GETTLER-RYAN INC.

5776
2480

RMP is acceptable
AG
7/6/01

TRANSMITTAL

TO: Mr. Amir Gholami
Alameda County Health Care Services
Department of Environmental Health
1131 Harbor Bay Parkway, Room 250
Alameda, California 94502-6577

DATE: July 2, 2001
PROJ.#: 240004.02
SUBJECT: Former Unocal #2512
1300 Davis Street
San Leandro, CA

RO
300

FROM:
Stephen J. Carter, R.G.
Senior Geologist
Gettler-Ryan Inc.
3140 Gold Camp Drive, Suite 170
Rancho Cordova, California 95670

WE ARE SENDING YOU:

COPIES	DATED	DESCRIPTION
1	June 28, 2001	Risk Management Plan

THESE ARE TRANSMITTED as checked below:

[ ] For review and comment
[ ] Approved as submitted
[ ] Resubmit __ copies for approval
[ ] As requested
[ ] Approved as noted
[ ] Submit __ copies for distribution
[X] For approval
[ ] Return for corrections
[ ] Return __ corrected prints
[ ] For Your Files

COMMENTS:

We are sending this RMP at the request of Unocal. Please call us at 916.631.1300 if you have questions.

cc: Mr. Nick Nickerson, Unocal Corporation, 8788 Elk Grove Boulevard, Building 3, Suite 15, Elk Grove, CA 95624
Ms. Jill Tracy, Unocal Corporation, 376 South Valencia, Avenue, Brea, CA 92823
Mr. Chuck Headlee, Regional Water Quality Control Board, 1515 Clay Street, Suite 1400, Oakland, CA 94612
Mr. Mike Bakaldin, City of San Leandro, Environmental Services Division, 835 E. 14th Street, San Leandro, CA 94577
Ms. Leah Goldberg, Hanson Bridgett, 333 Market Street, Suite 2300, San Francisco, CA 94105

GETTLER-RYAN INC.

rkryhw 5/16/02

STID 686
Closure

April 19, 2002

Mr. Nick Nickerson
Union Oil Company of California
8788 Elk Grove Boulevard, Buidling 3, Suite 15
Elk Grove, California 95624

APR 24 2002

Subject: **Well Abandonment at Former Unocal Service Station No. 2512, 1300 Davis Street, San Leandro, California**

Mr. Nickerson:

At the request of Union Oil Company of California (Unocal), Gettler-Ryan Inc. (GR) abandoned four groundwater monitoring wells at the subject site. On March 18, 2002, GR observed Cascade Drilling, Inc. (C-57 717510) abandon wells MW-3 and MW-7 through MW-9. Locations of the former wells are shown on the attached Site Plan (Figure 1). Well abandonment activities are summarized in Table 1. Copies of well abandonment permit W02-0308 through W02-0311 issued by Alameda County Public Works Agency (ACPWA) and encroachment permits issued by City of San Leandro and Caltrans are attached. Copies of the State of California well completion reports are attached.

Four 2-inch diameter wells (MW-3 and MW-7 through MW-9) were backfilled to the top of casing with neat cement. A pressure of approximately twenty-five pounds per square inch was applied to the top of each casing for five minutes. Following pressure grouting, the top five feet of well casing was drilled out and all borings were backfilled with cuttings and native material to approximately 0.5 feet below ground surface. Well MW-3 was then filled to ground surface with native material, and on April 12, 2002, GR construction personnel replaced the sidewalk flags containing wells MW-7 through MW-9 to original conditions. The wells have been properly abandoned as required by California Department of Water Resources Water Well Standards (Bulletins 74-81 and 74-90) and ACPWA guidelines.

If you have any questions, please call us in our Sacramento office at (916) 631-1300.

Gettler-Ryan Inc.

Geoffrey D. Risse
Project Geologist

David W. Herzog
Senior Geologist
R.G. 7211

REGISTERED GEOLOGIST
DAVID W. HERZOG
No. 7211
STATE OF CALIFORNIA

Attachments: Table 1: Summary of Well Abandonment Activities
Figure 1: Site Plan
Copies of Well Abandonment Permit and Encroachment Permits
State of California Well Completion Report

CC: Mr. Amir Gholami, Alameda County HealthCare Services Agency-Environmental Health Department, 1131 Harbor Bay Parkway, Suite 250, Alameda, CA 94502-6577
City of San Leandro Environmental Services Department, 835 E. 14th St., San Leandro, CA 94577-3767
Mr. James Yoo, Alameda County Public Works Agency, 399 Elmhurst St., Hayward, CA 94544
Mr. Doug Federighi (property owner), 1051 MacArthur Blvd., San Leandro, CA 94577

240004.03

APR 24 2002

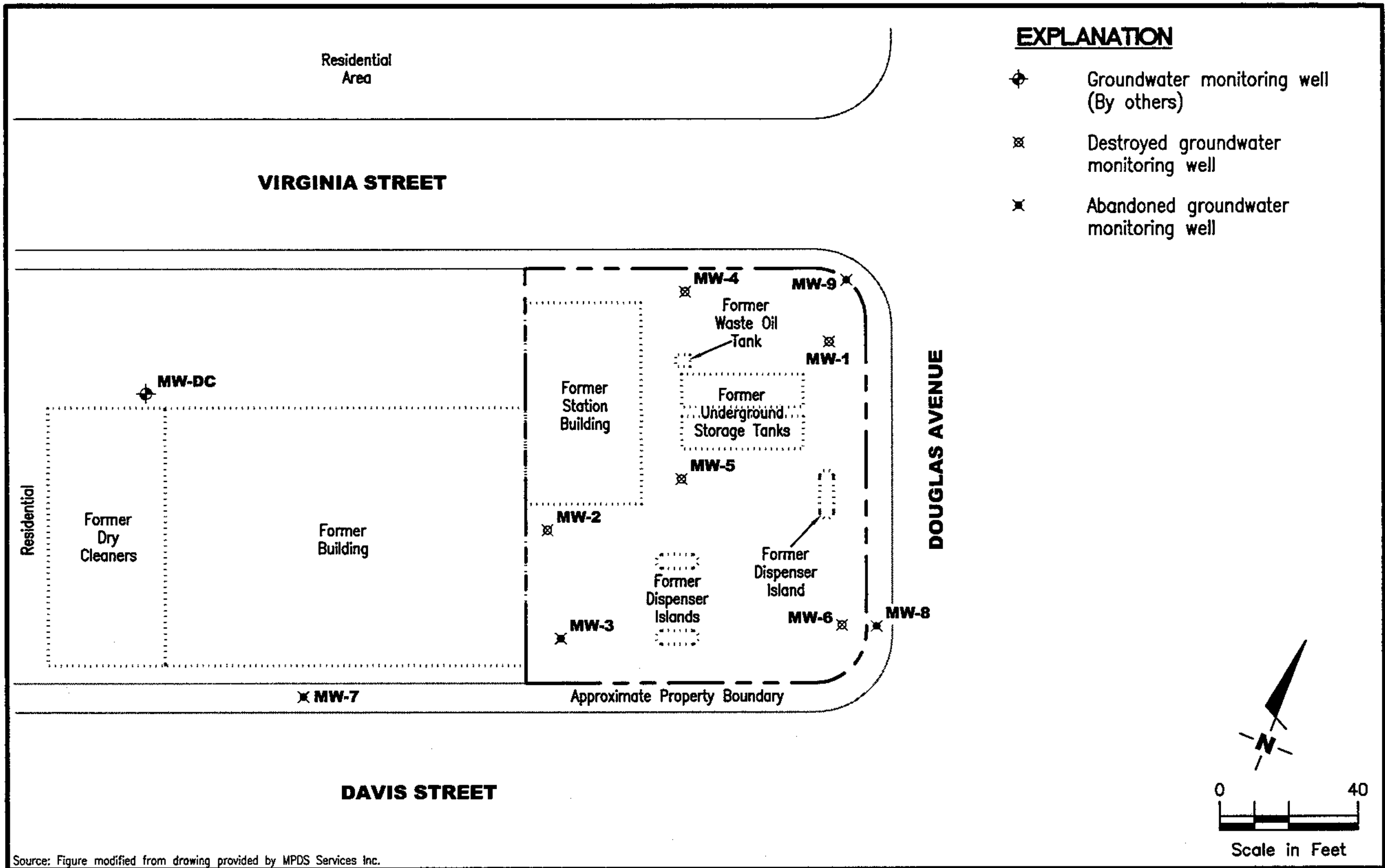
ATTACHMENTS

Table 1
Summary of Well Abandonment
Former Unocal Service Station No. 2512
1300 Davis Street
San Leandro, California

Well ID	Date Abandoned	Well Diameter (inches)	Measured Depth (ft bgs)	Installed Depth (ft bgs)	Depth-to-Water (ft btoc)
MW-3	3/18/2002	2	33.00	33.00	13.75
MW-7	3/18/2002	2	29.81	30.00	12.67
MW-8	3/18/2002	2	29.80	30.00	14.70
MW-9	3/18/2002	2	30.00	30.00	14.65

Explanations:
ft bgs = feet below ground surface
ft btoc = feet below top of casing

Wells were abandoned in accordance with DWR water well standards (Bulletins 74-81 and 74 - 90) and Alameda County Public Works Agency guidelines.



Source: Figure modified from drawing provided by MPDS Services Inc.

GETTLER - RYAN INC.
6747 Sierra Ct., Suite J
Dublin, CA 94568 (925) 551-7555

SITE PLAN
Former Unocal Service Station No. 2512
1300 Davis Street
San Leandro, California

FIGURE
1

PROJECT NUMBER	REVIEWED BY	DATE	REVISED DATE
240004.03		3/02	

FILE NAME: P:\ENVIRO\UNOCAL\2512\A02-2512.DWG | Layout Tab: Well Destruct 3-02

ALAMEDA COUNTY PUBLIC WORKS AGENCY

WATER RESOURCES SECTION
399 ELMHURST ST. HAYWARD CA. 94544-1395
PHONE (510) 670-5554
FAX (510)782-1939

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT 1300 Davis St San Leandro, CA (Former Unocal #2512)

CLIENT
Name Union Oil Company of California
Address 9788 Elk Grove Blvd Phone (916) 714-3205
City Elk Grove Zip 95624

APPLICANT
Name Gettler-Ryan INC
Fax (916) 631-1317
Address 3140 Gold Camp Dr Ste 170 Phone (916) 631-1300
City Rancho Cordova Zip 95670

TYPE OF PROJECT
Well Construction — Geotechnical Investigation
Cathodic Protection ☐ General ☐
Water Supply ☐ Contamination ☐
Monitoring ☐ Well Destruction ✓ by Pressure Grouting

PROPOSED WATER SUPPLY WELL USE
New Domestic ☐ Replacement Domestic ☐
Municipal ☐ Irrigation ☐
Industrial ☐ Other ______ ☐

DRILLING METHOD:
Mud Rotary ☐ Air Rotary ☐ Auger ☐
Cable ☐ Other ☐

DRILLER'S NAME Cascade Drilling

DRILLER'S LICENSE NO. 717510

WELL PROJECTS
Drill Hole Diameter ______ in. Maximum
Casing Diameter 2 in. Depth 33 ft.
Surface Seal Depth ______ ft. Owner's Well Number MW-3

GEOTECHNICAL PROJECTS
Number of Borings ______ Maximum
Hole Diameter ______ in. Depth ______ ft.

ESTIMATED STARTING DATE 3/18/02
ESTIMATED COMPLETION DATE 3/18/02

FOR OFFICE USE

PERMIT NUMBER W02-0308
WELL NUMBER ______
APN ______

PERMIT CONDITIONS
Circled Permit Requirements Apply

A. GENERAL
1. A permit application should be submitted so as to arrive at the ACPWA office five days prior to proposed starting date.
2. (circled) Submit to ACPWA within 60 days after completion of permitted original Department of Water Resources-Well Completion Report.
3. Permit is void if project not begun within 90 days of approval date

B. WATER SUPPLY WELLS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved.

C. GROUNDWATER MONITORING WELLS INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.

D. GEOTECHNICAL
Backfill bore hole by tremie with cement grout or cement grout/sand mixture. Upper two-three feet replaced in kind or with compacted cuttings.

E. CATHODIC
Fill hole anode zone with concrete placed by tremie.

(F.) WELL DESTRUCTION — Pressure Grout - Attached
Send a map of work site. A separate permit is required for wells deeper than 45 feet.

G. SPECIAL CONDITIONS

NOTE: One application must be submitted for each well or well destruction. Multiple borings on one application are acceptable for geotechnical and contamination investigations.

APPROVED [signature] DATE 3-14-02

I hereby agree to comply with all requirements of this permit and Alameda County Ordinance No. 73-68.

APPLICANT'S SIGNATURE [signature] DATE 3/7/02

PLEASE PRINT NAME Geoffrey P. Risse

Rev.5-13-00

ALAMEDA COUNTY PUBLIC WORKS AGENCY

PUBLIC WORKS

WATER RESOURCES SECTION
399 ELMHURST ST. HAYWARD CA. 94544-1395
PHONE (510) 670-5554
FAX (510)782-1939

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT 1300 Davis St
San Leandro, CA (Former Unocal #5121)

CLIENT
Name Union Oil Company of California
Address 9788 Elk Grove Blvd Phone (916) 714-3205
City Elk Grove Zip 95624

APPLICANT
Name Gettler-Ryan INC
Fax (916) 631-1317
Address 3140 Gold Camp Dr ste 170 Phone (916) 631-1300
City Rancho Cordova Zip 95670

TYPE OF PROJECT
Well Construction
Cathodic Protection [ ]
Water Supply [ ]
Monitoring [ ]
Geotechnical Investigation
General [ ]
Contamination [ ]
Well Destruction [✓] by Pressure Grouting

PROPOSED WATER SUPPLY WELL USE
New Domestic [ ]
Municipal [ ]
Industrial [ ]
Replacement Domestic [ ]
Irrigation [ ]
Other ______ [ ]

DRILLING METHOD:
Mud Rotary [ ]
Cable [ ]
Air Rotary [ ]
Other [ ]
Auger [ ]

DRILLER'S NAME Cascade Drilling

DRILLER'S LICENSE NO. 717510

WELL PROJECTS
Drill Hole Diameter ______ in.
Casing Diameter 2 in.
Surface Seal Depth ______ ft.
Maximum Depth 33 ft.
Owner's Well Number MW-7

GEOTECHNICAL PROJECTS
Number of Borings ______
Hole Diameter ______ in.
Maximum Depth ______ ft.

ESTIMATED STARTING DATE 3/18/02
ESTIMATED COMPLETION DATE 3/18/02

I hereby agree to comply with all requirements of this permit and Alameda County Ordinance No. 73-68.

APPLICANT'S SIGNATURE [signature] DATE 3/7/02

PLEASE PRINT NAME Geoffrey P. Risse

Rev.5-13-00

FOR OFFICE USE

PERMIT NUMBER W02-0309
WELL NUMBER ______
APN ______

PERMIT CONDITIONS
Circled Permit Requirements Apply

A. GENERAL
1. A permit application should be submitted so as to arrive at the ACPWA office five days prior to proposed starting date.
2. (circled) Submit to ACPWA within 60 days after completion of permitted original Department of Water Resources-Well Completion Report.
3. Permit is void if project not begun within 90 days of approval date

B. WATER SUPPLY WELLS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved.

C. GROUNDWATER MONITORING WELLS INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.

D. GEOTECHNICAL
Backfill bore hole by tremie with cement grout or cement grout/sand mixture. Upper two-three feet replaced in kind or with compacted cuttings.

E. CATHODIC
Fill hole anode zone with concrete placed by tremie.

(F.) (circled) WELL DESTRUCTION - Pressure Grout - Attached
Send a map of work site. A separate permit is required for wells deeper than 45 feet.

G. SPECIAL CONDITIONS

NOTE: One application must be submitted for each well or well destruction. Multiple borings on one application are acceptable for geotechnical and contamination investigations.

APPROVED [signature] DATE 3-14-02

ALAMEDA COUNTY PUBLIC WORKS AGENCY

WATER RESOURCES SECTION
399 ELMHURST ST. HAYWARD CA. 94544-1395
PHONE (510) 670-5554
FAX (510)782-1939

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT 1300 Davis St San Leandro, CA (Former Unocal #2512)

CLIENT
Name Union Oil Company of California
Address 9768 Elk Grove Blvd Phone (916) 714-3205
City Elk Grove Zip 95624

APPLICANT
Name Gettler-Ryan INC
Fax (916) 631-1317
Address 3140 Gold Camp Dr Ste 170 Phone (916) 631-1300
City Rancho Cordova Zip 95670

TYPE OF PROJECT
Well Construction
- Cathodic Protection ☐
- Water Supply ☐
- Monitoring ☐

Geotechnical Investigation
- General ☐
- Contamination ☐
- Well Destruction ☑ by Pressure Grouting

PROPOSED WATER SUPPLY WELL USE
- New Domestic ☐
- Municipal ☐
- Industrial ☐
- Replacement Domestic ☐
- Irrigation ☐
- Other ______ ☐

DRILLING METHOD:
- Mud Rotary ☐
- Cable ☐
- Air Rotary ☐
- Other ☐
- Auger ☐

DRILLER'S NAME Cascade Drilling

DRILLER'S LICENSE NO. 717510

WELL PROJECTS
Drill Hole Diameter ______ in.
Casing Diameter 2 in.
Surface Seal Depth ______ ft.
Maximum Depth 33 ft.
Owner's Well Number MW-8

GEOTECHNICAL PROJECTS
Number of Borings ______
Hole Diameter ______ in.
Maximum Depth ______ ft.

ESTIMATED STARTING DATE 3/18/02
ESTIMATED COMPLETION DATE 3/18/02

I hereby agree to comply with all requirements of this permit and Alameda County Ordinance No. 73-68.

APPLICANT'S SIGNATURE [signature] DATE 3/7/02

PLEASE PRINT NAME Geoffrey D. Risse

Rev.5-13-00

FOR OFFICE USE

PERMIT NUMBER W02-0310
WELL NUMBER ______
APN ______

PERMIT CONDITIONS
Circled Permit Requirements Apply

A. GENERAL
1. A permit application should be submitted so as to arrive at the ACPWA office five days prior to proposed starting date.
2. (circled) Submit to ACPWA within 60 days after completion of permitted original Department of Water Resources-Well Completion Report.
3. Permit is void if project not begun within 90 days of approval date

B. WATER SUPPLY WELLS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved.

C. GROUNDWATER MONITORING WELLS INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.

D. GEOTECHNICAL
Backfill bore hole by tremie with cement grout or cement grout/sand mixture. Upper two-three feet replaced in kind or with compacted cuttings.

E. CATHODIC
Fill hole anode zone with concrete placed by tremie.

(F.) (circled) WELL DESTRUCTION – Pressure [illegible] - Attached
Send a map of work site. A separate permit is required for wells deeper than 45 feet.

G. SPECIAL CONDITIONS

NOTE: One application must be submitted for each well or well destruction. Multiple borings on one application are acceptable for geotechnical and contamination investigations.

APPROVED [signature] DATE 3-14-02

ALAMEDA COUNTY PUBLIC WORKS AGENCY

WATER RESOURCES SECTION
399 ELMHURST ST. HAYWARD CA. 94544-1395
PHONE (510) 670-5554
FAX (510)782-1939

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT 1300 Davis St
San Leandro, CA (Fmr Unocal #2512)

CLIENT
Name Unocal Oil Company of California
Address 9766 Elk Grove Blvd Phone (916) 714-3205
City Elk Grove Zip 95624

APPLICANT
Name Gettler-Ryan INC
Fax (916) 631-1317
Address 3140 Gold Camp Dr. ste 170 Phone (916) 631-1300
City Rancho Cordova Zip 95670

TYPE OF PROJECT
Well Construction ☐ Geotechnical Investigation
Cathodic Protection ☐ General ☐
Water Supply ☐ Contamination ☐
Monitoring ☐ Well Destruction ✓ by Pressure Grouting

PROPOSED WATER SUPPLY WELL USE
New Domestic ☐ Replacement Domestic ☐
Municipal ☐ Irrigation ☐
Industrial ☐ Other ______ ☐

DRILLING METHOD:
Mud Rotary ☐ Air Rotary ☐ Auger ☐
Cable ☐ Other ☐

DRILLER'S NAME Cascade Drilling

DRILLER'S LICENSE NO. 717510

WELL PROJECTS
Drill Hole Diameter ______ in. Maximum
Casing Diameter 2 in. Depth 33 ft.
Surface Seal Depth ______ ft. Owner's Well Number MW-9

GEOTECHNICAL PROJECTS
Number of Borings ______ Maximum
Hole Diameter ______ in. Depth ______ ft.

ESTIMATED STARTING DATE 3/18/02
ESTIMATED COMPLETION DATE 3/18/02

FOR OFFICE USE

PERMIT NUMBER W02-0311
WELL NUMBER ______
APN ______

PERMIT CONDITIONS
Circled Permit Requirements Apply

A. GENERAL
1. A permit application should be submitted so as to arrive at the ACPWA office five days prior to proposed starting date.
2. (circled) Submit to ACPWA within 60 days after completion of permitted original Department of Water Resources-Well Completion Report.
3. Permit is void if project not begun within 90 days of approval date

B. WATER SUPPLY WELLS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved.

C. GROUNDWATER MONITORING WELLS INCLUDING PIEZOMETERS
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2. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.

D. GEOTECHNICAL
Backfill bore hole by tremie with cement grout or cement grout/sand mixture. Upper two-three feet replaced in kind or with compacted cuttings.

E. CATHODIC
Fill hole anode zone with concrete placed by tremie.

(F.) (circled) WELL DESTRUCTION — Pressure Grout - Attached
Send a map of work site. A separate permit is required for wells deeper than 45 feet.

G. SPECIAL CONDITIONS

NOTE: One application must be submitted for each well or well destruction. Multiple borings on one application are acceptable for geotechnical and contamination investigations.

APPROVED [signature] DATE 3-14-02

I hereby agree to comply with all requirements of this permit and Alameda County Ordinance No. 73-68.

APPLICANT'S SIGNATURE [signature] DATE 3/7/02

PLEASE PRINT NAME Geoffrey D. Risse Rev.5-13-00

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

ENCROACHMENT PERMIT RIDER

TR-0122 (REV 3/92)

Collected by	Permit No. (Original) 0491-6SV2021
Rider Fee Paid $170.00	DST/Co/Rte/PM 04-ALA-112 0.94
Date March 12, 2002	Rider Number 0402-6RT-0060

TO: Unical Corporation c/o Kaprealian Engineering, Inc
3140 Gold Camp Drive, Suite 170
Rancho Cordova, CA 95670

Attn: Geoffrey D. Risse
Phone: (916) 714-3205

, PERMITTEE

In compliance with your request of January 7, 2002, we are hereby amending the above numbered encroachment permit as follows:

Reference your original project to: "install, maintain and monitor one 2-inch diameter groundwater monotoring well on the north sidewalk area of State Highway 04-Ala-112 (Davis Street), Post Mile 0.94, approximately 170 feet west of Douglas Avenue in San Leandro."

Replace the second paragraph on Page 1 of your permit:

"Two days before work is started under this permit, notice shall be given to, and approval of construction details, operations, public safety, and traffic control shall be obtained from Permit Coordinator N. Freitag, P. O. Box 337, San Lorenzo, 510-352-0636."

with the following two paragraphs:

"A minimum of one week prior to the start of work under this permit, notice shall be given and advance approval of construction details, operations, public safety, and traffic control shall be obtained from State Representative N. Freitag, 600 Lewelling Blvd. , San Leandro, CA 94579, (510) 614-5951, weekdays, between 7:30 AM and 4:00 PM.

All permitted work requiring traffic control requires the permittee to apply for and obtain a lane closure number prior to the start of any work that may affect traffic. See the attached "Encroachment Permit Project Traffic Control Procedures" and the attached "Permit Project Traffic Control Request Form". Additional time beyond the minimum seven day advanced notice required in the above paragraph may be required for obtaining the traffic control approval."

Except as amended, all other terms and provisions of the original permit shall remain in effect.

APPROVED:

RANDELL H. IWASAKI, Acting District Director

BY:

S. S. NOZZARI, District Permit Engineer

Name: Unical Corporation c/o Kaprealian Engineering, Inc
Permit No: 0402-6RT-0060
March 12, 2002

Delete the first paragraph on Page 2 of 2 of the original permit:

"For any planned lane closures, the permittee shall comply with all the requirements shown on the attached Encroachment Permit Lane Closure Requirements Chart."

Replace the second paragraph on Page 2 of 2 of the original permit:

"Traffic control is authorized only between 9:00 A.M. and 3:00 P.M., Monday through Friday, holidays excluded. Any traffic control which requires lane closure shall be in compliance with the appropriate traffic control plan. Where required by the plan, the use of a flashing arrow sign is MANDATORY."

with the following paragraph:

"Traffic control is authorized only between 9:00 A.M. and 3:00 P.M., Monday through Friday, holidays excluded."

Delete the first paragraph on Page 2 of 2 of the original permit:

"All personnel shall wear hard hats and lime green reflective vests, shirts, or jackets as appropriate during construction."

Date of completion is extended to December 31, 2002.

MIS

Service No.

City of San Leandro
Application to Perform Work in the Public Right-of-Way

02030
Permit Number

1-9-02
Date Approved

Work Site: southwest corner of Douglas and Virginia streets

Applicant: Name Gettler-Ryan INC Address 3140 Gold Camp Dr Ste 170 Rancho Cordova, CA 95670 Tel. (916) 631-1300

Owner: Name UNOcal Corporation Address 8788 Elk Grove Blvd, Bldg 3 Ste 15 Elk Grove, CA 95624 Tel. (916) 714-2205

Purpose of Permit:

☐ Utility ☐ Street Excavation ☐ Curb, Gutter Sidewalk, Driveway ☑ Other Well Abandonment

Detailed Description and Dimensions of Work: Abandoning one groundwater monitoring well (see attached workplan). Work will be performed by Woodward Drilling INC (C-57 #710079), a licensed water well Driller

Plan Submitted: Yes ____ No ✓ Profile Submitted Yes ____ No ✓

Date Work to be Started: ____ Date Work to be Completed by: ____

Building Permit No. N/A State Encroachment Permit No. ____

Oro Loma Permit No. N/A Alameda County ~~Flood Control~~ PWA Permit No. W01-1067 thru 1070

Compliance with State Labor Code: In accordance with Section 3800

☑ Applicant has on file, with the City of San Leandro, evidence that workman's compensation insurance is carried. (Attached)

☐ Applicant will not employ anyone so as to become subject to the workman's compensation laws of California.

Statement of State Contractor's License: In accordance with Section 7031.5 of the State Business and Professions Code.

☑ Applicant has State License No. 710079, Class C-57 in full force and effect.

☐ Applicant is exempt from the State Contractor's License Law for the following reason(s):

By the application and acceptance of this permit, the undersigned intending to be legally bound does hereby agree that all work performed will be in accordance with all applicable provisions of this permit and all regulations, provisions, and specifications as adopted by the City. Further, the undersigned agrees that this permit is to serve as a guaranty for payment of all permit and/or inspection charges as billed by the City. Any misrepresentation of information requested from the applicant on this form shall make this permit null and void.

Signature Geoffrey P. Riese Date: 1/7/02

PLEASE CALL 577-3308 FOR INSPECTIONS Danny Gutierrez

SPECIAL PROVISIONS

Backfill Required / Pavement Section Required / Minimum Depth of Cover: ALL WORK PER CITY GENERAL PROVISIONS.

Police & Fire Dept. to be notified 24 hours prior to start: YES ____ NO ____

PEDESTRIAN SAFETY AND ACCESS SHALL BE MAINTAIN AT ALL TIMES ** $500- will Return After City ENVironmental Dept. received the Report.

SEE REVERSE SIDE FOR GENERAL PROVISIONS APPLICABLE TO ALL PERMIT WORK

PERMIT IS VALID WHEN SIGNED

Any omission on the part of the City to specify on this permit any rule, regulation, provision, or specification shall not excuse the permittee from complying with all requirements of law and appropriate ordinances and all applicable regulations, provisions, and specifications adopted by the City.

ISSUE FOR CITY ENGINEER

Jane Lo

INSPECTION RECORD

Date	Comments	Insp.	Hrs. Charged

NOTE: 1 hr. Minimum charge per inspection stop

Hours forwarded from reverse side: ____

TOTAL HOURS CHARGED: ____

FEES

PERMIT FEE: 50— To Acct. #3306

RESTORE/ INSPECT DEPOSIT: 725— To CN # 14544

STREET CUT FEE: ____ TO ACCT #3304

TOTAL: 775—

☐ All charges collected at permit insurance

☐ All charges to be billed to CN # 14544

ORIGINAL
File with DWR
Page 1 of 4
Owner's Well No. ____
Date Work Began 3/18/02, Ended 3/18/02
Local Permit Agency Alameda County Public Works Agency
Permit No. W02-0308 Permit Date 3/14/02

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 760662

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD H.S.A. FLUID ____

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	30	PRESSURE GROUT AND DRILL OUT TOP 5'

TOTAL DEPTH OF BORING ____ (Feet)
TOTAL DEPTH OF COMPLETED WELL ____ (Feet)

WELL OWNER

Name Union Oil Co.
Mailing Address 8788 Elk Grove Blvd, Bldg 3
Ste 15, Elk Grove, CA
CITY STATE ZIP

WELL LOCATION

Address 1300 Davis Street
City San Leandro
County Alameda
APN Book ____ Page ____ Parcel ____
Township ____ Range ____ Section ____
Latitude ____ DEG. MIN. SEC. NORTH Longitude ____ DEG. MIN. SEC. WEST

LOCATION SKETCH

NORTH

SEE ATTACHED SITE PLAN

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

___ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
X DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING X
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ____ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ____ (Ft.) & DATE MEASURED ____
ESTIMATED YIELD * ____ (GPM) & TEST TYPE ____
TEST LENGTH ____ (Hrs.) TOTAL DRAWDOWN ____ (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ____
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.
NAME Cascade Drilling, Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 3632 Omec Circle, Rancho Cordova, CA 95742
CITY STATE ZIP
Signed [signature] WELL DRILLER/AUTHORIZED REPRESENTATIVE 4-17-02 DATE SIGNED 717510 C-57 LICENSE NUMBER

ORIGINAL
File with DWR

Page 2 of 4

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 760663

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE / LONGITUDE
APN/TRS/OTHER

Owner's Well No. ______
Date Work Began 3/18/02, Ended 3/18/02
Local Permit Agency Alameda County Public Works Agency
Permit No. W02-0309 Permit Date 3/14/02

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD H.S.A. FLUID ______

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0 to 33	PRESSURE GROUT AND DRILL OUT TOP 5'

TOTAL DEPTH OF BORING ______ (Feet)
TOTAL DEPTH OF COMPLETED WELL ______ (Feet)

WELL OWNER

Name Union Oil Co.
Mailing Address 8788 Elk Grove Blvd. Bldg 3, Ste 15, Elk Grove, CA
CITY STATE ZIP

WELL LOCATION

Address 1300 Davis Street
City San Leandro
County Alameda
APN Book ______ Page ______ Parcel ______
Township ______ Range ______ Section ______
Latitude ___ DEG. ___ MIN. ___ SEC. NORTH Longitude ___ DEG. ___ MIN. ___ SEC. WEST

LOCATION SKETCH

NORTH

WEST — SEE ATTACHED SITE PLAN — EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

___ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
X DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING X
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ______ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ______ (Ft.) & DATE MEASURED ______
ESTIMATED YIELD * ______ (GPM) & TEST TYPE ______
TEST LENGTH ______ (Hrs.) TOTAL DRAWDOWN ______ (Ft.)
* *May not be representative of a well's long-term yield.*

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DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)

ATTACHMENTS (✓)

___ Geologic Log
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___ Soil/Water Chemical Analyses
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(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 3632 Omec Circle, Rancho Cordova, CA 95742
CITY STATE

Signed [signature] 4-17-02 717510
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

ORIGINAL
File with DWR
Page 3 of 4
Owner's Well No.
Date Work Began 3/18/02, Ended 3/18/02
Local Permit Agency Alameda County Public Works Agency
Permit No. W02-0310 Permit Date 3/14/02

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 760664

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD H.S.A. FLUID

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0 - 30	~~PRESSURE GROUT AND DRILL OUT~~ ~~top 5'~~

TOTAL DEPTH OF BORING ______ (Feet)
TOTAL DEPTH OF COMPLETED WELL ______ (Feet)

WELL OWNER

Name Union Oil Co.
Mailing Address 8788 Elk Grove Blvd, Bldg 3, Ste 15, Elk Grove, CA
CITY STATE ZIP

WELL LOCATION

Address 1300 Davis Street
City San Leandro
County Alameda
APN Book ___ Page ___ Parcel ___
Township ___ Range ___ Section ___
Latitude ___ DEG. MIN. SEC. NORTH Longitude ___ DEG. MIN. SEC. WEST

LOCATION SKETCH

NORTH

WEST SEE ATTACHED SITE PLAN EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

___ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

X DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING X
TEST WELL
CATHODIC PROTECTION
HEAT EXCHANGE
DIRECT PUSH
INJECTION
VAPOR EXTRACTION
SPARGING
REMEDIATION
OTHER (SPECIFY)

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TEST LENGTH ______ (Hrs.) TOTAL DRAWDOWN ______ (Ft.)
* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	TYPE: BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)

ATTACHMENTS (✓)

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___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ______
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(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 3632 Omec Circle, Rancho Cordova, CA 95742
CITY STATE ZIP

Signed [signature] 4-17-02 717510
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

ORIGINAL
File with DWR

Page 4 of 4

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 760665

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. ______
Date Work Began 3/18/02, Ended 3/18/02
Local Permit Agency Alameda County Public Works Agency
Permit No. W02-0311 Permit Date 3/14/02

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD H.S.A. FLUID ______

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0 to 30	PRESSURE GROUT AND DRILL OUT TOP 5'

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APN Book ___ Page ___ Parcel ___
Township ___ Range ___ Section ___
Latitude ___ DEG. MIN. SEC. NORTH Longitude ___ DEG. MIN. SEC. WEST

LOCATION SKETCH

NORTH

SEE ATTACHED SITE PLAN

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

___ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
X DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING X
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

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DEPTH TO FIRST WATER ______ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ______ (Ft.) & DATE MEASURED ______
ESTIMATED YIELD * ______ (GPM) & TEST TYPE ______
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DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)

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DEPTH FROM SURFACE Ft. to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)

ATTACHMENTS (✓)

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___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ______

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

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(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 3632 Omec Circle, Rancho Cordova, CA 95742
CITY STATE ZIP

Signed [signature] WELL DRILLER/AUTHORIZED REPRESENTATIVE
DATE SIGNED 4-17-02
C-57 LICENSE NUMBER 717510

GETTLER-RYAN INC.

RISK MANAGEMENT PLAN

Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

GR Report No. 240004.02-1

Prepared for:

Mr. Nick Nickerson
Unocal Corporation
8788 Elk Grove Boulevard, Building 3, Suite 15
Elk Grove, California 95624

Prepared by:

Gettler-Ryan Inc.
3140 Gold Camp Drive, Suite 170
Rancho Cordova, California 95670

REGISTERED GEOLOGIST
STEPHEN J. CARTER
No. 5577
STATE OF CALIFORNIA

Stephen J. Carter
Senior Geologist
R.G. 5577

Greg A. Gurss
Sr. Project Manager

June 28, 2001

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Appendix B. Figures, Tables, and Site Closure Summary

1.0 INTRODUCTION

Gettler-Ryan Inc. prepared this Risk Management Plan (RMP) at the request of Unocal Corporation. The subject site was formerly operated as Unocal Service Station #2512, located at 1300 Davis Street, San Leandro, California. An environmental investigation identified petroleum hydrocarbons in the soil and groundwater beneath the site, which were successfully remediated to acceptable levels. With the submittal of this RMP, the environmental investigation at this site will be closed by Alameda County Health Care Services Agency.

As part of the environmental investigation, Unocal requested a corrective action evaluation be performed for the site. The evaluation was completed by Geraghty & Miller (G&M), and concluded that maximum detected soil concentrations at the site are health-protective, and that future remediaton or control measures were not necessary. The exposure scenarios considered in this risk assessment included both adult and child residents and excavation workers. These conclusions are presented in a document titled *Site-Specific Health Risk Assessment for Former Unocal Service Station Facility #2512, San Leandro, California* (dated October 18, 1994). A copy of this document is included in Appendix A.

There is always some level of uncertainty in subsurface environmental investigations. Although highly unlikely, it is possible that the environmental investigation failed to identify some areas of impacted soil, and that future development of the site might encounter this impact. This document provides a Risk Management Plan (RMP) for the site **in the event soil or groundwater are encountered during construction activities that exhibit obvious evidence of petroleum hydrocarbons, such as strong gasoline or oil odors, or obvious staining of the soil.** In Section 2, the compounds of concern (COCs), risk, and sources of risk are summarized. In Section 3, risk management measures are developed. The RBCA evaluation that serves as a basis for this work is given in Appendix A, and figures showing the site location and relevant site features are provided in Appendix B.

2.0 RISK SUMMARY

2.1 Data

All aboveground and underground facilities have been removed. Delineation of soil and groundwater impact is complete. Impacted soil was excavated and removed. Dissolved fuel hydrocarbon concentrations have decreased to non-detectable levels. Fuel hydrocarbon impact at the site appears to pose very little risk to human health or the environment. Based on this lack of risk, the fuel hydrocarbon case at this site has been closed by ACHCSA.

