01-0460

Corporate Environmental Programs
General Electric Company
100 Woodlawn Avenue, Pittsfield, MA 01201

March 4, 2002

Bryan Olson
EPA Project Coordinator
U.S. Environmental Protection Agency
EPA New England
One Congress Street, Suite 1100
Boston, Massachusetts 02114-2023

Re: GE-Pittsfield/Housatonic River Site
20s, 30s, and 40s Complexes (GECD120)
Revised Risk Evaluation of Appendix IX+3 Constituents in Soils

Dear Mr. Olson:

In December 2001, General Electric (GE) submitted to the U.S. Environmental Protection Agency (EPA) a *Conceptual Removal Design/Removal Action Work Plan for the 20s, 30s, and 40s Complexes*. In subsequent communications, EPA has pointed out the need for a few modifications and corrections to Appendix C of that Work Plan, which is entitled "Risk Evaluation of Appendix IX+3 Constituents Detected in Soils of the 20s, 30s, and 40s Complexes of the General Electric Facility in Pittsfield, MA." The modifications and corrections identified by EPA have been made and incorporated in a Revised Appendix C, which is enclosed herewith. These modifications and corrections are as follows:

- Use of a conservative default oral absorption factor of 100% for all constituents evaluated;

- In calculating dermal contact risks, adjustment of the toxicity values (Cancer Slope Factor and Reference Dose) to take account of the estimated absorbed dose (through use of a "toxicity adjustment factor" based on the oral absorption in the studies underlying the toxicity values);

- In the application of the Adult Lead Model, use of updated default ranges for the background blood levels and the geometric standard deviation for such levels, as used in EPA's current version of that model; and

- Correction of a few typographical errors.

The enclosed Revised Appendix C incorporates these modifications and corrections and presents the revised risk evaluation results. These revised results do not lead to any change in the conclusions. For each of these three complexes and each scenario evaluated, the total estimated cancer risks are still below the target risk benchmark of 1×10^{-5}, the estimated non-cancer

hazards are still below the target Hazard Index of 1.0, and the modeled 95th percentile fetal blood lead concentrations are still below the target blood lead concentration of 10 µg/dl for children. Thus, the revised results continue to indicate that the concentrations of the non-PCB constituents evaluated in the surface and subsurface soils at the 20s, 30s, and 40s Complexes do not present an unacceptable cancer risk or non-cancer hazard.

Please replace the original Appendix C in the Conceptual RD/RA Work Plan with the enclosed Revised Appendix C.

Very truly yours,

Andrew T. Silfer/JHS

Andrew T. Silfer, P.E.
GE Project Coordinator

Enclosure

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REVISED APPENDIX C

Revised Risk Evaluation of Appendix IX+3 Constituents Detected in Soils of the 20s, 30s, and 40s Complexes of the General Electric Facility in Pittsfield, MA

Introduction

A number of non-PCB constituents were detected in the surface and subsurface soils of the 20s, 30s, and 40s Complexes of the General Electric (GE) facility in Pittsfield, MA. These constituents have been evaluated in accordance with the multi-step process established for non-PCB Appendix IX+3 constituents in the *Statement of Work for Removal Actions Outside the River* (SOW) (BBL, 1999). The steps in this process are described in the text of this Conceptual RD/RA Work Plan. These steps included screening by comparison of the maximum detected concentrations of the constituents to EPA's Preliminary Remediation Goals (PRGs) for soil in industrial/commercial areas (and, for one constituent, sulfide, comparison of site data with background levels). Following this screening, the average concentrations of the remaining constituents were compared to the applicable Method 1 standards set out in the Massachusetts Contingency Plan (MCP). As described in the text, a number of those constituents had average concentrations exceeding the Method 1 standards. Accordingly, GE requested AMEC Earth & Environmental to conduct area-specific risk evaluations of the constituents that remained prior to the comparison to MCP Method 1 standards, using the protocols for area-specific risk evaluations set forth in the SOW.

This Appendix describes and presents the results of these area-specific risk evaluations for the 20s, 30s, and 40s Complexes. In accordance with the SOW, these risk evaluations were based on the average constituent concentrations for each Complex, the same exposure scenarios, depth increments, and exposure assumptions used by EPA in developing the PCB Performance Standards for these areas (as described in EPA, 1999a), and standard EPA toxicity values. As discussed below, for the constituents evaluated, estimated cancer risks and non-cancer hazards fall well below the acceptable benchmarks prescribed in the SOW.

Constituents Evaluated

In accordance with the protocols set forth in the SOW, the risk evaluations presented herein have considered all chemicals of potential concern (COPCs) that were retained for evaluation after the initial screening steps but before the comparison to MCP Method 1 standards, and have used the average concentrations of those constituents in each of the Complexes in question. Given the SOW requirement to use the same exposure scenarios and depth increments that were assumed by EPA (1999a) in supporting the PCB Performance Standards, average concentrations have been calculated for the same depth increments evaluated by EPA (1999a) for commercial/industrial areas – i.e., the 0-1 foot depth and the 1-6 foot depth. The COPCs evaluated and their average concentrations are as follows:

		Ave. Concentration (mg/kg)	
Area	**Constituent**	**0-1 foot**	**1-6 foot**
20s Complex	Benzo(a)pyrene	0.847	0.616
	Arsenic	10.4	9.34
30s Complex	Benz(a)anthracene	0.966	0.690
	Benzo(a)pyrene	0.990	0.684
	Benzo(b)fluoranthene	0.915	0.695
	Dibenz(a,h)anthracene	1.43	1.13
	Indeno(1,2,3-cd)pyrene	1.54	1.17
	Arsenic	10.1	19.3
	Lead	118	163
40s Complex	Benz(a)anthracene	1.84	0.469
	Benzo(a)pyrene	1.92	0.471
	Benzo(b)fluoranthene	1.73	0.428
	Indeno(1,2,3-cd)pyrene	1.90	0.794
	Arsenic	11.6	8.79
	Lead	274	53.9

With the exception of lead, these COPCs have been included in risk calculations for each Complex to determine whether cancer risks and non-cancer hazards fall within acceptable limits. Since EPA has not developed standard toxicity values for lead, that constituent has been evaluated, as recommended by EPA, using EPA's *Adult Lead Methodology* (EPA, 1996, 1999b, 2001a).

