

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Metropolitan Boston – Northeast Regional Office


JANE SWIFT
Governor


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Secretary

LAUREN A. LISS
Commissioner

MEMORANDUM FOR THE RECORD

To: Baldwin Pond Wellfield Project

Thru: Stephen Johnson, Section Chief 

From: Larry Immerman, Environmental Analyst 

Subject: WAYLAND-Former Raytheon Facility site
430 Boston Post Road
RTNs: 3-3866, 3-1783, 3-13574, 3-14042, 3-19482, and 3-13302
February 2002 Groundwater Split Sampling

Date: May 22, 2002


Introduction

Since November 2001, the Department of Environmental Protection's Site Discovery group (DEP/SD) has been conducting a limited assessment of groundwater quality within the wellfield protection area (Zone II) of the Town of Wayland's Baldwin Pond supply wells. DEP/SD's work is being conducted due to the detection of volatile organic compounds (VOCs) at the supply wells. According to information on file with DEP, the former Raytheon Facility site located at 430 Boston Post Road is also situated within the Zone II, and chlorinated VOCs similar to those identified at the Baldwin Pond supply wells have also been detected in groundwater sampled at the former Raytheon Facility site. In light of this, on January 31, 2002, DEP/SD sent a letter to Raytheon C3I Systems (Raytheon) and Congress Group, Inc. (CGI), requesting that permission be given to DEP/SD to access the site for the purpose of collecting groundwater from on-site monitoring wells. Both Raytheon and CGI agreed to allow DEP access on to the site to collect the groundwater samples for VOCs and RCRA 8 metals. Raytheon also stated that they would collect split VOC samples with DEP. The remainder of this Memorandum memorializes the March 1, 2002 groundwater sample collection and results.

This information is available in alternate format by calling our ADA Coordinator at (617) 574-6872.

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March 1, 2002 DEP Field Work

On March 1, 2002, Mr. Larry Immerman of DEP/SD met with Mr. Ed Madera of Raytheon, and Ms. Viktoria Zoltay and Mr. Joe Fiacco of Environmental Resources Management (ERM) at the Raytheon site. At that time, Mr. Immerman requested access to the following on-site monitoring wells to collect samples for VOC screening and RCRA 8 metals analysis:

MW-1 MW-1 is located approximately 130 feet to the north of the facility's sanitary water treatment system. The well screen is ten feet long and set at 9.0 to 19 feet below grade.

MW-TP-3 MW-TP-3 is located approximately 390 feet to the northwest and downgradient of the facility's sanitary wastewater treatment system and at the location of the 1996 removal of polychlorinated biphenyls (PCB) contaminated soil. The well screen is ten feet long and set at 7.0 to 17 feet below grade.

MW-32 MW-32 is located approximately 520 feet northwest and downgradient of the facility's sanitary wastewater treatment system. The well screen is ten feet long and is set at a depth of 2.0 to 12 feet below grade.

MW-44S(*) MW-44S is located approximately 140 feet north of the TCE release area indicated by ERM and Raytheon in past assessment reports. The well screen is five feet long and set at a depth of 27 to 32 feet below grade. Based on groundwater elevation data contained in ERM's reports, it is not clear to the writer whether or not the MW-44S/M/D well triplet is downgradient of the TCE source release area (MW-43S/D well couplet).

[(*) The writer had initially requested that groundwater be taken from MW-44D, however, it was later noted by the writer after the sampling had been completed that MW-44S was sampled in error. A telephone conversation between the writer and Ms. Zoltay confirmed this, and Ms. Zoltay stated that ERM would make arrangements for DEP to re-visit the site and sample MW-44D, at DEP's request. However, upon further review of data, DEP/SD later determined that enough groundwater quality information had been obtained from the other wells included in the March 1, 2002 sampling round, and re-sampling MW-44D would not be essential to DEP/SD objectives.]

MW-43D MW-43D is located at the TCE release area as indicated by previously prepared ERM reports on file with DEP. The well screen is five feet long and set at a depth of 50 to 55 feet below grade, partially in bedrock.

MW-34 MW-34 is located approximately 420 feet east and likely upgradient of the facility's sanitary wastewater treatment facility. The well screen is ten feet long and set at a depth of 5.0 to 15 feet below grade.

Mr. Madera and Mr. Fiacco agreed to the sampling at these well locations and then left the site. These six monitoring wells were selected by the writer due to their location on the northern portion of the site, closest to the Town's Baldwin Pond supply wells. DEP also focused on the deeper wells at the MW-43 and 44 well clusters. Mr. Immerman and Ms. Zoltay then proceeded to sample the wells listed above. Mr. Immerman used high-density, polyethylene tubing fitted with an inertia-type foot valve to collect groundwater from the wells. With the exception of MW-1, Ms. Zoltay collected all of her VOC

samples from diffusion-type bags retrieved from within each well (MW-1 is a driven wellpoint with a diameter too small to fit a diffusion sample bag). Monitoring wells MW-1 and MW-34 did not have enough groundwater to support a sample for either VOCs or metals using the inertia foot valve sampling method, however, a water sample was collected by Ms. Zoltay from a diffusion bag at MW-34 for VOC analysis. Upon completion of the groundwater sampling round, DEP samples were brought to DEP's Northeast Regional Office (DEP/NERO) for VOC screening, and to DEP's Wall Experiment Station (Wall) for RCRA 8 metals analysis.

