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GEOMATRIX

2 March 1993
Project 2026.06

Ms. Patricia Murphy
Port of Oakland
530 Water Street
Oakland, California 94607

Subject: Application for Reclassification of Hazardous Soil
Berth 30
Port of Oakland
Oakland, California

Dear Ms. Murphy:

Enclosed is the subject report. If you have any questions about this report, please call either of the undersigned. We appreciate the opportunity to work with you on this project and look forward to working with you in the future.

Sincerely yours,

GEOMATRIX CONSULTANTS, INC.

Elizabeth K. Wells, P.E.
Project Engineer

Sally E. Goodin, R.G.
Senior Geologist

EKW/SEG/lam
20266RHS.LTR

Enclosure

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APPLICATION FOR RECLASSIFICATION OF HAZARDOUS SOIL

Berth 30
Port of Oakland
Oakland, California

VOLUME 1 - REPORT

Prepared for

Port of Oakland
530 Water Street
Oakland, California

March 1993
Project No. 2026.06

Geomatrix Consultants

GEOMATRIX

TABLE OF CONTENTS

LIST OF TABLES

TABLE OF CONTENTS
(Continued)

LIST OF FIGURES

LIST OF APPENDICES

GEOMATRIX

APPLICATION FOR RECLASSIFICATION OF HAZARDOUS SOIL
Berth 30
Port of Oakland
Oakland, California

1.0 INTRODUCTION

The Port of Oakland is submitting this application prepared by Geomatrix Consultants, Inc., for reclassification of a non-RCRA hazardous waste. This application has been prepared in accordance with the California Code of Regulations (CCR), Title 22, Section 66260.200 and includes information on the generator, waste material, sample collection, chemical testing, analytical laboratories, and analytical results.

2.0 GENERATING FACILITY

The generating facility is: Port of Oakland
530 Water Street
Oakland, California 94607

The contact person at the Port is: Ms. Patricia Murphy
(510) 272-1373

3.0 DESCRIPTION OF THE WASTE

The waste consists of a portion of material excavated from Berth 30 north of Seventh Street during Fall 1992 as part of construction for a new container terminal and loading berth at the Port (Figure 1). The waste comes from the post-1950s fill unit formerly underlying the shoreline adjacent to Berth 30, which consisted of a heterogeneous mixture of rubble, boulders, cobbles, gravel, sand, and clay, with some brick, timber and other miscellaneous materials. This material was segregated during excavation and placed across Seventh Street

on another portion of the Berth 30 property because preliminary sampling data (Geomatrix, 1992) had indicated that the matrix material of this unit potentially contained soluble lead at concentrations greater than the Soluble Threshold Limit Concentration (STLC, 5 mg/l) used to define a California hazardous waste (CCR, Title 22, Section 66261.24). The material was subsequently processed through a rock crusher to remove rocks and materials greater than 4 inches in diameter. The predominantly 4-inch-minus material was sampled for chemical analysis and placed in a total of 25 stockpiles ranging from approximately 1800 to 3000 cubic yards of soil per stockpile. Following receipt of analytical results, a determination was made for each stockpile as to whether the stockpile would be considered hazardous waste according to Title 22. Twelve of the 25 stockpiles of soil, which were considered hazardous, were combined into one pile consisting of a total volume of approximately 26,700 cubic yards. The stockpile is currently located on-site with plastic sheeting beneath and covering the stockpile.

Grain size analysis of a representative sample collected from the hazardous stockpile indicates the soil is a silty gravel (Unified Soil Classification System). A copy of the grain size distribution curve is included in Appendix A.

The waste material is proposed for placement in a Class II landfill to be constructed at the Berth 30 site (Figure 1). The landfill will be designed, constructed, operated, and closed in accordance with CCR, Title 23, Chapter 15.

4.0 SAMPLING INFORMATION

Soil samples were collected for chemical testing by:

Geomatrix Consultants, Inc.
100 Pine Street, 10th Floor
San Francisco, California 94111

The following Geomatrix employees collected the samples: James Abitz, Matthew Blankenship, James Carolan, Jeffrey Hasan, Timothy Keuscher, Michael Keim, Elizabeth Wells, Timothy Wood, and Paul Zianno. Soil samples were collected from a sampling platform located next to a conveyor belt of the rock crushing plant. Soil samples were collected directly from the flow of processed soil (the predominantly 4-inch-minus material) moving along the conveyor belt. Samples were collected using a systematic random sampling approach in accordance with the U.S. Environmental Protection Agency's (EPA's) Test Methods for Evaluating Solid Waste (SW-846). The first sample was collected randomly; subsequent samples were collected at a rate of approximately one sample per 50 cubic yards. An additional random sample was collected from each stockpile for acute aquatic toxicity testing. Soil samples were collected in clean, thin-walled brass tubes and sealed at each end with Teflon sheets, plastic end caps, and duct tape. Each sample was labeled with sample number, date, time, and sampler initials, and placed in an ice-cooled chest until delivery to the analytical laboratory under Geomatrix chain-of-custody procedures. The date and time of sample collection, and sample number are listed on the chain-of-custody records (Appendix B).

5.0 ANALYTICAL METHODS AND LABORATORIES

All of the soil samples collected from each stockpile were transported to the analytical laboratory under chain-of-custody procedures. Ten soil samples from each stockpile were selected for chemical analysis using a random number generator. A request for analysis form indicating which ten samples to analyze was transmitted to the laboratory. A copy of the form is shown in Appendix B. A total of 120 samples (10 samples per stockpile) were analyzed for 17 total Title 22 metals, and for soluble lead using the California Waste Extraction Test (WET) and Toxic Characteristic Leaching Procedure (TCLP). A total of 24 samples (two samples per stockpile) were analyzed for volatile and semivolatile organic compounds. One sample from each stockpile (a total of 12 samples) was also analyzed for pesticides and polychlorinated biphenyls (PCBs); reactivity, corrosivity, and ignitability;

and acute aquatic toxicity testing. Three samples from the entire set of randomly selected samples were also analyzed for soluble mercury by the WET because the total concentrations were greater than 2 (10 times the STLC of 0.2 mg/l). The preparation methods, test methods, and references for the methods are presented in Table 1.
Two analytical laboratories conducted chemical analyses of the soil samples. Aquatic toxicity tests were conducted by:

Western Bioassay Laboratories (WBL)
2950 Buskirk Avenue, Suite 120
Walnut Creek, California 94596
State Certification Number 1812

All other chemical analyses were conducted by:

Clayton Environmental Consultants (Clayton)
1252 Quarry Lane
P.O. Box 9019
Pleasanton, California 94566
State Certification Number 1196

Resumes for the individuals from each laboratory responsible for testing the soil samples are presented in Appendix C.

Samples were transferred under Geomatrix chain-of-custody procedures from the sampling personnel to the analytical laboratory. Following receipt of the samples by the laboratories, the laboratories conducted sample control procedures described below.

Samples received by Clayton were identified by batch and by individual sample. The group of samples was assigned a work order number and each sample was given a unique laboratory identification number. At the time of sample log-in, the following information was recorded in the master sample log and the laboratory's information management system: date logged, date received, laboratory work order number, laboratory sample number, client sample number, client name, sample type, analyses requested number of containers, size and type of container, preservatives, sample custodian initials, storage

location, and analytical data. Labels containing this information were placed on the samples, the samples were placed in storage, and necessary information regarding analyses to be performed was distributed to the appropriate laboratory department.

Samples received by WBL were logged into the laboratory sample log book upon receipt. Each sample was given a sequential laboratory number. At the time of sample log-in, the following information was recorded in the sample log book: laboratory sample number, client sample number, date of receipt, time of receipt, initials of sample receiver, project name and number, client contact and billing number. Each sample was labeled with the laboratory sample number, date of receipt, and expiration date of the sample. The samples were placed in storage and information regarding analyses to be performed was placed in a new project file.

6.0 ANALYTICAL RESULTS

The number of randomly selected samples analyzed for each analyte is presented in Table 1. Analytical results are summarized in Tables 2 and 3.

All metals concentrations are well below the Total Threshold Limit Concentration (TTLC) used to define a California hazardous waste (CCR, Title 22, Section 66261.24). Metals concentrations are below 10 times the STLC for all metals except mercury in 3 samples and lead in 117 samples. Comparison of the analytical results with background concentration ranges (Shacklette and Boerngen, 1984), shown on Table 4, indicates that the soil generally contains total metals at concentrations that would be considered within background ranges.

All of the soil samples contained total lead at concentrations less than 290 milligrams per kilogram (mg/kg) (except one of seven replicate samples, which indicated lead at 720 mg/kg, as compared to 78 to 150 mg/kg for the other six replicate samples). One hundred sixteen of the 120 samples contained total lead at concentrations less than 200 mg/kg.

Soluble lead by the WET indicated concentrations ranging from 1.4 to 43 milligrams per liter (mg/l). Thirty-seven of the 120 samples contained soluble lead when analyzed by the WET at concentrations less than the STLC of 5 mg/l; 109 of the 120 samples analyzed contained soluble lead when analyzed by the WET at concentrations less than 10 mg/l. In addition, soluble lead tested by the TCLP was not detected in 111 samples and was reported in 9 samples at concentrations between 0.1 and 0.4 mg/l. Soluble mercury by the WET, analyzed for in three samples, was not detected above the laboratory detection limit of 0.01 mg/l.

Volatile organic compounds (VOCs), including toluene, ethylbenzene, total xylenes, acetone, and 1,2-dichloroethane, were detected in 10 of the 24 samples analyzed at concentrations ranging from 0.005 to 0.065 mg/kg. Semivolatile compounds detected are polynuclear aromatic (PNA) compounds including naphthalene, 2-methyl naphthalene, acenaphthene, dibenzofuran, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and benzo(ghi)perylene at concentrations up to 10 mg/kg.

Pesticides detected include DDD, DDE, and DDT at concentrations up to 0.44 mg/kg, all below the TTLC of 1.0 mg/kg. Polychlorinated biphenyls (PCBs) were not detected in any of the samples analyzed. The soil samples did not exhibit reactivity, corrosivity, or ignitability. The results of the aquatic toxicity indicated that the acute aquatic toxicity level is greater than 500 mg/l. The waste does not contain any of the carcinogens listed in Title 22.

Acute oral and dermal toxicities were calculated for the constituents reported in the material. These calculations are presented on Table 5. The mean concentration for each compound was converted into a percentage value. LD50 values were obtained for each compound if available. For compounds for which no LD50 values were available, the lowest LD50 value for a similar compound or the LDLo was used (e.g. the oral LD50 for

naphthalene was used for 2-methyl naphthalene); this approach should over-estimate toxicity. The percent concentration for each compound was divided by its respective LD50. The resulting values for every compound were summed and the sum was divided into 100 to provide a total calculated LD50 value (in mg/kg) for the waste material. The acute oral and dermal LD50s for the waste were calculated to be 185,619 and 104,867,647 mg/kg, respectively. Title 22 specifies that a waste is not hazardous if the oral and dermal LD50s are greater than 5,000 and 4,300 mg/kg, respectively; therefore, the material is not considered hazardous based on these results.

In summary, the only constituent in the waste that exceeds regulatory thresholds is soluble lead by the WET; a statistical evaluation of these data is presented in the next section, followed by a discussion of the mobility of lead. The PNAs and volatile organic compounds detected, which do not have regulatory thresholds, were detected at low concentrations. A discussion of the toxicity of PNAs and VOCs, and an assessment of the potential for these compounds to leach from the soil is presented below.

7.0 STATISTICAL EVALUATION OF SOLUBLE LEAD DATA

Statistical evaluation of the analytical results is appropriate for constituents for which there are regulatory criteria. The standard statistical analysis for evaluation of solid waste is presented in the EPA's Test Methods for Evaluating Solid Waste (EPA, 1986). If the concentrations of particular constituents are all less than the regulatory criteria, then the statistical analysis is not required to establish that the material is not hazardous. As discussed above, soluble lead by the WET is the only constituent in the waste that exceeds regulatory criteria.

A statistical analysis of soluble lead results (by the WET) for all the stockpiles was conducted in accordance with SW-846 to evaluate soluble lead concentrations of the total volume of soil to be reclassified. The analysis was conducted to evaluate whether the

results are statistically representative of the waste material. A summary of the calculations performed is presented in Table 6.

A total of 120 soil samples were analyzed by the WET (Table 2). The mean concentration was calculated to be 6.90 mg/l. The upper confidence level (UCL) was calculated to be 7.48 mg/l. The UCL concentration of 7.48 mg/l is greater than the STLC of 5 mg/l.

The number of samples required to characterize the waste was calculated as 12. The number of samples analyzed was greater than the number required, therefore, the results are representative of the waste.

8.0 EVALUATION OF LEAD MOBILITY

Studies conducted on lead-containing soil have indicated that lead is essentially immobile when contained in soil. These studies evaluated the mobility of lead in soil; the results indicated that lead is strongly adsorbed and exhibits little mobility in soil (Korte, et al., 1976; Miller, et al., 1983; Abd-Elfattah and Wada, 1981). Additional studies conducted by Brown, et al. (1983), Chang, et al. (1984), and Williams, et al. (1980) indicated that lead remained in the surface horizons of soil and sludge after several years of application of lead to the soil. It is also important to note that the average and upper confidence level concentrations for the WET results, 6.9 and 7.48 mg/l, respectively, are close to the STLC of 5 mg/l. The TCLP results (which are all less than 0.4 mg/l) indicate that very little lead leaches from the material, except under the specific conditions of the WET. The acidic conditions of the WET are unlikely to occur at the site, particularly in the proposed Class II landfill. These results, together with the relatively low total lead concentrations (97% of the samples had total lead concentrations less than 200 mg/kg), suggest that lead in soil is not likely to leach and that a regulatory threshold greater than the current STLC of 5 mg/l would be more appropriate for classifying the waste described in this application.

9.0 TOXICITY EVALUATION AND LEACHING POTENTIAL OF PNAs AND VOCs

There are no regulatory thresholds for the specific PNAs and VOCs identified in this material. In order to evaluate the implications of the presence of these compounds with respect to waste classification, Geomatrix has calculated acute oral and dermal toxicities for the sum of the organic compounds. In addition, acute aquatic toxicity testing was performed on the waste material. We have also estimated the potential leachable quantities of these compounds, applied a site attenuation factor, and compared these results with available regulatory criteria. It is important to note that no leachate is expected to be produced because the material will be placed in a Class II landfill, which will be immediately closed with an impermeable cap.

Acute oral and dermal LD50s were calculated for the waste material using the compounds that do not have regulatory thresholds. The calculations are shown in Table 7. The acute oral and dermal LD50s for PNAs and VOCs were calculated to be 18,569,134 and 106,176,727 mg/kg, respectively. Title 22 specifies that a waste is not hazardous if the oral and dermal LD50s are greater than 5,000 and 4,300 mg/kg, respectively. In addition, the aquatic toxicity testing indicated 96-hour acute aquatic toxicity of greater than 750 mg/l for all of the samples analyzed. Title 22 specifies that a waste is not hazardous if the 96-hour acute aquatic toxicity is greater than 500 mg/l. Therefore, the waste material at the site has is not hazardous with respect to the toxicity criteria and the estimated exposure quantity in order to be toxic is 4 to 5 orders of magnitude greater than the regulatory limit.

