MCDONNELL DOUGLAS

Douglas Aircraft Company

INTEGRATED
Environmental Services, Inc.

REVIEW COMMENTS

on the

Lockheed Martin Corporation
International Light Metals Division
Baseline Risk Assessment
Dated March 22, 1996

ILM Facility
19200 South Western Avenue
Los Angeles, California

April 29, 1997

Prepared for:

McDonnell Douglas Reality Company

Prepared by:

Integrated Environmental Services, Inc.

3990 Westerly Place, Suite 210 ◆ Newport Beach, CA 92660 ◆ Tel: (714) 852-9050 ◆ Fax: (714) 852-9011

Review Comments on the Lockheed Martin Corporation, International Light Metals Division Baseline Risk Assessment

Finding 1. The Baseline Risk Assessment Fails to use Chemical Parameters Approved by Cal/EPA

The Preliminary Endangerment Assessment (PEA) guidance (Cal/EPA 1994) is referenced in the Baseline Risk Assessment as a source of information necessary for the preparation, review and interpretation of the risk assessment. For the 20 chemicals presented in the table below, the values for the chemical-specific characteristics used in the risk calculations (Table 6-1 of the risk assessment) conflict with the values cited in the PEA manual. The non-PEA values were subsequently used in the air dispersion modeling, groundwater modeling, exposure assessment, and health-based goal (HBG) derivation.

	Chemical Characteristics from PEA Manual					
Compound	**Henry's Law Constant ($atm\text{-}m^3/mol$)**	**Water Solubility (mg/l)**	**Diffusivity in Air (cm^2/sec)**	**Koc (l/kg)**	**Vapor Pressure (mm Hg)**	**Log Kow**
Benzene	5.43E-03	1791	0.088	65	-	2.13
Carbon Tetrachloride	3.04E-02	805	-	110	-	2.83
Chlorobenzene	3.45E-03	471.7	-	160	-	2.84
Chloroform	4.35E-03	7970	-	31	246	1.97
1,1-Dichlorobenzene	1.20E-03	156	0.13	1148	-	3.83
1,1-Dichloroethane	-	-	0.091	-	-	1.79
1,2-Dichloroethane	9.77E-04	8524	0.091	14	-	1.48
1,1-Dichloroethene	1.54E-01	400	0.079	-	-	-
1,2-Dichloroethene (trans)	6.72E-03	-	0.079	-	340	2.06
Ethylbenzene	8.44E-03	161	0.075	220	-	3.15
Methylene Chloride	-	13000	0.101	8.8	435	1.25
Anthracene	3.40E-05	0.08	0.058	12589	-	-
Fluorene	6.42E-05	1.9	0.061	7900	-	-
Naphthalene	5.00E-04	31.7	0.069	1288	0.082	3.3
Toluene	5.94E-03	534.8	-	257.04	-	2.73
Tetrachloroethene	1.49E-02	150.3	0.072	660.69	-	3.4
1,1,1-Trichloroethane	8.00E-03	1495	-	150	-	2.49
1,1,2-Trichloroethane	1.20E-03	4420	-	-	-	2.07
Trichloroethene	1.03E-02	1100	-	125.89	69	2.42
Xylenes	5.30E-03	200	-	240	-	-

Note:

- Indicates no discrepancy

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Impact of Finding 1

If the value of a chemical parameter used in the risk assessment calculations is not referenced to a regulatory source or independently confirmed, then the results of the risk assessment are suspect. The cumulative effects of these multiple changes could not be completely quantified in the limited review period; however, a review of impacts associated with the revised values for 1,1-dichloroethene indicates a full order-of-magnitude (10x) underestimation of receptor risks under the commercial land-use scenario.

Finding 2. Chemical Parameter Values used in the Baseline Risk Assessment Cannot be Independently Verified

Table 6-1 of the risk assessment presents ranges for numerous chemical-specific physical parameters. However, the values used in the risk assessment are not presented. The table should only present the specific values used in the computer modeling and risk calculations. In addition, discrete references should be provided so that the sources for each parameter can be verified.

Impact of Finding 2

The inclusion of these values in the risk assessment definitely increases the uncertainty in the verification of calculations. Based on the sources used and the robustness of the studies referenced, projected human health impacts and the associated cleanup levels could be significantly impacted.

Finding 3. The Wrong Soil-Cover Depth is used in the Risk Calculations, Thus Underestimating the Potential Impact to Human Health

Under the commercial/industrial exposure scenario, all subsurface contamination has been assigned an artificial depth of 15 feet (X = 457 cm) in the Daughtery emissions model. However, the tables referenced for exposure point concentrations (Tables A-3, A-7, A-16, A-19, A-23, A-26, A-30, A-34, A-38, A-42, A-45, and A-49) report these concentrations as being only at a depth greater than 2 feet. Therefore, the reasonable maximum depth to contamination that can be assumed is 2 feet (X = 60 cm). This value should be used in the calculation of future indoor air concentrations at the site.

Impact of Finding 3

Indoor air concentrations are increased in a linear fashion with decreased depth to the source term. Currently, the indoor air concentrations are underestimated by 760 percent based on the data tables provided in Appendix A of the risk assessment. This significantly impacts the potential risk to commercial/industrial workers.

Finding 4. Subdividing the Site Violates the Principle of Assessing Site-Wide Risks and Underestimates the Actual Risks Posed by the Site

For risk assessment purposes, the ILM site was subdivided into 16 "areas of potential concern" (AOPCs), and separate risk assessment calculations were performed for each area. Aggregate impacts from all sources defined on

the site are unknown. The cumulative impacts of emissions from all sources in the AOPCs are not quantified in the risk assessment. The segregated evaluation of emissions is not likely to reflect real-world exposures; nor is it conservative. The reasonable maximum approach would be to identify the on- and off-site points of maximum concentration originating from all site sources and to aggregate these data into a single site-wide risk assessment.

Impact of Finding 4

Segregating the sources without considering all site-related sources concurrently is likely to underestimate risk projections. The magnitude of this finding could not be quantified because of the limited review period.

Finding 5. Major Guidance Document used to Develop Preliminary Delineation Criteria Values is Not Recommended or Approved by Cal/EPA

As stated in the risk assessment, the draft health-based soil screening levels (HBSSLs) developed by Cal/EPA were never approved or recommended by Cal/EPA's Office of Science Advisory (OSA) for the development of preliminary delineation criteria values (PDCVs) and have since been withdrawn. Instead, the OSA recommends the use of the Preliminary Endangerment Assessment (PEA) approach to develop soil cleanup levels. The risk assessment does not derive the recommended PEA values and states that the impacts associated with using the wrong guidance (i.e., HBSSLs) have no significant effect on the findings of the risk assessment. However, as long as the HBSSL values are used and no effort is made to quantify the impacts associated with using the wrong guidance, the findings of this risk assessment and subsequent health-based goals (HBGs) can be called into question.

Impact of Finding 5

The PDCVs form the basis of all major decisions made on the site, including whether further delineation of soil contamination is needed during site characterization, the identification of areas needing interim measures, and the delineation of areas of potential concern. Any variance in the PDCVs will therefore require significant revision of the entire risk assessment and subsequent remedial efforts.

Finding 6. Spatial Screening of Contamination was Conducted, Thus Significantly Limiting the Projected Adverse Health Effects

Contamination was excluded from the risk assessment through the use of spatial screening to create areas of potential concern (AOPCs). AOPC boundaries were established to encompass all samples shown to contain one or more detections exceeding the preliminary delineation criteria value (PDCV) limits. Any adjacent samples shown not to exceed PDCV limits were not included in the AOPC. The risk assessment was designed to addressed only those areas identified as AOPCs. This approach to spatial delineation significantly reduces the estimated overall impacts to human health.

Impacts of Finding 6

Screening detected concentrations of contaminants prior to initiating the risk assessment is highly biased and significantly underestimates overall risk projections. All aspects of the risk assessment, including the contaminant selection, statistical analysis of the data set, additive health effects, and emission source strength, are underestimated.

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Contaminant Selection

Page 27 of the risk assessment states: "Constituents that were detected in less than 5 percent of the samples within an AOPC were excluded from consideration as COPCs..." Only those compounds found to exceed one or more PDCV limits are considered during implementation of this spatial screening. Using such screening, the overall number of non-detects will be inflated. Therefore, the number of compound exceeding 5 percent detection, and thus included as contaminants, will be grossly underestimated.

Statistics

Once the sample set has been established for an AOPC, it is highly unlikely that all samples would show the same number of detected contaminants. Therefore, due to the limited number of samples, the non-detect results are artificially provided more weight in all statistical analyses. Alternately, if the areas were defined based on where contaminants were detected, a more accurate representation of the exposure-point concentrations would be developed. A quantitative analysis of these impacts could not be performed for this review, due to the lack of a complete data set for the site.

Additive Health Effects

As previously mentioned, the list of contaminants selected under this approach is underestimated. As a result, compound are unnecessarily screened from evaluation in this risk assessment. The impact is that potential health effects are underestimated. Health-based goals (HBGs) may not be health protective.

Emission Source Strength

Emissions are estimated for each AOPC, but the effects of non-AOPC contaminants are ignored. The potential for impact from these contaminants through the inhalation pathway is significant and should be quantified.

Finding 7. Chemicals Released by the Site to the Outdoor Air are Not Included in the Assessment of Health Impacts Under the Commercial Land-Use Scenario

As used in this risk assessment, the Daugherty model is incomplete and does not account for all significant site contributions to indoor air contaminant concentrations. The model assumes a volumetric exchange rate in the building of 0.5 volumes per hour of clean outdoor air. This assumption is not reasonable because the outdoor air will contain emissions from residual volatile contamination in the soil. The outdoor air concentrations associated with these emissions must be estimated and added to the calculated intrusion model results.

Impact of Finding 7

The projected risk to the future commercial/industrial worker presented in this risk assessment is underestimated. The magnitude of this underestimation could not be ascertained due to the lack of air modeling in the risk assessment for the various site sources.

Finding 8. Residual Contaminants - those Left On Site after Implementation of Interim Remedial Measures - are Not Included in the Baseline Risk Calculations

Residual contaminant concentrations associated with interim measures at the site are not included in the risk assessment. Table 4-2 presents areas identified in the Interim Measures Report that require remedial activities prior to initiating the risk assessment. These areas were not remediated to the background concentrations and contain levels of residual contamination. Nevertheless, these areas are entirely excluded from the risk assessment. The results and residual contamination associated with these areas should have been included in the data set used for the risk assessment. A summary of the methods used to remediate these areas clearly indicates that some residual contamination will remain in these areas. In addition, it could not be determined which cleanup criteria were used to address each area. Post-remedial human health impacts associated with residual contaminants in these areas must be addressed in the report.

Impact of Finding 8

The approach taken has resulted in an underestimation of cleanup requirements and the risk to all receptors. In addition, this practice will negatively impact the statistics, contaminant selection process, emissions estimates, and additive adverse health impacts evaluated in the risk assessment. As a result, the findings of the baseline risk assessment are not health protective. No information was provided in the report which would allow the assessment of these impacts.

Finding 9. Background Metal Concentrations Appear to be Overestimated, Thus Reducing the Magnitude of Potential Health Impacts Associated with the Site

Maximum detected concentrations were assigned as background when fewer than 40 percent of background samples showed detections of target metals.

Impact of Finding 9

The impact is to artificially elevate the background concentrations of selected inorganic metals and thus reduce the significance of metal contamination at the site. This practice allows more metal contamination to be left at the site and underestimates the potential health impacts to receptors.

Finding 10. Cancer Potency Factors used in the Baseline Risk Assessment are Different from those Published by Cal/EPA at the time the Report was Prepared

A comparison of the factors in the California Cancer Potency Factors Memorandum (Cal/EPA 1994) and the factors presented in Table 5-2 identified two discrepancies.

	Cal/EPA Factors		ILM Factors	
Compound	**CPFo**	**CPFi**	**CPFo**	**CPFi**
Dibromochloromethane	0.094	0.094	0.084	Not Available
1,1,2-Trichloroethane	0.072	0.072	0.057	0.057

CPFo = Cancer potency factor for oral exposure
CPFi = Cancer potency factor for inhalation exposure route

Impact of Finding 10

The projected carcinogenic risks associated with these compounds are significantly underestimated. This error subsequently allows higher cleanup levels for the site and underestimates potential site-related health risks

Finding 11. Several Chemical Toxicity Values Cited in the Baseline Risk Assessment Cannot be Independently Confirmed

In comparing the toxicity values of chemicals evaluated in the baseline risk assessment (Table 5-1) to those published in the USEPA's Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables (HEAST), the following values could not be verified:

Compound	Issue
Carbon Tetrachloride	No subchronic value listed as referenced
Bis(2-ethylhexyl)phthalate	No values listed and no reference
Dimethylphthalate	No values listed as referenced
Thallium	No values listed as referenced

Impact of Finding 11

Toxicity values could not be duplicated as referenced. Actual impacts to the cleanup criteria used and the potential health impact projected cannot be quantified at this time.

Finding 12. The Methodology for Development of Preliminary Delineation Criteria Values was Not Followed for All Metals

The derivation of preliminary delineation criteria values (PDCVs) for metals cannot always be verified or duplicated. The methodology used, as presented in the RCRA Facility Investigation Report (Geraghty & Miller, 26 February 1996), does not yield the values presented in the Interim Measures Completion for Soils report, Table 5-4. It would appear the stated methodology for metals PDCVs was not consistently followed.

Impact of Finding 12

PDCVs were used to form the basis of many crucial site-wide decisions, including: the limits of site characterization, delineation of areas of potenial concern (AOPCs), and calculation of health-based goals (HBGs). Several of the PDCVs used in this report are significantly higher than what can be supported by the described PDCV development methodology; therefore, the AOPCs and calculated risks in this risk assessment may be significantly underestimated.

Finding 13. A Sensitive Sub-Population (Off-Site Child) is Not Evaluated in the Risk Assessment

Under the vacant land-use scenario, potential health impacts were evaluated for on-site adolescent trespassers and for off-site adult residents. An off-site child should also have been evaluated since children are more sensitive to toxic (non-carcinogenic) impacts.

Impact of Finding 13

Underestimation of potential off-site toxic (non-carcinogenic) impacts.

Finding 14. The Source of Many Key Exposure Parameters was Out of Date When the Risk Assessment was Prepared

The Exposure Factors Handbook, published in 1990 (USEPA 1990), was used as a primary guidance document for this risk assessment. This guidance document had been significantly revised at the time of the risk assessment preparation, and the updated values should have been used.

Impact of Finding 14

The impacts are unknown at this time, but are potentially significant.

Finding 15. Air Dispersion Modeling uses Outdated Regional Climate Data

Climatic data used in the risk assessment are from a regional survey and were compiled in 1980. The data should have been substituted with more recent site-specific data from the nearest airport or South Coast Air Quality Monitoring District (SCAQMD) station.

Impact of Finding 15

The impacts are unknown at this time, but depend significantly on the study and subsequent statistical regionalization of the data.

Finding 16. The Baseline Risk Assessment did Not use the Most Recent Available Reference Data as Required by Cal/EPA

The risk assessment uses USEPA Region IX preliminary remedial goals (PRGs) from the Second Half 1994 Update as a reference. Region IX updates the PRG document biannually with modifications to the methodology used to develop PRGs and with new toxicity factors as they are released by USEPA. For the March 1996 risk assessment, the Region IX PRGs from the Second Half 1995 Update should have been used.

Impact of Finding 16

The potential impacts need to be quantified.

Finding 17. The Baseline Risk Assessment Fails to Assess All Pertinent Contaminant Concentrations in Two of the Investigated Land-Use Scenarios

Under the vacant land-use and construction scenarios, exposure point concentrations for all pathways were derived from near surface soil results (0-2 feet bgs) and subsurface soil results (0-10 feet bgs), respectively. These assumptions are acceptable for all pathways except inhalation. For inhalation, residual chemicals may volatilize from deeper layers and establish a complete exposure pathway to the receptors.

Impact of Finding 17

This omission underestimates total receptor exposures at the site, resulting in underestimated risks.

Finding 18. Current Site Conditions are Not Evaluated for All Land-Use Scenarios

On page 63, the following statement is made: "Planned future redevelopment of the site will include importation of clean fill to elevate land surface in some locations and existing surface soils (0 to 2 feet bgs) in those locations will then become subsurface soils. In other locations, the upper 2 feet of soil will be removed. Therefore, the risk characterization evaluated vapors originating from impacted soils that are located below 2 feet bgs at this time."

The purpose of this document is to address current site conditions and associated potential health effects. The above quoted text is a generalization about anticipated redevelopment and does not adequately define the locations or quantities of materials to be removed or covered. Therefore, the potential impact to receptors should focus on all soil contamination, including that which may potentially be removed or covered.

Impact of Finding 18

The approach used disregards all contaminants found in the first 2 feet of material, regardless of whether the material is covered, removed, or untouched. The result is an underestimation of risks.

Finding 19. Residual Hexavalent Chromium Concentrations are Not Addressed in the Baseline Risk Assessment

Soil impacted by hexavalent chromium may be present at the site. In the Interim Measures Completion for Soils report, on-site interim measures are reported to have addressed chromium-impacted soils by chemical stabilization at multiple locations. In addition, records show the extensive use of liquids containing hexavalent chromium and a high concentration in groundwater. Hexavalent contamination must be included in the risk assessment.

Impact of Finding 19

Site-wide risks are potentially underestimated by not including the adverse health impacts associated with interim-measure residual concentrations and hexavalent concentrations outside the current boundaries of the areas of potential concern.

Finding 20. Many Cleanup Levels Derived from the Risk Assessment have Significantly Higher Values than those Developed by USEPA Region IX.

The deficiencies discussed in this study may partially explain the reasons for reaching these elevated cleanup levels. Cleanup values specific to the areas of potential concern (AOPCs), also called health-based goals (HBGs), were developed following the completion of the risk assessment. A comparison of the HBGs with the Region IX preliminary remedial goals (PRGs) (USEPA 1996) shows a significant variance (see Table below).

Compound	AOPC No.	Residential PRG (mg/kg)	Industrial PRG (mg/kg)	ILM HBG (mg/kg)
Arsenic	5	0.38	2.4	5
Cadmium	14	9.00	9.0	16
Tetrachloroethene	7	5.40	17	42
Vinyl Chloride	10	0.016	0.035	0.2

Impact of Finding 20

The impacts can only be evaluated following a thorough check of the validity and accuracy of each parameter used in the computer modeling and risk assessment calculations.

Finding 21. The Wrong T-Value was used in Volatilization Calculations, Thus Underestimating Risks by up to 5 Times the True Values

The T-value used in the estimation of volatilization factors was not corrected for each receptor exposure interval. The emissions portion of the volatilization factor calculation is designed to estimate an average emission rate of the contaminant of concern during the exposure interval (PEA, Cal/EPA 1994). The volatilization factor values used for risk calculations assume a universal exposure interval of 25 years, thus underestimating average emissions by the following amounts:

Land Use Scenario	Receptor-Specific T-Value (sec)	ILM T-Value (sec)	Variance (%)
Vacant	**6.3E+07**	**7.9E+08**	**1250**
Construction	**3.2E+07**	**7.9E+08**	**2500**

Impact of Finding 21

All receptors evaluated under the vacant land-use and construction land-use scenarios are significantly underestimated. All health-based goals (HBGs) associated with these receptors are consequently underestimated.

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Supporting Data
for
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Finding 1.

The Baseline Risk Assessment Fails to use Chemical Parameters Approved by Cal/EPA

Supporting Data

A) Table 6-1 of the Baseline Risk Assessment

B) Tables 1 and 3 of the Preliminary Endangerment Assessment Guidance Manual (Cal/EPA, DTSC, January 1994)

A) Table 6-1 of the Baseline Risk Assessment

Table 6-1. **Physical and Chemical Properties of Organic Constituents of Potential Concern, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Molecular Weight (g/mol)	Water Solubility (mg/L 25 °C)	Specific Gravity	Vapor Pressure (mm Hg 25 °C)	Henry's Law Constant (atm-m³/mol) (25 °C)	Diffusivity (cm²/sec)	Koc (mL/g)	Log Kow	Fish BCF (L/kg)	Groundwater T ½ (days) Low	Groundwater T ½ (days) High	Soil T ½ (days) Low	Soil T ½ (days) High
VOCs													
Benzene	78	1,780	0.88	9.5E+01	5.48E-03	0.09320	49 - 100	1.56 - 2.15	5.2	10 -	720	5 -	16
Bromodichloromethane	164	4,700	1.99	5.0E+01 (20 °C)	2.12E-04	0.08966	62	1.88	5.2	ND		ND	
Bromoform	253	3,130	2.89	5.6E+00	5.60E-04	0.08314	115 - 282	2.30 - 2.38	3.75	56 -	360	28 -	180
Carbon tetrachloride	154	770 - 1,160	1.59	1.1E+02	2.40E-02	0.07970	224 - 437	2.73 - 2.83	18.75	7 -	365	180 -	365
Chlorobenzene	113	295 - 500	1.1	1.2E+01	4.45E-03	0.07193	48 - 331	2.71 - 2.98	10.3	136 -	300	68 -	150
Chloroform	119	7,222 - 9,600	1.48	2.0E+02	3.20E-03	0.08868	44	1.90 - 1.97	3.8	56 -	1,825	28 -	180
Dibromochloromethane	208	4,000 (20 °C)	2.45	7.6E+01 (20 °C)	7.83E-03	0.08608	83	2.1	5.5 - 30	14 -	180	28 -	180
1,2-Dichlorobenzene	147	92.7 - 156	1.3	1.5E+00	2.40E-03	0.07113	180 - 1,700	3.38 - 3.55	55.6	56 -	360	28 -	180
1,1-Dichloroethane	99	5,060	1.17	2.3E+02	5.87E-03	0.09590	30	1.78 - 1.79	14	64 -	154	32 -	154
1,2-Dichloroethane	99	7,986 - 8,650	1.25	8.7E+01	1.31E-03	0.09451	14 - 19	1.45 - 1.48	1.2	100 -	360	100 -	180
1,1-Dichloroethene	97	273 - 6,400	1.22	5.9E+02	1.50E-02	0.10077	65	1.48 - 2.13	5.6	56 -	132	28 -	180
trans-1,2-Dichloroethene	97	6,300	1.25	2.7E+02 (20 °C)	6.74E-03	0.09980	59	2.09	1.58	56 -	2,850	28 -	180
Ethylbenzene	106	152 - 208	0.87	9.5E+00	8.68E-03	0.06667	95 - 260	3.05 - 3.15	37.5	6 -	228	3 -	10
Methylene chloride	85	13,000 - 16,700	1.32	4.4E+02 - 4.6E+02	2.69E-03	0.08500	8.7	1.25 - 1.30	0.9	14 -	56	7 -	28
Tetrachloroethene	166	150 - 485	1.6	1.9E+01	2.87E-03	0.07404	210 - 363	2.1 - 2.88	30.6	360 -	730	180 -	365
Toluene	92	490 - 627	0.87	2.8E+01	6.74E-03	0.07828	115 - 150	2.11 - 2.80	10.7	7 -	28	4 -	22
1,1,1-Trichloroethane	133	300 - 1,334	1.34	1.2E+02	1.62E-02	0.07965	104 - 151	2.17 - 2.49	5.6	140 -	546	140 -	273
1,1,2-Trichloroethane	133	4,400 (20 °C)	1.44	1.9E+01 (20 °C)	9.09E-04	0.07965	56	2.18	4.5	135 -	730	135 -	365
Trichloroethene	131	1,100 - 1,500	1.46	7.3E+01	9.90E-03	0.08116	65 -126	2.29 - 3.30	10.6	321 -	1,643	180 -	365
Vinyl chloride	63	1,100 - 2,700	0.91	2.7E+03	5.60E-02	0.10726	2.5	0.60	1.17	56 -	2,850	28 -	180
Xylenes (total)	106	162 - 200	0.87	6.6E+00 - 8.8E+00	6.30E-03	0.07164	128 - 1,580	2.77 - 3.20	132	14 -	360	7 -	28
SVOCs													
Bis(2-ethylhexyl)phthalate	391	0.047 - 0.4	0.98	6.2E-08	1.10E-05	0.03542	100,000	4.2 - 5.1	130	10 -	389	5 -	23
Butylbenzylphthalate	312	2.0 - 2.9	1.12	8.6E-06 (20 °C)	1.30E-06	0.04114	68 - 347	4.05 - 4.91	414	2 -	180	1 -	7
Di-n-butylphthalate	278	9.2 - 4,500	1.05	1.4E-05	6.30E-05	0.04383	1,380	4.31 - 4.79	89	2 -	23	2 -	23
Dimethylphthalate	194	3,960 - 45,000	1.19	ND	4.20E-07	0.05616	6 - 63	1.47 - 2.00	36	2 -	14	1 -	7
N-Nitrosodimethylamine	74	miscible	1.00	8.1E+00	1.43E-01	0.09693	26	0.06	0.026	42 -	360	21 -	180
N-Nitrosodiphenylamine	198	35.1	ND	1.0E-01	2.33E-08	0.06710	575	3.13	136	20 -	68	10 -	34
Pentachlorophenol	266	20 - 25	1.98	1.7E-05	3.40E-06	0.05528	891	5.01 - 5.86	11	46 -	1533	23 -	178
Phenol	94	67,000 - 93,000	1.06	3.4E-01	3.97E-07	0.08924	17 - 27	1.46 - 1.48	1.4	0.5 -	7	1 -	10

Footnotes appear on page 2.

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Table 6-1. Physical and Chemical Properties of Organic Constituents of Potential Concern, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.

