PACIFIC
ENVIRONMENTAL
GROUP, INC.

March 13, 1992
Project 330-06.13

Ms. Pamela Evans
Alameda County Health Care Services
Department of Environmental Health
Hazardous Materials Program
80 Swan Way, Room 200
Oakland, California 94621

Re: ARCO Service Station 0608
17601 Hesperian Boulevard at Hacienda Avenue
San Lorenzo, California

Dear Ms. Evans:

This letter presents the preliminary results of groundwater sampling of off-site domestic irrigation wells performed by Pacific Environmental Group, Inc. (PACIFIC), on behalf of ARCO Products Company (ARCO).

Fourteen domestic wells were identified by PACIFIC and ARCO in the vicinity of the above referenced site. Four of the wells were not able to be sampled due to inoperable pumps. The remaining 10 wells were sampled with the results presented herein for total petroleum hydrocarbons calculated as gasoline (TPH-g), and benzene, toluene, ethylbenzene, and xylenes (BTEX compounds). The owners of the inoperable wells located at 633, 634, and 675 Hacienda, and 17348 Via Encinas will be approached with the proposal that ARCO remove the inoperable pump equipment so a groundwater sample can be obtained for laboratory analysis. The well locations are shown on Figure 1, and certified analytical results and chain-of-custody documentation are presented in Attachment A.

Presented in Attachment B are three draft letters to the homeowners documenting the results of the sampling event. These letters will be sent to the homeowners 30 days after the date of this letter. Please direct any comments you may have regarding these letters to Mr. Chuck Carmel of ARCO Products Company prior to that date. These letters document the following scenarios: (1) the detection of

1601 Civic Center Drive, Suite 202, Santa Clara, California 95050 (408) 984-6536 FAX: (408) 243-3911
620 Contra Costa Boulevard, Suite 209, Pleasant Hill, California 94523 (510) 825-0855 FAX: (510) 825-0882

benzene in the water sample and the notification to the homeowner of the findings, (2) the inability to sample the well due to an inoperable pump, and the desire to sample the well after gaining necessary homeowner approval, and (3) groundwater samples with non-detectable dissolved concentrations of gasoline and/or benzene. Well conditions and results at each location are described below.

17349 Via Magdalena (M. E. Kast)

Mr. Kast was contacted by Debra Moser of PACIFIC and Chuck Carmel of ARCO on September 27, 1991. The well has a pump in it and is active. It is ARCO's understanding that the well is used for irrigation only. A sample was collected from the tap at the well head. The water had a sour odor.

The analysis indicated TPH-g at 780 micrograms per liter (ug/L), benzene at 13 ug/L, and non-detectable concentrations of toluene, ethylbenzene, and xylenes.

17372 Via Magdalena (Joseph Pimental)

Mr. Pimental was contacted by Debra Moser of PACIFIC and Chuck Carmel of ARCO on September 27, 1991. The well has a pump in it and is active. It is ARCO's understanding that the well is used for irrigation only. A sample was collected from the tap at the well head. The water had a sour odor.

The analysis indicated TPH-g at 300 micrograms per liter (ug/L), benzene at 5.5 ug/L, non-detectable concentrations of toluene, ethylbenzene at 1.3 ug/L, and xylenes at 0.72 ug/L.

17302 Via Magdalena (Terry Johansen)

Mr. Johansen was contacted by Debra Moser of PACIFIC on October 21, 1991. The well has a pump in it and is active. It is ARCO's understanding that the well is used for irrigation only. A sample was collected from the tap at the well head. The water had a sour odor. The well owner complained that the gaskets and fixtures in contact with the groundwater wear out quickly.

The analysis indicated TPH-g at 72 ug/L, benzene at 0.64 ug/L, non-detectable concentrations of toluene, ethylbenzene at 0.44 ug/L, and non-detectable concentrations of xylenes.

590 Hacienda (Mr. and Mrs. Silva)

Mrs. Silva was contacted by Debra Moser of PACIFIC on November 13, 1991. The well has a pump in it and is active. It is ARCO's understanding that the well is

used for irrigation only. A sample was collected from the tap at the well head. The water had no odor.

The analysis indicated non-detectable concentrations of TPH-g and BTEX compounds.

633 Hacienda (Mr. Dahmann)

Mr. Dahmann was contacted by Debra Moser of PACIFIC on November 13, 1991. The well owner reported that the well is approximately 30 feet deep, and was installed approximately 15 years ago. The well was not used after neighbors had experienced problems with gasoline in their wells, several years ago. Two years later, the well was found to be silted, and so has not been used since. The riser pipe for the pump and the well plate obstructed access to the well, and so the well was not sampled.

634 Hacienda (Mrs. Albright)

Mrs. Albright was not home when Debra Moser of PACIFIC arrived. Based on a prior arrangement, Ms. Moser went to the backyard of the residence to sample the well. The well is connected to a pump, but it is not active. The riser pipes for the pump obstructed access to the well. Therefore, the well was not sampled.

642 Hacienda (Mr. and Mrs. Corregedor)

Mrs. Corregedor was contacted by Debra Moser of PACIFIC on November 13, 1991. The well has a pump in it and is active. It is ARCO's understanding that the well is used for irrigation only. A sample was collected from the tap at the well head. The water had no odor.

The analysis indicated non-detectable concentrations of TPH-g and BTEX compounds.

675 Hacienda (Mr. and Mrs. Roberts)

Mr. Roberts was contacted by Ed Buskirk of PACIFIC on November 22, 1991. The well has a pump but is inactive. Mr. Roberts has not operated the well during his residence at this location. The well was sealed at the well head and was inaccessible so no sample was taken.

17197 Via Magdalena (Mr. Schrag)

Mr. Schrag was contacted by Debra Moser of PACIFIC on November 13, 1991. The well has a pump in it and is active. It is ARCO's understanding that the well is used for irrigation only. A sample was collected from the tap at the well head. The water had no odor.

The analysis indicated non-detectable concentrations of TPH-g and BTEX compounds.

17200 Via Magdalena (Calvary Church and School)

Mr. Dave Muler was contacted by Debra Moser on November 13, 1991. The well is located in a shed approximately 20 feet from Well MW-17, and has no pump in it. It is not active. The well cover was removed and a sample was bailed from the well. The water had a slight sour odor.

The analysis indicated TPH-g at 440 ug/L, benzene at 2.7 ug/L, non-detectable concentrations of toluene, ethylbenzene, and xylenes at 12 ug/L. The chromatographic pattern resembles gasoline.

17203 Via Magdalena (Mrs. Toole)

Mrs. Toole was contacted by Debra Moser of PACIFIC on November 13, 1991. The well has a pump in it and is active. It is ARCO's understanding that the well is used for irrigation only. A sample was collected from the tap at the well head. The water had no odor.

The analysis indicated non-detectable concentrations of TPH-g and BTEX compounds.

17348 Via Encinas (Gary Luehrs)

Mr. Luehrs was contacted by Ed Buskirk of PACIFIC on November 22, 1991. The well has a pump but is inactive. The well was blocked by an obstruction at approximately 12 feet below ground surface so no sample was taken.

