October 4, 1994

**Mr. Lynn Walker**
*Shell Oil Company*
P.O. Box 4023
Concord, California 94524

**RE:** **Quarterly Monitoring Report - Third Quarter 1994**
Former Shell Service Station
461 Eighth Street
Oakland, California
*WIC #204-5508-6205*

Dear Mr. Walker:

This Quarterly Monitoring Report describes the recently completed activities associated with groundwater monitoring and sampling at the referenced site (Plate 1). This report was prepared to meet quarterly reporting requirements issued by the Regional Water Quality Control Board, San Francisco Bay Region and Alameda County Health Care Services Agency.

This document presents the results of activities performed in the third quarter of 1994.

## Executive Summary

- Blaine Tech Services Inc. of San Jose, California measured groundwater levels from off-site Wells S-4, S-5, and S-6 on July 21, 1994.
- Groundwater samples collected from Well S-6 and Well S-4 were transported to National Environmental Testing (NET) of Santa Rosa, California. A trip blank, equipment blank, and a duplicate sample were prepared and analyzed for quality control purposes.
- Enviros, Inc. (Enviros) evaluated water-level measurement data and chemical analytical results and prepared this report, which includes the Blaine Tech Quarterly Groundwater Sampling Report, a site plan, a groundwater contour map and a benzene concentration map.
- Groundwater flow was calculated to be to the east-northeast at a gradient of 0.03 ft/ft.
- Well S-4 was re-developed by Blaine Tech Services on July 8 and July 19, 1994. Total well depth increased from 16.50 feet prior to development to 28.65 feet after development.
- Well S-4 was ND for TPH-G and BTEX.

- Well S-5 was gauged and evacuated on a monthly basis by Crosby & Overton. A total mixture of approximately 230 gallons of groundwater and seperate-phase hydrocarbons were evacuated from this well.

- Well S-5 contained separate-phase hydrocarbons at a measured thickness ranging from 0.32 feet to 0.47 feet (3.84 inches to 5.6 inches).

- Well S-6 contained 44,000 parts per billion (ppb) TPH-G and 8,200 ppb benzene.

## Site Conditions

There are currently three off-site groundwater monitoring wells; S-4, S-5, S-6 (Plate 2). These wells were installed in 1981. Wells S-1, S-2, S-3 and S-7 have been destroyed. Quarterly groundwater sampling began in October 1988.

## Third Quarter 1994 Sampling Evaluation

Monitoring wells S-6 and S-4 were purged and physical parameters monitored prior to sampling. Field measurements are presented in Table 1. Groundwater samples collected were analyzed for Total Petroleum Hydrocarbons calculated as Gasoline (TPH-G) according to EPA Method 8015 (Modified) and Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) according to EPA Method 8020. Additionally, a trip blank equipment blank, and a duplicate sample were prepared and analyzed for quality control purposes. The third quarter 1994 chemical analytical data for TPH-G and BTEX compounds have been included in the Historical Groundwater Quality Database (Table 2).

Groundwater samples were labeled, entered onto a chain of custody record, stored in a cooler with ice and transported to NET for chemical analysis.

The following field documents are included in this report (Appendix A):

- Blaine Tech Services Inc. Quarterly Groundwater Sampling Report
- Blaine Tech Services Inc. Well Development Report
- Chain-of-Custody Record
- NET Certified Analytical Report

The third quarter 1994 groundwater contour map is presented on Plate 3. A benzene concentration map is presented on Plate 4.

Chemical analytical data are presented in the NET certified analytical report contained in Appendix A.

## Conclusions

A site investigation on the former Shell property was performed on July 6-7, 1994. Results were transmitted in the Enviros report dated August 16, 1994.

**Well S-4, which has been inaccessible for previous sampling records was re-developed and sampled this quarter. Evacuation of separate-phase petroleum hydrocarbons from Well S-5 by Crosby and Overton will continue to be performed on a monthly frequency.**

Groundwater sampling and monitoring will continue on the established schedule.

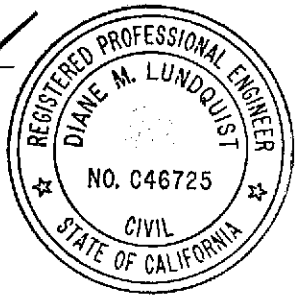
If you have any questions regarding the contents of this document, please call.

Sincerely,

Enviros, Inc.

Greg L. Vaughan
Staff Engineer

Diane M. Lundquist, P.E.
Senior Engineer
C46725



Attachments

Table 1. Field Monitoring Data
Table 2. Historical Groundwater Quality Database

Plate 1. Vicinity Map
Plate 2. Site Plan
Plate 3. Groundwater Elevation Map
Plate 4. Benzene Concentration Map

Appendix A. Blaine Tech Services Inc. - Quarterly Groundwater Sampling Report
Appendix B. Blaine Tech Services Inc. - Well Development Report

cc: Mr. Richard Hiett, San Francisco Bay Region, Regional Water Quality Control Board
Ms. Jennifer Eberlee, Alameda County Health Care Services Agency
Mr. Jim Matthews, Shell Oil Company

# TABLE 1

## FIELD MONITORING DATA

**FORMER SHELL SERVICE STATION**
**461 EIGHTH STREET**
**OAKLAND, CALIFORNIA**
**204-5508-6205**

| WELL NO. | DATE | CASING DIA. (IN.) | TOTAL WELL DEPTH (FT.) | WELL ELEV. (FT.) | PRODUCT THICKNESS (FT.) | DEPTH TO FIRST IMMISCIBLES LIQUID (FT.) | DEPTH TO WATER (FT.) | STATIC WATER ELEV. (FT.) |
|---|---|---|---|---|---|---|---|---|
| S-4 | 21-Jul-94 | 4 | 28.64 | 93.51 | 0.00 | NONE | 22.29 | 71.22 |
| S-5 | 25-Apr-94 | 4 | --- | 99.36 | 0.35 | 21.62 | 21.97 | 77.67 |
| | 26-May-94 | | | | 0.35 | 20.49 | 20.84 | 78.80 |
| | 10-Jun-94 | | --- | | 0.32 | 20.69 | 21.01 | 78.61 |
| | 21-Jul-94 | | --- | | 0.47 | 21.71 | 22.18 | 77.56 |
| S-6 | 21-Jul-94 | 4 | 36.82 | 100.58 | 0.00 | NONE | 21.78 | 78.80 |

NOTES

Static water elevations referenced to project site datum.

* = Groundwater elevation corrected to include 80 percent of the floating product thickness measured in the well.

# TABLE 2

## HISTORICAL GROUNDWATER QUALITY DATABASE

**FORMER SHELL SERVICE STATION**
**461 EIGHTH STREET**
**OAKLAND, CALIFORNIA**
**WIC 204-5508-6205**

| WELL DESIGNATION | SAMPLE DATE | TPH-G (PPB) | BENZENE (PPB) | TOLUENE (PPB) | ETHYLBENZENE (PPB) | XYLENES (PPB) |
|---|---|---|---|---|---|---|
| S-2 | 16-Apr-87 | 47,000 | 8,200 | 4,700 | --- | 3,100 |
| S-4 | 26-Oct-88 | 130 | 3.8 | 13 | 4 | 30 |
| | 14-Feb-89 | <50 | 0.5 | <1 | <1 | 3 |
| | 1-May-89 | | | Dry | | |
| | 27-Jul-89 | | | Dry | | |
| | 5-Oct-89 | | | Dry | | |
| | 9-Jan-90 | | | Dry | | |
| | 30-Apr-90 | <50 | <0.5 | <0.5 | <5 | <1 |
| | 31-Jul-90 | | | Dry | | |
| | 30-Oct-90 | | | Dry | | |
| | 6-May-91 | | | Dry | | |
| | 27-Jun-91 | <50 | <0.5 | <0.5 | <0.5 | <0.5 |
| | 24-Sep-91 | | | Dry | | |
| | 7-Nov-91 | | | Dry | | |
| | 13-Feb-92 | <50 | <0.5 | <0.5 | <0.5 | 3 |
| | 11-May-92 | | | Dry | | |
| | 3-Dec-92 | | | Inaccessible | | |
| | 13-May-93 | | | Inaccessible | | |
| | 22-Jul-93 | | | Inaccessible | | |
| | 20-Oct-93 | | | Inaccessible | | |
| | 25-Jan-94 | | | Inaccessible | | |
| | 25-Apr-94 | | | Inaccessible | | |
| | 21-Jul-94 | <50 | <0.5 | <0.5 | <0.5 | <0.5 |
| S-5 | 16-Apr-87 | 130,000 | 15,000 | 16,000 | --- | 14,000 |
| | 26-Oct-88 | 110,000 | 20,000 | 25,000 | 2,300 | 10,000 |
| | 14-Feb-89 | 94,000 | 16,000 | 21,000 | 1,800 | 10,000 |
| | 1-May-89 | 120,000 | 29,000 | 35,000 | 3,100 | 15,000 |
| | 27-Jul-89 | 110,000 | 20,000 | 29,000 | 2,400 | 14,000 |
| | 5-Oct-89 | | | Floating Product 0.01 ft | | |
| | 9-Jan-90 | | | Floating Product 0.01 ft | | |
| | 30-Apr-90 | 100,000 | 13,000 | 22,000 | 2,100 | 11,000 |
| | 31-Jul-90 | 53,000 | 8,300 | 14,000 | 1,200 | 7,400 |
| | 30-Oct-90 | | | Floating Product 0.03 ft | | |
| | 6-May-91 | | | Floating Product 0.13 ft | | |
| | 27-Jun-91 | | | Floating Product 0.03 ft | | |
| | 24-Sep-91 | | | Floating Product 0.06 ft | | |
| | 7-Nov-91 | | | Floating Product 0.25 ft | | |
| | 13-Feb-92 | | | Floating Product 0.31 ft | | |
| | 11-May-92 | | | Floating Product 0.58 ft | | |
| | 3-Dec-92 | | | Inaccessible | | |

