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NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Division of Environmental Remediation
625 Broadway, 12th Floor, Albany, New York 12233

CIRCUITRON CORPORATION SITE PILOT SOURCE AREA TREATMENT SYSTEM

Latitude 40.749787 °,
Longitude -73.418753 °

REPORT TITLE

Site Management Report No. 02

REPORTING PERIOD

February 2012 - July 2012

CLIENT

New York State Department of Environmental Conservation

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Site

NYSDEC Site No. 152082, Circuitron Corporation Site, Pilot Source Area Treatment System. East Farmingdale, Town of Babylon, Suffolk County, New York. Refer to *Figure 1* for a site location map.

Project Background and Site Description

The Circuitron Corporation Site (Site) Pilot Source Area Treatment System (PSTS) consists of a single integrated groundwater circulation well with an in-well vapor stripping and soil vapor extraction (GCW/IVS/SVE) system. The system was placed into operation by the United States Environmental Protection Agency (USEPA) in March 2008 to address moderate levels of residual contamination (chlorinated solvents) within soil and groundwater in the southwest corner of the Site. The GCW/IVS/SVE system was operated and maintained by the USEPA through June 2011 when site management responsibilities were transferred to the New York State Department of Environmental Conservation (NYSDEC) consistent with Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) requirements. Site management activities are now performed by the NYSDEC with funds allocated under the New York State Superfund Program. A copy of the Site Transfer Agreement is provided in *Appendix A*. The NYSDEC issued a Work Assignment (WA D004446-16) to Dvirka and Bartilucci Consulting Engineers (D&B) in July 2011 under D&B's State Superfund Contract with the NYSDEC to perform site management activities at the Site. During this reporting period the only activities occuring at the site are routine (bi-monthly) system monitoring and sampling.

Pilot Source Area Treatment System Overview

The PSTS consists of a single integrated groundwater circulation well with an in-well vapor stripping and soil vapor extraction system. The overall process, which is an extension of the air sparging technology, involves the creation of groundwater circulation cells around a well through which contaminated groundwater is cycled. As can be seen on *Figure 2*, the groundwater circulation well installed at the Site consists of a single well with separate upper and lower screened intervals. Nitrogen is injected at the base of the well, decreasing the density of the groundwater, driving it upward and out of the upper screened zone into the vadose and/or saturated zones while simultaneously drawing groundwater in through the lower screened zone. In the process, groundwater contaminants are transferred from the dissolved phase to the vapor phase by the rising air bubbles via air stripping. Once discharged, the air stripped groundwater flows downward, eventually reaching the lower portion of the saturated zone where it is cycled back through the well, replacing the water that rose resulting from the density gradient. This process creates a circulation pattern or cell that allows continuous cycling of groundwater through the well and air stripping process.

The portion of the well screen above the saturated zone is utilized by the SVE system to extract contaminants stripped from the groundwater. Extracted vapor is directed through a moisture knockout drum to remove any entrained water/moisture. Extracted soil vapor is subsequently processed through a series of vapor phase carbon adsorption vessels to remove targeted contaminants prior to being discharged to the atmosphere. It should be noted, however, that the process piping was reconfigured in August 2011 to bypass the vapor phase carbon adsorption vessels per the direction of the NYSDEC based on historic low contaminant concentrations detected in extracted soil vapor.

All treatment system components are located on-site within a mobile trailer. The treatment system is equipped with instrumentation and controls to allow for automated start-up and operation, as well as an autodial remote notification system. Refer to *Figure 3* for a schematic of the PSTS. Refer to *Figure 4* for a Process and Instrumentation Diagram of the PSTS.

Regulatory Requirements/Cleanup Goals

In line with the objectives and requirements of the Operable Unit 1 (OU-1) Record of Decision (ROD) and Operable Unit 2 (OU-2) ROD included in *Appendix B*, the PSTS was constructed and put into routine operation focusing on the following goals:

OU-1 ROD

- Reduce the concentrations of contaminants in Site soils and sediments to levels which are protective of human health and the environment; and,
- Prevent further deterioration of the area groundwater.

