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RISK-BASED DECISIONS, INC.

An Environmental Consulting Company

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January 26, 1999

Ms. Madhula Logan
Hazardous Materials Specialist
Alameda County Health Care Services Agency
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

99 JAN 27 4:10:49
ENVIRONMENTAL
PROTECTION

**Re: Risk Calculations for
Pacific Dry Dock and Repair
Company, Yards I and II in
Oakland, California**

Dear Ms. Logan:

As requested by you at our meeting in your offices in December 1998, Risk-Based Decisions, Inc. on behalf of Crowley Marine Services have recalculated the risks posed by residual chemicals in soils at the Pacific Dry Dock and Repair Company (PDD) Yards I and II sites located in Oakland, California.

The attached tables show the data and all the calculations. We would be happy to provide you with an electronic copy of the spreadsheets and calculation should you so request.

Specifically, in compliance with your request, we have calculated the arithmetic means and standard deviations for all the data, old and new, and including both targeted and random soil samples. The arithmetic mean for each chemical detected in soil was taken as the exposure point concentration and risks via soil ingestion, dermal contact, and particulate inhalation were calculated using USEPA's recommended default exposure assumptions for an industrial onsite worker exposure scenario. The total risks were then estimated by summing the risks for each of the three routes of exposure namely, soil ingestion, dermal contact and particulate inhalation. In summary, the risks are:

PDD Yard I

Sampling Type:	Targeted and Random
Depths:	All
Exposure Point Concentration:	Arithmetic mean
Routes of Exposure:	Soil Ingestion, Dermal Contact, Particulate Inhalation
Exposure Assumptions:	USEPA's default values for workers
Excess Cancer Risk:	
Soil Ingestion:	2.33E-06
Dermal Contact:	2.76E-06
Particulate Inhalation:	6.03E-08
TOTAL (all routes):	5.15E-06
Noncarcinogenic Hazard Index (all routes):	0.0056

Note: The excess cancer risks at PDD Yard I result entirely from the detection of PNAs in two targeted samples (7a.2S and 9a.2S) whose locations are shown in Figure 3-3a of the Update to Risk Assessment Report (Risk-Based Decisions, July 6, 1998). Furthermore, the randomized soil samples showed no PNAs above the limits of detection (Table 3). While the excess cancer risks obtained above are below the regulatory threshold of concern of 1.0E-05, the estimated risks are a function of the assumptions made that onsite workers could be exposed to these levels of contaminants in soils across the entire site for 8 hours a day, 250 days per year for 25 years...assumptions which are not likely to occur given the very limited areal extent of any detectable chemical of potential concern at this site.

Summary:

- PDD Yard I has been adequately investigated and characterized with oversight for all investigations provided by your office.
- All sources of contamination have been removed.
- No free product was identified.
- There is no groundwater contamination above levels of regulatory concern.
- Risks to human health have been shown to be below regulatory thresholds of concern (excess cancer risk of 1.0E-05 and noncancer hazard index of 1.0).
- The site poses no ecological threat.
- The site poses no threat to groundwater resources.
- Closure of the PDD Yard I site is hereby requested.

PDD Yard II

Sampling Type:	Targeted and Random
Depths:	All
Exposure Point Concentration:	Arithmetic mean
Routes of Exposure:	Soil Ingestion, Dermal Contact, Particulate Inhalation
Exposure Assumptions:	USEPA's default values for workers
Excess Cancer Risk:	
Soil Ingestion:	1.35E-06
Dermal Contact:	1.72E-06
Particulate Inhalation:	1.62E-08
TOTAL (all routes):	3.09E-06
Noncarcinogenic Hazard Index (all routes):	0.220

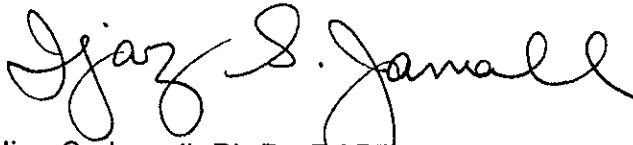
Note: The excess cancer risks at PDD Yard II result almost entirely from the detection of PCBs in soil samples (detected in the 1998 sampling event) near the entrance to the Yard and are not related to Crowley's operations (Figure 3, of the Update to Risk Assessment Report (Risk-Based Decisions, July 6, 1998)). The only other carcinogen detected was benzene in one soil sample at 3.2 mg/kg (Figure 2 of the Update Risk Assessment Report).

Summary:

- PDD Yard II has been adequately investigated and characterized with oversight for all investigations provided by your office.
- All sources of contamination have previously been removed under oversight by the RWQCB and your office.
- No free product was identified.
- Impacts to groundwater were shown to be below levels of regulatory concern.
- Risks to human health have been shown to be below regulatory thresholds of concern (excess cancer risk of 1.0E-05 and noncancer hazard index of 1.0).
- The site poses no ecological threat.
- The site poses no threat to groundwater resources.
- Closure of the PDD Yard II site is hereby requested.

We look forward to your approval of the findings of our risk assessments for PDD Yards I and II and formal closure of these sites by your office.

Sincerely,
Risk-Based Decisions, Inc.

A handwritten signature in black ink that reads "Ijaz S. Jamall". The signature is fluid and cursive, with the first name "Ijaz" being the most prominent.

Ijaz S. Jamall, Ph.D., DABT
Principal

C: Mr. Stephen R. Wilson
Crowley Marine Services

TABLE 1
SOIL SAMPLING RESULTS
METALS (mg/kg)
Pacific Dry Dock and Repair Company Yard I
1441 Embarcadero, Oakland, California

Sample ID	Date	Depth feet	Sample Type	Arsenic	Chromium	Cobalt	Copper	Lead	Mercury	Vanadium	Zinc
BH1E	Mar-92	4.0-4.5	T	10	2.2	<12	40	3.3	1.9	28	120
BH2E	Mar-92	7.0-7.5	T	3.4	18	<12	14	3.1	0.77	18	21
BH3E	Mar-92	7.0-7.5	T	3.4	27	<12	22	<2.5	0.57	20	31
BH4E	Mar-92	7.0-7.5	T	4.7	12	<12	8.8	<2.5	0.15	15	15
BH5E	Mar-92	4.5-5.0	T	14	37	<12	480	500	0.41	57	660
BH6E	Mar-92	9.5-10.0	T	3.9	21	<12	6.5	11	0.15	31	31
BH7E	Mar-92	7.0-7.5	T	4.3	27	<12	24	6.6	0.2	33	39
BH8E	Mar-92	7.0-7.5	T	1.6	42	<12	45	24	0.14	36	95
BH9	Oct-91	3.5-4.0	T	NA	15	NA	NA	14	NA	NA	140
BH11	Oct-91	9.5-10.0	T	NA	39	NA	NA	5.8	NA	NA	36
BH13	Oct-91	8.5-9.0	T	NA	36	NA	NA	8.6	NA	NA	250
MW1	Jun-93	5.5-6.0	T	9.2	18	17	16	29	<0.12	26	78
MW3	Jun-93	5.5-6.0	T	1.8	14	<12	22	5	0.48	16	71
PDDI-1	Jun-91	1.0	T	1.8	69	10	120	140	0.7	61	180
PDDI-2	Jun-91	1.0	T	1.7	85	13	110	110	0.6	68	130
PDDI-3	Jun-91	1.0	T	2.1	63	9.2	150	460	3.2	60	340
PDDI-4	Jun-91	1.0	T	4.2	220	31	1300	350	4.6	71	630
PDDI-5	Jun-91	1.0	T	3.1	71	9.4	70	370	0.5	54	94
PDDI-6	Jun-91	1.0	T	2.3	73	10	110	150	1.3	54	200
SW1	Feb-94	6.3	T	NA	NA	NA	NA	8.2	NA	NA	NA
SW2	Feb-94	6.7	T	NA	NA	NA	NA	6.9	NA	NA	NA
SW3	Feb-94	6.7	T	NA	NA	NA	NA	5.1	NA	NA	NA
BH9E	Mar-92	7.0-7.5	T	13	25	<12	720	190	9.7	40	340
BH10E	Mar-92	7.0-7.5	T	3.6	28	<12	22	3.1	0.13	25	38
BH11E	Mar-92	9.5-10.0	T	19	37	<12	1800	230	0.12	65	1000
BH12E	Mar-92	9.5-10.0	T	6.6	21	<12	17	<2.5	0.064	14	41
BH13E	Mar-92	4.5-5.0	T	15	130	<12	2900	590	13	10	1700
PDD#3	May-90		T	27	85	NA	9600	230	1.9	NA	1600
PDD#4	May-90		T	10	92	NA	720	160	7.7	NA	300
PDDI-5	Jan-90	2.5	T	4.6	39	13	50	55	0.65	28	160
PDDI-6	Jan-90	2.5	T	24	280	17	33	290	1.6	38	840
PDDI-7	Jan-90	1.5	T	47	77	99	3700	4400	21	38	1400
PDDI-11	Jan-90	0.5	T	NA	NA	NA	550	75	NA	NA	NA
PDD-12	Jan-90	0.5	T	NA	NA	NA	3300	290	NA	NA	NA
1a.S	Feb-98	05-1.0	R	<1	55	10	35	7.6	0.48	25	55
1a.D	Feb-98		R	1.9	11	6.6	41	7.5	0.55	26	80
1b.S	Feb-98	05-1.0	R	1.2	31	6.6	23	16	0.94	22	49
1b.D	Feb-98		R	1.5	24	7.3	32	54	0.94	26	66
1c.S	Feb-98	05-1.0	R	7.6	12	5.9	83	60	0.92	22	160
1c.D	Feb-98		R	3.4	14	5.6	140	48	0.41	24	140