In order to evaluate the possible hazards to human health and safety and wildlife, the potential concentrations of the organic compounds in leachate, if any formed, have been estimated. The potential concentrations in the leachate have been estimated by calculating the soil/water partition coefficient (Kp) based on the aqueous solubility of each compound and using this ratio to convert the concentrations in soil to a potential concentration in pore

water. The aqueous solubility and estimated Kp values for each compound are presented in Table 8. On Table 9, an attenuation factor of 10 is applied to the pore water concentrations and the results are compared to drinking water standards and the Regional Water Quality Control Board, San Francisco Bay Region (SFRWQCB) effluent limitations for point discharges to San Francisco Bay.

It is important to note that appropriate water quality criteria are not available for the Berth 30 site, where the waste is proposed to be placed. The groundwater in the vicinity of Berth 30 is brackish, with conductivities ranging from 900 to 5000 (WCC, 1990); this water could not be used as drinking water. Based on this, drinking water standards would not be appropriate water quality standards for comparison. Groundwater at the site ultimately discharges to San Francisco Bay. The SFRWQCB has established effluent limitations for point discharges to the Bay in the Basin Plan (SFRWQCB, 1992). However, these effluent limitations are not applicable to groundwater discharge. Water quality goals for groundwater discharge to the Bay would be expected to be higher than the Basin Plan limits based on the significantly higher mixing ratios (of receiving water to effluent water) associated with groundwater discharge as compared to point discharges. Effluent limitations for discharges with diffusers were selected because they were developed assuming a 10 to 1 mixing ratio of receiving to effluent water; these are considered more comparable to site conditions of the proposed landfill than the shallow Basin Plan water effluent limitations (which do not assume a mixing ratio), because groundwater discharge would be expected to have a significantly higher mixing ratio than any point discharge.

The mean attenuated concentrations, together with drinking water criteria and the Basin Plan effluent limitations for discharges with diffusers are presented in Table 9. The mean attenuated concentrations are all less than the Basin Plan effluent limitations and drinking water criteria, except 1,2-dichloroethane at 0.009, which is above the EPA drinking water level of 0.005 mg/l and the state drinking water level of 0.0005 mg/l; and benzo(a)pyrene at 0.002, which is equal to the EPA drinking water standard that becomes effective in

January 1994. These results indicate that potential leachable concentrations are very low and meet Basin Plan effluent limitations and generally meet drinking water standards. These data indicate that the waste should not represent a significant threat to human health and safety or wildlife.

10.0 DISCUSSION AND CONCLUSIONS

The DTSC may approve non-hazardous classification of a waste which is determined to be hazardous by the criteria specified in Title 22, Article 11 of the CCR if the waste possesses mitigating physical or chemical characteristics that render it insignificant as a hazard to human health and safety and wildlife.

The analytical results for the waste material indicate that the only constituent which exceeds Title 22 regulatory criteria is soluble lead with a mean concentration of 6.9 mg/l. The material is not toxic with respect to oral or dermal exposures; is not reactive, corrosive, or ignitable; and does not contain Title 22 listed carcinogens. The material does contain low concentrations of VOCs and PNAs, for which there are no regulatory criteria.

The soluble lead concentrations are not considered a significant hazard to human health and safety and/or wildlife because of the established immobility of lead, the low concentrations of total lead (with 97 percent of the samples less than 200 mg/kg), and the very low concentrations of soluble lead by the TCLP. The low levels of VOCs and PNAs are not considered a significant hazard to human health and safety and/or wildlife based on the very low toxicities of the observed concentrations and the very low estimated pore water concentrations (if any water entered the Class II landfill, which is not expected). The Port of Oakland therefore requests the soil be classified as non-hazardous.

11.0 REFERENCES

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TABLE 1

SOIL SAMPLE PREPARATION AND TEST METHODS

Berth 30
Port of Oakland
Oakland, California

Analyte	Preparation Method	Test Method	Number of Samples Analzed	Laboratory
California Title 22 Total Metals	EPA 3050	EPA 6010	120	Clayton
Total Mercury	EPA 7471	EPA 7471	120	Clayton
Soluble Lead by the WET	CAM WET	EPA 6010	120	Clayton
Soluble Lead by the TCLP	EPA 1311	EPA 6010	120	Clayton
Soluble Mercury by the WET	CAM WET	EPA 7471	2	Clayton
Purgeable Organic Compounds	EPA 5030	EPA 8240	24	Clayton
Base/Neutral Acid Extractables	EPA 3550	EPA 8270	24	Clayton
Organochlorine Pesticides and Polychlorinated Biphenyls	EPA 3550	EPA 8080	12	Clayton
Ignitability	NA	SW 7.1.2	12	Clayton
Reactive Cyanide	NA	EPA 9010	12	Clayton
Reactive Sulfide	NA	SW 7.3.4.2	12	Clayton
pH	NA	EPA 9045	12	Clayton
Bioassay (Acute Aquatic Toxicity)	APHA 105 and ASTM E729	DHS ELAP Test No. 8.1	12	WBL

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TABLE 1

SOIL SAMPLE PREPARATION AND TEST METHODS

Notes:

1. EPA = U.S. Environmental Protection Agency
   WET = Waste Extraction Test
   TCLP = Toxicity Characteristic Leaching Procedure
   NA = Not applicable
   SW = Solid Waste
   APHA = American Public Health Association
   ASTM = American Society for Testing and Materials
   DHS = Department of Health Services
   ELAP = Environmental Laboratory Accreditation Program
2. Clayton = Clayton Environmental Consultants of Pleasanton, California
   WBL = Western Bioassay Laboratory of Walnut Creek, California
3. References for preparation and test methods:
   - U.S. Environmental Protection Agency Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 2nd Edition.
   - California Code of Regulations, Title 22, Section 66700.
   - California Code of Regulations, Title 22, Section 66261.24(a)(6)
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TABLE 2

METALS ANALYTICAL RESULTS FOR STOCKPILE SAMPLES
Berth 30
Port of Oakland
Oakland, California

Concentrations in parts per million (mg/l or mg/kg)

Stockpile Number	Sample Number	WET Lead	TCLP Lead	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn
2	2-2	6.3	0.1	2	4	98	0.1	0.3	24	8	41	98	0.9	ND	28	ND	ND	8	26	120
	2-8	5.4	ND	3	8	110	0.1	0.3	22	7	50	110	1.5	ND	30	ND	ND	7	26	170
	2-9	6.8	ND	2	4	100	0.1	0.3	24	7	48	130	1.0	1	27	ND	ND	6	26	130
	2-16	5.9	ND	5	5	120	0.1	0.4	24	11	41	130	1.4	ND	32	ND	ND	8	31	140
	2-17	8.0	ND	2	5	120	0.1	0.4	26	8	45	210	0.8	ND	31	ND	ND	7	30	130
	2-21	4.4	ND	3	6	93	ND	0.3	23	9	49	91	0.8	ND	31	ND	ND	7	26	150
	2-24	9.9	ND	2	5	83	0.1	0.4	21	7	110	96	1.4	ND	27	ND	ND	6	24	120
	2-26	4.1	0.1	2	7	87	0.1	0.5	25	7	41	110	1.8	ND	31	ND	ND	6	26	140
	2-29	4.7	ND	3	5	86	0.2	0.5	26	8	47	110	1.0	ND	30	ND	ND	9	27	130
	2-34	7.7	ND	4	7	85	0.1	0.3	23	8	42	110	1.2	ND	30	ND	ND	7	25	130
3	3-1	6.5	ND	2	6	85	0.2	0.2	23	7	71	100	1.4	ND	26	ND	ND	8	27	130
	3-13	4.9	ND	2	6	78	0.2	0.2	24	7	53	79	1.8	ND	30	ND	ND	8	28	110
	3-16	4.5	0.1	2	8	73	0.2	0.4	22	7	66	76	2.4	ND	28	ND	ND	9	27	120
	3-21	6.8	0.1	2	4	72	0.3	0.2	21	7	35	65	2.4	ND	27	ND	ND	8	24	100
	3-26	5.0	ND	2	6	100	0.2	0.2	25	8	240	75	1.7	ND	34	ND	ND	8	29	110
	3-27	6.6	ND	3	6	91	0.2	0.3	22	7	37	84	1.1	ND	28	ND	ND	5	26	130
	3-29	5.7	ND	3	6	88	0.1	0.4	27	8	64	90	1.2	ND	35	ND	ND	9	28	130
	3-30	9.6	ND	2	4	81	0.2	0.3	22	7	100	97	1.8	ND	26	ND	ND	6	27	140

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TABLE 2

METALS ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/l or mg/kg)

Stockpile Number	Sample Number	WET Lead	TCLP Lead	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn
3	3-35	7.5	ND	2	5	120	0.2	0.3	21	6	69	97	1.2	ND	27	ND	ND	7	25	120
	3-36	7.4	ND	3	5	98	0.2	0.5	22	7	35	87	1.1	ND	29	ND	ND	8	27	130
4	4-1	6.2	ND	2	5	95	ND	0.2	25	7	43	81	1.5	ND	32	1	ND	5	26	120
	4-4	3.6	ND	2	4	92	ND	0.2	23	8	54	57	0.6	ND	32	ND	ND	7	33	110
	4-9	8.9	ND	2	8	110	ND	0.6	25	8	47	160	0.5	ND	30	ND	ND	10	28	160
	4-11	4.6	ND	3	7	110	ND	0.4	31	8	55	160	0.3	ND	32	ND	ND	9	29	160
	4-14	21	ND	3	6	110	ND	0.4	29	9	68	110	0.6	ND	36	ND	ND	11	32	140
	4-15	5.6	ND	2	5	94	ND	0.3	21	8	58	88	1.5	ND	25	ND	ND	9	30	120
	4-21	32	ND	2	5	93	ND	0.4	22	8	51	100	0.9	ND	28	ND	ND	11	28	130
	4-22	43	ND	3	6	130	0.1	0.4	28	7	41	100	0.9	ND	29	ND	ND	10	30	150
	4-24	5.5	ND	2	5	94	ND	0.4	26	7	38	91	0.5	ND	33	ND	ND	11	26	140
	4-27	4.1	ND	2	3	84	ND	0.2	27	7	32	70	0.7	ND	29	ND	ND	9	25	110
5	5-5	9.4	ND	3	8	110	ND	0.3	24	8	51	150	0.5	ND	31	ND	ND	5	29	180
	5-10	8.6	ND	3	6	110	ND	0.2	25	7	76	140	1.1	ND	29	ND	ND	2	26	180
	5-11	11	ND	3	5	100	ND	0.2	23	7	46	100	0.7	ND	29	ND	ND	4	26	140
	5-17	5.9	ND	2	6	83	ND	0.2	26	7	110	160	1.2	ND	27	ND	ND	4	26	120
	5-19	1.4	ND	2	5	61	ND	0.2	32	10	34	32	0.1	ND	29	ND	ND	6	23	84
	5-25	4.9	ND	2	3	74	ND	ND	27	6	29	210	1.1	ND	27	ND	ND	2	22	100
	5-26	2.7	ND	1	5	63	ND	ND	27	8	24	41	0.3	ND	29	ND	ND	4	26	66

GEOMATRIX

TABLE 2

METALS ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/l or mg/kg)

Stockpile Number	Sample Number	WET Lead	TCLP Lead	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn
5	5-39	5.9	ND	2	2	92	ND	ND	25	8	43	110	0.6	ND	27	ND	ND	4	30	130
	5-44	10	ND	3	8	110	ND	0.3	26	8	39	170	0.4	ND	33	ND	ND	4	29	150
	5-49	12	ND	3	8	75	ND	0.2	21	9	53	120	1.1	ND	28	ND	ND	5	25	130
7	7-6	3.8	ND	2	5	95	0.1	0.2	28	8	44	67	0.4	ND	41	ND	ND	6	33	140
	7-7	5.8	ND	3	8	120	0.2	0.3	40	10	58	95	0.5	ND	62	ND	ND	9	36	130
	7-15	5.3	ND	3	8	110	0.1	0.2	34	9	42	81	0.3	ND	44	ND	ND	6	31	130
	7-16	8.5	ND	2	5	110	0.1	0.3	27	8	39	76	0.3	ND	38	ND	ND	7	29	120
	7-17	5.2	ND	2	4	110	0.1	0.5	29	8	45	86	0.4	ND	39	ND	ND	8	30	160
	7-18	5.2	ND	3	9	100	0.1	ND	50	12	93	86	0.4	ND	100	ND	ND	7	33	95
	7-33	3.4	ND	3	7	100	0.1	0.6	37	9	38	60	0.4	3	49	ND	ND	6	31	95
	7-34	5.0	ND	3	6	110	0.1	0.3	29	9	40	120	0.7	ND	40	ND	ND	8	32	120
	7-39	7.1	ND	2	6	110	0.1	0.2	27	8	65	120	0.8	ND	37	ND	ND	7	29	170
	7-40	9.6	ND	3	6	110	0.1	0.3	33	9	61	230	0.6	ND	48	ND	ND	9	32	140
8	8-2	7.4	ND	1	6	90	ND	0.2	21	6	36	67	0.5	ND	30	ND	ND	10	26	90
	8-6	7.0	ND	3	8	85	0.1	0.3	25	8	49	76	0.7	ND	31	ND	ND	10	28	110
	8-12	6.9	ND	2	7	88	ND	0.3	22	8	41	81	0.5	ND	32	ND	ND	11	27	110
	8-29	3.1	ND	2	8	74	ND	ND	28	8	24	24	0.3	ND	56	ND	ND	9	28	58
	8-31	7.5	ND	3	13	120	ND	0.3	34	9	33	70	0.4	ND	46	ND	ND	13	31	96
	8-34	7.1	ND	3	5	88	ND	0.2	24	7	53	94	1.6	ND	29	ND	ND	7	26	120

GEOMATRIX

TABLE 2

METALS ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/l or mg/kg)

Stockpile Number	Sample Number	WET Lead	TCLP Lead	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn
8	8-35	5.5	ND	2	11	85	ND	0.3	29	9	44	86	0.3	ND	45	ND	ND	13	29	110
	8-37	5.3	ND	3	2	100	0.1	0.3	26	10	36	75	0.3	1	82	ND	ND	12	32	120
	8-44	7.9	ND	2	3	110	ND	0.2	41	11	28	58	0.4	ND	53	ND	ND	8	25	95
	8-47	7.6	ND	2	8	88	ND	0.2	23	7	34	93	0.6	ND	33	ND	ND	9	25	110
9	9-1	8.2	ND	2	3	120	ND	0.4	21	8	62	79	0.1	ND	38	1	ND	5	19	120
	9-2	15	ND	3	10	110	0.2	0.3	30	9	60	150	0.3	ND	40	ND	ND	9	28	150
	9-4	9.2	ND	5	5	100	0.2	0.5	30	9	51	110	0.3	ND	38	2	ND	8	26	160
	9-10	5.4	ND	2	5	98	0.2	0.6	44	11	37	84	0.3	ND	72	ND	ND	7	31	130
	9-12	7.2	ND	3	15	100	0.3	0.5	29	9	64	120	0.2	ND	36	ND	ND	8	31	190
	9-14	14	ND	3	12	100	0.2	0.2	21	9	46	99	0.4	ND	27	ND	ND	7	36	130
	9-22	5	ND	3	8	180	0.2	0.7	62	14	50	110	0.3	ND	100	ND	ND	9	36	160
	9-27	9.4	0.3	3	7	120	0.2	0.5	33	9	47	110	0.7	ND	46	3	ND	8	30	150
	9-30	5.4	ND	7	17	89	0.1	1.4	26	9	42	110	1.3	3	38	8	ND	18	30	130
	9-31	8.5	ND	5	15	110	0.2	0.5	29	10	70	120	0.8	ND	42	2	ND	26	32	130
10	10-4	5.2	ND	3	7	71	0.2	0.4	25	7	120	86	0.3	ND	32	ND	ND	11	25	140
	10-7	5.7	ND	3	9	100	0.2	0.4	22	9	83	100	0.2	ND	28	ND	ND	10	25	130
	10-11	6	ND	3	8	76	0.2	0.3	27	7	95	94	0.2	ND	31	ND	ND	9	25	240
	10-12	3.7	ND	2	7	130	0.3	0.4	23	8	99	100	0.3	ND	29	2	ND	16	29	180
	10-13	7.1	ND	3	8	130	0.4	0.6	33	9	120	140	0.3	ND	36	ND	ND	15	36	190

