REPORT ON
GROUNDWATER SAMPLING AND
FLOW RATE DETERMINATION
BOVANO SITE
830 SOUTH MAIN STREET
CHESHIRE, CONNECTICUT

by

Haley & Aldrich, Inc.
Bedford, New Hampshire

for

Bovano of Cheshire
Cheshire, Connecticut

June 1997
File No. 91017-402

HALEY & ALDRICH

RDMS Doc ID 106775

UNDERGROUND
ENGINEERING &
ENVIRONMENTAL
SOLUTIONS

Haley & Aldrich, Inc.
Ten Harvey Road
Bedford, NH 03110-6805
Tel: 603.625.5353
Fax: 603.624.8307
Email: MAN@HaleyAldrich.com

HALEY & ALDRICH

20 June 1997
File No. 91017-402

Mr. David Lim, Project Manager
RCRA Corrective Action Section
US Environmental Protection Agency
John F. Kennedy Building
Boston, Massachusetts 02203-2211

Subject: Groundwater Sampling and Flow Rate Determination
Bovano Site
830 South Main Street
Cheshire, Connecticut

Dear Mr. Lim:

This letter report is submitted to provide you with the May 1997 groundwater sampling and modeling results and for the Bovano Site in Cheshire. The report addresses the following actions taken by the site owner, Mr. James Flood and its consultant, Haley & Aldrich, Inc. of Glastonbury, Connecticut.

- Groundwater collection and analysis from monitoring wells MW-1 through MW-4, MW-A, MW-B and MW-C.
- Performed slug tests on monitoring wells MW-3 and MW-A to determine a groundwater flow rate.
- Performed groundwater modeling to predict the approximate extent of off-site trichloroethene (TCE) contaminant plume and associated approximate TCE concentration.
- Provided "background" copper concentrations in groundwater for the general area of Cheshire.

SUMMARY

This report is prepared on behalf of Bovano of Cheshire. As a result of our on-site activities and review of the recent groundwater quality results as compared to previous historic reports, it is Haley & Aldrich's opinion that the site poses a very minimal threat to the environment.

Based on on-site slug tests, it is projected that groundwater moves at a rate of 0.14 to 0.16 feet per day. The groundwater modeling predicts that the advective front of a TCE contaminant plume would be located approximately 786 to 858 ft downgradient of the former source area (chemical storage shed). TCE concentrations would range from approximately 31 to 34 ppb near the former source area, 15 to 20 ppb in the mid point of the contaminant

OFFICES

Boston
Massachusetts

Cleveland
Ohio

Denver
Colorado

Hartford
Connecticut

Los Angeles
California

Portland
Maine

Rochester
New York

San Francisco
California

Washington
District of Columbia

Printed on recycled paper.

plume (400 to 500 ft downgradient of the former source) and 1 ppb near the advective front of the contaminant plume (750 to 858 ft downgradient of the former source area). To address your requirements for an offsite groundwater sample in the projected plume, Haley & Aldrich recommends that a groundwater sample be collected in the right-of-way off Jinny Hill Road using Geoprobe sampling techniques which do not leave a permanent well installation (see Figure 1 for proposed off-site location). If the TCE concentration in the groundwater sample falls in the concentration range or less, as predicted by the model, it confirms that no active source exists on the Bovano site and Haley & Aldrich will recommend that the Bovano site be removed from the voluntary corrective action program.

If you have any questions about the report or its attachments, please don't hesitate to call me.

Sincerely yours,
HALEY & ALDRICH, INC.

Muriel S. Robinette, PG
Vice President

:/G:\02-HAR.JOB\91017\402\402EPA.WPF

Attachments

UNDERGROUND
ENGINEERING &
ENVIRONMENTAL
SOLUTIONS

Haley & Aldrich, Inc.
Ten Harvey Road
Bedford, NH 03110-6805
Tel: 603.625.5353
Fax: 603.624.8307
Email: MAN@HaleyAldrich.com

HALEY & ALDRICH

MEMORANDUM

20 June 1997
File No. 91017-402

TO: James Flood, President
Bovano of Cheshire

FROM: Muriel Robinette and Nancy Reid
Haley & Aldrich, Inc.

SUBJECT: Results of Groundwater Sampling and Groundwater Flow Rate Determination
Bovano Site
830 South Main Street
Cheshire, Connecticut

This memorandum summarizes the results of groundwater sampling and determination of the rate of groundwater flow at the above referenced site. Typical background levels of metals (copper, cadmium, chromium, and lead) for the general area of Cheshire are also discussed. This work was performed to assist you with complying with the 21 February 1996 letter Bovano of Cheshire received from the United States Environmental Protection Agency (EPA). Specifically, groundwater was collected on 8 May 1997 from monitoring wells MW-1, MW-2, MW-3, MW-4, MW-A, MW-B, and MW-C. In addition, groundwater was collected from an on-site water supply well (sample WS-1) (refer to Figure 1, Site Plan, for sampling locations).

GROUNDWATER MONITORING

On 8 May 1997, Haley and Aldrich measured groundwater levels prior to purging three well volumes from the following monitoring wells: MW-1, MW-2, MW-3, MW-4, MW-A, MW-B, and MW-C. Groundwater elevations are summarized in Appendix A. Groundwater was collected from each of the monitoring wells as well as from an on-site water supply well (sample WS-1). Samples were placed in 40 ml glass VOA vials with teflon septa and plastic bottles and were preserved in accordance with standard methods. Samples for dissolved metal analyses were field filtered and preserved prior to analysis. The groundwater samples were submitted to a state-certified laboratory for chemical testing for the presence of volatile organic compounds (VOCs) by EPA Method 8260 and total and dissolved chromium, cadmium, copper and lead. The on-site water supply well, WS-1, was analyzed for total chromium, cadmium, copper and lead.

OFFICES

Boston
Massachusetts

Cleveland
Ohio

Denver
Colorado

Hartford
Connecticut

Los Angeles
California

Portland
Maine

Rochester
New York

San Francisco
California

Washington
District of Columbia

Printed on recycled paper.

RESULTS OF CHEMICAL TESTING

The results of chemical testing of groundwater are summarized in Table I and presented in full in Appendix A. Previous groundwater chemical data generated by TRC Environmental Consultants, Inc. (TRC) and HRP Associates, Inc. (HRP) are also presented on the table. For clarity, TRC reported monitoring wells MW-1, MW-2, and MW-3 as Well E, Well, F, and Well A in their reports, respectively. Monitoring wells B, C and D are destroyed and therefore were not sampled by Haley & Aldrich or HRP (refer to Figure 1 for monitoring well locations).

Trichloroethene (TCE) (20 ppb) was detected in groundwater from only one monitoring well, MW-3, above the CTDEP groundwater protection criterion of 5 ppb. TCE was previously detected in groundwater at MW-3 in August 1996 (12 ppb), July 1995 (7 ppb) and June 1984 (50 ppb).

Cis-1,2-dichloroethene (22 ppb) was detected in groundwater from MW-3 below the CTDEP groundwater protection criterion of 70 ppb. Cis-1,2-dichloroethene was previously detected in groundwater at MW-3 in August 1996 (8 ppb).

Dissolved lead was detected in MW-1 (0.001 ppm) and MW-4 (0.003 ppm) below relevant regulatory criteria. Dissolved lead was previously detected at MW-A (0.008 ppm) and MW-B (0.002 ppm) below relevant regulatory criteria. Lead was not detected above the laboratory detection limit in MW-2, MW-3, MW-A , MW-B, and MW-C. Dissolved metals samples were not detected above the laboratory detection limit at MW-2, MW-3, MW-A, MW-B, and MW-C.

Total metals were not detected above the laboratory detection limit at the on-site water supply well, WS-1. Total copper (1.54 ppm) and total lead (0.494 ppm) and dissolved copper (0.74 ppm) and dissolved lead (0.016 ppm) were previously detected in WS-1 in August 1996.

GROUNDWATER ELEVATION AND FLOW DIRECTION

Based on observations of depth to groundwater on 8 May 1997 and referenced to a level survey performed by HRP Associates Inc. in 1995, the approximate direction of groundwater flow at the site is southerly on the western portion of the site and toward the southwest on the eastern portion of the site, as shown on Figure 1.

PERMEABILITY TESTING

On 9 May 1997, two rising head permeability tests were performed in monitoring wells MW-3 and MW-A. The tests were performed at depths ranging from 10.5 ft. to 17.5 ft. below ground surface. The permeability tests were conducted by recording an initial water level, inserting a 4 ft. slug into the well, allowing the well to equilibrate, removing the slug from the well, and them measuring the rise in water level with time.

An In-Situ Inc. Troll 4000 Data Logger was used to record the rise in water level at intervals of 5 seconds for a period of approximately 5 to 15 minutes. The data logger records the

pressure exerted by a head of water on the pressure transducer which is placed at a specific depth below the water surface. As the water level rises, the increased pressure on the transducer is converted to a rise in head of water in feet. Data logger readings were checked periodically against data obtained manually by an electric water level indicator.

The permeability data collected in the field were analyzed using a method developed by Hvorslev. Hvorslev's method used the theory that water must flow to or from the borehole until the pressure or head equals that in the surrounding soil. This flow must also occur with a corresponding time lag when the surrounding pore pressure increases or decreases. The magnitude of the time lag is inversely proportional to the permeability of the soil and that permeability is related to the seepage velocity.

The equation developed by Hvorslev is the following:

$$k = R^2/2L(t_2 - t_2)\ln(L/R)\ln(h_1/h_2)$$

where:

k = permeability value (cm/sec)
R = inside radius of the monitoring well (cm)
L = length of the screened interval (cm)
t_1 = time at head reading h_1 (sec)
t_2 = time at head reading h_2 (sec)
h_1 = head reading at t_1 (cm)
h_2 = head reading at t_2 (cm)

The results of the permeability testing are as follows:

Monitoring Well	**Permeability (cm/sec)**
MW-3	3.1×10^{-3}, 2.6×10^{-3}
MW-A	2.3×10^{-2}, 1.7×10^{-2}

The values are typical for the type of deposits, sands (stratified drift), which were identified at the site by HRP in the previous field program. The permeability data, plots and calculations are included in Appendix B.

GROUNDWATER FLOW RATE

Due to the presence of the contaminant, TCE, at the site, groundwater modeling was performed to predict the potential contaminant concentrations in groundwater downgradient of the site. The transport model is based on the assumption that the contaminant source area is a continuous planar source, wherein the concentration remains constant over time despite groundwater flushing and natural degradation, and the source is a plane perpendicular to the groundwater flow direction. The equation used to predict the plume geometry and advective front is by Domenico and Robbins Equation 17.18, modified for 2-dimensional transport

(vertical dispersion, which is typically a small fraction of longitudinal and transverse dispersion, is ignored) as presented in: Domenico, P.A. and Schwartz, F.W., 1990. Physical and Chemical Hydrogeology.

The transport model was calibrated based on groundwater quality data obtained from on-site monitoring wells on several different monitoring dates which included September 1982, June 1984, and May 1997. Transport parameters, including dispersion and retardation, were adjusted until the model predictions closely matched the temporal trend of TCE detected at the site in a representative downgradient monitoring well (MW-3). Contaminant source concentrations were based on historical data from Well B, adjacent to the former chemical storage shed. The calibrated model was then used to predict travel time and the approximate location of the maximum concentration of TCE downgradient of the source area (maximum concentrations remain near the source).

The transport model results indicate that with TCE concentrations of 1,200 ppb in September 1982 (prior to source remediation) and 34 ppb in June 1984 (post removal of drums of TCE in storage shed) at the source area, and groundwater velocity ranging from 0.14 ft/day to 0.16 ft/day, the contaminant plume advective front would have migrated approximately 786 ft to 858 ft downgradient of the source area by May 1997. TCE contaminant concentrations within the contaminant plume would range from approximately 1 to 34 ppb, with the higher concentrations (15 to 34 ppb) located at distances approximately 50 to 500 ft. downgradient of Well B. The model results also indicated the contaminant plume ranges from approximately 70 ft to 96 ft in width.

The model results indicate the TCE concentration in groundwater located adjacent to Jinny Hill Road, 490 to 560 ft downgradient (south), would be approximately 12 to 18 ppb, if the initial source of 1,200 ppb (June 1982) and 34 ppb (June 1984), are representative.

A groundwater sample was proposed to be collected from a dug well located on the fabric store property downgradient of the Bovano property. However, the dug well is located approximately 380 ft downgradient (south) and 150 ft. east of the inferred axis of the plume. Therefore, the well is located outside of the contaminant plume and would potentially not yield a representative groundwater sample of the projected plume.

BACKGROUND LEVELS OF METALS IN GROUNDWATER

The Connecticut Regional Water Authority has a wellfield located north of Cook Hill Road in Cheshire approximately 0.75 miles south of the Bovano Site (referred to as the South Cheshire Wellfield). Inorganic data from the South Cheshire Wellfield for 1994, 1995 and 1996 indicated the following:

- Lead was not detected above the detection limit, 0.001 ppm, from 1994 through 1996.

