National Environmental Consulting

November 22, 2021 ***Submitted Electronically***

Jason Pelton, PG
Project Manager
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau D, Remedial Section B
625 Broadway, 12th Floor
Albany, NY 12233-7013

Subject: **Proposed Modifications to the OU2 Groundwater On-Site Containment System, Tower 96 Treatment System**
Northrop Grumman Systems Corporation
Bethpage, New York

Dear Mr. Pelton:

This proposed modification document is being submitted on behalf of Northrop Grumman Systems Corporation (Northrop Grumman) to New York State Department of Environmental Conservation (NYSDEC) by HSW Consulting LLC (HSW) who is authorized and directed to retain National Environmental Consulting, Inc. (NECI), a New York licensed engineering firm, to perform engineering services. This engineering process modification document package is not intended to be used for construction purposes and is intended to represent process engineering changes only. The proposed modifications to the Operable Unit 2 (OU2) on-site containment and treatment (ONCT) system, Tower 96 (T96) vapor treatment system were prepared in conjunction with Northrop Grumman. Arcadis of New York, Inc. (Arcadis), Engineer of Record for the existing on-site containment system, has reviewed the proposed modifications and concluded that implementing the modifications will not result in adverse system operation or an exceedance of applicable NYSDEC Standards, Criteria, and Guidance (SCGs) (see **Attachment 1**).

Background

The OU2 ONCT is being operated to satisfy the applicable remedial objectives set forth in the March 2001 OU2 Record of Decision (ROD) and associated December 2019 Amended ROD (AROD). Groundwater treatment for the ONCT is provided by two separate treatment plants, Tower 96 and Tower 102. The schematic of the current OU2 ONCT Tower 96 and Tower 102 Treatment Plants is illustrated in **Attachment 2**. The Tower 96 (T96) treatment system has been operating for over 33 years and currently consists of a packed-tower air stripper to remove volatile organic compounds (VOCs) from groundwater pumped from remedial wells, Well 1 and Well 3R, at a combined flow rate of 1,500 gallons per minute (gpm). A regenerative vapor-phase granular activated carbon (RVPGAC) system removes VOCs from the air stripper's off-gas emissions. The RVPGAC system uses steam produced in on-site boilers to strip VOCs from the RVPGAC on a regular basis, which regenerates the carbon for reuse.

Supplemental vapor treatment at T96 is currently being provided by two vapor-phase granular activated carbon polishing units (hereafter referred to as VPGAC units). Previously, those units were used to provide off-gas treatment for vinyl chloride that was associated with the Occidental Chemical Corporation site (OXY) and consisted of VPGAC and potassium permanganate-impregnated zeolite (PPZ). NYSDEC concurrence to discontinue supplemental treatment of vinyl chloride was received on January 26, 2017. The VPGAC unit was removed from service on January 26, 2017. The PPZ was removed from the other unit on March 23, 2017 and replaced with GAC. Northrop Grumman has maintained these supplemental VPGAC units in lead-lag operation as polishing for the T96 off-gas treatment and has replaced the VPGAC as needed. The VPGAC was last replaced in the T96 supplemental units in October 2021.

Objective

The objective of the T96 modifications is to more efficiently and effectively treat the T96 air stripper off-gas by replacing the RVPGAC system with an updated vapor treatment system for VOCs. This modification will be accomplished through bypassing the RVPGAC units and redirecting air stripper off-gas directly to the VPGAC units that were formerly used to supplement the RVPGAC system, and is practical since current VOC concentrations have decreased compared to original design concentrations. Based on system performance monitoring and VPGAC usage data presented below, the two VPGAC units in series will treat current and projected T96 influent vapor concentrations to below the applicable emission limits in 6 NYCRR Subpart 212-2 and NYSDEC Division of Air Resources-1 (DAR-1) “Guidelines for the Evaluation and Control of Ambient Air Contaminants Under Part 212.” This objective will be accomplished by:

1. Addition of duct work to redirect the vapor flow from the RVPGAC system inside the T96 building to the T96 VPGAC treatment units located outside the T96 building.
2. Modification of the system controls and interlocks corresponding to system modifications.
3. Treatment of T96 vapors using the VPGAC units.

Description of T96 Modifications

Northrop Grumman plans to bypass the RVPGAC system and associated equipment to provide continued treatment of T96 vapors through the VPGAC treatment units. **Figure 1** illustrates the modifications that will be made to the current system, based on the Air Treatment Process and Instrumentation Flow Diagram provided in the OU2 Operation, Maintenance and Monitoring (OM&M) Manual (Arcadis, May 2014). The modifications are summarized as follows:

1. Bypass the following RVPGAC system equipment inside the T96 building through installation of new duct work using round 6061 aluminum alloy with 0.25-inch wall thickness and welded 0.25-inch-thick flanges and corrosion resistant assembly hardware and connections:
    a. Vapor treatment steam system;
        i. Heat exchanger and associated valves;
        ii. Vapor treatment blower and motor and associated indicators and switches;
        iii. Air compressor and associated indicator, valve, air dryer and pressure switch;
        iv. Two RVPGAC units and associated pressure indicators and valves;

b. Solvent recovery system including:
    i. Plate and frame condenser and associated, switches, and valves;
    ii. Decanter and associated level indicator;
    iii. Solvent recovery tank, pump, transmitter, and level indicator; and
    iv. Condensate receiving tank and associated level switch and pump.

