Chevron

98 APR -7 PM 3:02

Chevron Products Company
6001 Bollinger Canyon Road
Building L
San Ramon, CA 94583
P.O. Box 6004
San Ramon, CA 94583-0904

Marketing – Sales West
Phone 510 842-9500

April 3, 1998

Mr. Larry Seto
Alameda County Health Care Services
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Re: Former Chevron Service Station #9-1153
3126 Fernside Boulevard, Alameda, California

Dear Mr. Seto:

I am enclosing several informative studies on the use of hydrogen peroxide for reducing organic compounds, which I received from Chevron's consultant Pacific Environmental Group. This is in response to our previous conversations in which you wanted to see literature on the use of hydrogen peroxide, the benefits and any side effects.

In addition to the attached studies there are three actual case studies cited that shows the injection of hydrogen peroxide was effective in reducing TPH-g and BTEX concentrations. There appears to be no environmental side effects from the use of this chemical.

After your review of this information I believe that you will agree that it would be beneficial to use hydrogen peroxide in well C-2 at this site.
C-1

If you have questions or comments, call me at (510) 842-9136.

Sincerely,
CHEVRON PRODUCTS COMPANY

Philip R. Briggs
Site Assessment and Remediation Project Manager

Enclosure

Cc. Ms. Bette Owen, Chevron

PACIFIC
ENVIRONMENTAL
GROUP, INC.

AN IT COMPANY

March 31, 1998

Mr. Phil Briggs
Chevron Products Company
6001 Bollinger Canyon Road
P.O. Box 5004
San Ramon, California 94538-0804

Subject: Hydrogen Peroxide Technology

Dear Mr. Briggs,

The application of a strong oxidant, hydrogen peroxide, potassium permanganate, etc., has been shown to be effective at direct oxidation of contaminants. Researchers and consulting firms have published information on hydrogen peroxide. The most informative studies are:

Assessment of the Applicability of Chemical Oxidization Technologies for the Treatment of Contaminants at Leaking Underground Storage Tank (LUST) Sites: Chien T. Chen

Fenton's Reagent as a Chemical Oxidant for Soil Contamination: J.X. Ravikumar and M.D. Gurol

Pentachlorophenol (PCP) Degradation Using Heme and Hydrogen Peroxide: David Stevens, Shyitien Chen, and Goyoung Kang

Hydrogen Peroxide Decomposition Kinetics in the Presence of Iron Oxides: Ann Wang and Richard Valentine

Hydrogen Peroxide for Physicochemically Degrading Petroleum-Contaminated Soils: Richard Watts

Hydrogen peroxide in the presence of Fe^{++} produces a hydroxyl radical. The hydroxyl radical is an extremely strong oxidant and will react with most organic compounds. The contaminant is either broken down into water or less toxic compounds. There are many reaction pathways for hydrocarbon oxidation using hydrogen peroxide. One of the most simple is:

2025 Gateway Place, Suite 440 • San Jose, California 95110-1014 (408) 441-7500 FAX (408) 441-7539

(1) $2H_2O_2 + 2Fe_2 \rightarrow 2OH\bullet + 2OH^- + 2Fe^{3+}$

(2) $RCH_2 + OH\bullet \rightarrow H_2O + RCH\bullet$

(3) $RCH\bullet + 2H_2O_2 \rightarrow RH + CO_2 + 2H_2O$

(4) $RH + OH\bullet \rightarrow R + H_2O$

(5) $H_2O_2 + Fe^{3+} \rightarrow Fe^{2+} + H^+ + HO_2\bullet$

(6) $HO_2\bullet + Fe^{3+} \rightarrow O_2 + Fe^{2+} H^+$

(7) $2H^+ + 2OH^- \rightarrow 2H_2O$

The reaction of the hydroxyl radical with contaminant is exothermic. Observed vadose zone temperature increases of over 100° C have been observed with free phase chlorinated compounds. Application to groundwater will not result in such temperature increases due to the boiling of groundwater acts as a heat sink. Outlined below are three of the case studies using hydrogen peroxide.

