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November 19, 2010

Ms. Alicia Barraza
New York State Department of Environmental Conservation
Bureau of Hazardous Waste and Radiation Management
625 Broadway, 8th Floor
Albany, New York 12233-7258

Re: Response to Comments
Construction Certification Report
Vapor Intrusion Interim Corrective Measures
Main Manufacturing Area, Watervliet Arsenal, Watervliet, New York

Dear Ms. Barraza:

On behalf of the Watervliet Arsenal (WVA), this letter responds to your comments received via e-mail on November 3, 2010 regarding the *Vapor Intrusion Interim Corrective Measures Construction Certification Report* dated September 2010. To aid in your review, we have listed our responses in the order they appear in the November 2, 2010 communication.

<u>Comment #1</u>: *Section 4.2.1 - Building 21. The report states that a Type B system is used to mitigate the basement area. This should be corrected to Type A system, as shown in Figure M-3.*

<u>Response #1</u>: The text has been revised per the comment.

<u>Comment #2</u>: *Section 4.2.5 - Building 114.*

1. *The second sentence states that two extraction wells are located in building 114 yet three wells are listed. EW-3 should be eliminated from the text.*
2. *The report states that the ROI was consistent with pilot test results. What was the ROI during startup testing?*
3. *The maximum flow rate for the startup testing was 69 cfm. What was the flow rate for the second extraction well (Table 5-2 shows 90 cfm as the total flow rate)?*

<u>Response #2</u>:

1. The text has been revised to list only two extraction wells.
2. The ROI during startup testing was greater than 23 feet based on the pressure measurement at that distance. The design ROI was 23 feet based on the results of the pilot test.
3. The flow rate for the extraction wells was as follows:
    a. EW-1: 69 cubic feet per minute (cfm)
    b. EW-2: 21 cfm

Comment #3: *Section 5.1.3 - Estimated VOC Removal Mass*

1. *The total mass removal should be calculated for each reported VOC concentration, rather than adding the reported concentrations of all VOCs (as was done in Table 5-1).*
2. *The SSDS flow rate used to calculate the total mass removal should be the sum of flow rates from all extraction wells, divided by the total number of wells.*
3. *Table 5-2 should be revised to show the corrected Total CVOC Mass for each building.*

Response #3:

1. Mass removal was calculated for each VOC in the original table. Per the comment, the table has been revised to show results for compounds that were not detected in the effluent samples.
2. The table has been revised per the comment. However, it should be noted that the flow rate used in the original table was measured at the same point from which the effluent sample was collected. Therefore, the mass removal calculation using that total flow rate is valid.
3. The table has been revised per the comments.

Copies of the revised report text and Table 5-2 are attached to this letter. Please contact me at (518) 250-7359, or Ms. JoAnn Kellogg of the WVA at (518) 266-5286, if you have any questions.

Very truly yours,

MALCOLM PIRNIE, INC.

Andrew R. Vitolins, P.G.
Associate

arv

Enclosures

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Table 5-2
VOC Mass Removal Summary
Watervliet Arsenal
Watervliet, New York

Flow Rates (cfm)

Extraction Well	**Building**			
	20	**21**	**25**	**114**
EW-1	185	43	162	69
EW-2	85	---	117	21
EW-3	84	---	115	---
EW-4	---	---	148	---
Flow Rate for Mass Removal Calcuation*	**118**	**43**	**136**	**45**

Mass Removal (lb/year)*

Building	**20**	**21**	**25**	**114**
Date	**9/10/2010**	**8/12/2010**	**8/12/2010**	**8/12/2010**
SSDS Flow Rate (cfm)	**118**	**43**	**136**	**45**
Chloromethane	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
cis-1,2-Dichloroethene	ND	**0.062**	**0.1**	ND
1,1,1-Trichloroethane	**0.02**	ND	**0.4**	ND
Carbon Tetrachloride	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
Trichloroethene	**0.97**	**0.380**	**27.5**	**0.009**
1,1,2-Trichloroethane	ND	ND	ND	ND
Tetrachloroethene	**0.21**	**0.089**	**0.3**	**0.010**
Chlorobenzene	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
Total CVOC Mass Removal	**1.20**	**0.530**	**28.3**	**0.019**