17371 Via Magdalena (Mr. Manry)

Mr. Manry was contacted by Debra Moser of PACIFIC on November 13, 1991. The well has a pump in it and is active. It is ARCO's understanding that the well is used for irrigation only. A sample was collected from the tap at the well head. The water had a slight sour odor.

The analysis indicated TPH-g at 870 ug/L, benzene at 9.0 ug/L, toluene at 1.0 ug/L, ethylbenzene at 2.1 ug/L, and xylenes at 4.5 ug/L. The chromatographic pattern resembles gasoline.

17393 Via Magdalena (Mr. Hull)

Mr. Hull was contacted by Debra Moser of PACIFIC on November 13, 1991. The well has riser pipe in it for a pump, but the pump has been disconnected and removed. The well has been out of service for at least 7 years. The riser pipe was removed from the well in order to bail a sample; the riser pipe was then replaced into the well. The water had a slight sour odor.

The analysis indicated TPH-g at 31 ug/L, and non-detectable concentrations of BTEX compounds. The laboratory noted that the hydrocarbons detected are heavier than gasoline, or may be old gasoline.

It is ARCO's and PACIFIC's understanding that the wells described above are all used only for irrigation purposes. Based on the levels of benzene detected in groundwater from the individual wells and the conservative assumption that 1 liter of the groundwater from the respective wells is consumed on a daily basis for 35 years, the risk calculated using values for benzene from the California Department of Health Services Title 22 and Environmental Protection Agency (EPA) guidelines (EPA, *Risk Assessment Guidance for Superfund, Volume 1.*, December 1989) is minimal and within acceptable ranges in accordance with the California Safe Drinking Water and Toxic Enforcement Act of 1986. A letter documenting the "Groundwater Analytical Results and Risk Assessment Calculations" is presented in Attachment C.

Even though the risk to the residents posed by the groundwater is minimal, these wells should not be used for any other purpose other than irrigation. The enclosed letters include this recommendation to the residents and also recommend that until your department advises to the contrary, the residents should avoid ingesting this water. Additionally, the letter states that in the event of any changes in the characteristics of the water (color, odor, clarity, etc.), the wells exhibiting the changes will be resampled at ARCO's expense.

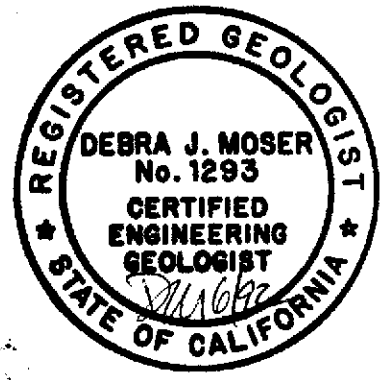
ARCO plans to sample all the domestic irrigation wells on a quarterly basis through 1992, semi-annually during 1993, and annually starting in 1994.

We will continue to keep you informed of activities regarding these wells. If you have any questions, please call.

Sincerely,

Pacific Environmental Group, Inc.

Debra Moser
Senior Geologist
CEG 1293



Attachments: Table 1 - Groundwater Analytical Results
Figure 1 - Domestic Well Dissolved Gasoline/Benzene Concentration Map
Attachment A - Certified Analytical Results and Chain-of-Custody Documentation
Attachment B - Draft Homeowner Letters
Attachment C - Groundwater Analytical Results and Risk Assessment Calculations, February 4, 1992

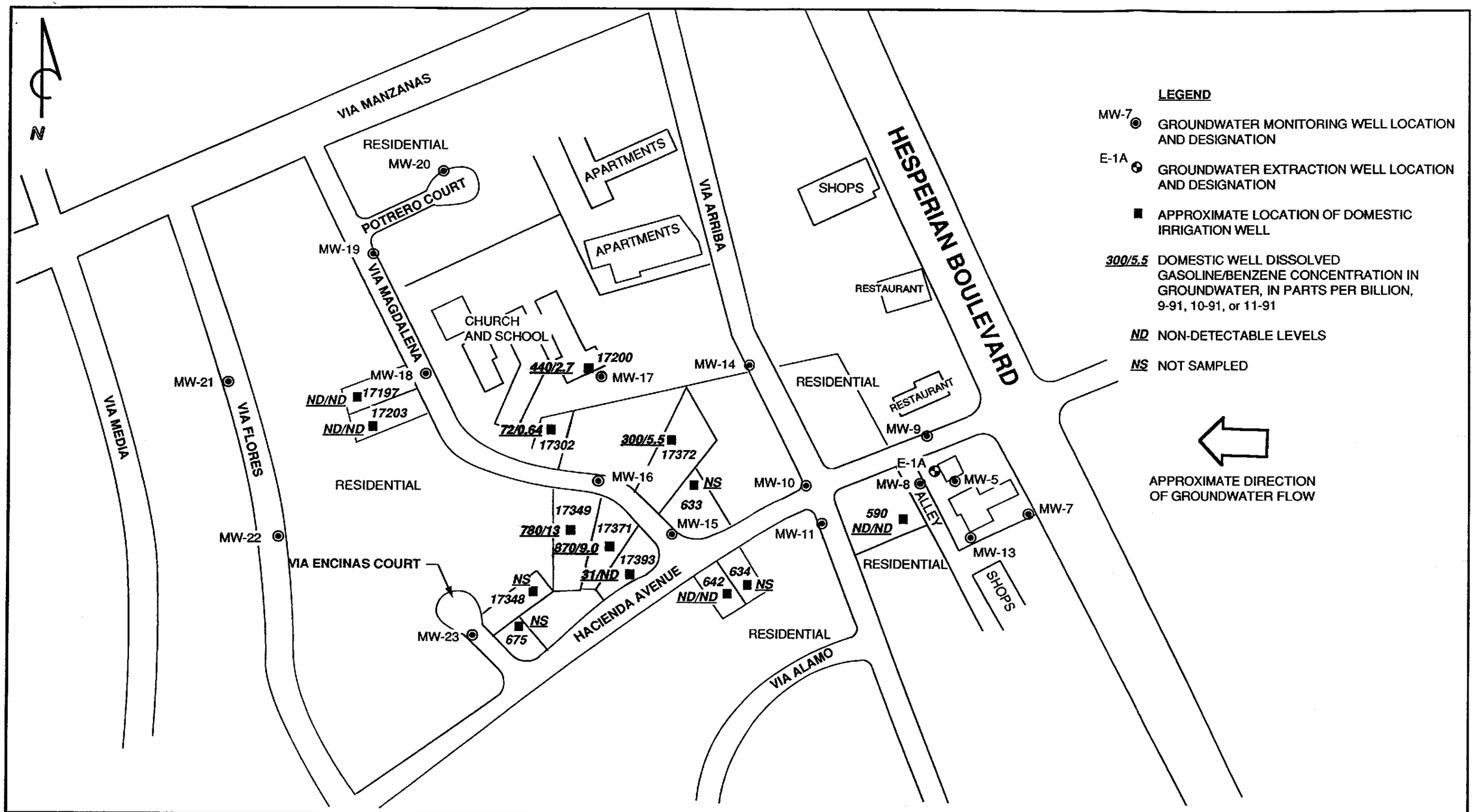
cc: Mr. Chuck Carmel, ARCO Products Company
Mr. Chris Winsor, ARCO Products Company
Mr. Charles Lapin, ARCO Products Company
Mr. John Meck, ARCO Products Company

