National Environmental Consulting

February 22, 2022 ***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 102 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 National Environmental Consulting, a Verdantas company. 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 102 (T102) vapor treatment system were prepared in conjunction with Northrop Grumman. Arcadis of New York, Inc. (Arcadis), Engineer of Record for the existing ONCT 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 102 treatment system has been operating for over 23 years and currently consists of a packed-tower air stripper to remove volatile organic compounds (VOCs) from groundwater pumped from remedial wells Well 17, Well 18 and Well 19, at a combined flow rate of 2,300 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.

Objective

The objective of the T102 modifications is to more efficiently and effectively treat the T102 air stripper off-gas (9,225 cubic feet per minute [cfm]) 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 a new vapor-phase GAC unit (hereafter VPGAC unit). Based on system performance monitoring and VPGAC usage data presented below, a 40,000-pound VPGAC unit, will treat current and projected T102 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 directly from the air stripper to a new mist eliminator and a new VPGAC unit to be located outside the T102 building. The off-gas will no longer be directed to the RVPGAC system inside the T102 building
2. Modification of the system controls and interlocks corresponding to system modifications.
3. Treatment of T102 vapors using the VPGAC unit.

Description of T102 Modifications

Northrop Grumman plans to bypass the RVPGAC system and associated equipment to provide continued treatment of T102 vapors through the VPGAC unit. **Figure 1 and Figure 2** illustrate the modifications that will be made to the current system. Figure 1 and Figure 2 are based on the Air Treatment Process and Instrumentation Flow Diagrams 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 T102 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. Mist eliminator and associated temperature indictors, knockout tank and pump, and associated level switches and pressure indicator;
        ii. Heat exchanger and associated valves and temperature indicator;
        iii. Vapor treatment blower and motor and associated indicators and switches;
        iv. Air compressor and associated indicator, valve, air dryer, and switch;
        v. Two RVPGAC units and associated pressure indicators and valves;
    b. Solvent recovery system including:
        i. Plate and frame condenser and associated switches and valve;
        ii. Decanter and associated switches;
        iii. Degasser and associated indicator;
        iv. Solvent receiver tank, pump, transmitter, level indicator, and drums; and
        v. Condensate receiving tank and associated level switch and pumps.
2. Installation of a new Hartzell Q05-1-294AH100STFCV3 blower (B-800) and 75-horsepower (hp) motor along with electrical conduit, power, and indicators and switches. The new vapor

treatment blower and motor are the same model as the existing B-500 except they are rated for outdoor use. The blower can overcome all losses across the system.

3. Installation of an exterior concrete equipment pad between the air stripping tower and the building for the new blower.
4. Installation of a 10,000 cfm Midwest Air Products Company vertical inline one-stage mist eliminator with remote-mounted magnehelic gage.
5. Installation of a V40OC, TetraSOLV, 40,000-pound VPGAC unit.
6. Installation of a Vor-Tek T-VTS130-2X2-31 air flow transmitter and meter.

The following are other features of the T102 modifications:

- Equipment inside the T102 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.
- Northrop Grumman will complete industrial controls modifications to account for the removal of the treatment system equipment listed above and the addition of the mist eliminator, blower and VPGAC unit.
- 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.
- Implementation of the above modifications will not require earthwork or other intrusive activities.

Vapor Treatment Requirements

The T102 RVPGAC system was originally designed to treat a 9,225-cfm air stream with a demonstrated trichloroethene (TCE) removal efficiency of at least 99.97 percent, and tetrachloroethene (PCE) removal efficiency of at least 99.61 percent. This is based on the ONCT Operation, Maintenance, and Monitoring Manual (Arcadis May 2014). The modified T102 system will provide vapor treatment through a 40,000-pound VPGAC treatment unit (**Figure 1**, VPGAC-900 vapor treatment unit). No modifications to the design of the 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 estimated based on the maximum concentrations detected in T102 system vapor influent during the 2020 reporting period, as presented in the OU2 2020 Annual OM&M Report (Arcadis, March 2021). Contaminants that would exceed the annual emission limits without treatment, which include TCE and tetrachloroethene (PCE), are identified in **Table 1**. **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.

