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

2013 Annual Summary

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

NYSDEC ID # 1-30-003A

ARCADIS

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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) 2013 Annual Summary Report for submittal to the New York State Department of Environmental Conservation (NYSDEC). The present day Bethpage Community Park property (Park), the Former Grumman Plant 24 Access Road and McKay Field 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 as 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 2013 (i.e., from January 2013 through December 2013). Additionally, this report summarizes the OM&M activities performed during the 4th Quarter of 2013 (i.e., October 1 through December 31, 2013 [the reporting period]). Detailed OM&M summaries for the previous three 2013 operational quarterly periods are available in the following reports (2013 Quarterly Reports):

- Quarterly OM&M Report for the Soil Gas IRM, March 2013 (ARCADIS 2013a)
- Quarterly OM&M Report for the Soil Gas IRM, June 2013 (ARCADIS 2013b)
- Quarterly OM&M Report for the Soil Gas IRM, September 2013 (ARCADIS 2013c)

During 2013, 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 certain compounds (e.g., Freon 12 and Freon 22) 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 understood to be unrelated 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 by the Town 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 locations of the treatment building (which houses the major process equipment, including two 20-horsepower [hp] and one 30-hp regenerative-type depressurization blowers, three 52-gallon moisture separators and associated transfer pumps, one heat exchanger, and one 33-foot tall by 16-inch diameter stack), the 18 depressurization wells, and the 47 induced vacuum monitoring wells is provided as Figure 2. Monitoring well vacuum measurements collected during 2013 are also shown on Figure 2. A process flow diagram that shows sampling and monitoring locations is provided as 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 Road and McKay Field Access Road, south and west of the Park, respectively.

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

The compliance 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 vacuum within a negative pressure curtain established along the former Plant 24 Access Road and McKay Field Access Road, 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 2010a). On December 29, 2008, NYSDEC approved removal of vapor phase treatment (NYSDEC 2008).

- To collect and transfer collected condensate to the Nassau County Department of Public Works (NCDPW) intake located on Northrop Grumman property, in accordance with the requirements set forth by the NCDPW (NCDPW 2007; NCDPW 2008) or dispose off-site at a NYSDEC-permitted disposal facility. The sanitary sewer intake ultimately discharges to the Town of Oyster Bay's Cedar Creek treatment facility.

3. Operation and Maintenance Activities

The following subsections of this report provide a summary of the soil gas operation and maintenance activities completed during the reporting period and 2013 annual period.

3.1 Fourth Quarter 2013

In general, the soil gas IRM operated continuously during the reporting period (greater than 99% uptime) with the exception of brief system shutdown events for routine system maintenance.

Routine monthly O&M activities completed during the reporting period included: inspection of piping, appurtenances, and mechanical equipment for leaks, defects, or other problems; maintenance of equipment in accordance with the manufacturers' specifications; testing of system alarms to confirm proper system response; and adjustment of valves and equipment set points to maintain treatment system operating ranges for flow and vacuum.

3.2 2013 Annual System Performance and Alarm Summary

Except as described below, the soil gas IRM operated continuously during 2013. Routine monthly O&M activities conducted throughout 2013 included: inspection of piping, appurtenances, and mechanical equipment for leaks, defects, or other problems; maintenance of equipment in accordance with the manufacturers' specifications and as described in the OM&M Manual (ARCADIS 2009).

A summary of soil gas IRM system operational up-time and system shut downs for 2013 are summarized below and are further described in the 2013 Quarterly OM&M Reports (ARCADIS 2013a, ARCADIS 2013b, and ARCADIS 2013c):

- The system operated full-time approximately 363 out of 365 days (greater than 99% uptime).
- There were approximately 2 days of system downtime, consisting of:
    - Approximately ten (10) hours due to system maintenance associated with condensate/storm water removal from the subsurface piping;
    - Approximately thirteen (13) hours due to a blower BL-300 motor fault alarm condition caused by a suspected power anomaly; and
    - Approximately one (1) cumulative day (system shut down four [4] times between July 17 and August 22, 2013) due to routine system maintenance.

4. Monitoring Activities and Results

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 Table 3 from the OM&M Manual (ARCADIS 2011b). The purpose of the compliance monitoring program (consisting of the collection of compliance-related induced vacuum readings and effluent vapor/water samples) is to demonstrate that the system is meeting the compliance objectives described in Section 2 of this report.

4.1 Fourth Quarter 2013 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.

4.1.1 Routine Performance Monitoring

The routine quarterly performance monitoring event was completed on December 4, 2013 (hereinafter referred to as the "December monitoring event"). A brief discussion of the monitoring results obtained is 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. Except as summarized below, system operating parameters were consistent with the recommended values in Table 3 of the OM&M Manual (ARCADIS 2011b). During the reporting period, system components were operated in accordance with manufacturers' recommendations. 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 measured during the December monitoring event that were not consistent with the recommended values in Table 3 of the OM&M Manual (ARCADIS 2011b) are as follows:

- Depressurization Well DW-5D had a manifold vacuum higher than the maximum recommended range.
- Blower B-200 had an influent vacuum higher than the maximum recommended range.
- Knockout Tank KO-200 had an influent vacuum higher than the maximum recommended range.

The observed changes in manifold vacuum are likely the result of condensate and/or storm water accumulation in the subsurface piping and normal seasonal fluctuation.

Despite the above system components operating outside of their recommended ranges, the annual time-weighted rolling average induced vacuum at all compliance-

related monitoring points was greater than or equal to -0.1 iwc (see Section 4.1.2.1 of this report). Therefore, no immediate action is warranted. The system operating parameters described above will continue to be evaluated and addressed, if necessary, during the next reporting period. Additional recommendations are provided in Section 6.2 of this report.

4.1.1.2 Vapor Sample

The total effluent screening level vapor sample (i.e., photoionization detector (PID) reading) measured during the reporting period is provided in Table 1. The screening result was 0.0 parts per million by volume (ppmv), which is consistent with 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. Additionally, the December measurements are also shown (in text box format) on Figure 2.

As shown in Table 2, during the December monitoring event the instantaneous induced vacuum at all compliance related monitoring points was greater than or equal to -0.1 iwc, with the exception of VMWC-7A and VMWC-7B. Although the December instantaneous induced vacuum measurements at VMWC-7A (-0.093 iwc) and VMWC-7B (-0.098 iwc) were slightly lower than -0.1 iwc, the annual time-weighted rolling average induced vacuum at all compliance related monitoring points was maintained at greater than or equal to -0.1 iwc.

4.1.2.2 Vapor Sample

A total effluent vapor sample was collected on December 4, 2013. As shown in the laboratory results in Table 3 and Appendix A-1, the total volatile organic compound (TVOC) concentration of 1,329 micrograms per cubic meter (µg/m^3) was lower than the September 2013 concentration (1,595 µg/m^3) but consistent with historical data. The

Project TVOC concentration of 1,114 µg/m^3 and the Non-project TVOC concentration of 215 µg/m^3 were also lower than the September 2013 concentrations (1,184 µg/m^3 and 411 µg/m^3, respectively) but consistent with historical data.

Vinyl chloride was the only environmentally "A" rated compound (as defined in Division of Air Resources [DAR-1] Annual Guideline Concentration [AGC]/Short-Term Guideline Concentration [SGC] tables revised October 18, 2010) detected in the effluent vapor sample during the December monitoring event; the concentration was consistent with historical data. No tentatively identified compounds (TIC) were identified by the laboratory (Appendix A-2) during December 2013.

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

4.1.2.3 Condensate Samples

A compliance monitoring condensate sample was not required to be collected for laboratory analysis during the reporting period, as indicated in Table 4 and Appendix B-1.

4.2 2013 Annual Summary of Monitoring Activities and Results

The following subsections of this report summarize the monitoring activities and results of routine performance and compliance monitoring for the 2013 annual period.

4.2.1 2013 Annual Summary of Routine Performance Monitoring

Discussion of the routine quarterly performance monitoring events performed during 2013 is provided below.

4.2.1.1 System Operating Parameters

Similar to the reporting period, system performance monitoring completed in 2013 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 2013a, ARCADIS 2013b, and ARCADIS 2013c).

4.2.1.2 Vapor Sample

The total effluent screening level vapor sample PID readings measured during 2013 are provided in Table 1. The screening results ranged from 0.0 to 0.1 ppmv and were consistent with 2012 and other historical data.

