

**Basis for Groundwater Releases Controlled Determination  
RCRIS Code CA750**

at

**Clean Harbors-Broderick Rd Facility  
EPA ID No. CT000604488  
51 Broderick Rd.  
Bristol, CT**

The purpose of this report is to provide the basis for determining that the Clean Harbors of Connecticut, Inc. - 51 Broderick Road, Bristol, CT Facility can be recorded with the status code of YE under the RCRIS Event Code of CA750--Groundwater Releases Controlled.

Based on the information available, the Agency has determined that the groundwater cleanup objectives can be met without the use of an engineered system through the remedial measures selected, including facilities where the contamination will naturally attenuate. This determination is made in accordance with the "Stabilization" guidance sent to Regional Waste Management Directors by Michael Shapiro on July 29, 1994, and is based on the facts, conclusions and references outlined below.

1. CONCLUSION

Investigations, including a RCRA Facility Investigation, performed by the facility demonstrate that low levels of dissolved-phase contaminants exist in site groundwater across the site. However, results of sampling and statistical analysis has demonstrated that the presence of these contaminants is likely attributable to the migration of contaminants onto the facility property from up gradient sources; thus, these dissolved-phase concentrations constitute background for the general area. This finding is consistent with the general industrial nature of the facility area.

Groundwater fate and transport modeling performed by EPA has demonstrated that specific on-site VOC and metal concentrations which are in slight exceedence of federal and state maximum contaminant levels (MCL) are not migrating off-site at concentrations above the MCL.

2. RELEASE SUMMARY<sup>1</sup>

The facility stores and treats a variety of aqueous and solid hazardous wastes. It is located in an industrial area served by public water and sewers. The closest private wells are 3000 to 4000 feet east of the site. No other use of area groundwater for potable purposes has been identified. A surface water stream adjacent to the site (Class B) drains to the Eightmile River which is a State of Connecticut Department of Environmental Protection (CTDEP) Class B stream located approximately 2500 feet to the southwest.

The site is underlain by a single overburden aquifer composed of glacial outwash and till deposits with a saturated thickness of approximately 30 to 40 feet. Average horizontal flow velocity in the aquifer is

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<sup>1</sup> RCRA Facility Investigation, 51 Broderick Road, Bristol, CT, January 1992.

estimated to be on the order of 150 to 380 feet per year ( $1.48E^{-9}$  to  $3.75E^{-9}$  cm<sup>2</sup>). Groundwater flow is in a southwesterly direction.

Certain metals (zinc, copper, chromium, cadmium, nickel) and VOCs (methylene chloride, PCE) were detected in site soils at low ppb levels both up and downgradient of the facility. However, only PCE has been detected consistently at concentrations slightly exceeding the MCL; detection of other constituents has occurred on a sporadic basis, and in general, detection of these constituents have steadily declined both in the frequency of detection and in concentration. The sporadic occurrence and isolated distribution of all dissolved-phase contaminants at the site is such that no discernable plume can be detected. The presence of VOCs at the site is considered to be attributable to the historic use of the area up gradient of the facility.

Eight to nine documented releases of hazardous wastes occurred at the facility, most of which occurred within containment areas. One of the releases involved a release on July 26, 1984 of treated waste waters from an effluent holding tank located along the northeast corner of the main building - the tank was repaired and the contaminated soils were excavated<sup>2</sup> - samples taken from the underlying soils indicated the release had been remediated. Another release consisted of treated waste waters and metal hydroxide sludges. The CTDEP was apparently satisfied with the facility's responses to these incidents.

As a result of RFI findings, EPA conditionally approved the RFI with the requirement that the facility implement a year-long groundwater monitoring program. The results of the program were to provide the requisite data for EPA to make a remedy decision including, inter alia, a "no further action" decision. The results of the one year groundwater monitoring program indicated the presence of low and decreasing levels of select metals and VOCs at the site. Further statistical analysis submitted by the facility at the request of EPA has demonstrated that the presence of groundwater contaminants is likely attributable to background for the general industrial area. EPA concurred, and in 1996, initiated an administrative no further action decision within the context of a Hazardous and Solid Waste Amendments (HSWA) permit modification.