A summary of the previous environmental investigations at this site was summarized by G&M in their *Site-Specific Health Risk Assessment*. Tables containing chemical analytical data from soil and grab groundwater samples collected during these investigations, copies of the most recent groundwater sampling events and the Site Closure Summary, and figures showing the hydrocarbon-affected areas are provided in Appendix B. Observations regarding the data are listed below.

- The highest hydrocarbon concentrations detected in soil samples were 270 parts per million (ppm) of Total Petroleum Hydrocarbons as gasoline (TPHg), 210 ppm of TPH as diesel (TPHd), 7,200 ppm of Oil and Grease (TOG), and 0.72 ppm of benzene. These samples were collected in the vicinity of the former underground storage tanks (USTs) and dispenser islands, which have been removed.

- The vertical and lateral extent of hydrocarbons in unsaturated soil has been well defined by soil samples collected at the furthest extent of the excavations, and by the soil borings drilled around the former UST pit and across the site. Therefore, hydrocarbon impact to soil has been adequately delineated.

- Groundwater fluctuates from approximately 10 to 19 feet below ground surface (bgs). Impacted soil remains in the soil outside the zone of groundwater fluctuation (0 to 10 feet bgs), but only at very low concentrations. TPHg concentrations up to 6.8 ppm, benzene concentrations up to 0.013 ppm, and TPHd concentrations up to 5.0 ppm have been detected in soil samples collected at approximately 5 or 10 feet bgs. While natural processes have undoubtedly reduced these concentrations, some level of hydrocarbons likely remain in these areas.

- Groundwater was gauged and analyzed quarterly from November 1993 to January 2000. Groundwater has been observed to flow toward the west-southwest and toward the northeast. TPHg, TPHd, benzene, methyl tert butyl ether (MtBE), and tetrachloroethene (PCE) have been detected in site wells in steadily decreasing concentrations over this time, indicating a stable and decreasing plume. During the most recent monitoring and sampling event conducted January 18, 2000, TPHg, TPHd, benzene, or PCE were not detected in the groundwater beneath the site. MtBE was detected at a concentration of 135 parts per billion by EPA Method 8020 (not confirmed by EPA Method 8260).

- In June 1996, Pacific Environmental Group conducted a survey of water wells immediately southwest of the site. A total of five wells were identified within ¼ mile of the site. The nearest well northeast of the site is an industrial supply well at 1052 Davis Street, approximately 600 feet from the site. The nearest water supply well to the west-southwest is an irrigation well located at 1309 Kelly Avenue, approximately 500 feet west-southwest of the site.

- During the most recent sampling event, monitoring wells MW-8 and MW-9, situated on the eastern boundary of the Unocal site, do not contain detectable concentrations of petroleum hydrocarbons. Monitoring wells MW-3 (southwest corner of the site) and MW-7 (65 feet southwest of the site) did not contain TPHg, TPHd or benzene during the most recent sampling event. These wells contained 135 ppb and 6.10 ppb of MtBE, respectively, by EPA Method 8020. The presence of MtBE in these wells was not confirmed by EPA Method 8260.

- Groundwater beneath the site and in the site vicinity have been impacted by solvents leaking from dry cleaners and manufacturing facilities in the area. Groundwater samples collected from monitoring wells at the former Unocal site have contained the chlorinated solvents PCE, trichlorethene, 1,1-dicholorethane, 1,1,1-trichloroethane, 1,1-dichloroethene, and 1,2-dichlorobenzene. Chlorinated solvents were not detected in groundwater samples during the most recent monitoring and sampling event.

- During a special sampling event conducted May 31, 2001, a well at a former dry cleaning facility situated approximately 110 feet west-southwest of the former Unocal site (well MW-DC) did not contain any detectable concentrations of petroleum hydrocarbons.

2.2 Risk Summary

Risks at the site were evaluated by G&M in their *Site-Specific Health Risk Assessment* (Appendix A). Per agreement with ACHCSA, this risk assessment considered only impacted soil. Groundwater beneath the site was also impacted. While the concentrations of dissolved fuel hydrocarbons in the groundwater has decreased to non-detectable concentrations, groundwater in the vicinity of the site remains impacted by chlorinated hydrocarbon solvents emanating from off-site sources unrelated to the former Unocal station. Risks identified by G&H's evaluation include:

- The *Risk Assessment* performed by G&M indicates that TPHg, TPHd and BTEX compounds in soil beneath the site do not pose a significant risk to occupants of an on-site building. This *Risk Assessment* is based on a conservative residential use scenario. Per agreement between Unocal and Alameda County Health Care Services Agency (ACHCSA), risks associated with impacted groundwater beneath the site were not included in G&M*'s Risk Assessment.*

- Complete exposure pathways identified by the *Risk Assessment* include: vapor intrusion into indoor air; incidental ingestion, dermal contact, and inhalation of contaminant-laden dust; and exposure of excavation workers to incidental ingestion, dermal contact, and inhalation of contaminant-laden dust.

- G&M's *Risk Assessment* concluded that "...detected soil concentrations at the site are health-protective assuming exposure under hypothetical exposure scenarios. Therefore, future remediation or control measures are not necessary to protect human health."

- G&M's *Risk Assessment* concluded that "Exposure of environmental receptors to site-related constituents is not likely to occur for several reasons."

As discussed above, the maximum soil concentrations identified at the site are protective of human health, both for future residents of the property and workers engaged in construction activities at the property. And as mentioned above, it is possible (although unlikely) that construction activities might encounter pockets of soil impacted at concentrations above the health-based goals calculated in G&H's *Risk Assessment.*

Possible scenarios where previously unidentified hydrocarbon might be encountered at concentrations above the health-based goals are discussed below.

- Construction workers engaged in subsurface piping or foundation excavation at the site could be exposed to hydrocarbon-impacted soil if excavating in unexplored portions of the site.

- Construction workers engaged in subsurface piping or foundation excavation could be exposed to impacted groundwater. Chlorinated hydrocarbon solvents are known to be present in groundwater in the site vicinity.

- Construction dewatering could take place at or near the site. Untreated groundwater could be inadvertently discharged to the street or storm drain.

- A groundwater extraction well could be installed for the purpose of providing an irrigation supply. Residents at the site could be exposed to untreated groundwater, or the irrigation well could act as a conduit to a deeper groundwater supplies;

- Impacted soil excavated from the site as a result of construction activities could be used as fill for landscaping;

- If previously unidentified pockets of highly impacted soil are intersected by excavations, atmospheric conditions, such as pressure and temperature, could create a situation where vapor phase hydrocarbons accumulate at the bottom of a trench or excavation. Workers might then be exposed to vapor phase hydrocarbons, or the mixture of air and vapor phase hydrocarbons could reach the lower explosive limit, and an ignition source could cause a fire or explosion.

3.0 RISK MANAGEMENT

It appears highly unlikely exposure risks identified in Section 2 above will be realized at this site. It is unlikely that petroleum hydrocarbons will be encountered during construction activities at concentrations exceeding the identified health-based goals. All areas of known petroleum usage (USTs, lifts, piping) were investigated and remediated. Soil borings drilled outside these areas did not encounter any hydrocarbon impact. The risk of either resident or construction worker being exposed to hydrocarbon concentrations that exceed the health-based goals identified in G&H's *Risk Assessment* appears very low.

In the unlikely event that construction activities encounter soil is encountered that exhibits a strong odor of gasoline or other petroleum product, has free-flowing oil or other petroleum-like substance, or is obviously stained or discolored relative to surrounding soil, work on that portion of the project should be halted immediately. Unocal should be contacted immediately (916.714.3204). Unocal will dispatch appropriately trained personnel to evaluate the situation and collect samples as appropriate. Unocal will also notify the appropriate regulatory agency. If petroleum hydrocarbons are present at concentrations that exceed the established health-based goals, Unocal will arrange for appropriate remedial measures to be implemented.

Historical monitoring data indicate that groundwater is not likely to be encountered during routine residential construction activities (foundation trenching, utility trenching). Construction dewatering will probably not be required. Water service is available from a public utility, so a well for either domestic supply or irrigation is not necessary. Because of these facts the risk of resident or construction worker to impacted groundwater appears very low. However, if it becomes necessary to pump groundwater at this site (construction dewatering, for example), Unocal should be contacted prior to initiating any pumping activities. Unocal will contact the appropriate regulatory agency, will assist in obtaining the necessary permits, and will provide assistance with any required remedial equipment or personnel required.

4.0 LIMITATIONS

Evaluations of the subsurface conditions at the site that serve as a basis for this RMP are inherently limited due to the limited number of observation points. There may be variations in subsurface conditions in areas away from the sample points. There are no representations, warranties, or guarantees that the points selected for sampling are representative of the entire site. The recommendations provided herein reflect the sample conditions at specific locations at a specific point in time. No other interpretations, representations, warranties, guarantees, express or implied, are included or intended in this RMP. Additional work, including further subsurface investigation, might reduce the inherent uncertainties associated with this RMP.

APPENDIX A

SITE-SPECIFIC HEALTH RISK ASSESSMENT FOR FORMER UNOCAL SERVICE STATION FACILITY #2512 SAN LEANDRO, CALIFORNIA

October 18, 1994
RC0286.001

Prepared for:

UNOCAL CORPORATION
2000 Crow Canyon Place, Suite 400
San Ramon, California 94583

Prepared by:

GERAGHTY & MILLER, INC.
Environmental Services
1050 Marina Way South
Richmond, California 94804

SITE-SPECIFIC HEALTH RISK ASSESSMENT FOR FORMER UNOCAL SERVICE STATION FACILITY #2512 SAN LEANDRO, CALIFORNIA

October 18, 1994
RC0286.001

Geraghty & Miller, Inc. is submitting this report to Unocal Corporation for work performed at the former Unocal Service Station Facility No. 2512 in San Leandro, California. The report was prepared in conformance with Geraghty & Miller's strict quality assurance/quality control procedures to ensure that the report meets industry standards in terms of the methods used and the information presented. If you have any questions or comments concerning this report, please contact one of the individuals listed below.

Respectfully submitted,

GERAGHTY & MILLER, INC.

Kathleen Neuber

Kathleen Neuber
Project Scientist/Risk Assessment Task Manager

Carol Day /KN

Carol B. Day
Senior Scientist

Craig Neuage for

Gary Keyes, P.E.
Principal Engineer/Project Officer

KN:CD:GK:kn

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GERAGHTY
& MILLER, INC.
Environmental Services

Ground Water *Engineering* *Hydrocarbon* *Remediation* *Education*

October 18, 1994
RC0286.001

Alameda County Health Agency
Department of Environmental Health
1131 Harbor Bay Parkway
Alameda, California 94502

Attention: Ms. Madhulla Logan

Subject: Risk Assessment
Former Unocal Service Station Facility #2512
1300 Davis Street, San Leandro, California

Dear Ms. Logan:

On behalf of Unocal Corporation (Unocal), Geraghty & Miller, Inc. (Geraghty & Miller) is submitting the results of a site-specific health risk assessment for the subject site. The risk assessment has been provided at the request of Alameda County Health Agency to support closure of the subject site. Unocal and Geraghty & Miller are confident that the risk assessment will satisfy any concerns raised by the County of Alameda regarding closure of the site. If you have any questions, please call Kathleen Neuber at (714) 753-0444.

Sincerely,
GERAGHTY & MILLER, INC.

Kathleen Neuber

Kathleen Neuber
Project Scientist

Craig Neslage for

Gary Keyes
Principal Engineer
Project Officer

encl: Site-Specific Health Risk Assessment

cc: Mr. Ed Ralston, Unocal Corporation

... California 92718 • (714) 753-0444 • FAX (714) 753-0945

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SITE-SPECIFIC HEALTH RISK ASSESSMENT FOR FORMER UNOCAL SERVICE STATION FACILITY #2512 SAN LEANDRO, CALIFORNIA

EXECUTIVE SUMMARY

The purpose of this risk assessment is to identify potential exposure pathways (both those complete and incomplete) associated with potential future exposure to soil and to develop health-protective soil goals for those potentially complete exposure pathways at the site. The site is the former Unocal service station facility #2512 at 1300 Davis Street in San Leandro, California. The soil health-based goals (HBGs) developed in this risk assessment can be used to determine if further remediation, or control measures should be employed at the site to protect human health.

Previous site investigation at the former Unocal service station indicated the presence of constituents in soil typically associated with a hydrocarbon release: benzene, toluene, ethylbenzene, xylenes (BTEX), and total petroleum hydrocarbons (TPH) as both gasoline (TPH-g) and diesel (TPH-d). The constituents of potential concern (COC) for the risk assessment were BTEX, TPH-g, and TPH-d.

Health-based goals (HBGs) were developed for COC in soil at the site based upon a hypothetical residential land use scenario. The evaluation of a residential scenario is conservative because current land use is commercial. A residential exposure scenario is expected to provide the most conservative (health-protective) HBGs, based upon longer potential exposure duration, the presence of sensitive receptors (i.e., children), and greatest number of potential routes of exposure to COC in soil.

Indoor exposure of hypothetical adult and child residents via inhalation to volatile COC originating from subsurface soil and accumulating in overlying buildings was assumed to occur. The migration pathway from soil beneath the site to indoor air was evaluated using a vapor intrusion model. Outdoor exposure of hypothetical adult and child residents via inhalation of volatile COC as vapors and nonvolatile COC as fugitive dust, incidental ingestion of surface soil, and dermal contact with surface soil was assumed to occur. The migration pathway from surface soil to outdoor air was evaluated using the volatilization factor (VF) and particulate emission factor (PEF) defined in USEPA guidance (1991b). Exposure of hypothetical excavation workers to subsurface soil via inhalation, incidental ingestion, and dermal contact was also assumed to occur.

HBGs were developed for each complete exposure pathway for all COC. Because TPH-g and TPH-d are complex mixtures of constituents and there are no constituent-specific toxicity values, chemical surrogates of n-hexane and naphthalene, respectively, were used.

To calculate HBGs for carcinogens, acceptable cancer risk levels were targeted. Following USEPA (1991b) guidance, the "target" cancer risk for each potential carcinogen was conservatively set at 1×10^{-6}. To calculate HBGs for non-carcinogenic health effects, the "target" hazard quotient (HQ) for non-cancer risk for constituents with different critical effects was set at 1. However, ethylbenzene and toluene both exert effects on the liver and kidney, so the target HQ were set at 0.5, for a cumulative hazard index (HI) of 1.

The constituent-specific and media-specific HBGs that were developed for these exposure pathways were compared to maximum detected soil concentrations to evaluate the need for risk management or remedial action for protection of human health and the environment (Table ES-1). The comparison indicated that maximum detected soil concentrations of COC at the site are health-protective under the assumed exposure conditions. Therefore, future remediation or control measures are not necessary to protect human health. The data, as presented herein, indicate that current site conditions would support future residential land use and that closure of this site should be granted.

Table ES-1. Comparison of Constituent Concentrations Detected in Soil to Health Based Goals, Former Unocal Service Station Facility #2512, San Leandro, California.

Constituent		MAXIMUM DETECTED CONCENTRATION Cs (mg/kg)	HEALTH-BASED GOALS: Vapor Intrusion Adult Resident HBG (mg/kg)		Vapor Intrusion Child Resident HBG (mg/kg)	Direct Contact Adult Resident HBG (mg/kg)	Direct Contact Child Resident HBG (mg/kg)	Direct Contact Excavation Worker HBG (mg/kg)
VOCs								
Benzene		0.12	3.2		3.4	0.56	0.43	1
Ethylbenzene		0.25	42,000		8,900	1,900	500	640
Toluene		0.21	13,000		2,800	2,000	280	680
Xylenes (total)		1.7	3,500,000	[c]	760,000	74,000	19,000	310,000
TPH								
TPH-g	[a]	20	830		180	700	68	58
TPH-d	[b]	13	7,000		3600	320	30	1,900

[a] n-Hexane used as a surrogate for TPH-g.
[b] Naphthalene used as a surrogate for TPH-d.
[c] Value is greater than a million (10^6) parts per million (ppm), and therefore is not itself a valid concentration goal, but indicates that concentrations below saturation are health-protective.

Cs Maximum detected constituent concentration in soil.
HBG Health-based goals for soil.
mg/kg Milligrams per kilogram.
TPH Total petroleum hydrocarbons.
VOCs Volatile organic compounds.

SITE-SPECIFIC HEALTH RISK ASSESSMENT FOR FORMER UNOCAL SERVICE STATION FACILITY #2512 SAN LEANDRO, CALIFORNIA

1.0 INTRODUCTION

Geraghty & Miller, Inc., (Geraghty & Miller) has been contracted to identify potential exposure pathways (both those complete and incomplete) associated with exposure to soil and to develop health-protective soil remediation goals for those potentially complete exposure pathways at the subject site. The site is the former Unocal Service Station Facility #2512 at 1300 Davis Street in San Leandro, California. The soil goals will be based on protection of human health assuming reasonable maximum exposure (RME) conditions for a hypothetical future residential land use scenario. This risk assessment was prepared for Unocal Corporation (Unocal) to develop, considering both the magnitude and likelihood of exposure to site-related constituents, appropriate health-based goals (HBGs) for soil that are protective in the event that exposure to impacted soil should occur. This information can be used to determine if additional remediation, remediation in conjunction with institutional or engineering controls, or control measures should be employed at the site to protect human health.

Groundwater is not addressed in this risk assessment due to the presence of the regional Caterpillar solvent flow. It was agreed upon, in a July 1994 meeting with the Alameda County Health Agency, that this risk assessment would only address potential exposure to soil.

Previous site investigation has indicated the presence of constituents in soil typically associated with a hydrocarbon release: benzene, toluene, ethylbenzene, xylenes (BTEX), and total petroleum hydrocarbons (TPH) as both gasoline (TPH-g) and diesel (TPH-d). Analytical results of soil samples collected during previous investigations have been provided in previous reports (Kaprealian Engineering Incorporated [KEI]; 1993a,b,c; 1992; 1989a,b,c,d,e).

The methodologies used in this health risk assessment were designed to be generally consistent with guidelines established by the U.S. Environmental Protection Agency (USEPA)

(1989a; 1991a,b,c) for risk assessments in general and the development of health-protective remedial goals specifically. This health risk assessment was also designed to be consistent with California Environmental Protection Agency (Cal/EPA) guidance for screening of hazardous substance release sites (Cal/EPA, 1994).

The risk assessment report is organized as follows:

- **Section 2: Site and Constituent Characterization**, briefly describes pertinent physical and hydrogeological characteristics of the site and current land use, summarizes previous site investigations, and identifies the constituents of potential concern (COC) at the site.

- **Section 3: Toxicity Assessment**, provides toxicological information and toxicity values for the COC used to evaluate the potential carcinogenic and systemic toxicant effects on exposed receptors.

- **Section 4: Exposure Assessment**, presents the physical and chemical properties relevant to environmental fate and transport for COC; identifies potential migration of COC in environmental media; and discusses potential exposure pathways, routes of exposure, exposure points, and receptors used in the derivation of the soil HBGs.

- **Section 5: Risk Characterization**, presents the mathematical equations and exposure parameter values used to calculate the soil HBGs for COC based on attainment of an acceptable risk, assuming that individuals contact impacted media under site-specific conditions.

- **Section 6: Uncertainties**, discusses the inherent uncertainties in the health risk assessment process and in the assumptions used in the HBG derivations.

- **Section 7: Findings and Conclusions**, presents goals based on protection of human health and the environment and summarizes the results and conclusions of the risk assessment.

- **Section 8: References**, presents a list of references used to support the risk assessment.

2.0 SITE AND CONSTITUENT CHARACTERIZATION

The following sections provide a concise description of the site, the facility background, previously conducted site investigations, and the hydrogeology of the site and area; and identify COC for the risk assessment.

2.1 BACKGROUND

The site is a rectangular 11,393 square foot lot on the northwest corner of the intersection of Davis Street and Douglas Drive in San Leandro, California (PHR, 1991). The site, 1300 Davis Street, was formerly a Unocal service station facility. Facility operations included routine automobile repair and service, and dispensing of gasoline (PHR, 1991). The property was occupied by a Union Oil or Unocal service station facility from 1946 to 1992. In 1966, the service station was renovated and two new 10,000 gallon gasoline underground storage tanks (USTs) and one 280 gallon waste oil UST were installed. The original USTs were probably removed at the time of the rebuild (PHR, 1991). In 1989, routine soil borings that were required one year before lease expiration indicated impacted soil in the vicinity of the original waste oil tank. Groundwater monitoring wells were installed and indicated potential impacts to groundwater beneath the site. The station building, pump islands, and other station equipment were recently demolished and removed from the site (KEI, 1993a).

The site is in an area of commercial and retail land use. Residential areas are located across Virginia Street to the north of the site and across Davis Street to the south (PHR, 1991). The adjacent property to the west (1335 to 1370 Davis Street) is occupied by a strip shopping center containing a bar, a beer and wine supplier, a barber shop and a dry cleaner (PHR, 1991).

In February and March 1990, five test borings were drilled at the adjacent property to the west of the site prior to finalization of the purchase agreement on that property. Unocal's plans to purchase the adjoining property were abandoned after it was determined in 1990 that the property at 1335 to 1370 Davis Street had been impacted by cleaning solvents beyond the maximum levels stipulated in the purchase option. In May 1991, Unocal notified the lessor, Douglas T. Federighi, of Federighi & Company, of their decision to cease operation of the service station.

The City of San Leandro approved dealer occupancy of the Unocal service station property through March 1992 and Unocal use of the property through June 1993 for the purpose of contamination remediation (PHR, 1991). Federighi & Company, the lessor of the Unocal service station property and owner of the property at 1335 to 1370 Davis Street, has requested that a risk assessment be conducted to evaluate the suitability of the property for future residential development. Therefore, this risk assessment identifies health-based goals for COC detected at the former Unocal service station under a hypothetical residential land use scenario.

2.2 PREVIOUS INVESTIGATIVE ACTIVITIES

On January 3, 1989, six exploratory soil borings were drilled at the site as part of Unocal's procedure for site divestment. The six borings (EB1 through EB6) were drilled to depths ranging from 26.5 to 30 feet below ground surface (bgs), and groundwater was encountered at depths ranging from 25 to 26.5 feet bgs (KEI, 1993b). Soil and water samples collected from borings EB2 through EB6 were analyzed for TPH-g, and BTEX. Soil and water samples from EB1 were analyzed for TPH-d, total oil and grease (TOG), and halogenated and aromatic volatile organic compounds. Soil samples collected from boring EB6 were also analyzed for TPH-d and TOG. Analytical results of soil samples collected from borings EB1 through EB6 indicated levels of TPH-g ranging from non-detectable to 73 parts per million (ppm). Benzene was detected only in samples EB5 (20 feet bgs) and EB6 (15 foot bgs) at concentrations of 0.12 ppm and 0.065 ppm, respectively. Analytical results of soil samples collected from boring EB6 indicated levels of TPH-d ranging from 3 ppm to 160 ppm, and levels of TOG ranging from 130 ppm to 7,800 ppm (KEI, 1993b). Toluene was the only volatile organic constituent detected in samples from EB1.

On May 11, 1989, the soil surrounding exploratory boring EB6 was excavated, sampled, and sent off-site for proper disposal (KEI, 1992). Samples collected from the sidewalls of the excavation indicated that detectable levels of TPH-d and TOG were still present and the excavation was extended laterally and to a depth of approximately 17 feet below grade in October 1993 (KEI, 1993a).

On July 28, 1992, the two fuel USTs and one waste oil tank were removed from the site. Four soil samples (A1, A2, B1, B2) were collected from beneath the fuel tanks at depths of about 14 feet bgs. Two soil samples (WO1 and WO1[15]) were collected from beneath the waste oil tank at depths of 10 and 15 feet bgs, respectively. Six soil samples (P1 through P6) were collected from beneath the product pipe trenches and dispensers at depths of about 3.5 feet below grade (KEI, 1993a). Four additional exploratory borings (EB7 through EB10) were drilled at the site on March 22 and 23, 1993. Analytical results indicated that TPH-g, TPH-d, BTEX and TOG were present in EB8 at 5 foot bgs. The area surrounding EB8 was subsequently excavated to a depth of approximately 7 feet bgs (KEI, 1993a).

In October 1993, additional excavation in the vicinity of the former fuel and waste oil tank pits was performed. Soil samples were collected at the bottom and sidewalls of the excavations. Additional soil excavation was performed in November 1993 in the vicinity of the former pump island. Soil was excavated to a depth of approximately 17 feet bgs. Analytical results of sidewall samples indicated the need for additional lateral excavation. Sidewall soil samples (SWBB, SWCC, and SWDD) were collected after the final excavation in the pump island area at depths of about 15.5 feet bgs (KEI, 1993a).

Analytical results of water samples collected from borings EB5 and EB6 prompted the installation of three monitoring wells in April 1989. The three wells were drilled and completed to total depths of 33 feet below grade. Groundwater was encountered at depths ranging from 17.5 to 18.5 feet bgs. A total of seven monitoring wells have been installed at the site since April of 1989 (KEI, 1993a). Although the constituents identified in soil at the site appear to be present in groundwater as well, this issue is complicated by a regional groundwater problem of intermingled plumes (the San Leandro Plume Site) and groundwater will not be addressed herein.

2.3 HYDROGEOLOGY

During the drilling of exploratory borings at the service station property in March 1993, groundwater was encountered at depths ranging from 18 to 24 feet bgs. Based on the water elevation data gathered in December 1991, January 1992, and October 1992, the groundwater flow direction appeared to be predominantly to the west (KEI, 1993b).

The results of subsurface studies at the service station property indicated that the site is underlain by fill materials to a depth of about 1 to 8 feet bgs. The fill is in turn underlain by alluvium to the maximum depth explored (33 feet bgs). The alluvium underlaying the site was observed to consist mainly of clay or silty clay interbedded with thin discontinuous beds or lenses of clayey or sandy silt, and silty sand (KEI, 1993b). The soil boring log for the boring advanced at 1370 Davis Street indicated that alluvium underlaying the adjacent property consists of clay and clayey silt (Hageman-Schank, 1990). Physical properties of site soils were not further characterized during previous site investigations.

2.4 CONSTITUENTS OF POTENTIAL CONCERN (COC)

Constituents detected in soil at the service station property during previous investigations included BTEX, TPH-d, TPH-g, and TOG. TPH-g and TPH-d are complex mixtures of petroleum-derived hydrocarbons with 4 to 11 carbon atoms and 9 to 22 carbon atoms, respectively, in their molecular structures (Millner et al., 1992).

When TPH-g or TPH-d enters the soil, changes in its composition, referred to as "weathering", begin immediately. Volatilization of the lighter compounds occurs at a higher rate than heavier compounds, resulting in a shift in the composition of the weathered gasoline toward heavier compounds. The solubilities of the heavier hydrocarbons generally are lower and the adsorption characteristics are stronger than those of the lighter fuel compounds. Therefore, these heavier compounds tend to remain adsorbed to soil organic matter for longer periods of time, while the more soluble components partition into soil moisture more quickly and/or more completely. Rates of biotransformation also are different; short-chain alkanes generally are biodegraded more readily than aromatics, cycloalkanes, and heavier alkanes (USEPA, 1989b). The net result of these weathering processes with respect to the TPH analytical data is that the TPH concentrations reported will reflect a greater proportion of the heavier TPH components than fresh TPH. These heavier components are comprised largely of cycloalkanes and straight- and branched-chain alkanes (Andrews and Snyder, 1991).

For the purposes of this report, the fate and transport characteristics of TPH-g will at times be compared to those of n-hexane, although n-hexane, a comparatively toxic, short-chained hydrocarbon, only reportedly comprises 0.24 percent to 3.5 percent by weight of fresh gasoline (California LUFT Task Force, 1989). Using n-hexane as a surrogate compound to describe the fate and transport behavior of weathered gasoline in soil represents a conservative approach, because n-hexane is as soluble and volatile, if not more soluble and volatile, than most of the heavier hydrocarbons. It has been shown that the toxicity and mobility of hydrocarbons generally decreases as the chain length increases (Rumack and Lovejoy, 1991). Therefore, n-hexane, a 6-carbon chain hydrocarbon, is expected to be the most toxic and most mobile component of the represented TPH-g mixture.

The fate and transport characteristics of TPH-d will be compared to those of naphthalene which comprises 0.13 percent by weight of fresh diesel (California LUFT Task Force, 1989). Naphthalene is one of the more mobile constituents found in diesel fuel. Therefore, using naphthalene as a surrogate for TPH-d will predict as great or greater mobility of TPH-d than is likely to occur at the site. Thus, naphthalene represents a conservative surrogate for the TPH-d mixture.

TOG may be comprised of a very wide range of hydrocarbon components. The major constituents of TOG that may be present are unknown, therefore, there are no readily available surrogates for the evaluation of fate, transport or toxicity of TOG. Samples that were analyzed for TOG were also analyzed for BTEX and TPH. TOG is generally used as a potential indicator of impacted soil, and because soil impacts were characterized as BTEX, TPH-g, or TPH-d, TOG was not considered to be a COC for the risk assessment. COC for the site are BTEX, TPH-g evaluated as n-hexane, and TPH-d evaluated as naphthalene.

3.0 TOXICITY ASSESSMENT

The risks associated with exposure to constituents detected at the site are a function of the inherent toxicity of the constituents and the exposure dose. There are two general categories of toxic effects evaluated in risk assessments: non-carcinogenic or systemic toxicant health effects and carcinogenic risk. The chemical-specific toxicity values used to evaluate potential non-carcinogenic and carcinogenic effects are determined from available federal databases and from State guidance. Toxicity values for noncarcinogenic effects were first obtained from the USEPA's Integrated Risk Information System (IRIS) (1994), and if not available on IRIS, from USEPA's Health Effects Assessment Summary Tables (HEAST) (USEPA, 1994), in accordance with USEPA guidance (1989a). Toxicity values for carcinogenic effects were obtained from the list of cancer potency factors (CPFs) compiled by the Standards and Criteria Work Group of Cal/EPA (1992). Additional toxicity information regarding potential tumor sites and USEPA cancer classification was obtained from IRIS (1994) and HEAST (USEPA, 1994). A further discussion of the basis for, and nature of, toxicity values used to assess potential risk posed by site-related COC is presented in Appendix A.

3.1 NON-CARCINOGENIC EFFECTS

Toxicity values for non-carcinogenic effects are presented as chronic reference doses (RfDs) and subchronic RfDs for oral, dermal and inhalation exposure routes. Chronic RfDs are used to assess exposures greater than seven years duration, subchronic RfDs are used for exposures ranging from two weeks to seven years. The toxicity values for non-carcinogenic effects for COC addressed in this risk assessment are presented in Table 1. Chronic RfDs were used to evaluate potential residential exposure because residents are assumed to be present at the site over a period of time greater than 7 years. Subchronic RfDs were used to evaluate potential excavation worker exposure because excavation workers are assumed to be present at the site for a short period of time. Where toxicity values for the inhalation route were not available for a particular constituent, the toxicity value for the oral route was used to evaluate toxicity via inhalation in compliance with California guidance (Cal/EPA, 1994).

3.2 CARCINOGENIC EFFECTS

Toxicity values used for evaluation of carcinogenic risk are cancer potency factors (CPFs) developed for oral and inhalation exposure routes. The toxicity values for carcinogenic risk via ingestion and inhalation used for this risk assessment are presented in Table 2. Neither USEPA nor Cal/EPA develop toxicity values specific to dermal exposure, thus, per USEPA guidance, toxicity values for dermal contact (RfDs and CPFs adjusted) were derived from those toxicity values based on oral exposure routes using the constituent-specific oral absorption efficiencies presented in Table 3.

4.0 EXPOSURE ASSESSMENT

This section provides information on the potential for constituent migration and describes the potential human exposure pathways at the site under a hypothetical future residential scenario. Exposure is defined as the actual contact of an organism with a chemical or physical agent (USEPA, 1989a). Exposure is characterized by estimating the type and magnitude of exposures to COC that are present at or migrating from a site. The potential for exposure is evaluated by estimating the way an individual or population may come into contact with constituents originating at a site. Typically this involves projecting concentrations along hypothetical or probable pathways between sources and receptors. The projection usually is accomplished using site-specific data and, when necessary, mathematical modeling. The assessment of exposure includes characterization of the physical environment, identification of exposure pathways (including migration pathways, exposure points, and exposure routes), identification of potentially exposed individuals and populations, and quantification of exposure as an average daily dose, where possible. For this site, because the results of the risk assessment will determine the necessity for further remedial action, once exposure pathways were identified as potentially complete, HBGs protective of those specific receptors were developed. Comparison of reported soil concentrations to the HBGs will identify if further remediation may be required. The following sections describe potential migration pathways and exposure pathways at the site, and identify those exposure pathways that may be complete.

4.1 PHYSICAL AND CHEMICAL PROPERTIES INFLUENCING CONSTITUENT MIGRATION

The environmental fate and transport of constituents are dependent on the physical and chemical properties of those constituents, the environmental transformation processes affecting them, and the media through which the constituents are migrating. The primary physical and chemical properties of the constituents that may influence the potential for migration of the COC in groundwater, saturated soil, and the vadose zone are presented in Table 4. A discussion of the key properties of water solubility, specific gravity, volatility, organic-carbon partition coefficient (K_{OC}), soil distribution coefficient (K_d), octanol-water partition coefficient (K_{OW}), bioconcentration factors (BCFs), and half lives, and the effect of these properties on the migration potential of the COC, is provided in Appendix B.

4.2 MECHANISMS OF MIGRATION

COC were detected in subsurface soils at the site. Soil containing residual levels of COC can act as a source of constituents to other environmental media. This section discusses the mechanisms by which migration to other media may occur at the site.

Migration of COC into the air from soil can occur via volatilization, the mass transfer of an organic compound from a specific medium (i.e., water) to the air. Vapors can diffuse from constituents in soil and migrate upwards through soil to the land surface. The ability for this transfer or migration to occur will depend on other competing processes which could hinder this migration. For example, if a constituent is highly soluble and dissolved in water, or strongly sorbed to soil; it will be less likely to volatilize into the air even though it may also have a high vapor pressure. Environmental factors that affect constituent volatilization and transport through soil include the soil temperature, porosity, water content, and the depth to impacted soil (Jury et al., 1983).

Generally, organic constituents with high vapor pressures (greater than 10 mm Hg) or high Henry's Law Constants (greater than 10^{-3} atm-m^3/mol) and molecular weights less than 200 g/mol are expected to volatilize readily from soil and water. BTEX and n-hexane have Henry's Law Constants greater than 10^{-3}, with the highest value being 0.77 atm-m^3/mol for n-hexane (the surrogate compound used to represent TPH-g). Using this high Henry's Law Constant to assess the volatilization potential of TPH-g is conservative since the TPH-g petroleum mixture at this site is believed to be weathered and composed of mostly heavier, much less volatile compounds.

Vapors that may migrate upward through the soil diffuse into ambient air when they reach the surface. These vapors that may be released into the ambient air are subject to dispersion by prevailing winds and diffusion into the atmosphere. Vapors originating from subsurface soil can, however, enter on-site buildings through cracks in building foundations. These vapors are subject to limited dispersion and diffusion forces and may accumulate in indoor air. Because hypothetical residential buildings may be built over impacted soil, the potential exists for vapors to migrate up through the subsurface and intrude into the overlying buildings.

The migration of volatile constituents from subsurface soil to indoor air may be predicted mathematically. A description of the vapor intrusion model used to predict COC migration to indoor air is provided in Appendix C. Site-specific environmental factors accounted for in the model include moisture content of soil, bulk density of soil, total soil porosity, and depth to impacted soil beneath the building. Site-specific values for these parameters were obtained from previous investigations at the site and from judgment based on known site conditions, such as soil type.

There are two processes by which COC in surface soil may migrate into outdoor air. Organic constituents may volatilize and migrate into the air. Constituents adsorbed to surface soil may migrate into the air through the generation of dust either through wind erosion in unpaved areas or mechanical means. Constituents released into the atmosphere are subject to transport and dispersion by prevailing winds.

The potential for fugitive dust generation at the site is considered low because the impacted soil is found at depth. However, during potential future construction at the site, dust may be generated by construction and earth-moving equipment. In addition, impacted subsurface soils may be moved to the land surface. Following construction, the majority of the site will likely again be covered by buildings, pavement, or landscaping, thereby reducing the probability of fugitive dust generation.

As discussed above, fugitive dust emissions may occur from wind or vehicle operations during invasive activities conducted at the site. Constituents with relatively low organic carbon partition coefficients (K_{OC} values less than 1,000) and moderate to high water solubility (greater than 1 mg/L) are more likely to be associated with the water or vapor phases than to remain in soil and therefore are unlikely to be present in emitted dust. BTEX and n-hexane fall into this category; therefore, these constituents are not expected to be emitted in fugitive dust. Naphthalene, used as a surrogate to represent TPH-d, is expected to adsorb to soil and migrate with dust, rather than in vapor form.

4.3 EXPOSURE PATHWAYS

Whether a constituent is actually of concern to human health depends on the likelihood of exposure, i.e., whether a complete exposure pathway exists. This section addresses the potential for reasonable maximum exposure (RME) to COC detected in soil under hypothetical future land use. The RME is defined as the highest exposure that is reasonably expected to occur at a site (USEPA, 1989a).