- Cadmium and chromium were not detected above their detection limits, 0.0001 ppm and 0.001 ppm, respectively in 1995. Cadmium and chromium were not tested for in 1994 and 1996.

- Copper was detected at concentrations of 0.03 ppm in 1995 and 0.04 ppm in 1996. Copper was not tested for in 1994.

CONCLUSIONS

Groundwater sampling, calculation of groundwater flow rates, contaminant concentration modeling and research of background concentration of metals (copper, cadmium, chromium and lead) have been completed at the site in accordance with our proposal dated 7 August 1996, as authorized. The results indicate the following:

- TCE is above the CTDEP groundwater protection criteria at only one monitoring well, MW-3. TCE was previously detected in groundwater at MW-3 in July 1996 (12 ppb), June 1995 (7 ppb) and June 1984 (50 ppb). Historical data indicate a significant decrease in TCE concentrations from 1,220 ppb to 6.1 ppb in Well B (September 1982 to May 1985) and 50 ppb to 22 ppb in MW-3 (June 1984 to May 1997).

- VOCs were not detected above regulatory criteria in monitoring wells MW-1, MW-2, MW-4, MW-A, MW-B, and MW-C.

- Dissolved metals were not detected in groundwater at or above relevant regulatory criteria in the monitoring wells at the site. Total metals were not detected in the on-site water supply well above the laboratory detection limit. It is Haley and Aldrich's opinion that groundwater does not appear adversely impacted by metals at this site due to the low to nondetectable concentrations of dissolved metals in the monitoring wells and the nondetectable concentrations of total metals in the on-site water supply well.

- Results of metal analysis from the South Cheshire Wellfield indicate that lead, cadmium and copper were not detected above their respective detection limits. However, copper was detected at concentrations of 0.03 ppm (1995) and 0.04 ppm (1996). This would indicate that copper is typically detected in the groundwater in the Cheshire area.

- Groundwater flow direction and permeability testing indicates the contaminant plume is migrating in a southerly direction at a velocity of approximately 0.15 ft/day.

- Groundwater modeling predicts the TCE contaminant plume advective front is located approximately 786 to 858 ft downgradient of Well B (former source area). TCE concentrations within the contaminant plume would range from 1 to 34 ppb, with the higher concentrations (15 to 34 ppb) located at distances approximately 50 to 500 ft. downgradient of Well B.

- Groundwater modeling predicts the contaminant plume ranges from approximately 20 ft to 96 ft in width.

- Based on the model-predicted plume width and the location of the fabric store dug well relative to the source area, the fabric store well is located outside of the contaminant plume and would not potentially yield a representative groundwater sample of the predicted plume.

- Groundwater modeling indicates the TCE concentration in the groundwater adjacent to Jinny Hill Road located approximately 490 to 560 ft. downgradient (south) of the former source area would be approximately 12 to 18 ppb.

RECOMMENDATIONS

- To address the EPA's requirement for an offsite groundwater quality sample from within a projected plume, we recommend a groundwater sample be collected and analyzed for VOCs from adjacent to Jinny Hill Road, as shown on Figure 1. This location would be in the right-of-way to expedite the field investigation and sample collection. The groundwater sample can be collected with a Geoprobe drilling rig which drives a sampler to the desired depth, collects a water sample and backs out of the hole, leaving no well in place.

- If the results of the groundwater sampling and analysis indicate TCE concentrations as predicted by the model then no active source remains on the Bovano property and Haley & Aldrich recommends the site should be removed from the voluntary corrective action program. In addition, Bovano should not be liable for other contaminants in this offsite sample, if detected, which historically have not been detected on the Bovano site.

LIMITATIONS

This memorandum has been prepared for the use of the Bovano of Cheshire in connection with voluntary corrective action measures taken at the Bovano of Cheshire property in Cheshire, Connecticut. The conclusions provided by Haley & Aldrich, Inc. are based solely on the scope of work conducted and the sources of information described in our memorandum. Any additional information that becomes available concerning this site should be provided to Haley & Aldrich, Inc. so that our conclusions may be reviewed and modified, as necessary.

The work performed by Haley & Aldrich, Inc. is subject to the terms and conditions stated in our proposal dated 19 March 1997. This work has been undertaken in accordance with generally accepted consulting practices. No other warranty, express or implied, is made.

Our memorandum is prepared for your exclusive use, solely for the purpose of rendering an opinion as to the likely liability due to contamination at the site. The report may not be circulated or conveyed, in whole or part, to any other party, nor used by any other party, except your attorneys, without the prior written permission of Haley & Aldrich, Inc.

Enclosures:

Table I	- Summary of Groundwater Chemical Analyses
Figure 1	- Site Plan
Appendix A	- Groundwater Laboratory Results
Appendix B	- Permeability Calculations
Appendix C	- Contaminant Transport Calculations

\WP\91017\LTR402.WPF

TABLE I

SUMMARY OF GROUNDWATER CHEMICAL ANALYSES (1)
BOVANO OF CHESHIRE
CHESHIRE, CONNECTICUT

SAMPLE NUMBER	Well B			MW-1			
SAMPLING DATE	Sept-82 (2)	19-Jun-84 (3)	May-85 (4)	19-Jun-84	29-Jun-95 (5)	09-Aug-96	08-May-97
DETECTED COMPOUND							
Volatile Organic Compounds: (parts-per-billion)							
trans-1,2,-Dichloroethene	ND	ND	ND	ND<1	ND	ND<1	ND<1
cis-1,2-Dichloroethene	--	--	ND	--	ND	ND<1	ND<1
Trichloroethene	**1220**	**34**	**6.1**	ND<1	ND	ND<1	ND<1
Total Metals: (parts-per-million)							
Cadmium	--	--	--	--	--	0.003	--
Chromium	--	--	--	--	--	0.04	--
Copper	--	--	--	--	--	**2.14**	--
Lead	--	--	--	--	--	**0.028**	--
Dissolved Metals: (parts-per-million)							
Cadmium	--	--	--	--	ND	ND<0.001	ND<0.001
Chromium	--	--	--	--	ND	ND<0.02	ND<0.02
Copper	--	--	--	--	ND	ND<0.04	ND<0.04
Lead	--	--	--	--	ND	ND<0.001	0.001

Refer to notes on page 5 of 5.

TABLE I

SUMMARY OF GROUNDWATER CHEMICAL ANALYSES (1)
BOVANO OF CHESHIRE
CHESHIRE, CONNECTICUT

SAMPLE NUMBER	MW-2				MW-3			
SAMPLING DATE	19-Jun-84	29-Jun-95	09-Aug-96	08-May-97	19-Jun-84	29-July-95	09-Aug-96	08-May-97
DETECTED COMPOUND								
Volatile Organic Compounds: (parts-per-billion)								
trans-1,2,-Dichloroethene	ND<1	ND	ND<1	ND<1	ND<1	4	ND<1	ND<1
cis-1,2-Dichloroethene	–	ND	ND<1	ND<1	--	ND	8	22
Trichloroethene	1	ND	ND<1	ND<1	**50**	**7**	**12**	**20**
Total Metals: (parts-per-million)								
Cadmium	–	–	ND<0.001	–	–	–	0.002	–
Chromium	–	–	ND<0.02	–	–	–	**0.07**	–
Copper	–	–	**0.18**	–	–	–	**0.23**	–
Lead	–	–	**0.084**	–	–	–	**0.103**	–
Dissolved Metals: (parts-per-million)								
Cadmium	–	ND	ND<0.001	ND<0.001	–	ND	ND<0.001	ND<0.001
Chromium	–	ND	ND<0.02	ND<0.02	–	**0.22**	ND<0.02	ND<0.02
Copper	–	ND	ND<0.04	ND<0.04	–	**0.74**	ND<0.04	ND<0.04
Lead	–	ND	ND<0.001	ND<0.001	–	**0.308**	ND<0.001	ND<0.001

Refer to notes on page 5 of 5.

TABLE I

SUMMARY OF GROUNDWATER CHEMICAL ANALYSES (1)
BOVANO OF CHESHIRE
CHESHIRE, CONNECTICUT

SAMPLE NUMBER	MW-4			MW-A		
SAMPLING DATE	29-Jun-95	26-Aug-96	08-May-97	29-Jun-95	09-Aug-96	08-May-97
DETECTED COMPOUND						
Volatile Organic Compounds: (parts-per-billion)						
trans-1,2,-Dichloroethene	ND	ND<1	ND<1	ND	ND<1	ND<1
cis-1,2-Dichloroethene	ND	ND<1	ND<1	ND	ND<1	ND<1
Trichloroethene	ND	ND<1	ND<1	ND	ND<1	ND<1
Total Metals: (parts-per-million)						
Cadmium	--	**0.005**	--	--	**0.015**	--
Chromium	--	**0.16**	--	--	**0.18**	--
Copper	--	**5.7**	--	--	**0.79**	--
Lead	--	**0.038**	--	--	**0.195**	--
Dissolved Metals: (parts-per-million)						
Cadmium	**0.01**	ND<0.001	ND<0.001	ND	ND<0.001	ND<0.001
Chromium	**0.45**	ND<0.02	ND<0.02	ND	ND<0.02	ND<0.02
Copper	**13.5**	ND<0.04	ND<0.04	ND	ND<0.04	ND<0.04
Lead	**0.52**	ND<0.001	0.003	ND	0.008	ND<0.001

Refer to notes on page 5 of 5.

TABLE I

SUMMARY OF GROUNDWATER CHEMICAL ANALYSES (1)
BOVANO OF CHESHIRE
CHESHIRE, CONNECTICUT

SAMPLE NUMBER	MW-B			MW-C			WS-1	
SAMPLING DATE	29-Jun-95	09-Aug-96	08-May-97	29-Jun-95	11-Apr-96	08-May-97	26-Aug-96	08-May-97
DETECTED COMPOUND								
Volatile Organic Compounds: (parts-per-billion)								
trans-1,2,-Dichloroethene	ND	ND<1	ND<1	ND	ND<1	ND<1	ND<1	ND<1
cis-1,2-Dichloroethene	ND	ND<1	ND<1	ND	ND<1	ND<1	ND<1	ND<1
Trichloroethene	ND	ND<1	ND<1	ND	ND<1	ND<1	ND<1	ND<1
Total Metals: (parts-per-million)								
Cadmium	--	0.002	--	--	0.003	--	ND<0.001	ND<0.001
Chromium	--	0.04	--	--	**0.14**	--	ND<0.02	ND<0.02
Copper	--	**0.13**	--	--	**0.572**	--	**1.54**	ND<0.04
Lead	--	**0.151**	--	--	**0.152**	--	**0.494**	ND<0.001
Dissolved Metals: (parts-per-million)								
Cadmium	ND	ND<0.001	ND<0.001	ND	ND<0.001	ND<0.001	ND<0.001	--
Chromium	ND	ND<0.02	ND<0.02	ND	ND<0.02	ND<0.02	ND<0.02	--
Copper	ND	ND<0.04	ND<0.04	ND	ND<0.04	ND<0.04	**0.74**	--
Lead	ND	0.002	ND<0.001	ND	ND<0.001	ND<0.001	**0.016**	--

Refer to notes on page 5 of 5.

