STREAMBORN

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18 March 2003

Project No. P257

P0132

Workplan
Groundwater Monitoring and Site-Specific Risk Assessment
4401 Market Street
Oakland CA

Dear Mr. and Ms. Damele:

This workplan describes continued investigation regarding petroleum releases from former underground tanks at 4401 Market Street, Oakland California (Figures 1 and 2). Planned activities include (1) continued groundwater monitoring, and (2) preparation of a site-specific risk assessment. This workplan has been prepared in response to a 27 December 2002 letter to you from the Alameda County Health Care Services Agency (ACHSA) (ACHCSA 2002) and pursuant to our proposal dated 17 January 2003.

BACKGROUND

A chronology of environmental activities associated with the site is summarized in Table 1.

In June 1990, one 1,000-gallon underground gasoline tank and three 500-gallon underground gasoline tanks were removed from the southeast portion of the subject site (Figure 2). Soil samples were collected from beneath the tanks and associated piping during removal.

Seven soil borings were drilled in October 1994, and three of the borings were completed as 2-inch PVC monitoring wells (MW1, MW2, and MW3). Soil samples were collected from each of the borings, and groundwater samples were collected from the monitoring wells. Groundwater monitoring was conducted periodically between November 1994 and June 1997.

In April and July 1999, nine soil borings were drilled. Soil and grab groundwater samples were collected from each of the borings. The investigation discovered free product, presumably gasoline, on the south side of 44th Street, Oakland CA.

In January 2001, four monitoring wells (MW4, MW5, MW6, and MW7) were installed. Soil samples were collected during drilling. Groundwater monitoring for all seven monitoring wells has been conducted periodically since 2001.

Tables 2-5 and Figure 2 summarize groundwater and free product monitoring results.

Upon review of the most recent groundwater monitoring report (Streamborn 2002), the ACHCSA requested additional investigation and the preparation of a site specific risk assessment (ACHCSA 2002).

SCOPE OF WORK

Site Specific Risk-Assessment

Our site specific risk-assessment will consist of the following:

- Compilation of historic investigation data.
- Temporal plots of groundwater concentrations (TPH-gasoline and BTEX) in monitoring wells MW1, MW2, MW4, and MW6.
- Fitting the groundwater concentration data for MW2 (TPH-gasoline and BTEX) to a first-order biological decay algorithm. Prediction of the date when groundwater concentrations will achieve drinking water criteria.
- Delineation of the extent and mass of residual TPH-gasoline in groundwater.
- Prediction of residual soil concentrations using the observed reduction (attenuation) for groundwater concentrations.
- Delineation of the extent and mass of residual TPH-gasoline in soil.
- Preparation of a site-specific, Tier 2 risk assessment (reference ASTM E 1739 - Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites), to consists of:
  - Calculation of cancer and non-cancer risks from inhalation of vapors that may volatile from soil and groundwater and intrude into buildings potentially constructed onsite.
  - Calculation of cancer and non-cancer risks from ingestion of groundwater wells that may be constructed onsite.

Groundwater Monitoring

Groundwater monitoring will be conducted for the seven groundwater monitoring wells (MW1, MW2, MW3, MW4, MW5, MW6, MW7) semi-annually for a period of two years (four events). Groundwater sampling will be performed in accordance with the attached standard operating procedure. Prior to purging and sampling, water levels will be measured. Field parameters and observations will be made during purging. Free product monitoring will not be conducted.

Groundwater samples will be analyzed for TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260). Groundwater monitoring requirements are summarized in Table 6.

Investigation-Derived Waste

Purge water will be containerized in steel 55-gallon drums and will be disposed of in accordance with applicable regulations. Decontamination wastewater will be discharged to the sanitary sewer.

Reporting

A separate report will be prepared summarizing the risk assessment.

Data from the first groundwater monitoring event will be incorporated into the risk-assessment report. The results of subsequent groundwater sampling events will be summarized in data submittals.

QUALITY ASSURANCE/QUALITY CONTROL

Specific quality control procedures for sample collection and field testing are discussed in the attached standard operating procedures.

Quality Control Samples

The laboratory will include laboratory blank, laboratory replicate, and laboratory spike quality control samples during soil and groundwater analysis. Field quality control samples will not be collected or analyzed.

Field Meter Quality Control Procedures

Meters for measurement of field parameters will be calibrated daily. Calibration standards should generally approximate or span the anticipated range of measurements. Recalibration may be appropriate if unusual measurements are noticed.

The field organic vapor monitor (used for site safety and to screen soil samples) will be calibrated using a standard gas prior to the beginning of each field day. Recalibration may be appropriate if unusual measurements are noticed.

HEALTH AND SAFETY

The attached Site Safety Plan presents the procedures to be followed to protect the safety of workers during planned fieldwork. Physical and chemical hazards, such as working around equipment and exposure to chemicals, are addressed. Work is planned in a previously investigated area, with existing data suggesting minimal chemical hazards. Although the proposed fieldwork does not necessarily require adherence to safety protocols for hazardous waste sites, the procedures in the Site Safety Plan are intended to comply with the pertinent sections of 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response.

BIBLIOGRAPHY

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ACHCSA (1999b). *Leon's Arco, 4401 Market Street, Oakland CA 94608; StId 812.* Correspondence to Casimiro and Josephine Damele, Oakland CA. Correspondence from Don Hwang, Alameda County Environmental Health Services, Alameda CA. 29 December 1999.

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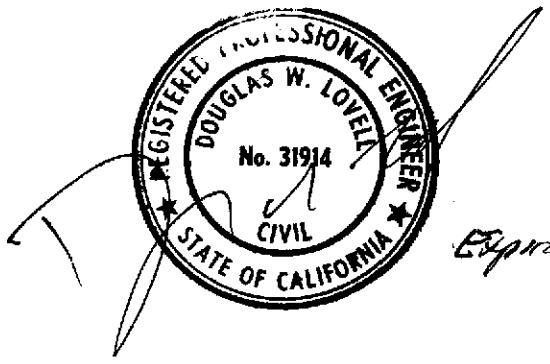
Streamborn (2002). *Letter Report, Groundwater Monitoring Conducted 29 November 2001, 4401 Market Street, Oakland CA.* Prepared for Casimiro and Josephine Damele, Oakland CA. Prepared by Streamborn, Berkeley CA. 18 January 2002.

Please contact us if you have any questions or comments.

