BASELINE HUMAN HEALTH RISK ASSESSMENT REPORT

OPERABLE UNIT I

LOCKHEED MARTIN TACTICAL DEFENSE SYSTEMS DIVISION
(Former Unisys Corp. Site)

Great Neck, New York
NYSDEC Site No.130045

Prepared for:
New York State
Department of Environmental Conservation

On behalf of:
Lockheed Martin Tactical Defense Systems Division of
Lockheed Martin Tactical Systems, Inc.

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Prepared by:
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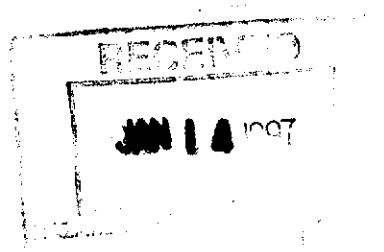

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1.0 Introduction

1.1 Purpose and Objectives

This baseline risk assessment has been designed and implemented to characterize risks to human health as a result of soil, groundwater and/or air contamination at the Lockheed Martin Tactical Defense Systems Division (Lockheed Martin) site in Great Neck, New York, and to determine whether site contaminants pose any potential exposure risks to nearby human receptors. The intent of the baseline risk assessment is to provide the information necessary to make risk management decisions, and to facilitate the selection of remedial actions during the Feasibility Study.

1.2 Site Background

The Lockheed Martin property consists of several large buildings on 94 acres of land located at the intersection of Marcus Avenue and Lakeville Road between the Village of Lake Success and the Town of North Hempstead in Nassau County, New York (Figure 2-1). Three drainage basins are located in the southwest corner of the property adjacent to Lakeville Road. The basins collect stormwater runoff from the roof and parking lots. The majority of the remaining property is used for parking.

Currently, the site is only used for engineering activities and, until recently, the site was an active manufacturing facility which has been in operation since after it was constructed in 1941. The facility was originally designed and built by the United States Government and operated under contract by the Sperry Gyroscope Company, a division of Sperry Rand Company, from 1941 until 1951. In 1951, the government sold the property to Sperry and in 1986, Sperry merged with Burroughs Corporation to form Unisys Corporation (Unisys). In May of 1995, Loral Corporation (Loral) acquired the assets of Unisys Defense Systems, a division of Unisys Corp., and in 1996, the electronic and systems integration businesses of Loral was acquired by Lockheed Martin Corporation (Lockheed Martin). Originally, the property included an additional 55 acres with a large manufacturing building immediately to the east of the present property. However, this building was demolished, the property was sold to a developer in the 1970s, on which the present day Triad Business Park was constructed.

At present, the Lockheed Martin facility houses administration offices and engineering departments. In the past, the facility has been used to manufacture a wide range of defense-related

products. Manufacturing processes used in the past included a foundry, etching, degreasing, plating, painting, machining and assembly. Chemicals used during manufacturing at the plant included halogenated and non-halogenated hydrocarbon solvents, cutting oil, paints and fuel oils.

Groundwater had been used for non-contact cooling purposes since the facility was constructed. The non-contact cooling system consisted of three extraction wells (EW-1, 2 and 3), piping and chillers in the main building, and four diffusion wells (DW-5, 6, 7 and 8). The extraction and diffusion wells are located to the north and south of the main manufacturing building, respectively. When operational, approximately 1,000 gallons per minute (gpm) was pumped from the extraction wells, used for non-contact cooling in the plant, and drained into the aquifer through the diffusion wells. On-site groundwater is no longer used in the the non-contact cooling system. The groundwater IRM, which was initiated in 1993, uses the existing system to remove, treat, and re-inject groundwater. The groundwater is no longer used for cooling purposes. In addition, a soil-vapor extraction (SVE) system was installed in 1994 to address source area remediation for volatile organic contamination in the area of the five former drywells.

1.3 Scope of Risk Assessment

The baseline risk assessment was conducted through a quantitative and qualitative evaluation of actual and potential risks to human health based on existing and future potential use scenarios. The "no action" remedy was evaluated even though Lockheed Martin has implemented IRMs consisting of a groundwater pump and treat and an SVE system, and plans additional remedial measures. This risk assessment also does consider future reductions in contaminant concentrations that would result from the existing IRMs and other remedial measures proposed for this site.

The baseline human health risk assessment was performed in accordance with guidance outlined in the USEPA "Risk Assessment Guidance for Superfund - Volume I Human Health Evaluation Manual", December 1989 (USEPA RAGS). The risk assessment was conducted based on available existing site data, and encompassed the following major tasks:

(1) Data evaluation/usability;

(2) Selection of indicator chemicals;

(3) Exposure assessment (exposure setting, exposure pathways, exposure quantification, and contaminant intake estimation);

(4) Toxicity assessment

(5) Quantitative and qualitative characterization of risk; and

(6) Human health evaluation summary.

2.0 Data Evaluation

This section of the report will concentrate on data usability as it pertains to completion of the quantitative baseline human health evaluation. In general, the following types of data were evaluated for use in the quantitative risk assessment:

Source/Regional Characteristics:	Geography, topography, population distributions, neighboring land uses, availability of public utilities, continuous vs. one-time releases, emission/release rates, climate data, precipitation, etc.
Soil Data:	Contaminant concentrations, contaminant depths, locations of "hot spots," contaminant degradation, etc.
Groundwater Data:	Contaminant concentrations, contaminant degradation, hydraulic conductivities, flow velocities, hydraulic gradients, etc.
Air Data:	Contaminant concentrations and migration, volatilization rates, receptor locations, etc.

Wherever possible, site-specific data was used in the risk assessment. In the absence of site-specific data, regulatory defaults were utilized after a review to determine their applicability to the Lockheed Martin site. In situations where either site-specific data or regulatory defaults were not available, engineering judgment was used to estimate an appropriate value for the specific parameter. The rationale behind the engineering estimate is provided in the text.

2.1 Source characteristics

Data generated from the Phase I Remedial Investigation and presented in the Remedial Investigation Report (RIR) submitted in March of 1995 identified various media containing detectable levels of VOCs, semi-volatile organics (SVOCs), pesticides, PCBs, and metals.

The highest levels of contamination are primarily located in the area of the five (5) inactive drywells. These drywells are believed to be approximately eight (8) feet in diameter and fifteen (15) feet deep with walls constructed of cinder blocks. The drywells were decommissioned some time prior to 1978, which included the plugging of lines leading to the drywells. Any residual effluent still existing within the lines was pumped out. Although the effluent was removed from these lines, some sludge was observed to remain at the bottom of the lines (RI/FS Workplan September 30, 1993). The drywells had been backfilled with sand.

Three (3) drainage basins are located in the southwest corner of the property. The basins receive stormwater runoff from the entire site through a network of on-site storm and roof drains. The results of the drainage basin sampling showed the presence of low levels of VOCs, semi-VOCs, pesticides and PCBs in the sediment samples, and higher levels of metals. These results are not inconsistent with the nature and purpose of the drainage basins which is to collect storm-water runoff from surrounding parking lots, walkways, rooftops and unpaved areas and allow it to drain to the underlying sediments. As this stormwater water collects in the basin, sediments settle to the bottom. Infiltrating water is filtered of impurities by these sediments, which results in an accumulation of impurities within the sediments at the bottom of the basin. Concentrations detected in the water and sediment samples collected from the basins appear to be consistent with findings from studies of drainage basins on Long Island (KU, 1986).

2.2 Soils

Soil and sediment contaminant data from the RI was validated by Environmental Standards, Inc. (ESI) of Valley Forge, Pennsylvania. Data validation by ESI resulted in some changes made to sample quantification limits, positive or non-detections of specific compounds, and rejection of data. The validated data was used in the baseline risk assessment.

The number of soil/sediment samples analyzed (over 35 samples) during the RI was considered sufficient to obtain representative site data. However, it is recognized that the relatively small quantity of samples collected (from a statistical point of view) may introduce error into the risk assessment. In order to ensure that any error introduced is conservative, either maximum concentrations or 95 percent Upper Confidence Limits (95% UCL) on the arithmetic mean soil concentrations were used in the assessment. Non-detectable concentrations were carried throughout the risk assessment to ensure that the risk assessment does not exclude relatively small concentrations that may impact human health. As a result of this extremely conservative approach, the quantitative risk assessment for compounds which were non-detectable should only be used for discussion purposes and not used to evaluate the impacts to the environmental quality of the site. All sample results with laboratory qualifiers were reviewed before inclusion in the quantitative risk assessment. "J" Qualifiers on organics data were included in the risk assessment without reservation. Whenever blank contamination was evidenced ("B" Qualifiers in organics), the Contracts Laboratory Protocols (CLP) Statement of Work (SOW) (EPA, 1988) was consulted to determine if the blank contaminants were common laboratory contaminants. Results with blank contamination were only considered positive results for use in the human health evaluation if the concentrations in the sample exceeded 10 times the maximum concentration detected in the blank for common laboratory contaminants, or exceeded 5 times the maximum concentration in the blanks for non-common laboratory contaminants.

In addition, although a background soil sample was collected, the background sample was only used to a very limited degree in assessing which contaminants would be selected for quantitative assessment (i.e., the indicator contaminant selection process). The background sample was used only to evaluate inorganic contaminants.

2.3 Groundwater

Data from seventy-five (75) groundwater samples collected from various monitoring points were used in the risk assessment. Of this data, over 80 percent (80%) of the data points have been reviewed for data validation by Environmental Standards, Inc. of Valley Force, Pennsylvania. The balance of the groundwater data (i.e., fourteen samples) had been collected from wells installed outside the scope of the RI and have not been data. The usability of the unvalidated groundwater data followed guidelines provided in the USEPA's guidance document Risk Assessment Guidance for Superfund Volume I, 1989.

The same criteria for data useability, handling of qualified lab data and data containing blank contamination was used in reviewing the groundwater data as that used for the soil and sediment data.

2.4 Air

Air monitoring data collected during the RI was used to evaluate potential for subsurface VOC emissions. A total of 6 samples, plus additional control samples for quality assurance/quality control were collected and analyzed. The air data was also reviewed for data validation by Environmental Standards, Inc. Usability of this data for the baseline risk assessment followed the same guidelines outlined above.

3.0 Selection of Indicator Chemicals

Only data from the Remedial Investigation Report and Supplemental RI Report (Lockheed Martin, 1996) was used in the quantitative risk assessment. Data developed from site investigations conducted prior to the Remedial Investigation was not used since the RI data represents the most updated concentrations at the site. In addition, only analytical data was considered for use in the quantitative risk assessment; field screening data (i.e., obtained using portable field instrumentation) or data that are not specific for a particular compound (i.e., total organic carbon) was not considered.

In addition to validated data, some unvalidated analytical data was also used in the risk assessment. Specifically, groundwater data from fourteen monitoring wells (i.e., well clusters numbered 23 through 29) collected during the RI, and soil, sediment and groundwater data from the Supplemental RI have not been validated. This set of unvalidated analytical data was reviewed and was found to be generally consistent with validated site data, and therefore, the unvalidated data was also included for use in the quantitative assessment of risks.

The RI data were grouped by media: groundwater (which included the hydropunch data), subsurface soil and sediment, and recharge basin water. Soil and sediment data from Lake Success (Supplemental RI, 1996) were not included in the risk assessment because only 2-butanone and acetone had been detected in the surface water and sediment samples collected from the lake. As was concluded in the Supplemental RI, these compounds are unrelated to the Lockheed Martin site.

Almost ninety (90) compounds were detected for the Lockheed Martin site, in at least one or more of the soil, sediment, or groundwater samples. In order to provide a detailed review of potential health impacts resulting from the Lockheed Martin site, it was necessary to minimize the number of compounds included in the quantitative health evaluation. USEPA RAGS Vol. I was followed to select representative compounds that would yield a conservative estimate of the potential risks to human health.

Several criteria were used in the selection of contaminants for inclusion in the quantitative risk assessment. The most important criteria evaluated included:

- Frequency of detection and confidence in lab data
- Review of background data and site history
- Comparison of quality data to standards
- Review of available toxicity information
- Use of concentration-toxicity screening
- Review of contaminant migration and persistence
- Engineering judgment

Detectable Compound Screening

As a first cut to reduce the number of samples in the quantitative risk assessment, any parameters in which all sample concentrations were non-detectable in a given media were eliminated. However, if a chemical was detected in at least one or more media, the chemical was included onto the Chemical of Potential Concern (COPC) list for the site. Therefore, only those chemicals that were not detected in any soil, sediment, groundwater or surface water (i.e., recharge basin water) were eliminated from consideration as indicator contaminants. Based on this review, a total of eighty-eight (88) chemicals were identified for the interim COPC list. Compounds included volatile organics, semi-volatile organics, pesticides, PCBs, and inorganics.

Tentatively Identified Compounds (TICs) were not considered in this assessment as allowed in EPA's risk assessment guidance (EPA RAGS, 1989). The estimated concentrations of TICs identified are highly uncertain and could be orders of magnitude higher or lower than their actual concentrations. Since assigned identities of TICs may be inaccurate and quantification is certainly inaccurate, they were not included in the quantitative risk evaluation.

Frequency of Detection Screening

Following the detectable compound screening, the remaining data was evaluated to assess the frequency of detection of those chemicals on the interim COPC list. The frequency of detection was calculated for each chemical in a given media. Chemicals which were detected at a frequency of five percent (5%) or less of the overall samples from a given media, and not at a concentration above its site background concentration were eliminated as indicator chemicals. Based on this review, seven VOCs and five (5) pesticide/PCB compounds were eliminated from the interim COPC list. These chemicals are:

Volatile Organic Compounds

- Methylene Chloride
- Acetone
- Carbon Disulfide
- Chloroform
- 2-Butanone
- Chlorobenzene

Pesticides/PCB Compounds

- Heptachlor
- Endosulfan II
- Aroclor 1016
- Aroclor 1232
- Aroclor 1242

Evaluate Against Soil Background Concentration (Inorganics Only) and NYSDEC Standards and Cleanup Objectives

Inorganics in soil and sediment were evaluated against background concentrations. The site background sample, as well as published literature values based on a study performed by the United States Geological Survey entitled, Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States (Professional Paper 1270, Shacklette and Boerngen), and the NYSDEC contaminant specific Recommended Soil Cleanup Objectives (NYSDEC TAGM No. HWR-92-4046,

1995) were used to establish acceptable background concentrations of inorganics in soil. Samples found to be below the background concentration, within acceptable range for background soils, or within NYSDEC recommended soil cleanup objectives were eliminated from inclusion in the qualitative risk assessment.

The remaining parameters were compared to New York State Department of Health (NYSDOH) Drinking Water Standards or NYSDEC Recommended Soil Cleanup Objectives (RSCOs) to further reduce the number of chemicals. Parameters which did not exceed either the NYSDEC RSCOs (for subsurface soil or recharge basin sediments) or NYSDOH Drinking Water Standards (for groundwater and recharge basin water samples) were eliminated from inclusion in the quantitative risk assessment for the given media. Where a compound exceeds either the soil or the groundwater standard, the compound remained on the interim COPC list. After these criteria were reviewed, the following chemicals were eliminated from inclusion in the quantitative risk assessment:

Volatile Organic Compounds

- 1,1-Dichloroethene

Inorganic Compounds

- Aluminum
- Beryllium
- Thallium

Semi-Volatile Organic Compounds

- Diethyl-phthalate
- Butylbenzyl phthalate
- 1,3-Dichlorobenzene
- 2-Methylphenol
- 4-Methylphenol
- 2,4-Dimethylphenol
- 1,2,4-Trichlorobenzene
- 2-Methylnapthalene
- Acenaphthylene
- Acenaphthene
- Fluorene
- Phenanthrene
- Anthracene
- Pyrene
- Benzo(g,h,i)perylene
- Bis(2-ethylhexyl) phthalate

Pesticides/Herbicides

- 4.4'-DDE
- 4-4'-DDD
- 4,4'-DDT
- Endosulfan Sulfate
- Methoxychlor
- Alpha-Chlordane
- Gamma-Chlordane

Elimination of Essential Nutrients

Where essential nutrients (e.g., iron, magnesium, calcium, potassium and sodium) are present above background concentrations, EPA guidance allows for elimination of these compounds from the quantitative risk assessment provided that: (1) the concentrations in which these compounds are present are at low concentrations (i.e., only slightly elevated above than naturally occurring level), and (2) these compounds are toxic at doses much higher than concentrations associated with the site. Based on this review, iron, magnesium, calcium, potassium and sodium were eliminated from the interim COPC list.

Toxicity Screening

Toxicity data for the remaining compounds was reviewed and a concentration-toxicity screening was performed to determine which compounds could have a significant impact upon the quantitative risk assessment. It is important to note that the concentration-toxicity screening was not used alone to either eliminate or include compounds in the quantitative risk assessment. There are several drawbacks with the screening procedure that preclude its use as the sole method of selecting indicator contaminants. The major drawbacks include; the lack of toxicity constants for all compounds, the failure to assess impacts to sensitive populations, and the use of maximum concentrations instead of statistically averaged concentrations.

In general, the concentration-toxicity screening estimates a quantitative risk for each specific compound and then compares the contaminant specific risk to the total site risk to estimate a contaminant risk ratio. The risk value used in the toxicity screening was calculated using the following equation:

$$Rij = Cij \times Tij$$

where:

Rij = Risk factor for chemical i in medium j

Cij = Concentration of chemical i in medium j.
The maximum detected concentration of a chemical in a given medium was used [mg/kg].

Tij = Toxicity value for chemical i in medium j [slope factor (mg/kg-day)-1, or 1/RfD (mg/kg-day)]

In order of preference, the sources of toxicity constants were: (1) USEPA Integrated Risk Information System (IRIS) Database, (2) USEPA Health Effects Assessment Summary Tables (HEAST) Database, and (3) 1986 Superfund Public Health Evaluation Manual* .

The calculated risk value, Rij, for each chemical in each medium was divided by the total risk (sum of the individual risk values) to obtain the relative risk for each chemical within the medium being evaluated. Because contaminants with a higher risk ratio are more likely to have a significant impact on the quantitative risk assessment, these were the contaminants that were kept as potential indicator chemicals. Contaminants with either a carcinogenic or non-carcinogenic risk ratio greater than 0.001 (0.1 percent) were included, while chemicals with a risk ratio of 0.001 (0.1%) or less were eliminated as an indicator chemical. A summary of the risk ratios developed in the concentration-toxicity screening is

* It is acknowledged that The 1986 Superfund Public Health Evaluation Manual (SPHEM) is no longer to be used in performing quantitative risk assessments. Use of SPHEM in this assessment was strictly limited to the selection of indicator contaminants only when toxicity values were not available in IRIS, HEAST or after discussions with USEPA, NYSDEC or NYSDOH. SPHEM was not used in any other context in any part of the Lockheed Martin risk assessment.

included in Tables 3-1 and 3-2, Preliminary Toxicity-Concentration Screening, Non-Carcinogenic and Carcinogenic Effects, respectively. Based on the toxicity screening, the following chemicals were eliminated as indicator chemicals because of a low risk ratio (0.1% or less).

Volatile Organic Compounds

- Toluene
- Ethylbenzene
- 1,1,1-Trichloroethane
- Xylenes
- Freon 113

Semi-Volatile Organic Compounds

- Phenol
- Di-n-butyl phthalate
- 1,2-Dichlorobenzene
- 1,4-Dichlorobenzene
- Chrysene
- Carbazole

Inorganics

- Barium
- Cobalt
- Selenium
- Zinc

In addition, there were several chemicals that do not have toxicity values (slope factors and reference doses (RfDs)). Since toxicity values are not available for these compounds, they can not be evaluated in the quantitative risk assessment. Therefore, the following chemicals were also eliminated:

- Indeno(1,2,3)pyrene
- Dibenzofuran
- Dibenzo(a,h)anthracene
- Gamma BHC (Lindane)
- Benzo(a)anthracene
- Benzo(b)anthracene
- Benzo(k)anthracene

After evaluation of all criteria and completion of an engineering review of the preliminary compounds identified, the 18 compounds listed below were selected as final indicator contaminants for the quantitative human health evaluation at Lockheed Martin:

Volatile Organic Compounds

- 1,2-Dichloroethene
- Trichloroethylene
- Benzene
- Tetrachloroethylene

Semi-Volatile Organic Compounds

- Fluoranthene
- Benzo(a)pyrene

PCBs

- Polychlorinated Biphenyls (PCBs - Aroclor 1248, 1254 and 1260)

Inorganics

- Antimony
- Arsenic
- Cadmium
- Chromium
- Copper
- Lead
- Manganese
- Mercury
- Nickel
- Selenium
- Vanadium

4.0 Exposure Assessment

The objective of the exposure assessment is to estimate the type and magnitude of exposures to the chemicals of potential concern that are present at or migrating from the Lockheed Martin site. This included a characterization and analysis of the exposure setting, identifying potential exposure pathways, predicting contaminant fate and transport, determining exposure point concentrations, and estimating intakes of contaminants at the exposure points. Three types of exposures were assessed; namely, sub-chronic exposure (short-term, non-carcinogenic effects), chronic exposure (long-term, non-carcinogenic effects), and carcinogenic exposure (long-term, cancer causing effects).

4.1 Characterization of the Exposure Setting

The characterization of the exposure setting encompasses evaluation of two different types of data, physical site data and potentially exposed population data. Each of these types of data is discussed below.

4.1.1 Physical Setting

The Lockheed Martin site is situated on the southeast intersection of Marcus Avenue and Lakeville Road in the Village of Lake Success, Town of North Hempstead, New York. Union Turnpike borders the site to the south. The site is located in an area comprised of industrial, commercial and residential properties. Industrial and commercial facilities (office buildings) lie adjacent to the property on the east, northeast and northwest. Residential properties border the site to the southeast, south and southwest. Several golf courses are located north and northwest of the site. Lake Success is located within 1,600 feet to the north.

The Lockheed Martin property is approximately 94 acres in size. It has a main manufacturing building, and six smaller buildings located immediately south of the main building, which total approximately 1.5 million sq. ft. The majority of the site is either covered by the footprint of the buildings, or is paved for use as parking lots and driveways. Three drainage basins which collect stormwater runoff from the property are located in the southwest corner of the property adjacent to Lakeville Road. The site is surrounded by a chain-link fence and access to the site is manned with 24-hour security.

LaGuardia Airport weather station data was used to estimate the climatological and meteorological setting at Lockheed Martin. Regional temperatures are varied throughout the year with lower temperatures in the winter months (December, January, February, and March) and higher temperatures in the summer months (June, July, August and September). The mean air temperature during winter months is 1.3 degrees Celsius (^{o}C). During summer months the mean air temperature is 21.7^{o}C. Precipitation in the area also varies throughout the year with the greatest precipitation present in

the spring (March, April, and May) and the late summer (August and September). Maximum monthly precipitation's during the spring and late summer are typically near 9 to 10 cm. Wind directions and average wind speeds at Lockheed Martin were estimated using LaGuardia Airport Weather Station data. The predominant wind direction is out of the south with west-northwesterly winds also present at a relatively high frequency. There is little variation in average wind speeds with direction; however, winds out of the west-northwest typically are the strongest with speeds of 5.9 to 6.0 meters per second (approximately 13 miles per hour average) typically encountered.

4.1.2 Potential Receptors

A review of potentially exposed populations was conducted with the aid of 1990 US Census data. Census data within a 3 kilometer (approximately 2 miles) radius of Lockheed Martin was reviewed to determine the most probable potentially exposed populations. A summary of the potentially exposed populations are included in Table 4-1. As indicated in Table 4-1, the largest local population is located to the south and southeast of Lockheed Martin with a potentially exposed population of approximately 19,957 people. Review of neighboring land uses indicates that the population to the immediate north-northeast and north-northwest is primarily commercial and industrial, with small residential developments also present. In addition to the general population, potentially significant sub-populations were also investigated. It was determined that there are six schools and one hospital which are located within a 3 km radius. Although the schools and the hospital represent a potential sub-population of concern because of the children in attendance or patients, none of them should be adversely impacted by the Lockheed Martin site because both the schools and the hospital are on the public water system and air emissions from the Lockheed Martin site are not significant.

Review of public water supply well locations and populations indicate that everyone within a 1-1/2 mile radius of Lockheed Martin are on a public water supply system. This was confirmed through a well search through Nassau County Department of Health (NCDOH) and Department of Public works (NCDPW). The well search identified a total of 37 wells, consisting of monitoring, industrial and municipal wells. None of the wells are domestic wells.

4.1.3 Land Use

For the purposes of this human health evaluation, it will be assumed that future residential land use both on-site and in the immediately adjacent areas is possible. This assumption is conservative because current zoning at the site is industrial; however, the presence of residences within close proximity to the subject property would make future residential expansion a potentially viable scenario in the long term (over the next 30 years). However, more realistically, the site would probably remain industrial or would converted to commercial use. For short term (sub-chronic) exposure, it will be

assumed that only industrial land use is possible on-site. This assumption is realistic because it is highly unlikely that the Lockheed Martin facility will become a residential or commercial development in the next couple of years.

4.2 Identification of Exposure Pathways

In general, an exposure pathway consists of four elements:

1. A source and mechanism of chemical release. (i.e., spill, leak, discharge, etc.),
2. A retention and/or transport medium (i.e., soil, groundwater, etc.),
3. An exposure point (i.e., dermal contact with soils, groundwater supply, etc.), and
4. An exposure route (i.e., ingestion, inhalation, absorption).

If all of the elements of the exposure pathway are present, then that pathway is said to be "completed". Completed exposure pathways are subject to evaluation in the baseline risk assessment. In this assessment, both current and potential future exposure pathways are considered. Future exposure pathways are developed assuming development for residential or commercial use, however, for the purposes of the risk assessment, residential use is assumed since this would result in a more conservative evaluation of potential risks.

4.2.1 Sources and Exposure Points

Based upon the results of the remedial investigation and review of past studies, several areas containing elevated levels of contaminants have been identified at the Lockheed Martin site. Both the former drywells and the recharge basins contain significant concentrations of site indicator chemicals. The primary contaminants detected in the drywell soil are VOCs and inorganics, while the primary contaminants detected in the recharge basin sediments are inorganics. For the purposes of the risk assessment, both the drywell soils and recharge basin sediments are considered to be sources of contamination at the Lockheed Martin facility from which chemical exposure to human receptors can potentially result.

For the quantitative risk assessment, the most recent rounds of soil, sediment and groundwater monitoring data will be used. It is assumed that the chemical concentrations detected during the remedial investigation (1993 and 1994) are at steady-state, and that contaminant concentrations will not significantly increase or decrease over time. By not accounting for contaminant reduction over time is a conservative assumption, particularly since groundwater and source area IRMs are on-going at this site with additional soil and groundwater remedial measures being proposed in the Feasibility Study report. With the implementation of IRMs and with the proposed soil and groundwater remedial actions, contaminant concentrations in both soil and groundwater will decrease in the long term. Therefore, by

assuming that contaminant concentrations identified during the RI represents steady-state conditions, worst case exposures would be calculated, resulting in an upper-bound estimation of potential risks.

Exposure points that pose potential human risk are associated with the drywell soils, and the stormwater recharge basins. Release and transport of contaminants from these two contaminant sources can be via direct contact, or via leaching and percolation to groundwater. Soil and sediment exposure routes potentially can include dermal contact (absorption) and incidental ingestion. Under normal site circumstances, it is unlikely that dermal contact or ingestion of subsurface soils or recharge basin sediments will occur since contaminants in the subsurface soils are located several feet underground beneath pavement or landscaped areas, and sediments in the recharge basin are normally saturated under several feet of water column. However, exposure to subsurface soils may occur as a result of remediation (i.e., excavation). Remediation workers engaged in these activities, as well as local residents, may risk exposure through incidental ingestion, dermal absorption or inhalation of remediation-generated dust. Therefore, these potential exposure routes will be considered a completed pathway if excavation of the former drywells and/or sediments occur. In addition, inhalation of fugitive dusts may also occur when excavation activities are performed on the contaminated soils. For the purposes of the risk assessment, it will also be assumed that future site work (i.e., remedial actions) may unearth these sources bringing subsurface soils or sediments to the surface, thus allowing the potential for contact exposure.

Exposure to recharge basin sediments is not considered a completed pathway if the basins are being used as drainage basins, since the sediments in the basins are not accessible for human contact. Access to the site and to the basins are restricted by site fencing and security. In addition, the sediments are typically always under several feet of water, with the water level varying depending on runoff amounts. A potential future concern may be dust generation from the recharge basins if the basins are to become inactive and no longer used for stormwater recharge. However, inhalation of dust from the recharge basin remains an uncompleted exposure pathway even under this scenario because the bottoms of the basins are over 10 feet deep, and the basins are heavily vegetated. Therefore, dust generation from these basins would realistically not occur, and dust inhalation would remain an uncompleted exposure pathway. For the purposes of this risk assessment, it will be assumed that these basins are no longer being be used for site drainage, and as a result, the sediments contained within these basins are not covered by standing water. It is also assumed that access to the basins will no longer be restricted allowing for free access to children and residents to enter upon the basin property. These assumptions ensure an extremely conservative analysis of the exposure pathway for both subsurface drywell soils and recharge basin sediments.

Another exposure point to be evaluated is groundwater. Since local groundwater is used locally as a potable water supply, human exposure to contaminated groundwater will be evaluated in the quantitative risk assessment. However, it should be noted that area residents obtain their water from public water supplies. A well search conducted of a 1-1/2-mile radius of the site through Nassau County Department of Health and Department of Public Works files did not identify any private potable wells in the area. In addition, although groundwater downgradient of the site is used for potable water, the water is pre-treated by the water purveyors prior to distribution to the public. However, for the purposes of the risk assessment and it will be assumed that no pre-treatment of groundwater is being conducted, and that private domestic wells could potentially be installed on the Lockheed Martin site where contaminant concentrations in groundwater are highest. The groundwater concentrations, based on RI data will represent the contaminant levels at the point of consumption. These assumptions are extremely conservative and represent worst case exposure. Both ingestion of groundwater and dermal contact with groundwater will be evaluated as possible routes of exposure.

Exposure via site runoff is not considered at this site since surface water runoff is recharged to the ground via the recharge basins, and therefore, potential exposure resulting from contaminated surface runoff is included in the groundwater exposure pathways. Since there are no surface waters in the vicinity of Lockheed Martin that receive runoff from the site, and groundwater does not discharge to any local surface waters, there are no surface water exposure points that require evaluation. It is acknowledged that swimming pools may be filled with the groundwater potable water supply, thus creating a possible surface water exposure point. However, this exposure point will be evaluated as a dermal exposure to groundwater and not a surface water exposure.

Volatilization of VOCs and erosion of dust to ambient air are also not considered to be completed exposure pathways for this site. Air sampling data collected during the RI in the area of the former drywells did not detect any measurable concentrations of site related contaminants in the flux gate samples collected. Low concentrations of several VOCs (benzene, trichlorofluoroethane, methylene chloride, toluene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene and xylenes) were detected in the flux gate samples, however, these same compounds were detected in the QA/QC samples at comparable levels, and therefore, were not considered to be confirmed detections for the purpose of this risk assessment. Only 1,2,4-trimethylbenzene was detected (at 0.22J ppbv) in an air sample and not in any of the QA/QC samples. 1,2,4-Trimethylbenzene is not a site indicator compound; this compounds was not detected in the soil, sediment or groundwater samples for this site. Based on the air sampling data, it can be concluded that contaminants in the subsurface soils in the area of the former drywells are not volatilizing to the ambient air and therefore, does not pose any risks to human health. While it is also possible that the sediments from the recharge basin may potentially become exposed, concentrations of

VOCs detected in the recharge basin sediments are relatively low, and therefore, this scenario would be considered an extremely minor route of exposure when compared to the other pathways to be evaluated.

Other exposure mechanisms not evaluated include soil erosion and contact with recharge basin water. Soil erosion is not a completed pathway since the zone of impacted drywell soils is located several feet below grade, under pavement or landscaped areas, and basin sediments are situated under water. Contact with recharge basin water is not evaluated because the concentrations detected in water samples collected from the basin were sufficiently low, and below drinking water standards with the exception of 1,2-dichloroethene and several inorganics. This exposure pathway is considered to be minor compared to other pathways, and therefore will not be evaluated.

A summary of the sources, transport media, exposure points, and routes of exposure to be quantitatively evaluated at Lockheed Martin is provided in Table 4-2 and presented schematically in Figure 4-1.

4.2.2 Current Land Use Scenarios

The site at present is a secured facility, surrounded by a fence. Entrances are manned by security guards 24-hour a day and site access is limited to site workers and authorized visitors only. The majority of the Lockheed Martin employees work inside office buildings and manufacturing/maintenance areas. Site maintenance workers may work outdoors, however, there is no regular contact with contaminated subsurface soils in the area of the former drywells. As a conservative measure, however, it will be assumed that site workers can potentially come into contact with subsurface soils through unplanned and non-routine maintenance work (e.g., repairing or replacing utilities, or performing maintenance on the soil and groundwater IRM systems). Similarly, it is assumed that maintenance workers may occasionally come into contact with the recharge basin sediments, when maintenance activities become necessary. In addition, site workers who perform maintenance on the facility's groundwater treatment system may come into occasional contact with contaminated groundwater resulting from maintenance and/or sampling and monitoring activities. Because the site is secured, residents can not access the site. Therefore, under the current land use scenario, soil and sediment exposure pathways (via incidental ingestion and dermal contact) will be limited to site workers. However, residential exposure to site soils will be addressed under the future land use scenarios.

Remedial actions may be undertaken for the subsurface soils and/or sediments which could involve the excavation of contaminated drywell soils or dredging of sediments. Short term exposures via direct contact and inhalation can potentially occur during implementation of these remedial actions. Potential receptors include remediation workers and nearby residents.

All potable water provided on the Lockheed Martin site used by employees are obtained from a public water source. This water is routinely tested and treated (as necessary) by the water districts prior to distribution. Residents and neighboring industrial and commercial facilities also obtain their water from public water supplies. This was confirmed by a well search performed of the NCDOH and NCDPW well records as part of the RI. Because there is no chemical exposure, this exposure point will not be evaluated under the current land use exposure scenario, however, is considered in the future land-use exposure scenario.

The Lockheed Martin facility does utilize on-site groundwater (after it is treated using liquid phase carbon for VOC removal) as non-contact cooling water (NCCW). However, because there is no chemical exposure from use of NCCW, this mode of groundwater usage is not considered an exposure pathway and will not be evaluated under the existing or future land use scenario.

4.2.3 Future Land Use Scenarios

There is no plans at this time to alter site usage, however, for the purposes of the risk assessment, it is assumed that the site will eventually become redeveloped for residential use. Future site usage may also include commercial, however, for the purposes of the risk assessment, residential usage is assumed to yield a more conservative estimate of risks. Commercial usage would more closely resemble that for industrial exposure since only part-time occupation of the site will occur, as opposed to full time occupation of the site if residential exposures are assumed.

Future exposures to chemicals at the Lockheed Martin site could be associated with two environmental media: soil (consisting of subsurface soils and recharge basin sediments) and groundwater. Under the future land use scenario, it is assumed that residential homes will be built on the Lockheed Martin site. Construction of these homes will necessitate excavation and removal of subsurface soils by construction workers for construction of foundations and basements. Assuming that no remediation is performed, excavation activities conducted for construction could potentially unearth the contaminated subsurface soils located in the area of the former drywells. It is further assumed that this soil will be brought to the surface, and deposited on the site for use in site grading. Children playing in the yards or adults performing gardening activities or yard work could then potentially come into contact with these soils. Fugitive dust from soil erosion will not be considered, since is expected that residences will have lawns and paved driveways and walkways to minimize dust erosion and limit fugitive dust.

The stormwater recharge basins, under normal site conditions are always covered with several feet of water, and therefore, the underlying sediments are not exposed or directly accessible to human receptors. Even if the site is redeveloped for residential use, it is likely and highly probable that the recharge basins will continue to be used for stormwater collection and recharge since stormwater management will still be needed for the property. However, under a hypothetical assumption that the new developer decides to construct new recharge basins at another location within the site, the sediments at the bottom of the basins can then become accessible for contact. Residents, particularly children could potentially access the property on which the basins are located. A worst case assumption would be if the recharge basins are abandoned, and houses are built in their place. It this occurs, both children and adults could potentially become exposed. Under these scenarios, the most probable routes of exposure for the residents would be via ingestion and dermal contact. Even if the basins are no longer used for stormwater recharge and left undeveloped, because the bottoms of the basins are at least 10 feet deep and the basins are extensively vegetated, dust generation from the basins would not pose any real concerns.

Under future land use conditions, it is also assumed that private wells may be installed on-site for potable water use. Primary routes of exposure from the groundwater exposure pathway is via ingestion and dermal contact during showering.

4.2.4 Contaminant Fate and Transport

In assessing the potential risk to the public and environmental health, an assessment is necessary to identify the pathways through which exposure could occur. A typical transport pathway consists of the following elements: (1) source and release mechanism; (2) an environmental transport mechanism; (3) a point of potential contact with the contaminated medium; and, (4) an exposure route to the receptor.

The major fate and transport medium under consideration in this risk assessment is the infiltration and potential transport of organic compounds and metals from the soil media and possibly into groundwater.

The potential migration through the soil profile into the groundwater occurs by infiltration into the soil and movement through the vadose zone into the aquifer. The BNAs and metals would be expected to be retained in soils more than VOCs. Since VOC concentrations are not found near the surface, direct volatilization is not feasible to a great extent. There is currently no free phase solvent identified as a possible driving force for the contamination in a downward direction. The only current driving force is the annual precipitation that falls on the surface soils and the resulting surface water.

The potential for the contaminants to move in the soil depends on a number of parameters. Table 4-3 lists the principal properties of the compounds of potential concern that affect their fate and transport in soil and groundwater. The properties include molecular weight, solubility, volatility and the partitioning of the chemicals between soil and water and between lipids and water. As shown in Table 4-3, many of the organic compounds are quite soluble in water but also can adsorb to soil particles, especially where the soil has a high carbon content.

The aqueous solubility of a compound influences the amount of chemical that can dissolve in the aqueous phase, how well water acts as a solute, and how well the water will act as a transport medium. Compounds that are highly soluble in water will tend to solubilize easily and remain in solution. Salts of metals tend to be more soluble than organics and organic compounds that are polar tend to dissolve readily in water. These compounds could be readily dispersed by water and transported. Compounds that are not soluble will not dissolve.

The organic partition coefficient (K_{oc}) values represent the mobility of an organic compound in soil and how strongly the compound will be sorbed by soil and/or partition into water. A low K_{oc} indicates that a compound is not strongly sorbed by soil organic matter, and will migrate through the unsaturated zone with less retardation compared to compounds with high K_{oc} values. In an aquifer, compounds with a K_{oc} in excess of 350 will mostly partition into the adjacent soil. This will prevent their rapid removal from the soil by percolating water but will not prevent their contributing to groundwater contamination in the future. This is a rough guideline, and could vary depending on the organic content of the aquifer material and the porosity of the aquifer. In soils, there are more factors to take into account, but compounds with a K_{oc} greater than 2,000 will be extremely immobile in soil. compounds with a lower K_{oc} can be desorbed by water and leach downward. Thus, most VOCs will preferentially move to the aqueous phase and compounds such as the BNAs will reside in the soil and soil organic material. These compounds will have less mobility in the unsaturated zone.

Compounds with high Henry's law constants tend to volatilize into the gaseous phase rather than remain in the liquid phase. The higher the Henry's law constant, the more readily the compound will leave the aqueous phase and enter the gaseous phase. Thus, compounds like the VOCs tend to volatilize from water into the atmosphere or into soil.

The octanol/water partition coefficient is an indicator of how well a compound will partition into lipid from an aqueous environment. Compounds with high octanol/water partition coefficients tend to be better bioaccumultors than compounds that have low coefficients. The lower the octanol/water partition

coefficient, the lower the propensity for the compound to bioaccumulate in the food chain and reach higher order accumulators such as man.

The combination of the aqueous solubility, K_{oc}, Henry's law constant, and the octanol/water partition coefficient determines how a compound might move in the environment and where it will tend to accumulate. These properties help determine whether or not a compound will stay in soil once it gets there or migrate into the air or groundwater. The properties also determine how well compounds bioconcentrate, which is especially important with respect to environmental receptors.

4.3 Quantification of Exposures

In general, the quantification of exposures involve quantification of the magnitude, frequency, and duration of exposure events for all completed exposure pathways. The soil and groundwater exposure pathways that are being evaluated are discussed in the following sections.

4.3.1 Estimating Exposure Concentrations

The exposure concentration used for the soil ingestion and dermal contact pathways, and the sediment ingestion and dermal contact pathways was the 95% UCL on the arithmetic average of all subsurface soil, and all sediment sample results from the RI, respectively. Since the RI sampling program was designed to delineate "hot spots", the 95% UCL on the arithmetic average concentrations will provide a conservatively high concentration for use in the quantitative risk evaluation. To further remain conservative, 1/2-the detection limit was used for all non-detectable sample results and it will be assumed that the soil and sediment concentrations will remain constant over the entire risk assessment period of 30 years during which exposure occurs (i.e., leaching, volatilization, photolysis, degradation, and soil remediation do not exist). Therefore, by assuming that concentrations will not decrease over the 30-year exposure period of the risk assessment, a worst case exposure is being calculated. The soil and sediment exposure point concentrations developed for use with the ingestion and dermal contact exposure pathways are summarized in Table 4-4.

For groundwater, it was assumed that the concentrations detected within the contaminant plume is at steady state, and that concentrations will not increase or decrease over time. The maximum detected concentrations from current RI data were used to represent the groundwater exposure point concentrations. Maximum groundwater concentrations were selected as opposed to the 95% UCL on average concentrations because concentrations of a number of VOCs (i.e., 1,2-dichloroethene, trichloroethene and tetrachloroethene) were present in a small number of wells at concentrations much higher than was detected in the majority of the wells. The maximum detected concentrations in groundwater for these three compounds were two orders of magnitude higher than the 95% UCL average

concentration. Therefore, for these chemicals, using the 95% UCL average concentration to estimate exposure point concentrations may not be sufficiently protective, particularly if residents could become exposed to groundwater being drawn from areas of highest contaminant concentration (i.e., closest to the source area). Therefore, in order to provide a conservative and probably an overestimation of exposure, the maximum detected concentration in groundwater was used in establishing groundwater exposure point concentrations.