TABLE 1
SOIL SAMPLING RESULTS
METALS (mg/kg)
Pacific Dry Dock and Repair Company Yard I
1441 Embarcadero, Oakland, California

Sample ID	Date	Depth feet	Sample Type	Arsenic	Chromium	Cobalt	Copper	Lead	Mercury	Vanadium	Zinc
1d.S	Feb-98	05-1.0	R	2.8	12	6.1	47	67	0.31	19	120
1d.D	Feb-98		R	2.8	26	7.9	98	130	0.45	25	160
4a.S	Feb-98	05-1.0	T	2.9	18	8	32	14	0.34	32	74
4a.D	Feb-98		T	2.5	21	5.7	26	43	1.5	17	60
6a.S	Feb-98	05-1.0	T	3	15	4	140	140	2.1	15	93
6a.D	Feb-98		T	3	25	4.1	460	84	1	28	290
7a.1S	Feb-98	05-1.0	T	<1	19	3.8	9.8	7.5	0.37	18	30
8a.S	Feb-98	05-1.0	T	<1	57	11	20	12	0.2	22	43
Mean (all depths)				3.52	37.25	8.21	124.17	80.66	0.87	32.30	138.82
S.D.(all depths)				3.01	39.16	5.14	249.53	131.21	0.98	17.04	151.90
Mean (0-1.0 ft bgs)				2.44	57.14	9.86	160.70	136.01	1.18	38.79	157.00
S.D.(0-1.0 ft bgs)				1.86	53.67	6.64	331.25	150.54	1.28	21.06	158.81
Background Mean				6.60	118.00	13.30	49.00	29.00	0.15	125.00	78.00
USEPA Region 9 Industrial PRG*				3	450	29,000	70,000	1,000	560	13,000	100,000

Note:

NA = Not Analyzed

: Areas were excavated during the grit removal. Data collected at these points are not included in the calculations of means and standard deviations.

* : Industrial PRGs (USEPA Region 9, May 1, 1998)

TABLE 2
HISTORICAL SOIL SAMPLING RESULTS
PETROLEUM HYDROCARBONS (mg/kg)
Pacific Dry Dock and Repair Company Yard I
1441 Embarcadero, Oakland, California

Sample ID	Date	Depth feet	TPH-D	TPH-G	Benzene	Toluene	Ethylbenzene	Xylenes
BH1	10/25/91	3.0-3.5	NA	NA	NA	NA	NA	NA
BH2	10/25/91	3.5-4.0	<0.05	NA	NA	NA	NA	NA
BH2	10/25/91	7.5-8.0	<0.05	<0.05	<0.005	<0.005	<0.005	<0.0015
BH3	10/25/91	1.5-2.0	NA	NA	NA	NA	NA	NA
BH3	10/25/91	7.0-7.5	23	NA	NA	NA	NA	NA
BH4	10/25/91	5.5-6.0	560	4.9	<0.005	<0.005	0.0087	0.065
BH5	10/25/91	3.5-4.0	57	<0.05	<0.005	<0.005	<0.005	<0.0015
BH6	10/25/91	5.5-6.0	NA	NA	NA	NA	NA	NA
BH7	10/25/91	3.5-4.0	NA	NA	NA	NA	NA	NA
BH7	10/25/91	5.5-6.0	NA	NA	NA	NA	NA	NA
BH7	10/25/91	7.5-8.0	<0.05	<0.05	<0.005	<0.005	<0.005	<0.0015
BH8	10/25/91	5.5-6.0	<0.05	<0.05	<0.005	<0.005	<0.005	<0.0015
BH9	10/25/91	3.5-4.0	<0.05	<0.05	0.0059	0.027	<0.005	0.035
BH10	10/25/91	3.5-4.0	9.8	65	0.022	0.047	0.52	2.3
BH10	10/25/91	7.5-8.0	NA	NA	NA	NA	NA	NA
BH11	10/25/91	9.5-10.0	<0.05	<0.05	<0.005	<0.005	<0.005	<0.0015
BH12	10/25/91	3.5-4.0	1800	970	1.3	1.8	<0.20	55
BH13	10/25/91	8.5-9.0	2100	52	<0.037	<0.030	<0.033	13
BH14	10/25/91	3.5-4.0	NA	<0.05	NA	NA	NA	NA
BH17	01/06/92	0.5-1.0	1200	32	<0.076	<0.080	<0.084	<0.020
BH19	01/06/92	2.0-2.5	<0.05	<0.05	0.0059	0.014	0.031	0.092
BH22	01/06/92	11.5-12.0	NA	NA	NA	NA	NA	NA
BH24	01/06/92	11.5-12.0	NA	NA	NA	NA	NA	NA
BH25	01/06/92	3.5-4.0	NA	NA	NA	NA	NA	NA
BH26	01/06/92	5.5-6.0	3.1	<0.05	<0.005	0.011	<0.005	0.021
BH27	01/06/92	2.5-3.0	5.9	<0.05	<0.005	0.017	0.0094	0.055
BH28	01/07/92	8.5-9.0	120	1.8	<0.005	<0.005	<0.005	<0.030
BH29	01/07/92	5.5-6.0	<0.05	<0.05	<0.005	<0.005	0.02	0.021
BH30	01/07/92	3.5-4.0	2100	22	<0.006	<0.005	<0.0079	0.55
BH31	01/07/92	1.0-1.5	2800	14	<0.076	<0.080	<0.089	<0.28
BH33	01/07/92	1.5-2.0	340	<0.05	<0.005	0.0083	0.02	0.037
BH34	01/07/92	1.5-2.0	9.4	6.3	0.017	0.011	<0.005	0.26
BH34	01/07/92	9.5-10.0	73	2.5	0.016	0.016	0.051	0.14
BH35	01/07/92	5.5-6.0	450	1.7	0.0065	0.017	0.027	0.087
BH37	01/07/92	3.5-4.0	<0.05	<0.05	<0.005	<0.005	<0.005	<0.0015
BH38	01/07/92	3.5-4.0	<0.05	0.78	<0.005	0.0056	<0.005	0.11
BH39	01/08/92	5.5-6.0	<0.05	<0.05	<0.005	0.013	0.022	0.04
BH46	01/08/92	2.5-3.0	<0.05	<0.05	<0.005	<0.005	<0.005	<0.0015
BH46	01/08/92	8.5-9.0	NA	NA	NA	NA	NA	NA
BH47	01/08/92	8.0-8.5	1400	9.2	<0.005	0.011	<0.005	0.26
BH48	01/08/92	2.5-3.0	75	47	<0.076	<0.080	<0.084	1

TABLE 2
HISTORICAL SOIL SAMPLING RESULTS
PETROLEUM HYDROCARBONS (mg/kg)
Pacific Dry Dock and Repair Company Yard I
1441 Embarcadero, Oakland, California