# TABLE 2

## HISTORICAL GROUNDWATER QUALITY DATABASE

**FORMER SHELL SERVICE STATION**
**461 EIGHTH STREET**
**OAKLAND, CALIFORNIA**
**WIC 204-5508-6205**

| WELL DESIGNATION | SAMPLE DATE | TPH-G (PPB) | BENZENE (PPB) | TOLUENE (PPB) | ETHYLBENZENE (PPB) | XYLENES (PPB) |
|---|---|---|---|---|---|---|
| S-5 | 13-May-93 | | | Floating Product 0.27 ft | | |
| | 22-Jul-93 | | | Floating Product 0.25 ft | | |
| | 20-Oct-93 | | | Floating Product 0.23 ft | | |
| | 25-Jan-94 | | | Floating Product 0.18 ft | | |
| | 25-Apr-94 | | | Floating Product 0.35 ft | | |
| | 26-May-94 | | | Floating Product 0.35 ft | | |
| | 16-Jun-94 | | | Floating Product 0.32 ft | | |
| | 21-Jul-94 | | | Floating Product 0.47 ft | | |
| S-6 | 16-Apr-87 | 81,000 | 16,000 | 9,000 | --- | 6,400 |
| | 26-Oct-88 | 110,000 | 29,000 | 18,000 | 2,500 | 8,200 |
| | 14-Feb-89 | 54,000 | 18,000 | 4,500 | 1,400 | 4,000 |
| | 1-May-89 | 93,000 | 43,000 | 9,900 | 3,000 | 8,000 |
| | 27-Jul-89 | 52,000 | 20,000 | 3,200 | 1,700 | 5,500 |
| | 5-Oct-89 | 55,000 | 20,000 | 2,900 | 1,600 | 5,500 |
| | 9-Jan-90 | 76,000 | 35,000 | 9,100 | 2,300 | 8,600 |
| | 30-Apr-90 | 39,000 | 13,000 | 2,300 | 900 | 2,800 |
| | 31-Jul-90 | 48,000 | 20,000 | 4,600 | 1,500 | 4,900 |
| | 30-Oct-90 | 27,000 | 7,400 | 900 | 600 | 1,400 |
| | 6-May-91 | 35,000 | 3,900 | 2,700 | 2,300 | 3,500 |
| | 27-Jun-91 | 51,000 | 19,000 | 5,600 | 1,700 | 6,300 |
| | 24-Sep-91 | 42,000 | 14,000 | 4,300 | 1,200 | 4,000 |
| | 7-Nov-91 | 39,000 | 11,000 | 2,000 | 800 | 2,300 |
| | 13-Feb-92 | 64,000 | 21,000 | 6,200 | 1,600 | 5,100 |
| | 11-May-92 | 57,000 | 22,000 | 7,600 | 2,200 | 7,700 |
| | 3-Dec-92 | 110,000 | 26,000 | 9,400 | 2,100 | 8,700 |
| | 13-May-93 | 58,000 | 21,000 | 6,800 | 2,500 | 9,800 |
| | 22-Jul-93 | 70,000 | 31,000 | 14,000 | 3,000 | 13,000 |
| | 20-Oct-93 | 48,000 | 28,000 | 9,800 | 3,200 | 12,000 |
| | 25-Jan-94 | 70,000 | 23,000 | 7,500 | 2,500 | 8,000 |
| | 25-Apr-94 | 61,000 | 16,000 | 4,000 | 1,800 | 5,100 |
| | 21-Jul-94 | 44,000 | 8,200 | 3,600 | 1,400 | 3,900 |
| S-6 DUP | 21-Jul-94 | 32,000 | 7,800 | 3,400 | 1,300 | 3,700 |

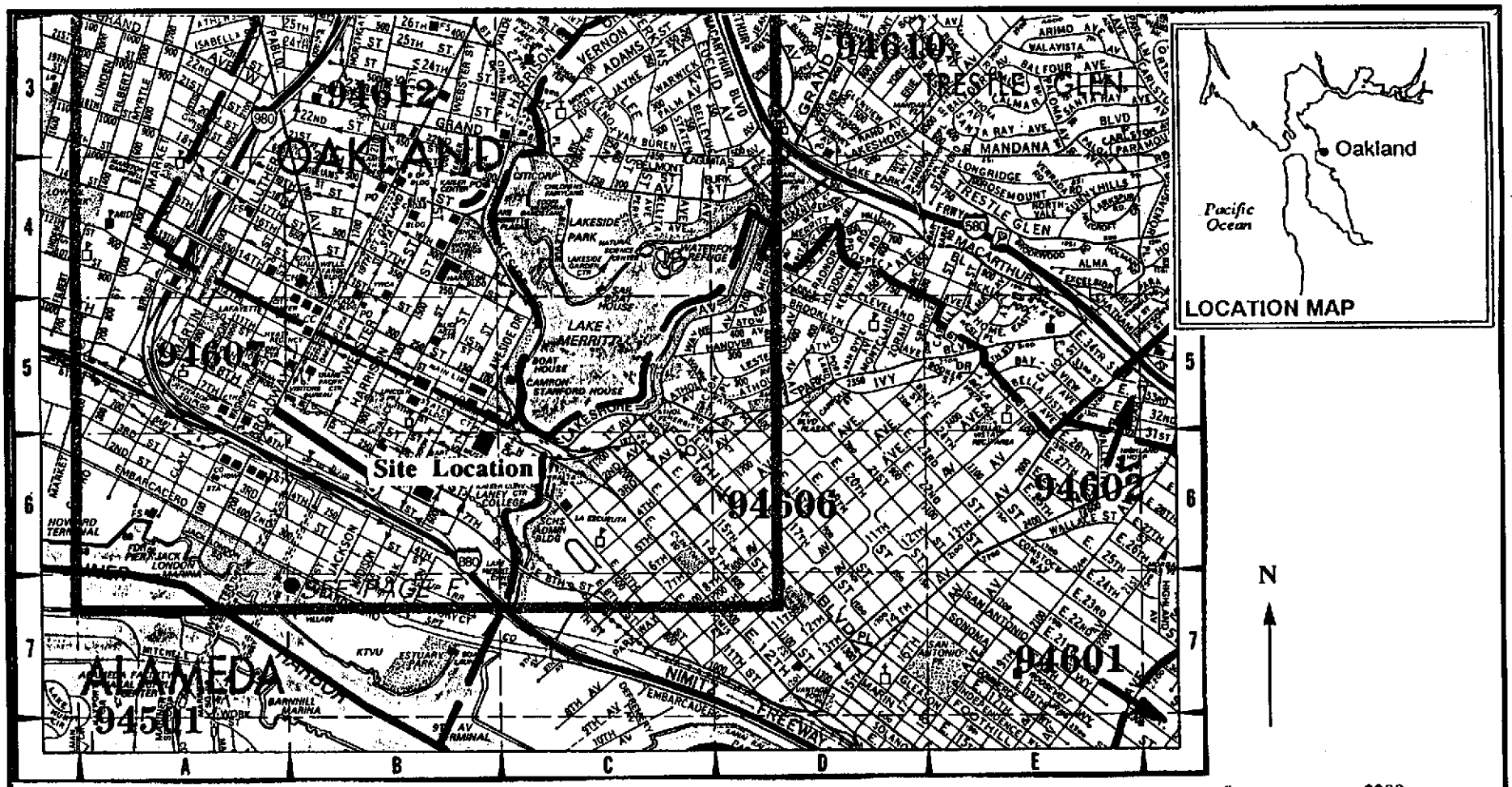
Abbreviations:

TPH-G = Total petroleum hydrocarbons as gasoline by Modified EPA Method 8015

Benzene, Toluene, Ethylbenzene, and Xylenes analyzed by EPA Method 8020

--- = Ethylbenzene and Xylenes were combined prior to May 1987

<x = Not detected at detection limit of x




Base Map: 1993 Thomas Guide

**PLATE**

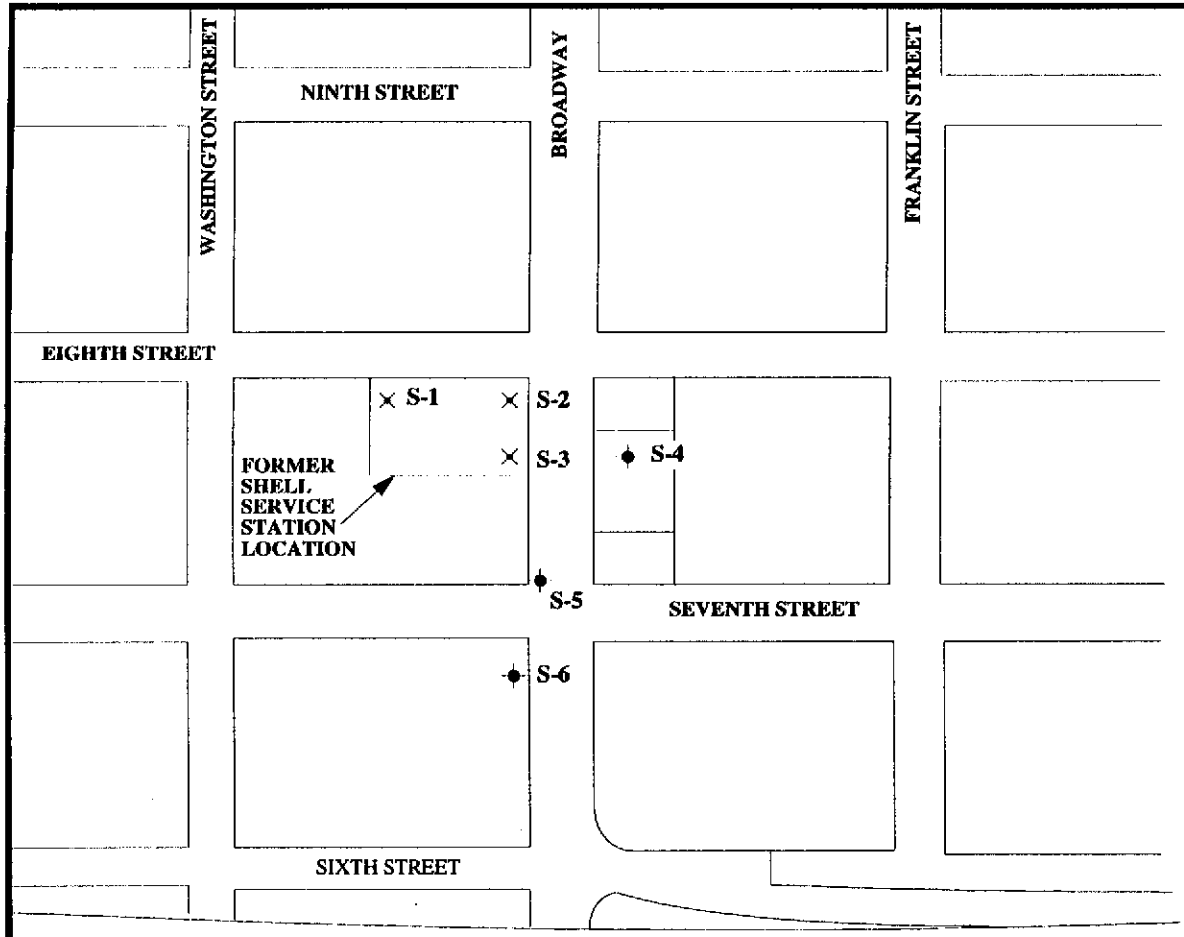
**1**

**VICINITY MAP**
Former Shell Service Station
461 Eighth Street
Oakland, California

***enviros***®
E49307216

Drawn By: CJG Date: 12/6/93

Approved By: [signature] Date: 10/4/94




## EXPLANATION

- Groundwater Monitoring Well
- Destroyed Well

Note: Well S-7 destroyed in 1987

N

0 200

Scale in Feet

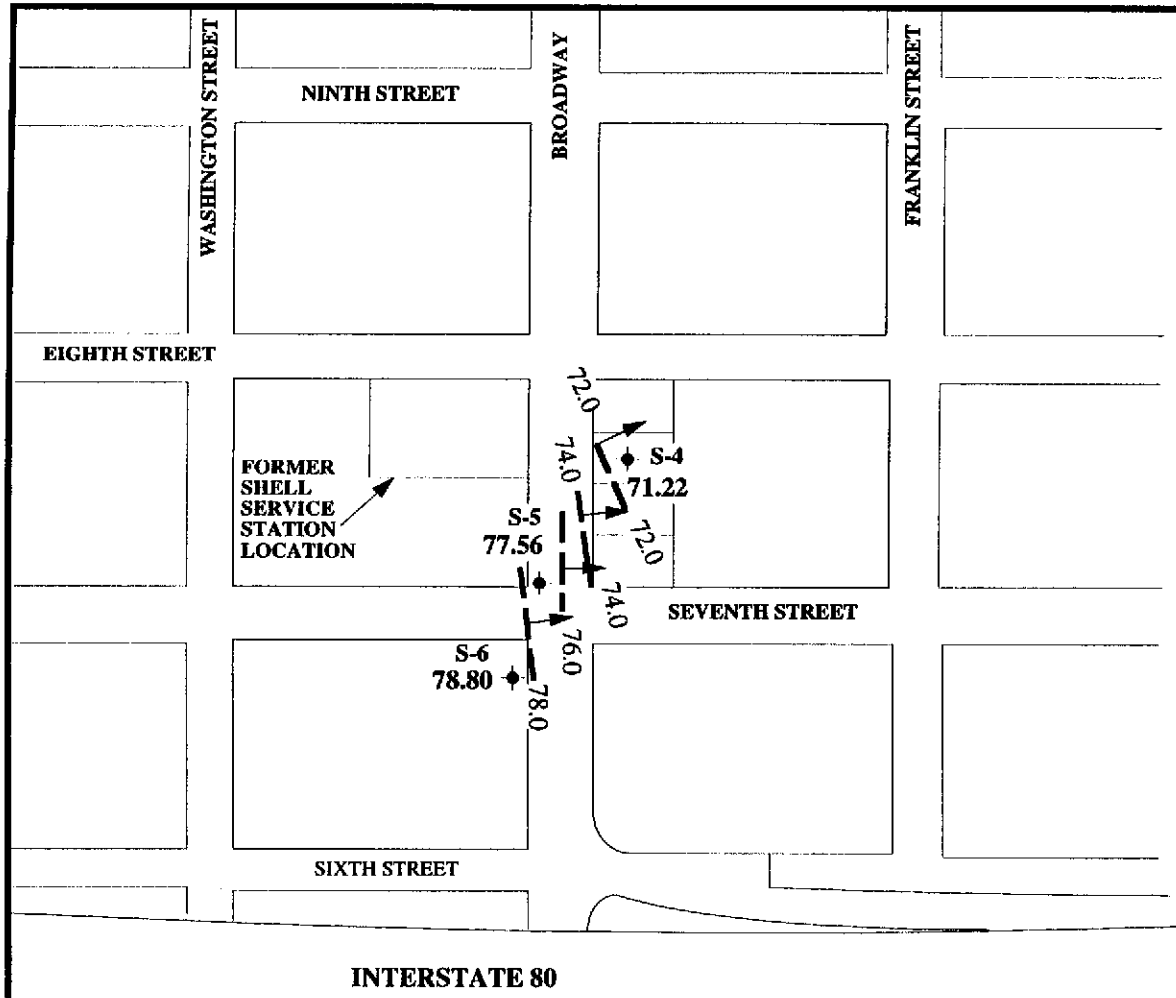
Note: Base Map taken from GeoStrategies Inc. Report dated 10-4-93.

**PLATE 2**

**SITE PLAN**
Former Shell Service Station
461 Eighth Street
Oakland, California

enviros®
E4/9307216

Drawn By: JLP | Date: 6-7-94 | Approved By: AV | Date: 10/4/94




## EXPLANATION

Groundwater Monitoring Well

Groundwater Elevation (Referenced to MSL.)

78.0

Groundwater Elevation Contour in feet (Referenced to Mean Sea Level). Arrows indicate approximate flow direction.