4.2.2 Routine Compliance Monitoring

Similar to the reporting period, system compliance monitoring completed in 2013 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 2013 and the annual time-weighted rolling averages are summarized in Table 2. Instantaneous vacuum readings measured in compliance monitoring wells during 2013 are also shown (in text box format) on Figure 2. The soil gas IRM performance objectives are described in Section 2.

Key compliance monitoring results from 2013 include the following:

- As of December 4, 2013, the time-weighted rolling average induced vacuum for all compliance related monitoring points was greater than or equal to the design objective of -0.1 iwc.

4.2.2.2 Vapor Sample

As shown in the laboratory results in Table 3 and Appendix A-1, the TVOC concentration of the effluent vapor stream remained relatively constant during 2013 and consistent with historical data. All emissions were below applicable discharge criteria during all monitoring events as discussed in Section 5 of this report.

- Three environmentally “A” rated compounds (i.e., benzene, carbon tetrachloride, and vinyl chloride), were detected in the effluent vapor during 2013. It should be noted that the mass emission rates for these “A” rated compounds were well below

the NYSDEC recommended action level of 0.01 lb/hr. Therefore, no treatment was required (ARCADIS 2013a, ARCADIS 2013b, and ARCADIS 2013c).

- Several TICs were identified on an inconsistent basis during 2013 (Appendix A-2). ARCADIS will continue to monitor TIC concentrations and will evaluate what action, if any, may be required.

4.2.2.3 Condensate Samples

A non-routine sample was collected for laboratory analysis as a composite grab sample of condensate water generated through normal system operation from the Storage Tank ST-510 location (sample ID ST-510) on March 27, 2013. As shown in Table 4 and Appendix B-1, the TVOC concentrations were below the limits of detection and 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 of TVOCs).

5. Air Emissions Model

Effluent vapor laboratory results were compared to the NYSDEC DAR-1 SGCs (Table 3). 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 SCREEN3 model in conjunction with the NYSDEC DAR-1 AGCs. A scaling factor was calculated using the SCREEN3 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. A summary of the instantaneous percent (i.e., 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 in Table 5. A 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.

- One environmentally "A" rated compound was detected in the effluent vapor during the reporting period. Specifically, vinyl chloride was detected at 0.92 µg/m^3. However, the mass emission rate for vinyl chloride was 2.62 x 10^{-6} pounds per hour (lbs/hr), which is well below the NYSDEC recommended action level of 0.01 lb/hr. Therefore, no treatment is required.

6. Conclusions and Recommendations

6.1 Conclusions

- The soil gas IRM operated continuously during the reporting period and 2013 with the exception of brief shutdown periods for routine maintenance and non-routine alarms and maintenance.

- System operating parameters were generally consistent with the recommended values in the OM&M Manual and system components were operated in accordance with manufacturers' recommendations.

- The soil gas IRM maintained -0.1 iwc or greater within all induced vacuum monitoring points based on a twelve-month rolling average (through December 2013). As previously discussed, collectively, these data indicates system vacuum was sufficient to prevent soil gas from migrating off-site.

- Vapor emissions met applicable guidance and regulatory criteria.

6.2 Recommendations

Based on the information provided herein, ARCADIS makes the following recommendations for 2014:

- Continue operation of the soil gas IRM.

- In accordance with NYSDEC guidance, review and update the OM&M Manual (ARCADIS 2009), to ensure it continues to effectively address current operating

conditions at the site. A draft copy of the OM&M Manual revisions will be completed and submitted to NYSDEC for review within the 1st quarter of 2014

- Due to the low instantaneous vacuum measured in VMWC-7A and VMWC-7B, continue to closely monitor the induced vacuum at these depressurization wells and if necessary, remove accumulated condensate from the subsurface depressurization well pipelines.

- Due to the continued accumulation of condensate within several of the depressurization pipelines and its effect on system performance, review and assess potential options to prevent and/or minimize its accumulation.

- Based on the consistent operation of the soil gas IRM since February 2008, we continue to recommend that the current, quarterly reporting frequency be reduced to annual. Consistent with the NYSDEC-approved OU3 Soil Gas IRM OM&M Manual (ARCADIS 2009), an annual report will be prepared to summarize system operation, performance, and monitoring data. The annual report will be prepared and submitted under the supervision of a licensed, professional engineer in the State of New York. Additionally, pertinent data collected for the soil gas IRM will be submitted to the NYSDEC as part of the semi-annual progress reports currently completed in accordance with Section III of AOC Index #W1-0018-04-01. Upon receipt of NYSDEC approval of this recommendation, the OU3 Soil Gas IRM OM&M Manual (ARCADIS 2009) will be updated to reflect this change.

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 Administrative 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

8. References

ARCADIS of New York, Inc. 2007. 95% Design Report, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, September 7, 2007.

ARCADIS of New York, Inc. 2008. 95% Design Report, Appendix C, Sampling and Analysis Plan, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, February 8, 2008.

ARCADIS of New York, Inc. 2009. Operable Unit 3, Operation, Maintenance, and Monitoring Manual, Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, January 23, 2009.

ARCADIS of New York, Inc. 2011a. Remedial Investigation Report (Site Area). Operable Unit 3 – Former Grumman Settling Ponds, Bethpage, New York. Site #1-30-003A. February 8, 2011.

ARCADIS of New York, Inc. 2011b. Operable Unit 3- Revised Table 3. Typical Operating Parameters, Operation, Maintenance, and Monitoring Manual, Operable Unit 3, Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, February 15, 2011.

ARCADIS of New York, Inc. 2013a. Quarterly Operation, Maintenance and Monitoring Report for the Soil Gas Interim Remedial Measure March 2013, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, May 16, 2013.

ARCADIS of New York, Inc. 2013b. Quarterly Operation, Maintenance and Monitoring Report for the Soil Gas Interim Remedial Measure June 2013, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, August 15, 2013.

ARCADIS of New York, Inc. 2013c. Quarterly Operation, Maintenance and Monitoring Report for the Soil Gas Interim Remedial Measure September 2013, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, November 15, 2013.

County of Nassau Department of Public Works, 2007. Letter Regarding Discharge of IRM Condensate Water, Northrop Grumman, OU3 Site, Bethpage, New York. October 16, 2007.

County of Nassau Department of Public Works, 2008. Letter Regarding Discharge of IRM Condensate Water Northrop, Grumman, OU3 Site, Bethpage, New York. September 17, 2008.

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

New York State Department of Environmental Conservation, 2007, 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, 2008. Letter of Approval For Proposed Modifications, December 12, 2008.

New York State Department of Environmental Conservation, 2010. DER-10, Technical Guidance for Site Investigation and Remediation, May 3, 2010.

New York State Department of Environmental Conservation, 2010. Division of Air Resources-1 (DAR-1) Guidelines for the Control of Toxic Ambient Air Contaminants dated 1991 and the AGC/SGC Tables dated October 18, 2010.

United States Environmental Protection Agency (USEPA), 1993, Radon Reduction Techniques for Existing Detached Houses: Technical Guidance (Third Edition) for Active Depressurization Systems, October 1993.

Zervos, Theodore, 2007. Deposition of Theodore Zervos in the matter Town of Oyster Bay v. Northrop Grumman Systems Corporation et al. Case No. 05-CV-1945 (TCP)(AKT). January 22, 2007.

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Tables

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				
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
	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)
03/28/13	87	-20	47	NM	-1.5	3.0	-8.5	49	NM	-0.34
06/19/13	85	-20	63	NM	-1.5	4.5	-11	67	NM	-0.41
09/05/13	86	-20	71	NM	-1.5	4.0	-13	71	NM	-0.43
12/04/13	100	-19	52	NM	-1.7	5.0	-11	56	NM	-0.46

	Extraction Well DW-3S Parameters					Extraction Well DW-3D 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
	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)
03/28/13	5.0	-6.8	55	NM	-0.21	15	-7.0	48	NM	-0.42
06/19/13	6.2	-5.0	66	NM	-0.24	11	-6.0	67	NM	-0.36
09/05/13	5.0	-8.0	73	NM	-0.24	10	-7.0	70	NM	-0.35
12/04/13	5.0	-6.5	62	NM	-0.22	10	-9.0	53	NM	-0.39

	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
	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)
03/28/13	70	-16	50	NM	-1.2	5.0	-9.0	50	NM	-2.4
06/19/13	92	-19	63	NM	-1.5	12	-13	65	NM	-2.4
09/05/13	95	-19	69	NM	-1.5	12	-13	71	NM	-2.3
12/04/13	85	-19	55	NM	-1.4	12	-13	53	NM	-2.3

Notes and Abbreviations:

°F	Degrees Fahrenheit.
DW	Depressurization well.
ft bmp	Feet below measuring point.
gal	Gallons.
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. Total gallons of water recorded at storage tank ST-510 per quarter.
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 scfm 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. Value was remeasured on October 2, 2013 due to an erroneous value of the total effluent flow rate recorded on September 5, 2013.
4. Value was measured on January 27, 2014 due to an erroneous value recorded on December 4, 2013 as a result of a faulty pressure gauge.
5. Value was remeasured on December 6, 2013 due to an erroneous value of the total effluent flow rate recorded on December 4, 2013.

