ARCADIS

Infrastructure, environment, facilities

RECEIVED
JAN 22 2007
REMEDIAL BUREAU D

ARCADIS of New York, Inc.
Two Huntington Quadrangle
Suite 1S10
Melville
New York 11747
Tel 631 249 7600
Fax 631 249 7610
www.arcadis-us.com

ENVIRONMENT

Mr. George Jacob
United States Environmental Protection Agency – Region 2
290 Broadway, 20th Floor
New York, New York 10007-1866

Subject:
Operational Year 4 Quarter Number 2 Monitoring Report,
Colesville Landfill, Broome County, New York. (Site No. 704010).

Date:
17 January 2007

Contact:
Steven M. Feldman

Phone:
(631) 391-5244

Email:
sfeldman@arcadis-us.com

Our ref:
NY000949.0019.00004

Dear Mr. Jacob:

On behalf of Broome County, ARCADIS is providing the Operational Year 4 Quarter Number 2 Monitoring Report for the Colesville Landfill, Broome County, New York.

Please feel free to contact me if you have any questions or comments.

Sincerely,

ARCADIS of New York, Inc.

Steven Feldman

Steven M. Feldman
Project Manager

Copies:
Payson Long, NYSDEC
David Donoghue, Broome County
Julia Guastella, NYSDOH

ARCADIS

Infrastructure, environment, facilities

Imagine the result

Broome County Division of Solid Waste Management

Operational Year 4 Quarter Number 2 Monitoring Report

Colesville Landfill,
Broome County, New York
NYSDEC Site 704010

January 17, 2007

ARCADIS

RECEIVED
JAN 22 2007
REMEDIAL BUREAU D

Kenneth Zegel, P.E.
Senior Engineer

Steven M. Feldman
Project Director

Christina Berardi Tuohy, P.E.
Vice President
License Number 078743-1, New York

Operation Year 4
Quarter Number 2
Monitoring Report

Colesville Landfill,
Broome County, New York
NYSDEC Site 704010

Prepared for:
Broome County Division of Solid Waste Management

Prepared by:
ARCADIS of New York, Inc.
Two Huntington Quadrangle
Suite 1S10
Melville
New York 11747
Tel 631.249.7600
Fax 631.249.7610

Our Ref.:
NY000949.0019.00004

Date:
January 17, 2007

This document is intended only for the use of the individual or entity for which it was prepared and may contain information that is privileged, confidential and exempt from disclosure under applicable law. Any dissemination, distribution or copying of this document is strictly prohibited.

Table of Contents

1. **Introduction** 1

2. **Methodology** 1

   2.1 Environmental Effectiveness Monitoring 1

   2.2 Groundwater Remediation System Performance Monitoring 2

   2.3 Spring Water Remediation System Performance Monitoring 3

3. **Groundwater Flow** 3

4. **Groundwater Quality** 3

   4.1 Volatile Organic Compounds 3

   4.2 Indicators of Reducing Conditions 4

   4.3 Evidence of Biodegradation 4

5. **Spring Water Quality** 5

6. **Surface Water Quality** 5

7. **Groundwater Remediation System Performance** 5

   7.1 PT System 5

      7.1.1 Summary of Operation, Maintenance, and Monitoring 5

      7.1.2 Results of Performance Sampling 6

   7.2 ARI System 7

      7.2.1 Summary of Operation, Maintenance, and Monitoring 7

      7.2.2 Results of Performance Sampling 8

8. **Spring Water Remediation System Performance** 8

9. **Conclusions** 9

10. **Recommendations** 10

11. **Project Schedule** 10

12. References 11

Tables

Table 1 Water-Level Measurements Collected During Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Table 2 Concentrations of Volatile Organic Compounds Detected in Groundwater, Spring Water and Surface Water, Operational Year 4, Quarter Number 2 Sampling Round, Colesville Landfill, Broome County, New York.

Table 3 Concentrations of Selected Metals, General Chemistry, Field Parameters, and Dissolved Gases Detected in Groundwater and Surface Water Samples, Operational Year 4, Quarter Number 2 Sampling Round, Colesville Landfill, Broome County, New York.

Table 4 PT System Operating Parameters, Operational Year 4, Quarter Number 2, Groundwater Remediation System, Colesville Landfill, Broome County, New York.

Table 5 Concentrations of Volatile Organic Compounds and Selected Metals Detected in Aqueous Samples Collected from the PT System, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Table 6 PT System Mass Removal Rate of Volatile Organic Compounds, Operational Year 4, Quarter Number 2, Groundwater Remediation System, Colesville Landfill, Broome County, New York.

Table 7 Concentrations of Volatile Organic Compounds Detected in Air Stripper Effluent, Operational Year 4, Quarter Number 2, Groundwater Remediation System, Colesville Landfill, Broome County, New York.

Table 8 Concentrations of Volatile Organic Compounds Detected in Aqueous Samples Collected from the SP-5 Remediation System, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Table 9 Spring Water Remediation System Mass Removal Rate of Volatile Organic Compounds, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Figures

Figure 1 Long-Term Effectiveness Monitoring Locations, Colesville Landfill, Broome County, New York.

Appendices

A Water-Level Measurement and Groundwater Sampling Logs

B New York State Department of Environmental Conservation DAR-1 Air Modeling Data

C Automated Reagent Injection System Operating Parameters

1. Introduction

This Monitoring Report (Report) was prepared on behalf of the Broome County Division of Solid Waste Management for the Colesville Landfill, located in Broome County, New York (site) to evaluate and document long-term monitoring (LTM) activities at the site. Remediation and monitoring activities are being conducted pursuant to the Record of Decision (ROD) and Explanation of Significant Difference (ESD) that were issued in March 1991 and September 2000, respectively. LTM activities (which include environmental effectiveness and remediation system performance monitoring) were performed in accordance with the LTM Plan (ARCADIS G&M, Inc. 2002), LTM Plan Addendum for Spring Water Remediation Systems (ARCADIS 2003), and Interim Remedial Action Report (ARCADIS 2004), which were approved by the United States Environmental Protection Agency (USEPA) and New York State Department of Environmental Conservation (NYSDEC). These documents provide a detailed description of the LTM program, methodology, and rationale. Where applicable these elements are either summarized or incorporated by reference herein.

This report describes the results of the March 2006 groundwater quality monitoring event conducted during Operational Year 4, Quarter Number 2. A description of the operation, maintenance, and monitoring (OM&M) associated with the Groundwater Remediation System from January 2006 through March 2006 has also been included. In addition, this report describes SP-5 Spring Water Remediation System OM&M activities conducted during this quarter. Following the detailed data analysis and discussion is a summary of findings, conclusions, and recommendations.

2. Methodology

The following section provides a summary of the environmental effectiveness and remedial system performance monitoring methodology for Operational Year 4, Quarter Number 2. A site plan, which shows the location of environmental effectiveness monitoring, is provided on Figure 1.

2.1 Environmental Effectiveness Monitoring

The environmental effectiveness monitoring performed during Operational Year 4, Quarter Number 2 included the following:

- Groundwater samples (Year 4, Q2 list of wells plus monitoring well W-7 [see "Recommendations" in Year 3 Annual Report]) were collected from six monitoring

wells during the week of March 27, 2006 and were selectively analyzed for volatile organic compounds (VOCs) and select inorganic parameters. Field parameters were also recorded at these monitoring locations.

- A sample (VOCs only) was collected and field parameters were measured at the SP-4 surface water location on March 31, 2006.

- A sample (VOCs only) was collected and field parameters were measured at the SP-2 spring water sampling location (see "Recommendations" in Operational Year 4, Quarter Number 1 Monitoring Report).

In accordance with the Proposed Modifications to the Long-Term Monitoring Program (ARCADIS 2005), groundwater samples were collected from monitoring wells utilizing passive diffusive bag (PDB) samplers.

2.2 Groundwater Remediation System Performance Monitoring

Groundwater Remediation System performance monitoring activities during Operational Year 4, Quarter Number 2 were as follows:

- Pump-and-treat (PT) system production well influent and effluent samples were collected during the OM&M quarterly site visit on March 30, 2006 and selectively analyzed for VOCs and total iron.

- One vapor sample from the PT system air stripper effluent was collected during the OM&M quarterly site visit on March 30, 2006 and analyzed for VOCs.

- PT system operating parameters were recorded during the quarterly OM&M site visit.

- Automated reagent injection (ARI) system operating parameters were recorded during each injection event; and,

- Total Organic Carbon (TOC) samples were collected from select injection wells.

PT system groundwater samples were collected as grab samples directly from production wells GMPW-3, GMPW-4 and GMPW-5, the combined influent water to the low profile air stripper, and the combined effluent after the cartridge filters. The effluent

air sample was collected as a grab sample directly from the designated point located on the low profile air stripper stack.

2.3 Spring Water Remediation System Performance Monitoring

SP-5 Spring Water Remediation System OM&M was conducted on March 31, 2006. System OM&M was conducted in accordance with the LTM Plan Addendum for Spring Water Remediation Systems (ARCADIS 2003) and consisted of the collection of an influent and effluent spring water sample for analysis of VOCs. Discharge flow rate and depth to water in the treatment unit were also collected during the reporting period. The influent sample was collected after removing three well volumes from the influent monitoring well, which is located within the SP-5 treatment unit and screened below the liquid phase granular activated carbon (LPGAC) zone. The treatment system effluent sample was collected as a grab sample from the discharge pipe prior to entering the riprap-lined outlet. All spring water samples were analyzed for VOCs using USEPA Method 8260.