2. The existing supplemental vapor treatment blower (B-700), which can overcome all losses across the system, will remain on-line. This blower will be evaluated for replacement in the same location in the future.

The following are other features of the T96 modifications:

- Equipment inside the T96 building to be bypassed will remain in place. In the future the equipment will be removed to make space available for installation of 1,4-dioxane treatment equipment.
- The mist eliminator will remain in place and continue to be used in the process. Northrop Grumman will complete industrial controls modifications to account for the removal of the treatment system equipment listed above.
- Systems modifications will be completed in a manner to minimize system downtime, and most work will be completed prior to the system ductwork tie-in. The system ductwork tie-in work is expected to be completed in one day.
- Implementation of the above modifications will not require earthwork or other intrusive activities.

Vapor Treatment Requirements

The T96 RVPGAC system was originally designed to treat a 6,700 scfm air stream with a demonstrated trichloroethene (TCE) removal efficiency of at least 95 percent. The modified T96 system will provide vapor treatment through two 10,000-pound VPGAC treatment units in series (**Figure 1**, GAC-700A and GAC-700B, vapor treatment units). No modifications to the design of the VPGAC units or T96 effluent stack are necessary or planned.

Vapor treatment requirements were evaluated based on 6 NYCRR Part 212 and the associated NYSDEC DAR-1 guidance. Part 212 requirements allow for demonstration of compliance with the air cleaning requirements for High Toxicity Air Contaminants (HTACs) through documenting that the actual annual emissions after treatment will be below the Mass Emission Limits in Part 212, Table 2.

VPGAC unit design influent concentrations were conservatively estimated based on the maximum concentrations detected in T96 system vapor influent during the 2020 reporting period, as presented in the OU2 2020 Annual OM&M Report (Arcadis, March 2021). Notably, the influent maximum concentration used in the design for TCE was more than two times higher than the average concentration during the reporting period.

Contaminants that would exceed the annual emission limits without treatment are identified in **Table 1**, which includes TCE and tetrachloroethene (PCE). **Table 1** also presents the Mass Emission Limits and

specific post-control emission reduction requirements. The modified vapor treatment process was designed to achieve these minimum control requirements; therefore, an air toxics evaluation is not required.

TCE and PCE isotherms provided by TetraSOLV were used to estimate carbon usage. Isotherms are included in **Attachment 3.** The carbon specification is included as **Attachment 4**. Calculations assume the T96 system running full time at 4,990 cubic feet per minute (cfm), based on the maximum recorded flow rate included in the 2020 Annual OM&M Report. Based on the influent concentrations in **Table 2**, total carbon usage is estimated to be 57.7 pounds per day. VPGAC media will be changed out, as needed, in accordance with the OU2 OM&M Manual.

Modified SGCS Monitoring

T96 treatment system air quality monitoring is currently completed on a quarterly basis to record the performance of the air treatment components of the OU2 ONCT T96 system. Air monitoring and analysis will be completed in accordance with the OM&M Manual (Arcadis, May 2014) as adapted to be consistent with the T96 modifications. **Table 3** presents proposed sample locations, frequency, and screening/sample analytical methods. Samples will be collected monthly for six months, after which the frequency will be changed to quarterly sampling. The monitoring and/or screening frequencies may be modified if supported by analytical results and approved by NYSDEC.

Please let us know if you have any questions or require any further information.

Sincerely,
National Environmental Consulting, Inc.

Christina Berardi Tuohy, P.E.
Senior Engineer

Derek E. Huston, P.E.
Vice President

Tables

1. Ambient Air Emissions Estimate and Vapor Treatment Requirements
2. Projected Carbon Usage
3. Vapor Treatment Process Monitoring Program Plan

Figures

1. Process and Instrumentation Diagram, Air Process

Attachments

1. November 16, 2021 Letter from Arcadis on the Proposed OU2 Tower 96 Modifications
2. Figure 2, ONCT Schematic and Drawing I-1, Notes and Legend
3. TCE and PCE Isotherms
4. VPGAC Specification (Activated Carbon Data Sheet)

cc: Fred Weber, Northrop Grumman
Edward Hannon, Northrop Grumman
Jim Sullivan, NYSDOH

TABLES

Table I

Ambient Air Emissions Estimate and Vapor Treatment Requirements
Proposed Modifications, OU2 Groundwater On-Site Containment System, T96 Treatment System

DAR-1 Environmental Rating	Chemical	Influent Concentration[1/] [ug/m3]	Untreated Mass Flow Rate [lbs/yr][2/]	212-2.2 Table 2 Annual Limit for HTACs [lbs/yr][3/]	Minimum Treatment Requirement to meet 212-2.2 Table 2
A	TCE	19300	3157	**500**	84%
A	Tetrachloroethene	882	144	**100**	31%

1/ Maximum influent vapor concentration during 2020 reporting period.

