UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5

DATE: May 29, 2012

SUBJECT: **Refuse Hideaway Landfill Superfund Site (the "Site"); Middleton, WI**
Comparison of of Historical and Current Groundwater Data and Estimate of Time Needed to Reach Cleanup Standards

FROM: John V. Fagiolo,
Remedial Project Manager JV Vfag/ 5/29/12

TO: Refuse Hideaway Landfill Project File

CC: Sherry Estes, Attorney
Office of Regional Counsel

During the development of the recent Explanation of Significant Differences, groundwater data was reviewed and it has been determined that the remedy operating at the Refuse Hideaway Landfill Site will achieve Enforcement Standards (ESs) well before achieving Preventive Action Limits (PALs). The change to the cleanup standard explained in the ESD will provide the most effective remedy in the shortest possible project time period.

The most persistent contaminant at the Site is tetrachloroethylene (also known as perchloroethylene or PCE). The attached Table 2 shows the highest concentrations of PCE are at the on-site monitoring well location P-27. The chronology summarized by Table 2 shows PCE concentrations have generally been stable or decreasing for the past 5 years. Also attached to this memo are copies of two letters dated August 29, 1997 and June 22, 1998 from experts at EPA's Kerr Laboratory in Ada, OK, in which clean-up times for PCE have been estimated.

A reference by the EPA experts to the Site Remedial Investigation noted that it would be approximately 13-14 years for a particle of PCE to travel from the landfill waste fill area (Location P-27) to the edge of the site property (Location P-22). The August 29, 1997 letter cites an average (mean) environmental rate constant for PCE dechlorination of 1.06. In 1997, Location P-27 had a maximum concentration of PCE of 42 ppb. Using an assumption of approximately one one-millionth of the dechlorination rate constant (0.00000104, based on 13 years of contaminant travel time), the EPA experts estimated that the PCE concentration at P-22 after 14 years should be 0.000034 ppb.

The August 29, 1997 letter further estimates clean-up times using an average PCE dechlorination rate constant and 1/10th of that value. Using the average rate constant, the PCE result at P-22 after 14 years was estimated as less than 0.5 ppb. Using 1/10th of the average rate constant, the estimate was 10.6 ppb of PCE at P-22.

At this time, the year 2012 represents approximately 14 years after the 1998 letter and estimates. Current field data (from 2011) shows a maximum PCE concentration of 23 ppb at Location P-27 and 1.6 ppb at Location P-22. This suggests that the dechlorination rate of PCE

at the Refuse Hideaway Landfill site is slightly below the average dechlorination rate cited in the 1997 Memorandum. It has taken 14 years to approximately halve the PCE levels at (on-site) Location P-27.

The PAL for PCE cited in the 1995 Record of Decision for the Site is 0.5 ppb. For Location P-27, extrapolating the 2011 PCE concentration to the PAL target of 0.5 ppb at the rate indicated by annual data would result in a time period of approximately 78 years to achieve the PAL standard of 5 ppb. For Location P-27, extrapolating the 2011 PCE concentration to its ES target of 5 ppb at the rate shown by annual data would result in a time period of approximately 31 years to achieve the ES standard of 5 ppb.

Achievement of ESs in the estimated 31 year time frame provides the most effective remedy in the shortest possible project time period. Using ESs as the cleanup standard for the Refuse Hideaway Landfill Site is the best alternative that provides protection of human health and the environment and the best cost effectiveness. Conversely, using PALs as the Site cleanup standards is not economically feasible.

Attachments:

(1) August 29, 1997 Letter from Mary E. Randolph and John T. Wilson; EPA National Risk Management Research Laboratory, Ada OK to Beth Reiner, Remedial Project Manager.

(2) June 22, 1998 Letter from Mary E. Gonsoulin and John T. Wilson; EPA National Risk Management Research Laboratory, Ada OK to Beth Reiner, Remedial Project Manager.

