0.03574
Adjusted Chi Square Value	56.386724

Log-transformed Statistics	
Minimum of log data	-3.218876
Maximum of log data	-0.544727
Mean of log data	-1.632949
Standard Deviation of log data	0.7103931
Variance of log data	0.5046584

RECOMMENDATION

Assuming gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8911513
Shapiro-Wilk 5% Critical Value	0.897
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	0.3018247

Gamma Distribution Test	
A-D Test Statistic	0.6751394
A-D 5% Critical Value	0.7489937
K-S Test Statistic	0.2144824
K-S 5% Critical Value	0.2056309
Data follow approximate gamma distibution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**0.3211467**
Adjusted Gamma UCL	0.3302606

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9237476
Shapiro-Wilk 5% Critical Value	0.897
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.3711921
95% Chebyshev (MVUE) UCL	0.4391966
97.5% Chebyshev (MVUE) UCL	0.5222718
99% Chebyshev (MVUE) UCL	0.6854569

95% Non-parametric UCLs	
CLT UCL	0.2985178
Adj-CLT UCL (Adjusted for skewness)	0.3036326
Mod-t UCL (Adjusted for skewness)	0.3026226
Jackknife UCL	0.3018247
Standard Bootstrap UCL	0.2967483
Bootstrap-t UCL	0.306678
Hall's Bootstrap UCL	0.304852
Percentile Bootstrap UCL	0.2980556
BCA Bootstrap UCL	0.3011111
95% Chebyshev (Mean, Sd) UCL	0.3932401
97.5% Chebyshev (Mean, Sd) UCL	0.4590664
99% Chebyshev (Mean, Sd) UCL	0.5883695

Soil EPCs for Vanadium Used for Calculation of EPCs for Locally-Grown Vegetables

Data File

Variable: Vanadium

Raw Statistics	
Number of Valid Samples	18
Number of Unique Samples	17
Minimum	7.7
Maximum	49
Mean	17.983333
Median	14.25
Standard Deviation	10.234558
Variance	104.74618
Coefficient of Variation	0.5691135
Skewness	1.8549509

Gamma Statistics	
k hat	4.3358975
k star (bias corrected)	3.650285
Theta hat	4.1475457
Theta star	4.926556
nu hat	156.09231
nu star	131.41026
Approx.Chi Square Value (.05)	105.92375
Adjusted Level of Significance	0.03574
Adjusted Chi Square Value	103.72833

Log-transformed Statistics	
Minimum of log data	2.0412203
Maximum of log data	3.8918203
Mean of log data	2.7697194
Standard Deviation of log data	0.4805019
Variance of log data	0.230882

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8032813
Shapiro-Wilk 5% Critical Value	0.897
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	22.179801

Gamma Distribution Test	
A-D Test Statistic	0.6761845
A-D 5% Critical Value	0.7427144
K-S Test Statistic	0.2040424
K-S 5% Critical Value	0.2044287
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**22.310335**
Adjusted Gamma UCL	22.782537

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9454901
Shapiro-Wilk 5% Critical Value	0.897
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	22.631665
95% Chebyshev (MVUE) UCL	26.839292
97.5% Chebyshev (MVUE) UCL	30.758826
99% Chebyshev (MVUE) UCL	38.457993

95% Non-parametric UCLs	
CLT UCL	21.951228
Adj-CLT UCL (Adjusted for skewness)	23.07819
Mod-t UCL (Adjusted for skewness)	22.355584
Jackknife UCL	22.179801
Standard Bootstrap UCL	21.854683
Bootstrap-t UCL	24.202794
Hall's Bootstrap UCL	25.07289
Percentile Bootstrap UCL	22.094444
BCA Bootstrap UCL	23.177778
95% Chebyshev (Mean, Sd) UCL	28.498342
97.5% Chebyshev (Mean, Sd) UCL	33.048195
99% Chebyshev (Mean, Sd) UCL	41.985499

Data Set Used to Calculate Soil EPCs for the Locally-Grown Beef, Chicken, and Eggs Pathways, Exposure Area 5

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper
5	soil	0-1	Inches		U04-1007	U04-1007	mg/kg	4.19	0.64	845
5	soil	0-1	Inches		U04-1009	U04-1009	mg/kg	2.74	1.14	803
5	soil	0-1	Inches		U04-1012	U04-1012	mg/kg	0.73	0.56	309
5	soil	0-1	Inches		U04-1013	U04-1013	mg/kg	2	0.66	521
5	soil	0-1	Inches		U04-1014	U04-1014	mg/kg	1.3	0.42	504
5	soil	0-1	Inches		U04-1017	U04-1017	mg/kg	2.7	0.21	216
5	soil	0-1	Inches		U04-1018	U04-1018	mg/kg	2.3	0.38	175
5	soil	0-1	Inches		U04-1020	U04-1020	mg/kg	2.8	0.3	436
5	soil	0-1	Inches		U04-1022	U04-1022	mg/kg	3.3	1.63	1790
5	soil	0-1	Inches		U04-1015	U04-1015	mg/kg	1.4	0.4	330
5	soil	0-1	Inches		U04-1016	U04-1016	mg/kg	3.3	0.83	922
5	soil	0-1	Inches		U06-3022	U06-3022	mg/kg	2.01	0.76	554

Soil EPCs for Arsenic Used for Calculation of EPCs for Locally-Grown Beef, Chicken, and Eggs

Data File

Variable: Arsenic

Raw Statistics	
Number of Valid Samples	12
Number of Unique Samples	11
Minimum	0.73
Maximum	4.19
Mean	2.3975
Median	2.5
Standard Deviation	0.9775026
Variance	0.9555114
Coefficient of Variation	0.4077175
Skewness	0.0338353

Gamma Statistics	
k hat	5.4548873
k star (bias corrected)	4.146721
Theta hat	0.4395141
Theta star	0.5781677
nu hat	130.9173
nu star	99.521305
Approx.Chi Square Value (.05)	77.502383
Adjusted Level of Significance	0.02896
Adjusted Chi Square Value	74.54183

Log-transformed Statistics	
Minimum of log data	-0.314711
Maximum of log data	1.4327007
Mean of log data	0.7799743
Standard Deviation of log data	0.4869696
Variance of log data	0.2371393

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9813198
Shapiro-Wilk 5% Critical Value	0.859
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**2.904264**

Gamma Distribution Test	
A-D Test Statistic	0.2898434
A-D 5% Critical Value	0.7318362
K-S Test Statistic	0.1645854
K-S 5% Critical Value	0.24588
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	3.078645
Adjusted Gamma UCL	3.2009186

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9263512
Shapiro-Wilk 5% Critical Value	0.859
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	3.3553864
95% Chebyshev (MVUE) UCL	3.9521773
97.5% Chebyshev (MVUE) UCL	4.6109504
99% Chebyshev (MVUE) UCL	5.9049827

95% Non-parametric UCLs	
CLT UCL	2.8616459
Adj-CLT UCL (Adjusted for skewness)	2.864591
Mod-t UCL (Adjusted for skewness)	2.9047234
Jackknife UCL	2.904264
Standard Bootstrap UCL	2.8434719
Bootstrap-t UCL	2.9113969
Hall's Bootstrap UCL	2.896774
Percentile Bootstrap UCL	2.8408333
BCA Bootstrap UCL	2.8391667
95% Chebyshev (Mean, Sd) UCL	3.6274972
97.5% Chebyshev (Mean, Sd) UCL	4.1597179
99% Chebyshev (Mean, Sd) UCL	5.2051625

Soil EPCs for Cadmium Used for Calculation of EPCs for Locally-Grown Beef, Chicken, and Eggs

Data File

Variable: Cadmium

Raw Statistics	
Number of Valid Samples	12
Number of Unique Samples	12
Minimum	0.21
Maximum	1.63
Mean	0.6608333
Median	0.6
Standard Deviation	0.3995784
Variance	0.1596629
Coefficient of Variation	0.6046583
Skewness	1.4237809

Gamma Statistics	
k hat	3.4404896
k star (bias corrected)	2.6359228
Theta hat	0.1920754
Theta star	0.2507028
nu hat	82.571751
nu star	63.262147
Approx.Chi Square Value (.05)	45.961797
Adjusted Level of Significance	0.02896
Adjusted Chi Square Value	43.718593

Log-transformed Statistics	
Minimum of log data	-1.560648
Maximum of log data	0.48858
Mean of log data	-0.566565
Standard Deviation of log data	0.5748928
Variance of log data	0.3305018

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8811568
Shapiro-Wilk 5% Critical Value	0.859
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**0.8679857**

Gamma Distribution Test	
A-D Test Statistic	0.2006187
A-D 5% Critical Value	0.7376004
K-S Test Statistic	0.1407456
K-S 5% Critical Value	0.2469651
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.9095757
Adjusted Gamma UCL	0.9562461

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9895525
Shapiro-Wilk 5% Critical Value	0.859
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.9865235
95% Chebyshev (MVUE) UCL	1.1504014
97.5% Chebyshev (MVUE) UCL	1.3629662
99% Chebyshev (MVUE) UCL	1.7805085

95% Non-parametric UCLs	
CLT UCL	0.8505645
Adj-CLT UCL (Adjusted for skewness)	0.901222
Mod-t UCL (Adjusted for skewness)	0.8758872
Jackknife UCL	0.8679857
Standard Bootstrap UCL	0.8413107
Bootstrap-t UCL	0.9695645
Hall's Bootstrap UCL	1.7476874
Percentile Bootstrap UCL	0.8491667
BCA Bootstrap UCL	0.8933333
95% Chebyshev (Mean, Sd) UCL	1.1636251
97.5% Chebyshev (Mean, Sd) UCL	1.3811835
99% Chebyshev (Mean, Sd) UCL	1.8085348

Soil EPCs for Copper Used for Calculation of EPCs for Locally-Grown Beef, Chicken, and Eggs

Data File

Variable: Copper

Raw Statistics	
Number of Valid Samples	12
Number of Unique Samples	12
Minimum	175
Maximum	1790
Mean	617.08333
Median	512.5
Standard Deviation	441.86042
Variance	195240.63
Coefficient of Variation	0.7160466
Skewness	1.8309179

Gamma Statistics	
k hat	2.6442094
k star (bias corrected)	2.0387126
Theta hat	233.37159
Theta star	302.68285
nu hat	63.461025
nu star	48.929102
Approx.Chi Square Value (.05)	33.868532
Adjusted Level of Significance	0.02896
Adjusted Chi Square Value	31.964936

Log-transformed Statistics	
Minimum of log data	5.164786
Maximum of log data	7.4899709
Mean of log data	6.2241533
Standard Deviation of log data	0.6565478
Variance of log data	0.431055

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8250944
Shapiro-Wilk 5% Critical Value	0.859
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	846.15581

Gamma Distribution Test	
A-D Test Statistic	0.2486251
A-D 5% Critical Value	0.739903
K-S Test Statistic	0.1523255
K-S 5% Critical Value	0.2478156
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**891.48632**
Adjusted Gamma UCL	944.57667

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9801643
Shapiro-Wilk 5% Critical Value	0.859
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	997.1802
95% Chebyshev (MVUE) UCL	1139.0878
97.5% Chebyshev (MVUE) UCL	1366.606
99% Chebyshev (MVUE) UCL	1813.5215

95% Non-parametric UCLs	
CLT UCL	826.89118
Adj-CLT UCL (Adjusted for skewness)	898.92777
Mod-t UCL (Adjusted for skewness)	857.39206
Jackknife UCL	846.15581
Standard Bootstrap UCL	819.53972
Bootstrap-t UCL	994.71209
Hall's Bootstrap UCL	1757.8712
Percentile Bootstrap UCL	844.25
BCA Bootstrap UCL	903.33333
95% Chebyshev (Mean, Sd) UCL	1173.0788
97.5% Chebyshev (Mean, Sd) UCL	1413.6585
99% Chebyshev (Mean, Sd) UCL	1886.2308

Soil EPCs for Iron, Thallium, and Vanadium Used for Calculation of EPCs for Locally-Grown Beef, Chicken, and Eggs

In the dataset used to calculate soil EPCs for this pathway, samples were not analyzed for Fe, Tl, and V. Therefore, the soil EPCs from the direct contact with soil pathway (0-1" Sample Depth, 250 μm Sieve) were used as the soil EPCs for this pathway in EA 5.

Data Set for Direct Contact with Soil Pathway, Smelter Area

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
SM	soil	0-1	Inches	250	S59	U04-1093	mg/kg	18.9	7.8	14100	62400	0.37	22.7
SM	soil	0-1	Inches	250	S60	U04-1094	mg/kg	21.8	4.9	18300	58600	0.37	23
SM	soil	0-1	Inches	250	S61	U04-1095	mg/kg	25.4	6.8	30500	34600	0.37	22.9
SM	soil	0-1	Inches	250	S62	U04-1096	mg/kg	16	5.7	20100	35500	0.93	20
SM	soil	0-1	Inches	250	S63	U04-1097	mg/kg	9.4	4.5	10500	24600	0.37	21.3

UCL Calculation of Arsenic, Direct Contact With Soil Pathway, Smelter Area

Data File

Variable: Arsenic

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	5
Minimum	9.4
Maximum	25.4
Mean	18.3
Median	18.9
Standard Deviation	6.0728906
Variance	36.88
Coefficient of Variation	0.3318519
Skewness	-0.58813

Gamma Statistics	
k hat	9.5838905
k star (bias corrected)	3.9668895
Theta hat	1.9094542
Theta star	4.6131862
nu hat	95.838905
nu star	39.668895
Approx.Chi Square Value (.05)	26.237216
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	21.585638

Log-transformed Statistics	
Minimum of log data	2.2407097
Maximum of log data	3.2347492
Mean of log data	2.8538239
Standard Deviation of log data	0.3830529
Variance of log data	0.1467295

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9815378
Shapiro-Wilk 5% Critical Value	0.762
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**24.089836**

Gamma Distribution Test	
A-D Test Statistic	0.2678508
A-D 5% Critical Value	0.6790323
K-S Test Statistic	0.1830006
K-S 5% Critical Value	0.3576499
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	27.668362
Adjusted Gamma UCL	33.630731

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9211397
Shapiro-Wilk 5% Critical Value	0.762
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	30.760661
95% Chebyshev (MVUE) UCL	32.055944
97.5% Chebyshev (MVUE) UCL	37.96805
99% Chebyshev (MVUE) UCL	49.581239

95% Non-parametric UCLs	
CLT UCL	22.767224
Adj-CLT UCL (Adjusted for skewness)	22.003952
Mod-t UCL (Adjusted for skewness)	23.970781
Jackknife UCL	24.089836
Standard Bootstrap UCL	22.300074
Bootstrap-t UCL	23.13766
Hall's Bootstrap UCL	22.640992
Percentile Bootstrap UCL	22.08
BCA Bootstrap UCL	21.64
95% Chebyshev (Mean, Sd) UCL	30.138243
97.5% Chebyshev (Mean, Sd) UCL	35.26066
99% Chebyshev (Mean, Sd) UCL	45.322657

UCL Calculation of Cadmium, Direct Contact With Soil Pathway, Smelter Area

Data File

Variable: Cadmium

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	5
Minimum	4.5
Maximum	7.8
Mean	5.94
Median	5.7
Standard Deviation	1.3612494
Variance	1.853
Coefficient of Variation	0.2291666
Skewness	0.4866803

Gamma Statistics	
k hat	24.268731
k star (bias corrected)	9.8408256
Theta hat	0.2447594
Theta star	0.6036079
nu hat	242.68731
nu star	98.408256
Approx.Chi Square Value (.05)	76.519795
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	68.116173

Log-transformed Statistics	
Minimum of log data	1.5040774
Maximum of log data	2.0541237
Mean of log data	1.760965
Standard Deviation of log data	0.2270283
Variance of log data	0.0515418

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9486303
Shapiro-Wilk 5% Critical Value	0.762
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**7.2378023**

Gamma Distribution Test	
A-D Test Statistic	0.2415982
A-D 5% Critical Value	0.6786288
K-S Test Statistic	0.2023248
K-S 5% Critical Value	0.3571173
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	7.639135
Adjusted Gamma UCL	8.5815896

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.958917
Shapiro-Wilk 5% Critical Value	0.762
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	7.706314
95% Chebyshev (MVUE) UCL	8.5625075
97.5% Chebyshev (MVUE) UCL	9.6977768
99% Chebyshev (MVUE) UCL	11.927793

95% Non-parametric UCLs	
CLT UCL	6.9413363
Adj-CLT UCL (Adjusted for skewness)	7.082913
Mod-t UCL (Adjusted for skewness)	7.2598854
Jackknife UCL	7.2378023
Standard Bootstrap UCL	6.8553985
Bootstrap-t UCL	7.928232
Hall's Bootstrap UCL	8.1826133
Percentile Bootstrap UCL	6.82
BCA Bootstrap UCL	6.94
95% Chebyshev (Mean, Sd) UCL	8.5935636
97.5% Chebyshev (Mean, Sd) UCL	9.7417627
99% Chebyshev (Mean, Sd) UCL	11.997178

UCL Calculation of Copper, Direct Contact With Soil Pathway, Smelter Area

Data File | **Variable: Copper**

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	5
Minimum	10500
Maximum	30500
Mean	18700
Median	18300
Standard Deviation	7578.9181
Variance	57440000
Coefficient of Variation	0.4052897
Skewness	0.9542579

Gamma Statistics	
k hat	7.9823506
k star (bias corrected)	3.3262736
Theta hat	2342.6683
Theta star	5621.9068
nu hat	79.823506
nu star	33.262736
Approx.Chi Square Value (.05)	21.073802
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	16.968838

Log-transformed Statistics	
Minimum of log data	9.2591305
Maximum of log data	10.325482
Mean of log data	9.7723348
Standard Deviation of log data	0.3991793
Variance of log data	0.1593441

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9456028
Shapiro-Wilk 5% Critical Value	0.762
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**25925.668**

Gamma Distribution Test	
A-D Test Statistic	0.2013501
A-D 5% Critical Value	0.6796185
K-S Test Statistic	0.1729436
K-S 5% Critical Value	0.3578805
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	29515.944
Adjusted Gamma UCL	36656.201

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9897313
Shapiro-Wilk 5% Critical Value	0.762
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	32230.694
95% Chebyshev (MVUE) UCL	33140.812
97.5% Chebyshev (MVUE) UCL	39396.394
99% Chebyshev (MVUE) UCL	51684.275

95% Non-parametric UCLs	
CLT UCL	24275.059
Adj-CLT UCL (Adjusted for skewness)	25820.61
Mod-t UCL (Adjusted for skewness)	26166.743
Jackknife UCL	25925.668
Standard Bootstrap UCL	23732.208
Bootstrap-t UCL	28045.003
Hall's Bootstrap UCL	50429.573
Percentile Bootstrap UCL	24060
BCA Bootstrap UCL	24420
95% Chebyshev (Mean, Sd) UCL	33474.031
97.5% Chebyshev (Mean, Sd) UCL	39866.766
99% Chebyshev (Mean, Sd) UCL	52424.057

UCL Calculation of Iron, Direct Contact With Soil Pathway, Smelter Area

Data File

Variable: Iron

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	5
Minimum	24600
Maximum	62400
Mean	43140
Median	35500
Standard Deviation	16469.608
Variance	271248000
Coefficient of Variation	0.3817712
Skewness	0.3169299

Gamma Statistics	
k hat	8.4462897
k star (bias corrected)	3.5118492
Theta hat	5107.5681
Theta star	12284.126
nu hat	84.462897
nu star	35.118492
Approx.Chi Square Value (.05)	22.557964
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	18.289781

Log-transformed Statistics	
Minimum of log data	10.110502
Maximum of log data	11.041321
Mean of log data	10.611842
Standard Deviation of log data	0.3917921
Variance of log data	0.153501

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8807609
Shapiro-Wilk 5% Critical Value	0.762
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**58841.968**

Gamma Distribution Test	
A-D Test Statistic	0.4034436
A-D 5% Critical Value	0.6794487
K-S Test Statistic	0.2670891
K-S 5% Critical Value	0.3578137
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	67160.837
Adjusted Gamma UCL	82833.781

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9057853
Shapiro-Wilk 5% Critical Value	0.762
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	73392.494
95% Chebyshev (MVUE) UCL	75942.045
97.5% Chebyshev (MVUE) UCL	90127.665
99% Chebyshev (MVUE) UCL	117992.57

95% Non-parametric UCLs	
CLT UCL	55255.059
Adj-CLT UCL (Adjusted for skewness)	56370.526
Mod-t UCL (Adjusted for skewness)	59015.958
Jackknife UCL	58841.968
Standard Bootstrap UCL	53912.295
Bootstrap-t UCL	78850.481
Hall's Bootstrap UCL	160009.89
Percentile Bootstrap UCL	54740
BCA Bootstrap UCL	54560
95% Chebyshev (Mean, Sd) UCL	75245.177
97.5% Chebyshev (Mean, Sd) UCL	89137.113
99% Chebyshev (Mean, Sd) UCL	116425.13

UCL Calculation of Thallium, Direct Contact With Soil Pathway, Smelter Area

Data File | **Variable: Thallium**

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	2
Minimum	0.37
Maximum	0.93
Mean	0.482
Median	0.37
Standard Deviation	0.2504396
Variance	0.06272
Coefficient of Variation	0.5195843
Skewness	2.236068

Gamma Statistics	
k hat	6.4038812
k star (bias corrected)	2.6948858
Theta hat	0.0752669
Theta star	0.1788573
nu hat	64.038812
nu star	26.948858
Approx.Chi Square Value (.05)	16.110118
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	12.59621

Log-transformed Statistics	
Minimum of log data	-0.994252
Maximum of log data	-0.072571
Mean of log data	-0.809916
Standard Deviation of log data	0.4121885
Variance of log data	0.1698994

RECOMMENDATION

Data are Non-parametric (0.05)

Use Student's-t UCL
or Modified-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.5521165
Shapiro-Wilk 5% Critical Value	0.762
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	0.7207667

Gamma Distribution Test	
A-D Test Statistic	1.3361388
A-D 5% Critical Value	0.6801962
K-S Test Statistic	0.4935978
K-S 5% Critical Value	0.3581078
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.8062852
Adjusted Gamma UCL	1.0312109

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.5521165
Shapiro-Wilk 5% Critical Value	0.762
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.8422375
95% Chebyshev (MVUE) UCL	0.8558539
97.5% Chebyshev (MVUE) UCL	1.0202935
99% Chebyshev (MVUE) UCL	1.3433033

95% Non-parametric UCLs	
CLT UCL	0.6662236
Adj-CLT UCL (Adjusted for skewness)	0.7858972
Mod-t UCL (Adjusted for skewness)	**0.7394334**
Jackknife UCL	0.7207667
Standard Bootstrap UCL	N/R
Bootstrap-t UCL	N/R
Hall's Bootstrap UCL	N/A
Percentile Bootstrap UCL	N/R
BCA Bootstrap UCL	N/R
95% Chebyshev (Mean, Sd) UCL	0.9701967
97.5% Chebyshev (Mean, Sd) UCL	1.1814398
99% Chebyshev (Mean, Sd) UCL	1.5963859

UCL Calculation of Vanadium, Direct Contact With Soil Pathway, Smelter Area

Data File

Variable: Vanadium

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	5
Minimum	20
Maximum	**23**
Mean	21.98
Median	22.7
Standard Deviation	1.3026895
Variance	1.697
Coefficient of Variation	0.059267
Skewness	-1.105188

Gamma Statistics	
k hat	345.97926
k star (bias corrected)	138.52504
Theta hat	0.0635298
Theta star	0.1586717
nu hat	3459.7926
nu star	1385.2504
Approx.Chi Square Value (.05)	1299.8064
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	1262.9532

Log-transformed Statistics	
Minimum of log data	2.9957323
Maximum of log data	3.1354942
Mean of log data	3.0886871
Standard Deviation of log data	0.0605526
Variance of log data	0.0036666

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8343885
Shapiro-Wilk 5% Critical Value	0.762
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**23.221972**

Gamma Distribution Test	
A-D Test Statistic	0.5343849
A-D 5% Critical Value	0.67808
K-S Test Statistic	0.3325827
K-S 5% Critical Value	0.35682
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	23.424876
Adjusted Gamma UCL	24.108416

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8304656
Shapiro-Wilk 5% Critical Value	0.762
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	N/A
95% Chebyshev (MVUE) UCL	24.574678
97.5% Chebyshev (MVUE) UCL	25.697203
99% Chebyshev (MVUE) UCL	27.902186

95% Non-parametric UCLs	
CLT UCL	22.93826
Adj-CLT UCL (Adjusted for skewness)	22.630588
Mod-t UCL (Adjusted for skewness)	23.173981
Jackknife UCL	23.221972
Standard Bootstrap UCL	22.83851
Bootstrap-t UCL	22.936969
Hall's Bootstrap UCL	22.541092
Percentile Bootstrap UCL	22.84
BCA Bootstrap UCL	22.62
95% Chebyshev (Mean, Sd) UCL	24.519409
97.5% Chebyshev (Mean, Sd) UCL	25.618214
99% Chebyshev (Mean, Sd) UCL	27.776602

Recommended UCL exceeds the maximum observation

Reference Area Soil Data

ExpArea	Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
REF	soil	0-1	Inches		HR-01	U05-4001	mg/kg	2.85	0.83	212	39300	5.9	85.9
REF	soil	0-1	Inches		HR-02	U05-4004	mg/kg	2.93	0.65	216	28300	6.1	79.2
REF	soil	0-1	Inches		R-01	U06-3016	mg/kg	3.06	0.34	71.9	42600	8.6	147
REF	soil	0-1	Inches		R-03	U06-3026	mg/kg	0.7	0.54	149	36500	6.9	105
REF	soil	0-1	Inches		R-05	U06-3015	mg/kg	2.35	0.51	137	34300	6.9	89.2
REF	soil	0-1	Inches		R-07	U06-3024	mg/kg	2.31	0.64	207	22700	8.1	49.3
REF	soil	0-1	Inches		R-08	U06-3028	mg/kg	1.46	0.59	114	38600	6.8	102
REF	soil	0-1	Inches		R-12	U06-3030	mg/kg	2.71	0.66	73	47300	8.3	140
REF	soil	0-1	Inches		R-14	U06-3037	mg/kg	0.7	0.42	43	39800	7.9	114

Data File **Variable: Arsenic**

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	8
Minimum	0.7
Maximum	3.06
Mean	2.12
Median	2.35
Standard Deviation	0.93
Variance	0.87
Coefficient of Variation	0.44
Skewness	-0.79

Gamma Statistics	
k hat	4.03
k star (bias corrected)	2.76
Theta hat	0.53
Theta star	0.77
nu hat	72.48
nu star	49.65
Approx.Chi Square Value (.05)	34.47
Adjusted Level of Significance	0.02
Adjusted Chi Square Value	31.82

Log-transformed Statistics	
Minimum of log data	-0.36
Maximum of log data	1.12
Mean of log data	0.62
Standard Deviation of log data	0.60
Variance of log data	0.36

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.84
Shapiro-Wilk 5% Critical Value	0.83
Data are normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**2.70**

Gamma Distribution Test	
A-D Test Statistic	0.88
A-D 5% Critical Value	0.72
K-S Test Statistic	0.30
K-S 5% Critical Value	0.28
Data do not follow gamma distribution	
at 5% significance level	
95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	3.05
Adjusted Gamma UCL	3.31

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.77
Shapiro-Wilk 5% Critical Value	0.83
Data not lognormal at 5% significance level	
95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	3.74
95% Chebyshev (MVUE) UCL	4.10
97.5% Chebyshev (MVUE) UCL	4.93
99% Chebyshev (MVUE) UCL	6.56

95% Non-parametric UCLs	
CLT UCL	2.63
Adj-CLT UCL (Adjusted for skewness)	2.54
Mod-t UCL (Adjusted for skewness)	2.68
Jackknife UCL	2.70
Standard Bootstrap UCL	2.61
Bootstrap-t UCL	2.61
Hall's Bootstrap UCL	2.52
Percentile Bootstrap UCL	2.59
BCA Bootstrap UCL	2.53
95% Chebyshev (Mean, Sd) UCL	3.48
97.5% Chebyshev (Mean, Sd) UCL	4.06
99% Chebyshev (Mean, Sd) UCL	5.22

Data File **Variable: Cadmium**

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	9
Minimum	0.34
Maximum	0.83
Mean	0.58
Median	0.59
Standard Deviation	0.14
Variance	0.02
Coefficient of Variation	0.25
Skewness	0.03

Gamma Statistics	
k hat	16.79
k star (bias corrected)	11.27
Theta hat	0.03
Theta star	0.05
nu hat	302.29
nu star	202.86
Approx.Chi Square Value (.05)	170.90
Adjusted Level of Significance	0.02
Adjusted Chi Square Value	164.71

Log-transformed Statistics	
Minimum of log data	-1.08
Maximum of log data	-0.19
Mean of log data	-0.58
Standard Deviation of log data	0.27
Variance of log data	0.07

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.97
Shapiro-Wilk 5% Critical Value	0.83
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**0.67**

Gamma Distribution Test	
A-D Test Statistic	0.25
A-D 5% Critical Value	0.72
K-S Test Statistic	0.15
K-S 5% Critical Value	0.28
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.68
Adjusted Gamma UCL	0.71

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.96
Shapiro-Wilk 5% Critical Value	0.83
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.70
95% Chebyshev (MVUE) UCL	0.80
97.5% Chebyshev (MVUE) UCL	0.90
99% Chebyshev (MVUE) UCL	1.09

95% Non-parametric UCLs	
CLT UCL	0.65
Adj-CLT UCL (Adjusted for skewness)	0.66
Mod-t UCL (Adjusted for skewness)	0.67
Jackknife UCL	0.67
Standard Bootstrap UCL	0.65
Bootstrap-t UCL	0.66
Hall's Bootstrap UCL	0.67
Percentile Bootstrap UCL	0.65
BCA Bootstrap UCL	0.65
95% Chebyshev (Mean, Sd) UCL	0.79
97.5% Chebyshev (Mean, Sd) UCL	0.88
99% Chebyshev (Mean, Sd) UCL	1.05

Data File **Variable: Copper**

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	9
Minimum	43
Maximum	216
Mean	135.88
Median	137.00
Standard Deviation	65.76
Variance	4324.71
Coefficient of Variation	0.48
Skewness	0.00

Gamma Statistics	
k hat	4.06
k star (bias corrected)	2.78
Theta hat	33.48
Theta star	48.89
nu hat	73.05
nu star	50.03
Approx.Chi Square Value (.05)	34.79
Adjusted Level of Significance	0.02
Adjusted Chi Square Value	32.13

Log-transformed Statistics	
Minimum of log data	3.76
Maximum of log data	5.38
Mean of log data	4.78
Standard Deviation of log data	0.57
Variance of log data	0.32

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.91
Shapiro-Wilk 5% Critical Value	0.83
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**176.64**

Gamma Distribution Test	
A-D Test Statistic	0.38
A-D 5% Critical Value	0.72
K-S Test Statistic	0.19
K-S 5% Critical Value	0.28
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	195.42
Adjusted Gamma UCL	211.60

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.90
Shapiro-Wilk 5% Critical Value	0.83
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	228.72
95% Chebyshev (MVUE) UCL	253.86
97.5% Chebyshev (MVUE) UCL	304.09
99% Chebyshev (MVUE) UCL	402.74

95% Non-parametric UCLs	
CLT UCL	171.93
Adj-CLT UCL (Adjusted for skewness)	171.91
Mod-t UCL (Adjusted for skewness)	176.64
Jackknife UCL	176.64
Standard Bootstrap UCL	170.03
Bootstrap-t UCL	177.45
Hall's Bootstrap UCL	166.88
Percentile Bootstrap UCL	170.22
BCA Bootstrap UCL	170.22
95% Chebyshev (Mean, Sd) UCL	231.43
97.5% Chebyshev (Mean, Sd) UCL	272.77
99% Chebyshev (Mean, Sd) UCL	353.99

Data File **Variable: Iron**

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	9
Minimum	22700
Maximum	47300
Mean	36600
Median	38600
Standard Deviation	7411.3089
Variance	54927500
Coefficient of Variation	0.2024948
Skewness	-0.698026

Gamma Statistics	
k hat	24.353649
k star (bias corrected)	16.30984
Theta hat	1502.8548
Theta star	2244.044
nu hat	438.36569
nu star	293.57713
Approx.Chi Square Value (.05)	254.88134
Adjusted Level of Significance	0.02308
Adjusted Chi Square Value	247.2628

Log-transformed Statistics	
Minimum of log data	10.03012
Maximum of log data	10.764266
Mean of log data	10.487132
Standard Deviation of log data	0.2231705
Variance of log data	0.0498051

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9540767
Shapiro-Wilk 5% Critical Value	0.829
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**41194**

Gamma Distribution Test	
A-D Test Statistic	0.3969934
A-D 5% Critical Value	0.7209047
K-S Test Statistic	0.1882511
K-S 5% Critical Value	0.2788326
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	42156.569
Adjusted Gamma UCL	43455.477

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.907529
Shapiro-Wilk 5% Critical Value	0.829
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	42839.158
95% Chebyshev (MVUE) UCL	48574.81
97.5% Chebyshev (MVUE) UCL	53733.887
99% Chebyshev (MVUE) UCL	63867.893

95% Non-parametric UCLs	
CLT UCL	40663.506
Adj-CLT UCL (Adjusted for skewness)	40049.314
Mod-t UCL (Adjusted for skewness)	41098.093
Jackknife UCL	41193.895
Standard Bootstrap UCL	40424.03
Bootstrap-t UCL	40525.269
Hall's Bootstrap UCL	40130.704
Percentile Bootstrap UCL	40277.778
BCA Bootstrap UCL	39966.667
95% Chebyshev (Mean, Sd) UCL	47368.382
97.5% Chebyshev (Mean, Sd) UCL	52027.87
99% Chebyshev (Mean, Sd) UCL	61180.531

Data File **Variable: Thallium**

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	8
Minimum	5.9
Maximum	8.6
Mean	**7.28**
Median	6.90
Standard Deviation	0.98
Variance	0.96
Coefficient of Variation	0.13
Skewness	-0.05

Gamma Statistics	
k hat	61.41
k star (bias corrected)	41.01
Theta hat	0.12
Theta star	0.18
nu hat	1105.35
nu star	738.23
Approx.Chi Square Value (.05)	676.17
Adjusted Level of Significance	0.02
Adjusted Chi Square Value	663.60

Log-transformed Statistics	
Minimum of log data	1.77
Maximum of log data	2.15
Mean of log data	1.98
Standard Deviation of log data	0.14
Variance of log data	0.02

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.92
Shapiro-Wilk 5% Critical Value	0.83
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**7.88**

Gamma Distribution Test	
A-D Test Statistic	0.40
A-D 5% Critical Value	0.72
K-S Test Statistic	0.20
K-S 5% Critical Value	0.28
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	7.95
Adjusted Gamma UCL	8.10

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.92
Shapiro-Wilk 5% Critical Value	0.83
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	7.97
95% Chebyshev (MVUE) UCL	8.72
97.5% Chebyshev (MVUE) UCL	9.34
99% Chebyshev (MVUE) UCL	10.57

95% Non-parametric UCLs	
CLT UCL	7.81
Adj-CLT UCL (Adjusted for skewness)	7.81
Mod-t UCL (Adjusted for skewness)	7.88
Jackknife UCL	7.88
Standard Bootstrap UCL	7.78
Bootstrap-t UCL	7.89
Hall's Bootstrap UCL	7.74
Percentile Bootstrap UCL	7.78
BCA Bootstrap UCL	7.78
95% Chebyshev (Mean, Sd) UCL	8.70
97.5% Chebyshev (Mean, Sd) UCL	9.31
99% Chebyshev (Mean, Sd) UCL	10.52

Data File **Variable: Vanadium**

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	9
Minimum	49.3
Maximum	147
Mean	101.29
Median	102.00
Standard Deviation	30.29
Variance	917.20
Coefficient of Variation	0.30
Skewness	-0.01

Gamma Statistics	
k hat	11.40
k star (bias corrected)	7.67
Theta hat	8.89
Theta star	13.20
nu hat	205.14
nu star	138.09
Approx.Chi Square Value (.05)	111.94
Adjusted Level of Significance	0.02
Adjusted Chi Square Value	106.97

Log-transformed Statistics	
Minimum of log data	3.90
Maximum of log data	4.99
Mean of log data	4.57
Standard Deviation of log data	0.33
Variance of log data	0.11

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.97
Shapiro-Wilk 5% Critical Value	0.83
Data are normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**120.06**

Gamma Distribution Test	
A-D Test Statistic	0.23
A-D 5% Critical Value	0.72
K-S Test Statistic	0.13
K-S 5% Critical Value	0.28
Data follow gamma distribution	
at 5% significance level	
95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	124.96
Adjusted Gamma UCL	130.76

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.94
Shapiro-Wilk 5% Critical Value	0.83
Data are lognormal at 5% significance level	
95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	129.90
95% Chebyshev (MVUE) UCL	150.44
97.5% Chebyshev (MVUE) UCL	171.57
99% Chebyshev (MVUE) UCL	213.07

95% Non-parametric UCLs	
CLT UCL	117.89
Adj-CLT UCL (Adjusted for skewness)	117.87
Mod-t UCL (Adjusted for skewness)	120.06
Jackknife UCL	120.06
Standard Bootstrap UCL	116.96
Bootstrap-t UCL	121.12
Hall's Bootstrap UCL	121.78
Percentile Bootstrap UCL	116.67
BCA Bootstrap UCL	116.93
95% Chebyshev (Mean, Sd) UCL	145.29
97.5% Chebyshev (Mean, Sd) UCL	164.33
99% Chebyshev (Mean, Sd) UCL	201.73

Surface Water and Sediment EPCs

Surface Water (mg/L)

Exposure Area	EA4	EA5
Arsenic	**7.8E-03**	4.9E-03
Cadmium	**7.0E-04**	1.5E-04
Copper	**1.1E+00**	2.6E-01
Iron	**6.4E+00**	1.2E+01
Thallium	**5.9E-04**	5.8E-04
Vanadium	**1.4E-02**	1.4E-02

Sediment (mg/kg)

Exposure Area	EA4	EA5
Arsenic	**2.1E+00**	1.8E+00
Cadmium	**5.8E-01**	2.1E-01
Copper	**4.2E+02**	1.1E+02
Iron	**2.7E+04**	1.4E+04
Thallium	**3.7E-01**	**3.7E-01**
Vanadium	**4.5E+01**	**2.4E+01**

Bold = EPC based on maximum value, because dataset too small to calculate a 95%UCL on the mean.

Surface Water Data from Stock Ponds and James River Canyon Reservoir

ExpArea		Medium	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
4	stock pond	water	SW04	U04-1256	mg/L	0.00225	0.0007	1.14	6.38	0.00059	0.0142
4	stock pond	water	SW-6	U04-1148	mg/L	0.0078	0.0003	0.468	1.81	0.00037	0.0039
4	reservoir	water	SW16	U04-1268	mg/L	0.00225	0.00015	0.0262	0.0815	0.00001	0.00035
4	Maximum	water				0.0078	0.0007	1.14	6.38	0.00059	0.0142
5	stock pond	water	SW-1	U04-1143	mg/L	0.0032	0.00011	0.205	7.63	0.00015	0.0078
5	stock pond	water	SW-2	U04-1144	mg/L	0.0032	0.00013	0.213	6.66	0.00015	0.0075
5	stock pond	water	SW-3	U04-1145	mg/L	0.0032	0.00005	0.0557	0.435	0.00015	0.00074
5	stock pond	water	SW-4	U04-1146	mg/L	0.0097	0.00017	0.275	17.1	0.00015	0.0215
5	stock pond	water	SW-5	U04-1147	mg/L	0.0032	0.00017	0.267	10.5	0.00015	0.0122
5	stock pond	water	SW11	U04-1263	mg/L	0.00255	0.0001	0.164	5.34	0.00042	0.0064
5	stock pond	water	SW12	U04-1264	mg/L	0.00255	0.0001	0.304	9.79	0.00047	0.0111
5	stock pond	water	SW13	U04-1265	mg/L	0.00255	0.0001	0.328	17.7	0.00064	0.0235
5	stock pond	water	SW14	U04-1266	mg/L	0.00225	0.00015	0.0866	2.43	0.00037	0.0025
5	stock pond	water	SW15	U04-1267	mg/L	0.00225	0.00015	0.204	4.24	0.00051	0.007

Sediment Data from Stock Ponds and James River Canyon Reservoir

ExpArea		Medium	SampleDepth	DepthUnits	Sieve	Sample	AOCsample	Units	Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
4	stock pond	sediment	0-6	Inches	2000	SED04	U04-1245	mg/kg	2.1	0.53	280	27400	0.175	44.9
4	stock pond	sediment	0-3	Inches	2000	SWS-6	U04-1154	mg/kg	1.6	0.58	423	11700	0.37	20.6
4	reservoir	sediment	0-6	Inches	2000	SED11	U04-1252	mg/kg	0.97	0.28	87.5	12800	0.175	33.3
4	Maximum	sediment							2.1	0.58	423	27400	0.37	44.9
5	stock pond	sediment	0-3	Inches	2000	SWS-1	U04-1149	mg/kg	1.2	0.13	47.8	10000	0.37	21.4
5	stock pond	sediment	0-3	Inches	2000	SWS-2	U04-1150	mg/kg	2.1	0.08	45.2	9240	0.37	23.9
5	stock pond	sediment	0-3	Inches	2000	SWS-3	U04-1151	mg/kg	0.92	0.05	42.5	4820	0.37	10.8
5	stock pond	sediment	0-3	Inches	2000	SWS-4	U04-1152	mg/kg	1.4	0.25	88.3	17800	0.37	23.5
5	stock pond	sediment	0-3	Inches	2000	SWS-5	U04-1153	mg/kg	0.96	0.16	137	5410	0.37	9.2

Data File **Variable: Arsenic**

Raw Statistics	
Number of Valid Samples	10
Number of Unique Samples	4
Minimum	0.00225
Maximum	0.0097
Mean	0.003465
Median	0.002875
Standard Deviation	0.0022266
Variance	4.96E-06
Coefficient of Variation	0.6426012
Skewness	2.9746144

Gamma Statistics	
k hat	4.8235064
k star (bias corrected)	3.4431212
Theta hat	0.0007184
Theta star	0.0010064
nu hat	96.470129
nu star	68.862424
Approx.Chi Square Value (.05)	50.757607
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	48.065759

Log-transformed Statistics	
Minimum of log data	-6.096825
Maximum of log data	-4.635629
Mean of log data	-5.772268
Standard Deviation of log data	0.4249126
Variance of log data	0.1805508

RECOMMENDATION

Data are Non-parametric (0.05)

Use Student's-t UCL
or Modified-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.5234515
Shapiro-Wilk 5% Critical Value	0.842
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	0.0047557

Gamma Distribution Test	
A-D Test Statistic	1.6568276
A-D 5% Critical Value	0.7294394
K-S Test Statistic	0.4075918
K-S 5% Critical Value	0.2674988
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.0047009
Adjusted Gamma UCL	0.0049642

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.665567
Shapiro-Wilk 5% Critical Value	0.842
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.0045998
95% Chebyshev (MVUE) UCL	0.0053769
97.5% Chebyshev (MVUE) UCL	0.0062435
99% Chebyshev (MVUE) UCL	0.0079458

95% Non-parametric UCLs	
CLT UCL	0.0046232
Adj-CLT UCL (Adjusted for skewness)	0.0053309
Mod-t UCL (Adjusted for skewness)	**0.0048661**
Jackknife UCL	0.0047557
Standard Bootstrap UCL	N/R
Bootstrap-t UCL	N/R
Hall's Bootstrap UCL	N/R
Percentile Bootstrap UCL	N/R
BCA Bootstrap UCL	N/R
95% Chebyshev (Mean, Sd) UCL	0.0065342
97.5% Chebyshev (Mean, Sd) UCL	0.0078622
99% Chebyshev (Mean, Sd) UCL	0.0104709

Data File **Variable: Cadmium**

Raw Statistics	
Number of Valid Samples	10
Number of Unique Samples	6
Minimum	5.00E-05
Maximum	0.00017
Mean	0.000123
Median	0.00012
Standard Deviation	3.80E-05
Variance	1.45E-09
Coefficient of Variation	0.3091094
Skewness	-0.45578

Gamma Statistics	
k hat	9.5369693
k star (bias corrected)	6.7425452
Theta hat	1.29E-05
Theta star	1.82E-05
nu hat	190.73939
nu star	134.8509
Approx.Chi Square Value (.05)	109.01689
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	104.9835

Log-transformed Statistics	
Minimum of log data	-9.903488
Maximum of log data	-8.679712
Mean of log data	-9.056669
Standard Deviation of log data	0.3672964
Variance of log data	0.1349066

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9220894
Shapiro-Wilk 5% Critical Value	0.842
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**0.000145**

Gamma Distribution Test	
A-D Test Statistic	0.4753851
A-D 5% Critical Value	0.7254665
K-S Test Statistic	0.2057188
K-S 5% Critical Value	0.2667041
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.0001521
Adjusted Gamma UCL	0.000158

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.856988
Shapiro-Wilk 5% Critical Value	0.842
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.0001603
95% Chebyshev (MVUE) UCL	0.0001872
97.5% Chebyshev (MVUE) UCL	0.0002146
99% Chebyshev (MVUE) UCL	0.0002685

95% Non-parametric UCLs	
CLT UCL	0.0001428
Adj-CLT UCL (Adjusted for skewness)	0.0001409
Mod-t UCL (Adjusted for skewness)	0.0001448
Jackknife UCL	0.000145
Standard Bootstrap UCL	0.0001419
Bootstrap-t UCL	0.0001435
Hall's Bootstrap UCL	0.0001409
Percentile Bootstrap UCL	0.000141
BCA Bootstrap UCL	0.000139
95% Chebyshev (Mean, Sd) UCL	0.0001754
97.5% Chebyshev (Mean, Sd) UCL	0.0001981
99% Chebyshev (Mean, Sd) UCL	0.0002426

Data File **Variable: Copper**

Raw Statistics	
Number of Valid Samples	10
Number of Unique Samples	10
Minimum	0.0557
Maximum	0.328
Mean	0.21023
Median	0.209
Standard Deviation	0.0891039
Variance	0.0079395
Coefficient of Variation	0.42384
Skewness	-0.543087

Gamma Statistics	
k hat	4.381347
k star (bias corrected)	3.1336096
Theta hat	0.047983
Theta star	0.0670888
nu hat	87.62694
nu star	62.672192
Approx.Chi Square Value (.05)	45.45864
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	42.921119

Log-transformed Statistics	
Minimum of log data	-2.887775
Maximum of log data	-1.114742
Mean of log data	-1.677992
Standard Deviation of log data	0.5712593
Variance of log data	0.3263372

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.943242
Shapiro-Wilk 5% Critical Value	0.842
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**0.2618818**

Gamma Distribution Test	
A-D Test Statistic	0.5466681
A-D 5% Critical Value	0.7294129
K-S Test Statistic	0.2389378
K-S 5% Critical Value	0.2676713
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.2898365
Adjusted Gamma UCL	0.3069718

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8456126
Shapiro-Wilk 5% Critical Value	0.842
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.3422065
95% Chebyshev (MVUE) UCL	0.3896833
97.5% Chebyshev (MVUE) UCL	0.4648893
99% Chebyshev (MVUE) UCL	0.6126168

95% Non-parametric UCLs	
CLT UCL	0.2565772
Adj-CLT UCL (Adjusted for skewness)	0.2514066
Mod-t UCL (Adjusted for skewness)	0.2610753
Jackknife UCL	0.2618818
Standard Bootstrap UCL	0.2544252
Bootstrap-t UCL	0.257548
Hall's Bootstrap UCL	0.2499027
Percentile Bootstrap UCL	0.2515
BCA Bootstrap UCL	0.2528
95% Chebyshev (Mean, Sd) UCL	0.3330512
97.5% Chebyshev (Mean, Sd) UCL	0.3861961
99% Chebyshev (Mean, Sd) UCL	0.4905888

Data File **Variable: Iron**

Raw Statistics	
Number of Valid Samples	10
Number of Unique Samples	10
Minimum	0.435
Maximum	17.7
Mean	8.1825
Median	7.145
Standard Deviation	5.7486314
Variance	33.046763
Coefficient of Variation	0.702552
Skewness	0.6174267

Gamma Statistics	
k hat	1.5456928
k star (bias corrected)	1.1486516
Theta hat	5.2937427
Theta star	7.1235697
nu hat	30.913856
nu star	22.973033
Approx.Chi Square Value (.05)	13.068739
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	11.789238

Log-transformed Statistics	
Minimum of log data	-0.832409
Maximum of log data	2.8735646
Mean of log data	1.7448858
Standard Deviation of log data	1.0905708
Variance of log data	1.1893446

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9332003
Shapiro-Wilk 5% Critical Value	0.842
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**11.514873**

Gamma Distribution Test	
A-D Test Statistic	0.2538949
A-D 5% Critical Value	0.7388964
K-S Test Statistic	0.1247563
K-S 5% Critical Value	0.2710003
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	14.383701
Adjusted Gamma UCL	15.944783

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8649377
Shapiro-Wilk 5% Critical Value	0.842
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	34.334562
95% Chebyshev (MVUE) UCL	24.65849
97.5% Chebyshev (MVUE) UCL	31.195846
99% Chebyshev (MVUE) UCL	44.037215

95% Non-parametric UCLs	
CLT UCL	11.172641
Adj-CLT UCL (Adjusted for skewness)	11.551895
Mod-t UCL (Adjusted for skewness)	11.574029
Jackknife UCL	11.514873
Standard Bootstrap UCL	11.00487
Bootstrap-t UCL	12.539558
Hall's Bootstrap UCL	13.167921
Percentile Bootstrap UCL	11.1135
BCA Bootstrap UCL	11.3645
95% Chebyshev (Mean, Sd) UCL	16.106441
97.5% Chebyshev (Mean, Sd) UCL	19.535137
99% Chebyshev (Mean, Sd) UCL	26.270146

Data File **Variable: Thallium**

Raw Statistics	
Number of Valid Samples	10
Number of Unique Samples	6
Minimum	0.00015
Maximum	0.00064
Mean	0.000316
Median	0.00026
Standard Deviation	0.0001879
Variance	3.53E-08
Coefficient of Variation	0.5946973
Skewness	0.4892175

Gamma Statistics	
k hat	3.0945858
k star (bias corrected)	2.2328767
Theta hat	0.0001021
Theta star	0.0001415
nu hat	61.891715
nu star	44.657534
Approx.Chi Square Value (.05)	30.327032
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	28.287775

Log-transformed Statistics	
Minimum of log data	-8.804875
Maximum of log data	-7.354042
Mean of log data	-8.229956
Standard Deviation of log data	0.6215476
Variance of log data	0.3863215

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8184165
Shapiro-Wilk 5% Critical Value	0.842
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	0.0004249

Gamma Distribution Test	
A-D Test Statistic	1.0588262
A-D 5% Critical Value	0.7319161
K-S Test Statistic	0.3329908
K-S 5% Critical Value	0.2683904
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.0004653
Adjusted Gamma UCL	0.0004989

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.7754052
Shapiro-Wilk 5% Critical Value	0.842
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.0005319
95% Chebyshev (MVUE) UCL	0.0005943
97.5% Chebyshev (MVUE) UCL	0.0007146
99% Chebyshev (MVUE) UCL	0.0009509

95% Non-parametric UCLs	
CLT UCL	0.0004137
Adj-CLT UCL (Adjusted for skewness)	0.0004236
Mod-t UCL (Adjusted for skewness)	0.0004265
Jackknife UCL	0.0004249
Standard Bootstrap UCL	0.0004096
Bootstrap-t UCL	0.0004385
Hall's Bootstrap UCL	0.0004043
Percentile Bootstrap UCL	0.000411
BCA Bootstrap UCL	0.000415
95% Chebyshev (Mean, Sd) UCL	**0.000575**
97.5% Chebyshev (Mean, Sd) UCL	0.0006871
99% Chebyshev (Mean, Sd) UCL	0.0009073

RECOMMENDATION

Data are Non-parametric (0.05)

Use 95% Chebyshev (Mean, Sd) UCL

Data File

Variable: Vanadium

Raw Statistics	
Number of Valid Samples	10
Number of Unique Samples	10
Minimum	0.00074
Maximum	0.0235
Mean	0.010024
Median	0.00765
Standard Deviation	0.0074206
Variance	5.51E-05
Coefficient of Variation	0.7402864
Skewness	0.8979078

Gamma Statistics	
k hat	1.6041216
k star (bias corrected)	1.1895518
Theta hat	0.0062489
Theta star	0.0084267
nu hat	32.082431
nu star	23.791035
Approx.Chi Square Value (.05)	13.688149
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	12.374791

Log-transformed Statistics	
Minimum of log data	-7.20886
Maximum of log data	-3.750755
Mean of log data	-4.94577
Standard Deviation of log data	1.0207958
Variance of log data	1.042024

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.895826
Shapiro-Wilk 5% Critical Value	0.842
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**0.0143256**

Gamma Distribution Test	
A-D Test Statistic	0.318045
A-D 5% Critical Value	0.7384699
K-S Test Statistic	0.199453
K-S 5% Critical Value	0.2708472
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.0174225
Adjusted Gamma UCL	0.0192715

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8898896
Shapiro-Wilk 5% Critical Value	0.842
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.0349316
95% Chebyshev (MVUE) UCL	0.0276484
97.5% Chebyshev (MVUE) UCL	0.0347816
99% Chebyshev (MVUE) UCL	0.0487933

95% Non-parametric UCLs	
CLT UCL	0.0138838
Adj-CLT UCL (Adjusted for skewness)	0.0145958
Mod-t UCL (Adjusted for skewness)	0.0144367
Jackknife UCL	0.0143256
Standard Bootstrap UCL	0.0136617
Bootstrap-t UCL	0.016638
Hall's Bootstrap UCL	0.0206114
Percentile Bootstrap UCL	0.013904
BCA Bootstrap UCL	0.014378
95% Chebyshev (Mean, Sd) UCL	0.0202526
97.5% Chebyshev (Mean, Sd) UCL	0.0246786
99% Chebyshev (Mean, Sd) UCL	0.0333725

Data File **Variable: Arsenic**

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	5
Minimum	0.92
Maximum	2.1
Mean	1.316
Median	1.2
Standard Deviation	0.4792494
Variance	0.22968
Coefficient of Variation	0.3641713
Skewness	1.4145974

Gamma Statistics	
k hat	10.736743
k star (bias corrected)	4.4280305
Theta hat	0.1225698
Theta star	0.2971976
nu hat	107.36743
nu star	44.280305
Approx.Chi Square Value (.05)	30.015937
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	24.997052

Log-transformed Statistics	
Minimum of log data	-0.083382
Maximum of log data	0.7419373
Mean of log data	0.2273055
Standard Deviation of log data	0.3343672
Variance of log data	0.1118014

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.862953
Shapiro-Wilk 5% Critical Value	0.762
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**1.7729118**

Gamma Distribution Test	
A-D Test Statistic	0.3493708
A-D 5% Critical Value	0.678866
K-S Test Statistic	0.2098952
K-S 5% Critical Value	0.3575583
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	1.941398
Adjusted Gamma UCL	2.3311901

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9146166
Shapiro-Wilk 5% Critical Value	0.762
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	2.0102104
95% Chebyshev (MVUE) UCL	2.1641614
97.5% Chebyshev (MVUE) UCL	2.53281
99% Chebyshev (MVUE) UCL	3.2569488

95% Non-parametric UCLs	
CLT UCL	1.6685363
Adj-CLT UCL (Adjusted for skewness)	1.8134151
Mod-t UCL (Adjusted for skewness)	1.79551
Jackknife UCL	1.7729118
Standard Bootstrap UCL	1.6327177
Bootstrap-t UCL	2.2160027
Hall's Bootstrap UCL	3.1540586
Percentile Bootstrap UCL	1.644
BCA Bootstrap UCL	1.724
95% Chebyshev (Mean, Sd) UCL	2.2502291
97.5% Chebyshev (Mean, Sd) UCL	2.6544708
99% Chebyshev (Mean, Sd) UCL	3.4485253

Data File **Variable: Cadmium**

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	5
Minimum	0.05
Maximum	0.25
Mean	0.134
Median	0.13
Standard Deviation	0.0776531
Variance	0.00603
Coefficient of Variation	0.5795006
Skewness	0.7370026

Gamma Statistics	
k hat	3.5781666
k star (bias corrected)	1.5646
Theta hat	0.0374493
Theta star	0.0856449
nu hat	35.781666
nu star	15.646
Approx.Chi Square Value (.05)	7.7117941
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	5.452407

Log-transformed Statistics	
Minimum of log data	-2.995732
Maximum of log data	-1.386294
Mean of log data	-2.156112
Standard Deviation of log data	0.6229568
Variance of log data	0.3880752

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9607026
Shapiro-Wilk 5% Critical Value	0.762
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**0.2080337**

Gamma Distribution Test	
A-D Test Statistic	0.178998
A-D 5% Critical Value	0.6818263
K-S Test Statistic	0.1626321
K-S 5% Critical Value	0.3588592
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.2718646
Adjusted Gamma UCL	0.3845208

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.9855656
Shapiro-Wilk 5% Critical Value	0.762
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.4015617
95% Chebyshev (MVUE) UCL	0.2958999
97.5% Chebyshev (MVUE) UCL	0.365651
99% Chebyshev (MVUE) UCL	0.5026635

95% Non-parametric UCLs	
CLT UCL	0.1911217
Adj-CLT UCL (Adjusted for skewness)	0.203352
Mod-t UCL (Adjusted for skewness)	0.2099414
Jackknife UCL	0.2080337
Standard Bootstrap UCL	0.1848279
Bootstrap-t UCL	0.2227481
Hall's Bootstrap UCL	0.2496709
Percentile Bootstrap UCL	0.19
BCA Bootstrap UCL	0.19
95% Chebyshev (Mean, Sd) UCL	0.2853737
97.5% Chebyshev (Mean, Sd) UCL	0.3508732
99% Chebyshev (Mean, Sd) UCL	0.4795344

Data File **Variable: Copper**

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	5
Minimum	42.5
Maximum	137
Mean	72.16
Median	47.8
Standard Deviation	40.818782
Variance	1666.173
Coefficient of Variation	0.5656705
Skewness	1.3273741

Gamma Statistics	
k hat	4.5764102
k star (bias corrected)	1.9638974
Theta hat	15.767817
Theta star	36.743264
nu hat	45.764102
nu star	19.638974
Approx.Chi Square Value (.05)	10.583961
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	7.8441776

Log-transformed Statistics	
Minimum of log data	3.7495041
Maximum of log data	4.9199809
Mean of log data	4.1656696
Standard Deviation of log data	0.5138965
Variance of log data	0.2640897

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.804078
Shapiro-Wilk 5% Critical Value	0.762
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**111.07624**

Gamma Distribution Test	
A-D Test Statistic	0.5556652
A-D 5% Critical Value	0.6809345
K-S Test Statistic	0.3464
K-S 5% Critical Value	0.3583693
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	133.89585
Adjusted Gamma UCL	180.66245

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8355399
Shapiro-Wilk 5% Critical Value	0.762
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	158.60311
95% Chebyshev (MVUE) UCL	142.41301
97.5% Chebyshev (MVUE) UCL	173.10298
99% Chebyshev (MVUE) UCL	233.38747

95% Non-parametric UCLs	
CLT UCL	102.18633
Adj-CLT UCL (Adjusted for skewness)	113.76514
Mod-t UCL (Adjusted for skewness)	112.8823
Jackknife UCL	111.07624
Standard Bootstrap UCL	98.989048
Bootstrap-t UCL	554.23625
Hall's Bootstrap UCL	439.28815
Percentile Bootstrap UCL	99.74
BCA Bootstrap UCL	108.36
95% Chebyshev (Mean, Sd) UCL	151.73046
97.5% Chebyshev (Mean, Sd) UCL	186.16066
99% Chebyshev (Mean, Sd) UCL	253.79212

Data File **Variable: Iron**

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	5
Minimum	4820
Maximum	17800
Mean	9454
Median	9240
Standard Deviation	5192.0015
Variance	26956880
Coefficient of Variation	0.5491857
Skewness	1.2380128

Gamma Statistics	
k hat	4.5782888
k star (bias corrected)	1.9646489
Theta hat	2064.9636
Theta star	4812.0558
nu hat	45.782888
nu star	19.646489
Approx.Chi Square Value (.05)	10.589482
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	7.8488394

Log-transformed Statistics	
Minimum of log data	8.4805292
Maximum of log data	9.7869537
Mean of log data	9.041025
Standard Deviation of log data	0.525696
Variance of log data	0.2763563

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8787387
Shapiro-Wilk 5% Critical Value	0.762
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**14404.005**

Gamma Distribution Test	
A-D Test Statistic	0.3174737
A-D 5% Critical Value	0.6809335
K-S Test Statistic	0.2238332
K-S 5% Critical Value	0.358369
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	17539.848
Adjusted Gamma UCL	23664.378

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.934708
Shapiro-Wilk 5% Critical Value	0.762
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	21497.164
95% Chebyshev (MVUE) UCL	18957.462
97.5% Chebyshev (MVUE) UCL	23088.352
99% Chebyshev (MVUE) UCL	31202.687

95% Non-parametric UCLs	
CLT UCL	13273.241
Adj-CLT UCL (Adjusted for skewness)	14646.873
Mod-t UCL (Adjusted for skewness)	14618.264
Jackknife UCL	14404.005
Standard Bootstrap UCL	12869.485
Bootstrap-t UCL	17372.249
Hall's Bootstrap UCL	28974.797
Percentile Bootstrap UCL	13120
BCA Bootstrap UCL	13610
95% Chebyshev (Mean, Sd) UCL	19575.074
97.5% Chebyshev (Mean, Sd) UCL	23954.471
99% Chebyshev (Mean, Sd) UCL	32556.948

Data File **Variable: Thallium**

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	1
Minimum	0.37
Maximum	**0.37**
Mean	0.37
Median	0.37

Data contains constant observations with no distinct values
There is no need to calculate lognormal statistics

Data File **Variable: Vanadium**

Raw Statistics	
Number of Valid Samples	5
Number of Unique Samples	5
Minimum	9.2
Maximum	**23.9**
Mean	17.76
Median	21.4
Standard Deviation	7.1695886
Variance	51.403
Coefficient of Variation	0.403693
Skewness	-0.560268

Gamma Statistics	
k hat	6.5442015
k star (bias corrected)	2.7510139
Theta hat	2.7138529
Theta star	6.4558015
nu hat	65.442015
nu star	27.510139
Approx.Chi Square Value (.05)	16.54528
Adjusted Level of Significance	0.0086
Adjusted Chi Square Value	12.976315

Log-transformed Statistics	
Minimum of log data	2.2192035
Maximum of log data	3.1738785
Mean of log data	2.7986039
Standard Deviation of log data	0.4611685
Variance of log data	0.2126764

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.8010957
Shapiro-Wilk 5% Critical Value	0.762
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	24.595418

Gamma Distribution Test	
A-D Test Statistic	0.6402519
A-D 5% Critical Value	0.6801448
K-S Test Statistic	0.3326762
K-S 5% Critical Value	0.3580876
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	29.529877
Adjusted Gamma UCL	37.651681

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.7944114
Shapiro-Wilk 5% Critical Value	0.762
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	35.046757
95% Chebyshev (MVUE) UCL	33.79156
97.5% Chebyshev (MVUE) UCL	40.68564
99% Chebyshev (MVUE) UCL	54.227724

95% Non-parametric UCLs	
CLT UCL	23.033956
Adj-CLT UCL (Adjusted for skewness)	22.175535
Mod-t UCL (Adjusted for skewness)	24.461521
Jackknife UCL	24.595418
Standard Bootstrap UCL	22.432916
Bootstrap-t UCL	23.716845
Hall's Bootstrap UCL	20.266066
Percentile Bootstrap UCL	22.74
BCA Bootstrap UCL	21.2
95% Chebyshev (Mean, Sd) UCL	31.736101
97.5% Chebyshev (Mean, Sd) UCL	37.783571
99% Chebyshev (Mean, Sd) UCL	49.662655

Recommended UCL exceeds the maximum observation

Summary of Soil EPCs Used for Calculation of Locally-Grown Beef, Chicken, and Egg EPCs

	Soil Concentration (mg/kg)				
COC	EA 1	EA 2	EA 3	EA 4	EA 5
Arsenic	1.96E+00	3.30E+00	3.24E+00	4.03E+00	2.90E+00
Cadmium	9.60E-01	9.00E-01	2.36E+01	3.08E+00	8.68E-01
Iron	2.40E+04	1.91E+04	5.72E+04	2.32E+04	2.66E+04
Thallium	2.00E+00	6.20E+00	6.59E-01	5.43E-01	3.20E-01
Vanadium	6.11E+01	3.25E+01	3.16E+01	2.92E+01	5.96E+01

Notes:

Copper is not included in the food pathways for reasons described in the report text.

