CAMBRIA

September 11, 1996

Mr. Tom Peacock
Alameda County Department
of Environmental Health
1131 Harbor Bay Parkway, 2nd Floor
Alameda, California 94502

Re: **Soil Vapor Extraction Test Report**
1432 Harrison Street
Oakland, CA

Dear Mr. Peacock:

Cambria Environmental Technology, Inc. (Cambria) performed a soil vapor extraction (SVE) test on behalf of Mr. Alvin H. Bacharach and Ms. Barbara Jean Borsuk on August 6, 1996 at the site referenced above (Figure 1). The test objective was to determine whether SVE could be used as a viable remediation alternative. Presented below are the SVE test procedures, test equipment, test results, conclusions and recommendations.

SOIL VAPOR EXTRACTION TESTING

SVE Test Procedures

Cambria performed SVE testing on two existing ground water monitoring wells for approximately 3 hours on each well. During testing, we measured the vapor extraction flow rate, the vacuum applied to the wellhead, and the vacuum influence in a nearby well. We also submitted bag samples of extracted vapor from each well for analysis for total petroleum hydrocarbons as gasoline (TPHg) and benzene, toluene, ethylbenzene and xylenes (BTEX). We selected wells MW-1 and MW-2 for SVE testing since they are located near the estimated hydrocarbon source area and have sufficient well screen available in the vadose zone. Prior to testing, we notified the Bay Area Air Quality Management District (BAAQMD) about the test procedures, scope of work and dates as required by the BAAQMD.

CAMBRIA
ENVIRONMENTAL
TECHNOLOGY, INC.
1144 65TH STREET,
SUITE B
OAKLAND,
CA 94608
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SVE Test Equipment

A VR Systems Model V3 internal combustion engine (ICE) was used to extract and treat soil vapor. A Foxboro Model 108 OVA Flame Ionization Detector (FID) was used to measure hydrocarbon concentrations in extracted vapor in the field. A TSI Model No. 8355 VelociCalc air mass flow meter was used to measure vapor extraction flow rates. A Thomas Industries Model No. 107CDC20 vacuum

pump was used to collect the vapor samples. Magnahelic differential pressure gauges were used to measure the vacuum applied at the subject wellhead and induced in the nearby monitoring well.

SVE Test Results

SVE testing results are presented in Tables 1 and 2, respectively. Analytic results for soil vapor are included in Attachment A. Although the analytic results are reported in micrograms per liter of air, we converted the readings to parts per million by volume (ppmv) to allow comparison to field instrumentation. As shown on Table 1, the TPHg concentrations in soil vapor ranged from 3,100 to 2,600 ppmv in well MW-1 and from 22,000 to 28,000 ppmv in well MW-2. The highest benzene concentration in extracted vapor was 590 ppmv in well MW-2.

Vapor extraction flow rates ranged from 1.0 to 2.2 standard cubic feet per minute (scfm) in well MW-1 under an applied vacuum ranging from 40 to 150 inches of water, resulting in a TPHg removal rate of 1 to 2 pounds per day (ppd). Vapor extraction flow rates ranged from 3.0 to 3.4 scfm in well MW-2 under an applied vacuum ranging from 40 to 150 inches of water, resulting in a TPHg removal rate of 21 to 31 ppd. Based on Levine Fricke's well logs, about three feet of well screen were available for vapor extraction in well MW-1 and about seven feet were available in well MW-2. This limited well screen may have affected the achievable vapor extraction flow rates. Well MW-2, with the most available well screen, had the highest vapor extraction flow rate. Although the relatively high applied vacuum most likely raised the water level within each test well, no water accumulated in the ICE water knockout container during testing.

The moderate vacuum required to induce vapor flow suggests that the subsurface consists of moderate permeability materials, which is consistent with the boring logs that show that the site is underlain by sand and silty sand.

Estimated SVE Radius of Influence

To determine the effective radius of influence, we compared the applied vacuum to the vacuum observed in nearby wells during SVE testing of well MW-1. We estimated the theoretical radius of influence according to the steady-state radial distribution equation by Johnson, et al .[1] As shown on Table 2, the theoretical radius of vacuum influence is about 44 ft.

