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May 15, 1998

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

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

**Re: Chevron Service Station #9-0076
4265 Foothill Blvd.
Oakland, California**

Dear Mr. Chan:

Enclosed is a copy of the *Evaluation of Intrinsic Bioremediation*, dated May 15, 1998, that was prepared by Curtis Peck of Chevron's CRTC group. This evaluation was made to make a determination of the presence of intrinsic bioremediation within the hydrocarbon plume at the above noted site.

The evaluation of indicator parameters across a dissolved contaminant plume can be used in the demonstration of intrinsic bioremediation. One or more trends observed across a dissolved plume (with increasing contaminant concentration) would suggest the potential occurrence of intrinsic bioremediation.

With increasing BTEX concentrations, the expected trend in indicator parameter concentrations would be:

Relative Decrease In:

Dissolved Oxygen
Oxidation-Reduction Potential (Redox)
Nitrate
Sulfate

Relative Increase In:

Dissolved Iron (Ferrous)
Alkalinity

The sampled wells are presented on the X-axis from the up-gradient wells to the down-gradient wells through the contaminant plume. The resulting order of the wells is C-1, C-2, C-4, C-6, C-8 and C-9 through the plume. The sum of the BTEX results for each well and the indicator bio-parameter analytical results for each well are plotted on the Y-axis to create the attached plots. The plots are then evaluated by observation for apparent trends in the data.

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Mr. Barney Chan
Chevron Service Station #9-0076
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The observed trend of the indicator parameters of nitrate, sulfate alkalinity and dissolved iron (ferrous) are consistent with the occurrence of intrinsic bioremediation in the groundwater at this site.

The plots of the indicator parameters versus total BTEX for the site wells indicates the potential for intrinsic bioremediation occurring in the groundwater plume associated with this site. The effect of this process will be to stabilize the containment plume and reduce the size of the plume as the source area concentrations are reduced.

If you have any questions or comments, call me at (510) 842-9136 or Curtis Peck at (510) 242-7086.

Sincerely,
CHEVRON PRODUCTS COMPANY



Philip R. Briggs
Site Assessment and Remediation Project Manager

Enclosure

CC. Mr. Alex Perez
Shell Oil Company
PO Box 8080
Matinez, CA 94553

Mr. Scott Hooton
BP Oil Company 295 SW 41st Street
Renton, WA 98055-4931

American Stores Properties, Inc.
348 East South Temple Street
Salt Lake City, UT 84111
Attn. Barbara Russell (Enclosed-copy of May 6, 1998 letter from Mr. Barney Chan)

Mr. Bill Scudder, Chevron

Mr. Curtis Peck, Chevron, CRTC, RIC 100/10-3514

MEMORANDUM

May 15, 1998
Richmond, California

**Evaluation of Intrinsic Bioremediation
Chevron Service Station #9-0076
4265 Foothill Boulevard
Oakland, California**

Mr. Phil Briggs:
San Ramon, California

I have reviewed the analytical data collected during the March 12, 1998 groundwater sampling event for this site in order to make a determination of the presence of intrinsic bioremediation within the hydrocarbon plume at this site. Based on the attached plots of total BTEX versus indicator parameter, it is likely that intrinsic bioremediation is occurring within the hydrocarbon plume at this site. The effect of this process will be to stabilize the plume and reduce the plume as the source area is depleted.

Background

The demonstration of intrinsic bioremediation requires multiple lines of evidence, including analytical data which suggest that bioremediation is actually occurring in the field. The evaluation of indicator parameters across a dissolved contaminant plume can be used in the demonstration of intrinsic bioremediation. One or more trends observed across a dissolved plume (with increasing contaminant concentration) would suggest the potential occurrence of intrinsic bioremediation.

With increasing BTEX concentrations, the expected trend in indicator parameter concentrations would be:

Relative Decrease In:

Dissolved Oxygen
Oxidation- Reduction Potential (Redox)
Nitrate
Sulfate

Relative Increase In:

Dissolved Iron (Ferrous)
Alkalinity

In the attached plots, the sampled wells are presented on the X-axis from the upgradient wells to downgradient wells through the contaminant plume. The resulting order of the wells is C-1, C-2, C-4, C-6, C-8 and C-9 through the plume. Data was collected for all site wells and was not plotted for wells C-3, C-5 and C-7 because of their location with respect to the hydrocarbon plume. The sum of the BTEX results for each well for the 3/12/98 sampling event and the indicator parameter analytical result for each well are plotted on the Y-axis to create the attached plots. The plots are then evaluated by observation for apparent trends in the data.

