PDD II

UPDATE TO RISK ASSESSMENT REPORT FOR THE FORMER PACIFIC DRY DOCK AND REPAIR COMPANY YARD II SITE IN OAKLAND, CALIFORNIA

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1.0 EXECUTIVE SUMMARY

In 1996, Crowley Marine Services, Inc. prepared and submitted to the Alameda County Health Care Services Agency ("Alameda County"), a Risk Assessment Report on the former Pacific Dry Dock and Repair Company Yard II. The Port of Oakland reviewed and commented at length on that Report. Alameda County also reviewed the Risk Assessment and asked that Crowley conduct certain further investigation work at the Site. This Update to the Risk Assessment Report describes and presents the results of that further effort. The additional work confirms the results of the earlier sampling conducted under regulatory oversight since 1989. Furthermore, the recently-collected data confirm that potential risks posed to a commercial/industrial worker (excess cancer risk of 2.4E-07 and hazard index of 0.017) are well within the range of risks computed in the original risk assessment and, in fact, are below levels of regulatory concern (typically 1.0E-05 for excess cancer risks and a hazard index of 1.0 for noncancer health effects). Based on these findings, the former Pacific Dry Dock Yard II Site constitutes a low risk soil and groundwater site based on the criteria set forth in the Water Board guidance (SWRCB, 1996; RWQCB-San Francisco Bay Region, 1996), and Crowley hereby requests regulatory closure of this Site.

2.0 INTRODUCTION

This is an update to the Risk Assessment (RA) Report (Risk-Based Decisions, May 16, 1997) previously submitted by Crowley Marine Services ("Crowley") which evaluated the human health and environmental significance of metals, petroleum hydrocarbon constituents, and chlorinated solvents in soils and groundwater at the former Pacific Dry Dock and Repair Company Yard II (the "Site") located at 321 Embarcadero, Oakland, California. The earlier RA showed that the chemicals remaining in soils and groundwater at the Site did not present carcinogenic or non-carcinogenic risks to future workers above levels of regulatory concern under an onsite commercial/industrial worker exposure scenario. Furthermore, the RA also showed that, using health-protective assumptions, the residual chemicals did not present a threat to the environment.

Crowley has performed extensive investigations at Yard II under the supervision of Alameda County and the California Regional Water Quality Control Board San Francisco Bay Region (RWQCB). A series of phased investigation programs were conducted at Yard I between 1989 and 1997. Aerial photographs, Site observations and Site histories were used to select areas for the initial environmental investigations. Many of the initial soil and water samples collected from the Site were tested for broad ranges of priority pollutants such as chlorinated and aromatic volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), Title 22 metals (metals), and petroleum hydrocarbons. The initial soil and water test results were used to focus areas for additional investigation and testing. The phased investigation approach that was used is consistent with the current ASTM standards for environmental investigations. The phased investigations had targeted areas

likely to be of environmental concern. Analyses were based on substances expected to be used or produced within each target area.

In response to discussions between Crowley and Alameda County, with input from the Port of Oakland ("Port"), Crowley agreed to conduct additional sampling of this Site to confirm the earlier Site characterization data. The additional sampling was conducted in accordance with the *Sampling Work Plan for the Former Pacific Dry Dock and Repair Company Yards I and II* (Risk-Based Decisions, November 14, 1997) which was approved by Alameda County with some modifications (Alameda County, January 21, 1998). A meeting was held with Mr. Barney Chan and Ms. Madhula Logan of Alameda County and representatives of Crowley at the Site on January 30, 1998 to review the *Sampling Work Plan.* Modifications to the Work Plan were confirmed in a letter from Crowley to Mr. Chan (February 3, 1998). The data collected reflects this agreed-upon sampling program.

3.0 DATA COLLECTION AND EVALUATION

The Site is an approximately 3.5-acre vacant property bounded by Lake Merritt Channel on the west, Oakland Inner Harbor on the south and the west, the Embarcadero Freeway on the north, and an industrial property to the east. It was used as a boat repair and dry dock facility from approximately 1935 to May 1991 when all repair activity ceased. When operational, the Site consisted of a floating dry dock, machine shop, warehouses, and support offices.

3.1 Overview of Sampling Strategy

A brief overview of the rationale underlying the Sampling Plan and interpretation of the data obtained is provided to place the current data in context. As stated in the Plan, the objectives of the sampling were to:

1. Acquire additional data about the shallow soils at the Site to ensure estimation of representative chemical concentrations.

2. Evaluate isolated areas on the Site believed to have some potential for chemical concentrations to exceed human health based regulatory thresholds.

3. Further evaluate potential risks, if any, posed by the Site.

To accomplish these objectives, the Work Plan combined randomized, representative sampling with targeted, judgmental sampling. This work was accomplished by clearly delineating the targeted regions and by specifying different approaches to finding sample locations in the targeted areas. Samples were collected from surficial soils (0.5 to 1.5 feet, bgs) and from deeper soils, typically one foot above the water table. Currently, the depth to groundwater at this Site is at about 2.5 to 6 feet bgs.