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1 P.C. Johnson, C.C. Stanley, M. W. Kemblowski, D.L. Byers, and J.D. Colthart, *A Practical Approach to the Design, Operation, and Monitoring of In Situ Soil Venting Systems*, Ground Water Monitoring and Review, Spring 1990

For comparison purposes, we also estimated the effective radius of influence according to Buscheck et al.[2] This approach first involves normalizing the vacuum data by dividing the vacuum observed at the wellhead and at the monitoring wells by the vacuum observed at the wellhead. The normalized vacuum data is then plotted on a log basis versus the distance to the vacuum influence monitoring wells. The effective radius of influence is frequently considered to be the distance corresponding to 1% of the normalized vacuum. Based on the influence data shown on Table 2 and presented in Figure 2, the estimated effective radius of influence ranges from about 25 to 31 ft. This radius of influence range is consistent with the estimate presented above using Johnson et al.

CONCLUSIONS

Test results indicate that SVE could effectively remove hydrocarbons from the subsurface soils, with an estimated radius of influence between 25 to 44 ft.

RECOMMENDATIONS

If active remediation is required, then short-term SVE combined with air sparging (AS) would probably be the most cost-effective solution for remediating this site since it is underlain by moderately permeable soils. SVE would remove the easily extractable hydrocarbons, while AS would increase volatilization of hydrocarbons in ground water. AS would also increase the levels of dissolved oxygen in ground water which would stimulate aerobic biodegradation of hydrocarbons. To increase achievable vapor extraction flow rates, we recommend installing vapor extraction wells with more well screen in the vadose zone than the existing monitoring wells.

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2 T.E. Buscheck, T. R. Peargin, *A Summary of Nationwide Vapor Extraction System Performance Study*, November 1991.

CLOSING

Cambria appreciates this opportunity to provide environmental consulting services for Mr. Alvin H. Bacharach and Ms. Barbara Jean Borsuk. Please call us if you have any questions or comments.

Sincerely,
Cambria Environmental Technology, Inc.

