



Shell Chemical Appalachia LLC  
300 Frankfort Rd  
Monaca, PA 15061

November 6, 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 Recovered Oil and Equalization Wastewater and Spent Caustic Storage Tanks (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, and spent caustic storage tanks and WEMCO Depurator between October 6 and October 8, 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 October 6, 2023 at 05:04, the blower that routes the Spent Caustic tank’s vapor space to the Spent Caustic Thermal Oxidizer<sup>1</sup> (SCTO) tripped offline due to high discharge temperature. Then, at 08:21 on the same day, the blower that routes the FEOR A/B and Recovered Oil tanks and WEMCO Depurator vapor spaces to the SCTO also tripped offline due to high discharge temperature. Operations initiated troubleshooting, and it was quickly determined that the flame arrestors in the SCTO common vent gas line were plugged. This resulted in backpressure in the blower discharge lines and the ultimate trip of the machines. While the blowers were offline, the Spent Caustic, FEOR, and Recovered Oil tanks, and WEMCO Depurator intermittently vented to atmosphere through the relief valves. Note that the SCTO remained online throughout this event.
- **Time when the malfunction or breakdown was first observed**  
October 6, 2023 at 05:04- Spent Caustic tank blower trip  
October 6, 2023 at 08:21- FEOR A/B and Recovered Oil tank blower trip
- **The date and time that the malfunction started and ended**  
October 8, 2023 at 13:18- FEOR and Recover Oil tank blower online  
October 8, 2023 at 13:25- Spent Caustic tank blower online
- **An estimate of the emissions associated with the malfunction**

---

<sup>1</sup> Identified as Spent Caustic Vent Incinerator (Source ID C206) in PA-04-00740C

Pollutant	Emissions (lbs)
Total VOC	18.86
Toluene	7.69
Benzene	8.46
Naphthalene	1.40
Total HAP	18.86

- **The calculations that were used to determine that quantity**

For reference, the blowers for the Spent Caustic, FEOR A/B, and Recovered Oil tanks route tank vapors and the WEMCO vent to a closed system, where they are incinerated in the SCTO. When the blowers are down, the Spent Caustic, FEOR, and Recovered Oil tanks periodically vent to atmosphere through relief valves. Similarly, the WEMCO also vents through the tank relieve valves when the blower is offline as it ties into the blower suction line.

Excess emissions from the storage tanks were modeled using Pro-Max equations of state for flashing, breathing, and working losses. Inputs into the model include the storage tank and internal floating roof physical characteristics, measured liquid throughputs using liquid level indicators, measured tank liquid temperatures, pressure of input liquid streams, and representative tank sample data. Emissions from the WEMCO unit were calculated Pro-II modeling software updated with WEMCO feed rate and composition at the time of the malfunction.

- **The steps, if any, that the facility took to limit the duration and/or quantity of emissions associated with the malfunction**

Emissions were minimized by escalation of the flame arrestor issue to the maintenance group. The decision was made to isolate, pull, and clean the flame arrestors, which was done on overtime throughout the weekend. Emissions were also minimized through design and operation of the storage tank internal floating roofs and nitrogen blankets.

- **A detailed analysis that sets forth the Root Cause of the malfunction, to the extent determinable**

Operations determined that the root cause of both blower trips was due to the plugging of the flame arrestors. The source of the plugging is suspected to be pipe scale.

Note that there are two flame arrestors in the system and, in the current configuration, the SCTO vent gas is split between them before combining again into one line entering the burner chamber of the thermal oxidizer. Flame arrestors are safety devices and, in this case, are there to prevent the SCTO burner flame from backing into the vent gas line.

- **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 the future**

The site is evaluating potential long-term solutions to the flame arrestor lineup arrangement and/or how to manage/mitigate pipe scale buildup in the line. One consideration is to run through just 1 flame arrestor at a time and have the other one available to swap flow to in the event of plugging of the in-service arrestor.

- **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**  
N/A- corrective action is evaluation only at this point.

