



Shell Chemical Appalachia LLC  
300 Frankfort Rd  
Monaca, PA 15061

November 10, 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 LP Multipoint Ground Flare (C204B) Ethylene Header Visible and 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 flaring visible and excess emissions from the LP Multipoint Ground Flare Ethylene Header on October 11, 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 11, 2023, at approximately 19:12, Visible Emissions (VE) were present at the Ethylene Header of the Multipoint Ground Flare (MPGF). It was quickly determined that the source of flow to the MPGF was the Ethylene Tank (Source ID 405 Misc. Pressurized/Refrigerated Storage Tanks) overpressure vent.

The Ethylene tank pressured up due to insufficient subcooling of the incoming ethylene, which is detailed in a later section of this report. Insufficient subcooling of incoming ethylene results excess boil off gas (BOG) from the ethylene tank, which cannot be fully recompressed.

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

Smoking first observed on October 11, 2023, at 19:12. Note that the ethylene tank started venting at 19:04 on the same day.

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

Smoking started on October 11, 2023, at 19:12 and ended on October 11, 2023, at 19:20. The ethylene tank venting subsided on October 11, 2023, at 20:01 when ECU operational moves could be made to reduce the BOG production.

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

Pollutant	Emissions (tons)
CO <sub>2</sub> e	1.012
CO	0.002
NO <sub>x</sub>	0.000
PM (filt)	0.000
PM 10	0.000
PM 2.5	0.000
VOC	0.003
HAP (total)	0.000

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

Estimated emissions from the flaring vent gas combustion were based on measured flow rates, calculated vent gas compositions, and the application of accepted hydrocarbon destruction efficiencies and emission factors for products of combustion. See attached gas composition and flow data used for these calculations (Attachment A).

Summary of VE elapsed time in the Ethylene Header of the LP Multipoint Ground Flare as determined by review of camera footage is captured below.

- 8 minutes and 13 seconds of VE observed between 19:12:08 and 19:20:21

Method 22 observations were performed by operations and are attached to this malfunction report (Attachment B). However, the VE had ended by time the observer was able to get into place due to the short overall duration of the VE.

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

The speed of the perimeter air assist fan that provides combustion air to the ethylene header of the MPGF was manually ramped up by Operators until the smoking ceased. In addition, ECU Operators made adjustment to restore sufficient subcooling and reduce the ethylene tank venting.

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

The cause of the smoking was quickly identified, and manual fan speed adjustments were made until the smoking ceased. Fan speed is on cascade control based on flow in the flare header, but the fan's response was not quick enough to avoid smoking for this particular event.

The inadequate ethylene subcooling, which ultimately caused the ethylene tank to send vapors to the MPGF, was investigated further. Field and console troubleshooting identified that there was insufficient level in the subcooler vessels when warm liquid ethylene was sent to the ethylene storage tank during ECU startup after the Ethylene Refrigerant Compressor (ERC) trip/upset. This event is detailed in a subsequent malfunction report with the subject *RE: PA-04-00740C Ethylene Manufacturing Line (Source ID 201), HP Ground Flares (Source IDs C205A and C205B), and HP Elevated Flare (Source ID C205C) Excess Emissions*.

- **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 corrective actions and path forward for the MPGF ethylene header air fan response/control scheme are detailed in the report titled *RE: PA-04-00740C LP Multipoint Ground Flare (C204B) Ethylene Header Visible Emissions Follow Up Report*, which was submitted to the department on

October 29, 2023.

The following corrective actions are in place to prevent future ethylene tank venting due to inadequate subcooling:

1. Ongoing- Added a step in the applicable Ethane Cracking Unit restart procedure to ensure adequate levels are in the subcoolers prior to sending ethylene to the storage tank. Steps will be reviewed for adequate performance.
- **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

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

**Attachment A**  
MPGF Ethylene Header Flow and Composition Data

**Attachment B**  
Method 22 Form

**MPGF Ethylene Header Average Vol% Compositions, Wt % Compositions, Flow, and NHV**

Date and Time	Nitrogen % vol	Ethylene % mol	Total % mol	Nitrogen % wt	Ethylene % wt	Total % wt	Mass Rate kg/hr	NHVcz Btu/scf
11-Oct-23 19:00:00	24.58	75.42	100.00	24.42	75.58	100.00	836.42	1113.98
11-Oct-23 20:00:00	95.04	4.96	100.00	95.00	5.00	100.00	178.45	73.25

*\*only the first 1 minute of this hour were flaring event emissions*

**Constants**

Property	Nitrogen (N2)	Ethylene (C2H4)
NHV (Btu/scf)	0	1,595
MW (lb/lb-mol)	28.01	28.05

**Shell Polymers Monaca**  
**Method 22 Visible Emissions Observation Form SPM-HSE-FO-0003**

Observer Name: [REDACTED]  
 Observer Title: Field Operator  
 Date and Time (MM/DD/YY XX:XX): 10/11/23 20:45  
 Sky Conditions: Clear  
 Precipitation: None  
 Wind Direction (direction from): E 70.15  
 Wind Speed (m/s): 0.75  
[Site MET Data \(Wind Direction 500QT-060A and Speed 500QT-050A\)](#)  
 Visible Emissions Source: Multipoint Ground Flare (A-59004)  
 Observation Location: H (MPGF)  
 Observation Picture:



**Observations**

Begin	Clock Time	Observation Period (when you are actually looking at stack)	Emissions Observed (when you actually see smoke)
10/11/2023	19:30		0:00:00
	19:45		0:00:00
	20:00		0:00:00
	20:15		0:00:00
	20:30		0:00:00
	20:45	10 sec intervals	0:00:00
	21:00		0:00:00
	21:15		0:00:00
	21:20		0:00:00
End	21:30		0:00:00
Compliant? (Y/N)	Y	Y	

**General Notes**

smoking observed for approximately 8 minutes on camera before M22 was started