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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				
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)
03/28/13	63	-14	50	NM	-1.2	6.6	-5.4	50	NM	-1.4	55	-18	51	NM	-1.3
06/19/13	83	-17	63	NM	-1.7	6.2	-5.0	67	NM	-1.4	92	-24	63	NM	-2.1
09/05/13	85	-17	70	NM	-1.7	6.2	-5.2	72	NM	-1.3	93	-24	70	NM	-1.8
12/04/13	75	-18	54	NM	-1.8	7.2	-5.5	55	NM	-1.5	80	-23	54	NM	-2.0

	Extraction Well DW-1D Parameters					Extraction Well DW-4S Parameters					Extraction Well DW-4D 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)
03/28/13	6.0	-3.3	50	NM	-1.8	60	-14	52	NM	-1.3	8.5	-7.1	50	NM	-0.66
06/19/13	3.9	-2.6	67	NM	-1.2	78	-16	63	NM	-1.6	6.0	-8.5	66	NM	-0.72
09/05/13	1.0	-1.6	72	NM	-1.2	82	-16	71	NM	-1.5	4.0	-5.4	73	NM	-0.59
12/04/13	3.2	-2.2	57	NM	-1.0	70	-16	54	NM	-1.5	4.0	-5.8	56	NM	-0.63

Notes and Abbreviations:

°F	Degrees Fahrenheit.
DW	Depressurization well.
ft bmp	Feet below measuring point.
gal	Gallons.
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. Total gallons of water recorded at storage tank ST-510 per quarter.
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 scfm 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. Value was remeasured on October 2, 2013 due to an erroneous value of the total effluent flow rate recorded on September 5, 2013.
4. Value was measured on January 27, 2014 due to an erroneous value recorded on December 4, 2013 as a result of a faulty pressure gauge.
5. Value was remeasured on December 6, 2013 due to an erroneous value of the total effluent flow rate recorded on December 4, 2013.

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)
03/28/13	62	-18	52	NM	-2.0	30	-13	56	NM	-1.4
06/19/13	46	-15	62	NM	-1.4	34	-14	63	NM	-1.5
09/05/13	48	-15	70	NM	-1.3	34	-14	70	NM	-1.4
12/04/13	47	-17	55	NM	-1.4	33	-14	57	NM	-1.3

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)
03/28/13	28	-18	56	NM	-1.4	32	-20	50	NM	-2.3
06/19/13	33	-22	64	NM	-1.6	38	-24	63	NM	-2.5
09/05/13	34	-21	69	NM	-1.6	19	-13	71	NM	-1.6
12/04/13	29	-24	57	NM	-1.4	21	-14	53	NM	-1.3

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)
03/28/13	35	-14	54	NM	-1.9	26	-12	51	NM	-1.9
06/19/13	36	-17	64	NM	-1.9	32	-17	64	NM	-2.5
09/05/13	38	-14	71	NM	-1.8	34	-21	68	NM	-2.2
12/04/13	30	-14	56	NM	-1.6	29	-22	54	NM	-2.6

Notes and Abbreviations:

°F	Degrees Fahrenheit.
DW	Depressurization well.
ft bmp	Feet below measuring point.
gal	Gallons.
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. Total gallons of water recorded at storage tank ST-510 per quarter.
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 scfm 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. Value was remeasured on October 2, 2013 due to an erroneous value of the total effluent flow rate recorded on September 5, 2013.
4. Value was meas Value was measured on January 27, 2013 due to an erroneous value recorded on December 4, 2013 as a result of a faulty pressure gauge.
5. Value was remeasured on December 6, 2013 due to an erroneous value of the total effluent flow rate recorded on December 4, 2013.

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			Condensate Water Collected [1]	Blower Parameters BL-200					Blower Parameters BL-300				Blower Parameters BL-400				Combined Blower Parameters VSP-601					Stack Parameters VSP-602			Water Levels in Wells				
	Vacuum																												
Date	Influent KO-200	Influent KO-300	Influent KO-400	Influent ST-510	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 Effluent 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)	(gal)	(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)
03/28/13	-20	0	0	185	-22	2.0	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	518.69	0.0	85	2.0	72	NM	NM	NM	Dry	Dry	64.59	Dry	Dry
06/19/13	-32	0	0	10	-34	3.0	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	515.01	0.1	104	2.0	96	NM	NM	NM	52.69	Dry	53.48	Dry	Dry
09/05/13	-32	0	0	10	-35	2.5	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	682.71[3]	0.0	110[3]	2.3[3]	115	NM	NM	NM	53.44	Dry	54.48	Dry	Dry
12/04/13	-40	0	0	0	-45	2.2[4]	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	719.61[5]	0.0	100[5]	2.0	100	NM	NM	NM	53.65	Dry	56.45	Dry	Dry

Notes and Abbreviations:

°F	Degrees Fahrenheit.
DW	Depressurization well.
ft bmp	Feet below measuring point.
gal	Gallons.
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. Total gallons of water recorded at storage tank ST-510 per quarter.
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 scfm 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. Value was remeasured on October 2, 2013 due to an erroneous value of the total effluent flow rate recorded on September 5, 2013.
4. Value was measured on January 27, 2014 due to an erroneous value recorded on December 4, 2013 as a result of a faulty pressure gauge.
5. Value was remeasured on December 6, 2013 due to an erroneous value of the total effluent flow rate recorded on December 4, 2013.

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]
03/28/13	-0.16	-0.16	-0.17	NM	NM	NM	-0.12	NM	NM	-0.14	-0.13	-0.14	-0.11	NM	NM	NM	-0.095	NM	NM	-0.11	NM	NM	NM	-0.11
06/19/13	-0.11	-0.17	-0.16	NM	NM	NM	-0.14	NM	NM	-0.13	-0.15	-0.14	-0.15	NM	NM	NM	-0.18	NM	NM	-0.19	NM	NM	NM	-0.17
09/05/13	-0.11	-0.14	-0.14	NM	NM	NM	-0.12	NM	NM	-0.12	-0.14	-0.14	-0.15	NM	NM	NM	-0.15	NM	NM	-0.16	NM	NM	NM	-0.18
12/04/13	-0.12	-0.19	-0.19	NM	NM	NM	-0.16	NM	NM	-0.15	-0.14	-0.14	-0.15	NM	NM	NM	-0.13	NM	NM	-0.13	NM	NM	NM	-0.14
Time Weighted[4] Rolling Average:	-0.13	-0.17	-0.16	NA	NA	NA	-0.14	NA	NA	-0.13	-0.14	-0.14	-0.14	NA	NA	NA	-0.14	NA	NA	-0.14	NA	NA	NA	-0.15
Gross Average Compliance Points[5]																								
12/04/13	-0.15																							

Notes and Abbreviations:

DW Depressurization well.
NA Not applicable.
NM Not measured.
VMWC Vapor monitoring well cluster.
iwc Inches of water column.

1. All induced vacuum measurements units in iwc. Values shown have been rounded to include two significant figures.
2. Compliance goal is -0.1 iwc of vacuum at all compliance monitoring points, based on a twelve-month rolling average.
3. Compliance related monitoring point.
4. Time weighted rolling 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. Value was remeasured on April 5, 2013 due to erroneous values recorded on March 28, 2013.
7. Value was remeasured on September 25, 2013 due to an erroneous value recorded on September 5, 2013.
8. Value was remeasured on December 16, 2013 due to an erroneous value recorded on December 4, 2013.