To yield results representative of extreme conditions, many samples were "focused" or "targeted" in areas believed to have a higher likelihood of exhibiting significant contamination ("strata"). The portion of the Site remaining after all targeted strata were sampled is still of considerable size. Sample locations within this larger area of the Site, outside the targeted areas, were selected at random so that their results could be used for valid statistical inferences about conditions across the Site.

Measurements of targeted samples do not represent average conditions; they only reflect the targeted areas, which typically are small. The data from the targeted samples were compared to the EPA Region 9 industrial soil Preliminary Remediation Goals (PRGs) at the 1.0E-06 risk threshold (one in one million excess risk), or for noncarcinogens at a hazard index of 1.0 (EPA, Region 9 PRG, May 1, 1998). Where the chemical concentration in any targeted sample exceeded its PRG, further evaluation of the targeted area was conducted.

Measurements of the random samples were statistically combined to estimate the average and variability of chemicals of concern throughout the Site. The procedure recommended by the EPA is to calculate a 95% upper confidence limit (UCL) of the mean. The 95% level means that repeated use of the UCL procedure is expected to overestimate the true mean 95 out of every 100 times it is applied.

Targeted and random samples were obtained at many locations and then composited into small groups before analysis to increase the spatial sampling intensity, thereby increasing the chance of identifying any localized high concentrations. Only samples for which the same set of analyses was required were composited. Furthermore, samples were grouped for compositing based on similarity of purpose (random or targeted) and soil horizon (shallow or deep).

Analysis for volatile organic compounds (VOCs), including benzene, toluene, ethylbenzene and xylenes (BTEX) were performed on the original, uncomposited samples.

Samples were systematically named to indicate:

1. (Test) Group: Numbers correspond to the different collections of analytical tests that were performed.

2. Composite: Within each group, for a given horizon, samples were composited. All those to be composited were assigned to a compositing group, designated by small latin letters a, b, c, *etc.*

3. Identifier: Within a compositing group, individual samples were identified by sequential whole numbers beginning with 1.

4. Horizon: "S" for shallow, "D" for deeper - near the water table.

The naming convention is of the form <group><composite>.<identifier><horizon>, with a period separating the first two from the second two. Thus, for example, the deep samples from composite b in group 1 at Yard I have been designated 1b.1D, 1b.2D, and 1b.3D (see Table 3.2). The samples contributing to a composite are called its "aliquots." For example, samples 1b.1D, 1b.2D, and 1b.3D are the designated aliquots for composite 1b(D).

3.2 Analytical Results

Figure 1 shows the locations of the target and random samples and the samples collected as part of the earlier Site investigations.

Table 1 shows the analytical results for metals in shallow and deep samples from target [T] and random [R] samples. As shown in the Table, all the metals were within the range of background concentrations reported for California soils or below the corresponding EPA Region 9 PRG. In fact, three of the four metals quantitatively evaluated in the original RA -- copper, lead, and zinc -- were found to be at or below levels measured in earlier investigations. For example, the 95% UCL of copper was 153 mg/kg whereas now it is 82 mg/kg; for lead the 95% UCL was 65 mg/kg, now it is 55 mg/kg; for zinc the 95% UCL was 273 mg/kg whereas now it is 101 mg/kg. For mercury, the 95% UCL was 0.57 mg/kg and now is 2.29 mg/kg but even this upper bound value is well below its PRG of 560 mg/kg (mercury and compounds).

The Sampling Work Plan had a provision that sampling for organtins would be conducted if the following two conditions occurred:

1. The noncarcinogenic risk for metals, computed including the zinc surrogate value for organotin and adjusted for the number of aliquots in the composite, exceeds 1.0.

2. The zinc concentration exceeded 300 ppm.

As can be seen from Tables 1 and 5, neither of these conditions occurred and so organotin analysis was not triggered in accordance with the Work Plan.

Table 2 shows the data for the fuel hydrocarbon constituents, benzene, toluene, ethylbenzene and xylenes (BTEX). As can be seen from the Table, only benzene (3.2 mg/kg) and ethylbenzene (44 mg/kg) were detected in only one sample and the ethylbenzene detection is very low. In this same sample, toluene and xylenes were not detected. Benzene is above its industrial PRG of 1.4 mg/kg and Figure 2 shows

the distribution of the benzene results. Note that a shallow soil sample (16a.2S) from the same location was non-detect.

Some samples were analyzed for polychlorinated biphenyls (PCBs) in order to ascertain whether bilge water disposed at the Site during its ship repair operations might have been contaminated with PCBs. The data showed no PCBs above their limit of detection in the bilge water disposal area soils. However, PCBs were detected in concentrations up to 18 mg/kg underneath paving near the Site boundary and in a landscaped area just straddling the Site boundary. PCBs detected were Aroclor 1248 with an occasional detection of Aroclor 1254.

