Revised Draft Final Report

Human Health Risk Assessment

Shieldalloy Metallurgical Corporation
Newfield, New Jersey

April 1994

TRC

TRC Environmental Corporation

REVISED
DRAFT FINAL REPORT

HUMAN HEALTH RISK ASSESSMENT

Shieldalloy Metallurgical Corporation
Newfield, New Jersey

April 1994

Submitted by:

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EXECUTIVE SUMMARY

A Remedial Investigation (RI) was conducted at the Shieldalloy Metallurgical Corporation (SMC) facility located in Newfield, New Jersey by TRC Environmental Consultants, Inc. (TRC) as required under Administrative Consent Order (1988) (Remedial Investigation Technical Report, 1992).

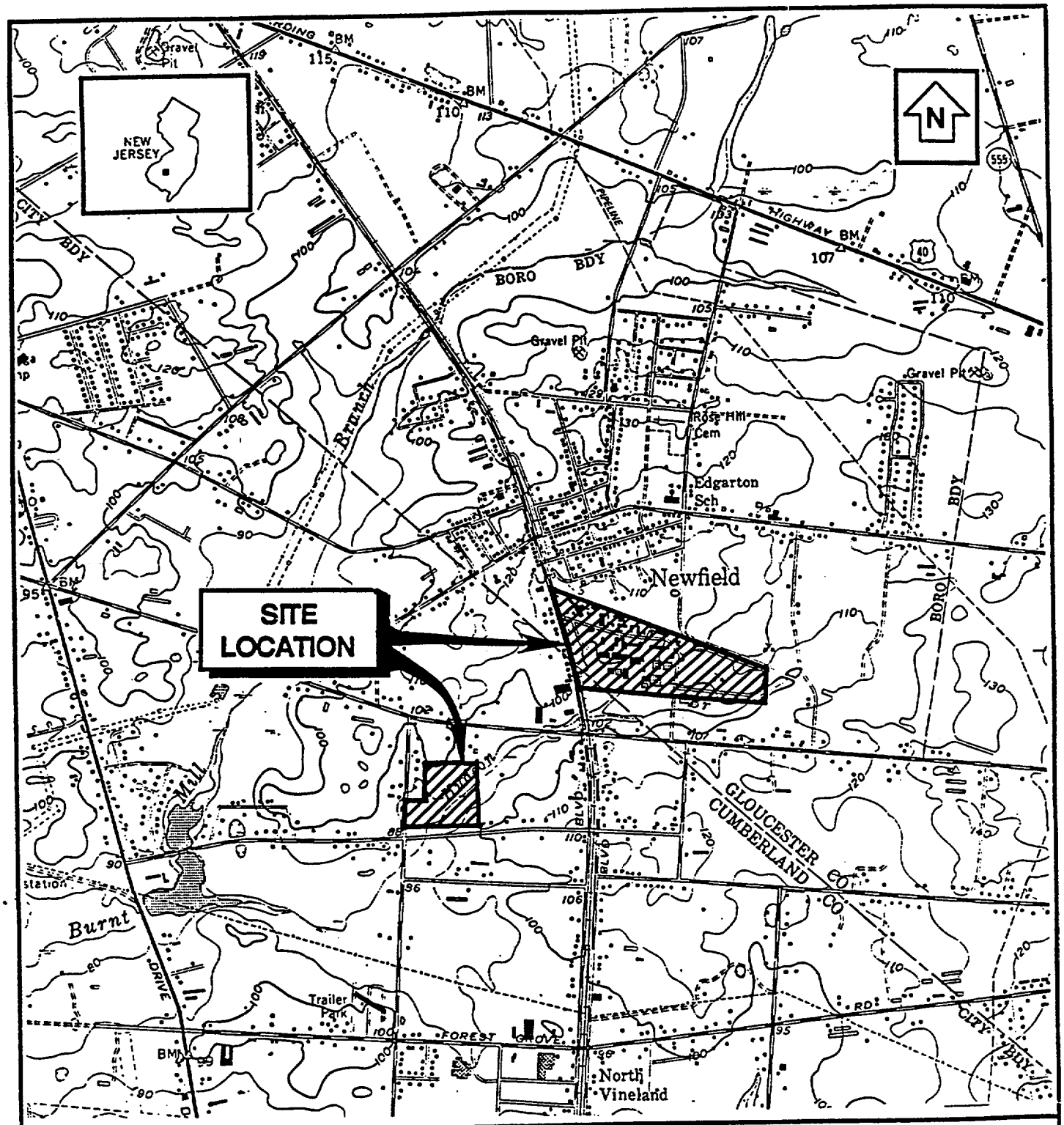
The SMC facility consists of approximately 67.5 acres. The manufacturing facilities and support areas are located on approximately 60 acres in Newfield, New Jersey, within Gloucester County. SMC also owns 7.5 acres of farmlands southwest of the main facility in Vineland, New Jersey within Cumberland County. A site location map is provided in Figure ES-1.

The purposes of the Remedial Investigation were to: 1) investigate the physical characteristics of the site; 2) determine the nature and extent of contamination resulting from operations at SMC; and 3) to characterize environmental impact and potential health risks. Figure ES-2 illustrates the four general areas studied in detail and presented in the RI.

This Human Health Evaluation report presents the results of the human health risk assessment, describing the chemicals of potential concern, assessing potential exposure pathways and chemical toxicity, and characterizing risks associated with the site. The site history, physical characteristics of the site, the activities conducted during the RI, and the nature and extent of contamination at and around the site are addressed in the RI report (TRC, 1992).

This human health risk assessment does not include risks associated with radioactive contaminants at the site. However, Appendix D contains the Assessment of Environmental Radiological Conditions at the Newfield Facility.

This Executive Summary presents an overview of the purpose and methodology of risk assessment activities, followed by a description of the study and its results.



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SCALE

FROM NEWFIELD, NJ 7 1/2' USGS
TOPOGRAPHIC MAP, 1953
PHOTOREVISED 1986

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SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE ES-1.

SITE LOCATION MAP

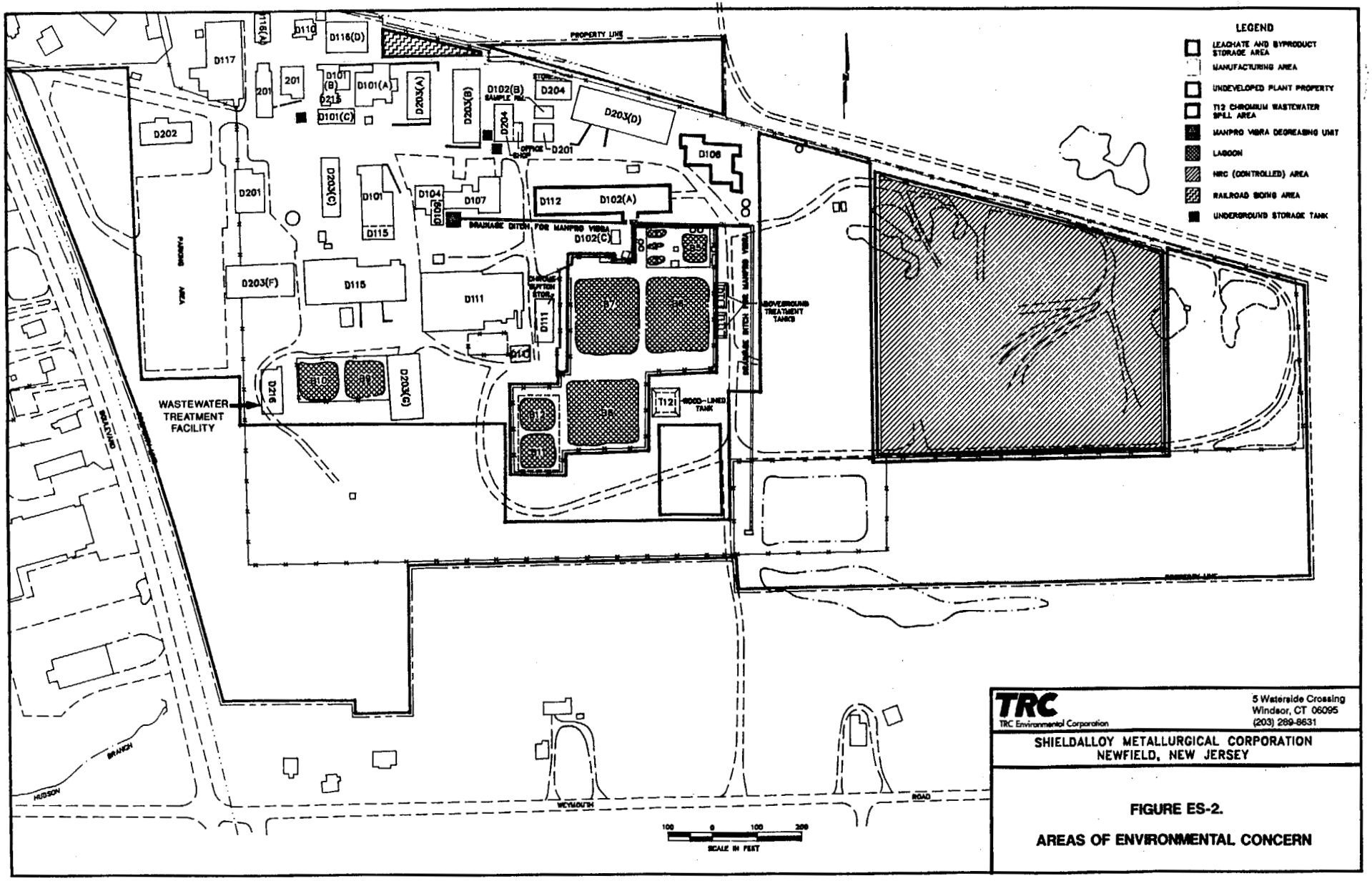

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FIGURE ES-2.

AREAS OF ENVIRONMENTAL CONCERN

PURPOSE AND METHODOLOGY - HUMAN HEALTH EVALUATION

The primary objectives of the Human Health Evaluation conducted at the SMC facility include the following:

- Examine exposure pathways and contaminant concentrations in environmental media;
- Estimate the potential for adverse effects associated with the contaminants of concern under current and future land use conditions;
- Provide a risk management framework upon which decisions can be made regarding what, if anything, should be done;
- Identify site or land use conditions that present unacceptable risks; and
- Provide a basis from which recommendations for future activities at the site can be made which are protective of human health.

Methodology

The risk assessment follows guidelines established by the U.S. Environmental Protection Agency in the Interim Final Risk Assessment Guidance for Superfund, Volume I (Human Health Evaluation Manual - Part A) (1989). The general format followed in conducting the risk assessment is presented below, followed by descriptions of risk assessment findings.

Chemicals of Potential Concern - Potential contaminants of concern have been evaluated and identified for the various media identified at the site. For each medium, the analytical data were evaluated following EPA guidelines (EPA, 1989). The chemicals of concern were identified on the basis of this evaluation, and a determination was made as to which chemicals would be addressed qualitatively and/or quantitatively in the risk assessment. In some cases, data qualified with U, J or UJ qualifiers (i.e., not verified "hits") were used in the quantitative

risk assessment in accordance with current guidance. However, these compounds were not significant in the risk assessment.

Exposure Assessment - The exposure assessment involved considerations of potential receptor populations and migration pathways by which contaminants could potentially be transported off-site. Specific exposure scenarios were developed to represent potential situations in which humans may be exposed to on-site contaminants.

Potential migration pathways included the following:

- Migration of surface soil contaminants directly via surface runoff, windblown dust, or tracking (tires, shoes, etc.);
- Migration of surface soil contaminants indirectly via precipitation, leaching and subsequent ground water migration, via volatilization to ambient air, or via uptake by plants or animals and subsequent human consumption;
- Migration of subsurface soil contaminants via precipitation, leaching or subsequent ground water migration; and
- Migration of ground water contaminants via ground water flow.

In accordance with NJS 40:63-52, et seq., the City of Vineland has designated an area of the city as an aquifer exclusion zone, requiring mandatory connection with Public Water Systems and sealing of domestic and supply wells. The SMC facility is not within this aquifer exclusion zone, but it is connected with the public water system. A residential area to the south of the site is also outside the aquifer exclusion zone.

Potential current human exposure scenarios developed for evaluation included the following:

- Trespassing Scenario - Exposure to children through direct access to the site (e.g., trespassers);
- Commercial/Industrial Use Scenario - Exposure to adult employees through current industrial use of the site; and

- Residential Use Scenario - Exposure to residents through current residential use of ground water (to the south of the SMC facility).

Potential future human exposure scenarios developed for evaluation at the site included the following:

- Construction Scenario - Exposure to construction workers for a one year period assuming development of the site as an industrial/residential site and no remedial activities prior to construction; and

- Residential Use Scenario - Exposure to children from 0 to 6 years of age and to adults (30 year period) through future residential use of the site.

Assumptions used in evaluating each exposure scenario were developed to be conservative yet representative of current and anticipated conditions. Uncertainties associated with these assumptions were addressed for each scenario at each site.

Toxicity Assessment - The toxic effects of each chemical of concern were evaluated, including effects associated with exposure and concentrations at which such effects may be expected to occur, when available. Chronic and subchronic non-carcinogenic effects for the oral and inhalation routes and slope factors associated with these effects were identified.

Risk Characterization - Human health risks were presented with regard to potential effects from the contaminants of concern. These effects may include potential risks of cancer or non-cancerous (systemic) effects. Cancer risk levels, the lifetime incremental probabilities of excess cancer due to exposure to the site contaminants, take into account exposure concentrations and the carcinogenic potencies of the chemicals. Cancer risks are calculated by multiplying exposure dose by the appropriate cancer slope factor for each compound and exposure route. Health effects associated with exposures to non-carcinogenic chemicals were evaluated primarily with regard to reference dose (RfD) values. The associated risk was quantitated by the Hazard Index ratio, which is the ratio of the exposure dose to the RfD.

The results of the quantitative risk analysis are presented in two basic forms. For carcinogenic risks, risk estimates are presented in scientific notation, where a lifetime risk of 1E-04 represents a lifetime risk of one in ten thousand. *The calculated risk is compared to the acceptable lifetime cancer risk range (1E-04 to 1E-06) for evaluating the need for remediation, as stated in 40 CFR Part 300 (EPA, 1990b). EPA (1990b) considers a cancer risk of 1E-06 as the point of departure for determining risk-based remediation goals.* For non-carcinogenic risks, the Hazard Index Ratio is used. When the total Hazard Index for an exposed individual or group of individuals exceeds unity, there may be concern for potential non-cancer health effects. Thus, the cancer risk and hazard index ratios that constitute a potential concern are *>1E-06* and >1E+00, respectively.

In the qualitative risk assessment, analytes for which quantitative assessments could not be conducted were evaluated to determine if their omission from the quantitative assessment would be expected to have a significant impact on the overall risk posed by the site.

The uncertainty analysis identified the major sources of uncertainty in the risk assessment as follows:

- Exposure assumptions;
- Exclusion of chemicals due to lack of quantitation or missing toxicity data;
- The use of models to estimate concentrations of chemicals in fugitive dust and the volatilization of chemicals during home use of ground water;
- Data uncertainties due to infrequent detections, limited numbers of samples, qualified data, or uncertainties in background sampling locations;
- Toxicity value derivations; and
- Potential interactions between carcinogens and between non-carcinogens which could lead to increased or diminished carcinogenic responses or toxicity.

Chemicals of Potential Concern - Field investigations at SMC included the collection of surface soil, subsurface soil, sediment, surface and ground water samples. Observed contaminants mainly consist of inorganics in soils, sediments and surface water; and VOCs and inorganics in the ground water.

Exposure Assessment - Potential migration pathways identified for this site were as previously described. For volatile organic compounds (VOCs), detections were greatest in ground water. The primary migration pathway for VOCs appears to be through ground water migration. Semi-volatile compounds, which are generally persistent in the environment, were identified primarily, although infrequently, in the surface and subsurface soils, with migration to ground water not considered a primary migration route. Pesticides and PCBs were not generally detected. Inorganics were detected at elevated levels in surface and subsurface soils and in ground water samples, indicating potential migration from the soils to the ground water, and potential for movement off-site within the ground water.

Potential current and future human exposure scenarios developed for evaluation included the common exposure scenarios listed previously.

Toxicity Assessment - The toxic effects of each chemical of concern were evaluated.

Risk Characterization - The estimated risks associated with each scenario evaluated and the exposure pathway(s) driving the calculated risk are summarized below and presented in Table ES-1.

- Trespassing Scenario (Scenario 1) - Total cancer risk *exceeded the target value of 1E-06 by a factor of 2. The* total hazard index ratio *is* below *the* target value *of 1E+00.* The major *pathway associated with the cancer risk is* incidental ingestion of arsenic and beryllium in surface water *(pathway risk = 2E-06) by children age 9 to 18 years.*

TABLE ES-1

SUMMARY OF CANCER AND NON-CANCER RISKS
FOR THE HUMAN HEALTH RISK ASSESSMENT

Scenario		Receptor	Cancer Risk Estimate	Hazard Index Ratio
1	Trespassing	Children	*2E-06*	*1E-01*
2	Commercial/Industrial	Adults	*8E-05*	*7E-01*
3	Residential (Current)	Adults	*4E-02*[A] *8E-03*[B]	6E+02[A] 2E+02[B]
4	Construction	Adults	*1E-06*	*1E+00*
5	Residential (Future)	Children Adults	*9E-05* *2E-04*	3E+00 4E-01

[A] Associated with shallow ground water
[B] Associated with deep ground water

- Commercial/Industrial Use Scenario (Scenario 2) - *Total cancer risk (8E-05) exceeds the target value of 1E-06. The total hazard index ratio is below the target value of 1E+00. The major pathways associated with the cancer risk are dermal contact with PCBs in soil (pathway risk = 5E-05) and incidental ingestion of arsenic, beryllium, and PCBs in soil (pathway risk = 3E-05). Current facility workers constitute the population under consideration for these exposures.*

- Residential Use (Current) Scenario (Scenario 3) - The total cancer risk and the hazard index ratio exceeded the target *values (1E-06 and 1E+00, respectively)* for both shallow and deep ground water. The major contributing factor to the calculation of cancer risk is ingestion of arsenic and beryllium in both shallow and deep ground water *(as a potable source) and trichloroethene in deep ground water (pathway risk = 4E-02 and 8E-03, respectively). Inhalation of airborne trichloroethene (pathway risk = 4E-04, deep ground water only) and dermal exposure to arsenic in ground water (pathway risk = 2E-05 and 1E-05, shallow and deep ground water, respectively) also contributed to the cancer risk.* Similarly, ingestion of inorganics in ground water *(pathway HIs = 6E+02 and 2E+02, shallow and deep ground water, respectively)* was also the primary contribution to the total hazard index ratio.

- Construction Use Scenario (Scenario 4) - The total cancer risk *and the hazard index ratio did not exceed target values.*

- Residential Use (Future) Scenario (Scenario 5) - The total cancer risk for both children and adult *residential* receptors exceeded target values. The hazard index ratio exceeded the target value for children, but not for adults. For children, the major contributing factor to the calculation of cancer risk is incidental ingestion of *arsenic,* beryllium, *several PAHs, and Aroclor-1254* in surface soil *(pathway risk = 9E-05). The major route of exposure for exceedance of the hazard index (for children) is incidental ingestion of vanadium in soil (pathway HI = 3E+00).* For adults, the major contributing factor to the calculation of cancer risk is incidental ingestion of *arsenic,* beryllium, *several PAHs, and PCBs* in soil *(pathway risk = 5E-05)* and dermal contact with PCBs in soil *(pathway risk = 1E-04).* It should be noted that PCBs were detected infrequently at the SMC facility and are not likely to be of concern.

Compounds missing quantitative dose response assessments were evaluated qualitatively. The qualitative analysis of risks did not identify any compounds expected to have a significant impact on the assessment, although the exclusion of strontium and titanium produces some uncertainty in the final estimates.

The uncertainty analysis described the major sources of uncertainty, as identified previously, with respect to the contaminants detected at this site. The most significant sources of uncertainty identified for this site include the use of shallow and deep ground water to the south of the site as a potable source and the limited quantity of the analytical data for selected monitoring wells; future residential use of the SMC site; and identification of PCBs as site contaminants of concern. An additional monitoring well location has been recommended for placement to the south of the SMC facility (along Weymouth Road). This well is expected to further delineate ground water contamination in this area; specifically to help distinguish the chromium plume, and evaluate potential impacts of contaminants such as arsenic and beryllium on private well water quality.

As requested by NJDEPE, a central tendency risk estimate was calculated for the pathways associated with the greatest risk using the 95% UCL exposure point concentration and most likely (50th percentile; central tendency) exposure (MLE) parameters. This sensitivity analysis provided insight into the magnitude of uncertainty associated with the exposure pathways contributing the majority of excess risk. In particular, risks which exceed 1E-06 for the RME, but not the MLE, include:

- *Ingestion of Surface Water (Scenario 1 Current Trespassing),*
- *Dermal Contact with Soil (Scenario 2 - Current Commercial/Industrial Use),*
- *Incidental Ingestion of Soil (Scenario 4 - Future Construction), and*
- *Dermal Contact with Soil (Scenario 5 - Future Residential).*

Elevated hazard indices which exceed 1E+00 for the RME, but not the MLE, is limited to incidental ingestion of soil (Scenario 5 - Future Residential, adult only).

As requested by NJDEPE, the uncertainty assessment also addresses the issue of evaluation of laboratory contaminants in blank samples using the EPA (1989) method versus the

NJDEPE method. This evaluation of the variance between policies with regard to target compounds detected in blank samples indicates that use of the EPA (1989) method would not alter the conclusions of the risk assessment.

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1.0 INTRODUCTION

This report provides a quantitative Human Health Evaluation for Shieldalloy Metallurgical Corporation's (SMC) Newfield, New Jersey facility, as required under Administrative Consent Order (1988). Its primary objectives are to examine exposure pathways and contaminant concentrations in environmental media, and to estimate the potential for adverse effects associated with the contaminants of concern at the site under current and future land use conditions. This assessment evaluates health risks associated with chemical contaminant exposures. An addendum to this report which addresses radiological contamination and associated health risks *is presented as Appendix D.*

Specific exposure scenarios have been considered and developed to represent potential situations in which humans receptors may be exposed to contaminants originating from the site. Efficacy of specific remedial programs are not included as part of this analysis.

Human health risks associated with each site are presented with regard to potential effects from the contaminants of concern. These effects may include potential risks of cancer or non-cancerous (systemic) effects. A quantitative risk assessment for carcinogens involves calculations of the lifetime incremental probabilities of cancer that take into account exposure concentrations and the carcinogenic potencies of the chemicals. Health effects associated with exposures to noncarcinogenic chemicals are evaluated primarily with regard to reference dose (RfD) values. This approach for non-cancer effects is most useful when exposure doses of the chemical are below the RfD thresholds. However, there is often no quantitative way to measure the degree of risk created when concentrations exceed the standard thresholds.

Ultimately, the risk assessment presented in this report is expected to be used within a risk management framework. In making decisions concerning what, if anything, should be done

at a site (including, for example, the collection of additional data or implementation of a remedial program), the results of the risk assessment should be used in concert with other information on the site. The risk assessment also identifies site or land use conditions that present unacceptable risks. The results of the risk assessment identify contaminants and exposure pathways contributing the greatest risk to the receptor population. From this information, recommendations for future activities at the site can be made such that public health is protected.

This evaluation focuses most strongly on the baseline conditions at the site. However, the results of this study will help decision makers focus on the areas, contaminants, media, pathways and receptors of greatest concern at the site, thereby helping to identify future remedial alternatives for the site.

2.0 HUMAN HEALTH EVALUATION

2.1 Methodology

The methodology is structured utilizing the most current methods accepted by the EPA in the Interim Final Risk Assessment Guidance for Superfund, Volume I (Human Health Evaluation Manual - Part A) (1989). Where assumptions are made, they are realistic but conservative, i.e., protective of human health. In keeping with accepted practices for conducting such assessments, all assumptions are carefully discussed and an assessment made of the uncertainty associated with the overall health risk estimates.

Following the guidelines accepted by the EPA, the basic components of the human health evaluation will be organized and presented as follows:

- Data Collection;
- Data Evaluation;
- Contaminant Fate and Transport;
- Exposure Assessment;
- Toxicity Assessment; and
- Risk Characterization *(including an uncertainty assessment)*.

2.2 Identification of Chemicals of Potential Concern

2.2.1 Data Collection

Key elements of the field investigation program are listed in Table 2-1. The primary goal of the field investigation program was to obtain data to:

- Characterize the hydrogeologic regime in the study area, including hydraulic properties of overburden deposits;
- Characterize the type(s) of contamination present in the study area;
- Determine areal and vertical extent of contamination in the media sampled;

- Identify pathways of contaminant migration; and
- Characterize the nature and extent of contaminant migration.

The field investigation activities were completed between October 1990 and April 1991. Results of these activities are presented in the Remedial Investigation (RI) Technical Report (TRC, 1991).

A Radiological Characterization Study required for NRC license renewal has been conducted by SMC for submittal (IT/PS-92-106, April 1992). The purpose of the Radiological Characterization Study is to determine the extent of radiological contamination at and around the facility. The results of the Radiological Characterization Study and radiological sampling and analyses from wells under the ACO will be included in appendices of the final RI report and in the Feasibility Study for the site.

2.2.2 Data Evaluation

As detailed in the RI report (TRC, 1991), SMC has been operating at the Newfield, NJ facility since 1955. Past raw materials and production processes include: chromium oxide and chromium metal production, vanadium pentoxide and ferrovanadium production, uranium oxide, thorium oxide, and ferrocolumbium and columbium nickel production. Field studies have revealed the presence of numerous organic and inorganic contaminants in the soils, surface water, sediments and ground water.

In order to organize the data into a form manageable and appropriate for the baseline health evaluation, the following steps were followed during the data evaluation process as described by EPA (1989):

1) Gather and sort all data by medium (i.e. surface soil, ground water);

2) Evaluate methods of analysis;

3) Evaluate the sample quantitation limits;

4) Evaluate the data qualifiers and codes;

5) Evaluate blank data;

6) Evaluate tentatively identified compounds (TIC's);

7) Evaluate background data;

8) Develop data sets by medium; and

9) Develop a set of chemicals of potential concern from the entire data set.

Briefly, the specific methods used for the SMC site include the following, which correlate with the previously described steps.

1) All analytical data was initially sorted by media (surface soil, subsurface soil, sediments, surface water, ground water and air);

2) An evaluation of analytical methods was not considered to be necessary as all data used in the quantitative analysis was analyzed by EPA's Superfund Contract Laboratory Program (CLP) procedures. *Note: Due to a miscommunication with the laboratory performing the total chromium and hexavalent chromium determinations in soil, all samples were extracted using a 24-hour cold water extraction followed by a colorometric analysis, rather than use of the requested alkaline digestion method. A technical agreement was reached between TRC and NJDEPE that only samples with total chromium results greater or equal to 100 mg/kg needed to be reanalyzed using the alkaline digestion method. Thus, the data set for chromium VI in this risk assessment consists of alkaline digestion method results, where available, and water leach method results, where alkaline digestion method results are not available*;

3) Unusually high sample quantitation limits (SQL's) were not commonly reported in any of the matrices analyzed. This indicates that in most cases, matrix or chemical interferences in the analytical determinations did not cause a loss of sensitivity at this site. One-half of the SQL was used for a non-detectable reading if there was evidence that the chemical is present in that medium. However, for non-detects where it appeared more likely that the chemical could be present at a value greater than 1/2 the SQL, the entire SQL was used. The decision to use the full SQL or 1/2 the SQL was based upon extent and degree of contamination within each medium and potential for migration between media. If a chemical

was not detected in a single medium, transport and fate information was used to determine if its presence in related media should dictate that it be included in the analysis of this apparently non-impacted medium;

4) Data validation qualifiers were assessed during the data evaluation process. As indicated in EPA guidance (EPA, 1989), data qualified with U, J or UJ qualifiers were used in the quantitative risk assessment when appropriate. Not-detect values were not ignored based on the presence of "hits" within the same media;

5) Field and laboratory blanks were used to segregate actual site contamination from cross contamination from field or laboratory procedures. As indicated in EPA (1989), sample results were considered positive only if concentrations exceeded ten times the concentration of a common laboratory contaminant in a blank, or five times the concentration of a chemical that is not considered a common laboratory contaminant. *(Note: As requested by NJDEPE, an evaluation of the variance between EPA (1989) and NJDEPE policies with regard to target compounds detected in blank samples has been included in Section 2.7.3 - Uncertainty Assessment*;

6) Tentatively identified compounds (TICs) were reported infrequently in surface and subsurface soil samples across the site. TICs were detected at 100-1000 mg/kg. Elevated levels of TICs were identified in soil boring 93 (SB-93) (tentatively identified as an organic acid at a concentration of 20,000 ug/kg) and SB-44 (tentatively identified as sulfur at a concentration of 30,000 ug/kg). Due to the uncertainty associated with the quantitative and qualitative nature of these TICs, a quantitative assessment of risk associated with exposure was not included in this assessment;

7) Background soil sampling locations were identified for this site. Surface soil samples *58,* 59, and 60 (*RA-58,* RA-59 and RA-60) were collected from the northwest portion of the site and used as reference points. National background levels (USGS, 1984) were *also* used as a screening method to evaluate non-site related chemicals or commonly encountered naturally occurring chemicals in soil. *Neither site-specific background or national background levels were used to eliminate naturally occurring inorganics from the risk assessment.* Monitoring well 14S (SC-14S) and 3D (W-3D) are located upgradient of the site, and were used as an indication of background ground water conditions. Due to the intermittent nature of the Hudson Branch at upstream locations, it was not possible to accurately determine background or reference points; and

8) Tables 2-2 through 2-5 provide the chemicals and concentrations sampled in surface soils, subsurface soils, surface water and ground water, respectively. Surface runoff sample data were not included in the quantitative assessment because the four runoff samples were collected from major drainage pathways (near their off-site discharge points) during a heavy rainfall and, therefore, were

not considered to be representative of normal surface water runoff. Sediments were not included in this assessment as the nature and extent of contamination was not materially different from soils. Air sampling data was not utilized in the risk analysis based on a short timeframe of sample collection (within a single season).

2.2.3 Field Investigation Summary

The following discussion provides a summary of the field investigation activities which took place between October 1990 and April 1991. Complete details of the field investigation are provided in the Remedial Investigation Technical Report (TRC, 1991). This section serves only as a summary of these activities. Volatile organic compounds and metals (inorganics) were the primary contaminants detected in environmental media at the SMC facility.

In evaluating detected contaminant levels, they were compared against available regulatory action levels. For soils and sediments, contaminant levels were compared to New Jersey Interim Soil Action Levels (referred to hereafter as action levels). For ground water samples, contaminant levels were compared to federal and New Jersey Maximum Contaminant Levels (MCLs). Surface water contaminant levels were compared to New Jersey Water Pollution Control Act (NJWPCA) Maximum Values of Protection of Aquatic Life (Freshwater) and federal MCLs. Air monitoring results were compared to federal Acceptable Ambient Levels (AALs). A summarized discussion is presented in this risk assessment report for informational purposes only. The Remedial Investigation Technical Report (TRC, 1991) contains a complete discussion of contamination at the SMC facility.

It should be noted that "action levels" provide an initial means for the evaluation of contaminant levels and areas of potential concern. It is necessary to evaluate the detected contaminant levels and associated potential risks to human health and the environment with

respect to site-specific land use conditions and exposure pathways. These activities are conducted in this comprehensive baseline risk assessment, in accordance with NJDEPE and USEPA guidance.

For each environmental media sampled, a discussion of the contaminant types detected, the environmental distribution of contaminants, and a comparison of detected levels to regulatory action levels is presented below. Tables 2-2 through 2-5 summarize the analytical data for contaminants in surface soil (0-2' depth), subsurface soil (test pits and borings greater than 2' depth, but no deeper than 12'), surface water and ground water, respectively. This information is presented to provide the reader with an overview of site contamination and to present the calculated representative site exposure point concentrations as used in each exposure scenario. Comparisons to site background were also presented when appropriate, and are discussed in Section 2.3 of this report.

Soil Samples - Soil samples collected from surface soils, test pits and soil borings at the SMC facility primarily exhibit inorganic compounds. Volatile organic, semi-volatile organic, and PCB compounds were detected in soil samples but at levels which do not exceed New Jersey Interim Soil Action Levels. DDT was detected in two soil boring samples at levels of 26 milligrams/kilogram (mg/kg) and 31 mg/kg, which exceed the New Jersey Interim Soil Action Level of 1-10 mg/kg for DDT.

Inorganics were detected most frequently at levels exceeding New Jersey Interim Soil Action Levels. The presence of individual inorganic compounds is discussed below:

> Beryllium (range of detection 0.08-6.01 mg/kg; action level 1 mg/kg) was detected at 152 locations (out of a possible 192 locations) (Tables 2-2 and 2-3) and was detected 66 times in soil samples (53 times in near-surface soil samples) at levels exceeding the action level of 1 mg/kg. The maximum detected concentration of beryllium was 60.1 milligrams/kilogram (mg/kg), detected in a surface sample collected in the southwestern

portion of the Undeveloped Plant Property, along the observed floodplain of the Hudson Branch. Other areas exhibiting elevated beryllium levels (with maximum detected level of beryllium noted) include the Lagoon Area (19.4 mg/kg), the Railroad Siding Area (20 mg/kg), and along the eastern and western sides of the By-products Storage Area (29.3 mg/kg and 22.5 mg/kg, respectively). Each of these elevated levels were detected in surface soils.

Chromium (range of detection 1.5-5,870 mg/kg; action level 100 mg/kg) was detected at 185 locations (out of a possible 192 locations) (Tables 2-2 and 2-3) and was detected at concentrations exceeding the action level of 100 mg/kg a total of 41 times (35 times in near-surface soil samples). The maximum detected concentration of total chromium was 5,870 mg/kg, detected in a surface sample collected in the southwestern portion of the Undeveloped Plant Property, along the observed floodplain of the Hudson Branch. Other areas exhibiting elevated total chromium levels (with maximum detected concentrations noted) include the Department 106 Area (2,280 mg/kg), the Department 102 Area (1,630 mg/kg), the Railroad Siding Area (260 mg/kg), and along the eastern and western sides of the By-products Storage Area (176 mg/kg and 473 mg/kg, respectively). Each of these elevated levels were detected in surface soils.

Nickel (range of detection 1.5-3,360 mg/kg; action level 100 mg/kg) was detected at 142 locations (out of a possible 192 locations) (Tables 2-2 and 2-3) and was detected at concentrations exceeding the action level of 100 mg/kg a total of 29 times (26 times in near-surface soil samples). The maximum detected concentration of nickel was 3,360 mg/kg, detected in a surface sample collected in the southwestern portion of the Undeveloped Plant Property, along the observed floodplain of the Hudson Branch. Other areas exhibiting elevated nickel levels (with maximum detected concentrations noted) include the Lagoon Area (912 mg/kg), the Railroad Siding Area (339 mg/kg), and along the eastern and western sides of the By-products Storage Area (530 mg/kg and 1,110 mg/kg, respectively). Each of these elevated levels were detected in surface soils.

Vanadium (range of detection 3.1-12,100 mg/kg; action level 100 mg/kg) was detected at 188 locations (out of a possible 192 locations) (Tables 2-2 and 2-3) and was at concentrations exceeding the action level of 100 mg/kg a total of 81 times (62 times in near-surface soil samples). The maximum detected concentration of vanadium was 12,100 mg/kg, detected in a surface sample collected in the southwestern portion of the Undeveloped Plant Property, along the observed floodplain of the Hudson Branch. Other areas exhibiting elevated vanadium levels (with maximum detected concentrations noted) include the Department 106 Area (1,190 mg/kg), the Lagoon Area (3,950 mg/kg), the Railroad Siding Area (4,110 mg/kg), the Tank T12 Area (1,810 mg/kg), and along the eastern and western sides of the By-products Storage Area (3,990 mg/kg and 4,750 mg/kg, respectively). Each of these elevated levels were detected in surface soils.

In addition to these inorganics, several other metals were detected at levels exceeding action levels, although less frequently than those discussed above. These metals and the

frequency with which they were detected at concentrations exceeding action levels include antimony (1 time), barium (6 times), lead (1 time), cadmium (1 time), and selenium (1 time). They were detected in the same areas (as identified above) in which other inorganics exceeded action levels. The lead exceedance in the sample was not from the background location. Total detection frequencies for these metals in soils include antimony (31/192), barium (189/192), lead (190/192), cadmium (12/192) and selenium (25/192) (Tables 2-2 and 2-3).

Surface Water Samples - Surface water samples included five water samples collected from the Hudson Branch, as well as four runoff samples collected during a rainfall event from major drainage pathways (near their off-site discharge points). Volatile organic and semi-volatile organic compounds were detected infrequently in surface water samples (Table 2-4), and at levels which do not exceed NJWPCA levels or federal MCLs. Pesticide/PCB compounds were not detected in surface water samples. As with the soil samples, inorganic contaminants were typically detected in surface water samples at levels exceeding regulatory action levels. Total chromium and lead levels (detected at maximum levels of 8,520 micrograms per liter (ug/l) and 1,240 ug/l, respectively) exceeded regulatory levels (50 ug/l and 0.75 ug/l, respectively) at seven sample locations each, beryllium (detected at a maximum level of 468 ug/l) exceeded the regulatory level (5.3 ug/l) at four sample locations, and nickel (detected at a maximum level of 618 ug/l) exceeded the regulatory level (56 ug/l) at three locations. The highest levels of inorganics were generally detected at runoff sample locations, with concentrations generally decreasing as a function of distance downstream of the SMC facility.

Stream Sediment Samples - Five sediment samples were collected from the Hudson Branch. Volatile organic, semi-volatile organic, and pesticide/PCB compounds were detected in the samples, but at levels which do not exceed action levels. Again, inorganic compounds

were commonly detected at levels exceeding action levels. Beryllium, total chromium and vanadium action levels (1 mg/kg, 100 mg/kg, and 100 mg/kg, respectively) were exceeded in each of the sediment samples. Antimony was detected in four of the five samples at levels greater than the action level of 10 mg/kg. In general, the highest levels of inorganics were detected in sediment sample SD02, which was collected south of the lagoon areas on the SMC facility. While inorganic concentrations generally decreased with distance downgradient of the SMC facility, a slight increase was observed in the sediment sample collected at the most downgradient sampling point (SD05).

Ground Water Samples - Two rounds of ground water sampling were conducted: the first in December 1990 and the second in April 1991. Sampling locations changed between sampling rounds, with 52 samples collected in the first round and 39 collected in the second round. In addition to the variations in the well locations sampled, the ground water extraction wells which are used for SMC's current ground water pump and treat system varied from one sampling round to the next. Prior to the December sampling event, SMC was pumping primarily from recovery wells IW2 and SC6D. On January 21, 1991, SMC modified the pumping strategy to increase the extraction of ground water from the lower Cohansey Sand, including ground water extraction at wells RIW2, RW6D and W9 and modification of extraction rates at wells IW2 and SC6D. The modified pumping program could be partially accountable for variations in detected contaminant concentrations at monitoring wells between sampling rounds. Specifically, the addition of ground water extraction at the location of recovery well W9 could impact the contaminant concentrations detected at wells A and SC22D.

Volatile Organics - Trichloroethene (TCE) was the volatile organic compound most commonly detected at levels exceeding MCLs. In the first round, the MCL for TCE (1 ug/l) was exceeded in 23 of 27 well samples, while in the second round it was exceeded

in 23 of 33 samples. In shallow wells screened in the upper Cohansey sand, the highest levels of TCE in each sampling round (120 ug/l and 840 ug/l, respectively) are detected in the general location of the Former Manpro-Vibra Degreasing Unit. Lower levels (5 to 55 ug/l) are detected downgradient to the southwest, extending to the northeast portion of SMC's 7.5 acre parcel. In the lower Cohansey Sand, maximum concentrations of TCE were detected in the first sampling round south of the Lagoon Area (70 ug/l) and to the southwest, with a "hot spot" detected in the northeast corner of SMC's 7.5 acre parcel (330 ug/l). During the second sampling round, maximum TCE concentrations shifted west, from south of the Lagoon Area (35 ug/l) to the southwest portion of the Undeveloped Plant Property (120 ug/l). The "hot spot" previously identified in the northeast portion of the 7.5 acre parcel was confirmed by the second round of sampling (430 ug/l).

Other volatile organics were detected at levels exceeding MCLs at a much lower frequency (1 to 4 times per sampling round), including 1,1-dichloroethene, 1,2-dichloroethene (total), benzene, toluene, and xylene. In both rounds, benzene, toluene and xylene were detected in well SC23S, which was located adjacent to an underground storage tank location. Methylene chloride and acetone, common laboratory contaminants, were typically detected in ground water samples but were also detected in laboratory blanks, indicating their presence may be associated with laboratory contamination.

Semi-Volatile Organics - No semi-volatile organic compounds were detected in either sampling round at concentrations exceeding MCLs.

Pesticide/PCBs - No pesticides/PCBs were detected in the first sampling round. Pesticides/PCBs were not analyzed for in the second round (agreed to by NJDEPE).

Inorganics - Filtered and unfiltered ground water samples were collected for inorganics analysis during the first sampling round. Major anion and cation analysis was also conducted on 15 first round samples to be used in conjunction with Eh and pH data to determine the valence state of chromium in the ground water. Only unfiltered samples were collected during the second round of sampling, and only unfiltered samples were used in this risk assessment.

In general, total chromium and lead were the inorganics most commonly detected above MCLs during the first sampling round, while total chromium and antimony were most commonly detected above MCLs during the second sampling round. The major anion and cation analysis indicated that chromium exists primarily in a trivalent state in the ground water. Although some variability was found, comparison of filtered and unfiltered ground water sample analyses indicated that soluble inorganics are present in the ground water, with metals concentrations in filtered samples typically at similar concentrations to those detected in unfiltered samples. The extent of chromium and other inorganics in the ground water based on unfiltered ground water samples is discussed in detail below.

Total Chromium - During the first sampling round, total chromium was the inorganic most commonly detected at levels exceeding the MCL (100 ug/l). Hexavalent chromium was also commonly detected, although no MCL has been established for hexavalent chromium. Total chromium was detected in the upper Cohansey Sand beneath the Manufacturing Area at concentrations ranging to 20,800 ug/l in the first round, with concentrations generally decreasing to the southwest. An elevated concentration (11,700 ug/l) was detected in a well located near the pumping wells, southwest of the facility. Lesser concentrations (1,180 ug/l and 368 ug/l) were detected further southwest of the pumping wells. In the second round of sampling, total chromium in the upper Cohansey Sand was detected at a maximum level of 7,960 ug/l beneath the Manufacturing Area, ranging to 5,190 ug/l in the area of the pumping wells. Total chromium levels did not extend as far to the southwest as they did in the first sampling round.

In the lower Cohansey Sand, total chromium levels ranged to 108,000 ug/l, detected at a well located just south of the Lagoon Area. Concentrations decreased to the southwest, generally mirroring the southwestern extent of total chromium in the upper Cohansey Sand in the first sampling round, although detected levels of total chromium in these areas were higher in the lower sands (12,600 ug/l and 26,400 ug/l compared to 1,180 and 368 ug/l). In the second sampling round, the maximum total chromium level was again detected south of the Lagoon Area (62,000 ug/l). The southwestern extent of total chromium also mirrored that identified in the shallow sands, with concentrations in the lower sands (12,600 ug/l) exceeding those detected in the upper sands (956 ug/l).

Hexavalent Chromium - For hexavalent chromium in the upper Cohansey Sand, first round sampling results indicated the highest detected level (26,400 ug/l) was located just west of the Lagoon Area, with a second area of elevated concentration (10,600 ug/l) located west of the By-product Storage Area. The contaminant plume extends to the southwest, but not to the same extent as total chromium was detected during the same sampling round. During the second sampling round, detected hexavalent chromium levels decreased in the By-product Storage Area (2,100 ug/l). The wells located west and southwest of the Lagoon Area (IWC2, Layne and K wells) exhibiting elevated hexavalent chromium levels (26,400 ug/l, 19,900 ug/l and 15,100 ug/l, respectively) in the first sampling round were not resampled during the second round; however, a well adjacent to the Layne well (well B) exhibited only 1,600 ug/l hexavalent chromium during the second round. Hexavalent chromium levels downgradient to the southwest remained relatively constant in the second round, with the maximum detected concentration (13,000 ug/l) located in the area of the pumping wells.

Hexavalent chromium in the lower Cohansey Sand was detected at the highest level (60,900 ug/l) in the southwestern portion of the Undeveloped Plant Property, with concentrations extending to the southwest and increasing slightly at a well located in the northeast portion of SMC's 7.5 acre parcel. The southwest extent of the plume generally agrees with the extent of the total chromium plume determined during first round sampling. In the second round of sampling, the maximum level of hexavalent chromium (69,000 ug/l) was detected south of the Lagoon Area, extending west and southwest,

although not into SMC's 7.5 acre parcel. The extent of hexavalent chromium mirrors the extent of total chromium measured during the same sampling round.

Other Inorganics - Lead was detected in ground water at levels exceeding the MCL (5 ug/l) 16 times during the first sampling round and 10 times during the second sampling round. *Lead concentrations in ground water also exceeded the Federal Safe Drinking Water action limit for lead of 15 ug/l. These exceedances occurred 12 times during the first sampling and 5 times during the second sampling round.* The highest level of lead (137 ug/l) was detected at an upgradient shallow well location (W3S). Shallow wells in the northwestern portion of the facility, near the locations of the Railroad Siding Area and Underground Storage Tanks also exhibited relatively high levels of lead (49 to 84 ug/l). MCLs were also exceeded in wells screened within the lower Cohansey Sand, with concentrations generally decreasing to the southwest for both the lower and upper sands. Second round results generally confirmed the lead levels detected in the first round.

Antimony was detected in ground water at levels exceeding the MCL (10 ug/l) 12 times during the first sampling round and 18 times during the second sampling round. During both sampling rounds, maximum levels (2,140 ug/l and 1,340 ug/l) were detected south of the Lagoon Area in well SC22D. A well located in the northeast portion of SMC's 7.5 acre parcel (IW2 - screened from 40 to 70 feet), which was sampled only during the first sampling round, exhibited 573 ug/l antimony, indicating a potential "hot spot". A well located approximately 300 feet northeast of IW2, SC4D, exhibited antimony at 258 ug/l during the first round and 272 ug/l during the second round. Downgradient wells located to the southwest exhibited lesser concentrations of antimony (19 to 45.7 ug/l), although these levels did exceed the MCL.

Other inorganics detected at levels exceeding their associated MCL at frequencies of 1 to 4 times per sampling round include arsenic, beryllium, cadmium, mercury, nickel, and selenium.

Included in the ground water investigation was the sampling of a monitoring well, SC23S, which had been installed downgradient of an inactive underground storage tank which previously held unleaded gasoline. The analytical data from monitoring well SC23S indicated that a discharge of fuel products had occurred. The Closure Plan and DICAR have been submitted to, received and approved by the NJDEPE for closure of the leaking tank near well SC-23S (NJDEPE, 1992).

Table 2-5 presents a summary of ground water contaminant concentrations for monitoring wells SC-22, SC-13, D and W2. These wells were chosen as representative of potential contaminant migration to private wells located to the south of the SMC facility and, therefore, outside of the well restriction area. Comparison of contamination in these wells to upgradient water quality is presented in Table 2-5.

Air Samples - A total of 72 air/dust samples were collected during twelve sampling events at the SMC facility. Titanium was the only metal species detected at a concentration exceeding federal Acceptable Ambient Levels (AALs), and it was detected at these levels at one sample location in only two (2) of twelve (12) sampling events. No site-specific air criteria for metal species have been developed by NJDEPE for the SMC facility.

A review of the meteorological and chemical concentration data indicates variability in contaminant levels, which would be expected given the various meteorological conditions under which the monitoring occurred, as well as a relative consistency between the areas in which the highest particulate concentrations were detected and potential upgradient source areas, depending on the wind conditions on a particular day. Based on the air monitoring results, it is likely that particulate sources are not collocated and that particulate source locations are variable based on ongoing site operations (especially material storage activities within the By-Products Storage Area).

Air/dust sample results were not used in this risk assessment for the following reasons:

- Air/dust samples were taken under non-operational conditions at the SMC facility;
- Air/dust samples were taken over a twelve-week period which may not be representative of annual dispersion events;
- Contribution of source areas (in particular, material storage in the By-Products Storage Area) can not be readily separated from surface contaminant erosion; and

- Scenarios of most concern which addresses exposure to fugitive dust constructed for this risk assessment include events involving activities on-site rather than non-operational conditions.

Fugitive dust modeling was used to evaluate dispersion of surficial contaminants at the SMC facility (EPA, 1988). This approach is highly conservative in that concentrations of modeled suspended contaminants are greater than monitored suspended contaminants.

2.3 Contaminant Fate and Transport

This section of the risk assessment evaluates the fate and transport of contaminants associated with the site and provides an indication of future contaminant movement. Section 2.2.3 outlines the occurrence of contamination across the site in surface soil, subsurface soil, and ground and surface water. Observed contamination consists mainly of numerous inorganics in the surface and subsurface soils, ground water and surface water, and VOCs in the ground water.

2.3.1 Potential Routes of Migration

To determine the fate of contaminants of potential concern at the site, information on the physical/chemical and environmental fate properties was collected for site contaminants. This information is presented in Table 2-6 for selected contaminants of concern. Several of the environmental media studied have the potential for off-site migration, primarily surface soils and ground water. Subsurface soils are not likely to be at risk of transport off-site unless exposed by excavation. Although the subsurface soils contain several chemicals of concern, the mode of transport of the chemicals would be primarily through leaching and ground water transport.

Contaminants in surface soils can migrate or be carried from the site by surface runoff (resulting from precipitation), in the form of fine particulates sorbed to windblown dust, and by users of the site via vehicle tires, shoes, etc. In addition, contaminants can move from the surface soils (leaving the soils in place) through leaching by infiltration of precipitation and transport by ground water, and volatilization to ambient air. Finally, transport of contaminants to plants or animals which may potentially be consumed by humans is a possible route of migration.

The sampling results have demonstrated that ground water has been impacted by the site thus presenting a possible migration path for contaminants which have leached downward through soils. In accordance with NJS 40:63-52, et seq., the City of Vineland has designated an area of the city as an aquifer exclusion zone, requiring mandatory connection with public water systems and sealing of domestic and supply wells. Thus, migration off the site via production wells is not occurring.

2.3.2 Contaminant Distribution and Observed Migration

The following section examines contaminant presence across the site, (also discussed in Section 2.2.3), in combination with the migration pathways to provide an understanding of contaminant persistence and migration at the site. The discussions below are presented with respect to individual contaminants or contaminant groups. Contaminants observed in the environmental samples collected from the site include inorganics, volatile organic compounds, semi-volatile organic compounds and pesticides/PCBs.

Inorganic Analytes

Many metals have an affinity for soils (particularly clay particles and organic matter in soils) which reduces their mobility. Under extremes of pH, some metals can be rendered mobile. The presence of the inorganic analytes, particularly the naturally occurring elements, must be examined in the context of site background concentrations, as presented in Table 2-2. The analytes which appeared elevated above site background surface soil levels in one or more samples are: aluminum, antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, chromium, iron, manganese, lead, mercury, nickel, selenium, silver, vanadium, cyanide, boron, niobium, strontium, titanium and zinc. The analytes which appeared elevated above site background in subsurface soil samples include aluminum, antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, chromium, lead, manganese, nickel, selenium, silver, vanadium, boron, titanium and zinc.

All inorganics with the exception of antimony (1/10), selenium (2/10), silver (1/10), cadmium (1/10), mercury (3/10) and cyanide (3/10) were widespread in ground water samples, suggesting migration has occurred from soils. Comparison of inorganic concentrations in ground water on-site to upgradient concentrations (monitoring well SC-14S and W-3D) indicates that a general trend of elevated concentrations occurs for all inorganics with the exception of zinc.

Detailed analysis of the ground water results indicates that inorganic contamination exists beneath the SMC facility, extending in a general plume to the southwest. While chromium is the major inorganic contaminant in the south-westerly plume, beryllium, nickel and vanadium levels are also significantly elevated, suggesting movement of these analytes in the ground water.

Further evidence of the potential migration of inorganics off-site was indicated in the five surface water (SW) samples collected from the Hudson Branch (SW-1 through SW-5) and the

four runoff samples collected south of the SMC facility (SW-6 through SW-9). Aluminum, barium, beryllium, chromium, copper, manganese, nickel, vanadium, zinc and fluoride were detected in these samples, with concentrations generally decreasing as a function of distance from the site, again suggesting movement of these analytes in the stream.

Analysis of stream sediments taken from the Hudson Branch also support the off-site migration of inorganic contaminants, showing a general decrease in contamination with distance downstream. However, there was a slight increase in sediment inorganic levels in sediment sample 05 (SD-05), the sampling point located the greatest distance from the SMC site. This suggests that there may be an additional off-site source of inorganic contamination.

Volatile Organic Compounds

In general, volatile organic compounds (VOCs) were detected infrequently, with some exceptions (e.g., trichloroethane (11/14), tetrachloroethane (7/14) and toluene (5/14) in surface soil; trichloroethene (10/38) and acetone (9/38) in subsurface soil), and at low concentrations in soils on-site. VOCs were not detected in ground water with the exception of trichloroethene (2/7) and tetrachloroethene (1/7). Only three VOCs were detected in surface water, each at a frequency of 1/5 (chloromethane, 1,2-dichloroethene and trichloroethene). These VOCs were detected at sampling point SW-4, which is downgradient of the SMC facility, suggesting either migration of the VOCs or an off-site contamination source.

The principal mechanism for the natural removal of aromatic VOCs is through volatilization (EPA, 1979). Vapor pressures (@ approximately 20°C) of the VOCs of concern range from 7 mm Hg (ethylbenzene) to 1011 mm Hg (chloromethane) and Henry's Law Constants range from 2.74 x 10^{-5} atm-m^3/mol (2-butanone) to 1.11 x 10^{-2} atm-m^3/mol

(chloromethane) (see Table 2-6 for Physical/Chemical and Environmental Fate Properties). The role of biodegradation in the natural attenuation of these compounds is compound specific. Ranges of half lives of VOCs in surface water tend to be short (1-2 weeks) with a few exceptions. Similarly the role of adsorption is compound specific (e.g. acetone has little tendency to be retained by soils); the amount adsorbed is highly related to the amount of organic carbon in the soil and is represented numerically by the organic carbon/water partition coefficient (K_{oc}). The compounds with higher K_{oc} (e.g., ethylbenzene) would be preferably partitioned to organic matter in soils and thus would be less likely to be leached from the soils and transported to the ground water. Some aromatic hydrocarbons are highly mobile. Benzene, for example, has a moderate solubility (1750 mg/l), low K_{oc} (83 ml/g) and short half life (1-6 days in surface water). Therefore, benzene, because of its tendency to volatilize and biodegrade, would be mobile but would not be expected to be very persistent in the environment. Conversely, xylenes, with their lower solubilities (198 mg/l) and higher K_{oc} (240 ml/g), would not be as mobile as benzene, but would be more persistent in the environment as they would tend to sorb to soil particles. Examples of VOCs identified in the surface soil samples included tetrachloroethene, trichloroethene and toluene, probably as a result of their relatively high K_{oc}, low water solubility and low vapor pressure.

Subsurface soils contained many VOCs; primarily at low concentrations. Subsurface soils showed the greatest pattern of occurrence of VOCs of the four media sampled. VOCs detected most frequently and at the greatest concentration in subsurface soils include acetone and trichloroethene. In general, these contaminants are only moderately mobile in soils, and their presence in subsurface soils may be enhanced by past site practices. Based on the mobility,

vapor pressure, water solubility and potentially, site practices, of these VOCs, it is not unusual that increasing patterns of detection were found in subsurface soils as compared to surface soil.

Four monitoring wells were used in this risk assessment. One sample was taken from each well during round one and one sample was taken from three of these wells for round two, for a total of seven samples. Only two VOCs were detected in ground water samples. Trichloroethene was detected in 2 of 7 samples at concentrations of 35 mg/l and 70 mg/l (SC-22D). Therefore, TCE was detected in the same well during both the first and second rounds of sampling. Tetrachloroethene was detected in 1 of 7 samples at a concentration of 1 mg/l. The chemical/physical and environmental fate data indicate that these hydrocarbons have the potential to migrate downward in soils to ground water.

Ground water beneath the site exits the site primarily to the southwest both as shallow and deep ground water. Contamination present in downgradient monitoring wells SC-2D, SC-21S and SC-21D is considered to be indicative of potential migration of contaminants in ground water off-site. Examination of patterns of VOC occurrence in these wells (both shallow and deep) indicates that some migration of VOCs, in particular trichloroethene, may be occurring. The presence of trichloroethene in the stream sediment sample SD-5, located farthest downstream from the SMC facility, suggests another source of contamination off-site.

Semi-Volatile Organic Compounds

The semi-volatile organic compounds were identified primarily in soils sampled on-site. The semi-volatile organic compounds, particularly the PAHs, are persistent in the environment due to their complex chemical nature. Some of the lighter PAHs (fewer aromatic rings) would be subject to biodegradation or volatilization, but the chemical persistence generally increases

with increasing number of aromatic rings. Semi-volatile organic compounds are generally characterized by high boiling point, low vapor pressure, and low solubility (except phenols) (Table 2-6).

The semi-volatile organic compounds will be divided into the following groups for discussion: polynuclear aromatic hydrocarbons (PAHs) and naphthalene, phenols, and phthalates.

Polynuclear aromatic hydrocarbons (PAHs) were infrequently detected in surface and subsurface soils on-site with the most frequent detection occurring for fluoranthene (9/34 in the subsurface soil). No PAHs were detected in ground water or surface water. PAHs generally have a very low solubility (<4.0 mg/l). The K_{oc}'s of PAHs are generally greater than 2,500 ml/g, with many greater than 100,000 ml/g. This indicates that PAHs readily adsorb to organic carbon in soils, and most likely accounts for the lack of contamination in ground water samples. However, there is an indication that PAHs can migrate off-site as evidenced by the presence of fluoranthene, pyrene, benzo(b)fluoranthene and chrysene in stream sediments, particularly from sampling point SD-04, located downstream from the SMC site. The route of migration is most likely due to surface runoff during storm events.

Phenols and phenol compounds were rarely detected in any of the media sampled. Phenols and phenol compounds are generally more soluble in water than other semi-volatile organic compounds and display a relatively low volatility (the vapor pressure of phenol is less than the aromatic hydrocarbons). Based on the relatively low K_{oc} and high solubility of phenols, they would not tend to adsorb to soils' organic matter; but would tend to leach from soil into ground water. Only phenol and pentachlorophenol were detected in surface soil, while phenol,

2,4,5-trichlorophenol and pentachlorophenol were detected at a frequency of only 5% in subsurface soil.

Phenols were not detected in ground water or surface water. However, phenol was detected in stream sediments at sampling points SD-01 and SD-04, and pentachlorophenol was detected at sampling point SD-01. It is unclear if phenols are migrating off-site, or if there is an off-site source of contamination.

Phthalate compounds were reported infrequently in samples from all environmental media collected at the site. Di-n-butylphthalate and bis(2-ethylhexyl)phthalate were detected at $<5\%$ in surface and subsurface soils and in surface water. It should be noted that phthalates are considered to be common laboratory contaminants and are widespread in the environment (ATSDR, 1987; ATSDR, 1989). Phthalate esters generally occur in association with other semi-volatile organic compounds. They generally exhibit low solubility and high K_{oc}, and so would not be particularly amenable to water transport. This is somewhat consistent with the site data which show the phthalates occur at much greater concentrations in soil samples as compared to ground water. Only bis(2-ethylhexyl)phthalate was detected in ground water at 4 mg/l (below the detection limit of 10 mg/l) in SC-13D. There is some evidence of migration of phthalate compounds since both di-n-butylphthalate and bis(2-ethylhexyl)phthalate were both detected in stream sediments at sampling point SD-04. Additionally, di-n-butylphthalate was detected in 3 of the 4 surface runoff samples collected south of the SMC facility. As indicated previously, it is unclear if an off-site source of contamination if present.

Pesticides and PCBs

The pesticide 4,4-DDT was detected in 5 of 34 subsurface soil samples but was not detected in surface soil. The PCBs (Aroclor-1248, Aroclor-1254 and Aroclor-1260) were detected at least one time in surface soil, while only Aroclor-1260 was detected in subsurface soil (1/40). PCBs and pesticides were not detected in ground water or surface water. In general, pesticides and PCBs have an affinity for organics in soils (e.g., K_{oc} of DDT is 243,000 ml/g), which tends to render them immobile. In addition, many pesticides and PCBs are very persistent.

While pesticides and PCBs at the site appear confined to soils, there is some evidence that these compounds may be migrating off-site since 4,4-DDE, 4,4-DDD and 4,4-DDT and Aroclor-1254 were detected at sampling points SD-01 and SD-04. In addition, it should be noted that agriculture in areas surrounding the plant and adjacent to the Hudson Branch, as well as other industry in the area, could be off-site sources of contamination.

2.4 Selection of Chemicals of Concern

The purpose of the selection process is to identify the site-related constituents which are likely to contribute significantly to the estimates of human health risk. The approach for selection of constituents of concern (COCs) included consideration of detection frequency but does not include comparison to available background data. A constituent was excluded if it was not detected in the medium of interest. Constituents were excluded if found in less than 5% of the samples for the medium (with a minimum of 20 samples). These constituents were excluded regardless of whether they were detected in more than 5% of the samples in another medium.

(Note: The 5% exclusion test is not used if fewer than 20 samples were collected for the area under consideration.)

Background samples RA-58, RA-59, and RA-60 were not used to exclude COCs from the risk assessment. Rather, this background data is used to evaluate any naturally occurring inorganics that are associated with elevated cancer risk or non-cancer hazard quotients in the uncertainty analysis.

For ground water, COCs were not excluded on the basis of comparison to background (upgradient) ground water quality.

For surface water, COCs were not excluded on the basis of comparison to concentrations upstream.

Table 2-7 presents the final list of COCs selected for inclusion in the risk assessment. Table 2-8 presents the list of constituents excluded as COCs in the risk assessment.

2.5 Exposure Assessment

2.5.1 Development of Exposure Scenarios

The most critical aspect of a technically sound exposure assessment is the identification of exposure routes, together with the identification of human receptors. A portion of the SMC site is currently an active industrial facility, and the property is covered with buildings and pavement. There is also an undeveloped portion of the site which is partially devoid of any ground cover (e.g., vegetation, pavement). Access to the SMC site is restricted at the road by a gate and guard. The restricted industrial area is surrounded by a chain link fence, which is topped by barbed wire. A portion of the undeveloped SMC site is unrestricted and, therefore,

accessible to trespassers. Based on discussions with field personnel, SMC personnel, NJDEPE, and a site visit, the following potential current human exposure scenarios were identified:

- Persons having access to the site (i.e., nearby residents) may be potential receptors (especially children playing on the site). Information from field personnel indicates that children do not trespass on the site or do so on a highly infrequent basis.

- SMC employees who are required on a daily basis to load/unload storage material on the undeveloped portion of the site (unpaved and unvegetated) would be exposed to site contaminants.

- Use of ground water as a potable drinking water or agricultural source is restricted. However, residents who live outside of the well restriction area (along East Weymouth Avenue) may currently be exposed to contaminants in ground water. The NJDEPE is currently investigating the presence of residential wells in this area.

Two potential future exposure pathways exist at the site, including:

- Construction of buildings on the site (i.e., development of the site as house lots or for further industrial development of the site), presenting a potential for exposure of construction workers to site contaminants.

- Residential use of the site, presenting a potential for exposure of adults and children to site contaminants.

Each scenario includes a particular potential "receptor population", and a consideration of the pathways by which those receptors may encounter contaminants of concern. The values and assumptions used for each exposure scenario were prepared in keeping with generally accepted values in the discipline of risk assessment; the values are not based on detailed time-activity studies, with the exception of current industrial for which activity patterns have been established. Specific assumptions and details for each exposure scenario are presented in Appendix A.

2.5.2 Exposure Scenarios Addressed in the Health Assessment

Scenario 1 - Trespassing Scenario (Current)

Appendix A presents the models for the exposure routes and assumptions associated with children trespassing on the unrestricted portion of the site as it currently exists. It is assumed that children living within the immediate vicinity of the site may trespass on an infrequent basis (30 days per year). Additionally, on days in which children trespass/play on-site, it is assumed that all soil ingestion (100 mg/day) for that day occurs on-site and that the ingestion rate for surface water is 50 ml/day (EPA, 1989). Children are not likely to enter the site on a regular basis and without adult supervision before the age of 9 years due to the distance of the site from residences. Regular exposures of this nature are not expected beyond the age of 18 years because of changes in the use of recreational time. Play activities are expected to involve contact with surface soil outside of the fenced industrial area and stream water from the Hudson Branch. As a result, they may receive dermal and ingestion exposures to contaminants in soil and water. *Thus, the following exposure pathways were selected for inclusion in the current trespassing scenario:*

- *Dermal absorption of contaminants in surface soils and surface water*
- *Incidental ingestion of contaminants in surface soils and surface water*

Exposure pathways not selected for inclusion in the current trespassing scenario and the accompanying rationale for exclusion include:

- *Dermal absorption of contaminants in sediments from the Hudson Branch (sediment samples SD-1 through SD-5). Contaminant type and concentrations were not materially different from surface soil and were expected to present similar or lower risks than those from surface soil.*

- *Dermal absorption or ingestion of contaminants in ground water, or inhalation of volatiles from ground water. Ground water is not accessible to a trespasser at the site.*

- *Inhalation of contaminants in fugitive dust. The unrestricted portion of the site is well vegetated with areas of grass, shrubs, and trees and, thus, this pathway is not likely to be of concern.*

Figure 2-1 presents the surface soil sampling locations utilized to estimate exposure to environmental concentrations of contaminants in soil. Surface water data utilized in this scenario include SW-1 through SW-5. Run-off samples (SW-6 through SW-9) were not included in this assessment. Contaminant type and concentrations were not materially different from surface soil and were expected to present similar or lower risks than those from surface soil. For dermal exposures, penetration of contaminants in soil and water was modeled as described in Appendix A (EPA, 1989). Absorption of soil and water contaminants after ingestion is also provided in Appendix A (NJDEPE, 1991).

Table 2-9 illustrates the routes of exposure and associated exposure parameter values for Scenario 1 - Trespassing (Current).

Scenario 2 - Industrial Use Scenario (Current)

Currently, employees at the Shieldalloy Metallurgical Corporation facility provide daily transport of materials from the industrial building to an undeveloped (fenced) portion of the site for storage. This storage area is completely devoid of any type of ground cover (e.g., vegetation, pavement). These SMC employees could be exposed through inhalation to contaminants in dust, as well as through dermal and ingestion exposures to contaminants in soil. It is assumed that exposure time will be limited to one hour per day based on known activity patterns at the site. Activities include periodic trips to pick-up and dump slag on the unpaved

portion of the site and other miscellaneous maintenance visits. *Thus, the following exposure pathways were selected for inclusion in the current industrial use scenario:*

- *Dermal absorption of contaminants in surface soils*
- *Incidental ingestion of contaminants in surface soils*

Exposure pathways not selected for inclusion in the current industrial use scenario and the accompanying rationale for exclusion include:

- *Dermal absorption of contaminants in sediments or surface water from the Hudson Branch. The Hudson Branch is outside the industrial area of the site. Activities are contained within the fenced area.*
- *Dermal absorption or ingestion of contaminants in ground water, or inhalation of volatiles from ground water. Ground water is not used as a potable source for the facility.*

Figure 2-2 presents surface soil sample locations used to estimate the exposure point concentrations for this scenario. In general, surface soil samples located outside of the by-product storage area or samples taken beneath paved areas were not included in the analysis. The inhalation rate is based upon workers undergoing moderate exertion (EPA, 1991). Dermal penetration and absorption of contaminants in soil was modeled as described in Appendix A (NJDEPE, 1991). The soil ingestion rate used is 100 mg/day (EPA, 1991).

Table 2-9 illustrates the routes of exposure and associated exposure parameter values for Scenario 2 - Industrial Use (Current).

Scenario 3 - Residential Scenario (Current)

In accordance with NJS 40:63-52, et seq., the City of Vineland has designated an area of the city as an aquifer exclusion zone, requiring mandatory connection with public water systems and sealing of domestic and supply wells (Figure 2-3). Residences located outside of

this well restriction, primarily to the south of the site (along East Weymouth Road) may use private wells as a potable drinking water source and thus may potentially be exposed to contaminated ground water. The NJDEPE is currently investigating the use of private wells in this area.

This scenario was constructed to evaluate the possible risks associated with current residential ground water use. *Thus, the following exposure pathways were selected for inclusion in the current residential scenario:*

- *Ingestion of ground water,*
- *Inhalation of volatile organic compounds from ground water released into bathroom air during showering, and*
- *Dermal contact with contaminants in ground water.*

These exposures are assumed to occur on 350 days/year for 30 years. The exposure period for bathing is 12 minutes/day and adults are assumed to ingest 2 liters of water per day. *Exposure pathways not selected for inclusion in the current residential scenario and the accompanying rationale for exclusion include:*

- *Dermal absorption of contaminants in sediments and surface water from the Hudson Branch. While residents may potentially have access to the Hudson Branch, these exposures are considered under the current trespassing scenario and not repeated here.*
- *Dermal absorption or ingestion of contaminants in surface soil. Surface soil at residential locations is not impacted by the site and therefore not of concern. While residents may potentially have access to the unrestricted portions of the site, these exposures are considered under the current trespassing scenario and not repeated here.*
- *Inhalation of contaminants in fugitive dust. Residential areas are located such that movement of fugitive dust from non-vegetated areas of the site is not likely to be of concern. Furthermore, physical features such as tree lines inhibit movement of such windborne dusts.*

Monitoring wells SC-22, SC-13, W2 and D were chosen in discussions with field personnel, SMC personnel and NJDEPE as monitoring points representative of current contamination to the south of the SMC site (Figure 2-4). It is not certain at this time whether private wells have been drilled into shallow or deep ground water. Because of this uncertainty, two potential exposure points were used to address risk from ground water use. That is, separate data sets, exposures and risks were assembled for shallow and deep ground water contamination.

Table 2-9 illustrates the routes of exposure and associated exposure parameter values for Scenario 3 - Residential (Current).

Scenario 4 - Construction Scenario (Future)

Appendix A presents the model inputs for the exposure routes that construction workers involved in site development (e.g., building homes) could potentially encounter. Excavation and site preparation activities could cause workers to receive inhalation exposure to contaminants in dust, as well as dermal and ingestion exposures to contaminants in soil. *Thus, the following exposure pathways were selected for inclusion in the current construction scenario:*

- *Dermal absorption of contaminants in subsurface soils*
- *Incidental ingestion of contaminants in subsurface soils*

Exposure pathways not selected for inclusion in the current construction scenario and the accompanying rationale for exclusion include:

- *Dermal absorption of contaminants in sediments or surface water from the Hudson Branch. The Hudson Branch is outside the industrial area of the site. Activities are likely to be contained within the fenced area.*

- *Dermal absorption or ingestion of contaminants in ground water, or inhalation of volatiles from ground water. Ground water is used as a potable source for the facility.*

Figure 2-5 presents the subsurface soil sampling locations (greater than two feet, but less than 12 feet in depth based on generic building foundations) used to model exposure estimates for construction workers. It is assumed that workers are engaged in construction, with excavation and site preparation activities lasting for 180 working days. It is also assumed that remediation of contaminants would not occur prior to construction. The inhalation rate is based upon workers undergoing moderate exertion (EPA, 1991), and dermal penetration of contaminants in soil was modeled as described in Appendix A (NJDEPE, 1991). The soil ingestion rate used is 480 mg/day (EPA, 1991).

Table 2-9 illustrates the routes of exposure and associated exposure parameter values for Scenario 4 - Construction (Future).

Scenario 5 - Residential Scenario: Children and Adults (Future)

A future use residential scenario was constructed to evaluate the possible risks associated with residing on the site and using the ground water under current conditions of contamination. All surface soil sampling locations (including borings 0-2 feet) and surface samples taken from beneath paved areas were included in the calculation of exposure point concentrations (Figure 2-5). Use of the ground water as a potable drinking water source is not included as this area is supplied with public water. The relevant exposure pathways are indoor and outdoor ingestion of dust/soil (this will be evaluated in 0-6 year old children and for adults), outdoor dermal exposure to soil contaminants (adults) and outdoor inhalation of contaminants in dust

(adults). *Exposure pathways not selected for inclusion in the future residential scenario and the accompanying rationale for exclusion include:*

- *Dermal absorption or incidental ingestion of contaminants in sediments or surface water from the Hudson Branch. These exposures are considered in the current trespassing scenario and are not repeated here.*
- *Dermal absorption or ingestion of contaminants in ground water, or inhalation of volatiles from ground water. Use of the ground water as a potable drinking water source is not included as this area is supplied with public water.*

Appendix A presents the model inputs for the exposure routes that children and adults who live on-site might receive. These exposures are assumed to occur 350 days/year for 6 years for children and 30 years for adults (EPA, 1989; 1991). The time period for outdoor exposure to fugitive dusts is 4 hours/day for adults. Children are assumed to ingest 200 mg of soil/house dust per day, while for adults, the value is 100 mg soil/day.

Table 2-9 illustrates the routes of exposure and associated exposure parameter values for Scenario 5 - Residential (Future).

2.5.3 Estimating Environmental Concentrations

All exposure point concentrations used in assessing receptor dose were calculated as specified in Chapter 6 of the Risk Assessment Guidance for Superfund (EPA, 1989). This statistical method uses a confidence interval to calculate a theoretical concentration from actual on-site samples. The confidence interval to be used is the 95% upper confidence limit. The results of this method represent an "upper-bound" on the average concentration; the probability that the actual average concentration on the site exceeds this value is estimated to be less than 5%. The confidence intervals for this application were calculated for a log-normal distribution. This distribution was chosen based on an examination of the measured data. Most measured

concentrations are relatively low, with a few values higher than the majority by at least one order of magnitude. For this type of data set, the log-normal distribution is more suitable than the standard normal distribution. The 95th % upper confidence limit was calculated for each compound in each environmental media based on actual compound concentrations found on-site. The upper confidence limits used in this assessment were calculated using the following formula:

$$UCL_{95} = \exp\left(Y_{ave} + 0.5\, Sy_2 + \frac{Sy\, H_{95}}{\sqrt{n-1}} \right)$$

where:

UCL_{95} = the 95th percentile upper confidence limit average concentration value

y = lnC

Y_{ave} = the average of the natural logarithms of all concentrations

Sy = the standard deviation of the logarithms of the concentrations

n = the number of samples

H_{95} = a statistical parameter which depends upon n and Sy, obtained from a look-up table (Gilbert, 1987).

As indicated in Section 2.2.2 (Data Evaluation), non-detected values were included in the calculation of exposure point concentrations (i.e., soil concentrations). These non-detected values included both detection limits and estimated sample quantitation limits (SQLs). In general, detection limits were used as reported, while SQLs were evaluated in light of detection limits and quantifiable concentrations ("hits") of each contaminant. Each SQL was independently analyzed and used either as the estimated SQL or one half (1/2) of the SQL.

When few data points are available for statistical analysis (<10 data points), the 95% UCL is artificially inflated and exceeds the maximum detected concentration. In these cases,

the maximum detected value was used as the exposure point concentration rather than the 95% UCL.

2.5.4 Evaluating Uncertainty

The exposure estimates produced for each receptor in each scenario are based on numerous parameters having varying degrees of uncertainty. This discussion will focus on these parameters, and the associated range of uncertainty. Table *2-10* and the discussion which follows are separated into those parameters which apply to all scenarios (i.e., global variables), and those which apply specifically to an individual scenario.

- Global Variables (All Scenarios)

Table *2-10* lists the *ranges of* parameters and associated values which are used in each of the scenarios. Body weight ranges for children (age 0-6 years and 9-18 years) were derived from EPA (1990). The actual values used represent an average body weight for each of the groups. Similarly, for adults (18-65 years), a range of body weights is presented, along with the average body weight for the group. While there is a range of body weights for each age group, these ranges are not large, and are not expected to contribute a significant degree of uncertainty to this assessment.