OU-2 ROD

- Prevent potential future ingestion of site-related contaminated groundwater;
- Restore the quality of the groundwater contaminated from the site-related activities to levels consistent with the Federal and State drinking water and groundwater quality standards; and,
- Mitigate the off-site migration of the site-related contaminated groundwater.

System Performance Summary

The treatment system performance during the current reporting period is summarized below:

In-Well Air Stripping System, SVE Component Performance Summary		
Average Groundwater Circulation Well Head Vacuum (in. H2O)	24.25	
Average Groundwater Circulation Well Head Flow Rate (SCFM)	525	
Average SVE System Discharge Pressure (in. H2O)	- -	
Average SVE System Discharge Flow Rate (SCFM)	508	
Average Total VOC Removal Rate (Lbs./Hour)	9.96E-04	
Total VOC Removal, Current Reporting Period (Lbs.)	4.99	
Cumulative VOC Removal (Lbs.)	25.93	
Cumulative SVE System Discharge Flow (SCF)	382,545,984	
Average Soil Vapor Monitoring Probe Vacuum Readings		
Soil Vapor Monitoring Probe Vacuum Readings	Min.	Max.
❖ **N07D, Located approximately 07 ft. from GCW (in. H2O)**	-1.08	-0.2
❖ **N30S, Located approximately 30 ft. from GCW (in. H2O)**	-0.93	-0.29
❖ **N30D, Located approximately 30 ft. from GCW (in. H2O)**	-0.71	-0.18
❖ **N45S, Located approximately 45 ft. from GCW (in. H2O)**	-0.28	-0.17
❖ **N45D, Located approximately 45 ft. from GCW (in. H2O)**	-0.2	-0.15
❖ **SE07, Located approximately 07 ft. from GCW (in. H2O)**	-1.9	-0.56
❖ **SE15S, Located approximately 15 ft. from GCW (in. H2O)**	-1.29	-0.47
❖ **SE15D, Located approximately 15 ft. from GCW (in. H2O)**	-1.3	-0.42

In-Well Air Stripping System, Nitrogen Sparging Component Performance Summary	
Combined Nitrogen Flow Rate, Nitrogen Compressor Outlet (SCFM)	2.24
Average Nitrogen Flow - Groundwater Circulation Well (SCFM)	0.45
Average Nitrogen Flow - AS-SW07 (SCFM)	0.52
Average Nitrogen Flow - AS-SE07 (SCFM)	0.74
Average Nitrogen Flow - AS-N07 (SCFM)	0.51

System Runtime/Downtime Summary

The total elapsed time for this reporting period was 4,354 hours (February 1, 2012 through July 31, 2012). Of this amount, the SVE component of the PSTS operated for 4,212 hours or approximately 97 percent of the total elapsed time. The nitrogen sparging component of the PSTS operated for 4,030 hours or approximately 93 percent of the total elapsed time. System runtime/downtime per component is summarized below.w. Refer to *Table 1* for treatment system operation and maintenance logs, which identify specific information regarding alarm conditions, downtime and repairs.

In-Well Air Stripping System, SVE Component Runtime/Downtime Summary

	(Hours)	*(Percentage)*
SVE System Runtime - Current Reporting Period (1)	**4,212**	**96.74%**
SVE System Downtime - Current Reporting Period (1)(3)	**142**	**3.26%**
Total SVE System Runtime To Date (2)	**26,414**	**--**

Notes:
1. Reported value based on the following: System start-up date of 8/24/2011; and total elapsed time 4,354 hours for the current reporting period
2. Reported value reflects system runtime since inception in July 2008, as recorded by the USEPA.

In-Well Air Stripping System, Nitrogen Sparging Component Runtime/Downtime Summary

	(Hours)	*(Percentage)*
System Runtime - Current Reporting Period (1)	**4,030**	**92.56%**
System Downtime - Current Reporting Period (1)(3)	**324**	**7.44%**
Total System Runtime To Date (2)	**23,403**	**--**

Notes:
1. Reported value based on the following: System start-up date of 8/24/2011; and total elapsed time 4,354 hours for the current reporting period
2. Reported value reflects system runtime since inception in July 2008, as recorded by the USEPA.

A tentative schedule for the performance of routine system maintenance next reporting period is presented below.