Sample ID	Date	Depth feet	TPH-D	TPH-G	Benzene	Toluene	Ethylbenzene	Xylenes
BH1E	03/23/92	4.0-4.5	1.6	2.4	<0.005	<0.005	<0.005	0.099
BH2E	03/23/92	7.0-7.5	2200	250	<0.28	<0.26	<0.3	4.4
BH3E	03/23/92	7.0-7.5	100	2.1	<0.005	<0.005	<0.005	0.078
BH4E	03/23/92	7.0-7.5	6.1	3.2	<0.005	<0.005	<0.005	0.089
BH5E	03/23/92	4.5-5.0	43	13	0.012	0.0066	<0.005	0.38
BH6E	03/23/92	9.5-10.0	<1.0	<0.5	<0.005	<0.005	<0.005	<0.015
BH7E	03/23/92	7.0-7.5	<1.0	<0.5	<0.005	<0.005	<0.005	<0.015
BH8E	03/23/92	7.0-7.5	<1.0	<0.5	<0.005	<0.005	<0.005	<0.015
BH18E	08/17/92	4.5-5.0	11	4.3	0.0051	<0.005	<0.005	<0.005
BH19E	08/17/92	4.5-5.0	8.4	<0.5	<0.005	<0.005	<0.005	<0.005
BH20E	08/17/92	7.0-7.5	350	<0.5	<0.005	<0.005	<0.005	0.017
BH21E	08/17/92	4.5-5.0	530	<0.5	<0.005	<0.005	<0.005	<0.005
BH22E	08/17/92	7.0-7.5	16	0.9	<0.005	<0.005	<0.005	<0.005
BH23E	08/17/92	4.5-5.0	9.2	<0.5	<0.005	<0.005	<0.005	0.016
BH24E	08/17/92	4.5-5.0	<1.0	<0.5	<0.005	<0.005	<0.005	<0.005
BH25E	08/17/92	4.5-5.0	180	4.7	<0.005	<0.005	0.018	<0.005
BH26E	08/17/92	7.0-7.5	2.5	2.4	<0.005	<0.005	<0.005	<0.005
BH27E	08/17/92	4.5-5.0	<1.0	<0.5	<0.005	<0.005	<0.005	<0.005
BH28E	08/17/92	4.5-5.0	<1.0	<0.5	<0.005	<0.005	<0.005	<0.005
BH29E	08/17/92	2.0-2.5	<1.0	<0.5	<0.005	<0.005	<0.005	<0.005
BH30E	08/18/92	4.5-5.0	<1.0	<0.5	<0.005	<0.005	<0.005	<0.005
BH31E	08/18/92	7.0-7.5	2400	2.8	<0.005	<0.005	0.0095	0.082
BH32E	08/18/92	4.5-5.0	160	0.88	<0.005	0.0095	<0.005	<0.005
BH33E	08/18/92	4.5-5.0	<1.0	<0.5	0.0059	0.0074	<0.005	<0.005
MW1	06/23/93	2.0-2.5	2.6	11	<0.012	0.1	<0.018	<0.048
MW1	06/23/93	5.5-6.0	20	1.4	0.11	0.81	0.019	0.096
MW2	06/23/93	2.5-3.0	2.2	0.58	<0.005	0.17	<0.005	<0.015
MW2	06/23/93	5.5-6.0	1.1	<0.5	<0.005	0.043	<0.005	<0.015
MW3	06/24/93	2.0-2.5	2.2	<0.5	<0.005	0.0046	<0.006	<0.015
MW3	06/24/93	5.5-6.0	32	<0.5	<0.005	<0.005	<0.005	<0.015
MW4	06/23/93	1.5-2.0	<1.0	<0.5	<0.005	0.031	<0.005	<0.015
MW4	06/23/93	5.5-6.0	3000	17	<0.036	0.078	0.13	0.3
MW5	06/24/93	2.0-2.5	<1.0	<0.5	<0.005	0.094	<0.005	<0.015
MW5	06/24/93	5.5-6.0	<1.0	<0.5	<0.005	0.022	<0.005	<0.015
PDDI-1	01/10/90	0.5	NA	340	NA	NA	NA	NA
PDDI-2	01/10/90	0.5	NA	1900	NA	NA	NA	NA

TABLE 2
HISTORICAL SOIL SAMPLING RESULTS
PETROLEUM HYDROCARBONS (mg/kg)
Pacific Dry Dock and Repair Company Yard I
1441 Embarcadero, Oakland, California

Sample ID	Date	Depth feet	TPH-D	TPH-G	Benzene	Toluene	Ethylbenzene	Xylenes
PDDI-3	01/10/90	1.0	NA	4600	NA	NA	NA	NA
PDDI-3	01/10/90	3.0	NA	330	<0.05	<0.05	<0.05	<0.05
PDDI-13	01/10/90	1.0	NA	NA	<0.05	<0.05	<0.05	<0.05
SW1	02/17/94	6.3	72	<0.5	<0.005	<0.005	<0.005	<0.015
SW2	02/17/94	6.7	<1.0	<0.5	<0.005	<0.005	<0.005	<0.015
SW3	02/17/94	6.7	<1.0	<0.5	<0.005	<0.005	<0.005	<0.015
BH9E	03/23/92	7.0-7.5	<1.0	0.62	<0.005	0.0067	0.016	0.094
BH10E	03/23/92	4.0-4.5	<1.0	<0.5	<0.005	<0.005	<0.005	<0.015
BH11E	03/23/92	4.0-4.5	3.7	9.4	<0.005	<0.005	0.087	0.29
BH12E	03/23/92	5.5-6.0	140	15	<0.0056	0.0091	0.075	0.32
BH13E	03/23/92	9.5-10.0	<1.0	<0.5	<0.005	<0.005	<0.005	<0.015
BH14E	03/23/92	7.0-7.5	<1.0	<0.5	<0.005	<0.005	<0.005	<0.015
BH15E	03/23/92	4.0-4.5	<1.0	<0.5	<0.005	<0.005	<0.005	<0.015
BH16E	03/23/92	7.0-7.5	8	0.97	<0.005	<0.005	<0.005	0.082
BH17E	03/23/92	7.0-7.5	<1.0	<0.5	<0.005	<0.005	<0.005	<0.015
ean (all depths)			329	123	0.03	0.07	0.02	1.18
.D. (all depths)			740	597	0.16	0.26	0.07	6.88

Note:

NA = Not Analyzed

see Figure 3 for sampling locations.

☐: Areas were excavated during the grit removal. Data collected at these points are not included in the calculations of means and standard deviations.

**TABLE 3
DISCRETE SOIL SAMPLING RESULTS
SVOCs INCLUDING PNAs (mg/kg)
Pacific Dry Dock and Repair Company Yard I
1441 Embarcadero, Oakland, California**

Analyte ¹ (mg/kg)	Sample Identification													USEPA Region 9		
	PDDI-3	PDDI-3	PDDI-4	PDDI-8	1d.1S	1d.2S	1d.3S	6a.1S	6a.2S	7a.1S	7a.2S	9a.1S	9a.2S	Mean	S.D.	Industrial PRG ²
Sampling Date	Jan-90	Jan-90	Jan-90	Jan-90	Feb-98	Feb-98	Feb-98	Feb-98	Feb-98	Feb-98	Feb-98	Feb-98	Feb-98	(0-1.0 ft bgs)	(0-1.0 ft bgs)	
Sample Type	T	T	T	T	R	R	R	T	T	T	T	T	T			
Depth (feet, bgs)	1	3	0.5	0.5	0.5-1.0	0.5-1.0	0.5-1.0	0.5-1.0	0.5-1.0	0.5-1.0	0.5-1.0	0.5-1.0	0.5-1.0			
Naphthalene	<0.4	<0.4	<0.4	<0.4	<2.5	<2.5	<0.10	<2.5	2.4	<0.10	<2.5	<0.10	<1.0	0.68	0.73	190
Acenaphthene	<0.4	<0.4	<0.4	<0.4	<2.5	<2.5	<0.10	<2.5	0.51	<0.10	<2.5	<0.10	<1.0	0.54	0.52	2,800
Fluorene	<0.4	<0.4	<0.4	<0.4	<2.5	<2.5	<0.10	<2.5	<0.50	<0.10	<2.5	<0.10	<1.0	0.52	0.52	2,200
Phenanthrene	<0.4	<0.4	<0.4	<0.4	<2.5	<2.5	<0.10	<2.5	2.7	<0.10	5.8	<0.10	1.9	1.16	1.63	NP ³
Anthracene	<0.4	<0.4	<0.4	<0.4	<2.5	<2.5	<0.10	<2.5	<0.50	<0.10	<2.5	<0.10	<1.0	0.52	0.52	220,000
Fluoranthene	<0.4	<0.4	<0.4	<0.4	<2.5	<2.5	<0.10	<2.5	1.4	<0.10	7	<0.10	2.1	1.17	1.88	37,000
Pyrene	<0.4	0.24	<0.4	<0.4	<2.5	<2.5	<0.10	<2.5	0.64	<0.10	3.3	<0.10	1.3	0.77	0.92	26,000
Benzo(a)anthracene	<0.4	<0.4	<0.4	<0.4	<2.5	<2.5	<0.10	<2.5	<0.50	<0.10	2.6	<0.10	<1.0	0.62	0.76	3.6
Chrysene	<0.4	<0.4	<0.4	<0.4	<2.5	<2.5	<0.10	<2.5	<0.50	<0.10	3.4	<0.10	1.3	0.74	0.96	360
Benzo(b)fluoranthene	<0.4	<0.4	<0.4	<0.4	<2.5	<2.5	<0.10	<2.5	<0.50	<0.10	<2.5	<0.10	1.5	0.59	0.59	3.6
Benzo(k)fluoranthene	<0.4	<0.4	<0.4	<0.4	<5.0	<5.0	<0.20	<5.0	<1.0	<0.20	<5.0	<0.20	<2.0	0.97	1.09	36
Benzo(a)pyrene	<0.4	<0.4	<0.4	<0.4	<0.88	<0.88	<0.035	<1.2	<0.25	<0.035	2.5	<0.035	1.2	0.47	0.69	0.36
Indeno(1,2,3-cd)pyrene	<0.4	<0.4	<0.4	<0.4	<5.0	<5.0	<0.20	<5.0	<0.20	<0.20	<5.0	<0.20	<2.0	0.94	1.11	3.6
Dibenzo(ah)anthracene	<0.4	<0.4	<0.4	<0.4	<5.0	<5.0	<0.20	<5.0	<0.20	<0.20	<5.0	<0.20	<2.0	0.94	1.11	0.36
Benzo(ghi)perylene	<0.4	<0.4	<0.4	<0.4	<5.0	<5.0	<0.20	<5.0	<0.20	<0.20	<5.0	<0.20	<2.0	0.76	1.02	NP
2-Methylnaphthalene	<0.4	<0.4	<0.4	<0.4	NA ⁴	NA	NA	<2.5	0.67	NA	NA	NA	NA	0.45	0.43	NP
Dibenzofuran	<0.4	<0.4	<0.4	<0.4	NA	NA	NA	<2.5	0.6	NA	NA	NA	NA	0.44	0.43	3,200