Another reason why this approach may be overly conservative is because groundwater exposure concentrations will be decreasing over the 30 year period of the risk assessment. The facility has operated since 1994 a groundwater pump and treat system which was installed as an IRM and a significantly larger capacity groundwater treatment system is being proposed in the Feasibility Study. In addition, a SVE system is in place and operational to control and minimize future contribution of VOCs to groundwater from the on-site source area. Therefore, these assumptions for the groundwater pathway will result in a higher exposure concentration than if actual site conditions were taken into account.

Exposure point concentrations used in the quantitative human health evaluation for the soil, sediment and groundwater exposure pathways are provided in Table 4-4.

4.4 Estimation of Contaminant Intakes

After exposure point concentrations were developed, chemical specific intakes were estimated for each completed pathway as outlined in USEPA RAGS. Site specific values were used as inputs whenever available. In the absence of site specific data, USEPA defaults were utilized to ensure a conservative analysis. For all exposure pathways, intakes in this section have been adjusted to measure the absorbed dose. In the absence of absorption coefficients, it will be assumed that 100 percent of the contaminants are absorbed to the target tissues or organs. This assumption will ensure conservative estimates of daily intakes. The following sections provides a summary of potential exposure scenarios for the soil and groundwater exposure pathways, along with an identification of potential human receptors and assumed input values for estimating soil and groundwater daily intakes.

4.4.1 Soils and Sediments

The three routes of exposure included in the Lockheed Martin quantitative human health evaluation, namely, soil ingestion, dermal contact with soils, and inhalation of fugitive dusts are discussed below.

4.4.1.1 Ingestion

Soil ingestion intakes were quantified using the following equation from USEPA "Risk Assessment Guidance For Superfund, Volume I - Human Health Evaluation Manual":

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

Where:

CS = Chemical Concentration in Soil (mg/kg) = 95% UCL on the average concentration.

IR = Ingestion rate (mg soil/day) = 100 mg soil/day (estimate for adults), or 200 mg soil/day, (estimate for child age 0 to 5 yrs.)

CF = 1.0E-06 kg/mg conversion factor

FI = Fraction Ingested = Fraction from contaminated source (assume 1.0 to remain conservative).

EF = Exposure Frequency (days/year)

ED = Exposure Duration (years)

BW = Body Weight (kg) = 70 kg (adult male assumed), or 16 kg (child)

AT = Averaging Time (days) = Period over which exposure is averaged.

A summary of the exposure scenarios evaluated under the soil ingestion pathway is discussed below. Intakes for soil and sediment exposure pathways were calculated separately since contaminant compounds and concentrations for the two contaminant areas differ. However, assumptions relative to potential receptors, exposure frequency and duration, and intake values for the soil and sediment exposure pathways will be the same, and therefore are grouped together in the discussions below. A summary of the input values used in calculating daily intakes is presented in Table 4-5.

Incidental Ingestion of Contaminated Soils or Sediments - Remediation or Construction Worker

This exposure pathway will only occur if soil excavation is being performed at the source areas. Under this scenario, only short term exposure was considered. Whether excavation is being performed as a remedial measure by remediation workers, or as general excavation by construction workers (under the future land use scenario), a maximum exposure duration of 6 months, corresponding to the duration of the excavation activity, was assumed. The exposure frequency was assumed to be 8 hours per day, 5 days per week, for a maximum of 6 months per year (i.e., 130 days). An ingestion rate of 480 mg soil per day was used (Exposure Factors Handbook, EPA 600/8-89/043, July 1989), and the fraction ingested is assumed conservatively to be 100%. The body weight used was 70 kg (based on an adult male). The averaging times for calculating subchronic (short term) non-carcinogenic effects is 0.5 years (182 days),

for chronic (long term) non-carcinogenic effects is 30 years, and for lifetime carcinogenic effects is 70 years.

Incidental Ingestion of Contaminated Soils or Sediments - Site Worker (Current)

For the site worker, the exposure frequency was assumed to be 8 hours per day, for two days each month, or a total of 26 days per year. Exposure durations for short term exposures are assumed to be 2 years, while long term exposure was assumed to be 30 years. The 30 year time period for exposure was chosen to present long term employment by a site worker at this same facility. A lower ingestion rate of 100 mg soil per day was used for the site worker than for the construction or remediation worker because, it is assumed that if extensive intrusive site work is needed, this work will not be performed by the site maintenance worker, but by an outside contractor. (See exposure assumptions above for a construction worker.) A body weight of 70 kg was used for the site worker. The averaging times for calculating non-carcinogenic subchronic (short term) and chronic (long term) effects was 2 years (730 days) and 30 years, respectively. For lifetime carcinogenic effects was 70 years, the averaging time was assumed to be 70 years.

Incidental Ingestion of Contaminated Soils or Sediments - Resident (Future)

For the future resident that may potentially be exposed to contaminated soils, an exposure frequency of 270 days per year, based on 30 days per month, and 9 months of mild weather per year (i.e., March through November) was assumed. During the balance of the year (December, January and February), the ground is either snow covered or frozen, and the weather is too extreme for prolonged outdoor activities. The short term/subchronic exposure duration was assumed to be 6 years (for a child age 0 to 5 years old) and 30 years was used for chronic/long term effects. The 30 year time frame chosen is based on EPA guidance (RAGS, 1989) to represent the national upper-bound time period (90th percentile) for staying at one resident. Averaging times used in calculating subchronic, chronic and lifetime exposure are 6 years, 30 years and 70 years, respectively.

The ingestion rate for a child age 0 to 5 years was assumed to be 200 mg soil/day and for the next 24 years from age 6 through 29 (adult) was assumed to be 100 mg soil/day. For a child age 0 to 5 years, an average body weight of 16 kg was used, while 70 kg was used for the next 24 years (age 6 through 29).

Average daily intakes were calculated for three time periods: age 0 to 5 years (total of 6 years), age 6 through 29 years (total of 24 years), and age 6 through 70 years (total of 64 years). Subchronic daily intake (which represent exposure during age 0 to 5 years) was calculated using exposure assumptions for a child. The chronic daily intake values (0 to 29 years) were estimated by calculating

the weighted average between the daily intakes value for the 0 to 5 years and 6 to 29 year age groups. Similarly, the lifetime daily intake values were estimated by calculating the weighted average of the daily intakes for the 0 to 5 years, and 6 to 70 years age groups.

Summaries of the calculated average daily soil and sediment intakes for sub-chronic, chronic and lifetime exposures are presented in Tables 4-6 through 4-8, and 4-14 through 4-16.

4.4.1.2 Dermal Contact (Absorption)

Daily intakes for dermal contact with soils and sediments were calculated using the following formula:

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

Where:

CS = Chemical Concentration in Soil (mg/kg) = 95% UCL on the average concentration.

CF = 1.0E-06 kg/mg conversion factor

SA = Skin Surface Area for Contact (cm^2/event)

AF = Soil To Skin Adherence Factor = assume 1.45 mg/cm^2 (EPA potting soil default)

ABS = Absorption Factor = 1 (conservative assumption assumes all contaminants are absorbed across the skin surface)

EF = Exposure Frequency (days/year)

ED = Exposure Duration (years)

BW = Body Weight (kg) = 70 kg (adult male assumed), or 16 kg (child)

AT = Averaging Time (days) = Period over which exposure is averaged.

Dermal Contact (Absorption) of Contaminated Soils or Sediments - Remediation and Construction Worker (Current and Future)

Exposure frequency and duration used for soil and sediment dermal contact by the remediation or construction worker were used for the dermal contact exposure pathway. Skin surface area was assumed to be 4,300 cm^2 (total for hands, arms, and head). Averaging times were also 0.5 years, 30 years and 70 years for sub-chronic, chronic and lifetime effects.

Dermal Contact (Absorption) of Contaminated Soils or Sediments - Site Worker Construction Worker (Current)

The assumed exposure frequency and duration used for site workers was 12 days per year for 2 years (sub-chronic exposures), and 30 years for (chronic exposures). Like the remediation/construction

worker, skin surface area was assumed to be 4,300 cm^2 (total for hands, arms, and head). Averaging times were 2 years, 30 years and 70 years for sub-chronic, chronic and lifetime effects.

Dermal Contact (Absorption) of Contaminated Soils or Sediments - Resident (Future)

Exposure frequency, duration, and averaging time used for this exposure pathway are the same as those used for the incidental ingestion by the residents. Skin surface area is assumed to be 9,800 cm^2 (total for hands, arms, head and lower legs).

Summaries of the absorbed dose (daily intake) of contaminants for dermal contact with soils were calculated for sub-chronic, chronic and lifetime exposures are presented in Tables 4-9 through 4-11 and 4-17 through 4-19.

4.4.1.3 Inhalation of Fugitive Dust

Daily intakes for inhalation of contaminated dust were calculated using the following formula:

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

Where:

CS = Chemical Conc. in Soil (mg/kg) = 95 % UCL on average concentration.

RD = Respirable Dust Concentration in Air (ug/m^3)

FI = Fraction Inhaled from the site (unitless) = Assume 100% is from site.

IR = Inhalation Rate (m^3/day) = 20 m^3/day

CF = Conversion Factor = 10^{-9} ug/kg.

EF = Exposure Frequency (days/year)

ED = Exposure Duration (year)

BW = Body Weight = 70 kg (adult male assumed)

AT = Averaging Time (days) = Period over which exposure is averaged.

A discussions of the assumptions made for each is presented below.

Inhalation of Fugitive Dust by Remediation or Construction Worker

Construction or remediation workers could be exposed to soil contaminants if the areas of contamination are built upon, or remediated by excavation. Exposure under this scenario will only occur if and when site excavation activities are conducted to create large concentrations of airborne dust. Exposure was estimated assuming that dust concentrations are equal to the OSHA nuisance limit of 5 mg/m^3. It is also assumed that potential exposure will only occur from the PM10 fraction of the dust,

with 100 percent of the 5 mg/m^3 concentration being absorbed. An inhalation rate of 20 mg/m^3 was used. Exposure frequency, duration, and averaging times are the same as for incidental ingestion and dermal contact.

Inhalation of Fugitive Dust by Remediation or Construction Worker

As with the inhalation pathway for construction and remediation workers, the potential also exists for residential exposure to airborne dust during site excavation or remediation activities. Exposure duration will be the same as for the construction/remediation worker since exposure will occur only when excavation activities are on-going. However, exposure frequency will be 7 days per week instead of 5 days per week used for the construction/remediation worker, because it is assumed that soil dust can linger. However, it is assumed that the dust concentration at the point of exposure of the resident is 50 ug/m^3 (or 1 percent of concentration on-site due to dispersion).

Summaries of the calculated air inhalation intakes for sub-chronic, chronic and lifetime exposures are presented in Tables 4-12, 4-13, 4-20 and 4-21.

4.4.2 Groundwater

Exposure to groundwater was quantified for two potential exposure routes, ingestion of drinking water from a groundwater supply well and dermal contact with groundwater. The basis for, and assumptions used in calculating these two intakes are discussed below.

4.4.2.1 Ingestion of Groundwater

Intakes of groundwater through ingestion were estimated using the exposure point concentrations of Table 4-3 and the following equation:

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

Where:

CW = Chemical Conc. in Groundwater (mg/l) = Maximum detected groundwater concentration.

IR = Ingestion rate = 2 liters/day (Conservative USEPA default).

EF = Exposure Frequency (days/year).

ED = Exposure Duration (days) = 2 years sub-chronic, 30 years chronic

BW = Body Weight = 70 kg (adult male assumed, USEPA default).

AT = Averaging Time (days) = Period over which exposure is averaged = 2 years sub-chronic, 30 years chronic & 70 years lifetime (carcinogenic).

Ingestion of Contaminated Groundwater - Residents (Future)

It is assumed that future land use conditions will allow for development of the site for residential use, and the residents could potentially obtain potable water for domestic use from on-site private supply wells. The exposure assumptions for drinking water follow EPA standard assumptions (ref. RAGS, 1989). For an adult (70 kg body weight), water ingestion is 2 liters per day, consumed for a period of 365 days per year. The 2 liters/day ingestion rate is the upper 90th percentile value provided by the USEPA. Exposure durations for short term and long term exposures are assumed to be 2 years, 30 years. Averaging times used are 2 years (subchronic), 30 years (chronic) and 70 years (lifetime - carcinogenic).

Sub-chronic, chronic and lifetime (carcinogenic) intakes by groundwater ingestion are summarized in Table 4-22.

4.4.2.2 Dermal Contact with Groundwater

Dermal contact with groundwater can result from normal household activities (showering, washing, etc.) and swimming in pools filled with groundwater. The following equation was used in conjunction with the exposure point concentration estimates of Table 4-4 to estimate daily intakes (absorbed doses) associated with dermal contact with groundwater:

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

Where:

CW = Chemical Conc. in Groundwater (mg/l) = Maximum detected groundwater concentration.

SA = Skin Surface Area for Contact = 19,400 cm2/event (assumes adult male total body, most conservative estimate)

PC = Dermal Permeability Constant = 8.4E-04 cm/hr (Value for water assumed for all contaminants, see text for discussion)

ET = Exposure Time = 0.5 hr/day (This assumption assumes approximately 20 to 30 minutes per day in the shower. Dermal contact during swimming is assumed to be included in this estimate)

CF = 1 liter/1000 cc conversion factor

EF = Exposure Frequency = 365 day/year

ED = Exposure Duration (days) = 2 years sub-chronic, 30 years chronic & carcinogenic.

BW = Body Weight = 70 kg (adult male assumed, USEPA default).

AT = Averaging Time (days) = Period over which exposure is averaged = 2 years sub-chronic, 30 years chronic & 70 years lifetime (carcinogenic).

Dermal Contact (Absorption) of Contaminated Groundwater - Site Workers (Current)

Site workers may occasionally be exposed to contaminated groundwater while performing maintenance work on the facility's groundwater pump and treat system, or while assisting in groundwater sampling. Exposure frequency for this potential pathway is assumed to be one day per week, or 50 days per year, while the exposure duration is assumed to be 2 years for short term and 30 years for long term exposure. The skin surface area for contact is assumed to be 8.2 cm^2/event (based on exposure to hands only). Due to limited amount of available of chemical specific data for dermal permeability, the dermal permeability constant used for all indicator chemicals was assumed equal to that for water (0.00084 cm/hr). While this assumption may yield conservative absorption estimates for some compounds, non-conservative estimates may be obtained for others. Exposure durations of 2 years for short term, and 30 years for long term exposure, and averaging times of 2 years (subchronic), 30 years (chronic) and 70 years (lifetime - carcinogenic) were assumed.

Dermal Contact (Absorption) of Contaminated Groundwater - Residents (Future)

For dermal contact, it was assumed that a person takes a 30 minute (0.5 hour) shower every day of the year (365 days). The skin surface area for contact was 19,400 cm^2 (based on an adult male). The dermal permeability for chemicals was also assumed to be 0.00084 cm/hr. Durations for exposure were assumed to be 2 years for short term and 30 years for long term exposures, while the averaging times used were 2 years (subchronic), 30 years (chronic) and 70 years (lifetime - carcinogenic).

Results of the quantitative estimate of absorbed doses from sub-chronic, chronic and lifetime dermal contact with groundwater are summarized in Tables 4-23 and 4-24.

5.0 Toxicity Assessment

The scope of the Lockheed Martin toxicity assessment was limited to review of toxicity studies and information developed by others. No dose-response studies were performed specifically for the Lockheed Martin site. Whenever possible, quantitative values for reference doses and carcinogenic slope factors were used in the quantitative baseline risk evaluation. In the absence of quantitative data, available dose response studies were reviewed to present a qualitative discussion of potential carcinogenic and non-carcinogenic effects.

5.1 Assessment of Toxicity Information

Available non-carcinogenic and carcinogenic data was reviewed as part of the Lockheed Martin risk assessment. Several sources of toxicity data were reviewed to obtain the most up-to-date information regarding contaminant specific toxic effects. A brief description of each source used is presented below:

USEPA Integrated Risk Information System (IRIS) - IRIS is an EPA database containing EPA regulatory information and the most recent toxicological information for numerous contaminants. The IRIS database is typically updated quarterly and is considered to be the best source of toxicological information because of the high level of review that data must undergo before inclusion in the database. The January 1996 IRIS database was the primary source of toxicological data used in the Lockheed Martin risk assessment. Only in the absence of IRIS data, were the remaining listed sources used.

Health Effects Assessment Summary Tables (HEAST) - HEAST is a tabular presentation of toxicity information for which toxicological documents have been prepared. HEAST provides much of the same data presented in IRIS and some information not on record with IRIS. It should be noted that some data in HEAST has not been verified, and therefore, IRIS data is preferred.

USEPA Environmental Criteria and Assessment Office (ECAO) - ECAO is a USEPA sponsored help line related to Superfund related health issues. ECAO was used to confirm information presented in IRIS and to derive quantitative toxicity values for Lockheed Martin contaminants from other known sources of information. Specifically, ECAO was contacted to obtain toxicity data for the following chemicals: tetrachloroethylene, trichloroethylene, 1,1,1-trichloroethane, napthalene, carbazol, cobalt, copper, and mercury.

New York State Department of Health - Bureau of Toxic Substances Assessment - NYSDOH was consulted for guidance whenever IRIS, HEAST, or ECAO data was not available. NYSDOH literature used for benzo(a)pyrene.

For risk assessment purposes, individual pollutants are separated into two categories of chemical toxicity, depending on whether they exhibit non-carcinogenic or carcinogenic effects. A discussion of carcinogenic and non-carcinogenic effects is presented below.

5.2 Non-Carcinogenic Effects

Non-carcinogenic effects are measured quantitatively as reference doses (RfD's). The RfD, expressed in units of mg/kg-day, is defined as an estimate of a daily exposure level for the human population, including sensitive sub-populations, that is likely to be without appreciable risk of deleterious effects during an exposure duration. These RfDs are usually derived either from human studies involving workplace exposures or from animal studies and are adjusted using uncertainty factors. The RfD provides a benchmark to which chemical intakes by other routes (e.g., via exposure to contaminated environmental media) may be compared.

Non-carcinogenic effects consist of both sub-chronic (short term) and chronic (long term) effects. Chronic RfDs were obtained from IRIS. However, when available, sub-chronic RfD's provided in HEAST were used in the toxicity assessment for subchronic effects. In most cases, however, the sub-chronic RfD's provided in HEAST were developed using chronic RfD's and therefore are not truly independent. The toxicity values used at Lockheed Martin in the non-carcinogenic risk assessment are summarized in Table 5-1. A summary of the toxic effects of each of the chemicals and the basis for the derivation of the RfD is given in Appendix A, Indicator Chemical Profiles.

Due to the lack of dermal exposure toxicity reference values for the indicator contaminants at Lockheed Martin, dermal toxicity values were estimated from oral RfD's using an assumed oral absorption efficiency of 20 percent. Use of a 20 percent oral absorption efficiency is a relatively conservative estimate that should yield conservative dermal toxicity values in the form of an absorbed RfD. Dermal (absorbed dose) RfD's were calculated for each indicator contaminant using the following equation:

$$\text{Absorbed (dermal) RfD} = \text{Oral Absorbtion Efficiency} \times \text{Oral RfD (mg/kg-day)}$$

Where:

- Oral Absorption Efficiency = 20 percent = 0.20 (dimensionless)
- Absorbed RfD = Dermal contact reference dose (mg/kg-day)

For the purposes of this risk assessment, sub-chronic effects will be considered effects related to an exposure duration of 0.5 years (for remediation and construction workers), and 2 years for site

workers and residents. A period of 6 month (0.5 year) was selected to represent the duration of any intrusive site work that would be most likely to occur at the site and would result in possible exposures to contaminants. Chronic effects will be based upon a 30-year exposure duration to simulate the upper bound level of the time spent living in one residences as approved by USEPA.

5.3 Carcinogenic Effects

Carcinogenic effects are measured both qualitatively and quantitatively. Qualitatively, chemicals are assigned a weight of evidence factor which is an indicator of the amount of study performed, the type of study, and the confidence in the study procedures and results. USEPA assigns weight-of-evidence classifications to potential carcinogens. Under this system, chemicals are classified as either Group A, Group B1, Group B2, Group C, Group D, or Group E. Group A chemicals (human carcinogens) are agents for which there is sufficient evidence to support the casual association between exposure to the agents in human and cancer. Groups B1 and B2 chemicals (probable human carcinogens) are agents for which there is limited (B1) or inadequate (B2) evidence of carcinogenicity from animal studies. Group C chemicals (possible human carcinogens) are agents for which there is limited evidence of carcinogenicity in animals, and Group D chemicals (not classified as to human carcinogenicity) are agents with inadequate human and animal evidence of carcinogenicity or for which no data are available. Group E chemicals (evidence of non-carcinogenicity in humans) are agents for which there is no evidence of carcinogenicity in adequate human or animal studies. Weight of evidence classifications for carcinogenicity are summarized in Table 5-2.

Carcinogenic effects are measured quantitatively as slope factors in units of mg/kg-day. The slope factor is defined as the plausible upper bound estimate of the probability of a response per unit intake of a chemical over a lifetime. The slope factor is used to estimate an upper bound probability of an individual developing cancer as a result of a lifetime of exposure to a particular level of a carcinogen. Whenever available, human data should be used to generate slope factors in place of animal or laboratory data. As with the non-carcinogenic toxicity assessment, no dose-response or other studies were performed directly for Lockheed Martin. The carcinogenic toxicity assessment was limited to review of available information obtained and compiled by others (USEPA, NYSDOH, etc.).

Due to the lack of dermal exposure slope factors for the indicator contaminants at Lockheed Martin, dermal toxicity values were estimated from oral slope factor's using an assumed oral absorption efficiency of 20 percent. Use of a 20 percent oral absorption efficiency is a relatively conservative estimate that should yield conservative dermal toxicity values in the form of an absorbed slope factor. Dermal (absorbed dose) slope factor's were calculated for each indicator contaminant using the following equation:

$$\text{Absorbed (dermal) Slope Factor} = \frac{\text{Oral Slope Factor}}{\text{Oral Absorbtion Efficiency}}$$

Where:

- Oral Absorption Efficiency = 20 percent = 0.20 (dimensionless)
- Absorbed slope factor = Dermal contact slope factor (mg/kg-day)

The toxicity values used at Lockheed Martin in the carcinogenic risk assessment are summarized in Table 5-2. A summary of the toxic effects of each of the chemicals and the basis for the derivation of the Slope Factors is given in Appendix A, Indicator Chemical Profiles.

For the purposes of this risk assessment, carcinogenic effects will be considered effects related to an exposure duration of 70 years, which represents a lifetime for an individual. This assumption essentially assumes that the exposed population will be in contact (either directly or indirectly) with the contaminants for a period of 30 years, and that the exposure will be averaged through the 70 year lifetime of an individual. Since most populations will not remain in one area consistently for 30 years, this exposure duration will yield an extremely conservative estimate of exposures.

6.0 Risk Characterization

6.1 Quantification of Risk

Quantitative non-carcinogenic risks are reported as hazard quotients (or hazard indices) by comparing predicted contaminant intakes directly to toxicity values in the form of reference doses. Hazard quotients for non-carcinogenic risks for the ingestion, dermal and inhalation contact pathways were estimated by dividing the exposure level (sub-chronic or chronic daily intakes) by the reference dose (RfD's) for each contaminant according to the following equation:

$$\text{Sub - chronic:} \quad \text{Hazard Quotient} = \frac{\text{Exposure Level (SDI)}}{\text{Toxicity Value } (RfD_{\text{sub-chronic}})}$$

$$\text{Chronic:} \quad \text{Hazard Quotient} = \frac{\text{Exposure Level (CDI)}}{\text{Toxicity Value } (RfD_{\text{chronic}})}$$

where:
SDI = Sub-chronic Daily Intake
CDI = Chronic Daily Intake

The hazard quotients for each contaminant, i, (over each time period) are then summed to yield a total pathway hazard index for the given pathway and time period being analyzed.

$$\text{Hazard Index} = \sum_{i} \frac{\text{Exposure Level } (SDI_i \text{ or } CDI_i)}{\text{Toxicity Value } (RfD_{i\,\text{sub-chronic or chronic}})} \quad \text{for each pathway}$$

Contaminants (or exposure pathways) with a hazard quotient (or hazard index) of 1 or greater are considered to have the potential to cause adverse effects in potentially exposed populations. It is stressed, however, that the non-carcinogenic hazard quotient is not a measure of statistical probability but a comparison of daily intakes to reference doses where adverse effects have been evidenced during validated studies.

Carcinogenic risks are expressed as the probability that an individual will develop cancer over a lifetime of exposure to a particular contaminant or to a mixture of contaminants. As with the non-carcinogenic risk characterization, carcinogenic risk characterization utilizes contaminant intakes and toxicity values (in the form of slope factors) to quantify risks. The carcinogenic risk (unitless probability) was calculated using the low-dose cancer risk equation by multiplying the carcinogenic daily

intakes developed in Section 4.4 by the slope factors discussed in Section 5.3 according to the following equation:

$$Risk_i = \text{Exposure Intake } (CDI_i) \text{ X Slope Factor } (SF_i)$$

If risk levels calculated using the low-dose cancer risk equation were found to be greater than 0.01, the one-hit equation for high carcinogenic risk levels was also calculated according to the following equation:

$$Risk_i = 1 - \exp^{(-CDI_i \text{ X } SF_i)}$$

Contaminants with a cancer probability (risk) greater than 10^{-4} (one in ten thousand) to 10^{-6} (one in one million) were considered acceptable risks. The risk levels represent a probability of one in 10,000 and one in 1,000,000 that an individual could contract cancer due to exposure to the potential carcinogens, under the conditions of exposure. The reason for using a range of acceptable risks instead of a single value is to allow a qualitative review of the individual contaminant risks based upon non-quantitative factors such as weight of evidence data, confidence in slope factors, etc.

Quantification of risks was performed for all potential exposure pathways where toxicity values are available and approved by federal and/or state agencies. Quantified risks for the soil, groundwater exposure pathways are summarized in Sections 6.1.1 and 6.1.2, respectively.

6.1.1 Soil

Risks were calculated for eighteen (18) different scenarios involving soil and sediments at Lockheed Martin. Specifically, the following potential risks were quantified:

Subsurface Soils (Includes Drywells)

- Non-carcinogenic, sub-chronic risk - soil ingestion
- Non-carcinogenic, chronic risk - soil ingestion
- Carcinogenic risk - soil ingestion
- Non-carcinogenic, sub-chronic risk - soil dermal contact
- Non-carcinogenic, chronic risk - soil dermal contact
- Carcinogenic risk - soil dermal contact
- Non-carcinogenic, sub-chronic risk - dust inhalation
- Non-carcinogenic, chronic risk - dust inhalation
- Carcinogenic risk - dust inhalation

Recharge Basin Sediments

- Non-carcinogenic, sub-chronic risk - sediment ingestion
- Non-carcinogenic, chronic risk - sediment ingestion
- Carcinogenic risk - sediment ingestion
- Non-carcinogenic, sub-chronic risk - sediment dermal contact
- Non-carcinogenic, chronic risk - sediment dermal contact
- Carcinogenic risk - sediment dermal contact
- Non-carcinogenic, sub-chronic risk - dust inhalation
- Non-carcinogenic, chronic risk - dust inhalation
- Carcinogenic risk - dust inhalation

Using the sub-chronic, chronic and lifetime daily intakes developed in Section 4.4.1 and the toxicity values derived in Sections 5.2 and 5.3 yields the non-carcinogenic hazard quotients of Table 6-1 through 6-6 for the soil and sediment ingestion, dermal contact ad soil inhalation pathways. A discussion of the quantitative risks for each of these exposure pathways is presented below.

6.1.1.1 Subsurface Soils

Incidental Soil Ingestion by Future Remediation and Construction Workers - As indicated in Table 6-1A, non-carcinogenic hazard quotients for all contaminants via the soil ingestion pathway were well within the acceptable benchmark of 1.0 for non-cancer systemic effects. In addition, the total pathway hazard index was also below 1.0, indicating that this exposure pathway, based on assumed exposure levels, does not pose any significant non-carcinogenic risks. Carcinogenic risks associated with the individual contaminants via the soil ingestion pathway were within the EPA acceptable range of 1.0E-04 to 1.0E-06. The total pathway risk was calculated to be 6.1E-6.

It should be noted that the hazard index and excess cancer risks for the total soil ingestion pathway is based only on the indicator chemicals, and not all the contaminants present at the site. For this reason, the total pathway hazard index and excess cancer risk presented in Tables 6-1 through 6-6 may not reflect actual total risk. Since a toxicity-concentration screen was used in selecting indicator contaminants, it is probable that the risks associated with contaminants not included in the quantitative assessment will be minimal when compared to risks associated with those included.

Incidental Soil Ingestion by Current Site Workers - For current site workers exposed to contaminated subsurface soils, the hazard index is below 1.0 for both short term (sub-chronic) and long term (chronic) non-cancer effects. The excess cancer risk associated with this exposure pathway (3E-6) is acceptable according to EPA guidelines. (See Table 6-1B.)

Incidental Soil Ingestion by Future Residents - For the potential future resident that might reside at a house constructed on the Lockheed Martin site, cancer and non-cancer risks were estimated based on assumed long term and short term exposure to contaminated subsurface soils through incidental ingestion. Under this exposure pathway, only PCBs pose a potential sub-chronic risk (a hazard index of 1.9). No individual chemicals exceeded the hazard index benchmark of 1.0 for non-cancer systemic chronic effects, however, the total pathway index is 1.8, which indicates the potential for adverse non-carcinogenic effects resulting from the total combination of chemicals. Similarly, although no individual compounds exceed the EPA's upper bound threshold for acceptable risk of 1E-4, the excess cancer risk for the total pathway is 2.1E-4. (See Table 6-1C.)

Soil Dermal Contact by Future Remediation / Construction Worker - Table 6-1C indicates that the non-carcinogenic hazard quotient for several inorganics, namely, antimony, arsenic, cadmium, chromium, manganese, nickel, and vanadium, as well as PCBs, trichloroethene, tetrachloroethene, and benzo(a)pyrene were exceeded for sub-chronic exposures. In addition, for non-carcinogenic chronic exposures, the hazard index of 1.0 was exceeded for PCBs and tetrachloroethene. Carcinogenic risks by dermal contact with the individual indicator contaminants were within EPA guidelines for acceptable risk (1E-4 to 1E-6), except for tetrachloroethene, which was slightly above with an excess cancer risk of 2.6E-4. This quantitative estimation of risks via the dermal pathway is provided for discussion purposes only and may not reflect actual risks at the site because contaminant specific dermal absorption data are not available for these compounds. By assuming the oral adsorption efficiency (of 20%) and skin adsorption factor (of 100%) for these chemicals, the quantitation of risks may be over conservative by a large degree, thus artificially inflating the estimation of dermal risks, potentially by as much as several orders of magnitude. (See Table 6-2A.)

Soil Dermal Contact by Current Site Worker - Sub-chronic and chronic non-carcinogenic exposures resulted in hazard quotients above 1.0 for PCBs, and trichloroethene, while tetrachloroethene exceeded the hazard quotient for chronic exposures. The excess cancer risk for this exposure pathway exceeds the EPA threshold for acceptable risk, primarily because of tetrachloroethene, with a calculated cancer risk of 1.8E-3. (See Table 6-2B.)

Soil Dermal Contact by Future Residents - Several chemicals, antimony, arsenic, cadmium, chromium, manganese, nickel, copper, vanadium, PCBs, trichloroethene, tetrachloroethene, and benzo(a)pyrene exceed the EPA's benchmark of 1.0 for potential non-cancer systemic effects from sub-chronic exposures. The same compounds, but also 1,2-dichloroethene exceed the 1.0 benchmark for non-cancer chronic exposures. For carcinogenic exposure, arsenic, PCBs, trichloroethene, tetrachloroethene, and benzo(a)pyrene all are in excess of the EPA threshold for acceptable cancer risk.

The sum of the excess cancer risk for this exposure pathway is 5.8E-2. As recognized above, all dermal contact pathway analysis must be interpreted cautiously because of the lack of compound specific dermal adsorption data. Because of the conservative nature in the assumptions made, the calculated risks for the dermal contact exposure pathway does not necessarily signify actual risk. (See Table 6-2C.)

Soil Inhalation by Future Remediation / Construction Worker - The excess cancer risk for this exposure pathway was well below EPA threshold levels of 1E-4 to 1E-6. However, only chromium and tetrachloroethene were evaluated for carcinogenic risk due to lack of inhalation slope factor data for the other indicator chemicals. The non-carcinogenic hazard indices were not calculated due to lack of inhalation RfD data. (See Table 6-3A.)

Soil Inhalation by Future Residents - For the same reasons noted above for the future remediation/construction worker exposure scenario, only chromium and tetrachloroethene were evaluated for carcinogenic risk, and was calculated to be well within acceptable thresholds. Hazard indices were not calculated for any of the indicator chemicals. (See Table 6-3B.)

6.1.1.2 Recharge Basin Sediments

Incidental Sediment Ingestion by Future Remediation and Construction Workers - Only PCBs exceed the hazard quotient of 1.0 for non-carcinogenic short term effects. All chemicals for non-carcinogenic chronic exposures were below 1.0. The excess cancer risk for carcinogenic exposure was 4.8E-6, which is within the range considered by EPA to be an acceptable risk. (See Table 6-4A.)

Incidental Sediment Ingestion by Current Site Workers - Both non-carcinogenic and carcinogenic exposures are below the hazard index of 1.0 and below the EPA threshold for excess cancer risk. (See Table 6-4B.)

Incidental Sediment Ingestion by Future Residents - This exposure pathway assumes that the site may become redeveloped for residential use, and that the sediments within the recharge basin could become exposed. Under this assumed scenario, PCB and benzo(a)pyrene both exceed the hazard quotient of 1.0. The hazard index for the total pathway is 5.7. No individual compounds exceed the 1.0 benchmark for chronic non-carcinogenic exposure, however, the hazard index for the total pathway is 1.7. The total excess cancer risk for this exposure pathway is slightly above the EPA threshold, at 1.6E-4. (See Table 6-4C.) The calculated risks for benzo(a)pyrene should be evaluated with caution because there is low confidence in the RfD for this compound (an uncertainty factor of 1000 was used). Additional discussions on the development of the RfD value for benzo(a)pyrene is included in Section

6.2. The actual hazard quotients for benzo(a)pyrene are most likely much lower than the hazard quotients presented above.

Sediment Dermal Contact by Future Remediation / Construction Worker - Antimony, arsenic, cadmium, chromium, nickel, vanadium, copper, PCBs and benzo(a)pyrene exceed the hazard index of 1.0 for short term (sub-chronic) non-carcinogenic exposures. PCBs also was above the 1.0 benchmark for non-carcinogenic chronic exposures. For carcinogenic effects, the sum of the excess cancer risk for this exposure pathway is 3.1E-4, with no individual compounds having an excess cancer risk higher than 1E-4. (See Table 6-5A.)

Sediment Dermal Contact by Current Site Worker - For sub-chronic non-carcinogenic effects, PCBs was the only indicator chemical that exceeded the hazard quotient of 1.0. For chronic exposures, silver, PCBs and benzo(a)pyrene all exceed the 1.0 index. The excess cancer risk for the exposure pathway is 7.4E-4, which signifies a potential cancer risk greater than the 1E-4 to 1E-6 risk levels considered by the EPA as acceptable. (See Table 6-5B).

Soil Dermal Contact - Future Residents - Antimony, arsenic, cadmium, chromium, nickel, silver, copper, vanadium, PCBs and benzo(a)pyrene exceed the hazard index of 1.0 for sub-chronic and chronic non-carcinogenic exposures. For carcinogenic exposure over a lifetime, the excess cancer risk of 1.0E-4 was exceeded for arsenic, PCBs, and benzo(a)pyrene. The sum of the excess cancer risk for individual chemicals for the pathway is 4.6E-2. (See Table 6-5C.) The entire dermal pathway analysis is extremely conservative because of the estimates of dermal RfD resulting from the lack of contaminant specific data, therefore, this exposure pathway should be evaluated with caution.

Sediment Inhalation by Future Remediation / Construction Worker - The excess cancer risk was evaluated for chromium and tetrachloroethene only, because of lack of available inhalation slope factor data for the other indicator chemicals. Carcinogenic exposure risk for chromium and tetrachloroethene were both well within acceptable EPA thresholds. Non-carcinogenic hazard indices were not calculated due to lack of inhalation RfD data. (See Table 6-6A).

Sediment Inhalation by Future Residents - As discussed above, only chromium and tetrachloroethene were evaluated for carcinogenic risk, and was calculated to be well within acceptable thresholds. Hazard indices were also not calculated for any of the indicator chemicals for the same reasons noted. (See Table 6-6B.)

6.1.2 Groundwater

Risks were calculated for six different scenarios involving groundwater contaminants at Lockheed Martin. Specifically, the following potential risks were quantified:

- Non-carcinogenic, sub-chronic risk - groundwater ingestion
- Non-carcinogenic, chronic risk - groundwater ingestion
- Carcinogenic risk - groundwater ingestion
- Non-carcinogenic, sub-chronic risk - groundwater dermal contact
- Non-carcinogenic, chronic risk - groundwater dermal contact
- Carcinogenic risk - groundwater dermal contact

Sub-chronic daily intakes used in risk characterization were based on maximum groundwater concentrations over a 2-year period, while chronic daily intakes for use in the chronic and carcinogenic risk characterization were estimated assuming a 30-year exposure duration. As an extreme conservative measure, maximum detected groundwater concentrations were used for the risk evaluation. Using the sub-chronic and chronic daily intakes developed in Section 4.4.2 and the toxicity values derived in Sections 5.2 and 5.3 yields the non-carcinogenic hazard quotients of Table 6-7 and 8 for the groundwater ingestion and dermal contact pathways.

Groundwater Ingestion by Current & Future Residents - For this exposure pathway, 1,2-dichloroethene exceeded the hazard index of 1.0 for both sub-chronic and chronic non-carcinogenic effects, while benzo(a)pyrene exceeded for sub-chronic, chronic and carcinogenic effects. The sum of the excess cancer risk for this exposure pathway is 6.6E-4. (See Table 6-7.) It should be noted, however, that benzo(a)pyrene was not detected in any of the groundwater samples (only in the soil and recharge basin sediment samples). When estimating sub-chronic and chronic daily intake concentrations for the groundwater exposure pathway, one-half of quantitation limit for benzo(a)pyrene in the groundwater samples was used even though this chemical was not detected in any of the groundwater samples. For this reason, the benzo(a)pyrene hazard quotient and excess cancer risk can not be directly related to any significant risk at the site. Since benzo(a)pyrene was not detected in the groundwater media, this chemical can be ignored in the evaluation of risk for this pathway.

Groundwater Dermal Contact by Current & Future Residents - This exposure pathway evaluates risks posed via dermal contact with contaminated water during showering. Only benzo(a)pyrene exceeds the hazard index of 1.0 for sub-chronic and chronic non-carcinogenic effects. The excess cancer risk for this exposure pathway is 6.6E-4, due primarily to benzo(a)pyrene. (See Table 6-8A.) As noted in the discussion above for the groundwater ingestion pathway, benzo(a)pyrene should be ignored in the evaluation of risks because this chemical has not been detected in any of the groundwater samples. If

benzo(a)pyrene were to be ignored, all individual contaminants would be within EPA's range for acceptable risk, for carcinogenic and non-carcinogenic effects.

Groundwater Dermal Contact by Future Site Workers - Sub-chronic, chronic and carcinogenic risks from the groundwater dermal contact pathway were found to be acceptable for all individual contaminants as well as for the total pathway. (See Table 6-8B.)

6.2 Uncertainties in the Quantitative Risk Assessment

Inherent in the characterization and performance of the risk analysis are uncertainties that may affect the evaluation process. Some of the major elements that contribute to uncertainties in the performance of this risk assessment is discussed below.

Background Soil and Groundwater Data - Background soil concentrations for inorganics were evaluated based on only one soil sample, which is statistically insignificant. Further, although this sample was collected from an area believed to be unimpacted by site activities, low levels of organic compounds (semi-volatiles and pesticides) were detected in this sample. For this reason, the VOC, semi-volatile organic, and pesticide/PCBs data from the background sample was not separated as a background sample, but included as an additional data point within the soil media. For inorganics, concentrations in the background soil sample are consistent with literature values (USGS, and NYSDEC TAGM) and the data from this sample was used together with literature values to evaluate background soil quality for the site.

Estimation of Exposure Point Concentrations - Exposure point concentrations used for the risk analysis assumed that soil and groundwater concentrations (based on RI data) are at steady state conditions, and will not change over time. These assumptions ignore various fate and transport mechanisms such as contaminant degradation, biotransformation, and dispersion. In addition, these assumptions ignore source area control and groundwater remedial measures that are being taken to address site contamination. In general, these assumptions are an overestimation of the soil and groundwater concentration over the long term, and will result in an overestimation of sub-chronic and chronic exposure doses (i.e., daily intakes). By ignoring VOC degradation and biotransformation, the appearance of potential degradation compounds, presently not detected, also adds uncertainty to the risk analysis.

Exposure concentrations used in estimating daily intakes for soil and sediment exposure pathways utilized the 95% UCL on the calculated average concentration. Where a contaminant was not detected, 1/2 of the quantitation limit was used to represent the concentration of that contaminant in the

sample. This procedure introduces uncertainty because substituting a numerical value for a non-detect result represents that the compound was actually detected. As discussed above, benzo(a)pyrene exceeded threshold risks for carcinogenic and non-carcinogenic effects in the groundwater exposure pathways even though this compound was not detected in any of the groundwater samples. Because this procedure is more conservative than using a value of zero in place of non-detect results, this procedure was utilized for the risk assessment.