Notes:
* Per NYSDEC, calculated as sum of flow rates divided by the number of extraction wells
** Calculated based on pre-carbon effluent concentrations
SSDS - sub-slab depressurization system
ND - compound not detected
ug/m^3 - micrograms per cubic meter
lb/year- pounds per year
cfm - cubic feet per minute

Conversion Factors:
2.2 E-09 lb/ug
0.0283 m^3/ft^3
525,600 min/year

Watervliet Arsenal

Watervliet, New York

Construction Certification Report

Vapor Intrusion Interim Corrective Measures

Main Manufacturing Area
Watervliet Arsenal
Watervliet New York

November 2010

Report Prepared By:

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US Army Corps of Engineers

Report Prepared For:

U.S. Army Corps of Engineers

Baltimore District, Baltimore, Maryland
Contract No. W912DR-09-D-0016

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1. Introduction

The Watervliet Arsenal (WVA) is a 140-acre government-owned installation under the command of the U.S. Army Tank-automotive and Armaments Command (TACOM) located in the City of Watervliet, New York. The WVA is located on the western shore of the Hudson River and approximately five miles north of the City of Albany (Figure 1-1). The WVA currently manufactures large caliber cannons and mortars.

The WVA consists of two primary areas: the Main Manufacturing Area (MMA), encompassing approximately 125 acres, where manufacturing and administrative operations occur, and the Siberia Area (SA), primarily used for the storage of raw and hazardous materials, finished goods, and supplies brought from the MMA (Figure 1-2). Broadway Street (New York State Route 32) and a six-lane interstate highway (Interstate 787) are located between the WVA and the Hudson River.

In accordance with the results and recommendations of the *Vapor Intrusion Investigation Report, Watervliet Arsenal, Watervliet, New York* (Malcolm Pirnie 2008), and subsequent discussions and agreements between the WVA, the New York State Department of Environmental Conservation (NYSDEC), and the New York State Department of Health (NYSDOH), the WVA implemented Interim Corrective Measures (ICMs) to mitigate vapor intrusion impacts at eight buildings within the Main Manufacturing Area of the WVA. The ICMs were implemented in accordance with the Administrative Order on Consent between the WVA, the NYSDEC, and the United States Environmental Protection Agency (USEPA), and consisted of the construction and operation of sub-slab depressurization systems (SSDSs) in eight buildings to prevent the intrusion of soil vapor containing chlorinated volatile organic compounds (VOCs). Malcolm Pirnie, Inc. (Malcolm Pirnie) was retained by the United States Army Corps of Engineers – Baltimore District (USACE) to implement the ICMs on behalf of the WVA.

This Construction Certification Report is intended to document and confirm that the MMA vapor intrusion corrective measures were completed in accordance with the approved ICM Work Plan (Malcolm Pirnie, 2009). Any deviations from the ICM Work Plan are noted in this Report.

2. Background

The WVA performed a vapor intrusion investigation within, and adjacent to, the Main Manufacturing Area (MMA), and adjacent to the Siberia Area of the WVA, in November 2007 and February 2008. The purpose of the investigation was to assess whether CVOCs were present in the sub-slab soil vapor beneath, and the indoor air within, buildings located in the MMA, including those that once contained degreasing operations, as well as three off-site private residences along the southeastern WVA property boundary. The evaluation also assessed whether soil vapor at the WVA southern property boundary and northern property boundary adjacent to the Siberia Area contained CVOCs.

A total of 25 buildings in the MMA were sampled during at least one of the two investigation phases. Based on the results of the investigations, no further action was required at the off-site residences, the WVA property boundary, and at WVA Buildings 9, 18, 19, 23, 24, 35, 38, 44, 108, 110, 112, 115, 124, and 126. Sub-slab VOC concentrations at Building 15 will require monitoring of the indoor air, but not corrective measures. VOCs detected in the sub-slab at Buildings 116 and 123 were also in the range where indoor air monitoring would be required. However, since Building 116 is not occupied and Building 123 is only periodically used for painting operations, no monitoring will be conducted at these buildings. Indoor air monitoring will be conducted at Buildings 116 and 123 if the use of either building changes in the future. The buildings that required interim corrective measures are summarized in Table 2-1 below.