For Scenario 1, the exposure duration (ED) for children was assumed to be nine years, based upon the age range of children (9 to 18) likely to trespass onto the site. In theory, this duration might range from 1 to 18 years; however, it is unlikely that children younger than 9 years of age would visit the site. For Scenario 2 (industrial exposure), employees were expected to spend 25 years on-site, which is representative of the amount of time expected for

employment at one location. For Scenario 3 (current residential), only adults were considered and they were assumed to have an ED equal to 30 years, which is the national upper-bound (90th percentile) time at one residence. For Scenario 4 (construction), workers were expected to have an ED of 1 year, based on the amount of time spent developing the site. Finally, for Scenario 5 (future residential), the exposure durations for children and adults were considered separately. Children ages 0-6 were expected to spend the entire six year timeframe on-site. For adults, the ED value was assumed to be 30 years, reflecting the national upper-bound (90th percentile) time at one residence. The ranges associated with ED are only large when considering adults. However, the values used are expected to provide conservative estimates and overstate the potential risk.

Averaging time (AT) which is a pathway specific period of exposure for non-carcinogenic effects, calculated as a product of exposure duration and the number of days/year, is dependent on exposure duration (ED), which was presented above. AT is not expected to lend a large degree of uncertainty to the exposure estimates.

The potential ranges of absorption factors (AF) for *cadmium and PCBs range from 0.001 to 0.01, and 0.006 to 0.06, respectively (EPA, 1992b).* This range is *not* likely to contribute a large degree of uncertainty to the exposure estimates. The values chosen for AF are *the upper-bound values for each of the two ranges.*

The permeability constant (PC) for each chemical was assumed to be equal to the penetration rate of water, rather than on a compound specific basis (EPA, 1989). Thus, the assumed PC may lend a degree of uncertainty in that some compounds will not readily penetrate skin, while others will penetrate at a rapid rate.

The range of adherence factor of soil to skin is small (0-2.77 mg/cm^2). Based upon the adherence of potting soil to skin, a value of 1.45 mg/cm^2 was used in the exposure estimates.

The fraction of soil ingested (FI) from the site ranges from 0-1 (EPA, 1989). As a highly conservative estimate, and on an event-based approach, was assumed that all soil ingested came from the site.

Finally, concentrations of contaminants in all media were presented as a 95% UCL or as a maximum detected concentration. For some chemicals the range of potential concentrations across the site is very large or the frequency of detection is very low, introducing a high degree of uncertainty to the exposure estimates. However, the exposure estimates are expected to over predict rather than under predict, and therefore are protective of human health.

- Scenario 1 - Recreational/Trespasser Exposure (Current Use)

The exposure frequency (EF may range from 1 to 365 days/year) may introduce the greatest degree of uncertainty. The value used (*30* days for children*; NJDEPE, 1994*) was based on *easy access to unrestricted portions of* the site. Skin surface area, exposure time and soil ingestion rate also present a large range of values but these parameters are not expected to introduce a large degree of uncertainty into the exposure estimates.

- Scenario 2 - Industrial Exposure (Current Use)

This site is currently an active industrial facility. SMC employees are responsible for moving material from buildings on the site to an undeveloped portion of the property on a daily basis. During this time workers may be exposed to site contaminants following inhalation of fugitive dusts, dermal contact with soil or incidental ingestion of soil. Of the parameters

presented in Table *2-10*, the modeled ambient dust concentration is expected to present the largest degree of uncertainty to the exposure estimates. Exposure point concentrations available at the site include concentrations in soils. Airborne concentrations of contaminants (i.e., fugitive dusts) were sampled during the field program. Comparison of monitored and modeled exposure point concentrations indicate that the modeled concentrations are highly conservative and thus overly protective of human health. Names and citations for the transport models used to estimate exposure point concentrations from laboratory measurements of field samples are given in Appendix A. As a caveat, it is always more accurate to have data for exposure point concentrations in the medium of concern at the exposure point of concern, and the use of transport models represents a good faith attempt to estimate unknown values from known values. However, the use of the models does introduce uncertainty into the results. Of the remaining parameters, the ranges of skin surface area are quite large, and may also contribute a large degree of uncertainty to the exposure estimates. The EF for Scenario 2 is not expected to contribute a large degree of uncertainty to the exposure assessment. Of the possible range of values (1-365 days/year), the value chosen (250 days/year) is most likely to be representative of exposure. The soil ingestion rate can also vary over a large range of values (0-480 mg/day), and the value of *100* mg/day was chosen for this scenario to reflect that the exposure would take place on an industrial site.

- Scenario 3 - Residential Scenario (Current Use)

Of the parameters presented in Table *2-10*, inhalation exposure to VOCs emanating from tap water during showering is expected to present the largest degree of uncertainty. Exposure point concentrations available at the site include concentrations of VOCs in shallow ground

water. However, airborne concentrations of contaminants (i.e., volatilization) were not sampled during the field program and thus exposure point concentrations must be modeled. Names and citations for the transport models used to estimate exposure point concentrations from laboratory measurements of field samples are given in Appendix A. As a caveat, it is always more accurate to have data for exposure point concentrations in the medium of concern at the exposure point of concern, and the use of transport models represents a good faith attempt to estimate unknown values from known values. However, the use of the models does introduce uncertainty into the results. Other exposure parameters are not expected to introduce major uncertainties into the quantitative assessment, and the values chosen are representative estimates.

- Scenario 4 - Construction Scenario (Future Use)

Of the parameters presented in Table *2-10*, the modeled ambient dust concentration is expected to present the largest degree of uncertainty to the exposure estimates. Airborne concentrations of contaminants (i.e., fugitive dusts) were sampled during the field program. Comparison of monitored and modeled exposure point concentrations indicate that modeled concentrations are highly conservative and thus overly protective of human health. Names and citations for the transport models used to estimate exposure point concentrations from laboratory measurements of field samples are given in Appendix A. As mentioned previously, it is always more accurate to have data for exposure point concentrations in the medium of concern at the exposure point of concern. However, the use of transport models, while introducing some degree of uncertainty into the results, represents a good faith attempt to estimate unknown values from known values. Of the remaining parameters, the ranges of skin surface area are quite large, and may also contribute a large degree of uncertainty to the exposure estimates.

- Scenario 5 - Residential Scenario (Future Use)

Of the parameters presented in Table *2-10*, the modeling of ambient dust concentrations are expected to present the largest degree of uncertainty. The use of transport models to estimate these unknown values and the degree of uncertainty introduced to an exposure estimate was discussed above.

2.6 Toxicity Assessment

Appendix B of this report presents a short description of the toxic effects of each chemical of concern, including a summary of the dose-response information pertinent to quantitative risk assessment, as available. Furthermore, Tables B-1 through B-4 present a summary of toxicity values associated with chronic and subchronic noncarcinogenic effects, for the oral and inhalation routes, respectively. Tables B-5 and B-6 summarize the slope factors associated with potential carcinogenic effects of chemicals of concern by the oral and inhalation routes, respectively.

2.7 Risk Characterization

2.7.1 Quantitative Risk Assessment

For potential carcinogens, risks are estimated as probabilities. The compound-specific potency factors for carcinogens are generally estimated through the use of mathematical extrapolation models (e.g., the linearized multistage model). These models estimate the largest possible linear slope, within a 95% confidence interval, at low extrapolated doses. Thus, the potency factor is characterized as a 95% upper-bound estimate, such that the true risk is not likely to exceed the upper-bound estimate and may be lower.

The evaluation of risk from noncarcinogenic health hazards is based on the use of RfDs (EPA, 1992; EPA, 1991a). RfDs are estimates of daily exposure to the population (including sensitive subpopulations) that are likely to be without appreciable risk of deleterious effects for the defined exposure period. The RfD is calculated by dividing the no adverse effect level (NOAEL) or lowest observed adverse effect level (LOAEL) derived from animal or human studies by an uncertainty factor, which is multiplied by a modifying factor. RfDs incorporate uncertainty factors which serve as a conservative downward adjustment of the numerical value and reflect scientific judgement regarding the data used to estimate the RfD. For example, a factor of 10 is used to account for variations in human sensitivity (i.e., to protect sensitive subpopulations) when the data stems from human studies involving average, healthy subjects. An additional factor of 10 may also be used for each of the following:

- extrapolation from chronic animal studies to humans,
- extrapolation from a LOAEL to a NOAEL, and
- extrapolation from subchronic to chronic studies.

Finally, based on the level of certainty of the study and database, an additional modifying factor (between zero and ten) may be used.

The results of the quantitative risk analysis are presented in two basic forms. In the case of human health effects associated with exposure to potential carcinogens, risk estimates are expressed as the lifetime probability of additional cancer risk associated with the given exposure. In numerical terms, these risk estimates are presented in scientific notation in this report. Thus, a lifetime risk of 1E-04 means a lifetime incremental risk of one in ten thousand; a lifetime risk of 1E-06 means an incremental lifetime risk of one in one million and so on.

In the cases of exposure to non-carcinogens, the Hazard Index Ratio is used. As noted in previous sections, the fundamental principles used to construct the RfD utilized in calculating

the Hazard Index Ratio are predicated on long term or chronic (usually measured in years) exposures and health effects. However, the RfD used was either the RfD derived from chronic studies (RfD_c) or the RfD which was derived from subchronic studies (RfD_s). Wherever possible, the RfD was matched to the type of exposure (chronic vs. subchronic) such that in scenarios involving subchronic exposures (e.g., construction), the RfD_s values were used, and those scenarios involving chronic exposure (trespasser, commercial/industrial use, current and future residential use), the RfD_c values were used.

Cancer and non-cancer health risks are discussed below for trespasser (Scenario 1 - current use), commercial/industrial (Scenario 2 - current use), residential (Scenario 3 - current use), construction (Scenario 4 - future use), and residential (Scenario 5 - future use) scenarios. Within the current trespasser and future residential scenarios, the risks to children (9-18 years old, current trespasser scenario; 0-6 years old, future residential scenario) and adults are presented separately. In each case, daily doses of the compounds of concern have been calculated for each exposure pathway modeled, and these doses were then used to calculate cancer risk levels and hazard index ratios. Cancer risk levels are the lifetime probability of excess cancer due to the exposure pathways resulting from use of the site. Cancer risk levels are derived by multiplying exposure dose by the appropriate cancer slope factor for each compound and exposure route. Non-cancer health risk is quantitated by the hazard index ratio which is the ratio of the exposure dose to the RfD (both in mg/kg/day). *The calculated risk is compared to the acceptable lifetime cancer risk range (1E-04 to 1E-06) for evaluating the need for remediation, as stated in 40 CFR Part 300 (EPA, 1990b). EPA (1990b) considers a cancer risk of 1E-06 as the point of departure for determining risk-based remediation goals.* Regarding

non-carcinogenic health hazards the Risk Assessment Guidance for Superfund (EPA, 1989) states that:

> "When the total hazard index for an exposed individual or group of individuals exceeds unity, there may be concern for potential health effects."

Thus, the cancer risk and hazard index ratios that constitute a concern are *>1E-06* and >1E+00, respectively. Tables *2-11* through *2-22* summarize cancer risk levels and hazard index ratios for all scenarios. Appendix A (Tables A.1.1 through A.5.9) contains cancer risk levels and hazard index ratios for all contaminants, pathways and scenarios.

Scenario 1 - Trespassing Scenario (Current): Cancer Risks and Hazard Index Ratios

Table *2-11* summarizes the cancer risks and hazard index ratios for all exposure pathways considered *for the trespassing scenario*. Tables A.1-1 through A.1-12 (Appendix A) contain the spreadsheets used to calculate dose, cancer risk and hazard index ratios for Scenario 1.

Exposure of children to contaminants while trespassing on-site is associated with a total cancer risk of *2E-06*, which is *a factor of two times greater than* 1E-06. The predominant factor contributing to this risk is incidental ingestion of arsenic and beryllium in surface water *(7E-07 and 1E-06, respectively)*.

Trespassing on-site is associated with a total hazard index (HI) ratio of *1E-01* which is below the target HI value of 1E+00. Incidental ingestion of inorganics in surface water (Hudson Branch) (HI=*1E-01*) *are* the primary contributors to this hazard index.

Scenario 2 - Commercial/Industrial Use Scenario (Current): Cancer Risks and Hazard Index Ratios

Table *2-12* summarizes the cancer risks and hazard index ratios, respectively, for all exposure pathways considered for this scenario. Tables A.2-1 through A.2-9 (Appendix A) contain the spreadsheets used to calculate dose, cancer risk and hazard index ratios for Scenario 2.

Exposure of adults to contaminants on-site during a current industrial use of the site is associated with a cancer risk of *8E-05*, which *exceeds 1E-06 by a factor of 80.* This risk is attributed *primarily with* dermal contact with PCBs (*5E-05*), and incidental ingestion of arsenic, *beryllium, and PCBs* in surface soil (*3E-05*).

Current industrial use of the site is associated with a total hazard index ratio of *7E-01* which is below the target value of 1E+00. Incidental ingestion of vanadium in soil (*HQ=5*E-01) and inhalation of chromium III in fugitive dust (*HQ=1*E-01) are the *primary* contributors to this hazard index.

Scenario 3 - Residential Use Scenario (Current): Cancer Risks and Hazard Index Ratios

Table *2-13* summarizes the cancer risks and hazard index ratios, respectively, for all exposure pathways considered in this scenario. Tables A.3-1D through A.3-10D and A.3-1S through A.3-10S (Appendix A) contain the spreadsheets used to calculate dose, cancer risk and hazard index ratios for Scenario 3.

Exposure of adults to contaminants in ground water detected in wells located to the south of the SMC facility was included in this assessment to provide a simple analysis of current ground water use conditions. This exposure is associated with a cancer risk range of *8E-03*

(deep ground water) to *4E-02* (shallow ground water), which exceeds *1E-06 by factors of 8,000 and 40,000, respectively. Ingestion of arsenic and beryllium in deep ground water accounts for 95% of this risk. Ingestion of trichloroethene is also associated with a cancer risk value which exceeds 1E-06 by a factor of 9 (i.e., 9E-06). Inhalation of airborne volatiles from deep ground water accounts for approximately 5% of the total risk due to deep ground water. The pathway risk for inhalation of airborne volatiles from deep ground water is 4E-04, which exceeds 1E-06 by 400-fold. Trichloroethene is the primary constituent of concern for this pathway. Finally, dermal contact with arsenic in deep ground water contributes a cancer risk of 1E-05, which exceeds 1E-06 by 10-fold.*

Ingestion of arsenic and beryllium in shallow ground water accounts for nearly 100% of the total scenario risk. Dermal contact with arsenic was associated with a cancer risk of 2E-05, which exceeds 1E-06 by 20-fold. Inhalation of airborne chemicals from shallow ground water was not of concern as VOCs were not detected in shallow ground water.

The hazard index ratios associated with current ground water use are 2E+02 (deep ground water) to 6E+02 (shallow ground water), which exceed the target value of 1E+00 *by 200- and 600-fold, respectively*. The elevated HI indices are associated with antimony (deep ground water only), arsenic, beryllium (shallow ground water only), chromium *III and VI* (deep ground water only), selenium (deep ground water only), vanadium, cyanide (shallow ground water only), and boron (shallow ground water only). *The HQs associated with these individual COCs each exceed 1E+00.*

Scenario 4 - Construction Use Scenario (Future): Cancer Risks and Hazard Index Ratios

Table *2-14* summarizes the cancer risks and hazard index ratios, respectively, associated with chemicals and exposure pathways included in this scenario. Tables A.4-1 through A.4-9 (Appendix A) contain the spreadsheets used to calculate dose, cancer risk and hazard index ratios for Scenario 4.

The total cancer risk *for the construction scenario* is *1E-06*, which *is equal to the target value of 1E-06*. Incidental ingestion of *arsenic, beryllium, benzo(b)fluoranthene, and DDT* in subsurface soil (1E-06) *is* the primary component of this risk. Inhalation of dust-borne contaminants *and dermal contact with soil do* not appreciably contribute to the cancer risk.

The total hazard index ratio associated with construction activities is *1E+00*, which *equals the target value of* 1E+00. Incidental ingestion of soil contaminants (HI=9E-01) makes the primary contribution to the hazard index. Inhalation of fugitive dust makes a minor contribution (HI=1E-01).

Scenario 5 - Residential Use Scenario (Future): Cancer Risks and Hazard Index Ratios

- Children

Table *2-15* summarizes the cancer risks and hazard index ratios, respectively, for childhood ingestion of soil and housedust associated with future residential use of the site. Tables A.5-2, A.5-5 and A.5-8 (Appendix A) contain the spreadsheets used to calculate dose, cancer risk and hazard index ratios for childhood receptors in Scenario 5. The cancer risk for children age 0-6 years residing on-site is *9E-05*, which *exceeds 1E-06 by 90-fold. Arsenic, beryllium, several carcinogenic PAHs, and PCBs contribute the majority of this risk.*

Table *2-15 also* presents the range of hazard index ratios by exposure pathway. The HI for children is 3E+00, which *exceeds 1E+00 by a factor of 3.* Vanadium in surface soil *contributes the majority of this exceedance with an HQ of 3E-01. None of the COC-specific HQs individually exceed the target value of 1E+00.*

- Adults

Table *2-15* presents a summary of the cancer risks by compound and exposure pathway for *adults in* Scenario 5. The total cancer risk for adults residing on-site is *2E-04*, which exceeds the target level *by a factor of 200.* The major contributors to this risk *are dermal exposure to PCBs in soil (1E-04) and incidental ingestion of several COCs (arsenic, beryllium, several carcinogenic PAHs, and PCBs) in soil (5E-05).*

Table *2-15 also* presents the hazard index ratios for *adults in* Scenario 5. The total HI for all pathways is *4E-01*, which is less than the target value of 1E+00. Incidental ingestion of vanadium in surface soil accounted for the majority of *this* HI (*HI*=3E-01). *None of the COC-specific HQs individually exceed the target value of 1E+00.*

Summary of Cancer and Non-Cancer Health Risks

This site currently contains elevated levels of certain key toxicants, which are responsible for driving the risk assessment. The current residential scenario was associated with the greatest cancer risk and HI values, due largely to the ingestion of ground water (as a potable drinking water source) which was absent from Scenarios 1, 2, 4 and 5. Scenario 5 (future residential) did not include the use of ground water as a potable drinking water source due to a well restriction zone; however, elevated risks due to long-term exposure to surface contaminants were

evident. Risks associated with Scenarios 1 (current trespassing) and 4 (future construction) were low due to either exposure to lower concentrations of contaminants outside the industrialized area or a shortened exposure duration, respectively. In general, inhalation of contaminants in fugitive dust was not a major exposure pathway.

The COCs associated with the greatest cancer risks in Scenario 1 - Trespassing (Current) include arsenic and beryllium in surface water. Cancer risks associated with other pathway COCs did not exceed 1E-06. Non-cancer HIs did not exceed the target value of 1E+00.

For Scenario 2 - Commercial/Industrial (Current), the cancer risks exceeded 1E-06 primarily for dermal contact with PCBs and incidental ingestion of arsenic, beryllium, and PCBs in soil. Cancer risks associated with other pathway COCs did not exceed 1E-06. Non-cancer HIs did not exceed the target value of 1E+00.

Ingestion of arsenic, beryllium, and trichloroethene in deep ground water, inhalation of trichloroethene from deep ground water, and dermal contact with arsenic in ground water are the primary exposure routes on COCs for Scenario 3 - Residential (current - deep ground water). Ingestion of arsenic and beryllium in shallow ground water and dermal contact with arsenic in shallow ground water are the primary exposure routes for Scenario 3 - Residential (current - shallow ground water). Elevated HIs for deep ground water use were associated with ingestion of antimony, arsenic, chromium III and VI, selenium, and vanadium. Elevated HIs for shallow ground water use were associated with ingestion of arsenic, beryllium, vanadium, cyanide, and boron.

For Scenario 4 - Construction (Future), cancer risks exceeded 1E-06 primarily for incidental ingestion of arsenic, beryllium, benzo(b)fluoranthene, and DDT in soil. Cancer risks

associated with other pathway COCs did not exceed 1E-06. Non-cancer HIs did not exceed the target value of 1E+00.

Childhood residential ingestion exposure (Scenario 5) to arsenic, beryllium, several carcinogenic PAHs, and Aroclor-1254 in soil is associated with a cancer risk greater than 1E-06. Although the HI for this pathway exceeded 1E+00, none of the individual COCs exceeded 1E+00.

Adult residential exposure to arsenic, beryllium, several carcinogenic PAHs, and PCBs are associated with cancer risks greater than 1E-06. The HIs for soil exposures did not exceed the target value of 1E+00.

Exposure to arsenic in *soil and* ground water is of primary importance. Arsenic is a group "A" carcinogen, whose carcinogenic efforts are most notable in the skin after oral absorption. While the arsenic oral slope factor for carcinogenic effects is based upon the evidence of human skin cancer, arsenic exposure by the oral route has also been associated with elevated cancer incidences in bladder, lung, liver, kidney and colon (EPA, 1992 - IRIS File).

Comparison of mean (95% UCL) arsenic concentrations in surface and subsurface soil to background soil concentrations (Tables 2-2 and 2-3) indicates that arsenic may be present due to naturally occurring conditions. Thus, risks associated with arsenic exposure in soil may be overstated.

Arsenic was detected at 4/10 sampling locations, at a range of 3.6 to 748 ug/l, although elevated concentrations were detected only in SC-22. Maximum detected values were used as exposure point concentrations. Background (upgradient) arsenic in ground water at this site is <2 ug/l. Thus, it appears that arsenic concentrations are elevated in SC-22 and that excess cancer risk due to arsenic ingestion may be site related.

Beryllium in *soil and* ground water is an additional primary component of excess cancer risk. Beryllium is a Class B2 carcinogen (probable human carcinogen) whose most notable carcinogenic effects occur in the lung. *Comparison of mean (95% UCL) beryllium concentrations in surface and subsurface soil to background beryllium soil concentrations (Tables 2-2 and 2-3) indicates beryllium levels may be elevated in the industrial areas of the site. However, unrestricted areas of the site (outside the fenced industrial area) do not appear to be impacted by industrial operations.*

Beryllium was detected in four out of ten well sampling locations at a range of 8.2-570 ug/l (SC-22 deep and SC-13 shallow). The background beryllium concentration at this site is <1 ug/l. Thus, it appears that elevated concentrations of beryllium in ground water and associated excess cancer risk may be site related.

Trichloroethene in ground water is the third primary component of excess cancer risk associated with current use of ground water to the south of the SMC facility. Trichloroethene is a Class B2 carcinogen (probable human carcinogen) whose most notable carcinogenic effect following ingestion is on the liver. Trichloroethene was detected 2/7 locations (SC-22, deep ground water only) at a range of 35-70 ug/l. The background trichloroethene concentration at this site is 17 ug/l. Thus, it appears that elevated concentrations of trichloroethene in ground water and associated excess cancer risk may be site-related.

The contaminants in ground water causing the greatest hazard index ratios are antimony (deep ground water only), arsenic, beryllium (shallow ground water only), chromium (deep ground water only), selenium (deep ground water only), vanadium, cyanide (shallow ground water only) and boron (shallow ground water only). Arsenic and beryllium were discussed in light of cancer risks and will not be repeated here. Antimony ingestion is associated with

decreased longevity, fasting blood glucose levels and alteration of cholesterol levels. Antimony was detected in two of ten well sampling locations at a range of 1340-2140 ug/l. Background for the site is <21 ug/l. Thus, it appears that antimony levels are elevated at the site and that ingestion of ground water may pose a health risk.

Chromium is thought to be an essential nutrient in humans. Short term, high levels of chromium VI are irritating to the G.I. tract, and adverse effects in the kidney and liver may occur. Chromium VI was detected in three of ten monitoring wells, at a range of 0.008 (shallow) to 1400 (deep) ug/l. The background chromium concentration is 0.3 ug/l. Thus, it appears that chromium is elevated in deep ground water and that excess non-cancer health effects may be associated with the ingestion of ground water containing chromium VI.

Chronic selenium ingestion has been shown to produce clinical selenosis. Selenium was detected in two of ten locations (deep ground water only) at a range of 49.6-130 ug/l. Site background is reported as <2 ug/l. Thus, selenium appears to be elevated in deep ground water and ingestion may contribute to adverse health effects.

Chronic ingestion of 5 mg/l vanadium in drinking water produced no observable effects in rats (Appendix B). Vanadium was detected in 8/10 locations at a range of 8.4-128,000 ug/l. Site background is reported as 8.3 ug/l. Thus, it appears that vanadium concentrations in ground water to the south of the site are elevated. However, because no observable effects were noted in the study used to base the RfD, it is difficult to determine at what exposure level adverse health effects may be produced.

Cyanide ingestion has been shown to produce weight loss, thyroid effects and myelin degeneration. Cyanide was detected three times in shallow ground water at a concentration range of 30.1-26,400 ug/l. Site background is reported as <10 ug/l. Thus, it appears that

cyanide is elevated in shallow ground water and ingestion may contribute to adverse health effects.

Chronic boron ingestion is associated with testicular lesions, while occupational exposure has been associated with pulmonary edema and hemorrhage in the alveolus. Boron was detected at four of seven locations in shallow ground water only, at a range of 130-14,700 ug/l. A site background concentration is not available. Exceedance of the target HI of 1E+00 by boron alone (HI_{boron} = 5E+00) suggests a potential for adverse health effects from the ingestion of boron in ground water.

2.7.2 Qualitative Analysis of Risks

Selected compounds were addressed qualitatively rather than quantitatively because compounds were lacking cancer slope factors or RfD values. It is not possible to include these cases in the quantitative analysis, and instead, the possible effect they could have on the assessment is discussed qualitatively.

- Inorganics

Aluminum is one of the most abundant metals in the earth's crust, and it is ubiquitous in air, water and soil (Goyer, 1986). The toxicity of aluminum can be divided into three major categories: (1) the effect of aluminum compounds on the gastrointestinal tract; (2) the effect of inhalation of aluminum compounds; and (3) systemic toxicity of aluminum (Alfrey, 1981). Data has been evaluated and found to be inadequate for quantitative risk assessment (EPA, 1992; 1991a), such that neither an inhalation nor oral RfD are available.

The range of detection for aluminum in soils is 257-104,000 mg/kg (Tables 2-2 and 2-3), as compared to a site background concentration of 4405 mg/kg. The 95% UCL for Scenarios 1, 2, 4 and 5 ranges from 4651-26,159 mg/kg, suggesting elevated aluminum concentrations on-site. Lack of a quantified dose-response relationship and elevated aluminum concentrations in soils may have an impact on the outcome of the risk assessment and may contribute some degree of uncertainty. However, it should be noted that doses and risks associated with inhalation of fugitive dusts are very low, and incidental ingestion of non-carcinogenic inorganic compounds generally do not contribute a significant risk in the scenarios presented in this report.

Currently, no oral or inhalation RfD for cobalt has been published by the EPA. Cobalt is an essential component of Vitamin B12, which is required for the production of red blood cells (see Appendix B). The range of detection for soil sample results is 0.95-87.1 mg/kg, as compared to a site background of 2.3 mg/kg and a U.S. mean background in soil of 5.9 mg/kg (range equal to 0.3-70 mg/kg) (USGS, 1984). Although the 95% UCL for cobalt in soil background is elevated over site background for Scenarios 1, 2, 4 and 5, comparison to the mean U.S. background concentration or the range of U.S. concentrations in soil suggests the levels on-site are not out of a normal range. Therefore, a cobalt RfD (oral or inhalation) is not expected to be crucial to the outcome of the risk assessment.

The range of detection of copper in soil is 0.88-887 mg/kg, which exceeds the site background concentration of 16.6 mg/kg. Similarly, calculated 95% UCL concentrations of copper (Tables 2-2 and 2-3) exceed reported U.S. mean concentrations for Scenarios 1, 2 and 5. Site concentrations exceed reported U.S. ranges for copper in only one surficial location. An inhalation RfD for copper is not available from EPA (see Appendix B). Because copper has been shown to cause local G.I. irritation following ingestion, it is not practical to extrapolate

from the oral route to the inhalation route. Thus, the contribution of copper to health risks following inhalation is uncertain. However, it should be noted that doses and risks associated with inhalation of fugitive dusts are very low.

The EPA weight of evidence for the carcinogenicity of lead is "B2" - a probable human carcinogen; however, a quantitative risk estimate has not been provided (see Appendix B). The Record of Decision (ROD) for NL Industrial Taracorp site (Granite City, Illinois) (EPA, 1990) provides a basis for a recommended 500 mg/kg cleanup level for lead. This ROD supports the 500 mg/kg level specifically for the Granite City site and other Superfund sites in general. *Similarly, the OSWER Directive No. 9355.4-02 recommends an interim soil cleanup level of 500-1,000 mg/kg for lead in soil. This interim soil cleanup level is considered to be protective of direct contact at residential settings, and may not be directly applicable to an industrial setting such as at SMC.* Lead concentrations appear to be elevated (greater than 500 mg/kg) in surface soil at only 2 out of 116 possible locations (RA-44 and RA-12), such that some minor degree of concern over the lack of quantitative cancer risk is noted. It should be noted that the 95% UCL for any scenario does not exceed 500 mg/kg.

There is no inhalation RfD for nickel at this time (see Appendix B). The range of detection of nickel in soil is 1.5-3360 mg/kg, which exceeds the reported U.S. background range (<5-700 mg/kg). However, nickel concentrations only exceed this range at three locations (RA-12, RA-14 and RA-28). Comparison of 95% UCL nickel concentrations to site and mean U.S. background concentrations indicate elevated nickel contamination on-site. However, because risks associated with inhalation of fugitive dusts carrying site contaminants are generally low, it is not likely that omission of the evaluation of systemic effects resulting from nickel

inhalation would significantly impact the risk assessment. Furthermore, the inhalation route is assessed for the carcinogenic effects of nickel.

Currently, no inhalation RfD for selenium has been published by the EPA (see Appendix B). The range of detection for soils is 0.43-5.1 mg/kg (Tables 2-2 and 2-3), as compared to a U.S. background range of 0.1-3.9 mg/kg. Comparison of 95% UCL for selenium to site background (0.49 mg/kg) indicates some elevation for Scenario 2 only (1.5 mg/kg). Selenium was detected infrequently in soils (25/192). Thus, although levels on-site appear to be slightly elevated, a lack of a quantified dose-response relationship is not likely to have a significant impact on the outcome of the risk assessment. Further, it should be noted that doses and risks associated with inhalation of fugitive dusts are very low.

An inhalation RfD is not available for silver at this time (EPA, 1992; 1991a). Silver concentrations on-site range from 0.37-4 mg/kg. Site background was reported as 0.86 mg/kg, which was exceeded by the 95% UCL for each scenario (1, 2, 4 and 5). Thus, levels on-site appear to be slightly elevated, and lack of a quantified dose-response relationship may contribute some uncertainty to the risk assessment. However, as indicated previously, it should be noted that doses and risks associated with inhalation of fugitive dusts are very low and, in general, do not contribute to excess risk.

Thallium is one of the more toxic metals and can cause neural, hepatic and renal injury. It may also cause deafness and loss of vision. An inhalation RfD for thallium is not available at this time (EPA, 1992; 1991a). Thallium was detected one time out of 192 possible sampling locations and was not detected in the site background sample. Based on the infrequent rate of detection, the omission of thallium from the quantitative risk assessment is not of concern.

The major toxicologic effects of boron are on the lung. Through occupational exposure, boron has been shown to induce pulmonary edema and hemorrhage in the alveolus (Menzel and Amdur, 1986; Dixon, 1986). The chronic inhalation RfD for boron has not been determined (EPA, 1992; 1991a). The range of detected boron concentrations on-site is 29.1-239 mg/kg, which exceeds the reported U.S. background range of <20-150 mg/kg. Comparison of site background (21.4 mg/kg) or mean U.S. background (31 mg/kg) to the 95% UCL for boron indicates boron concentrations should be considered to be elevated on-site for Scenario 2 (current industrial use). Because the primary effects of boron are on the lung, the absence of boron from the risk assessment should be noted. However, concentrations of contaminants in fugitive dusts and resulting doses tend to be small and, in general, do not contribute significantly to the quantitative analysis.

No oral or inhalation RfDs for niobium were located in IRIS or HEAST (EPA, 1992; 1991a). Niobium has not been evaluated by the EPA for evidence of carcinogenicity (EPA, 1992; 1991a). Niobium concentrations ranged from 52-845 mg/kg, with an apparent "hot spot" of 845 mg/kg at RA-44. With the exception of this "hot spot", niobium concentrations on-site did not appear to be greatly elevated when compared to site background (42.5 mg/kg) or U.S. background ranges in soil (<10-50 mg/kg). Niobium was detected infrequently (7/68) in soils.

Strontium, a metabolic analog of calcium, is readily absorbed from the gastrointestinal tract or the lungs into the bloodstream and is subsequently deposited in bone (Hobbs and McClellan, 1986). The adverse health effects associated with strontium exposure are currently under review by an EPA work group (EPA, 1992; 1991a) and consequently chronic oral and inhalation RfD values are not available at this time. Strontium has not been evaluated by the EPA for evidence of carcinogenicity (EPA, 1992; 1991a). Comparison of the ranges of

site-related (22.8-228 mg/kg) and U.S. background concentrations (<5-700 mg/kg) of strontium indicate site concentrations are not unusual. However, comparison of the 95% UCL values to site background (21.4 mg/kg) or mean U.S. background (53 mg/kg) suggest strontium concentrations associated with Scenario 2 are elevated.

Occupational exposure to titanium may be heavy and is associated with hyperplasia of the bronchial epithelium and pulmonary fibrosis following inhalation exposure (Menzel and Amdur, 1986). No RfDs were found in either IRIS or HEAST. Titanium has not been evaluated by the EPA for evidence of carcinogenicity (EPA, 1992; 1991a). Titanium concentrations on-site range from 29.4-941 mg/kg in soils, which is within the reported U.S. background range of 70-15,000 mg/kg (USGS, 1984). Comparison of the 95% UCL values for scenarios (Tables 2-2 and 2-3) suggest a slight elevation of titanium concentrations on-site. Thus, omission of this compound from the quantitative risk assessment may introduce a small degree of uncertainty.

No RfDs for zirconium were found in either IRIS or HEAST (EPA, 1992; 1991a). Zirconium has not been evaluated by the EPA for evidence of carcinogenicity (EPA, 1991a). Zirconium concentrations on-site ranged from 39.1-159 mg/kg in soils. No site-related background data is available. The reported range of U.S. background concentrations of zirconium in soil is <20-20,000 mg/kg, with a mean value of 220 mg/kg. Based on this information, it appears that site-related concentrations are not elevated and thus, the omission of zirconium from the quantitative risk assessment is not likely to be of concern.

- Volatile Organics

The risk assessment for trichloroethene is under review by an EPA workgroup. As a result, oral and inhalation RfDs have not been established (EPA, 1992). Trichloroethene was detected twice in deep ground water monitoring wells to the south of the site at concentrations of 35 and 70 mg/l. The reference (upgradient) concentration of trichloroethene is 17 mg/l. Elevated ground water concentrations of trichloroethene suggest omission of this compound may contribute to an underestimate of systemic effects. However, it should be noted that this volatile organic was included in the quantitative carcinogenic risk analysis.

- Semi-Volatiles

RfDs are not available for the carcinogenic PAHs (phenanthrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene and benzo(g,h,i)perylene. These PAHs were detected infrequently and at low concentrations in soils, and were not detected in surface and ground water. Based on structure activity relationships, it is possible to address the systemic toxicity of the carcinogenic PAHs by utilization of the RfD for naphthalene. However, it should be noted that: a) the RfD for naphthalene is the lowest of the group of PAHs, and b) the chemical and physical properties of naphthalene are most unlike any other PAH. A simple comparison of exposure doses of each carcinogenic PAH to the RfD for naphthalene indicates that omission of these PAHs from the quantitative risk analysis for systemic effects is not likely to introduce an underestimate of risk. Furthermore, the carcinogenic effects of these compounds are assessed quantitatively.

Seven carcinogenic PAH compounds, including benzo(a)pyrene, were included in the quantitative risk assessment. All were assigned the cancer slope factor derived for benzo(a)pyrene, which is among the most potent members of this chemical class. Most

carcinogenic members of this class have been shown to induce skin cancer upon topical administration, while the more heavily studied agent, benzo(a)pyrene, has also been shown to cause lung and stomach tumors (ATSDR, 1990).

Dermal cancer risk for PAHs was not calculated because of uncertainty regarding the carcinogenic potency of the agents by the dermal route. However, given the preponderance of evidence in rodents that these agents are carcinogenic by dermal exposure, it is likely that this analysis underestimates the cancer risk due to PAH compounds present in water and soil. The increase in cancer risk that could be associated with dermal exposure to PAHs in soil is not likely to be substantial since the dermal dosage to these agents was generally less than that received via oral exposure to PAHs in soil. Further, the dermal dose represents the absorbed dose, which is only 5% of the exposure dose for PAHs.

- Pesticides/PCBs

The PCBs Aroclor-1248, Aroclor-1254 and Aroclor-1260 were detected infrequently in soils on-site (1/54, 4/54 and 2/54, respectively) (Tables 2-2 and 2-3). Although data is inadequate to provide a dose-response relationship for systemic effects, these compounds are included in the quantitative assessment of carcinogenic risks. Based on this information, omission of these PCBs from the quantitative assessment of systemic effects is not expected to produce an underestimation of risk.

- Tentatively Identified Compounds (TICs)

TICs are not quantitatively addressed because their chemical identities were poorly characterized. In the vast majority of samples, the TICs are listed as "unknown". In the few

isolated cases where a specific chemical is listed as a TIC, the levels are generally low. Without a better indication of the contaminants which comprise the TIC listing, no qualitative or quantitative assessment can be made.

2.7.3 Uncertainty Assessment

- Uncertainty Associated with the Exposure Assessment

The scenarios developed for the site include exposures resulting from probable current use by trespassers, as a current active industrial facility, current residential ground water usage, potential future construction on the site, and potential future use of the site as a residential area. The risks associated with these scenarios are conditional on these land uses occurring. Observations made during field investigations indicate that activities such as trespassing have not occurred on the site, and evidence to the contrary is not available. Thus, the uncertainty associated with the exposure frequency and duration for Scenario 1 is not likely to be large, and is not likely to contribute significantly to an overestimation of risk. Current zoning for the site is industrial, and the site is currently active as an industrial facility. Thus, the uncertainty associated with Scenario 2 and with this land use is low. Use of shallow ground water as a potable source (Scenario 3) and resulting risks is associated with a large degree of uncertainty. The shallow ground water flow direction in the vicinity of monitoring wells SC-22S (shallow well), SC-13S (shallow well), and D (shallow well) are presented in Figures 14 and 16 of the Draft Final Remedial Investigation (RI) Report (TRC, 1991). These figures clearly indicate that the shallow ground water flow direction is to the southwest along the Hudson Branch. SMC's shallow ground water will follow the site topography until it intersects the Hudson Branch, then it will flow in the same direction as the Hudson Branch. This flow pattern was observed in the

TCE, hexavalent chromium, and total chromium plumes presented in the Draft Final RI Report (Figures 22, 24, 26, 28, 30 and 32 (TRC, 1991)). SMC's off property shallow ground water impact will be along the Hudson Branch west of East Boulevard. Thus, it is unlikely that contaminants will reach private wells that are or may be located along East Weymouth Avenue. An additional monitoring well location has been recommended for placement to the south of the SMC facility (along Weymouth Road). This well is expected to further delineate ground water contamination in this area; specifically to help distinguish the chromium plume, and evaluate potential impacts of contaminants such as arsenic and beryllium on private well water quality.

The deep ground water flow direction in the vicinity of monitoring well SC-22D (deep well), SC-13D (deep well), and W2 (deep well) are presented in Figures 15 and 17 of the Draft Final RI Report (TRC, 1991). These figures clearly indicate that the present deep ground water flow direction is toward the southwest. This ground water flow direction could be the result of ground water pumping by the recovery wells installed by SMC along the Hudson Branch. Inspection of Figures 23, 25, 27, 29, 31 and 33 of the Draft Final RI Report (TRC, 1991), reveals that significant concentrations of TCE and chromium were detected in monitoring well SC-22D and of chromium in monitoring well W2. At present, the direction of contamination is being controlled by ground water pumping at recovery well W9. The potential impact of contaminants south of the Hudson Branch will be addressed during the Phase II RI by installing a monitoring well directly south of SC-22D. Thus, it is uncertain at this point whether contaminants are migrating and impacting current and future wells located along East Weymouth Avenue. This uncertainty in future use of the site adds a degree of uncertainty to the risks associated with Scenario 3. An additional monitoring well location has been recommended for placement to the south of the SMC facility (along Weymouth Road). This well is expected to

further delineate ground water contamination in this area; specifically to help distinguish the chromium plume, and evaluate potential impacts of contaminants such as arsenic and beryllium on private well water quality.

Construction or development of the site is a potential future activity at the SMC facility; thus, Scenario 4 has a smaller degree of uncertainty associated with it.

Finally, it is unlikely that the site would be developed for residential use. The uncertainty associated with this scenario (Scenario 5) is quite large and is likely to contribute significantly to an overestimation of risk associated with the site.

Table *2-16* summarizes the exposure pathways considered for the risk assessment, and reasons for exclusion or inclusion. Ingestion of ground water as a future use scenario was not addressed as there is a well restriction in the vicinity of the site.

Two models were used to characterize exposure point concentrations. The first, a model used to estimate concentrations of chemicals in fugitive dust, was taken from AP-42 (EPA, 1988) (see Appendix A). The key model assumptions include the time frame during which the construction on-site is likely to take place and the use of a yearly average wind speed. The potential impact of these assumptions will be to underestimate risk if construction occurs for a longer period of time than originally estimated, or, if daily wind speeds exceed the annual average wind speed. Comparison of modeled contaminant concentrations in dust to monitored contaminant concentrations (TRC, 1991) indicate the fugitive dust modeling is extremely conservative and, thus, overly protective of human health. The second model, volatilization of chemicals during home use of ground water (i.e., showering) (see Appendix A) was taken from Andelman (1985). A key assumption for this model is likely to include the fraction of

contaminant volatilized, which is assumed to be 0.9 (90%). This assumption is likely to overpredict, rather than underpredict, risk.

The primary uncertainties associated with exposures in each scenario include:

- Scenario 1 - the frequency of use and types of activities associated with children trespassing on the site.
- Scenario 2 - the generation of fugitive dust due to current site activities is likely to be overly conservative, such that risk estimates may be overestimated.
- Scenario 3 - risks associated with ingestion of ground water rely on: a) the use of ground water as a potable source in the vicinity of the site, and b) the use of maximum detected values as representative of ground water contamination.
- Scenario 4 - the exposure duration for construction workers was based on a conservative assumption, but may over- or underestimate the risk estimate.
- Scenario 5 - future use of the site as a residential area is highly unlikely and contributes a large degree of uncertainty when evaluating the associated risks.

- *Uncertainty Associated with Blank Evaluation*

As requested by NJDEPE, this section provides an evaluation of the variance between EPA (1989) and NJDEPE policies with regard to target compounds detected in blank samples. Evaluation of common laboratory contaminants in blank samples for this risk assessment is based upon the EPA approach described in EPA (1989). NJDEPE has also developed a policy to evaluate blank contamination. This discussion focuses on the potential changes in the evaluation of blank contamination data using the NJDEPE approach, and the potential impacts of this policy on the risk assessment.

Media considered in the risk assessment included surface soil, subsurface soil, ground water, and surface water. An associated blank sample was determined for each sample using information contained in the RI report (TRC, 1991), and in the sample logs from the field

investigation. A list was compiled of compounds detected in blanks associated with each of these media. A comparison was made between the blank evaluation method outlined in EPA (1989) and the method developed by NJDEPE.

- *Surface Soil*

Compounds detected in the blank samples associated with surface soil include five VOCs (acetone, chloroform, methylene chloride, trichloroethene, and tetrachloroethene), two SVOCs (di-n-butylphthalate and pentachlorophenol), one pesticide (4,4'-DDT), and eleven inorganics (boron, calcium, copper, iron, lead, magnesium, manganese, selenium, sodium, vanadium, and zinc).

Of these 19 compounds detected in blanks associated with surface soil, only the data for four of these (boron, manganese, zinc, and acetone) would be treated differently with the application of the NJDEPE blank evaluation method versus the EPA (1989) method. That is, for acetone, boron, manganese, and zinc some of the data points included in the risk assessment based on the EPA (1989) blank evaluation method would be rejected using the NJDEPE blank evaluation method. This would result in a reduced frequency of detection and potentially alter the selection of these compounds as COCs and/or alter the exposure point concentration(s). For example, acetone would not have been included as a COC in the risk assessment based on the NJDEPE method for blank evaluation.

All four compounds were selected as COCs in surface soil (Table 2-7), and thus were included in calculation of exposure and risk in Scenarios 1 (current trespassing), 2 (current commercial/industrial), and 5 (future residential). None of these four compounds have been classified as carcinogens such that cancer risks were not evaluated. However, each of these four

compounds were evaluated quantitatively with regard to non-cancer endpoints but were not associated with elevated HQs in any of the scenarios (e.g., Scenarios 1, 2, and 5; see Appendix A). Thus, it is unlikely that use of the EPA (1989) method of blank evaluation (versus the NJDEPE method) would alter the conclusions of the risk assessment. Both blank evaluation methods agree on the treatment of the data for the remaining 15 compounds detected in surface soil blanks.

- *Subsurface Soil*

Compounds detected in blanks associated with subsurface soil are the same as those listed for surface soil. Of the compounds detected in blanks associated with subsurface soil only the data for five of these (boron, manganese, zinc, acetone, and methylene chloride) would be treated differently with the application of the NJDEPE blank evaluation method. For boron, manganese, and zinc some of the data points included in the risk assessment based on the EPA (1989) blank evaluation would be rejected using the NJDEPE blank evaluation method. This would result in a reduced frequency of detection and potentially alter the selection of the compounds as COCs and/or alter the exposure point concentration(s). These three inorganics were selected as COCs in subsurface soil (Table 2-7). None of these three inorganics are classified as carcinogens, such that cancer risks were not evaluated. However, these inorganics were evaluated quantitatively with regard to non-cancer endpoints and were not associated with elevated HQs in Scenario 4 (see Appendix A). Thus, it is unlikely that use of the EPA (1989) method of blank evaluation (versus the NJDEPE method) would alter the conclusions of the risk assessment for these three inorganic COCs. For acetone and methylene chloride some of the data points rejected based on the EPA (1989) blank evaluation approach would be included

based on the NJDEPE blank evaluation method. This would result in an increase in the frequency of detection and might alter the exposure point concentration(s). However, both acetone and methylene chloride were selected as COCs in subsurface soil (Table 2-7), and inclusion of additional sampling points would not affect this selection. Methylene chloride is classified as a B2 carcinogen and was evaluated quantitatively with regard to cancer in the risk assessment for Scenario 4 (future construction). Risks associated with exposure to methylene chloride were low (five to eight orders of magnitude less than 1E-06). Acetone is not classified as a carcinogen such that cancer risks were not evaluated. Acetone and methylene chloride were evaluated quantitatively with regard to non-cancer endpoints and were not associated with elevated HQs in Scenario 4. Thus, it is unlikely that use of the EPA (1989) method of blank evaluation (versus the NJDEPE method) would alter the conclusions of the risk assessment. Both blank evaluation methods agree on the treatment of the data for the remaining 14 compounds detected in subsurface soil blanks.

- *Ground Water*

Compounds detected in blanks associated with ground water include two VOCs (acetone and methylene chloride) and one inorganic (zinc). Both blank evaluation methods agree on the treatment of the data for these compounds. Thus, the use of the EPA (1989) method of blank evaluation (versus the NJDEPE method) would not alter the conclusions of the risk assessment.

Surface Water

Compounds detected in surface water include two VOCs (acetone and methylene chloride) and four inorganics (lead, manganese, vanadium, and zinc). For compounds detected in blank

associated with surface water, only the data points for zinc would be treated differently with the application of the NJDEPE blank evaluation method versus the EPA (1989) method. Some of the data points for zinc included in the risk assessment (based on the EPA (1989) blank evaluation method) would be rejected based on the NJDEPE blank evaluation method. This would result in a reduced frequency of detection and potentially alter the selection of this compound as a COC and/or alter the exposure point concentration. Zinc was selected as a COC in surface water (Table 2-7) and evaluated quantitatively in Scenario 1 (current trespassing) for non-cancer endpoints. The HQs for zinc in surface water are not elevated (Appendix A). Zinc is not classified as a carcinogen and is not evaluated with regard to cancer risk. Thus, it is unlikely that the use of either the NJDEPE or EPA (1989) methods for blank evaluation would impact the conclusions of the risk assessment.

In summary, this evaluation of the variance between policies with regard to target compounds detected in blank samples indicates that use of the EPA (1989) method would not alter the conclusions of the risk assessment.

- Uncertainty Associated with Site Data

Some significant uncertainties exist in the data used for this site. In most cases these uncertainties are likely to overestimate, rather than underestimate, the risk. A few examples of data uncertainties include chemicals detected infrequently in all media were assumed to occur in that media at estimated or maximum detected concentrations; and "U" data (non-detect values) were included as one half the SQL or the SQL, used in calculation of the 95% UCL, and considered as potential locations of contamination.

Specific examples of data uncertainties warrant detailed analysis. This section explores these uncertainties and presents this analysis by scenario.

Cancer risk estimates and hazard index ratios associated with Scenario 1 were low. That is, the estimates did not exceed target values for systemic or carcinogenic risk. The greatest risk associated with Scenario 1 was ingestion exposure to surface water contaminants in the Hudson Branch. Arsenic and beryllium were the compounds which contributed the majority of the risk estimate. The data uncertainty associated with these compounds is related to the use of a maximum detected value as representative of the exposure point concentration rather than the 95% UCL. As discussed in the data evaluation section, when a 95% UCL is calculated for data sets containing fewer than ten data points, the resulting 95% UCL is artificially inflated and exceeds the maximum detected concentration. Thus, in order to maintain a conservative approach throughout the assessment, the maximum detected value was chosen as the exposure point concentration. The impact of this approach is readily evident in that for both arsenic and beryllium, the maximum detected value is more than an order of magnitude larger than any other detected value. Furthermore, this value occurred in one location for both compounds (SW-2). In summary, risks associated with Scenario 1 are likely to be greatly overstated due to uncertainties associated with the data.

Cancer risks were associated with Scenario 2, current industrial use of the site. The primary route of exposure associated with these risks was dermal contact with PCBs in soil, and incidental ingestion of *arsenic,* beryllium and PCBs in soil. Data uncertainties play a role only in the case of PCBs, which were detected infrequently (1/14 and 4/14, respectively) in surface soil. Due to the low number of data points, a 95% UCL could not be calculated and the maximum detected value was used as the exposure point concentration. For Aroclor-1254, the

maximum value is more than an order of magnitude greater than other concentrations detected in soil. For Aroclor-1248, no other locations of contamination were detected. In summary, excess risk associated with exposure to PCBs in surface soil is likely to be overstated by (at least) an order of magnitude.

Scenario 3 (current ground water use) presented some of the largest risks estimated in this assessment. Use of the deep ground water as a potable aquifer was associated with a cancer risk of *8E-03* and a hazard index ratio of 2E+02. The route of exposure of most concern is ingestion of ground water (cancer risk of 8E-03 and hazard index of 2E+02), although inhalation of volatile organics is of concern (cancer risk of 4E-04). The contaminants of concern for Scenario 3 (deep ground water) include antimony, arsenic, beryllium, chromium III, chromium VI, selenium, vanadium and trichloroethene. The first data uncertainty associated with this scenario is the representative nature of contamination in SC-13, SC-22, W2 and D versus private well water quality.

Review of individual well data for a private well (Mohan) to the south of the SMC facility (and south of SC-22) for the period January to December 1989 indicates no impact on the basis of Cr VI and Cr III analysis. This data was not used in the quantitative risk assessment for the following reasons:

- The specific depth and screened interval information of the Mohan deep and shallow wells are unknown;
- The homeowners collect the water samples rather than qualified field personnel such that RI QA/QC protocols may or may not be followed; and
- The water samples are collected at the tap, while all other ground water samples are taken by bailer.

The remaining data uncertainties involve the infrequent rate of detection of these contaminants and the inability to calculate a 95% UCL. Antimony, arsenic, beryllium, chromium (III and VI), selenium and trichloroethene were detected only in SC-22D (in both sampling rounds). Thus, while an attempt was made to choose monitoring wells which were representative of ground water contamination conditions to the south of the site, only data from a single well was considered in this assessment. Thus, it is likely that the risk estimates greatly overstate the current use conditions.

Scenario 3 (shallow ground water use) was also associated with excess cancer risk (*4E-02*) and elevated hazard index ratios (6E+02), due to ingestion exposure. Similar to Scenario 3 (deep ground water use), the primary contaminants of concern include arsenic, beryllium, boron, cyanide, and vanadium. Data uncertainties are discussed in relation to each contaminant, although it should be noted that the maximum detected value was used rather than a 95% UCL due to the small data set. Arsenic was detected only in SC-22 (both rounds of sampling); beryllium was detected only in SC-13 (both rounds of sampling); boron was detected once in SC-13 and once in SC-22; cyanide was detected only one time (SC-13, round I); and vanadium was detected four times at a wide range of concentrations. Based on this information, it should be noted that a great deal of uncertainty is associated with this data, and the review of risks associated with Scenario 3 should be evaluated in light of this uncertainty.

Cancer risks and hazard index ratios associated with Scenario 4 were low. The greatest risk associated with Scenario 4 (future construction use) was incidental ingestion of DDT in subsurface soil. DDT was detected infrequently (five times out of 34 possible locations), and the range of concentrations was large (0.0093-31 mg/kg), and the maximum value was used as

the exposure point concentration rather than the 95% UCL. Thus, some degree of uncertainty is associated with the risks presented for Scenario 4.

Scenario 5 (future residential use) was associated with excess cancer risk and elevated hazard index ratios. Data uncertainties play a role only in the case of PCBs, which were detected infrequently (1/14 and 4/14, respectively) in surface soil. Due to the low number of data points, the 95% UCL could not be calculated and the maximum detected value was used as the exposure point concentration. For Aroclor-1254, the maximum value is more than an order of magnitude greater than other concentrations detected in soil. For Aroclor-1248, no other locations of contamination were detected: In summary, excess risk associated with exposure to PCBs in surface soil is likely to be overstated by (at least) an order of magnitude.

- Uncertainty Surrounding Cancer and Non-Cancer Risks

For the risk estimation of cancer and of chronic non-cancer health effects, risks from all exposure pathways and for all chemicals have been summed to yield the total site risk for a given receptor. This is a conservative approach, since, in general, different chemicals do not have the same target organ or mechanism of action. Thus, their toxic effects may be, at least in some cases, independent and not additive. Further, chemicals may antagonize one another through competition for enzymes and binding sites, and by inhibition of pathways needed for chemical transport (absorption, cellular uptake, etc.) or metabolic activation. However, it is also possible that certain chemicals can be synergistic such as is the case when a promotor-type carcinogen greatly enhances the expression of genetic damage induced by a low dose of an initiator.

- Uncertainties Associated with Toxicity Values

Uncertainty in the risk characterization may stem from exclusion of chemicals in the quantitative risk assessment. Chemicals which were not included in the quantitative risk assessment were excluded due to either lack of detection in the chemical analysis or as a consequence of missing toxicity data.

Chemicals with missing toxicity values are not expected to introduce a large degree of uncertainty into the risk estimates, as described in Section 2.6.2. Briefly, the exclusion of strontium and titanium may or may not underestimate the cumulative hazard index ratio due to a large degree of uncertainty associated with dose-response information.

In numerous cases in which a toxicity value was available for one exposure route but not another, a dose route extrapolation was performed. These extrapolations were utilized to go between the oral and inhalation routes of exposure if the toxic/carcinogenic effects were systemic rather than local. The compounds for which this was done are noted in Appendix B. The oral to inhalation dose route extrapolation can underestimate potency from inhalation exposure if the chemical is irritating, insoluble, slowly absorbed or highly reactive. Under these conditions, the dose to specific lung regions may be greater than that to the G.I. tract or internal organs, creating the possibility that the lung would be at greater risk. At this site, this possibility is greatest for the oral-to-inhalation extrapolation of RfD values for the metals arsenic, beryllium, nickel and zinc. However, inhalation of these metals was due to the dust inhalation pathway which was a minor exposure route. Therefore, underestimation of toxicity values for inhalation exposure should not have a large effect on the outcome of this risk assessment.

A correction factor was not used for dermal RfDs and slope factors to take into account the difference between absorbed vs. exposure doses in oral vs. dermal data, based on guidance

from EPA Region II. In general, the oral toxicity values are based upon an exposure dose, while the dermal doses for the modeled pathways are in terms of an absorbed dose. The absence of the use of such a correction factor provides a less conservative approach in estimating risk.

- *Sensitivity Analysis*

As requested by the NJDEPE, a central tendency risk estimate was calculated for the pathways associated with the greatest risk (outlined below) using the 95% UCL exposure point concentration and most likely (50th percentile) exposure (MLE) parameters.

The primary routes of exposure for each scenario are as follows:

- *Scenario 1 - incidental ingestion of surface water from the Hudson Branch (associated with a cancer risk of 2E-06).*
- Scenario 2 - dermal contact with soil *(associated with a cancer risk of 5E-05).* Incidental ingestion of soil also contributed as an exposure pathway of concern, *with a cancer risk of 3E-05.*
- Scenario 3 - ingestion of shallow or deep ground water as a potable source *(associated with cancer risks of 4E-02 and 8E-03, respectively, and non-cancer HIs exceeding 1E+00). Dermal contact with shallow and deep ground water is associated with cancer risks of 2E-05 and 1E-05, respectively.* Inhalation of volatile organics in deep ground water also contributed as an exposure pathway of concern *(associated with a cancer risk of 4E-04).*
- Scenario 4 - incidental ingestion of soil contributed as an exposure pathway of concern, *but risks did not exceed 1E-06 and HIs did not exceed 1E+00.*
- Scenario 5 - incidental ingestion of soil *is associated with cancer risks of 9E-05 (child) and 5E-05 (adult) and the HI for this pathway exceeded 1E+00 for children but not adults.* Dermal exposure to contaminants in soil also contributed as an exposure pathway of concern, *with a cancer risk of 1E-04.*

Table 2-17 presents the MLE parameters used in this sensitivity analysis. It should be noted that the guidance for selection of central tendency exposure parameters is incomplete (EPA, 1993), and best professional judgement was used in instances where documented

information could not be obtained. Further, in some instances, commonly used RME parameters (e.g., body weight) are actually averages and these values are used for the MLE case as well.

The results of this sensitivity analysis are presented in Table 2-18 and discussed below, by scenario.

- *Scenario 1 - Trespassing (Current)*

  For the trespassing scenario, the primary exposure pathway associated with excess cancer risk is ingestion of surface water (Table 2-18). The values of exposure frequency (EF) and exposure duration (ED) were the only MLE parameters applied in this analysis (Table 2-17). Substitution of RME values with MLE values for EF and ED reduces the cancer risk value for ingestion of surface water by approximately an order of magnitude (Table 2-18) such that the MLE cancer risk does not exceed 1E-06.

- *Scenario 2 - Commercial/Industrial (Current)*

  Dermal contact with soil and incidental ingestion of soil were the primary exposure pathways associated with excess cancer risk for the commercial/industrial scenario (Table 2-18). For dermal exposure, the exposed skin surface area (SA), absorption factors (ABS), adherence factors (AF), and ED were adjusted to reflect central tendency values (Table 2-17). The MLE cancer risk value for dermal contact with soil is approximately three orders of magnitude lower than the RME cancer risk value such that this pathway-specific risk is less than 1E-06. MLE parameters for incidental ingestion of soil include the soil ingestion rate (IR) and ED (Table 2-17). The MLE cancer risk value for ingestion of soil is an order of magnitude less than the RME cancer risk value, and exceeds 1E-06 by a factor of 3.

- *Scenario 3 - Residential (Current)*

  For the current residential scenario, the primary exposure pathways associated with excess cancer risk include ingestion of ground water, dermal contact with ground water, and inhalation of volatiles from ground water during showering (Table 2-18). Ingestion of ground water is also associated with an elevated HI.

  The parameters used to describe the MLE for ingestion of ground water include IR and ED (Table 2-17). The MLE cancer risks for this pathway are approximately 25% of the RME cancer risks (for both shallow and deep ground water), and exceed 1E-06 by factors of 9,000 and 2,000 for shallow and deep ground water, respectively. Similar reductions in the HI are also seen, and the MLE HI for deep and shallow ground water continues to exceed 1E+00.

The parameters used to describe the MLE for dermal contact with ground water include ED and the exposure time (ET) (Table 2-17). The MLE cancer risks for this pathway are approximately an order of magnitude less than the RME cancer risks (for both shallow and deep ground water), and exceed 1E-06 by 4- and 2-fold, for shallow and deep ground water, respectively (Table 2-18).

The parameters used to describe the MLE for inhalation of volatiles from ground water during showering include the inhalation rate, ED, and ET (Table 2-17). The MLE cancer risk for this pathway is approximately an order of magnitude less than the RME cancer risk, and exceeds 1E-06 by a factor of 60.

- *Scenario 4 - Construction (Future)*

  The primary exposure pathway associated with excess cancer risk for Scenario 4 - future construction is incidental ingestion of soil (Table 2-18). The parameters used to describe the MLE for incidental ingestion of soil include EF and ED (Table 2-17). The MLE cancer risk is approximately an order of magnitude lower than the RME cancer risk, and is less than 1E-06.

- *Scenario 5 - Residential (Future)*

  For the future residential scenario, the primary exposure pathways associated with excess cancer risk include childhood and adult incidental ingestion of soil, and dermal contact with soil (adult only). The soil ingestion pathway is also associated with an elevated HI for the child receptor (Table 2-18). The parameters used to describe the MLE for ingestion of soil include IR, EF, and ED (adults only) (Table 2-17). The MLE cancer risk for this pathway for the adult is approximately two orders of magnitude less than the RME cancer risk, and exceeds 1E-06 by a factor of 3. The MLE cancer risk for this pathway for the child is 5% of the RME cancer risk, and exceeds 1E-06 by a factor of 20. The MLE HI for this pathway for the child is 20% of the RME HI, and does not exceed the target of 1E+00.

  The parameters used to describe the MLE for dermal contact with soil include SA, ABS, AF, EF, and ED (Table 2-17). The MLE cancer risk for this pathway is approximately four orders of magnitude less than the RME cancer risk, and does not exceed 1E-06.

In summary, this sensitivity analysis provides insight into the magnitude of uncertainty associated with the exposure pathways contributing the majority of excess risk. In particular, risks which exceed 1E-06 for the RME, but not the MLE, include:

- *Ingestion of Surface Water (Scenario 1 - Current Trespassing),*
- *Dermal Contact with Soil (Scenario 2 - Current Commercial/Industrial Use),*
- *Incidental Ingestion of Soil (Scenario 4 - Future Construction), and*
- *Dermal Contact with Soil (Scenario 5 - Future Residential).*

Elevated hazard indices which exceed 1E+00 for the RME, but not the MLE, is limited to incidental ingestion of soil (Scenario 5 - Future Residential, adult only).

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TABLES

TABLE 2-1

FIELD INVESTIGATION PROGRAM SUMMARY

Field Reconnaissance and Instrument Survey
Mobilization
Sampling Grid Layout
Surface Soil Sampling (64 samples)
Test Pit Operations (5 test pits located along former drainage ditch - 5 samples)
Soil Gas Surveys - used to locate 6 soil borings in former product storage areas
Collection of one round of surface water samples from the Hudson Branch, including runoff samples during a rainfall event from major drainage pathways, and one round of sediment samples from the Hudson Branch
Completion of 72 soil borings across the site to characterize soil quality and geology above the water table
Installation of ground water monitoring wells to identify geologic and hydrogeologic conditions; 19 wells installed at 14 locations, including 7 deep and 12 shallow wells
Collection of 2 rounds of ground water samples from on-site and off-site newly installed and existing monitoring wells; initial round (52 monitoring wells sampled) characterized ground water quality and the second round (39 monitoring wells sampled) confirmed first round results and further defined the nature and extent of contamination
Collection of 72 air samples over the course of 12 air sampling events conducted during non-operational periods at the SMC facility

TABLE 2-2
SUMMARY OF SURFACE SOIL CONCENTRATION DATA

COMPOUND NAME	FREQUENCY OF DETECTION	RANGE OF SQL (mg/kg)	RANGE OF DETECTION (mg/kg)	95% UCL (mg/kg) CALCULATED FOR SCENARIO NUMBER * 1	2	5	SURFACE SOIL BACKGROUND CONCENTRATION (mg/kg)
INORGANICS							
ALUMINUM	116/116	NA	952-104000	4651.9	26159.5	8422.5	1840 - 4090
ANTIMONY	19/116	3.6-16.4	4.7-39.5	6.1	5.1	5.9	12.3 - <12.8
ARSENIC	112/116	0.4-4.1	0.51-43.1	2.1	2.4	2.0	<2.1
BARIUM	115/116	40.5	6.3-739	40.9	257.6	77.4	<40.9 - <42.7
BERYLLIUM	98/116	0.18-1.0	0.23-60.1	1.7	15.4	5.4	<1.0 - <1.1
CADMIUM	11/116	0.61-1.6	0.62-5.3	1.1	1.0	0.9	<1.0 - <1.1
CHROMIUM (total)	115/116	0.8	1.5-5870	80.1	254.8	246.6	2.1 - 18.2
CHROMIUM III a	NA	NA	NA	70	252.3	242.6	NA
CHROMIUM VI	38/44	0.12-0.22	0.12-53	10.0	2.5	4.0	<0.11
COBALT	75/116	0.97-10.6	1.3-87.1	3.8	6.9	4.3	<10.2 - <10.7
COPPER	115/116	0.93-1.1	1.1-887	17.4	32.7	15.6	<5.2 - 20.8
LEAD	116/116	NA	2.3-760	73.8	118.9	56.1	6.7 -17.9
MANGANESE	114/116	NA	4.3-3150	209.1	1156.7	436.1	19.4 - 103
MERCURY	28/116	0.04-0.16	0.04-2.5	0.2	0.1	0.1	<0.089 - <.11
NICKEL	98/116	2.0-8.1	2.0-3360	53.5	837.0	223.6	<8.3 - 8.3
SELENIUM	18/116	0.32-10.3	0.44-5.1	0.5	1.5	0.7	<1.0 - <1.1
SILVER	13/116	0.65-3.1	0.37-3.3	1.1	1.6	1.2	<2.1
THALLIUM	NA	NA	NA	0.0	0.0	0.0	<2.1
VANADIUM	116/116	NA	5.4-12100	361.7	3383.1	1548.6	<10.4 - 53.7
ZINC	116/116	NA	3.75-1310	77.7	168.8	69.9	15.2 - 18.1
CYANIDE	1/114	0.5-2.2	0.7	NA	NA	0.7	<1.1
BORON	10/69	16.2-74.4	37.9-239	27.7	108.1	33.6	<20.9 - <21.4
NIOBIUM	7/68	32.4-149	52-845	61.1	184.0	66.1	<40.5 - <42.5
STRONTIUM	15/69	16.2-74.4	22.8-228	27.9	160.3	41.6	<20.4 - <21.4
TITANIUM	72/72	NA	49.3-941	137.4	285.0	146.0	49.3 - 123
ZIRCONIUM	3/17	38.5-40.8	51.5-159	NA	101.0	90.2	NA
FLUORIDE	NA	NA	NA	NA	NA	NA	NA
VOLATILE ORGANICS							
CHLOROMETHANE	NA	NA	NA	NA	NA	NA	NA
METHYLENE CHLORIDE	NA	NA	NA	NA	NA	NA	NA
ACETONE	1/14	NA	0.082	NA	NA	0.082	NA
CARBON DISULFIDE	1/14	0.005-0.006	0.003	NA	NA	0.0030	NA
1,2-DICHLOROETHENE (total)	1/14	0.005-0.006	0.002	NA	NA	0.0020	NA
CHLOROFORM	NA	NA	NA	NA	NA	NA	NA
2-BUTANONE	2/14	0.01-0.012	0.008-0.009	NA	NA	0.0061	NA
1,1,1-TRICHLOROETHANE	NA	NA	NA	NA	NA	NA	NA
TRICHLOROETHENE	11/14	0.005-0.006	0.001-0.005	0.0055	0.0040	0.0035	NA
BENZENE	1/14	0.005-0.006	0.15	NA	NA	0.1500	NA
TETRACHLOROETHENE	7/14	0.005-0.006	0.001-0.004	0.0040	NA	0.0036	NA
TOLUENE	5/14	0.005-0.006	0.001-0.007	0.0045	NA	0.0038	NA
ETHYLBENZENE	1/14	0.005-0.006	0.058	NA	NA	0.0137	NA
XYLENE (total)	1/14	0.005-0.006	0.36	NA	NA	0.0506	NA
BASE NEUTRAL / ACIDS							
PHENOL	2/14	0.34-0.47	0.046-0.18	NA	NA	0.180	NA
2-CHLOROPHENOL	NA	NA	NA	NA	NA	NA	NA
BENZOIC ACID	3/14	1.7-2.4	0.059-0.15	NA	NA	0.150	NA
2,4-DICHLOROPHENOL	NA	NA	NA	NA	NA	NA	NA
NAPHTHALENE	1/14	0.34-0.47	0.13	NA	NA	0.130	NA
4-CHLORO-3-METHYLPHENOL	NA	NA	NA	NA	NA	NA	NA
2,4,5-TRICHLOROPHENOL	NA	NA	NA	NA	NA	NA	NA
4-NITROPHENOL	1/14	1.2-2.4	1.0	NA	NA	1.000	NA
2,4-DINITROTOLUENE	1/14	0.34-0.47	0.11	NA	NA	0.110	NA
PENTACHLOROPHENOL	9/14	1.8-2.4	0.040-0.79	0.074	NA	2.789	NA
PHENANTHRENE	3/14	0.34-0.47	0.045-0.13	NA	NA	0.130	NA
ANTHRACENE	1/14	0.34-0.47	0.084	NA	NA	0.084	NA
DI-n-BUTYLPHALATE	5/14	0.34-0.47	0.11-0.3	NA	0.21	0.093	NA
FLUORANTHENE	5/14	0.34-0.47	0.04-0.29	NA	NA	0.259	NA
PYRENE	4/14	0.34-0.47	0.042-0.055	0.055	NA	0.046	NA
BUTYLBENZYLPHTHALATE	1/14	0.34-0.47	0.12	NA	NA	0.120	NA
BENZO(a)ANTHRACENE	1/14	0.34-0.47	0.42	NA	NA	0.420	NA
CHRYSENE	4/14	0.34-0.47	0.52-0.58	0.338	NA	0.300	NA
bis(2-ETHYLHEXYL)PHTHALATE	5/14	0.35	0.062-0.25	NA	0.085	0.250	NA
BENZO(b)FLUORANTHENE	3/14	0.34-0.47	0.047-0.35	0.220	NA	0.267	NA
BENZO(k)FLUORANTHENE	1/14	0.34-0.47	0.16	NA	NA	0.16	NA
BENZO(a)PYRENE	1/14	0.34-0.47	0.74	NA	NA	0.74	NA
INDENO(1,2,3-cd)PYRENE	1/14	0.34-0.47	0.38	NA	NA	0.38	NA
BENZO(g,h,i)PERYLENE	1/14	0.34-0.47	1.1	NA	NA	1.1	NA
PESTICIDES / PCB'S							
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
AROCLOR-1248	1/14	0.039-0.088	1.9	NA	1.900	1.900	NA
AROCLOR-1254	4/14	0.084-0.18	0.013-1.5	NA	1.500	1.153	NA
AROCLOR-1260	1/14	0.077-0.18	0.022	NA	NA	0.022	NA

NA - EITHER NOT DETECTED OR NOT ANALYZED FOR INDICATED CONTAMINANT SUCH THAT CONTAMINANT NOT CARRIED THROUGH THE QUANTITATIVE RISK ANALYSIS.

a - FOR SCENARIOS 2&5 CHROMIUM III IS CALCULATED BY SUBTRACTING CHROMIUM VI FROM TOTAL CHROMIUM. FOR SCENARIO 1 CHROMIUM III IS CALCULATED ASSUMING THAT THE TOTAL CHROMIUM IS 7/8 CHROMIUM III AND 1/8 CHROMIUM VI.