The average concentration of contaminants used for estimating soil exposure concentrations are biased high since the RI sampling program was designed to identify source areas and "hot spots". In addition, soil samples collected were taken at depths that were determined in the field to be the likely "hot spots" based on observations during sample collection. This bias in the samples collected will introduce a conservative error into the quantitative risk analysis.

For groundwater, the maximum concentration of an individual contaminant was used to estimate exposure point concentrations. This assumption is also conservative and represents worst case exposure. Concentrations of 1,2-dichloroethene, trichloroethene, and tetrachloroethene within the majority of the contaminant plume is significantly lower (by as much as one to two orders of magnitude) than that detected in groundwater near the source area. Also for groundwater, sample MW-19GU was not considered when determining the exposure point concentration for the groundwater exposure pathways for manganese only. The manganese concentration was excluded because manganese detected in this one sample (at 3.43 mg/l) is between one to three orders of magnitude higher than the concentration detected in any of the other thirty-five groundwater samples. The next highest concentration in groundwater is 0.184 mg/l. The concentration of manganese in MW-19GU appear to be anomalous, and therefore was excluded. By excluding this elevated manganese data point, a lower daily intake concentration was calculated for the groundwater exposure pathways, however, it is believed that the lower manganese concentrations more accurately represents actual groundwater quality.

Availability of Toxicity Data

Toxicity values, either slope factors and/or oral RfDs, were available for the majority of the chemicals of potential concern. However, no toxicity data was available for dibenzofuran, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene, therefore, these compounds could not be evaluated. The inability to calculate non-cancer hazard indices and cancer risks for some of the site chemicals may result in an underestimation of the total pathway risks. Toxicity profiles for some of these chemicals where toxicity data are not available are also included in Appendix A, Indicator Chemical Profiles.

Slope factors and reference doses are not available for lead, and therefore, lead was not evaluated in the quantitative risk assessment. Lead poses a potential health concern, specifically to children, which is a potential sensitive sub-population for the future residential exposure scenario. From EPA Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children, (EPA/540/R-93/081, February 1994), based on the UBK biokinetic model, lead soil concentration between 500 and 1,000 mg/kg can result in an increase in blood plasma level. Site data does not support the presence of elevated lead in surface soils, but lead is confirmed to be present in subsurface soils and in the recharge basin sediment within or above 500 mg/kg and 1,000 mg/kg (in a total of five samples). At both locations, the contamination is not readily accessible within the media; the zone of contaminated subsurface soil is several feet (at least 6 feet) below grade, while the contaminated sediments is at the bottom of the basins under several feet of standing water. Actual potential for contact exposure to lead is low.

Chemical specific toxicity data was also not available for Aroclor 1248, or Aroclor 1260, however, since data is available for the general class of PCB compounds, Aroclors 1248, 1254 and 1260 were grouped together and represented generically as PCBs. Exposure point concentrations used for PCBs in the risk assessment represent the sum of the detected concentrations, and 1/2 of the non-detected quantification limits of the three Aroclor compounds. This approach may result in higher daily intake concentration than if the individual Aroclor compounds were being evaluated separately.

Due to the absence of federal IRIS or HEAST data, the reference doses used for benzo(a)pyrene were derived from a NYSDOH study performed to develop Ambient Air Criteria (AAC's) for polyaromatic hydrocarbons. The NYSDOH study stated that reproductive effects were noted following oral exposure to benzo(a)pyrene doses of 10 mg/kg-day. However, no details of the study were available. For this reason a relatively high uncertainty factor of 1000 was used to estimate an oral RfD of 1.0E-04. The oral RfD was further modified for absorption by assuming an oral absorption efficiency of 0.20 to yield a conservative dermal RfD of 2.0E-05. Therefore, the confidence in the RfD for this compound is extremely low and significant uncertainties were applied to yield very conservative results of risk. The actual hazard quotients for benzo(a)pyrene for the ingestion and dermal contact pathways are most likely much lower than the hazard quotients presented above.

Exposure Assumptions - Where possible, standard assumptions from EPA sources were used (EPA RAGS Vol. I, 1989, and EPA Exposure Factors Handbook, 1989). These standard assumptions, in themselves, are generally overly conservative. Further, using standard EPA assumptions (i.e., ingestion rates, soil adherence, skin surface area, body weight, life expectancy, and exposure frequency and duration) to represent the general population could result in an overestimation or underestimation of actual exposure and associated risks.

When assuming the frequency and duration for potential contact in and industrial setting (i.e., for remediation, construction and site workers), more realistic but still highly conservative assumptions were made when estimating daily chemical intakes. Use of conservative assumptions could overestimate actual exposure, resulting in worst case risks.

Dermal Exposure Pathway - The quantitative estimation of risks via the groundwater dermal pathways may not reflect actual risks at the site because contaminant specific dermal absorption data was not available. By assuming that contaminant dermal permeabilities are essentially equivalent to that of water, the quantitation of risks may be overly conservative by a large degree, thus artificially inflating the estimation of dermal risks by as much as several orders of magnitude. In addition, for soils and sediments dermal contact exposure pathway, due to the lack of chemical specific dermal exposure toxicity reference values, dermal toxicity values were estimated from oral RfD's and oral slope factors using an assumed oral absorption efficiency of 20 percent. Use of a 20 percent oral absorption efficiency is a relatively conservative estimate that should yield conservative dermal toxicity values in the form of an absorbed RfD. In addition, the absorption factor used for the soil and sediment dermal contact exposure pathways was 1.0, which conservatively assumes that all of the contaminants that comes into contact with the skin surface will become absorbed. These assumptions will likely result in a worst case over estimation of potential risk associated with dermal exposure.

Potential Land Use - Potential land use at the Lockheed Martin site will likely continue to be industrial or commercial (office buildings) based on current zoning. The residential land use scenario is evaluated as a potential worse case estimation of risk, since exposure durations and frequency for the residents is typically higher in frequency and longer in duration for industrial site workers. If the property is converted to commercial use, the exposure assumptions would more closely resemble that assumed for the site worker, therefore commercial usage was not evaluated separately.

6.3 Qualitative Characterization of Risk

This section of the human health evaluation will include a review of the quantified risks discussed in the previous sections and a discussion of the site specific and chemical specific factors that will estimate the actual risks at the Lockheed Martin site. Whereas the quantitative risk assessment is designed to be extremely conservative and estimate worst possible case scenarios, the qualitative risk assessment will present more realistic estimates of risks based upon site characteristics and proposed site and neighboring land uses.

6.3.1 Subsurface Soil

The quantitative evaluation of soil exposure pathways identified potential risk to residents from incidental ingestion of soils containing PCBs. In addition, the quantitative risk assessment revealed that the dermal contact with soil exposure pathways may exhibit non-carcinogenic and carcinogenic risks primarily due to elevated hazard quotients for antimony, arsenic, cadmium, chromium, manganese, nickel, vanadium, PCBs, trichloroethene, tetrachloroethene and benzo(a)pyrene to remediation/construction workers, site workers, and residents.

These calculated risks are based on soil quality data from samples collected from "hot spots" (i.e., former drywells that received discharges of process wastes), and therefore would be expected to be somewhat elevated. Specifically, of the thirteen (13) soil samples used to evaluate subsurface soil quality, two of the samples, from borings B-18 and B-19 both collected at a depth of 6-8 feet contained the highest concentrations of contaminants. Concentrations detected in these two samples were orders of magnitude higher than that detected in the other subsurface soil samples, primarily because these two samples were collected of sludge material encountered while boring through the former drywells. The quantitative evaluation of the soil exposure pathway included data from these two sludge samples. The resulting exposure point concentrations for the soil media were therefore skewed high because of the sludge.

Because it is recognized that this sludge material contain the bulk of the inorganic and organic contamination encountered at the site, Lockheed Martin is proposing in the Feasibility Study report to remove the sludge material. Potential risks associated with subsurface soils remaining in place after sludge removal was reevaluated. Non-carcinogenic and carcinogenic exposures were recalculated by omitting data from samples B-18 and B-19, 6-8 feet interval. The exposure point concentrations that represent contaminants remaining in soil after sludge removal is summarized in Table 6-9. The calculated non-carcinogenic hazard index after sludge removal for all of the soil ingestion exposure pathways were found to be less than 1.0 for both sub-chronic and chronic effects. The excess cancer risk for carcinogenic effects after sludge removal no longer exceed EPA risk levels of 1.0E-4 to 1.0E-6. The sum of the excess cancer risk for soil exposure to future residents decreased from an initial risk level of 2.1E-4 prior to sludge removal, to an acceptable excess cancer risk of 5.5E-5, after removal of the sludge. A summary of the calculated non-carcinogenic and carcinogenic risks for the soil ingestion pathway is presented in Table 6-10.

Although non-carcinogenic and carcinogenic risks associated with the soil dermal contact exposure pathways for remediation/construction workers, site workers and future residents also decreased after sludge removal, the sub-chronic, chronic and carcinogenic effects for these three receptor

groups still remained above EPA thresholds. As discussed in previous sections, gross assumptions were made in calculating risks associated with this exposure pathway. The lack of chemical specific adsorption data resulted in significant uncertainties associated with the quantitative evaluation of this exposure pathway. Because of this, actual exposure from dermal contact with subsurface soil is most likely to be overestimated, and therefore, are very likely to be significantly lower than those presented in Table 6-11. The dermal contact risk alone should not be used to conclude that the soil dermal exposure pathway pose unacceptable risks.

The potential for actual dermal contact by residents and/or site workers to contaminated subsurface soils is extremely low, mainly because the zone of contaminated soil is several feet (at least 6 feet) below grade. Residents, nor site workers would not access soils at this depth through normal daily activities. Under realistic conditions where the site zoning remains industrial, the site will remain paved and/or landscaped, and access to unauthorized visitors remains strictly limited, there will be no potential for dermal contact with contaminated subsurface soils. Therefore, given the low probability of dermal contact by both future residents and site workers, exposure via dermal contact is not considered to be a significant exposure pathway for the Lockheed Martin site.

The only likely receptor for contaminated subsurface soils via dermal contact would be remediation workers. The actual exposure risk, however, would be significantly lower than that calculated. If remediation activities are performed, it would be expected that workers would utilize personal protective equipment (i.e., gloves) and also implement engineering controls during field activities (such as dust control measures) to minimize the potential for chemical exposure to themselves as well as to others in the vicinity of the work. The risk calculated as part of this quantitative evaluation assumed that no personal protective equipment was used, which would be unrealistic.

In conclusion, the scenario for dermal exposure to soils used in the quantitative risk assessment assumed that all sub-surface soils are exposed on the surface (unrealistic), the site has unlimited access to children and adults (unrealistic), and that soil concentrations remain at the 95 percent upper confidence level on the arithmetic mean forever (highly improbable). Since none of these situations are actually in effect or anticipated to be in effect at Lockheed Martin, the analysis performed is extremely conservative and in all likelihood is not representative of actual risks at Lockheed Martin. Based upon knowledge of the site, the soil exposure pathways (ingestion and dermal contact) are not anticipated to present significant risks to potentially exposed populations, particularly after sludges from the former drywells are removed.

6.3.2 Recharge Basin Sediments

The quantitative risk assessment for ingestion, dermal contact and soil inhalation of recharge basin sediments identified potential sub-chronic, chronic and carcinogenic risks associated with the ingestion and dermal contact. Specifically, the sediment ingestion pathway poses sub-chronic risks (primarily due to PCBs and benzo(a)pyrene) as a result of exposure to remediation/construction workers, and to future residents. For the dermal contact pathway, potential risks were identified for the sub-chronic, chronic and carcinogenic effects, resulting from exposure to remediation/construction workers, site workers and residents. However, as discussed above, exceedance of EPA risk guidelines based on the dermal contact pathway does not necessarily signify the presence of risk, mainly because of the conservative assumptions made in evaluating the dermal contact exposure pathways.

Further, under this exposure scenario, it was assumed that current site workers (i.e., maintenance workers) could occasionally come into contact with sediments from the recharge basin. However, in actuality, based on current site conditions and worker responsibilities, there is no real potential for sediment contact, with the exception if emergency maintenance may be required. Even if any maintenance or repairs that are of significance are needed, it likely would be conducted by an outside contractor. Potential exposure to contractor personnel would only be on the order of several days, which is a significantly shorter exposure duration than that assumed for site workers (i.e., 26 days a year for 2 years or 30 years). Therefore, although this exposure pathway was evaluated as a completed pathway for the purposes of this risk assessment, in actuality, the probability for any exposure to recharge basin sediments by site worker is actually very low. The quantitative results from this exposure pathway should be reviewed with caution, and does not necessarily signify actual risks.

For both ingestion and dermal contact, potential risks would be present only if sediments from the recharge basin become accessible for contact. Given current usage of the recharge basins, the sediments contained in the basins are on the bottom under several feet of standing water. Thus the sediments are not exposed or accessible for human contact. Because the Lockheed Martin site is secured and fenced, access to the basins by children or other unauthorized personnel is further prevented, thus providing another level of safety in minimizing potential risk from contact exposure. Therefore, in actuality, ingestion of or dermal contact with basin sediments are not completed exposure pathways.

The only means for the sediments to potentially become accessible at some point in time in the future is if the recharge basins become inactive such that stormwater is no longer contained in the basins. However, under a realistic land use scenario, the site will likely remain industrial or converted to commercial use. Based on current site zoning, it is unlikely that the property will become residential. Whether the Lockheed Martin site continues to be industrial or is redeveloped for commercial use, the

recharge basins would be needed to provide for stormwater drainage. Even if the Lockheed Martin property is redeveloped, stormwater recharge would still be required of the new development. Provided that the basins continue to be used as recharge basins, the sediments contained within the basins will not become accessible for human receptor contact, and therefore, potential risks posed by ingestion and/or dermal contact with contaminated sediments can be avoided.

Continued use of these basins for stormwater drainage can be maintained through institutional controls such as a deed restriction. A deed restriction can be an effective means to ensure future usage of the portion of property on which the existing drainage basins are located as recharge basins, and also to prohibit future usage of this portion of the property for residential development. Maintenance of engineering controls such as a fence around the basins can be written into the deed restriction to further restrict access to the basins.

6.3.3 Groundwater

On the basis of the results of the quantitative risk assessment, ingestion of groundwater appears to represent the exposure pathway with the greatest potential risks to exposed populations. Both sub-chronic and chronic non-carcinogenic risks are estimated to be present for potentially exposed populations; primarily due to ingestion of 1,2-dichloroethene in groundwater. However, in estimating the quantitative risks, extreme conservative measures such as using maximum detected groundwater concentrations were employed. This assumption is very conservative because the groundwater concentrations used do not take into account future reductions in concentration that will result from soil and groundwater remediation programs in progress and others being proposed for this site. The groundwater IRM which was implemented in 1994 to reduce VOC concentrations in groundwater currently treats 1,000 gpm of contaminated groundwater. In addition, an expanded groundwater remediation system to capture and treat groundwater from the source area and within the zones of highest groundwater contamination is being proposed in the Feasibility Study report. Concurrent with implementation of the groundwater IRM, a SVE system was implemented to target VOCs in the subsurface soil from the former drywells. In addition, source area removal which will encompass excavation of sludges from the former drywells is proposed in the Feasibility Study report. With the implementation of active groundwater and soil remedial actions, as well as by natural degradation, the overall concentration in groundwater is expected to decrease over time, and certainly over the course of the next 30 years. Therefore, using the maximum detected groundwater in the risk assessment to represent short term as well as long term exposure point concentrations was a highly conservative assumption that yielded worst case estimates of exposures.

Exposures to groundwater assumed that a potable water supply well can be installed and draw water from the aquifer at the Lockheed Martin site, from the zone of highest contamination. In actuality, all domestic water usage in the area of the Lockheed Martin site is obtained from public water sources. A well search conducted through the NCDOH and NCDPW during the RI of a 1-1/2 mile radius surrounding the Lockheed Martin site did not identify any private domestic supply wells. Further, water obtained from public water supplies are first treated to remove contaminants to below federal and state drinking water standards. Therefore, in actuality, exposure to residents via the groundwater ingestion pathway is not a completed exposure pathway. Provided that the public water is used, there is no real human health risk to residents. However, it is recognized that with the absence of treatment, contaminants in groundwater can pose potential subchronic and chronic risks to the exposed population.

6.3.4 Air

In general, the only potential mechanism for the release of contaminants to the atmosphere at Lockheed Martin is via volatilization of contaminants from surface and shallow sub-surface soils in unpaved areas. However, the vast majority of the site is paved and the highest levels of VOCs in soil was detected in the area of the inactive drywells. The drywells are located below concrete pavement and have been filled in. The likelihood of any significant volatilization of VOCs from subsurface soils is extremely remote. This conclusion has been supported by air samples collected using an air emission isolation flux chamber to directly measure emission rates of VOCs permeating from soils in the vicinity of the former drywells. Based on the results of these samples, no significant levels of VOCs were detected in the flux gate samples. Since results of the subsurface VOC emissions tests indicate that VOCs are not being released from the site, and the majority of the site is paved or covered by buildings, it was concluded that this contaminant release mechanism does not result in a completed exposure pathway, and therefore, not evaluated in the risk assessment.

7.0 Human Health Evaluation Summary

Results from the remedial investigation and other past studies at Lockheed Martin were utilized to perform both a quantitative and qualitative evaluation of present and future risks to human health. The quantitative assessment was designed to present a worst case estimate of risks due to contaminants in soil, sediment and groundwater from the Lockheed Martin site. A qualitative assessment of risks was also performed which incorporated the findings of the quantitative risk characterization and factored in realistic site conditions and more probable potential future land uses to predict realistic risks at the Lockheed Martin site and to other potentially exposed populations.

The quantitative risk assessment indicated that potential risks may exists if exposure to contaminated subsurface soil and drainage basin sediment via the ingestion pathways were to occur. Potentially exposed populations for these exposure pathways include remediation or construction workers that would perform excavation of the drywell soils or dredging of the basin sediments. Potential risks may also exist for future residents residing at the site if the site were to become developed for residential use. In addition, there could also potentially exist dermal exposure risks to resident, site workers and remediation/construction workers from direct dermal contact with contaminated subsurface soil or sediments. For groundwater, the quantitative risk analysis identified potential exposure risks to residents drinking contaminated groundwater.

After the completion of the quantitative risk assessment, a qualitative review of risks was performed to determine what risks, if any were most likely to occur under realistic present and future land use scenarios. The qualitative risk analysis also assessed the likelihood of whether exposures scenarios would even occur. From the qualitative risk analysis, it was identified that many of the exposure pathways evaluated in the quantitative risk assessment are in fact not completed pathways. Examples of these include exposure to residents and site workers from subsurface soil and recharge basin sediments via soil ingestion or dermal contact. Contaminated media from the two soil contaminant areas (i.e., drywells and drainage basins) are not accessible for contact. Contaminants within the subsurface soils are located at depths ranging from 6 feet to 20 feet below grade, and are beneath pavement areas, and therefore, would not be accessible to residents or site workers through normal daily activities. In addition, the sediment in the drainage basins are covered by standing water. Since no one enters these basins for work or for recreation, there is also no potential for physical contact with the basin sediments.

Further, dermal contact with drainage basin sediments would occur only if the sediments became accessible at some future time (i.e., if the basins are no longer used for stormwater recharge). Under a realistic land use scenario, the site will likely remain industrial or converted to commercial use. Even with an alternate land use, the basins on this property would still be needed for stormwater management.

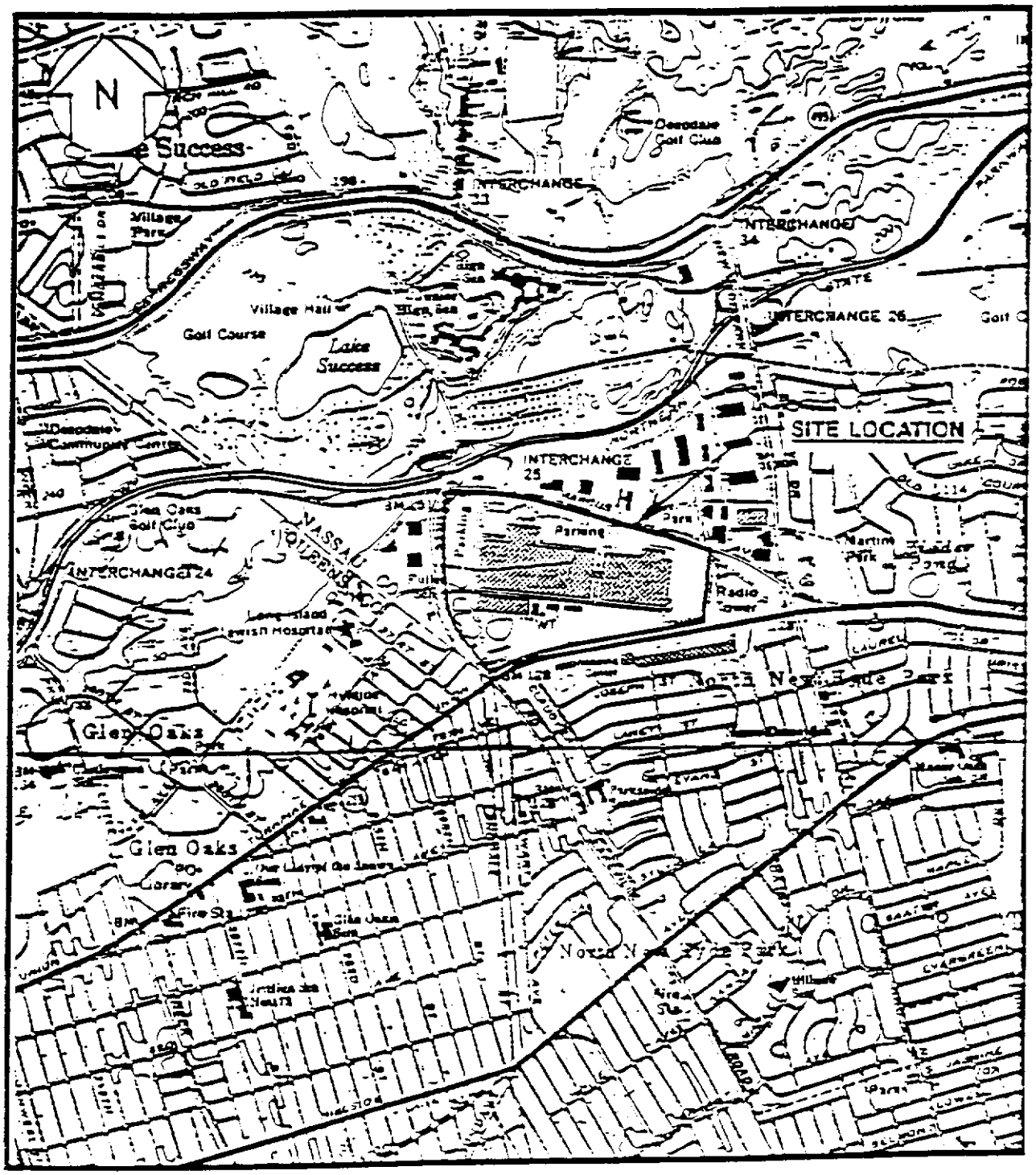
As long as the basins are used in their current capacity (i.e., for stormwater drainage), sediments contained within the basins are not accessible for human receptor contact and the potential risks posed by ingestion and/or dermal contact with contaminated sediments can be avoided. A deed restriction can be used to ensure future usage of this portion for stormwater recharge while also prohibiting future land use for residential housing. Fencing can also be used to further restrict access to the basins.

The groundwater exposure route is, in actuality, not a completed pathway because no one at the Lockheed Martin site or downgradient of the site utilizes private domestic wells. Further, public water companies must treat the groundwater to meet federal and state drinking water standards. Therefore, since the area surrounding and downgradient of the Lockheed Martin site is served by public water, no one is drinking contaminated groundwater. However, it is recognized that with the absence of treatment, contaminants in groundwater can pose potential sub-chronic and chronic risks to the exposed population and therefore, need to be addressed.

It is recognized that the sludge encountered while sampling the former drywells contain the majority of the inorganic and organic contamination encountered at the site. Lockheed Martin is proposing in the Feasibility Study report to remove this sludge material. The soil exposure pathway was recalculated to quantitatively assess potential risks from soils remaining in place after sludge removal. This was performed for soil ingestion and dermal contact. The potential non-carcinogenic and carcinogenic risks posed by the soil ingestion pathway after sludge removal was found to be within acceptable EPA thresholds, whereas these thresholds had been exceeded prior to sludge removal. For the dermal contact pathway, potential risks remain above EPA guidance for both carcinogenic and non-carcinogenic effects even after sludge removal. Because of uncertainties associated with the quantitative analysis of dermal contact risk, resulting from lack of available chemical specific adsorption data, the risks calculated for the dermal contact pathway is believed to be overly conservative, and not an accurate representation of actual site risk. Further, given the unliklihood of dermal contact by both future residents and site workers to soils located more than 6 feet below grade, exposure via dermal contact is not a significant exposure pathway for the Lockheed Martin site. Based upon knowledge of the site, the soil exposure pathways are not anticipated to present any significant real risks to potentially exposed populations, particularly after the sludge from the former drywells are removed.

Based upon the results of this baseline human health risk assessment, it is recommended that the sludges from the former drywells be removed, and that institutional controls be implemented (i.e., a deed restriction) to maintain current usage of the recharge basin property. In addition, because drinking untreated groundwater could pose a potential human health risk, groundwater is being addressed in the Feasibility Study.

FIGURES

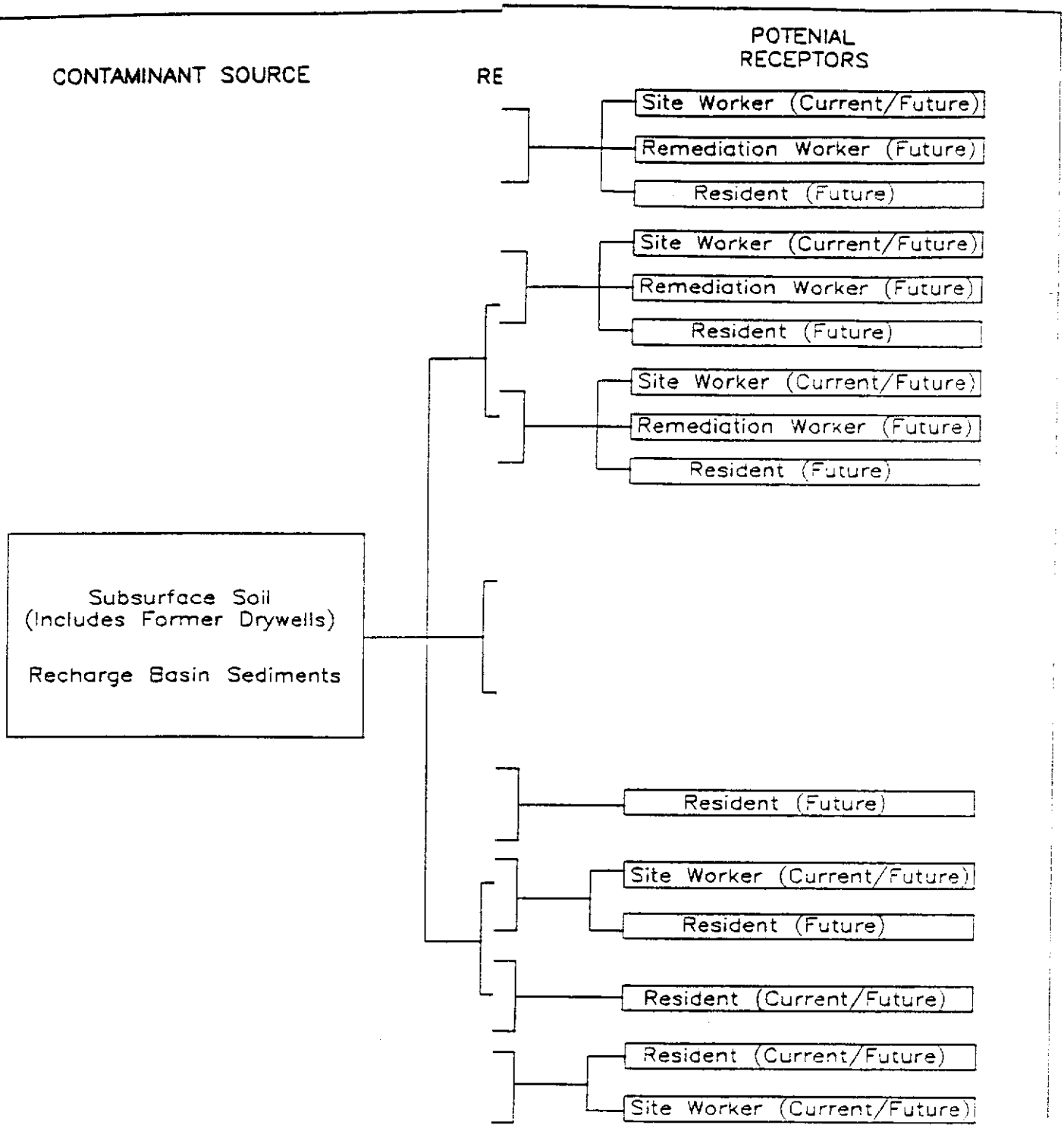


SOURCE: USGS QUADRANGLES
SEA CLIFF & LYNBROOK, NY

0 2,000
SCALE IN FEET

FIGURE 2-1
SITE LOCATION MAP

LOCKHEED MARTIN
GREAT NECK, NEW YORK


CONTAMINANT SOURCE
RE
POTENIAL RECEPTORS
Site Worker (Current/Future)
Remediation Worker (Future)
Resident (Future)
Site Worker (Current/Future)
Remediation Worker (Future)
Resident (Future)
Site Worker (Current/Future)
Remediation Worker (Future)
Resident (Future)
Subsurface Soil (Includes Former Drywells)
Recharge Basin Sediments
Resident (Future)
Site Worker (Current/Future)
Resident (Future)
Resident (Current/Future)
Resident (Current/Future)
Site Worker (Current/Future)

TABLES

Table 3-1
Preliminary Toxicity Screening
Non-Carcinogenic Effects

	SOIL DATA					GROUNDWATER DATA			
CHEMICAL	MAX SOIL CONC. (mg/kg)	RfD (mg/kg/day)	TOXICITY 1/Rfd * (1/(mg/kg))	SOIL RISK FACTOR	SOIL RISK RATIO	MAX GW CONC. (mg/l)	TOXICITY VALUE (1/(mg/l))	GW RISK FACTOR	GW RISK RATIO
Antimony	10.4	4.00E-04	2.50E+03	2.60E+04	0.255%	0.004	2.50E+03	1.00E+01	0.175%
Arsenic	24.9	3.00E-04	3.33E+03	8.30E+04	0.815%	0.002	3.33E+03	6.67E+00	0.117%
Barium	491	7.00E-02	1.43E+01	7.01E+03	0.069%	0.343	1.43E+01	4.90E+00	0.086%
Cadmium	23.9	1.00E-03	1.00E+03	2.39E+04	0.235%	0.014	2.00E+03	2.80E+01	0.491%
Chromium	670	5.00E-03	2.00E+02	1.34E+05	1.316%	0.004	2.00E+02	8.00E-01	0.014%
Cobalt	98.8	6.00E-02	1.67E+01	1.65E+03	0.016%	0.024	1.67E+01	4.00E-01	0.007%
Copper	9,570	4.00E-02	2.50E+01	2.39E+05	2.349%	0.086	7.69E-01	6.62E-02	0.001%
Lead	9,780	1.40E-03	7.14E+02	6.99E+06	68.589%	0.06	7.14E+02	3.93E+01	0.689%
Manganese	683	1.40E-01	7.14E+00	4.88E+03	0.048%	3.43	2.00E+02	6.86E+02	12.032%
Mercury	23.1	NA	3.33E+01	7.70E+02	0.008%	0.0008	3.33E+01	2.67E-02	0.000%
Nickel	679	2.00E-02	5.00E+01	3.40E+04	0.333%	0.107	5.00E+01	5.35E+00	0.094%
Selenium	9.4	5.00E-03	2.00E+02	1.88E+03	0.018%	0.004	2.00E+02	8.00E-01	0.014%
Silver	626	5.00E-03	2.00E+02	1.25E+05	1.229%	< 0.001	2.00E+02	2.00E-01	< 0.004%
Vanadium	256	7.00E-03	1.43E+02	3.66E+04	0.359%	0.016	1.43E+02	2.29E+00	0.040%
Zinc	4,350	3.00E-01	3.33E+00	1.45E+04	0.142%	0.127	3.33E+00	4.23E-01	0.007%
Aroclor 1248 (PCBs)	5	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1254 (PCBs)	7	2.00E-05	5.00E+04	3.50E+05	3.436%	NA	5.00E+04	NA	NA
Aroclor 1260 (PCBs)	2.1	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethylene	160	9.00E-03	1.11E+02	1.78E+04	0.175%	11	1.11E+02	1.22E+03	21.436%
1,1,1-Trichloroethane	65	2.00E-01	5.00E-01	3.25E+01	0.00032%	0.12	5.00E-01	6.00E-02	0.001%
Trichloroethylene	65	6.00E-03	9.09E+01	5.91E+03	0.058%	0.32	9.09E+01	2.91E+01	0.510%
Benzene	0.096	NA	NA	NA	NA	< 0.005	NA	NA	NA
Tetrachloroethylene	18,000	1.00E-02	1.00E+02	1.80E+06	17.673%	0.35	1.00E+02	3.50E+01	0.614%
Toluene	280	2.00E-01	5.00E+00	1.40E+03	0.014%	0.005	5.00E+00	2.50E-02	0.000%
Ethylbenzene	440	1.00E-01	1.00E+01	4.40E+03	0.043%	0.002	1.00E+01	2.00E-02	0.000%
Xylene	3,200	2.00E+00	5.00E-01	1.60E+03	0.016%	0.006	5.00E-01	3.00E-03	0.00005%
Freon 113	0.051	2.00E-01	5.00E+00	2.55E-01	0.000003%	0.077	5.00E+00	3.85E-01	0.007%
Phenol	27	6.00E-01	1.67E+00	4.50E+01	0.0004%	2.1	1.67E+00	3.50E+00	0.061%
Di-n-butyl-phthalate	210	1.00E-01	1.00E+01	2.10E+03	0.021%	0.015	1.00E+01	1.50E-01	0.003%
1,2-Dichlorobenzene	89	9.00E-02	1.11E+01	9.89E+02	0.010%	< 0.36	1.11E+01	4.00E+00	< 0.070%
1,4-Dichlorobenzene	14	9.00E-02	1.11E+01	1.56E+02	0.002%	< 0.36	1.11E+01	4.00E+00	< 0.070%
Naphthalene	28	NA	2.50E+01	7.00E+02	0.007%	< 0.36	2.50E+01	9.00E+00	0.158%
Dibenzofuran	100	NA	NA	NA	NA	< 0.36	NA	NA	NA

Table 3-1 (Cont'd)
Preliminary Toxicity Screening
Non-Carcinogenic Effects

	SOIL DATA					GROUNDWATER DATA				
CHEMICAL	MAX SOIL CONC. (mg/kg)	RfD (mg/kg/day)	TOXICITY 1/Rfd * (1/(mg/kg))	SOIL RISK FACTOR	SOIL RISK RATIO	MAX GW CONC. (mg/l)		TOXICITY VALUE (1/(mg/l))	GW RISK FACTOR	GW RISK RATIO
Carbazole	7.8	NA	NA	NA	NA	<	0.36	NA	NA	NA
Fluoranthene	60	4.00E-02	2.50E+01	1.50E+03	0.015%	<	0.36	2.50E+01	9.00E+00	< 0.158%
Chrysene	31	NA	NA	NA	NA	<	0.36	NA	NA	NA
Benzo(a)anthracene	31	NA	NA	NA	NA	<	0.36	NA	NA	NA
Benzo(b)fluoranthene	31	NA	NA	NA	NA	<	0.36	NA	NA	NA
Benzo(k)fluoranthene	33	NA	NA	NA	NA	<	0.36	NA	NA	NA
Benzo(a)pyrene	28	1.00E-04	1.00E+04	2.80E+05	2.749%	<	0.36	1.00E+04	3.60E+03	< 63.140%
Indeno(1,2,3-cd)pyrene	16	NA	NA	NA	NA	<	0.36	NA	NA	NA
Dibenzo(a,h)anthracene	0.25	NA	NA	NA	NA	<	0.36	NA	NA	NA
TOTALS:				1.02E+07	100.000%				5.70E+03	100.000%

Notes:

* Soil Toxicity Value = 1/RfD = 1/ (mg/kg/day), as published in IRIS (1/96) except as noted.

**Groundwater Toxicity Value = 1/RfD = 1/ (mg/l) assumming solvent used in the IRIS study was water (i.e., 1 mg/l is approx. equal to 1 mg/kg)

NA = Not Available for quantitative risk assessment.

1. RfD values for copper, cobalt, mercury, carbazole, napthalene obtained from USEPA ECAO, Data not available in IRIS.
2. Vanadium RfD values taken from HEAST Table 1, Data not available in IRIS.
3. Lead RfD values taken from 1986 Superfund Public Health Evaluation Manual, EPA (Data used for initial screening only !!).
4. 1,1,1-trichloroethane RfD values taken from HEAST Table 1, Data not available in IRIS.

Table 3-2
Preliminary Toxicity Screening
Carcinogenic Effects

CHEMICAL	SOIL DATA				GROUNDWATER DATA			
	MAX SOIL CONC. (mg/kg)	TOXICITY VALUE * (1/(mg/kg))	SOIL RISK FACTOR	SOIL RISK RATIO	MAX GW CONC. (mg/l)	TOXICITY VALUE** (1/(mg/l))	GW RISK FACTOR	GW RISK RATIO
Antimony	10.4	NA	NA	NA	0.004	NA	NA	NA
Arsenic	24.9	1.50E+00	3.74E+01	3.031%	0.002	5.00E-08	1.00E-10	0.131%
Barium	491	NA	NA	NA	0.343	NA	NA	NA
Cadmium	23.9	NA	NA	NA	0.014	NA	NA	NA
Chromium	670	NA	NA	NA	0.004	NA	NA	NA
Cobalt	98.8	NA	NA	NA	0.024	NA	NA	NA
Copper	9,570	NA	NA	NA	0.086	NA	NA	NA
Lead	9,780	NA	NA	NA	0.06	NA	NA	NA
Manganese	683	NA	NA	NA	3.43	NA	NA	NA
Mercury	23.1	NA	NA	NA	0.008	NA	NA	NA
Nickel	679	NA	NA	NA	0.107	NA	NA	NA
Selenium	9.4	NA	NA	NA	0.004	NA	NA	NA
Silver	626	NA	NA	NA	< 0.001	NA	NA	NA
Vanadium	256	NA	NA	NA	0.016	NA	NA	NA
Zinc	4,350	NA	NA	NA	0.127	NA	NA	NA
Aroclor 1248 (PCBs)	5	NA	NA	NA	NA	NA	NA	NA
Aroclor 1254 (PCBs)	7	7.70E+00	5.39E+01	4.373%	NA	7.70E+00	NA	NA
Aroclor 1260 (PCBs)	2.1	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethylene	160	NA	NA	NA	11	NA	NA	NA
1,1,1-Trichloroethane	65	NA	NA	NA	0.12	NA	NA	NA
Trichloroethylene	65	1.10E-02	7.15E-01	0.058%	0.32	3.20E-10	1.02E-10	0.134%
Benzene	0.096	2.90E-02	2.78E-03	0.00023%	< 0.005	8.30E-10	4.15E-12	< 0.005%
Tetrachloroethylene	18,000	5.20E-02	9.36E+02	75.946%	0.35	1.60E-09	5.60E-10	< 0.732%
Toluene	280	NA	NA	NA	0.005	NA	NA	NA
Ethylbenzene	440	NA	NA	NA	0.002	NA	NA	NA
Xylene	3,200	NA	NA	NA	0.006	NA	NA	NA
Freon 113	0.051	NA	NA	NA	0.077	NA	NA	NA
Phenol	27	NA	NA	NA	2.1	NA	NA	NA
Di-n-butyl-phthalate	210	NA	NA	NA	0.015	NA	NA	NA
1,2-Dichlorobenzene	89	NA	NA	NA	< 0.36	NA	NA	NA
1,4-Dichlorobenzene	14	NA	NA	NA	< 0.36	NA	NA	NA
Naphthalene	28	NA	NA	NA	< 0.36	NA	NA	NA
Dibenzofuran	100	NA	NA	NA	< 0.36	NA	NA	NA

Table 3-2 (Cont'd.)
Preliminary Toxicity Screening
Carcinogenic Effects

	SOIL DATA				GROUNDWATER DATA			
CHEMICAL	MAX SOIL CONC. (mg/kg)	TOXICITY VALUE * (1/(mg/kg))	SOIL RISK FACTOR	SOIL RISK RATIO	MAX GW CONC. (mg/l)	TOXICITY VALUE** (1/(mg/l))	GW RISK FACTOR	GW RISK RATIO
Carbazole	7.8	1.10E-02	8.58E-02	0.007%	0.32	3.20E-10	1.02E-10	0.134%
Fluoranthene	60	NA	NA	NA	< 0.36	NA	NA	NA
Chrysene	31	NA	NA	NA	< 0.36	NA	NA	NA
Benzo(a)anthracene	31	NA	NA	NA	< 0.36	NA	NA	NA
Benzo(b)fluoranthene	31	NA	NA	NA	< 0.36	NA	NA	NA
Benzo(k)fluoranthene	33	NA	NA	NA	< 0.36	NA	NA	NA
Benzo(a)pyrene	28	7.30E+00	2.04E+02	16.585%	< 0.36	2.10E-07	7.56E-08	< 98.864%
Indeno(1,2,3-cd)pyrene	16	NA	NA	NA	< 0.36	NA	NA	NA
Dibenzo(a,h)anthracene	0.25	NA	NA	NA	< 0.36	NA	NA	NA
TOTALS:			1.23E+03	100.000%			7.65E-08	100.000%

Notes:
* Soil Toxicity Value = Slope Factor = unit oral risk per mg/kg/day, as published in IRIS (10/94) unless noted.
**Groundwater Toxicity Value = unit drinking water risk per mg/l, as published in IRIS (10/94) unless noted.
NA = Not Available for quantitative risk assessment.
1. Chromium unit risks and slope factors assumed to be Hex. Chromium
2. PCB data used to represent Aroclor 1254.