Table 2-1 – Buildings Requiring Soil Vapor Interim Corrective Measures

Building	Impacted Media	Target Chlorinated VOCs
20	Sub-Slab Soil Vapor	PCE, TCE, TCA
21	Sub-Slab Soil Vapor	TCE
22	Sub-Slab Soil Vapor	TCE
25	Indoor Air, Sub-Slab Soil Vapor	TCE, TCA
114	Indoor Air, Sub-Slab Soil Vapor	PCE, TCE
120	Sub-Slab Soil Vapor	PCE, Carbon Tetrachloride
121	Sub-Slab Soil Vapor	TCE
130	Sub-Slab Soil Vapor	TCE

Notes:
PCE – Tetrachloroethene
TCE – Trichloroethene
TCA – 1,1,1-Trichloroethane

3. ICM Construction Summary

Construction and installation of the SSDSs was completed in accordance with the approved ICM Work Plan with minor deviations discussed below. Malcolm Pirnie retained Aztech Technologies (Aztech) to construct and install the SSDSs. As-built drawings for each system type (Type A, B, and C) and building installation are provided in Appendix A. Photographs documenting the installations of the SSDSs are provided in Appendix B.

3.1. Construction Schedule

A pre-construction meeting was held on July 23, 2009 and construction and installation of the SSDSs began on July 27, 2009. Major completion of the Type C system installations and startup testing was performed in December 2009. Finial SSDS construction and delivery of the Type A and B systems was completed on March 22, 2010. Installation for the Type A and B mechanical systems was completed on May 13, 2010, with incomplete items documented on a "punch-list". Major punch-list item and final system wiring and control panel programming was completed on July 22, 2010. A training session was held on August 5, 2010 to provide key personnel guidance on system operation. During the training session the Building 20 blower was found to be defective and was removed and returned to the manufacturer for service. Startup testing and effluent discharge sampling for the Type A and Building 25 Type B SSDSs was completed on August 12, 2010. The replacement blower for the Building 20 Type B SSDS was installed on September 2, 2010. Startup testing for the Building 20 SSDS was also completed on September 2, 2010 and effluent discharge samples were collected on September 10, 2010. As of September 3, 2010, all Type A, B, and C SSDSs were operating in accordance with the ICM Work Plan.

3.2. Type A SSDS

The Type A SSDSs were installed at Buildings 21 and 114 in accordance with the approved ICM Work Plan. The Type A SSDS is designed for buildings that required greater flow rates and vacuum pressures than can be supplied with traditional in-line fan systems. These systems were also used where off-gas treatment through GAC is required before discharge to the atmosphere, based on the sub-slab soil vapor concentrations measured during the investigation and effluent concentrations measures during the pilot studies. As shown in the As-built drawings, the Type A SSDSs is housed within an insulated enclosure. The enclosures are situated immediately adjacent to the building and are connected to the extraction wells via a wall penetration. The Type A SSDS includes the following major components:

- Regenerative blower equipped with a variable-speed drive;
- Remote-mounted control panel with alarms and automatic shutdown capability;
- Electrical panel;
- Programmable Logic Controller (PLC) with telemetry transmission;
- Vapor Knockout Tank;
- Critical Silencer;
- Air intake hood and dilution controls;
- In-series 200-pound or 400-pound GAC vessels;
- Vacuum/pressure gauges and sampling ports; and
- Environmental controls, including thermostat, exhaust fan, and lighting.

