



May 16, 2000

Ms. Caroline Kwan
Remedial Project Manager
U.S. Environmental Protection Agency – Region II
Emergency Remedial Response Division
290 Broadway, 20th Floor
New York, NY 10007-1866

**RE: VIRGIN ISLAND CHEMICAL SITE
ST. CROIX, U.S. VIRGIN ISLANDS
REVISIONS TO CALCULATION OF SITE-SPECIFIC DILUTION ATTENUATION FACTOR**

Dear Ms. Kwan:

On behalf of Berlex Laboratories, Inc. (Berlex) and Pharmacia & Upjohn (P&U), McLaren/Hart, Inc. (McLaren/Hart) is submitting this letter in response to comments on the calculation of a Site-specific Dilution Attenuation Factor (DAF) for the Virgin Island Chemical Site located in St. Croix, U.S. Virgin Islands. McLaren/Hart submitted correspondence on January 19, 2000 that presented the technical basis and input parameters used in the calculation of a Site-specific DAF. This value is to be used in conjunction with the U.S. Environmental Protection Agency's (EPA's) Generic Soil Screening Levels (SSLs) in the derivation of soil cleanup criteria for the Site. EPA forwarded comments to this submittal on January 27, 2000.

Specifically, EPA raised concerns with the technical approach of accounting for an impermeable surface cover in the calculation of an infiltration rate for the Site. Therefore, this input parameter has been revised from the January 19, 2000 submittal as follows:

- *Infiltration Rate (I)*: The infiltration rate on St. Croix varies from 1% to 6% (Robison 1972) of the total rainfall, which averages 44 inches/year. Based on empirical data for the island, one of Robison's principal findings presented in the 1972 *Ground Water in Central St. Croix*, is that groundwater recharge is estimated to be 3% of the rainfall. As discussed with and agreed to by CDM Federal Programs Corporation (CDM Federal) during a conference call held in February 2000, a value of 4.5% (mid-point between Robison's value of 3% and the "high end" value of 6% for the island) is being used for the infiltration rate. Therefore, the revised Site-specific infiltration rate is **0.050 meters/year**.

Based on this revision to the infiltration rate, the Site-specific **revised mixing zone depth (d) is 18.18 meters** and the **revised DAF is 9.42**. The calculation worksheet is provided as Attachment I.

As you are aware, McLaren/Hart collected additional Site-specific hydrogeologic information during the implementation of the soil vapor extraction (SVE)/air sparging (AS) pilot-scale study. Specifically, slug testing was conducted at shallow monitoring wells MW-6 and MW-11, and at deep monitoring wells MW-8, MW-12, and MW-15 (replacement well for P-1) to evaluate hydraulic conductivity values across the Site. This information is being submitted as part of the Addendum to the February 2000 *Final Remedial Investigation Report* for the Site. However, since one of the input parameters to the calculation of a Site-specific DAF is aquifer hydraulic conductivity (K), slug test evaluations for shallow wells MW-6 and MW-11 are provided for reference as Attachment II to this submittal.

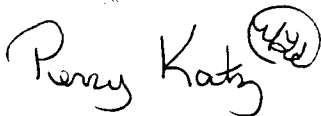
In the January 19, 2000 submittal, (K) was derived from the slug test conducted at shallow monitoring well MW-2 (3.19 feet/day or 355 meters/year). Using the most recently collected data from other shallow monitoring wells onsite, in conjunction with the data from MW-2, an average (K) can be calculated; thus, a representation of hydraulic conductivity across the Site. The geometric mean of MW-2 (3.19 feet/day), MW-11 (1.83 feet/day), and MW-6 (18.14 feet/day) is 4.73 feet/day $\Rightarrow$ 526 meters/year.

Using this average (K), the Site-specific mixing zone depth is calculated as 17.54 meters; the DAF 13.04. The calculation worksheet is provided in Attachment II.

To remain conservative in the derivation of soil cleanup criteria for the Site, Berlex and P&U proposes to use a **Site-specific DAF of 10** for the Virgin Island Chemical Site.

If you have any questions regarding this submittal, please do not hesitate to contact either of us at (908) 647-8111.

Very truly yours,



Perry Katz
Managing Environmental Scientist



Norma Eichlin
Supervising Engineer

cc: Terry Grimmer – Berlex Laboratories, Inc.
Kevin Walsh – Pharmacia & Upjohn
Bill Gierke – Pharmacia & Upjohn
Jose Agrelot – ERTEC
Syed Syedali – Virgin Islands Department of Planning and Natural Resources
Pam Philip – CDM Federal Programs Corporation

ATTACHMENT I

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Revised Calculation of Site-Specific Dilution Attenuation Factor
Virgin Island Chemical Site
St. Croix, U.S. Virgin Islands

Parameter	Value Used in Calculation	Units
<i>Mixing Zone Depth</i>		
Mixing zone depth (d)	18.18	meters
Source Length (L)	152	meters
Infiltration Rate (I)	0.050	meters/year
Aquifer Hydraulic Conductivity (K)	355	meters/year
Aquifer depth (d _a)	20	meters
Hydraulic Gradient (i _e)	0.01	meter/meter
<i>Dilution Attenuation Factor</i>		
Dilution Attenuation Factor (DAF)	9.42	unitless