TABLE 2-3
SUMMARY OF SUBSURFACE SOIL CONCENTRATIONS

COMPOUND NAME	FREQUNCY OF DETECTION	RANGE OF SQL (mg/kg)	RANGE OF DETECTION (mg/kg)	95% UCL CALCULATED FOR SCENARIO 4* (mg/kg)
INORGANICS				
ALUMINUM	76/76	NA	257-86300	5116.05
ANTIMONY	12/76	3.3-19.6	4.6-15.7	5.52
ARSENIC	47/76	0.38-4.3	0.42-69.8	1.30
BARIUM	74/76	39.1-65.2	2.6-452	24.60
BERYLLIUM	54/76	0.19-1.6	0.08-18.3	0.95
CADMIUM	1/76	0.6-1.6	1.0	0.84
CHROMIUM (total)	70/76	0.80-2.2	0.89-834	74.81
CHROMIUM III (a)	NA	NA	NA	48.09
CHROMIUM VI	27/27	NA	0.1-589	26.72
COBALT	51/76	1.0-16.3	0.95-15.8	3.48
COPPER	66/76	0.89-8.2	0.88-21.4	4.34
LEAD	74/76	2.5-33	0.58-110	12.96
MANGANESE	76/76	3.3	2.6-3950	132.84
MERCURY	8/76	0.04-0.7	0.05-0.10	0.10
NICKEL	44/76	1.5-13.0	1.5-245	12.93
SELENIUM	7/76	0.34-10.8	0.43-4	0.58
SILVER	9/76	0.6-3.3	1.3-4	1.41
THALLIUM	1/76	0.69-21.7	1.1	1.10
VANADIUM	72/76	1.1-11.1	3.1-3660	304.87
ZINC	76/76	4.0-4.4	1.6-248	20.03
CYANIDE	NA	NA	NA	NA
BORON	2/24	19.1-32.6	29.1-47.3	24.51
NIOBIUM	NA	NA	NA	NA
STRONTIUM	NA	NA	NA	NA
TITANIUM	30/30	NA	29.4-398	149.81
ZIRCONIUM	3/17	39.1-65.2	43.5-1120	106.11
FLUORIDE	NA	NA	NA	NA
VOLATILE ORGANICS				
CHLOROMETHANE	NA	NA	NA	NA
METHYLENE CHLORIDE	3/38	(0.005) b	0.15	0.15
ACETONE	9/38	(0.01) b	0.062-0.18	0.17
CARBON DISULFIDE	1/38	0.005-0.006	0.016	0.01
1,2-DICHLORETHENE (total)	1/38	0.005-0.006	0.003	0.0029
CHLOROFORM	2/38	0.005-0.006	0.001	0.0029
2-BUTANONE	1/38	0.010-0.012	0.007	0.0055
1,1,1-TRICHLOROETHANE	1/38	0.005-0.006	0.004	0.0029
TRICHLOROETHENE	10/38	0.005-0.006	0.001-0.024	0.0040
BENZENE	NA	NA	NA	NA
TETRACHLOROETHENE	2/38	0.005-0.006	0.004	0.0030
TOLUENE	2/38	0.005-0.006	0.002	0.0029
ETHYLBENZENE	NA	NA	NA	NA
XYLENE (total)	NA	NA	NA	NA
BASE NEUTRAL / ACIDS				
PHENOL	3/34	0.34-0.43	0.065-0.16	0.19
2-CHLOROPHENOL	1/34	0.34-0.43	0.047	0.20
BENZOIC ACID	1/34	1.7-2.2	0.095	1.10
2,4-DICHLOROPHENOL	1/34	0.34-0.43	0.11	0.20
NAPHTHALENE	NA	NA	NA	NA
4-CHLORO-3-METHYLPHENOL	1/34	0.34-0.43	0.039	0.20
2,4,5-TRICHLOROPHENOL	5/34	1.7-2.2	0.036-0.2	1.40
4-NITROPHENOL	1/34	1.7-2.2	0.099	1.08
2,4-DINITROTOLUENE	NA	NA	NA	NA
PENTACHLOROPHENOL	7/34	0.34-0.43	0.085-0.3	0.30
PHENANTHRENE	6/34	0.34-0.43	0.039-0.16	0.16
ANTHRACENE	NA	NA	NA	NA
DI-n-BUTYLPHALATE	9/34	0.34-0.43	0.05-1.2	1.20
FLUORANTHENE	9/34	0.34-0.43	0.037-0.24	0.20
PYRENE	7/34	0.34-0.43	0.039-0.25	0.21
BUTYLBENZYLPHTHALATE	2/34	0.34-0.43	0.036-0.13	0.13
BENZO(a)ANTHRACENE	7/34	0.34-0.43	0.036-0.13	0.13
CHRYSENE	5/34	0.34-0.43	0.038-0.13	0.13
bis(2-ETHYLHEXYL)PHTHALATE	8/34	0.34-0.43	0.037-0.95	0.47
BENZO(b)FLUORANTHENE	3/34	0.34-0.43	0.04-0.24	0.21
BENZO(k)FLUORANTHENE	2/34	0.34-0.43	0.051-0.075	0.075
BENZO(a)PYRENE	2/34	0.34-0.43	0.044-0.066	0.066
INDENO(1,2,3-cd)PYRENE	1/34	0.34-0.43	0.037	0.037
BENZO(g,h,i)PERYLENE	1/34	0.34-0.43	0.059	0.059
PESTICIDES / PCB'S				
4,4-DDT	5/34	0.0079-0.018	0.0093-31.0	31.00
AROCLOR-1248	NA	NA	NA	NA
AROCLOR-1254	NA	NA	NA	NA
AROCLOR-1260	1/40	0.077-170	0.028	0.028

NA: EITHER NOT DETECTED OR NOT ANALYZED FOR INDICATED CONTAMINANT SUCH THAT CONTAMINANT NOT CARRIED THROUGH THE QUANTITATIVE RISK ANALYSIS

(a): THE CHROMIUM III IS CALCULATED BY SUBTRACTING CHROMIUM VI FROM TOTAL CHROMIUM

(b): CONTRACT REQUIRED QUANTITATION LIMIT USED IN PLACE OF SAMPLE QUANTITATION LIMIT

TABLE 2-4
SUMMARY OF SURFACE WATER CONCENTRATION DATA (a)

COMPOUND NAME	FREQUNCY OF DETECTION	RANGE OF SQL (ug/L)	RANGE OF DETECTION (ug/L)	95% UCL FOR CALCULATED SCENARIO 1 (ug/L)
INORGANICS				
ALUMINUM	5/5	NA	224-44800	44800.0
ANTIMONY	2/5	22	44.2-151	151.0
ARSENIC	3/5	2	2-34.6	34.6
BARIUM	5/5	NA	24.5-292	292.0
BERYLLIUM	4/5	1	1-25.1	25.1
CADMIUM	1/5	4	9	7.6
CHROMIUM (total)	5/5	NA	43.3-8520	8520.0
CHROMIUM III (b)	NA	NA	NA	8519.9
CHROMIUM VI	1/1	NA	0.054	0.05
COBALT	1/5	7	62.2	62.2
COPPER	5/5	NA	7.3-432	432.0
LEAD	4/5	130	3.8-28	65.0
MANGANESE	5/5	NA	131-2590	2590.0
MERCURY	1/5	0.2	21.4	21.4
NICKEL	5/5	NA	17.1-618	618.0
SELENIUM	NA	NA	NA	NA
SILVER	NA	NA	NA	NA
THALLIUM	NA	NA	NA	NA
VANADIUM	5/5	NA	246-5700	5700.0
ZINC	5/5	NA	20.8-1070	1070.0
CYANIDE	1/5	10	11	10.6
BORON	2/2	NA	585-828	828.0
NIOBIUM	NA	NA	NA	NA
STRONTIUM	NA	NA	NA	NA
TITANIUM	NA	NA	NA	NA
ZIRCONIUM	NA	NA	NA	NA
FLUORIDE	5/5	NA	0.84-1.1	1.0
VOLATILE ORGANICS				
CHLOROMETHANE	1/5	10	9	7.7
METHYLENE CHLORIDE	NA	NA	NA	NA
ACETONE	NA	NA	NA	NA
CARBON DISULFIDE	NA	NA	NA	NA
1,2-DICHLORETHENE (total)	1/5	5	2	2.5
CHLOROFORM	NA	NA	NA	NA
2-BUTANONE	NA	NA	NA	NA
1,1,1-TRICHLOROETHANE	NA	NA	NA	NA
TRICHLOROETHENE	1/5	5	3	2.8
BENZENE	NA	NA	NA	NA
TETRACHLOROETHENE	NA	NA	NA	NA
TOLUENE	NA	NA	NA	NA
ETHYLBENZENE	NA	NA	NA	NA
XYLENE (total)	NA	NA	NA	NA
BASE NEUTRAL / ACIDS				
PHENOL	NA	NA	NA	NA
2-CHLOROPHENOL	NA	NA	NA	NA
BENZOIC ACID	NA	NA	NA	NA
2,4-DICHLOROPHENOL	NA	NA	NA	NA
NAPHTHALENE	NA	NA	NA	NA
4-CHLORO-3-METHYLPHENOL	NA	NA	NA	NA
2,4,5-TRICHLOROPHENOL	NA	NA	NA	NA
4-NITROPHENOL	NA	NA	NA	NA
2,4-DINITROTOLUENE	NA	NA	NA	NA
PENTACHLOROPHENOL	NA	NA	NA	NA
PHENANTHRENE	NA	NA	NA	NA
ANTHRACENE	NA	NA	NA	NA
DI-n-BUTYLPHALATE	2/2	NA	1	1.0
FLUORANTHENE	NA	NA	NA	NA
PYRENE	NA	NA	NA	NA
BUTYLBENZYLPHTHALATE	NA	NA	NA	NA
BENZO(a)ANTHRACENE	NA	NA	NA	NA
CHRYSENE	NA	NA	NA	NA
bis(2-ETHYLHEXYL)PHTHALATE	1/5	11	2	2.0
BENZO(b)FLUORANTHENE	NA	NA	NA	NA
BENZO(k)FLUORANTHENE	NA	NA	NA	NA
BENZO(a)PYRENE	NA	NA	NA	NA
INDENO(1,2,3-cd)PYRENE	NA	NA	NA	NA
BENZO(g,h,i)PERYLENE	NA	NA	NA	NA
PESTICIDES / PCB'S				
4,4-DDT	NA	NA	NA	NA
AROCLOR-1248	NA	NA	NA	NA
AROCLOR-1254	NA	NA	NA	NA
AROCLOR-1260	NA	NA	NA	NA

NA - EITHER NOT DETECTED OR NOT ANALYZED FOR INDICATED CONTAMINANT SUCH THAT CONTAMINANT NOT CARRIED THROUGH THE QUANTITATIVE RISK ANALYSIS.

(a) - DOES NOT INCLUDE FOUR RUNOFF SAMPLES COLLECTED DURING A RAINFALL EVENT

(b) - CHROMIUM III IS CALCULATED BY SUBTRACTING CHRUMIUM IV FROM THE TOTAL CHROMIUM

TABLE 2-5
SUMMARY OF GROUNDWATER CONCENTRATIONS (a)

COMPOUND NAME	FREQUENCY OF DETECTION	RANGE OF SQL (ug/L)	RANGE OF DETECTION (ug/L)	95% UCL CALCULATED FOR SCENARIO 3 SHALLOW (ug/L)	95% UCL CALCULATED FOR SCENARIO 3 DEEP (ug/L)	GROUNDWATER BACKGROUND CONCENTRATION (ug/L)
INORGANICS						
ALUMINUM	10/10	NA	196-99400	39200.0	99400.0	2550.0
ANTIMONY	2/10	19-21	1340-2140	NA	2140.0	< 21
ARSENIC	4/10	2	3.6-748	748.0	352.0	< 2
BARIUM	10/10	NA	9.8-507	86.7	507.0	128.0
BERYLLIUM	4/10	1	8.2-570	570.0	11.3	< 1
CADMIUM	1/10	4	7.7	7.7	NA	< 4
CHROMIUM (total)	9/10	3	7.4-102000	84.6	102000.0	91.7
CHROMIUM III (b)	NA	NA	NA	84.6	100600.0	NA
CHROMIUM VI	3/10	0.02	0.008-1400	0.008	1400.0	0.3
COBALT	4/10	4-5	5.2-43.8	7.5	43.8	< 5
COPPER	5/10	5-7	5.5-130	130.0	37.7	25.9
LEAD	5/10	2-20	5-68.8	68.8	24.4	16.2
MANGANESE	10/10	NA	21.4-1370	598.1	176.0	74.8
MERCURY	3/10	0.2	0.68-0.793	0.68	0.98	< 0.2
NICKEL	5/10	7-8	8.7-212	212.0	8.7	9.7
SELENIUM	2/10	2-10	49.6-130	NA	130.0	< 2
SILVER	1/10	4-5	5.1	NA	5.1	< 5
THALLIUM	NA	NA	NA	NA	NA	NA
VANADIUM	8/10	4-8	8.4-128000	128000.0	2000.0	8.3
ZINC	8/10	3	9.3-1080	1080.0	65.1	1080.0
CYANIDE	3/10	10	30.1-26400	26400.0	62.2	< 10
BORON	4/7	100	130-14700	14700.0	158.0	NA
NIOBIUM	NA	NA	NA	NA	NA	NA
STRONTIUM	2/7	100	294-318	NA	318.0	NA
TITANIUM	3/7	100	149-325	149.0	325.0	NA
ZIRCONIUM	NA	NA	NA	NA	NA	NA
FLUORIDE	NA	NA	NA	NA	NA	NA
VOLATILE ORGANICS						
CHLOROMETHANE	NA	NA	NA	NA	NA	NA
METHYLENE CHLORIDE	NA	NA	NA	NA	NA	NA
ACETONE	NA	NA	NA	NA	NA	NA
CARBON DISULFIDE	NA	NA	NA	NA	NA	NA
1,2-DICHLOROETHENE (total)	NA	NA	NA	NA	NA	NA
CHLOROFORM	NA	NA	NA	NA	NA	NA
2-BUTANONE	NA	NA	NA	NA	NA	NA
1,1,1-TRICHLOROETHANE	NA	NA	NA	NA	NA	NA
TRICHLOROETHENE	2/7	5	35-70	NA	70.0	17.0
BENZENE	NA	NA	NA	NA	NA	NA
TETRACHLOROETHENE	1/7	5	1	NA	1.0	1.0
TOLUENE	NA	NA	NA	NA	NA	NA
ETHYLBENZENE	NA	NA	NA	NA	NA	NA
XYLENE (total)	NA	NA	NA	NA	NA	NA
BASE NEUTRAL / ACIDS						
PHENOL	NA	NA	NA	NA	NA	NA
2-CHLOROPHENOL	NA	NA	NA	NA	NA	NA
BENZOIC ACID	NA	NA	NA	NA	NA	NA
2,4-DICHLOROPHENOL	NA	NA	NA	NA	NA	NA
NAPHTHALENE	NA	NA	NA	NA	NA	NA
4-CHLORO-3-METHYLPHENOL	NA	NA	NA	NA	NA	NA
2,4,5-TRICHLOROPHENOL	NA	NA	NA	NA	NA	NA
4-NITROPHENOL	NA	NA	NA	NA	NA	NA
2,4-DINITROTOLUENE	NA	NA	NA	NA	NA	NA
PENTACHLOROPHENOL	NA	NA	NA	NA	NA	NA
PHENANTHRENE	NA	NA	NA	NA	NA	NA
ANTHRACENE	NA	NA	NA	NA	NA	NA
DI-n-BUTYLPHALATE	NA	NA	NA	NA	NA	NA
FLUORANTHENE	NA	NA	NA	NA	NA	NA
PYRENE	NA	NA	NA	NA	NA	NA
BUTYLBENZYLPHTHALATE	NA	NA	NA	NA	NA	NA
BENZO(a)ANTHRACENE	NA	NA	NA	NA	NA	NA
CHRYSENE	NA	NA	NA	NA	NA	NA
bis(2-ETHYLHEXYL)PHTHALATE	1/5	10	4	NA	4.0	< 11
BENZO(b)FLUORANTHENE	NA	NA	NA	NA	NA	NA
BENZO(k)FLUORANTHENE	NA	NA	NA	NA	NA	NA
BENZO(a)PYRENE	NA	NA	NA	NA	NA	NA
INDENO(1,2,3-cd)PYRENE	NA	NA	NA	NA	NA	NA
BENZO(g,h,i)PERYLENE	NA	NA	NA	NA	NA	NA
PESTICIDES / PCB'S						
4,4-DDT	NA	NA	NA	NA	NA	NA
AROCLOR-1248	NA	NA	NA	NA	NA	NA
AROCLOR-1254	NA	NA	NA	NA	NA	NA
AROCLOR-1260	NA	NA	NA	NA	NA	NA

NA: EITHER NOT DETECTED OR NOT ANALYZED FOR INDICATED CONTAMINANT SUCH THAT CONTAMINANT NOT CARRIED THROUGH THE QUANTITATIVE RISK ANALYSIS

(a): INCLUDES DATA FROM SC-13, SC-22, SC-D AND SC-W2 ONLY

(b): THE CHROMIUM III IS CALCULATED BY SUBTRACTING CHROMIUM VI FROM TOTAL CHROMIUM

TABLE 2-6
PHYSICAL, CHEMICAL AND ENVIRONMENTAL
FATE PROPERTIES

COMPOUND	CASRN	Koc (ml/g)	Water Solubility at 25°C(mg/L)	Henry's Law Constant (atm*m3/mol)	Vapor Pressure (mm Hg)	Half life Soil (day's)	Half life Surface Water (day's)
INORGANICS							
ALUMINUM	7429-90-5						
ANTIMONY	7440-36-0			NA	1		persistent
ARSENIC	7440-38-2			NA	0		persistent
BARIUM	7440-39-3			NA			persistent
BERYLLIUM	7440-41-7			NA	0		
CADMIUM	7740-43-9			NA	0		persistent
CHROMIUM (total)	7440-47-3			NA	0		3
CHROMIUM III a							
CHROMIUM VI							
COBALT	7440-48-4						
COPPER	7440-50-8			NA	0		
LEAD	7439-92-1			NA	0		persistent
MANGANESE	7439-96-5			NA			
MERCURY	7439-97-6			NA	2E-03		persistent
NICKEL	7440-02-0			NA	0		
SELENIUM	7782-49-2			NA	0		
SILVER	7440-22-4			NA	0		
THALLIUM	7440-28-0				0		
VANADIUM	7440-62-2			NA			
ZINC	7440-66-6			NA	0		persistent
CYANIDE							0.33-0.8
BORON							
NIOBIUM							
STRONTIUM							
TITANIUM							
ZIRCONIUM							
FLUORIDE							
VOLATILE ORGANICS							
CHLOROMETHANE	75-00-3	3.2	4700	1.11E-02	1011		
METHYLENE CHLORIDE	75-09-2	8.7	1.3E+04	2E-03	440		
ACETONE	67-64-1	2.2	1E+06	2.06E-05	270		
CARBON DISULFIDE	75-15-0	54	2940	1.23E-02	360		
1,2-DICHLORETHENE (total)	540-59-0	59	6300	6.56E-03	324		1-6
CHLOROFORM	67-66-3	31	8200	2.87E-03	151		0.3-30
2-BUTANONE	78-93-3	4.5	2.68E+05	2.74E-05	77.5		10
1,1,1-TRICHLOROETHANE	71-55-6	152	1500	1.44E-02	123		0.14-7
TRICHLOROETHENE	79-01-6	126	1100	9.1E-03	57.9		1-90
BENZENE	71-43-2	83	1750	5.59E-03	95.2		1-6
TETRACHLOROETHENE	127-18-4	364	150	2.59E-02	17.8		1-30
TOLUENE	108-88-3	300	535	6.37E-03	28.1		0.17
ETHYLBENZENE	100-41-4	1100	152	6.43E-03	7		
XYLENE (total)	1330-20-7	240	198	7.04E-03	10		1.5-9
BASE NEUTRAL / ACIDS							
PHENOL	108-95-2	14	9.3E+04	4.54E-07	0.341		0.62-9
2-CHLOROPHENOL	95-57-8	16	2.8E+04	5.6E-07	1.42		73
BENZOIC ACID	65-85-0	57	2700 @ 18 deg. C	7.0E-08	4.5E-03	< 7	0.2-3.6
2,4-DICHLOROPHENOL	120-83-2	380	4600	2.75E-06	5.9E-02		6
NAPHTHALENE	91-20-3	550	30	4.6E-04	0.23		
4-CHLORO-3-METHYLPHENOL							
2,4,5-TRICHLOROPHENOL	95-95-4	89	1190	2.18E-04	1	72	
4-NITROPHENOL	100-02-7	17	2.5E+04	3.31E-08	1E-03	1-40	1-8
2,4-DINITROTOLUENE	121-14-2	62	270	8.67E-07	5.1E-03		0.4-10
PENTACHLOROPHENOL	87-86-5	53000	14	2.75E-06	1.1E-04		5
PHENANTHRENE	85-01-8	14000	1	1.59E-04	6.8E-04		0.38-2
ANTHRACENE	120-12-7	14000	4.5E-02	1.02E-03	1.95E-04		
DI-n-BUTYLPHALATE	84-74-2	170000	13	2.82E-07	1E-05		
FLUORANTHENE	206-44-0	38000	0.206	6.46E-06	5E-06		1-2
PYRENE	129-00-0	38000	0.132	5.04E-06	2.5E-06		
BUTYLBENZYLPHTHALATE	85-68-7	2530	2.69	1.3E-06	8.6E-06		
BENZO(a)ANTHRACENE	56-55-3	1380000	5.7E-03	1.16E-06	2.2E-08		0.1-5
CHRYSENE	218-01-9	200000	1.8E-03	1.05E-06	6.3E-09		0.2
bis(2-ETHYLHEXYL)PHTHALATE	117-81-7	100000	0.4	1.1E-05	6.2E-08		
BENZO(b)FLUORANTHENE	205-99-2	550000	1.4E-02	1.19E-05	5E-07		1-2
BENZO(k)FLUORANTHENE	207-08-9	550000	4.3E-03	3.94E-05	5.1E-07		
BENZO(a)PYRENE	50-32-8	5500000	1.2E-03	1.55E-06	5.6E-09	420-480	0.4
INDENO(1,2,3-cd)PYRENE	193-39-5	1600000	5.3E-04	6.86E-08	1E-10		0.0208-2.08
BENZO(g,h,i)PERYLENE	191-24-2	1600000	7E-04	5.34E-08	1.03E-10		
PESTICIDES / PCB'S							
4,4-DDT	50-29-3	243000	5E-03	5.13E-04	5.5E-06	1000-5500	56-110
AROCLOR-1248	12672-29-6	436516	0.06	3.5E-03	4.94E-04		
AROCLOR-1254	11097-69-1	407380	0.012	2.3E-03	7.71E-05		
AROCLOR-1260	11096-82-5	2630268	0.08	7.1E-03	4.05E-05		

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TABLE 2-7

CONSTITUENTS INCLUDED IN THE HUMAN HEALTH RISK ASSESSMENT

Surface Soil		Subsurface Soil		Ground Water	Surface Water
Inorganics	Base Neutral/Acids	Inorganics	Base Neutral/Acids	Inorganics	Inorganics
Aluminum	Phenol	Aluminum	Phenol	Aluminum	Aluminum
Antimony	Benzoic Acid	Antimony	2,4,5-Trichlorophenol	Antimony	Antimony
Arsenic	Naphthalene	Arsenic	Pentachlorophenol	Arsenic	Arsenic
Barium	4-Nitrophenol	Barium	Phenanthrene	Barium	Barium
Beryllium	2,4-Dinitrotoluene	Beryllium	Di-n-butylphthalate	Beryllium	Beryllium
Cadmium	Pentachlorophenol	Chromium III	Fluoranthene	Cadmium	Cadmium
Chromium III	Phenanthrene	Chromium VI	Pyrene	Chromium III	Chromium III
Chromium VI	Anthracene	Cobalt	Butylbenzylphthalate	Chromium VI	Chromium VI
Cobalt	Di-n-butylphthalate	Copper	Benzo(a)anthracene	Cobalt	Cobalt
Copper	Fluoranthene	Lead	Chrysene	Copper	Copper
Lead	Pyrene	Manganese	Bis(2-ethylhexyl)phthalate	Lead	Lead
Manganese	Butylbenzylphthalate	Mercury	Benzo(b)fluoranthene	Manganese	Manganese
Mercury	Benzo(a)anthracene	Nickel	Benzo(k)fluoranthene	Mercury	Mercury
Nickel	Chrysene	Selenium	Benzo(a)pyrene	Nickel	Nickel
Selenium	Bis(2-ethylhexyl)phthalate	Silver		Selenium	Vanadium
Silver	Benzo(b)fluoranthene	Vanadium	Pesticides/PCBs	Silver	Zinc
Vanadium	Benzo(k)fluoranthene	Zinc	4,4-DDT	Vanadium	Cyanide
Zinc	Benzo(a)pyrene	Boron		Zinc	Boron
Boron	Indeno(1,2,3-cd)pyrene	Titanium		Cyanide	Fluoride
Niobium	Benzo(g,h,i)perylene	Zirconium		Boron	
Strontium				Strontium	Volatile Organics
Titanium	Pesticides/PCBs	Volatile Organics		Titanium	Chloromethane
Zirconium	Aroclor-1248	Methylene Chloride			1,2-Dichloroethene (total)
	Aroclor-1254	Acetone		Volatile Organics	Trichloroethene
Volatile Organics	Aroclor-1260	Chloroform		Trichloroethene	
Acetone		Trichloroethene		Tetrachloroethene	Base Neutral/Acids
Carbon Disulfide		Tetrachloroethene			Di-n-butylphthalate
1,2-Dichloroethene (total)		Toluene		Base Neutral/Acids	Bis(2-ethylhexyl)phthalate
2-Butanone				Bis(2-ethylhexyl)phthalate	
Trichloroethene					
Benzene					
Tetrachloroethene					
Toluene					
Ethylbenzene					
Xylene (total)					

TABLE 2-8

CONSTITUENTS EXCLUDED FROM THE HUMAN HEALTH RISK ASSESSMENT

Surface Soil	Subsurface Soil	Ground Water		Surface Water	
Inorganics	Inorganics	Inorganics	Base Neutral/Acids	Inorganics	Base Neutral/Acids
Thallium[1]	Cadmium[2]	Thallium[1]	Phenol[1]	Selenium[1]	Phenol[1]
Cyanide[2]	Thallium[2]	Niobium[1]	2-Chlorophenol[1]	Silver[1]	2-Chlorophenol[1]
Fluoride[1]	Cyanide[1]	Zirconium[1]	Benzoic Acid[1]	Thallium[1]	Benzoic Acid[1]
	Niobium[1]	Fluoride[1]	2,4-Dichlorophenol[1]	Niobium[1]	2,4-Dichlorophenol[1]
Volatile Organics	Strontium[1]		Naphthalene[1]	Strontium[1]	Naphthalene[1]
Chloromethane[1]	Fluoride[1]	Volatile Organics	4-Chloro-3-methylphenol[1]	Titanium[1]	4-Chloro-3-methylphenol[1]
Methylene Chloride[1]		Chloromethane[1]	2,4,5-Trichlorophenol[1]	Zirconium[1]	2,4,5-Trichlorophenol[1]
Chloroform[1]	Volatile Organics	Methylene Chloride[1]	4-Nitrophenol[1]		4-Nitrophenol[1]
1,1,1-Trichloroethane[1]	Chloromethane[1]	Acetone[1]	2,4-Dinitrotoluene[1]	Volatile Organics	2,4-Dinitrotoluene[1]
	Carbon Disulfide[2]	Carbon Disulfide[1]	Pentachlorophenol[1]	Methylene Chloride[1]	Pentachlorophenol[1]
Base Neutral/Acids	1,2-Dichloroethene(total)[2]	1,2-Dichloroethene (total)[1]	Phenanthrene[1]	Acetone[1]	Phenanthrene[1]
2-Chlorophenol[1]	2-Butanone[2]	Chloroform[1]	Anthracene[1]	Carbon Disulfide[1]	Anthracene[1]
2,4-Dichlorophenol[1]	1,1,1-Trichloroethane[2]	2-Butanone[1]	Di-n-butylphthalate[1]	Chloroform[1]	Fluoranthene[1]
4-Chloro-3-methylphenol[1]	Benzene[1]	1,1,1-Trichloroethane[1]	Fluoranthene[1]	2-Butanone[1]	Pyrene[1]
2,4,5-Trichlorophenol[1]	Ethylbenzene[1]	Benzene[1]	Pyrene[1]	1,1,1-Trichloroethane[1]	Butylbenzylphthalate[1]
	Xylene (total)[1]	Toluene[1]	Butylbenzylphthalate[1]	Benzene[1]	Benzo(a)anthracene[1]
Pesticides/PCBs		Ethylbenzene[1]	Benzo(a)anthracene[1]	Tetrachloroethene[1]	Chrysene[1]
4,4-DDT[1]	Base Neutral/Acids	Xylene (total)[1]	Chrysene[1]	Toluene[1]	Benzo(b)fluoranthene[1]
	2-Chlorophenol[2]		Benzo(b)fluoranthene[1]	Ethylbenzene[1]	Benzo(k)fluoranthene[1]
	Benzoic Acid[2]		Benzo(k)fluoranthene[1]	Xylene (total)[1]	Benzo(a)pyrene[1]
	2,4-Dichlorophenol[2]		Benzo(a)pyrene[1]		Indeno(1,2,3-cd)pyrene[1]
	Naphthalene[1]		Indeno(1,2,3-cd)pyrene[1]		Benzo(g,h,i)perylene[1]
	4-Chloro-3-methylphenol[2]		Benzo(g,h,i)perylene[1]		
	4-Nitrophenol[2]				Pesticides/PCBs
	2,4-Dinitrotoluene[1]		Pesticides/PCBs		4,4-DDT[1]
	Anthracene[1]		4,4-DDT[1]		Aroclor-1248[1]
	Indeno(1,2,3-cd)pyrene[2]		Aroclor-1248[1]		Aroclor-1254[1]
	Benzo(g,h,i)perylene[2]		Aroclor-1254[1]		Aroclor-1260[1]
			Aroclor-1260[1]		
	Pesticides/PCBs				
	Aroclor-1248[1]				
	Aroclor-1254[1]				
	Aroclor-1260[2]				

[1] Either not detected or not analyzed for in the medium of concern.

[2] Excluded on the basis of detection frequency.

SUMMARY OF PARAMETER VALUES USED TO ESTIMATE EXPOSURE - I (VALUES SELECTED)

Scenario	Exposure Route	CR[A] (Units)	SA[B] (cm^2)	ABS[C]	AF[D] (mg/cm^2)	PC[E] (cm/hr)	FI[F]	EF[G] (d/yr)	ED[H] (yr)	ET[I] (Units)	BW[J] (kg)
1[K]	Dermal Contact with Soil	NA[L]	8,600	CS[M]	1.45	NA	NA	30	9	NA	49
1	Ingestion of Soil	100 (mg/d)	NA	NA	NA	NA	1	30	9	NA	49
1	Dermal Contact with Surface Water	NA	8,600	NA	NA	8.4E-04	NA	30	9	4 (hr/d)	49
1	Ingestion of Surface Water	50 (ml/hr)	NA	NA	NA	NA	NA	30	9	NA	49
2[N]	Dermal Contact with Soil	NA	6,300	CS	1.45	NA	NA	250	25	NA	70
2	Ingestion of Soil	100 (mg/d)	NA	NA	NA	NA	1	250	25	NA	70
2	Inhalation of Fugitive Dust	2 (m^3/hr)	NA	NA	NA	NA	NA	250	25	NA	70
3[O]	Dermal Contact with Ground Water	NA	18,150	NA	NA	8.4E-04	NA	350	30	12 (min/d)	70
3	Ingestion of Ground Water	2 (l/d)	NA	NA	NA	NA	1	350	30	NA	70
3	Inhalation of Vapor Phase Chemicals	0.83 (m^3/hr)	NA	NA	NA	NA	NA	350	30	24 (hr/d)	70
4[P]	Dermal Contact with Soil	NA	6,300	CS	1.45	NA	NA	180	1	NA	70
4	Ingestion of Soil	480 (mg/d)	NA	NA	NA	NA	1	180	1	NA	70
4	Inhalation of Fugitive Dust	2 (m^3/hr)	NA	NA	NA	NA	NA	180	1	NA	70
5[Q]	Dermal Contact with Soil	NA	9,440	CS	1.45	NA	NA	350	30	NA	70
5	Ingestion of Soil/Dust	200 (mg/d) (child); 100 (mg/d) (adult)	NA	NA	NA	NA	1	350	6 (child); 30 (adult)	NA	14.5 (child); 70 (adult)
5	Inhalation of Fugitive Dust	0.83 (m^3/hr)	NA	NA	NA	NA	NA	350	30	NA	70

[A] CR: Contact Rate
[B] SA: Surface Area
[C] ABS: Absorption Factor
[D] AF: Adherence Factor
[E] PC: Permeability Constant
[F] FI: Fraction Ingested
[G] EF: Exposure Frequency
[H] ED: Exposure Duration
[I] ET: Exposure Time
[J] BW: Body Weight
[K] Trespassing (Current)
[L] NA: Not Applicable
[M] CS: Chemical-Specific
[N] Commercial/Industrial (Current)
[O] Residential (Current)
[P] Construction (Future)
[Q] Residential (Future)

TABLE 2-10
SUMMARY OF PARAMETER VALUES USED TO ESTIMATE EXPOSURE - II (RANGE AND BASIS)

PARAMETER	VALUE OR RANGE	VALUE USED	RATIONALE	REFERENCE
Scenario 1-4: Global variables				
Body Weight (kg)				
- Child (scenario 1)	36-61.2	49	Value based on average of males and females between 9-18 yrs	EPA 1990
- Child (scenario 5)	11.6-17.4	14.5	Value based on average of males and females between 0-6 yrs	EPA 1990
- Adult	67.2-74.5	70	Value based on average of males and females between 18-65 yrs	EPA 1989
Exposure Duration (years)				
-Scenario 1	1-18	9	Based upon the age range of child likely to enter the site.	
-Scenario 2	1-70	25	National upper-bound (90th percentile) at one job.	EPA 1991
-Scenario 3	1-70	30	National upper-bound (90th percentile) at one residence.	EPA 1991
-Scenario 4	1-70	1	Amount of time spent building new homes.	EPA 1991
-Scenario 5				
Child	0-6	6	Based upon child living all six years at the residence.	
Adult	1-70	30	National upper-bound (90th percentile) at one residence.	EPA 1991
Averaging Time				
Cancer-risks (days)	NA	25,550	Value based upon 70 year life expectancy.	EPA 1989
Noncancer-risks (days)				
-Scenario 1	350-25,550	3,285	Value based upon exposure duration.	
-Scenario 2	250-25,550	9,125	Value based upon exposure duration.	
-Scenario 3	350-25,550	10,950	Value based upon exposure duration.	
-Scenario 4	180	180	Value based upon exposure duration.	
-Scenario 5				
Child	350-2,190	2,190	Value based upon exposure duration.	
Adult	350-25,550	10,950	Value based upon exposure duration.	
Absorption Factor				
Cadmium	0.001-0.01	0.01		EPA 1992b
PCBs	0.006-0.06	0.06		EPA 1992b
Permeability Constant - Dermal contact in Water (cm/hr)		8.4E-04	Based upon the penetration rate of water.	EPA 1989
Adherence Factor (mg/cm2)	0-2.77	1.45	Based upon commercial potting soil adherence to hands.	
Fraction Ingestion From Contaminated Source	0-1	1	Assuming 100% of the soil ingestion occurs while on site.	
Scenario 1-5 Chemical Concentration Justification				
Surface and subsurface soils; Ground and surface waters			95th percentile values used in exposure estimate were calculated using the methods described in text.	
Scenario 1 - Recreational/Trespasser Exposure: Current Use				
Exposure Frequency(days/year)	1-365	30	Based upon access to unrestricted areas of site.	NJDEPE 1994
Dermal Contact With Chemicals in Soils				
Skin Surface Area (cm2)	0-14,400	8,600	Based upon exposed arms, hands, and legs.	EPA 1989
Ingestion Of Chemicals In Soils				
Ingestion Rate (mg/day)	0-480	100	Soil ingestion rate for those over 6 years of age.	EPA 1991
Dermal Contact with Chemicals in Surface Water				
Skin Surface Area (cm2)	0-14,440	8,600	Based upon exposed arms, hands, and legs.	EPA 1989
Exposure Time (hr/day)	0-24	4	Assume clothing remains wet.	
Ingestion Of Chemicals In Surface Water				
Contact Rate (liter/hour)		0.05		EPA 1989
Exposure Time (hr/day)	0-24	1		
Scenario 2 - Industrial Exposure: Current Use				
Exposure Frequency (days/year)	1-365	250	Based on an estimate of the number of days at work.	EPA 1991
Dermal Contact with Chemicals In Soils				
Skin Surface Area (cm2)	0-18,150	6,300	Includes hands, arms, head, neck and portion of the trunk.	
Ingestion Of Chemicals in Soils				
Ingestion Rate (mg/day)	0-480	50	Based upon minimal contact with the soil.	EPA 1991
Inhalation Of Airborne Chemicals Absorbed to Dust				
Ambient Dust Concentration (kg/m3)				
Inhalation Rate (m3/hr)		2	Adults during moderate exertion	
Exposure Time (hrs/day)	1-24	1	Based upon known activity patterns.	
Scenario 3 - Residential Scenario: Current Use				
Exposure Frequency (days/yr)	1-365	350	Two weeks spent away from home.	EPA 1991
Ingestion of Chemicals in Drinking Water				
Ingestion Rate (L/day)	0-2	2	Adult, 90th percentile	EPA 1989
Dermal Contact with Chemicals in Water				
Skin Surface Area (cm2)	0-18,150	18,150	Adult total body exposure.	
Exposure Time (hrs/day)	0-24	0.2	Bathing or showering time.	
Inhalation Of Airborne (Vapor Phase) Chemicals				
Inhalation Rate (m3/hr)		0.83	Light activity assumed.	EPA 1990
Exposure Time (hrs/day)	0-24	0.1	Based upon duration of a shower.	
Scenario 4 - Construction Exposure: Future Use				
Exposure Frequency (days/year)	1-365	180	Based on an estimate of the number of days building homes.	
Dermal Contact with Chemicals In Soils				
Skin Surface Area (cm2)	0-18,150	6300	Includes hands, arms, head, neck and portion of trunk.	
Ingestion Of Chemicals in Soils				
Ingestion Rate (mg/day)	0-480	480	Based upon extensive contact with the soil.	EPA 1989
Inhalation Of Airborne Chemicals Absorbed to Dust				
Ambient Dust Concentration (kg/m3)				
Inhalation Rate (m3/hr)		2	Based upon moderate exertion.	
Exposure Time (hrs/day)	1-24	8	Based upon an eight hour work day.	
Scenario 5 - Residential Scenario: Future Use				
Exposure Frequency (days/yr)	1-365	350	Two weeks spent away from home.	EPA 1991
Dermal Contact With Chemicals in Soil				
Skin Surface Area (cm2)	0-18,150	9,440	Exposure of an adult's arms, hands, legs and head.	
Ingestion Of Chemicals In Soils and House Dust				
Ingestion Rate (mg/day)				
Child	0-480	200	Children, 1-6 years old.	EPA 1989
Adult	0-480	100	Age groups greater than 6 years old.	EPA 1989
Inhalation Of Airborne Chemicals Absorbed to Dust				
Ambient Dust Concentration				
Inhalation Rate (m3/hr)		0.83	Light activity assumed.	
Exposure Time (hrs/day)	1-24	4	The amount of time spent outdoors.	

TABLE 2-11

SUMMARY OF CANCER AND NON-CANCER RISK ESTIMATES
FOR SCENARIO 1 - TRESPASSING (CURRENT)

Pathway	Cancer Risks	Non-Cancer Hazard Indices
Incidental Ingestion of Soil	4E-07	1E-02
Dermal Contact with Soil	NA	2E-04
Ingestion of Surface Water	2E-06	1E-01
Dermal Contact with Surface Water	7E-08	1E-02
Total	2E-06	1E-01

NA: Not Applicable

TABLE 2-12

SUMMARY OF CANCER AND NON-CANCER RISK ESTIMATES
FOR SCENARIO 2 - COMMERCIAL/INDUSTRIAL (CURRENT)

Pathway	Cancer Risks	Non-Cancer Hazard Indices
Incidental Ingestion of Soil	3E-05	6E-01
Dermal Contact with Soil	5E-05	9E-04
Inhalation of Fugitive Dust	1E-07	2E-01
Total	8E-05	7E-01

TABLE 2-13

SUMMARY OF CANCER AND NON-CANCER RISK ESTIMATES
FOR SCENARIO 3 - RESIDENTIAL (CURRENT)

Pathway	Cancer Risks	Non-Cancer Hazard Indices
Ingestion of Ground Water	8E-03[A] 4E-02[B]	2E+02[A] 6E+02[B]
Inhalation of Airborne Chemicals from Ground Water	4E-04[A] NA[B]	NA[A,B]
Dermal Contact with Ground Water	1E-05[A] 2E-05[B]	3E-01[A] 9E-01[B]
Total	8E-03[A] 4E-02[B]	2E+02[A] 6E+02[B]

[A] Deep Ground Water
[B] Shallow Ground Water

NA: Not Applicable

TABLE 2-14

SUMMARY OF CANCER AND NON-CANCER RISK ESTIMATES
FOR SCENARIO 4 - CONSTRUCTION (FUTURE)

Pathway	Cancer Risks	Non-Cancer Hazard Indices
Incidental Ingestion of Soil	1E-06	9E-01
Dermal Contact with Soil	NA	NA
Inhalation of Fugitive Dust	7E-08	1E-01
Total	1E-06	1E+00

NA: Not Applicable

TABLE 2-15

SUMMARY OF CANCER AND NON-CANCER RISK ESTIMATES
FOR SCENARIO 5 - RESIDENTIAL (FUTURE)

Pathway		Cancer Risks	Non-Cancer Hazard Indices
Incidental Ingestion of Soil			
Child		9E-05	3E+00
Adult		5E-05	3E-01
Dermal Contact with Soil			
Child		NA	NA
Adult		1E-04	2E-03
Inhalation of Fugitive Dust			
Child		NA	NA
Adult		4E-08	8E-02
Total	Child	9E-05	3E+00
	Adult	2E-04	4E-01

NA: Not Applicable

TABLE 2-16
SUMMARY OF EXPOSURE PATHWAYS AND RISKS

Potentially Exposed Population	Exposure Route, Medium and Exposure Point	Pathway Selected for Evaluation?	Reason for Selection or Exclusion	Cancer Risk	HI Ratio
Current Land Use					
Residents	Ingestion of ground water from private wells (shallow)	Yes	Impacts on monitoring wells to south of site	4E-02	6E+02
	Ingestion of ground water from private wells (deep)	Yes	Impacts on monitoring wells to south of site	8E-03	2E+02
Residents	Dermal contact with well water (shallow)	Yes	Impacts on monitoring wells to south of site	2E-05	9E-01
	Dermal contact with well water (deep)	Yes	Impacts on monitoring wells to south of site	1E-05	3E-01
Residents	Inhalation of vapors from private well water (shallow)	Yes	Impacts on monitoring wells to south of site	NA	NA
	Inhalation of vapors from private well water (deep)	Yes	Impacts on monitoring wells to south of site	4E-04	NA
Residents	Ingestion of surface water on site	No	Adressed in trespasser scenario	NA	NA
Residents	Dermal contact with soils	No	No site related activities at residences	NA	NA
Residents	Inhalation of fugitive dusts	No	No site related activities at residences	NA	NA
Residents	Ingestion of soils on site	No	No site related activities at residences	NA	NA
Trespasser	Ingestion of soils on site	Yes	On site soils are accesible outside fence	4E-07	1E-02
Trespasser	Dermal contact with soils	Yes	On site soils are accesible outside fence	NA	2E-04
Trespasser	Dermal contact with surface water	Yes	On site surface water exist outside fence	7E-08	1E-02
Trespasser	Ingestion of surface water	Yes	On site surface water exist outside fence	2E-06	1E-01
Trespasser	Ingestion of sediments	No	Contaminant concentrations not materially different from surface soil	NA	NA
Trespasser	Inhalation of fugitive dusts	No	Site vegetated outside fenced in areas	NA	NA
Industrial Workers	Ingestion of ground water from local wells	No	Well restriction area	NA	NA
Industrial Workers	Ingestion of soils on site	Yes	Incidental ingestion expected	3E-05	6E-01
Industrial Workers	Dermal contact with soils	Yes	Contact with soils expected during industrial use	5E-05	9E-04
Industrial Workers	Inhalation of fugitive dusts	Yes	Generation of fugitive dust expected during industrial use	1E-07	2E-01
Future Land Use					
Residents	Ingestion of ground water from private wells on the site	No	Well restriction area	NA	NA
Residents	Ingestion of soils on site (child)	Yes	Potential residential use of site	9E-05	3E+00
Residents	Ingestion of soils on site (adult)	Yes	Potential residential use of site	5E-05	3E-01
Residents	Dermal contact with soils	Yes	Potential residential use of site	1E-04	2E-03
Residents	Inhalation of fugitive dusts	Yes	Potential residential use of site may produce areas devoid of cover	4E-08	8E-02
Residents	Inhalation of chemicals volatilized from ground water during home use	No	Well restriction area	NA	NA
Construction Workers	Ingestion of ground water from local wells	No	Well restriction area	NA	NA
Construction Workers	Ingestion of soils on site	Yes	Incidental ingestion expected	1E-06	9E-01
Construction Workers	Dermal contact with soils	Yes	Contact with soils expected during construction	NA	NA
Construction Workers	Inhalation of fugitive dusts	Yes	Generation of fugitive dust expected during construction	7E-08	1E-01

NA : Not Applicable

TABLE 2-17

SUMMARY OF MOST LIKELY EXPOSURE PARAMETER VALUES FOR PATHWAYS EXCEEDING TARGET RISK VALUES

Scenario	Exposure Route	CR[A] (Units)	SA[B] (cm^2)	ABS[C]	AF[D] (mg/cm^2)	PC[E] (cm/hr)	FI[F]	EF[G] (d/yr)	ED[H] (yr)	ET[I] (Units)	BW[J] (kg)
1[K]	Ingestion of Surface Water	50 (ml/d)	NA[L]	NA	NA	NA	1	7	6	1 (hr/d)	49
2[M]	Dermal Contact with Soil	NA	2,000	0.001 (cadmium); 0.006 (PCBs)	0.2	NA		250	4.5	NA	70
2	Ingestion of Soil	50 (mg/d)	NA	NA	NA	NA	1	250	4.5	NA	70
3[N]	Ingestion of Ground Water	1.4 (l/d)	NA	NA	NA	NA	1	350	9	NA	70
3	Inhalation of Volatiles from Ground Water	15 (m^3/d)	NA	NA	NA	NA	NA	350	9	15 (hr/d)	70
3	Dermal Contact with Ground Water	NA	18,150	NA	NA	8.4E-04	NA	350	9	7 (min/d)	70
4[O]	Ingestion of Soil	480	NA	NA	NA	NA	1	90	0.5	NA	70
5[P]	Dermal Contact with Soil	NA	2,000	0.001 (cadmium); 0.006 (PCBs)	0.2	NA	NA	150	9	NA	70
5	Ingestion of Soil	100 (mg/d) (child); 50 (mg/d) (adult)	NA	NA	NA	NA	1	150	6 (child); 9 (adult)	NA	15 (child); 70 (adult)

[A] CR: Contact Rate
[B] SA: Surface Area
[C] ABS: Absorption Factor
[D] AF: Adherence Factor
[E] PC: Permeability Constant
[F] FI: Fraction Ingested
[G] EF: Exposure Frequency
[H] ED: Exposure Duration
[I] ET: Exposure Time
[J] BW: Body Weight
[K] Trespassing (Current)
[L] NA: Not Applicable
[M] CS: Chemical-Specific
[N] Commercial/Industrial (Current)
[O] Residential (Current)
[P] Construction (Future)
[Q] Residential (Future)

Central Tendency Values

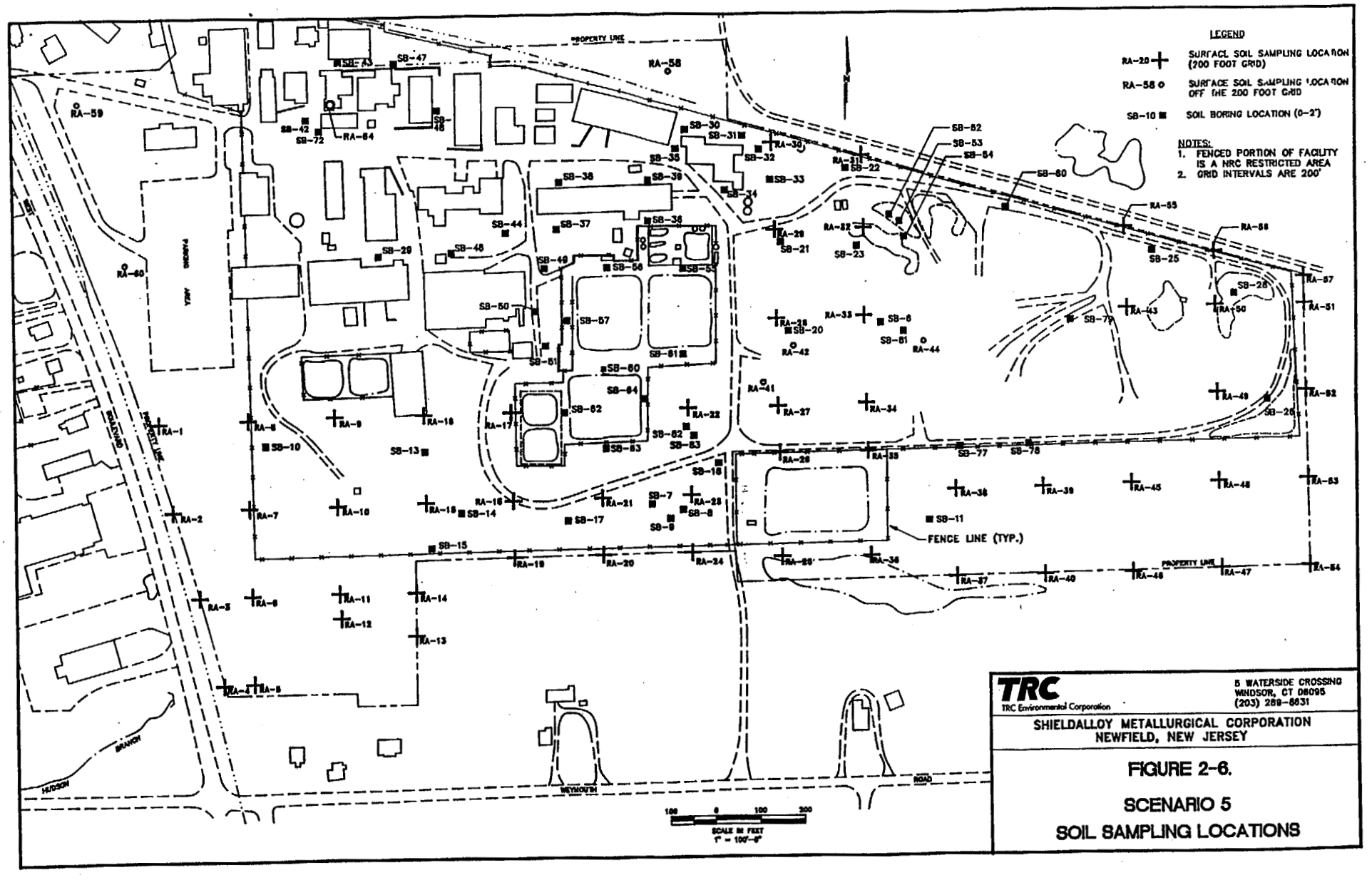
TABLE 2-18

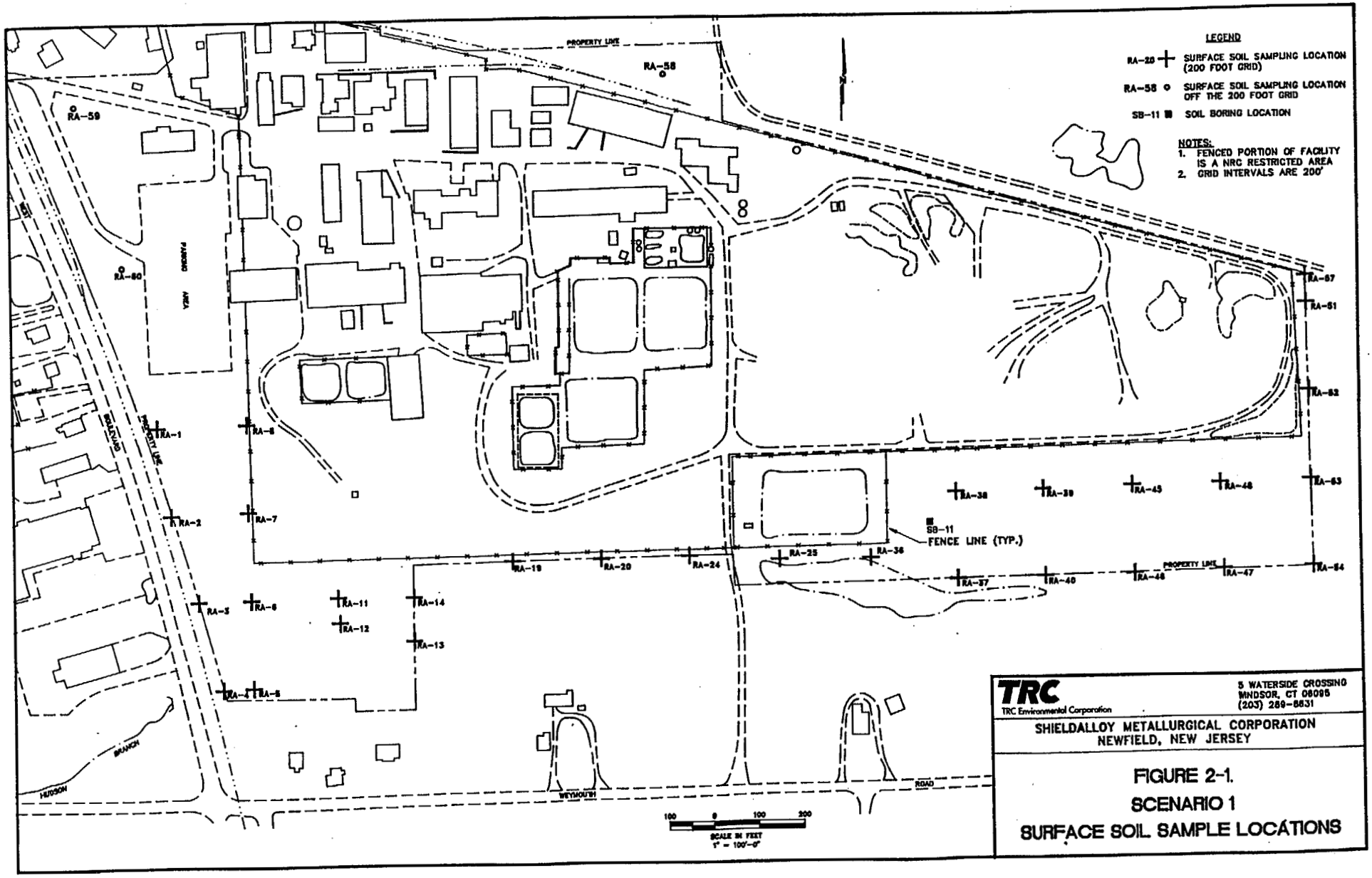
UNCERTAINTY ANALYSIS: COMPARISON OF RME AND MLE CANCER RISKS AND HAZARD INDEX RATIOS

		Cancer Risk		HI	
Scenario	Primary Route of Exposure	RME[A]	MLE[B]	RME	MLE
1[C]	Ingestion of Surface Water	2E-06	3E-07	NA[D]	NA
2[E]	Dermal Contact with Soil	5E-05	4E-08	NA	NA
2	Incidental Ingestion of Soil	3E-05	3E-06	NA	NA
3[F]	Ingestion of Ground Water				
	Shallow	4E-02	9E-03	6E+02	4E+02
	Deep	8E-03	2E-03	2E+02	1E+02
3	Dermal Contact with Ground Water				
	Shallow	2E-05	4E-06	NA	NA
	Deep	1E-05	2E-06	NA	NA
3	Inhalation of Volatiles from Ground Water				
	Deep	4E-04	6E-05	NA	NA
4[G]	Ingestion of Soil	2E-06	3E-07	NA	NA
5[H]	Dermal Contact with Soil	3E-04	4E-08	NA	NA
5	Ingestion of Soil				
	Adult	2E-04	3E-06	NA	NA
	Child	4E-04	2E-05	3E+01	7E-01

A RME: Reasonably Maximum Exposure
B MLE: Most Likely Exposure
C Trespassing (Current)
D NA: Not Applicable
E Commercial/Industrial (Current)
F Residential (Current)
G Construction (Future)
H Residential (Future)

FIGURES


LEGEND
RA-20 SURFACE SOIL SAMPLING LOCATION (200 FOOT GRID)
RA-58 SURFACE SOIL SAMPLING LOCATION OFF THE 200 FOOT GRID
SB-10 SOIL BORING LOCATION (0-2')
NOTES:
1. FENCED PORTION OF FACILITY IS A NRC RESTRICTED AREA
2. GRID INTERVALS ARE 200'
PROPERTY LINE
FENCE LINE (TYP.)
WEYMOUTH ROAD
HUDSON BRANCH
SCALE IN FEET
1" = 100'-0"
TRC
TRC Environmental Corporation
5 WATERSIDE CROSSING
WINDSOR, CT 06095
(203) 289-8631
SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY
FIGURE 2-6.
SCENARIO 5
SOIL SAMPLING LOCATIONS

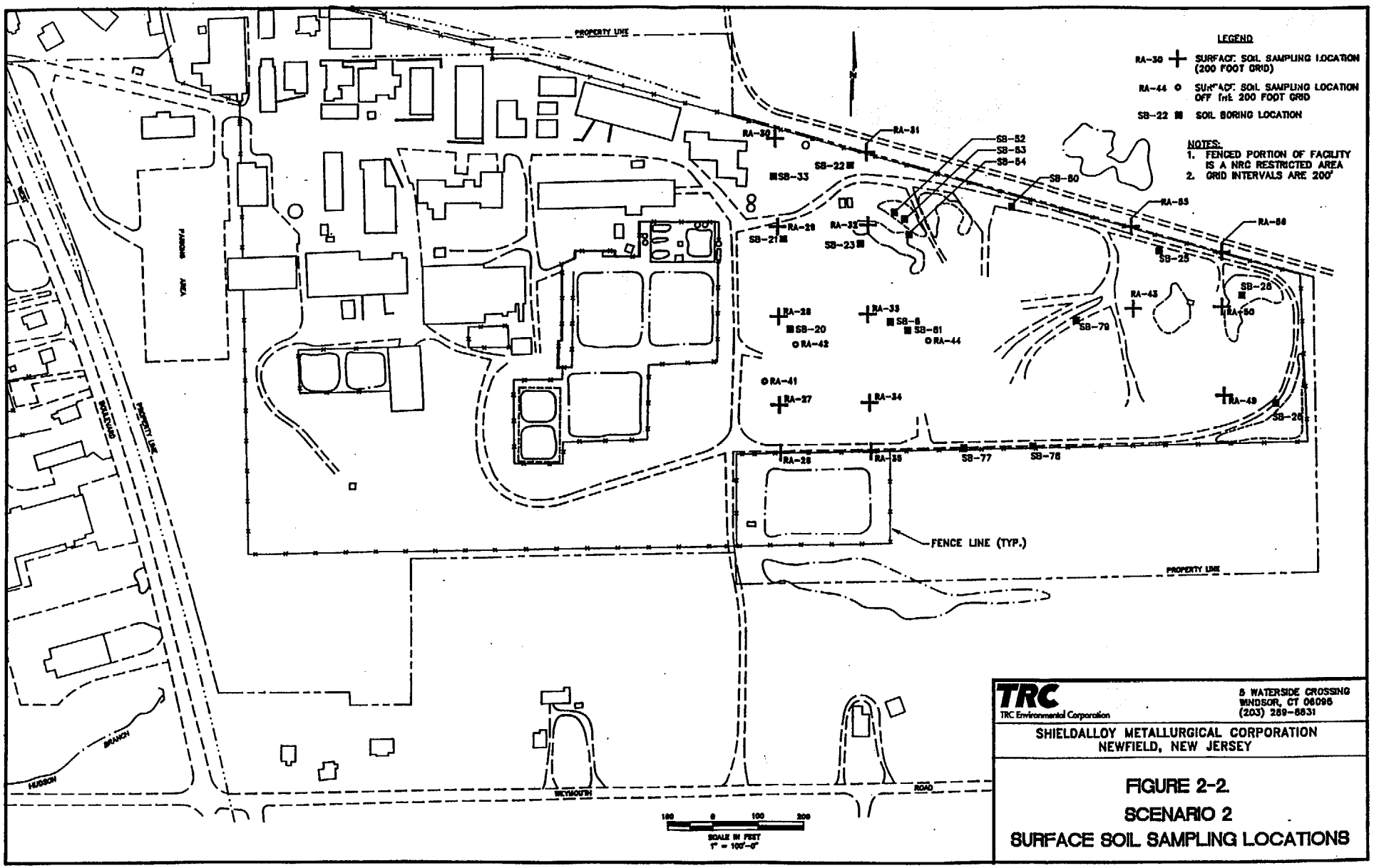


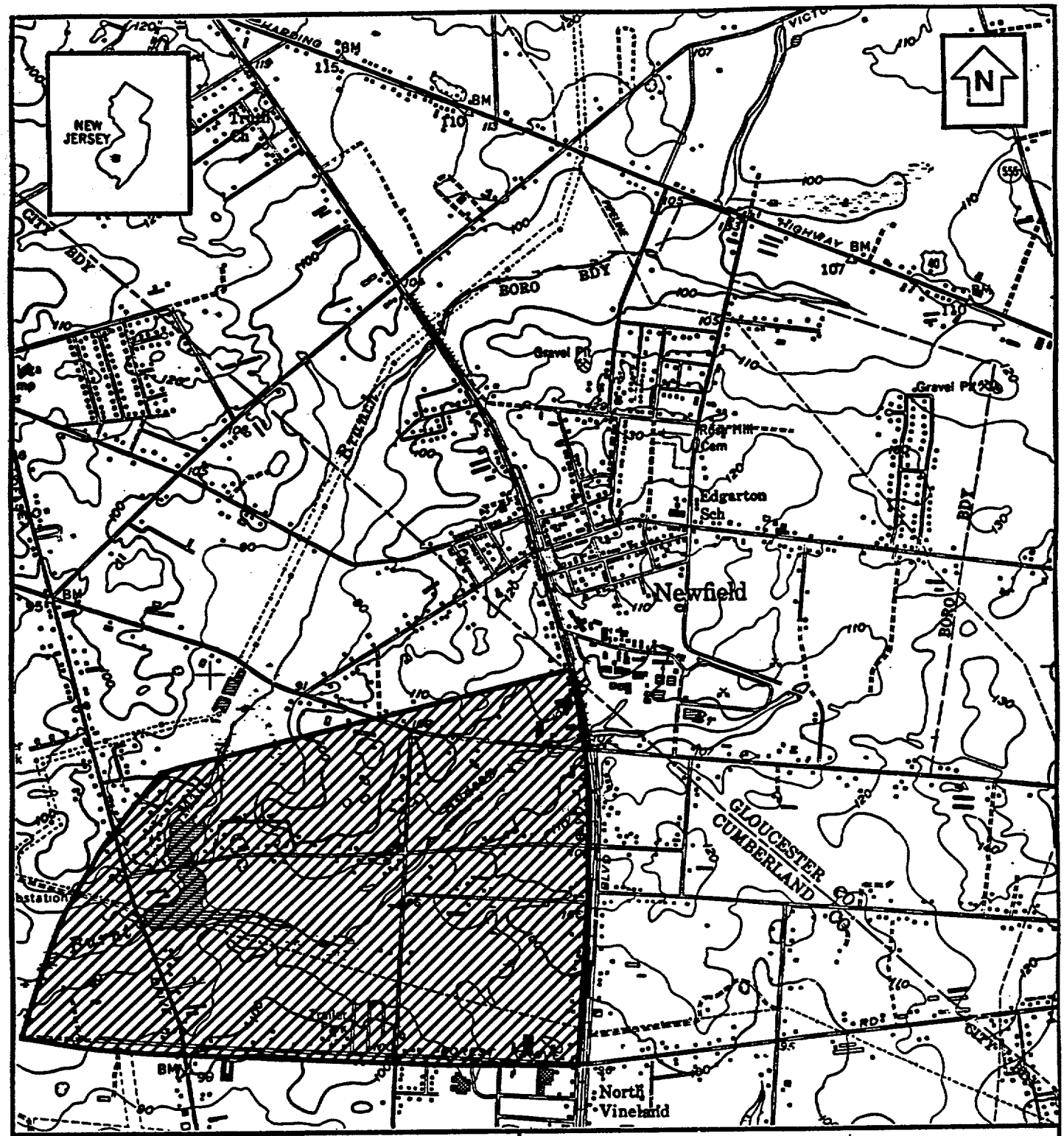
TRC
TRC Environmental Corporation

5 WATERSIDE CROSSING
WINDSOR, CT 06095
(203) 289-8631

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 2-1.
SCENARIO 1
SURFACE SOIL SAMPLE LOCATIONS


LEGEND
RA-30 SURFACE SOIL SAMPLING LOCATION (200 FOOT GRID)
RA-44 SURFACE SOIL SAMPLING LOCATION OFF THE 200 FOOT GRID
SB-22 SOIL BORING LOCATION
NOTES:
1. FENCED PORTION OF FACILITY IS A NRC RESTRICTED AREA
2. GRID INTERVALS ARE 200'
PROPERTY LINE
PARKING AREA
ROADWAY
FENCE LINE (TYP.)
HUDSON BRANCH
SKYMOUTH ROAD
SCALE IN FEET
1" = 100'-0"
TRC
TRC Environmental Corporation
5 WATERSIDE CROSSING
WINDSOR, CT 06095
(203) 289-8631
SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY
FIGURE 2-2.
SCENARIO 2
SURFACE SOIL SAMPLING LOCATIONS



0 2000 FT

SCALE

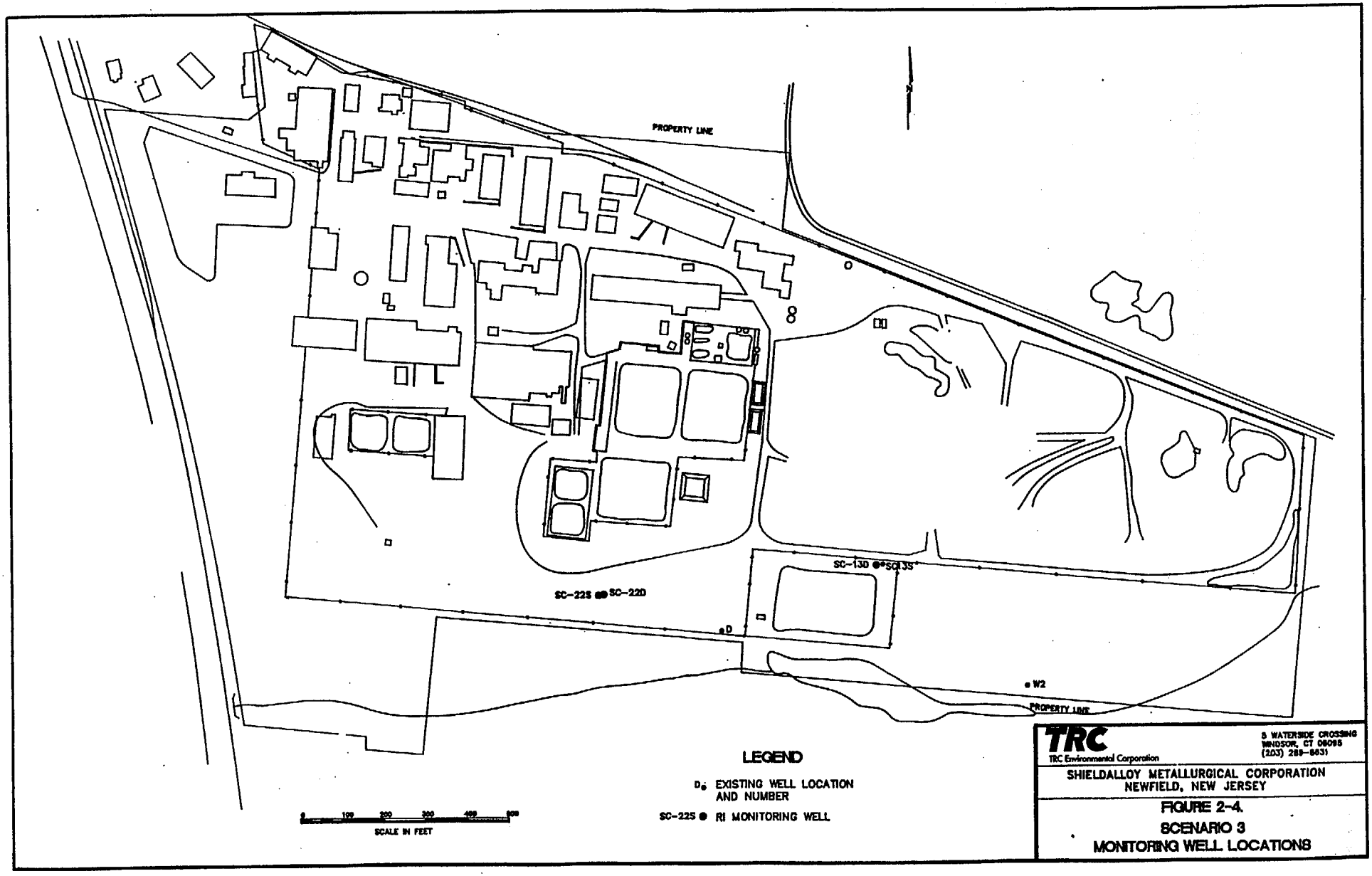
FROM NEWFIELD, NJ 7 1/2' USGS TOPOGRAPHIC MAP, 1953, PHOTOREVISED 1986

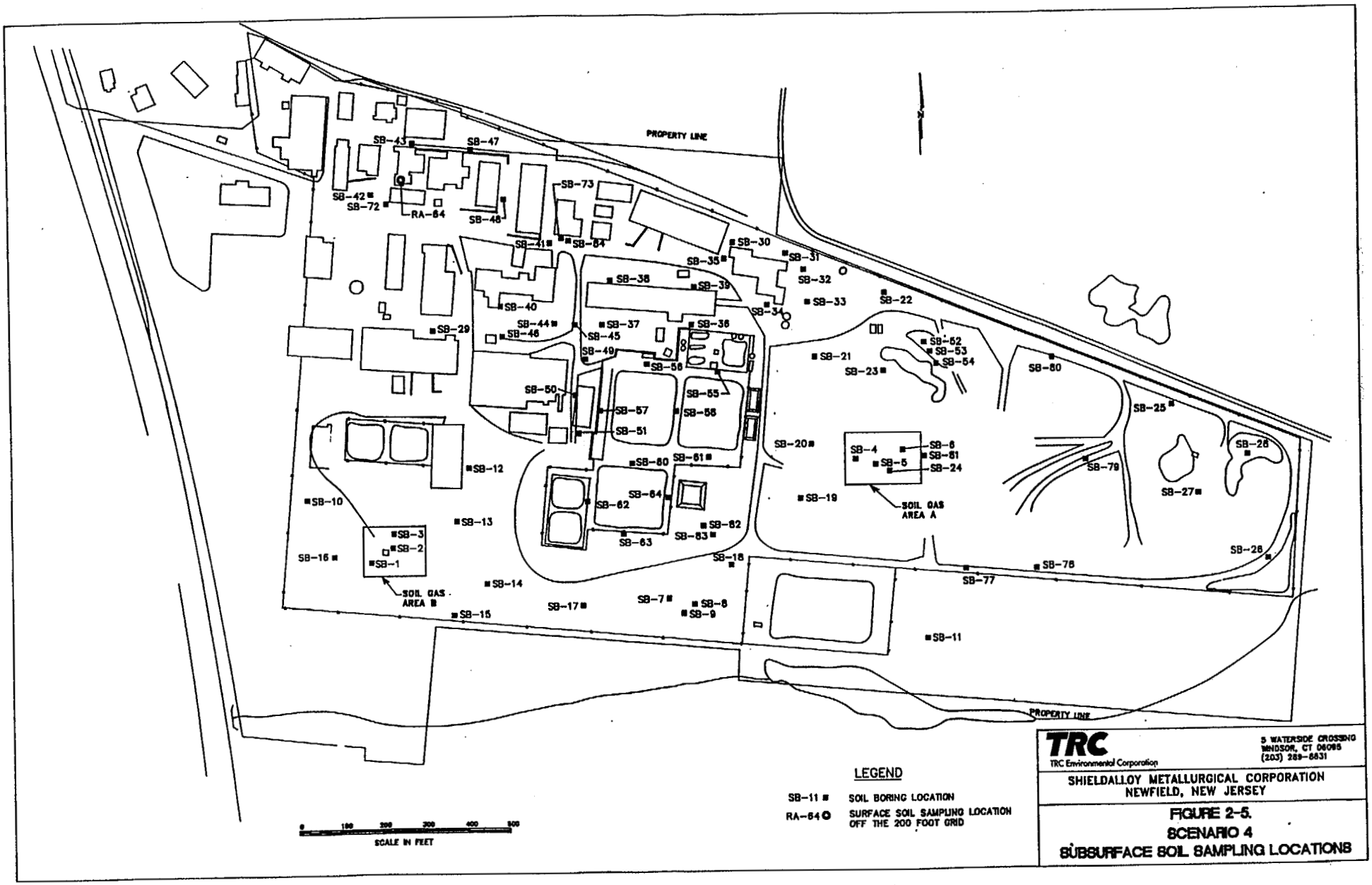
TRC
TRC Environmental Corporation
5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631

SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY

FIGURE 2-3.

APPROXIMATE LOCATION OF VINELAND GROUND WATER PUMPING EXCLUSION ZONE


PROPERTY LINE
SC-22S
SC-22D
SC-13D
SC-13S
D
W2
PROPERTY LINE
LEGEND
EXISTING WELL LOCATION AND NUMBER
SC-22S RI MONITORING WELL
SCALE IN FEET
TRC
TRC Environmental Corporation
5 WATERSIDE CROSSING
WINDSOR, CT 06095
(203) 289-8631
SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY
FIGURE 2-4.
SCENARIO 3
MONITORING WELL LOCATIONS


PROPERTY LINE
SB-43
SB-47
SB-42
SB-72
RA-64
SB-48
SB-73
SB-41
SB-84
SB-30
SB-35
SB-31
SB-32
SB-38
SB-39
SB-33
SB-22
SB-40
SB-34
SB-29
SB-44
SB-46
SB-37
SB-45
SB-36
SB-49
SB-56
SB-21
SB-52
SB-53
SB-54
SB-23
SB-80
SB-50
SB-57
SB-55
SB-58
SB-25
SB-51
SB-20
SB-4
SB-6
SB-81
SB-5
SB-24
SB-26
SB-12
SB-60
SB-61
SB-79
SB-10
SB-64
SB-62
SB-19
SOIL GAS AREA A
SB-27
SB-13
SB-3
SB-2
SB-1
SB-82
SB-63
SB-83
SB-16
SB-18
SB-28
SB-76
SB-77
SB-14
SOIL GAS AREA B
SB-17
SB-7
SB-8
SB-9
SB-15
SB-11
PROPERTY LINE
0
100
200
300
400
500
SCALE IN FEET
LEGEND
SB-11 ■ SOIL BORING LOCATION
RA-64 ● SURFACE SOIL SAMPLING LOCATION OFF THE 200 FOOT GRID
TRC
TRC Environmental Corporation
5 WATERSIDE CROSSING
WINDSOR, CT 06095
(203) 289-8631
SHIELDALLOY METALLURGICAL CORPORATION
NEWFIELD, NEW JERSEY
FIGURE 2-5.
SCENARIO 4
SUBSURFACE SOIL SAMPLING LOCATIONS

APPENDIX A

RISK ASSESSMENT METHODS

APPENDIX A

RISK ASSESSMENT METHODS

Five exposure scenarios will be included in the risk assessment for the Shieldalloy Metallurgical Corp. (SMC) Site. 1) A current use trespasser scenario will involve exposures to the site outside the restricted industrial area as it currently exists, 2) a current industrial use scenario will involve exposures to the site within the restricted industrial area and specifically addressing the undeveloped portion of the site due to the unvegetated and unpaved nature of this area, 3) a current residential use scenario involving exposure due to use of private wells outside the well restriction area, 4) future development of the site (construction scenario) and 5) a future residential use of the site property. The scenarios are briefly described below. Model equations and parameter values for each exposure pathway are detailed on the following pages.

Children may trespass on the unrestricted portion of the site as it currently exists, and thereby play with contaminated soils and stream water and/or sediments from the Hudson Branch. As a result, they may receive dermal and ingestion exposures to contaminants in soil and water. Based on information during the field investigation it is assumed that children trespass onto the site on an infrequent basis (30 days/year), that children are unlikely to enter this area of the site on a regular basis before the age of 9 due to its distance from residences, and regular exposures are not expected beyond the age of 18 due to changes in the use of recreational time.

SMC is currently an active industrial facility. The active industrial portion of the property is covered with buildings and pavement. Piles of material are stored on an undeveloped portion of the site. This area is devoid of any type of ground cover (e.g. vegetation, pavement). As a result, SMC employees who load/unload material in this area may be exposed to site

contaminants following inhalation of fugitive dusts, dermal contact with soil or incidental ingestion of soil.

Current plume migration has resulted in restriction of ground water as a potable source with the exception of homes to the south of the site. Thus, a current residential use scenario will be addressed to evaluate exposure to contaminants in ground water (i.e., ingestion, inhalation of airborne volatiles and dermal exposure).

In the future, construction workers may be involved in developing the site (e.g. building homes). Through excavation and site preparation activities, they could receive extensive inhalation exposure to contaminants in dust, as well as dermal and ingestion exposures to contaminants in subsurface soil. It is assumed that excavation and site preparation activities would last for a 6 month period, and that no remediation of contaminants prior to the construction or residential scenarios would occur.

Also in the future, children and adults may occupy residences on the site. The relevant exposure pathways are indoor and outdoor ingestion of dust/soil (this will be addressed for 0-6 year old children, and for adults), outdoor dermal exposure to soil contaminants (adults) and outdoor inhalation of contaminants in dust (adults). For children, parameter values for 0-6 year old children were selected, and exposure was assumed to take place over 6 years. For adults, exposure is assumed to occur for 30 years.