Sincerely,

STREAMBORN



Expires 12/31/04

Douglas W. Lovell, PE
Geoenvironmental Engineer

Attachments

cc: Barney Chan/Alameda County Health Care Services Agency, Alameda CA

Table 1

Environmental Chronology
4401 Market Street, Oakland CA

Date	Activities Performed By	Description
Unknown	Unknown	• Four underground gasoline tanks (one 1,000-gallon and three 500-gallon tanks) were installed. • W.A. Craig reported that the structure at 4401 Market Street was constructed in 1943 and used as a gasoline station until the 1970s.
22 June 1990	Environmental Bio-Systems	• The 4 underground gasoline tanks were removed. Removal of the fuel dispensers, product piping, and pump island was not documented. Soil excavated during tank removal was reused to backfill the excavation. • Soil samples were collected below the tanks and from the excavated soil. Soil samples were analyzed for TPH-gasoline and BTEX. Soil sampling indicated a release of gasoline compounds.
6 September 1990	W.A. Craig	• Two trenches were excavated to a depth of approximately 5 feet in the vicinity of the former dispenser island. • Contaminated soil was observed but no laboratory analyses were performed. Soil excavated during trenching was reused to backfill the trenches.
27 and 28 October 1994	W.A. Craig	• Seven borings were drilled at and near 4401 Market Street (SB1, SB2, SB3, SB4, MW1, MW2, and MW3); three of which were completed as monitoring wells (MW1, MW2, and MW3). • Free product, presumably gasoline, was observed in boring SB2, located near the southwest corner of 4401 Market Street. • Soil samples were analyzed for TPH-gasoline and BTEX.
8 November 1994	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline and BTEX.
14 February 1995	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline and BTEX.
7 June 1995	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline and BTEX.
29 August 1995	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline and BTEX.
8 December 1995	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline and BTEX.
7 March 1996	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline, BTEX, and MtBE.
19 June 1996	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline, BTEX, and MtBE.
20 December 1996	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline, BTEX, and MtBE.
12 June 1997	W.A. Craig	• Groundwater monitoring was conducted for wells MW1, MW2, and MW3. • Samples were analyzed for TPH-gasoline, BTEX, and MtBE.
31 March 1999	Streamborn	• Groundwater levels measured in wells MW1, MW2, and MW3.
April and July 1999	Streamborn	• Nine borings were drilled near 4401 Market Street (B8 through B16). Free product, presumably gasoline, was observed in boring B10, located on the south side of 44th Street, adjacent to 903 44th Street. • Soil samples and grab groundwater samples were collected from the 9 borings. Samples were analyzed for TPH-gasoline, BTEX, and fuel oxygenates.
4-5 January 2001	Streamborn	• Four monitoring wells (MW4, MW5, MW6, and MW7) were installed near 4401 Market Street. • Soil samples were collected and analyzed for TPH-Gasoline, BTEX, and fuel oxygenates. • Level survey was performed.
1 February 2001	Streamborn	• Wells MW4, MW5, MW6, and MW7 were developed. • Groundwater samples were collected from wells MW1, MW3, MW4, MW5, MW6 and MW7. Samples were analyzed for TPH-Gasoline, BTEX, and fuel oxygenates. • Water levels were measured in wells MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product.
9 March 2001	Streamborn	• Water levels were measured in wells MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product.
23 April 2001	Streamborn	• Water levels were measured in MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product.
30 May 2001	Streamborn	• Groundwater samples were collected from wells MW1, MW3, MW4, MW5, MW6 and MW7. Samples were analyzed for TPH-Gasoline, BTEX, and fuel oxygenates. • Water levels were measured in wells MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product.
19 June 2001	Streamborn	• Water levels were measured in MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product.
19 July 2001	Streamborn	• Water levels were measured in MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product.
22 August 2001	Streamborn	• Groundwater samples were collected from wells MW1, MW3, MW4, MW5, MW6 and MW7. Samples were analyzed for TPH-Gasoline, BTEX, and fuel oxygenates. • Water levels were measured in wells MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product.
29 November 2001	Streamborn	• Groundwater samples were collected from wells MW1, MW3, MW4, MW5, MW6 and MW7. Samples were analyzed for TPH-Gasoline, BTEX, and fuel oxygenates. • Water levels were measured in wells MW1, MW2, MW3, MW4, MW5, MW6, and MW7. • Wells MW4, MW5, and MW6 were monitored for free product.

General Notes

(a) TPH = Total petroleum hydrocarbons.

(b) BTEX = Benzene, toluene, ethylbenzene, and xylenes.

(c) MtBE = Methyl tertiary butyl ether.

Table 2

Groundwater Levels and Gradient Data
4401 Market Street, Oakland CA

Location		MW1		MW2		MW3		MW4		MW5		MW6		MW7		Groundwater Gradient	
Ground Surface		Elev = 998.74		Elev = 998.07		Elev = 999.64		Elev = 998.18		Elev = 997.78		Elev = 998.02		Elev = 999.12			
Measuring Point		TOC N Side, Elev = 998.22		TOC N Side, Elev = 997.73		TOC N Side, Elev = 998.90		TOC N Side, Elev = 997.87		TOC N Side, Elev = 997.33		TOC N Side, Elev = 997.50		TOC N Side, Elev = 998.69			
Measured By	Intercepted Interval slotted portion	Depth	Elev	Depth	Elev	Depth	Elev	Depth	Elev	Depth	Elev	Depth	Elev	Depth	Elev	Direction	Magnitude
W.A. Craig	14 February 1995	12.65	985.57	12.12	985.61	13.45	985.45	*	*	*	*	*	*	*	*		
W.A. Craig	7 June 1995	14.62	983.60	14.38	983.35	14.64	984.26	*	*	*	*	*	*	*	*		
W.A. Craig	29 August 1995	15.04	983.18	14.40	983.33	14.94	983.96	*	*	*	*	*	*	*	*		
W.A. Craig	8 December 1995	15.94	982.28	15.22	982.51	15.82	983.08	*	*	*	*	*	*	*	*		
W.A. Craig	7 March 1996	12.36	985.86	12.04	985.69	12.89	986.01	*	*	*	*	*	*	*	*		
W.A. Craig	19 June 1996	13.70	984.52	13.38	984.35	13.94	984.96	*	*	*	*	*	*	*	*		
W.A. Craig	20 December 1996	12.35	985.87	12.22	985.51	12.86	986.04	*	*	*	*	*	*	*	*		
W.A. Craig	12 June 1997	14.64	983.58	14.08	983.65	14.50	984.4	*	*	*	*	*	*	*	*		
Streamborn	31 March 1999	13.03	985.19	12.58	985.15	13.34	985.56	*	*	*	*	*	*	*	*		
Streamborn	1 February 2001	13.77	984.45	13.21	984.52	14.01	984.89	13.22	984.65	13.14	984.19	13.31	984.19	14.76	983.93		
Streamborn	9 March 2001	12.54	985.68	12.30	985.43	13.32	985.58	12.28	985.59	11.70	985.63	12.54	984.96	13.94	984.75	N 130° E	0.01
Streamborn	23 April 2001	14.01	984.21	13.36	984.37	14.15	984.75	13.05	984.82	13.30	984.03	13.39	984.11	14.63	984.06		
Streamborn	30 May 2001	14.74	983.48	NM	NM	14.67	984.23	13.93	983.94	14.14	983.19	14.17	983.33	15.79	982.90	N 222° E	0.01
Streamborn	19 June 2001	14.83	983.39	13.93	983.80	14.67	984.23	15.47	982.40	14.29	983.04	14.34	983.16	15.87	982.82		
Streamborn	19 July 2001	15.04	983.18	14.51	983.22	14.84	984.06	14.73	983.45	14.48	982.85	14.47	983.03	15.99	982.70		
Streamborn	22 August 2001	15.03	983.19	14.48	983.25	14.83	984.07	14.63	983.24	14.58	982.75	14.57	982.93	16.15	982.54	N 217° E	0.01
Streamborn	29 November 2001	12.59	985.63	12.01	985.72	12.66	986.24	12.78	985.09	11.05	986.28	11.42	986.08	12.94	985.75		
Total Depth (Last Measurement)		24.7		24.6		24.7		24.7		24.7		24.8		24.6			