The enclosure is heated by radiant heat generated from the blower exhaust piping, which is allowed to radiate before leaving the enclosure. The Type A SSDS is used at the following buildings:

Building 21 (basement) (200-pound GAC vessels)

Building 114 (400-pound GAC vessels)

3.2.1. Design Changes

Design changes in the Type A SSDS final construction included:

- Variable frequency drives (VFDs) were added to regulate the speed of the exhaust fan for the SSDS enclosures. This was done to mitigate potential noise concerns of occupants in buildings adjacent to the SSDS enclosures by providing the capability to control the speed of the exhaust fans.
- Additional electrical disconnects were required at each Type A SSDS location to facilitate the installation of the VFD for the exhaust fan.

3.3. Type B SSDS

The Type B SSDS was installed at Buildings 20 and 25 in accordance with the ICM Work Plan. The Type B SSDS required the largest flow rates and vacuum pressures due to the size of the buildings and treatment areas. The system services both buildings from a single location and is equipped with large capacity GAC vessels to treat off-gas before discharge to the atmosphere. The Type B SSDS is housed within an insulated 20 foot by 8 foot enclosure that is approximately 9 feet high (i.e., shipping container). The enclosure is situated adjacent to Building 20 in the alleyway between the north side of Building 25 and the south side of Building 20 and is connected to the extraction wells via wall penetrations. The piping from Building 25 crosses the alleyway via an overhead pipe that is supported from the ground. The Type B SSDS includes the following components:

- Two positive-displacement blowers equipped with variable-speed drives with a design flow rate of 360 cfm for Building 20 and 450 cfm for Building 25;
- Control panel with alarms and automatic shutdown capability;
- Electrical room with panels;
- PLC with telemetry transmission;
- Vapor Knockout Tanks;
- Critical Silencers;
- Air intake louver and dilution controls;
- Two 2,000-pound GAC vessels, in-series;
- Vacuum/pressure gauges and sampling ports; and
- Environmental controls, including thermostat, heating, exhaust fan, and lighting.

3.3.1. Design Changes

Design changes in the Type B SSDS final construction included:

- The roof-mounted heat exchanger was not provided for the Type B SSDS. The heat exchanger was originally designed to reduce discharge temperatures of the air from the blower into the inlet of the carbon vessels; however, based on the selected blowers' operating efficiencies and anticipated discharge temperatures, the heat exchanger was not required and was deleted from the final design.

3.4. Type C SSDS

The Type C SSDSs were used for smaller buildings and/or smaller treatment areas where off-gas treatment is not required. The systems consist of an in-line fan connected directly to the extraction well through piping and are similar to a traditional radon mitigation system. The fans are located outside of the structures and are connected to the extraction well through wall penetrations.

The Type C SSDSs include the following components:

- In-line Fantech radon mitigation fan;
- Pressure gauge and sampling ports.

The Type C SSDS were installed at the following buildings:

1. Building 21 (eastern end)
2. Building 22 (two systems)
3. Building 120
4. Building 121

5. Building 130

3.4.1. Design Changes

Only one design change was required for the Type C SSDS installations. Since Building 120 required two extraction wells for mitigation, a higher capacity fan was needed to produce the required flow and sub-slab pressure differentials; therefore, a high suction radon mitigation fan (RadonAway model HS2000) was used based on its ability to generate greater pressures at the design flow. The maximum pressure of the HS2000 is18 inches of water (H_20) at 110 cfm.

4. SSDS Startup Testing

Startup testing was performed to evaluate the effectiveness of the SSDS and to optimize SSDS operation.

4.1. Startup Testing Procedure

System performance was monitored by measuring flow and vacuum pressures at the extraction wells. The radius of influence (ROI) for each system was evaluated by measuring sub-slab differential pressures with a digital manometer at sub-slab monitoring points. Startup testing for the Type C SSDSs was completed in December 2009; Type A and B (Building 25) SSDS startup testing was completed in August 2010.

4.2. Startup Testing Results

4.2.1. Building 20

As indicated in Section 3.3, a Type B SSDS was used for Building 20. As shown in the as-built drawings in Appendix A, three extraction wells (SSDS-B20-EW-1, EW-2, and EW-3) are located in the south east corner of the building. Based on the pilot test results, SSDS-B20-EW-1 had a radius of influence (ROI) of approximately 57 feet at a flow rate of approximately 120 cfm (Malcolm Pirnie, 2009). The maximum flow rate measured at SSDS-B20-EW-1 during the startup testing was 185 cfm. The maximum flow rates measured at extraction wells SSDS-B20-EW-2 and EW-3 were 85 cfm and 84 cfm, respectively.

