



Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

October 30, 2025

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) Shut Down and Storage Tanks (Recovered Oil, Equalization Wastewater, and Spent Caustic) (Source IDs 401 and 402), Spent Caustic Vent Header System (Source ID 206), and Wemco 84/EC-15 Excess Emissions Malfunction Report

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell"), located in Beaver County, PA 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 Tanks, Recovered Oil Tank, Spent Caustic Storage Tank, the Spent Caustic Vent Header System, and the Wemco 84/EC-15 units on September 29 and September 30, 2025 following the shutdown of the Spent Caustic Vent Incinerator.

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 September 29, 2025, at 9:29, the Spent Caustic Thermal Oxidizer¹ (SCTO) tripped offline due to low combustion chamber temperature. Initial troubleshooting identified excess liquid water in the waste gas line to be the cause of the trip. Normal SCTO operations were restored at 11:43.

Then, on September 30, 2025, at 7:31, the SCTO tripped, was restarted quickly, and then tripped again at 8:20. The cause of these trips was also attributed to excess liquid water in the waste gas line. Normal SCTO operations were restored at 13:11.

- **Time when the malfunction or breakdown was first observed**

The malfunction was first observed with the first SCTO trip on September 29, 2025, at 9:29.

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

- **The date and time that the malfunction started and ended**

In addition to the 9/29/25 trip, there were 2 more SCTO trip events attributed to the same root cause. Timestamps are below.

- 9/29/25 9:29-11:43
- 9/30/25 7:31-7:50
- 9/30/25 8:20-13:11

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

The excess emissions from the event are provided in Table 1 below.

Table 1 – Emissions Summary

Pollutant	Emissions (lbs)
VOC	7.26
Total HAPs	0.83
Benzene	0.47

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

The SCTO controls four main sources (wastewater treatment storage tanks, spent caustic storage tank, temporary wastewater treatment plant equipment, and spent caustic oxidation) and when the SCTO trips, emissions may occur from those sources. The FEOR Tanks, Recovered Oil Tank, and Spent Caustic Tank have two emissions controls: internal floating roofs and blowers which sweep emissions to the SCTO. When the SCTO is shutdown, these tanks may periodically vent to the atmosphere through relief valves in the fixed roofs. The offgas generated via the temporary wastewater treatment plant nitrogen flotation units (Wemco 84 and EC-15) also intermittently vents to atmosphere through the tank relief valves as it ties into suction line of the FEOR/Recovered Oil tanks' blower. Finally, offgas generated by the Spent Caustic Oxidation System² may also vent via atmospheric relief devices. Note that this only occurred during the 9/29/25 SCTO trip as the spent caustic system pressure was not high enough to relieve to atmosphere on 9/30/25.

Reference Table 2 below for an overview of excess emissions duration and the emissions calculation basis for all impacted sources. See Appendix A for calculation details.

Table 2 – Source Excess Emissions Summary

Source	Excess Emissions Time Stamps	Excess Emissions Duration Basis	Excess Emissions Calculation Method
FEOR and Recovered Oil Tanks	9/29/25 9:33-11:30 9/30/25 7:36-7:50 9/30/25 8:37-11:26	Tanks operating pressure above RV setpoint	Tank IFR emission factors generated via ProMax software
Spent Caustic Tank	9/29/25 9:31-11:43 9/30/25 7:34-7:50 9/30/25 8:22-13:11	Tank operating pressure above RV setpoint	Tank IFR emission factors generated via ProMax software
Wemco 84/EC-15	9/29/25 9:29-9:49 9/30/25 7:31-7:50 9/30/25 8:20-8:25	SCTO down and nitrogen lined up to both pieces of equipment	Wemco/EC-15 flow rates, feed sample results, and modeled VOC removal efficiency
Spent Caustic Oxidation System	9/29/25 9:29-9:45	SCTO down and spent caustic system pressure above RV setpoint	Spent caustic system flow rate, feed sample results, and modeled VOC removal efficiency

² Spent Caustic Vent Header System (Source ID 206) in PA-04-00740C

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

The Spent Caustic Oxidation System was shut down and nitrogen was blocked into the Wemco 84 and EC-15 units as quickly as possible following the SCTO trip events.

Once the cause of the trips was determined, quick action was taken to drain excess water from the SCTO waste gas line and restore normal operations.