General Notes

(a) Measurements cited in units of feet (site-specific datum).

(b) Measurements by W.A. Craig (Napa CA) and Streamborn (Berkeley CA).

(c) TOC = top of PVC casing. N = north. Measuring points are the top of PVC casing, north side.

(d) Depth to water and total depth measured relative to the top of PVC casing.

(e) Depth of intercepted interval measured relative to the ground surface, and corresponds to the sand pack interval.

(f) Elevations referenced to assumed (site-specific) datum: Top of concrete, southeastern edge of eastern garage door, assumed elevation = 1000.00 feet. Elevation survey performed 5 January 2001 by Streamborn (Berkeley CA).

Table 3

Groundwater Purging and Sampling Information since 2001
4401 Market Street
Oakland CA

Location	Sample Date	Sample Type	Dissolved Oxygen (mg/L)	pH	Specific Conductance (μmho/cm^2 at field temperature)	Temperature (degrees C)	ORP (mV)	Turbidity and Color	Purge Method	Purge Duration (minutes)	Volume Purged (gallons)	Purged Dry ?	Standing Water Casing Volumes Removed
MW1	1 Feb 2001	Grab (bailer)	3.1	6.7	530	18.3	-210	Clear, none	Submersible pump	9	±5	Yes	±3
	30 May 2001	Grab (bailer)	1.0	6.8	560	24.2	30	Clear, none	Submersible pump	40	±5	Yes	±3
	22 August 2001	Grab (bailer)	3.0	6.9	510	20.4	50	Clear, none	Submersible pump	8	±5	Yes	±3
	29 Nov 2001	Grab (bailer)	NM	6.7	480	20.9	-170	Clear, none	Submersible pump	15	±4	Yes	±2
MW3	1 Feb 2001	Grab (bailer)	5.0	6.7	370	17.4	-230	Clear, none	Submersible pump	4	±5	No	±3
	30 May 2001	Grab (bailer)	5.8	7.0	390	23.6	60	Clear, none	Submersible pump	26	±5	Yes	±3
	22 August 2001	Grab (bailer)	4.5	7.1	370	21.5	90	Cloudy, brown	Submersible pump	6	±5	Yes	±3
	29 Nov 2001	Grab (bailer)	NM	6.8	330	19.3	20	Clear, none	Submersible pump	10	±6	Yes	±3
MW4	1 Feb 2001	Grab (bailer)	5.2	6.8	580	18.2	-210	Cloudy, grey	Submersible pump	47	±15	Yes	±9
	30 May 2001	Grab (bailer)	1.5	6.8	700	22.8	20	Clear, none	Submersible pump	23	±6	Yes	±3
	22 August 2001	Grab (bailer)	2.1	6.9	540	21.2	-20	Clear, none	Submersible pump	5	±5	No	±3
	29 Nov 2001	Grab (bailer)	NM	6.7	550	19.5	-170	Clear, none	Submersible pump	16	±5	Yes	±3
MW5	1 Feb 2001	Grab (bailer)	0.8	6.7	640	18.1	-250	Turbid, brown	Submersible pump	18	±20	No	±10
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	29 Nov 2001	Grab (bailer)	NM	6.8	390	19.5	-160	Clear, none	Submersible pump	8	±7	No	±3
MW7	1 Feb 2001	Grab (bailer)	3.0	6.8	430	16.1	-200	Cloudy, Brown	Submersible pump	25	±17	No	±11
	30 May 2001	Grab (bailer)	3.1	6.8	500	23.6	60	Clear, none	Submersible pump	5	±5	No	±3
	22 August 2001	Grab (bailer)	4.6	6.9	420	19.3	20	Turbid, grey	Submersible pump	5	±5	No	±3
	29 Nov 2001	Grab (bailer)	NM	6.7	400	19.2	-2	Clear, none	Submersible pump	6	±6	No	±3

General Notes

(a) Purging and sampling performed by Streamborn (Berkeley CA).

(b) ORP = oxidation/reduction potential.

(c) NM = Not Measured.

Table 4

Groundwater Analytical Data from Monitoring Wells
4401 Market Street, Oakland CA

Location	Sample Date	Sampled By	TPH-Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	MtBE (µg/L)	Tert-Butyl-alcohol (µg/L)	Other Fuel Oxygenates (EPA Method 8260) (µg/L)
MW1	8 November 1994	W.A. Craig	54	<0.5	<0.5	<0.5	1.2	NA	NA	NA
	14 February 1995	W.A. Craig	71	<0.5	<0.5	<0.5	0.97	NA	NA	NA
	7 June 1995	W.A. Craig	540	0.6	<0.5	1.7	1.3	NA	NA	NA
	29 August 1995	W.A. Craig	440	<0.5	<0.5	1.3	1.1	NA	NA	NA
	8 December 1995	W.A. Craig	<50	<0.5	<0.5	<0.5	<0.5	NA	NA	NA
	7 March 1996	W.A. Craig	77	<0.5	<0.5	<0.5	<0.5	44 (1)	NA	NA
	19 June 1996	W.A. Craig	500	<0.5	<0.5	0.85	0.36	84 (1)	NA	NA
	20 December 1996	W.A. Craig	<50	<0.5	<0.5	<0.5	<0.5	28 (1)	NA	NA
	30 May 2001	Streamborn	53 (2)	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	22 August 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	29 November 2001	Streamborn	130	5.7	<0.5	1.6	5.0	<5.0	<5.0	<5.0 to <10
MW7	1 February 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	30 May 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	22 August 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10
	29 November 2001	Streamborn	<50	<0.5	<0.5	<0.5	<0.5	<5.0	<5.0	<5.0 to <10

General Notes

(a) TPH = Total petroleum hydrocarbons. MtBE = Methyl tertiary Butyl Ether. NA = Not analyzed.