Approximate Hydraulic Gradient = 0.03

Note: Water levels measured on 7-21-94

N

0 200

Scale in Feet

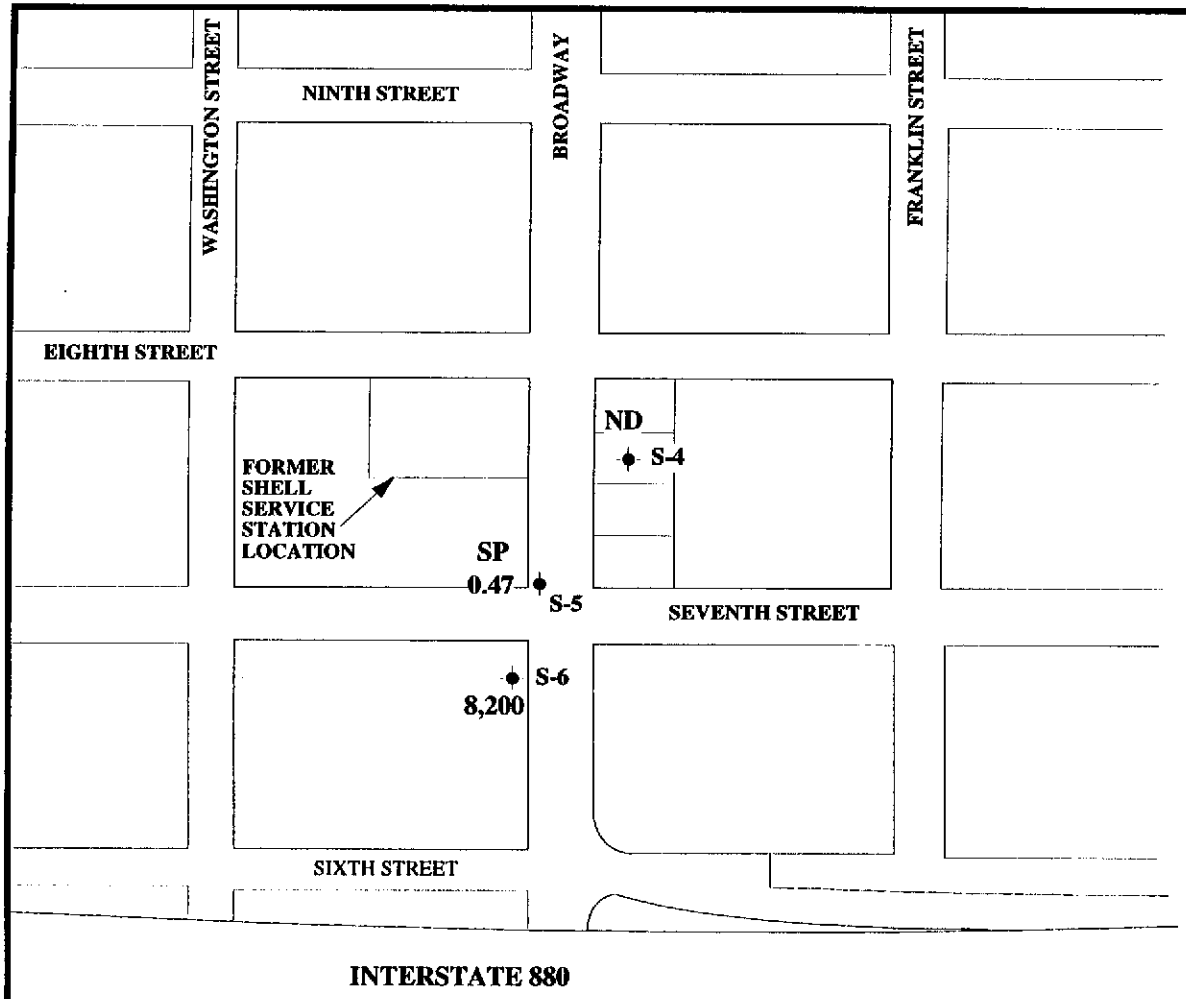
Note: Base Map taken from GeoStrategies Inc. Report dated 10-4-93.

PLATE **3**

**GROUNDWATER ELEVATION MAP**
Former Shell Service Station
461 Eighth Street
Oakland, California

*enviros*®
E4/9307216

Drawn By: GLV | Date: 8-30-94 | Approved By: KV | Date: 10/4/94




## EXPLANATION

- Groundwater Monitoring Well
- S-6
- 8,200 Benzene Concentrations in parts per billion (ppb)
- SP Separate Phase Product
- ND Not Detected
- Note: Wells sampled on 7-21-94

N

0 200

Scale in Feet

Note: Base Map taken from GeoStrategies Inc. Report dated 10-4-93.

PLATE **4**

**BENZENE CONCENTRATION MAP**
Former Shell Service Station
461 Eighth Street
Oakland, California

enviros®
E4/9307216

Drawn By: GLV Date: 8-30-94

Approved By: GV Date: 10/4/94

**Appendix A**

**Blaine Tech Services Inc.**

**Quarterly Groundwater Sampling Report**

BLAINE
TECH SERVICES INC.

985 TIMOTHY DRIV
SAN JOSE, CA 9513
(408) 995-553
FAX (408) 293-877

August 5, 1994

Shell Oil Company
P.O. Box 5278
Concord, CA 94520-9998

RECEIVED
AUG 16 1994

Attn: Lynn Walker

SITE:
Shell WIC #204-5508-6200
461 8th Street
Oakland, California

QUARTER:
3rd quarter of 1994

## QUARTERLY GROUNDWATER SAMPLING REPORT 940721-L-1

This report contains data collected during routine inspection, gauging and sampling of groundwater monitoring wells performed by Blaine Tech Services, Inc. in response to the request of the consultant who is overseeing work at this site on behalf of our mutual client, Shell Oil Company. Data collected in the course of our field work is presented in a TABLE OF WELL GAUGING DATA. The field information was collected during our preliminary gauging and inspection of the wells, the subsequent evacuation of each well prior to sampling, and at the time of sampling.

Measurements taken include the total depth of the well and the depth to water. The surface of water was further inspected for the presence of immiscibles which may be present as a thin film (a sheen on the surface of the water) or as a measurable free product zone (FPZ). At intervals during the evacuation phase, the purge water was monitored with instruments that measure electrical conductivity (EC), potential hydrogen (pH), temperature (degrees Fahrenheit), and turbidity (NTU). In the interest of simplicity, fundamental information is tabulated here, while the bulk of the information is turned over directly to the consultant who is making professional interpretations and evaluations of the conditions at the site.

## STANDARD PROCEDURES

### Evacuation

Groundwater wells are thoroughly purged before sampling to insure that the sample is collected from water that has been newly drawn into the well from the surrounding geologic formation. The selection of equipment to evacuate each well is based on the physical characteristics of the well and what is known about the performance of the formation in which the well has been installed. There are several suitable devices which can be used for evacuation. The most commonly employed devices are air or gas actuated pumps, electric submersible pumps, and hand or mechanically actuated bailers. Our personnel frequently employ USGS/Middleburg positive displacement pumps or similar air actuated pumps which do not agitate the water standing in the well.

Normal evacuation removes three case volumes of water from the well. More than three case volumes of water are removed in cases where more evacuation is needed to achieve stabilization of water parameters and when requested by the local implementing agency. Less water may be obtained in cases where the well dewaters and does not recharge to 80% of its original volume within two hours and any additional time our personnel have reason to remain at the site. In such cases, our personnel return to the site within twenty four hours and collect sample material from the water which has recharged into the well case.

### Decontamination

All apparatus is brought to the site in clean and serviceable condition. The equipment is decontaminated after each use and before leaving the site. Effluent water from purging and on-site equipment cleaning is collected and transported to Shell's Martinez Manufacturing Complex in Martinez, California.

### Free Product Skimmer

The column headed, VOLUME OF IMMISCIBLES REMOVED (ml) is included in the TABLE OF WELL GAUGING DATA to cover situations where a free product skimming device must be removed from the well prior to gauging. Skimmers are installed in wells with a free product zone on the surface of the water. The skimmer is a free product recovery device which often prevents normal well gauging and free product zone measurements. The 2.0" and 3.0" PetroTraps fall into the category of devices that obstruct normal gauging. In cases where the consultant elects to have our personnel pull the skimmers out of the well and gauge the well, our personnel perform the additional task of draining the accumulated free product out of the PetroTrap before putting it back in the well. This

recovered free product is measured and logged in the VOLUME OF IMMISCIBLES REMOVED column. Gauging at such sites is performed in accordance with specific directions from the professional consulting firm overseeing work at the site on Shell's behalf.

**Sample Containers**

Sample material is collected in specially prepared containers which are provided by the laboratory that performs the analyses.

**Sampling**

Sample material is collected in stainless steel bailer type devices normally fitted with both a top and a bottom check valve. Water is promptly decanted into new sample containers in a manner which reduces the loss of volatile constituents and follows the applicable EPA standard for handling volatile organic and semi-volatile compounds.

Following collection, samples are promptly placed in an ice chest containing prefrozen blocks of an inert ice substitute such as Blue Ice or Super Ice. The samples are maintained in either an ice chest or a refrigerator until delivered into the custody of the laboratory.

**Sample Designations**

All sample containers are identified with a site designation and a discrete sample identification number specific to that particular groundwater well. Additional standard notations (e.g. time, date, sampler) are also made on the label.

