NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Remediation, Region 8
6274 East Avon-Lima Road, Avon, NY 14414-9516
P: (585) 226-5353 I F: (585) 226-8139
www.dec.ny.gov

August 22, 2023

Mr. Warner Golden
Arxada
1200 Bluegrass Lakes Parkway
Alpharetta, Georgia, 30004

Re: Pilot Test Work Plan for Groundwater Extraction and Treatment – HW-1 Well
NYSDEC Site Name: Olin Corporation – Chemicals Group
NYSDEC Site No – 828018A
100 McKee Road, Rochester, Monroe County, New York, 14611

Mr. Golden,

The New York State Department of Environmental Conservation – Division of Environmental Remediation (NYSDEC-DER), the New York State Department of Environmental Conservation – Division of Air Resources (NYSDEC-DAR) and the New York State Department of Health (NYSDOH), collectively referred to as the Departments, have completed their review the "Well HW-1 Pilot Test Work Plan Addendum No. 1 for Groundwater Extraction and Treatment" (PTWP Addendum 1) dated August 07, 2023 for the former Olin Corporation – Chemicals Group (now known as Arch Chemicals, Inc. and as Arxada) prepared by MACTEC Engineering and Geology, P.C.

In accordance with 6 NYCRR Part 375-1.6, the Departments have determined that the Work Plan substantially address the requirements of the State Superfund's Order on Consent and the PTWP Addendum 1 is hereby approved. The Departments have the following notes:

1. If Carbon Tetrachloride concentrations consistently exceed the 788ug/L value, the NYSDEC-DAR may require additional information in the form of modeling or emission controls.
2. The other proposed changes in the workplan (flow rate adjustments, GAC sampling timeline, and the option to utilize air stripper for the remainder of the pilot test are pre-approved. Please continue to the NYSDEC-DER with timely and routine updates throughout the pilot study.

Within 10 days from the date of this letter, please submit the Departments a quick schedule for implementing the air stripping device. Also, in that 10-day interval, please compile this document with the appended schedule and with this approval as cover and place a copy in the document repository for the site. Thank you for your continued efforts on this project.

Sincerely,

Joshuah J. Klier

Joshuah J. Klier, G.I.T.
Assistant Geologist

NEW YORK STATE | Department of Environmental Conservation

Arch Chemicals, Inc.
c/o Arxada
100 Mckee Road
Rochester, NY 14611-2013
USA

August 7, 2023

Mr. Joshuah Klier
Project Manager
New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 8
6274 East Avon-Lima Road
Avon, New York 14414-9519

Subject: Well HW-1 Pilot Test Work Plan Addendum No. 1 for Groundwater Extraction and Treatment - HW-1 Well, Arch Chemicals (Site #828018a) 100 McKee Rd., Rochester, NY

Dear Mr. Klier:

Enclosed is an electronic copy of the subject work plan addendum. This is an addendum to the original pilot test work plan dated April 26, 2023 and is intended to support the planned operation of a pump and treat system for horizontal well HW-1 by testing additional treatment by air stripping.

Should you have any questions regarding this work plan, please give me a call at (205)960-4080.

Sincerely,

Warner Golden
Associate Director EHS
Arxada

cc: Christopher Budd, NYSDOH
Jean Robert Jean, US EPA Region 2
David Pratt, NYSDEC
Sean Keenan, MCDES
Ken Smith, MCDES
Matt Dillon, Arxada
David Harris, Arxada
Mark Stelmack, MACTEC
Nelson Breton, MACTEC
Eric Thompson, MACTEC
Steve Marchetti, Matrix

August 7, 2023

Mr. Warner Golden

Arch Chemicals, Inc.
Rochester Plant Site
100 McKee Road
Rochester, NY

Subject: Pilot Test Work Plan Addendum #1 for Groundwater Extraction and Treatment - HW-1 well, Arch Chemicals Inc., 100 McKee Road, Rochester NY

Dear Mr. Golden:

MACTEC Engineering and Geology, P.C. (MACTEC) submits this Pilot Test Work Plan Addendum proposing modifications to the HW-1 pilot test work plan submitted to the NYSDEC on April 26, 2023. This addendum details proposed modifications including installation of a pilot air stripper system to determine VOC removal capabilities and effect on GAC breakthrough, and a reduction in extraction flow rate to monitor containment of the contaminant plume.

Introduction

The groundwater extraction and treatment pilot test is ongoing at horizontal well HW-1. This test is intended to evaluate the effectiveness of pumping on containment of groundwater constituent plumes under extended pumping conditions, to monitor the concentration trend of contaminants of concern under long-term pumping conditions, and to determine the usability of granular activated carbon (GAC) as the primary and long-term treatment method. The objective of this pilot test is to reduce concentration of VOCs, pyridines, and other constituents, through three stage GAC treatment, to levels acceptable for discharge to the VanLare Wastewater Treatment Facility (POTW).

During the first two weeks of operation, rapid GAC breakthrough was observed, mainly due to the elevated chloroform levels. Flow rates were reduced from the initial target rate of 20 gpm, primarily due to pump cavitation and reduction in extraction efficiency after water levels continued to drop at the initial flow rate. Contaminant levels have remained elevated and therefore MACTEC is proposing to augment treatment by use of an air stripper. MACTEC is also proposing to reduce the flow rate during the planned pilot test period to evaluate mass removal rate and hydraulic containment.