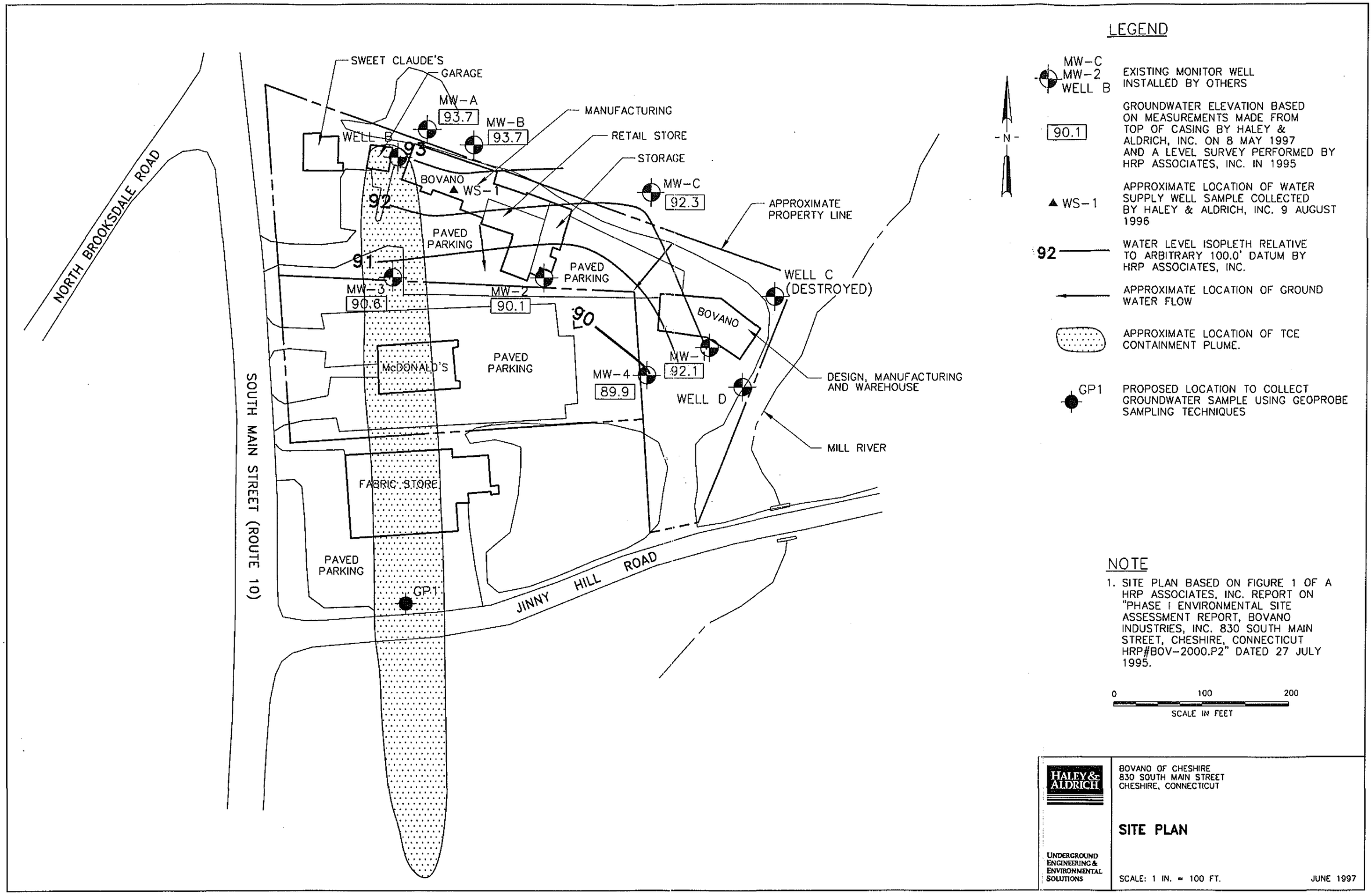
TABLE I

SUMMARY OF GROUNDWATER CHEMICAL ANALYSES (1)
BOVANO OF CHESHIRE
CHESHIRE, CONNECTICUT

SAMPLE NUMBER SAMPLING DATE DETECTED COMPOUND	GROUNDWATER PROTECTION CRITERIA (6)	SURFACE WATER PROTECTION CRITERIA (6)	RESIDENTIAL VOLITALIZATION CRITERIA FOR GROUNDWATER (6)
Volatile Organic Compounds: (parts-per-billion)			
trans-1,2,-Dichloroethene	100	NE	NE
cis-1,2-Dichloroethene	70	NE	NE
Trichloroethene	5	2340	219
Total or Dissolved Metals: (parts-per-million)			
Cadmium	0.005	0.006	NA
Chromium	0.05	1.2	NA
Copper	1.3	0.048	NA
Lead	0.015	0.013	NA

Notes:

1. Complete laboratory results are presented in Appendix B.
2. Sept-82 groundwater results are taken from a TRC Environmental Consultants, Inc. (TRC) report on "Preliminary Report of Ground Water Investigation at Bovano Industries of Cheshire" dated November 1982.
3. Jun-84 groundwater results are taken from a TRC report on "Technical Report to Bovano Industries on Ground Water Investigations" dated 13 July 1984.
4. May-95 groundwater results are taken from a letter to Bovano Industries from the CTDEP dated 11 July 1985.
5. 29-Jun-95 groundwater results are taken from an HRP Associates, Inc. report on "Phase I Environmental Site Assessment, Bovano of Cheshire, 830 South Main Street, Cheshire, Connecticut (HRP# BOV-0002.P2)" dated 27 July 1995.
6. Groundwater protection criteria, surface water criteria, and residential volitalization criteria for groundwater are from Appendices C, D, and E, respectively, of the CTDEP Remediation Standard.
7. ND<1 means the analyte was not detected at or above the laboratory detection limit.
8. Refer to Figure 1 "Site Plan" for sampling locations.
9. Values printed in bold are at or exceed relevant criteria.
10. NE means a regulatory criterion has not been established for this parameter.
11. NA means not applicable.
12. -- means parameter not tested for.



91017-402 B1

FIGURE 1

APPENDIX A

Groundwater Laboratory Results

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-006	Date Sampled:	05/08/97 12:55
Client ID:	MW-1	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SAMPLE PREPARATION						
Metal Digestion	05/08/97			3015		
TRACE METALS						
Cadmium	ND	mg/l	0.001	213.2	kb	05/14/97
Chromium	ND	mg/l	0.02	200.7	th	05/09/97
Copper	ND	mg/l	0.04	200.7	th	05/09/97
Lead	0.001	mg/l	0.001	239.2	kb	05/12/97
VOLATILE ORGANICS						
Acetone	ND	ug/l	25	8260	db	05/12/97
Benzene	ND	ug/l	1	8260	db	05/12/97
Bromodichloromethane	ND	ug/l	1	8260	db	05/12/97
Bromoform	ND	ug/l	1	8260	db	05/12/97
Bromomethane	ND	ug/l	1	8260	db	05/12/97
2-Butanone	ND	ug/l	25	8260	db	05/12/97
Carbon Disulfide	ND	ug/l	1	8260	db	05/12/97
Carbon Tetrachloride	ND	ug/l	0.5	8260	db	05/12/97
Chlorobenzene	ND	ug/l	1	8260	db	05/12/97
Chloroethane	ND	ug/l	1	8260	db	05/12/97
Chloroform	ND	ug/l	1	8260	db	05/12/97
Chloromethane	ND	ug/l	1	8260	db	05/12/97
Dibromochloromethane	ND	ug/l	0.5	8260	db	05/12/97
1,2-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,3-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,4-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-006	Date Sampled:	05/08/97 12:55
Client ID:	MW-1	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
VOLATILE ORGANICS						
1,1-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
cis-1,2-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
trans-1,2-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloropropane	ND	ug/l	1	8260	db	05/12/97
cis-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
trans-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
Ethylbenzene	ND	ug/l	1	8260	db	05/12/97
2-Hexanone	ND	ug/l	1	8260	db	05/12/97
Methylene Chloride	ND	ug/l	4	8260	db	05/12/97
4-Methyl-2-Pentanone	ND	ug/l	25	8260	db	05/12/97
MTBE	ND	ug/l	1	8260	db	05/12/97
Styrene	ND	ug/l	1	8260	db	05/12/97
1,1,2,2-Tetrachloroethane	ND	ug/l	0.5	8260	db	05/12/97
Tetrachloroethene	ND	ug/l	1	8260	db	05/12/97
Toluene	ND	ug/l	1	8260	db	05/12/97
1,1,1,-Trichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1,2-Trichloroethane	ND	ug/l	0.5	8260	db	05/12/97
Trichloroethene	ND	ug/l	1	8260	db	05/12/97
Trichlorofluoromethane	ND	ug/l	1	8260	db	05/12/97
Vinyl Acetate	ND	ug/l	1	8260	db	05/12/97
Vinyl Chloride	ND	ug/l	0.5	8260	db	05/12/97
o-Xylene	ND	ug/l	1	8260	db	05/12/97
p-m-Xylene	ND	ug/l	1	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-006	Date Sampled:	05/08/97 12:55
Client ID:	MW-1	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SURROGATE STUDIES - VOLATILES						
Bromofluorobenzene	93	Percent			db	05/12/97
Dibromofluoromethane	107	Percent			db	05/12/97
Toluene-D8	99	Percent			db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-007	Date Sampled:	05/08/97 14:15
Client ID:	MW-2	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SAMPLE PREPARATION						
Metal Digestion	05/08/97			3015		
TRACE METALS						
Cadmium	ND	mg/l	0.001	213.2	kb	05/14/97
Chromium	ND	mg/l	0.02	200.7	th	05/09/97
Copper	ND	mg/l	0.04	200.7	th	05/09/97
Lead	ND	mg/l	0.001	239.2	kb	05/12/97
VOLATILE ORGANICS						
Acetone	ND	ug/l	25	8260	db	05/12/97
Benzene	ND	ug/l	1	8260	db	05/12/97
Bromodichloromethane	ND	ug/l	1	8260	db	05/12/97
Bromoform	ND	ug/l	1	8260	db	05/12/97
Bromomethane	ND	ug/l	1	8260	db	05/12/97
2-Butanone	ND	ug/l	25	8260	db	05/12/97
Carbon Disulfide	ND	ug/l	1	8260	db	05/12/97
Carbon Tetrachloride	ND	ug/l	0.5	8260	db	05/12/97
Chlorobenzene	ND	ug/l	1	8260	db	05/12/97
Chloroethane	ND	ug/l	1	8260	db	05/12/97
Chloroform	ND	ug/l	1	8260	db	05/12/97
Chloromethane	ND	ug/l	1	8260	db	05/12/97
Dibromochloromethane	ND	ug/l	0.5	8260	db	05/12/97
1,2-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,3-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,4-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-007	Date Sampled:	05/08/97 14:15
Client ID:	MW-2	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
VOLATILE ORGANICS						
1,1-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
cis-1,2-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
trans-1,2-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloropropane	ND	ug/l	1	8260	db	05/12/97
cis-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
trans-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
Ethylbenzene	ND	ug/l	1	8260	db	05/12/97
2-Hexanone	ND	ug/l	1	8260	db	05/12/97
Methylene Chloride	ND	ug/l	4	8260	db	05/12/97
4-Methyl-2-Pentanone	ND	ug/l	25	8260	db	05/12/97
MTBE	ND	ug/l	1	8260	db	05/12/97
Styrene	ND	ug/l	1	8260	db	05/12/97
1,1,2,2-Tetrachloroethane	ND	ug/l	0.5	8260	db	05/12/97
Tetrachloroethene	ND	ug/l	1	8260	db	05/12/97
Toluene	ND	ug/l	1	8260	db	05/12/97
1,1,1,-Trichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1,2-Trichloroethane	ND	ug/l	0.5	8260	db	05/12/97
Trichloroethene	ND	ug/l	1	8260	db	05/12/97
Trichlorofluoromethane	ND	ug/l	1	8260	db	05/12/97
Vinyl Acetate	ND	ug/l	1	8260	db	05/12/97
Vinyl Chloride	ND	ug/l	0.5	8260	db	05/12/97
o-Xylene	ND	ug/l	1	8260	db	05/12/97
p-m-Xylene	ND	ug/l	1	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-007	Date Sampled:	05/08/97 14:15
Client ID:	MW-2	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SURROGATE STUDIES - VOLATILES						
Bromofluorobenzene	94	Percent			db	05/12/97
Dibromofluoromethane	95	Percent			db	05/12/97
Toluene-D8	93	Percent			db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-003	Date Sampled:	05/08/97 10:50
Client ID:	MW-3	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/22/97
Comment:	CORRECTED REPORT		

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SAMPLE PREPARATION						
Metal Digestion	05/08/97			3015		
TRACE METALS						
Cadmium	ND	mg/l	0.001	213.2	kb	05/14/97
Chromium	ND	mg/l	0.02	200.7	th	05/09/97
Copper	ND	mg/l	0.04	200.7	th	05/09/97
Lead	ND	mg/l	0.001	239.2	kb	05/12/97
VOLATILE ORGANICS						
Acetone	ND	ug/l	25	8260	db	05/12/97
Benzene	ND	ug/l	1	8260	db	05/12/97
Bromodichloromethane	ND	ug/l	1	8260	db	05/12/97
Bromoform	ND	ug/l	1	8260	db	05/12/97
Bromomethane	ND	ug/l	1	8260	db	05/12/97
2-Butanone	ND	ug/l	25	8260	db	05/12/97
Carbon Disulfide	ND	ug/l	1	8260	db	05/12/97
Carbon Tetrachloride	ND	ug/l	0.5	8260	db	05/12/97
Chlorobenzene	ND	ug/l	1	8260	db	05/12/97
Chloroethane	ND	ug/l	1	8260	db	05/12/97
Chloroform	ND	ug/l	1	8260	db	05/12/97
Chloromethane	ND	ug/l	1	8260	db	05/12/97
Dibromochloromethane	ND	ug/l	0.5	8260	db	05/12/97
1,2-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,3-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-003	Date Sampled:	05/08/97 10:50
Client ID:	MW-3	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/22/97
Comment:	CORRECTED REPORT		