(3) Table 2: Summary of Groundwater Data: Refuse Hideaway Landfill, Middleton, WI.

cc: S. Estes, C-14J

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL RISK MANAGEMENT RESEARCH LABORATORY
SUBSURFACE PROTECTION AND REMEDIATION DIVISION
P.O. BOX 1198 • ADA, OK 74820

August 29, 1997

MEMORANDUM

OFFICE OF
RESEARCH AND DEVELOPMENT

SUBJECT: Refuse Hideaway Landfill Site, Madison, Wisconsin
(97-R05-006)

FROM: Mary E. Randolph, Ph.D.
Microbiologist
Technical Assistance and Technology Transfer Branch

John T. Wilson, Ph.D.
Senior Research Microbiologist
Biotic Processes and Applications Branch

TO: Beth Reiner, RPM
U. S. EPA, Region 5

As per your request for Technical Assistance, Dr. John Wilson and I reviewed the documents you provided to evaluate the feasibility of using natural attenuation to address ground-water contamination at the Refuse Hideaway Landfill Site in Madison, Wisconsin.

The Statement of Work (SOW) and the Record of Decision (ROD) specify a remedial action consisting of ground-water extraction and treatment with reinjection of treated water. The Work Plan (WP) presents the methodology for predesign studies specified in the SOW, and describes additional studies deemed appropriate by the Refuse Hideaway Landfill PRP Group (PRP Group) to characterize changes in site conditions since completion of the Feasibility Study (FS) and ROD. The ROD selected a landfill cap, a gas and leachate extraction system, and ground water pump and treat for ground water contamination exceeding 200 ppb total volatile organic compounds (VOCs).

Trends in ground-water monitoring data from the site suggest that concentrations of chlorinated VOCs have significantly decreased since completion of the landfill cap in 1988, and the leachate collection and landfill gas (LFG) extraction systems in 1991. Concentrations at the margin of the landfill, specifically P-17S at 127.36 ppb total VOCs, P-22S at 19.574 ppb total VOCs, P-22D at 17.089 ppb total VOCs, and P-27D at 62.678 ppb total VOCs meet the criteria of less than 200 ppb total VOCs as of November, 1996.

The following analysis is a prediction of concentrations of tetrachloroethene in monitoring wells P-22S and P-22D, as a possible point for achieving concentration based standards at this site.

The ground-water flow calculations from Appendix E of the Remedial Investigation Report list an upper boundary for flow in the area between P-27 and P-42 in the sand and gravel layer of 0.5 feet per day, corresponding to 183 feet per year. Flow in the sandstone is 0.6 feet per day. Well P-22 is approximately 2,600 feet from the margin of the landfill, corresponding to a travel time of approximately 14 years. The RI and fact sheet state that the plume traveled approximately 3,800 feet between 1974 and 1988, giving an independant estimate of 190 feet per year with a travel time of 13 years from the landfill to P-22.

The fact that concentrations of tetrachloroethene in well P-22 and wells further down gradient have not declined following installation of the cap and leachate collection system, is consistent with the expectation that water would take 14 years to travel to P-22. The ground water with lower concentrations of tetrachloroethene, as a result of the benefit of the cap and leachate collection systems, should not have reached these down gradient wells because the cap was installed in 1988, less than nine years from the time of last sampling of well P-22 in 1996.

A recent review of environmental rate constants collected by the Syracuse Research Institute found sixteen publications that provided a rate constant for tetrachloroethene dechlorination in ground water plumes (Draft Final Report, Anaerobic Biodegradation of Organic Chemicals in Groundwater: A Summary of Field and Laboratory Studies, prepared by Dallas Aronson and Philip Howard, Environmental Science Center, Syracuse Research Corporation, 6225 Running Ridge Road, North Syracuse, NY 13212-2509, SRC TR-97-0223F, 1997). The mean rate is 1.06 per year.

With 13 years of residence along the flow path from the edge of the landfill to well P-22, the attenuation in concentration of tetrachloroethene will be 1.04 E-06. If this attenuation is applied to the existing concentration (11/96) at P-27D of 42 ppb, the predicted concentration at P-22 in 13 years when the ground water currently present at P-27 breaks through at P-22 would be 0.000043 ppb.