Results

The nitrate versus BTEX plot indicates that with increasing BTEX concentrations, nitrate is not present in the plume. As the BTEX concentration decreases downgradient of the site, nitrate concentrations increase, indicating the presence of intrinsic bioremediation in the core of the

hydrocarbon plume. Therefore, nitrate is an indicator parameter for intrinsic bioremediation at this site for this sampling event.

The sulfate versus BTEX plot indicates that sulfate is present where BTEX concentrations are low and reduced when BTEX concentrations are elevated. This is an expected trend for sulfate in the presence of BTEX and intrinsic bioremediation. Therefore, the observed sulfate trend through the plume suggests that intrinsic bioremediation is occurring in the groundwater at this site.

The alkalinity versus BTEX plot indicates that the upgradient waters and the interior plume at this site are elevated in alkalinity and the downgradient waters are lower in alkalinity. An increase in alkalinity across a contaminant plume is a potential indicator of biologic activity. Therefore, the observed trend for alkalinity is consistent with the occurrence of intrinsic bioremediation in the groundwater at this site.

The dissolved (ferrous) iron versus BTEX plot indicates that higher concentrations of ferrous iron are present in the higher BTEX waters of the contaminant plume. An increase of ferrous iron in the interior of a plume is a potential indicator of biologic activity at the site. Therefore, the observed trend for ferrous iron is consistent with the occurrence of intrinsic bioremediation in the groundwater at this site.

The plots of indicator parameter versus total BTEX for site wells indicates the potential for intrinsic bioremediation occurring in the groundwater plume associated with this site. The effect of this process will be to stabilize the contaminant plume and reduce the size of the plume as the source area concentrations are reduced.

Please contact me at 242-7086 with questions or comments regarding this review.