An isotherm for TCE, which was provided by TetraSOLV, was used to estimate carbon usage **(Attachment 3).** Carbon usage calculations assume the T102 system running full time at 8,070 cubic feet per minute (cfm), based on the maximum recorded flow rate and influent concentrations included in the 2020 Annual OM&M Report. The PCE isotherm provided by TetraSOLV does not include projected equilibrium per unit weight capacity loading rates for VPGAC at the influent concentration, so the carbon usage rate was conservatively estimated to be the same as TCE. Based on the T102 system 2020 maximum TCE and PCE influent concentrations and maximum 2020 flow rate shown in **Table 2** and a 20% factor of safety, projected total carbon usage is estimated to be 38 pounds per day. VPGAC media will be changed out as needed in accordance with the ONCT OM&M Manual. The carbon specification is included as **Attachment 4**.

Modified SGCS Monitoring

Air monitoring and analysis will be completed in accordance with the ONCT OM&M Manual (Arcadis, May 2014) as adapted to be consistent with the T102 modifications. T102 treatment system air quality monitoring is currently completed on a quarterly basis. **Table 3** presents proposed sample locations, frequencies, and screening/sample analytical methods. Samples will be collected monthly for six months, after which the frequency will be changed to quarterly. 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.
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
2. Process and Instrumentation Diagram, Solvent Recovery

Attachments

1. January 24, 2022 Letter from Arcadis on the Proposed OU2 Tower 102 Modifications
2. Figure 2, ONCT Schematic and Drawing I-1, Notes and Legend
3. TCE Isotherm
4. VPGAC Specification (Activated Carbon Data Sheet)

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

TABLES

NEC

Table I

Ambient Air Emissions Estimate and Vapor Treatment Requirements
Proposed Modifications, OU2 Groundwater On-Site Containment System, T102 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	3910	1034	**500**	52%
A	Tetrachloroethene	469	124	**100**	19%

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 (8,070 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, T102 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] with 20% SF
Trichloroethene	3910	0.728	2.8340	9	38
Tetrachloroethene	469	0.069	0.3399	9	0.05
Totals		0.797	3.174		38

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 (8070 acfm) 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 isotherm provided by TetraSOLV included as Attachment 4.

ug/m3: micrograms per cubic meter

ppmv: parts per millon by volume

lbs/day: pounds/day

% w/w: percentage weight per weight

SF - safety factor

NEC

Table 3
Vapor Treatment Process Monitoring Program Plan
Proposed Modifications, OU2 Groundwater On-Site Containment System
T102 Treatment System

Sample Location[1/]	Sampling Frequency[2/]	Purpose	Parameter(s)
Vapor Treatment Process Screening			
T102 Influent	1x/week	Monitor VPGAC for TVOC carbon breakthrough	TVOCs in vapor by hand-held PID (Tedlar bags)
T102 Mid Train (mid VPGAC vessel)			
T102 Effluent (Effluent Stack)			
Vapor Treatment Process Sampling			
T102 Influent	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)
T102 Mid Train (mid VPGAC vessel)			
T102 Effluent (Effluent Stack)			
Vapor Treatment Process Monitoring			
Air Flow Measurements			
T102 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	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			

Notes and Abbreviations:

[1/] Sample locations depicted on Figure 1

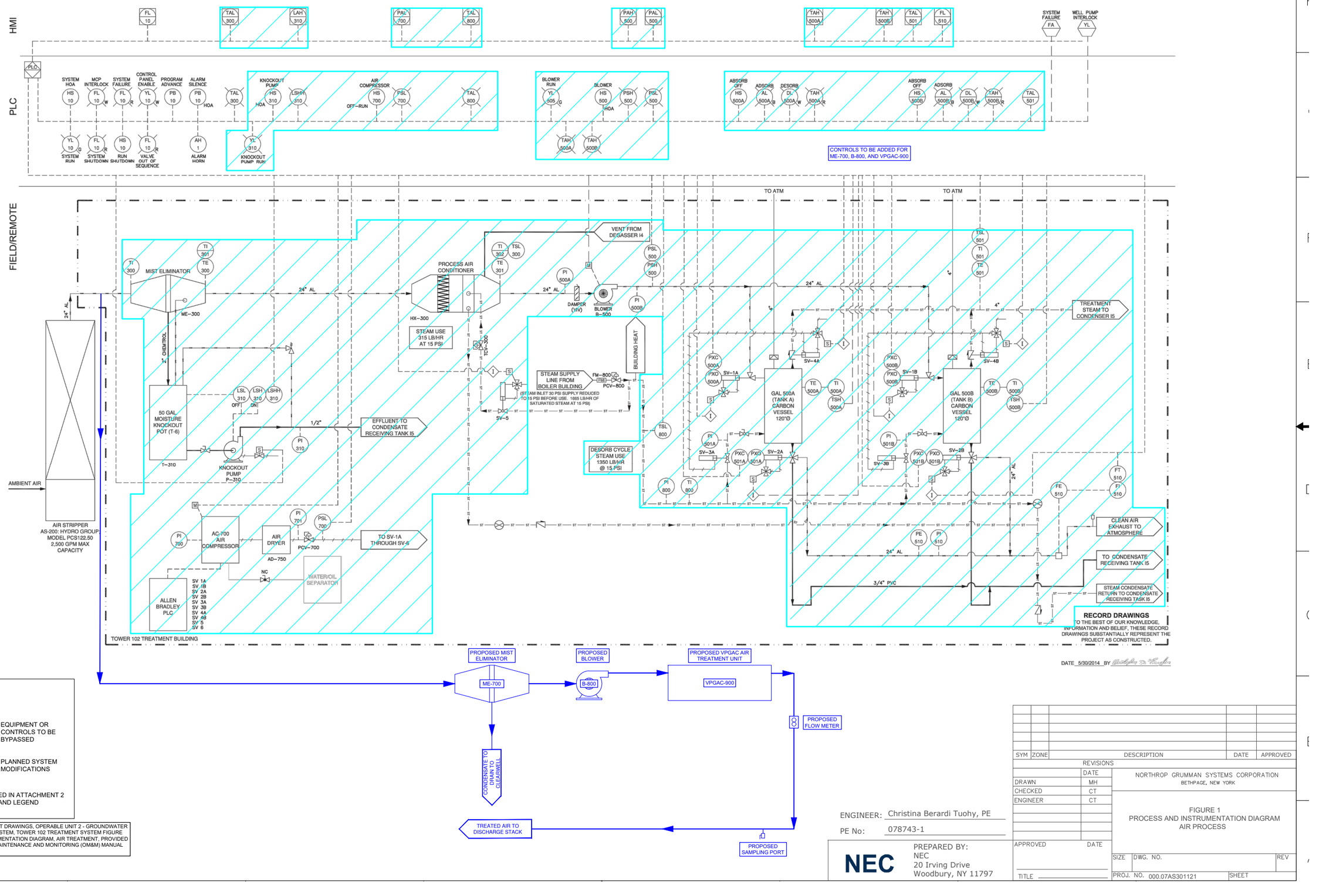
[2/] Or until data supports an alternate frequency

Orange text - indicates a change in sampling location

VPGAC - vapor-phase granular activated carbon

VOC - volatile organic compound

FIGURES



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 102 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	MH
CHECKED	CT
ENGINEER	CT
APPROVED	DATE

