EIELSON AIR FORCE BASE OU-1
BASELINE RISK ASSESSMENT

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EXECUTIVE SUMMARY

This Baseline Risk Assessment report is the second volume in a set of three volumes for Operable Unit 1 (OU-1). The companion documents contain the Remedial Investigation and the Feasibility Study.

Operable Unit 1 (OU-1) is one of several groups of hazardous waste sites located at Eielson Air Force Base (AFB) near Fairbanks, Alaska. Eielson AFB, built in the 1940s, is approximately 7,802 hectares (19,270 acres) in size. The Base is an active military facility and includes a residential housing area for military personnel and their dependents. However, with the exception of personnel quarters at the Blair Lakes Range, no housing is located on or near any of the OU-1 source areas. The operable units at Eielson are typically characterized by petroleum, oil, lubricant/solvent contamination, and by the presence of organics floating at the water table. Within OU-1 there are six distinct source area groupings, identified as ST20E-7, ST20E-8, ST20E-9, ST48, ST49, and ST50, ST51, ST52, ST53 and DP54 (Blair Lakes Range).

In 1989 and 1990, firms under contract to the Air Force conducted field studies to gather information about the extent of chemical contamination in soil, groundwater, and soil air pore space (soil gas) at the site. This report documents the results of a baseline risk assessment, which uses the 1989 and 1991 site characterization database to quantify the potential human health risk associated with past Base industrial activities in the vicinity of OU-1. Background data collected in 1992 were also used in the preparation of this report. Data from the 1993 sampling and analysis program have only recently become available. Therefore formal quantitative risk calculations on the 1993 data are not contained in this report. The 1993 analytical results are summarized in a companion document, Remedial Investigation (RI), Volume 1, (U.S. Air Force 1993b). The reader is referred to the RI for site characterization information based on the 1993 field investigation results. Analytical results as presented in the RI were reviewed and are discussed qualitatively in this report.

The methodological approach used for the Eielson AFB baseline risk assessment for OU-1 is given in the Remedial Investigation/Feasibility Study

Operable Unit 1 Management Plan (U.S. Air Force, 1993). This baseline risk assessment adheres to the work plan description. Every chemical analyte detected in the 1989 and 1991 sampling programs that might contribute to the risk (cancer risk $>10^{-7}$ or a hazard quotient of >0.1) at any source area was carried through the risk quantification process. Both a cancer risk and a hazard index were calculated for each OU-1 source area for a variety of assumed exposure pathways and exposure parameters. Three land uses were considered: current industrial, future industrial, and future residential. Each land use examines two source terms: an average exposure and a reasonable maximum exposure.

The Executive Summary tables presents the total cancer risk and hazard indices across all pathways for each OU-1 source area. Table ES.1 presents the results for the current industrial land use; Table ES.2 hypothesizes a conservative future residential land use scenario; and Table ES.3 presents the future industrial land use case. The current industrial land use assumes that contaminated groundwater is not presently used. Although the scenarios use different exposure assumptions, the calculated risks and hazard indexes for the future industrial land use and the future residential land use are close. The reason for this similarity is that both land uses assume that contaminated groundwater will be utilized and the groundwater medium is the predominant contributor to risk.

Regulatory agencies have not agreed on a single level of "acceptable" excess individual lifetime cancer risk or on the toxicological hazard expression (the hazard index). However, it is generally accepted that the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) post-remediation excess cancer risk goal should fall within the range of 10^{-4} to 10^{-6} . A rule of thumb is that a hazard index of equal to or less than one (1) denotes that a given site does not present a health hazard concern. The risks and hazard indices presented in Tables ES.1, ES.2, and ES.3 may be compared to the cited regulatory guidance.

TABLE ES.1. Total Pathway Risk Values for Operable Unit 1,
Current Industrial Land Use

Source Area	Average Exposure Source Term	
	Total Cancer Risk	Total Exposure Hazard Index
ST20E-7	1.0E-05	0.0
ST20E-8	6.0E-08	0.0
ST20E-9	7.6E-08	0.0
ST48	No carcinogens detected.	0.0
ST49	2.3E-07	0.0
Blair Lakes	4.1E-08	0.0
Source Area	Reasonable Maximum Exposure Source Term	
	Total Cancer Risk	Total Exposure Hazard Index
ST20E-7	1.8E-04	0.0
ST20E-8	2.7E-07	0.0
ST20E-9	4.1E-07	0.0
ST48	No carcinogens detected.	0.0
ST49	1.4E-06	0.0
Blair Lakes	6.5E-07	0.0

TABLE ES.2. Total Pathway Risk Values for Operable Unit 1,
Future Residential Land Use

Source Area	Average Exposure Source Term	
	Total Cancer Risk	Total Exposure Hazard Index
ST20E-7	6.5E-04	6.3
ST20E-8	1.8E-04	47.3
ST20E-9	1.6E-06	2.5
ST48	3.0E-04	2.7
ST49	9.0E-05	2.3
Blair Lakes	1.6E-04	14.6

Source Area	Reasonable Maximum Exposure Source Term	
	Total Cancer Risk	Total Exposure Hazard Index
ST20E-7	1.5E-02	18.4
ST20E-8	1.9E-03	767.9
ST20E-9	7.7E-06	40.8
ST48	7.6E-03	53.6
ST49	6.6E-04	4.9
Blair Lakes	2.5E-03	91.7

**TABLE ES.3. Total Pathway Risk Values for Operable Unit 1,
Future Industrial Land Use**

Source Area	Average Exposure Source Term	
	Total Cancer Risk	Total Exposure Hazard Index
ST20E-7	1.0E-04	4.2
ST20E-8	1.5E-04	1.6
ST20E-9	1.4E-06	2.3
ST48	2.5E-04	18.1
ST49	6.1E-05	1.5
Blair Lakes	1.1E-04	10.0

Source Area	Reasonable Maximum Exposure Source Term	
	Total Cancer Risk	Total Exposure Hazard Index
ST20E-7	6.9E-04	8.1
ST20E-8	1.0E-03	14.0
ST20E-9	4.4E-06	28.1
ST48	4.0E-03	23.6
ST49	2.4E-04	1.9
Blair Lakes	8.4E-04	39.9

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1.0 INTRODUCTION

This Baseline Risk Assessment report is the second volume in a set of three volumes for Operable Unit 1 (OU-1). The companion documents contain the Remedial Investigation and the Feasibility Study. Operable Unit 1 (OU-1) is one of several groups of hazardous waste sites located at Eielson Air Force Base (AFB) near Fairbanks, Alaska (Figure 1.1 Regional Location Map). Eielson AFB was built in the 1940s and is approximately 7,802 hectares (19,270 acres) in size. The Base is an active military facility and includes a residential housing area for military personnel and their dependents. However, with the exception of personnel temporary living quarters at the Blair Lakes Range, no housing is located on or near any of the OU-1 source areas. (Blair Lakes Range is a remote facility with no public access; crews work one week out of four at this facility.) The operable units at Eielson AFB are typically characterized by petroleum, oil, lubricant/solvent contamination, and the presence of organics at the water table. The operable units are being evaluated through the Remedial Investigation and Feasibility Study (RI/FS) process to a Record of Decision (ROD). The RI/FS is being performed under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (Referred to as "Superfund") 40 CFR Part 300 Section 120, under the section that applies to Federal facilities. The health and environmental risk assessment process is mandated by CERCLA. This report consolidates under one cover the results of six separate risk assessments, i.e., one risk assessment for each of the six OU-1 subdivisions (or source areas): ST20 E-7, ST20 E-8, ST-20 E-9, ST48, ST49, ST50, ST51, ST52, ST53 and DP54 (Blair Lakes Range).

Field studies were conducted by firms under contract to the Air Force in 1989, 1991, 1992, and 1993 to gather information about the extent of chemical contamination in soil, groundwater, and soil air pore space (soil gas) at the site. Data from the 1993 sampling and analysis program have only recently become available. Therefore, formal quantitative risk calculations on the 1993 data are not contained in this report. The 1993 analytical results are summarized in a companion document, Remedial Investigation (RI), Volume 1, (U.S. Air Force 1993b). The reader is referred to the RI for site characterization information based on the 1993 field investigation results.

FIGURE 1.1. Regional Location Map, Eielson AFB, Alaska

Analytical results from 1993, as presented in the RI, were reviewed and are discussed qualitatively in the baseline risk assessment report.

This Baseline Risk Assessment reports the results of a baseline risk assessment, which uses the 1989 and 1991 site characterization database to calculate a source term and to quantify the potential human health risk associated with past Base industrial activities in the vicinity of OU-1. Background data collected in 1992 were also used in the preparation of this report (U.S. Air Force 1992a, 1992b).

The methodological approach used for the Eielson AFB baseline risk assessment for OU-1 is given in the Remedial Investigation/Feasibility Study Operable Unit 1 Management Plan (U.S. Air Force, 1993). This baseline risk assessment adheres to the work plan description. All chemical analytes detected in the 1989 and 1991 sampling programs that might contribute to the risk (cancer risk $>10^{-7}$ or a hazard quotient of >0.1) at any source area was carried through the risk quantification process. Both a cancer risk and hazard index were calculated for each OU-1 source area assuming a variety of exposure pathways and exposure parameters. Three land uses were considered: current industrial, future industrial, and future residential. Each land use examines two source terms: an average exposure (AE) and a reasonable maximum exposure (RME).

The current industrial land use assumes that contaminated groundwater is not presently used. Although the scenarios use different exposure assumptions, the calculated risks and hazard indexes for the future industrial land use and the future residential land use are close. The reason for this similarity is that both land uses assume that contaminated groundwater will be utilized and the groundwater medium is the predominant contributor to risk.

1.1 PURPOSE OF THE BASELINE RISK ASSESSMENT PROCESS

A baseline risk assessment is performed on the assumption that no cleanup actions will be taken to remediate the site or contain the spread of contamination. Current land use conditions are examined as are future hypothetical conditions. Exposure pathways are postulated and screened. Exposure, dose, and risk to receptor populations are quantified.

This baseline risk assessment is designed as a resource to help answer the following questions: (1) Do any of the defined source areas pose an immediate threat to human health? (2) Do any of the defined source areas require further characterization via a supplemental remedial investigation (RI) and/or a feasibility study (FS) under CERCLA? and (3) Which of the defined source areas pose an acceptable/unacceptable long-term risk to worker and public health and require further/no further regulatory consideration under CERCLA? The CERCLA process is intended to address both human health and the ecological concerns. However, the focus of the OU-1 baseline risk assessment presented in this report is on human health issues. A Base-wide ecological assessment is planned for 1994 and will focus on the need for remediation from an ecological perspective.

1.2 METHODOLOGY AND FORMAT OF THE RISK ASSESSMENT REPORT

The methodological approach used for the Eielson AFB baseline risk assessment for OU-1 is given in the Remedial Investigation/Feasibility Study Operable Unit 1 Management Plan (U.S. Air Force 1993). This baseline risk assessment adheres to the work plan description.

In conducting a risk assessment, assumptions are made that influence estimates of potential exposure (and risk). Many assumptions are default and are used by convention. Others require judgement based on site-specific information (e.g., data quality, meteorology, residence time, etc.).

The methodology used for this baseline risk assessment is consistent with that described in the following United States Environmental Protection Agency (U.S. EPA) guidance and advisories:

- EPA Risk Assessment Guidelines (51 FR 33992, 51 FR 34014, 51 FR 34042).
- Risk Assessment Guidance for Superfund: Volume 1, Human Health Evaluation Manual (U.S. EPA 1989a).
- Exposure Factors Handbook (U.S. EPA 1989b).
- Supplemental Guidance for Superfund Risk Assessments in Region 10 (U.S. EPA 1991a).

- Supplemental Guidance for Superfund Risk Assessments in Region 10 (U.S. EPA 1991a).
- Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors (U.S. EPA 1991b).
- Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions, OSWER Directive 9355.0-30 (U.S. EPA 1991c).

Additional guidance documents, reports, and references consulted in the preparation of this risk assessment are listed in Section 10.0, References. The baseline risk assessment makes the following major assumptions:

- No remedial actions are taken.
- There is a potential for future development of the site under reasonably expected land-use conditions.

This site-specific risk assessment contains four basic elements. These are 1) data collection and evaluation, 2) exposure assessment, 3) toxicity assessment, and 4) risk characterization. These four elements constitute the major report topics addressed in the baseline risk assessment. In addition to the four elements, other steps are added to prepare the risk assessment in the context of a site-specific document. Additional steps include the preparation of a composite list of all chemical analyses collected in previous site investigations and sampling campaigns, the development of a conceptual site model, and the production of an uncertainty analysis qualitatively describing site-specific and toxicity assessment uncertainties.

The purposes of the four elements and the associated work performed for the baseline risk assessment (by element) are described in the following paragraphs.

1.2.1 Data Collection and Evaluation

The first step of the risk assessment process is as follows.

- o Data Collection and Evaluation involves gathering and analyzing the site and source data relevant to the human health evaluation and identifying the substances present at the site that are the focus of the risk-assessment process.

The Data Collection and Evaluation step of the risk assessment includes a review of all available site and source information (existing at the start

of the risk assessment), such as historical records, the CERCLA Hazard Ranking System documentation, information on the amounts of hazardous substances potentially disposed of, waste source characteristics, background levels of chemicals at the site, land-use planning, and source characteristics.

A composite list of the chemical analytical results from soil and groundwater data collected in the 1989 and 1991 investigations form the OU-1 site characterization database on which this baseline risk assessment is based. These data are examined and discussed in Section 8.0, "Identification of Chemicals of Concern." The database in its totality is presented in Appendix D, "Chemical Concentrations and Monitoring Data." Appendix Tables D.1 through D.7 include all analytes tested and their frequency of detection. Appendix Tables D.8 through D.12 include all analytes, sampled by source area, that were detected at least once (within the source area). These tables also list the reported concentration and the analytical detection limit for each analyte.

The pore space of soils (soil gas) was also sampled at the OU-1 source areas, and the chemical analytical results are presented in Appendix D. These soil gas data are also termed "air gas" and abbreviated as "AG" in Appendix D. The air or soil gas data are a useful qualitative aid for identifying potential hot spots of contamination in the subsurface, and for siting groundwater monitoring wells. No sampling and analysis details accompany the air gas data results; therefore, their quantitative interpretation is speculative. The air gas data do not measure, directly or indirectly, any human exposure pathway or condition. For example, air gas data do not approximate ambient air, residential basement air, trench or pit exposure conditions, or confined space air. Furthermore, it is doubtful that a person would be exposed to these air concentrations directly, in a nondispersed fashion (except perhaps when unlocking/opening a monitoring well head to collect a groundwater sample). The data indicate that any floating product is likely off-gassing volatile organics (such as benzene) which build up in the soil pore spaces. The presence of volatile organics, however, was not confirmed in subsurface soil samples collected from locations assumed to be in close proximity to the air gas samples. This is a qualitative interpretation of the data which indicates that significant hot spots of contamination are present. However, the human

was postulated and examined by modeling the volatilization of chemical contaminants in soil and their release into ambient air and the breathing zone.

A composite list of all analytes detected at least once in any medium is screened to a shorter list of chemicals of potential concern, i.e., toxic contaminants that may be related to past waste activities at the site. The shorter lists are presented by source area in Tables 2.2, 3.2, 4.2, 5.2, 6.2, and 7.2, and retained for subsequent quantitative risk analysis. The "closure" methodology employed to screen all detected analytes and retain chemicals of potential human health concern for subsequent risk quantification is described in Section 8.0, "Identification of Chemicals of Potential Concern." Tables 8.1 through 8.12 list each detected analyte, the medium in which detected, its average concentration, the maximum detected concentration, the 95% upper confidence limit concentration, and, if applicable, the reason the analyte was removed from subsequent risk quantification in the risk assessment. The "closure" process systematically considers and documents every chemical analytical value reported to ascertain if it is site-related and to assess its potential significance to public health.

Table 8.13, "Risk-Based Cutoff Concentrations for Contaminants of Concern," presents the groundwater and soil screening values used to assess the toxicological significance of a detected analyte. The chemical concentrations equate to an excess cancer risk of 10^{-6} for groundwater, 10^{-7} for soil, and a hazard quotient of 0.1 in both media.

Appendix E, "Determination of Background Metal Concentrations," presents a summary of available information on the occurrence and distribution of metals in local natural background.

Sections 2.0 through 7.0 contain the conceptual site models for each respective source area developed from the Data Collection and Evaluation step. Site-specific information on waste sources, waste chemistry, release mechanisms, receiving media, and routes of contaminant migration at the site are examined to develop a conceptual understanding of the site. The conceptual site model identifies potential or suspected sources of contamination, types

site model identifies potential or suspected sources of contamination, types and concentrations of contaminants detected, and potentially contaminated media.

1.2.2 Exposure Assessment

Identification of potential exposure pathways, potential receptors especially the exposure points, is a key element in the determination of potential risks to human health and the environment. Therefore, the second step is as follows.

- o Exposure Assessment analyzes contaminant releases, identifies exposed populations, identifies potential exposure pathways, estimates exposure point concentrations for pathways, and estimates contaminant intakes for pathways. An exposure assessment is conducted to estimate the magnitude of actual and/or potential human exposure, the frequency and duration of these exposures, and the pathways by which humans are potentially exposed. In the exposure assessment, reasonable maximum and average estimates of exposure are developed for both current and future land-use assumptions. Current exposure estimates are used to determine whether a threat exists based on existing exposure conditions at the site. Future exposure estimates are used to provide decision-makers with an understanding of potential future exposures and threats and include a qualitative estimate of the likelihood of such exposures occurring.

The Exposure Assessment step analyzes potential contaminant releases, identifies potentially exposed populations, identifies all potential pathways of exposure, estimates exposure point concentrations of chemicals of concern in media by source area, and estimates intakes for specific pathways. In Sections 2.2, 3.2, 4.2, 5.2, 6.2, and 7.2, "Exposure Assessment," all theoretical current and future human exposure pathways are postulated and then successively screened to determine which are important to assess quantitatively. The pathway screening (summarized in Tables 2.1, 3.1, 4.1, 5.1, 6.1, and 7.1) is qualitative in nature and designed to rule out pathways with a low probability of occurrence. The screening criteria include site-specific considerations such as current and anticipated land use and the nature and concentration of the chemicals detected in various environmental media.

For OU-1 the most important exposure pathways are associated with groundwater and the soil media. Surface and subsurface soil exposure is assumed to occur in an industrial or residential setting. Potential exposures

to subsurface soils are assumed to occur to utility workers through a trenching scenario.

Exposure to volatile compounds and particulate emissions transferred through the air pathway are also examined. The surface-water and sediment exposure pathways are not quantified because there are no useable surface-water bodies encompassed by OU-1. In addition, no data indicate that surface-water bodies have been impacted by site contamination.

The groundwater exposure scenario assumes current and future residential use of the aquifer underlying the base. Existing information indicates that the main Base has a single aquifer, which serves as its current source of drinking water. Exposure point concentrations for assumed future conditions are based on the direct measurement of current concentrations at source-area monitoring wells or at other nearby groundwater monitoring points. This assessment assumes that concentrations will not diminish over the assumed exposure duration.

In addition to these pathways, dermal exposure and its associated risk are quantified for chemicals having dermal-permeability constants. When dermal-permeability constants are not available in the literature, default values (i.e., the water-permeability constant) are used as suggested in U.S. EPA guidance. No toxicity values are usually available for the dermal route; therefore, oral toxicity values are sometimes used as surrogates.

The data are presented, analyzed statistically, and summarized in the context of exposure source terms in the sections entitled "Exposure Point Concentrations of Chemicals of Concern." The exposure point concentrations (or source terms) of chemicals of concern at the receptor locations are presented by site source area. Exposure parameters that describe the receptor, exposure duration, and exposure magnitude are compiled in Appendix B, "Exposure Factors."

Certain assumptions in the risk assessment rely on information that is specific to conditions at the Base. For example, exposure at the Base is less frequent than EPA's standard default exposure assumption (e.g., 350 days/yr for surface-soil ingestion) due to climatic conditions, snow cover, and/or length of residence time.

The results of the exposure assessment are pathway-specific intakes for current and future exposures to individual substances for use in the Risk Characterization step.

The methodology used to calculate the receptor's exposure/dose and resulting risk is shown in Appendix A, "Risk Calculation Spreadsheets and Formulas." The primary risk calculations for all source areas are presented in Appendix A. These primary risk calculations are summarized and presented in their respective source area sections: ST20 E-7 in Tables 2.3-2.5; ST20 E-8 in Tables 3.3-3.5; ST20 E-9 in Tables 4.3-4.5; ST48 in Tables 5.3-5.5; ST49 in Tables 6.3-6.5; and Source Areas 50-54 (Blair Lakes) in Tables 7.3-7.5.

1.2.3 Toxicity Assessment

The third step in the risk assessment process is as follows.

- o Toxicity Assessment collects qualitative and quantitative toxicity information and determines appropriate toxicity values. The Toxicity Assessment component of the baseline risk assessment considers the following: types of adverse health effects associated with chemical exposures, the relationship between the magnitude of exposure and adverse effects, and uncertainties such as the weight-of-evidence of a particular chemical's carcinogenicity in humans.

Toxicity is dependent on the dose or concentration of the substance (i.e., the dose-response relationship). A toxicity value is a quantitative expression of the dose-response relationship for a chemical. Toxicity values are used, in conjunction with exposure estimates, to quantify potential risks.

Section 9.0 documents the Toxicity Assessment for the risk assessment. Table 9.1, "Toxicity Data," presents the toxicity values that are used in subsequent risk calculations. Also identified are reference doses for non-carcinogens and cancer potency (slope) factors for carcinogens used in the risk calculations. An assessment is made of the toxicological significance of the chemicals of concern. For example, are the detected chemicals carcinogens or noncarcinogens?

As noted in Table 9.1, two primary reference sources for toxicity values were used to prepare the baseline risk assessment. The primary source is EPA's Integrated Risk Information System (IRIS) on-line database. If a

toxicity value was not available through IRIS, then the latest available update of the Health Effects Assessment Summary Tables (HEAST) was consulted as a secondary source. In the absence of toxicological data approved by EPA, values were derived from available biological studies.

When toxicity values were absent in these two regulatory sources, assumptions (described in the footnotes to Table 9.1) were made concerning the potential toxicity and carcinogenicity of chemicals of potential concern. For example, a reference dose for total petroleum hydrocarbons was developed.

1.2.4 Risk Characterization

The fourth and final step in the risk assessment process is as follows.

- o Risk Characterization summarizes and combines outputs of the exposure and toxicity assessment to characterize baseline risk, both in quantitative expressions and qualitative statements. This step characterizes the potential for adverse health or environmental effects to occur under the conditions of exposure defined in the exposure assessment.

The risk characterization takes the predicted exposure point concentration and estimates a receptor's exposure, intake, and dose. From the dose, an associated risk is calculated. The risks due to exposure to chemicals are expressed as carcinogenic (nonthreshold) and noncarcinogenic (threshold) effects and are calculated and presented separately. The ultimate purpose of the risk characterization is to present the risk manager(s) with information that will contribute to making decisions regarding remediation. The risk characterization makes conclusions about the nature and magnitude of the risk and specifies the assumptions used.

Regulatory agencies have not agreed to a single level of "acceptable" excess individual lifetime cancer risk or the toxicological hazard expression (the hazard index). However, it is generally accepted that the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) post-remediation excess cancer risk goal should fall within the range of 10^{-4} to 10^{-6} . A rule of thumb is that a hazard index of less than or equal to one (1) denotes that a given site does not present a health hazard concern.

In this baseline risk assessment, human health risks are presented by site source area in the respective "Risk Characterization" subsections.

Appendix A presents the overall risk characterization methodology used in this report, including a description of the computational methods used to calculate chemical exposure, intake, dose, and associated risk, and the primary risk calculation results. Appendix B lists the human exposure factors and their references.

1.3 UNCERTAINTY

Uncertainty is an inherent part of the overall risk-characterization process. A quantitative uncertainty analysis and/or sensitivity analysis is outside of the scope of this report. However, the topic is discussed qualitatively in the following text.

There is uncertainty in the numerical results presented in this (or any risk assessment), and such uncertainty has many causes. For example, the sampling program may not have adequately characterized site contamination. In directed, rather than random, sampling there is a likelihood of biasing toward higher concentrations, i.e., collecting samples in areas of likely or known contamination. There is also an inherent error in collecting, packaging, and shipping a representative environmental sample. Although the 1993 data were examined qualitatively in this risk assessment, the environmental data that form the source terms were collected in 1989 and 1991. Current conditions at the source areas may be different than represented by the database utilized because of contaminant migration, chemical degradation, biological activity, dilution, and source control. There is inherent error in the accuracy, reproducibility, and precision of the chemical analyses reported by the laboratory. In addition, contaminants can be introduced into the sample in the analytical laboratory. Common laboratory contaminants include acetone, methylene chloride, and phthalates. The exposure models used to approximate ambient conditions and estimate exposure and dose to a receptor have error imbedded in the process. In addition, there are varying levels of uncertainty in the numerical toxicity values that are extrapolated from animal studies.

Despite all this uncertainty, however, these toxicity values are frequently reported in regulatory references to four significant figures, implying a very high level of accuracy. Regulatory convention mandates that

toxicity values be used as reported. Therefore, reported toxicity values are not rounded or modified for use in this report. The risk calculations presented herein, however, are rounded. Individual pathway risks are reported to no more than three significant figures, while combined pathway risks are reported to no more than two significant figures. This reporting practice also implies a higher level of accuracy than may be justified. The "true" level of accuracy and/or the error bar around the risk values presented is not known, and no estimate is made herein. In some instances, a hazard index is reported as "0.0," implying that the calculated value is less than 0.0. The analytical data, exposure modeling, and toxicity data are inputs to the risk calculations, and these also, therefore, reflect an intrinsic uncertainty or error.

In spite of all the uncertainties, however, the CERCLA-type risk assessment process contains underlying assumptions designed to err on the side of public health by overestimating, rather than underestimating, risk.

As a result, the risk assessments such as this one, performed according to regulatory guidance, are believed to represent the likely upper bound risk values. In short, the risks will not likely be more than those reported.

Site-specific limitations and uncertainties and considerations are presented by source area in their respective sections.

1.4 OPERABLE UNIT-1 DESCRIPTION

Potential source areas at Eielson AFB were initially grouped into operable units based on similar waste or source characteristics, or similar contaminants. Potential source areas within OU-1 were grouped together because they have nonaqueous-phase petroleum (floating product) contamination. The source areas within OU-1 include the following:

- ST20--Aircraft Refueling Loop
- ST48--the AFB Utility Power Plant vicinity
- ST49--Building 1300, near the runway
- SS50--Blair Lakes Vehicle Maintenance
- SS51--Blair Lakes Ditch

- SS52--Blair Lakes Diesel Spill
- SS53--Blair Lakes Fuel Spill
- DP54--Blair Lakes Drum Disposal Site.

The locations are shown in Figure 1.2 "Source Area Locations in Operable Unit 1," and Figure 1.3 "Source Areas at the Blair Lake Facility."

Source Area ST20 has three discrete areas of contamination: the E-7, E-8, and E-9 Refueling Complexes. These three ST20 complexes are examined separately, and risk calculations for each are presented separately in this baseline risk assessment. Source Areas 48 and 49 are also examined separately, and risk calculations are performed separately for each of these two distinct source areas.

Study locations SS50, SS51, SS52, SS53, and DP54, located at the Blair Lakes Target Range facility, are addressed together as a group. The locations are grouped because of their close geographical proximity to one another and small overall size. The locations encompass a total area less than 0.75 hectare (1.8 acres). The group is referred to in this assessment by any of the following synonyms: "Source Areas ST50-54," "ST50," or "Blair Lakes." The Blair Lakes study locations are situated approximately 40 kilometers southwest of the main Eielson AFB.

1.5 RATIONALE FOR DATA GROUPINGS

Appendix D presents the chemical analytical data from the 1989 and 1991 OU-1 sampling programs. This is the database used in the risk assessment. Data samples, by medium, grouped to define the six OU-1 source areas are presented as follows; Table D.7 for ST20 E-7, Table D.8 for ST20 E-8, Table D.9 ST20 E-9, Table D.10 for ST48, Table D.11 for ST49, and Table D.12 for Blair Lakes Range.

Tables D.7 to D.12 present the concentrations of every chemical analyte detected at least once in any medium sorted by source area. In addition, the tables list the sample number, the U.S. EPA "U" (undetected) qualifier, and one-half of the detection level. If the sample is reported as nondetected, one-half of the detection level is used in the statistical analysis.

FIGURE 1.2. Source Area Locations in Operable Unit 1

FIGURE 1.3. Source Areas at the Blair Lakes Facility

In the tables, the first row (corresponding to the first occurrence of each analyte, by medium) also reports the average value, the maximum detected value, and the 95% upper confidence limit (UCL) for all reported results of that analyte for that medium.

The rationale for selecting data and grouping it to represent each OU-1 source area's groundwater and soil contamination is described in the following. The groundwater underlying a given source area was represented by grouping all data from all monitoring wells located in close proximity to the areas of known floating product, with all data from wells in the likely downgradient direction of floating product (or other source of contamination). Wells upgradient of the source area or floating product were not included in this group, unless these wells were located immediately outside the likely floating product boundary. Data from wells included in each source area group were averaged, and the 95% UCL was calculated and reported, along with the maximum detected value for the group. This statistical grouping design was chosen to approximate the most likely concentrations of contaminants in the block of groundwater underlying each source area. Every data point, including data collected from the same wells at different times, was treated as an independent value, i.e., no average well value, nor average value by year, was calculated. In total about 2% of the database results were eliminated because they were deemed to fall outside of the OU-1 source areas or their respective migration pathways.

Soil data were grouped by the geographical boundary for each source area. Typically, soil samples at OU-1 are spaced closely to the known or suspected source of contamination in a given source area. This sampling design is deterministic rather than random, and may result in biasing the data toward higher values of central tendency. (Deterministic sampling is directed at sampling where contamination is most likely to be found.) The chemical analytical database does not designate the depth at which the soil samples were collected. Therefore, in defining the groups, surface soil data are pooled with subsurface soil data. All soil samples are treated statistically as independent values, regardless of when the sample was taken. The calculated average concentration value and the 95% UCL used as the exposure source

terms (or exposure point concentrations) are designed to represent the soil profile as a whole across a given OU-1 source area.

In this risk assessment, there is no difference in the source terms (exposure point concentrations) used for the current or future land-use risk calculations. In other words, it is anticipated that all receptors will be exposed to the same groundwater or soil contaminant concentrations. The difference in current and future scenarios calculated in this risk assessment is that the exposure pathways and exposure parameters are expected to be dissimilar. The average exposure is based on the average concentration, while the reasonable maximum exposure (RME) is based on the 95% UCL, unless the group consists of 5 or fewer data points. In this event, the maximum detected value is used to represent the exposure point concentration of the RME. The maximum detected value is also used for the RME exposure point concentration if the 95% UCL exceeds the maximum detected value.

2.0 SOURCE AREA ST20: E-7 COMPLEX

The Source Area ST20 E-7 Complex is one of three refueling complexes located at the west end of the Refueling Loop at the southeast end of the airport runways (see Figure 1.2, "Source Area Locations in Operable Unit 1"). Source Area ST20 has three contaminated areas: the E-7, E-8, and E-9 refueling complexes. The E-7 Complex consists of the asphalt pad centered along the taxiway with adjacent unpaved areas of gravel and grass. The complex is served by a fuel pump house (Building 1315), three 19,000-L JP-4 underground storage tanks (UST), one 95,000-L defueling UST, and several fueling and defueling transfer pipes. The area around the pump house and buried tanks is covered with gravel and grass. A large area enclosed by the taxiway loop, north of the E-7 Complex, contains several ponds with dense willow and birch growth and tall grass. Garrison Slough is approximately 300 m southwest of the E-7 Complex. The relationship of the E-7 Complex to the other two ST20 complexes is shown in Figure 2.1, "Source Area ST20."

2.1 CONCEPTUAL SITE MODEL

A conceptual site model was originally developed based on the results of previous investigations reported in the Remedial Investigation/Feasibility Study Operable Unit 1 Management Plan (U.S. Air Force 1993a). The conceptual site model was subsequently updated based upon the Eielson AFB, Alaska, Operable Unit 1, Draft Remedial Investigation (RI) Report, Volume 1: Text and Appendices, August 1993 (U.S. Air Force 1993b, Volume 1). The reader is referred to the RI for the most current site-characterization information.

The components of the conceptual site model include geology, hydrogeology, and the nature and extent of contamination in soil and groundwater. The chemical contamination at this source area includes groundwater contamination, soil contamination, and secondary contamination of the ambient air via vaporization of volatile contaminants in the soils and groundwater.

FIGURE 2.1. Source Area ST20

2.1.1 Geology and Hydrogeology

At a depth of 2.5 m to 3 m the near-surface geology consists of a variety of lithologies including silty gravel, sandy gravel, gravelly sand, sand, and silty sand. Permafrost has not been encountered during previous subsurface investigations. Groundwater has been encountered at depths between 1.7 m and 2.6 m BGS.

Given the downgradient location of the Refueling Loop ponds, there is a potential for interaction between surface water in the pond and groundwater beneath the E-7 Complex. A 1993 Air Force Technical memo (U.S. Air Force 1993c) confirms that there is groundwater discharge to surface water at ST20 and that the Refueling Loop ponds are the result of a high water table. In addition, the groundwater plumes of lighter-molecular-weight petroleum constituents are moving toward the surface water. However, there are no data to indicate contamination present near or in the surface-water ponds (U.S. Air Force 1993b). In addition, the ponds are in a restricted area, inaccessible, and are not used for recreational purposes or industrial purposes, such as for cooling or fire-suppression water. Therefore, the risk from exposure via the surface-water pathway is not considered plausible and is not quantified in the risk assessment.

A detailed discussion of the geology and hydrogeology at the ST20 E-7 complex is described in the Eielson AFB, Alaska, Operable Unit 1, Draft Remedial Investigation (RI) Report, Volume 1: Text and Appendices, August 1993 (U.S. Air Force 1993b). The reader is referred to the RI for the most current information. The results of a field investigation conducted in May 1993 are contained in the RI and include monitoring-well water levels and measurements of floating-product thicknesses.

2.1.2 Groundwater Contamination

Groundwater contamination at this source area is thought to have originated from several sources. The major contributor to ground-water contamination was a leak in the underground fuel piping system. The floating product (an approximate volume of 2000 m³ in 1989) is centered at a 90° bend in the piping system located approximately 60 m southwest of the pumphouse. Because the leak occurred underground, the soils above the floating product

were not directly contaminated. A second source of groundwater contamination may have been surface spills of waste solvents and de-icers.

The floating product consists of two physically distinct phases: a water-soluble phase and a relatively non-water-soluble phase. The water-soluble chemical components of the floating product dissolve into the groundwater and migrate with the groundwater. The water-soluble contaminants (which tend to be the lighter-molecular-weight petroleum constituents, such as benzene, toluene, ethylbenzene, and xylene) solubilize and volatilize. As the water-soluble contaminants that dissolve into the groundwater are carried with the groundwater downgradient, each contaminant moves at a unique chemical-specific rate: e.g., benzene moves faster than toluene; toluene moves faster than the other soluble organic constituents; and soluble lead moves at the slowest rate.

The aquifer has a relatively high rate of horizontal groundwater flow (approximately 0.16 to 0.96 m/d) and a relatively slow rate of vertical mixing (U.S. Air Force 1993b, Volume 1). The combined effect is to confine groundwater contaminants near the top of the upper groundwater level. For example, the concentration of chlorobenzene in groundwater should be highest near the top of the aquifer (within the contamination plume). The floating product remains as a continuing source of lighter-molecular-weight petroleum constituents to be leached into the groundwater. It is assumed that the concentrations of lighter-molecular-weight petroleum constituents will not vary dramatically under or near the floating product over the thirty-year period for which risk is evaluated in this report. The concentrations of lighter-molecular-weight petroleum constituents, dissolved in groundwater, can be expected to decrease with distance away from the floating product.

The material of the less water-soluble phase, composed of higher-molecular-weight hydrocarbons, remains and accumulates in the subsurface soils above the groundwater level. As the lighter-molecular-weight petroleum constituents migrate out of the floating product, the viscosity of the remaining material increases. The higher-molecular-weight hydrocarbon accumulation in the subsurface soil likely varies in depth in accordance with fluctuations in the groundwater elevation. As they accumulate and increase in viscosity, the higher-molecular-weight hydrocarbon contaminants become less

mobile in the soil matrix, until eventually movement virtually stops and a highly viscous layer is formed in the soil. The presence of these higher-molecular-weight hydrocarbon contaminants in soil samples is inferred by measuring total petroleum hydrocarbons (TPH).

2.1.3 Soil Contamination

The source of soil contamination may have been surface spills of solvents, de-icers, aircraft fuel, gasoline, and diesel fuel. The soils are contaminated with solvents, polycyclic aromatic hydrocarbons (PAHs), and TPH. The absence of toluene, benzene, and ethylbenzene in the soils indicates that little fuel was spilled on the surface of the soils and allowed to infiltrate. However, the presence of TPH lower in the soil profile indicates that large amounts of fuel have likely been released directly to the deeper soils. This is in keeping with the known underground leaks of aircraft fuel discussed earlier. The soils are contaminated with solvents (e.g., tetrachloroethene and vinyl chloride) that were most likely spilled, or poured, onto the soil's surface. The PAHs found in the soils may have originated as dissolved contaminants in waste solvents spilled on the soils, and/or as deposition from the exhaust of vehicles and aircraft.

2.1.4 Ambient Air Contamination

Contamination of the ambient air may occur when contaminants with high vapor pressures (i.e., benzene, tetrachloroethene, and vinyl chloride) are also released to the atmosphere from existing soil contamination. No ambient air sampling for these contaminants has been undertaken; therefore, the exact magnitude of air contamination is unknown but is approximated by modeling from known soil concentrations of high-vapor-pressure contaminants.

2.1.5 1993 Sampling Results

According to the RI, the 1993 sampling at ST20 E-7 indicates that the soil is free of volatile and semivolatile contamination. Arsenic (3.2-6.3 mg/kg) and beryllium (0.6 mg/kg) were detected in ST20 E-7 soils at concentrations above the analytical detection limit. Decreases in the groundwater concentrations of benzene, toluene, ethylbenzene, xylene, and semivolatiles over time (from 1989 to 1993) are reported in the RI. The RI reports that in 1989 the highest benzene concentration was 12,000 $\mu\text{g/L}$ in well 53M04, while in

1993 the concentration in this well was 200 $\mu\text{g/L}$. The RI also concludes that the thickness of floating petroleum product has generally decreased in size since 1988 (except for that found in monitoring well 20M04, where the thickness has increased).

2.2 EXPOSURE ASSESSMENT

The Exposure Assessment section identifies all potential pathways of exposure and successively screens them to determine which are important to assess qualitatively. This step in the risk assessment process presents all potential pathways and screens the pathways based on site-specific considerations such as current and anticipated land use, past industrial practices, and the occurrence of site-related contaminants in environmental media. The Exposure Pathway screening step rules out pathways with a low probability of occurrence and identifies those pathways that will likely constitute the major risks to public health. These are the pathways that will be addressed in the subsequent quantitative risk characterization.

Exposure is defined as the contact of an organism with a chemical or physical agent. The overall objective of the exposure assessment is to estimate the types and magnitude of exposures to chemicals of potential concern that are present at, or migrating from, the site. The results of the exposure assessment are combined with chemical-specific toxicity information to characterize potential risks (U.S. EPA 1989a).

The Exposure Assessment section examines land use, exposure time frame, exposure setting, and exposure pathways. Table 2.1 lists the human exposure pathways that are viable for the specific OU-1 source area. Table 2.1 also summarizes the results of the exposure assessment, while the corresponding text provides details on the exposure pathway screening step. Fate and transport modeling results, intake variables and/or exposure factors, and toxicological values are presented elsewhere in this report. (See list in Section 2.4.)

**TABLE 2.1. Summary of Human Exposure Pathways
for Source Area ST20 E-7**

Theoretical Pathways	Current Land Use	Future Land Use	
	Industrial	Residential	Industrial
Ingestion of groundwater used as potable water supply	-(a)	X ^(b)	X
Dermal contact with contaminants during groundwater use	-	X	X
Inhalation of volatile contaminants during groundwater use	-	X	X
Incidental ingestion of surface water	-	-	-
Ingestion of fish	-	-	-
Incidental ingestion of surface soils	X	X	X
Ingestion of plants grown in contaminated soils	-	X	-
Ingestion of animals fed on plants grown in contaminated soils	-	-	-
Incidental ingestion of subsurface soils	X	X	X
Inhalation of volatile contaminants released from the soil into ambient air	X	X	X
Dermal contact with surface soils and dust	X	X	X
Dermal contact with subsurface soils	X	X	X
Inhalation of resuspended particulates	X	X	X
Dermal contact with surface water	-	-	-
Ingestion of sediments	-	-	-
Dermal contact with sediments	-	-	-

(a) - = Pathway eliminated; see text for elimination rationale.

(b) X = Pathway retained for quantitative risk evaluation.

2.2.1 Land-Use Assumptions

Health risk will be quantified for three land-use assumptions. The risk from current land use is industrial in nature while two different land-use assumptions are considered for evaluation of the future risk: residential housing and military/industrial land use. It is assumed throughout that no mitigation or corrective action is, or will be, undertaken. One difference between the current and future industrial land-use assumption is that the exposure conditions are expected to change. For example, new wells may be drilled where currently none exist, and these new wells might be used by workers as a potable supply (such as for showering and limited drinking).

Some areas of the Base are currently used for residences. However, ST20 E-7 is located in a restricted area, and there is no housing located within or near the Refueling Loop.

Property used for military purposes is subject to being closed at any time. However, current long-range land-use plans indicate that Eielson AFB will remain an active military facility and that all OU-1 source areas will be industrial sites for the foreseeable future.

2.2.2 Current Exposure Pathways: Industrial

Current land use of ST20 E-7 is for military aircraft re-fueling purposes. For the current time frame, the following industrial land-use human exposure pathways are complete and reasonable for further analysis:

- incidental ingestion of surface soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to the ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils
- inhalation of resuspended particulates.

A detailed explanation of the methodology and formulas used to calculate exposure/dose from these pathways is contained in Appendix A. Exposure factors or exposure parameter by pathway may be found in Appendix B.

Because groundwater is not currently used, the exposure pathways associated with groundwater media are not evaluated further. These include

- ingestion of groundwater
- dermal contact with contaminants during groundwater use
- inhalation of volatiles during groundwater use.

There is no accessible surface water in the vicinity of the OU-1 site source areas. Therefore, the plausible pathways do not encompass ingestion of, or dermal exposure to, surface water, sediment, or fish. Several ponds do exist in the taxiway loop, but these are not accessible to workers or the public. No grazing, gardening, or agricultural use is made of the OU-1 source areas; therefore, ingestion of plants grown in contaminated soils, or of animals fed on such plants, is not examined in this report, with the exception of ingestion of plants grown in contaminated soil as examined by the scenario for future residential land use.

2.2.3 Future Exposure Pathways: Residential

For residential housing land use as a future exposure assumption, the following pathways are considered to be complete and reasonable for analysis:

- ingestion of groundwater used as a potable water supply
- dermal contact with contaminants during groundwater use
- inhalation of volatile contaminants during groundwater use
- incidental ingestion of surface soils
- ingestion of plants grown in contaminated soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from the soil into the ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils
- inhalation of resuspended particulates.

Future residences are assumed to use groundwater as a potable supply and to have garden plots. All exposure pathways postulated (and listed above) will be examined.

Some conceivable pathways do not warrant examination. For example, exposure to surface water and/or sediment is not plausible and, therefore, is not considered in the subsequent risk calculations. In addition, it is also assumed that future housing areas will not be used to graze livestock. Therefore, human exposure via ingestion of animals fed on plants grown in contaminated soils is eliminated from further consideration.

2.2.4 Future Exposure Pathways: Industrial

For industrial land use as a future exposure assumption, the following pathways are considered to be complete and reasonable for analysis:

- ingestion of groundwater used as a limited potable water supply
- dermal contact with contaminants during groundwater use
- inhalation of volatile contaminants during groundwater use
- incidental ingestion of surface soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils
- inhalation of resuspended particulates.

Industrial activities are assumed to be similar to existing military activities. However, it is assumed that in the future, the area's groundwater plumes will be used as a potable supply on a limited basis. Therefore, three groundwater exposure scenarios have been included in the list above.

2.3 EXPOSURE POINT CONCENTRATIONS

The identities and concentrations of chemicals of potential concern for the source area are provided in Table 2.2, "Concentrations of Chemicals of Potential Concern for Source Area ST20 E-7." This table presents the exposure

**TABLE 2.2. Concentrations of Chemicals of Potential
Concern for Source Area ST20 E-7**

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Maximum Value Detected	95% UCL (a)
Soils						
Benzo(A) Anthracene	56-55-3	SO ^(b)	µg/kg ^(c)	210	390	NA ^(d)
Benzo(K) Fluoranthene	207-08-9	SO	µg/kg	140	1000	790
Chrysene	218-01-9	SO	µg/kg	250	1900	1300
Indeno(1,2,3-CD) Pyrene	193-39-5	SO	µg/kg	130	420	405
Tetrachloroethene	79-01-6	SO	µg/kg	550	8500	4800
TPH ^(e)	TPH	SO	µg/kg	31000	110000	101000
Vinyl Chloride	75-01-4	SO	µg/kg	1600	13000	10000
Groundwater						
1,1-Dichloroethylene	75-35-4	WD ^(f)	µg/L ^(g)	2	6	6
Arsenic, Dissolved	7440-38-2	WD	µg/L	30	50	NA
Barium, Total	7440-39-3	WD	µg/L	579	579	NA
Chlorobenzene	108-90-7	WD	µg/L	9	100	59
Chromium	7440-47-3	WD	µg/L	41	40.7	NA
Copper, Total	7440-50-8	WD	µg/L	218	218	NA
Ethylbenzene	100-41-4	WD	µg/L	68	380	340
Lead, Total	7439-92-1	WD	µg/L	73	90	NA
Mercury, Dissolved	7439-97-6	WD	µg/L	0.7	0.7	NA
Naphthalene	91-20-3	WD	µg/L	37	130	140
Phenanthrene	85-01-8	WD	µg/L	1	7	6
Total Xylenes	1330-20-7	WD	µg/L	550	3800	3430
Vanadium, Total	7440-62-2	WD	µg/L	73	73	NA

- (a) UCL = upper confidence limit
(b) SO = soil
(c) µg/kg = microgram (chemical) per kilogram soil
(d) NA = not applicable
(e) TPH = total petroleum hydrocarbons
(f) WD = groundwater
(g) µg/L = microgram (chemical) per liter of water

point concentrations corresponding to those of the anticipated receptors, given the particular site-related contaminants. The "Average Exposure Case" uses the arithmetic average concentration value for the contaminant by medium. The "Reasonable Maximum Exposure Case" uses the contaminant concentration corresponding to the 95% upper confidence value of the chemical analytical data, assuming it is normally distributed, or, when appropriate, the maximum detected concentration.

2.4 RISK CHARACTERIZATION

This section presents in table format the excess cancer risk and the hazard index for source area ST20 E-7 by exposure pathway. The cancer risk and hazard index are presented for both the "Average Exposure Case" and the "Reasonable Maximum Exposure Case." Table 2.3 presents risk values for the current industrial land use; Table 2.4 presents risk values for future residential land use; and Table 2.5 presents risk values for future industrial land use.

Each table presents, individually, the calculated cancer risk and the hazard index for each exposure pathway. All of the exposure pathway risks are then combined to show total cancer risk values and total hazard indices.

The calculation of the cancer risk and hazard index necessitates the use of information and data input from many sources presented elsewhere in this report. For ease of reference, the information used to perform the risk calculations is noted below along with a cross reference to its location within this document.

Identification of Chemicals of Potential Concern	Section 8.0
Toxicity Assessment	Section 9.0
Risk Calculation Spreadsheets and Formulas	Appendix A
Exposure Factors	Appendix B

TABLE 2.3. Source Area ST20 E-7: Summary of Cancer Risk and Hazard Index, Current Industrial Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Ingestion of surface soils	1.29E-07	0.0	2.15E-06	0.0
Dermal contact with surface soils	2.95E-08	0.0	2.15E-06	0.0
Ingestion of subsurface soils	2.12E-08	0.0	3.53E-07	0.0
Dermal contact with subsurface soils	4.84E-09	0.0	3.53E-07	0.0
Inhalation of volatiles from soils	9.91E-06	0.0	1.79E-04	0.0
Inhalation of resuspended particulates from soil	3.15E-12	0.0	4.05E-11	0.0
Total Cancer Risk	1.0E-05		1.8E-04	
Total Hazard Index		0.0		0.0

(a) RME = Reasonable Maximum Exposure

TABLE 2.4. Source Area ST20 E-7: Summary of Cancer Risk and Hazard Index, Future Residential Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Groundwater ingestion	1.04E-04 (2.32E-06)	5.7 (0.0)	1.07E-03 (4.23E-05)	14.1 (0.3)
Dermal contact during groundwater use	4.72E-07 (2.97E-07)	0.1 (0.1)	6.25E-06 (4.50E-06)	0.8 (0.8)
Inhalation of volatiles during groundwater use	2.49E-05 (2.49E-05)	0.5 (0.5)	3.17E-04 (3.17E-04)	3.5 (3.5)
Ingestion of surface soils	3.19E-07	0.0	1.69E-05	0.0
Dermal contact with surface soils	3.63E-08	0.0	4.86E-06	0.0
Ingestion of subsurface soils	3.19E-07	0.0	1.69E-05	0.0
Dermal contact with subsurface soils	3.63E-08	0.0	3.73E-06	0.0
Inhalation of volatiles from soils	9.91E-06	0.0	1.79E-04	0.0
Inhalation of resuspended particulates from soil	3.89E-12	0.0	5.99E-11	0.0
Ingestion of plants	5.08E-04	0.0	1.40E-02	0.0
Total Cancer Risk	6.5E-04 (5.5E-04)		1.5E-02 (1.4E-02)	
Total Hazard Index		6.3 (6.3)		18.4 (18.4)

(a) RME = Reasonable Maximum Exposure

TABLE 2.5. Source Area ST20 E-7: Summary of Cancer Risk and Hazard Index, Future Industrial Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Groundwater ingestion	6.76E-05 (1.51E-06)	3.7 (0.0)	3.18E-04 (1.26E-05)	5.0 (0.1)
Dermal contact during groundwater use	4.29E-07 (2.70E-07)	0.1 (0.1)	3.72E-06 (2.68E-06)	0.6 (0.5)
Inhalation of volatiles during groundwater use	2.26E-05 (2.26E-05)	0.4 (0.4)	1.89E-04 (1.89E-04)	2.5 (2.5)
Ingestion of surface soils	1.29E-07	0.0	2.15E-06	0.0
Dermal contact with surface soils	2.95E-08	0.0	2.15E-06	0.0
Ingestion of subsurface soils	2.12E-08	0.0	3.53E-07	0.0
Dermal contact with subsurface soils	4.84E-08	0.0	3.53E-07	0.0
Inhalation of volatiles from soils	9.91E-06	0.0	1.79E-04	0.0
Inhalation of resuspended particulates from soil	3.15E-12	0.0	4.05E-11	0.0
Total Cancer Risk	1.0E-04 (3.4E-05)		6.9E-04 (3.9E-04)	
Total Hazard Index		4.2 (0.5)		8.1 (3.1)

(a) RME = Reasonable Maximum Exposure

2.5 SITE-SPECIFIC UNCERTAINTIES AND CONSIDERATIONS

This section presents key information bearing on the level of confidence in the quantitative risk estimates for a site. The risk values are conditional, given a considerable number of assumptions about site characterization, exposure, and toxicity. Based on the existing data and the conceptual model, the following uncertainties have been identified:

The temporal and spatial variations in concentrations of naturally occurring metals in the groundwater are not known with certainty. Knowledge of this information could affect both the total risk predicted from groundwater use and the amount of groundwater contamination attributable to past site industrial practices.

The ratio of hexavalent chromium to trivalent chromium is not known for the chromium measured in the groundwater. Because the more toxic hexavalent state was assumed to be the only form of chromium present, knowing the ratio presumably would only lower the estimated risk.

The groundwater concentration of benzene was not reported in the 1989/1991 analytical data provided for this risk assessment. If, as reported in the RI, benzene is indeed present in the groundwater at OU-1, knowing its concentration would increase the estimated risk from groundwater use.

The source of solvent contamination in both soil and groundwater has not been identified. Therefore, this unknown source may still be contributing to the contamination at this source area.

The bis(2-ethylhexyl)phthalate in groundwater is likely a laboratory contaminant. It is unlikely that bis(2-ethylhexyl)phthalate in groundwater samples are representative of the overall aquifer conditions, and therefore its detection is not included in the risk calculations.

3.0 SOURCE AREA ST20: E-8 COMPLEX

Source Area ST20 E-8 Complex is one of three refueling complexes located at the east end of the Refueling Loop at the southeast end of the runway (see Figure 1.2). The E-8 Complex consists of an asphalt-covered pad centered along the taxiway with adjacent unpaved areas of gravel and grass cover. The complex is served by a fuel pumphouse (Building 1321), three 190,000-L JP-4 UST, one 95,000-L defueling UST, and several fueling and defueling transfer pipes. The area around the pumphouse and buried tanks is gravel with some grass cover. A large area enclosed by the taxiway loop, north of the E-8 Complex, contains several ponds with dense willow and birch forests and tall grass. Garrison Slough is approximately 300 m southwest of the E-8 complex. The relationship of the E-8 Complex to the other two complexes is shown in Figure 2.1, "Source Area ST20."

The majority of the aircraft refueling operations at Eielson AFB are conducted at the Refueling Loop, and numerous fuel spills have reportedly occurred there in the past. In 1972, a test hole was drilled to a depth of approximately 6 m at the fuel pumphouse; a hydrocarbon layer was detected on the water table. The source of floating product at the E-8 Complex is believed to be surface spills of fuel resulting from overfilled storage tanks and/or leaking underground storage fuel lines (U.S. Air Force 1993b, Volume 1). The soils of the source area do not contain the contaminants that would be indicative of a surface spill of petroleum. However, the groundwater does contain contaminants (benzene, ethylbenzene, toluene, and xylene) indicative of petroleum spills. These facts would indicate a subsurface release of petroleum, such as a pipe leak. The presence of solvents in the groundwater, however, is not accounted for by this hypothesis.

3.1 CONCEPTUAL SITE MODEL

A conceptual site model was originally developed based on the results of previous investigations reported in the Remedial Investigation/Feasibility Study Operable Unit 1 Management Plan (U.S. Air Force 1993a). The conceptual site model was subsequently updated based upon the Eielson AFB, Alaska, Operable Unit 1, Draft Remedial Investigation (RI) Report, Volume 1: Text and

Appendices, August 1993 (U.S. Air Force 1993b, Volume 1). The reader is referred to the RI for the most current site characterization information. The components of the conceptual site model include geology, hydrogeology, and the nature and extent of contamination in soil and groundwater. The chemical contamination at this source area includes groundwater contamination, soil contamination, and secondary contamination of the ambient air via vaporization of volatile contaminants in the soils and groundwater.

3.1.1 Geology and Hydrogeology

The near-surface geology (i.e., to a depth of 8.1 m) at the ST20 E-8 Complex consists of silty sand, underlain by gravelly sand and silty sand. Groundwater is encountered at depths between 0.9 to 2.4 m BGS. Groundwater flow is generally to the north-northwest at an estimated groundwater velocity ranging from 0.16 to 0.99 m/day, under a hydraulic gradient of about 0.7 to 0.9 m/km. Ponds are located both downgradient and crossgradient of the E-8 Complex. Given the downgradient location of the Refueling Loop ponds, there is a potential for interaction between the surface water in the ponds (which are also downgradient of the E-7 Complex) and the groundwater beneath the E-8 Complex. A 1993 Air Force Technical memo (U.S. Air Force 1993c) confirms that there is groundwater discharge to surface water at ST20 and that the Refueling Loop ponds are a result of a high water table. In addition, the groundwater plumes of lighter-molecular-weight petroleum constituents are moving toward the surface water. However, there are no data to indicate contamination present near or in the surface-water ponds (U.S. Air Force 1993b, Volume 1). In addition, the ponds are in a restricted area, inaccessible, and are not used for recreational purposes or industrial purposes, such as for cooling or fire-suppression water. Therefore, the risk from exposure via the surface-water pathway is not considered plausible and is not quantified in the risk assessment.

A detailed discussion of the geology and hydrogeology at the ST20 E-8 Complex is described in the Eielson AFB, Alaska, Operable Unit 1, Draft Remedial Investigation (RI) Report, Volume 1: Text and Appendices, August 1993 (U.S. Air Force 1993b). The reader is referred to the RI for the most current site information. A field investigation conducted in May 1993 is contained in

the RI and includes monitoring-well water levels and measurements of floating-product thicknesses.

3.1.2 Groundwater Contamination

Groundwater contamination at this source area has an unverified origin but may have originated from a leak in the underground fuel piping system which could have created the floating product reservoir. The leak most likely occurred underground because the soils above the floating-product reservoir are not directly contaminated with benzene, toluene, ethylbenzene, or xylenes. The presence of 1,1-dichloroethylene in the groundwater is unexplained since it would not have been in leaked petroleum products. It is also unlikely that it originated in a surface spill because the soil profile is not contaminated with the compound.

The floating product consists of two physically distinct phases: a water-soluble phase and a relatively non-water-soluble phase. The water-soluble chemical components of the floating product dissolve into and migrate with the groundwater. The water-soluble contaminants (which tend to be the lighter-molecular-weight petroleum constituents such as benzene, toluene, ethylbenzene, and xylene) solubilize and volatilize. As the water-soluble contaminants that dissolve into the groundwater are carried with the groundwater downgradient, each contaminant moves at a unique chemical-specific rate: e.g., benzene moves faster than toluene; toluene moves faster than the other soluble organic constituents; and soluble lead moves at the slowest rate.

The aquifer has a relatively high rate of horizontal groundwater flow (approximately 0.16 to 0.96 m/d) and a relatively slow rate of vertical mixing. The combined effect is to confine groundwater contaminants near the top of the upper groundwater level. For example, the concentration of chlorobenzene in groundwater should be highest near the top of the aquifer (within the contamination plume). The floating product remains as a continuing source of lighter-molecular-weight petroleum constituents to be leached into the groundwater. The leaching rate is most likely governed by physical constraints such as solubility, water infiltration rates, and temperature. It is assumed that the concentrations of lighter-molecular-weight petroleum constituents will not vary dramatically under or near the

floating-product reservoir over the thirty-year period for which risk is evaluated in this report. The concentrations of lighter-molecular-weight petroleum constituents can be expected to decrease with distance away from the floating product. The material of the less water-soluble phase, composed of higher-molecular-weight hydrocarbons, remains and accumulates in the subsurface soils above the groundwater level. As the lighter-molecular-weight petroleum constituents migrate out of the floating product, the viscosity of the remaining material increases.

The higher-molecular-weight hydrocarbon accumulation in the subsurface soil likely varies in depth in accordance with fluctuations in the groundwater elevation. As they accumulate and increase in viscosity, the higher-molecular-weight hydrocarbon contaminants become less mobile in the soil matrix, until eventually movement virtually stops and a highly viscous layer is formed in the soil. The presence of these higher-molecular-weight hydrocarbon contaminants in soil samples is inferred by measuring TPH.

3.1.3 Soil Contamination

The soils contain TPH and dibenzo(a,h)anthracene. Toluene, benzene, and ethylbenzene are notably absent in the soils; this indicates that little fuel was spilled on the surface of the soils and allowed to infiltrate. However, the presence of TPH lower in the soil profile indicates that large amounts of fuel have likely been released directly to the deeper soils. The dibenzo(a,h)anthracene found in the soils may have originated as deposition from the exhaust of vehicles and aircraft or from the nearby asphalt pavement.

3.1.4 Ambient Air Contamination

Contamination of the ambient air may occur when contaminants with high vapor pressures (e.g., benzene, toluene, xylene, and ethylbenzene) are also released to the atmosphere from existing soil contamination. No high-vapor-pressure contaminants were detected in the soils of this source area; therefore, there is no risk associated with this exposure pathway.

3.1.5 1993 Sampling Data

Floating petroleum products were encountered north of the pumphouse during a field investigation in September 1989; however, no product was found

at the same location during an earlier field investigation in 1988 or during later ones in 1991. No floating product was detected in any wells or product probes during the May 1993 sampling program (U.S. Air Force 1993b, Volume 1). The RI also reports that soil sampled at ST20 E-8 in 1993 contained no detectable concentrations of volatiles or semivolatiles. Benzene, toluene, and ethylbenzene were detected in ST20 E-8 monitoring well samples in 1993. However, these fuel-related compounds were not detected in downgradient wells. The highest detected concentrations of benzene, toluene, ethylbenzene, and xylene are in monitoring well 20M06. Benzene was measured at 570 $\mu\text{g/L}$ in 1993 and 481 $\mu\text{g/L}$ in 1989. Arsenic and manganese detected in 1993 groundwater samples are at concentrations similar to local natural background. The presence of PAHs and TPH in groundwater samples collected in 1989 was not confirmed in the 1993 sampling. Composite soil samples collected adjacent to the taxiway were found to contain pesticides.

3.2 EXPOSURE ASSESSMENT

The Exposure Assessment section identifies all potential pathways of exposure and successively screens them to determine which are important to assess qualitatively. This step in the risk assessment process presents all potential pathways and screens the pathways based on site-specific considerations such as current and anticipated land use, past industrial practices, and the occurrence of site-related contaminants in environmental media. The Exposure Pathway screening step rules out pathways with a low probability of occurrence and identifies those pathways that will likely constitute the major risks to public health. These are the pathways that will be addressed in the subsequent quantitative risk characterization.

Exposure is defined as the contact of an organism with a chemical or physical agent. The overall objective of the exposure assessment is to estimate the types and magnitude of exposures to chemicals of potential concern that are present at, or migrating, from the site. The results of the exposure assessment are combined with chemical-specific toxicity information to characterize potential risks (U.S. EPA 1989a).

The Exposure Assessment section examines land use, exposure time frame, exposure setting, and exposure pathways. Table 3.1 lists the human exposure

**TABLE 3.1. Summary of Human Exposure Pathways
for Source Area ST20 E-8**

Theoretical Pathways	Current Land Use	Future Land Use	
	Industrial	Residential	Industrial
Ingestion of groundwater used as potable water supply	-(a)	X ^(b)	X
Dermal contact with contaminants during groundwater use	-	X	X
Inhalation of volatile contaminants during groundwater use	-	X	X
Incidental ingestion of surface water	-	-	-
Ingestion of fish	-	-	-
Incidental ingestion of surface soils	X	X	X
Ingestion of plants grown in contaminated soils	-	X	-
Ingestion of animals fed on plants grown in contaminated soils	-	-	-
Incidental ingestion of subsurface soils	X	X	X
Inhalation of volatile contaminants released from the soil into ambient air	X	X	X
Dermal contact with surface soils and dust	X	X	X
Dermal contact with subsurface soils	X	X	X
Inhalation of resuspended particulates	X	X	X
Dermal contact with surface water	-	-	-
Ingestion of sediments	-	-	-
Dermal contact with sediments	-	-	-

(a) - = Pathway eliminated; see text for elimination rationale.

(b) X = Pathway retained for quantitative risk evaluation.

pathways that are viable for the specific OU-1 source area. Table 3.1 summarizes the results of the exposure assessment, while the corresponding text provides details on the exposure pathway screening step. Fate and transport modeling results, intake variables and/or exposure factors, and toxicological values are presented elsewhere in this report.

3.2.1 Land-Use Assumptions

Health risk will be quantified for three land-use assumptions. The risk from current land use is industrial in nature while two different land-use assumptions are considered for evaluation of the future risk: residential housing and military/industrial land use. It is assumed throughout that no mitigation or corrective action is, or will be, undertaken. One difference between the current and future industrial land-use assumptions is that the exposure conditions are expected to change. For example, new wells may be drilled where currently none exist, and these new wells might be used by workers as a potable supply (such as for showering and limited drinking).

Some areas of the Base are currently used for military residences. However, there is no housing located within or near ST20 E-8, which is in a restricted area.

Property used for military purposes is subject to being closed at any time. However, current long-range, land-use plans indicate that Eielson AFB will remain an active military facility and that all OU-1 source areas will be industrial sites for the foreseeable future.

3.2.2 Current Exposure Pathways: Industrial

Current land use of ST20 E-8 is for military aircraft re-fueling purposes. For the current timeframe, the following industrial land-use human-exposure pathways are complete and reasonable for further analysis:

- incidental ingestion of surface soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils

- inhalation of resuspended particulates.

A detailed explanation of the methodology and formulas used to calculate exposure/dose and risk from these pathways is contained in Appendix A. Exposure factors or exposure parameters used to describe each pathway may be found in Appendix B. Because groundwater is not currently used, the exposure pathways associated with the groundwater medium are not evaluated. These include

- ingestion of groundwater
- dermal contact with contaminants during groundwater use
- inhalation of volatiles during groundwater use.

There is no accessible surface water in the vicinity of the OU-1 site source areas. Therefore, the plausible pathways do not encompass ingestion of, or dermal exposure to, surface water, sediment, or fish. Several ponds do exist in the taxiway loop, but these are not accessible to workers or the public. No grazing, gardening, or agricultural use is made of the OU-1 source areas; therefore, ingestion of plants grown in contaminated soils, or of animals fed on such plants, is not examined in this report, with the exception of the ingestion of plants grown in contaminated soils under the scenario for further residential land use.

3.2.3 Future Exposure Pathways: Residential

For residential housing land use as a future exposure assumption, the following pathways are considered to be complete and reasonable for analysis:

- ingestion of groundwater used as potable water supply
- dermal contact with contaminants during groundwater use
- inhalation of volatile contaminants during groundwater use
- incidental ingestion of surface soils
- ingestion of plants grown in contaminated soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust

- dermal contact with subsurface soils
- inhalation of resuspended particulates.

Future residences are assumed to use site groundwater as a potable supply and to have garden plots associated with the homes. All exposure pathways postulated (and listed above) will be examined. Surface water and sediment exposure are not viable exposure media and are not considered in the subsequent risk calculations. In addition, it is assumed that future housing areas will not be used to graze livestock. Therefore, human exposure via ingestion of animals fed on plants grown in contaminated soils is eliminated from further consideration.

3.2.4 Future Exposure Pathways: Industrial

For industrial land use as a future exposure assumption, the following pathways are considered to be complete and reasonable for analysis:

- ingestion of groundwater used as limited potable water supply
- dermal contact with contaminants during groundwater use
- inhalation of volatile contaminants during groundwater use
- incidental ingestion of surface soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils
- inhalation of resuspended particulates.

Industrial activities are assumed to be similar to current military activities. However, it is assumed that in the future, the area's groundwater plumes will be used as a potable supply on a limited basis. Therefore, three groundwater exposure scenarios have been included in the pathways selected.

3.3 EXPOSURE POINT CONCENTRATIONS

The identities and concentrations of chemicals of potential concern for the source area are provided in Table 3.2, "Concentrations of Chemicals of

TABLE 3.2. Concentrations of Chemicals of Potential Concern for Source Area ST20 E-8

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Maximum Value Detected	95% UCL ^(a)
Soils						
Dibenzo(A,H) Anthracene	53-70-3	SO ^(b)	µg/kg ^(c)	140	140	NA ^(d)
TPH ^(e)	TPH	SO	µg/kg	41100	170000	150000
GROUNDWATER						
1,1-Dichloroethylene	75-35-4	WD ^(f)	µg/L ^(g)	13	32	41
Benzene	71-43-2	WD	µg/L	1	1	NA
Ethylbenzene	100-41-4	WD	µg/L	130	1600	840
Naphthalene	91-20-3	WD	µg/L	20	160	130
Phenanthrene	85-01-8	WD	µg/L	1	7	6
Toluene	108-88-3	WD	µg/L	910	21000	8200
Total Xylenes	1330-20-7	WD	µg/L	470	3820	2630

- (a) UCL = upper confidence limit
(b) SO = soil
(c) µg/kg = microgram (chemical) per kilogram soil
(d) NA = not applicable
(e) TPH = total petroleum hydrocarbons
(f) WD = groundwater
(g) µg/L = microgram (chemical) per liter of water

Potential Concern for Source Area ST20 E-8." This table presents the exposure point concentrations corresponding to those of the anticipated receptors, given the particular site-related contaminants. The "Average Exposure Case" uses the arithmetic average concentration value for the contaminant by medium. The "Reasonable Maximum Exposure Case," in contrast, uses the contaminant concentration corresponding to the 95% upper confidence value of the chemical analytical data, assuming it is normally distributed. If the 95% upper confidence value is statistically invalid, or is greater than the maximum detected value, the maximum detected value is used.

3.4 RISK CHARACTERIZATION

This section presents in table format the excess cancer risk and the hazard index for source area ST20 E-8 by exposure pathway. The cancer risk and hazard index are presented for both the "Average Exposure Case" and the "Reasonable Maximum Exposure Case." The tables presented in this section summarize the risk calculations. Table 3.3 presents risk values for the current industrial land use; Table 3.4 presents the future residential land-use values; and Table 3.5 presents the future industrial land-use values.

Each table presents, individually, the cancer risk and the hazard index for each exposure pathway. All of the exposure pathways are then combined to show total cancer risk values and total hazard indices. The primary risk calculations are presented in Appendix A.

The calculation of the cancer risk and hazard index necessitates the use of information and data input from many sources presented elsewhere in this report. For ease of reference, the information used to perform the risk calculations is noted below along with a cross reference to its location within this document.

Identification of Chemicals of Potential Concern	Section 8.0
Toxicity Assessment	Section 9.0
Risk Calculation Spreadsheets and Formulas	Appendix A
Exposure Factors	Appendix B

TABLE 3.3. Source Area ST20 E-8: Summary of Cancer Risk and Hazard Index, Current Industrial Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Ingestion of surface soils	4.17E-08	0.0	1.16E-07	0.0
Dermal contact with surface soils	9.50E-09	0.0	1.16E-07	0.0
Ingestion of subsurface soils	6.8E-09	0.0	1.90E-08	0.0
Dermal contact with subsurface soils	1.56E-09	0.0	1.90E-08	0.0
Inhalation of volatiles from soils	1.45E-11	0.0	4.04E-11	0.0
Inhalation of resuspended particulates from soil	3.60E-12	0.0	1.00E-11	0.0
Total Cancer Risk	6.0E-08		2.7E-07	
Total Hazard Index		0.0		0.0

(a) RME = Reasonable Maximum Exposure

TABLE 3.4. Source Area ST20 E-8: Summary of Cancer Risk and Hazard Index, Future Residential Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Groundwater ingestion	1.52E-05	45.5	2.26E-04	749.1
Dermal contact during ground-water use	1.98E-06	0.8	2.42E-05	9.0
Inhalation of volatiles during groundwater use	1.62E-04	1.0	1.69E-03	9.8
Ingestion of surface soils	1.03E-07	0.0	9.13E-07	0.0
Dermal contact with surface soils	1.17E-08	0.0	2.62E-07	0.0
Ingestion of subsurface soils	1.03E-07	0.0	9.13E-07	0.0
Dermal contact with subsurface soils	1.17E-08	0.0	1.99E-07	0.0
Inhalation of volatiles from soils	1.45E-11	0.0	4.04E-11	0.0
Inhalation of resuspended particulates from soil	4.44E-12	0.0	1.48E-11	0.0
Ingestion of plants	6.96E-07	0.0	2.95E-06	0.0
Total Cancer Risk	1.8E-04		1.9E-03	
Total Hazard Index		47.3		767.9

(a) RME = Reasonable Maximum Exposure

TABLE 3.5. Source Area ST20 E-8: Summary of Cancer Risk and Hazard Index, Future Industrial Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Groundwater ingestion	9.85E-06	0.1	6.72E-05	0.6
Dermal contact during groundwater use	1.80E-06	0.6	1.44E-05	6.4
Inhalation of volatiles during groundwater use	1.47E-04	0.9	1.01E-03	7.0
Ingestion of surface soils	4.17E-08	0.0	1.16E-07	0.0
Dermal contact with surface soils	9.50E-09	0.0	1.16E-07	0.0
Ingestion of subsurface soils	6.85E-09	0.0	1.90E-08	0.0
Dermal contact with subsurface soils	1.56E-09	0.0	1.90E-08	0.0
Inhalation of volatiles from soils	1.45E-11	0.0	4.04E-11	0.0
Inhalation of resuspended particulates from soil	3.60E-12	0.0	1.00E-11	0.0
Total Cancer Risk	1.5E-04		1.0E-03	
Total Hazard Index		1.6		14.0

(a) RME = Reasonable Maximum Exposure

3.5 SITE-SPECIFIC UNCERTAINTIES AND CONSIDERATIONS

This section presents key information bearing on the level of confidence in the quantitative risk estimates for a site. The risk values are conditional, given a considerable number of assumptions about site characterization, exposure, and toxicity. Major categories of uncertainty are discussed herein.

The bis(2-ethylhexyl)phthalate and methylene chloride reportedly detected in groundwater are believed to be laboratory contaminants. Therefore, these compounds are not included in the calculated risk. The probable source of solvent contamination in groundwater has not been identified. This unknown source may still be contributing to the contamination at this source area.

The source of the dibenzo(a,h)anthracene detected in subsurface soil may be the asphalt pavement present at the sampling location and, therefore, may not be representative of actual subsurface conditions. Results from the pesticide analyses for soils and groundwater have not been received at the time of this draft. The presence of pesticides would serve to increase the quantified risk.

4.0 SOURCE AREA ST20: E-9 COMPLEX

The E-9 Complex at Source Area ST20 is one of three refueling complexes, located along the north-northeast side of the Refueling Loop at the southeast end of the runway (see Figure 1.2). The E-9 Complex consists of an asphalt-covered pad centered along the taxiway with adjacent unpaved areas of gravel and grass cover. The complex is served by a fuel pumphouse (Building 1305), three 190,000-L JP-4 underground storage tanks (UST), one 95,000-L UST, and several fueling and defueling transfer pipes. The area around the pumphouse and buried tanks is gravel with some grass cover. A large area enclosed by the Refueling Loop, south of the Complex, contains several ponds with dense willow and birch forests and tall grass. Hangars are located along the northeast edge of the Complex, and an aircraft maintenance shop lies to the northwest. The closest water supply well (No. 8) is located 300 m to the northeast of the pumphouse in Building 1307. When in use, this 27-m-deep well pumps approximately 40 L per minute. Two storage tanks, a 10,000-L diesel fuel tank (removed in 1992) and a 5,000-L fuel oil tank, are located within 30 m of the water supply well.

The majority of aircraft refueling operations at Eielson AFB are conducted at the Refueling Loop, and numerous fuel spills have occurred there in the past. The source of the contamination at the E-9 Complex is believed to be leaks in subsurface JP-4 fuel lines north and east of the pumphouse. Contaminants typically associated with JP-4 fuel include total petroleum hydrocarbons (TPH); nonchlorinated volatile organics, such as benzene, toluene, ethylbenzene, and xylene (BTEX); polynuclear aromatic hydrocarbons (PNAs or PAHs) which are characteristically semivolatile (such as naphthalene); and metals.

4.1 CONCEPTUAL SITE MODEL

A conceptual site model was originally developed based on the results of previous investigations reported in the Remedial Investigation/Feasibility Study Operable Unit 1 Management Plan (U.S. Air Force 1993a). The conceptual site model was subsequently updated based on the Eielson AFB, Alaska, Operable Unit 1, Draft Remedial Investigation (RI) Report, Volume 1: Text and

Appendices, August 1993 (U.S. Air Force 1993b, Volume 1). The reader is referred to the RI for the most current site-characterization information. The components of this model include geology, hydrogeology, and the nature and extent of contamination in the soil and groundwater. The model addresses the nature and presence of floating product; TPH, BTEX, chlorinated aliphatics, polynuclear aromatics, and pesticides in soil; and fuel-related contaminants and phthalates in groundwater.

4.1.1 Geology and Hydrogeology

Several ponds are located crossgradient of ST20 E-9. A 1993 Air Force Technical Memo (U.S. Air Force 1993c) confirms that there is groundwater discharge to surface water at ST20 and that the Refueling Loop ponds are the result of a high water table. However, the groundwater plumes of lighter-molecular-weight petroleum constituents are not moving toward the surface water. In addition, the ponds are in a restricted area, inaccessible, and are not used for recreational purposes or industrial purposes, such as for cooling or fire-suppression water. Therefore, the risk from exposure via the surface-water pathway is not considered plausible and is not quantified in the risk assessment.

A detailed discussion of the geology and hydrogeology at the ST20 E-9 Complex is described in the Eielson AFB, Alaska, Operable Unit 1, Draft Remedial Investigation (RI) Report, Volume 1: Text and Appendices, August 1993 (U.S. Air Force 1993b). The reader is referred to the RI for the most current site information. A field investigation conducted in May 1993 is contained in the RI and includes monitoring-well water levels, sampling results, and measurements of floating-product thicknesses.

The near-surface geology (i.e., to a depth of 8.5 m) at the E-9 Complex consists a lower unit of sandy gravel overlain by sandy gravel, gravelly sand, sand, and silty sand. Permafrost conditions were not encountered during subsurface investigations at this complex. Groundwater was encountered 1.8 m to 2.4 m below ground surface. The groundwater velocity is calculated to be approximately 0.20 to 1.23 m/d.

4.1.2 Groundwater Contamination

Groundwater contamination at this source area is believed to have originated from several sources. The major contributor to groundwater contamination was a leak in an underground fuel-piping system. The resulting floating product has migrated outwardly from its origin. Because the leak occurred underground, the soils above the floating product were not directly contaminated. However, the presence of benzene in the soils indicates a second source of groundwater contamination may have been surface spills of petroleum. The floating product consists of two physically distinct phases: a water-soluble phase and a relatively non-water-soluble phase. The water-soluble chemical components of the floating product dissolve into and migrate with the groundwater. The water-soluble contaminants (which tend to be the lighter-molecular-weight petroleum constituents such as benzene, toluene, ethylbenzene, and xylene) solubilize and volatilize. As the water-soluble contaminants that dissolve into the groundwater are carried with the groundwater downgradient, each contaminant moves at a unique chemical-specific rate: e.g., benzene moves faster than toluene; toluene moves faster than the other soluble organic constituents; and soluble lead moves at the slowest rate.

The aquifer has a relatively high rate of horizontal groundwater flow (approximately 0.20 to 1.23 m/d) and a relatively slow rate of vertical mixing. The combined effect is to confine groundwater contaminants near the top of the upper groundwater level. For example, the concentration of chlorobenzene in groundwater should be highest near the top of the aquifer (within the contamination plume). The floating product remains as a continuing source of lighter-molecular-weight petroleum constituents to be leached into the groundwater. The leaching rate is most likely governed by physical constraints such as solubility, water infiltration rates, and temperature. It is assumed that the concentrations of lighter-molecular-weight petroleum constituents will not vary dramatically under or near the floating product over the thirty-year period for which risk is evaluated in this report. The concentrations of lighter-molecular-weight petroleum constituents can be expected to decrease with distance away from the floating product. The material of the less water-soluble phase, composed of higher-molecular-weight hydrocarbons, remains and accumulates in the subsurface soils

above the groundwater level. As the lighter-molecular-weight petroleum constituents migrate out of the floating product, the viscosity of the remaining material increases.

The higher-molecular-weight hydrocarbon accumulation in the subsurface soil likely varies in depth in accordance with fluctuations in the groundwater elevation. As they accumulate and increase in viscosity, the higher-molecular-weight hydrocarbon contaminants become less mobile in the soil matrix, until eventually movement virtually stops and a highly viscous layer is formed in the soil. The presence of these higher molecular-weight hydrocarbon contaminants in soil samples is inferred by measuring TPH.

4.1.3 Soil Contamination

The source of soil contamination may have been surface spills of aircraft fuel, gasoline, and diesel fuel. The soils are contaminated with benzene, chrysene, and TPH. The absence of toluene, xylene, and ethylbenzene in the soils may indicate that little fuel was spilled on the surface of the soils. The presence of TPH lower in the soil profile, however, indicates that large amounts of fuel have likely been released directly to the deeper soils. This hypothesis is in keeping with the location of the known underground leak of aircraft fuel discussed earlier. The chrysene found in the soils may have originated as deposition from the exhaust of vehicles and aircraft, as dissolved contaminants in waste oils spilled on the soils, and/or as contaminants that migrated to the soils from the nearby asphalt pads.

4.1.4 Ambient Air Contamination

Contamination of the ambient air may occur when contaminants with high vapor pressures (e.g., benzene) are released to the atmosphere from soil contamination. No ambient air sampling for these contaminants has been undertaken; therefore, the exact magnitude of air contamination is unknown but is approximated by modeling from known soil concentrations of high-vapor-pressure contaminants.

4.1.5 1993 Sampling Data

According to the RI, the 1993 data show no clear trend in the measured petroleum product thickness. The 1993 data confirm the presence of PAHs and the absence of aromatic volatile organics in soil. The 1993 data also indicate that groundwater under ST20 E-9 contains benzene, ethylbenzene, toluene, and naphthalene. Chlorobenzene and xylene were not detected in groundwater samples collected in 1993. The RI concludes that metals detected in groundwater are within the concentration range of local background. DDT was detected in a composite surface-soil sample.

4.2 EXPOSURE ASSESSMENT

The Exposure Assessment section identifies all potential pathways of exposure and successively screens them to determine which are important to assess qualitatively. This step in the risk assessment process presents all potential pathways and screens the pathways based on site-specific considerations, such as current and anticipated land use, past industrial practices, and the occurrence of site-related contaminants in environmental media. The Exposure Pathway screening step rules out pathways with a low probability of occurrence and identifies those pathways that will likely constitute the major risks to public health. These are the pathways that will be addressed in the subsequent quantitative risk characterization.

Exposure is defined as the contact of an organism with a chemical or physical agent. The overall objective of the exposure assessment is to estimate the types and magnitude of exposures to chemicals of potential concern that are present at, or migrating from, the site. The results of the exposure assessment are combined with chemical-specific toxicity information to characterize potential risks (U.S. EPA 1989a).

The Exposure Assessment section examines land use, exposure time frame, exposure setting, and exposure pathways. Table 4.1 lists the human exposure pathways that are viable for the specific OU-1 source area. Table 4.1 also summarizes the results of the exposure assessment, while the corresponding text provides details on the exposure pathway screening step. Fate and

**TABLE 4.1. Summary of Human Exposure Pathways
for Source Area ST20 E-9**

Theoretical Pathways	Current Land Use	Future Land Use	
	Industrial	Residential	Industrial
Ingestion of groundwater used as potable water supply	-(a)	X ^(b)	X
Dermal contact with contaminants during groundwater use	-	X	X
Inhalation of volatile contaminants during groundwater use	-	X	X
Incidental ingestion of surface water	-	-	-
Ingestion of fish	-	-	-
Incidental ingestion of surface soils	X	X	X
Ingestion of plants grown in contaminated soils	-	X	-
Ingestion of animals fed on plants grown in contaminated soils	-	-	-
Incidental ingestion of subsurface soils	X	X	X
Inhalation of volatile contaminants released from the soil into ambient air	X	X	X
Dermal contact with surface soils and dust	X	X	X
Dermal contact with subsurface soils	X	X	X
Inhalation of resuspended particulates	X	X	X
Dermal contact with surface water	-	-	-
Ingestion of sediments	-	-	-
Dermal contact with sediments	-	-	-

(a) - = Pathway eliminated; see text for elimination rationale.

(b) X = Pathway retained for quantitative risk evaluation.

transport modeling results, intake variables and/or exposure factors, and toxicological values are presented elsewhere in this report (see the list in Section 4.4).

4.2.1 Land-Use Assumptions

Health risk will be quantified for three land-use assumptions. The risk from current land use is industrial in nature while two different land-use assumptions are considered for evaluation of the future risk: residential housing and military/industrial land use. The assumption is made throughout that no mitigation or corrective action is, or will be, undertaken. One difference between the current and future industrial land-use assumptions is that the exposure conditions are expected to change. For example, new wells may be drilled where currently none exist, and these new wells might be used by workers for potable supply (such as for showering and limited drinking).

Some areas of the Base are currently used for residences. However, there is no housing located near ST20 E-9, which is in a restricted area.

Property used for military purposes is subject to being closed at any time. However, current long-range land-use plans indicate that Eielson AFB will remain an active military facility and that all OU-1 source areas will be industrial sites for the foreseeable future.

4.2.2 Current Exposure Pathways: Industrial

Current land use of ST20 E-9 is for military aircraft re-fueling purposes. For the current time frame, the following industrial land-use human exposure pathways are complete and reasonable for further analysis:

- incidental ingestion of surface soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils
- inhalation of resuspended particulates.

A detailed explanation of the methodology and formulas used to calculate exposure/dose from these pathways is contained in Appendix A. Exposure factors or exposure parameters used to describe each pathway may be found in Appendix B.

Because groundwater is not currently used, the exposure pathways associated with the groundwater medium are not evaluated further. These include:

- ingestion of groundwater
- dermal contact with contaminants during groundwater use
- inhalation of volatiles during groundwater use.

There is no accessible surface water in the vicinity of the OU-1 site source areas. Therefore, the plausible pathways do not encompass ingestion of, or dermal exposure to, surface water, sediment, or fish. Several ponds do exist in the taxiway loop, but these are not accessible to workers or the public. No grazing, gardening, or agricultural use is made of the OU-1 source areas; therefore, ingestion of plants grown in contaminated soils, or of animals fed on such plants, is not examined for this land use.

4.2.3 Future Exposure Pathways: Residential

For residential housing land use as a future exposure assumption, the following pathways are considered to be complete and reasonable for analysis:

- ingestion of groundwater used as a potable water supply
- dermal contact with contaminants during groundwater use
- inhalation of volatile contaminants during groundwater use
- incidental ingestion of surface soils
- ingestion of plants grown in contaminated soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils

- inhalation of resuspended particulates.

Future residences are assumed to utilize groundwater as a potable supply and to have garden plots associated with the homes. All exposure pathways postulated (and listed above) are examined. Surface water and sediment exposure are not viable pathways and are not considered in the subsequent risk calculations. In addition, it is assumed that future housing areas will not be used to graze livestock. Therefore, human exposure via ingestion of animals fed on plants grown in contaminated soils is eliminated from further consideration.

4.2.4 Future Exposure Pathways: Industrial

For industrial land use as a future exposure assumption, the following pathways are considered to be complete and reasonable for analysis:

- ingestion of groundwater used as a limited potable water supply
- dermal contact with contaminants during groundwater use
- inhalation of volatile contaminants during groundwater use
- incidental ingestion of surface soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils
- inhalation of resuspended particulates.

Industrial activities are assumed to be similar to existing military activities. However, it is assumed that in the future the area's groundwater plumes will be used as a potable supply on a limited basis. Therefore, three groundwater exposure scenarios have been included in the list above.

4.3 EXPOSURE POINT CONCENTRATIONS

The identity and concentrations of chemicals of potential concern for the source area are provided in Table 4.2, "Concentrations of Chemicals of Potential Concern for Source Area ST20 E-9." This table presents the exposure

**TABLE 4.2. Concentrations of Chemicals of Potential
Concern for Source Area ST20 E-9**

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Maximum Value Detected	95% UCL ^(a)
Soils						
Benzene	71-43-2	SO ^(b)	µg/kg ^(c)	1765	3310	NA ^(d)
Chrysene	218-01-9	SO	µg/kg	290	820	NA
TPH ^(e)	TPH	SO	µg/kg	4500	500000	500000
GROUNDWATER						
Benzene	71-43-2	WD ^(f)	µg/L ^(g)	4	4	NA
Chlorobenzene	108-90-7	WD	µg/L	2	10.6	10.4
Ethylbenzene	100-41-4	WD	µg/L	37	1050	370
Naphthalene	91-20-3	WD	µg/L	15	140	NA
Toluene	108-88-3	WD	µg/L	1580	19700	11180
Total Xylenes	1330-20-7	WD	µg/L	465	3820	2640

(a) UCL = upper confidence limit

(b) SO = soil

(c) µg/kg = microgram (chemical) per kilogram soil

(d) NA = not applicable, too few samples to calculate meaningful UCL

(e) TPH = total petroleum hydrocarbons

(f) WD = groundwater

(g) µg/L = microgram (chemical) per liter of water

point concentrations corresponding to those of the anticipated receptors, given the particular site-related contaminants. The "Average Exposure Case" uses the arithmetic average concentration value for the contaminant by medium. The "Reasonable Maximum Exposure Case" uses the contaminant concentration corresponding to the 95% upper confidence value of the chemical analytical data, assuming it is normally distributed, or, when appropriate, the maximum detected concentration.