Table 1
Groundwater Analytical Results

ARCO Service Station 0608
17601 Hesperian Boulevard at Hacienda Avenue
San Lorenzo, California

Well Address	Sample Date	Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Ethylbenzene (ppb)	Xylenes (ppb)
17349 VM	9/27/91	780	13	ND	ND	ND
17372 VM	9/27/91	300	5.5	ND	1.3	0.72
17302 VM	10/21/91	72	0.64	ND	0.44	ND
590 H	11/13/91	ND	ND	ND	ND	ND
633 H	NS					
634 H	NS					
642 H	11/13/91	ND	ND	ND	ND	ND
675 H	NS					
17197 VM	11/13/91	ND	ND	ND	ND	ND
17200 VM	11/13/91	440	2.7	ND	ND	12
17203 VM	11/13/91	ND	ND	ND	ND	ND
17348 VM	NS					
17371 VM	11/13/91	870	9.0	1.0	2.1	4.5
17393 VM	11/13/91	31	ND	ND	ND	ND

ppb = Parts per billion
ND = Not detected
NS = Not sampled



PACIFIC ENVIRONMENTAL GROUP, INC.

APPROXIMATE SCALE
0 150 300 FEET

ARCO SERVICE STATION #0608
17601 Hesperian Boulevard at Hacienda Avenue
San Lorenzo, California

DOMESTIC WELL DISSOLVED GASOLINE/BENZENE CONCENTRATION MAP

FIGURE: 1
PROJECT: 330-06.13

03/13/92

ATTACHMENT A

CERTIFIED ANALYTICAL RESULTS AND CHAIN-OF-CUSTODY DOCUMENTATION

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Pacific Environmental Group	Client Project ID:	#330-06.13, Arco 608, San Lorenzo	Sampled:	Sep 27, 1991
1601 Civic Center Drive, Suite 202	Sample Descript.:	Water, 17372	Received:	Sep 27, 1991
Santa Clara, CA 95050	Analysis Method:	EPA 5030/ 8015/8020	Analyzed:	Sep 30, 1991
Attention: Deb Moser	Lab Number:	109-4798	Reported:	Oct 2, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS WITH BTEX DISTINCTION (EPA 8015/8020)

Analyte	Detection Limit µg/L (ppb)	Sample Results µg/L (ppb)
Low to Medium Boiling Point Hydrocarbons	60	300
Benzene	0.60	5.5
Toluene	0.60	N.D.
Ethyl Benzene	0.60	1.3
Xylenes	0.60	0.72

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection. Because matrix effects and/or other factors required additional sample dilution, detection limits for this sample have been raised.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Pacific Environmental Group	Client Project ID:	#330-06.13, Arco 608, San Lorenzo	Sampled:	Sep 27, 1991
1601 Civic Center Drive, Suite 202	Sample Descript.:	Water, 17349	Received:	Sep 27, 1991
Santa Clara, CA 95050	Analysis Method:	EPA 5030/ 8015/8020	Analyzed:	Sep 30, 1991
Attention: Deb Moser	Lab Number:	109-4799	Reported:	Oct 2, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS WITH BTEX DISTINCTION (EPA 8015/8020)

Analyte	Detection Limit µg/L (ppb)	Sample Results µg/L (ppb)
Low to Medium Boiling Point Hydrocarbons	300	780
Benzene	3.0	13
Toluene	3.0	N.D.
Ethyl Benzene	3.0	N.D.
Xylenes	3.0	N.D.

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection. Because matrix effects and/or other factors required additional sample dilution, detection limits for this sample have been raised.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Pacific Environmental Group
1601 Civic Center Drive, Suite 202
Santa Clara, CA 95050
Attention: Deb Moser

Client Project ID: #330-06.13, Arco 608, San Lorenzo

QC Sample Group: 1094798-99

Reported: Oct 2, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	K. Gill	K. Gill	K. Gill	K. Gill
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Sep 30, 1991	Sep 30, 1991	Sep 30, 1991	Sep 30, 1991
QC Sample #:	GBLK093091	GBLK093091	GBLK093091	GBLK093091
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10	10	10	30
Conc. Matrix Spike:	9.4	9.4	9.3	28
Matrix Spike % Recovery:	94	94	93	93
Conc. Matrix Spike Dup.:	10	10	10	30
Matrix Spike Duplicate % Recovery:	100	100	100	100
Relative % Difference:	6.2	6.2	7.3	6.7

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

VM Tague

Vickie Tague
Project Manager

$$\text{\% Recovery:} \quad \frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$$

$$\text{Relative \% Difference:} \quad \frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$$

CLIENT NAME: Pacific Env.
REC. BY (PRINT): B Stamper
MASTER LOG NO. / PAGE: X
DATE OF LOG-IN: 9/27/91

CIRCLE THE APPROPRIATE RESPONSE

1. Custody Seal(s): Present / (Absent)
2. Custody Seal Nos.: Intact / Broken*
3. Chain-of-Custody Records: (Present) / Absent*
4. Traffic Reports or Packing List: Present / (Absent)
5. Airbill: Airbill / Sticker Present / (Absent)
6. Airbill No.:
7. Sample Tags: (Present) / Absent*
   Sample Tag Nos.: ~~Listed~~ / Not Listed on Chain-of-Custody
8. Sample Condition: (Intact) / Broken*/Leaking*
9. Does information on custody reports, traffic reports and sample tags agree? (Yes) / No*
10. Proper Preservatives Used: (Yes) / No*
11. Date Rec. at Lab: 9/27/91
12. Time Rec. at Lab: 1655

LAB SAMPLE #	DASH #	CLIENT IDENTIFICATION	CONTAINER DESCRIPTION	SAMPLE MATRIX	DATE SAMP.	REMARKS: CONDITION (ETC
109498	A-C	17372	3 VOAs	W	9/27	
499	A-C	17349	↓	↓	↓	

* If Circled, contact Project Manager and attach record of resolution

Form SC001

ARCO Products Company
Division of AtlanticRichfieldCompany

330-06,13 **Task Order No.** 608-91-2B

Chain of Custody

ARCO Facility no. 608	City (Facility) San Lorenzo	Project manager (Consultant) D. Moser	Laboratory name SEQUOIA
ARCO engineer C. Carmel	Telephone no. (ARCO)	Telephone no. (Consultant) 408-984-6536	Fax no. (Consultant) 408-243-3911
Consultant name PACIFIC ENVIRONMENTAL	Address (Consultant) 1601 CIVIC CENTER DR. #202, SANTA CLARA, 95050		Contract number 67-67