GEOMATRIX

TABLE 2

METALS ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/l or mg/kg)

Stockpile Number	Sample Number	WET Lead	TCLP Lead	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn
10	10-15	3.7	ND	2	16	73	0.2	1.3	23	9	130	110	0.3	ND	33	ND	ND	15	25	1300
	10-19	11	ND	3	7	100	0.2	0.6	29	8	67	130	0.3	ND	37	ND	ND	8	28	130
	10-24	5.6	ND	2	10	91	0.2	0.6	23	7	55	95	0.3	ND	32	ND	ND	11	25	350
	10-29	16	ND	3	8	85	0.2	0.5	25	8	46	120	0.4	ND	32	ND	ND	11	29	130
	10-48	6.8	ND	2	7	78	0.2	0.3	21	6	58	120	0.7	ND	27	ND	ND	9	25	120
11	11-2	11	ND	4	1	100	0.2	0.4	20	8	120	150	0.4	1	32	ND	ND	3	29	210
	11-12	5	ND	3	6	83	0.2	0.4	22	8	120	180	0.2	1	35	ND	ND	4	24	180
	11-19	7.3	ND	2	5	88	0.2	0.3	24	7	65	110	0.3	ND	28	ND	ND	ND	26	150
	11-27	5.3	ND	2	5	80	0.2	0.4	28	9	52	73	0.2	ND	37	ND	ND	4	28	110
	11-28	2.9	ND	2	6	97	0.3	0.2	42	10	40	70	0.2	ND	56	ND	ND	4	35	120
	11-30	4.7	ND	2	5	91	0.2	0.4	27	8	45	86	0.3	ND	35	ND	ND	3	27	170
	11-31	4.9	ND	3	5	120	0.3	0.6	31	9	51	100	0.3	1	50	ND	ND	3	34	140
	11-32	6.5	ND	7	12	110	0.2	0.6	32	11	120	190	0.2	6	43	ND	ND	14	26	210
	11-34	6.2	ND	3	6	97	0.3	0.3	24	8	54	290	ND	ND	38	ND	ND	3	29	120
	11-43	4.9	ND	3	6	110	0.3	0.3	35	10	46	80	0.3	1	60	ND	ND	2	37	120
14	14-6	7.4	ND	2	4	85	0.2	0.5	26	9	100	71	0.5	ND	36	ND	ND	ND	27	140
	14-19	2.6	ND	3	3	180	0.2	0.3	33	8	61	70	0.4	ND	37	ND	ND	ND	28	170
	14-20	3.9	ND	2	4	94	0.2	0.3	35	8	43	59	1.1	ND	34	ND	ND	ND	26	98
	14-21	2.7	ND	3	6	140	0.4	0.3	24	9	44	59	1.9	ND	45	1	ND	ND	27	120

GEOMATRIX

TABLE 2

METALS ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/l or mg/kg)

Stockpile Number	Sample Number	WET Lead	TCLP Lead	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn
14	14-24	2.5	0.3	2	5	69	0.2	0.3	19	8	110	57	1.1	ND	27	ND	ND	ND	23	130
	14-28	4.7	ND	2	4	75	0.2	0.3	23	7	130	67	1.2	ND	28	ND	ND	ND	24	170
	14-30	4.6	0.4	2	5	75	0.2	0.3	24	8	74	72	1.3	ND	34	ND	ND	ND	26	120
	14-37	6.6	ND	2	4	51	0.2	0.2	26	7	78	76	1.6	ND	30	ND	ND	ND	20	110
	14-39	9.4	0.3	2	4	68	0.2	0.3	20	7	94	67	0.4	ND	30	ND	ND	ND	22	140
	14-40	4.1	ND	2	5	62	0.2	0.3	22	8	81	57	1.7	ND	32	ND	ND	ND	24	170
16	16-1	8.1	ND	2	6	74	0.1	0.3	23	7	55	81	0.5	ND	27	ND	ND	ND	22	150
	16-3	3.1	ND	2	6	55	0.1	0.3	30	8	37	50	0.4	ND	38	ND	ND	ND	25	90
	16-5	6.5	ND	3	6	74	0.1	0.4	23	8	53	92	0.6	ND	28	1	ND	ND	25	130
	16-15	4.4	ND	2	8	64	0.1	0.3	17	6	77	65	0.4	ND	23	ND	ND	ND	17	110
	16-16	2.0	ND	2	5	57	0.2	0.3	25	8	95	60	1.2	ND	32	ND	ND	ND	26	120
	16-18	5.8	ND	3	6	82	0.1	0.4	25	9	58	100	0.6	ND	37	ND	ND	ND	26	130
	16-26	4.4	ND	3	5	63	0.3	0.4	21	8	86	130	1.1	ND	29	ND	ND	ND	25	160
	16-27	3.7	ND	2	4	62	0.2	0.4	21	8	73	88	2.6	ND	28	ND	ND	ND	23	130
	16-33	4.6	ND	4	9	61	ND	0.5	16	9	75	100	0.4	ND	26	ND	ND	ND	23	200
	16-42	6.1	ND	3	5	81	0.1	0.3	23	7	69	120	0.9	ND	27	ND	ND	ND	25	140
17	17-2	4.7	ND	3	10	71	0.1	0.2	33	12	85	81	0.7	ND	40	ND	ND	ND	44	130
	17-7	6.5	ND	2	6	89	0.2	0.3	28	8	78	110	0.3	ND	32	ND	ND	ND	29	170
	17-11	7.8	ND	2	5	87	0.2	0.3	29	10	65	100	0.3	ND	36	ND	ND	ND	30	140

GEOMATRIX

TABLE 2

METALS ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/l or mg/kg)

Stockpile Number	Sample Number	WET Lead	TCLP Lead	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn
17	17-12	8.1	ND	2	5	79	0.1	0.3	20	8	66	120	0.4	ND	28	ND	ND	ND	24	150
	17-13	7.9	ND	2	5	80	0.1	0.2	23	7	66	110	0.5	ND	28	ND	ND	ND	24	150
	17-21	5.1	ND	2	6	76	0.1	0.3	26	8	91	92	1.1	ND	32	ND	ND	ND	28	170
	17-23	4.8	0.2	2	6	58	0.1	0.2	24	8	75	72	0.7	ND	31	ND	ND	ND	23	130
	17-30	2.7	ND	3	6	72	0.2	0.6	26	8	60	90	0.7	ND	33	ND	ND	ND	25	140
	17-32	5.2	ND	2	5	75	0.1	0.3	24	8	69	110	0.9	ND	29	ND	ND	ND	25	140
	17-36	2.5	ND	3	5	64	0.1	0.4	24	7	130	65	1.8	ND	30	ND	ND	ND	24	120

Notes:

1. Samples collected by Geomatrix Consultants, Inc., and analyzed by Clayton Environmental Consultants of Pleasanton, California.
2. Analyses performed in accordance with U.S. Environmental Protection Agency (EPA) Methods 6010 and 7471 for total metals and the Waste Extraction Test (WET) and EPA Method 1311 (TCLP) followed by EPA Method 6010 for soluble lead.
3. WET - Waste Extraction Test
   TCLP - Toxic Characteristic Leaching Procedure

Sb - Antimony	As - Arsenic	Ba - Barium	Be - Beryllium	Cd - Cadmium	Cr - Chromium
Co - Cobalt	Cu - Copper	Pb - Lead	Hg - Mercury	Mo - Molybdenum	Ni - Nickel
Se - Selenium	Ag - Silver	Tl - Thallium	V - Vanadium	Zn - Zinc	ND - Not detected

4. Samples 2-2, 3-27, 4-22, 5-10, 7-18, 8-34, 9-1, 10-29, 11-2, 14-19, 16-1, and 17-11 also analyzed for reactivity, corrosivity, and ignitability. Results indicate soil is not reactive (reactive cyanide not detected and sulfide ranged from not detected to 30 ppm), corrosive (pH ranges from 8.5 to 11.1), or ignitable.
5. Samples 3-16, 3-21, and 16-27 also analyzed for soluble mercury by the WET followed by EPA Method 7471. Results indicate that soil samples do not contain soluble mercury above the detection limit of 0.01 mg/l.
6. One replicate analysis of 11-2 had a concentration of 720 mg/kg. An additional 5 replicate analyses indicated concentrations ranging from 78 to 110 mg/kg.

GEOMATRIX

TABLE 3

EPA METHODS 8240, 8270, AND 8080
ANALYTICAL RESULTS FOR STOCKPILE SAMPLES
Berth 30
Port of Oakland
Oakland, California

Concentrations in parts per million (mg/kg)

Stockpile Number	Sample Number	EPA Method 8240 Compounds		EPA Method 8270 Compounds		EPA Method 8080 Compounds	
2	2-17	--		--		4,4'-DDE	0.06
						4,4'-DDD	0.16
						4,4'-DDT	0.29
	2-29	ND		ND		--	
	2-34	ND		Acenaphthene	2	--	
				Dibenzofuran	1		
				Fluorene	2		
				Phenanthrene	5		
				Anthracene	1		
				Fluoranthene	3		
				Pyrene	2		
3	3-13	Ethylbenzene	0.009	Naphthalene	8	--	
		Total Xylenes	0.018	2-methyl naphthalene	2		
		Acetone	0.03	Acenaphthene	3		
				Dibenzofuran	2		
				Fluorene	3		
				Phenanthrene	8		
				Anthracene	2		
				Fluoranthene	3		
				Pyrene	2		
	3-29	--		--		4,4'-DDE	0.07
						4,4'-DDD	0.12
						4,4'-DDT	0.22

GEOMATRIX

TABLE 3

EPA METHODS 8240, 8270, AND 8080
ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/kg)

Stockpile Number	Sample Number	EPA Method 8240 Compounds		EPA Method 8270 Compounds		EPA Method 8080 Compounds	
3	3-36	1,2-DCA	0.008	Naphthalene	3	--	
		Ethylbenzene	0.006	Acenaphthene	2		
		Total Xylenes	0.007	Phenanthrene	3		
				Fluoranthene	2		
				Pyrene	2		
4	4-15	ND		Naphthalene	2.0	--	
				2-methyl naphthalene	0.7		
				Acenaphthene	1.4		
				Dibenzofuran	0.7		
				Fluorene	1.2		
				Phenanthrene	2.9		
				Anthracene	0.8		
				Fluoranthene	1.7		
				Pyrene	1.8		
				Benzo(a)anthracene	0.3		
				Chrysene	0.4		
				Benzo(b)fluoranthene	0.8		
				Benzo(k)fluoranthene	0.2		
				Benzo(a)pyrene	0.3		
				Indeno(1,2,3-cd)pyrene	0.2		
				Benzo(ghi)perylene	0.3		
	4-24	--		--		4,4'-DDE	0.22
						4,4'-DDD	0.17
						4,4'-DDT	0.44

GEOMATRIX

TABLE 3

EPA METHODS 8240, 8270, AND 8080
ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/kg)

Stockpile Number	Sample Number	EPA Method 8240 Compounds	EPA Method 8270 Compounds		EPA Method 8080 Compounds	
4	4-27	ND	Naphthalene	1.0	--	
			2-methyl naphthalene	0.3		
			Acenaphthene	0.6		
			Dibenzofuran	0.3		
			Fluorene	0.6		
			Phenanthrene	1.9		
			Anthracene	0.7		
			Fluoranthene	2.0		
			Pyrene	1.7		
			Benzo(a)anthracene	0.5		
			Chrysene	0.5		
			Benzo(b)fluoranthene	0.7		
			Benzo(k)fluoranthene	0.2		
			Benzo(a)pyrene	0.3		
5	5-25	--	--		4,4'-DDE	0.19
					4,4'-DDD	0.08
					4,4'-DDT	0.11
	5-26	ND	Naphthalene	0.6	--	
			Acenaphthene	0.3		
			Fluorene	0.3		
			Phenanthrene	0.8		
			Anthracene	0.2		
			Fluoranthene	0.5		
			Pyrene	0.4		
			Benzo(b)fluoranthene	0.2		
	5-44	ND	ND		--	
7	7-6	ND	ND		--	

TABLE 3

EPA METHODS 8240, 8270, AND 8080
ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/kg)

Stockpile Number	Sample Number	EPA Method 8240 Compounds	EPA Method 8270 Compounds		EPA Method 8080 Compounds	
7	7-15	ND	ND		--	
	7-39	--	--		4,4'-DDE	0.07
					4,4'-DDD	0.15
					4,4'-DDT	0.26
8	8-31	--	--		4-4'-DDE	0.02
					4,4'-DDD	0.05
					4,4'-DDT	0.08
	8-34	ND	Naphthalene	4	--	
			Acenaphthene	4		
			Dibenzofuran	2		
			Fluorene	3		
			Phenanthrene	8		
			Anthracene	2		
			Fluoranthene	3		
			Pyrene	2		
	8-47	ND	Phenanthrene	2	--	

GEOMATRIX

TABLE 3

EPA METHODS 8240, 8270, AND 8080
ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/kg)

Stockpile Number	Sample Number	EPA Method 8240 Compounds	EPA Method 8270 Compounds		EPA Method 8080 Compounds	
9	9-2	ND	Naphthalene	0.5	--	
			Acenaphthene	0.6		
			Fluorene	0.5		
			Phenanthrene	1.5		
			Anthracene	0.3		
			Fluoranthene	0.8		
			Pyrene	0.6		
			Benzo(a)anthracene	0.2		
			Chrysene	0.2		
			Benzo(b)fluoranthene	0.4		
			Benzo(a)pyrene	0.2		
	9-12	--	--		4,4'-DDE	0.05
					4,4'-DDD	0.13
					4,4'-DDT	0.14
	9-14	ND	Naphthalene	0.4	--	
			Acenaphthene	0.2		
			Fluorene	0.2		
			Phenanthrene	0.6		
			Fluoranthene	0.5		
			Pyrene	0.4		
			Chrysene	0.2		
			Benzo(b)fluoranthene	0.4		
			Benzo(k)fluoranthene	0.2		
			Benzo(a)pyrene	0.3		
10	10-4	--	--		4-4'-DDD	0.06
					4-4'-DDT	0.08

GEOMATRIX

TABLE 3

EPA METHODS 8240, 8270, AND 8080
ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/kg)