If average conditions for natural attenuation prevail at the Refuse Hideaway Landfill Site, current remedial action and natural attenuation will bring tetrachlorethene concentrations

below the Preventative Action Limit of 0.5 ppb before the ground water present at the margin of the landfill reaches well P-22.

If the rate of attenuation at the Refuse Hideaway Landfill Site is one tenth the average rate, the attenuation between the edge of the landfill and P-22 is only 0.252, predicting a concentration of tetrachlorethene of 10.6 ppb, which is above the Enforcement Standard of 5 ppb.

If the rate of attenuation of tetrachloroethene at the Refuse Hideaway Landfill Site is only one third of the average, the concentration would be below the Preventative Action Limit by the time water at the most contaminated well at the edge of the landfill reaches P-22.

The current cap and leachate collection system is probably adequate to protect ground water down gradient of P-22; however, there is a reasonable possibility (roughly one in ten) that they are not. An evaluation of the concentration of hydrogen gas in the contaminated ground water would help select a more appropriate rate constant. Under separate cover, the latest version of our in-house procedure for measuring concentrations of hydrogen in ground water has been forwarded to you. This material has not been published by EPA/ORD. If you choose to forward it to the Responsible Parties, it should be reviewed and approved by your Region 5 QA/QC Officer.

Specific Comments:

Well P-31, and well P-41 downgradient from well P-40I-bedrock should be sampled to strengthen the evaluation of natural attenuation.

Appendix A12 Hydrogen Waterloo Field Sampling Plan. It is recommended that the developing ORD procedure for hydrogen be considered to provide additional information to select the appropriate rate constant to forecast the future concentrations of tetrachloroethene in ground water down gradient of the Refuse Hideaway Landfill.

If you have any questions concerning these comments, please call me at your convenience (405-436-8616).

cc: Rich Steimle (5102G)
Paul Nadeau (5202G)
Doug Yeskis, Region 5
Luanne Vanderpool, Region 5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL RISK MANAGEMENT RESEARCH LABORATORY
SUBSURFACE PROTECTION AND REMEDIATION DIVISION
P.O. BOX 1198 • ADA, OK 74820

June 22, 1998

OFFICE OF
RESEARCH AND DEVELOPMENT

MEMORANDUM

SUBJECT: Hydrogen Concentrations at the Refuse Hideaway Landfill Site, Madison, Wisconsin (97-R05-006)

FROM: Mary E. Gonsoulin, Ph.D.
Microbiologist
Technical Assistance and Technology Transfer Branch

John T. Wilson, Ph.D.
Senior Research Microbiologist
Biotic Processes and Applications Branch

TO: Beth Reiner, RPM
U.S. EPA, Region 5

As per your continuing request for Technical Assistance, Dr. John Wilson and I reviewed the hydrogen analysis results of the 10 field samples. The results are arranged in groups and the calculated hydrogen concentrations (nmolar) are corrected for blanks (Data Summary Table).

Ground water moving away from Refuse Hideaway Landfill is still maintaining a hydrogen concentration adequate for reductive dechlorination in wells (BW-GWP8S-01, BW-GWP21S-01, BW-GWP32S) immediately down gradient of the landfill and wells (RH-GWP30I-01, RH-GWP40I-01, RH-GWP41I-01, RH-GWP41D-91, BW-GWP32S-01, RH-GWP27S-01) far down gradient of the landfill. Wells (BW-GWP25S-01, RH-GWP22D-01, RH-GWP31IA-01) far down gradient of the landfill are probably **not** carrying out reductive dechlorination.

The very high hydrogen concentration (28.32 nmolar) in well (RH-GWP40I-01) may be an artifact due to metal or in the construction of the well.

Reductive dechlorination and natural attenuation of PCE and TCE will continue as the ground water moves down gradient, because water presently moving out from under the cap contains high concentrations of hydrogen. Natural attenuation through reductive dechlorination should not be expected in flow paths that originate at down gradient monitoring wells with low concentrations of hydrogen.