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015 GAS	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
17372		3		X			X	9/27/91	11:10 am		X			1094798				A-C				
17349		3		X			X	9/27/91	10:50 am		X			1094799				A-C				

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number 1094798

Turnaround time

- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☒
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☐

Method of shipment

Condition of sample:		Temperature received:	
Relinquished by sampler	Date 9-27-91 Time 14.30	Received by	
Relinquished by	Date Time	Received by	
Relinquished by	Date Time	Received by laboratory	Date 9/28/91 Time 11:55

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant
APPC-3292 (2-91)

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Pacific Environmental Group
1601 Civic Center Drive, Suite 202
Santa Clara, CA 95050
Attention: Deb Moser

Project: 330-06.13, Arco 0608, San Lorenzo

Enclosed are the results from 2 water samples received at Sequoia Analytical on October 21,1991. The requested analyses are listed below:

1103899	Water, 17302	10/21/91	EPA 5030/8015/8020
1103900	Water, TB-1	10/21/91	EPA 5030/8015/8020

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Pacific Environmental Group	Client Project ID:	330-06.13, Arco 0608, San Lorenzo	Sampled:	Oct 21, 1991
1601 Civic Center Drive, Suite 202	Matrix Descript:	Water	Received:	Oct 21, 1991
Santa Clara, CA 95050	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Oct 21, 1991
Attention: Deb Moser	First Sample #:	110-3899	Reported:	Oct 24, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons µg/L (ppb)	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)
110-3899	17302	72	0.64	N.D.	0.44	N.D.
110-3900	TB-1	N.D.	N.D.	N.D.	N.D.	N.D.
Detection Limits:		30	0.30	0.30	0.30	0.30

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Pacific Environmental Group
1601 Civic Center Drive, Suite 202
Santa Clara, CA 95050
Attention: Deb Moser

Client Project ID: 330-06.13, Arco 0608, San Lorenzo

QC Sample Group: 1103899-3900

Reported: Oct 24, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	J. Jencks	J. Jencks	J. Jencks	J. Jencks
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Oct 21, 1991	Oct 21, 1991	Oct 21, 1991	Oct 21, 1991
QC Sample #:	BLK102191	BLK102191	BLK102191	BLK102191
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10	10	10	30
Conc. Matrix Spike:	9.9	10	9.9	30
Matrix Spike % Recovery:	99	100	99	100
Conc. Matrix Spike Dup.:	9.3	9.5	9.2	28
Matrix Spike Duplicate % Recovery:	93	95	92	93
Relative % Difference:	6.3	5.1	7.3	6.9

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

SEQUOIA ANALYTICAL SAMPLE RECEIPT LOG

CLIENT NAME: PEG
REC. BY (PRINT): AN
MASTER LOG NO. / PAGE:
DATE OF LOG-IN: 10/21/91

CIRCLE THE APPROPRIATE RESPONSE		LAB SAMPLE #	DASH #	CLIENT IDENTIFICATION	CONTAINER DESCRIPTION	SAMPLE MATRIX	DATE SAMP.	REMARKS: CONDITION (ETC)
1. Custody Seal(s):	Present / (Absent)	1103899	A-C	17302	3XVOA	W	10/21	
2. Custody Seal Nos.:	Intact / Broken* X	1103900	A-B	TB-1	2XVOA	↓	↓	
3. Chain-of-Custody Records:	(Present) / Absent*							
4. Traffic Reports or Packing List:	Present / (Absent)							
5. Airbill:	Airbill / Sticker Present / Absent							
6. Airbill No.:	X							
7. Sample Tags:	(Present) / Absent*							
Sample Tag Nos.:	(Listed) / Not Listed on Chain-of-Custody							
8. Sample Condition:	(Intact) / Broken* / Leaking*							
9. Does Information on custody reports, traffic reports and sample tags (agree)?	(Yes) / No*							
10. Proper Preservatives Used:	(Yes) / No*							
11. Date Rec. at Lab:	10/21							
12. Time Rec. at Lab:	1727							

* If Circled, contact Project Manager and attach record of resolution

ARCO Products Company Division of AtlanticRichfieldCompany

330-06.13 **Task Order No.** 608-91-2B

Chain of Custody

ARCO Facility no. 608	City (Facility) SAN LORENZO	Project manager (Consultant) D. MOSER	Laboratory name SEQUOIA
ARCO engineer C. CARMEL	Telephone no. (ARCO) 415-571-2434	Telephone no. (Consultant) 408-984-6536	Fax no. (Consultant) 408-243-3911
Consultant name PACIFIC ENVIRONMENTAL	Address (Consultant) 1601 CIVIC CENTER DR. #202, SANTA CLARA 95050		Contract number 07-073

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
17302		3		X			X	10/21/91	10:20		X				1100=8991							
TB-1		2		↓			↓				↓				↓ 8991							

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number 110 3899

Turnaround time

Priority Rush 1 Business Day ☐

Rush 2 Business Days ☐

Expedited 5 Business Days ☐

Standard 10 Business Days ☐

Method of shipment Sequoia Courier

Condition of sample: good

Temperature received: cool

	Date	Time		
Relinquished by sampler D. Moser	10/21/91	16:17	Received by	MANUEL MISSION
Relinquished by MANUEL MISSION	10/21/91	4:55	Received by	
Relinquished by	Date	Time	Received by laboratory	Date 10-21 Time 1727

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant

APPC-3292 (2-91)

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Pacific Environmental Group
1601 Civic Center Drive, Suite 202
Santa Clara, CA 95050
Attention: Dan Landry

330-06.13
Project: ~~300-06.~~13, Arco 608, San Lorenzo

Enclosed are the results from 8 water samples received at Sequoia Analytical on November 13,1991. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
1112557	Water, 590H	11/13/91	EPA 5030/8015/8020
1112558	Water, 642H	11/13/91	EPA 5030/8015/8020
1112559	Water, 17203VM	11/13/91	EPA 5030/8015/8020
1112560	Water, 17197VM	11/13/91	EPA 5030/8015/8020
1112561	Water, 17371VM	11/13/91	EPA 5030/8015/8020
1112562	Water, 17393VM	11/13/91	EPA 5030/8015/8020
1112563	Water, 17200VM	11/13/91	EPA 5030/8015/8020
1112564	Water, TB1	11/13/91	EPA 5030/8015/8020

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Pacific Environmental Group	Client Project ID:	300-06.13, Arco 608, San Lorenzo	Sampled:	Nov 13, 1991
1601 Civic Center Drive, Suite 202	Matrix Descript:	Water	Received:	Nov 13, 1991
Santa Clara, CA 95050	Analysis Method:	EPA 5030/8015/8020	Analyzed:	Nov 14-15, 1991
Attention: Dan Landry	First Sample #:	111-2557	Reported:	Nov 20, 1991