To characterize any site-related PCB concentrations in this area, additional sampling was performed in a hexagonal grid of points surrounding these locations. The sampling focused on cracks and other areas not covered by competent paving. These additional shallow soil samples were not composited before analysis. Their results effectively delineate the onsite soils where PCBs were detected. These PCB concentrations cannot be linked to any Crowley-related activities at the Site. The data are shown in Table 3 and plotted on Figure 3. Note that the EPA Region 9 PRG cited in Table 3 is for Aroclor 1254.

Table 4 presents the data for carcinogenic and non-carcinogenic polynuclear aromatic hydrocarbons (PNAs) and semi-volatile organic compounds (SVOCs) in soils. All the data from random and target samples were below their respective limits of detection.

One grab groundwater sample, GW-10, requested by Alameda County was collected near soil sample location 13a.1 in a targeted location (Figure 1). This sample was analyzed for VOCs, SVOCs and dissolved metals. No organic compounds were

detected and only a few dissolved metals showed concentrations close to their limits of detection (data not shown, see Supplemental Site Investigation Sampling and Analysis Results, Pacific Dry Dock Yards I and II, The Gauntlett Group, July, 1998).

4.0 EXPOSURE ASSESSMENT

The Site was used as an industrial facility and the original RA assumed future land use would remain industrial, although re-development of the Yard as a public park was qualitatively considered. As noted in the Risk Assessment Report, any development of the Site would require re-grading and additional soil cover, thereby mitigating any human exposure chemicals remaining in soils; such exposures cannot be quantitatively evaluated in the absence of more specific development plans and land use scenarios. The exposure assessment quantitatively evaluates direct worker exposure to chemicals in soils. Calculations and input parameters used for estimating intake rates, through direct contact with soils were obtained from the EPA (EPA, 1989 and 1994).

Intake (or exposure) was calculated as either the Average Daily Dose (ADD) or the Lifetime Average Daily Dose (LADD). The ADD was used in the evaluation of noncarcinogenic health effects, while the LADD was used to evaluate carcinogenic effects. For direct exposure to chemicals in soils, the equation used is written as:

$$\textbf{Intake} = \frac{(Cs)\,(Ir)\,(Fl)\,(EF)\,(ED)}{(BW)\,(AT)\,(365)}$$

Where:

Intake	=	ADD or LADD (mg/kg/day)
Cs	=	Concentration of Chemical in Soil (mg/m^3)
Ir	=	Soil ingestion rate (50 mg/day)

FI	=	Fraction of contaminated soil surface (0.10)
EF	=	Exposure Frequency (250 days/year)
ED	=	Exposure Duration (25 years)
BW	=	Body Weight (70 kg)
AT	=	Averaging Time (70 years)
365	=	Conversion Factor (days/year)

The parameters selected to quantify chemical intake (noted in parentheses above) represent default 95% upper bound estimates recommended by the USEPA (1989). The only site-specific parameter was the conservative estimate that approximately 10% of the surface soils at the Site contained chemical concentrations above background. In fact, as can be seen from Figures 2 and 3, the chemicals of potential concern, benzene and PCBs, were detected in a small fraction of the potential worker exposure domain represented by the Site as a whole. Thus, assuming that as much as 10 percent of the Site area is impacted is a health-protective assumption.

5.0 RISK CHARACTERIZATION

5.1 Carcinogenic Health Risks

The following calculation was used to obtain numerical estimates of lifetime cancer risks for humans:

$$Risk = Intake\ (or\ Exposure) * SF$$

Where:

Risk	=	Potential excess cancer risk adjusted for a 70-year lifetime (unitless)
Intake	=	Chemical intake (LADD) (mg/kg/day)
SF	=	Slope factor $(mg/kg/day)^{-1}$

Risks to commercial/industrial workers are typically regulated by the RWQCB and the DTSC at the 1.0E-05 (one in 100,000 excess cancers) level.

5.2 Noncarcinogenic Human Health Effects

Health hazards associated with exposure to noncarcinogenic compounds were evaluated using Reference Doses (RfDs) and calculating hazard quotients. The hazard quotient is the ratio of the intake rate to the RfD (developed by the EPA), as follows:

$$HQ = Intake/RfD$$

Where:

HQ	=	Hazard Quotient
Intake	=	Chemical intake (ADD) (mg/kg/day)
RfD	=	Reference dose (mg/kg/day)

Hazard quotients were summed for all noncarcinogenic chemicals to calculate a total hazard index. The EPA has set a hazard index of 1.0 as the threshold for noncancer health effects (EPA, 1989).

5.3 Results of the Human Health Evaluation

Table 5 shows the exposures and risks (carcinogenic and noncarcinogenic) from direct worker contact via ingestion of PCBs and benzene in soils/fill. This potential exposure resulted in an excess cancer risk of 2.4E-07. In spite of the conservative assumptions made in quantifying potential risks, this excess cancer risk is approximately 40 times lower than the risk (1.0E-05) considered acceptable by the RWQCB, DTSC and the EPA for commercial/industrial workers.

For noncancer health effects, the hazard index was 0.017, more than 58 times lower than the regulatory threshold of 1.0 (Table 5).

