RO-350

Delta
Environmental
Consultants, Inc.

3164 Gold Camp Drive
Suite 200
Rancho Cordova, CA 95670-6021
U.S.A.
916/638-2085
FAX: 916/638-8385

November 22, 2002

Mr. Scott Seery
Alameda County Health Care Services Agency
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Subject: *Evaluation of Dissolved Plume Length and Impacts to Crow Creek*
Former Chevron Service Station No. 9-5607
5269 Crow Canyon Road
Castro Valley, California
Delta Project No. DG95-607

Dear Mr. Seery:

Delta Environmental Consultants, Inc. (Delta), was authorized by Chevron Products Company to evaluate the dissolved plume length and potential impacts to Crow Creek. This letter is being prepared in response to Alameda County Health Care Services Agency (ACHCSA) letter dated January 13, 2000 included in Enclosure A. The location of the site is presented on Figure 1 and a site vicinity map illustrating on-site features is shown on Figure 2.

Evaluation of Plume Length and Potential Impacts to Crow Creek

The main purpose of this document is to present Weiss and Associate's (Weiss) Corrective Action Plan (CAP) included in Enclosure B, and to further assess the dissolved benzene concentrations in the leading edge of the petroleum hydrocarbon plume between the former Chevron UST basin and Crow Creek using recent data.

Historical benzene concentration data for wells C-3, C-6, C-9 and C-15 collected between January 2000 and April 2002 were used to assess whether the benzene plume was shrinking, stable or expanding. The nearest downgradient distance between the former Chevron UST basin and Crow Creek is approximately 270 feet (ft).

Well C-3 was assumed to be located at the center of the source, and wells C-6, C-9 and C-15 were assumed to lie along the plume center line downgradient of the source at locations of 40 ft, 96 ft, and 203 ft, respectively. Concentrations of dissolved benzene vs. distances from source were plotted using data collected during nine groundwater monitoring and sampling events beginning in January 2000. The concentration vs. distance data was fit with a first order exponential trend line. The first order exponential equation of each trend line was used to extrapolate the downgradient distance at which the concentrations declined to 0.001 milligrams per liter (mg/L). The extrapolated plume distances at which the concentrations declined to 0.001 mg/L ranged between 199 ft and 302 ft from the source. Calculations of the median and mean central tendencies for extrapolated plume distances were calculated to be approximately 226 ft and 230 ft, respectively. Plots of dissolved benzene concentrations vs. distance from source are included in Enclosure C.

Discharge of benzene in groundwater to Crow Creek likely fluctuates at concentrations near the State of California Maximum Contaminant Level (MCL) of 0.001 mg/L. Based on the extrapolation of data generated from the July 9, 2002 sampling event, the concentrations of dissolved benzene in groundwater may have been as high as 0.0028 mg/L at the edge of Crow Creek. The mean trend tendency for the eight remaining sampling events since January 2000 indicated that dissolved benzene was below the MCL at a location approximately 45 ft upgradient of Crow Creek.

Conclusions

In conclusion, Delta's recent evaluation of the benzene plume is consistent with Weiss' characterization of the potential impacts to the creek presented in their CAP.

The levels of dissolved benzene concentrations reported in the vicinity of well C-6 since April 2001 do not appear to be migrating downgradient towards well C-9 as evidenced by the decreasing benzene concentration trend in C-9. This decreasing trend is indicative of natural attenuation occurring downgradient of well C-6.

In July 2002, separate phase hydrocarbons (SPH) were reported in well C-3. This was the first reoccurrence of SPH in C-3 since July 1999. Delta submitted a *Source Area Assessment and Proposed Work* report dated September 23, 2002 to address the SPH in the vicinity C-3. Delta believes that the proposed work will reduce source area impacts and aid in the reduction off-site dissolved petroleum hydrocarbon concentrations, which, as a result, will mitigate potential impacts to the creek.

Since July 2000, concentrations of benzene in groundwater samples collected from wells C-9 and C-15 were below the reported benzene concentrations used by Weiss to characterize the plume in November 1999. The overall distance from the source to the leading edge of the plume appears to be decreasing.

Remarks/Signatures

The interpretations contained in this document represent our professional opinions are based, in part, on information supplied by the client. These opinions are based on currently available information and are arrived at in accordance with currently accepted hydrogeologic and engineering practices at this time and location. Other than this, no warranty is implied or intended.

If you have any questions regarding this project, please contact Ben Heningburg at (916) 536-2621 or Steven Meeks at (916) 536-2613.

Sincerely,

DELTA ENVIRONMENTAL CONSULTANTS, INC.

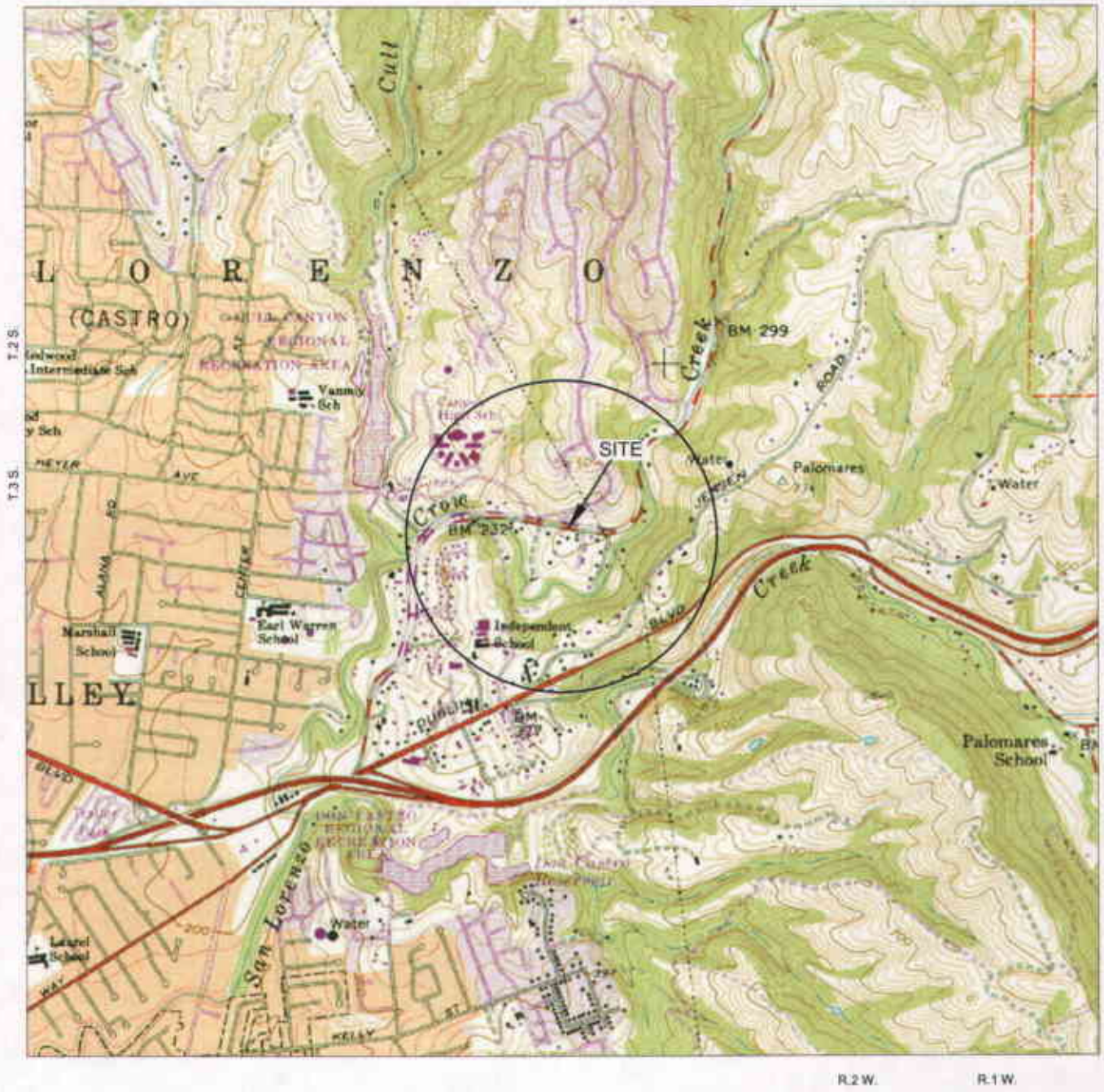
Benjamin I. Heningburg
Project Manager

Steven W. Meeks, P.E.
Senior Engineer
California Registered Civil Engineer No. C057461

11/22/02

Enclosures
BIH (CL003-9-5607 Eval Plume)

cc: Ms. Karen Streich – Chevron Products Company
Mr. Chuck Headlee – California Regional Water Quality Control Board, San Francisco
Mr. Kevin Hinckley - 5269 Crow Canyon Road, Castro Valley, CA 94546
Ms. Diane Riggs – Forest Creek Townhomes Association
Mr. Jim Brownell – Delta Environmental Consultants, Inc.