4.4 RISK CHARACTERIZATION

The primary risk calculations are presented in Appendix A. This section summarizes in table format the excess cancer risk and the hazard index for source area ST20 E-9 by exposure pathway. The cancer risk and hazard index are presented for both the "Average Exposure Case" and the "Reasonable Maximum Exposure Case." Table 4.3 presents risk values for the current industrial land use; Table 4.4 presents the values for future residential land use; and Table 4.5 presents the values for future industrial land use. Each table presents, individually, the cancer risk and the hazard index for each exposure pathway. All of the exposure pathway risks are then combined to show total cancer risk values and total hazard indices.

The calculation of the cancer risk and hazard index necessitates the use of information and data input from many sources presented elsewhere in this report. For ease of reference, the information used to perform the risk calculations is noted below along with a cross reference to its location within this document.

Identification of Chemicals of Potential Concern	Section 8.0
Toxicity Assessment	Section 9.0
Risk Calculation Spreadsheets and Formulas	Appendix A
Exposure Factors	Appendix B

TABLE 4.3. Source Area ST20 E-9: Summary of Cancer Risk and Hazard Index, Current Industrial Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Ingestion of surface soils	2.22E-09	0.0	1.25E-08	0.0
Dermal contact with surface soils	5.06E-10	0.0	1.25E-08	0.0
Ingestion of subsurface soils	3.66E-10	0.0	2.05E-09	0.0
Dermal contact with subsurface soils	8.32E-11	0.0	2.05E-09	0.0
Inhalation of volatiles from soils	7.39E-08	0.0	3.85E-07	0.0
Inhalation of resuspended particulates from soil	1.92E-13	0.0	1.08E-12	0.0
Total Cancer Risk	7.6E-08		4.1E-07	
Total Hazard Index		0.0		0.0

(a) RME = Reasonable Maximum Exposure

TABLE 4.4. Source Area ST20 E-9: Summary of Cancer Risk and Hazard Index, Future Residential Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Groundwater ingestion	2.25E-07	0.1	1.35E-06	2.9
Dermal contact during groundwater use	1.73E-07	1.0	8.73E-07	18.2
Inhalation of volatiles during groundwater use	1.20E-06	1.4	5.11E-06	19.7
Ingestion of surface soils	5.48E-09	0.0	9.84E-08	0.0
Dermal contact with surface soils	6.24E-10	0.0	2.82E-08	0.0
Ingestion of subsurface soils	5.48E-09	0.0	9.84E-08	0.0
Dermal contact with subsurface soils	6.24E-10	0.0	2.15E-08	0.0
Inhalation of volatiles from soils	7.39E-08	0.0	3.85E-07	0.0
Inhalation of resuspended particulates from soil	2.37E-13	0.0	1.59E-12	0.0
Ingestion of plants	2.37E-13	0.0	1.59E-12	0.0
Total Cancer Risk	1.6E-06		7.7E-06	
Total Hazard Index		2.5		40.8

(a) RME = Reasonable Maximum Exposure

TABLE 4.5. Source Area ST20 E-9: Summary of Cancer Risk and Hazard Index, Future Industrial Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Groundwater ingestion	1.46E-07	0.1	4.05E-07	1.0
Dermal contact during groundwater use	1.57E-07	0.9	5.20E-07	13.0
Inhalation of volatiles during groundwater use	1.09E-06	1.3	3.04E-06	14.1
Ingestion of surface soils	2.22E-09	0.0	1.25E-08	0.0
Dermal contact with surface soils	5.06E-10	0.0	1.25E-08	0.0
Ingestion of subsurface soils	3.65E-10	0.0	2.05E-09	0.0
Dermal contact with subsurface soils	8.32E-11	0.0	2.05E-09	0.0
Inhalation of volatiles from soils	7.39E-08	0.0	3.85E-07	0.0
Inhalation of resuspended particulates from soil	1.92E-13	0.0	1.08E-12	0.0
Total Cancer Risk	1.4E-06		4.4E-06	
Total Hazard Index		2.3		28.1

(a) RME = Reasonable Maximum Exposure

4.5 SITE-SPECIFIC UNCERTAINTIES AND CONSIDERATIONS

This section presents key information bearing on the level of confidence in the quantitative risk estimates for a site. The risk values are conditional, given a considerable number of assumptions about site characterization, exposure, and toxicity. Major categories of uncertainty are discussed herein.

The source of chlorobenzene contamination in 1988/1989 groundwater samples has not been identified. This unknown source may still be contributing to the contamination at this source area.

The bis(2-ethylhexyl)phthalate and methylene chloride detected in ST20 E-9 groundwater samples are believed to be laboratory contaminants, and, therefore, they are not included in the risk calculations. Soil concentration data for DDT detected in the 1993 sampling were not available at the time of preparation of this draft. Including this pesticide would increase the calculated cancer risk from soil exposure by approximately one order of magnitude.

The possibility exists that an active source is present at the source area and contributes fuel contamination to the groundwater.

5.0 SOURCE AREA ST48: POWER PLANT AREA FUEL LEAK

Source Area ST48 is located in the east-central portion of Eielson AFB, near the intersection of Division Street and Industrial Drive (Figure 1.2, "Source Area Locations in Operable Unit 1"). Source Area ST48 has ten active groundwater monitoring wells. Source Area ST48 is adjacent to an active coal-generated central heating and power plant, a coal storage pile, an ash storage house, active railroad lines, abandoned below-grade fuel lines, and a utility corridor. Groundwater wells in the area include the main base drinking water supply well (Base Water Supply Well D) and two cooling-water supply wells (Wells 1 and 2).

The abandoned gasoline and diesel fuel lines reportedly served as delivery lines from bulk storage tanks to an old military service station formerly located at the intersection of Division Street and Wabash Avenue. The suspected source of hydrocarbon contamination is leakage from the fuel lines where they pass beneath Industrial Drive. Primary contaminants of concern associated with the fuel leak include total petroleum hydrocarbons (TPH); nonchlorinated volatile organics, such as benzene, toluene, ethylbenzene, and xylene (BTEX); polycyclic aromatic hydrocarbons (PAHs) which are characteristically semivolatile (such as naphthalene); and trace amounts of metals.

5.1 CONCEPTUAL SITE MODEL

A conceptual site model was originally developed based on the results of previous investigations reported in the Remedial Investigation/Feasibility Study Operable Unit 1 Management Plan (U.S. Air Force 1993a). Subsequently the Eielson AFB, Alaska, Operable Unit 1, Draft Remedial Investigation (RI) Report, Volume 1: Text and Appendices, August 1993 (U.S. Air Force 1993b, Volume 1) was used to update the conceptual site model. The reader is referred to the RI for the most current site characterization information.

The components of this model include geology, hydrogeology, and the nature and extent of contamination in the soil and groundwater. The model addresses the nature and presence of floating product; BTEX, TPH in soil, benzene, and volatile organics in the groundwater.

5.1.1 Geology and Hydrology

Subsurface exploration by monitoring wells, soil borings, and test pits at ST48 indicates that the upper 25 m is dominated by sandy gravel. However, lenses/layers of silt or silty sand frequently occur in this interval. Permafrost conditions were not encountered during recent subsurface investigations, nor were permafrost conditions reported in the drilling logs for cooling-water supply Wells 1 and 2. The distance to groundwater generally ranges between 2.4 m to 4.2 m BGS.

Groundwater flow has a relatively high velocity and is influenced noticeably by pumping from Base Water Supply Well D, and to a lesser extent by pumping from the two cooling-water supply wells (Wells 1 and 2). Well D, which is screened from 31 to 37.7 m BGS, is pumped continuously at about 3,785 L/minute (1,000 gallons per minute). Nearby water supply Wells A and B are used when Well D is undergoing maintenance or repair, and during periods of high water demand.

A detailed discussion of the geology and hydrogeology at the ST48 complex is described in the Eielson AFB, Alaska, Operable Unit 1, Draft Remedial Investigation (RI) Report, Volume 1: Text and Appendices, August 1993 (U.S. Air Force 1993b). The reader is referred to the RI for the most current information. A field investigation conducted in May 1993 is contained in the RI and includes monitoring well water-levels, floating product thicknesses measurements, and chemical analytical results.

5.1.2 Groundwater Contamination

The major contributor to ground water contamination was a leak in an underground fuel piping system. The floating product is centered near the intersection of Industrial Drive and Division Street. Floating product is also present near the ash house but its likely source is unknown. Benzene, ethylbenzene, toluene, and xylenes have been detected in the groundwater. Metals and organics, not normally associated with petroleum (i.e., 2,4-dimethyphenol and trans-dichloroethylene) have also been detected in the groundwater at ST48.

The floating product consists of two physically distinct phases: a water-soluble phase and a relatively non-water-soluble phase. The water-soluble chemical components of the floating product dissolve into the groundwater and migrate with the groundwater. The water-soluble contaminants (which tend to be the lighter-molecular-weight petroleum constituents, such as benzene, toluene, ethylbenzene, and xylene) solubilize and volatilize. As the water-soluble contaminants that dissolve into the groundwater are carried with the groundwater downgradient, each contaminant moves at a unique chemical-specific rate: e.g., benzene moves faster than toluene; toluene moves faster than the other soluble organic constituents; and soluble lead moves at the slowest rate.

The aquifer has a relatively high rate of horizontal groundwater flow velocity (approximately 0.46 to 2.76 m/d), and a relatively slow rate of vertical mixing. The combined effect is to confine groundwater contaminants near the top of the upper groundwater level. For example, the concentration of benzene in groundwater should be highest near the top of the aquifer (within the contamination plume). The floating product remains as a continuing source of lighter-molecular-weight petroleum constituents to be leached into the groundwater. The leaching rate is most likely governed by physical constraints such as solubility, water infiltration rates, and temperature. It can be assumed that the concentrations of lighter-molecular-weight petroleum constituents will not vary dramatically under, or near, the floating product over the thirty-year period for which risk is evaluated in this report. The concentrations of lighter-molecular-weight petroleum constituents can be expected to decrease with distance away from the floating product.

The material of the less water-soluble phase, composed of higher-molecular-weight hydrocarbons, remains and accumulates in the subsurface soils above the groundwater level. As the lighter-molecular-weight petroleum constituents migrate out of the floating product, the viscosity of the remaining material increases. The higher-molecular-weight hydrocarbon accumulation in the subsurface soil likely varies in depth in accordance with fluctuations in the groundwater elevation. As they accumulate and increase in viscosity, the higher-molecular-weight hydrocarbon contaminants become less

mobile in the soil matrix, until eventually movement virtually stops and a highly viscous layer is formed in the soil. The presence of these higher-molecular-weight hydrocarbon contaminants in soil samples is inferred by measuring TPH.

5.1.3 Soil Contamination

The soils are contaminated with lead and TPH. The absence of toluene, xylene, and ethylbenzene in the soils, however, may indicate that little fuel was spilled on the surface of the soil and allowed to infiltrate. However, the presence of TPH lower in the soil profile indicates that large amounts of fuel have likely been released directly to the deeper soils. This hypothesis is in keeping with the location of the known underground petroleum leak discussed earlier.

5.1.4 Ambient Air Contamination

Contamination of the ambient air may occur when contaminants with high vapor pressures (e.g., benzene) are released to the atmosphere from soil contamination. No high-vapor-pressure contaminants were detected in the soils of this source area, and therefore there is no anticipated risk associated with this exposure pathway.

5.1.5 1993 Sampling Data

The RI reports that TPH was detected in soil samples collected in 1993 but was present at lower concentrations than reported in 1989. The maximum TPH value detected in surface soil in 1993 is 550 mg/kg. TPH was also detected near the coal piles at a concentration of 11 mg/kg. The highest soil TPH level (19,500 mg/kg) was found near free product at a depth of 4 m BGS. Several PAHs were detected in 1993 surface-soil samples. Benzo(a)pyrene was detected at 970 $\mu\text{g/kg}$ in a surface-soil sample collected adjacent to Division Street.

According to the RI, groundwater samples for 1993 contain benzene (@ 910 $\mu\text{g/L}$). Benzene was detected in previous sampling programs at higher concentrations. The RI reports that (based on 1993 data) a benzene plume extends from the free product to water supply well D. Well D was sampled in 1993 and found to contain detectable concentrations of benzene. The RI also

reports that naphthalene (250 $\mu\text{g/L}$) and methylnaphthalene (130 $\mu\text{g/L}$) were in two wells. The RI reports the presence of low concentrations (below the MCL) of trans-dichloroethylene and trichloroethylene detected in groundwater samples collected in 1993.

The 1993 sampling program tested for metals in soil and groundwater. The presence in groundwater of manganese, lead, and arsenic were confirmed by the 1993 sampling program. These three metals are consistently detected at ST48 at concentrations above background. In addition, they contribute the majority of the cancer risk and hazard index of the metals detected in groundwater. The risk from the following metals detected in groundwater in 1989/1991 were calculated: arsenic, barium, lead, manganese, mercury, and vanadium.

Metals detected in soil collected in 1989, 1991, and 1993 were concluded to be within the local natural background range and therefore not included in the risk assessment calculations.

5.2 EXPOSURE ASSESSMENT

The Exposure Assessment section identifies all potential pathways of exposure and successively screens them to determine which are important to assess qualitatively. This step in the risk assessment process presents all potential pathways and screens the pathways based on site-specific considerations such as current and anticipated land use, past industrial practices, and the occurrence of site-related contaminants in environmental media. The Exposure Pathway screening step rules out pathways with a low probability of occurrence and identifies those pathways that will likely constitute the major risks to public health. These are the pathways that will be addressed in the subsequent quantitative risk characterization.

Exposure is defined as the contact of an organism with a chemical or physical agent. The overall objective of the exposure assessment is to estimate the types and magnitude of exposures to chemicals of potential concern that are present at, or migrating from, the site. The results of the exposure assessment are combined with chemical-specific toxicity information to characterize potential risks (U.S. EPA 1989a).

The Exposure Assessment section examines land use, exposure time frame, exposure setting, and exposure pathways. Table 5.1 lists the human exposure pathways that are viable for the specific OU-1 source area. Table 5.1 summarizes the results of the exposure assessment, while the corresponding text provides details on the exposure pathway screening step. Fate and transport modeling results, intake variables and/or exposure factors, and toxicological values are presented elsewhere in this report. (See list in Section 5.4.)

5.2.1 Land-Use Assumptions

Health risk will be quantified for three land-use assumptions. The risk from current land use is industrial in nature, while two different land-use assumptions are considered for evaluation of the future risk: residential housing, and military/industrial land use. It is assumed throughout that no mitigation or corrective action is undertaken. One difference between the current and future industrial land-use assumption is that the exposure conditions are expected to change. For example, new wells may be drilled where currently none exist, and these new wells might be used by workers as a potable supply (such as showering and limited drinking).

Contaminants reaching Base Water Supply Well D, located downgradient from Source Area 48, are expected to change in concentration over time. The change in future concentrations of benzene in Base Supply Well D, resulting from migration of the known contamination at Source Area ST48, is modeled and the results presented in Appendix K. The estimated human health risk associated with the benzene migration to Base Water Supply Well D is discussed in Section 5.4.

Housing is within 100 meters of ST48 and a school is located across the street.

Property used for military purposes is subject to being closed at any time. However, current long-range, land-use plans indicate that Eielson AFB will remain an active military facility and that all OU-1 source areas will be industrial sites for the foreseeable future.

**TABLE 5.1. Summary of Human Exposure Pathways
for Source Area ST48**

	Current Land Use	Future Land Use	
	Industrial	Residential	Industrial
Ingestion of groundwater used as potable water supply	-(a)	X ^(b)	X
Dermal contact with contaminants during groundwater use	-	X	X
Inhalation of volatile contaminants during groundwater use	-	X	X
Incidental ingestion of surface water	-	-	-
Ingestion of fish	-	-	-
Incidental ingestion of surface soils	X	X	X
Ingestion of plants grown in contaminated soils	-	X	-
Ingestion of animals fed on plants grown in contaminated soils	-	-	-
Incidental ingestion of subsurface soils	X	X	X
Inhalation of volatile contaminants released from the soil into ambient air	X	X	X
Dermal contact with surface soils and dust	X	X	X
Dermal contact with subsurface soils	X	X	X
Inhalation of resuspended particulates	X	X	X
Dermal contact with surface water	-	-	-
Ingestion of sediments	-	-	-
Dermal contact with sediments	-	-	-

(a) - = Pathway eliminated; see text for elimination rationale.

(b) X = Pathway retained for quantitative risk evaluation.

5.2.2 Current Exposure Pathways: Industrial

Current land use of ST48 is for military/industrial purposes. For the current time frame, the following industrial land-use human exposure pathways are complete and reasonable for further analysis:

- incidental ingestion of surface soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils
- inhalation of resuspended particulates.

A detailed explanation of the methodology and formulas used to calculate exposure/dose from these pathways is contained in Appendix A. Exposure factors or exposure parameters used to describe each pathway may be found in Appendix B.

Because groundwater is not currently used, the exposure pathways associated with the groundwater medium are not evaluated further. These include:

- ingestion of groundwater
- dermal contact with contaminants during groundwater use
- inhalation of volatiles during groundwater use.

There is no accessible surface water in the vicinity of the OU-1 site source areas. Therefore, the plausible pathways do not encompass ingestion of, or dermal exposure to, surface water, sediment, or fish. Several ponds do exist in the taxiway loop, but these are not accessible to workers or the public. No grazing, gardening, or agricultural use is made of the OU-1 source areas; therefore, ingestion of plants grown in contaminated soils, or of animals fed on such plants, is not examined for this scenario.

5.2.3 Future Exposure Pathways: Residential

For residential housing land use as a future exposure assumption, the following pathways are considered to be complete and reasonable for analysis:

- ingestion of groundwater used as a potable water supply
- dermal contact with contaminants during groundwater use
- inhalation of volatile contaminants during groundwater use
- incidental ingestion of surface soils
- ingestion of plants grown in contaminated soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils
- inhalation of resuspended particulates.

Future residences are assumed to utilize groundwater as a potable supply and to have garden plots associated with the homes. All exposure pathways postulated (and listed above) are examined. Surface water and sediment exposure are not viable pathways and are not considered in the subsequent risk calculations. In addition, it is assumed that future housing areas will not be used to graze livestock. Therefore, human exposure via ingestion of animals fed on plants grown in contaminated soils is eliminated from further consideration.

5.2.4 Future Exposure Pathways: Industrial

For industrial land use as a future exposure assumption, the following pathways are considered to be complete and reasonable for analysis:

- ingestion of groundwater used as a limited potable water supply
- dermal contact with contaminants during groundwater use
- inhalation of volatile contaminants during groundwater use
- incidental ingestion of surface soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust

- dermal contact with subsurface soils
- inhalation of resuspended particulates.

Industrial activities are assumed to be similar to existing military activities. However, it is assumed that in the future the area's groundwater plumes will be used as a potable supply on a limited basis. Therefore, three groundwater exposure scenarios have been included in the list above.

5.3 EXPOSURE POINT CONCENTRATIONS

The identity and concentrations of chemicals of potential concern for the source area are provided in Table 5.2, "Concentrations of Chemicals of Potential Concern for Source Area ST48." This table presents the exposure point concentrations corresponding to those of the anticipated receptors, given the particular site-related contaminants. The "Average Exposure Case" uses the arithmetic average concentration value for the contaminant by medium. The "Reasonable Maximum Exposure Case" uses the contaminant concentration corresponding to the 95% upper confidence value of the chemical analytical data, assuming it is normally distributed, or, when appropriate, the maximum detected concentration.

5.4 RISK CHARACTERIZATION

The primary risk calculations are presented in Appendix A. This section summarizes in table format the excess cancer risk and the hazard index for source area ST48 by exposure pathway. The cancer risk and hazard index are presented for both the "Average Exposure Case" and the "Reasonable Maximum Exposure Case." Table 5.3 presents risk values for the current industrial land use; Table 5.4 presents the values for the future residential land use; and Tables 5.5 presents the values for the future industrial land use. Each table presents, individually, the cancer risk and the hazard index for each exposure pathway. All of the exposure pathway risks are then combined to show total cancer risk values and total hazard indices.

TABLE 5.2. Concentrations of Chemicals of Potential Concern for Source Area ST48

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Maximum Value Detected	95% UCL ^(a)
Soils						
TPH ^(d)	TPH	SO	µg/kg	830000	32000000	8500000
Groundwater						
2,4-Dimethylphenol	105-67-9	WD ^(e)	µg/L ^(f)	2	10	8
Arsenic, Total	7440-38-2	WD	µg/L	26.8	26.8	NA ^(g)
Barium, Total	7440-39-3	WD	µg/L	722	722	NA
Lead, Total	7439-92-1	WD	µg/L	37	152	133
Manganese, Total	7439-96-5	WD	µg/L	5670	5670	NA
Mercury, DISS	7439-97-6	WD	µg/L	0.7	0.7	NA
Naphthalene	91-20-3	WD	µg/L	67	440	330
Total Xylenes	1330-20-7	WD	µg/L	290	1990	1510
TPH	TPH	WD	µg/L	26000	400000	210000
Vanadium, Total	7440-62-2	WD	µg/L	37	37	NA
Benzene	71-43-2	WG	µg/L	530	7100	3800
Ethylbenzene	100-41-4	WG	µg/L	150	950	730
t-Dichloroethylene	156-60-5	WG	µg/L	25	490	240
Toluene	108-88-3	WG	µg/L	720	6600	4300

- (a) UCL = upper confidence limit
(b) SO = soil
(c) µg/kg = microgram (chemical) per kilogram soil
(d) TPH = total petroleum hydrocarbons
(e) WD = groundwater
(f) µg/L = microgram (chemical) per liter of water
(g) NA = not applicable

TABLE 5.3. Source Area ST48: Summary of Cancer Risk and Hazard Index, Current Industrial Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Ingestion of surface soils	0	0.0	0	0.0
Dermal contact with surface soils	0	0.0	0	0.0
Ingestion of subsurface soils	0	0.0	0	0.0
Dermal contact with subsurface soils	0	0.0	0	0.0
Inhalation of volatiles from soils	0	0.0	0	0.0
Inhalation of resuspended particulates from soil	0	0.0	0	0.0
Total Cancer Risk	0		0	
Total Hazard Index		0.0		0.0

(a) RME = Reasonable Maximum Exposure

TABLE 5.4. Source Area ST48: Summary of Cancer Risk and Hazard Index, Future Residential Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Groundwater ingestion	1.21E-04 (2.99E-05)	25.7 (0.3)	1.85E-03 (1.30E-03)	41.1 (3.7)
Dermal contact during groundwater use	2.32E-05 (2.30E-05)	0.7 (0.6)	8.37E-04 (8.36E-04)	5.4 (5.4)
Inhalation of volatiles during groundwater use	1.60E-04 (1.60E-04)	0.9 (0.9)	4.89E-03 (4.89E-03)	7.0 (7.0)
Ingestion of surface soils	0	0.0	0	0.1
Dermal contact with surface soils	0	0.0	0	0.0
Ingestion of subsurface soils	0	0.0	0	0.0
Dermal contact with subsurface soils	0	0.0	0	0.0
Inhalation of volatiles from soils	0	0.0	0	0.0
Inhalation of resuspended particulates from soil	0	0.0	0	0.0
Ingestion of plants	0	0.0	0	0.0
Total Cancer Risk	3.0E-04 (2.1E-04)		7.6E-03 (7.0E-03)	
Total Hazard Index		2.7 (1.8)		53.6 (16.2)

(a) RME = Reasonable Maximum Exposure

TABLE 5.5. Source Area ST48: Summary of Cancer Risk and Hazard Index, Future Industrial Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Groundwater ingestion	7.84E-05 (1.94E-05)	16.7 (0.2)	5.52E-04 (3.88E-04)	14.7 (1.3)
Dermal contact during groundwater use	2.11E-05 (2.09E-05)	0.6 (0.6)	4.98E-04 (4.98E-04)	3.9 (3.8)
Inhalation of volatiles during groundwater use	1.46E-04 (1.46E-04)	0.8 (0.8)	2.91E-03 (2.91E-03)	5.0 (5.0)
Ingestion of surface soils	0	0.0	0	0.0
Dermal contact with surface soils	0	0.0	0	0.0
Ingestion of subsurface soils	0	0.0	0	0.0
Dermal contact with subsurface soils	0	0.0	0	0.0
Inhalation of volatiles from soils	0	0.0	0	0.0
Inhalation of resuspended particulates from soil	0	0.0	0	0.0
Total Cancer Risk	2.5E-04 (1.9E-04)		4.0E-03 (3.8E-03)	
Total Hazard Index		18.1 (1.6)		23.6 (10.1)

(a) RME = Reasonable Maximum Exposure

The calculation of the cancer risk and hazard index necessitates the use of information and data input from many sources presented elsewhere in this report. For ease of reference, the information used to perform the risk calculations is noted below along with a cross reference to its location within this document.

Identification of Chemicals of Potential Concern	Section 8.0
Toxicity Assessment	Section 9.0
Risk Calculation Spreadsheets and Formulas	Appendix A
Exposure Factors	Appendix B

The risk values presented in Tables 5.3, 5.4 and 5.5 are based on the assumption that the concentrations of chemical contaminants do not change over the exposure duration. The current average and the 95% UCL concentration are assumed to be the long-term exposure source terms; i.e., these values correspond to those of the anticipated receptor. As shown in Table 5.2, TPH and benzene values in ST48 groundwater are high (maximum detected 400000 $\mu\text{g/L}$ and 7100 $\mu\text{g/L}$, respectively). However, the groundwater contamination at ST48 is not confined to the source area. Therefore, the off-site impact of ST48 was also assessed.

It is known that Base Supply Well D, a potable supply well, is located downgradient from ST48. Groundwater modeling (presented in Appendix K) is used to calculate the concentration of benzene in Well D (as a function of time) which is attributable to ST48. According to the model, benzene contamination from ST48 has already arrived at Well D. The peak benzene concentration at Well D is predicted to be approximately 300 $\mu\text{g/L}$ and occur in the year 2019. Cancer risk was calculated using the modeling concentration results for Well D. Residential sole-source use of Well D results in a cancer risk ranging from 3.2E-04 to 7.0E-05.

A 30-year exposure duration is assumed, which spans the period from 1993 through 2023. The following exposure pathways are represented in the risk values presented: groundwater ingestion, dermal contact with groundwater during use, and inhalation of volatiles during groundwater use (see Appendix B for exposure factors). An average benzene concentration value in groundwater

of 175 $\mu\text{g/L}$ was assumed for the 30-y exposure period and is based upon projected benzene concentration presented in Appendix K.

5.5 SITE-SPECIFIC UNCERTAINTIES AND CONSIDERATIONS

This section presents key information bearing on the level of confidence in the quantitative risk estimates for a site. The risk values are conditional, given a considerable number of assumptions about site characterization, exposure, and toxicity. Major categories of uncertainty are discussed herein.

The temporal and spatial variations in concentrations of naturally occurring metals in the groundwater are not known with certainty. Knowledge of this information could affect both the total risk of groundwater use and the amount of contamination contributed to the groundwater by past site activities.

PCB 1254 was reportedly detected in 1989 at 240 $\mu\text{g/kg}$ in a surface-soil sample. Pesticides analysis of soil detected DDT, DDD, and DDE. These sampling data were not input to the risk assessment database and therefore were not included in the risk calculations. The presence of PCBs was not confirmed in the 1993 sampling. Including the pesticide data will serve to increase the carcinogenic risk presented in the risk calculations.

The ratio of hexavalent chromium to trivalent chromium is not known for the chromium measured in the groundwater. Because the more toxic hexavalent was assumed to be the only form of chromium present, knowing the ratio would presumably lower the estimated risk.

Not all sources of soil and groundwater contamination have been identified. Unknown sources may still be contributing to the contamination at this source area.

The bis(2-ethylhexyl)phthalate in groundwater is likely a laboratory contaminant. It is unlikely that bis(2-ethylhexyl)phthalate detected in groundwater samples is representative of the overall aquifer conditions, and therefore its detection is not included in the risk calculations. Trichloroethylene was reported by the RI to have been detected in groundwater. The data were not available during the preparation of the risk assessment. If

The data were not available during the preparation of the risk assessment. If they were included, the calculated risk attributable to this source area would increase.

The source area's groundwater hydrogeology does not appear to be thoroughly defined. The monitoring data do not seem to fit the generalized conceptual site model, which assumes little or no vertical hydraulic mixing. For example, benzene was detected in Well D and 48M05 but not in groundwater sampled above and below in the same location. This finding may indicate that there is a source contributing to contamination in Well D (other than ST48) which might also account for the presence of 1, 2-DCE in groundwater.

Metals, TPH, and PAHs occur naturally in coal. Therefore, the coal-pile storage area was sampled in 1993 to ascertain if it is a contributing source of this type of contamination and was found to contain 11 mg/kg of TPH. It is also possible that diesel fuel or oil may have been sprayed on the coal pile to prevent freezing and for dust suppression.

6.0 SOURCE AREA ST49: ALERT HANGAR FUEL LEAK

Source Area ST49 is located south of the main airport runway, in the southern portion of the base as shown in Figure 1.2, "Source Area Locations in Operable Unit 1." The source area is approximately 7.5 acres (3 hectares) in size and includes Building 1300 and the adjacent taxiway, which together comprise a de-activated combat alert hangar complex. A 568-liters-per-minute (L/minute) base production well (Well No. 7) producing potable water for the secondary Base system is located approximately 183 m east (hydraulically upgradient) of ST49.

Soil and groundwater in ST49 are contaminated with fuel and solvents. The probable human-exposure pathways from this contamination are presented in Table 6.1. Contaminants of concern are shown in Table 6.2. One suspected source of fuel-related contamination at ST49 is a diesel fuel spill from an above-ground storage tank. Washdown water from the hangar, aprons, and/or the nearby taxiway is a suspected source of the chlorinated volatile organic compounds (VOC) detected in ST49 groundwater.

6.1 CONCEPTUAL SITE MODEL

A conceptual site model was originally developed based on the results of previous investigations reported in the Remedial Investigation/Feasibility Study Operable Unit 1 Management Plan (U.S. Air Force 1993a). The conceptual site model was subsequently updated based on the Eielson AFB, Alaska, Operable Unit 1, Draft Remedial Investigation (RI) Report, Volume 1: Text and Appendices, August 1993 (U.S. Air Force 1993b, Volume 1). The reader is referred to the RI for the most current site characterization information. The RI contains a field investigation conducted in May 1993 and includes monitoring-well water levels, chemical analytical sampling results, and measurements of floating-product thicknesses.

The components of this model include geology, hydrogeology, and the nature and extent of contamination in the soil and groundwater. The model addresses the nature and presence of floating petroleum-based product; total petroleum hydrocarbon (TPH) in soil; and benzene, toluene, ethylbenzene and xylene (BTEX); and trichloroethane (TCE) in groundwater.

**TABLE 6.1. Summary of Human Exposure Pathways
for Source Area ST49**

Theoretical Pathways	Current Land Use	Future Land Use	
	Industrial	Residential	Industrial
Ingestion of groundwater used as potable water supply	-(a)	X ^(b)	X
Dermal contact with contaminants during groundwater use	-	X	X
Inhalation of volatile contaminants during groundwater use	-	X	X
Incidental ingestion of surface water	-	-	-
Ingestion of fish	-	-	-
Incidental ingestion of surface soils	X	X	X
Ingestion of plants grown in contaminated soils	-	X	-
Ingestion of animals fed on plants grown in contaminated soils	-	-	-
Incidental ingestion of subsurface soils	X	X	X
Inhalation of volatile contaminants released from the soil into ambient air	X	X	X
Dermal contact with surface soils and dust	X	X	X
Dermal contact with subsurface soils	X	X	X
Inhalation of resuspended particulates	X	X	X
Dermal contact with surface water	-	-	-
Ingestion of sediments	-	-	-
Dermal contact with sediments	-	-	-

(a) - = Pathway eliminated; see text for elimination rationale.

(b) X = Pathway retained for quantitative risk evaluation.

TABLE 6.2. Concentrations of Chemicals of Potential Concern for Source Area ST49

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Maximum Value Detected	95% UCL ^(a)
Soils						
Benzo(A)Anthracene	56-55-3	SO ^(b)	µg/kg ^(c)	84	390	370
Benzo(A)Pyrene	50-32-8	SO	µg/kg	58	400	310
Benzo(B)Fluoranthene	205-99-2	SO	µg/kg	30	160	120
Beryllium	7440-41-7	SO	µg/kg	1053	1050	NA ^(d)
DDD, PP'	72-54-8	SO	µg/kg	178	356	NA
Indeno(1,2,3-CD)Pyrene	193-39-5	SO	µg/kg	58	290	230
TPH ^(e)	TPH	SO	µg/kg	171000	2530000	1110000
Groundwater						
1,1-Dichloroethane	75-35-3	WD ^(f)	µg/L ^(g)	0.4	1.57	1.20
1,2-Dichlorobenzene	95-50-1	WD	µg/L	0.2	0.25	0.33
1,4-Dichlorobenzene	106-46-7	WD	µg/L	1	4.53	4.12
Arsenic, Total	7440-38-2	WD	µg/L	22	22.4	NA
Barium, Total	7440-39-3	WD	µg/L	420	418	NA
Benzene	71-43-2	WD	µg/L	1	6	4
Benzo(A)-Anthracene	56-55-3	WD	µg/L	0.005	0.026	0.024
Benzo(A)Pyrene	50-32-8	WD	µg/L	0.004	0.015	NA
Benzo(B)-Fluoranthene	205-99-2	WD	µg/L	0.004	0.012	0.012
Dibenzo(A,H)-Anthracene	53-70-3	WD	µg/L	0.002	0.005	0.005
Indeno(1,2,3-CD)-Pyrene	193-39-5	WD	µg/L	0.003	0.009	0.009
Lead, Total	7439-92-1	WD	µg/L	20.8	20.8	NA
Naphthalene	91-20-3	WD	µg/L	13	62	54
Phenanthrene	85-01-8	WD	µg/L	3	21	19
TPH	TPH	WD	µg/L	44	32300	26500
Trichloroethene	79-01-6	WD	µg/L	1.4	6.93	4.6

(a) UCL = upper confidence limit

(b) SO = soil

(c) µg/kg = microgram (chemical) per kilogram soil

(d) NA = not applicable, sample size insufficient for statistically meaningful evaluation

(e) TPH = total petroleum hydrocarbons

(f) WD = groundwater

(g) µg/L = microgram (chemical) per liter of water

6.1.1 Geology and Hydrogeology

A detailed discussion of the geology and hydrogeology at the ST49 complex is described in the Eielson AFB, Alaska, Operable Unit 1, Draft Remedial Investigation (RI) Report, Volume 1: Text and Appendices, August 1993 (U.S. Air Force 1993b).

Subsurface conditions generally consist of sandy gravel encountered at a depth of 2.5 m to 4 m below ground surface (BGS) to a depth of 9.1 m. The upper 2.5 m to 4 m generally consist of a variety of sediments, including sandy gravel, gravelly silty sand, gravelly sand, and silty sand. Groundwater is generally encountered at 3 m BGS. Groundwater flow is generally to the north-northwest at a calculated speed of 0.46 to 2.76 m/d.

The hydraulic influence on groundwater flow from pumping at the Base's upgradient water supply well (Well 7) is not known. However, little influence is anticipated because of the well's relatively low pumping rate. The hydraulic influence of nearby Garrison Slough on upgradient shallow groundwater flow is also not known with certainty, but the RI suggests that Garrison Slough loses water to the aquifer most times of the year. North of the hangar, Garrison Slough has been routed through a corrugated metal pipe in order to pass beneath the taxiway. An inlet sump to this pipe is located in the middle of the field north of the alert hangar. The pipe discharges to ponds near the gun-clearing butt about 500 m away from ST49. There are no data to indicate that any site-related contaminants are migrating via this piping system. Contamination in groundwater and soil is likely due to past washdown practices and fuel tank leaks. Chemicals from maintenance activities in the hangar, taxiways, and aprons were likely rinsed. There is no indication that contamination has entered any surface-water system. In addition, ST49 groundwater does not appear to be actively discharging to surface-water systems, nor is groundwater migrating in the direction of potable wells. There is a theoretical potential that in the future contaminated groundwater could discharge into Garrison Slough if the contaminant plume is allowed to migrate to Garrison Slough ponds at the outfall of the culvert system. However, Garrison Slough and its ponds are located cross-gradient to the direction of flow of the main plume and therefore would likely only receive low plume "fringe" concentrations.

6.1.2 Groundwater Contamination

Groundwater contamination at this source area is believed to have originated from several sources. The major contributor to groundwater contamination is floating product. The suspected source of the floating product is spilled diesel fuel. It is reported that spilled fuel was flushed to a floor drain in the utility room on the east side of the hangar. The drain reportedly was connected to the on-site septic system leach field at the time of the spill; however, no product was observed in the septic tank after the spill. The possibility exists that the floor drain into which the fuel emptied either had a leaky piping system, or was never connected to the sanitary sewer system. In either case, via this mechanism, spilled fuel likely contaminated subsurface soils and groundwater. Two underground tanks on the south end of the hangar are also potential sources of the floating product. BTEX compounds were detected by soil vapor survey around the septic system drain field at the south end of the hangar, but not around the floating product. This finding may suggest that fuel-related compounds were flushed to the septic system in the past via the hangar's floor drain system. It also suggests that the diesel fuel has weathered, leaving little of the residual BTEX compounds to migrate into surrounding soils or groundwater.

The soils above the floating product were not found to be contaminated with the normal indicators of petroleum contamination: i.e., benzene, xylene, toluene, and ethylbenzene. This indicates that infiltration through the soil profile was not the mode of petroleum contamination of the groundwater.

An industrial source of metal contamination of groundwater has not been identified. Chlorinated organics not normally associated with petroleum (i.e., dichlorobenzene and trichloroethane) are also present in the groundwater.

The floating product consists of two physically distinct phases: a water-soluble phase and a relatively non-water-soluble phase. The water-soluble chemical components of the floating product dissolve into the groundwater and migrate with the groundwater. The water-soluble contaminants (which tend to be the lighter-molecular-weight petroleum constituents, such as benzene, toluene, ethylbenzene, and xylene) solubilize and volatilize. As the

water-soluble contaminants that dissolve into the groundwater are carried with the groundwater downgradient, each contaminant moves at a unique chemical-specific rate: e.g., benzene moves faster than toluene; toluene moves faster than the other soluble organic constituents; and soluble lead moves at the slowest rate.

The aquifer has a relatively high rate of horizontal groundwater flow velocity (approximately 168 m/y to 1,007 m/y) and a relatively slow rate of vertical mixing. The combined effect is to confine groundwater contaminants near the top of the upper groundwater level. For example, the concentration of benzene in groundwater should be highest near the top of the aquifer (within the contamination plume). The floating product remains as a continuing source of lighter-molecular-weight petroleum constituents to be leached into the groundwater. The leaching rate is most likely governed by physical constraints such as solubility, water infiltration rates, and temperature. It is assumed that the concentrations of lighter-molecular-weight petroleum constituents will not vary dramatically under, or near, the floating product over the thirty-year period for which risk is evaluated in this report. The concentrations of lighter-molecular-weight petroleum constituents can be expected to decrease with distance away from the floating product.

The material of the less water-soluble phase, composed of higher-molecular-weight hydrocarbons, remains and accumulates in the subsurface soils above the groundwater level. As the lighter-molecular-weight petroleum constituents migrate out of the floating product, the viscosity of the remaining material increases. The higher-molecular-weight hydrocarbon accumulation in the subsurface soil likely varies in depth in accordance with fluctuations in the groundwater elevation. As they accumulate and increase in viscosity, the higher-molecular-weight hydrocarbon contaminants become less mobile in the soil matrix, until eventually movement virtually stops and a highly viscous layer is formed in the soil. The presence of these higher-molecular-weight hydrocarbon contaminants in soil samples is inferred by measuring TPH.

6.1.3 Soil Contamination

The soils are contaminated with a metal (beryllium), a pesticide (DDD), polycyclic aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH). The absence of toluene, xylene, and ethylbenzene in the soils, however, indicates that little fuel was spilled on the surface of the soil and allowed to infiltrate. However, the presence of TPH lower in the soil profile indicates that large amounts of fuel have likely been released directly to the deeper soils. Two distinct areas of subsurface TPH soil contamination have been identified at ST49. The first is near the floating-product area and is likely attributable to "smearing" of the floating product due to seasonal changes in the water table. The second area of TPH soil contamination is downgradient of the floating-product area and is thought to be centered around a concrete sump into which water from several nearby drain lines empties. It is likely that TPH-contaminated water drained into the sump and migrated into surrounding soils.

The source of metals contamination in the soils is unknown. However, the PAH may have originated in oils washed from the hangar or from the nearby asphalt taxiway.

6.1.4 Ambient Air Contamination

Contamination of the ambient air may occur when contaminants with high vapor pressures (e.g., benzene) are released to the atmosphere from soil contamination. No high-vapor-pressure contaminants were detected in the soils of ST49; therefore, there is no appreciable risk associated with this exposure pathway.

6.1.5 1993 Sampling Data

The laboratory analyses performed in 1993 included groundwater samples collected from seven monitoring wells. Surface water and sediment samples were collected from Garrison Slough upstream and downstream of the Alert Hangar. Surface and subsurface soils were sampled for volatiles, TPH, semivolatiles, pesticides, and PCB analyses. Groundwater samples were collected and analyzed for organics and metals. Water levels and product thickness measurements were made in wells, groundwater probes, and product

probes. In the May 1993 field investigation, no product layer was detected in any of the monitoring wells or probes in ST49.

The RI reports that no BTEX compounds were detected in soil samples in 1989 or 1993. Low concentrations (7.9 to 11.0 mg/kg) of TPH were detected in soil near the inlet pump to Garrison Slough and in soil borings at ST49. Higher values were reported in 1989/1991 (171 mg/kg to 2530 mg/kg). The RI reports that "kerosene" was detected in Garrison Slough sediment samples and in groundwater. PAHs were detected in soil; the highest concentration was fluoranthene at 14,000 $\mu\text{g/kg}$. Garrison Slough sediment samples contained 41 $\mu\text{g/kg}$ of fluoranthene. The RI states that the data suggest that contamination may be entering Garrison Slough upgradient of ST49. Some phthalates were reportedly detected in 1993 samples. A 1993 sampling of metals in the soil reported them to be at background concentrations. Pesticides were detected in surface soil samples but not in subsurface soil samples collected in 1993. Pesticides detected in 1993 surface soil and Garrison Slough sediment samples included the following: chlordane, DDT, DDE, DDT, aldrin, dieldrin, heptachlor, heptachlor epoxide, aldrin, alpha-BHC, beta-BHC, and methoxychlor. The pesticide information was not received in time to be included in the baseline risk calculations. Groundwater samples were not collected in 1993 for pesticide analysis.

Petroleum hydrocarbons (32.3 mg/L) and benzene (8.2 $\mu\text{g/L}$) were detected in groundwater samples at ST49. The 1993 sampling of metals in the groundwater showed that lead and manganese are above local background concentrations.

6.2 EXPOSURE ASSESSMENT

The Exposure Assessment section identifies all potential pathways of exposure and successively screens them to determine which are important to assess qualitatively. This step in the risk assessment process presents all potential pathways and screens the pathways based on site-specific considerations, such as current and anticipated land use, past industrial practices, and the occurrence of site-related contaminants in environmental media. The Exposure Pathway screening step rules out pathways with a low probability of occurrence and identifies those pathways that will likely

constitute the major risks to public health. These are the pathways that will be addressed in the subsequent quantitative risk characterization.

Exposure is defined as the contact of an organism with a chemical or physical agent. The overall objective of the exposure assessment is to estimate the types and magnitude of exposures to chemicals of potential concern that are present at, or migrating from, the site. The results of the exposure assessment are combined with chemical-specific toxicity information to characterize potential risks (U.S. EPA 1989a).

The Exposure Assessment section examines land use, exposure time frame, exposure setting, and exposure pathways. Table 6.1 lists the human-exposure pathways that are viable for the specific OU-1 source area. Table 6.1 also summarizes the results of the exposure assessment, while the corresponding text provides details on the exposure pathway screening step.

Fate and transport modeling results, intake variables and/or exposure factors, and toxicological values are presented elsewhere in this report. (See list in Section 6.4.)

6.2.1 Land-Use Assumptions

Health risk will be quantified for three land-use assumptions. The risk from current land use is industrial in nature while two different land-use assumptions are considered for evaluation of the future risk: residential housing and military/industrial land use. The assumption is made throughout that no mitigation or corrective action is, or will be, undertaken. One difference between the current and future industrial land-use assumption is that the exposure conditions are expected to change. For example, new wells may be drilled where currently none exist, and these new wells might be used by workers for potable supply (such as showering and limited drinking).

Some areas of the Base are currently used for residences. However, there is no housing located near ST49.

Property used for military purposes is subject to being closed at any time. However, current long-range land-use plans indicate that Eielson AFB will remain an active military facility and that all OU-1 source areas will be industrial sites for the foreseeable future.

6.2.2 Current Exposure Pathways: Industrial

Current land use of ST49 is for military/industrial purposes. For the current time frame, the following industrial land use human-exposure pathways are complete and reasonable for further analysis:

- incidental ingestion of surface soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils
- inhalation of resuspended particulates.

A detailed explanation of the methodology and formulas used to calculate exposure/dose from these pathways is contained in Appendix A. Exposure factors or exposure parameters used to describe each pathway may be found in Appendix B.

Because groundwater is not currently used, the exposure pathways associated with the groundwater medium are not evaluated further. These include

- ingestion of groundwater
- dermal contact with contaminants during groundwater use
- inhalation of volatiles during groundwater use.

There is no accessible surface water in the vicinity of the OU-1 site source areas. Therefore, the plausible pathways do not encompass ingestion of, or dermal exposure to, surface water, sediment, or fish. Several ponds do exist in the taxiway loop, but these are not accessible to workers or the public. No grazing, gardening, or agricultural use is made of the OU-1 source areas; therefore, ingestion of plants grown in contaminated soils, or of animals fed on such plants, is not examined for this land use.

6.2.3 Future Exposure Pathways: Residential

For residential housing land use as a future exposure assumption, the following pathways are considered to be complete and reasonable for analysis:

- ingestion of groundwater used as a potable water supply
- dermal contact with contaminants during groundwater use
- inhalation of volatile contaminants during groundwater use
- incidental ingestion of surface soils
- ingestion of plants grown in contaminated soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils
- inhalation of resuspended particulates.

Future residences are assumed to utilize groundwater as a potable supply and to have garden plots associated with the homes. All exposure pathways postulated (and listed above) are examined. Surface water and sediment exposure are not viable pathways and are not considered in the subsequent risk calculations. In addition, it is assumed that future housing areas will not be used to graze livestock. Therefore, human exposure via ingestion of animals fed on plants grown in contaminated soils is eliminated from further consideration.

6.2.4 Future Exposure Pathways: Industrial

For industrial land use as a future exposure assumption, the following pathways are considered to be complete and reasonable for analysis:

- ingestion of groundwater used as a limited potable water supply
- dermal contact with contaminants during groundwater use
- inhalation of volatile contaminants during groundwater use
- incidental ingestion of surface soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust

- dermal contact with subsurface soils
- inhalation of resuspended particulates.

Industrial activities are assumed to be similar to existing military activities. However, it is assumed that in the future the area's groundwater plumes will be used as a potable supply on a limited basis. Therefore, three groundwater exposure scenarios have been included in the list above.

6.3 EXPOSURE POINT CONCENTRATIONS

The identity and concentrations of chemicals of potential concern for the source area are provided in Table 6.2, "Concentrations of Chemicals of Potential Concern for Source Area ST49." This table presents the exposure point concentrations corresponding to those of the anticipated receptors, given the particular site-related contaminants. The "Average Exposure Case" uses the arithmetic average concentration value for the contaminant by medium. The "Reasonable Maximum Exposure Case" uses the contaminant concentration corresponding to the 95% upper confidence value of the chemical analytical data, assuming it is normally distributed, or, when appropriate, the maximum detected concentration.

6.4 RISK CHARACTERIZATION

The primary risk calculations are presented in Appendix A. This section summarizes in table format the excess cancer risk and the hazard index for source area ST49 by exposure pathway. The cancer risk and hazard index are presented for both the "Average Exposure Case" and the "Reasonable Maximum Exposure Case." Table 6.3 presents risk values for the current industrial land use; Table 6.4 presents the values for future residential land use; and Tables 6.5 presents the values for future industrial land use. Each table presents, individually, the cancer risk and the hazard index for each exposure pathway. All of the exposure pathway risks are then combined to show total cancer risk values and total hazard indices.

TABLE 6.3. Source Area ST49: Summary of Cancer Risk and Hazard Index, Current Industrial Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Ingestion of surface soils	1.92E-07 (2.52E-08) ^(b)	0.0 (0.0)	8.52E-07 (3.35E-07)	0.0 (0.0)
Dermal contact with surface soils	9.55E-09 (5.75E-09)	0.0 (0.0)	3.86E-07 (3.35E-07)	0.0 (0.0)
Ingestion of subsurface soils	3.15E-08 (4.15E-09)	0.0 (0.0)	1.40E-07 (5.50E-08)	0.0 (0.0)
Dermal contact with subsurface soils	1.51E-09 (9.46E-10)	0.0 (0.0)	6.35E-08 (5.50E-08)	0.0 (0.0)
Inhalation of volatiles from soils	1.49E-10 (1.49E-10)	0.0 (0.0)	1.96E-09 (1.96E-09)	0.0 (0.0)
Inhalation of resuspended particulates from soil	3.03E-11 (2.18E-12)	0.0 (0.0)	1.16E-10 (2.89E-11)	0.0 (0.0)
Total Cancer Risk	2.3E-07 (3.6E-08)		1.4E-06 (7.8E-07)	
Total Hazard Index		0.0 (0.0)		0.0 (0.0)

(a) RME = Reasonable Maximum Exposure

(b) Values in parentheses exclude contribution from metals.

TABLE 6.4. Source Area ST49: Summary of Cancer Risk and Hazard Index, Future Residential Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Groundwater ingestion	7.67E-05 (7.40E-07) ^(b)	2.3 (0.0)	4.74E-04 (1.41E-05)	4.5 (0.4)
Dermal contact during groundwater use	5.35E-06 (5.22E-06)	0.0 (0.0)	7.96E-05 (7.88E-05)	0.1 (0.1)
Inhalation of volatiles during groundwater use	6.54E-06 (6.54E-06)	0.0 (0.0)	8.56E-05 (8.56E-05)	0.3 (0.3)
Ingestion of surface soils	4.72E-07 (6.22E-08)	0.0 (0.0)	6.73E-06 (2.64E-06)	0.0 (0.0)
Dermal contact with surface soils	1.18E-08 (7.10E-09)	0.0 (0.0)	8.73E-07 (7.56E-07)	0.0 (0.0)
Ingestion of subsurface soils	4.72E-07 (6.22E-08)	0.0 (0.0)	6.73E-06 (2.64E-06)	0.0 (0.0)
Dermal contact with subsurface soils	1.18E-08 (7.10E-09)	0.0 (0.0)	6.65E-07 (5.76E-07)	0.0 (0.0)
Inhalation of volatiles from soils	1.49E-10 (1.49E-10)	0.0 (0.0)	1.96E-09 (1.96E-09)	0.0 (0.0)
Inhalation of resuspended particulates from soil	3.73E-11 (2.67E-12)	0.0 (0.0)	1.72E-10 (4.28E-11)	0.0 (0.0)
Ingestion of plants	4.76E-07 (2.41E-07)	0.0 (0.0)	6.03E-06 (4.91E-06)	0.0 (0.0)
Total Cancer Risk	9.0E-05 (1.3E-05)		6.6E-04 (1.9E-04)	
Total Hazard Index		2.3 (0.0)		4.9 (0.8)

(a) RME = Reasonable Maximum Exposure

(b) Values in parentheses exclude contribution from metals.

TABLE 6.5. Source Area ST49: Summary of Cancer Risk and Hazard Index, Future Industrial Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Groundwater ingestion	4.98E-05 (4.81E-07) ^(b)	1.5 (0.0)	1.41E-04 (4.18E-06)	1.6 (0.1)
Dermal contact during groundwater use	4.87E-06 (4.75E-06)	0.0 (0.0)	4.74E-05 (4.69E-05)	0.1 (0.1)
Inhalation of volatiles during groundwater use	5.95E-06 (5.95E-06)	0.0 (0.0)	5.10E-05 (5.10E-05)	0.2 (0.2)
Ingestion of surface soils	1.92E-07 (2.52E-08)	0.0 (0.0)	8.52E-07 (3.35E-07)	0.0 (0.0)
Dermal contact with surface soils	9.55E-09 (5.75E-09)	0.0 (0.0)	3.86E-07 (3.35E-07)	0.0 (0.0)
Ingestion of subsurface soils	3.15E-08 (4.15E-09)	0.0 (0.0)	1.40E-07 (5.50E-08)	0.0 (0.0)
Dermal contact with subsurface soils	1.57E-09 (9.46E-10)	0.0 (0.0)	6.35E-08 (5.50E-08)	0.0 (0.0)
Inhalation of volatiles from soils	1.49E-10 (1.49E-10)	0.0 (0.0)	1.96E-09 (1.96E-09)	0.0 (0.0)
Inhalation of resuspended particulates from soil	3.03E-11 (2.18E-12)	0.0 (0.0)	1.16E-10 (2.89E-11)	0.0 (0.0)
Total Cancer Risk	6.1E-05 (1.1E-05)		2.4E-04 (1.0E-04)	
Total Hazard Index		1.5 (0.0)		1.8 (0.4)

(a) RME = Reasonable Maximum Exposure

(b) Values in parentheses exclude contribution from metals.

The calculation of the cancer risk and hazard index necessitates the use of information and data input from many sources presented elsewhere in this report. For ease of reference, the information used to perform the risk calculations is noted below along with a cross reference to its location within this document.

Identification of Chemicals of Potential Concern	Section 8.0
Toxicity Assessment	Section 9.0
Risk Calculation Spreadsheets and Formulas	Appendix A
Exposure Factors	Appendix B

6.5 SITE-SPECIFIC UNCERTAINTIES AND CONSIDERATIONS

This section presents key information bearing on the level of confidence in the quantitative risk estimates for a site. The risk values are conditional, given a considerable number of assumptions about site characterization, exposure, and toxicity. Major categories of uncertainty are discussed herein.

The RI reports that the 1993 sampling detected many pesticides in surface soil and Garrison Slough sediment. The analytical data were received too late to be incorporated in the baseline risk calculations. Many of the identified pesticides are potent carcinogens and toxicants and are present at toxicologically significant concentrations. Their inclusion will substantially raise the calculated cancer risk and hazard index presented herein. The 1993 subsurface soil samples did not contain pesticides, and the groundwater was not analyzed for the presence of pesticides.

The ratio of hexavalent chromium to trivalent chromium is not known for the chromium measured in the groundwater. Because the more toxic hexavalent species was assumed to be the only form of chromium present, knowing this ratio would presumably only lower the estimated risk.

Not all sources of contamination of both the soils and groundwater have been identified. Unknown sources may still be contributing to the contamination at this source area.

7.0 SOURCE AREAS 50 THROUGH 54: BLAIR LAKES RANGE

Study locations SS50, SS51, SS52, SS53, and DP54 are located at the Eielson AFB Blair Lakes Target Range Facility. A brief description of each study location is presented below:

SS50- Blair Lakes Vehicle Maintenance

SS50 is characterized by a heating oil spill at a storage tank and abandoned buried fuel lines.

SS51- Blair Lakes Ditch

SS51 consists of a 1-cm-thick layer of diesel fuel floating on water in a ditch excavated between the generator building and a fuel pump island. The source of the fuel leak is unknown.

SS52- Blair Lakes Diesel Spill

SS52 is a diesel fuel spill (of unknown quantity) from the failure of a 40-mm pipe connecting the main diesel fuel storage tanks to 2,100-L above-ground day tanks located near the generator building.

SS53- Blair Lakes Fuel Spill

SS53 consists of an unknown quantity of fuel spilled in an approximate 18-m by 18-m area northeast of the tank farm. The fuel spill likely occurred from fuel bladders (portable gas tanks).

DP54- Blair Lakes Drum Disposal Site

DP54 is a suspected drum disposal area. However, an intensive site investigation did not find drums in this location, and there is no evidence that drum disposal actually occurred here.

The five study locations (SS50, SS51, SS52, SS53, and DP54) at the Blair Lakes Target Range facility are addressed together as a single group. The locations are grouped because of their close geographical proximity to one another and their small overall size. The locations encompass a total area less than 0.75 hectare (1.8 acres) and are referred to in this assessment as "Source Areas ST50-54," "ST50," or "Blair Lakes."

The Blair Lakes Target Range is an off-base facility located approximately 40 km southwest of the main Eielson AFB (see Figures 1.1 and 1.3). The facility is not open to public access. The Range has offices and living

quarters for personnel who work on a rotational assignment. Crews work one week out of four at this facility, and the typical length of stay is 10 days. The Range is remote and can be reached in summer only by helicopter or in winter by way of an ice bridge across the Tanana River. The Blair Lakes Source Area includes a vehicle maintenance shop, an above-ground diesel and gasoline (MoGas) tank farm (and associated fuel product delivery lines), generators, and storage outbuildings on a central gravel pad area. Aircraft target ranges and heliports are located outside a gravel pad area (see Figure 1.3). The original water supply well was located in the southeast corner of the vehicle maintenance building. It was taken out of service after a strong petroleum taste and odor were detected. The well casing is split near the surface, which may have provided a pathway for surface contamination to enter the well. Potable water for the facility is now provided by a new water-supply well located hydraulically upgradient (south) of the central facility area. The primary contaminants at Blair Lakes are BTEX compounds, TPH, PAHs, and metals.

7.1 CONCEPTUAL SITE MODEL

A conceptual site model was originally developed based on the results of previous investigations reported in the Remedial Investigation/Feasibility Study Operable Unit 1 Management Plan (U.S. Air Force 1993a). Subsequently the Eielson AFB, Alaska, Operable Unit 1, Draft Remedial Investigation (RI) Report, Volume 1: Text and Appendices, August 1993 (U.S. Air Force 1993b, Volume 1) was used to update the conceptual site model. A field investigation conducted in 1993 is contained in the RI and includes monitoring-well water-levels, chemical analytical sampling results, background metals determination, aquifer tests, permafrost studies, and surface geophysical test results, and measurements of floating-product thicknesses.

The components of this model include a general description of the geology and hydrogeology, as well as the presence of contaminants. The model specifically addresses the nature and presence of floating product as well as soil and groundwater contamination within each study location.

7.1.1 Geology and Hydrogeology

A detailed discussion of the geology and hydrogeology at the Blair Lakes Range is described in the Eielson AFB, Alaska Operable Unit 1, Draft Remedial Investigation (RI) Report, Volume 1: Text and Appendices, August 1993 (U.S. Air Force 1993b). The reader is referred to the RI for the most current site-characterization information.

The general conceptual site model for the Blair Lakes area is different from the model for the main Base area. The upper 2.5 m is dominated by fine-grained deposits (silt, sandy silt, silty clay, gravelly sandy silt). Much of the Blair Lakes Target Range is built on gravel fill taken locally from pits. In general, the gravels are granite, granodiorite, conglomerate, sandstone, schist, gneiss, quartz, and gabbro. The facility has a permafrost layer varying between 2 and 9 m in depth ranging across it. Depth to groundwater generally ranges from 2.1 to 3 m (BGS), and flows northwest at a groundwater velocity ranging from about 0.27 to 4.31 m/day.

7.1.2 Metals

Elevated concentrations of metals were detected in soil and groundwater at all of the Blair Lakes study location areas where samples were collected. Background concentrations for metals specific to Blair Lakes have been reported for soils (U.S. Air Force 1993b).

7.1.3 PCBs and Pesticides

There has been no assessment of possible PCB or pesticide contamination of surface soil at the Blair Lakes facility. Possible sources of PCBs include PCB-laden transformer oil, which may have been used in road-oiling activities. There are no known transformers at Blair Lakes. The pesticide DDT was used extensively on the main Base until 1966. It is not known whether spraying of pesticides extended to the Blair Lakes facility. However, it is possible that spraying occurred around ponding areas of the facility.

7.1.4 Study Locations SS50-SS52

Blair Lake Range study locations SS50, SS51, and SS52 are locations of heating oil or diesel fuel spills. SS50 is at the vehicle maintenance area; SS51 is along a ditch line; and SS52 is near the generator building. The

three spill sites are characterized by the presence of floating petroleum product and metal contamination in surface soil. The major types of contaminants found in this study location are discussed in the following text.

Floating Product

The primary source of floating product in the SS50, SS51, and SS52 study locations is a diesel fuel spill. According to documents, the spill occurred at a failed fuel line elbow located outside of the tank farm. The spilled fuel likely migrated toward the vehicle maintenance building because of the hydraulic pull exerted by the old water-supply well. Migration of floating product into the water-supply well is likely the result of inflow through a split in the casing at or near the water table. Deep downward migration of fuel-related contaminants to the well screen's intake zone is not believed to have occurred.

TPH in Soil

Although not confirmed, subsurface soils immediately above the floating product and within the "smear zone" (a zone of seasonal water table fluctuation) can be expected to have TPH concentrations that exceed the 100 mg/kg State of Alaska cleanup level. TPH concentrations exceed 100 mg/kg in surface and subsurface soils around the tank farm and fuel pump island. The primary source is thought to be surface spill(s). Periodic scraping and regrading of the main pad and tank farm fill has also likely spread contamination over an area broader than the original surface spill(s). Leaks in the underground fuel piping at the pump island or leaks in the tank farm liner have also been suggested as other potential sources of subsurface TPH contamination in this vicinity. These sources also are suspected to have contributed to the elevated BTEX compounds found in groundwater (Well 50M05). Records also suggest that TPH-contaminated soil may be present to a distance 30 m southeast of the tank farm. Possible sources include fuel-contaminated soils that were spread to this area by regrading activities and/or discharge from a former french drain system that drained the tank farm area.

PAHs in Soil

Fuel-related semivolatile compounds were detected in soil samples collected in the area of the floating product and the fuel pump island.

Concentrations of PAHs tended to increase with depth. Compounds detected in the highest concentrations (2-methylnaphthalene and naphthalene) are some of the lighter, more soluble constituents typically associated with fuel products.

Benzene

A 180 m-long benzene plume has spread in an elongated northwest direction beneath the SS50, SS51, and SS52 facility. Benzene concentrations exceeding 5 $\mu\text{g/L}$ appear to cover an area of nearly 1 hectare (2.5 acres), and concentrate between the tank farm and the vehicle maintenance shop. The high benzene concentration detected at a monitoring well located cross gradient of the tank farm and upgradient of the fuel pump island (Well 50M05) is unexpected. The value may indicate locally or seasonally variable hydrologic conditions that influence the flow of groundwater and contaminants, or an unknown source.

7.1.5 Study Location SS53

The SS53 study location is a helicopter fuel spill area approximately 18-m by 18-m in size.

Floating Product

An unknown quantity of fuel was reportedly spilled from fuel bladders placed at the northeast end of the tank farm. The spill likely infiltrated to subsurface soils until reaching groundwater, and then migrated northward in the probable direction of groundwater flow. However, the quantity of fuel spilled was apparently not sufficient to produce a floating-product layer, since no floating product has been observed in monitoring wells (50M02 or 50M07) near the fuel bladder area.

TPH in Soil

TPH concentrations in soil exceed the 100 mg/kg State of Alaska cleanup level around the perimeter of the tank farm. An exception is the fuel bladder area where the TPH concentration in surface soil was only 22 mg/kg and the subsurface concentration was below the detection limit. (Concentrations of TPH in groundwater at 50M02 and 50M07 were below the detection limit.) Of the volatile constituents of fuel, only toluene (0.3 mg/kg) and xylenes

(0.2 mg/kg) were detected in surface soil at 50M02. No volatile compounds were detected in subsurface soil or groundwater near the fuel bladder area (50M02), and only low concentrations of BTEX compounds were detected in groundwater (50M07).

7.1.6 Study Location DP54

Drums of unknown material were suspected to have been buried in an area immediately to the west of the main Blair Lakes facility. However, a geophysical survey designed to locate buried metal did not indicate the presence of drums within DP54. There is no evidence for the existence of buried drums in the area.

7.1.7 1993 Sampling Data

The 1993 sampling program focuses on characterizing fuel-related contamination and the presence of PCBs, pesticides, and metals. The RI (U.S. Air Force 1993b, Volume I) reports the results of background soil sampling for the Blair Lakes Range facility. However, groundwater background was not empirically determined for the Blair Lakes Range facility.

Elevated concentrations of the following metals in background soil are reported in the RI: arsenic (9541 $\mu\text{g/kg}$), chromium (17750 $\mu\text{g/kg}$), cobalt (8583 $\mu\text{g/kg}$), lead (13775 $\mu\text{g/kg}$), magnesium (4125000 $\mu\text{g/kg}$), manganese (320833 $\mu\text{g/kg}$), nickel (21833 $\mu\text{g/kg}$), and vanadium (22250 $\mu\text{g/kg}$). The RI concludes that arsenic and beryllium concentrations in soil exceed local natural background. According to the RI, aldrin, alpha-BHC, and endosulfan II were detected in pesticide analyses of surface-soil samples. Surface-soil samples collected in 1993 at the reported fuel bladder spill (SS53) report the presence of diesel. Semivolatiles and volatiles (including acenaphthalene, 2-methynaphthalene, phenol, toluene, and xylene) were also detected in 1993 soil samples.

The RI concludes that lead in groundwater is concluded to be statistically different (higher) than assumed background concentrations. Benzene was detected in groundwater at SS50-SS52 in 1993 at a maximum concentration of 290 $\mu\text{g/L}$. The benzene values reported are lower overall than those reported in 1988/1989 sampling. In 1993, naphthalene was detected at a maximum value of 190 $\mu\text{g/L}$. Sampling results from 1989/1991 for naphthalene (5700 $\mu\text{g/L}$) in

groundwater were higher. The presence of 2-methylnaphthalene previously detected in groundwater was not confirmed by the 1993 sampling. The RI states that no BTEX compounds were detected in groundwater sampled in 1993. In addition, the RI concludes that the measurements made in 1993 of floating-product thicknesses do not demonstrate a clear trend (increase/decrease) when compared with measurements made in previous years.

7.2 EXPOSURE ASSESSMENT

The Exposure Assessment section identifies all potential pathways of exposure and successively screens them to determine which are important to assess qualitatively. This step in the risk assessment process presents all potential pathways and screens the pathways based on site-specific considerations, such as current and anticipated land use, past industrial practices, and the occurrence of site-related contaminants in environmental media. The Exposure Pathway screening step rules out pathways with a low probability of occurrence and identifies those pathways that will likely constitute the major risks to public health. These are the pathways that will be addressed in the subsequent quantitative risk characterization.

Exposure is defined as the contact of an organism with a chemical or physical agent. The overall objective of the exposure assessment is to estimate the types and magnitude of exposures to chemicals of potential concern that are present at, or migrating from, the site. The results of the exposure assessment are combined with chemical-specific toxicity information to characterize potential risks (U.S. EPA 1989a).

The Exposure Assessment section examines land use, exposure time frame, exposure setting, and exposure pathways. Table 7.1 lists the human exposure pathways that are viable for the specific OU-1 source area. Table 7.1 also summarizes the results of the exposure assessment, while the corresponding text provides details on the exposure pathway screening step. Fate and transport modeling results, intake variables and/or exposure factors, and toxicological values are presented elsewhere in this report. (See list in Section 7.4.)

**TABLE 7.1. Summary of Human Exposure Pathways
for Source Area ST50, Blair Lakes**

Theoretical Pathways	Current Land Use	Future Land Use	
	Industrial	Residential	Industrial
Ingestion of groundwater used as potable water supply	- ^(a)	X ^(b)	X
Dermal contact with contaminants during groundwater use	-	X	X
Inhalation of volatile contaminants during groundwater use	-	X	X
Incidental ingestion of surface water	-	-	-
Ingestion of fish	-	-	-
Incidental ingestion of surface soils	X	X	X
Ingestion of plants grown in contaminated soils	-	X	-
Ingestion of animals fed on plants grown in contaminated soils	-	-	-
Incidental ingestion of subsurface soils	X	X	X
Inhalation of volatile contaminants released from the soil into ambient air	X	X	X
Dermal contact with surface soils and dust	X	X	X
Dermal contact with subsurface soils	X	X	X
Inhalation of resuspended particulates	X	X	X
Dermal contact with surface water	-	-	-
Ingestion of sediments	-	-	-
Dermal contact with sediments	-	-	-

(a) - = Pathway eliminated; see text for elimination rationale.

(b) X = Pathway retained for quantitative risk evaluation.

7.2.1 Land-Use Assumptions

Health risk will be quantified for three land-use assumptions. The risk from current land use is industrial in nature while two different land-use assumptions are considered for evaluation of the future risk: residential housing and military/industrial land use. The assumption is made throughout that no mitigation or corrective action is, or will be, undertaken. One difference between the current and future industrial land-use assumption is that the exposure conditions are expected to change. For example, new wells may be drilled where currently none exist, and these new wells might be used by workers for potable supply (such as showering and limited drinking).

A portion of the Blair Lakes Range is used for office and living quarters. The living quarters do not house military dependents. The quarters are occupied by military personnel on a temporary basis according to a rotational work schedule.

Property used for military purposes is subject to being closed at any time. However, current long-range land-use plans indicate that Eielson AFB will remain an active military facility and that all OU-1 source areas will be industrial sites for the foreseeable future.

7.2.2 Current Exposure Pathways: Industrial

Current land use of the Blair Lakes Range is for military/industrial purposes. For the current time frame, the following industrial land-use human exposure pathways are complete and reasonable for further analysis:

- incidental ingestion of surface soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils
- inhalation of resuspended particulates.

A detailed explanation of the methodology and formulas used to calculate exposure/dose from these pathways is contained in Appendix A. Exposure

factors or exposure parameters used to describe each pathway may be found in Appendix B.

Because groundwater is not currently used, the exposure pathways associated with the groundwater medium are not evaluated further. These include:

- ingestion of groundwater
- dermal contact with contaminants during groundwater use
- inhalation of volatiles during groundwater use.

There is no accessible surface water in the vicinity of the OU-1 site source areas. Therefore, the plausible pathways do not encompass ingestion of, or dermal exposure to, surface water, sediment, or fish. No grazing, gardening, or agricultural use is made of the OU-1 source areas; therefore, ingestion of plants grown in contaminated soils, or of animals fed on such plants, is not examined for this land-use scenario.

7.2.3 Future Exposure Pathways: Residential

For residential housing land use as a future exposure assumption, the following pathways are considered to be complete and reasonable for analysis:

- ingestion of groundwater used as a potable water supply
- dermal contact with contaminants during groundwater use
- inhalation of volatile contaminants during groundwater use
- incidental ingestion of surface soils
- ingestion of plants grown in contaminated soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils
- inhalation of resuspended particulates.

Future residences are assumed to utilize groundwater as a potable supply and to have garden plots associated with the homes. All exposure pathways

postulated (and listed above) are examined. Exposure to surface water and sediment are not viable pathways and are not considered in the subsequent risk calculations. In addition, it is assumed that future housing areas will not be used to graze livestock. Therefore, human exposure via ingestion of animals fed on plants grown in contaminated soils is eliminated from further consideration.

7.2.4 Future Exposure Pathways: Industrial

For industrial land use as a future exposure assumption, the following pathways are considered to be complete and reasonable for analysis:

- ingestion of groundwater used as a limited potable water supply
- dermal contact with contaminants during groundwater use
- inhalation of volatile contaminants during groundwater use
- incidental ingestion of surface soils
- incidental ingestion of subsurface soils
- inhalation of volatile contaminants released from soil to ambient air
- dermal contact with surface soils and dust
- dermal contact with subsurface soils
- inhalation of resuspended particulates.

Industrial activities are assumed to be similar to existing military activities. However, it is assumed that in the future the area's groundwater plumes will be used as a potable supply on a limited basis. Therefore, three groundwater exposure scenarios have been included in the list above.

7.3 EXPOSURE POINT CONCENTRATIONS

The identity and concentrations of chemicals of potential concern for the source area are provided in Table 7.2, "Concentrations of Chemicals of Potential Concern for Source Area ST50-54." This table presents the exposure point concentrations corresponding to those of the anticipated receptors, given the particular site-related contaminants. The "Average Exposure Case" uses the arithmetic average concentration value for the contaminant by medium.

**TABLE 7.2. Concentrations of Chemicals of Potential
Concern for Source Area ST50, Blair Lakes**

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Maximum Value Detected	95% UCL ^(a)
Soils						
Benzene	71-43-2	SO	µg/kg	524	3790	2970
Cadmium	7440-43-9	SO	µg/kg	1110	1990	1840
N-Nitrosopiperidine	100-75-4	SO	µg/kg	49	320	230
TPH ^(d)	TPH	SO	µg/kg	2820000	91800000	2660000
Groundwater						
2,4-Dimethylphenol	105-67-9	WD ^(e)	µg/L ^(f)	2	12	8
2-Methyl-naphthalene	91-57-6	WD	µg/L	830	12000	7000
Arsenic, Total	7440-38-2	WD	µg/L	40	100	NA ^(g)
Barium, Total	7440-39-3	WD	µg/L	1330	4180	NA
Benzene	71-43-2	WD	µg/L	38	335	214
Chlorobenzene	108-90-7	WD	µg/L	6	85	50
Chloroform	67-66-3	WD	µg/L	0.2	1.01	0.8
Chloromethane	74-87-3	WD	µg/L	7	100	60
Chromium, Total	7440-47-3	WD	µg/L	240	820	NA
Copper, Total	7440-50-8	WD	µg/L	218.4	511	NA
Ethylbenzene	100-41-4	WD	µg/L	202	2210	1340
Lead, Total	7439-92-1	WD	µg/L	150	400	NA
Naphthalene	91-20-3	WD	µg/L	420	5700	3400
Toluene	108-88-3	WD	µg/L	397	2080	1250
Total Xylenes	1330-20-7	WD	µg/L	636	6940	4260
TPH	TPH	WD	µg/L	140000	1980000	1160000
Vanadium, Total	7440-62-2	WD	µg/L	111	254	NA

(a) UCL = upper confidence limit

(b) SO = soil

(c) µg/kg = microgram (chemical) per kilogram soil

(d) TPH = total petroleum hydrocarbons

(e) WD = groundwater

(f) µg/L = microgram (chemical) per liter of water

(g) NA = not applicable, sample size insufficient for statistically meaningful evaluation.

The "Reasonable Maximum Exposure Case" uses the contaminant concentration corresponding to the 95% upper confidence value of the chemical analytical data, assuming it is normally distributed, or, when appropriate, the maximum detected concentration.

7.4 RISK CHARACTERIZATION

The primary risk calculations are presented in Appendix A. This section summarizes in table format the excess cancer risk and the hazard index for source area SS50-54 by exposure pathway. The cancer risk and hazard index are presented for both the "Average Exposure Case" and the "Reasonable Maximum Exposure Case." Table 7.3 presents risk values for the current industrial land use; Table 7.4 presents the values for the future residential land use; and Tables 7.5 presents the values for the future industrial land use. Each table presents, individually, the cancer risk and the hazard index for each exposure pathway. All of the exposure pathway risks are then combined to show total cancer risk values and total hazard indices.

The calculation of the cancer risk and hazard index necessitates the use of information and data input from many sources presented elsewhere in this report. For ease of reference, the information used to perform the risk calculations is noted below along with a cross reference to its location within this document.

Identification of Chemicals of Potential Concern	Section 8.0
Toxicity Assessment	Section 9.0
Risk Calculation Spreadsheets and Formulas	Appendix A
Exposure Factors	Appendix B

TABLE 7.3. Source Area ST50, Blair Lakes: Summary of Cancer Risk and Hazard Index, Current Industrial Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Ingestion of surface soils	4.34E-09 (4.34E-09) ^(b)	0.0 (0.0)	5.83E-08 (5.83E-08)	0.0 (0.0)
Dermal contact with surface soils	9.89E-10 (9.89E-10)	0.0 (0.0)	5.83E-08 (5.83E-08)	0.0 (0.0)
Ingestion of subsurface soils	7.13E-10 (7.13E-10)	0.0 (0.0)	9.58E-09 (9.58E-09)	0.0 (0.0)
Dermal contact with subsurface soils	1.63E-10 (1.63E-10)	0.0 (0.0)	9.58E-09 (9.58E-09)	0.0 (0.0)
Inhalation of volatiles from soils	3.45E-08 (3.45E-08)	0.0 (0.0)	5.10E-07 (5.10E-07)	0.0 (0.0)
Inhalation of resuspended particulates from soil	2.18E-11 (3.75E-13)	0.0 (0.0)	1.04E-10 (5.04E-12)	0.0 (0.0)
Total Cancer Risk	4.1E-08 (4.1E-08)		6.5E-07 (6.5E-07)	
Total Hazard Index		0.0 (0.0)		0.0 (0.0)

(a) RME = Reasonable Maximum Exposure

(b) Values in parenthesis exclude contribution from metals.

TABLE 7.4. Source Area ST50, Blair Lakes: Summary of Cancer Risk and Hazard Index, Future Residential Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Groundwater ingestion	1.45E-04 (2.29E-06) ^(b)	12.2 (1.1)	2.14E-03 (8.19E-05)	69.7 (16.5)
Dermal contact during groundwater use	1.88E-06 (1.63E-06)	0.8 (0.8)	5.05E-05 (4.70E-05)	7.5 (7.5)
Inhalation of volatiles during groundwater use	1.20E-05 (1.20E-05)	1.5 (1.5)	2.92E-04 (2.92E-04)	13.5 (13.5)
Ingestion of surface soils	1.07E-08 (1.07E-08)	0.0 (0.0)	4.60E-07 (4.60E-07)	0.0 (0.0)
Dermal contact with surface soils	1.22E-09 (1.22E-09)	0.0 (0.0)	1.32E-07 (1.32E-07)	0.0 (0.0)
Ingestion of subsurface soils	1.07E-08 (1.07E-08)	0.0 (0.0)	4.60E-07 (4.60E-07)	0.0 0.0
Dermal contact with subsurface soils	1.22E-09 (1.22E-09)	0.0 (0.0)	1.00E-07 (1.00E-07)	0.0 (0.0)
Inhalation of volatiles from soils	3.45E-08 (3.45E-08)	0.0 (0.0)	5.10E-07 (5.10E-07)	0.0 (0.0)
Inhalation of resuspended particulates from soil	2.68E-11 (4.62E-13)	0.0 (0.0)	1.54E-10 (7.45E-12)	0.0 (0.0)
Ingestion of plants	2.68E-06 (2.68E-06)	0.1 (0.1)	5.75E-05 (5.75E-05)	1.0 (0.9)
Total Cancer Risk	1.6E-04 (1.9E-05)		2.5E-03 (4.8E-04)	
Total Hazard Index		14.6 (3.5)		91.7 (38.4)

(a) RME = Reasonable Maximum Exposure

(b) Values in parenthesis exclude contribution from metals.

TABLE 7.5. Source Area ST50, Blair Lakes: Summary of Cancer Risk and Hazard Index, Future Industrial Land Use

Pathway	Average Exposure		RME ^(a)	
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index
Groundwater ingestion	9.40E-05 (1.49E-06) ^(b)	7.9 (0.7)	6.36E-04 (2.44E-05)	24.9 (5.9)
Dermal contact during groundwater use	1.71E-06 (1.49E-06)	0.7 (0.7)	3.00E-05 (2.79E-05)	5.4 (5.4)
Inhalation of volatiles during groundwater use	1.09E-05 (1.09E-05)	1.4 (1.4)	1.74E-04 (1.74E-04)	9.6 (9.6)
Ingestion of surface soils	4.34E-09 (4.34E-09)	0.0 (0.0)	5.83E-08 (5.83E-08)	0.0 (0.0)
Dermal contact with surface soils	9.89E-10 (9.89E-10)	0.0 (0.0)	5.83E-08 (5.83E-08)	0.0 (0.0)
Ingestion of subsurface soils	7.13E-10 (7.13E-10)	0.0 (0.0)	9.58E-09 (9.58E-09)	0.0 (0.0)
Dermal contact with subsurface soils	1.63E-10 (1.63E-10)	0.0 (0.0)	9.58E-09 (9.58E-09)	0.0 (0.0)
Inhalation of volatiles from soils	3.45E-08 (3.45E-08)	0.0 (0.0)	5.10E-07 (5.10E-07)	0.0 (0.0)
Inhalation of resuspended particulates from soil	2.18E-11 (3.75E-13)	0.0 (0.0)	1.04E-10 (5.04E-12)	0.0 (0.0)
Total Cancer Risk	1.1E-04 (1.4E-05)		8.4E-04 (2.3E-04)	
Total Hazard Index		10.0 (2.8)		39.9 (20.9)

(a) RME = Reasonable Maximum Exposure

(b) Values in parenthesis exclude contribution from metals.

7.5 SITE-SPECIFIC UNCERTAINTIES AND CONSIDERATIONS

This section presents key information bearing on the level of confidence in the quantitative risk estimates for a site. The risk values are conditional, given a considerable number of assumptions about site characterization, exposure, and toxicity. Major categories of uncertainty are discussed herein. The temporal and spatial variations in concentrations of naturally occurring metals in the groundwater are not known with certainty. Knowledge of this information could affect both the total risk of groundwater use and the amount of contamination contributed to the groundwater by site-related activities.

The temporal and spatial variations in concentrations of naturally occurring metals in the groundwater are not known with certainty. Knowledge of this information could affect both the total risk of groundwater use and the amount of contamination contributed to the groundwater by site-related activities.

The ratio of hexavalent chromium to trivalent chromium is not known for the chromium measured in the groundwater. Because the more toxic hexavalent species was assumed to be the only form of chromium present, knowing this ratio would presumably lower the estimated risk.

Not all sources of contamination of both the soils and groundwater have been identified. Unknown sources may still be contributing to the contamination at this source area.

The source of the bis(2-ethylhexyl)phthalate in groundwater is likely a laboratory contaminant and unrelated to past industrial activities. Its presence is not included in the risk calculations.

The metals zinc, cadmium, and nickel are eliminated from the list of groundwater chemicals of concern on the basis of a comparison to background concentrations reported in the RI (U.S. Air Force 1993b, Volume 1). However, according to the RI it was not feasible to establish background groundwater concentrations for Blair Lakes from actual sampling. Therefore, "inferences based on comparative metal concentrations in the sediment as well as variances from the mean and areal distribution were used" to characterize groundwater background. As a result, there is inherent uncertainty in the

representativeness of the background groundwater concentrations reported in the RI and used to screen analytical results in the Baseline Risk Assessment.

The presence of several toxicologically important pesticides is reported in the RI for 1993 soil data samples. The results of pesticide sampling data were not available in the database provided for the Baseline Risk Assessment work. Including the pesticide results will presumably increase the calculated risk attributable to the Blair Lakes Range source area.

8.0 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

This section discusses the procedures employed to reduce the list of all chemicals detected to those likely to be site-related and most important to the risk evaluation. Reducing the number of chemicals assessed to only those chemicals of potential concern (those that represent 99 percent of the risk) is recommended in EPA guidance (U.S. EPA 1989a).

8.1 DOCUMENTATION OF RATIONALE FOR ELIMINATION

The rationale for eliminating detected chemicals from the quantitative risk assessment is documented in Tables 8.1 to 8.12, "Chemicals Detected in Soils/Groundwater of Source Area... Their Concentrations and Their Risk Evaluation Status." The approximate total number of chemical analytes tested in all media by source area are as follows: ST20 E-7=79; ST20 E-8=67; ST20 E-9=69; ST48=69; ST49=103; and Source Areas 50-54=100. Of the tested chemical analytes, the following number were detected at least once: ST20 E-7=54; ST20 E-8=24; ST20 E-9=28; ST48=64; ST49=98; and Source Areas 50-54=84. This information is contained in the "Analyte Detection Frequency for Source Area ...," Tables D.1 through D.6 contained in Appendix D.

By source area, the following number of chemicals were assessed in the quantitative risk calculations: ST20 E-7=18; ST20 E-8=14; ST20 E-9=8; ST48=14; ST49=18; and Source Areas 50-54=19.

Certain chemicals detected were eliminated for one or more of the following reasons: some chemicals were eliminated because they were below the risk-based screening concentration; some chemicals were removed because they are inherently virtually nontoxic or not toxic at the concentration detected; some chemicals were eliminated because they are essential nutrients and also not toxic at the concentrations detected; some metals and inorganics were eliminated because they were present at concentrations that did not exceed their local natural background at Eielson AFB; and some chemicals were eliminated because they were determined to be laboratory or sampling contaminants (thus not representative of actual environmental conditions).

8.2 SAMPLING DATA AND STATISTICAL ANALYSIS

A number of statistical and computational methodologies were employed with the data to develop a range of source terms (potential exposures) for the human exposure assessment (U.S. EPA 1989c, 1989d).

The list of chemical analytical results to be evaluated began as a tabulation of chemicals detected at least once. The data are primarily from the 1989 and 1990 sampling efforts. A positive detection was defined as any detectable quantity of the constituent.

Concentrations reported as "non detected" (ND) were assumed to be present at one-half the reported detection limit (assuming that the compound had been detected at least once in the source area). This method of including half the detection limit as a value for obtaining the "potential average exposure" or exposure source term is referred to as the L/2 method and is advised in an EPA guideline (U.S. EPA 1988).

In accordance with EPA guidance (U.S. EPA 1989a), the mean of concentrations averaged (arithmetic) across a data set is used as the source term for the average exposure. The 95% upper confidence limit is used as the source term for the reasonable maximum exposure scenario in this work. The average contaminant concentration is considered to be the average exposure or "most likely" source term parameter used to quantify risk in the risk assessment protocol. The 95% upper confidence limit value is assessed as the reasonable maximum exposure or a "plausible worst case."

The chemical analytical data were abstracted into a database and examined to determine the contaminant distribution and the rate of prevalence (i.e., percent of positive detections per number of analyses). The sampling results are presented in Appendix D, "Chemical Concentrations and Monitoring Data." Summary statistics are presented by source area in the subsections entitled "Exposure Point Concentrations." Appendix E, "Determination of Background Metal Concentrations and Laboratory Contaminants," compares background sampling data to site data. Unless they were eliminated on the basis of being below the risk-based screening concentration, all metals and inorganics were compared to local natural background concentrations. The methodology for elimination is given in Appendix E. Metals and inorganics

without local natural background concentration information were retained for quantitative risk evaluation. Appendix E also discusses the rationale for elimination of common laboratory and sampling contaminants from further quantitative risk evaluation.

8.3 RISK-BASED SCREENING

Contaminants of potential concern were identified based on the screening method suggested in the Supplemental Guidance for Superfund Risk Assessments in U.S. EPA Region 10 (U.S. EPA 1991a). This method, called the "risk-based screening approach," compares the maximum concentration levels detected at each site to a risk-based screening concentration. The criteria for the screening, as given in the Region 10 supplemental guidance, are as follows:

- 1) List the maximum concentration of each chemical in each medium for each site.
- 2) Compare the maximum concentration to the risk-based screening concentration.
- 3) Eliminate the chemical if the maximum detection for water $\leq$ a 10^{-6} cancer risk screening value and $\leq$ a 0.1 hazard quotient screening value and
the maximum detection for soil $\leq$ a 10^{-7} cancer risk screening value and $\leq$ a 0.1 hazard quotient screening value.
- 4) Carry any chemicals not thus eliminated through the baseline risk assessment.

Risk-based screening concentrations were calculated for all analytes sampled at Operable Unit 1 in 1989 and 1990. Risk-based screening concentrations were calculated with equations provided in "Supplemental Guidance for Superfund Risk Assessments in Region 10" (EPA 1991a). Table 8.13 provides the risk-based screening concentration corresponding to a 10^{-7} and 10^{-6} cancer risk from exposure to soil and water, respectively, and a hazard quotient for exposure to both soil and water.

The values in Table 8.13 were calculated using the equations in EPA guidance (U.S. EPA 1991a, Appendix I). Risk-based screening concentrations for the drinking-water ingestion of nonvolatile chemicals (Henry's Law Constant [unitless] less than or equal to 10^{-4}) or having molecular weights

greater than or equal to 200 were calculated with Equations 6 and 10, from the cited U.S. EPA guidance, for cancer risk and hazard quotient, respectively. A hazard quotient of 0.1 was substituted for 1 in Equation 10. Risk-based screening concentrations for the ingestion and inhalation of volatile chemicals from drinking water were calculated with Equations 8 and 12 of (U.S. EPA 1991a, Appendix I). A hazard quotient of 0.1 was substituted for 1 in Equation 12.