4.3.1 Conceptual Site Model

An exposure pathway is defined by four elements: (1) a source and mechanism of constituent release to the environment; (2) an environmental transport medium for the released constituent; (3) a point of potential contact by the receptor with the impacted medium (the exposure point); and (4) an exposure route to the receptor at the exposure point. The objective of the exposure assessment is to estimate the types and magnitudes of exposure to the COC, known through sampling to occur in soil, that are present at or migrating from the facility. Without exposure there is no risk. Thus, the exposure assessment is a key element of the risk assessment.

The conceptual site model is based on a conservative residential land use scenario. The evaluation of a residential scenario is conservative because current land use for the site is commercial. In addition, a residential exposure scenario is expected to provide the most conservative (health-protective) HBGs for the site, based upon potential exposure duration (i.e., 30 years for adult resident), the presence of sensitive receptors (i.e., children), and greater number of potential pathways of exposure to COC in soil (i.e., direct contact with soil).

The current source of COC in the environment is impacted subsurface soil at 5 foot depth and below. Surface soil at the site was not sampled, but is not expected to have been impacted due to the nature of the primary release mechanisms which were leaks originating from underground storage tanks and associated piping. Small surface spills that may have occurred at the site during normal operations are not expected to have adversely impacted underlaying soils due to the presence of asphalt and concrete paving. For the hypothetical future residential scenario, it was assumed that subsurface soils would be moved to the land surface as part of residential development. This assumption is conservative, given that most residential development involves removal or grading of only the top two feet of soil. The conceptual site model, however, is based upon the assumption that COC are present in surface soil. Potential exposure points therefore include surface soil, indoor air impacted by volatilization of COC from surface and subsurface soil, and outdoor air impacted by volatilization of COC and emission of fugitive dust from surface soil.

Possible exposure pathways for residential land use at the site include direct contact of human receptors with impacted soil outdoors and inhalation of indoor vapors originating from impacted subsurface soil. For each of the possible exposure pathways, a point of potential contact between the receptor and the impacted medium must be determined for the pathway to be considered complete.

It was assumed that impacted subsurface soils would be brought to the land surface during development, and that the resulting impacted surface soil would remain uncovered by vegetation or pavement. This scenario, although unlikely to occur, would result in potential exposure of residents to impacted soil by direct contact. Exposure of residents to COC by direct contact with impacted surface soil may occur via ingestion and dermal contact. Residents may also be exposed via inhalation to volatile COC as vapors and non-volatile COC absorbed to fugitive dust in ambient outdoor air. Indoor exposure of residents via inhalation to volatile COC originating from subsurface soil may occur if vapors intrude into buildings overlying the impacted area.

If development of the site for residential land use occurs in the near future, then construction workers may also be exposed to COC in subsurface soils. Excavation workers may be exposed to COC by direct contact with impacted subsurface soils via incidental ingestion and dermal contact. Excavation workers may also be exposed via inhalation to volatile COC as vapors and to non-volatile COC adsorbed to fugitive dust.

In summary, potentially complete exposure pathways to soil for the residential land use scenario are as follows:

- Exposure of adult and child residents via inhalation to volatile COC originating from subsurface soil and intruding into overlying buildings.
- Exposure of adult and child residents via incidental ingestion, dermal contact, and inhalation to COC in surface soil.
- Exposure of excavation workers via incidental ingestion, dermal contact, and inhalation to COC in surface and subsurface soil.

4.3.2 Human Receptors

Human receptors were identified for a residential land use scenario. Hypothetical residential receptors to the indoor air pathway include both adults and children that may occupy the future residential buildings at the site. Residents were assumed to be present in the residence for 350 days per year and 24 hours per day. Adult residents were assumed to be present at the residence for 30 years and child residents for 6 years. The estimates of RME residential exposure duration were derived from USEPA (1989a) and Cal/EPA (1994) guidance. Other default exposure parameters for residential exposure were obtained from USEPA (1989a, 1991b) and Cal/EPA guidance (1994).

Hypothetical residents, both adults and children, were also assumed to be potentially exposed to impacted soil via direct contact. Residents were assumed to be present on-site and outdoors for 350 days per year and 16 hours per day. Other default exposure parameters for residential exposure were obtained from USEPA (1989a, 1991b) and Cal/EPA guidance (1994).

Development is expected to occur in the near future at the site, and excavation workers were assumed to be potentially exposed to COC in soils. Workers were assumed to be in direct contact with impacted surface and subsurface soils and outdoor air. Excavation workers were assumed to be at the site for 8 hours/day, 5 days/week, for 12 weeks. Default exposure parameters for evaluation the excavation worker exposure were obtained from USEPA (1990, 1991b) guidance.

4.3.3 Environmental Receptors

Exposure of environmental receptors to site-related constituents is not likely to occur for several reasons. The site was 99 percent paved until recently, precluding exposure to soil (PHR, 1991). The commercial nature of the site operations is not conducive to developing or supporting a complex ecosystem. In addition, impacted soil is located at depths that even burrowing animals will not come in contact with under reasonable conditions. As a result, the potential for terrestrial wildlife to be exposed to the COC present in subsurface soils is severely limited or eliminated.

5.0 RISK CHARACTERIZATION

Information from the toxicity assessment and characterization of exposure are combined to generate quantitative HBGs. This section discusses the mathematical equations and exposure parameters used to calculate the soil HBGs.

5.1 DERIVATION OF HEALTH-BASED GOALS (HBGs)

HBGs were calculated for soil based on hypothetical exposure of receptors under site-specific exposure conditions. Equations presented in USEPA (1991b) guidance for development of preliminary remediation goals were adapted for use here to calculate health-protective medium-specific goals for soil. These goals, protective of the identified receptors, will be used to determine if further remedial action is necessary and to focus any additional remedial action at the site. A residential RME scenario was evaluated for future land use. Potential future receptors evaluated for exposure to COC originating in soil were adult and child residents and excavation workers.

To calculate HBGs, acceptable risk levels must be targeted. Following USEPA (1991) guidance, the "target" cancer risk for each potential carcinogen was conservatively set at 1 x 10^{-6}. USEPA has indicated that cumulative risk in the range of 10^{-6} to 10^{-4} may indicate the need for risk management. Cumulative risk of greater than 10^{-4} indicates a need for further investigation or remedial action (Federal Register, March 8, 1990). The "target" hazard quotient (HQ) for non-cancer risk for constituents with different critical effects was set at 1. However, ethylbenzene and toluene both exert effects on the liver and kidney (Table 1), so the target HQ were set at 0.5, for a cumulative hazard index (HI) of 1.

The following sections present the HBG calculations and the resulting constituent-specific HBGs.

5.1.1 HBG for Soil Based on Vapor Intrusion

It was assumed that receptors could hypothetically be exposed to vapors diffusing from the soil, migrating upwards, and entering on-site air spaces where the potential exists for the accumulation and inhalation of vapors. A vapor intrusion model was used to calculate soil HBGs for COC. The vapor intrusion model, developed by Daugherty (1991), was modified through the use of site-specific assumptions to more accurately represent site-specific exposure conditions. A discussion of the development of the vapor infiltration model is presented in Appendix C.

The result of the Daugherty (1991) volatilization and vapor diffusion model is a constituent-specific indoor air concentration potentially resulting from soil. This air concentration then can be used in exposure calculations to estimate the potential exposure for hypothetical occupants of the modeled building and subsequently to develop HBGs. Equations and model parameters used to calculate indoor air concentrations from target risk levels are presented in Table 5. Equations and model exposure parameters used to calculate soil HBGs from indoor air concentrations are presented in Table 6. A sample calculation is presented in each table to illustrate the application of the equations. Site-specific information was used whenever possible in place of default assumptions.

Site-specific values used in the model included an assumed residence of 2,000 square feet, with a volume of 454 cubic meters, and environmental factors (i.e., depth to impacted soil). For site-specific parameters for which values were uncertain, such as soil bulk density, conservative estimates were developed using information collected in previous investigations. Building air exchange rates and infiltration rates were estimated based on default values for standard residential buildings. Constituent- and receptor-specific HBGs calculated for COC at the site are presented in Tables 7 and 8 for adult and child residents, respectively.

The HBG for xylenes that is protective of an adult resident is 3,500,000 mg/kg. This value is greater than a million (10^6) ppm and, therefore, is not itself a valid concentration goal.

The calculation of a HBG greater than concentrations that are physically possible or probable in soil arises from low toxicity of the constituent and factors governing potential constituent migration. The calculated HBG for xylenes that exceeds a million ppm indicates that concentrations of xylenes below saturation in soil at the site are health-protective.

The HBG for benzene that is protective of human health at a target excess lifetime cancer risk (ELCR) level of 1 x 10^{-6}, assuming inhalation of vapors from subsurface soil that intrude into overlying residential buildings in a RME scenario, is 3.2 milligrams per kilogram (mg/kg) in soil based on adult resident exposure. HBGs for systemic toxicants that are protective of child residents are more restrictive than those protective of adult residents. The minimum HBGs for ethylbenzene, toluene, and xylenes in soil are 8,900; 2,800; and 760,000 mg/kg, respectively, based on hypothetical child resident exposure to indoor air. HBGs for TPH-g and TPH-d (using n-hexane and naphthalene as surrogates) are 180 and 3,600 mg/kg (Table 8).

5.1.2 HBG for Soil Based on Residential Direct Contact

Equations and exposure parameters used to calculate HBGs protective of outdoor residential exposure are presented in Table 9. A sample calculation is presented in the same table to illustrate the application of the equations. Site-specific information was used whenever possible in place of default assumptions. Receptor-specific default exposure factors, such as skin surface area and body weight were obtained from USEPA (1989a, 1991b) and Cal/EPA (1994) guidance. Soil HBGs, based upon target concentrations of COC at the point of exposure, were calculated based upon physical and chemical parameters derived from USEPA (1990).

There are three potential exposure routes for each residential receptor: inhalation, incidental ingestion, and dermal contact. A HBG for each potential exposure route was calculated for cancer effects and for non-cancer effects. One HBG for cancer effects and one HBG for non-cancer effects were then calculated for each constituent by combining HBGs for the exposure routes (Table 9). The cancer effects HBG and non-cancer effects HBG as indicated in Tables 9, 10 and 11 for adult and child residents, respectively; therefore, take into account exposure across multiple routes. The lower of the HBGs for cancer and non-cancer effects is considered to be the constituent-specific and receptor-specific soil HBG for the residential direct contact scenario.

The minimum HBG for benzene, protective of child health at a target ELCR level of 1×10^{-6}, assuming direct contact with impacted surface soil in a RME scenario, is 0.43 mg/kg. The minimum HBGs for ethylbenzene, toluene, and xylenes, in soil are 500; 280; and 19,000 mg/kg, respectively, based on hypothetical child resident exposure. Minimum HBGs for TPH-g and TPH-d based upon the use of toxicity surrogates, are 68 and 30 mg/kg, respectively, for protection of child residents exposed to impacted surface soil via direct contact.

5.1.3 HBG for Soil Based on Excavation Direct Contact

Equations and exposure parameters used to calculate HBGs protective of hypothetical excavation worker exposure are presented in Tables 12 and 13 for non-carcinogenic and carcinogenic effects, respectively. Sample calculations are presented in the same tables to illustrate the application of the equations. Site-specific information was used whenever possible in place of default assumptions. Receptor-specific default exposure factors, such as skin surface area and body weight were obtained from USEPA (1990) guidance. Soil HBGs, based upon target concentrations of COC at the point of exposure, were calculated based upon physical and chemical parameters derived from USEPA (1990).

The cancer effects HBG and non-cancer effects HBG indicated in Tables 14 and 15 take into account exposure across multiple exposure routes. The lower of the HBGs for cancer and non-cancer effects is considered to be the constituent-specific and receptor-specific soil HBG protective of health under the excavation worker scenario.

The minimum HBG for benzene that is protective of excavation worker health at a target ELCR level of 1×10^{-6}, assuming direct contact with impacted surface soil in a RME scenario, is 1 mg/kg (Table 15). The minimum HBGs for ethylbenzene, toluene, and xylenes in soil are

640; 680; and 310,000 mg/kg, respectively, based on hypothetical excavation worker exposure. Minimum HBGs for TPH-g and TPH-d, using toxicity surrogates, are 58 and 1,900 mg/kg, respectively, for protection of excavation workers directly exposed to impacted soil.

5.2 COMPARISON TO CURRENT MEDIA CONCENTRATIONS

The constituent-specific and receptor-specific HBGs may be compared to maximum detected soil concentrations to support a determination that no further remedial action is required. The maximum detected concentrations were obtained from soil samples collected in a judgmental manner (e.g., skewed toward impacted areas), thus, they cannot be considered representative of exposure point concentrations, and instead constitute conservative estimates of exposure point concentrations. Because they are conservative estimates in this case (areas of maximum expected impact were selectively sampled), maximum detected concentrations are appropriate to support the determination that further remediation is unnecessary based upon health concerns.

Site-related concentrations of COC in soil that exceed HBGs based upon RME scenarios and a target ELCR of 1×10^{-6} may indicate the need for further investigation, remedial action, or risk management activity if exposure under the identified scenario actually occurs. Site-related concentrations of COC in soil that are less than HBGs based upon RME and a target ELCR of 1×10^{-6} or HI of 1 indicate that the site-related concentrations are health-protective under the hypothetical future land use scenario.

Soil HBGs for protection of adult and child resident exposure via inhalation of vapors accumulated in indoor air are presented in Tables 7 and 8, respectively. Soil HBGs protective of adult and child resident RME, via incidental ingestion, dermal contact, and inhalation, to COC in surface soil are presented in Tables 10 and 11, respectively. Soil HBGs protective of excavation worker exposure, via incidental ingestion, dermal contact, and inhalation, to COC in soil are presented in Tables 14 and 15.

A summary of the minimum HBGs for each exposure scenario is presented in Table 16. In general, the child resident exposed to surface soil via direct contact is the critical and most sensitive receptor.

The maximum detected concentration of each constituent across the site is also presented in Table 16. These concentrations were detected in soil samples from depths of 15 to 20 feet bgs. For the purposes of this risk assessment, it was assumed that soils impacted at these concentrations would be brought to the land surface and made available for direct contact by hypothetical future residents. This scenario is unlikely to occur and represents a conservative outlook for the site. Additionally, the volatile organic compounds would not remain in soil at these concentrations for the prolonged exposure durations assumed, especially following exposure to air at land surface. Even given these conservative assumptions, the maximum detected soil concentrations remaining at the site do not exceed the most stringent HBGs for residents or excavation workers.

It should be noted that HBGs in general do not take into account additive/synergistic or antagonistic effects of chemical mixtures. Potential additive effects of toluene and ethylbenzene on the same target organs were addressed in this risk assessment by setting the target HQ for each constituent at 0.5. Recent sampling data indicate that benzene is the only carcinogen currently present in impacted soil; therefore, target ELCR values were not adjusted to address additivity of multiple carcinogens. Comparison of HBGs to individual constituent concentrations at this site is a valid approach to support a recommendation of no further action because of the limited number of COC at the site and the different target organs potentially affected by the COC.

6.0 UNCERTAINTIES

Uncertainty is inherent in the risk assessment process, and the potential sources of uncertainty are identified in this section. Each of the three basic building blocks for risk assessment (data evaluation, exposure assessment, and toxicity assessment) contribute uncertainties. Environmental sampling itself introduces uncertainty, largely because of the potential for uneven distribution of constituents in the environment.

Uncertainties in the risk assessment include selection of the exposed receptor population (hypothetical residents), and the assumptions used to calculate HBGs. Exposure scenarios were developed based on site-specific information supplemented by USEPA risk assessment guidance documents, and professional judgment. Although uncertainty is inherent in the exposure assessment, the exposure assumptions were chosen to err on the side of conservatism. The use of conservative exposure assumptions is believed to result in calculations of HBGs below which exposure will not result in adverse health effects.

The toxicity values and other toxicologic (health effects) information used in this report are associated with significant uncertainty. Toxicity values used by the USEPA and Cal/EPA are typically 10 to 10,000 times lower than the lowest concentration documented to produce adverse health effects. Many toxicity values are developed using results of studies in which laboratory animals are exposed to high doses, and the extrapolation to the low exposures for humans is difficult, producing uncertainty. Although species differences in absorption, distribution, metabolism, excretion, and target organ sensitivity are well documented, available data are usually insufficient to allow compensation for these differences. Most laboratory studies strictly control as many factors as possible, yet the human population is genetically diverse and affected by a variety of diets, occupations, pharmaceuticals, and other factors. When human epidemiologic data are available, a different set of uncertainties is present. For instance, exposure dose is seldom well characterized in epidemiologic studies.

Recent research on the mechanisms of carcinogenesis suggests that use of the linearized multistage model to develop CPFs may overestimate the cancer risks associated with exposure to low doses of chemicals. At high doses, many chemicals cause large-scale cell death which stimulates replacement by division. Dividing cells are more subject to mutations than quiescent (non-dividing) cells; thus, there is an increased potential for tumor formation. It is possible that administration of these same chemicals at lower doses would not increase cell division and thus would not increase mutations. This would suggest that the current methodology may overestimate cancer risk.

There is also uncertainty associated with the toxicity of mixtures. For the most part, data about the toxicity of chemical mixtures are unavailable. Rather, toxicity studies generally are performed using a single chemical. Chemicals present in a mixture can interact chemically to yield a new chemical or one can interfere with the absorption, distribution, metabolism, or excretion of another. Chemicals also may act by the same mechanism at the same target organ or can act completely independently. It was assumed that the mixture of constituents present at the site results in neither synergistic nor antagonistic interactions.

As described previously, the constituent composition of TPH varies (especially with weathering) and information in the literature is not always well defined. The TPH at the site is weathered, and is thus expected to be less volatile and less mobile than n-hexane and naphthalene (surrogates used to evaluate fate, transport, and toxicity of TPH-g and TPH-d, respectively). The assumption that n-hexane and naphthalene represent weathered TPH introduces additional uncertainty into the risk assessment.

The vapor intrusion modeling used to calculate the soil HBGs includes parameters for which values must be assumed when site-specific data are not available. While the parameter values for which site-specific data were not available were intentionally chosen to err on the side of conservatism, these assumptions contribute some uncertainty to the results of the vapor intrusion modeling.

The use of upperbound assumptions, focus on a RME scenario, no attenuation in constituent concentrations over the assumed exposure period, and the conservatism built into the RfDs and CPFs are believed to result in an overestimate of human health risk. Therefore, concentrations of COC that are greater than the HBGs estimated in this report may still be health-protective under site-specific conditions.

7.0 FINDINGS AND CONCLUSIONS

The health risk assessment was prepared to develop HBGs for soil for exposures and conditions unique to this site. For purposes of assessing potential exposures, it was assumed that the site would be redeveloped as a residential property.

The presence of impacted subsurface soils at the site indicate that it is possible that COC could volatilize and migrate into hypothetical future residential buildings. Exposure of adult and child residents via inhalation to vapors originating from subsurface soil and accumulating in overlying buildings is considered to be a complete exposure pathway for future land use. Direct exposure to COC in soil by adult and child residents via incidental ingestion, inhalation of vapors and dust, and dermal contact was also assumed to be a potentially complete future exposure pathway. Excavation workers could also come into direct contact with impacted soil during redevelopment activities.

HBGs were developed for BTEX, TPH-g, and TPH-d that would be protective of adult and child residents and excavation workers under hypothetical future conditions and the three assumed exposure scenarios. These concentration goals were based on a target ELCR of 1 x 10^{-6} (for potential carcinogens) or a target HQ of 1 (for noncancer effects potentially associated with benzene and xylenes) or 0.5 (for noncancer effects potentially associated with ethylbenzene and toluene).

The constituent-specific and media-specific HBGs presented in this report were compared to maximum detected soil concentrations that reflect current conditions (Table 16). Comparison of HBGs to individual constituent concentrations at this site indicate that maximum detected soil concentrations at the site are health-protective assuming exposure under the hypothetical exposure scenarios. Therefore, future remediation or control measures are not necessary to protect human health. The data, as presented herein, indicate that current site conditions would support residential land use and that closure of this site should be granted.

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TABLES

le 1. Reference Doses, Target Sites, and Confidence Levels for Constituents of Concern, Former Unocal Service Station Facility #2512, San Leandro, California.

nstituent		RfDo (mg/kg/day) Subchronic	RfDo (mg/kg/day) Chronic	RfDi (mg/kg/day) Subchronic	RfDi (mg/kg/day) Chronic	Target Sites Oral	Target Sites Inhalation	Confidence Level/ Uncertainty Factor
Cs								
nzene		NA	NA	NA	1.4E-04	NA	hematological	medium/100
ylbenzene		1.0E-01	1.0E-01	2.9E-01	2.9E-01	liver, kidney	developmental	low/1000
luene		2.0E+00	2.0E-01	2.9E-01	1.1E-01	liver, kidney	CNS	medium/1000
lenes		4.0E+00	2.0E+00	4.0E+00 *	2.0E+00 *	hyperactivity	NA	medium/100
mi-VOCs								
Hexane	[a]	6.0E-01	6.0E-02	5.7E-02	5.7E-02	CNS, testicles	CNS	medium/300
phthalene	[b]	4.0E-02	4.0E-02	4.0E-02 *	3.7E-04	GI system, anemia	nasal effects	low/1000

Cross-route extrapolation from oral to inhalation route (Cal/EPA, 1994).
] n-Hexane used as a surrogate for TPH as gasoline.
] Naphthalene used as a surrogate for TPH as diesel.

eferences: IRIS, 1994; USEPA, 1994; USEPA, provisional values for: naphthalene RfDi; subchronic RfDo for ethylbenzene; RfDi for benzene).
NS Central nervous system.
I Gastrointestinal.
g/kg/day Milligrams per kilogram per day.
A Not available.
fDi Inhalation reference dose.
fDo Oral reference dose.
emi-VOCs Semi-volatile organic compounds.
OCs Volatile organic compounds.

Table 2. Cancer Potency Factors, Tumor Sites, and USEPA Cancer Classifications for Constituents of Concern, Former Unocal Service Station Facility #2512, San Leandro, California.

Constituent	Oral CPF (kg-day/mg)	Inhalation CPF (kg-day/mg)	Tumor site		USEPA Classification
			Oral	Inhalation	
VOC					
Benzene	1.0E-01	1.0E-01	leukemia	leukemia	A

References: Cal/EPA, 1992; IRIS, 1994; USEPA, 1994.

CPF Cancer potency factor.
kg-day/mg Kilograms-day per milligram.
VOC Volatile organic compound.

Table 3. Adjusted Toxicity Values Used to Assess Dermal Exposure for Constituents of Concern, Former Unocal Service Station Facility #2512, San Leandro, California.

Constituent	RfDo (mg/kg/day)		CPFo (kg-day/mg)	Oral Absorption Efficiency [a]	Dermal Absorption Efficiency [b]	PC (cm/hour)	RfDa (mg/kg/day)		CPFa (kg-day/mg)
	Subchronic	Chronic					Subchronic	Chronic	
VOCs									
Benzene	NA	NA	1.0E-01	1.00	0.25	1.00E-01	NA	NA	1.0E-01
Ethylbenzene	1.0E-01	1.0E-01	NC	1.00	0.25	1.20E+00	1.0E-01	1.0E-01	NC
Toluene	2.0E+00	2.0E-01	NC	1.00	0.25	1.00E+00	2.0E+00	2.0E-01	NC
Xylenes	4.0E+00	2.0E+00	NC	1.00	0.25	8.00E-02	4.0E+00	2.0E+00	NC
Semi-VOCs									
n-Hexane	6.0E-01	6.0E-02	NC	1.00	0.10	5.30E-02	6.0E-01	6.0E-02	NC
Naphthalene	4.0E-02	4.0E-02	NC	0.85	0.03 [c]	6.90E-02	3.4E-02	3.4E-02	NC

CPF Cancer potency factor.
mg/kg/day Milligrams per kilogram per day.
NA Not available.
NC Not evaluated as a carcinogen.

PC Permeability constant.
RfD Reference dose.
Semi-VOCs Semi-volatile organic compounds.
VOCs Volatile organic compounds.

[a] RfDoral and CPForal are divided by the constituent-specific oral absorption efficency to derive an adjusted RfD and CPF to assess dermal exposure.
[b] Ryan, et al, 1987.
[c] ATSDR (1990) profile for Benzo(a)pyrene.

Table 4. Physical and Chemical Properties of Organic Constituents of Concern, Former Unocal Service Station Facility #2512, San Leandro, California.

Constituent	Molecular Weight (g/mol)	Water Solubility (mg/L 25 °C)	Specific Gravity	Vapor Pressure (mm Hg 25 °C)	Henry's Law Constant (atm-m³/mol) (25 °C)	Diffusivity (cm²/sec)	Koc (mL/g)	Log Kow	Groundwater T ½ Low (days)	Groundwater T ½ High (days)	Soil T ½ Low (days)	Soil T ½ High (days)
VOCs												
Benzene	78	1,780	0.88	9.5E+01	5.48E-03	0.09320	49 - 100	1.56 - 2.15	10 -	720	5 -	16
Ethylbenzene	106	152 - 208	0.87	9.5E+00	8.68E-03	0.06667	95 - 260	3.05 - 3.15	6 -	228	3 -	10
Toluene	92	490 - 627	0.87	2.8E+01	6.74E-03	0.07828	115 - 150	2.11 - 2.80	7 -	28	4 -	22
Xylenes (mixed)	106	162 - 200	0.87	6.6E+00 - 8.8E+00	6.30E-03	0.07164	128 - 1,580	2.77 - 3.20	14 -	360	7 -	28
TPH												
n-Hexane [a]	86	18 (20 °C)	0.66	1.20E+02 (20 °C)	7.70E-01	0.07461	890	2.77	ND		ND	
Naphthalene [b]	128	30 - 34	1.16	2.3E-01 - 8.7E-01	4.60E-04	0.08205	550 - 3,160	3.2 - 4.7	1 -	258	16.6 -	48

References: Howard et al., 1991; Howard, 1990 and 1989; Lugg, 1968; Mackay and Shiu, 1981; Montgomery and Welkom, 1990; Research Triangle Institute (RTI), 1987; Shen, 1982; USEPA, 1992; and Verschueren, 1983.

[a] n-Hexane used as a surrogate for TPH as gasoline.
[b] Naphthalene used as a surrogate for TPH as diesel.

atm-m³/mol	Atmospheres-cubic meters per mole.
BCF	Bioconcentration factor.
°C	Degrees Celsius.
cm²/sec	Square centimeters per second.
g/mol	Grams per mole.
Koc	Organic carbon partition coefficient.
Kow	Octanol-water partition coefficient.
L/kg	Liters per kilogram.
mg/L	Milligrams per liter.
mL/g	Milliliters per gram.
mm Hg	Millimeters of mercury.
ND	No data.
T ½	Half-life.
TPH	Total petroleum hydrocarbons.
VOCs	Volatile organic compounds.

Table 5. Equations for Calculation of Indoor Air Concentration for the Daugherty Vapor Intrusion Model, Former Unocal Service Station Facility #2512, San Leandro, California.

For Carcinogenic Effects:

$$Ci\ (mg/m^3) = \frac{TCR \times BW \times AP}{CPFi \times BR \times EF \times ED \times ET}$$

For Non-Carcinogenic Effects:

$$Ci\ (mg/m^3) = \frac{THI \times BW \times AP}{(1/RfDi) \times BR \times EF \times ED \times ET}$$

where:

AP	Averaging period (25,550 days [70 yrs × 365 days/yr] for cancer effects; ED [yrs] × 365 days/yr for non-cancer effects).
BR	Breathing rate (0.6 m^3/hour for reasonable maximum exposure [RME]).
BW	Body weight (70 kg for the adult and 15 kg for a child).
Ci	Indoor air concentration (mg/m^3).
CPFi	Cancer potency factor for inhalation (kg-day/mg).
ED	Exposure duration (30 years for adult RME and 6 years for a child).
EF	Exposure frequency (350 days/year for RME).
ET	Exposure time (24 hours/day at home for RME).
kg-day/mg	Kilogram-days per milligram.
mg/kg/day	Milligrams per kilogram per day.
RfDi	Inhalation reference dose (mg/kg/day).
TCR	Target carcinogenic risk (1.0E-06) for each constituent.
THI	Target hazard index (1) for those constituents without similar critical effects.

Sample calculation appears on page 2.

Table 5. Equations for Calculation of Indoor Air Concentration for the Daugherty Vapor Intrusion Model, Former Unocal Service Station Facility #2512, San Leandro, California.

Sample calculation for benzene vapors from soil; cancer effects; adult RME:

$$Ci = \frac{1.0E\text{-}06 \times 70\ \text{kg} \times 25{,}550\ \text{days}}{1.0E\text{-}01\ \text{kg-day/mg} \times 0.60\ \text{m}^3\text{/hour} \times 350\ \text{days/yr} \times 30\ \text{years} \times 24\ \text{hours/day}} = 1.2E\text{-}04\ \text{mg/m}^3$$

Sample calculation for ethylbenzene vapors in soil; non-cancer effects; adult RME:
(THI = 0.5 because ethylbenzene and and toluene may affect the same target organ)

$$Ci = \frac{0.5 \times 70\ \text{kg} \times 10{,}950\ \text{days}}{(1/0.29\ \text{mg/kg/day}) \times 0.60\ \text{m}^3\text{/hour} \times 350\ \text{days/yr} \times 30\ \text{years} \times 24\ \text{hours/day}} = 7.4E\text{-}01\ \text{mg/m}^3$$

Reference: Daugherty, 1991.

Table 6. Equations for Calculation of Vapor-Phase Flux and Health-Based Goal for Soil Using the Daugherty Vapor Intrusion Model, Former Unocal Service Station Facility #2512, San Leandro, California.

HBG (mg/kg) = Cpw x Koc x foc

where:

$$\text{Cpw (mg/L)} = \frac{\text{Csg}}{\text{UC1} \times \text{Ho}}$$

$$\text{Csg (mg/cm}^3\text{)} = \frac{\text{F} \times \text{X}}{\text{De}}$$

$$\text{De (cm}^2\text{/sec)} = \frac{\text{Di} \times (\text{Pt - Pw})\text{\textasciicircum}3.33}{\text{Pt}^2}$$

$$\text{F (mg/cm}^2\text{/sec)} = \frac{\text{Ci} \times \text{AER} \times \text{V}}{\text{A} \times \text{UC2} \times \text{UC3}}$$

where:

A	Area of infiltration (0.093 m^2) (area of apartment foundation [186 m^2] × infiltration ratio [0.0005]).
AER	Building air exchange rate (0.5 volumes per hour).
Ci	Indoor air concentration (mg/m^3) (see Table 5).
cm^2/m^2	Square centimeters per square meter.
cm^2/sec	Square centimeters per second.
Cpw	Concentration in soil pore water (mg/L).
Csg	Concentration in soil gas (mg/cm^3).
De	Effective diffusion coefficient (cm^2/sec).
Di	Diffusivity (constituent-specific) (cm^2/sec).
F	Flux (mg/cm^2/sec).
foc	Fraction of organic carbon (unitless) (assumed 0.02).
HBG	Health-based soil goal (mg/kg).
Ho	Unitless Henry's Law Constant (Henry's Law Constant [constituent-specific] /0.02404). (0.02404 is product of ideal gas constant [8.205E-06 atm-m^3/mol/K] and absolute temperature [293 K at 20° C] = atm-m^3/mol).
Koc	Organic carbon partition coefficient (L/kg); midpoint of range in Table 4 was used.
L/cm^3	Liters per cubic centimeter.
mg/cm^2/sec	Milligrams per square centimeter per second.
mg/cm^3	Milligrams per cubic centimeter.

Example calculation appears on page 2.

Table 6. Equations for Calculation of Vapor-Phase Flux and Health-Based Goal for Soil Using the Daugherty Vapor Intrusion Model, Former Unocal Service Station Facility #2512, San Leandro, California.

mg/kg	Milligrams per kilogram.
mg/L	Milligrams per liter.
mg/m^3	Milligrams per cubic meter.
Pt	Total soil porosity (0.35) (unitless) .
Pw	Water filled porosity, unitless (assumed 0.10).
sec	Second.
UC1	Unit conversion (0.001 L/cm^3).
UC2	Unit conversion (10,000 cm^2/m^2).
UC3	Unit conversion (3,600 sec/hour).
V	Volume of the residence (454 m^3) (area of foundation [186 m^2] x Hr [height of ceiling, 2.44 m]).
vph	Volumes per hour.
X	Depth to impacted soil (457 cm) (average depth of soil samples, 15 feet).

Sample calculation of vapor-phase flux and health-based goal for benzene in soil based on carcinogenic effects; adult RME:

$$F\ (mg/cm^2/sec) = \frac{1.2E\text{-}04\ mg/m^3 \times 0.5\ vph \times 454\ m^3}{0.093\ m^2 \times 10{,}000\ cm^2/m^2 \times 3{,}600\ sec/hour} = 8.0E\text{-}09\ mg/cm^2/sec$$

$$De\ (cm^2/sec) = \frac{0.09320\ cm^2/sec \times (0.35 - 0.1)\text{^}3.33}{(0.35)^2} = 0.00752\ cm^2/sec$$

$$Csg\ (mg/cm^3) = \frac{8.0E\text{-}09\ mg/cm^2/sec \times 457\ cm}{0.00752\ cm^2/sec} = 4.9E\text{-}04\ mg/cm^3$$

$$Cpw\ (mg/L) = \frac{4.9E\text{-}04\ mg/cm^3}{0.001\ L/cm^3 \times 0.228} = 2.1\ mg/L$$

$$HBG\ (mg/kg) = 2.1\ mg/L \times 74.5\ L/kg \times 0.02 = 3.2\ mg/kg$$

Reference: Daugherty, 1991.

Table 7. Soil Health-Based Goal Calculations Based on Vapor Intrusion for a Hypothetical Adult Resident, Reasonable Maximum Exposure, Former Unocal Service Station Facility #2512, San Leandro, California.

	Cancer Effects				Non-Cancer Effects				Minimum
Constituent	Ci (mg/m³)	CPFi (kg-day/mg)	TCR	HBG (mg/kg)	Ci (mg/m³)	RfDi (mg/kg/day)	THQ	HBG (mg/kg)	HBG* (mg/kg)
VOCs									
Benzene	1.2E-04	1.0E-01	1E-06	3.2E+00	7.1E-04	1.4E-04	1	1.9E+01	3.2
Ethylbenzene	NC	NC	NC	NC	7.4E-01	2.9E-01	0.5	4.2E+04	42,000
Toluene	NC	NC	NC	NC	2.8E-01	1.1E-01	0.5	1.3E+04	13,000
Xylenes	NC	NC	NC	NC	1.0E+01	2.0E+00	1	3.5E+06	3,500,000 [c]
TPH									
n-Hexane [a]	NC	NC	NC	NC	2.9E-01	5.7E-02	1	8.3E+02	830
Naphthalene [b]	NC	NC	NC	NC	1.9E-03	3.7E-04	1	1.7E+04	17,000

Goals developed using Daugherty (1991).

* The minimum of the HBGs calculated for cancer and non-cancer effects, rounded to 2 significant figures.

[a] n-Hexane used as a surrogate for TPH as gasoline.

[b] Naphthalene used as a surrogate for TPH as diesel.

[c] Value is greater than a million (10^6) parts per million (ppm), and therefore is not itself a valid concentration goal, but indicates that concentrations below saturation are health-protective.

Ci Indoor air concentration (mg/m³).
CPFi Cancer potency factor for inhalation (kg-day/mg).
HBG Health-based soil goal (mg/kg).
NC Not evaluated as a carcinogen.
RfDi Reference dose for inhalation exposure (mg/kg/day).
TCR Target cancer risk.
THQ Target hazard quotient.
TPH Total petroleum hydrocarbons.
VOCs Volatile organic compounds.

Table 8. Soil Health-Based Goal Calculations Based on Vapor Intrusion for a Hypothetical Child Resident, Reasonable Maximum Exposure, Former Unocal Service Station Facility #2512, San Leandro, California.

Constituent	Cancer Effects Ci (mg/m³)	CPFi (kg-day/mg)	TCR	HBG (mg/kg)	Non-Cancer Effects Ci (mg/m³)	RfDi (mg/kg/day)	THQ	HBG (mg/kg)	Minimum HBG* (mg/kg)
<u>VOCs</u>									
Benzene	1.3E-04	1.0E-01	1E-06	3.4E+00	1.5E-04	1.4E-04	1	4.1E+00	3.4
Ethylbenzene	NC	NC	NC	NC	1.6E-01	2.9E-01	0.5	8.9E+03	8,900
Toluene	NC	NC	NC	NC	6.0E-02	1.1E-01	0.5	2.8E+03	2,800
Xylenes	NC	NC	NC	NC	2.2E+00	2.0E+00	1	7.6E+05	760,000
<u>TPH</u>									
n-Hexane [a]	NC	NC	NC	NC	6.2E-02	5.7E-02	1	1.8E+02	180
Naphthalene [b]	NC	NC	NC	NC	4.0E-04	3.7E-04	1	3.6E+03	3,600

Goals developed using Daugherty (1991).

*	The minimum of the HBGs calculated for cancer and non-cancer effects, rounded to 2 significant figures.
[a]	n-Hexane used as a surrogate for TPH as gasoline.
[b]	Naphthalene used as a surrogate for TPH as diesel.