March 4, 2002 DEP VOC Screening Results

On March 4, 2002, groundwater samples collected at the Former Raytheon site in Wayland were screened at DEP's Northeast Regional Office using a gas chromatograph equipped with a photo-ionization detector and a dry-electrolytic conductivity detector (GC), in series. Results of the GC screening identified chlorinated VOCs at monitoring wells MW-TP-3, MW-44S, and MW-43D. The highest levels of chlorinated VOCs were detected in groundwater sampled from MW-TP-3 which identified cis(1,2)-dichloroethene (DCE) at 15 ug/l, TCE at 21 ug/l, and PCE at 3.4 ug/l. In addition, the gasoline additive methyl(t)butylether (MtBE) was also identified at MW-TP-3 at an estimated concentration of 20 ug/l, and naphthalene was detected at approximately 9.0 ug/l at MW-43D on the PID. (Please note: DEP/NERO is not certified in VOC analysis, but uses an in-house GC screening procedure to identify and quantify VOCs. MtBE and naphthalene were not confirmed in Raytheon's analytical results, and therefore, may be false positives). A complete listing of the screening results is attached to this Memorandum. Also, see "Table 1" for a comparison of DEP/SD's and Raytheon's VOC results.

March 2002 RCRA 8 Metals Results

During March and April 2002, Wall analyzed the groundwater samples for RCRA 8 metals (arsenic, barium, cadmium, chromium, lead, mercury, silver, and selenium). With the exception of silver, results of the metals analysis did not detect any target compounds above their respective RCGW-1 standards listed in the MCP. Please note that Wall's laboratory minimum detection level (MDL) for silver was indicated on the report sheet as 10ug/l. This MDL is slightly above the MCP RCGW-1 concentration of 7.0ug/l for this metal.

March 12, 2002 Raytheon VOC Results

On April 10, 2002, DEP received from Raytheon, VOC results of groundwater samples collected at monitoring wells MW-TP-3, MW-32, MW-44S, and MW-43D. The samples were collected at the time of the March 1, 2002 sampling round with DEP/SD and ERM. The submittal indicated that the sample taken from MW-TP-3 was analyzed using EPA Method 8260, with the remaining three samples analyzed using EPA Method 8021C (PID/ELCD). Two additional groundwater samples had also been collected by ERM during the March 1, 2002 sampling round, at monitoring wells MW-1 and MW-34, but it was later determined by ERM that these samples would not be representative of actual groundwater quality due to the poor groundwater recharge conditions found at these wells at the time of collection. In light of this, ERM decided to omit these two samples from their laboratory analysis. Upon review of the data, the writer noted that results from MW-TP-3 were similar to that of DEP/SD's March 4, 2002 VOC screening results. Both Raytheon and DEP/SD laboratory results are compared in Table 1, below, for the March 1, 2002 sampling event:

TABLE 1: Comparison of DEP/SD and Raytheon VOC Results – March 1, 2002 Round (ug/l)

SAMPLE ID COMPOUND	MW-TP-3		MW-32		MW-44S		MW-43D	
	DEP	ERM	DEP	ERM	DEP	ERM	DEP	ERM
cis(1,2)-dichloroethene	15	18	nd	<0.5	2.4	<0.5	nd	<0.5
(1,1,1)-trichloroethene	nd	<0.5	nd	<0.5	nd	0.63	nd	<0.5
trichloroethene	21	16	nd	<0.5	1.7	13	trace	<0.5
tetrachloroethene	3.4	2.2	nd	<0.5	trace	2.6	nd	<0.5

Writer's Summary and Recommendations

March 1, 2002 DEP/Raytheon VOC Sampling Round

On March 1, 2002, the writer collected groundwater samples from four monitoring wells at the Raytheon site. Two locations, MW-1 and MW-34 did not have a sufficient amount of water to support a representative sample at the time of collection. At that time, Raytheon's consultant, ERM, also split sampled for VOC analysis. DEP groundwater samples were screened by the writer for VOCs at DEP/NERO using a GC, and analyzed for RCRA 8 Metals at DEP/Wall. ERM's laboratory results were received by DEP on April 10, 2002. The highest levels of VOCs detected by both DEP and ERM were found at MW-TP-3, which identified cis(1,2)-dichloroethene (DCE) at 15 to 18 ug/l, TCE at 16 to 21 ug/l, and PCE at 2.2 to 3.4 ug/l. TCE was also detected at trace levels (<1.0 ug/l) in groundwater sampled at MW-43D. TCE has been historically detected in groundwater sampled from MW-43D's couplet well, MW-43S, at concentrations in the hundreds of parts per billion levels. Lastly, seven of eight metals included with DEP's RCRA 8 metals analysis were not detected in any of the groundwater samples above their respective MCP RCGW-1 standards. The remaining target metal, silver, was non-detect at the laboratory's reported MDL for silver at 10 ug/l (the MCP RCGW-1 standard is 7.0 ug/l for this metal).