Risk Evaluation Assumptions and Procedures (for All COPCs Except Lead)

In accordance with the SOW, the exposure scenarios that have been evaluated are the same exposure scenarios utilized by EPA (1999a) in supporting the PCB Performance Standards for commercial/industrial areas – namely, the Commercial Groundskeeper scenario for surface soil (0-1 foot depth) and the Utility Worker scenario for subsurface soil (1-6 foot depth).

The Commercial Groundskeeper scenario assumes that an adult is exposed to constituents in surficial soils 84 days per year for a period of 25 years. With the exception of chemical-specific absorption and toxicity criteria, all exposure assumptions used to evaluate this scenario were the same as those used by EPA (1999a). For all chemicals, a conservative default oral absorption factor of 100% was used, and the dermal absorption factors used were default values recommended by EPA. The carcinogenic COPCs were evaluated for potential carcinogenic risks, while the only COPC with a non-cancer Reference Dose (RfD), arsenic, was evaluated for potential non-cancer hazards. (In accordance with the SOW, PCBs and dioxins/furans were not included in these evaluations.) The toxicity values used in the evaluations were those set forth on EPA's Integrated Risk Information System (IRIS) for benzo(a)pyrene and arsenic, with use of Toxicity Equivalency Factors (TEFs) recommended by EPA (1993) to adjust the values for other carcinogenic polycyclic aromatic hydrocarbons (PAHs) based on their assumed potency relative to benzo(a)pyrene. The specific exposure assumptions and toxicity values used for the Commercial Groundskeeper scenario are listed in Table 1

The Utility Worker scenario assumes that an adult is in contact with subsurface soils in the affected area 5 days per year for 25 years. As with the Groundskeeper scenario, all

exposure assumptions used in this scenario were the same as the assumptions used by EPA (1999a) with the exception of chemical-specific absorption and toxicity criteria, for which the same values used for the Groundskeeper scenario were utilized. The specific exposure assumptions and toxicity values used for the Utility Worker scenario are listed in Table 2.

Based on these input values, predicted cancer risks and non-cancer hazards were calculated for the COPCs using standard risk assessment procedures, and were then compared to the benchmarks set forth in the SOW (for constituents other than PCBs and dioxins/furans) of 1×10^{-5} for cancer risks and a Hazard Index of 1.0 for non-cancer impacts.

Risk Estimates (for All COPCs Except Lead)

The predicted cancer risks and non-cancer hazards for the non-PCB COPCs at the 20s, 30s, and 40s Complexes are summarized in Table 3. Cancer risk and non-cancer hazard results for individual COPCs and for each exposure pathway and scenario evaluated in the three Complexes are provided in Tables 4a through 9b. As shown in Table 3, total estimated cancer risks do not exceed the identified risk benchmark of 1×10^{-5} for either the Commercial Groundskeeper or the Utility Worker scenario in any of the three facility Complexes evaluated. Similarly, non-cancer hazards resulting from exposures to surficial and subsurface soils do not exceed the target Hazard Index of 1.0 in any of the areas.

Evaluation of Lead Exposures and Risks

EPA has not developed toxicity criteria for lead (EPA, 2001b). Consequently, it is not possible to evaluate potential hazards associated with lead exposure in the same way that other COPCs are evaluated. Instead, EPA has established a "safe" fetal blood lead level of 10 µg/dL and has developed models to evaluate both adult and childhood exposures to lead, considering fetal or childhood blood levels as the critical endpoint. For the adult who may be exposed to lead in a non-residential setting, EPA has developed the Adult Lead Methodology (ALM) (EPA, 1996, 1999b, 2001a). This methodology predicts the blood levels of lead that would likely occur in a pregnant

woman and in her fetus after non-residential exposure to lead-contaminated soil and dust.

The biokinetic ALM incorporates background blood lead levels as a starting concentration and predicts blood levels that will likely result after additional exposure to lead-contaminated soil occurs. The range of default adult blood lead levels that was originally recommended by EPA (1996) was 1.7 to 2.2 µg/dL. The current version of the model (http://www.epa.gov/superfund/programs/lead), however, uses a range of 1.4 to 1.8 µg/dL. The model also incorporates a geometric standard deviation (GSD) for background blood lead levels to account for variability within an exposed population. While EPA (1996, Table 1) originally recommended default values ranging from 1.8 for homogeneous populations to 2.1 for heterogeneous populations, the current version of the model uses a range of 1.9 to 2.3 for this parameter. EPA (1996) defines homogeneous populations as exposed individuals who have similar socioeconomic and ethnic characteristics who live in a relatively small geographic area and are exposed to a single dominant source of lead. Heterogeneous populations are defined as individuals who have different socioeconomic backgrounds and ethnic characteristics and who live in a larger geographic area (e.g., the national population). The model then considers the ingestion of lead by adults in a non-residential setting, using a soil ingestion rate of 50 mg/day and an assumed exposure frequency of 219 days/year, based on occupational exposure. The oral absorption of lead after ingestion is assumed to be 12 percent. Using a starting soil concentration, the model is able to predict the 95th percentile blood lead concentration in the fetus of an exposed pregnant woman. If this concentration does not exceed the maximum allowable concentration of 10 µg/dL, it is concluded that exposures result in no risk of harm.

The model assumes that there is adequate exposure to result in a steady state blood lead concentration (EPA, 2001a) and assumes that exposure continues regularly and for an indefinite period of time. Thus, there is no exposure duration factor in the model. Instead, it assumes that exposure occurs 219 out of 365 days per year, for every year of exposure, and that steady state is reached. EPA states that certain short-term or intermittent exposures may not be well represented by the model (EPA, 2001a). Thus, if one were to put in the intermittent exposure frequency for the Utility Worker, the model might not predict a representative blood concentration.