If you have any questions concerning these comments, please call me at your convenience at 580-436-8616.

Attachment

cc: Rich Steimle (5102G)
Paul Nadeau (5202G)
Doug Yeskis, Region 5
Luanne Vanderpool, Region5

Data Summary Table

Correct Sample Identification Numbers	Sample Numbers in Report from Kerr Lab	Calculated Hydrogen Concentration Corrected for Blanks (nmolar)
Background Wells up gradient and cross gradient o f landfill		
RH-GWP34S-01	RH-GWP345-01	0.66
RH-GWP35S-01	RH-GWP355-01	0.70
Wells immediately down gradient of landfill		
BW-GWP8S-01	BW-GWP85-01	9.17
BW-GWP21S-01	BW-GWP215-01	3.23
BW-GWP32S-01	BW-GWP325-01	1.38
RH-GWP27S-01	RH-GWP275-01	3.80
Wells far down gradient of landfill that are probably carrying out reductive dechlorination		
RH-GWP30I-01	RH-GWP30I-01	1.30
RH-GWP40I-01	RH-GWP40I-01	28.32
RH-GWP41I-01	RH-GWP41I-01	1.71
RH-GWP41D-91	RH-GWP41D-91	3.98
BW-GWP32S-01	BW-GWP325-01	1.38
Wells far down gradient of landfill that are probably **not** carrying out reductive dechlorination		
BW-GWP25S-01	BW-GWP255-01	0.83
RH-GWP22D-01	RH-GWP22D-01	0.52
RH-GWP31IA-01	RH-GWP31IA-01	0.33

Table 2 - Summary of Groundwater Data[1]: Refuse Hideaway Landfill Middleton, WI

Results marked with an asterisk (*) are on-site ES exceedances; double asterisk (**) are off-site ES exceedances.

Well Number	Contaminant [2]	Year	Concentration (ug/L or ppb)	Health Based Cleanup Standard (WI ES, ppb)
P-08S [3]	Tetrachloroethylene [5]	1991	7 *	5
		1998	2.5	
		2006	1.3	
		2007		
		2008	0.83	
		2009	DNE [1]	
		2010	0.77	
		2011	0.69	
	Vinyl Chloride	1991	DNE	0.2
		2006	DNE	
		2007		
		2008	1.6 *	
		2009	DNE	
		2010	0.22 *	
		2011	0.22 *	
	Benzene	1998	DNE	5
		2006	DNE	
		2007		
		2008	DNE	
		2009	0.77	
		2010	DNE	
		2011	DNE	
	Trichloroethylene	1988	DNE	5
		2006	DNE	
		2007		
		2008	DNE	
		2009	0.77	
		2010	0.68	
		2011	0.59	
	cis -1,2-Dichloroethene	1998	DNE	5
		2006	DNE	
		2007		
		2008	DNE	
		2009	15 *	
		2010	DNE	
		2011	9.6 *	
P-08D [4]	Trichloroethylene	1988	45 *	5
		1998	1.6	
		2006	0.91	
		2007		
		2008	DNE	
		2009	DNE	
		2010	DNE	
		2011	DNE	
	Tetrachloroethylene	1988	DNE	5
		1991	DNE	
		1998	DNE	
		2006	DNE	
		2007		
		2008	0.68	

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Well Number	Contaminant [2]	Year	Concentration (ug/L or ppb)	Health Based Cleanup Standard (WI ES, ppb)
P-08D [4] (cont'd.)	Tetrachloroethylene (cont'd.)	2009	0.96	
		2010	DNE	
		2011	DNE	
P-09S	Tetrachloroethylene	1988	70 *	
		1991	16 *	
		1998	2.9	
		2006	0.93	5
		2007		
		2008	0.81	
		2009	0.65	5
		2010	0.62	
		2011	DNE	
P-09D	1,2- Dichloropropane	1998	2.8	
		2006	1.7	
		2007		
		2008	2.0	5
		2009	1.7	
		2010	1.2	
		2011	0.82	
	Benzene	1998	3.3	
		2006	1.4	
		2007		
		2008	2.9	5
		2009	3.2	
		2010	2.4	
		2011	1.0	
	Trichloroethylene	1988	36 *	
		2006	0.94	
		2007		
		2008	1.4	5
		2009	0.97	
		2010	0.76	
		2011	DNE	
	Vinyl Chloride	1991	32 *	
		2006	0.9	
		2007		
		2008	0.73	0.2
		2009	DNE	
		2010	0.27	
		2011	DNE	
	Tetrahydrofuran	1998	DNE	
		2006	DNE	50
		2007		