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Table 4-1
Summary of Exposed Populations
Lockheed Martin
Great Neck, New York

Direction from Site	Towns	1990 Census Data	Sub-Populations of Concern
Northeast	North Hills	3453	
Southwest	Glen Oaks	10,534	One Hospital within 3km radius
South	North New Hyde Park, New Hyde Park	19,957	Three schools within 3km radius
East	Herricks	4097	
Northwest	Lake Success	2484	Two schools w/i 3km radius

Note: Data obtained from 1990 Census as re-printed in the 1995 Long Island Almanac

Table 4-2
Summary of Sources and Exposure Points
Lockheed Martin

SOURCE	RELEASE MECHANISM	MEDIA	EXPOSURE POINT	EXPOSURE ROUTE
Sub-Surface Soils	Discharge to Drywell	Soil	Surface soils after future site work and excavations	Dermal contact, ingestion and inhalation excavation generated dust
Sub-Surface Soils	Volatilization	Soil/Air	Ambient Air	Inhalation. (Uncomplete Pathway)
Sub-Surface Soils	Leaching	Soil/Groundwater	Potable water supply, local wells	Dermal contact and ingestion
Sediments	Discharge to recharge basins	Soil	Surface soils if sediments become exposed, or after future dredging	Dermal contact, ingestion and inhalation (dust)
Groundwater	Direct discharge and possible migration off-site	Groundwater	Potable water supply, local wells	Dermal contact and ingestion

Table 4-3
Chemical and Environmental Fate Parameters of
Indicator Chemicals
Lockheed Martin
Great Neck, New York

CHEMICAL	Molecular Weight (g/mol)	Solubility in Water (mg/L)	Vapor Pressure (mm Hg)	Henry's Law Constant (H) (atm m^3/mol)	Log Octanal/ Water Partition Coefficient	Organic Partition Coefficient (K_{oc}) (ml/g)
Antimony	121.75	NA	NA	NA	NA	NA
Arsenic	74.9216	NA	NA	NA	NA	NA
Cadmium	112.4	NA	NA	NA	NA	NA
Chromium	51.996	NA	NA	NA	NA	NA
Lead	207.19	NA	NA	NA	NA	NA
Manganese	54.938	NA	NA	NA	NA	NA
Nickel	58.71	NA	NA	NA	NA	NA
Silver	107.868	NA	NA	NA	NA	NA
Vanadium	50.942	NA	NA	NA	NA	NA
PCBs (Aroclor 1248)	288	0.054	0.000494	0.0035	5.64	450
PCBs (Aroclor 1254)	327	0.057	0.0000771	0.0027	6.47	273
PCBs (Aroclor 1260)	370	0.08	0.0000405	0.0071	6.91	614
1,2-Dichloroethylene	96.94	6300	185	0.00674	2.09	5.87
Trichloroethylene	131.39	1100	35.2	0.0099	2.53	6.11
Benzene	78.11	1780	60	0.00548	2.13	5.42
Tetrachloroethylene	165.83	150	10	0.0153	2.6	11.25
Fluoranthene	202.26	0.265	0.01	0.0169	5.22	101.5
Benzo(a)pyrene	252.32	0.003	5.49E-09	< 2.4E-6	5.99	381.8

Notes:
All data obtained from "Groundwater Chemicals Desk Reference", Volumes 1 and 2, John H. Montgomery, 1990/1991.

Table 4-4
Summary of Exposure Point Concentrations
Lockheed Martin
Great Neck, New York

CHEMICAL	SUBSURFACE SOILS (MG/KG) (DRYWELLS & BORINGS)		RECHARGE BASIN SEDIMENTS (MG/KG)		GROUNDWATER (MG/L)	
	95% UCL ON AVERAGE	MAXIMUM DETECTED	95% UCL ON AVERAGE	MAXIMUM DETECTED	95% UCL ON AVERAGE	MAXIMUM DETECTED
Antimony	2.82	4.00	6.56	10.40	0.001	0.004
Arsenic	7.61	24.90	12.75	21.30	0.001	0.002
Cadmium	6.70	23.90	7.31	13.10	0.002	0.014
Chromium	164.54	670	120.37	171	0.004	0.004
Copper	2,239.01	9,570	1,805.41	2,860	0.012	0.086
Lead	2,278.78	9,780	1,183.35	1,820	0.007	0.055
Manganese	307.11	683	114.50	163	0.049	0.184
Mercury	5.63	23	2.45	3.40	0.0001	0.0008
Nickel	166.99	679	70.66	119	0.013	0.107
Silver	1.82	6.70	374.59	626	< 0.001	< 0.001
Vanadium	20.30	39.30	170.21	256	0.003	0.016
PCBs (Aroclor 1254)	4.20	4.20	5.560	12.00	< 0.0001	< 0.0003
1,2-Dichloroethylene	30.10	160.00	0.002	0.002	0.886	11.000
Trichloroethylene	932.98	7,800	0.005	0.005	0.078	0.320
Benzene	0.096	0.096	< 0.007	< 0.018	< 0.017	< 0.250
Tetrachloroethylene	2315.99	18,000	0.009	0.016	0.075	0.350
Fluoranthene	1.154	3.20	25.02	60	< 0.180	< 0.360
Benzo(a)pyrene	1.000	2.20	11.02	28	< 0.180	< 0.360

Notes:
Concentration for PCBs represent sum of the concentrations for Aroclors 1248, 1254, and 1260.
Manganese concentration from MW-19GU was not included because the concentration detected in this one sample was one to three orders of magnitude higher than that detected in the other 35 groundwater samples for this site. This data point was viewed to be anomolous and therefore, not included.

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Table 4-5
Soil, Sediment and Groundwater Exposure Pathways
Summary of Input Values Used in Estimating Daily Intake Concentrations
Remedial Investigation
Lockheed Martin

A. Soil and Sediment - Incidental Ingestion; Remediation / Construction Worker (Future)

Intake	= 480 mg/day (EPA recommended factor for adults, EPA Exposure Factors Handbook, 600/8-89/043, July 1989).
Fraction Ingested	= Assume 100% from site (conservative).
Exposure Frequency	= 250 days per year exposure based on 50 weeks per year, 5 days per week.
Exposure Duration	= Assume 6 months (0.5 years) to be the maximum duration of excavation activity.
Body Weight	= Average adult, 70 kg (realistic assumption accepted by EPA 1989a)
Averaging Time:	
Subchronic	= Short term exposure = 0.5 years (assumed duration of remediation activities to excavate source areas),
Chronic	= Long term = 30 years
Lifetime	= Lifetime = 70 years

B. Soil and Sediment - Incidental Ingestion; Site Worker (Current/Future)

Intake	= 100 mg/day (EPA recommended factor for adults, EPA 1989b).
Fraction Ingested	= Assume 100% from site (conservative).
Exposure Frequency	= Assume 1 day per month (12 days per year)
Exposure Duration	= Short term assumes 2 years. Long term assumes 30 years (based on 30 years at the same job).
Body Weight	= Average adult, 70 kg (realistic assumption accepted by EPA 1989a)
Averaging Time:	
Subchronic	= Short term exposure = 2 years
Chronic	= Long term = 30 years
Lifetime	= Lifetime = 70 years

C. Soil and Sediment - Ingestion; Residential (Adult & Child) (Future)

Intake	
Adult	= 100 mg/day for age 6-29 yrs. (EPA recommended factor for adults, EPA 1989b).
Child	= 200 mg/day for child age 0-5 yrs.
Fraction Ingested	= Assume 100%
Exposure Frequency	= Assumed 270 days per year exposure based on 9 months of mild weather per year, and 30 days per month.
Exposure Duration	= Short term assumes 6 years. = Long term = 30 years (national upper-bound time (90th percentile) at one residence.
Body Weight:	
Adult	= 70 kg
Child	= 16 kg
Averaging Time:	
Subchronic	= Short term exposure assumes 6-yrs (for child age 0-5 yrs).
Chronic	= Long term exposure assumes 30 years.
Lifetime	= Assume 70 year lifetime

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Table 4-5 (Cont'd.)
Soil, Sediment and Groundwater Exposure Pathways
Summary of Input Values Used in Estimating Daily Intake Concentrations
Remedial Investigation
Lockheed Martin

D. Soil and Sediment - Dermal Contact; Remediation / Construction Worker (Future)

Skin Surface Area	= Exposure to hands (820 sq. cm. - ref. RAGS), arms (2,300 sq. cm. - ref. RAGS) and head (1,180 sq. cm. - ref. EFH)
Adherence Factor	= Assumed value for commercial potting soil (EPA 1989a)
Absorption Factor	= Assumed worst case value of 1.0 due to lack of chemical specific data.
Exposure Frequency	= 250 days per year exposure based on 50 weeks per year, 5 days per week.
Exposure Duration	= Exposure duration for remedial contractor conservatively estimated at 6 months (0.5 yea
Body Weight	= Average adult, 70 kg (realistic assumption accepted by EPA 1989a)
Averaging Time:	
Subchronic	= Short term exposure = 0.5 years (assumed duration of remediation activities to excavate source areas),
Chronic	= Long term = 30 years
Lifetime	= Lifetime = 70 years

E. Soil and Sediment - Dermal Contact; Site Worker (Current & Future)

Skin Surface Area	= Exposure to hands (820 sq. cm. - ref. RAGS), arms (2,300 sq. cm. - ref. RAGS) and head (1,180 sq. cm. - ref. EFH)
Adherence Factor	= Assumed value for commercial potting soil (EPA 1989a)
Absorption Factor	= Assumed worst case value of 1.0 due to lack of chemical specific data.
Exposure Frequency	= Assume 1 day per month (12 days per year).
Exposure Duration	= Short term assumes 2 years. Long term assumes 30 years (based on 30 years at the same job).
Body Weight	= Average adult, 70 kg (realistic assumption accepted by EPA 1989a)
Averaging Time:	
Subchronic	= Short term exposure = 2 years
Chronic	= Long term = 30 years
Lifetime	= Lifetime = 70 years

F. Soil and Sediment - Dermal Contact; Resident (Future)

Skin Surface Area	= Exposure to hands (820 sq. cm. - ref. RAGS), arms (2,300 sq. cm. - ref. RAGS) and head (1,180 sq. cm. - ref. EFH) and lower leg (5,500 sq. cm. - ref. RAGS).
Adherence Factor	= Assumed value for commercial potting soil (EPA 1989a)
Absorption Factor	= Assumed worst case value of 1.0 due to lack of chemical specific data.
Exposure Frequency	= Assumed 270 days per year exposure based on 9 months of mild weather per year, and 30 days per month.
Exposure Duration	= Short term = 2 years. Long term = 30 years (national upper-bound time (90th percentile) at one residence.
Body Weight	= Average adult, 70 kg (realistic assumption accepted by EPA 1989a)
Averaging Time:	
Subchronic	= Short term exposure = 2 years
Chronic	= Long term = 30 years
Lifetime	= Lifetime = 70 years

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Table 4-5 (Cont'd.)
Soil, Sediment and Groundwater Exposure Pathways
Summary of Input Values Used in Estimating Daily Intake Concentrations
Remedial Investigation
Lockheed Martin

G. Soil and Sediment - Inhalation of Airborne Dust; Remediation / Construction Worker (Future)

Respirable Dust Conc.	= 5 mg/m3; Assumed concentration based on PM10 fraction of the dust utilizing the OSHA standard of 5 mg/m3.
Fraction Inhaled	= Assume 100% as conservative.
Inhalation Rate	= 20 mg/m3 (ref. EPA RAGS)
Exposure Frequency	= 250 days per year exposure based on 50 weeks per year, 5 days per week.
Exposure Duration	= Exposure duration for remedial contractor conservatively estimated at 6 months (0.5 yea
Body Weight	= Average adult, 70 kg (realistic assumption accepted by EPA 1989a)
Averaging Time:	
Subchronic	= Short term exposure = 0.5 years (assumed duration of remediation activities to excavate source areas),
Chronic	= Long term = 30 years
Lifetime	= Lifetime = 70 years

H. Soil and Sediment - Inhalation of Airborne Dust; Resident (Future)

Respirable Dust Conc.	= 0.05 mg/m3; Assume respirable dust concentration in air based on 1% of the PM10 fraction of the dust utilizing the OSHA standard of 5 mg/m3. Assumes indoor air concentration is same as outdoor air concentration.
Fraction Inhaled	= Assume 100% as conservative.
Inhalation Rate	= 20 mg/m3 (ref. EPA RAGS)
Exposure Frequency	= 365 days per year exposure as conservative.
Exposure Duration	= Exposure duration based on 6 months of soil remediation (period during which exposure route is viable).
Body Weight	= Average adult, 70 kg (realistic assumption accepted by EPA 1989a)
Averaging Time:	
Subchronic	= Short term exposure = 0.5 years (assumed duration of remediation activities to excavate source areas),
Chronic	= Long term = 30 years
Lifetime	= Lifetime = 70 years

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Table 4-5 (Cont'd.)
Soil, Sediment and Groundwater Exposure Pathways
Summary of Input Values Used in Estimating Daily Intake Concentrations
Remedial Investigation
Lockheed Martin

A. Groundwater - Ingestion; Residential (On-site-Future / Off-site-Current & Future)

Intake	= 2 liters/day (EPA recommended value for adults, 90th percentile).
Exposure Frequency	= 365 days per year.
Exposure Duration	= Short term = 2 years. Long term = 30 years (national upper-bound time (90th percentile) at one residence.
Body Weight	= Average adult, 70 kg (realistic assumption accepted by EPA 1989a)
Averaging Time:	
Subchronic	= Short term exposure = 2 years
Chronic	= Long term = 30 years
Lifetime	= Lifetime = 70 years

B. Groundwater - Dermal Contact; Site Worker (Current & Future)

Skin Surface Area	= Exposure to hands (820 sq. cm. - ref. RAGS)
Permeability Const.	= 0.00084 cm/hr - Assumed equivalent to water due to lack of chemical specific information.
Exposure Time	= 1 hour/day for site worker.
Exposure Frequency	= 52 days per year (average of one day per week).
Exposure Duration	= Short term assumes 2 years. Long term assumes 30 years (based on 30 years at the same job).
Body Weight	= Average adult, 70 kg (realistic assumption accepted by EPA 1989a)
Averaging Time:	
Subchronic	= Short term exposure = 2 years
Chronic	= Long term = 30 years
Lifetime	= Lifetime = 70 years

C. Groundwater - Dermal Contact - Resident (During Showering) (On-site-Future / Off-site-Current & Future)

Skin Surface Area	= 19,400 sq. cm. (Body surface area, adult).
Permeability Const.	= 0.00084 cm/hr - Assumed equivalent to water due to lack of chemical specific information.
Exposure Time	= 0.5 hrs/day for showering.
Exposure Frequency	= 365 days per year (assumes 1 shower per day).
Exposure Duration	= Short term assumes 2 years. Long term assumes 25 years (based on 30 year at the same job).
Body Weight	= Average adult, 70 kg (realistic assumption accepted by EPA 1989a)
Averaging Time:	
Subchronic	= Short term exposure = 2 years
Chronic	= Long term = 30 years
Lifetime	= Lifetime = 70 years

TABLE 4-6
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL CHEMICAL INTAKES
REMEDIATION/CONSTRUCTION WORKER - INGESTION

CHEMICAL	CHEMICAL CONC. (MG/KG) [1]	INGESTION RATE (MG SOIL/DAY) [2]	FRACTION OF SOIL INGESTED [3]	EXPOSURE FREQ. (DAY/YR) [4]	EXPOSURE DURATION (YRS) [5]	BODY WT. (KG) [6]	SUBCHRONIC AVERAGING TIME (DAYS) [7]	CHRONIC AVERAGING TIME (DAYS) [7]	LIFETIME AVERAGING TIME (DAYS) [7]	REMEDIATION WORKER		
										SUBCHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	2.82	480	1	250	0.5	70	182.5	10,950	25,550	1.32E-05	2.21E-07	9.46E-08
Arsenic	7.61	480	1	250	0.5	70	182.5	10,950	25,550	3.57E-05	5.96E-07	2.55E-07
Cadmium	6.7	480	1	250	0.5	70	182.5	10,950	25,550	3.15E-05	5.24E-07	2.25E-07
Chromium	164.54	480	1	250	0.5	70	182.5	10,950	25,550	7.73E-04	1.29E-05	5.52E-06
Copper	2,239.01	480	1	250	0.5	70	182.5	10,950	25,550	1.05E-02	1.75E-04	7.51E-05
Lead	2,278.78	480	1	250	0.5	70	182.5	10,950	25,550	1.07E-02	1.78E-04	7.64E-05
Manganese	307.11	480	1	250	0.5	70	182.5	10,950	25,550	1.44E-03	2.40E-05	1.03E-05
Mercury	5.63	480	1	250	0.5	70	182.5	10,950	25,550	2.64E-05	4.41E-07	1.89E-07
Nickel	166.99	480	1	250	0.5	70	182.5	10,950	25,550	7.84E-04	1.31E-05	5.60E-06
Silver	1.82	480	1	250	0.5	70	182.5	10,950	25,550	8.55E-06	1.42E-07	6.11E-08
Vanadium	20.3	480	1	250	0.5	70	182.5	10,950	25,550	9.53E-05	1.59E-06	6.81E-07
PCBs (Aroclor 1254)	4.2	480	1	250	0.5	70	182.5	10,950	25,550	1.97E-05	3.29E-07	1.41E-07
1,2-Dichloroethylene	30.1	480	1	250	0.5	70	182.5	10,950	25,550	1.41E-04	2.36E-06	1.01E-06
Trichloroethylene	932.98	480	1	250	0.5	70	182.5	10,950	25,550	4.38E-03	7.30E-05	3.13E-05
Benzene	0.096	480	1	250	0.5	70	182.5	10,950	25,550	4.51E-07	7.51E-09	3.22E-09
Tetrachloroethylene	2,315.99	480	1	250	0.5	70	182.5	10,950	25,550	1.09E-02	1.81E-04	7.77E-05
Fluoranthene	1.154	480	1	250	0.5	70	182.5	10,950	25,550	5.42E-06	9.03E-08	3.87E-08
Benzo(a)pyrene	1	480	1	250	0.5	70	182.5	10,950	25,550	4.70E-06	7.83E-08	3.35E-08

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.
[2] 100 mg/day (EPA recommended factor for adults, EPA 1989b).
[3] Assumed 100% ingested.
[4] Assumed 250 days per year exposure based on 50 weeks per year, 5 days per week.
[5] Exposure duration based on 26 weeks per year or a half year.
[6] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[7] Subchronic exposure (short term) based on .5 years, chronic exposure (long term) based on 30 years, carcinogenic exposure (lifetime) based on 70 years.

TABLE 4-7
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL CHEMICAL INTAKES
SITE WORKER - INGESTION

CHEMICAL	CHEMICAL CONC. (MG/KG) [1]	INGESTION RATE (MG SOIL/DAY) [2]	FRACTION OF SOIL INGESTED [3]	EXPOSURE FREQ. (DAY/YR) [4]	EXPOSURE DURATIONS		BODY WT. (KG) [6]	SUBCHRONIC AVERAGING TIME (DAYS) [7]	CHRONIC AVERAGING TIME (DAYS) [7]	LIFETIME AVERAGING TIME (DAYS) [7]	SITE WORKER		
					SUB-CHRONIC (YRS) [5]	CHRONIC / LIFETIME (YRS) [5]					SUBCHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	2.82	100	1	12	2	30	70	730	10,950	25,550	1.32E-07	1.32E-07	5.68E-08
Arsenic	7.61	100	1	12	2	30	70	730	10,950	25,550	3.57E-07	3.57E-07	1.53E-07
Cadmium	6.7	100	1	12	2	30	70	730	10,950	25,550	3.15E-07	3.15E-07	1.35E-07
Chromium	164.54	100	1	12	2	30	70	730	10,950	25,550	7.73E-06	7.73E-06	3.31E-06
Copper	2,239.01	100	1	12	2	30	70	730	10,950	25,550	1.05E-04	1.05E-04	4.51E-05
Lead	2,278.78	100	1	12	2	30	70	730	10,950	25,550	1.07E-04	1.07E-04	4.59E-05
Manganese	307.11	100	1	12	2	30	70	730	10,950	25,550	1.44E-05	1.44E-05	6.18E-06
Mercury	5.63	100	1	12	2	30	70	730	10,950	25,550	2.64E-07	2.64E-07	1.13E-07
Nickel	166.99	100	1	12	2	30	70	730	10,950	25,550	7.84E-06	7.84E-06	3.36E-06
Silver	1.82	100	1	12	2	30	70	730	10,950	25,550	8.55E-08	8.55E-08	3.66E-08
Vanadium	20.3	100	1	12	2	30	70	730	10,950	25,550	9.53E-07	9.53E-07	4.09E-07
PCBs (Aroclor 1304)	4.2	100	1	12	2	30	70	730	10,950	25,550	1.97E-07	1.97E-07	8.45E-08
1,2-Dichloroethylene	30.1	100	1	12	2	30	70	730	10,950	25,550	1.41E-06	1.41E-06	6.06E-07
Trichloroethylene	932.98	100	1	12	2	30	70	730	10,950	25,550	4.38E-05	4.38E-05	1.88E-05
Benzene	0.096	100	1	12	2	30	70	730	10,950	25,550	4.51E-09	4.51E-09	1.93E-09
Tetrachloroethylene	2,315.99	100	1	12	2	30	70	730	10,950	25,550	1.09E-04	1.09E-04	4.66E-05
Fluoranthene	1.154	100	1	12	2	30	70	730	10,950	25,550	5.42E-08	5.42E-08	2.32E-08
Benzo(a)pyrene	1	100	1	12	2	30	70	730	10,950	25,550	4.70E-08	4.70E-08	2.01E-08

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.
[2] 100 mg/day (EPA recommended factor for adults, EPA 1989b).
[3] Assumed 100% ingested.
[4] Assumed 12 days per year exposure based on 1 day per month.
[5] Exposure duration based on 2 years for subchronic (short term) exposure and 30 years for chronic (long term) exposure.
[6] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[7] Subchronic exposure (short term) based on 2 years, chronic exposure (long term) based on 30 years, carcinogenic exposure (lifetime) based on 70 years.

TABLE 4-8
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL CHEMICAL INTAKES
RESIDENT - INGESTION

CHEMICAL	CHEMICAL CONC. (MG/KG) [1]	INGESTION RATE: AGE 0-5 YEARS (MG SOIL / DAY) [2]	INGESTION RATE: AGE 6-29 YEARS (MG SOIL / DAY) [2]	FRACTION OF SOIL INGESTED [3]	EXPOSURE FREQ. (DAY/YR) [4]	EXPOSURE DURATION: AGE 0-5 YRS (YRS) [5]	EXPOSURE DURATION: AGE 6-29 YRS (YRS) [5]	BODY WEIGHT: AGE 0-5 YRS (KG) [6]	BODY WEIGHT: AGE 6-29 YRS (KG) [6]	SUBCHRONIC: AGE 0-5 YEARS AVERAGING TIME (DAYS) [7]	CHRONIC: AGE 6-29 YEARS AVERAGING TIME (DAYS) [7]	LIFETIME: AGE 0-5 & 6-29 YEARS AVERAGING TIME (DAYS) [7]	RESIDENT: AGE 0-5 YEARS CHEMICAL INTAKE (MG/KG-DAY)	RESIDENT: AGE 6-29 YEARS CHEMICAL INTAKE (MG/KG DAY)	RESIDENT: AGE 6-70 YEARS CHEMICAL INTAKE (MG/KG DAY)	RESIDENT: SUBCHRONIC (AGE 0-5 YRS.) CHEMICAL INTAKE (MG/KG-DAY)	RESIDENT: CHRONIC (AGE 0-5 & 6-29 YEARS) CHEMICAL INTAKE (MG/KG-DAY)	RESIDENT: LIFETIME (AGE 0-5 & 6-70 YEARS) CHEMICAL INTAKE (MG/KG-DAY)
Antimony	2.82	200	100	1	270	6	24	16	70	2,190	8,760	23,360	2.61E-05	2.98E-06	1.12E-06	2.61E-05	7.60E-06	3.26E-06
Arsenic	7.61	200	100	1	270	6	24	16	70	2,190	8,760	23,360	7.04E-05	8.04E-06	3.02E-06	7.04E-05	2.05E-05	8.79E-06
Cadmium	6.7	200	100	1	270	6	24	16	70	2,190	8,760	23,360	6.20E-05	7.08E-06	2.66E-06	6.20E-05	1.81E-05	7.74E-06
Chromium	164.54	200	100	1	270	6	24	16	70	2,190	8,760	23,360	1.52E-03	1.74E-04	6.52E-05	1.52E-03	4.43E-04	1.90E-04
Copper	2,239.01	200	100	1	270	6	24	16	70	2,190	8,760	23,360	2.07E-02	2.37E-03	8.87E-04	2.07E-02	6.03E-03	2.59E-03
Lead	2,278.78	200	100	1	270	6	24	16	70	2,190	8,760	23,360	2.11E-02	2.41E-03	9.03E-04	2.11E-02	6.14E-03	2.63E-03
Manganese	307.11	200	100	1	270	6	24	16	70	2,190	8,760	23,360	2.84E-03	3.25E-04	1.22E-04	2.84E-03	8.28E-04	3.55E-04
Mercury	5.63	200	100	1	270	6	24	16	70	2,190	8,760	23,360	5.21E-05	5.95E-06	2.23E-06	5.21E-05	1.52E-05	6.50E-06
Nickel	166.99	200	100	1	270	6	24	16	70	2,190	8,760	23,360	1.54E-03	1.76E-04	6.62E-05	1.54E-03	4.50E-04	1.93E-04
Silver	1.82	200	100	1	270	6	24	16	70	2,190	8,760	23,360	1.68E-05	1.92E-06	7.21E-07	1.68E-05	4.90E-06	2.10E-06
Vanadium	20.3	200	100	1	270	6	24	16	70	2,190	8,760	23,360	1.88E-04	2.15E-05	8.04E-06	1.88E-04	5.47E-05	2.34E-05
PCBs (Aroclor 1254)	4.2	200	100	1	270	6	24	16	70	2,190	8,760	23,360	3.88E-05	4.44E-06	1.66E-06	3.88E-05	1.13E-05	4.85E-06
1,2-Dichloroethylene	30.1	200	100	1	270	6	24	16	70	2,190	8,760	23,360	2.78E-04	3.18E-05	1.19E-05	2.78E-04	8.11E-05	3.48E-05
Trichloroethylene	932.98	200	100	1	270	6	24	16	70	2,190	8,760	23,360	8.63E-03	9.86E-04	3.70E-04	8.63E-03	2.51E-03	1.08E-03
Benzene	0.096	200	100	1	270	6	24	16	70	2,190	8,760	23,360	8.88E-07	1.01E-07	3.80E-08	8.88E-07	2.59E-07	1.11E-07
Tetrachloroethylene	2,315.99	200	100	1	270	6	24	16	70	2,190	8,760	23,360	2.14E-02	2.45E-03	9.18E-04	2.14E-02	6.24E-03	2.67E-03
Fluoranthene	1.154	200	100	1	270	6	24	16	70	2,190	8,760	23,360	1.07E-05	1.22E-06	4.57E-07	1.07E-05	3.11E-06	1.33E-06
Benzo(a)pyrene	1	200	100	1	270	6	24	16	70	2,190	8,760	23,360	9.25E-06	1.06E-06	3.96E-07	9.25E-06	2.69E-06	1.15E-06

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data
[2] 100 mg/day for Adult, 200 mg/day for Child [0-5 yrs] (EPA recommended factors, EPA 1989b)
[3] Assumed 100% ingestion fraction
[4] Assumed 270 days per year exposure based on 9 months of mild weather and 30 days per month
[5] Exposure duration based on 0-5 years (6 years) and 6-29 years (24 years)
[6] Weight of an average adult and child(realistic assumption accepted by EPA 1989a)
[7] Subchronic exposure (short term) based on 6 years, chronic exposure (long term) based on 24 years, carcinogenic exposure (lifetime) based on 64 years

TABLE 4-9
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL CHEMICAL INTAKES
REMEDIATION/CONSTRUCTION WORKER - DERMAL CONTACT

H2MGROUP

Soil; Dermal Contact; Remediation/Construction Worker (Future)

CHEMICAL	CHEMICAL CONC. (MG/KG) [1]	SKIN AREA FOR CONTACT (CM^2/EVENT) [2]	SOIL TO SKIN ADHERENCE (MG/CM^2) [3]	ABSORPTION FACTOR (UNITLESS) [4]	EXPOSURE FREQ. (EVENT/YR) [5]	EXPOSURE DURATION (YRS) [6]	BODY WT. (KG) [7]	SUBCHRONIC AVERAGING TIME (DAYS) [8]	CHRONIC AVERAGING TIME (DAYS) [8]	LIFETIME AVERAGING TIME (DAYS) [8]	REMEDIATION CONTRACTOR		
											SUBCHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	2.82	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.72E-04	2.87E-06	1.23E-06
Arsenic	7.61	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	4.64E-04	7.74E-06	3.32E-06
Cadmium	6.7	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	4.09E-04	6.81E-06	2.92E-06
Chromium	164.54	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.00E-02	1.67E-04	7.17E-05
Copper	2,239.01	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.37E-01	2.28E-03	9.76E-04
Lead	2,278.78	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.39E-01	2.32E-03	9.93E-04
Manganese	307.11	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.87E-02	3.12E-04	1.34E-04
Mercury	5.63	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	3.43E-04	5.72E-06	2.45E-06
Nickel	166.99	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.02E-02	1.70E-04	7.28E-05
Silver	1.82	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.11E-04	1.85E-06	7.93E-07
Vanadium	20.3	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.24E-03	2.06E-05	8.85E-06
PCBs (Aroclor 1254)	4.2	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	2.56E-04	4.27E-06	1.83E-06
1,2-Dichloroethylene	30.1	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.84E-03	3.06E-05	1.31E-05
Trichloroethylene	932.98	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	5.69E-02	9.49E-04	4.07E-04
Benzene	0.096	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	5.86E-06	9.76E-08	4.18E-08
Tetrachloroethylene	2,315.99	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.41E-01	2.35E-03	1.01E-03
Fluoranthene	1.154	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	7.04E-05	1.17E-06	5.03E-07
Benzo(a)pyrene	1	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	6.10E-05	1.02E-06	4.36E-07

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.
[2] Assumed exposure to hands (820 sq. cm - ref. RAGS), arms (2,300 sq. cm - ref. RAGS) and head (1,180 sq. cm - ref. EFH)
[3] Assumed value for commercial potting soil (EPA 1989a)
[4] Assumed worst case value of 1.0 due to lack of chemical specific data.
[5] Assumed 250 days per year exposure for site remediation worker or site maintenance personnel (5 days/week, 50 wks/yr)
[6] Exposure duration for remedial contractor conservatively estimated at 6 months (0.5 years).
[7] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[8] Sub-chronic exposure (short-term) based on 0.5 years, Chronic exposure (long-term) based on 30 years, and Carcinogenic exposure based on 70 yrs.

TABLE 4-10
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL CHEMICAL INTAKES
SITE WORKER - DERMAL CONTACT

Soil; Dermal Contact; Site Worker (Current & Future)

CHEMICAL	CHEMICAL CONC. (MG/KG)[1]	SKIN AREA FOR CONTACT (CM2/EVENT)[2]	SOIL TO SKIN ADHERENCE (MG/CM2)[3]	ABSORPTION FACTOR (UNITLESS)[4]	EXPOSURE FREQ. (EVENT/YR)[5]	EXPOSURE DURATION		BODY WT. (KG)[7]	SUB-CHRONIC AVERAGING TIME (DAYS)[8]	CHRONIC AVERAGING TIME (DAYS)[8]	LIFETIME AVERAGING TIME (DAYS)[8]	SITE WORKER		
						SUB-CHRONIC (YRS)[5]	CHRONIC / LIFETIME (YRS)[6]					SUBCHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	2.82	4,300	1.45	1	12	2	30	70	730	10950	25,550	8.26E-06	8.26E-06	3.54E-06
Arsenic	7.61	4,300	1.45	1	12	2	30	70	730	10950	25,550	2.23E-05	2.23E-05	9.55E-06
Cadmium	6.7	4,300	1.45	1	12	2	30	70	730	10950	25,550	1.96E-05	1.96E-05	8.41E-06
Chromium	164.54	4,300	1.45	1	12	2	30	70	730	10950	25,550	4.82E-04	4.82E-04	2.07E-04
Copper	2,239.01	4,300	1.45	1	12	2	30	70	730	10950	25,550	6.56E-03	6.56E-03	2.81E-03
Lead	2,278.78	4,300	1.45	1	12	2	30	70	730	10950	25,550	6.67E-03	6.67E-03	2.86E-03
Manganese	307.11	4,300	1.45	1	12	2	30	70	730	10950	25,550	8.99E-04	8.99E-04	3.85E-04
Mercury	5.63	4,300	1.45	1	12	2	30	70	730	10950	25,550	1.65E-05	1.65E-05	7.07E-06
Nickel	166.99	4,300	1.45	1	12	2	30	70	730	10950	25,550	4.89E-04	4.89E-04	2.10E-04
Silver	1.82	4,300	1.45	1	12	2	30	70	730	10950	25,550	5.33E-06	5.33E-06	2.28E-06
Vanadium	20.3	4,300	1.45	1	12	2	30	70	730	10950	25,550	5.94E-05	5.94E-05	2.55E-05
PCBs (Aroclor 1304)	4.2	4,300	1.45	1	12	2	30	70	730	10950	25,550	1.23E-05	1.23E-05	5.27E-06
1,2-Dichloroethylene	30.1	4,300	1.45	1	12	2	30	70	730	10950	25,550	8.81E-05	8.81E-05	3.78E-05
Trichloroethylene	932.98	4,300	1.45	1	12	2	30	70	730	10950	25,550	2.73E-03	2.73E-03	1.17E-03
Benzene	0.096	4,300	1.45	1	12	2	30	70	730	10950	25,550	2.81E-07	2.81E-07	1.20E-07
Tetrachloroethylene	2,315.99	4,300	1.45	1	12	2	30	70	730	10950	25,550	6.78E-03	6.78E-03	2.91E-03
Fluoranthene	1.154	4,300	1.45	1	12	2	30	70	730	10950	25,550	3.38E-06	3.38E-06	1.45E-06
Benzo(a)pyrene	1	4,300	1.45	1	12	2	30	70	730	10950	25,550	2.93E-06	2.93E-06	1.26E-06

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.
[2] Assumed exposure to hands (820 sq. cm - ref. RAGS), arms (2,300 sq. cm - ref. RAGS), head (1,180 sq. cm - ref. EFH) and lower leg (5,500 sq.cm - ref. RAGS)
[3] Assumed value for commercial potting soil (EPA 1989a)
[4] Assumed worst case value of 1.0 due to lack of chemical specific data.
[5] Assumed 12 days per year exposure based on 1 day per month.
[6] Exposure duration based on 0.5 years for site workers.
[7] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[8] Sub-chronic exposure (short-term) based on 0.5 years, Chronic exposure (long-term) based on 30 years, and lifetime (Carcinogenic) exposure based on 70 yrs.

TABLE 4-11
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL CHEMICAL INTAKES
RESIDENT - DERMAL CONTACT

CHEMICAL	CHEMICAL CONC. (MG/KG) [1]	SKIN AREA FOR CONTACT (CM^2/EVENT) [2]	SOIL TO SKIN ADHERENCE (MG/CM^2) [3]	ABSORPTION FACTOR (UNITLESS) [4]	EXPOSURE FREQ. (EVENT/YR) [5]	EXPOSURE DURATION		BODY WT. (KG) [7]	SUB-CHRONIC AVERAGING TIME (DAYS) [8]	CHRONIC AVERAGING TIME (DAYS) [8]	LIFETIME AVERAGING TIME (DAYS) [8]	RESIDENT		
						SUB-CHRONIC (YRS) [6]	CHRONIC / IFETIME (YRS) [6]					SUBCHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	2.82	9,800	1.45	1	270	2	30	70	732	10,950	25,550	4.22E-04	4.23E-04	1.81E-04
Arsenic	7.61	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.14E-03	1.14E-03	4.90E-04
Cadmium	6.7	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.00E-03	1.01E-03	4.31E-04
Chromium	164.54	9,800	1.45	1	270	2	30	70	732	10,950	25,550	2.46E-02	2.47E-02	1.06E-02
Copper	2,239.01	9,800	1.45	1	270	2	30	70	732	10,950	25,550	3.35E-01	3.36E-01	1.44E-01
Lead	2,278.78	9,800	1.45	1	270	2	30	70	732	10,950	25,550	3.41E-01	3.42E-01	1.47E-01
Manganese	307.11	9,800	1.45	1	270	2	30	70	732	10,950	25,550	4.60E-02	4.61E-02	1.98E-02
Mercury	5.63	9,800	1.45	1	270	2	30	70	732	10,950	25,550	8.43E-04	8.45E-04	3.62E-04
Nickel	166.99	9,800	1.45	1	270	2	30	70	732	10,950	25,550	2.50E-02	2.51E-02	1.07E-02
Silver	1.82	9,800	1.45	1	270	2	30	70	732	10,950	25,550	2.73E-04	2.73E-04	1.17E-04
Vanadium	20.3	9,800	1.45	1	270	2	30	70	732	10,950	25,550	3.04E-03	3.05E-03	1.31E-03
PCBs (Aroclor 1254)	4.2	9,800	1.45	1	270	2	30	70	732	10,950	25,550	6.29E-04	6.31E-04	2.70E-04
1,2-Dichloroethylene	30.1	9,800	1.45	1	270	2	30	70	732	10,950	25,550	4.51E-03	4.52E-03	1.94E-03
Trichloroethylene	932.98	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.40E-01	1.40E-01	6.00E-02
Benzene	0.096	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.44E-05	1.44E-05	6.18E-06
Tetrachloroethylene	2,315.99	9,800	1.45	1	270	2	30	70	732	10,950	25,550	3.47E-01	3.48E-01	1.49E-01
Fluoranthene	1.154	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.73E-04	1.73E-04	7.43E-05
Benzo(a)pyrene	1	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.50E-04	1.50E-04	6.44E-05

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.
[2] Assumed exposure to hands (820 sq. cm - ref. RAGS), arms (2,300 sq. cm - ref. RAGS), head (1,180 sq. cm - ref. EFH) and lower leg (5,500 sq.cm - ref. RAGS)
[3] Assumed value for commercial potting soil (EPA 1989a)
[4] Assumed worst case value of 1.0 due to lack of chemical specific data.
[5] Assumed 270 days per year exposure based on 9 months of mild weather and 30 days per month
[6] Short-term exposure duration 2 years (subchronic), and long-term exposure duration 30 years (Chronic).
[7] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[8] Sub-chronic exposure (short-term) based on 2 years, chronic exposure (long-term) based on 30 years, and lifetime (carcinogenic) exposure based on 70 yrs.