### 3. RELEVANT CONDITIONS AND ASSUMPTIONS

This natural attenuation determination is considered a "protective remedy." The term "protective remedy," however, is not considered to equate to a "final remedy," or to be associated with Corrective Measures, or the preparation of a Statement of Basis and Response to Comments.<sup>3</sup>

In efforts to demonstrate that the detectable on-site concentrations of dissolved-phase contaminants are not migrating off-site at concentrations in exceedence of MCLs, EPA performed simple, yet conservative, fate and transport (f&t) modeling using two different f&t models which provide analytical

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<sup>2</sup> Although this event is the effective equivalent of an interim measure (IM), at this time, there is no written evidence of State approval of the IM. EPA requested confirmation from the State, but was informed that no documentation of approval could be located.

<sup>3</sup> See Shapiro Stabilization Memorandum, Guidance Note 2 at p. 12.

solutions to the advection-dispersion equations for simulating advection, dispersion and adsorption.<sup>4</sup> The results of the f&t modeling indicate that specific on-site VOC and metal constituents which are present in slight exceedence of federal and state maximum contaminant levels (MCL) are not migrating off-site at concentrations above the MCL. The results of this modeling analysis are attached as Appendix 1.

Since the f&t modeling demonstrates that on-site dissolved phase contaminants are not migrating off-site in exceedence of MCLs, Groundwater Releases Controlled, CA750, has been achieved.

Although there is a surface water stream downgradient of the facility, the f&t modeling in this case indicates that consideration of impacts to surface water bodies is not necessary.

The following site-specific factors are also relevant:

- ◆ The site is located in an industrial area served by public water and sewers.
- ◆ Off-site human exposures is not plausible due to the lack of off-site groundwater receptors and the general industrial nature of the vicinity.

#### 4. REFERENCES

- a. RCRA Facility Investigation, 51 Broderick Road, Bristol, CT, January 1992.
- b. Annual Report on Groundwater Monitoring, December 1993.

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<sup>4</sup> Some of the more common assumptions of these f&t models include: negligible solute injection rates in relation to the groundwater flowrate, steady-state groundwater flow, negligible differences in density and viscosity between injected and native water, known uniform groundwater velocity in one direction, constant dispersion properties in time and space, horizontal scale of migration is much larger than the aquifer thickness, flow field is horizontally two-dimensional, and contaminants quickly mix over the vertical domain so that concentration is essentially uniform with depth.

5. SIGN OFF

Prepared by:

Date 3/26/97



Raphael J. Cody  
RCRA Facility Manager  
Corrective Action Section

Approved by:

Date 4/29/97



Matthew R. Hoagland, Chief  
Corrective Action Section

## Appendix 1

# Groundwater Fate and Transport (F/T) Modeling

Date: 2/10/97  
 Modeled by: rjc

This file to document results of f/t modeling using an analytical solution to simulate groundwater contaminant migration. The analytical f/t model is entitled, CONMIG, and was developed by Walton, William C. as presented in Walton, William C., Analytical Groundwater Modeling: Flow and Contaminant Migration, Lewis Publishers, Inc., 1989. CONMIG is underwritten by the National Water Well Association (NWWA).

Site: Clean Harbors, 51 Broderick Road  
 EPA CTD 000604488

## Introduction and Purpose

The purpose of f/t modeling at the site is to evaluate the fate and transport of low level concentrations of select VOCs and metals for demonstrating whether Groundwater Releases Controlled (CA750) may be entered for the site.

## Input Assumptions

1. Contaminants in groundwater at the site constitute simple point sources.
2. Where necessary, geologic and hydrogeologic input data were obtained from literature values based upon correlation with site-specific information.

## General Simulation Description

### Groundwater Monitoring Well BR-5

The geology of the site consists of outwash deposits (lt. brn. f/c sand, some silt) from approx. grade to 40 ft BG underlain by glacial till (lt. rd-bwn f/c sand and gravel with silt (20-50%)). Depth to GW is approx. 8 feet BG at well BR-5. BR-5 is screened in the till material.