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Well Number	Contaminant [2]	Year	Concentration (ug/L or ppb)	Health Based Cleanup Standard (WI ES, ppb)
P-09D (cont'd.)	Tetrahydrofuran (cont'd.)	2008	56.*	
		2009	56 *	
		2010	DNE	
		2011	DNE	
P-16S	Dichloromethane [6]	1988	1.0	
		2006	1.2	
		2007		
		2008	DNE	5
		2009	DNE	
		2010	DNE	
		2011	DNE	
P-16D	1,2-Dichloropropane	1998	1.2	
		2006	0.78	
		2007		
		2008	0.77	5
		2009	DNE	
		2010	DNE	
		2011	DNE	
	Benzene	1998	6.1 *	
		2006	2.3	
		2007		
		2008	2.6	5
		2009	3.4	
		2010	1.5	
		2011	0.70	
	Dichloromethane	1998	1.0	
		2006	1.2	
		2007		
		2008	DNE	5
		2009	DNE	
		2010	DNE	
		2011	DNE	
	Trichloroethylene	1998	11 *	
		2006	2.5	
		2007		
		2008	0.68	5
		2009	0.74	
		2010	DNE	
		2011	DNE	
	Vinyl Chloride	1998	7.1 *	
		2006	1.3 *	
		2007		0.2
		2008	0.5 *	
		2009	DNE	

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Well Number	Contaminant [2]	Year	Concentration (ug/L or ppb)	Health Based Cleanup Standard (WI ES, ppb)
P-16D (cont'd.)	Vinyl Chloride (cont'd.)	2010	DNE	0.2
		2011	0.23	
	Tetrahydrofuran	1998	DNE	50
		2006	DNE	
		2007		
		2008	89 *	
		2009	46 *	
		2010	DNE	
		2011	DNE	
P-17S	1,2-Dichloropropane	1998	DNE	5
		2006	DNE	
		2007		
		2008	1.2	
		2009	1.2	
		2010	0.68	
		2011	0.56	
	Benzene	1998	DNE	5
		2006	DNE	
		2007		
		2008	DNE	
		2009	0.79	
		2010	DNE	
		2011	DNE	
	cis -1,2-Dichloroethene	1998	DNE	70
		2006	DNE	
		2007		
		2008	65	
		2009	81 *	
		2010	19	
		2011	10	
	Tetrachloroethylene	1998	DNE	5
		2006	DNE	
		2007		
		2008	5.7 *	
		2009	4.5	
		2010	4	
		2011	4.2	
	Trichloroethylene	1998	DNE	5
		2006	DNE	
		2007		
		2008	7.5 *	
		2009	6.7 *	
		2010	3.5	
		2011	3.2	
	Vinyl Chloride	1998	DNE	0.2
		2006	DNE	
		2007		
		2008	6.1 *	
		2009	6.6 *	
		2010	0.51 *	
		2011	DNE	

