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Operable Unit 3 – Operation, Maintenance and Monitoring Report

2009 Annual Summary Report

Operable Unit 3 – Soil Gas Interim Remedial Measure
Former Grumman Settling Ponds
Bethpage, New York

NYSDEC ID # 1-30-003A

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Operable Unit 3 – Operation, Maintenance, and Monitoring Report

2009 Annual Summary Report

Operable Unit 3 Soil Gas Interim Remedial Measure

Former Grumman Settling Ponds
Bethpage, New York
NYSDEC ID# 1-30-003A

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1. Introduction

This Operable Unit 3 (OU3) Soil Gas Interim Remedial Measure (soil gas IRM) Operation, Maintenance, and Monitoring (OM&M) 2009 Annual Summary Report was prepared by ARCADIS of New York, Inc. (ARCADIS) on behalf of Northrop Grumman Systems Corporation (Northrop Grumman). This report is being submitted pursuant to the Order On Consent (Consent Order or CO) Index # W1-0018-04-01 that was executed by the New York State Department of Environmental Conservation (NYSDEC) and Northrop Grumman, effective July 4, 2005 (NYSDEC 2005). The present day Bethpage Community Park property (Park), which the NYSDEC has termed the "Former Grumman Settling Ponds Area" and designated as OU3, is referred to herein as the Site. A Site location map is provided on Figure 1.

This report summarizes the OM&M activities performed from September 30, 2009 to December 31, 2009. An annual summary of the results of OM&M for the soil gas IRM performed during 2009 is also provided. Finally, an evaluation and engineering certification of the soil gas IRM system performance, with respect to the design objectives specified in the Soil Gas Interim Remedial Measure Work Plan (ARCADIS 2007a) and 95% Design Report (ARCADIS 2007b), are also provided herein.

A description of the soil gas IRM system is provided below.

2. Soil Gas Interim Remedial Measure System Description

The OU3 soil gas IRM was constructed in accordance with the Soil Gas IRM 95% Design Report and Design Drawings, which was approved by the NYSDEC on September 19, 2007 (NYSDEC 2007b). A general site plan that shows the major process equipment and the depressurization and monitoring well locations is provided on Figure 2. Monitoring well quarterly vacuum measurements are also provided on Figure 2. A process flow diagram that shows sampling and monitoring locations is provided on Figure 3. A detailed description of the system and a complete set of record drawings are provided in the OM&M Manual (ARCADIS 2009a).

In summary, the soil gas IRM consists of the following major components:

- 18 depressurization wells and 47 associated induced vacuum monitoring wells (Figure 2).
- Two (2) "dry-van" type storage containers, which contain the following equipment:
  - Ø Three (3) 52-gallon moisture separators to remove condensate from the influent vapor stream;
  - Ø Two (2) 20-horsepower(hp) and one (1) 30-hp regenerative type depressurization blowers;
  - Ø A programmable logic controller based control system;
  - Ø An auto dialer;
  - Ø Associated piping, valves, sample ports, gauges, electrical equipment, and other devices necessary to safely control, operate, and monitor the system.
- One (1) heat exchanger; and,
- One (1) 33-foot tall by 16-inch diameter stack and associated ductwork.

3. Response Action Objectives

The specific objectives of the soil gas IRM specified in the NYSDEC-approved Soil Gas Interim Remedial Measure Work Plan (ARCADIS 2007a) are:

- Ø To mitigate the off-site migration of non-Freon 12 and non-Freon 22 Volatile Organic Compounds (VOCs) in the on-site soil gas through the implementation of a soil gas control system installed along the former Plant 24 access road south of the Park.
- Ø To comply with applicable NYSDEC Standards, Criteria and Guidelines (SCGs).

Subsequent to submittal of the Soil Gas Interim Remedial Measure Work Plan (ARCADIS 2007a), site-related VOCs were detected along the southwestern Park

boundary. Accordingly, the following additional soil gas IRM objective was specified in the 95% Design Report (ARCADIS 2007b):

- To mitigate the off-site migration of non-Freon 12 and non-Freon 22 VOCs in the on-site soil gas through the implementation of a soil gas control system installed along the former Plant 24 access road west of the Park.

Based on the response action objectives described above, the following design objectives were specified in the 95% Design Report (ARCADIS 2007b).

- To mitigate the offsite migration of soil gas, the system will be designed to maintain 0.1 inches of water column (iwc) of negative pressure within a negative pressure curtain established along the southern and western access roads, based on a twelve-month rolling average.

- Collected vapors will initially be treated until it is demonstrated that all VOCs in the influent (untreated) vapor stream are less than the NYSDEC Division of Air Resources Guide-1 (DAR-1) Annual Guidance Concentrations (AGCs) on a twelve-month rolling average and Short-Term Guidance Concentrations (SGCs) for any given grab sample (NYSDEC 2007a).

- Collected condensate will initially be transferred to the point of discharge under the existing approval for OU3 wells. The point of discharge, located near the Northrop Grumman, Plant 26, ultimately discharges to the Town of Oyster Bay's Cedar Creek treatment facility. Condensate transfer activities will be completed in accordance with the requirements set forth by the Nassau County Department of Public Works (NCDPW 2007; NCDPW 2008).

A description of the OM&M activities completed during the September to December 2009 operating period is provided below. An annual summary of the OM&M activities performed during 2009 is also provided.

4. Operation and Maintenance Activities

4.1 September to December 2009 OM&M Activities

In general, the soil gas IRM operated continuously between September 2009 and December 2009 with brief system shut down for routine maintenance or troubleshooting activities. Routine monthly OM&M activities conducted this period

included inspection of all piping, appurtenances, and mechanical equipment for leaks, defects, or other problems and maintenance of equipment, in accordance with the equipment manufacturers' specifications and as described in the OM&M Manual (ARCADIS 2009a). Additionally, the following non-routine maintenance activities were also completed this period:

- The influent manifold control valves for Depressurization Wells DW-6S, DW-6D, DW-4S, DW-4D, DW-9S and DW-10S were adjusted on November 30, 2009. The control valve adjustments were completed in an effort to return overall induced vacuum within compliance monitoring wells to design criteria values to the extent feasible. The vacuums and flow rates associated with these depressurization wells had increased due to changes in natural environmental conditions (e.g., soil moisture content, barometric pressure changes, etc.) following the September 24, 2009 adjustment.

- A Main Control Panel (MCP) system update was performed on December 4, 2009. The update was completed to correct an error with the autodialer alarm call out configuration. Periodic brief (totaling approximately 5 hours) system shut down allowed the control upgrades to be completed in the MCP and the Programmable Logic Controler (PLC) code to be re-configured. All system alarms were tested following the update.

4.2 2009 Annual Summary of OM&M Activities

In general, the soil gas IRM operated continuously during 2009 with scheduled system shut down for routine maintenance activities. Routine monthly OM&M activities conducted this period included inspection of all piping, appurtenances, and mechanical equipment for leaks, defects, or other problems and maintenance of equipment, in accordance with the manufacturers' specifications and as described in the OM&M Manual (ARCADIS 2009a). Additionally, the following non-routine maintenance activities were also completed this period:

- The influent manifold control valves were adjusted on February 10, 2009 to compensate for vacuum and flow rate changes caused by the removal of the temporary VPGAC unit and installation of the new flow meters (as referenced in the 2008 Annual Summary Report [ARCADIS 2009b]). The control valve adjustments were completed in an effort to return the overall induced vacuum within compliance monitoring wells to design criteria values to the extent feasible. Additionally, the operation of regenerative Blower BL-300 (20 hp)

was replaced on February 10, 2009 with regenerative Blower BL-200 (30 hp) due to the increased pressure loss caused by the new flow meters (ARCADIS 2009c). The system operated with Blower BL-200 only between February 10, 2009 and May 9, 2009 (see below).

- The system was shut down for approximately 4 hours on February 17, 2009 as a result of a system low temperature alarm. Upon physical inspection of the system, it was noted that the ventilation fan was left in the "hand" mode which caused the low temperature alarm. The ventilator was returned to "auto" mode (i.e., thermostat controlled) and the system was restarted.

- The system was shut down for approximately 1 hour on February 28, 2009 as a result of a system high temperature alarm. Upon inspection of the system, it was noted that the building temperature was 101°F. The ventilation fan was found in the "off" position and the room heater was on. The ventilator was returned to "auto" mode and the system was restarted.

- Approximately 257 gallons of condensate and/or storm water were removed from depressurization pipelines on March 12, 2009. The influent manifold control valves were subsequently adjusted to compensate for vacuum and flow rate changes caused by the removal of the condensate/storm water. The control valves adjustments were completed in an effort to return the overall induced vacuum within compliance monitoring wells to design criteria values to the extent feasible (ARCADIS 2009c).

- The flow meters at Depressurization Wells DW-4S and DW-11S were replaced on May 4, 2009. The flow rate at Depressurization Well DW-4S was then increased to approximately 80 standard cubic feet per minute (scfm). The flow rate was increased in an effort to minimize the amount of condensate accumulation within the below grade portion of the pipeline (ARCADIS 2009d).

- The influent manifold control valves for all depressurization wells were adjusted between May 5, 2009 and May 6, 2009. The control valve adjustments were completed in an effort to lower the induced vacuum at compliance wells located along the western and southwestern portion of the site to a level closer to design goals. In addition, the operation of regenerative Blower BL-200 (30 hp) was replaced with regenerative Blower BL-300 (20 hp) on May 5, 2009 during the rebalancing activities (ARCADIS 2009d).

Accordingly, the system currently operates with Blower BL-300 in operation only.

- Approximately 367 gallons of condensate were transferred to the Nassau County Department of Public Works intake located on the Northrop Grumman property on May 28, 2009.

- Approximately 190 gallons of condensate and/or storm water were removed from the depressurization pipelines on September 24, 2009. The influent manifold control valves were subsequently adjusted to compensate for vacuum and flow rate changes caused by the removal of the condensate/storm water the same day. The control valve adjustments were completed in an effort to return the overall induced vacuum within compliance monitoring wells to obtain values closer to their design criteria (ARCADIS 2009e).

- As described in Section 4.1, the influent manifold control valves for Depressurization Wells DW-6S, DW-6D, DW-4S, DW-4D, DW-9S and DW-10S were adjusted on November 30, 2009 in an effort to return overall induced vacuum values within compliance monitoring wells closer to their design criteria.

- As describe in Section 4.1 of this report, the system was shut down for approximately 5 hours on December 4, 2009 to allow for control upgrades to be completed in the MCP. The PLC code was re-configured and all of the system alarms were tested after the reconfiguration.

Additional details of the maintenance activities described above are provided in the 2009 quarterly monitoring reports prepared by ARCADIS, for the maintenance activities respective completion date. Discussion of the routine monitoring program and results is provided in the subsequent sections of this report.

A summary of the monitoring program that was implemented from September to December 2009 is provided below. An annual summary of the 2009 monitoring program is also provided.

5. Monitoring Activities

Section 5.1 (below) summarizes the routine performance monitoring and routine compliance monitoring activities completed during the September 2009 to December 2009 operating period. An annual summary of the routine performance and compliance monitoring activities performed during 2009 is provided in Section 5.2 (below).

5.1 September 2009 to December 2009 Monitoring Activities

The following sections summarize the routine performance monitoring and routine compliance monitoring activities completed during the September 2009 to December 2009 operation period. The performance monitoring program is conducted to ensure that the system components are operating in accordance with the manufacturers specifications and to ensure that the general system operating parameters remain consistent with design data and/or historical operating data. The compliance monitoring program consists of the collection of effluent vapor and/or water samples to demonstrate compliance with regulatory discharge criteria and the collection of induced vacuum readings from key monitoring points to demonstrate the soil gas IRM is achieving the design vacuum of 0.1 iwc within the subsurface.

A description of the monitoring activities completed during the September to December 2009 reporting period is provided below.

5.1.1 September 2009 to December 2009 Routine Performance Monitoring

The routine performance monitoring event for this report period was completed on December 2, 2009, in accordance with Table C-1 of the SAP (ARCADIS 2008a). A brief discussion of the routine performance monitoring methodology and/or deviations (if applicable for the subject reporting period) from the methodology described in the SAP is provided below.

5.1.1.1 September 2009 to December 2009 System Operating Parameters

System operating parameters that fall under the performance monitoring program include the parameters listed in Attachments C-3.2 and C-3.3 of the SAP (ARCADIS 2008a). There were no significant deviations from the recording of these parameters during the routine monitoring event conducted this period.

5.1.1.2 September 2009 to December 2009 Vapor Samples

A screening level vapor sample was collected and monitored from VSP-601 using a photoionization detector (PID) during the routine monitoring event.

5.1.2 September 2009 to December 2009 Routine Compliance Monitoring

Routine compliance monitoring was completed on December 2, 2009 in accordance with Table C-1 of the SAP (ARCADIS 2008a). A brief discussion of the routine compliance monitoring methodology and/or deviations (if applicable for the subject reporting period) from the methodology described in the SAP is provided below.

5.1.2.1 September 2009 to December 2009 System Operating Parameters

System operating parameters that fall under the compliance monitoring program include the compliance-related induced vacuum measurements listed in Table 2 of the OM&M Manual (ARCADIS 2009a).

