May 26, 2015

Project No.: 083-87071-06
VIA EMAIL

Mr. Kevin Whalen
International Business Machines Corporation
Corporate Environmental Affairs
8976 Wellington Road
Manassas, Virginia

RE: *REVISED* MONTHLY PERFORMANCE MONITORING SUMMARY REPORT #1
INTERIM CORRECTIVE MEASURE - SOLID WASTE MANAGEMENT UNIT S
FORMER IBM FACILITY
300 ENTERPRISE DRIVE
KINGSTON, ULSTER COUNTY, NEW YORK

Dear Mr. Whalen:

This revised Monthly Performance Monitoring Summary Report has been updated to incorporate comments and requests for clarification received from the New York State Department of Environmental Conservation (NYSDEC) on May 14, 2015 in response to the draft submitted to NYSDEC on May 6, 2015. The information provided herein summarizes system performance and remedial progress for the in-situ thermal desorption (ISTD) Interim Corrective Measure (ICM) implemented for Solid Waste Management Unit S (SWMU S): Former Building B001 1,1,1-Trichloroethane (TCA) Waste Tanks at the former IBM facility located at 300 Enterprise Drive in Kingston, Ulster County, New York (site).

This project is being conducted in accordance with the Interim Corrective Measure Work Plan (ICM Work Plan) prepared by Golder Associates Inc. (Golder) and approved by NYSDEC on October 7, 2014. ICM-related activities conducted during the first month of system operations for the period of March 19, 2015 through April 20, 2015 and a summary of baseline monitoring and ISTD system start-up activities completed prior to system operations are summarized in the following sections.

1.0 SITE OPERATIONS SUMMARY

ISTD treatment system construction and component installation activities for the SWMU S ICM were completed in the treatment area, located north of Building B021 and west of Building B001 (Figure 1), between October 13, 2014 and March 9, 2015. TRS Group (TRS) began equipment start-up testing during the week of March 9, 2015. Vapor control was initiated on February 26, 2015, prior to the completion of start-up, to establish a negative pressure differential in the subsurface between the treatment area and the surrounding area prior to energizing the electrical resistive heating (ERH) electrode array. TRS completed system operations testing, including current and voltage surveys, step and touch testing, and voltage mitigation activities on March 18, 2015.

During the design phase, the project team anticipated that the relatively more conductive soils in the lower interval of the treatment area (i.e., between 15 and 30 feet below ground surface [bgs]) would reach operational temperatures (approximately 65 degrees Celsius [°C]) before the relatively less conductive soils of the upper interval (i.e., between ground surface and 15 feet bgs), which had the potential to cause vapors generated in the relatively hotter lower interval to re-condense in the relatively cooler upper interval. To address this potential issue, the TRS final design included two separate electrodes in each electrode borehole (i.e., one electrode at approximately 5 to 15 feet bgs and the second at 15 to 30 feet bgs) such that energy could be applied to the upper and/or lower electrodes independently.

TRS energized the ERH electrodes installed in the upper interval of the treatment area on March 19, 2015. Following one week of heating, the upper interval had increased from approximately 12°C to an average of approximately 30°C while the average subsurface temperature in the lower interval remained at approximately 14°C. The project team considered this a sufficient temperature differential between the upper and lower intervals of the treatment area to reduce the potential for re-condensation in the upper interval and TRS began applying energy to the electrodes in the lower interval on March 26, 2015.

Five 20-yard and two 30-yard roll-off containers and 19 55-gallon drums of investigative derived waste were generated during ISTD system construction and component installation. Between March 19, 2015 and March 24, 2015, six of the roll-off containers were transported to Environmental Soil Management Inc. (ESMI) in Fort Edward, New York as non- hazardous waste and the remaining roll-off container and the 19 55-gallon drums were picked up for transport to a Veolia facility in Port Worth, Texas for incineration as hazardous waste.

Following observation of elevated process vapor effluent photo-ionization detector (PID) readings indicating that the carbon beds in both of the approximately 2,400-pound vapor polish carbon vessels were exhausted, TRS contracted Evoqua Water Treatment to remove the spent carbon and replenish the vapor polish carbon vessels with fresh carbon. Spent vapor polish carbon will be sent to an appropriate facility for regeneration following receipt of analytical results for a characterization sample submitted to the laboratory in April 2015.

Approximately 150 gallons of dense non-aqueous phase liquid (DNAPL) has been recovered from the treatment area since energizing the ERH system. Recovered DNAPL is containerized and stored within the treatment area. DNAPL will be disposed at an appropriate facility following receipt of analytical results for a characterization sample submitted to the laboratory in April 2015.

2.0 SYSTEM PERFORMANCE

The ERH system has operated at an average power application of approximately 752 kilowatts (kW) and has delivered a total of 601,196 kilowatt-hours (kWh) of energy to the treatment area since treatment began. As of April 20, 2015, the average subsurface temperature in the treatment area increased from approximately 12°C prior to ERH electrode energization to an average of approximately 86°C in the upper interval and approximately 62°C in the lower interval. Average subsurface temperature profiles for both the upper and lower intervals and total energy applied to the treatment area are illustrated on Figure 2.

O'Brien & Gere (OBG) personnel collected subsurface vapor pressure measurements from vacuum piezometers installed within and around the perimeter of the treatment area on a daily basis beginning on March 2, 2015, following initiating vapor control on February 26, 2015. After energizing the entire ERH system and achieving steady-state operations on March 26, 2015 (i.e., both the upper and lower intervals of the ERH electrodes were energized and operating 24-hours a day, 7-days a week), OBG began collecting influent, midfluent, and effluent total volatile organic compound (VOC) readings from the vapor treatment system using a handheld PID.

Since steady-state operations began on March 26, 2015, the treatment system has been taken offline twice. The first shutdown occurred on April 15, 2015 when a failure of the variable frequency drive (VFD), a component of the vapor recovery system that regulates the blower, caused the treatment system to be shut down for repairs. When the VFD failed, the blower ceased operations and vacuum was lost in the vapor treatment system, causing the system to shut down, which activated a pneumatically controlled automated valve to initiate passive venting, as verified by TRS on-site personnel. As a result of VFD failure and thus vapor recovery system shutdown, the ERH electrodes and steam-regenerated granular activated carbon (SRGAC) system were also temporarily shut down. The VFD was replaced and the treatment system was restored to normal operation on April 16, 2015.

The second treatment system shutdown occurred the evening of April 18, 2015 when a ruptured airline on the SRGAC system caused an automatic de-energization of the entire treatment system. Passive venting of the vapor treatment system was verified by TRS personnel upon arrival at the site. TRS replaced the ruptured airline and restored the treatment system to normal operation on April 19, 2015.

Treatment systems controls and alarms appropriately notified operations personnel of each mechanical issue and both of the treatment system shutdowns were resolved and normal treatment system operations restored within 24-hours. With the exception of these two minor shutdowns, the treatment system operated without issue during this reporting period and maintained consistent energy delivery to the treatment area.

2.1 Vapor Control System

Vapor phase discharges are generated through operation of the blower used to capture VOC vapors and steam generated as a result of operation of the ERH treatment system. Process vapors are directed first to the SRGAC units for primary treatment and then to the vapor polish granular activated carbon (VGAC) unit for secondary treatment prior to discharge to the atmosphere via the 35-foot exhaust stack, located adjacent to Building B001 (Figure 1).

The vapor recovery system has operated with an uptime efficiency of approximately 90 percent (%) since vapor control was initiated on February 26, 2015. Process vapor influent concentrations, recorded in the field with a hand held PID, have increased from 0.0 parts per million volume (ppmv) to a maximum of 172 ppmv, recorded on April 16, 2015. Recent process vapor influent and effluent PID readings average approximately 125 ppmv and less than 1 ppmv, respectively. The vapor recovery system has averaged approximately 837 standard cubic feet per minute (scfm) of airflow with an applied average vacuum of 2-inches of water (in H_2O), measured within the condensing unit.

TRS manages SRGAC regeneration cycle timing to increase the SRGAC unit contaminant removal efficiency (CRE) in response to changing process vapor influent PID readings, which are indicative of the relative volume of contaminants entering the system. The SRGAC regeneration cycle has been reduced throughout the reporting period as subsurface temperatures and subsequently the volume of mobilized VOCs increases. Initially, the SRGAC unit was programmed for a regeneration cycle frequency of once every 4 days. Currently, the SRGAC unit regenerates every 5 hours. In addition, TRS lengthened the bed drying and cooling segments of the regeneration cycle to optimize SRGAC performance, as moisture and elevated carbon bed temperatures reduce CRE. TRS will continue to use process vapor PID readings to manage the SRGAC regeneration cycle time and optimize efficiency.

2.1.1 Subsurface Vapor Pressure

Subsurface vapor pressure readings are used to evaluate the effectiveness of the vapor control system in capturing vapors generated during the heating process and preventing volatized contaminants within the carrier steam gas from escaping the treatment area.

Subsurface vapor pressure readings collected by OBG from each of the seven vacuum piezometers installed within and around the perimeter of the treatment area on a daily basis ranged from -0.5 in H_2O to -4.5 in H_2O and vapor pressure readings collected from vacuum piezometers installed along the perimeter of the treatment area ranged from 0.0 in H_2O to -3.1 in H_2O.

As illustrated on Figure 3, vapor pressure readings collected using a hand-held manometer demonstrate that the vapor control system maintained a negative pressure gradient in the subsurface between the treatment area and the surrounding areas. Paired vacuum piezometers, one located within the treatment area (solid line) and one located outside of the treatment area (dashed line) are indicated by color.

2.1.2 Process Vapor PID Readings

Vapor treatment system process vapor readings are collected on a daily basis from each of the influent (pre-SRGAC), midfluent (post-SRGAC, pre VGAC), and effluent (post-VGAC) locations using a handheld PID to evaluate relative mass removal and carbon treatment CRE. Steady-state operations, defined as energization of the electrodes installed in both the upper and lower intervals of the treatment area, began on March 26, 2015.

In response to elevated influent, midfluent, and effluent PID readings recorded on April 6, 2015 (included on Table 1), TRS reduced the SRGAC regeneration cycle frequency to once every 6-hours and lengthened the bed drying and cooling segments of the regeneration cycle to optimize CRE and replaced the polish carbon vessel. Following the reduction in SRGAC regeneration cycle timing and the replacement of the vapor polish carbon vessel, process vapor effluent PID readings collected on April 7, 2015 were significantly reduced (i.e., from 40 ppmv to 0.0 ppmv) and remained relatively low until April 14, 2015.