Stockpile Number	Sample Number	EPA Method 8240 Compounds		EPA Method 8270 Compounds		EPA Method 8080 Compounds
10	10-13	Ethylbenzene	0.016	Naphthalene	6	--
		Total Xylenes	0.027	2-methyl naphthalene	1	
				Acenaphthene	4	
				Dibenzofuran	2	
				Fluorene	3	
				Phenanthrene	9	
				Anthracene	2	
				Fluoranthene	3	
				Pyrene	2	
	10-19	Total Xylenes	0.006	Naphthalene	2	--
				Acenaphthene	1	
				Fluorene	1	
				Phenanthrene	3	
				Fluoranthene	1	
				Pyrene	1	

GEOMATRIX

TABLE 3

EPA METHODS 8240, 8270, AND 8080
ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/kg)

Stockpile Number	Sample Number	EPA Method 8240 Compounds		EPA Method 8270 Compounds		EPA Method 8080 Compounds
11	11-12	Ethylbenzene	0.007	Naphthalene	2.1	--
		Total Xylenes	0.013	2-methyl naphthalene	0.6	
				Acenaphthene	1.5	
				Dibenzofuran	0.6	
				Fluorene	1.2	
				Phenanthrene	3.2	
				Anthracene	1.0	
				Fluoranthene	1.8	
				Pyrene	1.4	
				Benzo(a)anthracene	0.5	
				Chrysene	0.5	
				Benzo(b)fluoranthene	0.6	
				Benzo(k)fluoranthene	0.3	
				Benzo(a)pyrene	0.4	
	11-32		ND	Naphthalene	1.5	--
				2-methyl naphthalene	0.3	
				Acenaphthene	0.8	
				Dibenzofuran	0.4	
				Fluorene	0.7	
				Phenanthrene	2.4	
				Anthracene	0.6	
				Fluoranthene	1.3	
				Pyrene	1.0	
				Benzo(a)anthracene	0.4	
				Chrysene	0.4	
				Benzo(b)fluoranthene	0.4	
				Benzo(k)fluoranthene	0.2	
				Benzo(a)pyrene	0.3	

TABLE 3

EPA METHODS 8240, 8270, AND 8080
ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/kg)

Stockpile Number	Sample Number	EPA Method 8240 Compounds		EPA Method 8270 Compounds		EPA Method 8080 Compounds	
11	11-34	--		--		4,4'-DDE	0.031
						4,4'-DDD	0.040
						4,4'-DDT	0.19
14	14-6	Toluene	0.007	Naphthalene	3.6	--	
		Ethylbenzene	0.017	2-methyl naphthalene	1.0		
		Total Xylenes	0.035	Acenaphthene	1.2		
				Dibenzofuran	0.8		
				Fluorene	1.0		
				Phenanthrene	2.8		
				Anthracene	0.6		
				Fluoranthene	1.2		
				Pyrene	1.2		
				Benzo(a)anthracene	0.3		
				Chrysene	0.3		
				Benzo(b)fluoranthene	0.3		
				Benzo(k)fluoranthene	0.4		
	14-20	--		--		4,4'-DDE	0.020
						4,4'-DDD	0.026
						4,4'-DDT	0.072

GEOMATRIX

TABLE 3

EPA METHODS 8240, 8270, AND 8080
ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/kg)

Stockpile Number	Sample Number	EPA Method 8240 Compounds		EPA Method 8270 Compounds		EPA Method 8080 Compounds	
14	14-24	Toluene	0.012	Naphthalene	9.8	--	
		Ethylbenzene	0.032	2-methyl naphthalene	3.2		
		Total Xylenes	0.065	Acenaphthene	4.0		
				Dibenzofuran	2.9		
				Fluorene	3.4		
				Phenanthrene	10		
				Anthracene	2.3		
				Fluoranthene	2.8		
				Pyrene	2.8		
				Benzo(a)anthracene	0.5		
				Chrysene	0.5		
				Benzo(b)fluoranthene	0.3		
				Benzo(k)fluoranthene	0.3		
				Benzo(a)pyrene	0.3		
16	16-15	Toluene	0.005	Naphthalene	4	--	
		Ethylbenzene	0.019	Phenanthrene	4		
		Total Xylenes	0.036				
	16-16	Ethylbenzene	0.019	Naphthalene	6	--	
		Total Xylenes	0.028	Acenaphthene	2		
				Phenanthrene	4		
	16-26		--		--	4,4'-DDE	0.05
						4,4'-DDD	0.11
						4,4'-DDT	0.36
17	17-7	Ethylbenzene	0.007	Fluoranthene	2	--	
		Total Xylenes	0.016	Naphthalene	4		
				Phenanthrene	4		

GEOMATRIX

TABLE 3

EPA METHODS 8240, 8270, AND 8080
ANALYTICAL RESULTS FOR STOCKPILE SAMPLES

Concentrations in parts per million (mg/kg)

Stockpile Number	Sample Number	EPA Method 8240 Compounds	EPA Method 8270 Compounds		EPA Method 8080 Compounds	
17	17-23	ND	Naphthalene	3	--	
			Phenanthrene	2		
	17-32	--	--		4,4'-DDE	0.045
					4,4'-DDD	0.095
					4,4'-DDT	0.20

Notes:

1. Samples collected by Geomatrix Consultants, Inc., and analyzed by Clayton Environmental Consultants of Pleasanton, California in accordance with the analytical methods indicated. Two samples from each stockpile were analyzed by U.S. Environmental Protection Agency (EPA) Methods 8240 and 8270, and one sample from each stockpile was analyzed by EPA Method 8080.
2. -- = not analyzed
   ND = not detected
   1,2-DCA = 1,2-dichloroethane

GEOMATRIX

TABLE 4

SUMMARY OF METALS CONCENTRATIONS, BACKGROUND CONCENTRATIONS, AND REGULATORY CRITERIA

Berth 30
Port of Oakland
Oakland, California

Concentrations in parts per million (mg/kg)

Metals	Range	Mean[1]	Background[2]	TTLC[3]	10 x STLC[3]
Antimony	1-7	2.6	< 1-10	500	150
Arsenic	1-17	6.3	6.5-65	500	50
Barium	51-180	92.7	500-3000	10000	1000
Beryllium	< 0.1-0.4	0.1	< 1	75	7.5
Cadmium	< 0.1-1.4	0.4	--	100	10
Chromium	16-62	26.5	100-1000	2500	5600
Cobalt	6-14	8.2	15-70	8000	800
Copper	24-240	63.1	30-500	2500	250
Lead	24-290	100.4	30-300	1000	50
Mercury	< 0.1-2.6	0.8	0.082-1.3	20	2
Molybdenum	< 1-6	0.6	< 3	3500	3500
Nickel	25-100	35.6	30-300	2000	200
Selenium	< 1-8	0.2	< 0.1-0.5	100	10
Silver	< 0.5	--	--	500	50
Thallium	< 1-26	6.1	--	700	70
Vanadium	17-44	27.5	150-500	2400	240
Zinc	58-1300	146.5	120-400	5000	2500

Notes:

[1] Mean concentrations calculated using half the detection limit for samples reported as non-detect.
[2] Shacklette, H.T., and Boerngen, J.G., 1984, Element Concentrations in Soils and other Surficial Materials of the Conterminous United States, U.S. Geological Survey Professional Paper 1270.
[3] TTLC = Total Threshold Limit Concentration and STLC = Soluble Threshold Limit Concentration, California Code of Regulations, Title 22, Section 66261.24.

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TABLE 5

ACUTE ORAL AND DERMAL LD50 CALCULATIONS FOR COMPOUNDS DETECTED

Berth 30
Port of Oakland
Oakland, California

Compound	Mean Concentration (mg/kg)	% Mean Concentration	Oral LD50 (mg/kg)	% Mean/ Oral LD50	Dermal LD50 (mg/kg)	% Mean/ Dermal LD50
Toluene	0.0032	0.00000032	2600	1.23e-10	12220	2.62e-11
Ethylbenzene	0.0071	0.00000071	5460	1.30e-10	12220	5.81e-11
Total Xylenes	0.0135	0.00000135	4300	3.14e-10	12690	1.06e-10
Acetone	0.0108	0.00000108	8320	1.30e-10	10970	9.85e-11
1,2-dichloroethane	0.0027	0.00000027	670	4.03e-10	3400	7.94e-11
Naphthalene	2.77	0.000277	354	7.82e-07	2000	1.39e-07
2-methyl naphthalene	0.87	0.000087	354	2.46e-07	2000	4.35e-08
Acenaphthene	1.48	0.000148	354	4.18e-07	2000	7.40e-08
Fluorene	1.28	0.000128	354	3.62e-07	2000	6.40e-08
Phenanthrene	3.4	0.00034	354	9.60e-07	2000	1.70e-07
Anthracene	0.98	0.000098	354	2.77e-07	2000	4.90e-08
Fluoranthene	1.55	0.000155	354	4.38e-07	2350	6.60e-08
Pyrene	1.28	0.000128	354	3.62e-07	2000	6.40e-08
Chrysene	0.69	0.000069	354	1.95e-07	2000	3.45e-08

GEOMATRIX

TABLE 5

ACUTE ORAL AND DERMAL LD50 CALCULATIONS FOR COMPOUNDS DETECTED

Compound	Mean Concentration (mg/kg)	% Mean Concentration	Oral LD50 (mg/kg)	% Mean/ Oral LD50	Dermal LD50 (mg/kg)	% Mean/ Dermal LD50
Dibenzofuran	0.96	0.000096	354	2.71e-07	2000	4.80e-08
Benzo(a)anthracene	0.66	0.000066	354	1.86e-07	2000	3.30e-08
Benzo(b)fluoranthene	0.7	0.00007	354	1.98e-07	2000	3.50e-08
Benzo(k)fluoranthene	0.63	0.000063	354	1.78e-07	2000	3.15e-08
Indeno(1,2,3-cd)pyrene	0.58	0.000058	354	1.64e-07	2000	2.90e-08
Benzo(a)pyrene	0.64	0.000064	354	1.81e-07	2000	3.20e-08
Benzo(ghi)perylene	0.59	0.000059	354	1.67e-07	2000	2.95e-08
DDE	0.07	0.000007	113	6.19e-08	2510	2.79e-09
DDD	0.1	0.00001	3400	2.94e-09	10000	1.00e-09
DDT	0.2	0.00002	113	1.77e-07	2510	7.97e-09
Antimony	2.6	0.00026	7000	3.71e-08	--	--
Arsenic	6.3	0.00063	10	6.30e-05	--	--
Barium	92.7	0.00927	1980	4.68e-06	--	--
Beryllium	0.1	0.00001	18	5.56e-07	--	--
Cadmium	0.4	0.00004	40	1.00e-06	--	--
Chromium	26.5	0.00265	16.7	1.59e-04	--	--

GEOMATRIX

TABLE 5

ACUTE ORAL AND DERMAL LD50 CALCULATIONS FOR COMPOUNDS DETECTED

Compound	Mean Concentration (mg/kg)	% Mean Concentration	Oral LD50 (mg/kg)	% Mean/ Oral LD50	Dermal LD50 (mg/kg)	% Mean/ Dermal LD50
Cobalt	8.2	0.00082	75	1.09e-05	--	--
Copper	63.1	0.00631	100	6.31e-05	--	--
Lead	100.4	0.01004	191	5.26e-05	--	--
Mercury	0.8	0.00008	25.9	3.09e-06	--	--
Molybdenum	0.6	0.00006	114	5.26e-07	--	--
Nickel	35.6	0.00356	118	3.02e-05	--	--
Selenium	0.2	0.00002	6700	2.99e-09	--	--
Silver	NA	NA	NA	NA	--	--
Thallium	6.1	0.00061	32	1.91e-05	--	--
Vanadium	27.5	0.00275	31.2	8.81e-05	--	--
Zinc	146.5	0.01465	390	3.76e-05	--	--
			SUM =	5.39e-04	SUM =	9.54e-07
			Calculated Oral LD50 =	851,619 mg/kg	Calculated Dermal LD50 =	104,867,647 mg/kg

Notes:

1. Mean concentrations calculated using half the deflection limit for compounds reported as non-detect. Silver was not detected in any of the samples analyzed.
2. % Mean Concentration = (Mean Concentration in mg/kg)/10,000

GEOMATRIX

TABLE 5

ACUTE ORAL AND DERMAL LD50 CALCULATIONS FOR COMPOUNDS DETECTED

3. Oral and dermal LD50 values from:
   TOXNET, Hazardous Substance Database, 1993.
   TOXNET, Registry of Toxic Effects Chemical Sutstances Database, 1993.
   Smyth, Jr., H.F., Carpenter, Weil, C.S., et al, Range-finding Toxicity Data, List VI, American Industrial Hygiene Journal, 23:95-107 (1962).
   Agency for Toxic Substances and Disease Registry, U.S. Public Health Services (ATSDR), 1990 Toxicological Profile for Naphthalene and 2-methyl Naphthalene, PB91-180562, December.
   American Conference of Government Industrial Hygienist, Inc., 1991, Documentation of the Threshold Limit Values and Biological Exposure Indices, btn edition, Cincinnati, Ohio.
   ATSDR, 1988, Toxicological Profile for Beryllium, PB89-148233, December.
   ATSDR, 1989, Toxicological Profile for Chromium, PB89-236665, July.
   ATSDR, 1989, Toxicological Profile for Mercury, PB89-181256, December.
   ATSDR, 1989, Toxicological Profile for Selenium.
   ATSDR, 1992, Toxicological Profile for Thallium, TP-91/26.
   ATSDR, 1992, Toxicological Profile for Vanadium, TP-91/29.
   ATSDR, 1992, Draft Toxicological Profile for Zinc.
   ATSDR, 1988, Toxicological Profile for Nickel, PB89-160378, December.
   Lewis, Jr, R.L., 1992, Sax's Dangerous Properties of Industrial Materials, 8th edition, Volume III, Van Nostrand, Deinhold, New York.
4. Calculated LD50 = 100/SUM(% Mean Concentration/LD50)
5. If no compound specific LD50 value was available, the LD50 for similar compounds or the LDLo was used. The LD50 for DDT was ussed for DDE.
6. The metals detected are not dermally toxic, therefore the acute dermal toxicity calculation is for organic compounds only.

GEOMATRIX

TABLE 6

SW-846 STATISTICAL ANALYSIS FOR SOLUBLE LEAD STOCKPILE SAMPLES

Berth 30
Port of Oakland
Oakland, California

UPPER CONFIDENCE LEVEL:

$$UCL = \bar{x} + t_{.20}s_{\bar{x}}$$

where:

$\bar{x}$ = average concentration
$t_{.20}$ = student t-test value
$s_{\bar{x}}$ = the standard error of the sample set

UCL for soluble lead = 6.90 + 1.289(0.45) = 7.48 mg/l
Regulatory Threshold (RT) for soluble lead = 5 mg/l
If UCL is greater than RT, as in this case, the waste is hazardous.

NUMBER OF SAMPLES NEEDED TO CHARACTERIZE WASTE:

$$n = \frac{t_{.20}^2 s^2}{(RT - \bar{x})^2}$$

where:

$t_{.20}$ = student t-test value
s = standard deviation of the sample set
RT = regulatory threshold
$\bar{x}$ = average concentration

$$n = \frac{(1.289)^2\ (4.97)^2}{(5 - 6.90)^2}$$

n = 11.41

Number of samples tested was 120, therefore results are statistically representative.