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
VOLATILE ORGANICS						
1,4-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,1-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
cis-1,2-Dichloroethene	22	ug/l	1	8260	db	05/12/97
trans-1,2-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloropropane	ND	ug/l	1	8260	db	05/12/97
cis-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
trans-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
Ethylbenzene	ND	ug/l	1	8260	db	05/12/97
2-Hexanone	ND	ug/l	1	8260	db	05/12/97
Methylene Chloride	ND	ug/l	4	8260	db	05/12/97
4-Methyl-2-Pentanone	ND	ug/l	25	8260	db	05/12/97
MTBE	ND	ug/l	1	8260	db	05/12/97
Styrene	ND	ug/l	1	8260	db	05/12/97
1,1,2,2-Tetrachloroethane	ND	ug/l	0.5	8260	db	05/12/97
Tetrachloroethene	ND	ug/l	1	8260	db	05/12/97
Toluene	ND	ug/l	1	8260	db	05/12/97
1,1,1,-Trichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1,2-Trichloroethane	ND	ug/l	0.5	8260	db	05/12/97
Trichloroethene	20	ug/l	1	8260	db	05/12/97
Trichlorofluoromethane	ND	ug/l	1	8260	db	05/12/97
Vinyl Acetate	ND	ug/l	1	8260	db	05/12/97
Vinyl Chloride	ND	ug/l	0.5	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-003	Date Sampled:	05/08/97 10:50
Client ID:	MW-3	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/22/97
Comment:	CORRECTED REPORT		

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
VOLATILE ORGANICS						
o-Xylene	ND	ug/l	1	8260	db	05/12/97
p-m-Xylene	ND	ug/l	1	8260	db	05/12/97
SURROGATE STUDIES - VOLATILES						
Bromofluorobenzene	90	Percent			db	05/12/97
Dibromofluoromethane	98	Percent			db	05/12/97
Toluene-D8	92	Percent			db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-005	Date Sampled:	05/08/97 12:40
Client ID:	MW-4	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SAMPLE PREPARATION						
Metal Digestion	05/08/97			3015		
TRACE METALS						
Cadmium	ND	mg/l	0.001	213.2	kb	05/14/97
Chromium	ND	mg/l	0.02	200.7	th	05/09/97
Copper	ND	mg/l	0.04	200.7	th	05/09/97
Lead	0.003	mg/l	0.001	239.2	kb	05/12/97
VOLATILE ORGANICS						
Acetone	ND	ug/l	25	8260	db	05/12/97
Benzene	ND	ug/l	1	8260	db	05/12/97
Bromodichloromethane	ND	ug/l	1	8260	db	05/12/97
Bromoform	ND	ug/l	1	8260	db	05/12/97
Bromomethane	ND	ug/l	1	8260	db	05/12/97
2-Butanone	ND	ug/l	25	8260	db	05/12/97
Carbon Disulfide	ND	ug/l	1	8260	db	05/12/97
Carbon Tetrachloride	ND	ug/l	0.5	8260	db	05/12/97
Chlorobenzene	ND	ug/l	1	8260	db	05/12/97
Chloroethane	ND	ug/l	1	8260	db	05/12/97
Chloroform	ND	ug/l	1	8260	db	05/12/97
Chloromethane	ND	ug/l	1	8260	db	05/12/97
Dibromochloromethane	ND	ug/l	0.5	8260	db	05/12/97
1,2-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,3-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,4-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-005	Date Sampled:	05/08/97 12:40
Client ID:	MW-4	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
VOLATILE ORGANICS						
1,1-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
cis-1,2-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
trans-1,2-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloropropane	ND	ug/l	1	8260	db	05/12/97
cis-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
trans-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
Ethylbenzene	ND	ug/l	1	8260	db	05/12/97
2-Hexanone	ND	ug/l	1	8260	db	05/12/97
Methylene Chloride	ND	ug/l	4	8260	db	05/12/97
4-Methyl-2-Pentanone	ND	ug/l	25	8260	db	05/12/97
MTBE	ND	ug/l	1	8260	db	05/12/97
Styrene	ND	ug/l	1	8260	db	05/12/97
1,1,2,2-Tetrachloroethane	ND	ug/l	0.5	8260	db	05/12/97
Tetrachloroethene	ND	ug/l	1	8260	db	05/12/97
Toluene	ND	ug/l	1	8260	db	05/12/97
1,1,1,-Trichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1,2-Trichloroethane	ND	ug/l	0.5	8260	db	05/12/97
Trichloroethene	ND	ug/l	1	8260	db	05/12/97
Trichlorofluoromethane	ND	ug/l	1	8260	db	05/12/97
Vinyl Acetate	ND	ug/l	1	8260	db	05/12/97
Vinyl Chloride	ND	ug/l	0.5	8260	db	05/12/97
o-Xylene	ND	ug/l	1	8260	db	05/12/97
p-m-Xylene	ND	ug/l	1	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-005	Date Sampled:	05/08/97 12:40
Client ID:	MW-4	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SURROGATE STUDIES - VOLATILES						
Bromofluorobenzene	101	Percent			db	05/12/97
Dibromofluoromethane	104	Percent			db	05/12/97
Toluene-D8	97	Percent			db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-001	Date Sampled:	05/08/97 09:00
Client ID:	MW-A	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SAMPLE PREPARATION						
Metal Digestion	05/08/97			3015		
TRACE METALS						
Cadmium	ND	mg/l	0.001	213.2	kb	05/14/97
Chromium	ND	mg/l	0.02	200.7	th	05/09/97
Copper	ND	mg/l	0.04	200.7	th	05/09/97
Lead	ND	mg/l	0.001	239.2	kb	05/12/97
VOLATILE ORGANICS						
Acetone	ND	ug/l	25	8260	sh	05/10/97
Benzene	ND	ug/l	1	8260	sh	05/10/97
Bromodichloromethane	ND	ug/l	1	8260	sh	05/10/97
Bromoform	ND	ug/l	1	8260	sh	05/10/97
Bromomethane	ND	ug/l	1	8260	sh	05/10/97
2-Butanone	ND	ug/l	25	8260	sh	05/10/97
Carbon Disulfide	ND	ug/l	1	8260	sh	05/10/97
Carbon Tetrachloride	ND	ug/l	0.5	8260	sh	05/10/97
Chlorobenzene	ND	ug/l	1	8260	sh	05/10/97
Chloroethane	ND	ug/l	1	8260	sh	05/10/97
Chloroform	ND	ug/l	1	8260	sh	05/10/97
Chloromethane	ND	ug/l	1	8260	sh	05/10/97
Dibromochloromethane	ND	ug/l	0.5	8260	sh	05/10/97
1,2-Dichlorobenzene	ND	ug/l	1	8260	sh	05/10/97
1,3-Dichlorobenzene	ND	ug/l	1	8260	sh	05/10/97
1,4-Dichlorobenzene	ND	ug/l	1	8260	sh	05/10/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	*Haley & Aldrich, Inc.*	*Project Name:*	*Bovano (5-8-97)*
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-001	Date Sampled:	05/08/97 09:00
Client ID:	MW-A	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
VOLATILE ORGANICS						
1,1-Dichloroethane	ND	ug/l	1	8260	sh	05/10/97
1,2-Dichloroethane	ND	ug/l	1	8260	sh	05/10/97
1,1-Dichloroethene	ND	ug/l	1	8260	sh	05/10/97
cis-1,2-Dichloroethene	ND	ug/l	1	8260	sh	05/10/97
trans-1,2-Dichloroethene	ND	ug/l	1	8260	sh	05/10/97
1,2-Dichloropropane	ND	ug/l	1	8260	sh	05/10/97
cis-1,3-Dichloropropene	ND	ug/l	0.5	8260	sh	05/10/97
trans-1,3-Dichloropropene	ND	ug/l	0.5	8260	sh	05/10/97
Ethylbenzene	ND	ug/l	1	8260	sh	05/10/97
2-Hexanone	ND	ug/l	1	8260	sh	05/10/97
Methylene Chloride	ND	ug/l	4	8260	sh	05/10/97
4-Methyl-2-Pentanone	ND	ug/l	25	8260	sh	05/10/97
MTBE	ND	ug/l	1	8260	sh	05/10/97
Styrene	ND	ug/l	1	8260	sh	05/10/97
1,1,2,2-Tetrachloroethane	ND	ug/l	0.5	8260	sh	05/10/97
Tetrachloroethene	ND	ug/l	1	8260	sh	05/10/97
Toluene	ND	ug/l	1	8260	sh	05/10/97
1,1,1,-Trichloroethane	ND	ug/l	1	8260	sh	05/10/97
1,1,2-Trichloroethane	ND	ug/l	0.5	8260	sh	05/10/97
Trichloroethene	ND	ug/l	1	8260	sh	05/10/97
Trichlorofluoromethane	ND	ug/l	1	8260	sh	05/10/97
Vinyl Acetate	ND	ug/l	1	8260	sh	05/10/97
Vinyl Chloride	ND	ug/l	0.5	8260	sh	05/10/97
o-Xylene	ND	ug/l	1	8260	sh	05/10/97
p-m-Xylene	ND	ug/l	1	8260	sh	05/10/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-001	Date Sampled:	05/08/97 09:00
Client ID:	MW-A	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SURROGATE STUDIES - VOLATILES						
Bromofluorobenzene	91	Percent			sh	05/10/97
Dibromofluoromethane	105	Percent			sh	05/10/97
Toluene-D8	94	Percent			sh	05/10/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-002	Date Sampled:	05/08/97 10:10
Client ID:	MW-B	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SAMPLE PREPARATION						
Metal Digestion	05/08/97			3015		
TRACE METALS						
Cadmium	ND	mg/l	0.001	213.2	kb	05/14/97
Chromium	ND	mg/l	0.02	200.7	th	05/09/97
Copper	ND	mg/l	0.04	200.7	th	05/09/97
Lead	ND	mg/l	0.001	239.2	kb	05/12/97
VOLATILE ORGANICS						
Acetone	ND	ug/l	25	8260	db	05/12/97
Benzene	ND	ug/l	1	8260	db	05/12/97
Bromodichloromethane	ND	ug/l	1	8260	db	05/12/97
Bromoform	ND	ug/l	1	8260	db	05/12/97
Bromomethane	ND	ug/l	1	8260	db	05/12/97
2-Butanone	ND	ug/l	25	8260	db	05/12/97
Carbon Disulfide	ND	ug/l	1	8260	db	05/12/97
Carbon Tetrachloride	ND	ug/l	0.5	8260	db	05/12/97
Chlorobenzene	ND	ug/l	1	8260	db	05/12/97
Chloroethane	ND	ug/l	1	8260	db	05/12/97
Chloroform	ND	ug/l	1	8260	db	05/12/97
Chloromethane	ND	ug/l	1	8260	db	05/12/97
Dibromochloromethane	ND	ug/l	0.5	8260	db	05/12/97
1,2-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,3-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,4-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-002	Date Sampled:	05/08/97 10:10
Client ID:	MW-B	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
VOLATILE ORGANICS						
1,1-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
cis-1,2-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
trans-1,2-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloropropane	ND	ug/l	1	8260	db	05/12/97
cis-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
trans-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
Ethylbenzene	ND	ug/l	1	8260	db	05/12/97
2-Hexanone	ND	ug/l	1	8260	db	05/12/97
Methylene Chloride	ND	ug/l	4	8260	db	05/12/97
4-Methyl-2-Pentanone	ND	ug/l	25	8260	db	05/12/97
MTBE	ND	ug/l	1	8260	db	05/12/97
Styrene	ND	ug/l	1	8260	db	05/12/97
1,1,2,2-Tetrachloroethane	ND	ug/l	0.5	8260	db	05/12/97
Tetrachloroethene	ND	ug/l	1	8260	db	05/12/97
Toluene	ND	ug/l	1	8260	db	05/12/97
1,1,1,-Trichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1,2-Trichloroethane	ND	ug/l	0.5	8260	db	05/12/97
Trichloroethene	ND	ug/l	1	8260	db	05/12/97
Trichlorofluoromethane	ND	ug/l	1	8260	db	05/12/97
Vinyl Acetate	ND	ug/l	1	8260	db	05/12/97
Vinyl Chloride	ND	ug/l	0.5	8260	db	05/12/97
o-Xylene	ND	ug/l	1	8260	db	05/12/97
p-m-Xylene	ND	ug/l	1	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-002	Date Sampled:	05/08/97 10:10
Client ID:	MW-B	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SURROGATE STUDIES - VOLATILES						
Bromofluorobenzene	86	Percent			db	05/12/97
Dibromofluoromethane	102	Percent			db	05/12/97
Toluene-D8	94	Percent			db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-004	Date Sampled:	05/08/97 11:40
Client ID:	MW-C	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SAMPLE PREPARATION						
Metal Digestion	05/08/97			3015		
TRACE METALS						
Cadmium	ND	mg/l	0.001	213.2	kb	05/14/97
Chromium	ND	mg/l	0.02	200.7	th	05/09/97
Copper	ND	mg/l	0.04	200.7	th	05/09/97
Lead	ND	mg/l	0.001	239.2	kb	05/12/97
VOLATILE ORGANICS						
Acetone	ND	ug/l	25	8260	db	05/12/97
Benzene	ND	ug/l	1	8260	db	05/12/97
Bromodichloromethane	ND	ug/l	1	8260	db	05/12/97
Bromoform	ND	ug/l	1	8260	db	05/12/97
Bromomethane	ND	ug/l	1	8260	db	05/12/97
2-Butanone	ND	ug/l	25	8260	db	05/12/97
Carbon Disulfide	ND	ug/l	1	8260	db	05/12/97
Carbon Tetrachloride	ND	ug/l	0.5	8260	db	05/12/97
Chlorobenzene	ND	ug/l	1	8260	db	05/12/97
Chloroethane	ND	ug/l	1	8260	db	05/12/97
Chloroform	ND	ug/l	1	8260	db	05/12/97
Chloromethane	ND	ug/l	1	8260	db	05/12/97
Dibromochloromethane	ND	ug/l	0.5	8260	db	05/12/97
1,2-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,3-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,4-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-004	Date Sampled:	05/08/97 11:40
Client ID:	MW-C	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
VOLATILE ORGANICS						
1,1-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
cis-1,2-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
trans-1,2-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloropropane	ND	ug/l	1	8260	db	05/12/97
cis-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
trans-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
Ethylbenzene	ND	ug/l	1	8260	db	05/12/97
2-Hexanone	ND	ug/l	1	8260	db	05/12/97
Methylene Chloride	ND	ug/l	4	8260	db	05/12/97
4-Methyl-2-Pentanone	ND	ug/l	25	8260	db	05/12/97
MTBE	ND	ug/l	1	8260	db	05/12/97
Styrene	ND	ug/l	1	8260	db	05/12/97
1,1,2,2-Tetrachloroethane	ND	ug/l	0.5	8260	db	05/12/97
Tetrachloroethene	ND	ug/l	1	8260	db	05/12/97
Toluene	ND	ug/l	1	8260	db	05/12/97
1,1,1,-Trichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1,2-Trichloroethane	ND	ug/l	0.5	8260	db	05/12/97
Trichloroethene	ND	ug/l	1	8260	db	05/12/97
Trichlorofluoromethane	ND	ug/l	1	8260	db	05/12/97
Vinyl Acetate	ND	ug/l	1	8260	db	05/12/97
Vinyl Chloride	ND	ug/l	0.5	8260	db	05/12/97
o-Xylene	ND	ug/l	1	8260	db	05/12/97
p-m-Xylene	ND	ug/l	1	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-004	Date Sampled:	05/08/97 11:40
Client ID:	MW-C	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SURROGATE STUDIES - VOLATILES						
Bromofluorobenzene	92	Percent			db	05/12/97
Dibromofluoromethane	96	Percent			db	05/12/97
Toluene-D8	97	Percent			db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-008	Date Sampled:	05/08/97 14:35
Client ID:	WS-1	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SAMPLE PREPARATION						
Metal Digestion	05/08/97			3015		
TRACE METALS						
Cadmium	ND	mg/l	0.001	213.2	kb	05/14/97
Chromium	ND	mg/l	0.02	200.7	th	05/09/97
Copper	ND	mg/l	0.04	200.7	th	05/09/97
Lead	ND	mg/l	0.001	239.2	kb	05/12/97
VOLATILE ORGANICS						
Acetone	ND	ug/l	25	8260	db	05/12/97
Benzene	ND	ug/l	1	8260	db	05/12/97
Bromodichloromethane	ND	ug/l	1	8260	db	05/12/97
Bromoform	ND	ug/l	1	8260	db	05/12/97
Bromomethane	ND	ug/l	1	8260	db	05/12/97
2-Butanone	ND	ug/l	25	8260	db	05/12/97
Carbon Disulfide	ND	ug/l	1	8260	db	05/12/97
Carbon Tetrachloride	ND	ug/l	0.5	8260	db	05/12/97
Chlorobenzene	ND	ug/l	1	8260	db	05/12/97
Chloroethane	ND	ug/l	1	8260	db	05/12/97
Chloroform	ND	ug/l	1	8260	db	05/12/97
Chloromethane	ND	ug/l	1	8260	db	05/12/97
Dibromochloromethane	ND	ug/l	0.5	8260	db	05/12/97
1,2-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,3-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97
1,4-Dichlorobenzene	ND	ug/l	1	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-008	Date Sampled:	05/08/97 14:35
Client ID:	WS-1	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
VOLATILE ORGANICS						
1,1-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
cis-1,2-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
trans-1,2-Dichloroethene	ND	ug/l	1	8260	db	05/12/97
1,2-Dichloropropane	ND	ug/l	1	8260	db	05/12/97
cis-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
trans-1,3-Dichloropropene	ND	ug/l	0.5	8260	db	05/12/97
Ethylbenzene	ND	ug/l	1	8260	db	05/12/97
2-Hexanone	ND	ug/l	1	8260	db	05/12/97
Methylene Chloride	ND	ug/l	4	8260	db	05/12/97
4-Methyl-2-Pentanone	ND	ug/l	25	8260	db	05/12/97
MTBE	ND	ug/l	1	8260	db	05/12/97
Styrene	ND	ug/l	1	8260	db	05/12/97
1,1,2,2-Tetrachloroethane	ND	ug/l	0.5	8260	db	05/12/97
Tetrachloroethene	ND	ug/l	1	8260	db	05/12/97
Toluene	ND	ug/l	1	8260	db	05/12/97
1,1,1,-Trichloroethane	ND	ug/l	1	8260	db	05/12/97
1,1,2-Trichloroethane	ND	ug/l	0.5	8260	db	05/12/97
Trichloroethene	ND	ug/l	1	8260	db	05/12/97
Trichlorofluoromethane	ND	ug/l	1	8260	db	05/12/97
Vinyl Acetate	ND	ug/l	1	8260	db	05/12/97
Vinyl Chloride	ND	ug/l	0.5	8260	db	05/12/97
o-Xylene	ND	ug/l	1	8260	db	05/12/97
p-m-Xylene	ND	ug/l	1	8260	db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	Nancy Reid