The potential health effects to onsite workers from direct contact with lead in fill/soils at the Site was evaluated using the Department of Toxic Substances Control's (DTSC's) LeadSpread Model. As shown in Table 6, default exposure assumptions recommended by the DTSC were used. The results show that the 95th percentile of blood lead in a potentially exposed worker would be 3.6 μg/L, well below the regulatory level of concern of 10 μg/L. The same Table shows that, for an industrial worker exposure scenario, the 95% UCL of the Preliminary Remedial Goal (PRG-95) for lead in soil would be 6,306.5 μg/g (or mg/kg), a level 83 times higher than the 95% UCL for lead in soils at the Site.

6.0 CONCLUSIONS

The additional sampling of the Site affirms the results of the earlier phases of sampling conducted since 1989. The only chemicals discovered during this round of sampling were PCBs. However, as stated above, the spatial distribution of PCBs in soils indicates that these were not related to operations conducted by Crowley at the Site. Furthermore, the additional sampling data confirm that potential risks posed to a commercial/industrial worker (excess cancer risk of 2.4E-07 and hazard index of 0.017) are well within the range of risks computed in the original risk assessment and, in fact, are below levels of regulatory concern (typically 1.0E-05 for excess cancer risks and a hazard index of 1.0 for noncancer health effects). Based on these findings, the former Pacific Dry Dock Yard II Site constitutes a low risk soil and groundwater site based on the criteria set forth in the Water Board guidance (SWRCB, 1996; RWQCB-San Francisco Bay Region, 1996) and regulatory closure of this Site is requested.

Table 1
Soil Sample Results
Metals
Pacific Dry Dock Yard II
Oakland, California

Analyte[1] (mg/kg)[2]	Sample Identification													Background		Regulatory Level
	12a.D	13a.S	13a.D	17a.S	20a.S	20a.D	20b.S	20b.D	20c.S	20c.D	Mean	S.D.	95%UCL	Mean	95%UCL	EPA Region 9
	T	T	T	T	R	R	R	R	R	R						Industrial PRG[3]
Antimony	<2	2.4	<2	<2	3.7	<2	<2	<2	<2	<2	1.45	1.10	2.36			750
Arsenic	2.4	6	3.1	1.8	<1	<1	4.4	1.1	1.6	<1	1.43	1.52	2.68	6.60	19.10	3
Barium	18	87	47	18	31	26	84	26	53	130	58.33	41.62	92.57			100,000
Beryllium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.25	0.00	0.25			3400
Cadmium	1.1	4.1	2.7	1.4	1.7	1.3	1.8	1.7	1.7	2	1.70	0.23	1.89			930
Chromium	22	16	14	14	31	39	6.2	23	29	13	23.53	12.14	33.52	118.00	99.60	450
Cobalt	3.9	14	5.7	4.2	9.9	10	4.6	6.6	6.9	8.5	7.75	2.11	9.48	13.30		29,000
Copper	12	490	140	16	130	16	20	30	35	51	47.00	42.49	81.96	49.00	69.40	70,000
Lead	5.6	8.3	15	6.4	100	2.5	4.6	6.8	24	4.5	23.73	38.18	55.14	29.00	16.10	1,000
Mercury	0.27	<0.05	0.24	1.1	4.2	<0.05	0.21	0.67	0.2	0.55	0.98	1.60	2.29	0.15	0.40	560
Molybdenum	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.50	0.00	0.50			9,400
Nickel	19	12	11	15	18	36	3.4	29	52	14	25.40	17.33	39.66			37,000
Selenium	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	1.00	0.00	1.00			9,400
Silver	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.50	0.00	0.50			9,400
Thallium	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	0.50	0.00	0.50			150
Vanadium	16	28	59	23	27	22	12	29	17	40	24.50	9.85	32.61	125.00		13,000
Zinc	27	67	160	44	140	34	48	44	86	58	68.33	39.34	100.70	78.00	106.10	100,000

Notes
1. Title 22 California Code of Regulations metals
2. mg/kg = miligrams per kilogram
3. Industrial preliminary remediation goal listed (Environmental Protection Agency, Region 9, May 1, 1998)
4. Mean, S.D, and UCL calculated for random samples (R) only
5. Background Mean and 95% UCL: Protocol for Determining Background Concentration of Metals in Soil. Lawrence Berkeley National laboratory (1995). Elements in North American Soils. Dragun, J. and Chiasson, A. (1991)

Table 2
Soil Sample Results
BTEX
Pacific Dry Dock Yard II
Oakland, California

SAMPLE ID	BENZENE	TOLUENE	ETHYLBENZENE	XYLENES
11a.2D	3.200	< 1.200	44.000	1.500
11a.3D	< 0.005	< 0.005	< 0.005	< 0.005
14a.2S	< 0.005	< 0.005	< 0.005	< 0.005
14a.3S	< 0.005	< 0.005	< 0.005	< 0.005
16a.1S	< 0.005	< 0.005	< 0.005	< 0.005
16a.2S	< 0.005	< 0.005	< 0.005	< 0.005

All data in mg/kg.