**Chain of Custody**

Samples are continuously maintained in an appropriate cooled container while in our custody and until delivered to the laboratory under a standard Shell Oil Company chain of custody. If the samples are taken charge of by a different party (such as another person from our office, a courier, etc.) prior to being delivered to the laboratory, appropriate release and acceptance records are made on the chain of custody (time, date, and signature of the person releasing the samples followed by the time, date and signature of the person accepting custody of the samples).

**Hazardous Materials Testing Laboratory**

The samples obtained at this site were delivered to National Environmental Testing, Inc. in Santa Rosa, California. NET is a California Department of Health Services certified Hazardous Materials Testing Laboratory and is listed as DOHS HMTL #178.

**Objective Information Collection**

Blaine Tech Services, Inc. performs specialized environmental sampling and documentation as an independent third party. In order to avoid compromising the objectivity necessary for the proper and disinterested performance of this work, Blaine Tech Services, Inc. performs no consulting and does not become involved in the marketing or installation of remedial systems of any kind. Blaine Tech Services, Inc. is concerned only with the generation of objective information, not with the use of that information to support evaluations and recommendations concerning the environmental condition of the site. Even the straightforward interpretation of objective analytical data is better performed by interested regulatory agencies, and those engineers and geologists who are engaged in the work of providing professional opinions about the site and proposals to perform additional investigation or design remedial systems.

**Reportage**

Submission of this report and the attached laboratory report to interested regulatory agencies is handled by the consultant in charge of the project. Any professional evaluations or recommendations will be made by the consultant under separate cover.

Please call if we can be of any further assistance.

Richard C. Blaine

RCB/lp

attachments: table of well gauging data
chain of custody
certified analytical report

cc: Enviros, Inc.
P.O. Box 259
Sonoma, CA 95476-0259
ATTN: Diane Lundquist

# TABLE OF WELL GAUGING DATA

| WELL I.D. | DATA COLLECTION DATE | MEASUREMENT REFERENCED TO | QUALITATIVE OBSERVATIONS (sheen) | DEPTH TO FIRST IMMISCIBLES LIQUID (FPZ) (feet) | THICKNESS OF IMMISCIBLES LIQUID ZONE (feet) | VOLUME OF IMMISCIBLES REMOVED (ml) | DEPTH TO WATER (feet) | DEPTH TO WELL BOTTOM (feet) |
|---|---|---|---|---|---|---|---|---|
| S-4 | 7/21/94 | TOB | -- | NONE | -- | -- | 22.29 | 28.64 |
| S-5 | 5/26/94 | TOB | FREE PRODUCT | 20.49 | 0.35 | -- | 20.84 | -- |
| | 6/16/94 | TOB | FREE PRODUCT | 20.69 | 0.32 | -- | 21.01 | -- |
| | 7/21/94 | TOB | FREE PRODUCT | 21.71 | 0.47 | -- | 22.18 | -- |
| S-6 * | 7/21/94 | TOB | ODOR | NONE | -- | -- | 21.78 | 36.82 |

* Sample DUP was a duplicate sample taken from well S-6.

1529

# SHELL OIL COMPANY
RETAIL ENVIRONMENTAL ENGINEERING - WEST

## CHAIN OF CUSTODY RECORD
Serial No: 940721-L1

Date: 7-21-94 (22)
Page 1 of 1

Site Address: 461 8th Street, Oakland

WIC#: 204-5508-6200

Shell Engineer: Lynn Walker — Phone No.: (510) 675-6169 Fax #: 675-6172

Consultant Name & Address: Blaine Tech Services, Inc. 985 Timothy Drive, San Jose, CA 95133

Consultant Contact: Jim Keller — Phone No.: (408) 995-5535 Fax #: 293-8773

Comments:

Sampled by: ZM BOLIVER

Printed Name: LADB OLIVER

LAB: NET

| Sample ID | Date | Sludge | Soil | Water | Air | No. of conts. | TPH (EPA 8015 Mod. Gas) | TPH (EPA 8015 Mod. Diesel) | BTEX (EPA 8020/602) | Volatile Organics (EPA 8240) | Test for Disposal | Combination TPH 8015 & BTEX 8020 | | | Asbestos | Container Size | Preparation Used | Composite Y/N | MATERIAL DESCRIPTION | SAMPLE CONDITION/ COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S-4 | 7/22 | | | X | | 3 | | | | | | X | | | | | | | | |
| S-6 | 7/21 | | | X | | 3 | | | | | | X | | | | | | | | |
| E.B. | 7/21 | | | X | | 3 | | | | | | X | | | | | | | | |
| DUP. | 7/21 | | | X | | 3 | | | | | | X | | | | | | | | |
| TB. | 7/21,22 | | | X | | 2 | | | | | | X | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |

CUSTODY SEALED 7/25/94 LD Blum

| | Printed Name | Date / Time | | Printed Name | Date / Time |
|---|---|---|---|---|---|
| Relinquished By (signature): ZM BOLIVER | LADB OLIVER | 7/25/94 12:50 | Received (signature): LD Lumbre | G.P. Lumbre | 7/25/94 12:50 |
| Relinquished By (signature): LD Lumbre | G.P. Lumbre | 7/25 17:50 | Received (signature): | | |
| Relinquished By (signature): (VIA NCS) | | | Received (signature): K. Temple | K. Temple | 7/26/94 0900 |

THE LABORATORY MUST PROVIDE A COPY OF THIS CHAIN-OF-CUSTODY WITH INVOICE AND RESULTS

| CHECK ONE (1) BOX ONLY | CT/DT | TURN AROUND TIME |
|---|---|---|
| Quarterly Monitoring XX | 6461 | 24 hours ☐ |
| Site Investigation ☐ | 6461 | 48 hours ☐ |
| Soil Classify/Disposal ☐ | 6462 | 15 days XX (Normal) |
| Water Classify/Disposal ☐ | 6463 | Other ☐ |
| Soil/Air Rem. or Sys. O & M ☐ | 6462 | NOTE: Notify us soon as Possible of 24/48 hr. TAT. |
| Water Rem. or Sys. O & M ☐ | 6463 | |
| Other ☐ | | |

NATIONAL ENVIRONMENTAL TESTING, INC.

Santa Rosa Division
435 Tesconi Circle
Santa Rosa, CA 95401
Tel: (707) 526-7200
Fax: (707) 526-9623

Jim Keller
Blaine Tech Services
985 Timothy Dr.
San Jose, CA 95133

Date: 08/05/1994
NET Client Acct. No: 1821
NET Pacific Job No: 94.03220
Received: 07/26/1994

Client Reference Information

SHELL, 461 8th Street, Oakland, Job No. 940721-L1

Sample analysis in support of the project referenced above has been completed and results are presented on following pages. Results apply only to the samples analyzed. Reproduction of this report is permitted only in its entirety. Please refer to the enclosed "Key to Abbreviations" for definition of terms. Should you have questions regarding procedures or results, please feel welcome to contact Client Services.

Approved by:

Judy Ridley
Project Coordinator

Jim Hoch
Operations Manager

Enclosure(s)

Ref: SHELL, 461 8th Street, Oakland, Job No. 940721-L1

SAMPLE DESCRIPTION: S-4
Date Taken: 07/22/1994
Time Taken:
NET Sample No: 201355

| Parameter | Results | Flags | Reporting Limit | Units | Method | Date Extracted | Date Analyzed |
|---|---|---|---|---|---|---|---|
| TPH (Gas/BTXE,Liquid) | | | | | | | |
| METHOD 5030/M8015 | -- | | | | | | 07/31/1994 |
| DILUTION FACTOR* | 1 | | | | | | 07/31/1994 |
| as Gasoline | ND | | 50 | ug/L | 5030 | | 07/31/1994 |
| Carbon Range: | -- | | | | | | 07/31/1994 |
| METHOD 8020 (GC,Liquid) | -- | | | | | | 07/31/1994 |
| DILUTION FACTOR* | 1 | | | | | | 07/31/1994 |
| Benzene | ND | | 0.5 | ug/L | 8020 | | 07/31/1994 |
| Toluene | ND | | 0.5 | ug/L | 8020 | | 07/31/1994 |
| Ethylbenzene | ND | | 0.5 | ug/L | 8020 | | 07/31/1994 |
| Xylenes (Total) | ND | | 0.5 | ug/L | 8020 | | 07/31/1994 |
| SURROGATE RESULTS | -- | | | | | | 07/31/1994 |
| Bromofluorobenzene (SURR) | 82 | | | % Rec. | 5030 | | 07/31/1994 |

Ref: SHELL, 461 8th Street, Oakland, Job No. 940721-L1

SAMPLE DESCRIPTION: S-6
Date Taken: 07/21/1994
Time Taken:
NET Sample No: 201356

| Parameter | Results | Flags | Reporting Limit | Units | Method | Date Extracted | Date Analyzed |
|---|---|---|---|---|---|---|---|
| TPH (Gas/BTXE,Liquid) | | | | | | | |
| METHOD 5030/M8015 | -- | | | | | | 08/01/1994 |
| DILUTION FACTOR* | 100 | | | | | | 08/01/1994 |
| as Gasoline | 44,000 | | 5,000 | ug/L | 5030 | | 08/01/1994 |
| Carbon Range: | C5-C14 | | | | | | 08/01/1994 |
| METHOD 8020 (GC,Liquid) | -- | | | | | | 08/01/1994 |
| DILUTION FACTOR* | 100 | | | | | | 08/01/1994 |
| Benzene | 8,200 | FI | 50 | ug/L | 8020 | | 08/01/1994 |
| Toluene | 3,600 | | 50 | ug/L | 8020 | | 08/01/1994 |
| Ethylbenzene | 1,400 | | 50 | ug/L | 8020 | | 08/01/1994 |
| Xylenes (Total) | 3,900 | | 50 | ug/L | 8020 | | 08/01/1994 |
| SURROGATE RESULTS | -- | | | | | | 08/01/1994 |
| Bromofluorobenzene (SURR) | 88 | | | % Rec. | 5030 | | 08/01/1994 |

FI : Compound quantitated at a 1000X dilution factor.