Constituent	Molecular Weight (g/mol)	Water Solubility (mg/L 25 °C)	Specific Gravity	Vapor Pressure (mm Hg 25 °C)	Henry's Law Constant (atm-m³/mol) (25 °C)	Diffusivity (cm²/sec)	Koc (mL/g)	Log Kow	Fish BCF (L/kg)	Groundwater T ½ (days) Low	Groundwater T ½ (days) High	Soil T ½ (days) Low	Soil T ½ (days) High
PAHs													
Anthracene	178	0.030 - 0.1125	1.24	1.7E-05 - 1.95E-04	6.51E-05	0.05904	16,000 - 26,000	4.34 - 4.54	30	100 -	920	50 -	460
Benzo(a)anthracene	228	0.0094 - 0.014	1.27	1.1E-07	8.00E-06	0.04564	1,400,000	5.61 - 5.91	30	204 -	1,361	102 -	679
Chrysene	228	0.0018 - 0.006	1.27	6.3E-09	3.15E-07	0.04531	240,000	5.60 - 5.91	30	744.6 -	2,000	372 -	993
Fluoranthene	202	0.206 - 0.373	1.25	5.0E-06	1.69E-02	0.04941	42,000	5.22	1,150	280 -	880	140 -	440
Fluorene	166	1.66 - 1.98	1.2	1.0E-03 - 1.0E-02	2.10E-04	0.05710	5,000	4.12 - 4.38	30	64 -	120	32 -	60
2-Methylnaphthalene	142	25	1.00	4.5E-02	3.36E-04	0.06196	7,400 - 8,500	3.86 - 4.11	190	ND		ND	
Naphthalene	128	30 - 34	1.16	2.3E-01 - 8.7E-01	4.60E-04	0.08205	550 - 3,160	3.2 - 4.7	10.5	1 -	258	16.6 -	48
Phenanthrene	178	0.71 - 1.29	1.18	6.8E-04	2.56E-05	0.05430	5,250 - 38,900	4.2 - 4.6	30	32 -	402	16 -	200
Pyrene	202	0.013 - 0.171	1.27	6.85E-07 - 2.5E-06	1.10E-05	0.05039	46,000 - 135,000	4.88 - 5.32	30	420 -	3,796	210 -	1,898
Dioxins/Furans													
2,3,7,8 - Tetrachloro-dibenzo-p-dioxin	322	0.0000193	1.83	1.49E-9 - 7.2E-10	3.07E-05	0.05303	4,570,000	5.38 - 7.02	NA	836 -	1,179	420 -	591
PCBs													
Aroclor 1016	258	0.049	1.33	4.0E-04	7.60E-04	0.05925	50,000	4.38 - 5.88	31,200	ND		ND	
Aroclor 1221	192	0.20	1.15	6.7E-03	3.24E-04	0.06717	275	2.8	31,200	ND		ND	
Aroclor 1232	221	1.45	1.24	4.6E-03	6.84E-04	0.06244	676	3.2	31,200	ND		ND	
Aroclor 1242	261	0.24	1.39	4.1E-04	5.60E-04	0.05829	5,130	4.11 - 5.58	31,200	ND		ND	
Aroclor 1248	288	0.06	1.41	4.9E-04	3.50E-03	0.05498	436,000	6.11	31,200	ND		ND	
Aroclor 1254	327	0.012 - 0.057	1.5	7.7E-05	2.30E-03	0.05251	410,000	5.61 - 6.47	31,200	ND		ND	
Aroclor 1260	370	0.080	1.57	4.1E-05	7.10E-03	0.04909	2,630,000	6.91	31,200	ND		ND	
TPH													
TPH (evaluated as n-Hexane)	86	18 (20 °C)	0.66	1.20E+02 (20 °C)	7.70E-01	0.07461	890	2.77	ND	ND		ND	
TPH (evaluated as Octane)	114	0.7	0.70	1.4E+01	3.21E+00	0.06436	5,500 - 15,600	4.00 - 5.18	780 - 5,100	ND		ND	

References: Foreman and Bidleman, 1985; Howard et al., 1991; Howard, 1991, 1990, and 1989; Lugg, 1968; Lyman et al., 1990; Mackay and Shiu, 1981; Montgomery and Welkom, 1990; Research Triangle Institute (RTI), 1987; Shea, 1982; TOXNET, 1994; USEPA, 1995b (tox sub sprdsht); USEPA, 1992 (tox sub sprdsht); Veith and Kosian, 1982; and Verschueren, 1983.

atm-m³/mol	Atmospheres-cubic meters per mole.
BCF	Bioconcentration factor.
°C	Degrees Celsius.
cm²/sec	Square centimeters per second.
g/mol	Grams per mole.
Koc	Organic carbon partition coefficient.
Kow	Octanol-water partition coefficient.
L/kg	Liters per kilogram.
mg/L	Milligrams per liter.
mL/g	Milliliters per gram.
mm Hg	Millimeters of mercury.
ND	No data.
T ½	Half-life.
TPH	Total petroleum hydrocarbons.

B) Tables 1 and 3 of the Preliminary Endangerment Assessment Guidance Manual (Cal/EPA, DTSC, January 1994)

PRELIMINARY ENDANGERMENT ASSESSMENT

GUIDANCE MANUAL

(A guidance manual for evaluating hazardous substance release sites.)

State of California
Environmental Protection Agency

Department of Toxic Substances Control

January 1994

BOE-C6-0093538

TABLE 1: PREDICTED Kp ESTIMATES FOR COMMON POLLUTANTS

Chemical	CAS No.	MWT	log Kow	Kp (cm/hr)
Acetaldehyde	75070	44.1	-0.22	7.2e-04
Acetamide	60355	59.0	-1.26	1.1e-04
Acetylaminofluorene, 2-	53963	223.0	3.24	1.7e-02
Acrolein	107028	56.1	-0.10	7.4e-04
Acrylamide	79061	71.0	-0.67	2.4e-04
Acrylonitrile	107131	53.1	0.25	1.4e-03
Aldrin	309002	365.0	3.01	1.6e-03
Allyl chloride	107051	76.5	1.45	7.0e-03
1-Amino-2 methylanthraquinone	82280	237.3	2.80	6.6e-03
Aminoanthraquinone, 2-	117793	223.0	2.15	2.8e-03
Aminoazobenzene, p-	60093	197.0	2.62	8.7e-03
Aminoazotoluene, o-	97563	225.3	3.92	4.9e-02
Aminobiphenyl, 4-	92671	169.2	2.80	1.7e-02
Aniline	62533	93.1	0.90	2.2e-03
Anisidine, o-	90040	145.0	1.18	1.7e-03
Auramine	492808	267.4	3.54	1.5e-02
Benzo-b-fluroanthene	205992	252.3	6.12	1.2e+00
Benzene	71432	78.1	2.13	2.1e-02
Benzidine	92875	184.2	1.34	1.3e-03
Benzo-a-anthracene	56553	228.3	5.66	8.1e-01
Benzo-a-pyrene	50328	250.0	6.10	1.2e+00
Benzoic acid	65850	122.0	1.87	7.3e-03
Benzotrichloride	98077	195.0	2.92	1.5e-02
Benzyl chloride	100447	127.0	2.30	1.4e-02
Bis(2-chlorethyl)ether	111444	143.0	1.29	2.1e-03
Bromodichloromethane	75274	163.8	2.09	5.8e-03
Bromoform	75252	252.8	2.37	2.6e-03
Bromomethane	74839	95.0	1.19	3.5e-03
Bromophenol, p-	106412	173.0	2.65	1.3e-02
Butadiene, 1,3-	106990	54.0	1.99	2.3e-02
Butanediol, 2,3-	513859	90.1	-0.92	1.2e-04
Butanol, n-	71363	74.1	0.65	1.9e-03
Butoxyethanol, 2-	111762	118.0	0.83	1.4e-03
Captan	133062	300.0	2.35	1.3e-.03
Carbon disulfide	75150	80.0	2.24	2.4e-02
Carbon tetrachloride	56235	153.8	2.83	2.2e-02
Chlordane	57749	409.8	5.54	5.2e-02
Chlordane (cis)	5103719	410.0	5.47	4.6e-02
Chlordane (trans)	5103742	410.0	5.47	4.6e-02
Chlorobenzene	108907	112.6	2.84	4.1e-02

SOURCE: U.S. Environmental Protection Agency. January 1992. Interim Report Dermal Exposure Assessment: Principles and Applications. EPA/600/8-9 011

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TABLE 1: (Continued)

Chemical	CAS No.	MWT	log Kow	Kp (cm/hr)
Chlorocresol	59507	142.6	3.10	4.1e-02
Chlorodibromomethane	124481	208.3	2.23	3.9e-03
Chloroethane	75003	64.5	1.43	8.0e-03
Chloroform	67663	119.4	1.97	8.9e-03
Chloromethane	74873	50.5	0.91	4.2e-03
Chloromethyl methyl ether	107302	80.5	0.00	6.2e-04
Chorophenol, o-	95578	128.6	2.16	1.1e-02
Chlorophenol, p-	106489	128.6	2.39	1.6e-02
Chlorothalonil	1897456	265.9	3.86	2.5e-02
Chloroxylenol	-	135.2	-	-
Chrysene	218019	228.3	5.66	8.1e-01
Cresidine, p-	120718	137.2	1.67	4.3e-03
Cresol, m-	108394	108.1	1.96	1.0e-02
Cresol, o-	95487	108.1	1.95	1.0e-02
Cresol, p-	106445	108.1	1.94	1.0e-02
D&C Red No. 19	81889	479.0	0.00	2.3e-06
DDD	72548	320.0	5.80	2.8e-01
DDE	72559	318.0	5.69	2.4e-01
DDT	50293	355.0	6.36	4.3e-01
Decanol	112301	158.3	4.11	1.7e-01
Di-2-ethylhexyl phthalate	117817	391.0	5.11	3.3e-02
Diaminoanisole, 2,4-	615054	138.2	-0.12	2.3e-04
Diaminotoluene	95807	122.0	0.34	6.0e-04
Diaminotoluene, 2,4-	101804	200.0	2.06	3.3e-03
Dibenzo (a,h)anthracene	226368	278.4	6.84	2.7e+00
Dibutyl phthalate	84742	278.0	4.13	3.3e-02
Dichlorobenzene, 1,2-	95501	147.0	3.38	6.1e-02
Dichlorobenzene, 1,3-	541731	147.0	3.60	8.7e-02
Dichlorobenzene, 1,4-	106467	147.0	3.39	6.2e-02
Dichlorobenzidine, 3,3'	91941	253.1	3.51	1.7e-02
Dichlorodifluoromethane	75718	120.9	2.16	1.2e-02
Dichloroethane, 1,1-	75343	99.0	1.79	8.9e-03
Dichloroethane, 1,2-	107062	99.0	1.48	5.3e-03
Dichloroethylene, 1,1-	75354	96.9	2.13	1.6e-02
Dichloroethylene, 1,2-	156592	96.9	1.86	1.0e-02
Dichlorophenol, 2,4-	102832	163.0	2.92	2.3e-02
Dichloropropane, 1,2-	78875	113.0	2.00	1.0e-02
Dichloropropene, 1,3-	542756	111.0	1.60	5.5e-03
Dichlorvos	62737	221.0	1.47	9.5e-04
Dieldrin	60571	381.0	4.56	1.6e-02
Diepoxybutane	1464535	86.1	-1.84	2.8e-05
Diethyl phthalate	84662	222.0	2.47	4.8e-03
Diethyl sulfate	64675	154.0	1.14	1.4e-03

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TABLE 1: (Continued)

Chemical	CAS No.	MWT	log Kow	Kp (cm/hr)
Dimethoxybenzidine, 3,3'-	119904	254.4	1.81	1.0e-03
Dimethyl phthalate	131113	194.0	1.56	1.6e-03
Dimethyl sulfate	77781	126.0	1.16	2.2e-03
Dimethylamine, n-nitroso-	62759	74.1	-0.57	2.7e-04
Dimethylaminoazobenzene, 4-	60117	225.0	4.58	1.4e-01
Dimethylbenzidine, 3,3'-	119937	212.3	2.34	4.4e-03
Dimethlycarbamyl chloride	79447	107.5	0.00	4.2e-04
Dimethylhylhydrazine, 1,1-	57147	60.0	-1.50	7.1e-05
Dimethylphenol, 2,4-	105679	122.2	2.30	1.5e-02
Dimethylphenol, 3,4-	95658	122.2	2.23	1.3e-02
Dinitrotoluene, 2,4-	121142	182.1	1.98	3.8e-03
Dinitrophenol, 2,4-	51285	184.1	1.54	1.8e-03
Dinitrotoluene, 2,6-	606202	182.1	1.72	2.5e-03
Dioxane, 1,4-	123911	88.1	-0.27	3.6e-04
Diphenylamine, n-nitroso-	86306	198.2	3.50	3.6e-02
Diphenylhydrazine, 1,2-	122667	184.2	2.94	1.8e-02
Dipropylamine, n-nitroso-	621647	130.2	1.36	2.8e-03
Endrin	72208	381.0	4.56	1.6e-02
Epichlorohydrin	106898	92.0	-0.21	3.7e-04
Ethanol	64175	46.0	-0.31	6.0e-04
Ethanol, 2-(2-butoxyethoxy)-	112345	162.0	-0.92	4.4e-05
Ethanol, 2-(2-ethoxyethoxy)-	111900	134.0	-0.08	2.5e-04
Ethanol, 2-(2-methoxyethoxy)-	111773	120.0	-0.42	1.8e-04
Ethoxyethanol, 2-	110805	90.0	-0.10	4.6e-04
Ethoxyethyl acetate, 2-	111159	132.0	0.65	8.6e-04
Ethyl acrylate	140885	100.0	1.32	4.0e-03
Ethyl carbamate	51796	89.0	-0.15	4.3e-04
Ethyl ether	60297	74.1	0.89	2.9e-03
Ethylbenzene	100414	106.2	3.15	7.4e-02
Ethylene oxide	75218	44.1	-0.30	6.3e-04
Ethylenedibromide	106934	188.0	1.96	3.3e-03
Ethyleneimine	151564	43.0	-1.12	1.7e-04
Ethylenethiourea	96457	96.0	-0.66	1.7e-04
Ethylphenol, p-	123079	120.0	2.26	1.4e-02
Fluoranthene	206440	202.3	4.95	3.6e-01
Formaldehyde	50000	30.0	0.35	2.2e-03
Glycerol	56815	92.1	-1.76	2.9e-05
Heptachlor	76448	373.5	4.27	1.1e-02
Heptanol	111706	116.0	2.41	1.9e-02
Hexachlorobenzene	118741	284.8	5.31	2.1e-01
Hexachlorobutadiene	87683	260.8	4.78	1.2e-01
Hexachloroethane	67721	236.7	3.93	4.2e-02
Hexamethylphosophoramide	680319	179.0	0.03	1.6e-04

TABLE 1: (Continued)

Chemical	CAS No.	MWT	log Kow	Kp (cm/hr)
Hexanol	111273	102.0	2.03	1.3e-02
Hydrazine/Hydrazine sulfate	302012	32.0	-2.07	4.1e-05
Indeno(1,2,3-CD)pyrene	193395	276.3	6.58	1.9e+00
Isophorone	78591	138.2	1.70	4.4e-03
Lindane	58899	291.0	3.72	1.4e-02
Maneb	12427382	265.3	0.00	4.6e-05
Mechlorethamine	51752	156.0	1.07	1.2e-03
Methanol	67561	32.0	-0.77	3.5e-04
Methoxyethanol, 2-	109864	76.0	-0.77	1.9e-04
Methoxypropan-2-ol, 1-	107982	90.0	-0.18	4.0e-04
Methyl ethyl ketone	78933	72.0	0.29	1.1e-03
Methyl hydroxybenzoate	99763	152.1	1.92	5.2e-03
Methyl iodide	74884	142.0	1.51	3.1e-03
Methylaziridine, 2-	75558	57.0	-0.60	3.2e-04
Methylene bis(2-chloroaniline), 4,4'-	101144	267.2	3.94	2.8e-02
Methylene bis(N,N'-dimethyl)aniline, 4,4'-	101611	254.0	4.75	1.3-01
Methylene chloride	75092	84.9	1.25	4.5e-03
Methylenedianiline, 4,4'-	101779	198.0	1.59	1.6e-03
Michler's ketone	90948	268.4	4.07	3.4e-02
Mustard Gas	505602	159.1	2.03	5.6e-03
Naphthalene	91203	128.2	3.30	6.9e-02
Naphthol, b-	135193	144.2	2.84	2.6e-02
Naphthylamine, 1-	134327	143.2	2.25	1.0e-02
Naphthylamine, 2-	91598	143.2	2.28	1.1e-02
Nitrilotriacetic acid	139139	191.0	-0.18	9.7e-05
Nitro-o-anisidine, 5-	99592	152.7	1.47	2.5e-03
Nitrobiphenyl, 4-	92933	199.2	3.77	5.5e-02
Nitrofen	1836755	284.1	5.53	3.0e-01
Nitrophenol, 2-	88755	139.1	1.79	5.0e-03
Nitrophenol, 2-amino-4	99570	154.1	1.36	2.0e-03
Nitrophenol, 3-	554847	139.1	2.00	7.1e-03
Nitrophenol, 4-	100027	139.1	1.91	6.1e-03
Nitrophenol, 4-amino-2-	119346	154.1	0.96	1.1e-03
Nitropropane, 2-	79469	110.0	0.55	1.0e-03
Nitroso-di-n-butylamine, n-	924163	158.2	1.92	4.8e-03
Nitroso-N-ethylurea, n-	759739	117.1	0.23	5.4e-04
Nitroso-N-methylurea, n-	684935	103.1	-0.03	4.3e-04
Nitrosodiethanolamine, n-	1116547	134.0	-1.58	2.2e-05
Nitrosodiethylamine, n-	55185	88.0	0.48	1.2e-03
Nitrosodiphenylamine, p-	156105	198.2	3.50	3.6e-02
Nitrosomethylvinylamine, n-	4549400	86.1	0.00	5.7e-04
Nitrosomorpholine, n-	59892	116.1	-0.44	1.8e-04
Nitrosonornicotine, n-	16543558	177.2	0.03	1.7e-04

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TABLE 1: (Continued)

Chemical	CAS No.	MWT	log Kow	Kp (cm/hr)
Nitrosopiperidine, n-	100754	350.3	0.36	2.5e-05
Nonanol	143088	144.0	3.47	7.3e-02
Octanol	111875	130.0	2.97	3.9e-02
Parathion	56382	291.0	3.83	1.7e-02
PCB-chlorobiphenyl, 4-	2051629	292.0	6.50	1.3e+00
PCB-hexachlorobiphenyl	26601649	361.0	6.72	7.1e-01
Pentachloronitrobenzene	82688	295.3	4.64	5.9e-02
Pentachlorophenol	87865	266.4	5.86	6.5e-01
Pentanol	71410	88.0	1.56	7.1e-03
Pentanone, 4-methyl-2-	108101	100.0	1.19	3.3e-03
Phenanthrene	85018	178.2	4.57	2.7e-01
Phenol	108952	94.0	1.46	5.5e-03
Phenol, 4,6-dinitro-2-methyl-	534521	198.1	2.12	3.8e-03
Propanol	71238	60.0	0.30	1.3e-03
Propiolactone, beta-	57578	575.8	-0.46	3.3e-04
Propylene oxide	75569	58.1	0.03	8.9e-04
Resorcinol	108463	110.1	0.80	1.5e-03
Safrole	94597	162.2	2.66	1.5e-02
Styrene	100425	104.1	2.95	5.5e-02
Styrene oxide	96093	120.0	1.61	4.9e-03
TCDD	1746016	322.0	6.8	1.4e+00
Tetrachlorethylene	127184	165.8	3.40	4.8e-02
Tetrachloroethane, 1,1,2,2-	79345	167.9	2.39	9.0e-03
Thioacetamide	62555	75.0	0.71	2.1e-03
Thiodianiline, 4,4'-	139651	216.0	2.03	2.5e-03
Thiourea	62566	76.0	-0.95	1.4e-04
Thymol	89838	150.2	3.30	5.1e-02
Toluene	108883	92.1	2.73	4.5e-02
Toluidine hydrochloride, o-	636215	143.2	0.00	2.1e-03
Toluidine,o-	95534	107.0	1.32	3.7e-03
Toxaphene	8001352	414.0	4.82	1.5e-02
Tricholorbenzene, 1,2,4-	120821	181.5	3.98	1.0e-01
Trichloroethane, 1,1,1-	71556	133.4	2.49	1.7e-02
Trichloroethane, 1,1,2-	79005	133.4	2.05	8.4e-03
Trichloroethylene	79016	131.4	2.42	1.6e-02
Trichlorofluoromethane	75694	137.4	2.53	1.7e-02
Trichlorophenol, 2,4,6-	88062	197.5	3.69	5.0e-02
Tris(2,3-dibromopropyl)phosphate	126727	697.6	4.98	3.6e-04
Tris(aziridinyl)-para-benzoquinone	68768	231.3	-1.34	8.3e-06
Urea	57136	60.0	-2.11	2.6e-05
Vinyl bromide	593602	107.0	1.57	5.5e-03
Vinyl chloride	75014	62.5	1.36	7.3e-03
Water	7732185	18.0	-1.38	1.6e-04
Xylene, m-	108383	106.2	3.20	8.0e-02

TABLE 3: PHYSICAL AND CHEMICAL PROPERTIES FOR VOLATILE COMPOUNDS (OSA, Jul-93)

Chemical	MW (g/mol)	Hc (atm-m3/mol)	Di (cm^2/sec)	Koc (l/kg)	S (mg/l)	VP (mm Hg)	Log Kow	BP Celsius	MP Celsius
Acetone	58.0	3.67E-05	0.103	2.20	1000000.00	231	-0.24	56.2	-95.4
Benzene	78.1	5.43E-03	0.088	65.00	1791.00	95	2.13	80.1	5.5
Carbon tetrachloride	154.0	3.04E-02	0.080	110.00	805.00	114	2.83	76.5	-23
Chlorobenzene	113.0	3.45E-03	0.072	160.00	471.70	11.9	2.84	132	-45.6
Chloroform	119.0	4.35E-03	0.089	31.00	7970.00	246	1.97	61.7	-63.5
1,2-Dibromoethane (EDB)	188.0	3.20E-04	0.073	28.10	3400.00	-	-	-	-
1,2-Dichlorobenzene	147.0	1.20E-03	0.130	1148.00	156.00	1.5	3.83	180.5	-17
1,4-Dichlorobenzene	147.0	1.50E-03	0.130	1175.00	87.00	1.8	3.52	174	53.1
1,1-Dichloroethane	99.0	5.87E-03	0.091	30.00	5060.00	227	1.79	57.3	-97
1,2-Dichloroethane (EDC)	99.0	9.77E-04	0.091	14.00	8524.00	78.7	1.48	83.5	-35.4
1,1-Dichloroethylene	97.0	1.54E-01	0.079	65.00	400.00	-	-	-	-
1,2-Dichloroethylene (trans)	97.0	6.72E-03	0.079	59.00	6300.00	340	2.06	48	-50
1,2-Dichloropropane	113.0	2.07E-03	0.080	51.00	2740.00	49.7	1.99	96.4	-100.5
Ethylbenzene	106.2	8.44E-03	0.075	220.00	161.00	9.5	3.15	136.2	-95
Methylene chloride	85.0	2.68E-03	0.101	8.80	13000.00	435	1.25	39.8	-95.1
Methyl ethyl ketone	72.0	1.05E-05	0.090	4.50	239000.00	90.6	0.29	79.6	-86.4
PAH Acenaphthene	154.2	1.20E-03	0.064	4600.00	3.88	-	-	-	-
PAH Anthracene	178.0	3.40E-05	0.058	12589.00	0.08	-	-	-	-
PAH Fluorene	166.2	6.42E-05	0.061	7900.00	1.90	-	-	-	-
PAH Naphthalene	128.2	5.00E-04	0.069	1288.00	31.70	0.082	3.3	217.9	80.2
Styrene	104.2	2.81E-03	0.071	360.00	310.00	6.6	2.95	145.2	-30.6
1,1,2,2-Tetrachloroethane	168.0	4.55E-04	0.073	218.78	2962.00	6.1	2.39	146.5	-36
Tetrachloroethylene (PCE)	165.8	1.49E-02	0.072	660.69	150.30	18.5	3.4	121	-19
Toluene	92.0	5.94E-03	0.078	257.04	534.80	28.4	2.73	110.6	-95
1,1,1-Trichloroethane	133.0	8.00E-03	0.080	150.00	1495.00	123.7	2.49	74.1	-30.4
1,1,2-Trichloroethane	133.0	1.20E-03	0.080	56.23	4420.00	30.3	2.07	113.8	-36.5
Trichloroethylene (TCE)	131.0	1.03E-02	0.081	125.89	1100.00	69	2.42	87	-73
Xylene (mixed)	106.2	5.30E-03	0.087	240.00	200.00	-	-	-	-

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Finding 2.

Chemical Parameter Values used in the Baseline Risk Assessment Cannot be Independently Verified

Supporting Data

Table 6-1 of the Baseline Risk Assessment

Table 6-1. **Physical and Chemical Properties of Organic Constituents of Potential Concern, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Molecular Weight (g/mol)	Water Solubility (mg/L 25 °C)	Specific Gravity	Vapor Pressure (mm Hg 25 °C)	Henry's Law Constant (atm-m³/mol) (25 °C)	Diffusivity (cm²/sec)	Koc (mL/g)	Log Kow	Fish BCF (L/kg)	Groundwater T ½ (days) Low	Groundwater T ½ (days) High	Soil T ½ (days) Low	Soil T ½ (days) High
VOCs													
Benzene	78	1,780	0.88	9.5E+01	5.48E-03	0.09320	49 - 100	1.56 - 2.15	5.2	10 -	720	5 -	16
Bromodichloromethane	164	4,700	1.99	5.0E+01 (20 °C)	2.12E-04	0.08966	62	1.88	5.2	ND		ND	
Bromoform	253	3,130	2.89	5.6E+00	5.60E-04	0.08314	115 - 282	2.30 - 2.38	3.75	56 -	360	28 -	180
Carbon tetrachloride	154	770 - 1,160	1.59	1.1E+02	2.40E-02	0.07970	224 - 437	2.73 - 2.83	18.75	7 -	365	180 -	365
Chlorobenzene	113	295 - 500	1.1	1.2E+01	4.45E-03	0.07193	48 - 331	2.71 - 2.98	10.3	136 -	300	68 -	150
Chloroform	119	7,222 - 9,600	1.48	2.0E+02	3.20E-03	0.08868	44	1.90 - 1.97	3.8	56 -	1,825	28 -	180
Dibromochloromethane	208	4,000 (20 °C)	2.45	7.6E+01 (20 °C)	7.83E-03	0.08608	83	2.1	5.5 - 30	14 -	180	28 -	180
1,2-Dichlorobenzene	147	92.7 - 156	1.3	1.5E+00	2.40E-03	0.07113	180 - 1,700	3.38 - 3.55	55.6	56 -	360	28 -	180
1,1-Dichloroethane	99	5,060	1.17	2.3E+02	5.87E-03	0.09590	30	1.78 - 1.79	14	64 -	154	32 -	154
1,2-Dichloroethane	99	7,986 - 8,650	1.25	8.7E+01	1.31E-03	0.09451	14 - 19	1.45 - 1.48	1.2	100 -	360	100 -	180
1,1-Dichloroethene	97	273 - 6,400	1.22	5.9E+02	1.50E-02	0.10077	65	1.48 - 2.13	5.6	56 -	132	28 -	180
trans-1,2-Dichloroethene	97	6,300	1.25	2.7E+02 (20 °C)	6.74E-03	0.09980	59	2.09	1.58	56 -	2,850	28 -	180
Ethylbenzene	106	152 - 208	0.87	9.5E+00	8.68E-03	0.06667	95 - 260	3.05 - 3.15	37.5	6 -	228	3 -	10
Methylene chloride	85	13,000 - 16,700	1.32	4.4E+02 - 4.6E+02	2.69E-03	0.08500	8.7	1.25 - 1.30	0.9	14 -	56	7 -	28
Tetrachloroethene	166	150 - 485	1.6	1.9E+01	2.87E-03	0.07404	210 - 363	2.1 - 2.88	30.6	360 -	730	180 -	365
Toluene	92	490 - 627	0.87	2.8E+01	6.74E-03	0.07828	115 - 150	2.11 - 2.80	10.7	7 -	28	4 -	22
1,1,1-Trichloroethane	133	300 - 1,334	1.34	1.2E+02	1.62E-02	0.07965	104 - 151	2.17 - 2.49	5.6	140 -	546	140 -	273
1,1,2-Trichloroethane	133	4,400 (20 °C)	1.44	1.9E+01 (20 °C)	9.09E-04	0.07965	56	2.18	4.5	135 -	730	135 -	365
Trichloroethene	131	1,100 - 1,500	1.46	7.3E+01	9.90E-03	0.08116	65 -126	2.29 - 3.30	10.6	321 -	1,643	180 -	365
Vinyl chloride	63	1,100 - 2,700	0.91	2.7E+03	5.60E-02	0.10726	2.5	0.60	1.17	56 -	2,850	28 -	180
Xylenes (total)	106	162 - 200	0.87	6.6E+00 - 8.8E+00	6.30E-03	0.07164	128 - 1,580	2.77 - 3.20	132	14 -	360	7 -	28
SVOCs													
Bis(2-ethylhexyl)phthalate	391	0.047 - 0.4	0.98	6.2E-08	1.10E-05	0.03542	100,000	4.2 - 5.1	130	10 -	389	5 -	23
Butylbenzylphthalate	312	2.0 - 2.9	1.12	8.6E-06 (20 °C)	1.30E-06	0.04114	68 - 347	4.05 - 4.91	414	2 -	180	1 -	7
Di-n-butylphthalate	278	9.2 - 4,500	1.05	1.4E-05	6.30E-05	0.04383	1,380	4.31 - 4.79	89	2 -	23	2 -	23
Dimethylphthalate	194	3,960 - 45,000	1.19	ND	4.20E-07	0.05616	6 - 63	1.47 - 2.00	36	2 -	14	1 -	7
N-Nitrosodimethylamine	74	miscible	1.00	8.1E+00	1.43E-01	0.09693	26	0.06	0.026	42 -	360	21 -	180
N-Nitrosodiphenylamine	198	35.1	ND	1.0E-01	2.33E-08	0.06710	575	3.13	136	20 -	68	10 -	34
Pentachlorophenol	266	20 - 25	1.98	1.7E-05	3.40E-06	0.05528	891	5.01 - 5.86	11	46 -	1533	23 -	178
Phenol	94	67,000 - 93,000	1.06	3.4E-01	3.97E-07	0.08924	17 - 27	1.46 - 1.48	1.4	0.5 -	7	1 -	10

Footnotes appear on page 2.