SCENARIO 1 - TRESPASSING (CURRENT)

- DERMAL CONTACT WITH CHEMICALS IN SOIL

Equation:

$$Absorbed\ Dose\ (mg/kg\text{-}day) = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

where:

CS	=	Chemical of Concentration in Soil (mg/kg)
CF	=	Conversion Factor (10^{-6} kg/mg)
SA	=	Skin Surface Area Available for Contact (cm^2/event)
AF	=	Soil to Skin Adherence Factor (mg/cm^2)
ABS	=	Absorption Factor (unitless)
EF	=	Exposure Frequency (events/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

CS	=	Concentration of chemicals in soil
SA	=	8,600 cm^2, based upon exposed arms, hands and legs.
AF	=	1.45 mg/cm^2, based upon commercial potting soil adherence to hands
ABS	=	0.01 for cadmium; 0.06 for PCBs (EPA, 1992b)
EF	=	30 days/year (NJDEPE, 1994)
ED	=	9 years
BW	=	49 kg
AT	=	3,285 days for non-cancer risks 25,550 days for cancer risks

- INGESTION OF CHEMICALS IN SOIL

Equation:

$$Intake\ (mg/kg\text{-}day) = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

where:

CS	=	Chemical Concentration in Soil (mg/kg)
IR	=	Ingestion Rate (mg soil/day)
CF	=	Conversion Factor (10^{-6} kg/mg)

FI	=	Fraction Ingested from Contaminated Source (unitless)
EF	=	Exposure Frequency (days/years)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

CS	=	Chemical concentration in soil
IR	=	100 mg/day, which is typical for this age group
FI	=	1.0, assuming 100% of soil ingestion occurs on-site on days in which children enter the site
EF	=	30 days/year (NJDEPE, 1994)
ED	=	9 years
BW	=	49 kg
AT	=	3,285 days for non-cancer risks 25,550 days for cancer risks

- DERMAL CONTACT WITH CHEMICALS IN SURFACE WATER

Equation:

$$\textit{Absorbed Dose } (mg/kg\text{-}day) = \frac{CW \times SA \times PC \times ET \times EF \times ED \times CF}{BW \times AT}$$

where:

CW	=	Chemical Concentration in Water (mg/liter)
SA	=	Skin Surface Area Available for Contact (cm^2)
PC	=	Chemical-specific Dermal Permeability Constant (cm/hr)
ET	=	Exposure Time (hours/day)
EF	=	Exposure Frequency (days/years)
ED	=	Exposure Duration (years)
CF	=	Volumetric Conversion Factor for Water (1 liter/1000 cm^3)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

SA	=	8,600 cm^2 based upon exposed arms, hands and legs
PC	=	8.4 E-4 cm/hour based upon penetration of water across skin (EPA, 1989)
ET	=	4 hr/day; assumes clothing remains wet for this time period
EF	=	30 days/year (NJDEPE, 1994)
ED	=	9 years

BW = 49 kg for children 9-18 years old
AT = 3,285 and 25,550 days for non-cancer and cancer risks, respectively

- INGESTION OF CHEMICALS IN SURFACE WATER

Equation:

$$Intake\ (mg/kg\text{-}day) = \frac{CW \times CR \times ET \times EF \times ED}{BW \times AT}$$

where:

CW = Chemical Concentration in Water (mg/litter)
CR = Contact Rate (liters/hour)
ET = Exposure Time (hours/day)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

CR = 50 ml/hour (EPA 1989)
ET = 1 hour/day
EF = 30 days/year (NJDEPE, 1994)
ED = 9 years
BW = 49 kg for children 9-18 years old
AT = 3,285 and 25,550 days for non-cancer and cancer risks, respectively

SCENARIO 2 - INDUSTRIAL (CURRENT)

- DERMAL CONTACT WITH CHEMICALS IN SOIL

Equation:

$$Absorbed\ Dose\ (mg/kg\text{-}day) = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

where:

CS	=	Chemical Concentration in Soil (mg/kg)
CF	=	Conversion Factor (10^{-6} kg/mg)
SA	=	Skin Surface Area Available for Contact (cm^2/event)
AF	=	Soil to Skin Adherence Factor (mg/cm^2)
ABS	=	Absorption Factor (unitless)
EF	=	Exposure Frequency (events/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

SA	=	6,300 cm^2 for hands, forearms, upper arms, head, neck and a portion of the trunk
AF	=	1.45 mg/cm^2
ABS	=	0.01 for cadmium; 0.06 for PCBs (EPA, 1992b)
EF	=	250 days/year
ED	=	25 years
BW	=	70 kg
AT	=	9,125 days for non-cancer risks 25,550 days for cancer risks

- INGESTION OF CHEMICALS IN SOIL

Equation:

$$Intake\ (mg/kg\text{-}day) = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

where:

CS	=	Chemical Concentration in Soil (mg/kg)
IR	=	Ingestion Rate (mg soil/day)
CF	=	Conversion Factor (10^{-6} kg/mg)

SCENARIO 3 - RESIDENTIAL (CURRENT)

- DERMAL CONTACT WITH CHEMICALS IN WATER

Equation:

$$Absorbed\ Dose\ (mg/kg\text{-}day) = \frac{CW \times SA \times PC \times ET \times EF \times ED \times CF}{BW \times AT}$$

where:

CW	=	Chemical Concentration in Water (mg/liter)
SA	=	Skin Surface Area Available for Contact (cm^2)
PC	=	Chemical-specific Dermal Permeability Constant (cm/hr)
ET	=	Exposure Time (hours/day)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
CF	=	Volumetric Conversion Factor for Water (1 liter/1000 cm^3)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

SA	=	18,150 cm^2 (EPA, 1990) for total body exposure
PC	=	8.4 E-4 cm/hour, based upon penetration of water across skin (EPA, 1989)
ET	=	12 minutes/day, bathing and showering time
EF	=	350 days/year
ED	=	30 years
CF	=	1 liter/1000 cm^3
BW	=	70 kg
AT	=	10,950 and 25,550 days for non-cancer and cancer risks, respectively

- INGESTION OF CHEMICALS IN DRINKING WATER

Equation:

$$Intake\ (mg/kg\text{-}day) = \frac{CW \times IR \times EF \times ED}{BW \times AT}$$

where:

CW	=	Chemical Concentration in Water (mg/liter)
IR	=	Ingestion Rate (liters/day)
EF	=	Exposure Frequency (days/years)

ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

IR = 2.0 liters/day (EPA, 1990)
EF = 350 days/year
ED = 30 years
BW = 70 kg
AT = 10,950 and 25,550 days for non-cancer and cancer risks, respectively

- INHALATION OF AIRBORNE (VAPOR PHASE) CHEMICALS

Equation:

$$Intake\ (mg/kg\text{-}day) = \frac{CR \times IR \times ET \times EF \times ED}{BW \times AT}$$

where:

CA = Contaminant Concentration in Air (mg/m^3) - derived from volatilization during showering (Andelman, 1985)
IR = Inhalation Rate (m^3/hour)
ET = Exposure Time (hours/day)
EF = Exposure Frequency (days/years)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

IR = 0.83 m^3/hour (light activity assumed) (EPA, 1990)
ET = 24 hours/day
EF = 350 days/year
ED = 30 years
BW = 70 kg
AT = 10,950 and 25,550 days for non-cancer and cancer risks, respectively

SCENARIO 4 - CONSTRUCTION (FUTURE)

- DERMAL CONTACT WITH CHEMICALS IN SOIL

Equation:

$$Absorbed\ Dose\ (mg/kg\text{-}day) = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

where:

CS	=	Chemical Concentration in Soil (mg/kg)
CF	=	Conversion Factor (10^{-6} kg/mg)
SA	=	Skin Surface Area Available for Contact (cm^2/event)
AF	=	Soil to Skin Adherence Factor (mg/cm^2)
ABS	=	Absorption Factor (unitless)
EF	=	Exposure Frequency (events/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

SA	=	6,300 cm^2 for hands, forearms, upper arms, head, neck and a portion of the trunk
AF	=	1.45 mg/cm^2
ABS	=	0.01 for cadmium; 0.06 for PCBs (EPA, 1992b)
EF	=	180 days/year
ED	=	1 year
BW	=	70 kg
AT	=	180 days for non-cancer risks 25,550 days for cancer risks

- INGESTION OF CHEMICALS IN SOIL

Equation:

$$Intake\ (mg/kg\text{-}day) = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

where:

CS	=	Chemical Concentration in Soil (mg/kg)
IR	=	Ingestion Rate (mg soil/day)
CF	=	Conversion Factor (10^{-6} kg/mg)

FI = Fraction Ingested from Contaminated Source (unitless)
EF = Exposure Frequency (days/years)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

IR = 480 mg/day, based upon extensive contact with soil
FI = 1.0; all soil ingested comes from on-site sources
EF = 180 days/year
ED = 1 year
BW = 70 kg
AT = 180 days for non-cancer risks
25,550 days for cancer risks

- INHALATION OF AIRBORNE CHEMICALS ADSORBED TO DUST

Equation:

$$Intake\ (mg/kg\text{-}day) = \frac{CD \times CS \times IR \times ET \times EF \times ED}{BW \times AT}$$

where:

CD = Ambient Dust Concentration
CS = Contaminant Concentration in Soil (mg/kg)
IR = Inhalation Rate (m^3/hour)
ET = Exposure Time (hours/day)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

IR = 2 m^3/hour for adults under moderate exertion
ET = 8 hour/day
EF = 180 days/year
ED = 1 year
BW = 70 kg
AT = 180 days for non-cancer risks
25,550 days for cancer risks

SCENARIO 5 - RESIDENTIAL (FUTURE)

- DERMAL CONTACT WITH CHEMICALS IN SOIL

Equation:

$$Absorbed\ Dose\ (mg/kg\text{-}day) = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

where:

CS	=	Chemical Concentration in Soil (mg/kg)
CF	=	Conversion Factor (10^{-6} kg/mg)
SA	=	Skin Surface Area Available for Contact (cm^2/event)
AF	=	Soil to Skin Adherence Factor (mg/cm^2)
ABS	=	Absorption Factor (unitless)
EF	=	Exposure Frequency (events/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

SA	=	9,440 cm^2 for adults based upon exposure to the arms, hands and legs
AF	=	1.45 mg/cm^2 based upon commercial potting soil adherence to hands
ABS	=	0.01 for cadmium; 0.06 for PCBs (EPA, 1992b)
EF	=	350 days/year
ED	=	30 years for adults
BW	=	70 kg for adults
AT	=	10,950 and 25,550 days for non-cancer and cancer risks, respectively

- INGESTION OF CHEMICALS IN SOIL AND HOUSE DUST

Equation:

$$Intake\ (mg/kg\text{-}day) = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

where:

CS	=	Chemical Concentration in Soil (mg/kg)
IR	=	Ingestion Rate (mg soil/day)
CF	=	Conversion Factor (10^{-6} kg/mg)
FI	=	Fraction Ingested from Contaminated Source (unitless)
EF	=	Exposure Frequency (days/years)

ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

IR = 100 mg/day for adults; 200 mg/day for children ages 1-6 years
FI = 1.0, all ingested soil and dust is contaminated
EF = 350 days/year
ED = 30 years for adults, 6 years for children
BW = 70 kg for adults, 14.5 kg for children 0-6 years old
AT = 2,190 and 25,550 days for children non-cancer and cancer risks, respectively
10,950 and 25,550 days for adult non-cancer and cancer risks, respectively

- OUTDOOR INHALATION OF AIRBORNE CHEMICALS ADSORBED TO DUST

Equation:

$$Intake\ (mg/kg\text{-}day) = \frac{CD \times CS \times IR \times ET \times EF \times ED}{BW \times AT}$$

where:

CD = Ambient Dust Concentration
CS = Contaminant Concentration in Soil (mg/kg)
IR = Inhalation Rate (m^3/hour)
ET = Exposure Time (hours/day)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

IR = 0.83 m^3/hour for adults
ET = 4 hours/day, time spent outdoors
EF = 350 days/year
ED = 30 years for adults
BW = 70 kg for adults
AT = 10,950 and 25,550 days for non-cancer and cancer risks, respectively

EXPOSURE POINT MODELS

- Model Estimates of Fugitive Dust Generation

Emissions estimates were calculated for activities resulting in soil disturbance, such as heavy equipment operation and wind erosion which may occur over the site during the construction scenario, or simple wind erosion which may occur in the future residential use scenario if areas are left unvegetated.

The potentially significant components of fugitive dust at this site are:

1) wind erosion of dust from surfaces without vegetative cover, and
2) dust from loading/unloading of excavated soil.

Fugitive dust from wind erosion over exposed soil and from loading/unloading activities was calculated using (EPA, AP-42, 1988). Fugitive dust generation tables showing all model inputs, are presented in Table A-2. The data are summarized in Table A-1. The models are described below.

$$E = a \cdot I \cdot K \cdot C \cdot L \cdot V \cdot A \cdot T$$

where:

E	=	Emission rate (kg/day)
a	=	Fraction of total wind losses (wind erosion of soil) that remain suspended
I	=	Soil erodibility
C	=	Climatic factor
K	=	Soil roughness factor
L	=	Field length factor
V	=	Vegetative cover factor
A	=	Area of the site
T	=	Time conversion factor

Most of these values are specified in USEPA (1988) for worst-case treatments. The climatic factor is read from a map and multiplied by .01 as specified. The variables a and I are determined based on-site soil characteristics. The following values were used:

a	=	0.01
I	=	134 tons $acre^{-1}$ yr^{-1}
K	=	1 (worst-case for flat terrain)
V	=	1 (no vegetative cover-worst case)
L	=	.7
C	=	0.06
A	=	30 acres (Scenario 2), 60 acres (Scenario 4), 2 acres (Scenario 5)
T	=	1 yr/365 days

The wind erosion emission rate is presented in Table A-1.

The second component is due to loading/unloading of soils due to excavation activities and can be accounted for by:

$$E = \frac{K \cdot (.0016) \cdot (U/2.2)^{1.3}}{(M/S)^{1.4}}$$

and

$$E_{ed} = V \cdot D \cdot E/T$$

where:

E	=	Emission factor due to loading/dumping (kg/Mg)
k	=	Particle size multiplier
U	=	Mean wind speed (m/s)
M	=	Soil moisture (%)
E_{ed}	=	Emission rate due to loading/dumping (kg/day)
V	=	Volume of soil excavated (m^3)
D	=	Density of soil (Mg/m^3)
T	=	Time conversion factor (days of excavation)

Using conservative assumptions and appropriate guidelines (EPA, AP-42, 1988):

k	=	.74
U	=	4.56 m/s
M	=	5%
V	=	3,900 m^3
D	=	1.5 Mg/m^3
T	=	365 days

The emissions due to loading/dumping are presented in Table A-1.

Total fugitive emissions (from wind activity and loading/dumping) are also presented in Table A-1.

The dust concentration on-site is calculated by:

$$Cs = \frac{E}{w \cdot W \cdot H} \cdot C_f$$

where:

Cs = Dust concentration on-site (mg/m^3)

E	=	Total emission rate (kg/day)
w	=	Wind speed = 4.56 m/s
W	=	Width (entire site) = 304.8 m (Scenarios 2 and 4), 89.9 m (Scenario 5)
H	=	Breathing height = 2 m
C_f	=	Factors for converting from days to seconds and from kg to mg

The third component is emissions due to vehicular traffic and are estimated by (EPA, 1988):

$$E = [\ 1.7K\ (\frac{S}{12})\ (\frac{S_p}{48})\ (\frac{W}{2.7})^{0.7}\ (\frac{W}{4})^{0.5}\ (\frac{(365-P)}{365})\ ]\ D_{vt}$$

where:

E	=	emissions due to vehicular traffic (kg/yr)
K	=	particle size multiplier
s	=	silt content of soil (%)
S	=	vehicle speed (km/hr)
w	=	mean number of wheels
p	=	day with >0.254 mm of precipitation
W	=	vehicle weight (Mg)
D_vt	=	vehicle miles (km/yr)

Using conservative assumptions and suggested values (EPA, 1988):

K	=	1.0
s	=	28%
S	=	7 km/hr
w	=	6 Mg
p	=	140 km/yr

Total fugitive dust concentrations on-site are shown in Table A-1.

The concentration of contaminant suspended in air is estimated by a simple ratio of contaminant concentration in soil to fugitive dust emissions:

$$A_c = CC \cdot C_s \cdot C_f$$

where:

A_c	=	Concentration of suspended contaminant (mg/m^3)
CC	=	Contaminant concentration in soil (mg/kg)
C_s	=	Dust concentration on-site (mg/m^3)
C_f	=	Conversion factor (kg/mg)

TABLE A-1

FUGITIVE DUST EMISSION RATES AND AMBIENT CONCENTRATION ESTIMATES

DUST EMISSION RATE (kg/day)

	Scenario 2	Scenario 4	Scenario 5
Wind Erosion	4.14E+00	8.27E+00	2.76E-01
Loading/Unloading	NA	1.36E-02	NA
Unpaved Road	1.02E-02	NA	NA
Total Dust Emission Rate	4.15E+00	8.28E+00	2.76E-01
Dust Concentration (kg/m^3)	1.73E-08	3.46E-08	3.90E-09

NA = Not Applicable

TABLE A.1-1
DERMAL CONTACT WITH CHEMICALS IN SOIL
SCENARIO 1 – Trespassing (Current)

CHEMICAL	ABSORBED DOSE (NONCANCER) (mg/kg/day)	ABSORBED DOSE (CANCER) (mg/kg/day)	CONC. IN SOIL (mg/kg)	CONVERSION FACTOR (1E-6 kg/mg)	SKIN SURFACE AREA (cm2/event)	ADHERENCE FACTOR (mg/cm2)	ABSORPTION FACTOR (unitless)	EXPOSURE FREQUENCY (event/year)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVG. TIME (NONCANCER) (days)	AVG. TIME (CANCER) (days)
INORGANICS												
ALUMINUM	NA	NA	4651.87	1E-06	8600	1.45	NA	30	9	49	3285	25550
ANTIMONY	NA	NA	6.12	1E-06	8600	1.45	NA	30	9	49	3285	25550
ARSENIC	NA	NA	2.13	1E-06	8600	1.45	NA	30	9	49	3285	25550
BARIUM	NA	NA	40.92	1E-06	8600	1.45	NA	30	9	49	3285	25550
BERYLLIUM	NA	NA	1.66	1E-06	8600	1.45	NA	30	9	49	3285	25550
CADMIUM	2.3E-07	2.9E-08	1.09	1E-06	8600	1.45	0.01	30	9	49	3285	25550
CHROMIUM III	NA	NA	70.10	1E-06	8600	1.45	NA	30	9	49	3285	25550
CHROMIUM VI	NA	NA	10.01	1E-06	8600	1.45	NA	30	9	49	3285	25550
COBALT	NA	NA	3.82	1E-06	8600	1.45	NA	30	9	49	3285	25550
COPPER	NA	NA	17.38	1E-06	8600	1.45	NA	30	9	49	3285	25550
LEAD	NA	NA	73.80	1E-06	8600	1.45	NA	30	9	49	3285	25550
MANGANESE	NA	NA	209.08	1E-06	8600	1.45	NA	30	9	49	3285	25550
MERCURY	NA	NA	0.21	1E-06	8600	1.45	NA	30	9	49	3285	25550
NICKEL	NA	NA	53.48	1E-06	8600	1.45	NA	30	9	49	3285	25550
SELENIUM	NA	NA	0.53	1E-06	8600	1.45	NA	30	9	49	3285	25550
SILVER	NA	NA	1.11	1E-06	8600	1.45	NA	30	9	49	3285	25550
VANADIUM	NA	NA	361.69	1E-06	8600	1.45	NA	30	9	49	3285	25550
ZINC	NA	NA	77.65	1E-06	8600	1.45	NA	30	9	49	3285	25550
BORON	NA	NA	27.67	1E-06	8600	1.45	NA	30	9	49	3285	25550
NIOBIUM	NA	NA	61.14	1E-06	8600	1.45	NA	30	9	49	3285	25550
STRONTIUM	NA	NA	27.86	1E-06	8600	1.45	NA	30	9	49	3285	25550
TITANIUM	NA	NA	137.36	1E-06	8600	1.45	NA	30	9	49	3285	25550
ZIRCONIUM	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
VOLATILE ORGANICS												
ACETONE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
CARBON DISULFIDE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
1,2-DICHLORETHENE (total)	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
2-BUTANONE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
TRICHLOROETHENE	NA	NA	0.0055	1E-06	8600	1.45	NA	30	9	49	3285	25550
BENZENE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
TETRACHLOROETHENE	NA	NA	0.0040	1E-06	8600	1.45	NA	30	9	49	3285	25550
TOLUENE	NA	NA	0.0045	1E-06	8600	1.45	NA	30	9	49	3285	25550
ETHYLBENZENE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
XYLENE (total)	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
BASE NEUTRAL / ACIDS												
PHENOL	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
BENZOIC ACID	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
NAPHTHALENE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
4-NITROPHENOL	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
2,4-DINITROTOLUENE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
PENTACHLOROPHENOL	NA	NA	0.0740	1E-06	8600	1.45	NA	30	9	49	3285	25550
PHENANTHRENE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
ANTHRACENE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
DI-n-BUTYLPHALATE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
FLUORANTHENE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
PYRENE	NA	NA	0.0550	1E-06	8600	1.45	NA	30	9	49	3285	25550
BUTYLBENZYLPHTHALATE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
BENZO(a)ANTHRACENE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
CHRYSENE	NA	NA	0.3383	1E-06	8600	1.45	NA	30	9	49	3285	25550
bis(2-ETHYLHEXYL)PHTHALATE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
BENZO(b)FLUORANTHENE	NA	NA	0.2200	1E-06	8600	1.45	NA	30	9	49	3285	25550
BENZO(k)FLUORANTHENE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
BENZO(a)PYRENE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
INDENO(1,2,3-cd)PYRENE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
BENZO(g,h,i)PERYLENE	NA	NA	NA	1E-06	8600	1.45	NA	30	9	49	3285	25550
PCB'S												
AROCLOR-1248	0.0E+00	0.0E+00	NA	1E-06	8600	1.45	0.06	30	9	49	3285	25550
AROCLOR-1254	0.0E+00	0.0E+00	NA	1E-06	8600	1.45	0.06	30	9	49	3285	25550
AROCLOR-1260	0.0E+00	0.0E+00	NA	1E-06	8600	1.45	0.06	30	9	49	3285	25550

TABLE A.1-2
DERMAL CONTACT WITH CHEMICALS IN SURFACE WATER
SCENARIO 1 – Trespassing (Current)

CHEMICAL	ABSORBED DOSE (NONCANCER) (mg/kg/day)	ABSORBED DOSE (CANCER) (mg/kg/day)	CONC. IN WATER (mg/l)	CONVERSION FACTOR (1liter/1000cm3)	SKIN SURFACE AREA (cm2)	PERM. CONSTANT (cm/hr)	EXPOSURE TIME (hr/day)	EXPOSURE FREQUENCY (days/years)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVG.TIME (NONCANCER) (days)	AVG.TIME (CANCER) (days)
INORGANICS												
ALUMINUM	1.7E-03	2.2E-04	44.80	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
ANTIMONY	1.4E-06	1.9E-07	0.15	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
ARSENIC	3.3E-07	4.3E-08	0.035	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
BARIUM	2.8E-06	3.6E-07	0.29	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
BERYLLIUM	2.4E-07	3.1E-08	0.025	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
CADMIUM	7.3E-08	9.4E-09	0.0076	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
CHROMIUM III	8.2E-05	1.0E-05	8.52	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
CHROMIUM VI	5.2E-10	6.7E-11	0.000054	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
COBALT	6.0E-07	7.7E-08	0.062	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
COPPER	4.1E-06	5.3E-07	0.43	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
LEAD	6.2E-07	8.0E-08	0.065	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
MANGANESE	2.5E-05	3.2E-06	2.59	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
MERCURY	2.1E-07	2.6E-08	0.021	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
NICKEL	5.9E-06	7.6E-07	0.62	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
VANADIUM	5.5E-05	7.0E-06	5.70	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
ZINC	1.0E-05	1.3E-06	1.07	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
CYANIDE	1.0E-07	1.3E-08	0.011	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
BORON	7.9E-06	1.0E-06	0.83	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
FLUORIDE	9.9E-09	1.3E-09	0.0010	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
VOLATILE ORGANICS												
CHLOROMETHANE	7.3E-08	9.4E-09	0.0077	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
1,2-DICHLORETHENE (total)	2.4E-08	3.1E-09	0.0025	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
TRICHLOROETHENE	2.7E-08	3.4E-09	0.0028	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
BASE NEUTRAL / ACIDS												
DI-n-BUTYLPHALATE	9.6E-09	1.2E-09	0.0010	1E-03	6800	8.4E-04	4	30	9	49	3285	25550
bis(2-ETHYLHEXYL)PHTHALATE	1.9E-08	2.5E-09	0.0020	1E-03	6800	8.4E-04	4	30	9	49	3285	25550

NA: Not Applicable

TABLE A.1–3
INGESTION OF CHEMICALS IN SOIL
SCENARIO 1 – Trespassing (Current)

CHEMICAL	INTAKE (NONCANCER) (mg/kg/day)	INTAKE (CANCER) (mg/kg/day)	CONC IN SOIL (mg/kg)	CONVERSION FACTOR (kg/mg)	INGESTION RATE (mg soil/day)	EXPOSURE FREQUENCY (days/year)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVG. TIME (NONCANCER) (days)	AVG. TIME (CANCER) (days)
INORGANICS										
ALUMINUM	7.8E–04	1.0E–04	4651.87	1E–06	100	30	9	49	3285	25550
ANTIMONY	1.0E–06	1.3E–07	6.12	1E–06	100	30	9	49	3285	25550
ARSENIC	3.6E–07	4.6E–08	2.13	1E–06	100	30	9	49	3285	25550
BARIUM	6.9E–06	8.8E–07	40.92	1E–06	100	30	9	49	3285	25550
BERYLLIUM	2.8E–07	3.6E–08	1.66	1E–06	100	30	9	49	3285	25550
CADMIUM	1.8E–07	2.4E–08	1.09	1E–06	100	30	9	49	3285	25550
CHROMIUM III	1.2E–05	1.5E–06	70.10	1E–06	100	30	9	49	3285	25550
CHROMIUM VI	1.7E–06	2.2E–07	10.01	1E–06	100	30	9	49	3285	25550
COBALT	6.4E–07	8.2E–08	3.82	1E–06	100	30	9	49	3285	25550
COPPER	2.9E–06	3.7E–07	17.38	1E–06	100	30	9	49	3285	25550
LEAD	1.2E–05	1.6E–06	73.80	1E–06	100	30	9	49	3285	25550
MANGANESE	3.5E–05	4.5E–06	209.06	1E–06	100	30	9	49	3285	25550
MERCURY	3.5E–08	4.5E–09	0.21	1E–06	100	30	9	49	3285	25550
NICKEL	9.0E–06	1.2E–06	53.48	1E–06	100	30	9	49	3285	25550
SELENIUM	8.9E–08	1.1E–08	0.53	1E–06	100	30	9	49	3285	25550
SILVER	1.9E–07	2.4E–08	1.11	1E–06	100	30	9	49	3285	25550
VANADIUM	6.1E–05	7.8E–06	361.69	1E–06	100	30	9	49	3285	25550
ZINC	1.3E–05	1.7E–06	77.65	1E–06	100	30	9	49	3285	25550
BORON	4.6E–06	6.0E–07	27.67	1E–06	100	30	9	49	3285	25550
NIOBIUM	1.0E–05	1.3E–06	61.14	1E–06	100	30	9	49	3285	25550
STRONTIUM	4.7E–06	6.0E–07	27.86	1E–06	100	30	9	49	3285	25550
TITANIUM	2.3E–05	3.0E–06	137.36	1E–06	100	30	9	49	3285	25550
ZIRCONIUM	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
VOLATILE ORGANICS										
ACETONE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
CARBON DISULFIDE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
1,2–DICHLOROETHENE (total)	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
2–BUTANONE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
TRICHLOROETHENE	9.2E–10	1.2E–10	0.0055	1E–06	100	30	9	49	3285	25550
BENZENE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
TETRACHLOROETHENE	6.7E–10	8.6E–11	0.0040	1E–06	100	30	9	49	3285	25550
TOLUENE	7.5E–10	9.6E–11	0.0045	1E–06	100	30	9	49	3285	25550
ETHYLBENZENE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
XYLENE (total)	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
BASE NEUTRAL / ACIDS										
PHENOL	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
BENZOIC ACID	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
NAPHTHALENE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
4–NITROPHENOL	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
2,4–DINITROTOLUENE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
PENTACHLOROPHENOL	1.2E–08	1.6E–09	0.0740	1E–06	100	30	9	49	3285	25550
PHENANTHRENE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
ANTHRACENE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
DI–n–BUTYLPHALATE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
FLUORANTHENE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
PYRENE	9.2E–09	1.2E–09	0.0550	1E–06	100	30	9	49	3285	25550
BUTYLBENZYLPHTHALATE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
BENZO(a)ANTHRACENE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
CHRYSENE	5.7E–08	7.3E–09	0.3383	1E–06	100	30	9	49	3285	25550
bis(2–ETHYLHEXYL)PHTHALATE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
BENZO(b)FLUORANTHENE	3.7E–08	4.7E–09	0.2200	1E–06	100	30	9	49	3285	25550
BENZO(k)FLUORANTHENE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
BENZO(a)PYRENE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
INDENO(1,2,3–cd)PYRENE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
BENZO(g,h,i)PERYLENE	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
PCB'S										
AROCLOR–1248	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
AROCLOR–1254	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550
AROCLOR–1260	0.0E+00	0.0E+00	NA	1E–06	100	30	9	49	3285	25550

TABLE A.1-4
INGESTION OF CHEMICALS IN SURFACE WATER
SCENARIO 1 - Trespassing (Current)

CHEMICAL	INTAKE (NONCANCER) (mg/kg/day)	INTAKE (CANCER) (mg/kg/day)	CONC. IN WATER (mg/L)	CONTACT RATE (ml/hr)	EXPOSURE TIME (hr/day)	EXPOSURE FREQUENCY (days/year)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVG. TIME (NONCANCER) (days)	AVG. TIME (CANCER) (days)
INORGANICS										
ALUMINUM	3.8E-03	4.8E-04	44.80	0.05	1	30	9	49	3285	25550
ANTIMONY	1.3E-05	1.6E-06	0.15	0.05	1	30	9	49	3285	25550
ARSENIC	2.9E-06	3.7E-07	0.035	0.05	1	30	9	49	3285	25550
BARIUM	2.4E-05	3.1E-06	0.29	0.05	1	30	9	49	3285	25550
BERYLLIUM	2.1E-06	2.7E-07	0.025	0.05	1	30	9	49	3285	25550
CADMIUM	6.4E-07	8.2E-08	0.0076	0.05	1	30	9	49	3285	25550
CHROMIUM III	7.1E-04	9.2E-05	8.52	0.05	1	30	9	49	3285	25550
CHROMIUM VI	4.5E-09	5.8E-10	0.000054	0.05	1	30	9	49	3285	25550
COBALT	5.2E-06	6.7E-07	0.062	0.05	1	30	9	49	3285	25550
COPPER	3.6E-05	4.7E-06	0.43	0.05	1	30	9	49	3285	25550
LEAD	5.5E-06	7.0E-07	0.065	0.05	1	30	9	49	3285	25550
MANGANESE	2.2E-04	2.8E-05	2.59	0.05	1	30	9	49	3285	25550
MERCURY	1.8E-06	2.3E-07	0.021	0.05	1	30	9	49	3285	25550
NICKEL	5.2E-05	6.7E-06	0.62	0.05	1	30	9	49	3285	25550
VANADIUM	4.8E-04	6.1E-05	5.70	0.05	1	30	9	49	3285	25550
ZINC	9.0E-05	1.2E-05	1.07	0.05	1	30	9	49	3285	25550
CYANIDE	8.9E-07	1.1E-07	0.011	0.05	1	30	9	49	3285	25550
BORON	6.9E-05	8.9E-06	0.83	0.05	1	30	9	49	3285	25550
FLUORIDE	8.7E-08	1.1E-08	0.0010	0.05	1	30	9	49	3285	25550
VOLATILE ORGANICS										
CHLOROMETHANE	6.4E-07	8.3E-08	0.0077	0.05	1	30	9	49	3285	25550
1,2-DICHLORETHENE (total)	2.1E-07	2.7E-08	0.0025	0.05	1	30	9	49	3285	25550
TRICHLOROETHENE	2.3E-07	3.0E-08	0.0028	0.05	1	30	9	49	3285	25550
BASE NEUTRAL / ACIDS										
DI-n-BUTYLPHALATE	8.4E-08	1.1E-08	0.0010	0.05	1	30	9	49	3285	25550
bis(2-ETHYLHEXYL)PHTHALATE	1.7E-07	2.2E-08	0.0020	0.05	1	30	9	49	3285	25550

NA: Not Applicable

TABLE A.1-5
CANCER RISK ESTIMATES
SCENARIO 1 – Trespassing (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK	TOTAL RISK
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOILS								0E+00	2E-06
PCB'S									
AROCLOR-1248	0.0E+00	No	7.70E+00				NA		
AROCLOR-1254	0.0E+00	No	7.70E+00				NA		
AROCLOR-1260	0.0E+00	No	7.70E+00	B2	Liver	Diet/IRIS	NA		

NA: Not Applicable

TABLE A.1-6
CANCER RISK ESTIMATES
SCENARIO 1 – Trespassing (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: INCIDENTAL INGESTION OF CHEMICALS IN SOIL								4E-07
INORGANICS								
ARSENIC	4.6E-08	No	1.75E+00	A	Skin	IRIS	8E-08	
BERYLLIUM	3.6E-08	No	4.30E+00	B2	gross tumors, all sites combined	Water/IRIS	2E-07	
LEAD	1.6E-06	No	NA	B2	Renal tumors	Oral/IRIS	NA	
VOLATILE ORGANICS								
TRICHLOROETHENE	1.2E-10	No	1.10E-02	B2	Liver	Gavage/HEAST	1E-12	
BENZENE	0.0E+00	No	2.90E-02	A	Leukemia	Occupational/IRIS	NA	
TETRACHLOROETHENE	8.6E-11	No	5.10E-02	B2	Liver	Gavage/HEAST	4E-12	
BASE NEUTRAL / ACIDS								
2,4-DINITROTOLUENE	0.0E+00	No	6.80E-01	B2	Liver, mammary gland	Diet/IRIS	NA	
PENTACHLOROPHENOL	1.6E-09	No	1.20E-01	B2	Hepatocellular adenoma, carcinomas, pheochromocytoma	Oral/IRIS	2E-10	
BUTYLBENZYLPHTHALATE	0.0E+00	No	NA	C	Leukemia	Diet/IRIS	NA	
BENZO(a)ANTHRACENE	0.0E+00	No	1.15E+01	B2	Liver, lung, skin	IRIS	NA	
CHRYSENE	7.3E-09	No	1.15E+01	B2	Malignant lymphoma	IRIS	8E-08	
bis(2-ETHYLHEXYL)PHTHALATE	0.0E+00	No	1.40E-02	B2	Liver	IRIS	NA	
BENZO(b)FLUORANTHENE	4.7E-09	No	1.15E+01	B2	Lung, thorax, skin	IRIS	5E-08	
BENZO(k)FLUORANTHENE	0.0E+00	No	1.15E+01	B2	Lung, thorax, skin	IRIS	NA	
BENZO(a)PYRENE	0.0E+00	No	1.15E+01	B2	Stomach, lung	IRIS	NA	
INDENO(1,2,3-cd)PYRENE	0.0E+00	No	1.15E+01	B2	Lung, skin	IRIS	NA	
PCB'S								
AROCLOR-1248	0.0E+00	No	7.70E+00				NA	
AROCLOR-1254	0.0E+00	No	7.70E+00				NA	
AROCLOR-1260	0.0E+00	No	7.70E+00	B2	Liver	Diet/IRIS	NA	

NA: Not Applicable

TABLE A.1-7
CANCER RISK ESTIMATES
SCENARIO 1 - Trespassing (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SURFACE WATER								7E-08
INORGANICS								
ARSENIC	4.3E-08	No	1.75E+00	A	Skin	IRIS	7E-08	
VOLATILES								
CHLOROMETHANE	9.4E-09		1.30E-02	C	Kidney	Inhalation/HEAST	1E-10	
TRICHLOROETHENE	3.4E-09	No	1.10E-02	B2	Liver	Gavage/HEAST	4E-11	
BASE NEUTRAL / ACIDS								
bis(2-ETHYLHEXYL)PHTHALATE	2.5E-09	No	1.40E-02	B2	Liver	IRIS	3E-11	

NA: Not Applicable

TABLE A.1-8
CANCER RISK ESTIMATES
SCENARIO 1 – Trespassing (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: INCIDENTIAL INGESTION OF CHEMICALS IN SURFACE WATER								2E-06
INORGANICS								
ARSENIC	3.7E-07	No	1.75E+00	A	Skin	IRIS	7E-07	
BERYLLIUM	2.7E-07	No	4.30E+00	B2	gross tumors, all sites combined	Water/IRIS	1E-06	
LEAD	7.0E-07	No	NA	B2	Renal tumors	Oral/IRIS	NA	
VOLATILE ORGANICS								
CHLOROMETHANE	8.3E-08	No	1.30E-02	C	Kidney	Inhalation/HEAST	1E-09	
TRICHLOROETHENE	3.0E-08	No	1.10E-02	B2	Liver	Gavage/HEAST	3E-10	
BASE NEUTRAL / ACIDS								
bis(2-ETHYLHEXYL)PHTHALATE	2.2E-08	No	1.40E-02	B2	Liver	IRIS	3E-10	

NA: Not Applicable

TABLE A.1–9
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 1 – Trespassing (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)	TOTAL HAZARD INDEX (HI)
EXPOSURE PATHWAY: DERMAL CONTACT WITH SOIL										2E–04	1E–01
INORGANICS											
CADMIUM	2.28E–07	No	1.00E–03	High	Proteinuria	Diet/IRIS	10	1.00	2E–04		
PCB'S											
AROCLOR–1248	0.0E+00	No	NA			NA/IRIS			NA		
AROCLOR–1254	0.0E+00	No	NA			NA/IRIS			NA		
AROCLOR–1260	0.0E+00	No	NA			NA/IRIS			NA		

NA: Not Applicable

TABLE A.1-10
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 1 - Trespassing (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)
EXPOSURE PATHWAY: INCIDENTAL INGESTION OF SOIL										1E-02
INORGANICS										
ALUMINUM	7.8E-04	No				NA/IRIS			NA	
ANTIMONY	1.0E-06	No	4.0E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	1000	1	3E-03	
ARSENIC	3.6E-07	No	1.0E-03		Keratosis and hyperpigmentation	Diet/HEAST	1		4E-04	
BARIUM	6.9E-06	No	7.0E-02	Medium	None observed	Water/IRIS	3	1	1E-04	
BERYLLIUM	2.8E-07	No	5.0E-03	Low	None observed	Water/IRIS	100	1	6E-05	
CADMIUM	1.8E-07	No	1.0E-03	High	Proteinuria	Diet/IRIS	10	1	2E-04	
CHROMIUM III	1.2E-05	No	1.0E+00	Low	Hepatotoxicity	IRIS	1000		1E-05	
CHROMIUM VI	1.7E-06	No	5.0E-03	Low	No effects observed	Water/IRIS	500	1	3E-04	
COBALT	6.4E-07	No	NA			NA/IRIS			NA	
COPPER	2.9E-06	No	4.0E-02		Local GI irritation	NA/HEAST			7E-05	
LEAD	1.2E-05	No	NA		Neurobehavioral effects	NA/IRIS			NA	
MANGANESE	3.5E-05	No	1.0E-01	Medium	CNS effects	Diet/IRIS	1	1	4E-04	
MERCURY	3.5E-08	No	3.0E-04		Kidney effects	Oral/HEAST	1000		1E-04	
NICKEL	9.0E-06	No	2.0E-02		Reduced body and organ weight	Diet/HEAST			4E-04	
SELENIUM	8.9E-08	No	5.0E-03	Medium	Clinical selenosis	Diet/IRIS	3	1	2E-05	
SILVER	1.9E-07	No	3.0E-03	Medium	Argyria	Oral/IRIS	2	1	6E-05	
VANADIUM	6.1E-05	No	7.0E-03		None observed	Water/HEAST	100		9E-03	
ZINC	1.3E-05	No	2.0E-01		Anemia	Therap./HEAST	10		7E-05	
BORON	4.6E-06	No	9.0E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IRIS	100	1	5E-05	
NIOBIUM	1.0E-05	No	NA			NA/IRIS			NA	
STRONTIUM	4.7E-06	No	NA			NA/IRIS			NA	
TITANIUM	2.3E-05	No	NA			NA/IRIS			NA	
ZIRCONIUM	0.0E+00	No	NA			NA/IRIS			NA	
VOLATILE ORGANICS										
ACETONE	0.0E+00	No	1.0E-01	Low	Increased liver and kidney weight	Gavage/IRIS	1000	1	NA	
CARBON DISULFIDE	0.0E+00	No	1.0E-01	Medium	Fetal toxicity	Inhal./IRIS	100	1	NA	
1,2-DICHLORETHENE (total)	0.0E+00	No	1.0E-02		Decreased hematocrit and hemoglobin	Gavage/HEAST	3000		NA	
2-BUTANONE	0.0E+00	No	5.0E-02	Medium	Fetotoxicity	Inhal./IRIS	1000		NA	
TRICHLOROETHENE	9.2E-10	No	NA			NA/IRIS			NA	
BENZENE	0.0E+00	No	NA			NA/IRIS			NA	
TETRACHLOROETHENE	6.7E-10	No	1.0E-02	Medium	Hepatotoxicity,weight gain	Gavage/IRIS	100	1	7E-08	
TOLUENE	7.5E-10	No	2.0E-01	Medium	Changes in liver and kidney weights	Gavage/IRIS	1000	1	4E-09	
ETHYLBENZENE	0.0E+00	No	1.0E-01	Low	Liver and kidney toxicity	Oral/IRIS	1000	1	NA	
XYLENE (total)	0.0E+00	No	2.0E+00	Medium	Hyperactivity,decreased body weight,increased	Gavage/IRIS	100	1	NA	
BASE NEUTRAL / ACIDS										
PHENOL	0.0E+00	No	6.0E-01	Low	Reduced fetal body weight	Gavage/IRIS	100	1	NA	
BENZOIC ACID	0.0E+00	No	4.0E+00	Medium		Oral/IRIS	1	1	NA	
NAPHTHALENE	0.0E+00	No	4.0E-03		Decreased body weight gain	Gavage/HEAST	10000		NA	
4-NITROPHENOL	0.0E+00	No	NA			NA/IRIS			NA	
2,4-DINITROTOLUENE	0.0E+00	No	NA			NA/IRIS			NA	
PENTACHLOROPHENOL	1.2E-08	No	3.0E-02	Medium	Liver and kidney pathology	Diet/IRIS	100	1	4E-07	
PHENANTHRENE	0.0E+00	No	NA			NA/IRIS			NA	
ANTHRACENE	0.0E+00	No	3.0E-01	Low	No observed effects	Gavage/IRIS	3000	1	NA	
DI-n-BUTYLPHALATE	0.0E+00	No	1.0E-01	Low	Increased mortality	Diet/IRIS	1000	1	NA	
FLUORANTHENE	0.0E+00	No	4.0E-02	Low	Nephropathy,changes in liver weight,hematology	Gavage/IRIS	3000	1	NA	
PYRENE	9.2E-09	No	3.0E-02	Low	Kidney effects	Gavage/IRIS	3000	1	3E-07	
BUTYLBENZYLPHTHALATE	0.0E+00	No	2.0E-01	Low	Effects on body weight gain, testes,liver,kidney	Diet/IRIS	1000	1	NA	
BENZO(a)ANTHRACENE	0.0E+00	No	NA			NA/IRIS			NA	
CHRYSENE	5.7E-08	No	NA			NA/IRIS			NA	
bis(2-ETHYLHEXYL)PHTHALATE	0.0E+00	No	2.0E-02	Medium	Increased relative liver weight	Diet/IRIS	1000	1	NA	
BENZO(b)FLUORANTHENE	3.7E-08	No	NA			NA/IRIS			NA	
BENZO(k)FLUORANTHENE	0.0E+00	No	NA			NA/IRIS			NA	
BENZO(a)PYRENE	0.0E+00	No	NA			NA/IRIS			NA	
INDENO(1,2,3-cd)PYRENE	0.0E+00	No	NA			NA/IRIS			NA	
BENZO(g,h,i)PERYLENE	0.0E+00	No	NA			NA/IRIS			NA	
PCB'S										
AROCLOR-1248	0.0E+00	No	NA			NA/IRIS			NA	
AROCLOR-1254	0.0E+00	No	NA			NA/IRIS			NA	
AROCLOR-1260	0.0E+00	No	NA			NA/IRIS			NA	

NA: Not Applicable

TABLE A.1-11
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 1 - Trespassing (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SURFACE WATER										1E-02
INORGANICS										
ALUMINUM	1.7E-03	No				NA/IRIS			NA	
ANTIMONY	1.4E-06	No	4.0E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	1000	1	4E-03	
ARSENIC	3.3E-07	No	1.0E-03		Keratosis and hyperpigmentation	Diet/HEAST	1		3E-04	
BARIUM	2.8E-06	No	7.0E-02	Medium	None observed	Water/IRIS	3	1	4E-05	
BERYLLIUM	2.4E-07	No	5.0E-03	Low	None observed	Water/IRIS	100	1	5E-05	
CADMIUM	7.3E-08	No	1.0E-03	High	Proteinuria	Diet/IRIS	10	1	7E-05	
CHROMIUM III	8.2E-05	No	1.0E+00	Low	Hepatotoxicity	IRIS	1000		8E-05	
CHROMIUM VI	5.2E-10	No	5.0E-03	Low	No effects observed	Water/IRIS	500	1	1E-07	
COBALT	6.0E-07	No	NA			NA/IRIS			NA	
COPPER	4.1E-06	No	4.0E-02		Local GI irritation	NA/HEAST			1E-04	
LEAD	6.2E-07	No	NA		Neurobehavioral effects	NA/IRIS			NA	
MANGANESE	2.5E-05	No	1.0E-01	Medium	CNS effects	Diet/IRIS	1	1	2E-04	
MERCURY	2.1E-07	No	3.0E-04		Kidney effects	Oral/HEAST	1000		7E-04	
NICKEL	5.9E-06	No	2.0E-02		Reduced body and organ weight	Diet/HEAST			3E-04	
VANADIUM	5.5E-05	No	7.0E-03		None observed	Water/HEAST	100		8E-03	
ZINC	1.0E-05	No	2.0E-01		Anemia	Therap./HEAST	10		5E-05	
CYANIDE	1.0E-07	No	2.0E-02	Medium	Weight loss,thyroid effects,myelin degeneration	Diet/IRIS	100	5	5E-06	
BORON	7.9E-06	No	9.0E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IRIS	100	1	9E-05	
FLUORIDE	9.9E-09	No	6.0E-02	High	Dental and skeletal fluorosis	Water/IRIS	1	1	2E-07	
VOLATILE ORGANICS										
CHLOROMETHANE	7.3E-08	No	NA			NA/IRIS			NA	
1,2-DICHLORETHENE (total)	2.4E-08	No	1.0E-02		Decreased hematocrit and hemoglobin	Gavage/HEAST	3000		2E-06	
TRICHLOROETHENE	2.7E-08	No	NA			NA/IRIS			NA	
BASE NEUTRAL / ACIDS										
DI-n-BUTYLPHALATE	9.6E-09	No	1.0E-01	Low	Increased mortality	Diet/IRIS	1000	1	1E-07	
bis(2-ETHYLHEXYL)PHTHALATE	1.9E-08	No	2.0E-02	Medium	Increased relative liver weight	Diet/IRIS	1000	1	1E-06	

NA: Not Applicable

TABLE A.1-12
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 1 – Trespassing (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)
EXPOSURE PATHWAY: INCIDENTAL INGESTION OF SURFACE WATER										1E-01
INORGANICS										
ALUMINUM	3.8E-03	No				NA/IRIS			NA	
ANTIMONY	1.3E-05	No	4.0E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	1000	1	3E-02	
ARSENIC	2.9E-06	No	1.0E-03		Keratosis and hyperpigmentation	Diet/HEAST	1		3E-03	
BARIUM	2.4E-05	No	7.0E-02	Medium	None observed	Water/IRIS	3	1	3E-04	
BERYLLIUM	2.1E-06	No	5.0E-03	Low	None observed	Water/IRIS	100	1	4E-04	
CADMIUM	6.4E-07	No	1.0E-03	High	Proteinuria	Diet/IRIS	10	1	6E-04	
CHROMIUM III	7.1E-04	No	1.0E+00	Low	Hepatotoxicity	IRIS	1000		7E-04	
CHROMIUM VI	4.5E-09	No	5.0E-03	Low	No effects observed	Water/IRIS	500	1	9E-07	
COBALT	5.2E-06	No	NA			NA/IRIS			NA	
COPPER	3.6E-05	No	4.0E-02		Local GI irritation	NA/HEAST			9E-04	
LEAD	5.5E-06	No	NA		Neurobehavioral effects	NA/IRIS			NA	
MANGANESE	2.2E-04	No	1.0E-01	Medium	CNS effects	Diet/IRIS	1	1	2E-03	
MERCURY	1.8E-06	No	3.0E-04		Kidney effects	Oral/HEAST	1000		6E-03	
NICKEL	5.2E-05	No	2.0E-02		Reduced body and organ weight	HEAST	300		3E-03	
VANADIUM	4.8E-04	No	7.0E-03		None observed	Water/HEAST	100		7E-02	
ZINC	9.0E-05	No	2.0E-01		Anemia	Therap./HEAST	10		4E-04	
CYANIDE	8.9E-07	No	2.0E-02	Medium	Weight loss,thyroid effects,myelin degeneration	Diet/IRIS	100	5	4E-05	
BORON	8.9E-05	No	9.0E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IRIS	100	1	8E-04	
FLUORIDE	8.7E-08	No	6.0E-02	High	Dental and skeletal fluorosis	Water/IRIS	1	1	1E-06	
VOLATILE ORGANICS										
CHLOROMETHANE	6.4E-07	No	NA			NA/IRIS			NA	
1,2-DICHLORETHENE (total)	2.1E-07	No	1.0E-02		Decreased hematocrit and hemoglobin	Gavage/HEAST	3000		2E-05	
TRICHLOROETHENE	2.3E-07	No	NA			NA/IRIS			NA	
BASE NEUTRAL/ACIDS										
DI-n-BUTYLPHALATE	8.4E-08	No	1.0E-01	Low	Increased mortality	Diet/IRIS	1000	1	8E-07	
bis(2-ETHYLHEXYL)PHTHALATE	1.7E-07	No	2.0E-02	Low	Nephropathy,changes in liver weight,hematology	Gavage/IRIS	3000	1	NA	

NA: Not Applicable

TABLE A.2-1
DERMAL CONTACT WITH CHEMICALS IN SOIL
SCENARIO 2 – Industrial (Current)

CHEMICAL	ABSORBED DOSE (NONCANCER) (mg/kg/day)	ABSORBED DOSE (CANCER) (mg/kg/day)	SOIL CONC (mg/kg)	CONVERSION FACTOR (1E-6kg/mg)	SKIN SURFACE AREA (cm2/event)	ADHERENCE FACTOR (mg/cm2)	ABSORPTION FACTOR (unitless)	EXPOSURE FREQUENCY (events/year)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVERAGING TIME (NONCANCER) (days)	AVERAGING TIME (CANCER) (days)
INORGANICS												
ALUMINUM	NA	NA	26159.5	1E-06	6300	1.45	NA	250	25	70	9125	25550
ANTIMONY	NA	NA	5.1	1E-06	6300	1.45	NA	250	25	70	9125	25550
ARSENIC	NA	NA	2.4	1E-06	6300	1.45	NA	250	25	70	9125	25550
BARIUM	NA	NA	257.6	1E-06	6300	1.45	NA	250	25	70	9125	25550
BERYLLIUM	NA	NA	15.4	1E-06	6300	1.45	NA	250	25	70	9125	25550
CADMIUM	8.52E-07	3.04E-07	0.95273	1E-06	6300	1.45	0.01	250	25	70	9125	25550
CHROMIUM III	NA	NA	252.3	1E-06	6300	1.45	NA	250	25	70	9125	25550
CHROMIUM VI	NA	NA	2.5	1E-06	6300	1.45	NA	250	25	70	9125	25550
COBALT	NA	NA	6.9	1E-06	6300	1.45	NA	250	25	70	9125	25550
COPPER	NA	NA	32.7	1E-06	6300	1.45	NA	250	25	70	9125	25550
LEAD	NA	NA	118.9	1E-06	6300	1.45	NA	250	25	70	9125	25550
MANGANESE	NA	NA	1156.7	1E-06	6300	1.45	NA	250	25	70	9125	25550
MERCURY	NA	NA	0.10	1E-06	6300	1.45	NA	250	25	70	9125	25550
NICKEL	NA	NA	637.0	1E-06	6300	1.45	NA	250	25	70	9125	25550
SELENIUM	NA	NA	1.5	1E-06	6300	1.45	NA	250	25	70	9125	25550
SILVER	NA	NA	1.8	1E-06	6300	1.45	NA	250	25	70	9125	25550
VANADIUM	NA	NA	3383.1	1E-06	6300	1.45	NA	250	25	70	9125	25550
ZINC	NA	NA	168.8	1E-06	6300	1.45	NA	250	25	70	9125	25550
BORON	NA	NA	108.1	1E-06	6300	1.45	NA	250	25	70	9125	25550
NIOBIUM	NA	NA	184.0	1E-06	6300	1.45	NA	250	25	70	9125	25550
STRONTIUM	NA	NA	160.3	1E-06	6300	1.45	NA	250	25	70	9125	25550
TITANIUM	NA	NA	285.0	1E-06	6300	1.45	NA	250	25	70	9125	25550
ZIRCONIUM	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
VOLATILE ORGANICS												
ACETONE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
CARBON DISULFIDE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
1,2-DICHLOROETHENE (total)	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
2-BUTANONE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
TRICHLOROETHENE	NA	NA	0.0040	1E-06	6300	1.45	NA	250	25	70	9125	25550
BENZENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
TETRACHLOROETHENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
TOLUENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
ETHYLBENZENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
XYLENE (total)	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
BASE NEUTRAL / ACIDS												
PHENOL	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
BENZOIC ACID	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
NAPHTHALENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
4-NITROPHENOL	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
2,4-DINITROTOLUENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
PENTACHLOROPHENOL	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
PHENANTHRENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
ANTHRACENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
DI-n-BUTYLPHALATE	NA	NA	0.21	1E-06	6300	1.45	NA	250	25	70	9125	25550
FLUORANTHENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
PYRENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
BUTYLBENZYLPHTHALATE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
BENZO(a)ANTHRACENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
CHRYSENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
bis(2-ETHYLHEXYL)PHTHALATE	NA	NA	0.085	1E-06	6300	1.45	NA	250	25	70	9125	25550
BENZO(b)FLUORANTHENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
BENZO(k)FLUORANTHENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
BENZO(a)PYRENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
INDENO(1,2,3-cd)PYRENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
BENZO(g,h,i)PERYLENE	NA	NA	NA	1E-06	6300	1.45	NA	250	25	70	9125	25550
PCB'S												
AROCLOR-1248	1.02E-05	3.64E-06	1.9	1E-06	6300	1.45	0.06	250	25	70	9125	25550
AROCLOR-1254	8.04E-06	2.87E-06	1.5	1E-06	6300	1.45	0.06	250	25	70	9125	25550
AROCLOR-1260	0.00E+00	0.00E+00	NA	1E-06	6300	1.45	0.06	250	25	70	9125	25550

TABLE A.2-2
INGESTION OF CHEMICALS IN SOIL
SCENARIO 2 – Industrial (Current)

CHEMICAL	INTAKE (NONCANCER) (mg/kg/day)	INTAKE (CANCER) (mg/kg/day)	SOIL CONC (mg/kg)	INGESTION RATE (mg/day)	CONVERSION FACTOR (1E-6kg/mg)	FRACTION INGESTED (unitless)	EXPOSURE FREQUENCY (days/year)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVERAGING TIME (NONCANCER) (days)	AVERAGING TIME (CANCER) (days)
INORGANICS											
ALUMINUM	2.56E-02	9.14E-03	26159.5	100	1E-06	1	250	25	70	9125	25550
ANTIMONY	4.97E-06	1.77E-06	5.1	100	1E-06	1	250	25	70	9125	25550
ARSENIC	2.38E-06	8.51E-07	2.4	100	1E-06	1	250	25	70	9125	25550
BARIUM	2.52E-04	9.00E-05	257.6	100	1E-06	1	250	25	70	9125	25550
BERYLLIUM	1.51E-05	5.38E-06	15.4	100	1E-06	1	250	25	70	9125	25550
CADMIUM	9.32E-07	3.33E-07	1.0	100	1E-06	1	250	25	70	9125	25550
CHROMIUM III	2.47E-04	8.82E-05	252.3	100	1E-06	1	250	25	70	9125	25550
CHROMIUM VI	2.45E-06	8.73E-07	2.5	100	1E-06	1	250	25	70	9125	25550
COBALT	6.75E-06	2.41E-06	6.9	100	1E-06	1	250	25	70	9125	25550
COPPER	3.20E-05	1.14E-05	32.7	100	1E-06	1	250	25	70	9125	25550
LEAD	1.16E-04	4.16E-05	118.9	100	1E-06	1	250	25	70	9125	25550
MANGANESE	1.13E-03	4.04E-04	1156.7	100	1E-06	1	250	25	70	9125	25550
MERCURY	1.02E-07	3.65E-08	0.10	100	1E-06	1	250	25	70	9125	25550
NICKEL	8.19E-04	2.93E-04	837.0	100	1E-06	1	250	25	70	9125	25550
SELENIUM	1.46E-06	5.22E-07	1.5	100	1E-06	1	250	25	70	9125	25550
SILVER	1.59E-06	5.68E-07	1.6	100	1E-06	1	250	25	70	9125	25550
VANADIUM	3.31E-03	1.18E-03	3383.1	100	1E-06	1	250	25	70	9125	25550
ZINC	1.65E-04	5.90E-05	168.8	100	1E-06	1	250	25	70	9125	25550
BORON	1.06E-04	3.78E-05	108.1	100	1E-06	1	250	25	70	9125	25550
NIOBIUM	1.80E-04	6.43E-05	184.0	100	1E-06	1	250	25	70	9125	25550
STRONTIUM	1.57E-04	5.60E-05	160.3	100	1E-06	1	250	25	70	9125	25550
TITANIUM	2.79E-04	9.96E-05	285.0	100	1E-06	1	250	25	70	9125	25550
ZIRCONIUM	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
VOLATILE ORGANICS											
ACETONE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
CARBON DISULFIDE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
1,2-DICHLORETHENE (total)	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
2-BUTANONE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
TRICHLOROETHENE	3.91E-09	1.40E-09	0.0040	100	1E-06	1	250	25	70	9125	25550
BENZENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
TETRACHLOROETHENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
TOLUENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
ETHYLBENZENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
XYLENE (total)	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
BASE NEUTRAL / ACIDS											
PHENOL	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
BENZOIC ACID	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
NAPHTHALENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
4-NITROPHENOL	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
2,4-DINITROTOLUENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
PENTACHLOROPHENOL	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
PHENANTHRENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
ANTHRACENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
DI-n-BUTYLPHALATE	2.05E-07	7.34E-08	0.21	100	1E-06	1	250	25	70	9125	25550
FLUORANTHENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
PYRENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
BUTYLBENZYLPHTHALATE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
BENZO(a)ANTHRACENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
CHRYSENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
bis(2-ETHYLHEXYL)PHTHALATE	8.32E-08	2.97E-08	0.085	100	1E-06	1	250	25	70	9125	25550
BENZO(b)FLUORANTHENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
BENZO(k)FLUORANTHENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
BENZO(a)PYRENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
INDENO(1,2,3-cd)PYRENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
BENZO(g,h,i)PERYLENE	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550
PCB'S											
AROCLOR-1248	1.86E-06	6.64E-07	1.9	100	1E-06	1	250	25	70	9125	25550
AROCLOR-1254	1.47E-06	5.24E-07	1.5	100	1E-06	1	250	25	70	9125	25550
AROCLOR-1260	0.00E+00	0.00E+00	NA	100	1E-06	1	250	25	70	9125	25550

TABLE A.2-3
INHALATION OF AIRBORNE CHEMICALS ADSORBED TO DUST
SCENARIO 2 – Industrial (Current)

CHEMICAL	INTAKE (NONCANCER) (mg/kg/day)	INTAKE (CANCER) (mg/kg/day)	SOIL CONC (mg/kg)	INHALATION RATE (m3/hr)	DUST CONC (kg/m3)	EXPOSURE TIME (hr/day)	EXPOSURE FREQUENCY (days/year)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVERAGING TIME (NONCANCER) (days)	AVERAGING TIME (CANCER) (days)
INORGANICS											
ALUMINUM	8.86E-06	3.16E-06	26159.5	2	1.73E-08	1	250	25	70	9125	25550
ANTIMONY	1.72E-09	6.14E-10	5.1	2	1.73E-08	1	250	25	70	9125	25550
ARSENIC	8.24E-10	2.94E-10	2.4	2	1.73E-08	1	250	25	70	9125	25550
BARIUM	8.72E-08	3.11E-08	257.6	2	1.73E-08	1	250	25	70	9125	25550
BERYLLIUM	5.21E-09	1.86E-09	15.4	2	1.73E-08	1	250	25	70	9125	25550
CADMIUM	3.23E-10	1.15E-10	1.0	2	1.73E-08	1	250	25	70	9125	25550
CHROMIUM III	8.54E-08	3.05E-08	252.3	2	1.73E-08	1	250	25	70	9125	25550
CHROMIUM VI	8.46E-10	3.02E-10	2.5	2	1.73E-08	1	250	25	70	9125	25550
COBALT	2.33E-09	8.34E-10	6.9	2	1.73E-08	1	250	25	70	9125	25550
COPPER	1.11E-08	3.95E-09	32.7	2	1.73E-08	1	250	25	70	9125	25550
LEAD	4.03E-08	1.44E-08	118.9	2	1.73E-08	1	250	25	70	9125	25550
MANGANESE	3.92E-07	1.40E-07	1156.7	2	1.73E-08	1	250	25	70	9125	25550
MERCURY	3.54E-11	1.26E-11	0.10	2	1.73E-08	1	250	25	70	9125	25550
NICKEL	2.83E-07	1.01E-07	837.0	2	1.73E-08	1	250	25	70	9125	25550
SELENIUM	5.08E-10	1.81E-10	1.5	2	1.73E-08	1	250	25	70	9125	25550
SILVER	5.51E-10	1.97E-10	1.6	2	1.73E-08	1	250	25	70	9125	25550
VANADIUM	1.15E-06	4.09E-07	3383.1	2	1.73E-08	1	250	25	70	9125	25550
ZINC	5.71E-08	2.04E-08	168.8	2	1.73E-08	1	250	25	70	9125	25550
BORON	3.66E-08	1.31E-08	108.1	2	1.73E-08	1	250	25	70	9125	25550
NIOBIUM	6.23E-08	2.22E-08	184.0	2	1.73E-08	1	250	25	70	9125	25550
STRONTIUM	5.43E-08	1.94E-08	160.3	2	1.73E-08	1	250	25	70	9125	25550
TITANIUM	9.65E-08	3.45E-08	285.0	2	1.73E-08	1	250	25	70	9125	25550
ZIRCONIUM	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
VOLATILE ORGANICS											
ACETONE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
CARBON DISULFIDE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
1,2-DICHLOROETHENE (total)	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
2-BUTANONE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
TRICHLOROETHENE	1.35E-12	4.84E-13	0.0040	2	1.73E-08	1	250	25	70	9125	25550
BENZENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
TETRACHLOROETHENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
TOLUENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
ETHYLBENZENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
XYLENE (total)	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
BASE NEUTRAL / ACIDS											
PHENOL	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
BENZOIC ACID	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
NAPHTHALENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
4-NITROPHENOL	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
2,4-DINITROTOLUENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
PENTACHLOROPHENOL	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
PHENANTHRENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
ANTHRACENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
DI-n-BUTYLPHALATE	7.11E-11	2.54E-11	0.21	2	1.73E-08	1	250	25	70	9125	25550
FLUORANTHENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
PYRENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
BUTYLBENZYLPHTHALATE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
BENZO(a)ANTHRACENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
CHRYSENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
bis(2-ETHYLHEXYL)PHTHALATE	2.88E-11	1.03E-11	0.085	2	1.73E-08	1	250	25	70	9125	25550
BENZO(b)FLUORANTHENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
BENZO(k)FLUORANTHENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
BENZO(a)PYRENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
INDENO(1,2,3-cd)PYRENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
BENZO(g,h,i)PERYLENE	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550
PCB'S											
AROCLOR-1248	6.43E-10	2.30E-10	1.9	2	1.73E-08	1	250	25	70	9125	25550
AROCLOR-1254	5.08E-10	1.81E-10	1.5	2	1.73E-08	1	250	25	70	9125	25550
AROCLOR-1260	0.00E+00	0.00E+00	NA	2	1.73E-08	1	250	25	70	9125	25550

TABLE A.2-4
CANCER RISK ESTIMATES
SCENARIO 2 – Industrial (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK	TOTAL RISK
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOILS								5E-05	8E-05
PCB'S									
AROCLOR-1248	3.6E-06	No	7.70E+00				3E-05		
AROCLOR-1254	2.9E-06	No	7.70E+00				2E-05		
AROCLOR-1260	0.0E+00	No	7.70E+00	B2	Liver	Diet/IRIS	NA		

NA: Not Applicable

TABLE A.2-5
CANCER RISK ESTIMATES
SCENARIO 2 – Industrial (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: INCIDENTAL INGESTION OF CHEMICALS IN SOIL								3E-05
INORGANICS								
ARSENIC	8.5E-07	No	1.75E+00	A	Skin	IRIS	1E-06	
BERYLLIUM	5.4E-06	No	4.30E+00	B2	gross tumors, all sites combined	Water/IRIS	2E-05	
LEAD	4.2E-05	No	NA	B2	Renal tumors	Oral/IRIS	NA	
VOLATILE ORGANICS								
TRICHLOROETHENE	1.4E-09	No	1.10E-02	B2	Liver	Gavage/HEAST	2E-11	
BENZENE	0.0E+00	No	2.90E-02	A	Leukemia	Occupational/IRIS	NA	
TETRACHLOROETHENE	0.0E+00	No	5.10E-02	B2	Liver	Gavage/HEAST	NA	
BASE NEUTRAL / ACIDS								
2,4-DINITROTOLUENE	0.0E+00	No	6.80E-01	B2	Liver, mammary gland	Diet/IRIS	NA	
PENTACHLOROPHENOL	0.0E+00	No	1.20E-01	B2	Hepatocellular adenoma, carcinomas,pheochrom	Oral/IRIS	NA	
BENZO(a)ANTHRACENE	0.0E+00	No	1.15E+01	B2	Liver, lung, skin	IRIS	NA	
CHRYSENE	0.0E+00	No	1.15E+01	B2	Malignant lymphoma	IRIS	NA	
bis(2-ETHYLHEXYL)PHTHALATE	3.0E-08	No	1.40E-02	B2	Liver	IRIS	4E-10	
BENZO(b)FLUORANTHENE	0.0E+00	No	1.15E+01	B2	Lung, thorax, skin	IRIS	NA	
BENZO(k)FLUORANTHENE	0.0E+00	No	1.15E+01	B2	Lung, thorax, skin	IRIS	NA	
BENZO(a)PYRENE	0.0E+00	No	1.15E+01	B2	Stomach, lung	IRIS	NA	
INDENO(1,2,3-cd)PYRENE	0.0E+00	No	1.15E+01	B2	Lung, skin	IRIS	NA	
PCB'S								
AROCLOR-1248	6.6E-07	No	7.70E+00				5E-06	
AROCLOR-1254	5.2E-07	No	7.70E+00				4E-06	
AROCLOR-1260	0.0E+00	No	7.70E+00	B2	Liver	Diet/IRIS	NA	

NA: Not Applicable

TABLE A.2-6
CANCER RISK ESTIMATES
SCENARIO 2 -- Industrial (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: INHALATION OF AIRBORNE CHEMICALS ABSORBED TO DUST								1E-07
INORGANICS								
ARSENIC	2.9E-10	No	5.00E+01	A	Respiratory Tract	Occupational/IRIS	1E-08	
BERYLLIUM	1.9E-09	No	8.40E+00	B2	Lung	Occupational/IRIS	2E-08	
CADMIUM	1.2E-10	No	6.3	B1	Respiratory Tract	Occupational/IRIS	NA	
CHROMIUM III	3.1E-08	No	NA			NA/IRIS	NA	
CHROMIUM VI	3.0E-10	No	4.20E+01	A	Lung	Occupational/IRIS	1E-08	
LEAD	1.4E-08	No	NA	B2		NA/IRIS	NA	
NICKEL	1.0E-07	No	8.40E-01	A	Lung and nasal tumors	Occupational/IRIS	9E-08	
VOLATILE ORGANICS								
TRICHLOROETHENE	4.8E-13	No	1.70E-02	B2	Lung	HEAST	8E-15	
BENZENE	0.0E+00	No	2.90E-02	A	Leukemia	Occupational/IRIS	NA	
TETRACHLOROETHENE	0.0E+00	No	1.80E-03	B2	Leukemia, liver	HEAST	NA	
BASE NEUTRAL / ACIDS								
2,4-DINITROTOLUENE	0.0E+00	No	NA	B2	Liver, mammary	IRIS	NA	
PENTACHLOROPHENOL	0.0E+00	No	NA	B2		NA/IRIS	NA	
BENZO(a)ANTHRACENE	0.0E+00	No	6.10E+00	B2	Liver, lung, skin	IRIS	NA	
CHRYSENE	0.0E+00	No	6.10E+00	B2	Malignant lymphoma	IRIS	NA	
bis(2-ETHYLHEXYL)PHTHALATE	1.0E-11	No	NA	B2		NA/IRIS	NA	
BENZO(b)FLUORANTHENE	0.0E+00	No	6.10E+00	B2	Lung, thorax, skin	IRIS	NA	
BENZO(k)FLUORANTHENE	0.0E+00	No	6.10E+00	B2	Lung, thorax, skin	IRIS	NA	
BENZO(a)PYRENE	0.0E+00	No	6.10E+00	B2	Respiratory tract, stomach	Inhalation/HEAST	NA	
INDENO(1,2,3-cd)PYRENE	0.0E+00	No	6.10E+00	B2	Lung, skin	IRIS	NA	
PCB'S								
AROCLOR-1248	2.3E-10	No	NA			NA/IRIS	NA	
AROCLOR-1254	1.8E-10	No	NA			NA/IRIS	NA	
AROCLOR-1260	0.0E+00	No	NA			NA/IRIS	NA	

NA: Not Applicable

TABLE A.2-7
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 2 - Industrial (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ BASIS	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)	TOTAL HAZARD INDEX (HI)
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOILS										9E-04	7E-01
INORGANICS											
ALUMINUM	NA	No	NA			NA/IRIS			NA		
ANTIMONY	NA	No	4.00E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	1000	1	NA		
ARSENIC	NA	No	1.00E-03		Keratosis and hyperpigmentation	Diet/HEAST	1		NA		
BARIUM	NA	No	7.00E-02	Medium	None observed	Water/IRIS	3	1	NA		
BERYLLIUM	NA	No	5.00E-03	Low	None observed	Water/IRIS	100	1	NA		
CADMIUM	8.5E-07	No	1.00E-03	High	Proteinuria	Diet/IRIS	10	1	9E-04		
CHROMIUM III	NA	No	1.00E+00	Low	Hepatotoxicity	IRIS	1000		NA		
CHROMIUM VI	NA	No	5.00E-03	Low	No effects observed	Water/IRIS	500	1	NA		
COBALT	NA	No	NA			NA/IRIS			NA		
COPPER	NA	No	4.00E-02		Local GI irritation	NA/HEAST			NA		
LEAD	NA	No	NA		Neurobehavioral effects	NA/IRIS			NA		
MANGANESE	NA	No	1.00E-01	Medium	CNS effects	Diet/IRIS	1	1	NA		
MERCURY	NA	No	3.00E-04		Kidney effects	Oral/HEAST	1000		NA		
NICKEL	NA	No	2.00E-02		Reduced body and organ weight	Diet/HEAST	300		NA		
SELENIUM	NA	No	5.00E-03	Medium	Clinical selenosis	Diet/IRIS	3	1	NA		
SILVER	NA	No	3.00E-03	Medium	Argyria	Oral/IRIS	2	1	NA		
VANADIUM	NA	No	7.00E-03		None observed	Water/HEAST	100		NA		
ZINC	NA	No	2.00E-01		Anemia	Therap./HEAST	10		NA		
BORON	NA	No	9.00E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IRIS	100	1	NA		
NIOBIUM	NA	No	NA			NA/IRIS			NA		
STRONTIUM	NA	No	NA			NA/IRIS			NA		
TITANIUM	NA	No	NA			NA/IRIS			NA		
ZIRCONIUM	NA	No	NA			NA/IRIS			NA		
VOLATILE ORGANICS											
ACETONE	NA	No	1.00E-01	Low	Increased liver and kidney weight	Gavage/IRIS	1000	1	NA		
CARBON DISULFIDE	NA	No	1.00E-01	Medium	Fetal toxicity	Inhal./IRIS	100	1	NA		
1,2-DICHLOROETHENE (total)	NA	No	1.00E-02		Decreased hematocrit and hemoglobin	Gavage/HEAST	3000		NA		
2-BUTANONE	NA	No	5.00E-02	Medium	Fetotoxicity	Inhal./IRIS	1000		NA		
TRICHLOROETHENE	NA	No	NA			NA/IRIS			NA		
BENZENE	NA	No	NA			NA/IRIS			NA		
TETRACHLOROETHENE	NA	No	1.00E-02	Medium	Hepatotoxicity,weight gain	Gavage/IRIS	100	1	NA		
TOLUENE	NA	No	2.00E-01	Medium	Changes in liver and kidney weights	Gavage/IRIS	1000	1	NA		
ETHYLBENZENE	NA	No	1.00E-01	Low	Liver and kidney toxicity	Oral/IRIS	1000	1	NA		
XYLENE (total)	NA	No	2.00E+00	Medium	Hyperactivity,decreased body weight,increased	Gavage/IRIS	100	1	NA		
BASE NEUTRAL / ACIDS											
PHENOL	NA	No	6.00E-01	Low	Reduced fetal body weight	Gavage/IRIS	100	1	NA		
BENZOIC ACID	NA	No	4.00E+00	Medium		Oral/IRIS	1	1	NA		
NAPHTHALENE	NA	No	4.00E-03		Decreased body weight gain	Gavage/HEAST	10000		NA		
4-NITROPHENOL	NA	No	NA			NA/IRIS			NA		
2,4-DINITROTOLUENE	NA	No	NA			NA/IRIS			NA		
PENTACHLOROPHENOL	NA	No	3.00E-02	Medium	Liver and kidney pathology	Diet/IRIS	100	1	NA		
PHENANTHRENE	NA	No	NA			NA/IRIS			NA		
ANTHRACENE	NA	No	3.00E-01	Low	No observed effects	Gavage/IRIS	3000	1	NA		
DI-n-BUTYLPHALATE	NA	No	1.00E-01	Low	Increased mortality	Diet/IRIS	1000	1	NA		
FLUORANTHENE	NA	No	4.00E-02	Low	Nephropathy,changes in liver weight,hematology	Gavage/IRIS	3000	1	NA		
PYRENE	NA	No	3.00E-02	Low	Kidney effects	Gavage/IRIS	3000	1	NA		
BUTYLBENZYLPHTHALATE	NA	No	2.00E-01	Low	Effects on body weight gain, testes,liver,kidney	Diet/IRIS	1000	1	NA		
BENZO(a)ANTHRACENE	NA	No	NA			NA/IRIS			NA		
CHRYSENE	NA	No	NA			NA/IRIS			NA		
bis(2-ETHYLHEXYL)PHTHALATE	NA	No	2.00E-02	Medium	Increased relative liver weight	Diet/IRIS	1000	1	NA		
BENZO(b)FLUORANTHENE	NA	No	NA			NA/IRIS			NA		
BENZO(k)FLUORANTHENE	NA	No	NA			NA/IRIS			NA		
BENZO(a)PYRENE	NA	No	NA			NA/IRIS			NA		
INDENO(1,2,3-cd)PYRENE	NA	No	NA			NA/IRIS			NA		
BENZO(g,h,i)PERYLENE	NA	No	NA			NA/IRIS			NA		
PCB'S											
AROCLOR-1248	1.0E-05	No	NA			NA/IRIS			NA		
AROCLOR-1254	8.0E-06	No	NA			NA/IRIS			NA		
AROCLOR-1260	0.0E+00	No	NA			NA/IRIS			NA		

