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Operation, Maintenance, and Monitoring Report for the Soil Gas Interim Remedial Measure

2011 Annual Summary

Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

NYSDEC ID # 1-30-003A

ARCADIS

Christine Casella
Staff Engineering Specialist

Kenneth Zegel, PE
Senior Engineer

Carlo San Giovanni
Project Manager

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NYSDEC ID# 1-30-003A

Prepared for:
Northrop Grumman Systems Corporation

Prepared by:
ARCADIS of New York, Inc.
Two Huntington Quadrangle
Suite 1S10
Melville
New York 11747
Tel 631 249 7600
Fax 631 249 7610

Our Ref.:
NY001496.1212.SGSI4

Date:
February 24, 2012

ARCADIS

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2011 Annual Summary

1. Introduction

Pursuant to the Administrative Order on Consent (AOC) Index # W1-0018-04-01 (NYSDEC 2005), ARCADIS of New York, Inc. (ARCADIS), on behalf of Northrop Grumman Systems Corporation (Northrop Grumman), has prepared this Operable Unit 3 (OU3) Soil Gas Interim Remedial Measure (soil gas IRM) Operation, Maintenance, and Monitoring (OM&M) 2011 Annual Summary Report for submittal to the New York State Department of Environmental Conservation (NYSDEC). The present day Bethpage Community Park property (Park) and the Former Grumman Plant 24 Access Road, which the NYSDEC has termed the "Former Grumman Settling Ponds Area" and designated as OU3, are referred to herein as the "Site Area". A Site Area location map is provided on Figure 1.

The soil gas IRM has been operational since February 18, 2008. This OM&M report summarizes the soil gas IRM activities conducted, data collected, system alarms, conclusions, recommendations, and engineering certification for the soil gas IRM during 2011 (i.e. from January 6 to December 31, 2011). Additionally, this report summarizes the OM&M activities performed during the 4th Quarter of 2011 (i.e. October 1 through December 31, 2010 [the "reporting period"]). Detailed OM&M summaries for the previous three 2011 operational quarterly periods are available in the following reports (2011 Quarterly Reports):

- Quarterly OM&M Report for the Soil Gas IRM, January to March 2011 (ARCADIS 2011c)
- Quarterly OM&M Report for the Soil Gas IRM, June 2011 (ARCADIS 2011d)
- Quarterly OM&M Report for the Soil Gas IRM, September 2011 (ARCADIS 2011e)

During 2011, the soil gas IRM system OM&M was conducted in accordance with the NYSDEC-approved OU3 Soil Gas IRM OM&M Manual (ARCADIS 2009) and the NYSDEC-approved Sampling and Analysis Plan (SAP) (ARCADIS 2008).

As discussed in the OU3 Site Area Remedial Investigation Report (Site Area RI) (ARCADIS 2011a), Northrop Grumman does not take responsibility for Freon 12 and Freon 22, which are present in the Site Area. Throughout this report, a distinction is made between the "project" and "non-project" Volatile Organic Compounds (VOCs), which are defined as follows:

- "Project VOCs": VOCs that may be related to former Grumman historical activities. For this report, Project VOCs include 1,1,1-Trichloroethane; 1,1-Dichloroethane; 1,2- Dichloroethane; 1,1-Dichloroethene; Tetrachloroethene; Trichloroethene; Vinyl Chloride; cis-1,2-Dichloroethene; trans-1,2-Dichloroethene; Benzene; Toluene; and Total Xylenes.

- "Non-project VOCs": VOCs, such as Freon 12 and Freon 22 that are not related to former Grumman activities but have been detected in the Site Area. As noted in the Site Area RI (ARCADIS 2011a), a sub-plume of Freon 22 has been identified originating from the area of the Town of Oyster Bay's (Town's) former ice rink. Based on Town information (Zervos, Theodore 2007), Freon 22 was used and released to the environment.

2. Soil Gas Interim Remedial Measure System Description and Objectives

The soil gas IRM was constructed in accordance with the NYSDEC-approved (NYSDEC 2007) Soil Gas IRM 95% Design Report and Design Drawings (ARCADIS 2007). A general site plan that shows the treatment building that houses the major process equipment (two [2] 20-horsepower [hp] and one [1] 30-hp regenerative-type depressurization blowers, three [3] 52-gallon moisture separators and associated transfer pumps, one [1] heat exchanger, and one [1] 33-foot tall by 16-inch diameter stack) and the 18 depressurization well and 47 induced vacuum monitoring well locations is provided on Figure 2. Monitoring well 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 2009).

The remedial action objectives of the soil gas IRM are as follows:

- To mitigate the off-site migration of project VOCs in the on-site soil gas through the implementation of a soil gas control system installed along the former Plant 24 access roads south and west of the Park.

- To comply with applicable NYSDEC Standards, Criteria and Guidelines (SCGs).

The performance objectives of the soil gas IRM are as follows:

- To mitigate the offsite migration of soil gas, the system was designed to maintain 0.1 inches of water column (iwc) of negative pressure within a negative pressure

curtain established along the former Plant 24 southern and western access roads, based on a twelve-month rolling average.

- To, initially, collect and treat vapors 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 2010). On December 29, 2008, NYSDEC approved removal of vapor phase treatment (NYSDEC 2008).

- To collect and transfer collected condensate to the point of discharge under the existing approval for OU3 wells. The point of discharge ultimately discharges to the Town of Oyster Bay's Cedar Creek treatment facility. Condensate transfer activities are to be completed in accordance with the requirements set forth by the Nassau County Department of Public Works (NCDPW 2007; NCDPW 2008).

3. Operation and Maintenance Activities

3.1 Fourth Quarter 2011

In general, the soil gas IRM operated continuously during the reporting period. Routine monthly operation and maintenance (O&M) activities 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.

Troubleshooting activities were completed on December 6 and 22, 2011 to assess the cause of the measured low induced vacuum at compliance monitoring wells VMCW-18A and VMCW-18B. It was determined that condensate accumulation in the Depressurization Well DW-11S subsurface pipeline is preventing the induced vacuum at compliance monitoring wells VMWC-18A and VMWC-18B from reaching their design values of -0.1 inches of water column (iwc). To address this issue, a subsurface depressurization well pipeline condensate removal event has been scheduled for the next reporting period.

3.2 2011 Annual System Performance and Alarm Summary

In general, except as described below, the soil gas IRM operated continuously during 2011 with scheduled system shut downs for routine maintenance activities. Routine monthly O&M activities conducted throughout 2011 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 2009). Additionally, the following non-routine maintenance activities or system shut downs occurred during 2011:

- The system shut down for approximately four days from January 6 to 10, 2011 as a result of a heat exchanger high-effluent-temperature alarm condition (TAH-602). It was determined that the heat exchanger effluent temperature transmitter (TT-602) had malfunctioned, likely as a result of snow accumulation on and around the transmitter. The alarm condition was cleared and the system was restarted and monitored throughout the remainder of the reporting period; without a reoccurrence of this alarm condition.

- To address the low flow rate at Depressurization Well DW-11S and the accompanying low induced vacuum at compliance monitoring point VMCW-18A measured during the December 2010 quarterly monitoring event, a subsurface depressurization well pipeline condensate removal event was conducted on March 31, 2011. Approximately 300 gallons of condensate and/or storm water were removed from depressurization pipelines. On June 15, 2011, the existing condensate stored in Storage Tank ST-510 (100 gallons) was transferred to the Nassau County publicly owned treatment works (POTW) intake for disposal, in accordance with the existing Nassau County Department of Public Works approval letter (NCDPW 2008).

- The system was manually shut down for approximately three days between August 26 and 29, 2011 as a preventative measure to avoid potential system damage from a tropical storm passing through the area.

Additional details of the maintenance activities described above are provided in the 2011 quarterly OM&M report (ARCADIS 2011c, ARCADIS 2011d, and ARCADIS 2011e). Discussions of the routine monitoring program and results are provided in the subsequent sections of this report.

4. Monitoring Activities and Results

The following subsections of this report summarize the monitoring activities and results of routine performance and compliance monitoring for the reporting period. An annual summary of the routine performance and compliance monitoring activities performed during 2011 is also provided in Section 4.2.

The objectives of the performance monitoring program are to demonstrate that the system components are operating in accordance with the manufacturer's specifications and that the operating parameters are within acceptable operating ranges, as provided in revised Table 3 from the OM&M Manual (ARCADIS 2011b). The objective of the compliance monitoring program (consisting of the collection of compliance-related induced vacuum readings and effluent vapor/water samples) is to demonstrate compliance with the design objectives described in Section 2.

4.1 Fourth Quarter 2011 Monitoring Activities and Results

4.1.1 Routine Performance Monitoring

The routine performance monitoring event was completed on December 5, 2011 (hereinafter referred to as the "December monitoring event"). A brief discussion of the monitoring methodology and results are provided below.

4.1.1.1 System Operating Parameters

System operating parameters measured during the December monitoring event are summarized in Tables 1 and 2, and except as summarized below, are generally consistent with the values provided in the revised Table 3 from the OM&M Manual (ARCADIS 2011b). Additionally, during the reporting period, system components operated in general accordance with manufacturers' recommendations, no condensate water was generated through normal system operation, and the heat exchanger influent temperature remained lower than the design influent temperature (i.e., 150 degrees Fahrenheit). Accordingly, the heat exchanger was kept on stand-by.

System operating parameters that were not consistent with the values provided in the revised Table 3 from the OM&M Manual (ARCADIS 2011b) are as follows:

- Depressurization Well DW-10S had a flow rate and a manifold vacuum slightly lower than the minimum recommended ranges.