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Table 6-1. Physical and Chemical Properties of Organic Constituents of Potential Concern, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.

Constituent	Molecular Weight (g/mol)	Water Solubility (mg/L 25 °C)	Specific Gravity	Vapor Pressure (mm Hg 25 °C)	Henry's Law Constant (atm-m³/mol) (25 °C)	Diffusivity (cm²/sec)	Koc (mL/g)	Log Kow	Fish BCF (L/kg)	Groundwater T ½ Low (days)	Groundwater T ½ High (days)	Soil T ½ Low (days)	Soil T ½ High (days)
PAHs													
Anthracene	178	0.030 - 0.1125	1.24	1.7E-05 - 1.95E-04	6.51E-05	0.05904	16,000 - 26,000	4.34 - 4.54	30	100 -	920	50 -	460
Benzo(a)anthracene	228	0.0094 - 0.014	1.27	1.1E-07	8.00E-06	0.04564	1,400,000	5.61 - 5.91	30	204 -	1,361	102 -	679
Chrysene	228	0.0018 - 0.006	1.27	6.3E-09	3.15E-07	0.04531	240,000	5.60 - 5.91	30	744.6 -	2,000	372 -	993
Fluoranthene	202	0.206 - 0.373	1.25	5.0E-06	1.69E-02	0.04941	42,000	5.22	1,150	280 -	880	140 -	440
Fluorene	166	1.66 - 1.98	1.2	1.0E-03 - 1.0E-02	2.10E-04	0.05710	5,000	4.12 - 4.38	30	64 -	120	32 -	60
2-Methylnaphthalene	142	25	1.00	4.5E-02	3.36E-04	0.06196	7,400 - 8,500	3.86 - 4.11	190	ND		ND	
Naphthalene	128	30 - 34	1.16	2.3E-01 - 8.7E-01	4.60E-04	0.08205	550 - 3,160	3.2 - 4.7	10.5	1 -	258	16.6 -	48
Phenanthrene	178	0.71 - 1.29	1.18	6.8E-04	2.56E-05	0.05430	5,250 - 38,900	4.2 - 4.6	30	32 -	402	16 -	200
Pyrene	202	0.013 - 0.171	1.27	6.85E-07 - 2.5E-06	1.10E-05	0.05039	46,000 - 135,000	4.88 - 5.32	30	420 -	3,796	210 -	1,898
Dioxins/Furans													
2,3,7,8 - Tetrachloro-dibenzo-p-dioxin	322	0.0000193	1.83	1.49E-9 - 7.2E-10	3.07E-05	0.05303	4,570,000	5.38 - 7.02	NA	836 -	1,179	420 -	591
PCBs													
Aroclor 1016	258	0.049	1.33	4.0E-04	7.60E-04	0.05925	50,000	4.38 - 5.88	31,200	ND		ND	
Aroclor 1221	192	0.20	1.15	6.7E-03	3.24E-04	0.06717	275	2.8	31,200	ND		ND	
Aroclor 1232	221	1.45	1.24	4.6E-03	6.84E-04	0.06244	676	3.2	31,200	ND		ND	
Aroclor 1242	261	0.24	1.39	4.1E-04	5.60E-04	0.05829	5,130	4.11 - 5.58	31,200	ND		ND	
Aroclor 1248	288	0.06	1.41	4.9E-04	3.50E-03	0.05498	436,000	6.11	31,200	ND		ND	
Aroclor 1254	327	0.012 - 0.057	1.5	7.7E-05	2.30E-03	0.05251	410,000	5.61 - 6.47	31,200	ND		ND	
Aroclor 1260	370	0.080	1.57	4.1E-05	7.10E-03	0.04909	2,630,000	6.91	31,200	ND		ND	
TPH													
TPH (evaluated as n-Hexane)	86	18 (20 °C)	0.66	1.20E+02 (20 °C)	7.70E-01	0.07461	890	2.77	ND	ND		ND	
TPH (evaluated as Octane)	114	0.7	0.70	1.4E+01	3.21E+00	0.06436	5,500 - 15,600	4.00 - 5.18	780 - 5,100	ND		ND	

References: Foreman and Bidleman, 1985; Howard et al., 1991; Howard, 1991, 1990, and 1989; Lugg, 1968; Lyman et al., 1990; Mackay and Shiu, 1981; Montgomery and Welkom, 1990; Research Triangle Institute (RTI), 1987; Shen, 1982; TOXNET, 1994; USEPA, 1995b (tox sub sprdsht); USEPA, 1992 (tox sub sprdsht); Veith and Kosian, 1982; and Verschueren, 1983.

atm-m³/mol	Atmospheres-cubic meters per mole.
BCF	Bioconcentration factor.
°C	Degrees Celsius.
cm²/sec	Square centimeters per second.
g/mol	Grams per mole.
Koc	Organic carbon partition coefficient.
Kow	Octanol-water partition coefficient.
L/kg	Liters per kilogram.
mg/L	Milligrams per liter.
mL/g	Milliliters per gram.
mm Hg	Millimeters of mercury.
ND	No data.
T ½	Half-life.
TPH	Total petroleum hydrocarbons.

Finding 3.

The Wrong Soil-Cover Depth is used in the Risk Calculations, Thus Underestimating the Potential Impact to Human Health

Supporting Data

Tables A-3, A-7, A-16, A-19, A-23, A-26, A-30 A-34, A-38, A-42, A-45, A-49

from the Baseline Risk Assessment

Table A-3. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 feet-bgs, Area of Potential Concern #1, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC	Background Site-Specific [a]	Background Regional [b]
VOCs								
Ethyl benzene	1 / 25	0.005 - 1	1.9	0.22	0.36	0.36	NAP	NAP
Methylene chloride	1 / 25	0.005 - 0.01	0.005	0.0043	0.0047	0.0047	NAP	NAP
Trichloroethene	1 / 25	0.005 - 0.06	0.03	0.016	0.021	0.021	NAP	NAP
Total Xylenes	4 / 25	0.01 - 2	1.3 - 12	0.93	1.8	1.8	NAP	NAP
SVOCs								
bis-2-ethylhexyl-phthalate	1 / 9	0.1 - 0.22	0.11	0.069	0.087	0.087	NAP	NAP
N-Nitrosodimethylamine	1 / 9	0.1 - 0.2	0.1	0.061	0.075	0.075	NAP	NAP
PAHs								
Chrysene	1 / 9	0.1 - 0.2	0.1	0.061	0.075	0.075	NAP	NAP
Phenanthrene	1 / 9	0.1 - 0.6	0.3	0.11	0.17	0.17	NAP	NAP
Pyrene	1 / 9	0.1 - 0.6	0.3	0.11	0.17	0.17	NAP	NAP
TPH								
TPH (diesel)	7 / 25	10 - 56	11 - 2400	110	270	270	NAP	NAP
TPH (gas)	3 / 10	1	390 - 840	170	340	340	NAP	NAP
TPH (kerosene)	12 / 18	10	110 - 22000	1800	3900	3900	NAP	NAP
Total Petroleum Hydrocarbons	5 / 16	20	23 - 2600	300	590	590	NAP	NAP
Inorganics								
Barium	6 / 6	NA	8.7 - 306	110	200	200	281	670
Copper	6 / 6	NA	3.2 - 63	20	38	38	53	27

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Table A-3. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 feet-bgs, Area of Potential Concern #1, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC	Background Site-Specific [a]	Background Regional [b]

Concentrations are reported in milligrams per kilogram (mg/kg).

[a] Background comparison value determined during RFI.
[b] Shacklette and Boerngen, 1984.

Detects Number of samples with detectable concentrations on constituent.
EPC Exposure point concentration.
Mean Arithmetic average concentration of constituents using measured concentrations in "detects" and proxy concentrations in "non-detects" for the total number of samples.
NA Not available.
NAP Not Applicable
PAHs Polycyclic aromatic hydrocarbons.
SVOCs Semivolatile organic compounds.
SQLs Sample quantitation limits for the non-detected constituents (detection limits).
Subsurface Greater than 2 feet below ground surface.
Total Total number of samples analyzed for constituent.
TPH Total petroleum hydrocarbons.
UCL 95 percent upper confidence limit (one-tailed) on the mean, assuming a normal distribution.
VOCs Volatile organic compounds.

BOE-C6-0093550

Table A-7. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 Feet bgs, Area of Potential Concern #2, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC	Background Site-Specific [a]	Background Regional [b]
VOCs								
1,1-Dichloroethane	7 / 14	0.005 - 1	0.0053 - 2.7	0.24	0.58	0.58	NAP	NAP
1,1-Dichloroethene	1 / 14	0.005 - 0.046	0.023	0.0054	0.0090	0.0090	NAP	NAP
Total Xylenes	2 / 14	0.01 - 3	0.12 - 4.6	0.45	1.0	1.0	NAP	NAP
Trichloroethene	11 / 14	0.005 - 0.005	0.012 - 95	7.1	19	19	NAP	NAP
1,1,1-Trichloroethane	2 / 14	0.005 - 0.046	0.0059 - 0.023	0.0071	0.011	0.011	NAP	NAP
TPH								
TPH (crude oil)	4 / 4	NA	120 - 15,000	5,700	14,000	14,000	NAP	NAP
TPH (kerosene)	1 / 14	10 - 1,000	1,400	140	320	320	NAP	NAP
Inorganics								
Cadmium	1 / 2	0.5	8.8	4.5	32	8.8	0.88	NAP
Copper	2 / 2	NA	33 - 117	75	340	120	53	27
Zinc	2 / 2	NA	68 - 900	480	3,100	900	198	65

Concentrations are reported in milligrams per kilogram (mg/kg).

[a] Background comparison value determined during RFI.
[b] Shacklette and Boerngen, 1984.

Detects Number of samples with detectable concentrations on constituent.
EPC Exposure point concentration.
Mean Arithmetic average concentration of constituents using measured concentrations in "detects" and proxy concentrations in "non-detects" for the total number of samples.

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Table A-7. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 Feet bgs, Area of Potential Concern #2, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC	Background Site-Specific [a]	Background Regional [b]

NA	Not available.
NAP	Not Applicable.
SQLs	Sample quantitation limits for the non-detected constituents (detection limits).
Subsurface	Greater than 2 feet below ground surface.
Total	Total number of samples analyzed for constituent.
TPH	Total petroleum hydrocarbons.
UCL	95 percent upper confidence limit (one-tailed) on the mean, assuming a normal distribution.
VOCs	Volatile organic compounds.

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Table A-16. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 Feet bgs, Area of Potential Concern #5, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC	Background Site-Specific [a]	Background Regional [b]
VOCs								
Tetrachloroethene	1 / 4	0.005	0.019	0.0066	0.016	0.016	NAP	NAP
Trichloroethene	3 / 4	0.005	0.028 - 0.11	0.043	0.098	0.098	NAP	NAP
PCBs								
PCBs (unspecified)	1 / 4	0.01	0.01	0.0063	0.0092	0.0092	NAP	NAP
TPH								
TPH (crude/waste oil)	3 / 5	50	54 - 980	230	630	630	NAP	NAP
Inorganics								
Arsenic	5 / 5	NA	2.1 - 260	78	190	190	14	7.0
Cadmium	2 / 5	0.5	1.4 - 2.7	0.97	2	2	0.88	NAP
Copper	5 / 5	NA	19 - 245	100	200	200	53	27

Concentrations are reported in milligrams per kilogram (mg/kg).

[a] Background comparison value determined during RFI.
[b] Shacklette and Boerngen, 1984.

Detects Number of samples with detectable concentrations on constituent.
EPC Exposure point concentration.
Mean Arithmetic average concentration of constituents using measured concentrations in "detects" and proxy concentrations in "non-detects" for the total number of samples.
NA Not available.
NAP Not Applicable.
PCBs Polychorinated biphenyls.
SQLs Sample quantitation limits for the non-detected constituents (detection limits).
Subsurface Greater than 2 feet below ground surface.
Total Total number of samples analyzed for constituent.
TPH Total petroleum hydrocarbons.
UCL 95 percent upper confidence limit (one-tailed) on the mean, assuming a normal distribution.
VOCs Volatile organic compounds.

BOE-C6-0093553

Table A-19. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 Feet bgs, Area of Potential Concern #6, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC
VOCs						
1,1-Dichloroethane	6 / 20	0.5	0.01 - 4.7	0.44	0.92	0.92
1,1-Dichloroethene	1 / 20	0.005 - 0.82	0.41	0.063	0.11	0.11
trans-1,2-Dichloroethene	1 / 20	0.005 - 1	0.58	0.076	0.14	0.14
Tetrachloroethene	5 / 20	0.005 - 0.5	0.011 - 36	2.6	6	6
Toluene	1 / 20	0.005 - 0.94	0.47	0.069	0.13	0.13
1,1,1-Trichloroethane	3 / 20	0.005 - 0.5	0.01 - 6.1	0.46	1	1
Trichloroethene	10 / 20	0.5	0.006 - 170	11	27	27
Vinyl chloride	1 / 20	0.001 - 0.78	0.39	0.051	0.096	0.096
Xylenes	2 / 20	0.01 - 1	4 - 40	2.2	5.7	5.7
SVOCs						
Naphthalene	1 / 5	0.1 - 0.22	0.11 - 0.11	0.098	0.12	0.11
n-Nitrosodiphenylamine	1 / 5	0.1 - 0.24	0.12 - 0.12	0.11	0.14	0.12
TPH						
TPH (crude/waste oil)	3 / 18	50 - 1000	7000	660	1300	1300
TPH (diesel)	1 / 18	10 - 48	24	12	16	16
TPH (kerosene)	2 / 18	10 - 500	1600	120	280	280
TPH (Z-oil)	5 / 15	50 - 50	50 - 11000	1100	2300	2300

Concentrations are reported in milligrams per kilogram (mg/kg).

Detects Number of samples with detectable concentrations on constituent.

BOE-C6-0093554

Table A-19. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 Feet bgs, Area of Potential Concern #6, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC

EPC	Exposure point concentration.
Mean	Arithmetic average concentration of constituents using measured concentrations in "detects" and proxy concentrations in "non-detects" for the total number of samples.
NA	Not available.
SQLs	Sample quantitation limits for the non-detected constituents (detection limits).
Subsurface	Greater than 2 feet below ground surface.
Total	Total number of samples analyzed for constituent.
TPH	Total petroleum hydrocarbons.
UCL	95 percent upper confidence limit (one-tailed) on the mean, assuming a normal distribution.
VOCs	Volatile organic compounds.

BOE-C6-0093555

Table A-23. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 Feet bgs, Area of Potential Concern #7, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC	Background Site-Specific [a]	Background Regional [b]
VOCs								
1,1-Dichloroethane	11 / 28	0.005 - 0.2	0.0052 - 0.1	0.022	0.032	0.032	NAP	NAP
1,1-Dichloroethene	10 / 28	0.005 - 0.28	0.005 - 0.14	0.029	0.043	0.043	NAP	NAP
Tetrachloroethene	19 / 28	0.005	0.0067 - 50	5.3	9.5	9.5	NAP	NAP
1,1,1-Trichloroethane	10 / 28	0.005 - 0.4	0.0052 - 0.2	0.036	0.056	0.056	NAP	NAP
Trichloroethene	14 / 28	0.005 - 1.14	0.0056 - 0.57	0.088	0.14	0.14	NAP	NAP
PAHs								
Chrysene	1 / 2	0.1	0.1	0.075	0.23	0.1	NAP	NAP
TPH								
TPH (crude/waste oil)	1 / 29	50	54	26	28	28	NAP	NAP
TPH (diesel)	1 / 29	10	10	5.2	5.5	5.5		
TPH (Z-oil)	1 / 29	50	75	27	30	30	NAP	NAP
Inorganics								
Barium	5 / 5	NA	165 - 290	200	250	250	281	670
Copper	5 / 5	NA	24 - 55	36	49	49	53	27

Concentrations are reported in milligrams per kilogram (mg/kg).

[a] Background comparison value determined during RFI.
[b] Shacklette and Boerngen, 1984.

Detects Number of samples with detectable concentrations on constituent.
EPC Exposure point concentration.
Mean Arithmetic average concentration of constituents using measured concentrations in "detects" and proxy concentrations in "non-detects" for the total number of samples.
NA Not available.
NAP Not Applicable.
PAHs Polycyclic aromatic hydrocarbons.
SQLs Sample quantitation limits for the non-detected constituents (detection limits).
Subsurface Greater than 2 feet below ground surface.
Total Total number of samples analyzed for constituent.
TPH Total petroleum hydrocarbons.
UCL 95 percent upper confidence limit (one-tailed) on the mean, assuming a normal distribution.
VOCs Volatile organic compounds.

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BOE-C6-0093556

Table A-26. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 Feet bgs, Area of Potential Concern #8, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC	Background Site-Specific [a]	Background Regional [b]
VOCs								
Tetrachloroethene	1 / 4	0.005	0.12	0.032	0.1	0.1	NAP	NAP
Trichloroethene	2 / 4	0.005	0.0078 - 0.078	0.023	0.066	0.066	NAP	NAP
Inorganics								
Arsenic	8 / 8	NA	1.7 - 19	6.6	12	12	14	7.0
Copper	4 / 4	NA	25 - 84	48	78	78	53	27
Vanadium	4 / 4	NA	41 - 91	59	85	85	82	88

Concentrations are reported in milligrams per kilogram (mg/kg).

[a] Background comparison value determined during RFI.
[b] Shacklette and Boerngen, 1984.

Detects Number of samples with detectable concentrations on constituent.
EPC Exposure point concentration.
Mean Arithmetic average concentration of constituents using measured concentrations in "detects" and proxy concentrations in "non-detects" for the total number of samples.
NA Not available.
NAP Not Applicable.
SQLs Sample quantitation limits for the non-detected constituents (detection limits).
Subsurface Greater than 2 feet below ground surface.
Total Total number of samples analyzed for constituent.
UCL 95 percent upper confidence limit (one-tailed) on the mean, assuming a normal distribution.
VOCs Volatile organic compounds.

BOE-C6-0093557

Table A-30. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 Feet bgs, Area of Potential Concern #9, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC	Background Site-Specific [a]	Background Regional [b]
PCBs								
PCBs (unspecified)	6 / 32	0.01 - 0.01	0.03 - 0.55	0.051	0.092	0.092	NAP	NAP
Aroclor 1242	2 / 72	0.01 - 0.1	0.44 - 0.55	0.02	0.036	0.036	NAP	NAP
Aroclor 1254	5 / 73	0.01 - 0.1	0.03 - 0.4	0.013	0.023	0.023	NAP	NAP
TPH								
Total Petroleum Hydrocarbons	3 / 8	20 - 20	51 - 23,000	3,700	9,200	9,200	NAP	NAP
TPH (Aviation Gas)	2 / 103	50 - 100	50	28	29	29	NAP	NAP
TPH (Crude Oil)	2 / 103	50 - 2,800	400 - 1,400	84	120	120	NAP	NAP
TPH (Diesel)	6 / 111	10 - 1,000	10 - 7,100	80	190	190	NAP	NAP
TPH (Gasoline)	2 / 111	1 - 1,680	42 - 840	62	88	88	NAP	NAP
TPH (Kerosene)	8 / 103	10 - 1,000	99 - 5,300	160	280	280	NAP	NAP
TPH (Motor Oil)	1 / 1	NA	160	160	NA	160	NAP	NAP
TPH (Z-Oil)	12 / 100	50 - 50	410 - 10,000	350	560	560	NAP	NAP
Inorganics								
Aluminum	42 / 42	NA	2,480 - 39,400	20,000	21,000	21,000	36,300	7.4
Barium	42 / 42	NA	10 - 1,480	220	270	270	281	670
Cadmium	7 / 66	0.5 - 0.5	0.5 - 8.3	0.44	0.64	0.64	0.88	
Chromium	66 / 66	NA	13 - 758	44	63	63	41	56
Cobalt	65 / 66	2.5 -	6.5 - 47	12	13	13	20	9
Copper	42 / 42	NA	9.8 - 244	42	52	52	53	27
Lead	64 / 66	2.5 - 2.5	3 - 1,050	30	57	57	111	20
Manganese	46 / 46	NA	237 - 4,470	590	740	740	1,393	
Molybdenum	5 / 42	2.5 - 2.5	2.5 - 30	2.6	4	4	23	1.1
Nickel	42 / 42	NA	5.6 - 142	24	29	29	29	19
Selenium	1 / 42	0.5 - 1	0.67	0.27	0.29	0.29	0.5	0.34
Vanadium	42 / 42	NA	9.8 - 289	53	63	63	82	88
Zinc	42 / 42	NA	19 - 1,370	110	170	170	198	65

Footnotes appear on page 3.

BOE-C6-0093558

Table A-30. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 Feet bgs, Area of Potential Concern #9, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC	Background Site-Specific [a]	Background Regional [b]

Concentrations are reported in milligrams per kilogram (mg/kg).

[a] Background comparison value determined during RFI.
[b] Shacklette and Boerngen, 1984.

Detects Number of samples with detectable concentrations on constituent.
EPC Exposure point concentration.
Mean Arithmetic average concentration of constituents using measured concentrations in "detects" and proxy concentrations in "non-detects" for the total number of samples.
NA Not available.
NAP Not Applicable.
ND Not detected.
PAHs Polycyclic aromatic hydrocarbons.
PCBs Polychlorinated biphenyls.
SQLs Sample quantitation limits for the non-detected constituents (detection limits).
SVOCs Semi-volatile organic compounds.
Total Total number of samples analyzed for constituent.
TPH Total petroleum hydrocarbons.
UCL 95 percent upper confidence limit (one-tailed) on the mean, assuming a normal distribution.
VOCs Volatile organic compounds.

BOE-C6-0093559

Table A-34. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 Feet bgs, Area of Potential Concern #10, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC
VOCs						
Chloroform	1 / 41	0.005 - 0.116	0.058	0.018	0.024	0.024
Ethyl benzene	3 / 41	0.005 - 42	1.9 - 21	1.3	2.5	2.5
Toluene	7 / 41	0.005 - 0.3	0.019 - 220	8	17	17
Trichloroethene	21 / 41	0.005 - 5	0.009 - 680	18	46	46
Vinyl chloride	1 / 41	0.001 - 0.118	0.059	0.018	0.025	0.025
Xylenes	7 / 41	0.01 - 0.6	0.025 - 190	10	20	20
PCBs						
Aroclor 1254	1 / 14	0.01 - 0.02	0.03	0.0071	0.01	0.01
TPH						
TPH (Crude/Waste Oil)	1 / 36	50 - 122	61	31	35	35
TPH (Diesel)	2 / 36	10 - 22	10 - 11	6.3	6.9	6.9
TPH (Kerosene)	7 / 36	10 - 200	46 - 15,000	820	1,600	1,600
TPH (Z-Oil)	6 / 36	50 - 50	370 - 6,300	400	730	730

Concentrations are reported in milligrams per kilogram (mg/kg).

Detects	Number of samples with detectable concentrations on constituent.
EPC	Exposure point concentration.
Mean	Arithmetic average concentration of constituents using measured concentrations in "detects" and proxy concentrations in "non-detects" for the total number of samples.
NA	Not available.
ND	Not detected.
PCBs	Polychlorinated biphenyls.
SQLs	Sample quantitation limits for the non-detected constituents (detection limits).
Total	Total number of samples analyzed for constituent.
TPH	Total petroleum hydrocarbons.
UCL	95 percent upper confidence limit (one-tailed) on the mean, assuming a normal distribution.
VOCs	Volatile organic compounds.

BOE-C6-0093560

Table A-38. **Constituent Occurrence Summary for Subsurface Soil Samples, Greater Than 2 Feet bgs, Area of Potential Concern #11, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC
VOCs						
1,1-Dichloroethane	3 / 12	0.005 - 0.64	0.005 - 0.32	0.06	0.12	0.12
1,1-Dichloroethene	8 / 12	0.005 - 0.42	0.005 - 0.21	0.068	0.11	0.11
Tetrachloroethene	3 / 12	0.005 - 0.26	0.013 - 0.13	0.031	0.056	0.056
1,1,1-Trichloroethane	8 / 12	0.005 - 0.02	0.044 - 22	3.8	7.2	7.2
Trichloroethene	4 / 12	0.005 - 0.64	0.022 - 0.32	0.066	0.13	0.13
TPH						
TPH (Crude/Waste Oil)	1 / 12	50 - 280	140	81	110	110
TPH (Diesel)	1 / 12	10 - 20	10	7.9	9.3	9.3
TPH (Kerosene)	1 / 12	10 - 500	5,000	470	1,200	1,200
TPH (Z-Oil)	6 / 10	50 - 50	210 - 6,800	1,900	3,400	3,400

Concentrations are reported in milligrams per kilogram (mg/kg).

Detects	Number of samples with detectable concentrations on constituent.
EPC	Exposure point concentration.
Mean	Arithmetic average concentration of constituents using measured concentrations in "detects" and proxy concentrations in "non-detects" for the total number of samples.
NA	Not available.
ND	Not detected.
SQLs	Sample quantitation limits for the non-detected constituents (detection limits).
Total	Total number of samples analyzed for constituent.
TPH	Total petroleum hydrocarbons.
UCL	95 percent upper confidence limit (one-tailed) on the mean, assuming a normal distribution.
VOCs	Volatile organic compounds.

BOE-C6-0093561

Table A-42. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 Feet bgs, Area of Potential Concern #12, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC	Background Site-Specific [a]	Background Regional [b]
VOCs								
Toluene	1 / 26	0.005 - 0.005	0.031	0.0036	0.0055	0.0055	NAP	NAP
Trichloroethene	13 / 26	0.005 - 0.005	0.0072 - 0.17	0.026	0.04	0.04	NAP	NAP
TPH								
TPH (Crude/Waste Oil)	8 / 45	50 - 1,000	59 - 910	75	110	110	NAP	NAP
TPH (Diesel)	2 / 46	10 - 24	10 - 12	5.8	6.3	6.3	NAP	NAP
TPH (Z-Oil)	3 / 32	50 - 50	180 - 3,300	140	310	310	NAP	NAP
Inorganics								
Beryllium	41 / 44	0.5 - 0.5	0.063 - 0.82	0.58	0.62	0.62	0.74	0.97
Chromium	44 / 44	NA	15 - 119	30	34	34	41	56
Cobalt	44 / 44	NA	5.4 - 21	11	12	12	20	9
Copper	21 / 21	NA	20 - 146	51	62	62	53	27
Lead	44 / 44	NA	3.7 - 334	20	33	33	111	20
Nickel	21 / 21	NA	13 - 67	22	26	26	29	19

Concentrations are reported in milligrams per kilogram (mg/kg).