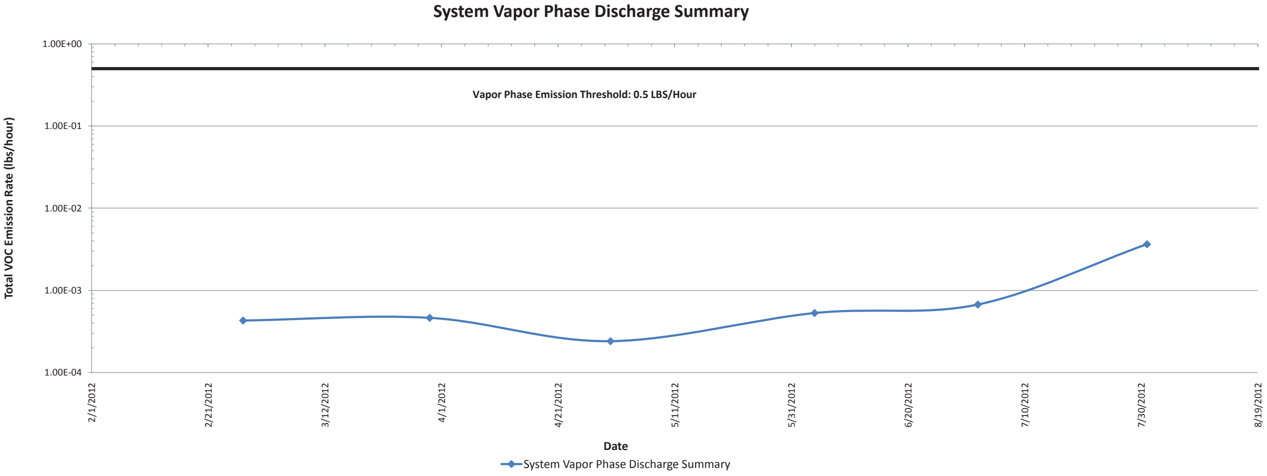
Major System Component	**Manufacturer**	**Model Number**	**Maintenance Frequency**	**Current Reporting Period (1)**					
				Feb-12	**Mar-12**	**Apr-12**	**May-12**	**Jun-12**	**Jul-12**
Air Sparge Compressor	Quincy Compressor	QR-25® Series, Model F325	Bi-Monthly	♦		♦		♦	
High Temperature Refrigerated Dryer	Parker	ZDHHT15-100 (60Hz)	Every Four Months	♦				♦	
Nitrogen Generator	O2N2 SITE Gas Systems	NM Model	Quarterly	♦			♦		
Vacuum Blower	Ametek	EN909BG72WL	Bi-Monthly	♦		♦		♦	
Vapor Phase Carbon Adsorption Vessels	Carbtrol Corporation	G-3	As Needed						

Major System Component	**Manufacturer**	**Model Number**	**Maintenance Frequency**	**Subsequent Reporting Periods (2)**					
				Aug-12	**Sep-12**	**Oct-12**	**Nov-12**	**Dec-12**	**Jan-13**
Air Sparge Compressor	Quincy Compressor	QR-25® Series, Model F325	Bi-Monthly	⌛		⌛		⌛	
High Temperature Refrigerated Dryer	Parker	ZDHHT15-100 (60Hz)	Every Four Months	⌛				⌛	
Nitrogen Generator	O2N2 SITE Gas Systems	NM Model	Quarterly	⌛			⌛		
Vacuum Blower	Ametek	EN909BG72WL	Bi-Monthly	⌛		⌛		⌛	
Vapor Phase Carbon Adsorption Vessels	Carbtrol Corporation	G-3	As Needed						

Notes:
1. Preventive maintenance activities (i.e., lubrication, filter replacements) were completed for major system components as noted.
2. The following represents tentative schedules for performance of routine maintenance of major system components.

Vapor Phase Discharge Summary

Six vapor-phase discharge samples were collected for laboratory analysis via Method TO-15 this reporting period. Sample results were evaluated using DAR-1 modeling software. All samples exhibited VOCs well below the site-specific effluent limit of 0.5 lbs/hr. The site-specific effluent limit of 0.5 lbs/hr was developed in consultation with the NYSDEC as a means to monitor the vapor-phase VOCs by the GCW/IVS/SVE. Refer to *Table 2* for analytical results.