NA: Not Applicable

TABLE A.2-8
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 2 – Industrial (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)
EXPOSURE PATHWAY: INCIDENTAL INGESTION OF CHEMICALS IN SOIL										6E-01
INORGANICS										
ALUMINUM	2.6E-02	No	NA			NA/IRIS			NA	
ANTIMONY	5.0E-06	No	4.00E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	1000	1	1E-02	
ARSENIC	2.4E-06	No	1.00E-03		Keratosis and hyperpigmentation	Diet/HEAST	1		2E-03	
BARIUM	2.5E-04	No	7.00E-02	Medium	None observed	Water/IRIS	3	1	4E-03	
BERYLLIUM	1.5E-05	No	5.00E-03	Low	None observed	Water/IRIS	100	1	3E-03	
CADMIUM	9.3E-07	No	1.00E-03	High	Proteinuria	Diet/IRIS	10	1	9E-04	
CHROMIUM III	2.5E-04	No	1.00E+00	Low	Hepatotoxicity	IRIS	1000		2E-04	
CHROMIUM VI	2.4E-06	No	5.00E-03	Low	No effects observed	Water/IRIS	500	1	5E-04	
COBALT	6.7E-06	No	NA			NA/IRIS			NA	
COPPER	3.2E-05	No	4.00E-02		Local GI irritation	NA/HEAST			8E-04	
LEAD	1.2E-04	No	NA		Neurobehavioral effects	NA/IRIS			NA	
MANGANESE	1.1E-03	No	1.00E-01	Medium	CNS effects	Diet/IRIS	1	1	1E-02	
MERCURY	1.0E-07	No	3.00E-04		Kidney effects	Oral/HEAST	1000		3E-04	
NICKEL	8.2E-04	No	2.00E-02		Reduced body and organ weight	Diet/HEAST	300		4E-02	
SELENIUM	1.5E-06	No	5.00E-03	Medium	Clinical selenosis	Diet/IRIS	3	1	3E-04	
SILVER	1.6E-06	No	3.00E-03	Medium	Argyria	Oral/IRIS	2	1	5E-04	
VANADIUM	3.3E-03	No	7.00E-03		None observed	Water/HEAST	100		5E-01	
ZINC	1.7E-04	No	2.00E-01		Anemia	Therap./HEAST	10		8E-04	
BORON	1.1E-04	No	9.00E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IRIS	100	1	1E-03	
NIOBIUM	1.8E-04	No	NA			NA/IRIS			NA	
STRONTIUM	1.6E-04	No	NA			NA/IRIS			NA	
TITANIUM	2.8E-04	No	NA			NA/IRIS			NA	
ZIRCONIUM	0.0E+00	No	NA			NA/IRIS			NA	
VOLATILE ORGANICS										
ACETONE	0.0E+00	No	1.00E-01	Low	Increased liver and kidney weight	Gavage/IRIS	1000	1	NA	
CARBON DISULFIDE	0.0E+00	No	1.00E-01	Medium	Fetal toxicity	Inhal./IRIS	100	1	NA	
1,2-DICHLOROETHENE (total)	0.0E+00	No	1.00E-02		Decreased hematocrit and hemoglobin	Gavage/HEAST	3000		NA	
2-BUTANONE	0.0E+00	No	5.00E-02	Medium	Fetotoxicity	Inhal./IRIS	1000		NA	
TRICHLOROETHENE	3.9E-09	No	NA			NA/IRIS			NA	
BENZENE	0.0E+00	No	NA			NA/IRIS			NA	
TETRACHLOROETHENE	0.0E+00	No	1.00E-02	Medium	Hepatotoxicity,weight gain	Gavage/IRIS	100	1	NA	
TOLUENE	0.0E+00	No	2.00E-01	Medium	Changes in liver and kidney weights	Gavage/IRIS	1000	1	NA	
ETHYLBENZENE	0.0E+00	No	1.00E-01	Low	Liver and kidney toxicity	Oral/IRIS	1000	1	NA	
XYLENE (total)	0.0E+00	No	2.00E+00	Medium	Hyperactivity,decreased body weight,increased	Gavage/IRIS	100	1	NA	
BASE NEUTRAL / ACIDS										
PHENOL	0.0E+00	No	6.00E-01	Low	Reduced fetal body weight	Gavage/IRIS	100	1	NA	
BENZOIC ACID	0.0E+00	No	4.00E+00	Medium		Oral/IRIS	1	1	NA	
NAPHTHALENE	0.0E+00	No	4.00E-03		Decreased body weight gain	Gavage/HEAST	10000		NA	
4-NITROPHENOL	0.0E+00	No	NA			NA/IRIS			NA	
2,4-DINITROTOLUENE	0.0E+00	No	NA			NA/IRIS			NA	
PENTACHLOROPHENOL	0.0E+00	No	3.00E-02	Medium	Liver and kidney pathology	Diet/IRIS	100	1	NA	
PHENANTHRENE	0.0E+00	No	NA			NA/IRIS			NA	
ANTHRACENE	0.0E+00	No	3.00E-01	Low	No observed effects	Gavage/IRIS	3000	1	NA	
DI-n-BUTYLPHALATE	2.1E-07	No	1.00E-01	Low	Increased mortality	Diet/IRIS	1000	1	2E-06	
FLUORANTHENE	0.0E+00	No	4.00E-02	Low	Nephropathy,changes in liver weight,hematology	Gavage/IRIS	3000	1	NA	
PYRENE	0.0E+00	No	3.00E-02	Low	Kidney effects	Gavage/IRIS	3000	1	NA	
BUTYLBENZYLPHTHALATE	0.0E+00	No	2.00E-01	Low	Effects on body weight gain, testes,liver,kidney	Diet/IRIS	1000	1	NA	
BENZO(a)ANTHRACENE	0.0E+00	No	NA			NA/IRIS			NA	
CHRYSENE	0.0E+00	No	NA			NA/IRIS			NA	
bis(2-ETHYLHEXYL)PHTHALATE	8.3E-08	No	2.00E-02	Medium	Increased relative liver weight	Diet/IRIS	1000	1	4E-06	
BENZO(b)FLUORANTHENE	0.0E+00	No	NA			NA/IRIS			NA	
BENZO(k)FLUORANTHENE	0.0E+00	No	NA			NA/IRIS			NA	
BENZO(a)PYRENE	0.0E+00	No	NA			NA/IRIS			NA	
INDENO(1,2,3-cd)PYRENE	0.0E+00	No	NA			NA/IRIS			NA	
BENZO(g,h,i)PERYLENE	0.0E+00	No	NA			NA/IRIS			NA	
PCB'S										
AROCLOR -1248	1.9E-06	No	NA			NA/IRIS			NA	
AROCLOR -1254	1.5E-06	No	NA			NA/IRIS			NA	
AROCLOR -1260	0.0E+00	No	NA			NA/IRIS			NA	

NA: Not Applicable

TABLE A2-9
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 2 – Industrial (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFC (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFC BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)
EXPOSURE PATHWAY: INHALATION OF AIRBORNE CHEMICALS ABSORBED TO DUST										2E-01
INORGANICS										
ALUMINUM	8.9E-06	No	NA			NA/RIS			NA	
ANTIMONY	1.7E-09	No	4.00E-04						4E-06	
ARSENIC	8.2E-10	No	1.00E-03						8E-07	
BARIUM	8.7E-08	No	1.00E-04		Petotoxicity	HEAST	1000		9E-04	
BERYLLIUM	5.2E-09	No	5.00E-03						1E-06	
CADMIUM	3.2E-10	No	1.00E-03						3E-07	
CHROMIUM III	8.5E-08	No	5.71E-07		Nasal mucosa atrophy	NA/RIS	300		1E-01	
CHROMIUM VI	8.5E-10	No	5.71E-07		Nasal mucosa atrophy	HEAST	300		1E-03	
COBALT	2.3E-09	No	NA			NA/RIS			NA	
COPPER	1.1E-08	No	NA			NA/RIS			NA	
LEAD	4.0E-08	No	NA		CNS effects	NA/RIS			NA	
MANGANESE	3.9E-07	No	1.00E-04	Medium	Increased prevalance of respiratory disease and psycomotor disturbances	Occupational/IRIS	300	3	4E-03	
MERCURY	3.5E-11	No	9.00E-06		Neurotoxicity	Occupational/HEAST	30		4E-06	
NICKEL	2.8E-07	No	NA			NA/RIS			NA	
SELENIUM	5.1E-10	No	NA			NA/RIS			NA	
SILVER	5.5E-10	No	NA			NA/RIS			NA	
VANADIUM	1.1E-06	No	7.00E-03						2E-04	
ZINC	5.7E-08	No	2.00E-01						3E-07	
BORON	3.7E-08	No	NA			NA/RIS			NA	
NIOBIUM	6.2E-08	No	NA			NA/RIS			NA	
STRONTIUM	5.4E-08	No	NA			NA/RIS			NA	
TITANIUM	9.6E-08	No	NA			NA/RIS			NA	
ZIRCONIUM	0.0E+00	No	NA			NA/RIS			NA	
VOLATILE ORGANICS										
ACETONE	0.0E+00	No	NA			NA/RIS			NA	
CARBON DISULFIDE	0.0E+00	No	3.00E-03		Fetal toxicity	HEAST	1000		NA	
1,2-DICHLOROETHENE (total)	0.0E+00	No	NA			NA/RIS			NA	
2-BUTANONE	0.0E+00	No	9.00E-02		CNS	HEAST	1000		NA	
TRICHLOROETHENE	1.4E-12	No	NA			NA/RIS			NA	
BENZENE	0.0E+00	No	NA			NA/RIS			NA	
TETRACHLOROETHENE	0.0E+00	No	NA			NA/RIS			NA	
TOLUENE	0.0E+00	No	6.00E-01		CNS effects, eyes and nose irritation	HEAST	100		NA	
ETHYLBENZENE	0.0E+00	No	3.00E-01	Low	Develop mental toxicity	IRIS	300	1	NA	
XYLENE (total)	0.0E+00	No	9.00E-02		CNS effects, eyes and nose irritation	HEAST	100		NA	
BASE NEUTRAL / ACIDS										
PHENOL	0.0E+00	No	NA			NA/RIS			NA	
BENZOIC ACID	0.0E+00	No	NA			NA/RIS			NA	
NAPHTHALENE	0.0E+00	No	4.00E-03						NA	
4-NITROPHENOL	0.0E+00	No	NA			NA/RIS			NA	
2,4-DINITROTOLUENE	0.0E+00	No	NA			NA/RIS			NA	
PENTACHLOROPHENOL	0.0E+00	No	NA			NA/RIS			NA	
PHENANTHRENE	0.0E+00	No	NA			NA/RIS			NA	
ANTHRACENE	0.0E+00	No	3.00E-01						NA	
DI-n-BUTYLPHALATE	7.1E-11	No	1.00E-01						NA	
FLUORANTHENE	0.0E+00	No	4.00E-02						7E-10	
PYRENE	0.0E+00	No	3.00E-02						NA	
BUTYLBENZYLPHTHALATE	0.0E+00	No	2.00E-01						NA	
BENZO(a)ANTHRACENE	0.0E+00	No	NA			NA/RIS			NA	
CHRYSENE	0.0E+00	No	NA			NA/RIS			NA	
bis(2-ETHYLHEXYL)PHTHALATE	2.9E-11	No	2.00E-02						NA	
BENZO(b)FLUORANTHENE	0.0E+00	No	NA			NA/RIS			1E-09	
BENZO(k)FLUORANTHENE	0.0E+00	No	NA			NA/RIS			NA	
BENZO(a)PYRENE	0.0E+00	No	NA			NA/RIS			NA	
INDENO(1,2,3-cd)PYRENE	0.0E+00	No	NA			NA/RIS			NA	
BENZO(g,h,i)PERYLENE	0.0E+00	No	NA			NA/RIS			NA	
PCB'S										
AROCLOR -1248	6.4E-10	No	NA			NA/RIS			NA	
AROCLOR -1254	5.1E-10	No	NA			NA/RIS			NA	
AROCLOR -1260	0.0E+00	No	NA			NA/RIS			NA	

NA: Not Applicable

TABLE A.3-1D
INGESTION OF CHEMICALS IN DEEP GROUND WATER
SCENARIO 3-Residential (Current)

CHEMICAL	INTAKE NONCANCER (mg/kg/day)	INTAKE CANCER (mg/kg/day)	CONC. IN WATER (mg/liter)	INGESTION RATE (liter/day)	EXPOSURE FREQUENCY (days/yr)	ED (years)	BODY WEIGHT (kg)	AVG. TIME NONCANCER ADULT (days)	AVG. TIME CANCER (days)
INORGANICS									
ALUMINUM	2.72E+00	1.17E+00	99.40	2.0	350	30	70	10950	25550
ANTIMONY	5.86E-02	2.51E-02	2.14	2.0	350	30	70	10950	25550
ARSENIC	9.64E-03	4.13E-03	0.35	2.0	350	30	70	10950	25550
BARIUM	1.39E-02	5.95E-03	0.51	2.0	350	30	70	10950	25550
BERYLLIUM	3.10E-04	1.33E-04	0.011	2.0	350	30	70	10950	25550
CADMIUM	0.00E+00	0.00E+00	NA	2.0	350	30	70	10950	25550
CHROMIUM III	2.76E+00	1.18E+00	100.60	2.0	350	30	70	10950	25550
CHROMIUM VI	3.84E-02	1.64E-02	1.40	2.0	350	30	70	10950	25550
COBALT	1.20E-03	5.14E-04	0.044	2.0	350	30	70	10950	25550
COPPER	1.03E-03	4.43E-04	0.038	2.0	350	30	70	10950	25550
LEAD	6.68E-04	2.86E-04	0.024	2.0	350	30	70	10950	25550
MANGANESE	4.82E-03	2.07E-03	0.18	2.0	350	30	70	10950	25550
MERCURY	2.68E-05	1.15E-05	0.0010	2.0	350	30	70	10950	25550
NICKEL	2.38E-04	1.02E-04	0.0087	2.0	350	30	70	10950	25550
SELENIUM	3.56E-03	1.53E-03	0.13	2.0	350	30	70	10950	25550
SILVER	1.40E-04	5.99E-05	0.0051	2.0	350	30	70	10950	25550
VANADIUM	5.48E-02	2.35E-02	2.00	2.0	350	30	70	10950	25550
ZINC	1.78E-03	7.64E-04	0.065	2.0	350	30	70	10950	25550
CYANIDE	1.70E-03	7.30E-04	0.062	2.0	350	30	70	10950	25550
BORON	4.33E-03	1.86E-03	0.16	2.0	350	30	70	10950	25550
STRONTIUM	8.71E-03	3.73E-03	0.32	2.0	350	30	70	10950	25550
TITANIUM	8.90E-03	3.82E-03	0.33	2.0	350	30	70	10950	25550
VOLATILE ORGANICS									
TRICHLOROETHENE	1.92E-03	8.22E-04	0.070	2.0	350	30	70	10950	25550
TETRACHLOROETHENE	2.74E-05	1.17E-05	0.0010	2.0	350	30	70	10950	25550
BASE NEUTRAL / ACIDS									
bis(2-ETHYLHEXYL)PHTHALATE	1.10E-04	4.70E-05	0.0040	2.0	350	30	70	10950	25550

NA: Not Applicable

TABLE A.3-2D
INHALATION OF AIRBORNE (VAPOR PHASE) CHEMICALS FROM DEEP GROUNDWATER
SCENARIO 3-Residential (Current)

CHEMICAL	INTAKE ADULT NONCANCER (mg/kg/day)	INTAKE ADULT CANCER (mg/kg/day)	CONC. IN AIR (mg/m3)	INHALATION RATE (m3/hour)	EXPOSURE TIME (hours/day)	EXPOSURE FREQUENCY (days/yr)	ED (years)	BODY WEIGHT (kg)	AVG. TIME NONCANCER (days)	AVG. TIME CANCER (days)
VOLATILE ORGANICS										
TRICHLOROETHENE	5.73E-02	2.46E-02	0.210	0.830	24.0	350	30	70	10950	25550
TETRACHLOROETHENE	8.19E-04	3.51E-04	0.0030	0.830	24.0	350	30	70	10950	25550
BASE NEUTRAL / ACIDS										
bis(2-ETHYLHEXYL)PHTHALATE	3.27E-03	1.40E-03	0.012	0.830	24.0	350	30	70	10950	25550

NA: Not Applicable

TABLE A.3–3D
COMPOUNDS CONCENTRATIONS EMITTED FROM DEEP GROUNDWATER
SCENARIO 3–Residential (Current)

CHEMICAL	Concentration tap water (mg/L)	Flow Rate Of Shower Water (l/hr)	Fraction Of Contaminant Volatilized	One Half The Duration Of Shower (hr)	Bathroom Volume (m3)	Mean Conc In Bathroom (mg/m3)
VOLATILE ORGANICS						
TRICHLOROETHENE	0.0700	400.0	0.9	0.1	12.0	2.1E–01
TETRACHLOROETHENE	0.0010	400.0	0.9	0.1	12.0	3.0E–03
BASE NEUTRAL / ACIDS						
bis(2–ETHYLHEXYL)PHTHALATE	0.0040	400.0	0.9	0.1	12.0	1.2E–02

NA: Not Applicable

TABLE A.3-4D
DERMAL CONTACT WITH CHEMICALS IN DEEP GROUNDWATER
SCENARIO 3-Residential (Current)

CHEMICAL	ABSORBED DOSE NONCANCER (mg/kg/day)	ABSORBED DOSE CANCER (mg/kg/day)	CONC. IN WATER (mg/liter)	SKIN SURFACE AREA (cm2/event)	DERMAL PERMEABILITY (cm/hr)	EXPOSURE TIME (hrs/day)	EXPOSURE FREQUENCY (days/year)	EXPOSURE DURATION (years)	CONVERSION FACTOR (L/cm3)	BODY WEIGHT (kg)	AVG TIME NONCANCER (days)	AVG. TIME CANCER (days)
INORGANICS												
ALUMINUM	4.15E-03	1.78E-03	99.40	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
ANTIMONY	8.94E-05	3.83E-05	2.14	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
ARSENIC	1.47E-05	6.30E-06	0.35	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
BARIUM	2.12E-05	9.08E-06	0.51	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
BERYLLIUM	4.72E-07	2.02E-07	0.011	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
CADMIUM	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
CHROMIUM III	4.20E-03	1.80E-03	100.60	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
CHROMIUM VI	5.85E-05	2.51E-05	1.40	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
COBALT	1.83E-06	7.84E-07	0.044	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
COPPER	1.57E-06	6.75E-07	0.038	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
LEAD	1.02E-06	4.37E-07	0.024	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
MANGANESE	7.35E-06	3.15E-06	0.18	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
MERCURY	4.09E-08	1.75E-08	0.0010	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
NICKEL	3.63E-07	1.56E-07	0.0087	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
SELENIUM	5.43E-06	2.33E-06	0.13	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
SILVER	2.13E-07	9.13E-08	0.0051	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
VANADIUM	8.35E-05	3.58E-05	2.00	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
ZINC	2.72E-06	1.17E-06	0.065	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
CYANIDE	2.60E-06	1.11E-06	0.062	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
BORON	6.60E-06	2.83E-06	0.16	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
STRONTIUM	1.33E-05	5.69E-06	0.32	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
TITANIUM	1.36E-05	5.82E-06	0.33	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
VOLATILE ORGANICS												
TRICHLOROETHENE	2.92E-06	1.25E-06	0.070	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
TETRACHLOROETHENE	4.18E-08	1.79E-08	0.0010	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
BASE NEUTRAL / ACIDS												
bis(2-ETHYLHEXYL)PHTHAL	1.67E-07	7.16E-08	0.0040	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550

NA: Not Applicable

TABLE A.3–5D
CANCER RISK ESTIMATES
SCENARIO 3–Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)–1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEM. SPEC. RISK	TOTAL PATHWAY RISK	TOTAL EXPOSURE RISK
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN DEEP GROUND WATER							ADULT	8E–03	8E–03
INORGANICS									
ARSENIC	4.1E–03	No	1.75E+00	A	Skin	IRIS	7E–03		
BERYLLIUM	1.3E–04	No	4.30E+00	B2	gross tumors, all sites combined	Water/IRIS	6E–04		
LEAD	2.9E–04	No	NA	B2	Renal tumors	Oral/IRIS	NA		
VOLATILE ORGANICS									
TRICHLOROETHENE	8.2E–04	No	1.10E–02	B2	Liver	Gavage/HEAST	9E–06		
TETRACHLOROETHENE	1.2E–05	No	5.10E–02	B2	Liver	Gavage/HEAST	6E–07		
BASE NEUTRAL / ACIDS									
bis(2–ETHYLHEXYL)PHTHALATE	4.7E–05	No	1.40E–02	B2	Liver	IRIS	7E–07		

NA: Not Applicable

TABLE A.3-6D
CANCER RISK ESTIMATES
SCENARIO 3-Residential (Current)

CHEMICAL	CDI-ADULT MEAN (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEM. SPEC. RISK-ADULT MEAN	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: INHALATION OF AIRBORNE (VAPOR PHASE) CHEMICALS FROM DEEP GROUNDWATER								4E-04
VOLATILE ORGANICS								
TRICHLOROETHENE	2.5E-02	No	1.70E-02	B2	Lung	HEAST	4.2E-04	
TETRACHLOROETHENE	3.5E-04	No	1.80E-03	B2	Leukemia, liver	HEAST	6.3E-07	

NA: Not Applicable

TABLE A.3-7D
CANCER RISK ESTIMATES
SCENARIO 3-Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEM. SPEC. RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN DEEP GROUNDWATER								1E-05
INORGANICS								
ARSENIC	6.3E-06	No	1.75E+00	A	Skin	IRIS	1E-05	
VOLATILE ORGANICS								
TRICHLOROETHENE	1.3E-06	No	1.10E-02	B2	Liver	Gavage/HEAST	1E-08	
TETRACHLOROETHENE	1.8E-08	No	5.10E-02	B2	Liver	Gavage/HEAST	9E-10	
BASE NEUTRAL / ACIDS								
bis(2-ETHYLHEXYL)PHTHALATE	7.2E-08	No	1.40E-02	B2	Liver	IRIS	1E-09	

NA: Not Applicable

TABLE A.3-8
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 3-Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)	TOTAL EXPOSURE HI
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN DEEP GROUND WATER										2E+02	2E+02
INORGANICS											
ALUMINUM	2.7E+00	No	NA			NA/IRIS			NA		
ANTIMONY	5.9E-02	No	4.00E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	1000	1	1E+02		
ARSENIC	9.6E-03	No	1.00E-03		Keratosis and hyperpigmentation	Diet/HEAST	1		1E+01		
BARIUM	1.4E-02	No	7.00E-02	Medium	None observed	Water/IRIS	3	1	2E-01		
BERYLLIUM	3.1E-04	No	5.00E-03	Low	None observed	Water/IRIS	100	1	6E-02		
CADMIUM	0.0E+00	No	1.00E-03	High	Proteinuria	Diet/IRIS	10	1	NA		
CHROMIUM III	2.8E+00	No	1.00E+00	Low	Hepatotoxicity	IRIS	1000		3E+00		
CHROMIUM VI	3.8E-02	No	5.00E-03	Low	No effects observed	Water/IRIS	500	1	8E+00		
COBALT	1.2E-03	No	NA			NA/IRIS			NA		
COPPER	1.0E-03	No	4.00E-02		Local GI irritation	NA/HEAST			3E-02		
LEAD	6.7E-04	No	NA		Neurobehavioral effects	NA/IRIS			NA		
MANGANESE	4.8E-03	No	1.00E-01	Medium	CNS effects	Diet/IRIS	1	1	5E-02		
MERCURY	2.7E-05	No	3.00E-04		Kidney effects	Oral/HEAST	1000		9E-02		
NICKEL	2.4E-04	No	2.00E-02		Reduced body and organ weight	Diet/HEAST			1E-02		
SELENIUM	3.6E-03	No	5.00E-03	Medium	Clinical selenosis	Diet/IRIS	3	1	7E-01		
SILVER	1.4E-04	No	3.00E-03	Medium	Argyria	Oral/IRIS	2	1	5E-02		
VANADIUM	5.5E-02	No	7.00E-03		None observed	Water/HEAST	100		8E+00		
ZINC	1.8E-03	No	2.00E-01		Anemia	Therap./HEAST	10		9E-03		
CYANIDE	1.7E-03	No	2.00E-02	Medium	Weight loss,thyroid effects,myelin degeneration	Diet/IRIS	100	5	9E-02		
BORON	4.3E-03	No	9.00E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IRIS	100	1	5E-02		
STRONTIUM	8.7E-03	No	NA			NA/IRIS			NA		
TITANIUM	8.9E-03	No	NA			NA/IRIS			NA		
VOLATILE ORGANICS											
TRICHLOROETHENE	1.9E-03	No	NA			NA/IRIS			NA		
TETRACHLOROETHENE	2.7E-05	No	1.00E-02	Medium	Hepatotoxicity,weight gain	Gavage/IRIS	100	1	3E-03		
BASE NEUTRAL / ACIDS											
bis(2-ETHYLHEXYL)PHTHALATE	1.1E-04	No	2.00E-02	Medium	Increased relative liver weight	Diet/IRIS	1000	1	5E-03		

NA: Not Applicable

TABLE A.3-9
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 3-Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE ADULT (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFC (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFC BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT ADULT	PATHWAY HAZARD INDEX (HI)
EXPOSURE PATHWAY: INHALATION OF AIRBORNE (VAPOR PHASE) CHEMICALS FROM DEEP GROUNDWATER										0E+00
VOLATILE ORGANICS										
TRICHLOROETHENE	5.7E-02	No	NA			NA/IRIS			NA	
TETRACHLOROETHENE	8.2E-04	No	NA			NA/IRIS			NA	

NA: Not Applicable

TABLE A.3-10
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 3-Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE ADULT (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN DEEP GROUNDWATER										3E-01
INORGANICS										
ALUMINUM	4.2E-03	No	NA			NA/IRIS			NA	
ANTIMONY	8.9E-05	No	4.00E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	1000	1	2E-01	
ARSENIC	1.5E-05	No	1.00E-03		Keratosis and hyperpigmentation	Diet/HEAST	1		1E-02	
BARIUM	2.1E-05	No	7.00E-02	Medium	None observed	Water/IRIS	3	1	3E-04	
BERYLLIUM	4.7E-07	No	5.00E-03	Low	None observed	Water/IRIS	100	1	9E-05	
CADMIUM	0.0E+00	No	1.00E-03	High	Proteinuria	Diet/IRIS	10	1	NA	
CHROMIUM III	4.2E-03	No	1.00E+00	Low	Hepatotoxicity	IRIS	1000		4E-03	
CHROMIUM VI	5.8E-05	No	5.00E-03	Low	No effects observed	Water/IRIS	500	1	1E-02	
COBALT	1.8E-06	No	NA			NA/IRIS			NA	
COPPER	1.6E-06	No	4.00E-02		Local GI irritation	NA/HEAST			4E-05	
LEAD	1.0E-06	No	NA		Neurobehavioral effects	NA/IRIS			NA	
MANGANESE	7.4E-06	No	1.00E-01	Medium	CNS effects	Diet/IRIS	1	1	7E-05	
MERCURY	4.1E-08	No	3.00E-04		Kidney effects	Oral/HEAST	1000		1E-04	
NICKEL	3.6E-07	No	2.00E-02		Reduced body and organ weight	Diet/HEAST			2E-05	
SELENIUM	5.4E-06	No	5.00E-03	Medium	Clinical selenosis	Diet/IRIS	3	1	1E-03	
SILVER	2.1E-07	No	3.00E-03	Medium	Argyria	Oral/IRIS	2	1	7E-05	
VANADIUM	8.4E-05	No	7.00E-03		None observed	Water/HEAST	100		1E-02	
ZINC	2.7E-06	No	2.00E-01		Anemia	Therap./HEAST	10		1E-05	
CYANIDE	2.6E-06	No	2.00E-02	Medium	Weight loss,thyroid effects,myelin degeneration	Diet/IRIS	100	5	1E-04	
BORON	6.6E-06	No	9.00E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IRIS	100	1	7E-05	
STRONTIUM	1.3E-05	No	NA			NA/IRIS			NA	
TITANIUM	1.4E-05	No	NA			NA/IRIS			NA	
VOLATILE ORGANICS										
TRICHLOROETHENE	2.9E-06	No	NA			NA/IRIS			NA	
TETRACHLOROETHENE	4.2E-08	No	1.00E-02	Medium	Hepatotoxicity,weight gain	Gavage/IRIS	100	1	4E-06	
BASE NEUTRAL / ACIDS										
bis(2-ETHYLHEXYL)PHTHALATE	1.7E-07	No	2.00E-02	Medium	Increased relative liver weight	Diet/IRIS	1000	1	8E-06	

NA: Not Applicable

TABLE A.3-1S
INGESTION OF CHEMICALS IN SHALLOW GROUNDWATER
SCENARIO 3-Residential (Current)

CHEMICAL	INTAKE NONCANCER (mg/kg/day)	INTAKE CANCER (mg/kg/day)	CONC. IN WATER (mg/liter)	INGESTION RATE (liter/day)	EXPOSURE FREQUENCY (days/yr)	ED (years)	BODY WEIGHT (kg)	AVG. TIME NONCANCER ADULT (days)	AVG. TIME CANCER (days)
INORGANICS									
ALUMINUM	1.07E+00	4.60E-01	39.2	2.0	350	30	70	10950	25550
ANTIMONY	0.00E+00	0.00E+00	NA	2.0	350	30	70	10950	25550
ARSENIC	2.05E-02	8.78E-03	0.75	2.0	350	30	70	10950	25550
BARIUM	2.38E-03	1.02E-03	0.09	2.0	350	30	70	10950	25550
BERYLLIUM	1.56E-02	6.69E-03	0.57	2.0	350	30	70	10950	25550
CADMIUM	2.11E-04	9.04E-05	0.0077	2.0	350	30	70	10950	25550
CHROMIUM III	2.32E-03	9.93E-04	0.08	2.0	350	30	70	10950	25550
CHROMIUM VI	2.19E-07	9.39E-08	0.000008	2.0	350	30	70	10950	25550
COBALT	2.05E-04	8.81E-05	0.008	2.0	350	30	70	10950	25550
COPPER	3.56E-03	1.53E-03	0.130	2.0	350	30	70	10950	25550
LEAD	1.88E-03	8.08E-04	0.069	2.0	350	30	70	10950	25550
MANGANESE	1.64E-02	7.02E-03	0.6	2.0	350	30	70	10950	25550
MERCURY	1.86E-05	7.98E-06	0.00068	2.0	350	30	70	10950	25550
NICKEL	5.81E-03	2.49E-03	0.21	2.0	350	30	70	10950	25550
SELENIUM	0.00E+00	0.00E+00	NA	2.0	350	30	70	10950	25550
SILVER	0.00E+00	0.00E+00	NA	2.0	350	30	70	10950	25550
VANADIUM	3.51E+00	1.50E+00	128.0	2.0	350	30	70	10950	25550
ZINC	2.96E-02	1.27E-02	1.1	2.0	350	30	70	10950	25550
CYANIDE	7.23E-01	3.10E-01	26.4	2.0	350	30	70	10950	25550
BORON	4.03E-01	1.73E-01	14.7	2.0	350	30	70	10950	25550
STRONTIUM	0.00E+00	0.00E+00	NA	2.0	350	30	70	10950	25550
TITANIUM	4.08E-03	1.75E-03	0.15	2.0	350	30	70	10950	25550
VOLATILE ORGANICS									
TRICHLOROETHENE	0.00E+00	0.00E+00	NA	2.0	350	30	70	10950	25550
TETRACHLOROETHENE	0.00E+00	0.00E+00	NA	2.0	350	30	70	10950	25550
BASE NEUTRAL / ACIDS									
bis(2-ETHYLHEXYL)PHTHALATE	0.00E+00	0.00E+00	NA	2.0	350	30	70	10950	25550

NA: Not Applicable

TABLE A.3-2S
INHALATION OF AIRBORNE (VAPOR PHASE) CHEMICALS FROM SHALLOW GROUNDWATER
SCENARIO 3-Residential (Current)

CHEMICAL	INTAKE ADULT NONCANCER (mg/kg/day)	INTAKE ADULT CANCER (mg/kg/day)	CONC. IN WATER (mg/liter)	INHALATION RATE (m3/hour)	EXPOSURE TIME (hours/day)	EXPOSURE FREQUENCY (days/yr)	ED (years)	BODY WEIGHT (kg)	AVG. TIME NONCANCER (days)	AVG. TIME CANCER (days)
VOLATILE ORGANICS										
TRICHLOROETHENE	0.00E+00	0.00E+00	NA	0.830	24.0	350	30	70	10950	25550
TETRACHLOROETHENE	0.00E+00	0.00E+00	NA	0.830	24.0	350	30	70	10950	25550
BASE NEUTRAL / ACIDS										
bis(2-ETHYLHEXYL)PHTHALATE	0.00E+00	0.00E+00	NA	0.830	24.0	350	30	70	10950	25550

NA: Not Applicable

TABLE A.3-3S
COMPOUND CONCENTRATIONS EMITTED FROM SHALLOW GROUNDWATER
SCENARIO 3-Residential (Current)

CHEMICAL	Concentration tap water (mg/L)	Flow Rate Of Shower Water (l/hr)	Fraction Of Contaminant Volatilized	One Half The Duration Of Shower (hr)	Bathroom Volume (m3)	Mean Conc In Bathroom (mg/m3)
VOLATILE ORGANICS						
TRICHLOROETHENE	NA	400.0	0.9	0.1	12.0	0.0E+00
TETRACHLOROETHENE	NA	400.0	0.9	0.1	12.0	0.0E+00
BASE NEUTRAL / ACIDS						
bis(2-ETHYLHEXYL)PHTHALATE	NA	400.0	0.9	0.1	12.0	0.0E+00

NA: Not Applicable

TABLE A.3-4S
DERMAL CONTACT WITH CHEMICALS IN SHALLOW GROUNDWATER
SCENARIO 3-Residential (Current)

CHEMICAL	ABSORBED DOSE NONCANCER (mg/kg/day)	ABSORBED DOSE CANCER (mg/kg/day)	CONC. IN WATER (mg/liter)	SKIN SURFACE AREA (cm2/event)	DERMAL PERMEABILITY (cm/hr)	EXPOSURE TIME (hrs/day)	EXPOSURE FREQUENCY (days/year)	EXPOSURE DURATION (years)	CONVERSION FACTOR (L/cm3)	BODY WEIGHT (kg)	AVG TIME NONCANCER (days)	AVG. TIME CANCER (days)
INORGANICS												
ALUMINUM	1.64E-03	7.02E-04	39.20	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
ANTIMONY	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
ARSENIC	3.12E-05	1.34E-05	0.75	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
BARIUM	3.62E-06	1.55E-06	0.09	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
BERYLLIUM	2.38E-05	1.02E-05	0.57	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
CADMIUM	3.22E-07	1.38E-07	0.0077	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
CHROMIUM III	3.53E-06	1.51E-06	0.08	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
CHROMIUM VI	3.34E-10	1.43E-10	0.000008	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
COBALT	3.13E-07	1.34E-07	0.008	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
COPPER	5.43E-06	2.33E-06	0.13	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
LEAD	2.87E-06	1.23E-06	0.069	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
MANGANESE	2.50E-05	1.07E-05	0.60	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
MERCURY	2.84E-08	1.22E-08	0.00068	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
NICKEL	8.86E-06	3.80E-06	0.21	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
SELENIUM	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
SILVER	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
VANADIUM	5.35E-03	2.29E-03	128.00	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
ZINC	4.51E-05	1.93E-05	1.1	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
CYANIDE	1.10E-03	4.73E-04	26.40	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
BORON	6.14E-04	2.63E-04	14.70	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
STRONTIUM	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
TITANIUM	6.22E-06	2.67E-06	0.15	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
VOLATILE ORGANICS												
TRICHLOROETHENE	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
TETRACHLOROETHENE	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550
BASE NEUTRAL / ACIDS												
bis(2-ETHYLHEXYL)PHTHALATE	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.20	350	30	0.001	70	10950	25550

NA: Not Applicable

TABLE A.3–5S
CANCER RISK ESTIMATES
SCENARIO 3–Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)–1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEM. SPEC. RISK	TOTAL PATHWAY RISK	TOTAL EXPOSURE RISK
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN SHALLOW GROUNDWATER							ADULT	4E–02	4E–02
INORGANICS									
ARSENIC	8.8E–03	No	1.75E+00	A	Skin	IRIS	2E–02		
BERYLLIUM	6.7E–03	No	4.30E+00	B2	gross tumors, all sites combined	Water/IRIS	3E–02		
LEAD	8.1E–04	No	NA	B2	Renal tumors	Oral/IRIS	NA		
VOLATILE ORGANICS									
TRICHLOROETHENE	0.0E+00	No	1.10E–02	B2	Liver	Gavage/HEAST	NA		
TETRACHLOROETHENE	0.0E+00	No	5.10E–02	B2	Liver	Gavage/HEAST	NA		
BASE NEUTRAL / ACIDS									
bis(2–ETHYLHEXYL)PHTHALATE	0.0E+00	No	1.40E–02	B2	Liver	IRIS	NA		

NA: Not Applicable

TABLE A.3-6S
CANCER RISK ESTIMATES
SCENARIO 3-Residential (Current)

CHEMICAL	CDI-ADULT MEAN (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEM. SPEC. RISK-ADULT MEAN	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: INHALATION OF AIRBORNE (VAPOR PHASE) CHEMICALS FROM SHALLOW GROUNDWATER								NA
VOLATILE ORGANICS								
TRICHLOROETHENE	0.0E+00	No	1.70E-02	B2	Lung	HEAST	NA	
TETRACHLOROETHENE	0.0E+00	No	1.80E-03	B2	Leukemia, liver	HEAST	NA	

NA: Not Applicable

TABLE A.3-7S
CANCER RISK ESTIMATES
SCENARIO 3-Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEM. SPEC. RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SHALLOW GROUNDWATER								2E-05
INORGANICS								
ARSENIC	1.3E-05	No	1.75E+00	A	Skin	IRIS	2E-05	
VOLATILE ORGANICS								
TRICHLOROETHENE	0.0E+00	No	1.10E-02	B2	Liver	Gavage/HEAST	NA	
TETRACHLOROETHENE	0.0E+00	No	5.10E-02	B2	Liver	Gavage/HEAST	NA	
BASE NEUTRAL / ACIDS								
bis(2-ETHYLHEXYL)PHTHALATE	0.0E+00	No	1.40E-02	B2	Liver	IRIS	NA	

NA: Not Applicable

TABLE A.3-8S
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 3-Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)	TOTAL EXPOSURE HI
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN SHALLOW GROUNDWATER										6E+02	6E+02
INORGANICS											
ALUMINUM	1.1E+00	No	NA			NA/IRIS			NA		
ANTIMONY	0.0E+00	No	4.00E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	1000	1	NA		
ARSENIC	2.0E-02	No	1.00E-03		Keratosis and hyperpigmentation	Diet/HEAST	1		2E+01		
BARIUM	2.4E-03	No	7.00E-02	Medium	None observed	Water/IRIS	3	1	3E-02		
BERYLLIUM	1.6E-02	No	5.00E-03	Low	None observed	Water/IRIS	100	1	3E+00		
CADMIUM	2.1E-04	No	1.00E-03	High	Proteinuria	Diet/IRIS	10	1	2E-01		
CHROMIUM III	2.3E-03	No	1.00E+00	Low	Hepatotoxicity	IRIS	1000		2E-03		
CHROMIUM VI	2.2E-07	No	5.00E-03	Low	No effects observed	Water/IRIS	500	1	4E-05		
COBALT	2.1E-04	No	NA			NA/IRIS			NA		
COPPER	3.6E-03	No	4.00E-02		Local GI irritation	NA/HEAST			9E-02		
LEAD	1.9E-03	No	NA		Neurobehavioral effects	NA/IRIS			NA		
MANGANESE	1.6E-02	No	1.00E-01	Medium	CNS effects	Diet/IRIS	1	1	2E-01		
MERCURY	1.9E-05	No	3.00E-04		Kidney effects	Oral/HEAST	1000		6E-02		
NICKEL	5.8E-03	No	2.00E-02		Reduced body and organ weight	Diet/HEAST	300		3E-01		
SELENIUM	0.0E+00	No	5.00E-03	Medium	Clinical selenosis	Diet/IRIS	3	1	NA		
SILVER	0.0E+00	No	3.00E-03	Medium	Argyria	Oral/IRIS	2	1	NA		
VANADIUM	3.5E+00	No	7.00E-03		None observed	Water/HEAST	100		5E+02		
ZINC	3.0E-02	No	2.00E-01		Anemia	Therap./HEAST	10		1E-01		
CYANIDE	7.2E-01	No	2.00E-02	Medium	Weight loss,thyroid effects,myelin degeneration	Diet/IRIS	100	5	4E+01		
BORON	4.0E-01	No	9.00E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IRIS	100	1	4E+00		
STRONTIUM	0.0E+00	No	NA			NA/IRIS			NA		
TITANIUM	4.1E-03	No	NA			NA/IRIS			NA		
VOLATILE ORGANICS											
TRICHLOROETHENE	0.0E+00	No	NA			NA/IRIS			NA		
TETRACHLOROETHENE	0.0E+00	No	1.00E-02	Medium	Hepatotoxicity,weight gain	Gavage/IRIS	100	1	NA		
BASE NEUTRAL / ACIDS											
bis(2-ETHYLHEXYL)PHTHALATE	0.0E+00	No	2.00E-02	Medium	Increased relative liver weight	Diet/IRIS	1000	1	NA		

NA: Not Applicable

TABLE A.3-9S
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 3-Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE ADULT (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFC (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFC BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT ADULT	PATHWAY HAZARD INDEX (HI)
EXPOSURE PATHWAY: INHALATION OF AIRBORNE (VAPOR PHASE) CHEMICALS FROM SHALLOW GROUNDWATER										NA
VOLATILE ORGANICS										
TRICHLOROETHENE	0.0E+00	No	NA			NA/IRIS			NA	
TETRACHLOROETHENE	0.0E+00	No	NA			NA/IRIS			NA	

NA: Not Applicable

TABLE A.3-10S
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 3-Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE ADULT (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SHALLOW GROUNDWATER										9E-01
INORGANICS										
ALUMINUM	1.6E-03	No	NA			NA/IRIS			NA	
ANTIMONY	0.0E+00	No	4.00E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	1000	1	NA	
ARSENIC	3.1E-05	No	1.00E-03		Keratosis and hyperpigmentation	Diet/HEAST	1		3E-02	
BARIUM	3.6E-06	No	7.00E-02	Medium	None observed	Water/IRIS	3	1	5E-05	
BERYLLIUM	2.4E-05	No	5.00E-03	Low	None observed	Water/IRIS	100	1	5E-03	
CADMIUM	3.2E-07	No	1.00E-03	High	Proteinuria	Diet/IRIS	10	1	3E-04	
CHROMIUM III	3.5E-06	No	1.00E+00	Low	Hepatotoxicity	IRIS	1000		4E-06	
CHROMIUM VI	3.3E-10	No	5.00E-03	Low	No effects observed	Water/IRIS	500	1	7E-08	
COBALT	3.1E-07	No	NA			NA/IRIS			NA	
COPPER	5.4E-06	No	4.00E-02		Local GI irritation	NA/HEAST			1E-04	
LEAD	2.9E-06	No	NA		Neurobehavioral effects	NA/IRIS			NA	
MANGANESE	2.5E-05	No	1.00E-01	Medium	CNS effects	Diet/IRIS	1	1	2E-04	
MERCURY	2.8E-08	No	3.00E-04		Kidney effects	Oral/HEAST	1000		9E-05	
NICKEL	8.9E-06	No	2.00E-02		Reduced body and organ weight	Diet/HEAST	300		4E-04	
SELENIUM	0.0E+00	No	5.00E-03	Medium	Clinical selenosis	Diet/IRIS	3	1	NA	
SILVER	0.0E+00	No	3.00E-03	Medium	Argyria	Oral/IRIS	2	1	NA	
VANADIUM	5.3E-03	No	7.00E-03		None observed	Water/HEAST	100		8E-01	
ZINC	4.5E-05	No	2.00E-01		Anemia	Therap./HEAST	10		2E-04	
CYANIDE	1.1E-03	No	2.00E-02	Medium	Weight loss,thyroid effects,myelin degeneration	Diet/IRIS	100	5	6E-02	
BORON	6.1E-04	No	9.00E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IRIS	100	1	7E-03	
STRONTIUM	0.0E+00	No	NA			NA/IRIS			NA	
TITANIUM	6.2E-06	No	NA			NA/IRIS			NA	
VOLATILE ORGANICS										
TRICHLOROETHENE	0.0E+00	No	NA			NA/IRIS			NA	
TETRACHLOROETHENE	0.0E+00	No	1.00E-02	Medium	Hepatotoxicity,weight gain	Gavage/IRIS	100	1	NA	
BASE NEUTRAL / ACIDS										
bis(2-ETHYLHEXYL)PHTHALATE	0.0E+00	No	2.00E-02	Medium	Increased relative liver weight	Diet/IRIS	1000	1	NA	

TABLE A.4-1
DERMAL CONTACT WITH CHEMICALS IN SOIL
SCENARIO 4 – *Construction (Future)*

CHEMICAL	ABS. DOSE NONCANCER (mg/kg/day)	ABS. DOSE CANCER (mg/kg/day)	CONC. IN SOIL (mg/kg)	CONVERSION FACTOR (kg/mg)	SURFACE AREA SKIN (cm2/event)	ADHERENCE FACTOR (mg/cm2)	ABSORPTION FACTOR (unitless)	EXPOSURE FREQUENCY (events/year)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVG. TIME NONCANCER (days)	AVG. TIME CANCER (days)
INORGANICS												
ALUMINUM	NA	0.00E+00	5116.1	1.0E-06	6300	1.45	NA	180	1	70	180	25550
ANTIMONY	NA	0.00E+00	5.5	1.0E-06	6300	1.45	NA	180	1	70	180	25550
ARSENIC	NA	0.00E+00	1.3	1.0E-06	6300	1.45	NA	180	1	70	180	25550
BARIUM	NA	0.00E+00	24.6	1.0E-06	6300	1.45	NA	180	1	70	180	25550
BERYLLIUM	NA	0.00E+00	0.95	1.0E-06	6300	1.45	NA	180	1	70	180	25550
CHROMIUM III	NA	0.00E+00	48.1	1.0E-06	6300	1.45	NA	180	1	70	180	25550
CHROMIUM VI	NA	0.00E+00	26.7	1.0E-06	6300	1.45	NA	180	1	70	180	25550
COBALT	NA	0.00E+00	3.5	1.0E-06	6300	1.45	NA	180	1	70	180	25550
COPPER	NA	0.00E+00	4.3	1.0E-06	6300	1.45	NA	180	1	70	180	25550
LEAD	NA	0.00E+00	13.0	1.0E-06	6300	1.45	NA	180	1	70	180	25550
MANGANESE	NA	0.00E+00	132.8	1.0E-06	6300	1.45	NA	180	1	70	180	25550
MERCURY	NA	0.00E+00	0.10	1.0E-06	6300	1.45	NA	180	1	70	180	25550
NICKEL	NA	0.00E+00	12.9	1.0E-06	6300	1.45	NA	180	1	70	180	25550
SELENIUM	NA	0.00E+00	0.58	1.0E-06	6300	1.45	NA	180	1	70	180	25550
SILVER	NA	0.00E+00	1.4	1.0E-06	6300	1.45	NA	180	1	70	180	25550
VANADIUM	NA	0.00E+00	304.9	1.0E-06	6300	1.45	NA	180	1	70	180	25550
ZINC	NA	0.00E+00	20.0	1.0E-06	6300	1.45	NA	180	1	70	180	25550
BORON	NA	0.00E+00	24.5	1.0E-06	6300	1.45	NA	180	1	70	180	25550
TITANIUM	NA	0.00E+00	149.8	1.0E-06	6300	1.45	NA	180	1	70	180	25550
ZIRCONIUM	NA	0.00E+00	106.1	1.0E-06	6300	1.45	NA	180	1	70	180	25550
VOLATILE ORGANICS												
METHYLENE CHLORIDE	NA	0.00E+00	0.15	1.0E-06	6300	1.45	NA	180	1	70	180	25550
ACETONE	NA	0.00E+00	0.17	1.0E-06	6300	1.45	NA	180	1	70	180	25550
CHLOROFORM	NA	0.00E+00	0.0029	1.0E-06	6300	1.45	NA	180	1	70	180	25550
TRICHLOROETHENE	NA	0.00E+00	0.0040	1.0E-06	6300	1.45	NA	180	1	70	180	25550
TETRACHLOROETHENE	NA	0.00E+00	0.0030	1.0E-06	6300	1.45	NA	180	1	70	180	25550
TOLUENE	NA	0.00E+00	0.0029	1.0E-06	6300	1.45	NA	180	1	70	180	25550
BASE NEUTRAL / ACIDS												
PHENOL	NA	0.00E+00	0.19	1.0E-06	6300	1.45	NA	180	1	70	180	25550
2,4,5-TRICHLOROPHENOL	NA	0.00E+00	1.40	1.0E-06	6300	1.45	NA	180	1	70	180	25550
PENTACHLOROPHENOL	NA	0.00E+00	0.30	1.0E-06	6300	1.45	NA	180	1	70	180	25550
PHENANTHRENE	NA	0.00E+00	0.16	1.0E-06	6300	1.45	NA	180	1	70	180	25550
DI-n-BUTYLPHALATE	NA	0.00E+00	1.20	1.0E-06	6300	1.45	NA	180	1	70	180	25550
FLUORANTHENE	NA	0.00E+00	0.20	1.0E-06	6300	1.45	NA	180	1	70	180	25550
PYRENE	NA	0.00E+00	0.21	1.0E-06	6300	1.45	NA	180	1	70	180	25550
BUTYLBENZYLPHTHALATE	NA	0.00E+00	0.13	1.0E-06	6300	1.45	NA	180	1	70	180	25550
BENZO(a)ANTHRACENE	NA	0.00E+00	0.13	1.0E-06	6300	1.45	NA	180	1	70	180	25550
CHRYSENE	NA	0.00E+00	0.13	1.0E-06	6300	1.45	NA	180	1	70	180	25550
bis(2-ETHYLHEXYL)PHTHALATE	NA	0.00E+00	0.47	1.0E-06	6300	1.45	NA	180	1	70	180	25550
BENZO(b)FLUORANTHENE	NA	0.00E+00	0.21	1.0E-06	6300	1.45	NA	180	1	70	180	25550
BENZO(k)FLUORANTHENE	NA	0.00E+00	0.075	1.0E-06	6300	1.45	NA	180	1	70	180	25550
BENZO(a)PYRENE	NA	0.00E+00	0.066	1.0E-06	6300	1.45	NA	180	1	70	180	25550
PESTICIDES / PCB'S												
4,4-DDT	NA	0.00E+00	31.0	1.0E-06	6300	1.45	NA	180	1	70	180	25550

NA: Not Applicable

TABLE A.4-2
INGESTION OF CHEMICALS IN SOIL
SCENARIO 4 – Construction (Future)

CHEMICAL	INTAKE NONCANCER (mg/kg/day)	INTAKE CANCER (mg/kg/day)	CONC. IN SOIL (mg/kg)	INGESTION RATE (mg soil/day)	CONVERSION FACTOR (10E-6 kg/mg)	FRACTION INGESTED (unitless)	EXPOSURE FREQUENCY (days/year)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVG. TIME NONCANCER (days)	AVG. TIME CANCER (days)
INORGANICS											
ALUMINUM	3.51E-02	2.47E-04	5116.1	480	1.0E-06	1	180	1	70	180	25550
ANTIMONY	3.78E-05	2.67E-07	5.5	480	1.0E-06	1	180	1	70	180	25550
ARSENIC	8.94E-06	6.30E-08	1.3	480	1.0E-06	1	180	1	70	180	25550
BARIUM	1.69E-04	1.19E-06	24.6	480	1.0E-06	1	180	1	70	180	25550
BERYLLIUM	6.49E-06	4.57E-08	0.95	480	1.0E-06	1	180	1	70	180	25550
CHROMIUM III	3.30E-04	2.32E-06	48.1	480	1.0E-06	1	180	1	70	180	25550
CHROMIUM VI	1.83E-04	1.29E-06	26.7	480	1.0E-06	1	180	1	70	180	25550
COBALT	2.39E-05	1.68E-07	3.5	480	1.0E-06	1	180	1	70	180	25550
COPPER	2.97E-05	2.09E-07	4.3	480	1.0E-06	1	180	1	70	180	25550
LEAD	8.89E-05	6.26E-07	13.0	480	1.0E-06	1	180	1	70	180	25550
MANGANESE	9.11E-04	6.42E-06	132.8	480	1.0E-06	1	180	1	70	180	25550
MERCURY	6.71E-07	4.73E-09	0.10	480	1.0E-06	1	180	1	70	180	25550
NICKEL	8.87E-05	6.25E-07	12.9	480	1.0E-06	1	180	1	70	180	25550
SELENIUM	3.97E-06	2.80E-08	0.58	480	1.0E-06	1	180	1	70	180	25550
SILVER	9.67E-06	6.81E-08	1.4	480	1.0E-06	1	180	1	70	180	25550
VANADIUM	2.09E-03	1.47E-05	304.9	480	1.0E-06	1	180	1	70	180	25550
ZINC	1.37E-04	9.68E-07	20.0	480	1.0E-06	1	180	1	70	180	25550
BORON	1.68E-04	1.18E-06	24.5	480	1.0E-06	1	180	1	70	180	25550
TITANIUM	1.03E-03	7.24E-06	149.8	480	1.0E-06	1	180	1	70	180	25550
ZIRCONIUM	7.28E-04	5.13E-06	106.1	480	1.0E-06	1	180	1	70	180	25550
VOLATILE ORGANICS											
METHYLENE CHLORIDE	1.03E-06	7.25E-09	0.15	480	1.0E-06	1	180	1	70	180	25550
ACETONE	1.17E-06	8.21E-09	0.17	480	1.0E-06	1	180	1	70	180	25550
CHLOROFORM	2.02E-08	1.42E-10	0.0029	480	1.0E-06	1	180	1	70	180	25550
TRICHLOROETHENE	2.74E-08	1.93E-10	0.0040	480	1.0E-06	1	180	1	70	180	25550
TETRACHLOROETHENE	2.04E-08	1.44E-10	0.0030	480	1.0E-06	1	180	1	70	180	25550
TOLUENE	1.96E-08	1.38E-10	0.0029	480	1.0E-06	1	180	1	70	180	25550
BASE NEUTRAL / ACIDS											
PHENOL	1.34E-06	9.42E-09	0.19	480	1.0E-06	1	180	1	70	180	25550
2,4,5-TRICHLOROPHENOL	9.58E-06	6.75E-08	1.40	480	1.0E-06	1	180	1	70	180	25550
PENTACHLOROPHENOL	2.06E-06	1.45E-08	0.30	480	1.0E-06	1	180	1	70	180	25550
PHENANTHRENE	1.10E-06	7.73E-09	0.16	480	1.0E-06	1	180	1	70	180	25550
DI-n-BUTYLPHALATE	8.23E-06	5.80E-08	1.20	480	1.0E-06	1	180	1	70	180	25550
FLUORANTHENE	1.37E-06	9.67E-09	0.20	480	1.0E-06	1	180	1	70	180	25550
PYRENE	1.43E-06	1.00E-08	0.21	480	1.0E-06	1	180	1	70	180	25550
BUTYLBENZYLPHTHALATE	8.91E-07	6.28E-09	0.13	480	1.0E-06	1	180	1	70	180	25550
BENZO(a)ANTHRACENE	8.91E-07	6.28E-09	0.13	480	1.0E-06	1	180	1	70	180	25550
CHRYSENE	8.91E-07	6.28E-09	0.13	480	1.0E-06	1	180	1	70	180	25550
bis(2-ETHYLHEXYL)PHTHALATE	3.22E-06	2.27E-08	0.47	480	1.0E-06	1	180	1	70	180	25550
BENZO(b)FLUORANTHENE	1.41E-06	9.94E-09	0.21	480	1.0E-06	1	180	1	70	180	25550
BENZO(k)FLUORANTHENE	5.14E-07	3.62E-09	0.075	480	1.0E-06	1	180	1	70	180	25550
BENZO(a)PYRENE	4.53E-07	3.19E-09	0.066	480	1.0E-06	1	180	1	70	180	25550
PESTICIDES / PCB'S											
4,4-DDT	2.13E-04	1.50E-06	31.0	480	1.0E-06	1	180	1	70	180	25550

TABLE A.4–3
INHALATION OF AIRBORNE CHEMICALS ADSORBED TO DUST
SCENARIO 4 – Construction (Future)

CHEMICAL	INTAKE NONCANCER (mg/kg/day)	INTAKE CANCER (mg/kg/day)	DUST CONC. AMBIENT (kg/m3)	CONC. IN SOIL (mg/kg)	INHALTION RATE (m3/hour)	EXPOSURE TIME (hours/day)	EXPOSURE FREQUENCY (days/year)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVG. TIME NONCANCER (days)	AVG. TIME CANCER (days)
INORGANICS											
ALUMINUM	4.05E–05	2.85E–07	3.46E–08	5116.1	2	8	180	1	70	180	25550
ANTIMONY	4.37E–08	3.08E–10	3.46E–08	5.5	2	8	180	1	70	180	25550
ARSENIC	1.03E–08	7.27E–11	3.46E–08	1.3	2	8	180	1	70	180	25550
BARIUM	1.95E–07	1.37E–09	3.46E–08	24.6	2	8	180	1	70	180	25550
BERYLLIUM	7.49E–09	5.27E–11	3.46E–08	0.95	2	8	180	1	70	180	25550
CHROMIUM III	3.80E–07	2.68E–09	3.46E–08	48.1	2	8	180	1	70	180	25550
CHROMIUM VI	2.11E–07	1.49E–09	3.46E–08	26.7	2	8	180	1	70	180	25550
COBALT	2.75E–08	1.94E–10	3.46E–08	3.5	2	8	180	1	70	180	25550
COPPER	3.43E–08	2.42E–10	3.46E–08	4.3	2	8	180	1	70	180	25550
LEAD	1.03E–07	7.22E–10	3.46E–08	13.0	2	8	180	1	70	180	25550
MANGANESE	1.05E–06	7.40E–09	3.46E–08	132.8	2	8	180	1	70	180	25550
MERCURY	7.74E–10	5.45E–12	3.46E–08	0.10	2	8	180	1	70	180	25550
NICKEL	1.02E–07	7.21E–10	3.46E–08	12.9	2	8	180	1	70	180	25550
SELENIUM	4.58E–09	3.23E–11	3.46E–08	0.58	2	8	180	1	70	180	25550
SILVER	1.11E–08	7.85E–11	3.46E–08	1.4	2	8	180	1	70	180	25550
VANADIUM	2.41E–06	1.70E–08	3.46E–08	304.9	2	8	180	1	70	180	25550
ZINC	1.58E–07	1.12E–09	3.46E–08	20.0	2	8	180	1	70	180	25550
BORON	1.94E–07	1.37E–09	3.46E–08	24.5	2	8	180	1	70	180	25550
TITANIUM	1.18E–06	8.35E–09	3.46E–08	149.8	2	8	180	1	70	180	25550
ZIRCONIUM	8.39E–07	5.91E–09	3.46E–08	106.1	2	8	180	1	70	180	25550
VOLATILE ORGANICS											
METHYLENE CHLORIDE	1.19E–09	8.36E–12	3.46E–08	0.15	2	8	180	1	70	180	25550
ACETONE	1.34E–09	9.47E–12	3.46E–08	0.17	2	8	180	1	70	180	25550
CHLOROFORM	2.33E–11	1.64E–13	3.46E–08	0.0029	2	8	180	1	70	180	25550
TRICHLOROETHENE	3.16E–11	2.23E–13	3.46E–08	0.0040	2	8	180	1	70	180	25550
TETRACHLOROETHENE	2.35E–11	1.66E–13	3.46E–08	0.0030	2	8	180	1	70	180	25550
TOLUENE	2.27E–11	1.60E–13	3.46E–08	0.0029	2	8	180	1	70	180	25550
BASE NEUTRAL / ACIDS											
PHENOL	1.54E–09	1.09E–11	3.46E–08	0.19	2	8	180	1	70	180	25550
2,4,5–TRICHLOROPHENOL	1.11E–08	7.79E–11	3.46E–08	1.40	2	8	180	1	70	180	25550
PENTACHLOROPHENOL	2.37E–09	1.67E–11	3.46E–08	0.30	2	8	180	1	70	180	25550
PHENANTHRENE	1.27E–09	8.91E–12	3.46E–08	0.16	2	8	180	1	70	180	25550
DI–n–BUTYLPHALATE	9.49E–09	6.69E–11	3.46E–08	1.20	2	8	180	1	70	180	25550
FLUORANTHENE	1.58E–09	1.12E–11	3.46E–08	0.20	2	8	180	1	70	180	25550
PYRENE	1.64E–09	1.16E–11	3.46E–08	0.21	2	8	180	1	70	180	25550
BUTYLBENZYLPHTHALATE	1.03E–09	7.24E–12	3.46E–08	0.13	2	8	180	1	70	180	25550
BENZO(a)ANTHRACENE	1.03E–09	7.24E–12	3.46E–08	0.13	2	8	180	1	70	180	25550
CHRYSENE	1.03E–09	7.24E–12	3.46E–08	0.13	2	8	180	1	70	180	25550
bis(2–ETHYLHEXYL)PHTHALATE	3.71E–09	2.62E–11	3.46E–08	0.47	2	8	180	1	70	180	25550
BENZO(b)FLUORANTHENE	1.63E–09	1.15E–11	3.46E–08	0.21	2	8	180	1	70	180	25550
BENZO(k)FLUORANTHENE	5.93E–10	4.18E–12	3.46E–08	0.075	2	8	180	1	70	180	25550
BENZO(a)PYRENE	5.22E–10	3.68E–12	3.46E–08	0.066	2	8	180	1	70	180	25550
PESTICIDES / PCB'S											
4,4–DDT	2.45E–07	1.73E–09	3.46E–08	31.0	2	8	180	1	70	180	25550

TABLE A.4-4
CANCER RISK ESTIMATES
SCENARIO 4 – Construction (Future)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK	TOTAL EXPOSURE RISK
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOIL								0E+00	1E-06
INORGANICS									
ARSENIC	0.0E+00	No	1.75E+00	A	Skin	IRIS	0E+00		
VOLATILE ORGANICS									
METHYLENE CHLORIDE	0.0E+00	No	7.50E-03	B2	Heptacellular carcinomas, neoplastic nodules	Water/IRIS	0E+00		
CHLOROFORM	0.0E+00	No	6.10E-03	B2	Kidney tumors	Oral/IRIS	0E+00		
TRICHLOROETHENE	0.0E+00	No	1.10E-02	B2	Liver	Gavage/HEAST	0E+00		
TETRACHLOROETHENE	0.0E+00	No	5.10E-02	B2	Liver	Gavage/HEAST	0E+00		
BASE NEUTRAL / ACIDS									
PENTACHLOROPHENOL	0.0E+00	No	1.20E-01	B2	Hepatocellular adenoma, carcinomas, pheochromocytoma	Oral/IRIS	0E+00		
BUTYLBENZYLPHTHALATE	0.0E+00	No	NA	C	Leukemia	Diet/IRIS	NA		
BENZO(a)ANTHRACENE	0.0E+00	No	NA	B2	Liver, lung, skin	IRIS	NA		
CHRYSENE	0.0E+00	No	NA	B2	Malignant lymphoma	IRIS	NA		
bis(2-ETHYLHEXYL)PHTHALATE	0.0E+00	No	1.40E-02	B2	Liver	IRIS	0E+00		
BENZO(b)FLUORANTHENE	0.0E+00	No	NA	B2	Lung, thorax, skin	IRIS	NA		
BENZO(k)FLUORANTHENE	0.0E+00	No	NA	B2	Lung, thorax, skin	IRIS	NA		
BENZO(a)PYRENE	0.0E+00	No	NA	B2	Stomach, lung	IRIS	NA		
PESTICIDES / PCB'S									
4,4-DDT	0.0E+00	No	3.40E-01	B2	Liver tumor	Oral/IRIS	0E+00		

NA: Not Applicable

TABLE A.4-5
CANCER RISK ESTIMATES
SCENARIO 4 – Construction (Future)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN SOIL								1E-06
INORGANICS								
ARSENIC	6.3E-08	No	1.75E+00	A	Skin	IRIS	1E-07	
BERYLLIUM	4.6E-08	No	4.30E+00	B2	gross tumors, all sites combined	Water/IRIS	2E-07	
LEAD	6.3E-07	No	NA	B2	Renal tumors	Oral/IRIS	NA	
VOLATILE ORGANICS								
METHYLENE CHLORIDE	7.2E-09	No	7.50E-03	B2	Heptacellular carcinomas, neoplastic nodules	Water/IRIS	5E-11	
CHLOROFORM	1.4E-10	No	6.10E-03	B2	Kidney tumors	Oral/IRIS	9E-13	
TRICHLOROETHENE	1.9E-10	No	1.10E-02	B2	Liver	Gavage/HEAST	2E-12	
TETRACHLOROETHENE	1.4E-10	No	5.10E-02	B2	Liver	Gavage/HEAST	7E-12	
BASE NEUTRAL / ACIDS								
PENTACHLOROPHENOL	1.4E-08	No	1.20E-01	B2	Hepatocellular adenoma, carcinomas, pheochromocytoma	Oral/IRIS	2E-09	
BUTYLBENZYLPHTHALATE	6.3E-09	No	NA	C	Leukemia	Diet/IRIS	NA	
BENZO(a)ANTHRACENE	6.3E-09	No	1.15E+01	B2	Liver, lung, skin	IRIS	7E-08	
CHRYSENE	6.3E-09	No	1.15E+01	B2	Malignant lymphoma	IRIS	7E-08	
bis(2-ETHYLHEXYL)PHTHALATE	2.3E-08	No	1.40E-02	B2	Liver	IRIS	3E-10	
BENZO(b)FLUORANTHENE	9.9E-09	No	1.15E+01	B2	Lung, thorax, skin	IRIS	1E-07	
BENZO(k)FLUORANTHENE	3.6E-09	No	1.15E+01	B2	Lung, thorax, skin	IRIS	4E-08	
BENZO(a)PYRENE	3.2E-09	No	1.15E+01	B2	Stomach, lung	IRIS	4E-08	
PESTICIDES / PCB'S								
4,4-DDT	1.5E-06	No	3.40E-01	B2	Liver tumor	Oral/IRIS	5E-07	

NA: Not Applicable

TABLE A.4-6
CANCER RISK ESTIMATES
SCENARIO 4 – Construction (Future)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: INHALATION OF AIRBORNE CHEMICALS ADSORBED TO DUST								7E-08
INORGANICS								
ARSENIC	7.27E-11	No	5.00E+01	A	Respiratory Tract	Occupational/IRIS	4E-09	
BERYLLIUM	5.27E-11	No	8.40E+00	B2	Lung	Occupational/IRIS	4E-10	
CHROMIUM VI	1.49E-09	No	4.20E+01	A	Lung	Occupational/IRIS	6E-08	
LEAD	7.22E-10	No	NA	B2		NA/IRIS	NA	
NICKEL	7.21E-10	No	8.40E-01	A	Lung and nasal tumors	Occupational/IRIS	6E-10	
VOLATILE ORGANICS								
METHYLENE CHLORIDE	8.36E-12	No	1.60E-03	B2	Combined adenomas and carcinomas	IRIS	1E-14	
CHLOROFORM	1.64E-13	No	8.10E-02	B2	Liver	IRIS	1E-14	
TRICHLOROETHENE	2.23E-13	No	1.70E-02	B2	Lung	HEAST	4E-15	
TETRACHLOROETHENE	1.66E-13	No	1.80E-03	B2	Leukemia, liver	HEAST	3E-16	
BASE NEUTRAL / ACIDS								
PENTACHLOROPHENOL	1.67E-11	No	NA	B2		NA/IRIS	NA	
BUTYLBENZYLPHTHALATE	7.24E-12	No	NA	C	Leukemia	IRIS	NA	
BENZO(a)ANTHRACENE	7.24E-12	No	6.10E+00	B2	Liver, lung, skin	IRIS	4E-11	
CHRYSENE	7.24E-12	No	6.10E+00	B2	Malignant lymphoma	IRIS	4E-11	
bis(2-ETHYLHEXYL)PHTHALATE	2.62E-11	No	NA	B2		NA/IRIS	NA	
BENZO(b)FLUORANTHENE	1.15E-11	No	6.10E+00	B2	Lung, thorax, skin	IRIS	7E-11	
BENZO(k)FLUORANTHENE	4.18E-12	No	6.10E+00	B2	Lung, thorax, skin	IRIS	3E-11	
BENZO(a)PYRENE	3.68E-12	No	6.10E+00	B2	Respiratory tract, stomach	Inhalation/HEAST	2E-11	
PESTICIDES / PCB'S								
4,4-DDT	1.73E-09	No	NA	B2		IRIS	NA	

NA: Not Applicable

TABLE A.4-7
SUBCHRONIC HAZARD INDEX ESTIMATES
SCENARIO 4 – Construction (Future)

CHEMICAL	SUBCHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)	PATHWAY HAZARD INDEX (HI)
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOIL										0E+00	1E+00
INORGANICS											
ALUMINUM	NA	No	NA			NA/IRIS			NA		
ANTIMONY	NA	No	4E-04		Reduced life span,altered blood chemistry	Water/HEAST	1000		NA		
ARSENIC	NA	No	1E-03		Keratosis and hyperpigmentation	NA/HEAST	1		NA		
BARIUM	NA	No	5E-02		Increased blood pressure	Water/HEAST	100		NA		
BERYLLIUM	NA	No	5E-03		None observed	Water/HEAST	100		NA		
CHROMIUM III	NA	No	1E+01		Hepatotoxicity	HEAST	100		NA		
CHROMIUM VI	NA	No	2E-02		Not defined	Water/HEAST	100		NA		
COBALT	NA	No	NA			NA/HEAST			NA		
COPPER	NA	No	4E-02		Local GI irritation	NA/HEAST	NA		NA		
LEAD	NA	No	NA			NA/HEAST			NA		
MANGANESE	NA	No	1E-01		No effect	Occupational/HEAST	1		NA		
MERCURY	NA	No	3E-04		Kidney effects	Oral/HEAST	1000		NA		
NICKEL	NA	No	2E-02		Decreased body and organ weight	Diet/HEAST	300		NA		
SELENIUM	NA	No	NA			NA/HEAST			NA		
SILVER	NA	No	3E-03		Argyria	HEAST	2		NA		
VANADIUM	NA	No	7E-03		None observed	Water/HEAST	100		NA		
ZINC	NA	No	2E-01		Anemia	Therapeutic/HEAST	10		NA		
BORON	NA	No	9E-02		Testicular atrophy	Diet/HEAST	100		NA		
TITANIUM	NA	No	NA			NA/IRIS			NA		
ZIRCONIUM	NA	No	NA			NA/IRIS			NA		
VOLATILE ORGANICS											
METHYLENE CHLORIDE	NA	No	6E-02		Liver toxicity	Water/HEAST	100		NA		
ACETONE	NA	No	1E+00		Increased liver and kidney weights,nephrotoxicity	Gavage/HEAST	100		NA		
CHLOROFORM	NA	No	1E-02		Liver lesions	HEAST	1000		NA		
TRICHLOROETHENE	NA	No	NA			NA/HEAST			NA		
TETRACHLOROETHENE	NA	No	1E-01		Hepatotoxicity	Gavage/HEAST	100		NA		
TOLUENE	NA	No	2E+00		Changes in liver and kidney weight	HEAST	100		NA		
BASE NEUTRAL / ACIDS											
PHENOL	NA	No	6E-01		Reduced fetal body weight	Gavage/HEAST			NA		
2,4,5-TRICHLOROPHENOL	NA	No	1E+00		Hepatotoxiciy and kidney effects	Diet/IRIS	100		NA		
PENTACHLOROPHENOL	NA	No	3E-02		Fetotoxicity	Gavage/HEAST	100		NA		
PHENANTHRENE	NA	No	NA			NA/HEAST			NA		
DI-n-BUTYLPHALATE	NA	No	1E+00		Mortality	Diet/HEAST	100		NA		
FLUORANTHENE	NA	No	4E-01		Nephropathy, liver weight changes,	Gavage/HEAST	300		NA		
PYRENE	NA	No	3E-01		Reanal effects	Gavage/HEAST	300		NA		
BUTYLBENZYLPHTHALATE	NA	No	2E+00		Effects on body weight gain,testes,liver	Diet/HEAST	100		NA		
BENZO(a)ANTHRACENE	NA	No	NA			NA/HEAST			NA		
CHRYSENE	NA	No	NA			NA/HEAST			NA		
bis(2-ETHYLHEXYL)PHTHALATE	NA	No	2E-02		Increased relative liver weight	Diet/HEAST	1000	1	NA		
BENZO(b)FLUORANTHENE	NA	No	NA			NA/HEAST			NA		
BENZO(k)FLUORANTHENE	NA	No	NA			NA/HEAST			NA		
BENZO(a)PYRENE	NA	No	NA			NA/HEAST			NA		
PESTICIDES / PCB'S											
4,4-DDT	NA	No	5E-04		Liver lesions	NA/HEAST	100		NA		

NA: Not Applicable

TABLE A.4-8
SUBCHRONIC HAZARD INDEX ESTIMATES
SCENARIO 4 - Construction (Future)

CHEMICAL	SUBCHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN SOIL										9E-01
INORGANICS										
ALUMINUM	3.5E-02	No	NA			NA/IRIS			NA	
ANTIMONY	3.8E-05	No	4E-04		Reduced life span,altered blood chemistry	Water/HEAST	1000		9E-02	
ARSENIC	8.9E-06	No	1E-03		Keratosis and hyperpigmentation	NA/HEAST	1		9E-03	
BARIUM	1.7E-04	No	5E-02		Increased blood pressure	Water/HEAST	100		3E-03	
BERYLLIUM	6.5E-08	No	5E-03		None observed	Water/HEAST	100		1E-03	
CHROMIUM III	3.3E-04	No	1E+01		Hepatotoxicity	HEAST	100		3E-05	
CHROMIUM VI	1.8E-04	No	2E-02		Not defined	Water/HEAST	100		9E-03	
COBALT	2.4E-05	No	NA			NA/HEAST			NA	
COPPER	3.0E-05	No	4E-02		Local GI irritation	NA/HEAST	NA		7E-04	
LEAD	8.9E-05	No	NA			NA/HEAST			NA	
MANGANESE	9.1E-04	No	1E-01		No effect	Occupational/HEAST	1		9E-03	
MERCURY	6.7E-07	No	3E-04		Kidney effects	Oral/HEAST	1000		2E-03	
NICKEL	8.9E-05	No	2E-02		Decreased body and organ weight	Diet/HEAST	300		4E-03	
SELENIUM	4.0E-06	No	NA			NA/HEAST			NA	
SILVER	9.7E-06	No	3E-03		Argyria	HEAST	2		3E-03	
VANADIUM	2.1E-03	No	7E-03		None observed	Water/HEAST	100		3E-01	
ZINC	1.4E-04	No	2E-01		Anemia	Therapeutic/HEAST	10		7E-04	
BORON	1.7E-04	No	9E-02		Testicular atrophy	Diet/HEAST	100		2E-03	
TITANIUM	1.0E-03	No	NA			NA/IRIS			NA	
ZIRCONIUM	7.3E-04	No	NA			NA/IRIS			NA	
VOLATILE ORGANICS										
METHYLENE CHLORIDE	1.0E-06	No	6E-02		Liver toxicity	Water/HEAST	100		2E-05	
ACETONE	1.2E-06	No	1E+00		Increased liver and kidney weights,nephrotoxicity	Gavage/HEAST	100		1E-06	
CHLOROFORM	2.0E-08	No	1E-02		Liver lesions	HEAST	1000		2E-06	
TRICHLOROETHENE	2.7E-08	No	NA			NA/HEAST			NA	
TETRACHLOROETHENE	2.0E-08	No	1E-01		Hepatotoxicity	Gavage/HEAST	100		2E-07	
TOLUENE	2.0E-08	No	2E+00		Changes in liver and kidney weight	HEAST	100		1E-08	
BASE NEUTRAL / ACIDS										
PHENOL	1.3E-06	No	6E-01		Reduced fetal body weight	Gavage/HEAST			2E-06	
2,4,5-TRICHLOROPHENOL	9.6E-06	No	1E+00		Hepatotoxiciy and kidney effects	Diet/IRIS	100		1E-05	
PENTACHLOROPHENOL	2.1E-06	No	3E-02		Fetotoxicity	Gavage/HEAST	100		7E-05	
PHENANTHRENE	1.1E-06	No	NA			NA/HEAST			NA	
DI-n-BUTYLPHALATE	8.2E-06	No	1E+00		Mortality	Diet/HEAST	100		8E-06	
FLUORANTHENE	1.4E-06	No	4E-01		Nephropathy, liver weight changes,	Gavage/HEAST	300		3E-06	
PYRENE	1.4E-06	No	3E-01		Reanal effects	Gavage/HEAST	300		5E-06	
BUTYLBENZYLPHTHALATE	8.9E-07	No	2E+00		Effects on body weight gain,testes,liver	Diet/HEAST	100		4E-07	
BENZO(a)ANTHRACENE	8.9E-07	No	NA			NA/HEAST			NA	
CHRYSENE	8.9E-07	No	NA			NA/HEAST			NA	
bis(2-ETHYLHEXYL)PHTHALATE	3.2E-06	No	2E-02		Increased relative liver weight	Diet/HEAST	1000	1	2E-04	
BENZO(b)FLUORANTHENE	1.4E-06	No	NA			NA/HEAST			NA	
BENZO(k)FLUORANTHENE	5.1E-07	No	NA			NA/HEAST			NA	
BENZO(a)PYRENE	4.5E-07	No	NA			NA/HEAST			NA	
PESTICIDES / PCB'S										
4,4-DDT	2.1E-04	No	5E-04		Liver lesions	NA/HEAST	100		4E-01	