Existing sub-slab pressure monitoring points were measured prior to the startup of the SSDS. Based on the readings, a positive sub-slab pressure was measured beneath the building slab ranging from 0.029 inches of H_20 to greater than 2 inches of H_20. Sub-slab pressures were re-measured approximately 30 minutes after the blower was started. As shown in the as-built drawings, sub-slab pressure readings in all but two of the monitoring points remained positive following startup of the blower, although a reduction in the positive pressure was noted. The reason for the positive pressure is not known, but could be potentially associated with leaks in the compressed air system that is present throughout the building. Based on the baseline and post-startup data, the Building 20 system has estimated ROI of at least 24 feet, but is likely greater. Additional pressure monitoring will be conducted during system operations and maintenance activities to further evaluate the area of influence for the extraction wells.

4.2.2. Building 21

As indicated in Section 3.3, Building 21 uses a Type C SSDS to mitigate the eastern portion of the first floor and a Type A system is used to mitigate the basement area.

4.2.2.1. Type A SSDS

As shown in the as-built drawings, the extraction well for the Type A SSDS (SSDS-B21-1) is located in the basement on the south side of the building. Based on the pilot test results, SSDS-B21-1 had a ROI of approximately 30 feet at a flow rate of approximately 27 cfm (Malcolm Pirnie, 2009). The maximum flow rate measured at SSDS-B21-1 during the startup testing was 43 cfm with a corresponding ROI of 52 feet.

4.2.2.2. Type C SSDS

Extraction well SSDS-B21-2 is located on the eastern side of Building 21 on the first floor (see as-built drawings in Appendix A). Following the installation of the SSDS, extraction well SSDS-B21-2 had a ROI of approximately 30 feet at a flow of 9 cfm, which is consistent with the design ROI.

4.2.3. Building 22

As indicated in Section 3.3, two Type C SSDSs were used for Building 22. As shown in the as-built drawings in Appendix A, extraction well SSDS-B22-1 is located in the eastern portion of the building in the rear of the vehicle garage area; SSDS-B22-2 is located in the basement portion of the building. Field pilot test results for Building 22 indicated that the pilot test well had a ROI of approximately 44 feet at a flow rate of approximately 120 cfm. Following installation of the Type C SSDSs, extraction wells SSDS-B22-1 and SSDS-B22-2 each had a ROI of approximately 45 feet at flow rates of 55 cfm and 12 cfm, respectively.

4.2.4. Building 25

As indicated in Section 3.3, a Type B SSDS was used for Building 25. Extraction well locations are presented in the as-built drawing in Appendix A. Based on the pilot test results, SSDS-B25-EW-1 had a ROI of approximately 37 feet at a flow rate of approximately 130 cfm (Malcolm Pirnie, 2009). The maximum flow rate measured at SSDS-B25-EW-1 during the startup testing was 162 cfm. The maximum flow rates measured at extraction wells SSDS-B25-EW-2, EW-3 and EW-4 were 117 cfm, 115 cfm, and 148 cfm, respectively. Pressure monitoring points measured during the startup testing confirmed that the SSDS ROI is greater than 37 feet, and up to 100 feet depending on the extraction point.

4.2.5. Building 114

As indicated in Section 3.3, a Type A SSDS was used for Building 114. As shown in the as-built drawings in Appendix A, two extraction wells (SSDS-B114-EW-1 and -EW-2) are located in the eastern and western portions of the building, respectively. Based on the pilot test results, SSDS-B114-EW-1 had a radius of influence (ROI) of approximately 23 feet at a flow rate of approximately 120 cfm (Malcolm Pirnie, 2009). The maximum flow rate for the startup testing was 69 cfm. A temporary sub-slab pressure monitoring point was installed approximately 23 feet from extraction well SSDS-B114-EW-1. Based on the observed pressure (vacuum) measurement, the system ROI is greater than 23 feet, which was the design ROI based on the pilot test results.