It is important to note, however, that the only substantial differences between the model default assumptions and the Groundskeeper and Utility Worker scenarios developed by EPA (1999a) are soil ingestion rate (for the Utility Worker) and exposure frequency (for both the Groundskeeper and Utility Worker scenarios). While the soil ingestion rate for the Utility Worker used by EPA (1999a) is higher than 50 mg/day, the exposure frequency assumed by EPA (1999a) is substantially lower. For the Groundskeeper, the soil ingestion rate used by EPA (1999a) is the same as the ALM default value but the exposure frequency is lower. Overall, the default ALM model assumes that adults ingest 50 mg/day for 219 days/year for a total annual soil ingestion of 10,950 mg. For the Groundskeeper scenario, which assumes 50 mg/day for 84 days/year (EPA, 1999a), the total yearly soil ingestion is 4,200 mg. For the Utility Worker scenario, which assumes 137 mg/day for 5 days/year, the total amount of soil ingested annually is 685 mg. Thus, the default ALM model certainly overestimates potential blood lead levels for both of these scenarios and hence is a highly conservative screening mechanism to evaluate potential hazards associated with lead in the soils of the GE facility.

To evaluate potential hazards associated with the presence of lead at 20s, 30s, and 40s Complexes, the highest average lead soil concentration, 274 mg/kg in surface soil (40s Complex), was input into the ALM model. If it is demonstrated that this highest lead concentration results in acceptable fetal blood concentrations, then there would be no need to evaluate areas or soil depth increments that have lower lead concentrations. The remaining parameters included as inputs to the ALM are presented in Table 10. To provide a range of predicted values, the range of values used in the current EPA model for background blood lead levels and the GSD for such levels were incorporated. The Low Range estimate assumes the lower end of EPA's default ranges for both the background blood lead level (1.4 µg/dL) and the GSD (1.9). The High Range estimate assumes the upper end of these ranges, incorporating a background blood lead concentration of 1.8 µg/dL and a GSD of 2.3.

The results of the ALM analysis for lead, using the highest average concentration reported (274 mg/kg in surface soil in the 40s Complex) are provided in Table 10. The predicted Low Range 95th percentile fetal blood concentration is 4.6 µg/dL and the predicted High Range 95th percentile fetal blood concentration is 7.8 µg/dl. These

predicted values are both below EPA's level of concern for children (10 µg/dL), indicating that lead levels in soils at the 20s, 30s, and 40s Complexes do not present a hazard. It should be noted that it is more likely that the Low Range estimate is more appropriate for the GE facility due to the fact that the exposed population is likely to be more accurately described by EPA's (1996) definition as a homogeneous population. These predicted blood levels are also overestimated for the site where, according to EPA's default parameters for Groundskeepers and Utility Workers (EPA, 1999a), exposure frequencies will be much lower than the default exposure frequency used in the model.

Summary

The above-described results of these area-specific risk evaluations indicate that the concentrations of the COPCs evaluated in surface and subsurface soils at the 20s, 30s, and 40s Complexes do not present an unacceptable cancer risk or non-cancer hazard.

References

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EPA. 2001a. *Review of Adult Lead Models - Evaluation of Models for Assessing Human Health Risks Associated with Lead Exposures at Non-Residential Areas of Superfund and Other Hazardous Waste Sites.* U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. EPA 9285.7-46. August.

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Table 1. Summary of Exposure Parameters and Toxicity Values for the Groundskeeper Scenario

Parameter	Value	Basis
Soil Ingestion Rate	50 mg/day	EPA, 1999a
Oral Absorption Factor		
Benz(a)anthracene	100%	Conservative Default
Benzo(a)pyrene	100%	Conservative Default
Benzo(b)fluoranthene	100%	Conservative Default
Dibenz(a,h)anthracene	100%	Conservative Default
Indeno(1,2,3-cd)pyrene	100%	Conservative Default
Arsenic	100%	Conservative Default
Dermal Adherence Factor	0.1	EPA, 1999a
Skin Surface Area Exposed	3300 cm^2	EPA, 1999a
Dermal Absorption Factor		
Benz(a)anthracene	0.13	EPA, 1999c
Benzo(a)pyrene	0.13	EPA, 1999c
Benzo(b)fluoranthene	0.13	EPA, 1999c
Dibenz(a,h)anthracene	0.13	EPA, 1999c
Indeno(1,2,3-cd)pyrene	0.13	EPA, 1999c
Arsenic	0.03	EPA, 1999c
Exposure Frequency	84 days/year	EPA, 1999a
Exposure Duration	25 years	EPA, 1999a
Body Weight	70 kg	EPA, 1999a
Carcinogenic Averaging Time	25,550 days	EPA, 1999a
Non-Carcinogenic Averaging Time	9125 days	EPA, 1999a
Cancer Slope Factor		
Benz(a)anthracene	0.73 $(mg/kg\text{-}day)^{-1}$	EPA, 2001b[a]
Benzo(a)pyrene	7.3 $(mg/kg\text{-}day)^{-1}$	EPA, 2001b
Benzo(b)fluoranthene	0.73 $(mg/kg\text{-}day)^{-1}$	EPA, 2001b[a]
Dibenz(a,h)anthracene	7.3 $(mg/kg\text{-}day)^{-1}$	EPA, 2001b[a]
Indeno(1,2,3-cd)pyrene	0.73 $(mg/kg\text{-}day)^{-1}$	EPA, 2001b[a]
Arsenic	1.5 $(mg/kg\text{-}day)^{-1}$	EPA, 2001b
Reference Dose		
Arsenic	0.0003 mg/kg-day	EPA, 2001b
Toxicity Adjustment Factor[b]		
PAHs	0.89	EPA, 1999c
Arsenic	0.95	EPA, 1999c

[a] Adjusted for applicable Toxic Equivalency Factors for PAHs as outlined in EPA, 1993.