Notes

1. Only constituents detected are listed. All other constituents were not detected.
2. Industrial Preliminary Remediation Goal (USEPA Region 9, May 1, 1998)
3. NP = not published
4. NA = not analyzed
5. Mean & S.D calculated for all random (R) and target (T) samples

Table 4-1
Exposure (Intake) for Onsite Workers by Soil Ingestion (All Depths)
Pacific Dry Dock and Repair Company Yard I
1441 Embarcadero, Oakland, California

Chemical	Cs (mg/kg)	IR (mg/d)	FI	EF (d/yr)	ED (yr)	CF (d/yr)	AT (yr)	BW (kg)	LADD (mg/kg/d)	SF mg/kg/d-1	ECR
Carcinogens											
Benzene	3.00E-02	50	1.00	250	25	365	70	70	5.2E-09	1.00E-01	5.24E-10
Benzo[a]anthracene	6.20E-01	50	1.00	250	25	365	70	70	1.1E-07	1.20E+00	1.30E-07
Chrysene	7.40E-01	50	1.00	250	25	365	70	70	1.3E-07	1.20E-01	1.55E-08
Benzo[b]fluoranthene	5.90E-01	50	1.00	250	25	365	70	70	1.0E-07	1.20E+00	1.24E-07
Benzo[k]fluoranthene	9.70E-01	50	1.00	250	25	365	70	70	1.7E-07	1.20E+00	2.03E-07
Benzo[a]pyrene	4.70E-01	50	1.00	250	25	365	70	70	8.2E-08	1.20E+01	9.85E-07
Indeno[1,2,3-c,d]pyrene	9.40E-01	50	1.00	250	25	365	70	70	1.6E-07	1.20E+00	1.97E-07
Dibenz[ah]anthracene	9.40E-01	50	1.00	250	25	365	70	70	1.6E-07	4.10E+00	6.73E-07
Total ECR-Ingestion											2.33E-06

Chemical	Cs (mg/kg)	IR (mg/d)	FI	EF (d/yr)	ED (yr)	CF (d/yr)	AT (yr)	BW (kg)	ADD (mg/kg/d)	RII mg/kg	HI
Noncarcinogenic Effects											
Copper	1.24E+02	50	1.00	250	25	365	25	70	6.1E-05	3.70E-02	1.64E-03
Mercury	8.70E-01	50	1.00	250	25	365	25	70	4.3E-07	3.00E-04	1.42E-03
Zinc	1.39E+02	50	1.00	250	25	365	25	70	6.8E-05	5.00E-02	1.36E-03
Benzene	3.00E-02	50	1.00	250	25	365	25	70	1.5E-08	3.00E-03	4.89E-06
Toluene	7.00E-02	50	1.00	250	25	365	25	70	3.4E-08	1.00E-02	3.42E-06
Ethylbenzene	2.00E-02	50	1.00	250	25	365	25	70	9.8E-09	5.70E-02	1.72E-07
Xylenes	1.18E+00	50	1.00	250	25	365	25	70	5.8E-07	1.10E-01	5.25E-06
Naphthalene	6.80E-01	50	1.00	250	25	365	25	70	3.3E-07	2.00E-02	1.66E-05
Acenaphthene	5.40E-01	50	1.00	250	25	365	25	70	2.6E-07	6.00E-02	4.40E-06
Fluorene	5.20E-01	50	1.00	250	25	365	25	70	2.5E-07	4.00E-02	6.36E-06
Anthracene	5.20E-01	50	1.00	250	25	365	25	70	2.5E-07	3.00E-01	8.48E-07
Fluoranthene	1.17E+00	50	1.00	250	25	365	25	70	5.7E-07	4.00E-02	1.43E-05
Pyrene	7.70E-01	50	1.00	250	25	365	25	70	3.8E-07	3.00E-02	1.26E-05
Dibenzofuran	4.40E-01	50	1.00	250	25	365	25	70	2.2E-07	4.00E-03	5.38E-05
Total HI-Ingestion											0.005

Notes:

Cancer Slope Factor (SF) obtained first from CalEPA (1994) and then from USEPA Region 9 PRG Table (May 1, 1998)

Table 4-2
Exposure (Intake) for Onsite Workers by Dermal Contact (All Depths)
Pacific Dry Dock and Repair Company Yard I
1441 Embarcadero, Oakland, California

Chemical	Cs (mg/kg)	GF kg/mg	SA cm ² /event	AF mg/cm ²	ABS	EF (event/yr)	ED (yr)	AT (yr)	BW (kg)	LADD (mg/kg-d)	SF mg/kg/d-1	ECR
Carcinogens												
Benzene	3.00E-02	1.00E-06	5700	0.08	0.10	250	25	70	70	4.8E-09	1.00E-01	4.78E-10
Benzo[a]anthracene	6.20E-01	1.00E-06	5700	0.08	0.13	250	25	70	70	1.3E-07	1.20E+00	1.54E-07
Chrysene	7.40E-01	1.00E-06	5700	0.08	0.13	250	25	70	70	1.5E-07	1.20E-01	1.84E-08
Benzo[b]fluoranthene	5.90E-01	1.00E-06	5700	0.08	0.13	250	25	70	70	1.2E-07	1.20E+00	1.47E-07
Benzo[k]fluoranthene	9.70E-01	1.00E-06	5700	0.08	0.13	250	25	70	70	2.0E-07	1.20E+00	2.41E-07
Benzo[a]pyrene	4.70E-01	1.00E-06	5700	0.08	0.13	250	25	70	70	9.7E-08	1.20E+01	1.17E-06
Indeno[1,2,3-cd]pyrene	9.40E-01	1.00E-06	5700	0.08	0.13	250	25	70	70	1.9E-07	1.20E+00	2.34E-07
Dibenz[ah]anthracene	9.40E-01	1.00E-06	5700	0.08	0.13	250	25	70	70	1.9E-07	4.10E+00	7.98E-07
Total ECR-Dermal Contact:												2.76E-06

Chemical	Cs (mg/kg)	GF kg/mg	SA cm ² /event	AF mg/cm ²	ABS	EF (d/yr)	ED (yr)	AT (yr)	BW (kg)	ADD (mg/kg-d)	RfD mg/kg	HI
Noncarcinogenic Effects												
Copper	1.24E+02	1.00E-06	5700	0.08	0.01	250	25	25	70	5.5E-06	3.70E-02	1.50E-04
Mercury	8.70E-01	1.00E-06	5700	0.08	0.01	250	25	25	70	3.9E-08	3.00E-04	1.29E-04
Zinc	1.39E+02	1.00E-06	5700	0.08	0.01	250	25	25	70	6.2E-06	5.00E-02	1.24E-04
Benzene	3.00E-02	1.00E-06	5700	0.08	0.10	250	25	25	70	1.3E-08	3.00E-03	4.02E-11
Toluene	7.00E-02	1.00E-06	5700	0.08	0.10	250	25	25	70	3.1E-08	1.00E-02	3.12E-06
Ethylbenzene	2.00E-02	1.00E-06	5700	0.08	0.10	250	25	25	70	8.9E-09	5.70E-02	1.57E-07
Xylenes	1.18E+00	1.00E-06	5700	0.08	0.10	250	25	25	70	5.3E-07	1.10E-01	4.79E-06
Naphthalene	6.80E-01	1.00E-06	5700	0.08	0.13	250	25	25	70	3.9E-07	2.00E-02	1.97E-05
Acenaphthene	5.40E-01	1.00E-06	5700	0.08	0.13	250	25	25	70	3.1E-07	6.00E-02	5.22E-06
Fluorene	5.20E-01	1.00E-06	5700	0.08	0.13	250	25	25	70	3.0E-07	4.00E-02	7.54E-06
Anthracene	5.20E-01	1.00E-06	5700	0.08	0.13	250	25	25	70	3.0E-07	3.00E-01	1.01E-06
Fluoranthene	1.17E+00	1.00E-06	5700	0.08	0.13	250	25	25	70	6.8E-07	4.00E-02	1.70E-05
Pyrene	7.70E-01	1.00E-06	5700	0.08	0.13	250	25	25	70	4.5E-07	3.00E-02	1.49E-05
Dibenzofuran	4.40E-01	1.00E-06	5700	0.08	0.10	250	25	25	70	2.0E-07	4.00E-03	4.91E-05
Total HI-Dermal Contact:												0.0005

Notes:

Values for absorption through skin (ABS) and soil-to skin adherence (AF) obtained from USEPA Region 9 PRG Tables
 Cancer Slope Factor (SF) obtained first from CalEPA (1994) and then from USEPA Region 9 PRG Table (May 1, 1998)

Table 4-3
Exposure (Intake) for Onsite Workers by Particulate Inhalation (All Depths)
Pacific Dry Dock and Repair Company Yard I
1441 Embarcadero, Oakland, California