(d) W.A. Craig analytical performed by McCampbell Analytical (Pacheco CA). Streamborn analytical performed by ChromaLab (Pleasanton CA).

Footnote

(1) MtBE analyses prior to 2001 were performed by EPA method 8020; the MtBE detections likely represent "false positives."

(2) The laboratory reported that the sample result did not match the standard.

Table 5

Free Product Monitoring
4401 Market Street, Oakland CA

Date	MW4 (feet)	MW5 (feet)	MW6 (feet)
1 February 2001	<0.005	<0.005	<0.005
9 March 2001	<0.005	<0.005	<0.005
23 April 2001	<0.005	<0.005	<0.005
30 May 2001	<0.005	<0.005	<0.005
19 June 2001	<0.005	<0.005	<0.005
19 July 2001	<0.005	<0.005	<0.005
22 August 2001	<0.005	<0.005	<0.005
29 November 2001	<0.005	<0.005	<0.005

General Notes

(a) Monitoring performed by Streamborn (Berkeley CA).

(b) Free product monitoring performed using a Water Mark Interface meter (model number H.OIL, serial number 4455).

Table 6

Groundwater Monitoring Requirements
4401 Market Street, Oakland CA

Item	Specification
Wells to be Monitored	• Seven wells (MW1, MW2, MW3, MW4, MW5, MW6, and MW7).
Monitoring Frequency and Duration	• Monitor semi-annually for two years (4 events).
Monitoring Dates	• Monitor during seasonally low (October) and seasonally high (February) conditions.
Free Product Monitoring	• None.
Purge Equipment	• Bailer or purge pump.
Purge Equipment Decontamination	• Wash with Alconox or other low-phosphate soap, rinse with tap water, rinse with distilled water.
Purge Criteria	• Wells that recharge in a timely manner should be purged of at least 3 (standing water) casing volumes and sampled after field parameters stabilize. If field parameters have not stabilized by the time 10 (standing water) casing volumes have been purged, sampling will be conducted anyway. • Wells that recharge slowly may be purged dry once and sampled after recharge is sufficient to submerge the sampling device.
Field Measurements and Observations	• Water level in well prior to purging, turbidity (qualitative clarity and color), pH, oxidation-reduction potential, temperature, specific conductivity, dissolved oxygen, and purge volume.
Sampler	• Teflon bailer with bottom-emptying device.
Sampler Decontamination	• Wash with Alconox or other low-phosphate soap, rinse with tap water, rinse with distilled water.
Natural Sample Collection	• Sample from the midpoint of standing water column.
Sample Filtration	• None.
Sample Analysis	• Analyze groundwater samples for TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260).
Sample Container	• Three 40-milliliter glass vials with hydrochloric acid as preservative for TPH-gasoline/BTEX/fuel oxygenates (EPA Method 8260).
Sample Handling and Storage During Transport to Laboratory	• Verify no headspace in 40-milliliter vials. Label sample containers, place in ziplock bag, store on ice in cooler, enter onto chain-of-custody, and maintain sample custody until sent to laboratory.
Field QC Samples	• None.

General Notes

(a) TPH = Total Petroleum Hydrocarbons.

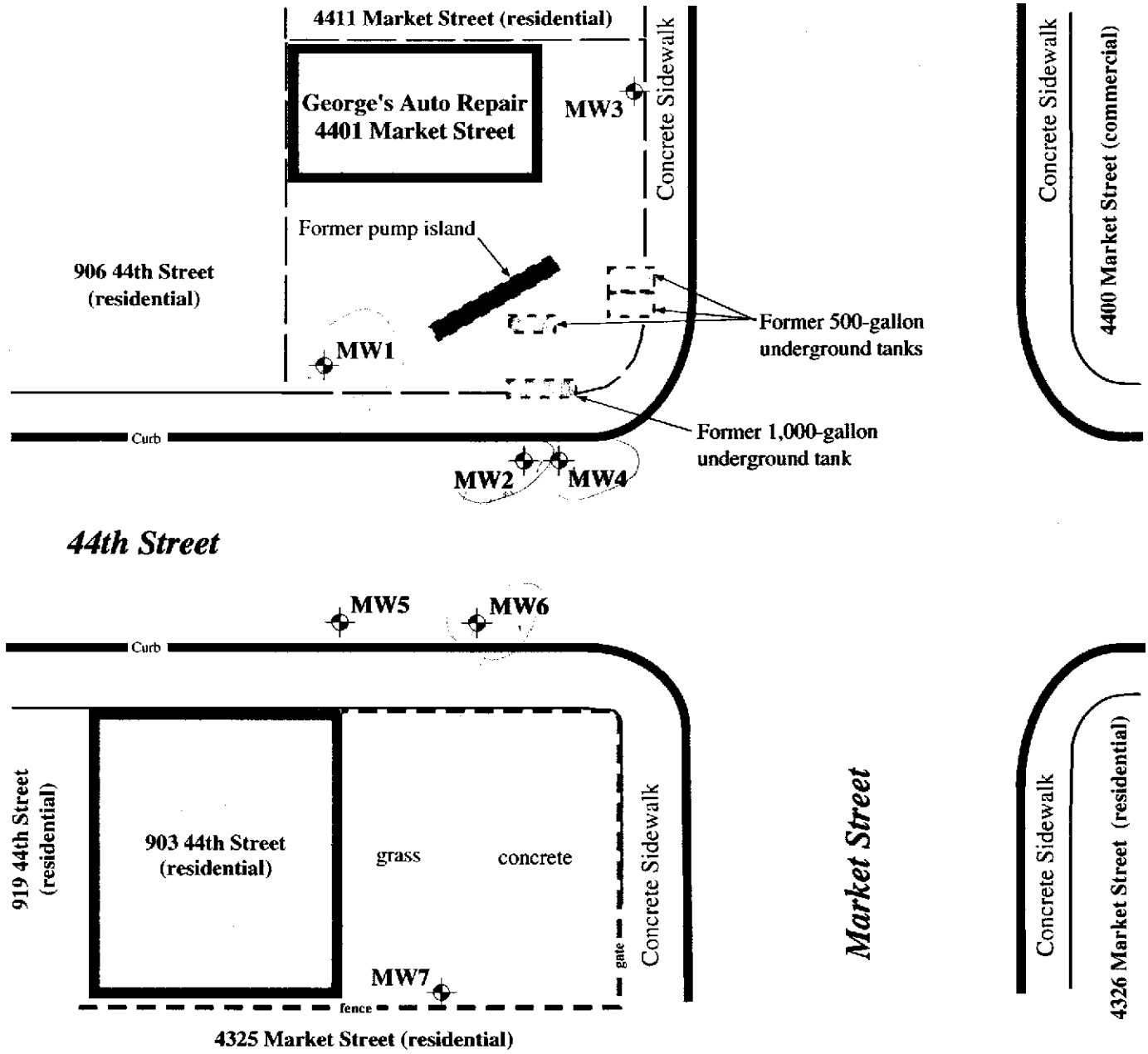
(b) BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes.