NA: Not Applicable

TABLE A.4-9
SUBCHRONIC HAZARD INDEX ESTIMATES
SCENARIO 4 – Construction (Future)

CHEMICAL	SUBCHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)
EXPOSURE PATHWAY: INHALATION OF AIRBORNE CHEMICALS ADSORBED TO DUST										1E-01
INORGANICS										
ALUMINUM	4.0E-05	No	NA			NA/HEAST			NA	
ANTIMONY	4.4E-08	No	4.00E-04						1E-04	
ARSENIC	1.0E-08	No	1.00E-03						1E-05	
BARIUM	1.9E-07	No	1.00E-03		Fetotoxicity	HEAST	100		2E-04	
BERYLLIUM	7.5E-09	No	5.00E-03						1E-06	
CHROMIUM III	3.8E-07	No	5.71E-06		Nasal mucosa atrophy	HEAST	30		7E-02	
CHROMIUM VI	2.1E-07	No	5.71E-06		Nasal mucosa atrophy	HEAST	30		4E-02	
COBALT	2.8E-08	No	NA			NA/HEAST			NA	
COPPER	3.4E-08	No	NA			NA/HEAST			NA	
LEAD	1.0E-07	No	NA			NA/HEAST			NA	
MANGANESE	1.1E-06	No	1.00E-04		Increased prevalance of respiratory disease, psycomotor disturbances	Occupational/HEAST	900		1E-02	
MERCURY	7.7E-10	No	9.00E-06		Neurotoxicity	Occupational/HEAST	30		9E-05	
NICKEL	1.0E-07	No	2.00E-02						5E-06	
SELENIUM	4.6E-09	No	NA			NA/HEAST			NA	
SILVER	1.1E-08	No	NA			NA/HEAST			NA	
VANADIUM	2.4E-06	No	7.00E-03						3E-04	
ZINC	1.6E-07	No	2.00E-01						8E-07	
BORON	1.9E-07	No	NA			NA/HEAST			NA	
TITANIUM	1.2E-06	No	NA			NA/HEAST			NA	
ZIRCONIUM	8.4E-07	No	NA			NA/HEAST			NA	
VOLATILE ORGANICS										
METHYLENE CHLORIDE	1.2E-09	No	9.00E-01			HEAST	100		1E-09	
ACETONE	1.3E-09	No	NA			NA/HEAST			NA	
CHLOROFORM	2.3E-11	No	NA			NA/HEAST			NA	
TRICHLOROETHENE	3.2E-11	No	NA			NA/HEAST			NA	
TETRACHLOROETHENE	2.4E-11	No	NA			NA/HEAST			NA	
TOLUENE	2.3E-11	No	6.00E-01		CNS effects, eyes and nose irritation	HEAST	100		4E-11	
BASE NEUTRAL / ACIDS										
PHENOL	1.5E-09	No	NA			NA/HEAST			NA	
2,4,5-TRICHLOROPHENOL	1.1E-08	No	NA			NA/HEAST			NA	
PENTACHLOROPHENOL	2.4E-09	No	NA			NA/HEAST			NA	
PHENANTHRENE	1.3E-09	No	NA			NA/HEAST			NA	
DI-n-BUTYLPHALATE	9.5E-09	No	1.00E+00						9E-09	
FLUORANTHENE	1.6E-09	No	4.00E-01						4E-09	
PYRENE	1.6E-09	No	3.00E-01						5E-09	
BUTYLBENZYLPHTHALATE	1.0E-09	No	2.00E+00						5E-10	
BENZO(a)ANTHRACENE	1.0E-09	No	NA			NA/HEAST			NA	
CHRYSENE	1.0E-09	No	NA			NA/HEAST			NA	
bis(2-ETHYLHEXYL)PHTHALATE	3.7E-09	No	2.00E-02						2E-07	
BENZO(b)FLUORANTHENE	1.6E-09	No	NA			NA/HEAST			NA	
BENZO(k)FLUORANTHENE	5.9E-10	No	NA			NA/HEAST			NA	
BENZO(a)PYRENE	5.2E-10	No	NA			NA/HEAST			NA	
PESTICIDES / PCB'S										
4,4-DDT	2.5E-07	No	NA			NA/HEAST			NA	

NA: Not Applicable

TABLE A.5-1
DERMAL CONTACT WITH CHEMICALS IN SOIL
SCENARIO 5 – Residential (Future)

CHEMICAL	ABS. DOSE ADULT (NONCANCER) (mg/kg/day)	ABS. DOSE ADULT (CANCER) (mg/kg/day)	SOIL CONC (mg/kg)	CONVERSION FACTOR (1E-6kg/mg)	SURFACE AREA ADULT (cm2/event)	ADHERENCE FACTOR (mg/cm2)	ABSORPTION FACTOR (unitless)	EXPOSURE FREQUENCY (events/year)	EXPOSURE DUR. ADULT (years)	BODY WT. ADULT (kg)	AVERAGING TIME NONCANCER ADULT (days)	AVERAGING TIME CANCER (days)
INORGANICS												
ALUMINUM	NA	0.00E+00	8422.5	1E-06	9440	1.45	NA	350	30	70	10950	25550
ANTIMONY	NA	0.00E+00	5.9	1E-06	9440	1.45	NA	350	30	70	10950	25550
ARSENIC	NA	0.00E+00	2.0	1E-06	9440	1.45	NA	350	30	70	10950	25550
BARIUM	NA	0.00E+00	77.4	1E-06	9440	1.45	NA	350	30	70	10950	25550
BERYLLIUM	NA	0.00E+00	5.4	1E-06	9440	1.45	NA	350	30	70	10950	25550
CADMIUM	1.77E-06	7.58E-07	0.94	1E-06	9440	1.45	0.01	350	30	70	10950	25550
CHROMIUM III	NA	0.00E+00	242.6	1E-06	9440	1.45	NA	350	30	70	10950	25550
CHROMIUM VI	NA	0.00E+00	4.0	1E-06	9440	1.45	NA	350	30	70	10950	25550
COBALT	NA	0.00E+00	4.3	1E-06	9440	1.45	NA	350	30	70	10950	25550
COPPER	NA	0.00E+00	15.6	1E-06	9440	1.45	NA	350	30	70	10950	25550
LEAD	NA	0.00E+00	56.1	1E-06	9440	1.45	NA	350	30	70	10950	25550
MANGANESE	NA	0.00E+00	436.1	1E-06	9440	1.45	NA	350	30	70	10950	25550
MERCURY	NA	0.00E+00	0.13	1E-06	9440	1.45	NA	350	30	70	10950	25550
NICKEL	NA	0.00E+00	223.6	1E-06	9440	1.45	NA	350	30	70	10950	25550
SELENIUM	NA	0.00E+00	0.66	1E-06	9440	1.45	NA	350	30	70	10950	25550
SILVER	NA	0.00E+00	1.2	1E-06	9440	1.45	NA	350	30	70	10950	25550
VANADIUM	NA	0.00E+00	1548.6	1E-06	9440	1.45	NA	350	30	70	10950	25550
ZINC	NA	0.00E+00	69.9	1E-06	9440	1.45	NA	350	30	70	10950	25550
BORON	NA	0.00E+00	33.6	1E-06	9440	1.45	NA	350	30	70	10950	25550
NIOBIUM	NA	0.00E+00	66.1	1E-06	9440	1.45	NA	350	30	70	10950	25550
STRONTIUM	NA	0.00E+00	41.6	1E-06	9440	1.45	NA	350	30	70	10950	25550
TITANIUM	NA	0.00E+00	146.0	1E-06	9440	1.45	NA	350	30	70	10950	25550
ZIRCONIUM	NA	0.00E+00	90.2	1E-06	9440	1.45	NA	350	30	70	10950	25550
VOLATILE ORGANICS												
ACETONE	NA	0.00E+00	0.082	1E-06	9440	1.45	NA	350	30	70	10950	25550
CARBON DISULFIDE	NA	0.00E+00	0.0030	1E-06	9440	1.45	NA	350	30	70	10950	25550
1,2-DICHLORETHENE (total)	NA	0.00E+00	0.0020	1E-06	9440	1.45	NA	350	30	70	10950	25550
2-BUTANONE	NA	0.00E+00	0.0061	1E-06	9440	1.45	NA	350	30	70	10950	25550
TRICHLOROETHENE	NA	0.00E+00	0.0035	1E-06	9440	1.45	NA	350	30	70	10950	25550
BENZENE	NA	0.00E+00	0.15	1E-06	9440	1.45	NA	350	30	70	10950	25550
TETRACHLOROETHENE	NA	0.00E+00	0.0036	1E-06	9440	1.45	NA	350	30	70	10950	25550
TOLUENE	NA	0.00E+00	0.0038	1E-06	9440	1.45	NA	350	30	70	10950	25550
ETHYLBENZENE	NA	0.00E+00	0.014	1E-06	9440	1.45	NA	350	30	70	10950	25550
XYLENE (total)	NA	0.00E+00	0.051	1E-06	9440	1.45	NA	350	30	70	10950	25550
BASE NEUTRAL / ACIDS												
PHENOL	NA	0.00E+00	0.18	1E-06	9440	1.45	NA	350	30	70	10950	25550
BENZOIC ACID	NA	0.00E+00	0.15	1E-06	9440	1.45	NA	350	30	70	10950	25550
NAPHTHALENE	NA	0.00E+00	0.13	1E-06	9440	1.45	NA	350	30	70	10950	25550
4-NITROPHENOL	NA	0.00E+00	1.0	1E-06	9440	1.45	NA	350	30	70	10950	25550
2,4-DINITROTOLUENE	NA	0.00E+00	0.11	1E-06	9440	1.45	NA	350	30	70	10950	25550
PENTACHLOROPHENOL	NA	0.00E+00	2.8	1E-06	9440	1.45	NA	350	30	70	10950	25550
PHENANTHRENE	NA	0.00E+00	0.13	1E-06	9440	1.45	NA	350	30	70	10950	25550
ANTHRACENE	NA	0.00E+00	0.084	1E-06	9440	1.45	NA	350	30	70	10950	25550
DI-n-BUTYLPHALATE	NA	0.00E+00	0.093	1E-06	9440	1.45	NA	350	30	70	10950	25550
FLUORANTHENE	NA	0.00E+00	0.26	1E-06	9440	1.45	NA	350	30	70	10950	25550
PYRENE	NA	0.00E+00	0.046	1E-06	9440	1.45	NA	350	30	70	10950	25550
BUTYLBENZYLPHTHALATE	NA	0.00E+00	0.12	1E-06	9440	1.45	NA	350	30	70	10950	25550
BENZO(a)ANTHRACENE	NA	0.00E+00	0.42	1E-06	9440	1.45	NA	350	30	70	10950	25550
CHRYSENE	NA	0.00E+00	0.30	1E-06	9440	1.45	NA	350	30	70	10950	25550
bis(2-ETHYLHEXYL)PHTHALATE	NA	0.00E+00	0.25	1E-06	9440	1.45	NA	350	30	70	10950	25550
BENZO(b)FLUORANTHENE	NA	0.00E+00	0.27	1E-06	9440	1.45	NA	350	30	70	10950	25550
BENZO(k)FLUORANTHENE	NA	0.00E+00	0.16	1E-06	9440	1.45	NA	350	30	70	10950	25550
BENZO(a)PYRENE	NA	0.00E+00	0.74	1E-06	9440	1.45	NA	350	30	70	10950	25550
INDENO(1,2,3-cd)PYRENE	NA	0.00E+00	0.38	1E-06	9440	1.45	NA	350	30	70	10950	25550
BENZO(g,h,i)PERYLENE	NA	0.00E+00	1.1	1E-06	9440	1.45	NA	350	30	70	10950	25550
PESTICIDES / PCB'S												
AROCLOR-1248	2.14E-05	9.16E-06	1.9	1E-06	9440	1.45	0.06	350	30	70	10950	25550
AROCLOR-1254	1.30E-05	5.56E-06	1.2	1E-06	9440	1.45	0.06	350	30	70	10950	25550
AROCLOR-1260	2.48E-07	1.06E-07	0.022	1E-06	9440	1.45	0.06	350	30	70	10950	25550

NA: Not Applicable

TABLE A.5-2
INGESTION OF CHEMICALS IN SOIL AND HOUSE DUST
SCENARIO 5 - Residential (Future)

CHEMICAL	INTAKE CHILD (NONCANCER) (mg/kg/day)	INTAKE CHILD (CANCER) (mg/kg/day)	INTAKE ADULT (NONCANCER) (mg/kg/day)	INTAKE ADULT (CANCER) (mg/kg/day)	SOIL CONC. (mg/kg)	INGESTION RATE CHILD (mg soil/day)	INGESTION RATE ADULT (mg soil/day)	CONVERSION FACTOR (1E-6 kg/mg)	FRACTION INGESTED (unitless)	EXPOSURE FREQUENCY (days/year)	EXP. DUR. CHILD (years)	EXP. DUR. ADULT (years)	BODY WT. CHILD (kg)	BODY WT. ADULT (kg)	AVERAGING TIME NONCANCER CHILD (days)	AVERAGING TIME NONCANCER ADULT (days)	AVERAGING TIME (CANCER) (days)
INORGANICS																	
ALUMINUM	1.11E-01	9.55E-03	1.15E-02	4.94E-03	8422.5	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
ANTIMONY	7.77E-05	6.66E-06	8.05E-06	3.45E-06	5.9	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
ARSENIC	2.67E-05	2.29E-06	2.77E-06	1.19E-06	2.0	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
BARIUM	1.02E-03	8.77E-05	1.06E-04	4.54E-05	77.4	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
BERYLLIUM	7.17E-05	6.16E-06	7.43E-06	3.18E-06	5.4	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
CADMIUM	1.25E-05	1.07E-06	1.29E-06	5.54E-07	0.94	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
CHROMIUM III	3.21E-03	2.75E-04	3.32E-04	1.42E-04	242.6	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
CHROMIUM VI	5.29E-05	4.53E-06	5.48E-06	2.35E-06	4.0	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
COBALT	5.75E-05	4.93E-06	5.95E-06	2.55E-06	4.3	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
COPPER	2.07E-04	1.77E-05	2.14E-05	9.18E-06	15.6	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
LEAD	7.42E-04	6.36E-05	7.68E-05	3.29E-05	56.1	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
MANGANESE	5.77E-03	4.94E-04	5.97E-04	2.56E-04	436.1	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
MERCURY	1.68E-06	1.44E-07	1.74E-07	7.47E-08	0.13	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
NICKEL	2.96E-03	2.53E-04	3.06E-04	1.31E-04	223.6	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
SELENIUM	8.77E-06	7.52E-07	9.09E-07	3.89E-07	0.66	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
SILVER	1.59E-05	1.37E-06	1.65E-06	7.07E-07	1.2	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
VANADIUM	2.05E-02	1.76E-03	2.12E-03	9.09E-04	1548.6	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
ZINC	9.25E-04	7.93E-05	9.58E-05	4.11E-05	69.9	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
BORON	4.44E-04	3.80E-05	4.60E-05	1.97E-05	33.6	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
NIOBIUM	8.74E-04	7.49E-05	9.05E-05	3.88E-05	66.1	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
STRONTIUM	5.51E-04	4.72E-05	5.70E-05	2.44E-05	41.6	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
TITANIUM	1.93E-03	1.65E-04	2.00E-04	8.57E-05	146.0	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
ZIRCONIUM	1.19E-03	1.02E-04	1.24E-04	5.30E-05	90.2	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
VOLATILE ORGANICS																	
ACETONE	1.06E-06	9.30E-08	1.12E-07	4.81E-08	0.082	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
CARBON DISULFIDE	4.00E-08	3.43E-09	4.14E-09	1.76E-09	0.0030	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
1,2-DICHLORETHENE (total)	2.65E-08	2.27E-09	2.74E-09	1.17E-09	0.0020	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
2-BUTANONE	8.08E-08	6.93E-09	8.37E-09	3.59E-09	0.0061	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
TRICHLOROETHENE	4.64E-08	3.98E-09	4.80E-09	2.06E-09	0.0035	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
BENZENE	1.98E-06	1.70E-07	2.05E-07	8.81E-08	0.15	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
TETRACHLOROETHENE	4.80E-08	4.11E-09	4.97E-09	2.13E-09	0.0036	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
TOLUENE	4.98E-08	4.27E-09	5.16E-09	2.21E-09	0.0038	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
ETHYLBENZENE	1.82E-07	1.56E-08	1.88E-08	8.07E-09	0.014	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
XYLENE (total)	6.69E-07	5.73E-08	6.93E-08	2.97E-08	0.051	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
BASE NEUTRAL / ACIDS																	
PHENOL	2.36E-06	2.04E-07	2.47E-07	1.05E-07	0.18	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
BENZOIC ACID	1.98E-06	1.70E-07	2.05E-07	8.81E-08	0.15	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
NAPHTHALENE	1.72E-06	1.47E-07	1.78E-07	7.63E-08	0.13	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
4-NITROPHENOL	1.32E-05	1.13E-06	1.37E-06	5.87E-07	1.0	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
2,4-DINITROTOLUENE	1.45E-06	1.25E-07	1.51E-07	6.46E-08	0.11	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
PENTACHLOROPHENOL	3.69E-05	3.16E-06	3.82E-06	1.64E-06	2.8	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
PHENANTHRENE	1.72E-06	1.47E-07	1.78E-07	7.63E-08	0.13	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
ANTHRACENE	1.11E-06	9.52E-08	1.15E-07	4.93E-08	0.084	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
DI-n-BUTYLPHALATE	1.23E-06	1.05E-07	1.27E-07	5.44E-08	0.093	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
FLUORANTHENE	3.42E-06	2.93E-07	3.54E-07	1.52E-07	0.26	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
PYRENE	6.08E-07	5.21E-08	6.30E-08	2.70E-08	0.046	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
BUTYLBENZYLPHTHALATE	1.59E-05	1.36E-06	1.64E-06	7.05E-08	0.12	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
BENZO(a)ANTHRACENE	5.66E-06	4.76E-07	5.75E-07	2.47E-07	0.42	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
CHRYSENE	3.97E-06	3.40E-07	4.11E-07	1.76E-07	0.30	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
bis(2-ETHYLHEXYL)PHTHALATE	3.31E-06	2.83E-07	3.42E-07	1.47E-07	0.25	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
BENZO(b)FLUORANTHENE	3.63E-06	3.03E-07	3.66E-07	1.57E-07	0.27	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
BENZO(k)FLUORANTHENE	2.12E-06	1.81E-07	2.19E-07	9.39E-08	0.16	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
BENZO(a)PYRENE	9.79E-06	8.39E-07	1.01E-06	4.34E-07	0.74	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
INDENO(1,2,3-cd)PYRENE	5.03E-06	4.31E-07	5.21E-07	2.23E-07	0.38	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
BENZO(g,h,i)PERYLENE	1.45E-05	1.25E-06	1.51E-06	6.46E-07	1.1	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
PESTICIDES / PCB'S																	
AROCLOR-1248	2.51E-05	2.15E-06	2.60E-06	1.12E-06	1.9	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
AROCLOR-1254	1.52E-05	1.31E-06	1.58E-06	6.77E-07	1.2	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550
AROCLOR-1260	2.91E-07	2.49E-08	3.01E-08	1.29E-08	0.022	200	100	1E-06	1	350	6	30	14.5	70	2190	10950	25550

NA: Not Applicable

TABLE A.5-3
OUTDOOR INHALATION OF AIRBORNE CHEMICALS ADSORBED TO DUST
SCENARIO 5 - Residential (Future)

CHEMICAL	ABS. DOSE ADULT (NONCANCER) (mg/kg/day)	ABS. DOSE ADULT (CANCER) (mg/kg/day)	SOIL CONC. (mg/kg)	DUST CONC. (mg/m3)	INHALATION RATE ADULT (m3/hr)	EXPOSURE TIME (hr/day)	EXPOSURE FREQUENCY (events/year)	EXP. DUR. ADULT (years)	BODY WT. ADULT (kg)	AVERAGING TIME NONCANCER ADULT (days)	AVERAGING TIME (CANCER) (days)
INORGANICS											
ALUMINUM	1.49E-06	6.40E-07	8422.5	3.9E-09	0.83	4	350	30	70	10950	25550
ANTIMONY	1.04E-09	4.47E-10	5.9	3.9E-09	0.83	4	350	30	70	10950	25550
ARSENIC	3.58E-10	1.54E-10	2.0	3.9E-09	0.83	4	350	30	70	10950	25550
BARIUM	1.37E-08	5.88E-09	77.4	3.9E-09	0.83	4	350	30	70	10950	25550
BERYLLIUM	9.62E-10	4.12E-10	5.4	3.9E-09	0.83	4	350	30	70	10950	25550
CADMIUM	1.67E-10	7.17E-11	0.94	3.9E-09	0.83	4	350	30	70	10950	25550
CHROMIUM III	4.30E-08	1.84E-08	242.6	3.9E-09	0.83	4	350	30	70	10950	25550
CHROMIUM VI	7.09E-10	3.04E-10	4.0	3.9E-09	0.83	4	350	30	70	10950	25550
COBALT	7.71E-10	3.30E-10	4.3	3.9E-09	0.83	4	350	30	70	10950	25550
COPPER	2.77E-09	1.19E-09	15.6	3.9E-09	0.83	4	350	30	70	10950	25550
LEAD	9.95E-09	4.26E-09	56.1	3.9E-09	0.83	4	350	30	70	10950	25550
MANGANESE	7.74E-08	3.32E-08	436.1	3.9E-09	0.83	4	350	30	70	10950	25550
MERCURY	2.26E-11	9.67E-12	0.13	3.9E-09	0.83	4	350	30	70	10950	25550
NICKEL	3.97E-08	1.70E-08	223.6	3.9E-09	0.83	4	350	30	70	10950	25550
SELENIUM	1.18E-10	5.04E-11	0.66	3.9E-09	0.83	4	350	30	70	10950	25550
SILVER	2.14E-10	9.15E-11	1.2	3.9E-09	0.83	4	350	30	70	10950	25550
VANADIUM	2.75E-07	1.18E-07	1548.6	3.9E-09	0.83	4	350	30	70	10950	25550
ZINC	1.24E-08	5.32E-09	69.9	3.9E-09	0.83	4	350	30	70	10950	25550
BORON	5.95E-09	2.55E-09	33.6	3.9E-09	0.83	4	350	30	70	10950	25550
NIOBIUM	1.17E-08	5.02E-09	66.1	3.9E-09	0.83	4	350	30	70	10950	25550
STRONTIUM	7.38E-09	3.16E-09	41.6	3.9E-09	0.83	4	350	30	70	10950	25550
TITANIUM	2.59E-08	1.11E-08	146.0	3.9E-09	0.83	4	350	30	70	10950	25550
ZIRCONIUM	1.60E-08	6.86E-09	90.2	3.9E-09	0.83	4	350	30	70	10950	25550
VOLATILE ORGANICS											
ACETONE	1.45E-11	6.23E-12	0.082	3.9E-09	0.83	4	350	30	70	10950	25550
CARBON DISULFIDE	5.37E-13	2.30E-13	0.0030	3.9E-09	0.83	4	350	30	70	10950	25550
1,2-DICHLORETHENE (total)	3.55E-13	1.52E-13	0.0020	3.9E-09	0.83	4	350	30	70	10950	25550
2-BUTANONE	1.08E-12	4.65E-13	0.0061	3.9E-09	0.83	4	350	30	70	10950	25550
TRICHLOROETHENE	6.22E-13	2.67E-13	0.0035	3.9E-09	0.83	4	350	30	70	10950	25550
BENZENE	2.66E-11	1.14E-11	0.15	3.9E-09	0.83	4	350	30	70	10950	25550
TETRACHLOROETHENE	6.43E-13	2.76E-13	0.0036	3.9E-09	0.83	4	350	30	70	10950	25550
TOLUENE	6.68E-13	2.86E-13	0.0038	3.9E-09	0.83	4	350	30	70	10950	25550
ETHYLBENZENE	2.44E-12	1.04E-12	0.014	3.9E-09	0.83	4	350	30	70	10950	25550
XYLENE (total)	8.97E-12	3.84E-12	0.051	3.9E-09	0.83	4	350	30	70	10950	25550
BASE NEUTRAL / ACIDS											
PHENOL	3.19E-11	1.37E-11	0.18	3.9E-09	0.83	4	350	30	70	10950	25550
BENZOIC ACID	2.66E-11	1.14E-11	0.15	3.9E-09	0.83	4	350	30	70	10950	25550
NAPHTHALENE	2.31E-11	9.88E-12	0.13	3.9E-09	0.83	4	350	30	70	10950	25550
4-NITROPHENOL	1.77E-10	7.60E-11	1.0	3.9E-09	0.83	4	350	30	70	10950	25550
2,4-DINITROTOLUENE	1.95E-11	8.36E-12	0.11	3.9E-09	0.83	4	350	30	70	10950	25550
PENTACHLOROPHENOL	4.95E-10	2.12E-10	2.8	3.9E-09	0.83	4	350	30	70	10950	25550
PHENANTHRENE	2.31E-11	9.88E-12	0.13	3.9E-09	0.83	4	350	30	70	10950	25550
ANTHRACENE	1.49E-11	6.39E-12	0.08	3.9E-09	0.83	4	350	30	70	10950	25550
DI-n-BUTYLPHALATE	1.64E-11	7.04E-12	0.09	3.9E-09	0.83	4	350	30	70	10950	25550
FLUORANTHENE	4.59E-11	1.97E-11	0.26	3.9E-09	0.83	4	350	30	70	10950	25550
PYRENE	8.16E-12	3.50E-12	0.046	3.9E-09	0.83	4	350	30	70	10950	25550
BUTYLBENZYLPHTHALATE	2.13E-11	9.12E-12	0.12	3.9E-09	0.83	4	350	30	70	10950	25550
BENZO(a)ANTHRACENE	7.45E-11	3.19E-11	0.42	3.9E-09	0.83	4	350	30	70	10950	25550
CHRYSENE	5.32E-11	2.28E-11	0.30	3.9E-09	0.83	4	350	30	70	10950	25550
bis(2-ETHYLHEXYL)PHTHALATE	4.43E-11	1.90E-11	0.25	3.9E-09	0.83	4	350	30	70	10950	25550
BENZO(b)FLUORANTHENE	4.74E-11	2.03E-11	0.27	3.9E-09	0.83	4	350	30	70	10950	25550
BENZO(k)FLUORANTHENE	2.84E-11	1.22E-11	0.16	3.9E-09	0.83	4	350	30	70	10950	25550
BENZO(a)PYRENE	1.31E-10	5.63E-11	0.74	3.9E-09	0.83	4	350	30	70	10950	25550
INDENO(1,2,3-cd)PYRENE	6.74E-11	2.89E-11	0.38	3.9E-09	0.83	4	350	30	70	10950	25550
BENZO(g,h,i)PERYLENE	1.95E-10	8.36E-11	1.1	3.9E-09	0.83	4	350	30	70	10950	25550
PESTICIDES / PCB'S											
AROCLOR-1248	3.37E-10	1.44E-10	1.9	3.9E-09	0.83	4	350	30	70	10950	25550
AROCLOR-1254	2.04E-10	8.76E-11	1.2	3.9E-09	0.83	4	350	30	70	10950	25550
AROCLOR-1260	3.90E-12	1.67E-12	0.022	3.9E-09	0.83	4	350	30	70	10950	25550

NA: Not Applicable

TABLE A.5-4
CANCER RISK ESTIMATES
SCENARIO 5 – Residential (Future)

CHEMICAL	CHRONIC DAILY INTAKE ADULT (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPEC. RISK ADULT	TOTAL PATHWAY RISK	TOTAL RISK
							CHILD	NA	9E-05
EXPOSURE PATHWAY: DERMAL CONTACT WITH SOILS							ADULT	1E-04	2E-04
INORGANICS									
ARSENIC	0.0E+00	No	1.75E+00	A	Skin	IRIS	0E+00		
VOLATILE ORGANICS									
TRICHLOROETHENE	0.0E+00	No	1.10E-02	B2	Liver	Gavage/HEAST	0E+00		
BENZENE	0.0E+00	No	2.90E-02	A	Leukemia	Occupational/IRIS	0E+00		
TETRACHLOROETHENE	0.0E+00	No	5.10E-02	B2	Liver	Gavage/HEAST	0E+00		
BASE NEUTRAL / ACIDS									
2,4-DINITROTOLUENE	0.0E+00	No	6.80E-01	B2	Liver, mammary gland	Diet/IRIS	0E+00		
PENTACHLOROPHENOL	0.0E+00	No	1.20E-01	B2	Hepatocellular adenoma, carcinomas,pheochromocytoma	Oral/IRIS	0E+00		
BUTYLBENZYLPHTHALATE	0.0E+00	No	NA	C	Leukemia	Diet/IRIS	NA		
BENZO(a)ANTHRACENE	0.0E+00	No	NA	B2	Liver, lung, skin	IRIS	NA		
CHRYSENE	0.0E+00	No	NA	B2	Malignant lymphoma	IRIS	NA		
bis(2-ETHYLHEXYL)PHTHALATE	0.0E+00	No	1.40E-02	B2	Liver	IRIS	0E+00		
BENZO(b)FLUORANTHENE	0.0E+00	No	NA	B2	Lung, thorax, skin	IRIS	NA		
BENZO(k)FLUORANTHENE	0.0E+00	No	NA	B2	Lung, thorax, skin	IRIS	NA		
BENZO(a)PYRENE	0.0E+00	No	NA	B2	Stomach, lung	IRIS	NA		
INDENO(1,2,3-cd)PYRENE	0.0E+00	No	NA	B2	Lung, skin	IRIS	NA		
PESTICIDES / PCB'S									
AROCLOR-1248	9.2E-06	No	7.70E+00				7E-05		
AROCLOR-1254	5.6E-06	No	7.70E+00				4E-05		
AROCLOR-1260	1.1E-07	No	7.70E+00	B2	Liver	Diet/IRIS	8E-07		

NA: Not Applicable

TABLE A.5-5
CANCER RISK ESTIMATES
SCENARIO 5 – Residential (Future)

CHEMICAL	CHRONIC DAILY INTAKE CHILD (mg/kg/day)	CHRONIC DAILY INTAKE ADULT (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPEC. RISK CHILD	CHEMICAL SPEC. RISK ADULT	TOTAL PATHWAY RISK
									ADULT	5E-05
EXPOSURE PATHWAY: INCIDENTAL INGESTION OF CHEMICALS IN SOILS									CHILD	9E-05
INORGANICS										
ARSENIC	2.3E-06	1.2E-06	No	1.75E+00	A	Skin	IRIS	4E-06	2E-06	
BERYLLIUM	6.1E-06	3.2E-06	No	4.30E+00	B2	gross tumors, all sites combined	Water/IRIS	3E-05	1E-05	
LEAD	6.4E-05	3.3E-05	No	NA	B2	Renal tumors	Oral/IRIS	NA	NA	
VOLATILE ORGANICS										
TRICHLOROETHENE	4.0E-09	2.1E-09	No	1.10E-02	B2	Liver	Gavage/HEAST	4E-11	2E-11	
BENZENE	1.7E-07	8.8E-08	No	2.90E-02	A	Leukemia	Occupational/IRIS	5E-09	3E-09	
TETRACHLOROETHENE	4.1E-09	2.1E-09	No	5.10E-02	B2	Liver	Gavage/HEAST	2E-10	1E-10	
BASE NEUTRAL / ACIDS										
2,4-DINITROTOLUENE	1.2E-07	6.5E-08	No	6.80E-01	B2	Liver, mammary gland	Diet/IRIS	8E-08	4E-08	
PENTACHLOROPHENOL	3.2E-06	1.6E-06	No	1.20E-01	B2	Hepatocellular adenoma, carcinomas pheochromocytoma	Oral/IRIS	4E-07	2E-07	
BUTYLBENZYLPHTHALATE	1.4E-07	7.0E-08	No	NA	C	Leukemia	Diet/IRIS	NA	NA	
BENZO(a)ANTHRACENE	4.8E-07	2.5E-07	No	1.15E+01	B2	Liver, lung, skin	IRIS	5E-06	3E-06	
CHRYSENE	3.4E-07	1.8E-07	No	1.15E+01	B2	Malignant lymphoma	IRIS	4E-06	2E-06	
bis(2-ETHYLHEXYL)PHTHALATE	2.8E-07	1.5E-07	No	1.40E-02	B2	Liver	IRIS	4E-09	2E-09	
BENZO(b)FLUORANTHENE	3.0E-07	1.6E-07	No	1.15E+01	B2	Lung, thorax, skin	IRIS	3E-06	2E-06	
BENZO(k)FLUORANTHENE	1.8E-07	9.4E-08	No	1.15E+01	B2	Lung, thorax, skin	IRIS	2E-06	1E-06	
BENZO(a)PYRENE	8.4E-07	4.3E-07	No	1.15E+01	B2	Stomach, lung	IRIS	1E-05	5E-06	
INDENO(1,2,3-cd)PYRENE	4.3E-07	2.2E-07	No	1.15E+01	B2	Lung, skin	IRIS	5E-06	3E-06	
PESTICIDES / PCB'S										
AROCLOR-1248	2.2E-06	1.1E-06	No	7.70E+00				2E-05	9E-06	
AROCLOR-1254	1.3E-06	6.8E-07	No	7.70E+00				1E-05	5E-06	
AROCLOR-1260	2.5E-06	1.3E-06	No	7.70E+00	B2	Liver	Diet/IRIS	2E-07	1E-07	

NA: Not Applicable

TABLE A.5–6
CANCER RISK ESTIMATES
SCENARIO 5 – Residential (Future)

CHEMICAL	CHRONIC DAILY INTAKE ADULT (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)–1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPEC. RISK ADULT	TOTAL PATHWAY RISK
							CHILD	NA
EXPOSURE PATHWAY: INHALATION OF CHEMICALS ADSORBED TO DUST							ADULT	4E–08
INORGANICS								
ARSENIC	1.5E–10	No	5.00E+01	A	Respiratory Tract	Occupational/IRIS	8E–09	
BERYLLIUM	4.1E–10	No	8.40E+00	B2	Lung	Occupational/IRIS	3E–09	
CADMIUM	7.2E–11	No	6.3	B1	Respiratory Tract	Occupational/IRIS	NA	
CHROMIUM VI	3.0E–10	No	4.20E+01	A	Lung	Occupational/IRIS	1E–08	
LEAD	4.3E–09	No	NA	B2		NA/IRIS	NA	
NICKEL	1.7E–08	No	8.40E–01	A	Lung and nasal tumors	Occupational/IRIS	1E–08	
VOLATILE ORGANICS								
TRICHLOROETHENE	2.7E–13	No	1.70E–02	B2	Lung	HEAST	5E–15	
BENZENE	1.1E–11	No	2.90E–02	A	Leukemia	Occupational/IRIS	3E–13	
TETRACHLOROETHENE	2.8E–13	No	1.80E–03	B2	Leukemia, liver	HEAST	5E–16	
BASE NEUTRAL / ACIDS								
2,4–DINITROTOLUENE	8.4E–12	No	NA	B2	Liver, mammary	IRIS	NA	
PENTACHLOROPHENOL	2.1E–10	No	NA	B2		NA/IRIS	NA	
BUTYLBENZYLPHTHALATE	9.1E–12	No	NA	C		NA/IRIS	NA	
BENZO(a)ANTHRACENE	3.2E–11	No	6.10E+00	B2	Liver, lung, skin	IRIS	2E–10	
CHRYSENE	2.3E–11	No	6.10E+00	B2	Malignant lymphoma	IRIS	1E–10	
bis(2–ETHYLHEXYL)PHTHALATE	1.9E–11	No	NA	B2		NA/IRIS	NA	
BENZO(b)FLUORANTHENE	2.0E–11	No	6.10E+00	B2	Lung, thorax, skin	IRIS	1E–10	
BENZO(k)FLUORANTHENE	1.2E–11	No	6.10E+00	B2	Lung, thorax, skin	IRIS	7E–11	
BENZO(a)PYRENE	5.6E–11	No	6.10E+00	B2	Respiratory tract, stomach	Inhalation/HEAST	3E–10	
INDENO(1,2,3–cd)PYRENE	2.9E–11	No	6.10E+00	B2	Lung, skin	IRIS	2E–10	
PESTICIDES / PCB'S								
AROCLOR–1248	1.4E–10	No	NA			NA/IRIS	NA	
AROCLOR–1254	8.8E–11	No	NA			NA/IRIS	NA	
AROCLOR–1260	1.7E–12	No	NA			NA/IRIS	NA	

NA: Not Applicable

TABLE A.5-7
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 5 – Residential (Future)

CHEMICAL	CHRONIC DAILY INTAKE ADULT (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT ADULT	PATHWAY HAZARD INDEX (HI)	TOTAL HAZARD INDEX (HI)
									CHILD	NA	3E+00
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOIL									ADULT	2E-03	4E-01
INORGANICS											
ALUMINUM	NA	No	NA			NA/IRIS			NA		
ANTIMONY	NA	No	4.00E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	1000	1	NA		
ARSENIC	NA	No	1.00E-03		Keratosis and hyperpigmentation	Diet/HEAST	1		NA		
BARIUM	NA	No	7.00E-02	Medium	None observed	Water/IRIS	3	1	NA		
BERYLLIUM	NA	No	5.00E-03	Low	None observed	Water/IRIS	100	1	NA		
CADMIUM	1.8E-06	No	1.00E-03	High	Proteinuria	Diet/IRIS	10	1	2E-03		
CHROMIUM III	NA	No	1.00E+00	Low	Hepatotoxicity	IRIS	1000		NA		
CHROMIUM VI	NA	No	5.00E-03	Low	No effects observed	Water/IRIS	500	1	NA		
COBALT	NA	No	NA			NA/IRIS			NA		
COPPER	NA	No	4.00E-02		Local GI irritation	NA/HEAST			NA		
LEAD	NA	No	NA		Neurobehavioral effects	NA/IRIS			NA		
MANGANESE	NA	No	1.00E-01	Medium	CNS effects	Diet/IRIS	1	1	NA		
MERCURY	NA	No	3.00E-04		Kidney effects	Oral/HEAST	1000		NA		
NICKEL	NA	No	NA			NA/IRIS			NA		
SELENIUM	NA	No	5.00E-03	Medium	Clinical selenosis	Diet/IRIS	3	1	NA		
SILVER	NA	No	3.00E-03	Medium	Argyria	Oral/IRIS	2	1	NA		
VANADIUM	NA	No	7.00E-03		None observed	Water/HEAST	100		NA		
ZINC	NA	No	2.00E-01		Anemia	Therap./HEAST	10		NA		
BORON	NA	No	9.00E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IRIS	100	1	NA		
NIOBIUM	NA	No	NA			NA/IRIS			NA		
STRONTIUM	NA	No	NA			NA/IRIS			NA		
TITANIUM	NA	No	NA			NA/IRIS			NA		
ZIRCONIUM	NA	No	NA			NA/IRIS			NA		
VOLATILE ORGANICS											
ACETONE	NA	No	1.00E-01	Low	Increased liver and kidney weight	Gavage/IRIS	1000	1	NA		
CARBON DISULFIDE	NA	No	1.00E-01	Medium	Fetal toxicity	Inhal./IRIS	100	1	NA		
1,2-DICHLOROETHENE (total)	NA	No	1.00E-02		Decreased hematocrit and hemoglobin	Gavage/HEAST	3000		NA		
2-BUTANONE	NA	No	5.00E-02	Medium	Fetotoxicity	Inhal./IRIS	1000		NA		
TRICHLOROETHENE	NA	No	NA			NA/IRIS			NA		
BENZENE	NA	No	NA			NA/IRIS			NA		
TETRACHLOROETHENE	NA	No	1.00E-02	Medium	Hepatotoxicity,weight gain	Gavage/IRIS	100	1	NA		
TOLUENE	NA	No	2.00E-01	Medium	Changes in liver and kidney weights	Gavage/IRIS	1000	1	NA		
ETHYLBENZENE	NA	No	1.00E-01	Low	Liver and kidney toxicity	Oral/IRIS	1000	1	NA		
XYLENE (total)	NA	No	2.00E+00	Medium	Hyperactivity,decreased body weight,increased	Gavage/IRIS	100	1	NA		
BASE NEUTRAL / ACIDS											
PHENOL	NA	No	6.00E-01	Low	Reduced fetal body weight	Gavage/IRIS	100	1	NA		
BENZOIC ACID	NA	No	4.00E+00	Medium		Oral/IRIS	1	1	NA		
NAPHTHALENE	NA	No	4.00E-03		Decreased body weight gain	Gavage/HEAST	10000		NA		
4-NITROPHENOL	NA	No	NA			NA/IRIS			NA		
2,4-DINITROTOLUENE	NA	No	NA			NA/IRIS			NA		
PENTACHLOROPHENOL	NA	No	3.00E-02	Medium	Liver and kidney pathology	Diet/IRIS	100	1	NA		
PHENANTHRENE	NA	No	NA			NA/IRIS			NA		
ANTHRACENE	NA	No	3.00E-01	Low	No observed effects	Gavage/IRIS	3000	1	NA		
DI-n-BUTYLPHALATE	NA	No	1.00E-01	Low	Increased mortality	Diet/IRIS	10000	1	NA		
FLUORANTHENE	NA	No	4.00E-02	Low	Nephropathy,changes in liver weight,hematology	Gavage/IRIS	3000	1	NA		
PYRENE	NA	No	3.00E-02	Low	Kidney effects	Gavage/IRIS	3000	1	NA		
BUTYLBENZYLPHTHALATE	NA	No	2.00E-01	Low	Effects on body weight gain, testes,liver,kidney	Diet/IRIS	10000	1	NA		
BENZO(a)ANTHRACENE	NA	No	NA			NA/IRIS			NA		
CHRYSENE	NA	No	NA			NA/IRIS			NA		
bis(2-ETHYLHEXYL)PHTHALATE	NA	No	2.00E-02	Medium	Increased relative liver weight	Diet/IRIS	1000	1	NA		
BENZO(b)FLUORANTHENE	NA	No	NA			NA/IRIS			NA		
BENZO(k)FLUORANTHENE	NA	No	NA			NA/IRIS			NA		
BENZO(a)PYRENE	NA	No	NA			NA/IRIS			NA		
INDENO(1,2,3-cd)PYRENE	NA	No	NA			NA/IRIS			NA		
BENZO(g,h,i)PERYLENE	NA	No	NA			NA/IRIS			NA		
PESTICIDES / PCB'S											
AROCLOR-1248	2.1E-05	No	NA			NA/IRIS			NA		
AROCLOR-1254	1.3E-05	No	NA			NA/IRIS			NA		
AROCLOR-1260	2.5E-07	No	NA			NA/IRIS			NA		

NA: Not Applicable

TABLE A.5-8
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 5 – Residential (Future)

CHEMICAL	CHRONIC DAILY INTAKE CHILD (mg/kg/day)	CHRONIC DAILY INTAKE ADULT (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAIN ADJUSTMEN	MODIFYING FACTORS	HAZARD QUOTIENT CHILD	HAZARD QUOTIENT ADULT	PATHWAY HAZARD INDEX (HI)
											ADULT	3E-01
EXPOSURE PATHWAY: INCIDENTAL INGESTION OF CHEMICALS IN SOILS											CHILD	3E+00
INORGANICS												
ALUMINUM	1.1E-01	1.2E-02	No	NA			NA/IRIS			NA	NA	
ANTIMONY	7.8E-05	8.1E-06	No	4.00E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	1000	1	2E-01	2E-02	
ARSENIC	2.7E-05	2.8E-06	No	1.00E-03		Keratosis and hyperpigmentation	Diet/HEAST	1		3E-02	3E-03	
BARIUM	1.0E-03	1.1E-04	No	7.00E-02	Medium	None observed	Water/IRIS	3	1	1E-02	2E-03	
BERYLLIUM	7.2E-05	7.4E-06	No	5.00E-03	Low	None observed	Water/IRIS	100	1	1E-02	1E-03	
CADMIUM	1.2E-05	1.3E-06	No	1.00E-03	High	Proteinuria	Diet/IRIS	10	1	1E-02	1E-03	
CHROMIUM III	3.2E-03	3.3E-04	No	1.00E+00	Low	Hepatotoxicity	IRIS	1000		3E-03	3E-04	
CHROMIUM VI	5.3E-05	5.5E-06	No	5.00E-03	Low	No effects observed	Water/IRIS	500	1	1E-02	1E-03	
COBALT	5.7E-05	6.0E-06	No	NA			NA/IRIS			NA	NA	
COPPER	2.1E-04	2.1E-05	No	4.00E-02		Local GI irritation	NA/HEAST			5E-03	5E-04	
LEAD	7.4E-04	7.7E-05	No	NA		Neurobehavioral effects	NA/IRIS			NA	NA	
MANGANESE	5.8E-03	6.0E-04	No	1.00E-01	Medium	CNS effects	Diet/IRIS	1	1	6E-02	6E-03	
MERCURY	1.7E-06	1.7E-07	No	3.00E-04		Kidney effects	Oral/HEAST	1000		6E-03	6E-04	
NICKEL	3.0E-03	3.1E-04	No	NA			NA/IRIS			NA	NA	
SELENIUM	8.8E-06	9.1E-07	No	5.00E-03	Medium	Clinical selenosis	Diet/IRIS	3	1	2E-03	2E-04	
SILVER	1.6E-05	1.6E-06	No	3.00E-03	Medium	Argyria	Oral/IRIS	2	1	5E-03	5E-04	
VANADIUM	2.0E-02	2.1E-03	No	7.00E-03		None observed	Water/HEAST	100		3E+00	3E-01	
ZINC	9.2E-04	9.6E-05	No	2.00E-01		Anemia	Therap./HEAST	10		5E-03	5E-04	
BORON	4.4E-04	4.6E-05	No	9.00E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IR	100	1	5E-03	5E-04	
NIOBIUM	8.7E-04	9.0E-05	No	NA			NA/IRIS			NA	NA	
STRONTIUM	5.5E-04	5.7E-05	No	NA			NA/IRIS			NA	NA	
TITANIUM	1.9E-03	2.0E-04	No	NA			NA/IRIS			NA	NA	
ZIRCONIUM	1.2E-03	1.2E-04	No	NA			NA/IRIS			NA	NA	
VOLATILE ORGANICS												
ACETONE	1.1E-06	1.1E-07	No	1.00E-01	Low	Increased liver and kidney weight	Gavage/IRIS	1000	1	1E-05	1E-06	
CARBON DISULFIDE	4.0E-08	4.1E-09	No	1.00E-01	Medium	Fetal toxicity	Inhal./IRIS	100	1	4E-07	4E-08	
1,2-DICHLOROETHENE (total)	2.6E-08	2.7E-09	No	1.00E-02		Decreased hematocrit and hemoglobin	Gavage/HEAST	3000		3E-06	3E-07	
2-BUTANONE	8.1E-08	8.4E-09	No	5.00E-02	Medium	Fetotoxicity	Inhal./IRIS	1000		2E-06	2E-07	
TRICHLOROETHENE	4.6E-08	4.8E-09	No	NA			NA/IRIS			NA	NA	
BENZENE	2.0E-06	2.1E-07	No	NA			NA/IRIS			NA	NA	
TETRACHLOROETHENE	4.8E-08	5.0E-09	No	1.00E-02	Medium	Hepatotoxicity,weight gain	Gavage/IRIS	100	1	5E-06	5E-07	
TOLUENE	5.0E-08	5.2E-09	No	2.00E-01	Medium	Changes in liver and kidney weights	Gavage/IRIS	1000	1	2E-07	3E-08	
ETHYLBENZENE	1.6E-07	1.9E-08	No	1.00E-01	Low	Liver and kidney toxicity	Oral/IRIS	1000	1	2E-06	2E-07	
XYLENE (total)	6.7E-07	6.9E-08	No	2.00E+00	Medium	Hyperactivity,decreased body weight,increased	Gavage/IRIS	100	1	3E-07	3E-08	
BASE NEUTRAL / ACIDS												
PHENOL	2.4E-06	2.5E-07	No	6.00E-01	Low	Reduced fetal body weight	Gavage/IRIS	100	1	4E-06	4E-07	
BENZOIC ACID	2.0E-06	2.1E-07	No	4.00E+00	Medium		Oral/IRIS	1	1	5E-07	5E-08	
NAPHTHALENE	1.7E-06	1.8E-07	No	4.00E-03		Decreased body weight gain	Gavage/HEAST	10000		4E-04	4E-05	
4-NITROPHENOL	1.3E-05	1.4E-06	No	NA			NA/IRIS			NA	NA	
2,4-DINITROTOLUENE	1.5E-06	1.5E-07	No	NA			NA/IRIS			NA	NA	
PENTACHLOROPHENOL	3.7E-05	3.8E-06	No	3.00E-02	Medium	Liver and kidney pathology	Diet/IRIS	100	1	1E-03	1E-04	
PHENANTHRENE	1.7E-06	1.8E-07	No	NA			NA/IRIS			NA	NA	
ANTHRACENE	1.1E-06	1.2E-07	No	3.00E-01	Low	No observed effects	Gavage/IRIS	3000	1	4E-06	4E-07	
DI-n-BUTYLPHALATE	1.2E-06	1.3E-07	No	1.00E-01	Low	Increased mortality	Diet/IRIS	10000	1	1E-05	1E-06	
FLUORANTHENE	3.4E-06	3.5E-07	No	4.00E-02	Low	Nephropathy,changes in liver weight,hematology	Gavage/IRIS	3000	1	9E-05	9E-06	
PYRENE	6.1E-07	6.3E-08	No	3.00E-02	Low	Kidney effects	Gavage/IRIS	3000	1	2E-05	2E-06	
BUTYLBENZYLPHTHALATE	1.6E-06	1.6E-07	No	2.00E-01	Low	Effects on body weight gain, testes,liver,kidney	Diet/IRIS	10000	1	8E-06	8E-07	
BENZO(a)ANTHRACENE	5.6E-06	5.8E-07	No	NA			NA/IRIS			NA	NA	
CHRYSENE	4.0E-06	4.1E-07	No	NA			NA/IRIS			NA	NA	
bis(2-ETHYLHEXYL)PHTHALATE	3.3E-06	3.4E-07	No	2.00E-02	Medium	Increased relative liver weight	Diet/IRIS	1000	1	2E-04	2E-05	
BENZO(b)FLUORANTHENE	3.5E-06	3.7E-07	No	NA			NA/IRIS			NA	NA	
BENZO(k)FLUORANTHENE	2.1E-06	2.2E-07	No	NA			NA/IRIS			NA	NA	
BENZO(a)PYRENE	9.6E-06	1.0E-06	No	NA			NA/IRIS			NA	NA	
INDENO(1,2,3-cd)PYRENE	5.0E-06	5.2E-07	No	NA			NA/IRIS			NA	NA	
BENZO(g,h,i)PERYLENE	1.5E-05	1.5E-06	No	NA			NA/IRIS			NA	NA	
PESTICIDES / PCB'S												
AROCLOR-1248	2.5E-05	2.6E-06	No	NA			NA/IRIS			NA	NA	
AROCLOR-1254	1.5E-05	1.6E-06	No	NA			NA/IRIS			NA	NA	
AROCLOR-1260	2.9E-07	3.0E-08	No	NA			NA/IRIS			NA	NA	

TABLE A.5-9
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 5 – Residential (Future)

CHEMICAL	CHRONIC DAILY INTAKE ADULT (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFC (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFC BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT ADULT	PATHWAY HAZARD INDEX (HI)
EXPOSURE PATHWAY: INHALATION OF CHEMICALS ADSORBED TO DUST									CHILD ADULT	NA 8E-02
INORGANICS										
ALUMINUM	1.5E-06	No	NA			NA/IRIS			NA	
ANTIMONY	1.0E-09	No	4.00E-04						3E-06	
ARSENIC	3.6E-10	No	1.00E-03						4E-07	
BARIUM	1.4E-08	No	1.00E-04		Fetotoxicity	HEAST	1000		1E-04	
BERYLLIUM	9.6E-10	No	5.00E-03						2E-07	
CADMIUM	1.7E-10	No	1.00E-03						2E-07	
CHROMIUM III	4.3E-08	No	5.71E-07		Nasal mucosa atrophy	HEAST	300		8E-02	
CHROMIUM VI	7.1E-10	No	5.71E-07		Nasal mucosa atrophy	HEAST	300		1E-03	
COBALT	7.7E-10	No	NA			NA/IRIS			NA	
COPPER	2.8E-09	No	NA			NA/IRIS			NA	
LEAD	9.9E-09	No	NA		CNS effects	NA/IRIS			NA	
MANGANESE	7.7E-08	No	1.00E-04	Medium	Increased prevalance of respiratory disease and psycomotor disturbances	Occupational/IRIS	300	3	8E-04	
MERCURY	2.3E-11	No	9.00E-05		Neurotoxicity	Occupational/HEAST	30		3E-06	
NICKEL	4.0E-08	No	NA			NA/IRIS			NA	
SELENIUM	1.2E-10	No	NA			NA/IRIS			NA	
SILVER	2.1E-10	No	NA			NA/IRIS			NA	
VANADIUM	2.7E-07	No	7.00E-03						4E-05	
ZINC	1.2E-08	No	2.00E-01						6E-08	
BORON	6.0E-09	No	NA			NA/IRIS			NA	
NIOBIUM	1.2E-08	No	NA			NA/IRIS			NA	
STRONTIUM	7.4E-09	No	NA			NA/IRIS			NA	
TITANIUM	2.6E-08	No	NA			NA/IRIS			NA	
ZIRCONIUM	1.6E-08	No	NA			NA/IRIS			NA	
VOLATILE ORGANICS										
ACETONE	1.5E-11	No	NA			NA/IRIS			NA	
CARBON DISULFIDE	5.4E-13	No	3.00E-03		Fetal toxicity	HEAST	1000		2E-10	
1,2-DICHLOROETHENE (total)	3.5E-13	No	NA			NA/IRIS			NA	
2-BUTANONE	1.1E-12	No	9.00E-02		CNS	HEAST	1000		1E-11	
TRICHLOROETHENE	6.2E-13	No	NA			NA/IRIS			NA	
BENZENE	2.7E-11	No	NA			NA/IRIS			NA	
TETRACHLOROETHENE	6.4E-13	No	NA			NA/IRIS			NA	
TOLUENE	6.7E-13	No	6.00E-01		CNS effects, eyes and nose irritation	HEAST	100		1E-12	
ETHYLBENZENE	2.4E-12	No	3.00E-01	Low	Developmental toxicity	IRIS	300	1	8E-12	
XYLENE (total)	9.0E-12	No	9.00E-02		CNS effects, eyes and nose irritation	HEAST	100		1E-10	
BASE NEUTRAL / ACIDS										
PHENOL	3.2E-11	No	NA			NA/IRIS			NA	
BENZOIC ACID	2.7E-11	No	NA			NA/IRIS			NA	
NAPHTHALENE	2.3E-11	No	4.00E-03						6E-09	
4-NITROPHENOL	1.8E-10	No	NA			NA/IRIS			NA	
2,4-DINITROTOLUENE	2.0E-11	No	NA			NA/IRIS			NA	
PENTACHLOROPHENOL	4.9E-10	No	NA			NA/IRIS			NA	
PHENANTHRENE	2.3E-11	No	NA			NA/IRIS			NA	
ANTHRACENE	1.5E-11	No	3.00E-01						5E-11	
DI-n-BUTYLPHALATE	1.6E-11	No	1.00E-01						2E-10	
FLUORANTHENE	4.6E-11	No	4.00E-02						1E-09	
PYRENE	8.2E-12	No	3.00E-02						3E-10	
BUTYLBENZYLPHTHALATE	2.1E-11	No	2.00E-01						1E-10	
BENZO(a)ANTHRACENE	7.4E-11	No	NA			NA/IRIS			NA	
CHRYSENE	5.3E-11	No	NA			NA/IRIS			NA	
bis(2-ETHYLHEXYL)PHTHALATE	4.4E-11	No	2.00E-02						2E-09	
BENZO(b)FLUORANTHENE	4.7E-11	No	NA			NA/IRIS			NA	
BENZO(k)FLUORANTHENE	2.8E-11	No	NA			NA/IRIS			NA	
BENZO(a)PYRENE	1.3E-10	No	NA			NA/IRIS			NA	
INDENO(1,2,3-cd)PYRENE	6.7E-11	No	NA			NA/IRIS			NA	
BENZO(g,h,i)PERYLENE	2.0E-10	No	NA			NA/IRIS			NA	
PESTICIDES / PCB'S										
AROCLOR-1248	3.4E-10	No	NA			NA/IRIS			NA	
AROCLOR-1254	2.0E-10	No	NA			NA/IRIS			NA	
AROCLOR-1260	3.9E-12	No	NA			NA/IRIS			NA	

NA: Not Applicable

APPENDIX B

TOXICITY PROFILES

INORGANICS

Aluminum

Aluminum is one of the most abundant metals in the earth's crust, and it is ubiquitous in air, water and soil (Goyer, 1986). The toxicity of aluminum can be divided into three major categories: (1) the effect of aluminum compounds on the gastrointestinal tract; (2) the effect of inhalation of aluminum compounds; and (3) systemic toxicity of aluminum (Alfrey, 1981). Aluminum compounds can alter absorption of other elements in the gastrointestinal tract (i.e., fluoride, calcium, iron, cholesterol, phosphorus) and alter gastrointestinal tract motility by inhibition of acetylcholine-induced contractions. Inhalation of aluminum dusts can lead to the development of pulmonary fibrosis producing both restrictive and obstructive pulmonary disease (Schaver, 1948). A progressive fatal neurologic syndrome has been noted in patients on long-term intermittent hemodialysis treatment for chronic renal failure (Alfrey et al., 1972) and may be due to aluminum intoxication. Symptoms in these patients include a speech disorder followed by dementia, convulsions and myoclonus. Aluminum content of brain, muscle and bone tissues is increased in these patients. Sources of the excess aluminum may be from oral aluminum hydroxide commonly given to these patients or from aluminum in dialysis fluid derived from tap water used to prepare the dialysate fluid. Data has been evaluated and found to be inadequate for quantitative risk assessment (EPA, 1991a).

Antimony

The best characterized human health effect associated with the inhalation of antimony is myocardial damage. The suggested no-observed-adverse-effect-level (NOAEL) for antimony induced myocardial damage is 0.003 mg antimony/kg body weight (bw)/day (mg/kg/day). This

is based upon studies by Brieger et al. (1954). The chronic oral Reference Dose (RfD) for antimony is 4E-04 mg/kg/day (EPA, 1991), and is based on a chronic rat bioassay (Schroeder et al., 1970). Rats were administered 5 mg/kg (0.35 mg/kg bw/day) potassium antimony tartrate in drinking water for two years. The critical effects associated with this study are a decrease in longevity, a decrease in fasting blood glucose levels and an alteration in cholesterol levels. An uncertainty factor of 1,000 was applied to the lowest observed adverse effect level (LOAEL) of 0.35 mg/kg bw/day to obtain the RfD. The confidence level in this RfD is low since there was only 1 dose level of antimony used and no observed adverse effect level (NOAEL) was established.

This compound has not been evaluated by the U.S. EPA for evidence of human carcinogenic potential (EPA, 1991).

Arsenic

Symptoms of arsenic intoxication consist of fever, anorexia, hepatomegaly, melanosis, and cardiac arrythmia. Other features include upper respiratory tract symptoms, peripheral neuropathy, and gastrointestinal, cardiovascular and hematopoietic effects. Liver injury is characteristic of longer term or chronic exposure (Goyer, 1986).

The chronic oral RfD is 1E-03 mg/kg/day (EPA, 1991a value pending current review). The critical effects associated with arsenic ingestion are keratosis and hyperpigmentation at a dose of 1 ug/kg/day in humans (Tseng et al., 1977).

The EPA weight of evidence classification for the carcinogenicity of this compound is "A" - a human carcinogen. Exposure to arsenic by the oral route is known to produce skin cancer, while inhalation will cause lung cancer. The slope factors for these carcinogenic effects

are 5E-05 ug/l (1.75 mg/kg/day) (Tseng et al., 1977) and 4.3E-03 ug/m^3 (5E+01 mg/kg/day) (Brown and Chu, 1983a, b, c; Lee-Feldstein, 1983; Higgins, 1982; Enterline and Marsh, 1982), respectively (EPA, 1991).

Barium

Symptoms of accidental poisoning from ingestion of soluble barium salts has resulted in gastroenteritis, muscular paralysis, decreased pulse rate, and ventricular fibrillation and extra-systoles (Goyer, 1986).

The chronic oral RfD for barium is 7E-2 mg/kg/day (EPA, 1991) and is based upon drinking water studies in humans (Wones et al., 1990; Brenniman and Levy, 1984) and various rodent studies (Perry et al., 1983; McCauley et al., 1985; Schroder and Mitchner, 1975a, b; Tardiff et al., 1980). Womes et al. (1990) administered barium (as barium chloride) in the drinking water of 0 mg/L for weeks 0-2; 5 mg/L for weeks 3-6; and 10 mg/L for weeks 7-10. A NOAEL of 10 mg/L was identified in this study which corresponds to 0.21 mg/kg/day. An uncertainty factor of 3 was applied to the NOAEL to obtain this RfD. The confidence level in this RfD is medium.

Occupational poisoning to barium is uncommon, but a benign pneumoconiosis (baritosis) may result from inhalation of barium sulfate dust and barium carbonate. It is not incapacitating and is usually reversible with cessation of exposure.

A chronic inhalation RfD for barium has been established as 1E-4 mg/kg/day (EPA, 1991a) on the basis of a chronic inhalation study in rats (Tarasenko et al., 1977). The LOAEL following barium inhalation was 1.15 mg $BaCO_3/m^3$ (0.80 mg/Ba/m^3) 4 hours/day for 4 months

(corresponds to 0.14 mg BA/kg/day). The critical effect observed was fetotoxicity. An uncertainty factor of 1,000 was applied to the LOAEL to obtain the RfD.

Barium has not been evaluated by the U.S. EPA for evidence of human carcinogenic potential (EPA, 1991).

Beryllium

The major toxicologic effects of beryllium are on the lung. It may produce an acute chemical pneumonitis, hypersensitivity or chronic granulomatous pulmonary disease (berylliosis) (Goyer, 1986).

The chronic oral RfD for beryllium is 5E-03 mg/kg/day (EPA, 1991). This value is based upon a study by Schroeder and Mitchner (1975). Beryllium was administered to rats over their lifetime in their drinking water at a concentration of 5 mg/kg (0.54 mg/kg/day). There were no observed adverse effects. An uncertainty factor of 100 was applied to the NOAEL to obtain the RfD. The confidence level for this RfD is low.

Beryllium compounds have been shown to induce malignant tumors of the lung in rats and monkeys and osteogenic sarcoma in rabbits.

The EPA weight of evidence classification for the carcinogenicity of this compound is "B2" - a probable human carcinogen (sufficient animal evidence, inadequate/no human evidence). The oral slope factor for beryllium is 4.3 $mg/kg/day^{-1}$ (EPA, 1991) and is based on a study by Schroeder and Mitchner (1975). The inhalation slope factor for beryllium is 2.4E-3 ug/m^3 (8.4E+0 mg/kg/day) (EPA, 1991) and is based upon Wagoner et al. (1980).

Cadmium

Ingestion of cadmium results in nausea, vomiting and abdominal pain. Inhalation of cadmium fumes may result in an acute chemical pneumonitis and pulmonary edema (Goyer, 1986).

The chronic oral RfDs for cadmium are 5E-04 mg/kg/day (water) and 1E-03 mg/kg/day (food) (EPA, 1991). The critical effects associated with chronic ingestion of cadmium are proteinuria and renal damage in humans. An uncertainty factor of 10 was applied in order to determine the RfD. The confidence level for this RfD is high.

The EPA weight of evidence classification for the carcinogenicity of this compound is "B1" - a probable human carcinogen (limited human evidence). The inhalation of cadmium has been shown to produce respiratory tract cancers and an inhalation slope factor of 1.8E-03 ug/m^3 (6.3 mg/kg/day) has been established based on Thun et al. (1985) (EPA, 1991). There are no positive studies of orally ingested cadmium suitable for quantitation (EPA, 1991).

Chromium VI

Note: Total chromium only was measured on-site. Total chromium was broken down to Cr III and Cr VI based on a 7:1 ratio (7/8 of total chromium is Cr III; 1/8 of total chromium of Cr VI).

The chronic oral Rfd for chromium VI is 5E-03 mg/kg/day (EPA, 1991) and is based upon a study by MacKenzie et al. (1958) in which no adverse effects were observed in rats which received 0-11 mg/l or 25 mg/l chromium in drinking water for 1 year. No adverse effects were seen in humans drinking well water contaminated with 1 mg/l chromium VI for 3 years.

An uncertainty factor of 500 was applied to the NOAEL to obtain the RfD. The confidence level in this RfD is low.

The chronic inhalation RfD for chromium VI has been established and verified as 2E-6 mg/m^3 (EPA, 1991a). Workgroup concurrence on the final data base file and IRIS input are pending. This value is based upon inhalation exposure in humans (Lindberg and Hedenstierna, 1983). The LOAEL was 0.002 mg/m^3 (as chromic acid) and the critical effect observed was nasal mucosa atrophy. An uncertainty factor of 300 was applied to the LOAEL to obtain the RfD.

The EPA weight of evidence classification for carcinogenicity of this compound by the inhalation route is "A" - a human carcinogen (EPA, 1991). Chromium VI produces lung tumors and an inhalation slope factor of 1.2E-02 ug/m^3 (4.2E+01 mg/kg/day) has been established based upon a study by Mancuso, 1975. There is insufficient evidence for carcinogenicity of this compound by the oral route.

Cobalt

Cobalt is essential as a component of Vitamin B12 which is required for the production of red blood cells. Cobalt is well absorbed orally, probably in the small intestine. Excessive cobalt intake is known to result in cardiomyopathy. One mg/kg cobalt was added to beer to enhance its foaming properties and the resultant signs and symptoms were those of congestive heart failure. Autopsy findings revealed a ten-fold increase in the cardiac levels of cobalt. Occupational exposure may result in respiratory symptoms (Goyer, 1986). No RfDs were found in either Integrated Risk Information Service (IRIS) (EPA, 1991) or Health Effects Assessment Summary Tables (HEAST) (EPA, 1991a).

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991a).

Copper

A single dose of 5.3 mg copper resulted in local gastrointestinal tract irritation in humans. A chronic oral RfD is reported as 1.3 mg/l, which is the current drinking water standard for copper (EPA, 1991a). The Drinking Water Criteria Document concluded toxicity data were inadequate for calculating an actual RfD for copper (U.S. EPA, 1987).

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

Lead

The health effects of lead have been well characterized through decades of medical and scientific observation. Some of these effects include cognitive and motor defects in children, lead induced anemias, increased susceptibility to viral infections and in chronic adult lead poisoning, peripheral neuropathies. It appears that some of these effects particularly the changes in the levels of certain blood enzymes and in aspects of children's neurobehavioral development, may occur at blood lead levels so low as to be essentially without a threshold. Therefore the EPA has considered it inappropriate to develop an RfD for inorganic lead (Goyer, 1986; EPA, 1991).

The EPA weight of evidence classification for the carcinogenicity of this compound is "B2" - a probable human carcinogen (sufficient animal evidence, inadequate/no human evidence). Lead has been shown to produce renal tumors (Azar et al., 1973; Kasprzak et al.,

1985; Koller et al., 1986; Van Esch and Kroes, 1969), however due to the many uncertainties associated with quantifying lead's cancer risk, it has been recommended that a numerical estimate not be used (EPA, 1991).

Manganese

Exposure to manganese results in two types of toxicities. The first, the result of acute inhalation exposure, results in manganese pneumonitis. The second, and more serious of the two, results from chronic exposure to manganese either by the oral or inhalation routes. Chronic manganese poisoning results in a psychiatric disorder characterized by psychological and motor difficulties (Goyer, 1986). The chronic oral RfD has been set at 1E-01 mg/kg/day (EPA, 1991) in order to prevent the central nervous system effects. This value is based upon studies by WHO (1973), Schroeder et al. (1966) and NRC (1989). The chronic RfD for inhalation is 4E-4 mg/m^3 (1E-04 mg/kg/day) (EPA, 1991) and is based upon a study by Roels et al. (1987). An uncertainty factor of 300 was applied to the LOAEL to obtain the RfD. The confidence level in these RfDs is medium.

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991a).

Mercury

Exposure to mercury vapor may produce an acute, corrosive bronchitis and interstitial pneumonitis resulting in either death or symptoms of central nervous system effects such as tremor or increased excitability. Ingestion of mercuric salts results in corrosive ulceration, bleeding and necrosis of the gastrointestinal tract usually accompanied by shock and circulatory

collapse. Renal failure occurs within 24 hours. Chronic mercury poisoning mainly affects the central nervous system. Characteristic symptoms include increased excitability, tremors, gingivitis, and increased salivation. There have been some instances of proteinuria and renal damage in persons chronically exposed to mercury vapors (Goyer, 1986). The chronic oral RfD for mercury is 3E-04 mg/kg/day (EPA, 1991a) (value pending current review), in order to prevent the critical effect of renal damage. This value is based upon the findings of several studies (Druet et al., 1978; Bernaudin et al., 1981; and Andres, 1984). An uncertainty factor of 1,000 was applied in order to determine the RfD.

The chronic RfD value for inhalation for mercury is 3E-4 mg/m^3 (9E-06 mg/kg/day) (value pending current review) (EPA, 1991a) and is based upon several occupational studies (Fawer et al., 1983; Piikivi and Tolonen, 1989; Piikivi and Hanninen, 1989; Piikivi, 1989). Neurotoxicity was the critical effect following inhalation exposure. An uncertainty factor of 30 was applied to obtain the RfD.

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

Nickel

Nickel is a common allergen which results in allergic contact dermatitis (Goyer, 1986). There is an inhalation RfD available for nickel; however, an oral RfD of 2E-02 mg/kg/day is available, but under consideration by EPA (EPA, 1991).

The EPA weight of evidence classification for carcinogenicity of this compound by the inhalation route is "A" - a human carcinogen. Nickel produces lung tumors and an inhalation slope factor of 2.4E-4 ug/m^3 (8.4E-01 mg/kg/day) has been established (EPA, 1991). This value

is based on Chovil et al. (1981), Enterline and Marsh (1982), Magnus et al. (1982), and Peto et al. (1983). There is insufficient evidence for carcinogenicity of this compound by the oral route.

Selenium

The availability as well as toxic potential of selenium is related to its chemical form. Selenates are readily absorbed from the gastrointestinal tract whereas elemental selenium is probably not absorbed. Acute selenium poisoning produces central nervous system effects including nervousness, drowsiness and sometimes convulsions. Eye and nasal irritation may occur from exposure to vapors. Signs of chronic selenium intoxication in humans may include discolored or decaying teeth, skin eruptions, gastrointestinal distress, lassitude and partial loss of hair and nails (Goyer, 1986). The chronic oral RfD for selenium is 5E-3 mg/kg/day (EPA, 1991) based upon studies by Yang et al. (1989). The critical effects associated with selenium exposure are chemical selenosis, including CNS abnormalities. An uncertainty factor of 3 was applied to the NOAEL in sensitive individuals to obtain the RfD. The confidence level in this RfD is medium. A chronic inhalation RfD is not available (EPA, 1991).

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991a).

Silver

The major effect of excessive absorption of silver is local or generalized impregnation of the tissues where it remains as silver sulfide, which forms an insoluble complex in elastic fibers resulting in argyria (Goyer, 1986).

The chronic oral RfD for silver is 3E-3 mg/kg/day (value may change pending current review) (EPA, 1991) and is based upon 1-3 year therapeutic treatments with silver in humans. In all studies argyria was the critical effect. In Gaul and Staud (1935), the LOAEL of 1.0 g (total dose) was established. The doses were administered iv over a 2 to 3 year period as silver arsphemamine. Blumberg and Carey (1934) estimated the total dose from a dosing schedule for silver nitrate taken orally for 1 year as 6.4 g. East et al., (1980) estimated the LOAEL to be 7.2 (total oral dose) in a subject who had ingested silver acetate over a period of 2.5 years. From these three studies, the LOAEL was calculated to be 0.0052 mg/kg/day. An uncertainty factor of 2 was applied to obtain the RfD. The confidence level in this RfD is medium.

The chronic inhalation RfD for silver is not available at this time (EPA, 1991).

The EPA weight of evidence classification of the human carcinogenic potential of silver is "D" - not classified as to human carcinogenicity (EPA, 1991).

Thallium

Thallium is one of the more toxic metals and can cause neural, hepatic and renal injury. It may also cause deafness and loss of vision. In some cases, deaths in humans have been reported as a result of long-term systemic thallium intake. These cases usually are caused by the contamination of food or the use of thallium as a depilatory (Browning, 1969; Fowler, 1982). The chronic oral RfD for thallium (soluble salts) is 7E-5 mg/kg/day (EPA, 1991a) and is based on a subchronic feeding study in rats (MRI, 1986). Administration of 0.20 mg thallium/kg/day for 90 days to rats produced increased SGOT levels and serum LDH levels and alopecia. An uncertainty factor of 3,000 was used to obtain this RfD. A chronic inhalation RfD for thallium is not available at this time (EPA, 1991a).

Vanadium

Vanadium is an ubiquitous element. Industrial exposure to vanadium may lead to bronchitis and bronchopneumonia. Vanadium overexposure may also cause skin and eye irritation, gastrointestinal distress, nausea, vomiting, abdominal pain, cardiac palpitation, tremor, nervous depression and kidney damage (Goyer, 1986). Ingestion of vanadium compounds may produce gastrointestinal disturbances, slight abnormalities of clinical chemistry related to renal function and nervous system effects. The chronic oral RfD for vanadium is 7E-3 mg/kg/day (under review by RfD/RfC Work Group) (EPA, 1991a) and is based on a chronic drinking water study in rats (Schroeder et al., 1970). No critical effects were observed in the rat following administration of 5 mg/kg vanadium from vanadyl sulfate in drinking water for lifetime (converted to 0.7 mg/kg/day). An uncertainty factor of 100 was applied to the NOEL to obtain this RfD.

Short term inhalation exposure to high levels of vanadium has been shown to produce toxic effects in the lung, kidney, liver, adrenals and bone marrow in experimental animals (Waters, 1977). A chronic inhalation RfD for vanadium is not available at this time (EPA, 1991a).

Zinc

Zinc is ubiquitous in the environment so that it is present in most food stuffs, water and air. About 20 to 30 percent of ingested zinc is absorbed. Acute toxicity from the ingestion of excessive zinc is uncommon (Goyer, 1986). The chronic oral RfD for zinc is 2E-01 mg/kg/day (EPA, 1991a) (value pending current review). This value is based on a therapeutic dosage of

2.14 mg/kg/day in man which resulted in anemia (Pories et al., 1967; Prasad et al., 1975). An uncertainty factor of 10 was applied to obtain the RfD.

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

Cyanide

The chronic oral RfD for cyanide is 2E-2 mg/kg/day (EPA, 1991) and is based upon a chronic oral feeding study in rats (Howard and Hanzal, 1955) and a subchronic to chronic oral bioassay in rats (Philbrick et al., 1979). The latter study showed decreased weight gain and thyroxin levels and myelin degeneration in rats at 30 mg/kg/day (established as the LOAEL). In the Howard and Hanzal 2 year dietary study (1955), rats were administered food fumigated with cyanide. At doses of 4.3 or 10.8 mg/kg/day, cyanide produced no treatment related effects on growth rate, no gross signs of toxicity and no histopathological lesions. An uncertainty factor of 100 and a modifying factor of 5 were supplied to the NOEL of 10.8 mg/kg/day to obtain the RfD. The confidence level in this RfD is medium.