John Espinoza
Staff Engineer

Bob Clark-Riddell, P.E.
Principal Engineer

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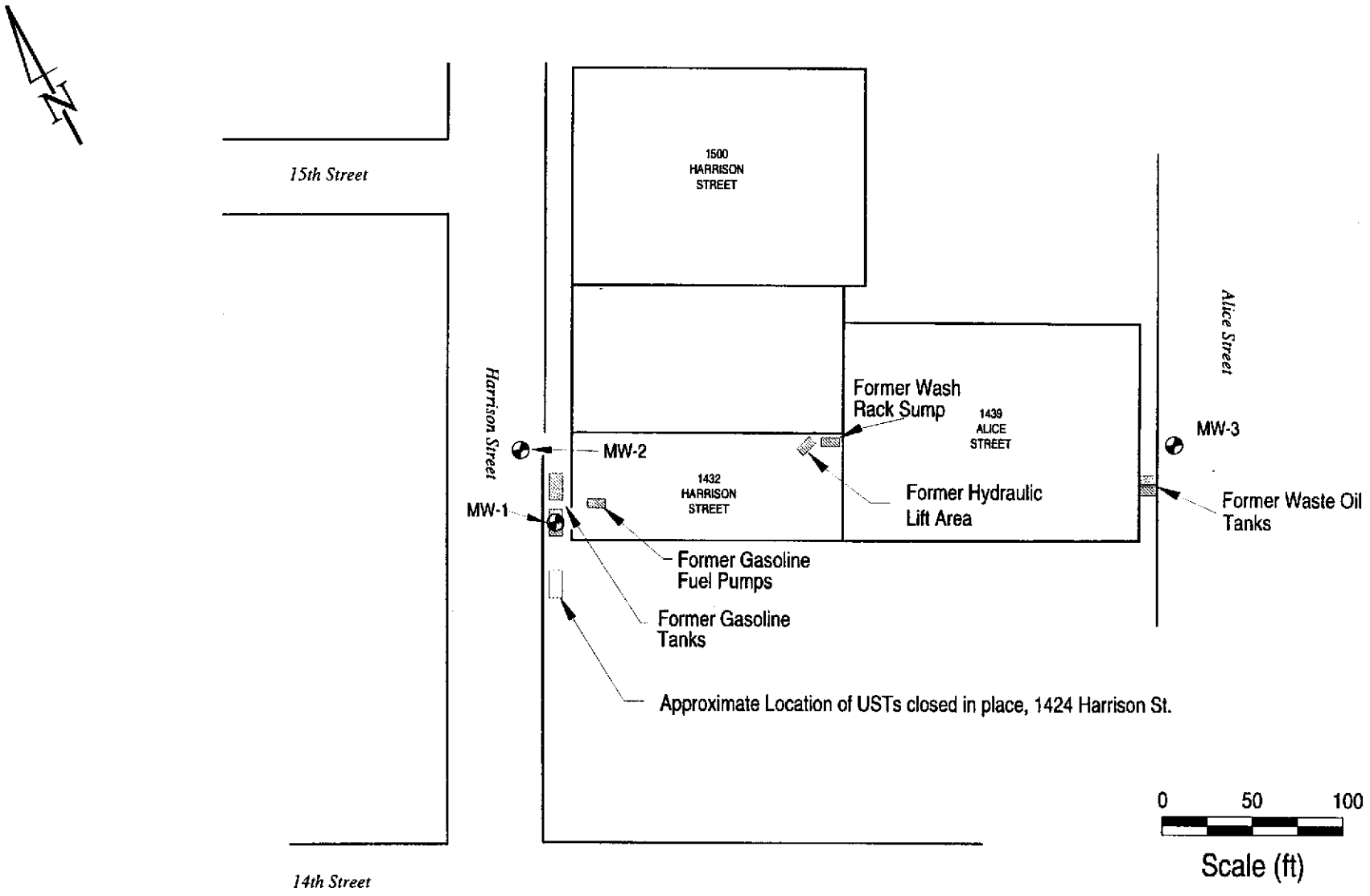
Attachments: A - Analytic Results for Soil Vapor

cc: Mr. Mark Borsuk, 1626 Vallejo Street, San Francisco, CA 94123-5116



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CAMBRIA
Environmental Technology, Inc.