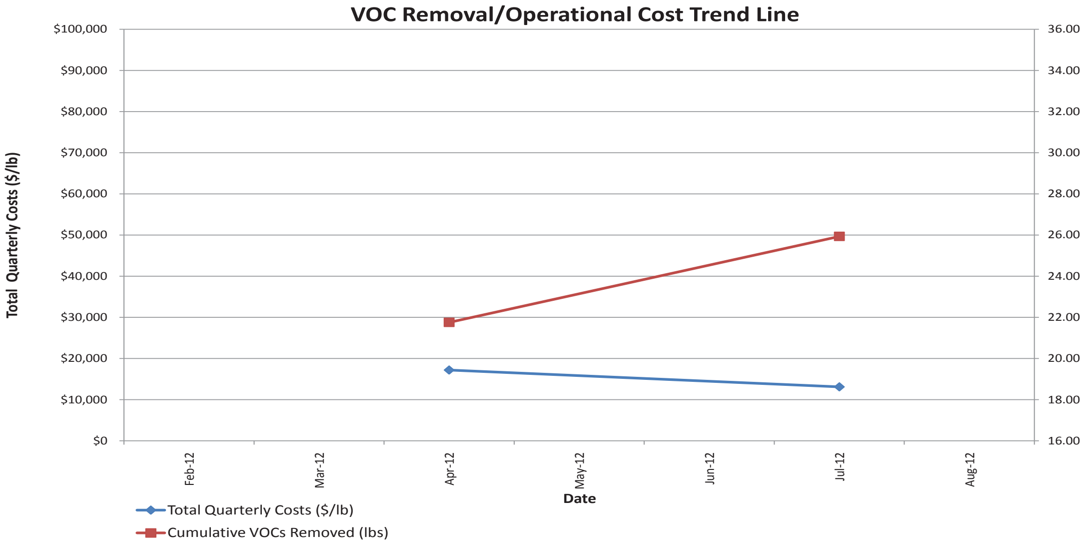


Operational Cost Summary

A figure illustrating project costs associated with operation and maintenance of the GCW/IVS/SVE system over the six month period from February 2012 through July 2012 is provided below. The figure presents operational costs on a quarterly basis relative to pounds of volatile organic compounds removed from the Site. Operational costs include monthly utility, maintenance, and engineering charges. Capitol construction costs and NYSDEC project management effort are not included in the evaluation.

The total operational cost incurred during the period from February 2012 through July 2012 was approximately $51,484. Of this amount, approximately $36,279 was related to engineering charges and approximately $15,205 was related to utilities and laboratory charges. Based on approximately 4.99 pounds of VOC contaminants removed from the Site during this reporting period, the average cost of VOC removal was approximately $10,317 per pound.

It should be noted that the treatment system operational costs were estimated to be approximately $100,000 annually during the initial alternative analysis conducted by the USEPA in 2007. Since D&B has taken over the project in July 2011, the PSTS yearly operating costs (including utility, maintenance and engineering costs) have been approximately $121,000. Based on a review of the operational costs since system inception (2008/4 years) it appears that actual operational costs may be trending higher than previous estimates. If this trend continues and/or it is determined that the cost per pound of VOC removal is excessive, a remedial system optimization evaluation may be warranted to identify means for reducing cost and time to site closure. Operational costs will be monitored during future reporting periods to evaluate efficiency and effectiveness of the treatment system.



Groundwater Monitoring Summary

Eighteen “on-site” groundwater monitoring wells were sampled during the period from May 2012 to June 2012 to determine groundwater quality at the Site, as well as the overall performance of the PSTS. Groundwater samples were collected from six monitoring wells (GW-N15S, GW-N15M, GW-N15D, GW-N45S, GW-N45M, and GW-N45D) located upgradient of the GCW/IVS/SVE system, nine monitoring wells (MW-4S, MW-4D, GW-SW45S, GW-SW45M, GW-SW45D, GCW-SPY-S, GCW-SPY-D, GW-SE07S, and GW-SE15S) in the vicinity of the GCW/IVS/SVE system, and three monitoring wells (GW-SE30S, GW-SE30M, and GW-SE30D) downgradient of the GCW/IVS/SVE system. Groundwater samples were collected from shallow, intermediate, and deep zones. All samples were analyzed for VOCs. The location of the groundwater monitoring wells and GCW/IVS/SVE system are depicted on *Figure 5*.