3. Groundwater Flow

Water-level measurements were made from existing wells on March 31, 2006. Water-level elevation data for Operational Year 4, Quarter Number 2 is provided in Table 1. The groundwater flow direction in the project area (i.e., adjacent to the landfill western perimeter) and site-wide in the Operational Year 4, Quarter Number 2 round was consistent with previous rounds. The groundwater flow direction in the project area is toward the southwest from the western perimeter of the landfill. The groundwater flow direction in areas further to the east of the project area is toward the south/southwest.

4. Groundwater Quality

The following sections describe the analytical results for groundwater samples collected during the March 2006 monitoring round (Operational Year 4, Quarter Number 2). Groundwater analytical results are provided in Tables 2 and 3. Where applicable, the previous round of analytical results for the respective sampling location has been provided on the same table for comparative purposes.

4.1 Volatile Organic Compounds

As shown in Table 2, total VOC (TVOC) concentrations in all monitoring wells sampled during the current reporting period remained generally consistent when compared with

their respective previous monitoring data. Specifically, monitoring well GMMW-5, which is located closest to the IRZ, remained stable at 297.4 micrograms per liter (ug/L) during the current reporting period. TVOC concentrations in downgradient monitoring wells W-5, GMMW-6, GMMW-2, and PW-4 were 231.2 ug/L, 989.5 ug/L, 435.2 ug/L and 77.2 ug/L, respectively. Landfill perimeter monitoring well W-7 decreased significantly to 29.5 ug/L in comparison to the previous round when TVOC concentrations were observed at 438.8 ug/L. TVOC concentrations of 29.5 ug/L are more consistent with historical values for monitoring well W-7 and indicate that the Operational Year 3, Quarter Number 4 data may have been an anomalous spike.

PT system analytical VOC results are provided in Table 5. During the current reporting period, groundwater TVOC concentrations at PT system production wells generally remained consistent with historical data. Specifically, TVOC concentrations in production wells GMPW-3, GMPW-4, and GMPW-5 were 337.3 ug/L, 482.2 ug/L, and 353.2 ug/L, respectively. A complete evaluation of performance monitoring conducted on the PT system is provided in Section 7.1.2 of this report.

4.2 Indicators of Reducing Conditions

Groundwater analytical results for biogeochemical parameters and field parameters were collected in accordance with the LTM plan and are provided in Table 3. In summary, field and laboratory groundwater data for Wells GMMW-5 and GMMW-6 indicate that strongly reducing conditions are being maintained within the IRZ. This is evidenced by the presence of reduced forms of alternate electron acceptors (i.e., methane). Further details of the ARI system performance monitoring are provided in Section 7.2.2 of this report.

4.3 Evidence of Biodegradation

Table 3 provides the results of biodegradation end product concentrations in monitoring wells and indicates the continued occurrence of bioactivity and biodegradation of VOCs within the IRZ. Specifically, the concentration of ethene within monitoring wells GMMW-5 and GMMW-6 continues to be elevated when compared to baseline conditions. Ethene results for monitoring well GMMW-6 remained elevated during Operational Year 4, Quarter Number 2 and continue to indicate that the IRZ has extended to the vicinity of this well. Additional details on the results of biogeochemical monitoring as evidence of Groundwater Remediation System performance and effectiveness are discussed in Section 7.2.2 of this report.

5. Spring Water Quality

As referenced in the Operational Year 4, Quarter Number 1 monitoring report, the SP-2 sampling location was resampled during the current reporting period to confirm obtained during Operational Year 4, Quarter Number 1. Spring water analytical results are summarized in Table 2. As shown in Table 2, TVOC concentrations at the SP-2 spring water sampling location decreased to 32.7 ug/L. TVOC concentrations will continue to be monitored at the SP-2 location to evaluate concentration trends.

Analytical results for the former SP-4 spring location are provided in Section 6. Analytical results for the SP-5 Spring Water Remediation System are discussed in Section 8 of this report.

6. Surface Water Quality

Surface water quality analytical results for the Operational Year 4, Quarter Number 2 monitoring round are summarized in Table 2. As shown in Table 2, surface water quality at SP-4 remains consistent with prior rounds of analytical data. Specifically, TVOCs at this location remained stable at 3.5 ug/L. The data continue to indicate that the SP-4 spring location remedial construction was successful in preventing surface water impacts caused by the former SP-4 spring.

In accordance with the LTM Plan monitoring schedule, surface water quality at F-6 was not conducted during Operational Year 4, Quarter Number 2.

7. Groundwater Remediation System Performance

The following section describes the results of the Groundwater Remediation System performance monitoring conducted during Operational Year 4, Quarter Number 2.

7.1 PT System

The following section describes the results of the PT system performance monitoring conducted during Operational Year 4, Quarter Number 2.

7.1.1 Summary of Operation, Maintenance, and Monitoring

During Operational Year 4, Quarter Number 2, the PT system operated continuously with only a few system shutdowns while on-site to conduct routine OM&M.

PT system OM&M was conducted on March 31, 2006 and included operation and maintenance of system equipment, the collection of system performance samples (water and vapor), and recording system operating parameters. Table 4 provides a summary of the recorded system operating parameters. As shown in Table 4, the total influent groundwater recovery rate was approximately 0.40-gallon per minute (gpm), with individual recovery rates of 0.01-gpm, 0.21-gpm, and 0.20-gpm for production wells GMPW-3, GMPW-4, and GMPW-5, respectively. The average recovery rate at GMPW-3 continued to remain well below system startup conditions during Operational Year 4, Quarter Number 2. Since the recovery wells were redeveloped in August 2005 and instantaneous water recovery rates in GMPW-3 indicate that GMPW-3 is operating as designed, ARCADIS will continue to evaluate whether the observed water recovery rate decline in GMPW-3 may be a result of an equipment malfunction rather than a well screen problem. In an effort to troubleshoot this problem, the GMPW-3 flowmeter was removed and cleaned during the current reporting period. The average recovery rate of production wells GMPW-4 and GMPW-5 were consistent when compared to previous operation. A total of 56,136 gallons of groundwater were recovered during the reporting period and a total of 1,073,885 gallons of groundwater have been recovered since system startup. The low profile air stripper operated at design specifications with the blower discharge pressure of 8.9-inches of water column (i.w.c.) and a low profile air stripper blower flowrate of 263 standard cubic feet per minute (scfm).

7.1.2 Results of Performance Sampling

PT system performance sampling for Operational Year 4, Quarter Number 2 was conducted on March 30, 2006. As discussed previously, five groundwater samples and one vapor sample were collected. Groundwater samples included collection of individual production well samples (GMPW-3, GMPW-4 and GMPW-5), total influent, and total effluent after the cartridge filters. The vapor sample was collected from the effluent stack of the low profile air stripper.

Table 5 provides a summary of the PT system performance groundwater sampling analytical results. As shown in Table 5, all groundwater VOCs were treated to below their respective Best Professional Judgment (BPJ) limits via the low profile air stripper. The total iron concentration after the cartridge filter was below the respective recommended daily maximum BPJ limit and the recommended daily average BPJ limit. Based on the total groundwater recovered during the reporting period and total influent groundwater concentration, an estimated 0.13 pounds (lbs) of VOC mass were removed from the subsurface during the quarterly reporting period, as shown in Table

6. A total of approximately 1.89 lbs of VOCs have been removed from the subsurface through groundwater extraction since system startup.

Table 7 provides a summary of the PT system performance vapor sampling analytical results. As shown in Table 7, all compounds were below their respective limits of detection. To be conservative, a NYSDEC DAR-1 air model was calculated using the actual analytical data for detected constituents or the detection limit of all constituents, which were not detected but have historically been detected in the influent groundwater. All COCs were below their respective short-term guidance concentrations (SGCs) and annual guidance concentrations (AGCs). Appendix B contains the NYSDEC DAR-1 AGC screening simulation based on the hand calculations provided in the NYSDEC DAR-1 AGC/SGC tables dated December 22, 2003.

7.2 ARI System

The following section describes the results of the ARI system performance monitoring conducted during Operational Year 4, Quarter Number 2.

7.2.1 Summary of Operation, Maintenance, and Monitoring

ARI system OM&M was conducted during the Operational Year 4, Quarter Number 2 OM&M site visit on March 31, 2006 and included operation and maintenance of system equipment. In addition, ARI system operating parameters were recorded during the automated injection event. One quarterly automated injection was conducted during Operational Year 4, Quarter Number 2. The injection began on February 15, 2006 and was completed on May 23, 2006. The total injection time was longer than anticipated due to minor system alarms which caused several injection interruptions and because the supply of raw molasses required replenishment during the injection. Based on the number of injection events, quantity of molasses solution delivered to each injection well, and molasses solution percentage, approximately 14,495-gallons of molasses solution were delivered to the subsurface during Operational Year 4, Quarter Number 2. A total of 94,909 gallons of molasses solution have been delivered since system startup. Appendix C provides a summary of the recorded system operating parameters for each of the injection events for this period.

7.2.2 Results of Performance Sampling

ARI system performance sampling was conducted on March 30, 2006. As discussed previously, this event consisted of obtaining TOC samples at three injection wells. In addition, analytical results from select monitoring wells under the environmental effectiveness monitoring program were utilized to determine the effectiveness of the ARI system. A summary of key observations is as follows:

- The TOC concentration at monitoring well GMMW-5 (37.6 mg/L) and injection wells IW-3 (630 mg/L), IW-8 (2,000 mg/L), and IW-13 (80.7 mg/L) indicate that sufficient organic carbon is being delivered to the subsurface to maintain the IRZ.

- The methane concentration in monitoring well GMMW-5 remained significantly elevated at 18,000 micrograms per liter (ug/L) providing evidence that strongly reducing conditions (methanogenic) are being maintained within the IRZ.