Equations 14 and 16 (EPA 1991a, Appendix I) were used to calculate the risk-based screening concentrations for soil ingestion. A target of 10^{-7} was substituted for 10^{-6} in Equation 14. A hazard quotient of 0.1 was substituted for 1.0 in equation 16 (U.S. EPA 1991a, Appendix I).

Table 9.1 lists the toxicity input for these equations, both slope factors and reference doses. More detailed information on the toxicity data is found in Section 9.0 of this assessment. Analytes for which no toxicity data were found in either IRIS or HEAST were assigned toxicity values based on similar chemical or toxicological surrogates. An exception to this general rule was made for six inorganic constituents: aluminum, calcium, magnesium, potassium, iron, and sodium. These were analyzed for, but are not typically associated with, toxicity to humans. Therefore, these elements were eliminated from quantitative risk assessment.

Table 8.13 lists the calculated risk-based screening concentrations. These concentrations were compared to the site maximum value for each medium. The chemicals that exceeded the risk-based screening are presented in the tables for the respective source areas.

TABLE 8.1. Chemicals Detected in Soil of ST20 E-7: Their Concentrations and Their Risk Evaluation Status

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Maximum Value Detected	95% ^(a) UCL	Risk Evaluation Status and Reason for Removal from Further Consideration
2-Methylnaphthalene	91-57-6	SO ^(b)	µg/kg	290	2500	1900	Removed: maximum value detected below screening level criteria.
Benzo(A)Anthracene	56-55-3	SO	µg/kg	210	390	NA ^(c)	
Benzo(K)Fluoranthene	207-08-9	SO	µg/kg	140	1000	790	
Chrysene	218-01-9	SO	µg/kg	250	1900	1300	
Indeno(1,2,3-CD)Pyrene	193-39-5	SO	µg/kg	130	420	405	
Tetrachloroethene	127-18-4	SO	µg/kg	550	8500	4800	
Total Xylenes	1330-20-7	SO	µg/kg	1060	6830	5390	Removed: maximum value detected below screening level criteria.
TPH ^(d)	TPH	SO	µg/kg	31000	110000	101000	
Vinyl Chloride	75-01-4	SO	µg/kg	1600	13000	10000	

Filename: E70T1DS0.XLS

(a) UCL = upper confidence limit

(b) SO = soil

(c) NA = not applicable (sample size too small for meaningful statistical evaluation)

(d) TPH = total petroleum hydrocarbons

TABLE 8.2. Chemicals Detected in Groundwater of ST20 E-7: Their Concentrations and Their Risk Evaluation Status

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Maximum Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
1,1-Dichloroethylene	75-35-4	WD (b)	µg/L	2	6	6	
Aluminum, Total	7429-90-5	WD	µg/L	25600	25600	NA (c)	Removed: low toxicity
Arsenic, DISS (d)	7440-38-2	WD	µg/L	30	50	NA	
Arsenic, Total	7440-38-2	WD	µg/L	27.5	27.5	NA	Removed: dissolved value for arsenic used for evaluation.
Barium, DISS	7440-39-3	WD	µg/L	200	200	NA	Removed: total value for Ba used for evaluation
Barium, Total	7440-39-3	WD	µg/L	579	579	NA	
BIS (2-Ethylhexyl)phthalate	117-81-7	WD	µg/L	6	21	21	Removed: laboratory or sampling contaminant
Calcium, DISS	7440-70-2	WD	µg/L	53600	53600	NA	Removed: low toxicity
Calcium, Total	7440-70-2	WD	µg/L	65200	65200	NA	Removed: low toxicity
Chloride	CHLORIDE	WD	µg/L	209	755	744	Removed: water quality parameter
Chlorobenzene	108-90-7	WD	µg/L	9	100	59	
Chromium	7440-47-3	WD	µg/L	40.7	40.7	NA	
Cobalt, Total	7440-48-4	WD	µg/L	32.8	32.8	NA	Removed: low toxicity
Copper, Total	7440-50-8	WD	µg/L	218	218	NA	
Ethylbenzene	100-41-4	WD	µg/L	68	380	341	
Iron, DISS	7439-89-6	WD	µg/L	3700	3700	NA	Removed: low toxicity
Iron, Total	7439-89-6	WD	µg/L	74400	74400	NA	Removed: low toxicity
Lead	7439-92-1	WD	µg/L	73	90	NA	
m,p-Xylene	108-38-3	WD	µg/L	1	3	4	Removed: isomer-specific toxicity data unavailable; total xylene value used
Magnesium, DISS	7439-95-4	WD	µg/L	13200	13200	NA	Removed: low toxicity

TABLE 8.2. (cont.)

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Maximum Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
Magnesium, Total	7439-95-4	WD	µg/L	22400	22400	NA	Removed: low toxicity
Manganese, DISS	7439-96-5	WD	µg/L	800	800	NA	Removed: total value for Mn used for evaluation.
Manganese, Total	7439-96-5	WD	µg/L	1190	1190	NA	Removed: average value below 95% UCL background
Mercury, DISS	7439-97-6	WD	µg/L	0.7	0.7	NA	
Mercury, Total	7439-97-6	WD	µg/L	0.4	0.4	NA	Removed: dissolved value for Hg use for evaluation.
Naphthalene	91-20-3	WD	µg/L	37	130	NA	
Nickel	7440-02-0	WD	µg/L	57.4	57.4	NA	Removed: maximum value detected below screening level criteria.
Nitrog, NO2+NO3	NO2+NO3	WD	µg/L	8	13	16	Removed: low toxicity
o-Xylene	95-47-6	WD	µg/L	1	2	2	Removed: isomer-specific toxicity data unavailable; total xylene value used
Phenol	108-95-2	WD	µg/L	2.7	7.8	8.9	Removed: maximum value detected below screening level criteria.
Potassium, DISS	7440-09-7	WD	µg/L	2530	2530	NA	Removed: low toxicity
Potassium, Total	7440-09-7	WD	µg/L	7440	7440	NA	Removed: low toxicity
Sodium, DISS	7440-23-5	WD	µg/L	4580	4580	NA	Removed: low toxicity
Sodium, Total	7440-23-5	WD	µg/L	8720	8720	NA	Removed: low toxicity
Sulfate	SULFATE	WD	µg/L	1061	5930	5355	Removed: low toxicity
Toluene	108-88-3	WD	µg/L	0.48	1.07	NA	Removed: maximum value detected below screening level criteria.
Total Xylenes	1330-20-7	WD	µg/L	550	3820	3434	
Vanadium, Total	7440-62-2	WD	µg/L	72.5	72.5	NA	Retained: only available measurement
Zinc, DISS	7440-66-6	WD	µg/L	40	40	NA	Removed: maximum value detected below screening level criteria.

TABLE 8.2. (cont.)

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Maximum Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
Zinc, Total	7440-66-6	WD	µg/L	191	191	NA	Removed: maximum value detected below screening level criteria.

Filename: E7DT1DWD.XLS

(a) UCL = upper confidence limit (c) NA = not applicable (sample size too small for meaningful statistical evaluation)
 (b) WD = groundwater (d) DISS = dissolved

TABLE 8.3. Chemicals Detected in Soil of ST20 E-8: Their Concentrations and Their Risk Evaluation Status

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
2-Methylnaphthalene	91-57-6	S0 (b)	µg/kg	398	780	NA (c)	Removed: maximum value detected below screening-level criteria.
Benzo(G,H,I)Perylene	191-24-2	S0	µg/kg	110	180	NA	Removed: low toxicity
Dibenzo(A,H)Anthracene	53-70-3	S0	µg/kg	140	140	NA	
TPH (d)	TPH	S0	µg/kg	41000	170000	148000	

Filename:E80TDS0.XLS

(a) UCL = upper confidence limit

(b) S0 = soil

(c) NA = not applicable (sample size too small for meaningful statistical evaluation)

(d) TPH = total petroleum hydrocarbon

TABLE 8.4. Chemicals Detected in Groundwater of ST20 E-8: Their Concentrations and Their Risk Evaluation Status

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
1,1-Dichloroethylene	75-35-4	WD (b)	µg/L	13	32	NA	
4-Methyl Phenol	106-44-5	WD	µg/L	2	12	10	Removed: maximum value detected below screening-level criteria.
Benzene	71-43-2	WD	µg/L	1	1	NA (c)	
Benzoic Acid	65-85-0	WD	µg/L	8	13	NA	Removed: maximum value detected below screening-level criteria.
BIS (2-Ethylhexyl)phthalate	117-81-7	WD	µg/L	243	2900	1916	Removed: laboratory or sampling contaminant
Ethylbenzene	100-41-4	WD	µg/L	130	1600	840	
Fluoranthene	206-44-0	WD	µg/L	1	6	5	Removed: maximum value detected below screening level criteria.
m,p-Xylene	108-38-3	WD	µg/L	160	2000	1010	Removed: isomer-specific toxicity data unavailable; total xylene value used.
Methylene Chloride	75-09-2	WD	µg/L	2	5	6	Removed: laboratory or sampling contaminant
Naphthalene	91-20-3	WD	µg/L	20	160	133	
o-Xylene	95-47-6	WD	µg/L	55	760	424	Removed: isomer-specific toxicity data unavailable; total xylene value used.
Phenanthrene	85-01-8	WD	µg/L	1	7	6	
Phenol	108-95-2	WD	µg/L	22	140	118	Removed: maximum value detected below screening-level criteria.
Pyrene	129-00-0	WD	µg/L	1	6	5	Removed: maximum value detected below screening-level criteria.
Toluene	108-88-3	WD	µg/L	900	21000	8200	
Total Xylenes	1330-20-7	WD	µg/L	465	3830	2627	

Filename: E80T10UD.XLS

(a) UCL = upper confidence limit

(b) WD = groundwater

(c) NA = not applicable (sample size too small for meaningful statistical evaluation)

TABLE 8.5. Chemicals Detected in Soils of ST20 E-9: Their Concentrations and Risk Evaluation Status

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL ^(a)	Risk Evaluation Status and Reason for Removal from Further Consideration
Anthracene	120-12-7	SO ^(b)	µg/kg	83	190	NA	Removed: maximum value detected below screening-level criteria.
Benzene	71-43-2	SO	µg/kg	1765	3310	NA ^(c)	
Chrysene	218-01-9	SO	µg/kg	290	820	NA	
Ethylbenzene	100-41-4	SO	µg/kg	1350	8800	7926	Removed: maximum value detected below screening-level criteria.
Fluorene	86-73-7	SO	µg/kg	54	100	NA	Removed: maximum value detected below screening-level criteria.
Total Xylenes	1330-20-7	SO	µg/kg	3130	12400	NA	Removed: maximum value detected below screening-level criteria.
TPH ^(d)	TPH	SO	µg/kg	100000	500000	480000	

Filename: E90T10SO.XLS

- (a) UCL = upper confidence limit
(b) SO = soil
(c) NA = not applicable (sample size too small for meaningful statistical evaluation)
(d) TPH = total petroleum hydrocarbons

TABLE 8.6. Chemicals Detected in Groundwater of ST20 E-9: Their Concentrations and Their Risk Evaluation Status

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
2-Methyl Phenol	95-48-7	WD (b)	µg/L	1.93	7.18	6.77	Removed: maximum value detected below screening-level criteria.
2-Methylnaphthalene	91-57-6	WD	µg/L	65	260	NA	Removed: maximum value detected below screening-level criteria.
4-Methyl Phenol	106-44-5	WD	µg/L	2	5	NA	Removed: maximum value detected below screening-level criteria.
Benzene	71-43-2	WD	µg/L	4	4	NA (c)	
BIS (2-Ethylhexyl)phthalate	117-81-7	WD	µg/L	16	56	53	Removed: laboratory or sampling contaminant
Chlorobenzene	108-90-7	WD	µg/L	1.9	10.6	10.4	
Dibenzofuran	132-64-9	WD	µg/L	0.57	2.56	2.01	Removed: maximum value detected below screening-level criteria.
Ethylbenzene	100-41-4	WD	µg/L	37	1050	373	
Fluoranthene	206-44-0	WD	µg/L	3	20	17	Removed: maximum value detected below screening-level criteria.
m,p-Xylene	108-38-3	WD	µg/L	260	4700	2150	Removed: isomer-specific toxicity data unavailable; total xylene value used.
Methylene Chloride	75-09-2	WD	µg/L	1	3	2	Removed: laboratory or sampling contaminant
Naphthalene	91-20-3	WD	µg/L	15	140	103	
Nitrog, NO2+NO3	NO2+NO3	WD	µg/L	11	16	NA	Removed: low toxicity
o-Xylene	95-47-6	WD	µg/L	60	1400	590	Removed: isomer-specific toxicity data unavailable; total xylene value used.
Toluene	108-88-3	WD	µg/L	1580	19700	11180	
Total Xylenes	1330-20-7	WD	µg/L	465	3820	2637	

Filename:E70T10D.XLS

(a) UCL = upper confidence limit

(b) WD = groundwater

(c) NA = not applicable (sample size too small for meaningful statistical evaluation)

TABLE 8.7. Chemicals Detected in Soils of ST-48: Their Concentrations and Their Risk Evaluation Status

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% (a) UCL	Risk Evaluation Status and Reason for Removal from Further Consideration
2-Methylnaphthalene	91-57-6	S0 ^(b)	µg/kg	3200	42000	25600	Removed: maximum value detected below screening-level criteria.
Benzene	71-43-2	S0	µg/kg	28	112	77	Removed: maximum value detected below screening-level criteria.
BIS (2-Ethylhexyl)phthalate	117-81-7	S0	µg/kg	130	1200	750	Removed: maximum value detected below screening-level criteria. Laboratory or sampling contaminant.
Chlorobenzene	108-90-7	S0	µg/kg	15	80	52	Removed: maximum value detected below screening-level criteria.
Di-N-Octylphthalate	117-84-0	S0	µg/kg	120	700	454	Removed: maximum value detected below screening-level criteria.
Ethylbenzene	100-41-4	S0	µg/kg	300	3700	2260	Removed: maximum value detected below screening-level criteria.
Fluorene	86-73-7	S0	µg/kg	29	210	133	Removed: maximum value detected below screening-level criteria.
Lead	7439-92-1	S0	µg/kg	8010	23500	20350	Remove: average value below 95% of background.
Naphthalene	91-20-3	S0	µg/kg	1600	21000	12800	Removed: maximum value detected below screening-level criteria.
Phenanthrene	85-01-8	S0	µg/kg	17	110	71	Removed: maximum value detected below screening-level criteria.
Toluene	108-88-3	S0	µg/kg	104	410	280	Removed: maximum value detected below screening-level criteria.
Total Xylenes	1330-20-7	S0	µg/kg	1.4	18.2	11.1	Removed: maximum value detected below screening-level criteria.
TPH ^(c)	TPH	S0	µg/kg	830000	32000000	8500000	

Filename: 48D1D50.XLS

(a) UCL = upper confidence limit

(b) S0 = soil

(c) TPH = total petroleum hydrocarbons

TABLE 8.8. Chemicals Detected in Groundwater of ST-48: Their Concentrations and Their Risk Evaluation Status

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
2,4-Dimethylphenol	105-67-9	WD (b)	µg/L	2	10	8	
2-Methylnaphthalene	91-57-6	WD	µg/L	33	261	176	Removed: maximum value detected below screening-level criteria.
Aluminum, Total	7429-90-5	WD	µg/L	11900	11900	NA (c)	Removed: low toxicity
Arsenic, DISS (d)	7440-38-2	WD	µg/L	20	20	NA	Removed: total arsenic value used for evaluation.
Arsenic, Total	7440-38-2	WD	µg/L	26.8	26.8	NA	
Barium, DISS	7440-39-3	WD	µg/L	50	50	NA	Removed: total barium value used for evaluation.
Barium, Total	7440-39-3	WD	µg/L	722	722	NA	
Benzene	71-43-2	WD	µg/L	187	1390	1063	Removed: monitoring data for benzene in WG matrix used for evaluation.
BIS (2-Ethylhexyl)phthalate	117-81-7	WD	µg/L	40	700	370	Removed: laboratory or sampling contaminant.
Butylbenzylphthalate	85-68-7	WD	µg/L	30	520	275	Removed: maximum value detected below screening-level criteria. Laboratory or sampling contaminant.
Calcium, DISS	7440-70-2	WD	µg/L	174000	174000	NA	Removed: low toxicity
Calcium, Total	7440-70-2	WD	µg/L	136000	136000	NA	Removed: low toxicity
Chloride	16887-00-6	WD	µg/L	11250	11250	NA	Removed: water quality parameter
Chromium	7440-47-3	WD	µg/L	12.3	12.3	NA	Removed: average value below 95% UCL for background.
Cobalt, Total	7440-48-4	WD	µg/L	18	18	NA	Removed: low toxicity
Copper, Total	7440-50-8	WD	µg/L	118	118	NA	Removed: low toxicity
Ethylbenzene	100-41-4	WD	µg/L	22	160	125	Removed: monitoring data for ethylbenzene in WG matrix used for evaluation.
Iron, DISS	7439-89-6	WD	µg/L	24700	24700	NA	Removed: low toxicity

TABLE 8.8. (cont.)

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
Iron, Total	7439-89-6	WD	µg/L	42400	42400	NA	Removed: low toxicity
Lead, DISS	7439-92-1	WD	µg/L	1	3	3	Removed: total lead value used for evaluation.
Lead, Total	7439-92-1	WD	µg/L	37	152	133	
Magnesium, DISS	7439-95-4	WD	µg/L	36900	36900	NA	Removed: low toxicity
Magnesium, Total	7439-95-4	WD	µg/L	43700	43700	NA	Removed: low toxicity
Manganese, DISS	7439-96-5	WD	µg/L	5200	5200	NA	Removed: total manganese value used for evaluation.
Manganese, Total	7439-96-5	WD	µg/L	5670	5670	NA	
Mercury, DISS	7439-97-6	WD	µg/L	0.7	0.7	NA	
Mercury, Total	7439-97-6	WD	µg/L	0.3	0.3	NA	Removed: higher mercury value used for evaluation.
Naphthalene	91-20-3	WD	µg/L	67	440	331	
Nitrog. NO2+NO3	7727-37-9	WD	µg/L	33	185	157	Removed: low toxicity
Potassium, DISS	7440-09-7	WD	µg/L	4980	4980	NA	Removed: low toxicity
Potassium, Total	7440-09-7	WD	µg/L	7200	7200	NA	Removed: low toxicity
Sodium, DISS	7440-23-5	WD	µg/L	11000	11000	NA	Removed: low toxicity
Sodium, Total	7440-23-5	WD	µg/L	13200	13200	NA	Removed: low toxicity
Sulfate	SULFATE	WD	µg/L	130700	130700	NA	Removed: low toxicity
Toluene	108-88-3	WD	µg/L	23	230	138	Removed: monitoring data for toluene in WG matrix used for evaluation.
Total Xylenes	1330-20-7	WD	µg/L	290	1990	1506	
TPH(e)	TPH	WD	µg/L	30000	400000	210000	
Vanadium, Total	7440-62-2	WD	µg/L	37	37	NA	
Zinc, DISS	7440-66-6	WD	µg/L	30	30	NA	Removed: low toxicity
Zinc, Total	7440-66-6	WD	µg/L	72.4	72.4	NA	Removed: low toxicity

TABLE 8.8. (cont.)

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL ^(a)	Risk Evaluation Status and Reason for Removal from Further Consideration
Benzene	71-43-2	WG ^(f)	µg/L	530	7100	3830	
Ethylbenzene	100-41-4	WG	µg/L	154	950	727	
m, p-Xylene	108-38-3	WG	µg/L	450	3300	2250	Removed: isomer-specific toxicity data unavailable; total xylene value used for evaluation.
o-Xylene	95-47-6	WG	µg/L	172	1300	828	Removed: isomer-specific toxicity data unavailable; total xylene value used for evaluation.
Dichloroethylene -1,2	156-60-5	WG	µg/L	25	490	238	
Toluene	108-88-3	WG	µg/L	720	6600	4300	

Filename: 480T10WD.XLS

- (a) UCL = upper confidence limit
 (b) WD = groundwater, well development
 (c) NA = not applicable (sample size too small for meaningful statistical evaluation)
 (d) DISS = dissolved
 (e) TPH = total petroleum hydrocarbons
 (f) WG = groundwater, well monitoring

TABLE 8.9. Chemicals Detected in Soils of ST-49: Their Concentrations and Their Risk Evaluation Status

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
Aluminum	7429-90-5	SO (b)	µg/kg	10100000	10300000	NA (c)	Removed: low toxicity
Arsenic	7440-38-2	SO	µg/kg	9330	9340	NA	Removed: average value below 95% UCL for background.
Barium	7440-39-3	SO	µg/kg	100100	108000	NA	Removed: maximum value detected below screening-level criteria.
Benzo(A)Anthracene	56-55-3	SO	µg/kg	84	390	367	
Benzo(A)Pyrene	50-32-8	SO	µg/kg	60	400	310	
Benzo(B)Fluoranthene	205-99-2	SO	µg/kg	30	160	121	
Benzo(G,H,I)Perylene	191-24-2	SO	µg/kg	31	130	103	Removed: low toxicity
Beryllium	7440-41-7	SO	µg/kg	1053	1180	NA	
BIS (2-Ethylhexyl)phthalate	117-81-7	SO	µg/kg	69	160	150	Removed: maximum value detected below screening-level criteria. Laboratory or sampling contaminant.
Butylbenzylphthalate	85-68-7	SO	µg/kg	71	390	295	Removed: maximum value detected below screening-level criteria. Laboratory or sampling contaminant.
Calcium	7440-70-2	SO	µg/kg	2598000	5190000	NA	Removed: low toxicity
Chromium	7440-47-3	SO	µg/kg	18800	18900	NA	Removed: average value below 95% UCL for background.
Chrysene	218-01-9	SO	µg/kg	96	490	390	Removed: maximum value detected below screening-level criteria.
Cobalt	7440-48-4	SO	µg/kg	11800	12100	NA	Removed: low toxicity
Cobalt, Total	7440-48-4	SO	µg/kg	18800	18900	NA	Removed: low toxicity
Copper	7440-50-8	SO	µg/kg	30800	34600	NA	Removed: low toxicity
DDD, -4,4' (d)	72-54-8	SO	µg/kg	178	356	681	
Fluoranthene	206-44-0	SO	µg/kg	170	630	NA	Removed: maximum value detected below screening-level criteria.
Indeno(1,2,3-CD)Pyrene	193-39-5	SO	µg/kg	58	290	226	

TABLE 8.9. (cont.)

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
Iron	7439-89-6	SO	µg/kg	19250000	19800000	NA	Removed: low toxicity
Lead	7439-92-1	SO	µg/kg	7960	8530	NA	Removed: average value below 95% UCL for background.
Magnesium	7439-95-4	SO	µg/kg	6090000	6320000	NA	Removed: low toxicity
Manganese	7439-96-5	SO	µg/kg	396000	437000	NA	Removed: average value below 95% UCL for background.
Methylene Chloride	75-09-2	SO	µg/kg	410	1500	NA	Removed: maximum value detected below screening-level criteria. Laboratory or sampling contaminant.
Nickel	7440-02-0	SO	µg/kg	24.6	25.6	NA	Removed: maximum value detected below screening-level criteria.
Phenanthrene	85-01-8	SO	µg/kg	117	520	488	Removed: maximum value detected below screening-level criteria.
Potassium	7440-09-7	SO	µg/kg	890000	890000	NA	Removed: low toxicity
Pyrene	129-00-0	SO	µg/kg	179	650	NA	Removed: maximum value detected below screening-level criteria.
Sodium	7440-23-5	SO	µg/kg	427000	435000	NA	Removed: low toxicity
TPH(e)	TPH	SO	µg/kg	170700	2530000	1113000	
Vanadium	7440-62-2	SO	µg/kg	37.7	38.7	NA	Removed: maximum value detected below screening-level criteria.
Zinc	7440-66-6	SO	µg/kg	65650	71600	NA	Removed: low toxicity

(a) UCL = upper confidence limit
 (b) SO = soil

(c) NA = not applicable (sample size too small for meaningful statistical evaluation)

(d) DDD, -4,4' = dichlorodiphenyldichloroethane

(e) TPH = total petroleum hydrocarbons

Filename:49011DS0.XLS

TABLE 8.10. Chemicals Detected in Groundwater of ST-49: Their Concentrations and Their Risk Evaluation Status

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL ^(a)	Risk Evaluation Status and Reason for Removal from Further Consideration
1,1,1-Trichloroethane	71-55-6	WD ^(b)	µg/L	0.64	4.77	3.12	Removed: maximum value detected below screening-level criteria.
1,1-Dichloroethane	75-34-3	WD	µg/L	0.40	1.57	1.20	
1,2-Dichlorobenzene	95-50-1	WD	µg/L	0.18	0.25	NA	
1,4-Dichlorobenzene	106-46-7	WD	µg/L	1.08	4.53	4.12	
2-Methylnaphthalene	91-57-6	WD	µg/L	17	117	105	Removed: maximum value detected below screening-level criteria.
Acenaphthene	83-32-9	WD	µg/L	2.27	6.43	NA	Removed: maximum value detected below screening-level criteria.
Aluminum, Total	7429-90-5	WD	µg/L	13200	13200	NA ^(c)	Removed: low toxicity
Anthracene	120-12-7	WD	µg/L	0.016	0.034	NA	Removed: maximum value detected below screening-level criteria.
Arsenic, DISS ^(d)	7440-38-2	WD	µg/L	10	10	NA	Removed: total value for arsenic used for evaluation.
Arsenic, Total	7440-38-2	WD	µg/L	22.4	22.4	NA	
Barium, DISS	7440-39-3	WD	µg/L	300	300	NA	Removed: total value for barium used for evaluation.
Barium, Total	7440-39-3	WD	µg/L	418	418	NA	
Benzene	71-43-2	WD	µg/L	1	6	4	
Benzo(A)Anthracene	56-55-3	WD	µg/L	0.005	0.026	0.024	
Benzo(A)Pyrene	50-32-8	WD	µg/L	0.004	0.015	0.015	
Benzo(B)Fluoranthene	205-99-2	WD	µg/L	0.004	0.012	0.012	
Benzo(G,H,I)Perylene	191-24-2	WD	µg/L	0.005	0.023	0.022	Removed: low toxicity
Benzo(K)Fluoranthene	207-08-9	WD	µg/L	0.002	0.008	0.008	Removed: maximum value detected below screening-level criteria.
Calcium, DISS	7440-70-2	WD	µg/L	56900	56900	NA	Removed: low toxicity
Calcium, Total	7440-70-2	WD	µg/L	67000	67000	NA	Removed: low toxicity

TABLE 8.10. (cont.)

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
Chloride	16887-00-6	MD	µg/L	2027	2027	NA	Removed: water quality parameter
Chlorobenzene	108-90-7	MD	µg/L	0.202	0.432	0.343	Removed: maximum value detected below screening-level criteria.
Chromium, Total	7440-47-3	MD	µg/L	18.1	18.1	NA	Removed: average value below 95% UCL for background.
Chrysene	218-01-9	MD	µg/L	0.01	0.03	0.03	Removed: maximum value detected below screening-level criteria.
Cobalt, Total	7440-48-4	MD	µg/L	16.4	16.4	NA	Removed: low toxicity
Copper, Total	7440-50-8	MD	µg/L	62.2	62.2	NA	Removed: low toxicity
Dibenzo(A,H)Anthracene	53-70-3	MD	µg/L	0.002	0.005	NA	
Dibenzofuran	132-64-9	MD	µg/L	0.09	0.62	0.56	Removed: maximum value detected below screening-level criteria.
Ethylbenzene	100-41-4	MD	µg/L	1	8	5	Removed: maximum value detected below screening-level criteria.
Fluoranthene	206-44-0	MD	µg/L	0.059	0.356	0.321	Removed: maximum value detected below screening-level criteria.
Fluorene	86-73-7	MD	µg/L	1.8	10.8	9.7	Removed: maximum value detected below screening-level criteria.
Indeno(1,2,3-CD)Pyrene	193-39-5	MD	µg/L	0.003	0.009	NA	
Iron, DISS	7439-89-6	MD	µg/L	700	700	NA	Removed: low toxicity
Iron, Total	7439-89-6	MD	µg/L	18600	18600	NA	Removed: low toxicity
Lead, Total	7439-92-1	MD	µg/L	20.8	20.8	NA	
m,p-Xylene	108-38-3	MD	µg/L	3	37	20	Removed: isomer-specific toxicity data unavailable; value for total xylene used.
Magnesium, DISS	7439-95-4	MD	µg/L	12400	12400	NA	Removed: low toxicity
Magnesium, Total	7439-95-4	MD	µg/L	18100	18100	NA	Removed: low toxicity
Manganese, DISS	7439-96-5	MD	µg/L	2400	2400	NA	Removed: low toxicity
Manganese, Total	7439-96-5	MD	µg/L	2960	2960	NA	Removed: low toxicity

TABLE 8.10. (cont.)

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
Methylene Chloride	75-09-2	MD	µg/L	1080	1400	NA	Removed: laboratory or sampling contaminant.
Naphthalene	91-20-3	MD	µg/L	13	62	54	
Nickel, Total	7440-02-0	MD	µg/L	26.2	26.2	NA	Removed: maximum value detected below screening-level criteria.
o-Xylene	95-47-6	MD	µg/L	3	24	15	Removed: isomer-specific toxicity data unavailable; value for total xylene used.
Phenanthrene	85-01-8	MD	µg/L	3	21	19	
Potassium, DISS	7440-09-7	MD	µg/L	2940	2940	NA	Removed: low toxicity
Potassium, Total	7440-09-7	MD	µg/L	5760	5760	NA	Removed: low toxicity
Pyrene	129-00-0	MD	µg/L	0.15	0.85	0.77	Removed: maximum value detected below screening-level criteria.
Sodium, DISS	7440-23-5	MD	µg/L	5010	5010	NA	Removed: low toxicity
Sodium, Total	7440-23-5	MD	µg/L	6840	6840	NA	Removed: low toxicity
Sulfate	SULFATE	MD	µg/L	63810	63810	NA	Removed: low toxicity
Dichloroethylene-1,2-t	156-60-5	MD	µg/L	1	2	1	Removed: maximum value detected below screening-level criteria.
Toluene	108-88-3	MD	µg/L	0.41	0.83	0.78	Removed: maximum value detected below screening-level criteria.
Xylenes, Total	1330-20-7	MD	µg/L	2.4	18.1	12	Removed: maximum value detected below screening-level criteria.
TPH (e)	TPH	MD	µg/L	4500	32300	26470	
Trichloroethene	79-01-6	MD	µg/L	1.39	6.93	4.6	
Trichlorofluoromethane	75-69-4	MD	µg/L	0.227	0.788	0.566	Removed: maximum value detected below screening-level criteria.
Vanadium, Total	7440-62-2	MD	µg/L	28.2	28.2	NA	Removed: average value below 95% UCL background.
Zinc, DISS	7440-66-6	MD	µg/L	60	60	NA	Removed: total value for Zn used for evaluation; however, maximum value detected below screening-level criteria.

TABLE 8.10. (cont.)

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
Zinc, Total	7440-66-6	WD	µg/L	79.9	79.9	NA	Removed: maximum value detected below screening-level criteria.

Filename:490T1DWD.XLS

(a) UCL = upper confidence limit

(b) WD = groundwater

(c) NA = not applicable (sample size too small for meaningful statistical evaluation)

(d) DISS = dissolved

(e) TPH = total petroleum hydrocarbons

TABLE 8.11. Chemicals Detected in Soils of ST50-54 (Blair Lakes): Their Concentrations and Their Risk Evaluation Status

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95%(a) UCL	Risk Evaluation Status and Reason for Removal from Further Consideration
2-Chlorophenol	95-57-8	S0 ^(b)	µg/kg	313	4150	2000	Removed: maximum value detected below screening-level criteria.
2-Methylnaphthalene	91-57-6	S0	µg/kg	34000	320000	182000	Removed: maximum value detected below screening-level criteria.
Acenaphthene	83-32-9	S0	µg/kg	140	1800	870	Removed: maximum value detected below screening-level criteria.
Acetophenone	98-86-2	S0	µg/kg	5900	75000	45500	Removed: maximum value detected below screening-level criteria.
Aluminum	7429-90-5	S0	µg/kg	9080000	13900000	NA	Removed: low toxicity
Arsenic	7440-38-2	S0	µg/kg	4900	18200	13800	Removed: average value below 95% UCL for background.
Barium	7440-39-3	S0	µg/kg	194100	366000	NA	Removed: maximum value detected below screening-level criteria.
Benzene	71-43-2	S0	µg/kg	520	3790	2970	
Beryllium	7440-41-7	S0	µg/kg	198	620	464	Removed: average value below 95% UCL for background.
BIS (2-Ethylhexyl)phthalate	117-81-7	S0	µg/kg	70	700	320	Removed: maximum value detected below screening-level criteria. Laboratory and sampling contaminant.
Cadmium	7440-43-9	S0	µg/kg	1105	1990	1842	
Calcium	7440-70-2	S0	µg/kg	3050000	5690000	5530000	Removed: low toxicity
Chromium	7440-47-3	S0	µg/kg	17330	25800	NA	Removed: average value below 95% UCL for background.
Cobalt	7440-48-4	S0	µg/kg	9960	15300	NA	Removed: low toxicity
Copper	7440-50-8	S0	µg/kg	24480	42700	NA	Removed: low toxicity
Dibenzofuran	132-64-9	S0	µg/kg	800	11000	5600	Removed: maximum value detected below screening-level criteria.
Ethylbenzene	100-41-4	S0	µg/kg	19000	170000	109000	Removed: maximum value detected below screening-level criteria.

TABLE 8.11. (cont.)

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
Fluorene	86-73-7	SO	µg/kg	600	12000	5300	Removed: maximum value detected below screening-level criteria.
Iron	7439-89-6	SO	µg/kg	20780000	34300000	NA	Removed: low toxicity
Lead	7439-92-1	SO	µg/kg	18230	31900	31400	Removed: average value below 95% UCL for background.
Magnesium	7439-95-4	SO	µg/kg	4422000	7440000	NA	Removed: low toxicity
Manganese	7439-96-5	SO	µg/kg	362300	661000	623100	Removed: average value below 95% UCL for background.
N-Nitrosopiperidine	100-75-4	SO	µg/kg	49	320	231	
Naphthalene	91-20-3	SO	µg/kg	17000	160000	93000	Removed: maximum value detected below screening-level criteria.
Nickel	7440-02-0	SO	µg/kg	21850	22400	NA	Removed: maximum value detected below screening-level criteria.
Phenol	108-95-2	SO	µg/kg	313	4150	1999	Removed: maximum value detected below screening-level criteria.
Potassium	7440-09-7	SO	µg/kg	1094000	1720000	NA	Removed: low toxicity
Sodium	7440-23-5	SO	µg/kg	119100	216000	198600	Removed: low toxicity
Toluene	108-88-3	SO	µg/kg	13000	150000	89000	Removed: maximum value detected below screening-level criteria.
Total Xylenes	1330-20-7	SO	µg/kg	170000	1470000	940000	Removed: maximum value detected below screening-level criteria.
TPH(c)	TPH	SO	µg/kg	2820000	91800000	26580000	
Vanadium	7440-62-2	SO	µg/kg	19600	23000	NA	Removed: maximum value detected below screening-level criteria.
Zinc	7440-66-6	SO	µg/kg	89700	157000	161400	Removed: maximum value detected below screening-level criteria.

(a) UCL = upper confidence limit (c) TPH = total petroleum hydrocarbons

(b) SO = soil

Filename: 500T1DS0.XLS

TABLE 8.12. Chemicals Detected in Groundwater of ST50-54 (Blair Lakes), Their Concentrations and Their Risk Evaluation Status

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
2,4- Dimethylphenol	105-67-9	WD (b)	µg/L	2	12	8	
2-Methylnaphthalene	91-57-6	WD	µg/L	800	12000	7000	
Aluminum, DISS(c)	7429-90-5	WD	µg/L	29	40	NA (d)	Removed: low toxicity
Aluminum, Total	7429-90-5	WD	µg/L	41900	90600	NA	Removed: low toxicity
Arsenic, Total	7440-38-2	WD	µg/L	42	100	NA	
Barium, DISS	7440-39-3	WD	µg/L	260	700	NA	Removed: total value for barium used in evaluation.
Barium, Total	7440-39-3	WD	µg/L	1332	4180	NA	
Benzene	71-43-2	WD	µg/L	37	335	214	
BIS (2-Ethylhexyl)-phthalate	117-81-7	WD	µg/L	1.3	4.1	3.4	Removed: laboratory or sampling contaminant.
Butylbenzylphthalate	85-68-7	WD	µg/L	2	12	8	Removed: maximum value detected below screening-level criteria. Laboratory or sampling contaminant.
Cadmium, Total	7440-43-9	WD	µg/L	9	20	NA	Removed: average value below 95% UCL for background.
Calcium, DISS	7440-70-2	WD	µg/L	45700	59700	NA	Removed: low toxicity
Calcium, Total	7440-70-2	WD	µg/L	65740	84200	NA	Removed: low toxicity
Chloride	CHLORIDE	WD	µg/L	1738	5877	NA	Removed: water quality parameter
Chlorobenzene	108-90-7	WD	µg/L	6	85	50	
Chloroform	67-66-3	WD	µg/L	0.22	1.01	0.82	
Chloromethane	74-87-3	WD	µg/L	7	100	58	
Chromium, Total	7440-47-3	WD	µg/L	243	820	NA	
Cobalt, Total	7440-48-4	WD	µg/L	63	150	NA	Removed: low toxicity
Copper, DISS	7440-50-8	WD	µg/L	2	4	NA	Removed: total value for copper used in evaluation.

TABLE 8.12. (cont.)

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
Copper, Total	7440-50-8	WD	µg/L	218	511	NA	
Diethylphthalate	84-66-2	WD	µg/L	0.9	6.6	4.1	Removed: maximum value detected below screening-level criteria.
Ethylbenzene	100-41-4	WD	µg/L	201	2210	1338	
Iron, DISS	7439-89-6	WD	µg/L	250	1000	NA	Removed: low toxicity
Iron, Total	7439-89-6	WD	µg/L	124000	309000	NA	Removed: low toxicity
Lead, DISS	7439-92-1	WD	µg/L	2	2	NA	Removed: total value for lead used in evaluation.
Lead, Total	7439-92-1	WD	µg/L	150	400	NA	
Magnesium, DISS	7439-95-4	WD	µg/L	8880	9350	NA	Removed: low toxicity
Magnesium, Total	7439-95-4	WD	µg/L	28200	51900	NA	Removed: low toxicity
Manganese, DISS	7439-96-5	WD	µg/L	1700	5000	NA	Removed: low toxicity
Manganese, Total	7439-96-5	WD	µg/L	8500	34600	NA	Removed: low toxicity
Molybdenum, Total	7439-98-7	WD	µg/L	17.3	51.8	NA	Removed: no industrial source
Naphthalene	91-20-3	WD	µg/L	420	5700	3350	
Nickel, Total	7440-02-0	WD	µg/L	104	344	NA	Removed: average value below 95% UCL for background.
Nitrog, NO2+NO3	7727-37-9	WD	µg/L	24	102	NA	Removed: low toxicity
Phenol	108-95-2	WD	µg/L	1.2	6.8	4.3	Removed: maximum value detected below screening-level criteria.
Potassium, DISS	7440-09-7	WD	µg/L	1500	2000	NA	Removed: low toxicity
Potassium, Total	7440-09-7	WD	µg/L	7400	13000	NA	Removed: low toxicity
Sodium, DISS	7440-23-5	WD	µg/L	3522	7470	7392	Removed: low toxicity
Sulfate	SULFATE	WD	µg/L	39628	64060	NA	Removed: low toxicity
Toluene	108-88-3	WD	µg/L	397	2080	1246	
Total Xylenes	1330-20-7	WD	µg/L	636	6940	4259	

TABLE 8.12. (cont.)

Analytes Measured	CAS Number	Matrix Code	Units	Average Value	Max. Value Detected	95% UCL (a)	Risk Evaluation Status and Reason for Removal from Further Consideration
TPH (e)	TPH	WD	µg/L	140000	1980000	1160000	
Vanadium, Total	7440-62-2	WD	µg/L	112	254	NA	
Zinc, DISS	7440-66-6	WD	µg/L	34	60	NA	Removed: total value for zinc used in evaluation.
Zinc, Total	7440-66-6	WD	µg/L	550	1180	NA	Removed: average value below 95% UCL for background.

Filename: 500T1DWD.XLS

(a) UCL = upper confidence limit

(b) WD = groundwater

(c) DISS = dissolved

(d) NA = not applicable (sample size too small for meaningful statistical evaluation)

(e) TPH = total petroleum hydrocarbons

TABLE 8.13. Risk-Based Contaminant of Concern Cutoff Concentrations

		Screening-Level Concentration Values			
		Groundwater		Soils	
		CR= 10-6(a)	HI = 0.1(b)	CR= 10-7	HI=0.1
Analyte	CAS #	ug/L(c)	ug/L	ug/kg	ug/kg
VOLATILES					
1,1,1-TRICHLOROETHANE	71556	NA	101.07	NA (d)	2250000.00
1,1-DICHLOROETHANE	75343	0.0089	42.94	41.67	2500000.00
1,1-DICHLOROETHENE	75354	0.0089	3.86	41.67	225000.00
1,2-DICHLOROETHENE (TRANS)	156605	NA	8.59	NA	500000.00
BENZENE	71432	0.3457	NA	862.07	NA
CHLOROBENZENE	108907	NA	2.35	NA	500000.00
CHLOROFORM	67663	0.1388	4.29	4098.36	250000.00
CHLOROMETHANE	74873	1.4147	NA	1923.08	NA
ETHYLBENZENE	100414	NA	100.75	NA	2500000.00
METHYLENE CHLORIDE	75092	1.3365	143.58	3333.33	1500000.00
TETRACHLOROETHENE	127184	1.1270	4.29	490.20	250000.00
TOLUENE	108883	NA	51.56	NA	5000000.00
TRICHLOROETHENE	79016	0.6151	246.47	2272.73	2500000.00
VINYL CHLORIDE	75014	0.0206	NA	13.16	NA
XYLENES	1330207	NA	96.04	NA	50000000.00
SEMI-VOLATILES					
1,2-DICHLOROBENZENE	95501	NA	5.46	NA	2250000.00
1,4-DICHLOROBENZENE	106467	0.4177	7.10	1041.67	52500.00
2,4-DIMETHYLPHENOL	105679	NA	8.59	NA	500000.00
2-CHLOROPHENOL	95578	NA	2.15	NA	125000.00
2-METHYLNAPHTHALENE	91576	NA	839.42	NA	5750000.00
2-METHYLPHENOL (o-cresol)	95487	NA	21.47	NA	1250000.00
4-METHYLPHENOL (p-cresol)	106445	NA	21.47	NA	1250000.00
ACENAPHTHENE	83329	NA	25.76	NA	1500000.00
ACETOPHENONE	98862	NA	42.94	NA	2500000.00
ANTHRACENE	120127	NA	1094.89	NA	7500000.00
BENZO(A)ANTHRACENE	56553	0.0091	NA	22.73	NA
BENZO(A)PYRENE	50328	0.0014	NA	3.42	NA
BENZO(B)FLUORANTHENE	205992	0.0100	NA	25.00	NA
BENZO(G,H,I)PERYLENE	191242	NA	NA	NA	NA
BENZO(K)FLUORANTHENE	207089	0.0209	NA	52.08	NA
BENZOIC ACID	65850	NA	1717.48	NA	100000000.00
BIS(2-ETHYLHEXYL)PHTHALATE	117817	0.7160	72.99	1785.71	500000.00
BUTYLBENZYLPHTHALATE, N-	85687	NA	729.93	NA	5000000.00
CHRYSENE	218019	0.3133	NA	781.25	NA
DI-N-OCTYLPHTHALATE	117840	NA	72.99	NA	500000.00
DIBENZ(A,H)ANTHRACENE	53703	0.0012	NA	3.09	NA
DIBENZOFURAN	132649	NA	1717.48	NA	100000000.00
DIETHYLPHTHALATE	84662	NA	2919.71	NA	20000000.00
FLUORANTHENE	206440	NA	145.99	NA	1000000.00
FLUORENE	86737	NA	145.99	NA	1000000.00
INDENO(1,2,3-CD)PYRENE	193395	0.0059	NA	14.71	NA
NAPHTHALENE	91203	NA	17.17	NA	1000000.00
N-NITROSOPIPERIDINE	100754	0.0048	2116.79	11.90	14500000.00
PHENANTHRENE	85018	NA	5.34	NA	1000000.00
PHENOL	108952	NA	257.62	NA	15000000.00
PYRENE	129000	NA	12.88	NA	750000.00
TRICHLOROFLUOROMETHANE	75694	NA	89.38	NA	7500000.00

TABLE 8.13. Risk-Based Contaminant of Concern Cutoff Concentrations

Analyte	CAS #	Screening-Level Concentration Values			
		Groundwater		Soils	
		CR= 10-6(a)	HI = 0.1(b)	CR= 10-7	HI=0.1
		ug/L(c)	ug/L	ug/kg	ug/kg
TPH (e)					
TOTAL PET HYDROCARBONS	no CAS#	NA	9124.09	NA	62500000.00
PESTICIDES					
4,4'-DDD (f)	72548	0.0418	1.82	104.17	12500.00
METALS					
ARSENIC	7440382	0.0002	1.09	14.29	7500.00
BARIUM	7440393	NA	0.01	NA	1750000.00
BERYLLIUM	7440417	0.0013	18.25	5.81	125000.00
CADMIUM	7440439	0.0019	1.82	4.10	12500.00
CHROMIUM VI	7440473	0.0003	18.25	0.61	125000.00
COPPER	7440508	NA	135.04	NA	925000.00
LEAD	7439921	NA	0.02	NA	7500.00
MANGANESE	7439965	NA	NA	NA	NA
MERCURY	7439976	NA	0.04	NA	7500.00
MOLYBDENUM	7439987	NA	18.25	NA	125000.00
NICKEL (soluble salts)	7440020	NA	72.99	NA	500000.00
VANADIUM	7440622	NA	25.55	NA	175000.00
ZINC COMPOUNDS	7440666	NA	1094.89	NA	7500000.00
(a) CR = cancer risk					
(b) HI = hazard index					
(c) ug = micrograms					
(d) NA = not applicable					
(e) TPH = total petroleum hydrocarbons					
(f) DDD = dichlorodiphenyldichloroetane					

9.0 TOXICITY ASSESSMENT

This section documents the Toxicity Assessment for Eielson AFB Operable Unit-1 source areas. This component of the baseline risk assessment collects qualitative and quantitative toxicity information and defines the most appropriate toxicity value for a detected chemical. Summarized in the Toxicity Assessment section are the results of a toxicological data evaluation for the 59 chemical analytes detected at Eielson OU-1.

The numerical values and references for all toxicity data used in this risk assessment are given in Table 9.1, "Toxicological and Carcinogenic Potency Values, and Carcinogenic Rating for Chemicals of Concern." This table presents a composite list of all toxicity values used in the subsequent risk calculations. Recent toxicological data on cancer potency (slope) factors (SF) for carcinogens and reference doses (RfDs) for noncarcinogens detected are summarized in this table. An assessment is also made of the toxicological significance of the chemicals of concern. For example, are the detected chemicals carcinogens or noncarcinogens?

There are multiple sources of toxicity data for chemicals. Following U.S. EPA Region 10 guidance (U.S. EPA 1991a), a hierarchy of toxicity sources was used. The primary reference was the U.S. EPA's Integrated Risk Information System (IRIS), (U.S. EPA 1993, online); the secondary reference was the U.S. EPA's Health Effects Assessment Summary Tables (HEAST), (U.S. EPA 1990, 1991d, 1992a). The footnotes in Table 9.1 reference the sources or describe derivation of all toxicity data used.

According to regulatory guidance, the analytes detected were initially screened so that every compound detected that contributed to the risk at any source area (excess cancer risk $>10^{-7}$ or Hazard Quotient >0.1) was carried through the risk quantification process.

9.1 TOXICITY INFORMATION FOR NONCARCINOGENIC EFFECTS

In this risk assessment, the noncarcinogenic effects of carcinogens are not included in the calculation of the hazard index (i.e., in the noncancer risk) calculations. However, detected chemicals were assessed as to systemic

chronic toxic effects, other than carcinogenic effects, that they might present. Supporting studies for the RfDs as presented in IRIS were examined. Table 9.1 gives the RfDs identified for the oral route (if available) for the chemicals found. The RfD values are used in the subsequent hazard index (noncancer risk) calculations. The RfD concept is based on the assumption that specific numerical thresholds exist for certain toxic effects.

9.2 TOXICITY INFORMATION FOR CARCINOGENIC EFFECTS

The decision of whether or not a chemical is a human carcinogen is a matter of assessing the strength of the scientific evidence (termed weight-of-evidence) supporting a causal relationship between exposure to the agent and cancer induction. Suspected carcinogens detected in any source area are identified in Table 9.1.

Two agencies, the International Agency for Research in Cancer (IARC) and the U.S. EPA, assign ratings to chemicals; however, their classification formats are slightly different. The U.S. EPA's "Guidelines for Carcinogen Risk Assessment" (51 FR 33992) classification is used for the chemicals detected at the OU-1 source areas that are suspected, and/or known, to be animal or human carcinogens. The SFs are used by regulatory convention and are typically the upper 95% confidence limit of the slope of the dose-response curve derived from animal test studies. Slope factors are used to quantify potential cancer risk. These factors, specific to different exposure routes (ingestion and inhalation), are given in the units of $(\text{mg/kg-day})^{-1}$ (note that the units are reciprocal).

Regulatory agencies have not agreed upon a single level of "acceptable" incremental individual lifetime risk for cancer. However, it is generally accepted that the CERCLA post-remediation excess cancer risk goal should fall within the 10^{-4} to 10^{-6} range.

9.3 TOXICOLOGICAL ASSUMPTIONS

As noted, the Toxicity Assessment relies heavily on existing toxicity information contained in either the IRIS or HEAST. When toxicity values were absent in these two regulatory sources, experienced toxicologists made

assumptions concerning the potential toxicity and carcinogenicity of the chemicals detected. These assumptions are described in the following paragraphs and also in the footnotes to Table 9.1. Some chemicals have toxicity values reported for the ingestion route of exposure but not for inhalation. This risk assessment typically assigned the ingestion value for inhalation for the high-volatility chemicals.

No quantitative toxicity data exist in IRIS or HEAST for two of the principal contaminants at Operable Unit 1 source areas: total petroleum hydrocarbons (TPH) and inorganic lead. Therefore, toxicity values were developed for these compounds so that they could be included in the primary risk calculations.

In addition, there are few data for many of the polynuclear aromatic hydrocarbons (PAHs or PNAs) except for benzo(a)pyrene. Therefore, in order to assign a toxicity to the other PAHs, toxicity equivalency factors from the literature were used.

Additional details regarding the derivation of toxicity values and assumptions used for TPH, inorganic lead, and PNAs are given herein.

Some of the chemicals detected are classified by U.S. EPA as noncarcinogens (Class D). Class D chemicals are not included in the cancer risk calculations. Class A, B, and C carcinogens are all treated identically, as in the cancer risk calculations. No differentiation is made in the relative risk contributed by different categories (Class A, B, or C) to the overall expression of cancer risk. As per regulatory guidance, the risks from the three carcinogen classes are assumed to be additive.

9.3.1 Total Petroleum Hydrocarbons

The RfD for TPH was derived from the RfD for "fresh" gasoline RfD=2E-1 mg/kg-day (U.S. EPA 1992b). Using the U.S. EPA toxicological additivity principle, the RfDs for the four principal volatile components of gasoline (Benzene [0.0], Ethylbenzene [2E-1], Xylene [2E+0], and Toluene [2E-1]) were added to the RfD for gasoline. Increasing the RfD has the effect of decreasing the toxicity. The derived RfD (2.5 mg/kg-day) represents the lower toxicity for hydrocarbon components remaining after the volatile components have migrated away. In addition, it is assumed that the volatile

components are the only contributors to the carcinogenicity of gasoline. RfDs for volatiles were obtained from IRIS (U.S. EPA 1993).

9.3.2 Polynuclear Aromatic Hydrocarbons

A technique called the relative potency estimate (RPE) factor method is used to relate the carcinogenicity of benzo(a)pyrene to those of other polynuclear aromatic hydrocarbons. The RPE methodology and the reference dose developed for TPH are described below.

The RPE factor method is a way to relate the carcinogenic response of less-studied compounds in a mixture to that of the best studied compound(s). The RPEs (presented in Table 9.2) used in this risk assessment relate the carcinogenic response of benzo(a)pyrene to other polynuclear aromatic hydrocarbons (PAHs). The RPE for benzo(a)pyrene is one (1), and the RPE of other carcinogenic PNAs is inferred from chemical and toxicological similarities to benzo(a)pyrene (ICF-Clement Associates 1988).

9.3.3 Lead

Lead was detected at several Operable Unit 1 source areas. Its chemical form (inorganic or organic) and oxidation state are unknown; such unknowns affect its toxicity. IRIS has an oral RfD value for tetraethyl lead of 1×10^{-7} mg/kg-day. There are no toxicity data for lead (inorganic) in either IRIS or HEAST. An oral reference dose of 3×10^{-4} mg/kg-day is used in these calculations since it appears to be appropriate based on the current toxicological literature.

Both IRIS and HEAST defer to the Clean Air Act's National Ambient Air Quality Standard (primary standard) for lead and lead compounds of 1.5 micrograms per cubic meter of air (U.S. EPA 1991e). This value can be converted to an inhalation reference dose of 4.3×10^{-4} mg/kg-day by assuming an inhalation rate of 20 m³ per day and a body weight of 70 kg.

TABLE 9.1. Toxicity Data

ANALYTE	CAS #	EPA WOE(a)	CANCER POTENCY FACTOR				RfD		Ref.
			(mg/kg-d)-1	Ref.	Inhalation	Ref.	(mg/kg-d)	Oral	
VOLATILES									
1,1,1-TRICHLOROETHANE	71556	D	b	b				9.00E-02	c
1,1-DICHLOROETHANE	75343	C	b	b	1.20E+00	h		1.00E-01	c
1,1-DICHLOROETHENE	75354	C	b	b	1.20E+00	g		9.00E-03	b
1,2-DICHLOROETHENE (TRANS)	156605	nr						2.00E-02	b
BENZENE	71432	A	b	b	2.90E-02	b			
CHLOROBENZENE	108907	D	b	b				2.00E-02	b
CHLOROFORM	67663	B2	b	b	8.10E-02	g		1.00E-02	b
CHLOROMETHANE	74873	C	g	g	6.30E-03	g			
ETHYLBENZENE	100414	D	b	b				1.00E-01	b
METHYLENE CHLORIDE	75092	B2	b	b	7.50E-03	f		6.00E-02	b
TETRACHLOROETHENE	127184	B2	g	g	3.30E-03	i		1.00E-02	b
TOLUENE	108883	D	b	b				2.00E-01	b
TRICHLOROETHENE	79016	B2	g	g	1.70E-02	g		1.00E-01	j
VINYL CHLORIDE	75014	A	c	c	3.00E-01	c			
XYLENES	1330207	D	b	b				2.00E+00	b
SEMI-VOLATILES									
1,2-DICHLOROBENZENE	95501	D	b	b				9.00E-02	b
1,4-DICHLOROBENZENE	106467	C	c	c	2.40E-02	f		2.10E-03	k
2,4-DIMETHYLPHENOL	105679	nr						2.00E-02	b
2-CHLOROPHENOL	95578	nr						5.00E-03	b
2-METHYLNAPHTHALENE	91576	nr						2.30E-01	e
2-METHYLPHENOL (o-cresol)	95487	C	b	b				5.00E-02	b
4-METHYLPHENOL (p-cresol)	106445	C	b	b				5.00E-02	b
ACENAPHTHENE	83329	nr						6.00E-02	b
ACETOPHENONE	98862	D	b	b				1.00E-01	b
ANTHRACENE	120127	nr						3.00E-01	b
BENZO(A)ANTHRACENE	56553	B2	b	b	1.10E+00	d			
BENZO(A)PYRENE	50328	B2	b	b	7.30E+00	f			
BENZO(B)FLUORANTHENE	205992	B2	l	l	1.00E+00	d			
BENZO(G,H,I)PERYLENE	191242	D	b	b					
BENZO(K)FLUORANTHENE	207089	B2	b	b	4.80E-01	d			
BENZOIC ACID	65850	D	b	b				4.00E+00	b

TABLE 9.1. Toxicity Data

ANALYTE	CAS #	EPA WOE(a)	CANCER POTENCY FACTOR				RfD		RfD (mg/kg-d)
			(mg/kg-d)-1	Ref.	Inhalation	Ref.	Oral	Ref.	
BIS(2-ETHYLHEXYL)PHTHALATE	117817	B2	1.40E-02	b	1.40E-02	f	2.00E-02	b	
BUTYLBENZYLPHTHALATE, N-	85687	C		b			2.00E-01	b	
CHRYSENE	218019	B2	3.20E-02	d	3.20E-02	f			
DI-N-OCTYLPHTHALATE	117840	nr					2.00E-02	g	
DIBENZ(A,H)ANTHRACENE	53703	B2	8.10E+00	d	8.10E+00	f			
DIBENZOFURAN	132649	D		b			4.00E+00	i	4.00E+00
DIETHYLPHTHALATE	84662	D		b			8.00E-01	b	
FLUORANTHENE	206440	D		b			4.00E-02	b	
FLUORENE	86737	D		b			4.00E-02	b	
INDENO(1,2,3-CD)PYRENE	193395	B2	1.70E+00	d	1.70E+00	f			
NAPHTHALENE	91203	D		b			4.00E-02	c	4.00E-02
N-NITROSOPYRIDINE	100754	B2	2.10E+00	p,b	2.10E+00	p,b	5.80E-01	e	
PHENANTHRENE	85018	D		b			4.00E-02	m	1.14E-02
PHENOL	108952	D		b			6.00E-01	b	6.00E-01
PYRENE	129000	D		b			3.00E-02	b	3.00E-02
TRICHLOROFLUOROMETHANE	75694	nr					3.00E-01	b	2.00E-01
TPH									
TOTAL PET HYDROCARBONS	no CAS#	nr					2.50E+00	e	
PESTICIDES									
4,4'-DDD	72548	B2	2.40E-01	b	2.40E-01	f	5.00E-04	n	
METALS									
ARSENIC	7440382	A	1.75E+00	o	5.00E+01	c	3.00E-04	b	
BARIUM	7440393	nr					7.00E-02	b	2.90E-05
BERYLLIUM	7440417	B2	4.30E+00	b	8.40E+00	c	5.00E-03	b	
CADMIUM	7440439	B1		b	6.10E+00	c	5.00E-04	b	
CHROMIUM VI	7440473	A		b	4.10E+01	c	5.00E-03	b	
COPPER	7440508	D		b			3.70E-02	g	
LEAD	7439921	B2		b			3.00E-04	e	4.00E-05
MANGANESE	7439965	D		b					1.14E-04
MERCURY	7439976	D		b			3.00E-04	g	8.60E-05
MOLYBDENUM	7439987	nr					5.00E-03	b	

TABLE 9.1. Toxicity Data

[illegible]

TABLE 9.2. Relative Cancer Potency Estimates for Polycyclic Aromatic Hydrocarbons (PAH)

PAH	Relative Potency Estimate
Anthracene	0.32
Benzo(a)pyrene	1.0
Benzo(e)pyrene	0.004
Benz(a)anthracene	0.145
Benzo(b)fluoranthene	0.14
Benzo(j)fluoranthene	0.061
Benzo(k)fluoranthene	0.066
Benzo(ghi)perylene	0.022
Chrysene	0.0044
Cyclopentadieno(dc)pyrene	0.023
Dibenz(ah)anthracene	1.11
Indeno(1,2,3-cd)pyrene	0.232
Pyrene	0.081

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APPENDIX A

RISK CALCULATION SPREADSHEETS AND FORMULAS

APPENDIX A

RISK CALCULATION SPREADSHEETS AND FORMULAS

The overall risk characterization methodology, including a description of the computational methods, calculation spreadsheets, and the chemical intake formulas, is presented in the following paragraphs.

A.1 RISK CHARACTERIZATION METHODOLOGY

This subsection describes the calculational methodology used for the final step in the process of assessing baseline health risk, or risk characterization. In the risk calculation spreadsheets, the exposure and toxicity assessments are summarized and integrated into quantitative expressions of risk. The exposure assessment component is described in the "intake" equation. The toxicity assessment component is embodied in the values used for slope factors (SFs) and reference doses (RfDs). Because the methodologies of chemical toxicity differ between noncarcinogens and carcinogens, separate equations are used to calculate intake and risk for these two modes of chemical hazard. To characterize potential noncarcinogenic effects, comparisons (formulated as hazard quotients) are made between projected intakes of individual chemicals and the corresponding safe intake threshold value. Values to characterize potential carcinogenic effects (probabilities that an individual will develop cancer [fatal and/or nonfatal] over a lifetime of exposure) are estimated from projected intakes and chemical-specific, dose-response information (cancer potency factor or slope factor).

The baseline risk assessment involves multiple chemicals of concern, including both carcinogenic and noncarcinogenic substances. Therefore, each spreadsheet calculates a total cancer risk and a total hazard quotient for the specific scenario described.

In risk quantification, the criteria used to evaluate the risks associated with exposure to carcinogenic and noncarcinogenic constituents (systemic toxicants) are, for carcinogens, individual lifetime incremental cancer risks and, for noncarcinogens, a hazard quotient. The sum of multiple hazard quotients is termed a "hazard index."

The first step in risk-characterization methodology is to gather, review, compare, and organize the results of the exposure assessment (i.e., chemical intake estimates for all exposure pathways and land uses) and the toxicity assessment (i.e., toxicity values by exposure mode). Modes of exposure are usually categorized as inhalation, ingestion, and direct contact (dermal absorption).

As discussed in Section 9.0, excess cancer risks are calculated herein using carcinogenic potency (slope) factors (SFs) developed by the U.S. Environmental Protection Agency (U.S. EPA 1993). These SFs are the 95% upper-bound values derived from the results of animal studies that conservatively reflect the dose-response relationship of the chemical. The SFs are usually based on the linearized multi-stage procedure, which leads to a plausible upper limit to the toxicologically derived cancer risk due to an agent. Using the SFs (and other health-conservative exposure parameters) has the effect of calculating the upper limit estimate of the plausible risk of excess cancer incidence. Therefore, the risks reported herein are the upper-bound estimate, and the true value of the risk is likely lower. The exposure factors used in the calculations to estimate intakes are presented and discussed in Appendix B.

A.2 FORMULAS

This section contains the general computational methodology and equations used to calculate risk in this baseline risk assessment.

Risk, Hazard Quotient, and Hazard Index Defined

The general form of the risk equation for carcinogens is as follows:

$$\text{Risk}_{ij} (\text{unitless}) = \text{SF}_{ij} (\text{mg/kg-day})^{-1} \times \text{intake}_{ij} (\text{mg/kg-day}) \quad (\text{A.1})$$

where Risk_{ij} is the upper-bound lifetime excess probability of cancer caused by exposure to contaminant i in exposure route j , SF_{ij} is the chemical-specific cancer (slope) factor for contaminant i by exposure route j , and intake_{ij} denotes the daily intake rate of contaminant i from exposure route j , estimated using site-specific or U.S. EPA-recommended default exposure assumptions.

The general form of the "risk" equation for noncarcinogens is as follows:

$$HQ_{ij} \text{ (unitless)} = \text{intake}_{ij} \text{ (mg/kg-day)} / RfD_{ij} \text{ (mg/kg-day)} \quad (A.2)$$

where HQ_{ij} is a hazard quotient that compares the relative hazard of exposure to contaminant i in exposure route j to the RfD , and RfD is an estimate of the daily exposure to the human population (including sensitive subgroups) likely to be without an appreciable risk of deleterious effects during a portion of their lifetime (U.S. EPA 1989).

Risks are calculated separately for carcinogens and noncarcinogens. Exposure to carcinogens is multiplied by the SF to obtain the cancer risk. The exposure to noncarcinogens is divided by the RfD to obtain hazard quotients. The hazard quotients summed across chemicals are defined as the Hazard Index (HI) by U.S. EPA.

Intake, Exposure, and Contact Rate Defined

The following definitions are used in the risk calculation formulas (U.S. EPA 1989): "Intake is a measure of exposure expressed as the mass of a substance in contact with the exchange boundary per unit body weight per unit time (e.g., mg chemical/kg-day). Also termed the normalized exposure rate; equivalent to the administered dose. Exposure is the contact of an organism with a chemical or physical agent. Exposure is quantified as the amount of the agent available at the exchange boundaries of the organism (e.g., skin, lungs, gut) and available for absorption. Contact Rate is the amount of medium (e.g., groundwater, soil) contacted per unit time or event (e.g., liters of water ingested per day)."

Sources of Data Input into Calculations

Table 9.1 lists the toxicity data as cancer slope factors and chronic reference doses. Media-specific chemical concentrations are listed in Appendix D (Tables D.7 through D.12). All exposure factors are cited in the respective scenario tables in Appendix B.

Exposure Calculations

This appendix lists the general equations used to calculate the risk for each exposure pathway permutation. All equations are based on the following general form for estimating exposure:

$$\text{Exposure} = \frac{\text{Concentration in Media of Concern} \times \text{Contact Rate} \times \text{Exposure Period}}{\text{Averaging Time} \times \text{Body Weight}} \quad (\text{A.3})$$

where Concentration is the concentration of contaminant *i* in a medium of concern, Contact Rate is the daily rate of contact with the contaminated medium, and Body Weight is the body weight of the exposed individual.

Ingestion of Chemicals in Soil/Dust/Sediment

The spreadsheets use the following equation (adapted from U.S. EPA 1989, p. 6.40) to estimate exposure (intake) from ingestion of chemicals in soil/dust/sediment:

$$\text{Intake (mg/kg-day)} = \frac{C \times IR \times EF \times ED \times CF}{BW (AT_{1 \text{ or } 2} \times 365)} \quad (\text{A.4})$$

where

- C = chemical concentration in soil (mg/kg) or (μg/kg)
- IR = ingestion rate (mg soil/d)
- EF = exposure frequency (d/y)
- ED = exposure duration (y)
- CF = conversion factor (10⁻⁶ kg/mg) or (kg/10⁹ μg)
- BW = body weight (kg)
- AT₁ = averaging time, carcinogen (period over which exposure is averaged, y)
- AT₂ = averaging time, noncarcinogen (period over which exposure is averaged, y)
- 365 = d/y.

Intakes are calculated separately for carcinogens and noncarcinogens. Intake (carcinogen) is multiplied by the chemical-specific cancer slope factor (SF) to obtain the cancer risk (Eq. A.1). The intake (noncarcinogen) is divided by the reference dose to obtain hazard quotients (Eq. A.2). The fraction ingested from a contaminated source is assumed to be 100% in this assessment.

Future exposure scenarios utilize an age-adjusted soil-ingestion factor (IF) that compensates for the greater rate of soil ingestion for small children. Below is the example for the cancer risk calculation:

$$\text{Risk} = \frac{\text{SF}_o \times C \times \text{IF} \times \text{EF} \times \text{CF}}{\text{AT} \times 365} \quad (\text{A.5})$$

where

$$\text{IF} = \frac{\text{IR}_c \times \text{ED}_c}{\text{BW}_c} + \frac{\text{IR}_a \times \text{ED}_a}{\text{BW}_a}$$

IR_c = ingestion rate, child (mg soil/d)

ED_c = exposure duration, child (y)

BW_c = body weight, child (kg)

IR_a = ingestion rate, adult (mg soil/d)

ED_a = exposure duration, adult (y)

BW_a = body weight, adult (kg).

Dermal Contact with Chemicals in Soil/Dust

The following formula (adapted from U.S. EPA 1989, p.6.41) is used in the spreadsheets to estimate exposure/intake associated with dermal contact with chemicals in soil or dust:

$$\text{Intake (mg/kg-day)} = \frac{C \times \text{CF} \times \text{SA} \times \text{AF} \times \text{SAF} \times \text{EF} \times \text{ED}}{\text{BW} (\text{AT}_{1 \text{ or } 2} \times 365)} \quad (\text{A.6})$$

where C = chemical concentration in soil (mg/kg) or ($\mu\text{g/kg}$)

CF = conversion factor (10^{-6} kg/mg) or ($\text{kg}/10^9 \mu\text{g}$)

SA = skin surface area available for contact (cm^2/event)

AF = soil-to-skin adherence factor (mg/cm^2)

SAF = skin absorption factor (unitless)

EF = exposure frequency (events/y)

ED = exposure duration (y)

BW = body weight (kg)

AT_1 = averaging time, carcinogen (period over which exposure is averaged, y)

AT_2 = averaging time, noncarcinogen (period over which exposure is averaged, y)

365 = (d/y).

The skin absorption factor value (the SAF variable), which is listed in Table J.1 under the heading "Soil Exposure, Unitless," is chemical-specific. Intakes are calculated separately for carcinogens and noncarcinogens. As before, intake (carcinogen) is multiplied by the chemical-specific cancer SF to obtain the cancer risk. The intake (noncarcinogen) is divided by the reference dose to obtain a hazard quotient.

Ingestion of Chemicals in Drinking Water

The following equation (adapted from U.S. EPA 1989, p. 6.35) is used in the spreadsheets to estimate intake for ingestion of chemicals in drinking water:

$$\text{Intake (mg/kg-day)} = \frac{C \times IR \times EF \times ED \times CF}{BW (AT_{1 \text{ or } 2} \times 365)} \quad (\text{A.7})$$

where C = chemical concentration in water ($\mu\text{g/L}$)
IR = ingestion rate (L water/d)
EF = exposure frequency (d/y)
ED = exposure duration (y)
CF = conversion factor (mg/1000 μg)
BW = body weight (kg)
AT₁ = averaging time, carcinogen (period over which exposure is averaged, y)
AT₂ = averaging time, noncarcinogen (period over which exposure is averaged, y).

Dermal Contact with Chemicals in Water

Carcinogenic Effects:

$$\text{Risk} = \frac{SF_o \times DA_{\text{event}} \times SA \times EF \times ED \times CF \times EV}{BW (AT \times 365)} \quad (\text{A.8})$$

Noncarcinogenic Effects:

$$\text{Hazard Quotient} = \frac{DA_{\text{event}} \times SA \times EF \times ED \times CF \times EV}{BW (AT \times RfD_o) \times 365} \quad (\text{A.9})$$

where SF_o = oral cancer slope factor [$(\text{mg/kg-day})^{-1}$]
RfD_o = oral chronic reference dose (mg/kg-day)
DA_{event} = absorbed dose/unit area/event (mg/cm²-event) (Appendix I, Eq. I.2, and Appendix J)
SA = skin surface area available for contact (cm²)
EF = exposure frequency (d/y)
ED = exposure duration (y)
CF = conversion factor (mg/10³ μg $\times$ L/10³ cm³)
EV = contact events per day (assumed: 1 event/d)
BW = body weight (kg)
AT = averaging time (y).

Inhalation of Volatiles During Water Use

Carcinogenic Effects:

$$\text{Risk} = \frac{\text{SF}_i \times C \times \text{IR} \times K \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} (\text{AT} \times 365)} \quad (\text{A.10})$$

Noncarcinogenic Effects:

$$\text{Hazard Quotient} = \frac{C \times \text{IR} \times K \times \text{EF} \times \text{ED} \times \text{CF} \times \text{ET}}{\text{BW} \times \text{AT} \times \text{RfD}_i \times 365} \quad (\text{A.11})$$

where SF_i = inhalation cancer slope factor $[(\text{mg}/\text{kg-d})^{-1}]$
 RfD_i = inhalation chronic reference dose $(\text{mg}/\text{kg-d})$
 C = chemical concentration in water $(\mu\text{g}/\text{L})$
 IR = inhalation rate (m^3/d)
 K = volatilization factor (unitless) 0.0005 (Andelman 1990)
 EF = exposure frequency (d/y)
 ED = exposure duration (y)
 CF = conversion factor $(\text{mg}/1000 \mu\text{g} \times 1000 \text{ L}/\text{m}^3)$
 ET = exposure time (h/d)
 BW = body weight (kg)
 AT = averaging time (y) .

Ingestion of Chemicals in Fish

Carcinogenic Effects:

$$\text{Risk} = \frac{\text{SF}_o \times C \times \text{I}_t \text{R} \times \text{B}_{if} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT} \times 365} \quad (\text{A.12})$$

Noncarcinogenic Effects:

$$\text{Hazard Quotient} = \frac{C \times \text{I}_t \text{R} \times \text{B}_{if} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT} \times \text{RfD}_o \times 365} \quad (\text{A.13})$$

where SF_o = oral cancer slope factor $[(\text{mg}/\text{kg-day})^{-1}]$
 RfD_o = oral chronic reference dose $(\text{mg}/\text{kg-day})$
 C = chemical concentration in water $(\mu\text{g}/\text{L})$
 $\text{I}_t \text{R}$ = fish intake rate $(\text{g-fish}/\text{day})$
 B_{if} = bioaccumulation factor for finfish (L/kg) (Appendix H)
 EF = exposure frequency (d/y)
 ED = exposure duration (y)
 CF = conversion factor $(\text{mg}/10^3 \mu\text{g} \times \text{kg}/10^3 \text{ g})$
 BW = body weight (kg)
 AT = averaging time (y) .

Ingestion of Chemicals in Plants

Carcinogenic Effects:

$$\text{Risk} = \frac{SF_o \times C \times I_t R \times B_{vi} \times EF \times ED \times CF}{BW \times AT \times 365} \quad (\text{A.14})$$

Noncarcinogenic Effects:

$$\text{Hazard Quotient} = \frac{C \times I_t R \times B_{vi} \times EF \times ED \times CF}{BW \times AT \times RfD_o \times 365} \quad (\text{A.15})$$

where SF_o = oral cancer slope factor [(mg/kg-day)⁻¹]
RfD_o = oral chronic reference dose (mg/kg-day)
C = chemical concentration in soil (μg/kg)
I_tR = vegetable intake rate (g-vegetable/day)
B_{vi} = soil-to-edible plant transfer ratio (unitless) (Appendix H)
EF = exposure frequency (d/y)
ED = exposure duration (y)
CF = conversion factor (mg/1000 μg × kg/1000 g)
BW = body weight (kg)
AT = averaging time (y).

Inhalation of Volatiles from Soils

Carcinogenic Effects:

$$\text{Risk} = \frac{SF_i \times C \times 1/VF \times IR \times EF \times ED \times CF}{BW \times AT \times 365} \quad (\text{A.16})$$

Noncarcinogenic Effects:

$$\text{Hazard Quotient} = \frac{C \times 1/VF \times IR \times EF \times ED \times CF}{BW \times AT \times RfD_i \times 365} \quad (\text{A.17})$$

where SF_i = inhalation cancer slope factor [(mg/kg-day)⁻¹]
RfD_i = inhalation chronic reference dose (mg/kg-day)
C = chemical concentration in soil (μg/kg)
IR = inhalation rate (m³/day)
VF = soil-to-air volatilization factor (m³/kg) (Appendix C contains derivation methodology.)
EF = exposure frequency (d/y)
ED = exposure duration (y)
CF = conversion factor (mg/1000 μg)
BW = body weight (kg)
AT = averaging time (y).

Inhalation of Resuspended Particulates

Carcinogenic Effects:

$$\text{Risk} = \frac{\text{SF}_i \times C \times 1/\text{PEF} \times \text{IR} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT} \times 365} \quad (\text{A.18})$$

Noncarcinogenic Effects:

$$\text{Hazard Quotient} = \frac{C \times 1/\text{PEF} \times \text{IR} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT} \times \text{RfD}_i \times 365} \quad (\text{A.19})$$

where SF_i = inhalation cancer slope factor $[(\text{mg}/\text{kg}\text{-day})^{-1}]$
 RfD_i = inhalation chronic reference dose $(\text{mg}/\text{kg}\text{-day})$
 C = chemical concentration in soil $(\mu\text{g}/\text{kg})$
 IR = inhalation rate (m^3/d)
 PEF = particulate emission factor (m^3/kg) (Appendix C contains derivation methodology.)
 EF = exposure frequency (d/y)
 ED = exposure duration (y)
 CF = conversion factor $(\text{mg}/1000 \mu\text{g})$
 BW = body weight (kg)
 AT = averaging time (y) .

Note: assessment assumes that 100% of particulates are respirable.

A.3 ASSESSMENT OF CHEMICAL MIXTURES

For estimating the dose (intake or exposure) and risk from a mixture of chemicals (such as those present in the site soil), "dose addition" and "response addition" models are employed in this risk assessment. These models are specified in the "Guidelines for the Health Risk Assessment of Chemical Mixtures" (51 FR 34000), which defines the terms as follows:

- o Dose addition assumes that the toxicants in a mixture behave as if they were dilutions or concentrations of each other; thus, the true slopes of the dose response curves for the individual compounds are identical, and the response elicited by the mixture can be predicted by summing the individual doses after adjusting for differences in potency; this is defined as the ratio of equitoxic doses.
- o Response addition assumes that the response to a given concentration of a mixture of toxicants is completely determined by the responses to the components and the pairwise correlation coefficient.

A risk addition model assumes that the risk associated with exposure to compounds in combination can be predicted by the additive risks associated

with separate exposure to the individual compounds. No synergistic or antagonistic effects are considered. Therefore, the additive incremental cancer risk approach represents neither a conservative nor a lenient estimate of risk when exposure to more than one contaminant occurs.

A.4 NONCARCINOGENS

For noncarcinogens, current risk assessment methodology is based on the derivation of a chemical exposure level that is not anticipated to cause significant adverse effects. (In this context, exposure level is equivalent to intake, exposed dose, and/or absorbed dose.) These exposure levels have various synonyms, such as "maximum exposure level," "acceptable daily intake," or "reference dose (RfD)". RfDs for the identified chemicals assessed are listed in Table 9.1, and the concept is discussed in detail in Subsection 9.1. Briefly, an RfD is an estimate of the long-term level of daily exposure to a substance that the general population may experience without any appreciable risk of deleterious health effects. Typically an uncertainty factor or safety factor further lowers the RfD level.

First, the level of exposure or the chronic daily (chemical) intake (CDI) is estimated from computing the total exposure and dose. The noncancer hazard quotient (HQ) is expressed as the ratio of the CDI to the RfD. Both CDI and RfD are expressed in the same units in order for the results to be unitless. They should also represent the same exposure period (i.e., chronic, subchronic, short-term).

In short, the noncancer hazard quotient is equal to the daily intake of this contaminant (CDI) divided by the RfD. This resulting quotient (which is unitless) is the fractional RfD received via an exposure. If the ratio is less than unity (a value of one), the allowable dose is not exceeded, and the predicted chemical concentration to which the receptor is exposed is not likely to present a health concern.

The ratio for an individual chemical is called the "hazard quotient," while the sum of the hazard quotients is called the "hazard index" (HI). A hazard index is calculated for multiple exposures to noncarcinogens. The HI of a mixture is based on the assumption of dose addition and is defined for this assessment as follows:

$$HI = CDI_1/RfD_1 + CDI_2/RfD_2 \dots CDI_i/RfD_i \quad (A.20)$$

where CDI_i = exposure concentration (chronic daily intake) of the toxicant, i
 RfD_i = reference concentration of the toxicant, i .

The hazard index is a numerical indicator of the degree to which acceptable levels are exceeded due to human exposure to a mixture of noncarcinogenic chemicals. As the hazard index approaches unity (a value of one), concern for the potential hazard posed by the mixture increases. If the HI exceeds unity, the concern is the same as if an individual chemical exposure exceeded its acceptable daily intake by the same proportion.

A.5 CARCINOGENS

Carcinogenic risk is quantified by multiplying the experimentally determined cancer potency or slope factor (SF) by the exposure concentration, expressed as mg/kg-day. The basic calculation is as follows:

$$Risk = 1 - \exp(-CDI \times SF) \quad (A.21)$$

For multiple compounds, this equation is generalized to

$$Risk_t = \sum Risk_i \quad (A.22)$$

where $Risk_t$ = the total cancer risk, expressed as a unitless probability
 $Risk_i$ = the risk estimate for the i^{th} toxicant.

A.6 EXPOSURE SOURCE TERMS

A quantitative risk assessment was developed for two exposure source terms: the reasonable maximum exposure and the average exposure. In each case, the reasonable maximum exposure source term was the calculated 95% upper confidence limit of the arithmetic distribution for the contaminant concentration within the source area in which it was detected. The average exposure source term, for each case, is the mean of all reported analytical results, for a specific chemical, within the source area being analyzed. Samples reported as nondetected were added into the calculations at half the detection limit, provided that at least one sample within the source area had a detectable concentration of the chemical being considered.

A.7 PRIMARY RISK CALCULATIONS

The primary risk calculations for the baseline risk assessment are included in Tables A.1 through A.114. The risk calculations are presented by chemical, by exposure pathway, and by land-use assumption, for each of the six OU-1 source areas examined. A total cancer risk and a hazard index are also presented for each exposure pathway.