GEOMATRIX

TABLE 7

ACUTE ORAL AND DERMAL LD50 CALCULATIONS
FOR PNAs AND VOCs
Berth 30
Port of Oakland
Oakland, California

Compound	Mean Concentration (mg/kg)	% Mean Concentration	Oral LD50 (mg/kg)	% Mean/Oral LD50	Dermal LD50 (mg/kg)	% Mean/ Dermal LD50
Toluene	0.0032	0.00000032	2600	1.23e-10	12220	2.62e-11
Ethylbenzene	0.0071	0.00000071	5460	1.30e-10	12220	5.81e-11
Total Xylenes	0.0135	0.00000135	4300	3.14e-10	12690	1.06e-10
Acetone	0.0108	0.00000108	8320	1.30e-10	10970	9.85e-11
1,2-dichloroethane	0.0027	0.00000027	670	4.03e-10	3400	7.94e-11
Naphthalene	2.77	0.000277	354	7.82e-07	2000	1.39e-07
2-methyl naphthalene	0.87	0.000087	354	2.46e-07	2000	4.35e-08
Acenaphthene	1.48	0.000148	354	4.18e-07	2000	7.40e-08
Fluorene	1.28	0.000128	354	3.62e-07	2000	6.40e-08
Phenanthrene	3.4	0.00034	354	9.60e-07	2000	1.70e-07
Anthracene	0.98	0.000098	354	2.77e-07	2000	4.90e-08
Fluoranthene	1.55	0.000155	354	4.38e-07	2350	6.60e-08
Pyrene	1.28	0.000128	354	3.62e-07	2000	6.40e-08
Chrysene	0.69	0.000069	354	1.95e-07	2000	3.45e-08
Dibenzofuran	0.96	0.000096	354	2.71e-07	2000	4.80e-08

GEOMATRIX

TABLE 8

CALCULATIONS OF PARTITION COEFFICIENTS

Berth 30
Port of Oakland
Oakland, California

Compound	Solubility[1] (mg/l)	Koc[2]	Kp[3]
Toluene	542	180	0.18
Ethylbenzene	165	376	0.38
Xylenes	199	335	0.33
Acetone[4]	--	--	--
1,2-Dichloroethane	8680	32.22	0.03
Naphthalene	32.1	1,037	1.04
2-methyl naphthalene	27	1,155	1.15
Acenaphthene	3.9	3,833	3.83
Dibenzofuran	10	2,138	2.14
Fluorene	1.9	5,986	5.99
Phenanthrene	1.6	6,660	6.66
Anthracene	1.29	7,611	7.61
Fluoranthene	0.265	20,304	20.30
Pyrene	0.032	75,302	75.30
Chrysene	0.006	212,592	212.59
Benzo(a)anthracene	0.01	154,882	154.88
Benzo(b)fluoranthene	0.014	125,719	125.72
Benzo(k)fluoranthene	0.00076	765,413	765.41
Benzo(a)pyrene	0.003	326,727	326.73
Benzo(ghi)perylene	0.00026	1,488,389	1,488.39
Indeno(1,2,3-cd)pyrene	0.62	49,971	49.97

[1] Solubilities taken from Roy, W.R., and Griffin, R.A., 1985, "Mobility of Organic Solvents in Water-Saturated Soil Materials," Environmental Geology Water Science, Volume 7, Number 4.

[2] Koc is octanol/water partition coefficient; log(Koc) = 3.95 - 0.62 log(S) where S is solubility (Roy and Griffin, 1985).

[3] Kp = soil/water partitioning coefficient (l/kg)
= (mg/kg in soil)/(mg/l in water) at equilibrium;
Kp = Koc x foc, where foc is fraction of organic carbon; in this case, assumed to be 0.001.

[4] Acetone is completely soluble in water.

GEOMATRIX

TABLE 9

COMPARISON OF ESTIMATED PORE WATER CONCENTRATIONS WITH WATER QUALITY CRITERIA

Berth 30
Port of Oakland
Oakland, California

Compound	Mean Concentration[1] (mg/kg)	Kp	Estimated Pore Water Concentration[2] (mg/l)	Attenuation Factor	Attenuated Concentration (mg/l)	Basin Plan[3]	California Drinking Water[4] (mg/l)
Toluene	0.0032	0.18	0.0178	10	0.0018	--	0.1 (1.0 EPA)
Ethylbenzene	0.0071	0.38	0.0187	10	0.0019	--	0.68 (0.7 EPA)
Total Xylenes	0.0135	0.33	0.0409	10	0.0041	--	1.75 (10 EPA)
Acetone	0.0108	--	--	--	--	--	--
1,2-dichloroethane	0.0027	0.03	0.09	10	0.009	--	0.0005 (0.005 EPA)
Naphthalene	2.77	1.04	2.6642	10	0.2664	--	--
2-methyl naphthalene	0.87	1.15	0.7572	10	0.0757	--	--
Acenaphthene	1.48	3.83	0.3873	10	0.0387	--	--
Fluorene	1.28	5.99	0.2128	10	0.0213	--	--
Phenanthrene	3.4	6.66	0.5105	10	0.0510	--	--
Anthracene	0.98	7.61	0.1292	10	0.0129	--	--
Fluoranthene	1.55	20.30	0.0761	10	0.0076	--	--
Pyrene	1.28	75.30	0.0170	10	0.0017	--	--
Chrysene	0.69	212.59	0.0032	10	0.0003	--	--

GEOMATRIX

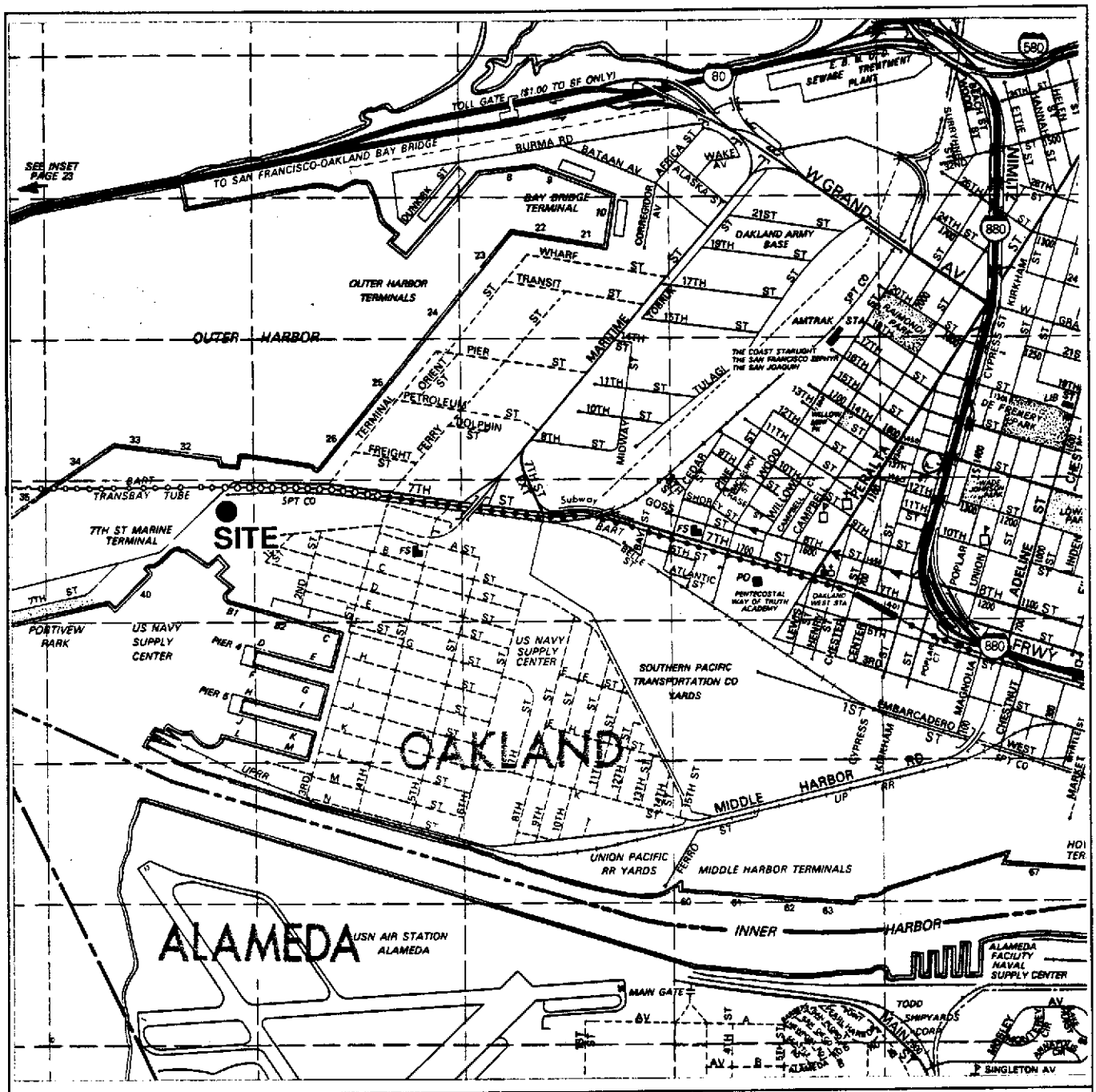
TABLE 9

COMPARISON OF ESTIMATED PORE WATER CONCENTRATIONS WITH WATER QUALITY CRITERIA

Compound	Mean Concentration[1] (mg/kg)	Kp	Estimated Pore Water Concentration[2] (mg/l)	Attenuation Factor	Attenuated Concentration (mg/l)	Basin Plan[3]	California Drinking Water[4] (mg/l)
Dibenzofuran	0.96	2.14	0.4478	10	0.0448	--	--
Benzo(a)anthracene	0.66	154.88	0.0043	10	0.0004	--	--
Benzo(b)fluoranthene	0.70	125.72	0.0056	10	0.0006	--	--
Benzo(k)fluoranthene	0.63	765.41	0.0008	10	0.0001	--	--
Indeno(1,2,3-cd)pyrene	0.58	49.97	0.0116	10	0.0012	--	--
Benzo(a)pyrene	0.64	326.73	0.0020	10	0.0002	--	(0.0002 EPA)[5]
Benzo(ghi)perylene	0.59	1,488.39	0.0004	10	0.00004	--	--

Notes:

1 Mean concentrations calculated using half the detection limit for compounds reported as non-detect.
2 Estimated pore water concentrations = Mean Concentration/Kp (mg/l).
3 Deep marine water effluent limitations, aquatic life daily average, California Regional Water Quality Control Board, San Francisco Bay Region, 1992, Basin Plan, Resolution 92-117, 16 September.
4 California Drinking Water Criteria include maximum contaminant levels (MCLs) and Action Levels (Region 9, U.S. Environmental Protection Agency [EPA] Drinking Water Standards and Health Advisory Table; Bruce Macler, Public Water Supply Section, December 1992)). If the EPA criteria is different from the California criteria, the criterion is shown in parentheses.
5 Effective January 1994.



GEOMATRIX	SITE LOCATION MAP Berth 30 - Port of Oakland 2801 Seventh Street Oakland, California	Figure 1 Project No. 2026.06

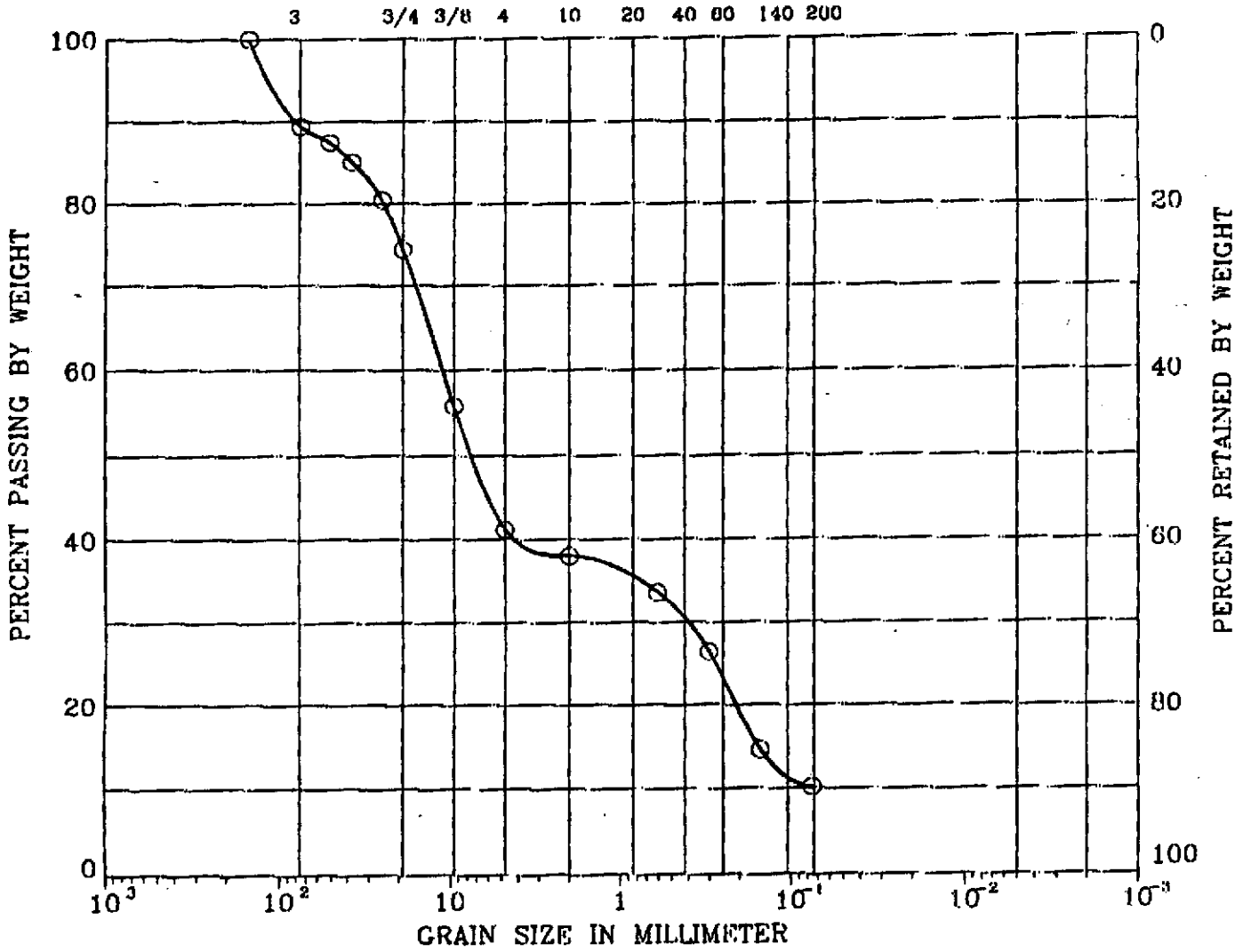
GEOMATRIX

APPENDIX A

GRAIN SIZE DISTRIBUTION CURVE

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
O	1				Brown gravel w/silt (GM-GP)

Remark :

Project No.109.024	Geomatrix 2026.061
Cooper Testing Labs Mountain View CA	GRAIN SIZE DISTRIBUTION Figure No.

Cooper Testing Laboratories

Project No.109.024

Geomatrix 2026.06I

Figure No.