- Similarly, the methane concentration in monitoring well GMMW-6 remained elevated at 2,400 ug/L.

- The ethene concentration in monitoring well GMMW-5 increased to 50,000 nanograms per liter (ng/L). This data continue to indicate that complete reductive dechlorination is occurring within the IRZ; and,

- The ethene concentration in monitoring well GMMW-6 remained elevated at 110,000 ng/L.

As referenced previously, TVOC concentrations remained stable at monitoring wells GMMW-5 and GMMW-6.

8. Spring Water Remediation System Performance

SP-5 Spring Water Remediation System OM&M was conducted on March 31, 2006 in accordance with the LTM Plan Addendum for Spring Water Remediation Systems (ARCADIS 2003). SP-5 remediation system analytical results are provided in Table 8. As shown in Table 8, all effluent COCs were treated to below their respective BPJ limits via the LPGAC. Influent TVOC analytical data (91.5 ug/L) remained consistent with historical analytical data. Table 9 contains the SP-5 Spring Water Remediation System field parameters recorded during Operational Year 4, Quarter Number 2. As

shown in Table 9, the SP-5 remedial system treated approximately 32,298 gallons of spring water during the operating period. An estimated 0.02 lbs of VOCs was removed by the SP-5 remedial system during the same period. An estimated 855,354 gallons of spring water has been treated and an estimated 0.64 lbs of VOC mass has been recovered since system startup.

9. Conclusions

Based on the data obtained from the Operational Year 4, Quarter Number 2 monitoring, ARCADIS concludes the following:

- The revised injection methodology continues to maintain the anaerobic IRZ and is completely degrading contaminant mass. This is evidenced by the observation of methanogenic conditions and significant increase in reductive dechlorination end-products (i.e., ethene).

- The Groundwater Remediation System operated continuously during the current reporting period. Similar to the Operational Year 4, Quarter Number 1 operating period, the recovery rate in production well GMPW-3 remained below historical levels. However, it is believed that troubleshooting (e.g., cleaning) of the GMPW-3 flowmeter may have resolved this problem. Further discussion will be provided in the Operational Year 4, Quarter Number 3 Monitoring Report.

- The PT system is operating as designed and is treating recovered groundwater VOCs and total iron to below BPJ limits prior to discharge.

- The ARI system is operating as designed and has established an anaerobic IRZ in the vicinity of and downgradient of the injection wells.

- The SP-5 Spring Water Remediation System is operating as designed and is treating recovered spring water VOCs to below BPJ limits prior to discharge.

- Groundwater monitoring data for well W-7 was consistent with historical data. This data suggests that the Operational Year 3, Quarter Number 4 monitoring data for well W-7 may have been a one-time anomalous observation.

10. Recommendations

The following recommendations are made for Operational Year 4, Quarter Number 3 activities:

- Continue to operate the ARI system following the modified injection methodology utilized during the current reporting period.
- Continue to evaluate and troubleshoot performance of the recovery well GMPW-3 to determine the cause of decreased performance.

11. Project Schedule

Groundwater environmental effectiveness monitoring is scheduled to be conducted for Operational Year 4 on the quarterly schedule set forth in the Proposed Modifications to Long-Term Monitoring Program (ARCADIS 2005). System OM&M of the Groundwater Remediation System will continue to be performed on a quarterly basis consistent with the LTM Plan.

12. References

ARCADIS G&M, Inc. 2002. Long-Term Monitoring Plan, Colesville Landfill, Broome County, New York, NYSDEC Site 704010. June 28, 2002.

ARCADIS G&M, Inc. 2003. Long-Term Monitoring Plan Addendum for Spring Water Remediation Systems, Colesville Landfill, Broome County, New York, NYSDEC Site 704010. November 3, 2003.

ARCADIS G&M, Inc. 2004. Interim Remedial Action Report, Colesville Landfill, Broome County, New York, NYSDEC Site 704010. September 22, 2004.

ARCADIS G&M, Inc. 2005 Proposed Modifications to Long-Term Monitoring Program, Broome County, New York, NYSDEC Site 704010. June 28, 2005.

ARCADIS G&M, Inc. 2006 Operational Year 3 Annual Monitoring Report, Broome County, New York, NYSDEC Site 704010. March 2, 2006.

ARCADIS

Table 1. Water-Level Measurements Collected During Opertational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Well Identification	MP Elevation (feet above msl)	3/31/2006 Depth to Water (feet below MP)	3/31/2006 Water-Table Elevation (feet above msl)	MP Description
GMMW-2	1030.95	35.77	995.18	Inner casing
GMMW-5	1043.66	46.46	997.20	Inner casing
GMMW-6	1033.56	37.83	995.73	Inner casing
GMMW-7	1045.43	41.67	1003.76	Inner casing
PW-3	988.92	11.19	977.73	Inner casing
PW-4	1001.75	16.54	985.21	Inner casing
PW-5	986.12	0.25	AM	Inner casing
W-5	1051.41	50.64	1000.77	Inner casing
W-6	1050.38	48.51	1001.87	Inner casing
PW-7	1042.47	38.27	1004.20	Inner casing
W-7	1049.12	41.67	1007.45	Inner casing
PW-10	1049.29	36.92	1012.37	Inner casing
PW-13	1072.41	60.39	1012.02	Inner casing
W-13	1053.43	45.67	1007.76	Inner casing
W-14S	957.68	8.44	949.24	Inner casing
W-16S	990.33	9.04	981.29	Outer casing
W-17S	959.13	10.04	949.09	Inner casing
W-18	973.56	10.35	963.21	Inner casing
W-20S	952.88	8.65	944.23	Inner casing

msl Mean sea level.
MP Measuring point.
NM Not measured.
AM Anomalous measurement.

ARCADIS

Table 2. Concentrations of Volatile Organic Compounds Detected in Groundwater, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Constituents (units in ug/L)	Sample ID: Date:	GMMW-02 12/21/2005	GMMW-02 3/30/2006	GMMW-05 12/21/2005	GMMW-05 3/30/2006	GMMW-06 12/21/2005	GMMW-06 3/30/2006	GMMW-06* 3/30/2006
1,1,1-Trichloroethane		**30**	**24**	<1.0	<1.0	**4.9**	**8.2**	**7.6**
1,1,2-Trichloroethane		<1.0	<1.0	<1.0	<1.0	**2.6**	<5.0	<5.0
1,1-Dichloroethane		**95**	**110**	**22**	**62**	**370**	**440**	**380**
1,1-Dichloroethene		**2.1**	**2.0**	<1.0	<1.1	**1.5**	<5.0	<5.0
1,2-Dichloroethane		<1.0	<1.0	**2.0**	**<1.0**	**3.0**	<5.0	<5.0
1,2-Dichloropropane		<1.0	<1.0	<1.0	<1.1	**1.3**	<5.0	<5.0
Benzene		**3.0**	**2.8**	**1.3**	**1.4**	**6.1**	**5.9**	**5.8**
Chlorobenzene		**38**	**37**	**19**	**17**	**39**	**36**	**35**
Chloroethane		**27**	**34**	**120**	**160**	**150**	**190**	**190**
Chloroform		<1.0	<1.0	<1.0	<1.1	**1.5**	<5.0	<5.0
cis-1,2-Dichloroethene		**140**	**140**	**43**	**38**	**200**	**200**	**200**
Dichlorodifluoromethane		**1.1**	<1.0	<1.0	<1.0	**3.6**	<5.0J	**7.8J**
Ethylbenzene		<1.0	<1.0	<1.0	<1.0	<1.0	<5.0	<5.0
Methylene chloride		**2.0**	**1.4**	**2.5**	**2.4**	**11**	**11**	**10**
Methyl tert-butyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	<5.0	<5.0
Naphthalene		<1.0	<1.0	<1.0	<1.0	<1.0	<5.0	<5.0
o-Xylene		<1.0	<1.0	**3.5**	**1.8**	**1.2**	<5.0	<5.0
Tetrachloroethene		<1.0	<1.0	<1.0	<1.1	<1.0	<5.0	<5.0
Toluene		<1.0	<1.0	**3.2**	**2.8**	**1.4**	<5.0	<5.0
trans-1,2-Dichloroethene		<1.0	<1.0	<1.0	<1.1	**1.9 J**	<5.0	<5.0
Trichloroethene		**82**	**67**	**1.6**	<1.1	**5.6**	**9**	**7.2**
Vinyl chloride		**15**	**17**	**9.8**	**12**	**95**	**87**	**89**
Total VOCs		**435.2**	**435.2**	**227.9**	**297.4**	**899.6**	**987.1**	**932.4**

(1) Springwater sample
(2) Surfacewater sample

Bold Constituent detected above MDL.
VOCs Volatile Organic Compounds.
ug/L Micrograms per liter.
* Field replicate.
J Estimated value.
MDL Method detection limit.
NA Not analyzed.