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**TABLE A.1. Cancer Risk and Hazard Index for Source Area ST20 E7,
Groundwater Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
1,1-DICHLOROETHYLENE	1.51E-06	0.00	1.26E-05	0.01
CHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.03
ETHYLBENZENE	0.00E+00	0.01	0.00E+00	0.03
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.02
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.01	0.00E+00	0.03
METALS				
ARSENIC	6.60E-05	0.98	3.06E-04	1.63
BARIUM	0.00E+00	0.08	0.00E+00	0.08
CHROMIUM VI	0.00E+00	0.08	0.00E+00	0.08
COPPER	0.00E+00	0.06	0.00E+00	0.06
LEAD	0.00E+00	2.37	0.00E+00	2.94
MERCURY	0.00E+00	0.02	0.00E+00	0.02
VANADIUM	0.00E+00	0.10	0.00E+00	0.10
Summary of Cancer Risk				
Summary of Cancer Risk	6.76E-05		3.18E-04	
Summary of Cancer Risk w/o Metals	1.51E-06		1.26E-05	
Hazard Index				
Hazard Index		3.7		5.0
Hazard Index w/o Metals		0.0		0.1

**TABLE A.2. Cancer Risk and Hazard Index for Source Area ST20 E8,
Groundwater Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
1,1-DICHLOROETHENE	9.81E-06	0.01	6.71E-05	0.03
BENZENE	3.65E-08	0.00	1.01E-07	0.00
ETHYLBENZENE	0.00E+00	0.01	0.00E+00	0.08
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.01
TOLUENE	0.00E+00	0.04	0.00E+00	0.40
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.00	0.00E+00	0.03
PHENANTHRENE	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	9.85E-06		6.72E-05	
Hazard Index		0.1		0.6

**TABLE A.3. Cancer Risk and Hazard Index for Source Area ST20 E9,
Groundwater ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	1.46E-07	0.00	4.05E-07	0.00
CHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.01
ETHYLBENZENE	0.00E+00	0.00	0.00E+00	0.04
TOLUENE	0.00E+00	0.08	0.00E+00	0.96
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.01
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.00	0.00E+00	0.03
Summary of Cancer Risk	1.46E-07		4.05E-07	
Hazard Index		0.1		1.0

**TABLE A.4. Cancer Risk and Hazard Index for Source Area ST48,
Groundwater Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
TRANS-1,2-DICHLOROETHENE	0.00E+00	0.01	0.00E+00	0.12
BENZENE	1.94E-05	0.00	3.88E-04	0.00
ETHYLBENZENE	0.00E+00	0.02	0.00E+00	0.07
TOLUENE	0.00E+00	0.04	0.00E+00	0.21
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.01
SEMI-VOLATILES				
2,4-DIMETHYLPHENOL	0.00E+00	0.00	0.00E+00	0.00
NAPHTHALENE	0.00E+00	0.02	0.00E+00	0.08
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.10	0.00E+00	0.84
METALS				
ARSENIC	5.90E-05	0.87	1.64E-04	0.87
BARIUM	0.00E+00	0.10	0.00E+00	0.10
LEAD	0.00E+00	4.34	0.00E+00	1.21
MANGANESE	0.00E+00	11.10	0.00E+00	11.10
MERCURY	0.00E+00	0.02	0.00E+00	0.02
VANADIUM	0.00E+00	0.05	0.00E+00	0.05
Summary of Cancer Risk	7.84E-05		5.52E-04	
Summary of Cancer Risk w/o Metals	1.94E-05		3.88E-04	
Hazard Index		16.7		14.7
Hazard Index w/o Metals		0.2		1.3

**TABLE A.5. Cancer Risk and Hazard Index for Source Area ST49,
Groundwater Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
1,1-DICHLOROETHANE	3.02E-07	0.00	2.52E-06	0.00
BENZENE	5.00E-08	0.00	4.46E-07	0.00
TRICHLOROETHENE	1.92E-08	0.00	1.77E-07	0.00
SEMI-VOLATILES				
1,2-DICHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.00
1,4-DICHLOROBENZENE	3.26E-08	0.01	3.46E-07	0.02
BENZO(A)ANTHRACENE	6.92E-09	0.00	9.23E-08	0.00
BENZO(A)PYRENE	3.77E-08	0.00	3.70E-07	0.00
BENZO(B)FLUORANTHENE	5.03E-09	0.00	4.19E-08	0.00
DIBENZ(A,H)ANTHRACENE	2.04E-08	0.00	1.42E-07	0.00
INDENO(1,2,3-CD)PYRENE	6.84E-09	0.00	5.35E-08	0.00
NAPHTHALENE	0.00E+00	0.00	0.00E+00	0.01
PHENANTHRENE	0.00E+00	0.00	0.00E+00	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.02	0.00E+00	0.10
METALS				
ARSENIC	4.93E-05	0.73	1.37E-04	0.73
BARIUM	0.00E+00	0.06	0.00E+00	0.06
LEAD	0.00E+00	0.68	0.00E+00	0.68
Summary of Cancer Risk				
Summary of Cancer Risk	4.98E-05		1.41E-04	
Summary of Cancer Risk w/o Metals	4.81E-07		4.18E-06	
Hazard Index				
Hazard Index		1.5		1.6
Hazard Index w/o Metals		0.0		0.1

**TABLE A.6. Cancer Risk and Hazard Index For Source Area ST50,
Groundwater Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	1.37E-06	0.00	2.17E-05	0.00
CHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.02
CHLOROFORM	1.69E-09	0.00	1.75E-08	0.00
CHLOROMETHANE	1.15E-07	0.00	2.66E-06	0.00
ETHYLBENZENE	0.00E+00	0.02	0.00E+00	0.13
TOLUENE	0.00E+00	0.02	0.00E+00	0.06
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.02
SEMI-VOLATILES				
2,4-DIMETHYLPHENOL	0.00E+00	0.00	0.00E+00	0.00
2-METHYLNAPHTHALENE	0.00E+00	0.04	0.00E+00	0.30
NAPHTHALENE	0.00E+00	0.10	0.00E+00	0.82
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.55	0.00E+00	4.54
METALS				
ARSENIC	9.25E-05	1.37	6.12E-04	3.26
BARIUM	0.00E+00	0.19	0.00E+00	0.58
CHROMIUM VI	0.00E+00	0.48	0.00E+00	1.60
COPPER	0.00E+00	0.06	0.00E+00	0.14
LEAD	0.00E+00	4.92	0.00E+00	13.05
VANADIUM	0.00E+00	0.16	0.00E+00	0.36
Summary of Cancer Risk	9.40E-05		6.36E-04	
Summary of Cancer Risk w/o Metals	1.49E-06		2.44E-05	
Hazard Index		7.9		24.9
Hazard Index w/o Metals		0.7		5.9

**TABLE A.7. Cancer Risk and Hazard Index For Source Area ST20 E7,
Groundwater Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
1,1-DICHLOROETHYLENE	2.32E-06	0.00	4.23E-05	0.02
CHLOROBENZENE	0.00E+00	0.01	0.00E+00	0.08
ETHYLBENZENE	0.00E+00	0.01	0.00E+00	0.09
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.05
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.01	0.00E+00	0.09
METALS				
ARSENIC	1.02E-04	1.51	1.03E-03	4.57
BARIUM	0.00E+00	0.12	0.00E+00	0.23
CHROMIUM VI	0.00E+00	0.12	0.00E+00	0.22
COPPER	0.00E+00	0.09	0.00E+00	0.16
LEAD	0.00E+00	3.66	0.00E+00	8.22
MERCURY	0.00E+00	0.04	0.00E+00	0.06
VANADIUM	0.00E+00	0.16	0.00E+00	0.28
Summary of Cancer Risk	1.04E-04		1.07E-03	
Summary of Cancer Risk w/o Metals	2.32E-06		4.23E-05	
Hazard Index		5.7		14.1
Hazard Index w/o Metals		0.0		0.3

**TABLE A.8 . Cancer Risk and Hazard Index For Source Area ST20 E8,
Groundwater Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
1,1-DICHLOROETHENE	1.51E-05	0.02	2.25E-04	0.10
BENZENE	5.62E-08	0.00	3.41E-07	0.00
ETHYLBENZENE	0.00E+00	0.02	0.00E+00	0.23
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.04
TOLUENE	0.00E+00	45.48	0.00E+00	748.66
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.01	0.00E+00	0.09
PHENANTHRENE	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.52E-05		2.26E-04	
Hazard Index		45.5		749.1

TABLE A.9 Cancer Risk and Hazard Index For Souce Area ST20 E9,
Groundwater Ingestion Pathway, Residential Land Use

ANALYTES	Average Exposure		RME	Cancer	Hazard
	Cancer	Hazard			
	Risk	Quotient		Risk	Quotient
VOLATILES					
BENZENE	2.25E-07	0.00	1.36E-06	0.00	
CHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.01	
ETHYLBENZENE	0.00E+00	0.01	0.00E+00	0.10	
TOLUENE	0.00E+00	0.12	0.00E+00	2.70	
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.04	
SEMI-VOLATILES					
NAPHTHALENE	0.00E+00	0.01	0.00E+00	0.07	
Summary of Cancer Risk	2.25E-07		1.36E-06		
Hazard Index		0.1			2.9

**TABLE A.10. Cancer Risk and Hazard Index for Source Area ST48,
Groundwater Ingestion Pathway, Residential Land Use**

	Average Exposure			RME	
	Cancer	Hazard		Cancer	Hazard
ANALYTES	Risk	Quotient		Risk	Quotient
VOLATILES					
TRANS-1,2-DICHLOROETHENE	0.00E+00	0.02		0.00E+00	0.33
BENZENE	2.99E-05	0.00		1.30E-03	0.00
ETHYLBENZENE	0.00E+00	0.02		0.00E+00	0.20
TOLUENE	0.00E+00	0.05		0.00E+00	0.59
XYLENES (TOTAL)	0.00E+00	0.00		0.00E+00	0.02
SEMI-VOLATILES					
2,4-DIMETHYLPHENOL	0.00E+00	0.00		0.00E+00	0.01
NAPHTHALENE	0.00E+00	0.03		0.00E+00	0.23
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.16		0.00E+00	2.34
METALS					
ARSENIC	9.09E-05	1.35		5.51E-04	2.45
BARIUM	0.00E+00	0.16		0.00E+00	0.28
LEAD	0.00E+00	6.69		0.00E+00	3.39
MANGANESE	0.00E+00	17.09		0.00E+00	31.07
MERCURY	0.00E+00	0.04		0.00E+00	0.06
VANADIUM	0.00E+00	0.08		0.00E+00	0.14
Summary of Cancer Risk	1.21E-04			1.85E-03	
Summary of Cancer Risk w/o Metals	2.99E-05			1.30E-03	
Hazard Index		25.7			41.1
Hazard Index w/o Metals		0.3			3.7

**TABLE A.11. Cancer Risk and Hazard Index for Source Area ST49,
Groundwater Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
1,1-DICHLOROETHANE	4.65E-07	0.00	8.45E-06	0.00
BENZENE	7.70E-08	0.00	1.50E-06	0.00
TRICHLOROETHENE	2.95E-08	0.00	5.93E-07	0.00
SEMI-VOLATILES				
1,2-DICHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.00
1,4-DICHLOROBENZENE	5.02E-08	0.01	1.16E-06	0.05
BENZO(A)ANTHRACENE	1.07E-08	0.00	3.10E-07	0.00
BENZO(A)PYRENE	5.80E-08	0.00	1.24E-06	0.00
BENZO(B)FLUORANTHENE	7.75E-09	0.00	1.41E-07	0.00
DIBENZ(A,H)ANTHRACENE	3.14E-08	0.00	4.76E-07	0.00
INDENO(1,2,3-CD)PYRENE	1.05E-08	0.00	1.80E-07	0.00
NAPHTHALENE	0.00E+00	0.00	0.00E+00	0.04
PHENANTHRENE	0.00E+00	0.00	0.00E+00	0.01
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.03	0.00E+00	0.29
METALS				
ARSENIC	7.59E-05	1.13	4.60E-04	2.05
BARIUM	0.00E+00	0.09	0.00E+00	0.16
LEAD	0.00E+00	1.04	0.00E+00	1.90
Summary of Cancer Risk	7.67E-05		4.74E-04	
Summary of Cancer Risk w/o Metals	7.40E-07		1.41E-05	
Hazard Index		2.3		4.5
Hazard Index w/o Metals		0.0		0.4

**TABLE A.12. Cancer Risk and Hazard Index for Source Area ST50,
Groundwater Ingestion Pathway, Residential Land Use**

	Average Exposure			RME	
	Cancer	Hazard		Cancer	Hazard
ANALYTES	Risk	Quotient		Risk	Quotient
VOLATILES					
BENZENE	2.11E-06	0.00		7.29E-05	0.00
CHLOROBENZENE	0.00E+00	0.00		0.00E+00	0.07
CHLOROFORM	2.60E-09	0.00		5.87E-08	0.00
CHLOROMETHANE	1.77E-07	0.00		8.92E-06	0.00
ETHYLBENZENE	0.00E+00	0.03		0.00E+00	0.37
TOLUENE	0.00E+00	0.03		0.00E+00	0.17
XYLENES (TOTAL)	0.00E+00	0.00		0.00E+00	0.06
SEMI-VOLATILES					
2,4-DIMETHYLPHENOL	0.00E+00	0.00		0.00E+00	0.01
2-METHYLNAPHTHALENE	0.00E+00	0.05		0.00E+00	0.84
NAPHTHALENE	0.00E+00	0.16		0.00E+00	2.30
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.84		0.00E+00	12.71
METALS					
ARSENIC	1.42E-04	2.11		2.05E-03	9.13
BARIUM	0.00E+00	0.29		0.00E+00	1.64
CHROMIUM VI	0.00E+00	0.73		0.00E+00	4.49
COPPER	0.00E+00	0.09		0.00E+00	0.38
LEAD	0.00E+00	7.58		0.00E+00	36.53
VANADIUM	0.00E+00	0.24		0.00E+00	0.99
Summary of Cancer Risk	1.45E-04			2.14E-03	
Summary of Cancer Risk w/o Metals	2.29E-06			8.19E-05	
Hazard Index		12.2			69.7
Hazard Index w/o Metals		1.1			16.5

**TABLE A.13. Cancer Risk and Hazard Index for Source Area ST20 E7,
Dermal Contact With Groundwater Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
1,1-DICHLOROETHENE	2.70E-07	0.00	2.68E-06	0.00
CHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.02
ETHYLBENZENE	0.00E+00	0.08	0.00E+00	0.47
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.02
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.01	0.00E+00	0.04
METALS				
ARSENIC	1.59E-07	0.00	1.04E-06	0.01
BARIUM	0.00E+00	0.00	0.00E+00	0.00
CHROMIUM VI	0.00E+00	0.00	0.00E+00	0.00
COPPER	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
MERCURY	0.00E+00	0.00	0.00E+00	0.00
VANADIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	4.29E-07		3.72E-06	
Summary of Cancer Risk w/o Metals	2.70E-07		2.68E-06	
Hazard Index		0.1		0.6
Hazard Index w/o Metals		0.1		0.5

**TABLE A.14. Cancer Risk and Hazard Index for Source Area ST20 E8,
Dermal Contact with Groundwater Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
1,1-DICHLOROETHENE	1.76E-06	0.00	1.43E-05	0.01
BENZENE	3.93E-08	0.00	1.30E-07	0.00
ETHYLBENZENE	0.00E+00	0.15	0.00E+00	1.16
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.01
TOLUENE	0.00E+00	0.48	0.00E+00	5.17
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.00	0.00E+00	0.04
PHENANTHRENE	0.00E+00	0.00	0.00E+00	0.01
Summary of Cancer Risk				
	1.80E-06		1.44E-05	
Hazard Index				
		0.6		6.4

**TABLE A.15. Cancer Risk and Hazard Index for Source Area ST20 E9,
Dermal Contact with Groundwater Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	1.57E-07	0.00	5.20E-07	0.00
CHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.00
ETHYLBENZENE	0.00E+00	0.04	0.00E+00	0.52
TOLUENE	0.00E+00	0.84	0.00E+00	12.41
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.01
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.00	0.00E+00	0.03
Summary of Cancer Risk	1.57E-07		5.20E-07	
Hazard Index		0.9		13.0

**TABLE A.16. Cancer Risk and Hazard Index for Source Area ST48,
Dermal Contact with Groundwater Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
TRANS-1,2-DICHLOROETHENE	0.00E+00	0.00	0.00E+00	0.00
BENZENE	2.09E-05	0.00	4.98E-04	0.00
ETHYLBENZENE	0.00E+00	0.18	0.00E+00	1.01
TOLUENE	0.00E+00	0.38	0.00E+00	2.71
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.01
SEMI-VOLATILES				
2,4-DIMETHYLPHENOL	0.00E+00	0.00	0.00E+00	0.01
NAPHTHALENE	0.00E+00	0.02	0.00E+00	0.09
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
ARSENIC	1.42E-07	0.00	5.57E-07	0.00
BARIUM	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
MANGANESE	0.00E+00	0.03	0.00E+00	0.04
MERCURY	0.00E+00	0.00	0.00E+00	0.00
VANADIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk				
Summary of Cancer Risk	2.11E-05		4.98E-04	
Summary of Cancer Risk w/o Metals	2.09E-05		4.98E-04	
Hazard Index				
Hazard Index		0.6		3.9
Hazard Index w/o Metals		0.6		3.8

**TABLE A.17. Cancer Risk and Hazard Index for Source Area ST49,
Dermal Contact with Groundwater Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
1,1-DICHLOROETHANE	3.05E-08	0.00	3.02E-07	0.00
BENZENE	5.38E-08	0.00	5.72E-07	0.00
TRICHLOROETHENE	6.28E-08	0.00	6.89E-07	0.00
SEMI-VOLATILES				
1,2-DICHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.00
1,4-DICHLOROBENZENE	3.21E-08	0.00	4.05E-07	0.02
BENZO(A)ANTHRACENE	1.57E-07	0.00	2.50E-06	0.00
BENZO(A)PYRENE	1.50E-06	0.00	1.76E-05	0.00
BENZO(B)FLUORANTHENE	2.01E-07	0.00	1.99E-06	0.00
DIBENZ(A,H)ANTHRACENE	2.20E-06	0.00	1.82E-05	0.00
INDENO(1,2,3-CD)PYRENE	5.12E-07	0.00	4.76E-06	0.00
NAPHTHALENE	0.00E+00	0.00	0.00E+00	0.02
PHENANTHRENE	0.00E+00	0.00	0.00E+00	0.03
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
ARSENIC	1.18E-07	0.00	4.66E-07	0.00
BARIUM	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	4.87E-06		4.74E-05	
Summary of Cancer Risk w/o Metals	4.75E-06		4.69E-05	
Hazard Index		0.0		0.1
Hazard Index w/o Metals		0.0		0.1

**TABLE A.18. Cancer Risk and Hazard Index for Source Area ST50,
Dermal Contact with Groundwater Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME		
	Cancer Risk	Hazard Quotient			
VOLATILES					
BENZENE	1.48E-06	0.00	2.78E-05		0.00
CHLOROBENZENE	0.00E+00	0.00	0.00E+00		0.01
CHLOROFORM	2.87E-09	0.00	3.53E-08		0.00
CHLOROMETHANE	3.89E-09	0.00	1.07E-07		0.00
ETHYLBENZENE	0.00E+00	0.24	0.00E+00		1.86
TOLUENE	0.00E+00	0.21	0.00E+00		0.78
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00		0.02
SEMI-VOLATILES					
2,4-DIMETHYLPHENOL	0.00E+00	0.00	0.00E+00		0.01
2-METHYLNAPHTHALENE	0.00E+00	0.17	0.00E+00		1.73
NAPHTHALENE	0.00E+00	0.10	0.00E+00		0.94
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00		0.00
METALS					
ARSENIC	2.22E-07	0.00	2.08E-06		0.01
BARIUM	0.00E+00	0.00	0.00E+00		0.00
CHROMIUM VI	0.00E+00	0.00	0.00E+00		0.01
COPPER	0.00E+00	0.00	0.00E+00		0.00
LEAD	0.00E+00	0.00	0.00E+00		0.00
VANADIUM	0.00E+00	0.00	0.00E+00		0.00
Summary of Cancer Risk	1.71E-06		3.00E-05		
Summary of Cancer Risk w/o Metals	1.49E-06		2.79E-05		
Hazard Index		0.7			5.4
Hazard Index w/o Metals		0.7			5.4

**TABLE A.19. Cancer Risk and Hazard Index for Source Area ST20 E7,
Dermal Contact with Groundwater Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
1,1-DICHLOROETHENE	2.97E-07	0.00	4.50E-06	0.00
CHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.02
ETHYLBENZENE	0.00E+00	0.09	0.00E+00	0.66
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.03
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.01	0.00E+00	0.05
METALS				
ARSENIC	1.74E-07	0.00	1.75E-06	0.01
BARIUM	0.00E+00	0.00	0.00E+00	0.00
CHROMIUM VI	0.00E+00	0.00	0.00E+00	0.00
COPPER	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
MERCURY	0.00E+00	0.00	0.00E+00	0.00
VANADIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	4.72E-07		6.25E-06	
Summary of Cancer Risk w/o Metals	2.97E-07		4.50E-06	
Hazard Index		0.1		0.8
Hazard Index w/o Metals		0.1		0.8

**TABLE A.20. Cancer Risk and Hazard Index for Source Area ST20 E8,
Dermal Contact with Groundwater Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
1,1-DICHLOROETHENE	1.93E-06	0.00	2.40E-05	0.01
BENZENE	4.32E-08	0.00	2.18E-07	0.00
ETHYLBENZENE	0.00E+00	0.17	0.00E+00	1.63
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.02
TOLUENE	0.00E+00	0.57	0.00E+00	7.23
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.01	0.00E+00	0.05
PHENANTHRENE	0.00E+00	0.00	0.00E+00	0.01
Summary of Cancer Risk	1.98E-06		2.42E-05	
Hazard Index		0.8		9.0

**TABLE A.21. Cancer Risk and Hazard Index for Source Area ST20 E9,
Dermal Contact with Groundwater Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	1.73E-07	0.00	8.73E-07	0.00
CHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.00
ETHYLBENZENE	0.00E+00	0.05	0.00E+00	0.73
TOLUENE	0.00E+00	0.92	0.00E+00	17.37
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.02
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.00	0.00E+00	0.04
Summary of Cancer Risk	1.73E-07		8.73E-07	
Hazard Index		1.0		18.2

**TABLE A.22. Cancer Risk and Hazard Index for Source Area ST48,
Dermal Contact with Groundwater Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME		
	Cancer	Hazard			
	Risk	Quotient			
VOLATILES					
TRANS-1,2-DICHLOROETHENE	0.00E+00	0.00	0.00E+00		0.00
BENZENE	2.30E-05	0.00	8.36E-04		0.00
ETHYLBENZENE	0.00E+00	0.20	0.00E+00		1.41
TOLUENE	0.00E+00	0.42	0.00E+00		3.79
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00		0.01
SEMI-VOLATILES					
2,4-DIMETHYLPHENOL	0.00E+00	0.00	0.00E+00		0.01
NAPHTHALENE	0.00E+00	0.02	0.00E+00		0.13
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00		0.00
METALS					
ARSENIC	1.56E-07	0.00	9.36E-07		0.00
BARIUM	0.00E+00	0.00	0.00E+00		0.00
LEAD	0.00E+00	0.00	0.00E+00		0.00
MANGANESE	0.00E+00	0.03	0.00E+00		0.05
MERCURY	0.00E+00	0.00	0.00E+00		0.00
VANADIUM	0.00E+00	0.00	0.00E+00		0.00
Summary of Cancer Risk	2.32E-05		8.37E-04		
Summary of Cancer Risk w/o Metals	2.30E-05		8.36E-04		
Hazard Index		0.7			5.4
Hazard Index w/o Metals		0.6			5.4

**TABLE A.23. Cancer Risk and Hazard Index for Source Area ST49,
Dermal Contact with Groundwater Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
1,1-DICHLOROETHANE	3.35E-08	0.00	5.08E-07	0.00
BENZENE	5.92E-08	0.00	9.61E-07	0.00
TRICHLOROETHENE	6.91E-08	0.00	1.16E-06	0.00
SEMI-VOLATILES				
1,2-DICHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.00
1,4-DICHLOROBENZENE	3.54E-08	0.01	6.81E-07	0.03
BENZO(A)ANTHRACENE	1.73E-07	0.00	4.20E-06	0.00
BENZO(A)PYRENE	1.65E-06	0.00	2.95E-05	0.00
BENZO(B)FLUORANTHENE	2.21E-07	0.00	3.34E-06	0.00
DIBENZ(A,H)ANTHRACENE	2.42E-06	0.00	3.05E-05	0.00
INDENO(1,2,3-CD)PYRENE	5.63E-07	0.00	7.99E-06	0.00
NAPHTHALENE	0.00E+00	0.00	0.00E+00	0.02
PHENANTHRENE	0.00E+00	0.00	0.00E+00	0.04
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
ARSENIC	1.30E-07	0.00	7.82E-07	0.00
BARIUM	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	5.35E-06		7.96E-05	
Summary of Cancer Risk w/o Metals	5.22E-06		7.88E-05	
Hazard Index		0.0		0.1
Hazard Index w/o Metals		0.0		0.1

**TABLE A.24. Cancer Risk and Hazard Index for Source Area ST50,
Dermal Contact with Groundwater Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	1.63E-06	0.00	4.67E-05	0.00
CHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.02
CHLOROFORM	3.15E-09	0.00	5.94E-08	0.00
CHLOROMETHANE	4.28E-09	0.00	1.80E-07	0.00
ETHYLBENZENE	0.00E+00	0.26	0.00E+00	2.60
TOLUENE	0.00E+00	0.23	0.00E+00	1.10
XYLENES (TOTAL)	0.00E+00	0.00	0.00E+00	0.03
SEMI-VOLATILES				
2,4-DIMETHYLPHENOL	0.00E+00	0.00	0.00E+00	0.01
2-METHYLNAPHTHALENE	0.00E+00	0.19	0.00E+00	2.42
NAPHTHALENE	0.00E+00	0.11	0.00E+00	1.31
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
ARSENIC	2.44E-07	0.00	3.49E-06	0.02
BARIUM	0.00E+00	0.00	0.00E+00	0.00
CHROMIUM VI	0.00E+00	0.00	0.00E+00	0.02
COPPER	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
VANADIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.88E-06		5.05E-05	
Summary of Cancer Risk w/o Metals	1.63E-06		4.70E-05	
Hazard Index		0.8		7.5
Hazard Index w/o Metals		0.8		7.5

**TABLE A.25. Cancer Risk and Hazard Index for Source Area ST20 E7,
Inhalation of Volatiles During Groundwater Use, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
1,1-DICHLOROETHENE	2.26E-05	0.02	1.89E-04	0.05
CHLOROBENZENE	0.00E+00	0.13	0.00E+00	0.86
ETHYLBENZENE	0.00E+00	0.02	0.00E+00	0.09
XYLENES (TOTAL)	0.00E+00	0.20	0.00E+00	1.26
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.07	0.00E+00	0.24
METALS				
ARSENIC	0.00E+00	0.00	0.00E+00	0.00
BARIUM	0.00E+00	0.00	0.00E+00	0.00
CHROMIUM VI	0.00E+00	0.00	0.00E+00	0.00
COPPER	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
MERCURY	0.00E+00	0.00	0.00E+00	0.00
VANADIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	2.26E-05		1.89E-04	
Summary of Cancer Risk w/o Metals	2.26E-05		1.89E-04	
Hazard Index		0.4		2.5
Hazard Index w/o Metals		0.4		2.5

**TABLE A.26. Cancer Risk and Hazard Index for Source Area ST20 E8,
Inhalation of Volatiles During Groundwater Use, Industrial Land Use**

	Average Exposure			RME		
	Cancer		Hazard		Cancer	Hazard
ANALYTES	Risk		Quotient		Risk	Quotient
VOLATILES						
1,1-DICHLOROETHENE	1.47E-04		0.11		1.01E-03	0.26
BENZENE	2.74E-07		0.00		7.60E-07	0.00
ETHYLBENZENE	0.00E+00		0.03		0.00E+00	0.21
XYLENES (TOTAL)	0.00E+00		0.17		0.00E+00	0.96
TOLUENE	0.00E+00		0.58		0.00E+00	5.28
SEMI-VOLATILES						
NAPHTHALENE	0.00E+00		0.04		0.00E+00	0.24
PHENANTHRENE	0.00E+00		0.01		0.00E+00	0.04
Summary of Cancer Risk	1.47E-04				1.01E-03	
Hazard Index			0.9			7.0

**TABLE A.27. Cancer Risk and Hazard Index for Source Area ST20 E9,
Inhalation of Volatiles During Groundwater Use, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	1.09E-06	0.00	3.04E-06	0.00
CHLOROBENZENE	0.00E+00	0.03	0.00E+00	0.15
ETHYLBENZENE	0.00E+00	0.01	0.00E+00	0.10
TOLUENE	0.00E+00	1.02	0.00E+00	12.68
XYLENES (TOTAL)	0.00E+00	0.17	0.00E+00	0.97
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.03	0.00E+00	0.19
Summary of Cancer Risk	1.09E-06		3.04E-06	
Hazard Index		1.3		14.1

**TABLE A.28. Cancer Risk and Hazard Index for Source Area ST48,
Inhalation of Volatiles During Groundwater Use, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
TRANS-1,2-DICHLOROETHENE	0.00E+00	0.09	0.00E+00	0.87
BENZENE	1.46E-04	0.00	2.91E-03	0.00
ETHYLBENZENE	0.00E+00	0.04	0.00E+00	0.19
TOLUENE	0.00E+00	0.47	0.00E+00	2.77
XYLENES (TOTAL)	0.00E+00	0.11	0.00E+00	0.55
SEMI-VOLATILES				
2,4-DIMETHYLPHENOL	0.00E+00	0.01	0.00E+00	0.03
NAPHTHALENE	0.00E+00	0.12	0.00E+00	0.61
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
ARSENIC	0.00E+00	0.00	0.00E+00	0.00
BARIUM	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
MANGANESE	0.00E+00	0.00	0.00E+00	0.00
MERCURY	0.00E+00	0.00	0.00E+00	0.00
VANADIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.46E-04		2.91E-03	
Summary of Cancer Risk w/o Metals	1.46E-04		2.91E-03	
Hazard Index		0.8		5.0
Hazard Index w/o Metals		0.8		5.0

**TABLE A.29. Cancer Risk and Hazard Index for Source Area ST49,
Inhalation of Volatiles During Groundwater Use, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
1,1-DICHLOROETHANE	4.53E-06	0.00	3.77E-05	0.00
BENZENE	3.75E-07	0.00	3.34E-06	0.00
TRICHLOROETHENE	2.22E-07	0.00	2.05E-06	0.00
SEMI-VOLATILES				
1,2-DICHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.00
1,4-DICHLOROBENZENE	2.45E-07	0.00	2.59E-06	0.00
BENZO(A)ANTHRACENE	5.19E-08	0.00	6.92E-07	0.00
BENZO(A)PYRENE	2.82E-07	0.00	2.77E-06	0.00
BENZO(B)FLUORANTHENE	3.77E-08	0.00	3.15E-07	0.00
DIBENZ(A,H)ANTHRACENE	1.53E-07	0.00	1.06E-06	0.00
INDENO(1,2,3-CD)PYRENE	5.13E-08	0.00	4.01E-07	0.00
NAPHTHALENE	0.00E+00	0.02	0.00E+00	0.10
PHENANTHRENE	0.00E+00	0.02	0.00E+00	0.12
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
ARSENIC	0.00E+00	0.00	0.00E+00	0.00
BARIUM	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	5.95E-06		5.10E-05	
Summary of Cancer Risk w/o Metals	5.95E-06		5.10E-05	
Hazard Index		0.0		0.2
Hazard Index w/o Metals		0.0		0.2

**TABLE A.30. Cancer Risk and Hazard Index for Source Area ST50,
Inhalation of Volatiles During Groundwater Use, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	1.03E-05	0.00	1.63E-04	0.00
CHLOROBENZENE	0.00E+00	0.09	0.00E+00	0.73
CHLOROFORM	1.68E-07	0.00	1.74E-06	0.01
CHLOROMETHANE	4.17E-07	0.00	9.65E-06	0.00
ETHYLBENZENE	0.00E+00	0.05	0.00E+00	0.34
TOLUENE	0.00E+00	0.26	0.00E+00	0.80
XYLENES (TOTAL)	0.00E+00	0.23	0.00E+00	1.56
SEMI-VOLATILES				
2,4-DIMETHYLPHENOL	0.00E+00	0.01	0.00E+00	0.03
2-METHYLNAPHTHALENE	0.00E+00	0.00	0.00E+00	0.00
NAPHTHALENE	0.00E+00	0.77	0.00E+00	6.15
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
ARSENIC	0.00E+00	0.00	0.00E+00	0.00
BARIUM	0.00E+00	0.00	0.00E+00	0.00
CHROMIUM VI	0.00E+00	0.00	0.00E+00	0.00
COPPER	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
VANADIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.09E-05		1.74E-04	
Summary of Cancer Risk w/o Metals	1.09E-05		1.74E-04	
Hazard Index		1.4		9.6
Hazard Index w/o Metals		1.4		9.6

**TABLE A.31. Cancer Risk and Hazard Index for Source Area ST20 E7,
Inhalation of Volatiles During Groundwater Use, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
1,1-DICHLOROETHENE	2.49E-05	0.02	3.17E-04	0.07
CHLOROBENZENE	0.00E+00	0.15	0.00E+00	1.21
ETHYLBENZENE	0.00E+00	0.02	0.00E+00	0.12
XYLENES (TOTAL)	0.00E+00	0.22	0.00E+00	1.76
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.08	0.00E+00	0.33
METALS				
ARSENIC	0.00E+00	0.00	0.00E+00	0.00
BARIUM	0.00E+00	0.00	0.00E+00	0.00
CHROMIUM VI	0.00E+00	0.00	0.00E+00	0.00
COPPER	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
MERCURY	0.00E+00	0.00	0.00E+00	0.00
VANADIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	2.49E-05		3.17E-04	
Summary of Cancer Risk w/o Metals	2.49E-05		3.17E-04	
Hazard Index		0.5		3.5
Hazard Index w/o Metals		0.5		3.5

**TABLE A.32. Cancer Risk and Hazard Index for Source Area ST20 E8,
Inhalation of Volatiles During Groundwater Use, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
1,1-DICHLOROETHENE	1.62E-04	0.12	1.69E-03	0.37
BENZENE	3.01E-07	0.00	1.28E-06	0.00
ETHYLBENZENE	0.00E+00	0.04	0.00E+00	0.30
XYLENES (TOTAL)	0.00E+00	0.19	0.00E+00	1.35
TOLUENE	0.00E+00	0.64	0.00E+00	7.39
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.04	0.00E+00	0.34
PHENANTHRENE	0.00E+00	0.01	0.00E+00	0.05
Summary of Cancer Risk	1.62E-04		1.69E-03	
Hazard Index		1.0		9.8

**TABLE A.33. Cancer Risk and Hazard Index for Source Area ST20 E9,
Inhalation of Volatiles During Groundwater Use, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	1.20E-06	0.00	5.11E-06	0.00
CHLOROBENZENE	0.00E+00	0.03	0.00E+00	0.21
ETHYLBENZENE	0.00E+00	0.01	0.00E+00	0.13
TOLUENE	0.00E+00	1.12	0.00E+00	17.75
XYLENES (TOTAL)	0.00E+00	0.19	0.00E+00	1.35
SEMI-VOLATILES				
NAPHTHALENE	0.00E+00	0.03	0.00E+00	0.26
Summary of Cancer Risk	1.20E-06		5.11E-06	
Hazard Index		1.4		19.7

**TABLE A.34. Cancer Risk and Hazard Index for Source Area ST48,
Inhalation of Volatiles During Groundwater Use, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
TRANS-1,2-DICHLOROETHENE	0.00E+00	0.10	0.00E+00	1.22
BENZENE	1.60E-04	0.00	4.89E-03	0.00
ETHYLBENZENE	0.00E+00	0.04	0.00E+00	0.26
TOLUENE	0.00E+00	0.51	0.00E+00	3.87
XYLENES (TOTAL)	0.00E+00	0.12	0.00E+00	0.77
SEMI-VOLATILES				
2,4-DIMETHYLPHENOL	0.00E+00	0.01	0.00E+00	0.04
NAPHTHALENE	0.00E+00	0.14	0.00E+00	0.85
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
ARSENIC	0.00E+00	0.00	0.00E+00	0.00
BARIUM	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
MANGANESE	0.00E+00	0.00	0.00E+00	0.00
MERCURY	0.00E+00	0.00	0.00E+00	0.00
VANADIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.60E-04		4.89E-03	
Summary of Cancer Risk w/o Metals	1.60E-04		4.89E-03	
Hazard Index		0.9		7.0
Hazard Index w/o Metals		0.9		7.0

**TABLE A.35. Cancer Risk and Hazard Index for Source Area ST49,
Inhalation of Volatiles During Groundwater Use, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
1,1-DICHLOROETHANE	4.98E-06	0.00	6.34E-05	0.00
BENZENE	4.12E-07	0.00	5.62E-06	0.00
TRICHLOROETHENE	2.44E-07	0.00	3.44E-06	0.00
SEMI-VOLATILES				
1,2-DICHLOROBENZENE	0.00E+00	0.00	0.00E+00	0.00
1,4-DICHLOROBENZENE	2.69E-07	0.00	4.35E-06	0.00
BENZO(A)ANTHRACENE	5.71E-08	0.00	1.16E-06	0.00
BENZO(A)PYRENE	3.11E-07	0.00	4.66E-06	0.00
BENZO(B)FLUORANTHENE	4.15E-08	0.00	5.28E-07	0.00
DIBENZ(A,H)ANTHRACENE	1.68E-07	0.00	1.78E-06	0.00
INDENO(1,2,3-CD)PYRENE	5.65E-08	0.00	6.74E-07	0.00
NAPHTHALENE	0.00E+00	0.03	0.00E+00	0.14
PHENANTHRENE	0.00E+00	0.02	0.00E+00	0.17
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
ARSENIC	0.00E+00	0.00	0.00E+00	0.00
BARIUM	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	6.54E-06		6.56E-05	
Summary of Cancer Risk w/o Metals	6.54E-06		6.56E-05	
Hazard Index		0.0		0.3
Hazard Index w/o Metals		0.0		0.3

**TABLE A.36. Cancer Risk and Hazard Index for Source Area ST50,
Inhalation of Volatiles During Groundwater Use, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	1.13E-05	0.00	2.73E-04	0.00
CHLOROBENZENE	0.00E+00	0.10	0.00E+00	1.02
CHLOROFORM	1.85E-07	0.00	2.92E-06	0.01
CHLOROMETHANE	4.58E-07	0.00	1.62E-05	0.00
ETHYLBENZENE	0.00E+00	0.06	0.00E+00	0.48
TOLUENE	0.00E+00	0.28	0.00E+00	1.12
XYLENES (TOTAL)	0.00E+00	0.28	0.00E+00	2.19
SEMI-VOLATILES				
2,4-DIMETHYLPHENOL	0.00E+00	0.01	0.00E+00	0.04
2-METHYLNAPHTHALENE	0.00E+00	0.00	0.00E+00	0.00
NAPHTHALENE	0.00E+00	0.84	0.00E+00	8.61
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
ARSENIC	0.00E+00	0.00	0.00E+00	0.00
BARIUM	0.00E+00	0.00	0.00E+00	0.00
CHROMIUM VI	0.00E+00	0.00	0.00E+00	0.00
COPPER	0.00E+00	0.00	0.00E+00	0.00
LEAD	0.00E+00	0.00	0.00E+00	0.00
VANADIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.20E-05		2.92E-04	
Summary of Cancer Risk w/o Metals	1.20E-05		2.92E-04	
Hazard Index		1.5		13.5
Hazard Index w/o Metals		1.5		13.5

**TABLE A.37. Cancer Risk and Hazard Index for Source Area ST20 E7,
Surface Soil Ingestion Path: ray, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
TETRACHLOROETHENE	1.03E-09	0.00	2.49E-08	0.00
VINYL CHLORIDE	1.09E-07	0.00	1.97E-06	0.00
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	8.40E-09	0.00	4.38E-08	0.00
BENZO(K)FLUORANTHENE	2.50E-09	0.00	3.85E-08	0.00
CHRYSENE	2.97E-10	0.00	4.39E-09	0.00
INDENO(1,2,3-CD)PYRENE	7.99E-09	0.00	7.03E-08	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.29E-07		2.15E-06	
Hazard Index		0.0		0.0

**TABLE A.38. Cancer Risk and Hazard Index for Source Area ST20 E8,
Surface Soil Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
DIBENZ(A,H)ANTHRACENE	4.17E-08	0.00	1.16E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	4.17E-08		1.16E-07	
Hazard Index		0.0		0.0

**TABLE A.39. Cancer Risk and Hazard Index for Source Area ST20 E9,
Surface Soil Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	1.88E-09	0.00	9.79E-09	0.00
SEMI-VOLATILES				
CHRYSENE	3.41E-10	0.00	2.68E-09	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	2.22E-09		1.25E-08	
Hazard Index		0.0		0.0

**TABLE A.40. Cancer Risk and Hazard Index for Source Area ST48,
Surface Soil Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure			RME		
	Cancer		Hazard	Cancer		Hazard
	Risk		Quotient	Risk		Quotient
TPH						
TOTAL PETROLEUM HYDROCARBONS	0.00E+00		0.00	0.00E+00		0.00
Summary of Cancer Risk	0.00E+00			0.00E+00		
Hazard Index			0.0			0.0

**TABLE A.41. Cancer Risk and Hazard Index for Source Area ST49,
Surface Soil Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	3.39E-09	0.00	4.12E-08	0.00
BENZO(A)PYRENE	1.56E-08	0.00	2.33E-07	0.00
BENZO(B)FLUORANTHENE	1.10E-09	0.00	1.23E-08	0.00
INDENO(1,2,3-CD)PYRENE	3.62E-09	0.00	3.92E-08	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
PESTICIDES				
4,4'-DDD	1.57E-09	0.00	8.72E-09	0.00
METALS				
BERYLLIUM	1.66E-07	0.00	5.18E-07	0.00
Summary of Cancer Risk	1.92E-07		8.52E-07	
Summary of Cancer Risk w/o Metals	2.52E-08		3.35E-07	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.42. Cancer Risk and Hazard Index for Source Area ST50,
Surface Soil Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	Cancer Risk	Hazard Quotient
	Cancer Risk	Hazard Quotient			
VOLATILES					
BENZENE	5.58E-10	0.00	8.80E-09		0.00
SEMI-VOLATILES					
N-NITROSOPIPERIDINE	3.78E-09	0.00	4.95E-08		0.00
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00		0.00
METALS					
CADMIUM	0.00E+00	0.00	0.00E+00		0.00
Summary of Cancer Risk	4.34E-09		5.83E-08		
Summary of Cancer Risk w/o Metals	4.34E-09		5.83E-08		
Hazard Index		0.0			0.0
Hazard Index w/o Metals		0.0			0.0

**TABLE A.43. Cancer Risk and Hazard Index for Source Area ST20 E7,
Surface Soil Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
TETRACHLOROETHENE	2.54E-09	0.00	1.97E-07	0.00
VINYL CHLORIDE	2.69E-07	0.00	1.55E-05	0.00
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	2.07E-08	0.00	3.45E-07	0.00
BENZO(K)FLUORANTHENE	6.17E-09	0.00	3.04E-07	0.00
CHRYSENE	7.33E-10	0.00	3.47E-08	0.00
INDENO(1,2,3-CD)PYRENE	1.97E-08	0.00	5.54E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	3.19E-07		1.69E-05	
Hazard Index		0.0		0.0

**TABLE A.44. Cancer Risk and Hazard Index for Source Area ST20 E8,
Surface Soil Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
DIBENZ(A,H)ANTHRACENE	1.03E-07	0.00	9.13E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.03E-07		9.13E-07	
Hazard Index		0.0		0.0

**TABLE A.45. Cancer Risk and Hazard Index for Source Area ST20 E9,
Surface Soil Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	4.64E-09	0.00	7.73E-08	0.00
SEMI-VOLATILES				
CHRYSENE	8.41E-10	0.00	2.11E-08	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	5.48E-09		9.84E-08	
Hazard Index		0.0		0.0

TABLE A.46. Cancer Risk and Hazard Index for Source Area ST48,
Surface Soil Ingestion Pathway, Residential Land Use

ANALYTES	Average Exposure		RME	Cancer Risk	Hazard Quotient
	Cancer Risk	Hazard Quotient			
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00		0.01
Summary of Cancer Risk	0.00E+00		0.00E+00		
Hazard Index		0.0			0.1

**TABLE A.47. Cancer Risk and Hazard Index for Source Area ST49,
Surface Soil Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	8.37E-09	0.00	3.25E-07	0.00
BENZO(A)PYRENE	3.84E-08	0.00	1.84E-06	0.00
BENZO(B)FLUORANTHENE	2.72E-09	0.00	9.74E-08	0.00
INDENO(1,2,3-CD)PYRENE	8.93E-09	0.00	3.09E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
PESTICIDES				
4,4'-DDD	3.87E-09	0.00	6.88E-08	0.00
METALS				
BERYLLIUM	4.10E-07	0.00	4.09E-06	0.00
Summary of Cancer Risk	4.72E-07		6.73E-06	
Summary of Cancer Risk w/o Metals	6.22E-08		2.64E-06	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.48. Cancer Risk and Hazard Index for Source Area ST50,
Surface Soil Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	1.38E-09	0.00	6.94E-08	0.00
SEMI-VOLATILES				
N-NITROSOPIPERIDINE	9.32E-09	0.00	3.91E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.02
METALS				
CADMIUM	0.00E+00	0.00	0.00E+00	0.01
Summary of Cancer Risk	1.07E-08		4.60E-07	
Summary of Cancer Risk w/o Metals	1.07E-08		4.60E-07	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.49. Cancer Risk and Hazard Index for Source Area ST20 E7,
Ingestion of Plants Grown in Contaminated Soils, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
TETRACHLOROETHENE	9.45E-07	0.01	3.49E-05	0.16
VINYL CHLORIDE	5.07E-04	0.00	1.40E-02	0.00
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	1.42E-07	0.00	1.13E-06	0.00
BENZO(K)FLUORANTHENE	2.29E-08	0.00	5.39E-07	0.00
CHRYSENE	4.97E-09	0.00	1.12E-07	0.00
INDENO(1,2,3-CD)PYRENE	4.08E-08	0.00	5.48E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	5.08E-04		1.40E-02	
Hazard Index		0.0		0.2

**TABLE A.50. Cancer Risk and Hazard Index for Source Area ST20 E8,
Ingestion of Plants Grown in Contaminated Soils, Residential Land Use**

ANALYTES	Average Exposure		RME		
	Cancer Risk	Hazard Quotient			
SEMI-VOLATILES					
DIBENZ(A,H)ANTHRACENE	6.96E-07	0.00	2.95E-06		0.00
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00		0.00
Summary of Cancer Risk	6.96E-07		2.95E-06		
Hazard Index		0.0			0.0

**TABLE A.51. Cancer Risk and Hazard Index for Source Area ST20 E9,
Ingestion of Plants Grown in Contaminated Soils, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	2.00E-13	0.00	1.25E-12	0.00
SEMI-VOLATILES				
CHRYSENE	3.63E-14	0.00	3.42E-13	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	1.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	2.37E-13		1.59E-12	
Hazard Index		0.0		0.0

**TABLE A.52. Cancer Risk and Hazard Index for Source Area ST48,
Ingestion of Plants Grown in Contaminated Soils, Residential Land Use**

ANALYTES	Average Exposure			RME		
	Cancer		Hazard	Cancer		Hazard
	Risk		Quotient	Risk		Quotient
TPH						
TOTAL PETROLEUM HYDROCARBONS	0.00E+00		0.02	0.00E+00		0.28
Summary of Cancer Risk	0.00E+00			0.00E+00		
Hazard Index			0.0			0.3

**TABLE A.53. Cancer Risk and Hazard Index for Source Area ST49,
Ingestion of Plants Grown in Contaminated Soils, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	5.74E-08	0.00	1.06E-06	0.00
BENZO(A)PYRENE	1.43E-07	0.00	3.26E-06	0.00
BENZO(B)FLUORANTHENE	1.01E-08	0.00	1.73E-07	0.00
INDENO(1,2,3-CD)PYRENE	1.85E-08	0.00	3.06E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.04
PESTICIDES				
4,4'-DDD	1.20E-08	0.00	1.02E-07	0.00
METALS				
BERYLLIUM	2.36E-07	0.00	1.12E-06	0.00
Summary of Cancer Risk	4.76E-07		6.03E-06	
Summary of Cancer Risk w/o Metals	2.41E-07		4.91E-06	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.54. Cancer Risk and Hazard Index for Source Area ST50,
Ingestion of Plants Grown in Contaminated Soils, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	9.69E-07	0.00	2.33E-05	0.00
SEMI-VOLATILES				
N-NITROSOPIPERIDINE	1.71E-06	0.00	3.42E-05	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.07	0.00E+00	0.87
METALS				
CADMIUM	0.00E+00	0.07	0.00E+00	0.15
Summary of Cancer Risk	2.68E-06		5.75E-05	
Summary of Cancer Risk w/o Metals	2.68E-06		5.75E-05	
Hazard Index		0.1		1.0
Hazard Index w/o Metals		0.1		0.9

**TABLE A.55. Cancer Risk and Hazard Index for Source Area ST20 E7,
Subsurface Soil Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
TETRACHLOROETHENE	1.69E-10	0.00	4.10E-09	0.00
VINYL CHLORIDE	1.79E-08	0.00	3.23E-07	0.00
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	1.38E-09	0.00	7.20E-09	0.00
BENZO(K)FLUORANTHENE	4.12E-10	0.00	6.33E-09	0.00
CHRYSENE	4.89E-11	0.00	7.22E-10	0.00
INDENO(1,2,3-CD)PYRENE	1.31E-09	0.00	1.15E-08	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	2.12E-08		3.53E-07	
Hazard Index		0.0		0.0

**TABLE A.56. Cancer Risk and Hazard Index for Source Area ST20 E8,
Subsurface Soil Ingestion Pathway, Industrial Land Use**

	Average Exposure			RME	
	Cancer	Hazard		Cancer	Hazard
ANALYTES	Risk	Quotient		Risk	Quotient
SEMI-VOLATILES					
DIBENZ(A,H)ANTHRACENE	6.85E-09	0.00		1.90E-08	0.00
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00		0.00E+00	0.00
Summary of Cancer Risk	6.85E-09			1.90E-08	
Hazard Index		0.0			0.0

**TABLE A.57. Cancer Risk and Hazard Index for ST20 E9,
Subsurface Soil Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	3.09E-10	0.00	1.61E-09	0.00
SEMI-VOLATILES				
CHRYSENE	5.60E-11	0.00	4.40E-10	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	3.65E-10		2.05E-09	
Hazard Index		0.0		0.0

**TABLE A.58. Cancer Risk and Hazard Index for Source Area ST48,
Subsurface Soil Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	0.00E+00		0.00E+00	
Hazard Index		0.0		0.0

**TABLE A.59. Cancer Risk and Hazard Index for Source Area ST49,
Subsurface Soil Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	5.58E-10	0.00	6.77E-09	0.00
BENZO(A)PYRENE	2.56E-09	0.00	3.83E-08	0.00
BENZO(B)FLUORANTHENE	1.81E-10	0.00	2.03E-09	0.00
INDENO(1,2,3-CD)PYRENE	5.95E-10	0.00	6.44E-09	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
PESTICIDES				
4,4'-DDD	2.58E-10	0.00	1.43E-09	0.00
METALS				
BERYLLIUM	2.73E-08	0.00	8.51E-08	0.00
Summary of Cancer Risk	3.15E-08		1.40E-07	
Summary of Cancer Risk w/o Metals	4.15E-09		5.50E-08	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.60. Cancer Risk and Hazard Index for Source Area ST50,
Subsurface Soil Ingestion Pathway, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	9.18E-11	0.00	1.45E-09	0.00
SEMI-VOLATILES				
N-NITROSOPIPERIDINE	6.21E-10	0.00	8.14E-09	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
CADMIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	7.13E-10		9.58E-09	
Summary of Cancer Risk w/o Metals	7.13E-10		9.58E-09	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.61. Cancer Risk and Hazard Index for Source Area ST20 E7,
Subsurface Soil Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
TETRACHLOROETHENE	2.54E-09	0.00	1.97E-07	0.00
VINYL CHLORIDE	2.69E-07	0.00	1.55E-05	0.00
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	2.07E-08	0.00	3.45E-07	0.00
BENZO(K)FLUORANTHENE	6.17E-09	0.00	3.04E-07	0.00
CHRYSENE	7.33E-10	0.00	3.47E-08	0.00
INDENO(1,2,3-CD)PYRENE	1.97E-08	0.00	5.54E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	3.19E-07		1.69E-05	
Hazard Index		0.0		0.0

**TABLE A.62. Cancer Risk and Hazard Index for Source Area ST20 E8,
Subsurface Soil Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
SEMI-VOLATILES				
DIBENZ(A,H)ANTHRACENE	1.03E-07	0.00	9.13E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.03E-07		9.13E-07	
Hazard Index		0.0		0.0

**TABLE A.63. Cancer Risk and Hazard Index for Source Area ST20 E9,
Subsurface Soil Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	4.64E-09	0.00	7.73E-08	0.00
SEMI-VOLATILES				
CHRYSENE	8.41E-10	0.00	2.11E-08	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	5.48E-09		9.84E-08	
Hazard Index		0.0		0.0

**TABLE A.64. Cancer Risk and Hazard Index for Source Area ST48,
Subsurface Soil Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.01
Summary of Cancer Risk	0.00E+00		0.00E+00	
Hazard Index		0.0		0.0

**TABLE A.65. Cancer Risk and Hazard Index for Source Area ST49,
Subsurface Soil Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	8.37E-09	0.00	3.25E-07	0.00
BENZO(A)PYRENE	3.84E-08	0.00	1.84E-06	0.00
BENZO(B)FLUORANTHENE	2.72E-09	0.00	9.74E-08	0.00
INDENO(1,2,3-CD)PYRENE	8.93E-09	0.00	3.09E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
PESTICIDES				
4,4'-DDD	3.87E-09	0.00	6.88E-08	0.00
METALS				
BERYLLIUM	4.10E-07	0.00	4.09E-06	0.00
Summary of Cancer Risk	4.72E-07		6.73E-06	
Summary of Cancer Risk w/o Metals	6.22E-08		2.64E-06	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.66. Cancer Risk and Hazard Index for Source Area ST50,
Subsurface Soil Ingestion Pathway, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	1.38E-09	0.00	6.94E-08	0.00
SEMI-VOLATILES				
N-NITROSOPIPERIDINE	9.32E-09	0.00	3.91E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.02
METALS				
CADMIUM	0.00E+00	0.00	0.00E+00	0.01
Summary of Cancer Risk	1.07E-08		4.60E-07	
Summary of Cancer Risk w/o Metals	1.07E-08		4.60E-07	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.67. Cancer Risk and Hazard Index for Source Area ST20 E7,
Inhalation of Volatiles Released from Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
TETRACHLOROETHENE	2.70E-09	0.00	6.54E-08	0.01
VINYL CHLORIDE	9.90E-06	0.00	1.79E-04	0.00
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	6.10E-11	0.00	3.18E-10	0.00
BENZO(K)FLUORANTHENE	6.51E-11	0.00	1.00E-09	0.00
CHRYSENE	2.13E-12	0.00	3.15E-11	0.00
INDENO(1,2,3-CD)PYRENE	5.14E-12	0.00	4.52E-11	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	9.91E-06		1.79E-04	
Hazard Index		0.0		0.0

**TABLE A.68. Cancer Risk and Hazard Index for Source Area ST20 E8,
Inhalation of Volatiles Released from Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
DIBENZ(A,H)ANTHRACENE	1.45E-11	0.00	4.04E-11	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.45E-11		4.04E-11	
Hazard Index		0.0		0.0

**TABLE A.69. Cancer Risk and Hazard Index for Source Area ST20 E9,
Inhalation of Volatiles Released from Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	7.39E-08	0.00	3.85E-07	0.00
SEMI-VOLATILES				
CHRYSENE	2.45E-12	0.00	1.92E-11	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	7.39E-08		3.85E-07	
Hazard Index		0.0		0.0

**TABLE A.70. Cancer Risk and Hazard Index for Source Area ST48,
Inhalation of Volatiles Released from Soil, Industrial Land Use**

ANALYTES	Average Exposure			RME		
	Cancer		Hazard	Cancer		Hazard
	Risk		Quotient	Risk		Quotient
TPH						
TOTAL PETROLEUM HYDROCARBONS	0.00E+00		0.00	0.00E+00		0.00
Summary of Cancer Risk	0.00E+00			0.00E+00		
Hazard Index			0.0			0.0

**TABLE A.71. Cancer Risk and Hazard Index for Source Area ST49,
Inhalation of Volatiles Released from Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	2.46E-11	0.00	2.99E-10	0.00
BENZO(A)PYRENE	9.16E-11	0.00	1.37E-09	0.00
BENZO(B)FLUORANTHENE	1.59E-11	0.00	1.78E-10	0.00
INDENO(1,2,3-CD)PYRENE	2.33E-12	0.00	2.52E-11	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
PESTICIDES				
4,4'-DDD	1.49E-11	0.00	8.25E-11	0.00
METALS				
BERYLLIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.49E-10		1.96E-09	
Summary of Cancer Risk w/o Metals	1.49E-10		1.96E-09	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.72. Cancer Risk and Hazard Index for Source Area ST50,
Inhalation of Volatiles Released from Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	2.19E-08	0.00	3.46E-07	0.00
SEMI-VOLATILES				
N-NITROSOPIPERIDINE	1.25E-08	0.00	1.64E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
CADMIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	3.45E-08		5.10E-07	
Summary of Cancer Risk w/o Metals	3.45E-08		5.10E-07	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.73. Cancer Risk and Hazard Index for Source Area ST20 E7,
Inhalation of Volatiles Released from Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	Cancer Risk	Hazard Quotient
	Cancer	Hazard			
	Risk	Quotient			
VOLATILES					
TETRACHLOROETHENE	2.70E-09	0.00	6.54E-08		0.01
VINYL CHLORIDE	9.90E-06	0.00	1.79E-04		0.00
SEMI-VOLATILES					
BENZO(A)ANTHRACENE	6.10E-11	0.00	3.18E-10		0.00
BENZO(K)FLUORANTHENE	6.51E-11	0.00	1.00E-09		0.00
CHRYSENE	2.13E-12	0.00	3.15E-11		0.00
INDENO(1,2,3-CD)PYRENE	5.14E-12	0.00	4.52E-11		0.00
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00		0.00
Summary of Cancer Risk	9.91E-06		1.79E-04		
Hazard Index		0.0			0.0

**TABLE A.74. Cancer Risk and Hazard Index for Source Area ST20 E8,
Inhalation of Volatiles Released from Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
DIBENZ(A,H)ANTHRACENE	1.45E-11	0.00	4.04E-11	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.45E-11		4.04E-11	
Hazard Index		0.0		0.0

**TABLE A.75. Cancer Risk and Hazard Index for Source Area ST20 E9,
Inhalation of Volatiles Released from Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	7.39E-08	0.00	3.85E-07	0.00
SEMI-VOLATILES				
CHRYSENE	2.45E-12	0.00	1.92E-11	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	7.39E-08		3.85E-07	
Hazard Index		0.0		0.0

**TABLE A.76. Cancer Risk and Hazard Index for Source Area ST48,
Inhalation of Volatiles Released from Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	0.00E+00		0.00E+00	
Hazard Index		0.0		0.0

**TABLE A.77. Cancer Risk and Hazard Index for Source Area ST49,
Inhalation of Volatiles Released from Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	2.46E-11	0.00	2.99E-10	0.00
BENZO(A)PYRENE	9.16E-11	0.00	1.37E-09	0.00
BENZO(B)FLUORANTHENE	1.59E-11	0.00	1.78E-10	0.00
INDENO(1,2,3-CD)PYRENE	2.33E-12	0.00	2.52E-11	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
PESTICIDES				
4,4'-DDD	1.49E-11	0.00	8.25E-11	0.00
METALS				
BERYLLIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.49E-10		1.96E-09	
Summary of Cancer Risk w/o Metals	1.49E-10		1.96E-09	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.78. Cancer Risk and Hazard Index for Source Area ST50,
Inhalation of Volatiles Released from Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	2.19E-08	0.00	3.46E-07	0.00
SEMI-VOLATILES				
N-NITROSOPIPERIDINE	1.25E-08	0.00	1.64E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
CADMIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	3.45E-08		5.10E-07	
Summary of Cancer Risk w/o Metals	3.45E-08		5.10E-07	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.79. Cancer Risk and Hazard Index for Source Area ST20 E7,
Dermal Contact with Surface Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
TETRACHLOROETHENE	2.35E-10	0.00	2.49E-08	0.00
VINYL CHLORIDE	2.49E-08	0.00	1.97E-06	0.00
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	1.92E-09	0.00	4.38E-08	0.00
BENZO(K)FLUORANTHENE	5.71E-10	0.00	3.85E-08	0.00
CHRYSENE	6.78E-11	0.00	4.39E-09	0.00
INDENO(1,2,3-CD)PYRENE	1.82E-09	0.00	7.03E-08	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	2.95E-08		2.15E-06	
Hazard Index		0.0		0.0

**TABLE A.80. Cancer Risk and Hazard Index for Source Area ST20 E8,
Dermal Contact with Surface Soil, Industrial Land Use**

	Average Exposure		RME		
	Cancer	Hazard			
ANALYTES	Risk	Quotient	Risk		Quotient
SEMI-VOLATILES					
DIBENZ(A,H)ANTHRACENE	9.50E-09	0.00	1.16E-07		0.00
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00		0.00
Summary of Cancer Risk	9.50E-09		1.16E-07		
Hazard Index		0.0			0.0

**TABLE A.81. Cancer Risk and Hazard Index for Source Area ST20 E9,
Dermal Contact with Surface Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	Cancer Risk	Hazard Quotient
	Cancer Risk	Hazard Quotient			
VOLATILES					
BENZENE	4.29E-10	0.00	9.79E-09		0.00
SEMI-VOLATILES					
CHRYSENE	7.77E-11	0.00	2.68E-09		0.00
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00		0.00
Summary of Cancer Risk	5.06E-10		1.25E-08		
Hazard Index		0.0			0.0

**TABLE A.82. Cancer Risk and Hazard Index for Source Area ST48,
Dermal Contact with Surface Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	Cancer Risk	Hazard Quotient
	Cancer	Hazard			
	Risk	Quotient			
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00		0.00E+00	0.00
Summary of Cancer Risk	0.00E+00			0.00E+00	
Hazard Index		0.0			0.0

**TABLE A.83. Cancer Risk and Hazard Index for Source Area ST49,
Dermal Contact with Surface Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	7.74E-10	0.00	4.12E-08	0.00
BENZO(A)PYRENE	3.55E-09	0.00	2.33E-07	0.00
BENZO(B)FLUORANTHENE	2.51E-10	0.00	1.23E-08	0.00
INDENO(1,2,3-CD)PYRENE	8.26E-10	0.00	3.92E-08	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
PESTICIDES				
4,4'-DDD	3.58E-10	0.00	8.72E-09	0.00
METALS				
BERYLLIUM	3.79E-09	0.00	5.18E-08	0.00
Summary of Cancer Risk	9.55E-09		3.86E-07	
Summary of Cancer Risk w/o Metals	5.75E-09		3.35E-07	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.84. Cancer Risk and Hazard Index for Source Area ST50,
Dermal Contact with Surface Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	1.27E-10	0.00	8.80E-09	0.00
SEMI-VOLATILES				
N-NITROSOPIPERIDINE	8.62E-10	0.00	4.95E-08	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
CADMIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	9.89E-10		5.83E-08	
Summary of Cancer Risk w/o Metals	9.89E-10		5.83E-08	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.85. Cancer Risk and Hazard Index for Source Area ST20 E7,
Dermal Contact with Surface Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
TETRACHLOROETHENE	2.90E-10	0.00	5.64E-08	0.00
VINYL CHLORIDE	3.06E-08	0.00	4.44E-06	0.00
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	2.36E-09	0.00	9.90E-08	0.00
BENZO(K)FLUORANTHENE	7.04E-10	0.00	8.70E-08	0.00
CHRYSENE	8.36E-11	0.00	9.93E-09	0.00
INDENO(1,2,3-CD)PYRENE	2.25E-09	0.00	1.59E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	3.63E-08		4.86E-06	
Hazard Index		0.0		0.0

**TABLE A.86. Cancer Risk and Hazard Index for Source Area ST20 E8,
Dermal Contact with Surface Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
DIBENZ(A,H)ANTHRACENE	1.17E-08	0.00	2.62E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.17E-08		2.62E-07	
Hazard Index		0.0		0.0

**TABLE A.87. Cancer Risk and Hazard Index for Source Area ST20 E9,
Dermal Contact with Surface Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
BENZENE	5.29E-10	0.00	2.21E-08	0.00
SEMI-VOLATILES				
CHRYSENE	9.58E-11	0.00	6.05E-09	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	6.24E-10		2.82E-08	
Hazard Index		0.0		0.0

**TABLE A.88. Cancer Risk and Hazard Index for Source Area ST48,
Dermal Contact with Surface Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	Cancer Risk	Hazard Quotient
	Cancer	Hazard			
	Risk	Quotient			
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00		0.00
Summary of Cancer Risk	0.00E+00		0.00E+00		
Hazard Index		0.0			0.0

**TABLE A.89. Cancer Risk and Hazard Index for Source Area ST49,
Dermal Contact with Surface Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	9.54E-10	0.00	9.31E-08	0.00
BENZO(A)PYRENE	4.37E-09	0.00	5.27E-07	0.00
BENZO(B)FLUORANTHENE	3.10E-10	0.00	2.79E-08	0.00
INDENO(1,2,3-CD)PYRENE	1.02E-09	0.00	8.86E-08	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
PESTICIDES				
4,4'-DDD	4.41E-10	0.00	1.97E-08	0.00
METALS				
BERYLLIUM	4.68E-09	0.00	1.17E-07	0.00
Summary of Cancer Risk	1.18E-08		8.73E-07	
Summary of Cancer Risk w/o Metals	7.10E-09		7.56E-07	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.90. Cancer Risk and Hazard Index for Source Area ST50,
Dermal Contact with Surface Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	1.57E-10	0.00	1.99E-08	0.00
SEMI-VOLATILES				
N-NITROSOPIPERIDINE	1.06E-09	0.00	1.12E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.01
METALS				
CADMIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.22E-09		1.32E-07	
Summary of Cancer Risk w/o Metals	1.22E-09		1.32E-07	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.91. Cancer Risk and Hazard Index for Source Area ST20 E7,
Dermal Contact with Subsurface Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
TETRACHLOROETHENE	3.86E-11	0.00	4.10E-09	0.00
VINYL CHLORIDE	4.09E-09	0.00	3.23E-07	0.00
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	3.15E-10	0.00	7.20E-09	0.00
BENZO(K)FLUORANTHENE	9.38E-11	0.00	6.33E-09	0.00
CHRYSENE	1.11E-11	0.00	7.22E-10	0.00
INDENO(1,2,3-CD)PYRENE	3.00E-10	0.00	1.15E-08	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	4.84E-09		3.53E-07	
Hazard Index		0.0		0.0

**TABLE A.92. Cancer Risk and Hazard Index for Source Area ST20 E8,
Dermal Contact with Subsurface Soils, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
DIBENZ(A,H)ANTHRACENE	1.56E-09	0.00	1.90E-08	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.56E-09		1.90E-08	
Hazard Index		0.0		0.0

**TABLE A.93. Cancer Risk and Hazard Index for Source Area ST20 E9,
Dermal Contact with Subsurface Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	7.05E-11	0.00	1.61E-09	0.00
SEMI-VOLATILES				
CHRYSENE	1.28E-11	0.00	4.40E-10	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	8.32E-11		2.05E-09	
Hazard Index		0.0		0.0

**TABLE A.94. Cancer Risk and Hazard Index for Source Area ST48,
Dermal Contact with Subsurface Soil, Industrial Land Use**

ANALYTES	Average Exposure			RME		
	Cancer		Hazard	Cancer		Hazard
	Risk		Quotient	Risk		Quotient
TPH						
TOTAL PETROLEUM HYDROCARBONS	0.00E+00		0.00	0.00E+00		0.00
Summary of Cancer Risk	0.00E+00			0.00E+00		
Hazard Index			0.0			0.0

**TABLE A.95. Cancer Risk and Hazard Index for Source Area ST49,
Dermal Contact with Subsurface Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	1.27E-10	0.00	6.77E-09	0.00
BENZO(A)PYRENE	5.83E-10	0.00	3.83E-08	0.00
BENZO(B)FLUORANTHENE	4.13E-11	0.00	2.03E-09	0.00
INDENO(1,2,3-CD)PYRENE	1.36E-10	0.00	6.44E-09	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
PESTICIDES				
4,4'-DDD	5.88E-11	0.00	1.43E-09	0.00
METALS				
BERYLLIUM	6.23E-10	0.00	8.51E-09	0.00
Summary of Cancer Risk	1.57E-09		6.35E-08	
Summary of Cancer Risk w/o Metals	9.46E-10		5.50E-08	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.96. Cancer Risk and Hazard Index for Source Area ST50,
Dermal Contact with Subsurface Soil, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	2.09E-11	0.00	1.45E-09	0.00
SEMI-VOLATILES				
N-NITROSOPIPERIDINE	1.42E-10	0.00	8.14E-09	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
CADMIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.63E-10		9.58E-09	
Summary of Cancer Risk w/o Metals	1.63E-10		9.58E-09	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.97. Cancer Risk and Hazard Index for Source Area ST20 E7,
Dermal Contact with Subsurface Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
TETRACHLOROETHENE	2.90E-10	0.00	4.29E-08	0.00
VINYL CHLORIDE	3.06E-08	0.00	3.39E-06	0.00
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	2.36E-09	0.00	7.54E-08	0.00
BENZO(K)FLUORANTHENE	7.04E-10	0.00	6.63E-08	0.00
CHRYSENE	8.36E-11	0.00	7.56E-09	0.00
INDENO(1,2,3-CD)PYRENE	2.25E-09	0.00	1.21E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	3.63E-08		3.70E-06	
Hazard Index		0.0		0.0

**TABLE A.98. Cancer Risk and Hazard Index for Source Area ST20 E8,
Dermal Contact with Subsurface Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
DIBENZ(A,H)ANTHRACENE	1.17E-08	0.00	1.99E-07	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.17E-08		1.99E-07	
Hazard Index		0.0		0.0

**TABLE A.99. Cancer Risk and Hazard Index for Source Area ST20 E9,
Dermal Contact with Subsurface Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	5.29E-10	0.00	1.69E-08	0.00
SEMI-VOLATILES				
CHRYSENE	9.58E-11	0.00	4.61E-09	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	6.24E-10		2.15E-08	
Hazard Index		0.0		0.0

**TABLE A.100. Cancer Risk and Hazard Index for Source Area ST48,
Dermal Contact with Subsurface Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	0.00E+00		0.00E+00	
Hazard Index		0.0		0.0

**TABLE A.101. Cancer Risk and Hazard Index for Source Area ST49,
Dermal Contact with Subsurface Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	9.54E-10	0.00	7.09E-08	0.00
BENZO(A)PYRENE	4.37E-09	0.00	4.02E-07	0.00
BENZO(B)FLUORANTHENE	3.10E-10	0.00	2.13E-08	0.00
INDENO(1,2,3-CD)PYRENE	1.02E-09	0.00	6.75E-08	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
PESTICIDES				
4,4'-DDD	4.41E-10	0.00	1.50E-08	0.00
METALS				
BERYLLIUM	4.68E-09	0.00	8.92E-08	0.00
Summary of Cance. Risk	1.18E-08		6.65E-07	
Summary of Cancer Risk w/o Metals	7.10E-09		5.76E-07	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.102. Cancer Risk and Hazard Index for Source Area ST50,
Dermal Contact with Subsurface Soil, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	1.57E-10	0.00	1.52E-08	0.00
SEMI-VOLATILES				
N-NITROSOPIPERIDINE	1.06E-09	0.00	8.52E-08	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
CADMIUM	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.22E-09		1.00E-07	
Summary of Cancer Risk w/o Metals	1.22E-09		1.00E-07	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.103. Cancer Risk and Hazard Index for Source Area ST20 E7,
Inhalation of Resuspended Particulates, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
VOLATILES				
TETRACHLOROETHENE	5.76E-15	0.00	1.39E-13	0.00
VINYL CHLORIDE	1.49E-12	0.00	2.68E-11	0.00
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	7.26E-13	0.00	3.78E-12	0.00
BENZO(K)FLUORANTHENE	2.16E-13	0.00	3.33E-12	0.00
CHRYSENE	2.57E-14	0.00	3.79E-13	0.00
INDENO(1,2,3-CD)PYRENE	6.91E-13	0.00	6.07E-12	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	3.15E-12		4.05E-11	
Hazard Index		0.0		0.0

**TABLE A.104. Cancer Risk and Hazard Index for Source Area ST20 E8,
Inhalation of Resuspended Particulates, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
DIBENZ(A,H)ANTHRACENE	3.60E-12	0.00	1.00E-11	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	3.60E-12		1.00E-11	
Hazard Index		0.0		0.0

**TABLE A.105. Cancer Risk and Hazard Index for Source Area ST20 E9,
Inhalation of Resuspended Particulates, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	1.62E-13	0.00	8.46E-13	0.00
SEMI-VOLATILES				
CHRYSENE	2.95E-14	0.00	2.31E-13	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	1.92E-13		1.08E-12	
Hazard Index		0.0		0.0

**TABLE A.106. Cancer Risk and Hazard Index for Source Area ST48,
Inhalation of Resuspended Particulates, Industrial Land Use**

ANALYTES	Average Exposure			RME	
	Cancer	Hazard		Cancer	Hazard
	Risk	Quotient		Risk	Quotient
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00		0.00	0.00E+00	0.00
Summary of Cancer Risk	0.00E+00			0.00E+00	
Hazard Index			0.0		0.0

**TABLE A.107. Cancer Risk and Hazard Index for Source Area ST49,
Inhalation of Resuspended Particulates, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	2.93E-13	0.00	3.56E-12	0.00
BENZO(A)PYRENE	1.34E-12	0.00	2.01E-11	0.00
BENZO(B)FLUORANTHENE	9.52E-14	0.00	1.07E-12	0.00
INDENO(1,2,3-CD)PYRENE	3.13E-13	0.00	3.39E-12	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
PESTICIDES				
4,4'-DDD	1.36E-13	0.00	7.53E-13	0.00
METALS				
BERYLLIUM	2.81E-11	0.00	8.74E-11	0.00
Summary of Cancer Risk	3.03E-11		1.16E-10	
Summary of Cancer Risk w/o Metals	2.18E-12		2.89E-11	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.108. Cancer Risk and Hazard Index for Source Area ST50,
Inhalation of Resuspended Particulates, Industrial Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	4.82E-14	0.00	7.60E-13	0.00
SEMI-VOLATILES				
N-NITROSOPIPERIDINE	3.27E-13	0.00	4.28E-12	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
CADMIUM	2.14E-11	0.00	9.91E-11	0.00
Summary of Cancer Risk	2.18E-11		1.04E-10	
Summary of Cancer Risk w/o Metals	3.75E-13		5.04E-12	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

**TABLE A.109. Cancer Risk and Hazard Index for Source Area ST20 E7,
Inhalation of Resuspended Particulates, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
TETRACHLOROETHENE	7.10E-15	0.00	2.06E-13	0.00
VINYL CHLORIDE	1.83E-12	0.00	3.97E-11	0.00
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	8.95E-13	0.00	5.60E-12	0.00
BENZO(K)FLUORANTHENE	2.67E-13	0.00	4.92E-12	0.00
CHRYSENE	3.17E-14	0.00	5.61E-13	0.00
INDENO(1,2,3-CD)PYRENE	8.51E-13	0.00	8.98E-12	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
Summary of Cancer Risk	3.89E-12		5.99E-11	
Hazard Index		0.0		0.0

**TABLE A.110. Cancer Risk and Hazard Index for Source Area ST20 E8,
Inhalation of Resuspended Particulates, Residential Land Use**

	Average Exposure		RME		
	Cancer	Hazard			
ANALYTES	Risk	Quotient	Risk		Quotient
SEMI-VOLATILES					
DIBENZ(A,H)ANTHRACENE	4.44E-12	0.00	1.48E-11		0.00
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00		0.00
Summary of Cancer Risk	4.44E-12		1.48E-11		
Hazard Index		0.0			0.0

**TABLE A.111. Cancer Risk and Hazard Index for Source Area ST20 E9,
Inhalation of Resuspended Particulates, Residential Land Use**

ANALYTES	Average Exposure		RME	Cancer Risk	Hazard Quotient
	Cancer	Hazard			
	Risk	Quotient			
VOLATILES					
BENZENE	2.00E-13	0.00	1.25E-12		0.00
SEMI-VOLATILES					
CHRYSENE	3.63E-14	0.00	3.42E-13		0.00
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00		0.00
Summary of Cancer Risk	2.37E-13		1.59E-12		
Hazard Index		0.0			0.0

**TABLE A.112. Cancer Risk and Hazard Index for Source Area ST48,
Inhalation of Resuspended Particulates, Residential Land Use**

	Average Exposure			RME	
	Cancer	Hazard		Cancer	Hazard
ANALYTES	Risk	Quotient		Risk	Quotient
TPH					
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00		0.00E+00	0.00
Summary of Cancer Risk	0.00E+00			0.00E+00	
Hazard Index		0.0			0.0

**TABLE A.113. Cancer Risk and Hazard Index for Source Area ST49,
Inhalation of Resuspended Particulates, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer	Hazard	Cancer	Hazard
	Risk	Quotient	Risk	Quotient
SEMI-VOLATILES				
BENZO(A)ANTHRACENE	3.62E-13	0.00	5.27E-12	0.00
BENZO(A)PYRENE	1.66E-12	0.00	2.98E-11	0.00
BENZO(B)FLUORANTHENE	1.17E-13	0.00	1.58E-12	0.00
INDENO(1,2,3-CD)PYRENE	3.86E-13	0.00	5.01E-12	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
PESTICIDES				
4,4'-DDD	1.67E-13	0.00	1.11E-12	0.00
METALS				
BERYLLIUM	3.46E-11	0.00	1.29E-10	0.00
Summary of Cancer Risk	3.73E-11		1.72E-10	
Summary of Cancer Risk w/o Metals	2.69E-12		4.28E-11	
Hazard Index		0.0		0.0
Hazard Index w/o metals		0.0		0.0

**TABLE A.114. Cancer Risk and Hazard Index for Source Area ST50,
Inhalation of Resuspended Particulates, Residential Land Use**

ANALYTES	Average Exposure		RME	
	Cancer Risk	Hazard Quotient	Cancer Risk	Hazard Quotient
VOLATILES				
BENZENE	5.95E-14	0.00	1.12E-12	0.00
SEMI-VOLATILES				
N-NITROSOPIPERIDINE	4.03E-13	0.00	6.33E-12	0.00
TPH				
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	0.00	0.00E+00	0.00
METALS				
CADMIUM	2.64E-11	0.00	1.47E-10	0.00
Summary of Cancer Risk	2.68E-11		1.54E-10	
Summary of Cancer Risk w/o Metals	4.62E-13		7.45E-12	
Hazard Index		0.0		0.0
Hazard Index w/o Metals		0.0		0.0

APPENDIX B

EXPOSURE FACTORS

APPENDIX B

EXPOSURE FACTORS

This appendix presents the variables that are used in the risk calculations to calculate a potential receptor's chemical intake or exposure. The variables (or exposure factors) fall into three major categories: 1) variables that describe the exposed population, 2) variables that are determined by the toxicity assessment, and 3) variables that are site-specific and chemically-related. The first category is described in the Exposure Factors Tables presented later in this appendix. The second category is described in Section 9.0. The third category includes the chemical concentration in media (Appendix D), modelled concentrations (Appendix K), and chemical-specific parameters in Appendix H, I, and J.

The first category (variables that describe the exposed population) and the second category (variables determined by the toxicity assessment) are presented in Tables B.1 through B.23. Each Exposure Factors table is for a given exposure scenario and land-use permutation examined in the risk assessment.

These tables define exposure parameters and their associated variables, such as exposure duration, exposure frequency, intake rate, contact rate, and body weight. The exposed individual (worker, adult, child) is identified. The averaging time or the period over which the exposure is averaged (days or years) is also presented. The averaging time selected depends upon the type of toxic effect being assessed.

The third category of variable (those that are site-specific and chemically-related) includes the projected chemical concentration over the exposure period. In this risk assessment the risks are defined by designated site source area and media sampled. For the reasonable maximum exposure scenario, the chemical concentration is assumed to be either the 95% upper confidence limit of the measured data or the maximum detected value if the data set is less than five data points. For contaminants with less than six data points in a medium, the maximum concentration is used in lieu of the 95%

upper confidence limit. In the case of the average exposure scenario, the chemical concentration is assumed to be the average (arithmetic) concentration. The values are presented in Tables 2.2, 3.2, 4.2, 5.2, 6.2, and 7.2. These tables are entitled "Concentrations of Chemicals of Concern for the Source Area...."

Demographic information for Eielson Air Force Base is in Appendix F. The current land use for all Operable Unit 1 sites is industrial and this fact is reflected in the risk assessment. Projected land use for all Operable Unit 1 sites is industrial (U.S. Air Force 1993a,b). Therefore, a future industrial land-use exposure scenario was also calculated for each site. In addition, a future residential land-use exposure scenario was calculated for each site.

The majority of the exposure factors listed are from U.S. EPA Region X guidance (U.S. EPA 1991). Those exposure factors that do not adhere to guidance have footnotes noting their source. The exposure duration for the average exposure scenario for industrial land is nine years. This assessment assumed that the value is equivalent to the average nine year residence in a home (U.S. EPA 1991).

Exposure duration for surface soils, for both ingestion and dermal contact, and particulate inhalation did not adhere to guidance. The values were adjusted to compensate for the sub-arctic climate at Eielson. The values used (146 days for industrial and 180 days for residential) were adjusted based on the number of days in Fairbanks without snow cover. The mean number of days without snow cover at Fairbanks is 146 days; 180 days is presented as a reasonable maximum value. These values were initially advanced by the Management Plan for Operable Units 1 of Eielson (U.S. Air Force 1993).

The exposure duration for subsurface soils for industrial land use, for both ingestion and dermal contact, do not adhere to guidance. The duration was adjusted to represent a trench worker scenario.

No fishable waters are affected by the site, nor is surface water in the path of any groundwater plumes. There are seven natural drainage ponds with dense willow and birch growth and tall grass. The ponds are enclosed by the refueling loop and are down-gradient of sites ST20 E-7 and ST20 E-8. The

nearest such pond is 350 m downgradient of ST20 E-7 while another pond is approximately 400 m downgradient from ST20 E-8. The location and limited access to these ponds currently preclude their use for recreation. In addition, these ponds are not industrially maintained; therefore, no worker exposure is anticipated.

There is no known subsistence or recreational fishing at Eielson. The limited size and depth of the surface-water bodies should also preclude chemical exposure via fishing. Garrison Slough does contain fish and is located approximately 300 southwest of the ST20 Complex. However, Garrison Slough is not known to be affected by any OU-1 source area. The slough is less than one meter deep and frozen much of the year.

References

OSWER. 1991. Directive 9285.6-03, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, March 1991.

U.S. Air Force. 1993a. Management Plan: Operable Units 1 Eielson Air Force Base.

U.S. Air Force. 1993b. Remedial Investigation/Feasibility Study -- Operable Unit 1 Eielson Air Force Base, Alaska, Volume 1.

U.S. Air Force. 1992. Remedial Investigation/Feasibility Study -- Operable Units 3, 4, and 5 Management Plan. Eielson Air Force Base, Alaska.

U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington.

TABLE B.1. Exposure Factors for Ingestion of Groundwater: Industrial Land Use

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body (BW)Weight (kg)	70	70	70	70
Exposure Duration (ED)(y)	g ^(b)	g ^(b)	25	25
Exposure Frequency (EF)(d/y)	250	250	250	250
Ingestion Rate (IR) (L H ₂ O/d)	1	1	1	1
Averaging Time (AT) (y)	g ^(b)	70	25	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 b).
- (b) Factor for average residence in a home (reference [a], Table III-1 b).

TABLE B.2. Exposure Factors for Ingestion of Groundwater: Residential Land Use

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	adult	adult	adult	adult
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9	9	30	30
Exposure Frequency (EF) (d/y)	275	275	350	350
Ingestion Rate (L H ₂ O/d)	1.4	1.4	2	2
Averaging Time (AT) (y)	9	70	30	70

Note: all factors were obtained from, U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a.)

TABLE B.3. Exposure Factors for Dermal Contact with Contaminants During Groundwater Use: Industrial Land Use

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (years)	g ^(b)	g ^(b)	25	25
Exposure Frequency (EF) (d/y)	250	250	250	250
Event Duration (T _{event}) (h/d)	0.12 ^(c)	0.12 ^(c)	0.17 ^(c)	0.17 ^(c)
Skin Surface Area Exposed (SA) (cm ²)	20,000 ^(c)	20,000 ^(c)	20,000 ^(c)	20,000 ^(c)
Averaging Time (AT) (years)	g ^(b)	70	25	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 b).
- (b) Factor for average residence in a home (reference [a], Table III-1 a).
- (c) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a.)

TABLE B.4. Exposure Factors for Dermal Contact with Contaminants During Groundwater Use: Residential Land Use

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	adult	adult	adult	adult
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9	9	30	30
Exposure Frequency (EF) (d/y)	275	275	350	350
Event Duration (T_{event}) (h/d)	0.12	0.12	0.17	0.17
Skin Surface Area (SA) Exposed (cm^2)	20,000	20,000	20,000	20,000
Averaging Time (AT) (y)	9	70	30	70

Note: all factors were obtained from, U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a.)

TABLE B.5. Exposure Factors for Inhalation of Volatile Contaminants During Groundwater Use: Industrial Land Use

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9 ^(b)	9 ^(b)	25	25
Exposure Frequency (EF) (d/y)	250	250	250	250
Event Duration (T _{event}) (h/d)	0.12 ^(c)	0.12 ^(c)	0.17 ^(c)	0.17 ^(c)
Inhalation Rate (IR) (m ³ /d)	15 ^(c)	15 ^(c)	15 ^(c)	15 ^(c)
Averaging Time (AT) (y)	9	70	25	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 b).
- (b) Factor for average residence in a home (reference [a], Table III-1 a).
- (c) Factor for daily indoor inhalation rate from OSWER Directive 9285.6-03, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, March 1991.

TABLE B.6. Exposure Factors for Inhalation of Volatile Contaminants During Groundwater Use: Residential Land Use

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	adult	adult	adult	adult
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9	9	30	30
Exposure Frequency (EF) (d/y)	275	275	350	350
Event Duration (T _{event}) (h/d)	0.12 ^(c)	0.12 ^(c)	0.17 ^(c)	0.17 ^(c)
Inhalation Rate (IR) (m ³ /day)	15 ^(b)	15 ^(b)	15 ^(b)	15 ^(b)
Averaging Time (AT) (y)	9	70	30	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a).
- (b) Factor for daily indoor inhalation rate from OSWER Directive 9285.6-03, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, March 1991.
- (c) Factor for daily indoor inhalation rate from OSWER Directive 9285.6-03, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, March 1991.

**TABLE B.7. Exposure Factors for Incidental Ingestion of Surface Water:
Industrial Land Use**

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9 ^(b)	9 ^(b)	25	25
Exposure Frequency (EF) (d/y)	10 ^(c)	10 ^(c)	10 ^(c)	20 ^(c)
Ingestion Rate (IR) (L H ₂ O/d)	0.1 ^(d)	0.1 ^(d)	0.2 ^(e)	0.2 ^(e)
Averaging Time (AT) (y)	9 ^(b)	70	25	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 b).
- (b) Factor for average residence in a home (reference [a], Table III-1 a).
- (c) Assumes two 5-day pond maintenance projects per year.
- (d) 10% of industrial water intake rate (reference [a]).
- (e) 20% of industrial water intake rate (reference [a]).

**TABLE B.8. Exposure Factors for Incidental Ingestion of Surface Water:
Residential Land Use**

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	adult	adult	adult	adult
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9	9	30	30
Exposure Frequency (EF) (d/y)	7 ^(b)	7 ^(b)	7 ^(b)	7 ^(b)
Ingestion Rate (IR) (L H ₂ O/d)	0.2 ^(c)	0.2 ^(c)	0.4 ^(d)	0.4 ^(d)
Averaging Time (AT) (y)	9	70	30	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a).
- (b) Assumes same frequency for nonswimming water sports (e.g., fishing, boating, picnicking) as suggested for "swimming" in reference [a].
- (c) 10 % of residential water intake rate (reference [a]).
- (d) 20 % of residential water intake rate (reference [a]).

TABLE B.9. Exposure Factors for Ingestion of Fish: Industrial Land Use

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9 ^(b)	9 ^(b)	25	25
Exposure Frequency (EF) (d/y)	7 ^(c)	7 ^(c)	7 ^(c)	7 ^(c)
Ingestion Rate (IR) (g of fish/d)	54 ^(d)	54 ^(d)	54 ^(d)	54 ^(d)
Averaging Time (AT) (y)	9 ^(b)	70	25	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 b).
- (b) Factor for average residence in a home (reference [a], Table III-1 a).
- (c) Assumes same frequency for nonswimming water sports (e.g., fishing, boating, picnicking as suggested for "swimming" in reference [a]).
- (d) OSWER Directive 9285.6-03, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, March 1991.

TABLE B.10. Exposure Factors for Ingestion of Fish: Residential Land Use

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9	9	30	30
Exposure Frequency (EF) (d/y)	7 ^(b)	7 ^(b)	7 ^(b)	7 ^(b)
Ingestion Rate (IR) (g of fish/d)	54 ^(c)	54 ^(c)	54 ^(c)	54 ^(c)
Averaging Time (AT) (y)	9	70	30	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a).
- (b) Assumes same frequency for nonswimming water sports (e.g., fishing, boating, picnicking as suggested for "swimming" in reference [a]).
- (c) OSWER Directive 9285.6-03, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, March 1991.

**TABLE B.11. Exposure Factors for Incidental Ingestion of Surface Soils:
Industrial Land Use**

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9 ^(b)	9 ^(b)	25	25
Exposure Frequency (EF) (d/y)	146 ^(c)	146 ^(c)	146 ^(c)	146 ^(c)
Ingestion Rate (mg soil/d)	50	50	50	50
Averaging Time (AT) (y)	9 ^(b)	70	25	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 b).
- (b) Factor for average residence in a home (reference [a], Table III-1 a).
- (c) Value represents the average number of days without snow cover. See U.S. Air Force. 1992. Remedial Investigation/Feasibility Study -- Operable Units 3, 4, and 5 Management Plan. Eielson Air Force Base, Alaska.

**TABLE B.12. Exposure Factors for Incidental Ingestion of Surface Soils:
Residential Land Use**

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	adult	adult	child/adult	child/adult
Body Weight (BW) (kg)	70	70	15/70	15/70
Exposure Duration (ED) (y)	9	9	6/24	6/24
Exposure Frequency (EF) (d/y)	180 ^(b)	180 ^(b)	180/180 ^(b)	180/180 ^(b)
Ingestion Rate (IR) (mg soil/d)	100	100	200/100	200/100
Averaging Time (AT) (y)	9	70	30/30	70/70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a).
- (b) U.S. Air Force. 1992. Remedial Investigation/Feasibility Study -- Operable Units 3, 4, and 5 Management Plan, Eielson Air Force Base, Alaska.

TABLE B.13. Exposure Factors for Ingestion of Plants Grown in Contaminated Soils: Residential Land Use

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	adult	adult	adult	adult
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9	9	30	30
Exposure Frequency (EF) (d/y)	275	275	350	350
Ingestion Rate (IR) (g of vegetables/d)	80 ^(b)	80 ^(b)	80 ^(b)	80 ^(b)
Averaging Time (AT) (y)	9	70	30	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a).
- (b) OSWER Directive 9285.6-03, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, March 1991. (Note: the Fairbanks, Alaska, growing season is too short to support fruit production: thus, only the factor for vegetable consumption is used.)

**TABLE B.14. Exposure Factors for Incidental Ingestion of Subsurface Soils:
Industrial Land Use**

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9 ^(b)	9 ^(b)	25	25
Exposure Frequency (EF) (d/y)	24 ^(c)	24 ^(c)	24 ^(c)	24 ^(c)
Ingestion Rate (IR) (mg soil/d)	50	50	50	50
Averaging Time (AT) (y)	9 ^(b)	70	25	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a).
- (b) Factor for average residence in a home (reference [a], Table III-1 a).
- (c) Trench worker scenario. See U.S. Air Force. 1992. Remedial Investigation/Feasibility Study -- Operable Units 3, 4, and 5 Management Plan. Eielson Air Force Base, Alaska.

**TABLE B.15. Exposure Factors for Incidental Ingestion of Subsurface Soils:
Residential Land Use**

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	adult	adult	child/adult	child/adult
Body Weight (BW) (kg)	70	70	15/70	15/70
Exposure Duration (ED) (y)	9	9	6/24	6/24
Exposure Frequency (EF) (d/y)	180 ^(b)	180 ^(b)	180/180 ^(b)	180/180 ^(b)
Ingestion Rate (IR) (mg soil/d)	100	100	200/100	200/100
Averaging Time (AT) (y)	9	70	30/30	70/70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a).
- (b) U.S. Air Force. 1992. Remedial Investigation/Feasibility Study -- Operable Units 3, 4, and 5 Management Plan. Eielson Air Force Base, Alaska.

TABLE B.16. Exposure Factors for Inhalation of Volatile Contaminants Released From Soil Into Ambient Air: Industrial Land Use

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9 ^(b)	9 ^(b)	25	25
Exposure Frequency (EF) (d/y)	250	250	250	250
Inhalation Rate (IR) (m ³ /d)	5 ^(c)	5 ^(c)	5 ^(c)	5 ^(c)
Averaging Time (AT) (y)	9	70	25	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a).
- (b) Factor for average residence in a home (reference [a], Table III-1 a).
- (c) Total intake rate of 20 m³/day is assumed. 25% of intake is assumed to be from inhalation of volatiles released from soil (outdoor). If there is no groundwater source for volatiles (indoor), it is concluded that 100% of intake rate is from inhalation of volatiles released from soil. The rates are based on OSWER Directive 9285.6-03, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, March 1991.

**TABLE B.17. Exposure Factors for Inhalation of Volatile Contaminants
Released From Soil Into Ambient Air:
Residential Land Use**

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9	9	30	30
Exposure Frequency (EF) (d/y)	275	275	350	350
Inhalation Rate (IR) (m^3_{air}/d)	5 ^(b)	5 ^(b)	5 ^(b)	5 ^(b)
Averaging Time (AT) (y)	9	70	30	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a).
- (b) Total intake rate of 20 m^3 /day is assumed. 25% of intake is assumed to be from inhalation of volatiles released from soil (outdoor). If there is no groundwater source for volatiles (indoor), it is concluded that 100% of intake rate is from inhalation of volatiles released from soil. The rates are based on OSWER Directive 9285.6-03, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, March 1991.