5.1.2.2 September 2009 to December 2009 Vapor Samples

One (1) routine, compliance monitoring vapor sample was collected for laboratory analysis from the total effluent sample location (VSP-601) during the December 2, 2009 monitoring event. The sample was collected and submitted for laboratory analysis in accordance with the requirements set forth in the SAP (ARCADIS 2008a). The sample was analyzed by Columbia Analytical Services in Simi Valley, California using United States Environmental Protection Agency (USEPA) Method TO-15 with the site-specific compound list provided in the SAP (ARCADIS 2008a). As requested by the NYSDEC, Freon 12, Freon 22, and Freon 142 were also quantified using USEPA Method TO-15 and the top 20 tentatively identified compounds (TICs) were reported.

5.1.2.3 September 2009 to December 2009 Condensate Samples

No condensate samples were collected during the September to December 2009 operating period.

5.2 2009 Annual Summary Monitoring Activities

During 2009, system monitoring was completed in accordance with the Sampling and Analysis Plan (SAP), which was provided to the NYSDEC as Appendix C of the 95% Design Report and Design Drawings dated September 7, 2007 (ARCADIS 2008a), the OM&M Manual dated January 23, 2009 (ARCADIS 2009a), and subsequent recommendations provided within the 2009 quarterly interim OM&M reports. The SAP (ARCADIS 2008a) was approved by the NYSDEC in a letter dated August 1, 2008 (NYSDEC 2008a). The following adjustments to the system monitoring program provided in the SAP (ARCADIS 2008a) were recommended, approved by the NYSDEC, and/or implemented during 2009, as noted below:

- Beginning with the June 2009 event, Freon 12, Freon 22, and Freon 142 were added to the quantitative laboratory vapor analytical list. Freon 12 and Freon 22 were added per the request of the NYSDEC in a monitoring letter dated August 5, 2008 (NYSDEC 2008b). Freon 142 was added as a quantitative analyte in response to its' presence as a TIC.

- The collection of induced vacuum measurements from the list of compliance related induced vacuum monitoring wells only. Non-compliance related induced vacuum monitoring data shall only be collected when system troubleshooting is required, based on the results of compliance related induced vacuum data. This revision was implemented beginning in September 2008.

- Except as needed for system troubleshooting, the frequency of system monitoring was completed on a quarterly basis. This revision was implemented beginning in March 2009 and was approved by the NYSDEC in a letter dated December 12, 2008 (NYSDEC 2008c).

A detailed description of the monitoring methodology implemented during each monthly monitoring event (or supplemental monitoring event) during 2009 is provided in each of the respective interim OM&M reports.

6. Monitoring Results

The following sections summarize the results of routine performance monitoring and routine compliance monitoring completed during the September to December 2009.

An annual summary of applicable performance and routine compliance monitoring data is also provided. The following tables and appendices are provided herein:

- Ø An annual summary of general system operating parameters, including the results of the December 2009 monitoring event, is provided in Table 1.
- Ø An annual summary of compliance-related induced vacuum measurements, including the results of the December 2009 monitoring event, is provided in Table 2.
- Ø An annual summary of the total effluent vapor (compliance monitoring) laboratory analytical results for detected compounds, including the results of the December 2009 monitoring event, are provided in Table 3.
- Ø An annual summary of the condensate water laboratory analytical is provided in Table 4.
- Ø An annual summary of TICs for vapor samples including the results of the December 2009 monitoring event is provided in Appendix A; and,
- Ø An annual summary of TICs for condensate samples including the results of the December 2009 monitoring event is provided in Appendix B.

A summary of system performance and compliance monitoring results is provided below.

6.1 System Performance Monitoring

Section 6.1.1 (below) summarizes and briefly discusses the results for routine performance monitoring and routine compliance monitoring during the September to December 2009 operating period. A summary of key monitoring results for 2009 is provided in Section 6.1.2 of this report.

6.1.1 September 2009 to December 2009 System Performance Monitoring

The following section summarizes the results of the routine system performance monitoring event completed on December 2, 2009.

6.1.1.1 September 2009 to December 2009 System Operating Parameters

A summary of the performance monitoring system operating parameters for the December 2, 2009 monitoring event is provided in Table 1.

In general, as shown in Table 1, individual depressurization well manifold flow rates, wellhead vacuums, individual well manifold vacuums, and general blower operating parameters remained consistent with data collected during the September 29, 2009 monitoring event. As noted below, variation reported for these parameters is the direct result of the system rebalancing activities discussed previously.

Key data and observations are as follows:

- The observed manifold vacuum remained generally consistent with September 2009 monitoring data at all depressurization wells, with the exception of Depressurization Wells DW-6S, DW-6D, and DW-4D. The DW-6S manifold vacuum was higher as compared to September 2009 data while the manifold vacuum at DW-6D and DW-4D were lower when comparing December 2009 to September 2009 data. The observed decreases in manifold vacuum are the direct result of the system rebalancing activities discussed previously while the observed increase at DW-6S is related to the increase of its respective flow rate.

- The manifold flow rate for the individual depressurization wells remained generally consistent when comparing December 2009 to September 2009 data, with the exception of Depressurization Wells DW-9S, DW-10S, DW-6S and DW-6D. Specifically, the flow rate at Depressurization Well DW-6S increased during the current reporting period when compared to September 2009 data. The flow rate at Depressurization Wells DW-9S, DW-10S and DW-6D decreased when compare to September 2009 data. The change in flow rates associated with these depressurization wells is the direct result of the rebalancing activities described previously.

- The system met its design objective of -0.1 iwc pressure at all compliance-related induced vacuum monitoring points despite the variation in general system operating parameters discussed herein.

- There was no condensate water generated during the reporting period through normal system operation (i.e., collection within the liquid knockout tanks).

- The heat exchanger influent temperature, (i.e., 100 degrees Fahrenheit), remained lower than the design influent temperature of 150 degrees Fahrenheit. Accordingly, the heat exchanger was kept on standby during the reporting period.

6.1.1.2 September 2009 to December 2009 Vapor Samples

A summary of the September 2009 to December 2009 qualitative vapor sample analytical results (i.e., PID readings) is provided in Table 1. Qualitative vapor analyses were generally consistent with previous data, and were 0.0 parts per million by volume (ppmv) for vapor sample location VSP-601.

6.1.2 2009 Annual Summary System Performance Monitoring

Similar to the September 2009 to December 2009 operating period, system performance monitoring completed in 2009 consisted of the collection of system operating parameters and system performance vapor samples (i.e., PID measurements). In general, the majority of system operating parameters (i.e., individual well flow rates, system vacuums, etc.) remained consistent. A detailed description of changes in system operating parameters is included in each monitoring period respective quarterly OM&M report.

Key performance monitoring results from 2009 include the following:

- Several minor system rebalancing events were performed in an effort to align induced vacuum levels to their respective design criteria, as described previously.

- As a result of removal of condensate/storm water from the depressurization pipelines and associated rebalancing activities, the majority of observed manifold vacuums decreased when compared to previous operation (i.e., prior to January 2009) for the period between January 2009 and September 2009. Observed manifold vacuums remained relatively constant between June 2009 and December 2009.

- The individual depressurization well flow rates were variable during 2009 due to rebalancing activities described previously. The soil gas IRM continued to meet its' respective design objectives despite the variation in flow rates.

- The heat exchanger remained on standby during 2009 as a result of the blower discharge temperature being less than 110 degrees Fahrenheit.
- Perched water was not encountered in Induced Vacuum Monitoring Wells VMWC-1C, VMWC-5B or VMWC-5D during 2009.
- Approximately 110 gallons of water was generated from Condensate Knockout Tanks KO-300 between January 2009 and December 2009. In addition, approximately 447 gallons of condensate/storm water was removed from the below grade pipeline as described previously.

A summary of the key system compliance monitoring results for the September 2009 to December 2009 operating period is provided below. An annual summary of the key system compliance monitoring results is also provided.

6.2 System Compliance Monitoring

6.2.1 September 2009 to December 2009 System Compliance Monitoring

This following section summarizes the results of the routine system compliance monitoring event completed on December 2, 2009.

6.2.1.1 September 2009 to December 2009 Induced Vacuum Measurements

Induced vacuum measurements collected during the December 2, 2009 monitoring event are summarized in Table 2. As described in the 95% Design Report (ARCADIS 2007), the soil gas IRM was designed to maintain a negative pressure of -0.1 iwc on an annual time-weighted rolling average within all monitoring points. Accordingly, the annual time-weighted rolling average for the compliance related induced vacuum monitoring points has been provided in Table 2. As shown on Table 2, the rolling average for all compliance related monitoring points was greater than or equal to -0.1 iwc as of December 2, 2009. In addition, the average induced vacuum for compliance monitoring wells during the December 2, 2009 monitoring event was -0.14 iwc, which indicate that the soil gas IRM is operating as designed.

6.2.1.2 September 2009 to December 2009 Vapor Samples

A summary of the December 2, 2009 total effluent vapor sample laboratory analytical results for detected compounds is provided in Table 3. A summary of all vapor sample analytical results (including detected, non-detect, and TICs) is provided in Appendix A.

Total effluent (VSP-601) laboratory analytical results for the December 2, 2009 monitoring event decreased when compared with analytical results from September 29, 2009 but remained relatively consistent with historical data. Specifically, the total volatile organic compound (TVOC) concentration was 2,432 micrograms per cubic meter (µg/m^3) during the December 2009, monitoring event. Two environmentally "A" rated compounds (as defined in Division of Air Resources [DAR-1] Annual Guideline Concentration [AGC]/Short-Term Guideline Concentration [SGC] tables revised September 10, 2007), i.e., benzene and vinyl chloride, were detected in the effluent vapor sample during December 2009. Specifically, benzene and vinyl chloride were detected at 140 µg/m^3 and 1.8 ug/m^3, respectively. However, the mass emission rate for benzene and vinyl chloride were 3.35 x 10^{-4} and 4.31 x 10^{-6} pounds per hour (lbs/hr) respectively, which is well below the NYSDEC recommended action level of 0.01 lb/hr. Therefore, no treatment is required. A summary of the air emissions modeling, completed to confirm compliance with applicable air discharge standards, is discussed in Section 7 of this report.

Several TICs were identified by the analytical laboratory. The majority of the TICs were detected for the first time during the December 2009 monitoring events and do not warrant further action.

6.2.1.3 September 2009 to December 2009 Condensate Samples

As discussed previously, no condensate/storm water sample was collected during September 2009 to December 2009 monitoring period.

6.2.2 2009 Annual Summary

Similar to September to December 2009 operating period, system compliance monitoring completed in 2009 consisted of the collection of system compliance vapor samples and the collection of compliance-only induced vacuum readings. A detailed description of the system compliance monitoring results is included in each monitoring period's respective quarterly OM&M report.

Key compliance monitoring results from 2009 include the following:

- As of December 2, 2009, the time-weighted rolling average for all compliance related monitoring points was greater than or equal to the design objective of -0.1 iwc.
- Similarly, the average instantaneous induced vacuum for all compliance related monitoring points was greater than or equal to -0.1 iwc for each respective monitoring period in 2009.
- Two environmentally "A" rated compounds (as defined in Division of Air Resources [DAR-1] Annual Guideline Concentration [AGC]/Short-Term Guideline Concentration [SGC] tables revised September 10, 2007), i.e., benzene and vinyl chloride, were detected in the effluent vapor sample during 2009. However, the mass emission rates for these compounds were below the NYSDEC recommended action level of 0.01 lb/hr during all monitoring events. Therefore, no treatment is required.
- The TVOC concentration of the effluent vapor stream remained relatively constant between January and December 2009. All emissions were below applicable discharge criteria during all monitoring events as discussed in Section 7 of this report.
- Several TICs were identified on an inconsistent basis during 2009. No additional action is warranted for these TICs at this time.

A summary of the air emissions model maintained during 2009 is provided below.

7. Air Emissions Model

Effluent vapor laboratory analytical results were compared to the NYSDEC DAR-1 SGCs during each monitoring event in 2009 including the September to December 2009 monitoring period. In addition, effluent vapor laboratory analytical results were compared to a site-specific modeled annual maximum allowable stack concentration (MASC). The annual MASC was calculated during each monitoring event for individual compounds using the output from a United States Environmental Protection Agency (USEPA) SCREEN 3 model in conjunction with the NYSDEC DAR-1 AGCs. Specifically, a scaling factor was calculated using the SCREEN 3 model with site-specific physical layout (e.g., building dimension, stack height, terrain, etc.) and

operating data (e.g., discharge flow rate, temperature, etc.) inputs for each monitoring event. The scaling factor was then used to adjust (scale) the NYSDEC DAR-1 AGC to a site-specific annual MASC. An annual summary of the instantaneous percent (e.g., not time-weighted) of the site-specific annual MASC for detected compounds is provided in Table 5. An annual summary of the cumulative annual percent (i.e., time-weighted) of the site-specific MASC for detected compounds is also provided on Table 5. An annual summary of the model input, outputs, and backup calculations is provided in Appendix C.