TABLE 4-12
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL CHEMICAL INTAKES
REMEDIATION/CONSTRUCTION WORKERS - INHALATION

CHEMICAL	CHEMICAL CONC. (MG/KG) [1]	RESP. DUST CONC. IN AIR (MG/M³) [2]	FRACTION INHALED FROM SITE [3]	INHALATION RATE (M³/DAY) [4]	EXPOSURE FREQ. (EVENT/YR) [5]	EXPOSURE DURATION (YRS) [6]	BODY WT. (KG) [7]	SUB-CHRONIC AVERAGING TIME (DAYS) [8]	CHRONIC AVERAGING TIME (DAYS) [8]	LIFETIME AVERAGING TIME (DAYS) [8]	REMEDIATION & SITE WORKERS		
											SUBCHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	2.82	5	1	20	250	0.5	70	182.5	10,950	25,550	2.76E-09	4.60E-11	1.97E-11
Arsenic	7.61	5	1	20	250	0.5	70	182.5	10,950	25,550	7.45E-09	1.24E-10	5.32E-11
Cadmium	6.7	5	1	20	250	0.5	70	182.5	10,950	25,550	6.56E-09	1.09E-10	4.68E-11
Chromium	164.54	5	1	20	250	0.5	70	182.5	10,950	25,550	1.61E-07	2.68E-09	1.15E-09
Copper	2,239.01	5	1	20	250	0.5	70	182.5	10,950	25,550	2.19E-06	3.65E-08	1.56E-08
Lead	2,278.78	5	1	20	250	0.5	70	182.5	10,950	25,550	2.23E-06	3.72E-08	1.59E-08
Manganese	307.11	5	1	20	250	0.5	70	182.5	10,950	25,550	3.00E-07	5.01E-09	2.15E-09
Mercury	5.63	5	1	20	250	0.5	70	182.5	10,950	25,550	5.51E-09	9.18E-11	3.93E-11
Nickel	166.99	5	1	20	250	0.5	70	182.5	10,950	25,550	1.63E-07	2.72E-09	1.17E-09
Silver	1.82	5	1	20	250	0.5	70	182.5	10,950	25,550	1.78E-09	2.97E-11	1.27E-11
Vanadium	20.3	5	1	20	250	0.5	70	182.5	10,950	25,550	1.99E-08	3.31E-10	1.42E-10
PCBs (Aroclor 1254)	4.2	5	1	20	250	0.5	70	182.5	10,950	25,550	4.11E-09	6.85E-11	2.94E-11
1,2-Dichloroethylene	30.1	5	1	20	250	0.5	70	182.5	10,950	25,550	2.95E-08	4.91E-10	2.10E-10
Trichloroethylene	932.98	5	1	20	250	0.5	70	182.5	10,950	25,550	9.13E-07	1.52E-08	6.52E-09
Benzene	0.096	5	1	20	250	0.5	70	182.5	10,950	25,550	9.39E-11	1.57E-12	6.71E-13
Tetrachloroethylene	2,315.99	5	1	20	250	0.5	70	182.5	10,950	25,550	2.27E-06	3.78E-08	1.62E-08
Fluoranthene	1.154	5	1	20	250	0.5	70	182.5	10,950	25,550	1.13E-09	1.88E-11	8.07E-12
Benzo(a)pyrene	1	5	1	20	250	0.5	70	182.5	10,950	25,550	9.78E-10	1.63E-11	6.99E-12

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.
[2] Respirable dust concentration in air based on PM_{10} fraction of the dust utilizing the OSHA standard.
[3] Assumed 100% as conservative.
[4] Inhalation rate of an average adult - 20 ug/m3 (RAGS).
[5] Assumed 250 days per year exposure for site workers (5 days/week, 50 weeks/year)
[6] Exposure duration based on 6 months of soil remediation (period during which exposure route is viable).
[7] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[8] Sub-chronic exposure (short-term) based on 0.5 years, chronic exposure (long-term) based on 30 years, and lifetime (carcinogenic) exposure based on 70 yrs

TABLE 4-13
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL CHEMICAL INTAKES
RESIDENT - INHALATION

CHEMICAL	CHEMICAL CONC. (MG/KG) [1]	RESP. DUST CONC. IN AIR (MG/M³) [2]	FRACTION INHALED FROM SITE [3]	INHALATION RATE (M³/DAY) [4]	EXPOSURE FREQ. (EVENT/YR) [5]	EXPOSURE DURATION (YRS) [6]	BODY WEIGHT (KG) [7]	SUBCHRONIC AVERAGING TIME (DAYS) [8]	CHRONIC AVERAGING TIME (DAYS) [8]	LIFETIME AVERAGING TIME (DAYS) [8]	RESIDENT		
											SUBCHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	2.82	0.05	1	20	365	0.5	70	182.5	10,950	25,550	4.03E-11	6.71E-13	2.88E-13
Arsenic	7.61	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.09E-10	1.81E-12	7.77E-13
Cadmium	6.7	0.05	1	20	365	0.5	70	182.5	10,950	25,550	9.57E-11	1.60E-12	6.84E-13
Chromium	164.54	0.05	1	20	365	0.5	70	182.5	10,950	25,550	2.35E-09	3.92E-11	1.68E-11
Copper	2,239.01	0.05	1	20	365	0.5	70	182.5	10,950	25,550	3.20E-08	5.33E-10	2.28E-10
Lead	2,278.78	0.05	1	20	365	0.5	70	182.5	10,950	25,550	3.26E-08	5.43E-10	2.33E-10
Manganese	307.11	0.05	1	20	365	0.5	70	182.5	10,950	25,550	4.39E-09	7.31E-11	3.13E-11
Mercury	5.63	0.05	1	20	365	0.5	70	182.5	10,950	25,550	8.04E-11	1.34E-12	5.74E-13
Nickel	166.99	0.05	1	20	365	0.5	70	182.5	10,950	25,550	2.39E-09	3.98E-11	1.70E-11
Silver	1.82	0.05	1	20	365	0.5	70	182.5	10,950	25,550	2.60E-11	4.33E-13	1.86E-13
Vanadium	20.3	0.05	1	20	365	0.5	70	182.5	10,950	25,550	2.90E-10	4.83E-12	2.07E-12
PCBs (Aroclor 1254)	4.2	0.05	1	20	365	0.5	70	182.5	10,950	25,550	6.00E-11	1.00E-12	4.29E-13
1,2-Dichloroethylene	30.1	0.05	1	20	365	0.5	70	182.5	10,950	25,550	4.30E-10	7.17E-12	3.07E-12
Trichloroethylene	932.98	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.33E-08	2.22E-10	9.52E-11
Benzene	0.096	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.37E-12	2.29E-14	9.80E-15
Tetrachloroethylene	2,315.99	0.05	1	20	365	0.5	70	182.5	10,950	25,550	3.31E-08	5.51E-10	2.36E-10
Fluoranthene	1.154	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.65E-11	2.75E-13	1.18E-13
Benzo(a)pyrene	1	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.43E-11	2.38E-13	1.02E-13

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.
[2] Respirable dust concentration in air based on 1% of the PM_{10} fraction of the dust utilizing the OSHA standard.
[3] Assumed 100% as conservative.
[4] Inhalation rate of an average adult - 20 ug/m3 (RAGS).
[5] Assumed 365 days per year exposure as conservative.
[6] Exposure duration based on 6 months of soil remediation (period during which exposure route is viable).
[7] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[8] Sub-chronic exposure (short-term) based on 0.5 years, chronic exposure (long-term) based on 30 years, and lifetime (carcinogenic) exposure based on 70 yrs.

TABLE 4-14
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SOIL CHEMICAL INTAKES
REMEDIATION / CONSTRUCTION WORKER - INGESTION

Sediment; Incidental Ingestion; Remediation Worker (Future)

CHEMICAL	CHEMICAL CONC. (MG/KG) [1]	ING. RATE (MG SOIL/ DAY) [2]	FRACTION OF SOIL INGESTED [3]	EXPOSURE FREQ. (DAY/YR) [4]	EXPOSURE DURATION [5]	BODY WEIGHT (KG) [6]	SUB CHRONIC AVERAGING TIME (DAYS) [7]	CHRONIC AVERAGING TIME (DAYS) [7]	LIFETIME AVERAGING TIME (DAYS) [7]	REMEDIATION WORKER		
										SUBCHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	6.56	480	1	250	0.5	70	182.5	10,950	25,550	3.08E-05	5.14E-07	2.20E-07
Arsenic	12.75	480	1	250	0.5	70	182.5	10,950	25,550	5.99E-05	9.98E-07	4.28E-07
Cadmium	7.31	480	1	250	0.5	70	182.5	10,950	25,550	3.43E-05	5.72E-07	2.45E-07
Chromium	120.37	480	1	250	0.5	70	182.5	10,950	25,550	5.65E-04	9.42E-06	4.04E-06
Copper	1,805.41	480	1	250	0.5	70	182.5	10,950	25,550	8.48E-03	1.41E-04	6.06E-05
Lead	1,183.35	480	1	250	0.5	70	182.5	10,950	25,550	5.56E-03	9.26E-05	3.97E-05
Manganese	114.50	480	1	250	0.5	70	182.5	10,950	25,550	5.38E-04	8.96E-06	3.84E-06
Mercury	2.42	480	1	250	0.5	70	182.5	10,950	25,550	1.14E-05	1.89E-07	8.12E-08
Nickel	70.66	480	1	250	0.5	70	182.5	10,950	25,550	3.32E-04	5.53E-06	2.37E-06
Silver	374.59	480	1	250	0.5	70	182.5	10,950	25,550	1.76E-03	2.93E-05	1.26E-05
Vanadium	170.21	480	1	250	0.5	70	182.5	10,950	25,550	7.99E-04	1.33E-05	5.71E-06
PCBs (Aroclor 1254)	5.56	480	1	250	0.5	70	182.5	10,950	25,550	2.61E-05	4.35E-07	1.87E-07
1,2-Dichloroethylene	0.002	480	1	250	0.5	70	182.5	10,950	25,550	9.39E-09	1.57E-10	6.71E-11
Trichloroethylene	0.005	480	1	250	0.5	70	182.5	10,950	25,550	2.35E-08	3.91E-10	1.68E-10
Benzene	0.007	480	1	250	0.5	70	182.5	10,950	25,550	3.29E-08	5.48E-10	2.35E-10
Tetrachloroethylene	0.009	480	1	250	0.5	70	182.5	10,950	25,550	4.23E-08	7.05E-10	3.02E-10
Fluoranthene	25.023	480	1	250	0.5	70	182.5	10,950	25,550	1.18E-04	1.96E-06	8.39E-07
Benzo(a)pyrene	11.02	480	1	250	0.5	70	182.5	10,950	25,550	5.18E-05	8.63E-07	3.70E-07

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.

[2] 100 mg/day (EPA recommended factor for adults, EPA 1989b)

[3] Assumed 100% ingestion fraction.

[4] Assumed 250 days per year exposure based on 50 weeks per year, 5 days per week.

[5] Exposure duration based on 26 weeks per year or a half year.

[6] Weight of an average adult (realistic assumption accepted by EPA 1989a)

[7] Subchronic exposure (short term) based on 0.5 years, chronic exposure (long term) based on 30 years, carcinogenic exposure (lifetime) based on 70 years.

TABLE 4-15
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SOIL CHEMICAL INTAKES
SITE WORKER - INGESTION

Sediment; Incidental Ingestion; Site Worker (Current/Future)

CHEMICAL	CHEMICAL CONC. (MG/KG) [1]	ING. RATE (MG SOIL/ DAY) [2]	FRACTION OF SOIL INGESTED [3]	EXPOSURE FREQ. (DAY/YR) [4]	EXPOSURE FREQUENCY		BODY WT (KG) [6]	SUB-CHRONIC AVERAGING TIME (DAYS) [7]	CHRONIC AVERAGING TIME (DAYS) [7]	LIFETIME AVERAGING TIME (DAYS) [7]	SITE WORKER		
					SUB-CHRONIC (YRS) [5]	CHRONIC/ LIFETIME (YRS) [5]					SUBCHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	6.56	100	1	12	2	30	70	730	10,950	25,550	3.08E-07	3.08E-07	1.32E-07
Arsenic	12.75	100	1	12	2	30	70	730	10,950	25,550	5.99E-07	5.99E-07	2.57E-07
Cadmium	7.31	100	1	12	2	30	70	730	10,950	25,550	3.43E-07	3.43E-07	1.47E-07
Chromium	120.37	100	1	12	2	30	70	730	10,950	25,550	5.65E-06	5.65E-06	2.42E-06
Copper	1,805.41	100	1	12	2	30	70	730	10,950	25,550	8.48E-05	8.48E-05	3.63E-05
Lead	1,183.35	100	1	12	2	30	70	730	10,950	25,550	5.56E-05	5.56E-05	2.38E-05
Manganese	114.50	100	1	12	2	30	70	730	10,950	25,550	5.38E-06	5.38E-06	2.30E-06
Mercury	2.42	100	1	12	2	30	70	730	10,950	25,550	1.14E-07	1.14E-07	4.87E-08
Nickel	70.66	100	1	12	2	30	70	730	10,950	25,550	3.32E-06	3.32E-06	1.42E-06
Silver	374.59	100	1	12	2	30	70	730	10,950	25,550	1.76E-05	1.76E-05	7.54E-06
Vanadium	170.21	100	1	12	2	30	70	730	10,950	25,550	7.99E-06	7.99E-06	3.43E-06
PCBs (Aroclor 1304)	5.56	100	1	12	2	30	70	730	10,950	25,550	2.61E-07	2.61E-07	1.12E-07
1,2-Dichloroethylene	0.002	100	1	12	2	30	70	730	10,950	25,550	9.39E-11	9.39E-11	4.03E-11
Trichloroethylene	0.005	100	1	12	2	30	70	730	10,950	25,550	2.35E-10	2.35E-10	1.01E-10
Benzene	0.007	100	1	12	2	30	70	730	10,950	25,550	3.29E-10	3.29E-10	1.41E-10
Tetrachloroethylene	0.009	100	1	12	2	30	70	730	10,950	25,550	4.23E-10	4.23E-10	1.81E-10
Fluoranthene	30.023	100	1	12	2	30	70	730	10,950	25,550	1.41E-06	1.41E-06	6.04E-07
Benzo(a)pyrene	11.02	100	1	12	2	30	70	730	10,950	25,550	5.18E-07	5.18E-07	2.22E-07

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.
[2] 100 mg/day (EPA recommended factor for adults, EPA 1989b)
[3] Assumed 100% ingestion fraction.
[4] Assumed 12 days per year exposure based on 1 day per month.
[5] Exposure duration based on 2 years for subchronic (short term) exposure and 30 years for chronic (long term) exposure.
[6] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[7] Subchronic exposure (short term) based on .5 years, chronic exposure (long term) based on 30 years, carcinogenic exposure (lifetime) based on 70 years

TABLE 4-16
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SOIL CHEMICAL INTAKES
RESIDENT - INGESTION

Sediment; Ingestion; Residential (Adult & Child)

CHEMICAL	CHEMICAL CONC. (MG/KG) [1]	AGE 0-5 YRS. INGESTION RATE (MG SOIL/ DAY) [2]	AGE 6-29 YRS. INGESTION RATE (MG SOIL/ DAY) [2]	FRACTION OF SOIL INGESTED [3]	EXPOSURE FREQ. (DAY/YR) [4]	EXPOSURE DURATION		BODY WEIGHT		SUB-CHRONIC (AGE 0-5 YRS)	CHRONIC (AGE 6-29 YRS)	LIFETIME (AGE 0-5 YRS. & 6-29 YRS.)	RESIDENT			RESIDENT		
						AGE 0-5 YRS (YRS) [5]	AGE 6-29 YRS (YRS) [5]	AGE 0-5 YRS (KG) [6]	AGE 6-29 YRS (KG) [6]	AVERAGING TIME (DAYS) [7]	AVERAGING TIME (DAYS) [7]	AVERAGING TIME (DAYS) [7]	AGE 0-5 YRS. CHEMICAL INTAKE (MG/KG-DAY)	AGE 6-29 YRS. CHEMICAL INTAKE (MG/KG-DAY)	AGE 6-70 YRS. CHEMICAL INTAKE (MG/KG-DAY)	SUB-CHRONIC (AGE 0-5 YRS.) CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC (AGE 0-5 & 6-29 YRS.) CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME (AGE 0-5 & 6-70 YRS.) CHEMICAL INTAKE (MG/KG-DAY)
Antimony	6.56	200	100	1	270	6	24	16	70	2190	8,760	23,360	6.07E-05	6.93E-06	2.60E-06	6.07E-05	1.77E-05	7.58E-06
Arsenic	12.75	200	100	1	270	6	24	16	70	2190	8,760	23,360	1.18E-04	1.35E-05	5.05E-06	1.18E-04	3.44E-05	1.47E-05
Cadmium	7.31	200	100	1	270	6	24	16	70	2190	8,760	23,360	6.76E-05	7.72E-06	2.90E-06	6.76E-05	1.97E-05	8.44E-06
Chromium	120.37	200	100	1	270	6	24	16	70	2190	8,760	23,360	1.11E-03	1.27E-04	4.77E-05	1.11E-03	3.24E-04	1.39E-04
Copper	1,805.41	200	100	1	270	6	24	16	70	2190	8,760	23,360	1.67E-02	1.91E-03	7.15E-04	1.67E-02	4.87E-03	2.09E-03
Lead	1,183.35	200	100	1	270	6	24	16	70	2190	8,760	23,360	1.09E-02	1.25E-03	4.69E-04	1.09E-02	3.19E-03	1.37E-03
Manganese	114.50	200	100	1	270	6	24	16	70	2190	8,760	23,360	1.06E-03	1.21E-04	4.54E-05	1.06E-03	3.09E-04	1.32E-04
Mercury	2.42	200	100	1	270	6	24	16	70	2190	8,760	23,360	2.24E-05	2.56E-06	9.59E-07	2.24E-05	6.52E-06	2.79E-06
Nickel	70.66	200	100	1	270	6	24	16	70	2190	8,760	23,360	6.53E-04	7.47E-05	2.80E-05	6.53E-04	1.90E-04	8.16E-05
Silver	374.59	200	100	1	270	6	24	16	70	2190	8,760	23,360	3.46E-03	3.96E-04	1.48E-04	3.46E-03	1.01E-03	4.33E-04
Vanadium	170.21	200	100	1	270	6	24	16	70	2190	8,760	23,360	1.57E-03	1.80E-04	6.75E-05	1.57E-03	4.59E-04	1.97E-04
PCBs (Aroclor 1254)	5.56	200	100	1	270	6	24	16	70	2190	8,760	23,360	5.14E-05	5.88E-06	2.20E-06	5.14E-05	1.50E-05	6.42E-06
1,2-Dichloroethylene	0.002	200	100	1	270	6	24	16	70	2190	8,760	23,360	1.85E-08	2.11E-09	7.93E-10	1.85E-08	5.39E-09	2.31E-09
Trichloroethylene	0.005	200	100	1	270	6	24	16	70	2190	8,760	23,360	4.62E-08	5.28E-09	1.98E-09	4.62E-08	1.35E-08	5.77E-09
Benzene	0.007	200	100	1	270	6	24	16	70	2190	8,760	23,360	6.47E-08	7.40E-09	2.77E-09	6.47E-08	1.89E-08	8.08E-09
Tetrachloroethylene	0.009	200	100	1	270	6	24	16	70	2190	8,760	23,360	8.32E-08	9.51E-09	3.57E-09	8.32E-08	2.43E-08	1.04E-08
Fluoranthene	25.023	200	100	1	270	6	24	16	70	2190	8,760	23,360	2.31E-04	2.64E-05	9.92E-06	2.31E-04	6.74E-05	2.89E-05
Benzo(a)pyrene	11.02	200	100	1	270	6	24	16	70	2190	8,760	23,360	1.02E-04	1.16E-05	4.37E-06	1.02E-04	2.97E-05	1.27E-05

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data
[2] 100 mg/day for Adult, 200 mg/day for Child [0-5 yrs] (EPA recommended factor for adults, EPA 1989b)
[3] Assumed 100% ingestion fraction because resident spends 2,800 hours (50 weeks, 8 hrs/day, 7 days/wk) of 8,760 hours in a year outside
[4] Assumed 270 days per year exposure based on 9 months of mild weather and 30 days per month
[5] Exposure duration based on 0-5 years (6 years) and 6-29 years (24 years)
[6] Weight of an average adult and child(realistic assumption accepted by EPA 1989b)
[7] Subchronic exposure (short term) based on 6 years, chronic exposure (long term) based on 24 years, carcinogenic exposure (lifetime) based on 64 years

TABLE 4-17
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SOIL CHEMICAL INTAKES
REMEDIATION /CONSTRUCTION WORKER - DERMAL CONTACT

Sediment; Dermal Contact; Remediation Worker (Future)

CHEMICAL	CHEMICAL CONC. (MG/KG) [1]	SKIN AREA FOR CONTACT (CM2/EVENT) [2]	SOIL TO SKIN ADHERENCE (MG/CM2) [3]	ABSORBTION FACTOR (UNITLESS) [4]	EXPOSURE FREQ. (EVENT/YR) [5]	EXPOSURE DURATION (YRS) [6]	BODY WT. (KG) [7]	SUB-CHRONIC AVERAGING TIME (YRS) [8]	CHRONIC AVERAGING TIME (DAYS) [8]	LIFETIME AVERAGING TIME (DAYS) [8]	REMEDIATION CONTRACTOR		
											SUB-CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	6.56	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	4.00E-04	6.67E-06	2.86E-06
Arsenic	12.75	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	7.78E-04	1.30E-05	5.56E-06
Cadmium	7.31	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	4.46E-04	7.43E-06	3.19E-06
Chromium	120.37	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	7.34E-03	1.22E-04	5.25E-05
Copper	1,805.41	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.10E-01	1.84E-03	7.87E-04
Lead	1,183.35	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	7.22E-02	1.20E-03	5.16E-04
Manganese	114.50	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	6.99E-03	1.16E-04	4.99E-05
Mercury	2.42	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.48E-04	2.46E-06	1.05E-06
Nickel	70.66	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	4.31E-03	7.18E-05	3.08E-05
Silver	374.59	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	2.29E-02	3.81E-04	1.63E-04
Vanadium	170.21	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.04E-02	1.73E-04	7.42E-05
PCBs (Aroclor 1254)	5.56	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	3.39E-04	5.65E-06	2.42E-06
1,2-Dichloroethylene	0.002	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.22E-07	2.03E-09	8.72E-10
Trichloroethylene	0.005	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	3.05E-07	5.08E-09	2.18E-09
Benzene	0.007	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	4.27E-07	7.12E-09	3.05E-09
Tetrachloroethylene	0.009	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	5.49E-07	9.15E-09	3.92E-09
Fluoranthene	25.023	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	1.53E-03	2.54E-05	1.09E-05
Benzo(a)pyrene	11.02	4,300	1.45	1	250	0.5	70	182.5	10,950	25,550	6.72E-04	1.12E-05	4.80E-06

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.
[2] Assumed exposure to hands (820 sq. cm - ref. RAGS), arms (2,300 sq. cm - ref. RAGS) and head (1,180 sq. cm - ref. EFH)
[3] Assumed value for commercial potting soil (EPA 1989a)
[4] Assumed worst case value of 1.0 due to lack of chemical specific data.
[5] Assumed 250 days per year exposure for site remediation worker or site maintenance personnel (5 days/week, 50 wks/yr)
[6] Exposure duration for remedial contractor conservatively estimated at 6 months (0.5 years).
[7] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[8] Sub-chronic exposure (short-term) based on 0.5 years, Chronic exposure (long-term) based on 30 years, and Carcinogenic exposure based on 70 yrs.

TABLE 4-18
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SOIL CHEMICAL INTAKES
SITE WORKER - DERMAL CONTACT

Sediment; Dermal Contact; Site Worker (Current & Future)

CHEMICAL	CHEMICAL CONC. (MG/KG)[1]	SKIN AREA FOR CONTACT (CM2/EVENT)[2]	SOIL TO SKIN ADHERENCE (MG/CM2)[3]	ABSORBTION FACTOR (UNITLESS)[4]	EXPOSURE FREQ. (EVENT/YR)[5]	EXPOSURE DURATION		BODY WT. (KG)[7]	SUB-CHRONIC AVERAGING TIME (YRS)[8]	CHRONIC AVERAGING TIME (DAYS)[8]	LIFETIME AVERAGING TIME (DAYS)[8]	SITE WORKER		
						SUB-CHRONIC (YRS)[6]	CHRONIC/ LIFETIME (YRS)[6]					SUB-CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	6.56	4,300	1.45	1	12	2	30	70	730	10950	25,550	1.92E-05	1.92E-05	8.23E-06
Arsenic	12.75	4,300	1.45	1	12	2	30	70	730	10950	25,550	3.73E-05	3.73E-05	1.60E-05
Cadmium	7.31	4,300	1.45	1	12	2	30	70	730	10950	25,550	2.14E-05	2.14E-05	9.17E-06
Chromium	120.37	4,300	1.45	1	12	2	30	70	730	10950	25,550	3.52E-04	3.52E-04	1.51E-04
Copper	1,805.41	4,300	1.45	1	12	2	30	70	730	10950	25,550	5.29E-03	5.29E-03	2.27E-03
Lead	1,183.35	4,300	1.45	1	12	2	30	70	730	10950	25,550	3.47E-03	3.47E-03	1.49E-03
Manganese	114.50	4,300	1.45	1	12	2	30	70	730	10950	25,550	3.35E-04	3.35E-04	1.44E-04
Mercury	2.42	4,300	1.45	1	12	2	30	70	730	10950	25,550	7.09E-06	7.09E-06	3.04E-06
Nickel	70.66	4,300	1.45	1	12	2	30	70	730	10950	25,550	2.07E-04	2.07E-04	8.87E-05
Silver	374.59	4,300	1.45	1	12	2	30	70	730	10950	25,550	1.10E-03	1.10E-03	4.70E-04
Vanadium	170.21	4,300	1.45	1	12	2	30	70	730	10950	25,550	4.98E-04	4.98E-04	2.14E-04
PCBs (Aroclor 1304)	5.56	4,300	1.45	1	12	2	30	70	730	10950	25,550	1.63E-05	1.63E-05	6.98E-06
1,2-Dichloroethylene	0.002	4,300	1.45	1	12	2	30	70	730	10950	25,550	5.86E-09	5.86E-09	2.51E-09
Trichloroethylene	0.005	4,300	1.45	1	12	2	30	70	730	10950	25,550	1.46E-08	1.46E-08	6.28E-09
Benzene	0.007	4,300	1.45	1	12	2	30	70	730	10950	25,550	2.05E-08	2.05E-08	8.79E-09
Tetrachloroethylene	0.009	4,300	1.45	1	12	2	30	70	730	10950	25,550	2.64E-08	2.64E-08	1.13E-08
Fluoranthene	30.023	4,300	1.45	1	12	2	30	70	730	10950	25,550	8.79E-05	8.79E-05	3.77E-05
Benzo(a)pyrene	11.02	4,300	1.45	1	12	2	30	70	730	10950	25,550	3.23E-05	3.23E-05	1.38E-05

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.
[2] Assumed exposure to hands (820 sq. cm - ref. RAGS), arms (2,300 sq. cm - ref. RAGS), head (1,180 sq. cm - ref. EFH) and lower leg (5,500 sq cm - ref. RAGS)
[3] Assumed value for commercial potting soil (EPA 1989a)
[4] Assumed worst case value of 1.0 due to lack of chemical specific data.
[5] Assumed 12 days per year exposure for site worker (1 day/month).
[6] Exposure duration for remedial contractor conservatively estimated at 6 months (0.5 years).
[7] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[8] Sub-chronic exposure (short-term) based on 0.5 years, Chronic exposure (long-term) based on 30 years, and Carcinogenic exposure based on 70 yrs.

TABLE 4-19
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SOIL CHEMICAL INTAKES
RESIDENT - DERMAL CONTACT

Sediment; Dermal Contact; Residential (Future)

CHEMICAL	CHEMICAL CONC. (MG/KG)[1]	SKIN AREA FOR CONTACT (CM2/EVENT)[1]	SOIL TO SKIN ADHERENCE (MG/CM2)[2]	ABSORBTION FACTOR (UNITLESS)[3]	EXPOSURE FREQ. (EVENT/YR)[4]	EXPOSURE DURATION		BODY WT. (KG)[7]	SUB-CHRONIC AVERAGING TIME (DAYS)[8]	CHRONIC AVERAGING TIME (DAYS)[8]	LIFETIME AVERAGING TIME (DAYS)[8]	RESIDENT		
						SUB-CHRONIC (YRS)[6]	CHRONIC/ LIFETIME (YRS)[6]					SUB-CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	6.56	9,800	1.45	1	270	2	30	70	732	10,950	25,550	9.82E-04	9.85E-04	4.22E-04
Arsenic	12.75	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.91E-03	1.91E-03	8.21E-04
Cadmium	7.31	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.09E-03	1.10E-03	4.70E-04
Chromium	120.37	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.80E-02	1.81E-02	7.75E-03
Copper	1,805.41	9,800	1.45	1	270	2	30	70	732	10,950	25,550	2.70E-01	2.71E-01	1.16E-01
Lead	1,183.35	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.77E-01	1.78E-01	7.62E-02
Manganese	114.50	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.71E-02	1.72E-02	7.37E-03
Mercury	2.42	9,800	1.45	1	270	2	30	70	732	10,950	25,550	3.62E-04	3.63E-04	1.56E-04
Nickel	70.66	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.06E-02	1.06E-02	4.55E-03
Silver	374.59	9,800	1.45	1	270	2	30	70	732	10,950	25,550	5.61E-02	5.63E-02	2.41E-02
Vanadium	170.21	9,800	1.45	1	270	2	30	70	732	10,950	25,550	2.55E-02	2.56E-02	1.10E-02
PCBs (Aroclor 1254)	5.56	9,800	1.45	1	270	2	30	70	732	10,950	25,550	8.33E-04	8.35E-04	3.58E-04
1,2-Dichloroethylene	0.002	9,800	1.45	1	270	2	30	70	732	10,950	25,550	3.00E-07	3.00E-07	1.29E-07
Trichloroethylene	0.005	9,800	1.45	1	270	2	30	70	732	10,950	25,550	7.49E-07	7.51E-07	3.22E-07
Benzene	0.007	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.05E-06	1.05E-06	4.50E-07
Tetrachloroethylene	0.009	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.35E-06	1.35E-06	5.79E-07
Fluoranthene	25.023	9,800	1.45	1	270	2	30	70	732	10,950	25,550	3.75E-03	3.76E-03	1.61E-03
Benzo(a)pyrene	11.02	9,800	1.45	1	270	2	30	70	732	10,950	25,550	1.65E-03	1.65E-03	7.09E-04

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.
[2] Assumed exposure to hands (820 sq. cm - ref. RAGS), arms (2,300 sq. cm - ref. RAGS), head (1,180 sq. cm - ref. EFH) and lower leg (5,500 sq cm - ref. RAGS)
[3] Assumed value for commercial potting soil (EPA 1989a)
[4] Assumed worst case value of 1.0 due to lack of chemical specific data.
[5] Assumed 240 days per year exposure based on 8 months of mild weather and 30 days per month
[6] Short-term exposure duration 2 years (subchronic), and long-term exposure duration 30 years (Chronic).
[7] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[8] Sub-chronic exposure (short-term) based on 2 years, chronic exposure (long-term) based on 30 years, and lifetime (carcinogenic) exposure based on 70 yrs.

TABLE 4-20
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SOIL CHEMICAL INTAKES
REMEDIATION/CONSTRUCTION WORKERS - INHALATION

Sediment; Inhalation; Remediation/Construction Worker (Future)

CHEMICAL	CHEMICAL CONC. (MG/KG) [1]	RESP. DUST CONC. IN AIR (MG/M^3) [2]	FRACTION INHALED FROM SITE [3]	INHALATION RATE (M^3/DAY) [4]	EXPOSURE FREQ. (EVENT/YR) [5]	EXPOSURE DURATION (YRS) [6]	BODY WT. (KG) [7]	SUB-CHRONIC AVERAGING TIME (DAYS) [8]	CHRONIC AVERAGING TIME (DAYS) [8]	LIFETIME AVERAGING TIME (DAYS) [8]	REMEDIATION AND SITE WORKERS		
											SUB-CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	6.56	5	1	20	250	0.5	70	182.5	10,950	25,550	6.42E-09	1.07E-10	4.58E-11
Arsenic	12.75	5	1	20	250	0.5	70	182.5	10,950	25,550	1.25E-08	2.08E-10	8.91E-11
Cadmium	7.31	5	1	20	250	0.5	70	182.5	10,950	25,550	7.15E-09	1.19E-10	5.11E-11
Chromium	120.37	5	1	20	250	0.5	70	182.5	10,950	25,550	1.18E-07	1.96E-09	8.41E-10
Copper	1,805.41	5	1	20	250	0.5	70	182.5	10,950	25,550	1.77E-06	2.94E-08	1.26E-08
Lead	1,183.35	5	1	20	250	0.5	70	182.5	10,950	25,550	1.16E-06	1.93E-08	8.27E-09
Manganese	114.50	5	1	20	250	0.5	70	182.5	10,950	25,550	1.12E-07	1.87E-09	8.00E-10
Mercury	2.42	5	1	20	250	0.5	70	182.5	10,950	25,550	2.37E-09	3.95E-11	1.69E-11
Nickel	70.66	5	1	20	250	0.5	70	182.5	10,950	25,550	6.91E-08	1.15E-09	4.94E-10
Silver	374.59	5	1	20	250	0.5	70	182.5	10,950	25,550	3.67E-07	6.11E-09	2.62E-09
Vanadium	170.21	5	1	20	250	0.5	70	182.5	10,950	25,550	1.67E-07	2.78E-09	1.19E-09
PCBs (Aroclor 1254)	5.56	5	1	20	250	0.5	70	182.5	10,950	25,550	5.44E-09	9.07E-11	3.89E-11
1,2-Dichloroethylene	0.002	5	1	20	250	0.5	70	182.5	10,950	25,550	1.96E-12	3.26E-14	1.40E-14
Trichloroethylene	0.005	5	1	20	250	0.5	70	182.5	10,950	25,550	4.89E-12	8.15E-14	3.49E-14
Benzene	0.007	5	1	20	250	0.5	70	182.5	10,950	25,550	6.85E-12	1.14E-13	4.89E-14
Tetrachloroethylene	0.009	5	1	20	250	0.5	70	182.5	10,950	25,550	8.81E-12	1.47E-13	6.29E-14
Fluoranthene	25.023	5	1	20	250	0.5	70	182.5	10,950	25,550	2.45E-08	4.08E-10	1.75E-10
Benzo(a)pyrene	11.02	5	1	20	250	0.5	70	182.5	10,950	25,550	1.08E-08	1.80E-10	7.70E-11

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.
[2] Respirable dust concentration in air based on PM_{10} fraction of the dust utilizing the OSHA standard.
[3] Assumed 100% as conservative
[4] Inhalation rate of an average adult - 20 ug/m3 (RAGS).
[5] Assumed 250 days per year exposure for site workers (5 days/week, 50 weeks/year)
[6] Exposure duration based on 6 months of soil remediation (period during which exposure route is viable).
[7] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[8] Sub-chronic exposure (short-term) based on 0.5 years, chronic exposure (long-term) based on 30 years, and lifetime (carcinogenic) exposure based on 70 yrs.

TABLE 4-21
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SOIL CHEMICAL INTAKES
RESIDENTS - INHALATION

Sediment; Inhalation; Resident (Future)

CHEMICAL	CHEMICAL CONC. (MG/KG) [1]	RESPIR. DUST CONC. IN AIR (MG/M^3) [2]	FRACTION INHALED FROM SITE [3]	INHALATION RATE (M^3/DAY) [4]	EXPOSURE FREQ. (EVENT/YR) [5]	EXPOSURE DURATION (YRS) [6]	BODY WT. (KG) [7]	SUB-CHRONIC AVERAGING TIME (DAYS) [8]	CHRONIC AVERAGING TIME (DAYS) [8]	LIFETIME AVERAGING TIME (DAYS) [8]	RESIDENT		
											SUB-CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	6.56	0.05	1	20	365	0.5	70	182.5	10,950	25,550	9.37E-11	1.56E-12	6.69E-13
Arsenic	12.75	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.82E-10	3.04E-12	1.30E-12
Cadmium	7.31	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.04E-10	1.74E-12	7.46E-13
Chromium	120.37	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.72E-09	2.87E-11	1.23E-11
Copper	1,805.41	0.05	1	20	365	0.5	70	182.5	10,950	25,550	2.58E-08	4.30E-10	1.84E-10
Lead	1,183.35	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.69E-08	2.82E-10	1.21E-10
Manganese	114.50	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.64E-09	2.73E-11	1.17E-11
Mercury	2.42	0.05	1	20	365	0.5	70	182.5	10,950	25,550	3.46E-11	5.76E-13	2.47E-13
Nickel	70.66	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.01E-09	1.68E-11	7.21E-12
Silver	374.59	0.05	1	20	365	0.5	70	182.5	10,950	25,550	5.35E-09	8.92E-11	3.82E-11
Vanadium	170.21	0.05	1	20	365	0.5	70	182.5	10,950	25,550	2.43E-09	4.05E-11	1.74E-11
PCBs (Aroclor 1254)	5.56	0.05	1	20	365	0.5	70	182.5	10,950	25,550	7.94E-11	1.32E-12	5.67E-13
1,2-Dichloroethylene	0.002	0.05	1	20	365	0.5	70	182.5	10,950	25,550	2.86E-14	4.76E-16	2.04E-16
Trichloroethylene	0.005	0.05	1	20	365	0.5	70	182.5	10,950	25,550	7.14E-14	1.19E-15	5.10E-16
Benzene	0.007	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.00E-13	1.67E-15	7.14E-16
Tetrachloroethylene	0.009	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.29E-13	2.14E-15	9.18E-16
Fluoranthene	25.023	0.05	1	20	365	0.5	70	182.5	10,950	25,550	3.57E-10	5.96E-12	2.55E-12
Benzo(a)pyrene	11.02	0.05	1	20	365	0.5	70	182.5	10,950	25,550	1.57E-10	2.62E-12	1.12E-12

NOTES:

[1] 95% ucl on arithmetic mean used, based on RI data.
[2] Respirable dust concentration in air based on 1% of the PM_{10} fraction of the dust utilizing the OSHA standard.
[3] Assumed 100% as conservative
[4] Inhalation rate of an average adult - 20 ug/m3 (RAGS).
[5] Assumed 365 days per year exposure as conservative.
[6] Exposure duration based on 6 months of soil remediation (period during which exposure route is viable).
[7] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[8] Sub-chronic exposure (short-term) based on 0.5 years, chronic exposure (long-term) based on 30 years, and lifetime (carcinogenic) exposure based on 70 yrs.

TABLE 4-22
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
GROUNDWATER CHEMICAL INTAKES
RESIDENT - INGESTION

Groundwater; Ingestion; Residents - (Current - Offsite / Future - Onsite & Off-site)

CHEMICAL	CHEMICAL CONC. (MG/L) [1]	INGEST. RATE (L/DAY) [2]	EXPOSURE FREQ. (DAY/YR) [3]	EXPOSURE DURATION		BODY WT. (KG) [5]	SUB-CHRONIC AVERAGING TIME (DAYS) [6]	CHRONIC AVERAGING TIME (DAYS) [6]	LIFETIME AVERAGING TIME (DAYS) [6]	RESIDENT		
				SUB-CHRONIC (YRS) [4]	CHRONIC/ LIFETIME (YRS) [4]					SUB-CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	0.004	1	365	2	30	70	730	10,950	25,550	5.71E-05	5.71E-05	2.45E-05
Arsenic	0.002	1	365	2	30	70	730	10,950	25,550	2.86E-05	2.86E-05	1.22E-05
Cadmium	0.014	1	365	2	30	70	730	10,950	25,550	2.00E-04	2.00E-04	8.57E-05
Chromium	0.004	1	365	2	30	70	730	10,950	25,550	5.71E-05	5.71E-05	2.45E-05
Copper	0.086	1	365	2	30	70	730	10,950	25,550	1.23E-03	1.23E-03	5.27E-04
Lead	0.055	1	365	2	30	70	730	10,950	25,550	7.86E-04	7.86E-04	3.37E-04
Manganese	0.184	1	365	2	30	70	730	10,950	25,550	2.63E-03	2.63E-03	1.13E-03
Mercury	0.0008	1	365	2	30	70	730	10,950	25,550	1.14E-05	1.14E-05	4.90E-06
Nickel	0.107	1	365	2	30	70	730	10,950	25,550	1.53E-03	1.53E-03	6.55E-04
Silver	0.001	1	365	2	30	70	730	10,950	25,550	1.43E-05	1.43E-05	6.12E-06
Vanadium	0.016	1	365	2	30	70	730	10,950	25,550	2.29E-04	2.29E-04	9.80E-05
PCBs (Aroclor 1254)	0.0003	1	365	2	30	70	730	10,950	25,550	4.29E-06	4.29E-06	1.84E-06
1,2-Dichloroethylene	11	1	365	2	30	70	730	10,950	25,550	1.57E-01	1.57E-01	6.73E-02
Trichloroethylene	0.32	1	365	2	30	70	730	10,950	25,550	4.57E-03	4.57E-03	1.96E-03
Benzene	0.25	1	365	2	30	70	730	10,950	25,550	3.57E-03	3.57E-03	1.53E-03
Tetrachloroethylene	0.35	1	365	2	30	70	730	10,950	25,550	5.00E-03	5.00E-03	2.14E-03
Fluoranthene	0.36	1	365	2	30	70	730	10,950	25,550	5.14E-03	5.14E-03	2.20E-03
Benzo(a)pyrene	0.36	1	365	2	30	70	730	10,950	25,550	5.14E-03	5.14E-03	2.20E-03

NOTES:

[1] Maximum detected groundwater concentration from RI used.

[2] 1 liter per day (EPA recommended value for adults, 90th percentile, EPA 1989b)

[3] Assumed 365 days per year exposure as worst case conservative assumption.

[4] Sub-chronic exposure duration based on 2 years, Chronic and Lifetime exposure durations are based on 30 years (national upper-bound time (90th percentile) at one residence, ref. EPA RAGs, 1989).