Ref: SHELL, 461 8th Street, Oakland, Job No. 940721-L1

SAMPLE DESCRIPTION: EB
Date Taken: 07/21/1994
Time Taken:
NET Sample No: 201357

| Parameter | Results | Flags | Reporting Limit | Units | Method | Date Extracted | Date Analyzed |
|---|---|---|---|---|---|---|---|
| TPH (Gas/BTXE,Liquid) | | | | | | | |
| METHOD 5030/M8015 | -- | | | | | | 07/31/1994 |
| DILUTION FACTOR* | 1 | | | | | | 07/31/1994 |
| as Gasoline | ND | | 50 | ug/L | 5030 | | 07/31/1994 |
| Carbon Range: | -- | | | | | | 07/31/1994 |
| METHOD 8020 (GC,Liquid) | -- | | | | | | 07/31/1994 |
| DILUTION FACTOR* | 1 | | | | | | 07/31/1994 |
| Benzene | ND | | 0.5 | ug/L | 8020 | | 07/31/1994 |
| Toluene | ND | | 0.5 | ug/L | 8020 | | 07/31/1994 |
| Ethylbenzene | ND | | 0.5 | ug/L | 8020 | | 07/31/1994 |
| Xylenes (Total) | ND | | 0.5 | ug/L | 8020 | | 07/31/1994 |
| SURROGATE RESULTS | -- | | | | | | 07/31/1994 |
| Bromofluorobenzene (SURR) | 74 | | | % Rec. | 5030 | | 07/31/1994 |

Ref: SHELL, 461 8th Street, Oakland, Job No. 940721-L1

SAMPLE DESCRIPTION: DUP
Date Taken: 07/21/1994
Time Taken:
NET Sample No: 201358

| Parameter | Results | Flags | Reporting Limit | Units | Method | Date Extracted | Date Analyzed |
|---|---|---|---|---|---|---|---|
| TPH (Gas/BTXE,Liquid) | | | | | | | |
| METHOD 5030/M8015 | -- | | | | | | 08/02/1994 |
| DILUTION FACTOR* | 100 | | | | | | 08/01/1994 |
| as Gasoline | 32,000 | | 5,000 | ug/L | 5030 | | 08/01/1994 |
| Carbon Range: | C5-C15 | | | | | | 08/01/1994 |
| METHOD 8020 (GC,Liquid) | -- | | | | | | 08/01/1994 |
| DILUTION FACTOR* | 100 | | | | | | 08/01/1994 |
| Benzene | 7,800 | FI | 50 | ug/L | 8020 | | 08/02/1994 |
| Toluene | 3,400 | | 50 | ug/L | 8020 | | 08/01/1994 |
| Ethylbenzene | 1,300 | | 50 | ug/L | 8020 | | 08/01/1994 |
| Xylenes (Total) | 3,700 | | 50 | ug/L | 8020 | | 08/01/1994 |
| SURROGATE RESULTS | -- | | | | | | 08/01/1994 |
| Bromofluorobenzene (SURR) | 86 | | | % Rec. | 5030 | | 08/01/1994 |

FI : Compound quantitated at a 1000X dilution factor.

Ref: SHELL, 461 8th Street, Oakland, Job No. 940721-L1

SAMPLE DESCRIPTION: TB
Date Taken: 07/21/1994
Time Taken:
NET Sample No: 201359

| Parameter | Results | Flags | Reporting Limit | Units | Method | Date Extracted | Date Analyzed |
|---|---|---|---|---|---|---|---|
| TPH (Gas/BTXE,Liquid) | | | | | | | |
| METHOD 5030/M8015 | -- | | | | | | 07/31/1994 |
| DILUTION FACTOR* | 1 | | | | | | 07/31/1994 |
| as Gasoline | ND | | 50 | ug/L | 5030 | | 07/31/1994 |
| Carbon Range: | -- | | | | | | 07/31/1994 |
| METHOD 8020 (GC,Liquid) | -- | | | | | | 07/31/1994 |
| DILUTION FACTOR* | 1 | | | | | | 07/31/1994 |
| Benzene | ND | | 0.5 | ug/L | 8020 | | 07/31/1994 |
| Toluene | ND | | 0.5 | ug/L | 8020 | | 07/31/1994 |
| Ethylbenzene | ND | | 0.5 | ug/L | 8020 | | 07/31/1994 |
| Xylenes (Total) | ND | | 0.5 | ug/L | 8020 | | 07/31/1994 |
| SURROGATE RESULTS | -- | | | | | | 07/31/1994 |
| Bromofluorobenzene (SURR) | 76 | | | % Rec. | 5030 | | 07/31/1994 |

Ref: SHELL, 461 8th Street, Oakland, Job No. 940721-L1

# CONTINUING CALIBRATION VERIFICATION STANDARD REPORT

| Parameter | CCV Standard % Recovery | CCV Standard Amount Found | CCV Standard Amount Expected | Units | Date Analyzed | Analyst Initials |
|---|---|---|---|---|---|---|
| TPH (Gas/BTXE,Liquid) | | | | | | |
| as Gasoline | 105.0 | 1.05 | 1.00 | mg/L | 07/31/1994 | jmh |
| Benzene | 86.4 | 4.32 | 5.00 | ug/L | 07/31/1994 | jmh |
| Toluene | 92.4 | 4.62 | 5.00 | ug/L | 07/31/1994 | jmh |
| Ethylbenzene | 88.8 | 4.44 | 5.00 | ug/L | 07/31/1994 | jmh |
| Xylenes (Total) | 94.7 | 14.2 | 15.0 | ug/L | 07/31/1994 | jmh |
| Bromofluorobenzene (SURR) | 88.0 | 88 | 100 | % Rec. | 07/31/1994 | jmh |
| TPH (Gas/BTXE,Liquid) | | | | | | |
| as Gasoline | 101.0 | 1.01 | 1.00 | mg/L | 08/01/1994 | jmh |
| Benzene | 97.8 | 4.89 | 5.00 | ug/L | 08/01/1994 | jmh |
| Toluene | 102.2 | 5.11 | 5.00 | ug/L | 08/01/1994 | jmh |
| Ethylbenzene | 95.6 | 4.78 | 5.00 | ug/L | 08/01/1994 | jmh |
| Xylenes (Total) | 99.1 | 14.86 | 15.0 | ug/L | 08/01/1994 | jmh |
| Bromofluorobenzene (SURR) | 92.0 | 92 | 100 | % Rec. | 08/01/1994 | jmh |
| TPH (Gas/BTXE,Liquid) | | | | | | |
| as Gasoline | 99.0 | 0.99 | 1.00 | mg/L | 08/02/1994 | jmh |
| Benzene | 89.6 | 4.48 | 5.00 | ug/L | 08/02/1994 | jmh |
| Toluene | 97.6 | 4.88 | 5.00 | ug/L | 08/02/1994 | jmh |
| Ethylbenzene | 88.6 | 4.43 | 5.00 | ug/L | 08/02/1994 | jmh |
| Xylenes (Total) | 94.0 | 14.1 | 15.0 | ug/L | 08/02/1994 | jmh |
| Bromofluorobenzene (SURR) | 94.0 | 94 | 100 | % Rec. | 08/02/1994 | jmh |