In summary, the soil gas IRM effluent vapor met applicable air discharge criteria for 2009 and the September to December 2009 operating period based on the following:

- The actual concentrations of individual VOCs in the vapor effluent did not exceed their respective SGCs during all monitoring events (Table 3).

- The actual concentration of individual VOCs in the vapor effluent did not exceed their respective instantaneous MASCs during all monitoring events, as calculated using the USEPA SCREEN 3 Model (Table 5). Similarly, the time-weighted rolling average for all detected compounds is currently well below the MASCs.

- Two environmentally "A" rated compounds (as defined in DAR-1 AGC/SGC tables revised September 10, 2007), i.e., benzene and vinyl chloride, were detected in the effluent vapor samples collected for 2009. However, the mass emission rates for benzene and vinyl chloride were well below the NYSDEC recommended action level of 0.01 lb/hr for 2009. Therefore, no treatment is required. As described previously, benzene and vinyl chloride were detected at 140 ug/m^3 and 1.8 ug/m^3, respectively during the December 2009 monitoring event. These concentrations result in mass emission rates of 3.35 x 10^{-4} lbs/hr and 4.31 x 10^{-6} lbs/hr, respectively, which are well below the NYSDEC recommended action level of 0.01 lbs/hr.

8. Conclusions and Recommendations

The following section summarizes the conclusions and recommendations based on the results of performance and compliance monitoring provided herein.

8.1 Conclusions

Based on the information provided herein, ARCADIS concludes that the soil gas IRM met or exceeded all design objectives referenced in Section 3.0 of this report as follows:

- Ø The soil gas IRM maintained 0.1 iwc of negative pressure within all induced vacuum monitoring points based on a twelve-month rolling average.
- Ø System emissions were maintained at or below all applicable regulatory discharge criteria for all monitoring events; and,
- Ø System condensate was characterized, discharged, and reported as required under the existing approval from the Nassau County Department of Public Works.

8.2 Recommendations

Based on the information provided herein, ARCADIS makes the following recommendations for 2010:

- Ø Continue operating the soil gas IRM in accordance with system operating parameters recorded during the December 2009 reporting period.
- Ø Continue to monitor the manifold vacuum of individual depressurization wells in conjunction with system operating parameters and induced vacuum measurements. If induced vacuum measurements decrease to below design criteria, evaluate if below grade pipeline condensate removal is warranted.
- Ø Conduct future OM&M activities in accordance with the Final OM&M Manual dated January 23, 2009 (ARCADIS 2009a).
- Ø Update Table 3 “Summary of Typical Operating Parameters” of the OM&M Manual dated January 23, 2009 based on the average typical operating parameters recorded during the 2009 operating period.

9. Certification

Statement of Certification

On behalf of Northrop Grumman Systems Corporation, I hereby certify and attest that the Operable Unit 3 Soil Gas Interim Remedial Measure is operated in compliance with the remedial action objectives provided within the NYSDEC approved Soil Gas Interim Remedial Measure Work Plan dated February 16, 2007 which was prepared pursuant to NYSDEC Order on Consent Index # W1-0018-04-01 referencing the Former Grumman Settling Ponds Site and dated July 4, 2005.

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Nassau County Department of Public Works 2007. Letter regarding Disposal of Condensate Water Northrop Grumman Operable Unit 3 Soil Gas IRM, Bethpage, New York, October 16, 2007.

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New York State Department of Environmental Conservation (NYSDEC), 2005, Order on Consent Index #WI-0018-04-01, Site # 1-30-003A, July 4, 2005.

New York State Department of Environmental Conservation (NYSDEC), 2007a, Division of Air Resources-1 (DAR-1) Guidelines for the Control of Toxic Ambient Air Contaminants dated 1991 and the AGC/SGC Tables, September 10, 2007.

New York State Department of Environmental Conservation (NYSDEC), 2007b, Approval Letter of 95 Percent Design, Former Grumman Settling Ponds, NYSDEC Nassau County Site No. 1-30-003A OU3 (Bethpage Community Park), September 19, 2007.

New York State Department of Environmental Conservation (NYSDEC), 2008a, Approval Letter regarding Former Grumman Settling Ponds, NYSDEC Nassau County Site No. 1-30-003A OU3 (Bethpage Community Park), August 1, 2008.

New York State Department of Environmental Conservation (NYSDEC), 2008b, Letter dated August 5, 2008 regarding Appendix C Soil Vapor Extraction (SVE) System Interim Remedial Measure (IRM) for referenced site - Former Grumman Settling Ponds, NYSDEC Nassau County Site No. 1-30-003A OU3 (Bethpage Community Park), August 5, 2008.

New York State Department of Environmental Conservation (NYSDEC), 2008c, Letter of Approval For Proposed Modifications, December 12, 2008.

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Table 1. Annual Summary of General System Operating Parameters, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

	Extraction Well DW-7S Parameters					Extraction Well DW-7D Parameters					Extraction Well DW-3S Parameters				
Date	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum
	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)
03/19/09(1)	95.0	-26.0	47.1	2.3	-0.85	21.0	-12.3	46.7	0.0	-1.7	13.0	-10.4	48.3	0.3	-0.51
06/26/09	83.0	-17.0	65.3	NM	-1.4	6.00	-7.50	67.8	NM	-0.46	5.00	-7.70	68.7	NM	-0.26
09/29/09	85.0	-16.0	64.0	NM	-1.6	5.50	-8.00	64.0	NM	-0.46	6.00	-4.50	64.0	NM	-0.24
12/02/09	85.0	-16.5	64.8	NM	-1.5	6.00	-7.70	65.6	NM	-0.46	6.50	-4.70	64.8	NM	-0.20

	Extraction Well DW-3D Parameters					Extraction Well DW-5S Parameters					Extraction Well DW-5D Parameters				
Date	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum
	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)
03/19/09(1)	26.0	-11.5	46.7	3.2	-0.78	89.0	-15.7	47.1	0.0	-1.6	30.0	-20.0	46.9	0.0	-6.5
06/26/09	10.0	-6.50	66.7	NM	-0.38	90.0	-16.0	64.7	NM	-1.5	13.5	-10.0	66.2	NM	-2.3
09/29/09	10.0	-6.50	64.0	NM	-0.39	90.0	-16.0	64.0	NM	-1.6	14.0	-9.00	64.0	NM	-2.0
12/02/09	9.50	-6.80	65.6	NM	-0.34	90.0	-17.2	64.8	NM	-1.5	14.0	-9.40	65.6	NM	-2.2

Notes and Abbreviations:

°F	°Degrees Fahrenheit.
DW	Depressurization well.
ft bmp	Feet below measuring point.
iwc	Inches of water column.
NM	Not measured.
scfm	Standard cubic feet per minute.
ppmv	Parts per million by volume.
VMWC	Vapor monitoring well cluster.
NA	Not applicable.

1. First round of monitoring with new variable area float type air flow meters installed.
2. Blower BL-200 taken off line on May 5, 2009 and replaced with Blower BL-300.
3. Totalizers not recording flow due to fouling. Total of 110 gallons of condensate collected in Storage Tank ST-510 between December 19, 2008 and March 19, 2009.
4. Field transcription error suspected.
5. Water and debris in flowmeter, no flow observed during this site visit.
6. Totalizers not recording flow due to fouling. There was no condensate collected in Storage Tank ST-510 between March 19, 2009 and June 26, 2009.
7. Totalizers not recording flow due to fouling. No appreciable amount of water was collected from Knockout tanks. ST-510 contains approximately 190 gallons of water produced during the liquid-vacuum truck removal of condensate from below grade pipelines completed on September 24, 2009.
8. Totalizers not recording flow due to fouling. There was no condensate collected in Storage Tank ST-510 between September 29, 2009 and December 2, 2009.

Standard Conditions Calculation:

scfm = Flow rate*Area*(Ts/Tm)*(Pm/Ps)

Flow rate in feet per minute.
Area in square feet.
Ts - Standard Temperature in Rankine.
Tm - Measured Temperature in Rankine.
Pm - Measured Pressure in pounds per square inch.
Ps - Standard Pressure in pounds per square inch.

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Table 1. Annual Summary of General System Operating Parameters, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

	Extraction Well DW-6S Parameters					Extraction Well DW-6D Parameters					Extraction Well DW-1S Parameters					Extraction Well DW-1D Parameters					Extraction Well DW-4S Parameters					Extraction Well DW-4D Parameters				
Date	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum
	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)
03/19/09(1)	47.0	-11.5	47.1	0.0	-0.95	5.10	-4.60	47.8	0.0	-1.1	59.0	-15.5	46.7	0.0	-1.2	8.00	-4.15	47.3	0.0	-2.4	18.0	-18.0	47.4	0.0	-0.43	19.0	-11.0	46.5	0.0	-0.96
06/26/09	36.0	-10.5	65.8	NM	-0.74	10.0	-6.00	67.1	NM	-1.9	65.0	-20.5	64.9	NM	-1.7	6.10	-3.00	69.0	NM	-1.6	82.0	-15.5	65.1	NM	-1.6	7.00	-7.00	67.6	NM	-0.78
09/29/09	34.0	-10.5	64.0	NM	-0.80	10.0	-6.40	64.0	NM	-1.9	85.0	-20.5	64.0	NM	-1.6	6.10	-3.40	64.0	NM	-1.8	85.0	-16.0	64.0	NM	-1.7	6.50	-9.50	64.0	NM	-0.80
12/02/09	89.0	-16.0	64.8	NM	-1.6	6.20	-4.90	65.6	NM	-1.1	90.0	-21.0	64.8	NM	-2.2	6.10	-4.30	65.6	NM	-1.6	78.0	-15.8	64.8	NM	-1.4	6.50	-5.40	65.6	NM	-0.30

Notes and Abbreviations:

°F	°Degrees Fahrenheit.
DW	Depressurization well.
ft bmp	Feet below measuring point.
iwc	Inches of water column.
NM	Not measured.
scfm	Standard cubic feet per minute.
ppmvc	Parts per million by volume.
VMWC	Vapor monitoring well cluster.
NA	Not applicable.

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Standard Conditions Calculation:

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Flow rate in feet per minute.
Area in square feet.
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Pm - Measured Pressure in pounds per square inch.
Ps - Standard Pressure in pounds per square inch.

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Table 1. Annual Summary of General System Operating Parameters, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

	Extraction Well DW-8S Parameters					Extraction Well DW-9S Parameters					Extraction Well DW-2S Parameters				
Date	Flow Rate at Manifold (scfm)	Vacuum at Manifold (iwc)	Temperature at Manifold (°F)	PID Measured Concentration (ppmv)	Wellhead Vacuum (iwc)	Flow Rate at Manifold (scfm)	Vacuum at Manifold (iwc)	Temperature at Manifold (°F)	PID Measured Concentration (ppmv)	Wellhead Vacuum (iwc)	Flow Rate at Manifold (scfm)	Vacuum at Manifold (iwc)	Temperature at Manifold (°F)	PID Measured Concentration (ppmv)	Wellhead Vacuum (iwc)
03/19/09(1)	73.0	-23.0	46.5	0.0	-2.1	73.0	-25.0	46.4	0.0	-3.1	29.0	-17.0	46.4	8.6	-1.4
06/26/09	85.0	-22.5	65.1	NM	-2.8	45.0	-26.5	65.6	NM	-2.0	0.00(5)	-26.5	NA	NM	-0.06
09/29/09	78.0	-21.0	64.0	NM	-2.4	45.0	-16.0	64.0	NM	-1.9	31.0	-19.0	64.0	NM	-1.8
12/02/09	72.0	-23.8	64.8	NM	-1.9	30.0	-13.3	64.8	NM	-1.2	31.0	-22.5	64.8	NM	-1.2

	Extraction Well DW-2D Parameters					Extraction Well DW-10S Parameters					Extraction Well DW-11S Parameters				
Date	Flow Rate at Manifold (scfm)	Vacuum at Manifold (iwc)	Temperature at Manifold (°F)	PID Measured Concentration (ppmv)	Wellhead Vacuum (iwc)	Flow Rate at Manifold (scfm)	Vacuum at Manifold (iwc)	Temperature at Manifold (°F)	PID Measured Concentration (ppmv)	Wellhead Vacuum (iwc)	Flow Rate at Manifold (scfm)	Vacuum at Manifold (iwc)	Temperature at Manifold (°F)	PID Measured Concentration (ppmv)	Wellhead Vacuum (iwc)
03/19/09(1)	55.0	-38.0	NA	0.0	-3.8	40.0	-22.0	46.4	0.4	-2.6	39.0	-23.0	46.4	0.0	-3.2
06/26/09	40.0	-24.0	NA	NM	-2.6	52.0	-22.0	64.7	NM	-3.4	30.0	-22.0	66.3	NM	-2.3
09/29/09	37.0	-23.5	64.0	NM	-2.4	55.0	-12.0	64.0	NM	-3.4	31.0	-22.0	64.0	NM	-2.4
12/02/09	37.0	-25.4	65.6	NM	-1.6	30.0	-14.4	64.8	NM	-2.3	32.0	-25.0	64.8	NM	-2.3

Notes and Abbreviations:

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DW	Depressurization well.
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Standard Conditions Calculation:

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Ps - Standard Pressure in pounds per square inch.