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

9/29/25- Excess Water in Spent Caustic Oxidation System

On September 29, 2025, at approximately 9:29, the SCTO tripped on low combustion chamber temperature. Initial troubleshooting identified that there was liquid water in SCTO's waste gas line, which caused low combustion chamber temperature and the subsequent low temperature trip.

Following the trip, operations drained excess water from the waste gas line, and normal SCTO operations were restored at 11:43. The initial investigation identified that lower than typical steam temperature contributed to excess water in the Spent Caustic Oxidation System, the offgas of which vents to the SCTO. The lower steam temperature occurred during planned maintenance of the steam system and was determined to be low enough to condense within the Spent Caustic Oxidation System. That afternoon, the steam temperature was increased back to a normal range.

9/30/25- Residual Water in Spent Caustic Oxidation System

On September 30, 2025, at approximately 7:31, the SCTO tripped on low combustion chamber temperature. The SCTO was restarted quickly but then tripped again at 8:20. Initial troubleshooting identified that liquid water in the waste gas line was also the cause of these trips, but that this was residual water from the 9/29/25 event.

It was concluded that more system draining was needed, which operations carried out. Normal SCTO operations were restored at 13:11.

Further Investigation of Excess Water's Impact on the System

The investigation identified that excess water in the Spent Caustic Oxidation System ended up in the SCTO's waste gas line due to an inaccurate level reading on the Separator, one of the oxidation system's vessels. Normally, the Separator separates liquid oxidized spent caustic from offgas generated in the oxidation process, which is routed to the SCTO via the waste gas line. Since most of the lower temperature steam was condensing into water in the Separator based its operating temperature, the vessel level increased, and this was not detected by the level instrument. Eventually, the Separator level got to the point in which liquid carried over into the SCTO's waste gas line. While there is a knockout drum upstream of the SCTO, the estimated volume of water in the waste gas line exceeded the capacity of this drum, which was drained by operations multiple times leading up to the event.

Separator Level Indicator Fouling

The level indicator was determined to not be working properly due to the buildup of fouling material on the instrument's sensing components. This fouling material stemmed from the residual hydrocarbon in the spent caustic from the Ethane Cracking Unit (ECU), which is processed through the Spent Caustic Oxidation System. Following the event, the level instrument was assessed and determined to be functioning properly; the fouling material likely came free during the system restart on 9/30/25.

- **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**
 - Steam temperature alarm
 - An alarm will be created to notify console operators of low steam header temperature with the action to increase temperature if possible and/or perform extra monitoring of the spent caustic oxidation/SCTO systems.
 - Separator level indicator PM
 - The preventative maintenance plan for the Separator's level instrument will be updated to include regular instrument flushing to mitigate potential future fouling.
- **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**
This is the final report for this malfunction.
- **Corrective action is final or timeline for implementation**

Table 3 – Root Causes and Corrective Actions

Root Cause	Corrective Action	Timing
Low steam temperature causing excess water in the spent caustic system	Steam temperature alarm	Q4 2025
Inaccurate Separator Level Reading due to Fouling	Update level indicator PM plan to include regular instrument flushing	November 2025

If you have any questions regarding this matter, please don't hesitate to contact Kimberly Kaal at kimberly.kaal@shell.com or me at nathan.levin@shell.com.

Sincerely,



Nathan Levin
Operations Manager

CC:
Scott Beaudway, Air Quality Specialist

Attachment A- Emissions Calculation Details

FEOR, Spent Caustic, Recovered Oil Tanks- Emissions Calculations Basis

IFR Pro-Max Modeling Software Emission Factors

	FEOR A	FEOR B	Spent Caustic	Recovered Oil
Tank Throughput (gpm)	99.12	11.63	13.47	1.01
Temperature (C)	28.44	23.54	41.38	28.95
Constituent	Emissions (lbs/hr)	Emissions (lbs/hr)	Emissions (lbs/hr)	Emissions (lbs/hr)
VOC	7.180E-04	2.389E-03	9.132E-04	7.305E-03
Benzene	4.880E-04	1.426E-03	6.848E-04	1.058E-03
Ethylbenzene	1.711E-05	5.806E-05	3.445E-06	4.293E-04
Styrene	1.286E-05	1.603E-05	5.890E-06	1.545E-04
Toluene	3.168E-04	8.080E-04	2.211E-04	5.253E-03
Xylenes	6.321E-06	3.033E-05	4.790E-06	2.884E-04
Naphthalene	1.197E-05	4.968E-05	1.334E-06	2.024E-05
Phenol	1.356E-08	8.546E-09	2.753E-09	0.000E+00
POM	1.591E-06	8.282E-07	1.351E-08	2.549E-06
HAP	8.547E-04	2.389E-03	9.214E-04	7.207E-03