[5] Weight of an average adult (realistic assumption accepted by EPA 1989a)

[6] Sub-chronic exposure based on 2 years, Chronic exposure is based on 30 years, and Lifetime (Carcinogenic) exposure based on 70 yrs (90th percentile for one year at a residence)

TABLE 4-23
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
GROUNDWATER CHEMICAL INTAKES
SITE WORKER - DERMAL CONTACT

Groundwater; Dermal Contact; Site Worker (Current/Future)

CHEMICAL	CHEMICAL CONC. (MG/L) [1]	SKIN AREA FOR CONTACT (CM2/EVENT) [2]	DERMAL PERM. (CM/HR) [3]	EXPOSURE TIME (HR/DAY) [4]	EXPOSURE FREQ. (DAY/YR) [5]	EXPOSURE DURATION		BODY WT. (KG) [7]	SUB-CHRONIC AVERAGING TIME (DAYS) [8]	CHRONIC AVERAGING TIME (DAYS) [8]	LIFETIME AVERAGING TIME (DAYS) [8]	SITE WORKERS		
						SUB-CHRONIC (YRS) [6]	CHRONIC/ LIFETIME (YRS) [6]					SUB-CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	0.004	820	0.00084	1	52	2	30	70	730	10,950	25,550	5.61E-09	5.61E-09	2.40E-09
Arsenic	0.002	820	0.00084	1	52	2	30	70	730	10,950	25,550	2.80E-09	2.80E-09	1.20E-09
Cadmium	0.014	820	0.00084	1	52	2	30	70	730	10,950	25,550	1.96E-08	1.96E-08	8.41E-09
Chromium	0.004	820	0.00084	1	52	2	30	70	730	10,950	25,550	5.61E-09	5.61E-09	2.40E-09
Copper	0.086	820	0.00084	1	52	2	30	70	730	10,950	25,550	1.21E-07	1.21E-07	5.17E-08
Lead	0.055	820	0.00084	1	52	2	30	70	730	10,950	25,550	7.71E-08	7.71E-08	3.30E-08
Manganese	0.184	820	0.00084	1	52	2	30	70	730	10,950	25,550	2.58E-07	2.58E-07	1.11E-07
Mercury	0.0008	820	0.00084	1	52	2	30	70	730	10,950	25,550	1.12E-09	1.12E-09	4.81E-10
Nickel	0.107	820	0.00084	1	52	2	30	70	730	10,950	25,550	1.50E-07	1.50E-07	6.43E-08
Silver	0.001	820	0.00084	1	52	2	30	70	730	10,950	25,550	1.40E-09	1.40E-09	6.01E-10
Vanadium	0.016	820	0.00084	1	52	2	30	70	730	10,950	25,550	2.24E-08	2.24E-08	9.61E-09
PCBs (Aroclor 1254)	0.0003	820	0.00084	1	52	2	30	70	730	10,950	25,550	4.21E-10	4.21E-10	1.80E-10
1,2-Dichloroethylene	11	820	0.00084	1	52	2	30	70	730	10,950	25,550	1.54E-05	1.54E-05	6.61E-06
Trichloroethylene	0.32	820	0.00084	1	52	2	30	70	730	10,950	25,550	4.49E-07	4.49E-07	1.92E-07
Benzene	0.25	820	0.00084	1	52	2	30	70	730	10,950	25,550	3.50E-07	3.50E-07	1.50E-07
Tetrachloroethylene	0.35	820	0.00084	1	52	2	30	70	730	10,950	25,550	4.91E-07	4.91E-07	2.10E-07
Fluoranthene	0.36	820	0.00084	1	52	2	30	70	730	10,950	25,550	5.05E-07	5.05E-07	2.16E-07
Benzo(a)pyrene	0.36	820	0.00084	1	52	2	30	70	730	10,950	25,550	5.05E-07	5.05E-07	2.16E-07

NOTES:

[1] Maximum detected groundwater concentration from RI used.
[2] Assumed exposure to hands, EPA 1989a
[3] Assumed equivalent to water due to lack of chemical specific information, see text for discussion.
[4] Assumed 1.0 hr. day for site workers.
[5] Assumed 52 days per year exposure is possible (1 day/week, 52 weeks/year).
[6] Sub-chronic exposure duration based on 2 years, Chronic and Lifetime exposure durations are based on 30 years (assume that worker stays at same job location for 30 years).
[7] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[8] Sub-chronic exposure based on 2 years, Chronic exposure is based on 30 years, and Lifetime (Carcinogenic) exposure based on 70 yrs (90th percentile for one year at a residence)

TABLE 4-24
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
GROUNDWATER CHEMICAL INTAKES
RESIDENT - DERMAL CONTACT

Groundwater; Dermal Contact; Residents - (Current - Offsite / Future - Onsite & Off-site)

CHEMICAL	CHEMICAL CONC. (MG/L) [1]	SKIN AREA FOR CONTACT (CM2/EVENT) [2]	DERMAL PERM. (CM/HR) [3]	EXPOSURE TIME (HR/DAY) [4]	EXPOSURE FREQ. (DAY/YR) [5]	EXPOSURE DURATION		BODY WT. (KG) [7]	SUB-CHRONIC AVERAGING TIME (DAYS) [8]	CHRONIC AVERAGING TIME (DAYS) [8]	LIFETIME AVERAGING TIME (DAYS) [8]	RESIDENT		
						SUB-CHRONIC (YRS) [6]	CHRONIC/ LIFETIME (YRS) [6]					SUB-CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	CHRONIC CHEMICAL INTAKE (MG/KG-DAY)	LIFETIME CHEMICAL INTAKE (MG/KG-DAY)
Antimony	0.004	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	4.66E-07	4.66E-07	2.00E-07
Arsenic	0.002	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	2.33E-07	2.33E-07	9.98E-08
Cadmium	0.014	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	1.63E-06	1.63E-06	6.98E-07
Chromium	0.004	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	4.66E-07	4.66E-07	2.00E-07
Copper	0.086	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	1.00E-05	1.00E-05	4.29E-06
Lead	0.055	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	6.40E-06	6.40E-06	2.74E-06
Manganese	0.184	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	2.14E-05	2.14E-05	9.18E-06
Mercury	0.0008	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	9.31E-08	9.31E-08	3.99E-08
Nickel	0.107	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	1.25E-05	1.25E-05	5.34E-06
Silver	0.001	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	1.16E-07	1.16E-07	4.99E-08
Vanadium	0.016	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	1.86E-06	1.86E-06	7.98E-07
PCBs (Aroclor 1254)	0.0003	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	3.49E-08	3.49E-08	1.50E-08
1,2-Dichloroethylene	11	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	1.28E-03	1.28E-03	5.49E-04
Trichloroethylene	0.32	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	3.72E-05	3.72E-05	1.60E-05
Benzene	0.25	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	2.91E-05	2.91E-05	1.25E-05
Tetrachloroethylene	0.35	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	4.07E-05	4.07E-05	1.75E-05
Fluoranthene	0.36	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	4.19E-05	4.19E-05	1.80E-05
Benzo(a)pyrene	0.36	19,400	0.00084	0.5	365	2	30	70	730	10,950	25,550	4.19E-05	4.19E-05	1.80E-05

NOTES:

[1] Maximum detected groundwater concentration from RI used.
[2] Assumed exposure to entire body during showering, EPA 1989a
[3] Assumed equivalent to water due to lack of chemical specific information, see text for discussion.
[4] Assumed 0.5 hr. day for showering and washing.
[5] Assumed 365 days per year exposure is possible (worst case assumption)
[6] Sub-chronic exposure duration based on 2 years, Chronic and Lifetime exposure durations are based on 30 years (national upper-bound time (90th percentile) at one residence, ref. EPA RAGs, 1989).
[7] Weight of an average adult (realistic assumption accepted by EPA 1989a)
[8] Sub-chronic exposure based on 2 years, Chronic exposure is based on 30 years, and Lifetime (Carcinogenic) exposure based on 70 yrs (90th percentile for one year at a residence)

Table 5-1
Summary of Non-Carcinogenic Toxicity Values
Lockheed Martin

CHEMICAL	Weight of Evidence Classification	SUBCHRONIC EFFECTS				CHRONIC EFFECTS			
		Oral Diet RfD (mg/kg/day)	Oral Water RfD (mg/kg/day)	Dermal RfD (mg/kg/day)	Inhalation Rfdi (ug/m3)	Oral Diet RfD (mg/kg/day)	Oral Water RfD (mg/kg/day)	Dermal RfD (mg/kg/day)	Inhalation Rfdi (mg/kg/day)
Antimony	-	4.00E-04	4.00E-04	8.00E-05	NA	4.00E-04	4.00E-04	8.00E-05	NA
Arsenic	A	3.00E-04	3.00E-04	6.00E-05	NA	3.00E-04	3.00E-04	6.00E-05	NA
Cadmium	B1	1.00E-03	5.00E-04	2.00E-04	NA	1.00E-03	5.00E-04	2.00E-04	NA
Chromium	-	5.00E-03	2.00E-02	1.00E-03	NA	5.00E-03	5.00E-03	1.00E-03	NA
Copper		6.00E-02	6.00E-02	1.20E-02	NA	6.00E-02	6.00E-02	1.20E-02	NA
Lead [5]	B2	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	D	1.40E-01	5.00E-03	2.80E-02	NA	1.40E-01	5.00E-03	2.80E-02	1.14E-01
Mercury		3.00E-02	3.00E-02	6.00E-03	NA	3.00E-02	3.00E-02	6.00E-03	NA
Nickel	C	2.00E-02	2.00E-02	4.00E-03	NA	2.00E-02	2.00E-02	4.00E-03	NA
Silver	D	5.00E-03	5.00E-03	1.00E-03	NA	5.00E-03	5.00E-03	1.00E-03	NA
Vanadium	-	7.00E-03	7.00E-03	1.40E-03	NA	7.00E-03	7.00E-03	1.40E-03	NA
PCBs (Aroclor 1254)	B2	2.00E-05	2.00E-05	4.00E-06	NA	2.00E-05	2.00E-05	4.00E-06	NA
1,2-Dichloroethylene	-	2.00E-01	9.00E-03	4.00E-02	NA	9.00E-03	9.00E-03	1.80E-03	NA
Trichloroethylene	-	1.00E-02	1.00E-02	2.00E-03	NA	1.00E-02	1.00E-02	2.00E-03	NA
Benzene	A	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethylene	-	1.00E-01	1.00E-01	2.00E-02	NA	1.00E-02	1.00E-02	2.00E-03	NA
Fluoranthene	D	4.00E-01	4.00E-01	8.00E-02	NA	4.00E-02	4.00E-02	8.00E-03	NA
Benzo(a)pyrene	B2	1.00E-04	1.00E-04	2.00E-05	NA	1.00E-04	1.00E-04	2.00E-05	NA

Notes:

* Soil Toxicity Value = 1/RfD = 1/ (mg/kg/day), as published in IRIS (10/94) except as noted.

** Groundwater Toxicity Value = 1/RfD = 1/ (mg/l) assumming solvent used in the IRIS study was water (i.e., 1 mg/l is approx. equal to 1 mg/kg)

(a) - Dermal RfD was derived assuming a 20% oral absorbtion efficiency to yield a conservative estimate.

NA = Not Available for quantitative risk assessment.

1. No data is available for Aroclors 1248 and 1260. All three Aroclor compounds are grouped together as PCBs, using data for Aroclor 1254.
2. Chromium oral slope factor taken from HEAST Table 1, Data not available in IRIS. Data assumes hexavalent chromium.

RfDi [mg/kg-day] = RfDi [mg/cm3] x 20 m3 air inhaled per person divided by 70 kg per person.

Table 5-2
Summary of Carcinogenic Toxicity Values
Lockheed Martin

CHEMICAL	SLOPE FACTORS			UNIT RISK	
	Oral (mg/kg/day)-1	Dermal [a] (mg/kg/day)-1	Inhalation (mg/kg/day)-1	Drinking Water (mg/l)	Inhalation (ug/cm3)
Antimony	NA	NA	NA	NA	NA
Arsenic	1.50E+00	7.50E+00	NA	5.00E-08	4.30E-03
Cadmium	NA	NA	NA	NA	1.80E-03
Chromium	NA	NA	4.10E+01	NA	1.20E-02
Copper	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA
PCBs (Aroclor 1254)	7.70E+00	3.85E+01	NA	2.20E-07	NA
1,2-Dichloroethylene	NA	NA	NA	NA	NA
Trichloroethylene	1.10E-02	5.50E-02	NA	3.2E-10	NA
Benzene	2.90E-02	1.45E-01	NA	8.30E-10	8.30E-06
Tetrachloroethylene	5.20E-02	2.60E-01	2.00E-03	1.50E-09	NA
Fluoranthene	NA	NA	NA	NA	NA
Benzo(a)pyrene	7.30E+00	3.65E+01	NA	2.10E-07	NA

Notes:

* Soil Toxicity Value = 1/RfD = 1/ (mg/kg/day), as published in IRIS (10/94) except as noted.

** Groundwater Toxicity Value = 1/RfD = 1/ (mg/l) assumming solvent used in the IRIS study was water (i.e., 1 mg/l is approx. equal to 1 mg/kg)

(a) - Dermal Slope Factor was derived assuming a 20% oral absorbtion efficiency to yield a conservative estimate.

NA = Not Available for quantitative risk assessment.

1. No data is available for Aroclors 1248 and 1260. All three Aroclor compounds are grouped together as PCBs, using data for Aroclor 1254.
2. Chromium oral slope factor taken from HEAST Table 1, Data not available in IRIS. Data assumes hexavalent chromium.

H2MGROUP

TABLE 6-1A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL INGESTION RISK CHARACTERIZATION SUMMARY

Soil; Incidental Ingestion; Remediation/Construction Worker (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.32E-05	4.00E-04	3.3E-02	
Arsenic	3.57E-05	3.00E-04	1.2E-01	
Cadmium	3.15E-05	1.00E-03	3.1E-02	
Chromium	7.73E-04	5.00E-03	1.5E-01	
Copper	1.05E-02	6.00E-02	1.8E-01	
Lead	1.07E-02	0.00E+00	NA	
Manganese	1.44E-03	1.40E-01	1.0E-02	
Mercury	2.64E-05	3.00E-02	8.8E-04	
Nickel	7.84E-04	2.00E-02	3.9E-02	
Silver	8.55E-06	5.00E-03	1.7E-03	
Vanadium	9.53E-05	7.00E-03	1.4E-02	
PCBs (Aroclor 1254)	1.97E-05	2.00E-05	9.9E-01	
1,2-Dichloroethylene	1.41E-04	2.00E-01	7.1E-04	
Trichloroethylene	4.38E-03	1.00E-02	4.4E-01	
Benzene	4.51E-07	NA	NA	
Tetrachloroethylene	1.09E-02	1.00E-01	1.1E-01	
Fluoranthene	5.42E-06	4.00E-01	1.4E-05	
Benzo(a)pyrene	4.70E-06	1.00E-04	4.7E-02	
				2.2E+00

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	2.21E-07	4.00E-04	5.5E-04	
Arsenic	5.96E-07	3.00E-04	2.0E-03	
Cadmium	5.24E-07	1.00E-03	5.2E-04	
Chromium	1.29E-05	5.00E-03	2.6E-03	
Copper	1.75E-04	6.00E-02	2.9E-03	
Lead	1.78E-04	0.00E+00	NA	
Manganese	2.40E-05	1.40E-01	1.7E-04	
Mercury	4.41E-07	3.00E-02	1.5E-05	
Nickel	1.31E-05	2.00E-02	6.5E-04	
Silver	1.42E-07	5.00E-03	2.8E-05	
Vanadium	1.59E-06	7.00E-03	2.3E-04	
PCBs (Aroclor 1254)	3.29E-07	2.00E-05	1.6E-02	
1,2-Dichloroethylene	2.36E-06	9.00E-03	2.6E-04	
Trichloroethylene	7.30E-05	1.00E-02	7.3E-03	
Benzene	7.51E-09	NA	NA	
Tetrachloroethylene	1.81E-04	1.00E-02	1.8E-02	
Fluoranthene	9.03E-08	4.00E-02	2.3E-06	
Benzo(a)pyrene	7.83E-08	1.00E-04	7.8E-04	
				5.3E-02

H2MGROUP

TABLE 6-1A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL INGESTION RISK CHARACTERIZATION SUMMARY

Soil; Incidental Ingestion; Remediation/Construction Worker (Future)

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	ORAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	9.46E-08	NA	NA	
Arsenic	2.55E-07	1.50E+00	3.8E-07	
Cadmium	2.25E-07	NA	NA	
Chromium	5.52E-06	NA	NA	
Copper	7.51E-05	NA	NA	
Lead	7.64E-05	NA	NA	
Manganese	1.03E-05	NA	NA	
Mercury	1.89E-07	NA	NA	
Nickel	5.60E-06	NA	NA	
Silver	6.11E-08	NA	NA	
Vanadium	6.81E-07	NA	NA	
PCBs (Aroclor 1254)	1.41E-07	7.70E+00	1.1E-06	
1,2-Dichloroethylene	1.01E-06	NA	NA	
Trichloroethylene	3.13E-05	1.10E-02	3.4E-07	
Benzene	3.22E-09	2.90E-02	9.3E-11	
Tetrachloroethylene	7.77E-05	5.20E-02	4.0E-06	
Fluoranthene	3.87E-08	NA	NA	
Benzo(a)pyrene	3.35E-08	7.30E+00	2.4E-07	
				6.1E-06

NOTES:

Low-dose cancer risk equation was used to calculate carcinogenic risks.

Toxicity values were adjusted for adsorbtion where appropriate.

H2MGROUP

TABLE 6-1B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL INGESTION RISK CHARACTERIZATION SUMMARY

Soil; Incidental Ingestion; Site Worker (Current/Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.32E-07	4.00E-04	3.3E-04	
Arsenic	3.57E-07	3.00E-04	1.2E-03	
Cadmium	3.15E-07	1.00E-03	3.1E-04	
Chromium	7.73E-06	5.00E-03	1.5E-03	
Copper	1.05E-04	6.00E-02	1.8E-03	
Lead	1.07E-04	0.00E+00	NA	
Manganese	1.44E-05	1.40E-01	1.0E-04	
Mercury	2.64E-07	3.00E-02	8.8E-06	
Nickel	7.84E-06	2.00E-02	3.9E-04	
Silver	8.55E-08	5.00E-03	1.7E-05	
Vanadium	9.53E-07	7.00E-03	1.4E-04	
PCBs (Aroclor 1254)	1.97E-07	2.00E-05	9.9E-03	
1,2-Dichloroethylene	1.41E-06	2.00E-01	7.1E-06	
Trichloroethylene	4.38E-05	1.00E-02	4.4E-03	
Benzene	4.51E-09	NA	NA	
Tetrachloroethylene	1.09E-04	1.00E-01	1.1E-03	
Fluoranthene	5.42E-08	4.00E-01	1.4E-07	
Benzo(a)pyrene	4.70E-08	1.00E-04	4.7E-04	
				2.2E-02

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.32E-07	4.00E-04	3.3E-04	
Arsenic	3.57E-07	3.00E-04	1.2E-03	
Cadmium	3.15E-07	1.00E-03	3.1E-04	
Chromium	7.73E-06	5.00E-03	1.5E-03	
Copper	1.05E-04	6.00E-02	1.8E-03	
Lead	1.07E-04	0.00E+00	NA	
Manganese	1.44E-05	1.40E-01	1.0E-04	
Mercury	2.64E-07	3.00E-02	8.8E-06	
Nickel	7.84E-06	2.00E-02	3.9E-04	
Silver	8.55E-08	5.00E-03	1.7E-05	
Vanadium	9.53E-07	7.00E-03	1.4E-04	
PCBs (Aroclor 1254)	1.97E-07	2.00E-05	9.9E-03	
1,2-Dichloroethylene	1.41E-06	9.00E-03	1.6E-04	
Trichloroethylene	4.38E-05	1.00E-02	4.4E-03	
Benzene	4.51E-09	NA	NA	
Tetrachloroethylene	1.09E-04	1.00E-02	1.1E-02	
Fluoranthene	5.42E-08	4.00E-02	1.4E-06	
Benzo(a)pyrene	4.70E-08	1.00E-04	4.7E-04	
				3.2E-02

H2MGROUP

TABLE 6-1B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL INGESTION RISK CHARACTERIZATION SUMMARY

Soil; Incidental Ingestion; Site Worker (Current/Future)

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	ORAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	5.68E-08	NA	NA	
Arsenic	1.53E-07	1.50E+00	2.3E-07	
Cadmium	1.35E-07	NA	NA	
Chromium	3.31E-06	NA	NA	
Copper	4.51E-05	NA	NA	
Lead	4.59E-05	NA	NA	
Manganese	6.18E-06	NA	NA	
Mercury	1.13E-07	NA	NA	
Nickel	3.36E-06	NA	NA	
Silver	3.66E-08	NA	NA	
Vanadium	4.09E-07	NA	NA	
PCBs (Aroclor 1254)	8.45E-08	7.70E+00	6.5E-07	
1,2-Dichloroethylene	6.06E-07	NA	NA	
Trichloroethylene	1.88E-05	1.10E-02	2.1E-07	
Benzene	1.93E-09	2.90E-02	5.6E-11	
Tetrachloroethylene	4.66E-05	5.20E-02	2.4E-06	
Fluoranthene	2.32E-08	NA	NA	
Benzo(a)pyrene	2.01E-08	7.30E+00	1.5E-07	
				3.7E-06

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Toxicity values were adjusted for adsorbtion where appropriate.

H2MGROUP

TABLE 6-1C
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL CHARACTERIZATION RISK SUMMARY

Soil; Ingestion; Residential (Adult & Child)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	2.61E-05	4.00E-04	6.5E-02	
Arsenic	7.04E-05	3.00E-04	2.3E-01	
Cadmium	6.20E-05	1.00E-03	6.2E-02	
Chromium	1.52E-03	5.00E-03	3.0E-01	
Copper	2.07E-02	6.00E-02	3.5E-01	
Lead	2.11E-02	0.00E+00	NA	
Manganese	2.84E-03	1.40E-01	2.0E-02	
Mercury	5.21E-05	3.00E-02	1.7E-03	
Nickel	1.54E-03	2.00E-02	7.7E-02	
Silver	1.68E-05	5.00E-03	3.4E-03	
Vanadium	1.88E-04	7.00E-03	2.7E-02	
PCBs (Aroclor 1254)	3.88E-05	2.00E-05	1.9E+00	
1,2-Dichloroethylene	2.78E-04	2.00E-01	1.4E-03	
Trichloroethylene	8.63E-03	1.00E-02	8.6E-01	
Benzene	8.88E-07	NA	NA	
Tetrachloroethylene	2.14E-02	1.00E-01	2.1E-01	
Fluoranthene	1.07E-05	4.00E-01	2.7E-05	
Benzo(a)pyrene	9.25E-06	1.00E-04	9.2E-02	
				4.3E+00

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	7.60E-06	4.00E-04	1.9E-02	
Arsenic	2.05E-05	3.00E-04	6.8E-02	
Cadmium	1.81E-05	1.00E-03	1.8E-02	
Chromium	4.43E-04	5.00E-03	8.9E-02	
Copper	6.03E-03	6.00E-02	1.0E-01	
Lead	6.14E-03	0.00E+00	NA	
Manganese	8.28E-04	1.40E-01	NA	
Mercury	1.52E-05	3.00E-02	5.1E-04	
Nickel	4.50E-04	2.00E-02	2.2E-02	
Silver	4.90E-06	5.00E-03	9.8E-04	
Vanadium	5.47E-05	7.00E-03	7.8E-03	
PCBs (Aroclor 1254)	1.13E-05	2.00E-05	5.7E-01	
1,2-Dichloroethylene	8.11E-05	9.00E-03	9.0E-03	
Trichloroethylene	2.51E-03	1.00E-02	2.5E-01	
Benzene	2.59E-07	NA	NA	
Tetrachloroethylene	6.24E-03	1.00E-02	6.2E-01	
Fluoranthene	3.11E-06	4.00E-02	7.8E-05	
Benzo(a)pyrene	2.69E-06	1.00E-04	2.7E-02	
				1.8E+00

Soil; Ingestion; Residential (Adult & Child)

H2MGROUP

TABLE 6-1C
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL CHARACTERIZATION RISK SUMMARY

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	ORAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	3.26E-06	NA	NA	
Arsenic	8.79E-06	1.50E+00	1.3E-05	
Cadmium	7.74E-06	NA	NA	
Chromium	1.90E-04	NA	NA	
Copper	2.59E-03	NA	NA	
Lead	2.63E-03	NA	NA	
Manganese	3.55E-04	NA	NA	
Mercury	6.50E-06	NA	NA	
Nickel	1.93E-04	NA	NA	
Silver	2.10E-06	NA	NA	
Vanadium	2.34E-05	NA	NA	
PCBs (Aroclor 1254)	4.85E-06	7.70E+00	3.7E-05	
1,2-Dichloroethylene	3.48E-05	NA	NA	
Trichloroethylene	1.08E-03	1.10E-02	1.2E-05	
Benzene	1.11E-07	2.90E-02	3.2E-09	
Tetrachloroethylene	2.67E-03	5.20E-02	1.4E-04	
Fluoranthene	1.33E-06	NA	NA	
Benzo(a)pyrene	1.15E-06	7.30E+00	8.4E-06	
				2.1E-04

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-2A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL DERMAL CONTACT RISK CHARACTERIZATION SUMMARY

Soil; Dermal Contact; Remediation Worker (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.72E-04	8.00E-05	2.2E+00	
Arsenic	4.64E-04	6.00E-05	7.7E+00	
Cadmium	4.09E-04	2.00E-04	2.0E+00	
Chromium	1.00E-02	1.00E-03	1.0E+01	
Copper	1.37E-01	1.20E-02	1.1E+01	
Lead	1.39E-01	0.00E+00	NA	
Manganese	1.87E-02	2.80E-02	6.7E-01	
Mercury	3.43E-04	6.00E-03	5.7E-02	
Nickel	1.02E-02	4.00E-03	2.5E+00	
Silver	1.11E-04	1.00E-03	1.1E-01	
Vanadium	1.24E-03	1.40E-03	8.8E-01	
PCBs (Aroclor 1254)	2.56E-04	4.00E-06	6.4E+01	
1,2-Dichloroethylene	1.84E-03	4.00E-02	4.6E-02	
Trichloroethylene	5.69E-02	2.00E-03	2.8E+01	
Benzene	5.86E-06	NA	NA	
Tetrachloroethylene	1.41E-01	2.00E-02	7.1E+00	
Fluoranthene	7.04E-05	8.00E-02	8.8E-04	
Benzo(a)pyrene	6.10E-05	2.00E-05	3.1E+00	
				1.4E+02

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	2.87E-06	8.00E-05	3.6E-02	
Arsenic	7.74E-06	6.00E-05	1.3E-01	
Cadmium	6.81E-06	2.00E-04	3.4E-02	
Chromium	1.67E-04	1.00E-03	1.7E-01	
Copper	2.28E-03	1.20E-02	1.9E-01	
Lead	2.32E-03	0.00E+00	NA	
Manganese	3.12E-04	2.80E-02	1.1E-02	
Mercury	5.72E-06	6.00E-03	9.5E-04	
Nickel	1.70E-04	4.00E-03	4.2E-02	
Silver	1.85E-06	1.00E-03	1.9E-03	
Vanadium	2.06E-05	1.40E-03	1.5E-02	
PCBs (Aroclor 1254)	4.27E-06	4.00E-06	1.1E+00	
1,2-Dichloroethylene	3.06E-05	1.80E-03	1.7E-02	
Trichloroethylene	9.49E-04	2.00E-03	4.7E-01	
Benzene	9.76E-08	NA	NA	
Tetrachloroethylene	2.35E-03	2.00E-03	1.2E+00	
Fluoranthene	1.17E-06	8.00E-03	1.5E-04	
Benzo(a)pyrene	1.02E-06	2.00E-05	5.1E-02	
				3.4E+00

Soil; Dermal Contact; Remediation Worker (Future)

H2MGROUP

TABLE 6-2A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL DERMAL CONTACT RISK CHARACTERIZATION SUMMARY

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	DERMAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	1.23E-06	NA	NA	
Arsenic	3.32E-06	7.50E+00	2.5E-05	
Cadmium	2.92E-06	NA	NA	
Chromium	7.17E-05	NA	NA	
Copper	9.76E-04	NA	NA	
Lead	9.93E-04	NA	NA	
Manganese	1.34E-04	NA	NA	
Mercury	2.45E-06	NA	NA	
Nickel	7.28E-05	NA	NA	
Silver	7.93E-07	NA	NA	
Vanadium	8.85E-06	NA	NA	
PCBs (Aroclor 1254)	1.83E-06	3.85E+01	7.0E-05	
1,2-Dichloroethylene	1.31E-05	NA	NA	
Trichloroethylene	4.07E-04	5.50E-02	2.2E-05	
Benzene	4.18E-08	1.45E-01	6.1E-09	
Tetrachloroethylene	1.01E-03	2.60E-01	2.6E-04	
Fluoranthene	5.03E-07	NA	NA	
Benzo(a)pyrene	4.36E-07	3.65E+01	1.6E-05	
				4.0E-04

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-2B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL DERMAL CONTACT RISK CHARACTERIZATION SUMMARY

Soil; Dermal Contact; Site Worker (Current & Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	8.26E-06	8.00E-05	1.0E-01	
Arsenic	2.23E-05	6.00E-05	3.7E-01	
Cadmium	1.96E-05	2.00E-04	9.8E-02	
Chromium	4.82E-04	1.00E-03	4.8E-01	
Copper	6.56E-03	1.20E-02	5.5E-01	
Lead	6.67E-03	0.00E+00	NA	
Manganese	8.99E-04	2.80E-02	3.2E-02	
Mercury	1.65E-05	6.00E-03	2.7E-03	
Nickel	4.89E-04	4.00E-03	1.2E-01	
Silver	5.33E-06	1.00E-03	5.3E-03	
Vanadium	5.94E-05	1.40E-03	4.2E-02	
PCBs (Aroclor 1254)	1.23E-05	4.00E-06	3.1E+00	
1,2-Dichloroethylene	8.81E-05	4.00E-02	2.2E-03	
Trichloroethylene	2.73E-03	2.00E-03	1.4E+00	
Benzene	2.81E-07	NA	NA	
Tetrachloroethylene	6.78E-03	2.00E-02	3.4E-01	
Fluoranthene	3.38E-06	8.00E-02	4.2E-05	
Benzo(a)pyrene	2.93E-06	2.00E-05	1.5E-01	
				6.7E+00

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	8.26E-06	8.00E-05	1.0E-01	
Arsenic	2.23E-05	6.00E-05	3.7E-01	
Cadmium	1.96E-05	2.00E-04	9.8E-02	
Chromium	4.82E-04	1.00E-03	4.8E-01	
Copper	6.56E-03	1.20E-02	5.5E-01	
Lead	6.67E-03	0.00E+00	NA	
Manganese	8.99E-04	2.80E-02	3.2E-02	
Mercury	1.65E-05	6.00E-03	2.7E-03	
Nickel	4.89E-04	4.00E-03	1.2E-01	
Silver	5.33E-06	1.00E-03	5.3E-03	
Vanadium	5.94E-05	1.40E-03	4.2E-02	
PCBs (Aroclor 1254)	1.23E-05	4.00E-06	3.1E+00	
1,2-Dichloroethylene	8.81E-05	1.80E-03	4.9E-02	
Trichloroethylene	2.73E-03	2.00E-03	1.4E+00	
Benzene	2.81E-07	NA	NA	
Tetrachloroethylene	6.78E-03	2.00E-03	3.4E+00	
Fluoranthene	3.38E-06	8.00E-03	4.2E-04	
Benzo(a)pyrene	2.93E-06	2.00E-05	1.5E-01	
				9.8E+00

Soil; Dermal Contact; Site Worker (Future)

H2MGROUP

TABLE 6-2B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL DERMAL CONTACT RISK CHARACTERIZATION SUMMARY

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	DERMAL SLOPE FACTOR (MG/KG-DAY)-1	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	8.26E-06	NA	NA	
Arsenic	2.23E-05	7.50E+00	1.7E-04	
Cadmium	1.96E-05	NA	NA	
Chromium	4.82E-04	NA	NA	
Copper	6.56E-03	NA	NA	
Lead	6.67E-03	NA	NA	
Manganese	8.99E-04	NA	NA	
Mercury	1.65E-05	NA	NA	
Nickel	4.89E-04	NA	NA	
Silver	5.33E-06	NA	NA	
Vanadium	5.94E-05	NA	NA	
PCBs (Aroclor 1254)	1.23E-05	3.85E+01	4.7E-04	
1,2-Dichloroethylene	8.81E-05	NA	NA	
Trichloroethylene	2.73E-03	5.50E-02	1.5E-04	
Benzene	2.81E-07	1.45E-01	4.1E-08	
Tetrachloroethylene	6.78E-03	2.60E-01	1.8E-03	
Fluoranthene	3.38E-06	NA	NA	
Benzo(a)pyrene	2.93E-06	3.65E+01	1.1E-04	
				2.7E-03

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-2C
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL DERMAL CONTACT RISK CHARACTERIZATION SUMMARY

Soil; Dermal Contact; Residential (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	4.22E-04	8.00E-05	5.3E+00	
Arsenic	1.14E-03	6.00E-05	1.9E+01	
Cadmium	1.00E-03	2.00E-04	5.0E+00	
Chromium	2.46E-02	1.00E-03	2.5E+01	
Copper	3.35E-01	1.20E-02	2.8E+01	
Lead	3.41E-01	0.00E+00	NA	
Manganese	4.60E-02	2.80E-02	1.6E+00	
Mercury	8.43E-04	6.00E-03	1.4E-01	
Nickel	2.50E-02	4.00E-03	6.3E+00	
Silver	2.73E-04	1.00E-03	2.7E-01	
Vanadium	3.04E-03	1.40E-03	2.2E+00	
PCBs (Aroclor 1254)	6.29E-04	4.00E-06	1.6E+02	
1,2-Dichloroethylene	4.51E-03	4.00E-02	1.1E-01	
Trichloroethylene	1.40E-01	2.00E-03	7.0E+01	
Benzene	1.44E-05	NA	NA	
Tetrachloroethylene	3.47E-01	2.00E-02	1.7E+01	
Fluoranthene	1.73E-04	8.00E-02	2.2E-03	
Benzo(a)pyrene	1.50E-04	2.00E-05	7.5E+00	
				3.4E+02

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	4.23E-04	8.00E-05	5.3E+00	
Arsenic	1.14E-03	6.00E-05	1.9E+01	
Cadmium	1.01E-03	2.00E-04	5.0E+00	
Chromium	2.47E-02	1.00E-03	2.5E+01	
Copper	3.36E-01	1.20E-02	2.8E+01	
Lead	3.42E-01	0.00E+00	NA	
Manganese	4.61E-02	2.80E-02	1.6E+00	
Mercury	8.45E-04	6.00E-03	1.4E-01	
Nickel	2.51E-02	4.00E-03	6.3E+00	
Silver	2.73E-04	1.00E-03	2.7E-01	
Vanadium	3.05E-03	1.40E-03	2.2E+00	
PCBs (Aroclor 1254)	6.31E-04	4.00E-06	1.6E+02	
1,2-Dichloroethylene	4.52E-03	1.80E-03	2.5E+00	
Trichloroethylene	1.40E-01	2.00E-03	7.0E+01	
Benzene	1.44E-05	NA	NA	
Tetrachloroethylene	3.48E-01	2.00E-03	1.7E+02	
Fluoranthene	1.73E-04	8.00E-03	2.2E-02	
Benzo(a)pyrene	1.50E-04	2.00E-05	7.5E+00	
				5.0E+02

Soil; Dermal Contact; Residential (Future)

H2MGROUP

TABLE 6-2C
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL DERMAL CONTACT RISK CHARACTERIZATION SUMMARY

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	DERMAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	1.81E-04	NA	NA	
Arsenic	4.90E-04	7.50E+00	3.7E-03	
Cadmium	4.31E-04	NA	NA	
Chromium	1.06E-02	NA	NA	
Copper	1.44E-01	NA	NA	
Lead	1.47E-01	NA	NA	
Manganese	1.98E-02	NA	NA	
Mercury	3.62E-04	NA	NA	
Nickel	1.07E-02	NA	NA	
Silver	1.17E-04	NA	NA	
Vanadium	1.31E-03	NA	NA	
PCBs (Aroclor 1254)	2.70E-04	3.85E+01	1.0E-02	
1,2-Dichloroethylene	1.94E-03	NA	NA	
Trichloroethylene	6.00E-02	5.50E-02	3.3E-03	
Benzene	6.18E-06	1.45E-01	9.0E-07	
Tetrachloroethylene	1.49E-01	2.60E-01	3.9E-02	
Fluoranthene	7.43E-05	NA	NA	
Benzo(a)pyrene	6.44E-05	3.65E+01	2.3E-03	
				5.8E-02

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-3A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL INCIDENTAL INHALATION RISK CHARACTERIZATION SUMMARY

Soil; Inhalation; Remediation Worker (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	INHALATION RfC (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	2.76E-09	NA	NA	
Arsenic	7.45E-09	NA	NA	
Cadmium	6.56E-09	NA	NA	
Chromium	1.61E-07	NA	NA	
Copper	2.19E-06	NA	NA	
Lead	2.23E-06	NA	NA	
Manganese	3.00E-07	NA	NA	
Mercury	5.51E-09	NA	NA	
Nickel	1.63E-07	NA	NA	
Silver	1.78E-09	NA	NA	
Vanadium	1.99E-08	NA	NA	
PCBs (Aroclor 1254)	4.11E-09	NA	NA	
1,2-Dichloroethylene	2.95E-08	NA	NA	
Trichloroethylene	9.13E-07	NA	NA	
Benzene	9.39E-11	NA	NA	
Tetrachloroethylene	2.27E-06	NA	NA	
Fluoranthene	1.13E-09	NA	NA	
Benzo(a)pyrene	9.78E-10	NA	NA	
				NA

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE(MG/KG-DAY)	INHALATION RfC (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	4.60E-11	NA	NA	
Arsenic	1.24E-10	NA	NA	
Cadmium	1.09E-10	NA	NA	
Chromium	2.68E-09	NA	NA	
Copper	3.65E-08	NA	NA	
Lead	3.72E-08	NA	NA	
Manganese	5.01E-09	NA	NA	
Mercury	9.18E-11	NA	NA	
Nickel	2.72E-09	NA	NA	
Silver	2.97E-11	NA	NA	
Vanadium	3.31E-10	NA	NA	
PCBs (Aroclor 1254)	6.85E-11	NA	NA	
1,2-Dichloroethylene	4.91E-10	NA	NA	
Trichloroethylene	1.52E-08	NA	NA	
Benzene	1.57E-12	NA	NA	
Tetrachloroethylene	3.78E-08	NA	NA	
Fluoranthene	1.88E-11	NA	NA	
Benzo(a)pyrene	1.63E-11	NA	NA	
				NA

Soil; Inhalation; Remediation Worker (Future)

H2MGROUP

TABLE 6-3A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL INCIDENTAL INHALATION RISK CHARACTERIZATION SUMMARY

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	INHALATION SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	1.97E-11	NA	NA	
Arsenic	5.32E-11	NA	NA	
Cadmium	4.68E-11	NA	NA	
Chromium	1.15E-09	4.10E+01	4.7E-08	
Copper	1.56E-08	NA	NA	
Lead	1.59E-08	NA	NA	
Manganese	2.15E-09	NA	NA	
Mercury	3.93E-11	NA	NA	
Nickel	1.17E-09	NA	NA	
Silver	1.27E-11	NA	NA	
Vanadium	1.42E-10	NA	NA	
PCBs (Aroclor 1254)	2.94E-11	NA	NA	
1,2-Dichloroethylene	2.10E-10	NA	NA	
Trichloroethylene	6.52E-09	NA	NA	
Benzene	6.71E-13	NA	NA	
Tetrachloroethylene	1.62E-08	2.00E-03	3.2E-11	
Fluoranthene	8.07E-12	NA	NA	
Benzo(a)pyrene	6.99E-12	NA	NA	
				4.7E-08

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-3B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL INCIDENTAL INHALATION RISK CHARACTERIZATION SUMMARY

Soil; Inhalation; Resident (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	INHALATION RfC (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	4.03E-11	NA	NA	
Arsenic	1.09E-10	NA	NA	
Cadmium	9.57E-11	NA	NA	
Chromium	2.35E-09	NA	NA	
Copper	3.20E-08	NA	NA	
Lead	3.26E-08	NA	NA	
Manganese	4.39E-09	NA	NA	
Mercury	8.04E-11	NA	NA	
Nickel	2.39E-09	NA	NA	
Silver	2.60E-11	NA	NA	
Vanadium	2.90E-10	NA	NA	
PCBs (Aroclor 1254)	6.00E-11	NA	NA	
1,2-Dichloroethylene	4.30E-10	NA	NA	
Trichloroethylene	1.33E-08	NA	NA	
Benzene	1.37E-12	NA	NA	
Tetrachloroethylene	3.31E-08	NA	NA	
Fluoranthene	1.65E-11	NA	NA	
Benzo(a)pyrene	1.43E-11	NA	NA	
				NA

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	INHALATION RfC (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	6.71E-13	NA	NA	
Arsenic	1.81E-12	NA	NA	
Cadmium	1.60E-12	NA	NA	
Chromium	3.92E-11	NA	NA	
Copper	5.33E-10	NA	NA	
Lead	5.43E-10	NA	NA	
Manganese	7.31E-11	NA	NA	
Mercury	1.34E-12	NA	NA	
Nickel	3.98E-11	NA	NA	
Silver	4.33E-13	NA	NA	
Vanadium	4.83E-12	NA	NA	
PCBs (Aroclor 1254)	1.00E-12	NA	NA	
1,2-Dichloroethylene	7.17E-12	NA	NA	
Trichloroethylene	2.22E-10	NA	NA	
Benzene	2.29E-14	NA	NA	
Tetrachloroethylene	5.51E-10	NA	NA	
Fluoranthene	2.75E-13	NA	NA	
Benzo(a)pyrene	2.38E-13	NA	NA	
				NA

Soil; Inhalation; Resident (Future)

H2MGROUP

TABLE 6-3B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL INCIDENTAL INHALATION RISK CHARACTERIZATION SUMMARY

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	INHALATION SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	2.88E-13	NA	NA	
Arsenic	7.77E-13	NA	NA	
Cadmium	6.84E-13	NA	NA	
Chromium	1.68E-11	4.10E+01	6.9E-10	
Copper	2.28E-10	NA	NA	
Lead	2.33E-10	NA	NA	
Manganese	3.13E-11	NA	NA	
Mercury	5.74E-13	NA	NA	
Nickel	1.70E-11	NA	NA	
Silver	1.86E-13	NA	NA	
Vanadium	2.07E-12	NA	NA	
PCBs (Aroclor 1254)	4.29E-13	NA	NA	
1,2-Dichloroethylene	3.07E-12	NA	NA	
Trichloroethylene	9.52E-11	NA	NA	
Benzene	9.80E-15	NA	NA	
Tetrachloroethylene	2.36E-10	2.00E-03	4.7E-13	
Fluoranthene	1.18E-13	NA	NA	
Benzo(a)pyrene	1.02E-13	NA	NA	
				6.9E-10

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-4A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

Recharge Basin Sediments; Incidental Ingestion; Remediation/Worker (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	3.08E-05	4.00E-04	7.7E-02	
Arsenic	5.99E-05	3.00E-04	2.0E-01	
Cadmium	3.43E-05	1.00E-03	3.4E-02	
Chromium	5.65E-04	5.00E-03	1.1E-01	
Copper	8.48E-03	6.00E-02	1.4E-01	
Lead	8.48E-03	0.00E+00	NA	
Manganese	5.56E-03	1.40E-01	4.0E-02	
Mercury	1.14E-05	3.00E-02	3.8E-04	
Nickel	5.38E-04	2.00E-02	2.7E-02	
Silver	1.14E-05	5.00E-03	2.3E-03	
Vanadium	3.32E-04	7.00E-03	4.7E-02	
PCBs (Aroclor 1254)	1.76E-03	2.00E-05	8.8E+01	
1,2-Dichloroethylene	7.99E-04	2.00E-01	4.0E-03	
Trichloroethylene	2.61E-05	1.00E-02	2.6E-03	
Benzene	9.39E-09	NA	NA	
Tetrachloroethylene	2.35E-08	1.00E-01	2.3E-07	
Fluoranthene	3.29E-08	4.00E-01	8.2E-08	
Benzo(a)pyrene	4.23E-08	1.00E-04	4.2E-04	
				8.9E+01