Table 3
Soil Sampling Results
PCBs
Pacific Dry Dock Yard II
Oakland, California

Sample ID	Depth (feet, bgs)	PCB (mg/kg)
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
95% UCL		6.69
PRG (Aroclor 1254)		18.00

Table 4
Composite Soil Sample Results
PNAs and SVOCs
Pacific Dry Dock Yard II
Oakland, California

Analyte[1] (mg/kg)[2]	Sample Identification											Regulatory Level EPA Region 9 Industrial PRG[3]
	11a.D	12a.D	14a.S	16a.S	17a.S	20a.S	20a.D	20b.S	20b.D	20c.S	20c.D	
Naphthalene	<1.0	<1.0	<0.50	<2.5	<0.10	<2.5	<0.10	<0.50	<1.0	<2.5	<1.0	190
Acenaphthene	<1.0	<1.0	<0.50	<2.5	<0.10	<2.5	<0.10	<0.50	<1.0	<2.5	<1.0	2,800
Fluorene	<1.0	<1.0	<0.50	<2.5	<0.10	<2.5	<0.10	<0.50	<1.0	<2.5	<1.0	2,200
Phenanthrene	<1.0	<1.0	<0.50	<2.5	<0.10	<2.5	<0.10	<0.50	<1.0	<2.5	<1.0	NP[4]
Anthracene	<1.0	<1.0	<0.50	<2.5	<0.10	<2.5	<0.10	<0.50	<1.0	<2.5	<1.0	220,000
Fluoranthene	<1.0	<1.0	<0.50	<2.5	<0.10	<2.5	<0.10	<0.50	<1.0	<2.5	<1.0	37,000
Pyrene	<1.0	<1.0	<0.50	<2.5	<0.10	<2.5	<0.10	<0.50	<1.0	<2.5	<1.0	26,000
Benzo(a)anthracene	<1.0	<1.0	<0.50	<2.5	<0.10	<2.5	<0.10	<0.50	<1.0	<2.5	<1.0	3.6
Chrysene	<1.0	<1.0	<0.50	<2.5	<0.10	<2.5	<0.10	<0.50	<1.0	<2.5	<1.0	360
Benzo(b)fluoranthene	<1.0	<1.0	<0.50	<2.5	<0.10	<2.5	<0.10	<0.50	<1.0	<2.5	<1.0	3.6
Benzo(k)fluoranthene	<2.0	<2.0	<1.0	<5.0	<0.20	<5.0	<0.20	<1.0	<2.0	<5.0	<2.0	36
Benzo(a)pyrene	<0.35	<0.50	<0.18	<0.88	<0.05	<0.88	<0.035	<0.18	<0.35	<0.88	<0.35	0.36
Indeno(1,2,3-cd)pyrene	<2.0	<2.0	<1.0	<5.0	<0.20	<5.0	<0.20	<1.0	<2.0	<5.0	<2.0	3.6
Dibenzo(ah)anthracene	<2.0	<2.0	<1.0	<5.0	<0.20	<5.0	<0.20	<1.0	<2.0	<5.0	<2.0	0.36
Benzo(ghi)perylene	<2.0	<2.0	<1.0	<5.0	<0.20	<5.0	<0.20	<1.0	<2.0	<5.0	<2.0	NP
2-Methylnaphthalene	NA[5]	<1.0	NA	NA	<0.10	NA	NA	NA	NA	NA	NA	NP
Dibenzofuran	NA	<1.0	NA	NA	<0.10	NA	NA	NA	NA	NA	NA	3,200

Notes
1. Only the constituents listed were detected. All other constituents were not detected.
2. mg/kg = miligrams per kilogram
3. Industrial preliminary remediation goal listed (Environmental Protection Agency, Region 9, May 1, 1998)
4. NP = not published
5. NA = not analyzed

Table 5
Excess Cancer Risks (ECR) and Noncarcinogenic Health Hazards for Onsite Workers Via
Direct Contact with Surface Soils
Pacific Dry Dock Yard II
Oakland, California

Chemical	Cs (mg/kg)	Ir (mg/d)	Fl	EF (d/yr)	ED (yr)	CF (d/yr)	AT (yr)	BW (kg)	LADD (mg/kg/d)	SF mg/kg/d-1	ECR
Carcinogens											
Benzene	3.20E+00	50	0.1	250	25	365	70	70	5.6E-08	1.00E-01	5.6E-09
PCBs	6.69E+00	50	0.1	250	25	365	70	70	1.2E-07	2.00E+00	2.3E-07
									Total ECR:		2.4E-07