Table 1. Annual Summary of General System Operating Parameters, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

	Knock Out Tank Parameters							Blower Parameters[2] BL-200				Blower Parameters[2] BL-300				Blower Parameters[2] BL-400				Combined Blower Parameters VSP-601					Stack Parameters VSP-602			Water levels in Wells				
	Vacuum			Totalizer																											
Date	Influent KO-200	Influent KO-300	Influent KO-400	Effluent KO-200	Effluent KO-300	Effluent KO-400	Influent Vacuum	Effluent Pressure	Effluent Flow Rate	Effluent PID	Influent Vacuum	Effluent Pressure	Effluent Flow Rate	Effluent PID	Influent Vacuum	Effluent Pressure	Effluent Flow Rate	Effluent PID	Total Effluent Flow Rate	Total Influent PID	Heat Exchanger Influent Temp.	Total Effluent Pressure	VPGAC Influent Temperature	VPGAC Effluent PID	Discharge Temperature	Effluent Relative Humidity	VMWC-1D	VMWC-5D	B24MW-3	VMWC-1C	VMWC-5B
	(iwc)	(iwc)	(iwc)	(Gallons)	(Gallons)	(Gallons)	(iwc)	(iwc)	(scfm)	(ppmv)	(iwc)	(iwc)	(scfm)	(ppmv)	(iwc)	(iwc)	(scfm)	(ppmv)	(scfm)	(ppmv)	(°F)	(iwc)	(°F)	(ppmv)	(°F)	(%)	(ft bmp)	(ft bmp)	(ft bmp)	(ft bmp)	(ft bmp)
03/19/09[1]	-41	0	0	132.67[3]	9,996,202.71[3]	35.94[3]	-44	3	828 [4]	1.1	NM	NM	NM	NM	NM	NM	NM	NM	533.63	0.40	100	2.7	90	NM	NM	NM	Dry	Dry	55.60	Dry	Dry
06/26/09	0	-31	0	132.67[6]	9,996,202.72[6]	36.94[6]	NM	NM	NM	NM	-34.5	2.4	NM	NM	NM	NM	NM	NM	572.80	0.60	105	2.4	90	NM	NM	NM	Dry	Dry	54.00	Dry	Dry
09/29/09	0	-23	0	132.67[7]	9,996,202.71[7]	36.94[7]	NM	NM	NM	NM	-23.0	2.0	NM	NM	NM	NM	NM	NM	595.36	0.00	100	2.7	90	NM	NM	NM	Dry	Dry	55.30	Dry	Dry
12/02/09	0	-25	0	132.67[8]	9,996,202.71	36.94[8]	NM	NM	NM	NM	-32.0	2.0	NM	NM	NM	NM	NM	NM	615.40	0.00	100	2.6	91	NM	NM	NM	Wet	Dry	55.44	Dry	Dry

Notes and Abbreviations:

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ft bmp	Feet below measuring point.
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Flow rate in feet per minute.
Area in square feet.
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Pm - Measured Pressure in pounds per square inch.
Ps - Standard Pressure in pounds per square inch.

Table 2. Annual Summary of Induced Vacuum Readings, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[1,2]

Well ID:	DW-7S			DW-7D	DW-3S				DW-3D				DW-5S		DW-5D	DW-1S										
Date	VMWC-14A [3]	VMWC-14B [3]	VMWC-14D [3]	VMWC-9A	VMWC-9B	VMWC-10B	VMWC-11B [3]	VMWC-10D	VMWC-11D	VMWC-12D [3]	VMWC-15A [3]	VMWC-15B [3]	VMWC-15D [3]	VMWC-1A	VMWC-2A	VMWC-4A	VMWC-3A [3]	VMWC-1B	VMWC-4B	VMWC-3B [3]	VMWC-1C	VMWC-2C	VMWC-4C	VMWC-3C [3]
03/19/09	-0.149	-0.245	-0.275	NM	NM	NM	-0.217	NM	NM	-0.212	-0.180	-0.179	-0.192	NM	NM	NM	-0.118	NM	NM	-0.123	NM	NM	NM	-0.125
06/26/09	-0.120	-0.155	-0.145	NM	NM	NM	-0.100	NM	NM	-0.120	-0.130	-0.140	-0.115	NM	NM	NM	-0.110	NM	NM	-0.135	NM	NM	NM	-0.200
09/29/09	-0.100	-0.140	-0.145	NM	NM	NM	-0.100	NM	NM	-0.160	-0.150	-0.140	-0.105	NM	NM	NM	-0.120	NM	NM	-0.120	NM	NM	NM	-0.100
12/02/09	-0.100	-0.140	-0.150	NM	NM	NM	-0.100	NM	NM	-0.135	-0.155	-0.150	-0.105	NM	NM	NM	-0.140	NM	NM	-0.135	NM	NM	NM	-0.140
Time Weighted[4] Rolling Average:	-0.13	-0.19	-0.20	NA	NA	NA	-0.15	NA	NA	-0.17	-0.15	-0.16	-0.14	NA	NA	NA	-0.12	NA	NA	-0.13	NA	NA	NA	-0.15

Gross Average Compliance Points

12/02/09	-0.14

Notes and Abbreviations:

DW Depressurization well.
NA Not applicable.
NM Not measured.
VMWC Vapor monitoring well cluster.

1. All induced vacuum measurements units in inches of water column (iwc).
2. Compliance goal is -0.1 iwc induced vacuum at all compliance monitoring points.
3. Compliance vapor monitoring point.
4. Time weighted average calculated by summing the products of the monthly induced vacuum reading and the numbers of days between the current and subsequent reading for each of the twelve months presented in this table, and dividing by the total time period between the first and last months induced vacuum readings.
5. Suspected field recording error.

Table 2. Annual Summary of Induced Vacuum Readings, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[1,2]

Well ID:	DW-1D					DW-4D	DW-8S	DW-2S								DW-2D							DW-11S
Date	VMWC-1D	VMWC-2D	VMWC-4D	VMWC-3D [3]	VMWC-16D [3]	VMWC-16A [3]	VMWC-16B [3]	VMWC-5A	VMWC-6A	VMWC-8A	VMWC-7A [3]	VMWC-5B	VMWC-6B	VMWC-8B	VMWC-7B [3]	VMWC-5D	VMWC-6D	VMWC-8D	VMWC-7D	VMWC-13D [3]	VMWC-17D [3]	VMWC-18A [3]	VMWC-18B [3]
03/19/09	NM	NM	NM	-0.278	-0.152	-0.134	-0.145	NM	NM	NM	-0.163	NM	NM	NM	-0.151	NM	NM	NM	NM	-0.364	-0.308	-0.140	-0.170
06/26/09	NM	NM	NM	-0.120	-0.160	-0.210	-0.220	NM	NM	NM	-0.100	NM	NM	NM	-0.110	NM	NM	NM	NM	-0.860	-0.110	-0.115	-0.130
09/29/09	NM	NM	NM	-0.175	-0.190	-0.160	-0.170	NM	NM	NM	-0.100	NM	NM	NM	-0.095	NM	NM	NM	NM	-0.190	-0.180	-0.099	-0.115
12/02/09	NM	NM	NM	-0.180	-0.100	-0.140	-0.150	NM	NM	NM	0.010[5]	NM	NM	NM	-0.100	NM	NM	NM	NM	-0.230	-0.300	-0.125	-0.135
Time Weighted[4] Rolling Average:	NA	NA	NA	-0.19	-0.16	-0.17	-0.18	NA	NA	NA	-0.12	NA	NA	NA	-0.12	NA	NA	NA	NA	-0.50	-0.20	-0.12	-0.14

Notes and Abbreviations:

DW Depressurization well.
NA Not applicable.
NM Not measured.
VMWC Vapor monitoring well cluster.

1. All induced vacuum measurements units in inches of water column (iwc).
2. Compliance goal is -0.1 iwc induced vacuum at all compliance monitoring points.
3. Compliance vapor monitoring point.
4. Time weighted average calculated by summing the products of the monthly induced vacuum reading and the numbers of days between the current and subsequent reading for each of the twelve months presented in this table, and dividing by the total time period between the first and last months induced vacuum readings.
5. Suspected field recording error.

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Table 3. Annual Summary of Total Effluent Vapor Sample Analytical Results, Northrop Grumman Operable Unit 3
Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[1]

Compound[2] (units in µg/m^3)	CAS No.	SGC	Location ID: VSP-601 Sample Date: 3/19/2009	VSP-601 6/26/2009	VSP-601 9/29/2009	VSP-601 12/2/2009
1,1,1-Trichloroethane	71-55-6	68,000	**57 J**	**24**	**26**	**22**
1,1-Dichloroethane	75-34-3	NS	**30 J**	**17**	**19**	**16**
1,1-Dichloroethene	75-35-4	380[4]	< 12 J	**3.9**	**3.9**	**3.8**
2-Butanone	78-93-3	13,000	< 17 J	**6.4**	**2**	**3.7**
Acetone	67-64-1	180,000	< 130 J	**25**	<15	<15
Benzene	71-43-2	1,300	**15 J**	**120**	**14**	**140**
Carbon Disulfide	75-15-0	6,200	< 9.1 J	<1.5	**1.7**	<1.5
Carbon Tetrachloride	56-23-5	1,900	< 3.8 J	<1.5	<1.5	<1.5
Trichlorofluoromethane (CFC-11)	75-69-4	68,000	< 17 J	**4**	**3.3**	**2.6**
Chloroform	67-66-3	150	**30 J**	**18**	**110**	**80**
cis-1,2-Dichloroethene	156-59-2	190,000[5]	**1,400 DJ**	**960 D**	**900 D**	**600 D**
Dichlorodifluoromethane (Freon 12)	75-71-8	NS	< 29 J	**10**	**5.7**	**4.4**
Tetrachloroethene	127-18-4	1,000	**24 J**	**22**	**31**	**19**
Toluene	108-88-3	37,000	**11J**	<1.5	<1.5	**2.2**
trans-1,2-Dichloroethene	156-60-5	NS	< 12 J	**9.4**	**10**	**6.2**
Trichloroethylene	79-01-6	14,000	**920 J**	**720 D**	**1,000 D**	**750 D**
Vinyl Chloride	75-01-4	180,000	< 2.7 J	**1.7**	<1.5	**1.8**
Xylene-O	95-47-6	4,300	< 25 J	<1.5	<1.5	<1.5
Xylenes - M,P	179601-23-1	4,300	< 51 J	< 2.9	<3.0	<3.1
Chlorodifluoromethane (Freon 22)	75-45-6	NS	--[6]	**260**	**660 D**	**430 D**
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3	NS	--[6]	**820**	**680 D**	**350 D**
TVOC[3]			**2,487 J**	**3,021**	**3,467**	**2,432**

Notes and Abbreviations on last page.

Table 3. Annual Summary of Total Effluent Vapor Sample Analytical Results, Northrop Grumman Operable Unit 3
Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.(1)

Notes and Abbreviations:

Bold	Compound detected above method detection limit.
CAS No.	Chemical Abstracts Service registration number.
D	Compound detected at a secondary dilution.
J	Estimated.
SGC	Short-term guideline concentrations specified in the NYSDEC DAR-1 AGC/SGC tables revised September 10, 2007.
NS	Guideline concentrations not specified in the NYSDEC DAR-1 AGC/SGC tables revised September 10, 2007. An interim SGC was not developed for these compounds because they have low toxicity ratings, as specified in the NYSDEC DAR-1 AGC/SGC tables revised September 10, 2007.
TVOC	Total volatile organic compounds.
µg/m^3	Micrograms per cubic meter.
--	Tentatively identified compound not detected; see note 6.
O&M	Operation and maintenance.
VOC	Volatile organic compound.
USEPA	United States Environmental Protection Agency.
DAR-1	Division of Air Resources-1.
AGC	Annual guideline concentration.

1. Samples were collected by O&M personnel on the dates shown and submitted to Columbia Analytical Services Laboratory for VOC analyses using USEPA Method TO-15 modified in accordance with the project Sampling and Analysis Plan (ARCADIS 2008a). Columbia Analytical Services Laboratory in Rochester, NY was used to analyze samples collected during the January 2009 - December 2009 operational period. Columbia Analytical Services Laboratory in Simi Valley, CA was used to analyze samples collected for the remainder of the reporting period. Data presented in this table corresponds to the year 2009 operational period.
2. Table summarizes detected compounds only.
3. Total volatile organic compounds determined by summing individual detections and rounding to the nearest whole number.
4. An SGC was not provided in the DAR-1 AGC/SGC Tables, dated September 10, 2007. An interim SGC was developed based on guidance provided in Section IV.A.2.b.1 of the New York State DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants, 1991 edition. Specifically for 1,1- dichloroethene, which is not defined as a high-toxicity compound, the Interim SGC = (smaller of Time Weighted Average [TWA] - Threshold Limit Value or TWA - Recommended Exposure Limit)/4.2. or 1,600 µg/m^3 / 4.2 = approximately 380 µg/m^3. An interim SGC was developed for this compound because it has a moderate toxicity rating, as specified in the DAR-1 AGC/SGC Tables, dated September 10, 2007.
5. An SGC was not provided in the DAR-1 AGC/SGC Tables, dated September 10, 2007. An interim SGC was developed based on guidance provided in Section IV.A.2.b.1 of the New York State DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants, 1991 edition. Specifically for cis-1,2 dichloroethene, which is not defined as a high-toxicity compound, the interim SGC = (smaller of Time Weighted Average [TWA] - Threshold Limit Value or TWA - Recommended Exposure Limit)/4.2 or 790,000 µg/m^3 / 4.2 = approximately 190,000 µg/m^3. An interim SGC was developed for this compound because it has a moderate toxicity rating, as specified in the DAR-1 AGC/SGC Tables, dated September 10, 2007.
6. Freon 22 and Freon 142b were reported as tentatively identified compounds through the March 2009 sampling event. Beginning with the April through June 2009 reporting period, Freon 22 and Freon 142b have been incorporated into the quantitative analyte list.