2/ Total mass flow rate calculated based on maximuim influent vapor concentration and maximum vapor flow rate (4,990 scfm) measured during the 2020 reporting period.

3/ DAR-1, Section V.A.2. High Toxicity Air Contaminant (HTAC) limits, in pounds per year (lbs/yr). 6 NYCRR 212-2.2, dated February 12, 2021. Division of Air Resources.

NEC

Table 2

Projected Carbon Usage

Proposed Modifications, OU2 Groundwater On-Site Containment System, T96 Treatment System

Chemical	Influent Concentration[1/] [ug/m3]	Influent Concentration[1/] [ppmv]	Vapor Mass Flow [lbs/day][2/]	Adsorption Capacity[3/] [% w/w]	Carbon Usage [lb/day]
Trichloroethene	19300	3.591	8.6499	15	57.67
Tetrachloroethene	882	0.130	0.3953	12	0.033
Totals		3.722	9.045		57.70

1/ Maximum influent vapor concentration during 2020 reporting period.

2/ Vapor mass flow rate calculated based on maximuim influent vapor concentration and maximum vapor flow rate (4,990 scfm) measured during the 2020 reporting period. Molecular weight trichloroethylene is 131.39 gram/gram mole (g/g mol) and tetrachorethene is 165g/g mol.

3/ Adsorption capacity presented on isotherms provided by TetraSOLV included as Attachment 3.

ug/m3: micrograms per cubic meter

ppmv: parts per millon by volume

lbs/day: pounds/day

% w/w: percentage weight per weight

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NEC

Table 3
Vapor Treatment Process Monitoring Program Plan
Proposed Modifications, OU2 Groundwater On-Site Containment System
T96 Treatment System

Sample Location[1/]	Sampling Frequency[2/]	Purpose	Parameter(s)
Vapor Treatment Process Screening			
T96 Influent T96 Mid Train (Between VPGAC vessels) T96 Effluent (Effluent Stack)	1x/week	Monitor VPGAC for TVOC carbon breakthrough	TVOCs in vapor by hand-held PID (Tedlar bags)
Vapor Treatment Process Sampling			
T96 Influent T96 Mid Train (Between VPGAC vessels) T96 Effluent (Effluent Stack)	Monthly for six months, quarterly thereafter	Monitor VPGAC breakthrough, effluent emissions, compliance with Part 212 annual emissions limits	VOCs in vapor by USEPA Method TO-15 (Summa canisters)
Vapor Treatment Process Monitoring			
Air Flow Measurements			
T96 Effluent (Effluent Stack)	Monthly for six months, quarterly thereafter	Monitor for system operation	Flow Rate (acfm)
Air Pressure Measurements			
Process Air Blower Influent Pressure (Before new blower)	Monthly for six months, quarterly thereafter	Monitor for system operation	Pressure (in. H2O)
Process Air Blower Effluent Pressure (After new blower)			
Air Temperature Measurement			
Ambient Influent Air Temperature (No change in location)	Monthly for six months, quarterly thereafter	Monitor for system operation	Temperature (°F)
Process Blower Air Effluent Temperature (Change in location)			
Effluent to VPGAC Units Temperature (No change in location)			

Notes and Abbreviations:

[1/] Sample locations depicted on Process Flow Diagram in Attachment 3

[2/] Or until data supports an alternate frequency

Orange text - indicates a change in sampling location

VPGAC - vapor-phase granular activated carbon

VOC - volatile organic compound

FIGURE

PRIVILEGED AND CONFIDENTIAL ATTORNEY/CLIENT COMMUNICATION
AND/OR ATTORNEY WORK PRODUCT SUBJECT TO ATTORNEY-CLIENT PRIVILEGE

HMI

MAIN

FIELD/ REMOTE

PROPOSED AIR LINE

FROM TREATED WATER CLEAR WELL

STEAM CONDENSATE RETURN

BLDG 96 SYSTEM STEAM

EXTENT OF BOILER BUILDING

STEAM SUPPLY LINE

BUILDING HEAT

AD-700 AIR DRYER

AC-700 AIR COMPRESSOR

INFLUENT AMBIENT AIR

AS-200 PACKED COLUMN AIR STRIPPER

ME-300 MIST ELIMINATOR

HX-300 HEAT EXCHANGER

B-500 PROCESS AIR BLOWER

GAC-600A REGENERATIVE VAPOR TREATMENT

GAC-600B REGENERATIVE VAPOR TREATMENT

PRESSURE RELIEF EFFLUENT DISCHARGE

DEGASSER EFFLUENT DISCHARGE

TO PC-600 PLATE & FRAME CONDENSER

B-700 SUPPLEMENTAL VAPOR TREATMENT BLOWER

GAC-700 A GAC VAPOR TREATMENT UNIT

GAC-700 B GAC VAPOR TREATMENT UNIT

TREATED AIR DISCHARGE

Notes:

EQUIPMENT OR CONTROLS TO BE BYPASSED

PLANNED SYSTEM MODIFICATIONS

Legend is provided in Attachment 2 Figure I-1, Notes and Legend.