Ci	Indoor air concentration (mg/m³).
CPFi	Cancer potency factor for inhalation (kg-day/mg).
HBG	Health-based soil goal (mg/kg).
NC	Not evaluated as a carcinogen.
RfDi	Reference dose for inhalation exposure (mg/kg/day).
TCR	Target cancer risk.
THQ	Target hazard quotient.
TPH	Total petroleum hydrocarbons.
VOCs	Volatile organic compounds.

Table 9. Equations for Health-Based Soil Goals for Outdoor Residential Exposure, Former Unocal Service Station Facility #2512, San Leandro, California.

Route-Specific HBGs:

Oral:

$$(HBG_o)_{C\ or\ NC} = \frac{(TCR\ or\ THI) \times BW \times (AP_C\ or\ AP_{NC}) \times (10^6\ mg/kg)}{IR_S \times EP \times EF \times [CPF_o\ or\ (1/RfD_o)]}$$

Dermal:

$$(HBG_d)_{C\ or\ NC} = \frac{(TCR\ or\ THI) \times BW \times (AP_C\ or\ AP_{NC}) \times (10^6\ mg/kg)}{SSA \times SAF \times ABS_d \times EF \times EP \times [CPF_a\ or\ (1/RfD_a)]}$$

Inhalation:

$$(HBG_i)_{C\ or\ NC} = \frac{(TCR\ or\ THI) \times BW \times (AP_C\ or\ AP_{NC}) \times 24\ hrs/day}{[(1/PEF) + (1/VF)] \times BR \times ET \times EF \times EP \times [CPF_i\ or\ (1/RfD_i)]}$$

where:

$$PEF = \frac{LS \times V \times DH}{A} \times \frac{(3{,}600\ sec/hr) \times (1{,}000\ g/kg)}{RF \times (1 - G) \times (Um/Ut)^3 \times F_X}$$

$$VF = \frac{LS \times V \times DH}{A \times (10{,}000\ cm^2/m^2)} \times \frac{(3.14 \times \alpha \times T)^{1/2}}{2 \times Dei \times Pt \times Kas \times (10^{-3}\ kg/g)}$$

$$\alpha = \frac{Dei \times Pt}{Pt + [\rho s \times (1 - Pt)/Kas]}$$

$$Dei = Di \times Pt^{0.33}$$

$$Kas = H/(RT \times Kd)$$

Cancer Effects HBG:

$$HBG_C = \frac{1}{\frac{1}{(HBG_o)_C} + \frac{1}{(HBG_d)_C} + \frac{1}{(HBG_i)_C}}$$

Non-Cancer Effects HBG:

$$HBG_{NC} = \frac{1}{\frac{1}{(HBG_o)_{NC}} + \frac{1}{(HBG_d)_{NC}} + \frac{1}{(HBG_i)_{NC}}}$$

Table 9. Equations for Health-Based Soil Goals for Outdoor Residential Exposure, Former Unocal Service Station Facility #2512, San Leandro, California.

HBG = Minimum result of HBG_C and HBG_{NC}.

where:

α	Alpha; calculation intermediate (cm^2/sec).
A	Contiguous area of contamination (2,025 m^2).
ABS_d	Dermal absorption efficiency, constituent-specific.
AP_C	Averaging period for cancer effects (25,550 days).
AP_{NC}	Averaging period for non-cancer effects (days); EP × 365 days/year.
BR	Breathing rate (20 m^3/day for adult, 10 m^3/day for child).
BW	Body weight (70 kg for adult, 15 kg for child).
CPF	Cancer potency factor for oral (CPF_o), dermal (adjusted to an absorbed dose, CPF_a), or inhalation exposure (CPF_i) (kg-day/mg; inverse of mg/kg/day) .
Dei	Effective diffusivity (cm^2/sec).
DH	Diffusion height (2 m).
Di	Diffusivity in air (cm^2/sec); constituent-specific .
EF	Exposure frequency (350 days/year) .
ET	Exposure time (16 hours/day) .
EP	Exposure period (30 years for adult, 6 years for child) .
Foc	Fraction organic carbon in soil (0.02), default value used to calculate Kd.
F_X	Function of Ut/Um (0.00254) (unitless); $F_X = 0.18 \times [\ 8x^3 + 12x\ ] \times \exp(-x^2)$, where $x = 0.886 \times$ (Ut/Um).
G	Fraction of vegetative cover (unitless); conservatively assumed as zero.
H	Henry's Law Constant (atm-m^3/mol); constituent-specific .
HBG	Health-based goal for soil (mg/kg); minimum of the HBG_C (based on cancer effects) and the HBG_{NC} (based on non-cancer effects), which are based on the route-specific HBGs (HBG_o for the oral route, HBG_d for the dermal route, and HBG_i for the inhalation route).
IR_S	Ingestion rate of soil (100 mg/day for adult, 200 mg/day for child) .
Kas	Soil-air partition coefficient (g soil/cm^3 air), constituent-specific.
Kd	Soil-water partition coefficient (cm^3/g or mL/g); constituent-specific. Kd is calculated as Foc × Koc.
Koc	Organic carbon partition coefficient (cm^3/g or mL/g); constituent-specific .
LS	Length of side (cross-wind) of contaminated area (45 m).
PEF	Particulate emission factor (4.63×10^9 m^3/kg).
Pt	Total soil porosity (0.35) (unitless), conservative default value.
ρs	True soil or particle density (2.65 g/cm^3), default value.
RF	Respirable fraction (0.036 g/m^2/hr).
RfD	Reference dose for oral (RfD_o), dermal (adjusted to an absorbed dose, RfD_a), or inhalation (RfD_i) intake (mg/kg/day).
RT	Product of the ideal gas constant (8.206×10^{-5} atm-m^3/mol/K) and the Kelvin temperature (298 K at 25 °C) = 0.02445 atm-m^3/mol.
SAF	Soil adherence factor (1 mg/cm^2/day).
SSA	Exposed skin surface area (5800 cm^2 for adult, 2000 cm^2 for child).
T	Exposure interval (9.5×10^8 seconds).
TCR	Target excess lifetime cancer risk (1×10^{-6} [unitless]).
THI	Target hazard index (sum of 1.0 [unitless] for constituents with same critical effect).
Um	Wind speed (3.6 m/sec [NOAA, 1974]).
Ut	Equivalent threshold value of windspeed at 10 meters (12.8 m/sec).
V	Wind speed in the mixing zone (1.8 m/sec), Um/2.
VF	Volatilization factor (site- and constituent-specific) (m^3/kg).

Table 9. Equations for Health-Based Soil Goals for Outdoor Residential Exposure, Former Unocal Service Station Facility #2512, San Leandro, California.

Example Calculation: (benzene, adult RME)

$$PEF = \frac{(45\ m) \times (1.8\ m/sec) \times (2\ m)}{(2{,}025\ m^2)} \times \frac{(3{,}600\ sec/hr) \times (1{,}000\ g/kg)}{(0.036\ g/m^2/hr) \times (1 - 0) \times [(3.6\ m/sec)/(12.8\ m/sec)]^3 \times (0.00254)}$$

$$= 1.4 \times 10^{11}\ m^3/kg$$

$$Dei = (0.0932\ cm^2/sec) \times (0.35)^{0.33} = 6.59 \times 10^{-2}\ cm^2/sec$$

$$Kas = \frac{(5.48 \times 10^{-3}\ atm\text{-}m^3/mol)}{(0.02445\ atm\text{-}m^3/mol) \times (74.5\ cm^3/g) \times (0.02)} = 1.5 \times 10^{-1}\ g/cm^3$$

$$\alpha = \frac{(6.59 \times 10^{-2}\ cm^2/sec) \times 0.35\text{-}}{0.35 + [(2.65\ g/cm^3) \times (1 - 0.35)/(1.5 \times 10^{-1}\ g/cm^3)]} = 1.95 \times 10^{-3}\ cm^2/sec$$

$$VF = \frac{(45\ m) \times (1.8\ m/sec) \times (2\ m)}{(2{,}025\ m^2) \times (10{,}000\ cm^2/m^2)} \times \frac{[3.14 \times (1.95 \times 10^{-3}\ m^3/kg) \times (9.5 \times 10^8\ sec)]^{1/2}}{2 \times (6.59 \times 10^{-2}\ cm^2/sec) \times (0.35) \times (1.5 \times 10^{-1}\ g/cm^3) \times (10^{-3}\ kg/g)}$$

$$= 8{,}802\ m^3/kg$$

Cancer Effects HBG:

$$(HBG_o)_C = \frac{(10^{-6}) \times (70\ kg) \times (25{,}550\ days) \times (10^6\ mg/kg)}{(100\ mg/day) \times (350\ day/yr) \times (30\ yr) \times (0.1\ kg\text{-}day/mg)}$$

$$= 17\ mg/kg$$

$$(HBG_d)_C = \frac{(10^{-6}) \times (70\ kg) \times (25{,}550\ days) \times (10^6\ mg/kg)}{(5{,}800\ cm^2) \times (1\ mg/cm^2/day) \times (0.25) \times (350\ days/yr) \times (30\ yr) \times (0.1\ kg\text{-}day/mg)}$$

$$= 1.2\ mg/kg$$

$$(HBG_i)_C = \frac{(10^{-6}) \times (70\ kg) \times (25{,}550\ days) \times (24\ hr/day)}{\left[\left(\frac{1}{1.4 \times 10^{11}\ \frac{m^3}{kg}}\right) + \left(\frac{1}{8{,}802\ \frac{m^3}{kg}}\right)\right] \times 20\ \frac{m^3}{day} \times 16\ \frac{hr}{day} \times 350\ \frac{day}{yr} \times 30\ yr \times (0.1\ kg\text{-}day/mg)}$$

$$= 1.1\ mg/kg$$

Table 9. Equations for Health-Based Soil Goals for Outdoor Residential Exposure, Former Unocal Service Station Facility #2512, San Leandro, California.

$$HBG_C = \frac{1}{\frac{1}{17\,mg/kg} + \frac{1}{1.2\,mg/kg} + \frac{1}{1.1\,mg/kg}}$$

$$= 0.56\,mg/kg$$

Non-Cancer Effects HBG:

There is no available toxicity value for non-carcinogenic effects of benzene via oral exposure, therefore $(HBG_o)_{NC}$ was not calculated.

There is no available toxicity value for non-carcinogenic effects of benzene via dermal exposure, therefore $(HBG_d)_{NC}$ was not calculated.

$$(HBG_i)_{NC} = \frac{(1) \times (70\,kg) \times (10{,}950\,yr) \times (24\,hr/day)}{\left[\left(\frac{1}{1.4 \times 10^{11}\,\frac{m^3}{kg}}\right) + \left(\frac{1}{8{,}802\,\frac{m^3}{kg}}\right)\right] \times 20\,\frac{m^3}{day} \times 16\,\frac{hr}{day} \times 350\,\frac{day}{yr} \times 30\,yr \times \left(\frac{1}{0.00014\,mg/kg\text{-}day}\right)}$$

$$= 6.7\,mg/kg$$

$$HBG_{NC} = 6.7\,mg/kg$$

HBG = Minimum (0.56 mg/kg ; 6.7 mg/kg) = 0.56 mg/kg

Table 10. Health-Based Goal Calculations for Outdoor Adult Resident Exposure to Soil, Former Unocal Service Station Facility #2512, San Leandro, California.

Constituent		VF (m³/kg)	CANCER EFFECTS: Route-Specific HBGs (mg/kg) Oral	Dermal	Inhalation	Cancer Effects HBG	NON-CANCER EFFECTS: Route-Specific HBGs (mg/kg) Oral	Dermal	Inhalation	Non-Cancer Effects HBG	Minimum HBG * (mg/kg)
			(HBGo)c	(HBGd)c	(HBGi)c	HBGc	(HBGo)nc	(HBGd)nc	(HBGi)nc	HBGnc	
VOCs											
Benzene		8,802	1.7E+01	1.2E+00	1.1E+00	5.6E-01	NA	NA	6.7E+00	6.7E+00	0.56
Ethylbenzene		12,828	NC	NC	NC	NC	3.7E+04	2.5E+03	1.0E+04	1.9E+03	1,900
Toluene		11,603	NC	NC	NC	NC	7.3E+04	5.0E+03	3.5E+03	2.0E+03	2,000
Xylenes		32,135	NC	NC	NC	NC	1.5E+06	1.0E+05	3.5E+05	7.4E+04	74,000
TPH											
n-Hexane	[a]	2.50E+03	NC	NC	NC	NC	4.4E+04	7.6E+03	7.8E+02	7.0E+02	700
Naphthalene	[b]	1.64E+05	NC	NC	NC	NC	2.9E+04	1.4E+04	3.3E+02	3.2E+02	320

*	The minimum of the HBGs calculated for cancer and non-cancer effects, rounded to 2 significant figures.
[a]	n-Hexane used as a surrogate for TPH as gasoline.
[b]	Naphthalene used as a surrogate for TPH as diesel.

mg/kg	Milligram per kilogram.
m³/kg	Cubic meters per kilogram.
NA	Not available; insufficient toxicity data.
NC	Not a suspected carcinogen.
HBG	Health-based goal for soil (mg/kg).
VF	Soil-to air volatilization factor (m³/kg).
VOCs	Volatile organic compounds.

Table 11. Health-Based Goal Calculations for Outdoor Child Resident Exposure to Soil, Former Unocal Service Station Facility #2512, San Leandro, California.

Constituent		VF (m^3/kg)	CANCER EFFECTS Route-Specific HBGs (mg/kg) Oral	Dermal	Inhalation	Cancer Effects HBG	NON-CANCER EFFECTS Route-Specific HBGs (mg/kg) Oral	Dermal	Inhalation	Non-Cancer Effects HBG	Minimum HBG * (mg/kg)
			(HBGo)c	(HBGd)c	(HBGi)c	HBGc	(HBGo)nc	(HBGd)nc	(HBGi)nc	HBGnc	
VOCs											
Benzene		2,784	9.1E+00	3.7E+00	5.1E-01	4.3E-01	NA	NA	6.1E-01	6.1E-01	0.43
Ethylbenzene		4,057	NC	NC	NC	NC	3.9E+03	1.6E+03	9.2E+02	5.0E+02	500
Toluene		3,669	NC	NC	NC	NC	7.8E+03	3.1E+03	3.2E+02	2.8E+02	280
Xylenes		10,162	NC	NC	NC	NC	1.6E+05	6.3E+04	3.2E+04	1.9E+04	19,000
TPH											
n-Hexane	[a]	7.90E+02	NC	NC	NC	NC	4.7E+03	4.7E+03	7.0E+01	6.8E+01	68
Naphthalene	[b]	5.19E+04	NC	NC	NC	NC	3.1E+03	8.9E+03	3.0E+01	3.0E+01	30

*	The minimum of the HBGs calculated for cancer and non-cancer effects, rounded to 2 significant figures.
[a]	n-Hexane used as a surrogate for TPH as gasoline.
[b]	Naphthalene used as a surrogate for TPH as diesel.
mg/kg	Milligram per kilogram.
m^3/kg	Cubic meters per kilogram.
NA	Not available; insufficient toxicity data.
NC	Not a suspected carcinogen.
HBG	Health-based goal for soil (mg/kg).
VF	Soil-to air volatilization factor (m^3/kg).
VOCs	Volatile organic compounds.

Table 12. Equation for Soil Human Health-Based Goals for a Hypothetical Excavation Worker, Non-Carcinogenic Effects, Former Unocal Service Station Facility #2512, San Leandro, California.

Non-Carcinogens

$$HBG\ (mg/kg) = \frac{THI \times BW \times AT}{EF \times ED \times ([1/RfDo \times UCF \times IRsoil]+[1/RfDa \times SSA \times SA \times ABS \times UCF]+[1/RfDi \times IRair \times ([1/VF]+[1/PEF])])}$$

where:

ABS	Dermal adsorption efficiency (Table 3).
AT	Averaging time for non-carcinogenic effects, (84 days [12 weeks x 7 days/week] for excavation worker).
BW	Adult body weight (70 kg).
ED	Exposure duration (1 year for excavation worker).
EF	Exposure frequency (60 days/year for excavation worker).
HBG	Health-based soil goal (mg/kg).
IRair	Workday inhalation rate (6.6 m^3/day [0.83 m^3/hour x 8 hours/day] for excavation worker).
IRsoil	Soil ingestion rate (480 mg/day for excavation worker).
PEF	Particulate emission factor (1.4E+11 m^3/kg) (USEPA, 1991b).
RfDa	Reference dose adjusted for subchronic dermal exposure (Table 1).
RfDi	Reference dose for subchronic inhalation exposure (Table 1).
RfDo	Reference dose for subchronic oral exposure (Table 1).
SA	Soil adherence rate (1 mg/cm^2/day).
SSA	Skin surface area (3160 cm^2 ; adult head, hands, and lower arms) (USEPA,1990).
THI	Target hazard index.
UCF	Unit conversion factor (1E-06 kg/mg).
VF	Soil-to-air volatilization factor (m^3/kg) (area-specific; constituent-specific; from Table 9).

Sample calculation of HBG for an excavation worker for toluene in soil (units omitted):

$$HBG = \frac{0.5 \times 70 \times 84}{60 \times 1 \times ([1/2 \times 1E\text{-}6 \times 480] + [1/2 \times 3{,}160 \times 1 \times 0.25 \times 1E\text{-}6] + [1/0.29 \times 6.6 \times ([1/321] + [1/1.4E\text{+}11])])}$$

$$= 680\ mg/kg$$

Reference:	USEPA (1991b).	mg/day	milligram per day
kg	kilogram	m^3/kg	cubic meters per day
mg/kg	milligram per kilogram	mg/cm^2-day	milligram per square centimeter times day
m^3/day	cubic meters per day	cm^2	square centimeter
kg/mg	kilogram per milligram		

e 13. Equation for Soil Human Health-Based Goals for a Hypothetical Excavation Worker, Carcinogenic Effects, Former Unocal Service Station Facility #2512, San Leandro, California.

cinogens

$$G\ (\text{mg/kg}) = \frac{TCR \times BW \times AT}{EF \times ED \times ([CPFo \times UCF \times IRsoil]+[CPFa \times SSA \times SA \times ABS \times UCF]+[CPFi \times IRair \times ([1/VF]+[1/PEF])])}$$

re:

S	Dermal absorption efficiency (Table 3).
	Averaging time for carcinogenic effects, 84 days [12 weeks x 7 days/week] for excavation worker).
	Adult body weight (70 kg).
Fa	Adjusted dermal cancer potency factor (Table 3).
Fi	Inhalation cancer potency factor (Table 2).
Fo	Oral cancer potency factor (Table 2).
	Exposure duration (1 year for excavation worker).
	Exposure frequency (60 days/year for excavation worker).
ir	Workday inhalation rate (6.6 m^3/day [0.83 m^3/hour x 8 hours/day] for excavation worker).
oil	Soil ingestion rate (480 mg/day for excavation worker).
F	Particulate emission factor (1.4E+11 m^3/kg) (USEPA, 1991a).
	Soil adherence rate (1 mg/cm^2/day).
G	Health-based soil goal (mg/kg).
A	Skin surface area (3160 cm^2 ; adult head, hands and lower arms) (USEPA, 1990).
R	Target excess individual lifetime cancer risk (1E-06).
F	Unit conversion factor (1E-06 kg/mg).
	Soil-to-air volatilization factor (m^3/kg) (area-specific; constituent-specific; from Table 9).

mple calculation of HBG for an excavation worker for benzene in soil (units omitted):

$$HBG = \frac{1E\text{-}6 \times 70 \times 25550}{60 \times 1 \times ([0.1 \times 1E\text{-}6 \times 480] + [0.01 \times 3{,}160 \times 1 \times 0.25 \times 1E\text{-}6] + [0.1 \times 6.6 \times ([1/244] + [1/1.4E{+}11])])}$$

= 11 mg/kg

ference:	USEPA (1991b).	mg/day	milligram per day.
	kilogram	m^3/kg	cubic meters per day
/kg	milligram per kilogram	mg/cm^2-day	milligram per square centimeter times day
/day	cubic meters per day	cm^2	square centimeter
mg	kilogram per milligram		

Table 14. Health-Based Soil Goals for a Hypothetical Future Excavation Worker, Non-Carcinogenic Effects, Former Unocal Service Station Facility #2512, San Leandro, California.

Constituent	VF (m^3/kg)	Subchronic Toxicity Values (mg/kg-day)			THI	Non-Cancer Effects HBG (mg/kg)
		RfDo	RfDa	RfDi		
VOCs						
Benzene	243	NA	NA	1.4E-04	1	1
Ethylbenzene	354	1.0E-01	1.0E-01	2.9E-01	0.5	640
Toluene	321	2.0E+00	2.0E+00	2.9E-01	0.5	680
Xylenes	888	4.0E+00	4.0E+00	4.0E+00	1	310,000
TPH						
n-Hexane [a]	69	6.0E-01	6.0E-01	5.7E-02	1	58
Naphthalene [b]	4,533	4.0E-02	3.4E-02	4.0E-02	1	1,900

[a] n-Hexane used as a surrogate for TPH as gasoline.
[b] Naphthalene used as a surrogate for TPH as diesel.
m^3/kg Cubic meters per kilogram.
mg/kg Milligrams per kilogram.
mg/kg-day Milligrams per kilogram per day.
NA Not available.
RfDa Adjusted reference dose, subchronic.
RfDi Inhalation reference dose, subchronic.
RfDo Oral reference dose, subchronic.
HBG Health-based soil goal.
THI Target hazard index.
TPH Total petroleum hydrocarbons.
VF Soil-to-air volatilization factor.
VOCs Volatile organic compounds.

Table 15. Soil Health-Based Goal for a Hypothetical Future Excavation Worker, Carcinogenic Effects, Former Unocal Service Station Facility #2512, San Leandro, California.

Constituent	VF (m^3/kg)	Toxicity Values (kg-day/mg)			TCR	Cancer Effects HBG (mg/kg)
		CPFo	CPFa	CPFi		
Benzene	244	1.0E-01	1.0E-01	1.0E-01	1.0E-06	11

CPFa	Adjusted dermal cancer potency factor, kg-day/mg.
CPFi	Inhalation cancer potency factor, kg-day/mg.
CPFo	Oral cancer potency factor, kg-day/mg.
m^3/kg	Cubic meters per kilogram.
mg/kg	Milligrams per kilogram.
HBG	Health-based soil goal, mg/kg.
kg-day/mg	Kilogram times day per milligram.
TCR	Target excess lifetime cancer risk.
VF	Soil-to-air volatilization factor, m^3/kg.

Table 16. Comparison of Constituent Concentrations Detected in Soil to Health Based Goals, Former Unocal Service Station Facility #2512, San Leandro, California.

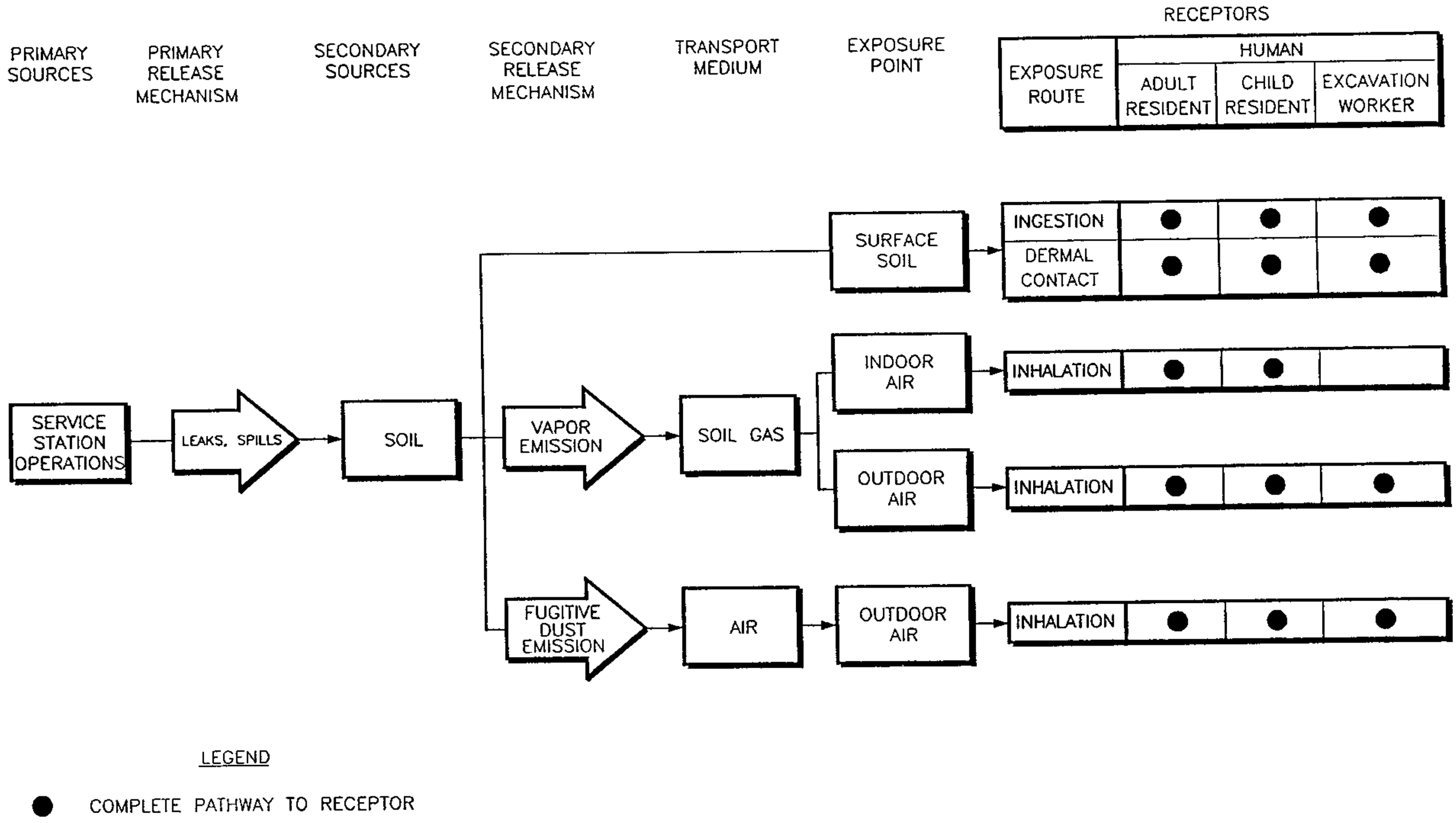
Constituent	MAXIMUM DETECTED CONCENTRATION	HEALTH-BASED GOALS				
		Vapor Intrusion		Direct Contact		Direct Contact
	Cs (mg/kg)	Adult Resident HBG (mg/kg)	Child Resident HBG (mg/kg)	Adult Resident HBG (mg/kg)	Child Resident HBG (mg/kg)	Excavation Worker HBG (mg/kg)
VOCs						
Benzene	0.12	3.2	3.4	0.56	0.43	1
Ethylbenzene	0.25	42,000	8,900	1,900	500	640
Toluene	0.21	13,000	2,800	2,000	280	680
Xylenes (total)	1.7	3,500,000 [c]	760,000	74,000	19,000	310,000
TPH						
TPH-g [a]	20	830	180	700	68	58
TPH-d [b]	13	7,000	3600	320	30	1,900

[a] n-Hexane used as a surrogate for TPH-g.
[b] Naphthalene used as a surrogate for TPH-d.
[c] Value is greater than a million (10^6) parts per million (ppm), and therefore is not itself a valid concentration goal, but indicates that concentrations below saturation are health-protective.

Cs Maximum detected constituent concentration in soil.
HBG Health-based goals for soil.
mg/kg Milligrams per kilogram.
TPH Total petroleum hydrocarbons.
VOCs Volatile organic compounds.

FIGURES

DWG DATE: 10-11-94 | PRJCT NO.: RC0286.001 | FILE: 4IR0415 | DRAWING: SANL-CSM | CHECKED: KN | APPROVED: KN | DRAFTER: SKP



GERAGHTY & MILLER, INC.
Environmental Services

CONCEPTUAL SITE MODEL FOR POTENTIAL EXPOSURE

FORMER UNOCAL SERVICE STATION #2512
SAN LEANDRO, CALIFORNIA

FIGURE
1

APPENDIX A

TOXICITY ASSESSMENT

This section discusses the two general categories of toxic effects (non-carcinogenic or systemic toxicant and carcinogenic) evaluated in risk assessments and the toxicity values used to calculate risk. Toxicity values for non-carcinogenic effects were determined from available databases. For this risk assessment, this included the USEPA's Integrated Risk Information System (IRIS), (1994); and when not available on IRIS, USEPA's Health Effects Assessment Summary Tables (HEAST) (USEPA, 1994). Toxicity values for carcinogenic effects were obtained from the list of cancer potency factors (CPFs) compiled by the Standards and Criteria Work Group of Cal/EPA (1992).

NON-CARCINOGENIC EFFECTS

For many systemic toxicant or non-carcinogenic effects, protective mechanisms must be overcome before the effect is manifested. Therefore, a finite dose (threshold), below which adverse effects will not occur, can be identified for non-carcinogens. A single compound might elicit several adverse effects depending on the dose, the exposure route, and the duration of exposure. For a given chemical, the dose that elicits no effect, the no observed effect level (NOEL), when evaluating the most sensitive response in the most sensitive species tested is used to establish a reference dose (RfD) for systemic toxicant effects.

The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level that is unlikely to cause non-carcinogenic health effects. Thus, exposure levels below the RfD are unlikely to produce toxic effects in even sensitive subpopulations. These values are calculated by the USEPA. Chronic RfDs are used to assess long-term exposures ranging from 7 years to a lifetime; subchronic RfDs evaluate the potential of adverse health effects associated with exposure to chemicals during a period of a few days to 7 years. RfDs are derived by the USEPA by dividing the NOELs by uncertainty factors typically ranging from 10 to 10,000 depending on the suitability and quality of the available database. RfDs that are sanctioned by the USEPA are called verified reference doses for oral exposure (RfD_os) or reference concentrations (RfCs) for inhalation exposure. In this risk assessment, RfCs have been converted to reference doses for inhalation exposure (RfD_is) by assuming an adult breathing rate of 20 cubic meters per day (m^3/day) and a body weight of 70 kilograms (kg) (USEPA, 1993). RfCs or RfDs for inhalation have not been established for many volatile organic compounds (VOCs). When they were not available, as with toluene, the oral RfD was substituted as an inhalation RfD. Table 1 in the text of this report presents the RfDs used in this risk assessment. Target sites affected by each constituent are shown in the table for both inhalation and oral exposures. The confidence value and uncertainty factors associated with the RfDs also are listed. The uncertainty factor represents a specific area of uncertainty inherent in the extrapolation from the available data. The confidence levels (low, medium, high) assess the degree of confidence the USEPA has in the extrapolation of available data.

Toxicity values (i.e., RfDs and CPFs) for dermal exposure are rarely available because appropriate toxicity data are scarce. Therefore, the oral RfD and CPF are adjusted to an absorbed dose, using the constituent-specific oral absorption efficiency, as recommended by the USEPA (1989a). In calculating a dermal RfD from an oral RfD, the oral RfD is multiplied by the oral absorption efficiency (1.0 for VOCs); therefore, the dermal RfDs are equal to the oral RfDs for VOCs.

CARCINOGENIC EFFECTS

Constituents are classified as known, probable, or possible human carcinogens based on a USEPA weight-of-evidence classification scheme in which chemicals are systematically evaluated for their ability to cause cancer in mammalian species and conclusions are reached about the potential to cause cancer in humans. The USEPA classification scheme (USEPA, 1989a) contains six classes, based on the weight of available evidence, as follows:

- A known human carcinogen;
- B1 probable human carcinogen -- limited evidence in humans;
- B2 probable human carcinogen -- sufficient evidence in animals and inadequate data in humans;
- C possible human carcinogen -- limited evidence in animals;

D inadequate evidence to classify; and

E evidence of non-carcinogenicity.

Constituents in Classes A, B1, B2 and C generally are included in risk assessments as potential human carcinogens; however, Class C carcinogens may be evaluated on a case-by-case basis (USEPA, 1989a). The only carcinogen at this site was benzene, a Class A, known human carcinogen.

The toxicity value used to evaluate cancer risk is called the cancer slope factor (CSF) by USEPA and the cancer potency factor (CPF) by Cal/EPA. The CSF is generated by the USEPA using a linearized (multistage) model for extrapolating cancer risk from high doses associated with occupational exposure or laboratory animal studies to the low doses typically associated with environmental exposures. The multistage model is based on a non-threshold theory in which any exposure to a carcinogen may result in tumor formation. The model provides a 95 percent upperbound estimate of cancer incidence at a given dose. The slope of the extrapolated curve, called the CSF, is used to calculate the probability of cancer associated with the exposure dose.

CPFs used in this risk assessment are taken from Cal/EPA (1994). The CPFs developed by Cal/EPA are generated using various models for extrapolating cancer risk from high doses associated with occupational exposure or laboratory animal studies to the low doses typically associated with environmental exposures. CPFs are derived from the assumption that any dose level has a probability of causing cancer. The cumulative dose regardless of the exposure period determines the risk; therefore, separate CPFs are not derived for subchronic and chronic exposure periods. CPFs are derived for oral and inhalation exposures. Dermal effects also are evaluated by calculating a dermal CPF from the oral CPF. This is done by dividing the oral CPF by the oral absorption efficiency (1.0 for VOCs). Therefore, dermal CPFs are equal to oral CPFs for VOCs. Table 2 in the text of this report presents the CPFs used in the risk assessment. Target sites affected by each constituent are shown in the table for both the oral and inhalation routes. USEPA cancer classifications also are listed.

APPENDIX B

PHYSICAL AND CHEMICAL PROPERTIES

The water solubility of a substance is an important property affecting environmental fate. Solubility is expressed in terms of the number of milligrams of a constituent that can dissolve in one liter of water (mg/L) under standard conditions of 25 degrees Centigrade (^{0}C) and one atmosphere of pressure (atm). In general, solubilities range from less than 1 mg/L to totally miscible, with most common organic chemicals falling between 1 mg/L and 1,000,000 mg/L (Lyman et al., 1990). The higher the value of the solubility, the greater the tendency of a constituent to dissolve in water. Thus, highly soluble constituents generally are more mobile in groundwater and surface water and are more likely to leach in soil than a constituent with a lower solubility. Benzene is the most soluble of the COC, with a reported solubility of 1,780 mg/L at 25 ^{0}C (Table 4) (constituents with solubilities greater than 1,000 mg/L are considered highly soluble [Ney, 1990]). n-Hexane is the least soluble, having a low reported solubility of 18 mg/L at 20 ^{0}C.

The specific gravity is the ratio of the density of a chemical in its pure state to the density of water. Non-aqueous phase liquids with a specific gravity greater than one are denser than water and will sink through the water table, whereas constituents with a specific gravity less than one will float on the water table. The volatile BTEX compounds have specific gravities of approximately 0.9 (Table 4), n-hexane has a specific gravity of 0.66 and the semi-volatile naphthalene has a specific gravity of 1.2. Constituents that are completely dissolved in water will not form a separate phase regardless of the specific gravity.

Volatilization of a constituent from an environmental medium will depend on its vapor pressure, water solubility, and diffusion coefficient. Highly water-soluble compounds generally have lower volatilization rates from water than do compounds with lower solubilities unless the constituents also have high vapor pressures. Vapor pressure, a relative measure of the volatility of constituents in their pure state, ranges from about 0.001 to 760 millimeters of mercury (mm Hg) for liquids, with solids ranging down to less than 10^{-10}mm Hg. The vapor pressures of the COC at this site range from a high of 120 mm Hg at 20 ^{0}C for n-hexane to 0.23 to 0.87 mm Hg at 25 ^{0}C for naphthalene.

The Henry's Law Constant, combining vapor pressure with solubility and molecular weight, can be used to estimate releases from water to air. The Henry's Law Constant is a partition coefficient used to predict the tendency of an organic constituent to volatilize or "partition" from the aqueous or water phase to the vapor phase and may be experimentally determined or calculated from vapor pressure and solubility. Organic compounds with Henry's Law Constants in the range of 10^{-3} atmospheres-cubic meters per mole (atm-m^3/mol) and larger and molecular weights equal to or less than 200 grams per mole (g/mol) can be expected to volatilize readily from water; those with values ranging from 10^{-3} to 10^{-5} atm-m^3/mol are associated with possibly significant, but not facile, volatilization; while compounds with values less than 10^{-5} atm-m^3/mol will only volatilize from water slowly and to a limited extent (Howard, 1989; Lyman et al., 1990). All of the COC, with the exception of naphthalene, have Henry's Law Constants greater than 10^{-3} atm-m^3/mol (Table 4), indicating the tendency to volatilize. Although n-hexane and naphthalene are used as surrogates, TPH-g and TPH-d are mixtures of compounds and as such do not have unique Henry's Law Constants. Much of the hydrocarbons comprising the TPH at the site are likely to be longer-chain hydrocarbons, which are not considered as volatile as BTEX compounds, and are more likely to remain sorbed to soil.

The diffusion coefficient can be used as a means to predict the rate at which a compound moves through the environment. Molecular diffusion is determined by both molecular properties (e.g., size and weight) and by the presence of a concentration gradient, which means that molecules of a chemical will migrate from areas of higher concentration to areas deficient in molecules of that compound.