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	5.14E-07	4.00E-04	1.3E-03	
Arsenic	9.98E-07	3.00E-04	3.3E-03	
Cadmium	5.72E-07	1.00E-03	5.7E-04	
Chromium	9.42E-06	5.00E-03	1.9E-03	
Copper	1.41E-04	6.00E-02	2.4E-03	
Lead	9.26E-05	0.00E+00	NA	
Manganese	8.96E-06	1.40E-01	6.4E-05	
Mercury	1.89E-07	3.00E-02	6.3E-06	
Nickel	5.53E-06	2.00E-02	2.8E-04	
Silver	2.93E-05	5.00E-03	5.9E-03	
Vanadium	1.33E-05	7.00E-03	1.9E-03	
PCBs (Aroclor 1254)	4.35E-07	2.00E-05	2.2E-02	
1,2-Dichloroethylene	1.57E-10	9.00E-03	1.7E-08	
Trichloroethylene	3.91E-10	1.00E-02	3.9E-08	
Benzene	5.48E-10	NA	NA	
Tetrachloroethylene	7.05E-10	1.00E-02	7.0E-08	
Fluoranthene	1.96E-06	4.00E-02	4.9E-05	
Benzo(a)pyrene	8.63E-07	1.00E-04	8.6E-03	
				4.8E-02

H2MGROUP

TABLE 6-4A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

Recharge Basin Sediments; Incidental Ingestion; Remediation/Worker (Future)

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	ORAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	2.20E-07	NA	NA	
Arsenic	4.28E-07	1.50E+00	6.4E-07	
Cadmium	2.45E-07	NA	NA	
Chromium	4.04E-06	NA	NA	
Copper	6.06E-05	NA	NA	
Lead	3.97E-05	NA	NA	
Manganese	3.84E-06	NA	NA	
Mercury	8.12E-08	NA	NA	
Nickel	2.37E-06	NA	NA	
Silver	1.26E-05	NA	NA	
Vanadium	5.71E-06	NA	NA	
PCBs (Aroclor 1254)	1.87E-07	7.70E+00	1.4E-06	
1,2-Dichloroethylene	6.71E-11	NA	NA	
Trichloroethylene	1.68E-10	1.10E-02	1.8E-12	
Benzene	2.35E-10	2.90E-02	6.8E-12	
Tetrachloroethylene	3.02E-10	5.20E-02	1.6E-11	
Fluoranthene	8.39E-07	NA	NA	
Benzo(a)pyrene	3.70E-07	7.30E+00	2.7E-06	
				4.8E-06

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Intakes and toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-4B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

Recharge Basin Sediment; Incidental Ingestion; Site Worker (Current/Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	3.08E-07	4.00E-04	7.7E-04	
Arsenic	5.99E-07	3.00E-04	2.0E-03	
Cadmium	3.43E-07	1.00E-03	3.4E-04	
Chromium	5.65E-06	5.00E-03	1.1E-03	
Copper	8.48E-05	6.00E-02	1.4E-03	
Lead	5.56E-05	0.00E+00	NA	
Manganese	5.38E-06	1.40E-01	3.8E-05	
Mercury	1.14E-07	3.00E-02	3.8E-06	
Nickel	3.32E-06	2.00E-02	1.7E-04	
Silver	1.76E-05	5.00E-03	3.5E-03	
Vanadium	7.99E-06	7.00E-03	1.1E-03	
PCBs (Aroclor 1254)	2.61E-07	2.00E-05	1.3E-02	
1,2-Dichloroethylene	9.39E-11	2.00E-01	4.7E-10	
Trichloroethylene	2.35E-10	1.00E-02	2.3E-08	
Benzene	3.29E-10	NA	NA	
Tetrachloroethylene	4.23E-10	1.00E-01	4.2E-09	
Fluoranthene	1.41E-06	4.00E-01	3.5E-06	
Benzo(a)pyrene	5.18E-07	1.00E-04	5.2E-03	
				2.9E-02

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	3.08E-07	4.00E-04	7.7E-04	
Arsenic	5.99E-07	3.00E-04	2.0E-03	
Cadmium	3.43E-07	1.00E-03	3.4E-04	
Chromium	5.65E-06	5.00E-03	1.1E-03	
Copper	8.48E-05	6.00E-02	1.4E-03	
Lead	5.56E-05	0.00E+00	NA	
Manganese	5.38E-06	1.40E-01	3.8E-05	
Mercury	1.14E-07	3.00E-02	3.8E-06	
Nickel	3.32E-06	2.00E-02	1.7E-04	
Silver	1.76E-05	5.00E-03	3.5E-03	
Vanadium	7.99E-06	7.00E-03	1.1E-03	
PCBs (Aroclor 1254)	2.61E-07	2.00E-05	1.3E-02	
1,2-Dichloroethylene	9.39E-11	9.00E-03	1.0E-08	
Trichloroethylene	2.35E-10	1.00E-02	2.3E-08	
Benzene	3.29E-10	NA	NA	
Tetrachloroethylene	4.23E-10	1.00E-02	4.2E-08	
Fluoranthene	1.41E-06	4.00E-02	3.5E-05	
Benzo(a)pyrene	5.18E-07	1.00E-04	5.2E-03	
				2.9E-02

Recharge Basin Sediment; Incidental Ingestion; Site Worker (Current/Future)

H2MGROUP

TABLE 6-4B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	ORAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	1.32E-07	NA	NA	
Arsenic	2.57E-07	1.50E+00	3.8E-07	
Cadmium	1.47E-07	NA	NA	
Chromium	2.42E-06	NA	NA	
Copper	3.63E-05	NA	NA	
Lead	2.38E-05	NA	NA	
Manganese	2.30E-06	NA	NA	
Mercury	4.87E-08	NA	NA	
Nickel	1.42E-06	NA	NA	
Silver	7.54E-06	NA	NA	
Vanadium	3.43E-06	NA	NA	
PCBs (Aroclor 1254)	1.12E-07	7.70E+00	8.6E-07	
1,2-Dichloroethylene	4.03E-11	NA	NA	
Trichloroethylene	1.01E-10	1.10E-02	1.1E-12	
Benzene	1.41E-10	2.90E-02	4.1E-12	
Tetrachloroethylene	1.81E-10	5.20E-02	9.4E-12	
Fluoranthene	6.04E-07	NA	NA	
Benzo(a)pyrene	2.22E-07	7.30E+00	1.6E-06	
				2.9E-06

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Intakes and toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-4C
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

Recharge Basin Sediments; Ingestion; Residential (Adult & Child)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	6.07E-05	4.00E-04	1.5E-01	
Arsenic	1.18E-04	3.00E-04	3.9E-01	
Cadmium	6.76E-05	1.00E-03	6.8E-02	
Chromium	1.11E-03	5.00E-03	2.2E-01	
Copper	1.67E-02	6.00E-02	2.8E-01	
Lead	1.09E-02	0.00E+00	NA	
Manganese	1.06E-03	1.40E-01	7.6E-03	
Mercury	2.24E-05	3.00E-02	7.5E-04	
Nickel	6.53E-04	2.00E-02	3.3E-02	
Silver	3.46E-03	5.00E-03	6.9E-01	
Vanadium	1.57E-03	7.00E-03	2.2E-01	
PCBs (Aroclor 1254)	5.14E-05	2.00E-05	2.6E+00	
1,2-Dichloroethylene	1.85E-08	2.00E-01	9.2E-08	
Trichloroethylene	4.62E-08	1.00E-02	4.6E-06	
Benzene	6.47E-08	NA	NA	
Tetrachloroethylene	8.32E-08	1.00E-01	8.3E-07	
Fluoranthene	2.31E-04	4.00E-01	5.8E-04	
Benzo(a)pyrene	1.02E-04	1.00E-04	1.0E+00	
				5.7E+00

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.77E-05	4.00E-04	4.4E-02	
Arsenic	3.44E-05	3.00E-04	1.1E-01	
Cadmium	1.97E-05	1.00E-03	2.0E-02	
Copper	3.24E-04	5.00E-03	6.5E-02	
Chromium	4.87E-03	6.00E-02	8.1E-02	
Lead	3.19E-03	0.00E+00	NA	
Mercury	3.09E-04	1.40E-01	2.2E-03	
Manganese	6.52E-06	3.00E-02	2.2E-04	
Nickel	1.90E-04	2.00E-02	9.5E-03	
Silver	1.01E-03	5.00E-03	2.0E-01	
Vanadium	4.59E-04	7.00E-03	6.6E-02	
PCBs (Aroclor 1254)	1.50E-05	2.00E-05	7.5E-01	
1,2-Dichloroethylene	5.39E-09	9.00E-03	6.0E-07	
Trichloroethylene	1.35E-08	1.00E-02	1.3E-06	
Benzene	1.89E-08	NA	NA	
Tetrachloroethylene	2.43E-08	1.00E-02	2.4E-06	
Fluoranthene	6.74E-05	4.00E-02	1.7E-03	
Benzo(a)pyrene	2.97E-05	1.00E-04	3.0E-01	
				1.7E+00

Recharge Basin Sediments; Ingestion; Residential (Adult & Child)

H2MGROUP

TABLE 6-4C
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	ORAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	7.58E-06	NA	NA	
Arsenic	1.47E-05	1.50E+00	2.2E-05	
Cadmium	8.44E-06	NA	NA	
Chromium	1.39E-04	NA	NA	
Copper	2.09E-03	NA	NA	
Lead	1.37E-03	NA	NA	
Manganese	1.32E-04	NA	NA	
Mercury	2.79E-06	NA	NA	
Nickel	8.16E-05	NA	NA	
Silver	4.33E-04	NA	NA	
Vanadium	1.97E-04	NA	NA	
PCBs (Aroclor 1254)	6.42E-06	7.70E+00	4.9E-05	
1,2-Dichloroethylene	2.31E-09	NA	NA	
Trichloroethylene	5.77E-09	1.10E-02	6.4E-11	
Benzene	8.08E-09	2.90E-02	2.3E-10	
Tetrachloroethylene	1.04E-08	5.20E-02	5.4E-10	
Fluoranthene	2.89E-05	NA	NA	
Benzo(a)pyrene	1.27E-05	7.30E+00	9.3E-05	
				1.6E-04

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Intakes and toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-5A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

Recharge Basin Sediments; Dermal Contact; Remediation Worker (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	4.00E-04	8.00E-05	5.0E+00	
Arsenic	7.78E-04	6.00E-05	1.3E+01	
Cadmium	4.46E-04	2.00E-04	2.2E+00	
Chromium	7.34E-03	1.00E-03	7.3E+00	
Copper	1.10E-01	1.20E-02	9.2E+00	
Lead	7.22E-02	0.00E+00	NA	
Manganese	6.99E-03	2.80E-02	2.5E-01	
Mercury	1.48E-04	6.00E-03	2.5E-02	
Nickel	4.31E-03	4.00E-03	1.1E+00	
Silver	2.29E-02	1.00E-03	2.3E+01	
Vanadium	1.04E-02	1.40E-03	7.4E+00	
PCBs (Aroclor 1254)	3.39E-04	4.00E-06	8.5E+01	
1,2-Dichloroethylene	1.22E-07	4.00E-02	3.1E-06	
Trichloroethylene	3.05E-07	2.00E-03	1.5E-04	
Benzene	4.27E-07	NA	NA	
Tetrachloroethylene	5.49E-07	2.00E-02	2.7E-05	
Fluoranthene	1.53E-03	8.00E-02	1.9E-02	
Benzo(a)pyrene	6.72E-04	2.00E-05	3.4E+01	
				1.9E+02

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	6.67E-06	8.00E-05	8.3E-02	
Arsenic	1.30E-05	6.00E-05	2.2E-01	
Cadmium	7.43E-06	2.00E-04	3.7E-02	
Chromium	1.22E-04	1.00E-03	1.2E-01	
Copper	1.84E-03	1.20E-02	1.5E-01	
Lead	1.20E-03	0.00E+00	NA	
Manganese	1.16E-04	2.80E-02	4.2E-03	
Mercury	2.46E-06	6.00E-03	4.1E-04	
Nickel	7.18E-05	4.00E-03	1.8E-02	
Silver	3.81E-04	1.00E-03	3.8E-01	
Vanadium	1.73E-04	1.40E-03	1.2E-01	
PCBs (Aroclor 1254)	5.65E-06	4.00E-06	1.4E+00	
1,2-Dichloroethylene	2.03E-09	1.80E-03	1.1E-06	
Trichloroethylene	5.08E-09	2.00E-03	2.5E-06	
Benzene	7.12E-09	NA	NA	
Tetrachloroethylene	9.15E-09	2.00E-03	4.6E-06	
Fluoranthene	2.54E-05	8.00E-03	3.2E-03	
Benzo(a)pyrene	1.12E-05	2.00E-05	5.6E-01	
				3.1E+00

Recharge Basin Sediments; Dermal Contact; Remediation Worker (Future)

H2MGROUP

TABLE 6-5A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	DERMAL SLOPE FACTOR (MG/KG-DAY)-1	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	2.86E-06	NA	NA	
Arsenic	5.56E-06	7.50E+00	4.2E-05	
Cadmium	3.19E-06	NA	NA	
Chromium	5.25E-05	NA	NA	
Copper	7.87E-04	NA	NA	
Lead	5.16E-04	NA	NA	
Manganese	4.99E-05	NA	NA	
Mercury	1.05E-06	NA	NA	
Nickel	3.08E-05	NA	NA	
Silver	1.63E-04	NA	NA	
Vanadium	7.42E-05	NA	NA	
PCBs (Aroclor 1254)	2.42E-06	3.85E+01	9.3E-05	
1,2-Dichloroethylene	8.72E-10	NA	NA	
Trichloroethylene	2.18E-09	5.50E-02	1.2E-10	
Benzene	3.05E-09	1.45E-01	4.4E-10	
Tetrachloroethylene	3.92E-09	2.60E-01	1.0E-09	
Fluoranthene	1.09E-05	NA	NA	
Benzo(a)pyrene	4.80E-06	3.65E+01	1.8E-04	
				3.1E-04

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Intakes and toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-5B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

Recharge Basin Sediments; Dermal Contact; Site Worker (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.92E-05	8.00E-05	2.4E-01	
Arsenic	3.73E-05	6.00E-05	6.2E-01	
Cadmium	2.14E-05	2.00E-04	1.1E-01	
Chromium	3.52E-04	1.00E-03	3.5E-01	
Copper	5.29E-03	1.20E-02	4.4E-01	
Lead	3.47E-03	0.00E+00	NA	
Manganese	3.35E-04	2.80E-02	1.2E-02	
Mercury	7.09E-06	6.00E-03	1.2E-03	
Nickel	2.07E-04	4.00E-03	5.2E-02	
Silver	1.10E-03	1.00E-03	1.1E+00	
Vanadium	4.98E-04	1.40E-03	3.6E-01	
PCBs (Aroclor 1254)	1.63E-05	4.00E-06	4.1E+00	
1,2-Dichloroethylene	5.86E-09	4.00E-02	1.5E-07	
Trichloroethylene	1.46E-08	2.00E-03	7.3E-06	
Benzene	2.05E-08	NA	NA	
Tetrachloroethylene	2.64E-08	2.00E-02	1.3E-06	
Fluoranthene	8.79E-05	8.00E-02	1.1E-03	
Benzo(a)pyrene	3.23E-05	2.00E-05	1.6E+00	
				9.0E+00

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.92E-05	8.00E-05	2.4E-01	
Arsenic	3.73E-05	6.00E-05	6.2E-01	
Cadmium	2.14E-05	2.00E-04	1.1E-01	
Chromium	3.52E-04	1.00E-03	3.5E-01	
Copper	5.29E-03	1.20E-02	4.4E-01	
Lead	3.47E-03	0.00E+00	NA	
Manganese	3.35E-04	2.80E-02	1.2E-02	
Mercury	7.09E-06	6.00E-03	1.2E-03	
Nickel	2.07E-04	4.00E-03	5.2E-02	
Silver	1.10E-03	1.00E-03	1.1E+00	
Vanadium	4.98E-04	1.40E-03	3.6E-01	
PCBs (Aroclor 1254)	1.63E-05	4.00E-06	4.1E+00	
1,2-Dichloroethylene	5.86E-09	1.80E-03	3.3E-06	
Trichloroethylene	1.46E-08	2.00E-03	7.3E-06	
Benzene	2.05E-08	NA	NA	
Tetrachloroethylene	2.64E-08	2.00E-03	1.3E-05	
Fluoranthene	8.79E-05	8.00E-03	1.1E-02	
Benzo(a)pyrene	3.23E-05	2.00E-05	1.6E+00	
				9.0E+00

H2MGROUP

TABLE 6-5B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

Recharge Basin Sediments; Dermal Contact; Site Worker (Future)

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	DERMAL SLOPE FACTOR (MG/KG-DAY)-1	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	8.23E-06	NA	NA	
Arsenic	1.60E-05	7.50E+00	1.2E-04	
Cadmium	9.17E-06	NA	NA	
Chromium	1.51E-04	NA	NA	
Copper	2.27E-03	NA	NA	
Lead	1.49E-03	NA	NA	
Manganese	1.44E-04	NA	NA	
Mercury	3.04E-06	NA	NA	
Nickel	8.87E-05	NA	NA	
Silver	4.70E-04	NA	NA	
Vanadium	2.14E-04	NA	NA	
PCBs (Aroclor 1254)	6.98E-06	3.85E+01	2.7E-04	
1,2-Dichloroethylene	2.51E-09	NA	NA	
Trichloroethylene	6.28E-09	5.50E-02	3.5E-10	
Benzene	8.79E-09	1.45E-01	1.3E-09	
Tetrachloroethylene	1.13E-08	2.60E-01	2.9E-09	
Fluoranthene	3.77E-05	NA	NA	
Benzo(a)pyrene	1.38E-05	3.65E+01	5.0E-04	
				8.9E-04

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Intakes and toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-5C
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

Recharge Basin Sediments; Dermal Contact; Residential (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	9.82E-04	8.00E-05	1.2E+01	
Arsenic	1.91E-03	6.00E-05	3.2E+01	
Cadmium	1.09E-03	2.00E-04	5.5E+00	
Chromium	1.80E-02	1.00E-03	1.8E+01	
Copper	2.70E-01	1.20E-02	2.3E+01	
Lead	1.77E-01	0.00E+00	NA	
Manganese	1.71E-02	2.80E-02	6.1E-01	
Mercury	3.62E-04	6.00E-03	6.0E-02	
Nickel	1.06E-02	4.00E-03	2.6E+00	
Silver	5.61E-02	1.00E-03	5.6E+01	
Vanadium	2.55E-02	1.40E-03	1.8E+01	
PCBs (Aroclor 1254)	8.33E-04	4.00E-06	2.1E+02	
1,2-Dichloroethylene	3.00E-07	4.00E-02	7.5E-06	
Trichloroethylene	7.49E-07	2.00E-03	3.7E-04	
Benzene	1.05E-06	NA	NA	
Tetrachloroethylene	1.35E-06	2.00E-02	6.7E-05	
Fluoranthene	3.75E-03	8.00E-02	4.7E-02	
Benzo(a)pyrene	1.65E-03	2.00E-05	8.3E+01	
				4.6E+02

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	9.85E-04	8.00E-05	1.2E+01	
Arsenic	1.91E-03	6.00E-05	3.2E+01	
Cadmium	1.10E-03	2.00E-04	5.5E+00	
Chromium	1.81E-02	1.00E-03	1.8E+01	
Copper	2.71E-01	1.20E-02	2.3E+01	
Lead	1.78E-01	0.00E+00	NA	
Manganese	1.72E-02	2.80E-02	6.1E-01	
Mercury	3.63E-04	6.00E-03	6.1E-02	
Nickel	1.06E-02	4.00E-03	2.7E+00	
Silver	5.63E-02	1.00E-03	5.6E+01	
Vanadium	2.56E-02	1.40E-03	1.8E+01	
PCBs (Aroclor 1254)	8.35E-04	4.00E-06	2.1E+02	
1,2-Dichloroethylene	3.00E-07	1.80E-03	1.7E-04	
Trichloroethylene	7.51E-07	2.00E-03	3.8E-04	
Benzene	1.05E-06	NA	NA	
Tetrachloroethylene	1.35E-06	2.00E-03	6.8E-04	
Fluoranthene	3.76E-03	8.00E-03	4.7E-01	
Benzo(a)pyrene	1.65E-03	2.00E-05	8.3E+01	
				4.6E+02

Recharge Basin Sediments; Dermal Contact; Residential (Future)

H2MGROUP

TABLE 6-5C
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	DERMAL SLOPE FACTOR (MG/KG-DAY)-1	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	4.22E-04	NA	NA	
Arsenic	8.21E-04	7.50E+00	6.2E-03	
Cadmium	4.70E-04	NA	NA	
Chromium	7.75E-03	NA	NA	
Copper	1.16E-01	NA	NA	
Lead	7.62E-02	NA	NA	
Manganese	7.37E-03	NA	NA	
Mercury	1.56E-04	NA	NA	
Nickel	4.55E-03	NA	NA	
Silver	2.41E-02	NA	NA	
Vanadium	1.10E-02	NA	NA	
PCBs (Aroclor 1254)	3.58E-04	3.85E+01	1.4E-02	
1,2-Dichloroethylene	1.29E-07	NA	NA	
Trichloroethylene	3.22E-07	5.50E-02	1.8E-08	
Benzene	4.50E-07	1.45E-01	6.5E-08	
Tetrachloroethylene	5.79E-07	2.60E-01	1.5E-07	
Fluoranthene	1.61E-03	NA	NA	
Benzo(a)pyrene	7.09E-04	3.65E+01	2.6E-02	
				4.6E-02

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Intakes and toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-6A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

Recharge Basin Sediments; Inhalation; Remediation Worker (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	INHALATION RfC (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	6.42E-09	NA	NA	
Arsenic	1.25E-08	NA	NA	
Cadmium	7.15E-09	NA	NA	
Chromium	1.18E-07	NA	NA	
Copper	1.77E-06	NA	NA	
Lead	1.16E-06	NA	NA	
Manganese	1.12E-07	NA	NA	
Mercury	2.37E-09	NA	NA	
Nickel	6.91E-08	NA	NA	
Silver	3.67E-07	NA	NA	
Vanadium	1.67E-07	NA	NA	
PCBs (Aroclor 1254)	5.44E-09	NA	NA	
1,2-Dichloroethylene	1.96E-12	NA	NA	
Trichloroethylene	4.89E-12	NA	NA	
Benzene	6.85E-12	NA	NA	
Tetrachloroethylene	8.81E-12	NA	NA	
Fluoranthene	2.45E-08	NA	NA	
Benzo(a)pyrene	1.08E-08	NA	NA	
				NA

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE(MG/KG-DAY)	INHALATION RfC (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.07E-10	NA	NA	
Arsenic	2.08E-10	NA	NA	
Cadmium	1.19E-10	NA	NA	
Chromium	1.96E-09	NA	NA	
Copper	2.94E-08	NA	NA	
Lead	1.93E-08	NA	NA	
Manganese	1.87E-09	NA	NA	
Mercury	3.95E-11	NA	NA	
Nickel	1.15E-09	NA	NA	
Silver	6.11E-09	NA	NA	
Vanadium	2.78E-09	NA	NA	
PCBs (Aroclor 1254)	9.07E-11	NA	NA	
1,2-Dichloroethylene	3.26E-14	NA	NA	
Trichloroethylene	8.15E-14	NA	NA	
Benzene	1.14E-13	NA	NA	
Tetrachloroethylene	1.47E-13	NA	NA	
Fluoranthene	4.08E-10	NA	NA	
Benzo(a)pyrene	1.80E-10	NA	NA	
				NA

Recharge Basin Sediments; Inhalation; Remediation Worker (Future)

H2MGROUP

TABLE 6-6A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	INHALATION SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	4.58E-11	NA	NA	
Arsenic	8.91E-11	NA	NA	
Cadmium	5.11E-11	NA	NA	
Chromium	8.41E-10	4.10E+01	3.4E-08	
Copper	1.26E-08	NA	NA	
Lead	8.27E-09	NA	NA	
Manganese	8.00E-10	NA	NA	
Mercury	1.69E-11	NA	NA	
Nickel	4.94E-10	NA	NA	
Silver	2.62E-09	NA	NA	
Vanadium	1.19E-09	NA	NA	
PCBs (Aroclor 1254)	3.89E-11	NA	NA	
1,2-Dichloroethylene	1.40E-14	NA	NA	
Trichloroethylene	3.49E-14	NA	NA	
Benzene	4.89E-14	NA	NA	
Tetrachloroethylene	6.29E-14	2.00E-03	1.3E-16	
Fluoranthene	1.75E-10	NA	NA	
Benzo(a)pyrene	7.70E-11	NA	NA	
				3.4E-08

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Intakes and toxicity values were adjusted for adsorbtion where appropriate

Sub-chronic daily intakes (SDI's) and chronic daily intakes (CDI's) calculated in Section 8.3.4.1
Toxicity values used were derived as discussed in Sections 8.4.1, 8.4.2, and 8.4.3.

H2MGROUP

TABLE 6-6B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

Soil; Inhalation; Resident (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	INHALATION RfC (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	9.37E-11	NA	NA	
Arsenic	1.82E-10	NA	NA	
Cadmium	1.04E-10	NA	NA	
Chromium	1.72E-09	NA	NA	
Copper	2.58E-08	NA	NA	
Lead	1.69E-08	NA	NA	
Manganese	1.64E-09	NA	NA	
Mercury	3.46E-11	NA	NA	
Nickel	1.01E-09	NA	NA	
Silver	5.35E-09	NA	NA	
Vanadium	2.43E-09	NA	NA	
PCBs (Aroclor 1254)	7.94E-11	NA	NA	
1,2-Dichloroethylene	2.86E-14	NA	NA	
Trichloroethylene	7.14E-14	NA	NA	
Benzene	1.00E-13	NA	NA	
Tetrachloroethylene	1.29E-13	NA	NA	
Fluoranthene	3.57E-10	NA	NA	
Benzo(a)pyrene	1.57E-10	NA	NA	
				NA

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	INHALATION RfC (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.56E-12	NA	NA	
Arsenic	3.04E-12	NA	NA	
Cadmium	1.74E-12	NA	NA	
Chromium	2.87E-11	NA	NA	
Copper	4.30E-10	NA	NA	
Lead	2.82E-10	NA	NA	
Manganese	2.73E-11	NA	NA	
Mercury	5.76E-13	NA	NA	
Nickel	1.68E-11	NA	NA	
Silver	8.92E-11	NA	NA	
Vanadium	4.05E-11	NA	NA	
PCBs (Aroclor 1254)	1.32E-12	NA	NA	
1,2-Dichloroethylene	4.76E-16	NA	NA	
Trichloroethylene	1.19E-15	NA	NA	
Benzene	1.67E-15	NA	NA	
Tetrachloroethylene	2.14E-15	NA	NA	
Fluoranthene	5.96E-12	NA	NA	
Benzo(a)pyrene	2.62E-12	NA	NA	
				NA

H2MGROUP

TABLE 6-6B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
RECHARGE BASIN SEDIMENT INGESTION RISK CHARACTERIZATION SUMMARY

Soil; Inhalation; Resident (Future)

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	INHALATION SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	6.69E-13	NA	NA	
Arsenic	1.30E-12	NA	NA	
Cadmium	7.46E-13	NA	NA	
Chromium	1.23E-11	4.10E+01	5.0E-10	
Copper	1.84E-10	NA	NA	
Lead	1.21E-10	NA	NA	
Manganese	1.17E-11	NA	NA	
Mercury	2.47E-13	NA	NA	
Nickel	7.21E-12	NA	NA	
Silver	3.82E-11	NA	NA	
Vanadium	1.74E-11	NA	NA	
PCBs (Aroclor 1254)	5.67E-13	NA	NA	
1,2-Dichloroethylene	2.04E-16	NA	NA	
Trichloroethylene	5.10E-16	NA	NA	
Benzene	7.14E-16	NA	NA	
Tetrachloroethylene	9.18E-16	2.00E-03	1.8E-18	
Fluoranthene	2.55E-12	NA	NA	
Benzo(a)pyrene	1.12E-12	NA	NA	
				5.0E-10

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Intakes and toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-7A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
GROUNDWATER INGESTION RISK CHARACTERIZATION SUMMARY

Groundwater; Ingestion; Residents - (Current - Offsite / Future - Onsite & Off-site)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	5.71E-05	4.00E-04	1.4E-01	
Arsenic	2.86E-05	3.00E-04	9.5E-02	
Cadmium	2.00E-04	5.00E-04	4.0E-01	
Chromium	5.71E-05	2.00E-02	2.9E-03	
Copper	1.23E-03	6.00E-02	2.0E-02	
Lead	7.86E-04	0.00E+00	NA	
Manganese	2.63E-03	5.00E-03	5.3E-01	
Mercury	1.14E-05	3.00E-02	3.8E-04	
Nickel	1.53E-03	2.00E-02	7.6E-02	
Silver	1.43E-05	5.00E-03	2.9E-03	
Vanadium	2.29E-04	7.00E-03	3.3E-02	
PCBs (Aroclor 1254)	4.29E-06	2.00E-05	2.1E-01	
1,2-Dichloroethylene	1.57E-01	9.00E-03	1.7E+01	
Trichloroethylene	4.57E-03	1.00E-02	4.6E-01	
Benzene	3.57E-03	NA	NA	
Tetrachloroethylene	5.00E-03	1.00E-01	5.0E-02	
Fluoranthene	5.14E-03	4.00E-01	1.3E-02	
Benzo(a)pyrene	5.14E-03	1.00E-04	5.1E+01	
				7.1E+01

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	5.71E-05	4.00E-04	1.4E-01	
Arsenic	2.86E-05	3.00E-04	9.5E-02	
Cadmium	2.00E-04	5.00E-04	4.0E-01	
Chromium	5.71E-05	5.00E-03	1.1E-02	
Copper	1.23E-03	6.00E-02	2.0E-02	
Lead	7.86E-04	0.00E+00	NA	
Manganese	2.63E-03	5.00E-03	5.3E-01	
Mercury	1.14E-05	3.00E-02	3.8E-04	
Nickel	1.53E-03	2.00E-02	7.6E-02	
Silver	1.43E-05	5.00E-03	2.9E-03	
Vanadium	2.29E-04	7.00E-03	3.3E-02	
PCBs (Aroclor 1254)	4.29E-06	2.00E-05	2.1E-01	
1,2-Dichloroethylene	1.57E-01	9.00E-03	1.7E+01	
Trichloroethylene	4.57E-03	1.00E-02	4.6E-01	
Benzene	3.57E-03	NA	NA	
Tetrachloroethylene	5.00E-03	1.00E-02	5.0E-01	
Fluoranthene	5.14E-03	4.00E-02	1.3E-01	
Benzo(a)pyrene	5.14E-03	1.00E-04	5.1E+01	
				7.1E+01

Groundwater; Ingestion; Residents - (Current - Offsite / Future - Onsite & Off-site)

H2MGROUP

TABLE 6-7A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
GROUNDWATER INGESTION RISK CHARACTERIZATION SUMMARY

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	ORAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	2.45E-05	NA	NA	
Arsenic	1.22E-05	1.50E+00	1.8E-05	
Cadmium	8.57E-05	NA	NA	
Chromium	2.45E-05	NA	NA	
Copper	5.27E-04	NA	NA	
Lead	3.37E-04	NA	NA	
Manganese	1.13E-03	NA	NA	
Mercury	4.90E-06	NA	NA	
Nickel	6.55E-04	NA	NA	
Silver	6.12E-06	NA	NA	
Vanadium	9.80E-05	NA	NA	
PCBs (Aroclor 1254)	1.84E-06	7.70E+00	1.4E-05	
1,2-Dichloroethylene	6.73E-02	NA	NA	
Trichloroethylene	1.96E-03	1.10E-02	2.2E-05	
Benzene	1.53E-03	2.90E-02	4.4E-05	
Tetrachloroethylene	2.14E-03	5.20E-02	1.1E-04	
Fluoranthene	2.20E-03	NA	NA	
Benzo(a)pyrene	2.20E-03	7.30E+00	1.6E-02	
				1.6E-02

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Intakes and toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-8A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
GROUNDWATER
DERMAL CONTACT RISK CHARACTERIZATION SUMMARY

Groundwater; Dermal Contact; Site Worker (Current/Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	5.61E-09	8.00E-05	7.0E-05	
Arsenic	2.80E-09	6.00E-05	4.7E-05	
Cadmium	1.96E-08	2.00E-04	9.8E-05	
Chromium	5.61E-09	1.00E-03	5.6E-06	
Copper	1.21E-07	1.20E-02	1.0E-05	
Lead	7.71E-08	0.00E+00	NA	
Manganese	2.58E-07	2.80E-02	9.2E-06	
Mercury	1.12E-09	6.00E-03	1.9E-07	
Nickel	1.50E-07	4.00E-03	3.7E-05	
Silver	1.40E-09	1.00E-03	1.4E-06	
Vanadium	2.24E-08	1.40E-03	1.6E-05	
PCBs (Aroclor 1254)	4.21E-10	4.00E-06	1.1E-04	
1,2-Dichloroethylene	1.54E-05	4.00E-02	3.9E-04	
Trichloroethylene	4.49E-07	2.00E-03	2.2E-04	
Benzene	3.50E-07	NA	NA	
Tetrachloroethylene	4.91E-07	2.00E-02	2.5E-05	
Fluoranthene	5.05E-07	8.00E-02	6.3E-06	
Benzo(a)pyrene	5.05E-07	2.00E-05	2.5E-02	
				2.6E-02

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	5.61E-09	8.00E-05	7.0E-05	
Arsenic	2.80E-09	6.00E-05	4.7E-05	
Cadmium	1.96E-08	2.00E-04	9.8E-05	
Chromium	5.61E-09	1.00E-03	5.6E-06	
Copper	1.21E-07	1.20E-02	1.0E-05	
Lead	7.71E-08	0.00E+00	NA	
Manganese	2.58E-07	2.80E-02	9.2E-06	
Mercury	1.12E-09	6.00E-03	1.9E-07	
Nickel	1.50E-07	4.00E-03	3.7E-05	
Silver	1.40E-09	1.00E-03	1.4E-06	
Vanadium	2.24E-08	1.40E-03	1.6E-05	
PCBs (Aroclor 1254)	4.21E-10	4.00E-06	1.1E-04	
1,2-Dichloroethylene	1.54E-05	1.80E-03	8.6E-03	
Trichloroethylene	4.49E-07	2.00E-03	2.2E-04	
Benzene	3.50E-07	NA	NA	
Tetrachloroethylene	4.91E-07	2.00E-03	2.5E-04	
Fluoranthene	5.05E-07	8.00E-03	6.3E-05	
Benzo(a)pyrene	5.05E-07	2.00E-05	2.5E-02	
				3.5E-02

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TABLE 6-8A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
GROUNDWATER
DERMAL CONTACT RISK CHARACTERIZATION SUMMARY

Groundwater; Dermal Contact; Site Worker (Current/Future)

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	DERMAL SLOPE FACTOR (MG/KG-DAY)-1	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	2.40E-09	NA	NA	
Arsenic	1.20E-09	7.50E+00	9.0E-09	
Cadmium	8.41E-09	NA	NA	
Chromium	2.40E-09	NA	NA	
Copper	5.17E-08	NA	NA	
Lead	3.30E-08	NA	NA	
Manganese	1.11E-07	NA	NA	
Mercury	4.81E-10	NA	NA	
Nickel	6.43E-08	NA	NA	
Silver	6.01E-10	NA	NA	
Vanadium	9.61E-09	NA	NA	
PCBs (Aroclor 1254)	1.80E-10	3.85E+01	6.9E-09	
1,2-Dichloroethylene	6.61E-06	NA	NA	
Trichloroethylene	1.92E-07	5.50E-02	1.1E-08	
Benzene	1.50E-07	1.45E-01	2.2E-08	
Tetrachloroethylene	2.10E-07	2.60E-01	5.5E-08	
Fluoranthene	2.16E-07	NA	NA	
Benzo(a)pyrene	2.16E-07	3.65E+01	7.9E-06	
				8.0E-06

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Intakes and toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-8B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
GROUNDWATER DERMAL CONTACT RISK CHARACTERIZATION SUMMARY

Groundwater; Dermal Contact; Residents - (Current - Offsite / Future - Onsite & Off-site)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	4.66E-07	8.00E-05	5.8E-03	
Arsenic	2.33E-07	6.00E-05	3.9E-03	
Cadmium	1.63E-06	2.00E-04	8.1E-03	
Chromium	4.66E-07	1.00E-03	4.7E-04	
Copper	1.00E-05	1.20E-02	8.3E-04	
Lead	6.40E-06	0.00E+00	NA	
Manganese	2.14E-05	2.80E-02	7.6E-04	
Mercury	9.31E-08	6.00E-03	1.6E-05	
Nickel	1.25E-05	4.00E-03	3.1E-03	
Silver	1.16E-07	1.00E-03	1.2E-04	
Vanadium	1.86E-06	1.40E-03	1.3E-03	
PCBs (Aroclor 1254)	3.49E-08	4.00E-06	8.7E-03	
1,2-Dichloroethylene	1.28E-03	4.00E-02	3.2E-02	
Trichloroethylene	3.72E-05	2.00E-03	1.9E-02	
Benzene	2.91E-05	NA	NA	
Tetrachloroethylene	4.07E-05	2.00E-02	2.0E-03	
Fluoranthene	4.19E-05	8.00E-02	5.2E-04	
Benzo(a)pyrene	4.19E-05	2.00E-05	2.1E+00	
				2.2E+00

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	4.66E-07	8.00E-05	5.8E-03	
Arsenic	2.33E-07	6.00E-05	3.9E-03	
Cadmium	1.63E-06	2.00E-04	8.1E-03	
Chromium	4.66E-07	1.00E-03	4.7E-04	
Copper	1.00E-05	1.20E-02	8.3E-04	
Lead	6.40E-06	0.00E+00	NA	
Manganese	2.14E-05	2.80E-02	7.6E-04	
Mercury	9.31E-08	6.00E-03	1.6E-05	
Nickel	1.25E-05	4.00E-03	3.1E-03	
Silver	1.16E-07	1.00E-03	1.2E-04	
Vanadium	1.86E-06	1.40E-03	1.3E-03	
PCBs (Aroclor 1254)	3.49E-08	4.00E-06	8.7E-03	
1,2-Dichloroethylene	1.28E-03	1.80E-03	7.1E-01	
Trichloroethylene	3.72E-05	2.00E-03	1.9E-02	
Benzene	2.91E-05	NA	NA	
Tetrachloroethylene	4.07E-05	2.00E-03	2.0E-02	
Fluoranthene	4.19E-05	8.00E-03	5.2E-03	
Benzo(a)pyrene	4.19E-05	2.00E-05	2.1E+00	
				2.9E+00

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TABLE 6-8B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
GROUNDWATER DERMAL CONTACT RISK CHARACTERIZATION SUMMARY

Groundwater; Dermal Contact; Residents - (Current - Offsite / Future - Onsite & Off-site)

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	DERMAL SLOPE FACTOR (MG/KG-DAY)-1	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	2.00E-07	NA	NA	
Arsenic	9.98E-08	7.50E+00	7.5E-07	
Cadmium	6.98E-07	NA	NA	
Chromium	2.00E-07	NA	NA	
Copper	4.29E-06	NA	NA	
Lead	2.74E-06	NA	NA	
Manganese	9.18E-06	NA	NA	
Mercury	3.99E-08	NA	NA	
Nickel	5.34E-06	NA	NA	
Silver	4.99E-08	NA	NA	
Vanadium	7.98E-07	NA	NA	
PCBs (Aroclor 1254)	1.50E-08	3.85E+01	5.8E-07	
1,2-Dichloroethylene	5.49E-04	NA	NA	
Trichloroethylene	1.60E-05	5.50E-02	8.8E-07	
Benzene	1.25E-05	1.45E-01	1.8E-06	
Tetrachloroethylene	1.75E-05	2.60E-01	4.5E-06	
Fluoranthene	1.80E-05	NA	NA	
Benzo(a)pyrene	1.80E-05	3.65E+01	6.6E-04	
				6.6E-04

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Intakes and toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

Table 6-9
Summary of Exposure Point Concentrations
Soil Concentration Remaining After Sludge Removal
Lockheed Martin
Great Neck, New York

CHEMICAL	SUBSURFACE SOILS (MG/KG) (DRYWELLS & BORINGS) AFTER SLUDGE REMOVAL	
	95% UCL ON AVERAGE	MAXIMUM DETECTED
Antimony	2.86	4.00
Arsenic	7.99	24.90
Cadmium	2.64	8.40
Chromium	21.89	55
Copper	98.80	217
Lead	96.06	188
Manganese	317.93	683
Mercury	0.57	2
Nickel	17.78	25
Silver	0.65	1.90
Vanadium	14.74	39.30
PCBs (Aroclor 1254)	0.85	0.89
1,2-Dichloroethylene	14.98	< 65.00
Trichloroethylene	5.25	28
Benzene	0.096	0.096
Tetrachloroethylene	410.99	2,300
Fluoranthene	1.514	3.20
Benzo(a)pyrene	1.000	2.20

Notes:
Concentration for PCBs represent sum of the concentrations for Aroclors 1248, 1254, and 126

H2MGROUP

TABLE 6-10A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL INGESTION RISK CHARACTERIZATION SUMMARY
POST SLUDGE REMOVAL

Soil; Incidental Ingestion; Remediation Worker (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.34E-05	4.00E-04	3.4E-02	
Arsenic	3.75E-05	3.00E-04	1.3E-01	
Cadmium	1.24E-05	1.00E-03	1.2E-02	
Chromium	1.03E-04	5.00E-03	2.1E-02	
Copper	4.64E-04	6.00E-02	7.7E-03	
Lead	4.51E-04	0.00E+00	NA	
Manganese	1.49E-03	1.40E-01	1.1E-02	
Mercury	2.68E-06	3.00E-02	8.9E-05	
Nickel	8.35E-05	2.00E-02	4.2E-03	
Silver	3.05E-06	5.00E-03	6.1E-04	
Vanadium	6.92E-05	7.00E-03	9.9E-03	
PCBs (Aroclor 1254)	3.99E-06	2.00E-05	2.0E-01	
1,2-Dichloroethylene	7.04E-05	2.00E-01	3.5E-04	
Trichloroethylene	2.47E-05	1.00E-02	2.5E-03	
Benzene	4.51E-07	NA	NA	
Tetrachloroethylene	1.93E-03	1.00E-01	1.9E-02	
Fluoranthene	7.11E-06	4.00E-01	1.8E-05	
Benzo(a)pyrene	4.70E-06	1.00E-04	4.7E-02	
				4.9E-01

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	2.24E-07	4.00E-04	5.6E-04	
Arsenic	6.25E-07	3.00E-04	2.1E-03	
Cadmium	2.07E-07	1.00E-03	2.1E-04	
Chromium	1.71E-06	5.00E-03	3.4E-04	
Copper	7.73E-06	6.00E-02	1.3E-04	
Lead	7.52E-06	0.00E+00	NA	
Manganese	2.49E-05	1.40E-01	1.8E-04	
Mercury	4.46E-08	3.00E-02	1.5E-06	
Nickel	1.39E-06	2.00E-02	7.0E-05	
Silver	5.09E-08	5.00E-03	1.0E-05	
Vanadium	1.15E-06	7.00E-03	1.6E-04	
PCBs (Aroclor 1254)	6.65E-08	2.00E-05	3.3E-03	
1,2-Dichloroethylene	1.17E-06	9.00E-03	1.3E-04	
Trichloroethylene	4.11E-07	1.00E-02	4.1E-05	
Benzene	7.51E-09	NA	NA	
Tetrachloroethylene	3.22E-05	1.00E-02	3.2E-03	
Fluoranthene	1.19E-07	4.00E-02	3.0E-06	
Benzo(a)pyrene	7.83E-08	1.00E-04	7.8E-04	
				1.1E-02

Soil; Incidental Ingestion; Remediation Worker (Future)

H2MGROUP

TABLE 6-10A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL INGESTION RISK CHARACTERIZATION SUMMARY
POST SLUDGE REMOVAL

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	ORAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	9.58E-08	NA	NA	
Arsenic	2.68E-07	1.50E+00	4.0E-07	
Cadmium	8.86E-08	NA	NA	
Chromium	7.34E-07	NA	NA	
Copper	3.31E-06	NA	NA	
Lead	3.22E-06	NA	NA	
Manganese	1.07E-05	NA	NA	
Mercury	1.91E-08	NA	NA	
Nickel	5.96E-07	NA	NA	
Silver	2.18E-08	NA	NA	
Vanadium	4.94E-07	NA	NA	
PCBs (Aroclor 1254)	2.85E-08	7.70E+00	2.2E-07	
1,2-Dichloroethylene	5.03E-07	NA	NA	
Trichloroethylene	1.76E-07	1.10E-02	1.9E-09	
Benzene	3.22E-09	2.90E-02	9.3E-11	
Tetrachloroethylene	1.38E-05	5.20E-02	7.2E-07	
Fluoranthene	5.08E-08	NA	NA	
Benzo(a)pyrene	3.35E-08	7.30E+00	2.4E-07	
				1.6E-06

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Toxicity values were adjusted for adsorbtion where appropriate.