Shaded values: Soils in the dataset with 0-1" unsieved soil were not analyzed for iron, thallium and vanadium. Therefore, the soil EPCs used here are the same as those used for the direct contact pathways.

Summary of Soil EPCs Used for Calculation of Locally-Grown Vegetable EPCs

	Soil Concentration (mg/kg)				
COC	EA 1	EA 2	EA 3	EA 4	EA 5
Arsenic	1.96E+00	1.99E+00	1.69E+00	3.15E+00	1.70E+00
Cadmium	9.60E-01	1.10E+00	1.06E+00	4.20E+00	1.16E+00
Iron	2.40E+04	1.42E+04	2.45E+04	3.29E+04	1.71E+04
Thallium	2.00E+00	9.19E-01	5.90E+00	1.75E-01	3.21E-01
Vanadium	6.11E+01	1.75E+01	2.24E+01	4.45E+01	2.23E+01

Notes:

Copper is not included in the food pathways for reasons described in the report text.

Shaded values: Soils in the dataset with 0-6" unsieved soil were not analyzed for iron, thallium and vanadium. Therefore, the soil EPCs used here are the same as those used for the direct contact pathways.

Beef EPC Calculations

Soil Exposure Point Concentrations (mg/kg)					
Exposure Area	1	2	3	4	5
Arsenic	2.0E+00	3.3E+00	3.2E+00	4.0E+00	2.9E+00
Cadmium	9.6E-01	9.0E-01	2.4E+01	3.1E+00	8.7E-01
Iron	2.4E+04	1.9E+04	5.7E+04	2.3E+04	2.7E+04
Thallium	2.0E+00	6.2E+00	6.6E-01	5.4E-01	3.2E-01
Vanadium	6.1E+01	3.3E+01	3.2E+01	2.9E+01	6.0E+01

Surface Water Exposure Point Concentrations (mg/L)				
1	2	3	4	5
			7.8E-03	4.9E-03
			7.0E-04	1.5E-04
			6.4E+00	1.2E+01
			5.9E-04	5.8E-04
			1.4E-02	1.4E-02

Notes:
Shading: Shaded cells indicate that surface water data were not available for EA2 and EA3.
Bold: Soil EPC is the maximum concentration, because the 95% UCL exceeded the maximum value.

$EPC_{beef} = [EPC_{soil} \times TF_{ib} \times ((IR_g \times K_{gs} \times CF_{dw}) + IR_s)] + [EPC_w \times TF_{wc} \times IR_w]$

where:

EPC_{beef} = Beef Exposure Point Concentration (mg/kg)
EPC_{soil} = Soil Exposure Point Concentration (mg/kg)
TF_{ib} = Ingestion-beef transfer factor (mg/kg meat per mg/day intake); (used for soil and grass)

IR_g = Ingestion rate of (wet) grass for cattle (kg/day)
K_{gs} = Grass-soil concentration ratio (mg/kg grass)/(mg/kg soil)
CF_{dw} = Dry-to-wet weight conversion factor for grass (kg dry grass/kg wet grass)

IR_s = Soil Ingestion rate for cattle
EPC_w = Exposure point concentration of chemical in surface water (mg/L)
TF_{wc} = Water-cattle transfer factor (mg/kg meat per mg/day intake) (calculated)
IR_w = Water Ingestion rate for cattle (L/day)

	Ingestion-Beef Transfer Factor		Soil Relative Bioavailability		Grass Ingestion Rate		Grass-soil Conc. Ratio		Dry-to-wet Conversion		Soil Ingestion Rate		Water-Cattle Transfer Factor		Water Ingestion Rate	
	(mg/kg meat per mg/day)				(kg/day)		(mg/kg grass per mg/kg soil)		(kg dry grass/ kg wet grass)		(kg/day)		(mg/kg meat per mg/day)		Liters/day	
COC	Value	Ref	Value	Ref	Value	Ref	Value	Ref	Value	Ref	Value	Ref	Value	Ref	Value	Ref
Arsenic	0.002	1	0.5	6	50	1	0.06	7	0.182	2	0.5	3	0.004	5	53	4
Cadmium	0.00012	8	1		50	1	0.14	7	0.182	2	0.5	3	0.000	5	53	4
Iron	0.02	1	1		50	1	0.003	2	0.182	2	0.5	3	0.020	5	53	4
Thallium	0.04	1	1		50	1	0.004	7	0.182	2	0.5	3	0.040	5	53	4
Vanadium	0.0025	1	1		50	1	0.0055	7	0.182	2	0.5	3	0.003	5	53	4

References:

1 - Baes et al. 1984. A review and analysis of parameters for assessing transport of environmentally released radionuclides through agriculture, Figure 2.25, p. 51.

2 - Wang et al. 1993. A compilation of radionuclide transfer factors for the plant, meat, milk, and aquatic food pathways and the suggested default values for the RESRAD code). For grass-soil conc. ratio, Table 10, p. 25 for grasses in group k=3. For dry-to-wet conversion, Table 2, p. 5 for grass in forage group.

3 - USEPA. 2005. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, p. 5-46.

4 - USEPA, 1999. Data Collection for the Hazardous Waste Identification Rule: Section 10 Farm Food Chain and Terrestrial Foodweb Data) - the average water intake on an annual basis for a 1,200-pound beef cow.

5 - Water-cattle Transfer Factor = (Ingestion-beef Transfer Factor / Soil Relative Bioavailability)

6 - See report.

7 - USEPA, 1995. "Technical support document for the hazardous waste identification rule: Risk assessment for human and ecological receptors.Appendix A, Table A-2, values for "Br - forage."

8 - USEPA. 2005. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Values are from chemical-specific database.

\\CAMFS02\G_Drive\PROJECTS\204013 Chino\EPC Calcs\[EPC_Food.xls]Chicken

Beef Exposure Point Concentrations (mg/Kg)					
Exp. Area	**1**	**2**	**3**	**4**	**5**
Arsenic	4.10E-03	6.90E-03	6.78E-03	1.01E-02	7.11E-03
Cadmium	2.04E-04	1.92E-04	5.03E-03	6.59E-04	1.86E-04
Iron	2.53E+02	2.01E+02	6.03E+02	2.44E+02	2.81E+02
Thallium	4.29E-02	1.33E-01	1.41E-02	1.16E-02	6.86E-03
Vanadium	8.40E-02	4.47E-02	4.35E-02	4.01E-02	8.20E-02

Chicken EPC Calculations

Soil Exposure Point Concentrations (mg/kg)						Soil-Chicken Transfer Factor mg/kg meat per mg/day		Chicken Feed Ingestion Rate kg/day		Fraction of soil in chicken feed (unitless)	
Exposure Area	**1**	**2**	**3**	**4**	**5**	Value	Ref	Value	Ref	Value	Ref
Arsenic	2.0E+00	3.3E+00	3.2E+00	4.0E+00	2.9E+00	0.83	1	0.1	1	0.093	4
Cadmium	9.6E-01	9.0E-01	2.4E+01	3.1E+00	8.7E-01	0.11	5	0.1	1	0.093	4
Iron	2.4E+04	1.9E+04	5.7E+04	2.3E+04	2.7E+04	1.5	1	0.1	1	0.093	4
Thallium	2.0E+00	6.2E+00	6.6E-01	5.4E-01	3.2E-01	0.3	2	0.1	1	0.093	4
Vanadium	6.1E+01	3.3E+01	3.2E+01	2.9E+01	6.0E+01	0.8	3	0.1	1	0.093	4

Chicken Exposure Point Concentrations (mg/kg)					
Exp Area	**1**	**2**	**3**	**4**	**5**
Arsenic	1.5E-02	2.5E-02	2.5E-02	3.1E-02	2.2E-02
Cadmium	9.8E-04	9.2E-04	2.4E-02	3.1E-03	8.9E-04
Iron	3.3E+02	2.7E+02	8.0E+02	3.2E+02	3.7E+02
Thallium	5.6E-03	1.7E-02	1.8E-03	1.5E-03	8.9E-04
Vanadium	4.5E-01	2.4E-01	2.4E-01	2.2E-01	4.4E-01

Note:
Bold: Soil EPC is the maximum concentration, because the 95% UCL exceeded the maximum value.

$EPC_{chicken} = EPC_{soil} \times TF_{s\text{-}ch} \times (IR_{feed} \times F_{s,f})$

where:

$EPC_{chicken}$ = Chicken Exposure Point Concentration (mg/kg)

EPC_{soil} = Soil Exposure Point Concentration (mg/kg)

$TF_{s\text{-}ch}$ = Soil-chicken transfer factor (mg/kg meat per mg/day)

IR_{feed} = Feed Ingestion rate for chicken (kg/day)

F_{sf} = Fraction of soil in chicken feed (unitless)

References

1 - Ng, et al., 1982: Transfer Coefficients for Assessing the Dose From Radionuclides in Meat and Eggs.

2 - Kennedy and Strenge, 1992: Residual radioactive contamination from decommissioning. Technical basis for translating contamination levels to annual total effective dose equivalent. Table 6.18, p. 6.29.

3 - Staven, L.H. et al. (2003) - A compendium of Transfer Factors for Agricultural and Animal Products - Pacific Northwest National Laboratory. A recommended default value of 0.8 was used for the soil-chicken transfer factor for Vanadium.

4 - Based on Bayer et al (1994: Estimates of Soil Ingestion by Wildlife) for wild turkey, a surrogate species.

5 - USEPA. 2005. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Values are from chemical-specific database.

Egg EPC Calculations

Soil Exposure Point Concentrations (mg/Kg)						Soil-Eggs Transfer Factor mg/kg meat per mg/day		Chicken Feed Ingestion Rate kg/day		Fraction of soil in chicken feed (unitless)		Eggs Exposure Point Concentrations (mg/Kg)					
Exposure Area	**1**	**2**	**3**	**4**	**5**	Value	Ref	Value	Ref	Value	Ref	**Exposure Area**	**1**	**2**	**3**	**4**	**5**
Arsenic	2.0E+00	3.3E+00	3.2E+00	4.0E+00	2.9E+00	0.8	1	0.1	1	0.093	4	Arsenic	1.5E-02	2.5E-02	2.4E-02	3.0E-02	2.2E-02
Cadmium	9.6E-01	9.0E-01	2.4E+01	3.1E+00	8.7E-01	0.0025	5	0.1	1	0.093	4	Cadmium	2.2E-05	2.1E-05	5.5E-04	7.2E-05	2.0E-05
Iron	2.4E+04	1.9E+04	5.7E+04	2.3E+04	2.7E+04	1.3	1	0.1	1	0.093	4	Iron	2.9E+02	2.3E+02	6.9E+02	2.8E+02	3.2E+02
Thallium	2.0E+00	6.2E+00	6.6E-01	5.4E-01	3.2E-01	0.002	2	0.1	1	0.093	4	Thallium	3.7E-05	1.2E-04	1.2E-05	1.0E-05	6.0E-06
Vanadium	6.1E+01	3.3E+01	3.2E+01	2.9E+01	6.0E+01	1	3	0.1	1	0.093	4	Vanadium	5.7E-01	3.0E-01	2.9E-01	2.7E-01	5.5E-01

Note:
Bold: Soil EPC is the maximum concentration, because the 95% UCL exceeded the maximum value.

EPCeggs = EPCsoil x TFs-eggs x (IRfeed x Fs,f)

where:
EPCeggs = Eggs Exposure Point Concentration (mg/kg)
EPCsoil = Soil Exposure Point Concentration (mg/kg)
TFs-eggs = Soil-Eggs transfer factor (mg/kg meat per mg/day)
IRfeed = Feed Ingestion rate for chicken (kg/day)
Fs,f = Fraction of soil in chicken feed (unitless)

References
1 - Ng, et al., 1982: Transfer Coefficients for Assessing the Dose From Radionuclides in Meat and Eggs.
2 - Kennedy and Strenge, 1992: Residual radioactive contamination from decommissioning. Technical basis for translating contamination levels to annual total effective dose equivalent. Table 6.18, p. 6.29.
3 - Staven, L.H. et al. (2003) - A compendium of Transfer Factors for Agricultural and Animal Products - Pacific Northwest National Laboratory. A recommended default value of 1 was used for the soil-egg transfer factor for Vanadium.
4 - Based on Bayer et al (1994: Estimates of Soil Ingestion by Wildlife) for wild turkey, a surrogate species.
5 - USEPA. 2005. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Values are from chemical-specific database.

Vegetable EPC Calculations

Soil Exposure Point Concentrations (mg/kg)					
Exposure Area	1	2	3	4	5
Arsenic	2.0E+00	2.0E+00	1.7E+00	3.2E+00	1.7E+00
Cadmium	9.6E-01	1.1E+00	1.1E+00	4.2E+00	1.2E+00
Iron	2.4E+04	1.4E+04	2.4E+04	3.3E+04	1.7E+04
Thallium	2.0E+00	9.2E-01	5.9E+00	1.8E-01	3.2E-01
Vanadium	6.1E+01	1.7E+01	2.2E+01	4.4E+01	2.2E+01

Non-Linear Uptake Factors (Unitless)			Linear Uptake Factors (Unitless)	
B0	B1	Ref.	P	Ref.
-1.99	0.56	1	N/A	
-0.48	0.55	1	N/A	
N/A	N/A		0.00425	1
N/A	N/A		0.0004	2
N/A	N/A		0.00485	1

Vegetable Exposure Point Concentrations (mg/kg)					
Exposure Area	1	2	3	4	5
Arsenic	2.0E-01	2.0E-01	1.8E-01	2.6E-01	1.8E-01
Cadmium	6.1E-01	6.5E-01	6.4E-01	1.4E+00	6.7E-01
Iron	1.0E+02	6.0E+01	1.0E+02	1.4E+02	7.3E+01
Thallium	8.0E-04	3.7E-04	2.4E-03	7.0E-05	1.3E-04
Vanadium	3.0E-01	8.5E-02	1.1E-01	2.2E-01	1.1E-01

Note:
Bold: Soil EPC is the maximum concentration, because the 95% UCL exceeded the maximum value.

Linear

$EPC_{veg} = EPC_{soil} * P$

where:

EPC_{veg} = Vegetable Exposure Point Concentration (mg/kg)

EPC_{soil} = Soil Exposure Point Concentration (mg/kg)

p = Linear plant uptake factor (kg chemical in soil/ kg chemical in plant)

Non-Linear

$EPC_{veg} = \exp[B_O + B_1 * \ln(EPC_{soil})]$

where:

EPC_{veg} = Vegetable Exposure Point Concentration (mg/kg)

EPC_{soil} = Soil Exposure Point Concentration (mg/kg)

B_O, B_1 = Non-linear uptake factors

References
1 - Bechtel/Jacobs, 1998: Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants, Table 7, p 22 for non-linear factors; Table D-1, p. D-3 for linear factors.
2 - Baes et al., 1984: A review and analysis of parameters for assessing transport of environmentally released radionuclides through agriculture. Value for root vegetables, Figure 2.2, p. 11.

Appendix D

Air Modeling in S/TSIU

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D.1 Overview

Gradient performed detailed air dispersion modeling of fugitive dust emissions using the latest version of the US EPA-recommended AERMOD steady-state Gaussian plume dispersion model (Version 07026) to determine the air quality impact of Smelter/Tailing wind-blown soil resuspension for six constituents of concern (COCs). These COCs include arsenic, cadmium, copper, iron, thallium and vanadium. Wind-blown dust emissions of individual compounds for area sources in the Smelter/Tailing Site Investigation Unit (S/TSIU) were calculated using all available soil measurements. The calculated emission rates were used in the AERMOD air dispersion model to predict long-term air concentrations for each COC at various receptor locations within the five exposure areas of the S/TSIU. Air concentration summary statistics were then calculated for each of the five exposure areas.

To determine the wind-blown dust emissions, the Smelter/Tailings Area was first divided into 280 contiguous 1 km by 1 km area sources, and fugitive dust emissions were determined for each chemical for each 1 km by 1 km source area. Emission rates for each chemical were calculated using a US EPA-recommended technique for estimating wind-blown dust emissions. These emissions rates were then used as inputs to the AERMOD air dispersion model. Annual-average air concentrations associated with wind-blown resuspension of Smelter/Tailings soils for the COCs were calculated for a total of 726 receptor locations in a grid pattern over the S/TSIU exposure areas.

The fugitive dust emission calculations for the 280 area sources are described in detail in Section D.2 below and the air model and meteorological parameters that were used in the dispersion modeling are discussed in Section D.3. The predicted air impact of the Smelter/Tailings soils for each chemical are presented in Section D.4.

D.2 Source Emission Rates and Parameters

A US EPA-recommended fugitive dust emission model was used to calculate the wind-blown emission rate of respirable particulates (*i.e.* particles smaller than 10 μm diameter or PM_{10}) from soil. The calculation is based on the empirical relationship between the wind-blown flux of particles and wind speed cubed, and is sometimes referred to as the Gillette model. This fugitive dust emission model is recommended for use in US EPA's "Air/Superfund National Technical Guidance Study Series. Volume II - Estimation of Baseline Air Emissions at Superfund Sites" (US EPA, 1990), and is described in more detail in US EPA's "Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites" (US EPA, 1985).

The fugitive dust model applies to bare surfaces of finely divided material such as sandy agricultural soil. Such surfaces are considered to have an "unlimited reservoir" of erodable particles. These surfaces have low threshold wind speeds for wind erosion, and particulate emission rates are assumed to be independent of time at a given wind speed. This model would not be applicable to nonhomogeneous surfaces containing non-erodable elements such as large rocks or stones, or to crusted surfaces.

The fugitive emission model relates the average rate of respirable particulate emissions (per unit area) to vegetative cover and meteorological factors using the following equation:

$$E_{10} = 10^{-5}(1-V)F(x)\left(\frac{U_{ave}}{U_t}\right)^3 \qquad (1)$$

where:

E_{10}	=	PM_{10} particulate emission factor, *i.e.*, annual average PM_{10} emission rate per unit area of contaminated surface (g/sec-m^2)
V	=	fraction of surface vegetative cover (*i.e.*, equals 0 for bare soil)
U_{ave}	=	mean annual wind speed (m/sec)
U_t	=	threshold wind speed at anemometer height (m/sec)
x	=	0.886 U_t /U_{ave} (dimensionless ratio)
F(x)	=	empirical function (described below)

U_t is the erosion threshold wind speed (in m/sec), typically measured at a weather station sensor height of about 7 meters. This is the minimum wind speed needed before wind erosion will occur. U_t is a function of the threshold friction velocity U_0, and the roughness height, Z_0, as given in the following equation, which assumes a logarithmic velocity profile near the earth's surface:

$$U_t = \frac{U_0}{0.4} \ln\left(\frac{Z}{Z_0}\right) \tag{2}$$

where:

U_t	=	wind speed at a height Z above the surface (m/sec)
U_0	=	threshold friction velocity (m/sec)
Z	=	height above surface (m)
Z_0	=	roughness height (m)

The aerodynamic roughness height, Z_0, is related to the size and spacing of physical surface flow obstructions, and is typically a small fraction of the physical height of the obstruction. The threshold friction velocity, U_0, may be determined from the mean of the aggregate size distribution for the surface soil particles.

The empirical function F(x) in Equation (1) is a numerical solution of an integral, usually presented in graphical form, which determines emissions from surfaces with unlimited erosion potential. This graph is presented in US EPA (1985), and the F(x) function approaches a constant value of 1.91 for small values of the parameter "x" ($0.886\ U_t/U_{ave}$).

To determine the emission rate of individual chemicals, the soil concentration of each individual chemical must be known or estimated for a given area. Based on the soil measurement data in the S/TSIU region, an area source emission grid was chosen that consisted of 280 individual square area sources, each 1 km by 1 km in size, covering the five exposure areas in the S/TSIU. The 280 emission areas are presented in Figure 1. Because measured soil concentrations were not available for each of the 280 area sources, soil concentration contours covering all five exposure areas were estimated using the

default kriging method in Surfer Version 8.02. The soil samples used in the kriging included 230 samples from 0-1 or 0-6 inches (Table 1).

Table 1
Soil Samples Used for Air Modeling

Exposure Area	Sample Depth (in)	Sieve (µm)	No. Samples
1	0-1		1
1	0-1	250	11
2	0-1		2
2	0-1	250	11
2	0-6	2000	10
3	0-1		9
3	0-1	250	22
3	0-6	2000	22
4	0-1		9
4	0-1	250	54
4	0-6	2000	5
5	0-1		12
5	0-1	250	30
5	0-6	2000	18
Smelter	0-1	250	5
Reference	0-1		9
		Total	**230**

Estimates of vegetative cover were made using the information of vegetative cover obtained from the remedial investigation background report for the Chino Mine Investigation Area and the associated Vegetation-Wildlife Habitat Map (Chino Mine Company, 1995, section 4.6 and Figure 4.6-1). For areas that had multiple vegetation values, an average vegetative fraction was calculated.

Using Equation (1), the total PM_{10} wind-blown emission rate was calculated for bare soil (*i.e.*, V=0), using an average wind speed for the Hurley area of 3.9 m/sec, a friction velocity of 0.65 m/sec, and a roughness height of 5 cm (appropriate for desert shrub land). The average wind speed for the area of 3.9 m/sec was calculated based on the measurements taken at the Hurley golf course site during September 1995 - August 1997. The result was a bare soil PM_{10} emission rate equal to 1.13×10^{-5} g/sec-m^2. To calculate emission estimates for each of the COCs, this total PM_{10} emission rate was multiplied by the estimated soil concentration and the vegetative fraction term (*i.e.*, 1-V) for each 1 km by 1 km area source. The vegetative fraction and calculated emission rates (g/sec-m^2) for all 280 area sources are presented in Attachment A. The grid numbers in Attachment A correspond to the grid numbers for each 1 km by 1 km emission area shown in Figure 1.

D.3 Air Modeling Parameters

The calculated area source emission rates shown in Attachment 1 were inputs into the current version of the AERMOD steady-state Gaussian plume dispersion model (Version 07026). In 2005, US EPA established the use of AERMOD as the preferred model for predicting short-term and long-term air quality concentrations resulting from point, volume, or area sources at distances less than 50 km (US EPA, 2005). AERMOD replaces the widely used ISCST3 air model, is applicable for use with complex terrain, and incorporates an improved building downwash algorithm, BPIP-PRIME. According to US EPA, AERMOD represents the best state-of-the-practice Gaussian plume dispersion model. The model is publicly available from the US EPA air modeling web site (US EPA, 2007).

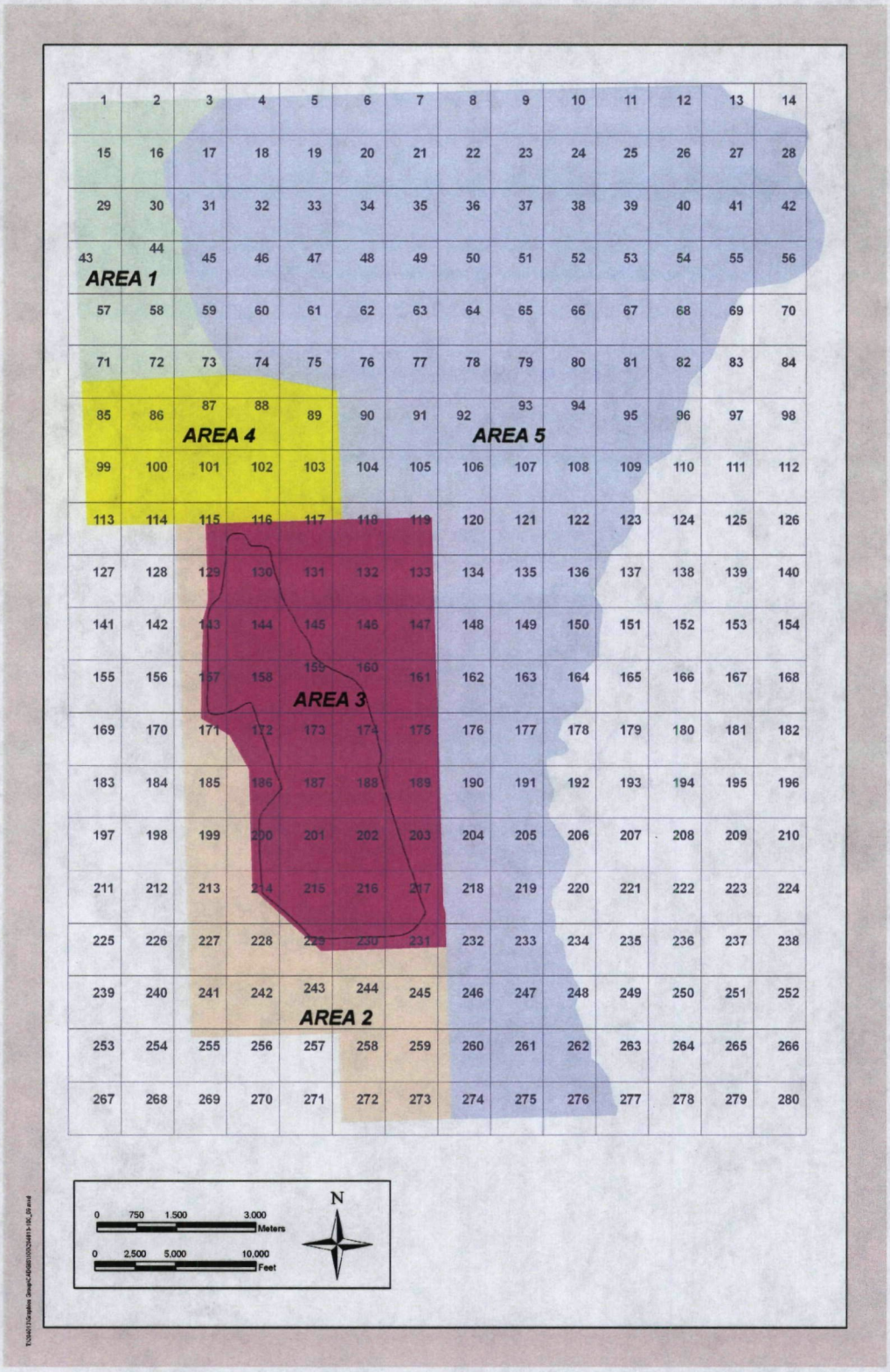

Figure 1. Area Sources for Smelter/Tailings Site Investigation Unit

The AERMOD air quality model incorporates two input data processors, AERMET and AERMAP, which are regulatory components of the modeling system. AERMET is a meteorological processor that incorporates planetary boundary layer turbulence structure and scaling concepts, and AERMAP is a terrain processor that uses USGS Digital Elevation Data to integrate complex terrain features into the model.

AERMOD was run in its regulatory default mode. To incorporate terrain elevation data, the AERMAP data processor was used to integrate USGS Digital Elevation maps that encompass the five exposure areas in the S/TSIU. A receptor grid was established, as shown in Figure 2, which consisted of 726 receptor locations (9 receptors in each 1 km by 1 km area source square), and long-term (1-year average) air concentrations were calculated for all receptors. The receptor locations and source locations were inputs to AERMOD in UTM coordinates (NAD27 datum). All receptor locations were modeled at a height of 1.5 meters, which corresponds to breathing height. Figure 2 also shows the number of receptor locations in each of the five exposure areas.

Wind speed and direction data were taken at the Hurley golf course site during September 1995 – August 1997, so the only complete year of data was 1996. These 1996 data were input into the AERMET meteorological data processor as on-site surface meteorological data. In addition, AERMET requires National Weather Service (NWS) surface and upper-air meteorological data, and for this we used 1996 data from El Paso, TX, which was the closest NWS station in the region. The annual-average wind rose from the Hurley golf course station is presented in Figure 3. As shown, the predominant wind direction is from the northwest quadrant.

D.4 Predicted Air Concentrations

Separate AERMOD air modeling runs were made to determine the air impact from wind-blown dust from the Smelter/Tailings Soils for each of the five exposure areas and COCs. Predicted air impacts from the estimated Smelter/Tailings soils were calculated for each COC on an annual-average basis at each receptor location.

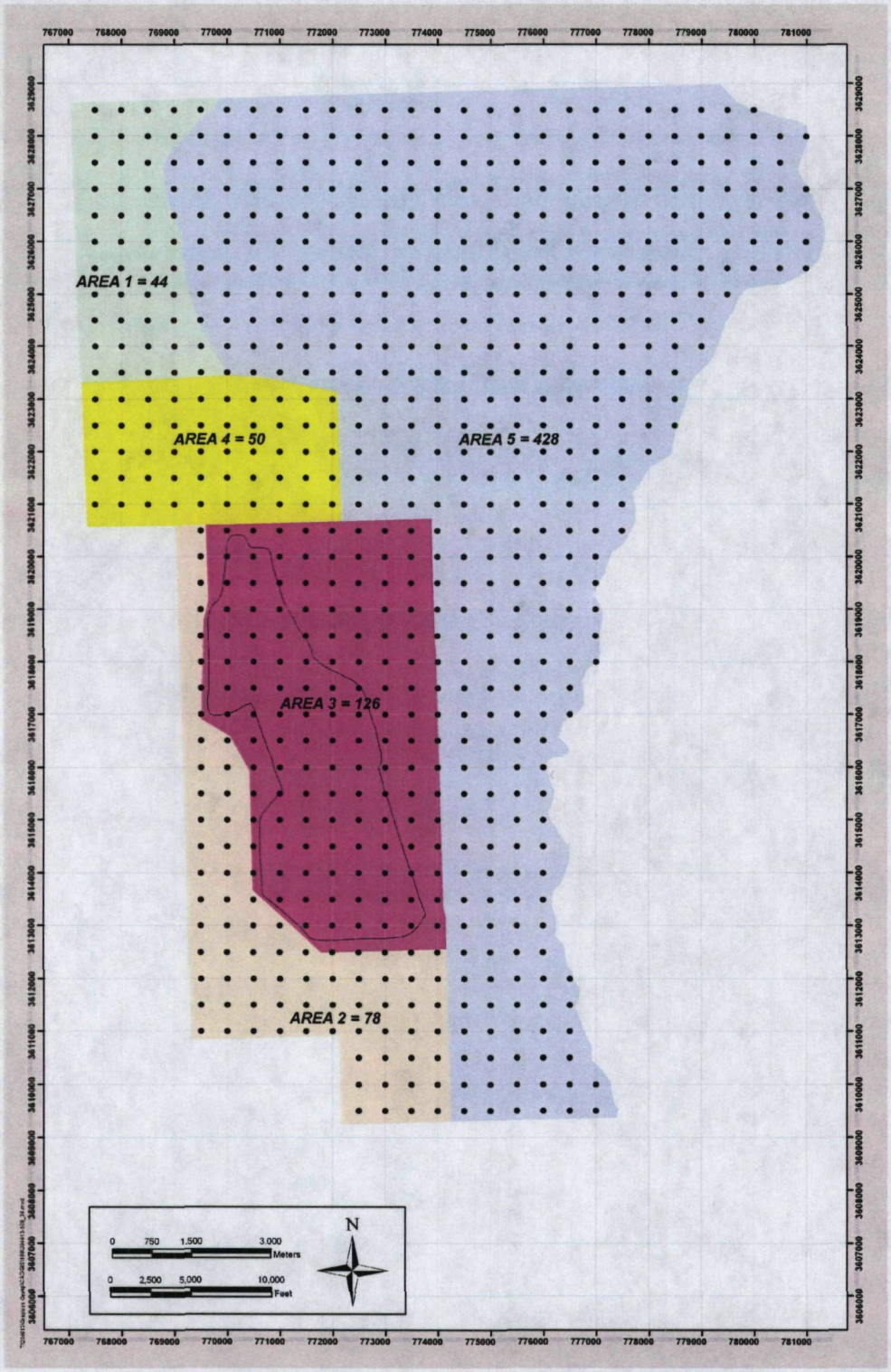

Figure 2. Receptor locations for each exposure area in the Smelter/Tailings Site Investigation Unit

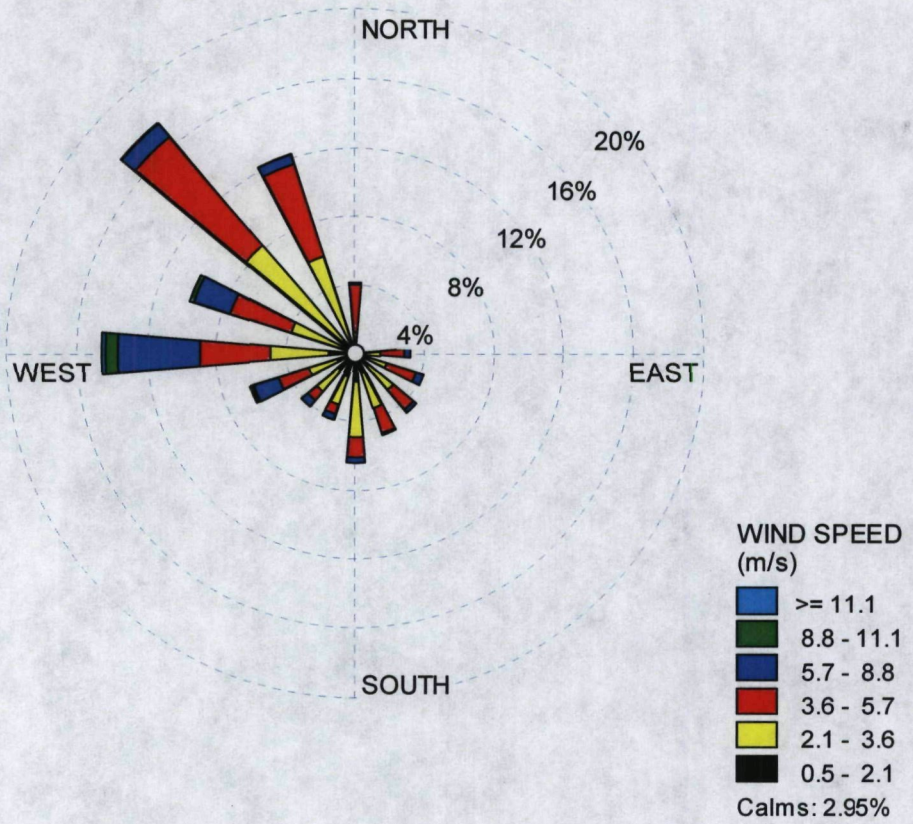

Figure 3. Annual Average Wind Rose for Hurley Golf Course, 1996.

The predicted annual average air concentrations due to wind-blown resuspension of Smelter/Tailings soils are shown in Figures 4 through 10 as concentration contours over the entire S/TSIU area for each of the COCs. For arsenic, cadmium, and copper, the highest predicted average air concentrations were found in Exposure Area 4. For iron, thallium, and vanadium, the highest predicted average air concentrations were in Exposure Area 2.

Table 2 presents a summary of the modeled annual-average air concentrations attributable to wind-blown soil in the S/TSIU for each of the COCs, by exposure area. This table presents summary statistics (average, median, minimum and maximum concentrations) for each of the five exposures areas. As shown in Table 2, the predicted air concentrations due to wind-blown dust for the six COCs were generally very low, with the average predicted air concentrations ranging from 7×10^{-5} $\mu g/m^3$ for thallium (Area 5) to about 5 $\mu g/m^3$ for iron (Area 2).

Table 2
Summary of Modeled Air Concentrations (μg/m^3) Due to Resuspension of Soil

		Arsenic	Cadmium	Copper	Iron	Thallium	Vanadium
Area 1	N = 44						
	Mean	4.51E-04	2.45E-04	2.08E-01	3.55E+00	2.12E-04	6.28E-03
	Median	4.25E-04	2.25E-04	1.53E-01	3.93E+00	2.35E-04	7.39E-03
	Min	6.00E-05	3.00E-05	8.73E-03	4.91E-01	4.00E-05	8.80E-04
	Max	1.10E-03	6.40E-04	8.24E-01	6.19E+00	3.90E-04	1.08E-02
Area 2	N= 78						
	Mean	3.82E-04	1.38E-04	6.57E-02	5.14E+00	4.84E-04	1.08E-02
	Median	3.85E-04	1.25E-04	5.15E-02	5.11E+00	4.40E-04	1.10E-02
	Min	2.40E-04	8.00E-05	1.81E-02	3.01E+00	2.30E-04	4.41E-03
	Max	5.50E-04	3.60E-04	3.39E-01	7.49E+00	9.40E-04	1.84E-02
Area 3	N= 126						
	Mean	5.40E-04	3.64E-04	2.43E-01	4.76E+00	2.14E-04	5.48E-03
	Median	5.10E-04	2.70E-04	1.82E-01	4.58E+00	1.90E-04	5.46E-03
	Min	2.20E-04	9.00E-05	5.47E-02	1.71E+00	9.00E-05	2.72E-03
	Max	1.40E-03	2.16E-03	1.04E+00	8.41E+00	4.20E-04	9.35E-03
Area 4	N= 50						
	Mean	9.18E-04	6.90E-04	7.83E-01	4.50E+00	1.69E-04	5.36E-03
	Median	5.85E-04	3.65E-04	4.71E-01	3.32E+00	1.70E-04	4.75E-03
	Min	1.90E-04	1.00E-04	9.65E-02	1.04E+00	3.00E-05	1.22E-03
	Max	2.64E-03	2.37E-03	2.46E+00	1.08E+01	3.50E-04	9.39E-03
Area 5	N= 428						
	Mean	2.93E-04	1.10E-04	8.27E-02	2.75E+00	7.17E-05	4.96E-03
	Median	2.70E-04	8.00E-05	5.74E-02	2.34E+00	5.00E-05	4.18E-03
	Min	4.00E-05	1.00E-05	5.18E-03	3.28E-01	1.00E-05	6.30E-04
	Max	1.16E-03	6.80E-04	8.38E-01	9.85E+00	3.00E-04	1.49E-02

Note:
N = Number of receptor locations used in air modeling

For three of the COCs (arsenic, cadmium, and copper) the modeled annual average air concentrations due to wind-blown resuspension of S/T soils can be compared to the annual average air concentrations measured at the Hurley Elementary School. These samples were collected as part of particulate matter (PM_{10}) air monitoring during the Phase I RI investigation of the Hurley Soils Investigation Unit (Golder Associates, 1998). Randomly selected filters from 1995 through 1997 were selected to represent a complete year of data and were analyzed for select elements. The comparison between our modeled estimates and the measured concentrations at the Hurley Elementary School is shown below in Table 3, using the average predicted air concentration in Exposure Area 4 (which includes Hurley) for comparison. As shown in Table 3, for arsenic and cadmium, the predicted air concentrations due to wind-blown soil in the exposure area, which includes the town of Hurleywere within a factor of two of the measured air concentrations.

Table 3
Comparison of Predicted Average Air Concentrations due to Resuspension of Soil to Measured Air Concentrations at the Hurley Elementary School

Element	Average Modeled Conc (µg/m³) (a)	Average Measured Conc (µg/m³) (b)
Arsenic	9.2×10^{-4}	1.4×10^{-3}
Cadmium	6.9×10^{-4}	1.4×10^{-3}
Copper	7.8×10^{-1}	1.3×10^{-1}

(a) Average annual average modeled concentration from Exposure Area 4
(b) Average measured concentration at the Hurley Elementary School

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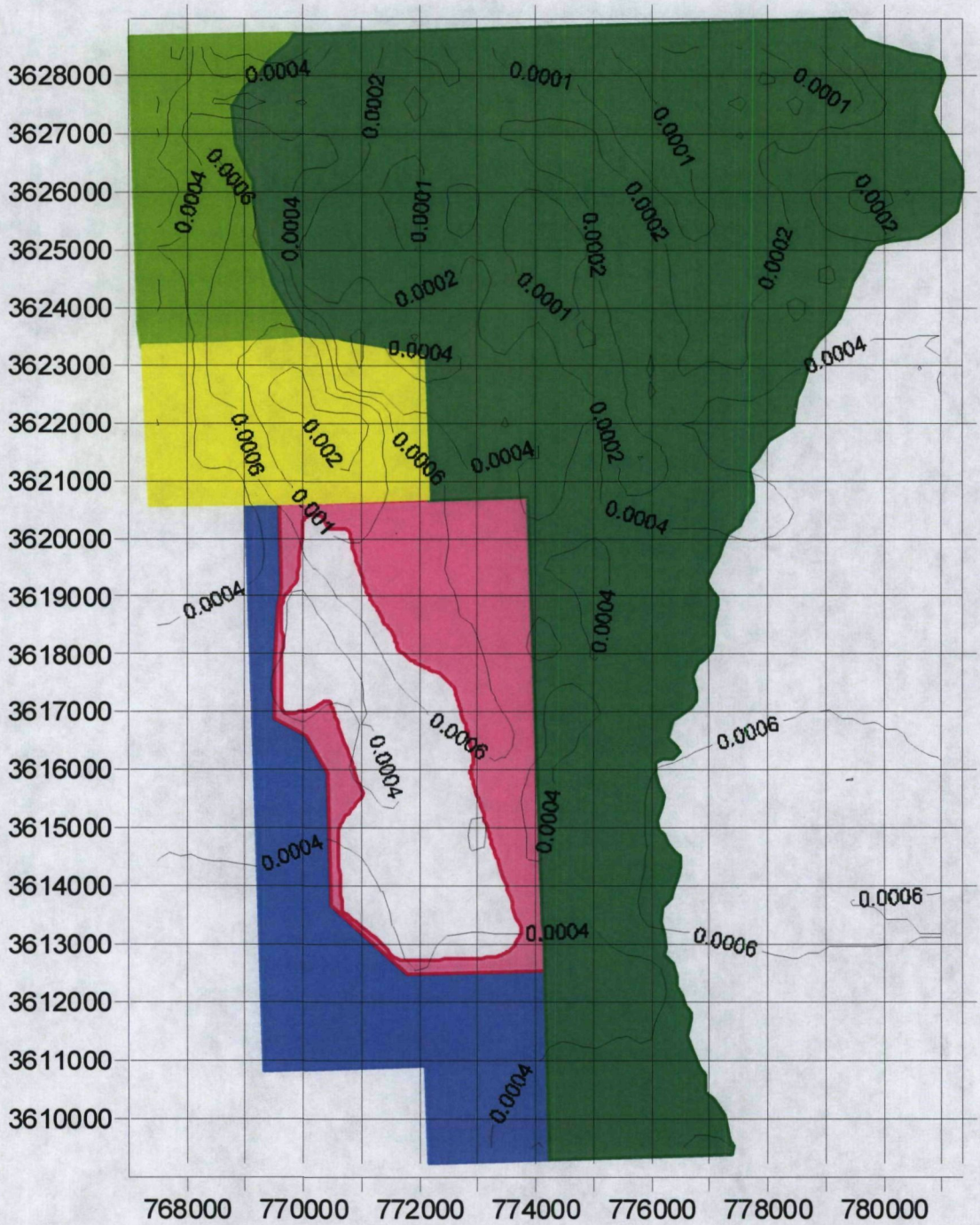

Figure 4. Arsenic Modeled Air Concentrations (μg/m^3)

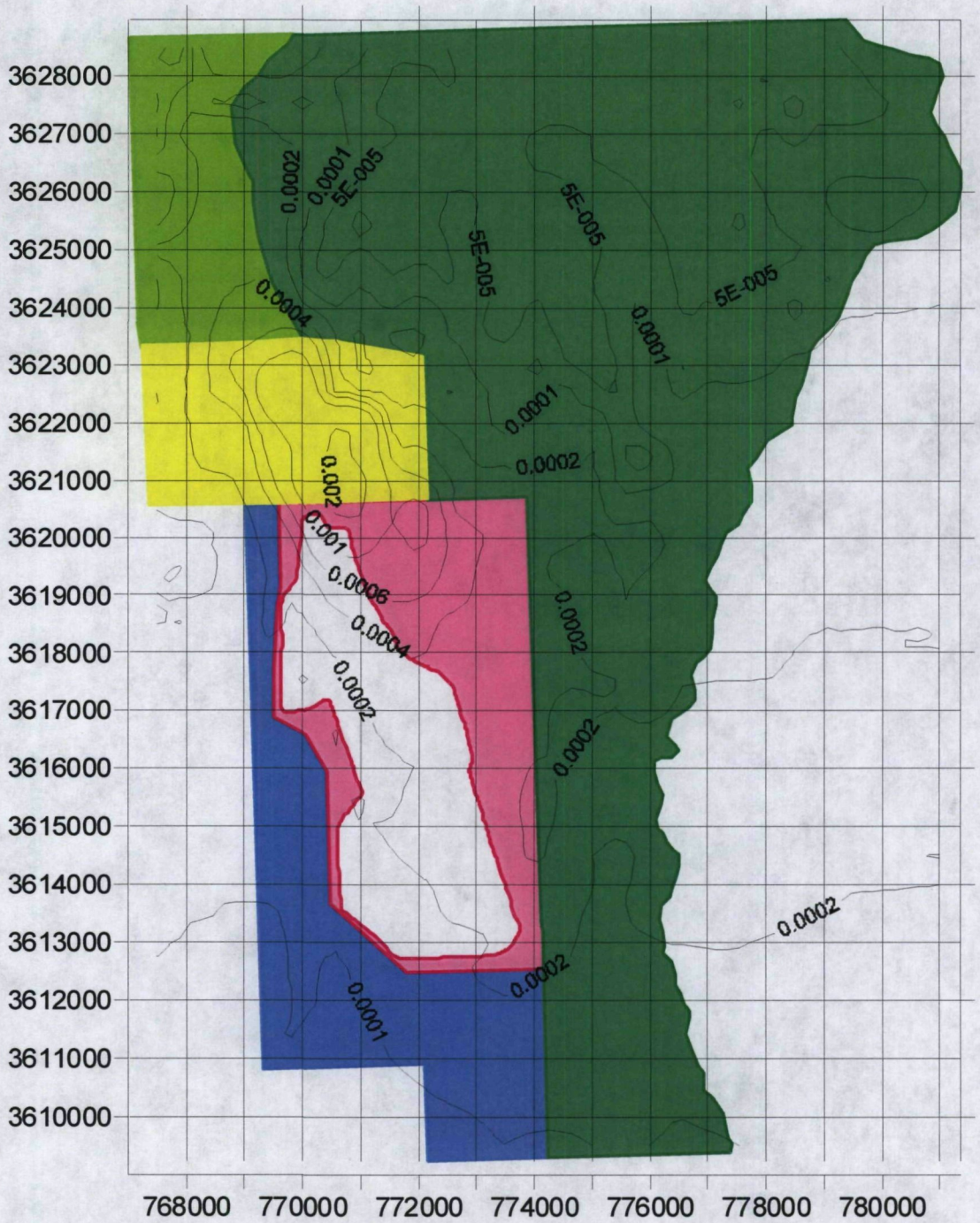

Figure 5. Cadmium Modeled Air Concentrations (µg/m3)

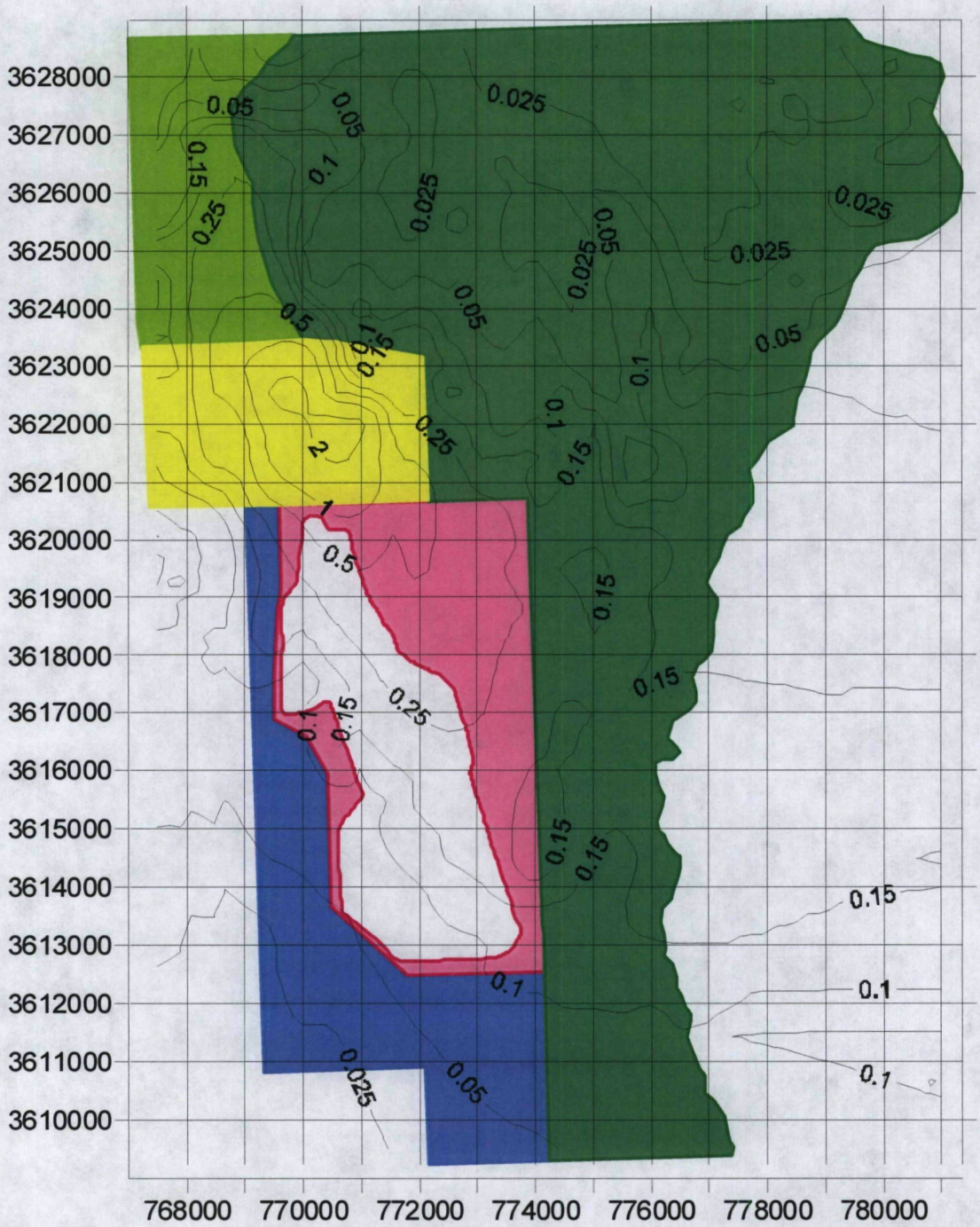

Figure 6. Copper Modeled Air Concentrations (μg/m³)

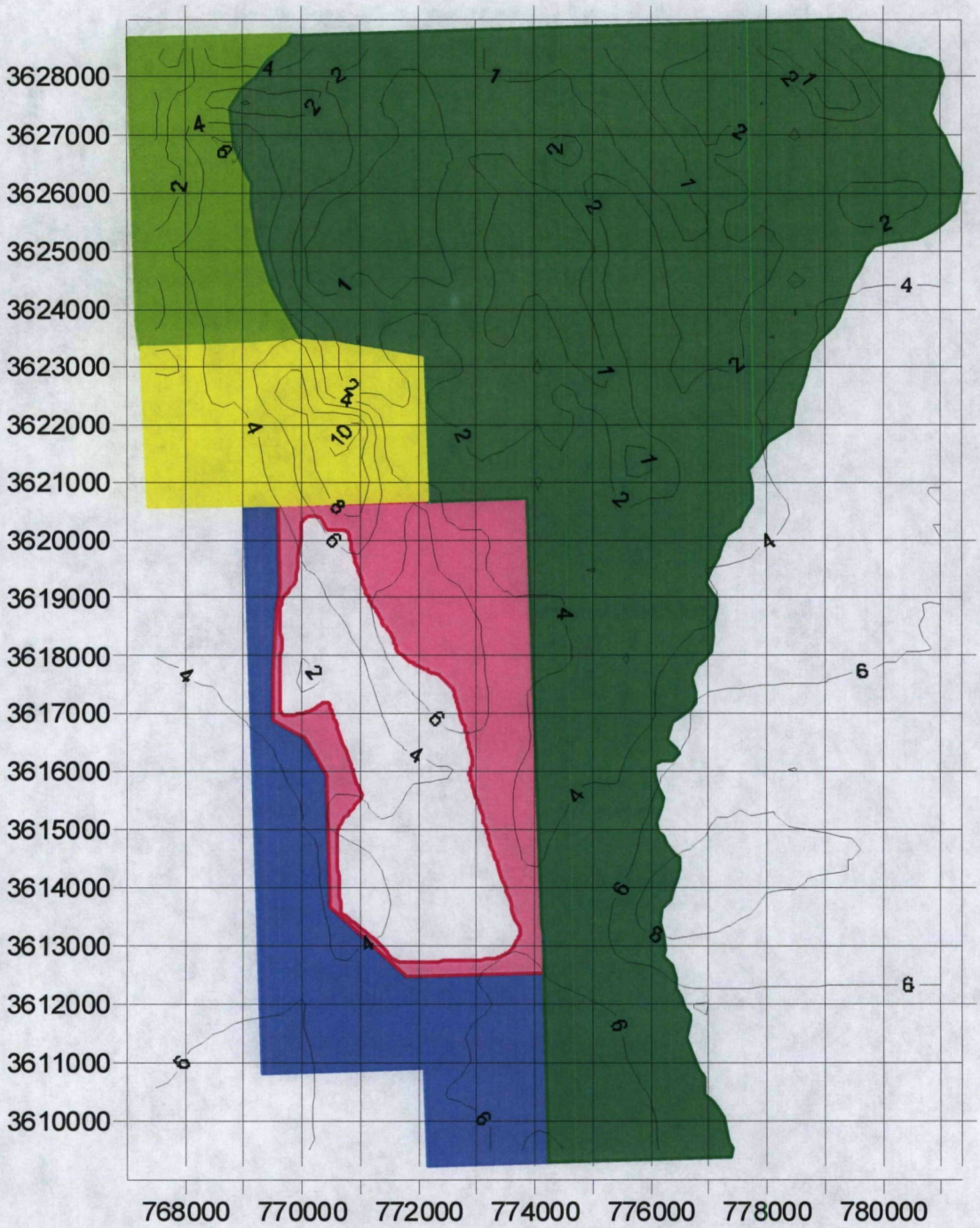

Figure 7. Iron Modeled Air Concentrations (μg/m^3)

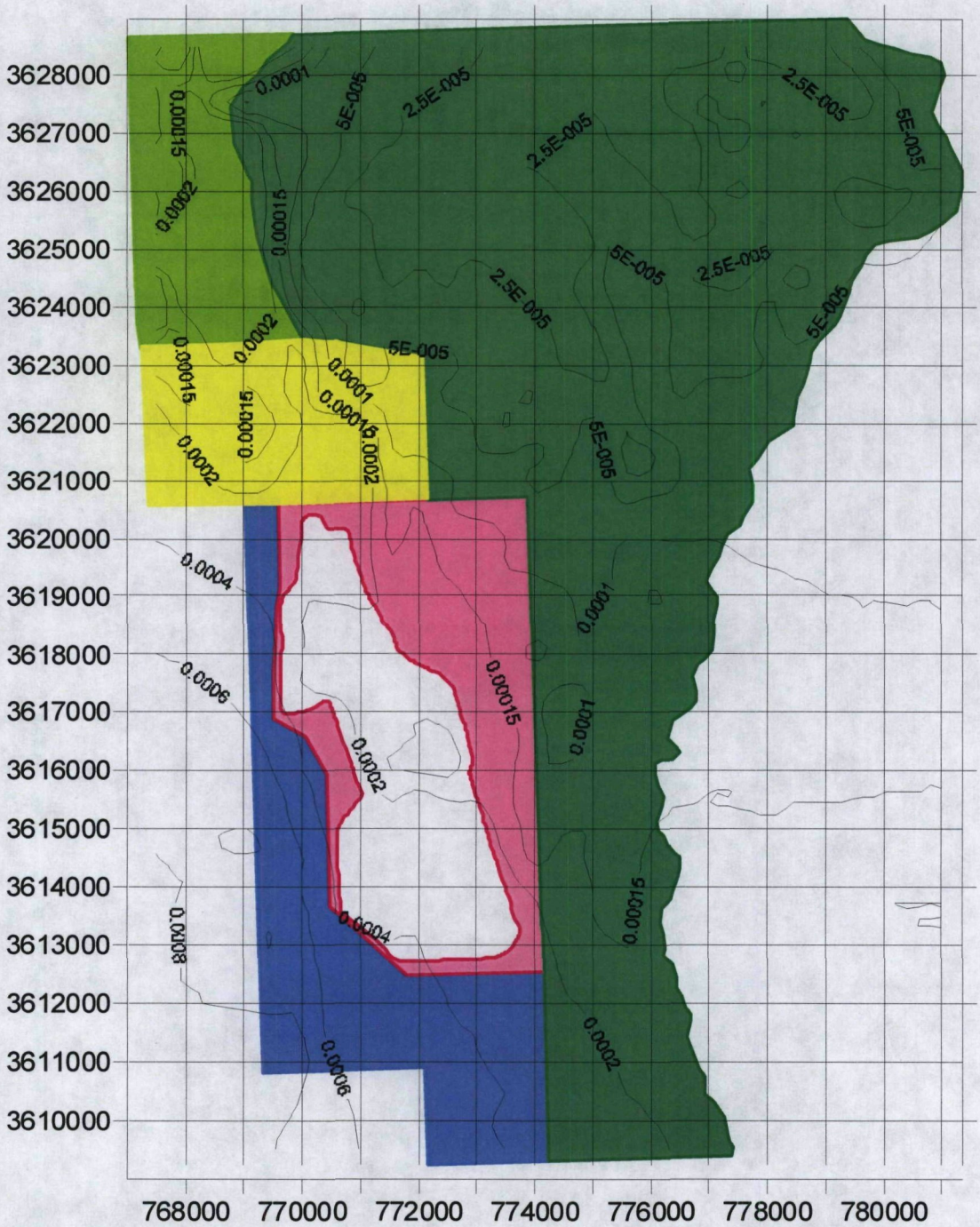

Figure 8. Thallium Modeled Air Concentrations (μg/m³)

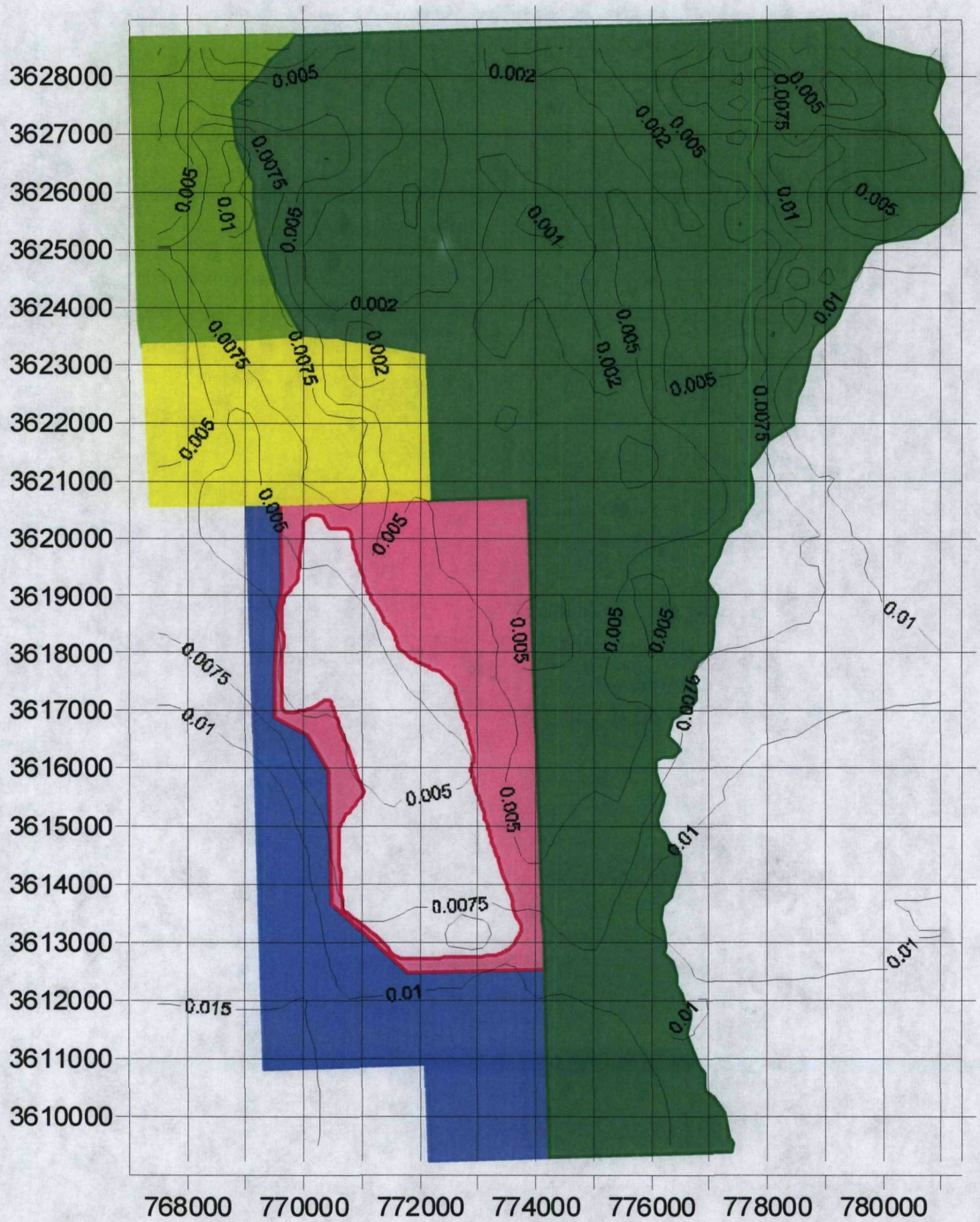

Figure 9. Vanadium Modeled Air Concentrations (µg/m3)

Attachment A: Calculated Emissions Rates

Area Source Emission Rates (g/sec-m^2)