Sample Information

Lab ID:	71281973-008	Date Sampled:	05/08/97 14:35
Client ID:	WS-1	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
SURROGATE STUDIES - VOLATILES						
Bromofluorobenzene	98	Percent			db	05/12/97
Dibromofluoromethane	98	Percent			db	05/12/97
Toluene-D8	95	Percent			db	05/12/97

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	

Sample Information

Lab ID:	71281973-009	Date Sampled:	/ / :
Client ID:	QC Report-Water	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
DUPLICATE STUDIES						
Cadmium ID:	1973-001					
Cadmium Variance:	0	Percent				
Chromium ID:	1973-001					
Chromium Variance:	0	Percent				
Copper ID:	1973-001					
Copper Variance:	0	Percent				
Lead ID:	1973-001					
Lead Variance:	0	Percent				
MATRIX SPIKE STUDIES - METALS						
Cadmium ID:	1973-001					
Cadmium Recovery:	98	Percent				
Chromium ID:	1973-001					
Chromium Recovery:	91	Percent				
Copper ID:	1973-001					
Copper Recovery:	78	Percent				
Lead ID:	1973-001					
Lead Recovery:	105	Percent				
METHOD BLANKS						
Method Blank - Volatile	ND	ug/l		8260		
MATRIX SPIKE STUDIES - VOLATILES						
Sample ID:	1874-007					
Benzene	95	Percent				

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748-2295
1 (800) 362-8749

F I N A L R E P O R T

Client Information

Account:	Haley & Aldrich, Inc.	Project Name:	Bovano (5-8-97)
Address:	10 Harvey Road	Project Number:	91017-402
	Bedford, NH 03110	Project Manager:	Muriel Robinette
		Sampler Name:	

Sample Information

Lab ID:	71281973-009	Date Sampled:	/ / :
Client ID:	QC Report-Water	Date Received:	05/08/97 : 0
Matrix:	Ground Water	Date Reported:	05/15/97

Analytical Parameter	Result	Unit	Detection Limit	Method No.	Analyst	Date Analyzed
MATRIX SPIKE STUDIES - VOLATILES						
Chlorobenzene	96	Percent				
1,1-Dichloroethene	110	Percent				
Toluene	93	Percent				
Trichloroethene	93	Percent				

METHOD SUMMARIES

Metal analysis is performed on digested extracts using Atomic Absorption or ICP Spectroscopy. AA samples are atomized using FASTAC auto deposition and are automatically deposited into graphite cells. Mercury is determined by Cold Vapor AA. ICP samples are automatically sampled, nebulized, and transported into the plasma torch. Final results are produced by auto data/reduction and graphics printer.

Volatile organic analysis is performed using H/P 5995 or 5970 GC/MS, Tekmar purge and trap, and ALS autosampler. Chromatography incorporates packed and megabore columns. Data reduction is performed on RTE 1000 and ChemStation systems. Tuning is based on BFB standards. Procedural guidelines follow EPA or SW846 for all analyses.

METHOD REFERENCES

1. Test Methods For Evaluating Solid Waste: Physical Chemical Methods. EPA SW 846. November 1986.
2. Methods For Chemical Analysis of Water and Wastes. EPA 600/4-79-200. Revised March 1983.
3. Standard Methods For Examination of Water and Wastewater. APHA-AWWA-WACF., 18th Edition. 1992.
4. EPA Methods For The Determination of Organic Compounds in Drinking Water.

Project Information		Client Information	
Project Name:	BOVANO	Send Reports to:	Nancy Reid
Project No.:	91017-102	Company:	Walter Associates
Project Location:	Cheshire, CT	Address:	10 Hungry Rd
Project Manager:	Mark Robinson		Rockland, MA 02370
Sampler(s):	Nancy Reid	Phone:	[illegible]
		Fax:	[illegible]
PO #:	Lab Quote #:	Account # (Lab Use Only)	
Turn-Around:	☑ Standard 10 business days ☐ Other (specify):	Final Report:	☑ Mail ☐ Overnight ☐ Fax ☐ EDT Diskette (If checked, call for pricing) Disk format:

Note: Less than 10 days must be pre-approved!

Form No. | Page 1

FILTRATION (0.45 um) & PRESERVATION INFORMATION

FILTRATION	PRESERVATION
☐ DONE	☐ DONE
☐ NOT NEEDED	☐ NOT NEEDED
☑ LAB TO DO*	☑ LAB TO DO*

**Please specify which samples need to be filtered and/or preserved by the lab.*

IF SPECIAL OR NON-ROUTINE DETECTION LIMITS ARE REQUIRED, PLEASE CALL THE LAB.

Lab ID (Lab Use Only)	Client/Field Sample ID	Collection Date	Collection Time	Sample Source / Matrix	VOCs	Pb								Sample Remarks (below)	TOTAL # OF BOTTLES
	MW-A	5/8/97	9:00	Groundwater	X	X									
	MW-B		10:10		X	X									
	MW-3		10:50		X	X									
	MW-C		11:40		X	X									
	MW-4		12:40		X	X									
	MW-1		12:45		X	X									
	MW-2		2:15		X	X									
	WS-1		2:30		X	X									

Matrix Analytical, Inc.
106 South Street
Hopkinton, MA 01748
Phone: (800) 362-8749
Fax: (508) 435-2497

NOTES: (1) [illegible] (Illegible) [illegible] (2) Metals to be analyzed: Arsenic, Cadmium, Copper, Lead (3) VOC analysis - EPA Method 8240. Need low detection limits.