GENERAL NOTES:
BASE MAP FROM U.S.G.S.
HAYWARD, CALIFORNIA
7.5 MINUTE TOPOGRAPHIC
PHOTOREVISED 1980

North

0 2000 FT

SCALE 1:24,000

QUADRANGLE LOCATION

FIGURE 1

SITE LOCATION MAP

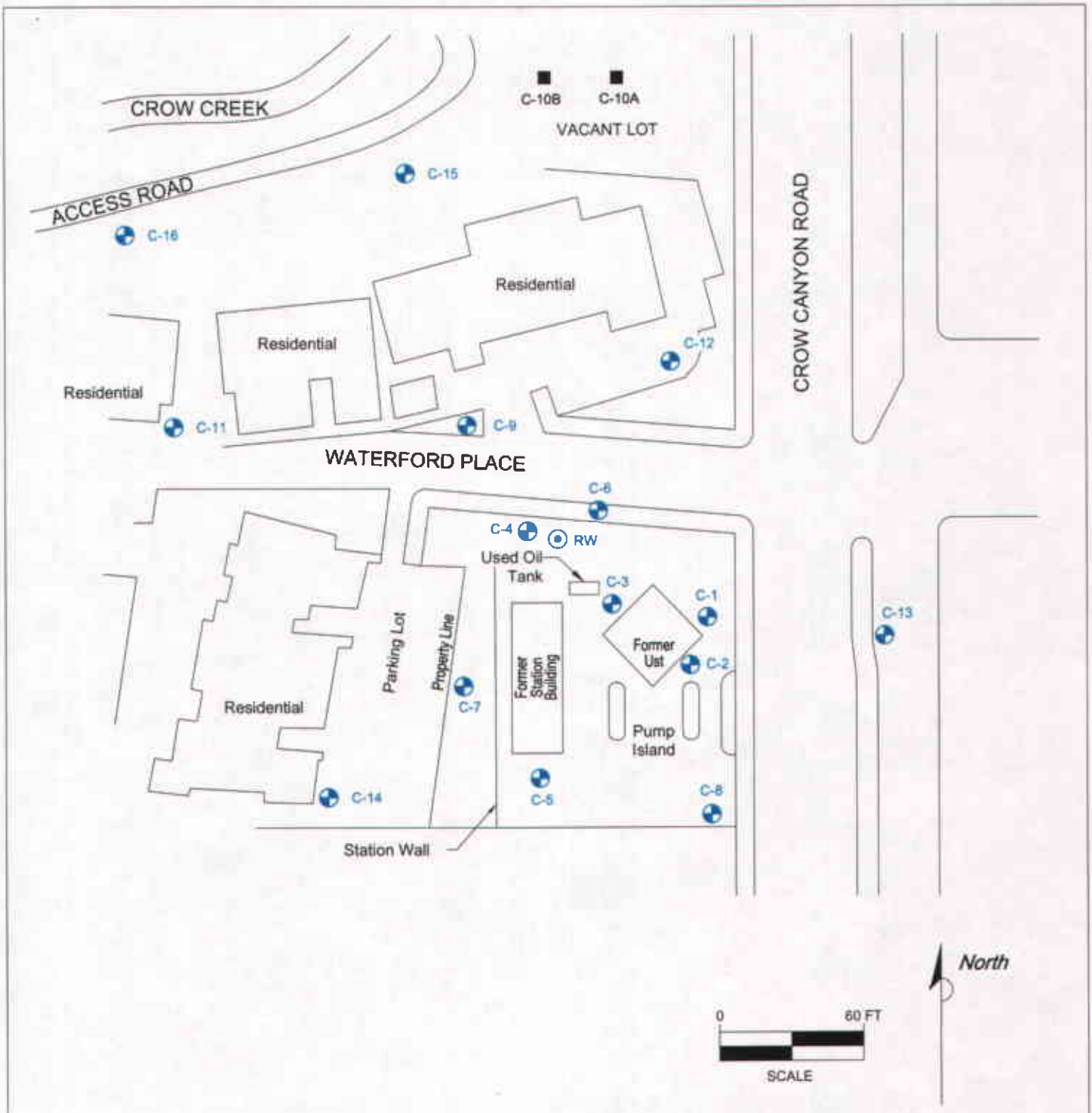
CHEVRON SERVICE STATION NO. 9-5607

5269 CROW CANYON ROAD

CASTRO VALLEY, CALIFORNIA

PROJECT NO. DG95-607	DRAWN BY TLA 7/12/01
FILE NO. 9-5607-1A	PREPARED BY TLA
REVISION NO. 2	REVIEWED BY

Delta Environmental Consultants, Inc.



LEGEND:

⊕	C-1	MONITORING WELL LOCATION
◉	RW	RECOVERY WELL LOCATION
■	C-10A	DESTROYED WELL LOCATION

NOTE: SITE MAP ADAPTED FROM HISTORICAL SITE FIGURES.
SITE DIMENSIONS AND FACILITY LOCATIONS NOT VERIFIED.

FIGURE 2
SITE VICINITY MAP

CHEVRON SERVICE STATION NO. 9-5607
5269 CROW CANYON ROAD
CASTRO VALLEY, CALIFORNIA

PROJECT NO. DG95-607	DRAWN BY TLA 8/19/01
FILE NO. 9-5607-A	PREPARED BY TLA
REVISION NO. 2	REVIEWED BY

Delta Environmental Consultants, Inc.

ENCLOSURE A

Alameda County Health Care Services Agency Letter
Dated June 28, 2002

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

ENVIRONMENTAL HEALTH SERVICES
ENVIRONMENTAL PROTECTION
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577
(510) 567-6700
FAX (510) 337-9335

June 28, 2002

RO0000350

Ms. Karen Streich
Chevron Products Company
P.O. Box 6004
San Ramon, CA 94583-0904

Re: Former Chevron Station #9-5607, 5269 Crow Canyon Road, Castro – Source removal plan and evaluation of impacts to Crow Creek

Dear Ms. Streich:

A meeting was held on January 12, 2000, with representatives from this office, the San Francisco Regional Water Quality Control Board (RWQCB), Chevron, and your consultant at the time, Weiss Associates. The outcome of that meeting was summarized in correspondence from this office dated January 13, 2000, which identified three tasks for Chevron to complete:

1) Revise the (then) current Tier 2 Risk-Based Corrective Action (RBCA) evaluation
2) Evaluate source removal options and submit a proposal for this work, and
3) Determine potential impacts to Crow Creek through plume modeling or other means

Tasks 2 and 3 were to be completed within 60 days of the date of the January 13th letter.

Although Task 1 was satisfied through submittal of a Weiss Associates report dated May 31, 2000, entitled "Project Summary", this office has not received any submittal addressing Tasks 2 and 3 to date. A copy of the referenced January 13, 2000, letter is attached for your reference.

At this time Chevron is directed to submit a response to Tasks 2 and 3, above, within 60 days of the date of this letter. Please be advised that this letter constitutes an official request for technical reports pursuant to Water Code Sec. 13267(b).

Please contact me at (510) 567-6783 should you have any questions about the content of this letter.

Sincerely,

Scott O. Seery, CHMM
Hazardous Materials Specialist

attachment (addressee, only)

c: Chuck Headlee, RWQCB

Post-it® Fax Note 7671	Date 9-26-02	# of pages ▶ 1
To Steven Meeks	From Scott Seery	
Co./Dept.	Co.	
Phone #	Phone # 510-567-6783	
Fax # 916-638-8385	Fax #	

ENCLOSURE B

Weiss and Associate's Corrective Action Plan
Dated May 31, 2000

Weiss Associates Environmental and Geologic Services

5801 Christie Avenue, Suite 600, Emeryville, CA 94608-1827 Fax: 510-547-5043 Phone: 510-450-6000

May 31, 2000

Tom Bauhs
Chevron Products Company
P.O. Box 5004
San Ramon, California 94583-0804

RE: **Corrective Action Plan**
Former Chevron Service Station #9-5607
5269 Crow Canyon Road
Castro Valley, California
Weiss Job #4-1129-4

Dear Mr. Bauhs:

On behalf of Chevron Products Company (Chevron), Weiss Associates (Weiss) has prepared this Corrective Action Plan (CAP) for the above referenced site. This CAP was prepared to satisfy the second and third action items in the January 13, 2000 letter from Scott Seery of Alameda County Health Care Services Agency (ACHCSA) to Brett Hunter of Chevron. The action items are:

- Explore source removal options and propose the best available technology (BAT); and,
- Evaluate plume length and potential impacts to Crow Creek.

The plume characterization and technology evaluation are presented below. A future action plan for plume monitoring and source removal is included.

PLUME CHARACTERIZATION

Separate-Phase Hydrocarbon Source

Between March 5 and March 21, 1985, Groundwater Technology Incorporated (GTI) of Concord, California installed groundwater monitoring wells C-1 through C-8 (Figure 1). GTI measured separate-phase hydrocarbon (SPH) thickness in wells C-1 and C-3 and immediately began bailing SPH from those wells. On May 31 1985, GTI installed well RW-1. GTI measured SPH in well RW-1 after installation and began SPH bailing on a bi-weekly basis. GTI also connected a groundwater extraction system to well RW-1 consisting of a submersible pump and carbon treatment. As of September 1987, product recovery records showed that at least 32 gallons of petroleum hydrocarbons were recovered due to SPH bailing.

On September 13, 1989, Chevron initiated groundwater monitoring and SPH bailing, if SPH was found, on a quarterly basis. As of November 1, 1999, SPH was found in well C-3 during 5 of 44 monitoring events since sample collection began. The largest SPH thickness in well C-3 was 0.7 ft on July 23, 1999. The SPH thickness ranged from 0.01 ft to 0.03 ft during the other 4 SPH events. Between September 13, 1989 and July 23, 1999 SPH was not found in any monitoring well except C-3.

Product recovery data indicates that most of the recoverable SPH was removed as of September of 1987. A small pocket of SPH may remain in the vicinity of well C-3. The pocket is likely located between 23 feet (ft) and 32 ft below ground surface (bgs) based on the depth to water during the 5 SPH events. Additionally, 4 out of the 5 SPH events occurred during the dry months of July through October, when the water table was low.