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Well Number	Contaminant [2]	Year	Concentration (ug/L or ppb)	Health Based Cleanup Standard (WI ES, ppb)
P-18S	Tetrachloroethylene	1998	11 *	5
		2006	7.8 *	
		2007		
		2008	12 *	
		2009	12 *	
		2010	5.3	
		2011	5.5 *	
	Trichloroethylene	1998	2.2	5
		2006	1.4	
		2007		
		2008	1.9	
		2009	1.8	
		2010	0.92	
		2011	0.84	
P-20SR [7]	Tetrachloroethylene	1998	3.7	5
		2006	2.6	
		2007		
		2008	1.5	
		2009	2.4	
		2010	2.1	
		2011	2.1	
P-21D	1,2-Dichloropropane	1998	2.1	5
		2006	0.54	
		2007		
		2008	DNE	
		2009	DNE	
		2010	DNE	
		2011	DNE	
	Benzene	1998	1.8	5
		2006	0.66	
		2007		
		2008	DNE	
		2009	1.2	
		2010	1.1	
		2011	DNE	
	cis 1,2-Dichloroethene	1998	120 *	70
		2006	27	
		2007		
		2008	12	
		2009	33	
		2010	10	
		2011	14	
	Dichloromethane	1988	3.7	5
		2006	1	

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Well Number	Contaminant [2]	Year	Concentration (ug/L or ppb)	Health Based Cleanup Standard (WI ES, ppb)
P-21D (cont'd.)	Dichloromethane (cont'd.)	2007		5
		2008	DNE	
		2009	DNE	
		2010	DNE	
		2011	DNE	
	Vinyl Chloride	1998	16 *	0.2
		2006	3.1 *	
		2007		
		2008	4.1 *	
		2009	9.3 *	
		2010	3.1 *	
		2011	7.3 *	
	Tetrahydrofuran	1998	DNE	50
		2006	DNE	
		2007		
		2008	DNE	
		2009	52 *	
		2010	DNE	
		2011	DNE	
P-22S	Tetrachloroethylene	1998	2.9	5
		2006	0.68	
		2007		
		2008	DNE	
		2009	3.1	
		2010	1.9	
		2011	DNE	
	Trichloroethylene	2005	DNE	5
		2006	DNE	
		2007		
		2008	DNE	
		2009	1.2	
		2010	DNE	
		2011	DNE	
P-22E	Tetrachloroethylene	2005	1.31	5
		2006	3.9	
		2007		
		2008	6.2	
		2009		
		2010	1.2	
		2011	1.6	
	Trichloroethylene	2005	0.62	5
		2006	1.1	
		2007		
		2008	DNE	

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Well Number	Contaminant [2]	Year	Concentration (ug/L or ppb)	Health Based Cleanup Standard (WI ES, ppb)
P-22E (cont'd.)	Trichloroethylene (cont'd.)	2009	0.74	5
		2010	0.59	
		2011	0.84	
P-22D	Tetrachloroethylene	1998	6.4 **	5
		2005	2.4	
		2006	3.1	
		2007		
		2008	3.0	
		2009	DNE	
		2010	3.3	
		2011	1.6	
	Trichloroethylene	1998	1.8	5
		2005	0.65	
		2006	0.66	
		2007		
		2008	0.73	
		2009	0.66	
		2010	0.7	
		2011	DNE	
P-23S	Tetrachloroethylene	1998	4.6	5
		2006	1.6	
		2007		
		2008	3.6	
		2009	5.6 **	
		2010	4.6	
		2011	3.4	
P-23D	Tetrachloroethylene	1988	2.3	5
		2006	1	
		2007		
		2008	0.9	
		2009		
		2010	0.68	
		2011	0.62	
P-24E	Vinyl Chloride	2004	4.1 *	0.2
		2006	5.7 *	
		2007		
		2008	2.1 *	
		2009	2.6 *	
		2010	1.1 *	
		2011	DNE	
P-24D	Vinyl Chloride	1998	2.2 *	0.2
		2006	3.2 *	
		2007		
		2008	1.4 *	
		2009	6.6 *	

