Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

August 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 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 on July 10, 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 July 10, 2023, at approximately 17:17, Visible Emissions (VE) were present at 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.

- **Time when the malfunction or breakdown was first observed**
  Smoking first observed July 10, 2023, at 17:17, which is the same time the ethylene tank started venting to the MPGF.

- **The date and time that the malfunction started and ended**
  Smoking started on July 10, 2023, at 17:17 and ended on July 10, 2023, at 17:23. The excess ethylene tank venting subsided on July 10, 2023, at 22:07.

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

Pollutant	Emissions (tons)
CO2e	28.940
CO	0.062
NOx	0.014
PM (filt)	0.000
PM 10	0.002
PM 2.5	0.002
VOC	0.093
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, measured vent gas compositions, and application of accepted hydrocarbon destruction efficiencies, and the application of emission factors for products of combustion. See attached gas composition and flow data used for these calculations.

  Summary of Visible Emissions (VE) elapsed time in the LP Multipoint Ground Flare as determined by review of camera footage is captured below. Method 22 observations were initiated and performed by field operations and are attached to the malfunction report. However, the VE had ended by time the observer was able to get into place due to the short overall duration of the VE.

  - 6 minutes and 3 seconds of VE observed between 17:17:39 and 17:23:42

- **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 ramped up until the smoking ceased.

- **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 the there was insufficient level in the subcooler vessels, which was the result of the Ethylene Cracking Unit trip/upset earlier that day, which is the subject of malfunction report *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) Visible and 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 following corrective actions will/have been implemented to further investigate the MPGF air fan response/control scheme.
  1. Pending- Possible long-term improvements to the perimeter air assist fans automatic response and speed control remain under investigation. The current mitigation remains taking manual control of the fan speed in response to events which result in VE from the MPGF.

The following corrective actions will/have been implemented to prevent future Ethylene Tank venting due to inadequate subcooling:

1. Complete- Added a step in the applicable Ethylene Cracking Unit restart procedure to ensure adequate levels are in the subcoolers prior to sending ethylene to the storage tank.

- **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**
  A follow-up report will be submitted on or by October 30, 2023.

- **Corrective action is final or timeline for implementation**
  A status update of the MPGF air fan response improvement study will be included in the follow-up report.

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:
Scott Beaudway, Air Quality Specialist
Beth Speicher, Environmental Group Manager

Attachment A
MPGF 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
10-Jul-23 17:00:00	4.96	95.04	100.00	4.92	95.08	100.00	4153.04	1403.76
10-Jul-23 18:00:00	6.21	93.79	100.00	6.16	93.84	100.00	3316.06	1385.29
10-Jul-23 19:00:00	16.39	83.61	100.00	16.27	83.73	100.00	1255.09	1234.91
10-Jul-23 20:00:00	14.83	85.17	100.00	14.72	85.28	100.00	1387.36	1257.96
10-Jul-23 21:00:00	16.70	83.30	100.00	16.58	83.42	100.00	1232.16	1230.41
* 10-Jul-23 22:00:00	95.04	4.96	100.00	95.00	5.00	100.00	203.26	73.25

**only the first 7 minutes 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):	7/10/23 17:25	
Sky Conditions:	Partly Cloudy	
Precipitation:	None	
Wind Direction (direction from):	S	198.14
Wind Speed (m/s):	1.06	
	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

		Clock Time	Observation Period (when you are actually looking at stack)	Emissions Observed (when you actually see smoke)
Begin	7/10/2023 17:25	17:25		0:00:00
	17:30			0:00:00
	17:40			0:00:00
	17:55			0:00:00
	18:10			0:00:00
	18:25			0:00:00
	18:35			0:00:00
	18:50			0:00:00
	19:05			0:00:00
End	19:25	19:25		0:00:00
Compliant? (Y/N)		YES	**Y**	

General Notes

No Emissions Observed between 7/10/2023 17:25 and 19:25. The picture above was taken later in the shift. Per camera footage, the smoking end at 17:23:42.