Dissolved-Phase Plume

Dissolved petroleum hydrocarbon concentrations are highest on the west side of the former UST complex. On November 1, 1999, the concentration of benzene in groundwater was 23.9 mg/L in well C-3. Dissolved hydrocarbon concentrations attenuate rapidly in the westward (downgradient) and southward (cross-gradient) directions. Benzene concentrations in groundwater in the vicinity of the Forest Creek Townhomes residential properties range from less than 0.0005 mg/L near Crow Creek to approximately 7 mg/L near the entrance to Waterford Place. Dissolved benzene concentrations decline in the downgradient direction and are near or below 0.0005 mg/L before groundwater reaches Crow Creek. Dissolved benzene concentrations are near or below 0.0005 mg/L between the former service station and the commercial property to the East and the privately owned open space to the North.

Evaluation of Plume Length and Potential Impacts to Crow Creek

Crow Creek is a natural surface water creek that flows into San Lorenzo Creek and discharges into San Francisco Bay. The nearest downgradient distance between the former Chevron USTs and Crow Creek is 270 ft (Figure 1).

The relationship between benzene concentration and downgradient distance was evaluated for plume centerline wells C-3, C-6, C-9, and C-15. Well C-3 was assumed to be located at the center of the source, and wells C-6, C-9, and C-15 were assumed to lie along the plume centerline at locations 40 ft, 96 ft, and 203 ft respectively downgradient of the source. A plot of dissolved benzene concentration vs. distance, based on November 1, 1999 monitoring data, is presented in Figure 2. The concentration vs. distance data were fit with a first order exponential trend line. Weiss used the first order exponential equation of the trend line to extrapolate the downgradient distance that the concentration declines to 0.001 mg/L. The extrapolated distance was approximately 300 ft. Based on this extrapolation, the concentration of dissolved benzene may have been approximately 0.0029 mg/L at the edge of Crow Creek.

Dissolved benzene data from well C-15 indicates that the concentration has fluctuated periodically between <0.0005 mg/L and 0.071 mg/L since monitoring began at that location. A plot

of dissolved benzene concentration vs. distance during the most recent low cycle is shown in Figure 3. Based on October 13, 1998 data the plume was approximately 200 ft long at that time.

Discharge of benzene in groundwater to Crow Creek likely fluctuates at concentrations near the State of California Maximum Contaminant Level of 0.001 mg/L. Based on the extrapolation generated from November 1, 1999 data, the concentration of benzene in groundwater may have been as high as 0.0029 mg/L at the edge of Crow Creek. Yet, October 13, 1998 data, collected during a low concentration cycle, indicated that dissolved benzene was below the MCL at a location 70 ft upgradient of the creek.

TECHNOLOGY EVALUATION

Recommended Separate-Phase Hydrocarbon Source Technology

The best available technology for this site is one that will remove the remaining SPH from the source area located in the vicinity of well C-3. Technologies that are capable of removing SPH include active skimmers/pumps, passive skimmers and hand bailing. These three technologies are applicable to SPH quantities that vary from continuous SPH recharge to thin layers of SPH occurring in a well on an occasional basis. The technologies and their applications are:

1. Active skimmers/pumps apply to continuous or frequent SPH recharge;
2. Passive skimmers are applicable if small amounts of SPH enter the well on a frequent basis; and,
3. Hand bailing is applicable if SPH enters the well on an occasional basis.

Based on the source characterization presented above, SPH is occasionally entering well C-3 during summer or fall when the depth to water is approximately 30 ft bgs. The frequency of SPH at the site indicates that hand bailing between July and October appears to be the most appropriate approach. In addition, SPH is more likely to become available for bailing when the water table is approximately 30 ft bgs in C-3.

Recommended Dissolved Plume Technology

The results of previous evaluations by Chevron[1] and Weiss[2] indicate that the hydrocarbon plume is currently undergoing biodegradation. If dissolved oxygen concentrations are increased along the plume centerline, then biodegradation will likely reduce the plume length and prevent discharge of dissolved benzene to Crow Creek. Therefore, we recommend installing ORC socks in plume centerline wells C-3, C-6, C-9, and C-15 to raise the dissolved oxygen concentration and

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[1] Chevron Research and Technology Company, August 13, 1992. Interoffice Memorandum, Predictions Concerning the Fate and Transport of Dissolved Benzene at Chevron Service Station #9-5607, 5269 Crow Canyon Road, Castro Valley, California.

[2] Weiss, 1997c. Soil Vapor Survey and Risk Assessment Results, Chevron Service Station #9-5607, 5269 Crow Canyon Road, Castro Valley, California. January 20, 1997.

enhance biodegradation of the plume between the source and Crow Creek. ORC treatment will not likely be necessary after the SPH source is removed.

FUTURE ACTION PLAN

SPH Source Remediation

We recommend allowing the water table to drop below 30 ft bgs before attempting to induce SPH into well C-3. When the water table declines below 30 ft bgs in C-3 or if SPH appears, the site should be visited to measure and bail SPH. If the water table is below 30 ft bgs and SPH is not present, then the well could be purged several times in an attempt to dislodge SPH. SPH should be bailed daily if it is encountered.

We recommend visiting the site to measure and bail SPH during the first week of each month between July and October of 2000. If SPH is not present during the monthly visit, then the technician should bail the well and return to inspect for SPH on the following day. Bailing should be discontinued for the month if SPH is not present after two consecutive daily visits. If SPH is found in the well during three consecutive daily visits, then the technician should install a passive skimmer and return one week later to measure and remove SPH. The frequency of site visits thereafter would be determined based on maintenance requirements for the passive skimmer.

We recommend that SPH removal volumes be summarized in a table at the end of October 2000, and evaluated to determine whether bailing activities are complete. If little or no SPH is encountered during bailing activities in 2000, then SPH measurement and bailing should only occur during the regular quarterly monitoring visits in the future. Otherwise, SPH skimming and/or bailing activities should continue as long as SPH is found in C-3 on a frequent basis.

Dissolved Plume Remediation

We recommend installing ORC socks in plume centerline wells C-3, C-6, C-9, and C-15 in June of 2000. The ORC should remain in place through October 2000, except in well C-3 during bailing or if SPH is present. After October 2000, the use of ORC socks should be re-evaluated. The recommended ORC replacement frequency is once per 6 months. We recommend using ORC for as long as SPH remains present in well C-3. If SPH is no longer present in the vicinity of well C-3, then the plume will likely retreat without the need for additional dissolved oxygen.

Groundwater Monitoring Plan

Groundwater monitoring should continue in wells C-3, C-6, C-9, and C-15 on a quarterly basis, until SPH is no longer present in the vicinity of well C-3. The monitoring frequency should be evaluated in October 2000, when SPH bailing and ORC remedial actions are being evaluated. If SPH is no longer present, then monitoring should be reduced to wells C-3 and C-15 on a yearly basis.

Wells C-5 and C-8 should be monitored on a yearly basis to detect potential releases at upgradient properties. Groundwater monitoring should be discontinued when data from wells C-3 and C-15 indicate that the benzene concentration is steadily declining to the MCL.

All other wells should be abandoned.

We trust this document meets your needs. Please call Weiss at (510) 450-6000, if you have any questions.

REGISTERED PROFESSIONAL ENGINEER
TIMOTHY R. UTTERBACK
No. C056986
Exp. 6/30/01
CIVIL
STATE OF CALIFORNIA

Sincerely,
Weiss Associates

Tim Utterback P.E.
Project Engineer

Enclosures: Figure 1. Site Plan View
Figure 2. Dissolved Benzene Concentration vs. Distance, November 1, 1999
Figure 3. Dissolved Benzene Concentration vs. Distance, October 13, 1998