EXPLANATION

Ground Water Monitoring Well

Monitoring Well Locations

1432 Harrison Street
Oakland, California

FIGURE

1

Figure 2 - Effective Radius of Influence During MW-1 Testing

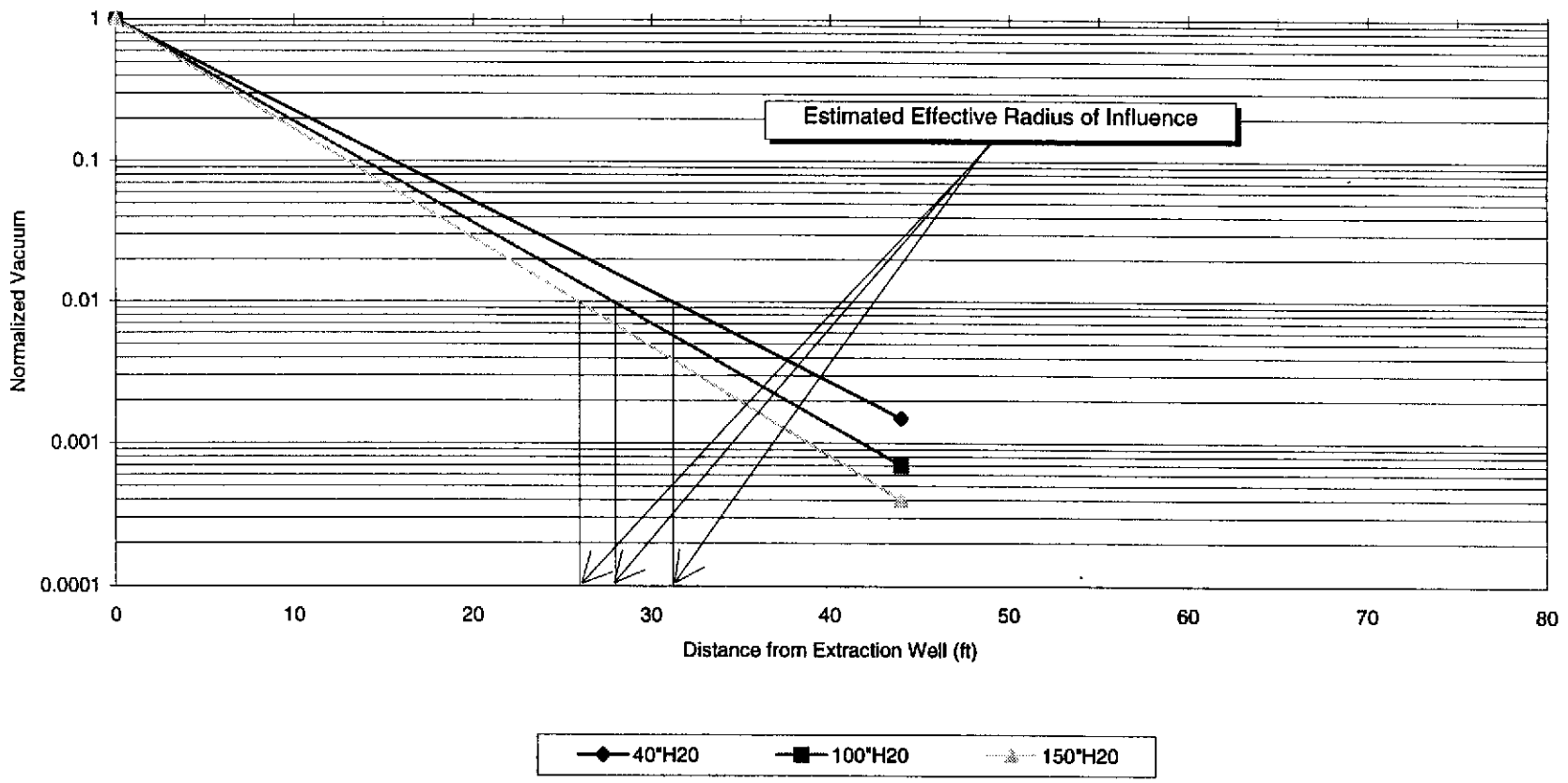

Table 1. SVE Test Results - 1432 Harrison Street, Oakland, California

Well	Date	Exposed Screen[1] (ft - ft)	Duration (hours)	Wellhead Vacuum[2] ("H20)	Flow Rate[3] (scfm)	Hydrocarbon Concentrations[4] (ppmv)			Hydrocarbon Removal[5] (lbs/day)	
						FID	TPHg	Benz	TPHg	Benz
MW-1	8/6/96	16-19	1	40	1.0	30,000	3,100	65	1	0.02
MW-1	8/6/96	16-19	2	150	2.2	30,000	2,600	55	2	0.04
MW-2	8/6/96	12-19	0.25	40	3.0	>100,000	22,000	310	21	0.27
MW-2	8/6/96	12-19	1.75	150	3.4	>100,000	28,000	590	31	0.58

Notes

1. The exposed screen interval is the depth between the top of screen and the depth to immiscible fluid measured prior to testing.

2. The wellhead vacuum is the vacuum measured at the wellhead.

3. The flow rate measured with an anemometer was converted to standard cubic feet per minute (scfm) based on pressure and temperature.

4. Total hydrocarbon oncentrations were measured in the field using a flame ionization detector (FID). TPHg and benzene concentrations were quantified in an analytic laboratory by modified EPA Method 8015 and EPA Method 8020, respectively. Concentrations reported as micrograms per liter in the laboratory report are converted to parts per million by volume (ppmv) by dividing by the molecular weight (78 for benzene and 86 for TPHg as Hexane), and multiplying by 24.45 (the volume one gram-mole of perfect gas occupies at standard temperature and pressure).