BORING	DEPTH	% COBBLES	% GRAVEL	% SAND	% FINE	% SILT	% CLAY	Cu	Cc
1		12.65	46.14	31.09	10.12				

1

Grain Size (mm)	% Finer	Grain Size (mm)	% Finer	Grain Size (mm)	% Finer	Grain Size (mm)	% Finer
0.0750	10.12						
0.1500	14.55						
0.3000	26.37						
0.6000	33.67						
2.0000	38.10						
4.7500	41.21						
9.5250	55.72						
19.0500	74.49						
25.4000	80.49						
38.1000	85.05						
50.8000	87.35						
76.2000	89.40						
152.4000	100.00						

GEOMATRIX

APPENDIX B

CHAIN-OF-CUSTODY RECORDS, REQUEST FOR ANALYSIS FORMS, AND ANALYTICAL LABORATORY REPORTS

(SEE VOLUME 2)

GEOMATRIX

APPENDIX B

CHAIN-OF-CUSTODY RECORDS, REQUEST FOR ANALYSIS FORMS, AND ANALYTICAL LABORATORY REPORTS

(SEE VOLUME 2)

APPENDIX C

ANALYTICAL LABORATORY PERSONNEL RESUMES

Name:	**Ronald Marvin Block**
Present Position:	Principal and Environmental Toxicologist
Education:	B.A. 1967, University of Alaska, Major: Zoology M.S. 1972, University of North Dakota, Major: Physiology Ph.D. 1974, University of North Dakota, Major: Biochemistry
Professional Societies:	American Association for the Advancement of Science Society for Risk Analysis Air Pollution Control Association New York Academy of Sciences Society of Environmental Toxicology and Chemistry Sigma XI
Registrations:	California Registered Environmental Assessor, REA-00870
Awards and Honors:	MacIntosch Scholarship (1966-67) AEC Fellowship (1972-73) Adjunct Research Associate, Dept. of Pathology, University of Maryland Medical School, Baltimore, MD (1977 - Present) Marquis's Who's Who in the East (17th ed., 1982-84) Marquis's Who's Who in the West (18th ed., to 23nd ed., 1984-92)
Committees:	Chairman, Air Pollution Control Association Committee on Regulating Air Toxics - 1989 HazMat Certificate Advisory Board, UC Berkley-Present National Advisory Board, Findlay College - Present National Editorial Board, HAZMAT WORLD - Present Advisory Board, HAZMAT WEST Member, Working Group on Toxic Substances Bi-State Conference on the Chesapeake Bay, 1977. Member, ASTM Committee F-20, Hazardous Material Spill Control Systems. Association, Northern Division, Fire Prevention Officer's Section, 1984 - present. Appointed Member, Sonoma County Hazardous Material Management Council, 1984-1986. Expert witness: Pennsylvania Superior Court; Alameda Superior, Los Angeles Superior Court - Environmental Toxicologist, and Hazardous Waste Management Specialist.

Current Teaching Responsibilities:

1. Instructor, "Principles of Hazardous Materials Management", "Site Assessments", Health and Environmental Effects of Hazardous Materials, Risk Assessment, Storm Water Compliance at University of California, Berkeley, CA (1990 - present).
2. Instructor, "Principles of Hazardous Material Management", "Proposition 65 Compliance", "Site Assessments", Complying with AB 2588, at University of California, Santa Cruz, CA (1987 - 1990).

3. Instructor for National Groundwater Association Course, "Risk Assessment for The Environmental Professional (1986 - present).

Experience:

May 1984 - Present. Principal and Technical Advisor. Aqua Terra Technologies, Inc., Walnut Creek, CA.

Development of human health and environmental risk assessment for contaminated waste sites, conduct environmental toxicology studies for air, groundwater and surface water contamination on human health and the environment. Project management experience includes providing supervision for projects involving environmental site assessments; risk assessments (Endangerment Assessments and Public Health and Environmental Evaluations); remedial investigation/ feasibility studies; evaluation of indoor air quality including new and sick building syndrome and development of acceptable levels of toxics in ambient air; proper management and disposal of infectious and radioactive wastes; interpretation of federal, state and local environmental regulatory requirements to ensure client compliance; preparation and implementation of health and safety plans; and provide liaison between regulatory agencies and clients in the development of compliance programs with regards to hazardous wastes and toxic materials. Experience also includes providing expert witness testimony in the area of toxicology and hazardous waste management.

1979 - 1984. Project Manager. Kennedy/Jenks Engineers, San Francisco, CA.

Regulatory analysis with emphasis on TSCA, CWA, and RCRA policy and regulations for industrial compliance.

Specific experience included development of hazardous waste management plans, assessments, remedial action, closure and post closure of hazardous waste sites, permit preparation, delisting of hazardous wastes under RCRA, and the performance of industrial environmental audits.

Other experience has included toxicological development and evaluation of pollutant criteria and action levels for groundwater, streams, estuaries and marine environments, new product toxicity evaluation, innovative toxicity design studies, toxicity acceptance studies for drinking water polymers, and expert witness in toxicology and hazardous waste.

Specific industrial experience has included mining, petroleum, electronics, chemical, automobile manufacturer, steam electric stations, railroad, military, hospitals and municipal agencies.

1978 - 1979. Senior Scientist. Tetra Tech, Inc., Lafayette, CA.

Developed environmental toxicology and physiology programs. Responsibilities included paper studies on oil/oil dispersant effects, pesticide evaluation, acid rain impact, sewage treatment plant impact on aquatic environments, impact of organics in drinking water on human health, and dredged material effects to marine biota.

1977 - 1978. Project Scientist. Potomac Research, Inc., Panama City, FL.

Toxicological evaluation of drilling mud components on a variety of species found in the Gulf of Mexico using acute bioassays and community diversity studies.

Responsibilities included direction of continuous flow laboratory 14 miles at sea, experimental design, and data interpretation (funded by EPA).

1975 - 1977. Research Associate. University of Maryland, Chesapeake Biological Lab, Solomons, MD.

Principal Investigator on environmental toxicological programs which included chlorine, ozone, phthlates, metals, chaff material, and other organics. Test species included oyster larvae, fish, phytoplankton and other invertebrate species.

Principal Investigator of the Chlorination Workshop. Responsibilities included organization, preparation and publication of the workshop and its proceedings (funded by EPA).

Director of NSF Summer Student Program (1977).

Chairman of Controlled Environmental Laboratory (1976 - 1977).

1973 - 1975. Research Associate. University of Maryland, Chesapeake Biological Laboratory, Hallowing Point Field Station, MD.

Program Manager for ichthyoplankton investigations on the Potomac River. Studies were concerned with horizontal and vertical distribution of fish eggs and larvae.

1972 - 1973. AEC Graduate Fellow. Battelle Northwest, Richland, WA.

Completed doctoral research on temperature and salinity effects on osmoregulatory functions in rainbow trout and channel catfish.

1969 - 1972. Research Assistant. University of North Dakota, Grand Forks, ND.

Developed water chemistry programs to investigate the pollution of rivers and lakes in North Dakota.

1967 - 1969. Analytical Chemist. Alaska Water Laboratory (FWPCA), Fairbanks, AK.

Conducted chemical analyses of water from lakes and rivers in Alaska to determine effects of cold climate on water quality and nutrient cycling.

Publications:

Block, R.M. April 1992. Conducting an Ecological Risk Assessment for Sites Contaminated with Petroleum Hydrocarbons. Hydrocarbon Symposium, Abstract, Long Beach, CA

Block, R.M., K.D. Jennings, November, 1990. A Simplified Approach to Environmental Risk Assessments at Superfund Sites. Society for Environmental Toxicological and Chemical, Abstract, pp. 24, SETAC 90, Washington, D.C.

Block, R.M. 1990. Air Toxics, Regulatory Implications, HAZMAT WEST, Long Beach, CA. November 6-8, 1990.

Block, R.M. 1989. Complying with AB 2588, A Consultant's Perspective. HAZMAT WEST, 1989. November 3-7, 1989.

Sheehan, P.J., R.W. Schneiter, T.K.G. Mohr and R.M. Block, 1987. Bioreclamation of Gasoline Contaminated Groundwater: Step by Step. Eighth Annual Meeting, Society of Environmental Toxicology and Chemistry, Pensacola, Florida. November 1987.

Block, R.M., Levin, Hale J., October, 1987. The 3rd Annual Hazardous Material Management Conference West. Solid Waste Assessment Testing: Where Is It and Where Is It Going?.

Block, R.M. 1986. Risk Analysis. National Water Well Association Symposium on Anatomy of Superfund. Kansas City, MO. September 24-27, 1986.

Block, R.M. 1986. Risk Assessment - A Consultants Guideline. Proceedings of the Hazardous Materials Management Conference/86. pp. 273-278. Tower Management Conference.

Block, R.M. 1985. Development of Clean-Up Criteria - A Consultants Perspective. Proceedings of the Hazardous Materials Management Conference/West 85', pp. 501-513.

Smith, L.R., R.M. Block, and T.M. Holsen. 1985. Studies on the Acute Toxicity of Fluoride to Several Species of Fish. Chemosphere, 14(9):1383-1389.

Block, R.M. and R.W. Schneiter. 1985. Development of Toxicological Criteria for the Protection of Human Health. Proceedings of Environmental and Public Health Effects of Soils with Petroleum Products. University of Massachusetts, Amherst, MA.

Block, R.M., J. Dragun, and T.W. Kalinowski. 1984. Chemical Engineering Aspects of Groundwater Contamination: II. Health and Environmental Aspects of Setting Cleanup Criteria. Chemical Engineering, 19(24):70-73.

Block, R.M., R.M. Kennedy. 1983. California and EPA Hazardous Waste Regulations. J. Professional Issues in Engineering, 109(1):10-17.

Block, R.M. and T.W. Kalinowski, 1983. Disposing of Old Drums under the RCRA Regulations II. Chemical Engineering, 90(8):103-105.

Block, R.M., D.T. Burton, S.R. Gullans and L.B. Richardson. 1978. Respiratory and Osmoregulatory Responses of White Perch (Morone americana) Exposed to Chlorine and Ozone in Estuarine Waters. In: Water Chlorination: Environmental Impact and Health Effects, edited by R.L. Jolley, Ann Arbor Science Publishers, Inc., pp. 351-360.

Helz, G.R., R.Y. Hsu and R.M. Block. 1978. Bromoform Production by Oxidative Biocides in Marine Waters. In: Ozone-Chlorine Dioxide Oxidation Production of Organic Materials, edited by R.G. Rice, J.A. Cotruro and M.E. Browning, pp. 68-76.

Roosenburg, W.H., R.M. Block, and J.C. Rhoderick. 1977. The Influence of Chlorine Produced Oxidants on Larval Stages of the Soft Shell Clam, Mya arenaria. Assoc. So. East/Biol. Bulletin, 24(2):82.

Rhoderick, J.C., R.M. Block, W.H. Roosenburg and K. Drobeck. 1977. Effects of Chlorination to the American Oyster, Crassostrea virginica, at Two Temperatures. Assoc. So. East. Biol. Bulletin, 24(2):80.

Vreenegoor, S.M., R.M. Block, J.C. Rhoderick, and S.R. Gullans. 1977. The Effects of Chlorination on the Osmoregulatory Ability of the Blue Crab, Callinectes sapidus. Assoc. So. East. Biol. Bulletin, 24(2):93.

Block, R.M., S.R. Gullans and J.C. Rhoderick. 1977. Physiological Response of White Perch, Morone Americana, to Chlorine. Published in Assoc. So. East. Biol. Bulletin, 24(2):37.

Block, R.M. 1977. Physiological Responses of Estuarine Organisms to Chlorine. Chlorination Workshop Proceedings, Ches. Sci., 18(1):156-160.

Block, R.M., G.R. Helz and W.P. Davis. 1977. The Fate and Effect of Chlorine in Coastal Waters, Chlorination Workshop Proceedings. Ches. Sci., 18(1):97-101, 1977.

Block, R.M. and G.R. Helz (Eds) 1977. Proceedings of the Chlorination Workshop. Ches. Sci., 18(1):97-160.

Gullans, S.R., R.M. Block and J.C. Rhoderick. 1977. Effects of Continuous Chlorination on White Perch (Morone americana) and Atlantic Menhaden (Brevoortia tyrannus) at Two Temperatures. Assoc. So. East Biol. Bulletin, 24(2):55.

Liden, J.H., D.T. Burton, S.L. Margrey, R.M. Block, and J.C. Rhoderick. 1977. Effects of Chlorinated and Bromochlorinated Power Plant Condenser Cooling Waters on Survival and Blood pH of Atlantic Menhaden (Brevoortia tyrannus) and Spot (Leiostromus xanthurus). Assoc. So. East Biol. Bulletin, 24(2):66.

Block, R.M. 1975. Effects of Temperature and Salinity on the Osmotic Adjustment in the Euryhaline Rainbow Trout, Salmo gairdneri Richardson and the Stenohaline Channel Catfish, Ictalurus punctatus (Rafinesque). Dissertation Abstracts, 35(10).

Block, R.M. 1974. Effects of Temperature and Salinity on the Osmotic Adjustment in the Euryhaline Rainbow Trout, Salmo gairdneri Richardson and the Stenohaline Channel Catfish, Ictalurus punctatus (Rafinesque). Doctoral Dissertation, University of North Dakota, 161 pp.

Block, R.M. 1974. Effects of Acute Cold Shock on the Channel Catfish, Ictalurus punctatus in: Thermal Ecology. J.W. Gibbons and R.R. Sharitz (Eds.), AEC Symposium Series, (CONF-730505), pp. 109-118.

Block, R.M. 1972. Free Amino Acids and Salts as an Osmoregulatory Substance in Three Species of Fish. Master's Thesis, University of North Dakota, Grand Forks, North Dakota. pp. 59.

Block, R.M. 1969. Methods for the Chemical Analysis of Fresh Water. 59 pp. Alaska Water Laboratory, College, Alaska.

Name: **Julianne Christine Fegley**

Present Position: Biologist

Education: B.S. 1973. Biology with a Chemistry minor, Western Washington State College, Bellingham, WA.
Graduate work in Fisheries, 1976-1981, University of Washington, Seattle, WA.
Education Certification Program, 1985-1986, Secondary Biology, Chemistry, and General Science University of Alaska, Anchorage, AK.

Experience: 1989 - Present. Biologist. Aqua Terra Technologies, Inc., Walnut Creek, CA.

Ms. Fegley serves as a field biologist and data analyst for programs involving biomonitoring of treated effluent prior to discharge into marine waters. Ms. Fegley is involved in biological resource assessments of estuarine intertidal habitats; she is also involved in the preparation of environmental sampling plans as part of remedial investigations. Ms. Fegley is involved in ecological risk assessment projects using bioaccumulation studies and toxicity testing to assess potential exposure of non-human receptors to chemicals of concern in aquatic systems. She is responsible for review of aquatic toxicity data and evaluation of laboratory reports.

Ms. Fegley is involved in permitting matters which require use of aquatic toxicity tests. These include State of California Title 22 Hazardous Waste Certification, NPDES point source and stormwater discharge permits, and EPA/Corps of Engineers dredge and disposal permits.

Ms. Fegley serves as a liaison between ATT's Environmental Consulting sector and ATT's bioassay laboratory. She provides technical review of the laboratory quality assurance/quality control program (QA/QC) and procedures and reports to the laboratory director. Ms. Fegley also serves as the laboratory safety officer; her duties include maintenance of laboratory MSDS and periodic review for revision of the laboratory's injury and illness prevention program.