### Hydraulic Conductivity (ft/day):

Outwash 25-50  
 Till 2-5  
 Contaminant: PCE  
 Contaminant Level 7

## Input Data

Actual Aquifer Porosity: 0.3  
 Effective Aquifer Porosity: 0.25  
 Aquifer Thickness (ft.): 15  
 Aquifer Longitudinal Dispersivity (ft.): 40  
 Aquifer Transversal Dispersivity (ft.): 4  
 Seepage Velocity (ft/day): 0.25  
 SimuAdsorption x  
 Radioactive Decay  
 Bulk Density of Dry Aquifer (g/cm3): 1.855  
 Distribution Coefficient (ml/g): 0.363  
 Type of Point Source: continuous  
 Cont. Point Source Injection Rate (gal/day): 1  
 Point Source Solute Concentration (mg/L): 0.007  
 Time after contaminant injection started (days):  
 Simulation #: 1 1  
                   2 30  
                   3 180  
                   4 365  
                   5 730  
 Type of Point Source: Slug  
 Point Source Injection Volume (gal): n/a  
 Point Source Solute Concentration (mg/L): n/a  
 Time after contaminant injection started (days):  
 Simulation #: 1  
                   2  
                   3  
                   4  
                   5

## Output

Output is expressed as concentration in mg/L at user-defined uniform grid nodes.

# of grid columns:

# of grid columns:

Grid spacing (ft.)

x-coord. of point source:

y-coord. of point source:

### Scenario 1: 1 day

(x,y)	1	2	3
1	0.00	0.00	0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00

### Scenario 2: 30 day

(x,y)	1	2	3
1	0.00	0.00	0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00

### Scenario 3: 180 day

(x,y)	1	2	3
1	0.00	0.00	0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00

### Scenario 4: 365 day

(x,y)	1	2	3
1	0.00	0.00	0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00

### Scenario 5: 730 day

(x,y)	1	2	3
1	0.00	0.00	0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00

## Conclusions

The modeling demonstrates that a continuous source of PCE, of concentration of 7 ug/L, will naturally attenuate by dilution and adsorption such that within 20 feet of well BR-5, the concentration of PCE is non-detect.

## Supporting Calculations for Fate and Transport Modeling

### Dispersivity

Longitudinal and transversal dispersivity varies significantly b/t field and lab empirical results.

#### Longitudinal

Laboratory column tests reveal that longitudinal dispersivity ranges from approx. 0.01–2 cm.

Field studies indicates longitudinal dispersivities on a much higher order: 39–200 ft.

#### Transversal

Field studies indicates transversal dispersivities range from: 13–98 ft.

Generally, transversal dispersivity is estimated as 10 to 20 times smaller than longitudinal dispersivity.

Sources: Freeze and Cherry, Groundwater, Prentice Hall, Inc., 1979., p. 430

Bear, Verruijt, Modeling Groundwater Flow and Pollution, D. Reidel Publishing Co., 1987, p. 162

Fetter, Applied Hydrogeology, 2nd Ed., Macmillan Publishing Co., 1988, p. 394

### Seepage Velocity

Seepage velocity or "Average Linear Velocity" is given by the following equation:

$$V_x = \frac{Q}{ne A} = \frac{K}{ne} \frac{dh}{dl}$$

where,

$V_x$  average linear velocity (cm/s)  
 $K$  hydraulic conductivity (cm/s)  
*see below for conversion to appropriate units*  
 $ne$  effective porosity (dimensionless)  
*(see table)*  
 $dh/dl$  potential gradient (ft/ft)

Source: Fetter, Applied Hydrogeology, 2nd Ed., p. 125–8.