TRU:all

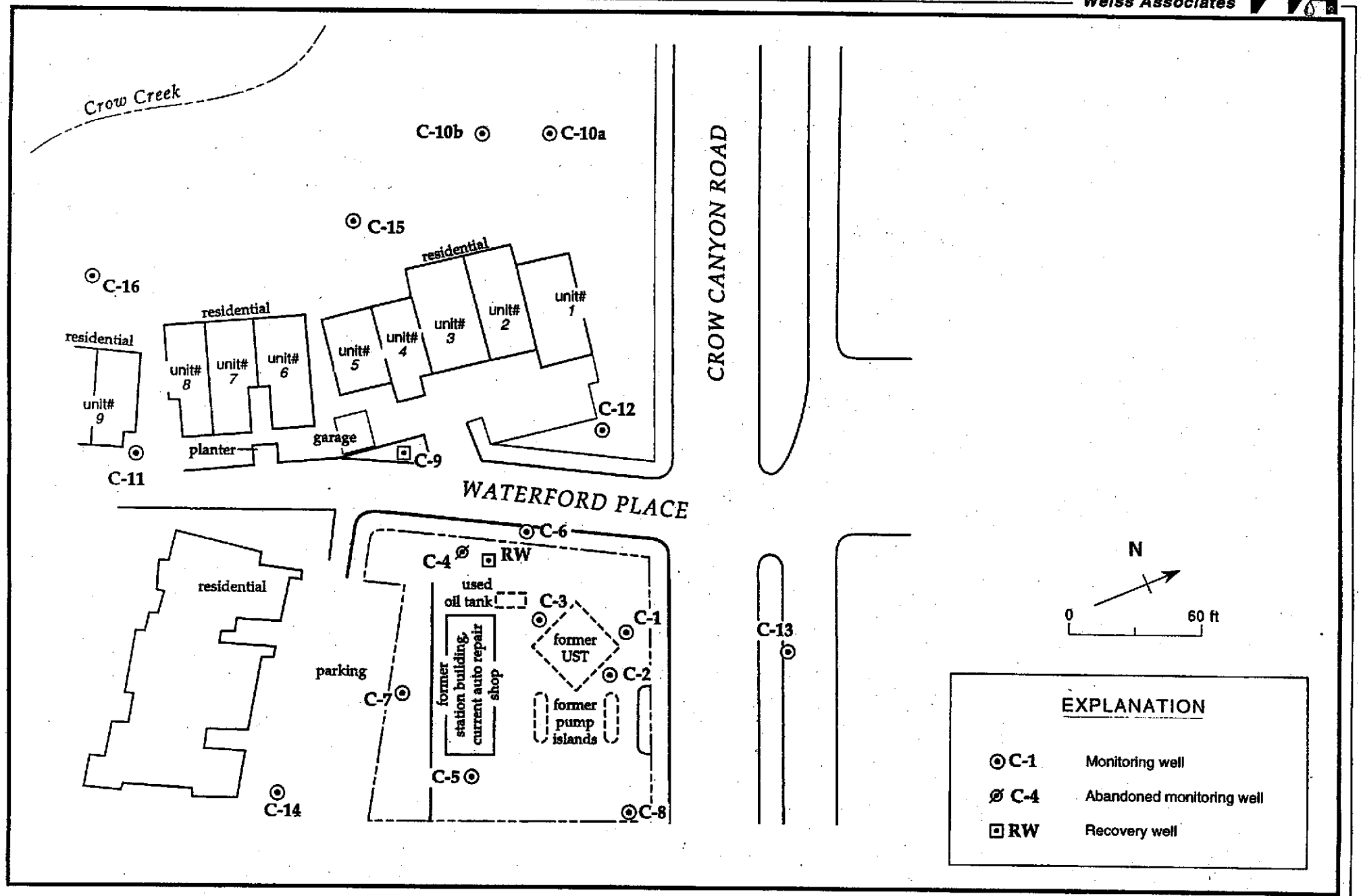
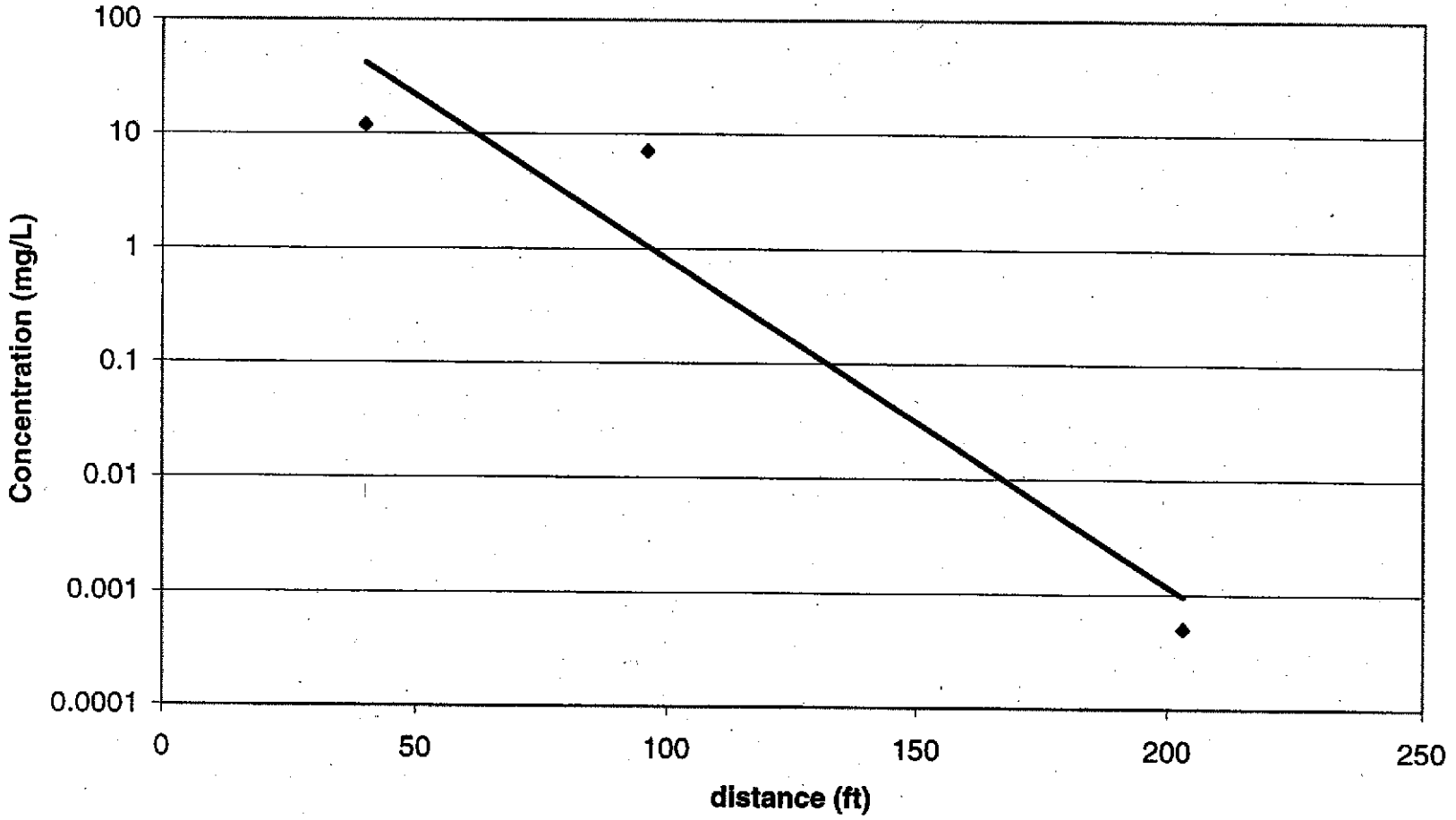


Figure 1. Site Plan - Chevron Station 9-5607, 5269 Crow Canyon Road, Castro Valley, California