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]
03/28/13	NM	NM	NM	-0.14	-0.18	-0.14[6]	-0.18	NM	NM	NM	-0.11	NM	NM	NM	-0.13	NM	NM	NM	NM	-0.18	-0.24	-0.096	-0.11
06/19/13	NM	NM	NM	-0.27	-0.25	-0.17	-0.18	NM	NM	NM	-0.12	NM	NM	NM	-0.13	NM	NM	NM	NM	-0.16	-0.26	-0.10	-0.13
09/05/13	NM	NM	NM	-0.21[7]	-0.21[7]	-0.11	-0.13	NM	NM	NM	-0.10	NM	NM	NM	-0.11	NM	NM	NM	NM	-0.27	-0.20	-0.10	-0.11
12/04/13	NM	NM	NM	-0.20	-0.20	-0.14	-0.14	NM	NM	NM	-0.093	NM	NM	NM	-0.098	NM	NM	NM	NM	-0.22[8]	-0.15	-0.10	-0.10
Time Weighted[4] Rolling Average:	NA	NA	NA	-0.20	-0.21	-0.14	-0.16	NA	NA	NA	-0.11	NA	NA	NA	-0.12	NA	NA	NA	NA	-0.21	-0.21	-0.10	-0.11

Notes and Abbreviations:

DW Depressurization well.
NA Not applicable.
NM Not measured.
VMWC Vapor monitoring well cluster.
iwc Inches of water column.

1. All induced vacuum measurements units in iwc. Values shown have been rounded to include two significant figures.
2. Compliance goal is -0.1 iwc of vacuum at all compliance monitoring points, based on a twelve-month rolling average.
3. Compliance related monitoring point.
4. Time weighted rolling 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. Value was remeasured on April 5, 2013 due to erroneous values recorded on March 28, 2013.
7. Value was remeasured on September 25, 2013 due to erroneous values recorded on September 5, 2013.
8. Value was remeasured on December 16, 2013 due to an erroneous value recorded on December 4, 2013.

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:	VSP-601	VSP-601	VSP-601	VSP-601
		Sample Date:	3/28/2013	6/19/2013	9/5/2013	12/4/2013
Project VOCs	CAS No.	SGC				
1,1,1-Trichloroethane	71-55-6	9,000	**8.4**	**11**	**14**	**13**
1,1-Dichloroethane	75-34-3	NS	**9.4**	**7.9**	**11**	**11**
1,1-Dichloroethene	75-35-4	380[4]	**3.0**	**2.4**	**2.1**	**1.6**
Benzene	71-43-2	1,300	**1.5**	**2.6**	**15**	< 0.91
cis-1,2-Dichloroethene	156-59-2	190,000[5]	**430 D**	**470 D**	**490 D**	**500 D**
Tetrachloroethene	127-18-4	1,000	**1.4**	**17**	**26**	**14**
trans-1,2-Dichloroethene	156-60-5	190,000[5]	**2.6**	**2.9**	**4.8**	**3.3**
Trichloroethylene	79-01-6	14,000	**260 D**	**470 D**	**620 D**	**570 D**
Vinyl chloride	75-01-4	180,000	**1.6**	**0.97**	**0.85**	**0.92**
Subtotal Project VOCs			**718**	**985**	**1,184**	**1,114**
Non-Project VOCs						
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3	NS	**160 D**	**230 D**	**380 D**	**170**
Bromodichloromethane	75-27-4	NS	< 0.80	< 0.75	**1.2**	< 0.91
Carbon Tetrachloride	56-23-5	NS	< 0.80	**0.78**	**0.96**	< 0.91
Chlorodifluoromethane (Freon 22)	75-45-6	NS	**4.1**	**4.2**	**7.0**	**3.0**
Chloroform	67-66-3	150	**18**	**14**	**17**	**38**
Dichlorodifluoromethane (Freon 12)	75-71-8	NS	**2.4**	**2.5**	**3.3**	**2.5**
Trichlorofluoromethane (Freon 11)	75-69-4	9,000	**1.5**	**2.1**	**1.8**	**1.3**
Subtotal Non-Project VOCs			**186**	**254**	**411**	**215**
TVOC[3]			**904**	**1,239**	**1,595**	**1,329**

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	Bold data indicates that the analyte was detected at or above its reporting 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.
µg/m^3	Micrograms per cubic meter.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to ALS Environmental, 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 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 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 µg/m^3 / 4.2 = approximately 190,000 µg/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.

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[4] 3/27/2013	ST-510 Qtr 2 2013	ST-510 Qtr 3 2013	ST-510 Qtr 4 2013
Project VOCs	CAS No.				
1,1,1-Trichloroethane	71-55-6	< 5.0			
1,1-Dichloroethane	75-34-3	< 5.0			
1,1-Dichloroethene	75-35-4	< 5.0			
Benzene	71-43-2	< 5.0			
cis-1,2-Dichloroethene	156-59-2	< 5.0			
Tetrachloroethene	127-18-4	< 5.0	No Sampling During This Quarter	No Sampling During This Quarter	No Sampling During This Quarter
Toluene	108-88-3	< 5.0			
trans-1,2-Dichloroethene	156-60-5	< 5.0			
Trichloroethylene	79-01-6	< 5.0			
Vinyl chloride	75-01-4	< 5.0			
Xylene-o	95-47-6	< 5.0			
Xylenes-m,p	1330-20-7	< 5.0			
Subtotal Project VOCs		ND	NA	NA	NA
Non-Project VOCs					
1,1,2,2-Tetrachloroethane	79-34-5	<5.0			
1,1,2-Trichloroethane	79-00-5	<5.0			
2-Butanone	78-93-3	<10			
2-Hexanone	591-78-6	<10			
4-Methyl-2-Pentanone	108-10-1	<10			
Acetone	67-64-1	<10			
Bromodichloromethane	75-27-4	<5.0			
Bromoform	75-25-2	<5.0			
Bromomethane	74-83-9	<5.0			
Carbon Disulfide	75-15-0	<10			
Carbon Tetrachloride	56-23-5	<5.0			
Chlorobenzene	108-90-7	<5.0	No Sampling During This Quarter	No Sampling During This Quarter	No Sampling During This Quarter
Dibromochloromethane	124-48-1	<5.0			
Chloroethane	75-00-3	<5.0			
Chloroform	67-66-3	<5.0			
Chloromethane	74-87-3	<5.0			
cis-1,3-Dichloropropene	10061-01-5	<5.0			
Trichlorotrifluoroethane (Freon 113)	76-13-1	<5.0			
Dichlorodifluoromethane (Freon 12)	75-71-8	<5.0			
Ethylbenzene	100-41-4	<5.0			
Methylene Chloride	75-09-2	<5.0			
Styrene	100-42-5	<5.0			
trans-1,3-Dichloropropene	10061-02-6	<5.0			
Subtotal Non-Project VOCs		ND	NA	NA	NA
TVOC[3]		ND	NA	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:

CAS No.	Chemical abstracts service list number.
µg/L	Micrograms per liter.
ND	No compounds detected.
NA	Not analyzed.
NA	Not applicable.
TVOC	Total volatile organic compounds.
VOC	Volatile organic compound.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to ALS Group, (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 Project VOCs and detected Non-Project VOCs only.
3. TVOC determined by summing individual detections and rounding to the nearest whole number.
4. Sample ST-510 was a non-routine condensate sample collected as a composite grab sample from the condensate water generated through normal system operation.

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]
		3/28/2013	6/19/2013	9/5/2013	12/4/2013	
1,1,1-Trichloroethane	5,000	0.0%	0.0%	0.0%	0.0%	0.0%
1,1-Dichloroethane	0.63	0.040%	0.036%	0.054%	0.052%	0.045%
1,1-Dichloroethene	70	0.0%	0.0%	0.0%	0.0%	0.0%
1-Chloro-1,1-difluoroethane (Freon 142b)	50,000	0.0%	0.0%	0.0%	0.0%	0.0%
Benzene	0.13	0.031%	0.058%	0.36%	0.0%	0.10%
Bromodichloromethane	70	0.0%	0.0%	0.0%	0.0%	0.0%
Carbon Tetrachloride	0.17	0.0%	0.034%	0.044%	0.0%	0.018%
Chlorodifluoromethane (Freon 22)	50,000	0.0%	0.0%	0.0%	0.0%	0.0%
Chloroform	0.043	1.1%	0.94%	1.2%	2.6%	1.5%
cis-1,2-Dichloroethene	63	0.018%	0.022%	0.024%	0.024%	0.022%
Dichlorodifluoromethane (Freon 12)	12,000	0.0%	0.0%	0.0%	0.0%	0.0%
Tetrachloroethene	1.0	0.0%	0.049%	0.080%	0.042%	0.041%
trans-1,2-Dichloroethene	63	0.0%	0.0%	0.0%	0.0%	0.0%
Trichloroethylene	0.5	1.4%	2.7%	3.8%	3.4%	2.8%
Trichlorofluoromethane (Freon 11)	5,000	0.0%	0.0%	0.0%	0.0%	0.0%
Vinyl chloride	0.11	0.039%	0.026%	0.024%	0.025%	0.029%

Notes and abbreviations on last page.