[a] Background comparison value determined during RFI.

[b] Shacklette and Boerngen, 1984.

Detects Number of samples with detectable concentrations on constituent.

EPC Exposure point concentration.

Mean Arithmetic average concentration of constituents using measured concentrations in "detects" and proxy concentrations in "non-detects" for the total number of samples.

NA Not available.

NAP Not Applicable.

ND Not detected.

SQLs Sample quantitation limits for the non-detected constituents (detection limits).

Total Total number of samples analyzed for constituent.

TPH Total petroleum hydrocarbons.

UCL 95 percent upper confidence limit (one-tailed) on the mean, assuming a normal distribution.

VOCs Volatile organic compounds.

BOE-C6-0093562

Table A-45. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 Feet bgs, Area of Potential Concern #13, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC
VOCs						
1,1,1-Trichloroethane	2 / 6	0.005 - 0.005	0.1976 - 0.429	0.11	0.25	0.25
1,1,2-Trichloroethane	2 / 6	0.005 - 0.005	0.0133 - 0.014	0.0062	0.011	0.011
1,1-Dichloroethane	1 / 6	0.005 - 0.005	0.0264	0.0065	0.015	0.015
Ethylbenzene	2 / 6	0.005 - 0.005	0.0369 - 0.0397	0.014	0.03	0.03
Tetrachloroethene	2 / 6	0.005 - 0.005	0.2366 - 0.334	0.097	0.22	0.22
Toluene	1 / 6	0.005 - 0.005	0.015	0.0046	0.0088	0.0088
Total Xylenes	3 / 6	0.005 - 0.005	0.0893 - 0.7564	0.21	0.46	0.46
Trichloroethene	5 / 6	0.005 - 0.005	0.0214 - 2.692	0.9	1.9	1.9
TPH						
Total Petroleum Hydrocarbons	4 / 6	0.01 - 0.01	2,684 - 26,194	9,000	18,000	18,000

Concentrations are reported in milligrams per kilogram (mg/kg).

Detects	Number of samples with detectable concentrations on constituent.
EPC	Exposure point concentration.
Mean	Arithmetic average concentration of constituents using measured concentrations in "detects" and proxy concentrations in "non-detects" for the total number of samples.
NA	Not available.
ND	Not detected.
SQLs	Sample quantitation limits for the non-detected constituents (detection limits).
Total	Total number of samples analyzed for constituent.
TPH	Total petroleum hydrocarbons.
UCL	95 percent upper confidence limit (one-tailed) on the mean, assuming a normal distribution.
VOCs	Volatile organic compounds.

BOE-C6-0093563

Table A-49. **Constituent Occurrence Summary for Subsurface Soil Samples Greater Than 2 Feet bgs, Area of Potential Concern #14, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC	Background Site-Specific [a]	Background Regional [b]
VOCs								
1,1-Dichloroethane	4 / 13	0.005 - 0.01	0.005 - 0.045	0.0075	0.013	0.013	NAP	NAP
1,1-Dichloroethene	3 / 13	0.005 - 0.01	0.016	0.0043	0.0062	0.0062	NAP	NAP
1,1,1-Trichloroethane	6 / 13	0.005 - 0.01	0.007 - 0.085	0.015	0.027	0.027	NAP	NAP
Trichloroethene	10 / 13	0.005 - 0.005	0.007 - 0.15	0.062	0.089	0.089	NAP	NAP
TPH								
TPH (diesel)	1 / 12	10 - 10	23	6.5	9.2	9.2	NAP	NAP
Inorganics								
Beryllium	12 / 15	0.5 - 0.5	0.53 - 0.94	0.58	0.67	0.67	0.74	0.97
Cadmium	7 / 16	0.5 0.5	0.6 - 813	57	150	150	0.88	NA
Chromium	16 / 16	NA	13 - 167	51	71	71	41	56
Copper	3 / 3	NA	26 - 63	44	75	63	53	27

Concentrations are reported in milligrams per kilogram (mg/kg).

[a] Background comparison value determined during RFI.
[b] From "Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States" (Shacklette and Boerngen, 1984).

Detects Number of samples with detectable concentrations on constituent.
EPC Exposure point concentration.
Mean Arithmetic average concentration of constituents using measured concentrations in "detects" and proxy concentrations in "non-detects" for the total number of samples.
NA Not available.
NAP Not applicable.
SQLs Sample quantitation limits for the non-detected constituents (detection limits).
Subsurface Greater than 2 feet below ground surface.
Total Total number of samples analyzed for constituent.
TPH Total petroleum hydrocarbons.
UCL 95 percent upper confidence limit (one-tailed) on the mean, assuming a normal distribution.
VOCs Volatile organic compounds.

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Finding 4.

Subdividing the Site Violates the Principle of Assessing Site-Wide Risks and Underestimates the Actual Risks Posed by the Site

Supporting Data

Figure 6-1, Areas of Potential Concern Identified in BRA, from the document Interim Measures Completion Report for Soil, Volume II (Lockheed Martin, July 1996)

Finding 5.

Major Guidance Document used to Develop Preliminary Delineation Criteria Values is Not Recommended or Approved by Cal/EPA

Supporting Data

The Health-Based Soil Screening Levels draft document (Cal/EPA, DTSC, January 1994) cited in the Baseline Risk Assessment has been withdrawn by Cal/EPA and is no longer available.

Finding 6.

Spatial Screening of Contamination was Conducted, Thus Significantly Limiting the Projected Adverse Health Effects

Supporting Data

Pages 27 and 28 of the Baseline Risk Assessment

the initial round of groundwater sampling. Analytical data from some of the groundwater locations may represent background or impacts from upgradient sources; however, for the purposes of the BRA, all were considered to represent site-related impacts.

4.4 CONSTITUENTS OF POTENTIAL CONCERN

COPCs were selected in accordance with USEPA (1989a) and Cal/EPA (1992) guidance for risk assessment as described in the following subsections. The database for each AOPC included all detected constituents, even those less than the individual constituent PDCV.

4.4.1 COPC Selection Criteria

The characteristics of the site and the analytical data were reviewed in the context of risk assessment guidance and standards of practice to establish criteria for inclusion/exclusion of chemicals as COPCs. Selection criteria included the following:

- Frequency of detection
- Elimination of nutrients (e.g., sodium, calcium, magnesium, potassium, and iron for human receptors),
- Adequacy of detection limits,
- Comparison to background,
- Comparison to laboratory/blank contamination,
- Toxicity potential,
- Degradation products of otherwise low-toxicity chemicals,
- Risk potential.

Constituents that were detected in less than 5 percent of the samples within an AOPC were excluded from consideration as COPCs, unless they are classified as known human carcinogens

(USEPA Class A). Constituents detected at levels that are statistically representative of background were also excluded from further consideration as COPCs, as described in Section 4.4.2 of this report.

Calcium, iron, magnesium, sodium, and potassium were detected at levels representative of background in soils across the site. These five constituents are essential nutrients for humans and are not considered toxic at naturally-occurring background levels. Therefore, these nutrients were not considered COPCs for the site.

During the RFI, several soil samples from locations across the site were analyzed for hexavalent chromium. The analytical results indicated that hexavalent chromium does not occur in site soils at detectable levels (Geraghty & Miller, 1996). The results of total chromium analyses for soil were, therefore, assumed to represent soil concentrations of trivalent chromium only.

Detected constituents that are known laboratory and equipment contaminants (e.g., methylene chloride, phthalate esters, and brominated chloromethanes) were excluded from further consideration as COPCs if the detected site concentrations were less than 10 times the associated method or equipment blank concentrations. Such constituents detected at greater than 10 times the associated blank also were excluded if they were not expected to be associated with site operations and if site concentrations were consistently detected at levels near the PQL, indicating a high probability that the constituent was an artifact of sampling or laboratory contamination. Constituents detected in soil that were excluded as COPCs on this basis are dibromochloromethane, methylene chloride, chloroform, and bis-2-(ethylhexyl)phthalate. All detected concentrations of these four constituents were within 1 order of magnitude of the associated PQL. In most cases, the detected concentrations only exceeded the PQL by a factor of 1/2 times the PQL.

Constituents detected in groundwater that were excluded because they appeared to be artifacts of sampling or laboratory contamination included bromodichloromethane, carbon tetrachloride, and bis-2-(ethylhexyl) phthalate. Each of these three constituents was detected within 1 order of magnitude of the PQL in only one sample location.

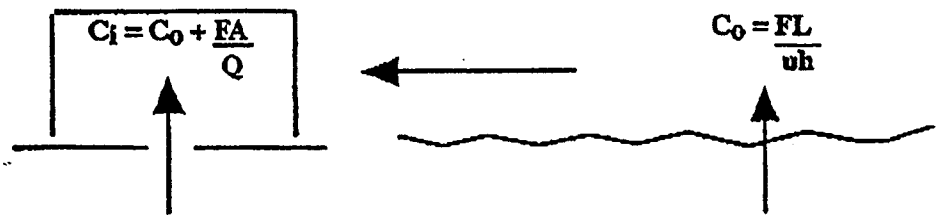
BOE-C6-0093569

Finding 7.

Chemicals Released by the Site to the Outdoor Air are Not Included in the Assessment of Health Impacts Under the Commercial Land-Use Scenario

Supporting Data

Orange County Health Care Agency, Vapor Pathway Evaluation Model



$Q = VE$

$F = \frac{D_e C_{sg}}{X}$

$D_e = D_a \frac{P_a^{3.33}}{P_t^2}$

$P_a = P_t - MB$

$C_{sg} = C_w H$ | DIRECT MEASUREMENT | $C_{sg} = \frac{(VP)(MW)(MF)}{RT}$ in the liquid phase

C_{sg} = Concentration in soil gas
C_w = Concentration in groundwater or soil pore water
C_i = Total Concentration in indoor air
C_o = Concentration in outdoor air
VP = Vapor pressure
MW = Molecular weight
MF = Mole fraction – in the liquid phase
H = Henry's Law constant
D_e = Effective diffusion coefficient
D_a = Diffusion coefficient in air
P_a = Air filled porosity
R = Universal gas constant
T = Absolute temperature

P_t = Total porosity
B = Bulk density
M = Soil moisture
F = Flux
X = Distance between contamination and surface
A = Area through which flux occurs
Q = Ventilation rate
V = Volume of building
E = Exchange rate with outdoor air
L = Downwind length of contamination
u = Wind speed
h = Height of "box", e.g., height of doorway or ventilation system intake

NOTES:

1. The area through which flux occurs may be reduced by a factor for attenuation of infiltration by the building foundation.
2. For contaminants dissolved in soil pore water, $C_w = \frac{C_t}{M_{wet}}$ where = C_t = contaminant concentration in soil and Mwet = wet weight moisture content of soil. Effects of adsorption may be considered where appropriate.

OCHCA's Vapor Pathway Evaluation Model

Finding 8.

Residual Contaminants - those Left On Site after Implementation of Interim Remedial Measures - are Not Included in the Baseline Risk Calculations

Supporting Data

A) Table 4-2 from the Baseline Risk Assessment

B) Figure 5-7, Potential Interim Measures Areas as of February 26, 1996, from the document Interim Measures Completion Report for Soil, Volume II (Lockheed Martin, July 1996)

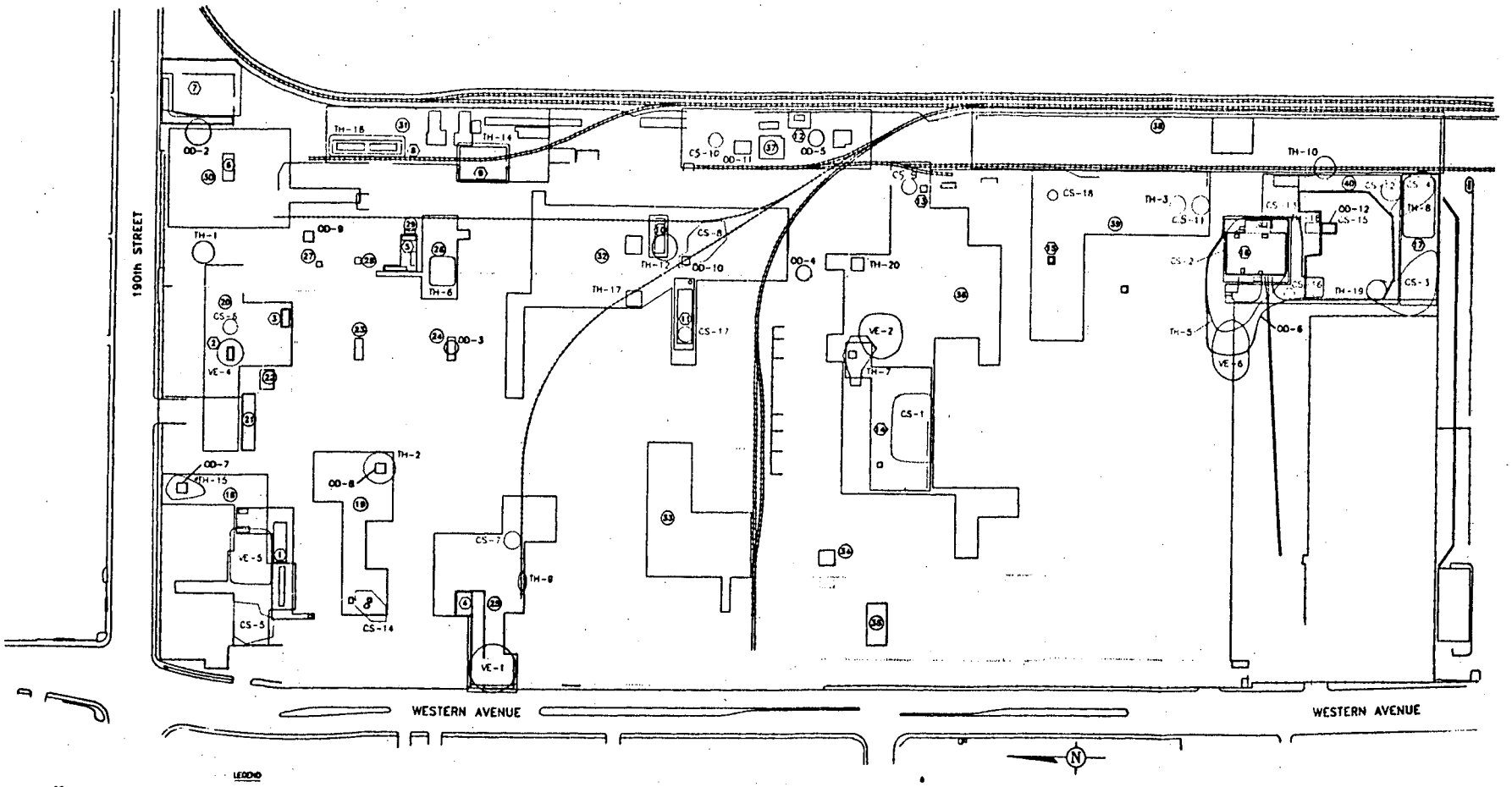
C) Reported Concentrations of Chemicals of Concern at Areas Not Included Within an AOPC (table), compiled by Integrated Environmental Services, Inc. from the document Interim Measures Completion Report for Soil, Volumes I and II (Lockheed Martin, July 1996)

A) Table 4-2 from the Baseline Risk Assessment

Table 4-2. Proposed Interim Measure (IM) areas Not Included Within an AOPC, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.

Chemical Stabilization	Thermal Treatment	Off-Site Disposal	Vapor Extraction
CS-06	TH-01	OD-02	VE-04
CS-07	TH-02	OD-03	
CS-09	TH-03	OD-04	
CS-10	TH-09	OD-05	
CS-11	TH-12	OD-08	
CS-14	TH-17	OD-09	
CS-17	TH-20	OD-11	
CS-18			

B) Figure 5-7, Potential Interim Measures Areas as of February 26, 1996, from the document Interim Measures Completion Report for Soil, Volume II (Lockheed Martin, July 1996)



LEGEND

OD-1 —— DESIGNATIONS AND LOCATIONS OF SOIL EXCAVATION FOR OFF-SITE DISPOSAL
TH-9 —— DESIGNATIONS AND LOCATIONS OF SOIL EXCAVATION FOR THERMAL TREATMENT
VE-1 —— DESIGNATIONS AND LOCATIONS OF IN-SITU SOIL VAPOR EXTRACTION
CS-5 —— DESIGNATIONS AND LOCATIONS OF SOIL EXCAVATION FOR CHEMICAL STABILIZATION
(16) RFI AREA OF INVESTIGATION
(1) RFI AREA OF INVESTIGATION

GERAGHTY & MILLER, INC.
Environmental Services

0 200 FT

POTENTIAL INTERIM MEASURES AREAS AS OF FEBRUARY 26, 1996

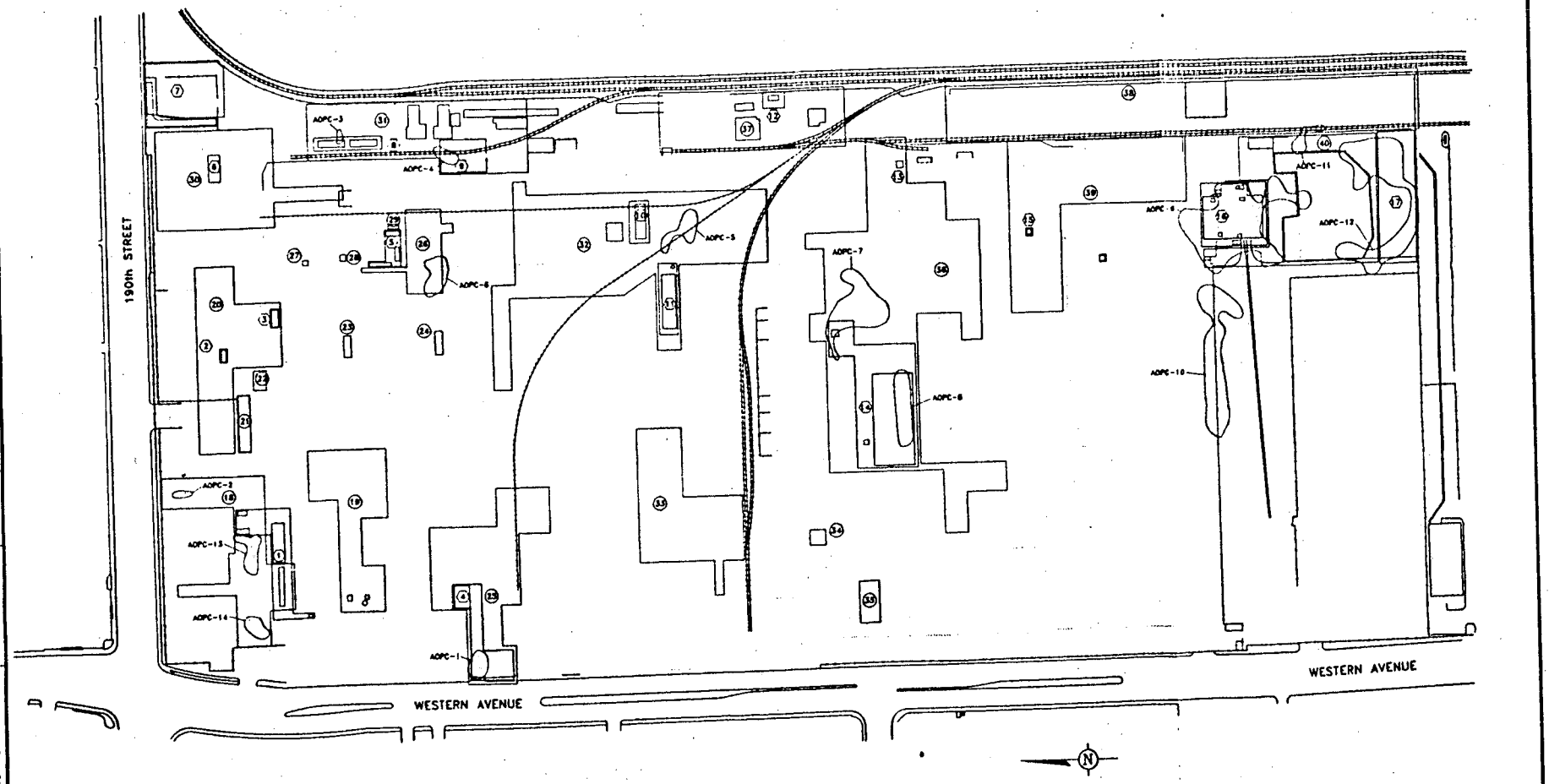
LOCKHEED MARTIN CORP./INTERNATIONAL LIGHT METALS FACILITY
TORRANCE, CA

FIGURE 5-7

DRAFTER: MRP | APPROVED: DLV | CHECKED: DLV | DRAWING: PIM_AREA | FILE: R11745C | PRJCT NO.: CA0217.028 | DWG DATE: 25 JUN 96

PIM_AREA

BOE-C6-0093576



LEGEND

(18) RI/I AREA OF INVESTIGATION

(1) RI/I AREA OF INVESTIGATION

AOPC-1 — APPROXIMATE BOUNDARY OF AREA OF POTENTIAL CONCERN FOR BASELINE RISK ASSESSMENT (BRA)

GERAGHTY & MILLER, INC.
Environmental Services

0 200 FT

AREAS OF POTENTIAL CONCERN IDENTIFIED IN BRA

LOCKHEED MARTIN CORP./INTERNATIONAL LIGHT METALS FACILITY
TORRANCE, CA

FIGURE 6-1

DRAFTER: MRP | APPROVED: DLV | CHECKED: DLV | DRAWING: AOPC_DWG | FILE: R11747C | PRJCT NO.: CA0217.028 | DWG DATE: 2 JULY 96

AOPC_DWG

BOE-C6-0093577

C) Reported Concentrations of Chemicals of Concern at Areas Not Included Within an AOPC (table), compiled by Integrated Environmental Services, Inc. from the document Interim Measures Completion Report for Soil, Volumes I and II (Lockheed Martin, July 1996)

Reported Concentrations of Chemicals of Concern at Areas Not Included Within an AOPC

Areas	CoC(s)	Reported Concentraions (mg/kg)	PDCV (mg/kg)	Excavated Soil Volume (CY)	Proposed RA Method
CS-06	Arsenic Cobalt	21 25	6 20	220	Excavation and Chemical Stabilization
CS-07	Chromium	234	20	NA	
CS-09	Beryllium	6.60	1.18	168	
CS-10	Lead	169	120	75	
CS-11	Chromium	55 to 404	20	NA	
CS-14	Chromium	49 to 50	20	NA	
CS-17	Chromium	113	20	NA	
CS-18	Chromium	48	20	NA	
TH-01	TPH (Crude Oil)	3,900	1,000	NA	Excavation and Thermal Treatment
TH-02	TPH (Crude Oil) TPH (Diesel) TPH (Kerosene) TPH (Z-Oil)	14,000 to 34,000 1,400 to 6,600 3,300 2,900 to 8,600	1,000 1,000 1,000 1,000	NA	
TH-03	TPH (Crude/Waste Oil)	2,300	1,000	NA	
TH-09	TPH (Crude Oil)	1,300	1,000	NA	
TH-12	TPH (Z-Oil)	4,700 to 14,000	1,000	NA	
TH-17	PCE TPH (Z-Oil)	8.20 2,300	4.00 1,000	NA	
TH-20	1,1-DCE	0.13	0.0052	NA	
OD-02	PCB-1260	0.34 to 41	0.03	25	Excavation and Off-site Disposal
OD-03	PCB-1260	0.04	0.03	NA	
OD-04	PCB-1260	0.09 to 0.12	0.03	NA	

Reported Concentrations of Chemicals of Concern at Areas Not Included Within an AOPC

Areas	CoC(s)	Reported Concentraions (mg/kg)	PDCV (mg/kg)	Excavated Soil Volume (CY)	Proposed RA Method
OD-05	PCB-1260	**0.21 to 0.33**	0.03	NA	Excavation and Off-site Disposal
OD-08	PCB-1254	**0.53 to 1.3**	0.03	NA	
OD-09	PCB-1260	**0.16**	0.03	NA	
OD-11	Arsenic	**23**	6	NA	
	Chromium	**109**	20		
	PCB-1254	**0.14 to 0.89**	0.03		
	TPH (Crude/Waste Oil)	**1,400 to 7,900**	1,000		
	TCE	**5.6 to 7.2**	3.30		
VE-04	TCE	0.007 to 0.033	3.30	NA	In-Situ Vapor Extraction
	PCE	0.009 to 1.3	4		
	1,1,1-TCA	0.0073	500		

Data compiled by Integrated Environmental Services, Inc. from:
Interim Measures Completion Report for Soil, Lockheed Martin Corp ILM Facility
(Geraghty & Miller, July 1996)

Finding 9.

Background Metal Concentrations Appear to be Overestimated, Thus Reducing the Magnitude of Potential Health Impacts Associated with the Site

Supporting Data

Pages 31 through 33 of the Baseline Risk Assessment

were normally distributed for each independent lithology at the site. Based on the results for these three constituents, it was also assumed that all inorganic constituents with similar overall site distributions are normally distributed for each lithologic unit.

A boxplot and a normal quantile plot were prepared for the overall background distribution of soil concentrations for each inorganic constituent. The boxplots summarize the data based on the median, quartiles, and extreme values and convey information about spread and skewness. The normal quantile plot is prepared by plotting the quantiles of a variable's distribution against the quantiles of the normal distribution, which provides a graphical representation of the goodness-of-fit of the data to a normal distribution. These plots were provided in Appendix B of the RFI report (Geraghty & Miller, 1996). A boxplot and a normal quantile plot also were prepared for the distributions of each inorganic constituent in all samples collected at the site, including both background and impacted area locations (Geraghty & Miller, 1996). The boxplot for the site-wide distribution can indicate extreme values that are not consistent with the overall distribution (including background) of the constituent at the site. Such extreme values may represent site impacts or they may represent statistically anomalous results. The normal quantile plot for the site-wide distribution of all site samples provides a graphical representation of the goodness-of-fit of the site data to a single normally distributed population. If the normal quantile data points fell on a straight line, the data were considered to represent a single normal distribution. If a straight line formed by the data points clearly changed direction (or slope), the data were considered to have originated from more than one normally distributed population. If the data points did not form a straight line, the distribution was determined to be non-normal.

For each inorganic constituent, a background comparison value was identified and is presented in Table 4-5. The background comparison value is the maximum concentration of the constituent that is assumed to represent background when detected at the site. If the constituent was not detected above the PQL in more than 40 percent of the background sample analyses, the maximum detected value was used as the background comparison value. If the constituent was

not detected at all in the background soil samples, then the arithmetic mean of the PQLs was identified as the background comparison value.

For inorganic constituents detected in 60 percent or more of the background samples, 95 percent and 99 percent upper tolerance levels (UTLs) were calculated. The 95 percent UTL is based upon a 95 percent probability that at least 95 percent of the complete background distribution is less than the UTL. The 99 percent UTL is based upon a 95 percent probability that at least 99 percent of the complete background distribution is less than the UTL. In these cases, the 99 percent UTL was identified as the background comparison value for all inorganic constituents except chromium and arsenic. The normal quantile plots for chromium and arsenic clearly indicated that overall site data originated from more than one normally distributed population. In the case of chromium, the change in slope observed on the normal quantile plot corresponded with the 95 percent UTL. Thus, the 95 percent UTL was identified as the background comparison value for chromium. In the case of arsenic, the change in slope on the normal quantile plot was associated with a value greater than the 99% UTL. This value of 14 milligrams per kilogram (mg/kg) represents the potential change from background to site-related population and was, therefore, used as the background comparison value for arsenic.