AQTESOLV Input Data - Shallow Monitoring Wells
Virgin Island Chemical Site
St. Croix, U.S. Virgin Islands

Well ID:	MW-6	MW-11
Test Type:	Rising	Rising
Test Number:	Test 1	Test 4
Casing Diameter (in)	4	4
Borehole Diameter (in)	8	8
Total Depth (ft)*	26.7	40
Static Depth to Water (ft)	14.2	24.86
Ho (ft)	2.265	2.877
Rc (ft)	0.167	0.167
Rw (ft)	0.333	0.333
D (ft)	66	10
L (ft)	9.3	10
H (ft)	12.5	15.14

*: Referenced from top of inner casing

in: inches

ft: feet

ATTACHMENT II

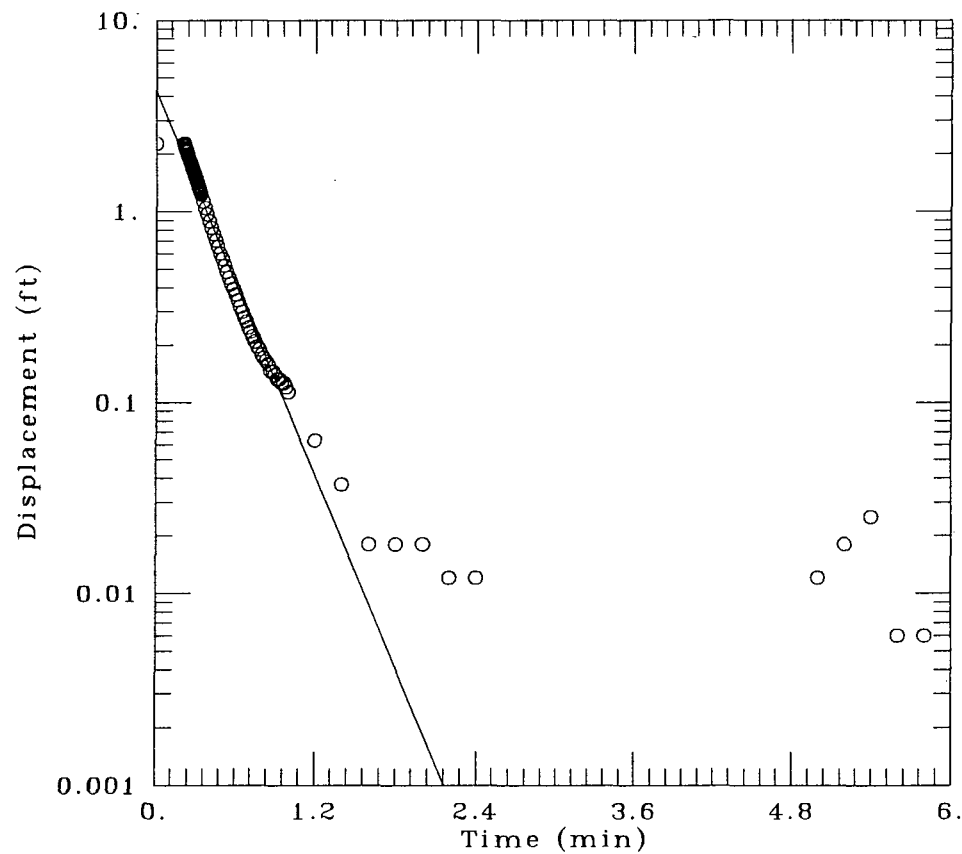
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McLaren/Hart, Inc.

Client: Island Chemical

Location: St. Croix

MW-6 Rising Head Slug Test



DATA SET:

mw6.dat

05/08/00

AQUIFER TYPE:

Unconfined

SOLUTION METHOD:

Bouwer-Rice

TEST DATE:

2/9/00

OBS. WELL:

MW 6

ESTIMATED PARAMETERS:

$K = 0.0126 \text{ ft/min}$

$y_0 = 4.246 \text{ ft}$

TEST DATA:

$H_0 = 2.265 \text{ ft}$

$r_c = 0.167 \text{ ft}$

$r_w = 0.333 \text{ ft}$

$L = 9.3 \text{ ft}$

$b = 66. \text{ ft}$

$H = 12.5 \text{ ft}$

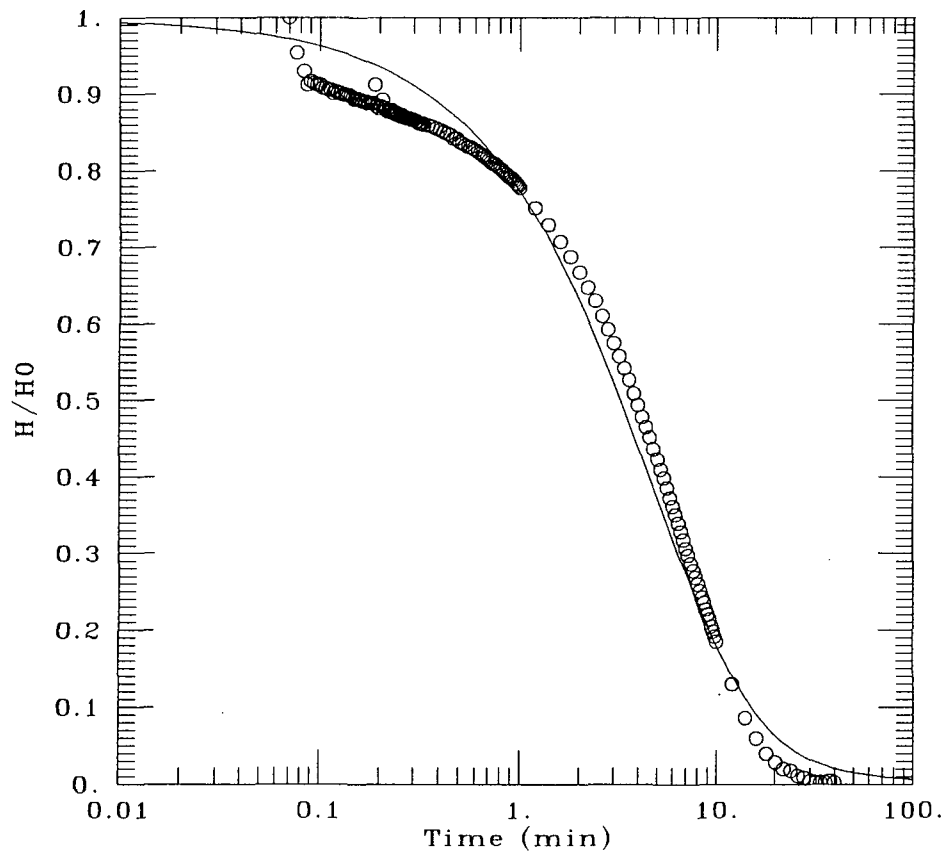
305327

McLaren/Hart, Inc.

Client: Island Chemical

Location: St. Croix

MW-11 Rising Head Slug Test



DATA SET:

mw11.dat

05/08/00

AQUIFER TYPE:

Confined

SOLUTION METHOD:

Cooper et al.

TEST DATE:

2/10/00

OBS. WELL:

MW 11

ESTIMATED PARAMETERS:

$T = 0.01271 \text{ ft}^2 / \text{min}$

$S = 0.0001$

TEST DATA:

$H_0 = 2.877 \text{ ft}$

$r_c = 0.167 \text{ ft}$

$r_w = 0.333 \text{ ft}$

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**Summary of Slug Test Data and Results - Shallow Monitoring Wells
Virgin Island Chemical Site
St. Croix, U.S. Virgin Islands**

Well ID	MW-6	MW-11
	Rising	Rising

*Input Parameters **

Ho (ft)	2.265	2.877
Rc (ft)	0.167	0.167
Rw (ft)	0.333	0.333
D (ft)	66	10
L (ft)	9.3	10
H (ft)	12.5	15.14

Computed Parameters

T (ft ² /min)	not calculated	1.271E-02
K (ft/min)	1.260E-02	1.271E-03
K (ft/day)	18.1440	1.830
K (cm/s)	6.300E-03	6.355E-04

*: Analytical Program: AQTESOLV, Duffield and Rumbaugh -1989

Ho: Initial drawdown in test well

(Note: Yo is recalculated by program based on linearity of graph)

Rc: Internal radius of test well casing

Rw: Effective radius of test well

D: Saturated aquifer thickness under static conditions

L: Length of test well screen

H: Height of water column in test well under static conditions

T: Transmissivity as calculated by Aqtesolve program.

K: Hydraulic conductivity

The value for K was computed by the Aqtesolve program for MW-6. For MW-11, K was calculated as the quotient of transmissivity divided by saturated thickness.

Note: The Bouwer-Rice method for unconfined aquifers was used to calculate parameters for MW-6. The Cooper-Bredehoeft-Papadopoulos method for confined aquifers was used to calculate parameters for MW-11.

**Calculation of Site-Specific Dilution Attenuation Factor Using Average (K) Value
Virgin Island Chemical Site
St. Croix, U.S. Virgin Islands**

Parameter	Value Used in Calculation	Units
<i>Mixing Zone Depth</i>		
Mixing zone depth (d)	17.54	meters
Source Length (L)	152	meters
Infiltration Rate (I)	0.050	meters/year
Aquifer Hydraulic Conductivity (K)	526	meters/year
Aquifer depth (d _a)	20	meters
Hydraulic Gradient (i _g)	0.01	meter/meter
<i>Dilution Attenuation Factor</i>		
Dilution Attenuation Factor (DAF)	13.04	unitless

K calculated from slug test at MW-2 (3.19 feet/day) and MW-11 (1.83 feet/day) in the FPP Area, and MW-6 (18.14 feet/day) in the AST Area for a Site-specific geometric mean of 4.73 feet/day.