- Compliance related monitoring points VMWC-18A and VMWC-18B had induced vacuums lower than the minimum recommended ranges.

Based on assessments conducted on December 6 and 22, 2011, the observed changes in flow rate, manifold vacuum and induced vacuum are likely the result of condensate and/or storm water accumulation in the subsurface piping and normal

seasonal fluctuation. As previously described, a subsurface depressurization well pipeline condensate removal event has been scheduled for the next reporting period.

4.1.1.2 Vapor Sample

The total effluent screening level vapor sample photoionization detector (PID) reading measured during the reporting period is provided in Table 1. The screening result was less than the detection limit, which is consistent with September 2011 and historical data.

4.1.2 Routine Compliance Monitoring

Routine compliance monitoring was conducted during the December monitoring event. A brief discussion of the compliance monitoring results is provided below.

4.1.2.1 System Operating Parameters

Instantaneous vacuum measurements in compliance monitoring wells from the December monitoring event and annual time-weighted rolling averages are summarized in Table 2; these measurements are also shown (in text box format) on Figure 2. The soil gas IRM design objectives are outlined in Section 2.

As shown on Table 2, the negative pressure annual time-weighted rolling average at all compliance related monitoring points, except for VMWC-18A, is greater than or equal to -0.1iwc (the December monitoring event average negative pressure was -0.15 iwc). The annual time-weighted rolling average at VMWC-18A through December 2011 was -0.078 iwc. As discussed in Section 3.1, a subsurface condensate removal event has been scheduled for the next reporting period to address this situation. It should be noted that a constant vacuum was maintained at VMWC-18A during the reporting period, and the fourth quarter data (-0.048 iwc) indicate the vacuum is sufficient to prevent soil gas from migrating off-site, as typical industry guidance recommends a negative pressure of -0.035 iwc for the control of soil vapor (USEPA 1993).

4.1.2.2 Vapor Sample

A total effluent vapor sample was collected from the total effluent sample location (VSP-601) on December 5, 2011. As shown in the laboratory results in Table 3 and Appendix A, the total volatile organic compound (TVOC) concentration of 1,407 micrograms per cubic meter (µg/m3) decreased when compared with the September

2011 concentration (1,819 µg/m3) but remained consistent with historical data. The Project TVOC concentration (1,152 µg/m3) and Non Project TVOC concentration (255 µg/m3) also decreased when compared with the September 2011 concentrations (1,329 µg/m3 and 490 µg/m3, respectively) but remained consistent with historical data.

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 October 18, 2010), i.e., benzene and vinyl chloride, were detected in the effluent vapor sample during the December monitoring event at concentrations of 2.5 and 1.6 ug/m3, respectively. These concentrations result in mass emission rates of 5.63×10^{-6} and 3.60×10^{-6} pounds per hour (lbs/hr), respectively, which are well below the NYSDEC recommended action level of 0.01 lbs/hr.

Air emissions modeling, completed to confirm compliance with applicable air discharge standards, is discussed in Section 5 of this report.

Two TICs, one of which has not been detected during recent sampling events, were identified by the laboratory (Appendix A). TICs will be monitored and evaluated for trends during future monitoring events.

4.1.2.3 Condensate Samples

A compliance monitoring condensate sample was not collected for laboratory analysis during the reporting period. Nonetheless, a table that indicates no samples were collected during the reporting period is provided as Table 4. A similar appendix table has been provided in Appendix B.

4.2 2011 Annual Summary of Monitoring Activities and Results

4.2.1 2011 Annual Summary of Routine Performance Monitoring

Discussion of the routine quarterly performance monitoring events performed during 2011 is provided below.

4.2.1.1 System Operating Parameters

Similar to the reporting period, system performance monitoring completed in 2011 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 and within their respective operating ranges provided in revised Table 3 from the OM&M Manual (ARCADIS 2011b). A detailed description of changes in system operating parameters is included in each monitoring periods respective quarterly OM&M report (ARCADIS 2011c, ARCADIS 2011d, and ARCADIS 2011e).

4.2.1.2 Vapor Sample

The total effluent screening level vapor sample photoionization detector (PID) readings measured during 2011 are provided in Table 1. The screening results were less than the detection limit, which is consistent with 2010 and historical data.

4.2.2 Routine Compliance Monitoring

Similar to the reporting period, system compliance monitoring completed in 2011 consisted of the collection of system compliance vapor samples and the collection of compliance-only induced vacuum readings.

4.2.2.1 System Operating Parameters

Instantaneous vacuum readings measured in compliance monitoring wells during 2011 and the annual time-weighted rolling averages are summarized in Table 2. The soil gas IRM design objectives are outlined in Section 2.

Key compliance monitoring results from 2011 include the following:

- As of December 5, 2011, the time-weighted rolling average induced vacuum for all compliance related monitoring points, with the exception of VMWC-18A, was greater than or equal to the design objective of -0.1 iwc. The annual time-weighted rolling average at VMWC-18A was -0.078 iwc. As discussed in Section 4.1.2.1, a subsurface condensate removal event has been scheduled for the next reporting period to address this situation. The goal of the planned condensate removal event is to remove accumulated condensate from the subsurface depressurization well

pipelines and returning the induced vacuum at VMWC-18A to greater than or equal to -0.1 iwc.

4.2.2.2 Vapor Sample

As shown in the laboratory results in Table 3 and Appendix A, the TVOC concentration of the effluent vapor stream remained relatively constant during 2011 and historical data. All emissions were below applicable discharge criteria during all monitoring events as discussed in Section 5 of this report.

- Two environmentally "A" rated compounds (i.e., benzene, and vinyl chloride), were detected in the effluent vapor during 2011. It should be noted that the mass emission rates for "A" rated compounds were well below the NYSDEC recommended action level of 0.01 lb/hr. Therefore, no treatment is required (ARCADIS 2011c, ARCADIS 2011d, and ARCADIS 2011e).

- Several TICs were identified on an inconsistent basis during 2011. ARCADIS will continue to monitor TIC concentrations and will evaluate corrective actions as necessary.

4.2.2.3 Condensate Samples

A routine condensate sample was collected for laboratory analysis from the Storage Tank ST-510 (sample ID SVE Condensate) location on March 31, 2011. In addition, a non-routine condensate sample was collected as a composite grab sample (sample ID ST-510) from the 300-gallons of condensate water generated during the March 2011 pipeline condensate removal event. As shown in Table 4 and Appendix B, the TVOC concentrations in the two samples were below the discharge criteria set forth in the Nassau County Department of Public Works approval letter (NCDPW 2008) (i.e., 1,000 micrograms per liter [ug/L] of TVOCs).

5. Air Emissions Model

Effluent vapor laboratory analytical results were compared to the NYSDEC DAR-1 SGCs during each monitoring event in 2011 including the October to December 2011 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 USEPA SCREEN 3 model in conjunction with the

NYSDEC DAR-1 AGCs. 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. A 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.

The soil gas IRM effluent vapor met applicable air discharge criteria based on the following:

- The measured concentrations of individual VOCs in the effluent did not exceed applicable SGCs (Table 3).

- The measured concentration of individual VOCs in the effluent did not exceed applicable instantaneous MASCs, as calculated using the USEPA SCREEN 3 Model (Table 5). Similarly, the time-weighted rolling average for all detected compounds is well below the MASCs.

- Two environmentally "A" rated compounds (i.e., benzene, and vinyl chloride) were detected in the effluent vapor during 2011. As described previously, the mass emission rates for benzene, and vinyl chloride were well below the NYSDEC recommended action level of 0.01 lb/hr for 2011. Therefore, no treatment is required.

6. Conclusions and Recommendations

6.1 Conclusions

- Based on the information provided herein, ARCADIS concludes that the soil gas IRM met or exceeded all design objectives summarized in Section 2 of this report as follows:

    - The soil gas IRM maintained 0.1 iwc of negative pressure within all induced vacuum monitoring points based on a twelve-month rolling average (through December 2011), with the exception of monitoring well VMWC-18A, which had

a twelve-month rolling average of -0.078 iwc. As previously discussed, collectively, the data indicates system vacuum was sufficient to prevent soil gas from migrating off-site.

- Vapor emissions met applicable guidance and regulatory criteria during the reporting period.

6.2 Recommendations

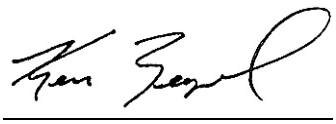
Based on the information provided herein, ARCADIS makes the following recommendations for 2012:

- Continue operation of the soil gas IRM.
- Remove accumulated condensate from the subsurface depressurization well pipelines to address the low induced vacuum values at compliance monitoring wells VMCW-18A and VMWC-18B.

7. 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.