The 95 percent and 99 percent UTLs were calculated based upon the background sample mean and standard deviation. For moderately censored data sets (many nondetects), the median was used as an unbiased estimate of the population mean, and is presented in Table 4-5 as the estimate of the mean (Gilbert, 1987). For lognormally distributed background data, the arithmetic mean of the nontransformed data was used as a statistically unbiased estimator of the population mean where the coefficient of variation was less than 1.2 (Gilbert, 1987).

For each inorganic constituent, the concentration detected in each individual soil sample was compared to the background comparison value shown in Table 4-5. If the concentration detected exceeded the background comparison value, the constituent was determined to be potentially site-related. If the concentration detected was lower than or equal to the background comparison value, the constituent in that sample was determined to represent background. The

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site specific background comparison value was also used to develop PDCVs. Where health-based values were less than the background comparison values, the PDCVs equaled the background comparison value. Inorganic soil concentrations above the PDCVs, therefore, were determined to be site-related.

The development of site-specific background comparison values described in the preceding paragraphs was performed using background samples collected during the first phase of the RFI. Soil samples collected during supplemental soil RFI indicated the presence of low levels of PCDDs and PCDFs at the site. The incidence, concentrations, and distribution of PCDDs/PCDFs at the site were evaluated and determined not to be associated with site operations. The evaluation of PCDDs and PCDFs and a presentation of urban background concentrations of PCDDs/PCDFs is provided in Appendix G.

Site-specific background for surface water was characterized by the constituent concentrations detected in the upgradient sample. One surface water sample (SW-1) was collected at the upgradient edge of the storm drain on the ILM facility. The upgradient sample was collected during the same sampling event as on-site and downgradient samples. Concentrations of constituents detected in this upgradient sample originated from off-site, upgradient sources. The single upgradient sample collected is not statistically representative of concentrations originating from off-site sources. It does, however, provide an indication of the nature and magnitude of concentrations that are not site-related in surface water at the site.

The only organic analyte detected in the upgradient surface water sample (SW-1) was total oil and grease at 218 milligrams per liter (mg/L). Total oil and grease was detected in on-site surface water samples SW-2, SW-3, and SW-4, at concentrations of 39, 8 and 5 mg/L, respectively, and at a concentration of 10 mg/L at the downgradient edge of the site (SW-5). The surface water data indicate that total oil and grease detected in surface water at the site is likely to have originated from off-site sources.

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Finding 10.

Cancer Potency Factors used in the Baseline Risk Assessment are Different from those Published by Cal/EPA at the time the Report was Prepared

Supporting Data

A) Table 5-2 of the Baseline Risk Assessment

B) California Cancer Potency Factors Memorandum (Cal/EPA, November 1994), Section 1, page 4 and page 14, Criteria for Carcinogens (table)

A) Table 5-2 of the Baseline Risk Assessment

Table 5-2. **Cancer Potency Factors, Tumor Sites, and USEPA Cancer Classifications for Constituents of Potential Concern, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	CPFo (kg-day/mg)	CPFi (kg-day/mg)	URi (µg/m³)	Tumor site		USEPA Classification
				Oral	Inhalation	
VOCs						
Benzene	1.0E-01	1.0E-01	2.9E-05	leukemia	leukemia	A
Bromodichloromethane	1.3E-01	1.3E-01	3.7E-05	large intestine/kidney	NA	B2
Bromoform	7.9E-03	3.9E-03	1.1E-06	large intestine	large intestine	B2
Carbon tetrachloride	1.5E-01	1.5E-01	4.2E-05	liver	liver	B2
Chloroform	3.1E-02	1.9E-02	5.3E-06	kidney	liver	B2
Dibromochloromethane	8.4E-02	NA	NA	liver	NA	C
1,1-Dichloroethane	5.7E-03	5.7E-03	1.6E-06	NA	NA	C
1,2-Dichloroethane	7.0E-02	7.0E-02	2.2E-05	circulatory system	circulatory system	B2
1,1-Dichloroethene	6.0E-01	1.2E+00	5.0E-05	adrenal gland	kidney	C
Methylene chloride	1.4E-02	3.5E-03	1.0E-06	liver	lung, liver	B2
Tetrachloroethene	5.1E-02	2.1E-02	5.9E-06	liver	liver	C-B2
1,1,2-Trichloroethane	5.7E-02	5.7E-02	1.6E-05	liver	liver	C
Trichloroethene	1.5E-02	1.0E-02	2.0E-06	liver	lung	C-B2
Vinyl chloride	2.7E-01	2.7E-01	7.8E-05	lung	liver	A
SVOCs						
Bis(2-ethylhexyl)phthalate	8.4E-03	8.4E-03	2.4E-06	liver	NA	B2
Butylbenzylphthalate	NA	NA	NA	NA	NA	C
N-Nitrosodiphenylamine	9.0E-03	9.0E-03	2.6E-06	liver	NA	B2
Pentachlorophenol	1.8E-02	1.8E-02	5.1E-06	liver, adrenal gland	NA	B2
2,4,6-Trichlorophenol	7.0E-02	7.0E-02	2.0E-05	liver	liver	B2

Notes on Page 3.

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Table 5-2. **Cancer Potency Factors, Tumor Sites, and USEPA Cancer Classifications for Constituents of Potential Concern, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	CPFo (kg-day/mg)	CPFi (kg-day/mg)	URi (µg/m³)	Tumor site		USEPA Classification
				Oral	Inhalation	
PAHs						
Benzo(a)anthracene *	1.2E+00	3.9E-01	1.1E-04	NA (stomach)	NA (respiratory tract)	B2
Chrysene **	1.2E-01	3.9E-02	1.1E-05	NA (stomach)	NA (respiratory tract)	B2
Dioxins/Furans						
2,3,7,8-TCDD	1.3E+05	1.3E+05	3.8E+01	liver	respiratory tract	B2
Inorganics						
Arsenic	1.5E+00	1.2E+01	3.3E-03	skin	respiratory tract	A
Beryllium	4.3E+00	8.4E+00	2.4E-03	total tumors	lung	B2
Cadmium	NAP	1.5E+01	4.2E-03	NA	respiratory tract	B1
Chromium VI	4.2E-01	5.1E+02	1.5E-01	NA	lung	A
Lead	NA	NA	NA	NA	NA	B2
Nickel	NAP	9.1E-01	2.6E-04	NA	respiratory tract	A
PCBs						
Aroclor	7.7E+00	7.7E+00	2.2E-03	liver	NA	B2

References: Cal/EPA, 1994; IRIS, 1996; USEPA, 1995a.
Notes on Page 3.

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Table 5-2. Cancer Potency Factors, Tumor Sites, and USEPA Cancer Classifications for Constituents of Potential Concern, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.

Constituent	CPFo (kg-day/mg)	CPFi (kg-day/mg)	URi (µg/m³)	Tumor site		USEPA Classification
				Oral	Inhalation	

NOTES:

* Estimated by multiplying the oral CPF of 1.2E+01 for benzo(a)pyrene , the inhalation CPF of 3.9E+00 for benzo(a)pyrene, or the unit risk of 1.1E-03 for benzo(a)pyrene by the potency equivalency factor of 0.1 (Cal/EPA, 1994).

** Estimated by multiplying the oral CPF of 1.2E+01 for benzo(a)pyrene , the inhalation CPF of 3.9E+00 for benzo(a)pyrene, or the unit risk of 1.1E-03 for benzo(a)pyrene by the potency equivalency factor of 0.01 (Cal/EPA, 1994).

CPF Cancer potency factor.
kg-day/mg Kilograms-day per milligram.
µg/m³ Micrograms per cubic meter.
NA Not available.
NAP Not applicable, since it is carcinogenic by inhalation.
PAHs Polyaromatic hydrocarbons.
PCBs Polychlorinated biphenyls.
SVOCs Semi-volatile organic compounds.
TCDD Tetrachlorodi-benzo-p-dioxin.
VOCs Volatile organic compounds.

USEPA Cancer Classifications:

A Human carcinogen (sufficient evidence of carcinogenicity in humans).
B1 Probable human carcinogen (limited evidence of carcinogenicity in humans).
B2 Probable human carcinogen (sufficient evidence of carcinogenicity in animals, but inadequate evidence in humans).
C Possible human carcinogen (limited evidence of carcinogenicity in animals and inadequate human data).

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B) California Cancer Potency Factors Memorandum (Cal/EPA, November 1994), Section 1, page 4 and page 14, Criteria for Carcinogens (table)

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
CRITERIA FOR CARCINOGENS - [1/(mg/kg-day)]

Chemical-Carcinogens	CAS Number	Inhalation [8]	Source	Oral	Source
Chlorodibromomethane	*124-48-1*	[7] *9.4 E-02* (2.7 E-05)	RCHAS (510) 540-2084	[7] *9.4 E-02*	RCHAS (510) 540-2084
Chloroform	67-66-3	[2] 1.9 E-02 (5.3 E-06)	ATES (510) 540-3324	[2] 3.1 E-02	PETS (510) 540-3063
Chloromethyl methyl ether (technical grade)	*107-30-2*	[7] *2.4 E+00* (6.9 E-04)	RCHAS (510) 540-2084	[7] *2.4 E+00*	RCHAS (510) 540-2084
3-Chloro-2-methylpropene	*563-47-3*	[7] *1.4 E-01* (4.0 E-05)	RCHAS (510) 540-2084	[7] *1.4 E-01*	RCHAS (510) 540-2084
4-Chloro-ortho-phenylenediamine	*95-83-0*	[7] *1.6 E-02* (4.6 E-06)	RCHAS (510) 540-2084	[7] *1.6 E-02*	RCHAS (510) 540-2084
Chlorothalonil	*1897-45-6*	[7] *3.1 E-03* (8.9 E-07)	RCHAS (510) 540-2084	[7] *3.1 E-03*	RCHAS (510) 540-2084
p-Chloro-o-toluidine	*95-69-2*	[7] *2.7 E-01* (7.7 E-05)	RCHAS (510) 540-2084	[7] *2.7 E-01*	RCHAS (510) 540-2084
Chlorozotocin	*54749-90-5*	[7] *2.4 E+02* (6.9 E-02)	RCHAS (510) 540-2084	[7] *2.4 E+02*	RCHAS (510) 540-2084
Chromium, hexavalent (Chromium VI)	7440-47-3	5.1 E+02 (1.5 E-01)	ATES (510) 540-3324	[4] 4.2 E-01	RCHAS (510) 540-2084
Chrysene	218-01-9	[9] Appendix 1	ATES (510) 540-3324	[9] Appendix 1	ATES (510) 540-3324
C. I. Basic Red 9 monohydrochloride	569-61-9	[7] *2.5 E-01* (7.1 E-05)	RCHAS (510) 540-2084	[7] *2.4 E+02*	RCHAS (510) 540-2084
Cinnamyl anthranilate	*87-29-6*	[7] *4.6 E-03* (1.3 E-06)	RCHAS (510) 540-2084	[7] *4.6 E-03*	RCHAS (510) 540-2084
Coke oven emissions		[1] 2.2 E+00 (6.2 E-04)	RCHAS (510) 540-2084	[5]	
para-Cresidine	*120-71-8*	[7] *1.5 E-01* (4.3 E-05)	RCHAS (510) 540-2084	[7] *1.5 E-01*	RCHAS (510) 540-2084
Cupferron	135-20-6	[7] *2.2 E-01* (6.3 E-05)	RCHAS (510) 540-2084	[7] *2.2 E-01*	RCHAS (510) 540-2084
Cyclophosphamide (anhydrous)	*50-18-0*	[7] *6.1 E-01* (1.7 E-04)	RCHAS (510) 540-2084	[7] *6.1 E-01*	RCHAS (510) 540-2084
Cyclophosphamide (hydrated)	*6055-19-2*	[7] *5.7 E-01* (1.6 E-04)	RCHAS (510) 540-2084	[7] *5.7 E-01*	RCHAS (510) 540-2084
D & C Red No. 9	5160-02-1	[7] *5.3 E-03* (1.5 E-06)	RCHAS (510) 540-2084	[7] *5.3 E-03*	RCHAS (510) 540-2084

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CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
CRITERIA FOR CARCINOGENS - [1/(mg/kg-day)]

Chemical-Carcinogens	CAS Number	Inhalation[8]	Source	Oral	Source
Trp-P-2 (Tryptophan-P-2)	*62450-07-1*	*3.2 E+00* [7] (9.1 E-04)	RCHAS (510) 540-2084	*3.2 E+00* [7]	RCHAS (510) 540-2084
Urethane (Ethyl carbamate)	51-79-6	1.0 E+00 (2.9 E-04)	RCHAS (510) 540-2084	1.0 E+00	RCHAS (510) 540-2084
Vinyl chloride	75-01-4	2.7 E-01 (7.8 E-05)	ATES (510) 540-3324	2.7 E-01	ATES (510) 540-3324
Vinyl trichloride (1,1,2-Trichloroethane)	*79-00-5*	*7.2 E-02* [7] (2.1 E-05)	RCHAS (510) 540-2084	*7.2 E-02* [7]	RCHAS (510) 540-2084

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Finding 11.

Several Chemical Toxicity Values Cited in the Baseline Risk Assessment Cannot be Independently Confirmed

Supporting Data

A) Table 5-1 of the Baseline Risk Assessment

B) Excerpts from the USEPA Integrated Risk Information System (IRIS) and USEPA Health Effects Assessment Summary Tables (HEAST)

A) Table 5-1 of the Baseline Risk Assessment

Table 5-1. Reference Doses, Target Sites, and Confidence Levels for Constituents of Potential Concern, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.

Constituent	RfDo (mg/kg-day) Subchronic	RfDo (mg/kg-day) Chronic	RfDi (mg/kg-day) Subchronic	RfDi (mg/kg-day) Chronic	RfC (mg/m³) Subchronic	RfC (mg/m³) Chronic	Target Organ Oral	Target Organ Inhalation	Confidence Level/ Uncertainty Factor
VOCs									
Benzene	NA	NA	1.7E-02 e	1.4E-04 e	6.0E-02 e	5.0E-04 e	NA	hematological	medium/100
Bromodichloromethane	2.0E-02 b	2.0E-02 a	2.0E-02 e	2.0E-02 e	7.0E-02 f	7.0E-02 f	kidney	NA	medium/1000
Bromoform	2.0E-01 b	2.0E-02 a	2.0E-01 e	2.0E-02 e	7.0E-01 f	7.0E-02 f	liver	NA	medium/1000
Carbon tetrachloride	7.0E-03 d	7.0E-04 a	7.0E-03 e	7.0E-04 e	2.5E-02 f	2.5E-03 f	liver	NA	medium/1000
Chlorobenzene	2.0E-01 d	2.0E-02 a	5.7E-02 d	5.7E-03 b	2.0E-01 d	2.0E-02 b	liver, kidney	liver, kidney	medium/1000
Chloroform	1.0E-02 b	1.0E-02 a	1.0E-02 e	1.0E-02 e	3.5E-02 f	3.5E-02 f	liver	NA	medium/1000
Dibromochloromethane	2.0E-01 b	2.0E-02 a	2.0E-01 e	2.0E-02 e	7.0E-01 f	7.0E-02 f	liver	NA	medium/1000
1,2-Dichlorobenzene	NA	9.0E-02 a	NA	4.0E-02 b	2.0E+00 b	2.0E-01 b	none	decreased body weight	low/1000
1,1-Dichloroethane	1.0E+00 b	1.0E-01 b	1.4E+00 b	1.4E-01 b	5.0E+0 b	5.0E-01 b	none	kidney	/1000
1,2-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	9.0E-03 b	9.0E-03 a	9.0E-03 e	9.0E-03 e	3.2E-02 f	3.2E-02 f	liver	NA	medium/1000
c-1,2-Dichloroethene	1.0E-01 b	1.0E-02 b	1.0E-01 e	1.0E-02 e	3.5E-01 f	3.5E-02 f	red blood cells	NA	NA
t-1,2-Dichloroethene	2.0E-01 b	2.0E-02 a	2.0E-01 e	2.0E-02 e	7.0E-01 f	7.0E-02 f	serum enzymes	NA	low/1000
1,2-Dichloroethene (mixed)	9.0E-03 b	9.0E-03 b	9.0E-03 e	9.0E-03 e	3.2E-02 f	3.2E-02 f	liver	NA	NA
Ethylbenzene	1.0E-01 e	1.0E-01 a	2.9E-01 a	2.9E-01 a	1.0E+00	1.0E+00 a	liver, kidney	developmental	low/1000
Methylene chloride	6.0E-02 b	6.0E-02 a	8.6E-01 b	8.6E-01 b	3.0E+00 b	3.0E+00 b	liver	liver	medium/100
Tetrachloroethene	1.0E-01 b	1.0E-02 a	1.0E-01 e	1.0E-02 e	3.5E-01 f	3.5E-02 f	liver	NA	medium/1000
Toluene	2.0E+00 b	2.0E-01 a	2.9E-01 e	NA	1.0E+00 e	4.0E-01 a	liver, kidney	CNS	medium/1000
1,1,1-Trichloroethane	NA	NA	2.9E-01 e	2.9E-01 e	1.0E+00 f	1.0E+00 f	liver	liver	NA
1,1,2-Trichloroethane	4.0E-02 b	4.0E-03 a	4.0E-02 e	4.0E-03 e	1.4E-01 f	1.4E-02 f	clinical serum chemistry	NA	medium/1000
Trichloroethene	7.4E-03 g	7.4E-03 g	7.4E-03 e	7.4E-03 e	2.6E-02 f	2.6E-02 f	liver	NA	low/3000
Vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylenes	4.0E-01 e	2.0E+00 a	4.0E-01 e	2.0E+00 e	1.4E+00 f	7.0E+00 f	hyperactivity	NA	medium/100
SVOCs									
Bis(2-ethylhexyl)phthalate	2.0E-02 [illegible]	2.0E-02 a	2.0E-02 e	2.0E-02 e	7.0E-02 f	7.0E-02 f	liver	NA	medium/1000
Butylbenzylphthalate	2.0E+00 b	2.0E-01 a	2.0E+00 e	2.0E-01 e	7.0E+00 f	7.0E-01 f	liver	NA	low/1000
Dimethylphthalate	1.0E+01 b	1.0E+01 d	1.0E+01 e	1.0E+01 e	3.5E+01 f	3.5E+01 f	kidney	NA	NA
Di-n-butylphthalate	1.0E+00 b	1.0E-01 a	1.0E+00 e	1.0E-01 e	3.5E+00 f	3.5E-01 f	fetotoxicity	NA	low/1000
n-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	3.0E-02 b	3.0E-02 a	3.0E-02 e	3.0E-02 e	1.1E-01 f	1.1E-01 f	liver, kidney	NA	medium/100
Phenol	6.0E-01 b	6.0E-01 a	6.0E-01 e	6.0E-01 e	2.1E+00 f	2.1E+00 f	fetotoxicity	NA	low/100
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA			
PAHs									
Anthracene	3.0E+00 b	3.0E-01 a	3.0E+00 e	3.0E-01 e	1.1E+01 f	1.1E+00 f	none	NA	low/3000
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	4.0E-01 b	4.0E-02 a	4.0E-01 e	4.0E-02 e	1.4E+00 f	1.4E-01 f	liver, kidney	NA	low/3000

Notes appear on page 3.

Table 5-1. Reference Doses, Target Sites, and Confidence Levels for Constituents of Potential Concern, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.

Constituent	RfDo (mg/kg-day) Subchronic	RfDo (mg/kg-day) Chronic	RfDi (mg/kg-day) Subchronic	RfDi (mg/kg-day) Chronic	RfC (mg/m³) Subchronic	RfC (mg/m³) Chronic	Target Organ Oral	Target Organ Inhalation	Confidence Level/ Uncertainty Factor
PAHs continued									
Fluorene	4.0E-01 b	4.0E-02 a	4.0E-01 a	4.0E-02 a	1.4E+00 f	1.4E-01 f	anemia	NA	low/3000
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	4.0E-02 d	4.0E-02 d	4.0E-02 a	3.7E-04 a	1.4E-01 f	1.3E-03 f	GI system, anemia	nasal effects	low/1000
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	3.0E-01 b	3.0E-02 a	3.0E-01 a	3.0E-02 a	1.1E+00 f	1.1E-01 f	kidney	NA	low/3000
Dioxins/Furans									
2,3,7,8-TCDD	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCBs									
Aroclor 1016	NA	7.0E-05 a	NA	7.0E-05 a	NA	2.5E-04 f	reduced birth rate	NA	medium/100
Aroclor 1248	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1254	5.0E-05 b	2.0E-05 a	5.0E-05 a	2.0E-05 a	1.8E-04 f	7.0E-05 f	immune function,eyes,nails	NA	medium/300
Aroclor 1260	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics									
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	4.0E-04 b	4.0E-04 a	NA	NA	NA	NA	increased mortality	NA	low/1000
Arsenic	3.0E-04 b	3.0E-04 a	NA	NA	NA	NA	skin	NA	medium/3
Barium	7.0E-02 b	7.0E-02 a	1.4E-03 b	1.4E-04 b	5.0E-03 b	5.0E-04 b	increased blood pressure	fetotoxicity	medium/3
Beryllium	5.0E-03 b	5.0E-03 a	NA	NA	NA	NA	none	NA	low/100
Cadmium (water)	NA	5.0E-04 a	NA	NA	NA	NA	kidney	NA	high/10
Cadmium (food)*	NA	1.0E-03 a	NA	NA	NA	NA	kidney	NA	high/10
Chromium III	1.0E+00 b	1.0E+00 a	NA	NA	NA	NA	liver	NA	low/100
Chromium VI	2.0E-02 b	5.0E-03 a	NA	NA	NA	NA	none	NA	low/500
Cobalt	NA	6.0E-02 a	NA	NA	NA	NA	NA	NA	NA
Copper**	3.7E-02	3.7E-02	NA	NA	NA	NA	gastrointestinal tract	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	CNS	CNS	NA
Manganese (food)	1.4E-01 b	1.4E-01 a	NA	1.4E-05 a	NA	5.0E-05 a	CNS	CNS, respiratory	medium/1
Manganese (water)	5.0E-03 b	5.0E-03 a	NA	1.4E-05 a	NA	5.0E-05 a	CNS	CNS, respiratory	NA
Mercury	3.0E-04 b	3.0E-04 b	8.6E-05 b	8.6E-05 b	3.0E-04 b	3.0E-04 b	kidney	CNS	medium/30
Molybdenum	5.0E-03 b	5.0E-03 a	NA	NA	NA	NA	increased uric acid	NA	medium/300
Nickel	2.0E-02 b	2.0E-02 a	NA	NA	NA	NA	decreased body weight	NA	medium/3
Selenium	5.0E-03 b	5.0E-03 a	NA	NA	NA	NA	selenosis	NA	low/3
Silver	5.0E-03 b	5.0E-03	NA	NA	NA	NA	argyria	NA	medium/300
Strontium, stable	6.0E-01 b	6.0E-01 a	NA	NA	NA	NA	bone	NA	

Notes appear on page 3.

Table 5-1. Reference Doses, Target Sites, and Confidence Levels for Constituents of Potential Concern, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.

Constituent	RfDo (mg/kg-day)		RfDi (mg/kg-day)		RfC (mg/m³)		Target Organ		Confidence Level/ Uncertainty Factor
	Subchronic	Chronic	Subchronic	Chronic	Subchronic	Chronic	Oral	Inhalation	
Inorganics continued									
Thallium	8.0E-04 b	8.0E-05 a	NA	NA	NA	NA	alopecia	NA	low/3000
Titanium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	7.0E-03 b	7.0E-03 b	NA	NA	NA	NA	none	NA	low/100
Zinc	3.0E-01 b	3.0E-01 a	NA	NA	NA	NA	anemia	NA	medium/3

References: IRIS, 1996; USEPA, 1995a; USEPA, 1992 (issue paper for 1,1,1-TCA); USEPA, undated for: naphthalene RfDi; RfDo for TCE, cobalt; subchronic RfDo for ethylbenzene; RfDi for benzene.

*	The RfD for food is used to assess soil exposure.
**	Based on current drinking water standard.
CNS	Central nervous system.
mg/kg/day	Milligrams per kilogram per day.
NA	Not available.
PAHs	Polyaromatic hydrocarbons.
PCBs	Polychlorinated biphenyls.
RfC	Reference concentration.
RfDi	Inhalation reference dose.
RfDo	Oral reference dose.
SVOCs	Semi-volatile organic compounds.
TCDD	Tetrachlorodi-benzo-p-dioxin.
VOCs	Volatile organic compounds.

a	IRIS
b	HEAST
c	Provisional value provided by the Superfund Health Risk Technical Support Center.
d	Value has been withdrawn.
e	Cross-route extrapolation from oral to inhalation exposure route.
f	Converted to RfC by multiplying RfDi by 70 kilograms assumed body weight and dividing by 20 cubic meters per day assumed inhalation rate (USEPA, 1995a).
g	Provisional value provided by the Office of Scientific Affairs, Department of Toxic Substances Control.

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B) Excerpts from the USEPA Integrated Risk Information System (IRIS) and USEPA Health Effects Assessment Summary Tables (HEAST), accessed through the Environmental Health Risk Assessment Values (EHRAV) database, March 15, 1997

Environmental Health Risk Assessment Values Database

Printout for Toxicity Values in Question

Chemical Name	SC Oral RfD	Source	C Oral RfD	Source	SC Inhal RfC	Source	C Inhal RfC	Source	USEPA Oral SF	Source	USEPA Inhal SF	Source	CA Inhal CPF	Source	CA Oral CPF	Source
	mg/kg-day		mg/kg-day		mg/m3		mg/m3		kg-day/mg		kg-day/mg		kg-day/mg		kg-day/mg	
carbon tetrachloride		Contact TSC	0.0007	IRIS (1994)		Contact TSC		NA	0.13	IRIS (1994)	0.053	HEAST (07/93)	0.15	ATES 510-540-332	0.15	ATES 510-540-332
phthalate, bis(2-ethylhexyl)		Contact TSC	0.02	IRIS (1994)		Contact TSC		NA	0.014	IRIS (1994)		NA	0.0084	PETS 510-540-306	0.0084	PETS 510-540-306
phthalate, dimethyl		NA		HEAST (07/94)		NA		IRIS (07/26/90)		NA		NA		NA		NA
thallium		NA		NA		NA		NA		NA		NA		NA		NA

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Finding 12.

The Methodology for Development of Preliminary Delineation Criteria Values was Not Followed for All Metals

Supporting Data

A) RCRA Facility Investigation Report, Martin Marietta Technologies, Inc., International Light Metals Division (Geraghty & Miller, February 1996)

B) Interim Measures Completion Report for Soil, Lockheed Martin Corporation, Industrial Light Metals Facility, Torrance California (Geraghty & Miller, July 1996)

A) RCRA Facility Investigation Report, Martin Marietta Technologies, Inc., International Light Metals Division (Geraghty & Miller, February 1996)

Physical Analytical Methods for Soil Samples-ILM RFI

Method	Description
ASTM D 2216-90	Initial Moisture Content
MOSA, Chp. 13, pp. 363-367	Dry Bulk Density
MOSA, Chp. 18, pp. 444-445	Calculated Porosity
ASTM D 2434-68 (74) MOSA, Chp. 28, pp. 700-703	Saturated Hydraulic Conductivity: Constant Head Falling Head
ASTM D 854-91	Particle Density
ASTM D 422-463 (90)	Particle Size Distribution (Sieve and Hydrometer)
ASTM E-871[1]	Total Organic Carbon

(1) Daniel B. Stephens & Associates Hydrologic Testing Laboratory forwarded eight soil samples to BC Labs for Total Organic Carbon tests utilizing DTSC SOP #860, a method that utilizes a C-analyzer. However, due to equipment failure, BC Labs was unable to perform the test as specified and substituted another less precise method, ASTM E871. This Method has a PQL of 0.05% organic carbon (Daniel B. Stephens & Associates, Inc., April 1995) (Appendix H).