Grid number	X (meters)	Y (meters)	Vegetation fraction	Arsenic	Copper	Cadmium	Iron	Thallium	Vanadium
1	767000	3628000	0.3	2.61E-05	3.25E-03	1.18E-05	2.36E-01	2.28E-05	4.31E-04
2	768000	3628000	0.0	4.12E-05	5.26E-03	1.98E-05	3.12E-01	2.00E-05	5.34E-04
3	769000	3628000	0.3	2.87E-05	3.64E-03	1.31E-05	2.09E-01	7.51E-06	3.94E-04
4	770000	3628000	0.6	1.30E-05	1.70E-03	4.72E-06	9.19E-02	2.49E-06	1.93E-04
5	771000	3628000	0.6	9.03E-06	1.24E-03	2.52E-06	5.56E-02	1.57E-06	1.05E-04
6	772000	3628000	0.6	6.12E-06	6.78E-04	1.10E-06	4.45E-02	9.65E-07	8.14E-05
7	773000	3628000	0.6	5.65E-06	4.21E-04	7.46E-07	4.81E-02	7.39E-07	9.68E-05
8	774000	3628000	0.6	6.14E-06	5.50E-04	8.93E-07	5.82E-02	7.48E-07	1.18E-04
9	775000	3628000	0.6	5.26E-06	4.03E-04	8.02E-07	6.40E-02	7.52E-07	1.69E-04
10	776000	3628000	0.6	6.91E-06	5.68E-04	1.34E-06	1.40E-01	7.97E-07	4.99E-04
11	777000	3628000	0.6	9.01E-06	8.42E-04	2.01E-06	1.96E-01	1.02E-06	7.24E-04
12	778000	3628000	0.6	8.49E-06	7.31E-04	1.88E-06	1.11E-01	1.60E-06	3.51E-04
13	779000	3628000	0.6	9.36E-06	1.00E-03	1.89E-06	7.20E-02	1.76E-06	1.50E-04
14	780000	3628000	0.6	9.61E-06	9.43E-04	1.67E-06	5.66E-02	1.76E-06	8.60E-05
15	767000	3627000	0.3	2.37E-05	4.00E-03	1.17E-05	2.13E-01	1.95E-05	3.81E-04
16	768000	3627000	0.0	3.83E-05	6.96E-03	2.11E-05	2.78E-01	1.43E-05	4.04E-04
17	769000	3627000	0.3	2.73E-05	5.92E-03	1.82E-05	2.28E-01	2.19E-06	3.62E-04
18	770000	3627000	0.6	1.29E-05	1.96E-03	3.42E-06	1.07E-01	7.77E-07	2.91E-04
19	771000	3627000	0.6	8.35E-06	1.57E-03	1.84E-06	4.36E-02	4.58E-07	9.54E-05
20	772000	3627000	0.6	6.23E-06	9.47E-04	9.93E-07	3.78E-02	3.27E-07	7.87E-05
21	773000	3627000	0.6	5.41E-06	5.94E-04	7.31E-07	4.08E-02	4.15E-07	8.69E-05
22	774000	3627000	0.6	5.68E-06	5.50E-04	8.97E-07	5.12E-02	6.59E-07	1.18E-04
23	775000	3627000	0.6	6.29E-06	6.00E-04	1.20E-06	7.33E-02	9.12E-07	2.08E-04
24	776000	3627000	0.6	7.14E-06	7.09E-04	1.62E-06	1.18E-01	1.03E-06	3.94E-04
25	777000	3627000	0.6	7.73E-06	8.40E-04	2.02E-06	1.43E-01	1.15E-06	4.88E-04
26	778000	3627000	0.6	8.08E-06	9.85E-04	2.25E-06	1.11E-01	1.50E-06	3.27E-04
27	779000	3627000	0.6	1.17E-05	2.21E-03	2.57E-06	1.17E-01	9.44E-07	2.30E-04
28	780000	3627000	0.6	9.52E-06	1.04E-03	1.74E-06	6.00E-02	1.70E-06	1.01E-04
29	767000	3626000	0.3	1.90E-05	4.61E-03	1.01E-05	1.93E-01	1.72E-05	3.62E-04
30	768000	3626000	0.3	1.72E-05	5.58E-03	1.02E-05	1.72E-01	8.81E-06	2.88E-04
31	769000	3626000	0.3	1.38E-05	5.60E-03	4.62E-06	1.52E-01	2.32E-06	3.18E-04
32	770000	3626000	0.6	1.03E-05	2.38E-03	2.21E-06	8.52E-02	5.56E-08	2.27E-04
33	771000	3626000	0.6	8.58E-06	1.90E-03	1.55E-06	4.99E-02	5.56E-08	1.22E-04
34	772000	3626000	0.6	6.55E-06	1.24E-03	1.05E-06	3.73E-02	1.19E-07	8.18E-05
35	773000	3626000	0.6	5.38E-06	7.61E-04	8.68E-07	3.68E-02	4.02E-07	7.73E-05
36	774000	3626000	0.5	7.04E-06	8.25E-04	1.33E-06	5.61E-02	9.99E-07	1.20E-04
37	775000	3626000	0.3	1.24E-05	1.41E-03	2.65E-06	1.05E-01	2.23E-06	2.41E-04
38	776000	3626000	0.6	7.13E-06	7.80E-04	1.67E-06	8.72E-02	1.29E-06	2.47E-04
39	777000	3626000	0.6	6.56E-06	8.06E-04	1.86E-06	1.18E-01	1.08E-06	3.61E-04
40	778000	3626000	0.6	6.93E-06	1.12E-03	2.37E-06	1.34E-01	9.60E-07	3.88E-04
41	779000	3626000	0.6	8.43E-06	1.36E-03	2.34E-06	1.22E-01	1.10E-06	3.15E-04
42	780000	3626000	0.6	8.62E-06	8.82E-04	1.74E-06	7.99E-02	1.62E-06	1.89E-04
43	767000	3625000	0.3	1.59E-05	5.26E-03	8.56E-06	1.78E-01	1.56E-05	3.59E-04
44	768000	3625000	0.3	1.35E-05	5.92E-03	8.85E-06	1.69E-01	8.83E-06	3.40E-04

Grid number	X (meters)	Y (meters)	Vegetation fraction	Arsenic	Copper	Cadmium	Iron	Thallium	Vanadium
45	769000	3625000	0.3	1.81E-05	5.40E-03	1.30E-05	1.94E-01	5.93E-06	4.36E-04
46	770000	3625000	0.3	1.77E-05	5.26E-03	4.59E-06	8.22E-02	5.79E-07	1.56E-04
47	771000	3625000	0.6	9.51E-06	2.76E-03	2.28E-06	4.45E-02	1.41E-07	8.90E-05
48	772000	3625000	0.6	7.20E-06	1.60E-03	1.40E-06	3.95E-02	3.09E-07	7.96E-05
49	773000	3625000	0.6	5.06E-06	8.54E-04	1.09E-06	3.46E-02	5.74E-07	6.85E-05
50	774000	3625000	0.6	5.15E-06	7.80E-04	1.24E-06	4.17E-02	9.66E-07	8.07E-05
51	775000	3625000	0.3	1.01E-05	1.38E-03	2.33E-06	8.99E-02	2.31E-06	1.78E-04
52	776000	3625000	0.6	4.48E-06	4.14E-04	9.03E-07	6.07E-02	1.06E-06	1.55E-04
53	777000	3625000	0.6	5.36E-06	5.95E-04	1.32E-06	1.04E-01	1.07E-06	3.05E-04
54	778000	3625000	0.6	6.23E-06	8.27E-04	1.83E-06	1.36E-01	1.08E-06	4.06E-04
55	779000	3625000	0.6	7.37E-06	8.85E-04	1.87E-06	1.34E-01	1.36E-06	3.88E-04
56	780000	3625000	0.6	8.21E-06	7.35E-04	1.66E-06	1.07E-01	1.62E-06	2.98E-04
57	767000	3624000	0.3	1.61E-05	6.77E-03	8.14E-06	1.64E-01	1.42E-05	3.34E-04
58	768000	3624000	0.3	1.47E-05	8.26E-03	7.66E-06	1.37E-01	7.38E-06	2.74E-04
59	769000	3624000	0.3	1.91E-05	5.15E-03	4.98E-06	9.35E-02	3.26E-06	1.81E-04
60	770000	3624000	0.3	2.39E-05	1.09E-02	1.01E-05	7.24E-02	1.89E-06	8.93E-05
61	771000	3624000	0.3	2.13E-05	6.68E-03	7.25E-06	8.95E-02	1.20E-06	1.25E-04
62	772000	3624000	0.6	9.68E-06	2.02E-03	1.96E-06	5.14E-02	7.25E-07	9.32E-05
63	773000	3624000	0.6	5.93E-06	1.26E-03	1.81E-06	4.07E-02	7.70E-07	7.75E-05
64	774000	3624000	0.6	5.92E-06	1.30E-03	1.77E-06	5.07E-02	1.09E-06	9.81E-05
65	775000	3624000	0.3	1.11E-05	2.19E-03	2.89E-06	1.16E-01	2.85E-06	2.33E-04
66	776000	3624000	0.6	7.30E-06	1.33E-03	1.85E-06	9.72E-02	2.28E-06	2.14E-04
67	777000	3624000	0.6	6.29E-06	6.69E-04	1.05E-06	1.12E-01	1.37E-06	3.14E-04
68	778000	3624000	0.6	7.02E-06	6.12E-04	1.16E-06	1.39E-01	1.38E-06	4.20E-04
69	779000	3624000	0.6	7.93E-06	5.74E-04	1.24E-06	1.43E-01	1.88E-06	4.39E-04
70	780000	3624000	0.6	8.41E-06	6.00E-04	1.51E-06	1.24E-01	1.69E-06	3.66E-04
71	767000	3623000	0.3	1.93E-05	8.78E-03	9.28E-06	1.57E-01	1.28E-05	2.95E-04
72	768000	3623000	0.3	2.08E-05	1.75E-02	1.22E-05	1.47E-01	6.63E-06	2.55E-04
73	769000	3623000	0.3	2.72E-05	1.89E-02	1.21E-05	1.24E-01	3.22E-06	2.21E-04
74	770000	3623000	0.3	2.89E-05	7.37E-03	2.35E-05	1.83E-01	1.46E-06	7.86E-05
75	771000	3623000	0.3	2.74E-05	7.33E-03	9.72E-06	1.22E-01	2.17E-06	1.29E-04
76	772000	3623000	0.3	2.72E-05	4.43E-03	4.01E-06	1.13E-01	1.66E-06	1.83E-04
77	773000	3623000	0.3	2.24E-05	4.75E-03	4.78E-06	1.13E-01	1.40E-06	2.13E-04
78	774000	3623000	0.5	1.02E-05	2.67E-03	2.71E-06	7.75E-02	1.25E-06	1.52E-04
79	775000	3623000	0.5	8.89E-06	1.92E-03	2.04E-06	8.96E-02	1.75E-06	1.90E-04
80	776000	3623000	0.6	8.57E-06	1.16E-03	1.32E-06	9.28E-02	1.60E-06	2.24E-04
81	777000	3623000	0.6	8.15E-06	7.69E-04	8.44E-07	1.20E-01	1.31E-06	3.35E-04
82	778000	3623000	0.6	8.03E-06	5.47E-04	8.22E-07	1.51E-01	1.13E-06	4.62E-04
83	779000	3623000	0.6	8.87E-06	5.91E-04	1.39E-06	1.48E-01	1.41E-06	4.52E-04
84	780000	3623000	0.6	8.83E-06	6.15E-04	1.68E-06	1.31E-01	1.42E-06	3.87E-04
85	767000	3622000	0.3	2.39E-05	9.17E-03	1.10E-05	1.52E-01	1.22E-05	2.64E-04
86	768000	3622000	0.3	1.76E-05	1.61E-02	1.34E-05	1.39E-01	2.28E-06	1.51E-04
87	769000	3622000	0.0	9.80E-05	1.02E-01	7.47E-05	2.96E-01	4.03E-06	2.97E-04
88	770000	3622000	0.1	1.17E-04	1.03E-01	5.46E-05	3.98E-01	3.35E-06	2.02E-04
89	771000	3622000	0.2	2.58E-05	1.08E-02	7.59E-06	1.22E-01	5.21E-06	2.22E-04
90	772000	3622000	0.6	1.65E-05	4.04E-03	3.33E-06	8.23E-02	1.07E-06	9.66E-05
91	773000	3622000	0.3	2.45E-05	5.71E-03	4.79E-06	1.08E-01	1.21E-06	1.81E-04
92	774000	3622000	0.5	1.04E-05	3.17E-03	2.86E-06	7.47E-02	9.55E-07	1.28E-04
93	775000	3622000	0.5	6.93E-06	1.48E-03	1.68E-06	7.31E-02	1.19E-06	1.56E-04

Grid number	X (meters)	Y (meters)	Vegetation fraction	Arsenic	Copper	Cadmium	Iron	Thallium	Vanadium
94	776000	3622000	0.6	1.01E-05	9.91E-04	1.06E-06	7.17E-02	1.01E-06	1.74E-04
95	777000	3622000	0.6	8.08E-06	8.70E-04	7.86E-07	9.66E-02	1.13E-06	2.48E-04
96	778000	3622000	0.6	9.89E-06	9.47E-04	1.47E-06	1.35E-01	9.61E-07	3.90E-04
97	779000	3622000	0.6	9.63E-06	8.29E-04	2.02E-06	1.37E-01	9.97E-07	3.98E-04
98	780000	3622000	0.6	8.94E-06	7.46E-04	2.11E-06	1.27E-01	1.03E-06	3.61E-04
99	767000	3621000	0.3	1.95E-05	4.62E-03	7.59E-06	1.53E-01	1.58E-05	2.90E-04
100	768000	3621000	0.3	1.78E-05	1.37E-02	8.77E-06	1.44E-01	4.52E-06	2.34E-04
101	769000	3621000	0.0	5.45E-05	7.15E-02	3.64E-05	1.88E-01	3.94E-06	2.13E-04
102	770000	3621000	0.1	8.90E-05	9.33E-02	8.32E-05	3.40E-01	5.20E-06	2.12E-04
103	771000	3621000	0.1	6.71E-05	6.55E-02	6.24E-05	2.25E-01	9.05E-06	2.58E-04
104	772000	3621000	0.6	8.68E-06	3.42E-03	5.91E-06	7.26E-02	1.15E-06	5.94E-05
105	773000	3621000	0.3	1.63E-05	5.05E-03	6.88E-06	1.17E-01	8.48E-07	1.05E-04
106	774000	3621000	0.3	1.89E-05	5.21E-03	5.67E-06	1.09E-01	1.24E-06	1.10E-04
107	775000	3621000	0.5	4.64E-06	1.63E-03	3.37E-06	5.42E-02	8.12E-07	8.14E-05
108	776000	3621000	0.6	6.32E-06	1.23E-03	1.65E-06	4.41E-02	9.19E-07	8.90E-05
109	777000	3621000	0.6	8.92E-06	1.62E-03	1.95E-06	6.17E-02	1.28E-06	1.10E-04
110	778000	3621000	0.6	8.97E-06	1.34E-03	2.44E-06	9.55E-02	9.65E-07	2.27E-04
111	779000	3621000	0.6	8.49E-06	1.03E-03	2.63E-06	1.14E-01	7.56E-07	2.97E-04
112	780000	3621000	0.6	8.31E-06	8.84E-04	2.60E-06	1.16E-01	7.06E-07	3.07E-04
113	767000	3620000	0.3	1.37E-05	1.55E-03	3.79E-06	1.47E-01	2.34E-05	3.00E-04
114	768000	3620000	0.3	1.08E-05	4.34E-03	3.73E-06	1.18E-01	1.24E-05	2.11E-04
115	769000	3620000	0.3	1.63E-05	1.22E-02	1.11E-05	1.02E-01	6.05E-06	1.47E-04
116	770000	3620000	0.1	4.56E-05	3.81E-02	9.88E-05	2.32E-01	4.67E-06	1.80E-04
117	771000	3620000	0.1	3.76E-05	1.76E-02	8.04E-05	3.20E-01	2.85E-06	1.80E-04
118	772000	3620000	0.4	7.35E-06	6.67E-03	5.84E-06	1.35E-01	9.65E-07	1.03E-04
119	773000	3620000	0.3	1.67E-05	5.35E-03	5.46E-06	1.05E-01	1.77E-06	1.07E-04
120	774000	3620000	0.3	1.54E-05	4.57E-03	5.84E-06	1.16E-01	2.28E-06	1.01E-04
121	775000	3620000	0.3	2.86E-06	2.13E-03	6.31E-06	7.76E-02	1.92E-06	7.36E-05
122	776000	3620000	0.6	5.15E-06	9.25E-04	1.61E-06	3.61E-02	1.27E-06	6.14E-05
123	777000	3620000	0.6	2.72E-06	1.18E-03	3.59E-06	5.39E-02	6.08E-07	7.71E-05
124	778000	3620000	0.6	5.21E-06	1.17E-03	3.47E-06	7.98E-02	5.06E-07	1.60E-04
125	779000	3620000	0.6	6.51E-06	1.05E-03	3.25E-06	9.86E-02	4.49E-07	2.26E-04
126	780000	3620000	0.6	7.31E-06	9.78E-04	3.04E-06	1.07E-01	4.31E-07	2.58E-04
127	767000	3619000	0.3	1.33E-05	1.06E-03	3.06E-06	1.42E-01	3.32E-05	2.97E-04
128	768000	3619000	0.3	1.29E-05	2.95E-03	3.58E-06	1.07E-01	2.01E-05	1.98E-04
129	769000	3619000	0.3	1.57E-05	7.10E-03	9.39E-06	8.59E-02	1.03E-05	1.17E-04
130	770000	3619000	0.0	2.75E-05	1.74E-02	3.94E-05	1.72E-01	5.74E-06	1.29E-04
131	771000	3619000	0.1	1.72E-05	1.22E-02	2.27E-05	1.83E-01	3.07E-06	1.04E-04
132	772000	3619000	0.2	4.46E-06	6.28E-03	7.79E-06	1.99E-01	9.01E-07	1.09E-04
133	773000	3619000	0.3	1.72E-05	3.39E-03	1.56E-06	1.05E-01	2.95E-06	1.53E-04
134	774000	3619000	0.3	1.21E-05	2.11E-03	1.11E-06	1.18E-01	2.27E-06	1.66E-04
135	775000	3619000	0.3	9.90E-06	3.09E-03	3.10E-06	8.54E-02	2.62E-06	1.05E-04
136	776000	3619000	0.6	1.08E-05	1.28E-03	1.48E-06	6.69E-02	1.90E-06	1.18E-04
137	777000	3619000	0.6	4.92E-06	1.47E-03	3.91E-06	7.69E-02	3.35E-07	1.22E-04
138	778000	3619000	0.6	3.35E-06	9.27E-04	3.96E-06	7.88E-02	1.63E-07	1.42E-04
139	779000	3619000	0.6	5.35E-06	1.06E-03	3.62E-06	9.56E-02	1.98E-07	1.96E-04
140	780000	3619000	0.6	6.70E-06	1.09E-03	3.33E-06	1.05E-01	2.26E-07	2.29E-04
141	767000	3618000	0.3	1.55E-05	1.58E-03	3.91E-06	1.45E-01	4.38E-05	3.05E-04
142	768000	3618000	0.3	1.46E-05	3.25E-03	4.44E-06	1.11E-01	2.54E-05	2.08E-04

Grid number	X (meters)	Y (meters)	Vegetation fraction	Arsenic	Copper	Cadmium	Iron	Thallium	Vanadium
143	769000	3618000	0.1	1.94E-05	9.14E-03	9.89E-06	1.22E-01	1.10E-05	1.59E-04
144	770000	3618000	0.0	2.09E-05	1.21E-02	1.53E-05	1.58E-01	2.40E-06	1.17E-04
145	771000	3618000	0.0	1.56E-05	8.93E-03	8.78E-06	2.13E-01	2.70E-06	1.12E-04
146	772000	3618000	0.6	7.28E-06	3.71E-03	1.01E-06	1.46E-01	1.62E-06	7.11E-05
147	773000	3618000	0.3	1.77E-05	4.00E-03	2.47E-06	1.19E-01	2.96E-06	1.78E-04
148	774000	3618000	0.3	1.57E-05	2.45E-03	1.30E-06	1.16E-01	2.92E-06	1.70E-04
149	775000	3618000	0.3	1.32E-05	3.12E-03	2.08E-06	8.17E-02	3.10E-06	1.31E-04
150	776000	3618000	0.6	9.49E-06	6.01E-04	8.32E-07	4.73E-02	1.70E-06	9.47E-05
151	777000	3618000	0.6	5.85E-06	1.14E-03	3.04E-06	8.59E-02	6.08E-07	1.40E-04
152	778000	3618000	0.6	4.75E-06	1.20E-03	3.71E-06	9.64E-02	1.61E-07	1.68E-04
153	779000	3618000	0.6	5.86E-06	1.29E-03	3.64E-06	1.04E-01	1.14E-07	1.98E-04
154	780000	3618000	0.6	6.91E-06	1.28E-03	3.43E-06	1.08E-01	1.30E-07	2.20E-04
155	767000	3617000	0.3	1.70E-05	1.78E-03	4.75E-06	1.62E-01	5.00E-05	3.64E-04
156	768000	3617000	0.3	1.61E-05	2.69E-03	4.89E-06	1.21E-01	2.89E-05	2.55E-04
157	769000	3617000	0.1	1.91E-05	5.08E-03	7.23E-06	1.12E-01	1.30E-05	1.84E-04
158	770000	3617000	0.0	2.36E-05	8.95E-03	9.50E-06	1.50E-01	3.00E-06	1.38E-04
159	771000	3617000	0.0	1.99E-05	9.30E-03	8.33E-06	2.21E-01	1.97E-06	1.34E-04
160	772000	3617000	0.1	1.96E-05	6.94E-03	7.69E-06	2.43E-01	2.34E-06	1.44E-04
161	773000	3617000	0.3	1.62E-05	4.12E-03	7.13E-06	1.47E-01	2.25E-06	1.41E-04
162	774000	3617000	0.5	1.01E-05	2.31E-03	3.46E-06	7.93E-02	1.79E-06	9.94E-05
163	775000	3617000	0.3	1.05E-05	1.17E-03	1.88E-06	7.99E-02	2.81E-06	1.45E-04
164	776000	3617000	0.6	7.43E-06	2.22E-03	2.95E-06	1.47E-01	6.19E-07	1.89E-04
165	777000	3617000	0.6	9.25E-06	2.55E-03	2.99E-06	1.48E-01	4.79E-07	2.39E-04
166	778000	3617000	0.6	7.58E-06	2.00E-03	3.42E-06	1.25E-01	2.41E-07	2.14E-04
167	779000	3617000	0.6	7.38E-06	1.72E-03	3.50E-06	1.17E-01	1.52E-07	2.14E-04
168	780000	3617000	0.6	7.76E-06	1.55E-03	3.41E-06	1.13E-01	1.41E-07	2.21E-04
169	767000	3616000	0.3	1.60E-05	1.41E-03	4.90E-06	1.97E-01	4.95E-05	4.97E-04
170	768000	3616000	0.3	1.69E-05	1.98E-03	5.29E-06	1.44E-01	3.03E-05	3.46E-04
171	769000	3616000	0.3	1.97E-05	3.08E-03	6.34E-06	1.02E-01	1.08E-05	2.03E-04
172	770000	3616000	0.1	2.25E-05	7.45E-03	8.92E-06	1.44E-01	3.54E-06	1.70E-04
173	771000	3616000	0.0	1.91E-05	8.54E-03	9.34E-06	1.97E-01	2.12E-06	1.46E-04
174	772000	3616000	0.0	2.19E-05	7.20E-03	9.85E-06	2.09E-01	1.77E-06	1.35E-04
175	773000	3616000	0.4	1.56E-05	3.96E-03	6.44E-06	1.13E-01	1.39E-06	8.80E-05
176	774000	3616000	0.4	1.71E-05	3.39E-03	5.81E-06	9.57E-02	1.60E-06	8.78E-05
177	775000	3616000	0.4	8.70E-06	1.96E-03	4.76E-06	1.05E-01	1.24E-06	9.23E-05
178	776000	3616000	0.6	9.50E-06	3.21E-03	3.08E-06	1.37E-01	6.93E-07	1.90E-04
179	777000	3616000	0.6	9.73E-06	2.93E-03	3.20E-06	1.47E-01	4.42E-07	2.26E-04
180	778000	3616000	0.6	9.20E-06	2.46E-03	3.33E-06	1.34E-01	3.24E-07	2.25E-04
181	779000	3616000	0.6	8.81E-06	2.06E-03	3.39E-06	1.24E-01	2.62E-07	2.22E-04
182	780000	3616000	0.6	8.77E-06	1.78E-03	3.34E-06	1.17E-01	2.40E-07	2.23E-04
183	767000	3615000	0.3	1.32E-05	9.45E-04	4.59E-06	2.43E-01	5.20E-05	6.61E-04
184	768000	3615000	0.3	1.44E-05	1.31E-03	5.05E-06	1.76E-01	3.32E-05	4.60E-04
185	769000	3615000	0.3	1.71E-05	1.68E-03	6.05E-06	1.13E-01	1.16E-05	2.54E-04
186	770000	3615000	0.1	1.66E-05	1.68E-03	7.35E-06	1.38E-01	2.18E-06	1.54E-04
187	771000	3615000	0.0	1.66E-05	4.15E-03	8.30E-06	1.68E-01	1.43E-06	1.19E-04
188	772000	3615000	0.0	2.07E-05	5.91E-03	9.58E-06	1.74E-01	1.86E-06	1.17E-04
189	773000	3615000	0.4	1.53E-05	4.03E-03	6.42E-06	1.05E-01	1.36E-06	7.99E-05
190	774000	3615000	0.4	1.52E-05	3.35E-03	5.45E-06	1.02E-01	1.64E-06	9.43E-05
191	775000	3615000	0.3	1.57E-05	3.79E-03	5.29E-06	1.37E-01	1.60E-06	1.40E-04

Grid number	X (meters)	Y (meters)	Vegetation fraction	Arsenic	Copper	Cadmium	Iron	Thallium	Vanadium
192	776000	3615000	0.6	8.96E-06	2.47E-03	3.03E-06	1.12E-01	6.37E-07	1.48E-04
193	777000	3615000	0.6	1.02E-05	2.79E-03	3.15E-06	1.29E-01	5.48E-07	2.01E-04
194	778000	3615000	0.6	1.01E-05	2.53E-03	3.27E-06	1.27E-01	4.90E-07	2.16E-04
195	779000	3615000	0.6	9.85E-06	2.20E-03	3.30E-06	1.22E-01	4.51E-07	2.20E-04
196	780000	3615000	0.6	9.68E-06	1.90E-03	3.26E-06	1.16E-01	4.22E-07	2.22E-04
197	767000	3614000	0.3	8.25E-06	5.00E-04	3.78E-06	2.97E-01	5.94E-05	8.43E-04
198	768000	3614000	0.3	1.00E-05	8.90E-04	4.16E-06	2.11E-01	3.80E-05	5.70E-04
199	769000	3614000	0.3	1.20E-05	1.39E-03	4.49E-06	1.26E-01	1.57E-05	2.95E-04
200	770000	3614000	0.1	1.36E-05	2.52E-03	5.17E-06	1.01E-01	4.74E-06	1.55E-04
201	771000	3614000	0.0	1.58E-05	3.10E-03	6.52E-06	1.29E-01	3.92E-06	1.21E-04
202	772000	3614000	0.0	1.82E-05	4.63E-03	8.57E-06	1.54E-01	3.78E-06	1.24E-04
203	773000	3614000	0.3	1.61E-05	4.48E-03	7.49E-06	1.30E-01	1.94E-06	1.08E-04
204	774000	3614000	0.3	1.93E-05	3.91E-03	6.13E-06	1.61E-01	2.16E-06	1.64E-04
205	775000	3614000	0.3	1.55E-05	2.62E-03	2.97E-06	2.03E-01	2.14E-06	2.36E-04
206	776000	3614000	0.6	1.07E-05	2.49E-03	2.66E-06	1.15E-01	7.79E-07	1.62E-04
207	777000	3614000	0.6	1.10E-05	2.61E-03	3.09E-06	1.16E-01	7.62E-07	1.90E-04
208	778000	3614000	0.6	1.08E-05	2.42E-03	3.23E-06	1.17E-01	7.71E-07	2.06E-04
209	779000	3614000	0.6	1.06E-05	2.15E-03	3.23E-06	1.16E-01	7.37E-07	2.15E-04
210	780000	3614000	0.6	1.04E-05	1.90E-03	3.18E-06	1.13E-01	6.87E-07	2.18E-04
211	767000	3613000	0.3	7.99E-06	3.37E-04	3.36E-06	3.04E-01	5.70E-05	8.74E-04
212	768000	3613000	0.3	8.72E-06	7.15E-04	3.54E-06	2.23E-01	3.80E-05	6.09E-04
213	769000	3613000	0.3	1.08E-05	1.28E-03	3.85E-06	1.34E-01	1.55E-05	3.10E-04
214	770000	3613000	0.3	1.14E-05	1.59E-03	3.69E-06	8.16E-02	3.49E-06	1.26E-04
215	771000	3613000	0.0	1.59E-05	1.95E-03	4.46E-06	1.22E-01	1.05E-05	1.79E-04
216	772000	3613000	0.0	1.36E-05	3.22E-03	7.13E-06	1.49E-01	7.04E-06	1.67E-04
217	773000	3613000	0.1	1.06E-05	4.18E-03	8.99E-06	1.71E-01	2.56E-06	1.56E-04
218	774000	3613000	0.3	1.30E-05	4.21E-03	6.48E-06	2.22E-01	1.10E-06	2.16E-04
219	775000	3613000	0.3	1.70E-05	4.54E-03	4.29E-06	3.07E-01	1.42E-06	3.30E-04
220	776000	3613000	0.6	1.08E-05	2.53E-03	3.00E-06	1.17E-01	1.03E-06	1.81E-04
221	777000	3613000	0.6	1.11E-05	2.35E-03	3.23E-06	1.07E-01	1.21E-06	1.90E-04
222	778000	3613000	0.6	1.11E-05	2.18E-03	3.22E-06	1.08E-01	1.21E-06	2.01E-04
223	779000	3613000	0.6	1.11E-05	1.99E-03	3.16E-06	1.09E-01	1.13E-06	2.10E-04
224	780000	3613000	0.6	1.09E-05	1.80E-03	3.08E-06	1.09E-01	1.03E-06	2.15E-04
225	767000	3612000	0.3	1.05E-05	2.97E-04	3.22E-06	2.86E-01	4.95E-05	8.23E-04
226	768000	3612000	0.3	9.90E-06	5.76E-04	3.21E-06	2.25E-01	3.54E-05	6.15E-04
227	769000	3612000	0.3	1.06E-05	9.43E-04	3.31E-06	1.58E-01	1.93E-05	3.86E-04
228	770000	3612000	0.3	1.08E-05	1.13E-03	3.21E-06	1.16E-01	9.71E-06	2.35E-04
229	771000	3612000	0.3	9.66E-06	1.15E-03	3.16E-06	1.09E-01	8.34E-06	1.93E-04
230	772000	3612000	0.3	7.06E-06	1.57E-03	4.21E-06	1.19E-01	6.00E-06	1.78E-04
231	773000	3612000	0.3	3.06E-06	2.10E-03	5.56E-06	1.37E-01	2.70E-06	1.77E-04
232	774000	3612000	0.3	2.12E-06	2.71E-03	5.28E-06	1.81E-01	1.18E-06	2.50E-04
233	775000	3612000	0.3	4.73E-06	3.05E-03	4.68E-06	2.04E-01	1.72E-06	3.31E-04
234	776000	3612000	0.6	8.07E-06	1.72E-03	3.53E-06	1.05E-01	1.94E-06	1.90E-04
235	777000	3612000	0.6	1.05E-05	1.85E-03	3.27E-06	1.00E-01	1.91E-06	1.91E-04
236	778000	3612000	0.6	1.13E-05	1.84E-03	3.12E-06	1.01E-01	1.76E-06	1.99E-04
237	779000	3612000	0.6	1.14E-05	1.75E-03	3.02E-06	1.04E-01	1.59E-06	2.07E-04
238	780000	3612000	0.6	1.13E-05	1.64E-03	2.93E-06	1.05E-01	1.43E-06	2.13E-04
239	767000	3611000	0.3	1.21E-05	2.01E-04	2.95E-06	2.78E-01	4.52E-05	8.00E-04
240	768000	3611000	0.3	1.11E-05	3.99E-04	2.89E-06	2.31E-01	3.45E-05	6.37E-04

Grid number	X (meters)	Y (meters)	Vegetation fraction	Arsenic	Copper	Cadmium	Iron	Thallium	Vanadium
241	769000	3611000	0.3	1.08E-05	6.20E-04	2.87E-06	1.85E-01	2.34E-05	4.73E-04
242	770000	3611000	0.3	1.04E-05	7.83E-04	2.84E-06	1.53E-01	1.53E-05	3.52E-04
243	771000	3611000	0.3	9.39E-06	9.26E-04	2.94E-06	1.41E-01	1.08E-05	2.88E-04
244	772000	3611000	0.3	7.70E-06	1.18E-03	3.35E-06	1.46E-01	7.50E-06	2.65E-04
245	773000	3611000	0.3	6.25E-06	1.50E-03	3.65E-06	1.63E-01	4.43E-06	2.73E-04
246	774000	3611000	0.3	7.10E-06	1.80E-03	3.24E-06	1.90E-01	2.22E-06	3.19E-04
247	775000	3611000	0.3	1.16E-05	2.02E-03	3.02E-06	2.02E-01	1.86E-06	3.57E-04
248	776000	3611000	0.6	9.58E-06	1.28E-03	2.51E-06	9.87E-02	2.29E-06	1.89E-04
249	777000	3611000	0.6	1.11E-05	1.42E-03	2.82E-06	9.44E-02	2.54E-06	1.90E-04
250	778000	3611000	0.6	1.16E-05	1.50E-03	2.82E-06	9.74E-02	2.31E-06	2.00E-04
251	779000	3611000	0.6	1.17E-05	1.50E-03	2.78E-06	1.00E-01	2.08E-06	2.08E-04
252	780000	3611000	0.6	1.16E-05	1.45E-03	2.74E-06	1.02E-01	1.87E-06	2.14E-04
253	767000	3610000	0.3	1.32E-05	8.58E-05	2.66E-06	2.75E-01	4.27E-05	7.95E-04
254	768000	3610000	0.3	1.22E-05	2.34E-04	2.59E-06	2.40E-01	3.44E-05	6.66E-04
255	769000	3610000	0.3	1.16E-05	3.94E-04	2.53E-06	2.07E-01	2.60E-05	5.42E-04
256	770000	3610000	0.3	1.10E-05	5.43E-04	2.50E-06	1.82E-01	1.89E-05	4.42E-04
257	771000	3610000	0.3	1.04E-05	6.95E-04	2.52E-06	1.71E-01	1.38E-05	3.79E-04
258	772000	3610000	0.3	9.90E-06	8.83E-04	2.58E-06	1.72E-01	9.85E-06	3.49E-04
259	773000	3610000	0.3	1.03E-05	1.09E-03	2.46E-06	1.84E-01	6.62E-06	3.50E-04
260	774000	3610000	0.3	1.30E-05	1.27E-03	1.95E-06	2.04E-01	4.08E-06	3.73E-04
261	775000	3610000	0.3	1.76E-05	1.43E-03	1.72E-06	2.12E-01	3.05E-06	3.89E-04
262	776000	3610000	0.6	1.13E-05	9.68E-04	1.78E-06	1.01E-01	2.80E-06	2.00E-04
263	777000	3610000	0.6	1.18E-05	1.12E-03	2.25E-06	9.53E-02	3.02E-06	1.98E-04
264	778000	3610000	0.6	1.19E-05	1.22E-03	2.43E-06	9.73E-02	2.81E-06	2.06E-04
265	779000	3610000	0.6	1.19E-05	1.26E-03	2.49E-06	9.96E-02	2.56E-06	2.12E-04
266	780000	3610000	0.6	1.18E-05	1.26E-03	2.50E-06	1.01E-01	2.32E-06	2.17E-04
267	767000	3609000	0.3	1.42E-05	2.37E-05	2.39E-06	2.75E-01	4.13E-05	7.98E-04
268	768000	3609000	0.3	1.33E-05	9.69E-05	2.32E-06	2.48E-01	3.44E-05	6.94E-04
269	769000	3609000	0.3	1.26E-05	2.27E-04	2.25E-06	2.23E-01	2.76E-05	5.95E-04
270	770000	3609000	0.3	1.22E-05	3.61E-04	2.20E-06	2.04E-01	2.15E-05	5.13E-04
271	771000	3609000	0.3	1.19E-05	5.01E-04	2.15E-06	1.93E-01	1.65E-05	4.54E-04
272	772000	3609000	0.3	1.21E-05	6.55E-04	2.08E-06	1.91E-01	1.25E-05	4.20E-04
273	773000	3609000	0.3	1.32E-05	8.17E-04	1.92E-06	1.97E-01	9.25E-06	4.08E-04
274	774000	3609000	0.3	1.54E-05	9.77E-04	1.72E-06	2.04E-01	6.92E-06	4.08E-04
275	775000	3609000	0.3	1.81E-05	1.15E-03	1.85E-06	2.02E-01	5.85E-06	4.03E-04
276	776000	3609000	0.6	1.14E-05	7.82E-04	1.44E-06	1.07E-01	3.40E-06	2.21E-04
277	777000	3609000	0.6	1.19E-05	9.06E-04	1.83E-06	1.02E-01	3.45E-06	2.16E-04
278	778000	3609000	0.6	1.20E-05	1.01E-03	2.07E-06	1.00E-01	3.28E-06	2.17E-04
279	779000	3609000	0.6	1.20E-05	1.07E-03	2.20E-06	1.01E-01	3.04E-06	2.20E-04
280	780000	3609000	0.6						

Human Health Risk Assessment

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Volume II
Appendices E - G

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Appendix E

Risk Calculation Tables

Appendix E.1

RME Cancer Risks

Index of Excess Lifetime Cancer Risks for Residents - Reasonable Maximum Exposure

Sheet Number	EA	Receptor	Media	Exposure Pathway
1	1	Child Future Resident	Air	Inhalation
2	1	Child Future Resident	Soil	Ingestion
3	1	Child Future Resident	Soil	Dermal
4	1	Child Future Resident	Beef	Ingestion
5	1	Child Future Resident	Chicken	Ingestion
6	1	Child Future Resident	Eggs	Ingestion
7	1	Child Future Resident	Vegetables	Ingestion
8	1	Adult Future Resident	Air	Inhalation
9	1	Adult Future Resident	Soil	Ingestion
10	1	Adult Future Resident	Soil	Dermal
11	1	Adult Future Resident	Beef	Ingestion
12	1	Adult Future Resident	Chicken	Ingestion
13	1	Adult Future Resident	Eggs	Ingestion
14	1	Adult Future Resident	Vegetables	Ingestion
15	2	Child Current and Future Resident	Air	Inhalation
16	2	Child Current and Future Resident	Soil	Ingestion
17	2	Child Current and Future Resident	Soil	Dermal
18	2	Child Future Resident	Beef	Ingestion
19	2	Child Future Resident	Chicken	Ingestion
20	2	Child Future Resident	Eggs	Ingestion
21	2	Child Future Resident	Vegetables	Ingestion
22	2	Adult Current and Future Resident	Air	Inhalation
23	2	Adult Current and Future Resident	Soil	Ingestion
24	2	Adult Current and Future Resident	Soil	Dermal
25	2	Adult Future Resident	Beef	Ingestion
26	2	Adult Future Resident	Chicken	Ingestion
27	2	Adult Future Resident	Eggs	Ingestion
28	2	Adult Future Resident	Vegetables	Ingestion
29	3	Child Future Resident	Air	Inhalation
30	3	Child Future Resident	Soil	Ingestion
31	3	Child Future Resident	Soil	Dermal
32	3	Child Future Resident	Beef	Ingestion
33	3	Child Future Resident	Chicken	Ingestion
34	3	Child Future Resident	Eggs	Ingestion
35	3	Child Future Resident	Vegetables	Ingestion
36	3	Adult Future Resident	Air	Inhalation
37	3	Adult Future Resident	Soil	Ingestion
38	3	Adult Future Resident	Soil	Dermal
39	3	Adult Future Resident	Beef	Ingestion
40	3	Adult Future Resident	Chicken	Ingestion
41	3	Adult Future Resident	Eggs	Ingestion
42	3	Adult Future Resident	Vegetables	Ingestion
43	4	Child Future Resident	Air	Inhalation
44	4	Child Future Resident	Soil	Ingestion
45	4	Child Future Resident	Soil	Dermal
46	4	Child Future Resident	Beef	Ingestion
47	4	Child Future Resident	Chicken	Ingestion
48	4	Child Future Resident	Eggs	Ingestion
49	4	Child Future Resident	Vegetables	Ingestion
50	4	Adult Future Resident	Air	Inhalation
51	4	Adult Future Resident	Soil	Ingestion
52	4	Adult Future Resident	Soil	Dermal
53	4	Adult Future Resident	Beef	Ingestion
54	4	Adult Future Resident	Chicken	Ingestion
55	4	Adult Future Resident	Eggs	Ingestion
56	4	Adult Future Resident	Vegetables	Ingestion
57	5	Child Future Resident	Air	Inhalation
58	5	Child Future Resident	Soil	Ingestion
59	5	Child Future Resident	Soil	Dermal
60	5	Child Future Resident	Beef	Ingestion
61	5	Child Future Resident	Chicken	Ingestion
62	5	Child Future Resident	Eggs	Ingestion
63	5	Child Future Resident	Vegetables	Ingestion
64	5	Adult Future Resident	Air	Inhalation
65	5	Adult Future Resident	Soil	Ingestion
66	5	Adult Future Resident	Soil	Dermal
67	5	Adult Future Resident	Beef	Ingestion
68	5	Adult Future Resident	Chicken	Ingestion
69	5	Adult Future Resident	Eggs	Ingestion
70	5	Adult Future Resident	Vegetables	Ingestion

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.1E-06	9.0E-08	4.3E-03	3.9E-07	80%
Cadmium	6.4E-07	5.3E-08	1.8E-03	9.5E-08	20%
Iron	6.2E-03	5.1E-04	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	3.2E-08	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	8.9E-07	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**4.8E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =	**8.22E-02**	
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	1.6E-06	1.5E+00	2.4E-06	100%
Cadmium	1.5E+00	100%	1.6E-06	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	2.8E-02	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	100%	4.5E-07	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	100%	6.1E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.4E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =	**1.10E-06**
25550	AT = Averaging Time - Cancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
200	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	2.7E-07	1.5E+00	4.0E-07	100%
Cadmium	1.5E+00	0.1%	4.5E-09	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	7.7E-04	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	1%	1.2E-08	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	1%	1.7E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.0E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**3.07E-06**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	2800	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.1E-03	7.4E-07	1.5E+00	1.1E-06	100%
Cadmium	2.0E-04	3.7E-08	0.0E+00	0.0E+00	0%
Iron	2.5E+02	4.6E-02	0.0E+00	0.0E+00	0%
Thallium	4.3E-02	7.8E-06	0.0E+00	0.0E+00	0%
Vanadium	8.4E-02	1.5E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.1E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.81E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.5E-02	1.6E-06	1.5E+00	2.4E-06	100%
Cadmium	9.8E-04	1.0E-07	0.0E+00	0.0E+00	0%
Iron	3.4E+02	3.6E-02	0.0E+00	0.0E+00	0%
Thallium	5.6E-03	6.0E-07	0.0E+00	0.0E+00	0%
Vanadium	4.6E-01	4.9E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.4E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.07E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.5E-02	1.3E-06	1.5E+00	1.9E-06	100%
Cadmium	2.2E-05	1.9E-09	0.0E+00	0.0E+00	0%
Iron	2.9E+02	2.5E-02	0.0E+00	0.0E+00	0%
Thallium	3.7E-05	3.2E-09	0.0E+00	0.0E+00	0%
Vanadium	5.7E-01	4.9E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.9E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**8.63E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.05	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.0E-01	2.0E-05	1.5E+00	2.9E-05	100%
Cadmium	6.1E-01	6.0E-05	0.0E+00	0.0E+00	0%
Iron	1.0E+02	1.0E-02	0.0E+00	0.0E+00	0%
Thallium	8.0E-04	7.9E-08	0.0E+00	0.0E+00	0%
Vanadium	3.0E-01	2.9E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.9E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **9.86E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.1E-06	3.6E-07	4.3E-03	1.6E-06	80%
Cadmium	6.4E-07	2.1E-07	1.8E-03	3.8E-07	20%
Iron	6.2E-03	2.0E-03	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	1.3E-07	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	3.6E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.9E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**3.29E-01**
	613200	AT = Averaging Time - Cancer (hours)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	6.9E-07	1.5E+00	1.0E-06	100%
Cadmium	1.5E+00	100%	7.0E-07	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	1.2E-02	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	100%	1.9E-07	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	100%	2.6E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**4.70E-07**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	1.6E-07	1.5E+00	2.5E-07	100%
Cadmium	1.5E+00	0.1%	2.8E-09	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	4.7E-04	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	1%	7.6E-09	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	1%	1.0E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.5E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.87E-06**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.1E-03	3.0E-06	1.5E+00	4.4E-06	100%
Cadmium	2.0E-04	1.5E-07	0.0E+00	0.0E+00	0%
Iron	2.5E+02	1.8E-01	0.0E+00	0.0E+00	0%
Thallium	4.3E-02	3.1E-05	0.0E+00	0.0E+00	0%
Vanadium	8.4E-02	6.1E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**4.4E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **7.23E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.5E-02	6.5E-06	1.5E+00	9.7E-06	100%
Cadmium	9.8E-04	4.2E-07	0.0E+00	0.0E+00	0%
Iron	3.4E+02	1.4E-01	0.0E+00	0.0E+00	0%
Thallium	5.6E-03	2.4E-06	0.0E+00	0.0E+00	0%
Vanadium	4.6E-01	1.9E-04	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**9.7E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**4.27E-04**	$(day)^{-1}$
	25550	AT = Averaging Time - Cancer (days)
	0.001	CF = Conversion Factor (kg/g)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	1.3	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**

Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.5E-02	5.0E-06	1.5E+00	7.6E-06	100%
Cadmium	2.2E-05	7.7E-09	0.0E+00	0.0E+00	0%
Iron	2.9E+02	1.0E-01	0.0E+00	0.0E+00	0%
Thallium	3.7E-05	1.3E-08	0.0E+00	0.0E+00	0%
Vanadium	5.7E-01	2.0E-04	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**7.6E-06**	

Notes:

NA indicates that an exposure point concentration is not available.

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**3.45E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
24	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.05	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.0E-01	7.9E-05	1.5E+00	1.2E-04	100%
Cadmium	6.1E-01	2.4E-04	0.0E+00	0.0E+00	0%
Iron	1.0E+02	4.0E-02	0.0E+00	0.0E+00	0%
Thallium	8.0E-04	3.2E-07	0.0E+00	0.0E+00	0%
Vanadium	3.0E-01	1.2E-04	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.2E-04**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**3.95E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
24	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Current and Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	5.5E-07	4.5E-08	4.3E-03	1.9E-07	78%
Cadmium	3.6E-07	3.0E-08	1.8E-03	5.3E-08	22%
Iron	7.5E-03	6.2E-04	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	7.7E-08	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	1.5E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.5E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**8.22E-02**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Current and Future**
Child Current Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	1.6E-06	1.5E+00	2.4E-06	100%
Cadmium	1.3E+00	100%	1.4E-06	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	2.8E-02	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	100%	6.4E-07	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	100%	4.9E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.4E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.10E-06**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	200	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Current and Future**

Child Current Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	2.7E-07	1.5E+00	4.0E-07	100%
Cadmium	1.3E+00	0.1%	4.1E-09	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	7.7E-04	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	1%	1.8E-08	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	1%	1.4E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.0E-07**	

Notes:

NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**3.07E-06**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	2800	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.9E-03	1.2E-06	1.5E+00	1.9E-06	100%
Cadmium	1.9E-04	3.5E-08	0.0E+00	0.0E+00	0%
Iron	2.0E+02	3.6E-02	0.0E+00	0.0E+00	0%
Thallium	1.3E-01	2.4E-05	0.0E+00	0.0E+00	0%
Vanadium	4.5E-02	8.1E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.9E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.81E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-02	2.7E-06	1.5E+00	4.1E-06	100%
Cadmium	9.2E-04	9.8E-08	0.0E+00	0.0E+00	0%
Iron	2.7E+02	2.8E-02	0.0E+00	0.0E+00	0%
Thallium	1.7E-02	1.8E-06	0.0E+00	0.0E+00	0%
Vanadium	2.4E-01	2.6E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**4.1E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.07E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.5E-02	2.1E-06	1.5E+00	3.2E-06	100%
Cadmium	2.1E-05	1.8E-09	0.0E+00	0.0E+00	0%
Iron	2.3E+02	2.0E-02	0.0E+00	0.0E+00	0%
Thallium	1.2E-04	9.9E-09	0.0E+00	0.0E+00	0%
Vanadium	3.0E-01	2.6E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.2E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**8.63E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.05	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.0E-01	2.0E-05	1.5E+00	3.0E-05	100%
Cadmium	6.5E-01	6.5E-05	0.0E+00	0.0E+00	0%
Iron	6.0E+01	5.9E-03	0.0E+00	0.0E+00	0%
Thallium	3.7E-04	3.6E-08	0.0E+00	0.0E+00	0%
Vanadium	8.5E-02	8.4E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.0E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **9.86E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Current and Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	5.5E-07	1.8E-07	4.3E-03	7.8E-07	78%
Cadmium	3.6E-07	1.2E-07	1.8E-03	2.1E-07	22%
Iron	7.5E-03	2.5E-03	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	3.1E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	6.0E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**9.9E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =	**3.29E-01**	
	613200	AT = Averaging Time - Cancer (hours)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Current and Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	6.8E-07	1.5E+00	1.0E-06	100%
Cadmium	1.3E+00	100%	6.2E-07	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	1.2E-02	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	100%	2.7E-07	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	100%	2.1E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**4.70E-07**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Current and Future**

Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	1.6E-07	1.5E+00	2.5E-07	100%
Cadmium	1.3E+00	0.1%	2.5E-09	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	4.7E-04	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	1%	1.1E-08	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	1%	8.4E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.5E-07**	

Notes:

NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.87E-06**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.9E-03	5.0E-06	1.5E+00	7.5E-06	100%
Cadmium	1.9E-04	1.4E-07	0.0E+00	0.0E+00	0%
Iron	2.0E+02	1.5E-01	0.0E+00	0.0E+00	0%
Thallium	1.3E-01	9.6E-05	0.0E+00	0.0E+00	0%
Vanadium	4.5E-02	3.2E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**7.5E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**7.23E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
24	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
2.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-02	1.1E-05	1.5E+00	1.6E-05	100%
Cadmium	9.2E-04	3.9E-07	0.0E+00	0.0E+00	0%
Iron	2.7E+02	1.1E-01	0.0E+00	0.0E+00	0%
Thallium	1.7E-02	7.4E-06	0.0E+00	0.0E+00	0%
Vanadium	2.4E-01	1.0E-04	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.6E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**4.27E-04**	$(day)^{-1}$
	25550	AT = Averaging Time - Cancer (days)
	0.001	CF = Conversion Factor (kg/g)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	1.3	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.5E-02	8.5E-06	1.5E+00	1.3E-05	100%
Cadmium	2.1E-05	7.2E-09	0.0E+00	0.0E+00	0%
Iron	2.3E+02	8.0E-02	0.0E+00	0.0E+00	0%
Thallium	1.2E-04	4.0E-08	0.0E+00	0.0E+00	0%
Vanadium	3.0E-01	1.0E-04	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.3E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**3.45E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
24	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.05	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.0E-01	7.9E-05	1.5E+00	1.2E-04	100%
Cadmium	6.5E-01	2.6E-04	0.0E+00	0.0E+00	0%
Iron	6.0E+01	2.4E-02	0.0E+00	0.0E+00	0%
Thallium	3.7E-04	1.4E-07	0.0E+00	0.0E+00	0%
Vanadium	8.5E-02	3.3E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.2E-04**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**3.95E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
24	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Inhalation of Outdoor Soil

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.4E-06	1.2E-07	4.3E-03	4.9E-07	61%
Cadmium	2.2E-06	1.8E-07	1.8E-03	3.2E-07	39%
Iron	8.4E-03	6.9E-04	0.0E+00	0.0E+00	0%
Thallium	4.2E-07	3.5E-08	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	7.7E-07	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**8.1E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**8.22E-02**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.2E+00	50%	3.4E-06	1.5E+00	5.1E-06	100%
Cadmium	2.8E+01	100%	3.1E-05	0.0E+00	0.0E+00	0%
Iron	5.7E+04	100%	6.3E-02	0.0E+00	0.0E+00	0%
Thallium	6.6E-01	100%	7.2E-07	0.0E+00	0.0E+00	0%
Vanadium	3.2E+01	100%	3.5E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**5.1E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =	**1.10E-06**
25550	AT = Averaging Time - Cancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
200	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.2E+00	3%	5.7E-07	1.5E+00	8.5E-07	100%
Cadmium	2.8E+01	0.1%	8.7E-08	0.0E+00	0.0E+00	0%
Iron	5.7E+04	1%	1.8E-03	0.0E+00	0.0E+00	0%
Thallium	6.6E-01	1%	2.0E-08	0.0E+00	0.0E+00	0%
Vanadium	3.2E+01	1%	9.7E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**8.5E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**3.07E-06**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	2800	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.8E-03	1.2E-06	1.5E+00	1.8E-06	100%
Cadmium	5.0E-03	9.1E-07	0.0E+00	0.0E+00	0%
Iron	6.0E+02	1.1E-01	0.0E+00	0.0E+00	0%
Thallium	1.4E-02	2.5E-06	0.0E+00	0.0E+00	0%
Vanadium	4.4E-02	7.9E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.8E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.81E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.5E-02	2.7E-06	1.5E+00	4.0E-06	100%
Cadmium	2.4E-02	2.6E-06	0.0E+00	0.0E+00	0%
Iron	8.0E+02	8.5E-02	0.0E+00	0.0E+00	0%
Thallium	1.8E-03	2.0E-07	0.0E+00	0.0E+00	0%
Vanadium	2.4E-01	2.5E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**4.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**1.07E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.3	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.4E-02	2.1E-06	1.5E+00	3.1E-06	100%
Cadmium	5.5E-04	4.7E-08	0.0E+00	0.0E+00	0%
Iron	6.9E+02	6.0E-02	0.0E+00	0.0E+00	0%
Thallium	1.2E-05	1.1E-09	0.0E+00	0.0E+00	0%
Vanadium	2.9E-01	2.5E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.1E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**8.63E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.05	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.8E-01	1.8E-05	1.5E+00	2.7E-05	100%
Cadmium	6.4E-01	6.3E-05	0.0E+00	0.0E+00	0%
Iron	1.0E+02	1.0E-02	0.0E+00	0.0E+00	0%
Thallium	2.4E-03	2.3E-07	0.0E+00	0.0E+00	0%
Vanadium	1.1E-01	1.1E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.7E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**9.86E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Adult Resident/Inhalation of Outdoor Soil

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.4E-06	4.6E-07	4.3E-03	2.0E-06	61%
Cadmium	2.2E-06	7.1E-07	1.8E-03	1.3E-06	39%
Iron	8.4E-03	2.8E-03	0.0E+00	0.0E+00	0%
Thallium	4.2E-07	1.4E-07	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	3.1E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.3E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =	**3.29E-01**	
	613200	AT = Averaging Time - Cancer (hours)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.2E+00	50%	1.5E-06	1.5E+00	2.2E-06	100%
Cadmium	2.8E+01	100%	1.3E-05	0.0E+00	0.0E+00	0%
Iron	5.7E+04	100%	2.7E-02	0.0E+00	0.0E+00	0%
Thallium	6.6E-01	100%	3.1E-07	0.0E+00	0.0E+00	0%
Vanadium	3.2E+01	100%	1.5E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.2E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**4.70E-07**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.2E+00	3%	3.5E-07	1.5E+00	5.2E-07	100%
Cadmium	2.8E+01	0.1%	5.3E-08	0.0E+00	0.0E+00	0%
Iron	5.7E+04	1%	1.1E-03	0.0E+00	0.0E+00	0%
Thallium	6.6E-01	1%	1.2E-08	0.0E+00	0.0E+00	0%
Vanadium	3.2E+01	1%	5.9E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**5.2E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.87E-06**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.8E-03	4.9E-06	1.5E+00	7.4E-06	100%
Cadmium	5.0E-03	3.6E-06	0.0E+00	0.0E+00	0%
Iron	6.0E+02	4.4E-01	0.0E+00	0.0E+00	0%
Thallium	1.4E-02	1.0E-05	0.0E+00	0.0E+00	0%
Vanadium	4.4E-02	3.1E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**7.4E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **7.23E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.5E-02	1.1E-05	1.5E+00	1.6E-05	100%
Cadmium	2.4E-02	1.0E-05	0.0E+00	0.0E+00	0%
Iron	8.0E+02	3.4E-01	0.0E+00	0.0E+00	0%
Thallium	1.8E-03	7.9E-07	0.0E+00	0.0E+00	0%
Vanadium	2.4E-01	1.0E-04	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.6E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**4.27E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
24	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.3	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Adult Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.4E-02	8.3E-06	1.5E+00	1.2E-05	100%
Cadmium	5.5E-04	1.9E-07	0.0E+00	0.0E+00	0%
Iron	6.9E+02	2.4E-01	0.0E+00	0.0E+00	0%
Thallium	1.2E-05	4.2E-09	0.0E+00	0.0E+00	0%
Vanadium	2.9E-01	1.0E-04	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.2E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.45E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.8E-01	7.2E-05	1.5E+00	1.1E-04	100%
Cadmium	6.4E-01	2.5E-04	0.0E+00	0.0E+00	0%
Iron	1.0E+02	4.1E-02	0.0E+00	0.0E+00	0%
Thallium	2.4E-03	9.3E-07	0.0E+00	0.0E+00	0%
Vanadium	1.1E-01	4.3E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.1E-04**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**3.95E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
24	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Inhalation of Outdoor Soil

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-06	2.2E-07	4.3E-03	9.3E-07	73%
Cadmium	2.4E-06	1.9E-07	1.8E-03	3.5E-07	27%
Iron	1.1E-02	8.9E-04	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	2.9E-08	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	7.7E-07	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.3E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**8.22E-02**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E+00	50%	2.7E-06	1.5E+00	4.1E-06	100%
Cadmium	4.1E+00	100%	4.5E-06	0.0E+00	0.0E+00	0%
Iron	2.3E+04	100%	2.5E-02	0.0E+00	0.0E+00	0%
Thallium	5.4E-01	100%	5.9E-07	0.0E+00	0.0E+00	0%
Vanadium	2.9E+01	100%	3.2E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.1E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.10E-06**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	200	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E+00	3%	4.5E-07	1.5E+00	6.8E-07	100%
Cadmium	4.1E+00	0.1%	1.2E-08	0.0E+00	0.0E+00	0%
Iron	2.3E+04	1%	7.1E-04	0.0E+00	0.0E+00	0%
Thallium	5.4E-01	1%	1.7E-08	0.0E+00	0.0E+00	0%
Vanadium	2.9E+01	1%	9.0E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**6.8E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**3.07E-06**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	2800	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.0E-02	1.8E-06	1.5E+00	2.7E-06	100%
Cadmium	6.6E-04	1.2E-07	0.0E+00	0.0E+00	0%
Iron	2.4E+02	4.4E-02	0.0E+00	0.0E+00	0%
Thallium	1.2E-02	2.1E-06	0.0E+00	0.0E+00	0%
Vanadium	4.0E-02	7.3E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.7E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.81E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	3.1E-02	3.3E-06	1.5E+00	5.0E-06	100%
Cadmium	3.2E-03	3.4E-07	0.0E+00	0.0E+00	0%
Iron	3.2E+02	3.5E-02	0.0E+00	0.0E+00	0%
Thallium	1.5E-03	1.6E-07	0.0E+00	0.0E+00	0%
Vanadium	2.2E-01	2.3E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**5.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.07E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	3.0E-02	2.6E-06	1.5E+00	3.9E-06	100%
Cadmium	7.2E-05	6.2E-09	0.0E+00	0.0E+00	0%
Iron	2.8E+02	2.4E-02	0.0E+00	0.0E+00	0%
Thallium	1.0E-05	8.7E-10	0.0E+00	0.0E+00	0%
Vanadium	2.7E-01	2.3E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.9E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **8.63E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-01	2.6E-05	1.5E+00	3.8E-05	100%
Cadmium	1.4E+00	1.3E-04	0.0E+00	0.0E+00	0%
Iron	1.4E+02	1.4E-02	0.0E+00	0.0E+00	0%
Thallium	7.0E-05	6.9E-09	0.0E+00	0.0E+00	0%
Vanadium	2.2E-01	2.1E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.8E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **9.86E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Adult Resident/Inhalation of Outdoor Soil

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-06	8.7E-07	4.3E-03	3.7E-06	73%
Cadmium	2.4E-06	7.8E-07	1.8E-03	1.4E-06	27%
Iron	1.1E-02	3.6E-03	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	1.2E-07	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	3.1E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**5.1E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**3.29E-01**
	613200	AT = Averaging Time - Cancer (hours)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E+00	50%	1.2E-06	1.5E+00	1.7E-06	100%
Cadmium	4.1E+00	100%	1.9E-06	0.0E+00	0.0E+00	0%
Iron	2.3E+04	100%	1.1E-02	0.0E+00	0.0E+00	0%
Thallium	5.4E-01	100%	2.5E-07	0.0E+00	0.0E+00	0%
Vanadium	2.9E+01	100%	1.4E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.7E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**4.70E-07**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E+00	3%	2.8E-07	1.5E+00	4.2E-07	100%
Cadmium	4.1E+00	0.1%	7.6E-09	0.0E+00	0.0E+00	0%
Iron	2.3E+04	1%	4.3E-04	0.0E+00	0.0E+00	0%
Thallium	5.4E-01	1%	1.0E-08	0.0E+00	0.0E+00	0%
Vanadium	2.9E+01	1%	5.5E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.2E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.87E-06**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.0E-02	7.3E-06	1.5E+00	1.1E-05	100%
Cadmium	6.6E-04	4.8E-07	0.0E+00	0.0E+00	0%
Iron	2.4E+02	1.8E-01	0.0E+00	0.0E+00	0%
Thallium	1.2E-02	8.4E-06	0.0E+00	0.0E+00	0%
Vanadium	4.0E-02	2.9E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.1E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **7.23E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	3.1E-02	1.3E-05	1.5E+00	2.0E-05	100%
Cadmium	3.2E-03	1.3E-06	0.0E+00	0.0E+00	0%
Iron	3.2E+02	1.4E-01	0.0E+00	0.0E+00	0%
Thallium	1.5E-03	6.5E-07	0.0E+00	0.0E+00	0%
Vanadium	2.2E-01	9.3E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.0E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**4.27E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
24	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.3	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Adult Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	3.0E-02	1.0E-05	1.5E+00	1.6E-05	100%
Cadmium	7.2E-05	2.5E-08	0.0E+00	0.0E+00	0%
Iron	2.8E+02	9.7E-02	0.0E+00	0.0E+00	0%
Thallium	1.0E-05	3.5E-09	0.0E+00	0.0E+00	0%
Vanadium	2.7E-01	9.4E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.6E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.45E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-01	1.0E-04	1.5E+00	1.5E-04	100%
Cadmium	1.4E+00	5.4E-04	0.0E+00	0.0E+00	0%
Iron	1.4E+02	5.5E-02	0.0E+00	0.0E+00	0%
Thallium	7.0E-05	2.8E-08	0.0E+00	0.0E+00	0%
Vanadium	2.2E-01	8.5E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.5E-04**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**3.95E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
24	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Inhalation of Outdoor Soil