Kenneth Zegel, P.E.
Senior Engineer
License # 081598-1

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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					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	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)
03/07/11	90	-23	44	NM	-1.6	6.0	-8.0	45	NM	-0.45	5.5	-7.0	49	NM	-0.21(3)	10	-7.0	46	NM	-0.41(3)	80	-21	45	NM	-1.4(3)	15	-11	45	NM	-2.7(3)
06/06/11	71	-16	64	NM	-1.2	7.0	-7.9	66	NM	-0.41	8.0	-8.4	64	NM	-0.30	14	-7.5	66	NM	-0.44	93	-17	64	NM	-1.5	14	-9.5	66	NM	-2.2
09/19/11	72	-16	67	NM	-1.3	7.0	-7.8	66	NM	-0.37	7.0	-8.5	67	NM	-0.29	13	-7.3	66	NM	-0.42	95	-18	67	NM	-1.7	14	-9.5	66	NM	-2.1
12/05/11	105	-21	53	NM	-1.5	8.0	-8.5	53	NM	-0.47	6.0(6)	-5.0(6)	54	NM	-0.29	15	-8.0	54	NM	-0.42	90	-20	54	NM	-1.7	15	-11	(7)	NM	-2.8

Notes and Abbreviations:

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

1. The system has been operating with Blower BL-300 online only since May 5, 2009.
2. Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in standard cubic feet per minute was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.
3. Values were remeasured on March 14, 2011 due to erroneous values recorded on March 7, 2011.
4. Totalizers not recording flow due to fouling. There was no condensate collected in Storage Tank ST-510 between March 7 and June 6, 2011.
5. Totalizers not recording flow due to fouling. There was no condensate collected in Storage Tank ST-510 between June 6 and September 19, 2011.
6. Values were remeasured on December 22, 2011 due to erroneous values recorded on December 5, 2011.
7. Temperature reading not recorded.
8. Totalizer removed and cleaned during the fourth quarter 2011 due to fouling. This accounts for the high volume of water recovered calculated using the two consecutive totalizer readings. Actual volume of water recovered was zero gallons based on measurements from Storage Tank ST-510.

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.

Date	Extraction Well DW-6S Parameters					Extraction Well DW-6D Parameters				
	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)
03/07/11	90	-19	46	NM	-1.8	6.3	-5.5	47	NM	-1.5(3)
06/06/11	95	-17	64	NM	-1.8	7.8	-5.5	66	NM	-1.6
09/19/11	100	-17	67	NM	-2.1	7.5	-5.5	66	NM	-1.7
12/05/11	93	-19	(7)	NM	-2.0	8.2	-6.0	(7)	NM	-1.8

Date	Extraction Well DW-1S Parameters					Extraction Well DW-1D Parameters				
	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)
03/07/11	93	-24	46	NM	-2.3	6.2	-3.4	NM	NM	-1.8
06/06/11	81	-23	64	NM	-2.0	6.1	-4.0	66	NM	-1.7
09/19/11	95	-27	67	NM	-2.2	6.0	-3.5	66	NM	-1.8
12/05/11	95	-22	(7)	NM	-2.3	6.7	-4.0	(7)	NM	-2.0

Date	Extraction Well DW-4S Parameters					Extraction Well DW-4D Parameters				
	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)
03/07/11	82	-16	47	NM	-1.7	8.0	-6.3	47	NM	-0.87(3)
06/06/11	67	-15	64	NM	-1.6	5.0	-12	66	NM	-0.62
09/19/11	68	-15	66	NM	-1.4	8.0	-6.0	66	NM	-0.76
12/05/11	83	-16	(7)	NM	-1.7	9.0	-6.0	(7)	NM	-0.84

Notes and Abbreviations:

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

1. The system has been operating with Blower BL-300 online only since May 5, 2009.
2. Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in standard cubic feet per minute was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.
3. Values were remeasured on March 14, 2011 due to erroneous values recorded on March 7, 2011.
4. Totalizers not recording flow due to fouling. There was no condensate collected in Storage Tank ST-510 between March 7 and June 6, 2011.
5. Totalizers not recording flow due to fouling. There was no condensate collected in Storage Tank ST-510 between June 6 and September 19, 2011.
6. Values were remeasured on December 22, 2011 due to erroneous values recorded on December 5, 2011.
7. Temperature reading not recorded.
8. Totalizer removed and cleaned during the fourth quarter 2011 due to fouling. This accounts for the high volume of water recovered calculated using the two consecutive totalizer readings. Actual volume of water recovered was zero gallons based on measurements from Storage Tank ST-510.

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.

Date	Extraction Well DW-8S Parameters					Extraction Well DW-9S Parameters				
	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)
03/07/11	80	-26	47	NM	-2.4	32	-14	48	NM	-1.4
06/06/11	84	-23	64	NM	-2.3	31	-14	64	NM	-1.2
09/19/11	83	-22	65	NM	-2.4	31	-14	65	NM	-1.3
12/05/11	70	-25	[7]	NM	-2.1	35	-15[6]	[7]	NM	-1.6

Date	Extraction Well DW-2S Parameters					Extraction Well DW-2D Parameters				
	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)
03/07/11	34	-25	48	NM	-2.0	36	-24	47	NM	-2.6
06/06/11	37	-21	64	NM	-1.6	41	-26	66	NM	-2.7
09/19/11	32	-22	65	NM	-1.7	42	-26	65	NM	-2.9
12/05/11	33[6]	-22[6]	[7]	NM	-1.8	44	-29	[7]	NM	-3.0

Date	Extraction Well DW-10S Parameters					Extraction Well DW-11S Parameters				
	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)
03/07/11	33	-11	49	NM	-2.1	15	-29	49	NM	-1.2[3]
06/06/11	31	-14	64	NM	-1.7	31	-26	64	NM	-2.4
09/19/11	30	-15	64	NM	-1.8	29	-26	65	NM	-2.3
12/05/11	25	-10[6]	[7]	NM	-0.9	35[6]	-22[6]	[7]	NM	-1.3

Notes and Abbreviations:

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

1. The system has been operating with Blower BL-300 online only since May 5, 2009.
2. Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in standard cubic feet per minute was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.
3. Values were remeasured on March 14, 2011 due to erroneous values recorded on March 7, 2011.
4. Totalizers not recording flow due to fouling. There was no condensate collected in Storage Tank ST-510 between March 7 and June 6, 2011.
5. Totalizers not recording flow due to fouling. There was no condensate collected in Storage Tank ST-510 between June 6 and September 19, 2011.
6. Values were remeasured on December 22, 2011 due to erroneous values recorded on December 5, 2011.
7. Temperature reading not recorded.
8. Totalizer removed and cleaned during the fourth quarter 2011 due to fouling. This accounts for the high volume of water recovered calculated using the two consecutive totalizer readings. Actual volume of water recovered was zero gallons based on measurements from Storage Tank ST-510.

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[1] BL-200				Blower Parameters[1] BL-300				Blower Parameters[1] 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[2]	Total Influent PID	Heat Exchanger Influent Temp.	Total Effluent Pressure	Heat Exchanger Effluent Temp.	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)
03/07/11	0	-25	0	132.67	9,996,285.25	36.94	NM	NM	NM	NM	-35.0	2.0	NM	NM	NM	NM	NM	NM	761.48	0.0	90.0	2.5	72	NM	NM	NM	53.50	49.32	54.52	38.13	18.43
06/06/11	0	-27	0	132.67	9,996,285.25[4]	36.94	NM	NM	NM	NM	-34.0	2.0	NM	NM	NM	NM	NM	NM	582.94	0.0	105	2.5	96	NM	NM	NM	52.20	48.98	53.38	38.10	NM
09/19/11	0	-28	0	132.67	9,996,285.25[5]	36.94	NM	NM	NM	NM	-32.0	2.0	NM	NM	NM	NM	NM	NM	572.16	0.0	110	2.5	92	NM	NM	NM	51.62	49.32	52.65	38.18	18.44
12/05/11	0	-32	0	132.67	10,000,177.33[8]	36.94	NM	NM	NM	NM	-38.0	3.0	NM	NM	NM	NM	NM	NM	589.90[6]	0.0	100[6]	2.5	80	NM	NM	NM	51.34	48.23	52.41	38.19	18.19

Notes and Abbreviations:

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

1. The system has been operating with Blower BL-300 online only since May 5, 2009.
2. Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in standard cubic feet per minute was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.
3. Values were remeasured on March 14, 2011 due to erroneous values recorded on March 7, 2011.
4. Totalizers not recording flow due to fouling. There was no condensate collected in Storage Tank ST-510 between March 7 and June 6, 2011.
5. Totalizers not recording flow due to fouling. There was no condensate collected in Storage Tank ST-510 between June 6 and September 19, 2011.
6. Values were remeasured on December 22, 2011 due to erroneous values recorded on December 5, 2011.
7. Temperature reading not recorded.
8. Totalizer removed and cleaned during the fourth quarter 2011 due to fouling. This accounts for the high volume of water recovered calculated using the two consecutive totalizer readings. Actual volume of water recovered was zero gallons based on measurements from Storage Tank ST-510.

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]
03/07/11	-0.15	-0.16	-0.17	NM	NM	NM	-0.13[6]	NM	NM	-0.12[6]	-0.14[6]	-0.13[6]	-0.15[6]	NM	NM	NM	-0.19	NM	NM	-0.18	NM	NM	NM	-0.20
06/06/11	-0.088	-0.16	-0.15	NM	NM	NM	-0.11	NM	NM	-0.11	-0.14	-0.14	-0.14	NM	NM	NM	-0.14	NM	NM	-0.15	NM	NM	NM	-0.16
09/19/11	-0.092	-0.11	-0.11	NM	NM	NM	-0.11	NM	NM	-0.10	-0.13	-0.13	-0.13	NM	NM	NM	-0.13	NM	NM	-0.14	NM	NM	NM	-0.14
12/05/11	-0.11	-0.19	-0.20	NM	NM	NM	-0.15	NM	NM	-0.15	-0.11	-0.11	-0.14	NM	NM	NM	-0.13	NM	NM	-0.14	NM	NM	NM	-0.15
Time Weighted[4] Rolling Average:	-0.11	-0.15	-0.16	NA	NA	NA	-0.12	NA	NA	-0.12	-0.13	-0.13	-0.14	NA	NA	NA	-0.15	NA	NA	-0.15	NA	NA	NA	-0.16

Gross Average Compliance Points[5]

12/05/11	-0.15

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). Values shown have been rounded to include two significant figures.
2. Compliance goal is -0.1 iwc induced vacuum at all compliance monitoring points.
3. Compliance related monitoring point.
4. Time weighted average calculated by summing the products of the instantaneous induced vacuum readings and the number of days between readings for a 12-month monitoring period, and dividing by the total time period between the first and last quarterly induced vacuum readings.
5. Gross average compliance points calculated by summing the induced vacuum values for the noted monitoring event and dividing by the number of readings.
6. Values were remeasured on March 14, 2011 due to erroneous values recorded on March 7, 2011.
7. Values were remeasured on December 6, 2011 due to erroneous values recorded on December 5, 2011.
8. Value was remeasured on December 22, 2011 due to erroneous values recorded on December 5 and 6, 2011.