**TABLE B.18. Exposure Factors for Dermal Contact with Surface Soils:
Industrial Land Use**

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9 ^(b)	9 ^(b)	25	25
Exposure Frequency (EF) (events/y)	146 ^(c)	146 ^(c)	146 ^(c)	146 ^(c)
Soil-to-Skin Adherence Factor (AF) (mg/cm ²)	0.6 ^(d)	0.6 ^(d)	1.0 ^(d)	1.0 ^(d)
Surface Area (SA) (cm ² /event)	1900 ^(d)	1900 ^(d)	5000 ^(d)	5000 ^(d)
Averaging Time (AT) (y)	9 ^(b)	70	25	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 b).
- (b) Factor for average residence in a home (reference [a], Table III-1 a).
- (c) U.S. Air Force. 1992. Remedial Investigation/Feasibility Study -- Operable Units 3, 4, and 5 Management Plan. Eielson Air Force Base, Alaska.
- (d) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a).

**TABLE B.19. Exposure Factors for Dermal Contact with Surface Soils:
Residential Land Use**

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	adult	adult	child/adult	child/adult
Body Weight (BW) (kg)	70	70	15/70	15/70
Exposure Duration (ED) (y)	9	9	6/24	6/24
Exposure Frequency (events/y)	180 ^(b)	180 ^(b)	180/180 ^(b)	180/180 ^(b)
Soil-to-Skin Adherence Factor (AF) (mg/cm ²)	0.6	0.6	1.0	1.0
Surface Area (SA) (cm ² /event)	1900	1900	3900/5000	3900/5000
Averaging Time (AT) (y)	9	70	30/30	70/70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 b).
- (b) U.S. Air Force. 1992. Remedial Investigation/Feasibility Study -- Operable Units 3, 4, and 5 Management Plan. Eielson Air Force Base, Alaska.

**TABLE B.20. Exposure Factors for Dermal Contact with Subsurface Soils:
Industrial Land Use**

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9 ^(b)	9 ^(b)	25	25
Exposure Frequency (events/y)	24 ^(c)	24 ^(c)	24 ^(c)	24 ^(c)
Soil-to-Skin Adherence Factor (AF) (mg/cm ²)	0.6 ^(d)	0.6 ^(d)	1.0 ^(d)	1.0 ^(d)
Surface Area (SA) (cm ² /event)	1900 ^(d)	1900 ^(d)	5000 ^(d)	5000 ^(d)
Averaging Time (AT) (y)	9 ^(b)	70	25	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 b).
- (b) Factor for average residence in a home (reference [a], Table III-1 a).
- (c) Trench worker scenario, see U.S. Air Force. 1992. Remedial Investigation/Feasibility Study -- Operable Units 3, 4, and 5 Management Plan. Eielson Air Force Base, Alaska.
- (d) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a).

**TABLE B.21. Exposure Factors for Dermal Contact with Subsurface Soils:
Residential Land Use**

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	adult	adult	child/adult	child/adult
Body Weight (BW) (kg)	70	70	15/70	15/70
Exposure Duration (ED) (y)	9	9	6/24	6/24
Exposure Frequency (EF) (events/y)	180 ^(b)	180 ^(b)	90/180 ^(b)	90/180 ^(b)
Soil-to-Skin Adherence Factor (AF) (mg/cm ²)	0.6	0.6	1.0	1.0
Surface Area (SA) (cm ² /event)	1900	1900	3900/5000	3900/5000
Averaging Time (AT) (y)	9	70	30/30	70/70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 a).
- (b) U.S. Air Force. 1992. Remedial Investigation/Feasibility Study -- Operable Units 3, 4, and 5 Management Plan. Eielson Air Force Base, Alaska.

**TABLE B.22. Exposure Factors for Inhalation of Resuspended Particulates:
Industrial Land Use**

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9 ^(b)	9 ^(b)	25	25
Exposure Frequency (EF) (d/y)	146 ^(c)	146 ^(c)	146 ^(c)	146 ^(c)
Inhalation Rate (IR) (m ³ /d)	20	20	20	20
Averaging Time (AT) (y)	9 ^(b)	70	25	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 b).
- (b) Factor for average residence in a home (reference [a], Table III-1 a).
- (c) U.S. Air Force. 1992. Remedial Investigation/Feasibility Study -- Operable Units 3, 4, and 5 Management Plan. Eielson Air Force Base, Alaska.

**TABLE B.23. Exposure Factors for Inhalation of Resuspended Particulates:
Residential Land Use**

Exposure Parameter	Average Exposure		Reasonable Maximum Exposure	
	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen
Exposed Individual	worker	worker	worker	worker
Body Weight (BW) (kg)	70	70	70	70
Exposure Duration (ED) (y)	9	9	30	30
Exposure Frequency (EF) (d/y)	180 ^(b)	180 ^(b)	180 ^(b)	180 ^(b)
Inhalation Rate (IR) (m ³ /d)	20	20	20	20
Averaging Time (AT) (y)	9	70	30	70

Note: all factors were obtained from reference (a), below, unless otherwise noted.

- (a) U.S. EPA. 1991. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Seattle, Washington. (Table III-1 b).
- (b) U.S. Air Force. 1992. Remedial Investigation/Feasibility Study -- Operable Units 3, 4, and 5 Management Plan. Eielson Air Force Base, Alaska.

APPENDIX C

MODELS USED FOR OUTDOOR VOLATILIZATION AND PARTICLE RESUSPENSION

APPENDIX C

MODELS USED FOR OUTDOOR VOLATILIZATION AND PARTICLE RESUSPENSION

C.1 Volatilization

In accordance with U.S. EPA (1991a, p.26), a volatile contaminant is defined as a chemical having a unitless Henry's law constant exceeding 10^{-4} and molecular weight of less than 200. For volatile compounds in soil, the outdoor ambient air concentrations of the volatiles were computed as $C_{air} = C_{soil} / VF$, where C_{air} and C_{soil} are concentrations in air (mg/m^3) and in soil (mg/kg), respectively, and VF (m^3/kg) is the soil-to-air volatilization factor. This factor is given in U.S. EPA (1991b, pp. 26-30) as

$$VF = \left(\frac{LS \times V \times DH}{A} \right) \times \frac{(3.14 \times \alpha \times T)^{1/2}}{2 \times D_{e1} \times E \times K_{as} \times 10^{-3} kg/g} \quad (C.1)$$

where

$$\alpha \text{ (cm}^2/\text{sec)} = \frac{(D_{e1} \times E)}{E + (P_s)(1 - E)/K_{as}} \quad (C.2)$$

Standard default parameters given in U.S. EPA (1991b, p. 29) were used to calculate this factor. They are listed below.

<u>Parameter</u>	<u>Definition (units)</u>	<u>Default</u>
LS	length of side of contaminated area (m)	45 m
V	wind speed in mixing zone (m/s)	2.25 m/s
DH	diffusion height (m)	2 m
A	area of contamination (cm^2)	20,250,000 cm^2
D_{e1}	effective diffusivity (cm^2/s)	$D_i \times E^{0.33}$
E	true soil porosity (unitless)	0.35
K_{as}	soil/air partition coefficient (g soil/ cm^3 air)	$H/K_d \times 41$
P_s	true soil density (g/cm^3)	2.65 g/cm^3
T	exposure interval (s)	7.9×10^8 s
D_i	gas diffusivity (cm^2/s)	Appendix G
H	Henry's law constant ($atm \cdot m^3/mol$)	Appendix G
K_d	soil water partition coefficient (cm^3/g)	$K_{oc} \times OC$
K_{oc}	organic carbon partition coefficient (cm^3/g)	Appendix G
OC	organic carbon content (fraction)	0.02

C.2 Resuspension of Particulates

The release of contaminated particulates is calculated as in $C_{air} = C_{soil}/PEF$ where C_{air} (mg/m³) and C_{soil} (mg/kg) are respectively air and soil contaminant concentrations. The value for the particulate emission factor (PEF) is calculated similarly to U.S. EPA (1991b, pp. 29-30) as:

$$PEF(m^3/kg) = \frac{LS \times V \times DH \times 3600s/hr}{A} \times \frac{1000g/kg}{0.036 \times (1-G) \times (U_m/U_t)^3 \times F(x)}$$

(C.3)

Standard default parameters given in EPA (1991b, p. 30) were used to calculate this factor. They are listed below.

<u>Parameter</u>	<u>Definition (units)</u>	<u>Default</u>
PEF	particulate emission factor (m ³ /kg)	4.63 x 10 ⁹ m ³ /kg
LS	width of contaminated area (m)	45 m
V	wind speed in mixing zone (m/s)	2.25 m/s
DH	diffusion height (m)	2 m
A	area of contamination (m ²)	2025 m ²
0.036	respirable fraction (g/m ² -hr)	0.036 g/m ² -hr
G	fraction of vegetative cover (unitless)	0
U _m	mean annual wind speed (m/s)	4.5 m/s
U _t	equivalent threshold value of wind speed at 10 m (m/s)	12.8 m/s
F(x)	function dependent on U _m /U _t (unitless)	0.0497 (Cowherd 1985)

The inhalation of soil and dust particles above 10 microns in diameter is accounted for in the soil-ingestion pathway. This is because large particles are trapped in the nasal passages, or on the mucous-ciliary blanket of the bronchial stems, and thus delivered to the cilia tract (not the respiratory system) for absorption/excretion. A conservative estimate is that ten percent (10%) of soil/dust particle loading in the air at any given time during a dust event is below the 10-micron cutoff. This means that the particulate inhalation pathway would constitute approximately ten percent of the inhalation portion of the ingested dose.

The soil-ingestion and particulate-inhalation pathways are evaluated (in

the risk assessment) for exposure frequencies of 146 and 180 days/year. These exposure frequencies are significantly less than the U.S. EPA (1991a) and U.S. EPA (1991c) guidance values of 250 and 350 days/year. The discrepancy is caused by the atypical climate of the Fairbanks, Alaska, region. The average number of days per year without snow cover in this area is 147 days (U.S. Air Force 1992). Snow cover would prevent dust generation. Summer rains would further reduce the total number of days per year available for dust generation.

REFERENCES

Cowherd, C., G. Muleski, P. Engelhart, and D. Gillete. 1985. Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination. Prepared for U.S. EPA Office of Health and Environmental Assessment. EPA/600/8-85/002.

U.S. Air Force. 1992. Remedial Investigation/Feasibility Study -- Operable Units 3, 4, and 5 Management Plan. Eielson Air Force Base, Alaska.

U.S. EPA. 1991a. "Supplemental Guidance for Superfund Risk Assessments in Region 10." U.S. Environmental Protection Agency, Region 10, Seattle, Washington. August 16, 1991.

U.S. EPA. 1991b. Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals). U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. (Interim). Pub. 9285.7-01B Dec. 1991.

U.S. EPA. 1991c. OSWER Directive 9285.6-03, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, March 1991.

APPENDIX D

CHEMICAL CONCENTRATIONS AND MONITORING DATA

APPENDIX D

CHEMICAL CONCENTRATIONS AND MONITORING DATA

The chemical analytical data were abstracted into a database and examined to determine the contaminant distribution and the rate of prevalence (i.e., the percent of positive detections per number of analyses). The sampling results are presented in this appendix. Summary statistics for the chemicals of concern are presented by source area in the subsections entitled "Exposure Point Concentrations." The data are from the 1989 and 1991 sampling efforts.

If a chemical was not detected, then Tables D.1 through D.6 list the maximum contract required quantitation limit (CRQL) reported for that chemical at the site. That is, all analyses for this chemical at the site had an EPA "U" qualifier (the compound was analyzed for, but not detected [U.S. EPA 1989]). Tables D.7 through D.12 list the concentrations for each analyte in each medium.

REFERENCE

U.S. EPA. 1989. Risk Assessment Guidance for Superfund (RAGS). Human Health Evaluation Manual: Part A. Interim Final. Office of Solid Waste and Emergency Response, Washington, DC. EPA/540/1-89/002. Available from NTIS, Springfield, VA; PB-90155581.

TABLE D.1. Analyte Detection Frequency for Source Area ST20-7

Analytes Measured	CAS Number	Matrix ^(a) Code	Number of Samples	Number of Detects	Fraction of Detects
Benzene	71-43-2	AG	25	8	0.32
Ethylbenzene	100-41-4	AG	7	1	0.14
mXylene	106-38-3	AG	10	10	1.00
Toluene	108-88-3	AG	6	6	1.00
Total BTEX	BTEX	AG	8	8	1.00
1,1-Dichloroethylene	75-35-4	SO	3	0	0.00
2-Butanone	78-93-3	SO	3	0	0.00
2-Methyl Phenol	95-48-7	SO	2	0	0.00
2-Methylnaphthalene	91-57-6	SO	9	1	0.11
4-Methyl Phenol	106-44-5	SO	3	0	0.00
Acenaphthylene	208-96-8	SO	3	0	0.00
Benzene	71-43-2	SO	4	0	0.00
Benzo(A)Anthracene	56-55-3	SO	2	1	0.50
Benzo(B)Fluoranthene	205-99-2	SO	1	0	0.00
Benzo(G,H,I)Perylene	191-24-2	SO	3	0	0.00
Benzo(K)Fluoranthene	207-08-9	SO	9	1	0.11
Chlorobenzene	108-96-7	SO	14	0	0.00
Chloroform	67-66-3	SO	4	0	0.00
Chrysene	218-01-9	SO	12	3	0.25
Dibenzo(A,H)Anthracene	53-70-3	SO	4	0	0.00
Indeno(1,2,3-CD)Pyrene	193-39-5	SO	8	3	0.38
Methylene Chloride	75-09-2	SO	3	0	0.00
oXylene	95-47-6	SO	3	0	0.00
Tetrachloroethene	79-01-6	SO	10	1	0.06
Total Xylenes	1330-20-7	SO	9	1	0.11
TPH	TPH	SO	9	5	0.56
Vinyl Chloride	75-01-4	SO	9	1	0.11
1,1-Dichloroethylene	75-35-4	WD	9	1	0.11
2,4-Dimethylphenol	105-87-9	WD	1	0	0.00
4-Methyl Phenol	106-44-5	WD	7	0	0.00
Acenaphthene	83-32-9	WD	4	0	0.00
Acenaphthylene	208-96-8	WD	3	0	0.00
Aluminum, Total	7429-90-5	WD	1	1	1.00

TABLE D.1. (cont.)

Arsenic, DISS	7446-38-2	WD	2	2	1.00
Arsenic, Total	7446-38-2	WD	1	1	1.00
Barium, DISS	7446-39-3	WD	1	1	1.00
Barium, Total	7446-39-3	WD	1	1	1.00
Benzo(A)Anthracene	56-55-3	WD	7	0	0.00
Benzo(G,H,I)Perylene	191-24-2	WD	7	0	0.00
BIS (2-Ethylhexyl)phthalate	117-81-7	WD	7	3	0.43
Calcium, DISS	7446-78-2	WD	1	1	1.00
Calcium, Total	7446-78-2	WD	1	1	1.00
Chloride	CHLORIDE	WD	6	1	0.17
Chlorobenzene	106-96-7	WD	19	1	0.05
Chromium	7446-47-3	WD	1	1	1.00
Cobalt, Total	7446-48-4	WD	1	1	1.00
Copper, Total	7446-58-8	WD	1	1	1.00
Dibenzofuran	132-64-9	WD	7	0	0.00
Ethylbenzene	106-41-4	WD	14	3	0.21
Fluoranthene	266-44-6	WD	7	0	0.00
Fluorene	86-73-7	WD	2	0	0.00
Indeno(1,2,3-CD)Pyrene	193-39-5	WD	5	0	0.00
Iron, DISS	7439-89-6	WD	1	1	1.00
Iron, Total	7439-89-6	WD	1	1	1.00
Lead, Total	7439-92-1	WD	2	2	1.00
m,p-Xylene	106-38-3	WD	7	3	0.43
Magnesium, DISS	7439-95-4	WD	1	1	1.00
Magnesium, Total	7439-95-4	WD	1	1	1.00
Manganese, DISS	7439-96-5	WD	1	1	1.00
Manganese, Total	7439-96-5	WD	1	1	1.00
Mercury, DISS	7439-97-6	WD	1	1	1.00
Mercury, Total	7439-97-6	WD	1	1	1.00
Naphthalene	91-20-3	WD	7	4	0.57
Nickel	7446-02-0	WD	1	1	1.00
Nitrogen, NO2+NO3	NO2+NO3	WD	7	3	0.43
oXylene	95-47-6	WD	7	2	0.29
Phenol	106-95-2	WD	7	3	0.43

TABLE D.1. (cont.)

Potassium, DISS	7448-89-7	WD	1	1	1.00
Potassium, Total	7448-89-7	WD	1	1	1.00
Pyrene	129-86-8	WD	3	0	0.00
Sodium, DISS	7448-23-5	WD	1	1	1.00
Sodium, Total	7448-23-5	WD	1	1	1.00
Sulfate	SULFATE	WD	7	1	0.14
Toluene	108-88-3	WD	4	2	0.50
Total Xylenes	1338-26-7	WD	7	3	0.43
Vanadium, Total	7448-62-2	WD	1	1	1.00
Vinyl Chloride	75-01-4	WD	3	0	0.00
Zinc, DISS	7448-86-8	WD	1	1	1.00
Zinc, Total	7448-86-8	WD	1	1	1.00

(a) SO = soil
AG = soil gas
WD = groundwater

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TABLE D.2. Analyte Detection Frequency for Source Area ST20 E-8

Analytes Measured	CAS Number	Matrix ^(a) Code	Number of Samples	Number of Detects	Fraction of Detects
Benzene	71-43-2	AG	12	4	0.33
Ethylbenzene	100-41-4	AG	9	3	0.33
mXylene	106-38-3	AG	3	3	1.00
Total BTEX	BTEX	AG	14	7	0.50
1,1-Dichloroethylene	75-35-4	SO	3	0	0.00
2-Butanone	78-93-3	SO	3	0	0.00
2-Methyl Phenol	95-48-7	SO	7	0	0.00
2-Methylnaphthalene	91-57-6	SO	2	1	0.50
4-Methyl Phenol	106-44-5	SO	3	0	0.00
Acenaphthylene	208-98-8	SO	3	0	0.00
Anthracene	128-12-7	SO	7	0	0.00
Benzene	71-43-2	SO	3	0	0.00
Benzo(A)Pyrene	50-32-8	SO	1	0	0.00
Benzo(B)Fluoranthene	205-99-2	SO	3	0	0.00
Benzo(G,H,I)Perylene	191-24-2	SO	2	1	0.50
Benzo(K)Fluoranthene	207-08-9	SO	2	0	0.00
Chlorobenzene	108-96-7	SO	9	0	0.00
Chloroform	67-66-3	SO	3	0	0.00
Chrysene	218-01-9	SO	2	0	0.00
Dibenzo(A,H)Anthracene	53-70-3	SO	1	1	1.00
Fluorene	86-73-7	SO	7	0	0.00
Indeno(1,2,3-CD)Pyrene	193-39-5	SO	1	0	0.00
Methylene Chloride	75-09-2	SO	3	0	0.00
Tetrachloroethene	79-01-6 ^(b)	SO	3	0	0.00
Total Xylenes	1330-26-7	SO	5	0	0.00
TPH	TPH	SO	8	7	0.88
Vinyl Chloride	75-01-4	SO	8	0	0.00
1,1,2,2-Tetrachloroethane	79-34-5	WD	5	0	0.00
1,1-Dichloroethylene	75-35-4	WD	8	3	0.38
2,4-Dimethylphenol	105-67-9	WD	8	0	0.00
2-Methyl Phenol	95-48-7	WD	8	0	0.00
2-Methylnaphthalene	91-57-6	WD	8	0	0.00
4-Methyl Phenol	106-44-5	WD	8	1	0.13

TABLE D.2. (cont.)

Acenaphthene	83-32-9	WD	9	0	0.00
Acenaphthylene	208-96-8	WD	7	0	0.00
Anthracene	120-12-7	WD	8	0	0.00
Benzene	71-43-2	WD	2	1	0.50
Benzo(A)Anthracene	56-55-3	WD	4	0	0.00
Benzo(A)Pyrene	50-32-8	WD	7	0	0.00
Benzo(B)Fluoranthene	205-99-2	WD	4	0	0.00
Benzo(G,H,I)Perylene	191-24-2	WD	1	0	0.00
Benzo(K)Fluoranthene	207-08-9	WD	8	0	0.00
Benzoic Acid	65-85-0	WD	7	1	0.14
Benzyl Alcohol	100-51-6	WD	11	0	0.00
BIS (2-Ethylhexyl)phthalate	117-81-7	WD	12	1	0.00
Chloride	CHLORIDE	WD	1	0	0.00
Chlorobenzene	108-90-7	WD	10	0	0.00
Chloroform	67-66-3	WD	1	0	0.00
Chrysene	218-01-9	WD	1	0	0.00
Dibenzo(A,H)Anthracene	53-70-3	WD	8	0	0.00
Dibenzofuran	132-84-9	WD	8	0	0.00
Ethylbenzene	100-41-4	WD	53	15	0.28
Fluoranthene	206-44-0	WD	8	1	0.13
Fluorene	86-73-7	WD	8	0	0.00
Indeno(1,2,3-CD)Pyrene	193-39-5	WD	8	0	0.00
m,p-Xylene	106-38-3	WD	32	11	0.34
Methylene Chloride	75-09-2	WD	11	4	0.36
Naphthalene	91-20-3	WD	8	1	0.13
Nitrogen, NO2+NO3	NO2+NO3	WD	1	0	0.00
oXylene	95-47-8	WD	32	6	0.19
Phenanthrene	85-01-8	WD	8	1	0.13
Phenol	108-95-2	WD	8	1	0.13
Pyrene	129-00-0	WD	8	1	0.13
Sulfate	SULFATE	WD	1	0	0.00
Toluene	108-88-3	WD	54	24	0.44
Total Xylenes	1330-20-7	WD	15	5	0.33
Vinyl Chloride	75-01-4	WD	6	0	0.00

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TABLE D.2. (cont.)

- (a) SO = soil
AG = soil gas
WD = groundwater

- (b) Chemical name does not match CAS number. Data are shown as received from original database.
CAS number listed is for Trichloroethylene, while Tetrachloroethene has a CAS number of 127-18-4.

TABLE D.3. Analyte Detection Frequency for Source Area ST20 E-9

Analytes Measured	CAS Number	Matrix ^(a) Code	Number of Samples	Number of Detects	Fraction of Detects
Benzene	71-43-2	AG	11	2	0.18
Ethylbenzene	100-41-4	AG	10	7	0.70
mXylene	106-38-3	AG	3	2	0.67
Toluene	108-88-3	AG	2	2	1.00
Total BTEX	BTEX	AG	8	5	0.63
1,1-Dichloroethylene	75-35-4	SD	6	0	0.00
2-Butanone	78-93-3	SD	3	0	0.00
2-Methyl Phenol	95-48-7	SD	5	0	0.00
2-Methylnaphthalene	91-57-6	SD	5	0	0.00
Acenaphthene	83-32-9	SD	5	0	0.00
Anthracene	120-12-7	SD	7	3	0.43
Benzene	71-43-2	SD	2	1	0.50
Benzo(A)Pyrene	50-32-8	SD	2	0	0.00
Benzo(B)Fluoranthene	205-99-2	SD	1	0	0.00
Benzo(K)Fluoranthene	207-08-9	SD	8	0	0.00
Chlorobenzene	108-90-7	SD	11	0	0.00
Chloroform	67-66-3	SD	5	0	0.00
Chrysene	218-01-9	SD	3	1	0.33
Dibenzo(A,H)Anthracene	53-70-3	SD	2	0	0.00
Ethylbenzene	100-41-4	SD	7	2	0.29
Fluorene	86-73-7	SD	5	3	0.60
Indeno(1,2,3-CD)Pyrene	193-39-5	SD	3	0	0.00
Methylene Chloride	75-09-2	SD	2	0	0.00
Naphthalene	91-20-3	SD	4	0	0.00
Tetrachloroethene	79-01-6 ^(b)	SD	5	0	0.00
Total Xylenes	1330-20-7	SD	4	1	0.25
TPH	TPH	SD	8	4	0.50
Vinyl Chloride	75-01-4	SD	13	0	0.00
1,1,2,2-Tetrachloroethane	79-34-5	WD	4	0	0.00
1,1-Dichloroethylene	75-35-4	WD	8	0	0.00
2,4-Dimethylphenol	105-87-9	WD	8	0	0.00
2-Methyl Phenol	95-48-7	WD	7	2	0.29
2-Methylnaphthalene	91-57-6	WD	7	2	0.29

TABLE D.3. (cont.)

4-Methyl Phenol	186-44-5	WD	12	1	0.08
Acenaphthene	83-32-9	WD	18	0	0.08
Acenaphthylene	288-98-8	WD	6	0	0.08
Anthracene	128-12-7	WD	7	0	0.08
Benzene	71-43-2	WD	1	1	1.00
Benzo(A)Anthracene	56-55-3	WD	4	0	0.08
Benzo(A)Pyrene	56-32-8	WD	5	0	0.08
Benzo(B)Fluoranthene	285-99-2	WD	5	0	0.08
Benzo(G,H,I)Perylene	191-24-2	WD	8	0	0.08
Benzo(K)Fluoranthene	287-88-9	WD	3	0	0.08
Benzoic Acid	65-85-0	WD	8	0	0.08
Benzyl Alcohol	100-51-6	WD	8	0	0.08
BIS (2-Ethylhexyl)phthalate	117-81-7	WD	8	6	0.75
Chloride	CHLORIDE	WD	3	0	0.08
Chlorobenzene	108-96-7	WD	6	1	0.17
Chloroform	67-68-3	WD	5	0	0.08
Chrysene	218-81-9	WD	5	0	0.08
Dibenzo(A,H)Anthracene	53-78-3	WD	6	0	0.08
Dibenzofuran	132-84-9	WD	18	1	0.18
Ethylbenzene	100-41-4	WD	44	6	0.14
Fluoranthene	296-44-8	WD	8	1	0.13
Fluorene	86-73-7	WD	9	0	0.08
Indeno(1,2,3-CD)Pyrene	193-39-5	WD	3	0	0.08
m,p-Xylene	106-38-3	WD	34	18	0.29
Methylene Chloride	75-09-2	WD	12	1	0.08
Naphthalene	91-20-3	WD	18	2	0.28
Nitrog,N02+N03	N02+N03	WD	3	2	0.67
oXylene	95-47-6	WD	38	11	0.37
Phenanthrene	85-81-8	WD	9	0	0.08
Phenol	108-95-2	WD	7	0	0.08
Pyrene	129-00-6	WD	9	0	0.08
Sulfate	SULFATE	WD	2	0	0.08
Tetrachloroethene	79-81-6(a)	WD	1	0	0.08
Toluene	108-88-3	WD	49	19	0.39

TABLE D.3. (cont.)

Total Xylenes	1330-20-7	WD	15	5	0.33
Trichlorofluoromethane	75-69-4	WD	1	0	0.00

Filename E9RATDFX.XLS

- (a) SQ = soil
AQ = soil gas
WD = groundwater

- (b) Chemical name does not match CAS number. Data are shown as received from original database.
CAS number listed is for Trichloroethylene, while Tetrachloroethene has a CAS number of 127-18-4.

TABLE D.4. Analyte Detection Frequency for Source Area ST48

Analytes Measured	CAS Number	Matrix ^(a) Code	Number of Samples	Number of Detects	Fraction of Detects
Benzene	71-43-2	AQ	45	14	0.31
BTEX	BTEX	AQ	45	24	0.53
Ethylbenzene	100-41-4	AQ	45	15	0.33
mXylene	100-38-3	AQ	45	12	0.27
Toluene	100-88-3	AQ	45	17	0.38
2-Methylnaphthalene	91-57-6	SO	14	2	0.14
Benzene	71-43-2	SO	14	1	0.07
BIS (2-Ethylhexyl)phthalate	117-81-7	SO	14	1	0.07
Chlorobenzene	100-96-7	SO	14	1	0.07
Di-N-Octylphthalate	117-84-8	SO	14	1	0.07
Ethylbenzene	100-41-4	SO	14	1	0.07
Fluorene	86-73-7	SO	14	1	0.07
Lead, SED	7439-92-1	SO	13	9	0.69
Naphthalene	91-20-3	SO	14	2	0.14
Phenanthrene	85-01-8	SO	14	1	0.07
Toluene	100-88-3	SO	14	1	0.07
Total Xylenes	1330-20-7	SO	14	2	0.14
TPH	TPH	SO	114	48	0.42
2,4-Dimethylphenol	105-67-9	WD	18	1	0.06
2-Methylnaphthalene	91-57-6	WD	18	5	0.28
Aluminum, Total	7429-90-5	WD	1	1	1.00
Arsenic, DISS	7440-38-2	WD	1	1	1.00
Arsenic, Total	7440-38-2	WD	1	1	1.00
Barium, DISS	7440-39-3	WD	1	1	1.00
Barium, Total	7440-39-3	WD	1	1	1.00
Benzene	71-43-2	WD	18	8	0.44
BIS (2-Ethylhexyl)phthalate	117-81-7	WD	18	2	0.11
Butylbenzylphthalate	85-88-7	WD	18	1	0.06
Calcium, DISS	7440-70-2	WD	1	1	1.00
Calcium, Total	7440-70-2	WD	1	1	1.00
Chloride	16887-00-6	WD	1	1	1.00
Chlorobenzene	100-96-7	WD	9	0	0.00
Chloroform	67-66-3	WD	9	0	0.00

TABLE D.4. (cont.)

Chromium	7440-47-3	WD	1	1	1.00
Cobalt, Total	7440-48-4	WD	1	1	1.00
Copper, Total	7440-50-8	WD	1	1	1.00
Di-N-Octylphthalate	117-84-0	WD	9	0	0.00
Ethylbenzene	100-41-4	WD	18	3	0.17
Fluorene	86-73-7	WD	9	0	0.00
Iron, DISS	7439-89-6	WD	1	1	1.00
Iron, Total	7439-89-6	WD	1	1	1.00
Lead, DISS	7439-92-1	WD	9	1	0.11
Lead, Total	7439-92-1	WD	9	7	0.78
Magnesium, DISS	7439-95-4	WD	1	1	1.00
Magnesium, Total	7439-95-4	WD	1	1	1.00
Manganese, DISS	7439-96-5	WD	1	1	1.00
Manganese, Total	7439-96-5	WD	1	1	1.00
Mercury, DISS	7439-97-6	WD	1	1	1.00
Mercury, Total	7439-97-6	WD	1	1	1.00
Naphthalene	91-20-3	WD	18	5	0.28
Nitrogen, NO2+NO3	7727-37-9	WD	8	4	0.50
Phenanthrene	85-01-8	WD	9	0	0.00
Potassium, DISS	7440-89-7	WD	1	1	1.00
Potassium, Total	7440-89-7	WD	1	1	1.00
Sodium, DISS	7440-23-5	WD	1	1	1.00
Sodium, Total	7440-23-5	WD	1	1	1.00
Sulfate	SULFATE	WD	1	1	1.00
Toluene	100-88-3	WD	18	4	0.22
Total Xylenes	1330-20-7	WD	18	5	0.28
TPH	TPH	WD	18	6	0.33
Vanadium, Total	7440-62-2	WD	1	1	1.00
Zinc, DISS	7440-66-6	WD	1	1	1.00
Zinc, Total	7440-66-6	WD	1	1	1.00
Benzene	71-43-2	WQ	21	6	0.29
Ethylbenzene	100-41-4	WQ	21	9	0.43
m,p-Xylene	100-38-3	WQ	21	9	0.43
oXylene	95-47-6	WQ	21	8	0.38

TABLE D.4. (cont.)

t-Dichloroethylene	156-60-5 ^(b)	WG	21	2	0.10
Toluene	108-88-3	WG	21	8	0.38

Filename: 48RATDFX.XLS

- (a) SO = soil
 AG = soil gas
 WD = groundwater

- (b) CAS number indicates this compound is Trans-1,2-Dichloroethylene.

TABLE D.5. Analyte Detection Frequency for Source Area ST49

Analytes Measured	CAS Number	Matrix ^(a) Code	Number of Samples	Number of Detects	Fraction of Detects
Benzene	71-43-2	AQ	17	5	0.29
BTEX	BTEX	AQ	17	5	0.29
Ethylbenzene	106-41-4	AQ	17	3	0.18
mXylene	106-38-3	AQ	17	4	0.24
Toluene	106-88-3	AQ	17	5	0.29
Aluminum, SED	7429-98-6	S0	2	2	1.00
Arsenic, SED	7440-38-2	S0	2	2	1.00
Barium, SED	7440-39-3	S0	2	2	1.00
Benzo(A)Anthracene	56-55-3	S0	10	3	0.30
Benzo(A)Pyrene	50-32-6	S0	10	2	0.20
Benzo(B)Fluoranthene	205-99-2	S0	10	1	0.10
Benzo(G,H,I)Perylene	191-24-2	S0	10	1	0.10
Beryllium, SED	7440-41-7	S0	2	2	1.00
BIS (2-Ethylhexyl)phthalate	117-81-7	S0	10	2	0.20
Butylbenzylphthalate	85-68-7	S0	10	1	0.10
Calcium, SED	7440-70-2	S0	2	2	1.00
Chromium, SED	7440-47-3	S0	2	2	1.00
Chrysene	218-01-9	S0	10	2	0.20
Cobalt, SED	7440-48-4	S0	2	2	1.00
Cobalt, Total	7440-48-4	S0	2	2	1.00
Copper, SED	7440-50-8	S0	2	2	1.00
DDD, PP'	72-54-8	S0	2	1	0.50
Endosulfan Sulfate	1031-07-8	S0	2	0	0.00
Endosulfan, A	959-98-8	S0	2	0	0.00
Endosulfan, B	33213-65-9	S0	2	0	0.00
Fluoranthene	206-44-0	S0	10	3	0.30
Indeno(1,2,3-CD)Pyrene	193-39-5	S0	10	2	0.20
Iron, SED	7439-89-6	S0	2	2	1.00
Lead, SED	7439-92-1	S0	2	2	1.00
Magnesium, SED	7439-95-4	S0	2	2	1.00
Manganese, SED	7439-96-5	S0	2	2	1.00
Methylene Chloride	75-09-2	S0	10	5	0.50
Nickel, SED	7440-02-0	S0	2	2	1.00

TABLE D.5. (cont.)

Phenanthrene	85-81-8	SO	10	3	0.30
Potassium, SED	7440-69-7	SO	2	2	1.00
Pyrene	129-00-0	SO	10	3	0.30
Sodium, SED	7440-23-5	SO	2	2	1.00
TPH	TPH	SO	35	23	0.66
Vanadium, SED	7440-62-2	SO	2	2	1.00
Zinc, SED	7440-66-6	SO	2	2	1.00
1,1,1-Trichloroethane	71-55-6	WD	14	6	0.43
1,1-Dichloroethane	75-34-3	WD	14	3	0.21
1,2-Dichlorobenzene	95-50-1	WD	13	1	0.08
1,3-Dichlorobenzene	541-73-1	WD	13	0	0.00
1,4-Dichlorobenzene	106-46-7	WD	7	1	0.14
2-Methylnaphthalene	91-57-6	WD	7	1	0.14
Acenaphthene	83-32-9	WD	7	4	0.57
Aluminum, Total	7429-98-5	WD	1	1	1.00
Anthracene	120-12-7	WD	7	2	0.29
Arsenic, DISS	7440-38-2	WD	1	1	1.00
Arsenic, Total	7440-38-2	WD	1	1	1.00
Barium, DISS	7440-39-3	WD	1	1	1.00
Barium, Total	7440-39-3	WD	1	1	1.00
Benzene	71-43-2	WD	34	19	0.56
Benzo(A)Anthracene	56-55-3	WD	7	7	1.00
Benzo(A)Pyrene	56-32-8	WD	7	6	0.86
Benzo(B)Fluoranthene	205-99-2	WD	7	7	1.00
Benzo(G,H,I)Perylene	191-24-2	WD	7	4	0.57
Benzo(K)Fluoranthene	207-08-9	WD	7	6	0.86
Calcium, DISS	7440-70-2	WD	1	1	1.00
Calcium, Total	7440-70-2	WD	1	1	1.00
Chloride	16887-00-6	WD	1	1	1.00
Chlorobenzene	106-95-7	WD	13	1	0.08
Chloroform	67-66-3	WD	14	0	0.00
Chromium, Total	7440-47-3	WD	1	1	1.00
Chrysene	218-01-9	WD	7	4	0.57
Cobalt, Total	7440-48-4	WD	1	1	1.00

TABLE D.5. (cont.)

Copper, Total	7448-58-8	WD	1	1	1.00
Dibenzo(A,H)Anthracene	53-78-3	WD	7	5	0.71
Dibenzofuran	132-64-9	WD	7	1	0.14
Ethylbenzene	100-41-4	WD	34	11	0.32
Fluoranthene	206-44-0	WD	7	7	1.00
Fluorene	86-73-7	WD	7	5	0.71
Indeno(1,2,3-CD)Pyrene	193-39-5	WD	7	4	0.57
Iron, DISS	7439-89-6	WD	1	1	1.00
Iron, Total	7439-89-6	WD	1	1	1.00
Lead, Total	7439-92-1	WD	1	1	1.00
m,p-Xylene	106-38-3	WD	20	5	0.25
Magnesium, DISS	7439-95-4	WD	1	1	1.00
Magnesium, Total	7439-95-4	WD	1	1	1.00
Manganese, DISS	7439-96-5	WD	1	1	1.00
Manganese, Total	7439-96-5	WD	1	1	1.00
Methylene Chloride	75-09-2	WD	13	7	0.54
Naphthalene	91-20-3	WD	14	8	0.57
Nickel, Total	7440-02-0	WD	1	1	1.00
oXylene	95-47-6	WD	20	3	0.15
Phenanthrene	85-01-8	WD	7	6	0.86
Potassium, DISS	7440-09-7	WD	1	1	1.00
Potassium, Total	7440-09-7	WD	1	1	1.00
Pyrene	129-00-0	WD	7	6	0.86
Sodium, DISS	7440-23-5	WD	1	1	1.00
Sodium, Total	7440-23-5	WD	1	1	1.00
Sulfate	SULFATE	WD	1	1	1.00
t-Dichloroethylene	TDICHLOR ^(b)	WD	20	1	0.05
Toluene	108-88-3	WD	34	4	0.12
Total Xylenes	1330-20-7	WD	14	4	0.29
TPH	TPH	WD	14	3	0.21
Trans-1,2-Dichloroethene	156-60-5 ^(b)	WD	13	1	0.08
Trichloroethene	79-01-6	WD	27	12	0.44
Trichlorofluoromethane	75-69-4	WD	13	1	0.08
Vanadium, Total	7440-02-2	WD	1	1	1.00

TABLE D.5. (cont.)

Zinc, DISS	7448-86-8	WD	1	1	1.00
Zinc, Total	7448-86-8	WD	1	1	1.00

Filename: 49RATDFX.XLS

- (a) SO = soil
AG = soil gas
WD = groundwater

- (b) t-Dichloroethylene and Trans-1,2-Dichloroethene are the same compound; however, they are listed as separate analytes in the database. An alternate name for this compound is Trans-1,2-Dichloroethylene.

TABLE D.6. Analyte Detection Frequency for Source Area 50-54 (Blair Lakes)

Analytes Measured	CAS Number	Matrix ^(a) Code	Number of Samples	Number of Detects	Fraction of Detects
Benzene	71-43-2	AG	15	3	0.20
Ethylbenzene	100-41-4	AG	15	4	0.27
mXylene	106-38-3	AG	15	4	0.27
Toluene	108-88-3	AG	15	5	0.33
Total BTEX	BTEX	AG	15	5	0.33
2,4- Dimethylphenol	105-67-9	S0	14	0	0.00
2-Chlorophenol	95-57-8	S0	26	1	0.04
2-Methylnaphthalene	91-57-8	S0	26	15	0.58
4-Methylphenol	106-44-5	S0	14	0	0.00
Acenaphthene	83-32-9	S0	26	1	0.04
Acetophenone	98-86-2	S0	14	1	0.07
Aluminum, SED	7429-90-5	S0	12	12	1.00
Arsenic, SED	7440-38-2	S0	12	2	0.17
Barium, SED	7440-39-3	S0	12	12	1.00
Benzene	71-43-2	S0	16	3	0.19
Beryllium, SED	7440-41-7	S0	12	1	0.08
BIS (2-Ethylhexyl)phthalate	117-81-7	S0	26	2	0.08
Butylbenzylphthalate	85-68-7	S0	14	0	0.00
Cadmium, SED	7440-43-9	S0	12	12	1.00
Calcium, SED	7440-70-2	S0	12	12	1.00
Chlorobenzene	108-90-7	S0	4	0	0.00
Chloroform	67-66-3	S0	4	0	0.00
Chloromethane	74-87-3	S0	4	0	0.00
Chromium, SED	7440-47-3	S0	12	12	1.00
Cobalt, SED	7440-48-4	S0	12	12	1.00
Copper, SED	7440-50-8	S0	12	12	1.00
Dibenzofuran	132-84-9	S0	26	5	0.19
Diethylphthalate	84-66-2	S0	14	0	0.00
Ethylbenzene	100-41-4	S0	16	6	0.38
Fluorene	86-73-7	S0	26	3	0.12
Iron, SED	7439-89-6	S0	12	12	1.00
Lead, SED	7439-92-1	S0	24	24	1.00
Magnesium, SED	7439-95-4	S0	12	12	1.00

TABLE D.6. (cont.)

Manganese, SED	7439-96-5	SO	12	12	1.00
Methylene Chloride	75-09-2	SO	4	0	0.00
Nickel, SED	7440-02-8	SO	12	12	1.00
Potassium, SED	7440-09-7	SO	12	12	1.00
Sodium, SED	7440-23-5	SO	12	12	1.00
Toluene	108-88-3	SO	16	5	0.31
Total Xylenes	1330-20-7	SO	16	7	0.44
TPH	TPH	SO	82	51	0.62
Vanadium, SED	7440-62-2	SO	12	12	1.00
Zinc, SED	7440-66-8	SO	12	12	1.00
N-Nitrosopiperidine	100-75-4	Soil	14	2	0.14
Naphthalene	91-20-3	Soil	26	13	0.50
Phenol	108-95-2	Soil	26	1	0.04
N-Nitrosopiperidine	100-75-4	Water	9	0	0.00
Naphthalene	91-20-3	Water	15	3	0.20
Phenol	108-95-2	Water	15	1	0.07
2,4- Dimethylphenol	105-67-9	WD	15	2	0.13
2-Chlorophenol	95-57-8	WD	9	0	0.00
2-Methylnaphthalene	91-57-6	WD	15	4	0.27
4-Methylphenol	106-44-5	WD	9	0	0.00
Acenaphthene	83-32-9	WD	9	0	0.00
Acetophenone	98-86-2	WD	9	0	0.00
Aluminum, DISS	7429-90-5	WD	5	4	0.80
Aluminum, Total	7429-90-5	WD	5	5	1.00
Arsenic, Total	7440-38-2	WD	5	2	0.40
Barium, DISS	7440-39-3	WD	5	5	1.00
Barium, Total	7440-39-3	WD	5	5	1.00
Benzene	71-43-2	WD	15	7	0.47
BIS (2-Ethylhexyl)phthalate	117-81-7	WD	9	1	0.11
Butylbenzylphthalate	85-68-7	WD	15	3	0.20
Cadmium, Total	7440-43-9	WD	5	3	0.60
Calcium, DISS	7440-70-2	WD	5	5	1.00
Calcium, Total	7440-70-2	WD	5	5	1.00
Chloride	CHLORIDE	WD	5	5	1.00

TABLE D.6. (cont.)

Chlorobenzene	108-90-7	WD	15	1	0.07
Chloroform	67-66-3	WD	9	1	0.11
Chloromethane	74-87-3	WD	15	4	0.27
Chromium, Total	7440-47-3	WD	5	4	0.80
Cobalt, Total	7440-48-4	WD	5	4	0.80
Copper, DISS	7440-50-8	WD	5	1	0.20
Copper, Total	7440-50-8	WD	5	5	1.00
Dibenzofuran	132-84-9	WD	9	0	0.00
Diethylphthalate	84-66-2	WD	15	1	0.07
Ethylbenzene	100-41-4	WD	15	4	0.27
Fluorene	86-73-7	WD	9	0	0.00
Iron, DISS	7439-89-6	WD	5	5	1.00
Iron, Total	7439-89-6	WD	5	5	1.00
Lead, DISS	7439-92-1	WD	5	3	0.60
Lead, Total	7439-92-1	WD	10	8	0.80
Magnesium, DISS	7439-95-4	WD	5	5	1.00
Magnesium, Total	7439-95-4	WD	5	5	1.00
Manganese, DISS	7439-96-5	WD	5	5	1.00
Manganese, Total	7439-96-5	WD	5	5	1.00
Methylene Chloride	75-09-2	WD	15	0	0.00
Molybdenum, Total	7439-98-7	WD	5	2	0.40
Nickel, Total	7440-02-0	WD	5	4	0.80
Nitrog, NO2+NO3	7727-37-9	WD	5	1	0.20
Potassium, DISS	7440-09-7	WD	5	5	1.00
Potassium, Total	7440-09-7	WD	5	5	1.00
Sodium, DISS	7440-23-5	WD	10	10	1.00
Sulfate	SULFATE	WD	5	5	1.00
Toluene	108-88-3	WD	35	8	0.23
Total Xylenes	1330-20-7	WD	15	5	0.33
TPH	TPH	WD	15	3	0.20
Vanadium, Total	7440-02-2	WD	5	4	0.80
Zinc, DISS	7440-66-8	WD	5	4	0.80
Zinc, Total	7440-66-8	WD	5	5	1.00

(a) SO = soil; AG = soil gas; WD = groundwater

Filename: 50RATDFX.XLS

TABLE D.7. Chemical Analytical Results for Source Area ST20 E7
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
53M04SA	Benzene	71-43-2	AG	UG/L	10	U	5	4179	52200	26713
53M04SA	Benzene	71-43-2	AG	UG/L	10	U	5			
53M04W1	Benzene	71-43-2	AG	UG/L	52200		52200			
20M02SA	Benzene	71-43-2	AG	UG/L	10	U	5			
20M02SA	Benzene	71-43-2	AG	UG/L	10	U	5			
20M02SB	Benzene	71-43-2	AG	UG/L	10	U	5			
20M02SB	Benzene	71-43-2	AG	UG/L	10	U	5			
20M02W1	Benzene	71-43-2	AG	UG/L	10	U	5			
20M02W1	Benzene	71-43-2	AG	UG/L	10	U	5			
20M03SA	Benzene	71-43-2	AG	UG/L	10	U	5			
20M03SA	Benzene	71-43-2	AG	UG/L	10	U	5			
20M03SB	Benzene	71-43-2	AG	UG/L	290		290			
20M03SB	Benzene	71-43-2	AG	UG/L	20		20			
20M03W1	Benzene	71-43-2	AG	UG/L	10	U	5			
20M04SA	Benzene	71-43-2	AG	UG/L	21000		21000			
20M04SA	Benzene	71-43-2	AG	UG/L	10	U	5			
20M04SB	Benzene	71-43-2	AG	UG/L	10600		10600			
20M04SB	Benzene	71-43-2	AG	UG/L	10	U	5			
20M04W1	Benzene	71-43-2	AG	UG/L	10	U	5			
20M05SA	Benzene	71-43-2	AG	UG/L	10600		10600			
20M05SA	Benzene	71-43-2	AG	UG/L	10	U	5			
20M05SB	Benzene	71-43-2	AG	UG/L	10	U	5			
20M05SB	Benzene	71-43-2	AG	UG/L	9620		9620			
20M05W1	Benzene	71-43-2	AG	UG/L	10	U	5			
20M09W1	Benzene	71-43-2	AG	UG/L	10	U	5			
20M10W1	Benzene	71-43-2	AG	UG/L	50		50			
53M04W2	Ethylbenzene	100-41-4	AG	UG/L	10	U	5	46	290	261
20A-3	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
20A-3	Ethylbenzene	100-41-4	AG	UG/L	290		290			
20A-3	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
20A-3	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
20A-3(15)	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
20A-3(5)	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
53M04SA	mXylene	108-38-3	AG	UG/L	10		10	1845	18200	13338
53M04W1	mXylene	108-38-3	AG	UG/L	10		10			
20M02W1	mXylene	108-38-3	AG	UG/L	60		60			
20M03W1	mXylene	108-38-3	AG	UG/L	60		60			
20M04W1	mXylene	108-38-3	AG	UG/L	20		20			
20M05SA	mXylene	108-38-3	AG	UG/L	10		10			
20M05SB	mXylene	108-38-3	AG	UG/L	10		10			
20M05W1	mXylene	108-38-3	AG	UG/L	10		10			
20M09W1	mXylene	108-38-3	AG	UG/L	60		60			
20M10W1	mXylene	108-38-3	AG	UG/L	18200		18200			
20M02SA	Toluene	108-88-3	AG	UG/L	80		80	6628	14000	19717
20M02SB	Toluene	108-88-3	AG	UG/L	490		490			

TABLE D.7. Chemical Analytical Results for Source Area ST20 E7
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M03SA	Toluene	108-88-3	AG	UG/L	13200		13200			
20M03SB	Toluene	108-88-3	AG	UG/L	10200		10200			
20M04SA	Toluene	108-88-3	AG	UG/L	14000		14000			
20M04SB	Toluene	108-88-3	AG	UG/L	1800		1800			
20M02W2	Total BTEX	BTEX	AG	UG/L	10		10	198	920	825
20M03W2	Total BTEX	BTEX	AG	UG/L	20		20			
20M04W2	Total BTEX	BTEX	AG	UG/L	40		40			
20M05W2	Total BTEX	BTEX	AG	UG/L	30		30			
20M09W2	Total BTEX	BTEX	AG	UG/L	320		320			
20M10W2R	Total BTEX	BTEX	AG	UG/L	20		20			
20M11W1	Total BTEX	BTEX	AG	UG/L	220		220			
20M12W1	Total BTEX	BTEX	AG	UG/L	920		920			
53M04SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15	291	2500	1948
20M02SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
20M02SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
20M03SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
20M03SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
20M04SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
20M04SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
20M05SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	2500	U	2500			
20M05SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
20A-3(15)	Benzo(A)Anthracene	56-55-3	SO	UG/KG	50	U	25	208	390	NA
53M04SA	Benzo(A)Anthracene	56-55-3	SO	UG/KG	390	U	390			
20M02SA	Benzo(K)Fluoranthene	207-08-9	SO	UG/KG	70	U	35	142	1000	786
20M02SB	Benzo(K)Fluoranthene	207-08-9	SO	UG/KG	70	U	35			
20M03SA	Benzo(K)Fluoranthene	207-08-9	SO	UG/KG	70	U	35			
20M03SB	Benzo(K)Fluoranthene	207-08-9	SO	UG/KG	70	U	35			
20M04SA	Benzo(K)Fluoranthene	207-08-9	SO	UG/KG	70	U	35			
20M04SB	Benzo(K)Fluoranthene	207-08-9	SO	UG/KG	70	U	35			
20M05SA	Benzo(K)Fluoranthene	207-08-9	SO	UG/KG	70	U	35			
20M05SB	Benzo(K)Fluoranthene	207-08-9	SO	UG/KG	1000	U	1000			
53M04SA	Chrysene	218-01-9	SO	UG/KG	50	U	25	253	1900	1345
20M02SA	Chrysene	218-01-9	SO	UG/KG	50	U	25			
20M02SB	Chrysene	218-01-9	SO	UG/KG	50	U	25			
20M02W1	Chrysene	218-01-9	SO	UG/KG	360		360			
20M03SA	Chrysene	218-01-9	SO	UG/KG	1900	U	1900			
20M03SB	Chrysene	218-01-9	SO	UG/KG	50	U	25			
20M03W1	Chrysene	218-01-9	SO	UG/KG	550		550			
20M04SA	Chrysene	218-01-9	SO	UG/KG	50	U	25			
20M04SB	Chrysene	218-01-9	SO	UG/KG	50	U	25			
20M04W1	Chrysene	218-01-9	SO	UG/KG	50	U	25			
20M05SA	Chrysene	218-01-9	SO	UG/KG	50	U	25			
20M05SB	Chrysene	218-01-9	SO	UG/KG	50	U	25			

TABLE D.7. Chemical Analytical Results for Source Area ST20 E7
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M02W2	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	80	U	40	128	420	405
20M03W2	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	80	U	40			
20M04W2	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	80	U	40			
20M05W2	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	80	U	40			
20M09W2	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	420		420			
20M10W2	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	190		190			
20M11W1	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	210		210			
20M12W1	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	80	U	40			
53M04SA	Tetrachloroethene	79-01-6	SO	UG/KG	5	U	2.5	550	8500	4790
53M04W1	Tetrachloroethene	79-01-6	SO	UG/KG	90	U	45			
20M02SA	Tetrachloroethene	79-01-6	SO	UG/KG	5	U	2.5			
20M02SB	Tetrachloroethene	79-01-6	SO	UG/KG	5	U	2.5			
20M02W1	Tetrachloroethene	79-01-6	SO	UG/KG	8500		8500			
20M03SA	Tetrachloroethene	79-01-6	SO	UG/KG	5	U	2.5			
20M03SB	Tetrachloroethene	79-01-6	SO	UG/KG	5	U	2.5			
20M03W1	Tetrachloroethene	79-01-6	SO	UG/KG	90	U	45			
20M04SA	Tetrachloroethene	79-01-6	SO	UG/KG	5	U	2.5			
20M04SB	Tetrachloroethene	79-01-6	SO	UG/KG	5	U	2.5			
20M04W1	Tetrachloroethene	79-01-6	SO	UG/KG	90	U	45			
20M05SA	Tetrachloroethene	79-01-6	SO	UG/KG	5	U	2.5			
20M05SB	Tetrachloroethene	79-01-6	SO	UG/KG	5	U	2.5			
20M05W1	Tetrachloroethene	79-01-6	SO	UG/KG	90	U	45			
20M09W1	Tetrachloroethene	79-01-6	SO	UG/KG	90	U	45			
20M10W1	Tetrachloroethene	79-01-6	SO	UG/KG	90	U	45			
53M04SA	Total Xylenes	1330-20-7	SO	UG/KG	770	U	385	1063	6830	5394
20M02SA	Total Xylenes	1330-20-7	SO	UG/KG	6830		6830			
20M02SB	Total Xylenes	1330-20-7	SO	UG/KG	80	U	40			
20M03SA	Total Xylenes	1330-20-7	SO	UG/KG	770	U	385			
20M03SB	Total Xylenes	1330-20-7	SO	UG/KG	770	U	385			
20M04SA	Total Xylenes	1330-20-7	SO	UG/KG	770	U	385			
20M04SB	Total Xylenes	1330-20-7	SO	UG/KG	770	U	385			
20M05SA	Total Xylenes	1330-20-7	SO	UG/KG	770	U	385			
20M05SB	Total Xylenes	1330-20-7	SO	UG/KG	770	U	385			
53M04W2	TPH	TPH	SO	UG/KG	110000		110000	30878	110000	100875
20M02W2	TPH	TPH	SO	UG/KG	10200	U	5100			
20M03W2	TPH	TPH	SO	UG/KG	10200	U	5100			
20M04W2	TPH	TPH	SO	UG/KG	10200	U	5100			
20M05W2	TPH	TPH	SO	UG/KG	10200	U	5100			
20M09W2	TPH	TPH	SO	UG/KG	39500		39500			
20M10W2	TPH	TPH	SO	UG/KG	56000		56000			
20M11W1	TPH	TPH	SO	UG/KG	34000		34000			
20M12W1	TPH	TPH	SO	UG/KG	18000		18000			
53M04W2	Vinyl Chloride	75-01-4	SO	UG/KG	370	U	185	1562	13000	10141
20M02W2	Vinyl Chloride	75-01-4	SO	UG/KG	5	U	2.5			

TABLE D.7. Chemical Analytical Results for Source Area ST20 E7
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Report Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL (e)
20M03W2	Vinyl Chloride	75-01-4	SO	UG/KG	290	U	145			
20M04W2	Vinyl Chloride	75-01-4	SO	UG/KG	13000		13000			
20M05W2	Vinyl Chloride	75-01-4	SO	UG/KG	290	U	145			
20M09W2	Vinyl Chloride	75-01-4	SO	UG/KG	290	U	145			
20M10W2	Vinyl Chloride	75-01-4	SO	UG/KG	290	U	145			
20M11W1	Vinyl Chloride	75-01-4	SO	UG/KG	290	U	145			
20M12W1	Vinyl Chloride	75-01-4	SO	UG/KG	290	U	145			
53M04W2	1,1-Dichloroethylene	75-35-4	WD	UG/L	1	U	0.5	2	6	6
20M02W2	1,1-Dichloroethylene	75-35-4	WD	UG/L	6		6			
20M03W2	1,1-Dichloroethylene	75-35-4	WD	UG/L	1	U	0.5			
20M04W2	1,1-Dichloroethylene	75-35-4	WD	UG/L	5	U	2.5			
20M05W2	1,1-Dichloroethylene	75-35-4	WD	UG/L	1	U	0.5			
20M09W2	1,1-Dichloroethylene	75-35-4	WD	UG/L	5	U	2.5			
20M10W2	1,1-Dichloroethylene	75-35-4	WD	UG/L	5	U	2.5			
20M11W1	1,1-Dichloroethylene	75-35-4	WD	UG/L	5	U	2.5			
20M12W1	1,1-Dichloroethylene	75-35-4	WD	UG/L	5	U	2.5			
53M04W1	Aluminum, Total	7429-90-5	WD	UG/L	25600		25600	25600	25600	NA
53M04W1	Arsenic, DISS	7440-38-2	WD	UG/L	10		10	30	50	NA
53M04W1	Arsenic, DISS	7440-38-2	WD	UG/L	50		50			
53M04W1	Arsenic, Total	7440-38-2	WD	UG/L	27.5		27.5	27.5	27.5	NA
53M04W1	Barium, DISS	7440-39-3	WD	UG/L	200		200	200	200	NA
53M04W1	Barium, Total	7440-39-3	WD	UG/L	579		579	579	579	NA
20M02W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	7.1		7.1	6.0	21	21.1
20M03W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	9.8		9.8			
20M04W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	21		21			
20M05W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
53M04W1	BIS (2-Ethylhexyl)phthalate	BEMP	WD	UG/L	2	U	1			
20M09W1	BIS (2-Ethylhexyl)phthalate	BEMP	WD	UG/L	2	U	1			
20M10W1	BIS (2-Ethylhexyl)phthalate	BEMP	WD	UG/L	2	U	1			
53M04W1	Calcium, DISS	7440-70-2	WD	UG/L	53600		53600	53600	53600	NA
53M04W1	Calcium, Total	7440-70-2	WD	UG/L	65200		65200	65200	65200	NA
53M04W1	Chloride	CHLORIDE	WD	UG/L	200	U	100	209	755	744
20M02W1	Chloride	CHLORIDE	WD	UG/L	200	U	100			
20M03W1	Chloride	CHLORIDE	WD	UG/L	200	U	100			
20M04W1	Chloride	CHLORIDE	WD	UG/L	755		755			
20M05W1	Chloride	CHLORIDE	WD	UG/L	200	U	100			
20M09W1	Chloride	CHLORIDE	WD	UG/L	200	U	100			
53M04SA	Chlorobenzene	108-90-7	WD	UG/L	200	U	100			
53M04W1	Chlorobenzene	108-90-7	WD	UG/L	4	U	2	9.14	100	58.88
20M02SA	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			
20M02SB	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
20M02W1	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
20M03SA	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			
20M03W1	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			
20M03SB	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			

TABLE D.7. Chemical Analytical Results for Source Area ST20 E7
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M03W1	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			
20M04SA	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			
20M04SB	Chlorobenzene	108-90-7	WD	UG/L	200	U	100			
20M04W1	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			
20M05SA	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			
20M05SB	Chlorobenzene	108-90-7	WD	UG/L	40	U	20			
20M05W1	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			
20M09W1	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			
20M10W1	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			
20A-3	Chlorobenzene	108-90-7	WD	UG/L	48.1	U	48.1			
20A-3(15)	Chlorobenzene	108-90-7	WD	UG/L	1	U	0.5			
20A-3(5)	Chlorobenzene	108-90-7	WD	UG/L	1	U	0.5			
53M04W1	Chromium	7440-47-3	WD	UG/L	40.7	U	40.7	40.7	40.7	NA
53M04W1	Cobalt, Total	7440-48-4	WD	UG/L	32.8	U	32.8	32.8	32.8	NA
53M04W1	Copper, Total	7440-50-8	WD	UG/L	218	U	218	218	218	NA
53M04W1	Ethylbenzene	100-41-4	WD	UG/L	380	U	380	68	380	341
53M04W1	Ethylbenzene	100-41-4	WD	UG/L	280	U	280			
20M02W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M02W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M03W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M03W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M04W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M04W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M05W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M05W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M09W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M09W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M10W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M10W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
53M04W1	Iron, DISS	7439-89-6	WD	UG/L	290	U	290			
53M04W1	Iron, Total	7439-89-6	WD	UG/L	3700	U	3700	3700	3700	NA
53M04W1	Lead, Total	7439-92-1	WD	UG/L	74400	U	74400	74400	74400	NA
53M04W1	Lead, Total	7439-92-1	WD	UG/L	55.6	U	55.6	72.8	90	NA
53M04W1	m,p-Xylene	108-38-3	WD	UG/L	90	U	90			
20M02W1	m,p-Xylene	108-38-3	WD	UG/L	2	U	2	1	3	4
20M03W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M04W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M05W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M09W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M09W1	m,p-Xylene	108-38-3	WD	UG/L	3	U	3			
20M10W1	m,p-Xylene	108-38-3	WD	UG/L	3	U	3			
53M04W1	Magnesium, DISS	7439-95-4	WD	UG/L	13200	U	13200	13200	13200	NA
53M04W1	Magnesium, Total	7439-95-4	WD	UG/L	22400	U	22400	22400	22400	NA
53M04W1	Manganese, DISS	7439-96-5	WD	UG/L	800	U	800	800	800	NA
53M04W1	Manganese, Total	7439-96-5	WD	UG/L	1190	U	1190	1190	1190	NA

TABLE D.7. Chemical Analytical Results for Source Area ST20 E7
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(s)	Units	Reported Result(s)	EPA Data Qualifier(s)	DL/2 Value(s)	Average Value	Max. Value Detected	95% UCL(e)
53M04W1	Mercury, DISS	7439-97-6	WD	UG/L	0.7		0.7	0.7	0.7	0.7 NA
53M04W1	Mercury, Total	7439-97-6	WD	UG/L	0.4		0.4	0.4	0.4	0.4 NA
53M04W1	Naphthalene	91-20-3	WD	UG/L	25		25	37.48	130	143.50
20M02W1	Naphthalene	91-20-3	WD	UG/L	95		95			
20M03W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
20M04W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
20M05W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
20M09W1	Naphthalene	91-20-3	WD	UG/L	130		130			
20M10W1	Naphthalene	91-20-3	WD	UG/L	12		12			
53M04W1	Nickel	7440-02-0	WD	UG/L	57.4		57.4	57.4	57.4	NA
53M04W1	Nitrog, NO2+NO3	NO2+NO3	WD	UG/L	13		13	8	13	16
20M02W1	Nitrog, NO2+NO3	NO2+NO3	WD	UG/L	12		12			
20M03W1	Nitrog, NO2+NO3	NO2+NO3	WD	UG/L	10	U	5			
20M04W1	Nitrog, NO2+NO3	NO2+NO3	WD	UG/L	10	U	5			
20M05W1	Nitrog, NO2+NO3	NO2+NO3	WD	UG/L	12		12			
20M09W1	Nitrog, NO2+NO3	NO2+NO3	WD	UG/L	10	U	5			
20M10W1	Nitrog, NO2+NO3	NO2+NO3	WD	UG/L	10	U	5			
53M04W1	oXylene	95-47-6	WD	UG/L	1	U	0.5	1	2	2
20M02W1	oXylene	95-47-6	WD	UG/L	1		1			
20M03W1	oXylene	95-47-6	WD	UG/L	2		2			
20M04W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M05W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M09W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M10W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
53M04W1	Phenol	108-95-2	WD	UG/L	1	U	0.5	2.7	7.8	8.9
20M02W1	Phenol	108-95-2	WD	UG/L	1	U	0.5			
20M03W1	Phenol	108-95-2	WD	UG/L	1	U	0.5			
20M04W1	Phenol	108-95-2	WD	UG/L	2.6		2.6			
20M05W1	Phenol	108-95-2	WD	UG/L	7.8		7.8			
20M09W1	Phenol	108-95-2	WD	UG/L	1	U	0.5			
20M10W1	Phenol	108-95-2	WD	UG/L	6.2		6.2			
53M04W1	Potassium, DISS	7440-09-7	WD	UG/L	2530		2530	2530	2530	NA
53M04W1	Potassium, Total	7440-09-7	WD	UG/L	7440		7440	7440	7440	NA
53M04W1	Sodium, DISS	7440-23-5	WD	UG/L	4580		4580	4580	4580	NA
53M04SA	Sodium, Total	7440-23-5	WD	UG/L	8720		8720	8720	8720	NA
53M04W1	Sulfate	SULFATE	WD	UG/L	500	U	250	1061	5930	5355
53M04W1	Sulfate	SULFATE	WD	UG/L	500	U	250			
53M04W1	Sulfate	SULFATE	WD	UG/L	500	U	250			
53M04W1	Sulfate	SULFATE	WD	UG/L	500	U	250			
53M04W1	Sulfate	SULFATE	WD	UG/L	5930		5930			
20M05W1	Sulfate	SULFATE	WD	UG/L	500	U	250			
20M09W1	Sulfate	SULFATE	WD	UG/L	500	U	250			
20M02W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15	0.48	1.07	1.36
20M03W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			

TABLE D.7. Chemical Analytical Results for Source Area ST20 E7
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M04W1	Toluene	108-88-3	WD	UG/L	1.07		1.07			
20M05W1	Toluene	108-88-3	WD	UG/L	0.56		0.56			
53M04W1	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2	550.33	3620	3433.98
20M02W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
20M03W1	Total Xylenes	1330-20-7	WD	UG/L	2.33		2.33			
20M04W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
20M05W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
20M09W1	Total Xylenes	1330-20-7	WD	UG/L	28.5		28.5			
20M10W1	Total Xylenes	1330-20-7	WD	UG/L	3820		3820			
53M04SA	Vanadium, Total	7440-62-2	WD	UG/L	72.5		72.5	72.5	72.5	NA
53M04SA	Zinc, DISS	7440-66-6	WD	UG/L	40		40	40	40	NA
53M04SA	Zinc, Total	7440-66-6	WD	UG/L	191		191	191	191	NA
(a) Definitions: AG (soil gas), SO (soil), WD and WG (groundwater).										
(b) "Reported Result" is the concentration as reported in Eielson Air Force Base database.										
(c) U and UF represent nondetected analytes at the detection limit listed in "Reported Result" column.										
(d) "DL2 Value" lists the reported concentration of detected analytes or one-half of the detection limit for nondetected analytes.										
(e) "UCL" represents Upper Confidence Limit.										

TABLE D.8. Chemical Analytical Results for Source Area ST20 E8
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DLZ Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M06SA	Benzene	71-43-2	AG	UG/L	10	U	5	7084	69400	47290
20M06SA	Benzene	71-43-2	AG	UG/L	10		10			
20M06SB	Benzene	71-43-2	AG	UG/L	10	U	5			
20M06SB	Benzene	71-43-2	AG	UG/L	10	U	5			
20M06W1	Benzene	71-43-2	AG	UG/L	10	U	5			
20M13SA	Benzene	71-43-2	AG	UG/L	10	U	5			
20M14SA	Benzene	71-43-2	AG	UG/L	360		360			
20M15SA	Benzene	71-43-2	AG	UG/L	69400		69400			
20M16SA	Benzene	71-43-2	AG	UG/L	10	U	5			
20M17SA	Benzene	71-43-2	AG	UG/L	15200		15200			
20M18SA	Benzene	71-43-2	AG	UG/L	10	U	5			
20M19SA	Benzene	71-43-2	AG	UG/L	10	U	5			
20M17W1	Ethylbenzene	100-41-4	AG	UG/L	10	U	5	96	800	624
20M18W1	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
20M19W1	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
20B-2	Ethylbenzene	100-41-4	AG	UG/L	20	U	20			
20B-2	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
20B-2	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
20B-2(10)	Ethylbenzene	100-41-4	AG	UG/L	800		800			
20B-2(20)	Ethylbenzene	100-41-4	AG	UG/L	10	U	10			
20M06SA	mXylene	108-38-3	AG	UG/L	10	U	5			
20M06SB	mXylene	108-38-3	AG	UG/L	10		10	10	10	10
20M06W1	mXylene	108-38-3	AG	UG/L	10		10			
20M06W2	Total BTEX	BTEX	AG	UG/L	60		60	47035	293000	253527
20M13SA	Total BTEX	BTEX	AG	UG/L	10	U	5			
20M13W1	Total BTEX	BTEX	AG	UG/L	86700		86700			
20M14SA	Total BTEX	BTEX	AG	UG/L	20		20			
20M14W1	Total BTEX	BTEX	AG	UG/L	10	U	5			
20M15SA	Total BTEX	BTEX	AG	UG/L	276000		276000			
20M15W1	Total BTEX	BTEX	AG	UG/L	20		20			
20M16SA	Total BTEX	BTEX	AG	UG/L	10	U	5			
20M16W1	Total BTEX	BTEX	AG	UG/L	293000		293000			
20M17SA	Total BTEX	BTEX	AG	UG/L	10	U	5			
20M18SA	Total BTEX	BTEX	AG	UG/L	2660		2660			
20M19SA	Total BTEX	BTEX	AG	UG/L	10	U	5			
20M06SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15	398	780	NA
20M06SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	780		780			
20B-2(10)	Benzo(G,H,I)Perylene	191-24-2	SO	UG/KG	180		180	110	180	NA
20B-2(20)	Benzo(G,H,I)Perylene	191-24-2	SO	UG/KG	80	U	40			
20M06W1	Dibenzo(A,H)Anthracene	53-70-3	SO	UG/KG	140		140	140	140	NA
20M06W2	TPH	TPH	SO	UG/KG	10200	U	5100	41138	170000	148649

TABLE D.8. Chemical Analytical Results for Source Area ST20 E8
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M13W1	TPH	TPH	SO	UG/KG	45000		45000			
20M14W1	TPH	TPH	SO	UG/KG	20000		20000			
20M15W1	TPH	TPH	SO	UG/KG	25000		25000			
20M16W1	TPH	TPH	SO	UG/KG	11000		11000			
20M17W1	TPH	TPH	SO	UG/KG	170000		170000			
20M18W1	TPH	TPH	SO	UG/KG	38000		38000			
20M19W1	TPH	TPH	SO	UG/KG	15000		15000			
20M06W2	1,1-Dichloroethylene	75-35-4	WD	UG/L	5	U	2.5	13	32	41
20M13W1	1,1-Dichloroethylene	75-35-4	WD	UG/L	5	U	2.5			
20M14W1	1,1-Dichloroethylene	75-35-4	WD	UG/L	5	U	2.5			
20M15W1	1,1-Dichloroethylene	75-35-4	WD	UG/L	5	U	2.5			
20M16W1	1,1-Dichloroethylene	75-35-4	WD	UG/L	31		31			
20M17W1	1,1-Dichloroethylene	75-35-4	WD	UG/L	26		26			
20M18W1	1,1-Dichloroethylene	75-35-4	WD	UG/L	32		32			
20M19W1	1,1-Dichloroethylene	75-35-4	WD	UG/L	5	U	2.5			
20M06W1	4-Methyl Phenol	106-44-5	WD	UG/L	12		12	2	12	10
20M13SA	4-Methyl Phenol	106-44-5	WD	UG/L	2	U	1			
20M14SA	4-Methyl Phenol	106-44-5	WD	UG/L	2	U	1			
20M15SA	4-Methyl Phenol	106-44-5	WD	UG/L	2	U	1			
20M16SA	4-Methyl Phenol	106-44-5	WD	UG/L	2	U	1			
20M17SA	4-Methyl Phenol	106-44-5	WD	UG/L	2	U	1			
20M18SA	4-Methyl Phenol	106-44-5	WD	UG/L	2	U	1			
20M19SA	4-Methyl Phenol	106-44-5	WD	UG/L	2	U	1			
20B-2(10)	Benzene	71-43-2	WD	UG/L	1		1	1	1	NA
20B-2(20)	Benzene	71-43-2	WD	UG/L	1	U	0.5			
20M06W2	Benzoic Acid	65-85-0	WD	UG/L	25	U	12.5	7.57	13	18.82
20M13W1	Benzoic Acid	65-85-0	WD	UG/L	25	U	12.5			
20M14W1	Benzoic Acid	65-85-0	WD	UG/L	25	U	12.5			
20M16SA	Benzoic Acid	65-85-0	WD	UG/L	3.18	U	1.59			
20M17SA	Benzoic Acid	65-85-0	WD	UG/L	3.18	U	1.59			
20M18SA	Benzoic Acid	65-85-0	WD	UG/L	3.18	U	1.59			
20M19SA	Benzoic Acid	65-85-0	WD	UG/L	10.7		10.7			
20M06W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1	243	2900	1916
20M15W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
20M16W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2900		2900			
20M17W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
20M18W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
20M19W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
20M13SA	BIS (2-Ethylhexyl)phthalate	BEMP	WD	UG/L	2	U	1			
20M14SA	BIS (2-Ethylhexyl)phthalate	BEMP	WD	UG/L	2	U	1			
20M15SA	BIS (2-Ethylhexyl)phthalate	BEMP	WD	UG/L	2	U	1			
20M16SA	BIS (2-Ethylhexyl)phthalate	BEMP	WD	UG/L	2	U	1			
20M17SA	BIS (2-Ethylhexyl)phthalate	BEMP	WD	UG/L	2	U	1			
20M18SA	BIS (2-Ethylhexyl)phthalate	BEMP	WD	UG/L	2	U	1			

TABLE D.8. Chemical Analytical Results for Source Area ST20 E8
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M06W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5	130.94	1600	837.53
20M06W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M06W2	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M06W2	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M06W2	Ethylbenzene	100-41-4	WD	UG/L	431		431			
20M13SA	Ethylbenzene	100-41-4	WD	UG/L	0.46	UF	0.46			
20M13SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M13SA	Ethylbenzene	100-41-4	WD	UG/L	150		150			
20M13SA	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M13W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M13W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M13W1	Ethylbenzene	100-41-4	WD	UG/L	19.3		19.3			
20M14SA	Ethylbenzene	100-41-4	WD	UG/L	87		87			
20M14SA	Ethylbenzene	100-41-4	WD	UG/L	470		470			
20M14SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M14SA	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M14W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M14W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M14W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M15SA	Ethylbenzene	100-41-4	WD	UG/L	1130		1130			
20M15SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M15SA	Ethylbenzene	100-41-4	WD	UG/L	1300		1300			
20M15W1	Ethylbenzene	100-41-4	WD	UG/L	11.2		11.2			
20M15W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M15W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M15W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	UF	0.5			
20M16SA	Ethylbenzene	100-41-4	WD	UG/L	0.46	U	0.23			
20M16SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M16SA	Ethylbenzene	100-41-4	WD	UG/L	2		2			
20M16SA	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M16W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M16W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M16W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	UF	0.5			
20M17SA	Ethylbenzene	100-41-4	WD	UG/L	86.7		86.7			
20M17SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M17SA	Ethylbenzene	100-41-4	WD	UG/L	115		115			
20M17SA	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M17W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M17W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M17W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M18SA	Ethylbenzene	100-41-4	WD	UG/L	0.46	UF	0.46			
20M18SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M18SA	Ethylbenzene	100-41-4	WD	UG/L	400		400			
20M18SA	Ethylbenzene	100-41-4	WD	UG/L	1120		1120			

TABLE D.8. Chemical Analytical Results for Source Area ST20 E8
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M18W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M18W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M18W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M18W1	Ethylbenzene	100-41-4	WD	UG/L	0.46	U	0.23			
20M19SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M19SA	Ethylbenzene	100-41-4	WD	UG/L	1600		1600			
20M19W1	Ethylbenzene	100-41-4	WD	UG/L	1		1			
20M19W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M19W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M06W1	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5	1.2	6	5.3
20M13SA	Fluoranthene	206-44-0	WD	UG/L	6.3		6.3			
20M14SA	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5			
20M15SA	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5			
20M16SA	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5			
20M17SA	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5			
20M18SA	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5			
20M19SA	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5			
20M06W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5	156	2000	1091
20M06W2	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M06W2	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M13SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M13SA	m,p-Xylene	108-38-3	WD	UG/L	340		340			
20M13W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M13W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M14SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M14SA	m,p-Xylene	108-38-3	WD	UG/L	930		930			
20M14W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M14W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M15SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M15SA	m,p-Xylene	108-38-3	WD	UG/L	1600		1600			
20M15W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M15W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M16SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M16SA	m,p-Xylene	108-38-3	WD	UG/L	4		4			
20M16W1	m,p-Xylene	108-38-3	WD	UG/L	2		2			
20M16W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M17SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M17SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M17W1	m,p-Xylene	108-38-3	WD	UG/L	2		2			
20M17W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M18SA	m,p-Xylene	108-38-3	WD	UG/L	4		4			
20M18SA	m,p-Xylene	108-38-3	WD	UG/L	1		1			
20M18W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M18W1	m,p-Xylene	108-38-3	WD	UG/L	110		110			

TABLE D.8. Chemical Analytical Results for Source Area ST20 E8
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M19SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M19SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M19SA	m,p-Xylene	108-38-3	WD	UG/L	2		2			
20M19W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M19W1	m,p-Xylene	108-38-3	WD	UG/L	2000		2000			
20M06W2	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5	2	5	6
20M13SA	Methylene Chloride	75-09-2	WD	UG/L	3		3			
20M13W1	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M14SA	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M14W1	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M15W1	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M16W1	Methylene Chloride	75-09-2	WD	UG/L	4		4			
20M17W1	Methylene Chloride	75-09-2	WD	UG/L	5		5			
20M18W1	Methylene Chloride	75-09-2	WD	UG/L	5		5			
20M19SA	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M19W1	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M06W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13	20.39	160	133.21
20M13SA	Naphthalene	91-20-3	WD	UG/L	160		160			
20M14SA	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
20M15SA	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
20M16SA	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
20M17SA	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
20M18SA	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
20M19SA	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
20M06W1	oXylene	95-47-6	WD	UG/L	1	U	0.5	55	760	424
20M06W2	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M06W2	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M06W2	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M13SA	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M13W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M13W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M13W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M14SA	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M14SA	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M14W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M14W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M15SA	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M15SA	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M15W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M15W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M16SA	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M16SA	oXylene	95-47-6	WD	UG/L	37		37			
20M16W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M16W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			

TABLE D.8. Chemical Analytical Results for Source Area ST20 E8
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M17SA	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M17SA	oXylene	95-47-6	WD	UG/L	760		760			
20M17W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M17W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M18SA	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M18W1	oXylene	95-47-6	WD	UG/L	720		720			
20M18W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M18W1	oXylene	95-47-6	WD	UG/L	2		2			
20M19SA	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M19SA	oXylene	95-47-6	WD	UG/L	230		230			
20M19W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M19W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M06W2	Phenanthrene	85-01-8	WD	UG/L	6.6		6.6	1.3	7	5.6
20M13W1	Phenanthrene	85-01-8	WD	UG/L	1	U	0.5			
20M14W1	Phenanthrene	85-01-8	WD	UG/L	1	U	0.5			
20M15W1	Phenanthrene	85-01-8	WD	UG/L	1	U	0.5			
20M16W1	Phenanthrene	85-01-8	WD	UG/L	1	U	0.5			
20M17W1	Phenanthrene	85-01-8	WD	UG/L	1	U	0.5			
20M18W1	Phenanthrene	85-01-8	WD	UG/L	1	U	0.5			
20M19W1	Phenanthrene	85-01-8	WD	UG/L	1	U	0.5			
20M06W1	Phenol	108-95-2	WD	UG/L	1	U	0.5	22	140	118
20M13SA	Phenol	108-95-2	WD	UG/L	140		140			
20M14SA	Phenol	108-95-2	WD	UG/L	10	U	5			
20M15SA	Phenol	108-95-2	WD	UG/L	10	U	5			
20M16SA	Phenol	108-95-2	WD	UG/L	40	U	20			
20M17SA	Phenol	108-95-2	WD	UG/L	2	U	1			
20M18SA	Phenol	108-95-2	WD	UG/L	2	U	1			
20M19SA	Phenol	108-95-2	WD	UG/L	2	U	1			
20M06W2	Pyrene	129-00-0	WD	UG/L	1	U	0.5	1.1	6	4.7
20M13W1	Pyrene	129-00-0	WD	UG/L	5.5		5.5			
20M14W1	Pyrene	129-00-0	WD	UG/L	1	U	0.5			
20M15W1	Pyrene	129-00-0	WD	UG/L	1	U	0.5			
20M16W1	Pyrene	129-00-0	WD	UG/L	1	U	0.5			
20M17W1	Pyrene	129-00-0	WD	UG/L	1	U	0.5			
20M18W1	Pyrene	129-00-0	WD	UG/L	1	U	0.5			
20M19W1	Pyrene	129-00-0	WD	UG/L	1	U	0.5			
20M06W1	Toluene	108-88-3	WD	UG/L	0.6		0.6	905.95	21000	8208.65
20M06W2	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M06W2	Toluene	108-88-3	WD	UG/L	3		3			
20M06W2	Toluene	108-88-3	WD	UG/L	2		2			
20M06W2	Toluene	108-88-3	WD	UG/L	0.83		0.83			
20M13SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M13SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M13SA	Toluene	108-88-3	WD	UG/L	20		20			

TABLE D.8. Chemical Analytical Results for Source Area ST20 E8
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M13W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M13W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M13W1	Toluene	108-88-3	WD	UG/L	4		4			
20M13W1	Toluene	108-88-3	WD	UG/L	1.68		1.68			
20M14SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M14SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M14SA	Toluene	108-88-3	WD	UG/L	1400		1400			
20M14W1	Toluene	108-88-3	WD	UG/L	2010		2010			
20M14W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M14W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M14W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
20M15SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M15SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M15W1	Toluene	108-88-3	WD	UG/L	4		4			
20M15W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
20M15W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M15W1	Toluene	108-88-3	WD	UG/L	2		2			
20M16SA	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
20M16SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M16SA	Toluene	108-88-3	WD	UG/L	21000		21000			
20M16W1	Toluene	108-88-3	WD	UG/L	348		348			
20M16W1	Toluene	108-88-3	WD	UG/L	10		10			
20M16W1	Toluene	108-88-3	WD	UG/L	4		4			
20M16W1	Toluene	108-88-3	WD	UG/L	1.67		1.67			
20M17SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M17SA	Toluene	108-88-3	WD	UG/L	2		2			
20M17SA	Toluene	108-88-3	WD	UG/L	12		12			
20M17W1	Toluene	108-88-3	WD	UG/L	15800		15800			
20M17W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M17W1	Toluene	108-88-3	WD	UG/L	3		3			
20M18SA	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
20M18SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M18SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M18W1	Toluene	108-88-3	WD	UG/L	40		40			
20M18W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
20M18W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M18W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M19SA	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
20M19SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M19SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M19W1	Toluene	108-88-3	WD	UG/L	7300		7300			
20M19W1	Toluene	108-88-3	WD	UG/L	939		939			
20M19W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			

TABLE D.8. Chemical Analytical Results for Source Area ST20 E8
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M19W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M19W1	Toluene	108-88-3	WD	UG/L	0.87		0.87			
20M06W1	Total Xylenes	1330-20-7	WD	UG/L	3830		3830	465.25	3830	2626.77
20M13SA	Total Xylenes	1330-20-7	WD	UG/L	1550		1550			
20M13W1	Total Xylenes	1330-20-7	WD	UG/L	1	U	0.5			
20M14SA	Total Xylenes	1330-20-7	WD	UG/L	1590		1590			
20M14W1	Total Xylenes	1330-20-7	WD	UG/L	1	U	0.5			
20M15SA	Total Xylenes	1330-20-7	WD	UG/L	3.44		3.44			
20M15W1	Total Xylenes	1330-20-7	WD	UG/L	1	U	0.5			
20M16SA	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
20M16W1	Total Xylenes	1330-20-7	WD	UG/L	1	U	0.5			
20M17SA	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
20M17W1	Total Xylenes	1330-20-7	WD	UG/L	1	U	0.5			
20M18SA	Total Xylenes	1330-20-7	WD	UG/L	1.21		1.21			
20M18W1	Total Xylenes	1330-20-7	WD	UG/L	1	U	0.5			
20M19SA	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
20M19W1	Total Xylenes	1330-20-7	WD	UG/L	1	U	0.5			
(a) Definitions: AG (soil gas), SO (soil), WD and WG (groundwater).										
(b) "Reported Result" is the concentration as reported in Eielson Air Force Base database.										
(c) U and UF represent nondetected analytes at the detection limit listed in "Reported Result" column.										
(d) "DL/2 Value" lists the reported concentration of detected analytes or one-half of the detection limit for nondetected analytes.										
(e) "UCL" represents Upper Confidence Limit.										