Chemical	Ca mg/cm ³	IR (m ³ /hr)	ET (hr/d)	EF (d/yr)	ED (yr)	AT (yr)	BW (kg)	LADD (mg/kg/d)	Sf mg/kg/d-1	ECR
Carcinogens										
Benzene	1.50E-09	1.5	8	250	25	70	70	6.3E-11	1.00E-01	6.29E-12
Benzo[a]anthracene	3.10E-08	1.5	8	250	25	70	70	1.3E-09	3.90E-01	5.07E-10
Chrysene	3.70E-08	1.5	8	250	25	70	70	1.6E-09	3.90E-02	6.05E-11
Benzo[b]fluoranthene	2.95E-08	1.5	8	250	25	70	70	1.2E-09	3.90E+01	4.82E-08
Benzo[k]fluoranthene	4.85E-08	1.5	8	250	25	70	70	2.0E-09	3.90E-01	7.93E-10
Benzo[a]pyrene	2.35E-08	1.5	8	250	25	70	70	9.9E-10	3.90E+00	3.84E-09
Indeno[1,2,3-cd]pyrene	4.70E-08	1.5	8	250	25	70	70	2.0E-09	3.90E-01	7.69E-10
Dibenz[ah]anthracene	4.70E-08	1.5	8	250	25	70	70	2.0E-09	3.10E+00	6.11E-09
Total ECR-Inhalation										6.03E-08

Chemical	Ca mg/cm ³	IR (m ³ /hr)	ET (hr/d)	EF (d/yr)	ED (yr)	AT (yr)	BW (kg)	ADD (mg/kg/d)	RfD mg/kg	HI
Noncarcinogenic Effects										
Copper	6.21E-06	1.5	8	250	25	25	70	7.3E-07	3.70E-02	1.97E-05
Mercury	4.35E-08	1.5	8	250	25	25	70	5.1E-09	3.00E-04	1.70E-05
Zinc	6.94E-06	1.5	8	250	25	25	70	8.1E-07	5.00E-02	1.63E-05
Benzene	1.50E-09	1.5	8	250	25	25	70	1.8E-10	3.00E-03	5.87E-08
Toluene	3.50E-09	1.5	8	250	25	25	70	4.1E-10	1.00E-02	4.11E-08
Ethylbenzene	1.00E-09	1.5	8	250	25	25	70	1.2E-10	5.70E-02	2.06E-09
Xylenes	5.90E-08	1.5	8	250	25	25	70	6.9E-09	1.10E-01	6.30E-08
Naphthalene	3.40E-08	1.5	8	250	25	25	70	4.0E-09	2.00E-02	2.00E-07
Acenaphthene	2.70E-08	1.5	8	250	25	25	70	3.2E-09	6.00E-02	5.28E-08
Fluorene	2.60E-08	1.5	8	250	25	25	70	3.1E-09	4.00E-02	7.63E-08
Anthracene	2.60E-08	1.5	8	250	25	25	70	3.1E-09	3.00E-01	1.02E-08
Fluoranthene	5.85E-08	1.5	8	250	25	25	70	6.9E-09	4.00E-02	1.72E-07
Pyrene	3.85E-08	1.5	8	250	25	25	70	4.5E-09	3.00E-02	1.51E-07
Dibenzofuran	2.20E-08	1.5	8	250	25	25	70	2.6E-09	4.00E-03	6.46E-07
Total HI-Inhalation										0.00005

Note: EF of 250 days/yr assumes exposure on every working day, including rainy days when, in actuality, exposure would not be likely
Cancer Slope Factor (SF) obtained first from CalEPA (1994) and then from USEPA Region 9 PRG Table (May 1, 1998)

Table 4-4
Total Excess Cancer Risks (ECR) and Noncarcinogenic Health Hazards for
Onsite Workers through Contact with PNAs, SVOCs and Metals in Soils (All Depths)
Pacific Dry Dock and Repair Company Yard I
1441 Embarcadero, Oakland, California

Chemical	Soil Ingestion	Dermal Contact	Particulate Inhalation
Carcinogens			
Benzene	5.24E-10	4.78E-10	6.29E-12
Benzo[a]anthracene	1.30E-07	1.54E-07	5.07E-10
Chrysene	1.55E-08	1.84E-08	6.05E-11
Benzo[b]fluoranthene	1.24E-07	1.47E-07	4.82E-08
Benzo[k]fluoranthene	2.03E-07	2.41E-07	7.93E-10
Benzo[a]pyrene	9.85E-07	1.17E-06	3.84E-09
Indeno[1,2,3-c,d]pyrene	1.97E-07	2.34E-07	7.69E-10
Dibenz[ah]anthracene	6.73E-07	7.98E-07	6.11E-09
Subtotal of ECR	2.33E-06	2.76E-06	6.03E-08

Chemical	Soil Ingestion	Dermal Contact	Particulate Inhalation
Noncarcinogenic Effects			
Copper	1.64E-03	1.50E-04	1.97E-05
Mercury	1.42E-03	1.29E-04	1.70E-05
Zinc	1.36E-03	1.24E-04	1.63E-05
Benzene	4.89E-06	4.02E-11	5.87E-08
Toluene	3.42E-06	3.12E-06	4.11E-08
Ethylbenzene	1.72E-07	1.57E-07	2.06E-09
Xylenes	5.25E-06	4.79E-06	6.30E-08
Naphthalene	1.66E-05	1.97E-05	2.00E-07
Acenaphthene	4.40E-06	5.22E-06	5.28E-08
Fluorene	6.36E-06	7.54E-06	7.63E-08
Anthracene	8.48E-07	1.01E-06	1.02E-08
Fluoranthene	1.43E-05	1.70E-05	1.72E-07
Pyrene	1.26E-05	1.49E-05	1.51E-07
Dibenzofuran	5.38E-05	4.91E-05	6.46E-07
Subtotal of HI	0.00454	0.00053	0.00005

Total ECR (soil ingestion + dermal contact + particulate inhalation) : **5.15E-06**

Total HI (soil ingestion + dermal contact + particulate inhalation) : **0.005**

**Table 4-5
Lead Risk Assessment (All Depths)
Pacific Dry Dock and Repair Company Yard I
1441 Embarcadero, Oakland, California**

INPUT		OUTPUT							
MEDIUM	LEVEL	percentiles					PRG-99	PRG-95	
LEAD IN AIR (ug/m ³)	0.15	50th	90th	95th	98th	99th	(ug/g)	(ug/g)	
LEAD IN SOIL (ug/g)	80.7	BLOOD Pb, ADULT (ug/dl)	2.0	3.2	3.6	4.2	4.6	3417.3	5102.9
LEAD IN WATER (ug/l)	15	BLOOD Pb, CHILD (ug/dl)	3.7	5.7	6.5	7.5	8.3	264.7	558.5
PLANT UPTAKE? 1=YES 0=NO (ug/m ³)	0	BLOOD Pb, PICA CHILD (ug/dl)	7.8	12.3	13.9	16.1	17.7	19.5	41.1
	50	BLOOD Pb, INDUSTRIAL (ug/dl)	1.9	3.0	3.5	4.0	4.4	4262.5	6306.5

EXPOSURE PARAMETERS

units	residential		industrial	
	adults	children	children with pica	adults

General

Days per week	days/wk	7	7	7	5
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Dermal Contact

Skin area	cm ²	3700	2800	2800	5800
Soil adherence	mg/cm ²	0.5	0.5	0.5	0.5
Route-specific constant	(ug/dl)/(ug/day)	0.00011	0.00011	0.00011	0.00011

Soil ingestion

Soil ingestion	mg/day	25	55	790	25
Route-specific constant	(ug/dl)/(ug/day)	0.0176	0.0704	0.0704	0.0176

Inhalation

Breathing rate	m ³ /day	20	10	10	20
Route-specific constant	(ug/dl)/(ug/day)	0.082	0.192	0.192	0.082

Water ingestion

Water ingestion	l/day	1.4	0.4	0.4	1.4
Route-specific constant	(ug/dl)/(ug/day)	0.04	0.16	0.16	0.04

Food ingestion

Food ingestion	kg/day	2.2	1.3	1.3	2.2
Route-specific constant	(ug/dl)/(ug/day)	0.04	0.16	0.16	0.04
Dietary concentration	ug/kg	10.0	10.0	10.0	10.0
Lead in produce	ug/kg	10.0	10.0	10.0	

PATHWAYS, ADULTS

Pathway	Residential		Industrial		concentration in medium
	Blood Pb ug/dl	percent of total	Blood Pb ug/dl	percent of total	
SOIL CONTACT:	0.02	1%	0.02	1%	81 ug/g
SOIL INGESTION:	0.04	2%	0.03	1%	81 ug/g
INHALATION:	0.25	12%	0.18	9%	0.15 ug/m ³
WATER INGESTION:	0.84	42%	0.84	43%	15 ug/l
FOOD INGESTION:	0.88	43%	0.88	45%	10.0 ug Pb/kg diet

PATHWAYS, CHILDREN

Pathway	Typical		with pica		concentration in medium
	Blood Pb ug/dl	percent of total	Blood Pb ug/dl	percent of total	
SOIL CONTACT:	0.01	0%	0.01	0%	81 ug/g
SOIL INGESTION:	0.31	9%	4.49	57%	81 ug/g
INHALATION:	0.30	8%	0.30	4%	0.15 ug/m ³
WATER INGESTION:	0.96	26%	0.96	12%	15 ug/l
FOOD INGESTION:	2.08	57%	2.08	27%	10.0 ug Pb/kg diet

TABLE 1
SOIL SAMPLING RESULTS
METALS (mg/kg)
Pacific Dry Dock and Repair Company Yard II
321 Embarcadero, Oakland, California