VOCs were detected in excess of SCGs in three of the eighteen “on-site” groundwater samples. In particular, the VOCs 1,1,1-trichloroethane, chlorobenzene, and cis-1,2-dichloroethene were detected in excess of SCGs in at least one of the samples at concentrations ranging from 10 μg/L to 34 μg/L. The VOCs were detected in samples collected from the shallow and deep groundwater zones. 1,1,1-Trichloroethane was detected in excess of its SCG (5 μg/L) in two shallow wells (MW-4S and GW-SE07S) in the vicinity of the GCW/IVS/SVE system at concentrations of 12 μg/L and 34 μg/L, respectively. Chlorobenzene was detected in excess of its SCG (5 μg/L) in one shallow well (MW-4S) at concentration of 11 μg/L. cis-1,2-Dichloroethene was detected in excess of its SCG (5 μg/L) in one downgradient deep well (GW-SE30D) at a concentration of 10 μg/L. *Table 3* presents tabulated analytical results relative to SCGs. *Figure 5* summarizes exceedances of SCGs in groundwater by well location.

Nineteen “off-site” groundwater monitoring wells were sampled during the period from May 2012 to June 2012 to determine groundwater quality in the vicinity of the Site. Groundwater samples were collected from two monitoring wells (MW-1S and MW-1D) located upgradient of the Site, five monitoring wells (MW-3S, MW-3D, MW-4S, MW-4D and MW-15) in the immediate vicinity of the Site, and twelve monitoring wells (MW-5D, MW-6S, MW-6D, MW-7S, MW-7D, MW-13, MW-14, MW-16, MW-17, MW-18, MW-19S and MW-19D) downgradient of the Site. Groundwater samples were collected from shallow and deep zones. All samples were analyzed for VOCs. The location of the groundwater monitoring wells and GCW/IVS/SVE system are depicted on *Figure 6* and *Figure 7*.

VOCs were detected in excess of SCGs in five of the nineteen “off-site” groundwater samples. In particular, the VOCs 1,1-dichloroethene, 1,1-dichloroethane, 1,1,1-trichloroethane, trichloroethene, and chlorobenzene were detected in excess of SCGs in at least one of the samples at concentrations ranging from 5.3 μg/L to 130 μg/L. The VOCs were detected in samples collected from the shallow and deep groundwater zones. 1,1-Dichloroethene was detected in excess of its SCG (5 µg/L) in one downgradient shallow well (MW-13S) at concentration of 6.4 µg/L and one downgradient deep well (MW-19D) at a concentration of 11 µg/L. 1,1-Dichloroethane was detected in excess of its SCG (5 µg/L) in one downgradient shallow well (MW-13) at a concentration of 12 µg/L. 1,1,1-Trichloroethane was detected in excess of its SCG (5 µg/L) in one shallow well (MW-4S) in the vicinity of the Site at concentration of 12 µg/L and one shallow well (MW-13) downgradient of the Site at concentration of 130 µg/L. 1,1,1-Trichloroethane was detected in excess of its SCG (5 µg/L) in one downgradient deep well (MW-19D) at concentration of 6.7 µg/L. Trichloroethene was detected in excess of its SCG (5 g/L) in one downgradient deep well (MW-19D) at concentration of 19 µg/L. Chlorobenzene was detected in excess of its SCG (5 µg/L) in one upgradient shallow well (MW-1S) at a concentration of 5.8 µg/L and one deep upgradient well (MW-1D) at concentration of 5.3 µg/L. Chlorobenzene was detected in excess of its SCG (5 µg/L) in one downgradient shallow well (MW-13) at concentration of 8.7 µg/L. *Table 4* presents tabulated analytical results relative to SCGs. *Figure 6* and *Figure 7* summarizes exceedances of SCGs in groundwater by well location.

Data Validation Summary

Six vapor phase samples and thirty-seven groundwater samples were collected this reporting period. All vapor phase samples were analyzed by Con-test Analytical Laboratory in accordance with USEPA Method TO-15 for VOCs and all groundwater samples were analyzed by Spectrum Analytical, Inc. in accordance with USEPA 8260 for VOCs.