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.2E-06	9.5E-08	4.3E-03	4.1E-07	80%
Cadmium	6.8E-07	5.6E-08	1.8E-03	1.0E-07	20%
Iron	9.9E-03	8.1E-04	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	2.5E-08	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	1.2E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**5.1E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**8.22E-02**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	50%	1.2E-06	1.5E+00	1.8E-06	100%
Cadmium	5.3E-01	100%	5.8E-07	0.0E+00	0.0E+00	0%
Iron	2.7E+04	100%	2.9E-02	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	100%	3.5E-07	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	100%	6.5E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.8E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.10E-06**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	200	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	3%	2.0E-07	1.5E+00	2.9E-07	100%
Cadmium	5.3E-01	0.1%	1.6E-09	0.0E+00	0.0E+00	0%
Iron	2.7E+04	1%	8.2E-04	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	1%	9.8E-09	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	1%	1.8E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.9E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =	**3.07E-06**
25550	AT = Averaging Time - Cancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
2800	SA = Surface Area (cm^2/d)
0.2	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	7.1E-03	1.3E-06	1.5E+00	1.9E-06	100%
Cadmium	1.9E-04	3.4E-08	0.0E+00	0.0E+00	0%
Iron	2.8E+02	5.1E-02	0.0E+00	0.0E+00	0%
Thallium	6.9E-03	1.2E-06	0.0E+00	0.0E+00	0%
Vanadium	8.2E-02	1.5E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.9E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**1.81E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
2.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.2E-02	2.4E-06	1.5E+00	3.6E-06	100%
Cadmium	8.9E-04	9.5E-08	0.0E+00	0.0E+00	0%
Iron	3.7E+02	4.0E-02	0.0E+00	0.0E+00	0%
Thallium	8.9E-04	9.5E-08	0.0E+00	0.0E+00	0%
Vanadium	4.4E-01	4.7E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.6E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.07E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.2E-02	1.9E-06	1.5E+00	2.8E-06	100%
Cadmium	2.0E-05	1.7E-09	0.0E+00	0.0E+00	0%
Iron	3.2E+02	2.8E-02	0.0E+00	0.0E+00	0%
Thallium	6.0E-06	5.1E-10	0.0E+00	0.0E+00	0%
Vanadium	5.5E-01	4.8E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.8E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **8.63E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.8E-01	1.8E-05	1.5E+00	2.7E-05	100%
Cadmium	6.7E-01	6.6E-05	0.0E+00	0.0E+00	0%
Iron	7.3E+01	7.2E-03	0.0E+00	0.0E+00	0%
Thallium	1.3E-04	1.3E-08	0.0E+00	0.0E+00	0%
Vanadium	1.1E-01	1.1E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.7E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **9.86E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Adult Resident/Inhalation of Outdoor Soil

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.2E-06	3.8E-07	4.3E-03	1.6E-06	80%
Cadmium	6.8E-07	2.2E-07	1.8E-03	4.0E-07	20%
Iron	9.9E-03	3.2E-03	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	9.9E-08	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	4.9E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**3.29E-01**
	613200	AT = Averaging Time - Cancer (hours)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	50%	5.0E-07	1.5E+00	7.5E-07	100%
Cadmium	5.3E-01	100%	2.5E-07	0.0E+00	0.0E+00	0%
Iron	2.7E+04	100%	1.3E-02	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	100%	1.5E-07	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	100%	2.8E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**7.5E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =	**4.70E-07**
25550	AT = Averaging Time - Cancer (days)
70	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	3%	1.2E-07	1.5E+00	1.8E-07	100%
Cadmium	5.3E-01	0.1%	9.9E-10	0.0E+00	0.0E+00	0%
Iron	2.7E+04	1%	5.0E-04	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	1%	6.0E-09	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	1%	1.1E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.8E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =	**1.87E-06**
25550	AT = Averaging Time - Cancer (days)
70	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
24	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
5700	SA = Surface Area (cm^2/d)
0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	7.1E-03	5.1E-06	1.5E+00	7.7E-06	100%
Cadmium	1.9E-04	1.3E-07	0.0E+00	0.0E+00	0%
Iron	2.8E+02	2.0E-01	0.0E+00	0.0E+00	0%
Thallium	6.9E-03	5.0E-06	0.0E+00	0.0E+00	0%
Vanadium	8.2E-02	5.9E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**7.7E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **7.23E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.2E-02	9.6E-06	1.5E+00	1.4E-05	100%
Cadmium	8.9E-04	3.8E-07	0.0E+00	0.0E+00	0%
Iron	3.7E+02	1.6E-01	0.0E+00	0.0E+00	0%
Thallium	8.9E-04	3.8E-07	0.0E+00	0.0E+00	0%
Vanadium	4.4E-01	1.9E-04	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.4E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **4.27E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Adult Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.2E-02	7.5E-06	1.5E+00	1.1E-05	100%
Cadmium	2.0E-05	7.0E-09	0.0E+00	0.0E+00	0%
Iron	*3.2E+02*	*1.1E-01*	*0.0E+00*	*0.0E+00*	*0%*
Thallium	6.0E-06	2.1E-09	0.0E+00	0.0E+00	0%
Vanadium	5.5E-01	1.9E-04	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.1E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**3.45E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
24	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.05	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.8E-01	7.3E-05	1.5E+00	1.1E-04	100%
Cadmium	6.7E-01	2.7E-04	0.0E+00	0.0E+00	0%
Iron	7.3E+01	2.9E-02	0.0E+00	0.0E+00	0%
Thallium	1.3E-04	5.0E-08	0.0E+00	0.0E+00	0%
Vanadium	1.1E-01	4.3E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.1E-04**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.95E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Index of Excess Lifetime Cancer Risks for Adolescents - Reasonable Maximum Exposure

Sheet Number	EA	Receptor	Media	Exposure Pathway
1b	1	Recreator 1	Air	Inhalation
2b	1	Recreator 1	Soil	Ingestion
3b	1	Recreator 1	Soil	Dermal
4b	3	Trespasser 1	Air	Inhalation
5b	3	Trespasser 1	Soil	Ingestion
6b	3	Trespasser 1	Soil	Dermal
7b	4	Trespasser 1	Air	Inhalation
8b	4	Trespasser 1	Soil	Ingestion
9b	4	Trespasser 1	Soil	Dermal
10b	4	Trespasser 2	Surface Water	Ingestion
11b	4	Trespasser 2	Surface Water	Dermal
12b	4	Trespasser 2	Sediment	Ingestion
13b	4	Trespasser 2	Sediment	Dermal
14b	5	Recreator 1	Air	Inhalation
15b	5	Recreator 1	Soil	Ingestion
16b	5	Recreator 1	Soil	Dermal
17b	5	Recreator 2	Surface Water	Ingestion
18b	5	Recreator 2	Surface Water	Dermal
19b	5	Recreator 2	Sediment	Ingestion
20b	5	Recreator 2	Sediment	Dermal

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Adolescent Recreator/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.1E-06	2.2E-09	4.3E-03	9.3E-09	80%
Cadmium	6.4E-07	1.3E-09	1.8E-03	2.3E-09	20%
Iron	6.2E-03	1.2E-05	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	7.6E-10	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	2.1E-08	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.2E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =	**1.96E-03**	
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Adolescent Recreator/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	3.2E-08	1.5E+00	4.9E-08	100%
Cadmium	1.5E+00	100%	3.3E-08	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	5.6E-04	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	100%	9.0E-09	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	100%	1.2E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.9E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =	**2.22E-08**
25550	AT = Averaging Time - Cancer (days)
53	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
50	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Adolescent Recreator/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	5.1E-09	1.5E+00	7.7E-09	100%
Cadmium	1.5E+00	0.1%	8.7E-11	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	1.5E-05	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	1%	2.4E-10	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	1%	3.3E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**7.7E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**5.88E-08**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	50	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3
Adolescent Trespasser/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.4E-06	5.5E-10	4.3E-03	2.4E-09	61%
Cadmium	2.2E-06	8.5E-10	1.8E-03	1.5E-09	39%
Iron	8.4E-03	3.3E-06	0.0E+00	0.0E+00	0%
Thallium	4.2E-07	1.6E-10	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	3.7E-09	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.9E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**3.91E-04**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3
Adolescent Trespasser/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.2E+00	50%	6.8E-09	1.5E+00	1.0E-08	100%
Cadmium	2.8E+01	100%	6.3E-08	0.0E+00	0.0E+00	0%
Iron	5.7E+04	100%	1.3E-04	0.0E+00	0.0E+00	0%
Thallium	6.6E-01	100%	1.5E-09	0.0E+00	0.0E+00	0%
Vanadium	3.2E+01	100%	7.0E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.0E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**2.22E-09**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	0.5	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 3
Adolescent Trespasser/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.2E+00	3%	2.2E-09	1.5E+00	3.3E-09	100%
Cadmium	2.8E+01	0.1%	3.3E-10	0.0E+00	0.0E+00	0%
Iron	5.7E+04	1%	6.7E-06	0.0E+00	0.0E+00	0%
Thallium	6.6E-01	1%	7.7E-11	0.0E+00	0.0E+00	0%
Vanadium	3.2E+01	1%	3.7E-09	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**3.3E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =	**1.18E-08**
25550	AT = Averaging Time - Cancer (days)
53	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
10	EF = Exposure Frequency (days/yr)
3790	SA = Surface Area (cm^2/d)
0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4
Adolescent Trespasser/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-06	1.0E-09	4.3E-03	4.4E-09	73%
Cadmium	2.4E-06	9.3E-10	1.8E-03	1.7E-09	27%
Iron	1.1E-02	4.2E-06	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	1.4E-10	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	3.7E-09	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**6.1E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**3.91E-04**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4
Adolescent Trespasser/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E+00	50%	5.5E-09	1.5E+00	8.2E-09	100%
Cadmium	4.1E+00	100%	9.0E-09	0.0E+00	0.0E+00	0%
Iron	2.3E+04	100%	5.1E-05	0.0E+00	0.0E+00	0%
Thallium	5.4E-01	100%	1.2E-09	0.0E+00	0.0E+00	0%
Vanadium	2.9E+01	100%	6.5E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**8.2E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**2.22E-09**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	0.5	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4
Adolescent Trespasser/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E+00	3%	1.7E-09	1.5E+00	2.6E-09	100%
Cadmium	4.1E+00	0.1%	4.8E-11	0.0E+00	0.0E+00	0%
Iron	2.3E+04	1%	2.7E-06	0.0E+00	0.0E+00	0%
Thallium	5.4E-01	1%	6.3E-11	0.0E+00	0.0E+00	0%
Vanadium	2.9E+01	1%	3.4E-09	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.6E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.18E-08**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	10	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4

Adolescent Trespasser 2/Ingestion of Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	7.8E-03	2.1E-08	1.5E+00	3.1E-08	100%
Cadmium	7.0E-04	1.9E-09	0.0E+00	0.0E+00	0%
Iron	6.4E+00	1.7E-05	0.0E+00	0.0E+00	0%
Thallium	5.9E-04	1.6E-09	0.0E+00	0.0E+00	0%
Vanadium	1.4E-02	3.8E-08	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.1E-08**	

Notes:

NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * EF * ED) / (BW * AT) =		**2.66E-06**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	6	ED = Exposure Duration (yr)
	12	EF = Exposure Frequency (days/yr)
	0.05	IR = Ingestion Rate (L/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4
Adolescent Trespasser 2/Dermal Contact with Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Dermal Permeability (Kp) (cm/hr)	Daily Intake DI = CxIFxKp (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	7.8E-03	1.E-03	6.6E-09	1.5E+00	9.8E-09	100%
Cadmium	7.0E-04	1.E-03	5.9E-10	0.0E+00	0.0E+00	0%
Iron	6.4E+00	1.E-03	5.4E-06	0.0E+00	0.0E+00	0%
Thallium	5.9E-04	1.E-03	5.0E-10	0.0E+00	0.0E+00	0%
Vanadium	1.4E-02	1.E-03	1.2E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**9.8E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (SA * ET * EF * ED * CF) / (BW * AT) =		**8.40E-04**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.001	CF = Conversion Factor (L/cm³)
	6	ED = Exposure Duration (years)
	12	EF = Exposure Frequency (days/yr)
	1	ET = Exposure Time (hrs/day)
	15800	SA = Surface Area (cm^2/d)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4
Trespasser 2/Incidental Ingestion of Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	50%	5.6E-09	1.5E+00	8.4E-09	100%
Cadmium	5.8E-01	100%	3.1E-09	0.0E+00	0.0E+00	0%
Iron	2.7E+04	100%	1.5E-04	0.0E+00	0.0E+00	0%
Thallium	3.7E-01	100%	2.0E-09	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	100%	2.4E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**8.4E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =	**5.32E-09**
25550	AT = Averaging Time - Cancer (days)
53	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
12	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 4
Trespasser 2/Dermal Contact with Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	3%	5.0E-09	1.5E+00	7.5E-09	100%
Cadmium	5.8E-01	0.1%	4.6E-11	0.0E+00	0.0E+00	0%
Iron	2.7E+04	1%	2.2E-05	0.0E+00	0.0E+00	0%
Thallium	3.7E-01	1%	2.9E-10	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	1%	3.6E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**7.5E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**7.94E-08**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	12	EF = Exposure Frequency (days/yr)
	4980	SA = Surface Area (cm^2/d)
	0.3	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator 1/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.2E-06	2.3E-09	4.3E-03	9.8E-09	80%
Cadmium	6.8E-07	1.3E-09	1.8E-03	2.4E-09	20%
Iron	9.9E-03	1.9E-05	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	5.9E-10	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	2.9E-08	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.2E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =	**1.96E-03**	
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator 1/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	50%	2.4E-08	1.5E+00	3.5E-08	100%
Cadmium	5.3E-01	100%	1.2E-08	0.0E+00	0.0E+00	0%
Iron	2.7E+04	100%	5.9E-04	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	100%	7.1E-09	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	100%	1.3E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**3.5E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =	**2.22E-08**
25550	AT = Averaging Time - Cancer (days)
53	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
50	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator 1/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	3%	3.8E-09	1.5E+00	5.6E-09	100%
Cadmium	5.3E-01	0.1%	3.1E-11	0.0E+00	0.0E+00	0%
Iron	2.7E+04	1%	1.6E-05	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	1%	1.9E-10	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	1%	3.5E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**5.6E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**5.88E-08**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	50	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator 2/Ingestion of Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E-03	2.6E-08	1.5E+00	3.9E-08	100%
Cadmium	1.5E-04	7.7E-10	0.0E+00	0.0E+00	0%
Iron	1.2E+01	6.1E-05	0.0E+00	0.0E+00	0%
Thallium	5.8E-04	3.1E-09	0.0E+00	0.0E+00	0%
Vanadium	1.4E-02	7.6E-08	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.9E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * EF * ED) / (BW * AT) =		**5.32E-06**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	6	ED = Exposure Duration (yr)
	24	EF = Exposure Frequency (days/yr)
	0.05	IR = Ingestion Rate (L/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator 2/Dermal Contact with Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Dermal Permeability (Kp) (cm/hr)	Daily Intake DI = CxIFxKp (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E-03	1.E-03	8.2E-09	1.5E+00	1.2E-08	100%
Cadmium	1.5E-04	1.E-03	2.4E-10	0.0E+00	0.0E+00	0%
Iron	1.2E+01	1.E-03	1.9E-05	0.0E+00	0.0E+00	0%
Thallium	5.8E-04	1.E-03	9.7E-10	0.0E+00	0.0E+00	0%
Vanadium	1.4E-02	1.E-03	2.4E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.2E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (SA * ET * EF * ED * CF) / (BW * AT) =		**1.68E-03**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.001	CF = Conversion Factor (L/cm³)
	6	ED = Exposure Duration (years)
	24	EF = Exposure Frequency (days/yr)
	1	ET = Exposure Time (hrs/day)
	15800	SA = Surface Area (cm^2/d)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator 2/Incidental Ingestion of Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.8E+00	50%	9.4E-09	1.5E+00	1.4E-08	100%
Cadmium	2.1E-01	100%	2.2E-09	0.0E+00	0.0E+00	0%
Iron	1.4E+04	100%	1.5E-04	0.0E+00	0.0E+00	0%
Thallium	3.7E-01	100%	3.9E-09	0.0E+00	0.0E+00	0%
Vanadium	2.4E+01	100%	2.5E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.4E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.06E-08**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	24	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator 2/Dermal Contact with Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.8E+00	3%	8.4E-09	1.5E+00	1.3E-08	100%
Cadmium	2.1E-01	0.1%	3.3E-11	0.0E+00	0.0E+00	0%
Iron	1.4E+04	1%	2.3E-05	0.0E+00	0.0E+00	0%
Thallium	3.7E-01	1%	5.9E-10	0.0E+00	0.0E+00	0%
Vanadium	2.4E+01	1%	3.8E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.3E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.59E-07**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	24	EF = Exposure Frequency (days/yr)
	4980	SA = Surface Area (cm^2/d)
	0.3	AF = Adherence Factor (mg/cm^2)

Index of Excess Lifetime Cancer Risks for Workers
Reasonable Maximum Exposure

Sheet Number	EA	Receptor	Media	Exposure Pathway
1c	1	Rancher	Air	Inhalation
2c	1	Rancher	Soil	Ingestion
3c	1	Rancher	Soil	Dermal
4c	1	Construction Worker	Air	Inhalation
5c	1	Construction Worker	Soil	Ingestion
6c	1	Construction Worker	Soil	Dermal
7c	2	Rancher	Air	Inhalation
8c	2	Rancher	Soil	Ingestion
9c	2	Rancher	Soil	Dermal
10c	2	Construction Worker	Air	Inhalation
11c	2	Construction Worker	Soil	Ingestion
12c	2	Construction Worker	Soil	Dermal
13c	5	Rancher	Air	Inhalation
14c	5	Rancher	Soil	Ingestion
15c	5	Rancher	Soil	Dermal
16c	SM	Industrial Worker	Air	Inhalation
17c	SM	Industrial Worker	Soil	Ingestion
18c	SM	Industrial Worker	Soil	Dermal

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Rancher/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) ($\mu g/m^3$)	Effective Conc. EC = CxIF ($\mu g/m^3$)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.1E-06	1.6E-07	4.3E-03	6.7E-07	80%
Cadmium	6.4E-07	9.1E-08	1.8E-03	1.6E-07	20%
Iron	6.2E-03	8.8E-04	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	5.6E-08	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	1.5E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**8.4E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (CF * ET* ED * EF) / (AT) =		**1.43E-01**
	613200	AT = Averaging Time - Cancer (hours)
	25	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Rancher/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	7.1E-07	1.5E+00	1.1E-06	100%
Cadmium	1.5E+00	100%	7.2E-07	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	1.2E-02	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	100%	2.0E-07	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	100%	2.7E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.1E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**4.89E-07**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Rancher/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	2.8E-07	1.5E+00	4.2E-07	100%
Cadmium	1.5E+00	0.1%	4.8E-09	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	8.1E-04	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	1%	1.3E-08	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	1%	1.8E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.2E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**3.23E-06**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Construction Worker/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) ($\mu g/m^3$)	Effective Conc. EC = CxIF ($\mu g/m^3$)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.1E-06	1.0E-07	4.3E-03	4.3E-07	80%
Cadmium	6.4E-07	5.9E-08	1.8E-03	1.1E-07	20%
Iron	6.2E-03	5.7E-04	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	3.6E-08	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	9.9E-07	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**5.4E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (CF * ET* ED * EF) / (AT) =		**9.17E-02**
	613200	AT = Averaging Time - Cancer (hours)
	25	ED = Exposure Duration (yr)
	225	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Construction Worker/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	4.6E-07	1.5E+00	6.9E-07	100%
Cadmium	1.5E+00	100%	4.7E-07	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	7.9E-03	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	100%	1.3E-07	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	100%	1.7E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**6.9E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**3.15E-07**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (yr)
	225	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Construction Worker/Dermal Contact with Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	1.8E-07	1.5E+00	2.7E-07	100%
Cadmium	1.5E+00	0.1%	3.1E-09	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	5.2E-04	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	1%	8.4E-09	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	1%	1.1E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.7E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**2.08E-06**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (years)
	225	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2
Rancher/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) ($\mu g/m^3$)	Effective Conc. EC = CxIF ($\mu g/m^3$)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	5.5E-07	7.8E-08	4.3E-03	3.4E-07	78%
Cadmium	3.6E-07	5.1E-08	1.8E-03	9.2E-08	22%
Iron	7.5E-03	1.1E-03	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	1.3E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	2.6E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**4.3E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (CF * ET* ED * EF) / (AT) =		**1.43E-01**
	613200	AT = Averaging Time - Cancer (hours)
	25	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2
Rancher/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	7.1E-07	1.5E+00	1.1E-06	100%
Cadmium	1.3E+00	100%	6.5E-07	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	1.2E-02	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	100%	2.8E-07	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	100%	2.2E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.1E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =	**4.89E-07**
25550	AT = Averaging Time - Cancer (days)
70	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
25	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2
Rancher/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	2.8E-07	1.5E+00	4.2E-07	100%
Cadmium	1.3E+00	0.1%	4.3E-09	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	8.1E-04	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	1%	1.9E-08	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	1%	1.4E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.2E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**3.23E-06**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2
Construction Worker/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) ($\mu g/m^3$)	Effective Conc. EC = CxIF ($\mu g/m^3$)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	5.5E-07	5.0E-08	4.3E-03	2.2E-07	78%
Cadmium	3.6E-07	3.3E-08	1.8E-03	5.9E-08	22%
Iron	7.5E-03	6.9E-04	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	8.6E-08	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	1.7E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.8E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (CF * ET* ED * EF) / (AT) =		***9.17E-02***
	613200	AT = Averaging Time - Cancer (hours)
	25	ED = Exposure Duration (yr)
	225	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2
Construction Worker/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	4.6E-07	1.5E+00	6.9E-07	100%
Cadmium	1.3E+00	100%	4.2E-07	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	7.9E-03	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	100%	1.8E-07	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	100%	1.4E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**6.9E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**3.15E-07**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (yr)
	225	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 2
Construction Worker/Dermal Contact with Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	1.8E-07	1.5E+00	2.7E-07	100%
Cadmium	1.3E+00	0.1%	2.7E-09	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	5.2E-04	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	1%	1.2E-08	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	1%	9.3E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.7E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**2.08E-06**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (years)
	225	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Rancher/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) ($\mu g/m^3$)	Effective Conc. EC = CxIF ($\mu g/m^3$)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.2E-06	1.7E-07	4.3E-03	7.1E-07	80%
Cadmium	6.8E-07	9.7E-08	1.8E-03	1.7E-07	20%
Iron	9.9E-03	1.4E-03	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	4.3E-08	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	2.1E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**8.9E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (CF * ET* ED * EF) / (AT) =		**1.43E-01**
	613200	AT = Averaging Time - Cancer (hours)
	25	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Rancher/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	50%	5.2E-07	1.5E+00	7.8E-07	100%
Cadmium	5.3E-01	100%	2.6E-07	0.0E+00	0.0E+00	0%
Iron	2.7E+04	100%	1.3E-02	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	100%	1.6E-07	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	100%	2.9E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**7.8E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**4.89E-07**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Rancher/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	3%	2.1E-07	1.5E+00	3.1E-07	100%
Cadmium	5.3E-01	0.1%	1.7E-09	0.0E+00	0.0E+00	0%
Iron	2.7E+04	1%	8.6E-04	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	1%	1.0E-08	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	1%	1.9E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**3.1E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =	**3.23E-06**
25550	AT = Averaging Time - Cancer (days)
70	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
25	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
3300	SA = Surface Area (cm^2/d)
0.2	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

SM
Industrial Worker/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) ($\mu g/m^3$)	Effective Conc. EC = CxIF ($\mu g/m^3$)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-06	4.8E-08	4.3E-03	2.1E-07	73%
Cadmium	2.4E-06	4.3E-08	1.8E-03	7.8E-08	27%
Iron	1.1E-02	2.0E-04	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	6.4E-09	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	1.7E-07	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.9E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (CF * ET* ED * EF) / (AT) =		**1.83E-02**
	613200	AT = Averaging Time - Cancer (hours)
	25	ED = Exposure Duration (yr)
	225	EF = Exposure Frequency (days/yr)
	2	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

SM
Industrial Worker/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.4E+01	50%	1.9E-06	1.5E+00	2.8E-06	100%
Cadmium	7.2E+00	100%	1.1E-06	0.0E+00	0.0E+00	0%
Iron	5.9E+04	100%	9.3E-03	0.0E+00	0.0E+00	0%
Thallium	7.4E-01	100%	1.2E-07	0.0E+00	0.0E+00	0%
Vanadium	2.3E+01	100%	3.6E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.8E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =	**1.57E-07**
25550	AT = Averaging Time - Cancer (days)
70	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
25	ED = Exposure Duration (yr)
225	EF = Exposure Frequency (days/yr)
0.5	FS = Fraction from Contaminated Source
100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Reasonable Maximum Exposure

SM
Industrial Worker/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.4E+01	3%	1.5E-06	1.5E+00	2.3E-06	100%
Cadmium	7.2E+00	0.1%	1.5E-08	0.0E+00	0.0E+00	0%
Iron	5.9E+04	1%	1.2E-03	0.0E+00	0.0E+00	0%
Thallium	7.4E-01	1%	1.5E-08	0.0E+00	0.0E+00	0%
Vanadium	2.3E+01	1%	4.8E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.3E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =	**2.08E-06**
25550	AT = Averaging Time - Cancer (days)
70	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
25	ED = Exposure Duration (years)
225	EF = Exposure Frequency (days/yr)
3300	SA = Surface Area (cm^2/d)
0.2	AF = Adherence Factor (mg/cm^2)

Appendix E.2

CT Cancer Risks

Index of Excess Lifetime Cancer Risks for Residents - Central Tendency

Sheet Number	EA	Receptor	Media	Exposure Pathway
1	1	Child Future Resident	Air	Inhalation
2	1	Child Future Resident	Soil	Ingestion
3	1	Child Future Resident	Soil	Dermal
4	1	Child Future Resident	Beef	Ingestion
5	1	Child Future Resident	Chicken	Ingestion
6	1	Child Future Resident	Eggs	Ingestion
7	1	Child Future Resident	Vegetables	Ingestion
8	1	Adult Future Resident	Air	Inhalation
9	1	Adult Future Resident	Soil	Ingestion
10	1	Adult Future Resident	Soil	Dermal
11	1	Adult Future Resident	Beef	Ingestion
12	1	Adult Future Resident	Chicken	Ingestion
13	1	Adult Future Resident	Eggs	Ingestion
14	1	Adult Future Resident	Vegetables	Ingestion
15	2	Child Current and Future Resident	Air	Inhalation
16	2	Child Current and Future Resident	Soil	Ingestion
17	2	Child Current and Future Resident	Soil	Dermal
18	2	Child Future Resident	Beef	Ingestion
19	2	Child Future Resident	Chicken	Ingestion
20	2	Child Future Resident	Eggs	Ingestion
21	2	Child Future Resident	Vegetables	Ingestion
22	2	Adult Current and Future Resident	Air	Inhalation
23	2	Adult Current and Future Resident	Soil	Ingestion
24	2	Adult Current and Future Resident	Soil	Dermal
25	2	Adult Future Resident	Beef	Ingestion
26	2	Adult Future Resident	Chicken	Ingestion
27	2	Adult Future Resident	Eggs	Ingestion
28	2	Adult Future Resident	Vegetables	Ingestion
29	3	Child Future Resident	Air	Inhalation
30	3	Child Future Resident	Soil	Ingestion
31	3	Child Future Resident	Soil	Dermal
32	3	Child Future Resident	Beef	Ingestion
33	3	Child Future Resident	Chicken	Ingestion
34	3	Child Future Resident	Eggs	Ingestion
35	3	Child Future Resident	Vegetables	Ingestion
36	3	Adult Future Resident	Air	Inhalation
37	3	Adult Future Resident	Soil	Ingestion
38	3	Adult Future Resident	Soil	Dermal
39	3	Adult Future Resident	Beef	Ingestion
40	3	Adult Future Resident	Chicken	Ingestion
41	3	Adult Future Resident	Eggs	Ingestion
42	3	Adult Future Resident	Vegetables	Ingestion
43	4	Child Future Resident	Air	Inhalation
44	4	Child Future Resident	Soil	Ingestion
45	4	Child Future Resident	Soil	Dermal
46	4	Child Future Resident	Beef	Ingestion
47	4	Child Future Resident	Chicken	Ingestion
48	4	Child Future Resident	Eggs	Ingestion
49	4	Child Future Resident	Vegetables	Ingestion
50	4	Adult Future Resident	Air	Inhalation
51	4	Adult Future Resident	Soil	Ingestion
52	4	Adult Future Resident	Soil	Dermal
53	4	Adult Future Resident	Beef	Ingestion
54	4	Adult Future Resident	Chicken	Ingestion
55	4	Adult Future Resident	Eggs	Ingestion
56	4	Adult Future Resident	Vegetables	Ingestion
57	5	Child Future Resident	Air	Inhalation
58	5	Child Future Resident	Soil	Ingestion
59	5	Child Future Resident	Soil	Dermal
60	5	Child Future Resident	Beef	Ingestion
61	5	Child Future Resident	Chicken	Ingestion
62	5	Child Future Resident	Eggs	Ingestion
63	5	Child Future Resident	Vegetables	Ingestion
64	5	Adult Future Resident	Air	Inhalation
65	5	Adult Future Resident	Soil	Ingestion
66	5	Adult Future Resident	Soil	Dermal
67	5	Adult Future Resident	Beef	Ingestion
68	5	Adult Future Resident	Chicken	Ingestion
69	5	Adult Future Resident	Eggs	Ingestion
70	5	Adult Future Resident	Vegetables	Ingestion

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.1E-06	9.0E-08	4.3E-03	3.9E-07	80%
Cadmium	6.4E-07	5.3E-08	1.8E-03	9.5E-08	20%
Iron	6.2E-03	5.1E-04	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	3.2E-08	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	8.9E-07	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**4.8E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**8.22E-02**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	8.0E-07	1.5E+00	1.2E-06	100%
Cadmium	1.5E+00	100%	8.1E-07	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	1.4E-02	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	100%	2.2E-07	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	100%	3.0E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.2E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**5.48E-07**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	2.7E-08	1.5E+00	4.0E-08	100%
Cadmium	1.5E+00	0.1%	4.5E-10	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	7.7E-05	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	1%	1.2E-09	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	1%	1.7E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.0E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**3.07E-07**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	2800	SA = Surface Area (cm^2/d)
	0.02	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.1E-03	4.0E-07	1.5E+00	6.1E-07	100%
Cadmium	2.0E-04	2.0E-08	0.0E+00	0.0E+00	0%
Iron	2.5E+02	2.5E-02	0.0E+00	0.0E+00	0%
Thallium	4.3E-02	4.2E-06	0.0E+00	0.0E+00	0%
Vanadium	8.4E-02	8.3E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**6.1E-07**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**9.86E-05**	$(day)^{-1}$
	25550	AT = Averaging Time - Cancer (days)
	0.001	CF = Conversion Factor (kg/g)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	1.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.5E-02	8.7E-07	1.5E+00	1.3E-06	100%
Cadmium	9.8E-04	5.6E-08	0.0E+00	0.0E+00	0%
Iron	3.4E+02	1.9E-02	0.0E+00	0.0E+00	0%
Thallium	5.6E-03	3.2E-07	0.0E+00	0.0E+00	0%
Vanadium	4.6E-01	2.6E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.3E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**5.75E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.7	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.5E-02	8.0E-07	1.5E+00	1.2E-06	100%
Cadmium	2.2E-05	1.2E-09	0.0E+00	0.0E+00	0%
Iron	2.9E+02	1.6E-02	0.0E+00	0.0E+00	0%
Thallium	3.7E-05	2.0E-09	0.0E+00	0.0E+00	0%
Vanadium	5.7E-01	3.1E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.2E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**5.51E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.67	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.0E-01	6.5E-06	1.5E+00	9.8E-06	100%
Cadmium	6.1E-01	2.0E-05	0.0E+00	0.0E+00	0%
Iron	1.0E+02	3.4E-03	0.0E+00	0.0E+00	0%
Thallium	8.0E-04	2.6E-08	0.0E+00	0.0E+00	0%
Vanadium	3.0E-01	9.7E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**9.8E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**3.29E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.4	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.1E-06	1.4E-07	4.3E-03	5.8E-07	80%
Cadmium	6.4E-07	7.9E-08	1.8E-03	1.4E-07	20%
Iron	6.2E-03	7.6E-04	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	4.8E-08	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	1.3E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**7.3E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**1.23E-01**
	613200	AT = Averaging Time - Cancer (hours)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	1.3E-07	1.5E+00	1.9E-07	100%
Cadmium	1.5E+00	100%	1.3E-07	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	2.2E-03	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	100%	3.6E-08	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	100%	4.9E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.9E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =	**8.81E-08**
25550	AT = Averaging Time - Cancer (days)
70	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	8.8E-09	1.5E+00	1.3E-08	100%
Cadmium	1.5E+00	0.1%	1.5E-10	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	2.5E-05	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	1%	4.1E-10	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	1%	5.6E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.3E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.00E-07**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.1E-03	6.1E-07	1.5E+00	9.1E-07	100%
Cadmium	2.0E-04	3.0E-08	0.0E+00	0.0E+00	0%
Iron	2.5E+02	3.7E-02	0.0E+00	0.0E+00	0%
Thallium	4.3E-02	6.3E-06	0.0E+00	0.0E+00	0%
Vanadium	8.4E-02	1.2E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**9.1E-07**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**1.48E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
9	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.5E-02	1.3E-06	1.5E+00	2.0E-06	100%
Cadmium	9.8E-04	8.5E-08	0.0E+00	0.0E+00	0%
Iron	3.4E+02	2.9E-02	0.0E+00	0.0E+00	0%
Thallium	5.6E-03	4.8E-07	0.0E+00	0.0E+00	0%
Vanadium	4.6E-01	3.9E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **8.63E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.5E-02	1.2E-06	1.5E+00	1.8E-06	100%
Cadmium	2.2E-05	1.8E-09	0.0E+00	0.0E+00	0%
Iron	2.9E+02	2.4E-02	0.0E+00	0.0E+00	0%
Thallium	3.7E-05	3.1E-09	0.0E+00	0.0E+00	0%
Vanadium	5.7E-01	4.7E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.8E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**8.26E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
9	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.67	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.0E-01	9.8E-06	1.5E+00	1.5E-05	100%
Cadmium	6.1E-01	3.0E-05	0.0E+00	0.0E+00	0%
Iron	1.0E+02	5.0E-03	0.0E+00	0.0E+00	0%
Thallium	8.0E-04	3.9E-08	0.0E+00	0.0E+00	0%
Vanadium	3.0E-01	1.5E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.5E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**4.93E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
9	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.4	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Current and Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	5.5E-07	4.5E-08	4.3E-03	1.9E-07	78%
Cadmium	3.6E-07	3.0E-08	1.8E-03	5.3E-08	22%
Iron	7.5E-03	6.2E-04	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	7.7E-08	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	1.5E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.5E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =	**8.22E-02**	
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Current and Future**
Child Current Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	8.0E-07	1.5E+00	1.2E-06	100%
Cadmium	1.3E+00	100%	7.2E-07	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	1.4E-02	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	100%	3.2E-07	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	100%	2.5E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.2E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**5.48E-07**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Current and Future**
Child Current Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	2.7E-08	1.5E+00	4.0E-08	100%
Cadmium	1.3E+00	0.1%	4.1E-10	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	7.7E-05	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	1%	1.8E-09	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	1%	1.4E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.0E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**3.07E-07**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	2800	SA = Surface Area (cm^2/d)
	0.02	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.9E-03	6.8E-07	1.5E+00	1.0E-06	100%
Cadmium	1.9E-04	1.9E-08	0.0E+00	0.0E+00	0%
Iron	2.0E+02	2.0E-02	0.0E+00	0.0E+00	0%
Thallium	1.3E-01	1.3E-05	0.0E+00	0.0E+00	0%
Vanadium	4.5E-02	4.4E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **9.86E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-02	1.5E-06	1.5E+00	2.2E-06	100%
Cadmium	9.2E-04	5.3E-08	0.0E+00	0.0E+00	0%
Iron	2.7E+02	1.5E-02	0.0E+00	0.0E+00	0%
Thallium	1.7E-02	1.0E-06	0.0E+00	0.0E+00	0%
Vanadium	2.4E-01	1.4E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.2E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**5.75E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.7	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.5E-02	1.4E-06	1.5E+00	2.0E-06	100%
Cadmium	2.1E-05	1.2E-09	0.0E+00	0.0E+00	0%
Iron	2.3E+02	1.3E-02	0.0E+00	0.0E+00	0%
Thallium	1.2E-04	6.3E-09	0.0E+00	0.0E+00	0%
Vanadium	3.0E-01	1.7E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**5.51E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.67	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Future**

Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.0E-01	6.6E-06	1.5E+00	9.9E-06	100%
Cadmium	6.5E-01	2.2E-05	0.0E+00	0.0E+00	0%
Iron	6.0E+01	2.0E-03	0.0E+00	0.0E+00	0%
Thallium	3.7E-04	1.2E-08	0.0E+00	0.0E+00	0%
Vanadium	8.5E-02	2.8E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**9.9E-06**	

Notes:

NA indicates that an exposure point concentration is not available.

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.29E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Current and Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	5.5E-07	6.8E-08	4.3E-03	2.9E-07	78%
Cadmium	3.6E-07	4.4E-08	1.8E-03	8.0E-08	22%
Iron	7.5E-03	9.2E-04	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	1.2E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	2.3E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.7E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =	**1.23E-01**	
	613200	AT = Averaging Time - Cancer (hours)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Current and Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	1.3E-07	1.5E+00	1.9E-07	100%
Cadmium	1.3E+00	100%	1.2E-07	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	2.2E-03	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	100%	5.1E-08	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	100%	3.9E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.9E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**8.81E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Current and Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	8.8E-09	1.5E+00	1.3E-08	100%
Cadmium	1.3E+00	0.1%	1.3E-10	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	2.5E-05	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	1%	5.8E-10	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	1%	4.5E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.3E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.00E-07**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.9E-03	1.0E-06	1.5E+00	1.5E-06	100%
Cadmium	1.9E-04	2.8E-08	0.0E+00	0.0E+00	0%
Iron	2.0E+02	3.0E-02	0.0E+00	0.0E+00	0%
Thallium	1.3E-01	2.0E-05	0.0E+00	0.0E+00	0%
Vanadium	4.5E-02	6.6E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.5E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**1.48E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
9	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-02	2.2E-06	1.5E+00	3.3E-06	100%
Cadmium	9.2E-04	7.9E-08	0.0E+00	0.0E+00	0%
Iron	2.7E+02	2.3E-02	0.0E+00	0.0E+00	0%
Thallium	1.7E-02	1.5E-06	0.0E+00	0.0E+00	0%
Vanadium	2.4E-01	2.1E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.3E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**8.63E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
9	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.7	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.5E-02	2.0E-06	1.5E+00	3.0E-06	100%
Cadmium	2.1E-05	1.7E-09	0.0E+00	0.0E+00	0%
Iron	2.3E+02	1.9E-02	0.0E+00	0.0E+00	0%
Thallium	1.2E-04	9.5E-09	0.0E+00	0.0E+00	0%
Vanadium	3.0E-01	2.5E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**8.26E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
9	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.67	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.0E-01	9.9E-06	1.5E+00	1.5E-05	100%
Cadmium	6.5E-01	3.2E-05	0.0E+00	0.0E+00	0%
Iron	6.0E+01	3.0E-03	0.0E+00	0.0E+00	0%
Thallium	3.7E-04	1.8E-08	0.0E+00	0.0E+00	0%
Vanadium	8.5E-02	4.2E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.5E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**4.93E-05**	$(day)^{-1}$
	25550	AT = Averaging Time - Cancer (days)
	0.001	CF = Conversion Factor (kg/g)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	0.4	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Inhalation of Outdoor Soil

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.4E-06	1.2E-07	4.3E-03	4.9E-07	61%
Cadmium	2.2E-06	1.8E-07	1.8E-03	3.2E-07	39%
Iron	8.4E-03	6.9E-04	0.0E+00	0.0E+00	0%
Thallium	4.2E-07	3.5E-08	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	7.7E-07	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**8.1E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**8.22E-02**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.2E+00	50%	1.7E-06	1.5E+00	2.5E-06	100%
Cadmium	2.8E+01	100%	1.6E-05	0.0E+00	0.0E+00	0%
Iron	5.7E+04	100%	3.1E-02	0.0E+00	0.0E+00	0%
Thallium	6.6E-01	100%	3.6E-07	0.0E+00	0.0E+00	0%
Vanadium	3.2E+01	100%	1.7E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.5E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =	**5.48E-07**
25550	AT = Averaging Time - Cancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.2E+00	3%	5.7E-08	1.5E+00	8.5E-08	100%
Cadmium	2.8E+01	0.1%	8.7E-09	0.0E+00	0.0E+00	0%
Iron	5.7E+04	1%	1.8E-04	0.0E+00	0.0E+00	0%
Thallium	6.6E-01	1%	2.0E-09	0.0E+00	0.0E+00	0%
Vanadium	3.2E+01	1%	9.7E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**8.5E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**3.07E-07**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	2800	SA = Surface Area (cm^2/d)
	0.02	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.8E-03	6.7E-07	1.5E+00	1.0E-06	100%
Cadmium	5.0E-03	5.0E-07	0.0E+00	0.0E+00	0%
Iron	6.0E+02	5.9E-02	0.0E+00	0.0E+00	0%
Thallium	1.4E-02	1.4E-06	0.0E+00	0.0E+00	0%
Vanadium	4.4E-02	4.3E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **9.86E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.5E-02	1.4E-06	1.5E+00	2.2E-06	100%
Cadmium	2.4E-02	1.4E-06	0.0E+00	0.0E+00	0%
Iron	8.0E+02	4.6E-02	0.0E+00	0.0E+00	0%
Thallium	1.8E-03	1.1E-07	0.0E+00	0.0E+00	0%
Vanadium	2.4E-01	1.4E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.2E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**5.75E-05**	$(day)^{-1}$
	25550	AT = Averaging Time - Cancer (days)
	0.001	CF = Conversion Factor (kg/g)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	0.7	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.4E-02	1.3E-06	1.5E+00	2.0E-06	100%
Cadmium	5.5E-04	3.0E-08	0.0E+00	0.0E+00	0%
Iron	6.9E+02	3.8E-02	0.0E+00	0.0E+00	0%
Thallium	1.2E-05	6.8E-10	0.0E+00	0.0E+00	0%
Vanadium	2.9E-01	1.6E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **5.51E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.67	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.8E-01	6.0E-06	1.5E+00	9.0E-06	100%
Cadmium	6.4E-01	2.1E-05	0.0E+00	0.0E+00	0%
Iron	1.0E+02	3.4E-03	0.0E+00	0.0E+00	0%
Thallium	2.4E-03	7.8E-08	0.0E+00	0.0E+00	0%
Vanadium	1.1E-01	3.6E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**9.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**3.29E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.4	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Adult Resident/Inhalation of Outdoor Soil

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.4E-06	1.7E-07	4.3E-03	7.4E-07	61%
Cadmium	2.2E-06	2.7E-07	1.8E-03	4.8E-07	39%
Iron	8.4E-03	1.0E-03	0.0E+00	0.0E+00	0%
Thallium	4.2E-07	5.2E-08	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	1.2E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.2E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**1.23E-01**
	613200	AT = Averaging Time - Cancer (hours)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.2E+00	50%	2.7E-07	1.5E+00	4.1E-07	100%
Cadmium	2.8E+01	100%	2.5E-06	0.0E+00	0.0E+00	0%
Iron	5.7E+04	100%	5.0E-03	0.0E+00	0.0E+00	0%
Thallium	6.6E-01	100%	5.8E-08	0.0E+00	0.0E+00	0%
Vanadium	3.2E+01	100%	2.8E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.1E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**8.81E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.2E+00	3%	1.9E-08	1.5E+00	2.8E-08	100%
Cadmium	2.8E+01	0.1%	2.9E-09	0.0E+00	0.0E+00	0%
Iron	5.7E+04	1%	5.7E-05	0.0E+00	0.0E+00	0%
Thallium	6.6E-01	1%	6.6E-10	0.0E+00	0.0E+00	0%
Vanadium	3.2E+01	1%	3.2E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.8E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.00E-07**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.8E-03	1.0E-06	1.5E+00	1.5E-06	100%
Cadmium	5.0E-03	7.4E-07	0.0E+00	0.0E+00	0%
Iron	6.0E+02	8.9E-02	0.0E+00	0.0E+00	0%
Thallium	1.4E-02	2.1E-06	0.0E+00	0.0E+00	0%
Vanadium	4.4E-02	6.4E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.5E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**1.48E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
9	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.5E-02	2.2E-06	1.5E+00	3.2E-06	100%
Cadmium	2.4E-02	2.1E-06	0.0E+00	0.0E+00	0%
Iron	8.0E+02	6.9E-02	0.0E+00	0.0E+00	0%
Thallium	1.8E-03	1.6E-07	0.0E+00	0.0E+00	0%
Vanadium	2.4E-01	2.0E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.2E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **8.63E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Adult Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.4E-02	2.0E-06	1.5E+00	3.0E-06	100%
Cadmium	5.5E-04	4.5E-08	0.0E+00	0.0E+00	0%
Iron	6.9E+02	5.7E-02	0.0E+00	0.0E+00	0%
Thallium	1.2E-05	1.0E-09	0.0E+00	0.0E+00	0%
Vanadium	2.9E-01	2.4E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**8.26E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
9	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.67	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.8E-01	9.0E-06	1.5E+00	1.4E-05	100%
Cadmium	6.4E-01	3.2E-05	0.0E+00	0.0E+00	0%
Iron	1.0E+02	5.1E-03	0.0E+00	0.0E+00	0%
Thallium	2.4E-03	1.2E-07	0.0E+00	0.0E+00	0%
Vanadium	1.1E-01	5.3E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.4E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **4.93E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Inhalation of Outdoor Soil

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-06	2.2E-07	4.3E-03	9.3E-07	73%
Cadmium	2.4E-06	1.9E-07	1.8E-03	3.5E-07	27%
Iron	1.1E-02	8.9E-04	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	2.9E-08	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	7.7E-07	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.3E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**8.22E-02**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E+00	50%	1.4E-06	1.5E+00	2.0E-06	100%
Cadmium	4.1E+00	100%	2.2E-06	0.0E+00	0.0E+00	0%
Iron	2.3E+04	100%	1.3E-02	0.0E+00	0.0E+00	0%
Thallium	5.4E-01	100%	3.0E-07	0.0E+00	0.0E+00	0%
Vanadium	2.9E+01	100%	1.6E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**5.48E-07**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E+00	3%	4.5E-08	1.5E+00	6.8E-08	100%
Cadmium	4.1E+00	0.1%	1.2E-09	0.0E+00	0.0E+00	0%
Iron	2.3E+04	1%	7.1E-05	0.0E+00	0.0E+00	0%
Thallium	5.4E-01	1%	1.7E-09	0.0E+00	0.0E+00	0%
Vanadium	2.9E+01	1%	9.0E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**6.8E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =	**3.07E-07**
25550	AT = Averaging Time - Cancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
2800	SA = Surface Area (cm^2/d)
0.02	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.0E-02	1.0E-06	1.5E+00	1.5E-06	100%
Cadmium	6.6E-04	6.5E-08	0.0E+00	0.0E+00	0%
Iron	2.4E+02	2.4E-02	0.0E+00	0.0E+00	0%
Thallium	1.2E-02	1.1E-06	0.0E+00	0.0E+00	0%
Vanadium	4.0E-02	4.0E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.5E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**9.86E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	3.1E-02	1.8E-06	1.5E+00	2.7E-06	100%
Cadmium	3.2E-03	1.8E-07	0.0E+00	0.0E+00	0%
Iron	3.2E+02	1.9E-02	0.0E+00	0.0E+00	0%
Thallium	1.5E-03	8.7E-08	0.0E+00	0.0E+00	0%
Vanadium	2.2E-01	1.2E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.7E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **5.75E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	3.0E-02	1.7E-06	1.5E+00	2.5E-06	100%
Cadmium	7.2E-05	3.9E-09	0.0E+00	0.0E+00	0%
Iron	2.8E+02	1.5E-02	0.0E+00	0.0E+00	0%
Thallium	1.0E-05	5.6E-10	0.0E+00	0.0E+00	0%
Vanadium	2.7E-01	1.5E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.5E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**5.51E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.67	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-01	8.5E-06	1.5E+00	1.3E-05	100%
Cadmium	1.4E+00	4.5E-05	0.0E+00	0.0E+00	0%
Iron	1.4E+02	4.6E-03	0.0E+00	0.0E+00	0%
Thallium	7.0E-05	2.3E-09	0.0E+00	0.0E+00	0%
Vanadium	2.2E-01	7.1E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.3E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**3.29E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.4	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Adult Resident/Inhalation of Outdoor Soil

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-06	3.3E-07	4.3E-03	1.4E-06	73%
Cadmium	2.4E-06	2.9E-07	1.8E-03	5.3E-07	27%
Iron	1.1E-02	1.3E-03	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	4.3E-08	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	1.2E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.9E-06**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =	**1.23E-01**	
	613200	AT = Averaging Time - Cancer (hours)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E+00	50%	2.2E-07	1.5E+00	3.3E-07	100%
Cadmium	4.1E+00	100%	3.6E-07	0.0E+00	0.0E+00	0%
Iron	2.3E+04	100%	2.0E-03	0.0E+00	0.0E+00	0%
Thallium	5.4E-01	100%	4.8E-08	0.0E+00	0.0E+00	0%
Vanadium	2.9E+01	100%	2.6E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**3.3E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =	**8.81E-08**
25550	AT = Averaging Time - Cancer (days)
70	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E+00	3%	1.5E-08	1.5E+00	2.2E-08	100%
Cadmium	4.1E+00	0.1%	4.1E-10	0.0E+00	0.0E+00	0%
Iron	2.3E+04	1%	2.3E-05	0.0E+00	0.0E+00	0%
Thallium	5.4E-01	1%	5.4E-10	0.0E+00	0.0E+00	0%
Vanadium	2.9E+01	1%	2.9E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.2E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =	**1.00E-07**	
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.0E-02	1.5E-06	1.5E+00	2.2E-06	100%
Cadmium	6.6E-04	9.7E-08	0.0E+00	0.0E+00	0%
Iron	2.4E+02	3.6E-02	0.0E+00	0.0E+00	0%
Thallium	1.2E-02	1.7E-06	0.0E+00	0.0E+00	0%
Vanadium	4.0E-02	5.9E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.2E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.48E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	3.1E-02	2.7E-06	1.5E+00	4.0E-06	100%
Cadmium	3.2E-03	2.7E-07	0.0E+00	0.0E+00	0%
Iron	3.2E+02	2.8E-02	0.0E+00	0.0E+00	0%
Thallium	1.5E-03	1.3E-07	0.0E+00	0.0E+00	0%
Vanadium	2.2E-01	1.9E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**4.0E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **8.63E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Adult Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	3.0E-02	2.5E-06	1.5E+00	3.7E-06	100%
Cadmium	7.2E-05	5.9E-09	0.0E+00	0.0E+00	0%
Iron	2.8E+02	2.3E-02	0.0E+00	0.0E+00	0%
Thallium	1.0E-05	8.3E-10	0.0E+00	0.0E+00	0%
Vanadium	2.7E-01	2.2E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.7E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**8.26E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
9	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.67	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-01	1.3E-05	1.5E+00	1.9E-05	100%
Cadmium	1.4E+00	6.7E-05	0.0E+00	0.0E+00	0%
Iron	1.4E+02	6.9E-03	0.0E+00	0.0E+00	0%
Thallium	7.0E-05	3.5E-09	0.0E+00	0.0E+00	0%
Vanadium	2.2E-01	1.1E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.9E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**4.93E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
9	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.4	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Inhalation of Outdoor Soil

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.2E-06	9.5E-08	4.3E-03	4.1E-07	80%
Cadmium	6.8E-07	5.6E-08	1.8E-03	1.0E-07	20%
Iron	9.9E-03	8.1E-04	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	2.5E-08	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	1.2E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**5.1E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**8.22E-02**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	50%	5.8E-07	1.5E+00	8.8E-07	100%
Cadmium	5.3E-01	100%	2.9E-07	0.0E+00	0.0E+00	0%
Iron	2.7E+04	100%	1.5E-02	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	100%	1.8E-07	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	100%	3.3E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**8.8E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**5.48E-07**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	3%	2.0E-08	1.5E+00	2.9E-08	100%
Cadmium	5.3E-01	0.1%	1.6E-10	0.0E+00	0.0E+00	0%
Iron	2.7E+04	1%	8.2E-05	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	1%	9.8E-10	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	1%	1.8E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.9E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**3.07E-07**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	2800	SA = Surface Area (cm^2/d)
	0.02	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	7.1E-03	7.0E-07	1.5E+00	1.1E-06	100%
Cadmium	1.9E-04	1.8E-08	0.0E+00	0.0E+00	0%
Iron	2.8E+02	2.8E-02	0.0E+00	0.0E+00	0%
Thallium	6.9E-03	6.8E-07	0.0E+00	0.0E+00	0%
Vanadium	8.2E-02	8.1E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.1E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**9.86E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.2E-02	1.3E-06	1.5E+00	1.9E-06	100%
Cadmium	8.9E-04	5.1E-08	0.0E+00	0.0E+00	0%
Iron	3.7E+02	2.1E-02	0.0E+00	0.0E+00	0%
Thallium	8.9E-04	5.1E-08	0.0E+00	0.0E+00	0%
Vanadium	4.4E-01	2.5E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.9E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **5.75E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.2E-02	1.2E-06	1.5E+00	1.8E-06	100%
Cadmium	2.0E-05	1.1E-09	0.0E+00	0.0E+00	0%
Iron	3.2E+02	1.8E-02	0.0E+00	0.0E+00	0%
Thallium	6.0E-06	3.3E-10	0.0E+00	0.0E+00	0%
Vanadium	5.5E-01	3.1E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.8E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **5.51E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.67	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.8E-01	6.0E-06	1.5E+00	9.1E-06	100%
Cadmium	6.7E-01	2.2E-05	0.0E+00	0.0E+00	0%
Iron	7.3E+01	2.4E-03	0.0E+00	0.0E+00	0%
Thallium	1.3E-04	4.2E-09	0.0E+00	0.0E+00	0%
Vanadium	1.1E-01	3.6E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**9.1E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.29E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Adult Resident/Inhalation of Outdoor Soil

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.2E-06	1.4E-07	4.3E-03	6.1E-07	80%
Cadmium	6.8E-07	8.4E-08	1.8E-03	1.5E-07	20%
Iron	9.9E-03	1.2E-03	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	3.7E-08	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	1.8E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**7.7E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**1.23E-01**
	613200	AT = Averaging Time - Cancer (hours)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	50%	9.4E-08	1.5E+00	1.4E-07	100%
Cadmium	5.3E-01	100%	4.6E-08	0.0E+00	0.0E+00	0%
Iron	2.7E+04	100%	2.3E-03	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	100%	2.8E-08	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	100%	5.2E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.4E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**8.81E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	3%	6.4E-09	1.5E+00	9.6E-09	100%
Cadmium	5.3E-01	0.1%	5.3E-11	0.0E+00	0.0E+00	0%
Iron	2.7E+04	1%	2.7E-05	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	1%	3.2E-10	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	1%	6.0E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**9.6E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.00E-07**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	7.1E-03	1.1E-06	1.5E+00	1.6E-06	100%
Cadmium	1.9E-04	2.8E-08	0.0E+00	0.0E+00	0%
Iron	2.8E+02	4.2E-02	0.0E+00	0.0E+00	0%
Thallium	6.9E-03	1.0E-06	0.0E+00	0.0E+00	0%
Vanadium	8.2E-02	1.2E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.6E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.48E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.2E-02	1.9E-06	1.5E+00	2.9E-06	100%
Cadmium	8.9E-04	7.7E-08	0.0E+00	0.0E+00	0%
Iron	3.7E+02	3.2E-02	0.0E+00	0.0E+00	0%
Thallium	8.9E-04	7.7E-08	0.0E+00	0.0E+00	0%
Vanadium	4.4E-01	3.8E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.9E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **8.63E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Adult Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.2E-02	1.8E-06	1.5E+00	2.7E-06	100%
Cadmium	2.0E-05	1.7E-09	0.0E+00	0.0E+00	0%
Iron	3.2E+02	2.7E-02	0.0E+00	0.0E+00	0%
Thallium	6.0E-06	4.9E-10	0.0E+00	0.0E+00	0%
Vanadium	5.5E-01	4.6E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.7E-06**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**8.26E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
9	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
0.67	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.8E-01	9.1E-06	1.5E+00	1.4E-05	100%
Cadmium	6.7E-01	3.3E-05	0.0E+00	0.0E+00	0%
Iron	7.3E+01	3.6E-03	0.0E+00	0.0E+00	0%
Thallium	1.3E-04	6.3E-09	0.0E+00	0.0E+00	0%
Vanadium	1.1E-01	5.3E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.4E-05**	

Notes:
NA indicates that an exposure point concentration is not available.
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **4.93E-05** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Index of Excess Lifetime Cancer Risks for Adolescents
Central Tendency

Sheet Number	EA	Receptor	Media	Exposure Pathway
1b	1	Recreator 1	Air	Inhalation
2b	1	Recreator 1	Soil	Ingestion
3b	1	Recreator 1	Soil	Dermal
4b	3	Trespasser 1	Air	Inhalation
5b	3	Trespasser 1	Soil	Ingestion
6b	3	Trespasser 1	Soil	Dermal
7b	4	Trespasser 1	Air	Inhalation
8b	4	Trespasser 1	Soil	Ingestion
9b	4	Trespasser 1	Soil	Dermal
10b	4	Trespasser 2	Surface Water	Ingestion
11b	4	Trespasser 2	Surface Water	Dermal
12b	4	Trespasser 2	Sediment	Ingestion
13b	4	Trespasser 2	Sediment	Dermal
14b	5	Recreator 1	Air	Inhalation
15b	5	Recreator 1	Soil	Ingestion
16b	5	Recreator 1	Soil	Dermal
17b	5	Recreator 2	Surface Water	Ingestion
18b	5	Recreator 2	Surface Water	Dermal
19b	5	Recreator 2	Sediment	Ingestion
20b	5	Recreator 2	Sediment	Dermal

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1
Adolescent Recreator/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.1E-06	2.2E-09	4.3E-03	9.3E-09	80%
Cadmium	6.4E-07	1.3E-09	1.8E-03	2.3E-09	20%
Iron	6.2E-03	1.2E-05	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	7.6E-10	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	2.1E-08	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.2E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**1.96E-03**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1
Adolescent Recreator/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	1.6E-08	1.5E+00	2.4E-08	100%
Cadmium	1.5E+00	100%	1.6E-08	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	2.8E-04	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	100%	4.5E-09	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	100%	6.1E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.4E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.11E-08**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1
Adolescent Recreator/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	7.4E-10	1.5E+00	1.1E-09	100%
Cadmium	1.5E+00	0.1%	1.2E-11	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	2.1E-06	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	1%	3.4E-11	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	1%	4.6E-09	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.1E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**8.40E-09**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	50	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3
Adolescent Trespasser/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.4E-06	5.5E-10	4.3E-03	2.4E-09	61%
Cadmium	2.2E-06	8.5E-10	1.8E-03	1.5E-09	39%
Iron	8.4E-03	3.3E-06	0.0E+00	0.0E+00	0%
Thallium	4.2E-07	1.6E-10	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	3.7E-09	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.9E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**3.91E-04**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3
Adolescent Trespasser/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.2E+00	50%	3.4E-09	1.5E+00	5.1E-09	100%
Cadmium	2.8E+01	100%	3.1E-08	0.0E+00	0.0E+00	0%
Iron	5.7E+04	100%	6.3E-05	0.0E+00	0.0E+00	0%
Thallium	6.6E-01	100%	7.3E-10	0.0E+00	0.0E+00	0%
Vanadium	3.2E+01	100%	3.5E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**5.1E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.11E-09**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	0.5	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 3
Adolescent Trespasser/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	6.2E+00	3%	3.1E-10	1.5E+00	4.7E-10	100%
Cadmium	2.8E+01	0.1%	4.8E-11	0.0E+00	0.0E+00	0%
Iron	5.7E+04	1%	9.6E-07	0.0E+00	0.0E+00	0%
Thallium	6.6E-01	1%	1.1E-11	0.0E+00	0.0E+00	0%
Vanadium	3.2E+01	1%	5.3E-10	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.7E-10**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.68E-09**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	10	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4
Adolescent Trespasser/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-06	1.0E-09	4.3E-03	4.4E-09	73%
Cadmium	2.4E-06	9.3E-10	1.8E-03	1.7E-09	27%
Iron	1.1E-02	4.2E-06	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	1.4E-10	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	3.7E-09	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**6.1E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**3.91E-04**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4
Adolescent Trespasser/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E+00	50%	2.7E-09	1.5E+00	4.1E-09	100%
Cadmium	4.1E+00	100%	4.5E-09	0.0E+00	0.0E+00	0%
Iron	2.3E+04	100%	2.6E-05	0.0E+00	0.0E+00	0%
Thallium	5.4E-01	100%	6.0E-10	0.0E+00	0.0E+00	0%
Vanadium	2.9E+01	100%	3.2E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.1E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.11E-09**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	0.5	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4
Adolescent Trespasser/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E+00	3%	2.5E-10	1.5E+00	3.7E-10	100%
Cadmium	4.1E+00	0.1%	6.8E-12	0.0E+00	0.0E+00	0%
Iron	2.3E+04	1%	3.9E-07	0.0E+00	0.0E+00	0%
Thallium	5.4E-01	1%	9.1E-12	0.0E+00	0.0E+00	0%
Vanadium	2.9E+01	1%	4.9E-10	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**3.7E-10**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.68E-09**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	10	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4
Adolescent Trespasser 2/Ingestion of Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	7.8E-03	2.1E-08	1.5E+00	3.1E-08	100%
Cadmium	7.0E-04	1.9E-09	0.0E+00	0.0E+00	0%
Iron	6.4E+00	1.7E-05	0.0E+00	0.0E+00	0%
Thallium	5.9E-04	1.6E-09	0.0E+00	0.0E+00	0%
Vanadium	1.4E-02	3.8E-08	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.1E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * EF * ED) / (BW * AT) =		**2.66E-06**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	6	ED = Exposure Duration (yr)
	12	EF = Exposure Frequency (days/yr)
	0.05	IR = Ingestion Rate (L/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4
Adolescent Trespasser 2/Dermal Contact with Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Dermal Permeability (Kp) (cm/hr)	Daily Intake DI = CxIFxKp (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	7.8E-03	1.E-03	3.3E-09	1.5E+00	4.9E-09	100%
Cadmium	7.0E-04	1.E-03	2.9E-10	0.0E+00	0.0E+00	0%
Iron	6.4E+00	1.E-03	2.7E-06	0.0E+00	0.0E+00	0%
Thallium	5.9E-04	1.E-03	2.5E-10	0.0E+00	0.0E+00	0%
Vanadium	1.4E-02	1.E-03	6.0E-09	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.9E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (SA * ET * EF * ED * CF) / (BW * AT) =		**4.20E-04**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.001	CF = Conversion Factor (L/cm^3)
	6	ED = Exposure Duration (years)
	12	EF = Exposure Frequency (days/yr)
	0.5	ET = Exposure Time (hrs/day)
	15800	SA = Surface Area (cm^2/d)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4
Trespasser 2/Incidental Ingestion of Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	50%	2.8E-09	1.5E+00	4.2E-09	100%
Cadmium	5.8E-01	100%	1.5E-09	0.0E+00	0.0E+00	0%
Iron	2.7E+04	100%	7.3E-05	0.0E+00	0.0E+00	0%
Thallium	3.7E-01	100%	9.8E-10	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	100%	1.2E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**4.2E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**2.66E-09**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	12	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 4
Trespasser 2/Dermal Contact with Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	3%	6.7E-10	1.5E+00	1.0E-09	100%
Cadmium	5.8E-01	0.1%	6.1E-12	0.0E+00	0.0E+00	0%
Iron	2.7E+04	1%	2.9E-06	0.0E+00	0.0E+00	0%
Thallium	3.7E-01	1%	3.9E-11	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	1%	4.8E-09	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.0E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.06E-08**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	12	EF = Exposure Frequency (days/yr)
	4980	SA = Surface Area (cm^2/d)
	0.04	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5
Adolescent Recreator/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.2E-06	2.3E-09	4.3E-03	9.8E-09	80%
Cadmium	6.8E-07	1.3E-09	1.8E-03	2.4E-09	20%
Iron	9.9E-03	1.9E-05	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	5.9E-10	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	2.9E-08	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.2E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (ET* ED * EF) / (AT) =		**1.96E-03**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5
Adolescent Recreator/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	50%	1.2E-08	1.5E+00	1.8E-08	100%
Cadmium	5.3E-01	100%	5.8E-09	0.0E+00	0.0E+00	0%
Iron	2.7E+04	100%	2.9E-04	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	100%	3.5E-09	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	100%	6.6E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.8E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.11E-08**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5
Adolescent Recreator/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	3%	5.4E-10	1.5E+00	8.0E-10	100%
Cadmium	5.3E-01	0.1%	4.4E-12	0.0E+00	0.0E+00	0%
Iron	2.7E+04	1%	2.2E-06	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	1%	2.7E-11	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	1%	5.0E-09	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**8.0E-10**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =	**8.40E-09**
25550	AT = Averaging Time - Cancer (days)
53	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
50	EF = Exposure Frequency (days/yr)
3790	SA = Surface Area (cm^2/d)
0.01	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5