Chlorinated VOC Source Areas Identified At The Former Raytheon Site

Building's #3, #4, #5, and #6: The writer has conducted a limited review of reports on file at DEP for the former Raytheon site. Information contained in the reports indicate that an area between the northern side of Building #4 and southern side of Building #3 (also referred to as the courtyard area), and areas just off of the southwestern corner of Building #6 and southern side of Building #5, are the principal source locations of the chlorinated VOC groundwater contamination at the site. Based on sub-surface data obtained during past assessment work, Raytheon and ERM have also identified the presence of a dense silt layer at approximately 15 to 60 feet below grade across the site, and determined that this dense layer has help retard vertical advancement of chlorinated VOCs to bedrock depths. VOC migration is traveling in a west and southwesterly direction across the site, towards Route 20 (Boston Post Road) and the Sudbury River. Raytheon conducted printed circuit board manufacturing at Building #4 from the 1960s to 1991. At Building #5, Raytheon operated an environmental testing laboratory from 1958 to 1995, and an AMICDO cleaning laboratory from the 1980s to 1994. Raytheon operated machine shops at Building #3 from 1955 to 1995, and at Building #6 from 1969 to 1995. Historic levels of chlorinated VOCs in groundwater have been in the hundreds of parts per billion range for these locations.

MW-TP-3 Area: Since 1996, parts per billion levels of chlorinated VOCs have been identified in the shallow groundwater at MW-TP-3. MW-TP-3 is located approximately 1600 feet to the northwest and cross-gradient to Building's #3 and #4, and approximately 900 feet to the northwest and possibly

downgradient of the facility's wastewater treatment plant and wellpoint MW-1. During Raytheon's 1996 phase I-initial site investigation activities, soil samples were collected from test pit "TP-3" for chemical characterization. Methanol preservation of soil samples for VOC analysis was not done. Results of the sampling identified a total petroleum hydrocarbon with an unknown oil signature, PCB, and the VOC, n-propylbenzene, at microgram per kilogram to milligram per kilogram levels in shallow soil sampled from Test Pit TP-3. Chlorinated VOCs were not detected in the soil at TP-3. Approximately 75 cubic yards of contaminated soil was removed under a Release Abatement Measure (RAM) from the TP-3 area, and the RAM completed in February 1997 (RTN: 3-14042). Monitoring well, MW-TP-3, was installed at that time of the RAM, when the excavation was being backfilled, to monitor shallow groundwater quality, and it was at that time that chlorinated VOCs in groundwater were detected. Raytheon stated in their December 24, 2001 "Response To Public Comments, Phase II/III" report that the chlorinated VOC contamination identified at MW-TP-3 is attributable to the residual impact of disposal at this location.

Writer's Recommendations

It is the opinion of the writer that the northern portion of the property bound by monitoring wells MW-1, MW-TP-3, and MW-32, at a minimum, needs to be assessed further for VOC contamination at greater depths in the soil and groundwater. These wells are only 19 feet, 17 feet, and 12 feet deep, respectively. Methanol preservation which was not required at the time of the 1996 VOC sampling, would now be needed for any soil sampling. Raytheon indicated in their December 24, 2001 report that chlorinated VOCs in groundwater at MW-TP-3 may be attributable to the residual impact of disposal at this location. The writer concurs with Raytheon's statement, and further points out that the facility's private wastewater treatment plant located at the northern portion of the property has serviced the facility since the 1960s, and is situated near MW-TP-3. Based on reviewed information, it is unclear to the writer as to whether or not chlorinated VOCs from past operations at the facility could have inadvertently been introduced into the waste stream of the treatment plant, and then subsequently discharged out of the plant and into the groundwater. Furthermore, elevated levels of chlorinated VOCs have been detected in groundwater sampled from on-site monitoring wells screened deeper than 20 feet below grade to the south and west of the treatment plant area, at the courtyard, and off of Building's #5 and #6. Based on the above information, the writer recommends that future groundwater assessment work at the northern portion of the property, extend to depths similar to the wells at the courtyard area and off of Building's #5 and #6. Groundwater quality at these depths is needed in order to better define fate and transport of VOCs and the localized groundwater movement across the northern portion of the property, and abutting Town conservation land to the north and northwest.