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

Sincerely,

Kimberly Kaal  
Environmental Manager, Attorney-in-Fact

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

**Attachment A**  
Pro-Max Model Inputs and Outputs

**Attachment B**  
WEMCO Pro-II Model Inputs and Outputs



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

**Timeframe of Analysis**

FEOR A/B Tanks and Recovered Oil		Spent Caustic	
Timeframe start	10/6/2023 8:21	Timeframe start	10/6/2023 5:04
Timeframe end	10/8/2023 13:18	Timeframe end	10/8/2023 13:25
Time	53.0 hours	Time	56.4 hours
	3,177 minutes		3,381 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	44.58	0.01	90,458.03	23.81	Average of 9/26/2023, 10/3/2023, 10/10/2023, 10/17/2023, Balance Water
FEOR B Tank	T-5970B	Waste Water, sheen of oil	47.9	55.8	31.11	0.01	399,040.91	83.04	Average of 10/3/2023, 10/10/2023, 10/17/2023, Balance Water
FEOR A Tank	T-5970A	Waste Water, sheen of oil	47.9	55.8	29.72	0.01	169,658.69	31.16	Average of 10/3/2023, 10/10/2023, 10/17/2023, Balance Water
Recovered Oil Tank	T-59708	Slop Oil/water mixture	48	43	27.37	0.01	30,052.94	6.13	5/24/2023, Balance Water

**Sample Data**

Constituent	9/26/2023 Spent Caustic		10/3/2023 Spent Caustic		10/10/2023 Spent Caustic		Average Spent Caustic Tank		10/3/2023 FEOR B		10/10/2023 FEOR B		10/17/2023 FEOR B		Average FEOR B		10/3/2023 FEOR A		10/10/2023 FEOR A		10/17/2023 FEOR A		Average FEOR A		5/24/2023 Recovered Oil Tank			
	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%		
Benzene	180	0.018	32	0.0032	53	0.0053	0.00883333	0.25	0.000025	0.63	0.000063	0.12	0.000012	0.00013333	0.75	0.000075	0.54	0.000054	0.97	0.000097	0.00013333	24.2	0.00242					
Ethylbenzene	0	0	0	0	0	0	0.00000000	0.047	0.0000047	0.62	0.000062	0	0	0.00000000	2	0.0002	0.62	0.000062	0.78	0.000078	0.00013333	32	0.0032					
Styrene	5.7	0.00057	0	0	0	0	0.00019000	0.047	0.0000047	0	0	0	0	0.00000000	0	0	0	0.49	0.000049	0.00016333	19.2	0.00192						
Toluene	38	0.0038	11	0.0011	15	0.0015	0.00213333	0.28	0.000028	0.56	0.000056	0.22	0.000022	0.00035333	6.6	0.00066	3	0.0003	3.3	0.00033	0.00043000	181	0.0181					
Xylenes	0	0	0	0	0	0	0.00000000	0	0	0	0	0	0	0.00000000	0	0	0	0.58	0.000058	0.00019333	25.51	0.002551						
1,2,4-Trimethylbenzene	0	0	0	0	0	0	0.00000000	0	0	0	0	0	0	0.00000000	0	0	0	0	0.00000000	0.00000000	1.16	0.000116						
n-Propyl Benzene	0	0	0	0	0	0	0.00000000	0	0	0	0	0	0	0.00000000	0	0	0	0	0.00000000	0.00000000	16	0.0016						
Butylbenzene	0	0	0	0	0	0	0.00000000	0	0	0	0	0	0	0.00000000	0	0	0	0	0.00000000	0.00000000	1.85	0.000185						
2-Methylnaphthalene	0	0	0	0	0	0	0.00000000	0	0	0	0	0	0	0.00000000	0	0	0	0	0.00000000	0.00000000	10.7	0.00107						
Acenaphthene	0	0.0059	0.00000059	0	0	0.00000020	0.014	0.0000014	0.056	0.0000056	0.01	0.000001	0.00000099	0.047	0.0000047	0.0031	0.0000031	0.0068	0.0000068	0.00000190	0	0						
Acenaphthylene	0	0	0	0	0	0.00000000	0.026	0.0000026	0.068	0.0000068	0.019	0.0000019	0.00000173	0	0.0033	0.0000033	0.0072	0.0000072	0.00000035	0	0							
Anthracene	0	0	0	0	0	0.00000000	0.0046	0.00000046	0	0	0	0	0.00000015	0.0058	0.0000058	0	0	0	0.00000023	0	0	0.00000023	0.0866	0.00000866				
Fluoranthene	0	0	0	0	0	0.00000000	0.006	0.0000006	0	0	0.0046	0.0000046	0.00000035	0.0082	0.0000082	0	0	0	0.00000027	0	0	0.00000027	0.14	0.000014				
Fluorene	0	0	0	0	0	0.00000000	0.017	0.0000017	0.067	0.0000067	0.013	0.0000013	0.00000122	0.043	0.0000043	0.0036	0.0000036	0.0067	0.0000067	0.00000178	0.529	0.0000529						
Naphthalene	0.28	0.000028	0.31	0.000031	0.15	0.000015	0.0002467	0.097	0.0000097	0.18	0.000018	0.026	0.0000026	0.0001010	2.4	0.00024	0.22	0.000022	0.39	0.000039	0.00010033	25.4	0.00254					
Phenanthrene	0	0	0	0	0	0	0.00000000	0.036	0.0000036	0.015	0.0000015	0.029	0.0000029	0.0000267	0.069	0.0000069	0.0063	0.0000063	0.0092	0.0000092	0.00000282	0.77	0.000077					
Phenol	0.074	0.0000074	0.069	0.0000069	0.03	0.000003	0.0000577	0	0	0	0	0	0.00000000	0.09	0.000009	0	0	0.062	0.0000062	0.00000507	0	0						
Pyrene	0	0	0	0	0	0	0.00000000	0.012	0.0000012	0	0	0	0	0.00000034	0.0086	0.0000086	0.00000080	0	0	0.00000000	0.21	0.000021						
Water	Balance	99.9775946	Balance	99.99566151	Balance	99.993182	99.98881270	Balance	99.99985305	Balance	99.99985305	Balance	99.99995498	99.99990969	Balance	99.9987986	Balance	99.99956037	Balance	99.99933981	99.99923293	Balance	99.96612444					


Table 2 SCTO Downtime Internal Floating Roof Tank Emissions Calculations, Emissions Calculations  
Shell Chemical Appalachia 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)	Deck Seam Losses (lb/event)	Withdrawal Losses (lb/event)	Total Losses (lb/event)	Rim Seal Losses (lb/event)	Deck Fitting Losses (lb/event)	Deck Seam Losses (lb/event)	Withdrawal Losses (lb/event)	Total Losses (lb/event)	Rim Seal Losses (lb/event)	Deck Fitting Losses (lb/event)	Deck Seam Losses (lb/event)	Withdrawal Losses (lb/event)	Total Losses (lb/event)	Rim Seal Losses (lb/event)	Deck Fitting Losses (lb/event)	Deck Seam Losses (lb/event)	Withdrawal Losses (lb/event)	Total Losses (lb/event)	Total Losses (lb/event)	Total Losses (lb/event)
Total VOC	3.399E-02	1.740E-02	0.000E+00	7.218E-05	5.146E-02	3.904E-03	1.412E-03	0.000E+00	3.818E-06	5.339E-03	4.173E-04	1.509E-04	0.000E+00	1.198E-06	5.694E-04	9.065E-02	5.798E-02	0.000E+00	4.310E-05	1.487E-01	0.20602	
Benzene	2.549E-02	1.305E-02	0.000E+00	5.703E-05	3.859E-02	3.259E-04	1.179E-04	0.000E+00	3.750E-07	4.441E-04	1.442E-04	5.215E-05	0.000E+00	4.421E-07	1.968E-04	7.704E-03	4.929E-03	0.000E+00	3.075E-06	1.264E-02	0.05187	
Ethylbenzene	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.645E-04	2.403E-04	0.000E+00	5.639E-07	9.054E-04	2.129E-05	7.699E-06	0.000E+00	4.815E-08	2.903E-05	8.070E-03	5.164E-03	0.000E+00	4.067E-06	1.324E-02	0.01417	
Styrene	2.187E-04	1.120E-04	0.000E+00	1.226E-06	3.319E-04	2.821E-05	1.020E-05	0.000E+00	8.128E-08	3.850E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.881E-03	1.205E-03	0.000E+00	2.440E-06	3.091E-03	0.00346		
Toluene	8.233E-03	4.312E-03	0.000E+00	1.837E-05	1.246E-02	2.488E-03	8.996E-04	0.000E+00	2.140E-06	3.390E-03	2.044E-04	7.392E-05	0.000E+00	4.687E-07	2.788E-04	6.523E-02	4.175E-02	0.000E+00	2.300E-05	1.070E-01	0.12314	
Xylenes	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.757E-05	2.806E-05	0.000E+00	9.621E-08	1.057E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.699E-03	3.007E-03	0.000E+00	3.242E-06	7.710E-03	0.00782		
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	0.000E+00	0.000E+00	1.114E-04	7.122E-05	0.000E+00	1.474E-07	1.827E-04	0.00018		
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	0.000E+00	0.000E+00	2.398E-03	1.534E-03	0.000E+00	2.033E-06	3.935E-03	0.00393		
Butylbenzene	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	0.000E+00	0.000E+00	1.167E-04	6.831E-05	0.000E+00	2.351E-07	1.753E-04	0.00018		
2-Methylnaphthalene	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	0.000E+00	0.000E+00	4.309E-05	2.757E-05	0.000E+00	1.360E-06	7.202E-05	0.00007		
Acenaphthene	5.029E-07	2.574E-07	0.000E+00	1.290E-09	7.616E-07	7.175E-06	2.595E-06	0.000E+00	9.457E-09	9.779E-06	3.739E-06	1.352E-06	0.000E+00	1.313E-08	5.105E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.00002	
Acenaphthylene	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.780E-13	6.433E-14	0.000E+00	1.742E-09	1.742E-09	8.795E-13	3.181E-13	0.000E+00	2.295E-08	2.295E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.00000	
Anthracene	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.091E-07	2.927E-07	0.000E+00	1.145E-09	1.103E-06	5.278E-07	1.909E-07	0.000E+00	1.990E-09	7.207E-07	4.854E-09	3.106E-09	0.000E+00	1.100E-08	1.896E-08	0.00000	
Fluoranthene	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.244E-06	2.982E-06	0.000E+00	1.344E-09	1.123E-05	1.909E-05	3.965E-06	0.000E+00	4.643E-09	1.456E-05	8.393E-10	5.369E-10	0.000E+00	1.779E-08	1.917E-08	0.00003	
Fluorene	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.116E-13	1.850E-13	0.000E+00	8.843E-09	8.843E-09	3.506E-13	1.268E-13	0.000E+00	1.618E-08	1.618E-08	1.172E-11	7.498E-12	0.000E+00	6.725E-08	6.727E-08	0.00000	
Naphthalene	4.960E-05	2.539E-05	0.000E+00	1.592E-07	7.515E-05	3.025E-04	1.094E-04	0.000E+00	4.994E-07	4.124E-04	3.045E-05	1.010E-05	0.000E+00	1.340E-07	4.160E-05	3.603E-04	2.305E-04	0.000E+00	3.228E-06	5.941E-04	0.00012	
Phenanthrene	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.303E-07	3.364E-07	0.000E+00	1.404E-08	1.281E-06	8.811E-07	3.185E-07	0.000E+00	3.542E-08	1.235E-06	1.716E-08	1.098E-08	0.000E+00	9.785E-08	1.260E-07	0.00000	
Phenol	3.484E-09	1.783E-09	0.000E+00	3.724E-08	4.250E-08	4.590E-09	1.660E-09	0.000E+00	2.514E-08	3.149E-08	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	0.00000	
Pyrene	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	1.098E-06	3.970E-07	0.000E+00	1.061E-08	1.505E-06	1.986E-10	1.271E-10	0.000E+00	2.669E-08	2.701E-08	0.00000	
Total POM (minus Naphthalene)	5.029E-07	2.574E-07	0.000E+00	1.290E-09	7.616E-07	1.716E-05	6.206E-06	0.000E+00	3.657E-08	2.340E-05	1.694E-05	6.124E-06	0.000E+00	1.049E-07	2.317E-05	4.311E-05	2.759E-05	0.000E+00	1.580E-06	7.228E-05	0.00012	
Total HAP	3.399E-02	1.739E-02	0.000E+00	7.222E-05	5.146E-02	3.904E-03	1.412E-03	0.000E+00	3.818E-06	5.320E-03	4.173E-04	1.509E-04	0.000E+00	1.198E-06	5.694E-04	8.799E-02	5.631E-02	0.000E+00	4.063E-05	1.443E-01	0.20169	



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

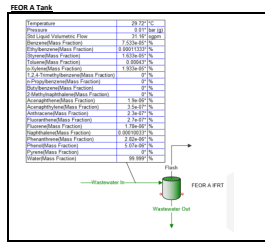
Spent Caustic Tank	
Temperature	41.30°C
Oil Leak Vaporized Mass	3.09E-05 kg/m
BenzenesMax Fraction	0.000033%
BenzeneMin Fraction	0%
SpinesMax Fraction	0.00019%
SpinesMin Fraction	0.000133%
o-x-ToluenesMax Fraction	0%
o-x-ToluenesMin Fraction	0%
m-PropylbenzenesMax Fraction	0%
m-PropylbenzenesMin Fraction	0%
o-DimethylbenzenesMax Fraction	0%
o-DimethylbenzenesMin Fraction	0%
CrudeOilsMax Fraction	26.20%
CrudeOilsMin Fraction	0%
PhenolMax Fraction	0%
PhenolMin Fraction	0%
NaphthalenesMax Fraction	7.44E-05%
NaphthalenesMin Fraction	0%
HexanesMax Fraction	0.75E-06%
HexanesMin Fraction	0%
WaterMax Fraction	99.989%
WaterMin Fraction	0%



Working and Boundary Parameters	Value	Units
Process Stream	Spent Caustic In	
Tank Geometry	Internal Floating Tank	
Shell Length	48	ft
Shell Diameter	35	ft
Number of Storage Tanks Employed	1	
Location	Pittsburgh, PA	
Time Frame	October	
Report Components	Non-exempt VOC	
Set Bulk Temperature to Stream Temperature?	<input type="checkbox"/>	
Use AP-42 Raoult's Vapor Pressure?	<input type="checkbox"/>	
Maximum Fraction Fill of Tank	90	%
Average Fraction Fill of Tank	50	%
Minimum Fraction Fill of Tank	30	%
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 Dome Roof		ft
Slope of Dome Roof	0.0625	
Roof Color	White	
Roof Paint Condition	Average	
Flashpoint Temperature	59.04	°F
Maximum Average Temperature	62.4	°F
Minimum Average Temperature	42.4	°F
Average Absolute Pressure	14.1	psia
Daily Solar Insolation	9.19	Btu/ft <sup>2</sup> /day
Average Wind Speed	6.9	m/s
Underground Tank?	<input type="checkbox"/>	
Bolted or Riveted Construction?	<input type="checkbox"/>	
Known Sum of Increases in Liquid Level?	<input type="checkbox"/>	
Sum of Increases in Liquid Level	0	ft/yr
Vapor Balanced Tank?	<input type="checkbox"/>	
Calculate Loading Losses?	<input type="checkbox"/>	
Output Loading Losses?	<input type="checkbox"/>	
Output Flashing Losses?	<input checked="" type="checkbox"/>	
Output Working/Breathing Losses?	<input checked="" type="checkbox"/>	

Roofing Roof Fittings	Value
Roofing Roof Type	Parabon
Tank Construction	Welded
Primary Seal	Mechanical Shoe
Secondary Seal Type #1	None
Secondary Seal Type #2	None
Seal Fitting Tightness	Tight
Self-Supported Roof?	<input checked="" type="checkbox"/>
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-Roat well type	Bolted cover, gasketed
Gauge-Roat 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
Center Deck leg type	N/A
Center Deck leg quantity	1
Parabon Deck leg type	N/A
Parabon 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	<input type="checkbox"/>

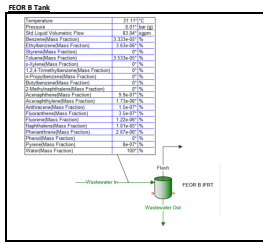
Table 4 SOTO Downtime Internal Floating Roof Tank Emissions Calculations, ProMax Inputs, FEOR A Tank  
Shell Chemical Appalachia LLC, Monaca Cracker Plant



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	October	
Report Components	Non-exempt VOC	
Set Bulk Temperature to Stream Temperature?	<input type="checkbox"/>	
Use API-2 Raoult's Vapor Pressure?	<input type="checkbox"/>	
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	Conc	
Radius of Domed Roof		ft
Slope of Coned Roof	0.0625	
Roof Color	White	
Roof Paint Condition	Average	
Flashing Temperature	58.95	°F
Maximum Average Temperature	62.4	°F
Minimum Average Temperature	45.4	°F
Average Absolute Pressure	14.1	psia
Daily Solar Insolation	9.19	Btu/ft <sup>2</sup> -2/day
Average Wind Speed	6.9	mi/h
Underground Tank?	<input type="checkbox"/>	
Bolted or Riveted Construction?	<input type="checkbox"/>	
Known Sum of Increases in Liquid Level?	<input type="checkbox"/>	
Sum of Increases in Liquid Level		ft/yr
Vapor Balanced Tank?	<input type="checkbox"/>	
Calculate Loading Losses?	<input type="checkbox"/>	
Output Loading Losses?	<input checked="" type="checkbox"/>	
Output Flashing Losses?	<input checked="" type="checkbox"/>	
Output Working/Breathing Losses?	<input checked="" type="checkbox"/>	

Property	Value	Units
Flashing Roof Type	Portion	
Tank Construction	Welded	
Primary Seal	Mechanical Shoe	
Secondary Seal Type #1	None	
Secondary Seal Type #2	None	
Seal Fitting Tightness	Tight	
Self Supported Roof?	<input checked="" type="checkbox"/>	
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-roof well type	N/A	
Gauge-roof 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	
Center Deck leg type	N/A	
Center Deck leg quantity	16	
Portion Deck leg type	N/A	
Portion 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	<input type="checkbox"/>	

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



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	October	
Report Components	Non-exempt VOC	
Set Bulk Temperature to Stream Temperature?	<input type="checkbox"/>	
Use API-2 Basic's Vapor Pressure?	<input type="checkbox"/>	
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 Domed Roof	0.5925	
Roof Color	White	
Roof Paint Condition	Average	
Flashing Temperature	58.95	°F
Maximum Average Temperature	62.4	°F
Minimum Average Temperature	45.4	°F
Average Absolute Pressure	14.1	psia
Daily Solar Insolation	9.19	Btu/ft <sup>2</sup> /day
Average Wind Speed	6.9	mi/h
Underground Tank?	<input type="checkbox"/>	
Bolted or Riveted Construction?	<input type="checkbox"/>	
Known Sum of Increases in Liquid Level?	<input type="checkbox"/>	
Sum of Increases in Liquid Level		ft/yr
Vapor Balanced Tank?	<input type="checkbox"/>	
Calculate Loading Losses?	<input type="checkbox"/>	
Output Loading Losses?	<input type="checkbox"/>	
Output Flashing Losses?	<input checked="" type="checkbox"/>	
Output Working/Breathing Losses?	<input checked="" type="checkbox"/>	

Property	Value
Flashing Roof Type	Portion
Tank Construction	Welded
Primary Seal	Mechanical Shoe
Secondary Seal Type #1	None
Secondary Seal Type #2	None
Seal Fitting Tightness	Tight <input checked="" type="checkbox"/>
Self Supported Roof?	<input type="checkbox"/>
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	0 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-roof well type	N/A
Gauge-roof 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
Hub drain quantity	0
Center Deck leg type	N/A
Center Deck leg quantity	16
Portion Deck leg type	N/A
Portion 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	<input type="checkbox"/>



**Wemco Pro II Model Inputs and Outputs**

Stream Name		WEMCO_FD_2	WEMCO_N2_2	WEMCO_OUT_2	WEMCO_VENT_2
Stream Phase		Wet Liquid	Vapor	Wet Liquid	Vapor
Temperature	C	25	25	24.99741329	24.99741329
Pressure	BARG	0.1	0.1	0.004	0.004
Total Mass Rate	kg/hr	118882.5187	45	118881.5543	46.09130917
Liquid Std Rate (vol) [at 1 atm, 15.56 C]	m3/hr	118.9998526	n/a	118.9988872	n/a
Liquid Act. Density	kg/m3	997.0571652	n/a	997.054745	n/a
<b>Total Weight Comp. Percents</b>		<b>WEMCO_FD_2</b>	<b>WEMCO_N2_2</b>	<b>WEMCO_OUT_2</b>	<b>WEMCO_VENT_2</b>
N2	wt%	0	100	5.88E-11	97.63228848
H2O	wt%	99.99986482	0	99.99999912	2.021318543
BENZENE	wt%	6.05E-05	0	1.80E-09	0.156042139
EBENZENE	wt%	7.25E-06	0	1.99E-09	0.018694689
CL2M	wt%	0	0	0	0
STYRENE	wt%	0	0	0	0
PCEE	wt%	0	0	0	0
TOLUENE	wt%	5.45E-05	0	5.34E-09	0.140557298
OXYLENE	wt%	0	0	0	0
NAPHTHLN	wt%	1.02E-05	0	1.12E-07	0.026018871
PHENOL	wt%	1.21E-06	0	3.91E-09	0.003110855
ACENAP	wt%	2.80E-07	0	4.83E-08	0.000597505
ACENAPHT	wt%	3.30E-07	0	5.09E-08	0.000719838
FLUORENE	wt%	3.10E-07	0	1.05E-07	0.000528927
ANTH	wt%	0	0	0	0
PHAN	wt%	4.50E-07	0	4.03E-07	0.000121169
FLUANTHE	wt%	0	0	0	0
PYRENE	wt%	1.50E-07	0	1.49E-07	1.69E-06
<b>Mass Rates</b>		<b>WEMCO_FD_2</b>	<b>WEMCO_N2_2</b>	<b>WEMCO_OUT_2</b>	<b>WEMCO_VENT_2</b>
N2	lb/hr	0.00	99.21	0.00	99.21
H2O	lb/hr	262088.05	0.00	262086.27	2.05
BENZENE	lb/hr	0.16	0.00	0.00	0.16
EBENZENE	lb/hr	0.02	0.00	0.00	0.02
CL2M	lb/hr	0.00	0.00	0.00	0.00
STYRENE	lb/hr	0.00	0.00	0.00	0.00
PCEE	lb/hr	0.00	0.00	0.00	0.00
TOLUENE	lb/hr	0.14	0.00	0.00	0.14
OXYLENE	lb/hr	0.00	0.00	0.00	0.00
NAPHTHLN	lb/hr	0.03	0.00	0.00	0.03
PHENOL	lb/hr	0.00	0.00	0.00	0.00
ACENAP	lb/hr	0.00	0.00	0.00	0.00
ACENAPHT	lb/hr	0.00	0.00	0.00	0.00
FLUORENE	lb/hr	0.00	0.00	0.00	0.00
ANTH	lb/hr	0.00	0.00	0.00	0.00
PHAN	lb/hr	0.00	0.00	0.00	0.00
FLUANTHE	lb/hr	0.00	0.00	0.00	0.00
PYRENE	lb/hr	0.00	0.00	0.00	0.00