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons µg/L (ppb)	Benzene µg/L (ppb)	Toluene µg/L (ppb)	Ethyl Benzene µg/L (ppb)	Xylenes µg/L (ppb)
111-2557	590H	N.D.	N.D.	N.D.	N.D.	N.D.
111-2558	642H	N.D.	N.D.	N.D.	N.D.	N.D.
111-2559	17203VM	N.D.	N.D.	N.D.	N.D.	N.D.
111-2560	17197VM	N.D.	N.D.	N.D.	N.D.	N.D.
111-2561	17371VM	870	9.0	1.0	2.1	4.5
111-2562	17393VM	31	N.D.	N.D.	N.D.	N.D.
111-2563	17200VM	440	2.7	N.D.	N.D.	12
111-2564	TB1	N.D.	N.D.	N.D.	N.D.	N.D.
Detection Limits:		**30**	**0.30**	**0.30**	**0.30**	**0.30**

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Pacific Environmental Group
1601 Civic Center Drive, Suite 202
Santa Clara, CA 95050
Attention: Dan Landry

Client Project ID: 300-06.13, Arco 608, San Lorenzo

QC Sample Group: 1112557, 61

Reported: Nov 20, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	L. Laikhtman	L. Laikhtman	L. Laikhtman	L. Laikhtman
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Nov 15, 1991	Nov 15, 1991	Nov 15, 1991	Nov 15, 1991
QC Sample #:	GBLK111591	GBLK111591	GBLK111591	GBLK111591
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10	10	10	30
Conc. Matrix Spike:	10	11	11	31
Matrix Spike % Recovery:	100	110	110	103
Conc. Matrix Spike Dup.:	11	11	11	33
Matrix Spike Duplicate % Recovery:	110	110	110	110
Relative % Difference:	9.5	0.0	0.0	6.3

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Pacific Environmental Group
1601 Civic Center Drive, Suite 202
Santa Clara, CA 95050
Attention: Dan Landry

Client Project ID: 300-06.13, Arco 608, San Lorenzo

QC Sample Group: 1112558-60, 62-64

Reported: Nov 20, 1991

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	L. Laikhtman	L. Laikhtman	L. Laikhtman	L. Laikhtman
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Nov 14, 1991	Nov 14, 1991	Nov 14, 1991	Nov 14, 1991
QC Sample #:	BLK111491	BLK111491	BLK111491	BLK111491
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	10	10	10	30
Conc. Matrix Spike:	11	11	11	33
Matrix Spike % Recovery:	110	110	110	110
Conc. Matrix Spike Dup.:	11	11	11	33
Matrix Spike Duplicate % Recovery:	110	110	110	110
Relative % Difference:	0.0	0.0	0.0	0.0

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

% Recovery:	Conc. of M.S. - Conc. of Sample / Spike Conc. Added	x 100
Relative % Difference:	Conc. of M.S. - Conc. of M.S.D. / (Conc. of M.S. + Conc. of M.S.D.) / 2	x 100

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH Gas SDX EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ VOA ☐	CAM Metals ☐ VOA ☐ TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐
590H		3		X			X	11/13/91			X						11	25	57	
642H		3		X			X												58	
17203VM		3		X			X												59	
17197VM		3		X			X												60	
17371VM		3		X			X												61	
17393VM		3		X			X												62	
17200VM		3		X			X												63	
TB-1		2		X			X												64	

COPY

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number

Turnaround time

- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☒
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☐

Condition of sample:

Temperature received:

Relinquished by sampler	Date	Time	Received by
	11/13/91	1645	Dan George
Relinquished by	Date	Time	Received by
Dan George	11-13-91	4:25	
Relinquished by	Date	Time	Received by laboratory	Date	Time
				11-13	4:25

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant

APPC-3292 (2-91)

ATTACHMENT B

DRAFT HOMEOWNER LETTERS

March 13, 1992

Name of Homeowner
Address

Re: Groundwater Analytical Results
Address

Dear :

This letter presents the results of the sampling of the irrigation water-supply well on your property at the above address. ARCO Products Company (ARCO) and Pacific Environmental Group, Inc. (PACIFIC) would like to express their gratitude for your cooperation in the completion of this project. PACIFIC, on behalf of ARCO performed the groundwater sampling to determine the source and extent of gasoline contamination found in shallow groundwater, and whether gasoline is present in the well on your property. The groundwater sample was collected on _____ and was submitted to a laboratory to be analyzed for total petroleum hydrocarbons calculated as gasoline (TPH-g) and benzene, toluene, ethylbenzene, and xylenes (BTEX compounds) in groundwater.

Laboratory analysis of the groundwater sample collected from your well has detected TPH-g and benzene at concentrations of _____ and _____ parts per billion (ppb), respectively. These compounds are indicative of gasoline. Benzene is a known carcinogen. In accordance with the provisions of Proposition 65, a health risk assessment was performed. Based on the risk assessment, which included the assumption that 1 liter of groundwater would be consumed on a daily basis for 35 years, there is no significant increase in risk.

It is ARCO's and PACIFIC's understanding that your well is used only for irrigation purposes. This well should **not** be used for any other purpose, other than irrigation unless permitted or advised differently by the Alameda County

Department of Environmental Health. Because of the presence of gasoline compounds detected in the groundwater from the well, ARCO would like permission to sample the well on a quarterly basis through 1992. If this is agreeable with you, please sign and date the enclosed copy of this letter and return the signed copy to me as soon as possible. In the event of any changes in the characteristics of the water (color, odor, clarity, etc.), please contact ARCO, and the well will be resampled immediately at ARCO's expense. Please call me at (415)-571-2434, and/or Ms. Pamela Evans of Alameda County Health Care Services (ACHCS) at (415)-271-4320 if you have any questions regarding the contents of this letter.

ARCO or PACIFIC, on behalf of ARCO, will contact you shortly in regards to this sampling activity.

Sincerely,

ARCO Products Company

Chuck Carmel
Environmental Engineer

Attachments: Attachment A - Certified Analytical Results and Chain-of-Custody Documentation

cc: Mr. Chris Winsor, ARCO Products Company
Mr. Charles Lapin, ARCO Products Company
Mr. John Meck, ARCO Products Company
Ms. Pamela Evans, Alameda County Health Care Services

March 13, 1992

Homeowners name
Address

Dear :

Pacific Environmental Group, Inc. (PACIFIC), on behalf of ARCO Products Company (ARCO) attempted to sample the irrigation water-supply well located at the above referenced property on _____. PACIFIC and ARCO would like to express their gratitude for your cooperation.

The water in the well was not accessible due to the presence of the inoperable pump at the well. Since your well is within ARCO's current study area, ARCO requests permission to dismantle the pump assembly to access your well for water sampling. The pump assembly will be reassembled to pre-sampling conditions at ARCO's expense, or if you prefer, the wellhead can be left accessible and a secure lockable well cap installed to allow future access. ARCO or our representative will contact you in regards to accessing your well.