TABLE D.9. Chemical Analytical Results for Source Area ST20 E9
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M01SA	Benzene	71-43-2	AG	UG/L	10	U	5	351	3800	2639
20M01SB	Benzene	71-43-2	AG	UG/L	10	U	5			
20M01SB	Benzene	71-43-2	AG	UG/L	10	U	5			
20M01W1	Benzene	71-43-2	AG	UG/L	10	U	5			
20M07W1	Benzene	71-43-2	AG	UG/L	10	U	5			
20M08W1	Benzene	71-43-2	AG	UG/L	10	U	5			
20M20SA	Benzene	71-43-2	AG	UG/L	10	U	5			
20M21SA	Benzene	71-43-2	AG	UG/L	10	U	5			
20M22SA	Benzene	71-43-2	AG	UG/L	10	U	5			
20M23SA	Benzene	71-43-2	AG	UG/L	20		20			
20M24SA	Benzene	71-43-2	AG	UG/L	3800		3800			
20M20W1	Benzene	71-43-2	AG	UG/L	10	U	5			
20M21W1	Ethylbenzene	100-41-4	AG	UG/L	10	U	5	2601	9680	9717
20M22W1	Ethylbenzene	100-41-4	AG	UG/L	4900		4900			
20M23W1	Ethylbenzene	100-41-4	AG	UG/L	9680		9680			
20M24W1	Ethylbenzene	100-41-4	AG	UG/L	5650		5650			
20C-2	Ethylbenzene	100-41-4	AG	UG/L	5650		5650			
20C-2	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
20C-2	Ethylbenzene	100-41-4	AG	UG/L	70		70			
20C-2	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
20C-2	Ethylbenzene	100-41-4	AG	UG/L	30		30			
20C-2(5)	Ethylbenzene	100-41-4	AG	UG/L	10		10			
20M01W1	mXylene	108-38-3	AG	UG/L	3680		3680	1232	3680	NA
20M07W1	mXylene	108-38-3	AG	UG/L	10		10			
20M08W1	mXylene	108-38-3	AG	UG/L	10	U	5			
20M01SA	Toluene	108-88-3	AG	UG/L	110		110	90	110	NA
20M01SB	Toluene	108-88-3	AG	UG/L	70		70			
20M01W2	Total BTEX	BTEX	AG	UG/L	43500		43500	9252	43500	42361
20M07W2	Total BTEX	BTEX	AG	UG/L	350		350			
20M08W2	Total BTEX	BTEX	AG	UG/L	26500		26500			
20M20SA	Total BTEX	BTEX	AG	UG/L	10	U	5			
20M21SA	Total BTEX	BTEX	AG	UG/L	860		860			
20M22SA	Total BTEX	BTEX	AG	UG/L	10	U	5			
20M23SA	Total BTEX	BTEX	AG	UG/L	10	U	5			
20M24SA	Total BTEX	BTEX	AG	UG/L	2790		2790			
20M20SA	Anthracene	120-12-7	SO	UG/KG	30	U	15	83	190	253
20M21SA	Anthracene	120-12-7	SO	UG/KG	190		190			
20M22SA	Anthracene	120-12-7	SO	UG/KG	160		160			
20M23SA	Anthracene	120-12-7	SO	UG/KG	170		170			
20M24SA	Anthracene	120-12-7	SO	UG/KG	30	U	15			
20C-2	Anthracene	120-12-7	SO	UG/KG	30	U	15			
20C-2(5)	Anthracene	120-12-7	SO	UG/KG	30	U	15			
20C-2	Benzene	71-43-2	SO	UG/KG	3310		3310	1765	3310	NA
20C-2(5)	Benzene	71-43-2	SO	UG/KG	440	U	220			
20M01SA	Chrysene	218-01-9	SO	UG/KG	50	U	25	290	820	NA

TABLE D.9. Chemical Analytical Results for Source Area ST20 E9
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M01SB	Chrysene	218-01-9	SO	UG/KG	50	U	25			
20M01W1	Chrysene	218-01-9	SO	UG/KG	820		820			
20M20SA	Ethylbenzene	100-41-4	SO	UG/KG	390		390	1355	8800	7926
20M21SA	Ethylbenzene	100-41-4	SO	UG/KG	8800		8800			
20M22SA	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
20M23SA	Ethylbenzene	100-41-4	SO	UG/KG	250	U	125			
20M24SA	Ethylbenzene	100-41-4	SO	UG/KG	250	U	125			
20C-2	Ethylbenzene	100-41-4	SO	UG/KG	5	U	2.5			
20C-2(5)	Ethylbenzene	100-41-4	SO	UG/KG	5	U	2.5			
20M20SA	Fluorene	86-73-7	SO	UG/KG	30	U	15	54	100 NA	
20M21SA	Fluorene	86-73-7	SO	UG/KG	50		50			
20M22SA	Fluorene	86-73-7	SO	UG/KG	100		100			
20M23SA	Fluorene	86-73-7	SO	UG/KG	90		90			
20M24SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
20M01SA	Total Xylenes	1330-20-7	SO	UG/KG	80	U	40	3130	12400 NA	
20M01SB	Total Xylenes	1330-20-7	SO	UG/KG	12400		12400			
20C-2	Total Xylenes	1330-20-7	SO	UG/KG	80	U	40			
20C-2(5)	Total Xylenes	1330-20-7	SO	UG/KG	80	U	40			
20M01W2	TPH	TPH	SO	UG/KG	10200	U	5100	104513	500000	477482
20M07W2	TPH	TPH	SO	UG/KG	500000		500000			
20M08W2	TPH	TPH	SO	UG/KG	283000		283000			
20M20W1	TPH	TPH	SO	UG/KG	10000	U	5000			
20M21W1	TPH	TPH	SO	UG/KG	23000		23000			
20M22W1	TPH	TPH	SO	UG/KG	10000		10000			
20M23W1	TPH	TPH	SO	UG/KG	10000	U	5000			
20M24W1	TPH	TPH	SO	UG/KG	10000	U	5000			
20M01W2	2-Methyl Phenol	95-48-7	WD	UG/L	2	U	1	1.93	7.18	6.77
20M07W2	2-Methyl Phenol	95-48-7	WD	UG/L	2	U	1			
20M08W2	2-Methyl Phenol	95-48-7	WD	UG/L	2	U	1			
20M21SA	2-Methyl Phenol	95-48-7	WD	UG/L	0.84	U	0.42			
20M22SA	2-Methyl Phenol	95-48-7	WD	UG/L	0.84	U	0.42			
20M23SA	2-Methyl Phenol	95-48-7	WD	UG/L	2.52		2.52			
20M24SA	2-Methyl Phenol	95-48-7	WD	UG/L	7.18		7.18			
20M01W2	2-Methylnaphthalene	91-57-6	WD	UG/L	260		260	65	260	288
20M07W2	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
20M08W2	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
20M20W1	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
20M21W1	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
20M22W1	2-Methylnaphthalene	91-57-6	WD	UG/L	191		191			
20M24SA	2-Methylnaphthalene	91-57-6	WD	UG/L	0.8	U	0.4	1.8	5	5.7
20M01W1	4-Methyl Phenol	106-44-5	WD	UG/L	10	U	5			
20M07W1	4-Methyl Phenol	106-44-5	WD	UG/L	10	U	5			
20M08W1	4-Methyl Phenol	106-44-5	WD	UG/L	10	U	5			
20M20SA	4-Methyl Phenol	106-44-5	WD	UG/L	2	U	1			

TABLE D.9. Chemical Analytical Results for Source Area ST20 E9
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL72 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M20W1	4-Methyl Phenol	106-44-5	WD	UG/L	0.8	U	0.4			
20M21SA	4-Methyl Phenol	106-44-5	WD	UG/L	2	U	1			
20M21W1	4-Methyl Phenol	106-44-5	WD	UG/L	0.8	U	0.4			
20M22SA	4-Methyl Phenol	106-44-5	WD	UG/L	2	U	1			
20M22W1	4-Methyl Phenol	106-44-5	WD	UG/L	0.8	U	0.4			
20M23SA	4-Methyl Phenol	106-44-5	WD	UG/L	2	U	1			
20M23W1	4-Methyl Phenol	106-44-5	WD	UG/L	5	U	5			
20M24W1	4-Methyl Phenol	106-44-5	WD	UG/L	0.8	U	0.4			
20C-2(5)	Benzene	71-43-2	WD	UG/L	4	U	4			
20M01W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	27		27	16.2	4	4 NA
20M20W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	6.4		6.4			
20M21W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	18		18			
20M22W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	9.2		9.2			
20M23W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	11		11			
20M24W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
20M07W1	BIS (2-Ethylhexyl)phthalate	BEMP	WD	UG/L	56		56			
20M08W1	BIS (2-Ethylhexyl)phthalate	BEMP	WD	UG/L	2	U	1			
20M01SA	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17	1.92	10.6	10.42
20M01SB	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
20M01W1	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			
20M07W1	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			
20M08W1	Chlorobenzene	108-90-7	WD	UG/L	0.4	U	0.2			
20C-2	Chlorobenzene	108-90-7	WD	UG/L	10.6		10.6			
20M01W1	Dibenzofuran	132-64-9	WD	UG/L	0.34	U	0.17	0.57	2.56	2.01
20M07W1	Dibenzofuran	132-64-9	WD	UG/L	0.34	U	0.17			
20M08W1	Dibenzofuran	132-64-9	WD	UG/L	0.34	U	0.17			
20M20SA	Dibenzofuran	132-64-9	WD	UG/L	1	U	0.5			
20M21SA	Dibenzofuran	132-64-9	WD	UG/L	1	U	0.5			
20M22SA	Dibenzofuran	132-64-9	WD	UG/L	1	U	0.5			
20M23SA	Dibenzofuran	132-64-9	WD	UG/L	1	U	0.5			
20M23W1	Dibenzofuran	132-64-9	WD	UG/L	2.56		2.56			
20M24SA	Dibenzofuran	132-64-9	WD	UG/L	1	U	0.5			
20M24W1	Dibenzofuran	132-64-9	WD	UG/L	0.34	U	0.17			
20M01W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M01W2	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M01W2	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M01W2	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M07W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M07W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M07W2	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M07W2	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M07W2	Ethylbenzene	100-41-4	WD	UG/L	387		387			
20M08W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M08W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			

TABLE D.9. Chemical Analytical Results for Source Area ST20 E9
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M08W2	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M08W2	Ethylbenzene	100-41-4	WD	UG/L	140		140			
20M08W2	Ethylbenzene	100-41-4	WD	UG/L	1.21		1.21			
20M20SA	Ethylbenzene	100-41-4	WD	UG/L	24.6		24.6			
20M20SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M20SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M20W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M20W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M20W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M21SA	Ethylbenzene	100-41-4	WD	UG/L	0.46	U	0.23			
20M21SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M21SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M21W1	Ethylbenzene	100-41-4	WD	UG/L	1		1			
20M21W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M21W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M22SA	Ethylbenzene	100-41-4	WD	UG/L	1050		1050			
20M22SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M22SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M22W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M22W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M22W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M23SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M23SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M23SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M23W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M23W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M23W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M24SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M24SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M24SA	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M24W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M24W1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
20M24W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
20M01W1	Fluoranthene	206-44-0	WD	UG/L	20		20	3	20	17
20M07W1	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5			
20M08W1	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5			
20M20SA	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5			
20M21SA	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5			
20M22SA	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5			
20M23SA	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5			
20M24SA	Fluoranthene	206-44-0	WD	UG/L	1	U	0.5			
20M01W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M01W2	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5	261	4700	2150
20M01W2	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			

TABLE D.9. Chemical Analytical Results for Source Area ST20 E9
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M07W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M07W2	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M07W2	m,p-Xylene	108-38-3	WD	UG/L	2		2			
20M08W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M08W2	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M08W2	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M20SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M20SA	m,p-Xylene	108-38-3	WD	UG/L	2		2			
20M20W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M20W1	m,p-Xylene	108-38-3	WD	UG/L	4700		4700			
20M21SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M21SA	m,p-Xylene	108-38-3	WD	UG/L	2		2			
20M21W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M21W1	m,p-Xylene	108-38-3	WD	UG/L	2		2			
20M22SA	m,p-Xylene	108-38-3	WD	UG/L	510		510			
20M22SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M22SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M22W1	m,p-Xylene	108-38-3	WD	UG/L	640		640			
20M22W1	m,p-Xylene	108-38-3	WD	UG/L	2		2			
20M23SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M23SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M23SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M23W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M23W1	m,p-Xylene	108-38-3	WD	UG/L	3000		3000			
20M24SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M24SA	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M24W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M24W1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
20M24W1	m,p-Xylene	108-38-3	WD	UG/L	3		3			
20M07W2	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5	1	3	2
20M08W2	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M20SA	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M20W1	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M21SA	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M21W1	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M22SA	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M22W1	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M23W1	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M24SA	Methylene Chloride	75-09-2	WD	UG/L	1	U	0.5			
20M24W1	Methylene Chloride	75-09-2	WD	UG/L	3		3			
20M01W1	Naphthalene	91-20-3	WD	UG/L	8.6		8.6	15.15	140	103.04

TABLE D.9. Chemical Analytical Results for Source Area ST20 E9
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL (e)
20M07W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
20M08W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
20M20SA	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
20M21SA	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
20M22SA	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
20M23SA	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
20M23W1	Naphthalene	91-20-3	WD	UG/L	140	U	140			
20M24SA	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
20M24W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
20M01W1	Nitrog. NO2+NO3	NO2+NO3	WD	UG/L	16	U	16	11	16	NA
20M07W1	Nitrog. NO2+NO3	NO2+NO3	WD	UG/L	10	U	5			
20M08W1	Nitrog. NO2+NO3	NO2+NO3	WD	UG/L	12	U	12			
20M01W1	oXylene	95-47-6	WD	UG/L	1	U	0.5	63	1400	589
20M01W2	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M01W2	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M01W2	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M01W1	oXylene	95-47-6	WD	UG/L	2	U	2			
20M07W2	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M07W2	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M08W1	oXylene	95-47-6	WD	UG/L	24	U	24			
20M08W2	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M08W2	oXylene	95-47-6	WD	UG/L	2	U	2			
20M20SA	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M20SA	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M20W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M20W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M21SA	oXylene	95-47-6	WD	UG/L	15	U	15			
20M21SA	oXylene	95-47-6	WD	UG/L	1400	U	1400			
20M21W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M21W1	oXylene	95-47-6	WD	UG/L	1	U	1			
20M22SA	oXylene	95-47-6	WD	UG/L	2	U	2			
20M22W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M22W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M23SA	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M23SA	oXylene	95-47-6	WD	UG/L	29	U	29			
20M23W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M23W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M24SA	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M24SA	oXylene	95-47-6	WD	UG/L	400	U	400			
20M24W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M24W1	oXylene	95-47-6	WD	UG/L	1	U	0.5			
20M01W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15	1583.13	19700	11184.10
20M01W2	Toluene	108-88-3	WD	UG/L	1	U	0.5			

TABLE D.9. Chemical Analytical Results for Source Area ST20 E9
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(s)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M01W2	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M01W2	Toluene	108-88-3	WD	UG/L	3		3			
20M01W2	Toluene	108-88-3	WD	UG/L	13200		13200			
20M07W1	Toluene	108-88-3	WD	UG/L	15900		15900			
20M07W2	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M07W2	Toluene	108-88-3	WD	UG/L	3		3			
20M07W2	Toluene	108-88-3	WD	UG/L	1		1			
20M07W2	Toluene	108-88-3	WD	UG/L	3040		3040			
20M08W2	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M08W2	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M08W2	Toluene	108-88-3	WD	UG/L	2		2			
20M08W2	Toluene	108-88-3	WD	UG/L	6600		6600			
20M20SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M20SA	Toluene	108-88-3	WD	UG/L	1		1			
20M20SA	Toluene	108-88-3	WD	UG/L	19000		19000			
20M20W1	Toluene	108-88-3	WD	UG/L	0.28		0.28			
20M20W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M20W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M20W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
20M21SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M21SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M21SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M21W1	Toluene	108-88-3	WD	UG/L	1.16		1.16			
20M21W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M21W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M21W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
20M22SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M22SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M22SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M22W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
20M22W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M22W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M22W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
20M23SA	Toluene	108-88-3	WD	UG/L	1		1			
20M23SA	Toluene	108-88-3	WD	UG/L	2		2			
20M23SA	Toluene	108-88-3	WD	UG/L	3		3			
20M23W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
20M23W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M23W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M23W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
20M24SA	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M24SA	Toluene	108-88-3	WD	UG/L	2		2			
20M24SA	Toluene	108-88-3	WD	UG/L	3		3			
20M24W1	Toluene	108-88-3	WD	UG/L	19700		19700			

TABLE D.9. Chemical Analytical Results for Source Area ST20 E9
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
20M24W1	Toluene	108-88-3	WD	UG/L	1	U	0.5			
20M24W1	Toluene	108-88-3	WD	UG/L	99		99			
20M24W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
20M01W1	Total Xylenes	1330-20-7	WD	UG/L	236		236	465.40	3820	2637.29
20M07W1	Total Xylenes	1330-20-7	WD	UG/L	432		432			
20M07W2	Total Xylenes	1330-20-7	WD	UG/L	1	U	0.5			
20M08W1	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
20M08W2	Total Xylenes	1330-20-7	WD	UG/L	1	U	0.5			
20M20SA	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
20M20W1	Total Xylenes	1330-20-7	WD	UG/L	2200		2200			
20M21SA	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
20M21W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
20M22SA	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
20M22W1	Total Xylenes	1330-20-7	WD	UG/L	290		290			
20M23SA	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
20M23W1	Total Xylenes	1330-20-7	WD	UG/L	3820		3820			
20M24SA	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
20M24W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
(a) Definitions: AG (soil gas), SO (soil), WD and WG (groundwater).										
(b) "Reported Result" is the concentration as reported in Elselon Air Force Base database.										
(c) U and UF represent nondetected analytes at the detection limit listed in "Reported Result" column.										
(d) "DL2 Value" lists the reported concentration of detected analytes or one-half of the detection limit for nondetected analytes.										
(e) "UCL" represents Upper Confidence Limit.										

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
48SV01	Benzene	71-43-2	AG	UG/L	390		390	19	390	135
48SV02	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV03	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV04	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV05	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV06	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV07	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV08	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV09	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV10	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV11	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV12	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV13	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV14	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV15	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV16	Benzene	71-43-2	AG	UG/L	40		40			
48SV17	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV18	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV19	Benzene	71-43-2	AG	UG/L	30		30			
48SV20	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV21	Benzene	71-43-2	AG	UG/L	50		50			
48SV22	Benzene	71-43-2	AG	UG/L	20		20			
48SV23	Benzene	71-43-2	AG	UG/L	30		30			
48SV24	Benzene	71-43-2	AG	UG/L	10		10			
48SV25	Benzene	71-43-2	AG	UG/L	40		40			
48SV26	Benzene	71-43-2	AG	UG/L	20		20			
48SV27	Benzene	71-43-2	AG	UG/L	10		10			
48SV28	Benzene	71-43-2	AG	UG/L	30		30			
48SV29	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV30	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV31	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV32	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV33	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV34	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV35	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV36	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV37	Benzene	71-43-2	AG	UG/L	20	U	20			
48SV38	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV39	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV40	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV41	Benzene	71-43-2	AG	UG/L	10		10			
48SV42	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV43	Benzene	71-43-2	AG	UG/L	10	U	5			
48SV44	Benzene	71-43-2	AG	UG/L	10	U	5			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
48SV45	Benzene	71-43-2	AG	UG/L	10		10			
48SV01	BTEX	BTEX	AG	UG/L	900		900	1397	43400	15038
48SV02	BTEX	BTEX	AG	UG/L	10	U	5			
48SV03	BTEX	BTEX	AG	UG/L	10	U	5			
48SV04	BTEX	BTEX	AG	UG/L	10		10			
48SV05	BTEX	BTEX	AG	UG/L	10	U	5			
48SV06	BTEX	BTEX	AG	UG/L	10	U	5			
48SV07	BTEX	BTEX	AG	UG/L	90		90			
48SV08	BTEX	BTEX	AG	UG/L	10	U	5			
48SV09	BTEX	BTEX	AG	UG/L	10		10			
48SV10	BTEX	BTEX	AG	UG/L	10	U	5			
48SV11	BTEX	BTEX	AG	UG/L	10	U	5			
48SV12	BTEX	BTEX	AG	UG/L	10		10			
48SV13	BTEX	BTEX	AG	UG/L	10	U	5			
48SV14	BTEX	BTEX	AG	UG/L	10	U	5			
48SV15	BTEX	BTEX	AG	UG/L	10	U	5			
48SV16	BTEX	BTEX	AG	UG/L	40		40			
48SV17	BTEX	BTEX	AG	UG/L	10	U	5			
48SV18	BTEX	BTEX	AG	UG/L	10	U	5			
48SV19	BTEX	BTEX	AG	UG/L	30		30			
48SV20	BTEX	BTEX	AG	UG/L	43400		43400			
48SV21	BTEX	BTEX	AG	UG/L	640		640			
48SV22	BTEX	BTEX	AG	UG/L	230		230			
48SV23	BTEX	BTEX	AG	UG/L	220		220			
48SV24	BTEX	BTEX	AG	UG/L	120		120			
48SV25	BTEX	BTEX	AG	UG/L	170		170			
48SV26	BTEX	BTEX	AG	UG/L	120		120			
48SV27	BTEX	BTEX	AG	UG/L	60		60			
48SV28	BTEX	BTEX	AG	UG/L	280		280			
48SV29	BTEX	BTEX	AG	UG/L	20		20			
48SV30	BTEX	BTEX	AG	UG/L	10	U	5			
48SV31	BTEX	BTEX	AG	UG/L	10	U	5			
48SV32	BTEX	BTEX	AG	UG/L	15800		15800			
48SV33	BTEX	BTEX	AG	UG/L	130		130			
48SV34	BTEX	BTEX	AG	UG/L	80		80			
48SV35	BTEX	BTEX	AG	UG/L	20		20			
48SV36	BTEX	BTEX	AG	UG/L	10	U	5			
48SV37	BTEX	BTEX	AG	UG/L	20		20			
48SV38	BTEX	BTEX	AG	UG/L	10	U	5			
48SV39	BTEX	BTEX	AG	UG/L	10	U	5			
48SV40	BTEX	BTEX	AG	UG/L	10	U	5			
48SV41	BTEX	BTEX	AG	UG/L	90		90			
48SV42	BTEX	BTEX	AG	UG/L	10	U	5			
48SV43	BTEX	BTEX	AG	UG/L	10	U	5			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
48SV44	BTEX	BTEX	AG	UG/L	10	U	5			
48SV45	BTEX	BTEX	AG	UG/L	260		260			
48SV01	Ethylbenzene	100-41-4	AG	UG/L	20		20	322	11800	3851
48SV02	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV03	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV04	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV05	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV06	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV07	Ethylbenzene	100-41-4	AG	UG/L	850		850			
48SV08	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV09	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV10	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV11	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV12	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV13	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV14	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV15	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV16	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV17	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV18	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV19	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV20	Ethylbenzene	100-41-4	AG	UG/L	1310		1310			
48SV21	Ethylbenzene	100-41-4	AG	UG/L	30		30			
48SV22	Ethylbenzene	100-41-4	AG	UG/L	20		20			
48SV23	Ethylbenzene	100-41-4	AG	UG/L	40		40			
48SV24	Ethylbenzene	100-41-4	AG	UG/L	30		30			
48SV25	Ethylbenzene	100-41-4	AG	UG/L	10		10			
48SV26	Ethylbenzene	100-41-4	AG	UG/L	10		10			
48SV27	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV28	Ethylbenzene	100-41-4	AG	UG/L	20		20			
48SV29	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV30	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV31	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV32	Ethylbenzene	100-41-4	AG	UG/L	11800		11800			
48SV33	Ethylbenzene	100-41-4	AG	UG/L	130		130			
48SV34	Ethylbenzene	100-41-4	AG	UG/L	20		20			
48SV35	Ethylbenzene	100-41-4	AG	UG/L	20		20			
48SV36	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV37	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV38	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV39	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV40	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV41	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV42	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
48SV43	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV44	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
48SV45	Ethylbenzene	100-41-4	AG	UG/L	20		20			
48SV01	Toluene	108-88-3	AG	UG/L	400	U	400	1228	39600	13587
48SV02	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV03	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV04	Toluene	108-88-3	AG	UG/L	10		10			
48SV05	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV06	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV07	Toluene	108-88-3	AG	UG/L	50		50			
48SV08	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV09	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV10	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV11	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV12	Toluene	108-88-3	AG	UG/L	80		80			
48SV13	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV14	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV15	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV16	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV17	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV18	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV19	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV20	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV21	Toluene	108-88-3	AG	UG/L	39600		39600			
48SV22	Toluene	108-88-3	AG	UG/L	450		450			
48SV23	Toluene	108-88-3	AG	UG/L	150		150			
48SV24	Toluene	108-88-3	AG	UG/L	140		140			
48SV25	Toluene	108-88-3	AG	UG/L	80		80			
48SV26	Toluene	108-88-3	AG	UG/L	110		110			
48SV27	Toluene	108-88-3	AG	UG/L	90		90			
48SV28	Toluene	108-88-3	AG	UG/L	50		50			
48SV29	Toluene	108-88-3	AG	UG/L	180		180			
48SV30	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV31	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV32	Toluene	108-88-3	AG	UG/L	13400		13400			
48SV33	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV34	Toluene	108-88-3	AG	UG/L	60		60			
48SV35	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV36	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV37	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV38	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV39	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV40	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV41	Toluene	108-88-3	AG	UG/L	80		80			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
48SV42	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV43	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV44	Toluene	108-88-3	AG	UG/L	10	U	5			
48SV45	Toluene	108-88-3	AG	UG/L	170		170			
48SV01	mXylene	108-38-3	AG	UG/L	90		90	126	2610	1180
48SV02	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV03	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV04	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV05	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV06	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV07	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV08	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV09	mXylene	108-38-3	AG	UG/L	10		10			
48SV10	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV11	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV12	mXylene	108-38-3	AG	UG/L	20		20			
48SV13	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV14	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV15	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV16	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV17	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV18	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV19	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV20	mXylene	108-38-3	AG	UG/L	2470		2470			
48SV21	mXylene	108-38-3	AG	UG/L	110		110			
48SV22	mXylene	108-38-3	AG	UG/L	40		40			
48SV23	mXylene	108-38-3	AG	UG/L	10		10			
48SV24	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV25	mXylene	108-38-3	AG	UG/L	10		10			
48SV26	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV27	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV28	mXylene	108-38-3	AG	UG/L	50		50			
48SV29	mXylene	108-38-3	AG	UG/L	20		20			
48SV30	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV31	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV32	mXylene	108-38-3	AG	UG/L	2610		2610			
48SV33	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV34	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV35	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV36	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV37	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV38	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV39	mXylene	108-38-3	AG	UG/L	10	U	5			
48SV40	mXylene	108-38-3	AG	UG/L	10	U	5			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
48M02SA	TPH	TPH	SO	UG/KG	142000		142000			
48M03SA	TPH	TPH	SO	UG/KG	89000		89000			
48M04SA	TPH	TPH	SO	UG/KG	38600		38600			
48M05SA	TPH	TPH	SO	UG/KG	10200	U	5100			
48M06SA	TPH	TPH	SO	UG/KG	46900		46900			
48TP01SA	TPH	TPH	SO	UG/KG	10200	U	5100			
48TP01SB	TPH	TPH	SO	UG/KG	10200	U	5100			
48TP02SA	TPH	TPH	SO	UG/KG	10200	U	5100			
48TP02SB	TPH	TPH	SO	UG/KG	10200	U	5100			
48TP03SA	TPH	TPH	SO	UG/KG	63100		63100			
48TP03SB	TPH	TPH	SO	UG/KG	10200	U	5100			
48TP04SA	TPH	TPH	SO	UG/KG	13000000		13000000			
53M03SA	TPH	TPH	SO	UG/KG	740000		740000			
SB#48-1A	TPH	TPH	SO	UG/KG	20000		20000			
SB#48-1B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-1C	TPH	TPH	SO	UG/KG	120000		120000			
SB#48-2A	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-2A	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-2B	TPH	TPH	SO	UG/KG	32000000		32000000			
SB#48-3A	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-3B	TPH	TPH	SO	UG/KG	33000		33000			
SB#48-3C	TPH	TPH	SO	UG/KG	3900000		3900000			
SB#48-3D	TPH	TPH	SO	UG/KG	12000000		12000000			
SB#48-4A	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-4B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-4C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-5A	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-5B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-5C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-5D	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-6A	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-6B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-6C	TPH	TPH	SO	UG/KG	94000		94000			
SB#48-6D	TPH	TPH	SO	UG/KG	150000		150000			
SB#48-8A	TPH	TPH	SO	UG/KG	160000		160000			
SB#48-8B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-8C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-9A	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-9B	TPH	TPH	SO	UG/KG	13000		13000			
SB#48-9C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-10A	TPH	TPH	SO	UG/KG	32000		32000			
SB#48-10B	TPH	TPH	SO	UG/KG	43000		43000			
SB#48-10C	TPH	TPH	SO	UG/KG	82000		82000			
SB#48-10D	TPH	TPH	SO	UG/KG	1700000		1700000			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
SB#48-11A	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-11B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-11C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-12A	TPH	TPH	SO	UG/KG	26000		26000			
SB#48-12B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-12C	TPH	TPH	SO	UG/KG	2600000		2600000			
SB#48-13A	TPH	TPH	SO	UG/KG	13000		13000			
SB#48-13B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-13C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-14A	TPH	TPH	SO	UG/KG	14000		14000			
SB#48-14B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-14C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-15A	TPH	TPH	SO	UG/KG	550000		550000			
SB#48-15B	TPH	TPH	SO	UG/KG	51000		51000			
SB#48-15C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-16A	TPH	TPH	SO	UG/KG	280000		280000			
SB#48-16B	TPH	TPH	SO	UG/KG	13000		13000			
SB#48-16C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-17A	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-17B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-17C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-18A	TPH	TPH	SO	UG/KG	460000		460000			
SB#48-18B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-18C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-18D	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-19A	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-19B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-19C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-19D	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-20A	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-20B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-20C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-21B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-21C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-21D	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-22B	TPH	TPH	SO	UG/KG	22000		22000			
SB#48-22C	TPH	TPH	SO	UG/KG	77000		77000			
SB#48-22D	TPH	TPH	SO	UG/KG	13000		13000			
SB#48-23A	TPH	TPH	SO	UG/KG	65000		65000			
SB#48-23B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-23C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#48-24A	TPH	TPH	SO	UG/KG	53000		53000			
SB#48-24B	TPH	TPH	SO	UG/KG	14000		14000			
SB#48-24C	TPH	TPH	SO	UG/KG	10000	U	5000			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
SB#48-24D	TPH	TPH	SO	UG/KG	10000	U	5000			
48X01SA	TPH	TPH	SO	UG/KG	39600		39600			
48X02SA	TPH	TPH	SO	UG/KG	47000		47000			
48X03SA	TPH	TPH	SO	UG/KG	34600		34600			
48X04SA	TPH	TPH	SO	UG/KG	13700	U	6850			
48X05SA	TPH	TPH	SO	UG/KG	19500000		19500000			
48X06SA	TPH	TPH	SO	UG/KG	13700	U	6850			
48X07SA	TPH	TPH	SO	UG/KG	13700	U	6850			
48X08SA	TPH	TPH	SO	UG/KG	135000		139000			
48X09SA	TPH	TPH	SO	UG/KG	1060000		1060000			
48X10SA	TPH	TPH	SO	UG/KG	3710000		3710000			
48X11SA	TPH	TPH	SO	UG/KG	13700	U	6850			
48X12SA	TPH	TPH	SO	UG/KG	229000		229000			
48X13SA	TPH	TPH	SO	UG/KG	13700	U	6850			
48X14SA	TPH	TPH	SO	UG/KG	13700	U	6850			
48X15SA	TPH	TPH	SO	UG/KG	13700	U	6850			
48X16SA	TPH	TPH	SO	UG/KG	13700	U	6850			
48X17SA	TPH	TPH	SO	UG/KG	13700	U	6850			
48X18SA	TPH	TPH	SO	UG/KG	215000		215000			
48X19SA	TPH	TPH	SO	UG/KG	28600		28600			
48X20SA	TPH	TPH	SO	UG/KG	219000		219000			
48X21SA	TPH	TPH	SO	UG/KG	1370	U	685			
48X22SA	TPH	TPH	SO	UG/KG	13700	U	6850			
48X23SA	TPH	TPH	SO	UG/KG	13700	U	6850			
48X24SA	TPH	TPH	SO	UG/KG	13700	U	6850			
48M01SA	Benzene	71-43-2	SO	UG/KG	44	U	22	28	112	77
48M02SA	Benzene	71-43-2	SO	UG/KG	44	U	22			
48M03SA	Benzene	71-43-2	SO	UG/KG	44	U	22			
48M04SA	Benzene	71-43-2	SO	UG/KG	44	U	22			
48M05SA	Benzene	71-43-2	SO	UG/KG	44	U	22			
48M06SA	Benzene	71-43-2	SO	UG/KG	44	U	22			
48TP01SA	Benzene	71-43-2	SO	UG/KG	44	U	22			
48TP01SB	Benzene	71-43-2	SO	UG/KG	44	U	22			
48TP02SA	Benzene	71-43-2	SO	UG/KG	44	U	22			
48TP02SB	Benzene	71-43-2	SO	UG/KG	44	U	22			
48TP03SA	Benzene	71-43-2	SO	UG/KG	44	U	22			
48TP03SB	Benzene	71-43-2	SO	UG/KG	44	U	22			
48TP04SA	Benzene	71-43-2	SO	UG/KG	112	U	112			
53M03SA	Benzene	71-43-2	SO	UG/KG	44	U	22			
48M01SA	Chlorobenzene	108-90-7	SO	UG/KG	20	U	10	15	80	52
48M02SA	Chlorobenzene	108-90-7	SO	UG/KG	20	U	10			
48M03SA	Chlorobenzene	108-90-7	SO	UG/KG	20	U	10			
48M04SA	Chlorobenzene	108-90-7	SO	UG/KG	20	U	10			
48M05SA	Chlorobenzene	108-90-7	SO	UG/KG	20	U	10			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
48M06SA	Chlorobenzene	108-90-7	SO	UG/KG	20	U	10			
48TP01SA	Chlorobenzene	108-90-7	SO	UG/KG	20	U	10			
48TP01SB	Chlorobenzene	108-90-7	SO	UG/KG	20	U	10			
48TP02SA	Chlorobenzene	108-90-7	SO	UG/KG	20	U	10			
48TP02SB	Chlorobenzene	108-90-7	SO	UG/KG	20	U	10			
48TP03SA	Chlorobenzene	108-90-7	SO	UG/KG	20	U	10			
48TP03SB	Chlorobenzene	108-90-7	SO	UG/KG	20	U	10			
48TP04SA	Chlorobenzene	108-90-7	SO	UG/KG	20	U	10			
53M03SA	Chlorobenzene	108-90-7	SO	UG/KG	80	U	80			
48M01SA	Ethylbenzene	100-41-4	SO	UG/KG	20	U	10			
48M02SA	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40	301	3700	2258
48M03SA	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
48M04SA	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
48M05SA	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
48M06SA	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
48TP01SA	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
48TP01SB	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
48TP02SA	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
48TP02SB	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
48TP03SA	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
48TP03SB	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
48TP04SA	Ethylbenzene	100-41-4	SO	UG/KG	3700	U	3700			
53M03SA	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
48M01SA	Toluene	108-88-3	SO	UG/KG	160	U	80	104	410	280
48M02SA	Toluene	108-88-3	SO	UG/KG	160	U	80			
48M03SA	Toluene	108-88-3	SO	UG/KG	160	U	80			
48M04SA	Toluene	108-88-3	SO	UG/KG	160	U	80			
48M05SA	Toluene	108-88-3	SO	UG/KG	160	U	80			
48M06SA	Toluene	108-88-3	SO	UG/KG	160	U	80			
48TP01SA	Toluene	108-88-3	SO	UG/KG	160	U	80			
48TP01SB	Toluene	108-88-3	SO	UG/KG	160	U	80			
48TP02SA	Toluene	108-88-3	SO	UG/KG	160	U	80			
48TP02SB	Toluene	108-88-3	SO	UG/KG	160	U	80			
48TP03SA	Toluene	108-88-3	SO	UG/KG	160	U	80			
48TP03SB	Toluene	108-88-3	SO	UG/KG	160	U	80			
48TP04SA	Toluene	108-88-3	SO	UG/KG	160	U	80			
53M03SA	Toluene	108-88-3	SO	UG/KG	410	U	410			
48M01SA	Total Xylenes	1330-20-7	SO	UG/KG	160	U	80			
48M02SA	Total Xylenes	1330-20-7	SO	UG/KG	0.08	U	0.04	1.36	18.2	11.06
48M03SA	Total Xylenes	1330-20-7	SO	UG/KG	0.08	U	0.04			
48M04SA	Total Xylenes	1330-20-7	SO	UG/KG	0.08	U	0.04			
48M05SA	Total Xylenes	1330-20-7	SO	UG/KG	0.08	U	0.04			
48M06SA	Total Xylenes	1330-20-7	SO	UG/KG	0.08	U	0.04			
48TP01SA	Total Xylenes	1330-20-7	SO	UG/KG	0.08	U	0.04			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	96% UCL(e)
48TP01SB	Total Xylenes	1330-20-7	SO	UG/KG	0.08	U	0.04			
48TP02SA	Total Xylenes	1330-20-7	SO	UG/KG	0.08	U	0.04			
48TP02SB	Total Xylenes	1330-20-7	SO	UG/KG	0.08	U	0.04			
48TP03SA	Total Xylenes	1330-20-7	SO	UG/KG	0.08	U	0.04			
48TP03SB	Total Xylenes	1330-20-7	SO	UG/KG	0.08	U	0.04			
48TP04SA	Total Xylenes	1330-20-7	SO	UG/KG	18.2		18.2			
53M03SA	Total Xylenes	1330-20-7	SO	UG/KG	0.42		0.42			
48M01SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50	132	1200	747
48M02SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
48M03SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
48M04SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	1200		1200			
48M05SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
48M06SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
48TP01SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
48TP01SB	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
48TP02SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
48TP02SB	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
48TP03SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
48TP03SB	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
48TP04SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
53M03SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
48M01SA	Fluorene	86-73-7	SO	UG/KG	30	U	15	29	210	133
48M02SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
48M03SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
48M04SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
48M05SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
48M06SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
48TP01SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
48TP01SB	Fluorene	86-73-7	SO	UG/KG	30	U	15			
48TP02SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
48TP02SB	Fluorene	86-73-7	SO	UG/KG	30	U	15			
48TP03SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
48TP03SB	Fluorene	86-73-7	SO	UG/KG	30	U	15			
48TP04SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
53M03SA	Fluorene	86-73-7	SO	UG/KG	210		210			
48M01SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15	3227	42000	25603
48M02SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
48M03SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
48M04SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
48M05SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
48M06SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
48TP01SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
48TP01SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
48TP02SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
48TP02SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
48TP03SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
48TP03SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
48TP04SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	42000		42000			
53M03SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	3000		3000			
48M01SA	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5	1604	21000	12794
48M02SA	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
48M03SA	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
48M04SA	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
48M05SA	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
48M06SA	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
48TP01SA	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
48TP01SB	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
48TP02SA	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
48TP02SB	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
48TP03SA	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
48TP03SB	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
48TP04SA	Naphthalene	91-20-3	SO	UG/KG	21000		21000			
53M03SA	Naphthalene	91-20-3	SO	UG/KG	1400		1400			
48M01SA	Di-N-Octylphthalate	117-84-0	SO	UG/KG	150	U	75	120	700	454
48M02SA	Di-N-Octylphthalate	117-84-0	SO	UG/KG	150	U	75			
48M03SA	Di-N-Octylphthalate	117-84-0	SO	UG/KG	150	U	75			
48M04SA	Di-N-Octylphthalate	117-84-0	SO	UG/KG	150	U	75			
48M05SA	Di-N-Octylphthalate	117-84-0	SO	UG/KG	150	U	75			
48M06SA	Di-N-Octylphthalate	117-84-0	SO	UG/KG	150	U	75			
48TP01SA	Di-N-Octylphthalate	117-84-0	SO	UG/KG	150	U	75			
48TP01SB	Di-N-Octylphthalate	117-84-0	SO	UG/KG	150	U	75			
48TP02SA	Di-N-Octylphthalate	117-84-0	SO	UG/KG	150	U	75			
48TP02SB	Di-N-Octylphthalate	117-84-0	SO	UG/KG	150	U	75			
48TP03SA	Di-N-Octylphthalate	117-84-0	SO	UG/KG	150	U	75			
48TP03SB	Di-N-Octylphthalate	117-84-0	SO	UG/KG	150	U	75			
48TP04SA	Di-N-Octylphthalate	117-84-0	SO	UG/KG	150	U	75			
53M03SA	Di-N-Octylphthalate	117-84-0	SO	UG/KG	700		700			
48M01SA	Phenanthrene	85-01-8	SO	UG/KG	20	U	10	17	110	71
48M02SA	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
48M03SA	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
48M04SA	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
48M05SA	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
48M06SA	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
48TP01SA	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
48TP01SB	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
48TP02SA	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
48TP02SB	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
48TP03SA	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
48TP03SB	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
48TP04SA	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
53M03SA	Phenanthrene	85-01-8	SO	UG/KG	110		110			
48M01SA	Lead, SED	7439-92-1	SO	UG/KG	10200		10200	6015	23500	20349
48M02SA	Lead, SED	7439-92-1	SO	UG/KG	23500		23500			
48M03SA	Lead, SED	7439-92-1	SO	UG/KG	6090		6090			
48M04SA	Lead, SED	7439-92-1	SO	UG/KG	4560	U	2280			
48M05SA	Lead, SED	7439-92-1	SO	UG/KG	9770		9770			
48M06SA	Lead, SED	7439-92-1	SO	UG/KG	15100		15100			
48TP01SA	Lead, SED	7439-92-1	SO	UG/KG	4560	U	2280			
48TP01SB	Lead, SED	7439-92-1	SO	UG/KG	6360		6360			
48TP02SA	Lead, SED	7439-92-1	SO	UG/KG	11600		11600			
48TP02SB	Lead, SED	7439-92-1	SO	UG/KG	7040		7040			
48TP03SA	Lead, SED	7439-92-1	SO	UG/KG	5420		5420			
48TP03SB	Lead, SED	7439-92-1	SO	UG/KG	4560	U	2280			
48TP04SA	Lead, SED	7439-92-1	SO	UG/KG	4560	U	2280			
48M01W1	TPH	TPH	WD	UG/L	44000		44000	25742	400000	213703
48M02W1	TPH	TPH	WD	UG/L	100	U	50			
48M03W1	TPH	TPH	WD	UG/L	100	U	50			
48M04W1	TPH	TPH	WD	UG/L	100	U	50			
48M05W1	TPH	TPH	WD	UG/L	100	U	50			
48M06W1	TPH	TPH	WD	UG/L	100	U	50			
48P01W1	TPH	TPH	WD	UG/L	100	U	50			
48P02W1	TPH	TPH	WD	UG/L	100	U	50			
53M03W1	TPH	TPH	WD	UG/L	100	U	50			
48M01W2	TPH	TPH	WD	UG/L	3400		3400			
48M02W2	TPH	TPH	WD	UG/L	10600		10600			
48M03W2	TPH	TPH	WD	UG/L	400000		400000			
48M04W2	TPH	TPH	WD	UG/L	200	U	100			
48M05W2	TPH	TPH	WD	UG/L	200	U	100			
48M06W2	TPH	TPH	WD	UG/L	200	U	100			
48M07W1	TPH	TPH	WD	UG/L	300		300			
53M03W2	TPH	TPH	WD	UG/L	4200		4200			
52P06W1	TPH	TPH	WD	UG/L	200	U	100			
48M01W1	Benzene	71-43-2	WD	UG/L	1330		1330	187.39	1390	1063.25
48M02W1	Benzene	71-43-2	WD	UG/L	1.65		1.65			
48M03W1	Benzene	71-43-2	WD	UG/L	0.34		0.34			
48M04W1	Benzene	71-43-2	WD	UG/L	0.15	U	0.075			
48M05W1	Benzene	71-43-2	WD	UG/L	28.5		28.5			
48M06W1	Benzene	71-43-2	WD	UG/L	0.15	U	0.075			
48P01W1	Benzene	71-43-2	WD	UG/L	0.15	U	0.075			
48P02W1	Benzene	71-43-2	WD	UG/L	0.15	U	0.075			
53M03W1	Benzene	71-43-2	WD	UG/L	0.15	U	0.075			
48M01W2	Benzene	71-43-2	WD	UG/L	299		299			
					1390		1390			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
48M01W1	Toluene	108-88-3	WD	UG/L	88		88	23.44	230	138.19
48M02W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
48M03W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
48M04W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
48M05W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
48M06W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
48P01W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
48P02W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
53M03W1	Toluene	108-88-3	WD	UG/L	53.2		53.2			
48M01W2	Toluene	108-88-3	WD	UG/L	48.8		48.8			
48M02W2	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
48M03W2	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
48M04W2	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
48M05W2	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
48M06W2	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
48M07W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
53M03W2	Toluene	108-88-3	WD	UG/L	230		230			
52P05W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
48M01W1	Total Xylenes	1330-20-7	WD	UG/L	929		929	290.48	1990	1505.61
48M02W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
48M03W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
48M04W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
48M05W1	Total Xylenes	1330-20-7	WD	UG/L	1.62		1.62			
48M06W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
48P01W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
48P02W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
53M03W1	Total Xylenes	1330-20-7	WD	UG/L	754		754			
48M01W2	Total Xylenes	1330-20-7	WD	UG/L	1550		1550			
48M02W2	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
48M03W2	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
48M04W2	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
48M05W2	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
48M06W2	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
48M07W1	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
53M03W2	Total Xylenes	1330-20-7	WD	UG/L	1990		1990			
52P06W1	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
48M01W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1	43	700	372
48M02W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
48M03W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
48M04W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
48M05W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
48M06W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
48P01W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	700		700			
48P02W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	96% UCL(e)
53M03W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
48M01W2	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
48M02W2	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
48M03W2	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
48M04W2	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
48M05W2	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
48M06W2	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
48M07W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	52		52			
53M03W2	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
52P06W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
48M01W1	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75	30.3	520	274.8
48M02W1	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
48M03W1	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
48M04W1	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
48M05W1	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
48M06W1	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
48P01W1	Butylbenzylphthalate	85-68-7	WD	UG/L	520		520			
48P02W1	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
53M03W1	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
48M01W2	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
48M02W2	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
48M03W2	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
48M04W2	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
48M05W2	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
48M06W2	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
48M07W1	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
53M03W2	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
52P06W1	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
48M01W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	5.1		5.1	1.85	10	8.20
48M02W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	0.28	U	0.14			
48M03W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	0.28	U	0.14			
48M04W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	0.28	U	0.14			
48M05W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	0.28	U	0.14			
48M06W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	0.28	U	0.14			
48P01W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	0.28	U	0.14			
48P02W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	0.28	U	0.14			
53M03W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	0.28	U	0.14			
48M01W2	2,4-Dimethylphenol	105-67-9	WD	UG/L	20	U	10			
48M02W2	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
48M03W2	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
48M04W2	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
48M05W2	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
48M06W2	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
48M07W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
53M03W2	2,4-Dimethylphenol	105-67-9	WD	UG/L	20	U	10			
52P06W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
(f)										
(f)										
(f)										
(f)										
(f)										
(f)										
(f)										
(f)										
(f)										
48M01W1	2-Methylnaphthalene	91-57-6	WD	UG/L	130		130	32.68	261	175.65
48M02W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.09	U	0.045			
48M03W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.09	U	0.045			
48M04W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.09	U	0.045			
48M05W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.09	U	0.045			
48M06W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.09	U	0.045			
48P01W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.09	U	0.045			
48P02W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.09	U	0.045			
53M03W1	2-Methylnaphthalene	91-57-6	WD	UG/L	261	U	261			
48M01W2	2-Methylnaphthalene	91-57-6	WD	UG/L	140		140			
48M02W2	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
48M03W2	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
48M04W2	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
48M05W2	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
48M06W2	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
48M07W1	2-Methylnaphthalene	91-57-6	WD	UG/L	24		24			
53M03W2	2-Methylnaphthalene	91-57-6	WD	UG/L	30		30			
52P06W1	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
48M01W1	Naphthalene	91-20-3	WD	UG/L	230		230	67.11	440	331.21
48M02W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
48M03W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
48M04W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
48M05W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
48M06W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
48P01W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
48P02W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
53M03W1	Naphthalene	91-20-3	WD	UG/L	440		440			
48M01W2	Naphthalene	91-20-3	WD	UG/L	270		270			
48M02W2	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
48M03W2	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
48M04W2	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
48M05W2	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
48M06W2	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
48M07W2	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			

[illegible]

TABLE D.13. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
53M03W1	Barium, Total	7440-39-3	WD	UG/L	722		722	722	722	NA
53M03W1	Calcium, DISS	7440-70-2	WD	UG/L	174000		174000	174000	174000	NA
53M03W1	Calcium, Total	7440-70-2	WD	UG/L	136000		136000	136000	136000	NA
53M03W1	Chromium	7440-47-3	WD	UG/L	12.3		12.3	12.3	12.3	NA
53M03W1	Cobalt, Total	7440-48-4	WD	UG/L	18		18	18	18	NA
53M03W1	Copper, Total	7440-50-8	WD	UG/L	118		118	118	118	NA
53M03W1	Iron, DISS	7439-89-6	WD	UG/L	24700		24700	24700	24700	NA
53M03W1	Iron, Total	7439-89-6	WD	UG/L	42400		42400	42400	42400	NA
48M01W1	Lead, DISS	7439-92-1	WD	UG/L	1.4	U	0.7	1.0	3	2.5
48M02W1	Lead, DISS	7439-92-1	WD	UG/L	1.4	U	0.7			
48M03W1	Lead, DISS	7439-92-1	WD	UG/L	3		3			
48M04W1	Lead, DISS	7439-92-1	WD	UG/L	1.4	U	0.7			
48M05W1	Lead, DISS	7439-92-1	WD	UG/L	1.4	U	0.7			
48M06W1	Lead, DISS	7439-92-1	WD	UG/L	1.4	U	0.7			
48P01W1	Lead, DISS	7439-92-1	WD	UG/L	1.4	U	0.7			
48P02W1	Lead, DISS	7439-92-1	WD	UG/L	1.4	U	0.7			
53M03W1	Lead, DISS	7439-92-1	WD	UG/L	1.4	U	0.7			
48M01W1	Lead, Total	7439-92-1	WD	UG/L	40		40	37.1	152	133.1
48M02W1	Lead, Total	7439-92-1	WD	UG/L	10.9		10.9			
48M03W1	Lead, Total	7439-92-1	WD	UG/L	2.7		2.7			
48M04W1	Lead, Total	7439-92-1	WD	UG/L	28.7		28.7			
48M05W1	Lead, Total	7439-92-1	WD	UG/L	152		152			
48M06W1	Lead, Total	7439-92-1	WD	UG/L	62.4		62.4			
48P01W1	Lead, Total	7439-92-1	WD	UG/L	1.4	U	0.7			
48P02W1	Lead, Total	7439-92-1	WD	UG/L	1.4	U	0.7			
53M03W1	Lead, Total	7439-92-1	WD	UG/L	36		36			
53M03W1	Magnesium, DISS	7439-95-4	WD	UG/L	36900		36900	36900	36900	NA
53M03W1	Magnesium, Total	7439-95-4	WD	UG/L	43700		43700	43700	43700	NA
53M03W1	Manganese, DISS	7439-96-5	WD	UG/L	5200		5200	5200	5200	NA
53M03W1	Manganese, Total	7439-96-5	WD	UG/L	5670		5670	5670	5670	NA
53M03W1	Mercury, DISS	7439-97-6	WD	UG/L	0.7		0.7	0.7	0.7	NA
53M03W1	Mercury, Total	7439-97-6	WD	UG/L	0.3		0.3	0.3	0.3	NA
53M03W1	Potassium, DISS	7440-09-7	WD	UG/L	4980		4980	4980	4980	NA
53M03W1	Potassium, Total	7440-09-7	WD	UG/L	7200		7200	7200	7200	NA
53M03W1	Sodium, DISS	7440-23-5	WD	UG/L	11000		11000	11000	11000	NA
53M03W1	Sodium, Total	7440-23-5	WD	UG/L	13200		13200	13200	13200	NA
53M03W1	Vanadium, Total	7440-62-2	WD	UG/L	37		37	37	37	NA
53M03W1	Zinc, DISS	7440-66-6	WD	UG/L	30		30	30	30	NA
53M03W1	Zinc, Total	7440-66-6	WD	UG/L	72.4		72.4	72.4	72.4	NA
FW#48-01	Benzene	71-43-2	WG	UG/L	1	U	0.5	532	7100	3830
FW48-02	Benzene	71-43-2	WG	UG/L	1	U	0.5			
FW48-03	Benzene	71-43-2	WG	UG/L	1	U	0.5			
FW48-04	Benzene	71-43-2	WG	UG/L	1	U	0.5			
FW48-05	Benzene	71-43-2	WG	UG/L	1	U	0.5			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
FW48-06	Benzene	71-43-2	WG	UG/L	1	U	0.5			
FW48-07	Benzene	71-43-2	WG	UG/L	1	U	0.5			
FW48-08	Benzene	71-43-2	WG	UG/L	1	U	0.5			
FW48-09	Benzene	71-43-2	WG	UG/L	1	U	0.5			
FW48-10	Benzene	71-43-2	WG	UG/L	1	U	0.5			
FW48-11b	Benzene	71-43-2	WG	UG/L	7100		7100			
FW48-12b	Benzene	71-43-2	WG	UG/L	220		220			
FW48-13b	Benzene	71-43-2	WG	UG/L	80		80			
FW48-14b	Benzene	71-43-2	WG	UG/L	510		510			
FW48-15	Benzene	71-43-2	WG	UG/L	97		97			
FW48-16b	Benzene	71-43-2	WG	UG/L	3100		3100			
FW48-17b	Benzene	71-43-2	WG	UG/L	1	U	0.5			
FW48-18	Benzene	71-43-2	WG	UG/L	1	U	0.5			
FW48-19b	Benzene	71-43-2	WG	UG/L	1	U	0.5			
FW48-20	Benzene	71-43-2	WG	UG/L	1	U	0.5			
FW48-21b	Benzene	71-43-2	WG	UG/L	100	U	50			
FW48-01	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5	25	490	238
FW48-02	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-03	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-04	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-05	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-06	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-07	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-08	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-09	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-10	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-11b	t-Dichloroethylene	156-60-5	WG	UG/L	17		17			
FW48-12b	t-Dichloroethylene	156-60-5	WG	UG/L	490		490			
FW48-13b	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-14b	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-15	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-16b	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-17b	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-18	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-19b	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-20	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-21b	t-Dichloroethylene	156-60-5	WG	UG/L	1	U	0.5			
FW48-01	Ethylbenzene	100-41-4	WG	UG/L	1	U	0.5	154	950	727
FW48-02	Ethylbenzene	100-41-4	WG	UG/L	1	U	0.5			
FW48-03	Ethylbenzene	100-41-4	WG	UG/L	1	U	0.5			
FW48-04	Ethylbenzene	100-41-4	WG	UG/L	1	U	0.5			
FW48-05	Ethylbenzene	100-41-4	WG	UG/L	1	U	0.5			
FW48-06	Ethylbenzene	100-41-4	WG	UG/L	1	U	0.5			
FW48-07	Ethylbenzene	100-41-4	WG	UG/L	1	U	0.5			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
FW48-08	Ethylbenzene	100-41-4	WG	UG/L	1	U	0.5			
FW48-09	Ethylbenzene	100-41-4	WG	UG/L	1	U	0.5			
FW48-10	Ethylbenzene	100-41-4	WG	UG/L	1	U	0.5			
FW#48-11b	Ethylbenzene	100-41-4	WG	UG/L	910		910			
FW#48-12b	Ethylbenzene	100-41-4	WG	UG/L	950		950			
FW#48-13b	Ethylbenzene	100-41-4	WG	UG/L	250		250			
FW#48-14b	Ethylbenzene	100-41-4	WG	UG/L	360		360			
FW48-15	Ethylbenzene	100-41-4	WG	UG/L	97		97			
FW#48-16b	Ethylbenzene	100-41-4	WG	UG/L	280		280			
FW#48-17b	Ethylbenzene	100-41-4	WG	UG/L	16		16			
FW#48-18	Ethylbenzene	100-41-4	WG	UG/L	1	U	0.5			
FW#48-19b	Ethylbenzene	100-41-4	WG	UG/L	3		3			
FW#48-20	Ethylbenzene	100-41-4	WG	UG/L	1	U	0.5			
FW#48-21b	Ethylbenzene	100-41-4	WG	UG/L	360		360			
FW#48-01	Toluene	108-88-3	WG	UG/L	1	U	0.5	724	6600	4296
FW48-02	Toluene	108-88-3	WG	UG/L	1	U	0.5			
FW48-03	Toluene	108-88-3	WG	UG/L	1	U	0.5			
FW48-04	Toluene	108-88-3	WG	UG/L	1	U	0.5			
FW48-05	Toluene	108-88-3	WG	UG/L	1	U	0.5			
FW48-06	Toluene	108-88-3	WG	UG/L	1	U	0.5			
FW48-07	Toluene	108-88-3	WG	UG/L	1	U	0.5			
FW48-08	Toluene	108-88-3	WG	UG/L	1	U	0.5			
FW48-09	Toluene	108-88-3	WG	UG/L	1	U	0.5			
FW48-10	Toluene	108-88-3	WG	UG/L	1	U	0.5			
FW#48-11b	Toluene	108-88-3	WG	UG/L	6600		6600			
FW#48-12b	Toluene	108-88-3	WG	UG/L	4800		4800			
FW#48-13b	Toluene	108-88-3	WG	UG/L	40		40			
FW#48-14b	Toluene	108-88-3	WG	UG/L	510		510			
FW48-15	Toluene	108-88-3	WG	UG/L	110		110			
FW#48-16b	Toluene	108-88-3	WG	UG/L	2800		2800			
FW#48-17b	Toluene	108-88-3	WG	UG/L	1	U	0.5			
FW#48-18	Toluene	108-88-3	WG	UG/L	1	U	0.5			
FW#48-19b	Toluene	108-88-3	WG	UG/L	1	U	0.5			
FW#48-20	Toluene	108-88-3	WG	UG/L	1	U	0.5			
FW#48-21b	Toluene	108-88-3	WG	UG/L	330		330			
FW#48-01	m,p-Xylene	108-38-3	WG	UG/L	1	U	0.5	445	3300	2251
FW48-02	m,p-Xylene	108-38-3	WG	UG/L	1	U	0.5			
FW48-03	m,p-Xylene	108-38-3	WG	UG/L	1	U	0.5			
FW48-04	m,p-Xylene	108-38-3	WG	UG/L	1	U	0.5			
FW48-05	m,p-Xylene	108-38-3	WG	UG/L	1	U	0.5			
FW48-06	m,p-Xylene	108-38-3	WG	UG/L	1	U	0.5			
FW48-07	m,p-Xylene	108-38-3	WG	UG/L	1	U	0.5			
FW48-08	m,p-Xylene	108-38-3	WG	UG/L	1	U	0.5			
FW48-09	m,p-Xylene	108-38-3	WG	UG/L	1	U	0.5			

TABLE D.10. Chemical Analytical Results for Source Area ST48
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
FW48-10	m,p-Xylene	108-38-3	WG	UG/L	1	U	0.5			
FW48-11b	m,p-Xylene	108-38-3	WG	UG/L	2500		2500			
FW48-12b	m,p-Xylene	108-38-3	WG	UG/L	3300		3300			
FW48-13b	m,p-Xylene	108-38-3	WG	UG/L	240		240			
FW48-14b	m,p-Xylene	108-38-3	WG	UG/L	870		870			
FW48-15	m,p-Xylene	108-38-3	WG	UG/L	320		320			
FW48-16b	m,p-Xylene	108-38-3	WG	UG/L	670		670			
FW48-17b	m,p-Xylene	108-38-3	WG	UG/L	40		40			
FW48-18	m,p-Xylene	108-38-3	WG	UG/L	1	U	0.5			
FW48-19b	m,p-Xylene	108-38-3	WG	UG/L	5		5			
FW48-20	m,p-Xylene	108-38-3	WG	UG/L	1	U	0.5			
FW48-21b	m,p-Xylene	108-38-3	WG	UG/L	1400		1400			
FW48-01	oXylene	95-47-6	WG	UG/L	1	U	0.5	172	1300	828
FW48-02	oXylene	95-47-6	WG	UG/L	1	U	0.5			
FW48-03	oXylene	95-47-6	WG	UG/L	1	U	0.5			
FW48-04	oXylene	95-47-6	WG	UG/L	1	U	0.5			
FW48-05	oXylene	95-47-6	WG	UG/L	1	U	0.5			
FW48-06	oXylene	95-47-6	WG	UG/L	1	U	0.5			
FW48-07	oXylene	95-47-6	WG	UG/L	1	U	0.5			
FW48-08	oXylene	95-47-6	WG	UG/L	1	U	0.5			
FW48-09	oXylene	95-47-6	WG	UG/L	1	U	0.5			
FW48-10	oXylene	95-47-6	WG	UG/L	1	U	0.5			
FW48-11b	oXylene	95-47-6	WG	UG/L	500		500			
FW48-12b	oXylene	95-47-6	WG	UG/L	1300		1300			
FW48-13b	oXylene	95-47-6	WG	UG/L	120		120			
FW48-14b	oXylene	95-47-6	WG	UG/L	440		440			
FW48-15	oXylene	95-47-6	WG	UG/L	180		180			
FW48-16b	oXylene	95-47-6	WG	UG/L	430		430			
FW48-17b	oXylene	95-47-6	WG	UG/L	5		5			
FW48-18	oXylene	95-47-6	WG	UG/L	1	U	0.5			
FW48-19b	oXylene	95-47-6	WG	UG/L	1	U	0.5			
FW48-20	oXylene	95-47-6	WG	UG/L	1	U	0.5			
FW48-21b	oXylene	95-47-6	WG	UG/L	640		640			

(a) Definitions: AG (soil gas), SO (soil), WD and WG (groundwater).

(b) "Reported Result" is the concentration as reported in Elieison Air Force Base database.

(c) U and UF represent nondetected analytes at the detection limit listed in "Reported Result" column.

(d) "DL/2 Value" lists the reported concentration of detected analytes or one-half of the detection limit for non-detected analytes.

(e) "UCL" represents Upper Confidence Limit.

(f) Space preserved for QA. Parameter not used in assessment.

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
49SV01	Benzene	71-43-2	AG	UG/L	30		30	11	40	32
49SV02	Benzene	71-43-2	AG	UG/L	10		10			
49SV03	Benzene	71-43-2	AG	UG/L	10	U	5			
49SV04	Benzene	71-43-2	AG	UG/L	20		20			
49SV05	Benzene	71-43-2	AG	UG/L	10	U	5			
49SV06	Benzene	71-43-2	AG	UG/L	20		20			
49SV07	Benzene	71-43-2	AG	UG/L	10	U	5			
49SV08	Benzene	71-43-2	AG	UG/L	10	U	5			
49SV09	Benzene	71-43-2	AG	UG/L	10	U	5			
49SV10	Benzene	71-43-2	AG	UG/L	10	U	5			
49SV11	Benzene	71-43-2	AG	UG/L	10	U	5			
49SV12	Benzene	71-43-2	AG	UG/L	10	U	5			
49SV13	Benzene	71-43-2	AG	UG/L	10	U	5			
49SV14	Benzene	71-43-2	AG	UG/L	10	U	5			
49SV15	Benzene	71-43-2	AG	UG/L	10	U	5			
49SV17	Benzene	71-43-2	AG	UG/L	40		40			
49SV18	Benzene	71-43-2	AG	UG/L	10	U	5			
49SV01	BTEX	BTEX	AG	UG/L	3360		3360	571	5860	3740
49SV02	BTEX	BTEX	AG	UG/L	80		80			
49SV03	BTEX	BTEX	AG	UG/L	10	U	5			
49SV04	BTEX	BTEX	AG	UG/L	60		60			
49SV05	BTEX	BTEX	AG	UG/L	10		5			
49SV06	BTEX	BTEX	AG	UG/L	290		290			
49SV07	BTEX	BTEX	AG	UG/L	10	U	5			
49SV08	BTEX	BTEX	AG	UG/L	10	U	5			
49SV09	BTEX	BTEX	AG	UG/L	10	U	5			
49SV10	BTEX	BTEX	AG	UG/L	10	U	5			
49SV11	BTEX	BTEX	AG	UG/L	10	U	5			
49SV12	BTEX	BTEX	AG	UG/L	10	U	5			
49SV13	BTEX	BTEX	AG	UG/L	10	U	5			
49SV14	BTEX	BTEX	AG	UG/L	10	U	5			
49SV15	BTEX	BTEX	AG	UG/L	10	U	5			
49SV17	BTEX	BTEX	AG	UG/L	10	U	5			
49SV18	BTEX	BTEX	AG	UG/L	5860		5860			
49SV01	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
49SV02	Ethylbenzene	100-41-4	AG	UG/L	49		49	328	5440	2963
49SV03	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
49SV04	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
49SV05	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
49SV06	Ethylbenzene	100-41-4	AG	UG/L	20		20			
49SV07	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
49SV08	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
49SV09	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
49SV10	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
49SV11	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
49SV12	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
49SV13	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
49SV14	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
49SV15	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
49SV17	Ethylbenzene	100-41-4	AG	UG/L	5440		5440			
49SV18	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
49SV01	Toluene	108-88-3	AG	UG/L	2080		2080	155	2080	1157
49SV02	Toluene	108-88-3	AG	UG/L	70		70			
49SV03	Toluene	108-88-3	AG	UG/L	10	U	5			
49SV04	Toluene	108-88-3	AG	UG/L	10		10			
49SV05	Toluene	108-88-3	AG	UG/L	10	U	5			
49SV06	Toluene	108-88-3	AG	UG/L	170		170			
49SV07	Toluene	108-88-3	AG	UG/L	10	U	5			
49SV08	Toluene	108-88-3	AG	UG/L	10	U	5			
49SV09	Toluene	108-88-3	AG	UG/L	10	U	5			
49SV10	Toluene	108-88-3	AG	UG/L	10	U	5			
49SV11	Toluene	108-88-3	AG	UG/L	10	U	5			
49SV12	Toluene	108-88-3	AG	UG/L	10	U	5			
49SV13	Toluene	108-88-3	AG	UG/L	10	U	5			
49SV14	Toluene	108-88-3	AG	UG/L	10	U	5			
49SV15	Toluene	108-88-3	AG	UG/L	10	U	5			
49SV17	Toluene	108-88-3	AG	UG/L	250		250			
49SV18	Toluene	108-88-3	AG	UG/L	10	U	5			
49SV01	mXylene	108-38-3	AG	UG/L	760		760	63	760	429
49SV02	mXylene	108-38-3	AG	UG/L	10	U	5			
49SV03	mXylene	108-38-3	AG	UG/L	10	U	5			
49SV04	mXylene	108-38-3	AG	UG/L	30		30			
49SV05	mXylene	108-38-3	AG	UG/L	10	U	5			
49SV06	mXylene	108-38-3	AG	UG/L	80		80			
49SV07	mXylene	108-38-3	AG	UG/L	10	U	5			
49SV08	mXylene	108-38-3	AG	UG/L	10	U	5			
49SV09	mXylene	108-38-3	AG	UG/L	10	U	5			
49SV10	mXylene	108-38-3	AG	UG/L	10	U	5			
49SV11	mXylene	108-38-3	AG	UG/L	10	U	5			
49SV12	mXylene	108-38-3	AG	UG/L	10	U	5			
49SV13	mXylene	108-38-3	AG	UG/L	10	U	5			
49SV14	mXylene	108-38-3	AG	UG/L	10	U	5			
49SV15	mXylene	108-38-3	AG	UG/L	10	U	5			
49SV17	mXylene	108-38-3	AG	UG/L	130		130			
49SV18	mXylene	108-38-3	AG	UG/L	10	U	5			
(f)										
(f)										
(f)										

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
49X03SA	TPH	TPH	SO	UG/KG	52000		52000			
49X04SA	TPH	TPH	SO	UG/KG	75000		75000			
49X05SA	TPH	TPH	SO	UG/KG	250500		250500			
49X06SA	TPH	TPH	SO	UG/KG	13700	U	6850			
49SS1S1	TPH	TPH	SO	UG/KG	176000		176000			
49SS2S1	TPH	TPH	SO	UG/KG	19100		19100			
49SS3S1	TPH	TPH	SO	UG/KG	18800		18800			
49M01SA	Methylene Chloride	75-09-2	SO	UG/KG	1400		1400	413	1500	1525
49M01SB	Methylene Chloride	75-09-2	SO	UG/KG	1500		1500			
49M02SA	Methylene Chloride	75-09-2	SO	UG/KG	150	U	75			
49M02SB	Methylene Chloride	75-09-2	SO	UG/KG	290		290			
49M03SA	Methylene Chloride	75-09-2	SO	UG/KG	150	U	75			
49M03SB	Methylene Chloride	75-09-2	SO	UG/KG	340		340			
49M04SA	Methylene Chloride	75-09-2	SO	UG/KG	150	U	75			
49M04SB	Methylene Chloride	75-09-2	SO	UG/KG	220		220			
53M05SA	Methylene Chloride	75-09-2	SO	UG/KG	150	U	75			
53M05SB	Methylene Chloride	75-09-2	SO	UG/KG	150	U	75			
53M06S1	Methylene Chloride	75-09-2	SO	UG/KG	120		120	84	390	367
49M01SARb	Benzo(A)Anthracene	56-55-3	SO	UG/KG	10	U	5			
49M01SBRb	Benzo(A)Anthracene	56-55-3	SO	UG/KG	10	U	5			
49M02SA	Benzo(A)Anthracene	56-55-3	SO	UG/KG	10	U	5			
49M02SB	Benzo(A)Anthracene	56-55-3	SO	UG/KG	10	U	5			
49M03SARb	Benzo(A)Anthracene	56-55-3	SO	UG/KG	290		290			
49M03SB	Benzo(A)Anthracene	56-55-3	SO	UG/KG	10	U	5			
49M04SARb	Benzo(A)Anthracene	56-55-3	SO	UG/KG	390		390			
49M04SBRb	Benzo(A)Anthracene	56-55-3	SO	UG/KG	10	U	5			
53M05SA	Benzo(A)Anthracene	56-55-3	SO	UG/KG	10	U	5			
53M05SB	Benzo(A)Anthracene	56-55-3	SO	UG/KG	10	U	5			
49M01SARb	Benzo(B)Fluoranthene	205-99-2	SO	UG/KG	160		160	30	160	121
49M01SBRb	Benzo(B)Fluoranthene	205-99-2	SO	UG/KG	30	U	15			
49M02SA	Benzo(B)Fluoranthene	205-99-2	SO	UG/KG	30	U	15			
49M02SB	Benzo(B)Fluoranthene	205-99-2	SO	UG/KG	30	U	15			
49M03SARb	Benzo(B)Fluoranthene	205-99-2	SO	UG/KG	30	U	15			
49M03SB	Benzo(B)Fluoranthene	205-99-2	SO	UG/KG	30	U	15			
49M04SARb	Benzo(B)Fluoranthene	205-99-2	SO	UG/KG	30	U	15			
49M04SBRb	Benzo(B)Fluoranthene	205-99-2	SO	UG/KG	30	U	15			
53M05SA	Benzo(B)Fluoranthene	205-99-2	SO	UG/KG	30	U	15			
53M05SB	Benzo(B)Fluoranthene	205-99-2	SO	UG/KG	30	U	15			
49M01SARb	Benzo(G,H,I)Perylene	191-24-2	SO	UG/KG	40	U	20	31	130	103
49M01SBRb	Benzo(G,H,I)Perylene	191-24-2	SO	UG/KG	40	U	20			
49M02SA	Benzo(G,H,I)Perylene	191-24-2	SO	UG/KG	0.4	U	0.2			
49M02SB	Benzo(G,H,I)Perylene	191-24-2	SO	UG/KG	260	U	130			
49M03SARb	Benzo(G,H,I)Perylene	191-24-2	SO	UG/KG	40	U	40			
49M03SB	Benzo(G,H,I)Perylene	191-24-2	SO	UG/KG	40	U	20			
49M04SARb	Benzo(G,H,I)Perylene	191-24-2	SO	UG/KG	40	U	20			

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
49M04SBRb	Benzo(G,H,I)Perylene	191-24-2	SO	UG/KG	40	U	20			
53M05SA	Benzo(G,H,I)Perylene	191-24-2	SO	UG/KG	40	U	20			
53M0PS1	Benzo(G,H,I)Perylene	191-24-2	SO	UG/KG	40	U	20			
49M01SARb	Benzo(A)Pyrene	50-32-8	SO	UG/KG	140	U	140	58	400	313
49M01SBRb	Benzo(A)Pyrene	50-32-8	SO	UG/KG	9	U	4.5			
49M02SA	Benzo(A)Pyrene	50-32-8	SO	UG/KG	9	U	4.5			
49M02SB	Benzo(A)Pyrene	50-32-8	SO	UG/KG	9	U	4.5			
49M03SARb	Benzo(A)Pyrene	50-32-8	SO	UG/KG	400	U	400			
49M03SB	Benzo(A)Pyrene	50-32-8	SO	UG/KG	9	U	4.5			
49M04SARb	Benzo(A)Pyrene	50-32-8	SO	UG/KG	9	U	4.5			
49M04SBRb	Benzo(A)Pyrene	50-32-8	SO	UG/KG	9	U	4.5			
53M05SA	Benzo(A)Pyrene	50-32-8	SO	UG/KG	9	U	4.5			
53M0PS1	Benzo(A)Pyrene	50-32-8	SO	UG/KG	9	U	4.5			
49M01SARb	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	130	U	130	69	160	150
49M01SBRb	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	160	U	160			
49M02SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
49M02SB	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
49M03SARb	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
49M03SB	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
49M04SARb	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
49M04SBRb	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
53M05SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
53M0PS1	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
49M01SARb	Butylbenzylphthalate	85-68-7	SO	UG/KG	70	U	35	71	390	295
49M01SBRb	Butylbenzylphthalate	85-68-7	SO	UG/KG	70	U	35			
49M02SA	Butylbenzylphthalate	85-68-7	SO	UG/KG	70	U	35			
49M02SB	Butylbenzylphthalate	85-68-7	SO	UG/KG	70	U	35			
49M03SARb	Butylbenzylphthalate	85-68-7	SO	UG/KG	70	U	35			
49M03SB	Butylbenzylphthalate	85-68-7	SO	UG/KG	70	U	35			
49M04SARb	Butylbenzylphthalate	85-68-7	SO	UG/KG	390	U	390			
49M04SBRb	Butylbenzylphthalate	85-68-7	SO	UG/KG	70	U	35			
53M05SA	Butylbenzylphthalate	85-68-7	SO	UG/KG	70	U	35			
53M0PS1	Butylbenzylphthalate	85-68-7	SO	UG/KG	70	U	35			
49M01SARb	Chrysene	218-01-9	SO	UG/KG	190	U	190	96	490	390
49M01SBRb	Chrysene	218-01-9	SO	UG/KG	70	U	35			
49M02SA	Chrysene	218-01-9	SO	UG/KG	70	U	35			
49M02SB	Chrysene	218-01-9	SO	UG/KG	70	U	35			
49M03SARb	Chrysene	218-01-9	SO	UG/KG	490	U	490			
49M03SB	Chrysene	218-01-9	SO	UG/KG	70	U	35			
49M04SARb	Chrysene	218-01-9	SO	UG/KG	70	U	35			
49M04SBRb	Chrysene	218-01-9	SO	UG/KG	70	U	35			
53M05SA	Chrysene	218-01-9	SO	UG/KG	70	U	35			
53M0PS1	Chrysene	218-01-9	SO	UG/KG	70	U	35			
49M01SARb	Fluoranthene	206-44-0	SO	UG/KG	300	U	300	170	630	665

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
49M01SBRb	Fluoranthene	206-44-0	SO	UG/KG	50	U	25			
49M02SA	Fluoranthene	206-44-0	SO	UG/KG	50	U	25			
49M02SB	Fluoranthene	206-44-0	SO	UG/KG	50	U	25			
49M03SARb	Fluoranthene	206-44-0	SO	UG/KG	590		590			
49M03SB	Fluoranthene	206-44-0	SO	UG/KG	50	U	25			
49M04SARb	Fluoranthene	206-44-0	SO	UG/KG	630		630			
49M04SBRb	Fluoranthene	206-44-0	SO	UG/KG	50	U	25			
53M05SA	Fluoranthene	206-44-0	SO	UG/KG	50	U	25			
53M0PS1	Fluoranthene	206-44-0	SO	UG/KG	50	U	25			
49M01SARb	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	90		90	58	290	226
49M01SBRb	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	50	U	25			
49M02SA	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	50	U	25			
49M02SB	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	50	U	25			
49M03SARb	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	290		290			
49M03SB	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	50	U	25			
49M04SARb	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	50	U	25			
49M04SBRb	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	50	U	25			
53M05SA	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	50	U	25			
53M0PS1	Indeno(1,2,3-CD)Pyrene	193-39-5	SO	UG/KG	50	U	25			
49M01SARb	Phenanthrene	85-01-8	SO	UG/KG	230		230	117	520	488
49M01SBRb	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
49M02SA	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
49M02SB	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
49M03SARb	Phenanthrene	85-01-8	SO	UG/KG	350		350			
49M03SB	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
49M04SARb	Phenanthrene	85-01-8	SO	UG/KG	520		520			
49M04SBRb	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
53M05SA	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
53M0PS1	Phenanthrene	85-01-8	SO	UG/KG	20	U	10			
49M01SARb	Pyrene	129-00-0	SO	UG/KG	300		300	179	650	693
49M01SBRb	Pyrene	129-00-0	SO	UG/KG	60	U	30			
49M02SA	Pyrene	129-00-0	SO	UG/KG	60	U	30			
49M02SB	Pyrene	129-00-0	SO	UG/KG	60	U	30			
49M03SARb	Pyrene	129-00-0	SO	UG/KG	630		630			
49M03SB	Pyrene	129-00-0	SO	UG/KG	60	U	30			
49M04SARb	Pyrene	129-00-0	SO	UG/KG	650		650			
49M04SBRb	Pyrene	129-00-0	SO	UG/KG	60	U	30			
53M05SA	Pyrene	129-00-0	SO	UG/KG	60	U	30			
53M0PS1	Pyrene	129-00-0	SO	UG/KG	60	U	30			
49M01SA	Aluminum, SED	7429-90-5	SO	UG/KG	9900000		9900000	10100000	10300000	NA
49M01SB	Aluminum, SED	7429-90-5	SO	UG/KG	10300000		10300000			
49M01SA	Arsenic, SED	7440-38-2	SO	UG/KG	9340		9340	9330	9340	NA
49M01SB	Arsenic, SED	7440-38-2	SO	UG/KG	9320		9320			
49M01SA	Barium, SED	7440-39-3	SO	UG/KG	108000		108000	100050	108000	NA

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
49M01SB	Barium, SED	7440-39-3	SO	UG/KG	92100		92100			
49M01SA	Beryllium, SED	7440-41-7	SO	UG/KG	925		925	1053	1180	NA
49M01SB	Beryllium, SED	7440-41-7	SO	UG/KG	1180		1180			
49M01SA	Calcium, SED	7440-70-2	SO	UG/KG	6060		6060	2598030	5190000	NA
49M01SB	Calcium, SED	7440-70-2	SO	UG/KG	5190000		5190000			
49M01SA	Chromium, SED	7440-47-3	SO	UG/KG	18700		18700	18800	18900	NA
49M01SB	Chromium, SED	7440-47-3	SO	UG/KG	18900		18900			
49M01SA	Cobalt, Total	7440-48-4	SO	UG/KG	18700		18700	18800	18900	NA
49M01SB	Cobalt, SED	7440-48-4	SO	UG/KG	18900		18900			
49M01SA	Cobalt, SED	7440-48-4	SO	UG/KG	12100		12100	11800	12100	NA
49M01SB	Cobalt, SED	7440-48-4	SO	UG/KG	11500		11500			
49M01SA	Copper, SED	7440-50-8	SO	UG/KG	34600		34600	30800	34600	NA
49M01SB	Copper, SED	7440-50-8	SO	UG/KG	27000		27000			
49M01SA	Iron, SED	7439-89-6	SO	UG/KG	19800000		19800000	19250000	19800000	NA
49M01SB	Iron, SED	7439-89-6	SO	UG/KG	18700000		18700000			
49M01SA	Lead, SED	7439-92-1	SO	UG/KG	8530		8530	7960	8530	NA
49M01SB	Lead, SED	7439-92-1	SO	UG/KG	7390		7390			
49M01SA	Magnesium, SED	7439-95-4	SO	UG/KG	5860000		5860000	6090000	6320000	NA
49M01SB	Magnesium, SED	7439-95-4	SO	UG/KG	6320000		6320000			
49M01SA	Manganese, SED	7439-96-5	SO	UG/KG	437000		437000	396000	437000	NA
49M01SB	Manganese, SED	7439-96-5	SO	UG/KG	355000		355000			
49M01SA	Nickel, SED	7440-02-0	SO	UG/KG	23.6		23.6	24.6	25.6	NA
49M01SB	Nickel, SED	7440-02-0	SO	UG/KG	25.6		25.6			
49M01SA	Potassium, SED	7440-09-7	SO	UG/KG	890000		890000	889500	890000	NA
49M01SB	Potassium, SED	7440-09-7	SO	UG/KG	889000		889000			
49M01SA	Sodium, SED	7440-23-5	SO	UG/KG	435000		435000	427000	435000	NA
49M01SB	Sodium, SED	7440-23-5	SO	UG/KG	419000		419000			
49M01SA	Vanadium, SED	7440-62-2	SO	UG/KG	36.6		36.6	37.7	38.7	NA
49M01SB	Vanadium, SED	7440-62-2	SO	UG/KG	38.7		38.7			
49M01SA	Zinc, SED	7440-66-6	SO	UG/KG	71600		71600	65650	71600	NA
49M01SB	Zinc, SED	7440-66-6	SO	UG/KG	59700		59700			
53M05SA	DDD, PP'	72-54-8	SO	UG/KG	356		356	178	356	681
53M0PS1	DDD, PP'	72-54-8	SO	UG/KG	1	U	0.5			
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49M01W1	TPH	TPH	WD	UG/L	10	U	5	4495	32300	26473
49M02W1	TPH	TPH	WD	UG/L	28400		28400			
49M03W1	TPH	TPH	WD	UG/L	10	U	5			

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
49M04W1	TPH	TPH	WD	UG/L	10	U	5			
49P01W1	TPH	TPH	WD	UG/L	10	U	5			
49P02W1	TPH	TPH	WD	UG/L	10	U	5			
53M05W1	TPH	TPH	WD	UG/L	10	U	5			
49M01W2	TPH	TPH	WD	UG/L	200	U	100			
49M02W2	TPH	TPH	WD	UG/L	200	U	100			
49M03W2	TPH	TPH	WD	UG/L	200	U	100			
49M04W2	TPH	TPH	WD	UG/L	200	U	100			
49M05W1	TPH	TPH	WD	UG/L	32300		32300			
49M06W1	TPH	TPH	WD	UG/L	1700		1700			
53M05W2	TPH	TPH	WD	UG/L	200	U	100			
49M01W1	Benzene	71-43-2	WD	UG/L	0.15	U	0.075	1.37	6	4.40
49M02W1	Benzene	71-43-2	WD	UG/L	0.59		0.59			
49M03W1	Benzene	71-43-2	WD	UG/L	4.71		4.71			
49M04W1	Benzene	71-43-2	WD	UG/L	0.57		0.57			
49P01W1	Benzene	71-43-2	WD	UG/L	0.15	U	0.075			
49P02W1	Benzene	71-43-2	WD	UG/L	0.15	U	0.075			
53M05W1	Benzene	71-43-2	WD	UG/L	0.15	U	0.075			
FW#49-1	Benzene	71-43-2	WD	UG/L	2		2			
FW#49-2	Benzene	71-43-2	WD	UG/L	1		1			
FW#49-3b	Benzene	71-43-2	WD	UG/L	4		4			
FW#49-4	Benzene	71-43-2	WD	UG/L	1	U	0.5			
FW#49-5	Benzene	71-43-2	WD	UG/L	1	U	0.5			
FW#49-6	Benzene	71-43-2	WD	UG/L	1		1			
FW#49-7c	Benzene	71-43-2	WD	UG/L	2		2			
FW#49-8	Benzene	71-43-2	WD	UG/L	6		6			
FW#49-9	Benzene	71-43-2	WD	UG/L	1	U	0.5			
FW#49-10	Benzene	71-43-2	WD	UG/L	2		2			
FW#49-11	Benzene	71-43-2	WD	UG/L	1	U	0.5			
FW#49-12	Benzene	71-43-2	WD	UG/L	3		3			
FW#49-13	Benzene	71-43-2	WD	UG/L	1	U	0.5			
FW#49-14	Benzene	71-43-2	WD	UG/L	1	U	0.5			
FW#49-15c	Benzene	71-43-2	WD	UG/L	3		3			
FW#49-16	Benzene	71-43-2	WD	UG/L	1	U	0.5			
FW#49-17	Benzene	71-43-2	WD	UG/L	1	U	0.5			
FW#49-18	Benzene	71-43-2	WD	UG/L	1	U	0.5			
FW#49-19	Benzene	71-43-2	WD	UG/L	1		1			
FW#49-20	Benzene	71-43-2	WD	UG/L	1	U	0.5			
49M01W2	Benzene	71-43-2	WD	UG/L	0.2	U	0.1			
49M02W2	Benzene	71-43-2	WD	UG/L	0.33		0.33			
49M03W2	Benzene	71-43-2	WD	UG/L	4.35		4.35			
49M04W2	Benzene	71-43-2	WD	UG/L	1.37		1.37			
49M05W1	Benzene	71-43-2	WD	UG/L	2.47		2.47			

Filename: 49ONEDTP.XLS

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
FW#49-14	t-Dichloroethylene	TDICHLOR	WD	UG/L	1	U	0.5			
FW#49-15c	t-Dichloroethylene	TDICHLOR	WD	UG/L	1	U	0.5			
FW#49-16	t-Dichloroethylene	TDICHLOR	WD	UG/L	1	U	0.5			
FW#49-17	t-Dichloroethylene	TDICHLOR	WD	UG/L	1	U	0.5			
FW#49-18	t-Dichloroethylene	TDICHLOR	WD	UG/L	1	U	0.5			
FW#49-19	t-Dichloroethylene	TDICHLOR	WD	UG/L	1	U	0.5			
FW#49-20	t-Dichloroethylene	TDICHLOR	WD	UG/L	1	U	0.5			
49M01W1	Trans-1,2-Dichloroethene	156-60-5	WD	UG/L	0.38	U	0.19	0.23	0.4	0.38
49M02W1	Trans-1,2-Dichloroethene	156-60-5	WD	UG/L	0.38	U	0.19			
49M03W1	Trans-1,2-Dichloroethene	156-60-5	WD	UG/L	0.38	U	0.19			
49M04W1	Trans-1,2-Dichloroethene	156-60-5	WD	UG/L	0.38	U	0.19			
49P01W1	Trans-1,2-Dichloroethene	156-60-5	WD	UG/L	0.38	U	0.19			
49P02W1	Trans-1,2-Dichloroethene	156-60-5	WD	UG/L	0.38	U	0.19			
53M05W1	Trans-1,2-Dichloroethene	156-60-5	WD	UG/L	0.4	U	0.4			
49M01W2	Trans-1,2-Dichloroethene	156-60-5	WD	UG/L	0.4	U	0.2			
49M02W2	Trans-1,2-Dichloroethene	156-60-5	WD	UG/L	0.4	U	0.2			
49M03W2	Trans-1,2-Dichloroethene	156-60-5	WD	UG/L	0.4	U	0.2			
49M04W2	Trans-1,2-Dichloroethene	156-60-5	WD	UG/L	0.4	U	0.2			
49M05W1	Trans-1,2-Dichloroethene	156-60-5	WD	UG/L	0.4	U	0.2			
49M06W1	Trans-1,2-Dichloroethene	156-60-5	WD	UG/L	0.4	UF	0.4			
49M01W1	Ethylbenzene	100-41-4	WD	UG/L	0.46	U	0.23	1.18	8	4.81
49M02W1	Ethylbenzene	100-41-4	WD	UG/L	5.37		5.37			
49M03W1	Ethylbenzene	100-41-4	WD	UG/L	0.55		0.55			
49M04W1	Ethylbenzene	100-41-4	WD	UG/L	0.2	U	0.1			
49P01W1	Ethylbenzene	100-41-4	WD	UG/L	0.2	U	0.1			
49P02W1	Ethylbenzene	100-41-4	WD	UG/L	0.2	U	0.1			
53M05W1	Ethylbenzene	100-41-4	WD	UG/L	0.72		0.72			
FW#49-1	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-2	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-3b	Ethylbenzene	100-41-4	WD	UG/L	8		8			
FW#49-4	Ethylbenzene	100-41-4	WD	UG/L	1		1			
FW#49-5	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-6	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-7c	Ethylbenzene	100-41-4	WD	UG/L	6		6			
FW#49-8	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-9	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-10	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-11	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-12	Ethylbenzene	100-41-4	WD	UG/L	2		2			
FW#49-13	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-14	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-15c	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-16	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-17	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
FW#49-18	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-19	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
FW#49-20	Ethylbenzene	100-41-4	WD	UG/L	1	U	0.5			
49M01W2	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
49M02W2	Ethylbenzene	100-41-4	WD	UG/L	2.35		2.35			
49M03W2	Ethylbenzene	100-41-4	WD	UG/L	0.63		0.63			
49M04W2	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
49M05W1	Ethylbenzene	100-41-4	WD	UG/L	0.92		0.92			
49M06W1	Ethylbenzene	100-41-4	WD	UG/L	3.26		3.26			
53M05W2	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
49M01W1	Methylene Chloride	75-09-2	WD	UG/L	1310		1310	1082	1400	1713
49M02W1	Methylene Chloride	75-09-2	WD	UG/L	1310		1310			
49M03W1	Methylene Chloride	75-09-2	WD	UG/L	1310		1310			
49M04W1	Methylene Chloride	75-09-2	WD	UG/L	1310		1310			
49P01W1	Methylene Chloride	75-09-2	WD	UG/L	1310		1310			
49P02W1	Methylene Chloride	75-09-2	WD	UG/L	1310		1310			
53M05W1	Methylene Chloride	75-09-2	WD	UG/L	1310		1310			
49M01W2	Methylene Chloride	75-09-2	WD	UG/L	1400	U	700			
49M02W2	Methylene Chloride	75-09-2	WD	UG/L	1400	U	700			
49M03W2	Methylene Chloride	75-09-2	WD	UG/L	1400	U	700			
49M04W2	Methylene Chloride	75-09-2	WD	UG/L	1400	U	700			
49M05W1	Methylene Chloride	75-09-2	WD	UG/L	1400	UF	1400			
49M06W1	Methylene Chloride	75-09-2	WD	UG/L	1400	U	700			
49M01W1	Toluene	108-88-3	WD	UG/L	0.31		0.31	0.41	0.83	0.78
49M02W1	Toluene	108-88-3	WD	UG/L	0.49		0.49			
49M03W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
49M04W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
49P01W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
49P02W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
53M05W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
FW#49-1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
FW#49-2	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-3b	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-4	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-5	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-6	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-7c	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-8	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-9	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-10	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-11	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-12	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-13	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-14	Toluene	108-88-3	WD	UG/L	1	U	0.5			