[b] Used to adjust Cancer Slope Factor and Reference Dose for dermal exposure

Table 2. Summary of Exposure Parameters and Toxicity Values for the Utility Worker Scenario

Parameter	Value	Basis
Soil Ingestion Rate	137 mg/day	EPA, 1999a
Oral Absorption Factor		
Benz(a)anthracene	100%	Conservative Default
Benzo(a)pyrene	100%	Conservative Default
Benzo(b)fluoranthene	100%	Conservative Default
Dibenz(a,h)anthracene	100%	Conservative Default
Indeno(1,2,3-cd)pyrene	100%	Conservative Default
Arsenic	100%	Conservative Default
Dermal Adherence Factor	0.8	EPA, 1999a
Skin Surface Area Exposed	3300 cm^2	EPA, 1999a
Dermal Absorption Factor		
Benz(a)anthracene	0.13	EPA, 1999c
Benzo(a)pyrene	0.13	EPA, 1999c
Benzo(b)fluoranthene	0.13	EPA, 1999c
Dibenz(a,h)anthracene	0.13	EPA, 1999c
Indeno(1,2,3-cd)pyrene	0.13	EPA, 1999c
Arsenic	0.03	EPA, 1999c
Exposure Frequency	5 days/year	EPA, 1999a
Exposure Duration	25 years	EPA, 1999a
Body Weight	70 kg	EPA, 1999a
Carcinogenic Averaging Time	25,550 days	EPA, 1999a
Non-Carcinogenic Averaging Time	9125 days	EPA, 1999a
Cancer Slope Factor		
Benz(a)anthracene	0.73 $(mg/kg\text{-}day)^{-1}$	EPA, 2001b[a]
Benzo(a)pyrene	7.3 $(mg/kg\text{-}day)^{-1}$	EPA, 2001b
Benzo(b)fluoranthene	0.73 $(mg/kg\text{-}day)^{-1}$	EPA, 2001b[a]
Dibenz(a,h)anthracene	7.3 $(mg/kg\text{-}day)^{-1}$	EPA, 2001b[a]
Indeno(1,2,3-cd)pyrene	0.73 $(mg/kg\text{-}day)^{-1}$	EPA, 2001b[a]
Arsenic	1.5 $(mg/kg\text{-}day)^{-1}$	EPA, 2001b
Reference Dose		
Arsenic	0.0003 mg/kg-day	EPA, 2001b
Toxicity Adjustment Factor[b]		
PAHs	0.89	EPA, 1999c
Arsenic	0.95	EPA, 1999c

[a] Adjusted for applicable Toxic Equivalency Factors for PAHs as outlined in EPA, 1993.

[b] Used to adjust Cancer Slope Factor and Reference Dose for dermal exposure

Table 3. Summary of Risks and Hazards at the 20s, 30s, and 40s Complexes

	20s Complex		30s Complex		40s Complex	
	Commercial	**Utility**	**Commercial**	**Utility**	**Commercial**	**Utility**
Cancer Risk						
Soil Ingestion	1.3E-06	1.8E-07	2.1E-06	4.2E-07	2.1E-06	1.7E-07
Dermal Contact	5.4E-07	2.0E-07	1.3E-06	5.8E-07	1.2E-06	2.0E-07
Total	1.8E-06	3.8E-07	3.4E-06	1.0E-06	3.3E-06	3.7E-07
Noncancer Hazard						
Soil Ingestion	5.7E-03	8.3E-04	5.5E-03	1.7E-03	6.4E-03	7.9E-04
Dermal Contact	1.2E-03	5.1E-04	1.2E-03	1.0E-03	1.3E-03	4.8E-04
Total	6.9E-03	1.3E-03	6.7E-03	2.8E-03	7.7E-03	1.3E-03

Table 4a. Cancer and Non-Cancer Risks from Commercial Worker Ingestion Exposure to Surface Soil in the 20s Complex

Pathway: Incidental Ingestion of Surface Soils
Receptor: Commercial Worker - 20s Complex

CARCINOGENIC
CSF = CDI x CSF
CDI = Cs x IgR x ROA x EF x ED x CF x 1/BW x 1/ATc

Chemical	Cs Soil Concentration (mg/kg)	IgR Ingestion Rate (mg/d)	ROA Relative Oral Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATc Averaging Time Carcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	CSF Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$	Risk
Benzo(a)pyrene	0.847	50	1.0	84	25	1E-06	70	25,550	5.0E-08	7.3	3.6E-07
Arsenic	10.4	50	1.0	84	25	1E-06	70	25,550	6.1E-07	1.5	9.2E-07
										Total	1.3E-06

NONCARCINOGENIC
HQ = CDI/RfD
CDI = Cs x IgR x ROA x EF x ED x CF x 1/BW x 1/ATnc

Chemical	Cs Soil Concentration (mg/kg)	IgR Ingestion Rate (mg/d)	ROA Relative Oral Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATnc Averaging Time Noncarcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	RfD Reference Dose (mg/kg-d)	HQ Hazard Quotient
Arsenic	10.4	50	1.0	84	25	1E-06	70	9,125	1.7E-06	3.0E-04	5.7E-03
										Total	5.7E-03

Table 4b. Cancer and Non-Cancer Risks from Commercial Worker Dermal Exposure to Surface Soil in the 20s Complex

Pathway: Dermal Contact with Surface Soils
Receptor: Commercial Worker - 20s Complex

CARCINOGENIC
Risk = CDI x CSF
CDI =Cs x DAF x SA x RDA x EF x ED x CF x 1/BW x 1/ATc

Chemical	Cs Soil Concentration (mg/kg)	DAF Dermal Adherence Factor (mg/cm^2)	SA Surface Area Exposed (cm^2/day)	RDA Relative Dermal Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATc Averaging Time Carcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	CSF Cancer Slope Factor[a] $(mg/kg\text{-}d)^{-1}$	Risk
Benzo(a)pyrene	0.847	0.1	3,300	0.13	84	25	1E-06	70	25,550	4.3E-08	8.2	3.5E-07
Arsenic	10.4	0.1	3,300	0.03	84	25	1E-06	70	25,550	1.2E-07	1.6	1.9E-07
											Total	5.4E-07

NONCARCINOGENIC
HQ = CDI/RfD
CDI =Cs x DAF x SA x RDA x EF x ED x CF x 1/BW x 1/ATnc

Chemical	Cs Soil Concentration (mg/kg)	DAF Dermal Adherence Factor (mg/cm^2)	SA Surface Area Exposed (cm^2/day)	RDA Relative Dermal Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATnc Averaging Time Noncarcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	RfD Reference Dose[b] (mg/kg-d)	HQ Hazard Quotient
Arsenic	10.4	0.1	3,300	0.03	84	25	1E-06	70	9,125	3.4E-07	2.9E-04	1.2E-03
											Total	1.2E-03

a. Cancer slope factor divided by oral absorption factor (89% for PAHs, 95% for arsenic) to derive an adjusted slope factor for dermal contact
b. Reference dose for arsenic multiplied by an oral absorption factor of 95% to derive an adjusted reference dose for dermal contact.