Elevated influent, midfluent, and effluent PID readings were recorded again on April 14, 2015 and TRS determined that the two polish carbon vessels had reached their maximum loading capacity and were beginning to desorb VOCs from the carbon bed back into the vapor stream. TRS also noted that relatively elevated moisture levels in the carbon vessel removed from service contributed to the lower than anticipated loading capacity of the carbon.

The carbon beds within the two polish carbon vessels were subsequently replaced on April 16, 2015. To reduce moisture in the vapor polish carbon vessel and thus increase vapor polish carbon CRE, TRS installed a moisture trap along the process vapor treatment line before the vapor stream enters the polish vessel to capture water and direct it back toward the condensing unit.

Following observation of an increasing trend in influent PID readings the week of April 13, 2015, TRS reduced the SRGAC regeneration cycle timing from once every 6 hours to once every 5 hours on April 16, 2015. SRGAC regeneration cycle timing has remained consistent at about once every 5 hours since April 16, 2015.

2.1.3 Process Vapor Analytical Results

In addition to the daily PID readings, Golder collected weekly process vapor grab samples from the influent, midfluent, and effluent locations between April 1, 2015 and April 14, 2015 for analysis of VOCs. Golder collected an additional round of process vapor samples on April 9, 2015 to confirm that response actions taken on April 6, 2015, in response to elevated process vapor influent PID readings (discussed in Section 2.1.2), adequately addressed a potential mass loading issue. TRS used the analytical results from these process vapor samples to supplement daily PID measurements and to estimate carbon loading and mass extraction.

The primary constituents of concern (COCs) in the SWMU S area are TCA, 1,1-dichloroethane (1,1-DCA), and 1,1-dichloroethene (1,1-DCE). Analytical results for the primary COCs in process vapor samples collected on April 1, April 6, April 9, and April 14, 2015 are summarized on Table 1. Included on Table 1 are trend plots for the concentrations of primary COCs detected in process vapor samples and PID readings recorded along the process vapor system throughout the reporting period.

Process vapor effluent results for all compounds were reported at concentrations below their respective NYSDEC Division of Air Resources (DAR)-1 Short-term Guidance Concentration (SGC) in the effluent sample collected on April 1, 2015.

Golder collected one process vapor sample from each of the three sample locations along the process vapor treatment train on April 6, 2015, prior to the reduction in the SRGAC regeneration cycle timing, and on April 9, 2015, following the reduction in SRGAC regeneration cycle timing (discussed in Section 2.1.2). Analytical results for the process vapor samples collected on April 6, 2015 reported concentrations of all compounds except TCA below their respective DAR-1 SGCs. TCA was detected at concentrations above the DAR-1 SGC of 9,000 micrograms per cubic meter ($\mu g/m^3$) in each of the three process vapor samples collected, confirming the elevated PID readings recorded on April 6, 2015 were indicative of elevated VOC concentrations.

On April 9, 2015 Golder collected process vapor samples to confirm the effectiveness of the response actions taken by TRS on April 6, 2015 to mitigate VOC concentrations in process vapor emissions. All VOCs, including TCA, were reported at concentrations below their respective DAR-1 SGCs in the process vapor effluent sample collected on the April 9, 2015. These analytical results confirmed that the reduction in the time between SRGAC regeneration cycles and the replacement of the carbon bed within the vapor carbon polish vessel adequately mitigated process vapor emissions.

Golder collected process vapor samples on April 14, 2015 to evaluate VOC concentrations associated with the elevated PID readings recorded on that day. Analytical results for the process vapor sample collected on April 14, 2015 reported concentrations of TCA above the 9,000 µg/m^3 DAR-1 SGC in each of the three process vapor samples collected. In response to this result, SRGAC regeneration cycle timing was reduced and the VGAC vessels replaced on April 16, 2015 to mitigate vapor emissions as previously described in Section 2.1.2.

Daily PID readings collected subsequent to adjusting the SRGAC cycle timing indicated that the modification was effective in reducing effluent VOC levels. Analytical results from process vapor samples collected on April 28, 2015 reported concentrations of COCs below the applicable DAR-1 SGCs. TRS and the project team will continue to use daily PID readings to monitor SRGAC and vapor polish carbon CRE and make adjustments as necessary to optimize vapor treatment system performance.

As discussed in Section 3.1, no VOCs have been detected above their respective NYSDEC DAR-1 SGCs in any air quality samples collected from the perimeter air monitoring locations since air monitoring began in December 2014, demonstrating that process vapor treatment is effective in removing contaminants from vapor emissions.

2.2 Process Water Treatment System

Process water (i.e., condensate water and hydraulic control groundwater) treatment system operations began on March 19, 2015 when energization of the electrodes installed in the upper interval of the treatment area began producing condensate. Hydraulic control system operations, which began on April 30, 2015, did not contribute to the process water waste stream during this reporting period.

OBG collected a total of eight process water effluent samples for analysis of VOCs to evaluate effluent for discharge to the on-site Groundwater Treatment Facility (GWTF) during this reporting period. Process water is first treated using a shallow tray air stripper and then is directed through a liquid-phase granular activated carbon (LGAC) unit prior to effluent discharge to the interim storage tank.

Concentrations of the primary COCs, metals, oil and grease, and general chemistry parameters in process water effluent samples, summarized on Table 2, have been reported as non-detect at laboratory reporting limits or at concentrations below State Pollutant Discharge Elimination System (SPDES) permit NY0108138 requirements for the effluent from the downstream GWTF. Concentrations of the primary COCs in process water effluent demonstrate that the process water treatment system is effective in removing dissolved-phase VOCs from process water, achieving approximately 99% CRE before discharge to the onsite GWTF.

Initial groundwater effluent discharge pH measurements have indicated discharge water is basic, with a pH of approximately 11. The project team identified the pH issue as attributable to the new carbon bed in the SRGAC units. As a corrective action, the project team flushed the SRGAC treatment system with potable water to neutralize the carbon beds. Recent pH readings indicate the pH has reduced from a high of 11.75 to 9.20 and continues to trend toward more neutral levels.

2.2.1 Hydraulic Control

Prior to remedy implementation, Golder collected groundwater samples from the hydraulic control, sentinel, and downgradient monitoring wells to establish baseline groundwater quality conditions downgradient of the treatment area. Analytical results for the primary COCs in baseline groundwater samples are summarized in Table 3.

Analytical results for groundwater samples collected in January and February 2015 indicate that a volume of groundwater containing dissolved-phase concentrations of the primary COCs at relatively higher levels than observed in SWMU S groundwater during past semi-annual groundwater monitoring events was present at those times. These observations are attributed to the mobilization of SWMU S COCs during drilling activities performed to install subsurface components of the ERH treatment system (i.e., electrodes, temperature monitoring points, etc.). Groundwater that comprises the site-wide VOC groundwater plume, including groundwater from the SWMU S area, is intercepted by the perimeter control system for treatment by the existing GWTF.

Hydraulic control system initiation threshold conditions include either observing a subsurface temperature of 55°C (i.e., 10°C below the hydrolysis temperature for TCA of approximately 65°C) in the Transition Zone and/or the Varved Clay Unit or recording a temperature differential between sentinel and hydraulic control wells of greater than 3°C (i.e., a temperature differential greater than observed background conditions). Although the hydraulic control system initiation threshold condition of an average temperature of 55°C has been observed at multiple locations (i.e., temperature monitoring points F04, F11, G06, and G09) within the treatment area and a temperature differential between sentinel and hydraulic control wells of 3°C has been recorded in the thermocouples located at 20 feet bgs at multiple monitoring locations (i.e., HCW-1/SW-1, HCW-2/SW-2, and HCW-4/SW-4), groundwater temperatures at these monitoring locations remain within range of normal ambient groundwater temperatures of approximately 14°C.

Analytical results for primary COCs in groundwater samples collected from hydraulic control and sentinel monitoring wells since steady-state ERH system operations began on March 26, 2015 are summarized in Table 3. Hydraulic control and sentinel well groundwater sample results demonstrate that concentrations of the primary COCs in the dissolved-phase are not significantly different from those concentrations reported for samples collected prior to remedy implementation.

Based upon these monitoring results, hydraulic controls were not implemented during this reporting period. Golder will continue to collect groundwater samples from hydraulic control and sentinel wells to monitor concentrations of VOCs in the dissolved-phase downgradient of the treatment area and evaluate the need for hydraulic controls.

3.0 PERFORMANCE MONITORING

In accordance with the Community Air Monitoring Plan (CAMP) and the Performance Monitoring and Waste Management Plan (PMWM Plan), prepared as Appendices D and E of the ICM Work Plan for SWMU S, Golder installed four air monitoring stations at select locations along a perimeter located approximately 500 feet from the treatment area security fence in December 2014 and performed system performance monitoring once treatment system steady-state operations were achieved.

3.1 Perimeter Air Monitoring

Each of the four perimeter air monitoring stations are equipped with a ppbRAE 3,000 PID capable of detecting total VOCs in air at concentrations between 1 part per billion volume (ppbv) and 10,000 ppbv with a precision of 1 ppbv. Three of the four VOC air monitoring stations are located downwind of the treatment area and one air monitoring station is located in an upwind position (Figure 4). One of the air monitoring stations is also equipped with a Davis VantagePro 2 weather station, capable of monitoring temperature, relative humidity, atmospheric pressure, wind direction, and wind speed. The three downwind air monitoring stations are placed such that one station is located in general alignment with the prevailing wind direction and the remaining two downwind monitoring stations are located in positions between 45° and 90° from the prevailing wind direction (Figure 4).

Perimeter air quality was monitored between December 2014 and March 2015 to establish background air quality conditions prior to treatment system operation, to establish background air quality conditions. The background air quality monitoring program included recording continuous total VOC readings at the perimeter air monitoring stations and collecting three rounds of air quality analytical samples.

Multiple low-level “warning” alarm threshold exceedances (i.e., 15-minute rolling average reading of 5 ppmv sustained for 15 consecutive minutes) were reported during the background air monitoring period performed prior to treatment system energization. In accordance with the CAMP, PID readings were manually collected utilizing a handheld PID at perimeter air stations reporting low-level alarm conditions during the work week. All manual PID readings collected at the perimeter air monitoring locations during low-level alarm conditions were recorded at 0.0 ppmv.