Hydrogen peroxide as an oxidizing agent to remove free product and reduce dissolved hydrocarbon levels. Listed below are 10 sites where hydrogen peroxide technology for contaminant reduction has been applied. Most of the site addressed fuel hydrocarbon in groundwater.

INDUSTRY	LOCATION	CONTAMINANT	MEDIA
Major Oil	Berkeley, Calif	BTEX	Groundwater
Municipal	Chula Vista, Calif	BTEX	Groundwater
Major Oil	Los Alamitos, Calif	BTEX	Groundwater
Rental Car Facility	Los Angeles	BTEX	Soil, Groundwater
Land Development	Gonesse, France	BTEX, Phenols, TCA	*Ex-situ* Soil
Cement Plant	Salt Lake City, Utah	BTEX	Groundwater
Municipal	Puyallup, Wash	BTEX	Groundwater
Service Station	Seattle, Wash	BTEX - FREE PHASE	Groundwater
Super Fund Site	King of Prussia, NJ	Chlorinated Compounds	Soil, Groundwater
Rental Car Facility	San Diego, Calif	MTBE	Groundwater

CASE STUDY 1. - Cement Plant. Utah

Conventional pump and treat technology had been applied unsuccessfully at the site for two years. A Dual Vacuum Extraction (DVE) system with 18 extraction wells was

subsequently installed to reduce contaminant levels and obtain site closure. The dissolved plume went beneath a rail line and building. The locations of wells were not optimum due to a rail line and building. After about 75 days of run time, extraction rates were reduced to less than one pound per day. Residual gasoline in a diffusion limited clay unit resulted in continued elevated dissolved levels in two wells.

Four hydrogen peroxide treatment were conducted at the site. The first in wells MW-5 and MW-11. Concentrations of all gasoline constituents were reduced by over half after one application. Well MW-5 was destroyed after the first application due to rail line construction. An additional three applications were conducted on well MW-11. Pre and post remediation dissolved hydrocarbon levels are shown in the following table. Each application consisted of approximately 50 gallons of 35 percent hydrogen peroxide injected into the well. A blower was used to force the hydrogen peroxide out from the well into the formation. Analytical results are in parts per billion (ppb). Site closure was granted by the State.

Date	Well Number	TPHg	Benzene	Toluene	Ethylbenzene	Xylenes	Comments
Jun-92	MW-5	72000	4200	8100	1500	8700	Pre Remediation
	MW-6	20000	400	690	580	3400	
	MW-8	40000	4400	920	1000	6700	
	MW-11	92000	6100	13000	2100	9200	
	MW-14	1400	20	20	34	33	
Aug-93	MW-5	24000	650	2100	390	4000	After DVE Operation
	MW-6	1900	68	33	8	390	
	MW-8	1100	130	12	21	160	
	MW-11	45000	1900	770	330	6100	
	MW-14	76	ND	1	1	9	
Sep-93	MW-5	12000	23	250	77	1700	First H_2O_2 Treatment
	MW-11	21000	900	210	240	2100	
Dec-93	MW-11	11000	3300	96	ND	770	Second H_2O_2 Treatment
Mar-94	MW-11	1100	180	76	28	81	Third H_2O_2 Treatment
Jun-94	MW-11	1000	83	6	37	76	Fourth H_2O_2 Treatment

CASE STUDY 2. - Major Oil Station, Seattle

Other contractors installed an active remediation system for groundwater at the site that operated for more than two years. Free phase product was still present when the system was modified for DVE technology. The subsurface was characterized by tight glacial till that acted as a diffusion limited zone. Extraction rates decreased from over 200 pounds per day at start up to less than one pound per day after one year. Dissolved hydrocarbon remained elevated in some wells due to diffusion from the till.