Chemical	Cs (mg/kg)	Ir (mg/d)	Fl	EF (d/yr)	ED (yr)	CF (d/yr)	AT (yr)	BW (kg)	ADD (mg/kg/d)	RfD mg/kg	HQ
Noncarcinogenic Effects											
Copper	8.20E+01	50	0.1	250	25	365	25	70	4.0E-06	3.70E-02	1.08E-04
Mercury	2.29E+00	50	0.1	250	25	365	25	70	1.1E-07	3.00E-04	3.73E-04
Zinc	1.01E+02	50	0.1	250	25	365	25	70	4.9E-06	5.00E-02	9.85E-05
Benzene	3.20E+00	50	0.1	250	25	365	25	70	1.6E-07	3.00E-03	5.22E-05
PCBs	6.69E+00	50	0.1	250	25	365	25	70	3.3E-07	2.00E-05	1.64E-02
									Hazard Index:		0.01700

SF for PCB is for Aroclor 1254 (EPA Region 9 PRG, May 1, 1998)

Table 6
Lead Risk Assessment
Pacific Dry Dock Repair Company Yard II
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)	55.1	BLOOD Pb, ADULT (ug/dl)	2.0	3.1	3.6	4.1	4.5	3417.3	5102.9
LEAD IN WATER (ug/l)	15	BLOOD Pb, CHILD (ug/dl)	3.6	5.6	6.3	7.3	8.0	264.7	558.5
PLANT UPTAKE? 1=YES 0=N	0	BLOOD Pb, PICA CHILD (ug/dl)	6.4	10.0	11.4	13.2	14.5	19.5	41.1
(ug/m^3)	50	BLOOD Pb, INDUSTRIAL (ug/dl)	1.9	3.0	3.4	4.0	4.4	4262.5	6306.5

EXPOSURE PARAMETERS

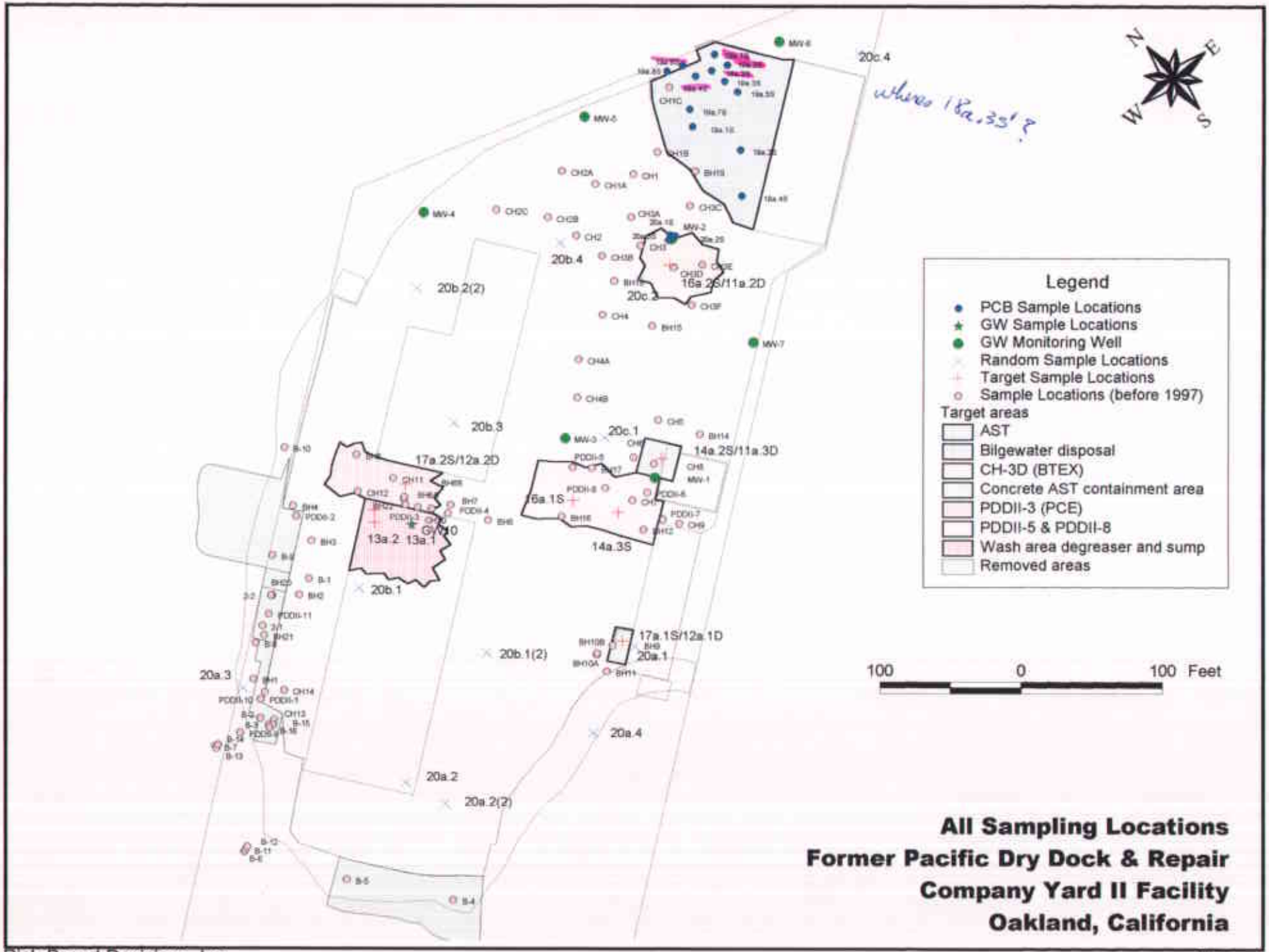
	units	residential			industrial
		adults	children	children with pica	adults
General					
Days per week	days/wk	7	7	7	5
Dermal Contact					
Skin area	cm^2	3700	2800	2800	5800
Soil adherence	mg/cm^2	0.5	0.5	0.5	0.5
Route-specific constant	(ug/dl)/(ug/day)	0.00011	0.00011	0.00011	0.00011
Soil ingestion					
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	1%	0.01	1%	55	ug/g
SOIL INGESTION:	0.02	1%	0.02	1%	55	ug/g
INHALATION:	0.25	12%	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