Adolescent Recreator 2/Ingestion of Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E-03	2.6E-08	1.5E+00	3.9E-08	100%
Cadmium	1.5E-04	7.7E-10	0.0E+00	0.0E+00	0%
Iron	1.2E+01	6.1E-05	0.0E+00	0.0E+00	0%
Thallium	5.8E-04	3.1E-09	0.0E+00	0.0E+00	0%
Vanadium	1.4E-02	7.6E-08	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.9E-08**	

Notes:

NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * EF * ED) / (BW * AT) =		**5.32E-06**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	6	ED = Exposure Duration (yr)
	24	EF = Exposure Frequency (days/yr)
	0.05	IR = Ingestion Rate (L/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5
Adolescent Recreator 2/Dermal Contact with Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Dermal Permeability (Kp) (cm/hr)	Daily Intake DI = CxIFxKp (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	4.9E-03	1.E-03	4.1E-09	1.5E+00	6.1E-09	100%
Cadmium	1.5E-04	1.E-03	1.2E-10	0.0E+00	0.0E+00	0%
Iron	1.2E+01	1.E-03	9.7E-06	0.0E+00	0.0E+00	0%
Thallium	5.8E-04	1.E-03	4.8E-10	0.0E+00	0.0E+00	0%
Vanadium	1.4E-02	1.E-03	1.2E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**6.1E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (SA * ET * EF * ED * CF) / (BW * AT) =		**8.40E-04**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.001	CF = Conversion Factor (L/cm³)
	6	ED = Exposure Duration (years)
	24	EF = Exposure Frequency (days/yr)
	0.5	ET = Exposure Time (hrs/day)
	15800	SA = Surface Area (cm^2/d)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5
Adolescent Recreator 2/Incidental Ingestion of Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.8E+00	50%	4.7E-09	1.5E+00	7.1E-09	100%
Cadmium	2.1E-01	100%	1.1E-09	0.0E+00	0.0E+00	0%
Iron	1.4E+04	100%	7.7E-05	0.0E+00	0.0E+00	0%
Thallium	3.7E-01	100%	2.0E-09	0.0E+00	0.0E+00	0%
Vanadium	2.4E+01	100%	1.3E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**7.1E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**5.32E-09**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	24	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5
Adolescent Recreator 2/Dermal Contact with Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	1.8E+00	3%	1.1E-09	1.5E+00	1.7E-09	100%
Cadmium	2.1E-01	0.1%	4.4E-12	0.0E+00	0.0E+00	0%
Iron	1.4E+04	1%	3.1E-06	0.0E+00	0.0E+00	0%
Thallium	3.7E-01	1%	7.8E-11	0.0E+00	0.0E+00	0%
Vanadium	2.4E+01	1%	5.1E-09	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.7E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**2.12E-08**
	25550	AT = Averaging Time - Cancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	24	EF = Exposure Frequency (days/yr)
	4980	SA = Surface Area (cm^2/d)
	0.04	AF = Adherence Factor (mg/cm^2)

Index of Excess Lifetime Cancer Risks for Workers
Central Tendency

Sheet Number	EA	Receptor	Media	Exposure Pathway
1c	1	Rancher	Air	Inhalation
2c	1	Rancher	Soil	Ingestion
3c	1	Rancher	Soil	Dermal
4c	1	Construction Worker	Air	Inhalation
5c	1	Construction Worker	Soil	Ingestion
6c	1	Construction Worker	Soil	Dermal
7c	2	Rancher	Air	Inhalation
8c	2	Rancher	Soil	Ingestion
9c	2	Rancher	Soil	Dermal
10c	2	Construction Worker	Air	Inhalation
11c	2	Construction Worker	Soil	Ingestion
12c	2	Construction Worker	Soil	Dermal
13c	5	Rancher	Air	Inhalation
14c	5	Rancher	Soil	Ingestion
15c	5	Rancher	Soil	Dermal
16c	SM	Industrial Worker	Air	Inhalation
17c	SM	Industrial Worker	Soil	Ingestion
18c	SM	Industrial Worker	Soil	Dermal

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1
Rancher/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) ($\mu g/m^3$)	Effective Conc. EC = CxIF ($\mu g/m^3$)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.1E-06	4.0E-08	4.3E-03	1.7E-07	80%
Cadmium	6.4E-07	2.3E-08	1.8E-03	4.2E-08	20%
Iron	6.2E-03	2.3E-04	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	1.4E-08	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	4.0E-07	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.2E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (CF * ET* ED * EF) / (AT) =		**3.67E-02**
	613200	AT = Averaging Time - Cancer (hours)
	9	ED = Exposure Duration (yr)
	250	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1
Rancher/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	9.2E-08	1.5E+00	1.4E-07	100%
Cadmium	1.5E+00	100%	9.3E-08	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	1.6E-03	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	100%	2.6E-08	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	100%	3.5E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.4E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**6.29E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	250	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1
Rancher/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	7.3E-09	1.5E+00	1.1E-08	100%
Cadmium	1.5E+00	0.1%	1.2E-10	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	2.1E-05	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	1%	3.4E-10	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	1%	4.6E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.1E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**8.30E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	250	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.02	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1
Construction Worker/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) ($\mu g/m^3$)	Effective Conc. EC = CxIF ($\mu g/m^3$)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.1E-06	3.5E-08	4.3E-03	1.5E-07	80%
Cadmium	6.4E-07	2.1E-08	1.8E-03	3.7E-08	20%
Iron	6.2E-03	2.0E-04	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	1.3E-08	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	3.5E-07	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	***1.9E-07***	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (CF * ET* ED * EF) / (AT) =		**3.21E-02**
	613200	AT = Averaging Time - Cancer (hours)
	9	ED = Exposure Duration (yr)
	219	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1
Construction Worker/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	8.0E-08	1.5E+00	1.2E-07	100%
Cadmium	1.5E+00	100%	8.2E-08	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	1.4E-03	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	100%	2.2E-08	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	100%	3.0E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.2E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**5.51E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	219	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 1
Construction Worker/Dermal Contact with Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	6.4E-09	1.5E+00	9.6E-09	100%
Cadmium	1.5E+00	0.1%	1.1E-10	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	1.8E-05	0.0E+00	0.0E+00	0%
Thallium	4.1E-01	1%	3.0E-10	0.0E+00	0.0E+00	0%
Vanadium	5.5E+01	1%	4.0E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**9.6E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**7.27E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	219	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.02	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2
Rancher/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) ($\mu g/m^3$)	Effective Conc. EC = CxIF ($\mu g/m^3$)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	5.5E-07	2.0E-08	4.3E-03	8.7E-08	78%
Cadmium	3.6E-07	1.3E-08	1.8E-03	2.4E-08	22%
Iron	7.5E-03	2.7E-04	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	3.4E-08	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	6.8E-07	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.1E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (CF * ET* ED * EF) / (AT) =		**3.67E-02**
	613200	AT = Averaging Time - Cancer (hours)
	9	ED = Exposure Duration (yr)
	250	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2
Rancher/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	9.2E-08	1.5E+00	1.4E-07	100%
Cadmium	1.3E+00	100%	8.3E-08	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	1.6E-03	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	100%	3.6E-08	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	100%	2.8E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.4E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**6.29E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	250	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2
Rancher/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	7.2E-09	1.5E+00	1.1E-08	100%
Cadmium	1.3E+00	0.1%	1.1E-10	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	2.1E-05	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	1%	4.8E-10	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	1%	3.7E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.1E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**8.30E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	250	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.02	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2
Construction Worker/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) ($\mu g/m^3$)	Effective Conc. EC = CxIF ($\mu g/m^3$)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	5.5E-07	1.8E-08	4.3E-03	7.6E-08	78%
Cadmium	3.6E-07	1.2E-08	1.8E-03	2.1E-08	22%
Iron	7.5E-03	2.4E-04	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	3.0E-08	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	5.9E-07	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**9.7E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (CF * ET* ED * EF) / (AT) =		**3.21E-02**
	613200	AT = Averaging Time - Cancer (hours)
	9	ED = Exposure Duration (yr)
	219	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2
Construction Worker/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	50%	8.0E-08	1.5E+00	1.2E-07	100%
Cadmium	1.3E+00	100%	7.3E-08	0.0E+00	0.0E+00	0%
Iron	2.5E+04	100%	1.4E-03	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	100%	3.2E-08	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	100%	2.5E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.2E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**5.51E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	219	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 2
Construction Worker/Dermal Contact with Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.9E+00	3%	6.3E-09	1.5E+00	9.5E-09	100%
Cadmium	1.3E+00	0.1%	9.6E-11	0.0E+00	0.0E+00	0%
Iron	2.5E+04	1%	1.8E-05	0.0E+00	0.0E+00	0%
Thallium	5.8E-01	1%	4.2E-10	0.0E+00	0.0E+00	0%
Vanadium	4.5E+01	1%	3.3E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**9.5E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**7.27E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	219	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.02	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5
Rancher/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) ($\mu g/m^3$)	Effective Conc. EC = CxIF ($\mu g/m^3$)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	1.2E-06	4.3E-08	4.3E-03	1.8E-07	80%
Cadmium	6.8E-07	2.5E-08	1.8E-03	4.5E-08	20%
Iron	9.9E-03	3.6E-04	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	1.1E-08	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	5.5E-07	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.3E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (CF * ET* ED * EF) / (AT) =		**3.67E-02**
	613200	AT = Averaging Time - Cancer (hours)
	9	ED = Exposure Duration (yr)
	250	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5
Rancher/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	50%	6.7E-08	1.5E+00	1.0E-07	100%
Cadmium	5.3E-01	100%	3.3E-08	0.0E+00	0.0E+00	0%
Iron	2.7E+04	100%	1.7E-03	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	100%	2.0E-08	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	100%	3.7E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**1.0E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**6.29E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	250	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

EA 5
Rancher/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E+00	3%	5.3E-09	1.5E+00	8.0E-09	100%
Cadmium	5.3E-01	0.1%	4.4E-11	0.0E+00	0.0E+00	0%
Iron	2.7E+04	1%	2.2E-05	0.0E+00	0.0E+00	0%
Thallium	3.2E-01	1%	2.7E-10	0.0E+00	0.0E+00	0%
Vanadium	6.0E+01	1%	4.9E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**8.0E-09**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**8.30E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	250	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.02	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

SM
Industrial Worker/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) ($\mu g/m^3$)	Effective Conc. EC = CxIF ($\mu g/m^3$)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	2.6E-06	1.7E-08	4.3E-03	7.3E-08	73%
Cadmium	2.4E-06	1.5E-08	1.8E-03	2.7E-08	27%
Iron	1.1E-02	6.9E-05	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	2.3E-09	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	6.0E-08	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.0E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (CF * ET* ED * EF) / (AT) =		**6.43E-03**
	613200	AT = Averaging Time - Cancer (hours)
	9	ED = Exposure Duration (yr)
	219	EF = Exposure Frequency (days/yr)
	2	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

SM
Industrial Worker/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.4E+01	50%	3.3E-07	1.5E+00	5.0E-07	100%
Cadmium	7.2E+00	100%	2.0E-07	0.0E+00	0.0E+00	0%
Iron	5.9E+04	100%	1.6E-03	0.0E+00	0.0E+00	0%
Thallium	7.4E-01	100%	2.0E-08	0.0E+00	0.0E+00	0%
Vanadium	2.3E+01	100%	6.3E-07	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**5.0E-07**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**2.76E-08**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	219	EF = Exposure Frequency (days/yr)
	0.5	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway - Central Tendency

SM
Industrial Worker/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.4E+01	3%	5.3E-08	1.5E+00	7.9E-08	100%
Cadmium	7.2E+00	0.1%	5.3E-10	0.0E+00	0.0E+00	0%
Iron	5.9E+04	1%	4.3E-05	0.0E+00	0.0E+00	0%
Thallium	7.4E-01	1%	5.4E-10	0.0E+00	0.0E+00	0%
Vanadium	2.3E+01	1%	1.7E-08	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**7.9E-08**	

Notes:
NA indicates that an exposure point concentration is not available.

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =	**7.27E-08**
25550	AT = Averaging Time - Cancer (days)
70	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
9	ED = Exposure Duration (years)
219	EF = Exposure Frequency (days/yr)
3300	SA = Surface Area (cm^2/d)
0.02	AF = Adherence Factor (mg/cm^2)

Appendix E.3

RME Noncancer Risks

Index of Noncancer Risks for Residents - Reasonable Maximum Exposure

Sheet Number	EA	Receptor	Media	Exposure Pathway
1	1	Child Future Resident	Air	Inhalation
2	1	Child Future Resident	Soil	Ingestion
3	1	Child Future Resident	Soil	Dermal
4	1	Child Future Resident	Beef	Ingestion
5	1	Child Future Resident	Chicken	Ingestion
6	1	Child Future Resident	Eggs	Ingestion
7	1	Child Future Resident	Vegetables	Ingestion
8	1	Adult Future Resident	Air	Inhalation
9	1	Adult Future Resident	Soil	Ingestion
10	1	Adult Future Resident	Soil	Dermal
11	1	Adult Future Resident	Beef	Ingestion
12	1	Adult Future Resident	Chicken	Ingestion
13	1	Adult Future Resident	Eggs	Ingestion
14	1	Adult Future Resident	Vegetables	Ingestion
15	2	Child Current and Future Resident	Air	Inhalation
16	2	Child Current and Future Resident	Soil	Ingestion
17	2	Child Current and Future Resident	Soil	Dermal
18	2	Child Future Resident	Beef	Ingestion
19	2	Child Future Resident	Chicken	Ingestion
20	2	Child Future Resident	Eggs	Ingestion
21	2	Child Future Resident	Vegetables	Ingestion
22	2	Adult Current and Future Resident	Air	Inhalation
23	2	Adult Current and Future Resident	Soil	Ingestion
24	2	Adult Current and Future Resident	Soil	Dermal
25	2	Adult Current Resident	Beef	Ingestion
26	2	Adult Current Resident	Chicken	Ingestion
27	2	Adult Current Resident	Eggs	Ingestion
28	2	Adult Current Resident	Vegetables	Ingestion
29	3	Child Future Resident	Air	Inhalation
30	3	Child Future Resident	Soil	Ingestion
31	3	Child Future Resident	Soil	Dermal
32	3	Child Future Resident	Beef	Ingestion
33	3	Child Future Resident	Chicken	Ingestion
34	3	Child Future Resident	Eggs	Ingestion
35	3	Child Future Resident	Vegetables	Ingestion
36	3	Adult Future Resident	Air	Inhalation
37	3	Adult Future Resident	Soil	Ingestion
38	3	Adult Future Resident	Soil	Dermal
39	3	Adult Future Resident	Beef	Ingestion
40	3	Adult Future Resident	Chicken	Ingestion
41	3	Adult Future Resident	Eggs	Ingestion
42	3	Adult Future Resident	Vegetables	Ingestion
43	4	Child Future Resident	Air	Inhalation
44	4	Child Future Resident	Soil	Ingestion
45	4	Child Future Resident	Soil	Dermal
46	4	Child Future Resident	Beef	Ingestion
47	4	Child Future Resident	Chicken	Ingestion
48	4	Child Future Resident	Eggs	Ingestion
49	4	Child Future Resident	Vegetables	Ingestion
50	4	Adult Future Resident	Air	Inhalation
51	4	Adult Future Resident	Soil	Ingestion
52	4	Adult Future Resident	Soil	Dermal
53	4	Adult Future Resident	Beef	Ingestion
54	4	Adult Future Resident	Chicken	Ingestion
55	4	Adult Future Resident	Eggs	Ingestion
56	4	Adult Future Resident	Vegetables	Ingestion
57	5	Child Future Resident	Air	Inhalation
58	5	Child Future Resident	Soil	Ingestion
59	5	Child Future Resident	Soil	Dermal
60	5	Child Future Resident	Beef	Ingestion
61	5	Child Future Resident	Chicken	Ingestion
62	5	Child Future Resident	Eggs	Ingestion
63	5	Child Future Resident	Vegetables	Ingestion
64	5	Adult Future Resident	Air	Inhalation
65	5	Adult Future Resident	Soil	Ingestion
66	5	Adult Future Resident	Soil	Dermal
67	5	Adult Future Resident	Beef	Ingestion
68	5	Adult Future Resident	Chicken	Ingestion
69	5	Adult Future Resident	Eggs	Ingestion
70	5	Adult Future Resident	Vegetables	Ingestion

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.1E-06	1.1E-06	0.0E+00	0.0E+00	0%
Cadmium	6.4E-07	6.1E-07	7.0E-04	8.8E-04	100%
Iron	6.2E-03	5.9E-03	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	3.7E-07	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	1.0E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**8.8E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**9.59E-01**
	52560	AT = Averaging Time - Noncancer (hours)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	1.9E-05	3.0E-04	6.2E-02	3%
Cadmium	1.5E+00	100%	1.9E-05	1.0E-03	1.9E-02	1%
Iron	2.5E+04	100%	3.2E-01	3.0E-01	1.1E+00	55%
Thallium	4.1E-01	100%	5.2E-06	6.6E-05	7.9E-02	4%
Vanadium	5.5E+01	100%	7.1E-04	1.0E-03	7.1E-01	36%
				Total Noncancer Hazard:	**1.9E+00**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) = **1.28E-05**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
200	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	3.1E-06	3.0E-04	1.0E-02	0%
Cadmium	1.5E+00	0.1%	5.3E-08	2.5E-05	2.1E-03	0%
Iron	2.5E+04	1%	9.0E-03	3.0E-03	3.0E+00	100%
Thallium	4.1E-01	1%	1.5E-07	6.6E-05	2.2E-03	0%
Vanadium	0.0E+00	1%	0.0E+00	2.6E-05	0.0E+00	0%
				Total Noncancer Hazard:	**3.0E+00**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) = **3.58E-05**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
2800	SA = Surface Area (cm^2/d)
0.2	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.1E-03	8.6E-06	3.0E-04	2.9E-02	1%
Cadmium	2.0E-04	4.3E-07	1.0E-03	4.3E-04	0%
Iron	2.5E+02	5.3E-01	3.0E-01	1.8E+00	53%
Thallium	4.3E-02	9.1E-05	6.6E-05	1.4E+00	41%
Vanadium	8.4E-02	1.8E-04	1.0E-03	1.8E-01	5%
			Total Noncancer Hazard:	**3.4E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **2.11E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.5E-02	1.9E-05	3.0E-04	6.3E-02	3%
Cadmium	9.8E-04	1.2E-06	1.0E-03	1.2E-03	0%
Iron	3.4E+02	4.2E-01	3.0E-01	1.4E+00	65%
Thallium	5.6E-03	7.0E-06	6.6E-05	1.1E-01	5%
Vanadium	4.6E-01	5.7E-04	1.0E-03	5.7E-01	27%
			Total Noncancer Hazard:	**2.1E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.25E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.5E-02	1.5E-05	3.0E-04	4.9E-02	3%
Cadmium	2.2E-05	2.2E-08	1.0E-03	2.2E-05	0%
Iron	2.9E+02	2.9E-01	3.0E-01	9.7E-01	61%
Thallium	3.7E-05	3.7E-08	6.6E-05	5.7E-04	0%
Vanadium	5.7E-01	5.7E-04	1.0E-03	5.7E-01	36%
			Total Noncancer Hazard:	**1.6E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.01E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.0E-01	2.3E-04	3.0E-04	7.6E-01	35%
Cadmium	6.1E-01	7.0E-04	1.0E-03	7.0E-01	32%
Iron	1.0E+02	1.2E-01	3.0E-01	3.9E-01	18%
Thallium	8.0E-04	9.2E-07	6.6E-05	1.4E-02	1%
Vanadium	3.0E-01	3.4E-04	1.0E-03	3.4E-01	15%
			Total Noncancer Hazard:	**2.2E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.1E-06	1.1E-06	0.0E+00	0.0E+00	0%
Cadmium	6.4E-07	6.1E-07	7.0E-04	8.8E-04	100%
Iron	6.2E-03	5.9E-03	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	3.7E-07	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	1.0E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**8.8E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

210240	AT = Averaging Time - Noncancer (hours)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	2.0E-06	3.0E-04	6.7E-03	3%
Cadmium	1.5E+00	100%	2.0E-06	1.0E-03	2.0E-03	1%
Iron	2.5E+04	100%	3.4E-02	3.0E-01	1.1E-01	55%
Thallium	4.1E-01	100%	5.6E-07	6.6E-05	8.4E-03	4%
Vanadium	5.5E+01	100%	7.6E-05	1.0E-03	7.6E-02	36%
				Total Noncancer Hazard:	**2.1E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.37E-06**
	8760	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	4.8E-07	3.0E-04	1.6E-03	0%
Cadmium	1.5E+00	0.1%	8.1E-09	2.5E-05	3.2E-04	0%
Iron	2.5E+04	1%	1.4E-03	3.0E-03	4.6E-01	79%
Thallium	4.1E-01	1%	2.2E-08	6.6E-05	3.4E-04	0%
Vanadium	5.5E+01	1%	3.0E-06	2.6E-05	1.2E-01	20%
				Total Noncancer Hazard:	**5.8E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**5.47E-06**
	8760	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.1E-03	8.6E-06	3.0E-04	2.9E-02	1%
Cadmium	2.0E-04	4.3E-07	1.0E-03	4.3E-04	0%
Iron	2.5E+02	5.3E-01	3.0E-01	1.8E+00	53%
Thallium	4.3E-02	9.1E-05	6.6E-05	1.4E+00	41%
Vanadium	8.4E-02	1.8E-04	1.0E-03	1.8E-01	5%
			Total Noncancer Hazard:	**3.4E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **2.11E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.5E-02	1.9E-05	3.0E-04	6.3E-02	3%
Cadmium	9.8E-04	1.2E-06	1.0E-03	1.2E-03	0%
Iron	3.4E+02	4.2E-01	3.0E-01	1.4E+00	65%
Thallium	5.6E-03	7.0E-06	6.6E-05	1.1E-01	5%
Vanadium	4.6E-01	5.7E-04	1.0E-03	5.7E-01	27%
			Total Noncancer Hazard:	**2.1E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.25E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.5E-02	1.5E-05	3.0E-04	4.9E-02	3%
Cadmium	2.2E-05	2.2E-08	1.0E-03	2.2E-05	0%
Iron	2.9E+02	2.9E-01	3.0E-01	9.7E-01	61%
Thallium	3.7E-05	3.7E-08	6.6E-05	5.7E-04	0%
Vanadium	5.7E-01	5.7E-04	1.0E-03	5.7E-01	36%
			Total Noncancer Hazard:	**1.6E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.01E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.0E-01	2.3E-04	3.0E-04	7.6E-01	35%
Cadmium	6.1E-01	7.0E-04	1.0E-03	7.0E-01	32%
Iron	1.0E+02	1.2E-01	3.0E-01	3.9E-01	18%
Thallium	8.0E-04	9.2E-07	6.6E-05	1.4E-02	1%
Vanadium	3.0E-01	3.4E-04	1.0E-03	3.4E-01	15%
			Total Noncancer Hazard:	**2.2E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Current and Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	5.5E-07	5.3E-07	0.0E+00	0.0E+00	0%
Cadmium	3.6E-07	3.5E-07	7.0E-04	4.9E-04	100%
Iron	7.5E-03	7.2E-03	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	9.0E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	1.8E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**4.9E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

52560	AT = Averaging Time - Noncancer (hours)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Current and Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	1.9E-05	3.0E-04	6.2E-02	3%
Cadmium	1.3E+00	100%	1.7E-05	1.0E-03	1.7E-02	1%
Iron	2.5E+04	100%	3.2E-01	3.0E-01	1.1E+00	58%
Thallium	5.8E-01	100%	7.4E-06	6.6E-05	1.1E-01	6%
Vanadium	4.5E+01	100%	5.7E-04	1.0E-03	5.7E-01	31%
				Total Noncancer Hazard:	**1.8E+00**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) = **1.28E-05**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
200	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Current and Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	3.1E-06	3.0E-04	1.0E-02	0%
Cadmium	1.3E+00	0.1%	4.7E-08	2.5E-05	1.9E-03	0%
Iron	2.5E+04	1%	9.0E-03	3.0E-03	3.0E+00	83%
Thallium	5.8E-01	1%	2.1E-07	6.6E-05	3.1E-03	0%
Vanadium	4.5E+01	1%	1.6E-05	2.6E-05	6.2E-01	17%
				Total Noncancer Hazard:	**3.6E+00**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) = **3.58E-05**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
2800	SA = Surface Area (cm^2/d)
0.2	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.9E-03	1.5E-05	3.0E-04	4.9E-02	1%
Cadmium	1.9E-04	4.1E-07	1.0E-03	4.1E-04	0%
Iron	2.0E+02	4.2E-01	3.0E-01	1.4E+00	24%
Thallium	1.3E-01	2.8E-04	6.6E-05	4.3E+00	73%
Vanadium	4.5E-02	9.4E-05	1.0E-03	9.4E-02	2%
			Total Noncancer Hazard:	**5.8E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **2.11E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-02	3.2E-05	3.0E-04	1.1E-01	6%
Cadmium	9.2E-04	1.1E-06	1.0E-03	1.1E-03	0%
Iron	2.7E+02	3.3E-01	3.0E-01	1.1E+00	60%
Thallium	1.7E-02	2.2E-05	6.6E-05	3.3E-01	18%
Vanadium	2.4E-01	3.0E-04	1.0E-03	3.0E-01	16%
			Total Noncancer Hazard:	**1.8E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.25E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.5E-02	2.5E-05	3.0E-04	8.3E-02	7%
Cadmium	2.1E-05	2.1E-08	1.0E-03	2.1E-05	0%
Iron	2.3E+02	2.3E-01	3.0E-01	7.8E-01	67%
Thallium	1.2E-04	1.2E-07	6.6E-05	1.8E-03	0%
Vanadium	3.0E-01	3.0E-04	1.0E-03	3.0E-01	26%
			Total Noncancer Hazard:	**1.2E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.01E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.0E-01	2.3E-04	3.0E-04	7.7E-01	41%
Cadmium	6.5E-01	7.5E-04	1.0E-03	7.5E-01	40%
Iron	6.0E+01	6.9E-02	3.0E-01	2.3E-01	12%
Thallium	3.7E-04	4.2E-07	6.6E-05	6.4E-03	0%
Vanadium	8.5E-02	9.8E-05	1.0E-03	9.8E-02	5%
			Total Noncancer Hazard:	**1.9E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Current and Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	5.5E-07	5.3E-07	0.0E+00	0.0E+00	0%
Cadmium	3.6E-07	3.5E-07	7.0E-04	4.9E-04	100%
Iron	7.5E-03	7.2E-03	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	9.0E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	1.8E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**4.9E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

210240	AT = Averaging Time - Noncancer (hours)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Current and Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	2.0E-06	3.0E-04	6.6E-03	3%
Cadmium	1.3E+00	100%	1.8E-06	1.0E-03	1.8E-03	1%
Iron	2.5E+04	100%	3.4E-02	3.0E-01	1.1E-01	58%
Thallium	5.8E-01	100%	7.9E-07	6.6E-05	1.2E-02	6%
Vanadium	4.5E+01	100%	6.1E-05	1.0E-03	6.1E-02	31%
				Total Noncancer Hazard:	**2.0E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.37E-06**
	8760	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Current and Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	4.8E-07	3.0E-04	1.6E-03	0%
Cadmium	1.3E+00	0.1%	7.2E-09	2.5E-05	2.9E-04	0%
Iron	2.5E+04	1%	1.4E-03	3.0E-03	4.6E-01	83%
Thallium	5.8E-01	1%	3.2E-08	6.6E-05	4.8E-04	0%
Vanadium	4.5E+01	1%	2.4E-06	2.6E-05	9.4E-02	17%
				Total Noncancer Hazard:	**5.6E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**5.47E-06**
	8760	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.9E-03	1.5E-05	3.0E-04	4.9E-02	1%
Cadmium	1.9E-04	4.1E-07	1.0E-03	4.1E-04	0%
Iron	2.0E+02	4.2E-01	3.0E-01	1.4E+00	24%
Thallium	1.3E-01	2.8E-04	6.6E-05	4.3E+00	73%
Vanadium	4.5E-02	9.4E-05	1.0E-03	9.4E-02	2%
			Total Noncancer Hazard:	**5.8E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **2.11E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-02	3.2E-05	3.0E-04	1.1E-01	6%
Cadmium	9.2E-04	1.1E-06	1.0E-03	1.1E-03	0%
Iron	2.7E+02	3.3E-01	3.0E-01	1.1E+00	60%
Thallium	1.7E-02	2.2E-05	6.6E-05	3.3E-01	18%
Vanadium	2.4E-01	3.0E-04	1.0E-03	3.0E-01	16%
			Total Noncancer Hazard:	**1.8E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.25E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**

Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.5E-02	2.5E-05	3.0E-04	8.3E-02	7%
Cadmium	2.1E-05	2.1E-08	1.0E-03	2.1E-05	0%
Iron	2.3E+02	2.3E-01	3.0E-01	7.8E-01	67%
Thallium	1.2E-04	1.2E-07	6.6E-05	1.8E-03	0%
Vanadium	3.0E-01	3.0E-04	1.0E-03	3.0E-01	26%
			Total Noncancer Hazard:	**1.2E+00**	

Notes:

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.01E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.0E-01	2.3E-04	3.0E-04	7.7E-01	41%
Cadmium	6.5E-01	7.5E-04	1.0E-03	7.5E-01	40%
Iron	6.0E+01	6.9E-02	3.0E-01	2.3E-01	12%
Thallium	3.7E-04	4.2E-07	6.6E-05	6.4E-03	0%
Vanadium	8.5E-02	9.8E-05	1.0E-03	9.8E-02	5%
			Total Noncancer Hazard:	**1.9E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIFxR (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.4E-06	1.3E-06	0.0E+00	0.0E+00	0%
Cadmium	2.2E-06	2.1E-06	7.0E-04	3.0E-03	100%
Iron	8.4E-03	8.1E-03	0.0E+00	0.0E+00	0%
Thallium	4.2E-07	4.0E-07	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	9.0E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**3.0E-03**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

52560	AT = Averaging Time - Noncancer (hours)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.2E+00	50%	4.0E-05	3.0E-04	1.3E-01	3%
Cadmium	2.8E+01	100%	3.6E-04	1.0E-03	3.6E-01	10%
Iron	5.7E+04	100%	7.3E-01	3.0E-01	2.4E+00	65%
Thallium	6.6E-01	100%	8.4E-06	6.6E-05	1.3E-01	3%
Vanadium	5.5E+01	100%	7.1E-04	1.0E-03	7.1E-01	19%
				Total Noncancer Hazard:	**3.8E+00**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.28E-05**
	2190	AT = Averaging Time - Noncancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	200	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.2E+00	3%	6.6E-06	3.0E-04	2.2E-02	0%
Cadmium	2.8E+01	0.1%	1.0E-06	2.5E-05	4.1E-02	1%
Iron	5.7E+04	1%	2.0E-02	3.0E-03	6.8E+00	93%
Thallium	6.6E-01	1%	2.4E-07	6.6E-05	3.6E-03	0%
Vanadium	3.2E+01	1%	1.1E-05	2.6E-05	4.4E-01	6%
				Total Noncancer Hazard:	**7.3E+00**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) = **3.58E-05**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
2800	SA = Surface Area (cm^2/d)
0.2	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.8E-03	1.4E-05	3.0E-04	4.8E-02	1%
Cadmium	5.0E-03	1.1E-05	1.0E-03	1.1E-02	0%
Iron	6.0E+02	1.3E+00	3.0E-01	4.2E+00	88%
Thallium	1.4E-02	3.0E-05	6.6E-05	4.5E-01	9%
Vanadium	4.4E-02	9.2E-05	1.0E-03	9.2E-02	2%
			Total Noncancer Hazard:	**4.8E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **2.11E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.5E-02	3.1E-05	3.0E-04	1.0E-01	3%
Cadmium	2.4E-02	3.0E-05	1.0E-03	3.0E-02	1%
Iron	8.0E+02	9.9E-01	3.0E-01	3.3E+00	88%
Thallium	1.8E-03	2.3E-06	6.6E-05	3.5E-02	1%
Vanadium	2.4E-01	2.9E-04	1.0E-03	2.9E-01	8%
			Total Noncancer Hazard:	**3.8E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.25E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.4E-02	2.4E-05	3.0E-04	8.1E-02	3%
Cadmium	5.5E-04	5.5E-07	1.0E-03	5.5E-04	0%
Iron	6.9E+02	7.0E-01	3.0E-01	2.3E+00	86%
Thallium	1.2E-05	1.2E-08	6.6E-05	1.9E-04	0%
Vanadium	2.9E-01	3.0E-04	1.0E-03	3.0E-01	11%
			Total Noncancer Hazard:	**2.7E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.01E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.8E-01	2.1E-04	3.0E-04	7.0E-01	35%
Cadmium	6.4E-01	7.4E-04	1.0E-03	7.4E-01	37%
Iron	1.0E+02	1.2E-01	3.0E-01	4.0E-01	20%
Thallium	2.4E-03	2.7E-06	6.6E-05	4.1E-02	2%
Vanadium	1.1E-01	1.2E-04	1.0E-03	1.2E-01	6%
			Total Noncancer Hazard:	**2.0E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.4E-06	1.3E-06	0.0E+00	0.0E+00	0%
Cadmium	2.2E-06	2.1E-06	7.0E-04	3.0E-03	100%
Iron	8.4E-03	8.1E-03	0.0E+00	0.0E+00	0%
Thallium	4.2E-07	4.0E-07	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	9.0E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**3.0E-03**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

210240	AT = Averaging Time - Noncancer (hours)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.2E+00	50%	4.2E-06	3.0E-04	1.4E-02	4%
Cadmium	2.8E+01	100%	3.9E-05	1.0E-03	3.9E-02	10%
Iron	5.7E+04	100%	7.8E-02	3.0E-01	2.6E-01	70%
Thallium	6.6E-01	100%	9.0E-07	6.6E-05	1.4E-02	4%
Vanadium	3.2E+01	100%	4.3E-05	1.0E-03	4.3E-02	12%
				Total Noncancer Hazard:	**3.7E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.37E-06**
	8760	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.2E+00	3%	1.0E-06	3.0E-04	3.4E-03	0%
Cadmium	2.8E+01	0.1%	1.6E-07	2.5E-05	6.2E-03	1%
Iron	5.7E+04	1%	3.1E-03	3.0E-03	1.0E+00	93%
Thallium	6.6E-01	1%	3.6E-08	6.6E-05	5.5E-04	0%
Vanadium	3.2E+01	1%	1.7E-06	2.6E-05	6.6E-02	6%
				Total Noncancer Hazard:	**1.1E+00**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**5.47E-06**
	8760	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.8E-03	1.4E-05	3.0E-04	4.8E-02	1%
Cadmium	5.0E-03	1.1E-05	1.0E-03	1.1E-02	0%
Iron	6.0E+02	1.3E+00	3.0E-01	4.2E+00	88%
Thallium	1.4E-02	3.0E-05	6.6E-05	4.5E-01	9%
Vanadium	4.4E-02	9.2E-05	1.0E-03	9.2E-02	2%
			Total Noncancer Hazard:	**4.8E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **2.11E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**

Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.5E-02	3.1E-05	3.0E-04	1.0E-01	3%
Cadmium	2.4E-02	3.0E-05	1.0E-03	3.0E-02	1%
Iron	8.0E+02	9.9E-01	3.0E-01	3.3E+00	88%
Thallium	1.8E-03	2.3E-06	6.6E-05	3.5E-02	1%
Vanadium	2.4E-01	2.9E-04	1.0E-03	2.9E-01	8%
			Total Noncancer Hazard:	**3.8E+00**	

Notes:

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.25E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.4E-02	2.4E-05	3.0E-04	8.1E-02	3%
Cadmium	5.5E-04	5.5E-07	1.0E-03	5.5E-04	0%
Iron	6.9E+02	7.0E-01	3.0E-01	2.3E+00	86%
Thallium	1.2E-05	1.2E-08	6.6E-05	1.9E-04	0%
Vanadium	2.9E-01	3.0E-04	1.0E-03	3.0E-01	11%
			Total Noncancer Hazard:	**2.7E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.01E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.8E-01	2.1E-04	3.0E-04	7.0E-01	35%
Cadmium	6.4E-01	7.4E-04	1.0E-03	7.4E-01	37%
Iron	1.0E+02	1.2E-01	3.0E-01	4.0E-01	20%
Thallium	2.4E-03	2.7E-06	6.6E-05	4.1E-02	2%
Vanadium	1.1E-01	1.2E-04	1.0E-03	1.2E-01	6%
			Total Noncancer Hazard:	**2.0E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-06	2.5E-06	0.0E+00	0.0E+00	0%
Cadmium	2.4E-06	2.3E-06	7.0E-04	3.2E-03	100%
Iron	1.1E-02	1.0E-02	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	3.4E-07	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	9.0E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**3.2E-03**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

52560	AT = Averaging Time - Noncancer (hours)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E+00	50%	3.2E-05	3.0E-04	1.1E-01	5%
Cadmium	4.1E+00	100%	5.2E-05	1.0E-03	5.2E-02	3%
Iron	2.3E+04	100%	3.0E-01	3.0E-01	9.9E-01	50%
Thallium	5.4E-01	100%	6.9E-06	6.6E-05	1.0E-01	5%
Vanadium	5.5E+01	100%	7.1E-04	1.0E-03	7.1E-01	36%
				Total Noncancer Hazard:	**2.0E+00**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) = **1.28E-05**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
200	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E+00	3%	5.3E-06	3.0E-04	1.8E-02	1%
Cadmium	4.1E+00	0.1%	1.5E-07	2.5E-05	5.8E-03	0%
Iron	2.3E+04	1%	8.3E-03	3.0E-03	2.8E+00	87%
Thallium	5.4E-01	1%	1.9E-07	6.6E-05	2.9E-03	0%
Vanadium	2.9E+01	1%	1.0E-05	2.6E-05	4.0E-01	13%
				Total Noncancer Hazard:	**3.2E+00**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) = **3.58E-05**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
2800	SA = Surface Area (cm^2/d)
0.2	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.0E-02	2.1E-05	3.0E-04	7.1E-02	3%
Cadmium	6.6E-04	1.4E-06	1.0E-03	1.4E-03	0%
Iron	2.4E+02	5.1E-01	3.0E-01	1.7E+00	76%
Thallium	1.2E-02	2.4E-05	6.6E-05	3.7E-01	17%
Vanadium	4.0E-02	8.5E-05	1.0E-03	8.5E-02	4%
			Total Noncancer Hazard:	**2.2E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **2.11E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**

Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	3.1E-02	3.9E-05	3.0E-04	1.3E-01	7%
Cadmium	3.2E-03	3.9E-06	1.0E-03	3.9E-03	0%
Iron	3.2E+02	4.0E-01	3.0E-01	1.3E+00	76%
Thallium	1.5E-03	1.9E-06	6.6E-05	2.9E-02	2%
Vanadium	2.2E-01	2.7E-04	1.0E-03	2.7E-01	15%
			Total Noncancer Hazard:	**1.8E+00**	

Notes:

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.25E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	3.0E-02	3.0E-05	3.0E-04	1.0E-01	8%
Cadmium	7.2E-05	7.2E-08	1.0E-03	7.2E-05	0%
Iron	2.8E+02	2.8E-01	3.0E-01	9.4E-01	72%
Thallium	1.0E-05	1.0E-08	6.6E-05	1.5E-04	0%
Vanadium	2.7E-01	2.7E-04	1.0E-03	2.7E-01	21%
			Total Noncancer Hazard:	**1.3E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.01E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-01	3.0E-04	3.0E-04	1.0E+00	30%
Cadmium	1.4E+00	1.6E-03	1.0E-03	1.6E+00	47%
Iron	1.4E+02	1.6E-01	3.0E-01	5.4E-01	16%
Thallium	7.0E-05	8.1E-08	6.6E-05	1.2E-03	0%
Vanadium	2.2E-01	2.5E-04	1.0E-03	2.5E-01	7%
			Total Noncancer Hazard:	**3.3E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-06	2.5E-06	0.0E+00	0.0E+00	0%
Cadmium	2.4E-06	2.3E-06	7.0E-04	3.2E-03	100%
Iron	1.1E-02	1.0E-02	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	3.4E-07	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	9.0E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**3.2E-03**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

210240	AT = Averaging Time - Noncancer (hours)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E+00	50%	3.4E-06	3.0E-04	1.1E-02	6%
Cadmium	4.1E+00	100%	5.6E-06	1.0E-03	5.6E-03	3%
Iron	2.3E+04	100%	3.2E-02	3.0E-01	1.1E-01	61%
Thallium	5.4E-01	100%	7.4E-07	6.6E-05	1.1E-02	6%
Vanadium	2.9E+01	100%	4.0E-05	1.0E-03	4.0E-02	23%
				Total Noncancer Hazard:	**1.7E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.37E-06**
	8760	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E+00	3%	8.1E-07	3.0E-04	2.7E-03	1%
Cadmium	4.1E+00	0.1%	2.2E-08	2.5E-05	8.9E-04	0%
Iron	2.3E+04	1%	1.3E-03	3.0E-03	4.2E-01	87%
Thallium	5.4E-01	1%	3.0E-08	6.6E-05	4.5E-04	0%
Vanadium	2.9E+01	1%	1.6E-06	2.6E-05	6.1E-02	13%
				Total Noncancer Hazard:	**4.9E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**5.47E-06**
	8760	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.0E-02	2.1E-05	3.0E-04	7.1E-02	3%
Cadmium	6.6E-04	1.4E-06	1.0E-03	1.4E-03	0%
Iron	2.4E+02	5.1E-01	3.0E-01	1.7E+00	76%
Thallium	1.2E-02	2.4E-05	6.6E-05	3.7E-01	17%
Vanadium	4.0E-02	8.5E-05	1.0E-03	8.5E-02	4%
			Total Noncancer Hazard:	**2.2E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **2.11E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	3.1E-02	3.9E-05	3.0E-04	1.3E-01	7%
Cadmium	3.2E-03	3.9E-06	1.0E-03	3.9E-03	0%
Iron	3.2E+02	4.0E-01	3.0E-01	1.3E+00	76%
Thallium	1.5E-03	1.9E-06	6.6E-05	2.9E-02	2%
Vanadium	2.2E-01	2.7E-04	1.0E-03	2.7E-01	15%
			Total Noncancer Hazard:	**1.8E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.25E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	3.0E-02	3.0E-05	3.0E-04	1.0E-01	8%
Cadmium	7.2E-05	7.2E-08	1.0E-03	7.2E-05	0%
Iron	2.8E+02	2.8E-01	3.0E-01	9.4E-01	72%
Thallium	1.0E-05	1.0E-08	6.6E-05	1.5E-04	0%
Vanadium	2.7E-01	2.7E-04	1.0E-03	2.7E-01	21%
			Total Noncancer Hazard:	**1.3E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.01E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-01	3.0E-04	3.0E-04	1.0E+00	30%
Cadmium	1.4E+00	1.6E-03	1.0E-03	1.6E+00	47%
Iron	1.4E+02	1.6E-01	3.0E-01	5.4E-01	16%
Thallium	7.0E-05	8.1E-08	6.6E-05	1.2E-03	0%
Vanadium	2.2E-01	2.5E-04	1.0E-03	2.5E-01	7%
			Total Noncancer Hazard:	**3.3E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.2E-06	1.1E-06	0.0E+00	0.0E+00	0%
Cadmium	6.8E-07	6.5E-07	7.0E-04	9.3E-04	100%
Iron	9.9E-03	9.4E-03	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	2.9E-07	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	1.4E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**9.3E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

52560	AT = Averaging Time - Noncancer (hours)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	50%	1.4E-05	3.0E-04	4.5E-02	2%
Cadmium	5.3E-01	100%	6.7E-06	1.0E-03	6.7E-03	0%
Iron	2.7E+04	100%	3.4E-01	3.0E-01	1.1E+00	56%
Thallium	3.2E-01	100%	4.1E-06	6.6E-05	6.2E-02	3%
Vanadium	6.0E+01	100%	7.6E-04	1.0E-03	7.6E-01	38%
				Total Noncancer Hazard:	**2.0E+00**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) = **1.28E-05**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
200	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	3%	2.3E-06	3.0E-04	7.6E-03	0%
Cadmium	5.3E-01	0.1%	1.9E-08	2.5E-05	7.5E-04	0%
Iron	2.7E+04	1%	9.5E-03	3.0E-03	3.2E+00	79%
Thallium	3.2E-01	1%	1.1E-07	6.6E-05	1.7E-03	0%
Vanadium	6.0E+01	1%	2.1E-05	2.6E-05	8.2E-01	20%
				Total Noncancer Hazard:	**4.0E+00**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) = **3.58E-05**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
2800	SA = Surface Area (cm^2/d)
0.2	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	7.1E-03	1.5E-05	3.0E-04	5.0E-02	2%
Cadmium	1.9E-04	3.9E-07	1.0E-03	3.9E-04	0%
Iron	2.8E+02	5.9E-01	3.0E-01	2.0E+00	82%
Thallium	6.9E-03	1.4E-05	6.6E-05	2.2E-01	9%
Vanadium	8.2E-02	1.7E-04	1.0E-03	1.7E-01	7%
			Total Noncancer Hazard:	**2.4E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **2.11E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.2E-02	2.8E-05	3.0E-04	9.3E-02	4%
Cadmium	8.9E-04	1.1E-06	1.0E-03	1.1E-03	0%
Iron	3.7E+02	4.6E-01	3.0E-01	1.5E+00	70%
Thallium	8.9E-04	1.1E-06	6.6E-05	1.7E-02	1%
Vanadium	4.4E-01	5.5E-04	1.0E-03	5.5E-01	25%
			Total Noncancer Hazard:	**2.2E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.25E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**

Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.2E-02	2.2E-05	3.0E-04	7.2E-02	4%
Cadmium	2.0E-05	2.0E-08	1.0E-03	2.0E-05	0%
Iron	3.2E+02	3.2E-01	3.0E-01	1.1E+00	63%
Thallium	6.0E-06	6.0E-09	6.6E-05	9.1E-05	0%
Vanadium	5.5E-01	5.6E-04	1.0E-03	5.6E-01	33%
			Total Noncancer Hazard:	**1.7E+00**	

Notes:

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.01E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.8E-01	2.1E-04	3.0E-04	7.1E-01	37%
Cadmium	6.7E-01	7.7E-04	1.0E-03	7.7E-01	41%
Iron	7.3E+01	8.4E-02	3.0E-01	2.8E-01	15%
Thallium	1.3E-04	1.5E-07	6.6E-05	2.2E-03	0%
Vanadium	1.1E-01	1.2E-04	1.0E-03	1.2E-01	7%
			Total Noncancer Hazard:	**1.9E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.2E-06	1.1E-06	0.0E+00	0.0E+00	0%
Cadmium	6.8E-07	6.5E-07	7.0E-04	9.3E-04	100%
Iron	9.9E-03	9.4E-03	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	2.9E-07	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	1.4E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**9.3E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

210240	AT = Averaging Time - Noncancer (hours)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	50%	1.5E-06	3.0E-04	4.9E-03	2%
Cadmium	5.3E-01	100%	7.2E-07	1.0E-03	7.2E-04	0%
Iron	2.7E+04	100%	3.6E-02	3.0E-01	1.2E-01	56%
Thallium	3.2E-01	100%	4.4E-07	6.6E-05	6.6E-03	3%
Vanadium	6.0E+01	100%	8.2E-05	1.0E-03	8.2E-02	38%
				Total Noncancer Hazard:	**2.2E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.37E-06**
	8760	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	3%	3.5E-07	3.0E-04	1.2E-03	0%
Cadmium	5.3E-01	0.1%	2.9E-09	2.5E-05	1.2E-04	0%
Iron	2.7E+04	1%	1.5E-03	3.0E-03	4.9E-01	79%
Thallium	3.2E-01	1%	1.7E-08	6.6E-05	2.7E-04	0%
Vanadium	6.0E+01	1%	3.3E-06	2.6E-05	1.3E-01	20%
				Total Noncancer Hazard:	**6.1E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**5.47E-06**
	8760	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	7.1E-03	1.5E-05	3.0E-04	5.0E-02	2%
Cadmium	1.9E-04	3.9E-07	1.0E-03	3.9E-04	0%
Iron	2.8E+02	5.9E-01	3.0E-01	2.0E+00	82%
Thallium	6.9E-03	1.4E-05	6.6E-05	2.2E-01	9%
Vanadium	8.2E-02	1.7E-04	1.0E-03	1.7E-01	7%
			Total Noncancer Hazard:	**2.4E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **2.11E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.2E-02	2.8E-05	3.0E-04	9.3E-02	4%
Cadmium	8.9E-04	1.1E-06	1.0E-03	1.1E-03	0%
Iron	3.7E+02	4.6E-01	3.0E-01	1.5E+00	70%
Thallium	8.9E-04	1.1E-06	6.6E-05	1.7E-02	1%
Vanadium	4.4E-01	5.5E-04	1.0E-03	5.5E-01	25%
			Total Noncancer Hazard:	**2.2E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.25E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.2E-02	2.2E-05	3.0E-04	7.2E-02	4%
Cadmium	2.0E-05	2.0E-08	1.0E-03	2.0E-05	0%
Iron	3.2E+02	3.2E-01	3.0E-01	1.1E+00	63%
Thallium	6.0E-06	6.0E-09	6.6E-05	9.1E-05	0%
Vanadium	5.5E-01	5.6E-04	1.0E-03	5.6E-01	33%
			Total Noncancer Hazard:	**1.7E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.01E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.8E-01	2.1E-04	3.0E-04	7.1E-01	37%
Cadmium	6.7E-01	7.7E-04	1.0E-03	7.7E-01	41%
Iron	7.3E+01	8.4E-02	3.0E-01	2.8E-01	15%
Thallium	1.3E-04	1.5E-07	6.6E-05	2.2E-03	0%
Vanadium	1.1E-01	1.2E-04	1.0E-03	1.2E-01	7%
			Total Noncancer Hazard:	**1.9E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Index of Noncancer Risks for Adolescents
Reasonable Maximum Exposure

Sheet Number	EA	Receptor	Media	Exposure Pathway
1b	1	Recreator 1	Air	Inhalation
2b	1	Recreator 1	Soil	Ingestion
3b	1	Recreator 1	Soil	Dermal
4b	3	Trespasser 1	Air	Inhalation
5b	3	Trespasser 1	Soil	Ingestion
6b	3	Trespasser 1	Soil	Dermal
7b	4	Trespasser 1	Air	Inhalation
8b	4	Trespasser 1	Soil	Ingestion
9b	4	Trespasser 1	Soil	Dermal
10b	4	Trespasser 2	Surface Water	Ingestion
11b	4	Trespasser 2	Surface Water	Dermal
12b	4	Trespasser 2	Sediment	Ingestion
13b	4	Trespasser 2	Sediment	Dermal
14b	5	Recreator 1	Air	Inhalation
15b	5	Recreator 1	Soil	Ingestion
16b	5	Recreator 1	Soil	Dermal
17b	5	Recreator 2	Surface Water	Ingestion
18b	5	Recreator 2	Surface Water	Dermal
19b	5	Recreator 2	Sediment	Ingestion
20b	5	Recreator 2	Sediment	Dermal

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Adolescent Recreator/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.1E-06	2.5E-08	0.0E+00	0.0E+00	0%
Cadmium	6.4E-07	1.5E-08	7.0E-04	2.1E-05	100%
Iron	6.2E-03	1.4E-04	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	8.9E-09	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	2.5E-07	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**2.1E-05**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**2.28E-02**
	52560	AT = Averaging Time - Noncancer (hours)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Adolescent Recreator/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	3.8E-07	3.0E-04	1.3E-03	3%
Cadmium	1.5E+00	100%	3.8E-07	1.0E-03	3.8E-04	1%
Iron	2.5E+04	100%	6.5E-03	3.0E-01	2.2E-02	55%
Thallium	4.1E-01	100%	1.1E-07	6.6E-05	1.6E-03	4%
Vanadium	5.5E+01	100%	1.4E-05	1.0E-03	1.4E-02	36%
				Total Noncancer Hazard:	**3.9E-02**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**2.58E-07**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Adolescent Recreator/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	6.0E-08	3.0E-04	2.0E-04	0%
Cadmium	1.5E+00	0.1%	1.0E-09	2.5E-05	4.1E-05	0%
Iron	2.5E+04	1%	1.7E-04	3.0E-03	5.7E-02	79%
Thallium	4.1E-01	1%	2.8E-09	6.6E-05	4.2E-05	0%
Vanadium	5.5E+01	1%	3.8E-07	2.6E-05	1.5E-02	20%
				Total Noncancer Hazard:	**7.2E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**6.86E-07**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	50	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3
Adolescent Trespasser/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.4E-06	6.4E-09	0.0E+00	0.0E+00	0%
Cadmium	2.2E-06	9.9E-09	7.0E-04	1.4E-05	100%
Iron	8.4E-03	3.8E-05	0.0E+00	0.0E+00	0%
Thallium	4.2E-07	1.9E-09	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	4.3E-08	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**1.4E-05**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**4.57E-03**
	52560	AT = Averaging Time - Noncancer (hours)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3
Adolescent Trespasser/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.2E+00	50%	8.0E-08	3.0E-04	2.7E-04	4%
Cadmium	2.8E+01	100%	7.3E-07	1.0E-03	7.3E-04	10%
Iron	5.7E+04	100%	1.5E-03	3.0E-01	4.9E-03	70%
Thallium	6.6E-01	100%	1.7E-08	6.6E-05	2.6E-04	4%
Vanadium	3.2E+01	100%	8.2E-07	1.0E-03	8.2E-04	12%
				Total Noncancer Hazard:	**7.0E-03**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**2.58E-08**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	0.5	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 3
Adolescent Trespasser/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.2E+00	3%	2.5E-08	3.0E-04	8.5E-05	0%
Cadmium	2.8E+01	0.1%	3.9E-09	2.5E-05	1.6E-04	1%
Iron	5.7E+04	1%	7.8E-05	3.0E-03	2.6E-02	93%
Thallium	6.6E-01	1%	9.0E-10	6.6E-05	1.4E-05	0%
Vanadium	3.2E+01	1%	4.3E-08	2.6E-05	1.7E-03	6%
				Total Noncancer Hazard:	**2.8E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.37E-07**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	10	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4
Adolescent Trespasser/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-06	1.2E-08	0.0E+00	0.0E+00	0%
Cadmium	2.4E-06	1.1E-08	7.0E-04	1.5E-05	100%
Iron	1.1E-02	4.9E-05	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	1.6E-09	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	4.3E-08	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**1.5E-05**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**4.57E-03**
	52560	AT = Averaging Time - Noncancer (hours)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4
Adolescent Trespasser/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E+00	50%	6.4E-08	3.0E-04	2.1E-04	6%
Cadmium	4.1E+00	100%	1.1E-07	1.0E-03	1.1E-04	3%
Iron	2.3E+04	100%	6.0E-04	3.0E-01	2.0E-03	61%
Thallium	5.4E-01	100%	1.4E-08	6.6E-05	2.1E-04	6%
Vanadium	2.9E+01	100%	7.5E-07	1.0E-03	7.5E-04	23%
				Total Noncancer Hazard:	**3.3E-03**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**2.58E-08**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	0.5	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4
Adolescent Trespasser/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E+00	3%	2.0E-08	3.0E-04	6.8E-05	1%
Cadmium	4.1E+00	0.1%	5.6E-10	2.5E-05	2.2E-05	0%
Iron	2.3E+04	1%	3.2E-05	3.0E-03	1.1E-02	87%
Thallium	5.4E-01	1%	7.4E-10	6.6E-05	1.1E-05	0%
Vanadium	2.9E+01	1%	4.0E-08	2.6E-05	1.5E-03	13%
				Total Noncancer Hazard:	**1.2E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.37E-07**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	10	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4
Adolescent Trespasser 2/Ingestion of Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	7.8E-03	2.4E-07	3.0E-04	8.1E-04	37%
Cadmium	7.0E-04	2.2E-08	1.0E-03	2.2E-05	1%
Iron	6.4E+00	2.0E-04	3.0E-01	6.6E-04	30%
Thallium	5.9E-04	1.8E-08	6.6E-05	2.8E-04	13%
Vanadium	1.4E-02	4.4E-07	1.0E-03	4.4E-04	20%
			Total Noncancer Hazard:	**2.2E-03**	

Notes:

IF = Intake Factor (IR * EF * ED) / (BW * AT) =		**3.10E-05**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	6	ED = Exposure Duration (yr)
	12	EF = Exposure Frequency (days/yr)
	0.05	IR = Ingestion Rate (L/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4
Adolescent Trespasser 2/Dermal Contact with Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Dermal Permeability (Kp) (cm/hr)	Daily Intake DI = CxIFxKp (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	7.8E-03	1.E-03	7.6E-08	3.0E-04	2.5E-04	1%
Cadmium	7.0E-04	1.E-03	6.9E-09	2.5E-05	2.7E-04	1%
Iron	6.4E+00	1.E-03	6.3E-05	3.0E-03	2.1E-02	78%
Thallium	5.9E-04	1.E-03	5.8E-09	6.6E-05	8.8E-05	0%
Vanadium	1.4E-02	1.E-03	1.4E-07	2.6E-05	5.4E-03	20%
				Total Noncancer Hazard:	**2.7E-02**	

Notes:

IF = Intake Factor (SA * ET * EF * ED * CF) / (BW * AT) =		**9.80E-03**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.001	CF = Conversion Factor (L/cm³)
	6	ED = Exposure Duration (years)
	12	EF = Exposure Frequency (days/yr)
	1	ET = Exposure Time (hour/day)
	15800	SA = Surface Area (cm^2/d)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4
Trespasser 2/Ingestion of Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	5.0E-01	6.5E-08	3.0E-04	2.2E-04	2%
Cadmium	5.8E-01	1.0E+00	3.6E-08	1.0E-03	3.6E-05	0%
Iron	2.7E+04	1.0E+00	1.7E-03	3.0E-01	5.7E-03	63%
Thallium	3.7E-01	1.0E+00	2.3E-08	6.6E-05	3.5E-04	4%
Vanadium	4.5E+01	1.0E+00	2.8E-06	1.0E-03	2.8E-03	31%
				Total Noncancer Hazard:	**9.1E-03**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**6.20E-08**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	12	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 4
Trespasser 2/Dermal Contact with Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	3%	5.8E-08	3.0E-04	1.9E-04	0%
Cadmium	5.8E-01	0.1%	5.4E-10	2.5E-05	2.2E-05	0%
Iron	2.7E+04	1%	2.5E-04	3.0E-03	8.5E-02	84%
Thallium	3.7E-01	1%	3.4E-09	6.6E-05	5.2E-05	0%
Vanadium	4.5E+01	1%	4.2E-07	2.6E-05	1.6E-02	16%
				Total Noncancer Hazard:	**1.0E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**9.27E-07**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	12	EF = Exposure Frequency (days/yr)
	4980	SA = Surface Area (cm^2/d)
	0.3	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.2E-06	2.6E-08	0.0E+00	0.0E+00	0%
Cadmium	6.8E-07	1.6E-08	7.0E-04	2.2E-05	100%
Iron	9.9E-03	2.2E-04	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	6.8E-09	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	3.4E-07	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**2.2E-05**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**2.28E-02**
	52560	AT = Averaging Time - Noncancer (hours)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	50%	2.8E-07	3.0E-04	9.2E-04	2%
Cadmium	5.3E-01	100%	1.4E-07	1.0E-03	1.4E-04	0%
Iron	2.7E+04	100%	6.9E-03	3.0E-01	2.3E-02	56%
Thallium	3.2E-01	100%	8.3E-08	6.6E-05	1.3E-03	3%
Vanadium	6.0E+01	100%	1.5E-05	1.0E-03	1.5E-02	38%
				Total Noncancer Hazard:	**4.1E-02**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**2.58E-07**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	3%	4.4E-08	3.0E-04	1.5E-04	0%
Cadmium	5.3E-01	0.1%	3.6E-10	2.5E-05	1.4E-05	0%
Iron	2.7E+04	1%	1.8E-04	3.0E-03	6.1E-02	79%
Thallium	3.2E-01	1%	2.2E-09	6.6E-05	3.3E-05	0%
Vanadium	6.0E+01	1%	4.1E-07	2.6E-05	1.6E-02	20%
				Total Noncancer Hazard:	**7.7E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**6.86E-07**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	50	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator 2/Ingestion of Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E-03	3.0E-07	3.0E-04	1.0E-03	21%
Cadmium	1.5E-04	9.0E-09	1.0E-03	9.0E-06	0%
Iron	1.2E+01	7.1E-04	3.0E-01	2.4E-03	49%
Thallium	5.8E-04	3.6E-08	6.6E-05	5.4E-04	11%
Vanadium	1.4E-02	8.9E-07	1.0E-03	8.9E-04	18%
			Total Noncancer Hazard:	**4.8E-03**	

Notes:

IF = Intake Factor (IR * EF * ED) / (BW * AT) =		**6.20E-05**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	6	ED = Exposure Duration (yr)
	24	EF = Exposure Frequency (days/yr)
	0.05	IR = Ingestion Rate (L/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator 2/Dermal Contact with Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Dermal Permeability (Kp) (cm/hr)	Daily Intake DI = CxIFxKp (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E-03	1.E-03	9.5E-08	3.0E-04	3.2E-04	0%
Cadmium	1.5E-04	1.E-03	2.8E-09	2.5E-05	1.1E-04	0%
Iron	1.2E+01	1.E-03	2.3E-04	3.0E-03	7.5E-02	87%
Thallium	5.8E-04	1.E-03	1.1E-08	6.6E-05	1.7E-04	0%
Vanadium	1.4E-02	1.E-03	2.8E-07	2.6E-05	1.1E-02	12%
				Total Noncancer Hazard:	**8.7E-02**	

Notes:

IF = Intake Factor (SA * ET * EF * ED * CF) / (BW * AT) =		**1.96E-02**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.001	CF = Conversion Factor (L/cm^3)
	6	ED = Exposure Duration (years)
	24	EF = Exposure Frequency (days/yr)
	1	ET = Exposure Time (hour/day)
	15800	SA = Surface Area (cm^2/d)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator 2/Ingestion of Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.8E+00	50.0%	1.1E-07	3.0E-04	3.7E-04	4%
Cadmium	2.1E-01	100.0%	2.6E-08	1.0E-03	2.6E-05	0%
Iron	1.4E+04	100.0%	1.8E-03	3.0E-01	6.0E-03	60%
Thallium	3.7E-01	100.0%	4.6E-08	6.6E-05	7.0E-04	7%
Vanadium	2.4E+01	100.0%	3.0E-06	1.0E-03	3.0E-03	30%
				Total Noncancer Hazard:	**1.0E-02**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.24E-07**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	24	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Adolescent Recreator 2/Dermal Contact with Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.8E+00	3%	9.8E-08	3.0E-04	3.3E-04	0%
Cadmium	2.1E-01	0.1%	3.9E-10	2.5E-05	1.5E-05	0%
Iron	1.4E+04	1%	2.7E-04	3.0E-03	8.9E-02	84%
Thallium	3.7E-01	1%	6.9E-09	6.6E-05	1.0E-04	0%
Vanadium	2.4E+01	1%	4.4E-07	2.6E-05	1.7E-02	16%
				Total Noncancer Hazard:	**1.1E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.85E-06**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	24	EF = Exposure Frequency (days/yr)
	4980	SA = Surface Area (cm^2/d)
	0.3	AF = Adherence Factor (mg/cm^2)