It is ARCO's and PACIFIC's understanding that past and future well usage was and will be for irrigation purposes only. If you choose not to let ARCO gain access to the well at this time and the well becomes operable in the future, at your request, ARCO will sample the well for gasoline constituents at ARCO's expense. However, because gasoline compounds have been detected in the groundwater in your vicinity the well should not be used for any purpose other than irrigation unless advised differently by the Alameda County Department of Environmental Health. Benzene is a component of gasoline and a known carcinogen. In accordance with the provisions of Proposition 65, a health risk assessment will be performed when results from your well are available if the results indicate the presence of gasoline. The risk assessment will include the assumption that 1 liter of groundwater is consumed on a daily basis for 35 years. Results of risk assessments performed for wells in your area indicate no significant increase in risk.

Please call me at (415)-571-2434, and/or Ms. Pamela Evans of Alameda County Health Care Services (ACHCS) at (415)-271-4320 if you have any questions regarding the contents of this letter.

Sincerely,

ARCO Products Company

Chuck Carmel
Environmental Engineer

cc: Mr. Chris Winsor, ARCO Products Company
Mr. Charles Lapin, ARCO Products Company
Mr. John Meck, ARCO Products Company
Ms. Pamela Evans, Alameda County Health Care Services

March 13, 1992

Homeowners name
Address

Re: Groundwater Analytical Results
Address

Dear :

This letter presents the results of the sampling of the irrigation water-supply well located on your property at the above referenced property. Pacific Environmental Group, Inc. (PACIFIC), on behalf of ARCO Products Company (ARCO) performed the groundwater sampling to test for gasoline in the water. The sample was collected on _____ and submitted to the laboratory for analysis of total petroleum hydrocarbons calculated as gasoline (TPH-g) and benzene, toluene, ethylbenzene, and xylenes (BTEX compounds) in groundwater. ARCO and PACIFIC would like to express their gratitude for your cooperation in the completion of this project.

The groundwater sample collected from your well did not contain any dissolved concentrations of TPH-g or BTEX compounds. It is ARCO's and PACIFIC's understanding that the well is used strictly for irrigation purposes. This well should not be for any other purpose other than irrigation unless advised differently by the Alameda County Department of Environmental Health.

Because gasoline compounds have been detected in the groundwater in your vicinity, ARCO would like your permission to sample your well on a quarterly basis through 1992. If this is agreeable with you, please sign and date the enclosed copy of this letter and return the signed copy to me as soon as possible. ARCO or our representative will be contacting you in regards to accessing your well.

In the event of any changes in the characteristics of the water (color, odor, clarity, etc.), please contact ARCO, and the well will be resampled at ARCO's expense.

Please call me at (415)-571-2434, and/or Ms. Pamela Evans of Alameda County Health Care Services (ACHCS) at (415)-271-4320 if you have any questions regarding the contents of this letter.

Sincerely,

ARCO Products Company

Chuck Carmel
Environmental Engineer

Attachments: Attachment A - Certified Analytical Results and Chain-of-Custody Documentation

cc: Mr. Chris Winsor, ARCO Products Company
Mr. Charles Lapin, ARCO Products Company
Mr. John Meck, ARCO Products Company
Ms. Pamela Evans, Alameda County Health Care Services

ATTACHMENT C

GROUNDWATER ANALYTICAL RESULTS AND RISK ASSESSMENT CALCULATIONS, FEBRUARY 4, 1992

PACIFIC
ENVIRONMENTAL
GROUP, INC.

February 4, 1991
Project 330-06.13

Mr. Chuck Carmel
ARCO Products Company
P.O. Box 5811
San Mateo, California

Re: Groundwater Analytical Results and
Risk Assessment Calculations
ARCO Service Station 608
17601 Hesperian Boulevard at Hacienda Avenue

Dear Mr. Carmel:

This letter presents the results of the sampling of the domestic irrigation water-supply wells located downgradient of the above referenced site. Pacific Environmental Group, Inc. (PACIFIC), on behalf of ARCO Products Company (ARCO) performed the groundwater sampling to determine whether groundwater has been impacted by petroleum hydrocarbons. PACIFIC and ARCO assume that the water-supply wells are only used for irrigation purposes, and not as a drinking water source. The sampling events were performed on September 27, October 21, and December 13, 1991. All groundwater samples were submitted to a state-certified laboratory to be analyzed for total petroleum hydrocarbons calculated as gasoline (TPH-g), and benzene, toluene, ethylbenzene, and xylenes (BTEX compounds) in groundwater.

Laboratory analysis of the groundwater samples collected from the domestic irrigation wells has detected TPH-g and benzene at concentrations ranging between non-detected and 870 parts per billion (ppb), and non-detected and 13 ppb, respectively.

Since the chemical benzene is listed in Proposition 65, PACIFIC performed a risk assessment to determine if a threat to human health exists as a result of the benzene noted in groundwater.

INITIAL RISK ASSESSMENT

The initial risk assessment was calculated using potency values from the EPA Health Effects Assessment Summary Tables, January 1991. These tables correspond to the EPA's Integrated Risk Information System (IRIS) Database which is updated on a monthly basis. The IRIS potency value (slope factor) for benzene is 2.9×10^{-2} $(mg/kg\text{-}day)^{-1}$.

The results of the calculations using the IRIS potency values for ingestion and dermal absorption of groundwater are 1.08×10^{-5} and 2.01×10^{-6}, respectively. Attachment A presents the assumptions used in the calculation of the initial risks for each specific pathway.

PRESENT RISK ASSESSMENT

The present risk assessment was calculated using values for benzene obtained from California Department of Health Services Title 22, which are based on the following risk assessment documents:

- *Report to the Scientific Review Panel on Benzene.* Prepared by the California Air Resources Board and California Department of Health Services, November 27, 1984.
- *Interim Quantitative Cancer Unit Risk Estimate Due to Inhalation of Benzene.* EPA 600/X-85-022. Interim Report. United States Environmental Protection Agency, February 15, 1985.

Potency values (slope factors) estimated by the California Department of Health Services (CDHS) were calculated from epidemiological studies on humans and animal cancer bioassays (mice and rats). The epidemiological studies analyzed leukemia incidence data for humans occupationally exposed to benzene via inhalation. The use of mice and rats provide an increase in the potency value (slope factor) since these animals are more sensitive to the effects of benzene than humans. The CDHS established a potency value (slope factor) of 0.1 $(mg/kg\text{-}day)^{-1}$ for estimating risks from the exposure of benzene.

Several assumptions were made in calculating the risks. The assumptions include: (1) the ingestion of groundwater at a rate of 1/2 and 1 liter per day (liter/day) and (2) the exposure duration of an individual living in the area and coming into contact with benzene is 35 years.

The calculations using the CDHS potency value (slope factor) for ingestion of groundwater at a rate of 1/2 and 1 liter/day, and dermal absorption of

groundwater are 9.29×10^{-6}, 4.64×10^{-6}, and 3.47×10^{-6}, respectively. Attachment B presents the assumptions used in the calculation of present risks for each specific pathway.

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

Sincerely,

Pacific Environmental Group, Inc.