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
FW#49-15c	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-16	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-17	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-18	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-19	Toluene	108-88-3	WD	UG/L	1	U	0.5			
FW#49-20	Toluene	108-88-3	WD	UG/L	1	U	0.5			
49M01W2	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
49M02W2	Toluene	108-88-3	WD	UG/L	0.83	U	0.83			
49M03W2	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
49M04W2	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
49M05W1	Toluene	108-88-3	WD	UG/L	0.72	U	0.72			
49M06W1	Toluene	108-88-3	WD	UG/L	0.3	UF	0.3			
53M05W2	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
49M01W1	1,1,1-Trichloroethane	71-55-6	WD	UG/L	0.2	U	0.1	0.642	4.77	3.118
49M02W1	1,1,1-Trichloroethane	71-55-6	WD	UG/L	0.447	U	0.447			
49M03W1	1,1,1-Trichloroethane	71-55-6	WD	UG/L	0.2	U	0.1			
49M04W1	1,1,1-Trichloroethane	71-55-6	WD	UG/L	0.2	U	0.1			
49P01W1	1,1,1-Trichloroethane	71-55-6	WD	UG/L	0.2	U	0.1			
49P02W1	1,1,1-Trichloroethane	71-55-6	WD	UG/L	0.2	U	0.1			
53M05W1	1,1,1-Trichloroethane	71-55-6	WD	UG/L	4.77	U	4.77			
49M01W2	1,1,1-Trichloroethane	71-55-6	WD	UG/L	0.2	U	0.1			
49M02W2	1,1,1-Trichloroethane	71-55-6	WD	UG/L	0.333	U	0.333			
49M03W2	1,1,1-Trichloroethane	71-55-6	WD	UG/L	0.2	U	0.1			
49M04W2	1,1,1-Trichloroethane	71-55-6	WD	UG/L	0.2	U	0.1			
49M05W1	1,1,1-Trichloroethane	71-55-6	WD	UG/L	0.499	U	0.499			
49M06W1	1,1,1-Trichloroethane	71-55-6	WD	UG/L	0.976	U	0.976			
53M05W2	1,1,1-Trichloroethane	71-55-6	WD	UG/L	1.16	U	1.16			
49M01W1	Trichlorofluoromethane	75-69-4	WD	UG/L	0.788	U	0.788	0.227	0.788	0.566
49M02W1	Trichlorofluoromethane	75-69-4	WD	UG/L	0.32	U	0.16			
49M03W1	Trichlorofluoromethane	75-69-4	WD	UG/L	0.32	U	0.16			
49M04W1	Trichlorofluoromethane	75-69-4	WD	UG/L	0.32	U	0.16			
49P01W1	Trichlorofluoromethane	75-69-4	WD	UG/L	0.32	U	0.16			
49P02W1	Trichlorofluoromethane	75-69-4	WD	UG/L	0.32	U	0.16			
53M05W1	Trichlorofluoromethane	75-69-4	WD	UG/L	0.32	U	0.16			
49M01W2	Trichlorofluoromethane	75-69-4	WD	UG/L	0.4	U	0.2			
49M02W2	Trichlorofluoromethane	75-69-4	WD	UG/L	0.4	U	0.2			
49M03W2	Trichlorofluoromethane	75-69-4	WD	UG/L	0.4	U	0.2			
49M04W2	Trichlorofluoromethane	75-69-4	WD	UG/L	0.4	U	0.2			
49M05W1	Trichlorofluoromethane	75-69-4	WD	UG/L	0.4	U	0.2			
49M06W1	Trichlorofluoromethane	75-69-4	WD	UG/L	0.4	U	0.2			
49M01W2	Trichloroethene	79-01-6	WD	UG/L	0.6	U	0.3	1.385	6.93	4.595
49M02W2	Trichloroethene	79-01-6	WD	UG/L	0.963	U	0.963			
49M03W2	Trichloroethene	79-01-6	WD	UG/L	0.6	U	0.3			
49M04W2	Trichloroethene	79-01-6	WD	UG/L	0.6	U	0.3			

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/Z Value(d)	Average Value	Max. Value Detected	95% UCL(e)
49M05W1	Trichloroethene	79-01-6	WD	UG/L	6.93		6.93			
49M05W1	Trichloroethene	79-01-6	WD	UG/L	2.68		2.68			
53M05W2	Trichloroethene	79-01-6	WD	UG/L	3.92		3.92			
FW#49-1	Trichloroethene	79-01-6	WD	UG/L	1		1			
FW#49-2	Trichloroethene	79-01-6	WD	UG/L	2		2			
FW#49-3b	Trichloroethene	79-01-6	WD	UG/L	2		2			
FW#49-4	Trichloroethene	79-01-6	WD	UG/L	1	U	0.5			
FW#49-5	Trichloroethene	79-01-6	WD	UG/L	1	U	0.5			
FW#49-6	Trichloroethene	79-01-6	WD	UG/L	1		1			
FW#49-7c	Trichloroethene	79-01-6	WD	UG/L	1	U	0.5			
FW#49-8	Trichloroethene	79-01-6	WD	UG/L	1	U	0.5			
FW#49-9	Trichloroethene	79-01-6	WD	UG/L	1	U	0.5			
FW#49-10	Trichloroethene	79-01-6	WD	UG/L	4		4			
FW#49-11	Trichloroethene	79-01-6	WD	UG/L	1	U	0.5			
FW#49-12	Trichloroethene	79-01-6	WD	UG/L	1	U	0.5			
FW#49-13	Trichloroethene	79-01-6	WD	UG/L	1	U	0.5			
FW#49-14	Trichloroethene	79-01-6	WD	UG/L	1	U	0.5			
FW#49-15c	Trichloroethene	79-01-6	WD	UG/L	4		4			
FW#49-16	Trichloroethene	79-01-6	WD	UG/L	1		1			
FW#49-17	Trichloroethene	79-01-6	WD	UG/L	1	U	0.5			
FW#49-18	Trichloroethene	79-01-6	WD	UG/L	1	U	0.5			
FW#49-19	Trichloroethene	79-01-6	WD	UG/L	1	U	0.5			
FW#49-20	Trichloroethene	79-01-6	WD	UG/L	1		1			
FW#49-1	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-2	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5	3	37	20.27
FW#49-3b	m,p-Xylene	108-38-3	WD	UG/L	37		37			
FW#49-4	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-5	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-6	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-7c	m,p-Xylene	108-38-3	WD	UG/L	13		13			
FW#49-8	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-9	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-10	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-11	m,p-Xylene	108-38-3	WD	UG/L	3		3			
FW#49-12	m,p-Xylene	108-38-3	WD	UG/L	4		4			
FW#49-13	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-14	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-15c	m,p-Xylene	108-38-3	WD	UG/L	4		4			
FW#49-16	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-17	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-18	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-19	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-20	m,p-Xylene	108-38-3	WD	UG/L	1	U	0.5			
FW#49-1	oXylene	95-47-6	WD	UG/L	1	U	0.5	3	24	15.06

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
FW#49-2	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-3b	oXylene	95-47-6	WD	UG/L	24		24			
FW#49-4	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-5	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-6	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-7c	oXylene	95-47-6	WD	UG/L	17		17			
FW#49-8	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-9	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-10	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-11	oXylene	95-47-6	WD	UG/L	2		2			
FW#49-12	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-13	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-14	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-15c	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-16	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-17	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-18	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-19	oXylene	95-47-6	WD	UG/L	1	U	0.5			
FW#49-20	oXylene	95-47-6	WD	UG/L	1	U	0.5			
49M01W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	UF	0.85	2.35	18.1	12.03
49M02W1	Total Xylenes	1330-20-7	WD	UG/L	18.1		18.1			
49M03W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	UF	0.85			
49M04W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
49P01W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
49P02W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
53M05W1	Total Xylenes	1330-20-7	WD	UG/L	3.99		3.99			
49M01W2	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
49M02W2	Total Xylenes	1330-20-7	WD	UG/L	5.95		5.95			
49M03W2	Total Xylenes	1330-20-7	WD	UG/L	0.94		0.94			
49M04W2	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
49M05W1	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
49M06W1	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
53M05W2	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
49M01W2	Acenaphthene	83-32-9	WD	UG/L	0.655	U	0.3275	2.268	6.43	7.767
49M02W2	Acenaphthene	83-32-9	WD	UG/L	6.43		6.43			
49M03W2	Acenaphthene	83-32-9	WD	UG/L	0.655	U	0.3275			
49M04W2	Acenaphthene	83-32-9	WD	UG/L	0.655	U	0.3275			
49M05W1	Acenaphthene	83-32-9	WD	UG/L	6.06		6.06			
49M06W1	Acenaphthene	83-32-9	WD	UG/L	1.4		1.4			
53M05W2	Acenaphthene	83-32-9	WD	UG/L	1		1			
49M01W2	Anthracene	120-12-7	WD	UG/L	0.031		0.031	0.016	0.034	0.039
49M02W2	Anthracene	120-12-7	WD	UG/L	0.019	U	0.0085			
49M03W2	Anthracene	120-12-7	WD	UG/L	0.019	U	0.0085			
49M04W2	Anthracene	120-12-7	WD	UG/L	0.034		0.034			

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
49M05W1	Anthracene	120-12-7	WD	UG/L	0.019	U	0.0095			
49M06W1	Anthracene	120-12-7	WD	UG/L	0.019	U	0.0095			
53M05W2	Anthracene	120-12-7	WD	UG/L	0.019	U	0.0095			
49M01W2	Benzo(A)Anthracene	56-55-3	WD	UG/L	0.001		0.001	0.005	0.026	0.024
49M02W2	Benzo(A)Anthracene	56-55-3	WD	UG/L	0.026		0.026			
49M03W2	Benzo(A)Anthracene	56-55-3	WD	UG/L	0.004		0.004			
49M04W2	Benzo(A)Anthracene	56-55-3	WD	UG/L	0.006		0.006			
49M05W1	Benzo(A)Anthracene	56-55-3	WD	UG/L	0.001		0.001			
49M06W1	Benzo(A)Anthracene	56-55-3	WD	UG/L	0.007		0.007			
53M05W2	Benzo(A)Anthracene	56-55-3	WD	UG/L	0.003		0.003	0.004	0.012	0.012
49M01W2	Benzo(B)Fluoranthene	205-99-2	WD	UG/L	0.012		0.012			
49M02W2	Benzo(B)Fluoranthene	205-99-2	WD	UG/L	0.004		0.004			
49M03W2	Benzo(B)Fluoranthene	205-99-2	WD	UG/L	0.004		0.004			
49M04W2	Benzo(B)Fluoranthene	205-99-2	WD	UG/L	0.008		0.008			
49M05W1	Benzo(B)Fluoranthene	205-99-2	WD	UG/L	0.001		0.001			
49M06W1	Benzo(B)Fluoranthene	205-99-2	WD	UG/L	0.003		0.003			
53M05W2	Benzo(K)Fluoranthene	207-08-9	WD	UG/L	0.001		0.001	0.002	0.008	0.008
49M01W2	Benzo(K)Fluoranthene	207-08-9	WD	UG/L	0.008		0.008			
49M02W2	Benzo(K)Fluoranthene	207-08-9	WD	UG/L	0.002		0.002			
49M03W2	Benzo(K)Fluoranthene	207-08-9	WD	UG/L	0.002		0.002			
49M04W2	Benzo(K)Fluoranthene	207-08-9	WD	UG/L	0.004		0.004			
49M05W1	Benzo(K)Fluoranthene	207-08-9	WD	UG/L	0.005		0.005			
49M06W1	Benzo(K)Fluoranthene	207-08-9	WD	UG/L	0.001	U	0.0005			
53M05W2	Benzo(G,H,I)Perylene	191-24-2	WD	UG/L	0.002		0.002	0.005	0.023	0.022
49M01W2	Benzo(G,H,I)Perylene	191-24-2	WD	UG/L	0.001	U	0.0005			
49M02W2	Benzo(G,H,I)Perylene	191-24-2	WD	UG/L	0.023		0.023			
49M03W2	Benzo(G,H,I)Perylene	191-24-2	WD	UG/L	0.01		0.01			
49M04W2	Benzo(G,H,I)Perylene	191-24-2	WD	UG/L	0.001	U	0.0005			
49M05W1	Benzo(G,H,I)Perylene	191-24-2	WD	UG/L	0.001		0.001			
49M06W1	Benzo(G,H,I)Perylene	191-24-2	WD	UG/L	0.001	U	0.0005			
53M05W2	Benzo(A)Pyrene	50-32-8	WD	UG/L	0.002		0.002	0.0041	0.015	0.0145
49M01W2	Benzo(A)Pyrene	50-32-8	WD	UG/L	0.015		0.015			
49M02W2	Benzo(A)Pyrene	50-32-8	WD	UG/L	0.005		0.005			
49M03W2	Benzo(A)Pyrene	50-32-8	WD	UG/L	0.005		0.005			
49M04W2	Benzo(A)Pyrene	50-32-8	WD	UG/L	0.006		0.006			
49M05W1	Benzo(A)Pyrene	50-32-8	WD	UG/L	0.006		0.006			
49M06W1	Benzo(A)Pyrene	50-32-8	WD	UG/L	0.006		0.006			
53M05W2	Benzo(A)Pyrene	50-32-8	WD	UG/L	0.003	U	0.00015			
49M01W2	Chrysene	218-01-9	WD	UG/L	0.02		0.02	0.012	0.03	0.032
49M02W2	Chrysene	218-01-9	WD	UG/L	0.008	U	0.004			
49M03W2	Chrysene	218-01-9	WD	UG/L	0.01		0.01			
49M04W2	Chrysene	218-01-9	WD	UG/L	0.03		0.03			
49M05W1	Chrysene	218-01-9	WD	UG/L	0.008	U	0.004			
49M06W1	Chrysene	218-01-9	WD	UG/L	0.01		0.01			

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
53M05W2	Chrysene	218-01-9	WD	UG/L	0.008	U	0.004			
49M01W2	Dibenzo(A,H)Anthracene	53-70-3	WD	UG/L	0.002		0.002	0.0020	0.005	0.0056
49M02W2	Dibenzo(A,H)Anthracene	53-70-3	WD	UG/L	0.005		0.005			
49M03W2	Dibenzo(A,H)Anthracene	53-70-3	WD	UG/L	0.004		0.004			
49M04W2	Dibenzo(A,H)Anthracene	53-70-3	WD	UG/L	0.0009		0.0009			
49M05W1	Dibenzo(A,H)Anthracene	53-70-3	WD	UG/L	0.001		0.001			
49M06W1	Dibenzo(A,H)Anthracene	53-70-3	WD	UG/L	0.0009	U	0.00045			
53M05W2	Dibenzo(A,H)Anthracene	53-70-3	WD	UG/L	0.0009	U	0.00045			
49M01W1	Dibenzofuran	132-64-9	WD	UG/L	0.01	U	0.005	0.09	0.62	0.56
49M02W1	Dibenzofuran	132-64-9	WD	UG/L	0.62		0.62			
49M03W1	Dibenzofuran	132-64-9	WD	UG/L	0.01	U	0.005			
49M04W1	Dibenzofuran	132-64-9	WD	UG/L	0.01	U	0.005			
49P01W1	Dibenzofuran	132-64-9	WD	UG/L	0.01	U	0.005			
49P02W1	Dibenzofuran	132-64-9	WD	UG/L	0.01	U	0.005			
53M05W1	Dibenzofuran	132-64-9	WD	UG/L	0.01	U	0.005			
49M01W2	Fluoranthene	206-44-0	WD	UG/L	0.005		0.005	0.059	0.356	0.321
49M02W2	Fluoranthene	206-44-0	WD	UG/L	0.356		0.356			
49M03W2	Fluoranthene	206-44-0	WD	UG/L	0.012		0.012			
49M04W2	Fluoranthene	206-44-0	WD	UG/L	0.011		0.011			
49M05W1	Fluoranthene	206-44-0	WD	UG/L	0.011		0.011			
49M06W1	Fluoranthene	206-44-0	WD	UG/L	0.017		0.017			
53M05W2	Fluoranthene	206-44-0	WD	UG/L	0.003		0.003			
49M01W2	Fluorene	86-73-7	WD	UG/L	0.142		0.142	1.768	10.8	9.749
49M02W2	Fluorene	86-73-7	WD	UG/L	10.8		10.8			
49M03W2	Fluorene	86-73-7	WD	UG/L	0.145		0.145			
49M04W2	Fluorene	86-73-7	WD	UG/L	0.125	U	0.0625			
49M05W1	Fluorene	86-73-7	WD	UG/L	0.423		0.423			
49M06W1	Fluorene	86-73-7	WD	UG/L	0.74		0.74			
53M05W2	Fluorene	86-73-7	WD	UG/L	0.125	U	0.0625			
49M01W2	Indeno(1,2,3-CD)Pyrene	193-39-5	WD	UG/L	0.001		0.001	0.0032	0.009	0.0103
49M02W2	Indeno(1,2,3-CD)Pyrene	193-39-5	WD	UG/L	0.009		0.009			
49M03W2	Indeno(1,2,3-CD)Pyrene	193-39-5	WD	UG/L	0.007		0.007			
49M04W2	Indeno(1,2,3-CD)Pyrene	193-39-5	WD	UG/L	0.004		0.004			
49M05W1	Indeno(1,2,3-CD)Pyrene	193-39-5	WD	UG/L	0.0008	U	0.0004			
49M06W1	Indeno(1,2,3-CD)Pyrene	193-39-5	WD	UG/L	0.0008	U	0.0004			
53M05W2	Indeno(1,2,3-CD)Pyrene	193-39-5	WD	UG/L	0.0008	U	0.0004			
49M01W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.008	U	0.0004			
49M02W1	2-Methylnaphthalene	91-57-6	WD	UG/L	117	U	0.45	17.1	117	105.2
49M03W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.9	U	0.45			
49M04W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.9	U	0.45			
49P01W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.9	U	0.45			
49P02W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.9	U	0.45			
53M05W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.9	U	0.45			
49M01W1	Naphthalene	91-20-3	WD	UG/L	6.2		6.2	12.582	62	53.714

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
49M02W1	Naphthalene	91-20-3	WD	UG/L	62		62			
49M03W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
49M04W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
49P01W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
49P02W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
53M05W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
49M01W2	Naphthalene	91-20-3	WD	UG/L	0.878		0.878			
49M02W2	Naphthalene	91-20-3	WD	UG/L	49.9		49.9			
49M03W2	Naphthalene	91-20-3	WD	UG/L	1.29		1.29			
49M04W2	Naphthalene	91-20-3	WD	UG/L	0.47	U	0.235			
49M05W1	Naphthalene	91-20-3	WD	UG/L	33.2		33.2			
49M06W1	Naphthalene	91-20-3	WD	UG/L	10.9		10.9			
53M05W2	Naphthalene	91-20-3	WD	UG/L	10.9		10.9			
49M01W2	Phenanthrene	85-01-8	WD	UG/L	0.02		0.02	3.14	21	18.90
49M02W2	Phenanthrene	85-01-8	WD	UG/L	21		21			
49M03W2	Phenanthrene	85-01-8	WD	UG/L	0.04		0.04			
49M04W2	Phenanthrene	85-01-8	WD	UG/L	0.02		0.02			
49M05W1	Phenanthrene	85-01-8	WD	UG/L	0.2		0.2			
49M06W1	Phenanthrene	85-01-8	WD	UG/L	0.7		0.7			
53M05W2	Phenanthrene	85-01-8	WD	UG/L	0.02	U	0.01			
49M01W2	Pyrene	129-00-0	WD	UG/L	0.015		0.015	0.145	0.85	0.767
49M02W2	Pyrene	129-00-0	WD	UG/L	0.85		0.85			
49M03W2	Pyrene	129-00-0	WD	UG/L	0.038		0.038			
49M04W2	Pyrene	129-00-0	WD	UG/L	0.049		0.049			
49M05W1	Pyrene	129-00-0	WD	UG/L	0.02		0.02			
49M06W1	Pyrene	129-00-0	WD	UG/L	0.036		0.036			
53M05W2	Pyrene	129-00-0	WD	UG/L	0.011	U	0.0055			
53M05W1	Chloride	16887-00-6	WD	UG/L	2027		2027	2027	2027	NA
(f)										
(f)										
(f)										
(f)										
(f)										
(f)										
(f)										
(f)										
53M05W1	Sulfate	SULFATE	WD	UG/L	63810		63810	63810	63810	NA
53M05W1	Aluminum, Total	7429-90-5	WD	UG/L	13200		13200	13200	13200	NA
53M05W1	Arsenic, DISS	7440-38-2	WD	UG/L	10		10	10	10	NA
53M05W1	Arsenic, Total	7440-38-2	WD	UG/L	22.4		22.4	22.4	22.4	NA
53M05W1	Barium, DISS	7440-39-3	WD	UG/L	300		300	300	300	NA
53M05W1	Barium, Total	7440-39-3	WD	UG/L	418		418	418	418	NA
53M05W1	Calcium, DISS	7440-70-2	WD	UG/L	56900		56900	56900	56900	NA
53M05W1	Calcium, Total	7440-70-2	WD	UG/L	67000		67000	67000	67000	NA
53M05W1	Chromium, Total	7440-47-3	WD	UG/L	18.1		18.1	18.1	18.1	NA

TABLE D.11. Chemical Analytical Results for Source Area ST49
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
53M05W1	Cobalt, Total	7440-48-4	WD	UG/L	16.4		16.4	16.4	16.4	NA
53M05W1	Copper, Total	7440-50-8	WD	UG/L	62.2		62.2	62.2	62.2	NA
53M05W1	Iron, DISS	7439-89-6	WD	UG/L	700		700	700	700	NA
53M05W1	Iron, Total	7439-89-6	WD	UG/L	18600		18600	18600	18600	NA
53M05W1	Lead, Total	7439-92-1	WD	UG/L	20.8		20.8	20.8	20.8	NA
53M05W1	Magnesium, DISS	7439-95-4	WD	UG/L	12400		12400	12400	12400	NA
53M05W1	Magnesium, Total	7439-95-4	WD	UG/L	18100		18100	18100	18100	NA
53M05W1	Manganese, DISS	7439-96-5	WD	UG/L	2400		2400	2400	2400	NA
53M05W1	Manganese, Total	7439-96-5	WD	UG/L	2960		2960	2960	2960	NA
53M05W1	Nickel, Total	7440-02-0	WD	UG/L	26.2		26.2	26.2	26.2	NA
53M05W1	Potassium, DISS	7440-09-7	WD	UG/L	2940		2940	2940	2940	NA
53M05W1	Potassium, Total	7440-09-7	WD	UG/L	5760		5760	5760	5760	NA
53M05W1	Sodium, DISS	7440-23-5	WD	UG/L	5010		5010	5010	5010	NA
53M05W1	Sodium, Total	7440-23-5	WD	UG/L	6840		6840	6840	6840	NA
53M05W1	Vanadium, Total	7440-62-2	WD	UG/L	28.2		28.2	28.2	28.2	NA
53M05W1	Zinc, DISS	7440-66-6	WD	UG/L	60		60	60	60	NA
53M05W1	Zinc, Total	7440-66-6	WD	UG/L	79.9		79.9	79.9	79.9	NA
(a) Definitions: AG (soil gas), SO (soil), WD and WG (groundwater).										
(b) "Reported Result" is the concentration as reported in Elison Air Force Base database.										
(c) U and UF represent nondetected analytes at the detection limit listed in "Reported Result" column.										
(d) "DL/2 Value" lists the reported concentration of detected analytes or one-half of the detection limit for nondetected analytes.										
(e) "UCL" represents Upper Confidence Limit.										
(f) Space preserved for QA. Parameter not used in assessment.										

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50SV01	Benzene	71-43-2	AG	UG/L	10	U	5	23	170	111
50SV02	Benzene	71-43-2	AG	UG/L	10	U	5			
50SV03	Benzene	71-43-2	AG	UG/L	50		50			
50SV04	Benzene	71-43-2	AG	UG/L	10	U	5			
50SV05	Benzene	71-43-2	AG	UG/L	170		170			
50SV06	Benzene	71-43-2	AG	UG/L	60		60			
50SV07	Benzene	71-43-2	AG	UG/L	10	U	5			
50SV08	Benzene	71-43-2	AG	UG/L	10	U	5			
50SV09	Benzene	71-43-2	AG	UG/L	10	U	5			
50SV10	Benzene	71-43-2	AG	UG/L	10	U	5			
50SV11	Benzene	71-43-2	AG	UG/L	10	U	5			
50SV12	Benzene	71-43-2	AG	UG/L	10	U	5			
50SV13	Benzene	71-43-2	AG	UG/L	10	U	5			
50SV14	Benzene	71-43-2	AG	UG/L	10	U	5			
50SV15	Benzene	71-43-2	AG	UG/L	10	U	5			
50SV01	Ethylbenzene	100-41-4	AG	UG/L	180		180	1918	26800	15712
50SV02	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
50SV03	Ethylbenzene	100-41-4	AG	UG/L	30		30			
50SV04	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
50SV05	Ethylbenzene	100-41-4	AG	UG/L	1700		1700			
50SV06	Ethylbenzene	100-41-4	AG	UG/L	26800		26800			
50SV07	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
50SV08	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
50SV09	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
50SV10	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
50SV11	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
50SV12	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
50SV13	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
50SV14	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
50SV15	Ethylbenzene	100-41-4	AG	UG/L	10	U	5			
50SV01	mXylene	108-38-3	AG	UG/L	40	U	40	304	3400	2088
50SV02	mXylene	108-38-3	AG	UG/L	10	U	5			
50SV03	mXylene	108-38-3	AG	UG/L	90		90			
50SV04	mXylene	108-38-3	AG	UG/L	10	U	5			
50SV05	mXylene	108-38-3	AG	UG/L	980		980			
50SV06	mXylene	108-38-3	AG	UG/L	3400		3400			
50SV07	mXylene	108-38-3	AG	UG/L	10	U	5			
50SV08	mXylene	108-38-3	AG	UG/L	10	U	5			
50SV09	mXylene	108-38-3	AG	UG/L	10	U	5			
50SV10	mXylene	108-38-3	AG	UG/L	10	U	5			
50SV11	mXylene	108-38-3	AG	UG/L	10	U	5			
50SV12	mXylene	108-38-3	AG	UG/L	10	U	5			
50SV13	mXylene	108-38-3	AG	UG/L	10	U	5			
50SV14	mXylene	108-38-3	AG	UG/L	10	U	5			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50SV15	mXylene	108-38-3	AG	UG/L	10	U	5			802
50SV01	Toluene	108-88-3	AG	UG/L	60		60	159	1130	
50SV02	Toluene	108-88-3	AG	UG/L	10	U	5			
50SV03	Toluene	108-88-3	AG	UG/L	320		320			
50SV04	Toluene	108-88-3	AG	UG/L	10	U	5			
50SV05	Toluene	108-88-3	AG	UG/L	1130		1130			
50SV06	Toluene	108-88-3	AG	UG/L	180		180			
50SV07	Toluene	108-88-3	AG	UG/L	640		640			
50SV08	Toluene	108-88-3	AG	UG/L	10	U	5			
50SV09	Toluene	108-88-3	AG	UG/L	10	U	5			
50SV10	Toluene	108-88-3	AG	UG/L	10	U	5			
50SV11	Toluene	108-88-3	AG	UG/L	10	U	5			
50SV12	Toluene	108-88-3	AG	UG/L	10	U	5			
50SV13	Toluene	108-88-3	AG	UG/L	10	U	5			
50SV14	Toluene	108-88-3	AG	UG/L	10	U	5			
50SV15	Toluene	108-88-3	AG	UG/L	10	U	5			
50SV01	Total BTEX	BTEX	AG	UG/L	280	U	280	2389	30400	18020
50SV02	Total BTEX	BTEX	AG	UG/L	10	U	5			
50SV03	Total BTEX	BTEX	AG	UG/L	490		490			
50SV04	Total BTEX	BTEX	AG	UG/L	10	U	5			
50SV05	Total BTEX	BTEX	AG	UG/L	3980		3980			
50SV06	Total BTEX	BTEX	AG	UG/L	30400		30400			
50SV07	Total BTEX	BTEX	AG	UG/L	640		640			
50SV08	Total BTEX	BTEX	AG	UG/L	10	U	5			
50SV09	Total BTEX	BTEX	AG	UG/L	10	U	5			
50SV10	Total BTEX	BTEX	AG	UG/L	10	U	5			
50SV11	Total BTEX	BTEX	AG	UG/L	10	U	5			
50SV12	Total BTEX	BTEX	AG	UG/L	10	U	5			
50SV13	Total BTEX	BTEX	AG	UG/L	10	U	5			
50SV14	Total BTEX	BTEX	AG	UG/L	10	U	5			
50SV15	Total BTEX	BTEX	AG	UG/L	10	U	5			
50M01SA	2-Chlorophenol	95-57-8	SO	UG/KG	9	U	4.5	313	4150	2000
50M01SB	2-Chlorophenol	95-57-8	SO	UG/KG	9	U	4.5			
50M02SA	2-Chlorophenol	95-57-8	SO	UG/KG	9	U	4.5			
50M02SB	2-Chlorophenol	95-57-8	SO	UG/KG	110		110			
50M03SA	2-Chlorophenol	95-57-8	SO	UG/KG	9	U	4.5			
50M03SB	2-Chlorophenol	95-57-8	SO	UG/KG	9	U	4.5			
50M04SA	2-Chlorophenol	95-57-8	SO	UG/KG	9	U	4.5			
50M04SB	2-Chlorophenol	95-57-8	SO	UG/KG	9	U	4.5			
50M05SA	2-Chlorophenol	95-57-8	SO	UG/KG	9	U	4.5			
50M05SB	2-Chlorophenol	95-57-8	SO	UG/KG	9	U	4.5			
50M06SA	2-Chlorophenol	95-57-8	SO	UG/KG	9	U	4.5			
50M06SB	2-Chlorophenol	95-57-8	SO	UG/KG	9	U	4.5			
50X01SA	2-Chlorophenol	95-57-8	SO	UG/KG	2400	U	1200			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	96% UCL(e)
50X02SA	2-Chlorophenol	95-57-8	SO	UG/KG	70	U	35			
50X03SA	2-Chlorophenol	95-57-8	SO	UG/KG	80	U	40			
50X04SA	2-Chlorophenol	95-57-8	SO	UG/KG	1700	U	850			
50X05SA	2-Chlorophenol	95-57-8	SO	UG/KG	1800	U	900			
50X06SA	2-Chlorophenol	95-57-8	SO	UG/KG	8300	U	4150			
50X07SA	2-Chlorophenol	95-57-8	SO	UG/KG	370	U	185			
50X08SA	2-Chlorophenol	95-57-8	SO	UG/KG	170	U	85			
50X09SA	2-Chlorophenol	95-57-8	SO	UG/KG	400	U	200			
50X10SA	2-Chlorophenol	95-57-8	SO	UG/KG	320	U	160			
50M07SA	2-Chlorophenol	95-57-8	SO	UG/KG	90	U	45			
50M08SA	2-Chlorophenol	95-57-8	SO	UG/KG	90	U	45			
50M09SA	2-Chlorophenol	95-57-8	SO	UG/KG	90	U	45			
50M10SA	2-Chlorophenol	95-57-8	SO	UG/KG	80	U	40			
50M01SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	65000		65000	34215	320000	182278
50M01SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	320000		320000			
50M02SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	1100		1100			
50M02SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	300		300			
50M03SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	95000		95000			
50M03SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	160000		160000			
50M04SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	290		290			
50M04SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
50M05SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	430		430			
50M05SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
50M06SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	9700		9700			
50M06SB	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
50X01SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	25000		25000			
50X02SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
50X03SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
50X04SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	54000		54000			
50X05SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	8200		8200			
50X06SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	150000		150000			
50X07SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
50X08SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	120		120			
50X09SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	290		290			
50X10SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
50M07SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
50M08SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
50M09SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
50M10SA	2-Methylnaphthalene	91-57-6	SO	UG/KG	30	U	15			
50M01SA	Acenaphthene	83-32-9	SO	UG/KG	30	U	15			
50M01SB	Acenaphthene	83-32-9	SO	UG/KG	10	U	5	136	1800	866
50M02SA	Acenaphthene	83-32-9	SO	UG/KG	10	U	5			
50M02SB	Acenaphthene	83-32-9	SO	UG/KG	10	U	5			
50M03SA	Acenaphthene	83-32-9	SO	UG/KG	50	U	50			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M03SB	Acenaphthene	83-32-9	SO	UG/KG	10	U	5			
50M04SA	Acenaphthene	83-32-9	SO	UG/KG	10	U	5			
50M04SB	Acenaphthene	83-32-9	SO	UG/KG	10	U	5			
50M05SA	Acenaphthene	83-32-9	SO	UG/KG	10	U	5			
50M05SB	Acenaphthene	83-32-9	SO	UG/KG	10	U	5			
50M06SA	Acenaphthene	83-32-9	SO	UG/KG	10	U	5			
50M06SB	Acenaphthene	83-32-9	SO	UG/KG	1000	U	500			
50X01SA	Acenaphthene	83-32-9	SO	UG/KG	30	U	15			
50X02SA	Acenaphthene	83-32-9	SO	UG/KG	40	U	20			
50X03SA	Acenaphthene	83-32-9	SO	UG/KG	750	U	375			
50X04SA	Acenaphthene	83-32-9	SO	UG/KG	790	U	395			
50X05SA	Acenaphthene	83-32-9	SO	UG/KG	3600	U	1800			
50X06SA	Acenaphthene	83-32-9	SO	UG/KG	160	U	80			
50X07SA	Acenaphthene	83-32-9	SO	UG/KG	70	U	35			
50X08SA	Acenaphthene	83-32-9	SO	UG/KG	170	U	85			
50X09SA	Acenaphthene	83-32-9	SO	UG/KG	140	U	70			
50X10SA	Acenaphthene	83-32-9	SO	UG/KG	40	U	20			
50M07SA	Acenaphthene	83-32-9	SO	UG/KG	40	U	20			
50M08SA	Acenaphthene	83-32-9	SO	UG/KG	40	U	20			
50M09SA	Acenaphthene	83-32-9	SO	UG/KG	0.03	U	0.015			
50M10SA	Acenaphthene	83-32-9	SO	UG/KG	30	U	15	5371	75000	45452
50X01SA	Acetophenone	98-86-2	SO	UG/KG	30	U	15			
50X02SA	Acetophenone	98-86-2	SO	UG/KG	30	U	15			
50X03SA	Acetophenone	98-86-2	SO	UG/KG	30	U	15			
50X04SA	Acetophenone	98-86-2	SO	UG/KG	30	U	15			
50X05SA	Acetophenone	98-86-2	SO	UG/KG	30	U	15			
50X06SA	Acetophenone	98-86-2	SO	UG/KG	75000	U	75000			
50X07SA	Acetophenone	98-86-2	SO	UG/KG	30	U	15			
50X08SA	Acetophenone	98-86-2	SO	UG/KG	30	U	15			
50X09SA	Acetophenone	98-86-2	SO	UG/KG	30	U	15			
50X10SA	Acetophenone	98-86-2	SO	UG/KG	30	U	15			
50M07SA	Acetophenone	98-86-2	SO	UG/KG	30	U	15			
50M08SA	Acetophenone	98-86-2	SO	UG/KG	30	U	15			
50M09SA	Acetophenone	98-86-2	SO	UG/KG	30	U	15			
50M10SA	Acetophenone	98-86-2	SO	UG/KG	30	U	15			
50M01SA	Aluminum, SED	7429-90-5	SO	UG/KG	9130000	U	9130000	9079167	13900000	15698249
50M01SB	Aluminum, SED	7429-90-5	SO	UG/KG	11900000	U	11900000			
50M02SA	Aluminum, SED	7429-90-5	SO	UG/KG	3660000	U	3660000			
50M02SB	Aluminum, SED	7429-90-5	SO	UG/KG	12800000	U	12800000			
50M03SA	Aluminum, SED	7429-90-5	SO	UG/KG	5720000	U	5720000			
50M03SB	Aluminum, SED	7429-90-5	SO	UG/KG	11000000	U	11000000			
50M04SA	Aluminum, SED	7429-90-5	SO	UG/KG	10500000	U	10500000			
50M04SB	Aluminum, SED	7429-90-5	SO	UG/KG	9400000	U	9400000			
50M05SA	Aluminum, SED	7429-90-5	SO	UG/KG	6180000	U	6180000			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M05SB	Aluminum, SED	7429-90-5	SO	UG/KG	4660000		4660000			
50M06SA	Aluminum, SED	7429-90-5	SO	UG/KG	10100000		10100000			
50M06SB	Aluminum, SED	7429-90-5	SO	UG/KG	13900000		13900000			
50M01SA	Arsenic, SED	7440-38-2	SO	UG/KG	6390	U	3195	4900	18200	13845
50M01SB	Arsenic, SED	7440-38-2	SO	UG/KG	6390	U	3195			
50M02SA	Arsenic, SED	7440-38-2	SO	UG/KG	6390	U	3195			
50M02SB	Arsenic, SED	7440-38-2	SO	UG/KG	18200		18200			
50M03SA	Arsenic, SED	7440-38-2	SO	UG/KG	6390	U	3195			
50M03SB	Arsenic, SED	7440-38-2	SO	UG/KG	6390	U	3195			
50M04SA	Arsenic, SED	7440-38-2	SO	UG/KG	8650		8650			
50M04SB	Arsenic, SED	7440-38-2	SO	UG/KG	6390	U	3195			
50M05SA	Arsenic, SED	7440-38-2	SO	UG/KG	6390	U	3195			
50M05SB	Arsenic, SED	7440-38-2	SO	UG/KG	6390	U	3195			
50M06SA	Arsenic, SED	7440-38-2	SO	UG/KG	6390	U	3195			
50M06SB	Arsenic, SED	7440-38-2	SO	UG/KG	6390	U	3195			
50M01SA	Barium, SED	7440-39-3	SO	UG/KG	165000	U	165000	194092	366000	369627
50M01SB	Barium, SED	7440-39-3	SO	UG/KG	281000		281000			
50M02SA	Barium, SED	7440-39-3	SO	UG/KG	80000		80000			
50M02SB	Barium, SED	7440-39-3	SO	UG/KG	201000		201000			
50M03SA	Barium, SED	7440-39-3	SO	UG/KG	116000		116000			
50M03SB	Barium, SED	7440-39-3	SO	UG/KG	366000		366000			
50M04SA	Barium, SED	7440-39-3	SO	UG/KG	269000		269000			
50M04SB	Barium, SED	7440-39-3	SO	UG/KG	243000		243000			
50M05SA	Barium, SED	7440-39-3	SO	UG/KG	112000		112000			
50M05SB	Barium, SED	7440-39-3	SO	UG/KG	82100		82100			
50M06SA	Barium, SED	7440-39-3	SO	UG/KG	206000		206000			
50M06SB	Barium, SED	7440-39-3	SO	UG/KG	208000		208000			
50M01SA	Benzene	71-43-2	SO	UG/KG	680		680	524	3790	2973
50M01SB	Benzene	71-43-2	SO	UG/KG	44	U	22			
50M02SA	Benzene	71-43-2	SO	UG/KG	44	U	22			
50M02SB	Benzene	71-43-2	SO	UG/KG	44	U	22			
50M03SA	Benzene	71-43-2	SO	UG/KG	44	U	22			
50M03SB	Benzene	71-43-2	SO	UG/KG	3790		3790			
50M04SA	Benzene	71-43-2	SO	UG/KG	3470		3470			
50M04SB	Benzene	71-43-2	SO	UG/KG	44	U	22			
50M05SA	Benzene	71-43-2	SO	UG/KG	44	U	22			
50M05SB	Benzene	71-43-2	SO	UG/KG	44	U	22			
50M06SA	Benzene	71-43-2	SO	UG/KG	44	U	22			
50M06SB	Benzene	71-43-2	SO	UG/KG	44	U	22			
50M07SA	Benzene	71-43-2	SO	UG/KG	127	U	63.5			
50M08SA	Benzene	71-43-2	SO	UG/KG	132	U	66			
50M09SA	Benzene	71-43-2	SO	UG/KG	127	U	63.5			
50M10SA	Benzene	71-43-2	SO	UG/KG	108	U	54			
50M01SA	Beryllium, SED	7440-41-7	SO	UG/KG	320	U	160	198	620	464

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M01SB	Beryllium, SED	7440-41-7	SO	UG/KG	320	U	160			
50M02SA	Beryllium, SED	7440-41-7	SO	UG/KG	320	U	160			
50M02SB	Beryllium, SED	7440-41-7	SO	UG/KG	620		620			
50M03SA	Beryllium, SED	7440-41-7	SO	UG/KG	320	U	160			
50M03SB	Beryllium, SED	7440-41-7	SO	UG/KG	320	U	160			
50M04SA	Beryllium, SED	7440-41-7	SO	UG/KG	320	U	160			
50M04SB	Beryllium, SED	7440-41-7	SO	UG/KG	320	U	160			
50M05SA	Beryllium, SED	7440-41-7	SO	UG/KG	320	U	160			
50M05SB	Beryllium, SED	7440-41-7	SO	UG/KG	320	U	160			
50M06SA	Beryllium, SED	7440-41-7	SO	UG/KG	320	U	160			
50M06SB	Beryllium, SED	7440-41-7	SO	UG/KG	320	U	160			
50M01SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50	66	700	327
50M01SB	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
50M02SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
50M02SB	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	1400	U	700			
50M03SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
50M03SB	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
50M04SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
50M04SB	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
50M05SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
50M05SB	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
50M06SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
50M06SB	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	100	U	50			
50X01SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	50	U	25			
50X02SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	90		90			
50X03SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	80		80			
50X04SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	50	U	25			
50X05SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	50	U	25			
50X06SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	50	U	25			
50X07SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	50	U	25			
50X08SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	50	U	25			
50X09SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	50	U	25			
50X10SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	50	U	25			
50M07SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	50	U	25			
50M08SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	50	U	25			
50M09SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	50	U	25			
50M10SA	BIS (2-Ethylhexyl)phthalate	117-81-7	SO	UG/KG	50	U	25			
50M01SA	Cadmium, SED	7440-43-9	SO	UG/KG	1390		1390	1105	1990	1842
50M01SB	Cadmium, SED	7440-43-9	SO	UG/KG	1000		1000			
50M02SA	Cadmium, SED	7440-43-9	SO	UG/KG	920		920			
50M02SB	Cadmium, SED	7440-43-9	SO	UG/KG	1990		1990			
50M03SA	Cadmium, SED	7440-43-9	SO	UG/KG	970		970			
50M03SB	Cadmium, SED	7440-43-9	SO	UG/KG	1220		1220			
50M04SA	Cadmium, SED	7440-43-9	SO	UG/KG	1140		1140			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/Z Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M04SB	Cadmium, SED	7440-43-9	SO	UG/KG	1460		1460			
50M05SA	Cadmium, SED	7440-43-9	SO	UG/KG	770		770			
50M05SB	Cadmium, SED	7440-43-9	SO	UG/KG	660		660			
50M06SA	Cadmium, SED	7440-43-9	SO	UG/KG	820		820			
50M06SB	Cadmium, SED	7440-43-9	SO	UG/KG	920		920			
50M01SA	Calcium, SED	7440-70-2	SO	UG/KG	2810000		2810000	3053167	5690000	5534469
50M01SB	Calcium, SED	7440-70-2	SO	UG/KG	5210000		5210000			
50M02SA	Calcium, SED	7440-70-2	SO	UG/KG	1690000		1690000			
50M02SB	Calcium, SED	7440-70-2	SO	UG/KG	5690000		5690000			
50M03SA	Calcium, SED	7440-70-2	SO	UG/KG	1880000		1880000			
50M03SB	Calcium, SED	7440-70-2	SO	UG/KG	3050000		3050000			
50M04SA	Calcium, SED	7440-70-2	SO	UG/KG	2810000		2810000			
50M04SB	Calcium, SED	7440-70-2	SO	UG/KG	2790000		2790000			
50M05SA	Calcium, SED	7440-70-2	SO	UG/KG	2380000		2380000			
50M05SB	Calcium, SED	7440-70-2	SO	UG/KG	1970000		1970000			
50M06SA	Calcium, SED	7440-70-2	SO	UG/KG	3530000		3530000			
50M06SB	Calcium, SED	7440-70-2	SO	UG/KG	2828000		2828000			
50M01SA	Chromium, SED	7440-47-3	SO	UG/KG	17325		17325	17325	25800	27945
50M01SB	Chromium, SED	7440-47-3	SO	UG/KG	20300		20300			
50M02SA	Chromium, SED	7440-47-3	SO	UG/KG	6200		6200			
50M02SB	Chromium, SED	7440-47-3	SO	UG/KG	25800		25800			
50M03SA	Chromium, SED	7440-47-3	SO	UG/KG	11300		11300			
50M03SB	Chromium, SED	7440-47-3	SO	UG/KG	19800		19800			
50M04SA	Chromium, SED	7440-47-3	SO	UG/KG	19700		19700			
50M04SB	Chromium, SED	7440-47-3	SO	UG/KG	18500		18500			
50M05SA	Chromium, SED	7440-47-3	SO	UG/KG	17100		17100			
50M05SB	Chromium, SED	7440-47-3	SO	UG/KG	11400		11400			
50M06SA	Chromium, SED	7440-47-3	SO	UG/KG	19000		19000			
50M06SB	Chromium, SED	7440-47-3	SO	UG/KG	21600		21600			
50M01SA	Cobalt, SED	7440-48-4	SO	UG/KG	10500		10500	9960	15300	17280
50M01SB	Cobalt, SED	7440-48-4	SO	UG/KG	9940		9940			
50M02SA	Cobalt, SED	7440-48-4	SO	UG/KG	3890		3890			
50M02SB	Cobalt, SED	7440-48-4	SO	UG/KG	15300		15300			
50M03SA	Cobalt, SED	7440-48-4	SO	UG/KG	6210		6210			
50M03SB	Cobalt, SED	7440-48-4	SO	UG/KG	13000		13000			
50M04SA	Cobalt, SED	7440-48-4	SO	UG/KG	12600		12600			
50M04SB	Cobalt, SED	7440-48-4	SO	UG/KG	9270		9270			
50M05SA	Cobalt, SED	7440-48-4	SO	UG/KG	7330		7330			
50M05SB	Cobalt, SED	7440-48-4	SO	UG/KG	5280		5280			
50M06SA	Cobalt, SED	7440-48-4	SO	UG/KG	12000		12000			
50M06SB	Cobalt, SED	7440-48-4	SO	UG/KG	14200		14200			
50M01SA	Copper, SED	7440-50-8	SO	UG/KG	28200		28200	24479	42700	46433
50M01SB	Copper, SED	7440-50-8	SO	UG/KG	27000		27000			
50M02SA	Copper, SED	7440-50-8	SO	UG/KG	7460		7460			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	CL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M02SB	Copper, SED	7440-50-8	SO	UG/KG	42700		42700			
50M03SA	Copper, SED	7440-50-8	SO	UG/KG	14300		14300			
50M03SB	Copper, SED	7440-50-8	SO	UG/KG	31700		31700			
50M04SA	Copper, SED	7440-50-8	SO	UG/KG	28700		28700			
50M04SB	Copper, SED	7440-50-8	SO	UG/KG	25900		25900			
50M05SA	Copper, SED	7440-50-8	SO	UG/KG	18100		18100			
50M05SB	Copper, SED	7440-50-8	SO	UG/KG	6790		6790			
50M06SA	Copper, SED	7440-50-8	SO	UG/KG	26100		26100			
50M06SB	Copper, SED	7440-50-8	SO	UG/KG	36800		36800			
50M01SA	Dibenzofuran	132-64-9	SO	UG/KG	10	U	5	818	11000	5621
50M01SB	Dibenzofuran	132-64-9	SO	UG/KG	11000		11000			
50M02SA	Dibenzofuran	132-64-9	SO	UG/KG	10	U	5			
50M02SB	Dibenzofuran	132-64-9	SO	UG/KG	10	U	5			
50M03SA	Dibenzofuran	132-64-9	SO	UG/KG	4800		4800			
50M03SB	Dibenzofuran	132-64-9	SO	UG/KG	4100		4100			
50M04SA	Dibenzofuran	132-64-9	SO	UG/KG	10	U	5			
50M04SB	Dibenzofuran	132-64-9	SO	UG/KG	10	U	5			
50M05SA	Dibenzofuran	132-64-9	SO	UG/KG	10	U	5			
50M05SB	Dibenzofuran	132-64-9	SO	UG/KG	10	U	5			
50M06SA	Dibenzofuran	132-64-9	SO	UG/KG	380		380			
50M06SB	Dibenzofuran	132-64-9	SO	UG/KG	10	U	5			
50X01SA	Dibenzofuran	132-64-9	SO	UG/KG	30	U	15			
50X02SA	Dibenzofuran	132-64-9	SO	UG/KG	30	U	15			
50X03SA	Dibenzofuran	132-64-9	SO	UG/KG	30	U	15			
50X04SA	Dibenzofuran	132-64-9	SO	UG/KG	750		750			
50X05SA	Dibenzofuran	132-64-9	SO	UG/KG	30	U	15			
50X06SA	Dibenzofuran	132-64-9	SO	UG/KG	30	U	15			
50X07SA	Dibenzofuran	132-64-9	SO	UG/KG	30	U	15			
50X08SA	Dibenzofuran	132-64-9	SO	UG/KG	30	U	15			
50X09SA	Dibenzofuran	132-64-9	SO	UG/KG	30	U	15			
50X10SA	Dibenzofuran	132-64-9	SO	UG/KG	30	U	15			
50M07SA	Dibenzofuran	132-64-9	SO	UG/KG	30	U	15			
50M08SA	Dibenzofuran	132-64-9	SO	UG/KG	30	U	15			
50M09SA	Dibenzofuran	132-64-9	SO	UG/KG	30	U	15			
50M10SA	Dibenzofuran	132-64-9	SO	UG/KG	30	U	15			
50M01SA	Ethylbenzene	100-41-4	SO	UG/KG	15000		15000	18832	170000	108626
50M01SB	Ethylbenzene	100-41-4	SO	UG/KG	170000		170000			
50M02SA	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
50M02SB	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
50M03SA	Ethylbenzene	100-41-4	SO	UG/KG	1900		1800			
50M03SB	Ethylbenzene	100-41-4	SO	UG/KG	76000		76000			
50M04SA	Ethylbenzene	100-41-4	SO	UG/KG	31000		31000			
50M04SB	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
50M05SA	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	86% UCL(e)
50M05SB	Ethylbenzene	100-41-4	SO	UG/KG	6700		6700			
50M06SA	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
50M06SB	Ethylbenzene	100-41-4	SO	UG/KG	80	U	40			
50M07SA	Ethylbenzene	100-41-4	SO	UG/KG	290	U	145			
50M08SA	Ethylbenzene	100-41-4	SO	UG/KG	300	U	150			
50M09SA	Ethylbenzene	100-41-4	SO	UG/KG	290	U	145			
50M10SA	Ethylbenzene	100-41-4	SO	UG/KG	250	U	125			
50M01SA	Fluorene	86-73-7	SO	UG/KG	30	U	15	621	12000	5319
50M01SB	Fluorene	86-73-7	SO	UG/KG	12000		12000			
50M02SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
50M02SB	Fluorene	86-73-7	SO	UG/KG	30	U	15			
50M03SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
50M03SB	Fluorene	86-73-7	SO	UG/KG	30	U	15			
50M04SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
50M04SB	Fluorene	86-73-7	SO	UG/KG	30	U	15			
50M05SA	Fluorene	86-73-7	SO	UG/KG	150		150			
50M05SB	Fluorene	86-73-7	SO	UG/KG	30	U	15			
50M06SA	Fluorene	86-73-7	SO	UG/KG	400		400			
50M06SB	Fluorene	86-73-7	SO	UG/KG	30	U	15			
50X01SA	Fluorene	86-73-7	SO	UG/KG	1000	U	500			
50X02SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
50X03SA	Fluorene	86-73-7	SO	UG/KG	40	U	20			
50X04SA	Fluorene	86-73-7	SO	UG/KG	750	U	375			
50X05SA	Fluorene	86-73-7	SO	UG/KG	790	U	395			
50X06SA	Fluorene	86-73-7	SO	UG/KG	3600	U	1800			
50X07SA	Fluorene	86-73-7	SO	UG/KG	160	U	80			
50X08SA	Fluorene	86-73-7	SO	UG/KG	70	U	35			
50X09SA	Fluorene	86-73-7	SO	UG/KG	170	U	85			
50X10SA	Fluorene	86-73-7	SO	UG/KG	140	U	70			
50M07SA	Fluorene	86-73-7	SO	UG/KG	40	U	20			
50M08SA	Fluorene	86-73-7	SO	UG/KG	40	U	20			
50M09SA	Fluorene	86-73-7	SO	UG/KG	40	U	20			
50M10SA	Fluorene	86-73-7	SO	UG/KG	30	U	15			
50M01SA	Iron, SED	7439-89-6	SO	UG/KG	20900000		20900000	20775833	34300000	36340795
50M01SB	Iron, SED	7439-89-6	SO	UG/KG	20100000		20100000			
50M02SA	Iron, SED	7439-89-6	SO	UG/KG	7510000		7510000			
50M02SB	Iron, SED	7439-89-6	SO	UG/KG	29200000		29200000			
50M03SA	Iron, SED	7439-89-6	SO	UG/KG	13700000		13700000			
50M03SB	Iron, SED	7439-89-6	SO	UG/KG	25300000		25300000			
50M04SA	Iron, SED	7439-89-6	SO	UG/KG	24100000		24100000			
50M04SB	Iron, SED	7439-89-6	SO	UG/KG	24100000		24100000			
50M05SA	Iron, SED	7439-89-6	SO	UG/KG	15900000		15900000			
50M05SB	Iron, SED	7439-89-6	SO	UG/KG	10300000		10300000			
50M06SA	Iron, SED	7439-89-6	SO	UG/KG	23900000		23900000			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL72 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M06SB	Iron, SED	7439-89-6	SO	UG/KG	34300000		34300000			
50M01SA	Lead, SED	7439-92-1	SO	UG/KG	21600		21600	18225	31900	31402
50M01SB	Lead, SED	7439-92-1	SO	UG/KG	19600		19600			
50M02SA	Lead, SED	7439-92-1	SO	UG/KG	12100		12100			
50M02SB	Lead, SED	7439-92-1	SO	UG/KG	31900		31900			
50M03SA	Lead, SED	7439-92-1	SO	UG/KG	17300		17300			
50M03SB	Lead, SED	7439-92-1	SO	UG/KG	27000		27000			
50M04SA	Lead, SED	7439-92-1	SO	UG/KG	24500		24500			
50M04SB	Lead, SED	7439-92-1	SO	UG/KG	17700		17700			
50M05SA	Lead, SED	7439-92-1	SO	UG/KG	16300		16300			
50M05SB	Lead, SED	7439-92-1	SO	UG/KG	13800		13800			
50M06SA	Lead, SED	7439-92-1	SO	UG/KG	26200		26200			
50M06SB	Lead, SED	7439-92-1	SO	UG/KG	26100		26100			
50M01SA	Lead, SED	7439-92-1	SO	UG/KG	16400		16400			
50M01SB	Lead, SED	7439-92-1	SO	UG/KG	11400		11400			
50M02SA	Lead, SED	7439-92-1	SO	UG/KG	10100		10100			
50M02SB	Lead, SED	7439-92-1	SO	UG/KG	22300		22300			
50M03SA	Lead, SED	7439-92-1	SO	UG/KG	5050		5050			
50M03SB	Lead, SED	7439-92-1	SO	UG/KG	23100		23100			
50M04SA	Lead, SED	7439-92-1	SO	UG/KG	16900		16900			
50M04SB	Lead, SED	7439-92-1	SO	UG/KG	12700		12700			
50M05SA	Lead, SED	7439-92-1	SO	UG/KG	14800		14800			
50M05SB	Lead, SED	7439-92-1	SO	UG/KG	9360		9360			
50M06SA	Lead, SED	7439-92-1	SO	UG/KG	16700		16700			
50M06SB	Lead, SED	7439-92-1	SO	UG/KG	24500		24500			
50M01SA	Magnesium, SED	7439-95-4	SO	UG/L	4330000		4330000	4421667	7440000	7883887
50M01SB	Magnesium, SED	7439-95-4	SO	UG/KG	4190000		4190000			
50M02SA	Magnesium, SED	7439-95-4	SO	UG/KG	1710000		1710000			
50M02SB	Magnesium, SED	7439-95-4	SO	UG/KG	7440000		7440000			
50M03SA	Magnesium, SED	7439-95-4	SO	UG/KG	2860000		2860000			
50M03SB	Magnesium, SED	7439-95-4	SO	UG/KG	5550000		5550000			
50M04SA	Magnesium, SED	7439-95-4	SO	UG/KG	4950000		4950000			
50M04SB	Magnesium, SED	7439-95-4	SO	UG/KG	5230000		5230000			
50M05SA	Magnesium, SED	7439-95-4	SO	UG/KG	2880000		2880000			
50M05SB	Magnesium, SED	7439-95-4	SO	UG/KG	2420000		2420000			
50M06SA	Magnesium, SED	7439-95-4	SO	UG/KG	4780000		4780000			
50M06SB	Magnesium, SED	7439-95-4	SO	UG/KG	6720000		6720000			
50M01SA	Manganese, SED	7439-96-5	SO	UG/KG	382000		382000	362250	661000	623084
50M01SB	Manganese, SED	7439-96-5	SO	UG/KG	230000		230000			
50M02SA	Manganese, SED	7439-96-5	SO	UG/KG	293000		293000			
50M02SB	Manganese, SED	7439-96-5	SO	UG/KG	661000		661000			
50M03SA	Manganese, SED	7439-96-5	SO	UG/KG	473000		473000			
50M03SB	Manganese, SED	7439-96-5	SO	UG/KG	304000		304000			
50M04SA	Manganese, SED	7439-96-5	SO	UG/KG	388000		388000			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M04SB	Manganese, SED	7439-96-5	SO	UG/KG	248000		248000			
50M05SA	Manganese, SED	7439-96-5	SO	UG/KG	262000		262000			
50M05SB	Manganese, SED	7439-96-5	SO	UG/KG	218000		218000			
50M06SA	Manganese, SED	7439-96-5	SO	UG/KG	472000		472000			
50M06SB	Manganese, SED	7439-96-5	SO	UG/KG	416000		416000			
50X01SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	30	U	15	49	320	231
50X02SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	30	U	15			
50X03SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	30	U	15			
50X04SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	30	U	15			
50X05SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	30	U	15			
50X06SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	30	U	15			
50X07SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	190		190			
50X08SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	320		320			
50X09SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	30	U	15			
50X10SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	30	U	15			
50M07SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	30	U	15			
50M08SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	30	U	15			
50M09SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	30	U	15			
50M10SA	N-Nitrosopiperidine	100-75-4	SO	UG/KG	30	U	15			
50M01SA	Naphthalene	91-20-3	SO	UG/KG	28000		28000	17289	160000	92765
50M01SB	Naphthalene	91-20-3	SO	UG/KG	160000		160000			
50M02SA	Naphthalene	91-20-3	SO	UG/KG	660		660			
50M02SB	Naphthalene	91-20-3	SO	UG/KG	160		160			
50M03SA	Naphthalene	91-20-3	SO	UG/KG	45000		45000			
50M03SB	Naphthalene	91-20-3	SO	UG/KG	84000		84000			
50M04SA	Naphthalene	91-20-3	SO	UG/KG	150		150			
50M04SB	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
50M05SA	Naphthalene	91-20-3	SO	UG/KG	180		180			
50M05SB	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
50M06SA	Naphthalene	91-20-3	SO	UG/KG	4100		4100			
50M06SB	Naphthalene	91-20-3	SO	UG/KG	9	U	4.5			
50X01SA	Naphthalene	91-20-3	SO	UG/KG	12000		12000			
50X02SA	Naphthalene	91-20-3	SO	UG/KG	30	U	15			
50X03SA	Naphthalene	91-20-3	SO	UG/KG	30	U	15			
50X04SA	Naphthalene	91-20-3	SO	UG/KG	32000		32000			
50X05SA	Naphthalene	91-20-3	SO	UG/KG	1100		1100			
50X06SA	Naphthalene	91-20-3	SO	UG/KG	82000		82000			
50X07SA	Naphthalene	91-20-3	SO	UG/KG	30	U	15			
50X08SA	Naphthalene	91-20-3	SO	UG/KG	30	U	15			
50X09SA	Naphthalene	91-20-3	SO	UG/KG	30	U	15			
50X10SA	Naphthalene	91-20-3	SO	UG/KG	30	U	15			
50M07SA	Naphthalene	91-20-3	SO	UG/KG	30	U	15			
50M08SA	Naphthalene	91-20-3	SO	UG/KG	30	U	15			
50M09SA	Naphthalene	91-20-3	SO	UG/KG	30	U	15			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M10SA	Naphthalene	91-20-3	SO	UG/KG	30	U	15			
50M01SA	Nickel, SED	7440-02-0	SO	UG/KG	22400		22400	21850	22400	23406
50M01SB	Nickel, SED	7440-02-0	SO	UG/KG	21300		21300			
50M02SA	Nickel, SED	7440-02-0	SO	UG/KG	8790		8790			
50M02SB	Nickel, SED	7440-02-0	SO	UG/KG	38600		38600			
50M03SA	Nickel, SED	7440-02-0	SO	UG/KG	11700		11700			
50M03SB	Nickel, SED	7440-02-0	SO	UG/KG	25700		25700			
50M04SA	Nickel, SED	7440-02-0	SO	UG/KG	24000		24000			
50M04SB	Nickel, SED	7440-02-0	SO	UG/KG	20300		20300			
50M05SA	Nickel, SED	7440-02-0	SO	UG/KG	15200		15200			
50M05SB	Nickel, SED	7440-02-0	SO	UG/KG	10600		10600			
50M06SA	Nickel, SED	7440-02-0	SO	UG/KG	24300		24300			
50M06SB	Nickel, SED	7440-02-0	SO	UG/KG	33400		33400			
50M01SA	Phenol	108-95-2	SO	UG/KG	30	U	15	313	4150	1999
50M01SB	Phenol	108-95-2	SO	UG/KG	30	U	15			
50M02SA	Phenol	108-95-2	SO	UG/KG	30	U	15			
50M02SB	Phenol	108-95-2	SO	UG/KG	170		170			
50M03SA	Phenol	108-95-2	SO	UG/KG	30	U	15			
50M03SB	Phenol	108-95-2	SO	UG/KG	30	U	15			
50M04SA	Phenol	108-95-2	SO	UG/KG	30	U	15			
50M04SB	Phenol	108-95-2	SO	UG/KG	30	U	15			
50M05SA	Phenol	108-95-2	SO	UG/KG	30	U	15			
50M05SB	Phenol	108-95-2	SO	UG/KG	30	U	15			
50M06SA	Phenol	108-95-2	SO	UG/KG	30	U	15			
50M06SB	Phenol	108-95-2	SO	UG/KG	30	U	15			
50X01SA	Phenol	108-95-2	SO	UG/KG	30	U	15			
50X02SA	Phenol	108-95-2	SO	UG/KG	2400	U	1200			
50X03SA	Phenol	108-95-2	SO	UG/KG	70	U	35			
50X04SA	Phenol	108-95-2	SO	UG/KG	80	U	40			
50X05SA	Phenol	108-95-2	SO	UG/KG	1700	U	850			
50X06SA	Phenol	108-95-2	SO	UG/KG	1800	U	900			
50X07SA	Phenol	108-95-2	SO	UG/KG	8300	U	4150			
50X08SA	Phenol	108-95-2	SO	UG/KG	370	U	185			
50X09SA	Phenol	108-95-2	SO	UG/KG	170	U	85			
50X10SA	Phenol	108-95-2	SO	UG/KG	40	U	20			
50M07SA	Phenol	108-95-2	SO	UG/KG	320	U	160			
50M08SA	Phenol	108-95-2	SO	UG/KG	90	U	45			
50M09SA	Phenol	108-95-2	SO	UG/KG	90	U	45			
50M10SA	Phenol	108-95-2	SO	UG/KG	80	U	40			
50M01SA	Potassium, SED	7440-09-7	SO	UG/KG	967000		967000	1093583	1720000	1926461
50M01SB	Potassium, SED	7440-09-7	SO	UG/KG	864000		864000			
50M02SA	Potassium, SED	7440-09-7	SO	UG/KG	565000		565000			
50M02SB	Potassium, SED	7440-09-7	SO	UG/KG	1680000		1680000			
50M03SA	Potassium, SED	7440-09-7	SO	UG/KG	676000		676000			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M03SB	Potassium, SED	7440-09-7	SO	UG/KG	1470000		1470000			
50M04SA	Potassium, SED	7440-09-7	SO	UG/KG	1130000		1130000			
50M04SB	Potassium, SED	7440-09-7	SO	UG/KG	1270000		1270000			
50M05SA	Potassium, SED	7440-09-7	SO	UG/KG	905000		905000			
50M05SB	Potassium, SED	7440-09-7	SO	UG/KG	496000		496000			
50M06SA	Potassium, SED	7440-09-7	SO	UG/KG	1380000		1380000			
50M06SB	Potassium, SED	7440-09-7	SO	UG/KG	1720000		1720000			
50M01SA	Sodium, SED	7440-23-5	SO	UG/KG	138000		138000	119050	216000	198562
50M01SB	Sodium, SED	7440-23-5	SO	UG/KG	216000		216000			
50M02SA	Sodium, SED	7440-23-5	SO	UG/KG	77000		77000			
50M02SB	Sodium, SED	7440-23-5	SO	UG/KG	155000		155000			
50M03SA	Sodium, SED	7440-23-5	SO	UG/KG	82500		82500			
50M03SB	Sodium, SED	7440-23-5	SO	UG/KG	128000		128000			
50M04SA	Sodium, SED	7440-23-5	SO	UG/KG	95000		95000			
50M04SB	Sodium, SED	7440-23-5	SO	UG/KG	108000		108000			
50M05SA	Sodium, SED	7440-23-5	SO	UG/KG	118000		118000			
50M05SB	Sodium, SED	7440-23-5	SO	UG/KG	73100		73100			
50M06SA	Sodium, SED	7440-23-5	SO	UG/KG	132000		132000			
50M06SB	Sodium, SED	7440-23-5	SO	UG/KG	106000		106000			
50M01SA	Toluene	108-88-3	SO	UG/KG	18000		18000	13174	150000	89156
50M01SB	Toluene	108-88-3	SO	UG/KG	150000		150000			
50M02SA	Toluene	108-88-3	SO	UG/KG	310		310			
50M02SB	Toluene	108-88-3	SO	UG/KG	160	U	80			
50M03SA	Toluene	108-88-3	SO	UG/KG	1500		1500			
50M03SB	Toluene	108-88-3	SO	UG/KG	160	U	80			
50M04SA	Toluene	108-88-3	SO	UG/KG	40000		40000			
50M04SB	Toluene	108-88-3	SO	UG/KG	160	U	80			
50M05SA	Toluene	108-88-3	SO	UG/KG	160	U	80			
50M05SB	Toluene	108-88-3	SO	UG/KG	160	U	80			
50M06SA	Toluene	108-88-3	SO	UG/KG	160	U	80			
50M06SB	Toluene	108-88-3	SO	UG/KG	160	U	80			
50M07SA	Toluene	108-88-3	SO	UG/KG	220	U	110			
50M08SA	Toluene	108-88-3	SO	UG/KG	220	U	110			
50M09SA	Toluene	108-88-3	SO	UG/KG	220	U	110			
50M10SA	Toluene	108-88-3	SO	UG/KG	180	U	90			
50M01SA	Total Xylenes	1330-20-7	SO	UG/KG	267000		267000	169873	1470000	939121
50M01SB	Total Xylenes	1330-20-7	SO	UG/KG	1470000		1470000			
50M02SA	Total Xylenes	1330-20-7	SO	UG/KG	200		200			
50M02SB	Total Xylenes	1330-20-7	SO	UG/KG	80	U	40			
50M03SA	Total Xylenes	1330-20-7	SO	UG/KG	34800		34800			
50M03SB	Total Xylenes	1330-20-7	SO	UG/KG	599000		599000			
50M04SA	Total Xylenes	1330-20-7	SO	UG/KG	293000		293000			
50M04SB	Total Xylenes	1330-20-7	SO	UG/KG	80	U	40			
50M05SA	Total Xylenes	1330-20-7	SO	UG/KG	80	U	40			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M05SB	Total Xylenes	1330-20-7	SO	UG/KG	51900		51900			
50M06SA	Total Xylenes	1330-20-7	SO	UG/KG	80	U	40			
50M06SB	Total Xylenes	1330-20-7	SO	UG/KG	80	U	40			
50M07SA	Total Xylenes	1330-20-7	SO	UG/KG	960	U	480			
50M08SA	Total Xylenes	1330-20-7	SO	UG/KG	1000	U	500			
50M09SA	Total Xylenes	1330-20-7	SO	UG/KG	960	U	480			
50M10SA	Total Xylenes	1330-20-7	SO	UG/KG	820	U	410			
50M01SA	TPH	TPH	SO	UG/KG	302000		302000	2818545	91800000	26579287
50M01SB	TPH	TPH	SO	UG/KG	91800000		91800000			
50M02SA	TPH	TPH	SO	UG/KG	22200		22200			
50M02SB	TPH	TPH	SO	UG/KG	10200	U	5100			
50M03SA	TPH	TPH	SO	UG/KG	289000		289000			
50M03SB	TPH	TPH	SO	UG/KG	6620000		6620000			
50M04SA	TPH	TPH	SO	UG/KG	10200	U	5100			
50M04SB	TPH	TPH	SO	UG/KG	10200	U	5100			
50M05SA	TPH	TPH	SO	UG/KG	1480000		1480000			
50M05SB	TPH	TPH	SO	UG/KG	521000		521000			
50M06SA	TPH	TPH	SO	UG/KG	126000		126000			
50M06SB	TPH	TPH	SO	UG/KG	24300		24300			
SS#50-01	TPH	TPH	SO	UG/KG	10000	U	5000			
SS#50-02	TPH	TPH	SO	UG/KG	10000	U	5000			
SS#50-03	TPH	TPH	SO	UG/KG	10000	U	5000			
SS#50-04	TPH	TPH	SO	UG/KG	10000	U	5000			
SS#50-05	TPH	TPH	SO	UG/KG	54000		54000			
SS#50-06	TPH	TPH	SO	UG/KG	10000	U	5000			
SS#50-07	TPH	TPH	SO	UG/KG	190000		190000			
SS#50-08	TPH	TPH	SO	UG/KG	1200000		1200000			
SS#50-09	TPH	TPH	SO	UG/KG	19000		19000			
SS#50-10	TPH	TPH	SO	UG/KG	10000	U	5000			
SS#50-11	TPH	TPH	SO	UG/KG	28000		28000			
SS#50-12	TPH	TPH	SO	UG/KG	10000	U	5000			
SS#50-13	TPH	TPH	SO	UG/KG	10000	U	5000			
SS#50-14	TPH	TPH	SO	UG/KG	250000		250000			
SS#50-15	TPH	TPH	SO	UG/KG	12000		12000			
SS#50-16	TPH	TPH	SO	UG/KG	95000		95000			
SS#50-17	TPH	TPH	SO	UG/KG	200000		200000			
SS#50-18	TPH	TPH	SO	UG/KG	95000		95000			
SS#50-19	TPH	TPH	SO	UG/KG	310000		310000			
SS#50-20	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#50-1A	TPH	TPH	SO	UG/KG	340000		340000			
SB#50-1B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#50-1C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#50-2A	TPH	TPH	SO	UG/KG	140000		140000			
SB#50-2B	TPH	TPH	SO	UG/KG	10000	U	5000			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	96% UCL(e)
SB#50-2C	TPH	TPH	SO	UG/KG	580000		580000			
SB#50-3A	TPH	TPH	SO	UG/KG	92000		92000			
SB#50-3B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#50-3C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#50-4A	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#50-4B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#50-4C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#50-5A	TPH	TPH	SO	UG/KG	220000		220000			
SB#50-5B	TPH	TPH	SO	UG/KG	1200000		1200000			
SB#50-5C	TPH	TPH	SO	UG/KG	9300000		9300000			
SB#50-6A	TPH	TPH	SO	UG/KG	2800000		2800000			
SB#50-6B	TPH	TPH	SO	UG/KG	49000000		49000000			
SB#50-6C	TPH	TPH	SO	UG/KG	28000000		28000000			
SB#50-7A	TPH	TPH	SO	UG/KG	430000		430000			
SB#50-7B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#50-7C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#50-8A	TPH	TPH	SO	UG/KG	1600000		1600000			
SB#50-8B	TPH	TPH	SO	UG/KG	56000		56000			
SB#50-8C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#50-9A	TPH	TPH	SO	UG/KG	940000		940000			
SB#50-9B	TPH	TPH	SO	UG/KG	250000		250000			
SB#50-9C	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#50-10A	TPH	TPH	SO	UG/KG	63000		63000			
SB#50-10B	TPH	TPH	SO	UG/KG	10000	U	5000			
SB#50-10C	TPH	TPH	SO	UG/KG	10000	U	5000			
50X01SA	TPH	TPH	SO	UG/KG	2100000		2100000			
50X02SA	TPH	TPH	SO	UG/KG	13700	U	6850			
50X03SA	TPH	TPH	SO	UG/KG	27200		27200			
50X04SA	TPH	TPH	SO	UG/KG	438000		438000			
50X05SA	TPH	TPH	SO	UG/KG	3350000		3350000			
50X06SA	TPH	TPH	SO	UG/KG	17000000		17000000			
50X07SA	TPH	TPH	SO	UG/KG	399000		399000			
50X08SA	TPH	TPH	SO	UG/KG	114000		114000			
50X09SA	TPH	TPH	SO	UG/KG	432000		432000			
50X10SA	TPH	TPH	SO	UG/KG	20400		20400			
50M07SA	TPH	TPH	SO	UG/KG	13700	U	6850			
50M08SA	TPH	TPH	SO	UG/KG	13700	U	6850			
50M09SA	TPH	TPH	SO	UG/KG	13700	U	6850			
50M10SA	TPH	TPH	SO	UG/KG	13700	U	6850			
50SS1S1	TPH	TPH	SO	UG/KG	2250000		2250000			
50SS2S1	TPH	TPH	SO	UG/KG	140000		140000			
50SS3S1	TPH	TPH	SO	UG/KG	570000		570000			
50SS4S1	TPH	TPH	SO	UG/KG	3070000		3070000			
50SS5S1	TPH	TPH	SO	UG/KG	1800000		1800000			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50SS6S1	TPH	TPH	SO	UG/KG	597000		597000			
50M01SA	Vanadium, SED	7440-62-2	SO	UG/KG	20100		20100	19624	29000	32166
50M01SB	Vanadium, SED	7440-62-2	SO	UG/KG	26600		26600			
50M02SA	Vanadium, SED	7440-62-2	SO	UG/KG	7990		7990			
50M02SB	Vanadium, SED	7440-62-2	SO	UG/KG	29000		29000			
50M03SA	Vanadium, SED	7440-62-2	SO	UG/KG	14900		14900			
50M03SB	Vanadium, SED	7440-62-2	SO	UG/KG	23100		23100			
50M04SA	Vanadium, SED	7440-62-2	SO	UG/KG	21300		21300			
50M04SB	Vanadium, SED	7440-62-2	SO	UG/KG	21600		21600			
50M05SA	Vanadium, SED	7440-62-2	SO	UG/KG	13300		13300			
50M05SB	Vanadium, SED	7440-62-2	SO	UG/KG	12000		12000			
50M06SA	Vanadium, SED	7440-62-2	SO	UG/KG	22100		22100			
50M06SB	Vanadium, SED	7440-62-2	SO	UG/KG	23500		23500			
50M01SA	Zinc, SED	7440-66-6	SO	UG/KG	108000		108000	89650	157000	161368
50M01SB	Zinc, SED	7440-66-6	SO	UG/KG	73000		73000			
50M02SA	Zinc, SED	7440-66-6	SO	UG/KG	38100		38100			
50M02SB	Zinc, SED	7440-66-6	SO	UG/KG	157000		157000			
50M03SA	Zinc, SED	7440-66-6	SO	UG/KG	59500		59500			
50M03SB	Zinc, SED	7440-66-6	SO	UG/KG	105000		105000			
50M04SA	Zinc, SED	7440-66-6	SO	UG/KG	103000		103000			
50M04SB	Zinc, SED	7440-66-6	SO	UG/KG	92900		92900			
50M05SA	Zinc, SED	7440-66-6	SO	UG/KG	59700		59700			
50M05SB	Zinc, SED	7440-66-6	SO	UG/KG	46100		46100			
50M06SA	Zinc, SED	7440-66-6	SO	UG/KG	97500		97500			
50M06SB	Zinc, SED	7440-66-6	SO	UG/KG	136000		136000			
50M01W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	0.28	U	0.14	1.69	12	7.82
50M02W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	0.28	U	0.14			
50M03W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	0.28	U	0.14			
50M04W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	0.28	U	0.14			
50M05W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	4.7	U	4.7			
50M06W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	0.28	U	0.14			
50M01W2	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
50M02W2	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
50M04W2	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
50M05W2R	2,4-Dimethylphenol	105-67-9	WD	UG/L	12	U	12			
50M06W2	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
50M07W2	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
50M08W1R	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
50M09W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
50M10W1	2,4-Dimethylphenol	105-67-9	WD	UG/L	2	U	1			
50M01W1	2-Methylnaphthalene	91-57-6	WD	UG/L	454	U	454	831.3	12000	7015.2
50M02W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.9	U	0.45			
50M03W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.9	U	0.45			
50M04W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.9	U	0.45			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M05W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.9	U	0.45			
50M06W1	2-Methylnaphthalene	91-57-6	WD	UG/L	0.9	U	0.45			
50M01W2	2-Methylnaphthalene	91-57-6	WD	UG/L	12000		12000			
50M02W2	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
50M04W2	2-Methylnaphthalene	91-57-6	WD	UG/L	1.3		1.3			
50M05W2R	2-Methylnaphthalene	91-57-6	WD	UG/L	9.4		9.4			
50M06W2	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
50M07W2	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
50M08W1R	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
50M09W1	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
50M10W1	2-Methylnaphthalene	91-57-6	WD	UG/L	1	U	0.5			
50M01W1	Aluminum, DISS	7429-90-5	WD	UG/L	30		30	29	40	NA
50M02W1	Aluminum, DISS	7429-90-5	WD	UG/L	40		40			
50M03W1	Aluminum, DISS	7429-90-5	WD	UG/L	30	U	15			
50M04W1	Aluminum, DISS	7429-90-5	WD	UG/L	30		30			
50M06W1	Aluminum, DISS	7429-90-5	WD	UG/L	30		30			
50M01W1	Aluminum, Total	7429-90-5	WD	UG/L	9900		9900	41896	90600	NA
50M02W1	Aluminum, Total	7429-90-5	WD	UG/L	72300		72300			
50M03W1	Aluminum, Total	7429-90-5	WD	UG/L	80		80			
50M04W1	Aluminum, Total	7429-90-5	WD	UG/L	36600		36600			
50M06W1	Aluminum, Total	7429-90-5	WD	UG/L	90600		90600			
50M01W1	Arsenic, Total	7440-38-2	WD	UG/L	40	U	20	42	100	NA
50M02W1	Arsenic, Total	7440-38-2	WD	UG/L	40	U	20			
50M03W1	Arsenic, Total	7440-38-2	WD	UG/L	40	U	20			
50M04W1	Arsenic, Total	7440-38-2	WD	UG/L	50		50			
50M06W1	Arsenic, Total	7440-38-2	WD	UG/L	100		100			
50M01W1	Barium, DISS	7440-39-3	WD	UG/L	100		100	260	700	NA
50M02W1	Barium, DISS	7440-39-3	WD	UG/L	100		100			
50M03W1	Barium, DISS	7440-39-3	WD	UG/L	100		100			
50M04W1	Barium, DISS	7440-39-3	WD	UG/L	700		700			
50M06W1	Barium, DISS	7440-39-3	WD	UG/L	300		300			
50M01W1	Barium, Total	7440-39-3	WD	UG/L	310		310	1332	4180	NA
50M02W1	Barium, Total	7440-39-3	WD	UG/L	1220		1220			
50M03W1	Barium, Total	7440-39-3	WD	UG/L	50		50			
50M04W1	Barium, Total	7440-39-3	WD	UG/L	900		900			
50M06W1	Barium, Total	7440-39-3	WD	UG/L	4180		4180			
50M01W1	Benzene	71-43-2	WD	UG/L	65.2		65.2	37.60	335	214.02
50M02W1	Benzene	71-43-2	WD	UG/L	0.15	U	0.075			
50M03W1	Benzene	71-43-2	WD	UG/L	0.15	UF	0.15			
50M04W1	Benzene	71-43-2	WD	UG/L	0.15	U	0.075			
50M05W1	Benzene	71-43-2	WD	UG/L	44.3		44.3			
50M06W1	Benzene	71-43-2	WD	UG/L	3		3			
50M01W2	Benzene	71-43-2	WD	UG/L	335		335			
50M02W2	Benzene	71-43-2	WD	UG/L	0.2	U	0.1			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M04W2	Benzene	71-43-2	WD	UG/L	0.2	U	0.1			
50M05W2	Benzene	71-43-2	WD	UG/L	108		108			
50M06W2	Benzene	71-43-2	WD	UG/L	3.84		3.84			
50M07W2	Benzene	71-43-2	WD	UG/L	3.8		3.8			
50M08W1	Benzene	71-43-2	WD	UG/L	0.2	U	0.1			
50M09W1	Benzene	71-43-2	WD	UG/L	0.2	U	0.1			
50M10W1	Benzene	71-43-2	WD	UG/L	0.2	U	0.1			
50M01W2	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1	1.3	4.1	3.4
50M02W2	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	µg/L	4.1		4.1			
50M04W2	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
50M05W2R	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	µg/L	2	U	1			
50M06W2	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
50M07W2	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	µg/L	2	U	1			
50M08W1R	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
50M09W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	µg/L	2	U	1			
50M10W1	BIS (2-Ethylhexyl)phthalate	117-81-7	WD	UG/L	2	U	1			
50M01W1	Butylbenzylphthalate	85-68-7	WD	µg/L	1.5	U	0.75	1.9	12	7.9
50M02W1	Butylbenzylphthalate	85-68-7	WD	UG/L	3.7		3.7			
50M03W1	Butylbenzylphthalate	85-68-7	WD	µg/L	1.5	U	0.75			
50M04W1	Butylbenzylphthalate	85-68-7	WD	UG/L	4		4			
50M05W1	Butylbenzylphthalate	85-68-7	WD	µg/L	12		12			
50M06W1	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
50M01W2	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
50M02W2	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
50M04W2	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
50M05W2R	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
50M06W2	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
50M07W2	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
50M08W1R	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
50M09W1	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
50M10W1	Butylbenzylphthalate	85-68-7	WD	UG/L	1.5	U	0.75			
50M01W1	Cadmium, Total	7440-43-9	WD	UG/L	3	U	1.5	9	20	NA
50M02W1	Cadmium, Total	7440-43-9	WD	UG/L	10		10			
50M03W1	Cadmium, Total	7440-43-9	WD	UG/L	3	U	1.5			
50M04W1	Cadmium, Total	7440-43-9	WD	UG/L	10		10			
50M05W1	Cadmium, Total	7440-43-9	WD	UG/L	20		20			
50M01W1	Calcium, DISS	7440-70-2	WD	UG/L	5230		5230	45726	59700	NA
50M02W1	Calcium, DISS	7440-70-2	WD	UG/L	59700		59700			
50M03W1	Calcium, DISS	7440-70-2	WD	UG/L	53600		53600			
50M04W1	Calcium, DISS	7440-70-2	WD	UG/L	52300		52300			
50M06W1	Calcium, DISS	7440-70-2	WD	UG/L	57800		57800			
50M01W1	Calcium, Total	7440-70-2	WD	UG/L	54900		54900	65740	84200	NA
50M02W1	Calcium, Total	7440-70-2	WD	UG/L	79200		79200			
50M03W1	Calcium, Total	7440-70-2	WD	UG/L	51100		51100			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M04W1	Calcium, Total	7440-70-2	WD	UG/L	59300		59300			
50M06W1	Calcium, Total	7440-70-2	WD	UG/L	84200		84200			
50M01W1	Chloride	CHLORIDE	WD	UG/L	1372		1372	1738	5877	NA
50M02W1	Chloride	CHLORIDE	WD	UG/L	482		482			
50M03W1	Chloride	CHLORIDE	WD	UG/L	511		511			
50M04W1	Chloride	CHLORIDE	WD	UG/L	448		448			
50M06W1	Chloride	CHLORIDE	WD	UG/L	5877		5877			
50M01W1	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17	6.03	85	49.74
50M02W1	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
50M03W1	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
50M04W1	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
50M05W1	Chlorobenzene	108-90-7	WD	UG/L	1.73		1.73			
50M06W1	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
50M01W2	Chlorobenzene	108-90-7	WD	UG/L	170	U	85			
50M02W2	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
50M04W2	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
50M05W2	Chlorobenzene	108-90-7	WD	UG/L	3.4	U	1.7			
50M06W2	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
50M07W2	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
50M08W1	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
50M09W1	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
50M10W1	Chlorobenzene	108-90-7	WD	UG/L	0.34	U	0.17			
50M01W2	Chloroform	67-66-3	WD	UG/L	0.2	U	0.1	0.22	1.01	0.82
50M02W2	Chloroform	67-66-3	WD	UG/L	0.2	U	0.1			
50M04W2	Chloroform	67-66-3	WD	UG/L	0.2	U	0.1			
50M05W2	Chloroform	67-66-3	WD	UG/L	0.2	U	0.1			
50M06W2	Chloroform	67-66-3	WD	UG/L	0.2	UF	0.2			
50M07W2	Chloroform	67-66-3	WD	UG/L	0.2	UF	0.2			
50M08W1	Chloroform	67-66-3	WD	UG/L	1.01		1.01			
50M09W1	Chloroform	67-66-3	WD	UG/L	0.2	U	0.1			
50M10W1	Chloroform	67-66-3	WD	UG/L	0.2	U	0.1			
50M01W1	Chloromethane	74-87-3	WD	UG/L	0.4	U	0.2	7.01	100	58.46
50M02W1	Chloromethane	74-87-3	WD	UG/L	0.4	UF	0.4			
50M03W1	Chloromethane	74-87-3	WD	UG/L	1.32		1.32			
50M04W1	Chloromethane	74-87-3	WD	UG/L	0.72		0.72			
50M05W1	Chloromethane	74-87-3	WD	UG/L	0.08		0.08			
50M06W1	Chloromethane	74-87-3	WD	UG/L	0.56		0.56			
50M01W2	Chloromethane	74-87-3	WD	UG/L	200	U	100			
50M02W2	Chloromethane	74-87-3	WD	UG/L	0.4	U	0.2			
50M04W2	Chloromethane	74-87-3	WD	UG/L	0.4	U	0.2			
50M05W2R	Chloromethane	74-87-3	WD	UG/L	0.4	UF	0.4			
50M06W2	Chloromethane	74-87-3	WD	UG/L	0.4	U	0.2			
50M07W2	Chloromethane	74-87-3	WD	UG/L	0.4	U	0.2			
50M08W1	Chloromethane	74-87-3	WD	UG/L	0.4	U	0.2			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M09W1	Chloromethane	74-87-3	WD	UG/L	0.4	U	0.2			
50M10W1	Chloromethane	74-87-3	WD	UG/L	0.4	U	0.2			
50M01W1	Chromium, Total	7440-47-3	WD	UG/L	150		150	243	820	NA
50M02W1	Chromium, Total	7440-47-3	WD	UG/L	10	U	5			
50M03W1	Chromium, Total	7440-47-3	WD	UG/L	820		820			
50M04W1	Chromium, Total	7440-47-3	WD	UG/L	220		220			
50M05W1	Chromium, Total	7440-47-3	WD	UG/L	20		20	63	150	NA
50M06W1	Cobalt, Total	7440-48-4	WD	UG/L	90		90			
50M07W1	Cobalt, Total	7440-48-4	WD	UG/L	10	U	5			
50M08W1	Cobalt, Total	7440-48-4	WD	UG/L	50		50			
50M09W1	Cobalt, Total	7440-48-4	WD	UG/L	150		150			
50M01W1	Copper, DISS	7440-50-8	WD	UG/L	3	U	1.5	2	4	NA
50M02W1	Copper, DISS	7440-50-8	WD	UG/L	3	U	1.5			
50M03W1	Copper, DISS	7440-50-8	WD	UG/L	4		4			
50M04W1	Copper, DISS	7440-50-8	WD	UG/L	3	U	1.5			
50M05W1	Copper, DISS	7440-50-8	WD	UG/L	3	U	1.5			
50M06W1	Copper, DISS	7440-50-8	WD	UG/L	3	U	1.5			
50M07W1	Copper, Total	7440-50-8	WD	UG/L	53.3		53.3	218.4	511	NA
50M08W1	Copper, Total	7440-50-8	WD	UG/L	342		342			
50M09W1	Copper, Total	7440-50-8	WD	UG/L	6.5		6.5			
50M01W1	Copper, Total	7440-50-8	WD	UG/L	179		179			
50M02W1	Copper, Total	7440-50-8	WD	UG/L	511		511			
50M03W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5	0.9	6.6	4.1
50M04W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M05W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M06W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M07W1	Diethylphthalate	84-66-2	WD	UG/L	6.6		6.6			
50M08W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M09W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M01W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M02W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M03W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M04W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M05W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M06W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M07W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M08W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M09W1	Diethylphthalate	84-66-2	WD	UG/L	1	U	0.5			
50M01W1	Ethylbenzene	100-41-4	WD	UG/L	332		332	201.6	2210	1338.0
50M02W1	Ethylbenzene	100-41-4	WD	UG/L	0.46	U	0.23			
50M03W1	Ethylbenzene	100-41-4	WD	UG/L	0.46	U	0.23			
50M04W1	Ethylbenzene	100-41-4	WD	UG/L	0.46	U	0.23			
50M05W1	Ethylbenzene	100-41-4	WD	UG/L	136		136			
50M06W1	Ethylbenzene	100-41-4	WD	UG/L	0.46	U	0.23			
50M07W1	Ethylbenzene	100-41-4	WD	UG/L	2210		2210			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M02W2	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
50M04W2	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
50M05W2	Ethylbenzene	100-41-4	WD	UG/L	342		342			
50M06W2	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
50M07W2	Ethylbenzene	100-41-4	WD	UG/L	0.99		0.99			
50M08W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
50M09W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
50M10W1	Ethylbenzene	100-41-4	WD	UG/L	0.5	U	0.25			
50M01W1	Iron, DISS	7439-89-6	WD	UG/L	1000		1000	254	1000	NA
50M02W1	Iron, DISS	7439-89-6	WD	UG/L	100		100			
50M03W1	Iron, DISS	7439-89-6	WD	UG/L	60		60			
50M04W1	Iron, DISS	7439-89-6	WD	UG/L	50		50			
50M06W1	Iron, DISS	7439-89-6	WD	UG/L	60		60			
50M01W1	Iron, Total	7439-89-6	WD	UG/L	24600		24600	123966	309000	NA
50M02W1	Iron, Total	7439-89-6	WD	UG/L	184000		184000			
50M03W1	Iron, Total	7439-89-6	WD	UG/L	230		230			
50M04W1	Iron, Total	7439-89-6	WD	UG/L	102000		102000			
50M06W1	Iron, Total	7439-89-6	WD	UG/L	309000		309000			
50M01W1	Lead, DISS	7439-92-1	WD	UG/L	1.4	U	0.7	1.5	2	NA
50M02W1	Lead, DISS	7439-92-1	WD	UG/L	1.4	U	0.7			
50M03W1	Lead, DISS	7439-92-1	WD	UG/L	2		2			
50M04W1	Lead, DISS	7439-92-1	WD	UG/L	2		2			
50M06W1	Lead, DISS	7439-92-1	WD	UG/L	2		2			
50M01W1	Lead, Total	7439-92-1	WD	UG/L	60		60	151	400	417
50M02W1	Lead, Total	7439-92-1	WD	UG/L	300		300			
50M03W1	Lead, Total	7439-92-1	WD	UG/L	30	U	15			
50M04W1	Lead, Total	7439-92-1	WD	UG/L	100		100			
50M06W1	Lead, Total	7439-92-1	WD	UG/L	400		400			
50M01W1	Lead, Total	7439-92-1	WD	UG/L	50.4		50.4			
50M02W1	Lead, Total	7439-92-1	WD	UG/L	218		218			
50M03W1	Lead, Total	7439-92-1	WD	UG/L	1.4	U	0.7			
50M04W1	Lead, Total	7439-92-1	WD	UG/L	127		127			
50M06W1	Lead, Total	7439-92-1	WD	UG/L	240		240			
50M01W1	Magnesium, DISS	7439-95-4	WD	UG/L	8390		8390	8880	9350	NA
50M02W1	Magnesium, DISS	7439-95-4	WD	UG/L	9350		9350			
50M03W1	Magnesium, DISS	7439-95-4	WD	UG/L	8820		8820			
50M04W1	Magnesium, DISS	7439-95-4	WD	UG/L	8600		8600			
50M06W1	Magnesium, DISS	7439-95-4	WD	UG/L	9240		9240			
50M01W1	Magnesium, Total	7439-95-4	WD	UG/L	11800		11800	28176	51900	NA
50M02W1	Magnesium, Total	7439-95-4	WD	UG/L	43600		43600			
50M03W1	Magnesium, Total	7439-95-4	WD	UG/L	8580		8580			
50M04W1	Magnesium, Total	7439-95-4	WD	UG/L	25000		25000			
50M06W1	Magnesium, Total	7439-95-4	WD	UG/L	51900		51900			
50M01W1	Manganese, DISS	7439-96-5	WD	UG/L	1800		1800	1696	5000	NA