ARCADIS

Table 4. Annual Summary of Condensate Sample Analytical Results, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York. [1]

Compound[2] (units in µg/L)	Location ID: / Sample Date:	ST-510 4/21/2009	SG001-6W[4] 4/21/2009	ST-510 9/29/2009	ST-510 Qtr 4 2009
	CAS No.				
2-Butanone	78-93-3	**430 D**	<5	<5	
Acetone	67-64-1	**42**	<5	<5	
cis-1,2-Dichloroethene	156-59-2	<1	**14**	< 5 J	
Isopropylbenzene	98-82-8	**6.4**	<1	< 5 J	No Sampling During
Trichloroethylene	79-01-6	< 1	**3**	< 5 J	this Quarter
Benzene	71-43-2	**4.8**	<1	< 5 J	
Chloroethane	75-00-3	**1.5**	<1	< 5 J	
Chloromethane	74-87-3	**1.9**	<1	< 5 J	
TVOC[3]		**487**	**17**	**0**	**NA**

Notes and Abbreviations:

Bold	Detected.
TVOC	Total volatile organic compounds.
µg/L	Micrograms per liter.
NA	Not applicable.
D	Compound detected at a secondary dilution.
J	Estimated
O&M	Operation and maintenance.
VOC	Volatile organic compound.
CAS No.	Chemical Abstracts Service registration number.

1. Samples were collected by O&M personnel on the dates shown and submitted to Columbia Analytical Services Laboratory (Rochester, NY) for VOC analyses using Method 8260 in accordance with the project Sampling and Analysis Plan (ARCADIS 2008a). Data presented in this table corresponds to January - December 2009.
2. Table summarizes detected compounds only.
3. Total volatile organic compounds determined by summing individual detections and rounding to the nearest whole number.
4. Sample SG001-6W was a non-routine condensate sample collected as a composite grab sample from the six drums of condensate water generated during the March 2009 below grade pipeline condensate removal activities, which are discussed in the January 2009 to March 2009 Operable Unit-3 Interim Operation, Maintenance and Monitoring Report (ARCADIS 2009c).

Table 5. Annual Summary of Air Emissions Model Output Summary, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York

Compound[1]	AGC[2] ($\mu g/m^3$)	Percent of MASC Per Event[3]				Cumulative % MASC[4]
		3/19/2009	6/26/2009	9/29/2009	12/2/2009	
Vinyl chloride	0.11	0.00%	0.05%	0.00%	0.05%	0.00%
1,1-Dichloroethane	0.63	0.13%	0.08%	0.09%	0.08%	0.09%
Trichloroethylene	0.5	4.95%	4.35%	6.18%	4.73%	5.03%
Tetrachloroethylene	1	0.06%	0.07%	0.10%	0.06%	0.07%
cis-1,2-Dichloroethylene	63	0.06%	0.05%	0.04%	0.03%	0.05%
Dichlorodifluoromethane (Freon 12)	12,000	0.00%	0.00%	0.00%	0.00%	0.00%
Acetone	28,000	0.00%	0.00%	0.00%	0.00%	0.00%
Chloroform	0.043	1.88%	1.27%	7.90%	5.86%	3.45%
trans-1,2-Dichloroethene	63	0.00%	0.00%	0.00%	0.00%	0.00%
Trichlorofluoromethane (Freon 11)	1,000	0.00%	0.00%	0.00%	0.00%	0.00%
1,1-Dichloroethene	70	0.00%	0.00%	0.00%	0.00%	0.00%
1,1,1-Trichloroethane	1,000	0.00%	0.00%	0.00%	0.00%	0.00%
Benzene	0.13	0.31%	2.79%	0.33%	3.39%	0.97%
Carbon Disulfide	700	0.00%	0.00%	0.00%	0.00%	0.00%
Toluene	5,000	0.00%	0.00%	0.00%	0.00%	0.00%
2-Butanone	5,000	0.00%	0.00%	0.00%	0.00%	0.00%
Chlorodifluoromethane (Freon 22)[5]	50,000	--	0.00%	0.00%	0.00%	0.00%
1-Chloro-1,1-difluoroethane (Freon 142b)[5]	50,000	--	0.00%	0.00%	0.00%	0.00%

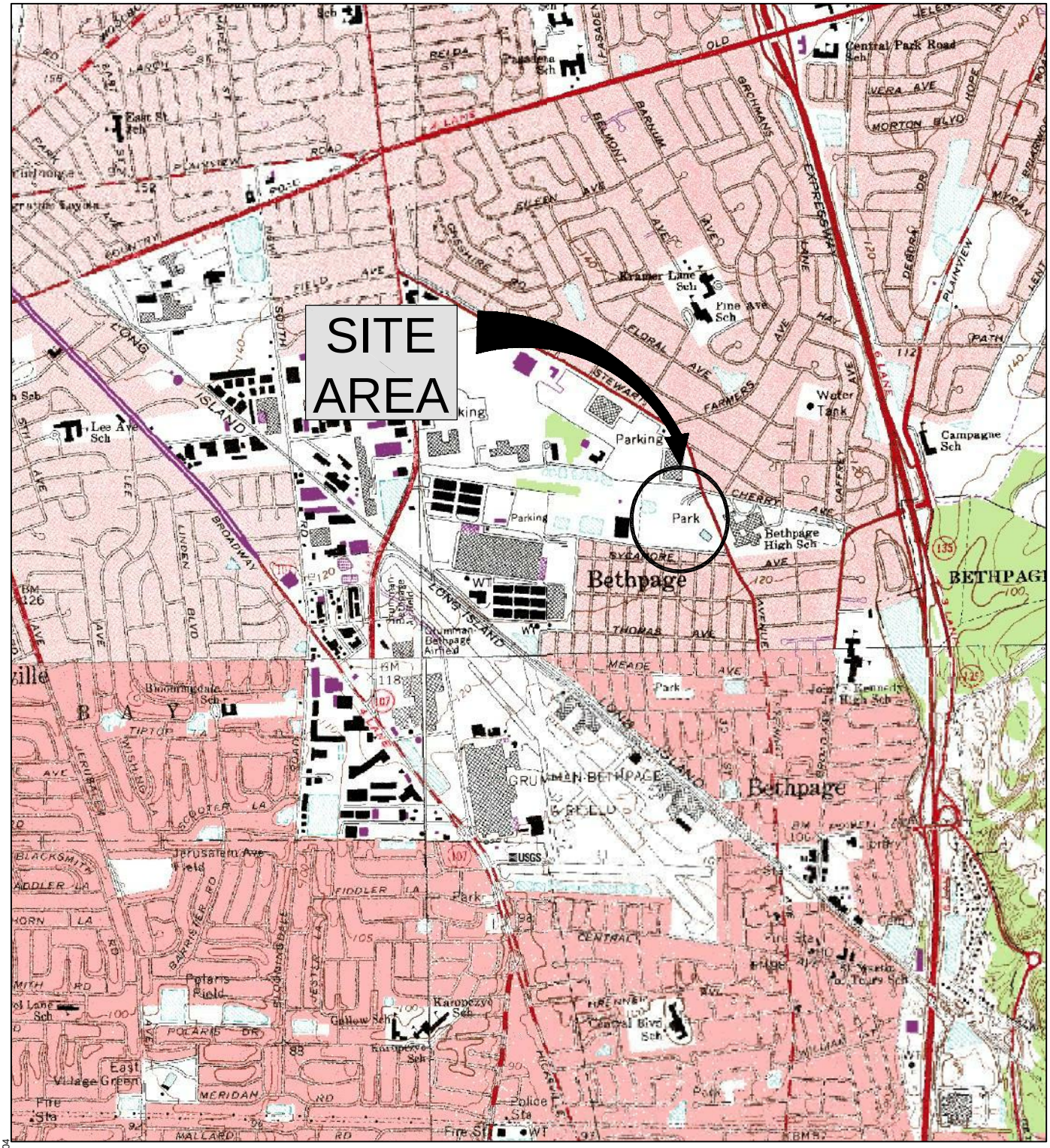
Notes and Abbreviations on next page.

Table 5. Annual Summary of Air Emissions Model Output Summary, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

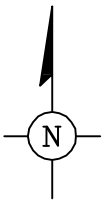
Notes and Abbreviations:

µg/m^3	Micrograms per cubic meter.
AGC	Annual guideline concentration.
MASC	Maximum allowable stack concentration.
--	Data not available. See note 5.
NYSDEC	New York State Department of Environmental Conservation.
DAR-1	Division of Air Resources-1.
SGC	Short-term guideline concentration.
USEPA	United States Environmental Protection Agency.

1. Compounds listed include all compounds detected in the system effluent vapor stream. Data in this table corresponds to the past year of system operation.
2. AGC refers to the compound-specific annual guideline concentration per the NYSDEC DAR-1 AGC/SGC tables, revised September 10, 2007. NYSDEC DAR-1 AGCs were scaled using the results of a site-specific USEPA SCREEN 3 model to calculate the annual MASC per monitoring event.
3. Percent of MASC per event was calculated by dividing the actual effluent concentration by the site-specific annual MASC. Detailed calculations are included in Appendix C.
4. Cumulative percent of the MASC was calculated using a time-weighted average of the percent MASC per event.
5. Freon 22 and Freon 142b were reported as tentatively identified compounds through the March 2009 sampling event. Beginning with the April through December 2009 operational period, Freon 22 and Freon 142b have been incorporated into the site quantitative analyte list.



QUADRANGLE LOCATION



0 2000' 4000'

SCALE IN FEET

SOURCE:
USGS 7.5 MIN. AMITYVILLE QUADRANGLE, AMITYVILLE, NY. 1994
USGS 7.5 MIN. FREEPORT QUADRANGLE, FREEPORT, NY., 1994
USGS 7.5 MIN. HICKSVILLE QUADRANGLE, HICKSVILLE, NY., 1967, PHOTOREVISED 1979
USGS 7.5 MIN. HUNTINGTON QUADRANGLE, HUNTINGTON, NY. 1967, PHOTOREVISED 1979

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK

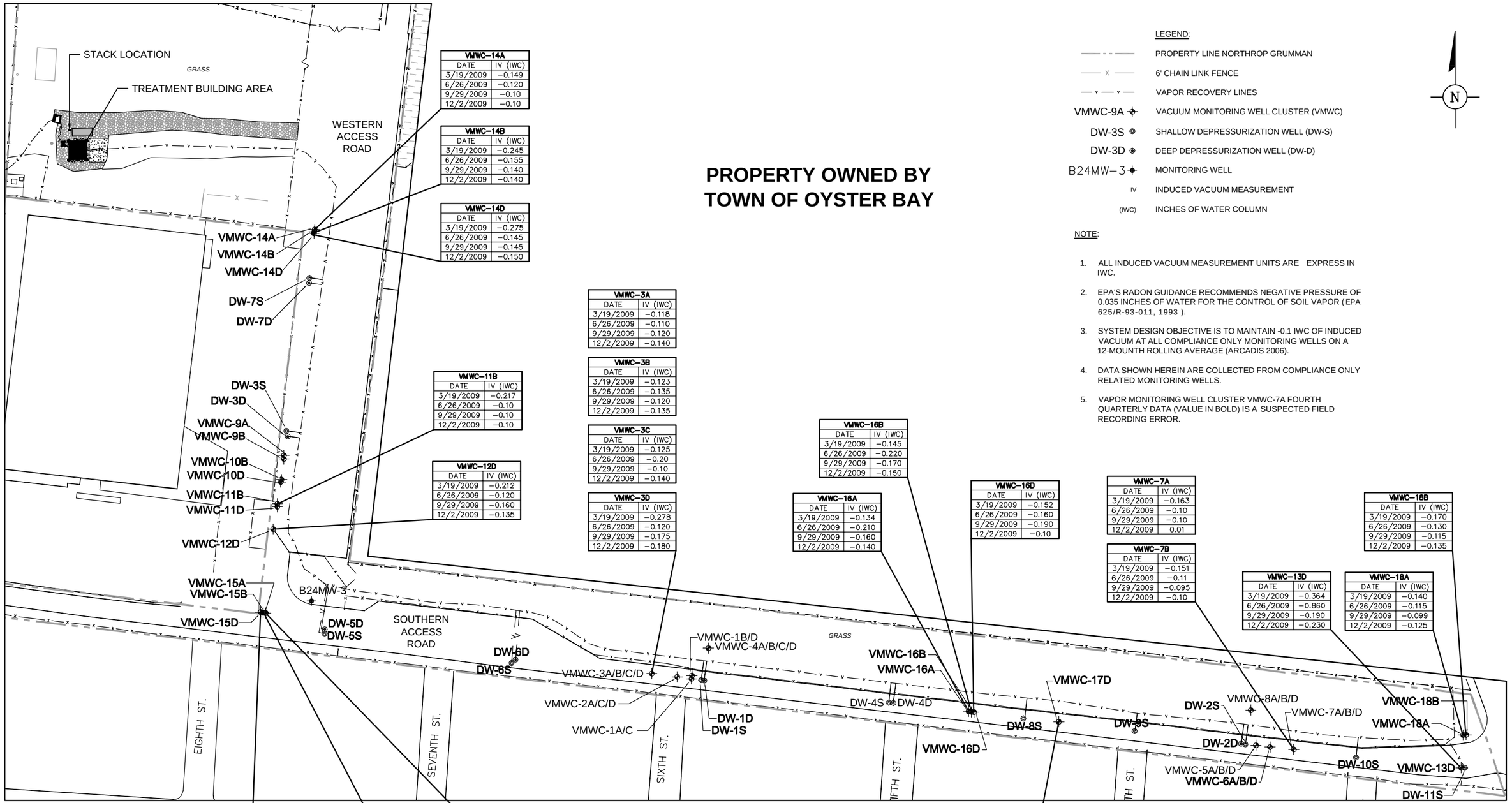
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