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]	
03/07/11	NM	NM	NM	-0.31	-0.19[6]	-0.23	-0.22	NM	NM	NM	-0.34	NM	NM	NM	-0.24	NM	NM	NM	NM	-0.22	-0.25	-0.048	-0.19	
06/06/11	NM	NM	NM	-0.21	-0.23	-0.070	-0.19	NM	NM	NM	-0.10	NM	NM	NM	-0.12	NM	NM	NM	NM	-0.28	-0.24	-0.11	-0.17	
09/19/11	NM	NM	NM	-0.20	-0.20	-0.19	-0.21	NM	NM	NM	-0.12	NM	NM	NM	-0.13	NM	NM	NM	NM	-0.17	-0.27	-0.10	-0.12	
12/05/11	NM	NM	NM	-0.22	-0.21	-0.18	-0.20	NM	NM	NM	-0.10[7]	NM	NM	NM	-0.10[7]	NM	NM	NM	NM	-0.25	-0.23	-0.048	-0.039[8]	
Time Weighted[4] Rolling Average:	NA	NA	NA	-0.23	-0.21	-0.17	-0.21	NA	NA	NA	-0.17	NA	NA	NA	-0.15	NA	NA	NA	NA	-0.23	-0.25	-0.078	-0.13	

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). Values shown have been rounded to include two significant figures.
2. Compliance goal is -0.1 iwc induced vacuum at all compliance monitoring points.
3. Compliance related monitoring point.
4. Time weighted average calculated by summing the products of the instantaneous induced vacuum readings and the number of days between readings for a 12-month monitoring period, and dividing by the total time period between the first and last quarterly induced vacuum readings.
5. Gross average compliance points calculated by summing the induced vacuum values for the noted monitoring event and dividing by the number of readings.
6. Values were remeasured on March 14, 2011 due to erroneous values recorded on March 7, 2011.
7. Values were remeasured on December 6, 2011 due to erroneous values recorded on December 5, 2011.
8. Value was remeasured on December 22, 2011 due to erroneous values recorded on December 5 and 6, 2011.

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)		Sample ID: / Sample Date:	VSP-601 3/7/2011	VSP-601 6/8/2011[6]	VSP-601 9/19/2011	VSP-601 12/5/2011
Project VOCs	CAS No.	SGC				
1,1,1-Trichloroethane	71-55-6	9,000	**17**	**11**	**17**	**11**
1,1-Dichloroethane	75-34-3	NS	**13**	**11**	**14**	**11**
1,1-Dichloroethene	75-35-4	380[4]	**4.9**	**5.7**	**4.3**	**3.3**
Benzene	71-43-2	1,300	< 4.4	< 0.78	< 1.6	**2.5**
cis-1,2-Dichloroethene	156-59-2	190,000[5]	**680**	**620 D**	**580 D**	**540 D**
Tetrachloroethene	127-18-4	1,000	**15**	**21**	**25**	**15**
Toluene	108-88-3	37,000	< 4.4	< 0.78	< 1.6	**1.8**
trans-1,2-Dichloroethene	156-60-5	190,000[5]	< 4.4	**4.8**	**6.5**	**3.8**
Trichloroethylene	79-01-6	14,000	**670**	**590 D**	**680 D**	**560 D**
Vinyl chloride	75-01-4	180,000	< 4.4	**1.3**	**1.7**	**1.6**
Xylenes - M,P	1330-20-7	4,300	< 8.8	< 1.6	< 3.2	**1.6**
Subtotal Project VOCs			**1,400**	**1,265**	**1,329**	**1,152**
Non-Project VOCs						
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3	NS	**210**	**560 D**	**360 D**	**150 D**
Acetone	67-64-1	180,000	< 44	**14**	< 16	< 7.5
Bromodichloromethane	75-27-4	NS	< 4.4	< 0.78	< 1.6	**1.1**
Chlorodifluoromethane (Freon 22)	75-45-6	NS	**95**	**24**	**25**	**17**
Chloroform	67-66-3	150	**40**	**23**	**98**	**83**
Dichlorodifluoromethane (Freon 12)	75-71-8	NS	< 4.4	**3.2**	**5.3**	**2.6**
Trichlorofluoromethane (Freon 11)	75-69-4	9,000	< 4.4	**1.7**	**1.9**	**1.4**
Subtotal Non-Project VOCs			**345**	**626**	**490**	**255**
TVOC[3]			**1,745**	**1,891**	**1,819**	**1,407**

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:

AGC	Annual guideline concentration.
Bold	Compound detected above method detection limit.
CAS No.	Chemical abstracts service list number.
D	Compound detected at a secondary dilution.
DAR-1	Division of Air Resources-1.
NS	Guideline concentrations not specified in the NYSDEC DAR-1 AGC/SGC tables revised October 18, 2010. 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 October 18, 2010.
NYSDEC	New York State Department of Environmental Conservation.
SGC	Short-term guideline concentrations specified in the NYSDEC DAR-1 AGC/SGC tables revised October 18, 2010.
TVOC	Total volatile organic compounds.
$\mu g/m^3$	Micrograms per cubic meter.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to Columbia Analytical Services Laboratory (Simi Valley, CA) for volatile organic compound analyses using United States Environmental Protection Agency Method TO-15 modified in accordance with the project Sampling and Analysis Plan (ARCADIS 2008). Data presented in this table corresponds to the past year of system operation.
2. Table summarizes detected compounds only.
3. TVOC 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 October 18, 2010. 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 $\mu g/m^3$ / 4.2 = approximately 380 $\mu g/m^3$. 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 October 18, 2010.
5. An SGC was not provided in the DAR-1 AGC/SGC Tables, dated October 18, 2010. 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 and trans-1,2 dichloroethene, which are not defined as a high-toxicity compounds, the interim SGC = (smaller of Time Weighted Average [TWA] - Threshold Limit Value or TWA - Recommended Exposure Limit)/4.2 or 790,000 $\mu g/m^3$ / 4.2 = approximately 190,000 $\mu g/m^3$. An interim SGC was developed for these compounds because they have moderate toxicity ratings, as specified in the DAR-1 AGC/SGC Tables, dated October 18, 2010.
6. The total effluent vapor sample was collected on June 8, 2011 as a result of a faulty summa canister.

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)	Sample ID: Sample Date:	ST-510 Quarter 1 2011	SVE Condensate[4] 3/29/2011	ST-510[5] 3/31/2011	ST-510 Quarter 3 2011	ST-510 Quarter 4 2011
Project VOCs	CAS No.					
1,1,1-Trichloroethane	71-55-6		< 5.0	< 5.0		
1,1-Dichloroethane	75-34-3		< 5.0	< 5.0		
1,1-Dichloroethene	75-35-4		< 5.0	< 5.0		
Benzene	71-43-2		< 5.0	< 5.0		
cis-1,2-Dichloroethene	156-59-2		< 5.0	**6.0**		
Tetrachloroethene	127-18-4		< 5.0	< 5.0		
Toluene	108-88-3		< 5.0	< 5.0		
trans-1,2-Dichloroethene	156-60-5		< 5.0	< 5.0		
Trichloroethylene	79-01-6		< 5.0	< 5.0		
Vinyl chloride	75-01-4		< 5.0	< 5.0		
Xylenes - M,P	1330-20-7	No Sampling During This Quarter	< 5.0	< 5.0	No Sampling During This Quarter	No Sampling During This Quarter
Subtotal Project VOCs			0.0	**6.0**		
Non-Project VOCs						
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3		< 5.0	< 5.0		
Acetone	67-64-1		< 20	< 20		
Bromodichloromethane	75-27-4		< 5.0	< 5.0		
Chlorodifluoromethane (Freon 22)	75-45-6		< 5.0	< 5.0		
Chloroform	67-66-3		< 5.0	< 5.0		
Dichlorodifluoromethane (Freon 12)	75-71-8		< 5.0	< 5.0		
Trichlorofluoromethane (Freon 11)	75-69-4		< 5.0	< 5.0		
Subtotal Non-Project VOCs			0.0	0.0		
TVOC[3]		NA	0.0	**6.0**	NA	NA

Notes and abbreviations on last page.