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DLJ2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M02W1	Manganese, UISS	7439-96-5	WD	UG/L	400		400			
50M03W1	Manganese, DISS	7439-96-5	WD	UG/L	80		80			
50M04W1	Manganese, DISS	7439-96-5	WD	UG/L	1200		1200			
50M06W1	Manganese, DISS	7439-96-5	WD	UG/L	5000		5000			
50M01W1	Manganese, Total	7439-96-5	WD	UG/L	2210		2210	8501.5	34600	NA
50M02W1	Manganese, Total	7439-96-5	WD	UG/L	2820		2820			
50M03W1	Manganese, Total	7439-96-5	WD	UG/L	77.6		77.6			
50M04W1	Manganese, Total	7439-96-5	WD	UG/L	2800		2800			
50M06W1	Manganese, Total	7439-96-5	WD	UG/L	34600		34600			
50M01W1	Molybdenum, Total	7439-98-7	WD	UG/L	10	U	5	17.3	51.8	NA
50M02W1	Molybdenum, Total	7439-98-7	WD	UG/L	19.8		19.8			
50M03W1	Molybdenum, Total	7439-98-7	WD	UG/L	10	U	5			
50M04W1	Molybdenum, Total	7439-98-7	WD	UG/L	10	U	5			
50M06W1	Molybdenum, Total	7439-98-7	WD	UG/L	51.8		51.8			
50M01W1	Naphthalene	91-20-3	WD	UG/L	540		540	418.41	5700	3353.74
50M02W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
50M03W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
50M04W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
50M05W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
50M06W1	Naphthalene	91-20-3	WD	UG/L	0.26	U	0.13			
50M01W2	Naphthalene	91-20-3	WD	UG/L	5700		5700			
50M02W2	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
50M04W2	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
50M05W2R	Naphthalene	91-20-3	WD	UG/L	32		32			
50M06W2	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
50M07W2	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
50M08W1R	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
50M09W1	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
50M10W1	Naphthalene	91-20-3	WD	UG/L	1	U	0.5			
50M01W1	Nickel, Total	7440-02-0	WD	UG/L	36.1		36.1	104.1	344	NA
50M02W1	Nickel, Total	7440-02-0	WD	UG/L	21.3		21.3			
50M03W1	Nickel, Total	7440-02-0	WD	UG/L	20	U	10			
50M04W1	Nickel, Total	7440-02-0	WD	UG/L	109		109			
50M06W1	Nickel, Total	7440-02-0	WD	UG/L	344		344			
50M01W1	Nitrogen, NO2+NO3	7727-37-9	WD	UG/L	10	U	5	24	102	NA
50M02W1	Nitrogen, NO2+NO3	7727-37-9	WD	UG/L	102		102			
50M03W1	Nitrogen, NO2+NO3	7727-37-9	WD	UG/L	10	U	5			
50M04W1	Nitrogen, NO2+NO3	7727-37-9	WD	UG/L	10	U	5			
50M06W1	Nitrogen, NO2+NO3	7727-37-9	WD	UG/L	10	U	5			
50M01W1	Phenol	108-95-2	WD	UG/L	1	U	0.5	1.2	6.8	4.3
50M02W1	Phenol	108-95-2	WD	UG/L	1	U	0.5			
50M03W1	Phenol	108-95-2	WD	UG/L	1	U	0.5			
50M04W1	Phenol	108-95-2	WD	UG/L	1	U	0.5			
50M06W1	Phenol	108-95-2	WD	UG/L	1	U	0.5			
50M05W1	Phenol	108-95-2	WD	UG/L	6.8		6.8			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M06W1	Phenol	108-95-2	WD	UG/L	1	U	0.5			
50M01W2	Phenol	108-95-2	WD	UG/L	2	U	1			
50M02W2	Phenol	108-95-2	WD	UG/L	2	U	1			
50M04W2	Phenol	108-95-2	WD	UG/L	2	U	1			
50M05W2R	Phenol	108-95-2	WD	UG/L	2	U	1			
50M06W2	Phenol	108-95-2	WD	UG/L	2	U	1			
50M07W2	Phenol	108-95-2	WD	UG/L	2	U	1			
50M08W1R	Phenol	108-95-2	WD	UG/L	2	U	1			
50M09W1	Phenol	108-95-2	WD	UG/L	2	U	1			
50M10W1	Phenol	108-95-2	WD	UG/L	2	U	1			
50M01W1	Potassium, DISS	7440-09-7	WD	UG/L	1100		1100	1494	2000	NA
50M02W1	Potassium, DISS	7440-09-7	WD	UG/L	1460		1460			
50M03W1	Potassium, DISS	7440-09-7	WD	UG/L	1420		1420			
50M04W1	Potassium, DISS	7440-09-7	WD	UG/L	1490		1490			
50M06W1	Potassium, DISS	7440-09-7	WD	UG/L	2000		2000			
50M01W1	Potassium, Total	7440-09-7	WD	UG/L	3610		3610	7446	13000	NA
50M02W1	Potassium, Total	7440-09-7	WD	UG/L	11900		11900			
50M03W1	Potassium, Total	7440-09-7	WD	UG/L	1420		1420			
50M04W1	Potassium, Total	7440-09-7	WD	UG/L	7300		7300			
50M06W1	Potassium, Total	7440-09-7	WD	UG/L	13000		13000			
50M01W1	Sodium, DISS	7440-23-5	WD	UG/L	2240		2240	3522	7470	7392
50M02W1	Sodium, DISS	7440-23-5	WD	UG/L	2490		2490			
50M03W1	Sodium, DISS	7440-23-5	WD	UG/L	2620		2620			
50M04W1	Sodium, DISS	7440-23-5	WD	UG/L	2300		2300			
50M06W1	Sodium, DISS	7440-23-5	WD	UG/L	6690		6690			
50M01W1	Sodium, DISS	7440-23-5	WD	UG/L	2400		2400			
50M02W1	Sodium, DISS	7440-23-5	WD	UG/L	3750		3750			
50M03W1	Sodium, DISS	7440-23-5	WD	UG/L	2350		2350			
50M04W1	Sodium, DISS	7440-23-5	WD	UG/L	2910		2910			
50M06W1	Sodium, DISS	7440-23-5	WD	UG/L	7470		7470			
50M01W1	Sulfate	SULFATE	WD	UG/L	32130		32130	39628	64060	NA
50M02W1	Sulfate	SULFATE	WD	UG/L	64060		64060			
50M03W1	Sulfate	SULFATE	WD	UG/L	34960		34960			
50M04W1	Sulfate	SULFATE	WD	UG/L	34330		34330			
50M06W1	Sulfate	SULFATE	WD	UG/L	32660		32660			
50M01W1	Toluene	108-88-3	WD	UG/L	261		261	397.31	2080	1246.00
50M02W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
50M03W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
50M04W1	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
50M06W1	Toluene	108-88-3	WD	UG/L	52.5		52.5			
FW#50-01	Toluene	108-88-3	WD	UG/L	0.25	U	0.125			
FW#50-02	Toluene	108-88-3	WD	UG/L	1000		1000			
FW#50-03	Toluene	108-88-3	WD	UG/L	1000	U	500			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
FW#50-04	Toluene	108-88-3	WD	UG/L	1000		1000			
FW#50-05	Toluene	108-88-3	WD	UG/L	1000	U	1000			
FW#50-06	Toluene	108-88-3	WD	UG/L	1000		1000			
FW#50-07	Toluene	108-88-3	WD	UG/L	1000	U	500			
FW#50-08	Toluene	108-88-3	WD	UG/L	1000	U	500			
FW#50-09	Toluene	108-88-3	WD	UG/L	1000	U	500			
FW#50-10	Toluene	108-88-3	WD	UG/L	1000	U	500			
FW#50-11	Toluene	108-88-3	WD	UG/L	1000	U	500			
FW#50-12	Toluene	108-88-3	WD	UG/L	1000	U	500			
FW#50-13	Toluene	108-88-3	WD	UG/L	1000	U	500			
FW#50-14	Toluene	108-88-3	WD	UG/L	1000	U	500			
FW#50-15	Toluene	108-88-3	WD	UG/L	1000	U	500			
FW#50-16	Toluene	108-88-3	WD	UG/L	1000	U	500			
FW#50-17	Toluene	108-88-3	WD	UG/L	1000	U	500			
FW#50-18	Toluene	108-88-3	WD	UG/L	1000	U	500			
FW#50-19	Toluene	108-88-3	WD	UG/L	1000	U	500			
FW#50-20	Toluene	108-88-3	WD	UG/L	1000	U	500			
50M01W2	Toluene	108-88-3	WD	UG/L	2080		2080			
50M02W2	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
50M04W2	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
50M05W2	Toluene	108-88-3	WD	UG/L	8.37		8.37			
50M06W2	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
50M07W2	Toluene	108-88-3	WD	UG/L	2.69		2.69			
50M08W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
50M09W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
50M10W1	Toluene	108-88-3	WD	UG/L	0.3	U	0.15			
50M01W1	Total Xylenes	1330-20-7	WD	UG/L	1860		1860	636.15	6940	4258.75
50M02W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
50M03W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
50M04W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
50M05W1	Total Xylenes	1330-20-7	WD	UG/L	602		602			
50M06W1	Total Xylenes	1330-20-7	WD	UG/L	0.85	U	0.425			
50M01W2	Total Xylenes	1330-20-7	WD	UG/L	6940		6940			
50M02W2	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
50M04W2	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
50M05W2	Total Xylenes	1330-20-7	WD	UG/L	126		126			
50M06W2	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
50M07W2	Total Xylenes	1330-20-7	WD	UG/L	11.3		11.3			
50M08W1	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
50M09W1	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
50M10W1	Total Xylenes	1330-20-7	WD	UG/L	0.4	U	0.2			
50M01W1	TPH	TPH	WD	UG/L	119000		119000	140017	1980000	1159889
50M02W1	TPH	TPH	WD	UG/L	100	U	50			
50M03W1	TPH	TPH	WD	UG/L	100	U	50			

TABLE D.12. Chemical Analytical Results for Source Area 50-54
(Analytes Detected at Least Once)

Sample Number	Analytes Measured	CAS Number	Matrix Code(a)	Units	Reported Result(b)	EPA Data Qualifier(c)	DL/2 Value(d)	Average Value	Max. Value Detected	95% UCL(e)
50M04W1	TPH	TPH	WD	UG/L	100	U	50			
50M05W1	TPH	TPH	WD	UG/L	100	U	50			
50M06W1	TPH	TPH	WD	UG/L	100	U	50			
50M01W2	TPH	TPH	WD	UG/L	1980000		1980000			
50M02W2	TPH	TPH	WD	UG/L	200	U	100			
50M04W2	TPH	TPH	WD	UG/L	200	U	100			
50M05W2	TPH	TPH	WD	UG/L	300		300			
50M06W2	TPH	TPH	WD	UG/L	200	U	100			
50M07W2	TPH	TPH	WD	UG/L	200	U	100			
50M08W1	TPH	TPH	WD	UG/L	200	U	100			
50M09W1	TPH	TPH	WD	UG/L	200	U	100			
50M10W1	TPH	TPH	WD	UG/L	200	U	100			
50M01W1	Vanadium, Total	7440-62-2	WD	UG/L	25.6	U	25.6	111.9		254 NA
50M02W1	Vanadium, Total	7440-62-2	WD	UG/L	177		177			
50M03W1	Vanadium, Total	7440-62-2	WD	UG/L	10	U	5			
50M04W1	Vanadium, Total	7440-62-2	WD	UG/L	97.9		97.9			
50M06W1	Vanadium, Total	7440-62-2	WD	UG/L	254		254			
50M01W1	Zinc, DISS	7440-66-6	WD	UG/L	30		30	34		60 NA
50M02W1	Zinc, DISS	7440-66-6	WD	UG/L	30		30			
50M03W1	Zinc, DISS	7440-66-6	WD	UG/L	60		60			
50M04W1	Zinc, DISS	7440-66-6	WD	UG/L	2	U	1			
50M06W1	Zinc, DISS	7440-66-6	WD	UG/L	50		50			
50M01W1	Zinc, Total	7440-66-6	WD	UG/L	114		114	549.7		1180 NA
50M02W1	Zinc, Total	7440-66-6	WD	UG/L	946		946			
50M03W1	Zinc, Total	7440-66-6	WD	UG/L	46.4		46.4			
50M04W1	Zinc, Total	7440-66-6	WD	UG/L	462		462			
50M06W1	Zinc, Total	7440-66-6	WD	UG/L	1180		1180			
(a) Definitions: AG (soil gas), SO (soil), WD and WG (groundwater).										
(b) "Reported Result" is the concentration as reported in Eielson Air Force Base database.										
(c) U and UF represent nondetected analytes at the detection limit listed in "Reported Result" column.										
(d) "DL/2 Value" lists the reported concentration of detected analytes or one-half of the detection limit for nondetected analytes.										
(e) "UCL" represents Upper Confidence Limit.										
(f) Space preserved for QA. Parameter not used in assessment.										

APPENDIX E

DETERMINATION OF BACKGROUND METAL CONCENTRATIONS
AND LABORATORY CONTAMINANTS

APPENDIX E

DETERMINATION OF BACKGROUND METAL CONCENTRATIONS AND LABORATORY CONTAMINANTS

Some metals and other inorganics detected at OU-1 were eliminated from further consideration in the baseline risk assessment. However this screening decision was made on the basis of a comparison first to risk-based concentrations and secondly on the basis of comparison of the detected concentration to site background, either natural background or anthropomorphic background.

In addition, in this risk assessment, no background concentration component was subtracted from the reported analyte concentrations.

E.1 BACKGROUND DATA

Metals occur naturally in groundwater and soil. Therefore assuming that metals are all related to past site-related industrial activities has the effect of biasing the site-attributable risk toward higher values. On the other hand, from a public health perspective, the assumption is reasonable. A person's total exposure and dose to a toxicant, rather than the toxicant's origin, is the important human risk parameter.

The published literature indicates that the Fairbanks area of Alaska generally has elevated concentrations of metals, in particular high levels of iron and manganese in the groundwater (Cederstrom 1963), and high levels of arsenic in groundwater (Nelson 1978; Krumhart 1982; Weddleton et al. 1989). The data presented in the Remedial Investigation/Feasibility Study Operable Unit 1 Management Plan (U.S. Air Force, 1993a, Table A.5)) support these conclusions. The Management Plan statistically analyzes and summarizes local Eielson AFB background metal concentrations of constituents in groundwater in lowland wells and a single upland well (Well 38M03). Groundwater concentration values are reported for anions, water quality parameters, TPH, and 20 metals. The background groundwater concentrations reported for Eielson indicate elevated concentrations of arsenic, barium, magnesium, manganese, iron, calcium, and sulfate. Local background information is also presented in U.S. Air Force 1993c and d.

Several of the metals analyzed in the background wells were not detected

at the detection limit. In some instances the detection limit concentration exceeds the chemical-specific risk-based screening concentrations (Table 8.13).

There are no background groundwater data reported for three important toxic metals: mercury, selenium, and thallium. In addition, the valence state of the chromium detected is not reported.

E.2 BACKGROUND CONCENTRATIONS OF METALS AND INORGANICS IN GROUNDWATER

The concentrations of metals and inorganics, which are natural to the Eielson AFB area, are presented in Background-Water Quality, Eielson Air Force Base, Alaska (U.S. Air Force 1993d). Table 5 of this work presents the mean concentration, standard deviation and 95% upper confidence limit for the analytes measured. In this risk assessment, the 95% Upper Confidence Limit (UCL) for each analyte was compared to the average concentration value, for the same measured analyte. The comparison was repeated for each source area. If the average concentration value was below the 95% UCL then the analyte was considered to be naturally occurring and was eliminated from further risk quantification. If the average concentration value was above the 95% UCL then the presence of the analyte was assumed to be due to site related activities, and the analyte was retained for further risk quantification.

The metal mercury was found at source area (ST20 E-7 and ST48) but, no information was available regarding its naturally occurring background concentration. Therefore mercury was retained for further risk quantification.

Published regional data suggest that reported arsenic concentrations at Eielson AFB may be attributable to natural background. Weber (1986) report arsenic levels (>50 mg/L) north of Fairbanks where water wells tap fractured reservoirs in mineralized bedrock. However, fluvial sands and gravels, not mineralized crystalline rocks, form the aquifer at Eielson. Weber (1986) notes that arsenic groundwater concentrations are higher along valley bottoms and ascribes this enrichment to concentration by fluvial processes (i.e., placer deposits).

Dissolved arsenic has little solubility control; it can not precipitate and its aqueous concentration is controlled solely by sorption (Crecelius et al. 1986). Arsenic preferentially adsorbs onto iron-rich amorphous oxides, and it has been shown elsewhere that when iron was removed from soils, arsenic sorption was eliminated or reduced appreciably (Jacobs et al. 1970). Elevated soluble arsenic concentrations may be attributable to local redox conditions.

Arsenic contamination is typically associated with wood treatment, fungicides, herbicides, and pesticides.

E.3 BACKGROUND CONCENTRATIONS OF METALS AND INORGANICS IN SURFACE SOILS

The concentrations of metals and inorganics that are naturally in surface soils of Eielson AFB are presented in Background Soil Quality, Eielson Air Force Base, Alaska (U.S. Air Force 1993c). Table 1 of that work presents the Mean, Standard Deviation and 95% Upper Confidence Limit (UCL) for nine metals common to the local surface soils. In this risk assessment, the 95% UCL (for fluvial soils) for each analyte, was compared to the average concentration value, for the same measured analyte. The comparison was repeated for each source area. If this average concentration value was below the 95% UCL, then the analyte was concluded to be naturally occurring and was eliminated from further risk quantification. If the average concentration value was above the 95% UCL then the presence of the analyte was assumed to be due to site-related activities, and the analyte was retained for further risk quantification.

E.4 LABORATORY AND SAMPLING CONTAMINANTS

Bis(2-Ethylhexyl)phthalate, methylene chloride, and butylbenzylphthalate were determined to be laboratory or sampling contaminants and were eliminated from further risk quantification. This is, the reported concentrations of these chemicals are believed not to represent actual environmental concentrations, but rather to represent the concentration of the chemicals added to the sample by the sampling equipment or by laboratory equipment.

The three chemicals are common laboratory contaminants. Their occurrence in the 1989-1991 data used for this risk assessment was not confirmed by the 1993 sampling and analyses program (U.S. Air Force 1993e) which sampled the same sites and media as in 1989 and 1991.

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APPENDIX F

DEMOGRAPHIC INFORMATION

APPENDIX F

DEMOGRAPHIC INFORMATION

Eielson Air Force Base (AFB) covers an area of approximately 19,270 acres, located approximately 25 miles southeast of Fairbanks, Alaska. Military operations have existed at the site almost continuously since 1944. However, a major construction program between 1947 and 1954 greatly expanded operations. The Base is contiguous to Fort Wainwright, an Army Facility larger than Eielson AFB.

The mission of Eielson AFB is to train and equip personnel for close air support of ground troops in an arctic environment. Eielson AFB operations include industrial areas, aircraft maintenance and operations, an active runway and associated facilities, and administrative offices, as well as residential and recreational facilities.

Eielson AFB is a major employer in the Fairbanks area. The Base employs approximately 3,400 military personnel and 500 civilians. The total population living and working on the Base is approximately 10,000. The total residential population of Eielson AFB in April 1992 was estimated to be 5,132 (U.S. Air Force 1993).

Demographic information is available on an annual basis from the Economic Resource Impact Statement prepared for Eielson AFB. Long-range demographic and housing/zoning information however, is not compiled as a planning activity. Generally, residential stays by staff at Eielson AFB are for short periods of time when compared with the typical duration of civilian residence. Military personnel are normally assigned to work at Eielson for 6 years or less.

Active ongoing Base functions include work, school, and recreational activities. The Base contains two elementary schools, one middle school, and one junior-senior high school. The Base also has a child-care center, a medical clinic, and a dental clinic.

The Base boundary is fenced and guarded. However, most of the Operable Unit 1 source areas are unfenced or partially fenced, and are accessible to onsite personnel.

Several areas of the Base are used for recreation, hunting, fishing, picnicking, and camping by onsite personnel and families. The Operable Unit 1 source areas are located within the industrial areas of the Base, and none are used for recreation.

Long-range land-use plans (U.S. Air Force 1992) indicate that all Operable Units will remain industrial sites for the foreseeable future.

Currently, the potentially exposed population at the Operable Unit 1 source areas is composed of on-duty military personnel, civilian employees of the U.S. Air Force, and seasonal contractor personnel. There are a limited number of personnel based at all Operable Unit 1 source areas.

REFERENCES

U.S. Air Force. 1993. Baseline Risk Assessment for Operable Unit 2 Eielson Air Force Base, Alaska. U.S. Air Force Environmental Restoration Program, 343rd Wing. Draft (April 1993).

APPENDIX G

CHEMICAL FATE AND TRANSPORT PARAMETERS

APPENDIX G

CHEMICAL FATE AND TRANSPORT PARAMETERS

Table G.1 presents the chemical parameters used in this risk assessment to estimate fate and transport. The parameters include molecular weight, Henry's Law constant, carbon-matter partition coefficient (K_{oc}), octanol-water partition coefficient (K_{ow}), and molecular diffusivity. All but the last set of values were taken from the Multimedia Environmental Pollutant Assessment System (MEPAS) database compiled by Streng and Peterson (1989). References for each parameter are provided in this compilation.

The values for gas diffusivity were calculated from the following equation presented in Thibodeaux (1979):

$$\left(\frac{DA}{DB}\right) = \sqrt{\frac{MB}{MA}}$$

where DA = gas diffusivity

MA = molecular weight.

The input values were for ethyl ether that has a molecular weight of 74.14 grams/mole and gas diffusivity of 0.089 mg/cm^3 at 20°C. The molecular weight is from Streng and Peterson (1989) and the gas diffusivity is from Weast et al. (1986). Temperature affects gas diffusivity. It is a function of the molecular speed of a gas, which in turn, is a function of its average kinetic energy, which is determined solely by temperature. Thus, the diffusivity reported is probably larger, i.e., more conservative, than the average value at Eielson because of the sub-arctic climate. This may lead to an overestimation of the risk of volatile contaminants released from soil.

All chemical parameters for total petroleum hydrocarbons (TPH) are set to those for 2-methyl naphthalene, a common constituent of JP-4.

Several of the compounds listed do not have identified chemical parameters in the MEPAS database.

REFERENCES

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TABLE G.1. Chemical Parameters Used in Risk Assessments

ANALYTES	CAS #	Molecular Weight (g/mole)	Henry's Law Constant (atm m ³ /mole)	Carbon-matter		Octanol-water		Gas Diffusivity (g/cm ³)
				Partition mL/g	Partition mL/g	Partition mL/g	Partition mL/g	
VOLATILES								
1,1,1-TRICHLOROETHANE	71556	133.41	4.92E-03	1.52E+02		3.16E+02		6.63E-02
1,1,2,2-TETRACHLOROETHANE	79345	167.85	3.81E-04	1.18E+02		2.45E+02		5.92E-02
1,1,2-TRICHLOROETHANE	79005	133.41	1.17E-03	5.60E+01		2.95E+02		6.63E-02
1,1-DICHLOROETHANE	75343	98.96	5.43E-03	3.00E+01		6.17E+01		7.70E-02
1,1-DICHLOROETHENE	75354	96.94	1.60E-01	6.50E+01		6.92E+01		7.78E-02
1,2-DICHLOROETHANE	107062	98.96	9.78E-04	1.40E+01		3.02E+01		7.70E-02
1,2-DICHLOROETHENE (TOTAL)	156605	96.94	6.90E-02	9.60E+00		3.02E+00		7.78E-02
1,2-DICHLOROPROPANE	78875	112.99	2.31E-03	5.10E+01		1.00E+02		7.21E-02
2-BUTANONE	78933	72.12	2.70E-05	4.50E+00		1.88E+00		9.02E-02
2-HEXANONE	591786	100.16	1.10E-05	1.48E+01		2.40E+01		7.66E-02
4-METHYL-2-PENTANONE								
ACETONE	67641	58	2.10E-05	2.20E+00		5.80E-01		1.01E-01
BENZENE	71432	78	5.59E-03	8.30E+01		1.32E+02		8.68E-02
BENZYL ALCOHOL								
BROMODICHLOROMETHANE	75274	163.8	2.12E-03	1.07E+02		1.74E+02		5.99E-02
BROMOFORM	75252	252.75	5.52E-04	1.16E+02		2.51E+02		4.82E-02
BROMOMETHANE	74839	94.94	1.16E-01	9.55E+00		1.55E+01		7.86E-02
CARBON DISULFIDE	75150	76.14	1.23E-02	5.40E+01		1.00E+02		8.78E-02
CARBON TETRACHLORIDE	56235	154	3.02E-02	5.02E+02		4.36E+02		6.18E-02
CHLOROBENZENE	108907	112.56	3.72E-03	3.30E+02		6.92E+02		7.22E-02
CHLOROETHANE	75003	64.52	1.48E-02	1.66E+01		2.69E+01		9.54E-02
CHLOROFORM	67663	119	2.87E-03	5.00E+01		9.33E+01		7.02E-02
CHLOROMETHANE	74873	50.49	4.42E-02	3.50E+01		8.91E+00		1.08E-01
CIS-1,3-DICHLOROPROPENE	542756	110.97	1.30E-03	2.47E+01		1.00E+02		7.27E-02
DIBROMOCHLOROMETHANE	124481	208.29	9.95E-04	7.59E+01		1.23E+02		5.31E-02
ETHYLBENZENE	100414	106.17	6.43E-03	1.10E+03		1.41E+03		7.44E-02
METHYLENE CHLORIDE	75092	84.93	2.03E-03	8.80E+00		2.00E+01		8.32E-02
STYRENE	100425	104.16	4.71E-03	5.49E+02		8.91E+02		7.51E-02
TETRACHLOROETHENE	127184	165.85	2.59E-02	3.64E+02		3.98E+02		5.95E-02
TOLUENE	108883	92.15	6.37E-03	3.00E+02		5.37E+02		7.98E-02
TRANS-1,3-DICHLOROPROPENE	10061026	110.97	1.30E-03	2.47E+01		1.00E+02		7.27E-02
TRICHLOROETHENE	79016	131.29	9.10E-03	1.26E+02		2.40E+02		6.69E-02

TABLE G.1. Chemical Parameters Used in Risk Assessments

ANALYTES	CAS #	Molecular Weight (g/mole)	Henry's Law Constant (atm m ³ /mole)	Carbon-matter		Octanol-water		Gas Diffusivity (g/cm ³)
				Partition mL/g	Partition mL/g	Partition mL/g	Partition mL/g	
VINYL ACETATE	108054	86.1	3.76E-04	1.66E+01	2.95E+00			8.26E-02
VINYL CHLORIDE	75014	62.5	8.19E-02	5.70E+01	2.40E+01			9.69E-02
XYLENES (TOTAL)	1330207	106.17	7.04E-03	2.40E+02	1.82E+03			7.44E-02
SEMI-VOLATILES								
1,2,4-TRICHLOROBENZENE	120821	181.45	2.31E-03	9.20E+03	2.00E+04			5.69E-02
1,2-DICHLOROBENZENE	95501	147.01	1.93E-03	1.70E+03	4.00E+03			6.32E-02
1,2-DIPHENYLDIAZINE	122667	184.24	3.42E-09	4.18E+02	7.94E+02			5.65E-02
1,3-DICHLOROBENZENE	541731	147.01	2.63E-03	1.70E+03	3.98E+03			6.32E-02
1,4-DICHLOROBENZENE	106467	147.01	2.89E-03	1.70E+03	3.98E+03			6.32E-02
2,4,5-TRICHLOROPHENOL	95954	197.44	2.18E-04	8.90E+01	5.25E+03			5.45E-02
2,4,6-TRICHLOROPHENOL	88062	197.44	4.00E-06	2.00E+03	7.41E+03			5.45E-02
2,4-DICHLOROPHENOL	94757	221	1.88E-04	2.00E+01	6.46E+02			5.15E-02
2,4-DIMETHYLPHENOL	105679	122.16	1.80E-05	9.60E+01	6.46E+02			6.93E-02
2,4-DINITROPHENOL	51285	184.11	6.50E-10	1.66E+01	3.16E+01			5.65E-02
2,4-DINITROTOLUENE	121142	182.14	5.00E-06	4.50E+01	1.00E+02			5.68E-02
2,6-DINITROTOLUENE								
2-CHLORONAPHTHALENE	91578	162.2	5.40E-04	4.80E+03	1.00E+04			6.02E-02
2-CHLOROPHENOL	95578	128.56	1.00E-05	7.30E+01	1.51E+02			6.76E-02
2-METHYLNAPHTHALENE	91576	142.2	3.10E-04	4.47E+03	7.24E+03			6.43E-02
2-METHYLPHENOL	95487	108.15	1.00E-06	1.48E+01	9.33E+01			7.37E-02
4-METHYLPHENOL	106445	138.12	2.20E-05	4.36E+01	6.17E+01			6.52E-02
2-NITROANILINE	88747	108.15	2.38E-07	1.70E+01	8.51E+01			7.37E-02
2-NITROPHENOL								
3,3'-DICHLOROBENZIDINE	91941	253.13	1.00E-06	4.35E+00	3.16E+03			4.82E-02
3-NITROANILINE								
4,6-DINITRO-2-METHYLPHENOL	534521	198.03	1.00E-06	2.41E+00	5.01E+02			5.45E-02
4-BROMOPHENYL-PHENYLETHER								
4-CHOLOR-3-METHYLPHENOL								
4-CHLOROANILINE	106478	127.57	1.00E-06	4.17E+01	6.76E+01			6.78E-02
4-CHLOROPHENYL-PHENYLETHER	7005723	204.66	2.67E-04	7.41E+03	1.20E+04			5.36E-02
4-NITROANILINE	100016	138.12	3.75E-07	1.51E+01	2.45E+01			6.52E-02
4-NITROPHENOL	100027	139.11	2.95E-04	2.37E+00	8.13E+01			6.50E-02

TABLE G.1. Chemical Parameters Used in Risk Assessments

ANALYTES	CAS #	Molecular Weight (g/mole)	Henry's Law Constant (atm m ³ /mole)	Carbon-matter		Octanol-water		Gas Diffusivity (g/cm ³)
				Partition mL/g	Partition mL/g	Partition mL/g	Partition mL/g	
ACENAPHTHENE	83329	154	2.41E-04	4.60E+03		1.00E+04		6.18E-02
ACENAPHTHYLENE	208968	152	1.14E-04	2.50E+03		5.01E+03		6.22E-02
ANTHRACENE	120127	178	1.90E-05	1.40E+04		2.82E+04		5.74E-02
BENZO(A)ANTHRACENE	56553	228	1.00E-06	1.38E+06		3.98E+05		5.08E-02
BENZO(A)PYRENE	50328	252	2.00E-06	5.50E+06		1.15E+06		4.83E-02
BENZO(B)FLUORANTHENE	205992	252	1.20E-05	5.50E+05		1.15E+06		4.83E-02
BENZO(G,H,I)PERYLENE								
BENZO(K)FLUORANTHENE	207089	252	3.90E-05	5.50E+05		1.15E+06		4.83E-02
BENZOIC ACID	65850	122.13	1.30E-07	1.50E+00		7.41E+01		6.93E-02
BIS(2-CHLOROETHOXY)METHANE								
BIS(2-CHLOROETHYL)ETHER	111444	143.02	1.30E-05	1.39E+01		3.16E+01		6.41E-02
BIS(2-CHLOROISOPROPYL)ETHER	39838329	171	1.13E-04	6.10E+01		1.26E+02		5.86E-02
BIS(2-ETHYLHEXYL)PHTHALATE	117817	391	4.40E-07	8.71E+04		4.10E+00		3.88E-02
BUTYLBENZYLPHTHALATE								
CHRYSENE	218019	228.3	1.00E-06	2.00E+05		4.07E+05		5.07E-02
DI-N-BUTYLPHTHALATE	84742	278	2.82E-07	1.70E+05		4.00E+05		4.60E-02
DI-N-OCTYLPHTHALATE	117840	391	6.00E-06	3.60E+09		7.41E+09		3.88E-02
DIBENZ(A,H)ANTHRACENE	53703	278	2.61E-09	3.30E+06		4.07E+05		4.60E-02
DIBENZOFURAN								
DIETHYLPHTHALATE	84662	222.2	2.00E-08	6.90E+01		2.88E+02		5.14E-02
DIMETHYLPHTHALATE	131113	194.18	1.00E-06	1.74E+01		3.63E+01		5.50E-02
FLUORANTHENE	206440	202.26	1.00E-05	3.80E+04		7.94E+04		5.39E-02
FLUORENE	86737	166	1.17E-04	7.30E+03		1.58E+04		5.95E-02
HEXACHLOROBENZENE	118741	284.79	6.81E-04	3.90E+03		1.70E+05		4.54E-02
HEXACHLOROBUTADIENE	87683	260.76	1.00E-02	2.90E+04		6.03E+04		4.75E-02
HEXACHLOROCYCLOPENTADIENE	77474	272.8	2.75E-02	3.60E+03		1.00E+04		4.64E-02
HEXACHLOROETHANE	67721	236.74	9.85E-03	2.00E+04		3.98E+04		4.98E-02
INDENO(1,2,3-CD)PYRENE	193395	276	6.86E-08	1.60E+06		3.16E+06		4.61E-02
ISOPHORONE	78591	138.2	6.00E-06	8.70E+01		1.82E+02		6.52E-02
N-NITROSO-DI-N-PROPYLAMINE	621647	130.2	6.00E-06	1.50E+01		3.09E+01		6.72E-02
N-NITROSODIPHENYLAMINE (1)	86306	198.2	6.60E-04	6.48E+02		1.35E+03		5.44E-02
NAPHTHALENE	91203	128.16	7.20E-04	9.40E+02		1.70E+03		6.77E-02
NITROBENZENE	98953	123.11	2.40E-05	3.60E+01		7.08E+01		6.91E-02

TABLE G.1. Chemical Parameters Used in Risk Assessments

ANALYTES	CAS #	Molecular Weight (g/mole)	Henry's Law Constant (atm m ³ /mole)	Carbon-matter		Octanol-water		Gas Diffusivity (g/cm ³)
				Partition mL/g	Partition mL/g	Partition mL/g	Partition mL/g	
PENTACHLOROPHENOL	87865	286	3.00E-06	5.30E+04		1.00E+05		4.70E-02
PHENANTHRENE	85018	178	2.30E-05	1.40E+04		2.88E+04		5.74E-02
PHENOL	108952	94.11	1.00E-06	1.42E+01		2.88E+01		7.90E-02
PYRENE	129000	202.26	5.00E-06	3.80E+04		2.09E+05		5.39E-02
TPH								
TOTAL PETROLEUM HYDROCARBONS (1)		142.2	2.90E-04	4.50E+03		7.20E+03		6.43E-02
PCB								
AROCOR-1016	12674112	257.9	3.30E-04	1.80E+05		3.80E+05		4.77E-02
AROCOR-1221	1104282	200.7	1.70E-04	5.80E+03		1.20E+04		5.41E-02
AROCOR-1232	11141165	232.2	1.10E-05	7.71E+02		1.59E+03		5.03E-02
AROCOR-1242	53469219	266.5	1.98E-03	6.30E+03		1.29E+04		4.69E-02
AROCOR-1248	12672296	299.5	3.60E-03	2.77E+05		5.75E+05		4.43E-02
AROCOR-1254	11091691	328.4	8.30E-03	5.30E+05		1.10E+06		4.23E-02
AROCOR-1260	11096825	375.7	1.70E-04	6.70E+06		1.41E+07		3.95E-02

TABLE G.1. Chemical Parameters Used in Risk Assessments

ANALYTES		CAS #	Molecular Weight (g/mole)	Henry's Law Constant (atm m3/mole)	Carbon-matter Partition mL/g	Octanol-water Partition mL/g	Gas Diffusivity (g/cm3)
PESTICIDES							
4,4'-DDD	72548	320	8.00E-08	7.70E+05	1.58E+06	4.28E-02	
4,4'-DDE	72559	318	6.80E-05	4.40E+06	1.00E+07	4.30E-02	
4,4'-DDT	50293	354.49	5.13E-04	2.43E+05	1.55E+06	4.07E-02	
4,4'-METHOXYCHLOR							
ALDRIN	309002	365	5.00E-04	9.60E+04	2.00E+05	4.01E-02	
ALPHA-BHC	319846	290.83	6.00E-06	3.80E+03	7.94E+03	4.49E-02	
ALPHA-CHLORDANE	57749	409.8	5.00E-05	9.50E+03	6.03E+04	3.79E-02	
BETA-BHC	319857	290.93	4.47E-07	3.80E+03	7.94E+03	4.49E-02	
DELTA-BHC	319868	290.83	2.07E-07	6.60E+03	1.26E+04	4.49E-02	
DIELDRIN	60571	380.95	5.80E-05	4.10E+00	3.16E+03	3.93E-02	
ENDOSULFAN I		406.9	1.00E-05	9.60E-03	3.55E+03	3.80E-02	
ENDOSULFAN II		406.9	1.90E-05	9.60E-03	4.17E+03	3.80E-02	
ENDOSULFAN SULFATE							
ENDRIN	72208	380.9	1.00E-06	1.06E+04	3.98E+05	3.93E-02	
ENDRIN KETONE							
GAMMA-BHC (LINDANE)	58899	290.83	8.00E-06	1.08E+03	7.94E+03	4.49E-02	
GAMMA-CHLORDANE	57749	409.8	5.00E-05	9.50E+03	6.03E+04	3.79E-02	
HEPTACHLOR	76448	373.5	2.90E-03	6.00E+03	2.51E+04	3.97E-02	
HEPTACHLOR EPOXIDE	1024573	389.2	4.39E-04	2.20E+02	5.10E+02	3.88E-02	
METHOXYCHLOR	72435	345.65	2.48E-08	4.90E+00	2.00E+04	4.12E-02	
TOXAPHENE	8001352	414	4.90E-03	9.64E+02	2.00E+03	3.77E-02	
METALS							
ALUMINIUM	7429905	26.98	0.00E+00	0.00E+00	0.00E+00		
ANTIMONY	7440360	122	0.00E+00	0.00E+00	0.00E+00		
ARSENIC	7440382	75	0.00E+00	0.00E+00	0.00E+00		
BARIUM	7440393	137	0.00E+00	0.00E+00	0.00E+00		
BERYLLIUM	7440417	9	0.00E+00	0.00E+00	0.00E+00		
CADMIUM	7440439	112	0.00E+00	0.00E+00	0.00E+00		
CALCIUM							
CHROMIUM	7440473	52	0.00E+00	0.00E+00	0.00E+00		
COBALT	7440484	58.93	0.00E+00	0.00E+00	0.00E+00		

TABLE G.1. Chemical Parameters Used in Risk Assessments

ANALYTES	CAS #	Molecular Weight (g/mole)	Henry's Law Constant (atm m ³ /mole)	Carbon-matter		Octanol-water		Gas Diffusivity (g/cm ³)
				Partition	ml/g	Partition	ml/g	
COPPER	7440508	63.55	0.00E+00	0.00E+00		0.00E+00		
IRON	15438310	56	0.00E+00	0.00E+00		0.00E+00		
LEAD	7439921	207	0.00E+00	0.00E+00		0.00E+00		
MAGNESIUM	7786303	24.3	0.00E+00	0.00E+00		0.00E+00		
MANGANESE	7439965	55	0.00E+00	0.00E+00		0.00E+00		
MERCURY	7439976	201	1.14E-03	0.00E+00		0.00E+00		
NICKEL	7440020	59	0.00E+00	0.00E+00		0.00E+00		
POTASSIUM	7447407							
SELENIUM	7782492	79	0.00E+00	0.00E+00		0.00E+00		
SILVER	7440224	108	0.00E+00	0.00E+00		0.00E+00		
SODIUM	7647145							
THALLIUM	7440280	204	0.00E+00	0.00E+00		0.00E+00		
VANADIUM	7440622	50.94	0.00E+00	0.00E+00		0.00E+00		
ZINC	7646857	65.38	0.00E+00	0.00E+00		0.00E+00		

APPENDIX H

ENVIRONMENTAL TRANSFER PARAMETERS

APPENDIX H

ENVIRONMENTAL TRANSFER PARAMETERS

Table H.1 presents the environmental transfer parameters used in this risk assessment for the fish-ingestion and vegetable-ingestion pathways. The parameters include bioconcentration factors for finfish and soil-to-edible plant transfer ratios. All nonitalicized values were taken from the Multimedia Environmental Pollutant Assessment System (MEPAS) database compiled by Streng and Peterson (1989). References for each parameter are provided in this compilation.

Italicized values were calculated from the chemical parameters provided in Table G.1. The calculated values for the bioconcentration factors for finfish are based on the equation from Veith et al. (1980):

$$\log (B_{if}) = [0.76 * \log (K_{ow})] - 0.23$$

where B_{if} = bioconcentration factor for finfish for compound i (L/kg)
 K_{ow} = the octanol-water partition coefficient for compound i.

The calculated values for the soil-to-edible plant transfer ratios are based on the equation from Travis and Arms (1988):

$$\log (B_{vi}) = 0.986 - [0.578 * \log (K_{ow})]$$

where B_{vi} = soil-to-edible plant transfer ratio for compound i
(mg/kg net-weight plant per mg/kg dry-weight soil)

K_{ow} = the octanol-water partition coefficient for compound i.

The parameters listed in Table H.1 are a first approximation of the true or site-specific values. As such, the risks calculated for the ingestion of vegetables and fish are approximate.

Several of the compounds listed do not have environmental transfer parameters reported in the literature.

REFERENCES

Streng, D.L., and S.R. Peterson. 1989. Chemical Data Bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1. PNL-7145, Pacific Northwest Laboratory, Richland, Washington.

Travis, C.C. and A.D. Arms. 1988. "Bioconcentration of Organics in Beef, Milk, and Vegetation." Environmental Science and Technology. 22(3):271-274.

Veith, G.D., K.J. Macek, R. Petrocelli, and J. Carroll. 1980. "An Evaluation of Using Partition Coefficients and Water Solubility to Estimate Bioconcentration Factors of Organic Chemicals in Fish." Journal of Fisheries Research Board of Canada.

TABLE H.1. Environmental Transfer Parameters Used in Risk Assessments

ANALYTES	CAS #	Bioaccumulation	Soil-to-Edible Plant
		Factor	Ratio (Bvi)
		for Finfish (Bif)	(a)
		(L/kg)	
VOLATILES			
1,1,1-TRICHLOROETHANE	71556	52	1.45E+01
1,1,2,2-TETRACHLOROETHANE	79345	39	1.69E+01
1,1,2-TRICHLOROETHANE	79005	39	1.51E+01
1,1-DICHLOROETHANE	75343	14	3.98E+01
1,1-DICHLOROETHENE	75354	15	3.71E+01
1,2-DICHLOROETHANE	107062	2	6.20E+01
1,2-DICHLOROETHENE (TOTAL)	156605	2.9	2.58E+02
1,2-DICHLOROPROPANE	78875	19	2.95E+01
2-BUTANONE	78933	1	3.47E+02
2-HEXANONE	591786	7	7.15E+01
4-METHYL-2-PENTANONE			
ACETONE	67641	0	7.19E+02
BENZENE	71432	24	2.48E+01
BENZYL ALCOHOL			
BROMODICHLOROMETHANE	75274	30	2.09E+01
BROMOFORM	75252	39	1.67E+01
BROMOMETHANE	74839	5	9.38E+01
CARBON DISULFIDE	75150	19	2.95E+01
CARBON TETRACHLORIDE	56235	150	1.18E+01
CHLOROBENZENE	108907	645	8.89E+00
CHLOROETHANE	75003	7	6.66E+01
CHLOROFORM	67663	18	3.08E+01
CHLOROMETHANE	74873	3	1.32E+02
CIS-1,3-DICHLOROPROPENE	542756	19	2.95E+01
DIBROMOCHLOROMETHANE	124481	23	2.60E+01
ETHYLBENZENE	100414	146	5.72E+00
METHYLENE CHLORIDE	75092	5.74	8.01E+01
STYRENE	100425	103	7.60E+00
TETRACHLOROETHENE	127184	100	1.25E+01
TOLUENE	108883	70	1.04E+01
TRANS-1,3-DICHLOROPROPENE	10061026	19	2.95E+01
TRICHLOROETHENE	79016	11	1.72E+01
VINYL ACETATE	108054	1	2.62E+02
VINYL CHLORIDE	75014	7	7.15E+01
XYLENES (TOTAL)	1330207	177	4.88E+00
SEMI-VOLATILES			
1,2,4-TRICHLOROBENZENE	120821	1093	1.10E+00
1,2-DICHLOROBENZENE	95501	89	3.00E+00
1,2-DIPHENYLHYDRAZINE	122667	94	8.17E+00
1,3-DICHLOROBENZENE	541731	66	3.01E+00
1,4-DICHLOROBENZENE	106467	60	3.01E+00
2,4,5-TRICHLOROPHENOL	95954	1900	2.53E+00
2,4,6-TRICHLOROPHENOL	88062	20	2.05E+00
2,4-DICHLOROPHENOL	94757	80	9.28E+00

TABLE H.1. Environmental Transfer Parameters Used in Risk Assessments

ANALYTES	CAS #	Bioaccumulation	Soil-to-Edible Plant
		Factor	Ratio (Bvl)
		for Finfish (Bif) (L/kg)	(a)
2,4-DIMETHYLPHENOL	105679	150	9.28E+00
2,4-DINITROPHENOL	51285	8	6.03E+01
2,4-DINITROTOLUENE	121142	19	2.95E+01
2,6-DINITROTOLUENE			
2-CHLORONAPHTHALENE	91578	646	1.70E+00
2-CHLOROPHENOL	95578	6.4	2.29E+01
2-METHYLNAPHTHALENE	91576	505	2.07E+00
2-METHYLPHENOL	95487	18	3.08E+01
4-METHYLPHENOL	106445	14	3.98E+01
2-NITROANILINE	88747	17	3.26E+01
2-NITROPHENOL			
3,3'-DICHLOROBENZIDINE	91941	269	3.47E+00
3-NITROANILINE			
4,6-DINITRO-2-METHYLPHENOL	534521	66	1.09E+01
4-BROMOPHENYL-PHENYLETHER			
4-CHOLOR-3-METHYLPHENOL			
4-CHLOROANILINE	106478	14	3.76E+01
4-CHLOROPHENYL-PHENYLETHER	7005723	742	1.52E+00
4-NITROANILINE	100016	7	7.06E+01
4-NITROPHENOL	100027	126	3.36E+01
ACENAPHTHENE	83329	646	1.70E+00
ACENAPHTHYLENE	208968	301	2.61E+00
ANTHRACENE	120127	1420	8.93E-01
BENZO(A)ANTHRACENE	56553	11700	1.73E-01
BENZO(A)PYRENE	50328	23776	8.96E-02
BENZO(B)FLUORANTHENE	205992	23776	8.96E-02
BENZO(G,H,I)PERYLENE			
BENZO(K)FLUORANTHENE	207089	23776	8.96E-02
BENZOIC ACID	65850	16	3.55E+01
BIS(2-CHLOROETHOXY)METHANE			
BIS(2-CHLOROETHYL)ETHER	111444	11	6.03E+01
BIS(2-CHLOROISOPROPYL)ETHER	39638329	23	2.56E+01
BIS(2-ETHYLHEXYL)PHTHALATE	117817	2	2.14E+02
BUTYLBENZYLPHTHALATE			
CHRYSENE	218019	10797	1.71E-01
DI-N-BUTYLPHTHALATE	84742	10655	1.72E-01
DI-N-OCTYLPHTHALATE	117840	18666455	3.90E-04
DIBENZ(A,H)ANTHRACENE	53703	113000	1.71E-01
DIBENZOFURAN			
DIETHYLPHTHALATE	84662	44	1.53E+01
DIMETHYLPHTHALATE	131113	57	5.53E+01
FLUORANTHENE	206440	3118	4.70E-01
FLUORENE	86737	713	1.28E+00
HEXACHLOROBENZENE	118741	5561	2.93E-01
HEXACHLOROBUTADIENE	87683	2530	5.57E-01
HEXACHLOROCYCLOPENTADIENE	77474	29	1.70E+00
HEXACHLOROETHANE	67721	1845	7.21E-01

TABLE H.1. Environmental Transfer Parameters Used in Risk Assessments

ANALYTES	CAS #	Bioaccumulation	Soil-to-Edible Plant
		Factor for Finfish (Bif) (L/kg)	Ratio (Bvi) (a)
INDENO(1,2,3-CD)PYRENE	193395	51258	4.79E-02
ISOPHORONE	78591	31	2.04E+01
N-NITROSO-DI-N-PROPYLAMINE	621647	8	6.11E+01
N-NITROSODIPHENYLAMINE (1)	86306	141	5.88E+00
NAPHTHALENE	91203	168	5.09E+00
NITROBENZENE	98953	15	3.66E+01
PENTACHLOROPHENOL	87865	3715	4.07E-01
PHENANTHRENE	85018	1443	8.81E-01
PHENOL	108952	8	6.39E+01
PYRENE	129000	2800	2.58E-01
TPH			
TOTAL PETROLEUM HYDROCARBONS (1)		0	4.00E-02
PCB			
AROCLOR-1016	12674112	17000	1.78E-01
AROCLOR-1221	1104282	742	1.52E+00
AROCLOR-1232	11141165	160	5.31E+00
AROCLOR-1242	53469219	784	1.45E+00
AROCLOR-1248	12672296	14039	1.38E-01
AROCLOR-1254	11091691	22986	9.21E-02
AROCLOR-1260	11096825	159737	1.89E-02
PESTICIDES			
4,4'-DDD	72548	2710	7.36E-02
4,4'-DDE	72559	8450	2.34E-02
4,4'-DDT	50293	29830	7.45E-02
4,4'-METHOXYCHLOR			
ALDRIN	309002	3140	2.65E-01
ALPHA-BHC	319846	500	1.96E+00
ALPHA-CHLORDANE	57749	322	5.57E-01
BETA-BHC	319857	542	1.96E+00
DELTA-BHC	319868	770	1.47E+00
DIELDRIN	60571	4870	3.47E+00
ENDOSULFAN I		294	3.23E+00
ENDOSULFAN II		332	2.92E+00
ENDOSULFAN SULFATE			
ENDRIN	72208	1480	1.73E-01
ENDRIN KETONE			
GAMMA-BHC (LINDANE)	58899	180	1.96E+00
GAMMA-CHLORDANE	57749	322	5.57E-01
HEPTACHLOR	76448	1299	9.60E-01
HEPTACHLOR EPOXIDE	1024573	67	1.07E+01
METHOXYCHLOR	72435	8300	1.10E+00
TOXAPHENE	8001352	190	4.61E+00
METALS			

TABLE H.1. Environmental Transfer Parameters Used in Risk Assessments

		Bioaccumulation	
		Factor	Soil-to-Edible Plant
		for Finfish (Bif)	Ratio (Bvl)
ANALYTES	CAS #	(L/kg)	(a)
ALUMINUM	7429905	10	1.80E-04
ANTIMONY	7440360	200	1.40E-04
ARSENIC	7440382	100	1.50E-03
BARIUM	7440393	200	3.75E-03
BERYLLIUM	7440417	19	4.70E-04
CADMIUM	7440439	200	3.75E-02
CALCIUM			
CHROMIUM	7440473	200	1.13E-03
COBALT	7440484	50	9.40E-03
COPPER	7440508	50	6.25E-02
IRON	15438310	2000	2.50E-04
LEAD	7439921	100	8.00E-04
MAGNESIUM	7786303	50	1.38E-01
MANGANESE	7439965	400	3.75E-02
MERCURY	7439976	1000	5.00E-02
NICKEL	7440020	100	1.50E-02
POTASSIUM	7447407		
SELENIUM	7782492	170	6.25E-03
SILVER	7440224	2.3	3.25E-04
SODIUM	7647145		
THALLIUM	7440280	10000	1.00E-04
VANADIUM	7440622	10	1.30E-03
ZINC	7646857	2500	1.48E-01
(a) = units are: mg/kg wet-weight plant per mg/kg dry weight soil			

APPENDIX I

DERMAL ABSORPTION ESTIMATION

APPENDIX I

DERMAL ABSORPTION ESTIMATION

Dermal absorption of chemical contaminants contained in water can occur from skin contact during such common daily activities as showering, bathing, or hand washing. Dermal absorption of chemicals contaminants can also occur while swimming and may present a significant exposure to some individuals. Swimming outdoor particularly in surface water was not considered a viable pathway in this risk assessment due to Eielson's prohibitively cold sub-arctic climate. Indoor swimming is a potential pathway. Risk from swimming was not quantified specifically because the "showering or bathing" scenario assessed and described here is analogous. The dermal exposure estimation methodology used for chemical contaminants in water is based on procedures in U.S. EPA (1992) and is described below.

I.1 ABSORPTION RATE

The total daily absorption rate, corrected by the gastrointestinal tract (GI) absorption fraction, is given by

$$\text{Dose} = \frac{(\text{DA}_{\text{event}})(\text{A})(\text{EV})(\text{f})}{(\text{BW})(\text{ABS}_{\text{GI}})} \quad (\text{I.1})$$

where Dose = daily intake via dermal absorption equivalent to oral intake (mg/kg-day)

DA_{event} = dose absorbed per unit area per event (mg/cm²-event)

A = area of skin exposed to contaminated water (cm²)
(Appendix B)

EV = frequency of events (events/d) (Appendix B)

ED = exposure duration (y)

ABS_{GI} = fraction of material absorbed in passing through the GI tract (assumed to be 100% or 1 in this risk assessment)

BW = body weight of exposed individual (kg) (Appendix B).

AT = averaging time (days)

The dose estimated by Equation (I.1) is equivalent to oral exposure because a GI correction has been applied. This adjustment for absorption in the GI tract and through the skin is needed because available toxicity data are generally based on the oral or inhalation exposure routes and on the administered dose of a chemical (U.S. EPA 1989). Equations in U.S. EPA (1992) used in the risk assessment for evaluation of the dose absorbed per exposure event are described below.

I.2 ESTIMATING ABSORBED DOSE FOR INORGANICS

The methodology used in this risk assessment to calculate absorbed dose for inorganic compounds is from U.S. EPA (1992, p.5.49, equation 5.10) and is evaluated as follows:

$$DA_{\text{event}} = (K_p)(C_w)(t_{\text{event}})(EV) \quad (I.2)$$

where DA_{event} = dose absorbed per unit area per event ($\text{mg}/\text{cm}^2\text{-event}$),
 K_p = skin permeability constant listed for aqueous solutions (cm/hr), provided in Appendix J,
 C_w = concentration of chemical in water (mg/cm^3), provided in Appendix D as $\mu\text{g}/\text{L}$,
 t_{event} = duration of event (hr/event), provided in Appendix B (one event per day assumed).
 EV = events per day (events/d)

I.3 ESTIMATING ABSORBED DOSE FOR ORGANICS

The methodology used in this assessment to calculate absorbed dose for organic compounds is also from U.S. EPA (1992, pp. 5.49- 5.51) and is evaluated using the steps outlined below:

Step 1: Calculate the value for B (dimensionless), derived from U.S. EPA (1992, p. 5.49, equation 5.12) given by

$$B = \frac{K_{ow}}{10^4} \quad (I.3)$$

where K_{ow} = octanol/water partition coefficient.

Step 2: Determine the diffusion coefficient for skin, D_{sc} (cm^2/hr), as presented in U.S. EPA (1992, p. 5.50, equation 5.13) given by

$$\text{Log } \frac{D_{sc}}{I_{sc}} = -2.72 - 0.0061 (\text{MW}) \quad (I.4)$$

$$D_{sc} = 0.00196 I_{sc} 10^{-0.0061 \text{MW}}$$

where MW is the molecular weight of the organic compound and I_{sc} is set to 10^{-3} cm.

Step 3: Calculate the time, τ (hr), based on U.S. EPA (1992, p.5.50, equation 5.14) from the following equation:

$$\tau = \frac{I_{sc}^2}{6D_{sc}} \quad (I.5)$$

Step 4: From U.S. EPA (1992, p. 5.50 equations 5.15-5.17) calculate the time to reach steady state, t^* (hr), based on the value calculated in Step 1 for B:

$$\text{If } B \leq 0.1, \text{ then } t^* = 2.4 \tau$$

$$\text{If } 0.1 \leq B \leq 1.17, \text{ then } t^* = (8.4 + 6 \log B) \tau$$

$$\text{If } B \geq 1.17, \text{ then}$$

$$t^* = 6 (b - \sqrt{b^2 - c^2}) \tau \quad (I.6)$$

where the constants b and c from U.S. EPA (1992, p. 5.51, equations 5.18 and 5.19) are given as

$$b = \frac{2}{\pi} (1 + B)^2 - c \quad (I.7)$$

and

$$c = \frac{1 + 3B}{3} \quad (I.8)$$

Step 5: Calculate DA_{event} (mg/cm^2 -event) using the following equations based on U.S. EPA (1992, p. 5.51, equations 5.20 and 5.21). The equation is chosen based on the value calculated for t relative to the duration of the event,

t_{event} :

If $t_{event} < t^*$, then

$$DA_{event} = 2K_p C_w \sqrt{\frac{6\tau t_{event}}{\pi}}$$

(I.9)

and for $t_{event} > t^*$, then

$$DA_{event} = K_p C_w \left(\frac{t_{event}}{1+B} + 2\tau \left(\frac{1+3B}{1+B} \right) \right)$$

(I.10)

REFERENCES

U.S. Environmental Protection Agency (EPA). 1992. Dermal Exposure Assessment: Principles and Applications. U.S. Environmental Protection Agency, Office of Research and Development. Washington, D.C. EPA/600/8-91/011B. PB92-205665. Interim Report.

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APPENDIX J

DERMAL PARAMETERS

APPENDIX J

DERMAL PARAMETERS

Table J.1 lists numerical constants used to estimate the rate of chemical transfer through the skin of an exposed individual. The dermal parameter values given in units of cm/hr (listed under the Table J.1 heading "for Aqueous Solutions") are the "skin permeability constants" for chemicals in aqueous solutions. These parameters are K_{pw} discussed in Appendix I (Section I.1). The dimensionless dermal parameters (listed under the Table J.1 heading "for Soil Exposure") is the "skin absorption fraction" for exposure to soil with chemicals absorbed to the soil particles. In the risk calculations the "skin permeability constant" is used for the water dermal contact pathway and the "skin absorption fraction" is used for the soil dermal contact pathway.

All nonitalicized values listed in Table J.1 for the skin permeability constant are from the Multimedia Environmental Pollutant Assessment System (MEPAS) database compiled by Streng and Peterson (1989). The MEPAS values have been updated with information contained in U.S. EPA (1992), laboratory measurements, and theoretical calculations. Italicized values in Table J.1 were calculated from octanol-water partition coefficients using the algorithms presented in U.S. EPA (1992, p.5.20). The skin absorption fraction for soil exposure is assumed to be 0.01 (1%) for all organic compounds, and 0.001 (0.1%) for all metals. Skin absorption is a complex process influenced by many variables such as chemical diffusivity, skin thickness, and exposure duration. The skin absorption factors assumed in this risk assessment are within the range of those reported in the scientific literature. Some volatile compounds tend to have higher absorption rates than 0.01, while semivolatiles, TPH, PCBs, and pesticides may have lower values than 0.01 (Jarvis, T.T. et al. 1993). Published data for metals supports an absorption factor of 0.001.

REFERENCES

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Streng, D.L., and S.R. Peterson. 1989. Chemical Data Bases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1. PNL-7145, Pacific Northwest Laboratory, Richland, Washington.

U.S. EPA. 1992. Dermal Exposure Assessment: Principles and Applications. U.S. Environmental Protection Agency, Office of Research and Development. Washington, D.C. EPA/600/8-91/011B. PB92-205665. Interim Report.

TABLE J.1. Dermal Parameters Used in Risk Assessments

		Skin Permeability	Skin
		Constant	Absorption
		for Aqueous	Fraction
		Solutions	for Soil
ANALYTES	CAS #	(cm/hr)	Exposure (Unitless)
VOLATILES			
1,1,1-TRICHLOROETHANE	71558	1.70E-02	0.01
1,1,2,2-TETRACHLOROETHANE	79345	9.00E-03	0.01
1,1,2-TRICHLOROETHANE	79005	8.40E-03	0.01
1,1-DICHLOROETHANE	75343	8.90E-03	0.01
1,1-DICHLOROETHENE	75354	1.60E-02	0.01
1,2-DICHLOROETHANE	107062	5.30E-03	0.01
1,2-DICHLOROETHENE (TOTAL)	156605	1.00E-02	0.01
1,2-DICHLOROPROPANE	78875	1.00E-02	0.01
2-BUTANONE	78933	5.00E-03	0.01
2-HEXANONE	591786		0.01
4-METHYL-2-PENTANONE			
ACETONE	67641	1.00E-03	0.01
BENZENE	71432	1.10E-01	0.01
BENZYL ALCOHOL			
BROMODICHLOROMETHANE	75274	5.80E-03	0.01
BROMOFORM	75252	2.60E-03	0.01
BROMOMETHANE	74839	3.50E-03	0.01
CARBON DISULFIDE	75150	5.00E-01	0.01
CARBON TETRACHLORIDE	56235	2.20E-02	0.01
CHLOROBENZENE	108907	4.10E-02	0.01
CHLOROETHANE	75003	8.00E-03	0.01
CHLOROFORM	67663	1.30E-01	0.01
CHLOROMETHANE	74873	4.20E-03	0.01
CIS-1,3-DICHLOROPROPENE	542756	0.00E+00	0.01
DIBROMOCHLOROMETHANE	124481	3.90E-03	0.01
ETHYLBENZENE	100414	1.00E+00	0.01
METHYLENE CHLORIDE	75092	4.50E-03	0.01
STYRENE	100425	6.70E-01	0.01
TETRACHLOROETHENE	127184	3.70E-01	0.01
TOLUENE	108883	1.00E+00	0.01
TRANS-1,3-DICHLOROPROPENE	10061026		0.01
TRICHLOROETHENE	79016	2.30E-01	0.01
VINYL ACETATE	108054		0.01
VINYL CHLORIDE	75014	7.30E-03	0.01
XYLENES (TOTAL)	1330207	8.00E-02	0.01
SEMI-VOLATILES			
1,2,4-TRICHLOROBENZENE	120821	1.00E-01	0.01
1,2-DICHLOROBENZENE	95501	6.10E-02	0.01
1,2-DIPHENYLHYDRAZINE	122667	1.80E-02	0.01
1,3-DICHLOROBENZENE	541731	8.70E-02	0.01
1,4-DICHLOROBENZENE	106467	6.20E-02	0.01
2,4,5-TRICHLOROPHENOL	95954		0.01

TABLE J.1. Dermal Parameters Used in Risk Assessments

ANALYTES	CAS #	Skin	
		Skin Permeability	Absorption
		Constant	Fraction
		for Aqueous Solutions (cm/hr)	for Soil Exposure (Unitless)
2,4,6-TRICHLOROPHENOL	88062	5.90E-02	0.01
2,4-DICHLOROPHENOL	94757		0.01
2,4-DIMETHYLPHENOL	105679	1.10E-01	0.01
2,4-DINITROPHENOL	51285	3.20E-03	0.01
2,4-DINITROTOLUENE	121142	3.80E-03	0.01
2,6-DINITROTOLUENE			
2-CHLORONAPHTHALENE	91578	0.00E+00	0.01
2-CHLOROPHENOL	95578	3.30E-02	0.01
2-METHYLNAPHTHALENE	91576	3.16E-01	0.01
2-METHYLPHENOL	95487	1.60E-02	0.01
4-METHYLPHENOL	106445		0.01
2-NITROANILINE	88747	1.80E-02	0.01
2-NITROPHENOL			
3,3'-DICHLOROBENZIDINE	91941	1.70E-02	0.01
3-NITROANILINE			
4,6-DINITRO-2-METHYLPHENOL	534521	3.80E-03	0.01
4-BROMOPHENYL-PHENYLETHER			
4-CHLOR-3-METHYLPHENOL			
4-CHLOROANILINE	106478		0.01
4-CHLOROPHENYL-PHENYLETHER	7005723		0.01
4-NITROANILINE	100016		0.01
4-NITROPHENOL	100027	5.60E-03	0.01
ACENAPHTHENE	83329		0.01
ACENAPHTHYLENE	208968		0.01
ANTHRACENE	120127	3.16E-02	0.01
BENZO(A)ANTHRACENE	56553	8.10E-01	0.01
BENZO(A)PYRENE	50328	1.20E+00	0.01
BENZO(B)FLUORANTHENE	205992	1.20E+00	0.01
BENZO(G,H,I)PERYLENE			0.01
BENZO(K)FLUORANTHENE	207089	3.16E-02	0.01
BENZOIC ACID	65850	7.30E-03	0.01
BIS(2-CHLOROETHOXY)METHANE			0.01
BIS(2-CHLOROETHYL)ETHER	111444	2.10E-03	0.01
BIS(2-CHLOROISOPROPYL)ETHER	39638329		0.01
BIS(2-ETHYLHEXYL)PHTHALATE	117817	3.30E+00	0.01
BUTYLBENZYLPHTHALATE			0.01
CHRYSENE	218019	8.10E-01	0.01
DI-N-BUTYLPHTHALATE	84742	3.30E-02	0.01
DI-N-OCTYLPHTHALATE	117840	3.16E-02	0.01
DIBENZ(A,H)ANTHRACENE	53703	2.70E+00	0.01
DIBENZOFURAN			0.01
DIETHYLPHTHALATE	84662	4.80E-03	0.01
DIMETHYLPHTHALATE	131113	1.60E-03	0.01
FLUORANTHENE	206440	3.60E-01	0.01

TABLE J.1. Dermal Parameters Used in Risk Assessments

ANALYTES	CAS #	Skin	
		Skin Permeability	Absorption
		Constant	Fraction
		for Aqueous Solutions (cm/hr)	for Soil Exposure (Unitless)
FLUORENE	86737	3.16E-02	0.01
HEXACHLOROBENZENE	118741	2.10E-01	0.01
HEXACHLOROBUTADIENE	87683	1.20E-01	0.01
HEXACHLOROCYCLOPENTADIENE	77474		0.01
HEXACHLOROETHANE	67721	4.20E-02	0.01
INDENO(1,2,3-CD)PYRENE	193395	1.90E+00	0.01
ISOPHORONE	78591	4.20E-03	0.01
N-NITROSO-DI-N-PROPYLAMINE	621647		0.01
N-NITROSODIPHENYLAMINE (1)	86306	2.00E-02	0.01
NAPHTHALENE	91203	6.90E-02	0.01
NITROBENZENE	98953	2.23E-02	0.01
PENTACHLOROPHENOL	87865	6.50E-01	0.01
PHENANTHRENE	85018	2.30E-01	0.01
PHENOL	108952	8.20E-03	0.01
PYRENE	129000	3.16E-02	0.01
TPH			
TOTAL PETROLEUM HYDROCARBONS			0.01
PCB			
AROCLOR-1016	12674112	3.16E-02	0.01
AROCLOR-1221	1104282	3.16E-02	0.01
AROCLOR-1232	11141165	5.02E-03	0.01
AROCLOR-1242	53469219	3.16E-02	0.01
AROCLOR-1248	12672296	3.16E-02	0.01
AROCLOR-1254	11091691	3.16E-02	0.01
AROCLOR-1260	11096825	3.16E-02	0.01
PESTICIDES			
4,4'-DDD	72548	2.80E-01	0.01
4,4'-DDE	72559	2.40E-01	0.01
4,4'-DDT	50293	4.30E-01	0.01
4,4'-METHOXYCHLOR			
ALDRIN	309002	1.60E-03	0.01
ALPHA-BHC	319846	3.16E-02	0.01
ALPHA-CHLORDANE	57749	5.20E-02	0.01
BETA-BHC	319857		0.01
DELTA-BHC	319868		0.01
DIELDRIN	60571	1.60E-02	0.01
ENDOSULFAN I			0.01
ENDOSULFAN II			0.01
ENDOSULFAN SULFATE			
ENDRIN	72208	1.60E-02	0.01
ENDRIN KETONE			

TABLE J.1. Dermal Parameters Used in Risk Assessments

		Skin Permeability	Skin Absorption
		Constant	Fraction
		for Aqueous	for Soil
		Solutions	Exposure
ANALYTES	CAS #	(cm/hr)	(Unitless)
GAMMA-BHC (LINDANE)	58899	1.40E-02	0.01
GAMMA-CHLORDANE	57749	5.20E-02	0.01
HEPTACHLOR	76448	1.10E-02	0.01
HEPTACHLOR EPOXIDE	1024573		0.01
METHOXYCHLOR	72435		0.01
TOXAPHENE	8001352	1.50E-02	0.01
METALS			
ALUMINUM	7429905	1.00E-05	0.001
ANTIMONY	7440360	1.00E-03	0.001
ARSENIC	7440382	1.00E-03	0.001
BARIUM	7440393	1.00E-03	0.001
BERYLLIUM	7440417	1.00E-03	0.001
CADMIUM	7440439	1.00E-03	0.01
CALCIUM			
CHROMIUM	7440473	2.00E-03	0.001
COBALT	7440484	4.00E-04	0.001
COPPER	7440508	1.00E-03	0.001
IRON	15438310	1.00E-03	0.001
LEAD	7439921	4.00E-06	0.001
MAGNESIUM	7786303	1.00E-03	0.001
MANGANESE	7439965	1.00E-03	0.001
MERCURY	7439976	1.00E-03	0.001
NICKEL	7440020	1.00E-04	0.001
POTASSIUM	7447407		
SELENIUM	7782492	1.00E-03	0.001
SILVER	7440224	6.00E-04	0.001
SODIUM	7647145		
THALLIUM	7440280	1.00E-03	0.001
VANADIUM	7440622	1.00E-03	0.001
ZINC	7646857	6.00E-04	0.001

APPENDIX K

GROUNDWATER MODELING

APPENDIX K

GROUNDWATER MODELING

K.1 DESCRIPTION OF MEPAS

This risk assessment uses the Multimedia Environmental Pollutant Assessment System (MEPAS), a physics-based computation code that integrates source-term, transport, and exposure models into a single framework. MEPAS is designed as a preliminary or initial tool for assessing environmental problems; it is designed for site-specific assessments using readily available information to estimate the release of contaminants from waste sites, their transport and fate in the environment, and the potential health impacts associated with exposures to surrounding sensitive receptors.

The MEPAS methodology is based on standard transport models that have been used by industry and government, including the U.S. Environmental Protection Agency. The groundwater model, which was employed in this assessment, is based on the one-dimensional advection, three-dimensional dispersive equation for solute movement through a porous medium with a unidirectional, constant flow velocity and degradation/decay (Clapp 1977; Code11 1982; U.S. EPA 1988; and Hillel 1980).

$$\frac{\partial C}{\partial t} + \left(\frac{u}{R_f} \right) \left(\frac{\partial C}{\partial x} \right) = \left(\frac{D_x}{R_f} \right) \left(\frac{\partial^2 C}{\partial x^2} \right) + \frac{D_y}{R_f} \frac{\partial^2 C}{\partial y^2} + \frac{D_z}{R_f} \frac{\partial^2 C}{\partial z^2} + \lambda C \quad (K.1)$$

in which

$$R_f = 1 + \beta K_d / n_e \quad (\text{saturated zone}) \quad (K.2)$$

$$R_f = 1 + \beta K_d / T \quad (\text{vadose zone}) \quad (K.3)$$

$$\text{where } T = n [K(T)/K_s]^b \quad (\text{vadose zone}) \quad (K.4)$$

where C = dissolved concentration (g/mL or Ci/mL)

u = pore-water velocity (cm/s)

R_f = retardation factor (dimensionless)

D_x , D_y , and D_z = dispersion coefficients in the x, y, and z

directions, respectively (cm^2/s)

R_f = degradation/decay rate ($1/\text{sec}$)

B = bulk density (g/cm^3)

K_d = distribution coefficient (mL/g)

n_e and n = effective and total porosities, respectively (fraction)

T = moisture content (fraction)

$K(T)$ = hydraulic conductivity (cm/s)

K_s = saturated hydraulic conductivity (cm/s)

b = empirically based parameter that is a function of soil properties.

By solving Equation (K.1) with appropriate initial and boundary conditions, a set of analytical expressions is obtained that characterizes contaminant transport through the vadose and saturated zones (Whelan 1987b). The solutions are based on Green's functions (Code11 1982; Selim 1976; Yeh 1976; Yeh 1981). Using this type of approach allows the subsurface pathway to easily consider multiple layers in the vadose zone. For vadose zone modeling, Equation (K.1) is reduced to one-dimensional (z -direction) solutions of the advection-dispersive equation. Saturated-zone modeling is based on two-dimensional (x and y directions), vertically averaged solutions to Equation (K.1). The vertically averaged depth is defined as the vertical distance over which the contaminant is considered fully mixed. MEPAS calculates the fully mixed region based on hydrodynamic (e.g., dispersion coefficient) and geometric (e.g., aquifer depth) considerations using a Gaussian-distribution analysis (Whelan 1987b). Contaminant transport between vadose-zone layers or between vadose and saturated zones are linked through contaminant-flux boundary conditions. The groundwater component also allows the analyst to assess degradation/decay at the source of contamination only, in the environment only, following release from the source, or both sequentially.

MEPAS was initially developed for the U.S. Department of Energy (DOE) to assess a suite of environmental concerns at each of its 35 facilities across the country, including its 16 defense production installations. The DOE

application involved over 400 waste sites called ranking units (U.S. DOE 1988). Previous applications included the evaluation of a variety of waste sites at different DOE facilities during the testing phase of the methodology (Whelan 1988; Whelan 1989b). At DOE's Hanford Site in Richland, Washington, MEPAS has been used on the single-shell tank (SST) waste-characterization project (Buck 1991; Droppo 1991). MEPAS was also used to develop data quality objectives (DQOs) for the SST waste-characterization project by defining risk-based detection limit goals for the analytical laboratory effort (Droppo 1989).

Whelan (1987a) performed similar assessments using MEPAS at 20 EPA Comprehensive Environmental Restoration and Liability Act (CERCLA) sites. Two additional applications (Codell 1982) under seven different site conditions evaluated the migration, fate, and effects of mixed wastes associated with creosote, pentachlorophenol, ammoniacal copper arsenate, ammoniacal copper zinc arsenate, copper chromate arsenical, coal-tar asbestos, newly coated asphalt asbestos, old-coated asphalt asbestos, and coal-tar epoxy. Three of these analyses were compared to actual sites; the results were confirmed by site monitoring.

The MEPAS methodology is currently associated with the Remedial Action Assessment System (RAAS), which is being developed by DOE's Office of Environmental Restoration; RAAS is a computer tool to help in the selection of a representative list of remediation alternatives in the feasibility stage of EPA's guidance for remediation at CERCLA sites. RAAS will first screen possible remediation technologies to obtain a candidate list for appropriate treatment technologies and then will provide attribute information on that list of candidates. The attributes will be based on a subset of EPA's ten attribute criteria (U.S. EPA 1988). To help in this process, MEPAS will be provided as a tool for computing the transport, fate, and risk for alternative remedies.

Although MEPAS is an extremely versatile methodology, it does have its limitations, as does every model or methodology. The current version of MEPAS does not

- provide spatially varying concentration isopleths, although the code is currently being modified to address this constraint

- consider complex geochemical interactions between constituents and soil, including kinetics, complexation, functional group interactions, waste mixtures, etc. - Chemical interactions with soil are described in MEPAS through a distribution coefficient (K_d).
- consider density differences from that of water, as illustrated by light or dense nonaqueous-phase liquids (i.e., LNAPL or DNAPL, respectively) - The model does allow the user to limit the vertical region over which the LNAPL might be distributed.
- consider time or spatial variations in pore-water flow velocities - As a result, the hydraulic gradient is considered constant over any given reach of the saturated zone. Time and spatial variations in pore-water velocity due to boundary conditions or pumpage are not addressed.

K.2 GROUNDWATER MODELING RESULTS

The MEPAS model was used to predict the future concentrations of benzene that would be expected in Eielson AFB Base Supply Well D. This modeling effort assumes that all of the benzene contamination in the well migrates to the well from Source Area ST48.

Source Area ST48 is located in the east-central portion of Eielson AFB. (U.S. Air Force 1993) Arctic diesel leaks in the abandoned fuel lines beneath the intersection of Industrial Drive and Division Street are suspected sources of the hydrocarbon contamination. The quantity of fuel released at the site and the time frame associated with the initial release are unknown. A drinking water supply well (Well D) is adjacent to the source area.

Floating product was observed in the vicinity of the source in 1988 and 1991, but no free product was detected in 1992 (U.S. Air Force 1993). At monitoring wells, benzene concentrations ranged from 0.34 to 1,330 $\mu\text{g/L}$ in 1989, and from 3.01 to 1,390 $\mu\text{g/L}$ in 1989 and 1991 (U.S. Air Force 1993). Soil benzene concentration of 0.112 mg/kg of dry soil was detected at a depth of 4.0 to 4.4 m at sampling site 48TP04. (U.S. Air Force 1993) As indicated by the groundwater benzene isopleths, (U.S. Air Force 1993) a considerable area was affected by the fuel leaks.

Based on this description of the site and other available information, (U.S. Air Force 1993) the events surrounding the contamination were modeled using the following assumptions:

- Benzene is used as the indicator chemical because of all of the BTEX components, it is the most mobile and toxic constituent.
- The source area is the area (60 m by 30 m) where floating product was observed in 1991 (U.S. Air Force 1993).
- Because Base Water Supply Well D (which has a screen depth of 29 to 35 m) is in the direction of the groundwater flow from site ST48, an analysis is performed from the waste site to Well D, located 171 m from the center of the contaminated ST48 area (U.S. Air Force 1993). Because detection levels ($< 0.2 - 1.4 \mu\text{g/L}$) of benzene were monitored at Well D (U.S. Air Force 1993) a front-line of benzene plume has reached Well D.
- Because source contaminants are concentrated at/near a groundwater table (smear zone), the assessment addresses contaminant movement from the waste site, through the saturated zone, to Well D.
- Because a typical screen-depth of monitoring wells is 6.1 m (20 ft), the vertical (z) dispersivity was set to assure that benzene was fully mixed within the top 6.1 m of the saturated zone.
- Because groundwater benzene concentration isopleths (based on 1989 data) are available (U.S. Air Force 1993). this analysis utilizes the concentration-isopleths to help calibrate the model. The groundwater benzene concentrations (at selected distances along the groundwater flow path) will be extrapolated from the isopleths and assumed as centerline concentrations for the purpose of model calibration.
- Because groundwater benzene levels monitored in 1993 show insignificant change in the concentration isopleths of 1989, the constant contaminant seepage of contaminant from the source was assumed. The current contamination emanating from the site is assumed to be constantly seeping from the weathered residual fuel due to rainfall and snowmelt recharge.

K.2.1 Site and Contaminant Data Utilized for the Transport and Fate Assessment

The groundwater model associated with the MEPAS methodology was utilized to model the transport of benzene at site ST48. Table K.1 presents the parameters, the values for each parameter, and the references associated with each value that was used in the assessment. The benzene contamination plume (U.S. Air Force 1993) was used to estimate the benzene inventory in the saturated zone. The soil benzene concentration of 0.112 mg/kg of dry soil (measured at sampling site 48TP04) (U.S. Air Force 1993) was used to estimate the benzene inventory in the vadose zone at the site. As noted earlier, the lower screen-

TABLE K.1. Site Data Used for the Fate and Transport Assessment at Site ST48

SOURCE-TERM INFORMATION		
• Source-Term Length	60 m	assumed
• Source-Term Width	30 m	assumed
• Distance to Well D	171 m	estimated
• Benzene Mass	153 kg	estimated
SATURATED ZONE		
• Thickness of Contamination	6.1 m	assumed
• Aquifer Thickness	60.1 m	assumed
• Pore-Water Velocity	50.0 cm/d	modeling
• Total Porosity	43.7 %	Droppo (1989)
• Effective Porosity	30.0 %	assumed
• Bulk Density	1.60 g/cm ³	Droppo (1989)

TABLE K.2. Results of Model Calibration at Site ST48.

• Distance, Lx (m)	50	100	145	estimated
• x-Dispersivity ^(a) (m)	1.25	2.50	3.63	modeling
• y-Dispersivity ^(b) (m)	0.25	0.50	0.73	modeling
• Distribution Coefficient, Kd, for benzene (mL/g)	4.0	4.0	4.0	modeling
• Benzene Flux Rate (g/y)	4,800	4,800	4,800	modeling
• Benzene Concentrations from Isopleths (µg/L)	1,000	100	5	USAF (1993)
• Model Benzene Concentration (µg/L)	985	101	5	modeling
^(a) x-Dispersivity = 0.025 (Lx), Lx = travel distance ^(b) y-Dispersivity = 0.2 (x-Dispersivity)				

depth of 6.1 m was assumed as the thickness (mixing depth) of contamination. The pore-water velocity determined by the model calibration was 50 cm/d for site ST48. It is at the low end of the range (i.e., 47 to 282 cm/d) estimated with the measured hydraulic conductivity values of 61 and 366 m/d and an assumed effective porosity of 30%.

K.2.2 Application Results and Discussion

Table K.2 presents information employed in the modeling exercise. Columns 2 through 4 in line 1 present the longitudinal distances (L_x) in the direction of the groundwater flow from the center of the source (U.S. Air Force 1993). Line 2 presents the longitudinal (x) and lateral (y) dispersivities. The x - and y -dispersivities are assumed to be proportional to the travel distance L_x . The proportionality constants are determined by a calibration exercise and presented in line 7 (Table K.2). Lines 3 and 4 present the distribution coefficients and mass flux for benzene. The values in lines 2 through 4 are the results of the calibration exercise. Lines 5 and 6 present groundwater benzene concentrations ($\mu\text{g/L}$) extrapolated from the isopleths and predicted from the modeling exercise, respectively.

The calibrated distribution coefficient (i.e., 4.0 mL/g) in line 3 is an order of magnitude larger than the theoretical K_d value based on K_{oc} and an assumed percent organic content of 0.5%. The K_{oc} value for benzene is 83 mL/g resulting in estimated distribution coefficient of 0.4 mL/g.

It was assumed that the initial fuel leak occurred in 1979 (indicated by model calibration) and that the initial contaminant mass moved directly into the saturated zone. The benzene concentration profile is associated with calibration runs to locations, which are 50 m, 100 m and 145 m from the source (see Table K.2). A front-line of the plume may exist about 170 m from the source. The benzene concentration drops by one order of magnitude as groundwater travels 50 m at the location between 50 m and 100 m from the source (also see Table K.2). A peak of the plume is calculated to be moving toward Well D at a rate of 2.2 cm/d (i.e., pore-water velocity/ R_f = 50 cm/d / 22.3 = 2.2 cm/d).

An analysis was also performed for simulating potential centerline contaminant levels at Well D (171 m from the source). As with the previous

analyses, it was assumed that benzene was constrained to the top 6.1 m (20 ft) of the aquifer. Benzene from ST48 is predicted to have reached Well D. The results indicate that the benzene concentration may reach the U.S. EPA maximum contaminant level (MCL) of 5 $\mu\text{g/L}$ within a few years. Because the modeling assessment assumes that no decay processes (e.g., volatilization, degradation, transformation) occur, the concentrations may reach the MCL level later than predicted. The simulated peak concentration is about 300 $\mu\text{g/L}$ and may pass Well D in modeled year 40 (i.e., in the year 2019). No data are available to confirm or dispute these results. Although the benzene fate and transport evaluation performed here is a preliminary order-of-magnitude analysis, the results suggest that the benzene level can rise above the MCL of 5 $\mu\text{g/L}$ at Well D, under the conditions utilized in the model simulation.

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