SITE LOCATION MAP
SOIL GAS INTERIM REMEDIAL MEASURE

ARCADIS

FIGURE
1

CITY:MELVILLE-NY DIV/GROUP:ENV cad DB:ALS LD: PIC: PM:CSG TM:KZ LYR:ON=*;OFF=*REF*
G:\ENVCAD\Melville-NY\NY001464\1407\0008\OM&M\01_Location Map.dwg LAYOUT: 1 SAVED: 2/6/2009 10:42 AM ACADVER: 17.1S (LMS TECH) PAGESETUP: ---PLOTSTYLETABLE: ARCADIS_MELVILLE.CTB PLOTTED: 2/16/2009 3:00 PM BY: SANCHEZ, ADRIAN
XREFS:
PROJECTNAME: NY001464.0908.00004



VMWC-14A	
DATE	IV (IWC)
3/19/2009	−0.149
6/26/2009	−0.120
9/29/2009	−0.10
12/2/2009	−0.10

VMWC-14B	
DATE	IV (IWC)
3/19/2009	−0.245
6/26/2009	−0.155
9/29/2009	−0.140
12/2/2009	−0.140

VMWC-14D	
DATE	IV (IWC)
3/19/2009	−0.275
6/26/2009	−0.145
9/29/2009	−0.145
12/2/2009	−0.150

VMWC-11B	
DATE	IV (IWC)
3/19/2009	−0.217
6/26/2009	−0.10
9/29/2009	−0.10
12/2/2009	−0.10

VMWC-12D	
DATE	IV (IWC)
3/19/2009	−0.212
6/26/2009	−0.120
9/29/2009	−0.160
12/2/2009	−0.135

VMWC-15D	
DATE	IV (IWC)
3/19/2009	−0.192
6/26/2009	−0.115
9/29/2009	−0.105
12/2/2009	−0.105

VMWC-15B	
DATE	IV (IWC)
3/19/2009	−0.179
6/26/2009	−0.140
9/29/2009	−0.140
12/2/2009	−0.150

VMWC-15A	
DATE	IV (IWC)
3/19/2009	−0.180
6/26/2009	−0.130
9/29/2009	−0.150
12/2/2009	−0.155

VMWC-3A	
DATE	IV (IWC)
3/19/2009	−0.118
6/26/2009	−0.110
9/29/2009	−0.120
12/2/2009	−0.140

VMWC-3B	
DATE	IV (IWC)
3/19/2009	−0.123
6/26/2009	−0.135
9/29/2009	−0.120
12/2/2009	−0.135

VMWC-3C	
DATE	IV (IWC)
3/19/2009	−0.125
6/26/2009	−0.20
9/29/2009	−0.10
12/2/2009	−0.140

VMWC-3D	
DATE	IV (IWC)
3/19/2009	−0.278
6/26/2009	−0.120
9/29/2009	−0.175
12/2/2009	−0.180

VMWC-16B	
DATE	IV (IWC)
3/19/2009	−0.145
6/26/2009	−0.220
9/29/2009	−0.170
12/2/2009	−0.150

VMWC-16A	
DATE	IV (IWC)
3/19/2009	−0.134
6/26/2009	−0.210
9/29/2009	−0.160
12/2/2009	−0.140

VMWC-16D	
DATE	IV (IWC)
3/19/2009	−0.152
6/26/2009	−0.160
9/29/2009	−0.190
12/2/2009	−0.10

VMWC-17D	
DATE	IV (IWC)
3/19/2009	−0.308
6/26/2009	−0.110
9/29/2009	−0.180
12/2/2009	−0.30

VMWC-7A	
DATE	IV (IWC)
3/19/2009	−0.163
6/26/2009	−0.10
9/29/2009	−0.10
12/2/2009	0.01

VMWC-7B	
DATE	IV (IWC)
3/19/2009	−0.151
6/26/2009	−0.11
9/29/2009	−0.095
12/2/2009	−0.10

VMWC-13D	
DATE	IV (IWC)
3/19/2009	−0.364
6/26/2009	−0.860
9/29/2009	−0.190
12/2/2009	−0.230

VMWC-18B	
DATE	IV (IWC)
3/19/2009	−0.170
6/26/2009	−0.130
9/29/2009	−0.115
12/2/2009	−0.135

VMWC-18A	
DATE	IV (IWC)
3/19/2009	−0.140
6/26/2009	−0.115
9/29/2009	−0.099
12/2/2009	−0.125

PROPERTY OWNED BY TOWN OF OYSTER BAY

LEGEND:

- PROPERTY LINE NORTHROP GRUMMAN
- 6' CHAIN LINK FENCE
- VAPOR RECOVERY LINES
- VMWC-9A — VACUUM MONITORING WELL CLUSTER (VMWC)
- DW-3S — SHALLOW DEPRESSURIZATION WELL (DW-S)
- DW-3D — DEEP DEPRESSURIZATION WELL (DW-D)
- B24MW−3 — MONITORING WELL
- IV — INDUCED VACUUM MEASUREMENT
- (IWC) — INCHES OF WATER COLUMN

N

NOTE:

1. ALL INDUCED VACUUM MEASUREMENT UNITS ARE EXPRESS IN IWC.
2. EPA'S RADON GUIDANCE RECOMMENDS NEGATIVE PRESSURE OF 0.035 INCHES OF WATER FOR THE CONTROL OF SOIL VAPOR (EPA 625/R-93-011, 1993).
3. SYSTEM DESIGN OBJECTIVE IS TO MAINTAIN -0.1 IWC OF INDUCED VACUUM AT ALL COMPLIANCE ONLY MONITORING WELLS ON A 12-MOUNTH ROLLING AVERAGE (ARCADIS 2006).
4. DATA SHOWN HEREIN ARE COLLECTED FROM COMPLIANCE ONLY RELATED MONITORING WELLS.
5. VAPOR MONITORING WELL CLUSTER VMWC-7A FOURTH QUARTERLY DATA (VALUE IN BOLD) IS A SUSPECTED FIELD RECORDING ERROR.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

GENERAL SITE PLAN AND MONITORING WELL VACUUM MEASUREMENTS SOIL GAS INTERIM REMEDIAL MEASURE

ARCADIS

FIGURE 2

CITY:MELVILLE-NY DIV/GROUP:ENV.cad DB:ALS LD: PIC: PM:CSG TM: LYR:ON=*;OFF=*REF*
G:\ENVCAD\Melville-NY\NY001496\09100000\IOM&M\02_Site Plan_IVR.dwg LAYOUT: 2 SAVED: 1/25/2010 5:16 PM ACADVER: 17.1S (LMS TECH) PAGESETUP: ---PLOTSTYLETABLE: ARCADIS_MELVILLE.CTB PLOTTED: 2/19/2010 2:24 PM BY: SANCHEZ, ADRIAN
XREFS: IMAGES: PROJECTNAME: NY001464.0909.00001
1464X01

DISCHARGE TO ATMOSPHERE

DISCHARGE TO ATMOSPHERE

VSP-602

V-27

TEMPORARY VAPOR PHASE GAC VP-600 (REMOVED FROM OPERATION DECEMBER 2006)

AMBIENT AIR OUTLET

TI 602

TT 602

HEAT EXCHANGER HX-601

ON STANDBY

AMBIENT AIR INLET

PIT 601

PI 601

FE

TI 601

V-26

VSP-601

VSP-201

FE

PI 201

BLOWER BL-200 ON STANDBY

VI 202

VIT 202

VSP-301

FE

PI 301

BLOWER BL-300

VI 302

VIT 302

VSP-401

FE

PI 401

BLOWER BL-400 ON STANDBY

VI 402

VIT 402

WSP-510

SG 510

STORAGE TANK ST-510

VENT

AIR FILTER AF-200

KNOCK OUT TANK KO-200

WSP-210

SG 200

VI 201

RECIRCULATION LINE (TYP. OF 3)

FE 210

FQI 210

TRANSFER PUMP TP-210

AIR FILTER AF-300

KNOCK OUT TANK KO-300

WSP-310

SG 300

VI 301

FE 310

FQI 310

TRANSFER PUMP TP-310

AIR FILTER AF-400

KNOCK OUT TANK KO-400

WSP-410

SG 400

VI 401

FE 410

FQI 410

TRANSFER PUMP TP-410

V-24

V-19

V-21

V-25

V-22

V-20

V-23

V-1

V-2

V-3

V-4

V-5

V-6

V-7

V-8

V-9

V-10

V-11

V-12

V-13

V-14

V-15

V-16

V-17

V-18

VI 119 VSP-101 FI 101

VI 120 VSP-102 FI 102

VI 121 VSP-103 FI 103

VI 122 VSP-104 FI 104

VI 123 VSP-105 FI 105

VI 124 VSP-106 FI 106

VI 125 VSP-107 FI 107

VI 126 VSP-108 FI 108

VI 127 VSP-109 FI 109

VI 128 VSP-110 FI 110

VI 129 VSP-111 FI 111

VI 130 VSP-112 FI 112

VI 131 VSP-113 FI 113

VI 132 VSP-114 FI 114

VI 133 VSP-115 FI 115

VI 134 VSP-116 FI 116

VI 135 VSP-117 FI 117

VI 136 VSP-118 FI 118

FROM DW-7D

FROM DW-3D

FROM DW-5D

FROM DW-6D

FROM DW-1D

FROM DW-4D

FROM DW-2D

FROM DW-11S

FROM DW-10S

FROM DW-2S

FROM DW-9S

FROM DW-8S

FROM DW-4S

FROM DW-1S

FROM DW-6S

FROM DW-5S

FROM DW-3S

FROM DW-7S

VI 101

VI 106

DEPRESSURIZATION WELL (TYPICAL OF 7 DEEP)

DEPRESSURIZATION WELL (TYPICAL OF 11 SHALLOW)

LIMIT OF TREATMENT BUILDING 2

LIMIT OF TREATMENT BUILDING 1

LEGEND:

- CONDENSATE LINE
- LIMITS OF TREATMENT BUILDING
- PROCESS VAPOR LINE
- BALL VALVE (NORMALLY OPEN)
- BALL VALVE (NORMALLY CLOSED)
- BUTTERFLY VALVE (NORMALLY OPEN)
- BUTTERFLY VALVE (NORMALLY CLOSED)
- CHECK VALVE
- UNION
- SAMPLE PORT/DRAIN
- REDUCER
- FERNCO
- FLEXIBLE HOSE
- FLANGE
- FLOW ELEMENT ACCESS
- 1/4" BARB INDUCED VACUUM MONITORING CONNECTION
- INLINE INSTRUMENT
- ISOLATED INSTRUMENT CONNECTED TO PROCESS LINE
- INSTRUMENT CONNECTED TO PROCESS LINE

FE	FLOW MONITORING ELEMENT
FI	FLOW RATE INDICATOR
FQI	FLOW TOTALIZER INDICATOR
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATING TRANSMITTER
SG	SIGHT GLASS
TT	TEMPERATURE TRANSMITTER
VI	VACUUM INDICATOR
VIT	VACUUM INDICATING TRANSMITTER
VSP	VAPOR SAMPLE POINT
WSP	WATER SAMPLE POINT

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

PROCESS FLOW DIAGRAM
SOIL GAS INTERIM REMEDIAL MEASURE

ARCADIS

FIGURE 3

CITY:(Req'd) DIV/GROUP:(Req'd) DB:(Req'd) LD:(Opt) PIC:(Opt) PM:(Req'd) TM:(Opt) LYR:(On|Off|*)=*OFF*;*REF*
G:\ENVCAD\Melville-NY\NY001464\1407\00008\IOM&MM\03_P&ID.dwg LAYOUT: 3 SAVED: 1/26/2009 11:44 AM ACADVER: 17.1S (LMS TECH) PAGESETUP: ---
XREFS: IMAGES: PROJECTNAME: ---
PLOTTED: 2/4/2009 2:59 PM BY: SANCHEZ, ADRIAN
PLOTSTYLETABLE: ARCADIS_MELVILLE.CTB