The chronic inhalation RfD for cyanide is not available at this time (EPA, 1991).

The EPA weight of evidence classification for the human carcinogenic potential of this compound is "D" - not classifiable as a human carcinogen (EPA, 1991).

Boron

The major toxicologic effects of boron are on the lung. Through occupational exposure, boron has been shown to induce pulmonary edema and hemorrhage in the alveolus (Menzel and Amdur, 1986; Dixon, 1986).

The chronic oral RfD for boron is 9E-2 mg/kg/day (EPA, 1991). This value is based upon a two year dietary study in dogs (Weir and Fisher, 1972). In this study, the NOAEL was established at 350 mg/kg (8.8 mg/kg/day). In an additional study, dogs were fed 1,170 mg/kg (29 mg/kg/day) for 38 weeks and severe testicular atrophy and spermatogenic arrest were observed. An uncertainty factor of 100 was applied to the NOAEL to obtain the RfD. The modifying factor was 1. The confidence level for this RfD is medium. The chronic inhalation RfD for boron has not been determined (EPA, 1991).

Boron has not been evaluated by the U.S. EPA for evidence of carcinogenicity (EPA, 1991).

Niobium

No RfDs were found in either IRIS or HEAST (EPA, 1991).

Niobium has not been evaluated by the U.S. EPA for evidence of carcinogenicity (EPA, 1991).

No critical effects were observed in the rat following administration of 5 ppm niobium from sodium niobate in drinking water for lifetime (converted to 0.7 mg/kg/day) (Schroeder, et al. 1970).

Strontium

Strontium, a metabolic analog of calcium, is readily absorbed from the gastrointestinal tract or the lungs into the bloodstream and is subsequently deposited in bone (Hobbs and McClellan, 1986). The adverse health effects associated with strontium exposure are currently

under review by an EPA work group (EPA, 1991) and consequently chronic oral and inhalation RfD values are not available at this time.

Strontium has not been evaluated by the U.S. EPA for evidence of carcinogenicity (EPA, 1991).

Titanium

Titanium compounds have been found to exist in the oxidation state +4 (titanic), +3 (titanous) and +2, as well as in several organometallic compounds (Goyer, 1986). Titanium dioxide, the most frequently occurring compound, is present in urban airs, rivers and drinking water and is detectable in many foods. Occupational exposure to titanium may be heavy and is associated with hyperplasia of the bronchial epithelium and pulmonary fibrosis following inhalation exposure (Menzel and Amdur, 1986). No RfDs were found in either IRIS or HEAST.

Titanium has not been evaluated by the U.S. EPA for evidence of carcinogenicity (EPA, 1991).

Zirconium

No RfDs were found in either IRIS or HEAST (EPA, 1991). No critical effects were observed in the rat following administration of 5 ppm zirconium from zirconium sulfate in drinking water for lifetime (converted to 0.7 mg/kg/day) (Schroeder, et al. 1970).

Zirconium has not been evaluated by the U.S. EPA for evidence of carcinogenicity (EPA, 1991).

Fluoride

It is well recognized that small amounts of fluoride have a beneficial effect in the reduction of dental cares, especially in children. However, chronic intake of excessive fluoride over a long period of time has been shown to produce dental fluorosis and skeletal fluorosis (Menzer and Nelson, 1986).

The chronic oral RfD for fluoride is 6E-2 mg/kg/day. This value is based upon an epidemiologic study in children consuming fluoride (0-14 mg/kg) in their drinking water (Hodge, 1950). The LOAEL was 2 mg/kg and the critical effect observed was dental mottling (objectionable dental fluorosis, a cosmetic effect). An uncertainty factor of 1 was applied to the NOAEL (1 mg/kg converted to 0.06 mg/kg/day) to obtain the RfD. The confidence level in this RfD is high.

The chronic inhalation RfD has not been determined (EPA, 1991).

Fluoride has not been evaluated by the U.S. EPA for evidence of carcinogenicity (EPA, 1991).

VOLATILE ORGANICS

Chloromethane

No RfDs were found in IRIS or HEAST.

Route-to-route extrapolation was used to establish an oral slope factor of 1.3E-2 mg/kg/day. An inhalation slope factor of 6.3E-3 mg/kg/day has been established for chloromethane (EPA, 1991a). These values are based on a 24-month inhalation study in mice where kidney tumors were induced following chloromethane (CIIT, 1981). The EPA weight of

evidence classification for the carcinogenicity of this compound is "C" - possible human carcinogen (inadequate human data, limited animal evidence) (EPA, 1991).

Methylene Chloride

The chronic oral RfD for methylene chloride is 6E-2 mg/kg/day (EPA, 1991) and is based on a drinking water bioassay in rats (National Coffee Association, 1982). Rats were given methylene chloride at doses of 5, 50, 125 or 250 mg/kg/day in drinking water for 2 years. The LOAEL was 52.58 and 58.32 mg/kg/day for males and females, respectively and the critical effect was liver toxicity. The NOAEL was 5.85 and 6.47 mg/kg/day for males and females, respectively and an uncertainty factor of 100 was applied to this NOAEL to obtain the RfD. The confidence level in this RfD is medium.

The chronic inhalation RfD for methylene chloride is 3E+0 mg/m^3 (9E-01 mg/kg/day) (work group concurrence on final data base file and IRIS input pending) (EPA, 1991a). This value is based upon a chronic inhalation study in rats (Nitschke et al., 1988). Rats were exposed to methylene chloride 6 hours/day, 5 days/week for 2 years. The NOAEL was 694.8 mg/m^3 and an uncertainty factor of 100 was applied to obtain the RfD.

The EPA weight of evidence classification for human carcinogenicity is "B2" - probable human carcinogen. Methylene chloride has been shown to induce increased incidence of hepatocellular neoplasms and alveolar/bronchiolar neoplasms in male and female mice, and increased incidence of benign mammary tumors in both sexes of rats, salivary gland sarcomas in male rats and leukemia in female rats. An oral slope factor of 7.5E-3 mg/kg/day (EPA, 1991) calculated as the arithmetic mean of slope factors derived from an inhalation study (NTP, 1986) and an oral/drinking water study (NCA, 1983) has been established. An inhalation unit

risk factor of 4.7E-7 ug/m^3 (1.6E-03 mg/kg/day) (EPA, 1991) has been established based upon the induction of adenomas and carcinomas (liver and lung) in mice following inhalation exposure (NTP, 1986).

Acetone

The chronic oral RfD for acetone is 1E-1 mg/kg/day (EPA, 1991) and is based on a subchronic oral study in rats (U.S. EPA, 1986). Acetone was administered by gavage for 90 days to groups of albino rats of 0, 100, 500 or 2,500 mg/kg/day. The LOAEL was 500 mg/kg/day and the critical effects were increased liver and kidney weights and nephrotoxicity. An uncertainty factor of 1,000 was applied to the NOEL of 100 mg/kg/day to obtain the RfD. The confidence level in this RfD is low.

The chronic inhalation RfD for acetone is not available at this time (EPA, 1991).

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

Carbon Disulfide

Adverse effects of human exposure to carbon disulfide resulting from prolonged exposure to high levels of carbon disulfide include organic brain damage, peripheral nervous system decrements, neurobehavioral dysfunction and ocular and auditory effects. Adverse effects on the cardiovascular system have also been reported (Goyer, 1986).

The chronic oral RfD for carbon disulfide is 1E-1 mg/kg/day (EPA, 1991) (may change pending current review). This value is based on route-to-route extrapolation of data from a rabbit inhalation study (Hardin et al., 1981). Rabbits were exposed to 20 mg/kg or 40 mg/kg

of carbon disulfide for 34 weeks prior to breeding and during the entire length of the pregnancy period. The NOEL for this study was 40 mg/kg (converted to 22.0 mg/kg/day), but this value should not be used to estimate an RfD since Jones-Price et al. (1984a, b) found adverse effects in rabbit fetuses (malformations) following oral exposure of pregnant doses to 25 mg/kg. As a result, 11 mg/kg has been used as the most appropriate basis for an RfD derivation. An uncertainty factor of 100 was applied to the NOEL to obtain the RfD. The confidence level in this RfD is medium.

The chronic inhalation RfD for carbon disulfide is 1E-2 mg/m^3 (3E-03 mg/kg/day) (EPA, 1991a; verified; Workgroup concurrence on final data base file and IRIS input pending) and is based upon an inhalation study in rats (Tabacova et al., 1978, 1983). Rats were exposed to carbon disulfide at different concentrations for 8 hours/day during gestation. The NOAEL was 10 mg/m^3 and the critical effect was fetal toxicity. An uncertainty factor of 1,000 was applied to obtain the RfD.

Carbon disulfide has not been evaluated by the U.S. EPA for evidence of human carcinogenic potential.

1,2-Dichloroethene

The chronic oral RfD for 1,2-dichloroethene is 1E-2 mg/kg/day (verified; workgroup concurrence on final data base and IRIS input pending) and is based on a 90 day rat gavage study (EPA, 1991a). The LOAEL was 32 mg/kg/day and the critical effects observed were decreased hematocrit and hemoglobin. An uncertainty factor of 3000 was applied to the LOAEL to obtain the RfD. A chronic inhalation RfD for 1,2-dichloroethene is not available at this time (EPA, 1991a).

The EPA weight of evidence classification for the carcinogenicity of this compound was not found.

Chloroform

The chronic oral RfD for chloroform is 1E-2 mg/kg/day (EPA, 1991) and is based upon a chronic dog study (Heywood et al., 1979). Beagle dogs received chloroform orally in a toothpaste base by capsule at a dose of 15 or 30 mg/kg/day for 6 days/week for 7.5 years. The LOAEL was 15 mg/kg/day (converted to 12.9 mg/kg/day) and the critical effects observed were fatty cyst formation in the liver and an increase in serum SGPT and SGOT levels. An uncertainty factor of 1,000 was applied to the LOAEL to obtain the RfD. The confidence level in this RfD is medium.

A risk assessment to establish a chronic inhalation RfD for chloroform is under review by an EPA work group (EPA, 1991).

The EPA weight of evidence classification for the carcinogenicity of this compound is "B2" - probable human carcinogen (sufficient animal evidence, inadequate/no human evidence) (EPA, 1991). Chloroform has been shown to produce kidney and/or hepatocellular tumors in rats, mice and beagle dogs (NCI, 1976; Jorgensen et al., 1985). An oral slope factor of 6.1E-3 mg/kg/day has been established (EPA, 1991) based upon the study by Jorgensen et al., 1985. An inhalation unit risk factor of 2.3E-5 ug/m^3 (8.1E-02 mg/kg/day) was established (EPA, 1991) based upon the NCI, 1976 study.

2-Butanone

The chronic oral RfD for 2-butanone has been estimated at 5E-2 mg/kg/day (value may change pending current review) (EPA, 1991) and is based upon route to route extrapolation of a subchronic inhalation study in rats (LaBelle and Briegen, 1955). Rats were exposed to 235 mg/kg of methyl ethyl ketone for 7 hours/day, 5 days/week for 12 weeks. No effects were observed, but only a few parameters were measured. A NOAEL for methyl ethyl ketone was estimated at 130.5 mg/kg/day in a developmental toxicity study in rats (Schwetz et al., 1974). Fetotoxicity was the critical effect. This observed LOAEL was higher than the NOAEL of LaBelle and Brieger (1955) (235 mg/kg converted to 46 mg/kg/day). An uncertainty factor of 1,000 was applied to this NOAEL to obtain the RfD. The confidence level in this RfD is medium.

While currently under review by an EPA Work Group and, therefore, subject to future change (EPA, 1991a), the chronic inhalation RfD was previously established at 9E-2 mg/kg/day based upon the LaBelle and Brieger study (1955). An uncertainty factor of 1,000 was applied to the LOAEL of 92 mg/kg/day to obtain this RfD. CNS toxicity was the critical effect.

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

1,1,1-Trichloroethane

The chronic oral RfD for 1,1,1-trichloroethane is 9E-2 mg/kg/day (EPA, 1991) (value pending current review) and is based upon two inhalation studies in guinea pigs. Torkelson et al. (1958) exposed guinea pigs to 1,1,1-trichloroethane at concentrations of 500, 1,000, 2,000 or 10,000 mg/kg. The NOAEL was 500 mg/kg (converted to 90 mg/kg/day) after exposure for

7 hours/day, 5 days/week for 6 months. Adams et al. (1950) exposed guinea pigs to 1,1,1-trichloroethane at a concentration of 650 mg/kg (converted to 120 mg/kg/day) for 7 hours/day, 5 days/week for 2-3 months. These animals exhibited slight growth retardation, thereby establishing to LOAEL of 650 mg/kg in guinea pigs. An uncertainty factor of 1,000 was applied to the NOAEL of 90 mg/kg/day to obtain the RfD. The confidence level in this RfD is medium to low.

The chronic inhalation RfD for 1,1,1-trichloroethane has been established at 3E-1 mg/kg/day (currently pending review by an EPA Work Group) (EPA, 1991a), on the basis of the inhalation study in guinea pigs mentioned above (Torkelson et al., 1958).

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

Trichloroethene

A risk assessment for this chemical is under review by an EPA work group. Oral and inhalation RfDs have not been established (EPA, 1991).

The evidence of human carcinogenic potential of this compound is currently under review by a CRAVE Workgroup. The previously established oral slope factor value of 1.1E-2 mg/kg/day, based upon a mouse gavage study (liver tumors; NCI, 1976; NTP, 1983), has been removed from IRIS pending further review. New, verified values are pending input into IRIS. The previously established inhalation slope factor of 1.7E-2 mg/kg/day (EPA, 1991a) has also been removed from IRIS pending further review. It is based upon two inhalation studies in mice (Maltoni et al., 1986; Fukuda et al., 1983). Lung tumors were induced. The EPA weight of

evidence classification for the carcinogenicity of this compound is "B2" - probable human carcinogen.

Benzene

The chronic oral and inhalation RfDs for benzene have not been established and are pending review by an EPA work group (EPA, 1991).

The EPA weight of evidence classification for the carcinogenicity of this compound is "A" - human carcinogen. Several studies have shown benzene to increase the incidence of nonlymphocytic leukemia in humans from occupational exposure (Rinsky et al., 1981; Ott et al., 1978; Wong et al., 1983). An oral slope factor of 2.9E-2 mg/kg/day and an inhalation unit risk factor of 8.3E-6 ug/m^3 (2.9E-02 mg/kg/day) have been established (EPA, 1991) based upon these studies.

Tetrachloroethene

The chronic oral RfD for tetrachloroethene is 1E-2 mg/kg/day (EPA, 1991) and is based upon a gavage study in mice (Buben and O'Flaherty, 1985). Swiss-Cox mice were exposed to tetrachloroethene by gavage at doses of 0, 20, 100, 200, 500, 1500, and 2000 mg/kg/day, 5 days/week for 6 weeks. The LOAEL was 100 mg/kg/day (converted to 71 mg/kg/day) and the critical effects observed were increased liver triglycerides and increased liver weight/body weight ratios. An uncertainty factor of 1,000 was applied to the NOAEL of 20 mg/kg/day (converted to 14 mg/kg/day) to obtain the oral RfD. The confidence level in this RfD is medium. A chronic inhalation RfD for tetrachloroethene is not available at this time (EPA, 1991, 1991a).

The evidence of human carcinogenic potential of this compound is currently under review by a CRAVE Workgroup. While this value may change pending the current review, the oral slope factor had previously been established at 5.1E-2 mg/kg/day on the basis of a mouse gavage study (NCI, 1977). Liver tumors were induced following tetrachloroethene administration. The inhalation slope factor has been established at 5.2E-7 ug/m^3 (1.8E-03 mg/kg/day) (currently pending review) (EPA, 1991a) and is based upon an inhalation study in rats and mice. Leukemia and liver lesions were observed following tetrachloroethene exposure (NTP, 1986). The EPA weight of evidence classification for the carcinogenicity of this compound is "B2" - probable human carcinogen.

Toluene

The chronic oral RfD for toluene is 2E-01 mg/kg/day (EPA, 1991) and is based on a subchronic oral gavage study in rats (NTP, 1989). F344 rats received oral doses of 0, 312, 625, 1250, 2500, or 5000 mg/kg/day for 5 days/week for 13 weeks. The LOAEL was 625 mg/kg/day and the critical effects observed were changes in liver and kidney weights. An uncertainty factor of 1,000 was applied to the NOAEL of 223 mg/kg/day (adjusted from 312 mg/kg/day to take into account 5/7 day exposure) to obtain the RfD. The confidence level in this RfD is medium. There were no adverse effects seen in human volunteers exposed to 100 mg/kg for twenty minutes. When exposed to 200 mg/kg for twenty minutes they exhibited incoordination, exhilaration, and prolonged reaction times.

The chronic inhalation RfD for toluene is 6E-01 mg/kg/day (2E+0 mg/m^3) (EPA, 1991a) and is based upon human exposure data (Anderson et al., 1983; CIIT, 1980). This value is currently under review by an EPA work group (EPA, 1991). Humans were exposed to toluene

at a concentration of 40 mg/kg for 6 hours and the critical effects observed were CNS effects and eyes and nose irritation. An uncertainty factor of 100 was applied to the NOAEL of 151 mg/m^3 to obtain this RfD.

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

Ethylbenzene

The chronic oral RfD for ethylbenzene is 1E-01 mg/kg/day (EPA, 1991) and is based on a oral subchronic rat bioassay (Wolf et al., 1956). Rats received oral doses of 13.6, 136, 408, or 680 mg/kg/day in olive oil for 26 weeks. The LOAEL was 408 mg/kg/day and the critical effects observed were liver and kidney toxicity. An uncertainty factor of 1,000 was applied to the NOAEL of 97.1 mg/kg/day (adjusted from 136 mg/kg/day to take into account 5/7 day exposure) to obtain the RfD. The confidence level in this RfD is low. There were no adverse effects seen in human volunteers exposed to 100 mg/kg (435 mg/cu.m) for eight hours.

The chronic inhalation RfD has been established and verified as 3E-01 mg/kg/day (1E+0 mg/m^3) (EPA, 1991) and is based upon inhalation studies in rats and rabbits (Andrew et al., 1981; Hardin et al., 1981). Rats were exposed to ethylbenzene on gestation days 1-19 and rabbits were exposed on gestation days 1-24. Exposures were for 6-7 hours/day. The NOAEL was 434 mg/m^3 and the critical effect observed was developmental toxicity. An uncertainty factor of 300 was applied to the NOAEL. The confidence level in this RfD is low.

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

Xylenes

The chronic oral RfD for toluene is 2E+00 mg/kg/day (EPA, 1991) and is based on a chronic oral gavage study in rats and mice (NTP, 1986). Rats and mice were given oral gavage doses of 0, 250 or 500 mg/kg/d (rats) and 0, 500 or 1,000 mg/kg/d (mice) for 5 days/week for 105 weeks. There was a dose-related increase in the mortality levels seen in male rats, as well as hyperactivity and decreased body weights. An uncertainty factor of 100 was applied to the NOAEL of 179 mg/kg/day (adjusted from 250 mg/kg/day to take into account 5/7 day exposure) to obtain the RfD. The confidence level in this RfD is medium.

The chronic inhalation RfD for xylene is 3E-1 ug/m^3 (9E-02 mg/kg/day) (EPA, 1991a) and is based upon human exposure data (Hake et al., 1981; Carpenter et al., 1975). This value is currently pending review (EPA, 1991). Humans were exposed to xylenes at a concentration of 20 mg/kg for 7.5 hours/day for 5 days and the critical effects observed were CNS effects and nose and throat irritation. An uncertainty factor of 100 was applied to the NOAEL of 27 mg/m^3 to obtain this RfD.

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

BASE NEUTRAL/ACIDS

Phenol

The chronic oral RfD for phenol is 6E-1 mg/kg/day (EPA, 1991) and is based upon a developmental study in rats (NTP, 1983). Pregnant CD rats were administered phenol by gavage at doses of 0, 30, 60, and 120 mg/kg/day on gestational days 6 to 15. The LOAEL was 120 mg/kg/day and the critical effect observed was a highly significant reduction in fetal body

weights. An uncertainty factor of 100 was applied to the highest fetal NOAEL in this study (60 mg/kg/day) to obtain the RfD. The confidence level in this RfD is low to medium.

The health effects data for phenol have been reviewed by the U.S. EPA RfD/RfC Work Group and determined to be inadequate for derivation of an inhalation RfD (EPA, 1991).

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

2-Chlorophenol

The chronic oral RfD for 2-chlorophenol is 5E-3 mg/kg/day (EPA, 1991) and is based upon a subchronic drinking water study in rats (Exon and Koller, 1982). Weanling female Sprague-Dawley rats were exposed to 0, 5, 50 or 500 mg/kg of 2-chlorophenol. The rats were bred after 10 weeks of treatment and treatment was continued during breeding, gestation and weaning. The LOAEL was 500 mg/kg and the critical effects were reproductive (an increase in the conception rate and in the number of stillborns as well as a decrease in the size of the litters). An uncertainty factor of 1,000 was applied to the NOAEL (50 mg/kg; converted to 5 mg/kg/day) to obtain the RfD. The confidence level in the RfD is low. The chronic inhalation RfD is not available at this time (EPA, 1991).

2-Chlorophenol has not been evaluated by U.S. EPA for evidence of human carcinogenic potential (EPA, 1991).

Benzoic Acid

The chronic oral RfD for benzoic acid is 4E+0 mg/kg/day (EPA, 1991) and is based on data regarding the amounts of benzoic acid and sodium benzoate produced as a food preservative

(FDA, 1973). The FDA estimated a daily per capita intake of 0.9-34 mg for benzoic acid and 34-328 mg for sodium benzoate. At these levels, there are no reports of toxic effects in humans. These compounds have Generally Recognized as Safe (GRAS) status by FDA. Therefore, the upper ranges can be considered NOAELs for benzoic acid and sodium benzoate. No uncertainty factors are applied and based on conversion factors, the RfD for benzoic acid has been established at 312 mg/day for a 70 kg human or 4 mg/kg/day. The confidence in this RfD is medium.

A chronic inhalation RfD is not available at this time (EPA, 1991).

The EPA weight of evidence classification for the human carcinogenicity of this compound is "D" (EPA, 1991).

2,4-Dichlorophenol

The chronic oral RfD for 2,4-dichlorophenol is 3E-3 mg/kg/day (EPA, 1991) and is based upon a subchronic to chronic drinking water study in rats (Exon and Koller, 1985). Female rats were exposed to 3, 30 or 300 mg/kg 2,4-dichlorophenol in drinking water from weaning age through breeding at 90 days, parturition and weaning of pups. The LOAEL was 30 mg/kg (converted to 3 mg/kg/day) and the critical effects were decreased delayed hypersensitivity response. The NOEL was 3 mg/kg (converted to 0.3 mg/kg/day). An UF of 100 was applied to the NOEL to obtain the RfD. The confidence level in this RfD is low.

The chronic inhalation RfD for 2,4-dichlorophenol is not available at this time (EPA, 1991).

This chemical has not been evaluated by the U.S. EPA for evidence of human carcinogenic potential (EPA, 1991).

Naphthalene

The chronic oral RfD for naphthalene is 4E-03 mg/kg/day (EPA, 1991a) (value pending current review) and is based on a subchronic gavage study in rats (NTP, 1980). An uncertainty factor of 10,000 was applied to the LOAEL of 35.7 mg/kg/day to obtain the RfD. The critical effect observed in this study was decreased body weight gain.

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

4-Chloro-3-Methylphenol

The chronic oral and inhalation RfDs for this compound are under review by an EPA work group (EPA, 1991). A subchronic oral RfD has been established at 2E+0 mg/kg/day (EPA, 1991a) based upon a 28-day oral study (200 mg/kg/day) in rats (Madsen et al., 1986). The critical effect observed was a decrease in weight gain. An uncertainty factor of 100 was applied to obtain this RfD.

4-Chloro-3-Methylphenol has not been evaluated by the U.S. EPA for evidence of carcinogenicity (EPA, 1991).

2,4,5-Trichlorophenol

The chronic oral RfD for 2,4,5-trichlorophenol is 1E-1 mg/kg/day (EPA, 1991) and is based upon a subchronic dietary rat study (McCollister et al., 1961). Rats were exposed to different levels (100 through 10,000 mg/kg) of 2,4,5-trichlorophenol for 98 days. The LOAEL was 300 mg/kg/day (3,000 mg/kg) and the critical effects observed were mild diuresis and slight degenerative changes in the liver and kidneys. An uncertainty factor of 1,000 was applied to

the NOAEL of 100 mg/kg/day (1,000 mg/kg) to obtain the RfD. The confidence level in this RfD is low. The health effects for 2,4,5-trichlorophenol were reviewed by the U.S. EPA RfD/RfC workgroup and determined to be inadequate for derivation of an inhalation RfD.

This substance has been evaluated by the U.S. EPA for evidence of human carcinogenic potential. The evaluation is pending future review by an inter-office agency work group. A risk assessment summary will be included on IRIS when the review has been completed (EPA, 1991).

4-Nitrophenol

The chronic oral RfD for 4-nitrophenol is under review by an EPA work group (EPA, 1991). The health effects data for 4-nitrophenol were reviewed by the U.S. EPA RfD/RfC work group and determined to be inadequate for the derivation of an inhalation RfD (EPA, 1991).

4-Nitrophenol has not been evaluated by the U.S. EPA for evidence of carcinogenicity (EPA, 1991).

2,4-Dinitrotoluene

The health effects data for 2,4-dinitrotoluene were reviewed by the U.S. EPA RfD/RfC Work Group and determined to be inadequate for derivation of an RfD (EPA, 1991).

The EPA weight of evidence classification for the human carcinogenic potential of this compound is "B2" (EPA, 1991). A mixture of 2,4- and 2,6-dinitrotoluene isomers has been shown to induce liver and mammary gland tumors in a 2 year dietary study in rats (Ellis et al., 1979). An oral slope factor of 6.8E-1 mg/kg/day has been established based on this study.

Quantitative estimate of carcinogenic risk from inhalation exposure to 2,4-dinitrotoluene is not available (EPA, 1991).

Pentachlorophenol

The chronic oral RfD for this compound is 3E-2 mg/kg/day (EPA, 1991) and is based on a chronic dietary study in rats (Schwetz et al., 1978). Rats were administered pentachlorophenol at doses of 3, 10 or 30 mg/kg/day in the diet for 2 years. The LOAEL was 10 mg/kg/day based on liver and kidney toxicity. An uncertainty factor of 100 was applied to the NOAEL of 3 mg/kg/day to obtain the RfD. The confidence level in this RfD is medium. The chronic inhalation RfD is under review by an EPA work group (EPA, 1991).

The EPA weight of evidence classification for the human carcinogenicity of this compound is "B2" - probable human carcinogen (EPA, 1991) and is based on an increase in hepatocellular adenomas and carcinomas, adrenal medulla pheochromocytomas and malignant pheochromocytomas and/or hemangiosarcomas and hemangiomas in mice. An oral slope factor of 1.2E-1 mg/kg/day (EPA, 1991) was established based on an increase in the tumor types listed previously in female mice following administration of pentachlorophenol (NTP, 1989). Quantitative estimate of carcinogenic risk from inhalation exposure is not available (EPA, 1991).

Phenanthrene

Data has been determined to be inadequate for quantitative risk assessment (EPA, 1991).

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

Anthracene

The chronic oral RfD for anthracene is 3E-01 mg/kg/day (EPA, 1991) and is based on a subchronic gavage study in mice (U.S. EPA, 1989). Mice received 0, 250, 500, or 1,000 mg/kg/day anthracene by oral gavage for 90 days. No treatment related effects on survival, clinical signs or body weight changes were observed. An uncertainty factor of 3000 was applied to the NOAEL of 1,000 mg/kg/day to obtain the RfD. The confidence level in this RfD is low.

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

Di-n-butylphthalate

The chronic oral RfD for di-n-butylphthalate is 1E-01 mg/kg/day (EPA, 1991) and is based on a subchronic feeding study in rats (Smith, 1953). Rats received 0, 0.01, 0.05, 0.25 and 1.25 percent di-n-butylphthalate in their diet for 1 year. The LOAEL was 600 mg/kg/day (1.25%) and the critical effect observed was an increase in mortality. No changes in behavior or other clinical signs of toxicity were observed. An uncertainty factor of 1,000 was applied to the NOAEL of 125 mg/kg/day (0.25%) to obtain the RfD. The confidence level in this RfD is low.

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

Fluoranthene

The chronic oral RfD for fluoranthene is 4E-02 mg/kg/day (EPA, 1991) and is based on a subchronic gavage study in mice (U.S. EPA, 1988). Mice received 0, 125, 250, or 500

mg/kg/day fluoranthene by oral gavage for 13 weeks. The LOAEL was 250 mg/kg/day and the critical effects seen were neuropathy, increased salivation and increased liver enzymes. An uncertainty factor of 3000 was applied to the NOAEL of 125 mg/kg/day to obtain the RfD. The confidence level in this RfD is low.

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

Pyrene

The chronic oral RfD for pyrene is 3E-02 mg/kg/day (EPA, 1991) and is based on a subchronic gavage study in mice (U.S. EPA, 1989). Mice received 0, 75, 125, or 250 mg/kg/day pyrene by oral gavage for 13 weeks. The LOAEL was 125 mg/kg/day and the critical effects seen were toxic effects to the kidney including changes to the renal tubular pathology and decreased kidney weight. An uncertainty factor of 3000 was applied to the NOAEL of 75 mg/kg/day to obtain the RfD. The confidence level in this RfD is low.

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

Butylbenzylphthalate

The chronic oral RfD for butylbenzylphthalate is 2E-01 mg/kg/day (EPA, 1991) and is based on a subchronic feeding study in rats (NTP, 1985). Rats received 0, 17, 51, 159, 470, 1417 mg/kg/day butylbenzylphthalate in their diet for 26 weeks. The LOAEL was 470 mg/kg/day and the critical effects observed were a decrease in body weight, decreased testes' size, decreased organ weights and hematological effects. An uncertainty factor of 1,000 was

applied to the NOAEL of 159 mg/kg/day to obtain the RfD. The confidence level in this RfD is medium.

The EPA weight of evidence classification for the carcinogenicity of this compound is "C" - a possible human carcinogen (EPA, 1991) based upon an increase in mononuclear cell leukemia in female rats fed butyl benzyl phthalate at doses of 0.6000 or 12,000 mg/kg (NTP, 1982). A quantitative estimate of carcinogenic risk from oral exposure is not available (EPA, 1991).

Benzo(a)anthracene

No RfDs were found in either IRIS or HEAST.

The EPA weight of evidence classification for the carcinogenicity of this compound is "B2" - a probable human carcinogen (sufficient animal evidence, inadequate/no human evidence). No oral slope factor for benzo(a)anthracene has been established (EPA, 1991), however this compound has been shown to produce liver, lung and skin cancer in animal models (Klein, 1963; IARC, 1973; Steiner and Faulk, 1951; Steiner and Edgecomb, 1952 and Wislocki et al., 1986). Current EPA guidance suggests the use of an oral slope factor of 11.5 $mg/kg/day^{-1}$ and an inhalation slope factor of 6.1 $mg/kg/day^{-1}$. These values are derived from experimental data utilizing benzo(a)pyrene as the test compound.

Chrysene

Data has been determined to be inadequate for quantitative risk assessment (EPA, 1991b).

The EPA weight of evidence classification for the carcinogenicity of this compound is "B2" - a probable human carcinogen (sufficient animal evidence, inadequate/no human evidence)

(EPA, 1991). No oral slope factor for chrysene has been established, however this compound has been shown to produce carcinomas, and malignant lymphomas in mice (Wislocki et al., 1986; Buening et al., 1979). Current EPA guidance suggests the use of an oral slope factor of 11.5 mg/kg/day^{-1} and an inhalation slope factor of 6.1 mg/kg/day^{-1}. These values are derived from experimental data utilizing benzo(a)pyrene as the test compound.

Bis(2-ethylhexyl)phthalate

The chronic oral RfD for Bis(2-ethylhexyl)phthalate (BEHP) is 2E-02 mg/kg/day (EPA, 1991) and is based on a subchronic feeding study in guinea pigs (Carpenter et al., 1953). Guinea pigs received 19 or 64 mg/kg/day BEHP in their food for 1 year. There were no treatment related toxic effects, however both dose groups had increased liver weights. An uncertainty factor of 1,000 was applied to the LOAEL of 19 mg/kg/day to obtain the RfD. The confidence level in this RfD is medium. The chronic inhalation RfD for this compound is not available at this time (EPA, 1991).

The EPA weight of evidence classification for the carcinogenicity of this compound is "B2" - a probable human carcinogen (sufficient animal evidence, inadequate/no human evidence). The oral slope factor for BEHP is 1.4E-2 mg/kg/day^{-1} (EPA, 1991), and has been shown to produce liver tumors in an animal model (NTP, 1982). A quantitative estimate of carcinogenic risk from inhalation exposure is not available (EPA, 1991).

Benzo(b)fluoranthene

No RfDs were found in either IRIS or HEAST.

The EPA weight of evidence classification for the carcinogenicity of this compound is "B2" - a probable human carcinogen (sufficient animal evidence, inadequate/no human evidence) (EPA, 1991). No oral slope factor for benzo(b)fluoranthene has been established, however this compound has been shown to produce lung and thorax carcinomas, lung adenomas and skin tumors in animal models (Deutsch-Wenzel et al., 1983; LaVoie et al., 1987; Lacassagne et al., 1963). Current EPA guidance suggests the use of an oral slope factor of 11.5 mg/kg/day^{-1} and an inhalation slope factor of 6.1 mg/kg/day^{-1}. These values are derived from experimental data utilizing benzo(a)pyrene as the test compound.

Benzo(k)fluoranthene

No RfDs were found in either IRIS or HEAST.

The EPA weight of evidence classification for the carcinogenicity of this compound is "B2" - a probable human carcinogen (sufficient animal evidence, inadequate/no human evidence) (EPA, 1991). No oral slope factor for benzo(k)fluoranthene has been established, however this compound has been shown to produce lung and thorax carcinomas, lung adenomas and skin tumors in animal models (Deutsch-Wenzel et al., 1983; LaVoie et al., 1982, 1987; Van Duuren et al., 1966). Current EPA guidance suggests the use of an oral slope factor of 11.5 mg/kg/day^{-1} and an inhalation slope factor of 6.1 mg/kg/day^{-1}. These values are derived from experimental data utilizing benzo(a)pyrene as the test compound.

Benzo(a)pyrene

No RfDs were found in either IRIS or HEAST.

The EPA weight of evidence classification for the carcinogenicity of this compound is "B2" - a probable human carcinogen (sufficient animal evidence, inadequate/no human evidence) (EPA, 1991). Benzo(a)pyrene has been shown to produce lung and stomach cancer in animal models (Neal and Rigdon, 1967; Feron et al., 1973; Kobayashi, 1975; Rigdon and Neal, 1966, 1969; Thyssen et al., 1981). The oral and inhalation slope factors for benzo(a)pyrene have been withdrawn by EPA. As an interim measure, the withdrawn values have been recommended for use by EPA. These values are 11.5 and 6.1 $mg/kg/day^{-1}$ for the oral and inhalation routes, respectively.

Indeno(1,2,3-cd)pyrene

No RfDs were found in either IRIS or HEAST.

The EPA weight of evidence classification for the carcinogenicity of this compound is "B2" - a probable human carcinogen (sufficient animal evidence, inadequate/no human evidence) (EPA, 1991). No oral slope factor for indeno(1,2,3-cd)pyrene has been established, however this compound has been shown to produce lung and skin tumors in animal models (Deutsch-Wenzel et al., 1983; Lacassagne et al., 1963; Hoffman and Wynder, 1966; Rice et al., 1985a, 1986). Current EPA guidance suggests the use of an oral slope factor of 11.5 $mg/kg/day^{-1}$ and an inhalation slope factor of 6.1 $mg/kg/day^{-1}$. These values are derived from experimental data utilizing benzo(a)pyrene as the test compound.

Benzo(ghi)perylene

No RfDs were found in either IRIS or HEAST.

The EPA weight of evidence classification for the carcinogenicity of this compound is "D" - not classifiable as to human carcinogenicity (EPA, 1991).

PESTICIDES/PCBs

4,4'-DDT

The chronic oral RfD for 4,4'-DDT is 5E-04 mg/kg/day (EPA, 1991) and is based on a subchronic feeding study in rats (Laug et al., 1950). Rats received 0, 1, 5, 10, or 50 mg/kg 4,4'-DDT in their food for 15 - 27 weeks. The LOAEL was 0.25 mg/kg/day (5 mg/kg diet) and the critical effects seen were histopathological effects to the liver. An uncertainty factor of 100 was applied to the NOAEL of 0.05 mg/kg/day (1 mg/kg diet) to obtain the RfD. The confidence level in this RfD is medium.

The EPA weight of evidence classification for the carcinogenicity of this compound is "B2" - a probable human carcinogen (sufficient animal evidence, inadequate/no human evidence). This compound has been shown to produce liver tumors in mice and rats. The oral slope factor for 4,4'-DDT is 3.4E-01 mg/kg/d^{-1} (EPA, 1991) and is based upon studies by Turusov et al., 1973; Terracini et al., 1973; Thorpe and Walker, 1973; Tomatis and Turusov, 1975; Cabral et al., 1982; and Rossi et al., 1977. On the basis of route-to-route extrapolation, the inhalation slope factor for 4,4'-DDT has been set at 3.4E-01 mg/kg/day (9.7E-5 ug/m^3) (EPA, 1991a).

PCBs

No RfD was found in IRIS or HEAST.

The EPA weight of evidence classification for the carcinogenicity of this compound is "B2" - probable human carcinogen (sufficient animal evidence, inadequate/no human evidence (EPA, 1991). PCBs have been shown to produce liver tumors in rats and mice (Kimbrough et al., 1975; NCI, 1978; Norback and Weltman, 1985; Ito et al., 1973). An oral slope factor of 7.7 mg/kg/day has been established (EPA, 1990) based on the study by Norback and Weltman (1985). A quantitative estimate of carcinogenic risk from inhalation exposure is not available (EPA, 1991).

APPENDIX B
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TABLE B.1-1
SUMMARY OF TOXICITY VALUES ASSOCIATED WITH NONCARCINOGENIC-SUBCHRONIC EFFECTS: ORAL

COMPOUND NAME	SUBCHRONIC RFD (ORAL) (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	ORAL RFD BASIS/ SOURCE	UNCERTAINTY AND MODIFYING FACTORS
INORGANICS					
ALUMINUM	NA			NA/IRIS	
ANTIMONY	4E-04		Reduced life span,altered blood chemistry	Water/HEAST	UF=1000
ARSENIC	1E-03		Keratosis and hyperpigmentation	NA/HEAST	UF=1
BARIUM	5E-02		Increased blood pressure	Water/HEAST	UF=100
BERYLLIUM	5E-03		None observed	Water/HEAST	UF=100
CADMIUM	NA			NA/HEAST	
CHROMIUM (total)					
CHROMIUM III	1E+01		Hepatotoxicity	HEAST	UF=100
CHROMIUM VI	2E-02		Not defined	Water/HEAST	UF=100
COBALT	NA			NA/HEAST	
COPPER	4E-02		Local GI irritation	NA/HEAST	UF=NA
LEAD	NA			NA/HEAST	
MANGANESE	1E-01		No effect	Occupational/HEAST	UF=1
MERCURY	3E-04		Kidney effects	Oral/HEAST	UF=1000
NICKEL	2E-02		Decreased body and organ weight	Diet/HEAST	UF=300
SELENIUM	NA			NA/HEAST	
SILVER	3E-03		Argyria	HEAST	UF=2
THALLIUM	7E-04		Increased SGOT and serum LDH levels,alopecia	HEAST	UF=300
VANADIUM	7E-03		None observed	Water/HEAST	UF=100
ZINC	2E-01		Anemia	Therapeutic/HEAST	UF=10
CYANIDE	2E-02		Weight loss, thyroid effects,myelin degeneration	Diet/HEAST	UF=500
BORON	9E-02		Testicular atrophy	Diet/HEAST	UF=100
NIOBIUM	NA			NA/IRIS,	
STRONTIUM	NA			NA/IRIS	
TITANIUM	NA			NA/IRIS	
ZIRCONIUM	NA			NA/IRIS	
FLUORIDE	6E-02	High	Dental and skeletal fluorosis	Water/IRIS	UF=1
VOLATILE ORGANICS					
CHLOROMETHANE	NA			NA/IRIS,HEAST	
METHYLENE CHLORIDE	6E-02		Liver toxicity	Water/HEAST	UF=100
ACETONE	1E+00		Increased liver and kidney weights,nephrotoxicity	Gavage/HEAST	UF=100
CARBON DISULFIDE	1E-01		Fetal toxicity, malformation	Inhalation/HEAST	UF=100
1,2-DICHLOROETHENE (total)	1E-01		Decreased hematocrit and hemoglobin	Gavage/HEAST	UF=300
CHLOROFORM	1E-02		Liver lesions	HEAST	UF=1000
2-BUTANONE	5E-01		Fetotoxicity	HEAST	UF=100
1,1,1-TRICHLOROETHANE	9E-01		Hepatotoxicity	HEAST	UF=100
TRICHLOROETHENE	NA			NA/HEAST	
BENZENE	NA			NA/HEAST	
TETRACHLOROETHENE	1E-01		Hepatotoxicity	Gavage/HEAST	UF=100
TOLUENE	2E+00		Changes in liver and kidney weight	HEAST	UF=100
ETHYLBENZENE	1E+00		Hepatotoxicty, nephrotoxicity	Oral/HEAST	UF=100
XYLENE (total)	4E+00		None observed	HEAST	UF=100
BASE NEUTRAL / ACIDS					
PHENOL	6E-01		Reduced fetal body weight	Gavage/HEAST	UF=100
2-CHLOROPHENOL	5E-03		Reproductive effects	Water/HEAST	UF=1000
BENZOIC ACID	4E+00		Irritation, malaise	Diet/HEAST	UF=1
2,4-DICHLOROPHENOL	3E-03		Immune function	Water/HEAST	UF=100
NAPHTHALENE c	4E-02		Decreased body weight gain	Gavage/HEAST	UF=1000
4-CHLORO-3-METHYLPHENOL	2E+00		Decrease in weight gain	Oral/?	UF=100
2,4,5-TRICHLOROPHENOL	1E+00		Hepatotoxiciy and kidney effects	Diet/IRIS	UF=100
4-NITROPHENOL					
2,4-DINITROTOLUENE	NA			NA/HEAST	
PENTACHLOROPHENOL	3E-02		Fetotoxicity	Gavage/HEAST	UF=100
PHENANTHRENE	NA			NA/HEAST	
ANTHRACENE	3E+00		No observed effects	Gavage/HEAST	UF=300
DI-n-BUTYLPHALATE	1E+00		Mortality	Diet/HEAST	UF=100
FLUORANTHENE	4E-01		Nephropathy, liver weight changes,	Gavage/HEAST	UF=300
PYRENE	3E-01		Reanal effects	Gavage/HEAST	UF=300
BUTYLBENZYLPHTHALATE	2E+00		Effects on body weight gain,testes,liver	Diet/HEAST	UF=100
BENZO(a)ANTHRACENE	NA			NA/HEAST	
CHRYSENE	NA			NA/HEAST	
bis(2-ETHYLHEXYL)PHTHALATE	2E-02		Increased relative liver weight	Diet/HEAST	UF=1000;MF=1
BENZO(b)FLUORANTHENE	NA			NA/HEAST	
BENZO(k)FLUORANTHENE	NA			NA/HEAST	
BENZO(a)PYRENE	NA			NA/HEAST	
INDENO(1,2,3-cd)PYRENE	NA			NA/HEAST	
BENZO(g,h,i)PERYLENE	NA			NA/HEAST	
PESTICIDES / PCB'S					
4,4-DDT	5E-04			NA/HEAST	
AROCLOR-1248	NA			NA/HEAST	
AROCLOR-1254	NA			NA/HEAST	
AROCLOR-1260	NA			NA/HEAST	

NA: Not available

TABLE B.1-2
SUMMARY OF TOXICITY VALUES ASSOCIATED WITH NONCARCINOGENIC--SUBCHRONIC EFFECTS: INHALATION

COMPOUND NAME	SUBCHRONIC RFC (INHALATION) (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	INHALATION RFD BASIS/ SOURCE	UNCERTAINTY AND MODIFYING FACTORS
INORGANICS					
ALUMINUM	NA			NA/HEAST	
ANTIMONY (a)	4.00E-04				
ARSENIC (a)	1.00E-03				
BARIUM	1.00E-03		Fetotoxicity	HEAST	UF=100
BERYLLIUM (a)	5.00E-03				
CADMIUM (a)	1.00E-03				
CHROMIUM (total)	NA				
CHROMIUM III	5.71E-06		Nasal mucosa atrophy	HEAST	UF=30
CHROMIUM VI	5.71E-06		Nasal mucosa atrophy	HEAST	UF=30
COBALT	NA			NA/HEAST	
COPPER	NA			NA/HEAST	
LEAD	NA			NA/HEAST	
MANGANESE	1.00E-04		Increased prevalance of respiratory disease and psycomotor disturbances	Occupational/HEAST	UF=900
MERCURY	9.00E-06		Neurotoxicity	Occupational/HEAST	UF=30
NICKEL (a)	2.00E-02				
SELENIUM	NA			NA/HEAST	
SILVER	NA			NA/HEAST	
THALLIUM	NA			NA/HEAST	
VANADIUM (a)	7.00E-03				
ZINC (a)	2.00E-01				
CYANIDE (a)	2.00E-02		Myelin degeneration		
BORON	NA			NA/HEAST	
NIOBIUM	NA			NA/HEAST	
STRONTIUM	NA			NA/HEAST	
TITANIUM	NA			NA/HEAST	
ZIRCONIUM	NA			NA/HEAST	
FLUORIDE	NA			NA/HEAST	
VOLATILE ORGANICS					
CHLOROMETHANE	NA			NA/HEAST	
METHYLENE CHLORIDE	9.00E-01			HEAST	UF=100
ACETONE	NA			NA/HEAST	
CARBON DISULFIDE	3.00E-03		Fetal toxicity	HEAST	UF=1000
1,2-DICHLOROETHENE (total)	NA			NA/HEAST	
CHLOROFORM	NA			NA/HEAST	
2-BUTANONE	9.00E-01		CNS	HEAST	UF=100
1,1,1-TRICHLOROETHANE	3.00E+00		Hepatotoxicity	HEAST	UF=100
TRICHLOROETHENE	NA			NA/HEAST	
BENZENE	NA			NA/HEAST	
TETRACHLOROETHENE	NA			NA/HEAST	
TOLUENE	6.00E-01		CNS effects, eyes and nose irritation	HEAST	UF=100
ETHYLBENZENE	3.00E-01		Developmental toxicity	HEAST	UF=300
XYLENE (total)	9.00E-02		CNS effects, eyes and nose irritation	HEAST	UF=100
BASE NEUTRAL / ACIDS					
PHENOL	NA			NA/HEAST	
2-CHLOROPHENOL	NA			NA/HEAST	
BENZOIC ACID	NA			NA/HEAST	
2,4-DICHLOROPHENOL	NA			NA/HEAST	
NAPHTHALENE (a,b)	4.00E-02				
4-CHLORO-3-METHYLPHENOL	NA			NA/HEAST	
2,4,5-TRICHLOROPHENOL	NA			NA/HEAST	
4-NITROPHENOL	NA			NA/HEAST	
2,4-DINITROTOLUENE	NA			NA/HEAST	
PENTACHLOROPHENOL	NA			NA/HEAST	
PHENANTHRENE	NA			NA/HEAST	
ANTHRACENE (a)	3.00E+00				
DI-n-BUTYLPHALATE (a)	1.00E+00				
FLUORANTHENE (a)	4.00E-01				
PYRENE (a)	3.00E-01				
BUTYLBENZYLPHTHALATE (a)	2.00E+00				
BENZO(a)ANTHRACENE	NA			NA/HEAST	
CHRYSENE	NA			NA/HEAST	
bis(2-ETHYLHEXYL)PHTHALATE (a)	2.00E-02				
BENZO(b)FLUORANTHENE	NA			NA/HEAST	
BENZO(k)FLUORANTHENE	NA			NA/HEAST	
BENZO(a)PYRENE	NA			NA/HEAST	
INDENO(1,2,3-cd)PYRENE	NA			NA/HEAST	
BENZO(g,h,i)PERYLENE	NA			NA/HEAST	
PESTICIDES / PCB'S					
4,4-DDT	5.00E-04		Liver lesions	NA/IRIS	100
AROCLOR-1248	NA			NA/HEAST	
AROCLOR-1254	NA			NA/HEAST	
AROCLOR-1260	NA			NA/HEAST	

NA: Not Available
a : The oral Rfd was used when an inhalation value was not avaliable
Inhalation RFC for Chromium VI is used for Chromium III

TABLE B.1-3
SUMMARY OF TOXICITY VALUES ASSOCIATED WITH NONCARCINOGENIC-CHRONIC EFFECTS: ORAL

COMPOUND NAME	CHRONIC RFD (ORAL) (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	ORAL RFD BASIS/ SOURCE	UNCERTAINTY FACTORS	MODIFYING FACTORS
INORGANICS						
ALUMINUM	NA			NA/IRIS,		
ANTIMONY	4.00E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS,	1000	1
ARSENIC	1.00E-03		Keratosis and hyperpigmentation	Diet/HEAST	1	
BARIUM	7.00E-02	Medium	None observed	Water/IRIS	3	1
BERYLLIUM	5.00E-03	Low	None observed	Water/IRIS,	100	1
CADMIUM	1.00E-03	High	Proteinuria	Diet/IRIS,	10	1
CHROMIUM (total)	NA					
CHROMIUM III	1.00E+00	Low	Hepatotoxicity	IRIS	1000	
CHROMIUM VI	5.00E-03	Low	No effects observed	Water/IRIS,	500	1
COBALT	NA			NA/IRIS,		
COPPER	4.00E-02		Local GI irritation	NA/HEAST		
LEAD	NA		Neurobehavioral effects	NA/IRIS,		
MANGANESE	1.00E-01	Medium	CNS effects	Diet/IRIS,	1	1
MERCURY	3.00E-04		Kidney effects	Oral/HEAST	1000	
NICKEL	2.00E-02		Reduced body and organ weight	Diet/HEAST	300	
SELENIUM	5.00E-03	Medium	Clinical selenosis	Diet/IRIS	3	1
SILVER	3.00E-03	Medium	Argyria	Oral/IRIS,	2	1
THALLIUM	7.00E-05		Increased SGOT and serum LDH levels,alopecia	Diet/HEAST	3000	
VANADIUM	7.00E-03		None observed	Water/HEAST	100	
ZINC	2.00E-01		Anemia	Therap./HEAST	10	
CYANIDE	2.00E-02	Medium	Weight loss,thyroid effects,myelin degeneration	Diet/IRIS	100	5
BORON	9.00E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IRIS	16100.00	1
NIOBIUM	NA			NA/IRIS,		
STRONTIUM	NA			NA/IRIS,		
TITANIUM	NA			NA/IRIS,		
ZIRCONIUM	NA			NA/IRIS,		
FLUORIDE	6.00E-02	High	Dental and skeletal fluorosis	Water/IRIS	1	1
VOLATILE ORGANICS						
CHLOROMETHANE	NA			NA/IRIS,		
METHYLENE CHLORIDE	6.00E-02	Medium	Liver toxicity	Water/IRIS	100	1
ACETONE	1.00E-01	Low	Increased liver and kidney weight	Gavage/IRIS	1000	1
CARBON DISULFIDE	1.00E-01	Medium	Fetal toxicity	Inhal./IRIS	100	1
1,2-DICHLORETHENE (total)	1.00E-02		Decreased hematocrit and hemoglobin	Gavage/HEAST	3000	
CHLOROFORM	1.00E-02	Medium	Fatty cysts formation in liver	Oral/IRIS	1000	1
2-BUTANONE	5.00E-02	Medium	Fetotoxicity	Inhal./IRIS	1000	
1,1,1-TRICHLOROETHANE	9.00E-02	Medium	No adverse effect	Inhal./IRIS	1000	1
TRICHLOROETHENE	NA			NA/IRIS,		
BENZENE	NA			NA/IRIS,		
TETRACHLOROETHENE	1.00E-02	Medium	Hepatotoxicity,weight gain	Gavage/IRIS	100	1
TOLUENE	2.00E-01	Medium	Changes in liver and kidney weights	Gavage/IRIS	1000	1
ETHYLBENZENE	1.00E-01	Low	Liver and kidney toxicity	Oral/IRIS,	1000	1
XYLENE (total)	2.00E+00	Medium	Hyperactivity,decreased body weight,increased	Gavage/IRIS	100	1
BASE NEUTRAL/ACIDS						
PHENOL	6.00E-01	Low	Reduced fetal body weight	Gavage/IRIS	100	1
2-CHLOROPHENOL	5.00E-03	Low	Reproductive effects	IRIS	1000	1
BENZOIC ACID	4.00E+00	Medium		Oral/IRIS,	1	1
2,4-DICHLOROPHENOL	3.00E-03	Low	Changed hypersensitivity response	Water/IRIS	100	1
NAPHTHALENE	4.00E-03		Decreased body weight gain	Gavage/HEAST	10000	
4-CHLORO-3-METHYLPHENOL	NA			NA/IRIS,		
2,4,5-TRICHLOROPHENOL	1.00E-01	Low	Liver and kidney pathology	Diet/IRIS	1000	1
4-NITROPHENOL	NA			NA/IRIS,		
2,4-DINITROTOLUENE	NA			NA/IRIS,		
PENTACHLOROPHENOL	3.00E-02	Medium	Liver and kidney pathology	Diet/IRIS	100	1
PHENANTHRENE	NA			NA/IRIS,		
ANTHRACENE	3.00E-01	Low	No observed effects	Gavage/IRIS,	3000	1
DI-n-BUTYLPHALATE	1.00E-01	Low	Increased mortality	Diet/IRIS	1000	1
FLUORANTHENE	4.00E-02	Low	Nephropathy,changes in liver weight,hematology	Gavage/IRIS	3000	1
PYRENE	3.00E-02	Low	Kidney effects	Gavage/IRIS	3000	1
BUTYLBENZYLPHTHALATE	2.00E-01	Low	Effects on body weight gain, testes,liver,kidney	Diet/IRIS,	1000	1
BENZO(a)ANTHRACENE	NA			NA/IRIS		
CHRYSENE	NA			NA/IRIS,		
bis(2-ETHYLHEXYL)PHTHALATE	2.00E-02	Medium	Increased relative liver weight	Diet/IRIS,	1000	1
BENZO(b)FLUORANTHENE	NA			NA/IRIS,		
BENZO(k)FLUORANTHENE	NA			NA/IRIS,		
BENZO(a)PYRENE	NA			NA/IRIS,		
INDENO(1,2,3-cd)PYRENE	NA			NA/IRIS,		
BENZO(g,h,i)PERYLENE	NA			NA/IRIS,		
PESTICIDES/PCB'S						
4,4'-DDT	5.00E-04	Medium	Liver lesions	Diet/IRIS	100	1
AROCLOR-1248	NA			NA/IRIS,		
AROCLOR-1254	NA			NA/IRIS,		
AROCLOR-1260	NA			NA/IRIS,		

NA:Not available
(a) - Value derived from data for Gamma-Chlordane.
(b) - Value derived from data for Endosulfan (a mixture of Endosulfan I and II).

TABLE B.1-4
SUMMARY OF TOXICITY VALUES ASSOCIATED WITH NONCARCINOGENIC-CHRONIC EFFECTS: INHALATION

COMPOUND NAME	CHRONIC RFD INHALATION (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	INHALATION RFD BASIS/ SOURCE	UNCERTAINTY FACTORS	MODIFYING FACTORS
INORGANICS						
ALUMINUM	NA			NA/IRIS,		
ANTIMONY (a)	4.00E-04					
ARSENIC (a)	1.00E-03		Fetotoxicity	HEAST	1000	
BARIUM	1.00E-04					
BERYLLIUM (a)	5.00E-03					
CADMIUM	1.00E-03					
CHROMIUM (total)	NA			HEAST	300	
CHROMIUM III	5.71E-07		Nasal mucosa atrophy	HEAST	300	
CHROMIUM VI	5.71E-07		Nasal mucosa atrophy	NA/IRIS,		
COBALT	NA			NA/IRIS,		
COPPER	NA			NA/IRIS,		
LEAD	NA		CNS effects			
MANGANESE	1.00E-04	Medium	Increased prevalance of respiratory disease and psycomotor disturbances	Occupational/IRIS	300	3
MERCURY	9.00E-06		Neurotoxicity	Occupational/HEAST	30	
NICKEL	NA			NA/IRIS,		
SELENIUM	NA			NA/IRIS		
SILVER	NA			NA/IRIS,		
THALLIUM	NA			NA/IRIS,		
VANADIUM (a)	7.00E-03					
ZINC (a)	2.00E-01					
CYANIDE (a)	2.00E-02		Myelin degeneration	NA/IRIS,		
BORON	NA			NA/IRIS,		
NIOBIUM	NA			NA/IRIS,		
STRONTIUM	NA			NA/IRIS,		
TITANIUM	NA			NA/IRIS,		
ZIRCONIUM	NA			NA/IRIS,		
FLUORIDE	NA					
VOLATILE ORGANICS						
CHLOROMETHANE	NA			NA/IRIS,		
METHYLENE CHLORIDE	9.00E-01		None observed	HEAST	100	
ACETONE	NA			NA/IRIS,		
CARBON DISULFIDE	3.00E-03		Fetal toxicity	HEAST	1000	
1,2-DICHLOROETHENE (total)	NA			NA/IRIS,		
CHLOROFORM	NA			NA/IRIS,		
2-BUTANONE	9.00E-02		CNS	HEAST	1000	
1,1,1-TRICHLOROETHANE	3.00E-01		Hepatotoxicity	HEAST	1000	
TRICHLOROETHENE	NA			NA/IRIS,		
BENZENE	NA			NA/IRIS,		
TETRACHLOROETHENE	NA			NA/IRIS,		
TOLUENE	6.00E-01		CNS effects, eyes and nose irritation	HEAST	100	
ETHYLBENZENE	3.00E-01	Low	Developmental toxicity	IRIS	300	1
XYLENE (total)	9.00E-02		CNS effects, eyes and nose irritation	HEAST	100	
BASE NEUTRAL / ACIDS						
PHENOL	NA			NA/IRIS,		
2-CHLOROPHENOL	NA			NA/IRIS,		
BENZOIC ACID	NA			NA/IRIS,		
2,4-DICHLOROPHENOL	NA			NA/IRIS,		
NAPHTHALENE (a)	4.00E-03			NA/IRIS,		
4-CHLORO-3-METHYLPHENOL	NA			NA/IRIS,		
2,4,5-TRICHLOROPHENOL	NA			NA/IRIS,		
4-NITROPHENOL	NA			NA/IRIS,		
2,4-DINITROTOLUENE	NA			NA/IRIS,		
PENTACHLOROPHENOL	NA			NA/IRIS,		
PHENANTHRENE	NA					
ANTHRACENE (a)	3.00E-01					
DI-n-BUTYLPHALATE (a)	1.00E-01					
FLUORANTHENE (a)	4.00E-02					
PYRENE (a)	3.00E-02					
BUTYLBENZYLPHTHALATE (a)	2.00E-01			NA/IRIS,		
BENZO(a)ANTHRACENE	NA			NA/IRIS,		
CHRYSENE	NA					
bis(2-ETHYLHEXYL)PHTHALATE (a)	2.00E-02			NA/IRIS,		
BENZO(b)FLUORANTHENE	NA			NA/IRIS,		
BENZO(k)FLUORANTHENE	NA			NA/IRIS,		
BENZO(a)PYRENE	NA			NA/IRIS,		
INDENO(1,2,3-cd)PYRENE	NA			NA/IRIS		
BENZO(g,h,i)PERYLENE	NA					
PESTICIDES / PCB'S						
4,4-DDT	5.00E-04		Liver lesions	NA/IRIS,	100	
AROCLOR-1248	NA			NA/IRIS		
AROCLOR-1254	NA			NA/IRIS,		
AROCLOR-1260	NA			NA/IRIS,		

NA: Not Available
a : The oral Rfd was used when an inhalation value was not available
Inhaltion RFC for Chromium VI used for Chromium (total)

TABLE B.1-5
SUMMARY OF TOXICITY VALUES ASSOCIATED WITH CARCINOGENIC EFFECTS: ORAL

COMPOUND NAME	SLOPE FACTOR (SF) ORAL (mg/kg/day)-1	WEIGHT-OF EVIDENCE CLASS	TYPE OF CANCER	SF BASIS/ SOURCE
INORGANICS				NA/IRIS
ALUMINUM	NA	D		NA/IRIS
ANTIMONY	NA			IRIS
ARSENIC	1.75E+00	A	Skin	NA/IRIS
BARIUM	NA			Water/IRIS
BERYLLIUM	4.30E+00	B2	gross tumors, all sites combined	NA/IRIS
CADMIUM	NA			NF/IRIS
CHROMIUM (total)	NA			NA/IRIS
CHROMIUM III	NA			NF/IRIS
CHROMIUM VI	NA			NA/IRIS
COBALT	NA	D		NA/IRIS
COPPER	NA	D		Oral/IRIS
LEAD	NA	B2	Renal tumors	NA/IRIS
MANGANESE	NA	D		NA/IRIS
MERCURY	NA	D		NA/IRIS
NICKEL	NA			NA/IRIS
SELENIUM	NA	D		NA/IRIS
SILVER	NA	D		NA/IRIS
THALLIUM	NA			NA/IRIS
VANADIUM	NA			NA/IRIS
ZINC	NA			NA/IRIS
CYANIDE	NA	D		NA/IRIS
BORON	NA			NA/IRIS
NIOBIUM	NA			NA/IRIS
STRONTIUM	NA			NA/IRIS
TITANIUM	NA			NA/IRIS
ZIRCONIUM	NA			NA/IRIS
FLUORIDE	NA			
VOLATILE ORGANICS				
CHLOROMETHANE	1.30E-02	C	Kidney	Inhalation/HEAST
METHYLENE CHLORIDE	7.50E-03	B2	Heptacellular carcinomas, neoplastic nodules	Water/IRIS
ACETONE	NA	D		NA/IRIS
CARBON DISULFIDE	NA			NA/IRIS
1,2-DICHLORETHENE (total)	NA			Oral/IRIS
CHLOROFORM	6.10E-03	B2	Kidney tumors	NA/IRIS
2-BUTANONE	NA	D		NA/IRIS
1,1,1-TRICHLOROETHANE	NA	D		Gavage/HEAST
TRICHLOROETHENE	1.10E-02	B2	Liver	Occupational/IRIS
BENZENE	2.90E-02	A	Leukemia	Gavage/HEAST
TETRACHLOROETHENE	5.10E-02	B2	Liver	NA/IRIS
TOLUENE	NA	D		NA/IRIS
ETHYLBENZENE	NA	D		NA/IRIS
XYLENE (total)	NA	D		
BASE NEUTRAL / ACIDS				
PHENOL	NA	D		NA/IRIS
2-CHLOROPHENOL	NA			NA/IRIS
BENZOIC ACID	NA			NA/IRIS
2,4-DICHLOROPHENOL	NA			NA/IRIS
NAPHTHALENE	NA	D		NA/IRIS
4-CHLORO-3-METHYLPHENOL	NA			NA/IRIS
2,4,5-TRICHLOROPHENOL	NA			NA/IRIS
4-NITROPHENOL	NA			Diet/IRIS
2,4-DINITROTOLUENE	6.80E-01	B2	Liver, mammary gland	Oral/IRIS
PENTACHLOROPHENOL	1.20E-01	B2	Hepatocellular adenoma, carcinomas,pheochromocytoma	NA/IRIS
PHENANTHRENE	NA	D		NA/IRIS
ANTHRACENE	NA	D		NA/IRIS
DI-n-BUTYLPHALATE	NA	D		NA/IRIS
FLUORANTHENE	NA	D		NA/IRIS
PYRENE	NA	D		Diet/IRIS
BUTYLBENZYLPHTHALATE	NA	C	Leukemia	IRIS
BENZO(a)ANTHRACENE (a)	1.15E+01	B2	Liver, lung, skin	IRIS
CHRYSENE (a)	1.15E+01	B2	Malignant lymphoma	IRIS
bis(2-ETHYLHEXYL)PHTHALATE	1.40E-02	B2	Liver	IRIS
BENZO(b)FLUORANTHENE (a)	1.15E+01	B2	Lung, thorax, skin	IRIS
BENZO(k)FLUORANTHENE (a)	1.15E+01	B2	Lung, thorax, skin	IRIS
BENZO(a)PYRENE	1.15E+01	B2	Stomach, lung	IRIS
INDENO(1,2,3-cd)PYRENE (a)	1.15E+01	B2	Lung, skin	NA/IRIS
BENZO(g,h,i)PERYLENE	NA	D		
PESTICIDES / PCB'S				
4,4-DDT	3.40E-01	B2	Liver tumor	Diet/IRIS
AROCLOR-1248 (b)	7.70E+00			
AROCLOR-1254 (b)	7.70E+00			
AROCLOR-1260	7.70E+00	B2	Liver	Diet/IRIS

NA:Not available
(a) - Value derived from data for benzo(a)pyrene.
(b) - Value derived from data for Aroclor-1260.