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)

Notes and Abbreviations:

Bold	Compound detected above method detection limit.
CAS No.	Chemical abstracts service list number.
NA	Not applicable.
TVOC	Total volatile organic compounds.
µg/L	Micrograms per liter.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to Columbia Analytical Services Laboratory (Rochester, NY) for volatile organic compound analyses using Method 8260 in accordance with the project Sampling and Analysis Plan (ARCADIS 2008). Data presented in this table corresponds to the past year of system operation.
2. Table summarizes compounds detected in the system effluent vapor sample (VSP-601) over the past year of system operation only.
3. TVOC determined by summing individual detections and rounding to the nearest whole number.
4. Sample SVE Condensate was a non-routine condensate sample collected as a composite grab sample from four drums of condensate water that were generated through normal system operation. The condensate water was transferred from storage tank ST-510 into four 55-gallon drums prior to the March 31, 2011 condensate removal event.
5. Sample ST-510 was a non-routine condensate sample collected as a composite grab sample from the condensate water generated during the March 31, 2011 below grade pipeline condensate removal activities.

Table 5. Annual Summary of Air Emissions Model Output, 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]
		3/7/2011	6/8/2011 [5]	9/19/2011	12/5/2011	
1,1,1-Trichloroethane	5,000	0.00%	0.00%	0.00%	0.00%	0.0%
1,1-Dichloroethane	0.63	0.07%	0.05%	0.07%	0.05%	0.060%
1,1-Dichloroethene	70	0.00%	0.00%	0.00%	0.00%	0.0%
Acetone	30,000	0.00%	0.00%	0.00%	0.00%	0.0%
Benzene	0.13	0.00%	0.00%	0.00%	0.06%	0.014%
Bromodichloromethane	70	0.00%	0.00%	0.00%	0.00%	0.0%
Trichlorofluoromethane (Freon 11)	5,000	0.00%	0.00%	0.00%	0.00%	0.0%
Chloroform	0.043	3.22%	1.64%	6.90%	5.68%	4.5%
cis-1,2-Dichloroethene	63	0.04%	0.03%	0.03%	0.03%	0.032%
Dichlorodifluoromethane (Freon 12)	12,000	0.00%	0.00%	0.00%	0.00%	0.0%
Tetrachloroethene	1.0	0.05%	0.06%	0.08%	0.04%	0.060%
Toluene	5,000	0.00%	0.00%	0.00%	0.00%	0.0%
trans-1,2-Dichloroethene	63	0.00%	0.00%	0.00%	0.00%	0.0%
Trichloroethylene	0.5	4.64%	3.63%	4.12%	3.30%	3.9%
Vinyl chloride	0.11	0.00%	0.04%	0.05%	0.04%	0.036%
Xylenes - M,P	100	0.00%	0.00%	0.00%	0.00%	0.0%
Chlorodifluoromethane (Freon 22)	50,000	0.00%	0.00%	0.00%	0.00%	0.0%
1-Chloro-1,1-difluoroethane (Freon 142b)	50,000	0.00%	0.00%	0.00%	0.00%	0.0%

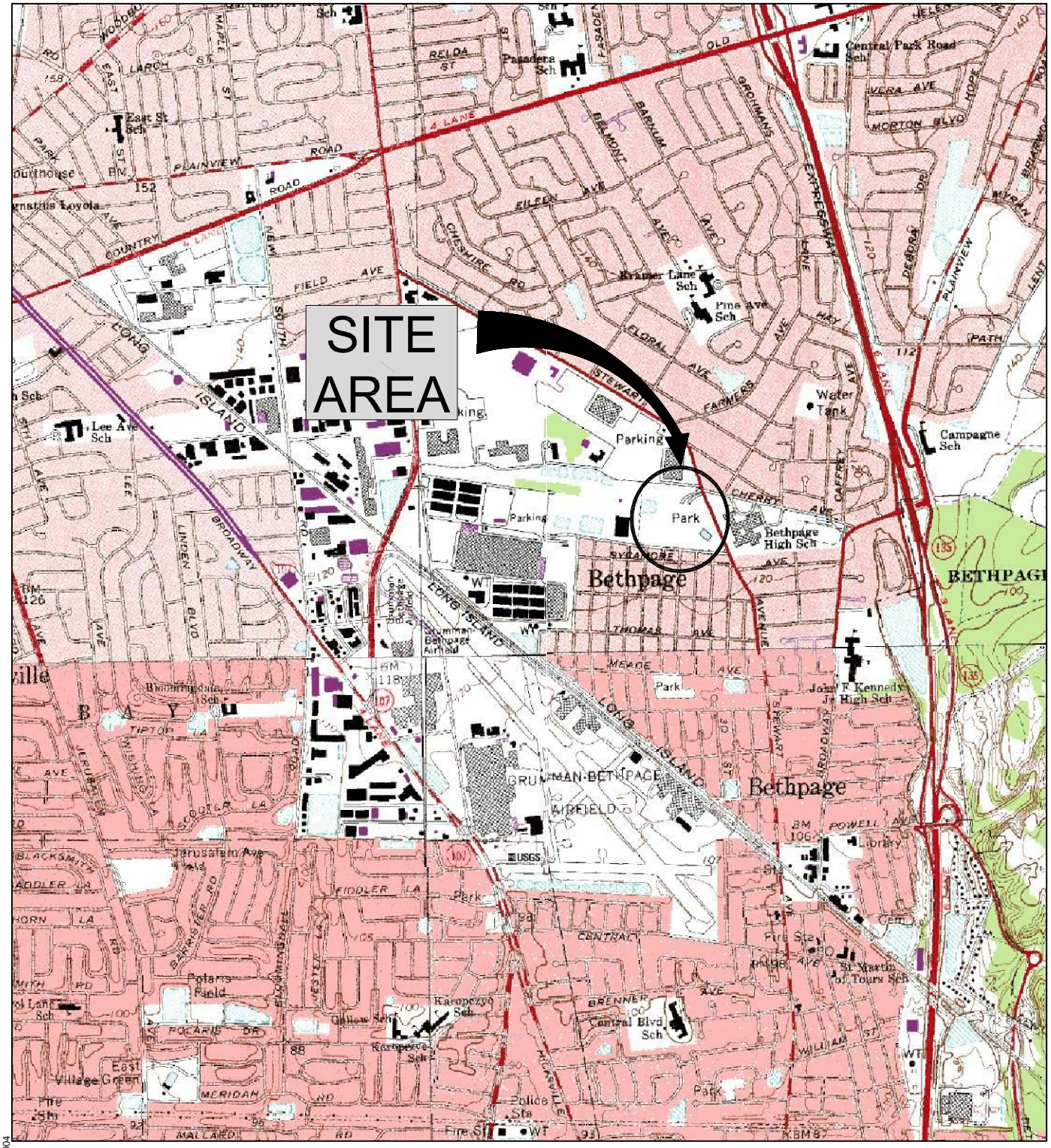
Notes and abbreviations on last page.

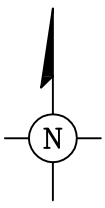
Table 5. Annual Summary of Air Emissions Model Output, Northrop Grumman Operable Unit 3
Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Notes and Abbreviations:

AGC	Annual guideline concentration.
DAR-1	Division of Air Resources-1.
MASC	Maximum allowable stack concentration.
NYSDEC	New York State Department of Environmental Conservation.
SGC	Short-term guideline concentration.
$\mu g/m^3$	Micrograms per cubic meter.

1. Table summarizes detected compounds only.
2. AGC refers to the compound-specific annual guideline concentration per the NYSDEC DAR-1 AGC/SGC tables, revised October 18, 2010. NYSDEC DAR-1 AGCs were scaled using the results of a site-specific United States Environmental Protection Agency 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. Values shown have been rounded to include two significant figures.
5. The total effluent vapor sample was collected on June 8, 2011 as a result of a faulty summa canister.





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

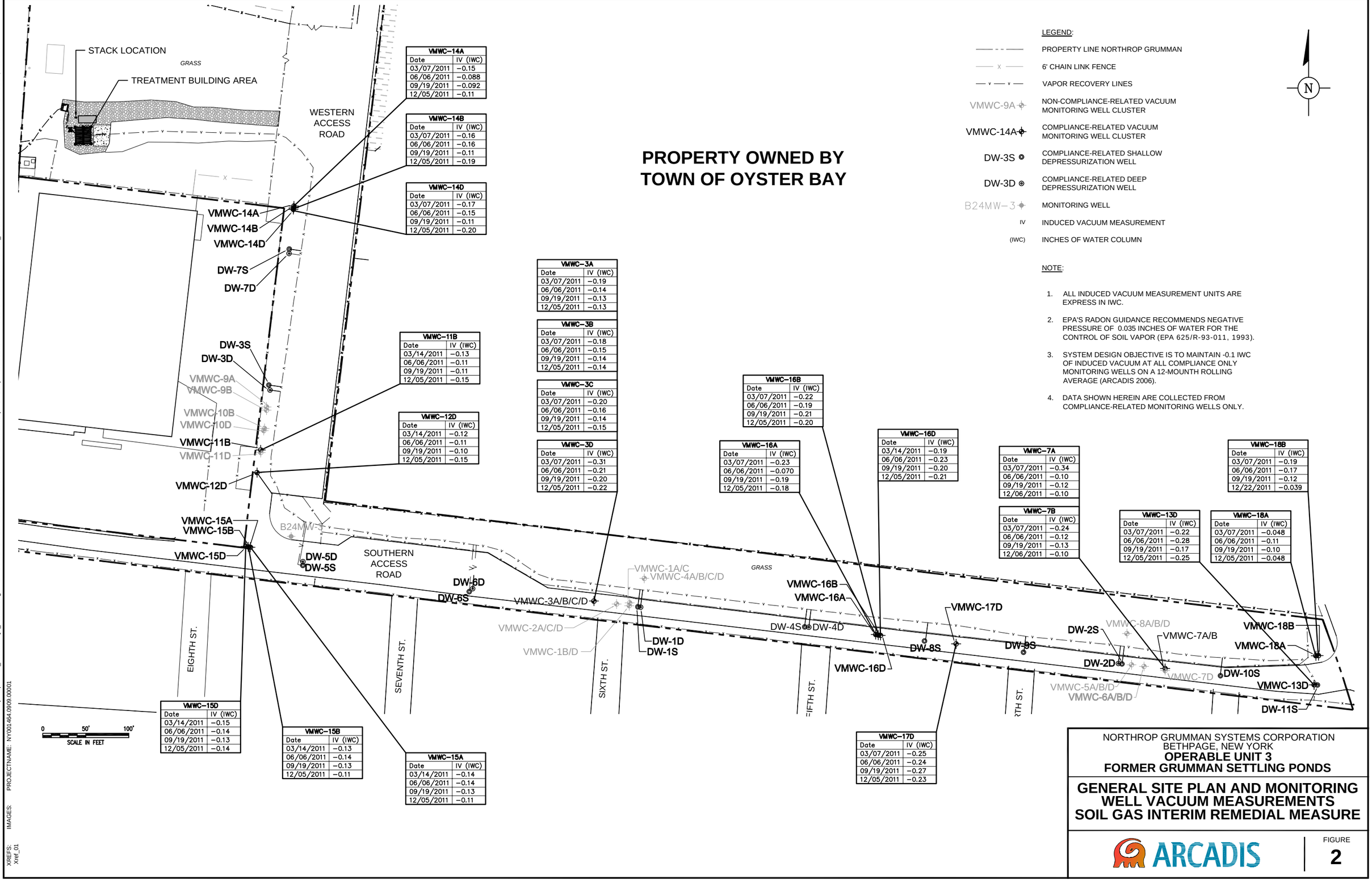
NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