This addendum was prepared to propose pre-treatment via air stripping to reduce loading of volatile organic compounds (VOCs) to the GAC vessels, and to propose a reduction in the groundwater extraction rate. Both measures are intended to evaluate balancing the contaminant loading rate on the GAC beds while maintaining hydraulic control of the contaminant plumes.

Pre-Treatment Via Air Stripping

As observed during the constant rate pumping test and expected during the long-term pumping test, concentrations of volatile organic compounds (VOCs) and pyridines measured in extracted

groundwater have remained elevated. Air stripping is expected to be effective in reducing VOC concentrations, but not intended to reduce pyridine concentrations as these constituents have much lower vapor pressures. Respective maximum VOC concentrations measured recently (7/10 thru 7/24) in HW-1 are as follows:

Contaminant	Maximum Observed Concentration (ug/L)
Acetone	432
Chloroform	1,382
Carbon Tetrachloride	788
Methylene Chloride	227
Benzene	10.5
Bromoform	180
Carbon disulfide	336
Chlorobenzene	196
1,2-Dichlorobenzene	44.6
1,4-Dichlorobenzene	68.3
Tetrachloroethene	321
Toluene	96.2
1,2,4-Trichlorobenzene	202
Trichloroethene	42.8

Extracted water from the HW-1 pilot test is currently treated through three stage GAC treatment. Upon breakthrough of the primary (1st) GAC, the secondary GAC vessel is placed in the primary position, the tertiary vessel is placed in the secondary position, and a new GAC vessel is placed in the tertiary position. Samples have been collected daily for analysis of pyridines (pyridine, 2-chloropyridine, and 3-chloropyridine) and VOCs (chloroform, carbon tetrachloride, and methylene chloride). Results from the influent (untreated extracted groundwater) are compared to that of the sample taken after the first GAC vessel to determine if GAC replacement is necessary.

During the first two weeks of operation, the lead GAC vessel required changeout seven times, or approximately every other day. Breakthrough was observed on the lead GAC bed, primarily due to chloroform and methylene chloride exceeding permit limits. Arch's monthly average discharge permit limits for chloroform and methylene chloride are 111 ug/L and 36 ug/L, respectively.

MACTEC proposes installation of a pilot air stripper system for treatment of VOCs prior to treatment for residual VOCs/pyridines via GAC. The air stripper system would include an air stripper unit, a blower capable of ~210 cubic feet per minute (CFM) of air, a pump to control flow out of the air stripper, and instrumentation to control the air stripper blower and pump. The air stripper would be installed after the influent bag filters and before the GAC treatment. Water would be pumped from bag filter effluent to the air stripper and then to a holding tank where the water would be returned to the lead GAC bed. Air from the air stripper would be discharged to the atmosphere above the breathing zone. A diagram of the treatment setup adding the air stripper is provided as **Attachment 1**.

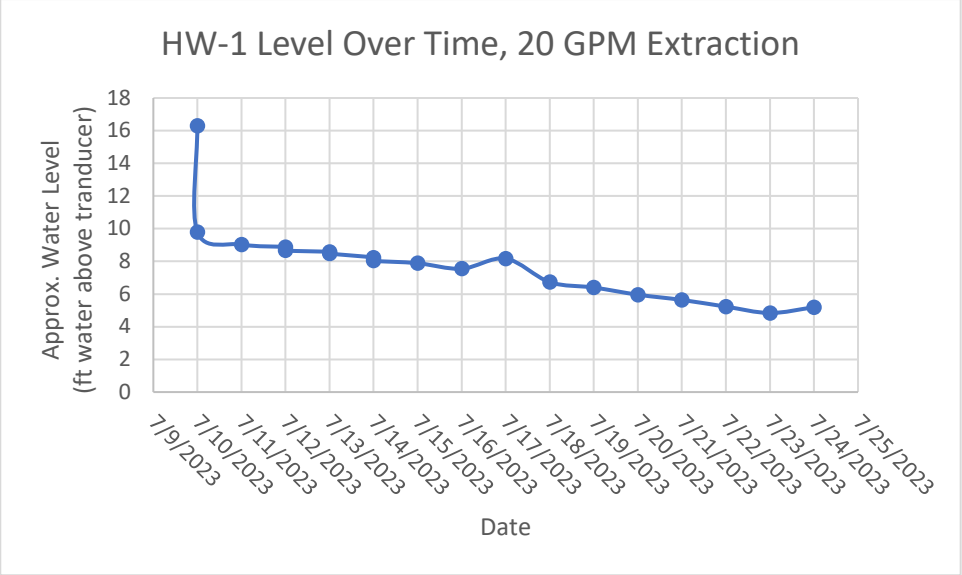
The air stripper would be in service for up to 2 weeks, with water samples taken initially on a daily basis from the well influent, post air stripper, post GAC 1, post GAC 2, and effluent. Sampling after 1 week may be reduced to once every two days or at each lead GAC bed changeout. Results would be used to determine air stripper removal efficiency and evaluate GAC breakthrough frequency.