Figure based on As-Built Drawings, Operable Unit 2 - Groundwater On-Site Containment System, Tower 96 Treatment System Figure I-4, Process and Instrumentation Diagram, Air Treatment, provided in the OU2 Operation, Maintenance and Monitoring (OM&M) Manual (Arcadis, May 2014)

SYM	ZONE	DESCRIPTION	DATE	APPROVED
		REVISIONS		

	DATE
DRAWN	FF
CHECKED	CT
ENGINEER	CT
APPROVED	DATE

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK

FIGURE 1
PROCESS AND INSTRUMENTATION DIAGRAM
AIR PROCESS

ENGINEER: Christina Berardi Tuohy, PE

PE No: 078743-1

NEC

PREPARED BY:
NEC
20 Irving Drive
Woodbury, NY 11797

TITLE

SIZE | DWG. NO. | REV

PROJ. NO. 000.07AS301121 | SHEET

ATTACHMENT I

November 16, 2021 Letter from Arcadis
on the Proposed OU2 Tower 96 Modifications

Jason Pelton, PG
Project Manager
Remedial Section B, Remedial Bureau D
Division of Environmental Remediation
New York State Department of Environmental Conservation
625 Broadway, 12th Floor
Albany, New York 12233-7013

Arcadis of New York, Inc.
Two Huntington
Quadrangle
Suite 1S10
Melville
New York 11747
Phone: 631 249 7600
Fax: 631 249 7610
www.arcadis.com

Date: November 16, 2021

Our Ref: 30059268
Subject: Proposed Modifications to the OU2 Tower 96 Groundwater Treatment System

Dear Jason,

As the Engineer of Record for the Northrop Grumman Operable Unit 2 Tower 96 Groundwater Treatment System located in Bethpage, NY, I have reviewed the proposed modifications as outlined in this document and, based on that review, have concluded that these modifications will not result in adverse operation of the system nor will the modifications result in an exceedence of regulatory standards, guidelines, or criteria that govern the operation of this system including both water and vapor treatment and emissions.

Sincerely,
Arcadis of New York, Inc.

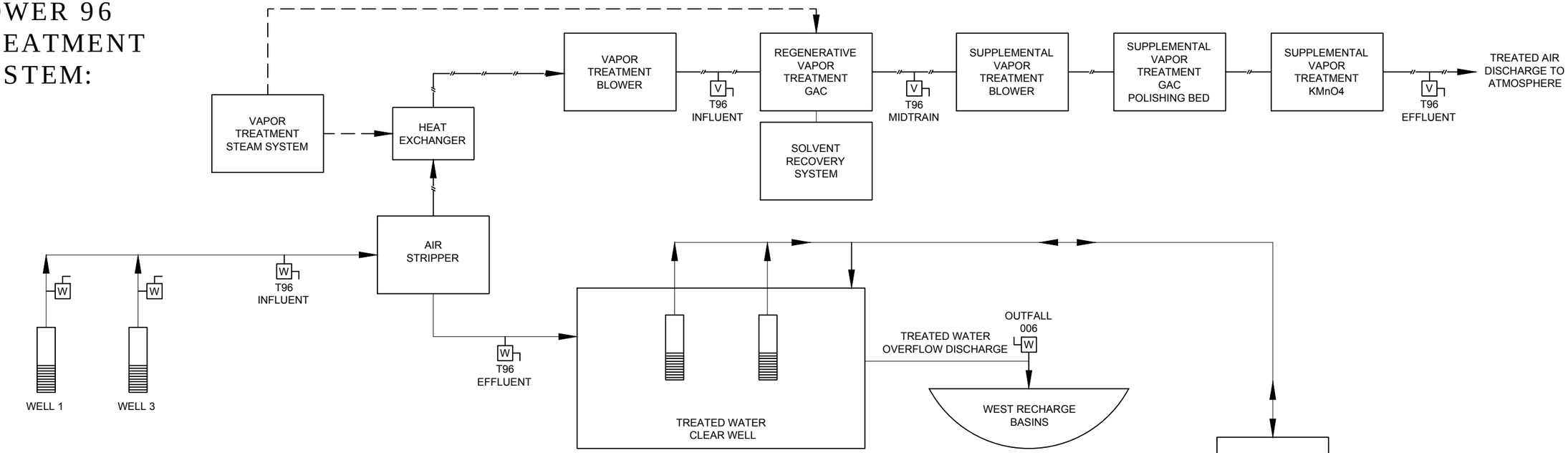
Christopher Engler, PE New York PE-069748
Vice President