5. The hydrocarbon removal rate is based on the Bay Area Air Quality Management District's Procedures for Soil Vapor Extraction. Rate = concentration (ppmv) x flow rate (scfm) x 1 lb-mole/386ft^3 x molecular weight x 1440 min/day.

Table 2. Radius of Influence Data - 1432 Harrison Street, Oakland, California

Extraction Well	Monitoring Well	Rw (ft)	r (ft)	Pw ("H20)	Pw (psia)	P(r) ("H20)	P(r) (psia)	Estimated Ri (ft)[1]
MW-1	MW-2	0.167	44	40	13.256	0.06	14.694	44
MW-1	MW-2	0.167	44	100	11.096	0.07	14.694	44
MW-1	MW-2	0.167	44	150	9.296	0.06	14.694	44

Notes and Abbreviations

1 = Based on steady-state radial pressure distribution equation from "A Practical Approach to the Design, Operation, and Monitoring of In Situ Soil-Venting Systems", P.C. Johnson, C.C. Stanley, M.W. Kemblowski, D.L. Byers, and J.D. Cothart, Ground Water Monitor and Review, Spring 1990

$$Ri = \frac{Rw}{(r/Rw)^{**}[(1-(Patm/Pw)^{**}2)/(((P(r)/Pw)^{**}2)-1)]}$$

"H20 = Pressure measured in inches of water
Rw = Radius of extraction well (feet)
r = Distance of monitoring well from extraction well (feet)
Psia = Pounds per square inch absolute
Pw = Pressure at extraction well (psia or inches of water column, gauge)
P(r) = Pressure at monitoring well (psia or inches of water column, gauge)
Patm = Absolute atmospheric pressure (14.696 psia)
Ri = Radius of influence (feet)

Attachment A

Analytic Results for Soil Vapor

McCAMPBELL ANALYTICAL INC.

110 2nd Avenue South, #D7, Pacheco, CA 94553
Tele: 510-798-1620 Fax: 510-798-1622

08/15/96

Dear John:

Enclosed are:

1). the results of 4 samples from your **# 54-188-13; Borsuk** project,

2). a QC report for the above samples

3). a copy of the chain of custody, and

4). a bill for analytical services.

If you have any questions please contact me. McCampbell Analytical Laboratories strives for excellence in quality, service and cost. Thank you for your business and I look forward to working with you again.

Yours truly,

Edward Hamilton, Lab Director

McCAMPBELL ANALYTICAL INC.
110 2nd Avenue South, #D7, Pacheco, CA 94553
Tele: 510-798-1620 Fax: 510-798-1622

Cambria Environmental Technology	Client Project ID: # 54-188-13; Borsuk	Date Sampled: 08/06/96
1144 65th Street, Suite C		Date Received: 08/07/96
Oakland, CA 94608	Client Contact: John Espinoza	Date Extracted: 08/07-08/12/96
	Client P.O:	Date Analyzed: 08/07-08/12/96

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline*, with Methyl tert-Butyl Ether* & BTEX*

EPA methods 5030, modified 8015, and 8020 or 602; California RWQCB (SF Bay Region) method GCFID(5030)

Lab ID	Client ID	Matrix	TPH(g)+	MTBE	Benzene	Toluene	Ethylben-zene	Xylenes	% Rec. Surrogate
67644	MW-1-SVE-Start	Air	11,000,c	---	210	500	22	270	---#
67645	MW-1-SVE-End	Air	9400,c	---	180	520	49	320	---#
67646	MW-2-SVE-Start	Air	78,000,c	---	1000	450	89	210	---#
67647	MW-2-SVE-End	Air	100,000,c	---	1900	880	190	390	---#
Reporting Limit unless otherwise stated; ND means not detected above the reporting limit		Air	50 ug/L	5.0	0.5	0.5	0.5	0.5	
		S	1.0 mg/kg	0.05	0.005	0.005	0.005	0.005	

* water and vapor samples are reported in ug/L, soil and sludge samples in mg/kg, and all TCLP extracts in mg/L

cluttered chromatogram; sample peak coelutes with surrogate peak

+ The following descriptions of the TPH chromatogram are cursory in nature and McCampbell Analytical is not responsible for their interpretation: a) unmodified or weakly modified gasoline is significant; b) heavier gasoline range compounds are significant(aged gasoline?); c) lighter gasoline range compounds (the most mobile fraction) are significant; d) gasoline range compounds having broad chromatographic peaks are significant; biologically altered gasoline?; e) TPH pattern that does not appear to be derived from gasoline (?); f) one to a few isolated peaks present; g) strongly aged gasoline or diesel range compounds are significant; h) lighter than water immiscible sheen is present; i) liquid sample that contains greater than ~ 5 vol. % sediment; j) no recognizable pattern.