Index of Noncancer Risks for Workers - Reasonable Maximum Exposure

Sheet Number	EA	Receptor	Media	Exposure Pathway
1c	1	Rancher	Air	Inhalation
2c	1	Rancher	Soil	Ingestion
3c	1	Rancher	Soil	Dermal
4c	1	Construction Worker	Air	Inhalation
5c	1	Construction Worker	Soil	Ingestion
6c	1	Construction Worker	Soil	Dermal
7c	2	Rancher	Air	Inhalation
8c	2	Rancher	Soil	Ingestion
9c	2	Rancher	Soil	Dermal
10c	2	Construction Worker	Air	Inhalation
11c	2	Construction Worker	Soil	Ingestion
12c	2	Construction Worker	Soil	Dermal
13c	5	Rancher	Air	Inhalation
14c	5	Rancher	Soil	Ingestion
15c	5	Rancher	Soil	Dermal
16c	SM	Industrial Worker	Air	Inhalation
17c	SM	Industrial Worker	Soil	Ingestion
18c	SM	Industrial Worker	Soil	Dermal

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Rancher/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.1E-06	4.4E-07	0.0E+00	0.0E+00	0%
Cadmium	6.4E-07	2.6E-07	7.0E-04	3.7E-04	100%
Iron	6.2E-03	2.5E-03	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	1.6E-07	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	4.3E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**3.7E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**4.00E-01**
	219000	AT = Averaging Time - Noncancer (hours)
	25	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Rancher/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	2.0E-06	3.0E-04	6.7E-03	3%
Cadmium	1.5E+00	100%	2.0E-06	1.0E-03	2.0E-03	1%
Iron	2.5E+04	100%	3.4E-02	3.0E-01	1.1E-01	55%
Thallium	4.1E-01	100%	5.6E-07	6.6E-05	8.4E-03	4%
Vanadium	5.5E+01	100%	7.6E-05	1.0E-03	7.6E-02	36%
				Total Noncancer Hazard:	**2.1E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.37E-06**
	9125	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Rancher/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	7.9E-07	3.0E-04	2.6E-03	0%
Cadmium	1.5E+00	0.1%	1.3E-08	2.5E-05	5.4E-04	0%
Iron	2.5E+04	1%	2.3E-03	3.0E-03	7.6E-01	79%
Thallium	4.1E-01	1%	3.7E-08	6.6E-05	5.6E-04	0%
Vanadium	5.5E+01	1%	5.0E-06	2.6E-05	1.9E-01	20%
				Total Noncancer Hazard:	**9.5E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		***9.04E-06***
	9125	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Construction Worker/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.1E-06	2.8E-07	0.0E+00	0.0E+00	0%
Cadmium	6.4E-07	1.6E-07	7.0E-03	2.3E-05	100%
Iron	6.2E-03	1.6E-03	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	1.0E-07	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	2.8E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**2.3E-05**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**2.57E-01**
	219000	AT = Averaging Time - Noncancer (hours)
	25	ED = Exposure Duration (yr)
	225	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Construction Worker/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	1.3E-06	3.0E-04	4.3E-03	3%
Cadmium	1.5E+00	100%	1.3E-06	1.0E-03	1.3E-03	1%
Iron	2.5E+04	100%	2.2E-02	3.0E-01	7.4E-02	55%
Thallium	4.1E-01	100%	3.6E-07	6.6E-05	5.4E-03	4%
Vanadium	5.5E+01	100%	4.9E-05	1.0E-03	4.9E-02	36%
				Total Noncancer Hazard:	**1.3E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**8.81E-07**
	9125	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (yr)
	225	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 1
Construction Worker/Dermal Contact with Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	5.1E-07	3.0E-04	1.7E-03	0%
Cadmium	1.5E+00	0.1%	8.6E-09	2.5E-05	3.4E-04	0%
Iron	2.5E+04	1%	1.5E-03	3.0E-03	4.9E-01	79%
Thallium	4.1E-01	1%	2.4E-08	6.6E-05	3.6E-04	0%
Vanadium	5.5E+01	1%	3.2E-06	2.6E-05	1.2E-01	20%
				Total Noncancer Hazard:	**6.1E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**5.81E-06**
	9125	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (years)
	225	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2
Rancher/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	5.5E-07	2.2E-07	0.0E+00	0.0E+00	0%
Cadmium	3.6E-07	1.4E-07	7.0E-04	2.1E-04	100%
Iron	7.5E-03	3.0E-03	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	3.8E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	7.4E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**2.1E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**4.00E-01**
	219000	AT = Averaging Time - Noncancer (hours)
	25	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2
Rancher/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	2.0E-06	3.0E-04	6.6E-03	3%
Cadmium	1.3E+00	100%	1.8E-06	1.0E-03	1.8E-03	1%
Iron	2.5E+04	100%	3.4E-02	3.0E-01	1.1E-01	58%
Thallium	5.8E-01	100%	7.9E-07	6.6E-05	1.2E-02	6%
Vanadium	4.5E+01	100%	6.1E-05	1.0E-03	6.1E-02	31%
				Total Noncancer Hazard:	**2.0E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.37E-06**
	9125	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2
Rancher/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	7.9E-07	3.0E-04	2.6E-03	0%
Cadmium	1.3E+00	0.1%	1.2E-08	2.5E-05	4.8E-04	0%
Iron	2.5E+04	1%	2.3E-03	3.0E-03	7.6E-01	83%
Thallium	5.8E-01	1%	5.2E-08	6.6E-05	7.9E-04	0%
Vanadium	4.5E+01	1%	4.1E-06	2.6E-05	1.6E-01	17%
				Total Noncancer Hazard:	**9.2E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**9.04E-06**
	9125	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2
Construction Worker/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	5.5E-07	1.4E-07	0.0E+00	0.0E+00	0%
Cadmium	3.6E-07	9.2E-08	7.0E-04	1.3E-04	100%
Iron	7.5E-03	1.9E-03	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	2.4E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	4.7E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**1.3E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**2.57E-01**
	219000	AT = Averaging Time - Noncancer (hours)
	25	ED = Exposure Duration (yr)
	225	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2
Construction Worker/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	1.3E-06	3.0E-04	4.3E-03	3%
Cadmium	1.3E+00	100%	1.2E-06	1.0E-03	1.2E-03	1%
Iron	2.5E+04	100%	2.2E-02	3.0E-01	7.4E-02	58%
Thallium	5.8E-01	100%	5.1E-07	6.6E-05	7.7E-03	6%
Vanadium	4.5E+01	100%	3.9E-05	1.0E-03	3.9E-02	31%
				Total Noncancer Hazard:	**1.3E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**8.81E-07**
	9125	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (yr)
	225	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 2
Construction Worker/Dermal Contact with Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	5.1E-07	3.0E-04	1.7E-03	0%
Cadmium	1.3E+00	0.1%	7.7E-09	2.5E-05	3.1E-04	0%
Iron	2.5E+04	1%	1.5E-03	3.0E-03	4.9E-01	83%
Thallium	5.8E-01	1%	3.4E-08	6.6E-05	5.1E-04	0%
Vanadium	4.5E+01	1%	2.6E-06	2.6E-05	1.0E-01	17%
				Total Noncancer Hazard:	**5.9E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**5.81E-06**
	9125	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (years)
	225	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Rancher/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.2E-06	4.6E-07	0.0E+00	0.0E+00	0%
Cadmium	6.8E-07	2.7E-07	7.0E-04	3.9E-04	100%
Iron	9.9E-03	3.9E-03	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	1.2E-07	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	6.0E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**3.9E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**4.00E-01**
	219000	AT = Averaging Time - Noncancer (hours)
	25	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Rancher/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	50%	1.5E-06	3.0E-04	4.9E-03	2%
Cadmium	5.3E-01	100%	7.2E-07	1.0E-03	7.2E-04	0%
Iron	2.7E+04	100%	3.6E-02	3.0E-01	1.2E-01	56%
Thallium	3.2E-01	100%	4.4E-07	6.6E-05	6.6E-03	3%
Vanadium	6.0E+01	100%	8.2E-05	1.0E-03	8.2E-02	38%
				Total Noncancer Hazard:	**2.2E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.37E-06**
	9125	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

EA 5
Rancher/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	3%	5.8E-07	3.0E-04	1.9E-03	0.2%
Cadmium	5.3E-01	0.1%	4.8E-09	2.5E-05	1.9E-04	0.0%
Iron	2.7E+04	1%	2.4E-03	3.0E-03	8.0E-01	79%
Thallium	3.2E-01	1%	2.9E-08	6.6E-05	4.4E-04	0%
Vanadium	6.0E+01	1%	5.4E-06	2.6E-05	2.1E-01	20%
				Total Noncancer Hazard:	**1.0E+00**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**9.04E-06**
	9125	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

SM
Industrial Worker/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-06	1.4E-07	0.0E+00	0.0E+00	0%
Cadmium	2.4E-06	1.2E-07	7.0E-04	1.7E-04	100%
Iron	1.1E-02	5.5E-04	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	1.8E-08	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	4.8E-07	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**1.7E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**5.14E-02**
	219000	AT = Averaging Time - Noncancer (hours)
	25	ED = Exposure Duration (yr)
	225	EF = Exposure Frequency (days/yr)
	2	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

SM
Industrial Worker/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.4E+01	50%	5.3E-06	3.0E-04	1.8E-02	14%
Cadmium	7.2E+00	100%	3.2E-06	1.0E-03	3.2E-03	3%
Iron	5.9E+04	100%	2.6E-02	3.0E-01	8.6E-02	71%
Thallium	7.4E-01	100%	3.3E-07	6.6E-05	4.9E-03	4%
Vanadium	2.3E+01	100%	1.0E-05	1.0E-03	1.0E-02	8%
				Total Noncancer Hazard:	**1.2E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**4.40E-07**
	9125	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (yr)
	225	EF = Exposure Frequency (days/yr)
	0.5	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Reasonable Maximum Exposure

SM
Industrial Worker/Dermal Contact with Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.4E+01	3%	4.2E-06	3.0E-04	1.4E-02	1.2%
Cadmium	7.2E+00	0.1%	4.2E-08	2.5E-05	1.7E-03	0.1%
Iron	5.9E+04	1%	3.4E-03	3.0E-03	1.1E+00	94%
Thallium	7.4E-01	1%	4.3E-08	6.6E-05	6.5E-04	0%
Vanadium	2.3E+01	1%	1.3E-06	2.6E-05	5.1E-02	4%
				Total Noncancer Hazard:	**1.2E+00**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**5.81E-06**
	9125	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	25	ED = Exposure Duration (years)
	225	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Appendix E.4

CT Noncancer Risks

Index of Noncancer Risks for Residents - Central Tendency

Sheet Number	EA	Receptor	Media	Exposure Pathway
1	1	Child Future Resident	Air	Inhalation
2	1	Child Future Resident	Soil	Ingestion
3	1	Child Future Resident	Soil	Dermal
4	1	Child Future Resident	Beef	Ingestion
5	1	Child Future Resident	Chicken	Ingestion
6	1	Child Future Resident	Eggs	Ingestion
7	1	Child Future Resident	Vegetables	Ingestion
8	1	Adult Future Resident	Air	Inhalation
9	1	Adult Future Resident	Soil	Ingestion
10	1	Adult Future Resident	Soil	Dermal
11	1	Adult Future Resident	Beef	Ingestion
12	1	Adult Future Resident	Chicken	Ingestion
13	1	Adult Future Resident	Eggs	Ingestion
14	1	Adult Future Resident	Vegetables	Ingestion
15	2	Child Current and Future Resident	Air	Inhalation
16	2	Child Current and Future Resident	Soil	Ingestion
17	2	Child Current and Future Resident	Soil	Dermal
18	2	Child Future Resident	Beef	Ingestion
19	2	Child Future Resident	Chicken	Ingestion
20	2	Child Future Resident	Eggs	Ingestion
21	2	Child Future Resident	Vegetables	Ingestion
22	2	Adult Current and Future Resident	Air	Inhalation
23	2	Adult Current and Future Resident	Soil	Ingestion
24	2	Adult Current and Future Resident	Soil	Dermal
25	2	Adult Current Resident	Beef	Ingestion
26	2	Adult Current Resident	Chicken	Ingestion
27	2	Adult Current Resident	Eggs	Ingestion
28	2	Adult Current Resident	Vegetables	Ingestion
29	3	Child Future Resident	Air	Inhalation
30	3	Child Future Resident	Soil	Ingestion
31	3	Child Future Resident	Soil	Dermal
32	3	Child Future Resident	Beef	Ingestion
33	3	Child Future Resident	Chicken	Ingestion
34	3	Child Future Resident	Eggs	Ingestion
35	3	Child Future Resident	Vegetables	Ingestion
36	3	Adult Future Resident	Air	Inhalation
37	3	Adult Future Resident	Soil	Ingestion
38	3	Adult Future Resident	Soil	Dermal
39	3	Adult Future Resident	Beef	Ingestion
40	3	Adult Future Resident	Chicken	Ingestion
41	3	Adult Future Resident	Eggs	Ingestion
42	3	Adult Future Resident	Vegetables	Ingestion
43	4	Child Future Resident	Air	Inhalation
44	4	Child Future Resident	Soil	Ingestion
45	4	Child Future Resident	Soil	Dermal
46	4	Child Future Resident	Beef	Ingestion
47	4	Child Future Resident	Chicken	Ingestion
48	4	Child Future Resident	Eggs	Ingestion
49	4	Child Future Resident	Vegetables	Ingestion
50	4	Adult Future Resident	Air	Inhalation
51	4	Adult Future Resident	Soil	Ingestion
52	4	Adult Future Resident	Soil	Dermal
53	4	Adult Future Resident	Beef	Ingestion
54	4	Adult Future Resident	Chicken	Ingestion
55	4	Adult Future Resident	Eggs	Ingestion
56	4	Adult Future Resident	Vegetables	Ingestion
57	5	Child Future Resident	Air	Inhalation
58	5	Child Future Resident	Soil	Ingestion
59	5	Child Future Resident	Soil	Dermal
60	5	Child Future Resident	Beef	Ingestion
61	5	Child Future Resident	Chicken	Ingestion
62	5	Child Future Resident	Eggs	Ingestion
63	5	Child Future Resident	Vegetables	Ingestion
64	5	Adult Future Resident	Air	Inhalation
65	5	Adult Future Resident	Soil	Ingestion
66	5	Adult Future Resident	Soil	Dermal
67	5	Adult Future Resident	Beef	Ingestion
68	5	Adult Future Resident	Chicken	Ingestion
69	5	Adult Future Resident	Eggs	Ingestion
70	5	Adult Future Resident	Vegetables	Ingestion

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.1E-06	1.1E-06	0.0E+00	0.0E+00	0%
Cadmium	6.4E-07	6.1E-07	7.0E-04	8.8E-04	100%
Iron	6.2E-03	5.9E-03	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	3.7E-07	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	1.0E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**8.8E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

52560	AT = Averaging Time - Noncancer (hours)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	9.3E-06	3.0E-04	3.1E-02	3%
Cadmium	1.5E+00	100%	9.5E-06	1.0E-03	9.5E-03	1%
Iron	2.5E+04	100%	1.6E-01	3.0E-01	5.4E-01	55%
Thallium	4.1E-01	100%	2.6E-06	6.6E-05	3.9E-02	4%
Vanadium	5.5E+01	100%	3.5E-04	1.0E-03	3.5E-01	36%
				Total Noncancer Hazard:	**9.7E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) = **6.39E-06**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	3.1E-07	3.0E-04	1.0E-03	0%
Cadmium	1.5E+00	0.1%	5.3E-09	2.5E-05	2.1E-04	0%
Iron	2.5E+04	1%	9.0E-04	3.0E-03	3.0E-01	100%
Thallium	4.1E-01	1%	1.5E-08	6.6E-05	2.2E-04	0%
Vanadium	0.0E+00	1%	0.0E+00	2.6E-05	0.0E+00	0%
				Total Noncancer Hazard:	**3.0E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) = **3.58E-06**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
2800	SA = Surface Area (cm^2/d)
0.02	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.1E-03	4.7E-06	3.0E-04	1.6E-02	1%
Cadmium	2.0E-04	2.3E-07	1.0E-03	2.3E-04	0%
Iron	2.5E+02	2.9E-01	3.0E-01	9.7E-01	53%
Thallium	4.3E-02	4.9E-05	6.6E-05	7.5E-01	41%
Vanadium	8.4E-02	9.7E-05	1.0E-03	9.7E-02	5%
			Total Noncancer Hazard:	**1.8E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.5E-02	1.0E-05	3.0E-04	3.4E-02	3%
Cadmium	9.8E-04	6.6E-07	1.0E-03	6.6E-04	0%
Iron	3.4E+02	2.2E-01	3.0E-01	7.5E-01	65%
Thallium	5.6E-03	3.7E-06	6.6E-05	5.7E-02	5%
Vanadium	4.6E-01	3.1E-04	1.0E-03	3.1E-01	27%
			Total Noncancer Hazard:	**1.1E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.71E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.5E-02	9.4E-06	3.0E-04	3.1E-02	3%
Cadmium	2.2E-05	1.4E-08	1.0E-03	1.4E-05	0%
Iron	2.9E+02	1.9E-01	3.0E-01	6.2E-01	61%
Thallium	3.7E-05	2.4E-08	6.6E-05	3.6E-04	0%
Vanadium	5.7E-01	3.6E-04	1.0E-03	3.6E-01	36%
			Total Noncancer Hazard:	**1.0E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.42E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.67	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.0E-01	7.6E-05	3.0E-04	2.5E-01	35%
Cadmium	6.1E-01	2.3E-04	1.0E-03	2.3E-01	32%
Iron	1.0E+02	3.9E-02	3.0E-01	1.3E-01	18%
Thallium	8.0E-04	3.1E-07	6.6E-05	4.6E-03	1%
Vanadium	3.0E-01	1.1E-04	1.0E-03	1.1E-01	15%
			Total Noncancer Hazard:	**7.4E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.84E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.1E-06	1.1E-06	0.0E+00	0.0E+00	0%
Cadmium	6.4E-07	6.1E-07	7.0E-04	8.8E-04	100%
Iron	6.2E-03	5.9E-03	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	3.7E-07	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	1.0E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**8.8E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

78840	AT = Averaging Time - Noncancer (hours)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	1.0E-06	3.0E-04	3.3E-03	3%
Cadmium	1.5E+00	100%	1.0E-06	1.0E-03	1.0E-03	1%
Iron	2.5E+04	100%	1.7E-02	3.0E-01	5.7E-02	55%
Thallium	4.1E-01	100%	2.8E-07	6.6E-05	4.2E-03	4%
Vanadium	5.5E+01	100%	3.8E-05	1.0E-03	3.8E-02	36%
				Total Noncancer Hazard:	**1.0E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**6.85E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	6.8E-08	3.0E-04	2.3E-04	0%
Cadmium	1.5E+00	0.1%	1.2E-09	2.5E-05	4.6E-05	0%
Iron	2.5E+04	1%	2.0E-04	3.0E-03	6.5E-02	79%
Thallium	4.1E-01	1%	3.2E-09	6.6E-05	4.8E-05	0%
Vanadium	5.5E+01	1%	4.3E-07	2.6E-05	1.7E-02	20%
				Total Noncancer Hazard:	**8.2E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**7.81E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.1E-03	4.7E-06	3.0E-04	1.6E-02	1%
Cadmium	2.0E-04	2.3E-07	1.0E-03	2.3E-04	0%
Iron	2.5E+02	2.9E-01	3.0E-01	9.7E-01	53%
Thallium	4.3E-02	4.9E-05	6.6E-05	7.5E-01	41%
Vanadium	8.4E-02	9.7E-05	1.0E-03	9.7E-02	5%
			Total Noncancer Hazard:	**1.8E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.5E-02	1.0E-05	3.0E-04	3.4E-02	3%
Cadmium	9.8E-04	6.6E-07	1.0E-03	6.6E-04	0%
Iron	3.4E+02	2.2E-01	3.0E-01	7.5E-01	65%
Thallium	5.6E-03	3.7E-06	6.6E-05	5.7E-02	5%
Vanadium	4.6E-01	3.1E-04	1.0E-03	3.1E-01	27%
			Total Noncancer Hazard:	**1.1E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.71E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.5E-02	9.4E-06	3.0E-04	3.1E-02	3%
Cadmium	2.2E-05	1.4E-08	1.0E-03	1.4E-05	0%
Iron	2.9E+02	1.9E-01	3.0E-01	6.2E-01	61%
Thallium	3.7E-05	2.4E-08	6.6E-05	3.6E-04	0%
Vanadium	5.7E-01	3.6E-04	1.0E-03	3.6E-01	36%
			Total Noncancer Hazard:	**1.0E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.42E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.67	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.0E-01	7.6E-05	3.0E-04	2.5E-01	35%
Cadmium	6.1E-01	2.3E-04	1.0E-03	2.3E-01	32%
Iron	1.0E+02	3.9E-02	3.0E-01	1.3E-01	18%
Thallium	8.0E-04	3.1E-07	6.6E-05	4.6E-03	1%
Vanadium	3.0E-01	1.1E-04	1.0E-03	1.1E-01	15%
			Total Noncancer Hazard:	**7.4E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.84E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Current and Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	5.5E-07	5.3E-07	0.0E+00	0.0E+00	0%
Cadmium	3.6E-07	3.5E-07	7.0E-04	4.9E-04	100%
Iron	7.5E-03	7.2E-03	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	9.0E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	1.8E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**4.9E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

52560	AT = Averaging Time - Noncancer (hours)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Current and Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	9.3E-06	3.0E-04	3.1E-02	3%
Cadmium	1.3E+00	100%	8.4E-06	1.0E-03	8.4E-03	1%
Iron	2.5E+04	100%	1.6E-01	3.0E-01	5.4E-01	58%
Thallium	5.8E-01	100%	3.7E-06	6.6E-05	5.6E-02	6%
Vanadium	4.5E+01	100%	2.9E-04	1.0E-03	2.9E-01	31%
				Total Noncancer Hazard:	**9.2E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) = **6.39E-06**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Current and Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	3.1E-07	3.0E-04	1.0E-03	0%
Cadmium	1.3E+00	0.1%	4.7E-09	2.5E-05	1.9E-04	0%
Iron	2.5E+04	1%	9.0E-04	3.0E-03	3.0E-01	83%
Thallium	5.8E-01	1%	2.1E-08	6.6E-05	3.1E-04	0%
Vanadium	4.5E+01	1%	1.6E-06	2.6E-05	6.2E-02	17%
				Total Noncancer Hazard:	**3.6E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) = **3.58E-06**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
2800	SA = Surface Area (cm^2/d)
0.02	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.9E-03	7.9E-06	3.0E-04	2.6E-02	1%
Cadmium	1.9E-04	2.2E-07	1.0E-03	2.2E-04	0%
Iron	2.0E+02	2.3E-01	3.0E-01	7.7E-01	24%
Thallium	1.3E-01	1.5E-04	6.6E-05	2.3E+00	73%
Vanadium	4.5E-02	5.1E-05	1.0E-03	5.1E-02	2%
			Total Noncancer Hazard:	**3.2E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-02	1.7E-05	3.0E-04	5.7E-02	6%
Cadmium	9.2E-04	6.2E-07	1.0E-03	6.2E-04	0%
Iron	2.7E+02	1.8E-01	3.0E-01	6.0E-01	60%
Thallium	1.7E-02	1.2E-05	6.6E-05	1.8E-01	18%
Vanadium	2.4E-01	1.6E-04	1.0E-03	1.6E-01	16%
			Total Noncancer Hazard:	**9.9E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.71E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.5E-02	1.6E-05	3.0E-04	5.3E-02	7%
Cadmium	2.1E-05	1.3E-08	1.0E-03	1.3E-05	0%
Iron	2.3E+02	1.5E-01	3.0E-01	4.9E-01	67%
Thallium	1.2E-04	7.4E-08	6.6E-05	1.1E-03	0%
Vanadium	3.0E-01	1.9E-04	1.0E-03	1.9E-01	26%
			Total Noncancer Hazard:	**7.4E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.42E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.67	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.0E-01	7.7E-05	3.0E-04	2.6E-01	41%
Cadmium	6.5E-01	2.5E-04	1.0E-03	2.5E-01	40%
Iron	6.0E+01	2.3E-02	3.0E-01	7.7E-02	12%
Thallium	3.7E-04	1.4E-07	6.6E-05	2.1E-03	0%
Vanadium	8.5E-02	3.3E-05	1.0E-03	3.3E-02	5%
			Total Noncancer Hazard:	**6.2E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.84E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Current and Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	5.5E-07	5.3E-07	0.0E+00	0.0E+00	0%
Cadmium	3.6E-07	3.5E-07	7.0E-04	4.9E-04	100%
Iron	7.5E-03	7.2E-03	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	9.0E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	1.8E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**4.9E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

78840	AT = Averaging Time - Noncancer (hours)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Current and Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	1.0E-06	3.0E-04	3.3E-03	3%
Cadmium	1.3E+00	100%	9.0E-07	1.0E-03	9.0E-04	1%
Iron	2.5E+04	100%	1.7E-02	3.0E-01	5.7E-02	58%
Thallium	5.8E-01	100%	4.0E-07	6.6E-05	6.0E-03	6%
Vanadium	4.5E+01	100%	3.1E-05	1.0E-03	3.1E-02	31%
				Total Noncancer Hazard:	**9.8E-02**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**6.85E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Current and Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	6.8E-08	3.0E-04	2.3E-04	0%
Cadmium	1.3E+00	0.1%	1.0E-09	2.5E-05	4.1E-05	0%
Iron	2.5E+04	1%	2.0E-04	3.0E-03	6.6E-02	83%
Thallium	5.8E-01	1%	4.5E-09	6.6E-05	6.9E-05	0%
Vanadium	4.5E+01	1%	3.5E-07	2.6E-05	1.3E-02	17%
				Total Noncancer Hazard:	**7.9E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**7.81E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.9E-03	7.9E-06	3.0E-04	2.6E-02	1%
Cadmium	1.9E-04	2.2E-07	1.0E-03	2.2E-04	0%
Iron	2.0E+02	2.3E-01	3.0E-01	7.7E-01	24%
Thallium	1.3E-01	1.5E-04	6.6E-05	2.3E+00	73%
Vanadium	4.5E-02	5.1E-05	1.0E-03	5.1E-02	2%
			Total Noncancer Hazard:	**3.2E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-02	1.7E-05	3.0E-04	5.7E-02	6%
Cadmium	9.2E-04	6.2E-07	1.0E-03	6.2E-04	0%
Iron	2.7E+02	1.8E-01	3.0E-01	6.0E-01	60%
Thallium	1.7E-02	1.2E-05	6.6E-05	1.8E-01	18%
Vanadium	2.4E-01	1.6E-04	1.0E-03	1.6E-01	16%
			Total Noncancer Hazard:	**9.9E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.71E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.5E-02	1.6E-05	3.0E-04	5.3E-02	7%
Cadmium	2.1E-05	1.3E-08	1.0E-03	1.3E-05	0%
Iron	2.3E+02	1.5E-01	3.0E-01	4.9E-01	67%
Thallium	1.2E-04	7.4E-08	6.6E-05	1.1E-03	0%
Vanadium	3.0E-01	1.9E-04	1.0E-03	1.9E-01	26%
			Total Noncancer Hazard:	**7.4E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.42E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.67	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 2 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.0E-01	7.7E-05	3.0E-04	2.6E-01	41%
Cadmium	6.5E-01	2.5E-04	1.0E-03	2.5E-01	40%
Iron	6.0E+01	2.3E-02	3.0E-01	7.7E-02	12%
Thallium	3.7E-04	1.4E-07	6.6E-05	2.1E-03	0%
Vanadium	8.5E-02	3.3E-05	1.0E-03	3.3E-02	5%
			Total Noncancer Hazard:	**6.2E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.84E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIFxR (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.4E-06	1.3E-06	0.0E+00	0.0E+00	0%
Cadmium	2.2E-06	2.1E-06	7.0E-04	3.0E-03	100%
Iron	8.4E-03	8.1E-03	0.0E+00	0.0E+00	0%
Thallium	4.2E-07	4.0E-07	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	9.0E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**3.0E-03**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

52560	AT = Averaging Time - Noncancer (hours)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.2E+00	50%	2.0E-05	3.0E-04	6.6E-02	3%
Cadmium	2.8E+01	100%	1.8E-04	1.0E-03	1.8E-01	10%
Iron	5.7E+04	100%	3.7E-01	3.0E-01	1.2E+00	65%
Thallium	6.6E-01	100%	4.2E-06	6.6E-05	6.4E-02	3%
Vanadium	5.5E+01	100%	3.5E-04	1.0E-03	3.5E-01	19%
				Total Noncancer Hazard:	**1.9E+00**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) = **6.39E-06**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.2E+00	3%	6.6E-07	3.0E-04	2.2E-03	0%
Cadmium	2.8E+01	0.1%	1.0E-07	2.5E-05	4.1E-03	1%
Iron	5.7E+04	1%	2.0E-03	3.0E-03	6.8E-01	93%
Thallium	6.6E-01	1%	2.4E-08	6.6E-05	3.6E-04	0%
Vanadium	3.2E+01	1%	1.1E-06	2.6E-05	4.4E-02	6%
				Total Noncancer Hazard:	**7.3E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) = **3.58E-06**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
2800	SA = Surface Area (cm^2/d)
0.02	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.8E-03	7.8E-06	3.0E-04	2.6E-02	1%
Cadmium	5.0E-03	5.8E-06	1.0E-03	5.8E-03	0%
Iron	6.0E+02	6.9E-01	3.0E-01	2.3E+00	88%
Thallium	1.4E-02	1.6E-05	6.6E-05	2.5E-01	9%
Vanadium	4.4E-02	5.0E-05	1.0E-03	5.0E-02	2%
			Total Noncancer Hazard:	**2.6E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.5E-02	1.7E-05	3.0E-04	5.6E-02	3%
Cadmium	2.4E-02	1.6E-05	1.0E-03	1.6E-02	1%
Iron	8.0E+02	5.4E-01	3.0E-01	1.8E+00	88%
Thallium	1.8E-03	1.2E-06	6.6E-05	1.9E-02	1%
Vanadium	2.4E-01	1.6E-04	1.0E-03	1.6E-01	8%
			Total Noncancer Hazard:	**2.0E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.71E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.4E-02	1.5E-05	3.0E-04	5.2E-02	3%
Cadmium	5.5E-04	3.5E-07	1.0E-03	3.5E-04	0%
Iron	6.9E+02	4.4E-01	3.0E-01	1.5E+00	86%
Thallium	1.2E-05	7.9E-09	6.6E-05	1.2E-04	0%
Vanadium	2.9E-01	1.9E-04	1.0E-03	1.9E-01	11%
			Total Noncancer Hazard:	**1.7E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.42E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.67	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.8E-01	7.0E-05	3.0E-04	2.3E-01	35%
Cadmium	6.4E-01	2.5E-04	1.0E-03	2.5E-01	37%
Iron	1.0E+02	4.0E-02	3.0E-01	1.3E-01	20%
Thallium	2.4E-03	9.1E-07	6.6E-05	1.4E-02	2%
Vanadium	1.1E-01	4.1E-05	1.0E-03	4.1E-02	6%
			Total Noncancer Hazard:	**6.7E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.84E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.4E-06	1.3E-06	0.0E+00	0.0E+00	0%
Cadmium	2.2E-06	2.1E-06	7.0E-04	3.0E-03	100%
Iron	8.4E-03	8.1E-03	0.0E+00	0.0E+00	0%
Thallium	4.2E-07	4.0E-07	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	9.0E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**3.0E-03**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

78840	AT = Averaging Time - Noncancer (hours)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.2E+00	50%	2.1E-06	3.0E-04	7.1E-03	4%
Cadmium	2.8E+01	100%	1.9E-05	1.0E-03	1.9E-02	10%
Iron	5.7E+04	100%	3.9E-02	3.0E-01	1.3E-01	70%
Thallium	6.6E-01	100%	4.5E-07	6.6E-05	6.8E-03	4%
Vanadium	3.2E+01	100%	2.2E-05	1.0E-03	2.2E-02	12%
				Total Noncancer Hazard:	**1.9E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**6.85E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.2E+00	3%	1.4E-07	3.0E-04	4.8E-04	0%
Cadmium	2.8E+01	0.1%	2.2E-08	2.5E-05	8.9E-04	1%
Iron	5.7E+04	1%	4.5E-04	3.0E-03	1.5E-01	93%
Thallium	6.6E-01	1%	5.1E-09	6.6E-05	7.8E-05	0%
Vanadium	3.2E+01	1%	2.5E-07	2.6E-05	9.5E-03	6%
				Total Noncancer Hazard:	**1.6E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**7.81E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.8E-03	7.8E-06	3.0E-04	2.6E-02	1%
Cadmium	5.0E-03	5.8E-06	1.0E-03	5.8E-03	0%
Iron	6.0E+02	6.9E-01	3.0E-01	2.3E+00	88%
Thallium	1.4E-02	1.6E-05	6.6E-05	2.5E-01	9%
Vanadium	4.4E-02	5.0E-05	1.0E-03	5.0E-02	2%
			Total Noncancer Hazard:	**2.6E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.5E-02	1.7E-05	3.0E-04	5.6E-02	3%
Cadmium	2.4E-02	1.6E-05	1.0E-03	1.6E-02	1%
Iron	8.0E+02	5.4E-01	3.0E-01	1.8E+00	88%
Thallium	1.8E-03	1.2E-06	6.6E-05	1.9E-02	1%
Vanadium	2.4E-01	1.6E-04	1.0E-03	1.6E-01	8%
			Total Noncancer Hazard:	**2.0E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.71E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.4E-02	1.5E-05	3.0E-04	5.2E-02	3%
Cadmium	5.5E-04	3.5E-07	1.0E-03	3.5E-04	0%
Iron	6.9E+02	4.4E-01	3.0E-01	1.5E+00	86%
Thallium	1.2E-05	7.9E-09	6.6E-05	1.2E-04	0%
Vanadium	2.9E-01	1.9E-04	1.0E-03	1.9E-01	11%
			Total Noncancer Hazard:	**1.7E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.42E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.67	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.8E-01	7.0E-05	3.0E-04	2.3E-01	35%
Cadmium	6.4E-01	2.5E-04	1.0E-03	2.5E-01	37%
Iron	1.0E+02	4.0E-02	3.0E-01	1.3E-01	20%
Thallium	2.4E-03	9.1E-07	6.6E-05	1.4E-02	2%
Vanadium	1.1E-01	4.1E-05	1.0E-03	4.1E-02	6%
			Total Noncancer Hazard:	**6.7E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.84E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-06	2.5E-06	0.0E+00	0.0E+00	0%
Cadmium	2.4E-06	2.3E-06	7.0E-04	3.2E-03	100%
Iron	1.1E-02	1.0E-02	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	3.4E-07	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	9.0E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**3.2E-03**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

52560	AT = Averaging Time - Noncancer (hours)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E+00	50%	1.6E-05	3.0E-04	5.3E-02	5%
Cadmium	4.1E+00	100%	2.6E-05	1.0E-03	2.6E-02	3%
Iron	2.3E+04	100%	1.5E-01	3.0E-01	4.9E-01	50%
Thallium	5.4E-01	100%	3.5E-06	6.6E-05	5.2E-02	5%
Vanadium	5.5E+01	100%	3.5E-04	1.0E-03	3.5E-01	36%
				Total Noncancer Hazard:	**9.8E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) = **6.39E-06**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E+00	3%	5.3E-07	3.0E-04	1.8E-03	1%
Cadmium	4.1E+00	0.1%	1.5E-08	2.5E-05	5.8E-04	0%
Iron	2.3E+04	1%	8.3E-04	3.0E-03	2.8E-01	87%
Thallium	5.4E-01	1%	1.9E-08	6.6E-05	2.9E-04	0%
Vanadium	2.9E+01	1%	1.0E-06	2.6E-05	4.0E-02	13%
				Total Noncancer Hazard:	**3.2E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) = **3.58E-06**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
2800	SA = Surface Area (cm^2/d)
0.02	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.0E-02	1.2E-05	3.0E-04	3.9E-02	3%
Cadmium	6.6E-04	7.6E-07	1.0E-03	7.6E-04	0%
Iron	2.4E+02	2.8E-01	3.0E-01	9.4E-01	76%
Thallium	1.2E-02	1.3E-05	6.6E-05	2.0E-01	17%
Vanadium	4.0E-02	4.6E-05	1.0E-03	4.6E-02	4%
			Total Noncancer Hazard:	**1.2E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	3.1E-02	2.1E-05	3.0E-04	7.0E-02	7%
Cadmium	3.2E-03	2.1E-06	1.0E-03	2.1E-03	0%
Iron	3.2E+02	2.2E-01	3.0E-01	7.2E-01	76%
Thallium	1.5E-03	1.0E-06	6.6E-05	1.5E-02	2%
Vanadium	2.2E-01	1.5E-04	1.0E-03	1.5E-01	15%
			Total Noncancer Hazard:	**9.6E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.71E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	3.0E-02	1.9E-05	3.0E-04	6.4E-02	8%
Cadmium	7.2E-05	4.6E-08	1.0E-03	4.6E-05	0%
Iron	2.8E+02	1.8E-01	3.0E-01	6.0E-01	72%
Thallium	1.0E-05	6.5E-09	6.6E-05	9.8E-05	0%
Vanadium	2.7E-01	1.7E-04	1.0E-03	1.7E-01	21%
			Total Noncancer Hazard:	**8.4E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.42E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.67	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-01	1.0E-04	3.0E-04	3.3E-01	30%
Cadmium	1.4E+00	5.2E-04	1.0E-03	5.2E-01	47%
Iron	1.4E+02	5.4E-02	3.0E-01	1.8E-01	16%
Thallium	7.0E-05	2.7E-08	6.6E-05	4.1E-04	0%
Vanadium	2.2E-01	8.3E-05	1.0E-03	8.3E-02	7%
			Total Noncancer Hazard:	**1.1E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.84E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-06	2.5E-06	0.0E+00	0.0E+00	0%
Cadmium	2.4E-06	2.3E-06	7.0E-04	3.2E-03	100%
Iron	1.1E-02	1.0E-02	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	3.4E-07	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	9.0E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**3.2E-03**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

78840	AT = Averaging Time - Noncancer (hours)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E+00	50%	1.7E-06	3.0E-04	5.6E-03	6%
Cadmium	4.1E+00	100%	2.8E-06	1.0E-03	2.8E-03	3%
Iron	2.3E+04	100%	1.6E-02	3.0E-01	5.3E-02	61%
Thallium	5.4E-01	100%	3.7E-07	6.6E-05	5.6E-03	6%
Vanadium	2.9E+01	100%	2.0E-05	1.0E-03	2.0E-02	23%
				Total Noncancer Hazard:	**8.7E-02**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**6.85E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E+00	3%	1.2E-07	3.0E-04	3.9E-04	1%
Cadmium	4.1E+00	0.1%	3.2E-09	2.5E-05	1.3E-04	0%
Iron	2.3E+04	1%	1.8E-04	3.0E-03	6.0E-02	87%
Thallium	5.4E-01	1%	4.2E-09	6.6E-05	6.4E-05	0%
Vanadium	2.9E+01	1%	2.3E-07	2.6E-05	8.8E-03	13%
				Total Noncancer Hazard:	**7.0E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**7.81E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.0E-02	1.2E-05	3.0E-04	3.9E-02	3%
Cadmium	6.6E-04	7.6E-07	1.0E-03	7.6E-04	0%
Iron	2.4E+02	2.8E-01	3.0E-01	9.4E-01	76%
Thallium	1.2E-02	1.3E-05	6.6E-05	2.0E-01	17%
Vanadium	4.0E-02	4.6E-05	1.0E-03	4.6E-02	4%
			Total Noncancer Hazard:	**1.2E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	3.1E-02	2.1E-05	3.0E-04	7.0E-02	7%
Cadmium	3.2E-03	2.1E-06	1.0E-03	2.1E-03	0%
Iron	3.2E+02	2.2E-01	3.0E-01	7.2E-01	76%
Thallium	1.5E-03	1.0E-06	6.6E-05	1.5E-02	2%
Vanadium	2.2E-01	1.5E-04	1.0E-03	1.5E-01	15%
			Total Noncancer Hazard:	**9.6E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.71E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	3.0E-02	1.2E-05	3.0E-04	3.8E-02	8%
Cadmium	7.2E-05	2.7E-08	1.0E-03	2.7E-05	0%
Iron	2.8E+02	1.1E-01	3.0E-01	3.6E-01	72%
Thallium	1.0E-05	3.9E-09	6.6E-05	5.9E-05	0%
Vanadium	2.7E-01	1.0E-04	1.0E-03	1.0E-01	21%
			Total Noncancer Hazard:	**5.0E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.84E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-01	3.0E-04	3.0E-04	1.0E+00	30%
Cadmium	1.4E+00	1.6E-03	1.0E-03	1.6E+00	47%
Iron	1.4E+02	1.6E-01	3.0E-01	5.4E-01	16%
Thallium	7.0E-05	8.1E-08	6.6E-05	1.2E-03	0%
Vanadium	2.2E-01	2.5E-04	1.0E-03	2.5E-01	7%
			Total Noncancer Hazard:	**3.3E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.2E-06	1.1E-06	0.0E+00	0.0E+00	0%
Cadmium	6.8E-07	6.5E-07	7.0E-04	9.3E-04	100%
Iron	9.9E-03	9.4E-03	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	2.9E-07	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	1.4E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**9.3E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = ***9.59E-01***

52560	AT = Averaging Time - Noncancer (hours)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	50%	6.8E-06	3.0E-04	2.3E-02	2%
Cadmium	5.3E-01	100%	3.4E-06	1.0E-03	3.4E-03	0%
Iron	2.7E+04	100%	1.7E-01	3.0E-01	5.7E-01	56%
Thallium	3.2E-01	100%	2.0E-06	6.6E-05	3.1E-02	3%
Vanadium	6.0E+01	100%	3.8E-04	1.0E-03	3.8E-01	38%
				Total Noncancer Hazard:	**1.0E+00**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) = **6.39E-06**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
100	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	3%	2.3E-07	3.0E-04	7.6E-04	0%
Cadmium	5.3E-01	0.1%	1.9E-09	2.5E-05	7.5E-05	0%
Iron	2.7E+04	1%	9.5E-04	3.0E-03	3.2E-01	79%
Thallium	3.2E-01	1%	1.1E-08	6.6E-05	1.7E-04	0%
Vanadium	6.0E+01	1%	2.1E-06	2.6E-05	8.2E-02	20%
				Total Noncancer Hazard:	**4.0E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) = **3.58E-06**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (years)
350	EF = Exposure Frequency (days/yr)
2800	SA = Surface Area (cm^2/d)
0.02	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	7.1E-03	8.2E-06	3.0E-04	2.7E-02	2%
Cadmium	1.9E-04	2.1E-07	1.0E-03	2.1E-04	0%
Iron	2.8E+02	3.2E-01	3.0E-01	1.1E+00	82%
Thallium	6.9E-03	7.9E-06	6.6E-05	1.2E-01	9%
Vanadium	8.2E-02	9.4E-05	1.0E-03	9.4E-02	7%
			Total Noncancer Hazard:	**1.3E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.2E-02	1.5E-05	3.0E-04	5.0E-02	4%
Cadmium	8.9E-04	6.0E-07	1.0E-03	6.0E-04	0%
Iron	3.7E+02	2.5E-01	3.0E-01	8.3E-01	70%
Thallium	8.9E-04	6.0E-07	6.6E-05	9.1E-03	1%
Vanadium	4.4E-01	3.0E-04	1.0E-03	3.0E-01	25%
			Total Noncancer Hazard:	**1.2E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.71E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 ***Future***
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.2E-02	1.4E-05	3.0E-04	4.6E-02	4%
Cadmium	2.0E-05	1.3E-08	1.0E-03	1.3E-05	0%
Iron	3.2E+02	2.1E-01	3.0E-01	6.9E-01	63%
Thallium	6.0E-06	3.8E-09	6.6E-05	5.8E-05	0%
Vanadium	5.5E-01	3.6E-04	1.0E-03	3.6E-01	33%
			Total Noncancer Hazard:	**1.1E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.42E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.67	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.8E-01	7.1E-05	3.0E-04	2.4E-01	37%
Cadmium	6.7E-01	2.6E-04	1.0E-03	2.6E-01	41%
Iron	7.3E+01	2.8E-02	3.0E-01	9.3E-02	15%
Thallium	1.3E-04	4.9E-08	6.6E-05	7.4E-04	0%
Vanadium	1.1E-01	4.1E-05	1.0E-03	4.1E-02	7%
			Total Noncancer Hazard:	**6.3E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.84E-04** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 **Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.2E-06	1.1E-06	0.0E+00	0.0E+00	0%
Cadmium	6.8E-07	6.5E-07	7.0E-04	9.3E-04	100%
Iron	9.9E-03	9.4E-03	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	2.9E-07	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	1.4E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**9.3E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

78840	AT = Averaging Time - Noncancer (hours)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	50%	7.3E-07	3.0E-04	2.4E-03	2%
Cadmium	5.3E-01	100%	3.6E-07	1.0E-03	3.6E-04	0%
Iron	2.7E+04	100%	1.8E-02	3.0E-01	6.1E-02	56%
Thallium	3.2E-01	100%	2.2E-07	6.6E-05	3.3E-03	3%
Vanadium	6.0E+01	100%	4.1E-05	1.0E-03	4.1E-02	38%
				Total Noncancer Hazard:	**1.1E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**6.85E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	3%	5.0E-08	3.0E-04	1.7E-04	0%
Cadmium	5.3E-01	0.1%	4.1E-10	2.5E-05	1.6E-05	0%
Iron	2.7E+04	1%	2.1E-04	3.0E-03	6.9E-02	79%
Thallium	3.2E-01	1%	2.5E-09	6.6E-05	3.8E-05	0%
Vanadium	6.0E+01	1%	4.7E-07	2.6E-05	1.8E-02	20%
				Total Noncancer Hazard:	**8.7E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**7.81E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	7.1E-03	8.2E-06	3.0E-04	2.7E-02	2%
Cadmium	1.9E-04	2.1E-07	1.0E-03	2.1E-04	0%
Iron	2.8E+02	3.2E-01	3.0E-01	1.1E+00	82%
Thallium	6.9E-03	7.9E-06	6.6E-05	1.2E-01	9%
Vanadium	8.2E-02	9.4E-05	1.0E-03	9.4E-02	7%
			Total Noncancer Hazard:	**1.3E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.2E-02	1.5E-05	3.0E-04	5.0E-02	4%
Cadmium	8.9E-04	6.0E-07	1.0E-03	6.0E-04	0%
Iron	3.7E+02	2.5E-01	3.0E-01	8.3E-01	70%
Thallium	8.9E-04	6.0E-07	6.6E-05	9.1E-03	1%
Vanadium	4.4E-01	3.0E-04	1.0E-03	3.0E-01	25%
			Total Noncancer Hazard:	**1.2E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.71E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.7	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.2E-02	1.4E-05	3.0E-04	4.6E-02	4%
Cadmium	2.0E-05	1.3E-08	1.0E-03	1.3E-05	0%
Iron	3.2E+02	2.1E-01	3.0E-01	6.9E-01	63%
Thallium	6.0E-06	3.8E-09	6.6E-05	5.8E-05	0%
Vanadium	5.5E-01	3.6E-04	1.0E-03	3.6E-01	33%
			Total Noncancer Hazard:	**1.1E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **6.42E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.67	IR = Ingestion Rate (g/kg-day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5 **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.8E-01	7.1E-05	3.0E-04	2.4E-01	37%
Cadmium	6.7E-01	2.6E-04	1.0E-03	2.6E-01	41%
Iron	7.3E+01	2.8E-02	3.0E-01	9.3E-02	15%
Thallium	1.3E-04	4.9E-08	6.6E-05	7.4E-04	0%
Vanadium	1.1E-01	4.1E-05	1.0E-03	4.1E-02	7%
			Total Noncancer Hazard:	**6.3E-01**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **3.84E-04** $(day)^{-1}$

3285	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
9	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
0.4	IR = Ingestion Rate (g/kg-day)

Index of Noncancer Risks for Adolescents - Central Tendency

Sheet Number	EA	Receptor	Media	Exposure Pathway
1b	1	Recreator 1	Air	Inhalation
2b	1	Recreator 1	Soil	Ingestion
3b	1	Recreator 1	Soil	Dermal
4b	3	Trespasser 1	Air	Inhalation
5b	3	Trespasser 1	Soil	Ingestion
6b	3	Trespasser 1	Soil	Dermal
7b	4	Trespasser 1	Air	Inhalation
8b	4	Trespasser 1	Soil	Ingestion
9b	4	Trespasser 1	Soil	Dermal
10b	4	Trespasser 2	Surface Water	Ingestion
11b	4	Trespasser 2	Surface Water	Dermal
12b	4	Trespasser 2	Sediment	Ingestion
13b	4	Trespasser 2	Sediment	Dermal
14b	5	Recreator 1	Air	Inhalation
15b	5	Recreator 1	Soil	Ingestion
16b	5	Recreator 1	Soil	Dermal
17b	5	Recreator 2	Surface Water	Ingestion
18b	5	Recreator 2	Surface Water	Dermal
19b	5	Recreator 2	Sediment	Ingestion
20b	5	Recreator 2	Sediment	Dermal

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1
Adolescent Recreator/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.1E-06	2.5E-08	0.0E+00	0.0E+00	0%
Cadmium	6.4E-07	1.5E-08	7.0E-04	2.1E-05	100%
Iron	6.2E-03	1.4E-04	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	8.9E-09	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	2.5E-07	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**2.1E-05**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**2.28E-02**
	52560	AT = Averaging Time - Noncancer (hours)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1
Adolescent Recreator/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	1.9E-07	3.0E-04	6.3E-04	3%
Cadmium	1.5E+00	100%	1.9E-07	1.0E-03	1.9E-04	1%
Iron	2.5E+04	100%	3.2E-03	3.0E-01	1.1E-02	55%
Thallium	4.1E-01	100%	5.3E-08	6.6E-05	8.0E-04	4%
Vanadium	5.5E+01	100%	7.1E-06	1.0E-03	7.1E-03	36%
				Total Noncancer Hazard:	**2.0E-02**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.29E-07**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 1
Adolescent Recreator/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	8.6E-09	3.0E-04	2.9E-05	0%
Cadmium	1.5E+00	0.1%	1.4E-10	2.5E-05	5.8E-06	0%
Iron	2.5E+04	1%	2.5E-05	3.0E-03	8.2E-03	79%
Thallium	4.1E-01	1%	4.0E-10	6.6E-05	6.0E-06	0%
Vanadium	5.5E+01	1%	5.4E-08	2.6E-05	2.1E-03	20%
				Total Noncancer Hazard:	**1.0E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**9.80E-08**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	50	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3
Adolescent Trespasser/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.4E-06	6.4E-09	0.0E+00	0.0E+00	0%
Cadmium	2.2E-06	9.9E-09	7.0E-04	1.4E-05	100%
Iron	8.4E-03	3.8E-05	0.0E+00	0.0E+00	0%
Thallium	4.2E-07	1.9E-09	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	4.3E-08	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**1.4E-05**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**4.57E-03**
	52560	AT = Averaging Time - Noncancer (hours)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3
Adolescent Trespasser/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.2E+00	50%	4.0E-08	3.0E-04	1.3E-04	4%
Cadmium	2.8E+01	100%	3.7E-07	1.0E-03	3.7E-04	10%
Iron	5.7E+04	100%	7.4E-04	3.0E-01	2.5E-03	70%
Thallium	6.6E-01	100%	8.5E-09	6.6E-05	1.3E-04	4%
Vanadium	3.2E+01	100%	4.1E-07	1.0E-03	4.1E-04	12%
				Total Noncancer Hazard:	**3.5E-03**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.29E-08**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	0.5	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 3
Adolescent Trespasser/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	6.2E+00	3%	3.6E-09	3.0E-04	1.2E-05	0%
Cadmium	2.8E+01	0.1%	5.6E-10	2.5E-05	2.2E-05	1%
Iron	5.7E+04	1%	1.1E-05	3.0E-03	3.7E-03	93%
Thallium	6.6E-01	1%	1.3E-10	6.6E-05	2.0E-06	0%
Vanadium	3.2E+01	1%	6.2E-09	2.6E-05	2.4E-04	6%
				Total Noncancer Hazard:	**4.0E-03**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.96E-08**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	10	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4
Adolescent Trespasser/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-06	1.2E-08	0.0E+00	0.0E+00	0%
Cadmium	2.4E-06	1.1E-08	7.0E-04	1.5E-05	100%
Iron	1.1E-02	4.9E-05	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	1.6E-09	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	4.3E-08	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**1.5E-05**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**4.57E-03**
	52560	AT = Averaging Time - Noncancer (hours)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4
Adolescent Trespasser/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E+00	50%	3.2E-08	3.0E-04	1.1E-04	6%
Cadmium	4.1E+00	100%	5.3E-08	1.0E-03	5.3E-05	3%
Iron	2.3E+04	100%	3.0E-04	3.0E-01	1.0E-03	61%
Thallium	5.4E-01	100%	7.0E-09	6.6E-05	1.1E-04	6%
Vanadium	2.9E+01	100%	3.8E-07	1.0E-03	3.8E-04	23%
				Total Noncancer Hazard:	**1.6E-03**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.29E-08**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	10	EF = Exposure Frequency (days/yr)
	0.5	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4
Adolescent Trespasser/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E+00	3%	2.9E-09	3.0E-04	9.7E-06	1%
Cadmium	4.1E+00	0.1%	8.0E-11	2.5E-05	3.2E-06	0%
Iron	2.3E+04	1%	4.5E-06	3.0E-03	1.5E-03	87%
Thallium	5.4E-01	1%	1.1E-10	6.6E-05	1.6E-06	0%
Vanadium	2.9E+01	1%	5.7E-09	2.6E-05	2.2E-04	13%
				Total Noncancer Hazard:	**1.7E-03**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.96E-08**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	10	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4
Adolescent Trespasser 2/Ingestion of Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	7.8E-03	2.4E-07	3.0E-04	8.1E-04	37%
Cadmium	7.0E-04	2.2E-08	1.0E-03	2.2E-05	1%
Iron	6.4E+00	2.0E-04	3.0E-01	6.6E-04	30%
Thallium	5.9E-04	1.8E-08	6.6E-05	2.8E-04	13%
Vanadium	1.4E-02	4.4E-07	1.0E-03	4.4E-04	20%
			Total Noncancer Hazard:	**2.2E-03**	

Notes:

IF = Intake Factor (IR * EF * ED) / (BW * AT) =		**3.10E-05**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	6	ED = Exposure Duration (yr)
	12	EF = Exposure Frequency (days/yr)
	0.05	IR = Ingestion Rate (L/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4
Adolescent Trespasser 2/Dermal Contact with Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Dermal Permeability (Kp) (cm/hr)	Daily Intake DI = CxIFxKp (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	7.8E-03	1.E-03	3.8E-08	3.0E-04	1.3E-04	1%
Cadmium	7.0E-04	1.E-03	3.4E-09	2.5E-05	1.4E-04	1%
Iron	6.4E+00	1.E-03	3.1E-05	3.0E-03	1.0E-02	78%
Thallium	5.9E-04	1.E-03	2.9E-09	6.6E-05	4.4E-05	0%
Vanadium	1.4E-02	1.E-03	7.0E-08	2.6E-05	2.7E-03	20%
				Total Noncancer Hazard:	**1.3E-02**	

Notes:

IF = Intake Factor (SA * ET * EF * ED * CF) / (BW * AT) =		**4.90E-03**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.001	CF = Conversion Factor (L/cm³)
	6	ED = Exposure Duration (years)
	12	EF = Exposure Frequency (days/yr)
	0.5	ET = Exposure Time (hour/day)
	15800	SA = Surface Area (cm^2/d)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4
Trespasser 2/Ingestion of Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	5.0E-01	3.3E-08	3.0E-04	1.1E-04	2%
Cadmium	5.8E-01	1.0E+00	1.8E-08	1.0E-03	1.8E-05	0%
Iron	2.7E+04	1.0E+00	8.5E-04	3.0E-01	2.8E-03	63%
Thallium	3.7E-01	1.0E+00	1.1E-08	6.6E-05	1.7E-04	4%
Vanadium	4.5E+01	1.0E+00	1.4E-06	1.0E-03	1.4E-03	31%
				Total Noncancer Hazard:	**4.5E-03**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**3.10E-08**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	12	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 4
Trespasser 2/Dermal Contact with Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	3%	7.8E-09	3.0E-04	2.6E-05	0%
Cadmium	5.8E-01	0.1%	7.2E-11	2.5E-05	2.9E-06	0%
Iron	2.7E+04	1%	3.4E-05	3.0E-03	1.1E-02	84%
Thallium	3.7E-01	1%	4.6E-10	6.6E-05	6.9E-06	0%
Vanadium	4.5E+01	1%	5.5E-08	2.6E-05	2.1E-03	16%
				Total Noncancer Hazard:	**1.3E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.24E-07**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	12	EF = Exposure Frequency (days/yr)
	4980	SA = Surface Area (cm^2/d)
	0.04	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5
Adolescent Recreator/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.2E-06	2.6E-08	0.0E+00	0.0E+00	0%
Cadmium	6.8E-07	1.6E-08	7.0E-04	2.2E-05	100%
Iron	9.9E-03	2.2E-04	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	6.8E-09	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	3.4E-07	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**2.2E-05**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**2.28E-02**
	52560	AT = Averaging Time - Noncancer (hours)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	4	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5
Adolescent Recreator/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	50%	1.4E-07	3.0E-04	4.6E-04	2%
Cadmium	5.3E-01	100%	6.8E-08	1.0E-03	6.8E-05	0%
Iron	2.7E+04	100%	3.4E-03	3.0E-01	1.1E-02	56%
Thallium	3.2E-01	100%	4.1E-08	6.6E-05	6.3E-04	3%
Vanadium	6.0E+01	100%	7.7E-06	1.0E-03	7.7E-03	38%
				Total Noncancer Hazard:	**2.0E-02**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.29E-07**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	50	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5
Adolescent Recreator/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	3%	6.3E-09	3.0E-04	2.1E-05	0%
Cadmium	5.3E-01	0.1%	5.2E-11	2.5E-05	2.1E-06	0%
Iron	2.7E+04	1%	2.6E-05	3.0E-03	8.7E-03	79%
Thallium	3.2E-01	1%	3.1E-10	6.6E-05	4.7E-06	0%
Vanadium	6.0E+01	1%	5.8E-08	2.6E-05	2.2E-03	20%
				Total Noncancer Hazard:	**1.1E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**9.80E-08**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	50	EF = Exposure Frequency (days/yr)
	3790	SA = Surface Area (cm^2/d)
	0.01	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5
Adolescent Recreator 2/Ingestion of Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E-03	3.0E-07	3.0E-04	1.0E-03	21%
Cadmium	1.5E-04	9.0E-09	1.0E-03	9.0E-06	0%
Iron	1.2E+01	7.1E-04	3.0E-01	2.4E-03	49%
Thallium	5.8E-04	3.6E-08	6.6E-05	5.4E-04	11%
Vanadium	1.4E-02	8.9E-07	1.0E-03	8.9E-04	18%
			Total Noncancer Hazard:	**4.8E-03**	

Notes:

IF = Intake Factor (IR * EF * ED) / (BW * AT) =		**6.20E-05**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	6	ED = Exposure Duration (yr)
	24	EF = Exposure Frequency (days/yr)
	0.05	IR = Ingestion Rate (L/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5
Adolescent Recreator 2/Dermal Contact with Surface Water

Chemicals	Surface Water Concentration (C) (mg/L)	Dermal Permeability (Kp) (cm/hr)	Daily Intake DI = CxIFxKp (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	4.9E-03	1.E-03	4.8E-08	3.0E-04	1.6E-04	0%
Cadmium	1.5E-04	1.E-03	1.4E-09	2.5E-05	5.7E-05	0%
Iron	1.2E+01	1.E-03	1.1E-04	3.0E-03	3.8E-02	87%
Thallium	5.8E-04	1.E-03	5.6E-09	6.6E-05	8.5E-05	0%
Vanadium	1.4E-02	1.E-03	1.4E-07	2.6E-05	5.4E-03	12%
				Total Noncancer Hazard:	**4.3E-02**	

Notes:

IF = Intake Factor (SA * ET * EF * ED * CF) / (BW * AT) =		**9.80E-03**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.001	CF = Conversion Factor (L/cm³)
	6	ED = Exposure Duration (years)
	24	EF = Exposure Frequency (days/yr)
	0.5	ET = Exposure Time (hour/day)
	15800	SA = Surface Area (cm^2/d)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5
Adolescent Recreator 2/Ingestion of Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.8E+00	50.0%	5.5E-08	3.0E-04	1.8E-04	4%
Cadmium	2.1E-01	100.0%	1.3E-08	1.0E-03	1.3E-05	0%
Iron	1.4E+04	100.0%	8.9E-04	3.0E-01	3.0E-03	60%
Thallium	3.7E-01	100.0%	2.3E-08	6.6E-05	3.5E-04	7%
Vanadium	2.4E+01	100.0%	1.5E-06	1.0E-03	1.5E-03	30%
				Total Noncancer Hazard:	**5.0E-03**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**6.20E-08**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	24	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway - Central Tendency

EA 5
Adolescent Recreator 2/Dermal Contact with Sediment

Chemicals	Sediment Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	1.8E+00	3%	1.3E-08	3.0E-04	4.4E-05	0%
Cadmium	2.1E-01	0.1%	5.1E-11	2.5E-05	2.1E-06	0%
Iron	1.4E+04	1%	3.6E-05	3.0E-03	1.2E-02	84%
Thallium	3.7E-01	1%	9.1E-10	6.6E-05	1.4E-05	0%
Vanadium	2.4E+01	1%	5.9E-08	2.6E-05	2.3E-03	16%
				Total Noncancer Hazard:	**1.4E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**2.47E-07**
	2190	AT = Averaging Time - Noncancer (days)
	53	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	24	EF = Exposure Frequency (days/yr)
	4980	SA = Surface Area (cm^2/d)
	0.04	AF = Adherence Factor (mg/cm^2)

Index of Noncancer Risks for Workers - Central Tendency

Sheet Number	EA	Receptor	Media	Exposure Pathway
1c	1	Rancher	Air	Inhalation
2c	1	Rancher	Soil	Ingestion
3c	1	Rancher	Soil	Dermal
4c	1	Construction Worker	Air	Inhalation
5c	1	Construction Worker	Soil	Ingestion
6c	1	Construction Worker	Soil	Dermal
7c	2	Rancher	Air	Inhalation
8c	2	Rancher	Soil	Ingestion
9c	2	Rancher	Soil	Dermal
10c	2	Construction Worker	Air	Inhalation
11c	2	Construction Worker	Soil	Ingestion
12c	2	Construction Worker	Soil	Dermal
13c	5	Rancher	Air	Inhalation
14c	5	Rancher	Soil	Ingestion
15c	5	Rancher	Soil	Dermal
18c	SM	Industrial Worker	Air	Inhalation
19c	SM	Industrial Worker	Soil	Ingestion
20c	SM	Industrial Worker	Soil	Dermal

Noncancer Hazard by Chemical And Pathway

EA 1
Rancher/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.1E-06	3.1E-07	0.0E+00	0.0E+00	0%
Cadmium	6.4E-07	1.8E-07	7.0E-04	2.6E-04	100%
Iron	6.2E-03	1.8E-03	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	1.1E-07	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	3.1E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**2.6E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**2.85E-01**
	78840	AT = Averaging Time - Noncancer (hours)
	9	ED = Exposure Duration (yr)
	250	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway

EA 1
Rancher/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	7.1E-07	3.0E-04	2.4E-03	3%
Cadmium	1.5E+00	100%	7.2E-07	1.0E-03	7.2E-04	1%
Iron	2.5E+04	100%	1.2E-02	3.0E-01	4.1E-02	55%
Thallium	4.1E-01	100%	2.0E-07	6.6E-05	3.0E-03	4%
Vanadium	5.5E+01	100%	2.7E-05	1.0E-03	2.7E-02	36%
				Total Noncancer Hazard:	**7.4E-02**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**4.89E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	250	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway

EA 1
Rancher/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	5.7E-08	3.0E-04	1.9E-04	0%
Cadmium	1.5E+00	0.1%	9.6E-10	2.5E-05	3.8E-05	0%
Iron	2.5E+04	1%	1.6E-04	3.0E-03	5.4E-02	79%
Thallium	4.1E-01	1%	2.6E-09	6.6E-05	4.0E-05	0%
Vanadium	5.5E+01	1%	3.6E-07	2.6E-05	1.4E-02	20%
				Total Noncancer Hazard:	**6.8E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**6.46E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	250	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.02	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway

EA 1
Construction Worker/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.1E-06	2.8E-07	0.0E+00	0.0E+00	0%
Cadmium	6.4E-07	1.6E-07	7.0E-03	2.3E-05	100%
Iron	6.2E-03	1.5E-03	0.0E+00	0.0E+00	0%
Thallium	3.9E-07	9.8E-08	0.0E+00	0.0E+00	0%
Vanadium	1.1E-05	2.7E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**2.3E-05**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**2.50E-01**
	78840	AT = Averaging Time - Noncancer (hours)
	9	ED = Exposure Duration (yr)
	219	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway

EA 1
Construction Worker/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	6.3E-07	3.0E-04	2.1E-03	3%
Cadmium	1.5E+00	100%	6.3E-07	1.0E-03	6.3E-04	1%
Iron	2.5E+04	100%	1.1E-02	3.0E-01	3.6E-02	55%
Thallium	4.1E-01	100%	1.7E-07	6.6E-05	2.6E-03	4%
Vanadium	5.5E+01	100%	2.4E-05	1.0E-03	2.4E-02	36%
				Total Noncancer Hazard:	**6.5E-02**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**4.29E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	219	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway

EA 1
Construction Worker/Dermal Contact with Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	7.4E-08	3.0E-04	2.5E-04	0%
Cadmium	1.5E+00	0.1%	1.3E-09	2.5E-05	5.0E-05	0%
Iron	2.5E+04	1%	2.1E-04	3.0E-03	7.1E-02	79%
Thallium	4.1E-01	1%	3.5E-09	6.6E-05	5.2E-05	0%
Vanadium	5.5E+01	1%	4.7E-07	2.6E-05	1.8E-02	20%
				Total Noncancer Hazard:	**9.0E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**8.49E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	219	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.03	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway

EA 2
Rancher/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	5.5E-07	1.6E-07	0.0E+00	0.0E+00	0%
Cadmium	3.6E-07	1.0E-07	7.0E-04	1.5E-04	100%
Iron	7.5E-03	2.1E-03	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	2.7E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	5.3E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**1.5E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**2.85E-01**
	78840	AT = Averaging Time - Noncancer (hours)
	9	ED = Exposure Duration (yr)
	250	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway

EA 2
Rancher/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	7.1E-07	3.0E-04	2.4E-03	3%
Cadmium	1.3E+00	100%	6.5E-07	1.0E-03	6.5E-04	1%
Iron	2.5E+04	100%	1.2E-02	3.0E-01	4.1E-02	58%
Thallium	5.8E-01	100%	2.8E-07	6.6E-05	4.3E-03	6%
Vanadium	4.5E+01	100%	2.2E-05	1.0E-03	2.2E-02	31%
				Total Noncancer Hazard:	**7.0E-02**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**4.89E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	250	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway

EA 2
Rancher/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	5.6E-08	3.0E-04	1.9E-04	0%
Cadmium	1.3E+00	0.1%	8.5E-10	2.5E-05	3.4E-05	0%
Iron	2.5E+04	1%	1.6E-04	3.0E-03	5.4E-02	83%
Thallium	5.8E-01	1%	3.7E-09	6.6E-05	5.7E-05	0%
Vanadium	4.5E+01	1%	2.9E-07	2.6E-05	1.1E-02	17%
				Total Noncancer Hazard:	**6.6E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**6.46E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	250	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.02	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway

EA 2
Construction Worker/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	5.5E-07	1.4E-07	0.0E+00	0.0E+00	0%
Cadmium	3.6E-07	9.0E-08	7.0E-04	1.3E-04	100%
Iron	7.5E-03	1.9E-03	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	2.4E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	4.6E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**1.3E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**2.50E-01**
	78840	AT = Averaging Time - Noncancer (hours)
	9	ED = Exposure Duration (yr)
	219	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway

EA 2
Construction Worker/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	50%	6.2E-07	3.0E-04	2.1E-03	3%
Cadmium	1.3E+00	100%	5.7E-07	1.0E-03	5.7E-04	1%
Iron	2.5E+04	100%	1.1E-02	3.0E-01	3.6E-02	58%
Thallium	5.8E-01	100%	2.5E-07	6.6E-05	3.8E-03	6%
Vanadium	4.5E+01	100%	1.9E-05	1.0E-03	1.9E-02	31%
				Total Noncancer Hazard:	***6.2E-02***	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**4.29E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	219	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway

EA 2
Construction Worker/Dermal Contact with Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.9E+00	3%	7.4E-08	3.0E-04	2.5E-04	0%
Cadmium	1.3E+00	0.1%	1.1E-09	2.5E-05	4.5E-05	0%
Iron	2.5E+04	1%	2.1E-04	3.0E-03	7.1E-02	83%
Thallium	5.8E-01	1%	4.9E-09	6.6E-05	7.5E-05	0%
Vanadium	4.5E+01	1%	3.8E-07	2.6E-05	1.5E-02	17%
				Total Noncancer Hazard:	**8.6E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**8.49E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	219	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.03	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway

EA 5
Rancher/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	1.2E-06	3.3E-07	0.0E+00	0.0E+00	0%
Cadmium	6.8E-07	1.9E-07	7.0E-04	2.8E-04	100%
Iron	9.9E-03	2.8E-03	0.0E+00	0.0E+00	0%
Thallium	3.0E-07	8.6E-08	0.0E+00	0.0E+00	0%
Vanadium	1.5E-05	4.3E-06	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**2.8E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**2.85E-01**
	78840	AT = Averaging Time - Noncancer (hours)
	9	ED = Exposure Duration (yr)
	250	EF = Exposure Frequency (days/yr)
	10	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway

EA 5
Rancher/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	50%	5.2E-07	3.0E-04	1.7E-03	2%
Cadmium	5.3E-01	100%	2.6E-07	1.0E-03	2.6E-04	0%
Iron	2.7E+04	100%	1.3E-02	3.0E-01	4.3E-02	56%
Thallium	3.2E-01	100%	1.6E-07	6.6E-05	2.4E-03	3%
Vanadium	6.0E+01	100%	2.9E-05	1.0E-03	2.9E-02	38%
				Total Noncancer Hazard:	**7.7E-02**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**4.89E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	250	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway

EA 5
Rancher/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E+00	3%	4.1E-08	3.0E-04	1.4E-04	0.2%
Cadmium	5.3E-01	0.1%	3.4E-10	2.5E-05	1.4E-05	0.0%
Iron	2.7E+04	1%	1.7E-04	3.0E-03	5.7E-02	79%
Thallium	3.2E-01	1%	2.1E-09	6.6E-05	3.1E-05	0%
Vanadium	6.0E+01	1%	3.8E-07	2.6E-05	1.5E-02	20%
				Total Noncancer Hazard:	**7.2E-02**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**6.46E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	250	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.02	AF = Adherence Factor (mg/cm^2)

Noncancer Hazard by Chemical And Pathway

SM
Industrial Worker/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C) (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	2.6E-06	1.3E-07	0.0E+00	0.0E+00	0%
Cadmium	2.4E-06	1.2E-07	7.0E-04	1.7E-04	100%
Iron	1.1E-02	5.4E-04	0.0E+00	0.0E+00	0%
Thallium	3.5E-07	1.8E-08	0.0E+00	0.0E+00	0%
Vanadium	9.4E-06	4.7E-07	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**1.7E-04**	

Notes:

IF = Intake Factor (ET* ED * EF) / (AT) =		**5.00E-02**
	78840	AT = Averaging Time - Noncancer (hours)
	9	ED = Exposure Duration (yr)
	219	EF = Exposure Frequency (days/yr)
	2	ET = Exposure Time (hours/day)

Noncancer Hazard by Chemical And Pathway

SM
Industrial Worker/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.4E+01	50%	2.6E-06	3.0E-04	8.6E-03	14%
Cadmium	7.2E+00	100%	1.6E-06	1.0E-03	1.6E-03	3%
Iron	5.9E+04	100%	1.3E-02	3.0E-01	4.2E-02	71%
Thallium	7.4E-01	100%	1.6E-07	6.6E-05	2.4E-03	4%
Vanadium	2.3E+01	100%	4.9E-06	1.0E-03	4.9E-03	8%
				Total Noncancer Hazard:	**6.0E-02**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**2.14E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (yr)
	219	EF = Exposure Frequency (days/yr)
	0.5	FS = Fraction from Contaminated Source
	50	IR = Ingestion Rate (mg/day)

Noncancer Hazard by Chemical And Pathway

SM
Industrial Worker/Dermal Contact with Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD Derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.4E+01	3%	4.1E-07	3.0E-04	1.4E-03	1.2%
Cadmium	7.2E+00	0.1%	4.1E-09	2.5E-05	1.6E-04	0.1%
Iron	5.9E+04	1%	3.3E-04	3.0E-03	1.1E-01	94%
Thallium	7.4E-01	1%	4.2E-09	6.6E-05	6.3E-05	0%
Vanadium	2.3E+01	1%	1.3E-07	2.6E-05	5.0E-03	4%
				Total Noncancer Hazard:	**1.2E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**5.66E-07**
	3285	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	9	ED = Exposure Duration (years)
	219	EF = Exposure Frequency (days/yr)
	3300	SA = Surface Area (cm^2/d)
	0.02	AF = Adherence Factor (mg/cm^2)

Appendix E.5

RME Background Cancer Risks

Summary of Total Excess Lifetime Cancer Risk, Reasonable Maximum Exposure (RME), Reference Area

EA	Exposure Pathway	Cancer Risk Child Resident	Cancer Risk Adult Resident	Total Excess Lifetime Cancer Risk	Percent Contribution	Food Total
REF	Inhalation of Outdoor Air	2.5E-07	9.9E-07	1.2E-06	1%	
REF	Ingestion of Soil	2.2E-06	9.5E-07	3.2E-06	1%	
REF	Dermal Contact with Soil	3.7E-07	2.3E-07	6.0E-07	0.3%	
REF	Ingestion of Locally-Grown Beef	1.5E-06	6.1E-06	7.7E-06	4%	
REF	Ingestion of Locally-Grown Chicken	3.3E-06	1.3E-05	1.7E-05	8%	
REF	Ingestion of Locally-Grown Eggs	2.6E-06	1.0E-05	1.3E-05	6%	
REF	Ingestion of Locally-Grown Vegetables	3.5E-05	1.4E-04	1.8E-04	81%	98%
	Total Cancer Risk Excluding Food Pathways:	3.E-06	2.E-06	**5E-06**		
	Total Cancer Risk:	5E-05	2E-04	**2E-04**		

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C)[1] (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	5.5E-07	4.5E-08	4.3E-03	1.9E-07	78%
Cadmium	3.6E-07	3.0E-08	1.8E-03	5.3E-08	22%
Iron	7.5E-03	6.2E-04	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	7.7E-08	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	1.5E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.5E-07**	

Notes:
1. Reference Area outdoor air concentrations were not available. Outdoor air concentrations from EA2 were used as a proxy value.

IF = Intake Factor (ET* ED * EF) / (AT) =		**8.22E-02**
	613200	AT = Averaging Time - Cancer (hours)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

4.3E-06

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.7E+00	50%	1.5E-06	1.5E+00	2.2E-06	100%
Cadmium	6.7E-01	100%	7.3E-07	0.0E+00	0.0E+00	0%
Iron	4.1E+04	100%	4.5E-02	0.0E+00	0.0E+00	0%
Thallium	7.9E+00	100%	8.6E-06	0.0E+00	0.0E+00	0%
Vanadium	1.2E+02	100%	1.3E-04	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.2E-06**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.10E-06**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	200	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.7E+00	3%	2.5E-07	1.5E+00	3.7E-07	100%
Cadmium	6.7E-01	0.1%	2.0E-09	0.0E+00	0.0E+00	0%
Iron	4.1E+04	1%	1.3E-03	0.0E+00	0.0E+00	0%
Thallium	7.9E+00	1%	2.4E-07	0.0E+00	0.0E+00	0%
Vanadium	1.2E+02	1%	3.7E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**3.7E-07**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**3.07E-06**
	25550	AT = Averaging Time - Cancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	2800	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	5.6E-03	1.0E-06	1.5E+00	1.5E-06	100%
Cadmium	*1.4E-04*	*2.6E-08*	*0.0E+00*	*0.0E+00*	0%
Iron	4.3E+02	7.9E-02	0.0E+00	0.0E+00	0%
Thallium	1.7E-01	3.1E-05	0.0E+00	0.0E+00	0%
Vanadium	1.7E-01	3.0E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.5E-06**	

Notes:

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**1.81E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
2.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E-02	2.2E-06	1.5E+00	3.3E-06	100%
Cadmium	6.9E-04	7.3E-08	0.0E+00	0.0E+00	0%
Iron	5.7E+02	6.1E-02	0.0E+00	0.0E+00	0%
Thallium	2.2E-02	2.4E-06	0.0E+00	0.0E+00	0%
Vanadium	8.9E-01	9.5E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.3E-06**	

Notes:

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**1.07E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.3	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.0E-02	1.7E-06	1.5E+00	2.6E-06	100%
Cadmium	1.6E-05	1.3E-09	0.0E+00	0.0E+00	0%
Iron	5.0E+02	4.3E-02	0.0E+00	0.0E+00	0%
Thallium	1.5E-04	1.3E-08	0.0E+00	0.0E+00	0%
Vanadium	1.1E+00	9.6E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**2.6E-06**	

Notes:

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**8.63E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.05	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.4E-01	2.4E-05	1.5E+00	3.5E-05	100%
Cadmium	5.0E-01	4.9E-05	0.0E+00	0.0E+00	0%
Iron	1.8E+02	1.7E-02	0.0E+00	0.0E+00	0%
Thallium	3.2E-03	3.1E-07	0.0E+00	0.0E+00	0%
Vanadium	5.8E-01	5.7E-05	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**3.5E-05**	

Notes:

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**9.86E-05**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
6	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.2	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C)[1] (mg/m^3)	Effective Conc. EC = CxIF (mg/m^3)	Unit Risk (UR) $(ug/m^3)^{-1}$	Total Cancer Risk CR = ECxUR	Percent Contribution To Total Cancer Risk
Arsenic	5.5E-07	1.8E-07	4.3E-03	7.8E-07	78%
Cadmium	3.6E-07	1.2E-07	1.8E-03	2.1E-07	22%
Iron	7.5E-03	2.5E-03	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	3.1E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	6.0E-06	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**9.9E-07**	

Notes:
1. Reference Area outdoor air concentrations were not available. Outdoor air concentrations from EA2 were used as a proxy value.

IF = Intake Factor (ET* ED * EF) / (AT) =		**3.29E-01**
	613200	AT = Averaging Time - Cancer (hours)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.7E+00	50%	6.3E-07	1.5E+00	9.5E-07	100%
Cadmium	6.7E-01	100%	3.1E-07	0.0E+00	0.0E+00	0%
Iron	4.1E+04	100%	1.9E-02	0.0E+00	0.0E+00	0%
Thallium	7.9E+00	100%	3.7E-06	0.0E+00	0.0E+00	0%
Vanadium	1.2E+02	100%	5.6E-05	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**9.5E-07**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**4.70E-07**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.7E+00	3%	1.5E-07	1.5E+00	2.3E-07	100%
Cadmium	6.7E-01	0.1%	1.2E-09	0.0E+00	0.0E+00	0%
Iron	4.1E+04	1%	7.7E-04	0.0E+00	0.0E+00	0%
Thallium	7.9E+00	1%	1.5E-07	0.0E+00	0.0E+00	0%
Vanadium	1.2E+02	1%	2.2E-06	0.0E+00	0.0E+00	0%
				Total Cancer Risk:	**2.3E-07**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**1.87E-06**
	25550	AT = Averaging Time - Cancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	5.6E-03	4.1E-06	1.5E+00	6.1E-06	100%
Cadmium	1.4E-04	1.0E-07	0.0E+00	0.0E+00	0%
Iron	4.3E+02	3.1E-01	0.0E+00	0.0E+00	0%
Thallium	1.7E-01	1.2E-04	0.0E+00	0.0E+00	0%
Vanadium	1.7E-01	1.2E-04	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**6.1E-06**	

Notes:

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **7.23E-04** $(day)^{-1}$

25550	AT = Averaging Time - Cancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.1E-02	8.9E-06	1.5E+00	1.3E-05	100%
Cadmium	6.9E-04	2.9E-07	0.0E+00	0.0E+00	0%
Iron	5.7E+02	2.5E-01	0.0E+00	0.0E+00	0%
Thallium	2.2E-02	9.4E-06	0.0E+00	0.0E+00	0%
Vanadium	8.9E-01	3.8E-04	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.3E-05**	

Notes:

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**4.27E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
24	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.3	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.0E-02	6.9E-06	1.5E+00	1.0E-05	100%
Cadmium	1.6E-05	5.4E-09	0.0E+00	0.0E+00	0%
Iron	5.0E+02	1.7E-01	0.0E+00	0.0E+00	0%
Thallium	1.5E-04	5.1E-08	0.0E+00	0.0E+00	0%
Vanadium	1.1E+00	3.9E-04	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.0E-05**	

Notes:

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**3.45E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
24	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.05	IR = Ingestion Rate (g/kg-day)	

Excess Lifetime Cancer Risk by Chemical And Pathway

Reference Area **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Slope Factor (SF) (kg-day/mg)	Total Cancer Risk CR = DIxSF	Percent Contribution To Total Cancer Risk
Arsenic	2.4E-01	9.4E-05	1.5E+00	1.4E-04	100%
Cadmium	5.0E-01	2.0E-04	0.0E+00	0.0E+00	0%
Iron	1.8E+02	6.9E-02	0.0E+00	0.0E+00	0%
Thallium	3.2E-03	1.2E-06	0.0E+00	0.0E+00	0%
Vanadium	5.8E-01	2.3E-04	0.0E+00	0.0E+00	0%
			Total Cancer Risk:	**1.4E-04**	

Notes:

Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) =	**3.95E-04**	$(day)^{-1}$
25550	AT = Averaging Time - Cancer (days)	
0.001	CF = Conversion Factor (kg/g)	
24	ED = Exposure Duration (yr)	
350	EF = Exposure Frequency (days/yr)	
1	FS = Fraction from Contaminated Source	
1.2	IR = Ingestion Rate (g/kg-day)	

Appendix E.6

RME Background Noncancer Risks

Summary of Total Noncancer Risk, Reasonable Maximum Exposure (RME), Reference Area

EA	Exposure Pathway	Noncancer Risk Child Resident	Percent Contribution	Noncancer Risk Adult Resident	Percent Contribution	Food Child	Food Adult
REF	Inhalation of Outdoor Air	0.00049	0.002%	0.00049	0.0%		
REF	Ingestion of Soil	4.9	19%	0.5	3%		
REF	Dermal Contact with Soil	2.7	10%	0.4	2%		
REF	Ingestion of Locally-Grown Beef	8.9	34%	8.9	45%		
REF	Ingestion of Locally-Grown Chicken	4.0	15%	4.0	20%		
REF	Ingestion of Locally-Grown Eggs	2.9	11%	2.9	15%		
REF	Ingestion of Locally-Grown Vegetables	2.9	11%	2.9	15%	71%	95%
	Total HI Excluding Food Pathways	**8**		**1**			
	Total Hazard Index	**26**		**20**			

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Child Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C)[1] (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	5.5E-07	5.3E-07	0.0E+00	0.0E+00	0%
Cadmium	3.6E-07	3.5E-07	7.0E-04	4.9E-04	100%
Iron	7.5E-03	7.2E-03	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	9.0E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	1.8E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**4.9E-04**	

Notes:
1. Reference Area outdoor air concentrations were not available. Outdoor air concentrations from EA2 were used as a proxy value.

IF = Intake Factor (ET* ED * EF) / (AT) = **9.59E-01**

52560	AT = Averaging Time - Noncancer (hours)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
24	ET = Exposure Time (hours/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Child Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.7E+00	50%	1.7E-05	3.0E-04	5.7E-02	1%
Cadmium	6.7E-01	100%	8.5E-06	1.0E-03	8.5E-03	0%
Iron	4.1E+04	100%	5.3E-01	3.0E-01	1.8E+00	36%
Thallium	7.9E+00	100%	1.0E-04	6.6E-05	1.5E+00	31%
Vanadium	1.2E+02	100%	1.5E-03	1.0E-03	1.5E+00	31%
				Total Noncancer Hazard:	**4.9E+00**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) = **1.28E-05**

2190	AT = Averaging Time - Noncancer (days)
15	BW = Body Weight (kg)
0.000001	CF = Conversion Factor (kg/mg)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
200	IR = Ingestion Rate (mg/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Child Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.7E+00	3%	2.9E-06	3.0E-04	9.7E-03	0%
Cadmium	6.7E-01	0.1%	2.4E-08	2.5E-05	9.5E-04	0%
Iron	4.1E+04	1%	1.5E-02	1.5E-02	9.8E-01	37%
Thallium	7.9E+00	1%	2.8E-06	6.6E-05	4.3E-02	2%
Vanadium	1.2E+02	1%	4.3E-05	2.6E-05	1.7E+00	61%
				Total Noncancer Hazard:	**2.7E+00**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**3.58E-05**
	2190	AT = Averaging Time - Noncancer (days)
	15	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	6	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	2800	SA = Surface Area (cm^2/d)
	0.2	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Child Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	5.6E-03	1.2E-05	3.0E-04	4.0E-02	0%
Cadmium	1.4E-04	3.0E-07	1.0E-03	3.0E-04	0%
Iron	4.3E+02	9.2E-01	3.0E-01	3.1E+00	34%
Thallium	1.7E-01	3.6E-04	6.6E-05	5.4E+00	61%
Vanadium	1.7E-01	3.5E-04	1.0E-03	3.5E-01	4%
			Total Noncancer Hazard:	**8.9E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **2.11E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Child Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E-02	2.6E-05	3.0E-04	8.7E-02	2%
Cadmium	6.9E-04	8.5E-07	1.0E-03	8.5E-04	0%
Iron	5.7E+02	7.2E-01	3.0E-01	2.4E+00	60%
Thallium	2.2E-02	2.7E-05	6.6E-05	4.2E-01	10%
Vanadium	8.9E-01	1.1E-03	1.0E-03	1.1E+00	28%
			Total Noncancer Hazard:	**4.0E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.25E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.0E-02	2.0E-05	3.0E-04	6.7E-02	2%
Cadmium	1.6E-05	1.6E-08	1.0E-03	1.6E-05	0%
Iron	5.0E+02	5.0E-01	3.0E-01	1.7E+00	58%
Thallium	1.5E-04	1.5E-07	6.6E-05	2.2E-03	0%
Vanadium	1.1E+00	1.1E-03	1.0E-03	1.1E+00	39%
			Total Noncancer Hazard:	**2.9E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.01E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Child Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.4E-01	2.7E-04	3.0E-04	9.1E-01	32%
Cadmium	5.0E-01	5.7E-04	1.0E-03	5.7E-01	20%
Iron	1.8E+02	2.0E-01	3.0E-01	6.7E-01	23%
Thallium	3.2E-03	3.6E-06	6.6E-05	5.5E-02	2%
Vanadium	5.8E-01	6.7E-04	1.0E-03	6.7E-01	23%
			Total Noncancer Hazard:	**2.9E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

2190	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
6	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Adult Resident/Inhalation of Outdoor Air

Chemicals	Outdoor Air Concentration (C)[1] (mg/m^3)	Daily Intake DI = CxIF (mg/m^3)	Inhalation RfC (RfC) (mg/m^3)	Total Noncancer Hazard Hazard = DI÷RfC	Percent Contribution To Total Noncancer Hazard
Arsenic	5.5E-07	5.3E-07	0.0E+00	0.0E+00	0%
Cadmium	3.6E-07	3.5E-07	7.0E-04	4.9E-04	100%
Iron	7.5E-03	7.2E-03	0.0E+00	0.0E+00	0%
Thallium	9.4E-07	9.0E-07	0.0E+00	0.0E+00	0%
Vanadium	1.8E-05	1.8E-05	0.0E+00	0.0E+00	0%
			Total Noncancer Hazard:	**4.9E-04**	

Notes:
1. Reference Area outdoor air concentrations were not available. Outdoor air concentrations from EA2 were used as a proxy value.

IF = Intake Factor (ET* ED * EF) / (AT) =		**9.59E-01**
	210240	AT = Averaging Time - Noncancer (hours)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	24	ET = Exposure Time (hours/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Adult Resident/Ingestion of Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Bioavailability (R)	Daily Intake DI = CxIFxR (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.7E+00	50%	1.8E-06	3.0E-04	6.2E-03	1%
Cadmium	6.7E-01	100%	9.1E-07	1.0E-03	9.1E-04	0%
Iron	4.1E+04	100%	5.6E-02	3.0E-01	1.9E-01	36%
Thallium	7.9E+00	100%	1.1E-05	6.6E-05	1.6E-01	31%
Vanadium	1.2E+02	100%	1.6E-04	1.0E-03	1.6E-01	31%
				Total Noncancer Hazard:	**5.2E-01**	

Notes:

IF = Intake Factor (IR * FS * EF * ED * CF) / (BW * AT) =		**1.37E-06**
	8760	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (yr)
	350	EF = Exposure Frequency (days/yr)
	1	FS = Fraction from Contaminated Source
	100	IR = Ingestion Rate (mg/day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Adult Resident/Dermal Contact with Outdoor Soil

Chemicals	Soil Concentration (C) (mg/kg)	Dermal Absorption Fraction (DA)	Daily Intake DI = CxIFxDA (mg/kg-day)	Dermal RfD (RfD derm.) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.7E+00	3%	4.4E-07	3.0E-04	1.5E-03	0%
Cadmium	6.7E-01	0.1%	3.6E-09	2.5E-05	1.5E-04	0%
Iron	4.1E+04	1%	2.3E-03	1.5E-02	1.5E-01	37%
Thallium	7.9E+00	1%	4.3E-07	6.6E-05	6.5E-03	2%
Vanadium	1.2E+02	1%	6.6E-06	2.6E-05	2.5E-01	61%
				Total Noncancer Hazard:	**4.1E-01**	

Notes:

IF = Intake Factor (AF * SA * EF * ED * CF) / (BW * AT) =		**5.47E-06**
	8760	AT = Averaging Time - Noncancer (days)
	70	BW = Body Weight (kg)
	0.000001	CF = Conversion Factor (kg/mg)
	24	ED = Exposure Duration (years)
	350	EF = Exposure Frequency (days/yr)
	5700	SA = Surface Area (cm^2/d)
	0.07	AF = Adherence Factor (mg/cm^2)

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Adult Resident/Ingestion of Beef

Chemicals	Beef Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	5.6E-03	1.2E-05	3.0E-04	4.0E-02	0%
Cadmium	1.4E-04	3.0E-07	1.0E-03	3.0E-04	0%
Iron	4.3E+02	9.2E-01	3.0E-01	3.1E+00	34%
Thallium	1.7E-01	3.6E-04	6.6E-05	5.4E+00	61%
Vanadium	1.7E-01	3.5E-04	1.0E-03	3.5E-01	4%
			Total Noncancer Hazard:	**8.9E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **2.11E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
2.2	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Adult Resident/Ingestion of Chicken

Chemicals	Chicken Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.1E-02	2.6E-05	3.0E-04	8.7E-02	2%
Cadmium	6.9E-04	8.5E-07	1.0E-03	8.5E-04	0%
Iron	5.7E+02	7.2E-01	3.0E-01	2.4E+00	60%
Thallium	2.2E-02	2.7E-05	6.6E-05	4.2E-01	10%
Vanadium	8.9E-01	1.1E-03	1.0E-03	1.1E+00	28%
			Total Noncancer Hazard:	**4.0E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.25E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.3	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Child Resident/Ingestion of Eggs

Chemicals	Egg Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.0E-02	2.0E-05	3.0E-04	6.7E-02	2%
Cadmium	1.6E-05	1.6E-08	1.0E-03	1.6E-05	0%
Iron	5.0E+02	5.0E-01	3.0E-01	1.7E+00	58%
Thallium	1.5E-04	1.5E-07	6.6E-05	2.2E-03	0%
Vanadium	1.1E+00	1.1E-03	1.0E-03	1.1E+00	39%
			Total Noncancer Hazard:	**2.9E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.01E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.05	IR = Ingestion Rate (g/kg-day)

Excess Lifetime Noncancer Hazard by Chemical And Pathway

Reference Area **Future**
Adult Resident/Ingestion of Vegetables

Chemicals	Vegetable Concentration (C) (mg/kg)	Daily Intake DI = CxIF (mg/kg-day)	Reference Dose (RfD) (mg/kg-day)	Total Noncancer Hazard Hazard = DI÷RfD	Percent Contribution To Total Noncancer Hazard
Arsenic	2.4E-01	2.7E-04	3.0E-04	9.1E-01	32%
Cadmium	5.0E-01	5.7E-04	1.0E-03	5.7E-01	20%
Iron	1.8E+02	2.0E-01	3.0E-01	6.7E-01	23%
Thallium	3.2E-03	3.6E-06	6.6E-05	5.5E-02	2%
Vanadium	5.8E-01	6.7E-04	1.0E-03	6.7E-01	23%
			Total Noncancer Hazard:	**2.9E+00**	

Notes:
Copper is not included in the food pathways for reasons described in the report text.

IF = Intake Factor (IR * FS * EF * ED * CF) / (AT) = **1.15E-03** $(day)^{-1}$

8760	AT = Averaging Time - Noncancer (days)
0.001	CF = Conversion Factor (kg/g)
24	ED = Exposure Duration (yr)
350	EF = Exposure Frequency (days/yr)
1	FS = Fraction from Contaminated Source
1.2	IR = Ingestion Rate (g/kg-day)

Appendix F

Copper Risk Evaluation Method

F.1 Introduction

The key adverse health effect of concern due to ingestion of copper from soil is temporary gastrointestinal (GI) symptoms, primarily consisting of nausea. Therefore, the risk from ingestion of copper in soil is given as an estimated number of episodes of nausea per year for a child. This should be interpreted that there is a 95% probability that a child will experience fewer than this number of episodes of nausea per year.

The aim of this analysis was to estimate the number of nausea episodes that an individual might experience on an annual basis, at a given EPC for copper. For the copper EPCs for the different exposure areas, our aim was to estimate the number of nausea episodes that an individual might experience in a year, with only a 5% probability of exceeding that number of nausea episodes.

The methodology for evaluating copper risks is based on the methodology used for calculating a remedial action criterion (RAC) for copper in soil, as presented in the Addendum for the Hurley Soils IU HHRA (Gradient Corporation, 2004). The RAC analysis used child input parameters because a child is expected to be the most sensitive receptor due to his smaller stomach volume and higher soil ingestion rate. We did not re-calculate the Monte Carlo distribution based on distributions for adult input parameters, because we do not have a set of reliable input distributions that describe inputs for adults. The inputs for fraction of soil ingested per hour are based on studies of children, and reliable data on hand-to-mouth behavior, and soil ingestion rates per hour, do not exist for adults.

This appendix includes an overview of the methodology; a review of copper toxicity and dose-response data for nausea due to ingestion of copper; and a discussion of the equations and input parameters for calculating risks from copper in soil, based on a probability of experiencing nausea in a year.

F.2 Overview of Methodology

To evaluate the potential for nausea associated with ingestion of copper in soil, we first used a Monte Carlo analysis to generate a distribution of soil copper concentrations at which nausea is not likely to occur in any given hour (Hourly C_{soil}), according to the following basic equation:

$$Hourly\, C_{soil}\ (mg/kg) = \left[\frac{AEC(mg/L)}{C_{stomach}\ (mg/L)}\right] \times \left[\frac{10^6\ mg}{kg}\right] \qquad \text{(Eq. 1)}$$

In this equation, AEC is the Acceptable Exposure Concentration at which there is no appreciable risk of experiencing nausea based on the studies by Pizarro *et al.* (1999), Olivares *et al.* (2001) and Araya *et al.* (2001; 2003). The copper concentration in the stomach ($C_{stomach}$) depends on the amount of copper-containing soil ingested ($Soil_{ing}$), the solubility or bioaccessibility (B) of copper in the stomach contents, and the volume of food and liquid in the stomach ($V_{stomach}$), as shown in the following equation:

$$C_{stomach}\ (mg/L) = \frac{Soil_{ing}\ (mg) \times B\ (unitless)}{V_{stomach}\ (L)} \qquad \text{(Eq. 2)}$$

Combining equations 1 and 2 results in the following equation for calculating Hourly C_{soil}:

$$Hourly\ C_{soil}(mg/kg) = \left[\frac{(AEC\,(mg/L))}{\left(\dfrac{Soil_{ing}\ (mg) \times B\,(unitless)}{V_{stomach}\ (L)}\right)}\right] \times \left[10^6\ \frac{mg}{kg}\right] \qquad \text{(Eq. 3)}$$

Because soil ingestion rates are higher for children than for adults, children would be more likely to develop nausea at any given copper soil concentration. Thus we generated a distribution of Hourly C_{soil} values that would minimize the occurrence of nausea in children (ages 1 to 6 years).

As noted above, the distribution of Hourly C_{soil} values for copper was determined by Monte Carlo analysis, which involves using a distribution of values, rather than a single value, as input for the parameters in Equation 3. The Monte Carlo analysis then calculates many different Hourly C_{soil} values (*e.g.*, on the order of tens of thousands of values), by randomly selecting values from the distribution of values for each of the input parameters. Thus, each Hourly C_{soil} value, which constitutes a different combination of values selected from the distributions for the input parameters in the Hourly C_{soil} equation, represents a soil concentration at which there is a negligible risk of experiencing nausea. In the

distribution of Hourly C_{soil} values, an Hourly C_{soil} corresponding to the 5th percentile of the distribution means that there is a 5% probability that an individual would experience nausea at the selected Hourly C_{soil}, and a 95% probability that an individual would not experience nausea at the selected Hourly C_{soil}.

Based on the distribution of hourly C_{soil} values, we can identify the probability of experiencing nausea in an hour for any given copper EPC (based on corresponding percentile in the distribution of hourly C_{soil} values). However, even if the probability of experiencing nausea in an hour is very low, the probability of experiencing nausea over the course of a longer period, such as a year, can be relatively high. Therefore, we would like to determine the number of nausea episodes that an individual might experience in a longer time period, such as a year. To accomplish this, we generated a distribution of copper concentrations in soil at which nausea is not likely to occur on any given day (daily C_{soil}), based on a distribution of the minimum hourly C_{soil} values for each day. For each copper EPC, we can identify the daily probability of experiencing nausea on a given day, π_{nausea}, as the corresponding percentile in the distribution of daily C_{soil} values. The number of days on which an individual might experience nausea can then be determined by solving for r, in the following equation:

$$P_{nausea,total}(r) = \sum_{i=r}^{N} P_{nausea}(i)$$

with:

$$P_{nausea}(i) = \frac{N!}{i!(N-i)!} \pi_{nausea}{}^{i} (1 - \pi_{nausea})^{N-i} \qquad \text{(Eq.4)}$$

where $P_{nausea,total}(r)$ is the probability of experiencing r or more episodes of nausea in N days, and π_{nausea} is the daily probability of experiencing nausea (corresponding with a percentile in the distribution of daily C_{soil} values).

F.3 Dose-Response for Nausea due to Ingestion of Copper

Several controlled studies have examined the incidence of gastrointestinal symptoms in humans following ingestion of water containing copper at defined concentrations. These studies involved relatively large groups of subjects who consumed drinking water with varying copper concentrations, and were conducted in a randomized, double-blind fashion. In other words, neither the study participants, nor

the researchers recording symptoms, were told which concentration of copper the study participants were drinking. Due to their size and study protocol, these studies are appropriate for evaluating the dose-response relationship for nausea as a function of copper concentration in drinking water.

Pizarro *et al.* (1999) conducted a study involving 60 healthy adult women recruited from Santiago, Chile. The study participants alternately drank water containing 0, 1, 3, or 5 mg/L copper *ad libitum* throughout the day, for a period of two weeks, followed by one week during which study participants ingested standard drinking water without additional copper. Study participants reported GI symptoms daily during the two weeks they were drinking study water. Nausea, abdominal pain and vomiting (but not diarrhea) were significantly related to copper concentration in drinking water, with incidence rates of 5, 12 17 and 15% at copper concentrations of 0, 1, 3 and 5 mg/L, respectively.

Olivares *et al.* (2001) conducted a controlled clinical study involving 61 healthy, adult subjects (male and female) recruited from Santiago, Chile. Subjects alternately drank 200 mL of purified water containing copper at 0, 2, 4, 6, 8, 10, or 12 mg/L, following an overnight fast. Olivares *et al.* reported symptoms of nausea (either by itself or accompanied with vomiting), diarrhea, and abdominal pain, at 15 and 60 minutes. Nausea was reported most frequently, usually by itself but occasionally accompanied with vomiting, especially at the highest concentration tested of 12 mg/L. Diarrhea was only reported by one subject (at 8 mg/L), and abdominal pain was not reported by any of the subjects. Incidence of nausea (including vomiting) was 0, 9, 12, 20, 21 and 29%, at increasing copper concentrations from 0 to 12 mg/L.

Araya *et al.* (2001) conducted a multi-site study very similar in design to that of Olivares *et al.* (2001), involving 179 subjects recruited from Chile, Ireland, and the United States, who alternately drank 200 mL of purified water following an overnight fast, with copper concentrations of 0, 2, 4, 6, and 8 mg/L. As with the study by Olivares *et al.*, nausea was reported most frequently (usually by itself), and showed the strongest association with copper concentration. There was no apparent dose-response relationship for abdominal pain, and diarrhea by itself was only observed in two subjects, at copper concentrations of 0 and 2 mg/L. Combined incidence of nausea (either alone or accompanied with vomiting and diarrhea), vomiting, and abdominal pain (either alone or accompanied with diarrhea) was 4, 3, 8, 13, and 24%, at increasing copper concentrations from 0 to 8 mg/L.

Araya *et al.* (2003) conducted a controlled clinical study in human adult volunteers using a factorial design to examine the influence of both dose and concentration on nausea and other gastrointestinal symptoms (*e.g.*, vomiting, abdominal pain, diarrhea). This study evaluated three different doses of copper (0.4, 0.8 and 1.2 mg) and three different volumes of drinking water (100, 150 and 200 mL). This study also evaluated doses of 0 and 1.6 mg copper in 200 mL of drinking water (*i.e.* copper concentrations of 0 and 8 mg/L), to determine a dose-response relationship for copper and to confirm results from earlier studies by Araya *et al.* (2001) and Olivares *et al.* (2001). The results from this study indicate that the GI effects of copper are related to both concentration as well as total dose of copper in the stomach. For example, at a copper concentration of 8 mg/L, incidence of nausea and other GI symptoms was 16% when given in a volume of 100 ml (total dose = 0.8 mg copper) *vs.* 20% when given in a volume of 150 ml (total dose = 1.2 mg copper). Conversely, at a dose of 0.8 mg copper, incidence of nausea and other GI symptoms was 16% when given in a volume of 100 ml (8 mg/L copper) *vs.* 10% when given in a volume of 200 ml (4 mg/L copper). In other words, at a given dose, incidence of nausea and other GI symptoms decreases as the concentration decreases (and the volume of water ingested increases). This study also found that the majority of GI symptoms occurred within the first 15 minutes following ingestion of copper, and subsided within an hour.

It is important to note that in the studies by Araya *et al.* (2001, 2003) and Olivares *et al.* (2001), ingestion of copper in drinking water occurred following an overnight fast. This is likely to be a worst-case scenario, as the presence of food in the stomach would provide a buffer that could adsorb some of the copper in the solution, as well as dilute the copper so that it is present at a lower concentration. Moreover, as discussed by Pizarro *et al.* (1999), the acute GI effects associated with copper intake may be at least partly a psychological response to the astringent and bitter taste of copper in the water, which would be less evident for copper ingested with food.

F.4 Input Parameters for Generating a Distribution of Hourly C_{soil} Values

As discussed in Section 2, Hourly C_{soil} values were calculated according to the following equation:

$$Hourly\,C_{soil}(mg/kg) = \left[\frac{(AEC\,(mg/L))}{\left(\frac{Soil_{ing}\,(mg) \times B\,(unitless)}{V_{stomach}\,(L)} \right)} \right] \times \left[10^6 \frac{mg}{kg} \right] \qquad \text{(Eq. 5)}$$

The distributions used for the parameters in this equation are described below.

F.4.1 Acceptable Exposure Concentration

The AEC can be identified from the drinking water studies by Araya *et al.* (2001, 2003) and Olivares *et al.* (2001), all of which reported incidence of GI symptoms at various concentrations of copper in drinking water. Incidence rate of GI symptoms (primarily consisting of nausea) ranged from 4% above background at a drinking water concentration of 2 mg/L copper (in the study by Araya *et al.*, 2003) to 30% above background at a drinking water concentration of 12 mg/L (in the study by Olivares *et al.*, 2001). The copper concentration in drinking water must be adjusted to account for the volume of gastric juice in an 'empty' stomach. For this analysis, we conservatively used a volume of 80 mL, as a reasonable maximum upper-end volume. This volume was selected based on information from the National Library of Medicine, which reports a range of 20 – 100 mL as the volume of gastric juice in an empty stomach (NLM, 2003) as well as a study by Cook-Sather *et al.* (1997), who reported a 95th percentile of approximately 1.13 mL/kg for gastric fluid volume in healthy, fasted children. Assuming a similar gastric fluid volume/weight ratio in adults, 80 mLs corresponds approximately with the 95th percentile for gastric fluid volume for a typical 70-kg adult. The dose-response frequency of gastrointestinal symptoms (including nausea), adjusted for gastric fluid volume (80 mL), is shown in the figure below:

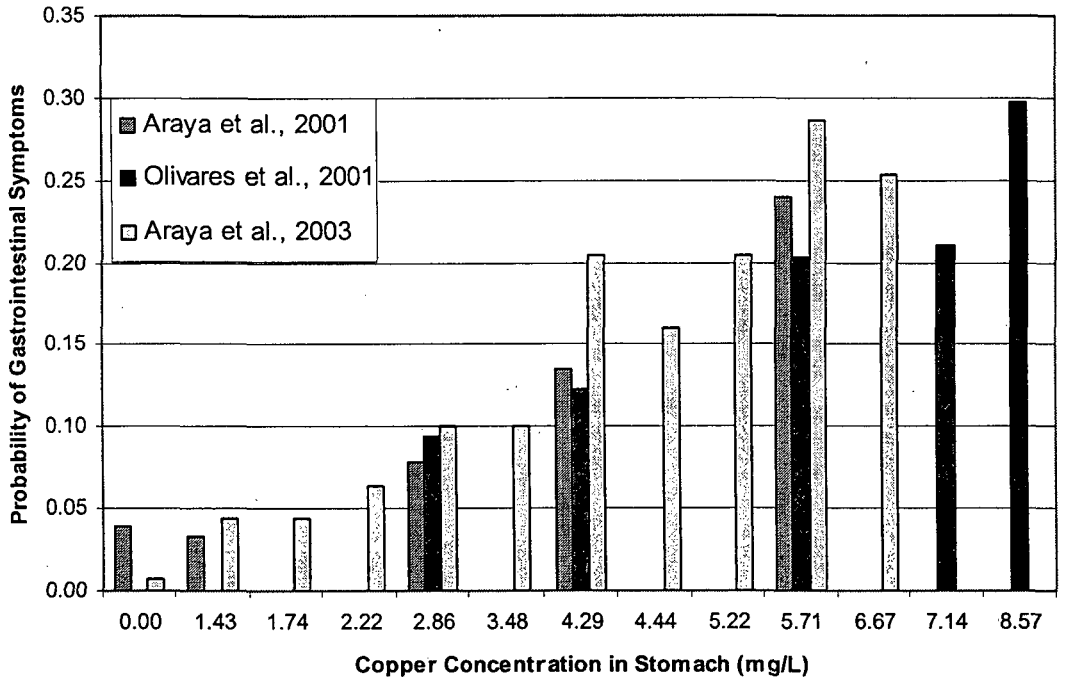

Figure 1. Probability of gastrointestinal effects as a function of copper concentration in stomach (mg/L)

We decided not to use the study by Pizarro *et al.* (1999) for identifying an AEC because the exact volume of water ingested, which is necessary for adjusting the copper concentration, is not known. Moreover, recording of symptoms may not have been as precise in the study by Pizarro *et al.*, because study participants were asked to note symptoms in a diary at home, such that there may have been recall bias in reporting the symptoms. Because the goal of the copper risk analysis is to predict the probability of nausea for the overall population, rather than predict the occurrence of nausea in the entire population including sensitive populations, the entire dose-response frequency can be used as the basis for the AEC distribution. Based on the dose-response frequency observed in the drinking water studies, we modeled the probability of nausea as a function of concentration, using a gamma function. This resulted in a gamma distribution for the AEC ranging from 1.4 (based on the lowest NOAEL of 2 mg/L from the drinking water studies, adjusted for a gastric juice volume of 80 mL) to 50 mg/L, with a most likely value of approximately 6.5 mg/L, as shown in the figure below:

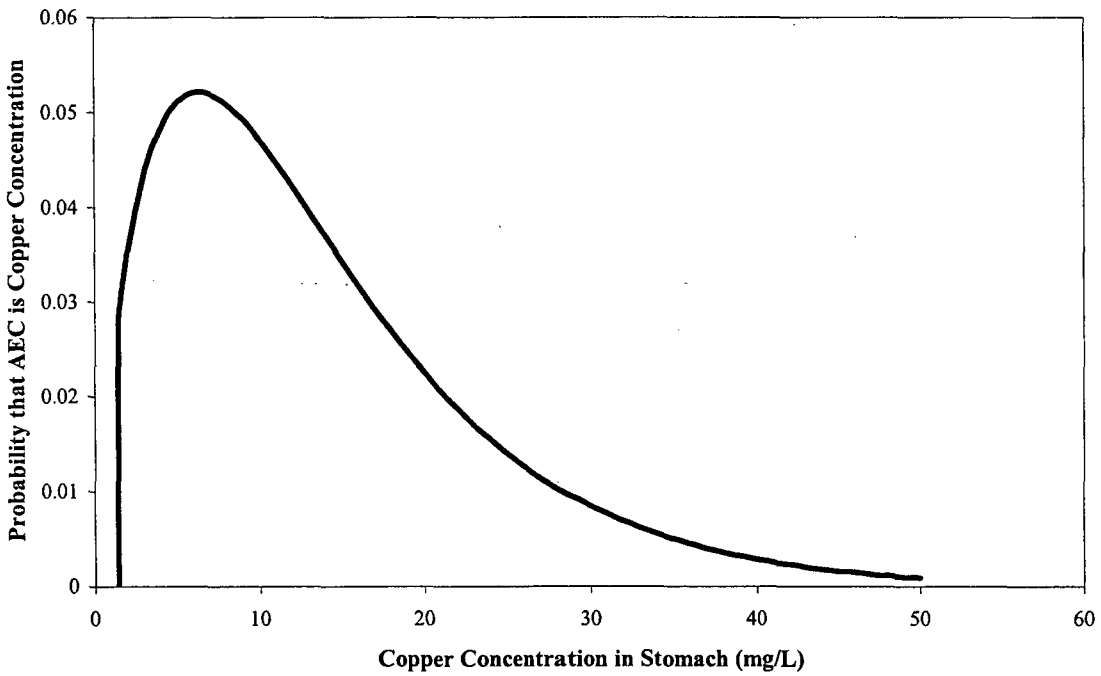

Figure 2. Distribution of Acceptable Exposure Concentrations

There is suggestive evidence that children may be more sensitive to the GI effects of copper. In several drinking water case studies discussed by Knobeloch *et al.* (1994), a greater percentage of children reported GI symptoms following ingestion of copper, as compared with adults. While this may be due to a greater inherent sensitivity, it also may be that children ingest a greater amount of water relative to their body weight, and to the size of their stomachs. Nonetheless, to account for the potential greater sensitivity of children to the GI effects of copper, it would be preferable to use the lower-bound on the response frequency. However, the lower bound on the response frequency varies with the concentration of copper in drinking water. Therefore, we do not believe that it is appropriate to define a lower-bound of the response frequency simultaneously for all concentrations tested, as this would provide a very poor fit of the original data, which would be inconsistent with the aim of using representative distributions wherever possible. However, it should be noted that conservative approaches are used in other aspects of this analysis. These conservative approaches are discussed below.

F.4.2 Amount of Soil Ingested

As discussed above under copper toxicity, the gastric effects of copper generally occur within the first 15 minutes following ingestion, and subside within an hour. Additionally, approximately 90% of clear liquids are emptied from the stomach within an hour (Maltby, 2000), such that copper concentrations in the stomach should not increase substantially from one hour to the next. As such, it is more appropriate to consider the amount of soil ingested in any given hour, as opposed to amount of soil ingested per day. Therefore, we separated the soil ingestion parameter ($Soil_{ing}$) into two parameters: daily soil ingestion rate ($Soil_{day}$), and fraction of daily soil ingestion occurring in any given hour (F_{hour}), as follows:

$$Hourly\ C_{soil}\ (mg/kg) = \left[\frac{(AEC(mg/L))}{\left(\frac{Soil_{day}(mg) \times F_{hour}\ (unitless) \times B\ (unitless)}{V_{stomach}\ (L)} \right)} \right] \times \left[10^6 \frac{mg}{kg} \right] \qquad \text{(Eq. 6)}$$

F.4.2.1 Daily Soil Ingestion Rate

For the daily soil ingestion rate we used data from Stanek and Calabrese (1995), which identifies a geometric mean soil ingestion rate for children (ages 1 – 4 years) of 45 mg/day. A later study by Stanek and Calabrese (2000) identified 124 mg/day as the 95th percentile soil ingestion rate for this same group of children, for an exposure period of 365 days. We used a lognormal distribution for this parameter, based on the typical distribution of soil ingestion data, with a geometric standard deviation (GSD) of 1.85.[1] We set the maximum soil ingestion rate at 300 mg/day, which is approximately the 99th percentile soil ingestion rate based on a GSD of 2.3, for an exposure period of 7 days[2].

F.4.2.2 Fraction of Daily Soil Ingested per Hour

For the fraction of daily soil ingested per hour, we considered behaviors that contribute to soil ingestion throughout the day. Incidental soil ingestion is typically assumed to occur throughout the day,

[1]Geometric standard deviation (GSD) calculated according to the following relationship:
95th percentile = GM*GSD$^{1.645}$ or 124 = 45(GSD)$^{1.645}$
[2] 99th percentile = GM*GSD$^{2.326}$ or 312 = 45(2.3)$^{2.326}$

due to hand-to-mouth and object-to-mouth behavior, rather than as a single ingestion incident. This type of behavior has been documented and discussed in two studies by Freeman *et al.* (2001) and Zartarian *et al.* (1998), in which children were videotaped and object-to-mouth activity (including hand-to-mouth activity) was recorded over the course of the day. In the study by Zartarian *et al.*, children were observed to exhibit at least some object-to-mouth behavior for most of the hours they were awake. Figure 3 shows the distribution of object-to-mouth contact rate per hour, as a percent of total daily object-to-mouth contact events, based on data presented in Zartarian *et al.* (1998). Object-to-mouth contact rate per hour ranged from 0 to 44%, which we modeled using a gamma function. Although the data from Zartarian *et al.* ranged only to 44%, or 0.44, we used a range of 0-1 for this parameter, assuming that a child could potentially ingest their total daily soil intake in one hour, as a bolus event.

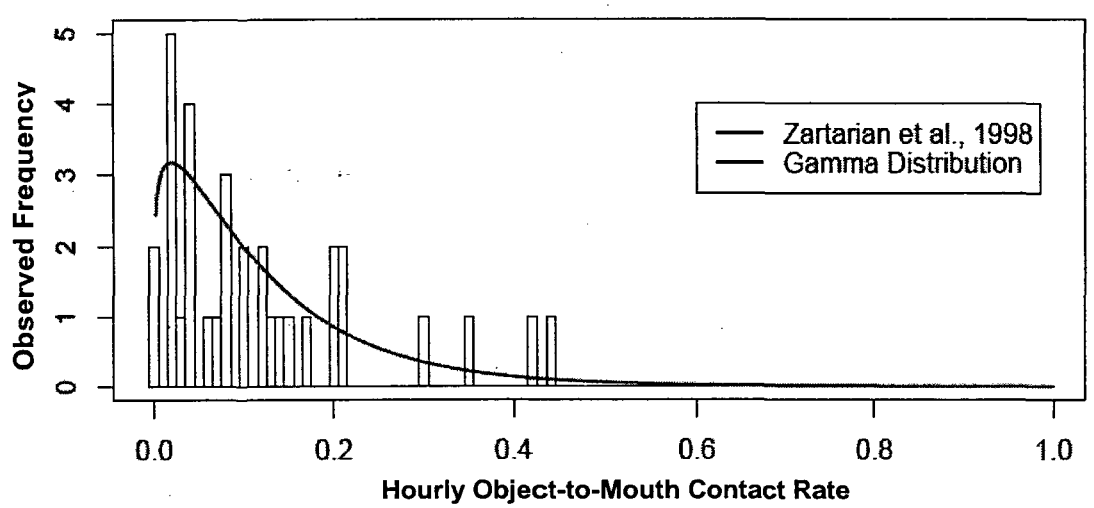

Figure 3. Distribution for fraction of daily soil ingested in an hour (F_{hour}), based on object-to-mouth contact rates from Zartarian et al. (1998)

F.4.3 Bioaccessibility

Bioaccessibility refers to the amount of copper from soil that becomes soluble in the stomach, and can thus interact with the lining of the stomach and potentially cause GI symptoms. Bioaccessibility is thus similar to bioavailability, which refers to the amount of a chemical that is both bioaccessible and subsequently absorbed, relative to the amount ingested. According to a U.S. Environmental Protection Agency (USEPA) Draft Action Plan, site-specific values for bioavailability can be used if sufficient data are available (USEPA, 2002). Because bioavailability is directly related to bioaccessibility (*i.e.*,

bioavailability increases as bioaccessibility increases), it follows that it would also be appropriate to use site-specific bioaccessibility data. Golder Associates, Inc. (2002) conducted a study to determine site-specific bioaccessibility of copper from soil for the Hurley Soils Investigational Unit, which we used to define the distribution for bioaccessibility. The bioaccessibility data from this study conformed to a normal distribtution, with a range of 0.48 – 0.78, a mean of 0.65, and a standard deviation of 0.08.

F.4.4 Volume of Stomach Contents

For this analysis we divided the volume of food and liquid in the stomac ($V_{stomach}$) into three components: $V_{gastric}$ - the volume of gastric juices in a child's stomach when empty; $V_{food/beverage}$ - the volume of food and beverages in the stomach (not including drinking water); and $V_{drinkingwater}$ - the volume of drinking water in the stomach. Thus, the equation for calculating the hourly C_{soil} becomes:

$$Hourly\, C_{soil}\,(mg/kg) = \left[\frac{(AEC\,(mg/L))}{\left(\frac{Soil_{day}\,(mg) \times F_{hour}\,(unitless) \times B\,(unitless)}{\left[V_{gastric}\,(L) + V_{food/beverage}\,(L) + V_{drinkingwater}\,(L) \right]} \right)} \right] \times \left[10^6 \frac{mg}{kg} \right] \qquad \text{(Eq. 7)}$$

F.4.4.1 Volume of Gastric Juice

For $V_{gastric}$ we used data from Cook-Sather *et al.* (1997), who conducted a meta-analysis of gastric fluid volume in 661 healthy, fasted infants and children (mean age = 5.9 $\pm$ 3.9 years). Cook-Sather *et al.* reported a mean gastric fluid volume of 0.4 + 0.45 mL/kg, a maximum volume of 4.1 mL/kg, a 50th percentile of 0.27 mL/kg, and a 95th percentile $\leq$ 1.25 mL/kg. The distribution of gastric fluid volumes from this meta-analysis is shown in the figure below:

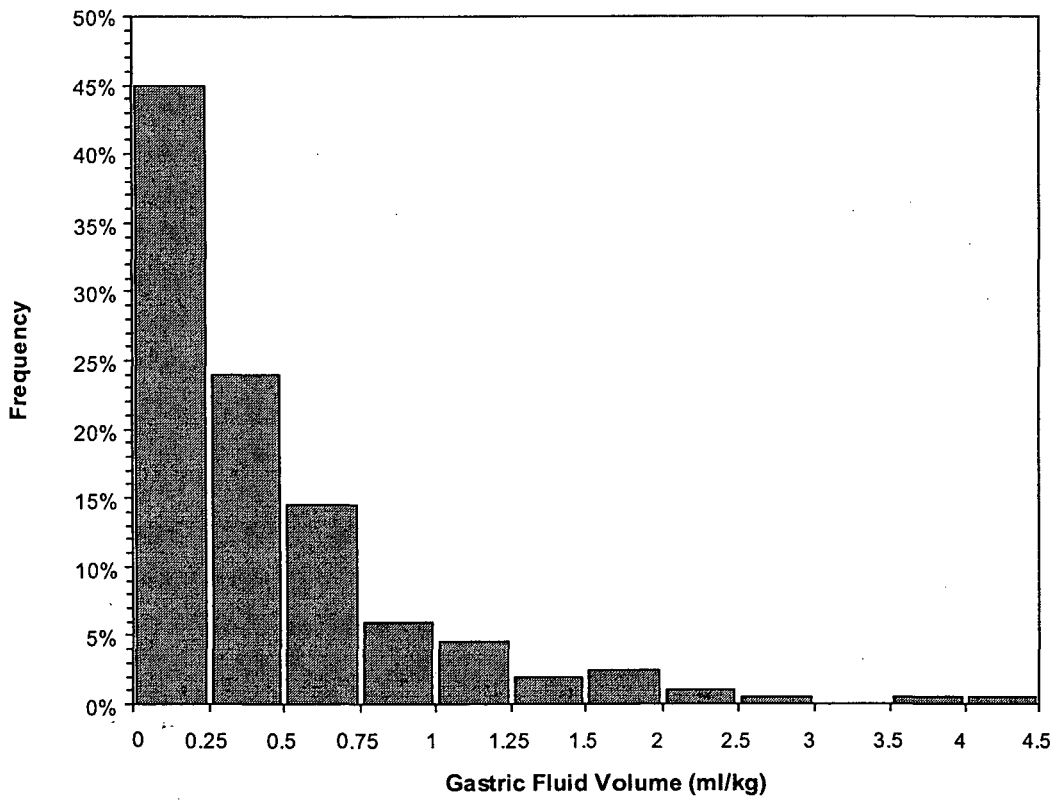

Figure 4. Frequency distribution of gastric fluid volume in fasted health children, based on data from Cook-Sather *et al.* (1997).

We converted the gastric fluid volumes reported by Cook-Sather *et al.* in units of mL/kg into units of mL, assuming a body weight of 15 kg, as recommended by USEPA for a 1-6 year old child (USEPA, 2001).

F.4.4.2 Volume of Food and Beverages

We estimated the volume of food and beverages in the stomach ($V_{food/beverage}$) based on information regarding stomach emptying rates, the frequency at which a typical child eats, and daily intake values for food an beverages. According to Maltby (2000), 3-5 hours is normally required for the stomach to empty after a meal. For this analysis, we conservatively assumed that the stomach would empty in three hours. The rate of gastric emptying is influenced by both volume and composition of gastric contents. For liquids, the principal determinants of gastric emptying rate are primarily volume and, secondarily, composition (Keet, 1998). Several studies have determined that there is an exponential relationship between food volume in the stomach and rate of emptying, with larger volumes emptying at

an exponentially faster rate than smaller volumes (Camilleri *et al.*, 1985; Griffith *et al.*, 1966, 1968; Heading *et al.*, 1974; and Meyer *et al.*, 1976).

We further assumed that the duration of a typical meal or snack is approximately 30 minutes, based on professional judgment. Therefore, the total duration during which food is in the stomach for any given meal or snack is 3.5 hours. According to data collected by the U.S. Department of Agriculture regarding children's eating patterns, children ages 2- to 5-years-old eat either a meal or snack an average of 4.1 times/day (Lin *et al.*, 1996). According to the USEPA's Child-Specific Exposure Factors Handbook, children are awake for a mean of 13.5 hours during the day (USEPA, 2002). Assuming that meals are evenly distributed during the day, there is at least some food in the stomach for each of the 13.5 hours during the day that children are awake.

For the volume of food and beverages in the stomach we used food intake values from the U.S. Department of Agriculture's (USDA's) most recent Continuing Survey of Food Intakes for Individuals (CSFII), which is for the 1994-1996 period (USDA, 1998). The CSFII provides mean daily intake values, in grams, for various food groups, including dairy, meat/fish, grains, vegetables, fruits, fats/eggs, and beverages (excluding drinking water). For this analysis we used the total mean intake value for these food categories for 2-5 year olds residing in the Western U.S. (which includes New Mexico), which is 1269 grams. Assuming that a typical child eats approximately 4 meals/snacks per day (Lin *et al.*, 1996), an average meal or snack would weigh 317 grams. We further assumed a unit density of 1 g/mL, and thus used a volume of 317 mL for the periodical maximum value of food and beverages in the stomach. We note that this volume would underestimate the actual volume of food and liquid in the stomach, considering that most foods have a density less than that of water. However, we believe that attempting to adjust the food intake for actual density would add too much uncertainty and complexity to the copper risk analysis, and that it is appropriate to use assumptions that may be conservative, yet still reasonable.

Using the information regarding food intake, meal duration, and stomach emptying rates, we modeled the volume of food and beverages in the stomach as a linearly increasing function corresponding to the time during which food is eaten and the stomach is filling (0.5 hours), and as an exponentially decreasing function, during the time food is emptying from the stomach (3 hours). This is illustrated in Figure 5, as the light grey line. This line represents the "instantaneous" $V_{food/beverage}$ at discrete time intervals. Because the time frame for calculating Hourly C_{soil} values is one hour, we computed hourly moving averages of $V_{food/beverage}$. The hourly moving averages were calculated from the instantaneous

volumes, at 3-second intervals. The hourly moving average is illustrated in Figure 5, as the dark grey line. These hourly moving averages range from 3.1 to 189 mL. Figure 6 shows the distribution of these hourly moving averages, which we used for the Monte Carlo analysis. Below we provide additional details on how we modeled the stomach volume.