Sincerely,

Curtis A. Peck
Hydrogeologist

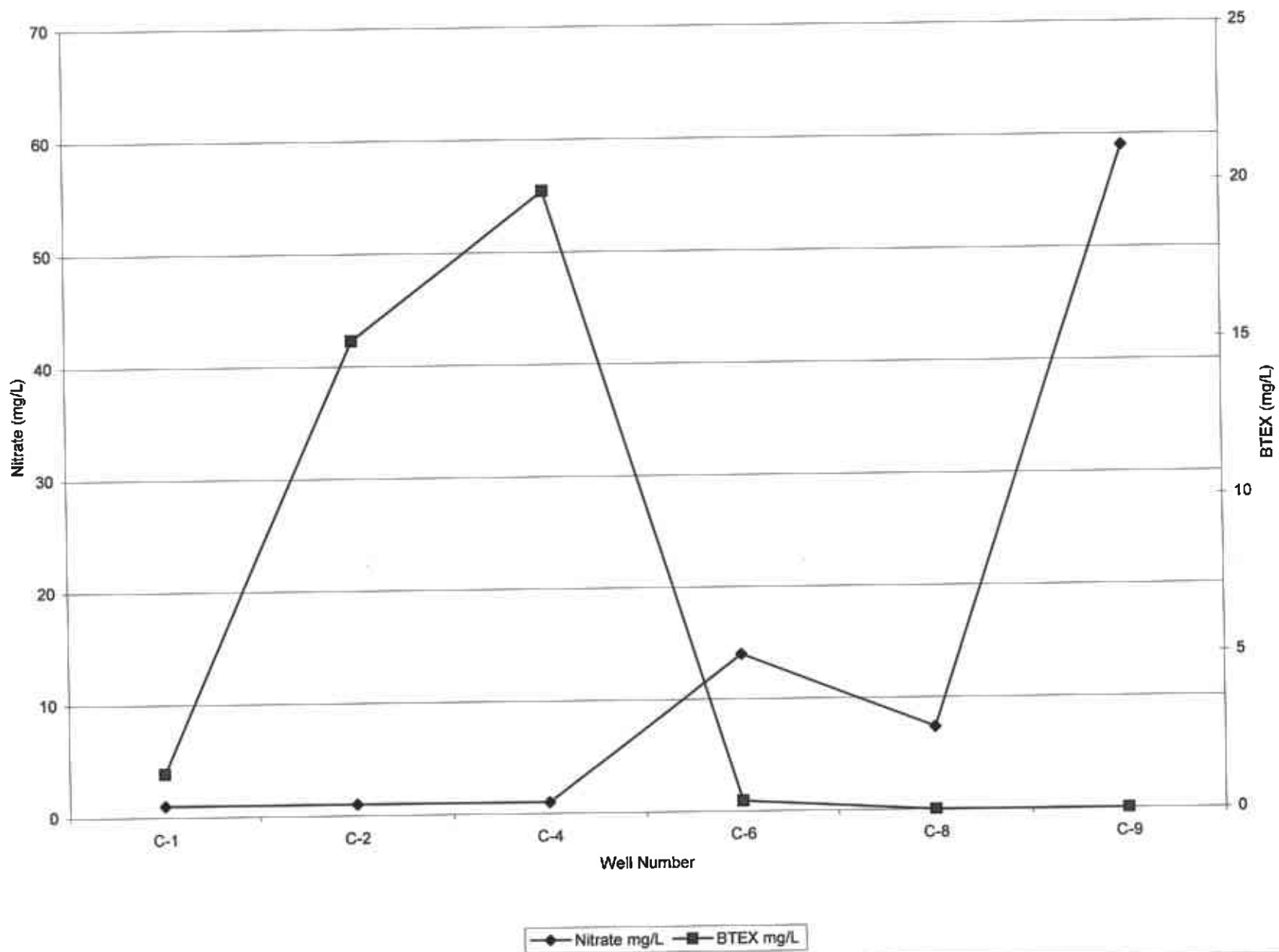
(925) 842-1000 *Chevron Assistance*

Attachments:

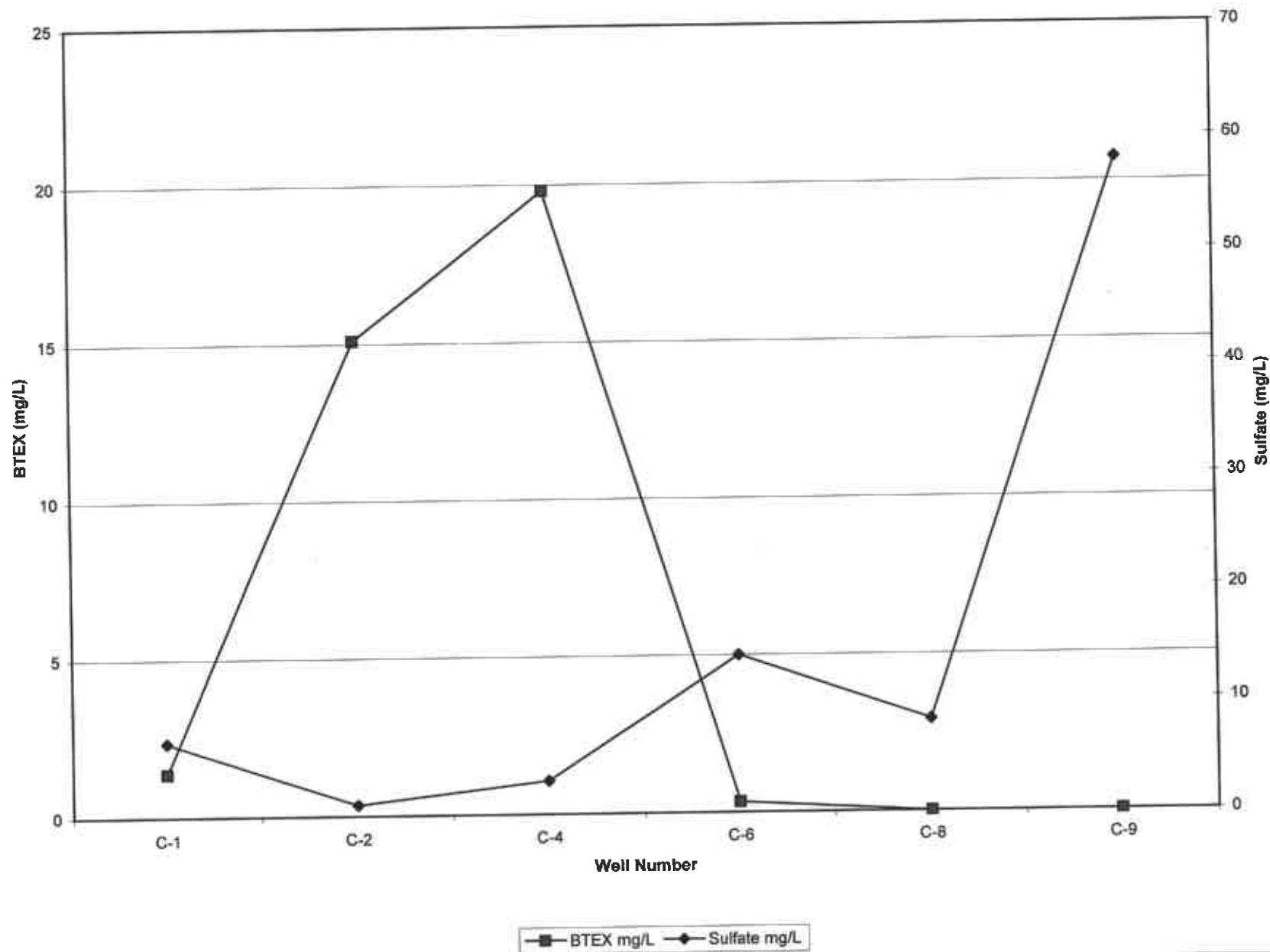
Data Table
Nitrate vs. BTEX
Sulfate vs. BTEX
Alkalinity vs. BTEX
Ferrous Iron vs. BTEX