The air stripper proposed for use is the QED EZ 4.6 SS (stainless steel); cut sheets and model outputs can be found in **Attachment 2**. Modelling has been conducted at both 10 and 25 GPM to determine removal efficiency for each contaminant using a 4-tray or 6-tray setup. Using a 6-tray setup that MACTEC proposes and assuming an influent chloroform concentration of 1,382 ug/L, the proposed air stripper would remove 94.5% of chloroform at 25 GPM and 99.9% of chloroform at 10 GPM. Chloroform is a primary target for air stripping due to observed GAC breakthrough time.

While proposed as a pilot alternative at this time, MACTEC is proposing an option to utilize the air stripper for the remainder of the pilot test pending operational efficiency.

HW-1 Extraction Rate Reduction

During the first two weeks of operation of the HW-1 pilot test system, continued drawdown of HW-1 was observed until cavitation of the pump prevented continued extraction at 20 GPM. The chart below details groundwater levels from startup (7/10/2023) through day 14 (7/23/2023). Water levels are presented as height of water above the transducer, which was set in the screened zone of the well and approximately 26 feet below ground surface.



Extraction at 20 GPM was consistent until day 14, when the groundwater level reached below 4.84 feet above the transducer (~21 feet below ground surface). At this time, the pneumatic extraction pump began cavitating with marginal efficiency. The extraction rate was reduced from 20 GPM to a range of 10 to 15 gpm while monitoring the level in the well. Extraction via an alternative extraction pump (non-pneumatic) was not considered for this pilot test, as the drawdown limit of the pneumatic pump is near the maximum target drawdown level of the well. Based on the rate

of drawdown observed in the well, MACTEC estimates the operational range of flow for well to be between 10 and 15 gpm. Higher flow rates may be achieved but may not be sustainable.

MACTEC is proposing an option to reduce the extraction rate from the current maximum sustainable rate of approximately 15 gpm to 10 gpm for a period sufficient to evaluate GAC usage while continuing to monitor water level responses in the current array of monitoring wells. The flow rate will be reduced while the air stripper is in operation and maintained for a period of 2 weeks, or until stabilization of groundwater levels is observed. Depending on system operation at 10 gpm, the reduced flowrate may be held for the remainder of the pilot test. Sampling of the HW-1 well influent and air stripper and GAC bed effluent ports at the lower flow rate will be performed just prior to each GAC bed changeout.

Upon your approval, the proposed work will be implemented and is anticipated to commence by mid-August 2023. If you need any additional details or clarifications, please contact us at 207-712-8020.

Sincerely,

Nelson Breton
Project Manager

Thomas Gerhard
Project Engineer

Mark Stelmack, PE (New York)
Engineer of Record

Cc:

Matt Dillon - Arch
Luke Ferruzza- Arch
Will Surdyka -Arch
David Harris – Arch
Tom Gerhard- MACTEC

Attachments:

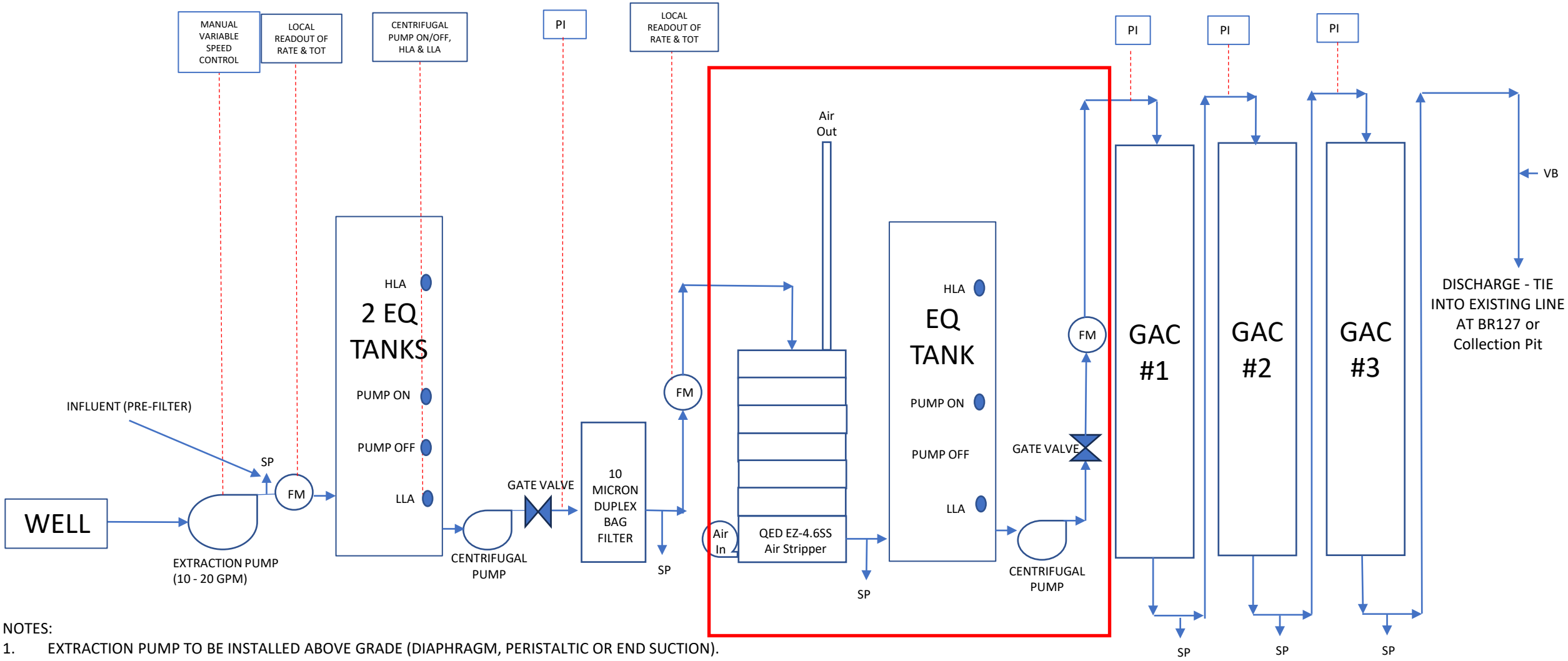
Attachment 1- Figure 1 -Pilot Test Treatment System Setup with Air Stripper Addition