Golder collected background air quality samples prior to initial ERH system energization and implementation of vapor control. Air quality samples were collected from each of the four perimeter monitoring locations (Figure 4). Air quality samples were submitted to the laboratory for analysis of VOCs by Environmental Protection Agency (EPA) Method TO-15 via secondary ion mass spectrometry (SIM). Background air quality sample results for the primary COCs are summarized on Table 4. Background air quality sample results demonstrate that low level concentrations of the primary COCs are detected in site-wide ambient air. No compounds were reported in background air quality samples at concentrations above their respective NYSDEC DAR-1 SGCs.

Following energization of the ERH electrodes installed in the lower interval of the treatment area on March 26, 2015, bi-weekly perimeter air quality sampling was implemented. Golder collected perimeter air quality samples on April 2, 2015 and April 14, 2015. Analytical results for primary COCs in perimeter air quality samples, summarized in Table 4, reported all compounds at concentrations below their respective NYSDEC DAR-1 SGCs. A trend plot of the concentrations of primary COCs detected in perimeter air samples is included in Table 4.

Based on a review of data collected during the background monitoring period, including the continuous PID readings and weather station measurements and the perimeter air quality samples, it is apparent that elevated relative humidity is the cause of the persistent low-level alarm exceedances. The majority of the recorded low-level alarm exceedances occurred between 10:00 PM and 10:00 AM, when temperatures dropped and relative humidity levels rose, or in relation to changes in weather patterns. The correlation of total VOCs (in ppmv) with relative humidity as recorded at a perimeter air station during typical low-level alarm exceedance events recorded between March 30, 2015 and April 6, 2015 are illustrated on Figure 5.

Low-level alarm exceedances as a result of relative humidity and rain events are expected to continue. Golder has implemented regular cleanings of the ultraviolet lamps in the perimeter air monitoring station PID units and the frequent replacement of PID unit moisture traps in an effort to mitigate PID unit sensitivity to moisture and reduce the frequency of low-level alarm exceedance events. Even with the elevated PID readings noted due to elevated relative humidity, sustained PID readings elevated above 25 ppmv for fifteen consecutive minutes (a condition that could result in a temporary cessation of system operations) have not been recorded.

No perimeter air alarm exceedances related to treatment system air emissions have occurred during this reporting period, demonstrating that the vapor treatment system is effective in mitigating contaminant concentrations in air emissions.

3.2 Indoor Air Monitoring

Golder began indoor air monitoring in December 2014 to establish background air quality conditions within Buildings B021 and B023 prior to ISTD system operations. Indoor air samples were collected from the eastern end of the northern hallway in B021 and from within an unoccupied office space in the northeastern corner of Building B023 (Figure 4).

Background indoor air quality samples were collected from both B021 and B023 monitoring locations on December 16, 2014, January 6, 2015, and March 10, 2015. Indoor air analytical results were compared to the New York State Department of Health (NYSDOH) Soil Gas/Indoor Air Matrices 1 and 2, as provided in the NYSDOH *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (NYSDOH, 2006). The Matrix 1 and 2 guidance concentrations represent the minimum recommended action levels.

Analytical results for primary COCs detected in indoor air quality samples are summarized in Table 5. Carbon tetrachloride was reported at a concentration above the 0.25 µg/m^3 Matrix 1 guidance concentration in each indoor air sample collected during all three events. However, carbon tetrachloride has been reported in each indoor air sample collected from within site buildings since 2011 and was reported in each perimeter air sample collected since December 2014. Therefore the presence of carbon tetrachloride in air quality samples is attributed to background conditions, not ISTD system operation activities, and will be eliminated from further discussion.

Overall, TCA is the primary compound of concern and was intermittently detected at concentrations above the 3 $\mu g/m^3$ NYSDOH Matrix 2 guidance concentrations in the three background indoor air monitoring samples collected in December 2014, January 2015, and March 2015. TCA was reported above the Matrix 2 guidance concentration in the sample collected from B021 in December 2014 and in the samples collected from B021 and B023 in January 2015.

As a result of the continued detections of TCA at concentrations above the 3 $\mu g/m^3$ Matrix 2 guidance concentration in the samples collected in December 2014 and January 2015, IBM met with NYSDEC and NYSDOH to discuss indoor air quality results and propose corrective measures. IBM and NYSDEC / NYSDOH agreed that turning on the vapor recovery system to establish vapor control in the subsurface within the treatment area was an adequate response action to mitigate indoor air impacts.

The vapor recovery system was activated on February 26, 2015. Subsequent indoor air quality samples collected on March 10, 2015 confirmed that the vapor control system was effective in reducing TCA by over two orders of magnitude to levels below NYSDOH Matrix minimum recommended guidance values. With the exception of two limited system operation interruptions (discussed in Section 2.0), vapor control has been maintained since February 26, 2015.

After energizing the ERH electrodes installed in the lower interval of the treatment area on March 26, 2015, bi-weekly indoor air quality sampling was implemented in accordance with the ICM Work Plan. Golder collected indoor air quality samples on April 2, 2015 and April 14, 2015. Analytical results for primary COCs in indoor air quality samples, summarized in Table 5, reported all compounds at concentrations below their respective NYSDOH Matrix 1 and 2 minimum recommended guidance concentrations in the samples collected on April 2, 2015. A trend plot of the concentrations of primary COCs detected in indoor air samples is included in Table 5.

TCA and DCE were detected in the indoor air quality samples collected on April 14, 2015 at concentrations slightly above the 3 $\mu g/m^3$ Matrix 2 minimum recommended guidance concentration in both Building B021 and B023. The concentrations of these compounds reported in the most recent indoor air sampling event are generally consistent with concentrations of these same compounds reported in indoor air quality samples collected over the past few years as part of the annual vapor intrusion monitoring program.

Based on the analytical results reported for the several rounds of indoor air quality sampling performed since initiation of vapor control and the continued demonstration of inward pressure gradients (Figure 3, Section 2.1.1) from daily manual manometer readings, the vapor control system is effective in reducing the potential of vapors generated in the subsurface from migrating outside the treatment area. Golder will continue indoor air quality monitoring in accordance with the ICM Work Plan.

4.0 REMEDY PROGRESS

Actual consumption of energy in the treatment area in the first five weeks of treatment system operations was approximately 0.75 times the anticipated usage. Based on the amount of total energy estimated as necessary to complete thermal remediation of the DNAPL present in the subsurface in SWMU S, the thermal remedy is approximately 30% complete.

Approximately 150 gallons (or approximately 1,650 pounds) of DNAPL has been recovered from the treatment area and an additional approximately 1,700 pounds of contaminant mass has been destroyed in place due to hydrolysis. Based on system performance to date, including energy applied and contaminant mass removed, the project is progressing on schedule and the ISTD ICM for SWMU S will likely be completed in July 2015.

5.0 CLOSING

ISTD system operation will continue as scheduled. Based on remedy progress and energy consumption to date, TRS anticipates reaching the approximate 50% to 60% completion point (based on total predicated energy necessary to complete thermal remediation) in mid-May 2015. Interim remedy performance monitoring sampling is currently scheduled for the week of May 18, 2015.

If you have any questions or require additional information, please contact the undersigned at (973) 645-1922.

Sincerely,

GOLDER ASSOCIATES INC.

Daniel P. Gorman
Senior Project Geologist

Christopher D. Hemingway, P.G.
Senior Consultant

Attachments
Tables: Table 1: Process Vapor Monitoring Results
Table 2: Groundwater Effluent Analytical Results – Primary COCs
Table 3: Groundwater Analytical Results – Primary COCs
Table 4: Perimeter Air Analytical Results – Primary COCs
Table 5: Indoor Air Analytical Results – Primary COCs
Figures: Figure 1: SWMU S ISTD Treatment System Layout
Figure 2: Treatment Area Subsurface Temperature Profile
Figure 3: Subsurface Vapor Pressure Trends
Figure 4: SWMU S ICM-Specific Community Air Monitoring Program Layout
Figure 5: Correlation of PID Readings with Relative Humidity

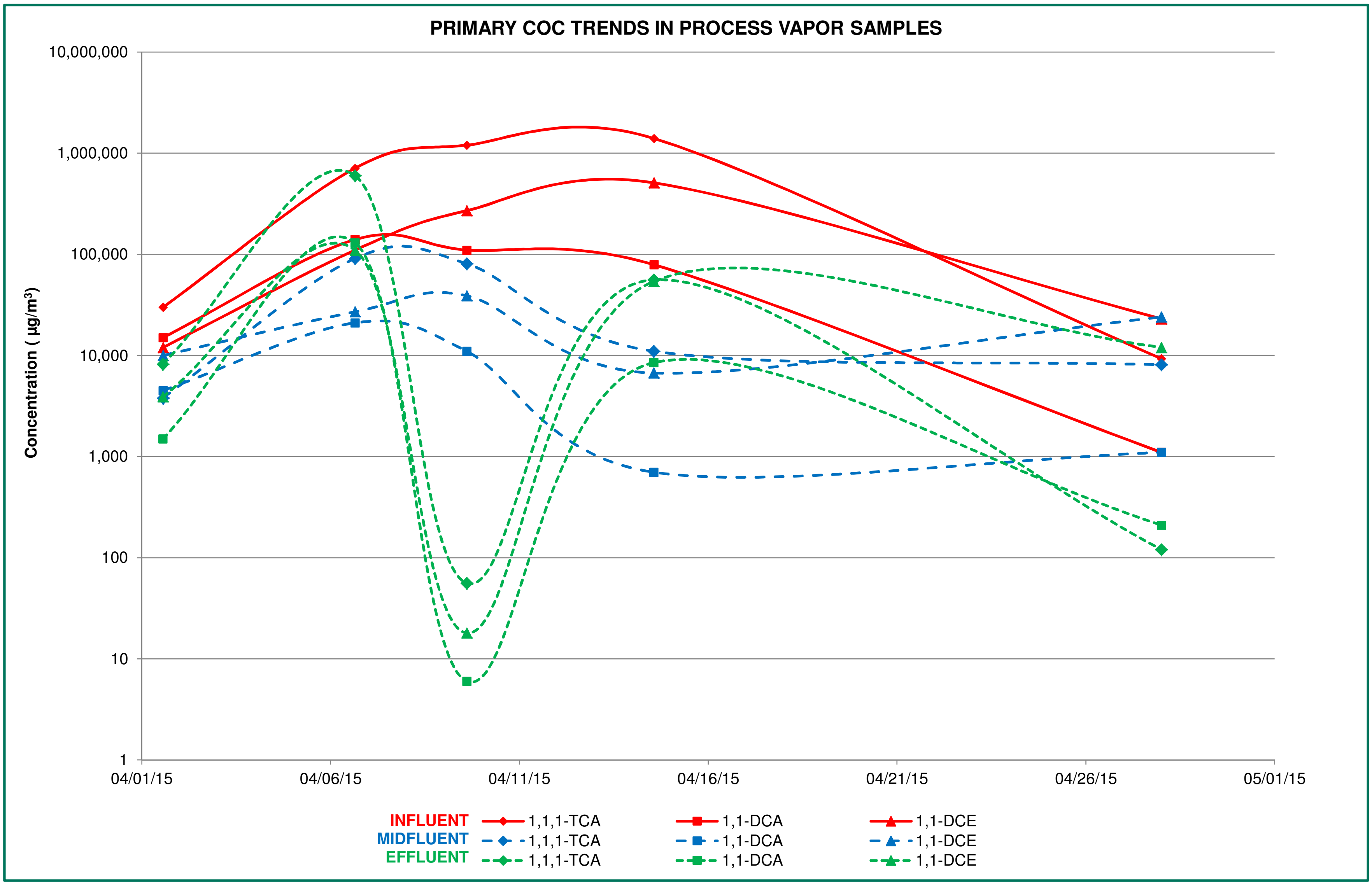
cc: Wayne Mizerak, NYSDEC
Kristin Kulow, NYSDOH
James Cavotta, O’Brien and Gere
Robert Poulin, TRS Group