Figure 1

Location Map

4401 Market Street
Oakland CA

STREAMBORN



Legend

MW1 Monitoring well

0 30 60

Approximate Scale in Feet

Figure 2

Well Locations

4401 Market Street
Oakland CA

Locations of former underground tanks and pump island from W.A. Craig report dated 1994.

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STANDARD OPERATING PROCEDURE (SOP) 4A
WELL PURGING AND SAMPLING

1.0 INTRODUCTION AND SUMMARY

This SOP describes procedures to purge and sample wells that have been properly installed and developed. Typically, this SOP will be used for sampling monitoring wells with 2- or 4-inch diameter casing. The sampling described herein is appropriate for a variety of groundwater analyses, including: total and dissolved metals, volatile and semi-volatile organic compounds, and general minerals. For newly installed and developed well, the purging and sampling described in this SOP is typically performed at least 7 days after well development to allow ambient groundwater conditions to re-establish in the vicinity of the well.

The procedures described in this SOP should be modified for domestic wells or wells with dedicated sampling equipment. The procedures should also be modified if product is observed in the well.

Typical well sampling and purging activities include decontaminating the purging and sampling equipment, purging the stagnant water from the well casing and filter pack by pumping or bailing, measuring field parameters and evacuated volume of groundwater during purging, terminating the purging process when field parameters stabilize, collecting groundwater samples by pumping or bailing, and labeling and preserving the collected samples.

2.0 EQUIPMENT AND MATERIALS

- Buckets and bristle brushes for decontamination
- Low residue, organic free soap such as Liquinox or Alconox
- If sampling is to be performed for metals, dilute (10%) reagent-grade nitric acid (for decontamination)
- Tap water (for decontamination)
- Distilled water (for decontamination and quality control blank samples)
- Cooler with ice (do not use blue ice or dry ice)
- Ziplock bags of size to accommodate sample containers
- Steel, 55-gallon, open-top drums, DOT 17H
- Field organic vapor monitor. The make, model, and calibration information of the field organic vapor monitor (including compound and concentration of calibration gas) should be documented.
- Laboratory-cleaned containers of proper type and size for the analytical parameters (refer to Table 1)
- Reagent-grade chemicals for sample preservation, as required for the analytical parameters (refer to Table 1)
- If dissolved metals analyses are required, 45-micron cellulose acetate filters and filtering device. Alternate filter type and size (cellulose nitrate, Teflon, or glass-fiber pre-filters) may be required as specified in the Quality Assurance Project Plan or Sampling Plan. The make, type, and size of filter, including disposable filters, should be documented.

- Glass beaker, ±250 milliliter for measurement of field parameters. A similar flow-through cell may also be used.
- Water level meter
- pH, temperature, and specific conductivity instruments, including pH and specific conductivity standards approximating or spanning the natural groundwater parameters. As specified in the Quality Assurance Project Plan or Sampling Plan, oxidation-reduction potential (ORP) or dissolved oxygen meters may also be required.
- Purging equipment consisting of one of the following:

  Bailer: Steel, PVC, Teflon, or stainless steel. Dedicated or new bailer rope.

  Bladder Pump: Plastic or Teflon bladder. 4-inch or 6-inch diameter by ±4-foot long decontamination chambers.

  Submersible Electric Pump: Normally used where relatively large quantities of purge water are expected from wells with quick recharge. Pump should have flow control valve and foot valve. 6-inch diameter by ±4-foot long decontamination chambers.

  Surface Centrifugal Pump: Limited to water lift of approximately 20 feet. Dedicated or new flexible plastic suction hose. Foot valve. Flow control valve.
- Sampling device consisting of one of the following:

  Bailer: Teflon or stainless steel. Dedicated or new bailer rope. If samples are collected for volatile organic compound analysis, bailer should also be fitted with bottom-emptying device.

  Bladder Pump: Teflon bladder. Dedicated or new Teflon or Tygon tubing for sample discharge line. 4-inch or 6-inch diameter by ±4-foot long decontamination chambers.

As specified in the Site Safety Plan, additional safety and personnel decontamination equipment and materials may be needed.

3.0 TYPICAL PROCEDURES

The following procedures are intended to cover the majority of purging and sampling conditions. However, normal field practice requires re-evaluation of these procedures and implementation of alternate procedures upon encountering unusual or unexpected conditions. Deviations from the following procedures may be expected and should be documented.

1. Remove top cap and perform field organic vapor monitoring of well casing
2. Measure static water level and total depth and compare to historic measurements. Remeasure if discrepancies are noted with historic data. Document observations of product, if appropriate. Calculate volume of standing water in casing.
3. Decontaminate purging and sampling equipment (see section DECONTAMINATION in this SOP)
4. Begin purging and if possible, adjust purge rate to expose as little of the screened interval as possible (subject to reasonable time constraints). Record the following observations at the beginning of purge, periodically during purge, and during sampling:

- Purge volume and time
- pH, temperature, and specific conductivity
- Turbidity (clarity and color)
- Approximate drawdown and well yield during purge
- Whether well was purged dry
- Other observations (such as presence of product) as appropriate

5. Terminate purging when one of the following conditions is observed:

   Quick Recharge Wells: Well shows stabilized field parameters and at least 3 casing volumes of standing water have been removed - ready for sampling. If field parameters have not stabilized after removal of 5 casing volumes of standing water, terminate purging anyway. Wells should be allowed to recover to at least 1/2 the original standing water depth prior to sampling.

   Slow Recharge Wells: Wells that are initially purged dry, and do not recover to 1/2 the original standing water depth within 4 hours, should be purged dry again and then sampled when sufficient recovery has occurred to submerge the sampling bailer or pump. Generally, 3 feet of recovery may be considered sufficient recovery for normal bailer or pump submergence.