CHAIN-OF-CUSTODY RECORD

Relinquished By:	Date/Time	Received By:	Date/Time
Nancy J Reid	5/8/97 2:55	[illegible]	5/8/97 2:50
[illegible]	5/8/97 5:00	[illegible]	[illegible]

Condition of Samples Upon Arrival
☐ Okay ☐ Problem(s)

Distribution of Copies
White-Lab Yellow-Report Pink-Client

APPENDIX B

Permeability Calculations

HALEY & ALDRICH, INC.	CALCULATIONS	File No. 91017-402
		Sheet 1 of 2
Client: Bovano of Cheshire		Date: 5/19/97
Project: Bovano		Computed By: NLR
Subject: Permeability Testing		Checked By: TAD

MW3A

$$K_h = \frac{R^2}{2L(t_2 - t_1)} \ln \frac{L}{R} \ln \frac{h_1}{h_2}$$

$R = 2.54$ cm
$L = 242.0$ cm
$t_1 = 0.1$ min
$t_2 = 0.95$ min
$h_1 = 1.038$ ft
$h_2 = 0.083$ ft

$$= \frac{6.45 \text{ cm}^2}{484 \text{ cm}(0.85 \text{ min})} \ln \frac{242}{2.54} \ln \frac{1.038}{0.083}$$

$$= .016 \text{ cm/min} \times 4.56 \times 2.53$$

$$= 1.8 \times 10^{-1} \text{ cm/min} \quad (3.1 \times 10^{-3} \text{ cm/sec})$$

MW3B

$$K_h = \frac{R^2}{2L(t_2 - t_1)} \ln \frac{L}{R} \ln \frac{h_1}{h_2}$$

$R = 2.54$ cm
$L = 242.0$ cm
$t_1 = 0.1$ min
$t_2 = 0.65$ min
$h_1 = 1.01$ ft
$h_2 = 0.242$ ft

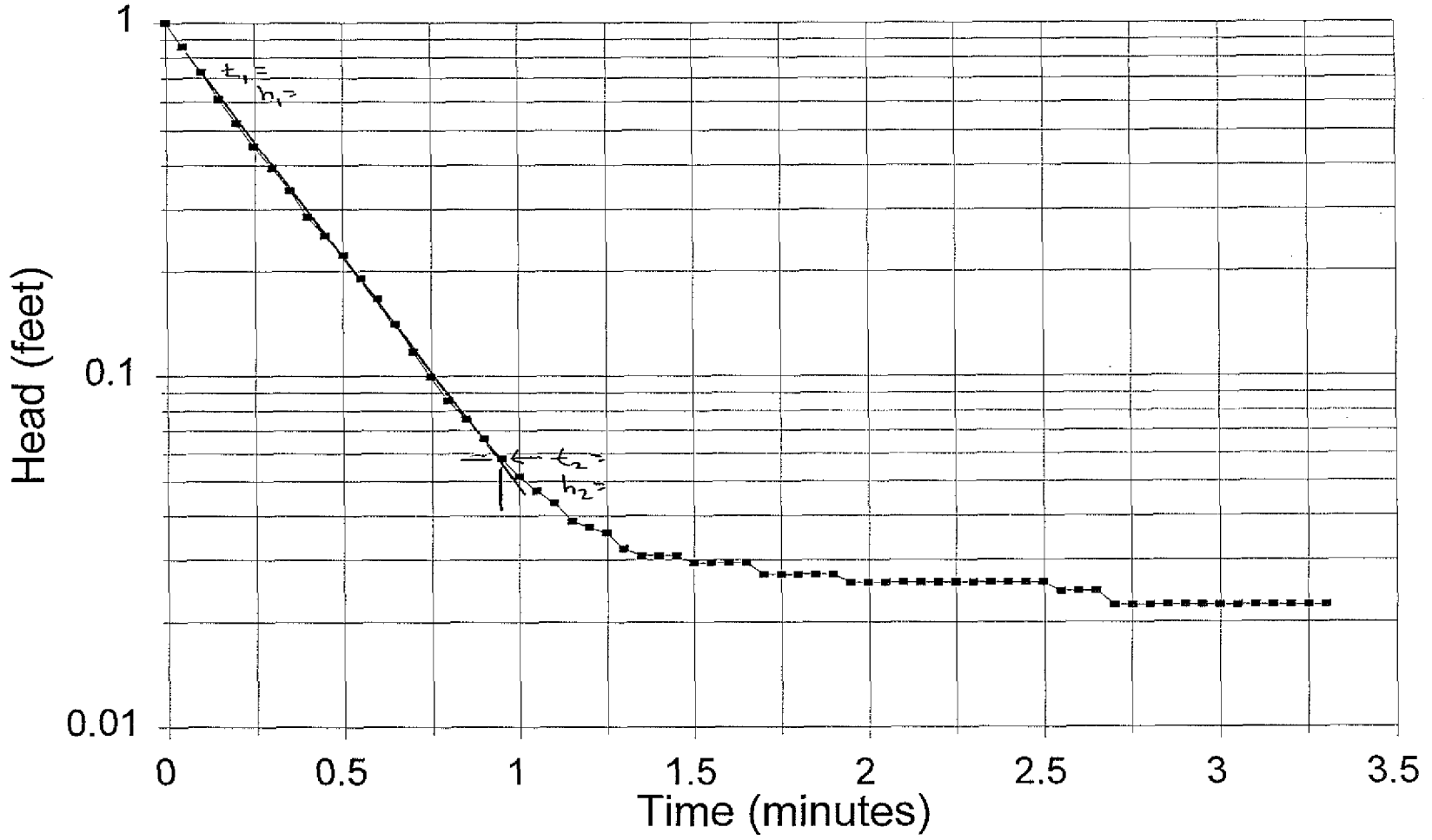
$$= \frac{6.45 \text{ cm}^2}{484 \text{ cm}(0.55 \text{ min})} \ln \frac{242}{2.54} \ln \frac{1.01}{0.242}$$

$$= 0.024 \text{ cm/min} \times 4.56 \times 1.43$$

$$= 1.6 \times 10^{-1} \text{ cm/min} \quad (2.6 \times 10^{-3} \text{ cm/sec})$$

Slug Test

MW-3A

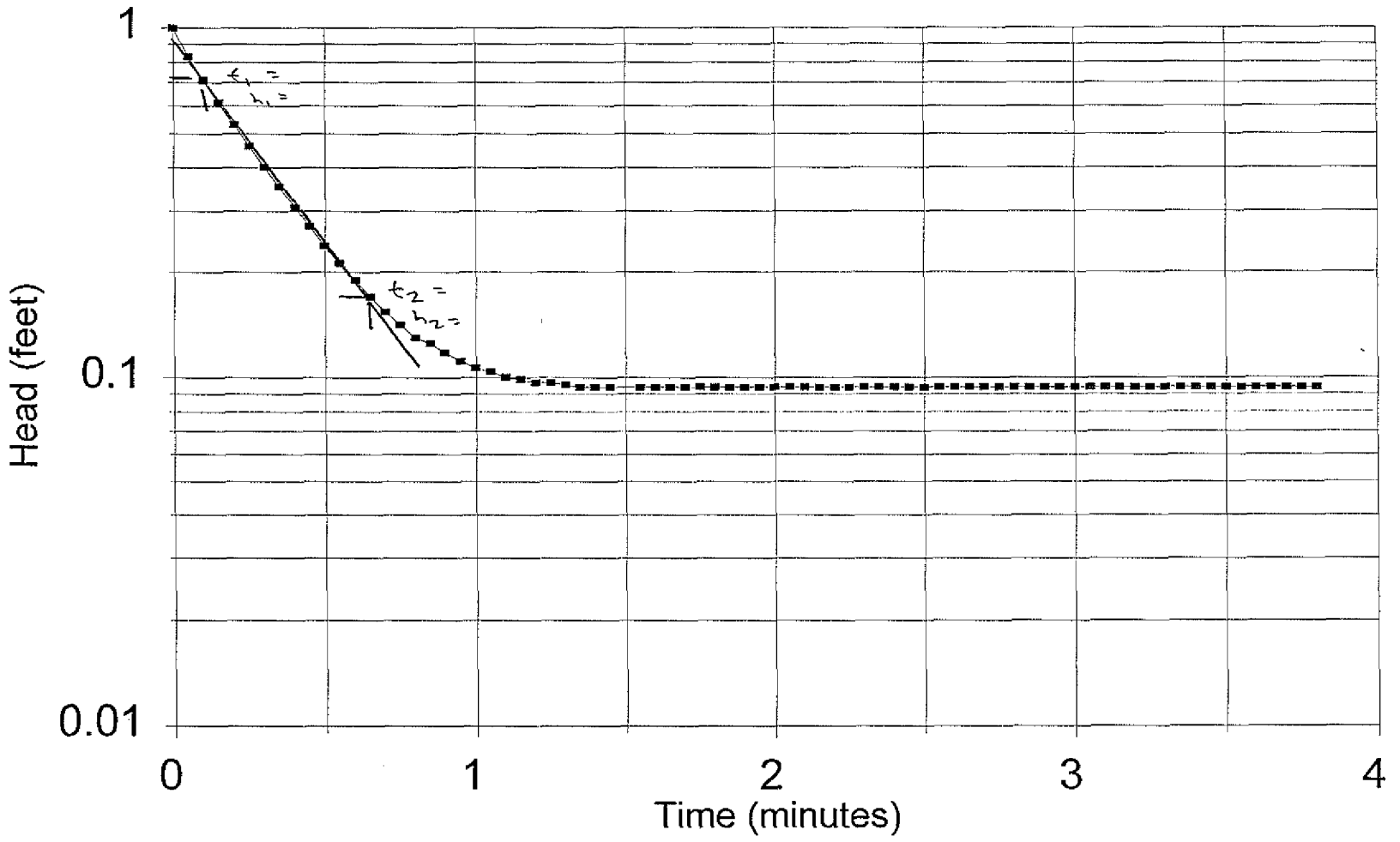


Slug Test:MW-3A

Static Head	Head (ft.)	Head Ratio	Time (min.)
8.29	1.432	1.000	0
	1.225	0.855	0.05
	1.038	0.725	0.1
	0.872	0.609	0.15
	0.75	0.524	0.2
	0.646	0.451	0.25
	0.561	0.392	0.3
	0.484	0.338	0.35
	0.408	0.285	0.4
	0.36	0.251	0.45
	0.318	0.222	0.5
	0.272	0.190	0.55
	0.238	0.166	0.6
	0.201	0.140	0.65
	0.168	0.117	0.7
	0.143	0.100	0.75
	0.122	0.085	0.8
	0.108	0.075	0.85
	0.095	0.066	0.9
	0.083	0.058	0.95
	0.074	0.052	1
	0.067	0.047	1.05
	0.062	0.043	1.1
	0.055	0.038	1.15
	0.053	0.037	1.2
	0.051	0.036	1.25
	0.046	0.032	1.3
	0.044	0.031	1.35
	0.044	0.031	1.4
	0.044	0.031	1.45
	0.042	0.029	1.5
	0.042	0.029	1.55
	0.042	0.029	1.6
	0.042	0.029	1.65
	0.039	0.027	1.7
	0.039	0.027	1.75
	0.039	0.027	1.8
	0.039	0.027	1.85
	0.039	0.027	1.9
	0.037	0.026	1.95
	0.037	0.026	2
	0.037	0.026	2.05
	0.037	0.026	2.1
	0.037	0.026	2.15
	0.037	0.026	2.2
	0.037	0.026	2.25
	0.037	0.026	2.3
	0.037	0.026	2.35
	0.037	0.026	2.4

Slug Test

MW-3B



Slug Test: MW-3B

Static Head	Head (ft.)	Head Ratio	Time (min.)
8.29	1.423	1.000	0
	1.181	0.830	0.05
	1.01	0.710	0.1
	0.87	0.611	0.15
	0.754	0.530	0.2
	0.655	0.460	0.25
	0.57	0.401	0.3
	0.501	0.352	0.35
	0.438	0.308	0.4
	0.385	0.271	0.45
	0.339	0.238	0.5
	0.302	0.212	0.55
	0.27	0.190	0.6
	0.242	0.170	0.65
	0.219	0.154	0.7
	0.201	0.141	0.75
	0.185	0.130	0.8
	0.178	0.125	0.85
	0.168	0.118	0.9
	0.159	0.112	0.95
	0.152	0.107	1
	0.148	0.104	1.05
	0.143	0.100	1.1
	0.141	0.099	1.15
	0.138	0.097	1.2
	0.138	0.097	1.25
	0.136	0.096	1.3
	0.134	0.094	1.35
	0.134	0.094	1.4
	0.134	0.094	1.45
	0.134	0.094	1.55
	0.134	0.094	1.6
	0.134	0.094	1.65
	0.134	0.094	1.7
	0.134	0.094	1.75
	0.134	0.094	1.8
	0.134	0.094	1.85
	0.134	0.094	1.9
	0.134	0.094	1.95
	0.134	0.094	2
	0.134	0.094	2.05
	0.134	0.094	2.1
	0.134	0.094	2.15
	0.134	0.094	2.2
	0.134	0.094	2.25
	0.134	0.094	2.3
	0.134	0.094	2.35
	0.134	0.094	2.4

HALEY & ALDRICH, INC.	CALCULATIONS	File No. 91017-402
		Sheet 2 of 2
Client: Bovano of Cheshire		Date: 5/19/97
Project: Bovano		Computed By: NLR
Subject: Permeability Testing		Checked By: TAD

MWa3

$$K_h = \frac{R^2}{2L(t_2 - t_1)} \ln \frac{L}{R} \ln \frac{h_1}{h_2}$$

$R = 2.54$ cm
$L = 203$ cm
$t_1 = 0.05$ min
$t_2 = 0.15$ min
$h_1 = 0.632$
$h_2 = 0.088$ min

$$= \frac{6.45 \text{ cm}^2}{406 \text{ cm } (0.1 \text{ min})} \ln \frac{203}{2.54} \ln \frac{0.632}{0.088}$$

$$= 0.16 \text{ cm/min} \times 4.38 \times 1.97$$

$$= 1.37 \text{ cm/min} \quad (2.3 \times 10^{-2} \text{ cm/sec})$$

MWa1

$$K_h = \frac{R^2}{2L(t_2 - t_1)} \ln \frac{L}{R} \ln \frac{h_1}{h_2}$$

$R = 2.54$ cm
$L = 203$ cm
$t_1 = 0.05$ min
$t_2 = 0.2$ min
$h_1 = .493$ ft
$h_2 = 0.057$ ft