A partition coefficient is the ratio of the concentration of adsorbed constituent to the concentration of aqueous phase constituent and is expressed in units of milliliters per gram (ML/g). The octanol-water partition coefficient (K_{ow}) often is used to estimate the extent to which a chemical will partition from water into lipophilic or water-containing parts of organisms, for example, animal fat. The organic carbon partition coefficient (K_{oc}), used to determine the adsorption potential of a constituent, may be determined empirically or may be estimated using constituent-specific and soil-specific parameters. K_{oc} reflects the propensity of a compound to adsorb to the organic matter found in the soil or sediments. The normal range of K_{oc} values is from 1 to 10^7, with higher values indicating greater adsorption potential. The potential for a constituent to absorb to soil particles will affect migration through soil and aquifer materials. When a constituent enters the soil/sediment environment, some of it will bind with particles through the process of sorption and some will dissolve in the water contained in the spaces between soil particles (pore water). The term "sorption" includes adsorption (constituent bound to the outside of soil particles) and absorption (constituent distributed throughout the particle matrix). Sorption to soil reduces volatilization, leaching, and biodegradation. A chemical that is absorbed is less mobile because it is not easily released from the particle. Conversely, a chemical that is adsorbed is released more easily and, therefore, may be mobile. The K_{oc}s for the COC at this site range from 49 mL/g (minimum value provided for benzene) to 3,160 mL/g (maximum provided for naphthalene) (Table 4). The K_{oc} indicates that naphthalene has the greatest tendency to adsorb to soil, and benzene is least likely to become and remain sorbed to soil. In general, K_{oc} increases with molecular weight. As a result, the longer chain, heavier components of TPH are more likely to adsorb to soil than to volatilize or leach. The COC for this site generally have low K_{ow}s and K_{oc}s indicating a tendency not to partition into media other than water.

The COC at this site do not tend to adsorb readily to soil or aquifer materials, and thus are characterized by relatively high mobility in the environment. The components of the weathered TPH are not expected to be as volatile or mobile as BTEX.

Constituent partitioning between soil and water generally is represented by the soil-water distribution coefficient, K_d. The K_d, like the K_{oc}, may be determined empirically or may be estimated using constituent-specific and soil-specific parameters. In the absence of site-specific data, the parameters most often used to calculate K_d for organic constituents are the K_{oc} and the fraction of organic carbon in soil (f_{oc}), since K_d commonly is expressed as the product of the K_{oc} and f_{oc} (USEPA, 1989b). As with the K_{oc}, higher K_d values indicate that a larger percentage of the constituent is associated with the soil solids, and the constituent therefore is less mobile in the subsurface environment. Low values of K_{oc} (i.e., less than 1,000) and f_{oc}, coupled with high solubility, characterize constituents with a higher potential to migrate through soils or aquifer materials (Ney, 1990).

Biodegradation is the biological process by which microorganisms break down organic chemicals. Environmental factors such as moisture, pH, temperature, and available nutrients will affect the rate of biodegradation. Constituents with high water solubility, low K_{oc}, and low K_{ow} values likely will biodegrade (Ney, 1990). The COC at the site have these properties. Persistence is the "lasting power" of constituents and is commonly expressed in terms of half-lives (T1/2) for specific environmental media. The half-life of a constituent is the period of time required for one-half of the original mass of a compound to be transformed into other constituents from the time of its introduction to the environment. Soil and groundwater half-lives obtained from literature of the COC are presented in Table 4. Ranges are shown because the rate of degradation varies according to environmental conditions and concentration. Half-lives may be used to characterize the relative persistence of a constituent in various environmental media.

APPENDIX C

VAPOR INTRUSION MODEL

A vapor intrusion model was used to calculate indoor exposure to BTEX, TPH-g and TPH-d, assuming the COC volatilize from soil and enter into an occupied building. The conceptual model consists of estimating the concentration of the constituent in soil air and the subsequent movement of the vapor phase constituent upward to the atmosphere, and then estimating concentrations of the constituent in outdoor and indoor air. The calculation follows the mathematical model developed by Daugherty (1991).

The vapor intrusion model is based on several assumptions (Daugherty, 1991). The model considers only diffusive flux, not pressure or convection driven flow. The constituent is assumed to be present as a nondiminishing steady state source. Biodegradation and other attenuation forces are expected to occur in subsurface soils over time, therefore, this is a conservative assumption. The system is assumed to be at equilibrium and exposure to COC above equilibrium levels due to shutdown of the building ventilation system is assumed to be trivial in terms of lifetime exposure. It is assumed that flux occurs only through infiltration areas such as cracks in the building slab and that flux through the building slab itself is insignificant.

The vapor intrusion model was proposed as a method to calculate concentrations of constituents in indoor air based upon specified constituent concentrations in soil gas (Daugherty, 1991). For the analysis at this site, an acceptable constituent concentration in indoor air was determined based upon target risk levels. The model was then applied in a backward direction and the acceptable indoor air concentration was used to derive the target concentration in soil gas and then the soil HBG.

The equations and parameter values used to calculate the soil HBGs are presented in Section 5 of this report. Physical parameters such as moisture content, dry soil density, porosity, and effective air permeability affect the rate at which the vapors from a volatile compound may migrate through the soils. Site-specific values for these soil parameters were used where available. Conservative default values were identified based upon known site characteristics for parameters that were not measured directly. Assumed parameters of the hypothetical building were also used to apply the model (i.e., building dimensions). In cases where site-specific values for model parameters were not readily available, conservative default values were identified based upon known site conditions (i.e., moisture content of soil).

A maximum acceptable vapor phase flux (mg/cm²/sec), given the indoor air concentration derived from target risk levels, was calculated by dividing the product of the indoor air concentration, building air exchange rate and building volume, by the area of infiltration:

$$F = \frac{Ci \times AER \times V}{A \times UC2 \times UC3}$$

where:

A	Area of infiltration (m^2)
AER	Building air exchange rate (volumes/hour)
Ci	Indoor air concentration (mg/m^3)
UC2	Unit conversion (10,000 cm^2/m^2)
UC3	Unit conversion (3,600 sec/hour)
V	Volume of building (m^3)

The volatilized constituent diffuses upward through the soil. The rate of diffusion through soil is determined by the soil characteristics and the constituent characteristics. If it is assumed that diffusion through the soil is primarily vapor-phase diffusion (neglecting diffusion through the soil moisture), then effective diffusivity (De) can be approximated as:

$$De = \frac{Di \times (Pt-[M \times B])^{3.33}}{Pt^2}$$

where:

B Bulk density of soil (g/cm^3)

De Effective diffusion coefficient (cm^2/sec)

Di Diffusivity (cm^2/sec)

M Moisture content of soil (cm^3/g)

Pt Total soil porosity (unitless).

The target concentration of constituent in soil gas was calculated by dividing the product of the maximum acceptable flux and depth to groundwater by the effective diffusion coefficient:

$$Csg = \frac{F \times X}{De}$$

where:

Csg Concentration in soil gas (mg/cm^3)

De Effective diffusion coefficient (cm^2/sec)

F Flux ($mg/cm^2/sec$)

X Depth to groundwater (cm).

Detected concentrations of COC at the site were relatively low; therefore, it was assumed that volatile COC were dissolved in soil pore water. Thus, the target concentration of constituent in soil gas was used to determine the target concentration in soil pore water based upon the Henry's Law Constant for the constituent dissolved in water:

$$Cpw = \frac{Csg}{UC1 \times Ho}$$

where:

Cpw Concentration in soil pore water (mg/L)

Csg Concentration in soil gas (mg/cm^3)

Ho Unitless Henry's Law Constant

UC1 Unit conversion (0.001 L/cm^3)

The target concentration of constituent in soil pore water was then used to determine the soil HBG:

$$HBG = Cpw \times K_{OC} \times f_{OC}$$

where:

Cpw Concentration in soil pore water (mg/L)

f_{oc} Fraction of organic carbon (unitless)

HBG Health-based goal (mg/L)

K_{oc} Organic carbon partition coefficient (L/kg)

The result of this application of the vapor intrusion model is a concentration of constituent in soil that is expected to result in exposure of receptors at or below the target risk levels. This concentration in soil is a medium-, constituent-, and receptor-specific HBG.

APPENDIX A

SITE CLOSURE SUMMARY

I. AGENCY INFORMATION

Date: 11/7/00

Agency Name: Alameda County Health Care Services	Address: 1131 Harbor Bay Parkway, Suite 250
City/State/Zip: Alameda, CA 94502- 6577	Phone: (510) 622-2300
Responsible Staff Person: Amir K. Gholami	Title: Hazardous Materials Specialist

II. SITE INFORMATION

Site Facility Name: Former Unocal #2512		
Site Facility Address: 1300 Davis Street, San Leandro		
RB/SMS Case No.:	Local or LOP Case No.: 2480	Priority:
URF Filing Date:	SWEEPS No.:	

Responsible Parties (include addresses and phone numbers): Mr. Nick Nickerson

Unocal Corporation, 8788 Elk Grove Blvd, Bldg 3, Suite 15, Elk Grove, CA 95624 916.714.3205

Tank No.	Size in Gallons	Contents	Closed In—Place/Removed?	Date
A	10,000	regular unleaded gasoline	removed	7/28/92
B	10,000	super unleaded gasoline	removed	7/28/92
C	280	waste oil	removed	7/28/92

III. RELEASE AND SITE CHARACTERIZATION INFORMATION

Cause and Type of Release: unknown		
Site characterization complete? Yes	Date Approved By Oversight Agency:	
Monitoring wells installed? Yes	Number: 9	Proper screened interval? Yes
Highest GW Depth below top of well casing: 10.41' 1/97 Well MW-7	Lowest:18.75' MW-2 10/91	Flow Direction: W-SW and NE
Most Sensitive Current Use: Domestic supply		
Most Sensitive Potential Use: Domestic or municipal supply and Probability of Use: Possibly none. Apparently site is within the San Leandro Plume Superfund Site.		
Are drinking water wells affected? No	Aquifer Name:	
Is surface water affected? No	Nearest SW Name: San Leandro Creek	
Off-Site Beneficial Use Impacts (Addresses/Locations): None		
Report(s) on file? Yes	Where is report(s) filed? ACHCSA and RWQCB	

TREATMENT AND DISPOSAL OF AFFECTED MATERIAL			
Material	**Amount (Include Units)**	**Action (Treatment or Disposal w/Destination)**	**Date**
Tank	20,280 gallons	Not identified; assumed destroyed.	7/28/92
Piping	unknown	Not identified; assumed destroyed	7/28/92
Free Product	amount unknown	Not identified	
Soil	250 cubic yards 1,044 cubic yards 12 drums 2 tons	Not identified Approved landfill (BFI, Forward) Approved landfill (Forward) Approved landfill (BFI)	6/89 2, 3/94 1/27, 30/95 10/28/95
Groundwater	4,200 gallons	Removed by H&H Services, dest. not identified	11/10/93
Barrels	12	Approved landfill or destroyed	1/27, 30/95

MAXIMUM DOCUMENTED POLLUTANT CONCENTRATIONS—BEFORE AND AFTER CLEANUP									
	Soil (ppm)		Water (ppb)			Soil (ppm)		Water (ppb)	
POLLUTANT	Before	After	Before	After	POLLUTANT	Before	After	Before	After
TPH (Gas)	270 P6@11'	73 EB6@10'	1,300,000 MW-3, 5/92	100,000 MW-3, 1/96	Xylenes	12	0.045	160,000 MW-3, 5/92	16,000 MW-3, 1/96
TPH (Diesel)	210 WO1@5'	160 EB6@10'	2,400,000 MW-3, 1/96	5,300 MW-3, 1/96	Oil & Grease	7,800 EB6@5'	850	880,000	NA
Benzene	0.72 P6@5'	0.12 EB5@20'	5,100 MW-3, 5/92	950 MW-3, 1/96	PCE	NA	NA	4.8 MW-1, 11/90	120 MW-9, 4/98
Toluene	3.3	0.040	66,000 MW-3, 5/92	3,300 MW-3, 1/96	MTBE (8260)	NA	NA	NA	6.4 MW-9, 4/99
Ethylbenzene	1.8	0.062	20,000 MW-3, 5/92	2,500 MW-3, 1/96	Heavy Metal	NA	NA	NA	NA

Comments (Depth of Remediation, etc.):

1. Impacted soil was limited to vicinity of former USTs, product lines, and boring EB-6. Impacted soil was excavated in 10/95. Dissolved fuel hydrocarbons appear restricted to the vicinity of well MW-3. Downgradient of the site dissolved fuel hydrocarbons (TPHg, BTEX compounds) are delineated by wells MW-8 and MW-9, and upgradient by well MW-7. MTBE is detected in well MW-3 (middle of the plume) and MW-9 (downgradient edge of plume).

2. The PCE detected in groundwater comes from a former dry cleaners located upgradient of the former Unocal station. PCE impact has been documented at the former dry cleaners, and from the regional Caterpillar solvent plume. A September 20, 1996 letter from the State Division of Clean Water Programs indicates that the solvent tank at the former cleaners was transferred to the City of San Leandro for further oversight, while the petroleum tank problem at the former Unocal station remained under Alameda County oversight. This information was discussed with Mr. Chuck Headlee of the Regional Water Quality Control Board on January 9, 2001. Mr. Headlee indicated that because of the confirmed upgradient PCE source, sampling soil at the former Unocal site for PCE was not necessary.

3. Concentrations of hydrocarbons listed in the "After" column above reflect the highest concentrations reported for groundwater samples after completion of remedial activities (10/95). Groundwater at this site was monitored and

benzene, toluene, ethylbenzene, or xylenes were not detected at concentrations above the laboratory reporting limits in any of the wells sampled (MW-3, MW-7, MW-8 or MW-9). MTBE was not reported in wells MW-8 or MW-9. MTBE by EPA Method 8020 was reported in wells MW-3 (135 ppb) and MW-7 (6.10 ppb), but EPA Method 8260 confirmation of these results was not performed. The wells were last analyzed for MTBE by EPA Method 8260 in April 1999. At that time, MTBE was confirmed only in wells MW-3 (4.7 ppb) and MW-9 (6.4 ppb). Wells MW-1, MW-2, MW-4, MW-5 and MW-7 were destroyed in January 1995 to accommodate remedial activities.

IV. CLOSURE

Does completed corrective action protect existing beneficial uses per the Regional Board Basin Plan? Yes

Does completed corrective action protect potential beneficial uses per the Regional Board Basin Plan? Yes

Does corrective action protect public health for current land use? Yes

Site Management Requirements: None

Monitoring Wells Decommissioned: Yes	Number Decommissioned: 5	Number Retained: 4

List Enforcement Actions Taken: None

List Enforcement Actions Rescinded: NA

V. TECHNICAL REPORTS, CORRESPONDENCE ETC., THAT THIS CLOSURE RECOMMENDATION WAS BASED UPON

Title:	Date:
Preliminary Subsurface Investigation (KEI #P88-1204.R1)	2/3/89
Preliminary Ground Water Investigation (KEI #P88-1204.R2)	5/16/89
Stockpiled Soil Sampling (KEI #P88-1204.R3)	6/19/89
Soil Sampling Report (KEI #J88-1204.R4)	6/15/89
Ground Water Investigation (KEI #P88-1204.QR1)	9/27/89
Report of Subsurface Environmental Conditions, 1335 to 1370 Davis Street, San Leandro (Hageman-Schank, Inc.)	10/9/90
Continuing Ground Water Investigation (KEI #P88-1204.R5)	4/9/92
Continuing Subsurface Investigation (KEI #P88-1204.R8)	4/26/93
Soil Sampling Report (KEI #P88-1204.R9)	12/21/93
Stockpiled Soil Sampling (KEI #P88-1204.R10)	3/24/94
Drill Cutting Sampling and Disposal Report (KEI #P88-1204.R12)	2/13/95
Drill Cutting Sampling and Disposal Report (KEI #P88-1204.R13)	11/20/95
Continuing Subsurface Investigation (KEI #P88-1204.R14)	1/10/96
First Quarter 2000 Groundwater Monitoring and Sampling Report (GR #280039)	2/17/00

VI. ADDITIONAL COMMENTS, DATA, ETC.

PLEASE INCLUDE/ATTACH THE FOLLOWING AS APPROPRIATE:

1) SITE MAP INDICATING TANK PIT LOCATION, MONITORING WELL LOCATION, GROUNDWATER GRADIENT, ETC.; AND,

2) SITE COMMENTS WORTHY OF NOTICE (E.G., AREA OF RESIDUAL POLLUTION LEFT IN PLACE, DEED NOTICES ETC.)

This document and the related CASE CLOSURE LETTER, shall be retained by the lead agency as part of the official site file.

TABLE 4

SUMMARY OF LABORATORY ANALYSES
SOIL

Sample Number	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Xylenes	TOG
(Collected on April 17, 1989)							
MW1(5)	ND	4.0	ND	ND	ND	ND	ND
MW1(10)	ND	ND	ND	ND	ND	ND	ND
MW1(15)	ND	ND	ND	ND	ND	ND	ND
MW1(17)	ND	ND	ND	ND	ND	ND	31
MW2(5)*	ND	ND	ND	ND	ND	ND	31
MW2(10)*	ND	1.1	ND	ND	ND	ND	60
MW2(15)*	ND	ND	ND	ND	ND	ND	71
MW3(5)	ND	ND	ND	ND	ND	ND	ND
MW3(10)	ND	1.1	ND	ND	ND	ND	ND
MW3(15)	ND	1.2	ND	ND	ND	ND	32
MW3(17)	ND	6.2	ND	0.21	ND	0.42	180
(Collected on August 16, 1989)							
MW4(5)	--	3.3	ND	ND	ND	0.11	ND
MW4(10)	--	ND	ND	ND	ND	ND	ND
MW4(15)	--	ND	ND	ND	ND	ND	ND
MW4(19)	--	ND	ND	ND	ND	ND	ND
MW5(5)	--	ND	MD	ND	ND	ND	ND
MW5(10)	--	ND	ND	ND	ND	ND	ND
MW5(15)	--	ND	ND	ND	ND	ND	ND
MW5(20)	--	20	ND	ND	ND	ND	ND
MW5(22)	--	ND	ND	ND	ND	ND	ND
MW6(5)	--	ND	ND	ND	ND	ND	ND
MW6(10)	--	ND	ND	ND	ND	ND	ND
MW6(15)	--	ND	ND	ND	ND	ND	ND
MW6(20)	--	ND	ND	ND	ND	ND	ND

TABLE 4 (Continued)

SUMMARY OF LABORATORY ANALYSES
SOIL

Sample Number	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Xylenes	TOG
(Collected on February 11, 1992)							
MW7(5)	ND	ND	ND	ND	ND	ND	--
MW7(9.5)	ND	ND	ND	ND	ND	ND	--
MW7(15)	ND	ND	ND	ND	ND	ND	--
MW7(16.5)	ND	ND	ND	ND	ND	ND	--

-- Indicates analysis not performed.

ND = Non-detectable.

* EPA method 8010 constituents were non-detectable.

Results are in milligrams per kilogram (mg/kg), unless otherwise indicated.

KEI-P88-1204.R14
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TABLE 5

SUMMARY OF LABORATORY ANALYSES
SOIL

Sample Number	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Ethyl-benzene	Xylenes	TOG
(Collected on January 3, 1989)							
EB1(5)*	5.0	--	ND	0.05	ND	ND	ND
EB1(10)*	1.0	--	ND	ND	ND	ND	ND
EB1(15)*	1.0	--	ND	ND	ND	ND	ND
EB1(25)*	2.0	--	--	--	--	--	ND
EB2(10)	--	ND	ND	ND	ND	ND	--
EB2(15)	--	ND	ND	ND	ND	ND	--
EB2(20)	--	ND	ND	ND	ND	ND	--
EB2(25)	--	1.9	ND	ND	ND	ND	--
EB3(5)	--	ND	ND	ND	ND	ND	--
EB3(10)	--	ND	ND	ND	ND	ND	--
EB3(15)	--	2.7	ND	ND	ND	ND	--
EB3(20)	--	2.2	ND	ND	ND	ND	--
EB3(25)	--	ND	ND	ND	ND	ND	--
EB4(5)	--	ND	ND	ND	ND	ND	--
EB4(10)	--	ND	ND	ND	ND	ND	--
EB4(15)	--	ND	ND	ND	ND	ND	--
EB4(20)	--	ND	ND	ND	ND	ND	--
EB4(25)	--	ND	ND	ND	ND	ND	--
EB5(5)	--	ND	ND	ND	ND	ND	--
EB5(10)	--	ND	ND	ND	ND	ND	--
EB5(15)	--	2.0	ND	ND	ND	ND	--
EB5(20)	--	17	0.12	0.15	0.25	1.4	--
EB5(25)	--	3.9	ND	ND	ND	0.17	--
EB6(5)	10	1.8	ND	ND	ND	ND	7,800
EB6(10)	160	73	ND	ND	ND	ND	1,200
EB6(15)	40	17	0.065	ND	ND	0.21	900
EB6(25)	3.0	ND	ND	ND	ND	ND	130

TABLE 5 (Continued)

SUMMARY OF LABORATORY ANALYSES
SOIL

Sample Number	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Ethyl-benzene	Xylenes	TOG
(Collected on March 22 and 23, 1993)							
EB7(5)*	ND	ND	0.018	ND	ND	ND	ND
EB7(10)*	1.3♦	3.2♦♦	ND	ND	ND	ND	140
EB7(15)*	6.4♦	17♦♦	ND	0.011	0.0090	0.025	340
EB7(19.5)*	3.5♦	4.4♦♦	ND	ND	ND	ND	80
EB7(23.5)*	ND	ND	ND	ND	ND	ND	60
EB8(5)*+	12♦	50♦♦	0.020	0.040	0.062	0.045	1,700
EB8(10)*+	1.2	ND	ND	ND	ND	ND	ND
EB8(15)*+	7.6	5.0♦♦	ND	ND	0.015	0.0070	ND
EB8(20)*+	ND	ND	ND	ND	ND	ND	ND
EB8(23)*+	ND	ND	ND	ND	ND	ND	ND
EB9(5)*+	ND	ND	ND	ND	ND	ND	ND
EB9(10)*+	ND	2.0	ND	ND	ND	ND	ND
EB9(14.5)*+	ND	ND	ND	ND	ND	ND	ND
EB10(5)*	ND	ND	ND	ND	ND	ND	ND
EB10(9.5)*	ND	1.6	ND	ND	ND	ND	ND
EB10(15)*	ND	ND	ND	ND	ND	ND	ND
EB10(20)*	ND	ND	ND	ND	ND	ND	ND
EB10(23)*	ND	ND	ND	ND	ND	ND	ND

NOTE: The soil samples were collected at the depths (below grade) indicated in the ( ) of the respective sample number.

* All EPA method 8010 constituents were non-detectable.
\+ TPH as Hydraulic Fluid was non-detectable, except in sample EB8(5), where it was detected at a concentration of 470 mg/kg.
♦ Sequoia Analytical Laboratory reported that the hydrocarbons detected appeared to be a diesel and non-diesel mixture.
♦♦ Sequoia Analytical Laboratory reported that the hydrocarbons detected appeared to be a gasoline and non-gasoline mixture.
ND = Non-detectable.
-- Indicates analysis was not performed.
Results are in milligrams per kilogram (mg/kg), unless otherwise indicated.

TABLE 6

SUMMARY OF LABORATORY ANALYSES
WATER

Sample Number	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Ethyl-benzene	Xylenes	TOG (mg/L)
(Collected on January 3, 1989)							
EB1	ND	--	ND	3.5	ND	ND	--
EB2	--	ND	8.2	7.4	0.67	3.3	--
EB3	--	ND	ND	ND	ND	ND	--
EB4	--	ND	ND	ND	0.73	ND	--
EB5	--	340	ND	ND	0.63	ND	--
EB6	--	1,500	1.5	1.4	8.1	12	--
Collected on March 22 and 23, 1993)							
EB7*	320++	1,000♦	19	ND	6.8	ND	ND
EB8*+	120++	510♦♦	ND	ND	ND	ND	ND
EB9*+	480++	2,600	ND	5.1	8.3	8.8	ND
EB10	*ND	180♦♦	ND	ND	ND	ND	ND

* All EPA method 8010 constituents were non-detectable, except for tetrachloroethene, which was detected in samples EB9 and EB10 at concentrations of 12 μg/L and 250 μg/L, respectively. Trichloroethene was also detected in sample EB9 at a concentration of 0.63 μg/L.

\+ TPH as hydraulic fluid was non-detectable.

++ Sequoia Analytical Laboratory reported that the hydrocarbons detected appeared to be a diesel and non-diesel mixture.

♦ Sequoia Analytical Laboratory reported that the hydrocarbons detected appeared to be a gasoline and non-gasoline mixture.

♦♦ Sequoia Analytical Laboratory reported that the hydrocarbons detected did not appear to be gasoline.

ND = Non-detectable.

-- Indicates analysis was not performed.

Results are in micrograms per liter (μg/L), unless otherwise indicated.

TABLE 7

SUMMARY OF LABORATORY ANALYSES
SOIL

Date	Sample	Depth (feet)	TOG	TPH as Diesel	EPA Method 8010 Constituents*	EPA Method 8270 Constituents*
10/27/93	A1(15.5)	15.5	200	13♦	ND	ND
	WO1(16.75)	16.75	ND	6.7♦	ND	ND
	WOSW1	15.0	ND	ND	ND	ND
	WOSW2	15.0	ND	ND	ND	ND
	WOSW3	15.0	ND	ND	ND	ND
	SWA(4)	15.5	ND	--	--	--
	SWB(3)	15.0	450	--	--	--
	SWC(3)	15.5	240	--	--	--
	SWD(3.5)	15.5	460	--	--	--
11/15/93	SWBB	15.5	ND	--	--	--
	SWCC	15.5	ND	--	--	--
	SWDD	15.5	ND	--	--	--

♦ Sequoia Analytical Laboratory reported that the hydrocarbons detected appeared to be a diesel and non-diesel mixture.

* Results are in micrograms per kilogram (mg/kg), unless otherwise indicated.

ND = Non-detectable.

-- Indicates analysis was not performed.

Results are in milligrams per kilogram (mg/kg), unless otherwise indicated.

TABLE 8

SUMMARY OF LABORATORY ANALYSES
SOIL

Date	Sample	Depth (feet)	TPH as Gasoline	Benzene	Toluene	Ethyl-benzene	Xylenes
10/27/93	A1(15.5)	15.5	17*	ND	0.017	0.040	0.088
	P6(11)	11.0	270	0.71	12	6.3	38
	WO1(16.75)	16.75	2.6	0.0059	0.0063	0.013	0.0095
	WOSW1	15.0	ND	ND	ND	ND	ND
	WOSW2	15.0	ND	ND	ND	ND	ND
	WOSW3	15.0	ND	ND	ND	ND	ND
11/15/93	P6SW1	15.5	ND	ND	ND	ND	ND
	P6SW2	15.5	ND	ND	ND	ND	ND
	P6SW3	15.5	ND	ND	ND	ND	0.078
	P6SW4	15.5	ND	ND	ND	ND	ND

* Sequoia Analytical Laboratory reported that the hydrocarbons detected did not appear to be gasoline.

ND = Non-detectable.

Results are in milligrams per kilogram (mg/kg), unless otherwise indicated.

TABLE 9

SUMMARY OF LABORATORY ANALYSES
WATER

Date	Sample	Depth to Water (feet)	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Ethyl-benzene	Xylenes	TOG (mg/L)
11/10/93	Water 1	16.5	410♦	1,500	67	10	33	45	7.4
11/19/93	Water 2	16.0	3,200♦	2,500	68	370	87	560	6.3
	Water 3	16.0	--	11,000	120	19	870	2,700	--

Sample	Cadmium*	Chromium*	Lead*	Nickel*	Zinc*	EPA Method 8270 Constituents	EPA Method 8010 Constituents
Water 1	ND	0.14	0.064	0.18	0.22	ND*	ND***
Water 2	ND	ND	ND	ND	0.035	ND**	ND

-- Indicates analysis was not performed.

ND = Non-detectable.

♦ Sequoia Analytical Laboratory reported that the hydrocarbons detected appeared to be a diesel and non-diesel mixture.

* EPA method 8270 constituents were all non-detectable, except for 2-methylnaphthalene and naphthalene, which were detected at concentrations of 16 μg/L and 22 μg/L, respectively.

** EPA Method 8270 constituents were all non-detectable, except for 2,4-dimethylphenol and naphthalene, which were detected at concentrations of 110 μg/L and 2.2 μg/L, respectively.

TABLE 9 (Continued)

SUMMARY OF LABORATORY ANALYSES
WATER

*** All EPA method 8010 constituents were non-detectable, except for 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichlorobenzene, 1,1-dichloroethane, 1,1-dichloroethene, tetrachloroethene, and 1,1,1-trichloroethane, which were detected at concentrations of 1.8 μg/L, 1.2 μg/L, 1.9 ppb, 24 μg/L 9.3 μg/L, 4.1 μg/L, and 24 μg/L, respectively.

* Results in milligrams per liter (mg/L), unless otherwise indicated.

Results are in micrograms per liter (μg/L), unless otherwise indicated.

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TABLE 10

SUMMARY OF LABORATORY ANALYSES
SOIL

Date	Sample	Depth (feet)	TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Xylenes	TOG
7/28/92	A1	14.0	23	0.078	0.093	0.061	0.16	--
	A2	14.0	ND	ND	ND	ND	ND	--
	B1	14.0	3.2	0.0056	ND	ND	0.023	--
	B2	14.0	8.4	0.0086	0.019	0.069	0.054	--
	P1	3.5	ND	0.013	ND	ND	0.0060	--
	P2	3.5	5.8	0.042	0.022	0.024	0.11	--
	P3	3.5	ND	ND	0.012	ND	0.025	--
	P4	3.5	ND	ND	ND	ND	0.0067	--
	P5	3.5	6.8	ND	ND	0.21	1.7	--
	P6	3.5	91	0.72	0.32	0.34	1.4	--
	WO1*	10.0	150	0.61	3.3	1.8	12	3,00
	WO1(15)	15.0	--	--	--	--	--	210

-- Indicates analysis was not performed.

ND = Non-detectable.

* EPA method 8010 constituents were all non-detectable, except for 1-1-Dichloroethane at 120 µg/kg, tetrachloroethene at 86 µg/kg, and 1,1,1-trichloroethane at 260 µg/kg. Cadmium, chromium, lead, nickel, and zinc were detected at concentrations of 0.95 mg/kg, 45 mg/kg, 5.8 mg/kg, 42 mg/kg, and 40 mg/kg, respectively. TPH as diesel was detected at a concentration of 210 mg/kg.

Results are in milligrams per kilogram (mg/kg), unless otherwise indicated.

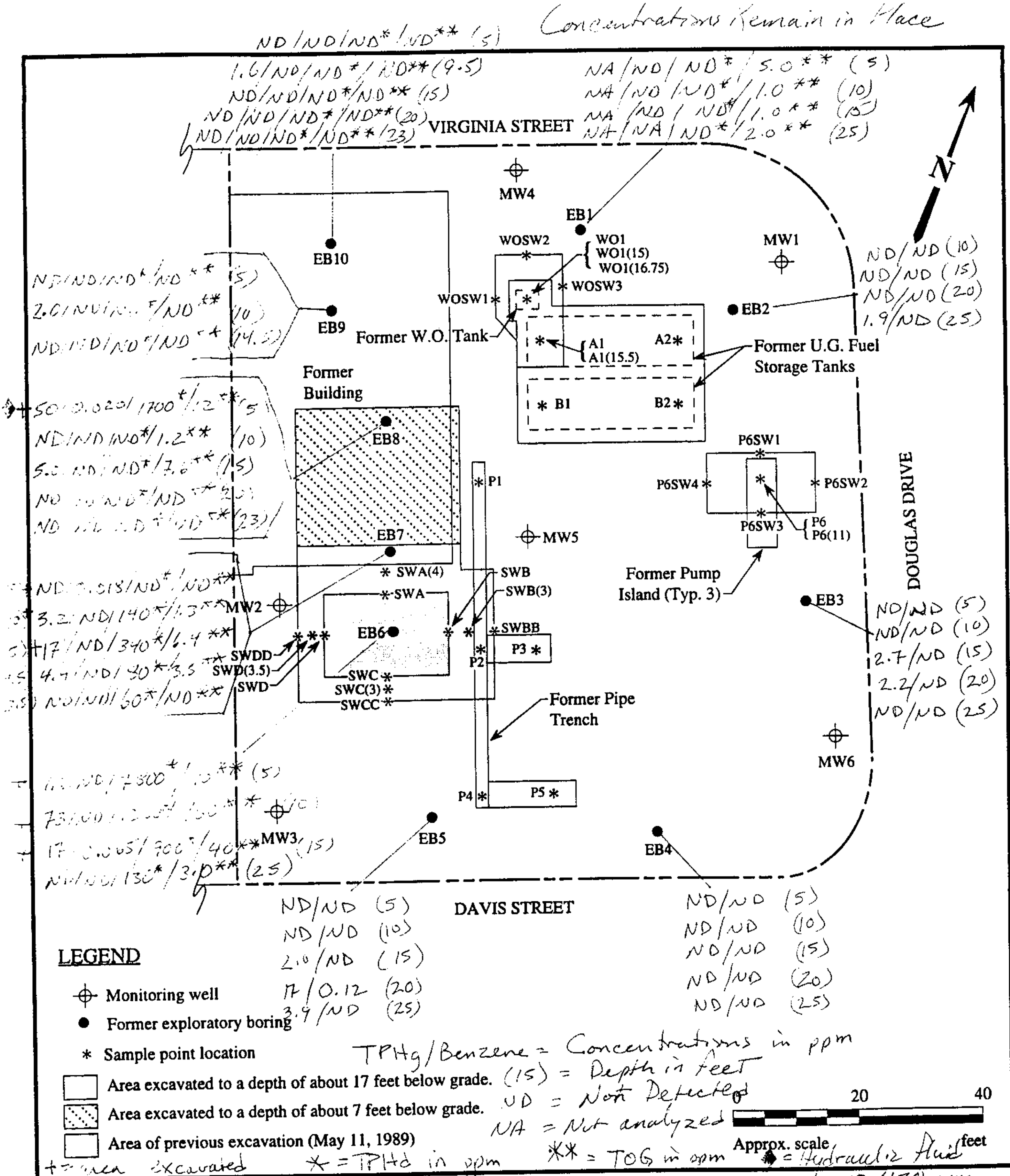
TABLE 11

SUMMARY OF LABORATORY ANALYSES
SOIL

Sample Number	Depth (feet)	TPH as Diesel	TPH as Gasoline	Benzene	Toluene	Ethyl-benzene	Xylenes	TOG
(Collected on May 11, 1989)								
SWA	16.5	21	--	--	--	--	--	850
SWB	16.5	18	--	--	--	--	--	580
SWC	16.5	26	--	--	--	--	--	680
SWD	16.5	16	--	--	--	--	--	170

-- Indicates analysis was not performed.

Results are in milligrams per kilogram (mg/kg), unless otherwise indicated.