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Well Number	Contaminant [2]	Year	Concentration (ug/L or ppb)	Health Based Cleanup Standard (WI ES, ppb)
P-24D (cont'd.)	Vinyl Chloride (cont'd.)	2010	4.8 *	0.2
		2011	4.0 *	
P-25D	Tetrachloroethylene	1998	DNE	5
		2006	DNE	
		2007		
		2008	0.97	
		2009	DNE	
		2010	1.9	
		2011	1.7	
	Trichloroethylene	1998	DNE	5
		2006	DNE	
		2007		
		2008	1.5	
		2009	0.87	
		2010	DNE	
		2011	DNE	
	Vinyl Chloride	1998	DNE	0.2
		2006	DNE	
		2007		
		2008	0.59 **	
		2009	DNE	
		2010	DNE	
		2011	DNE	
P-26S	Tetrachloroethylene	1998	33 **	5
		2006	16 **	
		2007		
		2008	6.4 **	
		2009	15 **	
		2010	8.8	
		2011	15	
	Trichloroethylene	1998	5.1 **	5
		2006	2.3	
		2007		
		2008	0.77	
		2009	2.2	
		2010	8.1 **	
		2011	2.2	
	Vinyl Chloride	1998	4 **	0.2
		2006	0.56 **	
		2007		
		2008	0.31 **	
		2009	0.6 **	
		2010		
		2011	0.27 **	

Table 2 - Summary of Groundwater Data[1]: Refuse Hideaway Landfill Middleton, WI

Results marked with an asterisk (*) are on-site ES exceedances; double asterisk (**) are off-site ES exceedances.

Well Number	Contaminant [2]	Year	Concentration (ug/L or ppb)	Health Based Cleanup Standard (WI ES, ppb)
P-26D	Tetrachloroethylene	1998	17	5
		2006	1.8	
		2007		
		2008	1.5	
		2009		
		2010	1.7	
		2011	DNE	
	Vinyl Chloride	1998	DNE	0.2
		2006	DNE	
		2007		
		2008	0.44 **	
		2009	DNE	
		2010	DNE	
		2011	DNE	
P-27S	Tetrachloroethylene	1998	30 **	5
		2006	10 **	
		2007		
		2008	6.6 **	
		2009	6.7 **	
		2010	12 **	
		2011	5.0	
	Vinyl Chloride	1998	4 **	0.2
		2006	0.56 **	
		2007		
		2008	DNE	
		2009	DNE	
		2010	DNE	
		2011	DNE	
	Trichloroethylene	1998	4.7	5
		2006	1.7	
		2007		
		2008	1.0	
		2009	1.0	
		2010	1.2	
		2011	0.64	
P-27D	Tetrachloroethylene	1998	54	5
		2006	10	
		2007		
		2008	33 **	
		2009	46 **	
		2010	26 **	
		2011	23 **	
	Trichloroethylene	1998	8.4 **	5
		2006	2.1	

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Results marked with an asterisk (*) are on-site ES exceedances; double asterisk (**) are off-site ES exceedances.

Well Number	Contaminant [2]	Year	Concentration (ug/L or ppb)	Health Based Cleanup Standard (WI ES, ppb)
P-27D (cont'd.)	Trichloroethylene (cont'd.)	2007		5
		2008	5.7 **	
		2009	8.7 **	
		2010	4.7	
		2011	3.9	
P-28S	Tetrachloroethylene	1998	DNE	5
		2006	DNE	
		2007		
		2008	33 **	
		2009	4.8	
		2010	1.4	
		2011	1.5	
P-29S	Chloromethane	1994	0.6	5
		2006	0.32	
		2007		
		2008	DNE	
		2009	DNE	
		2010	0.32	
		2011	DNE	
	Tetrachloroethylene	1998	0.9	5
		2006	0.75	
		2007		
		2008	1.6	
		2009	DNE	
		2010	1.1	
		2011	0.94	
P-31IA	Tetrachloroethylene	1998	13 **	5
		2006	4.8	
		2007		
		2008	5.4 **	
		2009	5.9 **	
		2010	5.0	
		2011	4.8	
	Trichloroethylene	1998	3.3	5
		2006	1.4	
		2007		
		2008	1.8	
		2009	2.1	
		2010	1.7	
		2011	1.6	
P-31IB	Tetrachloroethylene	1998	13	5
		2006	5.3 **	
		2007		
		2008	4.6	

Table 2 - Summary of Groundwater Data[1]: Refuse Hideaway Landfill Middleton, WI

Results marked with an asterisk (*) are on-site ES exceedances; double asterisk (**) are off-site ES exceedances.