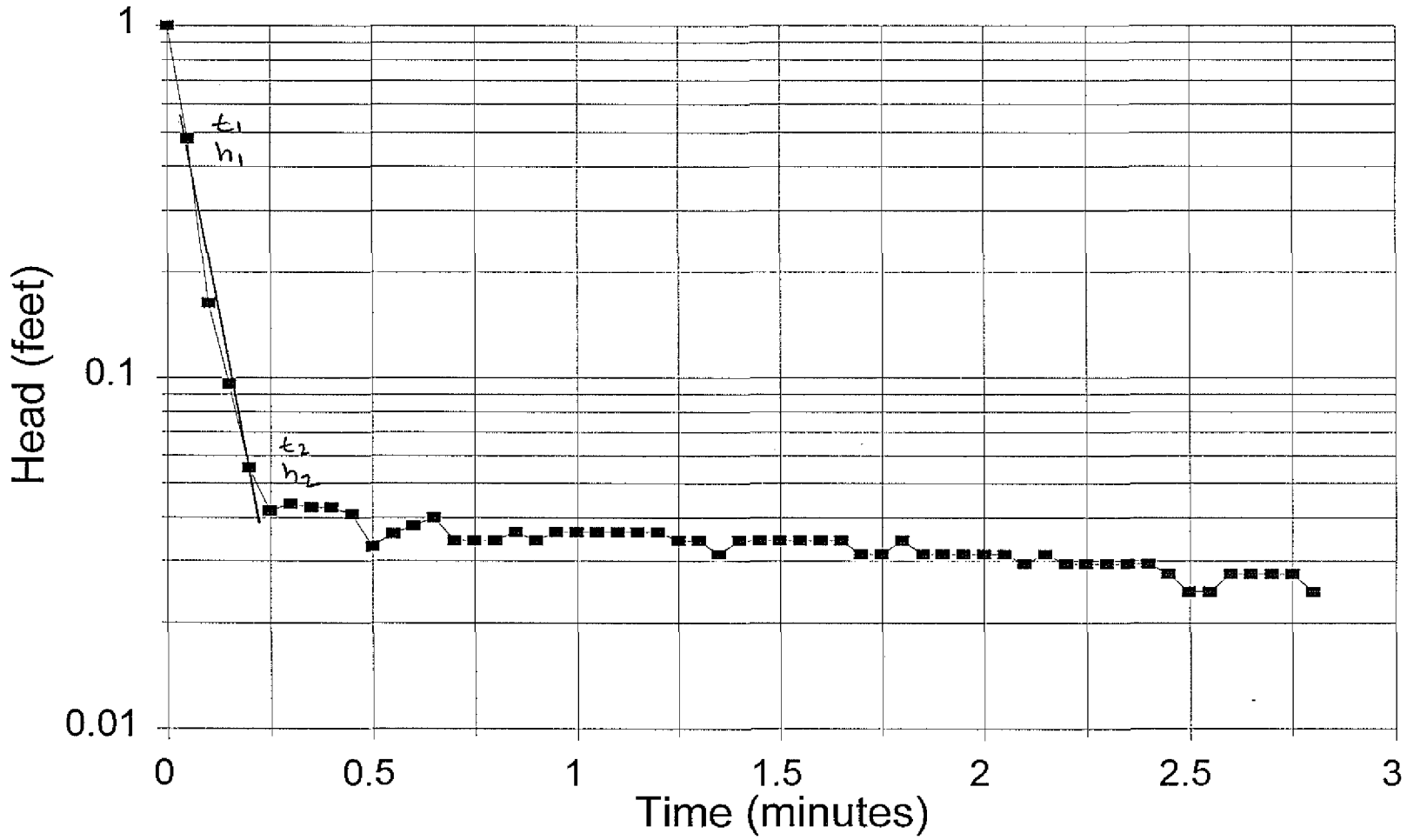
$$= \frac{6.45 \text{ cm}^2}{406 \text{ cm } (.15 \text{ min})} \ln \frac{203}{2.54} \ln \frac{.493}{0.057}$$

$$= 0.11 \text{ cm/min} \times 4.38 \times 2.15$$

$$= 1.0 \text{ cm/min} \quad (1.7 \times 10^{-2} \text{ cm/sec})$$

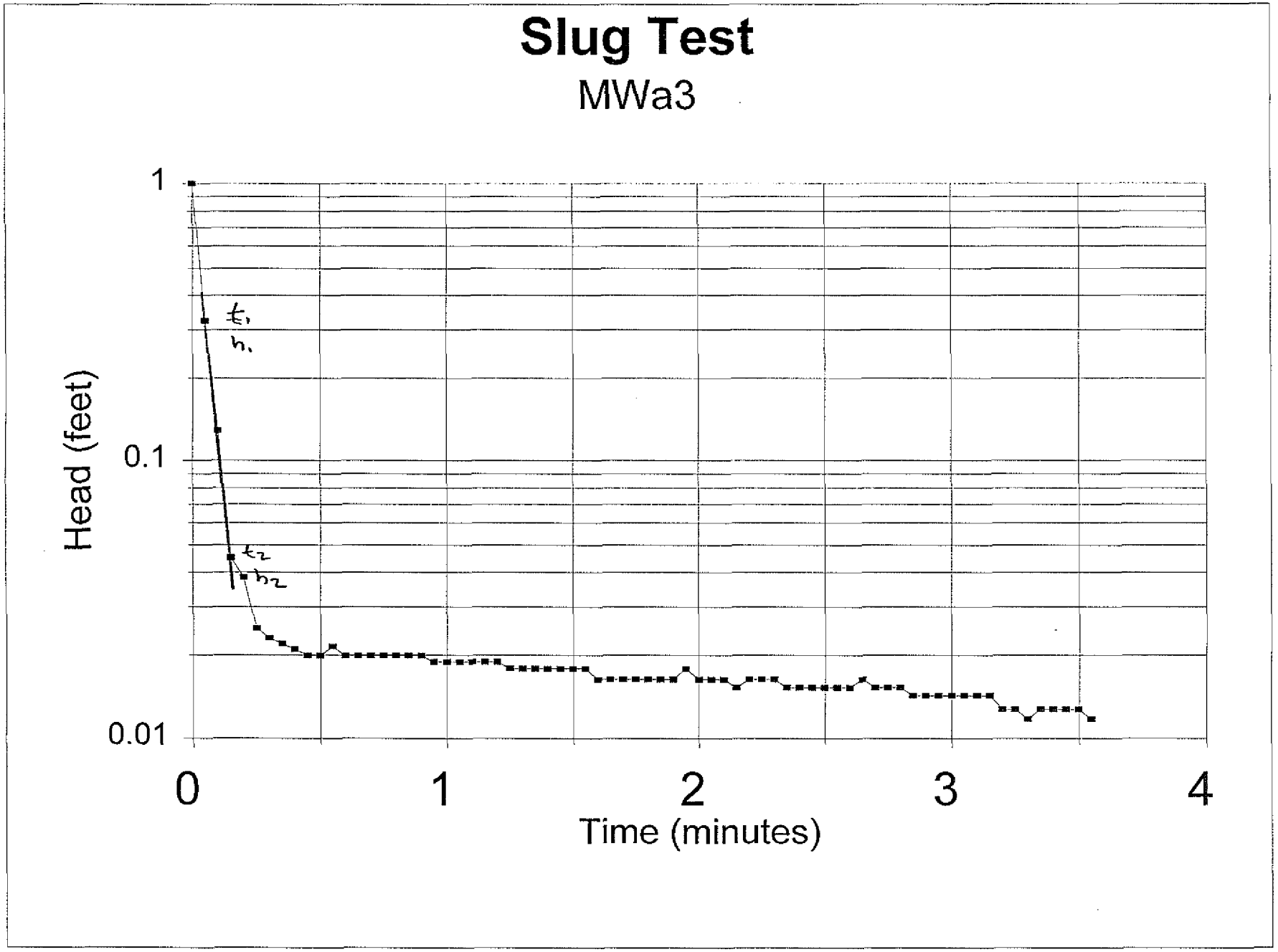
Slug Test

MWa1



Slug Test MWA1

Static Head (ft.)	Head (ft.)	Head Ratio	Time (min.)
6.5	1.031	1.000	0
	0.493	0.478	0.05
	0.168	0.163	0.1
	0.099	0.096	0.15
	0.057	0.055	0.2
	0.043	0.042	0.25
	0.045	0.044	0.3
	0.044	0.043	0.35
	0.044	0.043	0.4
	0.042	0.041	0.45
	0.034	0.033	0.5
	0.037	0.036	0.55
	0.039	0.038	0.6
	0.041	0.040	0.65
	0.035	0.034	0.7
	0.035	0.034	0.75
	0.035	0.034	0.8
	0.037	0.036	0.85
	0.035	0.034	0.9
	0.037	0.036	0.95
	0.035	0.036	1
	0.037	0.036	1.05
	0.037	0.036	1.1
	0.037	0.036	1.15
	0.037	0.036	1.2
	0.037	0.034	1.25
	0.037	0.034	1.3
	0.035	0.031	1.35
	0.035	0.034	1.4
	0.032	0.034	1.45
	0.035	0.034	1.5
	0.035	0.034	1.55
	0.035	0.034	1.6
	0.035	0.034	1.65
	0.035	0.031	1.7
	0.035	0.031	1.75
	0.032	0.034	1.8
	0.032	0.031	1.85
	0.035	0.031	1.9
	0.032	0.031	1.95
	0.032	0.031	2
	0.032	0.031	2.05
	0.032	0.029	2.1
	0.032	0.031	2.15
	0.03	0.029	2.2
	0.032	0.029	2.25
	0.03	0.029	2.3
	0.03	0.029	2.35
	0.03	0.029	2.4
	0.03	0.027	2.45


Slug Test
MWa3
Head (feet)
1
0.1
0.01
0
1
2
3
4
Time (minutes)
t_1
h_1
t_2
h_2

Slug Test MWA3

Static Head (ft.)	Head (ft.)	Head Ratio	Time (min.)
6.5	1.958	1.000	0
	0.632	0.323	0.05
	0.251	0.128	0.1
	0.088	0.045	0.15
	0.075	0.038	0.2
	0.049	0.025	0.25
	0.045	0.023	0.3
	0.043	0.022	0.35
	0.041	0.021	0.4
	0.039	0.020	0.45
	0.039	0.020	0.5
	0.042	0.021	0.55
	0.039	0.020	0.6
	0.039	0.020	0.65
	0.039	0.020	0.7
	0.039	0.020	0.75
	0.039	0.020	0.8
	0.039	0.020	0.85
	0.039	0.020	0.9
	0.037	0.019	0.95
	0.037	0.019	1
	0.037	0.019	1.05
	0.037	0.019	1.1
	0.037	0.019	1.15
	0.037	0.019	1.2
	0.035	0.018	1.25
	0.035	0.018	1.3
	0.035	0.018	1.35
	0.035	0.018	1.4
	0.035	0.018	1.45
	0.035	0.018	1.5
	0.035	0.018	1.55
	0.032	0.016	1.6
	0.032	0.016	1.65
	0.032	0.016	1.7
	0.032	0.016	1.75
	0.032	0.016	1.8
	0.032	0.016	1.85
	0.032	0.016	1.9
	0.035	0.018	1.95
	0.032	0.016	2
	0.032	0.016	2.05
	0.032	0.016	2.1
	0.03	0.015	2.15
	0.032	0.016	2.2
	0.032	0.016	2.25
	0.032	0.016	2.3
	0.03	0.015	2.35
	0.03	0.015	2.4
	0.03	0.015	2.45
	0.03	0.015	2.5

APPENDIX C

Contaminant Transport Calculations

CLIENT Jim Flood
PROJECT Bovano of Cheshire
SUBJECT Contaminant Transport Calculations

FILE NO. 91017-402
DATE June 17, 1997
COMPUTED BY N. Reid
CHECKED BY J. Kastrinos

PROBLEM STATEMENT:

Predict contaminant plume dimensions and position of advective front by calibrating a 2-dimensional contaminant transport solution to volatile organic compound (VOC) concentrations in two monitoring wells. Advection is the process by which moving groundwater carries with it dissolved solutes.

II. METHOD:

The analysis is based on the assumption that the contaminant source area is a continuous planar source, wherein the concentration remains constant over time despite groundwater flushing and natural degradation, and the source is a plane perpendicular to the groundwater flow direction. The equation used to predict the plume geometry and advective front is by Domenico and Robbins Equation 17.18, modified for 2-dimensional transport (vertical dispersion, which is typically a small fraction of longitudinal and transverse dispersion, is ignored) as presented in: Domenico, P.A. and Schwartz, F.W., 1990. Physical and Chemical Hydrogeology. John Wiley & Sons, New York, pp. 645-649.