Sample ID	Date	Depth ft	Sample Type	Arsenic	Chromium	Cobalt	Copper	Lead	Mercury	Vanadium	Zinc
2-1	Mar-97	0-0.5	T	ND	NA	NA	NA	NA	NA	NA	NA
2-2	Mar-97	0-0.5	T	ND	NA	NA	NA	NA	NA	NA	NA
BH10A	May-94	3.0	T	NA	NA	NA	28	8.1	0.56	NA	NA
BH11	May-94	3.0	T	11	ND	ND	56	7.9	0.16	44	80
BH17	May-94	2.5	T	15	3.8	ND	26	4	0.18	24	40
BH19	May-94	6.0	T	9.5	16	14	26	ND	0.12	60	67
BH22	May-94	9.0	T	11	10	ND	20	8.2	0.26	33	63
BH6A	May-94	3.0	T	NA	NA	NA	58	100	ND	NA	NA
CH10	Apr-95	2.5	T	NA	NA	NA	NA	5.4	NA	NA	NA
CH10	Apr-95	5.0	T	NA	NA	NA	NA	7.2	NA	NA	NA
CH11	Apr-95	2.5	T	NA	NA	NA	NA	17	NA	NA	NA
CH11	Apr-95	5.5	T	NA	NA	NA	NA	7.4	NA	NA	NA
CH12	Apr-95	2.5	T	NA	NA	NA	NA	38	NA	NA	NA
CH12	Apr-95	5.5	T	NA	NA	NA	NA	4.5	NA	NA	NA
CH14	Apr-95	2.5	T	NA	NA	NA	22	13	NA	NA	NA
MW4	Sep-95	5.0	T	NA	NA	NA	150	30	ND	NA	180
MW6	Sep-95	3.5	T	NA	NA	NA	200	39	1.3	NA	140
MW6	Sep-95	6.0	T	NA	NA	NA	32	ND	ND	NA	69
MW6	Sep-95	15.5	T	NA	NA	NA	360	5.8	ND	NA	87
MW7	Sep-95	15.5	T	NA	NA	NA	32	5.9	ND	NA	40
PDDII-3	Dec-89	2.5	T	5.5	27	9.5	140	220	0.38	ND	600
PDDII-6	Dec-89	5.0	T	3.3	37	11	90	78	0.5	5.2	360
B-10	Nov-96	3.5	T	51	70	22	84	9	ND	74	180
B-11	Mar-97	0-0.5	T	9.8	NA	NA	NA	NA	NA	NA	NA
B-11	Mar-97	3.0-3.5	T	3.2	NA	NA	NA	NA	NA	NA	NA
B-12	Mar-97	0-0.5	T	10	NA	NA	NA	NA	NA	NA	NA
B-12	Mar-97	3.0-3.5	T	2.1	NA	NA	NA	NA	NA	NA	NA
B-13	Mar-97	0-0.5	T	12	NA	NA	NA	NA	NA	NA	NA
B-13	Mar-97	3.0-3.5	T	7.6	NA	NA	NA	NA	NA	NA	NA
B-14	Mar-97	0-0.5	T	20	NA	NA	NA	NA	NA	NA	NA
B-14	Mar-97	3.0-3.5	T	5.4	NA	NA	NA	NA	NA	NA	NA
B-15	Mar-97	0-0.5	T	21	NA	NA	NA	NA	NA	NA	NA
B-15	Mar-97	3.0-3.5	T	14	NA	NA	NA	NA	NA	NA	NA
B-16	Mar-97	0-0.5	T	23	NA	NA	NA	NA	NA	NA	NA
B-16	Mar-97	3.0-3.5	T	25	NA	NA	NA	NA	NA	NA	NA
B-2	Nov-96	3.0-3.5	T	38	81	7	270	100	1.4	23	300
B-3	Nov-96	3.0-3.5	T	25	32	10	34	9	ND	40	120
B-4	Nov-96	3.5	T	ND	760	27	510	1100	3	34000	4500
B-5	Nov-96	3.5	T	46	51	16	45	13	ND	79	110
B-6	Nov-96	3.0-3.5	T	44	32	15	48	ND	ND	96	110
B-7	Nov-96	3.0-3.5	T	37	74	16	170	5.3	ND	51	83
B-8	Nov-96	3.0-3.5	T	15	34	6	12	7	ND	25	30
B-9	Nov-96	3.5	T	15	40	6	7	7	ND	29	23
BH1	May-94	3.0	T	14	12	ND	660	110	0.72	24	510
BH20	May-94	6.0	T	NA	NA	NA	15	8.4	0.24	NA	NA
BH21	May-94	9.0	T	NA	NA	NA	43	22	1.4	NA	NA
BH4	May-94	6.0	T	NA	NA	NA	7.5	3.9	0.2	NA	NA
CH13	Apr-95	2.5	T	NA	NA	NA	98	92	NA	NA	NA
PDDII-1	Dec-89	2.5	T	25	61	5.8	1900	7500	26	20	550

TABLE 1
SOIL SAMPLING RESULTS
METALS (mg/kg)
Pacific Dry Dock and Repair Company Yard II
321 Embarcadero, Oakland, California

Sample ID	Date	Depth ft	Sample Type	Arsenic	Chromium	Cobalt	Copper	Lead	Mercury	Vanadium	Zinc
PDDII-10	Dec-89	2.5	T	NA	NA	NA	1800	650	NA	NA	NA
PDDII-11	Dec-89	1.5	T	NA	NA	NA	770	290	NA	NA	NA
PDDII-9	Dec-89	2.5	T	NA	NA	NA	1600	660	NA	NA	NA
12a.D	Feb-98		T	2.4	22	3.9	12	5.6	0.27	16	27
13a.S	Feb-98	0.5-1.0	T	6	16	14	490	8.3	<0.05	28	67
13a.D	Feb-98		T	3.1	14	5.7	140	15	0.24	59	160
17a.S	Feb-98	0.5-1.0	T	1.8	14	4.2	16	6.4	1.1	23	44
20a.S	Feb-98	0.5-1.0	R	<1	31	9.9	130	100	4.2	27	140
20a.D	Feb-98		R	<1	39	10	16	2.5	<0.05	22	34
20b.S	Feb-98	0.5-1.0	R	4.4	6.2	4.6	20	4.6	0.21	12	48
20b.D	Feb-98		R	1.1	23	6.6	30	6.8	0.67	29	44
20c.S	Feb-98	0.5-1.0	R	1.6	29	6.9	35	24	0.2	17	86
20c.D	Feb-98		R	<1	13	8.5	51	4.5	0.55	40	58
Mean (all depths)				4.32	18.83	7.29	90.83	25.92	0.53	27.47	115.90
S.D. (all depths)				4.48	11.51	4.27	117.16	45.53	0.86	16.92	133.86
Mean (0-1.0 ft bgs)				2.11	19.24	7.92	138.20	28.66	1.15	21.40	77.00
S.D.(0-1.0 ft bgs)				2.25	10.51	4.09	202.10	40.62	1.76	6.80	38.99
Background Mean ¹				6.60	118.00	13.30	49.00	29.00	0.15	125.00	78.00
USEPA Region 9 Industrial PRG ²				3	450	29,000	70,000	1,000	560	13,000	100,000

Note:

NA = Not Analyzed

ND = Less than Detection Limit. (see Versar reports in references for detection limits)

☐: Areas were excavated during the grit removal. Data collected at these points are not included in the calculations of means and standard deviations.

1. Background Mean: Protocol for Determining Background Concentration of Metals in Soil. LBNL (1995).

Elements in North American Soils. Dragun, J. and Chiasson, A. (1991)

2. Industrial Preliminary Remediation Goal (USEPA Region 9, May 1, 1998)

TABLE 2
SOIL SAMPLING RESULTS
PETROLEUM AND CHLORINATED HYDROCARBONS (mg/kg)
Pacific Dry Dock and Repair Company Yard II
321 Embarcadero, Oakland, California