Hydraulic Conductivity (K)				
K can be estimated or empirically determined.				
Check one:	Estimated <input type="checkbox"/> Specify K: <u>5 ft/day</u> Empirical <input checked="" type="checkbox"/> (w/ units)			
List Source:	<u>RF1</u>			
To convert your K to cm/s, enter your value of K in the cell to the left of the appropriate unit:				
K (?)	units	to	K (cm/s) (decimal)	K (cm/s) (exponential)
	m/s	to	0.0000	0.0000E+00
	ft/s	to	0.0000	0.0000E+00
	5 ft/day	to	0.0018	1.7633E-03
	gal/day/ft <sup>2</sup>	to	0.0000	0.0000E+00

### Range of Values for Porosity

	n (%)
<b>Unconsolidated deposits</b>	
gravel	25–40
sand	25–50
silt	35–50
clay	40–70
<b>Rocks</b>	
Fractured basalt	5–50
Karst limestone	5–50
Sandstone	5–30
Limestone, dolomite	0–20
Shale	0–10
Fractured crystalline rock	0–10
Dense crystalline rock	0–5

Source: Freeze and Cherry, Groundwater, p. 37

Enter:

$K$  (cm/s)   
 $ne$    
 (as decimal)  
 $dh/dl$  (ft/ft)

$V_x =$  9.0000E-05 cm/s  
 0.2551 ft/day

Thus, at a rate =  $V_x$ , water would move  
 93.09 ft per year.

### Bulk Density of Dry Aquifer

Seepage velocity or "Average Linear Velocity" is given by the following equation:

$$n = 1 - \frac{pb}{ps}$$

where,

$n$  porosity  
 $pb$  bulk mass density (g/cm<sup>3</sup>)  
 $ps$  partical mass density (g/cm<sup>3</sup>)

$ps$  can be assumed to equal 2.65 g/cm<sup>3</sup> for most mineral soils.

rearranging for  $ps$ :

$$ps = \frac{pb}{1-n}$$

$$ps = 1.99$$

Source: Freeze and Cherry, Groundwater, p. 337

c:\123data\ft2.wk1

# Groundwater Fate and Transport (F/T) Modeling

Date: 2/10/97  
Modeled by: bjc

This file documents results of f/t modeling using an analytical solution to simulate groundwater contaminant migration. The analytical f/t model is entitled, CONMIG, and was developed by Walton, William C. as presented in Walton, William C., Analytical Groundwater Modeling: Flow and Contaminant Migration, Lewis Publishers, Inc., 1989. CONMIG is underwritten by the National Water Well Association (NWWA).

Site: Clean Harbors, 51 Broderick Road  
EPA ID No.: CTD 000604488

## Introduction and Purpose

The purpose of f/t modeling at the site is to evaluate the fate and transport of low level concentrations of select VOCs and metals for demonstrating whether Groundwater Releases Controlled (CA750) may be entered for the site.

## Input Assumptions

1. Contaminants in groundwater at the site constitute simple point sources.
2. Where necessary, geologic and hydrogeologic input data were obtained from literature values based upon correlation with site-specific information.

## General Simulation Description

Groundwater Monitoring Well BR-6

The geology of the site consists of outwash deposits (ft. brn. f/c sand, some silt) from approx. grade to 40 ft BG underlain by glacial till (ft. rd-bwn f/c sand and gravel with silt (20-50%)). Depth to GW is approx. 8 feet BG at well BR-6. BR-6 is screened in the outwash deposits.

Hydraulic Conductivity (ft/day):

Outwash 25-50  
Till 2-5

Contaminant: methylene chloride  
Contaminant Level (ug/l): 44

## Input Data

Actual Aquifer Porosity: 0.3  
Effective Aquifer Porosity: 0.25  
Aquifer Thickness (ft.): 30  
Aquifer Longitudinal Dispersivity (ft.): 40  
Aquifer Transversal Dispersivity (ft.): 4  
Seepage Velocity (ft/day): 1.502  
Simulation: Adsorption   
Radioactive Decay   
Bulk Density of Dry Aquifer (g/cm<sup>3</sup>): 1.855  
Distribution Coefficient (ml/g): 0.0208  
Type of Point Source: continuous  
Cont. Point Source Injection Rate (gal/day): 1  
Point Source Solute Concentration (mg/L): 0.044  
Time after contaminant injection started (days):  
Simulation #: 1 1  
2 4  
3 30  
4  
5  
Type of Point Source: Slug  
Point Source Injection Volume (gal): n/a  
Point Source Solute Concentration (mg/L): n/a  
Time after contaminant injection started (days):  
Simulation #: 1  
2  
3  
4  
5

## Output

Output is expressed as concentration in mg/L at user-defined uniform grid nodes.