Two injections of 15 percent hydrogen peroxide were applied to the wells, 10 gallons on the first application and 20 gallons on the second application. Applications were spaced three days apart. Both injections were under positive pressure. Well MW-17 had a sheen prior to the first application. After the second application the DVE system was restarted to purge the wells for a representative sampling of groundwater. Dissolved concentrations were cut in half with the two applications. The following table summarizes the dissolved hydrocarbon concentrations in groundwater before DVE, after DVE, and after hydrogen peroxide treatment.

Well Number	**Pre DVE Concentration**		**Post DVE Concentration**		**After Hydrogen Peroxide Treatment**	
	TPHg	*Benzene*	*TPHg*	*Benzene*	*TPHg*	*Benzene*
MW-5	230	35	802	26	ND	ND
MW-8s	Sheen	3800	8150	594	2510	211
MW-10	6000	180	ND	ND	ND	ND
MW-17	Free Phase	Free Phase	62900	1250	43800	649
N1	2000	560	124	7	ND	ND
N2	19000	970	1600	31	758	5

CASE STUDY 3. - Industrial Facility, Washington

An industrial facility experienced a 300 gallon fuel release that necessitated remedial action. Limited excavation removed some of the impacted soil. Groundwater monitoring during the six months following the release indicated that residual gasoline in the vadose zone was acting as a source for groundwater. The dissolved plume was expanding and moving offsite. Hydrogen peroxide was the only technology implemented to address residual vadose zone and groundwater impact. Seven remediation ports were installed for hydrogen peroxide injection into the vadose zone. Site restriction prevented installation of remediation ports.

Multiple injections (about one per week) of 10 percent hydrogen peroxide were applied for a period of two months. The initial approximately 1,500 ft^2 area of above 2000 ppb TPHg was reduced to less than 50 ft^2 by the end of two months. A more rapid cleanup could have occurred if additional remediation ports could have been installed.

Technology Summary

Hydrogen peroxide remediation has been shown to be very effective at reducing dissolved concentrations of gasoline in specific site conditions. The rate of oxidation of contaminants is dependent upon specific site conditions. Caution must be used during the

initial hydrogen peroxide applications to assure temperature rises do not compromise well integrity.

Pacific Environmental Group is pleased to provide technology information and expertise to Chevron. Please feel free to call me at (408) 441-7500 ext 239 if you require additional information. Attached to this letter are some of the articles discussing application of hydrogen peroxide.

Sincerely
Pacific Environmental Group

James A. Perkins
Senior Geologist

LOP - CHANGE RECORD REQUEST FORM

printed: 09/02/97

Mark Out What Needs Changing and Hand to LOP Data Entry
(Name/Address changes go to Annual Programs Data Entry)

Insp:

AGENCY # : 10000 SOURCE OF FUNDS: F SUBSTANCE: 8006619
StID : 3565 LOC:
SITE NAME: Chevron Station #9-1153 DATE REPORTED : 09/15/86
ADDRESS : 3126 Fernside Ave DATE CONFIRMED: 09/15/86
CITY/ZIP : Alameda 94501 MULTIPLE RPs : Y

SITE STATUS

CASE TYPE: O CONTRACT STATUS: 4 PRIOR CODE:1B3 EMERGENCY RESP:
RP SEARCH: S DATE COMPLETED: 11/20/91
PRELIMINARY ASMNT: U DATE UNDERWAY: 06/09/89 DATE COMPLETED:
REM INVESTIGATION: U DATE UNDERWAY: 10/03/91 DATE COMPLETED:
REMEDIAL ACTION: I DATE UNDERWAY: 10/03/91 DATE COMPLETED:
POST REMED ACT MON: DATE UNDERWAY: DATE COMPLETED:

ENFORCEMENT ACTION TYPE: 1 DATE ENFORCEMENT ACTION TAKEN: 11/20/91
LUFT FIELD MANUAL CONSID: 3HSCARWG
CASE CLOSED: DATE CASE CLOSED:
DATE EXCAVATION STARTED : 06/04/86 REMEDIAL ACTIONS TAKEN: NT