Well Number	Contaminant [2]	Year	Concentration (ug/L or ppb)	Health Based Cleanup Standard (WI ES, ppb)
P-31IB (cont'd,.)	Tetrachloroethylene (cont'd.)	2009	5.9 **	5
		2010	4.7	
		2011	4.2	
	Trichloroethylene	1998	3.6	5
		2006	1.6	
		2007		
		2008	1.7	
		2009	2.0	
		2010	1.6	
		2011	1.4	
P-34S	Dichloromethane	1995	2	5
		2006	1.9	
		2007		
		2008	DNE	
		2009	DNE	
		2010	DNE	
		2011	DNE	
P-40I	Tetrachloroethylene	1998	9.2	5
		2006	4.6	
		2007		
		2008	6.3 **	
		2009	4.9	
		2010	4.5	
		2011	5.1 **	
	Trichloroethylene	1998	2.5	5
		2006	1.3	
		2007		
		2008	1.6	
		2009	1.3	
		2010	1.1	
		2011	1.3	
NOLES [8] (formerly Schultz)	Dichloromethane	1996	0.14	5
		2006	4.1	
		2007		
		2008	DNE	
		2009	DNE	
		2010	DNE	
		2011	DNE	
	Tetrachloroethylene	1998	9.2 **	5
		2006	4.6	
		2007		
		2008	6.3 **	
		2009	5.6 **	

Table 2 - Summary of Groundwater Data[1]: Refuse Hideaway Landfill Middleton, WI

Results marked with an asterisk (*) are on-site ES exceedances; double asterisk (**) are off-site ES exceedances.

Well Number	Contaminant [2]	Year	Concentration (ug/L or ppb)	Health Based Cleanup Standard (WI ES, ppb)
NOLES (cont'd.)	Tetrachloroethylene (cont'd.)	2010	DNE	5
		2011	DNE	
	Trichloroethylene	1998	DNE	5
		2006	DNE	
		2007		
		2008	1.7	
		2009	2.2	
		2010	DNE	
		2011	DNE	
SATHER	Dichloromethane	1996	0.14	5
		2006	4.3	
		2007		
		2008	DNE	
		2009	DNE	
		2010	DNE	
		2011	DNE	
	Bromodichloromethane	2011	0.45	0.6
	Chloroform	2011	1.2	6
STOPPLEWORTH [8]	Chloromethane	2004	DNE	5
		2006	DNE	
		2007		
		2008	DNE	
		2009	3.5	
		2010	DNE	
		2011	DNE	
	Tetrachloroethylene	2004	3.3	5
		2006	2.9	
		2007		
		2008	2.9	
		2009	3.5	
		2010	3.2	
		2011	3.1	
	Trichloroethylene	2004	0.85	5
		2006	0.63	
		2007		
		2008	0.63	
		2009	0.74	
		2010	0.68	
		2011	0.72	

TABLE 2 FOOTNOTES

[1] The summary of groundwater data is for contaminants that continue to be present at potentially unacceptable levels, shown in annual reports. DNE: "Did Not Exceed" the cleanup standard. Figure 4 shows the sampling locations.

[2] Contaminants listed are the only contaminants of concern shown in 2006 to remain at or near the Site. Data collected since 1998 has shown that other contaminants no longer pose any further threat. Approximately 70 contaminants are analyzed for twice a year at on- and off-site wells. Table 2 shows only those contaminants that are still present at the Site.

[3] Wells with S designations have screens at shallow depths.

[4] Wells with D designations have screens at deeper depths.

[5] Tetrachloroethylene is Perchloroethylene (PCE).

[6] Dichloromethane is Methylene Chloride.

[7] Wells with E, I, and R designations are monitoring wells that have been replaced since 1988.

[8] These wells are at residences with Point of Entry Water Treatment Systems.