# of grid columns: 3  
# of grid rows: 3  
Grid spacing (ft.): 2  
x-coord. of point source: 0  
y-coord. of point source: 0

### Scenario 1: 1 day

(x,y)	1	2	3
1	0.00	0.00	0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00

### Scenario 2: 4 day

(x,y)	1	2	3
1	0.00	0.00	0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00

### Scenario 3: 30 day

(x,y)	1	2	3
1	0.00	0.00	0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00

## Note:

BR-6 is 6.25 feet from downgradient property line. At  $V_x = 1.5$  ft/day, it would take 4.16 days to reach the property line. Hence, the 4 day scenario.

## Conclusions

The modeling demonstrates that a continuous source of methylene chloride, of concentration of 44 ug/L, will naturally attenuate by dilution such that within 2 feet of well BR-6, the concentration of methylene chloride is non-detect to  $10E-2$  mg/L. Note that the MCL, however, is 0.005 mg/L. Is this a problem? No, because were the result 0.005 mg/L, then the result would be rounded up to 0.01 mg/L. Thus, the result must be below 0.005 mg/L.

## Supporting Calculations for Fate and Transport Modeling

### Dispersivity

Longitudinal and transversal dispersivity varies significantly b/t field and lab empirical results.

#### Longitudinal

Laboratory column tests reveal that longitudinal dispersivity ranges from approx. 0.01 – 2 cm.

Field studies indicates longitudinal dispersivities on a much higher order: 39 – 200 ft.

#### Transversal

Field studies indicates transversal dispersivities range from: 13 – 98 ft.

Generally, transversal dispersivity is estimated as 10 to 20 times smaller than longitudinal dispersivity.

Sources: Freeze and Cherry, Groundwater, Prentice Hall, Inc., 1979, p. 430

Bear, Verruijt, Modeling Groundwater Flow and Pollution, D. Reidel Publishing Co., 1987, p. 162

Fetter, Applied Hydrogeology, 2nd Ed., Macmillan Publishing Co., 1988, p. 394

### Seepage Velocity

Seepage velocity or "Average Linear Velocity" is given by the following equation:

$$V_x = \frac{Q}{ne A} = \frac{K}{ne} \frac{dh}{dl}$$

where,

$V_x$  average linear velocity (cm/s)  
 $K$  hydraulic conductivity (cm/s)  
*see below for conversion to appropriate units*  
 $ne$  effective porosity (dimensionless)  
*(see table)*  
 $dh/dl$  potential gradient (ft/ft)

Source: Fetter, Applied Hydrogeology, 2nd Ed., p. 125–8

### Hydraulic Conductivity (K)

K can be estimated or empirically determined.

Check one: Estimated  Specify K: 30  
 Empirical  (w/ units)

List Source: RFI Report

To convert your K to cm/s, enter your value of K in the cell to the left of the appropriate unit:

K (?)	units	to	K (cm/s) (decimal)	K (cm/s) (exponential)
	m/s	to	0.0000	0.0000E+00
	ft/s	to	0.0000	0.0000E+00
	30 ft/day	to	0.0106	1.0580E-02
	gal/day/ft <sup>2</sup>	to	0.0000	0.0000E+00

### Range of Values for Porosity

	n (%)
<b>Unconsolidated deposits</b>	
gravel	25 – 40
sand	25 – 50
silt	35 – 50
clay	40 – 70
<b>Rocks</b>	
Fractured basalt	5 – 50
Karst limestone	5 – 50
Sandstone	5 – 30
Limestone, dolomite	0 – 20
Shale	0 – 10
Fractured crystalline rock	0 – 10
Dense crystalline rock	0 – 5

Source: Freeze and Cherry, Groundwater, p. 37

Enter:

$K$  (cm/s)   
 $ne$    
 (as decimal)  
 $dh/dl$  (ft/ft)

$V_x =$  5.3000E-04 cm/s  
 1.5020 ft/day

Thus, at a rate =  $V_x$ , water would move  
 548.22 ft per year.