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

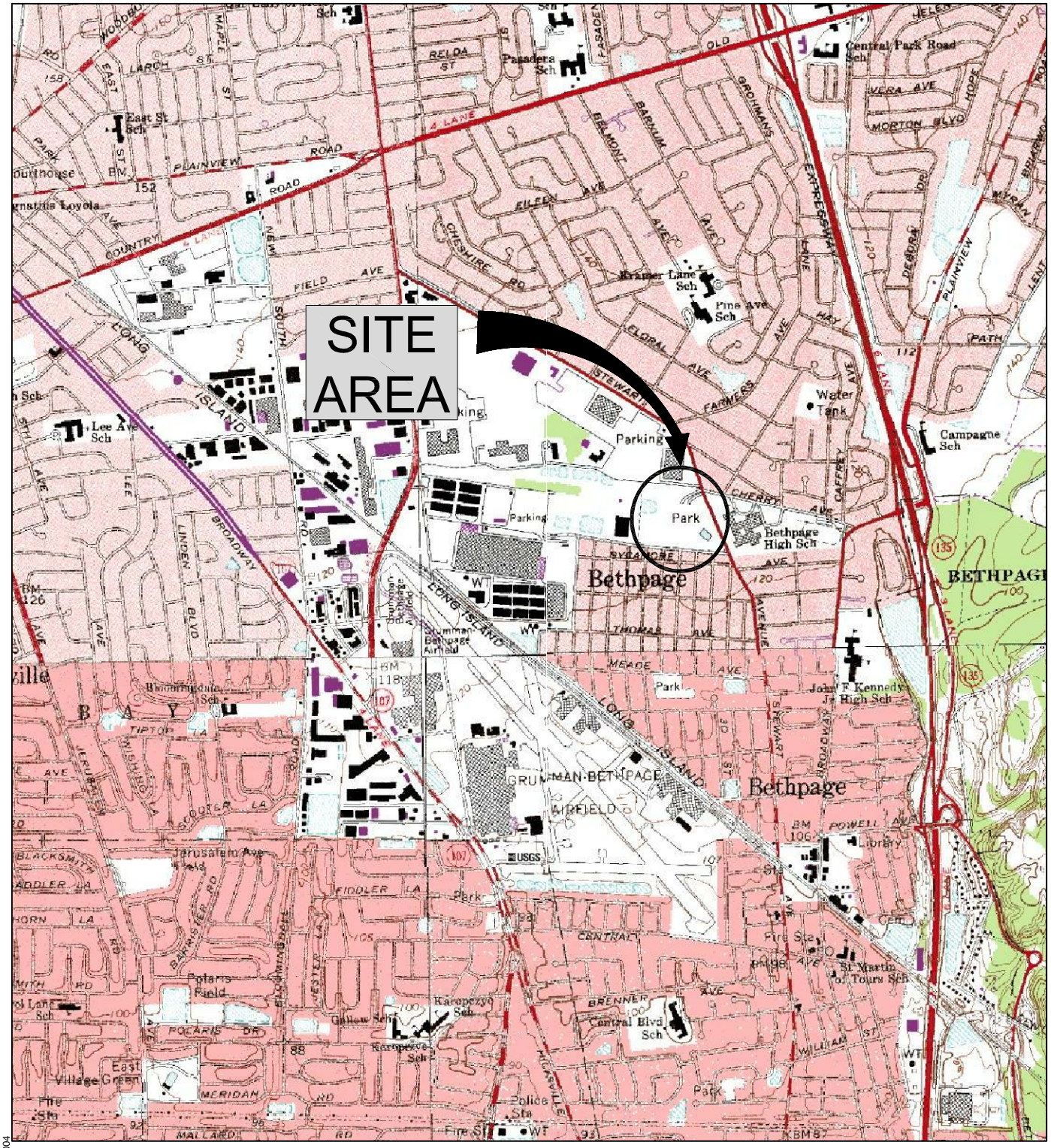
Notes and Abbreviations:

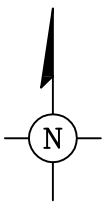
AGC	Annual guideline concentration.
DAR-1	Division of Air Resources-1.
MASC	Maximum allowable stack concentration.
µg/m^3	Micrograms per cubic meter.
NYSDEC	New York State Department of Environmental Conservation.
SGC	Short-term guideline concentration.

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.

ARCADIS

Figures





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

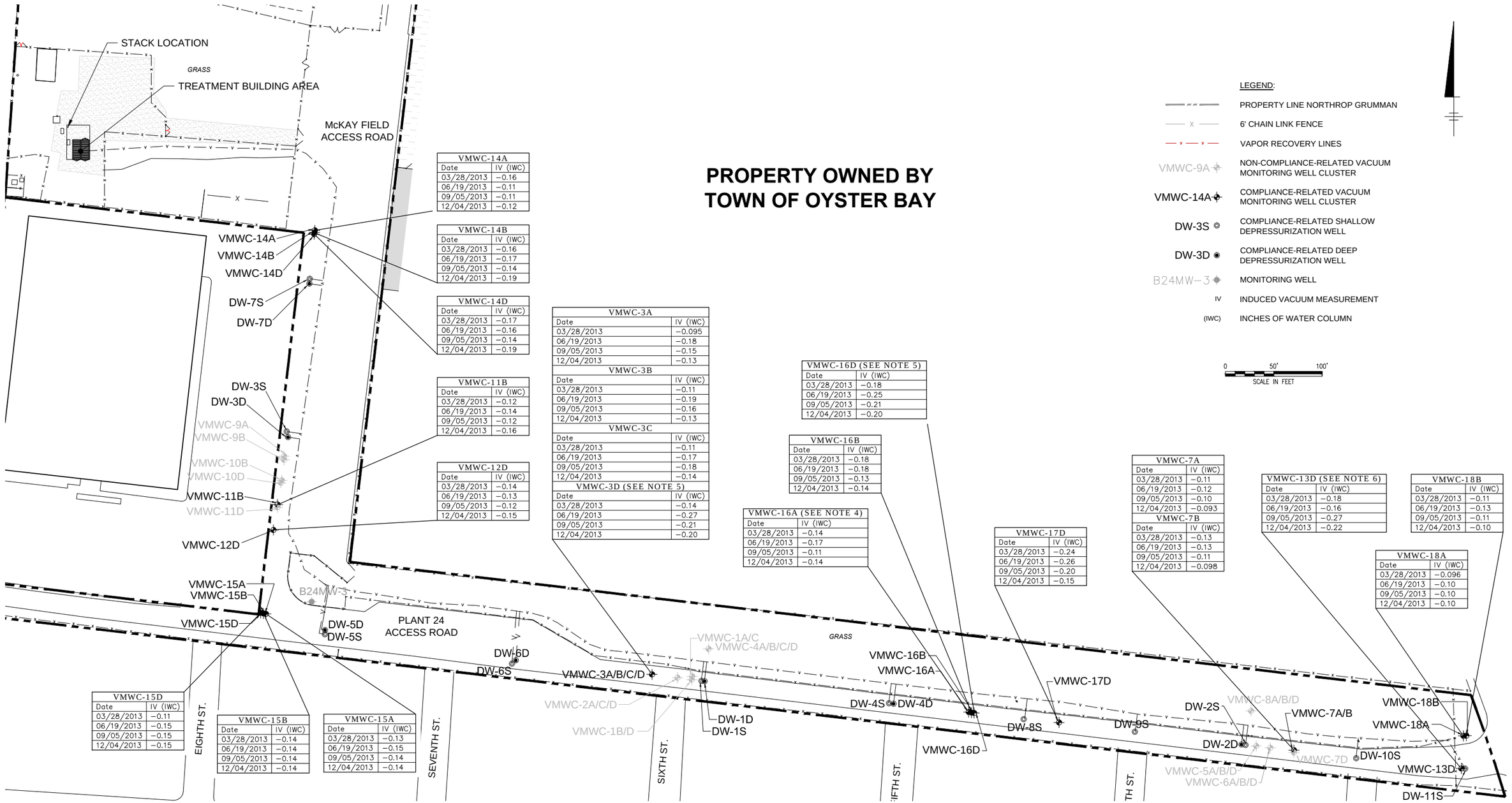
NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