Table 2. Concentrations of Volatile Organic Compounds Detected in Groundwater, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Constituents (units in ug/L)	Sample ID: Date:	PW-04 12/21/2005	PW-04 3/30/2006	W-05 12/21/2005	W-05 3/30/2006	W-07 9/13/2005	W-07 3/30/2006
1,1,1-Trichloroethane		**13**	**18**	<1.0	<1.0	**28**	<1.0
1,1,2-Trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane		**8.8**	**17**	**72**	**94**	**170**	**13**
1,1-Dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzene		<1.0	<1.0	**5.2**	**5.2**	<1.0	<1.0
Chlorobenzene		<1.0	<1.0	**19**	**20**	**27**	**3.1**
Chloroethane		**2.4**	**7.2**	**84**	**95**	**34**	**8.3**
Chloroform		**1.4**	**1.4**	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene		**7.5**	**13**	**3.2**	**3.2**	**55**	**2**
Dichlorodifluoromethane		**1.3**	**2.1**	<1.0	**2.3**	<1.0	<1.0
Ethylbenzene		<1.0	<1.0	<1.0	<1.0	**17**	<1.0
Methylene chloride		<1.0	<1.0	**2.5**	**2.5**	**4.8**	<1.0
Methyl tert-butyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Naphthalene		<1.0	<1.0	<1.0	<1.0	**67**	<1.0
o-Xylene		<1.0	<1.0	**1.3**	<1.0	**12**	<1.0
Tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene		<1.0	<1.0	**1.3**	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene		**17**	**17**	**3.3**	**2.8**	**11**	**1.2**
Vinyl chloride		<1.0	1.5	**5.1**	**6.2**	**13**	**1.9**
Total VOCs		**51.4**	**77.2**	**196.9**	**231.2**	**438.8**	**29.5**

(1) Springwater sample
(2) Surfacewater sample

Bold Constituent detected above MDL.

VOCs Volatile Organic Compounds.
ug/L Micrograms per liter.
* Field replicate.
J Estimated value.
MDL Method detection limit.
NA Not analyzed.

Table 2. Concentrations of Volatile Organic Compounds Detected in Groundwater, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Constituents (units in ug/L)	Sample ID: Date:	SP-2[1] 12/23/2005	SP-2[1] 3/31/2006	SP-4[2] 12/23/05	SP-4[2] 3/31/06	TBV122105 3/31/06	FBV122105 3/31/06
1,1,1-Trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane		**46**	**26.0**	**2.6**	**3.5**	<1.0	<1.0
1,1-Dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorobenzene		**2.9**	**2.5**	<1.0	<1.0	<1.0	<1.0
Chloroethane		**7.0**	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene		**3.7**	**1.6**	<1.0	<1.0	<1.0	<1.0
Dichlorodifluoromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methyl tert-butyl ether		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Naphthalene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
o-Xylene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene		**3.5**	**2.6**	<1.0	<1.0	<1.0	<1.0
Vinyl chloride		**2.1**	<1.0	<1.0	<1.0	<1.0	<1.0
Total VOCs		**65.2**	**32.7**	**2.6**	**3.5**	**0.0**	**0.0**

(1) Springwater sample
(2) Surfacewater sample

Bold Constituent detected above MDL.
VOCs Volatile Organic Compounds.
ug/L Micrograms per liter.
* Field replicate.
J Estimated value.
MDL Method detection limit.
NA Not analyzed.

ARCADIS

Table 3. Concentrations of Selected Metals, General Chemistry, Field Parameters, and Dissolved Gases Detected in Groundwater, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Parameters	Sample ID: Date:	GMMW-02 12/22/05	GMMW-02 3/30/06	GMMW-05 12/22/05	GMMW-05 3/30/06
	UNITS				
METALS					
Iron, Dissolved	mg/L	--	--	--	--
Manganese, Dissolved	mg/L	--	--	--	--
GENERAL CHEMISTRY					
Bromide	mg/L	--	--	--	--
Chloride	mg/L	--	--	--	--
Nitrogen, Nitrate (As N)	mg/L	--	--	--	--
Nitrogen, Nitrite	mg/L	--	--	--	--
Total Organic Carbon	mg/L	**5.07**	**4.6**	**84.3**	**37.6**
Sulfate	mg/L	--	--	--	--
Sulfide (field)	mg/L	--	--	--	--
Iron (field)	mg/L	--	--	--	--
FIELD PARAMETERS					
pH	Standard units	**6.4**	**6.4**	**6.47**	**6.07**
Specific Conductance	mmhos/cm	**0.472**	**0.704**	**0.603**	**0.687**
Turbidity	NTU	--	--	--	--
Dissolved Oxygen	mg/L	--	--	--	--
Temperature	deg C	**7.7**	**13.1**	**6**	**10.4**
ORP	mV	--	--	--	--
DISSOLVED GASES					
Carbon dioxide	mg/L	--	**220**	--	**170**
Carbon monoxide	mg/L	--	**<1.0**	--	**<1.0**
Ethane	ng/L	--	**550**	--	**1400**
Ethene	ng/L	--	**2900**	--	**50000**
Methane	ug/L	--	**1500**	--	**18000**
Nitrogen	mg/L	--	**23**	--	**13**
Oxygen	mg/L	--	**3.7**	--	**2.6**

Bold Constituent detected above MDL.

mg/L	Milligrams per liter.
mmhos/cm	Millimhos per centimeter.
NTU	Nephelometric Turbidity Units.
deg C	Degrees Celsius.
mV	Millivolts.
ng/L	Nanograms per liter.
--	Not analyzed or collected.
ug/L	Micrograms per liter.
IW	Injection well.
ORP	Oxidation-reduction potential.
J	Qualifier assigned to analytical data indicating result is estimated.

ARCADIS

Table 3. Concentrations of Selected Metals, General Chemistry, Field Parameters, and Dissolved Gases Detected in Groundwater, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Parameters	Sample ID: / Date:	GMMW-06 12/22/05	GMMW-06 3/30/06	PW-04 12/22/05	PW-4 3/30/06
	UNITS				
METALS					
Iron, Dissolved	mg/L	--	--	--	--
Manganese, Dissolved	mg/L	--	--	--	--
GENERAL CHEMISTRY					
Bromide	mg/L	--	--	--	--
Chloride	mg/L	--	--	--	--
Nitrogen, Nitrate (As N)	mg/L	--	--	--	--
Nitrogen, Nitrite	mg/L	--	--	--	--
Total Organic Carbon	mg/L	**5.00**	**19.8**	**2.47**	**3.98**
Sulfate	mg/L	--	--	--	--
Sulfide (field)	mg/L	--	--	--	--
Iron (field)	mg/L	--	--	--	--
FIELD PARAMETERS					
pH	Standard units	**6.78**	**6.59**	**6.86**	**6.02**
Specific Conductance	mmhos/cm	**0.869**	**1.139**	**0.362**	**0.647**
Turbidity	NTU	--	--	--	--
Dissolved Oxygen	mg/L	--	--	--	--
Temperature	deg C	**6.7**	**11.1**	**7.2**	**10**
ORP	mV	--	--	--	--
DISSOLVED GASES					
Carbon dioxide	mg/L	--	**210**	--	**220**
Carbon monoxide	mg/L	--	**<1.0**	--	**<1.0**
Ethane	ng/L	--	**1500**	--	**70**
Ethene	ng/L	--	**110000**	--	**310**
Methane	ug/L	--	**2400**	--	**31**
Nitrogen	mg/L	--	**20**	--	**14**
Oxygen	mg/L	--	**2.9**	--	**2.8**

Bold Constituent detected above MDL.

mg/L	Milligrams per liter.
mmhos/cm	Millimhos per centimeter.
NTU	Nephelometric Turbidity Units.
deg C	Degrees Celsius.
mV	Millivolts.
ng/L	Nanograms per liter.
--	Not analyzed or collected.
ug/L	Micrograms per liter.
IW	Injection well.
ORP	Oxidation-reduction potential.
J	Qualifier assigned to analytical data indicating result is estimated.

ARCADIS

Table 3. Concentrations of Selected Metals, General Chemistry, Field Parameters, and Dissolved Gases Detected in Groundwater, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Parameters	Sample ID: / Date:	W-05 12/22/05	W-05 3/30/06	IW-02 12/22/05	IW-03 3/30/06
	UNITS				
METALS					
Iron, Dissolved	mg/L	--	--	--	--
Manganese, Dissolved	mg/L	--	--	--	--
GENERAL CHEMISTRY					
Bromide	mg/L	--	--	--	--
Chloride	mg/L	--	--	--	--
Nitrogen, Nitrate (As N)	mg/L	--	--	--	--
Nitrogen, Nitrite	mg/L	--	--	--	--
Total Organic Carbon	mg/L	**7.86**	**6.79**	**4010**	**630**
Sulfate	mg/L	--	--	--	--
Sulfide (field)	mg/L	--	--	--	--
Iron (field)	mg/L	--	--	--	--
FIELD PARAMETERS					
pH	Standard units	**5.02**	**6.77**	**4.24**	--
Specific Conductance	mmhos/cm	**0.839**	**0.946**	--	--
Turbidity	NTU	--	--	--	--
Dissolved Oxygen	mg/L	--	--	--	--
Temperature	deg C	**8.6**	**12.5**	--	--
ORP	mV	--	--	--	--
DISSOLVED GASES					
Carbon dioxide	mg/L	--	**210**	--	--
Carbon monoxide	mg/L	--	**<1.0**	--	--
Ethane	ng/L	--	**16000**	--	--
Ethene	ng/L	--	**8100**	--	--
Methane	ug/L	--	**1500**	--	--
Nitrogen	mg/L	--	**15**	--	--
Oxygen	mg/L	--	**1.8**	--	--

Bold Constituent detected above MDL.

mg/L	Milligrams per liter.
mmhos/cm	Millimhos per centimeter.
NTU	Nephelometric Turbidity Units.
deg C	Degrees Celsius.
mV	Millivolts.
ng/L	Nanograms per liter.
--	Not analyzed or collected.
ug/L	Micrograms per liter.
IW	Injection well.
ORP	Oxidation-reduction potential.
J	Qualifier assigned to analytical data indicating result is estimated.