C1129-19.ai

04/24/00

Figure 3. Dissolved Benzene Concentration vs Distance, October 13, 1998

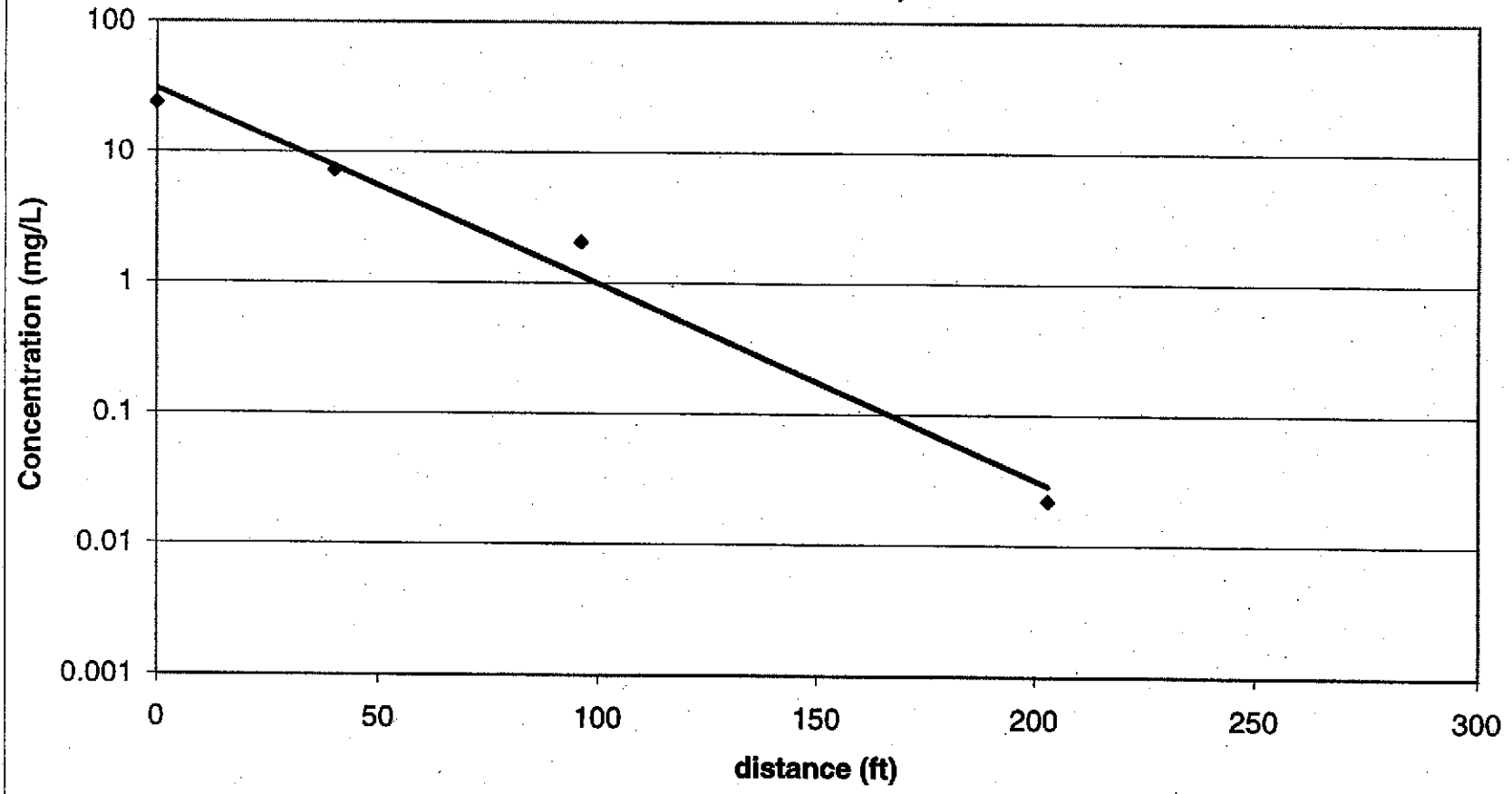


$y = 573.51e^{-0.0655x}$ Concentration = 1 ug/L when distance = 200 feet

$R^2 = 0.9134$

J:\Chevron\1129\CAP\Conc v dist Oct 98 Chart 2Conc v dist Oct 98 Chart 2

Figure 2. Dissolved Benzene Concentration vs Distance, November 1, 1999



$y = 30.833e^{-0.0344x}$

$R^2 = 0.9825$

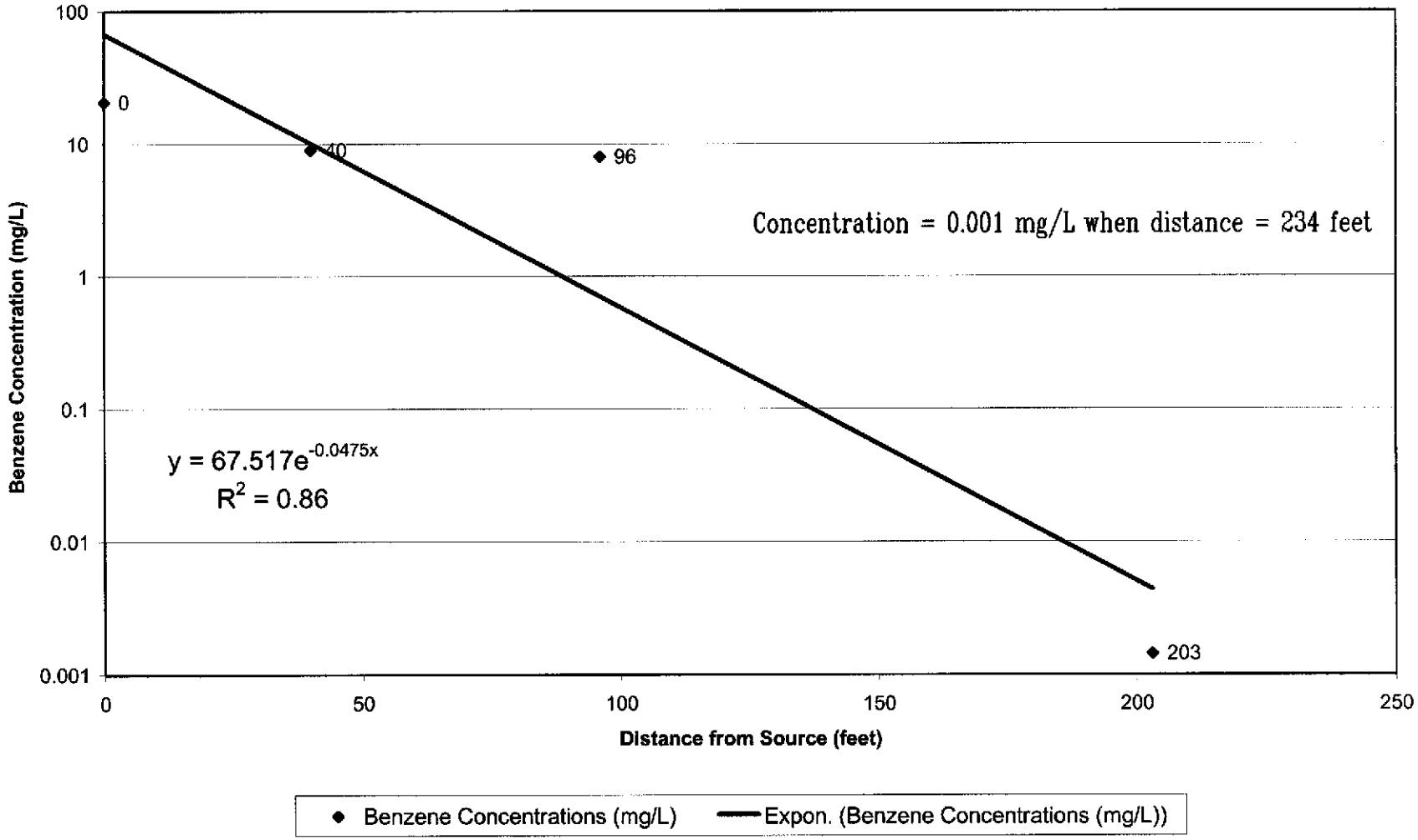
Concentration = 0.001 mg/L when distance = 300 feet

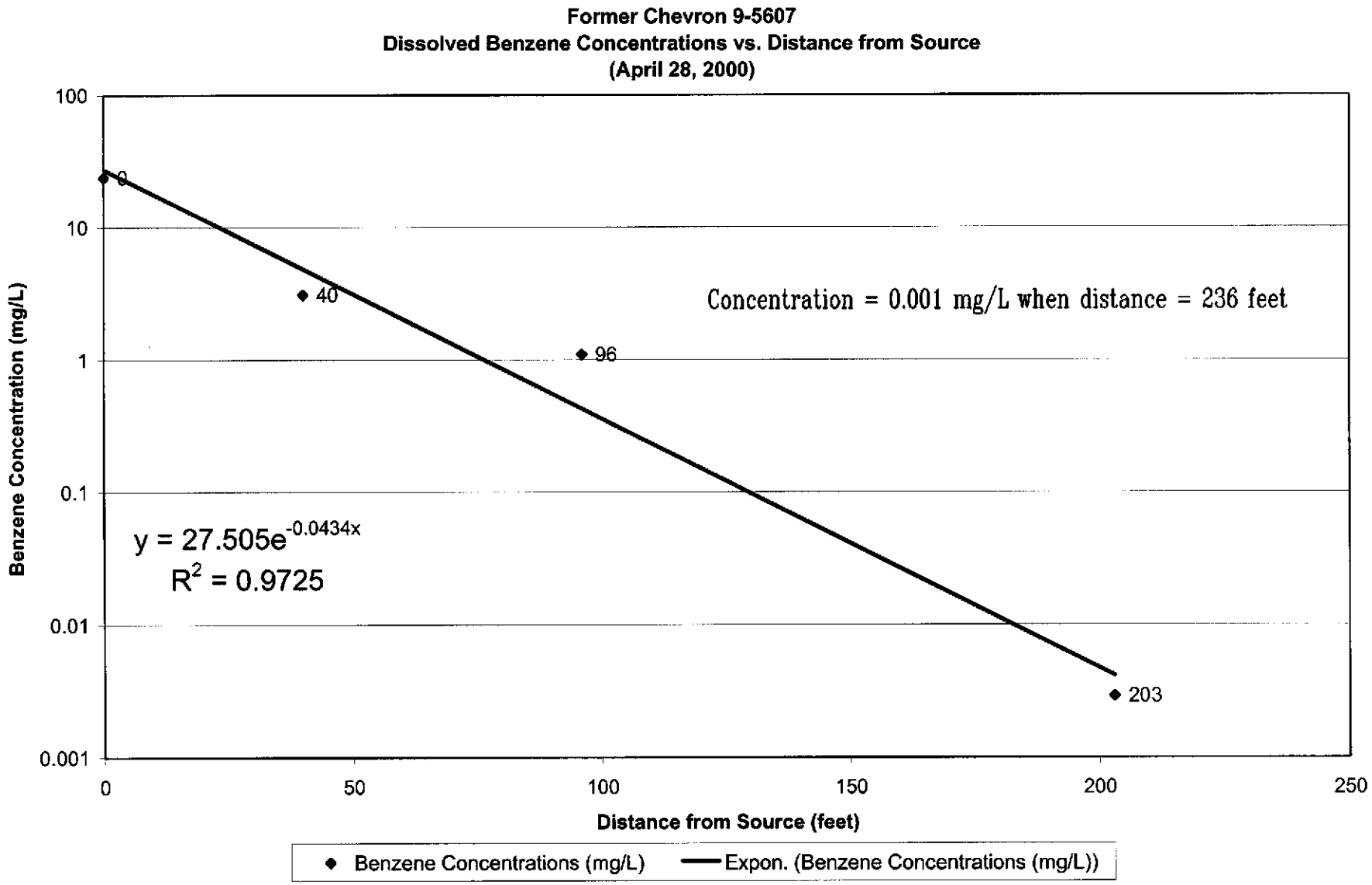
J:\Chevron\1129\CAP\Conc v dist Nov 99 Chart 2Conc v dist Nov 99 Chart 2