Results of the physical tests are discussed in Section 6.5 (Laboratory Analysis of Soil Hydraulic Properties) and presented in Appendix H.

5.3 DATA EVALUATION METHODS

Preliminary delineation criteria values (PDCVs) were developed to guide the delineation of vertical and lateral extent of defined impacts.

All laboratory data for soils were compared to PDCVs to determine the need for subsequent delineation. In samples that exceeded PDCVs, additional delineation was completed to determine the lateral and vertical extent of impact. Delineation was considered complete when delineation borings yielded concentrations below PDCVs.

The PDCVs do not represent final cleanup levels, which will be developed in the Baseline Risk Assessment (BRA).

Organic analytical results from the QLSV, RFI and RCRA Closure activities were compared to both the Region IX USEPA PRGs and the DTSC proposed HBSSLs for

preliminary evaluation of soil sample points requiring additional delineation. The lower of the PRG and HBSSL values was identified as the PDVC for each analyte. The resulting PDCVs are shown in Table 5-2. For TPH, which is not directly addressed in the PRGs or HBSSLs, the Leaking Underground Fuel Tank (LUFT) Manual (State Water Resources Control Board, 1989) was utilized as a guidance.

PDCVs for metals were based on the results of background soil samples collected from 12 borings located in the southwest quarter of the facility. The calculated acceptable background concentration (Section 3.10) was compared to the lower of the PRG or the HBSSL. The PDCV for each constituent was then established by using the higher of the health risk-based delineation goal or the background concentration. The resulting PDCVs for metals are shown in Table 5-3.

Organic and inorganic analytical results from the RFI activities were compared to the Summary of California Drinking Water Standards MCLs for preliminary evaluation of water samples (State of California, 1994b). The California MCLs for each analyte detected at the site are provided in Table 5-4.

G:\COMMON\LMSOIL\REPORT\SECS.DOC

B) Interim Measures Completion Report for Soil, Lockheed Martin Corporation, Industrial Light Metals Facility, Torrance California (Geraghty & Miller, July 1996)

In the absence of site-specific health-based goals (which could not be calculated until after RFI soil data were collected), soil analytical results were compared to preliminary delineation criteria values (PDCVs) established for this investigation through a comparison of the USEPA Region IX Preliminary Remediation Goals (PRGs) First Half 1995 dated February 1, 1995 (USEPA 1995), the Draft DTSC Health-Based Soil Screening Levels (HBSSLs) dated January 1994 (DTSC 1994d), and site-specific soil background levels (for inorganic compounds only). The PDCVs did not represent soil clean-up levels, which were subsequently determined in the BRA; rather, they were used as a conservative indicator of a release to soil, and they represented potential areas for corrective action. Final PDCVs approved by DTSC are shown in Tables 5-3 and 5-4. A more detailed description of PDCVs and other RFI methodology is included in the RFI Report (Geraghty & Miller 1996b).

Soil, concrete, surface water, and groundwater samples were collected at the site in the following manner:

- A total of 666 soil borings were drilled or hand augered throughout the ILM facility at depths ranging from 1 to 81.5 feet bgs.
- Shallow soil samples (0.5 feet below the concrete/soil interface) were collected from beneath 12 catch basins and exposed sections of the storm channel on the property.
- Concrete samples were collected from the bottom of eight equipment foundations. The top 2 inches of each concrete core were submitted to a laboratory for analysis.
- Surface water samples were collected from one upgradient offsite location, one downgradient location, and three onsite locations along the north/south drainage channel that extends along the eastern site boundary.
- Groundwater samples were collected from 10 monitoring wells and 15 HydroPunch borings to provide a preliminary assessment of impacts to groundwater. A separate RFI, designed to address groundwater at the site, has been initiated.
- Quality assurance/quality control (QA/QC) samples, such as equipment blanks, trip blanks, and duplicates, were collected throughout the RFI process.

Table 5-3. Preliminary Delineation Criteria Values (PDCVs) for Organic Compounds and Acid Salts in Soil, Interim Measures Completion Report for Soil, International Light Metals Facility, Torrance, California

Class	Constituents	REGULATORY LIMITS			Preliminary Delineation Criteria Value (mg/kg)
		DTSC HBSSL (Proposed) (mg/kg)	PRG Residential (mg/kg)	LUFT Maximum Allowable Level (ppm)	
Volatile Organic Compounds	Benzene	1	1.9	NA	1
	Chlorobenzene	200	220	NA	200
	1,2-Dichlorobenzene	350	2300	NA	350
	1,1-Dichloroethane	12	1100	NA	12
	1,2-Dichloroethane	1.5	0.61	NA	0.61
	1,1-Dichloroethene	0.1	0.052	NA	0.052
	Trans 1,2-Dichloroethene	350	230	NA	230
	Ethylbenzene	100	3400	NA	100
	Methylene Chloride	10	4.9	NA	4.9
	Tetrachloroethene	4	5.6	NA	4
	1,1,1-Trichloroethane	500	1900	NA	500
	1,1,2-Trichloroethane	2.6	0.66	NA	0.66
	Trichloroethene	8.5	3.3	NA	3.3
	Toluene	300	870	NA	300
	Vinyl chloride	NA	0.0017	NA	0.0017
	Xylenes	100	980	NA	100
Semi-Volatile Organic Compounds	2-Methyl napthalene	100	NA	NA	100
	Benzl-butyl-phthalate	NA	13,000	NA	13,000
	Bis-2-ethylhexyl-phthalate	NA	32	NA	32
	Chloroform	3.6	0.75	NA	0.75
	Chrysene	0.01	24	NA	0.01(2)
	Di-n-butyl-phthalate	3900	6500	NA	3,900
	Dimethyl-phthlalate	NA	100,000	NA	100,000
	Fluoranthene	1250	2600	NA	1,250
	Napthalene	120	800	NA	120
	Phenathrene	NA	NA	NA	NA
	Phenol	NA	39,000	NA	39,000
	Pyrene	940	2000	NA	940
Total Petroleum Hydrocarbons	TPH as gasoline	NA	NA	100	100
	TPH as diesel (1)	NA	NA	1000	1,000
Polychlorinated Biphenyls	PCB	0.03	0.066	NA	0.03
	PCB-1254	NA	NA	NA	0.03
	PCB-1260	NA	NA	NA	0.03

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Table 5-3. Preliminary Delineation Criteria Values (PDCVs) for Organic Compounds and Acid Salts in Soil, Interim Measures Completion Report for Soil, International Light Metals Facility, Torrance, California

Class	Constituents	REGULATORY LIMITS			Preliminary Delineation Criteria Value (mg/kg)
		DTSC HBSSL (Proposed) (mg/kg)	PRG Residential (mg/kg)	LUFT Maximum Allowable Level (ppm)	
Acid Salts	Chloride	NA	NA	NA	NA
	Fluoride	NA	3900	NA	3,900
	Nitrate	NA	100000	NA	100,000
	Sulfate	NA	NA	NA	NA
	Cyanide	780	1300	NA	780

(1) For purposes of determining the Preliminary Delineation Criteria Value for TPH as kerosene, crude oil, z-oil, and waste oil, each has been assigned the equivalent value of diesel fuel (1000 mg/kg).
(2) California EPA Potency Equivalency Factor.

DTSC - Department of Toxic Substances Control
HBSSL - health-based soil screening level
mg/kg - milligrams per kilograms
PRG - preliminary remediation goal
LUFT - Leaking Underground Fuel Tank Manual
ppm - parts per million

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Table 5-4. Preliminary Delineation Criteria Values (PDCVs) for Metals in Soil, Interim Measures Completion Report for Soil, International Light Metals Facility, Torrance, California

Analyte	Site Background Mean (mg/kg)	REGULATORY LIMITS		PDCV (mg/kg)
		DTSC HBSSL (Proposed) (mg/kg)	PRG Residential (mg/kg)	
Aluminum	14,778.33	NA	77,000	77,000
Antimony	0	NA	31	31
Arsenic	2.79	0.3	0.32	6
Barium	91.5	5,000	5,300	5,000
Beryllium	0.25	0.08	0.14	1.18
Cadmium	0.16	9	9 [1]	9
Calcium	6,621.22	NA	NA	32,081
Chromium	21.84	0.2	0.2 [1]	57
Cobalt	7.17	NA	NA	20
Copper	22.43	2,650	2,800	2,650
Iron	19,405	NA	NA	50,392
Lead	12.58	NA	120 [1]	120
Lithium	9.48	NA	1,500	1,500
Magnesium	5,095.56	NA	NA	14,590
Manganese	348.5	NA	380	1,172
Mercury	0.02	21	23	21
Molybdenum	1.28	NA	380	380
Nickel	12.84	150	1,500	150
Potassium	2,601.22	NA	NA	7,059
Selenium	NA	NA	380	380
Silver	1.31	NA	380	380
Sodium	584.39	NA	NA	1,665
Strontium	52.13	NA	46,000	46,000
Thallium	0	NA	5.4	5.4
Titanium	871.22	NA	NA	2,305
Vanadium	36	NA	540	540
Zinc	62.06	21,500	23,000	21,500

[1] California Modified PRG

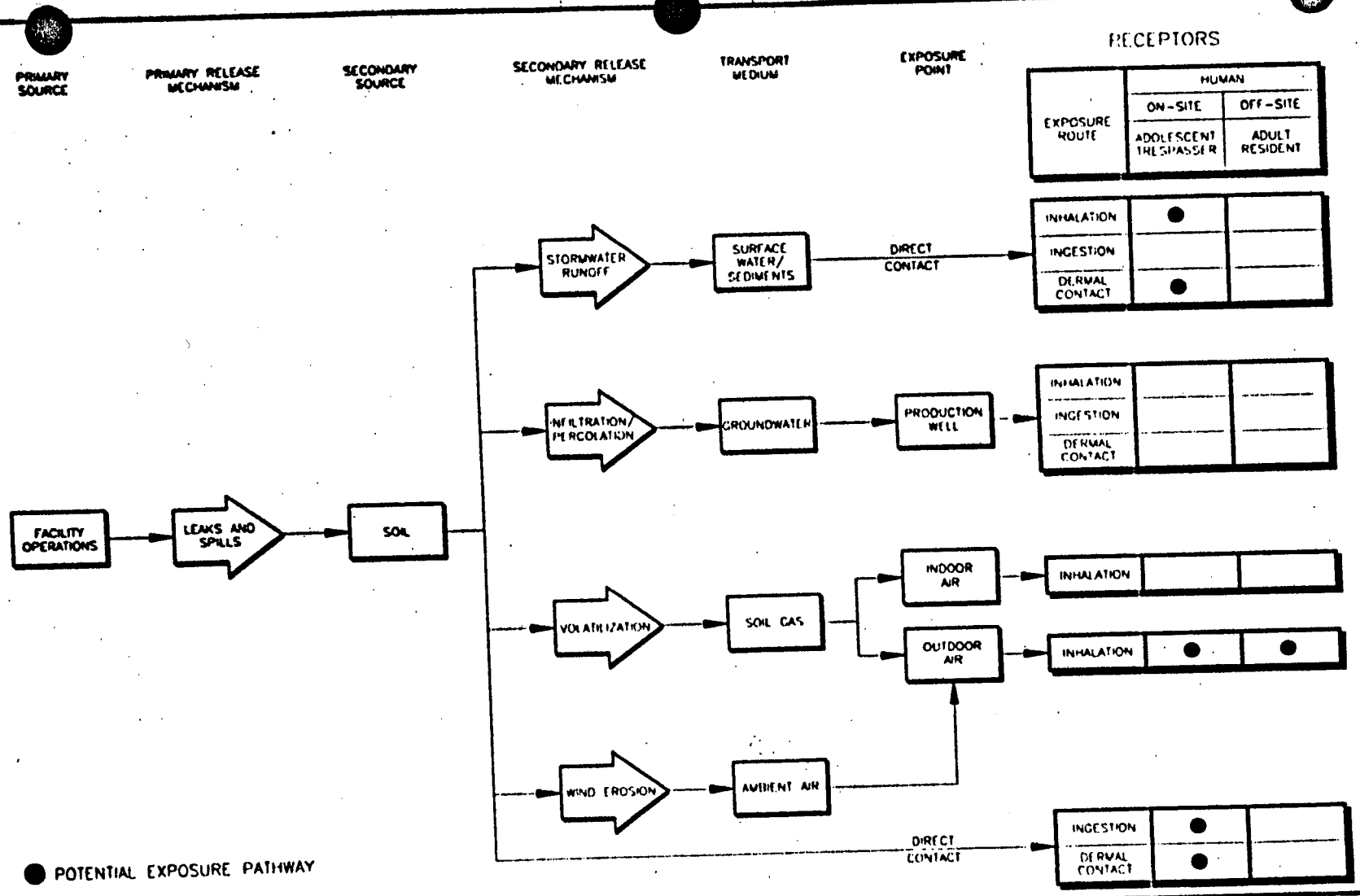
mg/kg - milligrams per kilogram
DTSC - Department of Toxic Substances Control
HBSSL - health-based soil screening level
PRG - preliminary remediation goal
PDCV - preliminary delineation criteria value
NA - not applicable

Finding 13.

A Sensitive Sub-Population (Off-Site Child) is Not Evaluated in the Risk Assessment

Supporting Data

Figure 6.1, Conceptual Site Model for Potential Human Exposure Under Vacant Land Use Scenario, from the Baseline Risk Assessment



GERAGHTY & MILLER, INC.
Environmental Services

NOT TO SCALE

CONCEPTUAL SITE MODEL FOR POTENTIAL HUMAN EXPOSURE UNDER VACANT LAND USE SCENARIO

LOCKHEED MARTIN CORPORATION/INTERNATIONAL LIGHT METALS DIVISION
LOS ANGELES, CALIFORNA

FIGURE 6.1

ILM-CSP4/ /3-15-96

BOE-C6-0093610

Finding 14.

The Source of Many Key Exposure Parameters was Out of Date When the Risk Assessment was Prepared

Supporting Data

Page 5 of the Baseline Risk Assessment

2.0 GUIDANCE DOCUMENTS

The following documents were the main sources of guidance for this BRA:

"Draft Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities, Part A: Overview," (Cal/EPA, 1994a),

"Draft Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities, Part B: Scoping Assessment," (Cal/EPA, 1994b),

"Exposure Factors Handbook" (USEPA, 1990b),

"Guidance for Data Usability in Risk Assessment, Part A," Final (USEPA, 1992a),

"National Oil and Hazardous Substances Pollution Contingency Plan," Final Rule (USEPA, 1990a),

"RCRA Facility Investigation (RFI) Guidance, Volume I of IV, Development of an RFI Workplan and General Considerations for RCRA Facility Investigations, Interim Final," (EPA, 1989b),

"Risk Assessment Guidance for Superfund, Volume 1, Part A, Human Health Evaluation Manual" (USEPA, 1989a),

"Risk Assessment Guidance for Superfund, Volume 1, Part B, Development of Risk-Based Preliminary Remediation Goals" (USEPA, 1991a),

"Superfund Exposure Assessment Manual" (USEPA, 1988),

BOE-C6-0093612

Finding 15.

Air Dispersion Modeling uses Outdated Regional Climate Data

Supporting Data

Pages 10 and 116 of the Baseline Risk Assessment

site. Equipment foundations and building footings that extend to depths of several feet may be left in place although concrete pavement and the tops of the foundations may be removed. The facility currently is surrounded by a chain link fence and access is restricted and monitored 24 hours a day by on-site security personnel.

3.4 CLIMATE

The area has a semi-arid, temperate climate, characterized by relatively wet and dry seasons. Although the site is located within the City of Los Angeles, it borders the smaller City of Torrance. The mean annual precipitation in Torrance is approximately 13.5 inches. Over 95 percent of the average annual rainfall occurs in the 7 months from October through April. The mean annual temperature in Torrance is approximately 63 degree Fahrenheit (°F).

The predominant wind direction in the vicinity of the site is from the west. During the day, the westerly winds move at speeds ranging from 7 to 12 miles per hour. During night time hours, prevailing wind directions change and are dominated by "land breezes" from the east. The easterly winds generally move at about half the speed of their daytime counterparts. Winds from the northwest associated with large storm fronts that move in from the Pacific Ocean occur occasionally throughout the year and are often in excess of 12 miles per hour. Strong easterly winds also are known to occur, most commonly for a few days during the late summer and early fall seasons. A more detailed discussion of climate in the vicinity of the site is presented in Section 3.2 of the RFI report (Geraghty & Miller, 1996).

Keith 1980

3.5 GEOLOGY AND HYDROGEOLOGY

The following subsections summarize geologic and hydrologic conditions at the site that are pertinent to the BRA.

BOE-C6-0093614

Gilbert, Richard O., 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold Company, Inc., New York, New York.

Hammond Management Consulting, 1993a, "Historical Review Project," prepared for International Light Metals, October.

Hammond Management Consulting, 1993b, Lockheed Martin Corporation, International Light Metals Division, Area Real Estate Review Report: Consultant report dated August 18 1993, revised October 25, 1993.

Hayduk, W., and H. Laudie, 1974, Prediction of Diffusion Coefficients for Non-Electrolysis in Dilute Aqueous Solutions, American Institute Chemical Engineering Journal, Vol. 20, No. 3, pp. 611-615.

Heath, J.S., Koblis, K., and S.L. Sager, 1993, Review of Chemical, Physical, and Toxologic Components of Total Petroleum Hydrocarbons, Journal of Soil Contamination, Vol. 2, No. 1, pp. 1-25.

Howard, P.H., 1991. Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Volume III, Pesticides, Lewis Publishers, Inc., Chelsea, MI. 684 pp.

Howard, P.H., 1990. Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Volume II, Solvents, Lewis Publishers, Inc., Chelsea, MI. 546 pp.

Howard, P.H., 1989. Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Volume I, Large Production and Priority Contaminants, Lewis Publishers, Inc., Chelsea, MI. 574 pp.

Howard, P.H., Boethling, R.S., Jarvis, W.H., Meylan, W.M., and E.M. Michalenko, 1991, Handbook of Environmental Degradation Rates, Chelsea, MI, Lewis Publishers.

Integrated Risk Information System (IRIS), 1996. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Cincinnati, OH.

James M. Montgomery Consulting Engineers, Inc., 1990, Metropolitan Water District of Southern California, Los Angeles County Department of Public Works, Central and West Basin Water Replenishment District; West Basin Municipal Water District, Progress Report on West Coast Basin Plume Mitigation Study Task 1 and 2. August.

Jury, W.A., W.F. Spencer and W.J. Farmer, 1983. Behavior Assessment Model for Trace Organics in Soil: I. Model Description. J. Environ. Qual. 12:558-564.

Keith, Ralph W., 1980, A Climatological-Air Quality Profile, California South Coast Air Basin, South Coast Air Quality Management District Headquarters, dated January 1980.

BOE-C6-0093615

Finding 16.

The Baseline Risk Assessment did Not use the Most Recent Available Reference Data as Required by Cal/EPA

Supporting Data

Copy of Region IX Preliminary Remediation Goals (PRGs) Second Half 1995 Unavailable at Time of Review

Finding 17.

The Baseline Risk Assessment Fails to Assess All Pertinent Contaminant Concentrations in Two of the Investigated Land-Use Scenarios

Supporting Data

Tables A-3, A-7, A-16, A-19, A-23, A-26, A-30 A-34, A-38, A-42, A-45, A-49

from the Baseline Risk Assessment (presented in the supporting data for Finding 3)

Finding 18.

Current Site Conditions are Not Evaluated for All Land-Use Scenarios

Supporting Data

Page 63 of the Baseline Risk Assessment

7.4 COMMERCIAL/INDUSTRIAL LAND USE

For anticipated future commercial land use, potential cancer risk and health hazard were quantified for on-site workers. Both average and RME assumptions were used to calculate potential ELCRs and HIs for commercial site workers. Potential risk and health hazard were evaluated for each AOPC with soil impacts at depths greater than 2 feet bgs (AOPCs 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14). The pathway of exposure evaluated for commercial site workers was inhalation of vapors originating in subsurface soils.

Planned future redevelopment of the site will include importation of clean fill to elevate land surface in some locations and existing surface soils (0 to 2 feet bgs) in those locations will then become subsurface soils. In other locations, the upper 2 feet of soil will be removed. Therefore, the risk characterization evaluated vapors originating from impacted soils that are located below 2 feet bgs at this time. The equations used to calculate potential ELCR and HI for commercial site worker exposure are presented in Table 7-101. Table 7-101 also includes example calculations.

7.4.1 Estimates of Potential Risk and Hazard and HBGs by AOPC

Tables 7-102 through 7-127 provide the results of the risk characterization for a commercial site worker. There are two tables of risk calculations for each AOPC. The first provides an estimate of total ELCR and HI under assumed average exposure conditions. The second provides estimates of total ELCR and HI under RME conditions.

The total ELCRs calculated for exposure of a commercial site worker to vapors originating from soils below 2 feet bgs and intruding into overlying buildings, were compared to a target risk of $1x10^{-6}$. Estimated ELCRs for all the AOPCs were below the $1x10^{-6}$ target level. Total estimated HIs for all the AOPCs were also less than the target level of 1.0. Because estimated cancer risks and health hazards from the AOPCs did not exceed target levels, HBGs were not developed for the commercial land use scenario.

Finding 19.

Residual Hexavalent Chromium Concentrations are Not Addressed in the Baseline Risk Assessment

Supporting Data

A) Reported Concentrations of Chemicals of Concern at Areas Not Included Within an AOPC (table), compiled by Integrated Environmental Services, Inc. from the document Interim Measures Completion Report for Soil, Volumes I and II (Lockheed Martin, July 1996)

B) Spill description, 900 gallons of chromic anhydride, VISTA printout of Emergency Response Notification System (ERNS) report, taken from the document Phase I Environmental Assessment, Parcel A, McDonnell Douglas Realty Company (Kennedy/Jenks, March 1996)

C) Letter from James J. DeNapoli, Associate General Counsel, Martin Marietta Corporation, to Nancy J. Nadel, USEPA Region IX, dated 22, 1992, regarding RCRA Preliminary Assessment Report

D) Draft Groundwater Data Assessment Report, RCRA Facility Investigation, Lockheed Martin Corporation, International Light Metals Facility, Torrance, California, Volume I (Geraghty & Miller, May 1996)

E) Environmental Priorities Initiative Preliminary Assessment, RCRA Preliminary Assessment, International Light Metals (Ecology & Environment, Sept. 1991)

F) Table A-51 of the Baseline Risk Assessment

A) Reported Concentrations of Chemicals of Concern at Areas Not Included Within an AOPC (table), compiled by Integrated Environmental Services, Inc. from the document Interim Measures Completion Report for Soil, Volumes I and II (Lockheed Martin, July 1996)

Reported Concentrations of Chemicals of Concern at Areas Not Included Within an AOPC

Areas	CoC(s)	Reported Concentraions (mg/kg)	PDCV (mg/kg)	Excavated Soil Volume (CY)	Proposed RA Method
CS-06	Arsenic Cobalt	21 25	6 20	220	Excavation and Chemical Stabilization
CS-07	Chromium	234	20	NA	
CS-09	Beryllium	6.60	1.18	168	
CS-10	Lead	169	120	75	
CS-11	Chromium	55 to 404	20	NA	
CS-14	Chromium	49 to 50	20	NA	
CS-17	Chromium	113	20	NA	
CS-18	Chromium	48	20	NA	
TH-01	TPH (Crude Oil)	3,900	1,000	NA	Excavation and Thermal Treatment
TH-02	TPH (Crude Oil) TPH (Diesel) TPH (Kerosene) TPH (Z-Oil)	14,000 to 34,000 1,400 to 6,600 3,300 2,900 to 8,600	1,000 1,000 1,000 1,000	NA	
TH-03	TPH (Crude/Waste Oil)	2,300	1,000	NA	
TH-09	TPH (Crude Oil)	1,300	1,000	NA	
TH-12	TPH (Z-Oil)	4,700 to 14,000	1,000	NA	
TH-17	PCE TPH (Z-Oil)	8.20 2,300	4.00 1,000	NA	
TH-20	1,1-DCE	0.13	0.0052	NA	
OD-02	PCB-1260	0.34 to 41	0.03	25	Excavation and Off-site Disposal
OD-03	PCB-1260	0.04	0.03	NA	
OD-04	PCB-1260	0.09 to 0.12	0.03	NA	

Reported Concentrations of Chemicals of Concern at Areas Not Included Within an AOPC

Areas	CoC(s)	Reported Concentraions (mg/kg)	PDCV (mg/kg)	Excavated Soil Volume (CY)	Proposed RA Method
OD-05	PCB-1260	**0.21 to 0.33**	0.03	NA	Excavation and Off-site Disposal
OD-08	PCB-1254	**0.53 to 1.3**	0.03	NA	
OD-09	PCB-1260	**0.16**	0.03	NA	
OD-11	Arsenic	**23**	6	NA	
	Chromium	**109**	20		
	PCB-1254	**0.14 to 0.89**	0.03		
	TPH (Crude/Waste Oil)	**1,400 to 7,900**	1,000		
	TCE	**5.6 to 7.2**	3.30		
VE-04	TCE	0.007 to 0.033	3.30	NA	In-Situ Vapor Extraction
	PCE	0.009 to 1.3	4		
	1,1,1-TCA	0.0073	500		

Data compiled by Integrated Environmental Services, Inc. from:
Interim Measures Completion Report for Soil, Lockheed Martin Corp ILM Facility
(Geraghty & Miller, July 1996)

B) Spill description, 900 gallons of chromic anhydride, VISTA printout of Emergency Response Notification System (ERNS) report, taken from the document Phase I Environmental Assessment, Parcel A, McDonnell Douglas Realty Company (Kennedy/Jenks, March 1996)

VISTA Address*:	INTERNATIONAL LIGHT METAL 19200 S WESTERN AVE TORRANCE, CA 90501	VISTA ID#:	200062175	Map ID
		Distance/Direction:	0.25 MI / W	7
		Plotted as:	Point	
ERNS - Emergency Response Notification System / SRC# 2255		Agency ID:	94656	

Agency Address:	*INTERNATIONAL LIGHT METAL 19200 S WESTERN AVE TORRANCE, CA*
Spill Date Time:	*OCTOBER 25, 1991 UNKNOWN*
Case Number:	*94656*
Spill Location:	*19200 S WESTERN AVE*
Source Agency:	*N*
Discharger Name:	*PEPPER, HERDERT*
Discharger Org:	*INTERNATIONAL LIGHT METAL*
Material Spilled:	*CHROMIC ANHYDRIDE, 900.00 (GAL)*
Waterway Affected:	*POTW OF LOS ANGELES*
Fields Not Reported:	*Discharger Phone*

Air Release:	Land Release:	Water Release:	Ground Release:	Facility Release:	Other Release:
NO	*NO*	*YES*	*NO*	*NO*	*NO*

VISTA Address*:	INT. LIGHT METALS 19200 SOUTHWESTERN AVENUE TORRANCE, CA 90501	VISTA ID#:	200081903	Map ID
		Distance/Direction:	0.25 MI / W	7
		Plotted as:	Point	
ERNS - Emergency Response Notification System / SRC# 2255		Agency ID:	90-7112	

Agency Address:	*INT. LIGHT METALS 19200 SOUTHWESTERN AVENUE TORRANCE, CA 90509*
Spill Date Time:	*MAY 29, 1990 10:30:00 AM*
Case Number:	*90-7112*
Spill Location:	*19200 SOUTHWESTERN AVENUE*
Source Agency:	*E*
Discharger Org:	*INT. LIGHT METALS*
Material Spilled:	*OIL, 100.00 (GAL)*
Waterway Affected:	*NONE*
Fields Not Reported:	*Discharger Name, Discharger Phone*

Air Release:	Land Release:	Water Release:	Ground Release:	Facility Release:	Other Release:
NO	*YES*	*NO*	*NO*	*NO*	*NO*

C) Letter from James J. DeNapoli, Associate General Counsel, Martin Marietta Corporation, to Nancy J. Nadel, USEPA Region IX, dated 22, 1992, regarding RCRA Preliminary Assessment Report

Figures 1 and 2

These figures incorrectly define the boundaries of the ILMD facility to include part or all of the Capital Metals facility located to the south of ILMD and part of the McDonnel Douglas facility located to the east of ILMD. I am enclosing corrected figures with the ILMD facility boundaries designated in red.