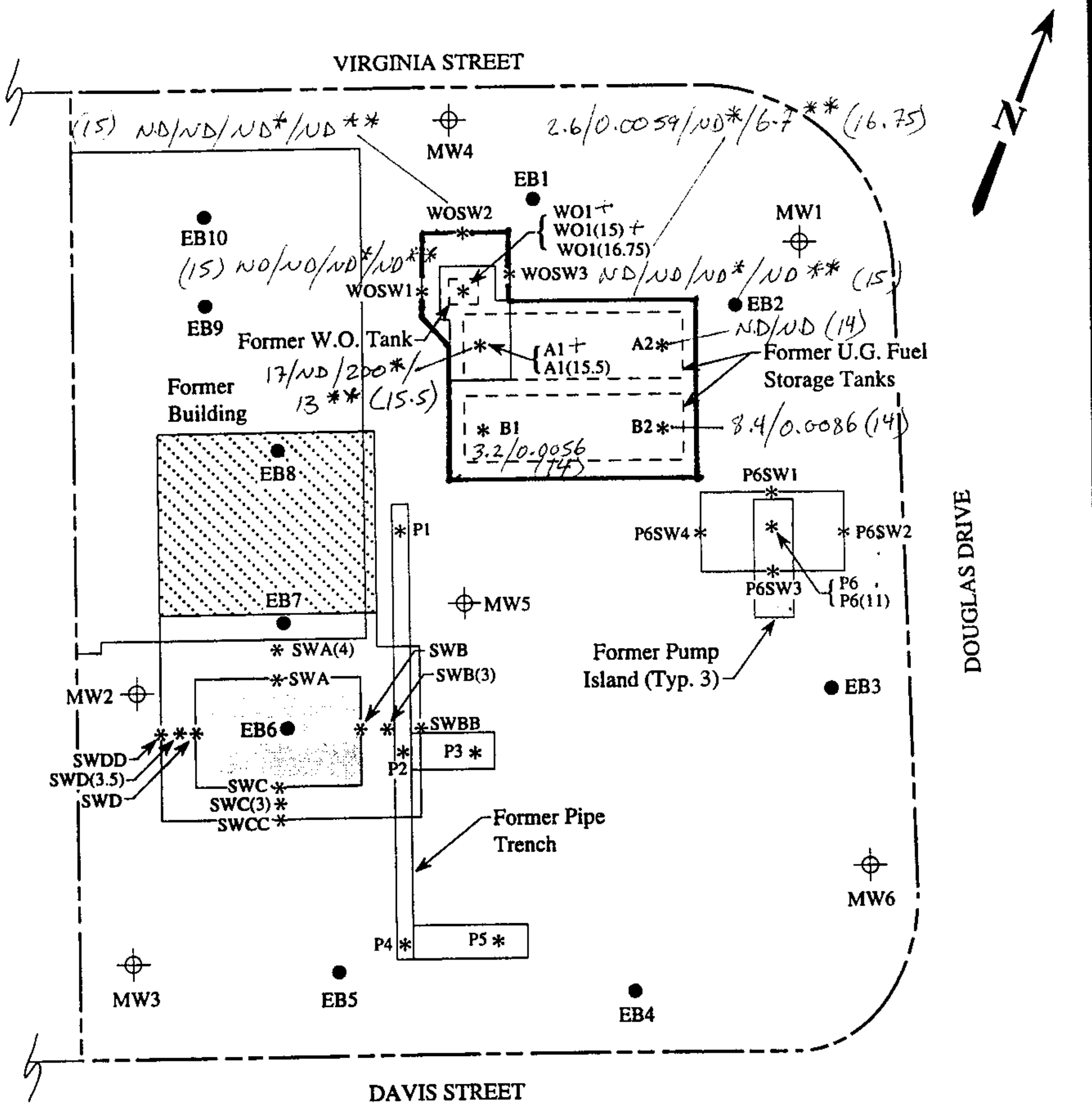
MONITORING WELL, BORING LOG, AND SAMPLE POINT LOCATION MAP

KAPREALIAN ENGINEERING INCORPORATED

UNOCAL SERVICE STATION #2512
1300 DAVIS STREET
SAN LEANDRO, CALIFORNIA

FIGURE 1

Concentrations Remaining in Place



LEGEND

TPHg/Benzene = Concentrations in ppm
(15) = Depth in feet
ND = None Detected
* = TOG in ppm
** = TPHd in ppm
+ = Sample excavated

- Monitoring well
- Former exploratory boring
- * Sample point location
- Area excavated to a depth of about 17 feet below grade.
- Area excavated to a depth of about 7 feet below grade.
- Area of previous excavation (May 11, 1989)

0 20 40
Approx. scale feet

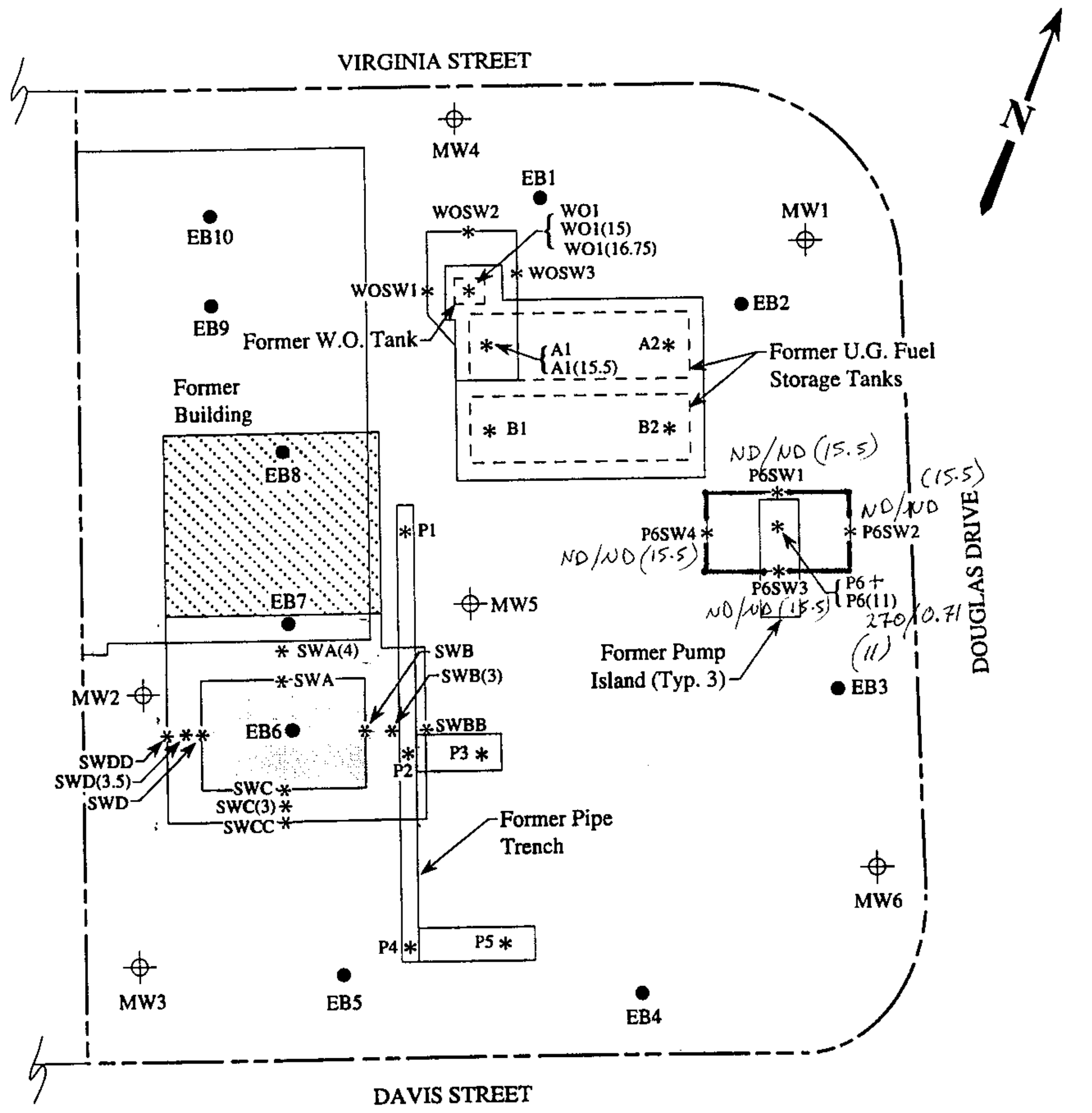
MONITORING WELL, BORING LOG, AND SAMPLE POINT LOCATION MAP

KAPREALIAN ENGINEERING INCORPORATED

UNOCAL SERVICE STATION #2512
1300 DAVIS STREET
SAN LEANDRO, CALIFORNIA

FIGURE **1**

Concentrations Remaining in Place



LEGEND

- ⌖ Monitoring well
- ● Former exploratory boring
- * Sample point location
- ☐ Area excavated to a depth of about 17 feet below grade.
- ▨ Area excavated to a depth of about 7 feet below grade.
- ☐ Area of previous excavation (May 11, 1989)

TPHg/Benzene = Concentrations in ppm
(15) = Depth in feet
ND = None Detected
+ = Sample area excavated

0 20 40
Approx. scale feet

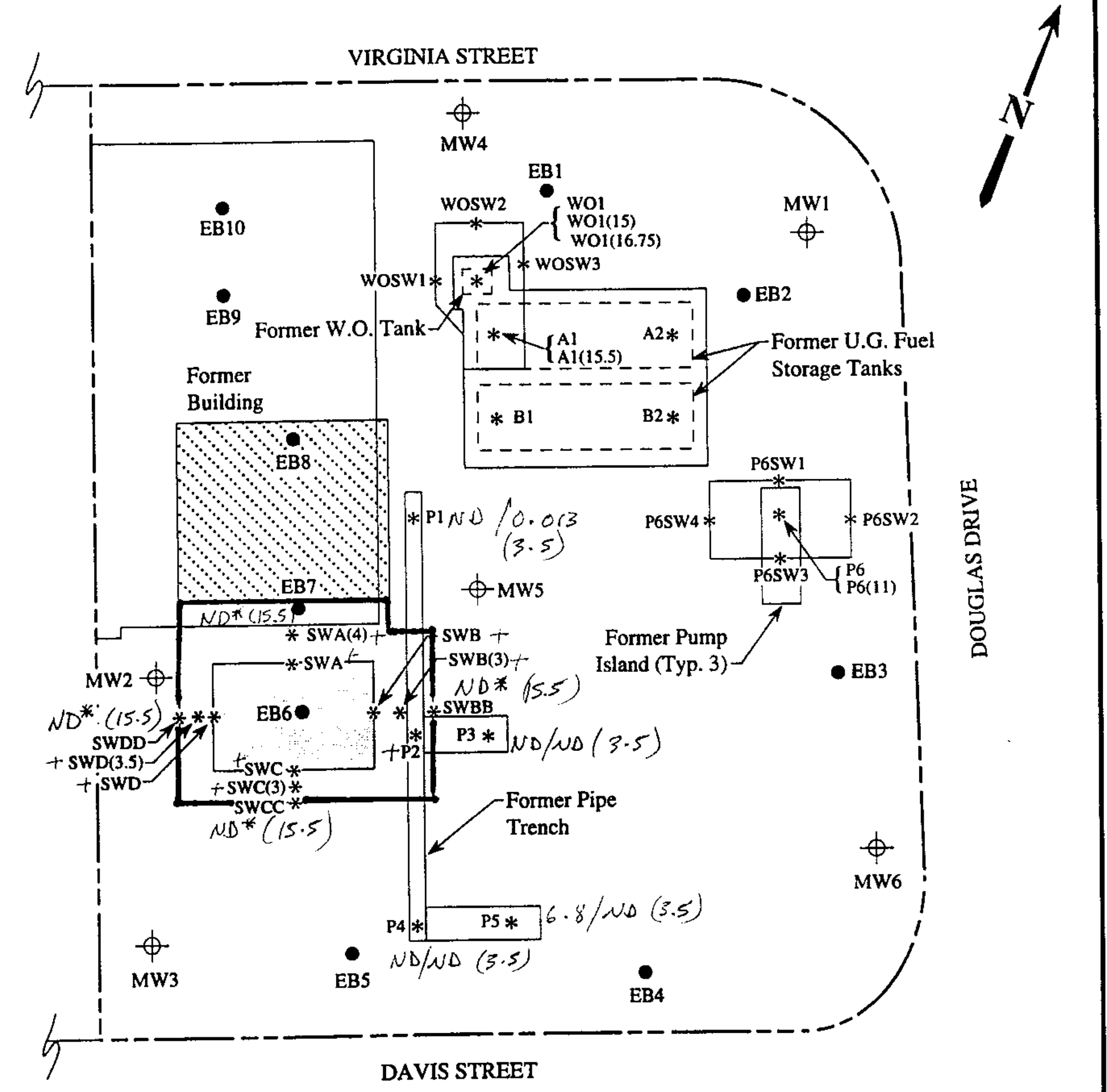
MONITORING WELL, BORING LOG, AND SAMPLE POINT LOCATION MAP

KAPREALIAN ENGINEERING INCORPORATED

UNOCAL SERVICE STATION #2512
1300 DAVIS STREET
SAN LEANDRO, CALIFORNIA

FIGURE
1

Concentrations Remaining in Place



LEGEND

- Monitoring well
- Former exploratory boring
- * Sample point location
- Area excavated to a depth of about 17 feet below grade.
- Area excavated to a depth of about 7 feet below grade.
- Area of previous excavation (May 11, 1989)

TPHg/Benzene = Concentrations in ppm
(15) = Depth in feet
ND = None Detected
** = TPHd in ppm
* = TOG in ppm
\+ = Sample excavated

0 20 40
Approx. scale feet

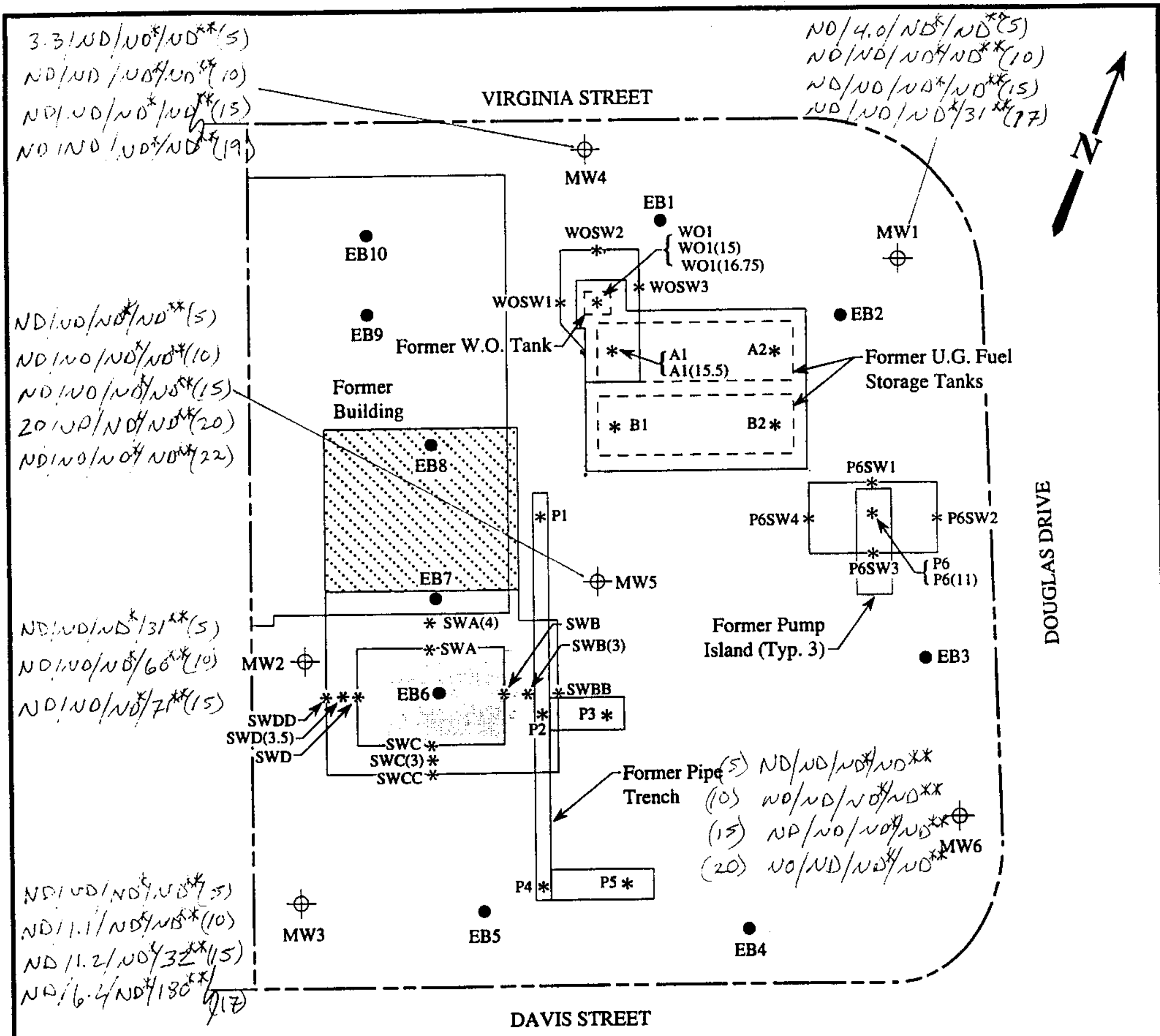
MONITORING WELL, BORING LOG, AND SAMPLE POINT LOCATION MAP

KAPREALIAN ENGINEERING INCORPORATED

UNOCAL SERVICE STATION #2512
1300 DAVIS STREET
SAN LEANDRO, CALIFORNIA

FIGURE **1**

Concentrations Remaining in Place



LEGEND

TPHg / Benzene = Concentrations in ppm
(15) = Depth in feet
ND = None detected
** = TPHd in ppm * = TOG in ppm

- ⌖ Monitoring well
- ● Former exploratory boring
- * Sample point location
- Area excavated to a depth of about 17 feet below grade.
- Area excavated to a depth of about 7 feet below grade.
- Area of previous excavation (May 11, 1989)

0 20 40
Approx. scale feet

MONITORING WELL, BORING LOG, AND SAMPLE POINT LOCATION MAP

KAPREALIAN ENGINEERING INCORPORATED

UNOCAL SERVICE STATION #2512
1300 DAVIS STREET
SAN LEANDRO, CALIFORNIA

FIGURE
1

APPENDIX B

GETTLER-RYAN INC.

February 17, 2000
G-R Job #280036

Mr. Robert A. Boust
Unocal - DBG/AMG
2121 North California Boulevard, Suite 250
Walnut Creek, California 94596

RE: First Quarter 2000 Groundwater Monitoring & Sampling Report
Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

Dear Mr. Boust:

This report documents the quarterly groundwater monitoring and sampling event performed by Gettler-Ryan Inc. (G-R). On January 18, 2000, field personnel monitored and sampled four wells (MW-3, MW-7, MW-8, and MW-9) at the above referenced site.

Static groundwater levels were measured and all wells were checked for the presence of separate-phase hydrocarbons. Separate-phase hydrocarbons were not present in the wells. Static water level data and groundwater elevations are summarized in Table 1. A Potentiometric Map is included as Figure 1.

Groundwater samples were collected from the monitoring wells as specified by G-R Standard Operating Procedure - Groundwater Sampling (attached). The field data sheets are also attached. The samples were analyzed by Sequoia Analytical. Analytical results are summarized in Tables 1, 2 and 3. A Concentration Map is included as Figure 2. The chain of custody document and laboratory analytical reports are also attached.

Sincerely,

Deanna L. Harding
Project Coordinator

Barbara Sieminski
Project Geologist, R.G. No. 6676

REGISTERED GEOLOGIST
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Figure 1:	Potentiometric Map
Figure 2:	Concentration Map
Table 1:	Groundwater Monitoring Data and Analytical Results
Table 2:	Groundwater Analytical Results
Table 3:	Groundwater Analytical Results - Oxygenate Compounds
Attachments:	Standard Operating Procedure - Groundwater Sampling
	Field Data Sheets
	Chain of Custody Document and Laboratory Analytical Reports

2512.qml

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Table 2

Groundwater Analytical Results

Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

EXPLANATIONS:

Groundwater analytical results prior to January 21, 1998, were compiled from reports prepared by MPDS Services, Inc.

PCE = Tetrachloroethene
1,1-DCA = 1,1-Dichloroethane
1,1,1-TCA = 1,1,1-Trichlorethane
1,1-DCE = 1,1-Dichloroethene
1,2-DCB = 1,2-Dichlorobenzene

TCE = Trichloroethene
ppb = Parts per billion
-- = Not Analyzed
ND = Not Detected

[1] 1,2-Dichlorothane (1,2-DCA) was detected at a concentration of 4.8 ppb.
[2] Chloroform was detected at a concentration of 1.7 ppb.
[3] Chloroform was detected at a concentration of 0.68 ppb.
[4] Chloroform was detected at a concentration of 0.53 ppb.
[5] Laboratory report indicates Methylene chloride, which is a suspected laboratory contaminant, was detected at a concentration of 9.6 ppb.
[6] Laboratory report indicates reanalysis by an alternate column or method has confirmed the identification and/or concentration of this result.
[7] Laboratory report indicates Methylene chloride, which is a suspected laboratory contaminant, was detected at a concentration of 8.2 ppb.
[8] Laboratory report indicates Methylene chloride, which is a suspected laboratory contaminant, was detected at a concentration of 7.8 ppb.
[10] Bromodichloromethane was detected at a concentration of 3.79 ppb and Chloroform at 40.3 ppb.
[11] Bromodichloromethane was detected at a concentration of 4.78 ppb and Chloroform at 52.8 ppb.
[12] Chloroform was detected at a concentration of 52.9 ppb.
[13] Chloroform was detected at a concentration of 51.9 ppb.
[14] Detection limit raised. Refer to analytical reports.

All EPA Method 8010 constituents were ND, except as indicated.

Table 3

Groundwater Analytical Results - Oxygenate Compounds

Former Unocal Service Station #2512

1300 Davis Street

San Leandro, California

Well ID	Date	Ethanol (ppb)	TBA (ppb)	MTBE (ppb)	DIPE (ppb)	ETBE (ppb)	TAME (ppb)	EDB (ppb)	1,2-DCA (ppb)
MW-3	04/07/99	ND	ND	4.7	ND	ND	ND	ND	ND
MW-7	04/07/99	ND	ND	ND	ND	ND	ND	ND	ND
MW-8	04/07/99	ND	ND	ND	ND	ND	ND	ND	ND
MW-9	04/07/99	ND	ND	6.4	ND	ND	ND	ND	ND

EXPLANATIONS:

TBA = Tertiary Butyl Alcohol
MTBE = Methyl Tertiary Butyl Ether
DIPE = Di-isopropyl Ether
ETBE = Ethyl Tertiary Butyl Ether
TAME = Tertiary Amyl Methyl Ether
EDB = 1,2-Dibromoethane
1,2-DCA = 1,2-Dichloroethane
ppb = Parts per billion
ND = Not Detected

ANALYTICAL METHOD:

EPA Method 8260 for Oxygenate Compounds

Table 2

Groundwater Analytical Results

Former Unocal Service Station #2512

1300 Davis Street

San Leandro, California

Well ID	Date	PCE *(ppb)*	1,1-DCA *(ppb)*	1,1,1-TCA *(ppb)*	Chloro-methane *(ppb)*	1,1-DCE *(ppb)*	1,2-DCB *(ppb)*	TCE *(ppb)*
MW-3 (cont)	10/25/96	ND	ND	ND	ND	ND	ND	ND
	01/28/97	ND	ND	ND	ND	ND	ND	ND
	04/16/97	ND	ND	ND	ND	ND	ND	ND
	07/21/97	ND	ND	ND	ND	ND	ND	ND
	10/20/97	ND	ND	ND	ND	ND	ND	ND
	01/21/98	ND	ND	ND	ND	ND	ND	ND
	04/17/98	ND	ND	ND	ND	ND	ND	ND
	07/14/98	0.55	ND	ND	ND	ND	ND	ND
	10/12/98	0.51	ND	ND	ND	ND	ND	ND
	01/19/99	ND	ND	ND	ND	ND	ND	ND
	04/07/99	0.54	ND	ND	ND	ND	ND	ND
	07/12/99	ND	ND	ND	ND	ND	ND	ND
	10/25/99[5]	ND	ND	ND	ND	ND	ND	ND
	01/18/00[10]	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**
MW-4	11/06/90	2.9	ND	ND	ND	ND	ND	ND
	05/24/91	4.1	2.5	3.9	ND	ND	ND	ND
	08/15/91	3.6	ND	ND	ND	ND	ND	ND
	11/19/91	3.4	ND	ND	ND	ND	ND	ND
	02/27/92	3.5	6	ND	ND	ND	ND	ND
	05/26/92	2.4	13	3.5	ND	0.83	ND	ND
	10/30/92	INACCESSIBLE	--	--	--	--	--	--
	06/09/94	2.8	8.8	0.83	ND	0.51	ND	0.70
	09/08/94[1]	1.8	ND	ND	ND	ND	ND	0.60
	01/25/95	DESTROYED	--	--	--	--	--	--
MW-5	11/06/90	0.7	ND	ND	ND	ND	ND	ND
	05/24/91	0.89	ND	ND	ND	ND	ND	ND
	06/09/94	INACCESSIBLE	--	--	--	--	--	--
	09/08/94	INACCESSIBLE	--	--	--	--	--	--
	01/25/95	DESTROYED	--	--	--	--	--	--

Table 2

Groundwater Analytical Results

Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

Well ID	Date	PCE (ppb)	1,1-DCA (ppb)	1,1,1-TCA (ppb)	Chloro-methane (ppb)	1,1-DCE (ppb)	1,2-DCB (ppb)	TCE (ppb)
MW-6	11/06/90	1.2	ND	ND	ND	ND	ND	ND
	05/24/91	0.88	ND	ND	5.6	ND	ND	ND
	08/15/91	1.2	ND	ND	ND	ND	ND	ND
	11/19/91	1.3	ND	ND	ND	ND	ND	ND
	02/27/92	1.5	ND	ND	ND	ND	1.6	ND
	05/26/92	1.1	ND	ND	ND	ND	1.7	ND
	10/30/92	1.2	ND	ND	ND	ND	ND	ND
	06/09/94	INACCESSIBLE	--	--	--	--	--	--
	09/08/94	INACCESSIBLE	--	--	--	--	--	--
	01/25/95	DESTROYED	--	--	--	--	--	--
MW-7	02/27/92	2.4	ND	ND	ND	ND	ND	ND
	05/26/92	2.2	ND	ND	ND	ND	ND	ND
	10/30/92	2.2	ND	ND	ND	ND	ND	ND
	06/09/94	0.67	ND	ND	ND	ND	ND	ND
	09/08/94	0.76	ND	ND	ND	ND	ND	ND
	10/21/95	ND	ND	ND	ND	ND	ND	ND
	01/24/96	1.2	ND	ND	ND	ND	ND	ND
	04/23/96	0.84	ND	ND	ND	ND	ND	ND
	07/25/96	1.7	ND	ND	ND	ND	ND	ND
	10/25/96[2]	1.2	ND	ND	ND	ND	ND	ND
	01/28/97	1.4	ND	ND	ND	ND	ND	ND
	04/19/97	0.75	ND	ND	ND	ND	ND	ND
	07/21/97	1.5	ND	ND	ND	ND	ND	ND
	10/20/97	1.5	ND	ND	ND	ND	ND	ND
	01/21/98	1.2	ND	ND	ND	ND	ND	ND
	04/17/98	0.76	ND	ND	ND	ND	ND	ND
	07/14/98	1.4	ND	ND	ND	ND	ND	ND
	10/12/98	1.4	ND	ND	ND	ND	ND	ND
	01/19/99	1.3	ND	ND	ND	ND	ND	ND
	04/07/99[3]	1.6	ND	ND	ND	ND	ND	ND

Table 2

Groundwater Analytical Results

Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

Well ID	Date	PCE *(ppb)*	1,1-DCA *(ppb)*	1,1,1-TCA *(ppb)*	Chloro-methane *(ppb)*	1,1-DCE *(ppb)*	1,2-DCB *(ppb)*	TCE *(ppb)*
MW-7	07/12/99	1.1	ND	ND	ND	ND	ND	ND
(cont)	10/25/99	3.1[6]	ND	ND	ND	ND	ND	ND
	01/18/00[11]	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**
MW-8	10/21/95	ND	ND	ND	ND	ND	ND	ND
	01/24/96	0.74	ND	ND	ND	ND	ND	ND
	04/23/96	1.1	ND	ND	ND	ND	ND	ND
	07/25/96	1.1	ND	ND	ND	ND	ND	ND
	10/25/96	0.90	ND	ND	ND	ND	ND	ND
	01/28/97	0.96	ND	ND	ND	ND	ND	ND
	04/16/97	0.51	ND	ND	ND	ND	ND	ND
	07/21/97	ND	ND	ND	ND	ND	ND	ND
	10/20/97	1.1	ND	ND	ND	ND	ND	ND
	01/21/98	0.77	ND	ND	ND	ND	ND	ND
	04/17/98	ND	ND	ND	ND	ND	ND	ND
	07/14/98	1.3	ND	ND	ND	ND	ND	ND
	10/12/98	1.5	ND	ND	ND	ND	ND	ND
	01/19/99	0.71	ND	ND	ND	ND	ND	ND
	04/07/99[4]	1.0	ND	ND	ND	ND	ND	ND
	07/12/99	0.66	ND	ND	ND	ND	ND	ND
	10/25/99[7]	1.5[6]	ND	ND	ND	ND	ND	ND
	01/18/00[12]	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**
MW-9	10/21/95	17	1.0	ND	ND	ND	ND	ND
	01/24/96	17	2.2	ND	ND	ND	ND	0.64
	04/23/96	71	ND	ND	ND	ND	ND	ND
	07/25/96	1.0	ND	ND	ND	ND	ND	ND
	10/25/96	80	ND	ND	ND	ND	ND	ND
	01/28/97	39	ND	ND	ND	ND	ND	ND
	04/16/97	0.51	ND	ND	ND	ND	ND	ND
	07/21/97	7.5	ND	ND	ND	ND	ND	ND
	10/20/97	47	ND	ND	ND	ND	ND	ND

Table 2

Groundwater Analytical Results

Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

Well ID	Date	PCE (ppb)	1,1-DCA (ppb)	1,1,1-TCA (ppb)	Chloro-methane (ppb)	1,1-DCE (ppb)	1,2-DCB (ppb)	TCE (ppb)
MW-9	01/21/98	22	0.73	ND	ND	ND	ND	0.50
(cont)	04/17/98	120	ND	ND	ND	ND	ND	ND
	07/14/98	110	ND	ND	ND	ND	ND	0.72
	10/12/98	46	ND	ND	ND	ND	ND	ND
	01/19/99	38	0.72	ND	ND	ND	ND	0.54
	04/07/99	41	ND	ND	ND	ND	ND	0.64
	07/12/99	26	ND	ND	ND	ND	ND	ND
	10/25/99[8]	23[6]	ND	ND	ND	ND	ND	ND
	01/18/00[13]	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**	**ND[14]**

Table 1

Groundwater Monitoring Data and Analytical Results

Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

EXPLANATIONS:

Groundwater monitoring data and laboratory results prior to January 21, 1998, were compiled from reports prepared by MPDS Services, Inc.

TOC = Top of Casing elevation
DTW = Depth to Water
(ft.) = Feet
GWE = Groundwater Elevation
msl = Relative to mean sea level
TPH(D) = Total Petroleum Hydrocarbons as Diesel

TPH(G) = Total Petroleum Hydrocarbons as Gasoline
B = Benzene
T = Toluene
E = Ethylbenzene
X = Xylenes

TOG = Total Oil & Grease
MTBE = Methyl tertiary butyl ether
ppb = Parts per billion
ppm = Parts per million
ND = Not Detected
-- = Not Measured/Not Analyzed

* TOC elevations are relative to msl, per East Bay MUD Benchmark DAVIS FREE #2 - San Leandro 1952 (Elevation = 32.02 feet msl). Prior to October 5, 1993, the DTW measurements were taken from top of well covers. Prior to February 27, 1992, the DTW measurements were surveyed assuming well cover MW-1 100 feet as datum.

** Groundwater elevation corrected due to presence of free product; correction factor [(TOC-DTW)+(Product Thickness x 0.75)].

*** Groundwater elevation corrected due to presence of free product; correction factor [(TOC-DTW)+(Product Thickness x 0.77)].

1 Laboratory report indicates the hydrocarbons detected did not appear to be gasoline.
2 Laboratory report indicates the hydrocarbons detected appeared to be a gasoline and non-gasoline mixture.
3 Laboratory report indicates the hydrocarbons detected appeared to be a diesel and non-diesel mixture.
4 Laboratory report indicates the hydrocarbons detected did not appear to be diesel.
5 Laboratory has potentially identified the presence of MTBE at reportable levels in the sample collected from this well.
6 Laboratory has identified the presence of MTBE at a level above or equal to the taste and odor threshold of 40 ppb in the sample collected from this well. Free product was detected in well MW-3; however, a water sample was collected and analyzed to determine if the product was predominantly hydrocarbon based.
7 Laboratory report indicates unidentified hydrocarbons C9-C24.
8 Detection limit raised. Refer to analytical reports.
9 Laboratory report indicates unidentified hydrocarbons C6-C12.
10 Purged additional 100 gallons from well after sampling.
11 Laboratory report indicates unidentified hydrocarbons <C14.
12 Christy box for this well was damaged during tank removal and soil excavation at the site; therefore, GWE could not be accurately determined.
13 Laboratory report indicates a non diesel mix <C17.
14 Laboratory report indicates gasoline and unidentified hydrocarbons C6-C12.
15 Laboratory report indicates unidentified hydrocarbons <C20.
16 MTBE by EPA Method 8260.
17 Laboratory report indicates discrete peaks.
18 Laboratory report indicates unidentified hydrocarbons <C16.

Table 2

Groundwater Analytical Results

Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

Well ID	Date	PCE (ppb)	1,1-DCA (ppb)	1,1,1-TCA (ppb)	Chloro-methane (ppb)	1,1-DCE (ppb)	1,2-DCB (ppb)	TCE (ppb)
MW-1	04/25/89	3.3	ND	ND	ND	ND	ND	0.55
	11/06/90	4.8	ND	ND	ND	ND	ND	ND
	05/24/91	4.6	ND	ND	ND	ND	ND	ND
	06/09/94	1.0	ND	ND	ND	ND	ND	ND
	09/08/94	1.2	ND	ND	ND	ND	ND	ND
	01/25/95	DESTROYED	--	--	--	--	--	--
MW-2	04/25/89	0.68	ND	ND	ND	ND	ND	ND
	11/06/90	ND	ND	ND	ND	ND	ND	ND
	05/24/91	ND	ND	ND	ND	ND	ND	ND
	08/15/91	ND	ND	ND	ND	ND	ND	ND
	11/19/91	ND	ND	ND	ND	ND	ND	ND
	02/27/92	ND	ND	ND	ND	ND	ND	ND
	05/26/92	ND	ND	ND	ND	ND	ND	ND
	10/30/92	ND	ND	ND	ND	ND	ND	ND
	06/09/94	ND	ND	ND	ND	ND	ND	ND
	09/08/94	ND	ND	ND	ND	ND	ND	ND
	01/25/95	DESTROYED	--	--	--	--	--	--
MW-3	04/25/89	1.0	ND	ND	ND	ND	ND	ND
	11/06/90	ND	ND	ND	ND	ND	ND	ND
	05/24/91	ND	ND	ND	ND	ND	ND	ND
	08/15/91	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT				--	--	--
	11/19/91	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT				--	--	--
	02/27/92	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT				--	--	--
	05/26/92	ND	ND	ND	ND	ND	ND	ND
	10/30/92	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT				--	--	--
	06/09/94	ND	ND	ND	ND	ND	ND	ND
	09/08/94	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT				--	--	--
	10/21/95	ND	ND	ND	ND	ND	ND	ND
	01/24/96	ND	ND	ND	ND	ND	ND	ND
	04/23/96	ND	ND	ND	ND	ND	ND	ND
	07/25/96	ND	ND	ND	ND	ND	ND	ND

Table 1
Groundwater Monitoring Data and Analytical Results
Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

Well ID/ TOC*	Date	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPH(D) (ppb)	TPH(G) (ppb)	B (ppb)	T (ppb)	E (ppb)	X (ppb)	MTBE (ppb)	TOG (ppm)
MW-8 (cont)	07/14/98	14.85	17.88	0.00	--	ND	ND	ND	ND	ND	ND	--
	10/12/98	15.86	16.87	0.00	--	ND	ND	ND	ND	ND	ND	--
	01/19/99	14.69	18.04	0.00	--	ND	ND	ND	ND	ND	ND	--
	04/07/99	13.88	18.85	0.00	--	ND	ND	ND	ND	ND	ND/ND[16]	--
	07/12/99	15.21	17.52	0.00	--	ND	ND	ND	ND	ND	ND	--
	10/25/99	15.30	17.43	0.00	--	ND	ND	ND	ND	ND	ND	--
	01/18/00	**14.67**	**18.06**	**0.00**	**--**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**--**
MW-9 32.33	10/05/95	15.27	17.06	0.00	--	--	--	--	--	--	--	--
	10/21/95	15.59	16.74	0.00	--	ND	ND	ND	ND	ND	--[5]	--
	01/24/96	14.28	18.05	0.00	--	ND	ND	ND	ND	ND	--[6]	--
	04/23/96	14.60	17.73	0.00	--	ND	ND	ND	ND	ND	ND	--
	07/25/96	15.05	17.28	0.00	--	ND	ND	ND	ND	ND	ND	--
	10/25/96	15.66	16.67	0.00	--	ND	ND	ND	ND	ND	180	--
	01/28/97	13.76	18.57	0.00	--	ND	ND	ND	ND	ND	75	--
	04/16/97	12.66	19.67	0.00	--	ND	ND	ND	ND	ND	ND	--
	07/21/97	15.44	16.89	0.00	--	ND	ND	ND	ND	ND	ND	--
	10/20/97	15.67	16.66	0.00	--	ND	ND	ND	ND	ND	100	--
	01/21/98	13.97	18.36	0.00	--	ND	ND	ND	ND	ND	140	--
	04/17/98	14.38	17.95	0.00	--	56[9]	ND	ND	ND	ND	18	--
	07/14/98	14.87	17.46	0.00	--	ND	ND	ND	ND	ND	6.6	--
	10/12/98	15.19	17.14	0.00	--	ND	ND	ND	ND	ND	16	--
	01/19/99	14.54	17.79	0.00	--	ND	ND	ND	ND	ND	30	--
	04/07/99	13.62	18.71	0.00	--	ND	ND	ND	ND	ND	6.9/6.4[16]	--
	07/12/99	15.03	17.30	0.00	--	ND	ND	ND	ND	ND	3.8	--
	10/25/99	**14.25**	**18.08**	**0.00**	**--**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**--**
Trip Blank TB-LB	01/21/98	--	--	--	--	ND	ND	ND	ND	ND	ND	--
	04/17/98	--	--	--	--	ND	ND	ND	ND	ND	ND	--
	07/14/98	--	--	--	--	ND	ND	ND	ND	ND	ND	--
	10/12/98	--	--	--	--	ND	ND	ND	ND	ND	ND	--