Attachment 2 – Air Stripper Cut Sheets and Model Runs

Attachment 1
Pilot Test Treatment System Setup with Air Stripper Addition

FIGURE 1 - PILOT TEST TREATMENT SYSTEM SETUP
AIR STRIPPER ADDITION

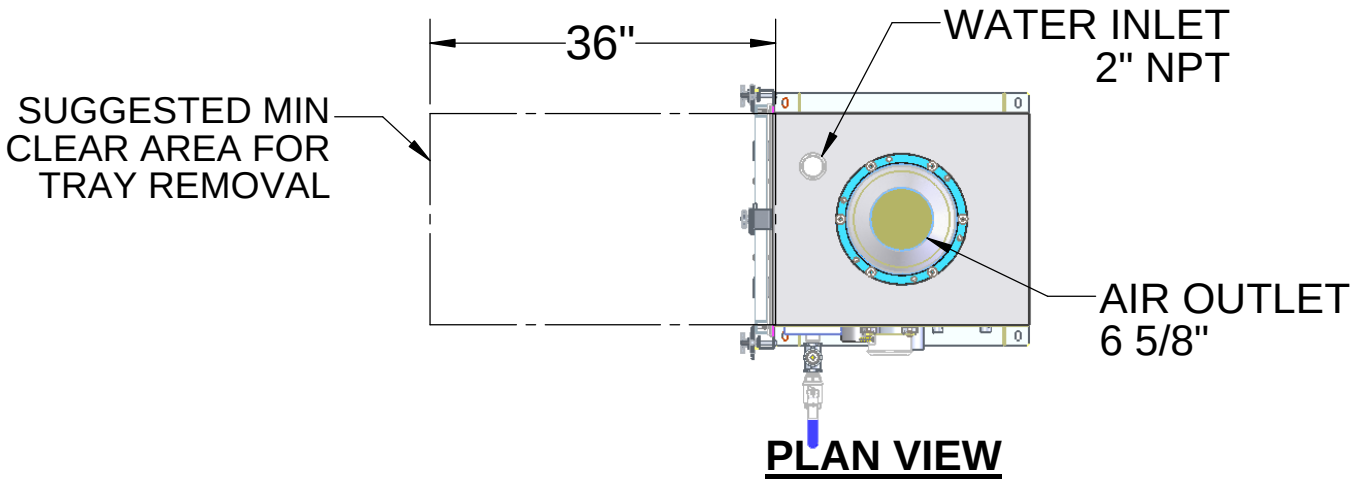
FM – FLOW METER
PI – PRESSURE INDICATOR
SP – SAMPLE PORT
VB – VACUUM BREAK



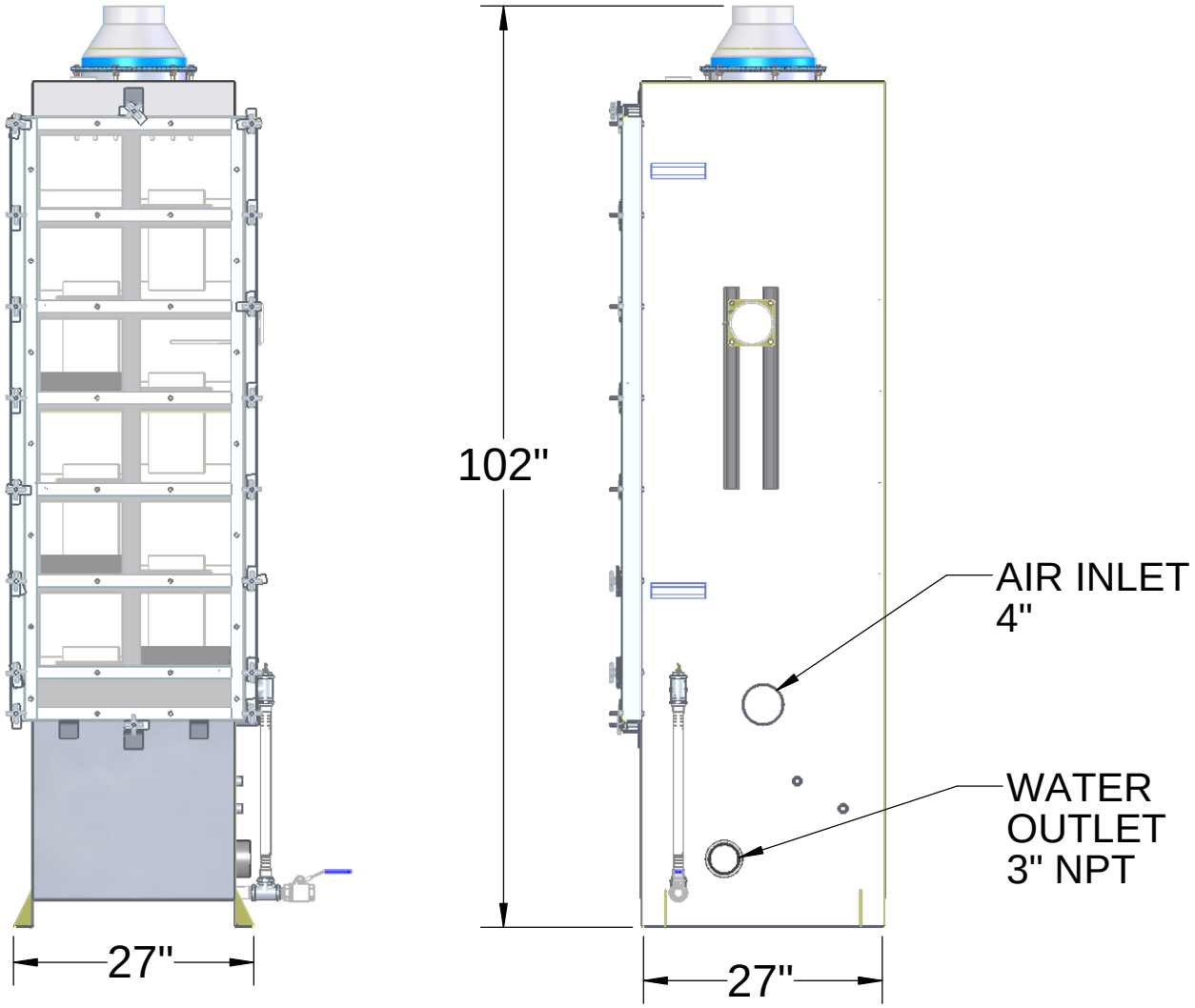
NOTES:

1. EXTRACTION PUMP TO BE INSTALLED ABOVE GRADE (DIAPHRAGM, PERISTALTIC OR END SUCTION).
2. ISOLATION VALVES TO BE PROVIDED FOR ALL EQUIPMENT (NOT SHOWN).