Section 2.2.

Page 5 - Casthouse Operations

The oil referenced in this section is food grade peanut oil, not petroleum based oil. The peanut oil and water mixture produced in the casthouse is separated when the peanut oil/water mixture is sent to a cooling tower, where skimmers separate the oil from the water. The separated water, after compliance verification, is discharged to the sanitary sewer. The separated oil (which contains some water) is transported directly off-site to a hazardous waste treatment facility. This material is not stored on-site in the 8,000 gallon storage tanks adjacent to the hazardous waste storage yard. Finally, vermiculite and Zorb-All, not clay, is used to absorb small oil spills.

Page 5 - Forge Operations, Paragraph 2

This section incorrectly refers to the use of hexavalent chromium in an etchant process used in the press forge operations. The hexavalent chromium is actually used in a conversion coating process. Regarding the handling of spent solutions from the conversion coating process, these solutions are not placed in 55 gallon drums or 3-4 cubic yard containers. Liquid solutions are pumped into tankers and sent off-site for disposal. Solids, however, are placed in drums or containers for storage prior to disposal. Hydraulic oil is also not typically placed in 55-gallon drums, but is either collected in ILMD's mobile tanker and transferred to holding tanks or shipped from collection points directly off-site in tanker trucks.

Page 6 - Titanium Division, Paragraph 2

This section incorrectly identifies 1,1,1, - trichloroethane (TCA) as a currently generated waste stream. ILMD has not used TCA at the Los Angeles facility in several years. Further, as explained more fully below, aluminum dross is not considered by ILMD to be a waste material, but rather a product which is sold on the secondary aluminum market.

D) Draft Groundwater Data Assessment Report, RCRA Facility Investigation, Lockheed Martin Corporation, International Light Metals Facility, Torrance, California, Volume I (Geraghty & Miller, May 1996)

this report incorporates data from one groundwater sampling event (as well as groundwater data collected during the Soil RFI), further evaluation will be conducted and interpretations refined with each subsequent sampling event. To facilitate interpretation, groundwater concentrations from this event were compared to primary MCLs to identify appropriate COCs. Groundwater concentrations of VOCs, chromium, and aluminum have been found to exceed their respective primary MCLs in shallow groundwater beneath the site. Interpetations and conclusions will be formally presented in the GW RFI report, to be completed subsequent to four quarters of groundwater sampling.

5.1 ALUMINUM

Total aluminum concentrations in shallow groundwater beneath the site range from 87 to 47,200 µg/L. Dissolved aluminum concentrations range from 926 to 1,830 µg/L. The MCL for aluminum is 1 milligram per liter (mg/L), or 1,000 µg/L. Although the total concentration of aluminum exceeds the MCL, dissolved concentrations are much lower, and it is believed that the elevated concentrations result from sample turbidity and not from releases to groundwater, as discussed in Section 4.5.4. Sample turbidity largely results from the presence of fine-grained clays in the groundwater sample; aluminum is a primary constituent of clay particles. Therefore, aluminum was eliminated as a COC in groundwater.

5.2 CHROMIUM

Chromium in waste materials or in the environment exists primarily in two forms: the trivalent cation Cr^{3+} and the hexavalent chromate anion CrO_4^{2-}. Depending on Eh and pH conditions, one form may convert to the other over a period of time.

Trivalent chromium (Cr^{3+}) adsorbs strongly to soils through the process of ion exchange. The soils data for the site confirm that nearly all the chromium present in soil samples is in the Cr^{3+} form (Geraghty & Miller, 1996b). In contrast, the hexavalent (CrO_4^{2-})

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form is only weakly sorbed to soils and, therefore, can be leached into the groundwater. Figures 4-27 and 4-28 show that nearly all the chromium in groundwater is in the hexavalent form.

An isoconcentration map of total chromium in groundwater is presented as Figure 4-27. The concentration pattern suggests that two plumes exist beneath the site, centered in the vicinity of wells P-1 and P-14. Possible onsite sources from these plumes are addressed below.

5.2.1 Plume P-1

Total chromium was detected in this area in wells P-1 and P-15 at concentrations of 1,420 and 372 µg/L, respectively. Chromium detected in soil samples from 20 borings in the vicinity of wells P-1 and P-15 generally ranged from 5.6 to 29 mg/kg. These concentrations are within the range of detections from borings drilled to determine background concentrations of metals in soil. The single exception to this occurred in boring RB-267, where chromium was detected at a concentration of 109 mg/kg at 25 ft bgs. Boring RB-267 was drilled to characterize feature #NMD-34, a dry well located in AOI #37. The purpose of the dry well was to provide drainage for stormwater runoff. The elevated concentration of chromium at this location indicates that it may be a source of chromium in groundwater in this area.

5.2.2 Plume P-14

Total chromium was detected in well P-14 at a concentration of 2,400 µg/L. Chromium was detected in soil in nine borings in the area, at depths ranging from 1.5 to 55 ft bgs and at concentrations ranging from 10 to 30 mg/kg. These concentrations are within the range of detections from borings drilled to determine background concentrations of metals in soil. Activities at several features in this area were related to foundry operations, including drainage sumps for casting pits (Features #4015, #4016, and #4017), cooling towers (Features

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#NMD-8 and #NMD-9), and a furnace with its associated pit (Feature #NMD-14). In particular, chromium was used as a corrosion inhibitor in the water of the cooling towers and casting pits (Sebok, 1996). These features may therefore be a source of chromium in the soil and groundwater in this area.

5.3 DIOXINS AND FURANS

A summary of dioxins and furans found in groundwater is presented in Table 4-15. Although 2,3,7,8-TCDD, the most toxic congener, was not detected in soil or groundwater at the site, the detected concentrations of all other congeners were converted to TCDD equivalents, or Toxicity Equivalency Quotient (TEQ) for 2,3,7,8-TCDD. Because 2,3,7,8-TCDD is the most studied of the congeners, by U.S. EPA and international convention the toxicity associated with the remaining dioxin/furan congeners is presented in terms of comparison to 2,3,7,8-TCDD or TEQ. The TEQ values shown in Table 4-16 were derived using the toxicity equivalency factors (TEFs) published by the U.S. EPA (1989). Nondetect results were not included in the calculations of sums of 2,3,7,8-substituted congeners, nor in the calculations of TEQ. The sums of 2,3,7,8-substituted congeners are presented on Figure 4-31. The concentrations of PCDDs and PCDFs in TEQ are depicted in Figure 4-32. The TEQ concentrations in groundwater at the site are less than the Maximum Contaminant Level of 0.00003 µg/L for 2,3,7,8-TCDD.

An evaluation of dioxins and furans was conducted in the Soil RFI and assessed for risk in the Baseline Risk Assessment. The evaluation concluded that the levels of dioxins and furans found in soil were indicative of an anthropogenic origin and did not pose a health risk. Based on this conclusion, dioxins and furans were not considered a COC.

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E) Environmental Priorities Initiative Preliminary Assessment, RCRA Preliminary Assessment, International Light Metals (Ecology & Environment, Sept. 1991)

Casthouse Operations

Commercially pure and pedigree scrap aluminum is alloyed with chromium, zinc, copper, and manganese, depending on customer specifications regarding its intended use. The alloyed aluminum is then cast into logs which are cut to size. These logs are then heated, cut into billets and sent to the facility's forge or extrusion departments. Wastes generated in the casthouse operations include spent lubricating oil, clay used in absorbing oil spills, rags and filters from the maintenance of hydraulic equipment, and oil-contaminated wastewater (22).

The spent clay, rags and filters are stored in 55-gallon drums in the hazardous waste storage yard, and are eventually transported off-site for disposal. The oil-contaminated wastewater has the oil skimmed off and sent to one of two 8,000-gallon waste oil storage tanks (see Section 4.3, Oil/Water Tanks). Wastes from the Oil/Water Tanks are transported to an off site treatment facility (2,4). The spent lubricating oil is also sent to these tanks (22).

Forge Operations

Aluminum billets are placed into a furnace and forged by a hydraulic press. After forging, the aluminum is etched by dipping it into two separate tanks, one containing sodium hydroxide and the other containing rinse water. The aluminum is then placed into a tank which contains nitric acid, rinsed with water and rinsed again with hot water. Occasionally, hexavalent chromium is used as an etchant, but only on those billets which are being forged for specific industries. The aluminum goes through two heat treating processes, is quenched, and then placed into an aqueous solution which contains corrosion inhibitors. The aluminum is aged at 300 °F to enhance its strength, and then visually inspected. After the aluminum is visually inspected it is immersed in a fluorescent material, rinsed with water, and placed into a developer to expose imperfections. If no imperfections are observed the aluminum is sold (22).

Wastes generated from this operation include spent acidic and caustic solutions, tank bottoms containing metals (both of these waste streams are from the etching process), waste hydraulic oil from the forge press, steam-cleaning water contaminated with hydraulic fluid (equipment contaminated with hydraulic fluid from the forge press must be steam-cleaned before reuse). The spent solutions from the etching process are pumped out and stored in 55-gallon drums or 3- to 4-cubic yard containers, and then transported off site for disposal. Hydraulic oil is pumped out and placed into 55-gallon drums, and the steam-cleaning water is collected by a 1,200-gallon mobile tanker and stored in one of the 8,000-gallon waste oil storage tanks until disposal (see Section 4.3, Oil/Water Tanks) (22).

Extrusion Operations

Aluminum billets are heated almost to the melting point of aluminum and sent through the extrusion press where they are squeezed into long extrusions. The aluminum is heat treated at high temperatures, and then

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F) Table A-51 of the Baseline Risk Assessment

Table A-51. **Constituent Occurrence Summary for Groundwater Samples, Lockheed Martin Corporation, International Light Metals Division, Los Angeles, California.**

Constituent	Frequency Detects / Total	Range of SQLs Min - Max	Range of Detects Min - Max	Mean	UCL	EPC
Inorganics						
Arsenic	11 / 17	0.002	0.002 - 0.012	0.004	0.0056	0.0056
Barium	9 / 17	0.1	0.11 - 0.199	0.091	0.11	0.11
Chromium	6 / 17	0.01	0.028 - 1.57	0.22	0.42	0.42
Copper	1 / 17	0.01	0.022	0.006	0.0077	0.0077
Fluoride	7 / 7	NA	0.16 - 0.27	0.21	0.24	0.24
Hexavalent Chromium	13 / 24	0.01	0.01 - 1.8	0.18	0.34	0.34
Iron	4 / 9	0.05	0.388 - 6.24	0.99	2.2	2.2
Lead	2 / 17	0.005	0.0063 - 0.0074	0.003	0.0036	0.0036
Magnesium	7 / 7	NA	41 - 114	72	95	95
Manganese	6 / 9	0.01	0.016 - 2.15	0.44	0.92	0.92
Mercury	1 / 18	0.0002	0.0003	0.00011	0.00012	0.00012
Potassium	7 / 7	NA	7.1 - 11.2	8.8	10	10
Selenium	8 / 17	0.002	0.002 - 0.0041	0.0017	0.0021	0.0021
Sodium	7 / 7	NA	121 - 442	280	390	390
Titanium	1 / 17	0.01	0.029	0.0064	0.0089	0.0089
Zinc	14 / 17	0.01	0.013 - 0.334	0.05	0.084	0.084

Concentrations are reported in milligrams per liter (mg/L).

[a] USEPA, 1989.

CDD	Chlorodi-benzo-p-dioxin.
CDF	Chlorodi-benzofuran.
Detects	Number of samples with detectable concentrations of constituent.
EPC	Exposure point concentration.
HpCDD	Heptachlorodi-benzo-p-dioxin.
HpCDF	Heptachlorodi-benzofuran.
Mean	Arithmetic average concentration of constituents using measured concentrations in "detects" and proxy concentrations in "non-detects" for the total number of samples.
N	Not a contributor to TEQ because the USEPA TEF is zero.
NA	Not available.
OCDD	Octachlorodi-benzo-p-dioxin.
OCDF	Octachlorodi-benzofuran.
PAHS	Polycyclic aromatic hydrocarbons.
SQLs	Sample quantitation limits for the non-detected constituents (detection limits).
SVOCs	Semi-volatile organic compounds.
TEF	Toxicity Equivalency Factors, 1989.
TEQ	Tetrachlorodibenzo-p-dioxin equivalents.
Total	Total number of samples analyzed for constituent.
TPH	Total petroleum hydrocarbons.
UCL	95 percent upper confidence limit (one-tailed) on the mean, assuming a normal distribution.
VOCs	Volatile organic compounds.

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Finding 20.

Many Cleanup Levels Derived from the Risk Assessment have Significantly Higher Values than those Developed by USEPA Region IX.

Supporting Data

A) Page 110 of the Baseline Risk Assessment

B) Region IX Preliminary Remediation Goals (PRGs) 1996 (USEPA, August 1996)

A) Page 110 of the Baseline Risk Assessment

action. A summary of HBGs for these AOPCs is provided in Table 10-21. The corrective action objectives for AOPCs 5, 7, 10, and 14 are to reduce or eliminate potential exposure to COPCs that have been identified as posing potential risks or hazards greater than target levels.

To facilitate the corrective action process, HBGs were developed for each COPC in each AOPC recommended for corrective action. The minimum value of the HBG identified for each COPC under each anticipated exposure scenario may be used as a preliminary cleanup level for the COPCs and AOPCs requiring further action. A preliminary cleanup level of 5 mg/Kg of arsenic in soil applies to AOPC 5. A preliminary cleanup level of 42 mg/Kg of tetrachloroethene in soil applies to AOPC 7. A preliminary cleanup level of 0.2 mg/Kg vinyl chloride in soil applies at AOPC 10. Preliminary cleanup levels of 1.2 mg/Kg beryllium and 16 mg/Kg cadmium apply to AOPC 14. These preliminary cleanup levels are health-protective values only, and do not take into account natural background, technological feasibility or cost-effectiveness. These values are provided merely to facilitate the corrective action decision-making process.

B) Region IX Preliminary Remediation Goals (PRGs), 1996
(USEPA, August 1996)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

August 1, 1996

Subject: Region 9 Preliminary Remediation Goals (PRGs) 1996

From: Stanford J. Smucker, Ph.D.
Regional Toxicologist (H-9-3)
Technical Support Team

To: PRG Table Mailing List

Please find the annual update to the Region 9 PRG table. The table has been revised to reflect the most current EPA toxicological and risk assessment information. Updates to EPA toxicity values were obtained from IRIS through July 1996, HEAST through May 1995, and EPA's National Center for Environmental Assessment (NCEA, formerly ECAO).

Region 9 PRGs are "evergreen" and have evolved as new methodologies and parameters have been developed. In several cases the models, equations, and assumptions presented in RAGS HHEM, *Part B, Development of Risk-Based Preliminary Remediation Goals* (1991) have been replaced with new information that is consistent with the document, *Soil Screening Guidance*, recently issued by the Office of Solid Waste and Emergency Response (OSWER), dated April 1996.

The updated PRG table also contains soil screening levels (SSLs) for protection of groundwater. The SSLs were obtained directly from EPA/OSWER's *Soil Screening Guidance* document which is available from NTIS as EPA/540/R-96/018 and EPA/540/R-95/128. Please note that because R 9 PRGs currently evaluate intermedia transfer of volatile organic chemicals (VOCs) and heavy metals from soil to air, the PRG table does not include a separate list of SSLs for the air pathway.

To help users rapidly identify substances with new PRGs, these contaminants are printed in boldface type. Changes in PRG values are either due to new toxicity constants or new physico-chemical information. This version of the table contains revised toxicity values for acetaldehyde, chlorine cyanide, 1,3-dichlorobenzene, 2-dichloroethane, endosulfan, manganese, phosphoric acid, and 1,1,1-trichloroethane. Also, 23 additional VOCs have been identified and evaluated for inhalation exposures resulting from intermedia transfer from soil and water to air.

EPA Region 9 has established a homepage on the World Wide Web which you can find at http://www.epa.gov/region 9/. Our homepage will soon include the PRG table in downloadable form. The electronic table contains additional information not presented in the printed table (e.g. physico-chemical constants, non-cancer PRGs for carcinogens, pathway-specific PRGs, and volatilization factors for VOCs). Meanwhile, we still provide the electronic PRG table (PRG96.zip) on California Regional Water Board's BBS (510.286.0404) for those of you who have a modem.

Before relying on any number in the table, it is recommended that the user verify the numbers with an agency toxicologist or risk assessor because the toxicity / exposure information in the table may contain errors or default assumptions that need to be refined based on further evaluation. If you find an error please send me a note via email at Smucker.Stan@epamail.epa.gov or fax at 415.744.1916.

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Key: i=IRIS h=HEAST n=NCEA x=WITHDRAWN r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 100X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS	
												Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	V O C	abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water* (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
8.7E-03 i	4.0E-03 i	8.7E-03 r	4.0E-03 r	0	0.10	30560-19-1	Acephate	5.1E+01 ca**	2.2E+02 ca*	7.7E-01 ca*	7.7E+00 ca*		
7.7E-03 r	2.6E-03 r	7.7E-03 i	2.6E-03 i	1	0.10	75-07-0	Acetaldehyde	9.2E+00 ca**	2.1E+01 ca**	8.7E-01 ca*	1.5E+00 ca*		
	2.0E-02 i		2.0E-02 r	0	0.10	34256-82-1	Acetochlor	1.3E+03 nc	1.4E+04 nc	7.3E+01 nc	7.3E+02 nc		
	1.0E-01 i		1.0E-01 r	1	0.10	67-64-1	Acetone	2.1E+03 nc	8.8E+03 nc	3.7E+02 nc	6.1E+02 nc	1.6E+01	8.0E-01
	8.0E-04 h		2.9E-03 x	0	0.10	75-86-5	Acetone cyanohydrin	5.2E+01 nc	5.5E+02 nc	1.0E+01 nc	2.9E+01 nc		
	6.0E-03 i		1.4E-02 h	1	0.10	75-05-8	Acetonitrile	2.2E+02 nc	1.2E+03 nc	5.2E+01 nc	7.1E+01 nc		
	1.0E-01 i		5.7E-06 x	1	0.10	98-86-2	Acetophenone	4.9E-01 nc	1.6E+00 nc	2.1E-02 nc	4.2E-02 nc		
	1.3E-02 i		1.3E-02 r	0	0.10	50594-66-6	Acifluorfen	8.5E+02 nc	8.9E+03 nc	4.7E+01 nc	4.7E+02 nc		
	2.0E-02 h		5.7E-06 i	1	0.10	107-02-8	Acrolein	1.0E-01 nc	3.4E-01 nc	2.1E-02 nc	4.2E-02 nc		
4.6E+00 i	2.0E-04 i	4.6E+00 i	2.0E-04 r	0	0.10	79-06-1	Acrylamide	9.8E-02 ca*	4.2E-01 ca	1.5E-03 ca	1.5E-02 ca		
	5.0E-01 i		2.9E-04 i	0	0.10	79-10-7	Acrylic acid	3.1E+04 nc	2.9E+05 nc	1.0E+00 nc	1.8E+04 nc		
5.4E-01 i	1.0E-03 h	2.4E-01 i	5.7E-04 i	1	0.10	107-13-1	Acrylonitrile	1.9E-01 ca*	4.7E-01 ca*	2.8E-02 ca*	3.7E+00 ca*		
8.1E-02 h	1.0E-02 i	8.0E-02 r	1.0E-02 r	0	0.10	15972-60-8	Alachlor	5.5E+00 ca*	2.4E+01 ca	8.4E-02 ca	8.4E-01 ca		
	1.5E-01 i		1.5E-01 r	0	0.10	1596-84-5	Alar	9.8E+03 nc	1.0E+05 nc	5.5E+02 nc	5.5E+03 nc		
	1.0E-03 i		1.0E-03 r	0	0.10	116-06-3	Aldicarb	6.5E+01 nc	6.8E+02 nc	3.7E+00 nc	3.7E+01 nc		
	1.0E-03 i		1.0E-03 r	0	0.10	1646-88-4	Aldicarb sulfone	6.5E+01 nc	6.8E+02 nc	3.7E+00 nc	3.7E+01 nc		
1.7E+01 i	3.0E-05 i	1.7E+01 i	3.0E-05 r	0	0.10	309-00-2	Aldrin	2.6E-02 ca*	1.1E-01 ca	3.9E-04 ca	4.0E-03 ca	1.2E+04	5.9E+02
	2.5E-01 i		2.5E-01 r	0	0.10	5585-64-6	Ally	1.6E+04 nc	1.0E+05 max	9.1E+02 nc	9.1E+03 nc		
	5.0E-03 x		5.0E-03 r	0	0.10	107-18-6	Allyl alcohol	3.3E+02 nc	3.4E+03 nc	1.8E+01 nc	1.8E+02 nc		
	5.0E-02 h		2.9E-04 i	0	0.10	107-05-1	Allyl chloride	3.2E+03 nc	3.3E+04 nc	1.0E+00 nc	1.8E+03 nc		
	1.0E+00 n			0	0.01	7429-90-5	Aluminum	7.7E+04 nc	1.0E+05 max		3.7E+04 nc		
	4.0E-04 i			0	0.01	20859-73-8	Aluminum phosphide	3.1E+01 nc	6.8E+02 nc		1.5E+01 nc		
	3.0E-04 i		3.0E-04 r	0	0.10	67485-29-4	Amdro	2.0E+01 nc	2.0E+02 nc	1.1E+00 nc	1.1E+01 nc		
	9.0E-03 i		9.0E-03 r	0	0.10	834-12-8	Ametryn	5.9E+02 nc	6.1E+03 nc	3.3E+01 nc	3.3E+02 nc		
	7.0E-02 h		7.0E-02 r	0	0.10	591-27-5	m-Aminophenol	4.6E+03 nc	4.8E+04 nc	2.6E+02 nc	2.6E+03 nc		
	2.0E-05 h		2.0E-05 r	0	0.10	504-24-5	4-Aminopyridine	1.3E+00 nc	1.4E+01 nc	7.3E-02 nc	7.3E-01 nc		
	2.5E-03 i		2.5E-03 r	0	0.10	33089-61-1	Amitraz	1.6E+02 nc	1.7E+03 nc	9.1E+00 nc	9.1E+01 nc		
			2.9E-02 i	n/a	n/a	7664-41-7	Ammonia			1.0E+02 nc			
	2.0E-01 i			0	0.10	7773-06-0	Ammonium sulfamate	1.3E+04 nc	1.0E+05 max		7.3E+03 nc		
5.7E-03 i	2.9E-04 r	5.7E-03 r	2.9E-04 i	0	0.10	62-53-3	Aniline	1.9E+01 nc	2.0E+02 nc	1.0E+00 nc	1.1E+01 nc		
	4.0E-04 i			0	0.01	7440-36-0	Antimony and compounds	3.1E+01 nc	6.8E+02 nc		1.5E+01 nc	5.0E+00	3.0E-01
	6.0E-04 h			0	0.01	1314-60-9	Antimony pentoxide	3.8E+01 nc	8.5E+02 nc		1.8E+01 nc		
	9.0E-04 h			0	0.01	28300-74-5	Antimony potassium tartrate	6.9E+01 nc	1.5E+03 nc		3.3E+01 nc		
	4.0E-04 h			0	0.01	1332-81-6	Antimony tetroxide	3.1E+01 nc	6.8E+02 nc		1.5E+01 nc		
	4.0E-04 h			0	0.01	1309-64-4	Antimony trioxide	3.1E+01 nc	6.8E+02 nc		1.5E+01 nc		
	1.3E-02 i		1.3E-02 r	0	0.10	74115-24-5	Apollo	8.5E+02 nc	8.9E+03 nc	4.7E+01 nc	4.7E+02 nc		
2.5E-02 i	5.0E-02 h	2.5E-02 i	5.0E-02 r	0	0.10	140-57-8	Aramite	1.8E+01 ca*	7.6E+01 ca	2.7E-01 ca	2.7E+00 ca		
	3.0E-04 i			0	0.03	7440-38-2	Arsenic (noncancer endpoint)	2.2E+01 nc					
1.5E+00 i	3.0E-04 i	1.5E+01 i		0	0.03	7440-38-2	Arsenic (cancer endpoint)	3.8E-01 ca*	2.4E+00 ca	4.5E-04 ca	4.5E-02 ca	2.9E+01	1.0E+00
			1.4E-05 i	n/a	n/a	7784-42-1	Arsine			5.2E-02 nc			
	9.0E-03 i		9.0E-03 r	0	0.10	76578-12-6	Assure	5.9E+02 nc	6.1E+03 nc	3.3E+01 nc	3.3E+02 nc		
	6.0E-02 i		6.0E-02 r	0	0.10	3337-71-1	Asulam	3.3E+03 nc	3.4E+04 nc	1.8E+02 nc	1.8E+03 nc		
2.2E-01 h	3.5E-02 h	2.2E-01 r	3.5E-02 h	0	0.10	1912-24-9	Atrazine	2.0E+00 ca	8.6E+00 ca	3.1E-02 ca	3.0E-01 ca		
	4.0E-04 i		4.0E-04 r	0	0.10	71751-41-2	Avermectin B1	2.6E+01 nc	2.7E+02 nc	1.5E+00 nc	1.5E+01 nc		
1.1E-01 i		1.1E-01 i		0	0.10	103-33-3	Azobenzene	4.0E+00 ca	1.7E+01 ca	6.2E-02 ca	6.1E-01 ca		
	7.0E-02 i		1.4E-04 h	0	0.01	7440-39-3	Barium and compounds	5.3E+03 nc	1.0E+05 max	5.2E-01 nc	2.6E+03 nc	1.6E+03	8.2E+01
	4.0E-03 i		4.0E-03 r	0	0.10	114-26-1	Baygon	2.6E+02 nc	2.7E+03 nc	1.5E+01 nc	1.5E+02 nc		