Table 1

Groundwater Monitoring Data and Analytical Results

Former Unocal Service Station #2512

1300 Davis Street

San Leandro, California

Well ID/ TOC*	Date	DTW *(ft.)*	GWE *(msl)*	Product Thickness *(ft.)*	TPH(D) *(ppb)*	TPH(G) *(ppb)*	B *(ppb)*	T *(ppb)*	E *(ppb)*	X *(ppb)*	MTBE *(ppb)*	TOG *(ppm)*
TB-LB	01/19/99	--	--	--	--	ND	ND	ND	ND	ND	ND	--
(cont)	04/07/99	--	--	--	--	ND	ND	ND	ND	ND	ND	--
	07/12/99	--	--	--	--	ND	ND	ND	ND	ND	ND	--
	10/25/99	--	--	--	--	ND	ND	ND	ND	ND	ND	--
	01/18/00	**--**	**--**	**--**	**--**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**--**

Table 1

Groundwater Monitoring Data and Analytical Results

Former Unocal Service Station #2512

1300 Davis Street

San Leandro, California

Well ID/ TOC*	Date	DTW *(ft.)*	GWE *(msl)*	Product Thickness *(ft.)*	TPH(D) *(ppb)*	TPH(G) *(ppb)*	B *(ppb)*	T *(ppb)*	E *(ppb)*	X *(ppb)*	MTBE *(ppb)*	TOG *(ppm)*
MW-5	06/09/94	INACCESSIBLE	--	--	--	--	--	--	--	--	--	--
(cont)	09/08/94	INACCESSIBLE	--	--	--	--	--	--	--	--	--	--
	01/25/95	DESTROYED	--	--	--	--	--	--	--	--	--	--
MW-6	08/29/89	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	11/21/89	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	02/23/90	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	05/10/90	--	--	--	ND	ND	ND	1.2	ND	ND	--	ND
	08/09/90	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	11/06/90	--	--	--	ND	ND	1.6	0.35	ND	ND	--	ND
	02/04/91	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	05/24/91	--	--	--	--	ND	ND	ND	ND	ND	--	ND
	08/15/91	--	--	--	--	ND	ND	ND	ND	ND	--	ND
100.50	09/18/91	18.34	82.16	0.00	--	--	--	--	--	--	--	--
	10/15/91	18.65	81.85	0.00	--	--	--	--	--	--	--	--
	11/19/91	17.94	82.56	0.00	--	ND	ND	ND	ND	ND	--	--
33.19	02/27/92	15.70	17.49	0.00	--	ND	3.2	ND	ND	3.8	--	--
	03/27/92	15.56	17.63	0.00	--	--	--	--	--	--	--	--
	04/27/92	16.07	17.12	0.00	--	--	--	--	--	--	--	--
	05/26/92	16.34	16.85	0.00	--	ND	ND	ND	ND	0.65	--	--
	06/23/92	16.70	16.49	0.00	--	--	--	--	--	--	--	--
	07/24/92	17.00	16.19	0.00	--	--	--	--	--	--	--	--
	10/30/92	17.07	16.12	0.00	--	ND	ND	ND	ND	ND	--	--
	06/09/94	INACCESSIBLE	--	--	--	--	--	--	--	--	--	--
	09/08/94	INACCESSIBLE	--	--	--	--	--	--	--	--	--	--
	01/25/95	DESTROYED	--	--	--	--	--	--	--	--	--	--
MW-7												
32.09	02/27/92	15.12	16.97	0.00	--	38	ND	0.97	0.69	4	--	--
	03/27/92	14.26	17.83	0.00	--	--	--	--	--	--	--	--
	04/27/92	14.86	17.23	0.00	--	--	--	--	--	--	--	--
	05/26/92	15.30	16.79	0.00	--	ND	ND	ND	ND	0.6	--	--
	06/23/92	15.80	16.29	0.00	--	--	--	--	--	--	--	--
	07/24/92	16.26	15.83	0.00	--	--	--	--	--	--	--	--

Table 1

Groundwater Monitoring Data and Analytical Results

Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

Well ID/ TOC*	Date	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPH(D) (ppb)	TPH(G) (ppb)	B (ppb)	T (ppb)	E (ppb)	X (ppb)	MTBE (ppb)	TOG (ppm)
MW-7	10/30/92	16.31	15.78	0.00	--	ND	ND	ND	ND	ND	--	--
(cont)	06/09/94	14.43	--	0.00	--	610[1]	ND	ND	ND	ND	--	--
	09/08/94	15.32	--	0.00	--	ND	ND	1.3	ND	1.6	--	--
31.71	10/21/95	14.74	16.97	0.00	--	ND	ND	ND	ND	ND	--	--
	01/24/96	12.50	19.21	0.00	--	ND	ND	ND	ND	ND	--	--
	04/23/96	12.48	19.23	0.00	--	220	ND	0.62	0.88	5.4	ND	--
	07/25/96	14.30	17.41	0.00	--	ND	ND	ND	ND	ND	ND	--
	10/25/96	15.13	16.58	0.00	--	ND	ND	ND	ND	ND	ND	--
	01/28/97	10.41	21.30	0.00	--	ND	ND	ND	ND	ND	ND	--
	04/16/97	12.12	19.59	0.00	--	ND	ND	ND	ND	ND	ND	--
	07/21/97	15.01	16.70	0.00	--	ND	ND	ND	ND	ND	ND	--
	10/20/97	15.18	16.53	0.00	--	ND	ND	ND	ND	ND	ND	--
	01/21/98	10.46	21.25	0.00	--	ND	ND	ND	ND	ND	ND	--
	04/17/98	11.57	20.14	0.00	--	ND	ND	ND	ND	ND	ND	--
	07/14/98	13.10	18.61	0.00	--	ND	ND	ND	ND	ND	ND	--
	10/12/98	14.22	17.49	0.00	--	ND	ND	ND	ND	ND	ND	--
	01/19/99	12.12	19.59	0.00	--	ND	ND	ND	ND	ND	ND	--
	04/07/99	11.47	20.24	0.00	--	ND	ND	ND	ND	ND	ND/ND[16]	--
	07/12/99	14.17	17.54	0.00	--	ND	ND	ND	ND	ND	ND	--
	10/25/99	14.22	17.49	0.00	--	ND	ND	ND	ND	ND	ND	--
	01/18/00	**12.38**	**19.33**	**0.00**	**--**	**ND**	**ND**	**ND**	**ND**	**ND**	**6.10**	**--**
MW-8												
32.73	10/05/95	15.56	17.17	0.00	--	--	--	--	--	--	--	--
	10/21/95	15.65	17.08	0.00	--	ND	ND	ND	ND	ND	--	--
	01/24/96	14.51	18.22	0.00	--	ND	ND	ND	ND	ND	--	--
	04/23/96	15.70	17.03	0.00	--	ND	ND	ND	ND	ND	ND	--
	07/25/96	15.10	17.63	0.00	--	ND	ND	ND	ND	ND	ND	--
	10/25/96	15.96	16.77	0.00	--	ND	ND	ND	ND	ND	ND	--
	01/28/97	13.86	18.87	0.00	--	ND	ND	ND	ND	ND	ND	--
	04/16/97	12.74	19.99	0.00	--	ND	ND	ND	ND	ND	ND	--
	07/21/97	15.71	17.02	0.00	--	ND	ND	ND	ND	ND	ND	--
	10/20/97	15.98	16.75	0.00	--	ND	ND	ND	ND	ND	ND	--
	01/21/98	14.20	18.53	0.00	--	ND	ND	ND	ND	ND	ND	--
	04/17/98	14.40	18.33	0.00	--	ND	ND	ND	ND	ND	ND	--

Table 1

Groundwater Monitoring Data and Analytical Results

Former Unocal Service Station #2512

1300 Davis Street

San Leandro, California

Well ID/ TOC*	Date	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPH(D) (ppb)	TPH(G) (ppb)	B (ppb)	T (ppb)	E (ppb)	X (ppb)	MTBE (ppb)	TOG (ppm)
MW-3	05/26/92	16.06	16.76**	0.12	2,400,000	1,300,000	5,100	66,000	20,000	160,000	--	880
(cont)	06/09/92	16.29	16.46**	0.03	--	--	--	--	--	--	--	--
	06/23/92	16.52	16.26**	0.06	--	--	--	--	--	--	--	--
	07/06/92	16.60	16.24**	0.14	--	--	--	--	--	--	--	--
	07/24/92	INACCESSIBLE	--	--	--	--	--	--	--	--	--	--
	10/30/92	17.08	--[12]	0.07	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT						--	--
	06/09/94	14.74	--	0.00	17,000[3]	69,000	1,300	7,100	1,900	11,000	--	--
	09/08/94	15.54	--	Sheen	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT						--	--
32.02	10/05/95	14.86	17.16	0.00	--	--	--	--	--	--	--	--
	10/21/95	14.98	17.04	0.00	5,900[3]	50,000	250	4,200	1,700	18,000	--[5]	--
	01/24/96	13.15	18.87	0.00	5,300[3]	100,000	950	3,300	2,500	16,000	--[6]	--
	04/23/96	13.11	18.91	0.00	4,900[3]	50,000	430	1,700	1,600	7,600	ND	--
	07/25/96	14.40	17.62	0.00	2,400[4]	17,000	170	ND	650	3,300	240	--
	10/25/96	15.33	16.69	0.00	3,700[4]	26,000	420	1,100	1,800	6,400	340	--
	01/28/97	11.55	20.47	0.00	3,900[3]	32,000	230	1,000	1,000	4,500	ND	--
	04/16/97	12.05	19.97	0.00	3,100[3]	12,000	76	ND	330	1,600	ND	--
	07/21/97	15.17	16.85	0.00	2,400[3]	10,000	82	28	430	1,400	76	--
	10/20/97	15.41	16.61	Sheen	2,900[4]	12,000	200	540	1,400	4,600	210	--
	01/21/98[10]	11.59	20.43	0.00	3,700[7]	25,000	170	640	1,200	4,800	ND[8]	--
	04/17/98[10]	12.46	19.56	0.00	3,400	25,000	980	1,400	5,800	ND[8]	ND[8]	--
	07/14/98[10]	13.43	18.59	0.00	1,100[11]	6,200	76	ND[8]	550	810	ND[8]	--
	10/12/98[10]	14.60	17.42	0.00	420[13]	1,600	28	ND[8]	28	81	ND[8]	--
	01/19/99[10]	12.97	19.05	0.00	870[15]	27,000[14]	18	ND[8]	48	69	ND[8]	--
	04/07/99	12.36	19.66	0.00	ND	1,700	10	ND[8]	28	72	[8]ND/4.7[16]	ND
	07/12/99	14.41	17.61	0.00	160[17]	78	0.68	ND	ND	2.4	ND	--
	10/25/99	14.53	17.49	0.00	95[18]	220	0.82	ND	0.77	6.8	3.9	--
	01/18/00	**13.05**	**18.97**	**0.00**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**135**	**--**
MW-4	08/29/89	--	--	--	120	ND	ND	ND	ND	ND	--	ND
	11/21/89	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	02/23/90	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	05/10/90	--	--	--	88	54	ND	2	ND	0.37	--	ND
	08/09/90	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	11/06/90	--	--	--	ND	ND	ND	0.36	ND	0.98	--	ND
	02/04/91	--	--	--	ND	ND	ND	0.72	ND	1.1	--	ND

Table 1

Groundwater Monitoring Data and Analytical Results

Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

Well ID/ TOC*	Date	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPH(D) (ppb)	TPH(G) (ppb)	B (ppb)	T (ppb)	E (ppb)	X (ppb)	MTBE (ppb)	TOG (ppm)
MW-4	05/24/91	--	--	--	ND	ND	0.64	ND	ND	ND	--	ND
(cont)	08/15/91	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
99.66	09/18/91	17.67	81.99	0.00	--	--	--	--	--	--	--	--
	10/15/91	17.95	81.71	0.00	--	--	--	--	--	--	--	--
	11/19/91	17.25	82.41	0.00	ND	ND	ND	ND	ND	ND	--	--
32.38	02/27/92	14.96	17.42	0.00	ND	43	ND	1	0.37	2.5	--	--
	03/27/92	15.01	17.37	0.00	--	--	--	--	--	--	--	--
	04/27/92	15.37	17.01	0.00	--	--	--	--	--	--	--	--
	05/26/92	15.62	16.76	0.00	ND	120	0.59	0.82	ND	1.9	--	--
	06/23/92	16.02	16.36	0.00	--	--	--	--	--	--	--	--
	07/24/92	16.10	--[12]	0.00	--	--	--	--	--	--	--	--
	10/30/92	INACCESSIBLE	--	--	--	--	--	--	--	--	--	--
	06/09/94	15.08	--	0.00	ND	780[1]	ND	ND	ND	ND	--	--
	09/08/94	15.72	--	0.00	ND	300[1]	ND	ND	ND	ND	--	--
	01/25/95	DESTROYED	--	--	--	--	--	--	--	--	--	--
MW-5	08/29/89	--	--	--	100	ND	ND	0.94	0.3	ND	--	ND
	11/21/89	--	--	--	70	ND	ND	ND	ND	ND	--	ND
	02/23/90	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	05/10/90	--	--	--	83	ND	ND	ND	ND	0.31	--	ND
	08/09/90	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	11/06/90	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	02/04/91	--	--	--	ND	ND	ND	0.35	ND	ND	--	ND
	05/24/91	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
100.32	09/18/91	18.30	82.02	0.00	--	--	--	--	--	--	--	--
	10/15/91	18.59	81.73	0.00	--	--	--	--	--	--	--	--
	11/19/91	17.87	82.45	0.00	--	--	--	--	--	--	--	--
33.02	02/27/92	15.50	17.52	0.00	--	--	--	--	--	--	--	--
	03/27/92	15.68	17.34	0.00	--	--	--	--	--	--	--	--
	04/27/92	15.96	17.06	0.00	--	--	--	--	--	--	--	--
	05/26/92	16.22	16.80	0.00	--	--	--	--	--	--	--	--
	06/23/92	16.63	16.39	0.00	--	--	--	--	--	--	--	--
	07/24/92	16.73	--[12]	0.00	--	--	--	--	--	--	--	--
	10/30/92	INACCESSIBLE	--	0.00	--	--	--	--	--	--	--	--

Table 1

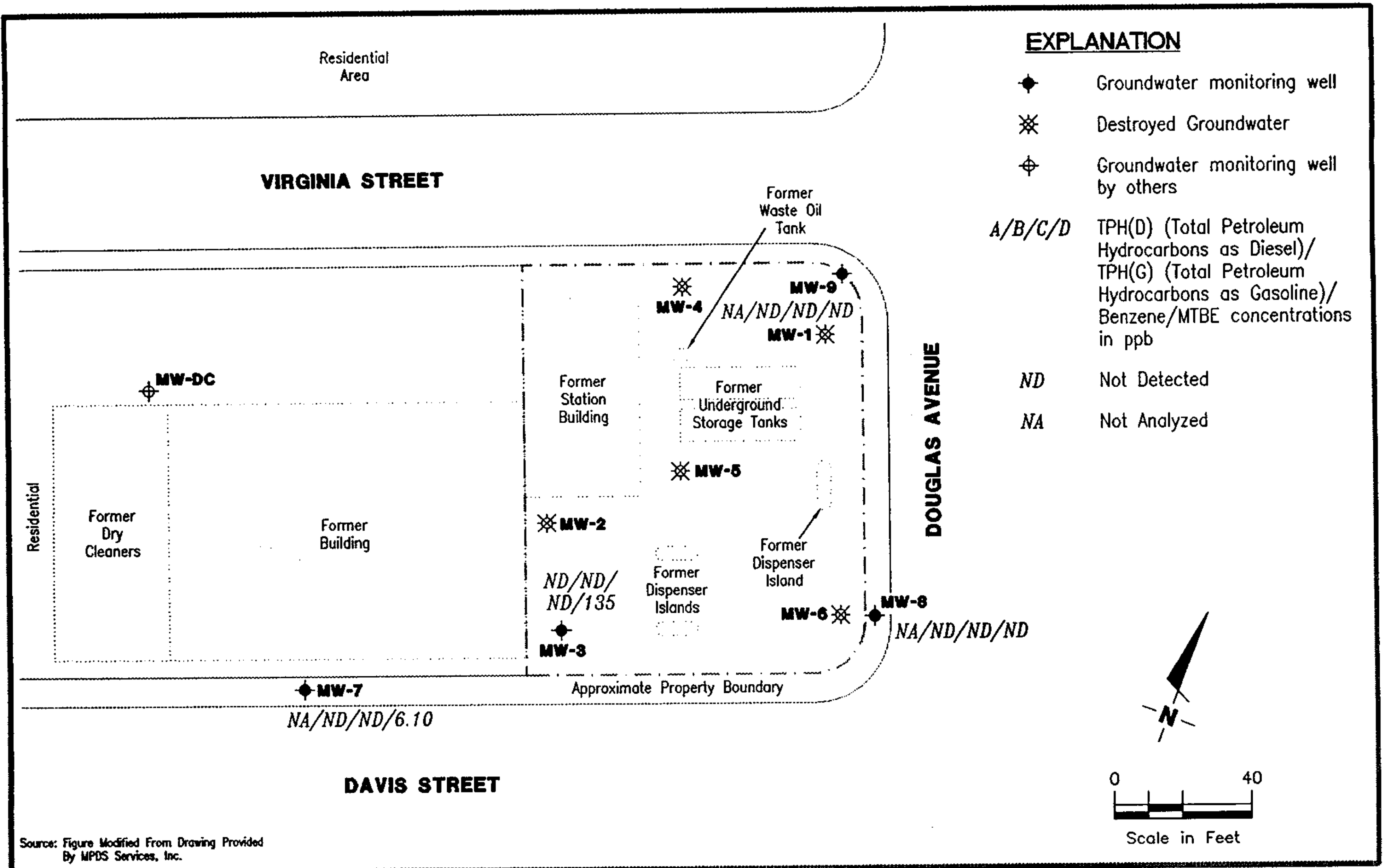
Groundwater Monitoring Data and Analytical Results

Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

Well ID/ TOC*	Date	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPH(D) (ppb)	TPH(G) (ppb)	B (ppb)	T (ppb)	E (ppb)	X (ppb)	MTBE (ppb)	TOG (ppm)
MW-1	04/25/89	--	--	--	100	ND	0.31	ND	ND	ND	--	--
	08/10/89	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	11/21/89	--	--	--	ND	ND	ND	ND	ND	ND	--	8.9
	02/23/90	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	05/10/90	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	08/09/90	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	11/06/90	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	02/04/91	--	--	--	ND	ND	ND	0.31	ND	0.62	--	ND
	05/24/91	--	--	--	--	ND	ND	ND	ND	ND	--	ND
	08/15/91	--	--	--	--	--	--	--	--	--	--	--
100.00	09/18/91	17.88	82.12	0.00	--	--	--	--	--	--	--	--
	10/15/91	18.17	81.83	0.00	--	--	--	--	--	--	--	--
	11/19/91	17.48	82.52	0.00	--	--	--	--	--	--	--	--
32.69	02/27/92	15.36	17.33	0.00	--	--	--	--	--	--	--	--
	03/27/92	15.53	17.16	0.00	--	--	--	--	--	--	--	--
	04/27/92	15.68	17.01	0.00	--	--	--	--	--	--	--	--
	05/26/92	15.90	16.79	0.00	--	--	--	--	--	--	--	--
	06/23/92	16.25	16.44	0.00	--	--	--	--	--	--	--	--
	07/24/92	16.54	16.15	0.00	--	--	--	--	--	--	--	--
	10/30/92	16.58	16.11	0.00	--	--	--	--	--	--	--	--
	06/09/94	15.22	--	0.00	--	580[1]	ND	ND	ND	ND	--	--
	09/08/94	15.81	--	0.00		160[2]	ND	1.6	ND	3.1	--	--
	01/25/95	DESTROYED	--	--	--	--	--	--	--	--	--	--
MW-2	04/25/89	--	--	--	ND	32	0.35	ND	ND	ND	--	--
	08/10/89	--	--	--	ND	ND	ND	0.39	ND	ND	--	ND
	11/21/89	--	--	--	ND	48	ND	0.51	ND	ND	--	1.6
	02/23/90	--	--	--	ND	44	ND	ND	ND	ND	--	ND
	05/10/90	--	--	--	ND	43	ND	1	ND	ND	--	ND
	08/09/90	--	--	--	ND	ND	ND	ND	ND	ND	--	ND
	11/06/90	--	--	--	ND	ND	ND	0.42	ND	1.4	--	ND
	02/04/91	--	--	--	ND	ND	ND	0.38	ND	0.87	--	ND
	05/24/91	--	--	--	--	ND	1.5	ND	ND	ND	--	ND
	08/15/91	--	--	--	--	ND	ND	ND	ND	ND	--	ND
100.32	09/18/91	18.48	81.84	0.00	--	--	--	--	--	--	--	--

Table 1
Groundwater Monitoring Data and Analytical Results
Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

Well ID/ TOC*	Date	DTW (ft.)	GWE (msl)	Product Thickness (ft.)	TPH(D) (ppb)	TPH(G) (ppb)	B (ppb)	T (ppb)	E (ppb)	X (ppb)	MTBE (ppb)	TOG (ppm)
MW-2	10/15/91	18.75	81.57	0.00	--	--	--	--	--	--	--	--
(cont)	11/19/91	18.01	82.31	0.00	--	220	2.5	8.4	2.4	14	--	--
33.04	02/27/92	15.40	17.64	0.00	--	330	12	12	10	93	--	--
	03/27/92	15.61	17.43	0.00	--	--	--	--	--	--	--	--
	04/27/92	15.96	17.08	0.00	--	--	--	--	--	--	--	--
	05/26/92	16.30	16.74	0.00	--	2,900	8.8	9.3	54	36	--	--
	06/23/92	16.76	16.28	0.00	--	--	--	--	--	--	--	--
	07/24/92	16.66	--[12]	0.00	--	--	--	--	--	--	--	--
	10/30/92	17.38	--[12]	0.00	--	1,200[1]	ND	ND	ND	ND	--	--
	06/09/94	15.48	--	0.00	--	1,900[2]	6.7	ND	66	ND	--	--
	09/08/94	16.22	--	0.00	--	3,000[1]	ND	ND	ND	17	--	--
	01/25/95	DESTROYED	--	--	--	--	--	--	--	--	--	--
MW-3	04/25/89	--	--	--	5,700	56	ND	ND	0.31	0.49	--	--
	08/10/89	--	--	--	860	3,200	73	140	35	240	--	ND
	11/21/89	--	--	--	110	1,900	ND	ND	ND	ND	--	3.8
	02/23/90	--	--	--	350	ND	0.32	ND	ND	ND	--	1.3
	05/10/90	--	--	--	850	6,200	94	460	160	540	--	2.8
	08/09/90	--	--	--	500	1,900	56	140	140	31	--	ND
	11/06/90	--	--	--	940	16,000	820	1,500	2,200	770	--	ND
	02/04/91	--	--	--	NOT SAMPLED DUE TO A TRACE OF FREE PRODUCT					--	--	--
	05/24/91	--	--	--	2,000	23,000	940	3,400	590	2,600	--	ND
	08/15/91	--	--	--	NOT SAMPLED DUE TO A TRACE OF FREE PRODUCT					--	--	--
100.03	09/04/91	17.97	82.08***	0.03	--	--	--	--	--	--	--	--
	09/18/91	18.38	81.73***	0.10	--	--	--	--	--	--	--	--
	10/02/91	18.50	81.65***	0.16	--	--	--	--	--	--	--	--
	10/15/91	18.59	81.62***	0.24	--	--	--	--	--	--	--	--
	11/05/91	17.75	82.49***	0.27	--	--	--	--	--	--	--	--
	11/19/91	17.87	82.36***	0.26	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT						--	--
32.73	02/27/92	14.98	17.82**	0.09	NOT SAMPLED DUE TO THE PRESENCE OF FREE PRODUCT						--	--
	03/12/92	14.94	17.79	0.00	--	--	--	--	--	--	--	--
	03/27/92	15.12	17.61	0.00	--	--	--	--	--	--	--	--
	04/13/92	15.17	17.56	0.00	--	--	--	--	--	--	--	--
	04/27/92	15.58	17.17**	0.02	--	--	--	--	--	--	--	--
	05/11/92	15.84	16.92**	0.04	--	--	--	--	--	--	--	--



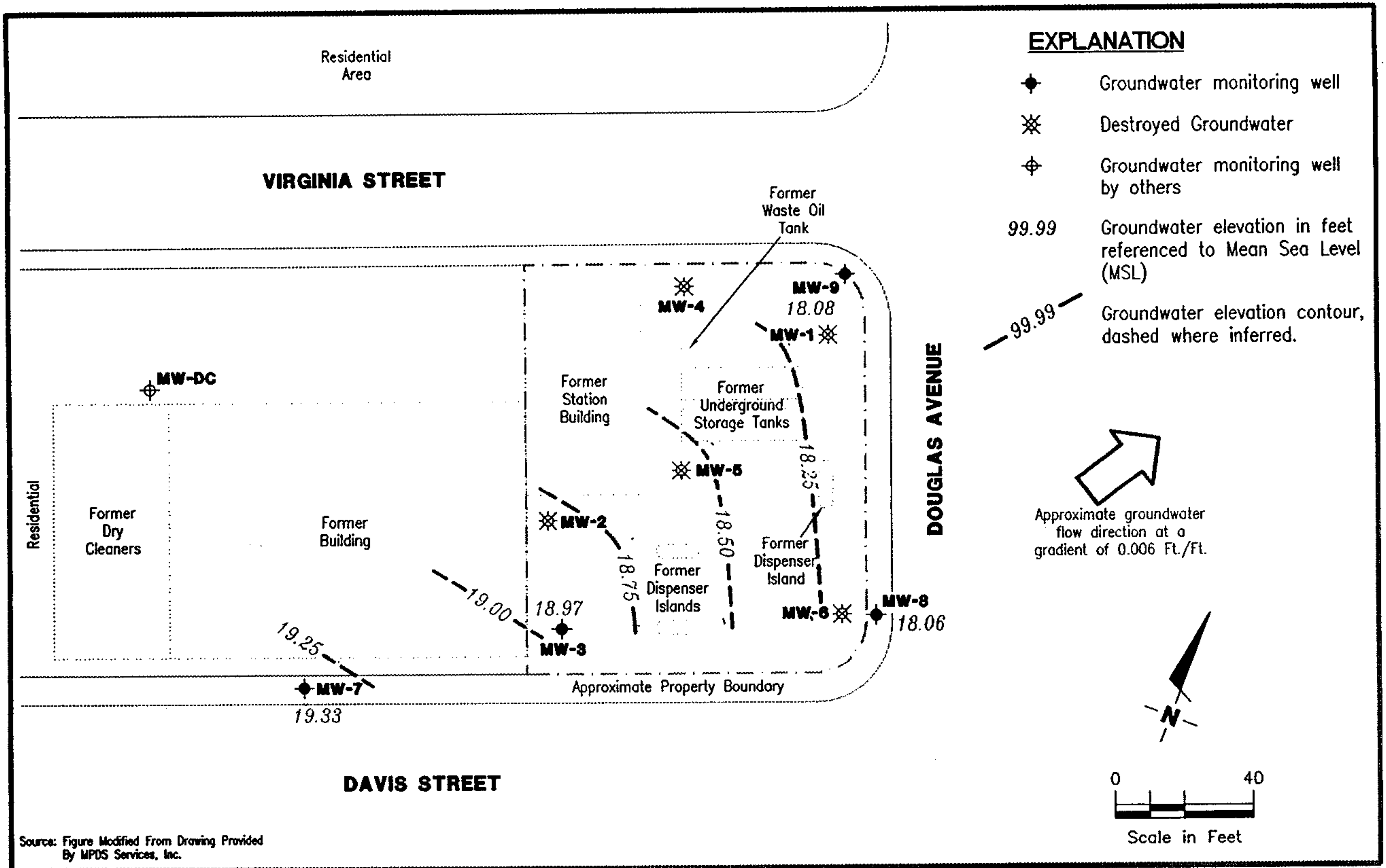
Gettler - Ryan Inc.

6747 Sierra Ct., Suite J (925) 551-7555
Dublin, CA 94568

CONCENTRATION MAP
Former Unocal Service Station No. 2512
1300 Davis Street
San Leandro, California

FIGURE
2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
280036		January 18, 2000	



Gettler - Ryan Inc.

6747 Sierra Ct., Suite J (925) 551-7555
Dublin, CA 94568

POTENTIOMETRIC MAP
Former Unocal Service Station No. 2512
1300 Davis Street
San Leandro, California

FIGURE
1

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
280036		January 18, 2000	

STANDARD OPERATING PROCEDURE - GROUNDWATER SAMPLING

Gettler-Ryan Inc. field personnel adhere to the following procedures for the collection and handling of groundwater samples prior to analysis by the analytical laboratory. Prior to sample collection, the type of analysis to be performed is determined. Loss prevention of volatile compounds is controlled and sample preservation for subsequent analysis is maintained.

Prior to sampling, the presence or absence of free-phase hydrocarbons is determined using a MMC flexi-dip interface probe. Product thickness, if present, is measured to the nearest 0.01 foot and is noted in the field notes. In addition, static water level measurements are collected with the interface probe and are also recorded in the field notes.

After water levels are collected and prior to sampling, each well is purged a minimum of three well casing volumes of water using pre-cleaned pumps (stack, suction, Grundfos), or polyvinyl chloride bailers. Temperature, pH and electrical conductivity are measured a minimum of three times during the purging. Purging continues until these parameters stabilize.

Groundwater samples are collected using disposable bailers. The water samples are transferred from the bailer into appropriate containers. Pre-preserved containers, supplied by analytical laboratories, are used when possible. When pre-preserved containers are not available, the laboratory is instructed to preserve the sample as appropriate. Duplicate samples are collected for the laboratory to use in maintaining quality assurance/quality control standards. The samples are labeled to include the job number, sample identification, collection date and time, analysis, preservation (if any), and the sample collector's initials. The water samples are placed in a cooler, maintained at 4°C for transport to the laboratory. Once collected in the field, all samples are maintained under chain of custody until delivered to the laboratory.

The chain of custody document includes the job number, type of preservation, if any, analysis requested, sample identification, date and time collected, and the sample collector's name. The chain of custody is signed and dated (including time of transfer) by each person who receives or surrenders the samples, beginning with the field personnel and ending with the laboratory personnel.

A laboratory supplied trip blank accompanies each sampling set. For sampling sets greater than 20 samples, 5% trip blanks are included. The trip blank is analyzed for some or all of the same compounds as the groundwater samples.

As requested by Unocal Corporation, the purge water and decontamination water generated during sampling activities is transported to Tosco - San Francisco Area Refinery, located in Rodeo, California.

WELL MONITORING/SAMPLING
FIELD DATA SHEET

Client/
Facility #2512 — Job#: 280036

Address: 1300 Davis st. — Date: 1-18-00

City: San Leandro — Sampler: Joe

Well ID: Mw-3 — Well Condition: o.k.

Well Diameter: 2 in. — Hydrocarbon Thickness: 0 (feet) — Amount Bailed (product/water): 0 (Gallons)

Total Depth: 32.20 ft.

Depth to Water: 13.05 ft.

Volume Factor (VF)			
2" = 0.17	3" = 0.38	4" = 0.66	
6" = 1.50	12" = 5.80		

19.15 x VF 0.17 = 3.26 x 3 (case volume) = Estimated Purge Volume: 10 (gal.)

Purge Equipment: Disposable Bailer, Bailer, Stack, ~~Suction~~, Grundfos, Other: ______

Sampling Equipment: (Disposable Bailer — circled), Bailer, Pressure Bailer, Grab Sample, Other: ______

Starting Time: 9:17 — Weather Conditions: rain

Sampling Time: 9:37A.m — Water Color: clear — Odor: some

Purging Flow Rate: 1 gpm. — Sediment Description: none

Did well de-water? ______ — If yes; Time: ______ Volume: ______ (gal.)

Time	Volume (gal.)	pH	Conductivity µmhos/cm × 1000	Temperature •F	D.O. (mg/L)	ORP (mV)	Alkalinity (ppm)
9:25	3	7.51	4.92	69.6			
9:27	7	7.33	4.55	69.5			
9:28	10	7.38	4.45	69.3			

LABORATORY INFORMATION

SAMPLE ID	(#) - CONTAINER	REFRIG.	PRESERV. TYPE	LABORATORY	ANALYSES
Mw-3	3VOA	Y	HCl	SEQUOIA	TPH(G)/btex/mtbe
"	2VOA	"	"	"	8010
"	1Amb	"	—	"	TPHD

COMMENTS: ______

WELL MONITORING/SAMPLING FIELD DATA SHEET

Client/ Facility: #2512 Job#: 280036

Address: 1300 Davis st. Date: 1-18-00

City: San Leandro Sampler: Joe

Well ID: MW-7 Well Condition: o.k

Well Diameter: 2 in.

Hydrocarbon Thickness: 0 (feet) Amount Bailed (product/water): 0 (Gallons)

Total Depth: 29.70 ft.

Depth to Water: 12.38 ft.

Volume Factor (VF)	2" = 0.17	3" = 0.38	4" = 0.66	6" = 1.50	12" = 5.80

17.32 x VF 0.17 = 2.94 x 3 (case volume) = Estimated Purge Volume: 9 (gal.)

Purge Equipment: Disposable Bailer, Bailer, Stack, Suction (circled), Grundfos, Other:

Sampling Equipment: Disposable Bailer (circled), Bailer, Pressure Bailer, Grab Sample, Other:

Starting Time: 7:21

Sampling Time: 7:46 A.m

Purging Flow Rate: 1 gpm.

Did well de-water?

Weather Conditions: rain

Water Color: clear Odor: none

Sediment Description: none

If yes; Time: Volume: (gal.)

Time	Volume (gal.)	pH	Conductivity µmhos/cm x10³	Temperature °F	D.O. (mg/L)	ORP (mV)	Alkalinity (ppm)
7:33	3	7.60	8.85	69.3			
7:35	6	7.62	8.78	69.5			
7:36	9	7.52	8.79	69.9			

LABORATORY INFORMATION

SAMPLE ID	(#) - CONTAINER	REFRIG.	PRESERV. TYPE	LABORATORY	ANALYSES
MW-7	3VOA	Y	HCL	SEQUOIA	TPH(G)/btex/mtbe
	2VOA	"	"	"	8010

COMMENTS:

WELL MONITORING/SAMPLING
FIELD DATA SHEET

Client/
Facility #2512 — Job#: 280036

Address: 1300 Davis St. — Date: 1-18-00

City: San Leandro — Sampler: Joo

Well ID: mw-8 — Well Condition: o.k.

Well Diameter: 2 in. — Hydrocarbon Thickness: 0 (feet) — Amount Bailed (product/water): 0 (Gallons)

Total Depth: 29.90 ft.

Depth to Water: 14.67 ft.

Volume Factor (VF)	2" = 0.17	3" = 0.38	4" = 0.66	6" = 1.50	12" = 5.80

15.23 x VF 0.17 = 2.59 x 3 (case volume) = Estimated Purge Volume: 8 (gal.)

Purge Equipment:
- Disposable Bailer
- Bailer
- Stack
- ~~Suction~~
- Grundfos
- Other: ______

Sampling Equipment:
- ~~Disposable Bailer~~
- Bailer
- Pressure Bailer
- Grab Sample
- Other: ______

Starting Time: 8:20 A.m — Weather Conditions: clear

Sampling Time: 8:10 — Water Color: clear — Odor: none

Purging Flow Rate: 1 gpm. — Sediment Description: none

Did well de-water? ______ — If yes; Time: ______ Volume: ______ (gal.)

Time	Volume (gal.)	pH	Conductivity µmhos/cm (K)	Temperature •F	D.O. (mg/L)	ORP (mV)	Alkalinity (ppm)
8:05	3	7.69	10.22	69.8			
8:07	5	7.46	10.25	70.2			
8:08	8	7.47	10.30	69.6			

LABORATORY INFORMATION

SAMPLE ID	(#) - CONTAINER	REFRIG.	PRESERV. TYPE	LABORATORY	ANALYSES
mw-8	3 voA	Y	HCL	SEQUOIA	TPH(G)/btex/mtbe
	2 voA	"	"	"	8010

COMMENTS: ______

WELL MONITORING/SAMPLING
FIELD DATA SHEET

Client/ Facility: #2512 Job#: 280036

Address: 1300 Davis St. Date: 1-18-00

City: San Leandro Sampler: Joe

Well ID: MW-9 Well Condition: o.k.

Well Diameter: 2 in. Hydrocarbon Thickness: 0 (feet) Amount Bailed (product/water): 0 (Gallons)

Total Depth: 30.00 ft.

Depth to Water: 14.25 ft.

Volume Factor (VF)	2" = 0.17	3" = 0.38	4" = 0.66	6" = 1.50	12" = 5.80

15.75 x VF 0.17 = 2.68 x 3 (case volume) = Estimated Purge Volume: 8 (gal.)

Purge Equipment: Disposable Bailer, Bailer, Stack, Suction (circled), Grundfos, Other: ____

Sampling Equipment: Disposable Bailer (circled), Bailer, Pressure Bailer, Grab Sample, Other: ____

Starting Time: 8:30 Weather Conditions: rain

Sampling Time: 8:55 Am Water Color: clear Odor: none

Purging Flow Rate: 1 gpm. Sediment Description: none

Did well de-water? ____ If yes; Time: ____ Volume: ____ (gal.)