1988. Assistant Environmental Scientist. Dames & Moore, San Francisco, CA.

Ms. Fegley was involved in preparation of environmental documents pursuant to guidelines presented in the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). She performed field reconnaissance to assess habitat and species potentially affected by proposed projects. Ms. Fegley utilized procedures for identification of wetlands pursuant to U.S. Fish and Wildlife Service, EPA, and the U.S. Army Corps of Engineers determination procedures. Ms. Fegley performed site assessments which involved site examination and examination of available maps,

aerial photographs, and records in order to evaluate site history and hazardous materials onsite. She also provided assistance in project management.

1979-1981. Fisheries Biologist. National Marine Fisheries Service Seattle, WA.

Ms. Fegley served as a fisheries biologist during the Marine Ecosystems Survey and Assessment of Puget Sound. She participated in the field collection of target marine invertebrate species; processed specimens for histological examination; and performed pathological examinations of specimens, utilizing photomicrography to document conditions. Ms. Fegley devised a computerized recording system and format for data storage. She was involved in all aspects of the preparation and presentation of laboratory reports and publications. Ms. Fegley has been formally trained in both fish and invertebrate pathology.

1976-1979. Fisheries Biologist. Fisheries Research Institute University of Washington, Seattle, WA.

Ms. Fegley served as a fisheries biologist during the Puget Sound Nearshore Fish and Microinvertebrate Assemblages Study. She supervised and trained laboratory technicians in the identification of predatory fish and invertebrate prey species encountered in food web studies. Ms. Fegley served as an epibenthic and benthic fish and invertebrate taxonomist for Seattle Metropolitan Sewage Outfall Baseline Study and the Kodiak Nearshore Fish Assemblages Study, Alaska Department of Fish and Game.

Name: Glen Richard Daggett

Present Position: Aquatic Biologist

Education: B.A., Biology, 1972. Sonoma State University.
1978-1979, University of California Davis at Sonoma State: Biochemistry, Advanced Organic Chemistry, Calculus I, II and III.

Professional Societies: Bodega Marine Science Association

Experience: July 1, 1992 - Present. Marine Criticle Life-Stage Testing Specialist/Senior Culturist. Western Bioassay Laboratory, Walnut Creek, CA

Mr. Daggett is in charge of all criticle life-stage bioassays performed on marine organisms. His duties include supervision of test set-up, generation and statistical analysis of data, report preparation, and training and supervision of all technicians assisting in marine criticle lifestage bioassays. Mr. Daggett also serves as senior culturist. His duties include set-up and maintenance of fish and invertebrate cultures and holding tanks, determination and maintenance of the health of test organisms, maintaining marine shellfish in spawning condition for criticle lifestage testing, and inspection of temperature control, aeration and water filtration equipment for proper function. Mr. Daggett is responsible for monitoring the culture and equipment logs for the laboratory; he advises when cultured organisms are suitable for use in bioassays, and oversees service and maintenance of culture equipment.

1988 - June 30, 1992. Bioassay Scientist. Aqua Terra Technologies, Inc., Walnut Creek, CA.

Mr. Daggett served as a bioassay scientist with ATT's Aquatic Bioassay Laboratory. He was responsible for the day-to-day operations of the bioassay services program. He planned, conducted, and interpreted bioassays performed in accordance with Title 22 and NPDES requirements. He maintained cultures of bioassay organisms. He prepared and maintained records of samples, organisms and testing procedures to document quality assurance in bioassay testing.

1986 - 1988. Manager Bioassay Services. NET Pacific, Inc. (formerly ANATEC). Mr. Daggett designed and maintained bioassay test and culture systems including flow-through delivery, recirculating holding tanks, treatment center and general plumbing. He also designed and built specialized systems for on-site testing. Mr. Daggett assisted in routine and specialized bioassay functions including test set-ups, water quality control monitoring, test termination and culturing techniques.

He trained and supervised NET Pacific staff in on-site monitoring procedures, and coordinated interdepartmental activities with client's personnel.

1981 - 1983. Assistant Manager. Petaluma Wholesale Fish and Lobster Company.

Mr. Daggett constructed and maintained a 3,500 gallon refrigerated recirculating seawater system for holding live seafoods, primarily Atlantic lobsters. He performed maintenance, quality control, and delivery of seafood.

1973 - 1983. Staff Research, Associate II. University of California, Crustacean Aquaculture Project, Bodega Marine Laboratory, Bodega Bay, CA.

Mr. Daggett designed and constructed experimental crustacean rearing system, collected and analyzed water quality data, prepared progress and monitoring reports for the University and California Water Quality Control Board, and trained and supervised laboratory assistants. He was responsible for maintenance of laboratory equipment. Mr. Daggett advised staff members, students, state agencies and private aquaculture enterprises on water quality problems in aquaculture and provided analytical services for interdepartmental aquaculture groups (i.e., nutrition, genetics, etc).

Mr. Daggett operated a variety of laboratory equipment including: Techicon Auto Analyzer II (automated spectrophotometer), total organic carbon analyzer, infrared spectrophotometer, particle counter, H.P. gas chromatographs, ultracentrifuge, pH meters, dissolved oxygen meters, turbidity meters, salinity meters, and moisture analyzers.

1973. Graduate student assistant. California Regional Water Quality Control Board. Santa Rosa, CA.

Mr. Daggett's duties included: water analysis (i.e., total phosphorus, nitrates, chlorine, dissolved oxygen, suspended solids, settleable solids, pH, alkalinity, electroconductivity, BOD, and trace elements), algae growth potential, and particle size analysis. He participated in a variety of studies which involved identification of aquatic organisms, non-point source discharges, biological monitoring, field and aerial surveillance, and photography.

Publications:

Co-author, "Development of Aquaculture Systems," 1977. Sea Grant Publication 58.

Co-author, "Density Dependent Growth Inhibition in Juvenile Lobsters," 1980. Journal of Experimental Marine Biology and Ecology.

Co-author, "Relationships Among Dietary Lipids, Tissue Lipids, and Growth in Juvenile Lobsters", 1980. World Mariculture Society Journal.

Name: Linda S. Mortensen

Present Position: Laboratory Scientist

Education: B.S. 1989, Biochemistry. University of Vermont, Burlington, Vermont

Experience: July 1, 1992 - Present. Laboratory Scientist, Specialist-Hazardous Waste Bioassays. Western Bioassay Laboratory, Walnut Creek, CA.

Ms. Mortensen manages the hazardous waste bioassay program. Her duties include scheduling hazardous waste bioassays, preparation and periodic revision of Standard Operating Procedures for conducting hazardous waste bioassays, supervision of test set-up and monitoring, statistical analysis of data, report preparation, client and test records maintenance, and laboratory QA/QC of hazardous waste testing.

Ms. Mortensen serves as the laboratory health and safety officer. She also provides support in data management and test monitoring for a variety of bioassays performed at Western Bioassay Laboratory.

1991 - June 30, 1992. Laboratory Scientist. Aqua Terra Technologies, Inc., Walnut Creek, CA.

Ms. Mortensen assisted in the operation of the bioassay laboratory. Her duties included the performance of bioassays on effluent, sediment and hazardous waste samples using both freshwater and marine algal, invertebrate, and fish species. She was responsible for revisions to Standard Operating Procedures for conducting Title 22 Hazardous Waste testing. Ms. Mortensen also assisted in data analysis using a variety of statistical software.

October, 1989 to October, 1991, Roy F. Weston, Inc., Burlington, MA. Ms. Mortensen performed EPA approved bioassay tests for Superfund sites using marine, freshwater, and benthic indicator organisms as part of the Environmental Services Assistance Team (ESAT) to the U.S. EPA Region I, Environmental Services Division.

Within the chemistry laboratory, Ms. Mortensen assisted on the Boston Lead Free Kids Program performing X-Ray Fluorescence (XRF) spectroscopy on soil and dust samples, Inductively Coupled Plasma (ICP) analysis on selected QA/AC samples and report formulation. Ms. Mortensen also assisted the Superfund Environmental Assistant Team (SEAT) through the review of site documents (RI/FS), Work Plans and FSP pertaining to the potential ecological risk at hand. Document review was supplemented with site visits and monthly meetings to present comments to Remedial Project Managers.

Ms. Mortensen's extensive involvement with a marine Superfund site through two consecutive (1989, 1990) summer sampling events, sample analysis and report formulation, enabled her to give a slide presentation of the analytical results before the SEAT and reformat presentation at the 1991 annual NEAEB meeting.

Name: **Phyllis Fassini Riboni**

Present Position: Laboratory Scientist

Education: Undergraduate Research in Zoology,
Reproductive and Animal Behavior, 1979-1986,
University of New Mexico

B.S. 1991, Chemistry and Zoology,
University of California Berkeley

Professional Societies: Society for Environmental Toxicology and Chemistry, Northern California.

Experience: July 1, 1992 to Present. Laboratory Scientist, Specialist - Chronic Toxicity and Critical Life-Stage Bioassays, Western Bioassay Laboratory, Walnut Creek, CA.

Ms. Riboni manages the chronic toxicity testing program. Her duties include determination of NPDES toxicity testing requirements, scheduling bioassays, preparation and periodic revision of Standard Operating Procedures for chronic bioassays, maintenance of Ceriodaphnia dubia and Selenastrum capricornutum cultures, supervision of test set-up and monitoring, statistical analysis of data, report preparation, client and test records maintenance, and laboratory QA/QC of chronic and critical life stage testing (including maintenance of reference toxicant test data).

Ms. Riboni is responsible for compliance reporting of chronic toxicity testing. She is also responsible for the preparation of Variability Phase Study Plans for Effluent Toxicity Characterization Program clients.

Ms. Riboni also serves as a laboratory project manager for the Corps of Engineers sediment bioassays and special projects utilizing greenbook protocols for ecological assessment. She serves as laboratory QA/QC supervisor for sediment testing.

1990 - June 30, 1992. Laboratory Scientist
Aqua Terra Technologies, Inc., Walnut Creek, California

Ms. Riboni performed aquatic bioassays for estimating the chronic and acute toxicity of effluent and receiving water to freshwater, marine, and estuarine organisms. She regularly performed a wide variety of bioassays on effluent, sediment, and hazardous waste samples, using both freshwater and marine algal, invertebrate and fish species.

Ms. Riboni was responsible for data input and analysis as part of report production. She routinely used a variety of statistical software, as well as methods using a handheld calculator.

Ms. Riboni was responsible for test organism culture maintenance and in-house QA/QC for freshwater effluent testing. Her activities included the maintenance of neonatal fathead minnows obtained from commercial suppliers, and the cultures of algae (Skeletonema costatum) and invertebrates (Ceriodaphnia dubia); Ms. Riboni was also responsible for QA/QC of dilution water used in freshwater effluent testing.

Ms. Riboni served as laboratory project manager for marine sediment testing projects. Her duties included scheduling of testing, determination of staffing needs, determination of test supply and organism needs, reference toxicant testing, and report preparation.

1988-1990. Technician II, EA Engineering Science and Technology, Inc.

Ms. Riboni's responsibilities consisted of performance of acute and chronic aquatic bioassays, performance of water quality and water chemistry measurements, preparation of weekly reference toxicant tests, and computer input of test results. Ms. Riboni was also responsible for logging in and disposition of incoming test samples.

1984 - 1987. Research Assistant, The University of California at Berkeley, Berkeley, CA, under the direction of Dr. Stephen M. Schuster, Zoology Department.

Ms. Riboni assisted in the research on the life history of sperm storage, mating behavior, and reproductive biology on the Parcusas sculpta. Field studies were performed in Porto Penasco, Mexico at the CEDO marine station (of the University of Arizona at Tucson). The findings of these research studies were published in Animal Behavior, 1987, and Crustaceana, 1988.

1983-1984. Research Assistant, The University of Albuquerque, Albuquerque, New Mexico.

Ms. Riboni performed research on the life history and sperm storage in the Sphaeromatid isopod, Thermosphaeroma. Under the direction of Stephen M. Shuster, she conducted embryological studies on T. thermophilum (Crustacea: Peracaripa). The research has not yet been published.

1980-1983. Research Assistant, The University of New Mexico.

Ms. Riboni performed research in the history and reproductive biology of the Socorro Isopod, Thermosphaeroma thermophilum, (Crustacea: Peracarripa) (Crustacea:Peracarida).

1979-1980. Research Assistant, Under the Direction of Dr. Randy Thornhill.

Ms. Riboni assisted in the research of adaptive female mimicking behavior of Hyibitacus Scorpionflies.

Clayton
ENVIRONMENTAL
CONSULTANTS

Emmanuel Akanyirige-Karibo
Senior Environmental Chemist
Laboratory Services
Western Operations

AREA OF EXPERTISE

Experienced with Liquid and Gas Chromatography. HPLC analyses for formaldehyde, polynuclear aromatic hydrocarbons, carbamate pesticides and phenols using reverse and normal phase HPLC techniques. GC analyses include quantitative determinations of PCBs, halocarbons, petroleum hydrocarbons using EPA Methods 608/8080, 601/8010, 602/8020, 8015, and 8040.

EDUCATION

B.S., Chemistry/Math
Ball State University
Muncie, Indiana

M.S., Math/Chemistry
Ball State University
Muncie, Indiana

CERTIFICATION, LICENSE, REGISTRATION

Perkin Elmer introductory certificate course in HPLC techniques and troubleshooting.

PROJECT EXPERIENCE

Clayton Environmental Consultants, Inc.
1988 to Present

- GC - Method development and validation of EPA 502 Method using photo ionization and hall electrolytic conductivity detectors in series.
- HPLC - Method development and instrument configuration for method validation study of EPA 531.2 (Carbamate Pesticides).

International Technology Corporation
Martinez, California
1985 to 1988

Analytical Chemist

- Performed extensive gas chromatographic analyses of hazardous waste and industrial solvents to determine conformity with EPA physical and chemical standards for appropriate disposal and treatment.

- Emphasized qualitative and quantitative determinations of PCB's, pesticides, halocarbons, aromatics, phenols, and petroleum hydrocarbons using EPA Methods 608/8080, 601/8010, 602/8020, 8015 and 8040.

GC Supervising Chemist

- Planned and organized daily GC analysis requests using EPA Methods 608/8080, 601/8010, 602/8020, 8015 and 604/8040.
- Delegated various tasks to other GC chemists.
- Supervised and reviewed analyses to ensure conformity with EPA guidelines as well as with customer specifications.

PROFESSIONAL AFFILIATIONS

American Chemical Society

American Mathematical Society

Toastmasters International Club

Clayton
ENVIRONMENTAL
CONSULTANTS

Stefanie Bulilan
Associate Chemist
Laboratory Services
Western Operations
Pleasanton, California Office

AREA OF EXPERTISE

Professional experience in extraction of various analytes from water and soil.

EDUCATION

B.S., Biological Sciences
California State University, Hayward

PROJECT EXPERIENCE

Clayton Environmental Consultants, Inc.
1992 to Present

- Performs sample extractions on water, soil, and waste by EPA Methods for TPH, 418.1, Oil and Grease, 625/8270, 608/8080, and 3550/8015.
- Performs sample preparation of soils and waste for CAM Waste Extraction Test and EP Toxicity Tests.