3. SCHEMATIC BASED ON THE USE OF 2000 POUND GAC VESSELS (6000# EST. WEEKLY USAGE RATE).
4. EXTERNAL GENERAL ALARM LIGHT TO BE PROVIDED FOR LOCAL INDICATION OF SYSTEM SHUTDOWN.
5. SYSTEM MUST INCLUDE PROVISIONS FOR SECONDARY CONTAINMENT.
6. SYSTEM SHOULD ALSO BE CONFIGURED TO ALLOW WINTERIZATION (HEAT TRACING/INSULATION) SHOULD OPERATING SCHEDULE WARRANT.

Attachment 2
Air Stripper Cut Sheets and Model Runs



PLAN VIEW



FRONT VIEW

SIDE VIEW

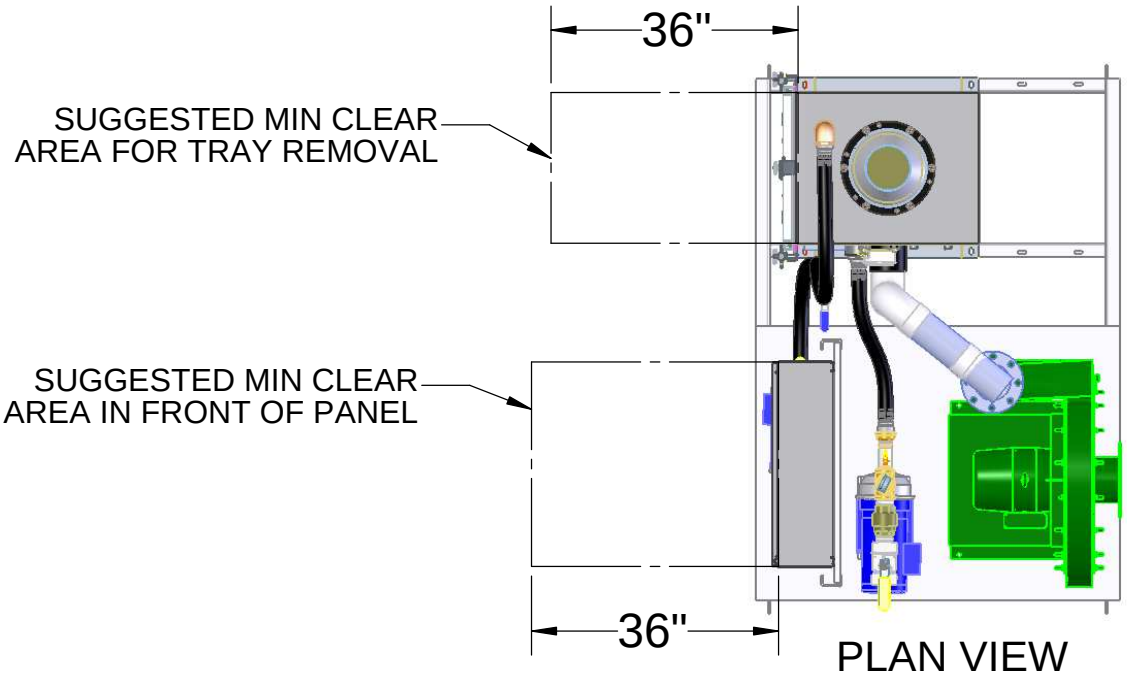
EZ-4.6SS (AIR STRIPPER ONLY)