TABLES

TABLE 1: PROCESS VAPOR MONITORING RESULTS

SAMPLE LOCATION			Influent					Midfluent					Effluent				
SAMPLE DATE			04/01/15	04/06/15	04/09/15	04/14/15	4/28/2015	4/1/2015	4/6/2015	4/9/2015	4/14/2015	4/28/2015	4/1/2015	4/6/2015	4/9/2015	4/14/2015	4/28/2015
PARAMTER	SGC	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	9,000	µg/m^3	30,000	710,000	1,200,000	1,400,000	9,300	3,800	91,000	81,000	11,000	8,100	8,200	600,000	56	56,000	120
1,1-Dichloroethane	NS	µg/m^3	15,000	140,000	110,000	79,000	1,100	4,500	21,000	11,000	700	1,100	1,500	130,000	6	8,500	210
1,1-Dichloroethene	NS	µg/m^3	12,000	110,000	270,000	510,000	23,000	10,000	27,000	39,000	6,700	24,000	3,900	110,000	18	54,000	12,000

Notes:
1) Analytical results are unvalidated laboratory data
2) SGC = NYSDEC Division of Air Resources (DAR)-1 Guidance Compound Emission Threshold Values Short Term Guideline Concentration (SGC)
3) µg/m^3 = micrograms per cubic meter
4) NS = No Standard
5) Gray shading indicates compound detected at a concentration above the applicable standard



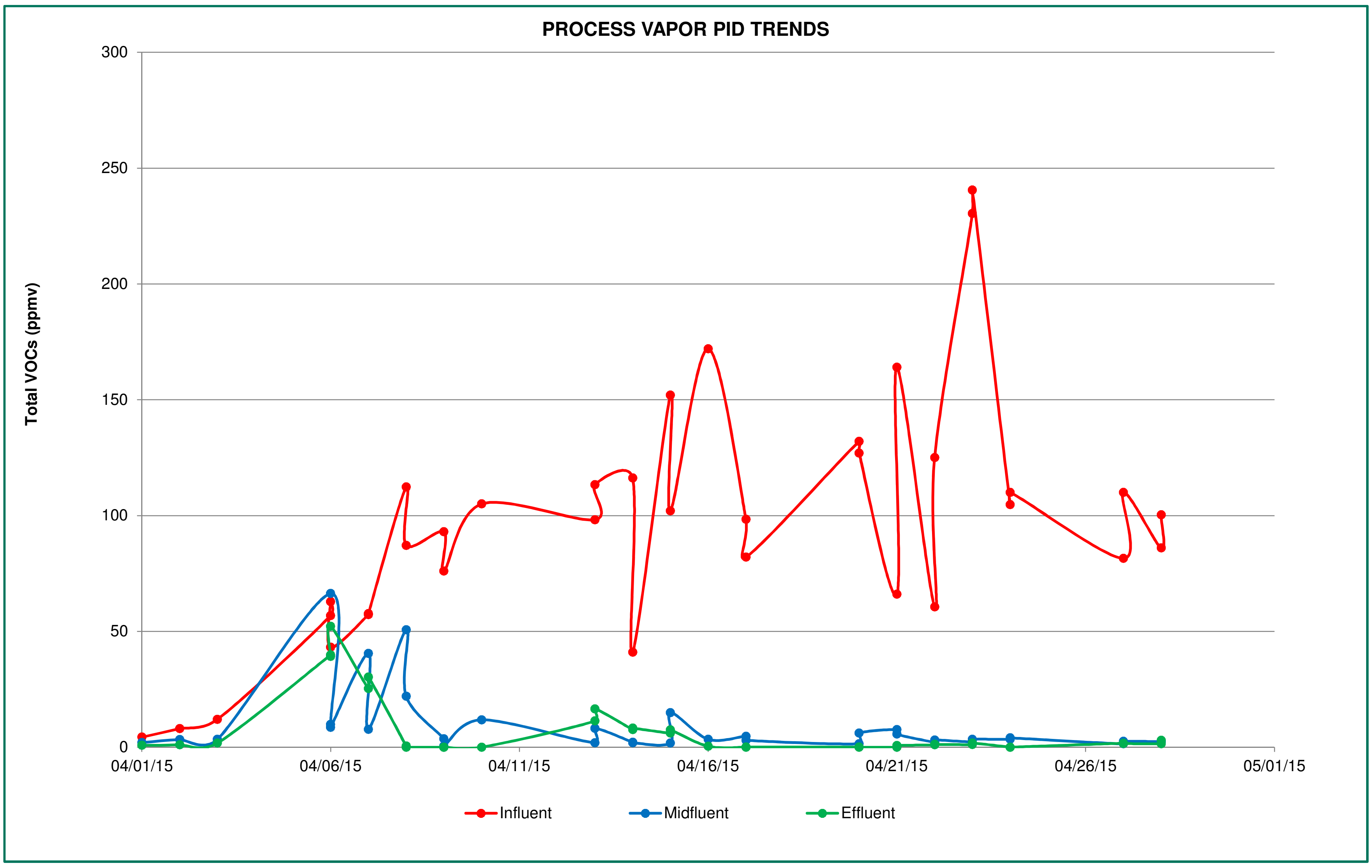


TABLE 2: GROUNDWATER EFFLUENT ANALYTICAL RESULTS - PRIMARY COCs

		SAMPLE LOCATION	EFFLUENT	EFFLUENT	EFFLUENT	EFFLUENT	EFFLUENT	EFFLUENT	EFFLUENT	EFFLUENT
		SAMPLE DATE	3/11/2015	3/30/2015	3/31/2015	4/1/2015	4/2/2015	4/3/2015	4/9/2015	4/15/2015
Parameter	**Unit**	**Std**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Volatile Organic Compounds										
1,1,1-Trichloroethane	µg/L	10	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	µg/L	10	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	µg/L	10	ND	ND	ND	ND	ND	ND	ND	ND
Metals										
Lead	µg/L	NS	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	mg/L	NS	ND	ND	ND	ND	ND	ND	ND	ND
Oil & Grease										
HEM (oil & grease)	mg/L	NS	1.4 J	ND	ND	1.5 J	ND	ND	ND	ND
General Chemistry										
Total Dissolved Solids	mg/L	NS	582	146	124	100	87.5	92.0	73.5	120
Total Suspended Solids	mg/L	NS	ND	ND	ND	ND	ND	ND	ND	ND
Settleable Solids	mg/L	NS	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

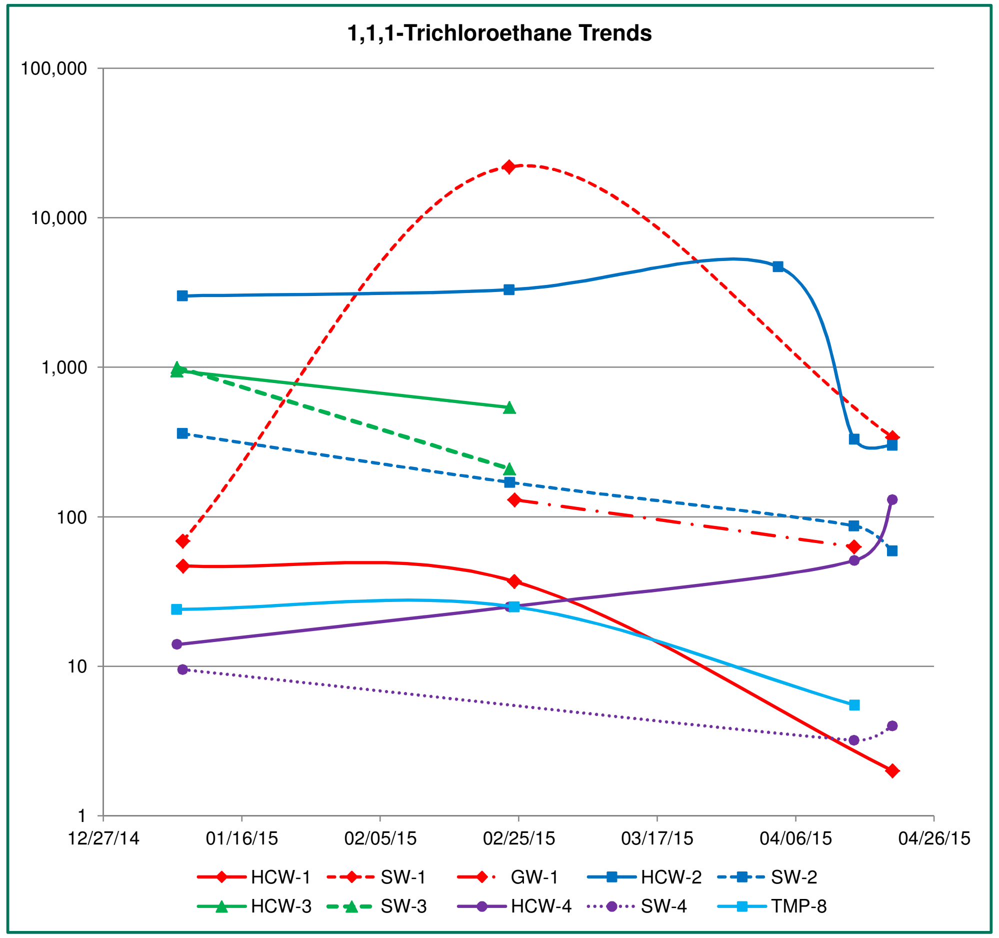
1) Groundwater effluent samples are collected following treatment by the liquid granular activated carbon vessel and prior to discharge to the temporary storage tank
2) Std = Groundwater effluent results are compared to the daily effluent discharge concentrations established by State Pollution Discharge Elimination System (SPDES) Permit NY0108138 for the Groundwater Treatment Facility at Outfall 01A
3) µg/L = micrograms per liter
4) mg/L = milligrams per liter
5) ND = Not detected above the method detection limit
6) NS = No Standard
7) J = the value was estimated between the MDL and LOQ
8) Groundwater effluent samples collected by and analytical results provided by O'Brien & Gere