Kelly C. Brown
Senior Staff Geologist

Debra J. Moser
Senior Geologist

Attachments: Attachment A - Initial Carcinogenic Risk Calculations Based on Using IRIS Potency Value
Attachment B - Present Carcinogenic Risk Calculations Based on Using CDHS Potency Value

cc: Mr. Charles Lapin, ARCO Products Company
Mr. John Meck, ARCO Products Company
Mr. Chris Winsor, ARCO Products Company

ATTACHMENT A

INITIAL CARCINOGENIC RISK CALCULATIONS BASED ON USING IRIS POTENCY VALUE

ATTACHMENT A
INITIAL CARCINOGENIC RISK CALCULATIONS BASED ON USING IRIS POTENCY VALUE

The risk level was calculated using Environmental Protection Agency (EPA) guidelines (EPA, *Risk Assessment Guidance for Superfund. Volume 1.*, December 1989), and The California Safe Drinking Water and Toxic Enforcement Act of 1986, which establishes specific regulatory levels posing no significant risk. The EPA standard values are developed to include safety factors to protect the sensitive individual. These values are conservative for the majority of the population.

The risk assessment due to existing conditions covers the groundwater environmental media. Possible exposure pathways are evaluated for the groundwater media. These pathways include: (1) ingestion of groundwater and (2) dermal absorption of groundwater. In other words, this assessment considers the risk by (1) a person drinking 2 liters (approximately 1/2 gallon) of the groundwater everyday for 70 years and (2) a person wetting their skin with the groundwater for 1/2 hour everyday for 70 years.

Because benzene is the only carcinogen of the compounds identified at the site, the carcinogenic risk is determined by evaluating the presence of benzene.

Data used in the risk assessment was obtained from the groundwater sampling events performed during the months of September, October, and December 1991. Due to the low concentrations of benzene detected in groundwater, the highest concentration (13 micrograms per liter [ug/L]) noted in all of the neighborhood water-supply wells will be used to determine any risks to human health.

Assumptions used in the calculation of a risk for a specific pathway are discussed in the individual sections below.

Carcinogenic Risks

The carcinogenic risk is the estimated excess probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen. The numerical value generated for the carcinogenic risk is a unitless number. The values are based

on a formula using known parameters and assumptions. The use of these parameters and assumptions in the calculation will result in the carcinogenic risk estimate to be generally a high estimate. The EPA is reasonably confident that the "true risk" will not exceed the risk estimate.

Ingestion of Groundwater:

$$\text{Risk} = \frac{\text{CW} \times \text{IR} \times \text{EF} \times \text{ED} \times \text{SF}}{\text{BW} \times \text{AT}}$$

CW = The concentration of the compound in the water (milligrams per liter [mg/L]). This is the highest benzene concentration calculated from the September, October, and December 1991 results for all wells sampled (0.013 mg/L).

IR = The ingestion rate of water (liters per day [L/day]). The EPA value of 2 L/day (approximately 0.5 gallon) was used.

EF = Pathway specific exposure frequency (days per year [day/yr]). A residential exposure of 365 days/yr was used.

ED = Exposure duration (years [yr]). A duration of 70 years was used. This assumption is based on the average lifetime of an individual.

SF = Slope factor (milligrams per kilogram per day $[\text{mg/kg/day}]^{-1}$). This is the compound-specific slope for increased cancer risk. The value for benzene is 2.9×10^{-2} $(\text{mg/kg/day})^{-1}$ (IRIS Database, EPA 1989).

BW = Body weight (kilograms [kg]). 2 The EPA standard value of 70 kg for the average body weight of an adult was used.

AT = Averaging time (day). This is calculated by the number of days in a year multiplied by the average lifetime of an individual, which is 70 years (365 day/yr x 70 yr) = 25,550 day.

$$\text{EF} \times \text{ED} \times \text{SF} = \text{constant} = 740.95\ \text{day}([\text{mg/kg/day}]^{-1})$$

$$\text{Risk} = \frac{(0.013\ \text{mg/L})(2\ \text{L/day})(740.95\ \text{day}[\text{mg/kg/day}]^{-1})}{(70\ \text{kg})(25{,}550\ \text{day})}$$

$$\text{Risk} = 1.08 \times 10^{-5}$$

Dermal Absorption of Groundwater:

$$\text{Risk} = \frac{CW \times CF \times SA \times PC \times ET \times EF \times ED \times CF \times SF}{BW \times AT}$$

CW = The concentration of compound in water (mg/L). The highest benzene concentration for the wells was 0.013 mg/L.

CF = Conversion factor (1 L/1,000 cm^3).

SA = Skin surface area available for contact (centimeter squared [cm^2]). The surface area for an adult male is 1.94 meter squared (m^2) and the surface area for a adult female is 1.69 m^2. The average of these two, 1.82 m^2 or 18,200 cm^2 for total skin area. To consider the incidental contact caused by landscape watering and other outdoor activities, one tenth of the total, or 1,820 cm^2 was used.

PC = Chemical specific dermal permeability constant (centimeter per hour [cm/hr]). Benzene is poorly absorbed through the skin (NIOSH 1974); therefore, a factor of 0.41 cm/hr was used. This is an estimate and is being further researched.

ET = Exposure time (hours per day [hr/day]). A value of 0.5 hr/day was used. This represents the time for watering landscape, washing cars, and other outdoor chores.

EF = Exposure frequency (365 day/yr).

ED = Exposure duration (70 yr).

SF = Slope factor for benzene (2.9 x 10^{-2} $(mg/kg/day)^{-1}$).

BW = Body weight (70 kg).

AT = Averaging time (25,550 day).

EF x ED x SF = 740.95 day($[mg/kg/day]^{-1}$)

$$\text{Risk} = \frac{(0.013\ mg/L)(1\ L/1{,}000\ cm^3)(1{,}820\ cm^2)(0.41\ cm/hr)(0.5\ hr/day)(740.95\ day([mg/kg/day]^{-1})}{(70\ kg)(25{,}550\ day)}$$

$$\text{Risk} = 2.01 \times 10^{-6}$$

This calculated risk for the exposure to groundwater was based on the drinking of 2 liters of water, or skin contact for 70 years, 365 days a year. It is very unlikely that this amount of exposure will occur. Also, the risk is based on the current concentration of benzene existing at the same concentration for 70 years. Under these conditions,

benzene concentrations usually decline with time. Therefore, the actual risk will be less than the calculated risk. Therefore, there is no increased risk to health based on the use of the IRIS potency value for benzene.

ATTACHMENT B

PRESENT CARCINOGENIC RISK CALCULATIONS BASED ON USING CDHS POTENCY VALUE

ATTACHMENT B
PRESENT CARCINOGENIC RISK CALCULATIONS
BASED ON USING CDHS POTENCY VALUE

The risk level was calculated using Environmental Protection Agency (EPA) guidelines (EPA, *Risk Assessment Guidance for Superfund. Volume I.*, December 1989), and The California Safe Drinking Water and Toxic Enforcement Act of 1986, which establishes specific regulatory levels posing no significant risk. The EPA standard values are developed to include safety factors to protect the sensitive individual. These values are conservative for the majority of the population.