Table 5a. Cancer and Non-Cancer Risks from Utility Worker Ingestion Exposure to Subsurface Soil in the 20s Complex

Pathway: Incidental Ingestion of Subsurface Soils
Receptor: Utility Worker - 20s Complex

CARCINOGENIC
CSF = CDI x CSF
CDI = Cs x IgR x ROA x EF x ED x CF x 1/BW x 1/ATc

	Cs	IgR	ROA	EF	ED	CF	BW	ATc	CDI	CSF	Risk
Chemical	Soil Concentration (mg/kg)	Ingestion Rate (mg/d)	Relative Oral Absorption (unitless)	Exposure Frequency (d/yr)	Exposure Duration (yrs)	Conversion Factor (kg/mg)	Body Weight (kg)	Averaging Time Carcinogenic (days)	Chronic Daily Intake (mg/kg-d)	Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$	
Benzo(a)pyrene	0.616	137	1.0	5	25	1E-06	70	25,550	5.9E-09	7.3	4.3E-08
Arsenic	9.34	137	1.0	5	25	1E-06	70	25,550	8.9E-08	1.5	1.3E-07
										Total	1.8E-07

NONCARCINOGENIC
HQ = CDI/RfD
CDI = Cs x IgR x ROA x EF x ED x CF x 1/BW x 1/ATnc

	Cs	IgR	ROA	EF	ED	CF	BW	ATnc	CDI	RfD	HQ
Chemical	Soil Concentration (mg/kg)	Ingestion Rate (mg/d)	Relative Oral Absorption (unitless)	Exposure Frequency (d/yr)	Exposure Duration (yrs)	Conversion Factor (kg/mg)	Body Weight (kg)	Averaging Time Noncarcinogenic (days)	Chronic Daily Intake (mg/kg-d)	Reference Dose (mg/kg-d)	Hazard Quotient
Arsenic	9.34	137	1.0	5	25	1E-06	70	9,125	2.5E-07	3.0E-04	8.3E-04
										Total	8.3E-04

Table 5b. Cancer and Non-Cancer Risks from Utility Worker Dermal Exposure to Subsurface Soil in the 20s Complex

Pathway: Dermal Contact with Subsurface Soils
Receptor: Utility Worker - 20s Complex

CARCINOGENIC
Risk = CDI x CSF
CDI =Cs x DAF x SA x RDA x EF x ED x CF x 1/BW x 1/ATc

Chemical	Cs Soil Concentration (mg/kg)	DAF Dermal Adherence Factor (mg/cm^2)	SA Surface Area Exposed (cm^2/day)	RDA Relative Dermal Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATc Averaging Time Carcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	CSF Cancer Slope Factor[a] $(mg/kg\text{-}d)^{-1}$	Risk
Benzo(a)pyrene	0.616	0.8	3,300	0.13	5	25	1E-06	70	25,550	1.5E-08	8.2	1.2E-07
Arsenic	9.34	0.8	3,300	0.03	5	25	1E-06	70	25,550	5.2E-08	1.6	8.2E-08
											Total	2.0E-07

NONCARCINOGENIC
HQ = CDI/RfD
CDI =Cs x DAF x SA x RDA x EF x ED x CF x 1/BW x 1/ATnc

Chemical	Cs Soil Concentration (mg/kg)	DAF Dermal Adherence Factor (mg/cm^2)	SA Surface Area Exposed (cm^2/day)	RDA Relative Dermal Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATnc Averaging Time Noncarcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	RfD Reference Dose[b] (mg/kg-d)	HQ Hazard Quotient
Arsenic	9.34	0.8	3,300	0.03	5	25	1E-06	70	9,125	1.4E-07	2.9E-04	5.1E-04
											Total	5.1E-04

a. Cancer slope factor divided by oral absorption factor (89% for PAHs, 95% for arsenic) to derive an adjusted slope factor for dermal contact
b. Reference dose for arsenic multiplied by an oral absorption factor of 95% to derive an adjusted reference dose for dermal contact.

Table 6a. Cancer and Non-Cancer Risks from Commercial Worker Ingestion Exposure to Surface Soil in the 30s Complex

Pathway: Incidental Ingestion of Surface Soils
Receptor: Commercial Worker - 30s Complex

CARCINOGENIC
CSF = CDI x CSF
CDI = Cs x IgR x ROA x EF x ED x CF x 1/BW x 1/ATc

	Cs	IgR	ROA	EF	ED	CF	BW	ATc	CDI	CSF	Risk
Chemical	Soil Concentration (mg/kg)	Ingestion Rate (mg/d)	Relative Oral Absorption (unitless)	Exposure Frequency (d/yr)	Exposure Duration (yrs)	Conversion Factor (kg/mg)	Body Weight (kg)	Averaging Time Carcinogenic (days)	Chronic Daily Intake (mg/kg-d)	Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$	
Benz(a)anthracene	0.966	50	1.0	84	25	1E-06	70	25550	5.7E-08	0.73	4.1E-08
Benzo(a)pyrene	0.99	50	1.0	84	25	1E-06	70	25550	5.8E-08	7.3	4.2E-07
Benzo(b)fluoranthene	0.915	50	1.0	84	25	1E-06	70	25550	5.4E-08	0.73	3.9E-08
Dibenzo(a,h)anthracene	1.43	50	1.0	84	25	1E-06	70	25550	8.4E-08	7.3	6.1E-07
Indeno(1,2,3-cd)pyrene	1.54	50	1.0	84	25	1E-06	70	25550	9.0E-08	0.73	6.6E-08
Arsenic	10.1	50	1.0	84	25	1E-06	70	25550	5.9E-07	1.5	8.9E-07
										Total	2.1E-06