H2MGROUP

TABLE 6-10B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL INGESTION RISK CHARACTERIZATION SUMMARY
POST SLUDGE REMOVAL

Soil; Incidental Ingestion; Site Worker (Current/Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.34E-07	4.00E-04	3.4E-04	
Arsenic	3.75E-07	3.00E-04	1.3E-03	
Cadmium	1.24E-07	1.00E-03	1.2E-04	
Chromium	1.03E-06	5.00E-03	2.1E-04	
Copper	4.64E-06	6.00E-02	7.7E-05	
Lead	4.51E-06	0.00E+00	NA	
Manganese	1.49E-05	1.40E-01	1.1E-04	
Mercury	2.68E-08	3.00E-02	8.9E-07	
Nickel	8.35E-07	2.00E-02	4.2E-05	
Silver	3.05E-08	5.00E-03	6.1E-06	
Vanadium	6.92E-07	7.00E-03	9.9E-05	
PCBs (Aroclor 1254)	3.99E-08	2.00E-05	2.0E-03	
1,2-Dichloroethylene	7.04E-07	2.00E-01	3.5E-06	
Trichloroethylene	2.49E-07	1.00E-02	2.5E-05	
Benzene	4.51E-09	NA	NA	
Tetrachloroethylene	1.93E-05	1.00E-01	1.9E-04	
Fluoranthene	7.11E-08	4.00E-01	1.8E-07	
Benzo(a)pyrene	4.70E-08	1.00E-04	4.7E-04	
				4.9E-03

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.34E-07	4.00E-04	3.4E-04	
Arsenic	3.75E-07	3.00E-04	1.3E-03	
Cadmium	1.24E-07	1.00E-03	1.2E-04	
Chromium	1.03E-06	5.00E-03	2.1E-04	
Copper	4.64E-06	6.00E-02	7.7E-05	
Lead	4.51E-06	0.00E+00	NA	
Manganese	1.49E-05	1.40E-01	1.1E-04	
Mercury	2.68E-08	3.00E-02	8.9E-07	
Nickel	8.35E-07	2.00E-02	4.2E-05	
Silver	3.05E-08	5.00E-03	6.1E-06	
Vanadium	6.92E-07	7.00E-03	9.9E-05	
PCBs (Aroclor 1254)	3.99E-08	2.00E-05	2.0E-03	
1,2-Dichloroethylene	7.04E-07	9.00E-03	7.8E-05	
Trichloroethylene	2.49E-07	1.00E-02	2.5E-05	
Benzene	4.51E-09	NA	NA	
Tetrachloroethylene	1.93E-05	1.00E-02	NA	
Fluoranthene	7.11E-08	4.00E-02	1.8E-06	
Benzo(a)pyrene	4.70E-08	1.00E-04	4.7E-04	
				4.8E-03

H2MGROUP

TABLE 6-10B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL INGESTION RISK CHARACTERIZATION SUMMARY
POST SLUDGE REMOVAL

Soil; Incidental Ingestion; Site Worker (Current/Future)

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	ORAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	5.75E-08	NA	NA	
Arsenic	1.61E-07	1.50E+00	2.4E-07	
Cadmium	5.31E-08	NA	NA	
Chromium	4.41E-07	NA	NA	
Copper	1.99E-06	NA	NA	
Lead	1.93E-06	NA	NA	
Manganese	6.40E-06	NA	NA	
Mercury	1.15E-08	NA	NA	
Nickel	3.58E-07	NA	NA	
Silver	1.31E-08	NA	NA	
Vanadium	2.97E-07	NA	NA	
PCBs (Aroclor 1254)	1.71E-08	7.70E+00	1.3E-07	
1,2-Dichloroethylene	3.02E-07	NA	NA	
Trichloroethylene	1.07E-07	1.10E-02	1.2E-09	
Benzene	1.93E-09	2.90E-02	5.6E-11	
Tetrachloroethylene	8.27E-06	5.20E-02	4.30E-07	
Fluoranthene	3.05E-08	NA	NA	
Benzo(a)pyrene	2.01E-08	7.30E+00	1.5E-07	
				9.5E-07

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Toxicity values were adjusted for adsorbtion where appropriate.

H2MGROUP

TABLE 6-10C
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL CHARACTERIZATION RISK SUMMARY
POST SLUDGE REMOVAL

Soil; Ingestion; Residential (Adult & Child)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	2.64E-05	4.00E-04	6.6E-02	
Arsenic	7.39E-05	3.00E-04	2.5E-01	
Cadmium	2.44E-05	1.00E-03	2.4E-02	
Chromium	2.02E-04	5.00E-03	4.0E-02	
Copper	9.14E-04	6.00E-02	1.5E-02	
Lead	8.88E-04	0.00E+00	NA	
Manganese	2.94E-03	1.40E-01	2.1E-02	
Mercury	5.27E-06	3.00E-02	1.8E-04	
Nickel	1.64E-04	2.00E-02	8.2E-03	
Silver	6.01E-06	5.00E-03	1.2E-03	
Vanadium	1.36E-04	7.00E-03	1.9E-02	
PCBs (Aroclor 1254)	7.86E-06	2.00E-05	3.9E-01	
1,2-Dichloroethylene	1.39E-04	2.00E-01	6.9E-04	
Trichloroethylene	4.85E-05	1.00E-02	4.9E-03	
Benzene	8.88E-07	NA	NA	
Tetrachloroethylene	3.80E-03	1.00E-01	3.8E-02	
Fluoranthene	1.40E-05	4.00E-01	3.5E-05	
Benzo(a)pyrene	9.25E-06	1.00E-04	9.2E-02	
				9.7E-01

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	ORAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	7.70E-06	4.00E-04	1.9E-02	
Arsenic	2.15E-05	3.00E-04	7.2E-02	
Cadmium	7.11E-06	1.00E-03	7.1E-03	
Chromium	5.90E-05	5.00E-03	1.2E-02	
Copper	2.66E-04	6.00E-02	4.4E-03	
Lead	2.59E-04	0.00E+00	NA	
Manganese	8.57E-04	1.40E-01	6.1E-03	
Mercury	1.54E-06	3.00E-02	5.1E-05	
Nickel	4.79E-05	2.00E-02	2.4E-03	
Silver	1.75E-06	5.00E-03	3.5E-04	
Vanadium	3.97E-05	7.00E-03	5.7E-03	
PCBs (Aroclor 1254)	2.29E-06	2.00E-05	1.1E-01	
1,2-Dichloroethylene	4.04E-05	9.00E-03	4.5E-03	
Trichloroethylene	1.41E-05	1.00E-02	1.4E-03	
Benzene	2.59E-07	NA	NA	
Tetrachloroethylene	1.11E-03	1.00E-02	NA	
Fluoranthene	4.08E-06	4.00E-02	1.0E-04	
Benzo(a)pyrene	2.69E-06	1.00E-04	2.7E-02	
				2.8E-01

Soil; Ingestion; Residential (Adult & Child)

H2MGROUP

TABLE 6-10C
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL CHARACTERIZATION RISK SUMMARY
POST SLUDGE REMOVAL

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	ORAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	3.30E-06	NA	NA	
Arsenic	9.23E-06	1.50E+00	1.4E-05	
Cadmium	3.05E-06	NA	NA	
Chromium	2.53E-05	NA	NA	
Copper	1.14E-04	NA	NA	
Lead	1.11E-04	NA	NA	
Manganese	3.67E-04	NA	NA	
Mercury	6.58E-07	NA	NA	
Nickel	2.05E-05	NA	NA	
Silver	7.51E-07	NA	NA	
Vanadium	1.70E-05	NA	NA	
PCBs (Aroclor 1254)	9.82E-07	7.70E+00	7.6E-06	
1,2-Dichloroethylene	1.73E-05	NA	NA	
Trichloroethylene	6.06E-06	1.10E-02	6.7E-08	
Benzene	1.11E-07	2.90E-02	3.2E-09	
Tetrachloroethylene	4.75E-04	5.20E-02	2.5E-05	
Fluoranthene	1.75E-06	NA	NA	
Benzo(a)pyrene	1.15E-06	7.30E+00	8.4E-06	
				5.5E-05

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-11A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL DERMAL CONTACT RISK CHARACTERIZATION SUMMARY
POST SLUDGE REMOVAL

Soil; Dermal Contact; Remediation Worker (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.74E-04	8.00E-05	2.2E+00	
Arsenic	4.87E-04	6.00E-05	8.1E+00	
Cadmium	1.61E-04	2.00E-04	8.1E-01	
Chromium	1.34E-03	1.00E-03	1.3E+00	
Copper	6.03E-03	1.20E-02	5.0E-01	
Lead	5.86E-03	0.00E+00	NA	
Manganese	1.94E-02	2.80E-02	6.9E-01	
Mercury	3.48E-05	6.00E-03	5.8E-03	
Nickel	1.08E-03	4.00E-03	2.7E-01	
Silver	3.97E-05	1.00E-03	4.0E-02	
Vanadium	8.99E-04	1.40E-03	6.4E-01	
PCBs (Aroclor 1254)	5.19E-05	4.00E-06	1.3E+01	
1,2-Dichloroethylene	9.14E-04	4.00E-02	2.3E-02	
Trichloroethylene	3.20E-04	2.00E-03	1.6E-01	
Benzene	5.86E-06	NA	NA	
Tetrachloroethylene	2.51E-02	2.00E-02	1.3E+00	
Fluoranthene	9.24E-05	8.00E-02	1.2E-03	
Benzo(a)pyrene	6.10E-05	2.00E-05	3.1E+00	
				3.2E+01

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	2.91E-06	8.00E-05	3.6E-02	
Arsenic	8.12E-06	6.00E-05	1.4E-01	
Cadmium	2.68E-06	2.00E-04	1.3E-02	
Chromium	2.23E-05	1.00E-03	2.2E-02	
Copper	1.00E-04	1.20E-02	8.4E-03	
Lead	9.77E-05	0.00E+00	NA	
Manganese	3.23E-04	2.80E-02	1.2E-02	
Mercury	5.80E-07	6.00E-03	9.7E-05	
Nickel	1.81E-05	4.00E-03	4.5E-03	
Silver	6.61E-07	1.00E-03	6.6E-04	
Vanadium	1.50E-05	1.40E-03	1.1E-02	
PCBs (Aroclor 1254)	8.64E-07	4.00E-06	2.2E-01	
1,2-Dichloroethylene	1.52E-05	1.80E-03	8.5E-03	
Trichloroethylene	5.34E-06	2.00E-03	2.7E-03	
Benzene	9.76E-08	NA	NA	
Tetrachloroethylene	4.18E-04	2.00E-03	2.1E-01	
Fluoranthene	1.54E-06	8.00E-03	1.9E-04	
Benzo(a)pyrene	1.02E-06	2.00E-05	5.1E-02	
				7.3E-01

Soil; Dermal Contact; Remediation Worker (Future)

H2MGROUP

TABLE 6-11A
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL DERMAL CONTACT RISK CHARACTERIZATION SUMMARY
POST SLUDGE REMOVAL

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	DERMAL SLOPE FACTOR (MG/KG-DAY)-1	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	1.25E-06	NA	NA	
Arsenic	3.48E-06	7.50E+00	2.6E-05	
Cadmium	1.15E-06	NA	NA	
Chromium	9.54E-06	NA	NA	
Copper	4.31E-05	NA	NA	
Lead	4.19E-05	NA	NA	
Manganese	1.39E-04	NA	NA	
Mercury	2.48E-07	NA	NA	
Nickel	7.75E-06	NA	NA	
Silver	2.83E-07	NA	NA	
Vanadium	6.42E-06	NA	NA	
PCBs (Aroclor 1254)	3.70E-07	3.85E+01	1.4E-05	
1,2-Dichloroethylene	6.53E-06	NA	NA	
Trichloroethylene	2.29E-06	5.50E-02	1.3E-07	
Benzene	4.18E-08	1.45E-01	6.1E-09	
Tetrachloroethylene	1.79E-04	2.60E-01	4.7E-05	
Fluoranthene	6.60E-07	NA	NA	
Benzo(a)pyrene	4.36E-07	3.65E+01	1.6E-05	
				1.0E-04

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-11B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL DERMAL CONTACT RISK CHARACTERIZATION SUMMARY
POST SLUDGE REMOVAL

Soil; Dermal Contact; Site Worker (Current & Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	8.37E-06	8.00E-05	1.0E-01	
Arsenic	2.34E-05	6.00E-05	3.9E-01	
Cadmium	7.73E-06	2.00E-04	3.9E-02	
Chromium	6.41E-05	1.00E-03	6.4E-02	
Copper	2.89E-04	1.20E-02	2.4E-02	
Lead	2.81E-04	0.00E+00	NA	
Manganese	9.31E-04	2.80E-02	3.3E-02	
Mercury	1.67E-06	6.00E-03	2.8E-04	
Nickel	5.21E-05	4.00E-03	1.3E-02	
Silver	1.90E-06	1.00E-03	1.9E-03	
Vanadium	4.32E-05	1.40E-03	3.1E-02	
PCBs (Aroclor 1254)	2.49E-06	4.00E-06	6.2E-01	
1,2-Dichloroethylene	4.39E-05	4.00E-02	1.1E-03	
Trichloroethylene	1.55E-05	2.00E-03	7.8E-03	
Benzene	2.81E-07	NA	NA	
Tetrachloroethylene	1.20E-03	2.00E-02	6.0E-02	
Fluoranthene	4.43E-06	8.00E-02	5.5E-05	
Benzo(a)pyrene	2.93E-06	2.00E-05	1.5E-01	
				1.5E+00

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	8.37E-06	8.00E-05	1.0E-01	
Arsenic	2.34E-05	6.00E-05	3.9E-01	
Cadmium	7.73E-06	2.00E-04	3.9E-02	
Chromium	6.41E-05	1.00E-03	6.4E-02	
Copper	2.89E-04	1.20E-02	2.4E-02	
Lead	2.81E-04	0.00E+00	NA	
Manganese	9.31E-04	2.80E-02	3.3E-02	
Mercury	1.67E-06	6.00E-03	2.8E-04	
Nickel	5.21E-05	4.00E-03	1.3E-02	
Silver	1.90E-06	1.00E-03	1.9E-03	
Vanadium	4.32E-05	1.40E-03	3.1E-02	
PCBs (Aroclor 1254)	2.49E-06	4.00E-06	6.2E-01	
1,2-Dichloroethylene	4.39E-05	1.80E-03	2.4E-02	
Trichloroethylene	1.55E-05	2.00E-03	7.8E-03	
Benzene	2.81E-07	NA	NA	
Tetrachloroethylene	1.20E-03	2.00E-03	6.0E-01	
Fluoranthene	4.43E-06	8.00E-03	5.5E-04	
Benzo(a)pyrene	2.93E-06	2.00E-05	1.5E-01	
				2.1E+00

Soil; Dermal Contact; Site Worker (Future)

H2MGROUP

TABLE 6-11B
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL DERMAL CONTACT RISK CHARACTERIZATION SUMMARY
POST SLUDGE REMOVAL

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	DERMAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	3.59E-06	NA	NA	
Arsenic	1.00E-05	7.50E+00	7.5E-05	
Cadmium	3.31E-06	NA	NA	
Chromium	2.75E-05	NA	NA	
Copper	1.24E-04	NA	NA	
Lead	1.21E-04	NA	NA	
Manganese	3.99E-04	NA	NA	
Mercury	7.15E-07	NA	NA	
Nickel	2.23E-05	NA	NA	
Silver	8.16E-07	NA	NA	
Vanadium	1.85E-05	NA	NA	
PCBs (Aroclor 1254)	1.07E-06	3.85E+01	4.1E-05	
1,2-Dichloroethylene	1.88E-05	NA	NA	
Trichloroethylene	6.65E-06	5.50E-02	3.7E-07	
Benzene	1.20E-07	1.45E-01	1.7E-08	
Tetrachloroethylene	5.16E-04	2.60E-01	1.3E-04	
Fluoranthene	1.90E-06	NA	NA	
Benzo(a)pyrene	1.26E-06	3.65E+01	4.6E-05	
				3.0E-04

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Toxicity values were adjusted for adsorbtion where appropriate

H2MGROUP

TABLE 6-11C
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL DERMAL CONTACT RISK CHARACTERIZATION SUMMARY
POST SLUDGE REMOVAL

Soil; Dermal Contact; Residential (Future)

SUB-CHRONIC RISKS:

CHEMICAL	SUB-CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	4.28E-04	8.00E-05	5.3E+00	
Arsenic	1.20E-03	6.00E-05	2.0E+01	
Cadmium	3.95E-04	2.00E-04	2.0E+00	
Chromium	3.28E-03	1.00E-03	3.3E+00	
Copper	1.48E-02	1.20E-02	1.2E+00	
Lead	1.44E-02	0.00E+00	NA	
Manganese	4.76E-02	2.80E-02	1.7E+00	
Mercury	8.54E-05	6.00E-03	1.4E-02	
Nickel	2.66E-03	4.00E-03	6.7E-01	
Silver	9.73E-05	1.00E-03	9.7E-02	
Vanadium	2.21E-03	1.40E-03	1.6E+00	
PCBs (Aroclor 1254)	1.27E-04	4.00E-06	3.2E+01	
1,2-Dichloroethylene	2.24E-03	4.00E-02	5.6E-02	
Trichloroethylene	7.86E-04	2.00E-03	3.9E-01	
Benzene	1.44E-05	NA	NA	
Tetrachloroethylene	6.15E-02	2.00E-02	3.1E+00	
Fluoranthene	2.27E-04	8.00E-02	2.8E-03	
Benzo(a)pyrene	1.50E-04	2.00E-05	7.5E+00	
				7.9E+01

CHRONIC RISKS (NON-CARCINOGENIC):

CHEMICAL	CHRONIC INTAKE (MG/KG-DAY)	DERMAL RfD (MG/KG-DAY)	HAZARD QUOTIENT	TOTAL PATHWAY INDEX
Antimony	4.29E-04	8.00E-05	5.4E+00	
Arsenic	1.20E-03	6.00E-05	2.0E+01	
Cadmium	3.96E-04	2.00E-04	2.0E+00	
Chromium	3.29E-03	1.00E-03	3.3E+00	
Copper	1.48E-02	1.20E-02	1.2E+00	
Lead	1.44E-02	0.00E+00	NA	
Manganese	4.77E-02	2.80E-02	1.7E+00	
Mercury	8.56E-05	6.00E-03	1.4E-02	
Nickel	2.67E-03	4.00E-03	6.7E-01	
Silver	9.76E-05	1.00E-03	9.8E-02	
Vanadium	2.21E-03	1.40E-03	1.6E+00	
PCBs (Aroclor 1254)	1.28E-04	4.00E-06	3.2E+01	
1,2-Dichloroethylene	2.25E-03	1.80E-03	1.2E+00	
Trichloroethylene	7.88E-04	2.00E-03	3.9E-01	
Benzene	1.44E-05	NA	NA	
Tetrachloroethylene	6.17E-02	2.00E-03	3.1E+01	
Fluoranthene	2.27E-04	8.00E-03	2.8E-02	
Benzo(a)pyrene	1.50E-04	2.00E-05	7.5E+00	
				1.1E+02

Soil; Dermal Contact; Residential (Future)

H2MGROUP

TABLE 6-11C
LOCKHEED MARTIN
REMEDIAL INVESTIGATION
SOIL DERMAL CONTACT RISK CHARACTERIZATION SUMMARY
POST SLUDGE REMOVAL

CARCINOGENIC EFFECTS:

CHEMICAL	LIFETIME INTAKE (MG/KG-DAY)	DERMAL SLOPE FACTOR (MG/KG-DAY)-1	CANCER RISK	TOTAL PATHWAY INDEX
Antimony	1.84E-04	NA	NA	
Arsenic	5.14E-04	7.50E+00	3.9E-03	
Cadmium	1.70E-04	NA	NA	
Chromium	1.41E-03	NA	NA	
Copper	6.36E-03	NA	NA	
Lead	6.18E-03	NA	NA	
Manganese	2.05E-02	NA	NA	
Mercury	3.67E-05	NA	NA	
Nickel	1.14E-03	NA	NA	
Silver	4.18E-05	NA	NA	
Vanadium	9.49E-04	NA	NA	
PCBs (Aroclor 1254)	5.47E-05	3.85E+01	2.1E-03	
1,2-Dichloroethylene	9.64E-04	NA	NA	
Trichloroethylene	3.38E-04	5.50E-02	1.9E-05	
Benzene	6.18E-06	1.45E-01	9.0E-07	
Tetrachloroethylene	2.64E-02	2.60E-01	6.9E-03	
Fluoranthene	9.74E-05	NA	NA	
Benzo(a)pyrene	6.44E-05	3.65E+01	2.3E-03	
				1.5E-02

NOTES:
Low-dose cancer risk equation was used to calculate carcinogenic risks.
Toxicity values were adjusted for adsorbtion where appropriate

APPENDIX A
INDICATOR CHEMICAL PROFILES

APPENDIX A
INDICATOR CHEMICAL PROFILES

Antimony:

The IRIS database contained both qualitative and quantitative toxicity information on antimony and was used as the primary reference. An oral RfD for antimony of 4E-4 mg/kg-day was derived from drinking water studies using rats. The study was performed on rats. Intake was by oral chronic ingestion of potassium antimony tartrate in water. The study did not identify any affects of growth rates of the treated animals, however, the lifespans of the treated animals were lower than for the control group at median lifespans. In addition, the study found that nonfasting blood glucose levels were decreased in treated males, and cholesterol levels were altered in both sexes. In addition, a decrease in mean heart weight for the males was noted. No increase in tumors was seen as a result of treatment. Although not precisely stated, the concentration of 5 ppm antimony was expressed as an exposure (LOAEL) of 0.35 mg/kg bw/day by the authors of the study. An uncertainty factor of 1000 (10 for interspecies conversion, 10 to protect sensitive individuals, and 10 because the effect level was a LOAEL and no NOEL was established) was applied to the LOAEL of 0.35 mg/kg bw/day, resulting in an oral reference dose of 4E-4 mg/kg-day. Reference concentrations for chronic inhalation exposures (RfC's) are not currently available for antimony. This substance/agent has not been evaluated by the U.S. EPA for evidence of human carcinogenic potential.

Arsenic:

The oral RfD and NOAEL for arsenic was developed by on studies conducted on humans via ingestion of water. Studies have shown increased incidences of hyperpigmentation and keratosis, and possible vascular complications. Increased incidence of skin lesions and abnormal nerve conduction may also be linked to arsenic exposure, however, the association between skin cancer and arsenic is weak because of the small number of cases, small cohort size, and short duration of the study. The NOAEL was based on an arithmetic mean of 0.009 mg/L, converted was to 0.0008 mg/kg-day. An uncertainty factor of 3 was used to account for both the lack of data to preclude reproductive toxicity as a

critical effect and to account for some uncertainty in whether the NOAEL of the critical study accounts for all sensitive individuals. The oral RfD for arsenic is 3E-4 mg/kg-day. The inhalation reference does (RfC) is not available at this time.

EPA has classified arsenic in Group A - Human Carcinogen based on sufficient evidence from human data. An increased lung cancer mortality was observed in multiple human populations exposed primarily through inhalation. Also, increased mortality from multiple internal organ cancers (liver, kidney, lung, and bladder) and an increased incidence of skin cancer were observed in populations consuming drinking water high in inorganic arsenic. The oral slope factor and inhalation unit risk factor developed for arsenic are: .5E+0 $(mg/kg\text{-}day)^{-1}$ and 4.3E-6$(mg/cu.m)^{-1}$, respectively.

Cadmium:

The IRIS database contained both qualitative and quantitative toxicity information on cadmium and was used as the primary reference. A chronic oral RfD for cadmium of 1E-03 mg/kg-day was derived from human studies involving chronic exposures.. The RfD was calculated from a NOAEL of 0.01 mg/kg-day and an uncertainty factor of 10 to account for intrahuman variability and the absence of specific data on sensitive individuals. The confidence level in the cadmium oral RfD is considered high due to the large number of studies performed on both humans and animals. Reference concentrations for chronic inhalation exposures (RfC's) are not currently available for cadmium; however, NYSDOH has developed an ambient air criterion (AAC) value of 0.02 ug/m3 that can be used for concentration comparisons. The reader is referred to NYSDOH "Ambient Air Criteria Document-Cadmium", March 1990 for additional information regarding toxicological studies performed to derive the AAC value for cadmium.

Cadmium is classified as a B1 carcinogen and has been shown to induce carcinogenicity in rats and mice by inhalation and intramuscular and subcutaneous injection. Oral doses of cadmium salts have shown no evidence of carcinogenic response, therefore, no oral slope factors or unit risks are available in IRIS, HEAST or NYSDOH documents. The unit inhalation risk for cadmium

was calculated by a two stage extrapolation method to be 1.8E-03 $(ug/m3)^{-1}$. The amount and confidence level of human carcinogenic data is considered limited.

Chromium:

The IRIS database contained both qualitative and quantitative toxicity information on chromium (III) and was used as the primary reference. A chronic oral RfD for chromium of 1E+00 mg/kg-day was derived from rat chronic feeding studies. The RfD was calculated from a NOAEL of 1468 mg/kg-day and an uncertainty factor of 100 to account for intrahuman and interspecies variability. The NOAEL was further modified using a modifying factor of 10 to reflect uncertainty in the NOAEL. The confidence level in the chromium oral RfD is considered low due to the lack of explicit detail on the study protocol and results, as well as the lack of high dose supporting data. Reference concentrations for chronic inhalation exposures (RfC's) are not currently available for chromium but are under review by an EPA work group. NYSDOH has developed an ambient air criteria (AAC) value of 0.1 ug/m3 which can be used for concentration comparisons. The reader is referred to NYSDOH "Ambient Air Criteria Document-Chromium", January 1990 for additional information regarding toxicological studies performed to derive the AAC value for chromium. The IRIS database notes that chromium is currently being investigated by an EPA work group; however, there is currently no quantitative carcinogenic data available.

Lead:

The IRIS database contained only qualitative toxicity information on lead and was used as the primary reference. A chronic oral RfD for lead is unavailable and the IRIS database states that the EPA's work group "considered it inappropriate to develop an RfD for inorganic lead." For this reason, an estimate of the oral RfD for lead will not be made and the risk assessment will be performed qualitatively only. Reference concentrations for chronic inhalation exposures (RfC's) are not currently available for lead. The U.S. Department of Health and Human Services (USDOHHS) has issued a Toxicological Profile for Lead which documents hundreds of studies related to lead exposure and human

intakes. However; due to the high variability in the data obtained, the USDOHHS document limited its discussions to LOAELs and NOAELs without estimating uncertainty factors to derive an RfD.

The IRIS database contained substantial qualitative but only limited quantitative carcinogenic information on lead. Lead is classified as a B2 carcinogen and has been shown to induce carcinogenicity in rats and mice by ingestion and subcutaneous injection. Human carcinogenic data is considered inadequate. Due to numerous uncertainties in quantifying cancer risks related to lead exposure, no oral slope factors or unit risks are available in IRIS, HEAST or NYSDOH documents.

Manganese:

EPA established a chronic oral reference dose (RfD) of 1.4E-1 mg/kg-day for manganese based on no observed adverse effects (NOAEL) in food of 10 mg/day (0.14 mg/kg-day). An uncertainty factor of 1 was used. EPA calculated an inhalation reference dose (RfC) based upon occupational studies. and using a LOAEL based on an 8-hour TWA occupational exposure. The inhalation RfC is 5E-5 mg/cu.m., based on an uncertainty factor of 1000 (10 to protect sensitive individuals, 10 for use of a LOAEL, and 10 for database limitations reflecting both the less-than-chronic periods of exposure and the lack of developmental data, as well as potential but unquantified differences in the toxicity of different forms of manganese. Both the oral and inhalation intake values are based upon central nervous system effects.

Mercury:

EPA has reported both oral and inhalation reference doses for mercury. The oral reference dose of 3.0E-4 mg/kg-day was developed based on mercuric chloride, while the inhalation reference dose (RfC) is based on elemental mercury. The central nervous system is a major target for organic mercury compounds. Adverse effects in humans, resulting from sub-chronic and chronic inhalation exposures to mercury vapors include neurobehavioral effects, hand tremors, and memory disturbances, and autonomic dysfunction. Exposure to organic mercury

compounds have included destruction of cortical cerebral neurons and lesions of the cerebellum.

EPA has assigned a weight-of-evidence classification of D; not classifiable as to human carcinogenicity. A number of epidemiological studies have been conducted that examined mortality among elemental mercury vapor-exposed workers. Epidemiologic studies failed to show a correlation between exposure to elemental mercury vapor and carcinogenicity. Conflicting data regarding a correlation between mercury exposure and an increased incidence of cancer mortalities have been obtained. Findings from genotoxicity tests are severely limited and provide equivocal evidence that mercury adversely affects the number or structure of chromosomes in human somatic cells.

Nickel:

The oral RfD for nickel of 2E-2 mg/kg-day (using an uncertainty factor of 300) is based on a 2-year feeding study using rats given concentrations of nickel resulted in depressed body and organ weights. A similar result occurred in a study using dogs. The NOAEL of 5 mg/kg/day was developed. In addition to the effects on organ weights, two other sensitive endpoints exist: neonatal mortality and dermatotoxicity. While no reproductive effects have been associated with nickel exposure to humans, several studies in laboratory animals have demonstrated fetotoxicity. A risk assessment for this substance/agent is under review by an EPA work group.

Silver:

The critical effect in humans ingesting silver is argyria, a medically benign but permanent bluish-gray discoloration of the skin. Argyria results from the deposition of silver in the dermis and also from silver-induced production of melanin. Although the deposition of silver is permanent, it is not associated with any adverse health effects. No pathologic changes or inflammatory reactions have been shown to result from silver deposition. Silver compounds have been employed for medical uses for centuries. In the nineteenth and early twentieth centuries, silver arsphenamine was used in the treatment of syphillis; more recently it has been used as an astringent in topical preparations. While argyria

occurred more commonly before the development of antibiotics, it is now a rare occurrence. The oral RfD for silver is 5E-3 mg/kg-day, based on a NOAEL of 1 gram (total dose) or 0.014 mg/kg/day. An inhalation reference dose is presently not available. No evidence of cancer in humans has been reported despite frequent therapeutic use of the compound over the years.

PCBs:

Quantitative toxicity information on Aroclor 1254 was used as the primary reference for the oral RfD value. A chronic oral RfD for PCBs was derived from monkey clinical and immunologic studies. Varying does of Aroclor 1254 was administered to 12 monkeys for five years. Analyses of clinical signs of toxicity identified increased occurrences of ocular exudate, inflammation and/or prominence of the eyelid Meibomian (tarsal) glands, distorted growth of finger and toe nails, and decreased antibody(IgG and IgM) response to sheep erythrocytes. The RfD was calculated from a NOAEL of 0.005 mg/kg-day and an uncertainty factor of 300 to account for interspecies differences and limitations in the database . The confidence level in the PCB oral RfD is considered medium since only one group of monkeys has been examined even though the study was well conducted. Reference concentrations for chronic inhalation exposures (RfC's) are not currently available for PCBs.

PCBs are classified as B2 carcinogens because sufficient evidence of liver tumors were induced in rats, and suggestive evidence of liver tumors in humans exists. The oral slope factor was calculated to be 7.7E $(mg/kg\text{-}day)^{-1}$. The drinking water unit risk is estimated at 2.2E-4 $(ug/l)^{-1}$. The amount and confidence level of carcinogenic data is considered adequate.

1,2-Dichloroethene:

The IRIS database contained both qualitative and quantitative toxicity information on trans-1,2-dichloroethene and was used as the primary reference. A chronic oral RfD for 1,2-DCE of 2E-02 mg/kg-day was derived 90 day mouse drinking water studies. The RfD was calculated from a NOAEL of 17 mg/kg-day and an uncertainty factor of 1000 to account for uncertainty in extrapolation of a sub-chronic RfD to its chronic equivalent, uncertainty in the threshold for

sensitive human sub-populations, and uncertainty related to extrapolation of dose levels from laboratory animals to humans. The confidence level in the 1,2-DCE oral RfD is considered low due to the lack of chronic studies and the lack of data on reproductive and developmental toxicity. Reference concentrations for chronic inhalation exposures (RfC's) are not currently available for 1,2-DCE.

1,2-DCE is classified as a D carcinogen and as such is by definition, not classifiable as to human carcinogenicity. No reported human data and animal studies have demonstrated carcinogenicity and mutagenicity assays have shown generally nonpositive results. Since 1,2-DCE is a Class D Carcinogen, no oral slope factors or unit risks are available in IRIS, HEAST or NYSDOH documents.

Trichloroethylene:

This compound is a central nervous system depressant. In humans, ingestion of TCE of 15 ml to 25 ml (21 to 35 grams) can result in vomiting and abdominal pain, followed by transient unconsciousness. High level exposures can result in death due to respiratory and cardiac failure.

EPA has classified TCE in Group B2: sufficient evidence in animals and inadequate evidence in humans. Significant increases in the incidence of liver tumors have been reported in B6C3F1 mice of both sexes. Malignant lymphomas and pulmonary adenocarcinomas were also reported in mice. In July 1989, EPA withdrawn the carcinogenicity file for TCE from IRIS. The quantitative risk estimates provided in the 1985 HEAST and 1987 Addendum have been reviewed by IRIS-CRAVE Workgroup but are not verified because EPA has not taken a position on the weight-of-evidence classification for TCE. The upper bound risk values from the 1985 HEAST for oral slope factor and drinking unit risk are 1.1E-2 $(mg/kg/day)^{-1}$ and 3.2E-4 $(mg/L)^{-1}$. Inhalation slope factor is 6.0E-3 $(mg/kg/day)^{-1}$ and inhalation unit risk is 1.7E-3 $(mg/cu.m)^{-1}$.

Benzene:

Benzene is classified with a weight-of-evidence of A; human carcinogen. Studies have found increased incidence of nonlymphocytic leukemia from occupational exposure, increased incidence of neoplasia in rats and mice exposed by inhalation and gavage from exposure to benzene. The oral slope factor for benzene is 2.9E-2 $(mg/kg/day)^{-1}$. EPA is currently developing an inhalation slope factor for benzene.

Tetrachloroethylene:

A chronic oral RfD for tetrachloroethylene of 1E-02 mg/kg-day was derived from 6 week mouse studies. The RfD was calculated from a NOAEL of 14 mg/kg-day and an uncertainty factor of 1000 to account for intra and interspecies variation and extrapolation of a sub-chronic RfD to its chronic equivalent. The confidence level in the tetrachloroethylene oral RfD is considered medium due to the lack of study encompassing all necessary factors for the proper derivation of an RfD. Reference concentrations for chronic inhalation exposures (RfC's) are not currently available for tetrachloroethylene.

The IRIS database is currently being updated to include tetrachloroethylene studies performed recently. ECAO has provided quantitative and qualitative information to be incorporated in the Loral risk assessment. Tetrachloroethylene classification is currently being modified and will either be a class C or class B2 carcinogen after EPA finalizes its review. Oral and inhalation slope factors and unit risks have been developed by USEPA but have not yet been validated by the IRIS -CRAVE work group. The proposed oral slope factor is 5.2E-02 $(mg/kg-day)^{-1}$. The proposed drinking water unit risk is estimated at 1.50E-06 $(ug/l)^{-1}$. The proposed inhalation slope factor for tetrachloroethylene was calculated to be 2.0E-03 $(mg/kg-day)^{-1}$. A final determination as to the confidence of both human and animal study data is not yet available.

Fluoranthene:

The oral RfD for this compounds is 4E-2 mg/kg-day, based on a NOAEL of 125 mg/kg/day and an uncertainty factor of 3000. Male and female CD-1 mice were gavaged for 13 weeks doses of fluoranthene. Body weight, food consumption,

and hematological and serum parameter values were recorded at regular intervals during the experiment. At the end of 13 weeks, the animals were sacrificed and autopsied, which included organ weight measurement and histological evaluation. All treated mice exhibited nephropathy, increased salivation, and increased liver enzyme levels in a dose-dependent manner. Mice exposed to the higher doses of fluoranthene had increased food consumption and increased body weight, and increased liver weights. A risk assessment for this substance/agent is under review by an EPA work group. Fluoranthene is assigned a weight-of-evidence classification of D based on no human data and inadequate data from animal bioassays.

Benzo(a)pyrene:

The IRIS database and HEAST did not contain any data on the non-carcinogenic effects of benzo(a)pyrene. NYSDEC and NYSDOH was contacted for assistance and it was recommended that the NYSDOH "Ambient Air Criteria Document-Polynuclear Aromatic Hydrocarbons", November 1989 by used for guidance in deriving an oral RfD for benzo(a)pyrene. The NYSDOH AACD quotes that reproductive effects have been observed following oral exposures to benzo(a)pyrene of 10 mg/kg-day; however there is only limited discussion of the details of the study. For the purposes of the Loral risk assessment, an uncertainty factor of 1000 will be used to account for sensitive sub-populations, interspecies variation between humans and other mammals, and uncertainty in extrapolating from NOAELs. Use of the 10 mg/kg-day NOAEL and the 1000 uncertainty factor yields an approximate chronic oral RfD of 1E-04 mg/kg-day. The confidence level in the benzo(a)pyrene oral RfD is considered extremely low because of the lack of information available regarding oral toxicity studies. Reference concentrations for chronic inhalation exposures (RfC's) are not currently available for benzo(a)pyrene.

Benzo(a)pyrene is classified as a B2 carcinogen because lung cancer has been shown to be induced in humans by varying mixtures of polynuclear aromatic hydrocarbons known to contain benzo(a)pyrene. It is not possible to conclude that benzo(a)pyrene was directly responsible for the documented responses. The oral slope factor was calculated to be 7.3 $(mg/kg\text{-}day)^{-1}$. The drinking water unit risk is estimated at 2.10E-04 $(ug/l)^{-1}$. An inhalation slope factor of 2.1

$(mg/kg\text{-}day)^{-1}$ was determined by NYSDOH during study performed as part of ambient air criteria development. The amount and confidence level of animal carcinogenic data is considered sufficient due to the presence of numerous studies with proper procedures and validated results. Human data is considered inadequate because studies specifically on benzo(a)pyrene (as compared to general PAH's) have not been validated.