The equation is as follows:

$$C(x,y,t) = (C_o/4)\ \mathrm{erfc}\ [(x-vt)/(2(\alpha_x\ vt)^{1/2})]\ \{\mathrm{erf}\ [(y+Y/2)/(2(\alpha_y\ x)^{1/2})] - \mathrm{erf}\ [(y-Y/2)/(2(\alpha_y\ x)^{1/2})]$$

where:

$C(x,y,t)$ =	concentration at point of interest for a given elapsed time, μg/l (to be solved for)
C_o =	concentration in planar source, μg/l, (based on site data)
x =	distance downgradient of planar source, along axis of longitudinal dispersion, ft.
v =	groundwater flow velocity, ft./day [based on site data - using Darcy velocity equation v = ki/n; where k = hydraulic conductivity, ft./day;
i =	hydraulic gradient, ft./ft.; and n = porosity, unitless (estimated from published data based on grain size characteristics of water-bearing soils at the site)] As necessary, v is adjusted to calibrate equation to site concentration data over time, within the range of magnitude of hydraulic conductivity tests completed at the site, and allowing for decreases in v to account for retardation of the contaminant front.
t =	elapsed time, days
α_x =	longitudinal dispersivity, ft., estimated based on published data
y =	distance of point of interest perpendicular to and from the axis of longitudinal dispersion
Y =	planar contaminant source dimension perpendicular to groundwater flow direction, ft.
α_y =	transverse dispersivity, ft., estimated based on published data

CLIENT Jim Flood
PROJECT Bovano of Cheshire
SUBJECT Contaminant Transport Calculations

FILE NO. 91017-402
DATE June 17, 1997
COMPUTED BY N. Reid
CHECKED BY J. Kastrinos

III. INPUT:

$C(x,y,t)$ = 50 μg/l for initial calibration run, based on 6/19/84 data from well MW3.
$C(x,y,t)$ = 20 μg/l for second calibration run, based on 5/08/97 data from well MW3.
C_o = 1220 μg/l for initial calibration run, based on 9/82 data from Well B.
C_o = 34 μg/l for second calibration run, based on 6/19/84 data from Well B.
x = 140 ft. at well MW3.
v = 0.20 ft./day, based on:
k = 2.8 ft./day, based on hydraulic conductivity testing
i = 0.018 ft./ft. based on site groundwater elevation contours
n = 0.25 typical value for coarse to fine sand, based on published data, including Freeze, R.A., and Cherry, J.A., 1979. Groundwater. Prentice-Hall, Inc., p.37.
t = 660 days for initial calibration run
t = 4745 days for second calibration run
$\propto_x$ = say 2 to 4 ft. (equation will be solved for both values). This range is consistent with values based on field investigations by the U.S. Geological Survey in glacial outwash soils on Cape Cod, Massachusetts (0.96 m. = 3.1 ft.) and the Stanford University-University of Waterloo experiments in sandy, unconfined soils at Camp Borden, Canada (0.43 m. = 1.4 ft.) as reported in proceedings of the National Water Well Association IBM-PC Applications in Groundwater Course by R.W. Cleary.
y = 0 ft. at MW-3, which is approximately "directly" downgradient of the source area.
Y = 20 ft. (based on site historical information and soil and groundwater quality data)
$\propto_y$ = 0.2 to 0.4 ft. (corresponding to $\propto_x$ values of 2 and 4, respectively), which equals 10% of the longitudinal dispersivity. In the Stanford University study, estimated $\propto_y$ was 0.04 m. = 0.13 ft., or roughly 10% of $\propto_x$. In addition, Freeze and Cherry (1979) report that transverse dispersivity values are typically lower than longitudinal dispersivity by a factor of 5 to 20.

IV. RESULTS

The transport equation, model calibration results, and plume dimension simulations are summarized in the attached spreadsheet.

The equation was first calibrated using two separate groundwater data sets; the first data set obtained prior to source remediation, with Co = 1220 μg/l and C(x,y,t) = 50 μg/l (MW-3); the second obtained after remediation, with Co = 34 μg/l and C(x,y,t) = 20 μg/l (MW-3). In both data sets, the equation was approximately calibrated by reducing the groundwater flow velocity from 0.2 ft./day to 0.14 to 0.16 ft./day, which is within the range of estimated flow velocities, given the range of hydraulic conductivity and hydraulic gradient, from which the velocity is estimated.

Based on the plume dimensions, the advective front of the contaminant plume under current conditions ranges from 786 to 858 ft. downgradient of the former source, and the width of the plume ranges from 70 to 96 ft. downgradient of the former source.

CONTAMINANT TRANSPORT CALCULATIONS

Receptor	Co	(Co/4)	x	v	t	y	Y	Sigx	Sigy	Term 1	Term 2	Term 3	(erfc term)	(erf y+Y/2)	(erf y-Y/2)	C(x,y,t)	Comment
MW-3	1220	305	140	0.2	660	0	20	4	0.4	0.1740777	0.6681531	-0.668153	0.8055405867	0.6552957776	-0.655295778	322	plume expanding
MW-3	1220	305	140	0.15	660	0	20	4	0.4	1.0301638	0.6681531	-0.668153	0.145151838	0.6552957776	-0.655295778	58	plume expanding
MW-3	1220	305	140	0.14	660	0	20	4	0.4	1.2379724	0.6681531	-0.668153	0.079987707	0.6552957776	-0.655295778	32	plume expanding
MW-3	1220	305	140	0.16	660	0	20	2	0.2	1.183536	0.94491118	-0.944911	0.094175275	0.8185507912	-0.818550791	47	plume expanding
MW-3	34	8.5	140	0.14	4745	0	20	4	0.4	-5.085548	0.6681531	-0.668153	2	0.6552957776	-0.655295778	22	steady state
MW-3	34	8.5	140	0.16	4745	0	20	2	0.2	-7.945255	0.94491118	-0.944911	2	0.8185507912	-0.818550791	28	steady state
Fabric Store Well	34	8.5	380	0.14	4745	150	20	4	0.4	-2.757622	6.48885685	5.6777497	1.9999037543	1	1	0	steady state
Fabric Store Well	34	8.5	380	0.16	4745	150	20	2	0.2	-4.865699	9.17662935	149.42646	2	1	1	0	steady state
Est. Plume Width	34	8.5	380	0.14	4745	48	20	4	0.4	-2.757622	2.35221061	1.5411035	1.9999037543	0.9991206486	0.9707017051	0	steady state
Est. Plume Width	34	8.5	380	0.16	4745	37	20	2	0.2	-4.865699	2.69563487	1.5485562	2.000000	0.9998622665	0.9714749784	0	steady state
Est. Plume Width	34	8.5	380	0.14	4745	47	20	4	0.4	-2.757622	2.31165525	1.5005481	1.9999037543	0.9989213813	0.9661702836	1	steady state
Est. Plume Width	34	8.5	380	0.16	4745	36	20	2	0.2	-4.865699	2.63828094	1.4912023	2.000000	0.9998093489	0.9650449269	1	steady state
Est. Plume Width	34	8.5	500	0.14	4745	34	20	4	0.4	-1.593659	1.55563492	33.646447	1.9757896364	0.9721931046	1	-0	plume expanding
Est. Plume Width	34	8.5	500	0.16	4745	21	20	2	0.2	-3.325921	1.55	20.5	1.9999974434	0.9716227329	1	-0	steady state
Est. Plume Width	34	8.5	500	0.14	4745	33	20	4	0.4	-1.593659	1.52027958	32.646447	1.9757896364	0.9684447846	1	-1	plume expanding
Est. Plume Width	34	8.5	500	0.16	4745	20	20	2	0.2	-3.325921	1.5	19.5	1.9999974434	0.9661051461	1	-1	steady state
Adj. Jinny Hill Rd.	34	8.5	490	0.14	4745	0	20	4	0.4	-1.690656	0.35714286	-0.357143	1.9831951015	0.3864947338	-0.386494734	13	plume expanding
Adj. Jinny Hill Rd.	34	8.5	490	0.16	4745	0	20	2	0.2	-3.454236	0.50507627	-0.505076	1.9999989659	0.5249494758	-0.524949476	18	steady state
Adj. Jinny Hill Rd.	34	8.5	540	0.14	4745	0	20	4	0.4	-1.205672	0.34020691	-0.340207	1.9118199428	0.3695724984	-0.369572498	12	plume expanding
Adj. Jinny Hill Rd.	34	8.5	540	0.16	4745	0	20	2	0.2	-2.812661	0.48112522	-0.481125	1.999930	0.5037575254	-0.503757525	17	steady state

CONTAMINANT TRANSPORT CALCULATIONS

Receptor	Co	(Co/4)	x	v	t	y	Y	Sigx	Sigy	Term 1	Term 2	Term 3	Term 1 (erfc term)	Term 2 (erf y+Y/2)	Term 3 (erf y-Y/2)	C(x,y,t)	Comment
Area 1	34	8.5	787	0.14	4745	0	20	4	0.4	1.190152	0.28180756	-0.281808	0.0923500929	0.3097649287	-0.309764929	0	plume expanding
Area 1	34	8.5	859	0.16	4745	0	20	2	0.2	1.2805822	0.38146827	-0.381468	0.070138	0.4104426556	-0.410442656	0	plume expanding
Area 2	34	8.5	786	0.14	4745	0	20	4	0.4	1.1904523	0.28198677	-0.281987	0.0950358135	0.309951698	-0.309951698	1	plume expanding
Area 2	34	8.5	858	0.16	4745	0	20	2	0.2	1.2677507	0.38169051	-0.381691	0.072994	0.4106594436	-0.410659444	1	plume expanding
Area 3	34	8.5	700	0.14	4745	0	20	4	0.4	0.346279	0.29880715	-0.298807	0.6243374297	0.3273961824	-0.327396182	3	plume expanding
Area 3	34	8.5	700	0.16	4745	0	20	2	0.2	-0.759624	0.42257713	-0.422577	1.717298	0.4499026825	-0.449902683	13	plume expanding
Area 4	34	8.5	600	0.14	4745	0	20	4	0.4	-0.62369	0.32274861	-0.322749	1.6222399607	0.3519231318	-0.351923132	10	plume expanding
Area 4	34	8.5	600	0.16	4745	0	20	2	0.2	-2.042772	0.45643546	-0.456435	1.996134	0.4813949835	-0.481394983	16	steady state
Area 5	34	8.5	500	0.14	4745	0	20	4	0.4	-1.593659	0.35355339	-0.353553	1.9757896364	0.3829249225	-0.382924922	13	plume expanding
Area 5	34	8.5	500	0.16	4745	0	20	2	0.2	-3.325921	0.5	-0.5	1.999997	0.5204998777	-0.520499878	18	steady state
Area 6	34	8.5	400	0.14	4745	0	20	4	0.4	-2.563628	0.39528471	-0.395285	1.999711617	0.4238498778	-0.423849878	14	steady state
Area 6	34	8.5	400	0.16	4745	0	20	2	0.2	-4.609069	0.55901699	-0.559017	2.000000	0.5708046991	-0.570804699	19	steady state
Area 7	34	8.5	300	0.14	4745	0	20	4	0.4	-3.533597	0.45643546	-0.456435	1.9999994185	0.4813949835	-0.481394983	16	steady state
Area 7	34	8.5	300	0.16	4745	0	20	2	0.2	-5.892218	0.64549722	-0.645497	2.000000	0.6386895712	-0.638689571	22	steady state
Area 8	34	8.5	200	0.14	4745	0	20	4	0.4	-4.503566	0.55901699	-0.559017	1.9999999998	0.5708046991	-0.570804699	19	steady state
Area 8	34	8.5	200	0.16	4745	0	20	2	0.2	-7.175366	0.79056942	-0.790569	2.000000	0.7364475222	-0.736447522	25	steady state
Area 9	34	8.5	100	0.14	4745	0	20	4	0.4	-5.473535	0.79056942	-0.790569	2	0.7364475222	-0.736447522	25	steady state
Area 9	34	8.5	100	0.16	4745	0	20	2	0.2	-8.458515	1.11803399	-1.118034	2.000000	0.8861537016	-0.886153702	30	steady state
Area 10	34	8.5	50	0.14	4745	0	20	4	0.4	-5.95852	1.11803399	-1.118034	2	0.8861537016	-0.886153702	30	steady state
Area 10	34	8.5	50	0.16	4745	0	20	2	0.2	-9.100089	1.58113883	-1.581139	2.000000	0.9746526811	-0.974652681	33	steady state

NOTE: Spreadsheet is based on Equation 17.19, of Domenico and Schwartz, 1990, modified for 2-dimensional dispersion (vertical dispersion ignored).