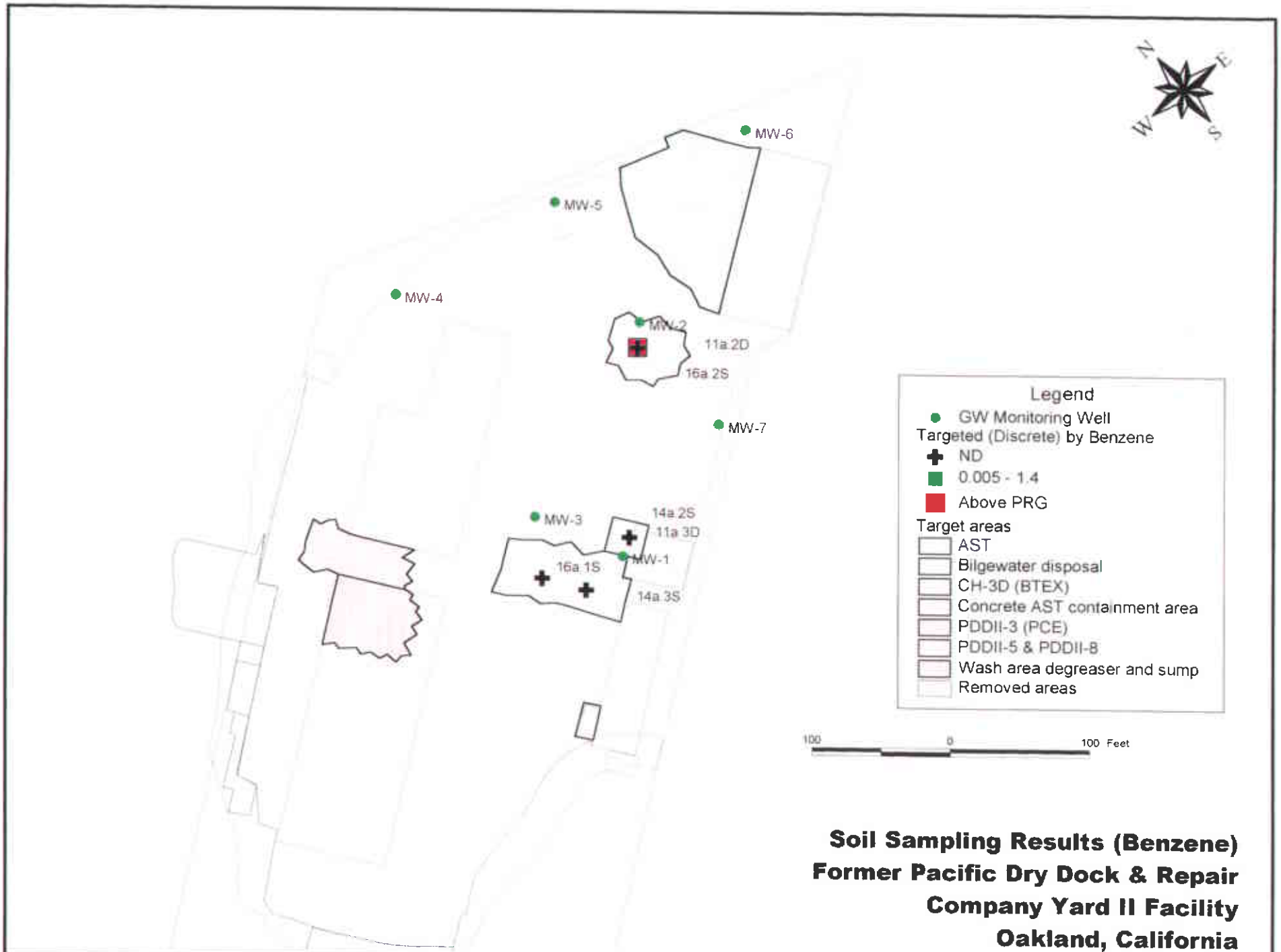
Pathway	Typical		with pica		concentration in medium	
	Blood Pb ug/dl	percent of total	Blood Pb ug/dl	percent of total		
SOIL CONTACT:	0.01	0%	0.01	0%	55	ug/g
SOIL INGESTION:	0.21	6%	3.07	48%	55	ug/g
INHALATION:	0.29	8%	0.29	5%	0.15	ug/m^3
WATER INGESTION:	0.96	27%	0.96	15%	15	ug/l
FOOD INGESTION:	2.08	59%	2.08	32%	10.0	ug Pb/kg diet



All Sampling Locations
Former Pacific Dry Dock & Repair
Company Yard II Facility
Oakland, California

Risk-Based Decisions, Inc.