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK

FIGURE 1
PROCESS AND INSTRUMENTATION DIAGRAM
AIR PROCESS

SIZE | DWG. NO. | REV

PROJ. NO. 000.07AS301121 | SHEET

TITLE

ENGINEER: Christina Berardi Tuohy, PE

PE No: 078743-1

NEC

PREPARED BY:
NEC
20 Irving Drive
Woodbury, NY 11797

HMI

PLC

FIELD/REMOTE

FAL 600 | TAH 600

LAH 610 | LALA 610 | TAH 610 | TAH 611 | LAH 630 | LAH 620

PLC 102

CONDENSATE FLOW/TEMP ALARM — FAL/TAL 600 R

LSHH 620 R

CONDENSATE PUMP — HS 620 HOA

CONDENSATE PUMP — YL 620 R RUN

LSH 620 R | LSL 620 R

DECANTER — LSLL 610 | LSHH 610 | TAH 610 | TAH 611

LSHH 630 R

SOLVENT PUMP — HS 630 HOA

SOLVENT PUMP — YL 630 R RUN

LSH 630 R | LSL 630 R

VENTED OUTSIDE THE BUILDING

TI 600 | TSH 600

NON-CONTACT COOLING WATER TO CLEARWELL I3

PLATE & FRAME CONDENSER PC-600

I — S — SVE–6

CV–600

DEGASSER AIR VENT RETURN TO PROCESS AIR CONDITIONER I4

TI 611 | TSH 611

NON-CONTACT COOLING WATER FROM CLEARWELL I3

DEGASSER

TI 610 | TSH 610

TREATMENT STEAM FROM RVP-GAC TANK A & TANK B DESORB CYCLE I4

LSHH 610 | LSLL 610

LG 610

125 GAL DECANTER T-610

ARV–630

LG 630

150 GAL SOLVENT RECEIVER TANK T-630

LSL 630 | LSH 630 | LSHH 630

ON | OFF

PI 630

CONDENSATE DRAIN FROM GAC TANK A & TANK B DESORB CYCLE I4

EFFLUENT FROM KNOCKOUT POT I4

ARV–620

LG 620

250 GAL CONDENSATE RECEIVER TANK T-620

LSL 620 | LSH 620 | LSHH 620

ON | OFF

PI 620

FM–620

SATURATED CONDENSATE RETURN TO AIR STRIPPER INFLUENT I2

SOLVENT PUMP P–630

55-GALLON SOLVENT RECOVERY DRUMS

CONDENSATE PUMP P–620

CONDENSATE PUMP P–621

TOWER 102 TREATMENT BUILDING

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

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 102 TREATMENT SYSTEM FIGURE I-5, 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	MH
CHECKED	CT
ENGINEER	CT
APPROVED	DATE

ENGINEER: Christina Berardi Tuohy, PE

PE No: 078743-1

NEC

PREPARED BY:
NEC
20 Irving Drive
Woodbury, NY 11797

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK

FIGURE 2
PROCESS AND INSTRUMENTATION DIAGRAM
AIR PROCESS

SIZE | DWG. NO. | REV

PROJ. NO. 000.07AS301121 | SHEET

TITLE

ATTACHMENT I

January 24, 2022 Letter from Arcadis
on the Proposed OU2 Tower 102 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: January 24, 2022

Our Ref: 30059268
Subject: Proposed Modifications to the OU2 Tower 102 Groundwater Treatment System

Dear Jason,

As the Engineer of Record for the Northrop Grumman Operable Unit 2 Tower 102 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

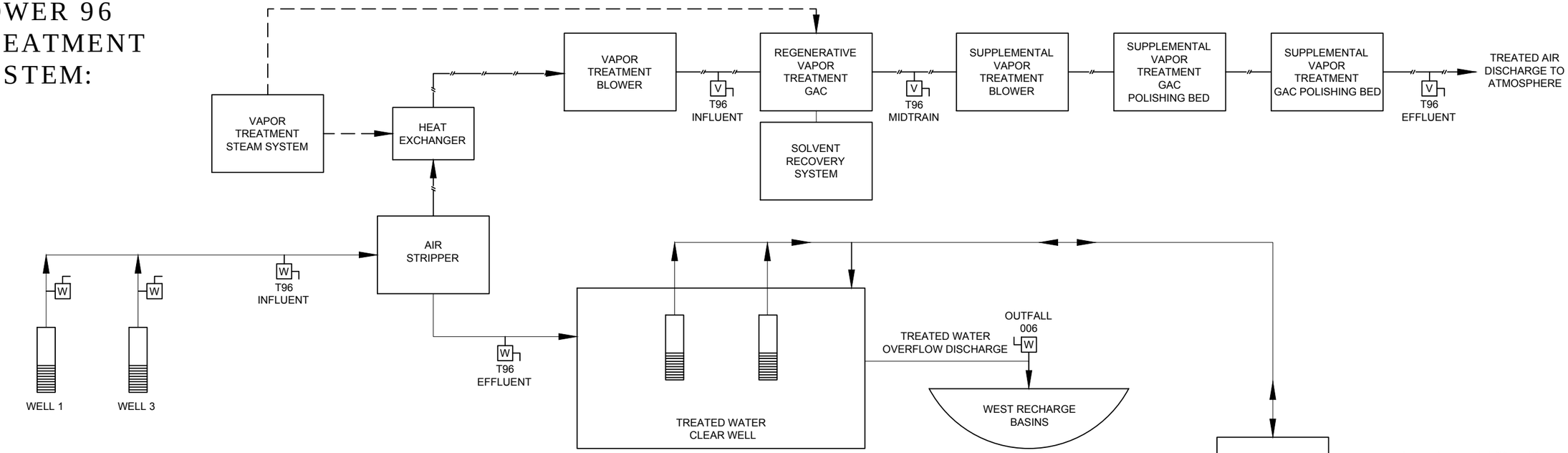
Email: Christopher.Engler@arcadis.com
Direct Line: 315.409.6579