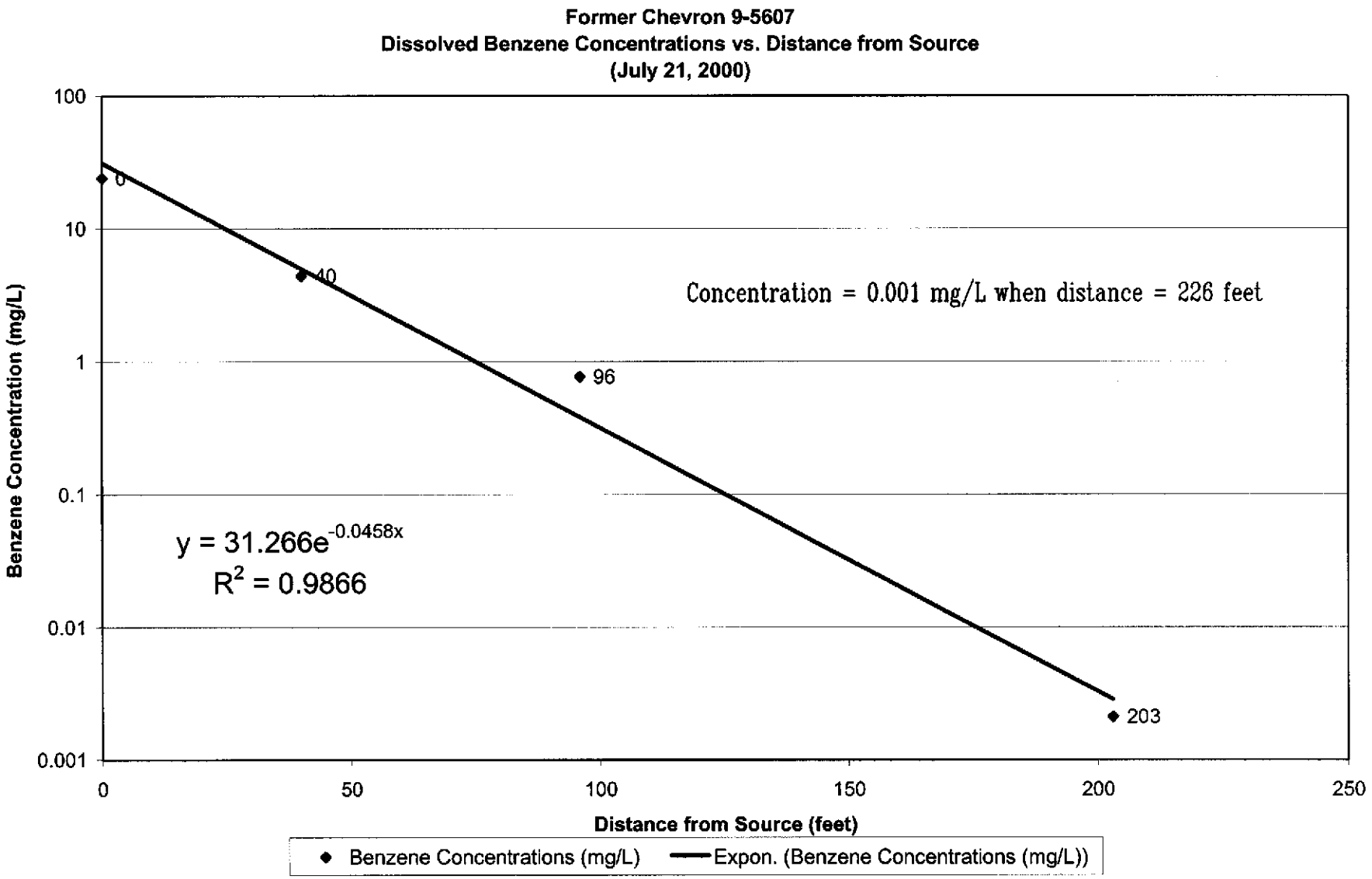
ENCLOSURE C

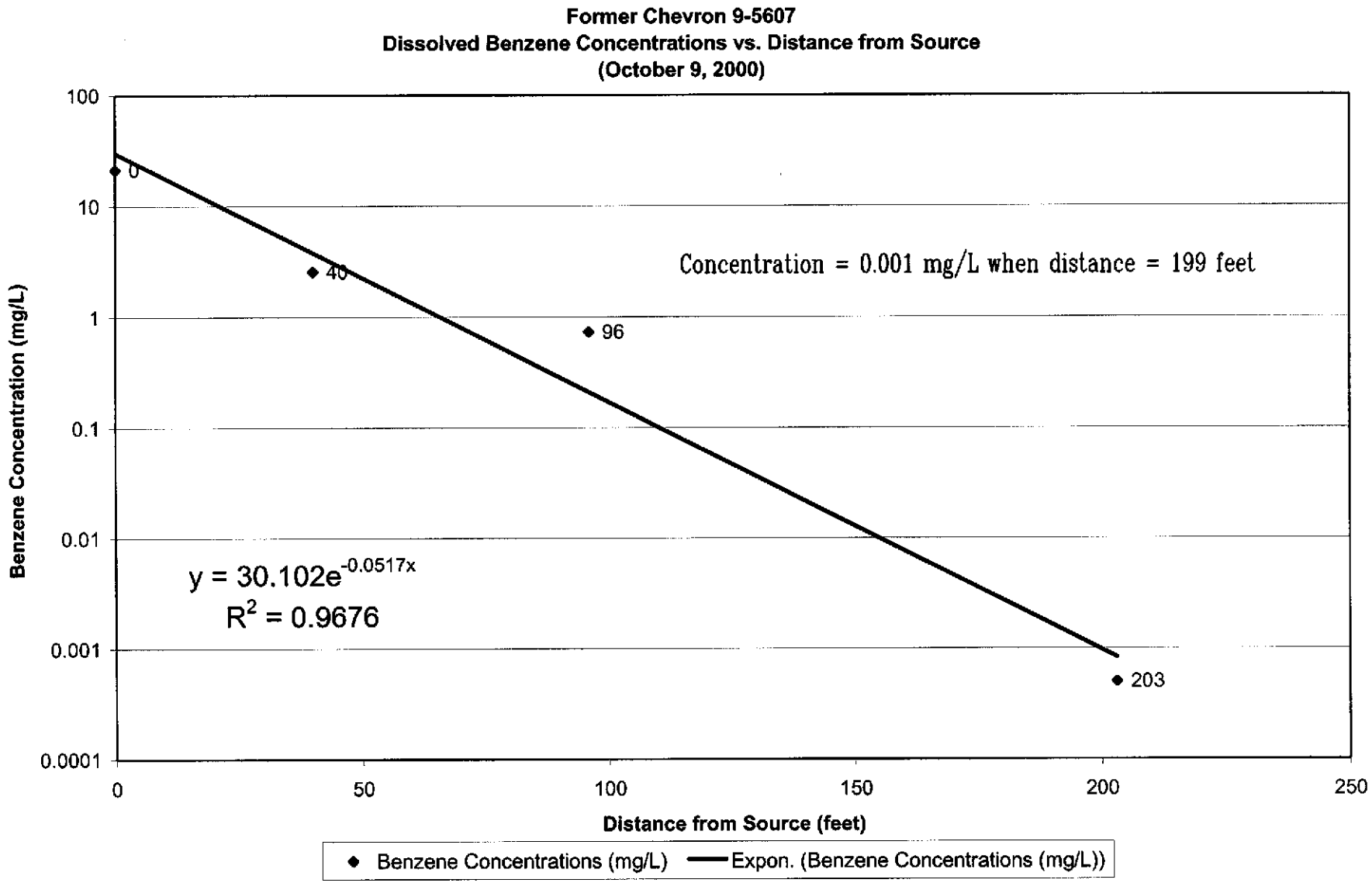
Graphs of Dissolved Benzene Concentrations vs. Distance From Source
For Monitoring Wells C-1, C-6, C-9, and C-12

Former Chevron 9-5607
Dissolved Benzene Concentrations vs. Distance from Source
(January 20, 2000)