6. If recharge has submerged the entire screened interval, sample from mid-depth of screened interval. Otherwise, sample from mid-depth of water column at time of sampling.
7. If dissolved metals analyses are to be performed, filter sample. Also if dissolved metals analyses are to be performed and the sample is moderately turbid or very turbid, collect companion filtered and unfiltered samples.
8. For parameters other than dissolved metals, do not filter sample. Fill sample containers directly and preserve according to the requirements of Table 1. Containers should generally filled to capacity. 40 milliliter glass vials should be filled from the bottom using a sample discharge tube (bottom-emptying device for bailer or discharge tube of bladder pump). 40 milliliter vials should not have headspace.
9. Label sample containers, place in ziplock bag, and place on ice in cooler.
10. Log samples onto chain-of-custody form and maintain sample custody until shipped to laboratory.
11. Containerize purge water, excess sample, and decontamination wastewater in steel drum(s). Label drum(s) with hazardous waste label, contents, and well number from which waste originated.

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality control samples should consist of the following:

- Duplicate samples at a frequency of 1 per 10 natural samples
- Cross-contamination blank (also known as a sampler rinsate blank) at a frequency of 1 per 10 natural samples. Cross-contamination blanks are prepared by passing deionized water over and through decontaminated sampling equipment (including sample filter if used).

- If analyses require collection of samples in 40 milliliter vials, travel blanks should also be included at a frequency of 1 per day of sampling.
- Optional quality control samples include standard reference materials and natural matrix spikes.

Meters for measurement of field parameters should be calibrated at least once per day. Calibration standards should generally approximate or span natural groundwater characteristics. Recalibration may be appropriate if unusual measurements are noticed. Calibration activities should be documented on the instrument calibration log.

5.0 DOCUMENTATION

The following information should be collected prior to sampling and taken into the field for reference:

- Well completion schematic
- Summary of historic water level, total depth, and field parameter measurements

Observations, measurements, and other documentation of the purging and sampling effort should be recorded on the following:

- Daily Report
- Field Notebook
- Instrument Calibration Log
- Well Purge and Sample Log
- Chain-of-Custody

Documentation should include any deviations from this SOP, as well as documentation of the containerization and disposition/disposal of investigation-derived waste.

6.0 DECONTAMINATION

Prior to entering the site, purging and sampling equipment should be decontaminated by steam cleaning, pressure washing, or equivalent.

Prior to sampling each well, down-well equipment and equipment that will contact the sample (except sample containers) should be decontaminated according to the following procedure:

- Steam clean or pressure wash (optional unless oily contamination covers equipment)
- Wash with soap
- Rinse with tap water
- Double rinse with distilled water

If metals are included in the analytical parameters, the decontamination procedures should include:

- Steam clean or pressure wash (optional unless oily contamination covers equipment)
- Wash with soap

- Rinse with tap water
- Rinse with dilute nitric acid (skip for pumps containing metal parts)
- Rinse with tap water
- Double rinse with distilled water

Suction or discharge hoses from purge pumps need external decontamination only. Purge or sampling pumps should be decontaminated by filling the decontamination chamber with the aforementioned solutions and pumping the solutions from the chamber to the waste drum.

Prior to leaving the site, purging and sampling equipment should be steam cleaned, pressure washed, or equivalent.

7.0 INVESTIGATION-DERIVED WASTE

Purge water, excess sample, and decontamination wastewater should be containerized in steel drums. Drums should be labeled with hazardous waste labels, including: Generator's name and accumulation date. Wastes from different wells may be combined, but wastes that are anticipated to contain chemical should not be mixed with waste that are not thought to be contaminated.

8.0 SAFETY

Primary chemical hazards during well purging and sampling are associated with dermal exposure. Acids used for decontamination and sample preservation may also present chemical hazards. Primary protection against dermal exposure includes splash protection and gloves. Special chemical hazards may be associated with the presence of product, if discovered during sampling. Water quality samples are not generally considered representative in the presence of product. Accordingly, it may be appropriate to abandon sampling efforts if product is discovered.

Other specific site safety guidance is provided in the Site Safety Plan.

9.0 REFERENCES

Aller, L., T.W. Bennett, G. Hackett, R.J. Petty, J.H. Lehr, H. Sedoris, and D.M. Nielsen, 1989. Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells. National Water Well Association, Dublin, OH. 1989.

U.S. Environmental Protection Agency, 1989a. A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001, OSWER Directive 9355.0-14. USEPA, Office of Emergency and Remedial Response, Washington, DC. December 1989.

U.S. Environmental Protection Agency, 1989b. USEPA Method Study #39, Method 504, 1,2-Dibromoethane (EDB) and 1,2-Dibromo-3-Chloropropane (DBCP) in Water, Pb 89-119 580/AS. National Technical Information Service, Springfield VA. 1989.

Table 1

Sampling and Preservation for Groundwater Samples

Parameter	Analytical Method	Container	Preservation	Maximum Holding Time
Purgeable Halocarbons by GC	EPA 8010	Three 40-ml glass vials	HCl to pH<2, cool to 4 degrees Celsius	14 days after collection
Purgeable Aromatics by GC	EPA 8020	Three 40-ml glass vials	HCl to pH<2, cool to 4 degrees Celsius	14 days after collection
Organochlorine Pesticides and PCB's	EPA 8080	Two 1-liter amber glass	Cool to 4 degrees Celsius	Extract 7 days after collection Analyze 40 days after extraction
Organophosphorus Pesticides	EPA 8140	Two 1-liter amber glass	Cool to 4 degrees Celsius	Extract 7 days after collection Analyze 40 days after extraction
Chlorinated Herbicides (Phenoxy Herbicides)	EPA 8150	Two 1-liter amber glass	Cool to 4 degrees Celsius	Extract 7 days after collection Analyze 40 days after extraction
Volatile Organic Compounds by GC/MS	EPA 8240 or 8260	Three 40-ml glass vials	HCl to pH<2, Cool to 4 degrees Celsius	14 days after collection
Fuel Oxygenates (MTBE, TAME, ETBE, DIPE)	EPA SW846 8260 Modified	Three 40-ml glass vials	Cool to 4 degrees Celsius	14 days after collection
Semi-Volatile Organic Compounds by GC/MS (Base/Neutral/Acid Extractable Organics)	EPA 8270	Two 1-liter amber glass	Cool to 4 degrees Celsius	Extract 7 days after collection Analyze 40 days after extraction
Dibromoethane (EDB) and 1,2-Dibromo-3-Chloropropane (DBCP)	EPA 504	Two 1-liter amber glass	Cool to 4 degrees Celsius	Extract 7 days after collection Analyze 40 days after extraction
Total Petroleum Hydrocarbons Gasoline/BTEX	Extract by EPA 5030, analyze by EPA 8015	Three 40-ml glass vials	HCl to pH<2, cool to 4 degrees Celsius	Extract 7 days after collection Analyze 7 days after extraction
Total Petroleum Hydrocarbons Diesel, Kerosene, or Motor Oil	Extract by EPA 3510, analyze by EPA 8015	One 1-liter amber glass	HCl to pH<2, cool to 4 degrees Celsius	Extract 7 days after collection Analyze 7 days after extraction
Oil & Grease	SM 503	One 1-liter glass with aluminum foil-lined cap	H_2SO_4 to pH<2, cool to 4 degrees Celsius	28 days after collection
Total Metals	EPA 7000 Series	One 1/2 liter poly	HNO3 to pH<2, cool to 4 degrees Celsius	6 months after collection (28 days for mercury)
Dissolved Metals	EPA 7000 Series	One 1/2 liter poly	HNO3 to pH<2, cool to 4 degrees Celsius	6 months after collection (28 days for mercury)
General Minerals	Various	Two 1-liter poly	Cool to 4 degrees Celsius	7 days after collection