Engineering Science
1991 to 1992

- Performed extractions on water and soil in accordance with CLP and client protocols.

Pathology Service Inc.
1987 to 1988

- Stained microscopic slides
- Data entry

Clayton
ENVIRONMENTAL
CONSULTANTS

Amy Chen
Senior Environmental Chemist
Laboratory Services
Western Operations
Pleasanton, California Office

AREA OF EXPERTISE

Professional experience in instrumental analysis of environmental samples. Special experience in gas chromatography (GC) and in gas-chromatography-mass spectrometry (GC/MS).

EDUCATION

B.S., Chemistry
Ginn-Yee University
Taiwan

PROJECT EXPERIENCE

Clayton Environmental Consultants, Inc.
1986 to Present

- Analyses of volatile and semi-volatile organics in water, soil, and hazardous waste by GC/MS using EPA Methods 524.2, 624/8240, and 625/8270.
- Analysis of toxic contaminants by GC/MS using EPA Methods TO1/TO2 and NIOSH Methods.
- Analysis of Agricultural Chemicals (Chlorinated Pesticides and PCB's, Organophosphorus Pesticides, Herbicides, and Fumigants) in water, soil, and waste by gas chromatography using EPA Methods 608/8080, 614/8140, 504, 508.
- Project chemist for EPA Method 505, (Organochlorine Pesticides) Method validation study under EPA laboratory contract.
- Analysis of air sample media for organic contaminants using gas chromatography by NIOSH and OSHA approved methodologies.

Chung Shan Science and Institute Center
Taiwan
Research Engineer
1980 to 1985

- Synthesis and analyses of high temperature resistant materials by using GC, IR, HPLC, DSC, TMA and RDS-7700.

Research Assistant
1970 to 1980

- Analyses of propellants and explosives

Clayton
ENVIRONMENTAL
CONSULTANTS

Lei Chen
Senior Environmental Chemist
Laboratory Services
Western Operations
Pleasanton, California Office

AREA OF EXPERTISE

Professional experience in instrumental analysis of environmental and industrial hygiene samples. Special experience in gas chromatography (GC) and in gas-chromatography/mass spectrometry (GC/MS).

EDUCATION

M.S., Physical Chemistry
San Jose State University

B.S., Chemistry
Fujian Normal University, China

PROJECT EXPERIENCE

Clayton Environmental Consultants, Inc.
1992 to Present

- Analysis of Agricultural Chemicals (Chlorinated Pesticides and PCB's, Organophosphorus Pesticides, Herbicides, and Fumigants) in water, soil, and waste by gas chromatography using EPA Methods 608/8080, 614/8140, 504, and 508.

California Advanced Environmental Technology Corporation
1990 to 1992

- Analytical method development (GC EPA 601/8010 and 602/8020, 608/8080, GC/MS EPA 624/8240 and 625/8270).
- Performed sample analysis for analytical method development for EPA Methods 601/8010, 602/8020, 608/8080, 624/8240, and 625/8270.
- Data validation and QA/QC support
- Instrument troubleshooting and maintenance

Bay Area Environmental Inc.
1990

- Supervised state certified environmental lab including, assessment of chemical waste and waste water in varied matrices.
- Performed air, waste water and waste solid analyses.
- Data validation and QA/QC support

Romic Chemical Corporation
1987 to 1990

- Environmental Sample analyses by GC, GC/MS, ICP and wet chemistry.
- Instrument troubleshooting and maintenance

Clayton
ENVIRONMENTAL
CONSULTANTS

Margaret S. Foster
Associate Chemist III
Laboratory Services
Western Operations
Pleasanton, California Office

AREA OF EXPERTISE

Experienced in analysis of environmental samples by gas chromatography and mass spectrometry.

EDUCATION

B.S., Environmental Toxicology
University of California, Davis - 1989

PROJECT EXPERIENCE

Clayton Environmental Consultants, Inc.
1991 to Present

- Perform EPA Methods 601/602, 624, 8240, 524.2, 502.2 and BTX Gas
- Prepare standards

Med-Tox & Associates, Inc.
1989 to 1991

- Prepared standards
- Performed EPA Methods 601/602, 624, 8240, 8010/8020 and 608/8080
- Performed polychlorinated biphenyls and total petroleum hydrocarbons by gas chromatography

Clayton
ENVIRONMENTAL
CONSULTANTS

Michael Lynch
Technical Supervisor
Laboratory Services
Western Operations
Pleasanton, California Office

AREA OF EXPERTISE

Expert in the analysis of environmental samples including soil, water, air and hazardous wastes. Hands-on experience with inorganic and organics analyses, with special emphasis on GC/MS Extensive knowledge of current and emerging technologies for the analysis of environmental samples.

EDUCATION

Graduate Studies in Chemistry
California Polytechnic State University
San Luis Obispo, California

B.S., Fisheries
University of Washington
Seattle, Washington

PROJECT EXPERIENCE

Clayton Environmental Consultants, Inc.
1991 to Present

- Provides technical support to staff and clients regarding analytical methodologies.
- Supervise staff chemists, in all analytical sections of the laboratory including hiring and performance evaluation of laboratory personnel.
- Oversees personnel and instrumental resources to meet project data quality and turnaround requirements.
- Performs data review for completeness and acceptability of results.
- Research and implementation of new methodologies.

Med-Tox Associates
Technical Director
Manager, Organic Laboratory
Senior Chemist
1987 to 1991

- Managed and supervised department for organics analysis of environmental samples by EPA protocol.
- Developed sampling programs, provided written reports, and consulted with clients in regards to their analytical problems.
- Maintained laboratory instruments
- Supervised chemists and technicians
- Developed and implemented new methodologies
- Responsible for laboratory quality control

Central Coast Analytical Services
Mass Spectrometer Operator
1985 to 1986 (Part time position)

- Operated two Hewlett-Packard mass spectrometers, analyzing environmental and air samples

Environmental Research Group
Project Chemist, ICP Operator
1985 (Part time position)

- Established ICP operating parameters
- Begun production mode for routine metals analysis

Technical Director: Manager, Organics Department
1982 to 1984

- Managed and supervised department for organics analysis of environmental samples by EPA protocol.
- Developed sampling programs, provided written reports, and consulted with clients in regards to their analytical problems.
- Maintained laboratory instruments
- Supervised technicians

- Developed new methodologies
- Responsible for laboratory quality control

Ultrachem Corporation
Analyst to Manager, Water Testing Services
1978 to 1982

- Performed wet bench chemistry on water samples in inorganics department
- Analysis of anions by wet bench methods and ion chromatography
- Analysis of metals by flame, hydride and cold vapor atomic absorption spectroscopy.

Hui-Yao Tsai
Senior Environmental Chemist
Laboratory Services
Western Operations
Pleasanton, California Office

AREA OF EXPERTISE

Professional and academic experience in chemical fermentation process operation and control, various inorganic and chemical analytical techniques, and quality assurance and control. Special emphasis on sample preparation and extraction techniques, and standard inorganic analytical methods.

CERTIFICATION, LICENSE REGISTRATION

NIOSH 582 Equivalent
Sampling and Evaluating Airborne Asbestos Dust

McCrone Research Institute
Bulk Asbestos Identification by Polarized Light Microscopy

EDUCATION

Ph.D. (Honorary), Chemistry
May Kong University
Hong Kong 1977

B.S. Agriculture chemistry
National Taiway University
Taipei, Taiwan 1953

RELEVANT WORK EXPERIENCE

Clayton Environmental Consultants, Inc.
Senior Chemist, Extraction Laboratory and Asbestos Analysis
1982 to Present

- Direct technical aspects of extraction and asbestos laboratory.
- Supervise extraction and asbestos lab personnel.
- Manage QA/QC program requirements as specified by the program manager.
- Coordinate and execute sample preparation activities in Extraction Lab, including soil, tissue, and water sample matrices.
- Perform standard wet chemical analysis on water and waste water.

Clayton
ENVIRONMENTAL
CONSULTANTS

Richard A. Hale
Environmental Chemist
Laboratory Services
Western Operations
Pleasanton, California Office

AREA OF EXPERTISE

Professional experience in performing metal analysis in digestions of soil, water and air samples. Experienced with AA and ICP instrumentation, Ion Chromatography, wet and TCLP extractions.

EDUCATION

B.S., Chemistry, 1990
University of California
Davis, California

PROJECT EXPERIENCE

Clayton Environmental Consultants, Inc.
1991 to Present

- Performs trace metals and general inorganic analysis for environmental samples.
- Performs inorganic tests for characterization of hazardous wastes.

Med-Tox Associates, Inc.
Pleasant Hill, California
Chemist
1990-1991

- Performed soil, water and air sample digestion.
- Ran Atomic Absorbtion (Flame, Nitrous and Furnace) and ICP instrumentation.
- Troubleshot, repaired and maintained instruments.

Clayton
ENVIRONMENTAL
CONSULTANTS

Tinni Kar
Chemist
Laboratory Services
Western Operations
Pleasanton, California Office

AREA OF EXPERTISE

Professional experience in analysis of hazardous waste using graphite furnace atomic absorption spectrophotometry (GFAA), flame atomic absorption (AA) and wet chemistry techniques.

EDUCATION

B.S., Environmental Toxicology
University of California, Davis

PROJECT EXPERIENCE

Clayton Environmental Consultants, Inc.
1992 to Present

- Analysis of environmental samples using wet chemistry techniques

Chemical Waste Management
1992

- Chemical analysis of hazardous waste using GFAA and Flame AA

FGL Environmental
1990 to 1992

- Waste water analysis for metals using flame AA
- Sampling for waste streams, underground storage tank removal and wet chemistry
- Wet chemistry analyses

Eureka Labs
1990

- Inorganic analysis of soil and water samples, extractions for AA and ICP
- Wet chemistry analyses

Enesco Labs
1988

- Analysis of soil, water and air for dioxins and furans by GC/MS

Clayton
ENVIRONMENTAL
CONSULTANTS

John Labash
Senior Environmental Chemist
Laboratory Services
Western Operations
Pleasanton, California Office

AREA OF EXPERTISE

Professional experience in performing trace metal analysis in semiconductor and industrial waste media. Experienced with EPA-CLP protocols and familiar with EPA methods for hazardous waste, synfuel and sludge. Solid background in wet chemistry and sampling techniques.

EDUCATION

B.S., Wildlife Biology and Environmental Chemistry
Juniata College
Huntington, Pennsylvania

PROJECT EXPERIENCE

Clayton Environmental Consultants, Inc.
1988 to Present

- Performs trace metals and general inorganic analysis for environmental samples.
- Trains and oversees laboratory staff.
- Performs inorganic tests for characterization of hazardous wastes.

IT Corporation
Martinez, California

Swing Shift Supervisor/Operations Manager
1987 to 1988

- Managed organic, metals, wet chemistry and sample control section of laboratory.
- Directed scheduling, job tracking, and systems troubleshooting.

Instrumentation Engineer
1986 to 1987

- Developed treatment methods for nontypical hazardous waste streams.
- Provided analytical support via ICPES, GC, F-AAS, HGA-AAS, CV-AAS, and TOC.

Chemist II
1984 to 1986

- Characterized hazardous waste streams by ICPES, AAS, and GC for predisposal and treatability assessment.

- Acted as nighttime supervisor and on-call chemist for emergency response cleanup crew.

Acurex Analytical Laboratories
Mountainview, California
1980 to 1984

- Prepared and analyzed samples using AAS, and wet chemistry.

Clayton
ENVIRONMENTAL
CONSULTANTS

Maria Christina C. Navarro
Associate Chemist
Laboratory Services
Western Operations
Pleasanton, California Office

AREA OF EXPERTISE

Experience in performing wet chemistry analyses of soil, water and air samples. Proficient in the use of a LACHET automated ion analyzer.

EDUCATION

B.A., Chemistry, 1991
California State University
Hayward, California

PROJECT EXPERIENCE

Clayton Environmental Consultants, Inc.
1991 to Present

- Performs general wet chemistry inorganic analyses for environmental and industrial hygiene samples.
- Conducts inorganic tests for characterization of hazardous wastes.

Clayton
ENVIRONMENTAL
CONSULTANTS

David B. Sandusky
Group Leader, Inorganics
Laboratory Services
Western Operations
Pleasanton, California Office

AREA OF EXPERTISE

Experienced in various inorganic, analytical and quality techniques. Direct experience with wet chemistry, metals analysis and other standard analytical techniques.

EDUCATION

B.S., Chemistry
University of California, Berkeley

M.S., Chemistry (expected 1993)
California State University, Hayward

PROFESSIONAL HISTORY

Clayton Environmental Consultants, Inc.
1991 to Present

- Coordinate and execute all phases of wet chemical and metal analysis utilizing EPA protocols.
- Supervise department personnel to insure quality data generation and on-time completion of analysis.
- Develop new procedures and train personnel to increase department efficiency.
- Manage Inorganic Department's expenses to assure profitability.

Med-Tox Associates
Pleasant Hill, California
1990-1991

Responsible for daily operations of Inorganic Department including administration, personnel, quality control, methodology certification, report generation and business development.

Med-Tox Associates
Pleasant Hill, California
1987-1990

Lead chemist for Inorganic Department. Responsible for sample analysis, methods development, training and instrument maintenance.

Union Oil Company of California
Rodeo, California
1986-1987

Chemist for Quality Assurance Laboratory. Performed organic and inorganic analyses of waste water, process water and petrochemical samples.

Clayton
ENVIRONMENTAL
CONSULTANTS

Hing Yi Wong
Environmental Chemist
Laboratory Services
Western Operations
Pleasanton, California Office

AREA OF EXPERTISE

Experienced in organic extraction techniques, various inorganic and chemical analytical techniques, and quality techniques, and standard inorganic analytical methods.

EDUCATION

Hong Kong Polytechnic
Center of Environmental Studies
Two Years Higher Certificate in Water Pollution Control, 1985

Lingnan College (Hong Kong)
Department of Science
Four Years Post-Secondary Diploma in Science (major in biology and minor in chemistry)

PROFESSIONAL HISTORY

Clayton Environmental Consultants, Inc.
1987 to Present

- Coordinate and execute all phases of wet chemical analysis, mercury analysis, and metal analysis by atomic absorption.

Extractions Chemist
1986 to 1987

- Prepared samples for organic lab analysis (GC, GC/MS, HPLC, and others)
- Performed any assigned environmental projects

Oriental Environmental Services Limited
Taikoo Shing, Quarry Bay, Hong Kong
Landscape Supervisor
1982 to 1986

- Organized and supervised a group of operations staff to carry out environmental and landscape projects

Asia-Pharm Marketing Limited
Kwai Chung
Kowloon, Hong Kong
Medical Sales Representative
1980 to 1982

- Promoted and sold pharmaceutical products to doctors and pharmaceutical stores

Lingnan Middle School
Wanchai, Hong Kong
High School Teacher
1977 to 1980

- Taught integrated science, mathematics, and biology

Lingnan College
Wanchai, Hong Kong
Biological Laboratory Assistant
1974 to 1977

- Prepared, taught, and demonstrated laboratory works for undergraduate students. Subjects included general biology, plant morphology, plant physiology, zoology, histology, microbiology, ecology, and genetics.

PROFESSIONAL AFFILIATIONS

Associate member of the Institute of Water Pollution Control
Associate member of the Institution of Water and Environmental Management