(925) 842-3561

Chevron Station #9-0076 Nitrate vs. BTEX

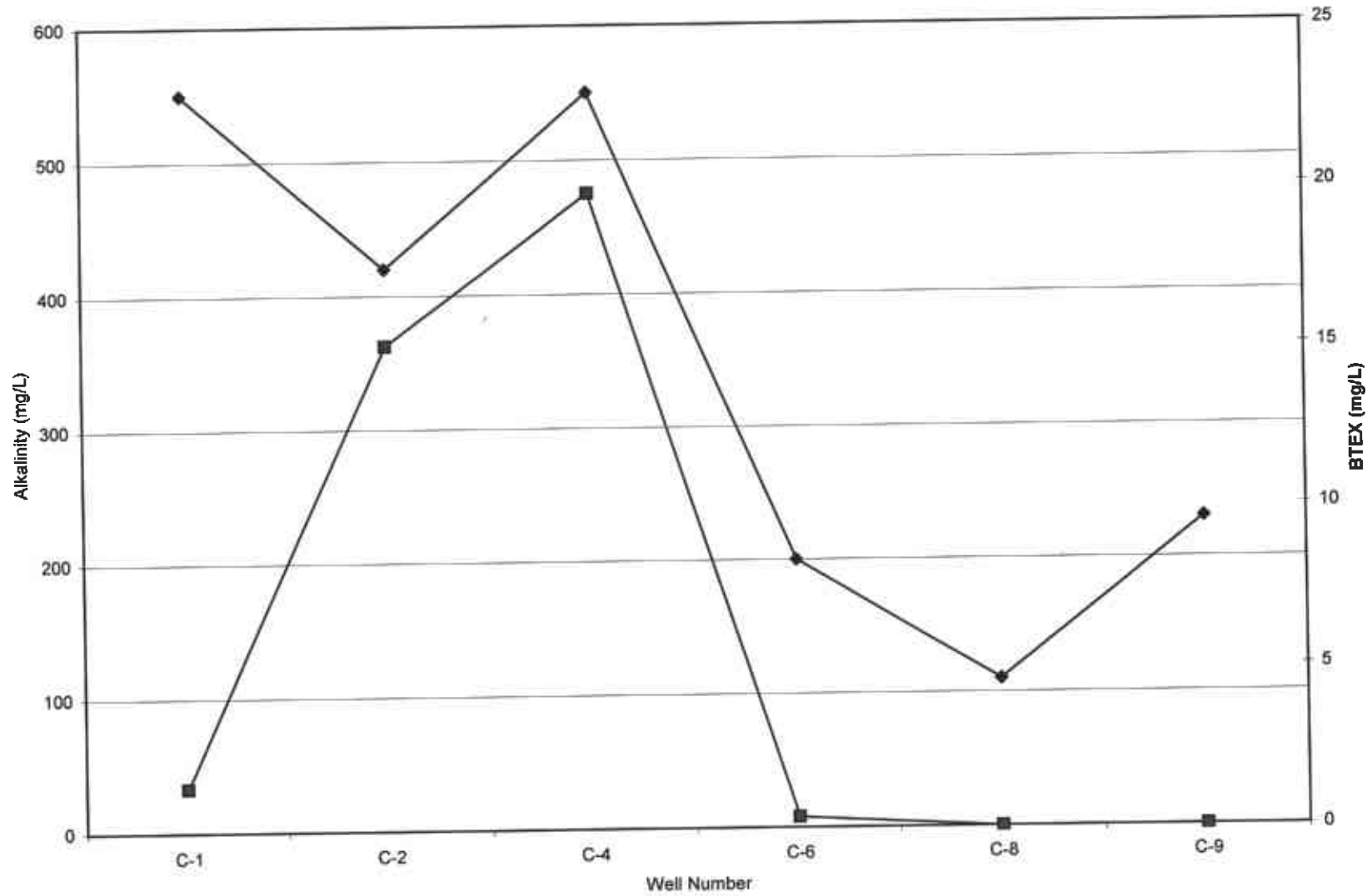


Chevron Station #9-0076 Sulfate vs. BTEX

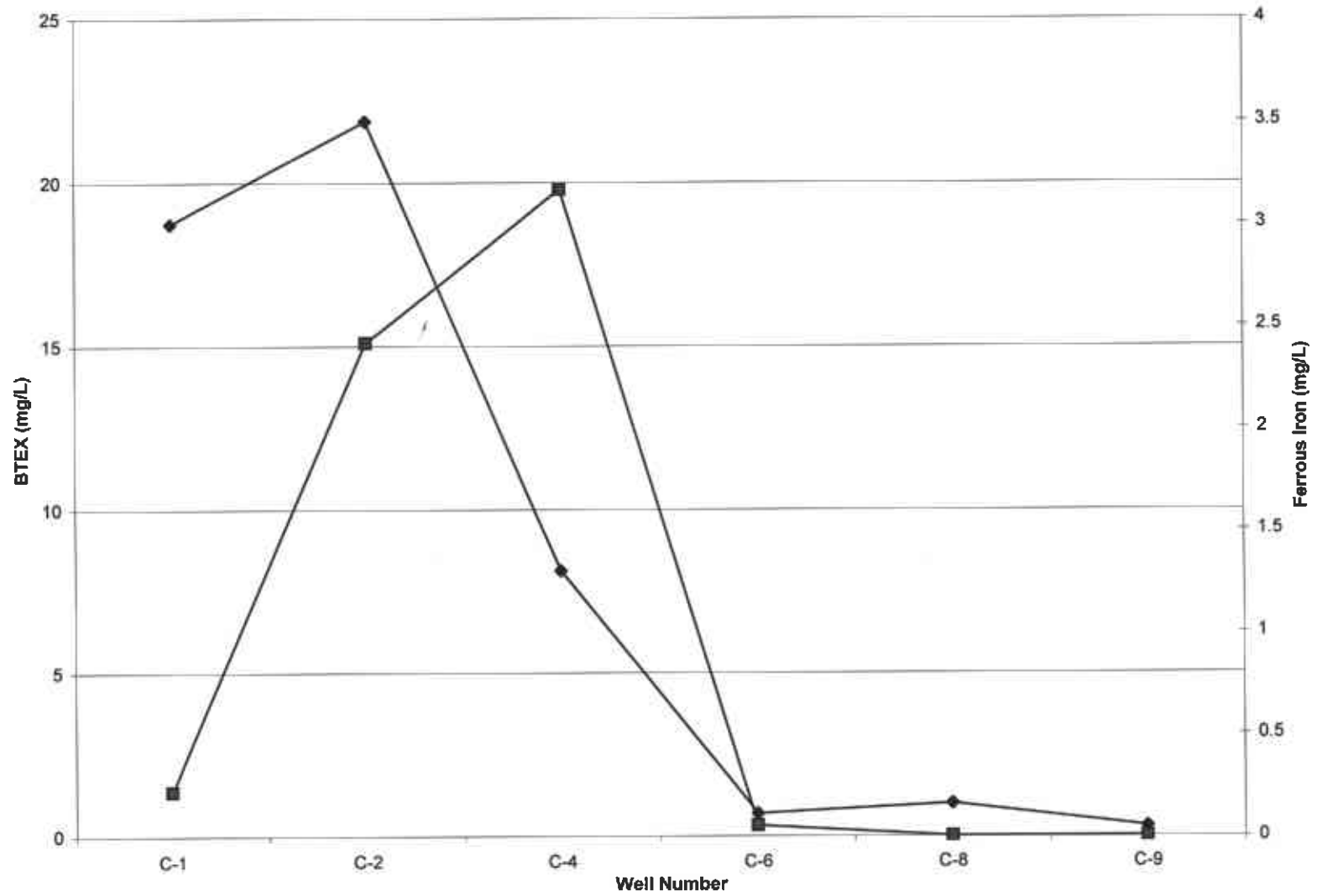


Chevron Station #9-0076

Alkalinity vs. BTEX



◆ Alkalinity mg/L ■ BTEX mg/L



■ BTEX mg/L ♦ Ferrous Iron mg/L