NONCARCINOGENIC
HQ = CDI/RfD
CDI = Cs x IgR x ROA x EF x ED x CF x 1/BW x 1/ATnc

	Cs	IgR	ROA	EF	ED	CF	BW	ATnc	CDI	RfD	HQ
Chemical	Soil Concentration (mg/kg)	Ingestion Rate (mg/d)	Relative Oral Absorption (unitless)	Exposure Frequency (d/yr)	Exposure Duration (yrs)	Conversion Factor (kg/mg)	Body Weight (kg)	Averaging Time Noncarcinogenic (days)	Chronic Daily Intake (mg/kg-d)	Reference Dose (mg/kg-d)	Hazard Quotient
Arsenic	10.1	50	1.0	84	25	1E-06	70	9,125	1.7E-06	3.0E-04	5.5E-03
										Total	5.5E-03

Table 6b. Cancer and Non-Cancer Risks from Commercial Worker Dermal Exposure to Surface Soil in the 30s Complex

Pathway: Dermal Contact with Surface Soils
Receptor: Commercial Worker - 30s Complex

CARCINOGENIC
Risk = CDI x CSF
CDI = Cs x DAF x SA x RDA x EF x ED x CF x 1/BW x 1/ATc

Chemical	Cs Soil Concentration (mg/kg)	DAF Dermal Adherence Factor (mg/cm^2)	SA Surface Area Exposed (cm^2/day)	RDA Relative Dermal Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATc Averaging Time Carcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	CSF Cancer Slope Factor[a] $(mg/kg\text{-}d)^{-1}$	Risk
Benzo(a)anthracene	0.966	0.1	3,300	0.13	84	25	1E-06	70	25,550	4.9E-08	0.82	4.0E-08
Benzo(a)pyrene	0.99	0.1	3,300	0.13	84	25	1E-06	70	25,550	5.0E-08	8.2	4.1E-07
Benzo(b)fluoranthene	0.915	0.1	3,300	0.13	84	25	1E-06	70	25,550	4.6E-08	0.82	3.8E-08
Dibenzo(a,h)anthracene	1.43	0.1	3,300	0.13	84	25	1E-06	70	25,550	7.2E-08	8.2	5.9E-07
Indeno(1,2,3-cd)pyrene	1.54	0.1	3,300	0.13	84	25	1E-06	70	25,550	7.8E-08	0.82	6.4E-08
Arsenic	10.1	0.1	3,300	0.03	84	25	1E-06	70	25,550	1.2E-07	1.6	1.9E-07
											Total	1.3E-06

NONCARCINOGENIC
HQ = CDI/RfD
CDI = Cs x DAF x SA x RDA x EF x ED x CF x 1/BW x 1/ATnc

Chemical	Cs Soil Concentration (mg/kg)	DAF Dermal Adherence Factor (mg/cm^2)	SA Surface Area Exposed (cm^2/day)	RDA Relative Dermal Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATnc Averaging Time Noncarcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	RfD Reference Dose[b] (mg/kg-d)	HQ Hazard Quotient
Arsenic	10.1	0.1	3,300	0.03	84	25	1E-06	70	9,125	3.3E-07	2.9E-04	1.2E-03
											Total	1.2E-03

a. Cancer slope factor divided by oral absorption factor (89% for PAHs, 95% for arsenic) to derive an adjusted slope factor for dermal contact
b. Reference dose for arsenic multiplied by an oral absorption factor of 95% to derive an adjusted reference dose for dermal contact.

Table 7a. Cancer and Non-Cancer Risks from Utility Worker Ingestion Exposure to Subsurface Soil in the 30s Complex

Pathway: Incidental Ingestion of Subsurface Soils
Receptor: Utility Worker - 30s Complex

CARCINOGENIC
CSF = CDI x CSF
CDI = Cs x IgR x ROA x EF x ED x CF x 1/BW x 1/ATc

Chemical	Cs Soil Concentration (mg/kg)	IgR Ingestion Rate (mg/d)	ROA Relative Oral Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATc Averaging Time Carcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	CSF Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$	Risk
Benz(a)anthracene	0.69	137	1	5	25	1E-06	70	25,550	6.6E-09	0.73	4.8E-09
Benzo(a)pyrene	0.684	137	1	5	25	1E-06	70	25,550	6.5E-09	7.3	4.8E-08
Benzo(b)fluoranthene	0.695	137	1	5	25	1E-06	70	25,550	6.7E-09	0.73	4.9E-09
Dibenzo(a,h)anthracene	1.13	137	1	5	25	1E-06	70	25,550	1.1E-08	7.3	7.9E-08
Indeno(1,2,3-cd)pyrene	1.17	137	1	5	25	1E-06	70	25,550	1.1E-08	0.73	8.2E-09
Arsenic	19.3	137	1	5	25	1E-06	70	25,550	1.8E-07	1.5	2.8E-07
										Total	4.2E-07

NONCARCINOGENIC
HQ = CDI/RfD
CDI = Cs x IgR x ROA x EF x ED x CF x 1/BW x 1/ATnc

Chemical	Cs Soil Concentration (mg/kg)	IgR Ingestion Rate (mg/d)	ROA Relative Oral Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATnc Averaging Time Noncarcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	RfD Reference Dose (mg/kg-d)	HQ Hazard Quotient
Arsenic	19.3	137	1	5	25	1E-06	70	9,125	5.2E-07	3.0E-04	1.7E-03
										Total	1.7E-03

Table 7b. Cancer and Non-Cancer Risks from Utility Worker Dermal Exposure to Subsurface Soil in the 30s Complex

Pathway: Dermal Contact with Suburface Soils
Receptor: Utility Worker - 30s Complex

CARCINOGENIC
Risk = CDI x CSF
CDI =Cs x DAF x SA x RDA x EF x ED x CF x 1/BW x 1/ATc