4.2.6. Building 120

As indicated in Section 3.3, a Type C SSDS was used for Building 120. As shown in the as-built drawings, two extraction wells (SSDS-B120-1 and SSDS-B120-2) are located in the southwest corner of the building. Based on the pilot test results, SSDS-B120-1 had a ROI of approximately 27 feet at a flow rate of approximately 140 cfm (Malcolm Pirnie, 2009). Following installation of the system, SSDS-B120-1 had a ROI of approximately 23 feet and SSDS-B120-2 had a ROI of approximately 32 feet. The flow rate measured at each extraction well during the startup testing was 32 cfm.

4.2.7. Building 121

As indicated in Section 3.3, a Type C SSDS was used for Building 121. As shown in the as-built drawings, extraction well SSDS-B121-1is located in the southwest corner of the building. Based on the pilot test results, SSDS-B120-1 had a ROI of approximately 45 feet at a flow rate of approximately 120 cfm (Malcolm Pirnie, 2009). Following installation of the system, startup testing measurements confirmed a ROI greater than 45 feet at a flow of 65 cfm.

4.2.8. Building 130

As indicated in Section 3.3, a Type C SSDS was used for Building 130. As shown in the as-built drawings, extraction well SSDS-B130-EW1is located in the northwestern corner of the building. Based on the pilot test results, SSDS-B130-EW1 had a ROI of approximately 25feet at a flow rate of approximately 160 cfm (Malcolm Pirnie, 2009). Following installation of the system, startup testing measurements confirmed a ROI greater than 25 feet at a flow of 51 cfm.

4.3. SSDS Controls

As indicated in Sections 3.2 and 3.3, the Type A and Type B SSDSs are controlled by PLCs. Each system has a touch-screen display monitor that provides system status and real-time system pressure and flow data. As shown in the As-built drawings, the control panels for the Type A SSDS are remote-mounted. The control panel for the Building 21 system is located in the basement of the building. The control panel for the Building 114 system is located on the east wall in Room 102. The As-built drawings show that a single display panel for the Building 20/25 Type B SSDS is located in the electrical room of the system enclosure.

The information from each system is transmitted via a 900 hertz radio telemetry system to a central display monitor located in Room 204 of Building 10. From the central display monitor, the user can access the Type A and B systems remotely and view the same information (pressure, flow, and alarm conditions) that is available at each system's display monitor.

5. ICM Performance Monitoring

Performance monitoring will be conducted in accordance with the approved ICM Work Plan (Malcolm Pirnie, 2009). Annual monitoring of the indoor air was conducted in March 2010. A letter report summarizing the results of the sampling event was submitted to the NYSDEC and NYSDOH on June 24, 2010 (Malcolm Pirnie, 2010). A copy of the letter report is provided in Appendix C.

5.1. Effluent Sampling

Pre- and post-carbon effluent samples were collected on August 12, 2010 from the Type A SSDSs (Building 21 and 114), and the Building 25 Type B SSDS. Pre-carbon effluent samples were collected from the Building 20 Type B SSDS in September, 2010 after installation of the repaired blower. The purpose of the sampling was to evaluate VOC discharge mass and assess removal efficacy of the SSDS GAC vessels.

5.1.1. Sampling Procedures

Effluent samples were collected from the SSDS pre- and post-carbon sampling ports using 6 liter Summa Canisters equipped with a thirty minute flow controllers. The samples were submitted to Air Toxics LTD, Folsom, California, following chain-of-custody procedures for analysis of VOCs by United States Environmental Protection Agency (USEPA) Method TO-15. Analytical reporting forms are provided in Appendix D.

5.1.2. Sampling Results

Effluent sample results are summarized in Table 5-1.