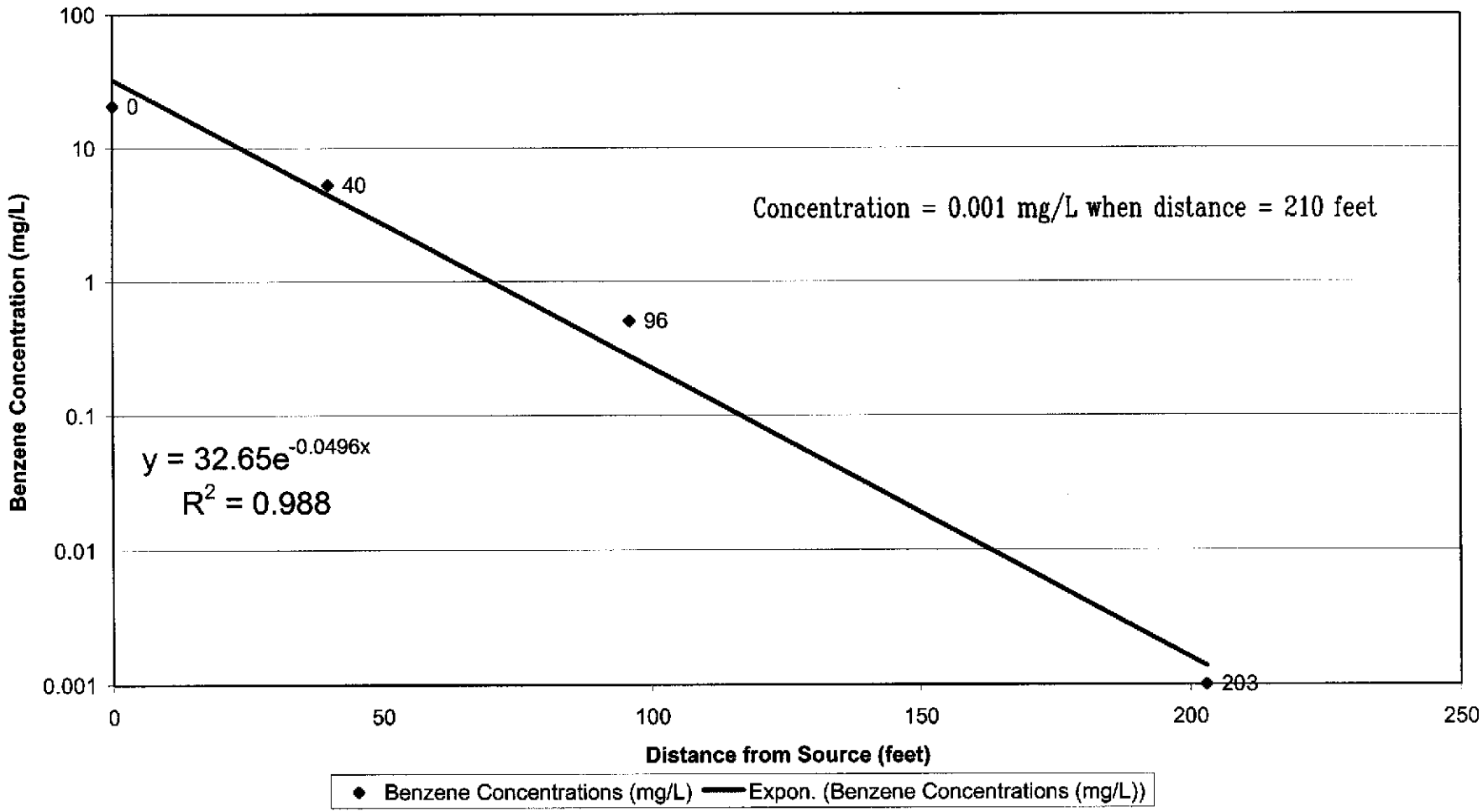


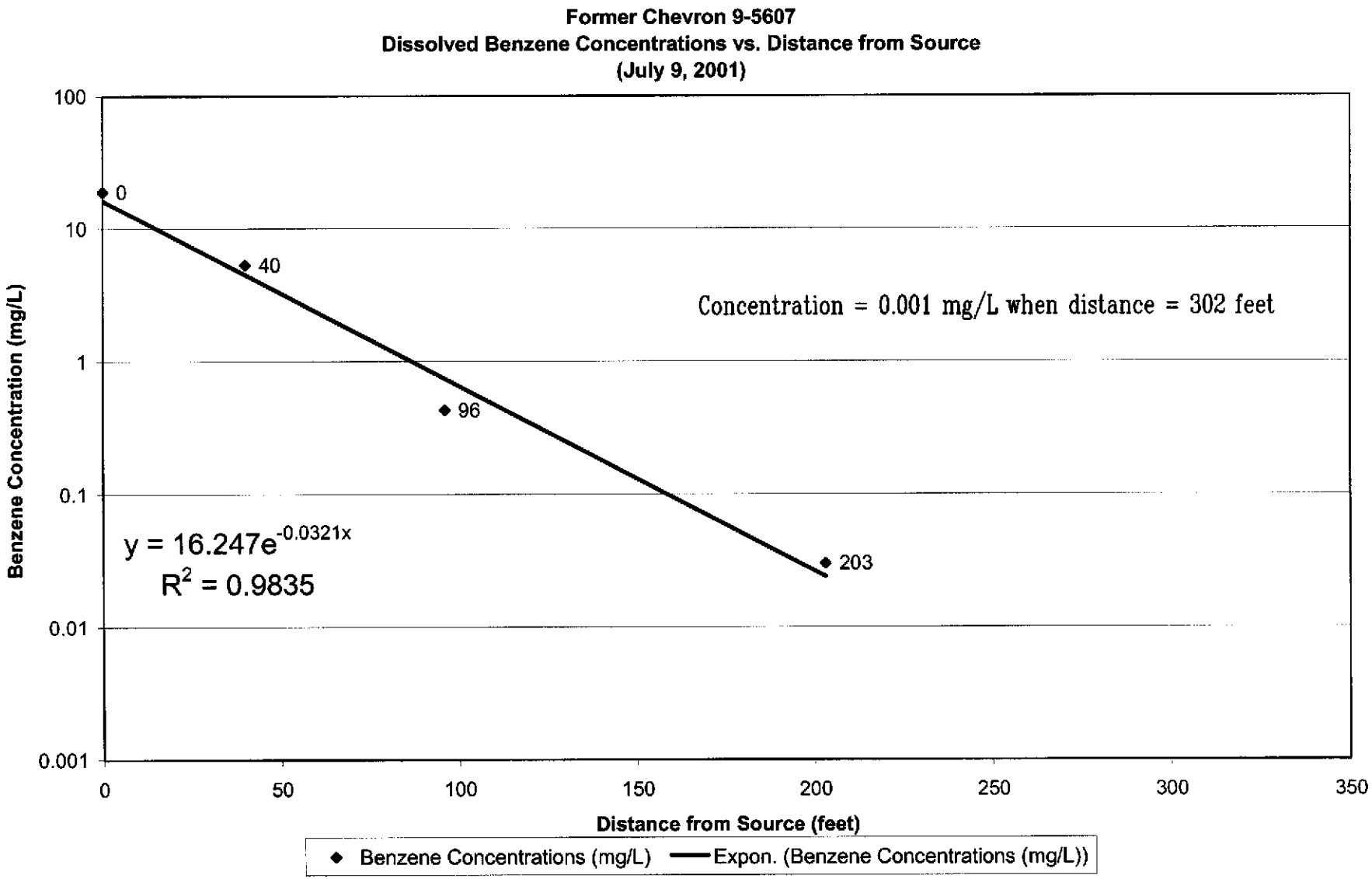

Former Chevron 9-5607
Dissolved Benzene Concentrations vs. Distance from Source
(April 28, 2000)
Benzene Concentration (mg/L)
100
10
1
0.1
0.01
0.001
0
50
100
150
200
250
Distance from Source (feet)
0
40
96
203
Concentration = 0.001 mg/L when distance = 236 feet
y = 27.505e-0.0434x
R2 = 0.9725
Benzene Concentrations (mg/L)
Expon. (Benzene Concentrations (mg/L))

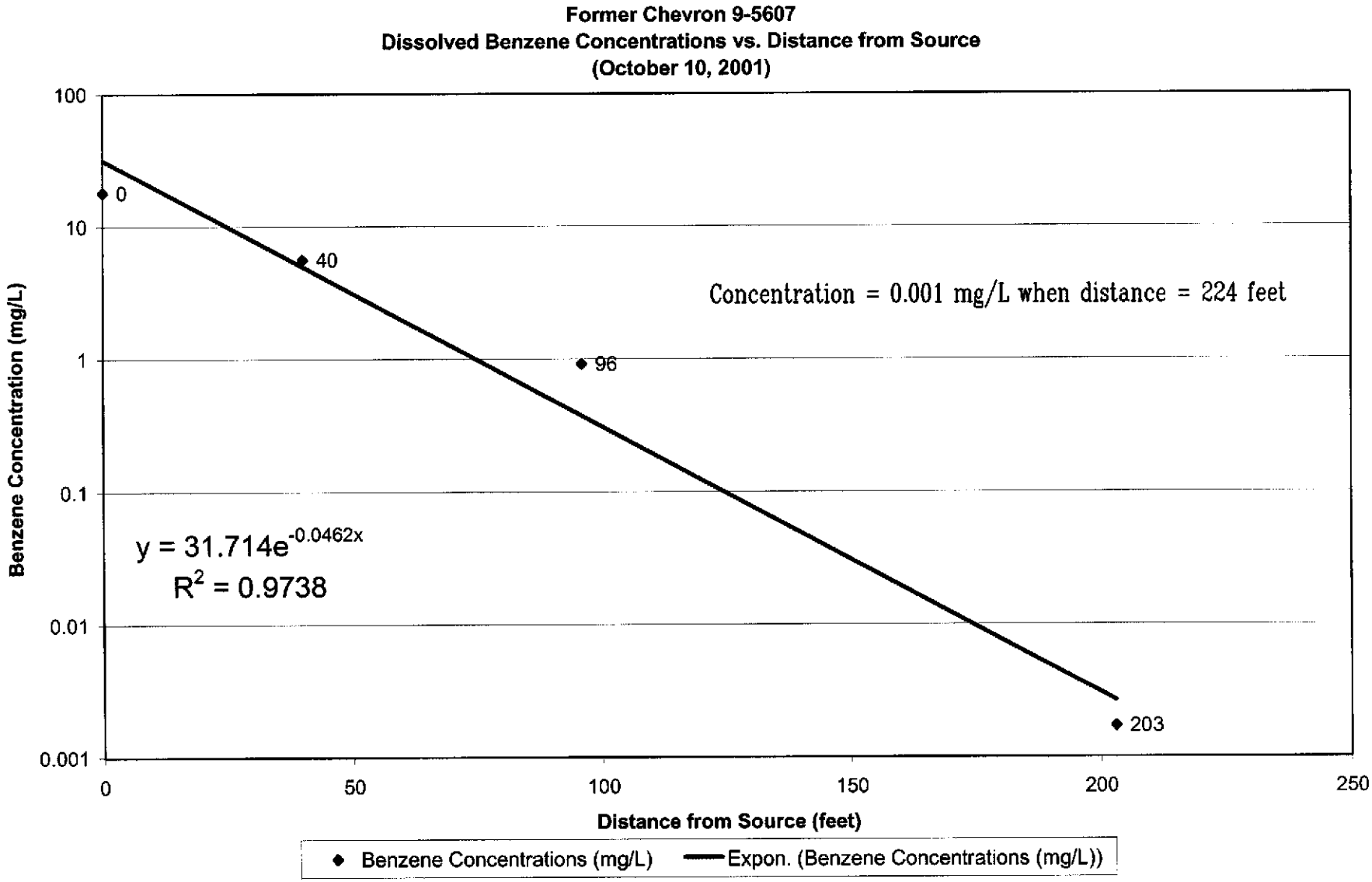

Former Chevron 9-5607
Dissolved Benzene Concentrations vs. Distance from Source
(July 21, 2000)
Benzene Concentration (mg/L)
100
10
1
0.1
0.01
0.001
0
40
96
203
Concentration = 0.001 mg/L when distance = 226 feet
y = 31.266e-0.0458x
R2 = 0.9866
0
50
100
150
200
250
Distance from Source (feet)
Benzene Concentrations (mg/L)
Expon. (Benzene Concentrations (mg/L))