ARCADIS

Appendix **A**

Annual Summary of Vapor Sample Analytical Results Including Tentatively Identified Compounds

Appendix A-1. Annual Summary of Total Effluent Vapor Sample Analytical Results, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[1]

Compound (units in µg/m^3)	Location ID: Sample Date:	VSP-601 3/19/2009	VSP-601 6/26/2009	VSP-601 9/29/2009	VSP-601 12/2/2009
	CAS No.				
1,1,1-Trichloroethane	71-55-6	**57 J**	**24**	**26**	**22**
1,1,2,2-Tetrachloroethane	79-34-5	< 4 UJ	<1.5	<1.5	<1.5
1,1,2-Trichloroethane	79-00-5	< 16 UJ	<1.5	<1.5	<1.5
1,1-Dichloroethane	75-34-3	**30 J**	**17**	**19**	**16**
1,1-Dichloroethene	75-35-4	< 12 UJ	**3.9**	**3.9**	**3.8**
1,2-Dichloroethane	107-06-2	< 12 UJ	<1.5	<1.5	<1.5
1,2-Dichloropropane	78-87-5	< 14 UJ	<1.5	<1.5	<1.5
1,3-Butadiene	106-99-0	< 13 UJ	<1.5	<1.5	<1.5
2-Butanone	78-93-3	< 17 UJ	**6.4**	**2**	**3.7**
2-Hexanone	591-78-6	< 12 UJ	<1.5	<1.5	<1.5
4-Methyl-2-Pentanone	108-10-1	< 24 UJ	<1.5	<1.5	<1.5
Acetone	67-64-1	< 130 UJ	**25**	<15	<15
Benzene	71-43-2	**15 J**	**120**	**14**	**140**
Bromodichloromethane	75-27-4	< 4 UJ	<1.5	<1.5	<1.5
Bromoform	75-25-2	< 31 UJ	<1.5	<1.5	<1.5
Bromomethane	74-83-9	< 12 UJ	<1.5	<1.5	<1.5
Carbon Disulfide	75-15-0	< 9.1 UJ	<1.5	**1.7**	<1.5
Carbon Tetrachloride	56-23-5	< 3.8 UJ	<1.5	<1.5	<1.5
Trichlorofluoromethane (CFC-11)	75-69-4	< 17 UJ	**4**	**3.3**	**2.6**
Chlorobenzene	108-90-7	< 14 UJ	<1.5	<1.5	<1.5
Chlorodibromomethane	124-48-1	< 5.1 UJ	<1.5	<1.5	<1.5
Chloroethane	75-00-3	< 16 UJ	<1.5	<1.5	<1.5
Chloroform	67-66-3	**30 J**	**18**	**110**	**80**
Chloromethane	74-87-3	< 12 UJ	<1.5	<1.5	<1.5
cis-1,2-Dichloroethene	156-59-2	**1,400 DJ**	**960 D**	**900 D**	**600 D**
cis-1,3-Dichloropropene	10061-01-5	< 27 UJ	<1.5	<1.5	<1.5
Ethylbenzene	100-41-4	< 25 UJ	<1.5	<1.5	<1.5
Trichlorotrifluoroethane (Freon 113)	76-13-1	< 4.6 UJ	<1.5	<1.5	<1.5
Dichlorodifluoromethane (Freon 12)	75-71-8	< 29 UJ	**10**	**5.7**	**4.4**
Methyl Tert-Butyl Ether	1634-04-4	< 21 UJ	<1.5	<1.5	<1.5
Methylene Chloride	75-09-2	< 10 UJ	<1.5	<1.5	<1.5
Styrene	100-42-5	< 25 UJ	<1.5	<1.5	<1.5
Tetrachloroethene	127-18-4	**24 J**	**22**	**31**	**19**
Toluene	108-88-3	**11J**	<1.5	<1.5	**2.2**
trans-1,2-Dichloroethene	156-60-5	< 12 UJ	**9.4**	**10**	**6.2**
trans-1,3-Dichloropropene	10061-02-6	< 13 UJ	<1.5	<1.5	<1.5
Trichloroethylene	79-01-6	**920J**	**720 D**	**1,000 D**	**750 D**
Vinyl Chloride	75-01-4	< 2.7 UJ	**1.7**	<1.5	**1.8**
Xylene-o	95-47-6	< 25 UJ	<1.5	<1.5	<1.5
Xylenes - m,p	179601-23-1	< 51 UJ	< 2.9	<3.0	<3.1
Chlorodifluoromethane (Freon 22)[3]	75-45-6	--	**260**	**660 D**	**430 D**
1-Chloro-1,1-difluoroethane (Freon 142b)[3]	75-68-3	--	**820**	**680 D**	**350 D**
TVOC[2]		**2,487**	**3,021**	**3,467**	**2,432**

Notes and Abbreviations on last page.

Appendix A-1. Annual Summary of Total Effluent Vapor Sample Analytical Results, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.(1)

Notes and Abbreviations:

Bold	Compound detected above method detection limit.
µg/m^3	Micrograms per cubic meter.
CAS No.	Chemical Abstracts Service registration number.
D	Compound detected at a secondary dilution.
J	Estimated value.
O&M	Operation and maintenance.
TVOC	Total volatile organic compounds.
USEPA	United States Environmental Protection Agency.
VOC	Volatile organic compound.
--	Tentatively identified compound not detected; see note 3.

1. Samples were collected by O&M personnel on the dates shown and submitted to Columbia Analytical Services Laboratory for VOC analyses using USEPA Method TO-15 modified in accordance with the project Sampling and Analysis Plan (ARCADIS 2008a). Columbia Analytical Services Laboratory in Rochester, NY was used to analyze samples collected during the January 2009 - December 2009 operational period. Columbia Analytical Services Laboratory in Simi Valley, CA was used to analyze samples collected for the remainder of the reporting period. Data presented in this table corresponds to the year 2009 operational period.
2. Total volatile organic compounds determined by summing individual detections and rounding to the nearest whole number.
3. Freon 22 and Freon 142b were reported as tentatively identified compounds through the March 2009 sampling event. Beginning with the April through June 2009 reporting period, Freon 22 and Freon 142b have been incorporated into the quantitative analyte list.

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Appendix A-2. Annual Summary of Total Effluent Vapor Sample Analytical Results, Tentatively Identified Compounds, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[1,2]

Tentatively Identified Compounds	Location ID:	VSP-601	VSP-601	VSP-601	VSP-601	
	Sample Date:	3/19/2009	6/26/2009	9/29/2009	12/2/2009	
	Units:	µg/m^3	ppbv	ppbv	ppbv	
Chlorodifluoromethane (Freon 22)[3]		**1,500**	NA	NA	NA	
Acetophenone		**67**	**4.7**	**36**	**67**	
alpha-Cumyl Alcohol		--	--	**53**	**50**	
Methylcyclohexane		**130**	--	--	--	
Acetaldehyde		--	**4.2**	--	--	
Heptane		**87**	--	--	--	
Unknown cyclic hydrocarbon		**36**	--	--	--	
Unknown aliphatic hydrocarbon		**33**	--	--	--	
Unknown aliphatic hydrocarbon		**41**	--	--	--	
1,3-dimethyl-cis-cyclohexane		**54**	--	--	--	
Ethane, 1-chloro-1,1-difluoro (Freon 142b)[3]		**910**	NA	NA	NA	
3-Methylheptane		**33**	--	--	--	
Octane		**70**	--	--	--	
3-Methylnonane		**34**	--	--	--	
Unknown aliphatic hydrocarbon		**59**	--	--	--	
Isobutene		--	**13**	--	--	
2,4,4-Trimethyl-1-Pentene		--	**2.7**	--	--	
2-Phenyl-2-Propanol		--	**6.4**	--	--	
Benzaldehyde		--	--	**3.4**	**7.4**	
alpha-Methylstyrene		--	--	**2.8**	**17**	
1-Decene		--	--	**1.4**	--	
2-Hydroxypropyl-methacrylate		--	--	**9.4**	**--**	
Unidentified Compound		--	--	--	--	
1-Dodecene		--	--	**2.2**	--	
3-Hydroxypropyl-methacrylate		--	--	--	**8.5**	
Unidentified Oxygenated Compound[4]		--	--	--	**11**	
Unidentified Oxygenated Compound[4]		--	--	--	**17**	

Notes and Abbreviations:

--	Tentatively identified compound not detected.
Bold	Detected.
µg/m^3	Micrograms per cubic meter.
ppbv	Parts per billion by volume.
O&M	Operation and maintenance.
VOC	Volatile organic compound.
NA	Not applicable; see note 3.

1. Samples were collected by O&M personnel on the dates shown and submitted to Columbia Analytical Services Laboratory for VOC analyses using USEPA Method TO-15 modified in accordance with the project Sampling and Analysis Plan (ARCADIS 2008a). Columbia Analytical Services Laboratory in Rochester, NY was used to analyze samples collected during the January 2009 - December 2009 operational period. Columbia Analytical Services Laboratory in Simi Valley, CA was used to analyze samples collected for the remainder of the reporting period. Data presented in this table corresponds to the year 2009 operational period.
2. Tentatively Identified Compounds (TICs) are identified based on review of mass spectrometry results via a comprehensive library search of all organic compounds. All results are estimated.
3. Freon 22 and Freon 142b were reported as tentatively identified compounds through the March 2009 sampling event. Beginning with the April through June 2009 reporting period, Freon 22 and Freon 142b have been incorporated into the quantitative analyte list.
4. Unidentified oxygenated compound results are in micrograms per cubic meter.

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Appendix **B**

Annual Summary of Condensate Sample Analytical Results Including Tentatively Identified Compounds

Appendix B-1. Annual Summary of Condensate Sample Analytical Results, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[1]

Compound (units in µg/L)	Location ID: / Sample Date:	ST-510 4/21/2009	SG001-6W[3] 4/21/2009	ST-510 9/29/2009	ST-510 Qtr 4 2009
	CAS No.				
1,1,2,2-Tetrachloroethane	79-34-5	< 1	< 1	< 5 J	
1,1,2-Trichloroethane	79-00-5	< 1	< 1	< 5 J	
1,1-Dichloroethane	75-34-3	< 1	< 1	< 5 J	
1,1-Dichloroethene	75-35-4	< 1	< 1	< 5 J	
1,2-Dibromoethane (EDB)	106-93-4	< 1	< 1	< 5 J	
1,2-Dichloroethane	107-06-2	< 1	< 1	< 5 J	
1,2-Dichloropropane	78-87-5	< 1	< 1	< 5 J	
1,4-Dichlorobenzene	106-46-7	< 1	< 1	< 5 J	
2-Butanone	78-93-3	**430 D**	< 5	< 10 J	
2-Hexanone	591-78-6	< 5	< 5	< 10 J	
4-Methyl-2-Pentanone	108-10-1	< 5	< 5	< 10 J	
Acetone	67-64-1	**42**	< 5	< 20 J	
Benzene	71-43-2	**4.8**	< 1	< 5 J	
Bromodichloromethane	75-27-4	< 1	< 1	< 5 J	
Bromoform	75-25-2	< 1	< 1	< 5 J	
Bromomethane	74-83-9	< 1	< 1	< 5 J	
Carbon Disulfide	75-15-0	< 1	< 1	< 10 J	
Carbon Tetrachloride	56-23-5	< 1	< 1	< 5 J	
Trichlorofluoromethane (CFC-11)	75-69-4	< 1	< 1	< 5 J	
Chlorobenzene	108-90-7	< 1	< 1	< 5 J	
Chlorodibromomethane	124-48-1	< 1	< 1	< 5 J	
Chloroethane	75-00-3	**1.5**	< 1	< 5 J	No Sampling During this Quarter
Chloroform	67-66-3	< 1	< 1	< 5 J	
Chloromethane	74-87-3	**1.9**	< 1	< 5 J	
cis-1,2-Dichloroethene	156-59-2	< 1	**14**	< 5 J	
cis-1,3-Dichloropropene	10061-01-5	< 1	< 1	< 5 J	
Cyclohexane	110-82-7	< 1	< 1	< 10 J	
Ethylbenzene	100-41-4	< 1	< 1	< 5 J	
Trichlorotrifluoroethane (Freon 113)	76-13-1	< 1	< 1	< 5 J	
Dichlorodifluoromethane (Freon 12)	75-71-8	< 1	< 1	< 5 J	
Isopropylbenzene	98-82-8	**6.4**	< 2	< 5 J	
m-Dichlorobenzene	541-73-1	< 1	< 1	< 5 J	
Methyl Acetate	79-20-9	< 2	< 1	< 10 J	
Methyl tert-butyl ether	1634-04-4	< 1	< 1	< 5 J	
Methylcylohexane	108-87-2	< 1	< 1	< 10 J	
Methylene Chloride	75-09-2	< 1	< 1	< 5 J	
Styrene	100-42-5	< 1	< 1	< 5 J	
Tetrachloroethene	127-18-4	< 1	< 1	< 5 J	
Toluene	108-88-3	< 1	< 1	< 5 J	
trans-1,2-Dichloroethene	156-60-5	< 1	< 1	< 5 J	
trans-1,3-Dichloropropene	10061-02-6	< 1	< 1	< 5 J	
Trichloroethylene	79-01-6	< 1	**3**	< 5 J	
Vinyl Chloride	75-01-4	< 1	< 1	< 5 J	
Xylene-o	95-47-6	< 1	< 1	< 5 J	
Xylenes - m,p	179601-23-1	< 2	< 2	< 5 J	
TVOC[2]		**487**	**17**	**0**	**NA**

Notes and Abbreviations on next page.