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)
03/28/2013	−0.16
06/19/2013	−0.11
09/05/2013	−0.11
12/04/2013	−0.12

VMWC-14B	
Date	IV (IWC)
03/28/2013	−0.16
06/19/2013	−0.17
09/05/2013	−0.14
12/04/2013	−0.19

VMWC-14D	
Date	IV (IWC)
03/28/2013	−0.17
06/19/2013	−0.16
09/05/2013	−0.14
12/04/2013	−0.19

VMWC-11B	
Date	IV (IWC)
03/28/2013	−0.12
06/19/2013	−0.14
09/05/2013	−0.12
12/04/2013	−0.16

VMWC-12D	
Date	IV (IWC)
03/28/2013	−0.14
06/19/2013	−0.13
09/05/2013	−0.12
12/04/2013	−0.15

VMWC-3A	
Date	IV (IWC)
03/28/2013	−0.095
06/19/2013	−0.18
09/05/2013	−0.15
12/04/2013	−0.13
VMWC-3B	
Date	IV (IWC)
03/28/2013	−0.11
06/19/2013	−0.19
09/05/2013	−0.16
12/04/2013	−0.13
VMWC-3C	
Date	IV (IWC)
03/28/2013	−0.11
06/19/2013	−0.17
09/05/2013	−0.18
12/04/2013	−0.14
VMWC-3D (SEE NOTE 5)	
Date	IV (IWC)
03/28/2013	−0.14
06/19/2013	−0.27
09/05/2013	−0.21
12/04/2013	−0.20

VMWC-16D (SEE NOTE 5)	
Date	IV (IWC)
03/28/2013	−0.18
06/19/2013	−0.25
09/05/2013	−0.21
12/04/2013	−0.20

VMWC-16B	
Date	IV (IWC)
03/28/2013	−0.18
06/19/2013	−0.18
09/05/2013	−0.13
12/04/2013	−0.14

VMWC-16A (SEE NOTE 4)	
Date	IV (IWC)
03/28/2013	−0.14
06/19/2013	−0.17
09/05/2013	−0.11
12/04/2013	−0.14

VMWC-17D	
Date	IV (IWC)
03/28/2013	−0.24
06/19/2013	−0.26
09/05/2013	−0.20
12/04/2013	−0.15

VMWC-7A	
Date	IV (IWC)
03/28/2013	−0.11
06/19/2013	−0.12
09/05/2013	−0.10
12/04/2013	−0.093
VMWC-7B	
Date	IV (IWC)
03/28/2013	−0.13
06/19/2013	−0.13
09/05/2013	−0.11
12/04/2013	−0.098

VMWC-13D (SEE NOTE 6)	
Date	IV (IWC)
03/28/2013	−0.18
06/19/2013	−0.16
09/05/2013	−0.27
12/04/2013	−0.22

VMWC-18B	
Date	IV (IWC)
03/28/2013	−0.11
06/19/2013	−0.13
09/05/2013	−0.11
12/04/2013	−0.10

VMWC-18A	
Date	IV (IWC)
03/28/2013	−0.096
06/19/2013	−0.10
09/05/2013	−0.10
12/04/2013	−0.10

VMWC-15D	
Date	IV (IWC)
03/28/2013	−0.11
06/19/2013	−0.15
09/05/2013	−0.15
12/04/2013	−0.15

VMWC-15B	
Date	IV (IWC)
03/28/2013	−0.14
06/19/2013	−0.14
09/05/2013	−0.14
12/04/2013	−0.14

VMWC-15A	
Date	IV (IWC)
03/28/2013	−0.13
06/19/2013	−0.15
09/05/2013	−0.14
12/04/2013	−0.14

NOTE:

1. USEPA'S RADON GUIDANCE RECOMMENDS NEGATIVE PRESSURE OF 0.035 INCHES OF WATER FOR THE CONTROL OF SOIL VAPOR (EPA 625/R-93-011, 1993).
2. 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 2007).
3. DATA SHOWN HEREIN ARE COLLECTED FROM COMPLIANCE-RELATED MONITORING WELLS ONLY.
4. VALUE WAS REMEASURED ON APRIL 5, 2013 DUE TO ERRONEOUS VALUES RECORDED ON MARCH 28, 2013.
5. VALUE WAS REMEASURED ON SEPTEMBER 25, 2013 DUE TO AN ERRONEOUS VALUE RECORDED ON SEPTEMBER 5, 2013.
6. VALUE WAS REMEASURED ON DECEMBER 16, 2013 DUE TO AN ERRONEOUS VALUE RECORDED ON DECEMBER 4, 2013.

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\SYRACUSE\ACTNY\001496\12125SGSI4\NY1496_12125SGSI4 C04.dwg LAYOUT: 2 SAVED: 2/6/2014 11:05 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: PDF 11X17 PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 2/6/2014 9:17 AM BY: SANCHEZ, ADRIAN
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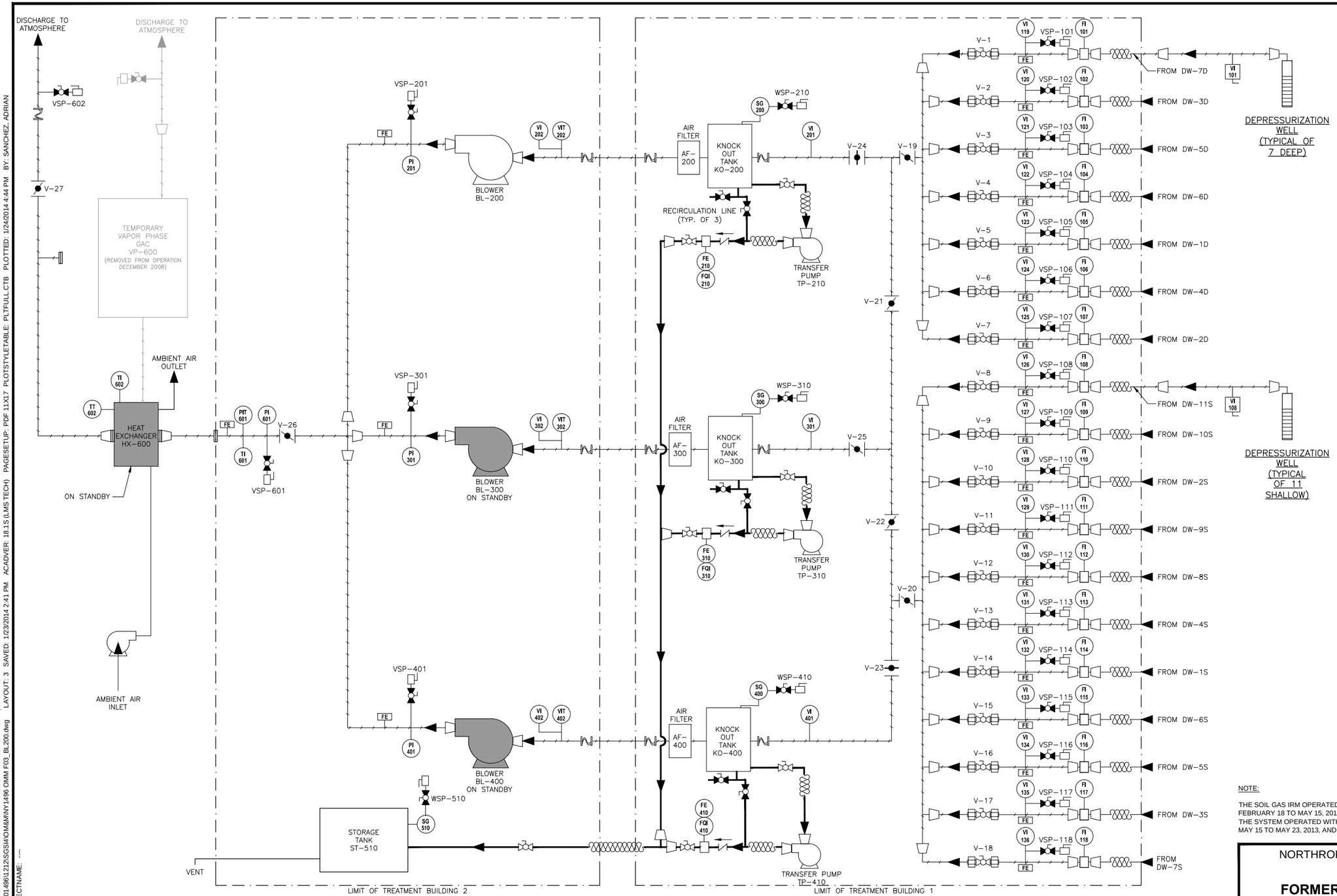

LEGEND:

- 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 108 — 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

NOTE:

THE SOIL GAS IRM OPERATED WITH BLOWER BL-200 ONLINE FROM FEBRUARY 18 TO MAY 15, 2013, MAY 23 TO JULY 24, 2013, AND JULY 31 TO DECEMBER 31, 2013. THE SYSTEM OPERATED WITH BLOWER BL-400 ONLINE FROM JANUARY 1 TO FEBRUARY 18, 2013, MAY 15 TO MAY 23, 2013, AND JULY 24 TO JULY 31, 2013.