In closing, DEP/SD is currently conducting groundwater assessment work at properties owned by the Town of Wayland which are located to the north of the Raytheon site. As previously mentioned in this Memorandum, DEP/SD's work is being conducted in response to the detection of both chlorinated VOCs and VOCs associated with petroleum at the Baldwin Pond supply wells. Information obtained from DEP/SD's field work will be presented in a forthcoming memorandum.

cc : Town Of Wayland – Public Repository, Wayland Public Library, Ms. Louise Brown, 5 Concord Road, Wayland, MA 01778
Town Of Wayland – Public Repository, Board Of Health, Wayland Town Hall, 41 Cochituate Road, Wayland, MA 01778
Mr. Edwin Madera, Environmental Restoration Program, Raytheon Company, 1001 Boston Post Road, Mail Stop-1-2-1567, Marlborough, MA 01752-3789
Congress Group, Inc., 1 Memorial Drive, Cambridge, MA 02142 Attn: Ms. Paula Phillips

Attachments: -Copy of Raytheon/ERM March 1, 2002 “Table 1: Groundwater Quality Data”
-March 4, 2002 “NERO Lab Report” package
-Maps, “Figure 2”, “Figure 4”, and “Figure 16”, photo-copied from ERM Submittals

Table 1 (below) summarizes the analytical results collected by ERM. Concentrations observed in the wells were similar to previous historical ranges. Photocopies of the laboratory analytical reports are attached.

TABLE 1. Summary of Groundwater Quality Data

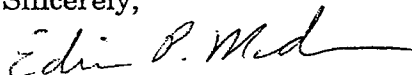
Sample ID	MW-TP-3	MW-32	MW-44S	MW-43D
Sampling Date	1-Mar-02	1-Mar-02	1-Mar-02	1-Mar-02
Depth to Groundwater (ft)	12.54	5.56	17.22	17.40
Tetrachloroethene (Previous Historical Range)	2.2 (ND - 2.0)	<0.5 (ND)	2.6 (ND)	<0.5 (ND)
Trichloroethene (Previous Historical Range)	16 (ND - 23)	<0.5 (ND)	13 (ND - 0.78)	<0.5 (ND)
cis-1,2 Dichloroethene (Previous Historical Range)	18 (1.7 - 35)	<0.5 (ND)	<0.5 (ND)	<0.5 (ND)
1,1,1-Trichloroethane (Previous Historical Range)	<0.5 (ND)	<0.5 (ND)	0.63 (ND)	<0.5 (ND)

Notes:

Concentrations expressed in parts per billion (ug/l).
ND indicates non-detect.

If you have any questions, please do not hesitate to contact me at 508-490-1351.

Sincerely,



Edwin P. Madera
Sr. Environmental Technologist

Attachment

cc: Mr. Joseph R. Fiacco, Jr. - ERM - Boston, MA
Ms. Paula Phillips - Congress Group Ventures - Cambridge, MA
Mr. Don Levine - Levco, Inc. - Needham, MA
Public Repository - Wayland BOH
Wayland Public Library

NERO LAB QC RECOVERY

Prepared by: Larry Im rman

LAB I.D.: P2361 / E2361

DATE: 3/4/02

QUALITY CONTROL SAMPLE AT APPROX. 120 ppbv

GC Conc. = ppmv concentration from gas chromatograph

Calc. STD. = Actual concentration of compound in the standard, prepared at WES

%R = Calculated recovery of compound, defined as: $GC\ Conc. / Calc.\ STD. \times 100 = \%R$

NOTE: NERO LAB uses a deviation of +/-30% from the actual standard concentration.
If a compound falls out of this window, the %R value will be flagged.

Channel 1 (PID) Compound	Absolute RT	RT WINDOW		GC Conc.	Calc. STD.	%R
methyl(t)butylether	2.28	2.31	2.54	0.112	0.137	82
cis(1,2)-dichloroethene	3.08	3.05	3.42	0.130	0.124	105
benzene	4.07	3.98	4.54	0.153	0.154	99
trichloroethene	5.05	4.92	5.59	0.103	0.092	112
toluene	7.20	7.02	7.68	0.140	0.131	107
tetrachloroethene	8.10	7.94	8.55	0.085	0.073	116
chlorobenzene	9.48	9.30	9.88	0.117	0.107	109
ethylbenzene	9.70	9.51	10.09	0.126	0.113	112
p-xylene	9.90	9.73	10.28	0.132	0.113	117
o-xylene	10.52	10.33	10.88	0.130	0.113	115
(1,2,4)-trimethylbenzene	12.62	12.46	12.94	0.096	0.098	98
naphthalene	16.80	18.32	19.51	0.108	0.094	115