DHS Certification No. 1644

Edward Hamilton, Lab Director

McCAMPBELL ANALYTICAL INC.
110 2nd Avenue South, #D7, Pacheco, CA 94553
Tele: 510-798-1620 Fax: 510-798-1622

QC REPORT FOR HYDROCARBON ANALYSES

Date: 08/07/96 Matrix: Air

Analyte	Concentration (ug/L)			Amount Spiked	% Recovery		RPD
	Sample	MS	MSD		MS	MSD	
TPH (gas)	0.0	101.5	101.3	100.0	101.5	101.3	0.2
Benzene	0.0	10.8	11.1	10.0	108.0	111.0	2.7
Toluene	0.0	10.5	10.7	10.0	105.0	107.0	1.9
Ethyl Benzene	0.0	10.6	10.8	10.0	106.0	108.0	1.9
Xylenes	0.0	31.2	32.0	30.0	104.0	106.7	2.5
TPH (diesel)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TRPH (oil & grease)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

% Rec. = (MS - Sample) / amount spiked x 100

RPD = (MS - MSD) / (MS + MSD) x 2 x 100

6940AC128

McCAMPBELL ANALYTICAL

110 2nd AVENUE, # D7
PACHECO, CA 94553
(510) 798-1620 FAX (610) 798-1622

CHAIN OF CUSTODY RECORD

TURN AROUND TIME: ☐ RUSH ☐ 24 HOUR ☐ 48 HOUR ☒ 5 DAY

REPORT TO: JOHN ESPARZA BILL TO: CAMBRIA

COMPANY: CAMBRIA
1144 65th STREET SUITE C
OAKLAND, CA 94608

TELE: 420-9177 FAX #: 420-9170

PROJECT NUMBER: 54-188-13 PROJECT NAME: BASIC

PROJECT LOCATION: 1432 HARRISON OAKLAND CA SAMPLER SIGNATURE:

SAMPLE ID	LOCATION	SAMPLING DATE	SAMPLING TIME	# CONTAINERS	TYPE CONTAINERS	MATRIX: WATER	SOIL	AIR	SLUDGE	OTHER	METHOD PRESERVED: HCL	HNO3	OTHER	BTEX & TPH as Gasoline (602/8020 + 8015)	TPH as Diesel (8015)	Total Petroleum Oil & Grease (5520 E&F/5520 B&F)	Total Petroleum Hydrocarbons (418.1)	EPA 601/8010	EPA 602/8020	EPA 608/8080	EPA 608/8080 - PCBs Only	EPA 624/8240/8260	EPA 625/8270	CAM - 17 Metals	EPA - Priority Pollutant Metals	LEAD (7240/7420/239.2/6010)	ORGANIC LEAD	RCI	COMMENTS
MW-1-SVE-START		8/6/96		2	BAGS			X						X															67644
MW-1-SVE-END		8/6/96		2										X															67645
MW-2-SVE	START	8/6/96		2										X															67646
MW-2-SVE	END	8/6/96		2	↓			↓						X															67647
STRAIGHT THROUGH CHAIN OF CUSTODY				10																									

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
	8/7/96	11:15	
RELINQUISHED BY:	DATE	TIME	RECEIVED BY:
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	8/7/96	11:2[illegible]	

REMARKS:

MOS | OSG | METALS/TR

ICE/T ____
GOOD CONDITION ✓
HEAD SPACE ABSENT ____

PRESERVATIVE APPROPRIATE ____
CONTAINERS ✓