ARCADIS

Table 3. Concentrations of Selected Metals, General Chemistry, Field Parameters, and Dissolved Gases Detected in Groundwater, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Parameters	Sample ID: / Date:	IW-08 12/22/05	IW-08 3/30/06	IW-13 12/22/05	IW-13 3/30/06
	UNITS				
METALS					
Iron, Dissolved	mg/L	--	--	--	--
Manganese, Dissolved	mg/L	--	--	--	--
GENERAL CHEMISTRY					
Bromide	mg/L	--	--	--	--
Chloride	mg/L	--	--	--	--
Nitrogen, Nitrate (As N)	mg/L	--	--	--	--
Nitrogen, Nitrite	mg/L	--	--	--	--
Total Organic Carbon	mg/L	**2,100**	**2000**	**577**	**80.7**
Sulfate	mg/L	--	--	--	--
Sulfide (field)	mg/L	--	--	--	--
Iron (field)	mg/L	--	--	--	--
FIELD PARAMETERS					
pH	Standard units	**4.14**	--	**5.43**	--
Specific Conductance	mmhos/cm	--	--	--	--
Turbidity	NTU	--	--	--	--
Dissolved Oxygen	mg/L	--	--	--	--
Temperature	deg C	--	--	--	--
ORP	mV	--	--	--	--
DISSOLVED GASES					
Carbon dioxide	mg/L	--	--	--	--
Carbon monoxide	mg/L	--	--	--	--
Ethane	ng/L	--	--	--	--
Ethene	ng/L	--	--	--	--
Methane	ug/L	--	--	--	--
Nitrogen	mg/L	--	--	--	--
Oxygen	mg/L	--	--	--	--

Bold Constituent detected above MDL.

mg/L	Milligrams per liter.
mmhos/cm	Millimhos per centimeter.
NTU	Nephelometric Turbidity Units.
deg C	Degrees Celsius.
mV	Millivolts.
ng/L	Nanograms per liter.
--	Not analyzed or collected.
ug/L	Micrograms per liter.
IW	Injection well.
ORP	Oxidation-reduction potential.
J	Qualifier assigned to analytical data indicating result is estimated.

ARCADIS

Table 4. PT System Operating Parameters, Operational Year 4, Quarter Number 2, Groundwater Remediation System, Colesville Landfill, Broome County, New York.

Date	Time Recorded	Air Stripper Measurements: Blower Discharge Pressure PI-301 (i.w.c.)	Air Stripper Measurements: Blower Effluent Flowrate (scfm)	Flow Measurements: Total Effluent Totalizer FQI-401 (gallons)	Flow Measurements: Water Bypass Totalizer FQI-402 (gallons)	Flow Measurements: GMPW-3 Totalizer FQI-101 (gallons)	Flow Measurements: GMPW-4 Totalizer FQI-102 (gallons)	Flow Measurements: GMPW-5 Totalizer FQI-103 (gallons)
12/23/2005	4:00 PM	8.9	292	1,017,539.5	898,562.4	365,695.4	401.0 (1)	351,187.3
3/31/2006	5:30 PM	8.9	263	1,073,885.4	949,698.8	366,582.0	30,641.3	379,936.8
		Average Daily Flowrate (gpm) =		**0.40**	**0.36**	**0.01**	**0.21**	**0.20**
Total Groundwater Recovered During Reporting Period (gallons) =				**56,346**	**51,136**	**887**	**30,240**	**28,750**

gpm Gallons per minute.
i.w.c. Inches of water column.
scfm Standard cubic feet per minute.

Notes:
1. GMPW-4 totalizing flow meter malfuctioned and was replaced on 12/23/2005.

ARCADIS

Table 5. Concentrations of Volatile Organic Compounds and Selected Metals Detected in Aqueous Samples Collected from the PT System, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York[5,6].

Constituents	Model Technology BPJ Limits[1,2] (ug/L)	Sample ID: Date:	GMPW-3 INF 3/30/2006	GMPW-4 INF 3/30/2006	GMPW-5 INF 3/30/2006	COMBINED INF 3/30/2006	EFFLUENT AC II 3/30/2006
1,1,1-Trichloroethane	10-20		**50**	**50**	**45**	**37**	<1.0
1,1,2-Trichloroethane	10		<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	10		**67**	**110**	**85**	**67**	<1.0
1,1-Dichloroethene	10		**4.1**	**3.7**	**2.6**	**2.8**	<1.0
1,2-Dichloroethane	10-30		<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	NA		<1.0	<1.0	<1.0	<1.0	<1.0
Benzene	5		**5.2**	**5.1**	4	**3.7**	<1.0
Chlorobenzene	NA			**5.8**	1.7	**2.4**	<1.0
Chloroethane	NA		**23**	**40**	**29**	**24**	<1.0
Chloroform	NA		<1.0	**1.2**	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	10		**110**	**120**	**110**	**82**	<1.0
Dichlorodifluoromethane	NA		**2.4**	**2.9**	<1.0	<1.0	<1.0
Ethylbenzene	5		<1.0	<1.0	<1.0	<1.0	<1.0
Methylene Chloride	10-50		**3.6**	**4.5**	3.9	**2.9**	<1.0
Methyl tert-butyl ether	50		<1.0	<1.0	<1.0	<1.0	<1.0
Naphthalene	10		<1.0	<1.0	<1.0	<1.0	<1.0
o-Xylene	5		<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	10		<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	5		<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	10-50		<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	10		**59**	**97**	**56**	**56**	<1.0
Vinyl Chloride	10-50		**13**	**42**	**16.0**	**22**	<1.0
Total VOCs			**337.3**	**482.2**	**353.2**	**299.8**	**0**

Metals (units in mg/L)	Model Technology BPJ Limits[3,4] (mg/L)					
Total Iron	1.2 / 0.61	**0.343**	**1.53**	**1.09**	**2.65**	**0.072**

See Notes on Last Page.

Table 5. Concentrations of Volatile Organic Compounds and Selected Metals Detected in Aqueous Samples Collected from the PT System, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York[5,6].

Notes:

1. Model Technology Best Professional Judgment (BPJ) Limits recommended for Air Stripping with appropriate pretreatment from Attachment C of TOGS 1.2.1.
2. When a range is listed for the BPJ limit, a variation in available references was found. Recommended daily maximum limits should be in this range.
3. Model Technology BPJ Limits recommended for Lime, Settle and Filter treatment.
4. The recommended daily maximum permit limit is 1.2 mg/L and the recommended daily average permit limit is 0.61 mg/L.
5. Production wells were sampled in accordance with the schedule set forth in Table 3 of the Long-Term Monitoring Plan (ARCADIS 2002).
6. Bold values indicate compound detected above method detection limit.

NA	No BPJ limit listed.
J	Estimated Value.
ug/L	Micrograms Per Liter.
mg/L	Milligrams Per Liter.
VOCs	Volatile Organic Compounds.
AC	After Cartridge Filter.
PT	Pump and Treat.
--	Not Analyzed or Collected.
<	Analyte Below Detection Limit.

ARCADIS

Table 6. PT System Mass Removal Rate of Volatile Organic Compounds, Operational Year 4, Quarter Number 2, Groundwater Remediation System, Colesville Landfill, Broome County, New York.

Date Sampled	Total VOC Influent Concentration (ug/L)	Total Effluent Totalizer FQI-401 (gallons)	Total Groundwater Recovered[1] Between Sampling Intervals (gal)	Influent Concentration[2] Geometric Mean (ug/L)	Total Estimated Mass[3] Removed (lbs)
12/23/2005	267.3	1,017,539.5	NA	NA	NA
3/30/2006	299.8	1,073,885.4	56,345.9	283	0.13
			Total Estimated Mass Removed During Operational Year 4, Quarter Number 2 (lbs) =		**0.13**
			Total Estimated Mass Removed Since System Startup (lbs) =		**1.89**

Notes:

NA	Not applicable.
ug/L	Micrograms per liter.
gal	Gallons.
lbs	Pounds.
VOC	Volatile organic compound.

1. Total Groundwater Recovered Between Sampling Intervals = Well Totalizer Reading for current sampling event - Well Totalizer Reading for prior sampling event.
2. Influent Concentration Geometric Mean = (Influent Concentration for prior sampling event x Influent Concentration for current sampling event) ^ (1/2).
3. Total Mass Removed = (Total Groundwater Recovered Between Sampling Intervals) x Influent Concentration Geometric Mean x 3.7854 L/gallon x (1 lb / 453,592,370 ug).

ARCADIS

Table 7. Concentrations of Volatile Organic Compounds Detected in Air Stripper Effluent, Operational Year 4, Quarter Number 2, Groundwater Remediation System, Colesville Landfill, Broome County, New York.

Compounds	CAS Numbers	Sample ID: Date Sampled:	Effluent 3/31/2006 ppbv
Vinyl Chloride	75-01-4		<7.3
Chloroethane(Ethyl Chloride)	75-00-3		<7.3
1,1-Dichloroethene(Vinylidene Chloride)	75-35-4		<7.3
Methylene Chloride(Dichloromethane)	75-09-2		<7.3
1,1-Dichloroethane	75-34-3		<7.3
cis-1,2-Dichloroethylene	156-59-2		<7.3
Chloroform	67-66-3		<7.3
1,1,1-Trichloroethane(Methyl Chloroform)	71-55-6		<7.3
Benzene	71-43-2		<7.3
Trichloroethene	79-01-6		<7.3
Toluene	108-88-3		<7.3
Ethyl benzene	100-41-4		<7.3
m,p-Xylene	108-38-3/106-42-3		<7.3
o-Xylene	95-47-6		<7.3
1,2,4-Trimethylbenzene	95-63-6		<7.3
2-Propanol (Isopropyl alcohol)	67-63-0		<7.3
Dichlorodifluoromethane(Freon 12)	75-71-8		<7.3

Bold Constituent detected above MDL.
ppbv: parts per billion by volume

Notes/Assumptions:

1. Samples collected by ARCADIS personnel on the dates shown and submitted to Air Toxics Laboratories LTD. for volatile organic compound (VOC) analyses using a modified USEPA Method TO-14A.