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Key: i=IRIS h=HEAST n=NCEA x=WITHDRAWN r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 100X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS	
												Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water* (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
	3.0E-02 i		3.0E-02 r	0	0.10	43121-43-3	Bayleton	2.0E+03 nc	2.0E+04 nc	1.1E+02 nc	1.1E+03 nc		
	2.5E-02 i		2.5E-02 r	0	0.10	66359-37-5	Baythroid	1.6E+03 nc	1.7E+04 nc	9.1E+01 nc	9.1E+02 nc		
	3.0E-01 i		3.0E-01 r	0	0.10	1861-40-1	Benefin	2.0E+04 nc	1.0E+05 max	1.1E+03 nc	1.1E+04 nc		
	5.0E-02 i		5.0E-02 r	0	0.10	17804-35-2	Benomyl	3.3E+03 nc	3.4E+04 nc	1.8E+02 nc	1.8E+03 nc		
	2.5E-03 i		2.5E-03 r	0	0.10	25057-89-0	Bentazon	1.6E+02 nc	1.7E+03 nc	9.1E+00 nc	9.1E+01 nc		
	1.0E-01 i		1.0E-01 r	0	0.10	100-52-7	Benzaldehyde	6.5E+03 nc	6.8E+04 nc	3.7E+02 nc	3.7E+03 nc		
2.9E-02 i	1.7E-03 r	2.9E-02 i	1.7E-03 n	1	0.10	71-43-2	Benzene	6.3E-01 ca*	1.4E+00 ca*	2.3E-01 ca*	3.9E-01 ca*	3.0E-02	2.0E-03
2.3E+02 i	3.0E-03 i	2.3E+02 i	3.0E-03 r	0	0.10	92-87-5	Benzidine	1.9E-03 ca	8.3E-03 ca	2.9E-05 ca	2.9E-04 ca		
	4.0E+00 i		4.0E+00 i	0	0.10	65-85-0	Benzoic acid	1.0E+05 max	1.0E+05 max	1.5E+04 nc	1.5E+05 nc	4.0E+02	2.0E+01
1.3E+01 i		1.3E+01 r		0	0.10	98-07-7	Benzotrichloride	3.4E-02 ca	1.5E-01 ca	5.2E-04 ca	5.2E-03 ca		
	3.0E-01 h		3.0E-01 r	0	0.10	100-51-6	Benzyl alcohol	2.0E+04 nc	1.0E+05 max	1.1E+03 nc	1.1E+04 nc		
1.7E-01 i		1.7E-01 r		1	0.10	100-44-7	Benzyl chloride	8.1E-01 ca	2.0E+00 ca	4.0E-02 ca	6.6E-02 ca		
4.3E+00 i	5.0E-03 i	8.4E+00 i		0	0.01	7440-41-7	Beryllium and compounds	1.4E-01 ca	1.1E+00 ca	8.0E-04 ca	1.6E-02 ca	6.3E+01	3.0E+00
	1.0E-04 i		1.0E-04 r	0	0.10	141-66-2	Bidrin	6.5E+00 nc	6.8E+01 nc	3.7E-01 nc	3.7E+00 nc		
	1.5E-02 i		1.5E-02 r	0	0.10	82657-04-3	Biphenthrin (Talstar)	9.8E+02 nc	1.0E+04 nc	5.5E+01 nc	5.5E+02 nc		
	5.0E-02 i		5.0E-02 r	1	0.10	92-52-4	1,1-Biphenyl	3.5E+02 sat	3.5E+02 sat	1.8E+02 nc	3.0E+02 nc		
1.1E+00 i		1.2E+00 i		1	0.10	111-44-4	Bis(2-chloroethyl)ether	4.3E-02 ca	9.7E-02 ca	5.8E-03 ca	9.8E-03 ca	4.0E-04	2.0E-05
7.0E-02 h	4.0E-02 i	3.5E-02 h	4.0E-02 r	1	0.10	39638-32-9	Bis(2-chloroisopropyl)ether	2.5E+00 ca	6.7E+00 ca	1.9E-01 ca	2.7E-01 ca		
2.2E+02 i		2.2E+02 i		1	0.10	542-88-1	Bis(chloromethyl)ether	1.9E-04 ca	4.2E-04 ca	3.1E-05 ca	5.2E-05 ca		
7.0E-02 x		7.0E-02 x		0	0.10	108-60-1	Bis(2-chloro-1-methylethyl)ether	6.3E+00 ca	2.7E+01 ca	9.6E-02 ca	9.6E-01 ca		
1.4E-02 i	2.0E-02 i	1.4E-02 r	2.2E-02 r	0	0.10	117-81-7	Bis(2-ethylhexyl)phthalate (DEHP)	3.2E+01 ca*	1.4E+02 ca	4.8E-01 ca	4.8E+00 ca		
	5.0E-02 i		5.0E-02 r	0	0.10	80-05-7	Bisphenol A	3.3E+03 nc	3.4E+04 nc	1.8E+02 nc	1.8E+03 nc		
	9.0E-02 i		5.7E-03 h	0	0.10	7440-42-8	Boron	5.9E+03 nc	6.1E+04 nc	2.1E+01 nc	3.3E+03 nc		
			2.0E-04 h	0	0.10	7637-07-2	Boron trifluoride			7.3E-01 nc			
6.2E-02 i	2.0E-02 i	6.2E-02 r	2.0E-02 r	1	0.10	75-27-4	Bromodichloromethane	6.3E-01 ca	1.4E+00 ca	1.1E-01 ca	1.8E-01 ca	6.0E-01	3.0E-02
7.9E-03 i	2.0E-02 i	3.9E-03 i	2.0E-02 r	0	0.10	75-25-2	Bromoform (tribromomethane)	5.6E+01 ca**	2.4E+02 ca*	1.7E+00 ca*	8.5E+00 ca*	8.0E-01	4.0E-02
	1.4E-03 i		1.4E-03 i	1	0.10	74-83-9	Bromomethane	6.8E+00 nc	2.3E+01 nc	5.2E+00 nc	8.7E+00 nc	2.0E-01	1.0E-02
				0	0.10	101-55-3	4-Bromophenyl phenyl ether						
	5.0E-03 h		5.0E-03 r	0	0.10	2104-96-3	Bromophos	3.3E+02 nc	3.4E+03 nc	1.8E+01 nc	1.8E+02 nc		
	2.0E-02 i		2.0E-02 r	0	0.10	1689-84-5	Bromoxynil	1.3E+03 nc	1.4E+04 nc	7.3E+01 nc	1.8E+02 nc		
	2.0E-02 i		2.0E-02 r	0	0.10	1689-99-2	Bromoxynil octanoate	1.3E+03 nc	1.4E+04 nc	7.3E+01 nc	7.3E+02 nc		
9.8E-01 r		9.8E-01 i		1	0.10	106-99-0	1,3-Butadiene	6.5E-03 ca	1.4E-02 ca	6.9E-03 ca	1.1E-02 ca	1.7E+01	9.0E-01
	1.0E-01 i		1.0E-01 r	0	0.10	71-36-3	1-Butanol	6.5E+03 nc	6.8E+04 nc	3.7E+02 nc	3.7E+03 nc		
	5.0E-02 i		5.0E-02 r	0	0.10	2008-41-5	Butylate	3.3E+03 nc	3.4E+04 nc	1.8E+02 nc	1.8E+03 nc	9.3E+02	8.1E+02
	2.0E-01 i		2.0E-01 r	0	0.10	85-68-7	Butyl benzyl phthalate	9.3E+02 sat	9.3E+02 sat	7.3E+02 nc	7.3E+03 nc		
	1.0E+00 i		1.0E+00 r	0	0.10	85-70-1	Butylphthalyl butylglycolate	6.5E+04 nc	1.0E+05 max	3.7E+03 nc	3.7E+04 nc		
	3.0E-03 h		3.0E-03 r	0	0.10	75-60-5	Cacodylic acid	2.0E+02 nc	2.0E+03 nc	1.1E+01 nc	1.1E+02 nc	8.0E+00	4.0E-01
	5.0E-04 i	6.3E+00 i	5.7E-05 x	0	0.01	7440-43-9	Cadmium and compounds	3.8E+01 nc	8.5E+02 nc	1.1E-03 ca	1.8E+01 nc		
							"CAL-Modified PRG" (PEA, 1994)	9.0E+00					
	5.0E-01 i		5.0E-01 r	0	0.10	105-60-2	Caprolactam	3.3E+04 nc	1.0E+05 max	1.8E+03 nc	1.8E+04 nc		
8.6E-03 h	2.0E-03 i	8.6E-03 r	2.0E-03 r	0	0.10	2425-06-1	Captafol	5.2E+01 ca**	2.2E+02 ca*	7.8E-01 ca*	7.8E+00 ca*		
3.5E-03 h	1.3E-01 i	3.5E-03 r	1.3E-01 r	0	0.10	133-06-2	Captan	1.3E+02 ca*	5.5E+02 ca	1.9E+00 ca	1.9E+01 ca		
	1.0E-01 i		1.1E-01 r	0	0.10	63-25-2	Carbaryl	6.5E+03 nc	6.8E+04 nc	4.0E+02 nc	3.7E+03 nc		
2.0E-02 h		2.0E-02 r		0	0.10	86-74-8	Carbazole	2.2E+01 ca	9.5E+01 ca	3.4E-01 ca	3.4E+00 ca	6.0E-01	3.0E-02
	5.0E-03 i		5.0E-03 r	0	0.10	1563-66-2	Carbofuran	3.3E+02 nc	3.4E+03 nc	1.8E+01 nc	1.8E+02 nc		
	1.0E-01 i		2.9E-03 h	1	0.10	75-15-0	Carbon disulfide	7.5E+00 nc	2.4E+01 nc	1.0E+01 nc	2.1E+01 nc	3.2E+01	2.0E+00
1.3E-01 i	7.0E-04 i	5.3E-02 i	5.7E-04 h	1	0.10	56-23-5	Carbon tetrachloride	2.3E-01 ca*	5.0E-01 ca*	1.3E-01 ca*	1.7E-01 ca*	7.0E-02	3.0E-03

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FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS	
												Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
	6.0E-01 i			0	0.01	7440-24-6	Strontium, stable	4.6E+04 nc	1.0E+05 max		2.2E+04 nc		
	3.0E-04 i		3.0E-04 r	0	0.10	57-24-9	Strychnine	2.0E+01 nc	2.0E+02 nc	1.1E+00 nc	1.1E+01 nc		
	2.0E-01 i		2.9E-01 i	1	0.10	100-42-5	Styrene	6.8E+02 sat	6.8E+02 sat	1.1E+03 nc	1.6E+03 nc	4.0E+00	2.0E-01
	2.5E-02 i		2.5E-02 r	0	0.10	88671-89-0	Systhane	1.6E+03 nc	1.7E+04 nc	9.1E+01 nc	9.1E+02 nc		
1.5E+05 h		1.5E+05 h		0	0.03	1746-01-6	2,3,7,8-TCDD (dioxin)	3.8E-06 ca	2.4E-05 ca	4.5E-08 ca	4.5E-07 ca		
	7.0E-02 i		7.0E-02 r	0	0.10	34014-18-1	Tebuthiuron	4.6E+03 nc	4.8E+04 nc	2.6E+02 nc	2.6E+03 nc		
	2.0E-02 h		2.0E-02 r	0	0.10	3383-96-8	Temephos	1.3E+03 nc	1.4E+04 nc	7.3E+01 nc	7.3E+02 nc		
	1.3E-02 i		1.3E-02 r	0	0.10	5902-51-2	Terbacil	8.5E+02 nc	8.9E+03 nc	4.7E+01 nc	4.7E+02 nc		
	2.5E-05 h		2.5E-05 r	0	0.10	13071-79-9	Terbufos	1.6E+00 nc	1.7E+01 nc	9.1E-02 nc	9.1E-01 nc		
	1.0E-03 i		1.0E-03 r	0	0.10	886-50-0	Terbutryn	6.5E+01 nc	6.8E+02 nc	3.7E+00 nc	3.7E+01 nc		
	3.0E-04 i		3.0E-04 r	0	0.10	95-94-3	1,2,4,5-Tetrachlorobenzene	2.0E+01 nc	2.0E+02 nc	1.1E+00 nc	1.1E+01 nc		
2.6E-02 i	3.0E-02 i	2.6E-02 i	3.0E-02 r	1	0.10	630-20-6	1,1,1,2-Tetrachloroethane	2.4E+00 ca	5.4E+00 ca	2.6E-01 ca	4.3E-01 ca		
2.0E-01 i		2.0E-01 i		1	0.10	79-34-5	1,1,2,2-Tetrachloroethane	4.5E-01 ca	1.1E+00 ca	3.3E-02 ca	5.5E-02 ca	3.0E-03	2.0E-04
5.2E-02 n	1.0E-02 i	2.0E-03 n	1.0E-02 r	1	0.10	127-18-4	Tetrachloroethylene (PCE)	5.4E+00 ca	1.7E+01 ca	3.3E+00 ca	1.1E+00 ca	6.0E-02	3.0E-03
							"CAL-Modified PRG" (PEA, 1994)			3.2E-01			
	3.0E-02 i		3.0E-02 r	0	0.10	58-90-2	2,3,4,6-Trachlorophenol	2.0E+03 nc	2.0E+04 nc	1.1E+02 nc	1.1E+03 nc		
2.0E+01 h		2.0E+01 r		0	0.10	5216-25-1	p,a,a,a-Tetrachlorotoluene	2.2E-02 ca	9.5E-02 ca	3.4E-04 ca	3.4E-03 ca		
2.4E-02 h	3.0E-02 i	2.4E-02 r	3.0E-02 r	0	0.10	961-11-5	Tetrachlorovinphos	1.9E+01 ca	7.9E+01 ca	2.8E-01 ca	2.8E+00 ca		
	5.0E-04 i		5.0E-04 r	0	0.10	3689-24-5	Tetraethyldithiopyrophosphate	3.3E+01 nc	3.4E+02 nc	1.8E+00 nc	1.8E+01 nc		
	7.0E-05 h			0	0.01	1314-32-5	Thallic oxide	5.4E+00 nc	1.2E+02 nc		2.6E+00 nc		
	9.0E-05 i			0	0.01	563-68-8	Thallium acetate	6.9E+00 nc	1.5E+02 nc		3.3E+00 nc	7.0E-01	4.0E-01
	8.0E-05 i			0	0.01	6533-73-9	Thallium carbonate	6.1E+00 nc	1.4E+02 nc		2.9E+00 nc	7.0E-01	4.0E-01
	8.0E-05 i			0	0.01	7791-12-0	Thallium chloride	6.1E+00 nc	1.4E+02 nc		2.9E+00 nc	7.0E-01	4.0E-01
	9.0E-05 i			0	0.01	10102-45-1	Thallium nitrate	6.9E+00 nc	1.5E+02 nc		3.3E+00 nc	7.0E-01	4.0E-01
	9.0E-05 x			0	0.01	12039-52-0	Thallium selenite	6.9E+00 nc	1.5E+02 nc		3.3E+00 nc	7.0E-01	4.0E-01
	8.0E-05 i			0	0.01	7446-18-6	Thallium sulfate	6.1E+00 nc	1.4E+02 nc		2.9E+00 nc	7.0E-01	4.0E-01
	1.0E-02 i		1.0E-02 r	0	0.10	28249-77-6	Thiobencarb	6.5E+02 nc	6.8E+03 nc	3.7E+01 nc	3.7E+02 nc		
	3.0E-02 x		3.0E-02 r	0	0.10	3689-24-5	2-(Thiocyanomethylthio)- benzothiazole (TCMTB)	2.0E+03 nc	2.0E+04 nc	1.1E+02 nc	1.1E+03 nc		
	3.0E-04 h		3.0E-04 r	0	0.10	39196-18-4	Thiofanox	2.0E+01 nc	2.0E+02 nc	1.1E+00 nc	1.1E+01 nc		
	8.0E-02 i		8.0E-02 r	0	0.10	23564-05-8	Thiophanate-methyl	5.2E+03 nc	5.5E+04 nc	2.9E+02 nc	2.9E+03 nc		
	5.0E-03 i		5.0E-03 r	0	0.10	137-26-8	Thiram	3.3E+02 nc	3.4E+03 nc	1.8E+01 nc	1.8E+02 nc		
	6.0E-01 h			0	0.01	n/a	Tin (inorganic, see tributyltin oxide for organic tin)	4.6E+04 nc	1.0E+05 max		2.2E+04 nc		
	2.0E-01 i		1.1E-01 h	1	0.10	108-88-3	Toluene	7.9E+02 nc	8.8E+02 sat	4.0E+02 nc	7.2E+02 nc	1.2E+01	6.0E-01
3.2E+00 h		3.2E+00 r		0	0.10	95-80-7	Toluene-2,4-diamine	1.4E-01 ca	6.0E-01 ca	2.1E-03 ca	2.1E-02 ca		
	6.0E-01 h		6.0E-01 r	0	0.10	95-70-5	Toluene-2,5-diamine	3.9E+04 nc	1.0E+05 max	2.2E+03 nc	2.2E+04 nc		
	2.0E-01 h		2.0E-01 r	0	0.10	823-40-5	Toluene-2,6-diamine	1.3E+04 nc	1.0E+05 max	7.3E+02 nc	7.3E+03 nc		
1.9E-01 i		1.9E-01 r		0	0.10	106-49-0	p-Toluidine	2.3E+00 ca	1.0E+01 ca	3.5E-02 ca	3.5E-01 ca		
1.1E+00 i		1.1E+00 i		0	0.10	8001-35-2	Toxaphene	4.0E-01 ca	1.7E+00 ca	6.0E-03 ca	6.1E-02 ca	3.1E+01	2.0E+00
	7.5E-03 i		7.5E-03 r	0	0.10	66841-25-6	Tralomethrin	4.9E+02 nc	5.1E+03 nc	2.7E+01 nc	2.7E+02 nc		
	1.3E-02 i		1.3E-02 r	0	0.10	2303-17-5	Triallate	8.5E+02 nc	8.9E+03 nc	4.7E+01 nc	4.7E+02 nc		
	1.0E-02 i		1.0E-02 r	0	0.10	82097-50-5	Triasulfuron	6.5E+02 nc	6.8E+03 nc	3.7E+01 nc	3.7E+02 nc		
	5.0E-03 i		5.0E-03 r	0	0.10	615-54-3	1,2,4-Tribromobenzene	3.3E+02 nc	3.4E+03 nc	1.8E+01 nc	1.8E+02 nc		
	3.0E-05 i		3.0E-05 r	0	0.10	56-35-9	Tributyltin oxide (TBTO)	2.0E+00 nc	2.0E+01 nc	1.1E-01 nc	1.1E+00 nc		
3.4E-02 h		3.4E-02 r		0	0.10	634-93-5	2,4,6-Trichloroaniline	1.3E+01 ca	5.6E+01 ca	2.0E-01 ca	2.0E+00 ca		
2.9E-02 h		2.9E-02 r		0	0.10	33663-50-2	2,4,6-Trichloroaniline hydrochloride	1.5E+01 ca	6.6E+01 ca	2.3E-01 ca	2.3E+00 ca		
	1.0E-02 i		5.7E-02 h	1	0.10	120-82-1	1,2,4-Trichlorobenzene	5.7E+02 nc	5.5E+03 sat	2.1E+02 nc	1.9E+02 nc	5.0E+00	3.0E-01
	3.6E-02 n		2.9E-01 x	1	0.10	71-55-6	1,1,1-Trichloroethane	1.2E+03 nc	3.0E+03 sat	1.0E+03 nc	7.9E+02 nc	2.0E+00	1.0E-01

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Key: i=IRIS h=HEAST n=NCEA x=WITHDRAWN r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS	
												Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
5.7E-02 i	4.0E-03 i	5.6E-02 i	4.0E-03 r	1	0.10	79-00-5	1,1,2-Trichloroethane	6.5E-01 ca	1.5E+00 ca	1.2E-01 ca	2.0E-01 ca	2.0E-02	9.0E-04
1.1E-02 n	6.0E-03 n	6.0E-03 n	6.0E-03 r	1	0.10	79-01-6	Trichloroethylene (TCE)	3.2E+00 ca*	7.0E+00 ca*	1.1E+00 ca*	1.6E+00 ca*	6.0E-02	3.0E-03
	3.0E-01 i		2.0E-01 h	1	0.10	75-69-4	Trichlorofluoromethane	3.8E+02 nc	1.3E+03 nc	7.3E+02 nc	1.3E+03 nc		
	1.0E-01 i		1.0E-01 r	0	0.10	95-95-4	2,4,5-Trichlorophenol	6.5E+03 nc	6.8E+04 nc	3.7E+02 nc	3.7E+03 nc	2.7E+02	1.4E+01
1.1E-02 i		1.1E-02 i		0	0.10	88-06-2	2,4,6-Trichlorophenol	4.0E+01 ca	1.7E+02 ca	6.2E-01 ca	6.1E+00 ca	2.0E-01	8.0E-03
	1.0E-02 i		1.0E-02 r	0	0.10	93-76-5	2,4,5-Trichlorophenoxyacetic Acid	6.5E+02 nc	6.8E+03 nc	3.7E+01 nc	3.7E+02 nc		
	8.0E-03 i		8.0E-03 r	0	0.10	93-72-1	2-(2,4,5-Trichlorophenoxy) propionic acid	5.2E+02 nc	5.5E+03 nc	2.9E+01 nc	2.9E+02 nc		
	5.0E-03 i		5.0E-03 r	1	0.10	598-77-6	1,1,2-Trichloropropane	1.5E+01 nc	5.0E+01 nc	1.8E+01 nc	3.0E+01 nc		
7.0E+00 h	6.0E-03 i	7.0E+00 r	5.0E-03 r	1	0.10	96-18-4	1,2,3-Trichloropropane	1.4E-03 ca	3.1E-03 ca	9.6E-04 ca	1.6E-03 ca		
	5.0E-03 h		5.0E-03 r	1	0.10	96-19-5	1,2,3-Trichloropropene	1.1E+01 nc	3.8E+01 nc	1.8E+01 nc	3.0E+01 nc		
	3.0E+01 i		8.6E+00 h	1	0.10	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	5.6E+03 sat	5.6E+03 sat	3.1E+04 nc	5.9E+04 nc		
	3.0E-03 i		3.0E-03 r	0	0.10	58138-08-2	Tridiphane	2.0E+02 nc	2.0E+03 nc	1.1E+01 nc	1.1E+02 nc		
	2.0E-03 r		2.0E-03 i	1	0.10	121-44-8	Triethylamine	2.3E+01 nc	8.4E+01 nc	7.3E+00 nc	1.2E+01 nc		
7.7E-03 i	7.5E-03 i	7.7E-03 r	7.5E-03 r	0	0.10	1582-09-8	Trifluralin	5.8E+01 ca**	2.5E+02 ca*	8.7E-01 ca*	8.7E+00 ca*		
3.7E-02 h		3.7E-02 r		0	0.10	512-56-1	Trimethyl phosphate	1.2E+01 ca	5.2E+01 ca	1.8E-01 ca	1.8E+00 ca		
	5.0E-05 i		5.0E-05 r	0	0.10	99-35-4	1,3,5-Trinitrobenzene	3.3E+00 nc	3.4E+01 nc	1.8E-01 nc	1.8E+00 nc		
	1.0E-02 h		1.0E-02 r	0	0.10	479-45-8	Trinitrophenylmethylnitramine	6.5E+02 nc	6.8E+03 nc	3.7E+01 nc	3.7E+02 nc		
3.0E-02 i	5.0E-04 i	3.0E-02 r	5.0E-04 r	0	0.10	118-96-7	2,4,6-Trinitrotoluene	1.5E+01 ca**	6.4E+01 ca**	2.2E-01 ca**	2.2E+00 ca**		
	3.0E-03 i			0	0.01	7440-61-1	Uranium (soluble salts)	5.4E+02 nc	1.2E+04 nc		2.6E+02 nc	6.0E+03	3.0E+02
	7.0E-03 h			0	0.01	7440-62-2	Vanadium	6.9E+02 nc	1.5E+04 nc		3.3E+02 nc	6.0E+03	3.0E+02
	9.0E-03 i			0	0.01	1314-62-1	Vanadium pentoxide	1.5E+03 nc	3.4E+04 nc		7.3E+02 nc	6.0E+03	3.0E+02
	2.0E-02 h			0	0.01	13701-70-7	Vanadium sulfate	6.5E+01 nc	6.8E+02 nc	3.7E+00 nc	3.7E+01 nc		
	1.0E-03 i		1.0E-03 r	0	0.10	1929-77-7	Vernam	1.6E+03 nc	1.7E+04 nc	9.1E+01 nc	9.1E+02 nc		
	2.5E-02 i		2.5E-02 r	0	0.10	50471-44-8	Vinclozolin	7.8E+02 nc	2.6E+03 nc	2.1E+02 nc	4.1E+02 nc	1.7E+02	8.0E+00
	1.0E+00 h		5.7E-02 i	1	0.10	108-05-4	Vinyl acetate	1.9E-01 ca*	4.1E-01 ca*	6.1E-02 ca*	1.0E-01 ca*		
1.1E-01 r	8.6E-04 r	1.1E-01 h	8.6E-04 i	1	0.10	593-60-2	Vinyl bromide (bromoethene)	1.6E-02 ca	3.5E-02 ca	2.2E-02 ca	2.0E-02 ca	1.0E-02	7.0E-04
1.9E+00 h		3.0E-01 h		1	0.10	75-01-4	Vinyl chloride	2.0E+01 nc	2.0E+02 nc	1.1E+00 nc	1.1E+01 nc		
	3.0E-04 i		3.0E-04 r	0	0.10	81-81-2	Warfarin	3.2E+02 sat	3.2E+02 sat	7.3E+02 nc	1.4E+03 nc	2.1E+02	1.0E+01
	2.0E+00 i		2.0E-01 x	1	0.10	108-38-3	m-Xylene	3.2E+02 sat	3.2E+02 sat	7.3E+02 nc	1.4E+03 nc	1.9E+02	9.0E+00
	2.0E+00 i		2.0E-01 x	1	0.10	95-47-6	o-Xylene	3.2E+02 sat	3.2E+02 sat			2.0E+02	1.0E+01
				1	0.10	106-42-3	p-Xylene	3.2E+02 sat	3.2E+02 sat	7.3E+02 nc	1.4E+03 nc	2.0E+02	1.0E+01
	2.0E+00 i		2.0E-01 x	1	0.10	1330-20-7	Xylene (mixed)	2.3E+04 nc	1.0E+05 max		1.1E+04 nc	1.2E+04	6.2E+02
	3.0E-01 i			0	0.01	7440-66-6	Zinc	2.3E+01 nc	5.1E+02 nc		1.1E+01 nc		
	3.0E-04 i			0	0.01	1314-84-7	Zinc phosphide	3.3E+03 nc	3.4E+04 nc	1.8E+02 nc	1.8E+03 nc		
	5.0E-02 i		5.0E-02 r	0	0.10	12122-67-7	Zineb						

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Finding 21.

The Wrong T-Value was used in Volatilization Calculations, Thus Underestimating Risks by up to 5 Times the True Values

Supporting Data

Calculations Illustrating Impact of T Value Variable

INTEGRATED
Environmental Services, Inc.

GENERAL DESIGN &
CALCULATION FORM

Project ILM BCRA Review

Project No.

Date 4/26/97

Design/Calculation By C. Stoken

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$$VF = Q/C \times \frac{(3.1416 * \alpha * T)^{1/2}}{2 * De_i * \rho_a * K_{as}} * UC_4$$

Example presented in Table 7-4 $T = 7.9 \times 10^8$ sec or 25yrs.

$$VF = 121\,(g/m^2/sec)(kg/m^3) * \frac{(3.1416 * (2.0 \times 10^{-4}\,cm^2/s) * (7.9 \times 10^8\,s))^{1/2}}{2 * (0.0000723\,cm^2/s) * 0.07 * (1.06\,g/cm^3)} * (10^{-4}\,m^2/cm^2)$$

$VF = 80,707\ m^3$ of air / kg of contaminant

Impacts of T when varied by Receptor All other parameters remain constant as presented in the ILM BCRA.

$T = 6.307 \times 10^7$ or 2yrs Based on Interim VACANT Scenario

$$VF = 121\,(g/m^2/sec)(kg/m^3) * \frac{(3.1416 * (2.06 \times 10^{-4}\,cm^2/s) * (6.307 \times 10^7\,s))^{1/2}}{2 * (0.0000723\,cm^2/s) * 0.07 * (1.06\,g/cm^3)} * (10^{-4}\,m^2/cm^2)$$

$VF = 22,780\ m^3$ of air / kg of contaminant

It is important to note that 1/VF is multiplied times the soil concentration to calculate the average emission concentration the receptor is exposed to over the duration of the exposure. Therefore, the smaller VF the greater exposure the receptor will experience.