Sample ID	Date	Depth ft	TPH-D	TPH-G	Benzene	Toluene	Ethylbenzene	Xylenes	Chlorobenzene	1,2-DCE	1,4-DCB	TCE	PCE
BH1	May-94	9.0	210	72	ND	ND	ND	0.44	NA	NA	NA	NA	NA
BH13	May-94	6.0	1700	25	ND	ND	ND	ND	ND	ND	ND	ND	ND
BH14	May-94	6.0	NA	5	ND	ND	ND	ND	NA	NA	NA	NA	NA
BH15	May-94	6.0	NA	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
BH15	May-94	9.0	180	31	ND	ND	ND	ND	NA	NA	NA	NA	NA
BH18	May-94	8.0	NA	NA	NA	NA	NA	NA	0.61	ND	ND	ND	ND
BH19	May-94	6.0	NA	NA	NA	NA	NA	NA	1.7	ND	0.61	ND	ND
BH22	May-94	9.0	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND
BH5	May-94	8.0	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
BH8	May-94	8.5	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
BH9	May-94	3.0	190	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
CH1	Apr-95	4.0	1300	73	0.58	0.088	ND	1.5	0.54	ND	0.19	ND	ND
CH13	Apr-95	2.5	59	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
CH14	Apr-95	2.5	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
CH1A	Apr-95	2.0	240	5.4	0.048	0.0069	ND	0.14	0.22	ND	ND	ND	ND
CH1B	Apr-95	3.0	1.4	ND	ND	ND	ND	ND	0.034	ND	ND	ND	ND
CH1C	Apr-95	2.0	ND	ND	ND	ND	0.0068	0.018	ND	ND	ND	ND	ND
CH1C	Apr-95	4.5	910	23	0.1	ND	ND	0.3	0.48	ND	0.41	ND	ND
CH2	Apr-95	1.0	18	4.5	ND	ND	ND	0.019	ND	ND	ND	0.02	ND
CH2A	Apr-95	2.5	8.7	16	2.1	ND	ND	0.66	0.063	ND	ND	ND	ND
CH2B	Apr-95	1.5	55	ND	ND	ND	0.0053	ND	ND	ND	ND	ND	ND
CH2C	Apr-95	2.5	44	ND	0.011	ND	ND	ND	ND	ND	ND	ND	ND
CH2C	Apr-95	4.5	8.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CH3	Apr-95	4.0	ND	ND	ND	ND	0.0092	0.022	ND	ND	ND	ND	ND
CH3A	Apr-95	1.5	26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CH3B	Apr-95	2.5	240	1.8	0.15	0.017	0.012	0.096	0.89	0.031	ND	ND	ND
CH3C	Apr-95	2.0	ND	0.88	0.0054	ND	ND	0.07	0.079	ND	ND	ND	ND
CH3D	Apr-95	2.0	940	9.6	0.81	ND	ND	3.6	2.3	ND	1.2	ND	ND
CH3E	Apr-95	1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CH3E	Apr-95	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CH3F	Apr-95	1.5	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND
CH3F	Apr-95	4.0	ND	0.8	ND	ND	ND	ND	0.027	ND	ND	ND	ND
CH4	Apr-95	3.0	1.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CH4A	Apr-95	2.5	26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE 2
SOIL SAMPLING RESULTS
PETROLEUM AND CHLORINATED HYDROCARBONS (mg/kg)
Pacific Dry Dock and Repair Company Yard II
321 Embarcadero, Oakland, California

Sample ID	Date	Depth ft	TPH-D	TPH-G	Benzene	Toluene	Ethylbenzene	Xylenes	Chlorobenzene	1,2-DCE	1,4-DCB	TCE	PCE
CH4A	Apr-95	4.5	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CH5	May-94	1.5	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
CH6	May-94	2.5	5.3	ND	ND	ND	0.0052	0.043	NA	NA	NA	NA	NA
CH7	May-94	2.5	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
CH8	May-94	3.5	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA
CH9	May-94	2.0	7	ND	ND	ND	ND	0.038	NA	NA	NA	NA	NA
MW2	Jul-94	16.5	2700	500	ND	1	8.3	7.4	9	ND	5.4	ND	ND
MW4	Sep-95	5.5	1600	58	ND	ND	ND	ND	0.22	ND	0.067	ND	ND
MW6	Sep-95	3.5	280	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW6	Sep-95	6.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW6	Sep-95	15.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW7	Sep-95	15.5	1.6	0.61	ND	ND	ND	ND	ND	ND	ND	ND	ND
PDDII-3	Dec-89	0.5	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	0.2
11a.2D	Feb-98				3.2	<1.2	44	1.5	NA	NA	NA	NA	NA
11a.3D	Feb-98				<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
14a.2S	Feb-98	0.5-1			<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
14a.3S	Feb-98	0.5-1			<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
16a.1S	Feb-98	0.5-1			<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
16a.2S	Feb-98	0.5-1			<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA
Mean (all depths)			277	21	0.13	0.04	1.07	0.33	0.48	0.01	0.24	0.01	0.01
S.D. (all depths)			595	78	0.53	0.16	6.37	1.19	1.61	0.005	0.96	0.00	0.04
Mean (0-1.0 ft bgs)					0.003	0.003	0.003	0.006	0.01	0.01	0.01	0.01	0.11
S.D.(0-1.0 ft bgs)					0.001	0.001	0.001	0.007					

Note:

NA = Not Analyzed

ND = Less than Detection Limit (see original reports for detection limits)

TABLE 3
SOIL SAMPLING RESULTS - February, 1998
PCBs (mg/kg)
Pacific Dry Dock and Repair Company Yard II
321 Embarcadero, Oakland, California

Sample ID	Depth (feet, bgs)	PCB
19a.1S	0.5-1.0	13.00
19a.2S	0.5-1.0	14.00
19a.3S	0.5-1.0	0.72
19a.4S	0.5-1.0	3.80
19a.5S	0.5-0.8	< 0.10
19a.6S	0.5-1.0	7.70
19a.7S	0.5-1.0	< 0.10
19a.8S	0.5-1.0	< 0.20
20a.1S	0.5-1.0	< 0.10
20a.2S	0.5-1.0	< 0.10
20a.3S	0.5-1.0	< 0.10
18a.3S'	0.5-1.5	18.00
18a.1S	0.5-1.5	< 0.20
18a.2S	0.5-1.5	< 0.20
18a.4S	0.5-1.5	< 0.33
18a.3S	0.5-1.5	3.64
Mean		3.86
S.D.		6.21
PRG (PCBs)		1.30

Table 4-1
Exposure (Intake) for Onsite Workers by Soil Ingestion (All Depths)
Pacific Dry Dock and Repair Company Yard II
321 Embarcadero, Oakland, California

Chemical	Cs (mg/kg)	IR (mg/d)	FI	EF (d/yr)	ED (yr)	CF (d/yr)	AT (yr)	BW (kg)	IADD (mg/kg/d)	SE (mg/kg/d)	EGR
Carcinogens											
Benzene	1.30E-01	50	1.00	250	25	365	70	70	2.3E-08	1.00E-01	2.27E-09
PCBs	3.86E+00	50	1.00	250	25	365	70	70	6.7E-07	2.00E+00	1.35E-06
PCE	1.00E-02	50	1.00	250	25	365	70	70	1.7E-09	5.10E-02	8.91E-11
TCE	1.00E-02	50	1.00	250	25	365	70	70	1.7E-09	1.50E-02	2.62E-11
Total ECR-Ingestion											1.35E-06

Chemical	Cs (mg/kg)	IR (mg/d)	FI	EF (d/yr)	ED (yr)	CF (d/yr)	AT (yr)	BW (kg)	ADD (mg/kg/d)	RfD mg/kg	HQ
Noncarcinogenic Effects											
Copper	9.08E+01	50	1.00	250	25	365	25	70	4.4E-05	3.70E-02	1.20E-03
Mercury	5.30E-01	50	1.00	250	25	365	25	70	2.6E-07	3.00E-04	8.64E-04
Zinc	1.16E+02	50	1.00	250	25	365	25	70	5.7E-05	5.00E-02	1.13E-03
Toluene	4.00E-02	50	1.00	250	25	365	25	70	2.0E-08	1.00E-02	1.96E-06
Ethylbenzene	1.07E+00	50	1.00	250	25	365	25	70	5.2E-07	5.70E-02	9.18E-06
Xylenes	3.30E-01	50	1.00	250	25	365	25	70	1.6E-07	1.10E-01	1.47E-06
Benzene	1.30E-01	50	1.00	250	25	365	25	70	6.4E-08	3.00E-03	2.12E-05
PCBs	3.86E+00	50	1.00	250	25	365	25	70	1.9E-06	2.00E-05	9.44E-02
PCE	1.00E-02	50	1.00	250	25	365	25	70	4.9E-09	1.00E-02	4.89E-07
TCE	1.00E-02	50	1.00	250	25	365	25	70	4.9E-09	6.00E-03	8.15E-07
Total HI-Ingestion											0.098

Table 4-2
Exposure (Intake) for Onsite Workers by Dermal Contact (All Depths)
Pacific Dry Dock and Repair Company Yard II
321 Embarcadero, Oakland, California

Chemical	Cs (mg/kg)	CF kg/mg	SA cm ² /event	AF mg/cm ²	ABS	EF (event/yr)	ED (yr)	AT (yr)	BW (kg)	LADD (mg/kg-d)	SF (mg/kg/d) ⁻¹	ECR
Carcinogens												
Benzene	1.30E-01	1.00E-06	5700	0.08	0.10	250	25	70	70	2.1E-08	1.00E-01	2.07E-09
PCBs	3.86E+00	1.00E-06	5700	0.08	0.14	250	25	70	70	8.6E-07	2.00E+00	1.72E-06
PCE	1.00E-02	1.00E-06	5700	0.08	0.10	250	25	70	70	1.6E-09	5.10E-02	8.13E-11
TCE	1.00E-02	1.00E-06	5700	0.08	0.10	250	25	70	70	1.6E-09	1.50E-02	2.39E-11
Total ECR-Dermal Contact:												1.72E-06