The data packages were reviewed for contract and method compliance to determine the usability of the sample results. The findings of the review process are summarized below:

Vapor Phase Samples

1. February 27, 2012
    - The percent recovery was above the quality control (QC) limit for benzyl chloride in the laboratory control sample (LCS) associated with the sample. It was not detected in the sample; therefore, qualification of the data was not required.
    - The percent differences for benzyl chloride, bromomethane and carbon disulfide were above the QC limits in the continuing calibration. They were qualified as estimated (UJ) in the sample.
2. March 30, 2012
    - The percent recovery was below the QC limit for 4-methyl-2-pentanone in the LCS associated with the sample. It was qualified as estimated (UJ) in the sample.
    - The percent relative standard deviation was above the QC limit for methylene chloride in the duplicate associated with the sample. It was qualified as estimated (J) in the sample.
    - The percent difference for 4-methyl-2-pentanone was above the QC limits in the continuing calibration. It was qualified as estimated (UJ) in the sample.
3. April 30, 2012
    - The percent recovery was below the QC limit for 4-methyl-2-pentanone in the LCS associated with the sample. It was qualified as estimated (UJ) in the sample.
    - The percent difference for 4-methyl-2-pentanone was above the QC limits in the continuing calibration. It was qualified as estimated (UJ) in the sample.
4. June 4, 2012
    - No performance issues were noted.

5. July 2, 2012
   - No performance issues were noted.

6. July 31, 2012
   - The 4-methyl-2-pentanone percent recovery was below the QC limit in the LCS. The hexachlorobutadiene percent recovery was above the QC limit in the LCS. Both 4-methyl-2-pentanone and hexachlorobutadiene also had the percent differences outside the QC limits in the continuing calibration associated with the sample. 4-Methyl-2-pentanone and hexachlorobutadiene were not detected in the sample; and therefore, 4-methyl-2pentanone and hexachlorobutadiene were qualified as an estimated detection limit (UJ) in the sample.

<u>Groundwater Samples</u>

1. May 3, 2012
   - Methylene chloride was detected in the Trip Blank. Methylene chloride was not detected in the samples; therefore, qualification of the data was not required.
   - The percent recoveries for iodomethane and 2,2-dichloropropane were below the QC limits in the Matrix Spike (MS) and/or Matrix Spike Duplicate (MSD) samples. They were not detected in the associated samples and were qualified as estimated (UJ) in all samples.

2. May 7, 2012
   - No performance issues were noted.

3. June 20, 2012
   - No performance issues were noted.

No other problems were found with the sample results and all results are deemed usable for environmental assessment purposes as qualified above.

All analytical data associated with the Site have been submitted to the NYSDEC in the required EQuIS format within 30 days of receipt of the data from the laboratory.

Findings, Conclusion and Recommendations

<u>Findings:</u>

- Since July 2008, total SVE system runtime is 26,414 hours and total nitrogen sparging system runtime is 23,403 hours. Total elapsed time for this reporting period is 4,354 hours. The SVE system operated for 4,212 hours or approximately 97 percent of the time and the nitrogen sparging component operated for 4,030 hours or approximately 93 percent of the time.
- The system was shut-down on several occasions this reporting period for routine and non-routine maintenance. The system was shut-down in February, April, May and July for routine maintenance. The system was shut-down in June 2012 for non-routine maintenance. The system was also shut-down on a separate occasion in May for groundwater sampling.
- The average VOC removal rate this reporting period was approximately 0.000996 lbs/hr. The total VOCs removed this reporting was approximately 4.99 lbs. Total VOCs removed since system inception is approximately 25.93 lbs.
- Six vapor phase discharge samples were collected from the treatment system and analyzed for VOCs via method TO-15. Total VOC concentrations ranged from 126.55 µg/m3 to 1913.02 µg/m3. The total VOC emissions rate was consistently below the NYSDEC threshold of 0.5 lbs/hour.