The risk assessment due to existing conditions covers the groundwater environmental media. Possible exposure pathways are evaluated for the groundwater media. These pathways include: (1) ingestion of groundwater and (2) dermal absorption of groundwater. In other words, this assessment considers the risk by (1) a person drinking 1/2 to 1 liter (approximately 1/4 to 1/2 gallon) of the groundwater everyday for 35 years and (2) a person wetting their skin with the groundwater for 1/2 hour everyday for 35 years.

Because benzene is the only carcinogen of the compounds identified at the site, the carcinogenic risk is determined by evaluating the presence of benzene.

Data used in the risk assessment was obtained from the groundwater sampling event performed during the month of September, October, and December 1991. Due to the low concentrations of benzene detected in groundwater, the highest benzene concentration (13 ug/L) noted in all of the neighborhood water-supply wells will be used to determine any risks to human health.

Assumptions used in the calculation of a risk for a specific pathway are discussed in the individual sections below.

Carcinogenic Risks

The carcinogenic risk is the estimated excess probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen. The numerical value generated for the carcinogenic risk is a unitless number. The values are based on a formula using known parameters and assumptions. The use of these parameters

and assumptions in the calculation will result in the carcinogenic risk estimate to be generally a high estimate. The California Health and Welfare Agency has established these levels determining "no significant risk."

Ingestion of Groundwater (Ingestion Rate = 1 L/day):

$$\text{Risk} = \frac{CW \times IR \times EF \times ED \times SF}{BW \times AT}$$

CW = The concentration of the compound in the water (milligrams per liter [mg/L]). This is the highest benzene concentration calculated from the September, October, and December 1991 results for all wells sampled (0.013 mg/L).

IR = The ingestion rate of water (liters per day [L/day]). The value of 1 L/day (approximately 0.25 gallon) was used.

EF = Pathway specific exposure frequency (days per year [day/yr]). A residential exposure of 365 days/yr was used.

ED = Exposure duration (years [yr]). A duration of 35 years was used. This assumption is based on the average time an individual would remain living in the area.

SF = Slope factor (milligrams per kilogram per day $[mg/kg/day]^{-1}$). This is the compound-specific slope for increased cancer risk. The value for benzene is 0.1 $(mg/kg/day)^{-1}$ (CDHS, 1990).

BW = Body weight (kilograms [kg]). The EPA standard value of 70 kg for the average body weight of an adult was used.

AT = Averaging time (day). This is calculated by the number of days in a year multiplied by the average lifetime of an individual, which is 70 years (365 day/yr x 70 yr) = 25,550 day.

$$EF \times ED \times SF = \text{constant} = 1{,}277.50\ \text{day}([mg/kg/day]^{-1})$$

$$\text{Risk} = \frac{(0.013\ mg/L)(1\ L/day)(1{,}277.50\ day[mg/kg/day]^{-1})}{(70\ kg)(25{,}550\ day)}$$

$$\text{Risk} = 9.29 \times 10^{-6}$$

Ingestion of Groundwater (Ingestion Rate = 1/2 L/day):

$$\text{Risk} = \frac{CW \times IR \times EF \times ED \times SF}{BW \times AT}$$

CW = The concentration of the compound in the water (mg/L). This is the highest benzene concentration calculated from the September, October, and December 1991 results for all wells sampled (0.013 mg/L).

IR = The ingestion rate of water (liters per day [L/day]). The value of 1/2 L/day (approximately 0.25 gallon) was used.

EF = Pathway specific exposure frequency (days per year [day/yr]). A residential exposure of 365 days/yr was used.

ED = Exposure duration (years [yr]). A duration of 35 years was used. This assumption is based on the average time an individual would remain living in the area.

SF = Slope factor (milligrams per kilogram per day $[mg/kg/day]^{-1}$). This is the compound-specific slope for increased cancer risk. The value for benzene is 0.1 $(mg/kg/day)^{-1}$ (CDHS, 1990).

BW = Body weight (kilograms [kg]). The EPA standard value of 70 kg for the average body weight of an adult was used.

AT = Averaging time (day). This is calculated by the number of days in a year multiplied by the average lifetime of an individual, which is 70 years (365 day/yr x 70 yr) = 25,550 day.

$$EF \times ED \times SF = \text{constant} = 1{,}277.50\ \text{day}([mg/kg/day]^{-1})$$

$$\text{Risk} = \frac{(0.013\ mg/L)(0.5\ L/day)(1{,}277.50\ day[mg/kg/day]^{-1})}{(70\ kg)(25{,}550\ day)}$$

$$\text{Risk} = 4.64 \times 10^{-6}$$

Dermal Absorption of Groundwater:

$$\text{Risk} = \frac{CW \times CF \times SA \times PC \times ET \times EF \times ED \times CF \times SF}{BW \times AT}$$

CW = The concentration of compound in water (mg/L). The highest benzene concentration for the wells sampled in September, October, and December 1991 was used (0.013 mg/L).

CF = Conversion factor (1 L/1,000 cm^3).

SA = Skin surface area available for contact (centimeter squared [cm^2]). The surface area for an adult male is 1.94 meter squared (m^2) and the surface area for a adult female is 1.69 m^2. The average of these two, 1.82 m^2 or 18,200 cm^2 for total skin area. To consider the incidental contact caused by landscape watering and other outdoor activities, one tenth of the total, or 1,820 cm^2 was used.

PC = Chemical specific dermal permeability constant (centimeter per hour [cm/hr]). Benzene is poorly absorbed through the skin (NIOSH 1974); therefore, a factor of 0.41 cm/hr was used. This is an estimate and is being further researched.

ET = Exposure time (hours per day [hr/day]). A value of 0.5 hr/day was used. This represents the time for watering landscape, washing cars, and other outdoor activities.

EF = Exposure frequency (365 day/yr).

ED = Exposure duration (35 yrs).

SF = Slope factor for benzene (0.1 $(mg/kg/day)^{-1}$).

BW = Body weight (70 kg).

AT = Averaging time (25,550 day).

$$EF \times ED \times SF = 1{,}277.50\ day([mg/kg/day]^{-1})$$

$$Risk = \frac{(0.013\ mg/L)(1\ L/1{,}000\ cm^3)(1{,}820\ cm^2)(0.41\ cm/hr)(0.5\ hr/day)(1{,}277.50\ day([mg/kg/day]^{-1})}{(70\ kg)(25{,}550\ day)}$$

$$Risk = 3.47 \times 10^{-6}$$

This calculated risk for the exposure to groundwater was based on the drinking of 1/2 to 1 liter of groundwater, or skin contact for 35 years, 365 days a year. It is very unlikely that this amount of exposure will occur. Also, the risk is based on the current concentration of benzene existing at the same concentration for 35 years. Under these conditions, benzene concentrations usually will decline with time. The actual risk will be less than the calculated risk. Therefore, there is no increased risk to health based on the use of CDHS potency value for benzene.