Appendix B-1. Annual Summary of Condensate Sample Analytical Results, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[(1)]

Notes and Abbreviations:

Bold	Compound detected above method detection limit.
CAS No.	Chemical Abstracts Service registration number.
D	Compound detected at a secondary dilution.
J	Estimated.
TVOC	Total volatile organic compounds.
µg/L	Micrograms per liter.
O&M	Operation and maintenance.
VOC	Volatile organic compound.
NA	Not applicable.

1. Samples were collected by O&M personnel on the dates shown and submitted to Columbia Analytical Services Laboratory (Rochester, NY) for VOC analyses using Method 8260 in accordance with the project Sampling and Analysis Plan (ARCADIS 2008a) . Data presented in this table corresponds to January - December 2009.
2. Total volatile organic compounds determined by summing individual detections and rounding to the nearest whole number.
3. Sample SG001-6W was a non-routine condensate sample collected as a composite grab sample from the six drums of condensate water generated during the March 2009 below grade pipeline condensate removal activities, which are discussed in the January 2009 to March 2009 Operable Unit-3 Interim Operation, Maintenance and Monitoring Report (ARCADIS 2009c).

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Appendix B-2. Annual Summary of Condensate Sample Analytical Results, Tentatively Identified Compounds (TICs), Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[1]

Tentatively Identified Compounds[2,3] (units in µg/L)	Sample ID:	ST-510	SG001-6W[4]	ST-510	ST-510
	Date:	4/21/2009	4/21/2009	9/29/2009	Qtr 4 2009
Unknown Ethanol Furan, tetrahydro- Unknown alcohol Cyclohexanone Isoproply Alcohol Butanal Heptanal 1-Hexanol, 2-ethyl-		There were no Tentatively Identified Compounds Detected			No Sampling During this Quarter

Notes and Abbreviations:

µg/L Micrograms per liter.
O&M Operation and maintenance.
VOC Volatile organic compound.

1. Samples were collected by O&M personnel on the dates shown and submitted to Columbia Analytical Services Laboratory (Rochester, NY) for VOC analyses using Method 8260 in accordance with the project Sampling and Analysis Plan (ARCADIS 2008a) . Data presented in this table corresponds to January - December 2009.
2. Tentatively identified compounds are identified based on review of mass spectrometry results via a comprehensive library search of all organic compounds.
3. All results are estimated.
4. Sample SG001-6W was a non-routine condensate sample collected as a composite grab sample from the six drums of condensate water generated during the March 2009 below grade pipeline condensate removal activities, which are discussed in the January 2009 to March 2009 Operable Unit-3 Interim Operation, Maintenance and Monitoring Report (ARCADIS 2009c).

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Appendix **C**

Annual Summary of Air Modeling Calculations

Table C-1. Annual Summary of SCREEN3 Model Input and Outputs, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Parameters	Date Sampled:	3/19/2009	6/26/2009	9/29/2009	12/2/2009
SCREEN3 Model Input					
Source Type		Point	Point	Point	Point
Emission Rate (g/s)		1	1	1	1
Stack Height (ft)		33	33	33	33
Stack Height (m)		10.1	10.1	10.1	10.1
Stack Inside Diameter (m)		0.41	0.41	0.41	0.41
Air Flow Rate (scfm)(1)		534	573	595	615
Air Flow Rate (acfm @ stack temp)(2)		553	594	617	639
Stack Gas Exit Temperature (K)(1)		305	305	305	306
Ambient Air Temperature (K)(3)		279	300	289	286
Receptor Height (m)(4)		1.5	1.5	1.5	1.5
Urban/Rural		Urban	Urban	Urban	Urban
Building Height (m)		2.4	2.4	2.4	2.4
Min Horizontal Bldg Dim (m)		4.9	4.9	4.9	4.9
Max Horizontal Bldg Dim (m)		5.0	5.0	5.0	5.0
Consider Bldg Downwash?		Yes	Yes	Yes	Yes
Simple/Complex Terrain Above Stack		Simple	Simple	Simple	Simple
Simple/Complex Terrain Above Stack Base		Simple	Simple	Simple	Simple
Meteorology		Full	Full	Full	Full
Automated Distances Array		Yes	Yes	Yes	Yes
Terrain Height Above Stack Base		0	0	0	0
SCREEN3 Model Output					
1-HR Max Concentration at Receptor Height ($\mu g/m^3$)(5)		1,289	1,348	1,326	1,306
Annualization Factor(6)		0.08	0.08	0.08	0.08
Average Annual Concentration at Receptor Height ($\mu g/m^3$)(7)		103.1	107.8	106.1	104.5
Distance To Max Concentration (m)(8)		45	44	44	45

Notes and Abbreviations on next page.

Table C-1. Annual Summary of SCREEN3 Model Input and Outputs, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Notes and Abbreviations:

g/s	Grams per second.
ft	Feet.
m	Meters.
scfm	Standard cubic feet per minute.
acfm	Actual cubic feet per minute.
K	Kelvin.
$\mu g/m^3$	Micrograms per cubic meter.

1. The stack air flow rate (in scfm) and exit temperature were measured using a handheld thermo-anemometer. Values were measured at the stack effluent location.
2. The stack air flow rate at the stack temperature (in acfm) was calculated by dividing the stack air flow rate in scfm by the ratio of the standard temperature to the actual stack gas exit temperature.
3. The ambient temperature was recorded from the weather.newday.com website for Islip, New York. The mean actual temperature from the website was used in model calculation.
4. The receptor height corresponds to the average inhalation level.
5. SCREEN3 calculated constituent concentration at listed conditions at the specified inhalation level.
6. A USEPA time averaging conversion factor of 0.08 was used to convert the 1-hour maximum concentration output to an annual average.
7. Average annual constituent concentration at the receptor height was calculated by multiplying the one hour maximum concentration by the annualization factor.
8. SCREEN3 calculated distance to the 1-hour maximum concentration.

Table C-2. Annual Summary of Maximum Allowable Stack Concentration Calculations, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Compound	Actual Effluent Concentrations[1] (µg/m^3)			
	3/19/2009	6/26/2009	9/29/2009	12/2/2009
Vinyl chloride	0	1.7	0	1.8
1,1-Dichloroethane	30	17	19	16
Trichloroethylene	920	720	1,000	750
Tetrachloroethylene	24	22	31	19
cis-1,2-Dichloroethylene	1,400	960	900	600
Dichlorodifluoromethane (Freon 12)	0	10	5.7	4.4
Acetone	0	25	0	0
Chloroform	30	18	110	80
trans-1,2-Dichloroethene	0	9.4	10	6.2
Trichlorofluoromethane (Freon 11)	0	4	3.3	2.6
1,1-Dichloroethene	0	3.9	3.9	3.8
1,1,1-Trichloroethane	57	24	26	22
Benzene	15	120	14	140
Carbon disulfide	0	0	1.7	0
Toluene	11	0	0	2.2
2-Butanone	0	6	2.0	3.7
Chlorodifluoromethane (Freon 22)[5]	--	260	660	430
1-Chloro-1,1-difluoroethane (Freon 142b)[5]	--	820	680	350

Notes and Abbreviations on last page.

Table C-2. Annual Summary of Maximum Allowable Stack Concentration Calculations, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Compound	AGC[2] ($\mu g/m^3$)	Annual Maximum Allowable Stack Concentration[3] ($\mu g/m^3$)			
		3/19/2009	6/26/2009	9/29/2009	12/2/2009
Vinyl chloride	0.11	4.09E+03	3.64E+03	3.56E+03	3.49E+03
1,1-Dichloroethane	0.63	2.34E+04	2.08E+04	2.04E+04	2.00E+04
Trichloroethylene	0.5	1.86E+04	1.65E+04	1.62E+04	1.59E+04
Tetrachloroethylene	1	3.72E+04	3.31E+04	3.24E+04	3.17E+04
cis-1,2-Dichloroethylene	63	2.34E+06	2.08E+06	2.04E+06	2.00E+06
Dichlorodifluoromethane (Freon 12)	12,000	4.46E+08	3.97E+08	3.88E+08	3.81E+08
Acetone	28,000	1.04E+09	9.27E+08	9.06E+08	8.88E+08
Chloroform	0.043	1.60E+03	1.42E+03	1.39E+03	1.36E+03
trans-1,2-Dichloroethene	63	2.34E+06	2.08E+06	2.04E+06	2.00E+06
Trichlorofluoromethane (Freon 11)	1,000	3.72E+07	3.31E+07	3.24E+07	3.17E+07
1,1-Dichloroethene	70	2.60E+06	2.32E+06	2.27E+06	2.22E+06
1,1,1-Trichloroethane	1,000	3.72E+07	3.31E+07	3.24E+07	3.17E+07
Benzene	0.13	4.83E+03	4.30E+03	4.21E+03	4.13E+03
Carbon disulfide	700	2.60E+07	2.32E+07	2.27E+07	2.22E+07
Toluene	5,000	1.86E+08	1.65E+08	1.62E+08	1.59E+08
2-Butanone	5,000	1.86E+08	1.65E+08	1.62E+08	1.59E+08
Chlorodifluoromethane (Freon 22)[5]	50,000	--	1.65E+09	1.62E+09	1.59E+09
1-Chloro-1,1-difluoroethane (Freon 142b)[5]	50,000	--	1.65E+09	1.62E+09	1.59E+09

Notes and Abbreviations on last page.

Table C-2. Annual Summary of Maximum Allowable Stack Concentration Calculations, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Compound	Percent of Annual Maximum Allowable Stack Concentration[4]			
	3/19/2009	6/26/2009	9/29/2009	12/2/2009
Vinyl chloride	0.00%	0.05%	0.00%	0.05%
1,1-Dichloroethane	0.13%	0.08%	0.09%	0.08%
Trichloroethylene	4.95%	4.35%	6.18%	4.73%
Tetrachloroethylene	0.06%	0.07%	0.10%	0.06%
cis-1,2-Dichloroethylene	0.06%	0.05%	0.04%	0.03%
Dichlorodifluoromethane (Freon 12)	0.00%	0.00%	0.00%	0.00%
Acetone	0.00%	0.00%	0.00%	0.00%
Chloroform	1.88%	1.27%	7.90%	5.86%
trans-1,2-Dichloroethene	0.00%	0.00%	0.00%	0.00%
Trichlorofluoromethane (Freon 11)	0.00%	0.00%	0.00%	0.00%
1,1-Dichloroethene	0.00%	0.00%	0.00%	0.00%
1,1,1-Trichloroethane	0.00%	0.00%	0.00%	0.00%
Benzene	0.31%	2.79%	0.33%	3.39%
Carbon disulfide	0.00%	0.00%	0.00%	0.00%
Toluene	0.00%	0.00%	0.00%	0.00%
2-Butanone	0.00%	0.00%	0.00%	0.00%
Chlorodifluoromethane (Freon 22)[5]	--	0.00%	0.00%	0.00%
1-Chloro-1,1-difluoroethane (Freon 142b)[5]	--	0.00%	0.00%	0.00%

Notes and Abbreviations on last page.

Notes and Abbreviations:

Table C-2. Annual Summary of Maximum Allowable Stack Concentration Calculations, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

$\mu g/m^3$	Micrograms per cubic meter.
AGC	Annual guideline concentration.
NYSDEC	New York State Department of Environmental Conservation.
DAR-1	Division of Air Resources-1.
SGC	Short-term guideline concentration.
MASC	Maximum allowable stack concentration.
--	Data not available. See note 5.

1. Actual effluent concentrations are analytical results from air samples collected on the dates shown. Data in this table corresponds to the past year of system operation.
2. AGC refers to the compound-specific annual guideline concentration per the NYSDEC DAR-1 AGC/SGC tables, revised September 10, 2007.
3. Annual maximum allowable stack concentrations were calculated by dividing the product of the annual guideline concentration of a compound and the ratio of the SCREEN3 gas emission rate and the SCREEN 3 average annual concentration at receptor height by the air flow rate at the stack temperature and multiplying by the appropriate conversion factors.
4. Percent of MASC was calculated by dividing the actual effluent concentration by the MASC for a given monitoring event.
5. Freon 22 and Freon 142b were reported as tentatively identified compounds through the March 2009 sampling event. Beginning with the April through December 2009 operational period, Freon 22 and Freon 142b have been incorporated into the quantitative analyte list.