TABLE B.1-6
SUMMARY OF TOXICITY VALUES ASSOCIATED WITH CARCINOGENIC EFFECTS: INHALATION

COMPOUND NAME	SLOPE FACTOR INHALATION (MG/KG/DAY)-1	WEIGHT-OF-EVIDENCE CLASSIFICATION	TYPE OF CANCER	SF BASIS/ SOURCE
INORGANICS				
ALUMINUM	NA			NA/IRIS
ANTIMONY	NA			NA/IRIS
ARSENIC	5.00E+01	A	Respiratory Tract	Occupational/IRIS
BARIUM	NA			NA/IRIS
BERYLLIUM	8.40E+00	B2	Lung	Occupational/IRIS
CADMIUM	6.3	B1	Respiratory Tract	Occupational/IRIS
CHROMIUM (total)	NA			
CHROMIUM III	NA			NA/IRIS
CHROMIUM VI	4.20E+01	A	Lung	Occupational/IRIS
COBALT	NA	D		NA/IRIS
COPPER	NA	D		NA/IRIS
LEAD	NA	B2		NA/IRIS
MANGANESE	NA	D		NA/IRIS
MERCURY	NA	D		NA/IRIS
NICKEL	8.40E-01	A	Lung and nasal tumors	Occupational/IRIS
SELENIUM	NA	D		NA/IRIS
SILVER	NA	D		NA/IRIS
THALLIUM	NA			NA/IRIS
VANADIUM	NA			NA/IRIS
ZINC	NA			NA/IRIS
CYANIDE	NA	D		NA/IRIS
BORON	NA			NA/IRIS
NIOBIUM	NA			NA/IRIS
STRONTIUM	NA			NA/IRIS
TITANIUM	NA			NA/IRIS
ZIRCONIUM	NA			NA/IRIS
FLUORIDE	NA			
VOLATILE ORGANICS				
CHLOROMETHANE	6.00E-03	C	Kidney	Inhalation/HEAST
METHYLENE CHLORIDE	1.60E-03	B2	Combined adenomas and carcinomas	IRIS
ACETONE	NA	D		NA/IRIS
CARBON DISULFIDE	NA			NA/IRIS
1,2-DICHLORETHENE (total)	NA			NA/IRIS
CHLOROFORM	8.10E-02	B2	Liver	IRIS
2-BUTANONE	NA	D		NA/IRIS
1,1,1-TRICHLOROETHANE	NA	D		NA/IRIS
TRICHLOROETHENE	1.70E-02	B2	Lung	HEAST
BENZENE	2.90E-02	A	Leukemia	Occupational/IRIS
TETRACHLOROETHENE	1.80E-03	B2	Leukemia, liver	HEAST
TOLUENE	NA	D		NA/IRIS
ETHYLBENZENE	NA	D		NA/IRIS
XYLENE (total)	NA	D		NA/IRIS
BASE NEUTRAL / ACIDS				
PHENOL	NA	D		NA/IRIS
2-CHLOROPHENOL	NA			NA/IRIS
BENZOIC ACID	NA	D		NA/IRIS
2,4-DICHLOROPHENOL	NA			NA/IRIS
NAPHTHALENE	NA	D		NA/IRIS
4-CHLORO-3-METHYLPHENOL	NA			NA/IRIS
2,4,5-TRICHLOROPHENOL	NA			NA/IRIS
4-NITROPHENOL	NA			NA/IRIS
2,4-DINITROTOLUENE	NA	B2	Liver, mammary	IRIS
PENTACHLOROPHENOL	NA	B2		NA/IRIS
PHENANTHRENE	NA	D		NA/IRIS
ANTHRACENE	NA	D		NA/IRIS
DI-n-BUTYLPHALATE	NA	D		NA/IRIS
FLUORANTHENE	NA	D		NA/IRIS
PYRENE	NA	D		NA/IRIS
BUTYLBENZYLPHTHALATE	NA	C		NA/IRIS
BENZO(a)ANTHRACENE (a)	6.10E+00	B2	Liver, lung, skin	IRIS
CHRYSENE (a)	6.10E+00	B2	Malignant lymphoma	IRIS
bis(2-ETHYLHEXYL)PHTHALATE	NA	B2		NA/IRIS
BENZO(b)FLUORANTHENE (a)	6.10E+00	B2	Lung, thorax, skin	IRIS
BENZO(k)FLUORANTHENE (a)	6.10E+00	B2	Lung, thorax, skin	IRIS
BENZO(a)PYRENE	6.10E+00	B2	Respiratory tract, stomach	Inhalation/HEAST
INDENO(1,2,3-cd)PYRENE (a)	6.10E+00	B2	Lung, skin	IRIS
BENZO(g,h,i)PERYLENE	NA	D		NA/IRIS
PESTICIDES / PCB'S				
4,4-DDT	NA	B2		IRIS,HEAST
AROCLOR-1248	NA			NA/IRIS
AROCLOR-1254	NA			NA/IRIS
AROCLOR-1260	NA			NA/IRIS

NA: Not Available
a : The oral Rfd was used when an inhalation value was not avaliable

APPENDIX C

UNCERTAINTY ASSESSMENT

TABLE C.1-1
UNCERTAINTY ANALYSIS
INGESTION OF CHEMICALS IN SURFACE WATER
SCENARIO 1 - Trespassing (Current)

CHEMICAL	INTAKE (NONCANCER) (mg/kg/day)	INTAKE (CANCER) (mg/kg/day)	CONC. IN WATER (mg/L)	CONTACT RATE (ml/hr)	EXPOSURE TIME (hr/day)	EXPOSURE FREQUENCY (days/year)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVG. TIME (NONCANCER) (days)	AVG. TIME (CANCER) (days)
INORGANICS										
ALUMINUM	8.8E-04	7.5E-05	44.80	0.05	1	7	6	49	2190	25550
ANTIMONY	3.0E-06	2.5E-07	0.15	0.05	1	7	6	49	2190	25550
ARSENIC	6.8E-07	5.8E-08	0.035	0.05	1	7	6	49	2190	25550
BARIUM	5.7E-06	4.9E-07	0.29	0.05	1	7	6	49	2190	25550
BERYLLIUM	4.9E-07	4.2E-08	0.025	0.05	1	7	6	49	2190	25550
CADMIUM	1.5E-07	1.3E-08	0.0076	0.05	1	7	6	49	2190	25550
CHROMIUM III	1.7E-04	1.4E-05	8.52	0.05	1	7	6	49	2190	25550
CHROMIUM VI	1.1E-09	9.1E-11	0.000054	0.05	1	7	6	49	2190	25550
COBALT	1.2E-06	1.0E-07	0.062	0.05	1	7	6	49	2190	25550
COPPER	8.5E-06	7.2E-07	0.43	0.05	1	7	6	49	2190	25550
LEAD	1.3E-06	1.1E-07	0.065	0.05	1	7	6	49	2190	25550
MANGANESE	5.1E-05	4.3E-06	2.59	0.05	1	7	6	49	2190	25550
MERCURY	4.2E-07	3.6E-08	0.021	0.05	1	7	6	49	2190	25550
NICKEL	1.2E-05	1.0E-06	0.62	0.05	1	7	6	49	2190	25550
VANADIUM	1.1E-04	9.6E-06	5.70	0.05	1	7	6	49	2190	25550
ZINC	2.1E-05	1.8E-06	1.07	0.05	1	7	6	49	2190	25550
CYANIDE	2.1E-07	1.8E-08	0.011	0.05	1	7	6	49	2190	25550
BORON	1.6E-05	1.4E-06	0.83	0.05	1	7	6	49	2190	25550
FLUORIDE	2.0E-08	1.7E-09	0.0010	0.05	1	7	6	49	2190	25550
VOLATILE ORGANICS										
CHLOROMETHANE	1.5E-07	1.3E-08	0.0077	0.05	1	7	6	49	2190	25550
1,2-DICHLORETHENE (total)	4.9E-08	4.2E-09	0.0025	0.05	1	7	6	49	2190	25550
TRICHLOROETHENE	5.5E-08	4.7E-09	0.0028	0.05	1	7	6	49	2190	25550
BASE NEUTRAL / ACIDS										
DI-n-BUTYLPHALATE	2.0E-08	1.7E-09	0.0010	0.05	1	7	6	49	2190	25550
bis(2-ETHYLHEXYL)PHTHALATE	3.9E-08	3.4E-09	0.0020	0.05	1	7	6	49	2190	25550

NA: Not Applicable

TABLE C.1-2
UNCERTAINTY ANALYSIS
CANCER RISK ESTIMATES
SCENARIO 1 – Trespassing (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: INCIDENTIAL INGESTION OF CHEMICALS IN SURFACE WATER								3E-07
INORGANICS								
ARSENIC	5.8E-08	No	1.75E+00	A	Skin	IRIS	1E-07	
BERYLLIUM	4.2E-08	No	4.30E+00	B2	gross tumors, all sites combined	Water/IRIS	2E-07	
LEAD	1.1E-07	No	NA	B2	Renal tumors	Oral/IRIS	NA	
VOLATILE ORGANICS								
CHLOROMETHANE	1.3E-08	No	1.30E-02	C	Kidney	Inhalation/HEAST	2E-10	
TRICHLOROETHENE	4.7E-09	No	1.10E-02	B2	Liver	Gavage/HEAST	5E-11	
BASE NEUTRAL / ACIDS								
bis(2-ETHYLHEXYL)PHTHALATE	3.4E-09	No	1.40E-02	B2	Liver	IRIS	5E-11	

NA: Not Applicable

TABLE C.2-1
UNCERTAINTY ANALYSIS
DERMAL CONTACT WITH CHEMICALS IN SOIL
SCENARIO 2 – Industrial (Current)

CHEMICAL	ABSORBED DOSE (NONCANCER) (mg/kg/day)	ABSORBED DOSE (CANCER) (mg/kg/day)	SOIL CONC (mg/kg)	CONVERSION FACTOR (1E-6 kg/mg)	SKIN SURFACE AREA (cm2/event)	ADHERENCE FACTOR (mg/cm2)	ABSORPTION FACTOR (unitless)	EXPOSURE FREQUENCY (events/year)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVERAGING TIME (NONCANCER) (days)	AVERAGING TIME (CANCER) (days)
INORGANICS												
ALUMINUM	NA	NA	26159.5	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
ANTIMONY	NA	NA	5.1	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
ARSENIC	NA	NA	2.4	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
BARIUM	NA	NA	257.6	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
BERYLLIUM	NA	NA	15.4	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
CADMIUM	3.73E-09	2.40E-10	0.95273	1E-06	2000	0.2	0.001	250	4.5	70	1643	25550
CHROMIUM III	NA	NA	252.3	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
CHROMIUM VI	NA	NA	2.5	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
COBALT	NA	NA	6.9	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
COPPER	NA	NA	32.7	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
LEAD	NA	NA	118.9	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
MANGANESE	NA	NA	1156.7	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
MERCURY	NA	NA	0.10	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
NICKEL	NA	NA	837.0	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
SELENIUM	NA	NA	1.5	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
SILVER	NA	NA	1.6	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
VANADIUM	NA	NA	3383.1	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
ZINC	NA	NA	168.8	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
BORON	NA	NA	108.1	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
NIOBIUM	NA	NA	164.0	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
STRONTIUM	NA	NA	160.3	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
TITANIUM	NA	NA	285.0	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
ZIRCONIUM	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
VOLATILE ORGANICS												
ACETONE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
CARBON DISULFIDE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
1,2-DICHLORETHENE (total)	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
2-BUTANONE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
TRICHLOROETHENE	NA	NA	0.0040	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
BENZENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
TETRACHLOROETHENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
TOLUENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
ETHYLBENZENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
XYLENE (total)	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
BASE NEUTRAL / ACIDS												
PHENOL	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
BENZOIC ACID	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
NAPHTHALENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
4-NITROPHENOL	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
2,4-DINITROTOLUENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
PENTACHLOROPHENOL	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
PHENANTHRENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
ANTHRACENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
DI-n-BUTYLPHALATE	NA	NA	0.21	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
FLUORANTHENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
PYRENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
BUTYLBENZYLPHTHALATE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
BENZO(a)ANTHRACENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
CHRYSENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
bis(2-ETHYLHEXYL)PHTHALATE	NA	NA	0.085	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
BENZO(b)FLUORANTHENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
BENZO(k)FLUORANTHENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
BENZO(a)PYRENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
INDENO(1,2,3-cd)PYRENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
BENZO(g,h,i)PERYLENE	NA	NA	NA	1E-06	2000	0.2	NA	250	4.5	70	1643	25550
PCB'S												
AROCLOR-1248	4.46E-08	2.87E-09	1.9	1E-06	2000	0.2	0.006	250	4.5	70	1643	25550
AROCLOR-1254	3.52E-08	2.26E-09	1.5	1E-06	2000	0.2	0.006	250	4.5	70	1643	25550
AROCLOR-1260	0.00E+00	0.00E+00	NA	1E-06	2000	0.2	0.006	250	4.5	70	1643	25550

Not Applicable

TABLE C.2-2
UNCERTAINTY ANALYSIS
INGESTION OF CHEMICALS IN SOIL
SCENARIO 2 – Industrial (Current)

CHEMICAL	INTAKE (NONCANCER) (mg/kg/day)	INTAKE (CANCER) (mg/kg/day)	SOIL CONC (mg/kg)	INGESTION RATE (mg/day)	CONVERSION FACTOR (1E-6 kg/mg)	FRACTION INGESTED (unitless)	EXPOSURE FREQUENCY (days/year)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVERAGING TIME (NONCANCER) (days)	AVERAGING TIME (CANCER) (days)
INORGANICS											
ALUMINUM	1.28E-02	8.23E-04	26159.5	50	1E-06	1	250	4.5	70	1643	25550
ANTIMONY	2.46E-06	1.60E-07	5.1	50	1E-06	1	250	4.5	70	1643	25550
ARSENIC	1.19E-06	7.65E-08	2.4	50	1E-06	1	250	4.5	70	1643	25550
BARIUM	1.26E-04	8.10E-06	257.6	50	1E-06	1	250	4.5	70	1643	25550
BERYLLIUM	7.54E-06	4.84E-07	15.4	50	1E-06	1	250	4.5	70	1643	25550
CADMIUM	4.66E-07	3.00E-08	1.0	50	1E-06	1	250	4.5	70	1643	25550
CHROMIUM III	1.23E-04	7.93E-06	252.3	50	1E-06	1	250	4.5	70	1643	25550
CHROMIUM VI	1.22E-06	7.86E-08	2.5	50	1E-06	1	250	4.5	70	1643	25550
COBALT	3.37E-06	2.17E-07	6.9	50	1E-06	1	250	4.5	70	1643	25550
COPPER	1.60E-05	1.03E-06	32.7	50	1E-06	1	250	4.5	70	1643	25550
LEAD	5.82E-05	3.74E-06	118.9	50	1E-06	1	250	4.5	70	1643	25550
MANGANESE	5.66E-04	3.64E-05	1156.7	50	1E-06	1	250	4.5	70	1643	25550
MERCURY	5.11E-08	3.29E-09	0.10	50	1E-06	1	250	4.5	70	1643	25550
NICKEL	4.10E-04	2.63E-05	837.0	50	1E-06	1	250	4.5	70	1643	25550
SELENIUM	7.31E-07	4.70E-08	1.5	50	1E-06	1	250	4.5	70	1643	25550
SILVER	7.96E-07	5.12E-08	1.6	50	1E-06	1	250	4.5	70	1643	25550
VANADIUM	1.66E-03	1.06E-04	3383.1	50	1E-06	1	250	4.5	70	1643	25550
ZINC	8.26E-05	5.31E-06	168.8	50	1E-06	1	250	4.5	70	1643	25550
BORON	5.29E-05	3.40E-06	108.1	50	1E-06	1	250	4.5	70	1643	25550
NIOBIUM	9.00E-05	5.79E-06	184.0	50	1E-06	1	250	4.5	70	1643	25550
STRONTIUM	7.84E-05	5.04E-06	160.3	50	1E-06	1	250	4.5	70	1643	25550
TITANIUM	1.39E-04	8.96E-06	285.0	50	1E-06	1	250	4.5	70	1643	25550
ZIRCONIUM	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
VOLATILE ORGANICS											
ACETONE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
CARBON DISULFIDE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
1,2-DICHLOROETHENE (total)	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
2-BUTANONE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
TRICHLOROETHENE	1.96E-09	1.26E-10	0.0040	50	1E-06	1	250	4.5	70	1643	25550
BENZENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
TETRACHLOROETHENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
TOLUENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
ETHYLBENZENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
XYLENE (total)	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
BASE NEUTRAL / ACIDS											
PHENOL	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
BENZOIC ACID	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
NAPHTHALENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
4-NITROPHENOL	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
2,4-DINITROTOLUENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
PENTACHLOROPHENOL	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
PHENANTIRENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
ANTHRACENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
DI-n-BUTYLPHALATE	1.03E-07	6.60E-09	0.21	50	1E-06	1	250	4.5	70	1643	25550
FLUORANTHENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
PYRENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
BUTYLBENZYLPHTHALATE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
BENZO(a)ANTHRACENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
CHRYSENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
bis(2-ETHYLHEXYL)PHTHALATE	4.16E-08	2.67E-09	0.085	50	1E-06	1	250	4.5	70	1643	25550
BENZO(b)FLUORANTHENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
BENZO(k)FLUORANTHENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
BENZO(a)PYRENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
INDENO(1,2,3-cd)PYRENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
BENZO(g,h,i)PERYLENE	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550
PCB'S											
AROCLOR-1248	9.30E-07	5.98E-08	1.9	50	1E-06	1	250	4.5	70	1643	25550
AROCLOR-1254	7.34E-07	4.72E-08	1.5	50	1E-06	1	250	4.5	70	1643	25550
AROCLOR-1260	0.00E+00	0.00E+00	NA	50	1E-06	1	250	4.5	70	1643	25550

NA = Not Applicable

TABLE C.2-3
UNCERTAINTY ANALYSIS
CANCER RISK ESTIMATES
SCENARIO 2 – Industrial (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK	TOTAL RISK
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SOILS								4E-08	3E-06
PCB'S									
AROCLOR-1248	2.9E-09	No	7.70E+00				2E-08		
AROCLOR-1254	2.3E-09	No	7.70E+00				2E-08		
AROCLOR-1260	0.0E+00	No	7.70E+00	B2	Liver	Diet/IRIS	NA		

NA: Not Applicable

TABLE C.2-4
UNCERTAINTY ANALYSIS
CANCER RISK ESTIMATES
SCENARIO 2 – Industrial (Current)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: INCIDENTAL INGESTION OF CHEMICALS IN SOIL								3E-06
INORGANICS								
ARSENIC	7.7E-08	No	1.75E+00	A	Skin	IRIS	1E-07	
BERYLLIUM	4.8E-07	No	4.30E+00	B2	gross tumors, all sites combined	Water/IRIS	2E-06	
LEAD	3.7E-06	No	NA	B2	Renal tumors	Oral/IRIS	NA	
VOLATILE ORGANICS								
TRICHLOROETHENE	1.3E-10	No	1.10E-02	B2	Liver	Gavage/HEAST	1E-12	
BENZENE	0.0E+00	No	2.90E-02	A	Leukemia	Occupational/IRIS	NA	
TETRACHLOROETHENE	0.0E+00	No	5.10E-02	B2	Liver	Gavage/HEAST	NA	
BASE NEUTRAL / ACIDS								
2,4-DINITROTOLUENE	0.0E+00	No	6.80E-01	B2	Liver, mammary gland	Diet/IRIS	NA	
PENTACHLOROPHENOL	0.0E+00	No	1.20E-01	B2	Hepatocellular adenoma, carcinomas,pheochrom	Oral/IRIS	NA	
BENZO(a)ANTHRACENE	0.0E+00	No	1.15E+01	B2	Liver, lung, skin	IRIS	NA	
CHRYSENE	0.0E+00	No	1.15E+01	B2	Malignant lymphoma	IRIS	NA	
bis(2-ETHYLHEXYL)PHTHALATE	2.7E-09	No	1.40E-02	B2	Liver	IRIS	4E-11	
BENZO(b)FLUORANTHENE	0.0E+00	No	1.15E+01	B2	Lung, thorax, skin	IRIS	NA	
BENZO(k)FLUORANTHENE	0.0E+00	No	1.15E+01	B2	Lung, thorax, skin	IRIS	NA	
BENZO(a)PYRENE	0.0E+00	No	1.15E+01	B2	Stomach, lung	IRIS	NA	
INDENO(1,2,3-cd)PYRENE	0.0E+00	No	1.15E+01	B2	Lung, skin	IRIS	NA	
PCB'S								
AROCLOR-1248	6.0E-08	No	7.70E+00				5E-07	
AROCLOR-1254	4.7E-08	No	7.70E+00				4E-07	
AROCLOR-1260	0.0E+00	No	7.70E+00	B2	Liver	Diet/IRIS	NA	

NA: Not Applicable

TABLE C.3-1D
UNCERTAINTY ANALYSIS
INGESTION OF CHEMICALS IN DEEP GROUND WATER
SCENARIO 3-Residential (Current)

CHEMICAL	INTAKE NONCANCER (mg/kg/day)	INTAKE CANCER (mg/kg/day)	CONC. IN WATER (mg/liter)	INGESTION RATE (liter/day)	EXPOSURE FREQUENCY (days/yr)	ED (years)	BODY WIEGHT (kg)	AVG. TIME NONCANCER ADULT (days)	AVG. TIME CANCER (days)
INORGANICS									
ALUMINUM	1.91E+00	2.45E-01	99.40	1.4	350	9	70	3285	25550
ANTIMONY	4.10E-02	5.28E-03	2.14	1.4	350	9	70	3285	25550
ARSENIC	6.75E-03	8.68E-04	0.35	1.4	350	9	70	3285	25550
BARIUM	9.72E-03	1.25E-03	0.51	1.4	350	9	70	3285	25550
BERYLLIUM	2.17E-04	2.79E-05	0.011	1.4	350	9	70	3285	25550
CADMIUM	0.00E+00	0.00E+00	NA	1.4	350	9	70	3285	25550
CHROMIUM III	1.93E+00	2.48E-01	100.60	1.4	350	9	70	3285	25550
CHROMIUM VI	2.68E-02	3.45E-03	1.40	1.4	350	9	70	3285	25550
COBALT	8.40E-04	1.08E-04	0.044	1.4	350	9	70	3285	25550
COPPER	7.23E-04	9.30E-05	0.038	1.4	350	9	70	3285	25550
LEAD	4.68E-04	6.02E-05	0.024	1.4	350	9	70	3285	25550
MANGANESE	3.38E-03	4.34E-04	0.18	1.4	350	9	70	3285	25550
MERCURY	1.88E-05	2.42E-06	0.0010	1.4	350	9	70	3285	25550
NICKEL	1.67E-04	2.15E-05	0.0087	1.4	350	9	70	3285	25550
SELENIUM	2.49E-03	3.21E-04	0.13	1.4	350	9	70	3285	25550
SILVER	9.78E-05	1.26E-05	0.0051	1.4	350	9	70	3285	25550
VANADIUM	3.84E-02	4.93E-03	2.00	1.4	350	9	70	3285	25550
ZINC	1.25E-03	1.61E-04	0.065	1.4	350	9	70	3285	25550
CYANIDE	1.19E-03	1.53E-04	0.062	1.4	350	9	70	3285	25550
BORON	3.03E-03	3.90E-04	0.16	1.4	350	9	70	3285	25550
STRONTIUM	6.10E-03	7.84E-04	0.32	1.4	350	9	70	3285	25550
TITANIUM	6.23E-03	8.01E-04	0.33	1.4	350	9	70	3285	25550
VOLATILE ORGANICS									
TRICHLOROETHENE	1.34E-03	1.73E-04	0.070	1.4	350	9	70	3285	25550
TETRACHLOROETHENE	1.92E-05	2.47E-06	0.0010	1.4	350	9	70	3285	25550
BASE NEUTRAL / ACIDS									
bis(2-ETHYLHEXYL)PHTHALATE	7.67E-05	9.86E-06	0.0040	1.4	350	9	70	3285	25550

NA: Not Applicable

TABLE C.3-2D
UNCERTAINTY ANALYSIS
INHALATION OF AIRBORNE (VAPOR PHASE) CHEMICALS FROM DEEP GROUNDWATER
SCENARIO 3-Residential (Current)

CHEMICAL	INTAKE ADULT NONCANCER (mg/kg/day)	INTAKE ADULT CANCER (mg/kg/day)	CONC. IN AIR (mg/m3)	INHALATION RATE (m3/hour)	EXPOSURE TIME (hours/day)	EXPOSURE FREQUENCY (days/yr)	ED (years)	BODY WIEGHT (kg)	AVG. TIME NONCANCER (days)	AVG. TIME CANCER (days)
VOLATILE ORGANICS										
TRICHLOROETHENE	2.70E-02	3.47E-03	0.210	0.625	15	350	9	70	3285	25550
TETRACHLOROETHENE	3.85E-04	4.95E-05	0.0030	0.625	15	350	9	70	3285	25550
BASE NEUTRAL / ACIDS										
bis(2-ETHYLHEXYL)PHTHALATE	1.54E-03	1.98E-04	0.012	0.625	15	350	9	70	3285	25550

NA: Not Applicable

TABLE C.3-3D
UNCERTAINTY ANALYSIS
DERMAL CONTACT WITH CHEMICALS IN DEEP GROUNDWATER
SCENARIO 3-Residential (Current)

CHEMICAL	ABSORBED DOSE NONCANCER (mg/kg/day)	ABSORBED DOSE CANCER (mg/kg/day)	CONC. IN WATER (mg/liter)	SKIN SURFACE AREA (cm2/event)	DERMAL PERMEABILITY (cm/hr)	EXPOSURE TIME (hrs/day)	EXPOSURE FREQUENCY (days/year)	EXPOSURE DURATION (years)	CONVERSION FACTOR (L/cm3)	BODY WEIGHT (kg)	AVG TIME NONCANCER (days)	AVG. TIME CANCER (days)
INORGANICS												
ALUMINUM	2.49E-03	3.20E-04	99.40	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
ANTIMONY	5.36E-05	6.90E-06	2.14	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
ARSENIC	8.82E-06	1.13E-06	0.35	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
BARIUM	1.27E-05	1.63E-06	0.51	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
BERYLLIUM	2.83E-07	3.64E-08	0.011	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
CADMIUM	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
CHROMIUM III	2.52E-03	3.24E-04	100.60	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
CHROMIUM VI	3.51E-05	4.51E-06	1.40	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
COBALT	1.10E-06	1.41E-07	0.044	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
COPPER	9.45E-07	1.21E-07	0.038	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
LEAD	6.12E-07	7.86E-08	0.024	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
MANGANESE	4.41E-06	5.67E-07	0.18	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
MERCURY	2.46E-08	3.16E-09	0.0010	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
NICKEL	2.18E-07	2.80E-08	0.0087	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
SELENIUM	3.26E-06	4.19E-07	0.13	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
SILVER	1.28E-07	1.64E-08	0.0051	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
VANADIUM	5.01E-05	6.44E-06	2.00	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
ZINC	1.63E-06	2.10E-07	0.065	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
CYANIDE	1.56E-06	2.00E-07	0.062	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
BORON	3.96E-06	5.09E-07	0.16	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
STRONTIUM	7.97E-06	1.02E-06	0.32	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
TITANIUM	8.15E-06	1.05E-06	0.33	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
VOLATILE ORGANICS												
TRICHLOROETHENE	1.75E-06	2.26E-07	0.070	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
TETRACHLOROETHENE	2.51E-08	3.22E-09	0.0010	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
BASE NEUTRAL / ACIDS												
bis(2-ETHYLHEXYL)PHTHA	1.00E-07	1.29E-08	0.0040	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550

NA: Not Applicable

TABLE C.3-4D
UNCERTAINTY ANALYSIS
CANCER RISK ESTIMATES
SCENARIO 3-Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEM. SPEC. RISK	TOTAL PATHWAY RISK	TOTAL EXPOSURE RISK
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN DEEP GROUND WATER							ADULT	2E-03	2E-03
INORGANICS									
ARSENIC	8.7E-04	No	1.75E+00	A	Skin	IRIS	2E-03		
BERYLLIUM	2.8E-05	No	4.30E+00	B2	gross tumors, all sites combined	Water/IRIS	1E-04		
LEAD	6.0E-05	No	NA	B2	Renal tumors	Oral/IRIS	NA		
VOLATILE ORGANICS									
TRICHLOROETHENE	1.7E-04	No	1.10E-02	B2	Liver	Gavage/HEAST	2E-06		
TETRACHLOROETHENE	2.5E-06	No	5.10E-02	B2	Liver	Gavage/HEAST	1E-07		
BASE NEUTRAL/ACIDS									
bis(2-ETHYLHEXYL)PHTHALATE	9.9E-06	No	1.40E-02	B2	Liver	IRIS	1E-07		

NA: Not Applicable

TABLE C.3-5D
UNCERTAINTY ANALYSIS
CANCER RISK ESTIMATES
SCENARIO 3 - Residential (Current)

CHEMICAL	CDI-ADULT MEAN (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEM. SPEC. RISK-ADULT MEAN	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: INHALATION OF AIRBORNE (VAPOR PHASE) CHEMICALS FROM DEEP GROUNDWATER								6E-05
VOLATILE ORGANICS								
TRICHLOROETHENE	3.5E-03	No	1.70E-02	B2	Lung	HEAST	5.9E-05	
TETRACHLOROETHENE	5.0E-05	No	1.80E-03	B2	Leukemia, liver	HEAST	8.9E-08	

NA: Not Applicable

TABLE C.3-6D
UNCERTAINTY ANALYSIS
CANCER RISK ESTIMATES
SCENARIO 3 - Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEM. SPEC. RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN DEEP GROUNDWATER								2E-06
INORGANICS								
ARSENIC	1.1E-06	No	1.75E+00	A	Skin	IRIS	2E-06	
VOLATILE ORGANICS								
TRICHLOROETHENE	2.3E-07	No	1.10E-02	B2	Liver	Gavage/HEAST	2E-09	
TETRACHLOROETHENE	3.2E-09	No	5.10E-02	B2	Liver	Gavage/HEAST	2E-10	
BASE NEUTRAL / ACIDS								
bis(2-ETHYLHEXYL)PHTHALATE	1.3E-08	No	1.40E-02	B2	Liver	IRIS	2E-10	

NA: Not Applicable

TABLE C.3-7D
UNCERTAINTY ANALYSIS
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 3-Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)	TOTAL EXPOSURE HI
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN DEEP GROUND WATER										1E+02	1E+02
INORGANICS											
ALUMINUM	1.9E+00	No	NA			NA/IRIS			NA		
ANTIMONY	4.1E-02	No	4.00E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	1000	1	1E+02		
ARSENIC	6.8E-03	No	1.00E-03		Keratosis and hyperpigmentation	Diet/HEAST	1		7E+00		
BARIUM	9.7E-03	No	7.00E-02	Medium	None observed	Water/IRIS	3	1	1E-01		
BERYLLIUM	2.2E-04	No	5.00E-03	Low	None observed	Water/IRIS	100	1	4E-02		
CADMIUM	0.0E+00	No	1.00E-03	High	Proteinuria	Diet/IRIS	10	1	NA		
CHROMIUM III	1.9E+00	No	1.00E+00	Low	Hepatotoxicity	IRIS	1000		2E+00		
CHROMIUM VI	2.7E-02	No	5.00E-03	Low	No effects observed	Water/IRIS	500	1	5E+00		
COBALT	8.4E-04	No	NA			NA/IRIS			NA		
COPPER	7.2E-04	No	4.00E-02		Local GI irritation	NA/HEAST			2E-02		
LEAD	4.7E-04	No	NA		Neurobehavioral effects	NA/IRIS			NA		
MANGANESE	3.4E-03	No	1.00E-01	Medium	CNS effects	Diet/IRIS	1	1	3E-02		
MERCURY	1.9E-05	No	3.00E-04		Kidney effects	Oral/HEAST	1000		6E-02		
NICKEL	1.7E-04	No	2.00E-02		Reduced body and organ weight	Diet/HEAST			8E-03		
SELENIUM	2.5E-03	No	5.00E-03	Medium	Clinical selenosis	Diet/IRIS	3	1	5E-01		
SILVER	9.8E-05	No	3.00E-03	Medium	Argyria	Oral/IRIS	2	1	3E-02		
VANADIUM	3.8E-02	No	7.00E-03		None observed	Water/HEAST	100		5E+00		
ZINC	1.2E-03	No	2.00E-01		Anemia	Therap./HEAST	10		6E-03		
CYANIDE	1.2E-03	No	2.00E-02	Medium	Weight loss,thyroid effects,myelin degeneration	Diet/IRIS	100	5	8E-02		
BORON	3.0E-03	No	9.00E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IRIS	100	1	3E-02		
STRONTIUM	6.1E-03	No	NA			NA/IRIS			NA		
TITANIUM	6.2E-03	No	NA			NA/IRIS			NA		
VOLATILE ORGANICS											
TRICHLOROETHENE	1.3E-03	No	NA			NA/IRIS			NA		
TETRACHLOROETHENE	1.9E-05	No	1.00E-02	Medium	Hepatotoxicity,weight gain	Gavage/IRIS	100	1	2E-03		
BASE NEUTRAL / ACIDS											
bis(2-ETHYLHEXYL)PHTHALATE	7.7E-05	No	2.00E-02	Medium	Increased relative liver weight	Diet/IRIS	1000	1	4E-03		

NA: Not Applicable

3LE C.3-1S
UNCERTAINTY ANALYSIS
INGESTION OF CHEMICALS IN SHALLOW GROUNDWATER
SCENARIO 3-Residential (Current)

CHEMICAL	INTAKE NONCANCER (mg/kg/day)	INTAKE CANCER (mg/kg/day)	CONC. IN WATER (mg/liter)	INGESTION RATE (liter/day)	EXPOSURE FREQUENCY (days/yr)	ED (years)	BODY WEIGHT (kg)	AVG. TIME NONCANCER ADULT (days)	AVG. TIME CANCER (days)
INORGANICS									
ALUMINUM	7.52E-01	9.67E-02	39.2	1.4	350	9	70	3285	25550
ANTIMONY	0.00E+00	0.00E+00	NA	1.4	350	9	70	3285	25550
ARSENIC	1.43E-02	1.84E-03	0.75	1.4	350	9	70	3285	25550
BARIUM	1.66E-03	2.14E-04	0.09	1.4	350	9	70	3285	25550
BERYLLIUM	1.09E-02	1.41E-03	0.57	1.4	350	9	70	3285	25550
CADMIUM	1.48E-04	1.90E-05	0.0077	1.4	350	9	70	3285	25550
CHROMIUM III	1.62E-03	2.09E-04	0.08	1.4	350	9	70	3285	25550
CHROMIUM VI	1.53E-07	1.97E-08	0.000008	1.4	350	9	70	3285	25550
COBALT	1.44E-04	1.85E-05	0.008	1.4	350	9	70	3285	25550
COPPER	2.49E-03	3.21E-04	0.130	1.4	350	9	70	3285	25550
LEAD	1.32E-03	1.70E-04	0.069	1.4	350	9	70	3285	25550
MANGANESE	1.15E-02	1.47E-03	0.6	1.4	350	9	70	3285	25550
MERCURY	1.30E-05	1.68E-06	0.00068	1.4	350	9	70	3285	25550
NICKEL	4.07E-03	5.23E-04	0.21	1.4	350	9	70	3285	25550
SELENIUM	0.00E+00	0.00E+00	NA	1.4	350	9	70	3285	25550
SILVER	0.00E+00	0.00E+00	NA	1.4	350	9	70	3285	25550
VANADIUM	2.45E+00	3.16E-01	128.0	1.4	350	9	70	3285	25550
ZINC	2.07E-02	2.66E-03	1.1	1.4	350	9	70	3285	25550
CYANIDE	5.06E-01	6.51E-02	26.4	1.4	350	9	70	3285	25550
BORON	2.82E-01	3.62E-02	14.7	1.4	350	9	70	3285	25550
STRONTIUM	0.00E+00	0.00E+00	NA	1.4	350	9	70	3285	25550
TITANIUM	2.86E-03	3.67E-04	0.15	1.4	350	9	70	3285	25550
VOLATILE ORGANICS									
TRICHLOROETHENE	0.00E+00	0.00E+00	NA	1.4	350	9	70	3285	25550
TETRACHLOROETHENE	0.00E+00	0.00E+00	NA	1.4	350	9	70	3285	25550
BASE NEUTRAL / ACIDS									
bis(2-ETHYLHEXYL)PHTHALATE	0.00E+00	0.00E+00	NA	1.4	350	9	70	3285	25550

NA: Not Applicable

TABLE C.3-2S
UNCERTAINTY ANALYSIS
DERMAL CONTACT WITH CHEMICALS IN SHALLOW GROUNDWATER
SCENARIO 3-Residential (Current)

CHEMICAL	ABSORBED DOSE NONCANCER (mg/kg/day)	ABSORBED DOSE CANCER (mg/kg/day)	CONC. IN WATER (mg/liter)	SKIN SURFACE AREA (cm2/event)	DERMAL PERMEABILITY (cm/hr)	EXPOSURE TIME (hrs/day)	EXPOSURE FREQUENCY (days/year)	EXPOSURE DURATION (years)	CONVERSION FACTOR (L/cm3)	BODY WEIGHT (kg)	AVG TIME NONCANCER (days)	AVG. TIME CANCER (days)
INORGANICS												
ALUMINUM	9.55E-04	1.23E-04	39.20	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
ANTIMONY	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
ARSENIC	1.82E-05	2.34E-06	0.75	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
BARIUM	2.11E-06	2.72E-07	0.09	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
BERYLLIUM	1.39E-05	1.79E-06	0.57	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
CADMIUM	1.88E-07	2.41E-08	0.0077	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
CHROMIUM III	2.06E-06	2.65E-07	0.08	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
CHROMIUM VI	1.95E-10	2.51E-11	0.000008	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
COBALT	1.83E-07	2.35E-08	0.008	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
COPPER	3.17E-06	4.07E-07	0.13	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
LEAD	1.68E-06	2.16E-07	0.069	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
MANGANESE	1.46E-05	1.87E-06	0.60	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
MERCURY	1.66E-08	2.13E-09	0.00068	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
NICKEL	5.17E-06	6.64E-07	0.21	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
SELENIUM	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
SILVER	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
VANADIUM	3.12E-03	4.01E-04	128.00	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
ZINC	2.63E-05	3.38E-06	1.1	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
CYANIDE	6.43E-04	8.27E-05	26.40	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
BORON	3.58E-04	4.61E-05	14.70	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
STRONTIUM	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
TITANIUM	3.63E-06	4.67E-07	0.15	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
VOLATILE ORGANICS												
TRICHLOROETHENE	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
TETRACHLOROETHENE	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550
BASE NEUTRAL / ACIDS												
bis(2-ETHYLHEXYL)PHTHALATE	0.00E+00	0.00E+00	NA	18150	8.4E-04	0.12	350	9	0.001	70	3285	25550

NA: Not Applicable

ABLE C.3-3S
UNCERTAINTY ANALYSIS
CANCER RISK ESTIMATES
SCENARIO 3--Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEM. SPEC. RISK	TOTAL PATHWAY RISK	TOTAL EXPOSURE RISK
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN SHALLOW GROUNDWATER							ADULT	9E-03	9E-03
INORGANICS									
ARSENIC	1.8E-03	No	1.75E+00	A	Skin	IRIS	3E-03		
BERYLLIUM	1.4E-03	No	4.30E+00	B2	gross tumors, all sites combined	Water/IRIS	6E-03		
LEAD	1.7E-04	No	NA	B2	Renal tumors	Oral/IRIS	NA		
VOLATILE ORGANICS									
TRICHLOROETHENE	0.0E+00	No	1.10E-02	B2	Liver	Gavage/HEAST	NA		
TETRACHLOROETHENE	0.0E+00	No	5.10E-02	B2	Liver	Gavage/HEAST	NA		
BASE NEUTRAL / ACIDS									
bis(2-ETHYLHEXYL)PHTHALATE	0.0E+00	No	1.40E-02	B2	Liver	IRIS	NA		

NA: Not Applicable

TABLE C.3-4S
UNCERTAINTY ANALYSIS
CANCER RISK ESTIMATES
SCENARIO 3 - Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEM. SPEC. RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: DERMAL CONTACT WITH CHEMICALS IN SHALLOW GROUNDWATER								4E-06
INORGANICS								
ARSENIC	2.3E-06	No	1.75E+00	A	Skin	IRIS	4E-06	
VOLATILE ORGANICS								
TRICHLOROETHENE	0.0E+00	No	1.10E-02	B2	Liver	Gavage/HEAST	NA	
TETRACHLOROETHENE	0.0E+00	No	5.10E-02	B2	Liver	Gavage/HEAST	NA	
BASE NEUTRAL / ACIDS								
bis(2-ETHYLHEXYL)PHTHALATE	0.0E+00	No	1.40E-02	B2	Liver	IRIS	NA	

NA: Not Applicable

TABLE C.3-5S
UNCERTAINTY ANALYSIS
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 3--Residential (Current)

CHEMICAL	CHRONIC DAILY INTAKE (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENTS	MODIFYING FACTORS	HAZARD QUOTIENT	PATHWAY HAZARD INDEX (HI)	TOTAL EXPOSURE HI
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN SHALLOW GROUNDWATER										4E+02	4E+02
INORGANICS											
ALUMINUM	7.5E-01	No	NA			NA/IRIS			NA		
ANTIMONY	0.0E+00	No	4.00E-04	Low	Longevity,blood glucose and cholesterol	Water/IRIS	1000	1	NA		
ARSENIC	1.4E-02	No	1.00E-03		Keratosis and hyperpigmentation	Diet/HEAST	1		1E+01		
BARIUM	1.7E-03	No	7.00E-02	Medium	None observed	Water/IRIS	3	1	2E-02		
BERYLLIUM	1.1E-02	No	5.00E-03	Low	None observed	Water/IRIS	100	1	2E+00		
CADMIUM	1.5E-04	No	1.00E-03	High	Proteinuria	Diet/IRIS	10	1	1E-01		
CHROMIUM III	1.6E-03	No	1.00E+00	Low	Hepatotoxicity	IRIS	1000		2E-03		
CHROMIUM VI	1.5E-07	No	5.00E-03	Low	No effects observed	Water/IRIS	500	1	3E-05		
COBALT	1.4E-04	No	NA			NA/IRIS			NA		
COPPER	2.5E-03	No	4.00E-02		Local GI irritation	NA/HEAST			6E-02		
LEAD	1.3E-03	No	NA		Neurobehavioral effects	NA/IRIS			NA		
MANGANESE	1.1E-02	No	1.00E-01	Medium	CNS effects	Diet/IRIS	1	1	1E-01		
MERCURY	1.3E-05	No	3.00E-04		Kidney effects	Oral/HEAST	1000		4E-02		
NICKEL	4.1E-03	No	2.00E-02		Reduced body and organ weight	Diet/HEAST	300		2E-01		
SELENIUM	0.0E+00	No	5.00E-03	Medium	Clinical selenosis	Diet/IRIS	3	1	NA		
SILVER	0.0E+00	No	3.00E-03	Medium	Argyria	Oral/IRIS	2	1	NA		
VANADIUM	2.5E+00	No	7.00E-03		None observed	Water/HEAST	100		4E+02		
ZINC	2.1E-02	No	2.00E-01		Anemia	Therap./HEAST	10		1E-01		
CYANIDE	5.1E-01	No	2.00E-02	Medium	Weight loss,thyroid effects,myelin degeneration	Diet/IRIS	100	5	3E+01		
BORON	2.8E-01	No	9.00E-02	Medium	Pulmonary edema and hemorrhage in the alveolus	Occupational/IRIS	100	1	3E+00		
STRONTIUM	0.0E+00	No	NA			NA/IRIS			NA		
TITANIUM	2.9E-03	No	NA			NA/IRIS			NA		
VOLATILE ORGANICS											
TRICHLOROETHENE	0.0E+00	No	NA			NA/IRIS			NA		
TETRACHLOROETHENE	0.0E+00	No	1.00E-02	Medium	Hepatotoxicity,weight gain	Gavage/IRIS	100	1	NA		
BASE NEUTRAL / ACIDS											
bis(2-ETHYLHEXYL)PHTHALATE	0.0E+00	No	2.00E-02	Medium	Increased relative liver weight	Diet/IRIS	1000	1	NA		

NA: Not Applicable

TABLE C.4-1
UNCERTAINTY ANALYSIS
INGESTION OF CHEMICALS IN SOIL
SCENARIO 4 – Construction (Future)

CHEMICAL	INTAKE NONCANCER (mg/kg/day)	INTAKE CANCER (mg/kg/day)	CONC. IN SOIL (mg/kg)	INGESTION RATE (mg soil/day)	CONVERSION FACTOR (10E-6 kg/mg)	FRACTION INGESTED (unitless)	EXPOSURE FREQUENCY (days/year)	EXPOSURE DURATION (years)	BODY WEIGHT (kg)	AVG. TIME NONCANCER (days)	AVG. TIME CANCER (days)
INORGANICS											
ALUMINUM	8.77E-03	6.18E-05	5116.1	480	1.0E-06	1	90	0.5	70	180	25550
ANTIMONY	9.46E-06	6.67E-08	5.5	480	1.0E-06	1	90	0.5	70	180	25550
ARSENIC	2.24E-06	1.57E-08	1.3	480	1.0E-06	1	90	0.5	70	180	25550
BARIUM	4.22E-05	2.97E-07	24.6	480	1.0E-06	1	90	0.5	70	180	25550
BERYLLIUM	1.62E-06	1.14E-08	0.95	480	1.0E-06	1	90	0.5	70	180	25550
CHROMIUM III	8.24E-05	5.81E-07	48.1	480	1.0E-06	1	90	0.5	70	180	25550
CHROMIUM VI	4.58E-05	3.23E-07	26.7	480	1.0E-06	1	90	0.5	70	180	25550
COBALT	5.97E-06	4.20E-08	3.5	480	1.0E-06	1	90	0.5	70	180	25550
COPPER	7.43E-06	5.24E-08	4.3	480	1.0E-06	1	90	0.5	70	180	25550
LEAD	2.22E-05	1.57E-07	13.0	480	1.0E-06	1	90	0.5	70	180	25550
MANGANESE	2.28E-04	1.60E-06	132.8	480	1.0E-06	1	90	0.5	70	180	25550
MERCURY	1.68E-07	1.18E-09	0.10	480	1.0E-06	1	90	0.5	70	180	25550
NICKEL	2.22E-05	1.56E-07	12.9	480	1.0E-06	1	90	0.5	70	180	25550
SELENIUM	9.93E-07	7.00E-09	0.58	480	1.0E-06	1	90	0.5	70	180	25550
SILVER	2.42E-06	1.70E-08	1.4	480	1.0E-06	1	90	0.5	70	180	25550
VANADIUM	5.23E-04	3.68E-06	304.9	480	1.0E-06	1	90	0.5	70	180	25550
ZINC	3.43E-05	2.42E-07	20.0	480	1.0E-06	1	90	0.5	70	180	25550
BORON	4.20E-05	2.96E-07	24.5	480	1.0E-06	1	90	0.5	70	180	25550
TITANIUM	2.57E-04	1.81E-06	149.8	480	1.0E-06	1	90	0.5	70	180	25550
ZIRCONIUM	1.82E-04	1.28E-06	106.1	480	1.0E-06	1	90	0.5	70	180	25550
							90	0.5			
VOLATILE ORGANICS							90	0.5			
METHYLENE CHLORIDE	2.57E-07	1.81E-09	0.15	480	1.0E-06	1	90	0.5	70	180	25550
ACETONE	2.91E-07	2.05E-09	0.17	480	1.0E-06	1	90	0.5	70	180	25550
CHLOROFORM	5.05E-09	3.56E-11	0.0029	480	1.0E-06	1	90	0.5	70	180	25550
TRICHLOROETHENE	6.85E-09	4.82E-11	0.0040	480	1.0E-06	1	90	0.5	70	180	25550
TETRACHLOROETHENE	5.10E-09	3.60E-11	0.0030	480	1.0E-06	1	90	0.5	70	180	25550
TOLUENE	4.91E-09	3.46E-11	0.0029	480	1.0E-06	1	90	0.5	70	180	25550
BASE NEUTRAL / ACIDS											
PHENOL	3.34E-07	2.35E-09	0.19	480	1.0E-06	1	90	0.5	70	180	25550
2,4,5-TRICHLOROPHENOL	2.40E-06	1.69E-08	1.40	480	1.0E-06	1	90	0.5	70	180	25550
PENTACHLOROPHENOL	5.14E-07	3.62E-09	0.30	480	1.0E-06	1	90	0.5	70	180	25550
PHENANTHRENE	2.74E-07	1.93E-09	0.16	480	1.0E-06	1	90	0.5	70	180	25550
DI-n-BUTYLPHALATE	2.06E-06	1.45E-08	1.20	480	1.0E-06	1	90	0.5	70	180	25550
FLUORANTHENE	3.43E-07	2.42E-09	0.20	480	1.0E-06	1	90	0.5	70	180	25550
PYRENE	3.56E-07	2.51E-09	0.21	480	1.0E-06	1	90	0.5	70	180	25550
BUTYLBENZYLPHTHALATE	2.23E-07	1.57E-09	0.13	480	1.0E-06	1	90	0.5	70	180	25550
BENZO(a)ANTHRACENE	2.23E-07	1.57E-09	0.13	480	1.0E-06	1	90	0.5	70	180	25550
CHRYSENE	2.23E-07	1.57E-09	0.13	480	1.0E-06	1	90	0.5	70	180	25550
bis(2-ETHYLHEXYL)PHTHALATE	8.05E-07	5.67E-09	0.47	480	1.0E-06	1	90	0.5	70	180	25550
BENZO(b)FLUORANTHENE	3.53E-07	2.49E-09	0.21	480	1.0E-06	1	90	0.5	70	180	25550
BENZO(k)FLUORANTHENE	1.29E-07	9.06E-10	0.075	480	1.0E-06	1	90	0.5	70	180	25550
BENZO(a)PYRENE	1.13E-07	7.97E-10	0.066	480	1.0E-06	1	90	0.5	70	180	25550
PESTICIDES / PCB'S											
4,4-DDT	5.31E-05	3.74E-07	31.0	480	1.0E-06	1	90	0.5	70	180	25550

TABLE C.4-2
UNCERTAINTY ANALYSIS
CANCER RISK ESTIMATES
SCENARIO 4 – Construction (Future)

CHEMICAL	CHRONIC DAILY INTAKE(CDI) (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPECIFIC RISK	TOTAL PATHWAY RISK
EXPOSURE PATHWAY: INGESTION OF CHEMICALS IN SOIL								3E-07
INORGANICS								
ARSENIC	1.6E-08	No	1.75E+00	A	Skin	IRIS	3E-08	
BERYLLIUM	1.1E-08	No	4.30E+00	B2	gross tumors, all sites combined	Water/IRIS	5E-08	
LEAD	1.6E-07	No	NA	B2	Renal tumors	Oral/IRIS	NA	
VOLATILE ORGANICS								
METHYLENE CHLORIDE	1.8E-09	No	7.50E-03	B2	Heptacellular carcinomas, neoplastic nodules	Water/IRIS	1E-11	
CHLOROFORM	3.6E-11	No	6.10E-03	B2	Kidney tumors	Oral/IRIS	2E-13	
TRICHLOROETHENE	4.8E-11	No	1.10E-02	B2	Liver	Gavage/HEAST	5E-13	
TETRACHLOROETHENE	3.6E-11	No	5.10E-02	B2	Liver	Gavage/HEAST	2E-12	
BASE NEUTRAL / ACIDS								
PENTACHLOROPHENOL	3.6E-09	No	1.20E-01	B2	Hepatocellular adenoma, carcinomas, pheochromocytoma	Oral/IRIS	4E-10	
BUTYLBENZYLPHTHALATE	1.6E-09	No	NA	C	Leukemia	Diet/IRIS	NA	
BENZO(a)ANTHRACENE	1.6E-09	No	1.15E+01	B2	Liver, lung, skin	IRIS	2E-08	
CHRYSENE	1.6E-09	No	1.15E+01	B2	Malignant lymphoma	IRIS	2E-08	
bis(2-ETHYLHEXYL)PHTHALATE	5.7E-09	No	1.40E-02	B2	Liver	IRIS	8E-11	
BENZO(b)FLUORANTHENE	2.5E-09	No	1.15E+01	B2	Lung, thorax, skin	IRIS	3E-08	
BENZO(k)FLUORANTHENE	9.1E-10	No	1.15E+01	B2	Lung, thorax, skin	IRIS	1E-08	
BENZO(a)PYRENE	8.0E-10	No	1.15E+01	B2	Stomach, lung	IRIS	9E-09	
PESTICIDES / PCB'S								
4,4-DDT	3.7E-07	No	3.40E-01	B2	Liver tumor	Oral/IRIS	1E-07	

NA: Not Applicable

TABLE C.5-1
UNCERTAINTY ANALYSIS
DERMAL CONTACT WITH CHEMICALS IN SOIL
SCENARIO 5 – Residential (Future)

CHEMICAL	ABS. DOSE ADULT (NONCANCER) (mg/kg/day)	ABS. DOSE ADULT (CANCER) (mg/kg/day)	SOIL CONC (mg/kg)	CONVERSION FACTOR (1E-6kg/mg)	SURFACE AREA ADULT (cm2/event)	ADHERENCE FACTOR (mg/cm2)	ABSORPTION FACTOR (unitless)	EXPOSURE FREQUENCY (events/year)	EXPOSURE DUR. ADULT (years)	BODY WT. ADULT (kg)	AVERAGING TIME NONCANCER ADULT (days)	AVERAGING TIME CANCER (days)
INORGANICS												
ALUMINUM	NA	0.00E+00	8422.5	1E-06	2000	0.2	NA	150	9	70	3285	25550
ANTIMONY	NA	0.00E+00	5.9	1E-06	2000	0.2	NA	150	9	70	3285	25550
ARSENIC	NA	0.00E+00	2.0	1E-06	2000	0.2	NA	150	9	70	3285	25550
BARIUM	NA	0.00E+00	77.4	1E-06	2000	0.2	NA	150	9	70	3285	25550
BERYLLIUM	NA	0.00E+00	5.4	1E-06	2000	0.2	NA	150	9	70	3285	25550
CADMIUM	2.22E-09	2.85E-10	0.94	1E-06	2000	0.2	0.001	150	9	70	3285	25550
CHROMIUM III	NA	0.00E+00	242.6	1E-06	2000	0.2	NA	150	9	70	3285	25550
CHROMIUM VI	NA	0.00E+00	4.0	1E-06	2000	0.2	NA	150	9	70	3285	25550
COBALT	NA	0.00E+00	4.3	1E-06	2000	0.2	NA	150	9	70	3285	25550
COPPER	NA	0.00E+00	15.6	1E-06	2000	0.2	NA	150	9	70	3285	25550
LEAD	NA	0.00E+00	56.1	1E-06	2000	0.2	NA	150	9	70	3285	25550
MANGANESE	NA	0.00E+00	436.1	1E-06	2000	0.2	NA	150	9	70	3285	25550
MERCURY	NA	0.00E+00	0.13	1E-06	2000	0.2	NA	150	9	70	3285	25550
NICKEL	NA	0.00E+00	223.6	1E-06	2000	0.2	NA	150	9	70	3285	25550
SELENIUM	NA	0.00E+00	0.66	1E-06	2000	0.2	NA	150	9	70	3285	25550
SILVER	NA	0.00E+00	1.2	1E-06	2000	0.2	NA	150	9	70	3285	25550
VANADIUM	NA	0.00E+00	1548.6	1E-06	2000	0.2	NA	150	9	70	3285	25550
ZINC	NA	0.00E+00	69.9	1E-06	2000	0.2	NA	150	9	70	3285	25550
BORON	NA	0.00E+00	33.6	1E-06	2000	0.2	NA	150	9	70	3285	25550
NIOBIUM	NA	0.00E+00	66.1	1E-06	2000	0.2	NA	150	9	70	3285	25550
STRONTIUM	NA	0.00E+00	41.6	1E-06	2000	0.2	NA	150	9	70	3285	25550
TITANIUM	NA	0.00E+00	146.0	1E-06	2000	0.2	NA	150	9	70	3285	25550
ZIRCONIUM	NA	0.00E+00	90.2	1E-06	2000	0.2	NA	150	9	70	3285	25550
VOLATILE ORGANICS												
ACETONE	NA	0.00E+00	0.082	1E-06	2000	0.2	NA	150	9	70	3285	25550
CARBON DISULFIDE	NA	0.00E+00	0.0030	1E-06	2000	0.2	NA	150	9	70	3285	25550
1,2-DICHLORETHENE (total)	NA	0.00E+00	0.0020	1E-06	2000	0.2	NA	150	9	70	3285	25550
2-BUTANONE	NA	0.00E+00	0.0061	1E-06	2000	0.2	NA	150	9	70	3285	25550
TRICHLOROETHENE	NA	0.00E+00	0.0035	1E-06	2000	0.2	NA	150	9	70	3285	25550
BENZENE	NA	0.00E+00	0.15	1E-06	2000	0.2	NA	150	9	70	3285	25550
TETRACHLOROETHENE	NA	0.00E+00	0.0036	1E-06	2000	0.2	NA	150	9	70	3285	25550
TOLUENE	NA	0.00E+00	0.0039	1E-06	2000	0.2	NA	150	9	70	3285	25550
ETHYLBENZENE	NA	0.00E+00	0.014	1E-06	2000	0.2	NA	150	9	70	3285	25550
XYLENE (total)	NA	0.00E+00	0.051	1E-06	2000	0.2	NA	150	9	70	3285	25550
BASE NEUTRAL / ACIDS												
PHENOL	NA	0.00E+00	0.18	1E-06	2000	0.2	NA	150	9	70	3285	25550
BENZOIC ACID	NA	0.00E+00	0.15	1E-06	2000	0.2	NA	150	9	70	3285	25550
NAPHTHALENE	NA	0.00E+00	0.13	1E-06	2000	0.2	NA	150	9	70	3285	25550
4-NITROPHENOL	NA	0.00E+00	1.0	1E-06	2000	0.2	NA	150	9	70	3285	25550
2,4-DINITROTOLUENE	NA	0.00E+00	0.11	1E-06	2000	0.2	NA	150	9	70	3285	25550
PENTACHLOROPHENOL	NA	0.00E+00	2.8	1E-06	2000	0.2	NA	150	9	70	3285	25550
PHENANTHRENE	NA	0.00E+00	0.13	1E-06	2000	0.2	NA	150	9	70	3285	25550
ANTHRACENE	NA	0.00E+00	0.084	1E-06	2000	0.2	NA	150	9	70	3285	25550
DI-n-BUTYLPHALATE	NA	0.00E+00	0.093	1E-06	2000	0.2	NA	150	9	70	3285	25550
FLUORANTHENE	NA	0.00E+00	0.26	1E-06	2000	0.2	NA	150	9	70	3285	25550
PYRENE	NA	0.00E+00	0.046	1E-06	2000	0.2	NA	150	9	70	3285	25550
BUTYLBENZYLPHTHALATE	NA	0.00E+00	0.12	1E-06	2000	0.2	NA	150	9	70	3285	25550
BENZO(a)ANTHRACENE	NA	0.00E+00	0.42	1E-06	2000	0.2	NA	150	9	70	3285	25550
CHRYSENE	NA	0.00E+00	0.30	1E-06	2000	0.2	NA	150	9	70	3285	25550
bis(2-ETHYLHEXYL)PHTHALATE	NA	0.00E+00	0.25	1E-06	2000	0.2	NA	150	9	70	3285	25550
BENZO(b)FLUORANTHENE	NA	0.00E+00	0.27	1E-06	2000	0.2	NA	150	9	70	3285	25550
BENZO(k)FLUORANTHENE	NA	0.00E+00	0.16	1E-06	2000	0.2	NA	150	9	70	3285	25550
BENZO(a)PYRENE	NA	0.00E+00	0.74	1E-06	2000	0.2	NA	150	9	70	3285	25550
INDENO(1,2,3-cd)PYRENE	NA	0.00E+00	0.38	1E-06	2000	0.2	NA	150	9	70	3285	25550
BENZO(g,h,i)PERYLENE	NA	0.00E+00	1.1	1E-06	2000	0.2	NA	150	9	70	3285	25550
PESTICIDES / PCB'S												
AROCLOR-1248	2.68E-08	3.44E-09	1.9	1E-06	2000	0.2	0.006	150	9	70	3285	25550
AROCLOR-1254	1.62E-08	2.09E-09	1.2	1E-06	2000	0.2	0.006	150	9	70	3285	25550
AROCLOR-1260	3.10E-10	3.99E-11	0.022	1E-06	2000	0.2	0.006	150	9	70	3285	25550

NA: Not Applicable

TABLE C.5-2
UNCERTAINTY ANALYSIS
INGESTION OF CHEMICALS IN SOIL AND HOUSE DUST
SCENARIO 5 – Residential (Future)

CHEMICAL	INTAKE CHILD (NONCANCER) (mg/kg/day)	INTAKE CHILD (CANCER) (mg/kg/day)	INTAKE ADULT (NONCANCER) (mg/kg/day)	INTAKE ADULT (CANCER) (mg/kg/day)	SOIL CONC. (mg/kg)	INGESTION RATE CHILD (mg soil/day)	INGESTION RATE ADULT (mg soil/day)	CONVERSION FACTOR (1E-6 kg/mg)	FRACTION INGESTED (unitless)	EXPOSURE FREQUENCY (days/year)	EXP. DUR. CHILD (years)	EXP. DUR. ADULT (years)	BODY WT. CHILD (kg)	BODY WT. ADULT (kg)	AVERAGING TIME NONCANCER CHILD (days)	AVERAGING TIME NONCANCER ADULT (days)	AVERAGING TIME (CANCER) (days)
INORGANICS																	
ALUMINUM	2.31E-02	1.98E-03	2.47E-03	3.18E-04	8422.5	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
ANTIMONY	1.61E-05	1.38E-06	1.73E-06	2.22E-07	5.9	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
ARSENIC	5.54E-06	4.75E-07	5.93E-07	7.63E-08	2.0	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
BARIUM	2.12E-04	1.82E-05	2.27E-05	2.92E-06	77.4	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
BERYLLIUM	1.49E-05	1.27E-06	1.59E-06	2.05E-07	5.4	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
CADMIUM	2.58E-06	2.22E-07	2.77E-07	3.56E-08	0.94	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
CHROMIUM III	6.65E-04	5.70E-05	7.12E-05	9.16E-06	242.6	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
CHROMIUM VI	1.10E-05	9.39E-07	1.17E-06	1.51E-07	4.0	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
COBALT	1.19E-05	1.02E-06	1.28E-06	1.64E-07	4.3	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
COPPER	4.28E-05	3.67E-06	4.59E-06	5.90E-07	15.6	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
LEAD	1.54E-04	1.32E-05	1.65E-05	2.12E-06	56.1	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
MANGANESE	1.19E-03	1.02E-04	1.28E-04	1.65E-05	436.1	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
MERCURY	3.49E-07	2.99E-08	3.73E-08	4.80E-09	0.13	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
NICKEL	6.12E-04	5.25E-05	6.56E-05	8.44E-06	223.6	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
SELENIUM	1.82E-06	1.56E-07	1.95E-07	2.50E-08	0.66	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
SILVER	3.30E-06	2.83E-07	3.53E-07	4.54E-08	1.2	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
VANADIUM	4.24E-03	3.64E-04	4.55E-04	5.84E-05	1548.6	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
ZINC	1.92E-04	1.64E-05	2.05E-05	2.64E-06	69.9	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
BORON	9.19E-05	7.88E-06	9.85E-06	1.27E-06	33.6	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
NIOBIUM	1.81E-04	1.55E-05	1.94E-05	2.49E-06	66.1	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
STRONTIUM	1.14E-04	9.78E-06	1.22E-05	1.57E-06	41.6	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
TITANIUM	4.00E-04	3.43E-05	4.28E-05	5.51E-06	146.0	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
ZIRCONIUM	2.47E-04	2.12E-05	2.65E-05	3.41E-06	90.2	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
VOLATILE ORGANICS																	
ACETONE	2.25E-07	1.93E-08	2.41E-08	3.09E-09	0.082	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
CARBON DISULFIDE	8.29E-09	7.10E-10	8.88E-10	1.14E-10	0.0030	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
1,2-DICHLOROETHENE (total)	5.48E-09	4.70E-10	5.87E-10	7.55E-11	0.0020	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
2-BUTANONE	1.67E-08	1.44E-09	1.79E-09	2.31E-10	0.0061	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
TRICHLOROETHENE	9.61E-09	8.24E-10	1.03E-09	1.32E-10	0.0035	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
BENZENE	4.11E-07	3.52E-08	4.40E-08	5.66E-09	0.15	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
TETRACHLOROETHENE	9.94E-09	8.52E-10	1.06E-09	1.37E-10	0.0036	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
TOLUENE	1.03E-08	8.84E-10	1.11E-09	1.42E-10	0.0038	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
ETHYLBENZENE	3.77E-08	3.23E-09	4.03E-09	5.19E-10	0.014	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
XYLENE (total)	1.39E-07	1.19E-08	1.48E-08	1.91E-09	0.051	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
BASE NEUTRAL / ACIDS																	
PHENOL	4.93E-07	4.23E-08	5.28E-08	6.79E-09	0.18	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
BENZOIC ACID	4.11E-07	3.52E-08	4.40E-08	5.66E-09	0.15	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
NAPHTHALENE	3.56E-07	3.05E-08	3.82E-08	4.91E-09	0.13	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
4-NITROPHENOL	2.74E-06	2.35E-07	2.94E-07	3.77E-08	1.0	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
2,4-DINITROTOLUENE	3.01E-07	2.58E-08	3.23E-08	4.15E-09	0.11	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
PENTACHLOROPHENOL	7.64E-06	6.55E-07	8.19E-07	1.05E-07	2.8	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
PHENANTHRENE	3.56E-07	3.05E-08	3.82E-08	4.91E-09	0.13	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
ANTHRACENE	2.30E-07	1.97E-08	2.47E-08	3.17E-09	0.084	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
DI-n-BUTYLPHALATE	2.54E-07	2.18E-08	2.72E-08	3.50E-09	0.093	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
FLUORANTHENE	7.09E-07	6.07E-08	7.59E-08	9.76E-09	0.26	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
PYRENE	1.26E-07	1.08E-08	1.35E-08	1.74E-09	0.046	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
BUTYLBENZYLPHTHALATE	3.29E-07	2.82E-08	3.52E-08	4.53E-09	0.12	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
BENZO(a)ANTHRACENE	1.15E-06	9.86E-08	1.23E-07	1.59E-08	0.42	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
CHRYSENE	8.22E-07	7.04E-08	8.80E-08	1.13E-08	0.30	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
bis(2-ETHYLHEXYL)PHTHALATE	6.85E-07	5.87E-08	7.34E-08	9.44E-09	0.25	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
BENZO(b)FLUORANTHENE	7.32E-07	6.27E-08	7.84E-08	1.01E-08	0.27	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
BENZO(k)FLUORANTHENE	4.38E-07	3.76E-08	4.70E-08	6.04E-09	0.16	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
BENZO(a)PYRENE	2.03E-06	1.74E-07	2.17E-07	2.79E-08	0.74	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
INDENO(1,2,3-cd)PYRENE	1.04E-06	8.92E-08	1.12E-07	1.43E-08	0.38	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
BENZO(g,h,i)PERYLENE	3.01E-06	2.58E-07	3.23E-07	4.15E-08	1.1	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
PESTICIDES / PCB'S																	
AROCLOR-1248	5.21E-06	4.46E-07	5.58E-07	7.17E-08	1.9	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
AROCLOR-1254	3.16E-06	2.71E-07	3.38E-07	4.35E-08	1.2	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550
AROCLOR-1260	6.03E-08	5.17E-09	6.46E-09	8.30E-10	0.022	100	50	1E-06	1	150	6	9	15	70	2190	3285	25550

NA: Not Applicable

TABLE C.5-3
UNCERTAINTY ANALYSIS
CANCER RISK ESTIMATES
SCENARIO 5 – Residential (Future)

CHEMICAL	CHRONIC DAILY INTAKE ADULT (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPEC. RISK ADULT	TOTAL PATHWAY RISK	TOTAL RISK
							CHILD	NA	2E-05
EXPOSURE PATHWAY: DERMAL CONTACT WITH SOILS							ADULT	4E-08	3E-06
INORGANICS									
ARSENIC	0.0E+00	No	1.75E+00	A	Skin	IRIS	0E+00		
VOLATILE ORGANICS									
TRICHLOROETHENE	0.0E+00	No	1.10E-02	B2	Liver	Gavage/HEAST	0E+00		
BENZENE	0.0E+00	No	2.90E-02	A	Leukemia	Occupational/IRIS	0E+00		
TETRACHLOROETHENE	0.0E+00	No	5.10E-02	B2	Liver	Gavage/HEAST	0E+00		
BASE NEUTRAL / ACIDS									
2,4-DINITROTOLUENE	0.0E+00	No	6.80E-01	B2	Liver, mammary gland	Diet/IRIS	0E+00		
PENTACHLOROPHENOL	0.0E+00	No	1.20E-01	B2	Hepatocellular adenoma, carcinomas,p	Oral/IRIS	0E+00		
BUTYLBENZYLPHTHALATE	0.0E+00	No	NA	C	Leukemia	Diet/IRIS	NA		
BENZO(a)ANTHRACENE	0.0E+00	No	NA	B2	Liver, lung, skin	IRIS	NA		
CHRYSENE	0.0E+00	No	NA	B2	Malignant lymphoma	IRIS	NA		
bis(2-ETHYLHEXYL)PHTHALATE	0.0E+00	No	1.40E-02	B2	Liver	IRIS	0E+00		
BENZO(b)FLUORANTHENE	0.0E+00	No	NA	B2	Lung, thorax, skin	IRIS	NA		
BENZO(k)FLUORANTHENE	0.0E+00	No	NA	B2	Lung, thorax, skin	IRIS	NA		
BENZO(a)PYRENE	0.0E+00	No	NA	B2	Stomach, lung	IRIS	NA		
INDENO(1,2,3-cd)PYRENE	0.0E+00	No	NA	B2	Lung, skin	IRIS	NA		
PESTICIDES / PCB'S									
AROCLOR-1248	3.4E-09	No	7.70E+00				3E-08		
AROCLOR-1254	2.1E-09	No	7.70E+00				2E-08		
AROCLOR-1260	4.0E-11	No	7.70E+00	B2	Liver	Diet/IRIS	3E-10		

NA: Not Applicable

TABLE C.5-4
UNCERTAINTY ANALYSIS
CANCER RISK ESTIMATES
SCENARIO 5 – Residential (Future)

CHEMICAL	CHRONIC DAILY INTAKE CHILD (mg/kg/day)	CHRONIC DAILY INTAKE ADULT (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	SF (mg/kg/day)-1	WEIGHT OF EVIDENCE	TYPE OF CANCER	SF BASIS/ SOURCE	CHEMICAL SPEC. RISK CHILD	CHEMICAL SPEC. RISK ADULT	TOTAL PATHWAY RISK
									ADULT	3E-06
EXPOSURE PATHWAY: INCIDENTAL INGESTION OF CHEMICALS IN SOILS									CHILD	2E-05
INORGANICS										
ARSENIC	4.7E-07	7.6E-08	No	1.75E+00	A	Skin	IRIS	8E-07	1E-07	
BERYLLIUM	1.3E-06	2.0E-07	No	4.30E+00	B2	gross tumors, all sites	Water/IRIS	5E-06	9E-07	
LEAD	1.3E-05	2.1E-06	No	NA	B2	Renal tumors	Oral/IRIS	NA	NA	
VOLATILE ORGANICS										
TRICHLOROETHENE	8.2E-10	1.3E-10	No	1.10E-02	B2	Liver	Gavage/HE/	9E-12	1E-12	
BENZENE	3.5E-08	5.7E-09	No	2.90E-02	A	Leukemia	Occupationa	1E-09	2E-10	
TETRACHLOROETHENE	8.5E-10	1.4E-10	No	5.10E-02	B2	Liver	Gavage/HE/	4E-11	7E-12	
BASE NEUTRAL / ACIDS										
2,4-DINITROTOLUENE	2.6E-08	4.2E-09	No	6.80E-01	B2	Liver, mammary glan	Diet/IRIS	2E-08	3E-09	
PENTACHLOROPHENOL	6.5E-07	1.1E-07	No	1.20E-01	B2	Hepatocellular adenc	Oral/IRIS	8E-08	1E-08	
BUTYLBENZYLPHTHALATE	2.8E-08	4.5E-09	No	NA	C	Leukemia	Diet/IRIS	NA	NA	
BENZO(a)ANTHRACENE	9.9E-08	1.6E-08	No	1.15E+01	B2	Liver, lung, skin	IRIS	1E-06	2E-07	
CHRYSENE	7.0E-08	1.1E-08	No	1.15E+01	B2	Malignant lymphoma	IRIS	8E-07	1E-07	
bis(2-ETHYLHEXYL)PHTHALATE	5.9E-08	9.4E-09	No	1.40E-02	B2	Liver	IRIS	8E-10	1E-10	
BENZO(b)FLUORANTHENE	6.3E-08	1.0E-08	No	1.15E+01	B2	Lung, thorax, skin	IRIS	7E-07	1E-07	
BENZO(k)FLUORANTHENE	3.8E-08	6.0E-09	No	1.15E+01	B2	Lung, thorax, skin	IRIS	4E-07	7E-08	
BENZO(a)PYRENE	1.7E-07	2.8E-08	No	1.15E+01	B2	Stomach, lung	IRIS	2E-06	3E-07	
INDENO(1,2,3-cd)PYRENE	8.9E-08	1.4E-08	No	1.15E+01	B2	Lung, skin	IRIS	1E-06	2E-07	
PESTICIDES / PCB'S										
AROCLOR-1248	4.5E-07	7.2E-08	No	7.70E+00				3E-06	6E-07	
AROCLOR-1254	2.7E-07	4.3E-08	No	7.70E+00				2E-06	3E-07	
AROCLOR-1260	5.2E-09	8.3E-10	No	7.70E+00	B2	Liver	Diet/IRIS	4E-08	6E-09	

NA: Not Applicable

TABLE C.5-5
UNCERTAINTY ANALYSIS
CHRONIC HAZARD INDEX ESTIMATES
SCENARIO 5 – Residential (Future)

CHEMICAL	CHRONIC DAILY INTAKE CHILD (mg/kg/day)	CHRONIC DAILY INTAKE ADULT (mg/kg/day)	CDI ADJUSTED FOR ABSORPTION	RFD (mg/kg/day)	CONFIDENCE LEVEL	CRITICAL EFFECT	RFD BASIS/ SOURCE	RFD UNCERTAINTY ADJUSTMENT	MODIFYING FACTORS	HAZARD QUOTIENT CHILD	HAZARD QUOTIENT ADULT	PATHWAY HAZARD INDEX (HI)
											ADULT	7E-02
EXPOSURE PATHWAY: INCEDENTAL INGESTION OF CHEMICALS IN SOILS											CHILD	7E-01
INORGANICS												
ALUMINUM	2.3E-02	2.5E-03	No	NA			NA/IRIS			NA	NA	
ANTIMONY	1.6E-05	1.7E-06	No	4.00E-04	Low	Longevity,blood glucose	Water/IRIS	1000	1	4E-02	4E-03	
ARSENIC	5.5E-06	5.9E-07	No	1.00E-03		Keratosis and hyperpigr	Diet/HEAST	1		6E-03	6E-04	
BARIUM	2.1E-04	2.3E-05	No	7.00E-02	Medium	None observed	Water/IRIS	3	1	3E-03	3E-04	
BERYLLIUM	1.5E-05	1.6E-06	No	5.00E-03	Low	None observed	Water/IRIS	100	1	3E-03	3E-04	
CADMIUM	2.6E-06	2.8E-07	No	1.00E-03	High	Proteinuria	Diet/IRIS	10	1	3E-03	3E-04	
CHROMIUM III	6.6E-04	7.1E-05	No	1.00E+00	Low	Hepatotoxicity	IRIS	1000		7E-04	7E-05	
CHROMIUM VI	1.1E-05	1.2E-06	No	5.00E-03	Low	No effects observed	Water/IRIS	500	1	2E-03	2E-04	
COBALT	1.2E-05	1.3E-06	No	NA			NA/IRIS			NA	NA	
COPPER	4.3E-05	4.6E-06	No	4.00E-02		Local GI irritation	NA/HEAST			1E-03	1E-04	
LEAD	1.5E-04	1.6E-05	No	NA		Neurobehavioral effects	NA/IRIS			NA	NA	
MANGANESE	1.2E-03	1.3E-04	No	1.00E-01	Medium	CNS effects	Diet/IRIS	1	1	1E-02	1E-03	
MERCURY	3.5E-07	3.7E-08	No	3.00E-04		Kidney effects	Oral/HEAST	1000		1E-03	1E-04	
NICKEL	6.1E-04	6.6E-05	No	NA			NA/IRIS			NA	NA	
SELENIUM	1.8E-06	1.9E-07	No	5.00E-03	Medium	Clinical selenosis	Diet/IRIS	3	1	4E-04	4E-05	
SILVER	3.3E-06	3.5E-07	No	3.00E-03	Medium	Argyria	Oral/IRIS	2	1	1E-03	1E-04	
VANADIUM	4.2E-03	4.5E-04	No	7.00E-03		None observed	Water/HEAST	100		6E-01	6E-02	
ZINC	1.9E-04	2.1E-05	No	2.00E-01		Anemia	Therap./HEAST	10		1E-03	1E-04	
BORON	9.2E-05	9.8E-06	No	9.00E-02	Medium	Pulmonary edema and h	Occupational/IR	100	1	1E-03	1E-04	
NIOBIUM	1.8E-04	1.9E-05	No	NA			NA/IRIS			NA	NA	
STRONTIUM	1.1E-04	1.2E-05	No	NA			NA/IRIS			NA	NA	
TITANIUM	4.0E-04	4.3E-05	No	NA			NA/IRIS			NA	NA	
ZIRCONIUM	2.5E-04	2.6E-05	No	NA			NA/IRIS			NA	NA	
VOLATILE ORGANICS												
ACETONE	2.2E-07	2.4E-08	No	1.00E-01	Low	Increased liver and kidn	Gavage/IRIS	1000	1	2E-06	2E-07	
CARBON DISULFIDE	8.3E-09	8.9E-10	No	1.00E-01	Medium	Fetal toxicity	Inhal./IRIS	100	1	8E-08	9E-09	
1,2-DICHLOROETHENE (total)	5.5E-09	5.9E-10	No	1.00E-02		Decreased hematocrit a	Gavage/HEAST	3000		5E-07	6E-08	
2-BUTANONE	1.7E-08	1.8E-09	No	5.00E-02	Medium	Petotoxicity	Inhal./IRIS	1000		3E-07	4E-08	
TRICHLOROETHENE	9.6E-09	1.0E-09	No	NA			NA/IRIS			NA	NA	
BENZENE	4.1E-07	4.4E-08	No	NA			NA/IRIS			NA	NA	
TETRACHLOROETHENE	9.9E-09	1.1E-09	No	1.00E-02	Medium	Hepatotoxicity,weight g	Gavage/IRIS	100	1	1E-06	1E-07	
TOLUENE	1.0E-08	1.1E-09	No	2.00E-01	Medium	Changes in liver and kid	Gavage/IRIS	1000	1	5E-08	6E-09	
ETHYLBENZENE	3.8E-08	4.0E-09	No	1.00E-01	Low	Liver and kidney toxicity	Oral/IRIS	1000	1	4E-07	4E-08	
XYLENE (total)	1.4E-07	1.5E-08	No	2.00E+00	Medium	Hyperactivity,decreased	Gavage/IRIS	100	1	7E-08	7E-09	
BASE NEUTRAL / ACIDS												
PHENOL	4.9E-07	5.3E-08	No	6.00E-01	Low	Reduced fetal body wei	Gavage/IRIS	100	1	8E-07	9E-08	
BENZOIC ACID	4.1E-07	4.4E-08	No	4.00E+00	Medium		Oral/IRIS	1	1	1E-07	1E-08	
NAPHTHALENE	3.6E-07	3.8E-08	No	4.00E-03		Decreased body weight	Gavage/HEAST	10000		9E-05	1E-05	
4-NITROPHENOL	2.7E-06	2.9E-07	No	NA			NA/IRIS			NA	NA	
2,4-DINITROTOLUENE	3.0E-07	3.2E-08	No	NA			NA/IRIS			NA	NA	
PENTACHLOROPHENOL	7.6E-06	8.2E-07	No	3.00E-02	Medium	Liver and kidney pathol	Diet/IRIS	100	1	3E-04	3E-05	
PHENANTHRENE	3.6E-07	3.8E-08	No	NA			NA/IRIS			NA	NA	
ANTHRACENE	2.3E-07	2.5E-08	No	3.00E-01	Low	No observed effects	Gavage/IRIS	3000	1	8E-07	8E-08	
DI-n-BUTYLPHALATE	2.5E-07	2.7E-08	No	1.00E-01	Low	Increased mortality	Diet/IRIS	10000	1	3E-06	3E-07	
FLUORANTHENE	7.1E-07	7.6E-08	No	4.00E-02	Low	Nephropathy,changes in	Gavage/IRIS	3000	1	2E-05	2E-06	
PYRENE	1.3E-07	1.4E-08	No	3.00E-02	Low	Kidney effects	Gavage/IRIS	3000	1	4E-06	5E-07	
BUTYLBENZYLPHTHALATE	3.3E-07	3.5E-08	No	2.00E-01	Low	Effects on body weight g	Diet/IRIS	10000	1	2E-06	2E-07	
BENZO(a)ANTHRACENE	1.2E-06	1.2E-07	No	NA			NA/IRIS			NA	NA	
CHRYSENE	8.2E-07	8.8E-08	No	NA			NA/IRIS			NA	NA	
bis(2-ETHYLHEXYL)PHTHALATE	6.8E-07	7.3E-08	No	2.00E-02	Medium	Increased relative liver v	Diet/IRIS	1000	1	3E-05	4E-06	
BENZO(b)FLUORANTHENE	7.3E-07	7.8E-08	No	NA			NA/IRIS			NA	NA	
BENZO(k)FLUORANTHENE	4.4E-07	4.7E-08	No	NA			NA/IRIS			NA	NA	
BENZO(a)PYRENE	2.0E-06	2.2E-07	No	NA			NA/IRIS			NA	NA	
INDENO(1,2,3-cd)PYRENE	1.0E-06	1.1E-07	No	NA			NA/IRIS			NA	NA	
BENZO(g,h,i)PERYLENE	3.0E-06	3.2E-07	No	NA			NA/IRIS			NA	NA	
PESTICIDES / PCB'S												
AROCLOR-1248	5.2E-06	5.6E-07	No	NA			NA/IRIS			NA	NA	
AROCLOR-1254	3.2E-06	3.4E-07	No	NA			NA/IRIS			NA	NA	
AROCLOR-1260	6.0E-06	6.5E-09	No	NA			NA/IRIS			NA	NA	

NA: Not Applicable

APPENDIX D

ASSESSMENT OF RADIOLOGICAL CONDITIONS AT THE NEWFIELD, NJ FACILITY

SCENARIO 1 - TRESPASSING (CURRENT)

- DERMAL CONTACT WITH CHEMICALS IN SOIL

Equation:

$$Absorbed\ Dose\ (mg/kg\text{-}day) = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

where:

CS	=	Chemical of Concentration in Soil (mg/kg)
CF	=	Conversion Factor (10^{-6} kg/mg)
SA	=	Skin Surface Area Available for Contact (cm^2/event)
AF	=	Soil to Skin Adherence Factor (mg/cm^2)
ABS	=	Absorption Factor (unitless)
EF	=	Exposure Frequency (events/year)
ED	=	Exposure Duration (years)
BW	=	Body Weight (kg)
AT	=	Averaging Time (period over which exposure is averaged - days)

Specific Parameter Values:

CS	=	Concentration of chemicals in soil
SA	=	8,600 cm^2, based upon exposed arms, hands and legs.
AF	=	1.45 mg/cm^2, based upon commercial potting soil adherence to hands
ABS	=	0.01 for cadmium; 0.06 for PCBs (EPA, 1992b)
EF	=	30 days/year (NJDEPE, 1994)
ED	=	9 years
BW	=	49 kg
AT	=	3,285 days for non-cancer risks 25,550 days for cancer risks

- INGESTION OF CHEMICALS IN SOIL

Equation:

$$Intake\ (mg/kg\text{-}day) = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

where:

CS	=	Chemical Concentration in Soil (mg/kg)
IR	=	Ingestion Rate (mg soil/day)
CF	=	Conversion Factor (10^{-6} kg/mg)

contaminants following inhalation of fugitive dusts, dermal contact with soil or incidental ingestion of soil.

Current plume migration has resulted in restriction of ground water as a potable source with the exception of homes to the south of the site. Thus, a current residential use scenario will be addressed to evaluate exposure to contaminants in ground water (i.e., ingestion, inhalation of airborne volatiles and dermal exposure).

In the future, construction workers may be involved in developing the site (e.g. building homes). Through excavation and site preparation activities, they could receive extensive inhalation exposure to contaminants in dust, as well as dermal and ingestion exposures to contaminants in subsurface soil. It is assumed that excavation and site preparation activities would last for a 6 month period, and that no remediation of contaminants prior to the construction or residential scenarios would occur.

Also in the future, children and adults may occupy residences on the site. The relevant exposure pathways are indoor and outdoor ingestion of dust/soil (this will be addressed for 0-6 year old children, and for adults), outdoor dermal exposure to soil contaminants (adults) and outdoor inhalation of contaminants in dust (adults). For children, parameter values for 0-6 year old children were selected, and exposure was assumed to take place over 6 years. For adults, exposure is assumed to occur for 30 years.

APPENDIX A

RISK ASSESSMENT METHODS

Five exposure scenarios will be included in the risk assessment for the Shieldalloy Metallurgical Corp. (SMC) Site. 1) A current use trespasser scenario will involve exposures to the site outside the restricted industrial area as it currently exists, 2) a current industrial use scenario will involve exposures to the site within the restricted industrial area and specifically addressing the undeveloped portion of the site due to the unvegetated and unpaved nature of this area, 3) a current residential use scenario involving exposure due to use of private wells outside the well restriction area, 4) future development of the site (construction scenario) and 5) a future residential use of the site property. The scenarios are briefly described below. Model equations and parameter values for each exposure pathway are detailed on the following pages.

Children may trespass on the unrestricted portion of the site as it currently exists, and thereby play with contaminated soils and stream water and/or sediments from the Hudson Branch. As a result, they may receive dermal and ingestion exposures to contaminants in soil and water. Based on information during the field investigation it is assumed that children trespass onto the site on an infrequent basis (30 days/year), that children are unlikely to enter this area of the site on a regular basis before the age of 9 due to its distance from residences, and regular exposures are not expected beyond the age of 18 due to changes in the use of recreational time.

SMC is currently an active industrial facility. The active industrial portion of the property is covered with buildings and pavement. Piles of material are stored on an undeveloped portion of the site. This area is devoid of any type of ground cover (e.g. vegetation, pavement). As a result, SMC employees who load/unload material in this area may be exposed to site

APPENDIX A

RISK ASSESSMENT METHODS