### Bulk Density of Dry Aquifer

Seepage velocity or "Average Linear Velocity" is given by the following equation:

$$n = 1 - \frac{pb}{ps}$$

where,

$n$  porosity  
 $pb$  bulk mass density (g/cm<sup>3</sup>)  
 $ps$  partial mass density (g/cm<sup>3</sup>)

$ps$  can be assumed to equal 2.65 g/cm<sup>3</sup> for most mineral soils.

rearranging for  $ps$ :

$$ps = \frac{2.65(1-n)}{1-n}$$

$$ps = 1.99$$

Source: Freeze and Cherry, Groundwater, p. 337

c:\123data\ft2 wk1

Date: Feb. 11, 1997

Modeller: rjc

## CDM Federal Programs Corp. Rough Groundwater Flushing Report

### PARAMETERS USED

Porosity: 0.30  
Density: 2.65 kilograms per liter  
Plume volume: 0 cubic feet  
Pump rate: 1.00 gallons per minute  
100.00% of contaminated liquid replaced each iteration  
Foc (percent organic carbon in soil): 0.1000%

#### Contaminant: PCE

Koc (Organic carbon partition coefficient): 0 liters per kg  
Kd (Distribution coefficient): 0.363 liters per kg  
Maximum Contamination Level: 5.0 micrograms per liter  
Initial concentration in gw: 7.0 micrograms per liter

'Mass' refers to total mass of contaminant in a volume containing one liter of groundwater. 'Conc' is mass in 1 liter of gw. Both are given in micrograms.

Flush #	0.00	Mass =	22.71	Conc =	7.00
Flush #	1.00	Mass =	15.71	Conc =	4.84

Number of flush volumes required: 1.00  
Final concentration in groundwater: 4.84 micrograms per liter  
Time to cleanup: 0.00 years

c:\123data\flush1.wk1

### PARAMETERS USED

Porosity: 0.30  
Density: 2.65 kilograms per liter  
Plume volume: 0 cubic feet  
Pump rate: 1.00 gallons per minute  
100.00% of contaminated liquid replaced each iteration  
Foc (percent organic carbon in soil): 0.1000%

#### Contaminant: methylene chloride

Koc (Organic carbon partition coefficient): 0 liters per kg  
Kd (Distribution coefficient): 0.020 liters per kg  
Maximum Contamination Level: 5.0 micrograms per liter  
Initial concentration in gw: 44.0 micrograms per liter

'Mass' refers to total mass of contaminant in a volume containing one liter of groundwater. 'Conc' is mass in 1 liter of gw. Both are given in micrograms.

Flush #	0.00	Mass =	49.44	Conc =	44.00
Flush #	1.00	Mass =	5.44	Conc =	4.84

Number of flush volumes required: 1.00  
Final concentration in groundwater: 4.84 micrograms per liter  
Time to cleanup: 0.00 years

### PARAMETERS USED

Porosity: 0.30  
Density: 2.65 kilograms per liter  
Plume volume: 0 cubic feet  
Pump rate: 1.00 gallons per minute  
100.00% of contaminated liquid replaced each iteration  
Foc (percent organic carbon in soil): 0.1000%

#### Contaminant: chromium (VI)

Koc (Organic carbon partition coefficient): 0 liters per kg  
Kd (Distribution coefficient): 0.160 liters per kg  
Maximum Contamination Level: 50.0 micrograms per liter  
Initial concentration in gw: 100.0 micrograms per liter

'Mass' refers to total mass of contaminant in a volume containing one liter of groundwater. 'Conc' is mass in 1 liter of gw. Both are given in micrograms.

Flush #	0.00	Mass =	198.93	Conc =	100.00
Flush #	1.00	Mass =	98.93	Conc =	49.73

Number of flush volumes required: 1.00  
Final concentration in groundwater: 49.73 micrograms per liter  
Time to cleanup: 0.00 years