Chemical	Cs Soil Concentration (mg/kg)	DAF Dermal Adherence Factor (mg/cm^2)	SA Surface Area Exposed (cm^2/day)	RDA Relative Dermal Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATc Averaging Time Carcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	CSF Cancer Slope Factor[a] $(mg/kg-d)^{-1}$	Risk
Benz(a)anthracene	0.69	0.8	3,300	0.13	5	25	1E-06	70	25,550	1.7E-08	0.82	1.4E-08
Benzo(a)pyrene	0.684	0.8	3,300	0.13	5	25	1E-06	70	25,550	1.6E-08	8.2	1.3E-07
Benzo(b)fluoranthene	0.695	0.8	3,300	0.13	5	25	1E-06	70	25,550	1.7E-08	0.82	1.4E-08
Dibenzo(a,h)anthracene	1.13	0.8	3,300	0.13	5	25	1E-06	70	25,550	2.7E-08	8.2	2.2E-07
Indeno(1,2,3-cd)pyrene	1.17	0.8	3,300	0.13	5	25	1E-06	70	25,550	2.8E-08	0.82	2.3E-08
Arsenic	19.3	0.8	3,300	0.03	5	25	1E-06	70	25,550	1.1E-07	1.6	1.7E-07
											Total	5.8E-07

NONCARCINOGENIC
HQ = CDI/RfD
CDI =Cs x DAF x SA x RDA x EF x ED x CF x 1/BW x 1/ATnc

Chemical	Cs Soil Concentration (mg/kg)	DAF Dermal Adherence Factor (mg/cm^2)	SA Surface Area Exposed (cm^2/day)	RDA Relative Dermal Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATnc Averaging Time Noncarcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	RfD Reference Dose[b] (mg/kg-d)	HQ Hazard Quotient
Arsenic	19.3	0.8	3,300	0.03	5	25	1E-06	70	9,125	3.0E-07	2.9E-04	1.0E-03
											Total	1.0E-03

a. Cancer slope factor divided by oral absorption factor (89% for PAHs, 95% for arsenic) to derive an adjusted slope factor for dermal contact
b. Reference dose for arsenic multiplied by an oral absorption factor of 95% to derive an adjusted reference dose for dermal contact.

Table 8a. Cancer and Non-Cancer Risks from Commercial Worker Ingestion Exposure to Surface Soils in the 40s Complex

Pathway: Incidental Ingestion of Surface Soils
Receptor: Commercial Worker - 40s Complex

CARCINOGENIC
CSF = CDI x CSF
CDI = Cs x IgR x ROA x EF x ED x CF x 1/BW x 1/ATc

Chemical	Cs Soil Concentration (mg/kg)	IgR Ingestion Rate (mg/d)	ROA Relative Oral Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATc Averaging Time Carcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	CSF Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$	Risk
Benz(a)anthracene	1.84	50	1	84	25	1E-06	70	25,550	1.1E-07	0.73	7.9E-08
Benzo(a)pyrene	1.92	50	1	84	25	1E-06	70	25,550	1.1E-07	7.3	8.2E-07
Benzo(b)fluoranthene	1.73	50	1	84	25	1E-06	70	25,550	1.0E-07	0.73	7.4E-08
Indeno(1,2,3-cd)pyrene	1.9	50	1	84	25	1E-06	70	25,550	1.1E-07	0.73	8.1E-08
Arsenic	11.6	50	1	84	25	1E-06	70	25,550	6.8E-07	1.5	1.0E-06
										Total	2.1E-06

NONCARCINOGENIC
HQ = CDI/RfD
CDI = Cs x IgR x ROA x EF x ED x CF x 1/BW x 1/ATnc

Chemical	Cs Soil Concentration (mg/kg)	IgR Ingestion Rate (mg/d)	ROA Relative Oral Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATnc Averaging Time Noncarcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	RfD Reference Dose (mg/kg-d)	HQ Hazard Quotient
Arsenic	11.6	50	1	84	25	1E-06	70	9,125	1.9E-06	3.0E-04	6.4E-03
										Total	6.4E-03

Table 8b. Cancer and Non-Cancer Risks from Commercial Worker Dermal Exposure to Surface Soils in the 40s Complex

Pathway: Dermal Contact with Surface Soils
Receptor: Commercial Worker - 40s Complex

CARCINOGENIC
Risk = CDI x CSF
CDI = Cs x DAF x SA x RDA x EF x ED x CF x 1/BW x 1/ATc

Chemical	Cs Soil Concentration (mg/kg)	DAF Dermal Adherence Factor (mg/cm^2)	SA Surface Area Exposed (cm^2/day)	RDA Relative Dermal Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATc Averaging Time Carcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	CSF Cancer Slope Factor[a] $(mg/kg-d)^{-1}$	Risk
Benz(a)anthracene	1.84	0.1	3,300	0.13	84	25	1E-06	70	25,550	9.3E-08	0.82	7.6E-08
Benzo(a)pyrene	1.92	0.1	3,300	0.13	84	25	1E-06	70	25,550	9.7E-08	8.2	7.9E-07
Benzo(b)fluoranthene	1.73	0.1	3,300	0.13	84	25	1E-06	70	25,550	8.7E-08	0.82	7.1E-08
Indeno(1,2,3-cd)pyrene	1.9	0.1	3,300	0.13	84	25	1E-06	70	25,550	9.6E-08	0.82	7.9E-08
Arsenic	11.6	0.1	3,300	0.03	84	25	1E-06	70	25,550	1.3E-07	1.6	2.1E-07
											Total	1.2E-06

NONCARCINOGENIC
HQ = CDI/RfD
CDI = Cs x DAF x SA x RDA x EF x ED x CF x 1/BW x 1/ATnc

Chemical	Cs Soil Concentration (mg/kg)	DAF Dermal Adherence Factor (mg/cm^2)	SA Surface Area Exposed (cm^2/day)	RDA Relative Dermal Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATnc Averaging Time Noncarcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	RfD Reference Dose[b] (mg/kg-d)	HQ Hazard Quotient
Arsenic	11.6	0.1	3,300	0.03	84	25	1E-06	70	9,125	3.8E-07	2.9E-04	1.3E-03
											Total	1.3E-03

a. Cancer slope factor divided by oral absorption factor (89% for PAHs, 95% for arsenic) to derive an adjusted slope factor for dermal contact
b. Reference dose for arsenic multiplied by an oral absorption factor of 95% to derive an adjusted reference dose for dermal contact.