ARCADIS

Table 8. Concentrations of Volatile Organic Compounds Detected in Aqueous Samples Collected from the SP-5 Spring Water Remediation System, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Constituents	Model Technology BPJ Limits[1,2] (ug/L)	Sample ID: Date:	SP-5 INF. 3/31/2006	SP-5 EFF. 3/31/2006
VOCs (units in ug/L)				
1,1,1-Trichloroethane	10		<1.0	<1.0
1,1-Dichloroethane	10		**40**	**3.9**
1,2-Dichloroethane	10-100		<1.0	<1.0
Benzene	5		**2.8**	<1.0
Chlorobenzene	10-25		**33**	**2.2**
Chloroethane	10		**11**	**8.2**
cis-1,2-Dichloroethene	10		**1.9**	<1.0
Dichlorodifluoromethane	NA		<1.0	<1.0
Ethylbenzene	5		<1.0	<1.0
Toluene	5		<1.0	<1.0
trans-1,2-Dichloroethene	10-100		<1.0	<1.0
Trichloroethene	10		**2.8**	<1.0
Vinyl Chloride	10		<1.0	<1.0
Total VOCs			**91.5**	**14.3**

Bold Constituent detected above MDL.

ug/L	Micrograms per liter.
VOCs	Volatile organic compounds.
<	Analyte below detection limit.
INF.	Influent.
EFF.	Effluent.
NA	No BPJ limit listed.

Notes:

1. Model Technology Best Professional Judgment (BPJ) Limits recommended for carbon adsorption with appropriate pretreatment from Attachment C of TOGS 1.2.1.
2. When a range is listed for the BPJ limit, a variation in available references was found. Recommended daily maximum limits should be in this range.

ARCADIS

Table 9. Spring Water Remediation System Mass Removal Rate of Volatile Organic Compounds, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Date Sampled	Total VOC Influent Concentration (ug/L)	Effluent Flowrate (gpm)	Depth to Water (feet btc)	Total Groundwater Treated[1] Between Sampling Intervals (gal)	Influent Concentration[2] Geometric Mean (ug/L)	Total Estimated Mass[3] Removed (lbs)
12/23/2005	73.4	0.053	0	NA	NA	NA
3/31/2006	91.5	0.990	0	32,298	82.0	0.02
				Total Estimated Mass Removed During Current Quarter (lbs) =		**0.02**
				Total Estimated Mass Removed Since System Startup (lbs) =		**0.64**
				Total Effluent Treated Since System Startup (gallons) =		**855,354**

Notes:

NA	Not applicable.
NR	Not recorded.
ug/L	Micrograms per liter.
gpm	Gallons per minute.
btc	Below top of casing.
gal	Gallons.
lbs	Pounds.
VOC	Volatile organic compound.

1. Total Spring Water Treated Between Sampling Intervals = Effluent Flowrate x 1440 min/day x days between sampling events.
2. Influent Concentration Geometric Mean = (Influent Concentration for prior sampling event x Influent Concentration for current sampling event)^(1/2).
3. Total Mass Removed = (Total Groundwater Treated Between Sampling Intervals) x Influent Concentration Geometric Mean x 3.7854 L/gallon x (1 lb / 453,592,370 ug).

ARCADIS

Appendix A

Water-Level Measurement and Groundwater Sampling Logs

Table 3. Field Measurements of Depth to Water in Select Wells, Colesville Landfill, Broome County, New York.

Date: 3/31/06

Well Identification		Depth to Water (feet below MP)	Comments
GMMW-2		35.77	
GMMW-3		33.48	
GMMW-4		45.31	
GMMW-5		46.46	
GMMW-6		37.83	
GMMW-7		46.49	
PW-3		11.19	
PW-4		16.54	
PW-5		0.25	
W-5		50.64	
W-6		48.51	
PW-7		38.27	
W-7		41.67	
PW-10		36.92	
PW-11 ?		105.44	~3ft West of PW-5
PW-13		60.39	
W-13		45.67	
W-14S		8.44	
W-16S		9.01	Top of Steel Casing - no PVC
W-17S		10.04	
W-18		10.35	
W-20S		8.65	

ARCADIS

Water Sampling Log

Project Colesville Project No. [illegible] Page ___ of ___

Site Location ___ Date 3-30-06

Site/Well No. IW-13 Replicate No. ___

Weather Sunny Sampling Time: Begin ___ End ___

Evacuation Data

Measuring Point ___

Sounded Well Depth (ft bmp) ___

Depth to Water (ft bmp) ___

Depth to Packer (ft bmp) ___

Water Column in Well (ft) ___

Casing Diameter ___

Gallons in Well ___

Gallons Pumped/Bailed Prior to Sampling ___

Sample Pump Intake Setting (ft bmp) ___

Packer Pressure (psi) ___

Pumping Rate (gpm) ___

Evacuation Method ___

Sampling Method ___

Purge Time Begin ___ End ___

Field Parameters

Color ___

Odor ___

Appearance ___

	I	1V	2V	3V
pH (s.u.)	5.78			
Conductivity (mS/cm)				
Conductivity (µmhos/cm)				
Temperature (°C)				
DO (mg/L)				
Turbidity (NTU)				
Time				
DTW (ft bmp)				

Remarks: From TOC - LEL 0-1 OTHER GASES -0 4" ~~[illegible]~~ DIA.

Constituents Sampled: See COC Sampling Personnel: ___

Well Casing Volumes

Gal./Ft.				
	1 1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1 1/2" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	mS/cm	Milisiemens per centimeter	VOC	Volatile Organic Compounds
°C	Degrees Celsius	s.u.	Standard units	umhos/cm	Micromhos per centimeter
ft	feet	NTU	Nephelometric Turbidity Units		
gpm	Gallons per minute	N/A	Not Applicable		
mg/L	Miligrams per liter	COC	Chain of Custody		

ARCADIS

Water Sampling Log

Project Colesville Project No. 14049-0019 0003A Page ___ of ___

Site Location ___ Date 3-30-06

Site/Well No. IW-8 Replicate No. ___

Weather Sunny Sampling Time: Begin ___ End ___

Evacuation Data		Field Parameters				
Measuring Point		Color				
Sounded Well Depth (ft bmp)		Odor				
Depth to Water (ft bmp)		Appearance				
Depth to Packer (ft bmp)						
Water Column in Well (ft)			I	1V	2V	3V
Casing Diameter		pH (s.u.)	4.31			
Gallons in Well		Conductivity				
Gallons Pumped/Bailed		(mS/cm)				
Prior to Sampling		(µmhos/cm)				
Sample Pump Intake						
Setting (ft bmp)		Temperature (°C)				
Packer Pressure (psi)						
Pumping Rate (gpm)		DO (mg/L)				
Evacuation Method		Turbidity (NTU)				
Sampling Method		Time				
Purge Time Begin ___ End ___		DTW (ft bmp)				

Remarks: AT TOC- LEL 0-1 OTHER GASES 0 4" well

Constituents Sampled: See COC Sampling Personnel: ___

Well Casing Volumes

Gal./Ft.	1 1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1 1/2" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	mS/cm	Milisiemens per centimeter	VOC	Volatile Organic Compounds
°C	Degrees Celsius	s.u.	Standard units	umhos/cm	Micromhos per centimeter
ft	feet	NTU	Nephelometric Turbidity Units		
gpm	Gallons per minute	N/A	Not Applicable		
mg/L	Miligrams per liter	COC	Chain of Custody		

ARCADIS GERAGHTY & MILLER

Groundwater Sampling Form

Page ____ of ____

Project/No. NY000949.0022.0003A Well IW-3 Date 3-30-06

Screen Setting ____ Measuring Point Description TOC Casing Diameter (inches) 4

Static Water Level ____ Measured Width ____ Well Materials PVC ✓ ____ ST. Steel

Total depth ____ Pump On: ____ Pump Intake: ____

Purge Method Pump Off: ____ Volumes Purged 2 Bailers

Centrifugal ____ Sample Time: ____

Submersible ____ Sampled By: D. McLaughlin

Other ____ Bailer Type: Double

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)
					9.8						

Lowflo.xls.xls
10/20/98

MULTI GAS METER - 0

ARCADIS

Water Sampling Log

Project NY0009449.0022.0003A Project No. _____ Page ___ of ___

Site Location COLESVILLE Date _____

Site/Well No. SPS INF/EFF Replicate No. _____

Weather SUNNY/WARM Sampling Time: Begin 1110 End 1120

Evacuation Data

Measuring Point	TOC
Sounded Well Depth (ft bmp)	
Depth to Water (ft bmp)	FLOW
Depth to Packer (ft bmp)	
Water Column in Well (ft)	
Casing Diameter	
Gallons in Well	
Gallons Pumped/Bailed Prior to Sampling	
Sample Pump Intake Setting (ft bmp)	
Packer Pressure (psi)	
Pumping Rate (gpm)	
Evacuation Method	
Sampling Method	
Purge Time	Begin ___ End ___

Field Parameters

Color	CLEAR - CLEAR		
Odor			
Appearance			
	INF	EFF	2V
pH (s.u.)	5.92	6.28	
Conductivity (mS/cm)	634	673	
Conductivity (µmhos/cm)			
Temperature (°C)	13.1	9.0°	
DO (mg/L)			
Turbidity (NTU)			
Time			
DTW (ft bmp)			

Remarks: EFF. OUT FLOW 500 mL x 8 SEC.