Ref: SHELL, 461 8th Street, Oakland, Job No. 940721-L1

# METHOD BLANK REPORT

| Parameter | Method Blank Amount Found | Reporting Limit | Units | Date Analyzed | Analyst Initials |
|---|---|---|---|---|---|
| TPH (Gas/BTXE,Liquid) | | | | | |
| as Gasoline | ND | 0.05 | mg/L | 07/31/1994 | jmh |
| Benzene | ND | 0.5 | ug/L | 07/31/1994 | jmh |
| Toluene | ND | 0.5 | ug/L | 07/31/1994 | jmh |
| Ethylbenzene | ND | 0.5 | ug/L | 07/31/1994 | jmh |
| Xylenes (Total) | ND | 0.5 | ug/L | 07/31/1994 | jmh |
| Bromofluorobenzene (SURR) | 74 | | % Rec. | 07/31/1994 | jmh |
| TPH (Gas/BTXE,Liquid) | | | | | |
| as Gasoline | ND | 0.05 | mg/L | 08/01/1994 | jmh |
| Benzene | ND | 0.5 | ug/L | 08/01/1994 | jmh |
| Toluene | ND | 0.5 | ug/L | 08/01/1994 | jmh |
| Ethylbenzene | ND | 0.5 | ug/L | 08/01/1994 | jmh |
| Xylenes (Total) | ND | 0.5 | ug/L | 08/01/1994 | jmh |
| Bromofluorobenzene (SURR) | 88 | | % Rec. | 08/01/1994 | jmh |
| TPH (Gas/BTXE,Liquid) | | | | | |
| as Gasoline | ND | 0.05 | mg/L | 08/02/1994 | jmh |
| Benzene | ND | 0.5 | ug/L | 08/02/1994 | jmh |
| Toluene | ND | 0.5 | ug/L | 08/02/1994 | jmh |
| Ethylbenzene | ND | 0.5 | ug/L | 08/02/1994 | jmh |
| Xylenes (Total) | ND | 0.5 | ug/L | 08/02/1994 | jmh |
| Bromofluorobenzene (SURR) | 88 | | % Rec. | 08/02/1994 | jmh |

Ref: SHELL, 461 8th Street, Oakland, Job No. 940721-L1

# MATRIX SPIKE / MATRIX SPIKE DUPLICATE

| Parameter | Matrix Spike % Rec. | Matrix Spike Dup % Rec. | RPD | Spike Amount | Sample Conc. | Matrix Spike Conc. | Matrix Spike Dup. Conc. | Units | Date Analyzed | Analyst Initials |
|---|---|---|---|---|---|---|---|---|---|---|
| TPH (Gas/BTXE,Liquid) | | | | | | | | | | |
| as Gasoline | 103.0 | 107.0 | 3.8 | 1.00 | ND | 1.03 | 1.07 | mg/L | 07/31/1994 | jmh |
| Benzene | 106.2 | 105.9 | 0.3 | 32.4 | ND | 34.4 | 34.3 | ug/L | 07/31/1994 | jmh |
| Toluene | 102.6 | 103.0 | 0.4 | 92.9 | ND | 95.3 | 95.7 | ug/L | 07/31/1994 | jmh |
| TPH (Gas/BTXE,Liquid) | | | | | | | | | | |
| as Gasoline | 110.0 | 106.0 | 3.7 | 1.0 | ND | 1.10 | 1.06 | mg/L | 08/01/1994 | jmh |
| TPH (Gas/BTXE,Liquid) | | | | | | | | | | |
| as Gasoline | 97.0 | 91.0 | 6.4 | 1.00 | ND | 0.97 | 0.91 | mg/L | 08/02/1994 | jmh |
| Benzene | 97.2 | 93.6 | 3.8 | 32.6 | ND | 31.7 | 30.5 | ug/L | 08/02/1994 | jmh |
| Toluene | 96.6 | 93.0 | 3.8 | 94.3 | ND | 91.1 | 87.7 | ug/L | 08/02/1994 | jmh |

NET®

**KEY TO ABBREVIATIONS and METHOD REFERENCES**

| | | |
|---|---|---|
| < | : | Less than; When appearing in results column indicates analyte not detected at the value following. This datum supercedes the listed Reporting Limit. |
| * | : | Reporting Limits are a function of the dilution factor for any given sample. Actual reporting limits and results have been multiplied by the listed dilution factor. Do not multiply the reporting limits or reported values by the dilution factor. |
| dw | : | Result expressed as dry weight. |
| mean | : | Average; sum of measurements divided by number of measurements. |
| mg/Kg (ppm) | : | Concentration in units of milligrams of analyte per kilogram of sample, wet-weight basis (parts per million). |
| mg/L | : | Concentration in units of milligrams of analyte per liter of sample. |
| mL/L/hr | : | Milliliters per liter per hour. |
| MPN/100 mL | : | Most probable number of bacteria per one hundred milliliters of sample. |
| N/A | : | Not applicable. |
| NA | : | Not analyzed. |
| ND | : | Not detected; the analyte concentration is less than the applicable listed reporting limit. |
| NTU | : | Nephelometric turbidity units. |
| RPD | : | Relative percent difference, 100 [Value 1 - Value 2]/mean value. |
| SNA | : | Standard not available. |
| ug/Kg (ppb) | : | Concentration in units of micrograms of analyte per kilogram of sample, wet-weight basis (parts per billion). |
| ug/L | : | Concentration in units of micrograms of analyte per liter of sample. |
| umhos/cm | : | Micromhos per centimeter. |

Method References

Methods 100 through 493: see "Methods for Chemical Analysis of Water & Wastes", U.S. EPA, 600/4-79-020, Rev. 1983.

Methods 601 through 625: see "Guidelines Establishing Test Procedures for the Analysis of Pollutants" U.S. EPA, 40 CFR, Part 136, Rev. 1988.

Methods 1000 through 9999: see "Test Methods for Evaluating Solid Waste", U.S. EPA SW-846, 3rd edition, 1986., Rev. 1, December 1987.

SM: see "Standard Methods for the Examination of Water & Wastewater, 17th Edition, APHA, 1989.

Revised September, 1993
abb.93

COOLER RECEIPT FORM

ect: Shell Oakland 940721-L1 Log No: 1569
er received on: 7-26-94 and checked on 7-26-94 by J Sorensen
(signature)

| | | |
|---|---|---|
| custody papers present? | YES | NO |
| custody papers properly filled out? | YES | NO |
| the custody papers signed? | YES | NO |
| sufficient ice used? | YES | NO 4°C |
| all bottles arrive in good condition (unbroken)? | YES | NO |
| bottle labels match COC? | YES | NO |
| proper bottles used for analysis indicated? | YES | NO |
| ect preservatives used? | YES | NO |
| vials checked for headspace bubbles? | YES | NO |

Note which voas (if any) had bubbles:*

| ple descriptor: | Number of vials: |
|---|---|
| TB | 1 of 2 |

VOAs with headspace bubbles have been set aside so they will not be ed for analysis..... YES NO

here all other jobs received in the same cooler:

| ent Job # | NET log # |
|---|---|
| | |

(coolerrec)

**Appendix B**

**Blaine Tech Services Inc.**

**Well Development Report**

BLAINE
TECH SERVICES INC.

985 TIMOTHY DRIV
SAN JOSE, CA 951
(408) 995-55
FAX (408) 293-87

August 12, 1994

Shell Oil Company
P.O. Box 5278
Concord, CA 94520-9998

Attention: Lynn Walker

SITE:
Shell Wic #204-5508-6200
461 8th Street
Oakland, California

PROJECT:
Well Development

PROJECT DATES:
July 8 and 19, 1994

## WELL DEVELOPMENT REPORT 940721-L-1

Blaine Tech Services, Inc. performs specialized environmental sampling and documentation as an independent third party. In order to avoid compromising the objectivity necessary for the proper and disinterested performance of this work, Blaine Tech Services, Inc. does not participate in the interpretation of analytical results or become involved with the marketing or installation of remedial systems. The interpretation of results should be performed by representatives of the interested regulatory agencies and those certified professionals who are engaged as paid consultants in the business of providing professional opinions along with recommendations and proposals for further investigative or remedial activities.

As an independent third party, Blaine Tech Services, Inc. routinely performs evacuation and sampling of groundwater wells. In addition, we are frequently asked to provide specialized personnel, instruments and equipment for well development work. Similar standards of care and cleanliness are required in all these activities and our personnel are accustomed to the safety measures that must be taken.

## Scope of Requested Services

Blaine Tech Services, Inc. was asked to provide specialized equipment, instruments and personnel for a well development project being overseen by Enviros, Inc..

## Execution of the Recent Work

Our personnel arrived at the site on July 8 and 19, 1994 and developed one well in accordance with our client's specifications communicated to us by Ms. Diane Lundquist. A summary of the well development actions is presented in the tables of field data which follow.