SITE AREA LOCATION MAP
SOIL GAS INTERIM REMEDIAL MEASURE

ARCADIS

FIGURE
1

CITY:MELVILLE-NY DIV/GROUP:ENV/cad DE:ALS LD: PIC: PM:CSG TM:KZ LYR:ON=*;OFF=*REF*
G:\ENVCAD\Melville-NY\ACTIVITY\001496\1211\SGSI\401_Location Map.dwg LAYOUT: 1 SAVED: 2/16/2009 4:00 PM ACADVER: 18.0S (LMS TECH) PAGESETUP: PDF PLOTSTYLETABLE: ARCADIS_MELVILLE.CTB PLOTTED: 5/9/2011 8:37 AM BY: SANCHEZ, ADRIAN
XREFS:
PROJECTNAME: NY001464.0908.00004



VMWC-14A	
Date	IV (IWC)
03/07/2011	−0.15
06/06/2011	−0.088
09/19/2011	−0.092
12/05/2011	−0.11

VMWC-14B	
Date	IV (IWC)
03/07/2011	−0.16
06/06/2011	−0.16
09/19/2011	−0.11
12/05/2011	−0.19

VMWC-14D	
Date	IV (IWC)
03/07/2011	−0.17
06/06/2011	−0.15
09/19/2011	−0.11
12/05/2011	−0.20

VMWC-11B	
Date	IV (IWC)
03/14/2011	−0.13
06/06/2011	−0.11
09/19/2011	−0.11
12/05/2011	−0.15

VMWC-12D	
Date	IV (IWC)
03/14/2011	−0.12
06/06/2011	−0.11
09/19/2011	−0.10
12/05/2011	−0.15

VMWC-15D	
Date	IV (IWC)
03/14/2011	−0.15
06/06/2011	−0.14
09/19/2011	−0.13
12/05/2011	−0.14

VMWC-15B	
Date	IV (IWC)
03/14/2011	−0.13
06/06/2011	−0.14
09/19/2011	−0.13
12/05/2011	−0.11

VMWC-15A	
Date	IV (IWC)
03/14/2011	−0.14
06/06/2011	−0.14
09/19/2011	−0.13
12/05/2011	−0.11

VMWC-3A	
Date	IV (IWC)
03/07/2011	−0.19
06/06/2011	−0.14
09/19/2011	−0.13
12/05/2011	−0.13

VMWC-3B	
Date	IV (IWC)
03/07/2011	−0.18
06/06/2011	−0.15
09/19/2011	−0.14
12/05/2011	−0.14

VMWC-3C	
Date	IV (IWC)
03/07/2011	−0.20
06/06/2011	−0.16
09/19/2011	−0.14
12/05/2011	−0.15

VMWC-3D	
Date	IV (IWC)
03/07/2011	−0.31
06/06/2011	−0.21
09/19/2011	−0.20
12/05/2011	−0.22

VMWC-16B	
Date	IV (IWC)
03/07/2011	−0.22
06/06/2011	−0.19
09/19/2011	−0.21
12/05/2011	−0.20

VMWC-16A	
Date	IV (IWC)
03/07/2011	−0.23
06/06/2011	−0.070
09/19/2011	−0.19
12/05/2011	−0.18

VMWC-16D	
Date	IV (IWC)
03/14/2011	−0.19
06/06/2011	−0.23
09/19/2011	−0.20
12/05/2011	−0.21

VMWC-17D	
Date	IV (IWC)
03/07/2011	−0.25
06/06/2011	−0.24
09/19/2011	−0.27
12/05/2011	−0.23

VMWC-7A	
Date	IV (IWC)
03/07/2011	−0.34
06/06/2011	−0.10
09/19/2011	−0.12
12/06/2011	−0.10

VMWC-7B	
Date	IV (IWC)
03/07/2011	−0.24
06/06/2011	−0.12
09/19/2011	−0.13
12/06/2011	−0.10

VMWC-13D	
Date	IV (IWC)
03/07/2011	−0.22
06/06/2011	−0.28
09/19/2011	−0.17
12/05/2011	−0.25

VMWC-18B	
Date	IV (IWC)
03/07/2011	−0.19
06/06/2011	−0.17
09/19/2011	−0.12
12/22/2011	−0.039

VMWC-18A	
Date	IV (IWC)
03/07/2011	−0.048
06/06/2011	−0.11
09/19/2011	−0.10
12/05/2011	−0.048

PROPERTY OWNED BY TOWN OF OYSTER BAY

LEGEND:

- PROPERTY LINE NORTHROP GRUMMAN
- 6' CHAIN LINK FENCE
- VAPOR RECOVERY LINES
- VMWC-9A — NON-COMPLIANCE-RELATED VACUUM MONITORING WELL CLUSTER
- VMWC-14A — COMPLIANCE-RELATED VACUUM MONITORING WELL CLUSTER
- DW-3S — COMPLIANCE-RELATED SHALLOW DEPRESSURIZATION WELL
- DW-3D — COMPLIANCE-RELATED DEEP DEPRESSURIZATION WELL
- B24MW-3 — MONITORING WELL
- IV — INDUCED VACUUM MEASUREMENT
- (IWC) — INCHES OF WATER COLUMN

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-RELATED MONITORING WELLS ONLY.

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:ENVcad DB:ALS LD: PIC: PM:CSG TM: LYR:ON=*;OFF=*REF* G:\ENVCAD\Melville-NY\ACTIVE\NY001496\0312\GWM\2Q2011 4qtr Report\Fig2_2011VR4Qtr_012012.dwg LAYOUT: 2 SAVED: 1/20/2012 10:52 AM ACADVER: 18.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS_MELVILLE.CTB PLOTTED: 1/24/2012 9:45 AM BY: BEGA, ALBANA
XREFS: IMAGES: PROJECTNAME: NY001.464.0909.00001
Xref_01

DISCHARGE TO ATMOSPHERE

DISCHARGE TO ATMOSPHERE

VSP-602

V-27

TEMPORARY VAPOR PHASE GAC VP-600 (REMOVED FROM OPERATION DECEMBER 2008)

AMBIENT AIR OUTLET

TI 602

TT 602

HEAT EXCHANGER HX-600

ON STANDBY

AMBIENT AIR INLET

PIT 601

PI 601

TI 601

FE

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

LIMIT OF TREATMENT BUILDING 2

WSP-210

SG 200

AIR FILTER AF-200

KNOCK OUT TANK KO-200

VI 201

RECIRCULATION LINE (TYP. OF 3)

FE 210

FQI 210

TRANSFER PUMP TP-210

WSP-310

SG 300

AIR FILTER AF-300

KNOCK OUT TANK KO-300

VI 301

FE 310

FQI 310

TRANSFER PUMP TP-310

WSP-410

SG 400

AIR FILTER AF-400

KNOCK OUT TANK KO-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 116

VI 134 VSP-116 FI 116

VI 135 VSP-117 FI 117

VI 136 VSP-118 FI 118

FE

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 108

DEPRESSURIZATION WELL (TYPICAL OF 7 DEEP)

DEPRESSURIZATION WELL (TYPICAL OF 11 SHALLOW)

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
- FE — FLOW ELEMENT ACCESS
- VI 109 — 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