Time	Volume (gal.)	pH	Conductivity µmhos/cm x10	Temperature °F	D.O. (mg/L)	ORP (mV)	Alkalinity (ppm)
8:40	2.5	7.27	8.66	70.0			
8:42	5	7.35	9.35	69.2			
8:43	8	7.41	9.38	69.6			

LABORATORY INFORMATION

SAMPLE ID	(#) - CONTAINER	REFRIG.	PRESERV. TYPE	LABORATORY	ANALYSES
MW-9	3 VOA	Y	HCl	SEQUOIA	TPH(G)/btex/mtbe
	2 VOA	"	"	"	8010

COMMENTS: ____

UNOCAL 76

☐ 819 Striker Ave., Suite 8 • Sacramento, CA 95834 • (916) 921-9600
☐ 404 N. Wiget Lane • Walnut Creek, CA 94598 • (510) 988-9600
☐ East 11115 Montgomery, Suite B • Spokane, WA 99206 • (509) 924-9200
☐ 15055 S.W. Sequoia Pkwy, Suite 110 • Portland, OR 97222 • (503) 624-9800

Consultant Company: Gettler-Ryan Inc. L001145	Project Name: Former Unocal SS# 2512
Address: 6747 Sierra Ct. Suite J	UNOCAL Project Manager: Mr. Bob Boust iNB
City: Dublin State: CA Zip Code: 94568	AFE #:
Telephone: (925) 551-7555 FAX #: (925) 551-7899	Site #, City, State: 1300 Davis st. San Leandro
Report To: Deanna Harding Sampler: Joe Ajemian/	QC Data: ☐ Level D (Standard) ☐ Level C ☐ Level B ☐ Level A

Turnaround Time: ☒ 10 Work Days ☐ 5 Work Days ☐ 3 Work Days ☐ 2 Work Days ☐ 1 Work Day ☐ 2-8 Hours

CODE: ☐ Misc. ☐ Detect. ☐ Eval. ☐ Remed. ☐ Demol. ☐ Closure

☐ Drinking Water ☐ Waste Water ☐ Other

Analyses Requested

Client Sample I.D.	Date/Time Sampled	Matrix Desc.	# of Cont.	Cont. Type	Laboratory Sample #	TPHG, BTEX, MTBE	TPHD	TOG	8010					Comments
1. TB-LB	1-18-00	W	1	VOA		✓								Please don't bill
2. MW-3	" 9:37	/	5 VOA 1 Amb	VOA		✓	✓		✓					TB-LB analyses.
3. MW-7	" 7:46	/	5 VOA	"		✓			✓					
4. MW-8	" 8:00	/	"	"		✓			✓					
5. MW-9	" 8:55	/	"	"		✓			✓					
6.														
7.														
8.														
9.														
10.														

Relinquished By: Joe Ajemian	Date: 1-18-00	Time: 1:30	Received By: Nevin Cosa	Date: 1/18/00	Time: 13:30
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By Lab:	Date:	Time:

Were Samples Received in Good Condition? ☐ Yes ☐ No Samples on Ice? ☐ Yes ☐ No Method of Shipment ____ Page 1 of ___

To be completed upon receipt of report:

Were the analyses requested on the Chain of Custody reported? ☐ Yes ☐ No If no, what analyses are still needed? ____

Was the report issued within the requested turnaround time? ☐ Yes ☐ No If no, what was the turnaround time? ____

____ Signature: ____ Company: ____ Date:

Pink - Client Yellow - Laboratory White - Laboratory

Sequoia
Analytical

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FAX (650) 232-9612

RECEIVED

FEB 02 2000

GETTLER-RYAN INC.
GENERAL CONTRACTORS

February 1, 2000

Deanna Harding
Gettler-Ryan/Geostrategies(1)
6747 Sierra Court, Suite D
Dublin, CA 94568

RE: Unocal(1)/L001145

Dear Deanna Harding:

Enclosed are the results of analyses for sample(s) received by the laboratory on January 18, 2000. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Wayne Stevenson
Project Manager

CA ELAP Certificate Number I-2360

Sequoia Analytical

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FAX (650) 232-9612

ettler-Ryan/Geostrategies(1)	Project: Unocal(1)	Sampled: 1/18/00
747 Sierra Court, Suite D	Project Number: Unocal SS# 2512	Received: 1/18/00
ublin, CA 94568	Project Manager: Deanna Harding	Reported: 2/1/00

ANALYTICAL REPORT FOR L001145

ample Description	Laboratory Sample Number	Sample Matrix	Date Sampled
B-LB	L001145-01	Water	1/18/00
1W-3	L001145-02	Water	1/18/00
1W-7	L001145-03	Water	1/18/00
1W-8	L001145-04	Water	1/18/00
1W-9	L001145-05	Water	1/18/00

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Gettler-Ryan/Geostrategies(1) 6747 Sierra Court, Suite D Dublin, CA 94568	Project: Unocal(1) Project Number: Unocal SS# 2512 Project Manager: Deanna Harding	Sampled: 1/18/00 Received: 1/18/00 Reported: 2/1/00

Sample Description: **TB-LB**
Laboratory Sample Number: **L001145-01**

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method/ Surrogate Limits	Reporting Limit	Result	Units	Notes*
				Sequoia Analytical - San Carlos				
Total Purgeable Hydrocarbons (C6-C12), BTEX and MTBE by DHS LUFT								
Purgeable Hydrocarbons as Gasoline	0010116	1/24/00	1/25/00		50.0	ND	ug/l	
Benzene	"	"	"		0.500	ND	"	
Toluene	"	"	"		0.500	ND	"	
Ethylbenzene	"	"	"		0.500	ND	"	
Xylenes (total)	"	"	"		0.500	ND	"	
Methyl tert-butyl ether	"	"	"		5.00	ND	"	
Surrogate: a,a,a-Trifluorotoluene	"	"	"	*70.0-130*		*102*	*%*	

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Gettler-Ryan/Geostrategies(1)	Project: Unocal(1)	Sampled: 1/18/00
6747 Sierra Court, Suite D	Project Number: Unocal SS# 2512	Received: 1/18/00
Dublin, CA 94568	Project Manager: Deanna Harding	Reported: 2/1/00

Sample Description: **MW-3**
Laboratory Sample Number: **L001145-02**

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method/ Surrogate Limits	Reporting Limit	Result	Units	Notes*
				Sequoia Analytical - San Carlos				
Total Purgeable Hydrocarbons (C6-C12), BTEX and MTBE by DHS LUFT								
Purgeable Hydrocarbons as Gasoline	0010126	1/25/00	1/25/00		50.0	ND	ug/l	
Benzene	"	"	"		0.500	ND	"	
Toluene	"	"	"		0.500	ND	"	
Ethylbenzene	"	"	"		0.500	ND	"	
Xylenes (total)	"	"	"		0.500	ND	"	
Methyl tert-butyl ether	"	"	"		5.00	**135**	"	
Surrogate: a,a,a-Trifluorotoluene	"	"	"	*70.0-130*		*78.9*	%	
Volatile Organic Compounds by EPA Method 8010B								
Freon 113	0010103	1/20/00	1/21/00		2.00	ND	ug/l	
Bromodichloromethane	"	"	"		1.00	**3.79**	"	
Bromoform	"	"	"		1.00	ND	"	
Bromomethane	"	"	"		2.00	ND	"	
Carbon tetrachloride	"	"	"		1.00	ND	"	
Chlorobenzene	"	"	"		1.00	ND	"	
Chloroethane	"	"	"		2.00	ND	"	
2-Chloroethylvinyl ether	"	"	"		2.00	ND	"	
Chloroform	"	"	"		1.00	**40.3**	"	
Chloromethane	"	"	"		2.00	ND	"	
Dibromochloromethane	"	"	"		1.00	ND	"	
1,3-Dichlorobenzene	"	"	"		1.00	ND	"	
1,4-Dichlorobenzene	"	"	"		1.00	ND	"	
1,2-Dichlorobenzene	"	"	"		1.00	ND	"	
1,1-Dichloroethane	"	"	"		1.00	ND	"	
1,2-Dichloroethane	"	"	"		1.00	ND	"	
1,1-Dichloroethene	"	"	"		1.00	ND	"	
cis-1,2-Dichloroethene	"	"	"		1.00	ND	"	
trans-1,2-Dichloroethene	"	"	"		1.00	ND	"	
1,2-Dichloropropane	"	"	"		1.00	ND	"	
cis-1,3-Dichloropropene	"	"	"		1.00	ND	"	
trans-1,3-Dichloropropene	"	"	"		1.00	ND	"	
Methylene chloride	"	"	"		10.0	ND	"	
1,1,2,2-Tetrachloroethane	"	"	"		1.00	ND	"	
Tetrachloroethene	"	"	"		1.00	ND	"	
1,1,1-Trichloroethane	"	"	"		1.00	ND	"	
1,1,2-Trichloroethane	"	"	"		1.00	ND	"	
Trichloroethene	"	"	"		1.00	ND	"	
Trichlorofluoromethane	"	"	"		1.00	ND	"	
Vinyl chloride	"	"	"		1.00	ND	"	
Surrogate: 1-Chloro-2-fluorobenzene	"	"	"	*70.0-130*		*114*	%	

***Refer to end of report for text of notes and definitions.**

Sequoia
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Gettler-Ryan/Geostrategies(1) 6747 Sierra Court, Suite D Dublin, CA 94568	Project: Unocal(1) Project Number: Unocal SS# 2512 Project Manager: Deanna Harding	Sampled: 1/18/00 Received: 1/18/00 Reported: 2/1/00

Sample Description: **MW-3**
Laboratory Sample Number: **L001145-02**

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method/ Surrogate Limits	Reporting Limit	Result	Units	Notes*
Diesel Hydrocarbons (C9-C24) by DHS LUFT								
Diesel Range Hydrocarbons	0A26057	1/26/00	1/29/00	DHS LUFT	50.0	ND	ug/l	
Surrogate: n-Pentacosane	"	"	"	*50-150*		*108*	*%*	

**Refer to end of report for text of notes and definitions.*

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ettler-Ryan/Geostrategies(1)	Project: Unocal(1)	Sampled: 1/18/00
747 Sierra Court, Suite D	Project Number: Unocal SS# 2512	Received: 1/18/00
ublin, CA 94568	Project Manager: Deanna Harding	Reported: 2/1/00

ample Description: **MW-7**
aboratory Sample Number: **L001145-03**

nalyte	Batch Number	Date Prepared	Date Analyzed	Specific Method/ Surrogate Limits	Reporting Limit	Result	Units	Notes*
				Sequoia Analytical - San Carlos				
otal Purgeable Hydrocarbons (C6-C12), BTEX and MTBE by DHS LUFT								
urgeable Hydrocarbons as Gasoline	0010126	1/25/00	1/25/00		50.0	ND	ug/l	
enzene	"	"	"		0.500	ND	"	
oluene	"	"	"		0.500	ND	"	
thylbenzene	"	"	"		0.500	ND	"	
ylenes (total)	"	"	"		0.500	ND	"	
Methyl tert-butyl ether	"	"	"		5.00	**6.10**	"	
urrogate: a,a,a-Trifluorotoluene	"	"	"	*70.0-130*		*79.9*	%	
olatile Organic Compounds by EPA Method 8010B								
Freon 113	0010103	1/20/00	1/21/00		2.50	ND	ug/l	
Bromodichloromethane	"	"	"		1.25	**4.78**	"	
Bromoform	"	"	"		1.25	ND	"	
Bromomethane	"	"	"		2.50	ND	"	
Carbon tetrachloride	"	"	"		1.25	ND	"	
Chlorobenzene	"	"	"		1.25	ND	"	
Chloroethane	"	"	"		2.50	ND	"	
2-Chloroethylvinyl ether	"	"	"		2.50	ND	"	
Chloroform	"	"	"		1.25	**52.8**	"	
Chloromethane	"	"	"		2.50	ND	"	
Dibromochloromethane	"	"	"		1.25	ND	"	
1,3-Dichlorobenzene	"	"	"		1.25	ND	"	
1,4-Dichlorobenzene	"	"	"		1.25	ND	"	
1,2-Dichlorobenzene	"	"	"		1.25	ND	"	
1,1-Dichloroethane	"	"	"		1.25	ND	"	
1,2-Dichloroethane	"	"	"		1.25	ND	"	
1,1-Dichloroethene	"	"	"		1.25	ND	"	
cis-1,2-Dichloroethene	"	"	"		1.25	ND	"	
trans-1,2-Dichloroethene	"	"	"		1.25	ND	"	
1,2-Dichloropropane	"	"	"		1.25	ND	"	
cis-1,3-Dichloropropene	"	"	"		1.25	ND	"	
trans-1,3-Dichloropropene	"	"	"		1.25	ND	"	
Methylene chloride	"	"	"		12.5	ND	"	
1,1,2,2-Tetrachloroethane	"	"	"		1.25	ND	"	
Tetrachloroethene	"	"	"		1.25	ND	"	
1,1,1-Trichloroethane	"	"	"		1.25	ND	"	
1,1,2-Trichloroethane	"	"	"		1.25	ND	"	
Trichloroethene	"	"	"		1.25	ND	"	
Trichlorofluoromethane	"	"	"		1.25	ND	"	
Vinyl chloride	"	"	"		1.25	ND	"	
Surrogate: 1-Chloro-2-fluorobenzene	"	"	"	*70.0-130*		*104*	%	

***Refer to end of report for text of notes and definitions.**

Sequoia Analytical

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Gettler-Ryan/Geostrategies(1) 6747 Sierra Court, Suite D Dublin, CA 94568	Project: Unocal(1) Project Number: Unocal SS# 2512 Project Manager: Deanna Harding	Sampled: 1/18/00 Received: 1/18/00 Reported: 2/1/00

Sample Description: **MW-8**
Laboratory Sample Number: **L001145-04**

Analyte	Batch Number	Date Prepared	Date Analyzed	Specific Method/ Surrogate Limits	Reporting Limit	Result	Units	Notes*
				Sequoia Analytical - San Carlos				
Total Purgeable Hydrocarbons (C6-C12), BTEX and MTBE by DHS LUFT								
Purgeable Hydrocarbons as Gasoline	0010116	1/24/00	1/25/00		50.0	ND	ug/l	
Benzene	"	"	"		0.500	ND	"	
Toluene	"	"	"		0.500	ND	"	
Ethylbenzene	"	"	"		0.500	ND	"	
Xylenes (total)	"	"	"		0.500	ND	"	
Methyl tert-butyl ether	"	"	"		5.00	ND	"	
Surrogate: a,a,a-Trifluorotoluene	"	"	"	*70.0-130*		*98.9*	*%*	
Volatile Organic Compounds by EPA Method 8010B								
Freon 113	0010103	1/21/00	1/21/00		2.50	ND	ug/l	
Bromodichloromethane	"	"	"		1.25	ND	"	
Bromoform	"	"	"		1.25	ND	"	
Bromomethane	"	"	"		2.50	ND	"	
Carbon tetrachloride	"	"	"		1.25	ND	"	
Chlorobenzene	"	"	"		1.25	ND	"	
Chloroethane	"	"	"		2.50	ND	"	
2-Chloroethylvinyl ether	"	"	"		2.50	ND	"	
Chloroform	"	"	"		1.25	**52.9**	"	
Chloromethane	"	"	"		2.50	ND	"	
Dibromochloromethane	"	"	"		1.25	ND	"	
1,3-Dichlorobenzene	"	"	"		1.25	ND	"	
1,4-Dichlorobenzene	"	"	"		1.25	ND	"	
1,2-Dichlorobenzene	"	"	"		1.25	ND	"	
1,1-Dichloroethane	"	"	"		1.25	ND	"	
1,2-Dichloroethane	"	"	"		1.25	ND	"	
1,1-Dichloroethene	"	"	"		1.25	ND	"	
cis-1,2-Dichloroethene	"	"	"		1.25	ND	"	
trans-1,2-Dichloroethene	"	"	"		1.25	ND	"	
1,2-Dichloropropane	"	"	"		1.25	ND	"	
cis-1,3-Dichloropropene	"	"	"		1.25	ND	"	
trans-1,3-Dichloropropene	"	"	"		1.25	ND	"	
Methylene chloride	"	"	"		12.5	ND	"	
1,1,2,2-Tetrachloroethane	"	"	"		1.25	ND	"	
Tetrachloroethene	"	"	"		1.25	ND	"	
1,1,1-Trichloroethane	"	"	"		1.25	ND	"	
1,1,2-Trichloroethane	"	"	"		1.25	ND	"	
Trichloroethene	"	"	"		1.25	ND	"	
Trichlorofluoromethane	"	"	"		1.25	ND	"	
Vinyl chloride	"	"	"		1.25	ND	"	
Surrogate: 1-Chloro-2-fluorobenzene	"	"	"	*70.0-130*		*119*	*%*	

**Refer to end of report for text of notes and definitions.*

Sequoia Analytical

1551 Industrial Road
San Carlos, CA 94070-4111
(650) 232-9600
FAX (650) 232-9612

ettler-Ryan/Geostrategies(1)	Project: Unocal(1)	Sampled: 1/18/00
747 Sierra Court, Suite D	Project Number: Unocal SS# 2512	Received: 1/18/00
ublin, CA 94568	Project Manager: Deanna Harding	Reported: 2/1/00

ample Description: **MW-9**
aboratory Sample Number: **L001145-05**

nalyte	Batch Number	Date Prepared	Date Analyzed	Specific Method/ Surrogate Limits	Reporting Limit	Result	Units	Notes*
				Sequoia Analytical - San Carlos				
otal Purgeable Hydrocarbons (C6-C12), BTEX and MTBE by DHS LUFT								
urgeable Hydrocarbons as Gasoline	0010116	1/24/00	1/25/00		50.0	ND	ug/l	
enzene	"	"	"		0.500	ND	"	
oluene	"	"	"		0.500	ND	"	
thylbenzene	"	"	"		0.500	ND	"	
ylenes (total)	"	"	"		0.500	ND	"	
lethyl tert-butyl ether	"	"	"		5.00	ND	"	
urrogate: a,a,a-Trifluorotoluene	*"*	*"*	*"*	*70.0-130*		*98.4*	*%*	
olatile Organic Compounds by EPA Method 8010B								
reon 113	0010103	1/21/00	1/21/00		2.00	ND	ug/l	
romodichloromethane	"	"	"		1.00	ND	"	
romoform	"	"	"		1.00	ND	"	
romomethane	"	"	"		2.00	ND	"	
arbon tetrachloride	"	"	"		1.00	ND	"	
hlorobenzene	"	"	"		1.00	ND	"	
hloroethane	"	"	"		2.00	ND	"	
-Chloroethylvinyl ether	"	"	"		2.00	ND	"	
hloroform	"	"	"		1.00	**51.9**	"	
hloromethane	"	"	"		2.00	ND	"	
Dibromochloromethane	"	"	"		1.00	ND	"	
1,3-Dichlorobenzene	"	"	"		1.00	ND	"	
1,4-Dichlorobenzene	"	"	"		1.00	ND	"	
1,2-Dichlorobenzene	"	"	"		1.00	ND	"	
1,1-Dichloroethane	"	"	"		1.00	ND	"	
1,2-Dichloroethane	"	"	"		1.00	ND	"	
1,1-Dichloroethene	"	"	"		1.00	ND	"	
cis-1,2-Dichloroethene	"	"	"		1.00	ND	"	
trans-1,2-Dichloroethene	"	"	"		1.00	ND	"	
1,2-Dichloropropane	"	"	"		1.00	ND	"	
cis-1,3-Dichloropropene	"	"	"		1.00	ND	"	
trans-1,3-Dichloropropene	"	"	"		1.00	ND	"	
Methylene chloride	"	"	"		10.0	ND	"	
1,1,2,2-Tetrachloroethane	"	"	"		1.00	ND	"	
Tetrachloroethene	"	"	"		1.00	ND	"	
1,1,1-Trichloroethane	"	"	"		1.00	ND	"	
1,1,2-Trichloroethane	"	"	"		1.00	ND	"	
Trichloroethene	"	"	"		1.00	ND	"	
Trichlorofluoromethane	"	"	"		1.00	ND	"	
Vinyl chloride	"	"	"		1.00	ND	"	
Surrogate: 1-Chloro-2-fluorobenzene	*"*	*"*	*"*	*70.0-130*		*109*	*%*	

**Refer to end of report for text of notes and definitions.*

GETTLER-RYAN INC.

Original

June 5, 2001
G-R Job #280036

Mr. Nick Nickerson
Unocal - DBG/AMG
8788 Elk Grove Boulevard
Building 3, Suite 15
Elk Grove, California 95624

RE: Groundwater Monitoring & Sampling - Special Event of May 31, 2001
Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

Dear Mr. Nickerson:

This letter report documents the groundwater monitoring and sampling event performed by Gettler-Ryan Inc. (G-R), pursuant to a letter request dated May 22, 2001, from Alameda County Health Care Services. On May 31, 2001, field personnel monitored and sampled one well (MW-DC) which is located next to the above referenced site. A Depth to Water/Concentration Map is included as Figure 1.

A static groundwater level was measured and the well was checked for the presence of separate-phase hydrocarbons. Separate-phase hydrocarbons were not present in the well. Static water level data and field sampling parameters are presented in the attached Field Data Sheet.

A groundwater sample was collected from the monitoring well as specified by G-R Standard Operating Procedure - Groundwater Sampling (attached). The sample was analyzed by Sequoia Analytical. The chain of custody document and laboratory analytical reports are also attached.

Sincerely,

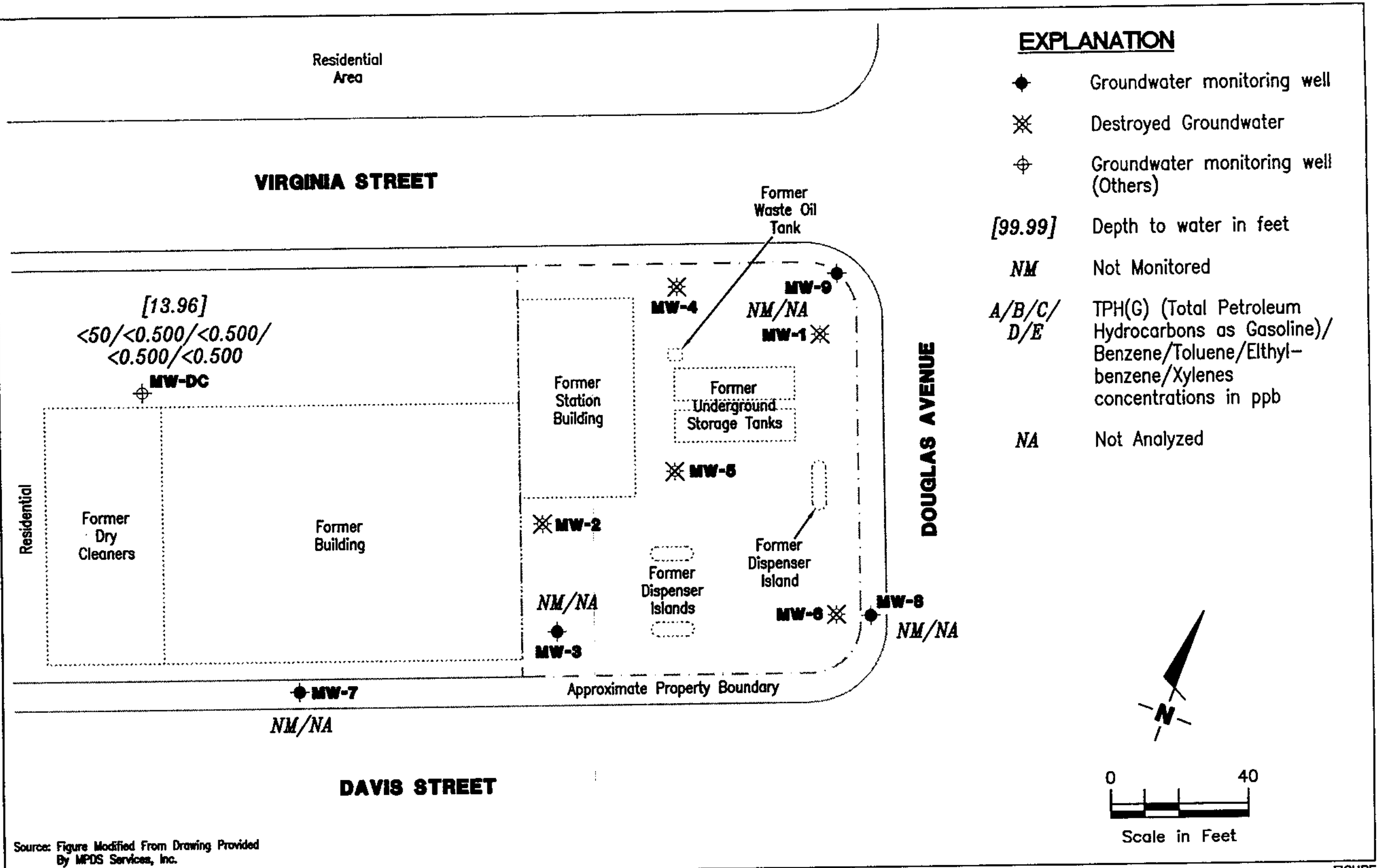
Deanna L. Harding
Project Coordinator

Figure 1: Depth to Water/Concentration Map
Attachments: Standard Operating Procedure - Groundwater Sampling
Field Data Sheet
Chain of Custody Document and Laboratory Analytical Reports

cc: Mr. Amir K. Gholami, Alameda County Health Care Services, 1131 Harbor Bay Parkway, Alameda, CA 94502
Mr. Mike Bakaldin, City of San Leandro, Environmental Services Division, 835 East 14th Street, San Leandro, CA 94577
Mr. Chuck Headlee, SF-RWQCB, 1515 Clay Street, Suite 1400, Oakland, CA 94612
Ms. Leah S. Goldberg, Hanson Bridgett, 333 Market Street, Suite 2300, San Francisco, CA 94105-2173
Mr. Stephen J. Carter, Gettler-Ryan, Inc., 3140 Gold Camp Drive, Suite 170, Rancho Cordova , CA 95670

2512.qml

6747 Sierra Court, Suite J • Dublin, California 94568 • (925) 551-7555



Gettler - Ryan Inc.

6747 Sierra Ct., Suite J (925) 551-7555
Dublin, CA 94568

DEPTH TO WATER/CONCENTRATION MAP
Former Unocal Service Station #2512
1300 Davis Street
San Leandro, California

FIGURE
1

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
280036		May 31, 2001	

STANDARD OPERATING PROCEDURE - GROUNDWATER SAMPLING

Gettler-Ryan Inc. field personnel adhere to the following procedures for the collection and handling of groundwater samples prior to analysis by the analytical laboratory. Prior to sample collection, the type of analysis to be performed is determined. Loss prevention of volatile compounds is controlled and sample preservation for subsequent analysis is maintained.

Prior to sampling, the presence or absence of free-phase hydrocarbons is determined using an interface probe. Product thickness, if present, is measured to the nearest 0.01 foot and is noted in the field notes. In addition, static water level measurements are collected with the interface probe and are also recorded in the field notes.

After water levels are collected and prior to sampling, each well is purged a minimum of three well casing volumes of water using pre-cleaned pumps (stack, suction, Grundfos), or polyvinyl chloride bailers. Temperature, pH and electrical conductivity are measured a minimum of three times during the purging. Purging continues until these parameters stabilize.

Groundwater samples are collected using disposable bailers. The water samples are transferred from the bailer into appropriate containers. Pre-preserved containers, supplied by analytical laboratories, are used when possible. When pre-preserved containers are not available, the laboratory is instructed to preserve the sample as appropriate. Duplicate samples are collected for the laboratory to use in maintaining quality assurance/quality control standards. The samples are labeled to include the job number, sample identification, collection date and time, analysis, preservation (if any), and the sample collector's initials. The water samples are placed in a cooler, maintained at 4°C for transport to the laboratory. Once collected in the field, all samples are maintained under chain of custody until delivered to the laboratory.

The chain of custody document includes the job number, type of preservation, if any, analysis requested, sample identification, date and time collected, and the sample collector's name. The chain of custody is signed and dated (including time of transfer) by each person who receives or surrenders the samples, beginning with the field personnel and ending with the laboratory personnel.

A laboratory supplied trip blank accompanies each sampling set. For sampling sets greater than 20 samples, 5% trip blanks are included. The trip blank is analyzed for some or all of the same compounds as the groundwater samples.

As requested by Unocal Corporation, the purge water and decontamination water generated during sampling activities is transported to Tosco - San Francisco Area Refinery, located in Rodeo, California.

WELL MONITORING/SAMPLING
FIELD DATA SHEET

Client/ Facility #: 2512 | Job#: 280036
Address: 1300 Davis st. | Date: 5-31-01
City: San Leandro | Sampler: Joe

Well ID: MW-DC | Well Condition: Damaged. See notes below

Well Diameter: 8 in. | Hydrocarbon Thickness: 0 in. | Amount Bailed (product/water): 0 (gal.)

Total Depth: 24.50 ft.

Depth to Water: 13.96 ft.

Volume Factor (VF)	2" = 0.17	3" = 0.38	4" = 0.66	6" = 1.50	12" = 5.80

10.54 x VF 2.60 = 27.4 x 3 (case volume) = Estimated Purge Volume: 82 (gal.)

Purge Equipment: Disposable Bailer, Bailer, Stack, ~~Suction~~ (circled), Grundfos, Other: ____

Sampling Equipment: ~~Disposable Bailer~~, Bailer, Pressure Bailer, Grab Sample, Other: ____

Starting Time: 1:15
Sampling Time: 1:55P.m (1:55)
Purging Flow Rate: 3 gpm
Did well de-water? ____

Weather Conditions: Hot
Water Color: clear | Odor: none
Sediment Description: ____
If yes; Time: ____ Volume: ____ (gal.)

Time	Volume (gal.)	pH	Conductivity µmhos/cm x 10²	Temperature °F	D.O. (mg/L)	ORP (mV)	Alkalinity (ppm)
1:32	27	6.98	3.81	70.2			
1:37	56	7.10	3.82	70.1			
1:45	82	7.12	4.01	70.3			

LABORATORY INFORMATION

SAMPLE ID	(#) - CONTAINER	REFRIG.	PRESERV. TYPE	LABORATORY	ANALYSES
MW-DC	3 VOA	Y	HCL	Seq.	TPHG, BTEX, ~~MTBE~~

COMMENTS: Well box is damaged; Cover is loose; collar is shattered; casing rim (metal) is corroded & bent. Over-all well is exposed to the elements and not secured.

UNOCAL 76

❑ 680 Chesapeake Drive • Redwood City, CA 94063 • (415) 364-9600
❑ 819 Striker Ave., Suite 8 • Sacramento, CA 95834 • (916) 921-9600
❑ 404 N. Wiget Lane • Walnut Creek, CA 94598 • (510) 988-9600
❑ 18939 120th Ave., N.E., Suite 101 • Bothell, WA 98011 • (206) 481-9200
❑ East 11115 Montgomery, Suite B • Spokane, WA 99206 • (509) 924-9200
❑ 15055 S.W. Sequoia Pkwy, Suite 110 • Portland, OR 97222 • (503) 624-9800

Consultant Company: Gettler-Ryan Inc.
Address: 6747 Sierra Ct. Suite J
City: Dublin State: CA Zip Code: 94568
Telephone: (925) 551-7555 FAX #: (925) 551-7899
Report To: Deanne Harding Sampler: Joe Ajemian

Project Name: Former Unocal #2512
UNOCAL Project Manager: M. B. Boust
AFE #:
Site #, City, State: 1300 Davis st. San Leandro
QC Data: ❑ Level D (Standard) ❑ Level C ❑ Level B ❑ Level A

Turnaround Time: ☒ 10 Work Days ❑ 5 Work Days ❑ 3 Work Days ❑ 2 Work Days ☒ 1 Work Day ❑ 2-8 Hours

CODE: ❑ Misc. ❑ Detect. ❑ Eval. ❑ Remed. ❑ Demol. ❑ Closure

❑ Drinking Water
❑ Waste Water
❑ Other

Analyses Requested

	Client Sample I.D.	Date/Time Sampled	Matrix Desc.	# of Cont.	Cont. Type	Laboratory Sample #	TPHG, BTEX,	TPHD	TOG							Comments
1.	TB-LB	5-31-01	W	1	voA		✓									Please don't bill TB-LB analyses.
2.	MW-DC	" 13:55	"	3	voA		✓									
3.																24 hr. TAT
4.																
5.																
6.																
7.																
8.																
9.																
10.																

Relinquished By: [signature]	Date: 5-31-01	Time: 16:00	Received By: K. [signature]	Date: 5/31/01	Time: 1600
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By Lab:	Date:	Time:

Were Samples Received in Good Condition? ❑ Yes ❑ No Samples on Ice? ❑ Yes ❑ No Method of Shipment______ Page __ of __

To be completed upon receipt of report:
1) Were the analyses requested on the Chain of Custody reported? ❑ Yes ❑ No If no, what analyses are still needed? ______
2) Was the report issued within the requested turnaround time? ❑ Yes ❑ No If no, what was the turnaround time? ______
Approved by: ______ Signature: ______ Company: ______ Date: ______

Pink - Client
Yellow - Laboratory
White - Laboratory

Sequoia Analytical

1551 Industrial Road
San Carlos, CA 94070-4111
(650) 232-9600
FAX (650) 232-9612
www.sequoialabs.com

June 01 , 2001

Deanna Harding
Gettler-Ryan/Geostrategies(1)
6747 Sierra Court, Suite J
Dublin, CA 94568
RE: Unocal(1) / L105220

Enclosed are the results of analyses for samples received by the laboratory on 05/31/01. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Latonya K. Pelt

Latonya Pelt
Project Manager

CA ELAP Certificate Number 2360

Gettler-Ryan/Geostrategies(1) 6747 Sierra Court, Suite J Dublin CA, 94568	Project: Unocal(1) Project Number: Former Unocal #2512, San Leandro Project Manager: Deanna Harding	**Reported:** 06/01/01 13:18

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
TB-LB	L105220-01	Water	05/31/01 00:00	05/31/01 16:00
MW-DC	L105220-02	Water	05/31/01 13:55	05/31/01 16:00

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Gettler-Ryan/Geostrategies(1) 6747 Sierra Court, Suite J Dublin CA, 94568	Project: Unocal(1) Project Number: Former Unocal #2512, San Leandro Project Manager: Deanna Harding	**Reported:** 06/01/01 13:18

Total Purgeable Hydrocarbons (C6-C12) and BTEX by DHS LUFT

Sequoia Analytical - San Carlos

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
TB-LB (L105220-01) Water Sampled: 05/31/01 00:00 Received: 05/31/01 16:00									
Purgeable Hydrocarbons as Gasoline	ND	50.0	ug/l	1	1060002	06/01/01	06/01/01	DHS LUFT	
Benzene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
Xylenes (total)	ND	0.500	"	"	"	"	"	"	
Surrogate: a,a,a-Trifluorotoluene		*91.4 %*	*60-140*		"	"	"	"	
MW-DC (L105220-02) Water Sampled: 05/31/01 13:55 Received: 05/31/01 16:00									
Purgeable Hydrocarbons as Gasoline	ND	50.0	ug/l	1	1060002	06/01/01	06/01/01	DHS LUFT	
Benzene	ND	0.500	"	"	"	"	"	"	
Toluene	ND	0.500	"	"	"	"	"	"	
Ethylbenzene	ND	0.500	"	"	"	"	"	"	
Xylenes (total)	ND	0.500	"	"	"	"	"	"	
Surrogate: a,a,a-Trifluorotoluene		*93.5 %*	*60-140*		"	"	"	"	

Gettler-Ryan/Geostrategies(1) 6747 Sierra Court, Suite J Dublin CA, 94568	Project: Unocal(1) Project Number: Former Unocal #2512, San Leandro Project Manager: Deanna Harding	Reported: 06/01/01 13:18

Total Purgeable Hydrocarbons (C6-C12) and BTEX by DHS LUFT - Quality Control

Sequoia Analytical - San Carlos

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1060002 - EPA 5030B (P/T)										
Blank (1060002-BLK1)				Prepared & Analyzed: 06/01/01						
Purgeable Hydrocarbons as Gasoline	ND	50.0	ug/l							
Benzene	ND	0.500	"							
Toluene	ND	0.500	"							
Ethylbenzene	ND	0.500	"							
Xylenes (total)	ND	0.500	"							
Surrogate: a,a,a-Trifluorotoluene	*8.67*		*"*	*10.0*		*86.7*	*60-140*			
LCS (1060002-BS1)				Prepared & Analyzed: 06/01/01						
Benzene	7.73	0.500	ug/l	10.0		77.3	70-130			
Toluene	7.72	0.500	"	10.0		77.2	70-130			
Ethylbenzene	7.70	0.500	"	10.0		77.0	70-130			
Xylenes (total)	23.4	0.500	"	30.0		78.0	70-130			
Surrogate: a,a,a-Trifluorotoluene	*9.24*		*"*	*10.0*		*92.4*	*60-140*			
LCS (1060002-BS2)				Prepared & Analyzed: 06/01/01						
Purgeable Hydrocarbons as Gasoline	251	50.0	ug/l	250		100	70-130			
Surrogate: a,a,a-Trifluorotoluene	*9.13*		*"*	*10.0*		*91.3*	*60-140*			

Gettler-Ryan/Geostrategies(1) 6747 Sierra Court, Suite J Dublin CA, 94568	Project: Unocal(1) Project Number: Former Unocal #2512, San Leandro Project Manager: Deanna Harding	Reported: 06/01/01 13:18

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference