Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

July 26, 2023

Mark Gorog P.E., Regional Manager Air Quality Program
Pennsylvania Department of Environmental Protection (PADEP)
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: PA-04-00740C Spent Caustic Vent Incinerator (Source ID C206), Storage Tanks (Recovered Oil, Equalization Wastewater, and Spent Caustic) (Source IDs 401 and 402), and WEMCO Depurator (Source ID 505) Excess Emissions Malfunction Report

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell") is submitting this malfunction report to the Pennsylvania Department of Environmental Protection (PADEP) for excess emissions from the flow equalization and oil removal (FEOR) A and B, recovered oil, spent caustic storage tanks, and temporary WEMCO Depurator between June 24 and June 28, 2023.

This malfunction did not pose an imminent and substantial danger to the public health and safety or the environment.

- **Name and location of the facility**
  Shell Polymers Monaca
  300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**
  On June 24, 2023 at 17:32 the Spent Caustic Thermal Oxidizer[1] (SCTO) tripped offline due to low natural gas supply pressure. Operations initiated troubleshooting of the process control indicators and equipment and discovered that the natural gas pressure transmitter had failed and was giving a false low reading. A work notification was written to have the instrument replaced.

  Following the replacement of the pressure transmitter, SCTO startup commenced on June 26. During heatup, the SCTO tripped again due to low air flow. After extensive troubleshooting, it was determined that the fan used to supply combustion air had a malfunctioning damper position controller. Specifically, the air regulator was failed. The spare air fan was put into service and SCTO startup commenced again, and the target combustion temperature was reached early morning on June 28.

- **Time when the malfunction or breakdown was first observed**
  June 24, 2023 at 17:32

- **The date and time that the malfunction started and ended**
  June 24, 2023 at 17:32 and ended on June 28, 2023 at 01:45

- **An estimate of the emissions associated with the malfunction**

[1] Identified as Spent Caustic Vent Incinerator (Source ID C206) in PA-04-00740C

Pollutant	Emissions (lbs)
Total VOC	7.57
Benzene	0.92
Styrene	0.49
Toluene	5.05
Naphthalene	1.00
HAP (Total)	7.56

- **The calculations that were used to determine that quantity**
  For reference, the SCTO controls overhead vapors collected in a closed vent system from the FEOR A and B, recovered oil, and spent caustic storage tanks as well as the spent caustic oxidation system[2]. Each storage tank is additionally controlled by internal floating roof and a nitrogen blanket which normally would flow to the SCTO. When the SCTO trips offline, the spent caustic oxidation system is isolated from the spent caustic storage tank and any generated spent caustic accumulates in the storage tank. The spent caustic storage, FEOR, and recovered oil tanks periodically vented to atmosphere through relief valves following the SCTO trip. The emissions associated with this are addressed in a later section of this report.

  Excess emissions from the internal floating roof-controlled storage tanks during this outage were modeled using Pro-Max equations of state for flashing, breathing, and working losses. Inputs to the model include the storage tank and internal floating roof physical characteristics, measured liquid throughputs using liquid level indicators, measured tank liquid temperatures, and pressure of input liquid streams. Emissions from the WEMCO unit were modeled in Pro-II as a single stage flash separator. Representative samples were taken from the FEOR A and B, recovered oil, and spent caustic tanks and the resultant sample data used as the Pro-Max and Pro-II model inputs.

- **The steps, if any, that the facility took to limit the duration and/or quantity of emissions associated with the malfunction**
  Emissions were minimized through the isolation and shutdown of the spent caustic oxidation system during the SCTO outage and utilizing the spent caustic storage tank to accumulate spent caustic. Emissions were also minimized through design and operation of the storage tank internal floating roofs and nitrogen blanket. Lastly, emissions were also minimized through prioritization of the troubleshooting and maintenance required to get the SCTO back in service before the spent caustic storage tank filled to its high level and necessitated use of the spent caustic oxidation system.

- **A detailed analysis that sets forth the Root Cause of the malfunction, to the extent determinable**
  The cause of the initiating trip was identified quickly and is known to be the result of a failed pressure transmitter. The failure of the transmitter was deemed to be not abnormal.

  The cause of the secondary trip is known to be the result of a failed air regulator used to the control the SCTO fan damper. After further investigation, it was discovered that water was in the air line going to the regulator and it is suspected that this caused the regulator failure.

- **An analysis of the measures, if any, that are available to reduce the likelihood of a recurrence of a malfunction resulting from the same Root Cause or contributing causes in**

[2] Identified as the Spent Caustic Vent Header System (Source ID 206) in PA-04-00740C

the future

The following corrective actions will be implemented to mitigate future issues with the SCTO air fan damper control system:

1. Update applicable procedures to blow down the air lines prior to commencing a fan startup
2. Add a regular operator round to check the air lines for water on some frequency

- **To the extent that investigations of the causes and/or possible corrective action(s) still are underway on the due date of the report, a statement of the anticipated date by which a follow-up report will be submitted**

  No follow up report is anticipated

- **Corrective action is final or timeline for implementation**

  Both corrective actions 1 and 2 identified above will be complete by August 15, 2023.

If you have any questions regarding this matter, please contact me at (724) 709-2467 or kimberly.kaal@shell.com.

Sincerely,

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Kristin Goddard, Air Quality District Supervisor
Scott Beaudway, Air Quality Specialist
Beth Speicher, Environmental Group Manager

Attachment A
Pro-Max Model Inputs and Outputs

Attachment B
Pro II Model Inputs and Outputs

Table 1 SCTO Downtime Internal Floating Roof Tank Emissions Calculations, ProMax Input Summary
Shell Chemical Applachia LLC, Monaca Cracker Plant

Timeframe of Analysis

Timeframe start	6/24/2023 17:35	*Tank Throughput Calculator FEOR ROT and SC.xlsx*
Timeframe end	6/28/2023 1:45	*Tank Throughput Calculator FEOR ROT and SC.xlsx*
Time	80.2	hours
	4,810	minutes

Tank Data/Sample Data

Tank Name	Tank ID	Contents	Length/ Height (ft)	Diameter (ft)	Temp (C)	Pressure (barg)	Throughput (gal)	Flow Rate (gpm)	Samples Used
Spent Caustic Tank	T-53501	2% Spent Caustic	48	35	45.06	0.01	74,474.90	15.48	6/12/2023, Balance Water
FEOR B Tank	T-59707B	Waste Water, sheen of oil	47.9	55.8	22.93	0.01	62,443.64	12.98	Average of 6/5/2023, 6/12/2023, 6/20/2023, Balance Water
FEOR A Tank	T-59707A	Waste Water, sheen of oil	47.9	55.8	27.54	0.01	702,896.90	146.13	Average of 6/5/2023, 6/12/2023, 6/20/2023, Balance Water
Recovered Oil Tank	T-59708	Slop Oil/water mixture	48	43	26.81	0.01	65,979.38	13.72	5/24/2023, Balance Water

Sample Data

	6/12/2023 Spent Caustic		6/5/2023 FEOR B		6/12/2023 FEOR B		6/20/2023 FEOR B		FEOR B	6/5/2023 FEOR A		6/12/2023 FEOR A		6/20/2023 FEOR A		FEOR A	5/24/2023 Rec Oil Tank	
Constituent	mg/L	%	mg/L	%	mg/L	%	mg/L	%	%	mg/L	%	mg/L	%	mg/L	%	%	mg/L	%
Benzene	1	0.0001	30	0.003	28	0.0028	0.08	0.000008	0.00193600	0.87	0.000087	1.1	0.00011	0.12	0.000012	0.00006967	24.2	0.00242
Ethylbenzene		0		0		0	1.2	0.00012	0.00004000		0		0		0	0.00000000	32	0.0032
Styrene		0		0		0	1.1	0.00011	0.00003667		0	0.8	0.00008	0.08	0.000008	0.00002933	19.2	0.00192
Toluene	1.1	0.00011	10	0.001	11	0.0011	0.058	0.0000058	0.00070193	3.3	0.00033	4.2	0.00042	0.76	0.000076	0.00027533	181	0.0181
Xylenes		0		0		0	0.93	0.000093	0.00003100		0		0		0	0.00000000	25.51	0.002551
1,2,4-Trimethylbenzene		0		0		0		0	0.00000000		0		0		0	0.00000000	1.16	0.000116
n-Propyl Benzene		0		0		0		0	0.00000000		0		0		0	0.00000000	16	0.0016
Naphthalene	0.0092	0.00000092	0.8	0.00008	1	0.0001	0.28	0.000028	0.00006933	0.13	0.000013	0.2	0.00002	0.17	0.000017	0.00001667	25.4	0.00254
Water	Balance	99.99978598	Balance	99.995896	Balance	99.99596036	Balance	99.99963501	99.99716379	Balance	99.99956305	Balance	99.99935704	Balance	99.99988571	99.99960193	Balance	99.96612444

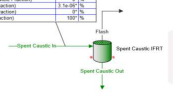
Table 2 SCTO Downtime Internal Floating Roof Tank Emissions Calculations, Emissions Calculations
Shell Chemical Applachia LLC, Monaca Cracker Plant

	Spent Caustic Tank Emissions (lb/event)				FEOR A Tank Emissions (lb/h)				FEOR B Tank Emissions (lb/h)				Recovered Oil Tank Emissions (lb/h)				Total (4 Tanks)
	Rim Seal Losses (lb/event)	Deck Fitting Losses (lb/event)	Withdrawal Losses (lb/event)	Total Losses (lb/event)	Rim Seal Losses (lb/event)	Deck Fitting Losses (lb/event)	Withdrawal Losses (lb/event)	Total Losses (lb/event)	Rim Seal Losses (lb/event)	Deck Fitting Losses (lb/event)	Withdrawal Losses (lb/event)	Total Losses (lb/event)	Rim Seal Losses (lb/event)	Deck Fitting Losses (lb/event)	Withdrawal Losses (lb/event)	Total Losses (lb/event)	Total Losses (lb/event)
Total VOC	7.375E-03	3.775E-03	6.097E-06	1.116E-02	2.314E-02	8.369E-03	7.233E-05	3.159E-02	1.406E-01	5.086E-02	4.160E-05	1.915E-01	3.338E-01	2.136E-01	8.153E-04	5.482E-01	0.78245
Benzene	2.703E-03	1.384E-03	2.594E-06	4.089E-03	3.014E-03	1.090E-03	1.070E-05	4.115E-03	8.393E-02	3.037E-02	2.641E-05	1.143E-01	4.885E-02	3.126E-02	4.523E-05	8.016E-02	0.20269
Ethylbenzene	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.418E-03	1.236E-03	7.417E-07	4.654E-03	1.940E-02	1.241E-02	8.129E-05	3.189E-02	0.03655
Styrene	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.528E-04	2.722E-04	6.008E-06	1.031E-03	9.436E-04	3.411E-04	6.671E-07	1.285E-03	6.975E-03	4.463E-03	4.784E-05	1.149E-02	0.01380
Toluene	4.648E-03	2.379E-03	3.366E-06	7.030E-03	1.861E-02	6.732E-03	4.989E-05	2.540E-02	4.756E-02	1.720E-02	1.130E-05	6.478E-02	2.401E-01	1.536E-01	3.990E-04	3.941E-01	0.49130
Xylenes	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.785E-03	6.458E-04	5.749E-07	2.432E-03	1.304E-02	8.345E-03	6.480E-05	2.145E-02	0.02388
1,2,4-Trimethylbenzene	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.029E-04	1.298E-04	3.336E-06	3.360E-04	0.00034
n-Propyl Benzene	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.357E-03	2.788E-03	4.602E-05	7.191E-03	0.00719
Naphthalene	2.423E-05	1.240E-05	3.916E-08	3.668E-05	7.018E-04	2.538E-04	4.202E-06	9.598E-04	2.924E-03	1.057E-03	1.552E-06	3.983E-03	5.962E-04	3.814E-04	7.789E-05	1.056E-03	0.00603
Total POM (minus Naphthalene)	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.325E-05	2.288E-05	5.379E-07	8.667E-05	2.053E-05	7.424E-06	7.584E-09	2.796E-05	8.881E-05	5.685E-05	4.385E-05	1.895E-04	0.00030
Total HAP	7.376E-03	3.775E-03	6.096E-06	1.116E-02	2.315E-02	8.372E-03	7.234E-05	3.159E-02	1.406E-01	5.086E-02	4.160E-05	1.915E-01	3.291E-01	2.105E-01	7.599E-04	5.403E-01	0.77456

Table 3 SCTO Downtime Internal Floating Roof Tank Emissions Calculations, ProMax Inputs, Spent Caustic Tank
Shell Chemical Applachia LLC, Monaca Cracker Plant

Spent Caustic Tank

Temperature	45.56° °C
Pressure	0.07 bar (g)
Std Liquid Volumetric Flow	10.49° ggpm
Benzene(Mole Fraction)	0.0001 °F %
Ethylbenzene(Mole Fraction)	0° %
Toluene(Mole Fraction)	0° %
*Xylenes(Mole Fraction)	0.0001 °F %
o-Xylene(Mole Fraction)	0° %
1,2,4-Trimethylbenzene(Mole Fraction)	0° %
n-Propylbenzene(Mole Fraction)	0° %
Butylbenzene(Mole Fraction)	0° %
2-Methylnaphthalene(Mole Fraction)	0° %
Acenaphthene(Mole Fraction)	0° %
Acenaphthylene(Mole Fraction)	0° %
Anthracene(Mole Fraction)	0° %
Fluoranthene(Mole Fraction)	0° %
Fluorene(Mole Fraction)	0° %
Naphthalene(Mole Fraction)	9.2e-07 %
Phenanthrene(Mole Fraction)	0° %
Phenol(Mole Fraction)	1.1e-06 %
Pyrene(Mole Fraction)	0° %
Water(Mole Fraction)	100° %



Working and Breathing Parameters

Property	Value	Units
Process Stream	Spent Caustic In	
Tank Geometry	Internal Floating Roof Tank	
Shell Length	48	ft
Shell Diameter	35	ft
Number of Storage Tanks Employed	1	
Location	Pittsburgh, PA	
Time Frame	June	
Report Components	Non-exempt VOC	
Set Bulk Temperature to Stream Temperature?	☐	
Use API2 Raoult's Vapor Pressure?	☐	
Maximum Fraction Fill of Tank	90	%
Average Fraction Fill of Tank	50	%
Minimum Fraction Fill of Tank	10	%
Material Category	Light Organics	
Insulation	Uninsulated	
Tank Color	White	
Tank Condition	Light Rust	
Shell Paint Condition	Average	
Operating Pressure	0	psig
Breather Vent Pressure	0.03	psig
Breather Vacuum Pressure	-0.03	psig
Roof Type	Dome	
Radius of Domed Roof		ft
Slope of Coned Roof	0.0625	
Roof Color	White	
Roof Paint Condition	Average	
Flashing Temperature	77.63	°F
Maximum Average Temperature	78.9	°F
Minimum Average Temperature	59.6	°F
Average Absolute Pressure	14.1	psia
Daily Solar Insolation	1,946	Btu/ft^2/day
Average Wind Speed	6.9	mi/h
Underground Tank?	☐	
Bolted or Riveted Construction?	☐	
Known Sum of Increases in Liquid Level?	☐	
Sum of Increases in Liquid Level		ft/yr
Vapor Balanced Tank?	☐	
Calculate Loading Losses?	☐	
Output Loading Losses?	☐	
Output Flashing Losses?	☑	
Output Working/Breathing Losses?	☑	

Floating Roof Fittings

Property	Value
Floating Roof Type	Welded
Tank Construction	Welded
Primary Seal	Mechanical Shoe
Secondary Seal Type #1	None
Secondary Seal Type #2	None
Seal Fitting Tightness	Tight
Self Supported Roof?	☑
Deck Construction	Sheet
Construction Type for Continuous Sheet Style Deck	5 feet wide
Construction Type for Panel Style Deck	5 x 7.5 feet
Number of Columns	0
Effective Column Diameter	Default
Construction Type of Internal Floating Roof Tank	Welded
Access hatch type	Bolted cover, gasketed
Access hatch quantity	1
Fixed roof support column well type	N/A
Fixed roof support column well quantity	0
Unslotted guide-pole and well type	N/A
Unslotted guide-pole and well quantity	0
Slotted guide-pole/sample well type	Gasketed sliding cover, with pole sleeve
Slotted guide-pole/sample well quantity	2
Gauge-float well type	Bolted cover, gasketed
Gauge-float well quantity	1
Gauge-hatch/sample port type	Weighted mechanical actuation, gasketed
Gauge-hatch/sample port quantity	1
Vacuum breaker type	Weighted mechanical actuation, gasketed
Vacuum breaker quantity	0
Deck drain type	N/A
Deck drain quantity	0
Deck drain quantity	0
Center Deck leg type	N/A
Center Deck leg quantity	0
Pontoon Deck leg type	N/A
Pontoon Deck leg quantity	0
Rim vent type	N/A
Rim vent quantity	0
Ladder well type	N/A
Ladder well quantity	0
Ladder-slotted guidepole combination well type	N/A
Ladder well quantity	0
Reset fittings to defaults	☐

Table 4 SCTO Downtime Internal Floating Roof Tank Emissions Calculations, ProMax Inputs, FEOR A Tank
Shell Chemical Applachia LLC, Monaca Cracker Plant

FEOR A Tank

Temperature	27.547 [°C]
Pressure	5.01* [bar (g)]
Std Liquid Volumetric Flow	146.13* [ugpm]
Benzene(Mole Fraction)	6.967e-05* [%]
Ethylbenzene(Mole Fraction)	0* [%]
Styrene(Mole Fraction)	2.933e-05* [%]
Toluene(Mole Fraction)	0.00027537* [%]
m-Xylene(Mole Fraction)	0* [%]
o-Xylene(Mole Fraction)	0* [%]
1-Prop(Benzene(Mole Fraction)	0* [%]
Butylbenzene(Mole Fraction)	0* [%]
2-Methylnaphthalene(Mole Fraction)	0* [%]
Acenaphthene(Mole Fraction)	5.1e-07* [%]
Acenaphthylene(Mole Fraction)	3e-07* [%]
Anthracene(Mole Fraction)	1e-09* [%]
Fluoranthene(Mole Fraction)	3e-09* [%]
Fluorene(Mole Fraction)	2.7e-07* [%]
Naphthalene(Mole Fraction)	9.2e-05* [%]
Phenanthrene(Mole Fraction)	2.8e-07* [%]
Phenol(Mole Fraction)	6.6e-06* [%]
Pyrene(Mole Fraction)	6e-09* [%]
Water(Mole Fraction)	99.9996* [%]

Working and Breathing Parameters

Property	Value	Units
Process Stream	Wastewater In	
Tank Geometry	Internal Floating Roof Tank	
Shell Length	47.8	ft
Shell Diameter	55.8	ft
Number of Storage Tanks Employed	1	
Location	Pittsburgh, PA	
Time Frame	June	
Report Components	Non-exempt VOC	
Set Bulk Temperature to Stream Temperature?	☐	
Use API42 Raoult's Vapor Pressure?	☐	
Maximum Fraction Fill of Tank	90	%
Average Fraction Fill of Tank	50	%
Minimum Fraction Fill of Tank	10	%
Material Category	Light Organics	
Insulation	Uninsulated	
Tank Color	White	
Tank Condition	Light Rust	
Shell Paint Condition	Average	
Operating Pressure	0	psig
Breather Vent Pressure	0.03	psig
Breather Vacuum Pressure	-0.03	psig
Roof Type	Dome	
Radius of Domed Roof		ft
Slope of Cone Roof	0.0625	
Roof Color	White	
Roof Paint Condition	Average	
Flashing Temperature	77.69	°F
Maximum Average Temperature	78.9	°F
Minimum Average Temperature	56.6	°F
Average Absolute Pressure	14.7	psia
Daily Solar Insolation	1,846	Btu/ft^2/day
Average Wind Speed	6.9	m/h
Underground Tank?	☐	
Bolted or Riveted Construction?	☐	
Known Sum of Increases in Liquid Level?	☐	
Sum of Increases in Liquid Level		ft/yr
Vapor Balanced Tank?	☐	
Calculate Loading Losses?	☐	
Output Loading Losses?	☐	
Output Flashing Losses?	☑	
Output Working/Breathing Losses?	☑	

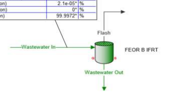
Floating Roof Fittings

Property	Value
Floating Roof Type	Pontoon
Tank Construction	Welded
Primary Seal	Mechanical Shoe
Secondary Seal Type #1	None
Secondary Seal Type #2	None
Seal Fitting Tightness	Tight
Self Supported Roof?	☑
Deck Construction	Sheet
Construction Type for Continuous Sheet Style Deck	5 feet wide
Construction Type for Panel Style Deck	5 x 7.5 feet
Number of Columns	0
Effective Column Diameter	Default
Construction Type of Internal Floating Roof Tank	Welded
Access hatch type	Bolted cover, gasketed
Access hatch quantity	1
Fixed roof support column well type	N/A
Fixed roof support column well quantity	0
Unslotted guide-pole and well type	N/A
Unslotted guide-pole and well quantity	0
Slotted guide-pole/sample well type	Gasketed sliding cover, with pole sleeve
Slotted guide-pole/sample well quantity	2
Gauge-float well type	N/A
Gauge-float well quantity	1
Gauge-hatch/sample port type	Weighted mechanical actuation, gasketed
Gauge-hatch/sample port quantity	1
Vacuum breaker type	Weighted mechanical actuation, gasketed
Vacuum breaker quantity	1
Deck drain type	N/A
Deck drain quantity	0
Stub drain quantity	0
Center Deck leg type	N/A
Center Deck leg quantity	16
Pontoon Deck leg type	N/A
Pontoon Deck leg quantity	0
Rim vent type	N/A
Rim vent quantity	0
Ladder well type	N/A
Ladder well quantity	0
Ladder-slotted guidepole combination well type	N/A
Ladder well quantity	0
Reset fittings to defaults	☐

Table 5 SCTO Downtime Internal Floating Roof Tank Emissions Calculations, ProMax Inputs, FEOR B Tank
Shell Chemical Applachia LLC, Monaca Cracker Plant

FEOR B Tank

Temperature	22.93*	°C
Pressure	0.01*	bar (g)
Std Liquid Volumetric Flow	12.98*	sgpm
Benzene(Mole Fraction)	0.001936*	%
Ethylbenzene(Mole Fraction)	4e-05*	%
Styrene(Mole Fraction)	3.667e-05*	%
Toluene(Mole Fraction)	0.00070193*	%
o-Xylene(Mole Fraction)	3.1e-05*	%
1,2,4-Trimethylbenzene(Mole Fraction)	0*	%
n-Propylbenzene(Mole Fraction)	0*	%
Butylbenzene(Mole Fraction)	0*	%
2-Methylnaphthalene(Mole Fraction)	0*	%
Acenaphthene(Mole Fraction)	2.6e-07*	%
Acenaphthylene(Mole Fraction)	0*	%
Anthracene(Mole Fraction)	0*	%
Fluoranthene(Mole Fraction)	0*	%
Fluorene(Mole Fraction)	2e-08*	%
Naphthalene(Mole Fraction)	6.933e-05*	%
Phenanthrene(Mole Fraction)	0*	%
Phenol(Mole Fraction)	2.1e-05*	%
Pyrene(Mole Fraction)	0*	%
Water(Mole Fraction)	99.9972*	%



Working and Breathing Parameters

Property	Value	Units
Process Stream	Wastewater In	
Tank Geometry	Internal Floating Roof Tank	
Shell Length	47.9	ft
Shell Diameter	55.8	ft
Number of Storage Tanks Employed	1	
Location	Pittsburgh, PA	
Time Frame	June	
Report Components	Non-exempt VOC	
Set Bulk Temperature to Stream Temperature?	☐	
Use AP42 Raoult's Vapor Pressure?	☐	
Maximum Fraction Fill of Tank	90	%
Average Fraction Fill of Tank	50	%
Minimum Fraction Fill of Tank	10	%
Material Category	Light Organics	
Insulation	Uninsulated	
Tank Color	White	
Tank Condition	Light Rust	
Shell Paint Condition	Average	
Operating Pressure	0	psig
Breather Vent Pressure	0.03	psig
Breather Vacuum Pressure	-0.03	psig
Roof Type	Dome	
Radius of Domed Roof		ft
Slope of Coned Roof	0.0625	
Roof Color	White	
Roof Paint Condition	Average	
Flashing Temperature	77.69	°F
Maximum Average Temperature	78.9	°F
Minimum Average Temperature	59.6	°F
Average Absolute Pressure	14.1	psia
Daily Solar Insolation	1,846	Btu/ft^2/day
Average Wind Speed	6.9	mi/h
Underground Tank?	☐	
Bolted or Riveted Construction?	☐	
Known Sum of Increases in Liquid Level?	☐	
Sum of Increases in Liquid Level		ft/yr
Vapor Balanced Tank?	☐	
Calculate Loading Losses?	☐	
Output Loading Losses?	☐	
Output Flashing Losses?	☑	
Output Working/Breathing Losses?	☑	

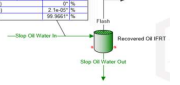
Floating Roof Fittings

Property	Value
Floating Roof Type	Pontoon
Tank Construction	Welded
Primary Seal	Mechanical Shoe
Secondary Seal Type #1	None
Secondary Seal Type #2	None
Seal Fitting Tightness	Tight
Self Supported Roof?	☑
Deck Construction	Sheet
Construction Type for Continuous Sheet Style Deck	5 feet wide
Construction Type for Panel Style Deck	5 x 7.5 feet
Number of Columns	0
Effective Column Diameter	Default
Construction Type of Internal Floating Roof Tank	Welded
Access hatch type	Bolted cover, gasketed
Access hatch quantity	1
Fixed roof support column well type	N/A
Fixed roof support column well quantity	0
Unslotted guide-pole and well type	N/A
Unslotted guide-pole and well quantity	0
Slotted guide-pole/sample well type	Gasketed sliding cover, with pole sleeve
Slotted guide-pole/sample well quantity	2
Gauge-float well type	N/A
Gauge-float well quantity	1
Gauge-hatch/sample port type	Weighted mechanical actuation, gasketed
Gauge-hatch/sample port quantity	1
Vacuum breaker type	Weighted mechanical actuation, gasketed
Vacuum breaker quantity	1
Deck drain type	N/A
Deck drain quantity	0
Stub drain quantity	0
Center Deck leg type	N/A
Center Deck leg quantity	16
Pontoon Deck leg type	N/A
Pontoon Deck leg quantity	0
Rim vent type	N/A
Rim vent quantity	0
Ladder well type	N/A
Ladder well quantity	0
Ladder-slotted guidepole combination well type	N/A
Ladder well quantity	0
Reset fittings to defaults	☐

Table 6 SCTO Downtime Internal Floating Roof Tank Emissions Calculations, ProMax Inputs, Recovered Oil Tank
Shell Chemical Applachia LLC, Monaca Cracker Plant

Recovered Oil Tank

Temperature	26.61	°C
Pressure	0.01	bar (g)
Std Liquid Volumetric Flow	13.72	sgpm
Benzene(Mole Fraction)	0.00242	%
Ethylbenzene(Mole Fraction)	0.0032	%
Naphthalene(Mole Fraction)	0.0035	%
Toluene(Mole Fraction)	0.0187	%
o-Xylene(Mole Fraction)	0.00255	%
1,2,4-Trimethylbenzene(Mole Fraction)	0.00119	%
n-Propylbenzene(Mole Fraction)	0.0016	%
Butylbenzene(Mole Fraction)	0.000189	%
2-Methylnaphthalene(Mole Fraction)	0.00107	%
Acenaphthene(Mole Fraction)	0	%
Acenaphthylene(Mole Fraction)	0	%
Anthracene(Mole Fraction)	8.66e-06	%
Fluorene(Mole Fraction)	1.6e-05	%
Fluorene(Mole Fraction)	5.29e-05	%
Naphthalene(Mole Fraction)	0.00254	%
Phenanthrene(Mole Fraction)	7.7e-05	%
Phenol(Mole Fraction)	0	%
Pyrene(Mole Fraction)	2.1e-05	%
Water(Mole Fraction)	99.9691	%



Working and Breathing Parameters

Property	Value	Units
Process Stream	Slop Oil Water In	
Tank Geometry	Internal Floating Roof Tank	
Shell Length	48	ft
Shell Diameter	43	ft
Number of Storage Tanks Employed	1	
Location	Pittsburgh, PA	
Time Frame	June	
Report Components	Non-exempt VOC	
Set Bulk Temperature to Stream Temperature?	☐	
Use API42 Raoult's Vapor Pressure?	☐	
Maximum Fraction Fill of Tank	90	%
Average Fraction Fill of Tank	50	%
Minimum Fraction Fill of Tank	10	%
Material Category	Light Organics	
Insulation	Uninsulated	
Tank Color	White	
Tank Condition	Light Rust	
Shell Paint Condition	Average	
Operating Pressure	0	psig
Breather Vent Pressure	0.03	psig
Breather Vacuum Pressure	-0.03	psig
Roof Type	Dome	
Radius of Domed Roof		ft
Slope of Cone Roof	0.0625	
Roof Color	White	
Roof Paint Condition	Average	
Flashing Temperature	77.66	°F
Maximum Average Temperature	78.9	°F
Minimum Average Temperature	59.8	°F
Average Absolute Pressure	14.1	psia
Daily Solar Insolation	1,846	Btu/ft^2/day
Average Wind Speed	6.9	m/h
Underground Tank?	☐	
Bolted or Riveted Construction?	☐	
Known Sum of Increases in Liquid Level?	☐	
Sum of Increases in Liquid Level		ft/yr
Vapor Balanced Tank?	☐	
Calculate Loading Losses?	☐	
Output Loading Losses?	☐	
Output Flashing Losses?	☑	
Output Working/Breathing Losses?	☑	

Floating Roof Fittings

Property	Value
Floating Roof Type	Pontoon
Tank Construction	Welded
Primary Seal	Mechanical Shoe
Secondary Seal Type #1	None
Secondary Seal Type #2	None
Seal Fitting Tightness	Tight
Self Supported Roof?	☑
Deck Construction	Sheet
Construction Type for Continuous Sheet Style Deck	5 feet wide
Construction Type for Panel Style Deck	5 x 7.5 feet
Number of Columns	0
Effective Column Diameter	Default
Construction Type of Internal Floating Roof Tank	Welded
Access hatch type	Bolted cover, gasketed
Access hatch quantity	1
Fixed roof support column well type	N/A
Fixed roof support column well quantity	0
Unslotted guide-pole and well type	N/A
Unslotted guide-pole and well quantity	0
Slotted guide-pole/sample well type	Gasketed sliding cover, with pole sleeve
Slotted guide-pole/sample well quantity	3
Gauge-float well type	N/A
Gauge-float well quantity	1
Gauge-hatch/sample port type	Weighted mechanical actuation, gasketed
Gauge-hatch/sample port quantity	1
Vacuum breaker type	Weighted mechanical actuation, gasketed
Vacuum breaker quantity	1
Deck drain type	N/A
Deck drain quantity	0
Deck drain quantity	0
Center Deck leg type	N/A
Center Deck leg quantity	0
Pontoon Deck leg type	N/A
Pontoon Deck leg quantity	0
Rim vent type	N/A
Rim vent quantity	0
Ladder well type	N/A
Ladder well quantity	0
Ladder-slotted guidepole combination well type	N/A
Ladder well quantity	0
Reset fittings to defaults	☐

WEMCO Pro II Model Inputs and Outputs					
		WEMCO_FEED	**WEMCO_N2**	**WEMCO_OUT**	**WEMCO_VENT**
Stream Phase		Wet Liquid	Vapor	Wet Liquid	Vapor
Temperature	C	25	25	24.99906861	24.99906861
Pressure	BARG	0.1	0.1	0.004	0.004
Total Mass Rate	kg/hr	184857.3556	45	184856.3841	46.14087907
Phase		Wet Liquid	Vapor	Wet Liquid	Vapor
Liquid Std Rate (vol) [at 1 atm, 15.56 C]	m3/hr	185.0398048	n/a	185.0388324	n/a
Liquid Act. Density	kg/m3	997.0573513	n/a	997.0543178	n/a
Vapor Sp. Gr.		n/a	0.967182683	n/a	0.959492942
Total Weight Comp. Percents		**WEMCO_FEED**	**WEMCO_N2**	**WEMCO_OUT**	**WEMCO_VENT**
BENZENE	wt%	0.000012	0	8.78042E-10	0.048072947
TOLUENE	wt%	0.000076	0	1.81485E-08	0.304411565
STYRENE	wt%	0.000008	0	8.65546E-09	0.032016299
NAPHTHLN	wt%	0.000017	0	4.58866E-07	0.066269946
PHENOL	wt%	0	0	0	0
ACENAP	wt%	0.00000033	0	1.11006E-07	0.000877373
ACENAPHT	wt%	0.00000021	0	6.48138E-08	0.000581672
ANTH	wt%	0	0	0	0
FLUANTHE	wt%	0.000000047	0	4.69367E-08	2.54864E-07
FLUORENE	wt%	0.00000028	0	1.5974E-07	0.000481811
PHAN	wt%	0.00000035	0	3.34118E-07	6.36375E-05
PYRENE	wt%	0.000000072	0	7.18706E-08	5.20276E-07
N2	wt%	0	100	8.85639E-11	97.52740031
H2O	wt%	99.99988571	0	99.99999872	2.019823663
Total Molar Comp. Percents		**WEMCO_FEED**	**WEMCO_N2**	**WEMCO_OUT**	**WEMCO_VENT**
BENZENE	mol%	2.77E-06	0	2.03E-10	0.017103075
TOLUENE	mol%	1.49E-05	0	3.55E-09	0.091814404
STYRENE	mol%	1.38E-06	0	1.50E-09	8.54E-03
NAPHTHLN	mol%	2.39E-06	0	6.45E-08	1.44E-02
PHENOL	mol%	0	0	0	0
ACENAP	mol%	3.86E-08	0	1.30E-08	1.58E-04
ACENAPHT	mol%	2.49E-08	0	7.67E-09	1.06E-04
ANTH	mol%	0.00E+00	0	0.00E+00	0.00E+00
FLUANTHE	mol%	4.19E-09	0	4.18E-09	3.50E-08
FLUORENE	mol%	3.03E-08	0	1.73E-08	8.06E-05
PHAN	mol%	3.54E-08	0	3.38E-08	9.92E-06
PYRENE	mol%	6.41E-09	0	6.40E-09	7.15E-08
N2	mol%	0.00E+00	100	5.70E-11	9.68E+01
H2O	mol%	99.99997846	0	99.99999985	3.115822922
Mass Rates		**WEMCO_FEED**	**WEMCO_N2**	**WEMCO_OUT**	**WEMCO_VENT**
BENZENE	lb/hr	0.048904885	0	3.57836E-06	0.048901352
TOLUENE	lb/hr	0.309730938	0	7.3962E-05	0.309657263
STYRENE	lb/hr	0.032603257	0	3.52743E-05	0.032568013
NAPHTHLN	lb/hr	0.06928192	0	0.001870057	0.067411927
PHENOL	lb/hr	0	0	0	0
ACENAP	lb/hr	0.001344884	0	0.000452394	0.000892492
ACENAPHT	lb/hr	0.000855835	0	0.000264141	0.000591695
ANTH	lb/hr	0	0	0	0
FLUANTHE	lb/hr	0.000191544	0	0.000191285	2.59256E-07
FLUORENE	lb/hr	0.001141114	0	0.000651002	0.000490113
PHAN	lb/hr	0.001426392	0	0.00136166	6.47341E-05
PYRENE	lb/hr	0.000293429	0	0.0002929	5.29242E-07
N2	lb/hr	0	99.2080179	3.60932E-07	99.20801754
H2O	lb/hr	407540.2419	0	407538.5606	2.054629784