Constituents Sampled: See COC Sampling Personnel: D. McLAFFERTY

Well Casing Volumes

Gal./Ft.	1 1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1 1/2" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	mS/cm	Milisiemens per centimeter	VOC	Volatile Organic Compounds
°C	Degrees Celsius	s.u.	Standard units	umhos/cm	Micromhos per centimeter
ft	feet	NTU	Nephelometric Turbidity Units		
gpm	Gallons per minute	N/A	Not Applicable		
mg/L	Miligrams per liter	COC	Chain of Custody		

ARCADIS

Water Sampling Log

Project NY000549.0019.0038A Project No. NY000549.0019.0038A Page ___ of ___

Site Location ___ Date 3-31-06

Site/Well No. SP2 + SP4 Replicate No. ___

Weather Sunny warm Sampling Time: Begin ___ End ___

Evacuation Data

Measuring Point ___

Sounded Well Depth (ft bmp) ___

Depth to Water (ft bmp) ___

Depth to Packer (ft bmp) ___

Water Column in Well (ft) ___

Casing Diameter ___

Gallons in Well ___

Gallons Pumped/Bailed Prior to Sampling ___

Sample Pump Intake Setting (ft bmp) ___

Packer Pressure (psi) ___

Pumping Rate (gpm) ___

Evacuation Method ___

Sampling Method ___

Purge Time Begin ___ End ___

Field Parameters

Color ___

Odor ___

Appearance ___

	SP2	SP4	2V	3V
pH (s.u.)	6.93	7.05		
Conductivity (mS/cm)	339	173.2		
Conductivity (µmhos/cm)				
Temperature (°C)	11.9	13.1		
DO (mg/L)				
Turbidity (NTU)				
Time				
DTW (ft bmp)				

Remarks: ___

Constituents Sampled: See COC Sampling Personnel: ___

Well Casing Volumes

Gal./Ft.				
	1 1/4" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1 1/2" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	mS/cm	Milisiemens per centimeter	VOC	Volatile Organic Compounds
°C	Degrees Celsius	s.u.	Standard units	umhos/cm	Micromhos per centimeter
ft	feet	NTU	Nephelometric Turbidity Units		
gpm	Gallons per minute	N/A	Not Applicable		
mg/L	Miligrams per liter	COC	Chain of Custody		

ARCADIS GERAGHTY & MILLER

Groundwater Sampling Form

Page ____ of ____

Project/No. A1000949.0022.0003A Well GMPW3 Date 3-30-06

Screen Setting _____ Measuring Point Description _____ Casing Diameter (inches) _____

Static Water Level _____ Measured Width _____ Well Materials ___ PVC ___ ST. Steel

Total depth _____ Pump On: _____ Pump Intake: _____

Purge Method Pump Off: _____ Volumes Purged _____

Centrifugal _____ Sample Time: _____

Submersible _____

Other SP. Bailer Type: _____ Sampled By: D. McLaughlin

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)
					7.24						

Lowflo.xls.xls
10/20/98

ARCADIS GERAGHTY & MILLER

Groundwater Sampling Form

Page ____ of ____

Project/No. AY000949.0022.00031A Well GMW04 Date 3-30-02

Screen Setting _____ Measuring Point Description _____ Casing Diameter (inches) _____

Static Water Level _____ Measured Width _____ Well Materials PVC / ST. Steel

Total depth _____ Pump On: _____ Pump Intake: _____

Purge Method Pump Off: _____ Volumes Purged _____

Centrifugal _____ Sample Time: _____

Submersible _____

Other S.P. Bailer Type: _____ Sampled By: D. McCLAGHERTY

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)
					7.11						

Lowflo.xls.xls
10/20/98

ARCADIS GERAGHTY & MILLER

Groundwater Sampling Form

Page ____ of ____

Project/No. NY008999.0022.0003A Well COMB. FNE Date 3-30-04

Screen Setting _____ Measuring Point Description _____ Casing Diameter (inches) _____

Static Water Level _____ Measured Width _____ Well Materials PVC ___ ST. Steel

Total depth _____ Pump On: _____ Pump Intake: _____

Purge Method Pump Off: _____ Volumes Purged _____

Centrifugal _____ Sample Time: _____

Submersible _____

Other S.P. Bailer Type: _____ Sampled By: D MECLAFFERTY

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)
					6.97						

Lowflo.xls.xls
10/20/98

ARCADIS GERAGHTY & MILLER

Groundwater Sampling Form

Page ____ of ____

Project/No. AIY000999.0022.0003A Well TOTAL EFF. Date 3-30-06

Screen Setting _____ Measuring Point Description _____ Casing Diameter (inches) _____

Static Water Level _____ Measured Width _____ Well Materials PVC ___ ST. Steel

Total depth _____ Pump On: _____ Pump Intake: _____

Purge Method Pump Off: _____ **Volumes Purged** _____

Centrifugal _____ **Sample Time:** _____

Submersible _____

Other SP. Bailer Type: _____ Sampled By: D. McCLAFFERTY

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)
					7.32						

Lowflo.xls.xls
10/20/98

ARCADIS GERAGHTY & MILLER

Groundwater Sampling Form

Page ____ of ____

Project/No. XY000949.0022.0003A Well 6MMW2 Date ____

Screen Setting ____ Measuring Point Description ____ Casing Diameter (inches) 2"

Static Water Level ____ Measured Width ____ Well Materials PVC ✓ ____ ST. Steel

Total depth ____ Pump On: ____ Pump Intake: ____

Purge Method Pump Off: ____ Volumes Purged ____

Centrifugal ____ Sample Time: ____

Submersible ____

Other PDB Bailer Type: Double Sampled By: D. McCLaffert

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)
1105			35.92		6.40	204				13.1	

Lowflo.xls.xls
10/20/98

ARCADIS GERAGHTY & MILLER

Groundwater Sampling Form

Page ____ of ____

Project/No. NY000449.0022.0003A Well GMW 6 Date 3·30·06

Screen Setting ____ Measuring Point Description TOC Casing Diameter (inches) 2"

Static Water Level ____ Measured Width ____ Well Materials PVC ____ ST. Steel

Total depth ____ Pump On: ____ Pump Intake: ____

Purge Method Pump Off: ____ **Volumes Purged** ____

Centrifugal ____ **Sample Time:** ____

Submersible ____ Sampled By: ____

Other PDB Bailer Type: DOUBLE

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)
0945			3.59		6.59	1139				11.1	

Lowflo.xls.xls
10/20/98

ARCADIS GERAGHTY & MILLER

Groundwater Sampling Form

Page ____ of ____

Project/No. NY000949.0022.0003A Well PW-4 Date 3-30-06

Screen Setting ____ Measuring Point Description TOC Casing Diameter (inches) 2"

Static Water Level ____ Measured Width ____ Well Materials PVC✓ ___ ST. Steel

Total depth ____ Pump On: ____ Pump Intake: ____

Purge Method Pump Off: ____ Volumes Purged ____

Centrifugal ____ Sample Time: ____

Submersible ____

Other PDB Bailer Type: Double Sampled By: D. McCLAFFERTY

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)
1015			16.50		6.02	697				10.0	

Lowflo.xls.xls
10/20/98

ARCADIS GERAGHTY & MILLER

Groundwater Sampling Form

Page ____ of ____

Project/No. X4000949.0022.0003A Well 6mmw5 Date 3-30-05

Screen Setting ____ Measuring Point Description ____ Casing Diameter (inches) 2

Static Water Level ____ Measured Width ____ Well Materials ✓ PVC ___ ST. Steel

Total depth ____ Pump On: ____ Pump Intake: ____

Purge Method Pump Off: ____ Volumes Purged ____

Centrifugal ____ Sample Time: ____

Submersible ____

Other PDB Bailer Type: ~~Disposable~~ Double Sampled By: D. McCafferty

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)
0830			49.09	—	6.07	687		-		10.4	

Lowflo.xls.xls
10/20/98

ARCADIS GERAGHTY & MILLER

Groundwater Sampling Form

Page ____ of ____

Project/No. N-100949.0022.0003A Well W-7 Date 3-30-04

Screen Setting _____ Measuring Point Description _____ Casing Diameter (inches) 2"

Static Water Level _____ Measured Width _____ Well Materials ✓ PVC ___ ST. Steel

Total depth _____ Pump On: _____ Pump Intake: _____

Purge Method Pump Off: _____ Volumes Purged _____

Centrifugal _____ Sample Time: _____

Submersible _____ Sampled By: _____

Other ODB Bailer Type: Double

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW 41.92	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)
1205			42.46		4.49	525				12.3	

Lowflo.xls.xls
10/20/98

ARCADIS GERAGHTY & MILLER

Groundwater Sampling Form

Page ____ of ____

Project/No. NY000949.0022.0003A Well W-5 Date 3-30-06

Screen Setting ____ Measuring Point Description TOC Casing Diameter (inches) 2"

Static Water Level ____ Measured Width ____ Well Materials PVC ✓ ____ ST. Steel

Total depth ____ Pump On: ____ Pump Intake: ____

Purge Method Pump Off: ____ Volumes Purged ____

Centrifugal ____ Sample Time: ____

Submersible ____

Other PDB Bailer Type: DOUBLE Sampled By: D. McCLAFFERTY

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)
1325			50.89		6.77	946				12.5	