- Total operational cost during the period from February 2012 through July 2012 was approximately $51,484. Based on 4.99 pounds of VOCs removed this reporting period, the average cost of removal was approximately $10,317 per pound. Based on cost data for this reporting period, actual system operational costs appear to be trending slightly higher than estimates established by the USEPA during the initial alternative analyses in 2007.
- Eighteen groundwater samples were collected and analyzed for VOCs in May and June 2012 from "on-site" wells. The VOCs 1,1,1-trichloroethane, chlorobenzene, and cis-1,2-dichloroethene were detected in excess of SCGs in at least one of the samples at concentrations ranging from 10 µg/L to 34 µg/L. The VOCs were detected in samples collected from the shallow and deep groundwater zones.
- Nineteen groundwater samples were collected and analyzed for VOCs in May and June 2012 from "off-site" wells. The VOCs 1,1-dichloroethene, 1,1-dichloroethane, 1,1,1-trichloroethane, trichloroethene, and chlorobenzene were detected in excess of SCGs in at least one of the samples at concentrations ranging from 5.3 µg/L to 130 µg/L. The VOCs were detected in samples collected from the shallow and deep groundwater zones.

Conclusions:

- Excluding scheduled system downtime, the GCW/IVS/SVE is reliable. Performance of routine maintenance has improved system reliability.
- Based on cost data for this reporting period, actual system operational costs may be trending slightly higher than previous estimates.
- The cleanup time for the GCW/IVS/SVE system was estimated to be at least three years to remediate 1,1,1-trichloroethane levels from hundreds of parts per million (ppm) to low ppm level in the vadose and saturated zone soil and down to low part per billion (ppb) level in groundwater. To date, the system has operated for approximately 4 years. Chlorinated VOC concentrations in groundwater remain elevated above the Site cleanup criteria. 1,1,1-Trichloroethane was detected at a concentration of 130 ppb or two orders of magnitude higher than the cleanup standard in an "off-site" downgradient monitoring well (MW-13).
- Based on a side-by-side comparison of groundwater analytical data, it appears chlorinated VOC concentrations may be "rebounding" in off-site monitoring wells.
- Analytical and operational data indicate a steady increase in contaminant mass removal. Asymptotic conditions have not been reached.

Recommendations:

- Operation of the PSTS should continue until analytical and operational data indicate asymptotic conditions are reached for contaminant mass removal.
- Operational costs and cleanup time should continue to be closely monitored. If operational costs and/or cleanup time consistently exceed estimates, a remedial site optimization evaluation may be necessary to: 1) develop improvements in remedy effectiveness; 2) reduce operation and maintenance costs; 3) identify technical improvements; 4) recommend alternative remedial technologies; and, 4) gain site closure.
- All monitoring wells associated with the PSTS should be sampled as part of the monitoring program to ensure a reliable and consistent data set suitable for assessing groundwater conditions at the Site.
- Chlorinated VOC concentrations in off-site wells should be closely monitored. In the event concentrations continue to be detected or exhibit an increasing concentration trend, further investigation may be warranted.

Reclassification/Delisting Evaluation

USEPA finalized the NPL Listing for the Site on March 31, 1989. Since that time, completion of the following project phases has occurred, as summarized below:

Project Phase	Completion Dates
Operable Unit 01A	
IRM Waste Removal	04/1989
Operable Unit 01	
Remedial Investigation	03/1991
Remedial Design	09/1994
Remedial Action	01/1997
Operable Unit 02	
Remedial Investigation	09/1994
Remedial Design	09/1996
Remedial Action	06/2000

Given the above, NYSDEC reclassified the Site pursuant to the requirements identified in 6 NYCRR §375-2.7 as a Class 4 Site on July 21, 2011 since the residual contamination does not appear to constitute a significant threat to public health or the environment based on remedial efforts performed to date. Site delisting is not feasible at this time, as all remediation and post-remediation activities have not been completed.

Report Certification:

I have personally examined and am familiar with the information submitted in the referenced Report. To the best of my knowledge and belief, and based upon my inquiry of those individuals immediately responsible for obtaining the information reported therein, I certify that the submitted information is true, accurate, and complete.

Project Director: M. Walka 9.20.12

Richard M. Walka
Senior Vice President
Date

Project Manager: Robbin Petrella 9-20-12

Robbin Petrella
Associate
Date