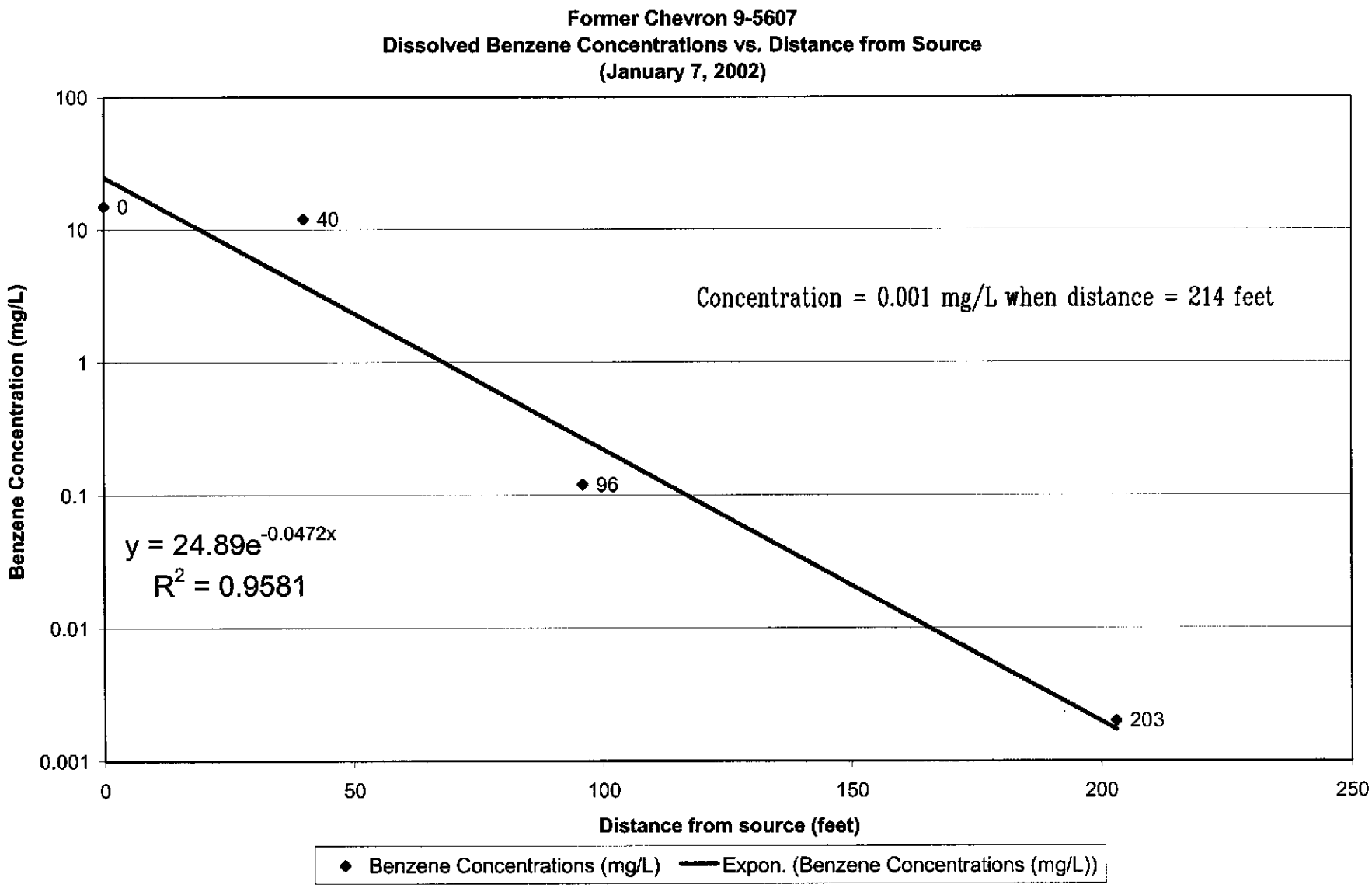

Former Chevron 9-5607
Dissolved Benzene Concentrations vs. Distance from Source
(October 9, 2000)
Benzene Concentration (mg/L)
100
10
1
0.1
0.01
0.001
0.0001
0
50
100
150
200
250
Distance from Source (feet)
0
40
96
203
Concentration = 0.001 mg/L when distance = 199 feet
y = 30.102e-0.0517x
R2 = 0.9676
Benzene Concentrations (mg/L)
Expon. (Benzene Concentrations (mg/L))

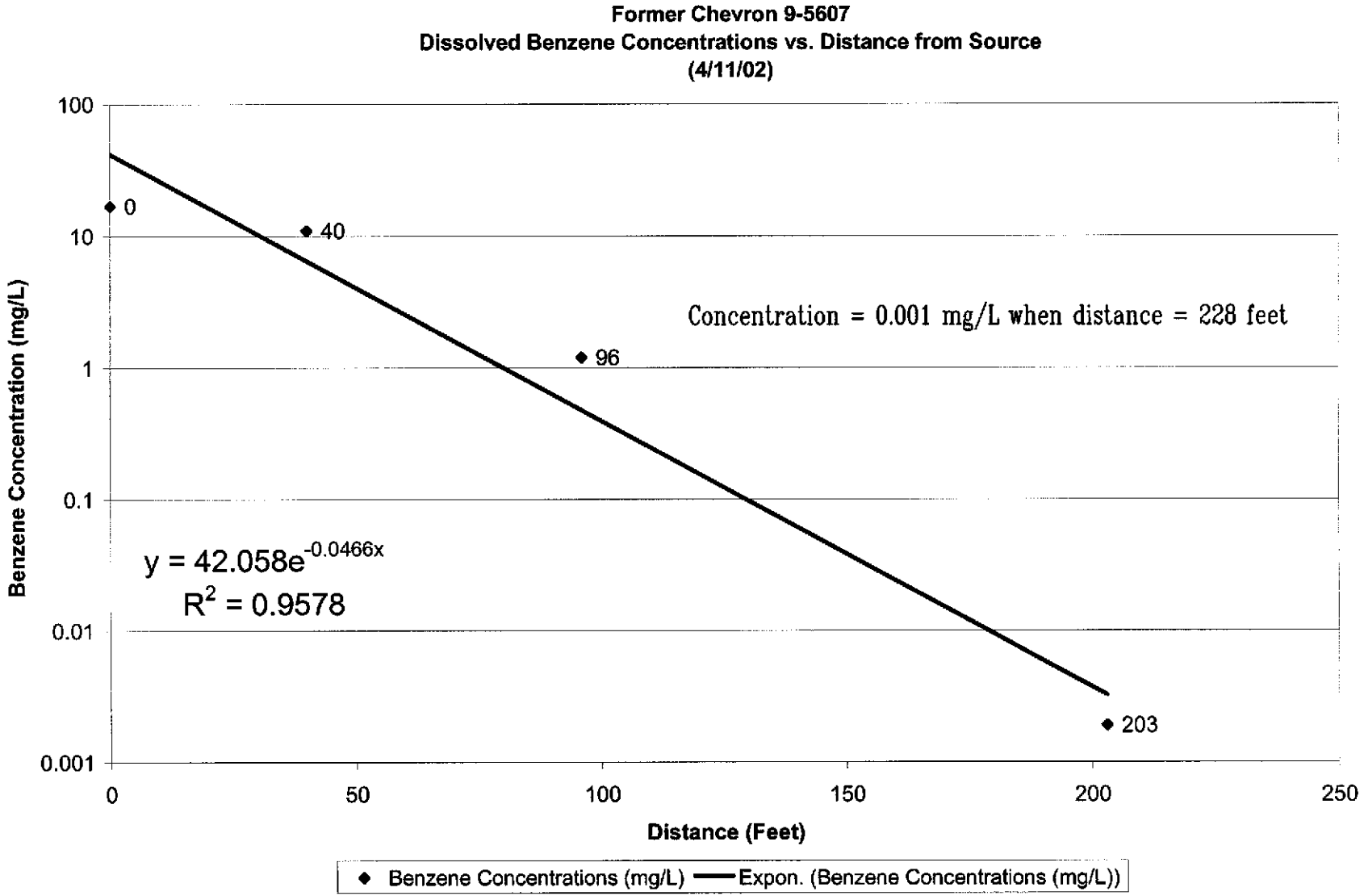
Former Chevron 9-5607
Dossolved Benzene Concentrations vs. Distance from Source
(April 30, 2001)




Former Chevron 9-5607
Dissolved Benzene Concentrations vs. Distance from Source
(July 9, 2001)
Benzene Concentration (mg/L)
100
10
1
0.1
0.01
0.001
0
40
96
203
Concentration = 0.001 mg/L when distance = 302 feet
y = 16.247e-0.0321x
R2 = 0.9835
0
50
100
150
200
250
300
350
Distance from Source (feet)
Benzene Concentrations (mg/L)
Expon. (Benzene Concentrations (mg/L))


Former Chevron 9-5607
Dissolved Benzene Concentrations vs. Distance from Source
(October 10, 2001)
Benzene Concentration (mg/L)
100
10
1
0.1
0.01
0.001
0
40
96
203
Concentration = 0.001 mg/L when distance = 224 feet
y = 31.714e-0.0462x
R2 = 0.9738
0
50
100
150
200
250
Distance from Source (feet)
Benzene Concentrations (mg/L)
Expon. (Benzene Concentrations (mg/L))


Former Chevron 9-5607
Dissolved Benzene Concentrations vs. Distance from Source
(January 7, 2002)
Benzene Concentration (mg/L)
100
10
1
0.1
0.01
0.001
0
40
96
203
Concentration = 0.001 mg/L when distance = 214 feet
y = 24.89e-0.0472x
R2 = 0.9581
0
50
100
150
200
250
Distance from source (feet)
Benzene Concentrations (mg/L)
Expon. (Benzene Concentrations (mg/L))


Former Chevron 9-5607
Dissolved Benzene Concentrations vs. Distance from Source
(4/11/02)
Benzene Concentration (mg/L)
100
10
1
0.1
0.01
0.001
0
40
96
203
Concentration = 0.001 mg/L when distance = 228 feet
y = 42.058e-0.0466x
R2 = 0.9578
0
50
100
150
200
250
Distance (Feet)
Benzene Concentrations (mg/L)
Expon. (Benzene Concentrations (mg/L))