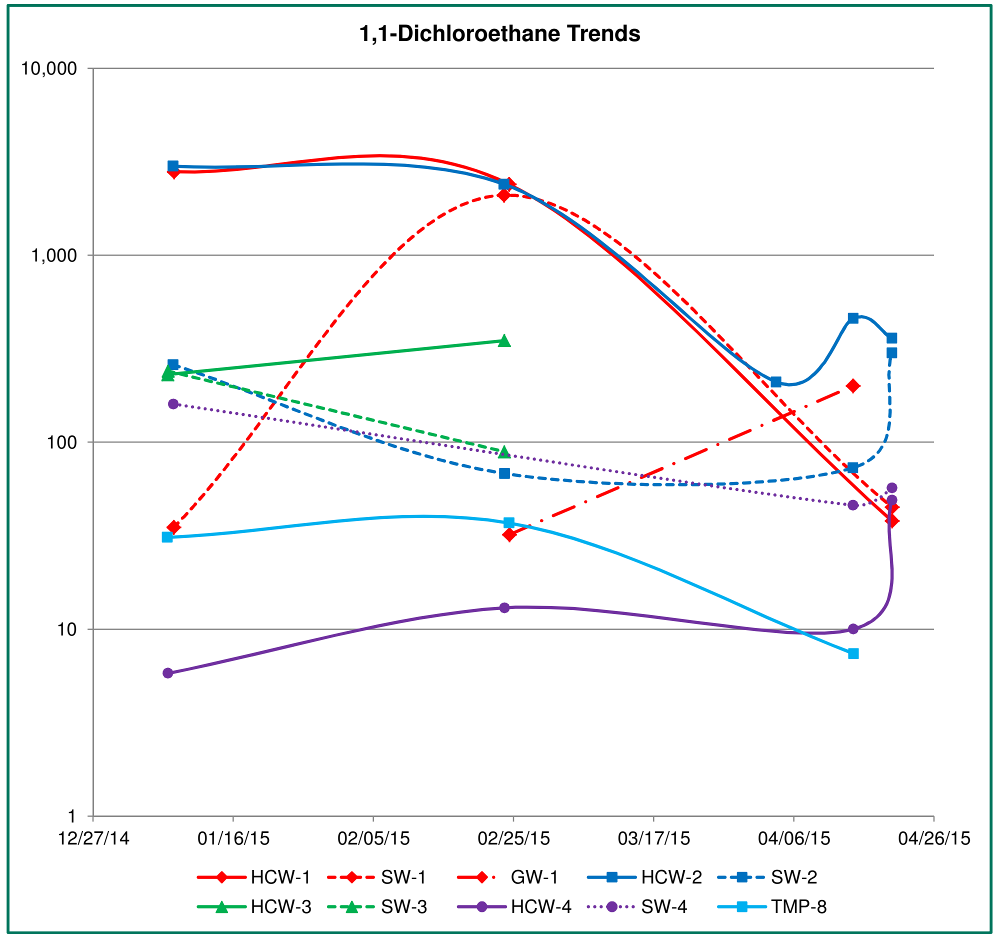
TABLE 3: GROUNDWATER ANALYTICAL RESULTS - PRIMARY COCs

SAMPLE LOCATION			HCW-1			HCW-2					HCW-3		HCW-4				GW-1		SW-1			SW-2				SW-3	
SAMPLE DATE			01/07/15	02/24/15	04/20/15	01/07/15	02/23/15	04/03/15	04/14/15	04/20/15	01/06/15	02/23/15	01/06/15	02/23/15	04/14/15	04/20/15	02/24/15	04/14/15	01/07/15	02/23/15	04/20/15	01/07/15	02/23/15	04/14/15	04/20/15	01/06/15	02/23/15
PARAMETER	Std	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	5	µg/L	47	37	2	3,000	3,300	4,700	330	300	950	540	14	25	51	130	130	63	69	22,000	340	360	170	87	59	1,000	210
1,1-Dichloroethane	5	µg/L	2,800	2,400	38	3,000	2,400	210	460	360	230	350	5.8	13	10	49	32	200	35	2,100	45	260	68	73	300	240	89
1,1-Dichloroethene	5	µg/L	460	490	190	810	710	240	4,600	2,700	68	110	1.7	3.9	45	240	17	36	16	1,300	54	64	30	21	510	83	33

SAMPLE LOCATION			SW-4			TMP-8		
SAMPLE DATE			01/07/15	04/14/15	04/20/15	01/06/15	02/24/15	04/14/15
PARAMETER	Std	Unit	Result	Result	Result	Result	Result	Result
1,1,1-Trichloroethane	5	µg/L	9.5	3.2	4	24	25	5.5
1,1-Dichloroethane	5	µg/L	160	46	57	31	37	7.4
1,1-Dichloroethene	5	µg/L	73	21	49	27	32	4.7

Notes:
1) Analytical results are unvalidated laboratory data
2) Std = 6 NYCRR 703.6 Groundwater Effluent Limitations for Discharges to Class GA Water, and as supplemented by NYSDEC TOGS 1.1.1 (6/1998)
3) µg/L = micrograms per liter
4) Gray shading indicates compound detected at a concentration above the applicable standard





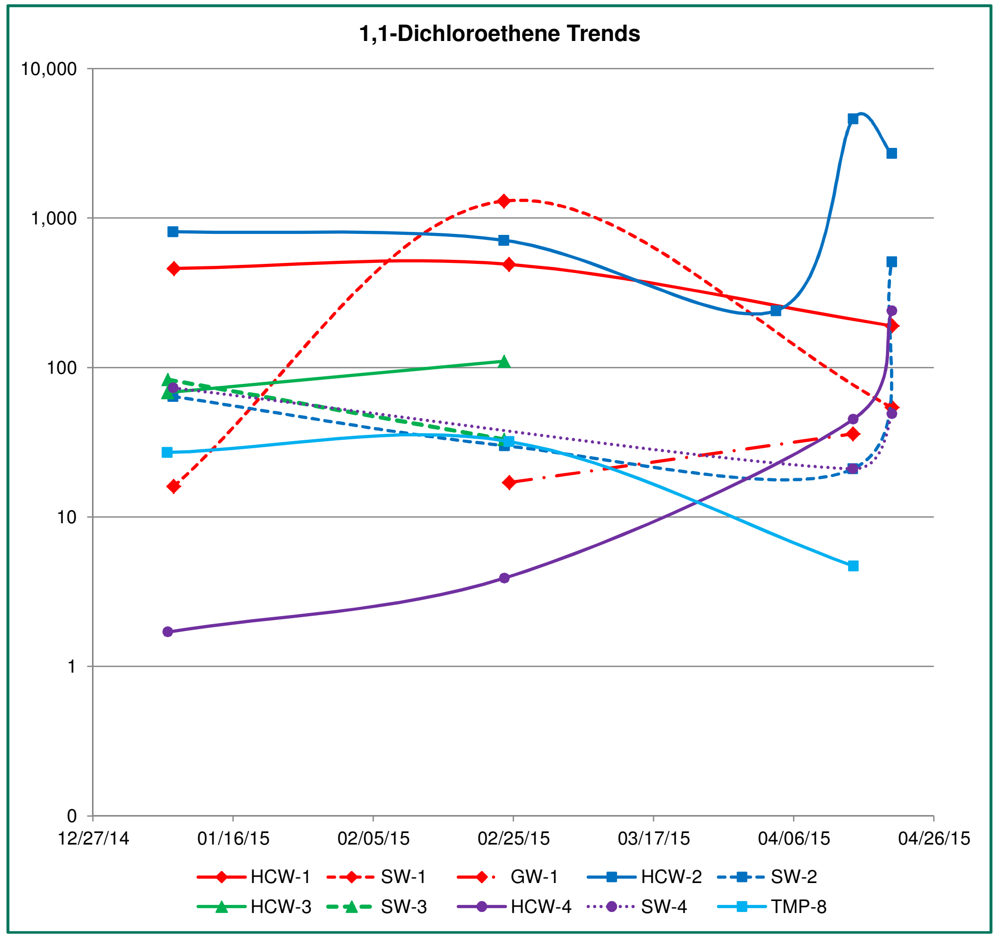


TABLE 4: PERIMETER AIR ANALYTICAL RESULTS - PRIMARY COCs

SAMPLE LOCATION			PAM-01												PAM-02											
SAMPLE DATE			12/16/14		01/06/15		03/10/15		04/02/15		04/14/15		04/28/15		12/16/14		01/06/15		03/10/15		04/02/15		4/14/2015		04/28/15	
PARAMETER	**SGC**	**Unit**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**
1,1,1-Trichloroethane	9,000	$\mu g/m^3$	0.514		0.109	UJ	0.109	U	0.109	U	2.27		0.109	U	0.109	U	0.109	U	0.109	U	0.109	U	1.16		0.109	
1,1-Dichloroethane	NS	$\mu g/m^3$	0.0809	U	0.0809	UJ	0.0809	U	0.0809	U	0.337		0.0809	U	0.0809	U	0.0809	U	0.0809	U	0.0809	U	0.183	J	0.0809	U
1,1-Dichloroethene	NS	$\mu g/m^3$	0.0793	U	0.0793	UJ	0.0793	U	0.0793	U	1.97		0.0809	U	0.0793	U	0.0793	U	0.0793	U	0.0793	U	1.08		0.0793	U