RESPONSIBLE PARTY INFORMATION

RP#1-CONTACT NAME: J L & Jane Bolton
COMPANY NAME:
ADDRESS: 3135 Gibbons Dr.
CITY/STATE: Alameda CA 94501

RP#2-CONTACT NAME: Mark Miller
COMPANY NAME: Chevron U S A Inc.
ADDRESS: 2410 Camino Ramon
CITY/STATE: San Ramon, Ca 94583-0804

INSPECTOR VERIFICATION:

NAME _____ SIGNATURE _____ DATE _____

DATA ENTRY INPUT:

Name/Address Changes Only

ANNPGMS _____ LOP____ DATE _____

Case Progress Changes

LOP _____ DATE _____

Larry - Separate phase fuel 5771 detected -

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EMCON Associates	**Date Received:**	11/08/93
Project:	EMCON Project No. 0G70-007.01	**Service Request No.:**	SJ93-1373
	ARCO Facility No. 601	**Sample Matrix:**	Water

Surrogate Recovery Summary
Halogenated Volatile Organic Compounds
EPA Methods 5030/601

Sample Name	Date Analyzed	**Percent Recovery** 4-Bromofluorobenzene
MW-8 (10)	11/09/93	106.
MW-8 (10) MS	11/09/93	100.
MW-8 (10) DMS	11/09/93	107.
Method Blank	11/09/93	96.
	CAS Acceptance Criteria	70-130

Approved by: Edward Murphy Date: November 23, 1993

1921 Ringwood Avenue • San Jose, California 95131 • Telephone 408/437-2400 • Fax 408/437-9356

#3838 BC

- 2301 Santa Clara Avenue, Alameda - A feasibility study discussing remediation options is due to this office. Contact Peter Hudson, ENSR, for an update.

#3952 LS

- 2425 Encinal Avenue, Alameda - A workplan was recently approved to further delineate the groundwater contaminant plume at the site, to assure that the site's contaminant concentrations are not affecting the adjacent residences. If it is confirmed that the contaminant plume is limited to the site, then the site may be allowed closure, with site management requirements outlined in the Case Closure Summary.

Other Alameda cases (formerly Juliet's):

#3565 LS

- 3126 Fernside Blvd., Alameda - Continued groundwater monitoring at the site. A risk assessment for the site has been conducted. There is still some concern that the plume may eventually migrate to the Inner Harbor. The french-drain extraction system was recently discontinued, and we are keeping a close watch on whether this plume, without the extraction system containing it, will migrate more readily. Residences are also potential sensitive receptors.

#1202 LS

- 1801 Hibbard St., Alameda - Continued groundwater monitoring and vapor extraction system at site. I have explained to Brian West, consultant, that the vapor extraction system is only effecting the TPH and BTEX concentrations, and my actually be hindering the degradation of the chlorinateds in the water, which degrade more readily in anaerobic situations with TPH as the electron acceptors.

#5844 PE

- 510 Lincoln Avenue, Alameda - I believe that investigations were recently conducted at the site in response to contamination being identified at the time of the tank removal. The files for this site, I believe, are with Ron O. in Room 201 or on the file shelf under Alameda.

#3566 LS

- 1127 Lincoln Avenue, Alameda - Currently continuing quarterly groundwater monitoring. Operation of extraction system was discontinued at the site recently, per approval of the County. Primary concern is the potential impact to the residences based on the ASTM RBCA threshold values.

#2765 LS

- 2900 Main Street, Alameda - Work plan approved in April 1997, and the work plan should have been implemented by now, and a report should be due to this office shortly. Need to call and check on status of workplan implementation.

#1771 LS

- 3255 Mecartney Rd., Alameda - MTBE is only remaining concern. Quarterly groundwater monitoring currently required. Please refer to County's June 9, 1997 letter.

#598 LS

- 900 Otis Drive, Alameda - One more round of quarterly groundwater monitoring and the site may be considered for closure.

Larry - Please take over