FOR MORE SPECIFICATIONS CLICK:

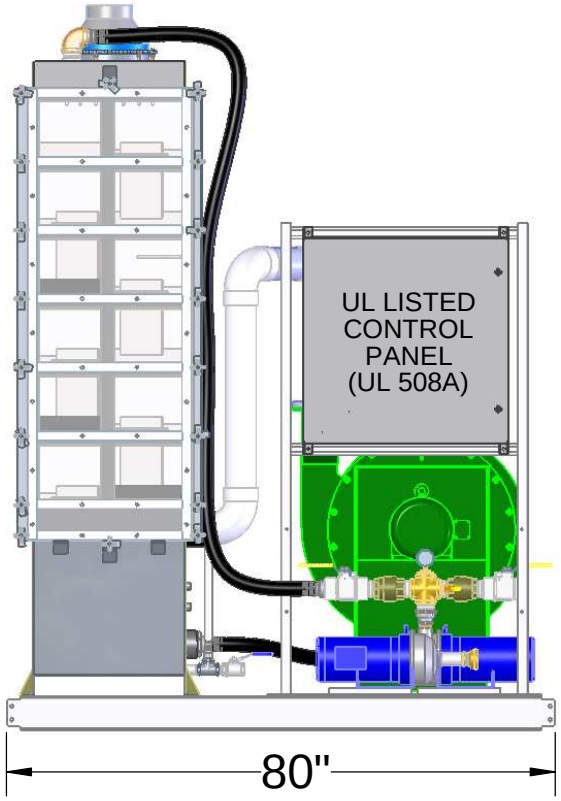
http://www.qedenv.com/Products/Airstrippers_VOC_Removal/Air_Stripper_Specifications/

NOT TO SCALE

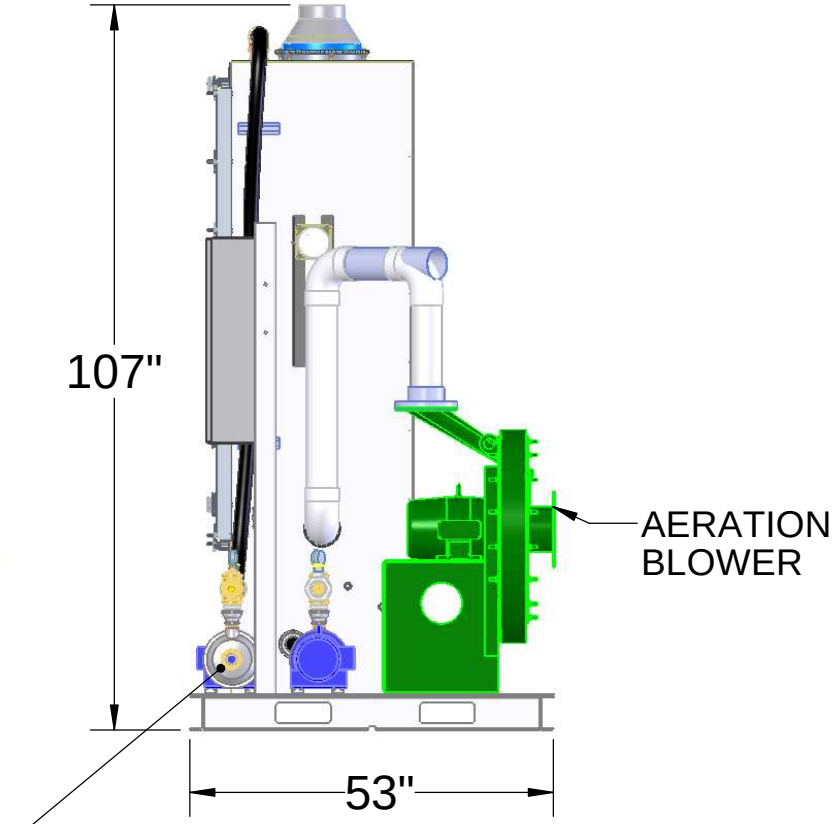
NOT FOR CONSTRUCTION, FOR REFERENCE ONLY



PLAN VIEW



FRONT VIEW



SIDE VIEW

EZ-4.6SS

EXAMPLE OF A SKID SYSTEM WITH CONTROL PANEL, PUMPS, AND BLOWER
CONTACT QED FOR INFORMATION ON ALL OPTIONS.
NOT TO SCALE

NOT FOR CONSTRUCTION, FOR REFERENCE ONLY

QED Air Stripper Model ver. 3.0 **7/26/2023**

Site Data

Name: Thomas Gerhard
e-mail: thomas.gerhard@wsp.com
Project: GAC Pre-treatment -nornd
Units: English
Altitude: 540 ft
Air Temp: 80 F
Flow: 10 gpm
Water Temp: 50 F
Stripper: EZ-Tray 4.x HF - Click for details
Stripper Air Flow: 210 cfm
Stripper Max Flow: 120 gpm
Ease of Stripping: Max High Med Low Min