FEOR A, FEOR B, and Recovered Oil Tank IFR Emissions

9/29/25 SCTO Downtime

Excess Emissions Start 9/29/2025 9:33

Excess Emissions End 9/29/2025 11:30

Delta (hrs) 1.95

9/30/25 SCTO Downtime

Excess Emissions Start 9/30/2025 7:36

Excess Emissions End 9/30/2025 7:50

Delta (hrs) 0.23

Excess Emissions Start 9/30/2025 8:37

Excess Emissions End 9/30/2025 11:26

Delta (hrs) 2.82

Total Excess Emissions

Duration (hrs) 5.00

VOC Emissions (lbs)	5.2E-02
HAP Emissions (lbs)	5.2E-02
Benzene Emissions (lbs)	1.5E-02

Spent Caustic Tank IFR Emissions

Excess Emissions Start 9/29/2025 9:31

Excess Emissions End 9/29/2025 11:43

Delta (hrs) 2.20

Excess Emissions Start 9/30/2025 7:34

Excess Emissions End 9/30/2025 7:50

Delta (hrs) 0.27

Excess Emissions Start 9/30/2025 8:22

Excess Emissions End 9/30/2025 13:11

Delta (hrs) 4.82

Total Excess Emissions

Duration (hrs) 7.28

VOC Emissions (lbs)	6.7E-03
HAP Emissions (lbs)	6.7E-03
Benzene Emissions (lbs)	5.0E-03

Wemco 84/EC 15- Emissions Calculations Basis

10/1/25 Wemco/EC-15 Feed Sample Results

Pollutant	wppm
Benzene	1.78
Toluene	0.41
Ethylbenzene	0.02
Xylenes	0.04
Styrene	0.14
Naphthalene	1.81
TOC	51.57

9/29/25 SCTO Downtime

Excess Emissions Start	9/29/2025 9:29
Excess Emissions End	9/29/2025 9:49
Delta (hrs)	0.33

Avg Wemco Flow (m ³ /hr)	107.9
Avg EC-15 Flow (m ³ /hr)	52.9
Density (kg/m ³)	1000
Combined Flow (kg/hr)	160833
Wemco/EC 15 VOC Removal Efficiency (%)	100
VOC Emissions (lbs)*	2.76
HAP Emissions (lbs)	0.22
Benzene Emissions (lbs)	0.10

*utilized sample result TOC

9/30/25 SCTO Downtime

Excess Emissions Start	9/30/2025 7:31
Excess Emissions End	9/30/2025 7:50
Delta (hrs)	0.32

Excess Emissions Start	9/30/2025 8:20
Excess Emissions End	9/30/2025 8:25
Delta (hrs)	0.08

Total Excess Emissions Duration (hrs)	0.40
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Avg Wemco Flow (m ³ /hr)	102.8
Avg EC-15 Flow (m ³ /hr)	53.0
Density (kg/m ³)	1000
Combined Flow (kg/hr)	155845
Wemco/EC 15 VOC Removal Efficiency (%)	100
VOC Emissions (lbs)*	3.21
HAP Emissions (lbs)	0.26
Benzene Emissions (lbs)	0.11

*utilized sample result TOC

Spent Caustic Oxidation- Emissions Calculations Basis

9/30/25 Spent Caustic Tank Results

Pollutant	wppm
Benzene	113.10
Toluene	15.96
Ethylbenzene	2.09
Xylenes	0.81
Styrene	0.32
Naphthalene	0.39
TOC	572

9/29/25 SCTO Downtime

Excess Emissions Start	9/29/2025 9:29
Excess Emissions End	9/29/2025 9:45
Delta (hrs)	0.27

Avg Spent Caustic Feed Flow (kg/hr)	8005
Spent Caustic Oxidation VOC Removal Efficiency (%)	100
VOC Emissions (lbs)*	1.22
HAP Emissions (lbs)	0.28
Benzene Emissions (lbs)	0.24

*utilized sample result TOC