Email: Christopher.Engler@arcadis.com
Direct Line: 315.409.6579

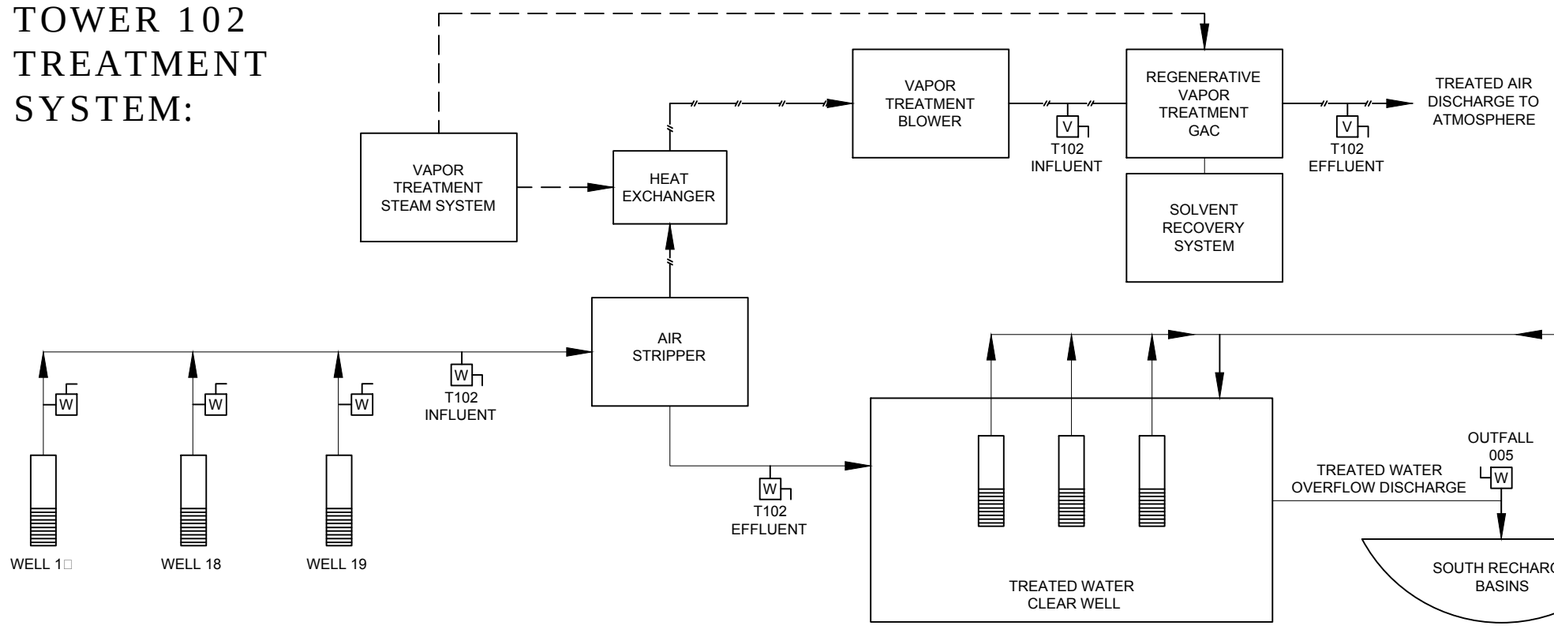
ATTACHMENT 2

ONCT Schematic
Drawing I-1, Notes and Legend

TOWER 96 TREATMENT SYSTEM:



TOWER 102 TREATMENT SYSTEM:



LEGEND:

———	PROCESS WATER
——//——//——	PROCESS AIR
— — — —	STEAM
W	SAMPLE LOCATION
W	WATER SAMPLE
V	VAPOR SAMPLE
ONCT	ON-SITE CONTAINMENT

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 2

ONCT SCHEMATIC

ARCADIS

FIGURE
2

LEGEND

- IN–LINE INSTRUMENT
- INSTRUMENT CONNECTED TO PROCESS LINE
- PORTABLE INSTRUMENT NOT CONNECTED
- INSTRUMENT FIELD MOUNTED
- INSTRUMENT LOCAL PANEL MOUNTED
- INSTRUMENT MAIN CONTROL PANEL MOUNTED
- HAND SWITCH (HS #) — 1–0–1 = (ON/OFF/AUTO)/3 POSITION
- PUSH BUTTON (PB #) — 0–1 = (OFF/ON)/2 POSITION
- INDICATOR LIGHT (YL)
- MAIN CONTROL PANEL CONTROL/INDICATOR FUNCTION
- SHARED CONTROL/ALARM INTERLOCK (AD) —
  - AP: PRIMARY ALARM
  - AC: CRITICAL ALARM
  - AL: PRIMARY ALARM W/ LOCALIZED RESPONSE
  - AD: ADVISORY
- PROGRAMMABLE LOGIC CONTROL (PID) —
  - PID: PROPORTIONAL, DERIVATIVE, INTEGRAL CONTROLLER
  - PLC: PROGRAMMABLE LOGIC CONTROLLER
- CONTROL/ALARM INTERLOCK (1) —
  - 1: CRITICAL ALARM INPUT
  - 2: PRIMARY PLC INPUT
  - 3: PRIMARY PLC OUTPUT
  - 4: SECONDARY PLC OUTPUT/CRITICAL ALARM SHUTDOWN
- ALARM COMMUNICATION FUNCTION