5.1.2.1. Building 20

As shown in Table 5-1, the September 10, 2010 pre-carbon effluent sample from the Building 20 SSDS contained 1,1,1-trichloroethane (1,1,1-TCA), trichloroethene (TCE), and tetrachloroethene (PCE) at concentrations of 6.4 micrograms per cubic meter (ug/m^3), 250 ug/m^3, and 54 ug/m^3, respectfully.

5.1.2.2. Building 21

As shown in Table 5-1, the pre-carbon effluent sample from the Building 21 SSDS contained cis-1,2-dichloroethene (cDCE), TCE, and PCE at concentrations of 44 ug/m^3, 270 ug/m^3, and 63 ug/m^3, respectfully. Table 5-1 shows that chloromethane was detected in the post-carbon effluent sample at a concentration of 11 ug/m^3. The detection of chloromethane in the post-carbon sample is considered to be anomalous since it was not detected in the influent samples from the SSDS.

5.1.2.3. Building 25

As shown in Table 5-1, the pre-carbon effluent sample from the Building 25 SSDS contained cDCE, 1,1,1-TCA, TCE, and PCE at concentrations of 23 ug/m^3, 100 ug/m^3, 6,200 ug/m^3, and 58 ug/m^3, respectfully. As shown in Table 5-1, no VOCs were detected in the Building 25 SSDS post-carbon effluent samples.

5.1.2.4. Building 114

As shown in Table 5-1, the pre-carbon effluent sample from the Building 114 SSDS contained TCE, and PCE at concentrations of 6 ug/m^3 and 7.1 ug/m^3, respectfully. Table 5-1 shows that PCE (6.6 ug/m^3) was also detected in the post-carbon effluent sample. Based on the relatively low influent CVOC concentrations and the length of time the SSDS has operated, "breakthrough" is not likely to have occurred; therefore, the presence of this compound is considered to be anomalous and will be evaluated during the next effluent sampling event.

5.1.3. Estimated VOC Removal Mass

Table 5-2 provides a summary of the estimated VOC removal mass for the Type A and B SSDSs.

5.1.3.1. Building 20

Table 5-1 shows that the total VOC concentration in the September 10, 2010 Building 20 Type B SSDS pre-carbon effluent sample was 310 ug/m3. As shown in Table 5-2, based on a flow of 118 cfm, the Type B SSDS was removing CVOCS at a rate of approximately 1.2 pounds per year (lb/year).

5.1.3.2. Building 21

As shown in Table 5-1, the total VOC concentration in the August 12, 2010 pre-carbon effluent sample from the Building 21 Type A SSDS was 377 ug/m^3. Table 5-2 shows that flow from the SSDS was approximately 43 cfm. As shown in Table 5-2, this corresponds to a total estimated VOC removal mass of 0.53 lb/year.

5.1.3.3. Building 25

As shown in Table 5-1, the August 12, 2010 pre-carbon effluent sample from the Building 25 SSDS contained a total VOC concentration of 6,381 ug/m^3. Table 5-2 shows that, at a flow of 136 cfm, the system was removing COVCs at a rate of approximately 28.3 lb/year.

5.1.3.4. Building 114

Table 5-1 shows that the total VOC concentration in the August 14, 2010 pre-carbon effluent sample from the Building 114 SSDS was 13.1ug/m^3. As shown in Table 5-2, based on a flow of 45 cfm, the Type A SSDS was removing CVOCs at a rate of approximately 0.019 lb/year.

5.2. Performance Assessment

Based on the results of the startup testing, the SSDSs are operating at, or greater, than their design parameters.

6. References

Malcolm Pirnie 2007. *Vapor Intrusion Evaluation Work Plan, Main Manufacturing Area, Watervliet Arsenal, Watervliet, New York*, June 2007 (amended August 1, 2007 and approved September 20, 2007).

Malcolm Pirnie 2008a. *Vapor Intrusion Evaluation Work Plan Addendum, Main Manufacturing Area, Watervliet Arsenal, Watervliet, New York*, January 2008 (supplemented February 8, 2008).

Malcolm Pirnie 2008b. *Vapor Intrusion Investigation Report, Main Manufacturing Area, Watervliet Arsenal, Watervliet New York*, August 2008.

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