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:	VSP-601	VSP-601	VSP-601	VSP-601
	Sample Date:	3/28/2013	6/19/2013	9/5/2013	12/4/2013
	CAS No.				
1,1,1-Trichloroethane	71-55-6	**8.4**	**11**	**14**	**13**
1,1,2,2-Tetrachloroethane	79-34-5	< 0.80	< 0.75	< 0.77	< 0.91
1,1,2-Trichloroethane	79-00-5	< 0.80	< 0.75	< 0.77	< 0.91
1,1-Dichloroethane	75-34-3	**9.4**	**7.9**	**11**	**11**
1,1-Dichloroethene	75-35-4	**3.0**	**2.4**	**2.1**	**1.6**
1,2-Dichloroethane	107-06-2	< 0.80	< 0.75	< 0.77	< 0.91
1,2-Dichloropropane	78-87-5	< 0.80	< 0.75	< 0.77	< 0.91
1,3-Butadiene	106-99-0	< 0.80	< 0.75	< 0.77	< 0.91
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3	**160 D**	**230 D**	**380 D**	**170**
2-Butanone	78-93-3	< 8.0	< 7.5	< 7.7	< 9.1
2-Hexanone	591-78-6	< 0.80	< 0.75	< 0.77	< 0.91
4-Methyl-2-Pentanone	108-10-1	< 0.80	< 0.75	< 0.77	< 0.91
Acetone	67-64-1	< 8.0	< 7.5	< 7.7	< 9.1
Benzene	71-43-2	**1.5**	**2.6**	**15**	< 0.91
Bromodichloromethane	75-27-4	< 0.80	< 0.75	**1.2**	< 0.91
Bromoform	75-25-2	< 0.80	< 0.75	< 0.77	< 0.91
Bromomethane	74-83-9	< 0.80	< 0.75	< 0.77	< 0.91
Carbon Disulfide	75-15-0	< 8.0	< 7.5	< 7.7	< 9.1
Carbon Tetrachloride	56-23-5	< 0.80	**0.78**	**0.96**	< 0.91
Chlorobenzene	108-90-7	< 0.80	< 0.75	< 0.77	< 0.91
Chlorodibromomethane	124-48-1	< 0.80	< 0.75	< 0.77	< 0.91
Chlorodifluoromethane (Freon 22)	75-45-6	**4.1**	**4.2**	**7.0**	**3.0**
Chloroethane	75-00-3	< 0.80	< 0.75	< 0.77	< 0.91
Chloroform	67-66-3	**18**	**14**	**17**	**38**
Chloromethane	74-87-3	< 0.80	< 0.75	< 0.77	< 0.91
cis-1,2-Dichloroethene	156-59-2	**430 D**	**470 D**	**490 D**	**500 D**
cis-1,3-Dichloropropene	10061-01-5	< 0.80	< 0.75	< 0.77	< 0.91
Ethylbenzene	100-41-4	< 0.80	< 0.75	< 0.77	< 0.91
Dichlorodifluoromethane (Freon 12)	75-71-8	**2.4**	**2.5**	**3.3**	**2.5**
Methyl Tert-Butyl Ether	1634-04-4	< 0.80	< 0.75	< 0.77	< 0.91
Methylene Chloride	75-09-2	< 0.80	< 0.75	< 0.77	< 0.91
Styrene	100-42-5	< 0.80	< 0.75	< 0.77	< 0.91
Tetrachloroethene	127-18-4	**1.4**	**17**	**26**	**14**
Toluene	108-88-3	< 0.80	< 0.75	< 0.77	< 0.91
trans-1,2-Dichloroethene	156-60-5	**2.6**	**2.9**	**4.8**	**3.3**
trans-1,3-Dichloropropene	10061-02-6	< 0.80	< 0.75	< 0.77	< 0.91
Trichloroethylene	79-01-6	**260 D**	**470 D**	**620 D**	**570 D**
Trichlorofluoromethane (Freon 11)	75-69-4	**1.5**	**2.1**	**1.8**	**1.3**
Trichlorotrifluoroethane (Freon 113)	76-13-1	< 0.80	< 0.75	< 0.77	< 0.91
Vinyl chloride	75-01-4	**1.6**	**0.97**	**0.85**	**0.92**
Xylene-o	95-47-6	< 0.80	< 0.75	< 0.77	< 0.91
Xylenes - m,p	179601-23-1	< 1.6	< 1.5	< 1.5	< 1.8
TVOC[2]		**904**	**1,239**	**1,595**	**1,329**

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	Bold data indicates that the analyte was detected at or above its reporting limit.
CAS No.	Chemical abstracts service list number.
D	Compound detected at a secondary dilution.
µg/m^3	Micrograms per cubic meter.
TVOC	Total volatile organic compounds.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to ALS Environmental, 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.

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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.[1,2,3]

	Sample ID:	VSP-601	VSP-601	VSP-601	VSP-601
	Sample Date:	3/28/2013	6/19/2013	9/5/2013	12/4/2013
	Units:	ppbv	ppbv	ppbv	ppbv
1-Butanol		ND	ND	**4.7 JN**	
1-Decene		ND	**0.53 JN**	**0.90 JN**	
1-Dodecene		ND	**1.0 JN**	ND	
2-Butoxyethanol		ND	ND	**33 JN**	
2-Hydroxyproppylmethacrylate		ND	ND	**13 JN**	
Acetophenone		ND	**4.0 JN**	**80 JN**	
alpha-Cumyl Alcohol		ND	**24 JN**	**80 JN**	
alpha-Methylstyrene		ND	**1.5 JN**	**8.8 JN**	
Benzaldehyde		ND	ND	**7.3 JN**	
Butoxyethoxyethanol		ND	ND	**4.7 JN**	
Butylformate		ND	ND	**3.0 JN**	
$C_8H_8O_2$ Compound		ND	ND	**0.88 JN**	No Tentatively Identfied Compounds Detected
$C_{12}H_{24}$ Compound		ND	ND	**1.2 JN**	
Ethyleneglycol monohexylether		ND	ND	**0.91 JN**	
Hexamethylcyclotrisiloxane		ND	ND	ND	
Isobutane		**1.4 JN**	**2.9 JN**	ND	
Isooctane		ND	ND	ND	
Methyl Methacrylate		ND	ND	**2.4 JN**	
n-Butanal		ND	ND	**6.2 JN**	
Phenol		ND	ND	**1.6 JN**	
Propylene Glycol		ND	ND	**10 JN**	
Unidentified Compound		ND	NA	NA	
Unidentified Compound		ND	NA	NA	
Unidentified Compound		ND	NA	NA	

Notes and Abbreviations:

Bold Detected.
JN Compound tentatively identified, concentration is estimated.
NA Unidentified compound detected but estimated concentration cannot be calculated.
ND Unidentified compound detected historically, but not detected during this reporting period.
ppbv Parts per billion by volume.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to ALS Environmental, 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.