SAMPLE LOCATION			PAM-03												UAM-01											
SAMPLE DATE			12/16/14		01/06/15		03/10/15		04/02/15		04/14/15		4/28/2015		12/16/14		01/06/15		03/10/15		04/02/15		04/14/15		04/28/15	
PARAMETER	**SGC**	**Unit**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**
1,1,1-Trichloroethane	9,000	$\mu g/m^3$	0.109	U	0.109	U	0.109	U	0.109	U	0.109	U	0.109	U	0.109	U	0.109	U	0.109	U	0.109	U	0.109	U	0.109	U
1,1-Dichloroethane	NS	$\mu g/m^3$	0.0809	U	0.0809	U	0.0809	U	0.0809	U	0.0809	U	0.0809	U	0.0809	U	0.0809	U	0.0809	U	0.0809	U	0.0809	U	0.0809	U
1,1-Dichloroethene	NS	$\mu g/m^3$	0.0793	U	0.0793	U	0.0793	U	0.0793	U	0.0793	U	0.0809	U	0.0793	U	0.0793	U	0.0793	U	0.0793	U	0.0793	U	0.0809	U

Notes:

1) Analytical results are unvalidated laboratory data
2) SGC = NYSDEC Division of Air Resources (DAR)-1 Guidance Compound Emission Threshold Values Short Term Guideline Concentration (SGC)
3) $\mu g/m^3$ = micrograms per cubic meter
4) NS = No Standard
5) Q = Laboratory qualifier, data not validated
6) U = The analyte was not detected above the reporting limit (RL)
7) J = The analyte was detected between the RL and the method detection limit (MDL), or qualified for QC reasons, and is considered an estimated value

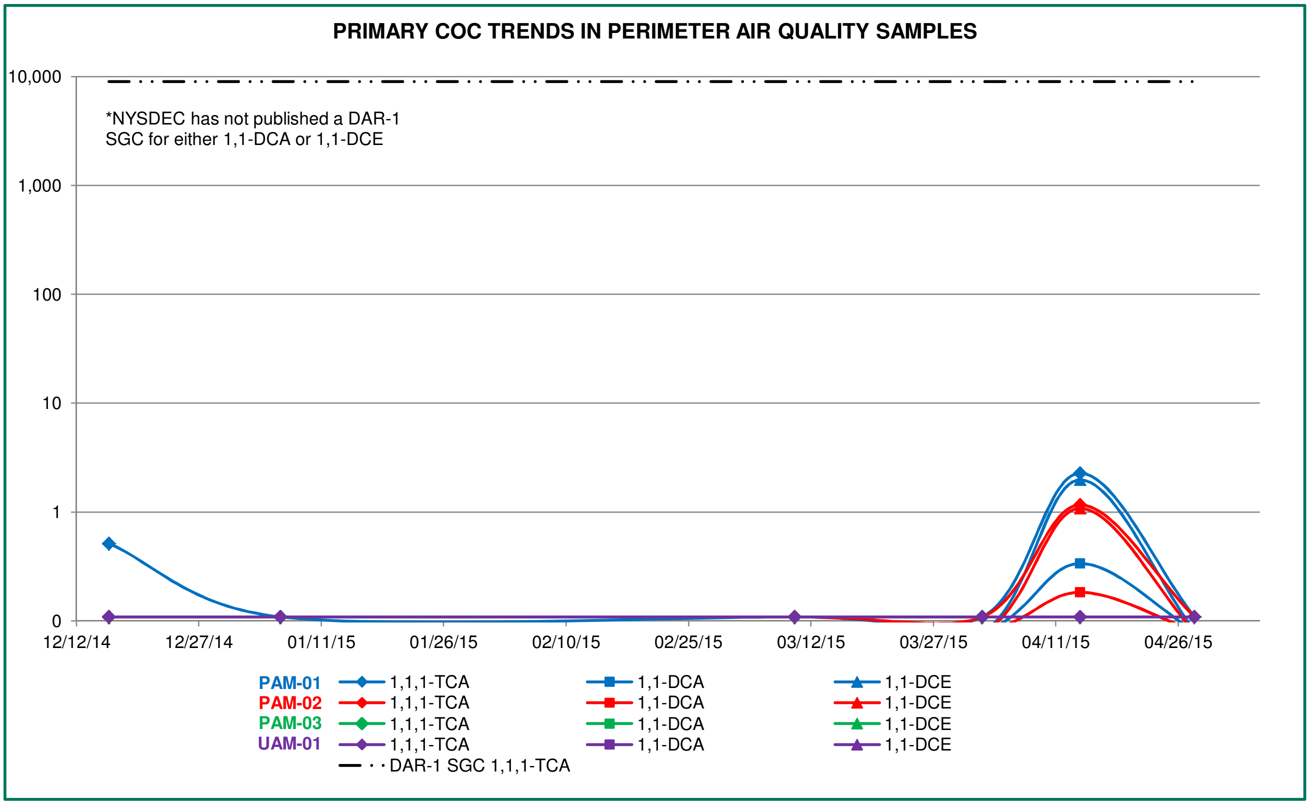
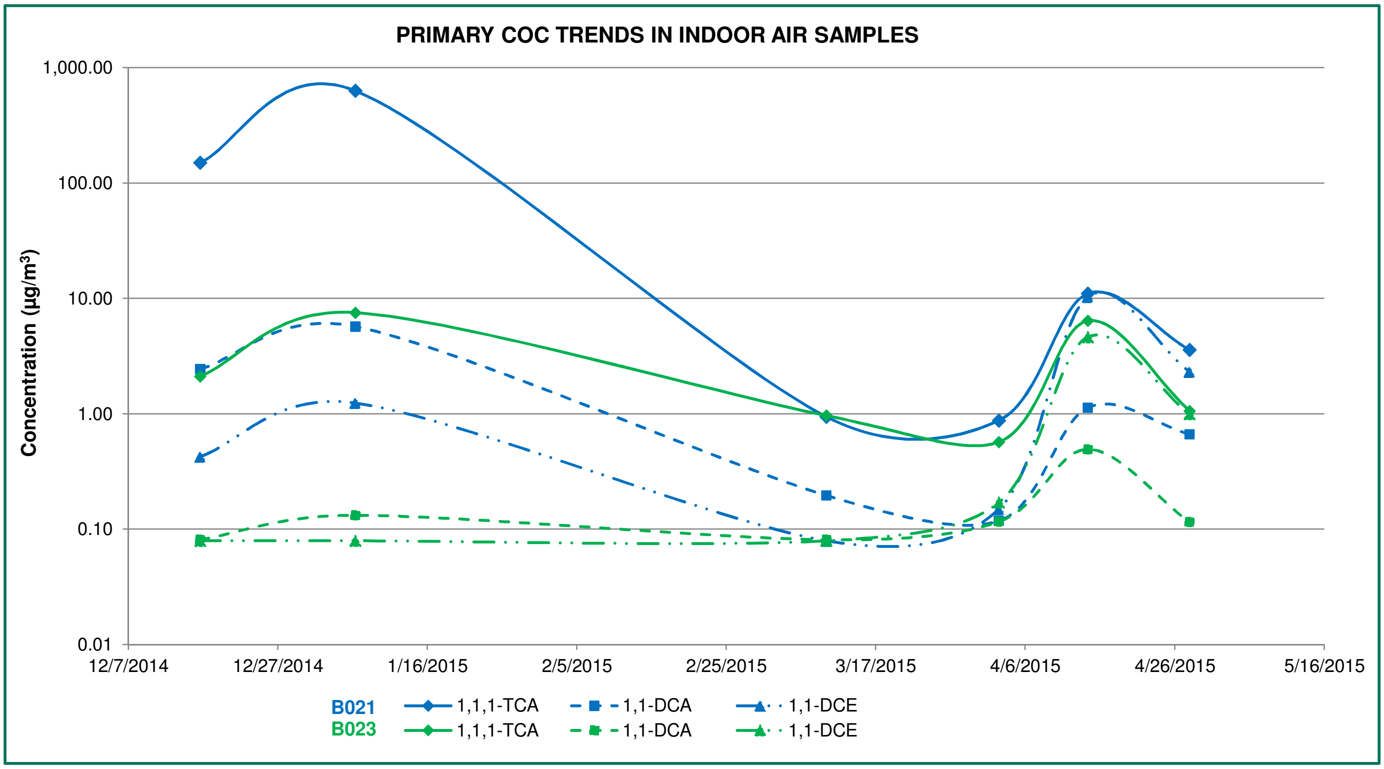

PRIMARY COC TRENDS IN PERIMETER AIR QUALITY SAMPLES

TABLE 5: INDOOR AIR ANALYTICAL RESULTS - PRIMARY COCs

SAMPLE LOCATION			B-021												B-023											
SAMPLE DATE			12/16/2014		1/6/2015		3/10/2015		4/2/2015		4/14/2015		4/28/2015		12/16/2014		1/6/2015		3/10/2015		4/2/2015		4/20/2015		4/28/2015	
PARAMETER	Std	Unit	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
1,1,1-Trichloroethane	3	µg/m^3	150		630		0.942		0.875		11		3.57		2.11		7.53		0.964		0.569		6.40		1.06	
1,1-Dichloroethane	NS	µg/m^3	2.44		5.71		0.196	J	0.118	J	1.13		0.665		0.0809	U	0.132	J	0.0809	U	0.116	J	0.492		0.115	J
1,1-Dichloroethene	3	µg/m^3	0.425		1.24		0.0793	U	0.149	J	10.3		2.31		0.0793	U	0.0793	U	0.0793	U	0.17	J	4.63		0.991	