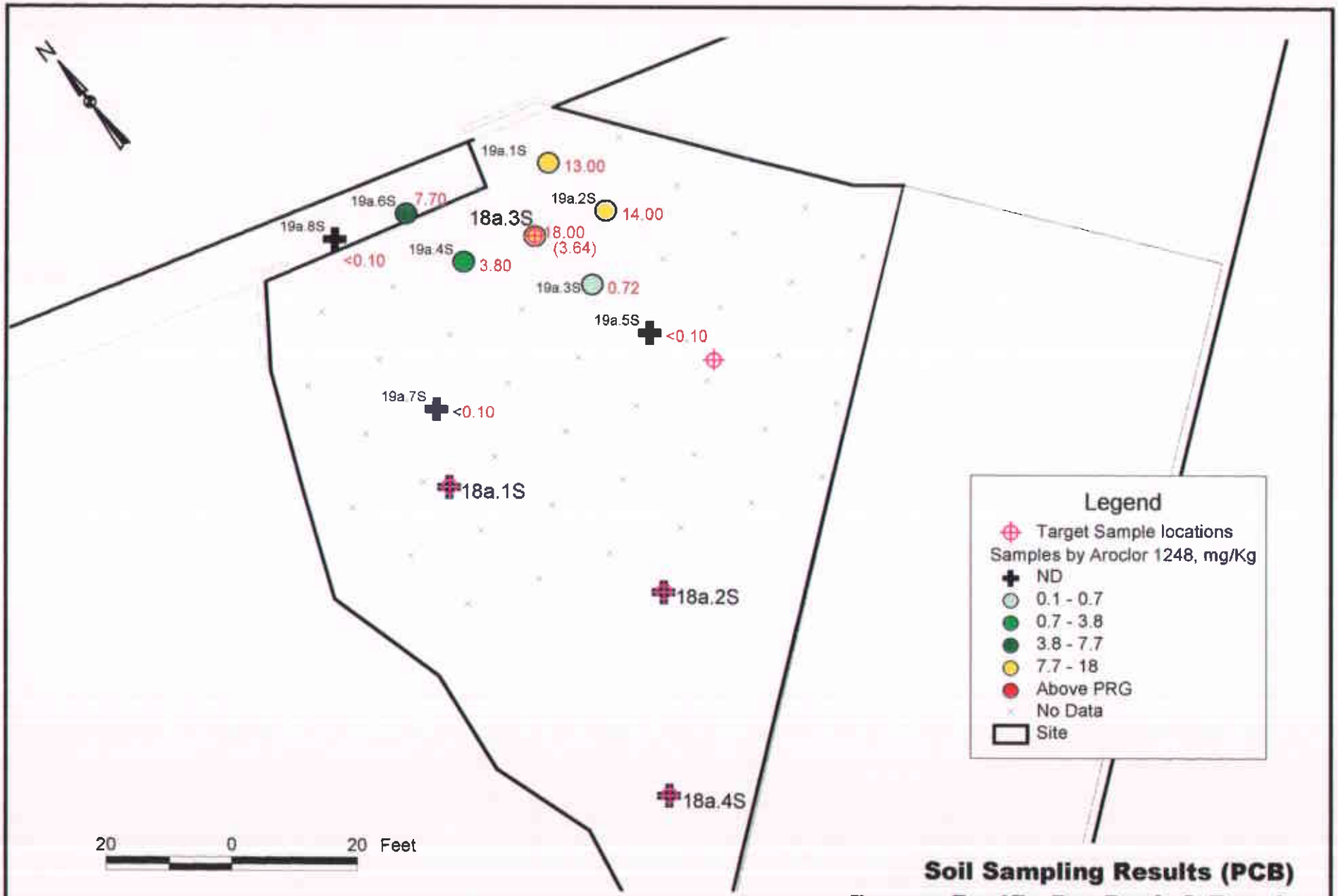
Figure 1



Soil Sampling Results (Benzene)
Former Pacific Dry Dock & Repair
Company Yard II Facility
Oakland, California

Risk-Based Decisions, Inc.

Figure 2



Soil Sampling Results (PCB)
Former Pacific Dry Dock & Repair
Company Yard II Facility
Oakland, California

Note: PCB were ND at locations of 20a.1S, 20a.2S and 20a.3S (see Figure 1 for sample locations)

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Figure 3