ATTACHMENT 2

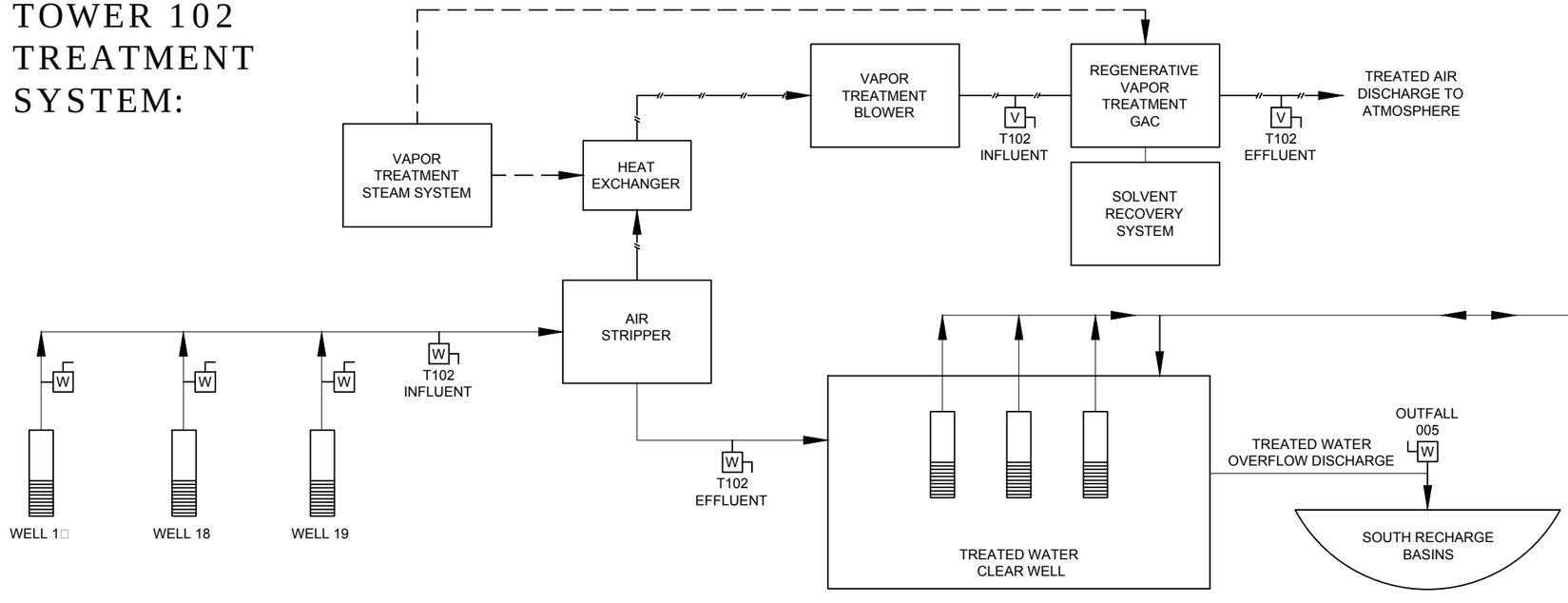
ONCT Schematic

Drawing I-1, Notes and Legend

TOWER 96 TREATMENT SYSTEM:



TOWER 102 TREATMENT SYSTEM:



LEGEND:

	PROCESS WATER
	PROCESS AIR
	STEAM
	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 — (I)
  - 1: CRITICAL ALARM INPUT
  - 2: PRIMARY PLC INPUT
  - 3: PRIMARY PLC OUTPUT
  - 4: SECONDARY PLC OUTPUT/CRITICAL ALARM SHUTDOWN
- ALARM COMMUNICATION FUNCTION

- BUILDING EXTENTS
- PNEUMATIC LINE
- VAPOR LINE
- STEAM LINE (ST — ST)
- PROCESS LINE
- ELECTRONIC SIGNAL
- CONTROL PANEL INPUT/OUTPUT
- AMBIENT AIR
- FLOW DIRECTION
- GLOBE VALVE
- CHECK VALVE
- FLANGED CHECK VALVE
- PLUG VALVE (NORMALLY OPEN)
- PLUG VALVE (NORMALLY CLOSED)
- GATE VALVE
- RISING STEM GATE VALVE
- FLANGED GATE VALVE (NORMALLY OPEN)
- FLANGED GATE VALVE (NORMALLY CLOSED)
- BALL VALVE (NORMALLY OPEN)
- BALL VALVE (NORMALLY CLOSED)
- FLANGED BALL VALVE (NORMALLY OPEN)
- BUTTERFLY VALVE (NORMALLY OPEN) (N.O.)
- 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
- RUPTURE DISK
- CLA-VALVE (S)
- DAMPER (VIV)