Water Results

Ease	Contaminant	Influent (ppb)	Target (ppb)	4-Tray Results (ppb)	4-Tray %Removal	6-Tray Results (ppb)	6-Tray %Removal
MED	1,2,4-trichlorobenzene	202	0	5.563	97.246	1.110	99.450
HI	1,2-dichlorobenzene	44.6	0	0.223	99.500	0.017	99.962
HI	1,4-dichlorobenzene	68.3	0	0.703	98.971	0.079	99.884
MIN	acetone	432	0	377.241	12.676	377.193	12.687
MAX	benzene	10.5	0	0.008	99.924	0.000	100.000
LOW	bromoform	180	0	27.219	84.878	15.228	91.540
MAX	carbon disulfide	336	0	0.008	99.998	0.000	100.000
MAX	carbon tetrachloride	788	0	0.008	99.999	0.000	100.000
HI	chlorobenzene	196	0	0.279	99.858	0.011	99.994
MED	chloroform (trichloromethane)	1382	0	13.464	99.026	1.500	99.891
HI	methylene chloride	227	0	1.140	99.498	0.088	99.961
MAX	tetrachloroethylene (PERC,PCE)	321	0	0.004	99.999	0.000	100.000
MAX	toluene	96.2	0	0.064	99.933	0.002	99.998
MAX	trichloroethylene (TCE)	42.8	0	0.004	99.991	0.000	100.000

Air Results

Contaminant	4-Tray (ppmV)	4-Tray (lb/hr)	6-Tray (ppmV)	6-Tray (lb/hr)
1,2,4-trichlorobenzene	0.1695	0.00098	0.1734	0.00101
1,2-dichlorobenzene	0.0473	0.00022	0.0475	0.00022
1,4-dichlorobenzene	0.0720	0.00034	0.0727	0.00034
acetone	0.1477	0.00027	0.1478	0.00027
benzene	0.0210	0.00005	0.0211	0.00005
bromoform	0.0947	0.00076	0.1021	0.00082
carbon disulfide	0.6912	0.00168	0.6912	0.00168
carbon tetrachloride	0.8022	0.00395	0.8023	0.00395
chlorobenzene	0.2723	0.00098	0.2727	0.00098
chloroform (trichloromethane)	1.7953	0.00685	1.8110	0.00691
methylene chloride	0.4165	0.00113	0.4184	0.00114
tetrachloroethylene (PERC,PCE)	0.3031	0.00161	0.3031	0.00161
toluene	0.1634	0.00048	0.1635	0.00048
trichloroethylene (TCE)	0.0510	0.00021	0.0510	0.00021

Warnings

Warning: User request for non-rounded results. Consult with QED for removal requirements below 1ppb.

Notes

PH-> 1-800-624-2026 or 1-734-995-2547, FX-> 1-734-995-1170. E-mail->info@qedenv.com. WEB->www.qedenv.com.

The QED modeler estimates unit performance for the listed contaminants. ***Results assume -***

1. *Contaminants are in the dissolved-phase, within a water matrix*
2. *Stripper Influent air is contaminant-free*
3. *Influent liquid does not have surfactants, oil, grease, other immiscible phase(s) or other Henry's constant altering additions present, such as dissolved phase polar organic contaminants*
4. *The air stripper is operated within the given parameters listed above and as instructed in the E-Z Tray O&M manual*

Stripper performance shall meet or exceed either the required effluent concentration(s) or effluent estimates, whichever is greater, for the conditions supplied and assumes the influent concentrations of each contaminant are less than 25% solubility in water. QED makes no claim of the model's accuracy beyond the 25% solubility in water limit.

Standard E-Z Tray material is 304SS - contact QED for other material options, 304SS is not recommended for chloride levels greater than 80-100ppm. Induced draft blower and piping is recommeneded for systems with off-gas treatment, such as VGAC. Check all downstream pipe and systems losses to ensure that blower and discharge transfer pump(s) are sized correctly. Gravity drain discharge systems must include a water trap.

Save Data

Use the following URL to reconstruct your data form for future remodeling with changes. This URL can be saved in any text file for record keeping and later retrieval. This run's URL:

```
http://10.4.2.50/cgi-bin/remodel.pl?u=e&tw=50&ta=80&f=10&a=540&
s=20&n=Thoma&e=thomas.gerhard@wsp.com&p=GAC+P&c=21,202;26,44.6;
32,68.3;55,432;63,10.5;77,180;84,336;85,788;88,196;91,1382;150,227;
182,321;186,96.2;189,42.8;
```

(Use this IP for external remodeling - http://64.9.197.49)

QED Air Stripper Model ver. 3.0 **7/26/2023**

Site Data

Name: Thomas Gerhard
e-mail: thomas.gerhard@wsp.com
Project: GAC Pre-treatment -nornd
Units: English
Altitude: 540 ft
Air Temp: 80 F
Flow: 25 gpm
Water Temp: 50 F
Stripper: EZ-Tray 4.x HF - Click for details
Stripper Air Flow: 210 cfm
Stripper Max Flow: 120 gpm
Ease of Stripping: Max High Med Low Min