Table 9a. Cancer and Non-Cancer Risks from Utility Worker Ingestion Exposure to Subsurface Soils in the 40s Complex

Pathway: Incidental Ingestion of Subsurface Soils
Receptor: Utility Worker - 40s Complex

CARCINOGENIC
CSF = CDI x CSF
CDI = Cs x IgR x ROA x EF x ED x CF x 1/BW x 1/ATc

Chemical	Cs Soil Concentration (mg/kg)	IgR Ingestion Rate (mg/d)	ROA Relative Oral Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATc Averaging Time Carcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	CSF Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$	Risk
Benz(a)anthracene	0.469	137	1	5	25	1E-06	70	25,550	4.5E-09	0.73	3.3E-09
Benzo(a)pyrene	0.471	137	1	5	25	1E-06	70	25,550	4.5E-09	7.3	3.3E-08
Benzo(b)fluoranthene	0.428	137	1	5	25	1E-06	70	25,550	4.1E-09	0.73	3.0E-09
Indeno(1,2,3-cd)pyrene	0.794	137	1	5	25	1E-06	70	25,550	7.6E-09	0.73	5.5E-09
Arsenic	8.79	137	1	5	25	1E-06	70	25,550	8.4E-08	1.5	1.3E-07
										Total	1.7E-07

NONCARCINOGENIC
HQ = CDI/RfD
CDI = Cs x IgR x ROA x EF x ED x CF x 1/BW x 1/ATnc

Chemical	Cs Soil Concentration (mg/kg)	IgR Ingestion Rate (mg/d)	ROA Relative Oral Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATnc Averaging Time Noncarcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	RfD Reference Dose (mg/kg-d)	HQ Hazard Quotient
Arsenic	8.79	137	1	5	25	1E-06	70	9,125	2.4E-07	3.0E-04	7.9E-04
										Total	7.9E-04

Table 9b. Cancer and Non-Cancer Risks from Utility Worker Dermal Exposure to Subsurface Soils in the 40s Complex

Pathway: Dermal Contact with Subsurface Soils
Receptor: Utility Worker - 40s Complex

CARCINOGENIC
Risk = CDI x CSF
CDI =Cs x DAF x SA x RDA x EF x ED x CF x 1/BW x 1/ATc

Chemical	Cs Soil Concentration (mg/kg)	DAF Dermal Adherence Factor (mg/cm^2)	SA Surface Area Exposed (cm^2/day)	RDA Relative Dermal Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATc Averaging Time Carcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	CSF Cancer Slope Factor[a] $(mg/kg-d)^{-1}$	Risk
Benz(a)anthracene	0.469	0.8	3,300	0.13	5	25	1E-06	70	25,550	1.1E-08	0.82	9.2E-09
Benzo(a)pyrene	0.471	0.8	3,300	0.13	5	25	1E-06	70	25,550	1.1E-08	8.2	9.3E-08
Benzo(b)fluoranthene	0.428	0.8	3,300	0.13	5	25	1E-06	70	25,550	1.0E-08	0.82	8.4E-09
Indeno(1,2,3-cd)pyrene	0.794	0.8	3,300	0.13	5	25	1E-06	70	25,550	1.9E-08	0.82	1.6E-08
Arsenic	8.79	0.8	3,300	0.03	5	25	1E-06	70	25,550	4.9E-08	1.6	7.7E-08
											Total	2.0E-07

NONCARCINOGENIC
HQ = CDI/RfD
CDI =Cs x DAF x SA x RDA x EF x ED x CF x 1/BW x 1/ATnc

Chemical	Cs Soil Concentration (mg/kg)	DAF Dermal Adherence Factor (mg/cm^2)	SA Surface Area Exposed (cm^2/day)	RDA Relative Dermal Absorption (unitless)	EF Exposure Frequency (d/yr)	ED Exposure Duration (yrs)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATnc Averaging Time Noncarcinogenic (days)	CDI Chronic Daily Intake (mg/kg-d)	RfD Reference Dose[b] (mg/kg-d)	HQ Hazard Quotient
Arsenic	8.79	0.8	3,300	0.03	5	25	1E-06	70	9,125	1.4E-07	2.9E-04	4.8E-04
											Total	4.8E-04

a. Cancer slope factor divided by oral absorption factor (89% for PAHs, 95% for arsenic) to derive an adjusted slope factor for dermal contact
b. Reference dose for arsenic multiplied by an oral absorption factor of 95% to derive an adjusted reference dose for dermal contact.

Table 10. Input Parameters and Results for the ALM Model for Lead Exposure Using Site-Specific Soil Concentrations

Calculations of Blood Lead Concentrations (PbBs)
U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 8/14/01

Exposure Variable	Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario	
			Low Range	High Range
PbS	Soil lead concentration	ug/g or ppm	274	274
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4
PbB_0	Baseline PbB	ug/dL	1.4	1.8
GSD_i	Geometric standard deviation PbB	--	1.9	2.3
IR_S	Soil ingestion rate	g/day	0.050	0.050
$AF_{S,D}$	Absorption fraction	--	0.12	0.12
$EF_{S,D}$	Exposure frequency	days/yr	219	219
$AT_{S,D}$	Averaging time	days/yr	365	365
PbB_{adult}		**ug/dL**	**1.8**	**2.2**
$PbB_{fetal,\ 0.95}$		**ug/dL**	**4.6**	**7.8**
PbB_t		**ug/dL**	**10.0**	**10.0**

Source: http://www.epa.gov/superfund/programs/lead

Equation 1, based on Eq. 1, 2 in USEPA (1996).

PbB_{adult} =	$(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_S/AT_{S,D}) + PbB_0$
$PbB_{fetal,\ 0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$