- 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
- VERTICAL TURBINE PUMP
- SUBMERSIBLE PUMP
- BLOWER – CENTRIFUGAL
- LEVEL SWITCH
- COPPER LINE
- THERMOSTATIC STEAM TRAP

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 Christopher D. Engler

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	Date Signed	Project Mgr.
NY	MAY 2014	CSG
Designed by	Drawn by	Checked by
	AS	PR

STATE OF NEW YORK — CHRISTOPHER DANIEL ENGLER — LICENSED PROFESSIONAL ENGINEER — NO. 069748

ARCADIS OF NEW YORK, INC.

NORTHROP GRUMMAN SYSTEMS CORPORATION • BETHPAGE, NEW YORK
TOWER 102

PROCESS AND INSTRUMENTATION DIAGRAM NOTES AND LEGEND

PROCESS

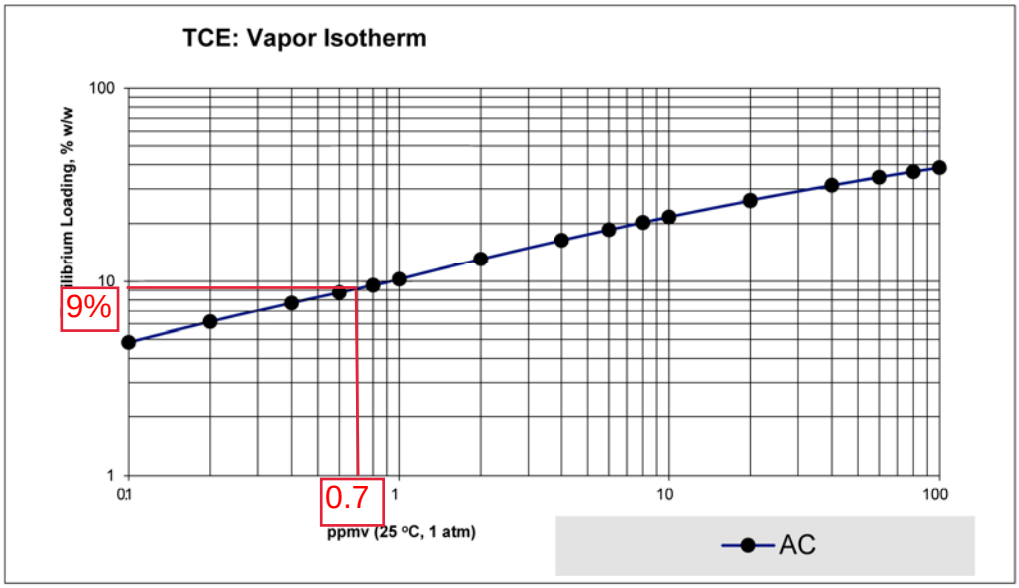
ARCADIS Project No. NY001496.0314.SMPH2
Date MAY 2014

ARCADIS
2 HUNTINGTON QUADRANGLE
SUITE 1S10
MELVILLE, NEW YORK
TEL. 631.249.7600

I1

ATTACHMENT 3

TCE Isotherm


TCE: Vapor Isotherm
100
10
1
9%
0.7
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

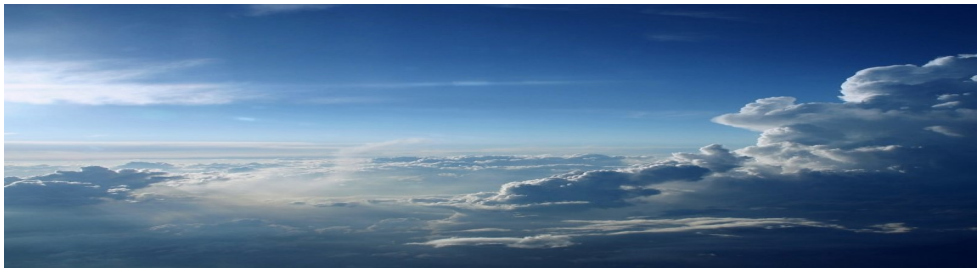
Phone: 713.703.6516

E-mail: info@tetrasolv.com

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%



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.*