Chemical	Cs (mg/kg)	CF kg/mg	SA cm ² /event	AF mg/cm ²	ABS	EF (d/yr)	ED (yr)	AT (yr)	BW (kg)	ADD (mg/kg-d)	RfD mg/kg	HQ
Noncarcinogenic Effects												
Copper	9.08E+01	1.00E-06	5700	0.08	0.01	250	25	25	70	4.1E-06	3.70E-02	1.10E-04
Mercury	5.30E-01	1.00E-06	5700	0.08	0.01	250	25	25	70	2.4E-08	3.00E-04	7.88E-05
Zinc	1.16E+02	1.00E-06	5700	0.08	0.01	250	25	25	70	5.2E-06	5.00E-02	1.03E-04
Toluene	4.00E-02	1.00E-06	5700	0.08	0.10	250	25	25	70	1.8E-08	1.00E-02	1.78E-06
Ethylbenzene	1.07E+00	1.00E-06	5700	0.08	0.10	250	25	25	70	4.8E-07	5.70E-02	8.38E-06
Xylenes	3.30E-01	1.00E-06	5700	0.08	0.10	250	25	25	70	1.5E-07	1.10E-01	1.34E-06
Benzene	1.30E-01	1.00E-06	5700	0.08	0.10	250	25	25	70	5.8E-08	3.00E-03	1.93E-05
PCBs	3.86E+00	1.00E-06	5700	0.08	0.14	250	25	25	70	2.4E-06	2.00E-05	1.21E-01
PCE	1.00E-02	1.00E-06	5700	0.08	0.10	250	25	25	70	4.5E-09	1.00E-02	4.46E-07
TCE	1.00E-02	1.00E-06	5700	0.08	0.10	250	25	25	70	4.5E-09	6.00E-03	7.44E-07
Total HI-Dermal Contact:												0.121

Note: EF of 250 days/yr assumes exposure on every working day, including rainy days when, in actuality, exposure would not be likely

Table 4-3
Exposure (Intake) for Onsite Workers by Particulate Inhalation (All Depths)
Pacific Dry Dock and Repair Company Yard II
321 Embarcadero, Oakland, California

Chemical	Ca mg/cm ³	IR (m ³ /hr)	ET (hr/d)	EF (d/yr)	ED (yr)	AT (yr)	BW (kg)	ADD (mg/kg/d)	SF (mg/kg/d)	ECR
Carcinogens										
Benzene	6.50E-09	1.5	8	250	25	70	70	2.7E-10	1.00E-01	2.73E-11
PCBs	1.93E-07	1.5	8	250	25	70	70	8.1E-09	2.00E+00	1.62E-08
PCE	5.00E-10	1.5	8	250	25	70	70	2.1E-11	2.10E-02	4.40E-13
TCE	5.00E-10	1.5	8	250	25	70	70	2.1E-11	1.00E-02	2.10E-13
Total ECR-Inhalation										1.62E-08

Chemical	Ca mg/cm ³	IR (m ³ /hr)	ET (hr/d)	EF (d/yr)	ED (yr)	AT (yr)	BW (kg)	ADD (mg/kg/d)	RfD mg/kg	HQ
Noncarcinogenic Effects										
Copper	4.54E-06	1.5	8	250	25	25	70	5.3E-07	3.70E-02	1.44E-05
Mercury	2.65E-08	1.5	8	250	25	25	70	3.1E-09	3.00E-04	1.04E-05
Zinc	5.80E-06	1.5	8	250	25	25	70	6.8E-07	5.00E-02	1.36E-05
Toluene	2.00E-09	1.5	8	250	25	25	70	2.3E-10	1.00E-02	2.35E-08
Ethylbenzene	5.35E-08	1.5	8	250	25	25	70	6.3E-09	5.70E-02	1.10E-07
Xylenes	1.65E-08	1.5	8	250	25	25	70	1.9E-09	1.10E-01	1.76E-08
Benzene	6.50E-09	1.5	8	250	25	25	70	7.6E-10	3.00E-03	2.54E-07
PCBs	1.93E-07	1.5	8	250	25	25	70	2.3E-08	2.00E-05	1.13E-03
PCE	5.00E-10	1.5	8	250	25	25	70	5.9E-11	1.10E-01	5.34E-10
TCE	5.00E-10	1.5	8	250	25	25	70	5.9E-11	6.00E-03	9.78E-09
Total HI-Inhalation										0.001

Note: EF of 250 days/yr assumes exposure on every working day, including rainy days when, in actuality, exposure would not be likely

Table 4-4
Total Excess Cancer Risks (ECR) and Noncarcinogenic Health Hazards for
Onsite Workers by Direct Contact with Petroleum Hydrocabons, PCBs and Metals in Surface Soils (All Depths)
Pacific Dry Dock and Repair Company Yard II
321 Embarcadero, Oakland, California

Chemical	Soil Ingestion	Dermal Contact	Particulate Inhalation
Carcinogens			
Benzene	2.27E-09	2.07E-09	2.73E-11
PCBs	1.35E-06	1.72E-06	1.62E-08
PCE	8.91E-11	8.13E-11	4.40E-13
TCE	2.62E-11	2.39E-11	2.10E-13
Subtotal of ECR	1.35E-06	1.72E-06	1.62E-08
Noncarcinogenic Effects			
Copper	1.20E-03	1.10E-04	1.44E-05
Mercury	8.64E-04	7.88E-05	1.04E-05
Zinc	1.13E-03	1.03E-04	1.36E-05
Toluene	1.96E-06	1.78E-06	2.35E-08
Ethylbenzene	9.18E-06	8.38E-06	1.10E-07
Xylenes	1.47E-06	1.34E-06	1.76E-08
Benzene	2.12E-05	1.93E-05	2.54E-07
PCBs	9.44E-02	1.21E-01	1.13E-03
PCE	4.89E-07	4.46E-07	5.34E-10
TCE	8.15E-07	7.44E-07	9.78E-09
Subtotal of HI	0.098	0.121	0.001

Total ECR (soil ingestion + dermal contact + particulate inhalation) :

3.09E-06

Total HI (soil ingestion + dermal contact + particulate inhalation) :

0.220

Table 4-5
Lead Risk Assessment (All Depths)
Pacific Dry Dock and Repair Company Yard II
321 Embarcadero, Oakland, California

INPUT		OUTPUT								
MEDIUM	LEVEL		percentiles					PRG-99	PRG-95	
LEAD IN AIR (ug/m ³)	0.15		50th	90th	95th	98th	99th	(ug/g)	(ug/g)	
LEAD IN SOIL (ug/g)	25.9	BLOOD Pb, ADULT (ug/dl)	2.0	3.1	3.5	4.1	4.5	3417.3	5102.9	
LEAD IN WATER (ug/l)	15	BLOOD Pb, CHILD (ug/dl)	3.4	5.4	6.1	7.1	7.8	264.7	558.5	
PLANT UPTAKE? 1=YES 0=N	0	BLOOD Pb, PICA CHILD (ug/dl)	4.8	7.5	8.5	9.8	10.8	19.5	41.1	
RESPIRABLE DUST (ug/m ³)	50	BLOOD Pb, INDUSTRIAL (ug/dl)	1.9	3.0	3.4	3.9	4.3	4262.5	6306.5	

EXPOSURE PARAMETERS

units	residential		industrial	
	adults	children	children with pica	adults

General

Days per week	days/wk	7	7	7	5
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Dermal Contact

Skin area	cm ²	3700	2800	2800	5800
Soil adherence	mg/cm ²	0.5	0.5	0.5	0.5
Route-specific constant	(ug/dl)/(ug/day)	0.00011	0.00011	0.00011	0.00011

Soil Ingestion

Soil ingestion	mg/day	25	55	790	25
Route-specific constant	(ug/dl)/(ug/day)	0.0176	0.0704	0.0704	0.0176

Inhalation

Breathing rate	m ³ /day	20	10	10	20
Route-specific constant	(ug/dl)/(ug/day)	0.082	0.192	0.192	0.082

Water ingestion

Water ingestion	l/day	1.4	0.4	0.4	1.4
Route-specific constant	(ug/dl)/(ug/day)	0.04	0.16	0.16	0.04

Food ingestion

Food Ingestion	kg/day	2.2	1.3	1.3	2.2
Route-specific constant	(ug/dl)/(ug/day)	0.04	0.16	0.16	0.04
Dietary concentration	ug/kg	10.0	10.0	10.0	10.0
Lead in produce	ug/kg	10.0	10.0	10.0	

PATHWAYS, ADULTS

Pathway	Residential		Industrial		Concentration in medium
	Blood Pb ug/dl	percent of total	Blood Pb ug/dl	percent of total	
SOIL CONTACT:	0.01	0%	0.01	0%	26 ug/g
SOIL INGESTION:	0.01	1%	0.01	0%	26 ug/g
INHALATION:	0.25	13%	0.18	9%	0.15 ug/m ³
WATER INGESTION:	0.84	42%	0.84	44%	15 ug/l
FOOD INGESTION:	0.88	44%	0.88	46%	10.0 ug Pb/kg diet

PATHWAYS, CHILDREN

Pathway	Typical		with pica		concentration in medium
	Blood Pb ug/dl	percent of total	Blood Pb ug/dl	percent of total	
SOIL CONTACT:	0.00	0%	0.00	0%	26 ug/g
SOIL INGESTION:	0.10	3%	1.44	30%	26 ug/g
INHALATION:	0.29	8%	0.29	6%	0.15 ug/m ³
WATER INGESTION:	0.96	28%	0.96	20%	15 ug/l
FOOD INGESTION:	2.08	61%	2.08	44%	10.0 ug Pb/kg diet