Channel 2 (dry-ELCD) Compound	Absolute RT	RT WINDOW		GC Conc.	Calc. STD.	%R	
methylene chloride	2.20	2.24	2.46	0.083	0.142	58	FLAG
(1,1)-dichloroethane	2.68	2.69	2.98	0.128	0.121	106	
cis(1,2)-dichloroethene	3.17	3.15	3.52	0.134	0.124	108	
(1,1,1)-trichloroethane	3.72	3.65	4.13	0.093	0.090	103	
(1,2)-dichloroethane	4.17	4.08	4.64	0.130	0.122	106	
trichloroethene	5.15	5.02	5.69	0.113	0.092	123	
tetrachloroethene	8.20	8.03	8.65	0.081	0.073	111	
chlorobenzene	9.57	9.39	9.98	0.096	0.107	90	

QC PERFORMANCE REVIEWER: CHECK THE ITEMS IN THIS BOX ALONG WITH ANY COMMENTS

- YES NO PID RT's Within Window
- YES NO PID % Recovery Within Acceptable Deviation.
- YES NO ELCD RT's Within Window
- YES NO ELCD % Recovery Within Acceptable Deviation.

WRITE COMMENTS HERE



Massachusetts Department of Environmental Protection
 Northeast Region Office/Bureau of Waste Site Cleanup

Analytical Screening Data Report
WATER SAMPLES

Release Tracking Number:

N/A

Town:

WAYLAND

Name of Site	Address	Sample Collected By
FORMER RAYTHEON	430 BOSTON POST ROAD	L. IMMERMAN

Sample Location	Field ID	Lab ID	Date Sampled	Date Analyzed
MW-TP3 AT 17 FT. B.G.	MW-TP3	P2362 / E2362	3/1/02	3/4/02
MW-32 AT 12 FT. B.G.	MW-32	P2363 / E2363	3/1/02	3/4/02
MW-44S AT 32 FT. B.G.	MW-44S	P2364 / E2364	3/1/02	3/4/02
MW-43D @ 55 FT. B.G.	MW-43D	P2365 / E2365	3/1/02	3/4/02

SAMPLE RESULTS Estimated Aqueous Concentration Headspace Screening Technique		Sample Identifier								
		Est. RL ug/L	MW-TP3 Estimated Water Conc ug/L		MW-32 Estimated Water Conc ug/L		MW-44S Estimated Water Conc ug/L		MW-43D Estimated Water Conc ug/L	
ANALYTE	Detector									
methyl(t)butylether	PID	22.00	20	(J)	ND		ND		ND	
benzene	PID	1.50	ND		0.65	(J)	0.087	(K)	ND	
toluene	PID	1.50	0.056	(K)	ND		ND		ND	
ethylbenzene	PID	0.51	ND		ND		ND		ND	
total xylenes	PID	0.89	0.13	(K)	ND		ND		ND	
(1,2,4)-trimethylbenzene	PID	3.40	ND		ND		ND		ND	
naphthalene	PID	46.00	ND		ND		ND		9.1	(K)
Total unk. non-chloro (as xylene)	PID	0.89	ND		ND		ND		ND	
methylene chloride	ELCD	6.30	ND		ND		ND		ND	
(1,1)-dichloroethane	ELCD	1.10	ND		ND		ND		ND	
cis(1,2)-dichloroethane	ELCD	1.30	15		ND		2.4		ND	
(1,1,1)-trichloroethane	ELCD	0.87	ND		ND		ND		ND	
(1,2)-dichloroethane	ELCD	0.99	ND		ND		ND		ND	
trichloroethene (TCE)	ELCD	1.30	21		ND		1.7		0.18	(K)
tetrachloroethene	ELCD	0.90	3.4		ND		0.25	(K)	ND	
chlorobenzene	ELCD	2.70	ND		ND		ND		ND	
unk chloro VOC	ELCD	1.30	ND		ND		ND		ND	
unk chloro VOC	ELCD	1.30	ND		ND		ND		ND	
unk chloro VOC	ELCD	1.30	ND		ND		ND		ND	

COMMENTS

1. Estimated water concentrations based upon application of Henry's Law, assuming 80% headspace equilibrium conditions and single analyte systems. 2. ND means a compound was not detected. 3. (J) means that a target compound was found at a trace level - less than it's reportable level "RL", but above it's method detection limit (MDL). 4. (K) means a compound was detected below it's MDL, but above the instrument detection limit (IDL).