- BUILDING EXTENT
- PROCESS
- OPTIONAL FLOW
- AIR VENT LINES
- PROCESS AIR
- COMPRESSED AIR
- STEAM
- CONDENSATE/PRODUCT
- ELECTRONIC SIGNAL
- CONTROL PANEL INPUT/OUTPUT
- FLOW DIRECTION
- CHECK VALVE
- FLANGED CHECK VALVE
- GATE VALVE
- FLANGED GATE VALVE (NORMALLY OPEN)
- FLANGED GATE VALVE (NORMALLY CLOSED)
- BALL VALVE (NORMALLY OPEN) (O)
- BALL VALVE (NORMALLY CLOSED) (C)
- FLANGED BALL VALVE (NORMALLY OPEN) (N.O.)
- BUTTERFLY VALVE (NORMALLY OPEN)
- BUTTERFLY VALVE (NORMALLY CLOSED) (N.C.)
- FLANGED BUTTERFLY VALVE
- HYDRAULICALLY OPERATED VALVE (H)
- MOTOR OPERATED VALVE (M)
- MOTORIZED BUTTERFLY VALVE (M)
- FLANGED STRAINER (SINGLE BASKET)
- WYE STRAINER
- CARTRIDGE FILTER VESSEL
- FLANGED CONNECTION
- CONNECTION BLANKED
- SAMPLE PORT
- FLEXIBLE COUPLING
- UNION
- PIPE DESIGNATION CHANGE (PVC — DIP)
- FLEXIBLE HOSE
- COUPLING
- DUCT TRANSITION
- REDUCER (CONCENTRIC)
- AIR RELEASE VALVE
- PRESSURE RELIEF VALVE
- VACUUM SAFETY VALVE
- AUTOMATIC CONTROL VALVE
- PRESSURE REGULATING VALVE
- DRAIN
- PUMP
- BLOWER – CENTRIFUGAL (WITH VIV)
- LEVEL SWITCH
- RUPTURE DISK

IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		ADVISORY
C	USER'S CHOICE COMMUNICATION	CONTROL			
D	USER'S CHOICE	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			FAILURE
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
P	PRESSURE (VACUUM)		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	REMOTE				
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE, TORQUE			WELL	
X	USER'S CHOICE			EXTREME	
Y	EVENT, STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

RECORD DRAWINGS
TO THE BEST OF OUR KNOWLEDGE, INFORMATION AND BELIEF, THESE RECORD DRAWINGS SUBSTANTIALLY REPRESENT THE PROJECT AS CONSTRUCTED.

DATE 5/30/2014 BY

CITY:MELVILLE-NY DIV/GROUP:ENV DB:A.SANCHEZ LD: PIC: D. JOHNSTON PM: C.SAN GIOVANNI TM: C. ENGLER LYR:ON=*;OFF=*REF*
I:\ARCADIS-US\offices\data\Syracuse-NY\ENV\CAD\SYRACUSE\ACTIVITY\00149603\4\SMPH2\02 OMM\FINAL MAY 2014\Tower96\dwg\NY1496_314_96 I01.dwg LAYOUT: I-1 SAVED: 6/18/2014 12:40 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 6/18/2014 4:11 PM
BY: OBERLANDER, ROSEANNE

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: CHRISTOPHER D. ENGLER
Professional Engineer's No.: 069748
State: NY | Date Signed: MAY 2014 | Project Mgr.: CSG
Designed by | Drawn by | Checked by: PM

STATE OF NEW YORK — CHRISTOPHER DANIEL ENGLER — LICENSED PROFESSIONAL ENGINEER — 069748

ARCADIS
ARCADIS OF NEW YORK, INC.