ARCADIS

Appendix B

Annual Summary of Condensate Sample Analytical Results Including Tentatively Identified Compounds

ARCADIS

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[2] 3/27/2013	ST-510 Qtr 2 2013	ST-510 Qtr 3 2013	ST-510 Qtr 4 2013
1,1,1-Trichloroethane	71-55-6	<5.0			
1,1,2,2-Tetrachloroethane	79-34-5	<5.0			
1,1,2-Trichloroethane	79-00-5	<5.0			
1,1-Dichloroethane	75-34-3	<5.0			
1,1-Dichloroethene	75-35-4	<5.0			
2-Butanone	78-93-3	<10			
2-Hexanone	591-78-6	<10			
4-Methyl-2-Pentanone	108-10-1	<10			
Acetone	67-64-1	<10			
Benzene	71-43-2	<5.0			
Bromodichloromethane	75-27-4	<5.0			
Bromoform	75-25-2	<5.0			
Bromomethane	74-83-9	<5.0			
Carbon Disulfide	75-15-0	<10			
Carbon Tetrachloride	56-23-5	<5.0			
Chlorobenzene	108-90-7	<5.0			
Dibromochloromethane	124-48-1	<5.0			
Chloroethane	75-00-3	<5.0	No Sampling During This Quarter	No Sampling During This Quarter	No Sampling During This Quarter
Chloroform	67-66-3	<5.0			
Chloromethane	74-87-3	<5.0			
cis-1,2-Dichloroethene	156-59-2	<5.0			
cis-1,3-Dichloropropene	10061-01-5	<5.0			
Trichlorotrifluoroethane (Freon 113)	76-13-1	<5.0			
Dichlorodifluoromethane (Freon 12)	75-71-8	<5.0			
Ethylbenzene	100-41-4	<5.0			
Methylene Chloride	75-09-2	<5.0			
Styrene	100-42-5	<5.0			
Tetrachloroethene	127-18-4	<5.0			
Toluene	108-88-3	<5.0			
trans-1,2-Dichloroethene	156-60-5	<5.0			
trans-1,3-Dichloropropene	10061-02-6	<5.0			
Trichloroethylene	79-01-6	<5.0			
Vinyl Chloride	75-01-4	<5.0			
Xylene-o	95-47-6	<5.0			
Xylenes - m,p	1330-20-7	<5.0			
TVOC		ND	NA	NA	NA

Notes and Abbreviations:

CAS No.	Chemical abstracts service list number.
NA	Not applicable.
ND	No compounds detected.
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 ALS Group, (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. Sample ST-510 was a non-routine condensate sample collected as a composite grab sample from the condensate water generated through normal system operation.

ARCADIS

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]

	Sample ID:	ST-510[3]	ST-510	ST-510	ST-510
	Sample Date:	3/27/2013	Qtr 2 2013	Qtr 3 2013	Qtr 4 2013
	Units:	ug/L	ug/L	ug/L	ug/L
1-Decene		No Tentatively Identified Compounds Detected	No Sampling During This Quarter	No Sampling During This Quarter	No Sampling During This Quarter
1-Dodecene					
2,3,3-Trimethylpentane					
2,3,4-Trimethylpentane					
alpha-Cumyl Alcohol					
Acetophenone					
alpha-Methylstyrene					
Hexamethylcyclotrisiloxane					
Isobutane					
Isooctane					
Unidentified Compound					
Unidentified Siloxane					

Notes and Abbreviations:

µg/L Micrograms per liter.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to ALS Group, (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. Sample ST-510 was a non-routine condensate sample collected as a composite grab sample from the condensate water generated through normal system operation.

ARCADIS

Appendix C

Annual Summary of Air Modeling Calculations

ARCADIS

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:	3/28/2013	6/19/2013	9/5/2013	12/4/2013
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)]		519	515	683 [(9)]	720[(11)]
Air Flow Rate (acfm @ stack temp)[(2)]		533	548	741	760
Stack Gas Exit Temperature (K)[(1)]		303	313	319 [(10)]	311
Ambient Air Temperature (K)[(3)]		279	292	288	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 (µg/m^3)[(5)]		1,345	1,402	1,104	1,036
Annualization Factor[(6)]		0.08	0.08	0.08	0.08
Average Annual Concentration at Receptor Height (µg/m^3)[(7)]		107.6	112.2	88.3	82.9
Distance To Max Concentration (m)[(8)]		44	43	49	50

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.
9. The effluent air flow rate was remeasured on October 2, 2013 due to an erroneous value recorded on September 5, 2013.
10. As of September 5, 2013 the stack gas exit temperature was measured at the heat exchanger effluent location.
11. The effluent air flow rate was remeasured on December 6, 2013 due to an erroneous value recorded on December 4, 2013.

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)			
	3/28/2013	6/19/2013	9/5/2013	12/4/2013
1,1,1-Trichloroethane	8.4	11	14	13
1,1-Dichloroethane	9.4	7.9	11	11
1,1-Dichloroethene	3.0	2.4	2.1	1.6
1-Chloro-1,1-difluoroethane (Freon 142b)	160	230	380	170
Benzene	1.5	2.6	15	0
Bromodichloromethane	0	0	1.2	0
Carbon tetrachloride	0	0.78	0.96	0
Chlorodifluoromethane (Freon 22)	4.1	4.2	7.0	3.0
Chloroform	18	14	17	38
cis-1,2-Dichloroethene	430	470	490	500
Dichlorodifluoromethane (Freon 12)	2.4	2.5	3.3	2.5
Tetrachloroethene	1.4	17	26	14
trans-1,2-Dichloroethene	2.6	2.9	4.8	3.3
Trichloroethylene	260	470	620	570
Trichlorofluoromethane (Freon 11)	1.5	2.1	1.8	1.3
Vinyl chloride	1.6	0.97	0.85	0.92

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] ($\mu g/m^3$)			
		3/28/2013	6/19/2013	9/5/2013	12/4/2013
1,1,1-Trichloroethane	5,000	1.8E+08	1.7E+08	1.6E+08	1.7E+08
1,1-Dichloroethane	0.63	2.3E+04	2.2E+04	2.0E+04	2.1E+04
1,1-Dichloroethene	70	2.6E+06	2.4E+06	2.3E+06	2.4E+06
1-Chloro-1,1-difluoroethane (Freon 142b)	50,000	1.8E+09	1.7E+09	1.6E+09	1.7E+09
Benzene	0.13	4.8E+03	4.5E+03	4.2E+03	4.4E+03
Bromodichloromethane	70	2.6E+06	2.4E+06	2.3E+06	2.4E+06
Carbon tetrachloride	0.067	2.5E+03	2.3E+03	2.2E+03	2.3E+03
Chlorodifluoromethane (Freon 22)	50,000	1.8E+09	1.7E+09	1.6E+09	1.7E+09
Chloroform	0.043	1.6E+03	1.5E+03	1.4E+03	1.4E+03
cis-1,2-Dichloroethene	63	2.3E+06	2.2E+06	2.0E+06	2.1E+06
Dichlorodifluoromethane (Freon 12)	12,000	4.4E+08	4.1E+08	3.9E+08	4.0E+08
Tetrachloroethene	1.0	3.7E+04	3.4E+04	3.2E+04	3.4E+04
trans-1,2-Dichloroethene	63	2.3E+06	2.2E+06	2.0E+06	2.1E+06
Trichloroethylene	0.5	1.8E+04	1.7E+04	1.6E+04	1.7E+04
Trichlorofluoromethane (Freon 11)	5,000	1.8E+08	1.7E+08	1.6E+08	1.7E+08
Vinyl chloride	0.11	4.1E+03	3.8E+03	3.6E+03	3.7E+03

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]			
	3/28/2013	6/19/2013	9/5/2013	12/4/2013
1,1,1-Trichloroethane	0.0%	0.0%	0.0%	0.0%
1,1-Dichloroethane	0.040%	0.036%	0.054%	0.052%
1,1-Dichloroethene	0.0%	0.0%	0.0%	0.0%
1-Chloro-1,1-difluoroethane (Freon 142b)	0.0%	0.0%	0.0%	0.0%
Benzene	0.031%	0.058%	0.36%	0.00%
Bromodichloromethane	0.0%	0.0%	0.0%	0.0%
Carbon tetrachloride	0.0%	0.034%	0.044%	0.0%
Chlorodifluoromethane (Freon 22)	0.0%	0.0%	0.0%	0.0%
Chloroform	1.1%	0.94%	1.2%	2.6%
cis-1,2-Dichloroethene	0.018%	0.022%	0.024%	0.024%
Dichlorodifluoromethane (Freon 12)	0.0%	0.0%	0.0%	0.0%
Tetrachloroethene	0.0%	0.049%	0.080%	0.042%
trans-1,2-Dichloroethene	0.0%	0.0%	0.0%	0.0%
Trichloroethylene	1.4%	2.7%	3.8%	3.4%
Trichlorofluoromethane (Freon 11)	0.0%	0.0%	0.0%	0.0%
Vinyl chloride	0.039%	0.026%	0.024%	0.025%

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

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.