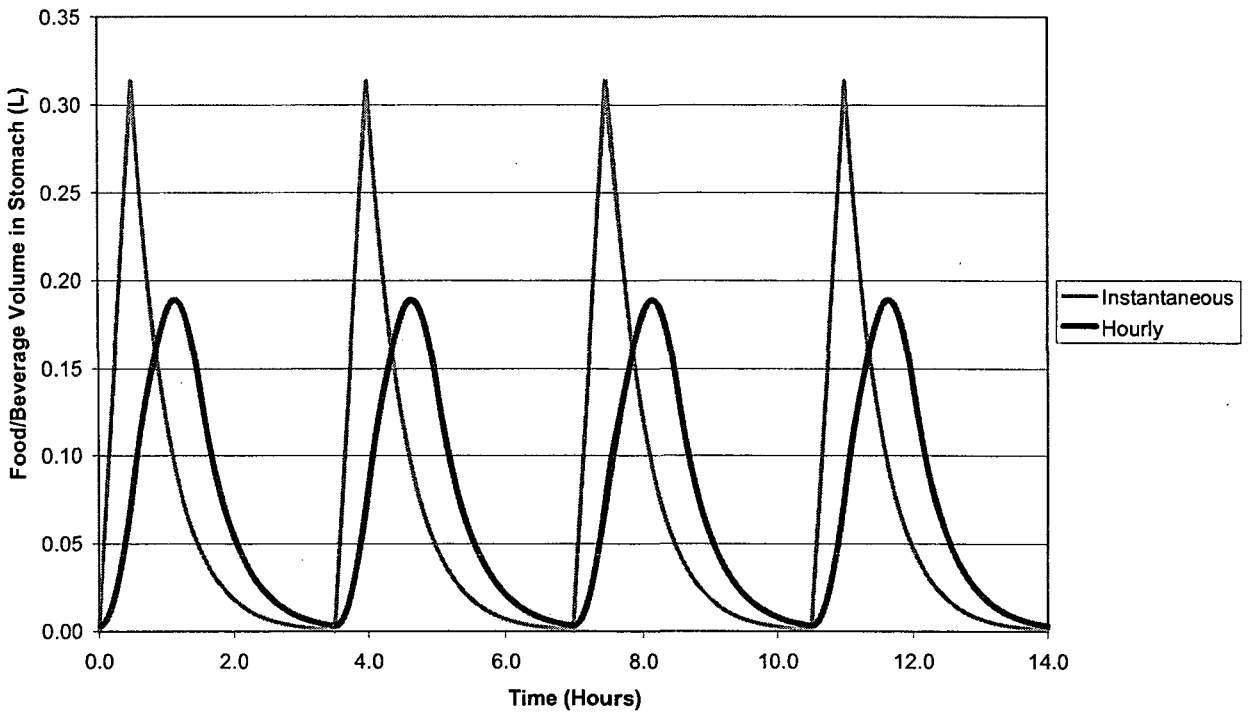

Figure 5
Instantaneous ($V_{food\,/\,beverage}$) and hourly ($\overline{V}_{food\,/\,beverage}$) volume of food and beverage in a child's stomach (ages 2-5 years).

F.4.4.3 Modeling Volume of Food and Beverage in the Stomach

Using the information regarding food intake, meal duration, and stomach emptying rates, we modeled the instantaneous volume of ingested food and beverages in the stomach ($V_{food/beverage}$) as a linearly increasing function corresponding to the time during which food is eaten and the stomach is filling (30 minutes), and as an exponentially decreasing function, during the time food is emptying from

the stomach (3 hours). Thus, we modeled the volume of food/liquid in the stomach with the following equation, which is a composite function:

$$V_{food/beverage} = \begin{cases} \beta_1 * t, & if \quad t \bmod(3.5) \le 0.5 \\ \alpha * \exp(-\beta_2 * t), & if \quad t \bmod(3.5) > 0.5 \end{cases} \qquad \text{(Eq. 8)}$$

where:

$V_{food/beverage}$	=	Volume of ingested food and beverage in the stomach (L);
β_1	=	Slope of the ascending linear portion of the curve;
α	=	Scale parameter of the descending exponential portion of the curve;
β_2	=	Shape for the descending exponential portion of the curve;
t	=	Time, in hours; and
mod	=	A mathematical function of the form [a mod (b)], equal to the remainder of a divided by b.

Best professional estimates of values for these parameters, based on qualitative modeling, are as follows: $\beta_1 = 750$, $\alpha = 980$, and $\beta_2 = 1.9$. The instantaneous $V_{food/beverage}$ curve is a repeating pattern, ranging from 0 to 317 mL, with a cycling period of 3.5 hours. Although the instantaneous $V_{food/beverage}$ reaches zero, the average $V_{food/beverage}$ in the stomach for any given hour will always be greater than zero, because we assume the child starts eating again as soon as the stomach has emptied.

Equation 9 calculates the "instantaneous" volume of ingested food/liquid at discrete time intervals. Because the time frame for the copper risk calculations is one hour, we computed hourly moving averages of volume of food/liquid ($\overline{V}_{food/beverage}$), based on the instantaneous volumes, according to the following equation:

$$\overline{V}_{food/beverage} = \frac{1}{n} \sum_{t-3.5}^{t} V_{food/beverage} \qquad \text{(Eq. 9)}$$

In this equation, n is the number of instantaneous time intervals included in the sum. For this analysis we calculated $\overline{V}_{food/beverage}$ based on estimates of $V_{food/beverage}$ for every 3 seconds; therefore, n is equal to 1200 per hour. $\overline{V}_{food/beverage}$ is also a repeating pattern, with a range of 3.1 to 189 mL, and with a 3.5-hour

cycling period. Hence, there are a total of 4,200 measurements[3] contributing to this frequency distribution for one period. The frequency distribution of these 4,200 measurements, characterizing the average hourly volume of food and beverage in a child's stomach, was used as a custom distribution in the Monte Carlo simulation.

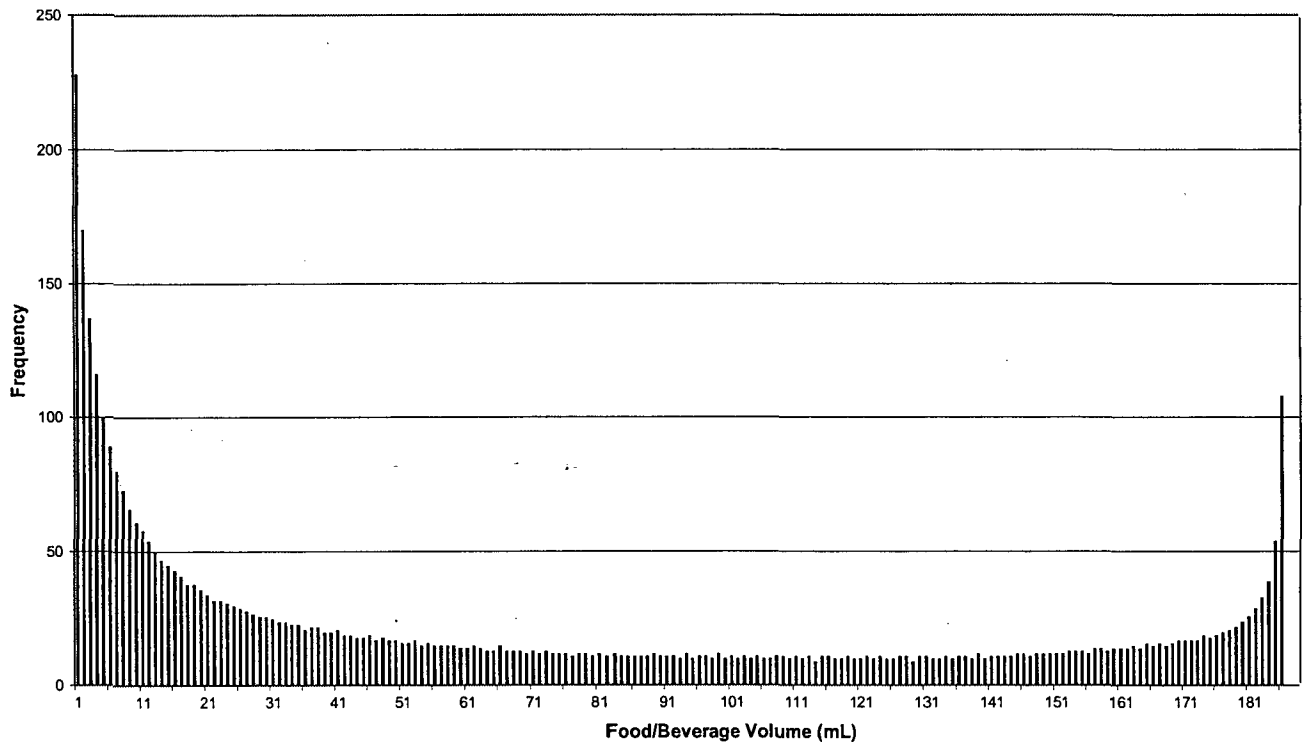

Figure 6. Distribution of hourly volumes of food and beverage in a 2-5 year old child's stomach (n = 4,200 hourly volumes)

F.4.4.4 Volume of Drinking Water

Because data from USDA's CSFII does not include intake of drinking water, we have also included a drinking water term in the Hourly C_{soil} equation. For the drinking water intake term, we used data provided in USEPA's Child-Specific Exposure Factors Handbook, which provides intake values at different percentiles of the population (USEPA, 2002). We used drinking water intake values for 1-6 year old children, which range from 11 mL/day at the 10th percentile, to 1,603 mL/day at the 99th percentile. We further assumed that drinking water intake is distributed evenly throughout the 14 hours that we assume a child is awake during the day, resulting in hourly drinking water intakes ranging from

[3] = 1200 seconds/hour x 3.5 hours

approximately 0.8 – 115 mL. We approximated the distribution of hourly drinking water intakes with a Weibull function, as shown in the figure below:

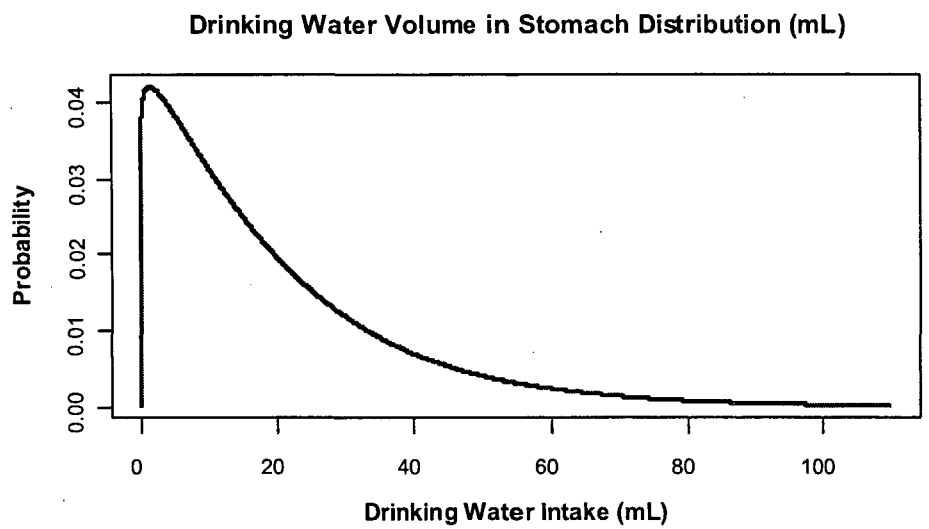

Figure 7. Distribution of average hourly drinking water intake (mL) for a 1-6 year old child

F.4.5 Summary of Input Parameters for Hourly C_{soil}

The following table summarizes the distributions and basis for the input parameters used in for generating the Hourly C_{soil} values. A more detailed description of the input parameters is included at the end of this Appendix.

Table 1
Distribution and Basis for Input Parameters for Calculating Hourly C_{soil} Values

Input Parameter	Distribution	Basis
Acceptable Exposure Concentration (AEC)	Gamma Slope = 0.132 Power = 1.834 P = 0.08	Araya *et al.* (2001, 2003) Olivares *et al.* (2001)
Daily Soil Ingestion ($Soil_{day}$)	Lognormal Geometric mean = 45 GSD = 1.85 Maximum = 300	Stanek and Calabrese (1995, 2000)
Fraction Daily Soil Ingested per Hour (F_{hour})	Gamma Slope = 9.72 Power = 1.19	Zartarian *et al.* (1998)
Bioaccessibility (B)	Normal Mean = 0.65 SD = 0.08 Range = 0.48 – 0.78	Golder Associates, Inc. (2002)
Volume Gastric Juice ($V_{gastric}$)	Custom Mean = 6 Median = 4 95th Percentile = 18.75 Maximum = 61.5	Cook-Sather *et al.* (1997)
Food/Beverage Volume ($V_{food/beverage}$)	Custom	Lin *et al.* (1996) Maltby (2000) USDA (1998)
Drinking Water Volume ($V_{drinkingwater}$)	Weibull Slope = 0.0037 Power = 0.9413 P = 2.25×10^{-81}	USEPA (2002)

In selecting the distributions for the input parameters, we have aimed to use conservative, yet reasonable assumptions. These conservative assumptions include use of 80 mL as the volume of gastric juice in an empty stomach, given that this volume ranges from 20 – 100 mL (NLM, 2001), the use of 3 hours as the time required for the stomach to empty, given a range of 3-5 hours (Maltby, 2000), and the assumption of unit density for the amount of food consumed (in grams) by a typical child. Because most foods have a density less than that of water, the actual volume of food consumed would be greater than that assuming a density of 1 g/mL (as assumed in this analysis). In addition, the bioaccessibility

distribution is likely conservative, because it was determined at a pH of 1.5, which is at the lower end of the pH range for the stomach of 1.5 – 3.5 (NLM, 2001), and because we did not consider the ability of food to bind to copper, which would reduce the bioaccessibility of copper. Another conservative assumption is that the copper concentration in indoor dust is the same as that in outdoor soil. For this analysis we assumed that soil ingestion occurs throughout the waking hours of the day, and thus could occur both indoors and outdoors. Although soil is a major component of indoor dust, copper concentrations would likely be lower in indoor dust as compared with outdoor soil.

In the following section we discuss the procedure we used for determining the probability of experiencing nausea over the course of a year, given that nausea can occur as discrete events on an hourly basis.

F.5 Defining a Distribution of Daily C_{soil} Values based on Simulated Hourly C_{soil} Values

In order to extrapolate from the probability of experiencing nausea in a single hour to the probability of experiencing nausea on multiple days in a year, it is necessary to consider each potential episode of nausea as an independent event. "Independence" means that the probability of one event occurring is not affected by the occurrence or nonoccurrence of another event. The amount of soil ingested per hour is a critical factor in determining whether a child will experience nausea. This quantity is estimated as (F_{hour}) x ($Soil_{day}$). Because the sum of F_{hour} over all individual hours of each day must equal 1 for any given child, F_{hour} is not an independent variable. Therefore, on any given day, potential episodes of nausea cannot be considered independent events. Our solution to this problem is described below.

Although potential episodes of nausea within one day cannot be considered independent events (due to the dependence of F_{hour} on F_{hour}'s for previous hours in the day), potential episodes of nausea between different days can be considered as independent events. Therefore, we generated a new distribution of Daily C_{soil} values based on the lowest simulated Hourly C_{soil} value for any given day. In order to accurately identify small percentiles from this distribution, we determined Daily C_{soil} values for a total of 400,000 days. Using this new distribution of minimum Hourly C_{soil} values, or Daily C_{soil} values, we can determine the probability of experiencing nausea at all on any given day. Because we are

considering the probability of experiencing nausea in a day (instead of an hour), the AEC, B, $Soil_{day}$, $V_{gastric}$, and $V_{drinkingwater}$ were all held constant for any given day, while F_{hour} and $V_{food/beverage}$ were allowed to vary for each hour of the day.

In order to ensure that the sum of F_{hour} for the individual hours was equal to 1, we modified the Monte Carlo simulation. In this modified simulation, F_{hour} was selected randomly (based on the assumptions specified for the Monte Carlo simulation) for each hour of the day, up to 14 hours[4], until the total percentage for the day was equal to 100%. In other words, the hourly soil ingestion rates within a day were conditioned on the percentage allotted to the previous hours in the day, such that the sum of the hourly soil ingestion rates for the day totaled exactly 100% of the daily soil ingestion rate. Once the sum of hourly soil ingestion rates totaled exactly 100% of daily soil ingestion rates, F_{hour} was set to zero for the remaining hours in the day.

Figure 8 outlines the process of generating a distribution of Daily C_{soil} values, based on the Monte Carlo simulation of Hourly C_{soil} values. Note that some combinations of values result in Hourly C_{soil} values that are greater than 1,000,000 mg/kg. Because such concentrations cannot exist in the real world, we have set 1,000,000 as the maximum value for the Hourly C_{soil} value. On this figure we show the distribution of Daily C_{soil} values, where each Daily C_{soil} value corresponds with a unique percentile of this distribution. As indicated in Figure 8, the 5th percentile for all the Daily C_{soil} values is 8,077 mg/kg.

[4] According to the Children's Exposure Factors Handbook (USEPA, 2002), children ages 3-5 years spend approximately 10.5 hours sleeping, and therefore are awake for approximately 13.5 hours. For the sake of simplicity in this analysis, the number of waking hours is rounded to 14 hours.

Step 1. Generate Hourly C_{soil} values, using MC simulation for 400,000 days
Example for one day:

Hour	AEL (mg/L)	Bio-availability	Daily Soil Ingestion Rate (mg/day)	Percentage Daily Soil Ingestion Occurring in any given Hour	Percentage Daily Soil Ingestion (100% = max total)	$V_{gastric}$	$V_{drinking\ water}$	$V_{food/bev}$	Csoil
Range	0-50	48 - 78%	0 - 300	0% - 100%	0% - 100%	20-100 mL	0-110 mL	4-189 mL	
1	13.5	64%	54	12.1%	12.1%	60	20	10	286,599
2				1.5%	1.5%			5	1,000,000
3				1.2%	1.2%			26	1,000,000
4				7.6%	7.6%			16	491,059
5				14.4%	14.4%			127	557,669
6				0.9%	0.9%			9	1,000,000
7				14.7%	14.7%			39	313,875
8				9.5%	9.5%			11	370,851
9				53.3%	38.1%			92	174,947
10				11.0%	0.0%			107	1,000,000
11				4.9%	0.0%			97	1,000,000
12				13.3%	0.0%			25	1,000,000
13				4.0%	0.0%			176	1,000,000
14				5.9%	0.0%			23	1,000,000

Values selected randomly from specified distribution

Constrained such that sum = 100%

Step 2. Select minimum hourly C_{soil} for each day = daily Csoil
For example, this occurs in hour 9

Step 3. Generate new probability distribution of daily C_{soil} values[5]

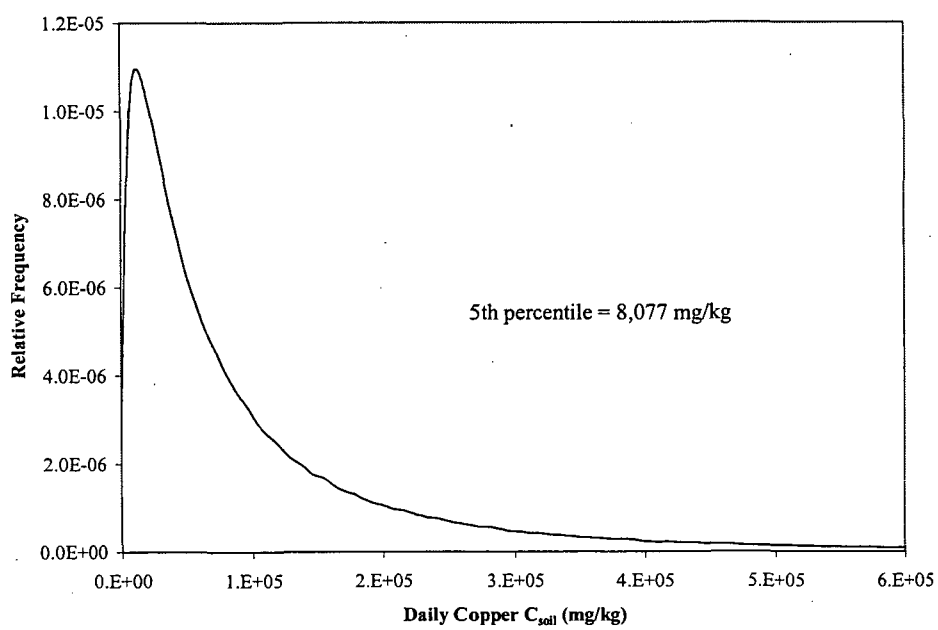

Figure 8. Distribution of Daily C_{soil} Values based on Monte-Carlo simulated Hourly C_{soil} values

[5] This frequency distribution is based on the 400,000 daily Csoil values. The y-axis gives the relative frequency of each Csoil value in the distribution, whereas the percentiles of the daily Csoil distribution correspond to daily probabilities of nausea. For instance, 8.077 mg/kg is the 5th percentile and corresponds with a 5% daily probability of nausea.

F.6 Sensitivity, Variable Dependencies, and Stability of Monte Carlo Analysis

F.6.1 Sensitivity Analysis

The following sensitivity chart (pertaining to the minimum Daily C_{soil} value) shows the contribution of each of the six input variables to the total variability for the Daily C_{soil} distribution.

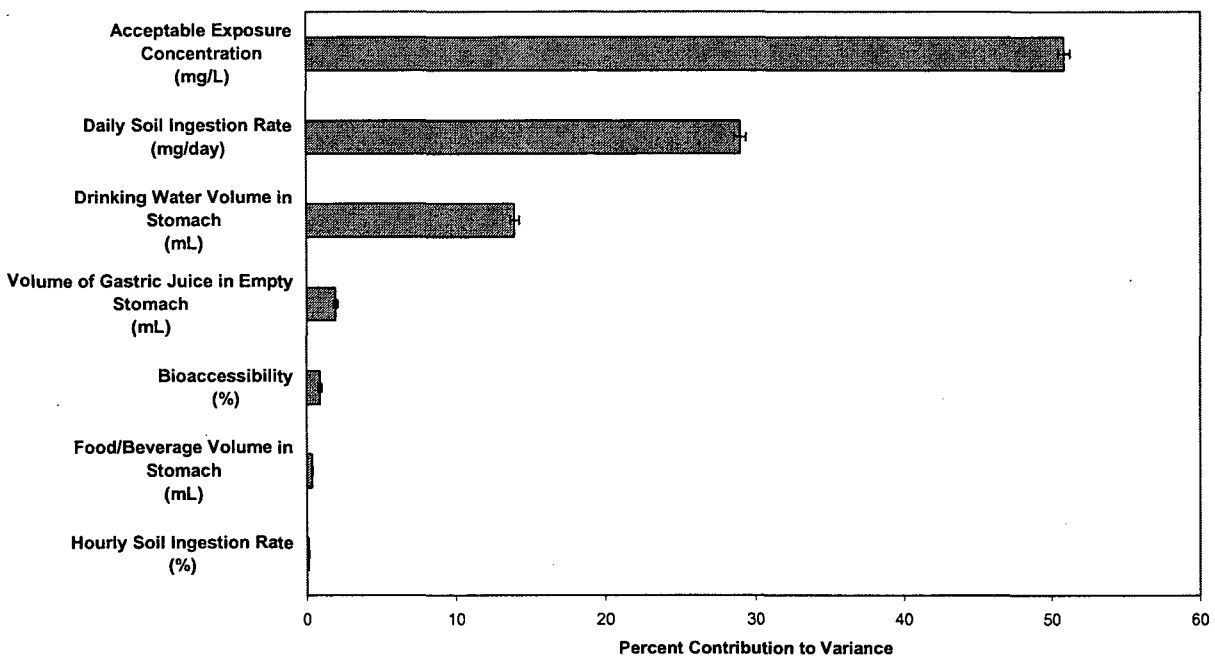

Figure 9. Contribution of Input Parameters to Total Variability in Monte-Carlo Model.

As shown in this chart, the Acceptable Exposure Concentration (AEC) is the most sensitive input parameter in the Monte Carlo model, contributing 50% of the total variability in the C_{soil} calculations. Following the AEC, the daily soil ingestion rate and the drinking water volume contributed 18.4% and 18.3% to the total variability, respectively.

F.6.2 Model Stability

The ouptut of the minimum Daily C_{soil} model is generally stable, as can be seen by examining the customary 1st, 5th, 95th and 99th percentiles for ten mutually exclusive subsets (n = 40,000) selected from within the original C_{soil} dataset, which are listed in Table 2. Among these subsets, the coefficient of variation[6] ranged from 1.99% at the 95th percentile, to 1.34% at the 1st percentile. Gradient thereby infers that if a similar assessment were based on the entire dataset of 400,000 values, there would be sufficient stability at the customary percentiles. Therefore, it is appropriate to combine the 10 datasets into one larger dataset of 400,000 values.

Table 2
Percentiles for Subsets (n = 40,000)
of the Entire Minimum Daily C_{soil} (mg/kg) Data Set (n = 400,000)

Subset	1%	5%	95%	99%
1	3,447	8,194	403,602	818,665
2	3,448	7,972	396,897	804,190
3	3,500	8,076	400,053	806,402
4	3,538	8,181	411,747	834,162
5	3,500	7,972	404,016	825,535
6	3,490	8,264	400,509	812,676
7	3,483	8,013	411,268	827,918
8	3,557	8,070	404,546	822,290
9	3,499	7,975	396,953	777,136
10	3,394	8,148	401,549	809,496
Average	3,486	8,086	403,114	813,847
Standard Deviation	47	105	5,157	16,188
Coefficient of Variation	1.34%	1.30%	1.28%	1.99%

[6] Coefficient of variation = standard deviation / mean

F.7 Risk of Nausea Based on a Given Copper Soil Concentration

F.7.1 Probability of a Single Occurrence of Nausea in a Year

Given a specific concentration of copper in soil (C_{soil}), we can use the generated Monte Carlo distribution to determine the daily probability of experiencing nausea at that C_{soil}. We can then extrapolate to the probability of experiencing nausea at least once in a year. The cumulative probability of experiencing nausea (P_{nausea}) at least once during a particular time period (t) due to a particular copper concentration in soil (C_{soil}) is given by the following general formula:

$$P_{nausea}(t) = 1 - [1 - \pi_{nausea}]^t \qquad \text{(Eq. 10)}$$

where π_{nausea} is the probability of experiencing nausea at least once on any given day, and t is time, in days. Because the acute effects of copper are considered both reversible and independent, π_{nausea} is constant for a given C_{soil}. Therefore, the average number of nausea episodes in time t is equal to the product of the period of time in days, t, and the daily probability of nausea, π_{nausea}, at the daily C_{soil}. The probability of an individual not experiencing nausea on any given day is the complement of the probability of experiencing nausea at least once, or $[1-\pi_{nausea}]$. In this analysis, π_{nausea} corresponds to a percentile of the distribution of minimum daily C_{soil} values (Figure 8).

Table 3 presents extrapolations from a daily probability of nausea to longer time periods, to illustrate the cumulative probability of a child experiencing nausea due to ingestion of soil containing copper at a specified daily C_{soil}. For this example, we calculate the probability that a child, when ingesting soil at a C_{soil} corresponding to the 2.5th percentile of the distribution of daily C_{soil} values (5,475 mg/kg), might experience nausea at least once, for various time frames. In each case, the probability of nausea in a day, π_{nausea}, is equal to 0.025. Both the duration of time in days, t, and the average number of nausea episodes up to that time, $t*\pi_{nausea}$, are also listed. Finally, the cumulative probability of a child experiencing nausea at least once, P_{nausea}, and of never experiencing nausea, $(1-P_{nausea})$, are listed.

Table 3
Cumulative Probability of Nausea based on a 2.5% Daily Probability of Nausea
(Daily C_{soil} =5,475 mg/kg)

				Cumulative Probability of Nausea	
Time period	***t***	**Daily Probability of Nausea** π_{nausea}	**Average Number of Nausea Episodes** $t^*\pi_{nausea}$	**At Least Once** (P_{nausea})	**Never** ($1-P_{nausea}$)
One day	1	0.025	0.025	0.025	0.975
One week	7	0.025	0.175	0.162	0.838
One month	30	0.025	0.750	0.532	0.468
One year[7]	350	0.025	8.750	0.99986	0.00014

For the daily C_{soil} selected (= 5,475 mg/kg, based on a 2.5% probability of experiencing nausea in a day), we observe that a given child is highly likely (99.99% probability) to experience nausea at least once in a one-year period. Likewise, the probability of not experiencing nausea in a one year period is extremely small (0.01%). Note that this is true even though the daily probability of experiencing nausea is relatively low (2.5%).

F.7.2 Probability of Multiple Occurrences of Nausea

To calculate copper risk, we calculated the maximum expected number of episodes of nausea in a year caused by exposure to C_{soil} with a certainty of 95%. This analysis is described below.

Equation 10 gives the probability of experiencing nausea at least once, in a given time *t*. This equation was reformulated to account for the potential for multiple episodes of nausea. Equation 11 uses a binomial distribution[8] to determine the probability of experiencing nausea exactly *r* times in *N* days:

$$P_{nausea}(r) = \frac{N!}{r!(N-r)!}\pi_{nausea}{}^{r}(1-\pi_{nausea})^{N-r} \qquad \text{(Eq. 11)}$$

where $P_{nausea}(r)$ is the probability of exactly *r* (daily) episodes of nausea, *N* is the number of days, and π is the probability of nausea on any given day. The probability of a nausea event on any given day, π, corresponds to the percentiles of the C_{soil} distribution shown in Figure 8. Equation 11 assumes that the

[7] According to the Children's Exposure Factors Handbook (USEPA, 2002), children ages 3-5 years spend 350 days/year at home.
[8] The binomial distribution is used to model the counts of a sequence of independent binary trials (*i.e.,* the event either occurs or it does not) in which the probability of a success, P, is constant.

outcomes are dichotomous (*i.e.*, on a given day there are only two possible outcomes, either experiencing nausea, or not experiencing nausea), mutually exclusive, independent, and randomly determined.

Our objective is to determine the probability of becoming nauseous fewer than r times in N days. If we sum all the individual probabilities from exactly 0 to exactly r-1 occurrences of nausea, we obtain the probability of becoming nauseous fewer than r times:

$$P_{<r} = P_{nausea}(0) + P_{nausea}(1) + \ldots + P_{nausea}(r-1) = \sum_{i=0}^{r-1} P_{nausea}(i) \qquad \text{(Eq. 12)}$$

Using Equation 11, we specified C_{soil} (and could therefore find π, the daily probability of a single episode of nausea), N, and an annual probability goal in order to solve for r.

Here we provide an example to illustrate how this calculation works in practice. Consider the case where C_{soil} is 3,000 mg/kg and we want to calculate the likely maximum number of nausea events in a year with 95% certainty. Thus C_{soil} = 3,000 mg/kg, N = 350, and $\sum_{i=0}^{r-1} P_{nausea}(r_i) = 0.95$. From the distribution presented in Figure 8, we determine that the daily probability, π, corresponding to a C_{soil} of 3,000 mg/kg is 0.00712 (that is, 3,000 mg/kg is the 0.712th percentile of the C_{soil} distribution). We can use Equation 12 to determine the probability of becoming nauseous fewer than r times in a year as follows:

$$P_{<r} = \sum_{i=0}^{r-1} P_{nausea}$$

$$= (P_{nausea}(0) + \ldots + P_{nausea}(r-1))$$

Substituting from Equation 11 and re-arranging:

$$\left(\frac{350!}{0!(350-0)!} \pi^0 (1-\pi)^{350-0} + \ldots + \frac{350!}{(r-1)![350-(r-1)]!} \pi^{r-1} (1-\pi)^{350-(r-1)} \right) = 0.95 .$$

This equation can not be solved analytically, thus we solve for r using an iterative process. Substituting π=0.00712, r was determined to be 6. In other words, there is a 95% probability that there will be less than 6 nausea events in a year due to exposure to a C_{soil} of 3,000 mg/kg.

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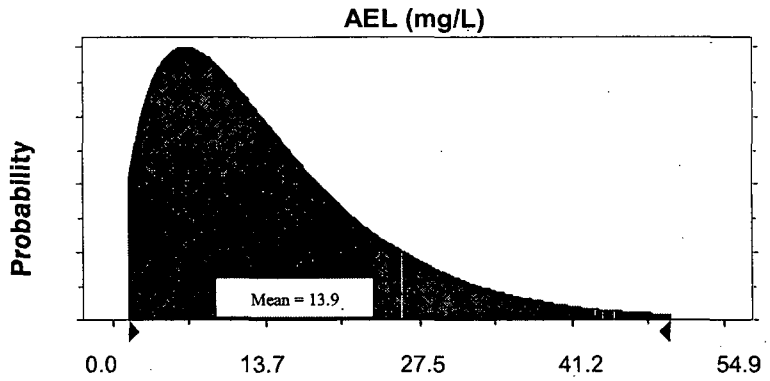
Attachment 1
Distributions for Input Parameters Used in Copper Risk Analysis

Assumption: Acceptable Exposure Concentration (mg/L)

Gamma distribution with parameters:

Location	0.0
Scale	7.6
Shape	1.83553

Selected range is from 1.4 to 50.0

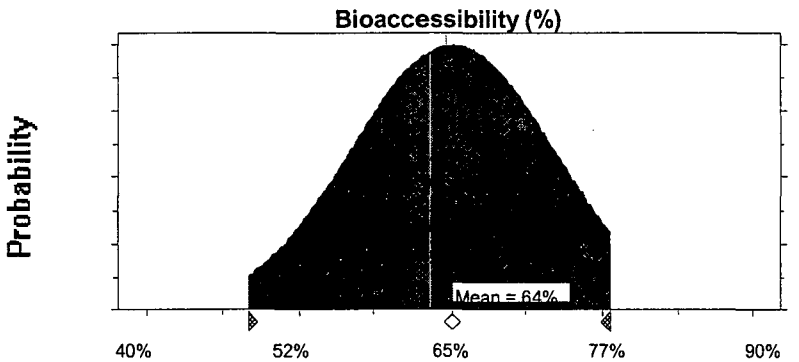


Assumption: Bioaccessibility (%)

Normal distribution with parameters:

Mean	65%
Standard Dev.	8%

Selected range is from 48% to 78%

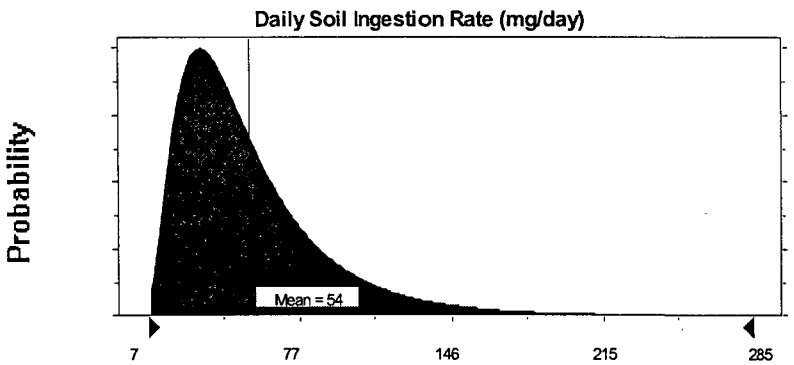


Assumption: Daily Soil Ingestion Rate (mg/day)

Lognormal distribution with parameters:

Geometric Mean	45
Geometric Std. Dev.	2

Selected range is from 0 to 300

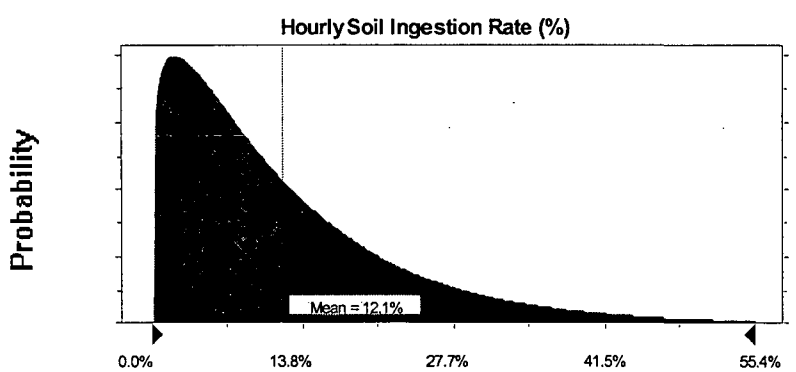


Assumption: Hourly Soil Ingestion Rate (%)

Gamma distribution with parameters:

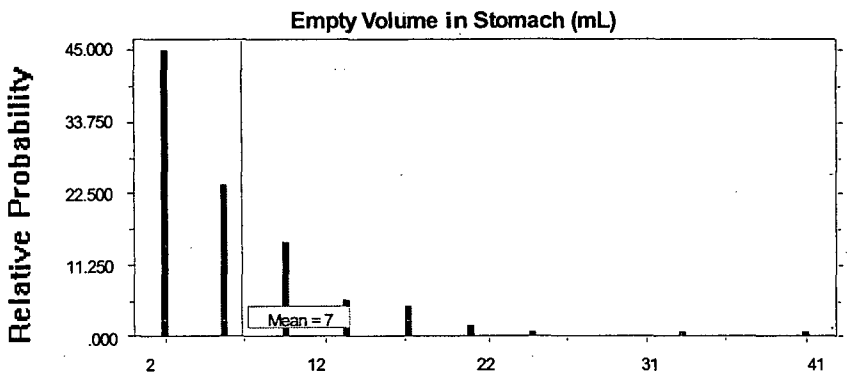
Location	0.0%
Scale	10.2%
Shape	1.19

Selected range is from 0.0% to 100.0%



Assumption: Volume of Gastric Juice in Stomach (mL)

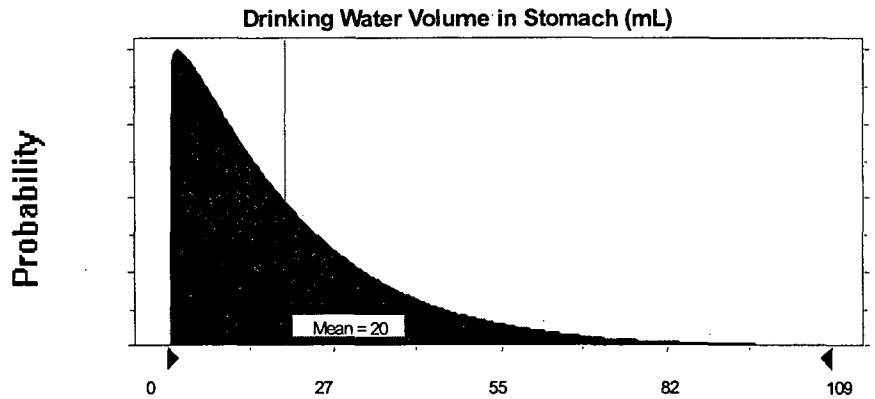
Custom distribution with parameters:	mL	Relative Probability
Single point	2	45.00
Single point	6	24.00
Single point	9	15.00
Single point	13	6.00
Single point	17	5.00
Single point	21	2.00
Single point	24	1.00
Single point	34	1.00
Single point	41	1.00
Total Relative Probability		100.00



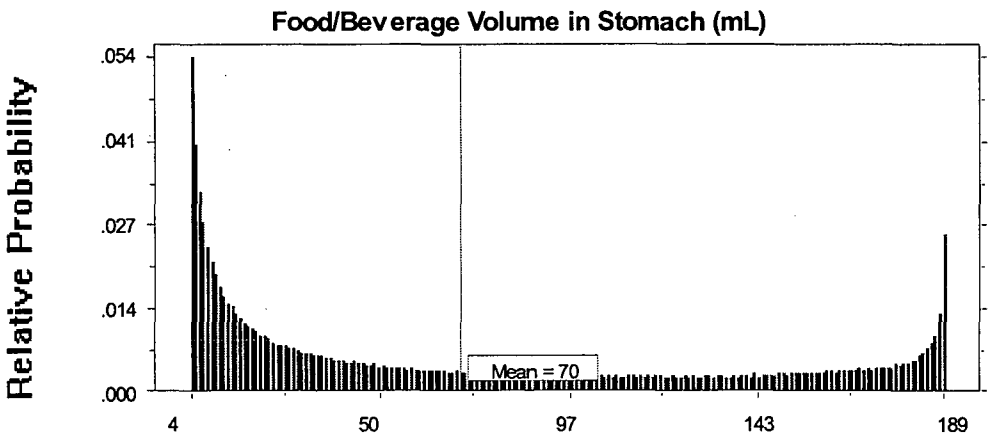
Assumption: Drinking Water Volume in Stomach (mL)

Weibull distribution with parameters:

Location	0
Scale	20
Shape	1.06152
Selected range	0 to 110



Assumption: Food/Beverage Volume in Stomach (mL)



Values from this custom distribution are listed in the following table.

Assumption: Food/Beverage Volume in Stomach (mL)

Custom distribution with parameters:	mL	Relative Probability
Single point	4	0.054273
Single point	5	0.040467
Single point	6	0.032611
Single point	7	0.027612
Single point	8	0.023804
Single point	9	0.021185
Single point	10	0.019043
Single point	11	0.017377
Single point	12	0.015711
Single point	13	0.01452
Single point	14	0.013806
Single point	15	0.012854
Single point	16	0.011902
Single point	17	0.011188
Single point	18	0.010712
Single point	19	0.010236
Single point	20	0.00976
Single point	21	0.009045
Single point	22	0.009045
Single point	23	0.008569
Single point	24	0.008093
Single point	25	0.007617
Single point	26	0.007617
Single point	27	0.007379
Single point	28	0.007141
Single point	29	0.006903
Single point	30	0.006665
Single point	31	0.006427
Single point	32	0.006189
Single point	33	0.006189
Single point	34	0.005951
Single point	35	0.005713
Single point	36	0.005713
Single point	37	0.005475
Single point	38	0.005475
Single point	39	0.004999
Single point	40	0.005237
Single point	41	0.005237
Single point	42	0.004761
Single point	43	0.004761
Single point	44	0.004999
Single point	45	0.004523
Single point	46	0.004523
Single point	47	0.004285
Single point	48	0.004285
Single point	49	0.004523
Single point	50	0.004047

Custom distribution with parameters:	mL	Relative Probability
Single point	51	0.004285
Single point	52	0.004047
Single point	53	0.004047
Single point	54	0.003809
Single point	55	0.003809
Single point	56	0.004047
Single point	57	0.003571
Single point	58	0.003809
Single point	59	0.003571
Single point	60	0.003571
Single point	61	0.003571
Single point	62	0.003571
Single point	63	0.003333
Single point	64	0.003333
Single point	65	0.003571
Single point	66	0.003333
Single point	67	0.003095
Single point	68	0.003095
Single point	69	0.003571
Single point	70	0.003095
Single point	71	0.003095
Single point	72	0.003095
Single point	73	0.002856
Single point	74	0.003095
Single point	75	0.002856
Single point	76	0.003095
Single point	77	0.002856
Single point	78	0.002856
Single point	79	0.002856
Single point	80	0.002618
Single point	81	0.002856
Single point	82	0.002856
Single point	83	0.002618
Single point	84	0.002856
Single point	85	0.002618
Single point	86	0.002856
Single point	87	0.002618
Single point	88	0.002618
Single point	89	0.002618
Single point	90	0.002618
Single point	91	0.002618
Single point	92	0.002856
Single point	93	0.002618
Single point	94	0.002618
Single point	95	0.002618
Single point	96	0.00238
Single point	97	0.002856
Single point	98	0.00238
Single point	99	0.002618

Custom distribution with parameters:	mL	Relative Probability
Single point	100	0.002618
Single point	101	0.00238
Single point	102	0.002856
Single point	103	0.00238
Single point	104	0.002618
Single point	105	0.00238
Single point	106	0.002618
Single point	107	0.00238
Single point	108	0.002618
Single point	109	0.00238
Single point	110	0.00238
Single point	111	0.002618
Single point	112	0.002618
Single point	113	0.00238
Single point	114	0.002618
Single point	115	0.00238
Single point	116	0.002618
Single point	117	0.002142
Single point	118	0.002618
Single point	119	0.002618
Single point	120	0.00238
Single point	121	0.00238
Single point	122	0.002618
Single point	123	0.00238
Single point	124	0.00238
Single point	125	0.002618
Single point	126	0.00238
Single point	127	0.002618
Single point	128	0.00238
Single point	129	0.00238
Single point	130	0.002618
Single point	131	0.002618
Single point	132	0.002142
Single point	133	0.002618
Single point	134	0.002618
Single point	135	0.00238
Single point	136	0.00238
Single point	137	0.002618
Single point	138	0.00238
Single point	139	0.002618
Single point	140	0.002618
Single point	141	0.00238
Single point	142	0.002856
Single point	143	0.00238
Single point	144	0.002618
Single point	145	0.002618
Single point	146	0.002618
Single point	147	0.002618
Single point	148	0.002856

Custom distribution with parameters:	mL	Relative Probability
Single point	149	0.002856
Single point	150	0.002618
Single point	151	0.002856
Single point	152	0.002856
Single point	153	0.002856
Single point	154	0.002856
Single point	155	0.002856
Single point	156	0.003095
Single point	157	0.003095
Single point	158	0.003095
Single point	159	0.002856
Single point	160	0.003333
Single point	161	0.003333
Single point	162	0.003095
Single point	163	0.003333
Single point	164	0.003333
Single point	165	0.003333
Single point	166	0.003571
Single point	167	0.003333
Single point	168	0.003809
Single point	169	0.003571
Single point	170	0.003809
Single point	171	0.003571
Single point	172	0.003809
Single point	173	0.004047
Single point	174	0.004047
Single point	175	0.004047
Single point	176	0.004047
Single point	177	0.004523
Single point	178	0.004285
Single point	179	0.004523
Single point	179	0.004523
Single point	180	0.004761
Single point	181	0.004999
Single point	182	0.005237
Single point	183	0.005713
Single point	184	0.006189
Single point	185	0.006903
Single point	186	0.007855
Single point	187	0.009284
Single point	188	0.012854
Single point	189	0.025708
Total Relative Probability		1.00

Appendix G

Monte Carlo Simulations for Uncertainty Analysis

Probabilistic Risk Analysis for Cancer

EA 3 Resident
Ingestion of Arsenic in Outdoor Soil

Inputs		Child	Adult	Common
CF	CF = Conversion Factor (kg/mg)			1.00E-06
AT	AT = Averaging Time - Cancer (d)			25550
C	Soil Arsenic Conc.			6.18
SF	Cancer Slope Factor (kg·d/mg)			1.5
FS	FS = Fraction from Site	1.00	1.00	
RBA	Bioavailability			0.5
EF	EF = Exposure Frequency (d/yr)			350
ED	ED = Exposure Duration (yr)	6	24	
IR	IR = Soil Ingestion Rate (mg/d)	53	32	
BW	BW = Body Weight (kg)	15	70	

Note: Shaded values are inputs that used input distributions.

Calculations		Child	Adult	Common
IF	Intake Factor (IR * FS * EF * ED * CF) / (BW * AT)	2.9E-07	1.5E-07	
DI	Daily Intake (mg/kg·d) DI = C×IF×RBA	9.0E-07	4.7E-07	
CR	Cancer Risk CR = DI×SF	1.3E-06	7.0E-07	
ELCR	Total Excess Lifetime Cancer Risk			2.05E-06

Crystal Ball Report

Forecast: ELCR **Cell: I27**

Summary:
Display Range is from 0.00 to 0.00
Entire Range is from 0.00 to 0.00
After 10,000 Trials, the Std. Error of the Mean is 0.00

Statistics:	Value
Trials	1.00E+04
Mean	1.47E-06
Median	1.26E-06
Mode	---
Standard Deviation	8.66E-07
Variance	7.49E-13
Skewness	1.51E+00
Kurtosis	6.39E+00
Coeff. of Variability	5.90E-01
Range Minimum	1.71E-07
Range Maximum	8.42E-06
Range Width	8.25E-06
Mean Std. Error	8.66E-09

Forecast: ELCR (cont'd) **Cell: I27**

Percentiles:

Percentile	Value
0%	1.71E-07
5%	4.88E-07
10%	5.96E-07
15%	6.88E-07
20%	7.75E-07
25%	8.53E-07
30%	9.25E-07
35%	9.98E-07
40%	1.08E-06
45%	1.18E-06
50%	1.26E-06
55%	1.36E-06
60%	1.46E-06
65%	1.58E-06
70%	1.71E-06
75%	1.86E-06
80%	2.04E-06
85%	2.28E-06
90%	2.63E-06
95%	3.18E-06
100%	8.42E-06

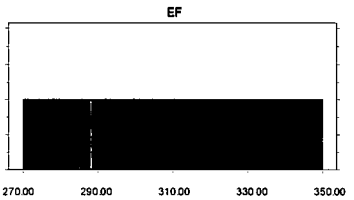
End of Forecast

Assumptions

Assumption: EF **Cell: I15**

Uniform distribution with parameters:

Minimum	270.00
Maximum	350.00

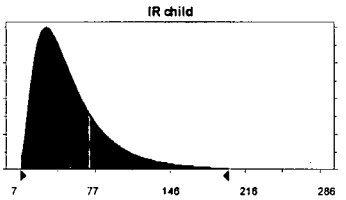


Assumption: IR child **Cell: G17**

Lognormal distribution with parameters:

50% - tile	45
95% - tile	124

Selected range is from 0 to 200

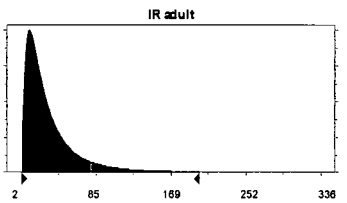


Assumption: IR adult **Cell: H17**

Lognormal distribution with parameters:

50% - tile	23
95% - tile	100

Selected range is from 0 to 200

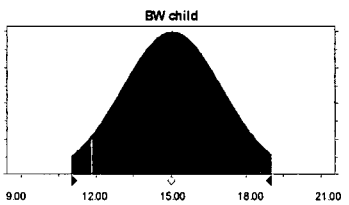


Assumption: BW child **Cell: G18**

Normal distribution with parameters:

Mean	15.00
Standard Dev.	2.00

Selected range is from 11.00 to 19.00



Correlated with:

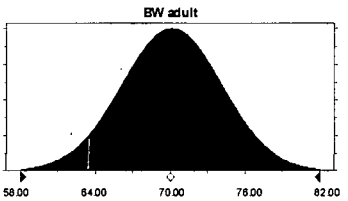
BW adult (H18)	0.60

Assumption: BW adult **Cell: H18**

Normal distribution with parameters:

Mean	70.00
Standard Dev.	4.00

Selected range is from 34.00 to 216.00



Correlated with:

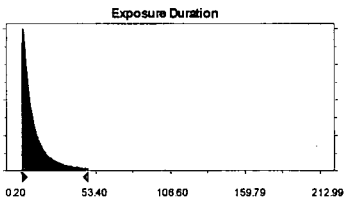
BW child (G18)	0.60

Assumption: Exposure Duration **Cell: H9**

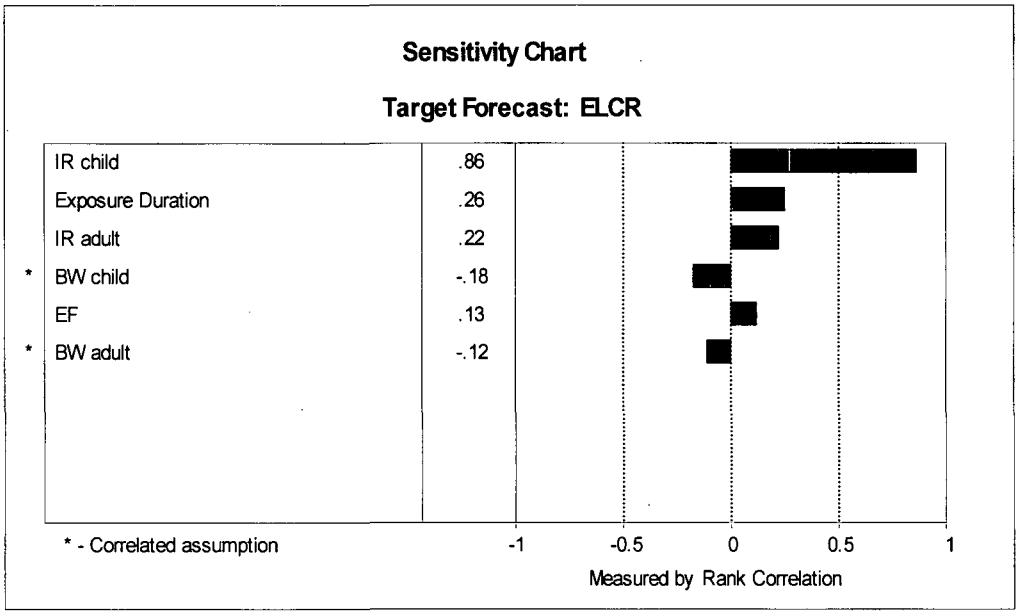
Lognormal distribution with parameters:

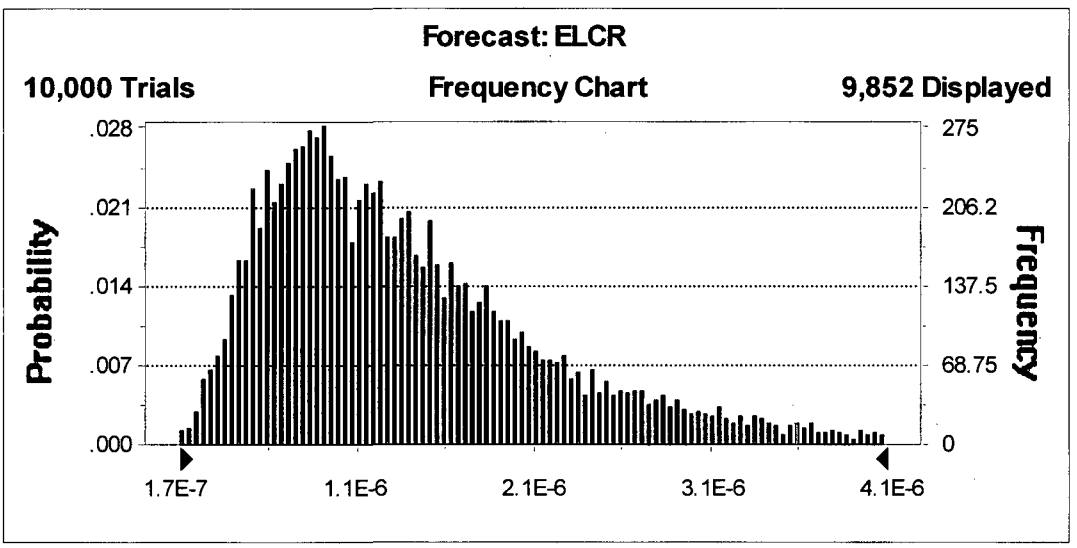
Geometric Mean	6.50
Geometric Std. Dev.	3.20

Selected range is from 1.00 to 48.00



End of Assumptions


Sensitivity Chart
Target Forecast: ELCR
IR child .86
Exposure Duration .26
IR adult .22
* BW child -.18
EF .13
* BW adult -.12
* - Correlated assumption
-1
-0.5
0
0.5
1
Measured by Rank Correlation


Forecast: ELCR
10,000 Trials
Frequency Chart
9,852 Displayed
Probability
.028
.021
.014
.007
.000
Frequency
275
206.2
137.5
68.75
0
1.7E-7
1.1E-6
2.1E-6
3.1E-6
4.1E-6

Probabilistic Risk Analysis for Noncancer

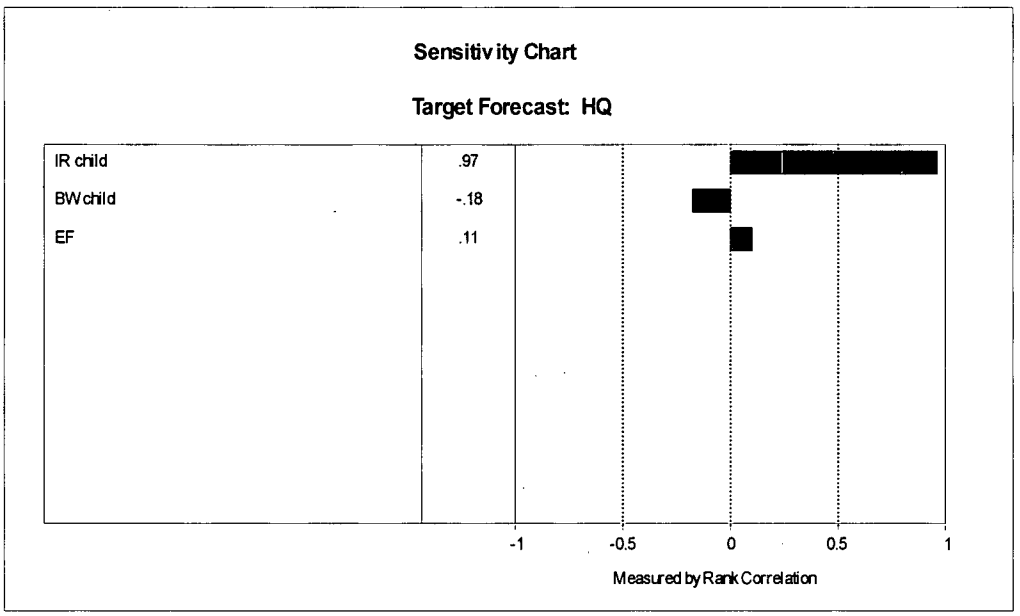
EA 3 Child Resident
Ingestion of Iron in Outdoor Soil

Inputs		Child
CF	CF = Conversion Factor (kg/mg)	1.00E-06
ED	ED = Exposure Duration (yr)	6
AT	AT = Averaging Time - Noncancer (d)	2190
C	Soil Conc.	5.72E+04
RfD	Reference Dose (mg/kg-day)	3.00E-01
RBA	Bioavailability	1
FS	FS = Fraction from Site	1
EF	EF = Exposure Frequency (d/yr)	310
IR	IR = Soil Ingestion Rate (mg/d)	53
BW	BW = Body Weight (kg)	15

Note: Shaded values are inputs that used input distributions.

Calculations		
IF	Intake Factor (IR * FS * EF * ED * CF) / (BW * AT)	2.99E-06
DI	Daily Intake (mg/kg·d) DI = C×IF×RBA	1.71E-01
HQ	Hazard Quotient = DI / RfD	5.71E-01

Crystal Ball Report

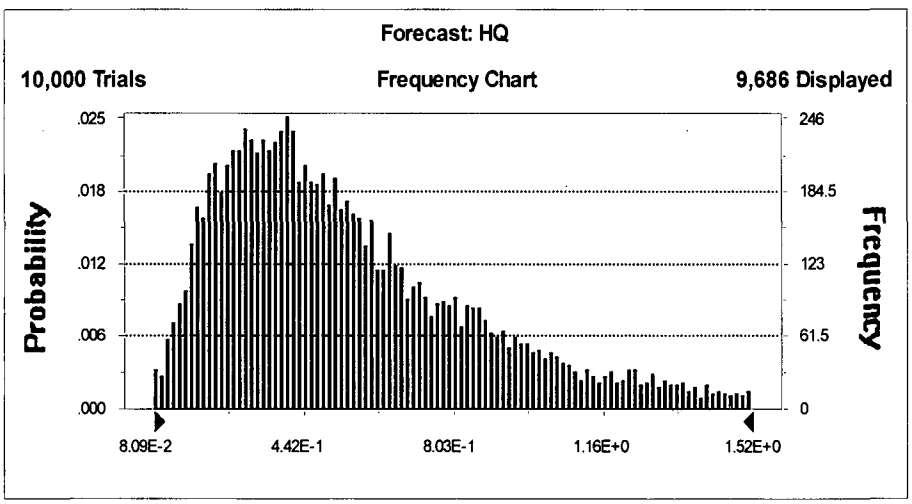


Forecast: HQ **Cell: G25**

Summary:

Display Range is from 8.09E-2 to 1.52E+0
Entire Range is from 3.38E-2 to 2.81E+0
After 10,000 Trials, the Std. Error of the Mean is 3.65E-3

Statistics:	Value
Trials	10000
Mean	5.82E-01
Median	4.88E-01
Mode	---
Standard Deviation	3.65E-01
Variance	1.33E-01
Skewness	1.47
Kurtosis	5.63
Coeff. of Variability	0.63
Range Minimum	3.38E-02
Range Maximum	2.81E+00
Range Width	2.78E+00
Mean Std. Error	3.65E-03



Forecast: HQ (cont'd) **Cell: G25**

Percentiles:

Percentile	Value
0%	3.38E-02
5%	1.77E-01
10%	2.20E-01
15%	2.56E-01
20%	2.90E-01
25%	3.21E-01
30%	3.54E-01
35%	3.87E-01
40%	4.17E-01
45%	4.50E-01
50%	4.88E-01
55%	5.27E-01
60%	5.69E-01
65%	6.17E-01
70%	6.75E-01
75%	7.44E-01
80%	8.27E-01
85%	9.25E-01
90%	1.07E+00
95%	1.33E+00
100%	2.81E+00

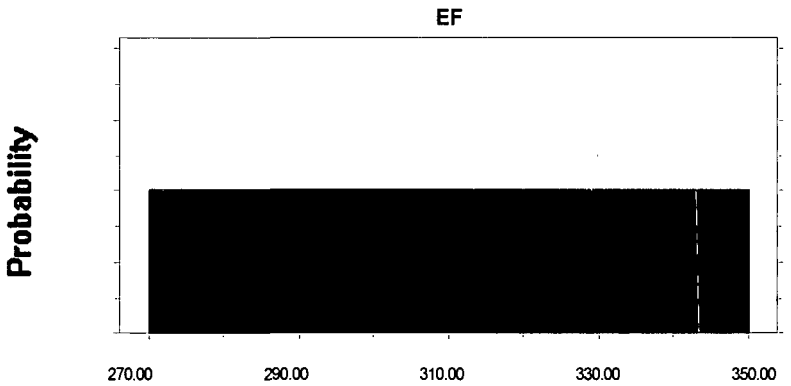
End of Forecast

Assumptions

Assumption: EF **Cell: G15**

Uniform distribution with parameters:

Minimum	270.00
Maximum	350.00



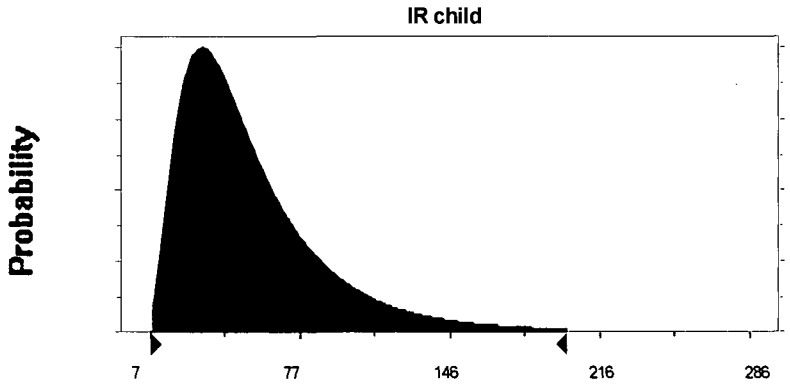
Assumption: IR child **Cell: G16**

Lognormal distribution with parameters:

50% - tile	45
95% - tile	124

Selected range is from 0 to 200

Assumption: IR child (cont'd) **Cell: G16**

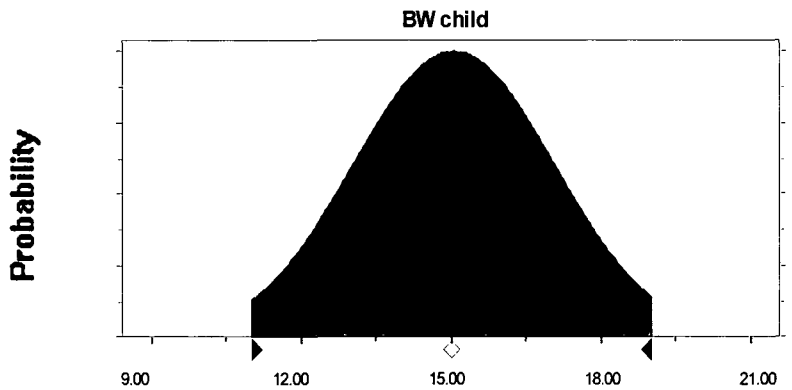


Assumption: BW child **Cell: G17**

Normal distribution with parameters:

Mean	15.00
Standard Dev.	2.00

Selected range is from 11.00 to 19.00



End of Assumptions