Site Safety Plan
Groundwater Monitoring
4401 Market Street
Oakland CA

Anticipated Fieldwork The anticipated fieldwork includes measuring water levels and purging and sampling groundwater monitoring wells.

Chemical Hazard Evaluation Gasoline constituents, which have been detected in soil and groundwater during previous investigations at the property, are summarized in Table 1.

Physical Hazard Evaluation Physical hazards which may be encountered include: heavy machinery, heavy lifting, slip-trip-fall, loud noise, and heat exposure.

Health and Safety Responsibilities This site safety plan will be implemented by the site safety officer under the supervision of the project manager and in coordination with an appropriate client representative. Safety personnel and their responsibilities are presented in Table 2.

Work Zone A work zone will be established around the area of work. The work zone is an area of sufficient size to allow safe completion of the work while maintaining control of access to the work area. The work zone will be restricted by requesting people not directly involved in the work to stay out of the immediate work area, and/or by restricting access by other suitable means, such as with a work fence, traffic cones, or barricades.

No smoking, chewing of tobacco or gum, eating, or drinking will be allowed in the work zone.

Personal Protective Equipment Fieldwork will begin in modified Level-D personal protection (Table 3). If air monitoring results of the work zone exceed the action levels specified below, then personal protective equipment will be upgraded to modified Level-C (Table 3).

Monitoring Visual monitoring should be routinely conducted by the workers. Workers should evaluate themselves and co-workers for signs of fatigue as the work progresses. Work breaks should be taken as reasonably required to maintain safety and efficiency.

The breathing zone in the work area will be monitored using a field organic vapor monitor (Thermo Environmental Instruments Model 580B, 10.0 eV photoionization detector, calibrated to 100 ppm v/v isobutylene). If continual readings greater than 5 ppm above background are detected in the breathing zone, personal protection should be upgraded to modified Level-C from modified Level-D. 5 ppm was selected using the exposure criteria in Table 1.

If continual readings greater than 50 ppm above background are recorded in the breathing zone, work should stop. Work should be resumed after consultation with the project manager and possibly the client, and may include additional safety precautions.

Emergency Procedures. These procedures are designed to allow rapid treatment of workers for injuries or exposure to hazardous substances occurring on the worksite. A secondary purpose of these procedures is to allow documentation of emergencies.

Emergency information is summarized in Table 4. The location of the nearest hospital is shown on Figure 1.

If required, first aid will be provided for injured workers.

The site safety officer will be notified immediately of an emergency. It is the site safety officer's responsibility to document the emergency and report it to the project manager and client in a timely manner.

Decontamination Decontamination refers to removal of potential chemical contamination from worker's clothing and from health and safety monitoring equipment. In many instances, removal and thorough cleaning of work clothing is adequate for worker decontamination. However, if skin contact with chemical-containing material occurs during fieldwork, the affected area will be washed thoroughly with soap and water.

Monitoring equipment should be kept clean by wiping as required with a paper towel or other suitable material.

Health and Safety Wastes Wastes generated by health and safety practices include disposable protective equipment such as gloves, tyvek-coveralls, and boot covers, as well as used paper towels. These items may be disposed of with normal municipal refuse.

Liquid wastes from washing may be disposed of in the sanitary sewer.

Table 1

Chemical Hazard Evaluation
4401 Market Street
Oakland CA

Chemical	Maximum Measured in Soil (mg/kg)	Maximum Measured in Groundwater (µg/L)	Odor Threshold (ppm v/v)	Lower Explosive Limit (ppm v/v)	Time Weighted Average or Permissible Exposure Limit (whichever is lower) (ppm v/v)	Immediately Dangerous to Life and Health (ppm v/v)
Total Petroleum Hydrocarbons as Gasoline	1,300	free product	NA	14,000	300	NA
MtBE	not detected	84	NA	NA	NA	NA
Benzene	12	1,400	34 – 119	13,000	1	500 – 1,000
Toluene	24	960	0.16 – 37	12,000	50	2,000
Ethylbenzene	26	980	0.092 – 0.6	10,000	100	800
Xylenes	140	4,600	20	10,000	100	900

General Notes

(a) Exposure criteria from: (1) American Conference of Governmental Industrial Hygienists, *1993-1994 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices,* (2) 3M Occupational Health and Environmental Safety Division, *1996 Respirator Selection Guide*, 1996, (3) American Conference of Governmental Industrial Hygienists, *Guide to Occupational Exposure Values*, Undated (circa 1990), (4) National Institute for Occupational Safety and Health, *Pocket Guide to Chemical Hazards*, June 1990, and (5) *Material Safety Data Sheet, Chevron Unleaded Gasoline*, Chevron Environmental Health Center, Richmond CA, 12 September 1991.

(b) NA = applicable value was not found in the cited references.

Table 2

Safety Personnel and Responsibilities
4401 Market Street
Oakland CA

Personnel	Responsibilities
Project Manager (Douglas W. Lovell)	Development and overall implementation of Site Safety Plan, provide properly trained onsite personnel to complete the work, coordination of safety issues with client.
Site Safety Officer (Paul Fairbairn)	Onsite implementation of Site Safety Plan, coordination and documentation of field safety procedures, communication of safety issues to project manager, delineate work zone, atmospheric monitoring, review site safety procedures with subcontractors, contact Underground Service Alert, clear underground utilities, maintain adequate supply of safety equipment onsite for Streamborn personnel.
Subcontractor's Site Safety Officer (not anticipated)	Understand and obtain subcontracting crews' compliance with Site Safety Plan, maintain onsite supply of safety equipment for subcontractor's personnel, relay safety concerns to Site Safety Officer.