## S-4 WELL DEVELOPMENT LOG

| Well Designation | Well Diameter (inches) | Well Depth (feet) | Initial Depth to Water (feet) | Volume of single case (gallons) |
|---|---|---|---|---|
| S-4 | 4 | 16.50 | 14.29 | 1.40 |

**Equipment Used:** Middleburg

**Data collection during well development:**

| Date | Time | Notes |
|---|---|---|
| 07/08/94 | 10:00 | Cleaned out well box, surged well bottom for 5 minutes. |
| | 10:10 | Unable to remove water due to pump clogging with sand/gravel. |
| | 10:15 | Added 7 gals. of D.I. water, surged well bottom for 5 minutes. |
| | 10:35 | Pumped out 7 gals. of D.I. water/sediment. |
| | 10:40 | Total depth of well at 17.25'. |
| | 10:45 | Added 7 gals. of D.I. water, surged well bottom for 5 minutes. |
| | 11:10 | Pumped out 7 gals. of D.I. water/sediment. |
| | | Total depth of well at 17.52'. |
| | 11:20 | Added 7 gals. of D.I. water, surged well bottom for 5 minutes. |
| | 11:45 | Pumped out 7 gals. of D.I. water/sediment. |
| | | Total depth of well at 17.70'. |
| | 11:50 | Repeated procedure, added 7 gals, removed 7 gals. |
| | 12:30 | Total depth of well remained 17.70', bottom of well is firm/ packed with sand and gravel, unable to be removed with a middleburg pump. |
| | 12:30 | End log. |

## S-4 WELL DEVELOPMENT LOG

| Well Designation | Well Diameter (inches) | Well Depth (feet) | Initial Depth to Water (feet) | Volume of single case (gallons) |
|---|---|---|---|---|
| S-4 | 4 | 17.54 | 15.08 | -- |

**Equipment Used:** Middleburg/hand auger/electric pump/suction pump/pneumatic pump

**Data collection during well development:**

| Date | Time | Notes |
|---|---|---|
| 07/19/94 | 09:10 | Used 2" handauger to remove approx. 2' of sand. |
| | 09:35 | Total well depth at 19.10', removed approx. 3' of sand. |
| | 10:00 | Total well depth at 22.0 ', removed 1.3' of sand. Sand has turned from green to black. |
| | 10:15 | Total well depth at 23.30', depth to water at 19.55'. |
| | 11:00 | Total well depth at 27.20', depth to water at 22.20'. |
| | 11:30 | 2" auger is not removing sand since sand and water have mixed. |
| | 11:35 | Started using 3" pneumatic pump to remove sand/water. |
| | 11:40 | Added 3 gals. of D.I. water to dilute sand. |
| | 12:00 | Purged out the 3 gals. of D.I. water, put pump in well bottom and removed sand. |
| | 13:00 | Depth to water at 24.0', total well depth at 28.40'. |
| | 13:30 | Removed an aluminum can from well bottom with auger. |
| | 13:45 | Depth to water at 23.90', total well depth at 29.30'. Bottom of well is hard. |
| | 15:00 | Repeated the procedure of placing the pump at well bottom, allowing it to fill up with sand and pulling it out & cleaning it. |
| | 15:00 | Hand bailed for 1 hour-what are we finding? |
| | 16:00 | Depth to well bottom at 28.65', more sand has entered well. |
| | 16:00 | End log. |

## STANDARD PROCEDURES

### Overview

Because formations vary in their geologic composition, transmissivity and water production capability, well development cannot be reduced to a set of fixed procedures that will always produce a complete and satisfactory result if just repeated for a predetermined period of time. Instead, well development is accomplished by selecting procedures that (a.) repair that portion of the native formation that was disrupted by the cutting action of the well drilling tool, and (b.) promote the flow of water out of the native formation into the newly installed well (through the granular filter pack and well screen). Execution of development actions that are not appropriate to the native formation will be inefficient and in some cases even deleterious.

Time constraints usually prevent a precise classification of the saturated zone materials by analysis of soil samples for physical characteristics at a laboratory equipped to do physical testing. Physical tests cannot usually be completed during the brief timespan of a project that combines exploration, design, and well installation into a one day effort. Instead, the subjective judgments of the field geologist are recorded in the boring log and well installation log. The field geologist must quickly evaluate soil types by their appearance and observable characteristics and record his or her estimation of the material in the log according to the categorical definitions provided by the Unified Soil Classification System. These categorical judgments are also the basis for determining the final construction specifications of the well.

The well's total depth, the length of the screened interval, the slot size, and the size of the sand used in the filter pack are all decided on the *appearance* of soil cuttings and whatever quick tests the field geologist can perform. Because the physical specifications for the well are set at that moment and cannot be corrected later, any misclassification of soil that results in a mismatching of the well to the native formation will have to be addressed and corrected (to whatever extent is possible) with well development actions, alone.

Well development work can be directed in two ways:

> First, specific well development actions can be called for by the geologist who installed the wells or by another professional reviewing that installation work. Typically, consultants specify the use of certain equipment and techniques.
>
> Second, the consultant or client can define the goal which is being sought and place limits on the amount of effort which should be taken to achieve the goal.

Of the two types of direction, the second is far more common and also more important. Defining the extent of effort which can be expended is vital to controlling costs on a project and scheduling personnel and equipment to complete the work. Moreover, it is possible to undertake and complete work without the added and frequently unnecessary effort of working out very detailed specification which may be impractical or unwarranted.

This does not mean that our personnel cannot make use of well installation logs when they are available or are not receptive to very specific directions from the consultant. It does, however, mean that when very detailed directions are given, rapid communications between our personnel and the geologist become very important. This is especially true of sites where multiple wells have been installed, because wells even a short distance apart may demonstrate quite different characteristics which may require a rapid reevaluation of what well development procedures are appropriate in light of the hydrologic condition presented by the native formation at that location on the site.

In most cases, tightly controlled action sequences are less productive than more general directions combined with plain statements of what evaluation criteria should be used for judging the progress and completeness of the well development work. The most common standards are volumetric (removal of set volumes of water), recharge rate, and water clarity (measured as nephelometric turbidity units). Given these goals and limitations, our personnel can work independently of the project geologist. In most cases, our personnel can proceed with the work without supervision or direction by relying on empirical information obtained directly from the water in the well.

## Selection of Development Equipment

Each Blaine Tech Services, Inc. vehicle provided for a well development project will have a wide assortment of development tools including stainless steel surgeblocks and swabs, several types of pumps, and complete instrumentation for determining standard parameters. Special equipment which includes certain types of winches, jetting heads, and drop surging pumps can be provided.

## General Policy

Truly difficult conditions which can only be resolved by the application of massive force or large volumes of high pressure air should be addressed by a drilling or pump installation contractor. Blaine Tech Services, Inc. is not in the heavy salvage business and has a general policy against the use of tools or techniques which provide enough mechanical advantage to pose a serious risk of damaging the well. The same policy prohibits introducing foreign materials into a well which could carry contaminants into the groundwater. In keeping with this policy, our personnel avoid surging with slugs of effluent water, or jetting with unfiltered air unless these actions are specifically requested by a registered professional who is cognizant of the problems and hazards that accompany the action. In a similar vein, our personnel will, whenever possible, avoid development actions that are likely to seal clay formations or promote bridging, and make every attempt to call obvious indications of such conditions to the attention of the project geologist so that a different regimen can be selected.

## Effluent Materials

Groundwater well sampling protocols call for the evacuation of a sufficient volume of water from the well to insure that the sample is collected from water that has been newly drawn into the well from the surrounding geologic formation.

Well development routinely generates as much or more effluent water as does routine evacuation prior to monitoring. In some cases very large amounts of water must be removed from the well before a satisfactory level of development has been achieved. The effluent water from these development actions must be contained. Blaine Tech Services, Inc. will place this water in appropriate containers of the client's choice or bring new DOT 17 E drums to the site which are appropriate for the containment of the effluent materials. The determination of how to properly dispose of the effluent water must usually await the results of laboratory analyses of subsequent samples collected from each individual groundwater well. If those individual samples do not establish whether or not the effluent water is contaminated, or if effluent from more than one source has been combined in the same container, it may be necessary to conduct additional analyses on the effluent material.

## Decontamination

All apparatus is brought to the site in clean and serviceable condition. The equipment will be decontaminated after use in each well and before leaving the site. Decontamination consists of complete disassembly of the device to a point where a jet of steam cleaner water can be directed onto all the internal surfaces. Blaine Tech Services, Inc. frequently modifies apparatus to allow complete disassembly and proper cleaning.

## Personnel

All Blaine Tech Services, Inc. personnel receive 29 CFR 1910.120 training as soon after being hired as is practical. In addition, many of our personnel have additional certifications that include specialized training in level B supplied air apparatus and the supervision of employees working on hazardous materials sites. Employees are not sent to a site unless we are confident they can adhere to any site safety provisions in force at the site and unless we know that they can follow the written provisions of an SSP and the verbal directions of an SSO.

In general, employees sent to a site to perform groundwater well sampling will assume an OSHA level D (wet) environment exists unless otherwise informed. The use of gloves and double glove protocols protects both our employees and the integrity of the samples being collected. Additional protective gear and procedures for higher OSHA levels of protection are available.

Please call if we can be of any further assistance.

Richard C. Blaine

RCB/lp