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)	Sample ID: / Sample Date:	VSP-601 3/7/2011	VSP-601 6/8/2011[3]	VSP-601 9/19/2011	VSP-601 12/5/2011
	CAS No.				
1,1,1-Trichloroethane	71-55-6	**17**	**11**	**17**	**11**
1,1,2,2-Tetrachloroethane	79-34-5	< 4.4	< 0.78	< 1.6	< 0.75
1,1,2-Trichloroethane	79-00-5	< 4.4	< 0.78	< 1.6	< 0.75
1,1-Dichloroethane	75-34-3	**13**	**11**	**14**	**11**
1,1-Dichloroethene	75-35-4	**4.9**	**5.7**	**4.3**	**3.3**
1,2-Dichloroethane	107-06-2	< 4.4	< 0.78	< 1.6	< 0.75
1,2-Dichloropropane	78-87-5	< 4.4	< 0.78	< 1.6	< 0.75
1,3-Butadiene	106-99-0	< 4.4	< 0.78	< 1.6	< 0.75
2-Butanone	78-93-3	< 44	< 7.8	< 16	< 7.5
2-Hexanone	591-78-6	< 4.4	< 0.78	< 1.6	< 0.75
4-Methyl-2-Pentanone	108-10-1	< 4.4	< 0.78	< 1.6	< 0.75
Acetone	67-64-1	< 44	**14**	< 16	< 7.5
Benzene	71-43-2	< 4.4	< 0.78	< 1.6	**2.5**
Bromodichloromethane	75-27-4	< 4.4	< 0.78	< 1.6	**1.1**
Bromoform	75-25-2	< 4.4	< 0.78	< 1.6	< 0.75
Bromomethane	74-83-9	< 4.4	< 0.78	< 1.6	< 0.75
Carbon Disulfide	75-15-0	< 44	< 7.8	< 16	< 7.5
Carbon Tetrachloride	56-23-5	< 4.4	< 0.78	< 1.6	< 0.75
Trichlorofluoromethane (Freon 11)	75-69-4	< 4.4	**1.7**	**1.9**	**1.4**
Chlorobenzene	108-90-7	< 4.4	< 0.78	< 1.6	< 0.75
Chlorodibromomethane	124-48-1	< 4.4	< 0.78	< 1.6	< 0.75
Chloroethane	75-00-3	< 4.4	< 0.78	< 1.6	< 0.75
Chloroform	67-66-3	**40**	**23**	**98**	**83**
Chloromethane	74-87-3	< 4.4	< 0.78	< 1.6	< 0.75
cis-1,2-Dichloroethene	156-59-2	**680**	**620 D**	**580 D**	**540 D**
cis-1,3-Dichloropropene	10061-01-5	< 4.4	< 0.78	< 1.6	< 0.75
Ethylbenzene	100-41-4	< 4.4	< 0.78	< 1.6	< 0.75
Trichlorotrifluoroethane (Freon 113)	76-13-1	< 4.4	< 0.78	< 1.6	< 0.75
Dichlorodifluoromethane (Freon 12)	75-71-8	< 4.4	**3.2**	**5.3**	**2.6**
Methyl Tert-Butyl Ether	1634-04-4	< 4.4	< 0.78	< 1.6	< 0.75
Methylene Chloride	75-09-2	< 4.4	< 0.78	< 1.6	< 0.75
Styrene	100-42-5	< 4.4	< 0.78	< 1.6	< 0.75
Tetrachloroethene	127-18-4	**15**	**21**	**25**	**15**
Toluene	108-88-3	< 4.4	< 0.78	< 1.6	**1.8**
trans-1,2-Dichloroethene	156-60-5	< 4.4	**4.8**	**6.5**	**3.8**
trans-1,3-Dichloropropene	10061-02-6	< 4.4	< 0.78	< 1.6	< 0.75
Trichloroethylene	79-01-6	**670**	**590 D**	**680 D**	**560 D**
Vinyl chloride	75-01-4	< 4.4	**1.3**	**1.7**	**1.6**
Xylene-o	95-47-6	< 4.4	< 0.78	< 1.6	< 0.75
Xylenes - m,p	179601-23-1	< 8.8	< 1.6	< 3.2	**1.6**
Chlorodifluoromethane (Freon 22)	75-45-6	**95**	**24**	**25**	**17**
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3	**210**	**560 D**	**360 D**	**150 D**
TVOC[2]		**1,745**	**1,891**	**1,819**	**1,407**

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.
TVOC	Total volatile organic compounds.
CAS No.	Chemical abstracts service list number.
D	Compound detected at a secondary dilution.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to Columbia Analytical Services Laboratory (Simi Valley, CA) for volatile organic compound analyses using United States Environmental Protection Agency Method TO-15 modified in accordance with the project Sampling and Analysis Plan (ARCADIS 2008). Data presented in this table corresponds to the past year of system operation.
2. TVOC determined by summing individual detections and rounding to the nearest whole number.
3. The total effluent vapor sample was collected on June 8, 2011 as a result of a faulty summa canister.

ARCADIS

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.[1,2,3]

	Sample ID:	VSP-601	VSP-601	VSP-601	VSP-601
	Sample Date:	3/7/2011	6/8/2011[4]	9/19/2011	12/5/2011
	Units:	ppbv	ppbv	ppbv	ppbv
Acetophenone		No Tentatively Identified Compounds Detected	ND	ND	**6.2 JN**
Isobutane			**4.7 JN**	ND	**4.1 JN**
Isobutene			**1.9 JN**	ND	ND
Isooctane			**1.1 JN**	ND	ND
1- Dodedene			**NA**	ND	ND
2,3,3, Trimethylpentane			**NA**	ND	ND
Trimethylcyclohexane isomer			**NA**	ND	ND
Trimethylcyclohexane isomer			**NA**	ND	ND
Trimethylcyclohexane isomer			**NA**	ND	ND
Trimethylcyclohexane isomer			**NA**	ND	ND
C_9H_{18} Compound			**NA**	ND	ND
C_9H_{18} Compound			**NA**	ND	ND
Unidentified Compound			**NA**	ND	ND
$C_{10}H_{20}$ Compound			**NA**	ND	ND
$C_{10}H_{20}$ Compound			**NA**	ND	ND
$C_{12}H_{24}$ Compound			ND	**NA**	ND

Notes and Abbreviations:

Bold Detected.

ppbv Parts per billion by volume.

NA Unidentified compound detected but estimated concentration cannot be calculated.

ND Unidentified compound not detected.

1. Samples were collected by operation and maintenance personnel on the date shown and submitted to Columbia Analytical Services Laboratory (Simi Valley, CA) for volatile organic compound analyses using United States Environmental Protection Agency Method TO-15 modified in accordance with the project Sampling and Analysis Plan (ARCADIS 2008). Data presented in this table corresponds to the past year of system operation.
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. The total effluent vapor sample was collected on June 8, 2011 as a result of a faulty summa canister.

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)	CAS No.	ST-510 Quarter 1 2011	SVE Condensate[3] 3/29/2011	ST-510[4] 3/31/2011	ST-510 Quarter 3 2011	ST-510 Quarter 4 2011
1,1,1-Trichloroethane	71-55-6		< 5.0	< 5.0		
1,1,2,2-Tetrachloroethane	79-34-5		< 5.0	< 5.0		
1,1,2-Trichloroethane	79-00-5		< 5.0	< 5.0		
1,1-Dichloroethane	75-34-3		< 5.0	< 5.0		
1,1-Dichloroethene	75-35-4		< 5.0	< 5.0		
1,2,4-Trichlorobenzene	120-82-1		< 5.0	< 5.0		
1,2-Dibromo-3-Chloropropane (DBCP)	96-12-8		< 5.0	< 5.0		
1,2-Dibromoethane (EDB)	106-93-4		< 5.0	< 5.0		
1,2-Dichlorobenzene	95-50-1		< 5.0	< 5.0		
1,2-Dichloroethane	107-06-2		< 5.0	< 5.0		
1,2-Dichloropropane	78-87-5		< 5.0	< 5.0		
1,4-Dichlorobenzene	106-46-7		< 5.0	< 5.0		
2-Butanone	78-93-3		< 10	< 10		
2-Hexanone	591-78-6		< 10	< 10		
4-Methyl-2-Pentanone	108-10-1		< 10	< 10		
Acetone	67-64-1		< 20	< 20		
Benzene	71-43-2		< 5.0	< 5.0		
Bromodichloromethane	75-27-4		< 5.0	< 5.0		
Bromoform	75-25-2		< 5.0	< 5.0		
Bromomethane	74-83-9		< 5.0	< 5.0		
Carbon Disulfide	75-15-0		< 10	< 10		
Carbon Tetrachloride	56-23-5		< 5.0	< 5.0		
Trichlorofluoromethane (Freon-11)	75-69-4		< 5.0	< 5.0		
Chlorobenzene	108-90-7	No Sampling	< 5.0	< 5.0	No Sampling	No Sampling
Chlorodibromomethane	124-48-1	During This	< 5.0	< 5.0	During This	During This
Chloroethane	75-00-3	Quarter	< 5.0	< 5.0	Quarter	Quarter
Chloroform	67-66-3		< 5.0	< 5.0		
Chloromethane	74-87-3		< 5.0	< 5.0		
cis-1,2-Dichloroethene	156-59-2		< 5.0	**6.0**		
cis-1,3-Dichloropropene	10061-01-5		< 5.0	< 5.0		
Cyclohexane	110-82-7		< 10	< 10		
Ethylbenzene	100-41-4		< 5.0	< 5.0		
Trichlorotrifluoroethane (Freon 113)	76-13-1		< 5.0	< 5.0		
Dichlorodifluoromethane (Freon 12)	75-71-8		< 5.0	< 5.0		
Isopropylbenzene	98-82-8		< 5.0	< 5.0		
m-Dichlorobenzene	541-73-1		< 5.0	< 5.0		
Methyl Acetate	79-20-9		< 10	< 10		
Methyl tert-butyl ether	1634-04-4		< 5.0	< 5.0		
Methylcylohexane	108-87-2		< 10	< 10		
Methylene Chloride	75-09-2		< 5.0	< 5.0		
Styrene	100-42-5		< 5.0	< 5.0		
Tetrachloroethene	127-18-4		< 5.0	< 5.0		
Toluene	108-88-3		< 5.0	< 5.0		
trans-1,2-Dichloroethene	156-60-5		< 5.0	< 5.0		
trans-1,3-Dichloropropene	10061-02-6		< 5.0	< 5.0		
Trichloroethylene	79-01-6		< 5.0	< 5.0		
Vinyl Chloride	75-01-4		< 5.0	< 5.0		
Xylene-o	95-47-6		< 5.0	< 5.0		
Xylenes - m,p	1330-20-7		< 5.0	< 5.0		
TVOC		NA	0.0	**6.0**	NA	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:

CAS No.	Chemical abstracts service list number.
NA	Not applicable.
TVOC	Total volatile organic compounds.
µg/L	Micrograms per liter.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to Columbia Analytical Services Laboratory (Rochester, NY) for volatile organic compound analyses using Method 8260 in accordance with the project Sampling and Analysis Plan (ARCADIS 2008). Data presented in this table corresponds to the past year of system operation.
2. TVOC determined by summing individual detections and rounding to the nearest whole number.
3. Sample SVE Condensate was a non-routine condensate sample collected as a composite grab sample from four drums of condensate water that were generated through normal system operation. The condensate water was transferred from storage tank ST-510 into four 55-gallon drums prior to the March 31, 2011 condensate removal event.
4. Sample ST-510 was a non-routine condensate sample collected as a composite grab sample from the condensate water generated during the March 31, 2011 below grade pipeline condensate removal activities.

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

	Sample ID:	ST-510	SVE Condensate[4]	ST-510[5]	ST-510	ST-510
	Sample Date:	Quarter 1 2011	3/29/2011	3/31/2011	Quarter 3 2011	Quarter 4 2011
	Units:	ug/L	ug/L	ug/L	ug/L	ug/L
Unknown Ethanol Furan, tetrahydro- Unknown alcohol Cyclohexanone Isopropyl Alcohol Butanal Heptanal 1-Hexanol, 2-ethyl-		No Sampling During This Quarter	No Tentatively Identified Compounds Detected	No Tentatively Identified Compounds Detected	No Sampling During This Quarter	No Sampling During This Quarter

Notes and Abbreviations:

µg/L Micrograms per liter.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to Columbia Analytical Services Laboratory (Rochester, NY) for volatile organic compound analyses using Method 8260 in accordance with the project Sampling and Analysis Plan (ARCADIS 2008). Data presented in this table corresponds to the past year of system operation.
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 SVE Condensate was a non-routine condensate sample collected as a composite grab sample from four drums of condensate that were generated through normal system operation. The condensate water was transferred from storage tank ST-510 into four 55-gallon drums prior to the March 31, 2011 condensate removal event.
5. Sample ST-510 was a non-routine condensate sample collected as a composite grab sample from the condensate water generated during the March 31, 2011 below grade pipeline condensate removal activities.

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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:	3/7/2011	6/6/2011	9/19/2011	12/5/2011
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)		761	583	572	590
Air Flow Rate (acfm @ stack temp)(2)		764	611	596	601
Stack Gas Exit Temperature (K)(1)		295	309	306	300
Ambient Air Temperature (K)(3)		276	294	291	277
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)		1,201	1,332	1,346	1,298
Annualization Factor(6)		0.08	0.08	0.08	0.08
Average Annual Concentration at Receptor Height ($\mu g/m^3$)(7)		96.1	106.6	107.7	103.8
Distance To Max Concentration (m)(8)		46	44	44	45

Notes and abbreviations on last 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:

acfm	Actual cubic feet per minute.
ft	Feet.
g/s	Grams per second.
K	Kelvin.
m	Meters.
scfm	Standard cubic feet per minute.
$\mu g/m^3$	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 United States Environmental Protection Agency 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] ($\mu g/m^3$)			
	3/7/2011	6/8/2011[5]	9/19/2011	12/5/2011
1,1,1-Trichloroethane	17	11	17	11
1,1-Dichloroethane	13	11	14	11
1,1-Dichloroethene	4.9	5.7	4.3	3.3
Acetone	0	14	0	0
Benzene	0	0	0	2.5
Bromodichloromethane	0	0	0	1.1
Trichlorofluoromethane (Freon 11)	0	1.7	1.9	1.4
Chloroform	40	23	98	83
cis-1,2-Dichloroethene	680	620	580	540
Dichlorodifluoromethane (Freon 12)	0	3.2	5.3	2.6
Tetrachloroethene	15	21	25	15
Toluene	0	0	0	1.8
trans-1,2-Dichloroethene	0	4.8	6.5	3.8
Trichloroethylene	670	590	680	560
Vinyl chloride	0	1.3	1.7	1.6
Xylenes - M,P	0	0	0	1.6
Chlorodifluoromethane (Freon 22)	95	24	25	17
1-Chloro-1,1-difluoroethane (Freon 142b)	210	560	360	150

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 MASC[3] ($\mu g/m^3$)			
		3/7/2011	6/8/2011[5]	9/19/2011	12/5/2011
1,1,1-Trichloroethane	5,000	1.44E+08	1.63E+08	1.65E+08	1.70E+08
1,1-Dichloroethane	0.63	1.82E+04	2.05E+04	2.08E+04	2.14E+04
1,1-Dichloroethene	70	2.02E+06	2.28E+06	2.31E+06	2.38E+06
Acetone	30,000	8.66E+08	9.76E+08	9.90E+08	1.02E+09
Benzene	0.13	3.75E+03	4.23E+03	4.29E+03	4.42E+03
Bromodichloromethane	70	2.02E+06	2.28E+06	2.31E+06	2.38E+06
Trichlorofluoromethane (Freon 11)	5,000	1.44E+08	1.63E+08	1.65E+08	1.70E+08
Chloroform	0.043	1.24E+03	1.40E+03	1.42E+03	1.46E+03
cis-1,2-Dichloroethene	63	1.82E+06	2.05E+06	2.08E+06	2.14E+06
Dichlorodifluoromethane (Freon 12)	12,000	3.46E+08	3.90E+08	3.96E+08	4.08E+08
Tetrachloroethene	1.0	2.89E+04	3.25E+04	3.30E+04	3.40E+04
Toluene	5,000	1.44E+08	1.63E+08	1.65E+08	1.70E+08
trans-1,2-Dichloroethene	63	1.82E+06	2.05E+06	2.08E+06	2.14E+06
Trichloroethylene	0.5	1.44E+04	1.63E+04	1.65E+04	1.70E+04
Vinyl chloride	0.11	3.17E+03	3.58E+03	3.63E+03	3.74E+03
Xylenes - M,P	100	2.89E+06	3.25E+06	3.30E+06	3.40E+06
Chlorodifluoromethane (Freon 22)	50,000	1.44E+09	1.63E+09	1.65E+09	1.70E+09
1-Chloro-1,1-difluoroethane (Freon 142b)	50,000	1.44E+09	1.63E+09	1.65E+09	1.70E+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 MASC[4]			
	3/7/2011	6/8/2011[5]	9/19/2011	12/5/2011
1,1,1-Trichloroethane	0.00%	0.00%	0.00%	0.00%
1,1-Dichloroethane	0.07%	0.05%	0.07%	0.05%
1,1-Dichloroethene	0.00%	0.00%	0.00%	0.00%
Acetone	0.00%	0.00%	0.00%	0.00%
Benzene	0.00%	0.00%	0.00%	0.06%
Bromodichloromethane	0.00%	0.00%	0.00%	0.00%
Trichlorofluoromethane (Freon 11)	0.00%	0.00%	0.00%	0.00%
Chloroform	3.22%	1.64%	6.90%	5.68%
cis-1,2-Dichloroethene	0.04%	0.03%	0.03%	0.03%
Dichlorodifluoromethane (Freon 12)	0.00%	0.00%	0.00%	0.00%
Tetrachloroethene	0.05%	0.06%	0.08%	0.04%
Toluene	0.00%	0.00%	0.00%	0.00%
trans-1,2-Dichloroethene	0.00%	0.00%	0.00%	0.00%
Trichloroethylene	4.64%	3.63%	4.12%	3.30%
Vinyl chloride	0.00%	0.04%	0.05%	0.04%
Xylenes - M,P	0.00%	0.00%	0.00%	0.00%
Chlorodifluoromethane (Freon 22)	0.00%	0.00%	0.00%	0.00%
1-Chloro-1,1-difluoroethane (Freon 142b)	0.00%	0.00%	0.00%	0.00%

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.

Notes and Abbreviations:

AGC	Annual guideline concentration.
DAR-1	Division of Air Resources-1.
NYSDEC	New York State Department of Environmental Conservation.
MASC	Maximum allowable stack concentration.
SGC	Short-term guideline concentration.
$\mu g/m^3$	Micrograms per cubic meter.

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. Table summarizes detected compounds only.
2. AGC refers to the compound-specific annual guideline concentration per the NYSDEC DAR-1 AGC/SGC tables, revised October 18, 2010.
3. Annual MASC was 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. The total effluent vapor sample was collected on June 8, 2011 as a result of a faulty summa canister.