Lowflo.xls.xls
10/20/98

ARCADIS

Appendix B

New York State Department of
Environmental Conservation DAR-1
Air Modeling Data

ARCADIS

Table B-1. NYSDEC DAR-1 Air Modeling Data, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Parameters for 3/31/2006 Sampling Event			
Discharge Temperature	T	508	°R
Ambient Temperature	Ta	533	°R
Stack Diameter	D	6	in
Stack Radius	R	0.25	ft
Stack Area	A	0.20	ft^2
Exit Velocity	V	21.5	fps
Exit Flow	Q	253	acfm
Exit Flow	Q	263	scfm
Stack Height	h_s	17	ft
Building Height	h_b	13.25	ft
Ratio of Heights	h_s/h_b	1.28	
Plume rise credit? $h_s/h_b > 1.5$?	(If no, $h_e=h_s$)	(If Yes, $h_e = h_s + 1.1\ (F_m)^{1/3}$)	
Momentum Flux	Fm = Ta/T * V2 * R2	n/a	ft^4/s^2
Effective Stack Height	h_e	17.0	ft
Reduction Factor? $2.5 > h_s/h_b > 1.5$?		No, do not reduce impact	
Actual Annual Impact	C_a	$RF*6*Q_a/h_e^{2.25}$	
Mass Flow	Q_a	S lbs emitted for last 12 months	

fps: feet per second
acfm: actual cubic feet per minute
ug/m^3: micrograms per cubic meter
lb/yr: pounds per year
lb/hr: pounds per hour
ppb: parts per billion

Notes/Assumptions:

1. The stack discharge temperature is 48°F based on recorded parameters.
2. The ambient temperature is approximately 73°F based on recorded conditions.
3. Calculations assume that the system will run with the maximum allowable concentrations between quarterly readings.
4. AGC refers to the Annual Guideline Concentration as determined using the hand calculations in the DAR-1 AGC/SGC Tables dated December 22, 2003.
5. To be conservative the lower detection limit was used for compounds that were below the limit of detection, but are found in the influent groundwater of the Groundwater Remediation System.

ARCADIS

Table B-2. NYSDEC DAR-1 Air Modeling Data, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Calculation of the Short-Term Guideline Concentration (SGC) for Sampling Event on 3/31/2006

Compounds	CAS Numbers	Maximum Limit (SGC) (ug/m^3)	Analytical Concentration (ppb)	Detection Limit Used	Actual Emissions C_a (ug/m^3)	Mass/hour (lb/hr)	Maximum Potential Impact (Step III.A.3 in DAR-1) (ug/m^3)	Short Term Impact (Step III.A.5 in DAR-1) (ug/m^3)	Percent of the SGC (%)
Vinyl Chloride	75-01-4	180,000	7.3	*	18.97	2.66E-05	0.0046	0.29596	1.6E-04
Chloroethane(Ethyl Chloride)	75-00-3	--	7.3	*	19.58	2.75E-05	0.0047	0.30553	NA
1,1-Dichloroethene(Vinylidene Chloride)	75-35-4	--	7.3	*	29.42	4.13E-05	0.0071	0.45909	NA
Methylene Chloride(Dichloromethane)	75-09-2	14,000	7.3	*	25.78	3.62E-05	0.0062	0.40222	2.9E-03
1,1-Dichloroethane	75-34-3	--	7.3	*	30.03	4.22E-05	0.0072	0.46866	NA
cis-1,2 - Dichloroethylene	156-59-2	--	7.3	*	29.42	4.13E-05	0.0071	0.45909	NA
1,1,1-Trichloroethane(Methyl Chloroform)	71-55-6	68,000	7.3	*	40.49	5.69E-05	0.0097	0.63179	9.3E-04
Trichloroethene	79-01-6	54,000	7.3	*	39.88	5.60E-05	0.0096	0.62223	1.2E-03
Dichlorofluoromethane(Freon 12)	75-71-8	--	7.3	*	36.69	5.15E-05	0.0088	0.57251	NA

ug/m^3: Micrograms per cubic meter
ppb: parts per billion
*: Analyte concentration below detection limit, detection limit was used in calculations
lb/hr: pounds per hour
--: No SGC listed for compound
NA: Not applicable

Notes:

1. DAR-1 refers to DAR-1 AGC/SGC Tables dated December 22, 2003.
2. SGC refers to the Short-Term Guideline Concentration as determined using the hand calculations in the DAR-1 AGC/SGC Tables dated December 22, 2003.
3. To be conservative the lower detection limit was used for compounds that were below the limit of detection, but are found in the influent groundwater of the Groundwater Remediation System.

ARCADIS

Table B-3. NYSDEC DAR-1 Air Modeling Data, Operational Year 4, Quarter Number 2, Colesville Landfill, Broome County, New York.

Calculation of AGC based on 3/31/2006 Sampling Event

Compounds	CAS Numbers	Maximum Limit on C_a (AGC[4]) ug/m^3	Maximum Mass Flow Q_a lb/yr	Lab Data ppb	Detection Limit Used[5]	Actual Emissions C_a ug/m^3	Actual Mass Flow per Hour lb/hr	Actual Mass Flow per Year lb/yr	**Percent of Annual %**
Vinyl Chloride	75-01-4	0.11	10.76	7.3	*	18.97	1.87E-05	0.15727	**1.46**
Chloroethane(Ethyl Chloride)	75-00-3	10,000	978,044.97	7.3	*	19.58	1.93E-05	0.16235	**0.00**
1,1-Dichloroethene(Vinylidene Chloride)	75-35-4	70	6,846.31	7.3	*	29.42	2.89E-05	0.24395	**0.00**
Methylene Chloride(Dichloromethane)	75-09-2	2.1	205.39	7.3	*	25.78	2.54E-05	0.21373	**0.10**
1,1-Dichloroethane	75-34-3	0.63	61.62	7.3	*	30.03	2.95E-05	0.24904	**0.40**
cis-1,2-Dichloroethylene	156-59-2	1,900	185,828.54	7.3	*	29.42	2.89E-05	0.24395	**0.00**
1,1,1-Trichloroethane(Methyl Chloroform)	71-55-6	1,000	97,804.50	7.3	*	40.49	3.98E-05	0.33572	**0.00**
Trichloroethene	79-01-6	0.5	48.90	7.3	*	39.88	3.92E-05	0.33064	**0.68**
Dichlorodifluoromethane(Freon 12)	75-71-8	12,000	1,173,653.96	7.3	*	18.24	1.79E-05	0.15123	**0.00**

fps: feet per second
acfm: actual cubic feet per minute
ug/m^3: micrograms per cubic meter
lb/yr: pounds per year
lb/hr: pounds per hour
ppb: parts per billion

Notes/Assumptions:

1. The stack discharge temperature is 48°F based on recorded parameters.
2. The ambient temperature is approximately 73°F based on recorded conditions.
3. Calculations assume that the system will run with the maximum allowable concentrations between quarterly readings.
4. AGC refers to the Annual Guideline Concentration as determined using the hand calculations in the DAR-1 AGC/SGC Tables dated December 22, 2003.
5. To be conservative the lower detection limit was used for compounds that were below the limit of detection, but are found in the influent groundwater of the Groundwater Remediation System.

ARCADIS

Appendix C

Automated Reagent Injection System
Operating Parameters

ARCADIS

Table C-1. Automated Reagent Injection System Summary of Operational Year 4, Quarter Number 2 Injection Quantities, Groundwater Remediation System, Colesville Landfill, Broome County, New York.

Summary of Automated Reagant Injections

Date	Total Quantity of Molasses Solution Injected (gal.)	Total Quantity of Molasses Injected (gal.)	Total Quantity of Rinse Water Injected (gal.)
2/15/2006	14,695	147	157
Quarter Totals (gal.) =	**14,695**	**147**	157
Totals Since Startup (gal.) =	**94,909**	**8,195**	**7,681**

Notes:

gal. Gallons

ARCADIS

Table C-2. Automated Reagent Injection System, Operational Year 4, Quarter Number 2 Operating Parameters, Groundwater Remediation System, Colesville Landfill, Broome County, New York.

Injection Number 52

Injection Start Date = 2/15/2006
Injection Completion Date = 5/23/2006

Molasses to Water Ratio (%) = 1.0 Programmed Mixing Time (min.)[1] = 60

Injection Well ID	Molasses Solution Injection Quantity (gal.)	Rinse[2] Quantity (gal.)	Raw Molasses Per Well (gal.)	Min. Injection[3] Flowrate (gpm)	Max. Injection Pressure (psi)
PW-6	530	5	5.3	NM	34
IW-3	530	5	5.3	NM	33
IW-1	210	4	2.1	NM	28
IW-2	210	3	2.1	NM	28
GMMW-1	140	3	1.4	NM	NM
IW-4	989	4	9.9	NM	31
IW-5	989	5	9.9	NM	32
IW-6	989	7	9.9	NM	28
IW-7	989	8	9.9	NM	28
IW-8	989	9	9.9	NM	29
IW-9	1,230	11	12.3	NM	27
IW-10	1,230	12	12.3	NM	31
IW-11	1,230	13	12.3	NM	32
IW-12	1,230	15	12.3	NM	33
IW-13	1,230	16	12.3	NM	30
IW-14	989	18	9.9	NM	30
IW-15	989	19	9.9	NM	38
Totals (gal.) =	14,695	157	146.9	NA	NA

Notes:

gal. Gallons.
min. Minutes.
i.w.c. Inches of water column.
psi Pounds per square inch.
gpm Gallons per minute.
NA Not applicable.
NM Not measured.
1. Programmed mixing time is calculated from the expiration time of the molasses injection countdown timer to the startup of transfer pump TP-900 during an injection sequence or from the end of transfer pump TP-600 operation to the restart of an injection during a mixing sequence.
2. Rinse quantity is approximately 1-pipeline volume for each injection well.
3. Parameter not measured due to SCADA system malfunction.