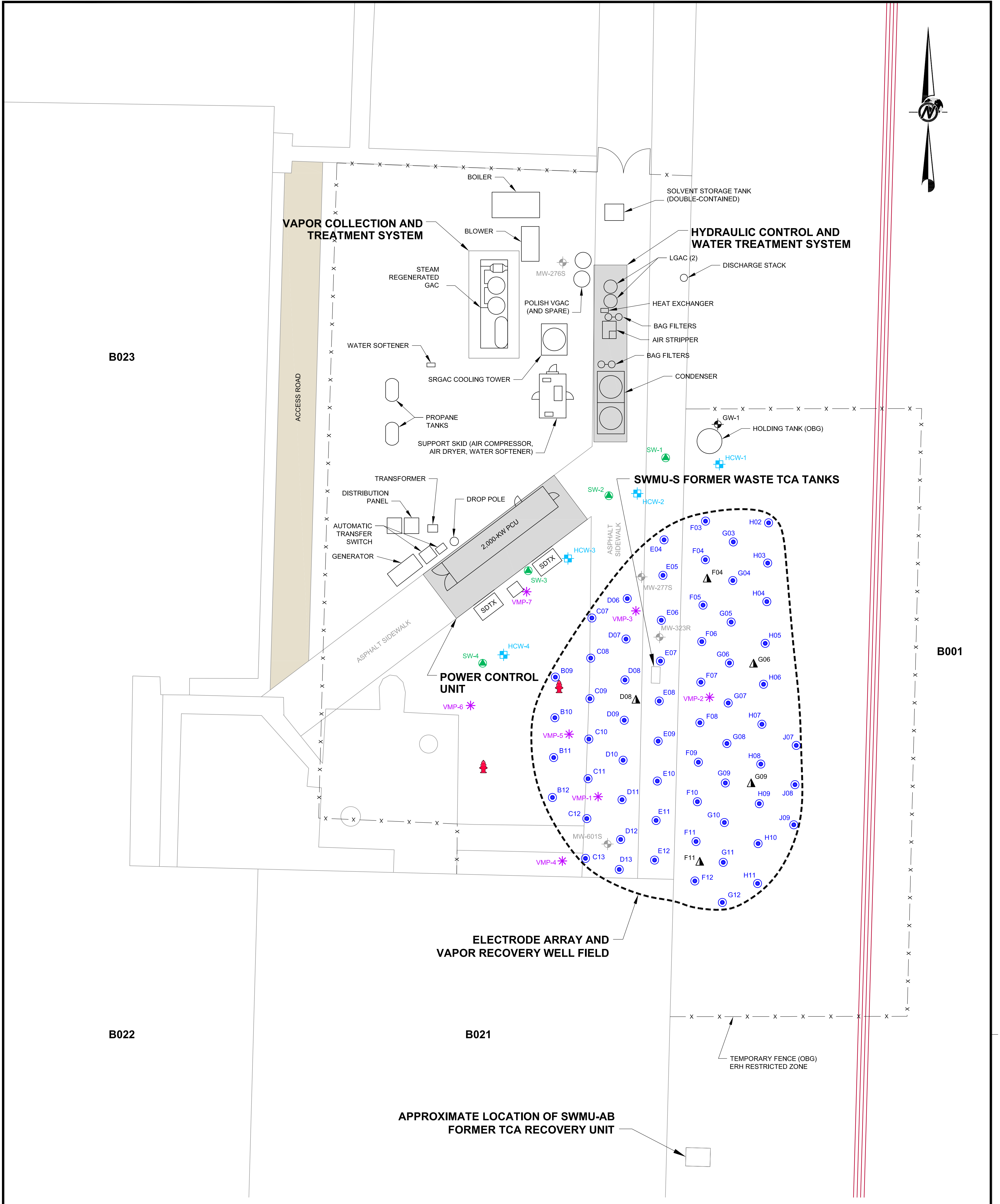
Notes:

1) Analytical results are unvalidated laboratory data
2) Std = Matrix 1 / Matrix 2 New York State Department of Health Soil Vapor/Indoor Air Matrix Minimum Recommended Action Level; Matrix 1 = 0.25 µg/m^3, Matrix 2 = 3 µg/m^3
3) µg/m3 = micrograms per cubic meter
4) NS = No standard
5) Q = Laboratory qualifier, data not valiated
6) U = The analyte was not detected above the reporting limit
7) J = The analyte was detected between the reporting limit and the method detection limit, or qualified for QC reasons, and is considered an estimated value
8) Gray shading indicates compound detected at a concentration above the applicable standard



FIGURES

Drawing file: 08387071AB01.DWG May 05, 2015 - 9:00am



LEGEND

—	INACTIVE SUBSURFACE INDUSTRIAL WASTE LINES
B005	BUILDING NUMBER
⊕	EXISTING MONITORING WELL
- - - -	SWMU S ISTD TREATMENT AREA
◉	CO-LOCATED ELECTRODE AND VAPOR RECOVERY WELL LOCATION
▲	SENTINEL WELL
⊞	GROUNDWATER RECOVERY WELL
◭	TEMPERATURE MONITORING POINT
♦	FIRE HYDRANT
⊕	NEW MONITORING WELL
✳	VAPOR PRESSURE MONITORING LOCATION

NOTE

1.) ALL LOCATIONS ARE APPROXIMATE AND WILL BE ADJUSTED AS APPROPRIATE BASED ON ACTUAL FIELD CONDITIONS.

REFERENCES

1.) BASE MAP TAKEN FROM DIGITAL CAD FILE SITEMAP.DWG, DRAWING NUMBER 93002-SITEMAP/2 ENTITLED "SITE MAP," DATED MAY 9, 2005, PROVIDED BY GROUNDWATER SCIENCES CORPORATION.

2.) INACTIVE SUBSURFACE INDUSTRIAL WASTE LINES TAKEN FROM DIGITAL FILE 3002-108-I3.DWG, ENTITLED "LOCATION MAP," DATED MARCH 5, 2009, PREPARED BY GROUNDWATER SCIENCES CORPORATION.

3.) ASPHALT SIDEWALK, TEMPORARY FENCE, SECONDARY CONTAINMENT STRUCTURES, ELECTRODES, TEMPERATURE MONITORING POINTS, SENTINEL WELLS, GROUNDWATER RECOVERY WELLS, FIRE HYDRANTS AND TREATMENT AREA DIGITIZED FROM A HARDCOPY FILE ENTITLED "SITE PLAN WITH ELECTRODE LOCATIONS," SHEET Y-1 REV. 2, DATED DECEMBER 01, 2014, PREPARED BY TRS.