Table 3

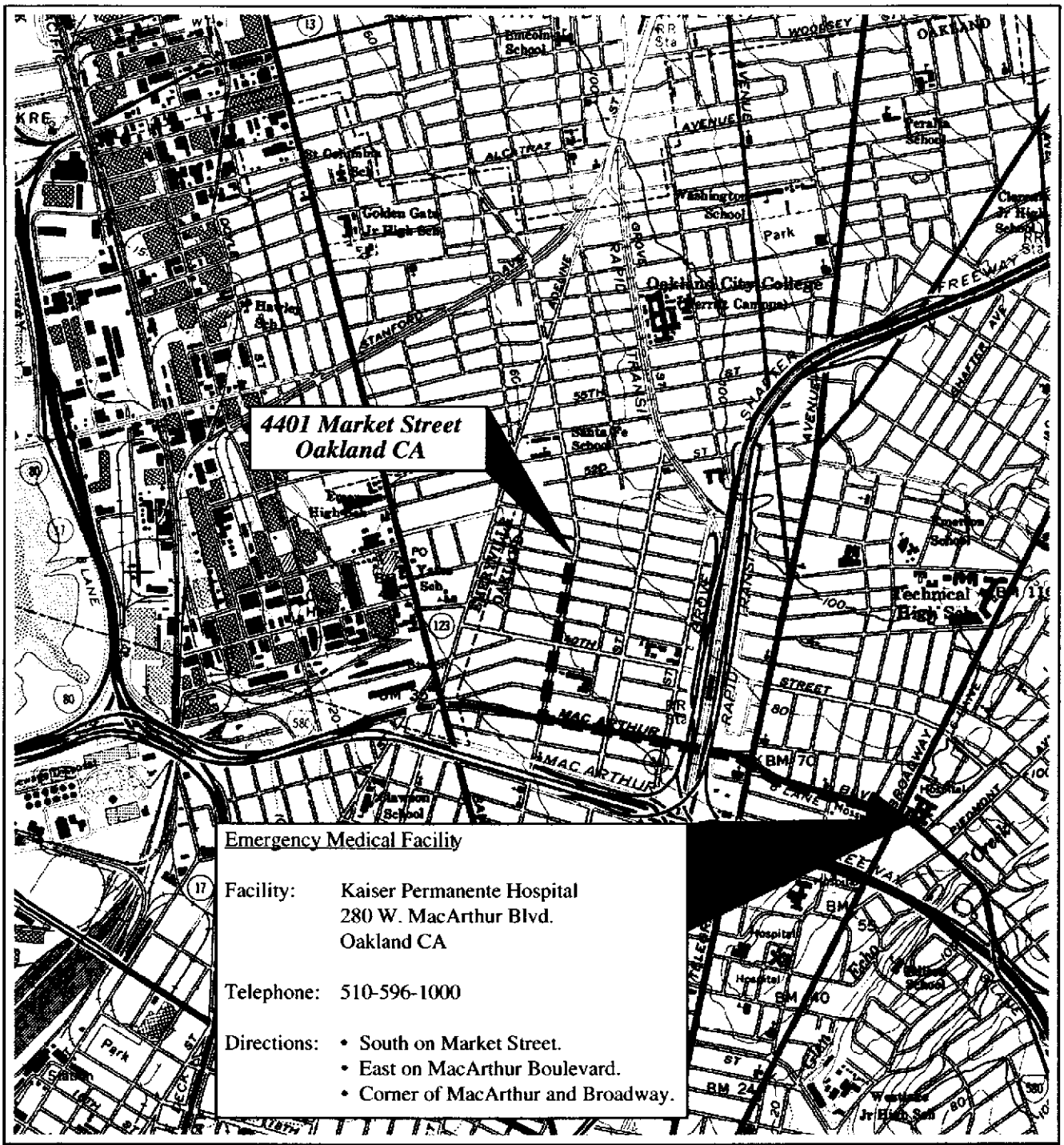
Personnel Protective and Monitoring Equipment
4401 Market Street
Oakland CA

Item	Requirement
Modified Level-D Personal Protective Equipment	Hardhat, dedicated work clothing (cotton coveralls or tyveks), water repellent steel-toed boots, work gloves, latex gloves (as appropriate), nitrile gloves (as appropriate), first aid kit, fire extinguisher, warning tape, optional eye and hearing protection.
Modified Level-C Personal Protective Equipment	Add Half-face respirator with OV-HEPA cartridges and mandatory tyveks to modified Level-D protective equipment. Change respirator cartridges upon detection of breakthrough (by smell), increase in breathing resistance, or daily (whichever is more frequent).
Atmospheric Monitoring	Field organic vapor monitor capable of detecting organic vapor concentrations of 1 ppm (v/v). Field organic vapor monitor to be calibrated to known reference gas daily. Action levels (measurement in the breathing zone of work area): >5 ppm for 10 minutes: upgrade to modified Level C >50 ppm for 10 minutes: stop work, consult with project manager
Visual Monitoring	Evaluate yourself and co-workers for signs of fatigue and visual signs of distress (that may be caused by physical labor and possible chemical exposure).

Table 4

Emergency Information
4401 Market Street
Oakland CA

Emergency Service or Contact	Telephone	Address and Directions
Hospital	510-596-1000	• Kaiser Permanente Hospital 280 W. MacArthur Boulevard Oakland CA • From property, go south on Market Street. • Turn left on MacArthur Boulevard. • Hospital is on the left after crossing Broadway. • See Figure 1 for the route.
Ambulance	911	
Fire Department	911	
Police Department	911	
Onsite Telephone	none	
Site Safety Officer	Paul Fairbairn 510-528-4234 (work) 510-407-1155 (mobile)	
Project Manager	Douglas W. Lovell 510-528-4234 (work) 510-520-3146 (mobile)	
Property Owner (or Representative)	Casimiro and Josie Damele 510-531-0778	
Subcontractors	Not anticipated	



0 0.5 1.0

Approximate Scale in Miles

0 5,000

Approximate Scale in Feet

N

Basemap: U.S. Geological Survey, 7.5 Minute Topographic Quadrangle, Oakland West CA, 1959 (Photorevised 1980).

Figure 1

Hospital Location Map

4401 Market Street
Oakland CA