Sampling Method: NERO Lab	Instrumentation: SRI	Analytical Method: NERO
Daily Quality Control Standards: <input checked="" type="checkbox"/> Air Blanks <input checked="" type="checkbox"/> QC Calibration Check Standard (gaseous)		
Chromatograms Attached? <input checked="" type="checkbox"/> Yes	Sample(s) Analyzed By: <i>L. Immerman</i> 3/1/02	

WATER CONVERSION SPREADSHEET - SRI 8610B W (PID\dry-ELCD)

SAMPLE #1

Prepared by Larry Immerman, EAIII 1/14/00

Site:	FORMER RAYTHEON	Address:	430 BOSTON POST ROAD	Town:	WAYLAND
Sample Location:	MW-TP3 AT 17 FT. B.G.	Date Sampled:	3/1/02	RTN:	N/A
Date Analyzed:	3/4/02	Lab ID	P2362 / E2362	Field Identification No:	MW-TP3
				Collector	L. IMMERMAN

<p>Estimation Of Water VOC Concentration</p> <p>1:1 ratio of water phase to headspace phase in a 40 ml vial</p> <p>Where:</p> <p>Cw(ug/l) = Estimated water concentration in micrograms per liter (ug/l) units</p> <p>Ca(ppmv) = GC headspace concentration in parts per million volumetric (ppmv) units</p> <p>CFactor = Conversion factor from air concentration (ppmv) units to (ug/l) units</p> <p>k value = Henry's Constant value at approx. 21 c (dimensionless)</p>	<p>Equation:</p> $C_w = C_a * C_F * ((k \text{ value} + 1) / k \text{ value})$
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CHANNEL 1 (PID)

Compound	Ca (ppmv)	CFactor	k Value	k Source	MDL	RL	Cw (ug/l)	
methyl(t)butylether	0.052	3.66	0.012	DEP RISK	7.10	22	20	(J)
benzene		3.25	0.23	DEP RISK	0.48	1.50	ND	
toluene	0.003	3.83	0.27	NIOSH	0.48	1.50	0.056	(K)
ethylbenzene		4.41	0.32	NIOSH	0.16	0.51	ND	
total xylenes	0.004	4.41	0.21	DEP RISK	0.29	0.89	0.13	(K)
(1,2,4)-trimethylbenzene		5.12	0.23	TPH97-WG	1.10	3.40	ND	
naphthalene		5.32	0.02	NIOSH	14.84	46	ND	
Total unk. non-chloro (as xylene)		4.41	0.21	DEP RISK	0.29	0.89	ND	
trichloroethene	0.67	5.46	0.42	NIOSH	0.27	0.845	15	
tetrachloroethene	0.14	6.89	0.75	NIOSH	0.32	0.985	2.8	
chlorobenzene		4.68	0.15	NIOSH	0.75	2.32	ND	
cis (1,2)-dichloroethene	0.557	4.03	0.17	EPA	0.37	1.16	19	

CHANNEL 2 (dry-ELCD)

Compound	Ca (ppmv)	CFactor	k Value	k Source	MDL	RL	Cw (ug/l)	
methylene chloride		3.53	0.090	NIOSH	2.03	6.30	ND	
(1,1)-dichloroethane		4.12	0.230	NIOSH	0.35	1.10	ND	
cis (1,2)-dichloroethene	0.44	4.03	0.170	EPA	0.42	1.30	15	
(1,1,1)-trichloroethane		5.55	0.710	NIOSH	0.28	0.87	ND	
(1,2)-dichloroethane		4.11	0.040	used (1,1,)- DCA	0.32	0.99	ND	
trichloroethene (TCE)	0.920	5.46	0.420	NIOSH	0.42	1.30	21	
tetrachloroethene	0.17	6.89	0.750	NIOSH	0.29	0.90	3.4	
chlorobenzene		4.68	0.150	NIOSH	0.87	2.70	ND	
unk.chloro VOC(as TCE)		5.46	0.420	NIOSH	0.42	1.30	ND	
unk.chloro VOC (as TCE)		5.46	0.420	NIOSH	0.42	1.30	ND	
unk. chloro VOC (as TCE)		5.46	0.420	NIOSH	0.42	1.30	ND	

WATER CONVERSION SPREADSHEET - SRI 8610B w\ (PID)\dry-ELCD)

SAMPLE #2

Prepared by Larry Immerman, EAIII 1/14/00

Site:	FORMER RAYTHEON	Address:	430 BOSTON POST ROAD	Town:	WAYLAND
Sample Location:	MW-32 AT 12 FT. B.G.	Date Sampled:	3/1/02	RTN:	N/A
Date Analyzed:	3/4/02	Lab ID	P2363 / E2363	Field Identification No:	MW-32
				Collector	L.IMMERMAN

Estimation Of Water VOC Concentration Equation:
 1:1 ratio of water phase to headspace phase in a 40 ml vial $C_w = C_a * C_F * ((k \text{ value} + 1) / k \text{ value})$

Where:
 C_w(ug/l) = Estimated water concentration in micrograms per liter (ug/l) units
 C_a(ppmv) = GC headspace concentration in parts per million volumetric (ppmv) units
 C_FFactor = Conversion factor from air concentration (ppmv) units to (ug/l) units
 k value = Henry's Constant value at approx. 21 c (dimensionless)

CHANNEL 1 (PID)