NORTHROP GRUMMAN SYSTEMS CORPORATION • BETHPAGE, NEW YORK
TOWER 96

NOTES AND LEGEND

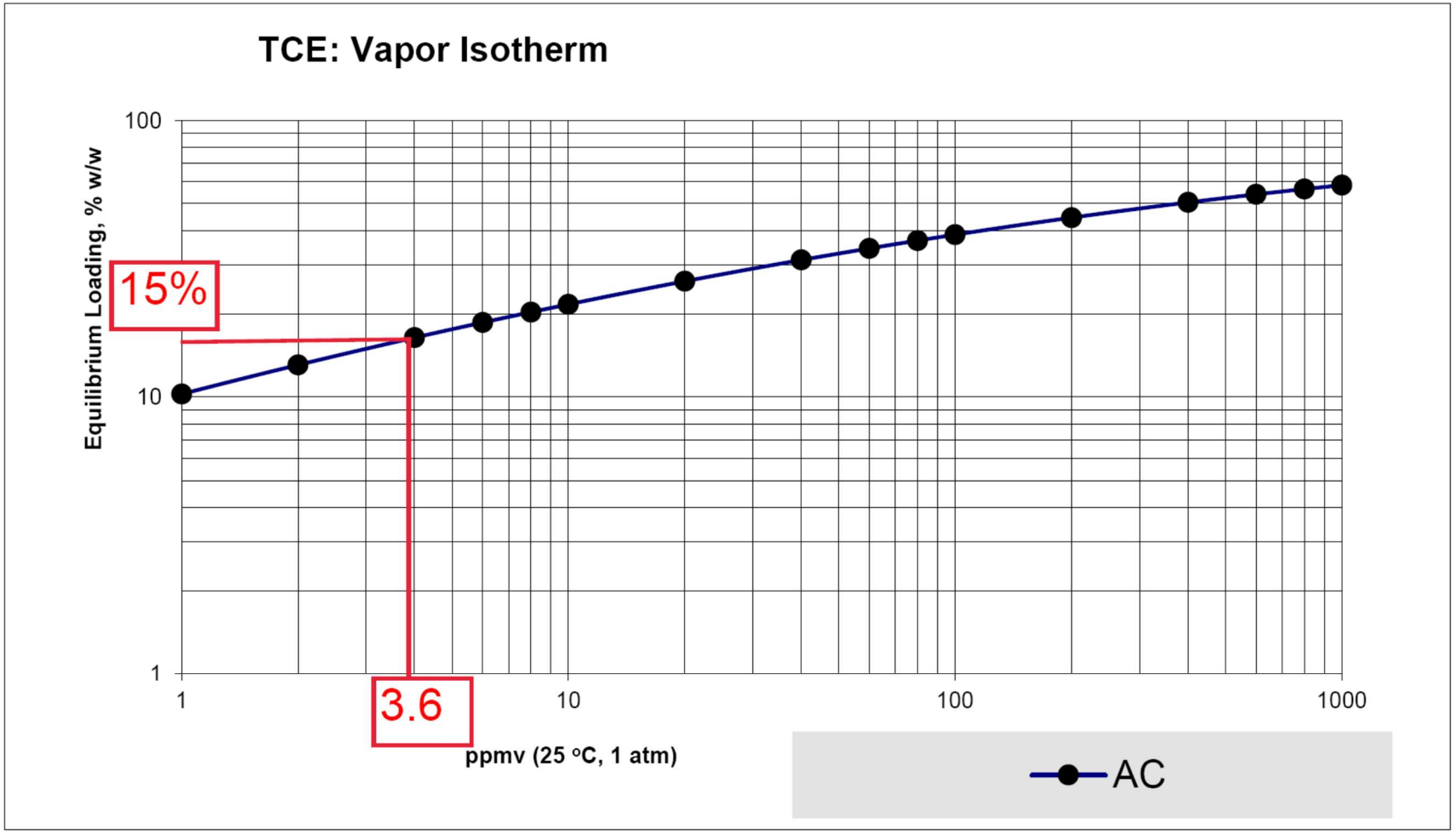
PROCESS

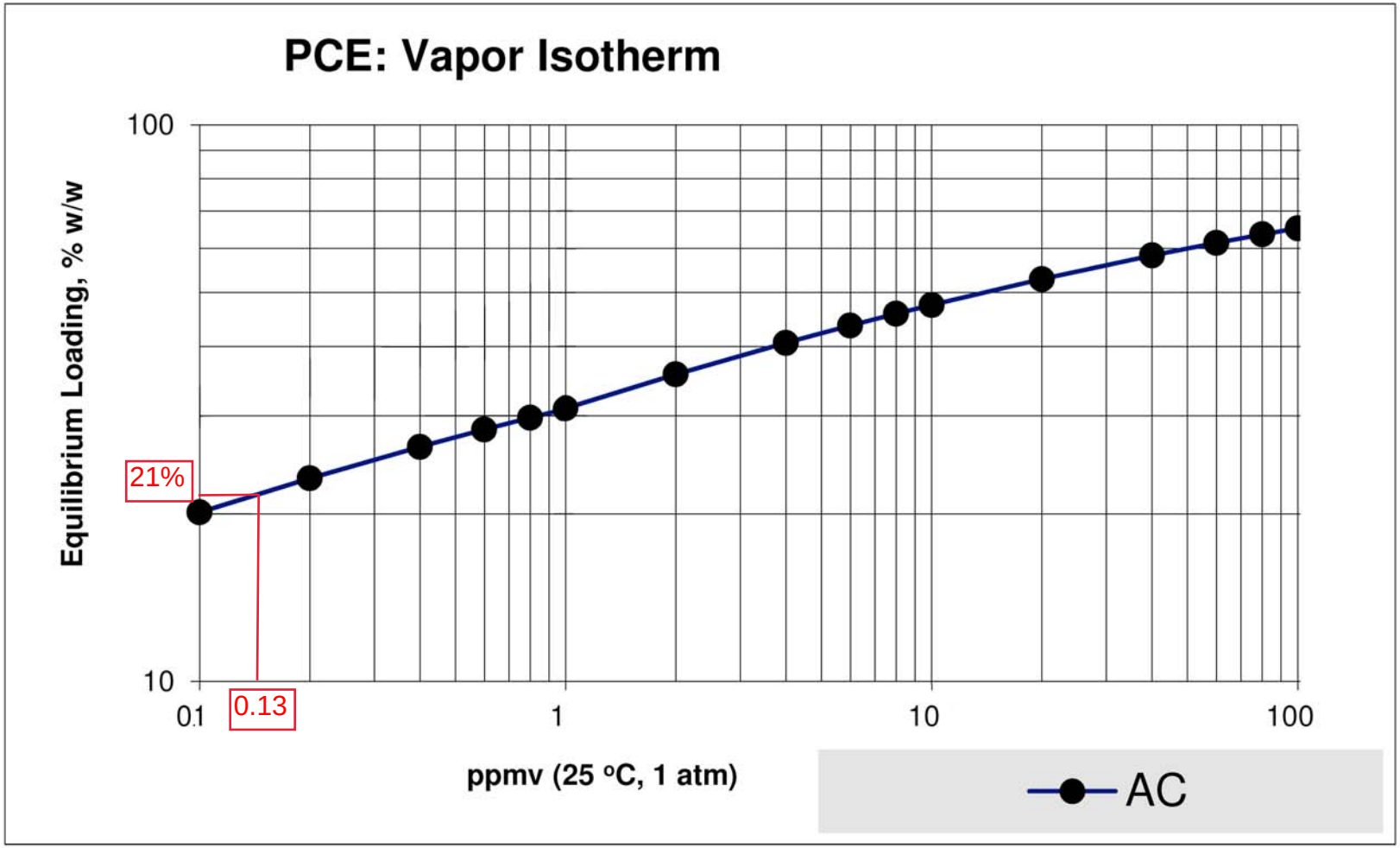
ARCADIS Project No.: NY001496.0314.SMPH2
Date: MAY 2014
ARCADIS
2 HUNTINGTON QUADRANGLE
SUITE 1S10
MELVILLE, NEW YORK
TEL. 631.249.7600

I-1

ATTACHMENT 3

TCE and PCE Isotherms


TCE: Vapor Isotherm
Equilibrium Loading, % w/w
100
10
1
15%
3.6
1
10
100
1000
ppmv (25 °C, 1 atm)
AC


PCE: Vapor Isotherm
Equilibrium Loading, % w/w
100
10
21%
0.13
0.1
1
10
100
ppmv (25 °C, 1 atm)
AC

ATTACHMENT 4

VPGAC Specification (Activated Carbon Data Sheet)

Activated Carbon Data Sheet

Stags - SR4R

Applications

VOC Abatement

Solvent Recover Systems

Air Purification

BTEX Removal

Features / Benefits

High Activity

High Hardness

Low Attrition Rates

No Preconditioning Required

Various Size Pellets:

3 or 4 mm.

Packaging

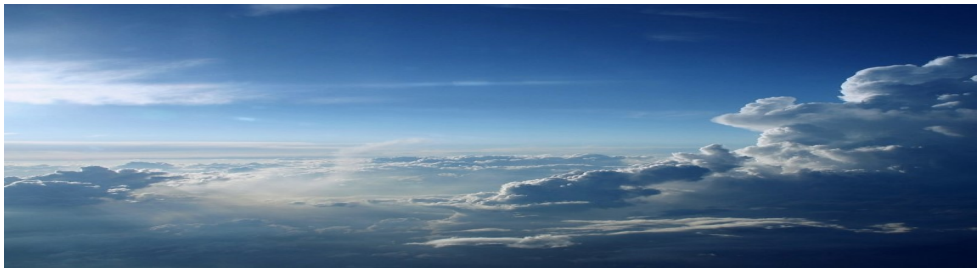
50 lb bags

1000 lb bulk bags

Stags - SR4R is a high activity coal based reactivated carbon **Stags - SR4R** is a high VOC capacity carbon which is excellent for solvent recovery systems and sensitive fugitive emissions control. The high hardness and low dust levels makes it very easy to use and ideal for solvent recovery systems. **Stags - SR4R** can be sold separately or part of a turnkey package involving equipment and service.

Specifications

Ball Pan Hardness	98 min
Carbon Tetrachloride Activity	60 min (g/100g)
Iodine Number	1200 mg/g
Apparent Density	.45 - .48 g/cc
Total Surface Area	1250 m^2/g
Moisture	2% max
Pellet Size Tolerance	+/- 5%



Stags

Phone: 713.703.6516

E-mail: info@tetrasolv.com

CAUTION *Activated carbon can remove oxygen from air under wet or humid conditions. Care should be taken when entering confined spaces where wet activated carbon is present. Use proper breathing apparatus to prevent prolong dust exposure.*