15 0 15 30
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

FORMER IBM FACILITY
KINGSTON, NEW YORK

TITLE

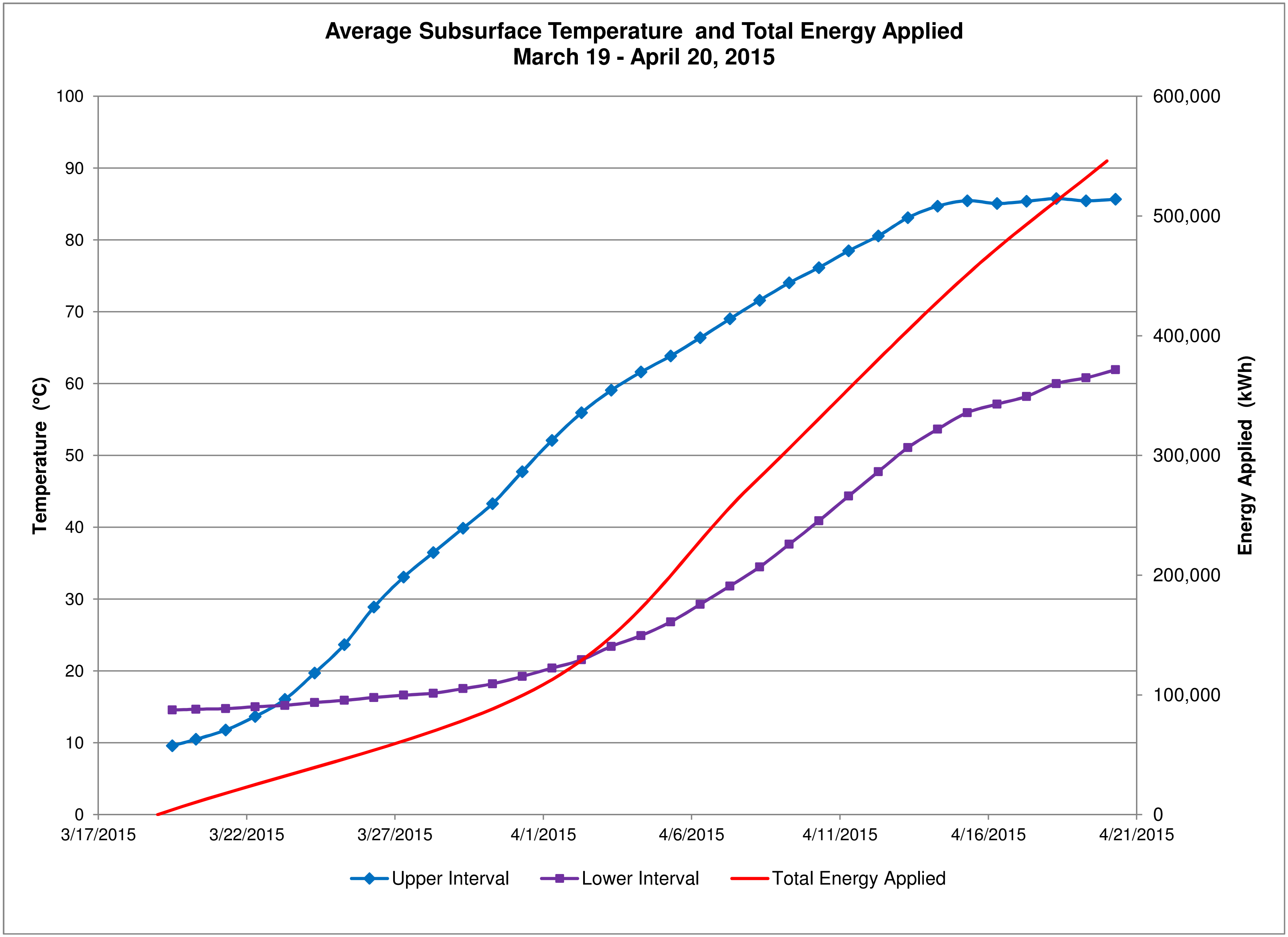
SWMU S ISTD TREATMENT SYSTEM LAYOUT

NJ Authorization #24GA28029100

Golder Associates
Newark, New Jersey

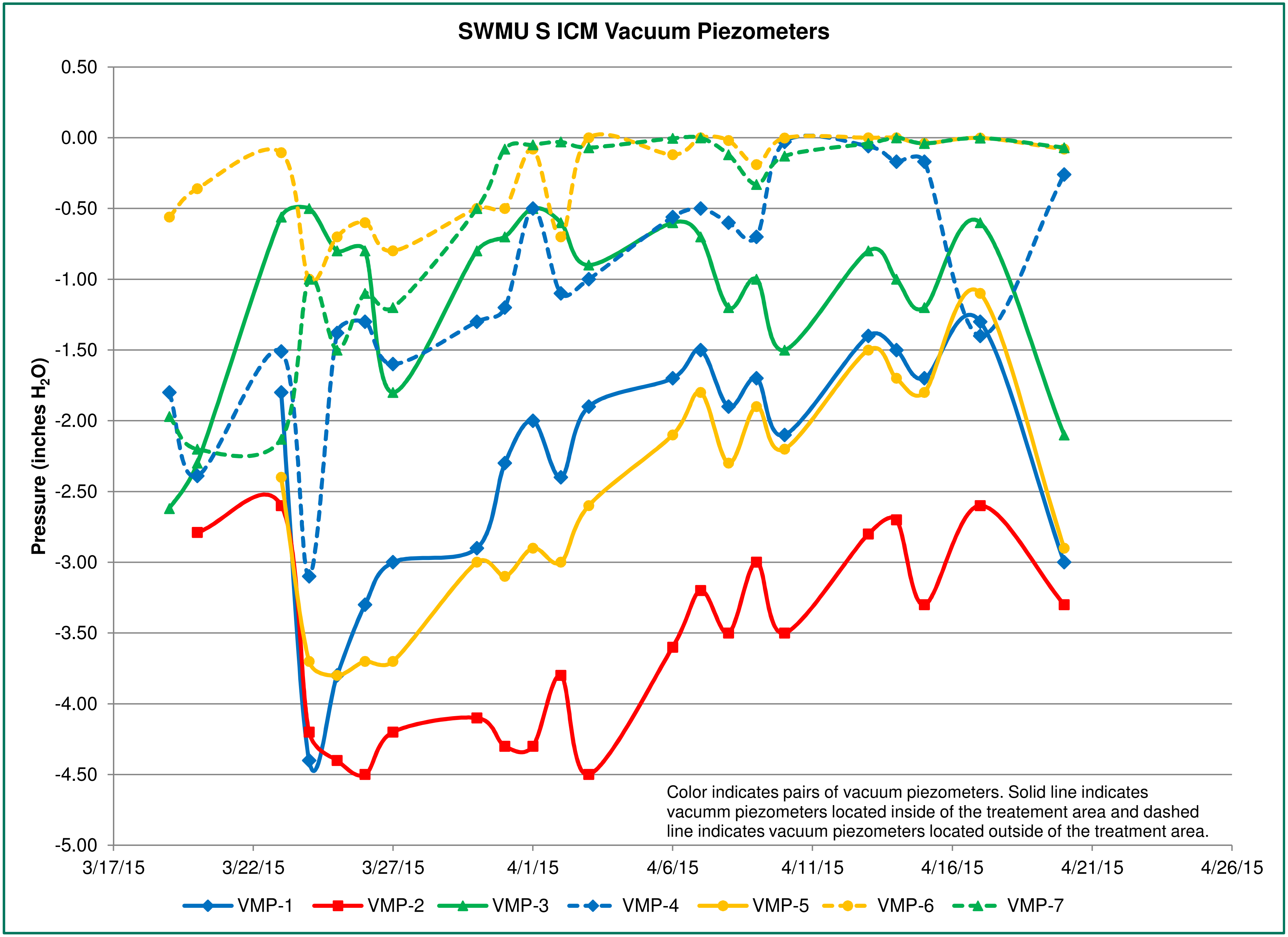
PROJECT No.		083-87071	FILE No.	08387071AB01
DESIGN	DPG	05/05/15	SCALE AS SHOWN	REV. 0
CADD	RG	05/05/15		
CHECK	DPG	05/05/15	**FIGURE 1**	
REVIEW	CDH	05/05/15		

FIGURE 2: TREATMENT AREA SUBSURFACE TEMPERATURE PROFILE



Golder Associates

FIGURE 3: SUBSURFACE VAPOR PRESSURE TRENDS



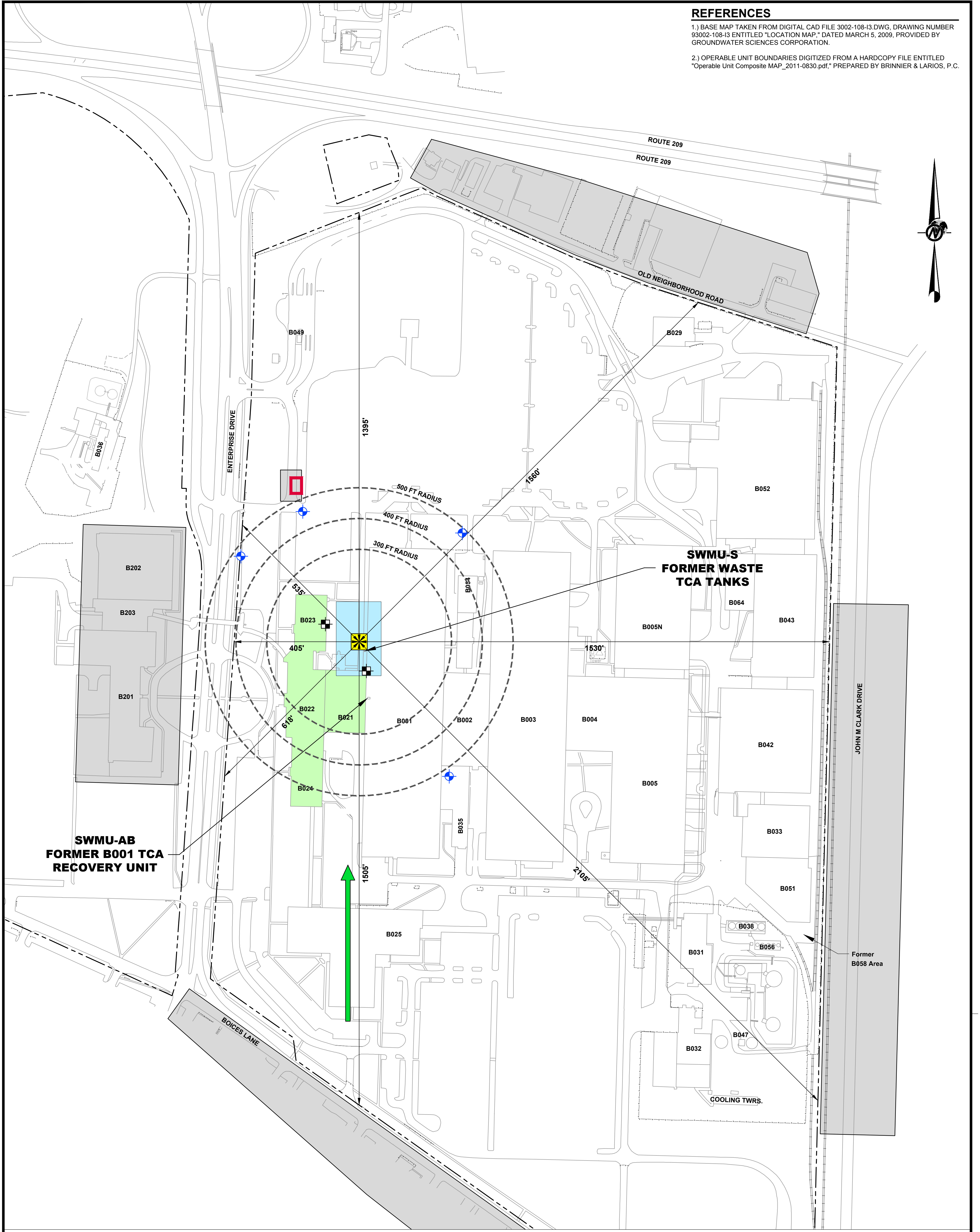
Color indicates pairs of vacuum piezometers. Solid line indicates vacumm piezometers located inside of the treatement area and dashed line indicates vacuum piezometers located outside of the treatment area.

Drawing file: 08387071AB02.dwg May 05, 2015 - 9:00am

REFERENCES

1.) BASE MAP TAKEN FROM DIGITAL CAD FILE 3002-108-I3.DWG, DRAWING NUMBER 93002-108-I3 ENTITLED "LOCATION MAP," DATED MARCH 5, 2009, PROVIDED BY GROUNDWATER SCIENCES CORPORATION.

2.) OPERABLE UNIT BOUNDARIES DIGITIZED FROM A HARDCOPY FILE ENTITLED "Operable Unit Composite MAP_2011-0830.pdf," PREPARED BY BRINNIER & LARIOS, P.C.



200 0 200 400
SCALE FEET

LEGEND

- ―― - ―― PROPERTY/PARCEL BOUNDARY
- B003 BUILDING NUMBER
- 🟦 SWMU S ISTD TREATMENT AREA
- ⬜ POTENTIAL EXPOSURE POINTS
- 🟨 APPROXIMATE LOCATION OF EXHAUST STACK
- 🟥 APPROXIMATE LOCATION OF ULSTER COUNTY TRANSIT BUS STATION
- 🟩 OCCUPIED BUILDINGS
- ➡ PREVAILING WIND DIRECTION
- ▣ INDOOR AIR QUALITY MONITORING STATION
- ⊕ PERIMETER AIR MONITORING LOCATION

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

FORMER IBM FACILITY
KINGSTON, NEW YORK

TITLE

SWMU S ICM-SPECIFIC COMMUNITY AIR MONITORING PROGRAM LAYOUT

NJ Authorization #24GA28029100

Golder Associates
Newark, New Jersey

PROJECT No.		083-87071	FILE No.	08387071AB02
DESIGN	DPG	05/05/15	SCALE AS SHOWN	REV. 0
CADD	RG	05/05/15		
CHECK	DPG	05/05/15		
REVIEW	CDH	05/05/15		

FIGURE 4

FIGURE 5: CORRELATION OF PID READINGS WITH RELATIVE HUMIDITY