Water Results

Ease	Contaminant	Influent (ppb)	Target (ppb)	4-Tray Results (ppb)	4-Tray %Removal	6-Tray Results (ppb)	6-Tray %Removal
MED	1,2,4-trichlorobenzene	202	0	46.329	77.065	30.170	85.064
HI	1,2-dichlorobenzene	44.6	0	2.846	93.619	0.874	98.040
HI	1,4-dichlorobenzene	68.3	0	6.263	90.830	2.373	96.526
MIN	acetone	432	0	410.089	5.072	410.077	5.075
MAX	benzene	10.5	0	0.109	98.962	0.012	99.886
LOW	bromoform	180	0	95.584	46.898	89.623	50.209
MAX	carbon disulfide	336	0	0.158	99.953	0.004	99.999
MAX	carbon tetrachloride	788	0	0.176	99.978	0.003	100.000
HI	chlorobenzene	196	0	3.590	98.168	0.541	99.724
MED	chloroform (trichloromethane)	1382	0	168.738	87.790	76.348	94.476
HI	methylene chloride	227	0	14.534	93.597	4.473	98.030
MAX	tetrachloroethylene (PERC,PCE)	321	0	0.094	99.971	0.002	99.999
MAX	toluene	96.2	0	0.906	99.058	0.095	99.901
MAX	trichloroethylene (TCE)	42.8	0	0.074	99.827	0.003	99.993

Air Results

Contaminant	4-Tray (ppmV)	4-Tray (lb/hr)	6-Tray (ppmV)	6-Tray (lb/hr)
1,2,4-trichlorobenzene	0.3359	0.00195	0.3708	0.00215
1,2-dichlorobenzene	0.1112	0.00052	0.1165	0.00055
1,4-dichlorobenzene	0.1652	0.00078	0.1756	0.00082
acetone	0.1477	0.00027	0.1478	0.00027
benzene	0.0521	0.00013	0.0526	0.00013
bromoform	0.1308	0.00106	0.1400	0.00113
carbon disulfide	1.7271	0.00420	1.7279	0.00421
carbon tetrachloride	2.0052	0.00986	2.0056	0.00986
chlorobenzene	0.6693	0.00241	0.6799	0.00245
chloroform (trichloromethane)	3.9790	0.01519	4.2820	0.01634
methylene chloride	0.9794	0.00266	1.0258	0.00279
tetrachloroethylene (PERC,PCE)	0.7576	0.00402	0.7578	0.00402
toluene	0.4049	0.00119	0.4084	0.00120
trichloroethylene (TCE)	0.1273	0.00053	0.1275	0.00054

Warnings

Warning: User request for non-rounded results. Consult with QED for removal requirements below 1ppb.

Notes

PH-> 1-800-624-2026 or 1-734-995-2547, FX-> 1-734-995-1170. E-mail->info@qedenv.com. WEB->www.qedenv.com.

The QED modeler estimates unit performance for the listed contaminants. ***Results assume -***

1. *Contaminants are in the dissolved-phase, within a water matrix*
2. *Stripper Influent air is contaminant-free*
3. *Influent liquid does not have surfactants, oil, grease, other immiscible phase(s) or other Henry's constant altering additions present, such as dissolved phase polar organic contaminants*
4. *The air stripper is operated within the given parameters listed above and as instructed in the E-Z Tray O&M manual*

Stripper performance shall meet or exceed either the required effluent concentration(s) or effluent estimates, whichever is greater, for the conditions supplied and assumes the influent concentrations of each contaminant are less than 25% solubility in water. QED makes no claim of the model's accuracy beyond the 25% solubility in water limit.

Standard E-Z Tray material is 304SS - contact QED for other material options, 304SS is not recommended for chloride levels greater than 80-100ppm. Induced draft blower and piping is recommeneded for systems with off-gas treatment, such as VGAC. Check all downstream pipe and systems losses to ensure that blower and discharge transfer pump(s) are sized correctly. Gravity drain discharge systems must include a water trap.

Save Data

Use the following URL to reconstruct your data form for future remodeling with changes. This URL can be saved in any text file for record keeping and later retrieval. This run's URL:

```
http://10.4.2.50/cgi-bin/remodel.pl?u=e&tw=50&ta=80&f=25&a=540&
s=20&n=Thoma&e=thomas.gerhard@wsp.com&p=GAC+P&c=21,202;26,44.6;
32,68.3;55,432;63,10.5;77,180;84,336;85,788;88,196;91,1382;150,227;
182,321;186,96.2;189,42.8;
```

(Use this IP for external remodeling - http://64.9.197.49)

ec: Mark Stelmack, MACTEC Engineering and Geology, P.C.
Nelson Breton, MACTEC Engineering and Geology, P.C.
Eric Thompson, MACTEC Engineering and Geology, P.C.
Steven Marchetti, Matrix Environmental Technologies, Inc.
Pat Bliek, Matric Environmental Technologies, Inc.
Matt Dillon, Arxada
David Harris, Arxada
Jean Robert Jean, US EPA
David Pratt, NYSDEC-DER
Adam Morgan, NYSDEC-DER
Frank Sowers, NYSDEC-DAR
Christopher Budd, NYSDOH
Julia Kenney, NYSDOH
Justin Deming, NYSDOH