Compound	Ca (ppmv)	CFactor	k Value	k Source	MDL	RL	Cw (ug/l)
methyl(t)butylether	0.0298	3.66	0.012	DEP RISK	7.10	22	ND
benzene		3.25	0.23	DEP RISK	0.48	1.50	0.65 (J)
toluene		3.83	0.27	NIOSH	0.48	1.50	ND
ethylbenzene		4.41	0.32	NIOSH	0.16	0.51	ND
total xylenes		4.41	0.21	DEP RISK	0.29	0.89	ND
(1,2,4)-trimethylbenzene		5.12	0.23	TPH97-WG	1.10	3.40	ND
naphthalene		5.32	0.02	NIOSH	14.84	46	ND
Total unk. non-chloro (as xylene)		4.41	0.21	DEP RISK	0.29	0.89	ND
trichloroethene		5.46	0.42	NIOSH	0.27	0.845	ND
tetrachloroethene		6.89	0.75	NIOSH	0.32	0.985	ND
chlorobenzene		4.68	0.15	NIOSH	0.75	2.32	ND
cis (1,2)-dichloroethene		4.03	0.17	EPA	0.37	1.16	ND

CHANNEL 2 (dry-ELCD)

Compound	Ca (ppmv)	CFactor	k Value	k Source	MDL	RL	Cw (ug/l)
methylene chloride	0.0298	3.53	0.090	NIOSH	2.03	6.30	ND
(1,1)-dichloroethane		4.12	0.230	NIOSH	0.35	1.10	ND
cis (1,2)-dichloroethene		4.03	0.170	EPA	0.42	1.30	ND
(1,1,1)-trichloroethane		5.55	0.710	NIOSH	0.28	0.87	ND
(1,2)-dichloroethane		4.11	0.040	used (1,1,-) DCA	0.32	0.99	ND
trichloroethene (TCE)		5.46	0.420	NIOSH	0.42	1.30	ND
tetrachloroethene		6.89	0.750	NIOSH	0.29	0.90	ND
chlorobenzene		4.68	0.150	NIOSH	0.87	2.70	ND
unk.chloro VOC(as TCE)		5.46	0.420	NIOSH	0.42	1.30	ND
unk. chloro VOC (as TCE)		5.46	0.420	NIOSH	0.42	1.30	ND
unk. chloro VOC (as TCE)		5.46	0.420	NIOSH	0.42	1.30	ND

WATER CONVERSION SPREADSHEET - SRI 8610B w\ (PID\dry-ELCD)

SAMPLE #3

Prepared by Larry Immerman, EAIII 1/14/00

Site:	FORMER RAYTHEON	Address:	430 BOSTON POST ROAD	Town:	WAYLAND
Sample Location:	MW-44S AT 32 FT. B.G.	Date Sampled:	3/1/02	RTN:	N/A
Date Analyzed:	3/4/02	Lab ID	P2364 / E2364	Field I.D. No:	MW-44S
				Collector	L. IMMERMAN

Estimation Of Water VOC Concentration

1:1 ratio of water phase to headspace phase in a 40 ml vial

Equation:
 $C_w = C_a \cdot C_F \cdot ((k \text{ value} + 1) / k \text{ value})$

Where:

C_w (ug/l) = Estimated water concentration in micrograms per liter (ug/l) units
 C_a (ppmv) = GC headspace concentration in parts per million volumetric (ppmv) units
 C_F = Conversion factor from air concentration (ppmv) units to (ug/l) units
 k value = Henry's Constant value at approx. 21 c (dimensionless)

CHANNEL 1 (PID)

Compound	Ca (ppmv)	CFactor	k Value	k Source	MDL	RL		Cw (ug/l)	
methyl(t)butylether		3.66	0.012	DEP RISK	7.10	22		ND	(K)
benzene	0.004	3.25	0.23	DEP RISK	0.48	1.50		0.087	
toluene		3.83	0.27	NIOSH	0.48	1.50		ND	
ethylbenzene		4.41	0.32	NIOSH	0.16	0.51		ND	
total xylenes		4.41	0.21	DEP RISK	0.29	0.89		ND	
(1,2,4)-trimethylbenzene		5.12	0.23	TPH97-WG	1.10	3.40		ND	
naphthalene		5.32	0.02	NIOSH	14.84	46		ND	
Total unk. non-chloro (as xylene)		4.41	0.21	DEP RISK	0.29	0.89		ND	
trichloroethene	0.0650	5.46	0.42	NIOSH	0.27	0.845		1.5	
tetrachloroethene	0.0131	6.89	0.75	NIOSH	0.32	0.985		0.26	
chlorobenzene		4.68	0.15	NIOSH	0.75	2.32		ND	
cis (1,2)-dichloroethene	0.0159	4.03	0.17	EPA	0.37	1.16		0.6	(J)

CHANNEL 2 (dry-ELCD)

Compound	Ca (ppmv)	CFactor	k Value	k Source	MDL	RL		Cw (ug/l)	
methylene chloride		3.53	0.090	NIOSH	2.03	6.30		ND	(K)
(1,1)-dichloroethane		4.12	0.230	NIOSH	0.35	1.10		ND	
cis (1,2)-dichloroethene	0.069	4.03	0.170	EPA	0.42	1.30		2.4	
(1,1,1)-trichloroethane		5.55	0.710	NIOSH	0.28	0.87		ND	
(1,2)-dichloroethane		4.11	0.040	used (1,1,)- DCA	0.32	0.99		ND	
trichloroethene (TCE)	0.0744	5.46	0.420	NIOSH	0.42	1.30		1.7	
tetrachloroethene	0.0126	6.89	0.750	NIOSH	0.29	0.90		0.25	
chlorobenzene		4.68	0.150	NIOSH	0.87	2.70		ND	
unk. chloro VOC(as TCE)		5.46	0.420	NIOSH	0.42	1.30		ND	
unk. chloro VOC (as TCE)		5.46	0.420	NIOSH	0.42	1.30		ND	
unk. chloro VOC (as TCE)		5.46	0.420	NIOSH	0.42	1.30		ND	

WATER CONVERSION SPREADSHEET - SRI 8610B w\ (PID)\dry-ELCD)

SAMPLE #4

Prepared by Larry Immerman, EAIII 1/14/00

Site:	FORMER RAYTHEON	Address:	430 BOSTON POST ROAD	Town:	WAYLAND
Sample Location:	MW-43D @ 55 FT. B.G.	Date Sampled:	3/1/02	RTN:	N/A
Date Analyzed:	3/4/02	Lab ID	P2365 / E2365	Field Identification No:	MW-43D
				Collector	L.IMMERMAN

Estimation Of Water VOC Concentration

1:1 ratio of water phase to headspace phase in a 40 ml vial

Equation:
 $C_w = C_a * C_F * ((k \text{ value} + 1) / k \text{ value})$

Where:
 C_w (ug/l) = Estimated water concentration in micrograms per liter (ug/l) units
 C_a (ppmv) = GC headspace concentration in parts per million volumetric (ppmv) units
 C_F = Conversion factor from air concentration (ppmv) units to (ug/l) units
 k value = Henry's Constant value at approx. 21 c (dimensionless)

CHANNEL 1 (PID)

Compound	Ca (ppmv)	CFactor	k Value	k Source	MDL	RL	Cw (ug/l)
methyl(t)butylether		3.66	0.012	DEP RISK	7.10	22	ND
benzene		3.25	0.23	DEP RISK	0.48	1.50	ND
toluene		3.83	0.27	NIOSH	0.48	1.50	ND
ethylbenzene		4.41	0.32	NIOSH	0.16	0.51	ND
total xylenes		4.41	0.21	DEP RISK	0.29	0.89	ND
(1,2,4)-trimethylbenzene		5.12	0.23	TPH97-WG	1.10	3.40	ND
naphthalene	0.0269	5.32	0.02	NIOSH	14.84	46	9.1
Total unk. non-chloro (as xylene)		4.41	0.21	DEP RISK	0.29	0.89	ND
trichloroethene		5.46	0.42	NIOSH	0.27	0.845	ND
tetrachloroethene		6.89	0.75	NIOSH	0.32	0.985	ND
chlorobenzene		4.68	0.15	NIOSH	0.75	2.32	ND
cis (1,2)-dichloroethene		4.03	0.17	EPA	0.37	1.16	ND

CHANNEL 2 (dry-ELCD)

Compound	Ca (ppmv)	CFactor	k Value	k Source	MDL	RL	Cw (ug/l)
methylene chloride		3.53	0.090	NIOSH	2.03	6.30	ND
(1,1)-dichloroethane		4.12	0.230	NIOSH	0.35	1.10	ND
cis (1,2)-dichloroethene		4.03	0.170	EPA	0.42	1.30	ND
(1,1,1)-trichloroethane		5.55	0.710	NIOSH	0.28	0.87	ND
(1,2)-dichloroethane		4.11	0.040	used (1,1,-) DCA	0.32	0.99	ND
trichloroethene (TCE)	0.01	5.46	0.420	NIOSH	0.42	1.30	0.18
tetrachloroethene		6.89	0.750	NIOSH	0.29	0.90	ND
chlorobenzene		4.68	0.150	NIOSH	0.87	2.70	ND
unk.chloro VOC(as TCE) RT 1.52		5.46	0.420	NIOSH	0.42	1.30	ND
unk. chloro VOC (as TCE)		5.46	0.420	NIOSH	0.42	1.30	ND
unk.chloro VOC (as TCE)		5.46	0.420	NIOSH	0.42	1.30	ND