



Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

August 29, 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 Polyethylene Manufacturing Lines (Source ID 202), Low Pressure (LP) Header System (Source ID 204) 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 excess emissions and visible emissions from the multipoint ground flare (MPGF)¹ on August 03, 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 August 03, 2023, at approximately 11:56, the Ethylene Boil-Off Gas (BOG) Compressor from the Ethane Cracker Unit (ECU) had a trip for an unknown reason that caused the ethylene product tank pressure to increase above its pressure controller setpoint, thus sending ethylene vapor flow from the tank to the Low-Pressure Multipoint Ground Flare (MPGF)¹. This resulted in visible emissions from the MPGF which were determined in excess of 5 minutes in a 2-hour period.

The Ethylene BOG Compressor trip was determined to stem from a false SIS (Safety Instrumented System) signal that was sent to the variable frequency drive (VFD) issuing a trip command. The false signal did not come from the Distributed Control System (DCS), so further investigation revealed that was a loose wiring between the DCS cabinet and the VFD.
- **Time when the malfunction or breakdown was first observed**
Smoking first observed August 03, 2023, at 12:09, which is the same time the ethylene product tank valve started opening and relieving ethylene vapor to the MPGF.
- **The date and time that the malfunction started and ended**
Smoking started on August 03, 2023, at 12:09 and ended on August 03, at 12:15. The excess ethylene product tank venting ceased on August 04, at 13:40.

¹ Identified as the LP Multipoint Ground Flare (MPGF), Control ID C204B in PA-04-00740C, and part of the LP Header System. The MPGF ethylene storage tank Vent Header was used during this event.

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

Pollutant	Emissions (tons)
CO ₂ e	138.407
CO	0.299
NO _x	0.066
PM (filt)	0.002
PM 10	0.007
PM 2.5	0.007
VOC	0.446

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

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

Method 22 was not performed as VE had ended by the time the observer was able to get into place due to the short overall duration of the VE. Summary of Visible Emissions (VE) elapsed time in the MPGF as determined by review of camera footage is captured below and as Attachment B:

- 5 minutes and 57 seconds of VE observed between 12:09:40 and 12:15:37

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

The board operator received a high flare flow alarm at 12:09 and observed smoke via the flare camera. The operator took manual control and ramped up the speed of the perimeter air assist blower that provides combustion air to the MPGF ethylene storage tank vent header until the smoking stopped.

In the ECU Unit, the Operations and Electrical teams gathered after the BOG compressor trip (August 03, 2023) to diagnose and troubleshoot control instrumentation and address required system repairs. Following the repairs and once all permissive checks (Statement of Fitness) were met, the BOG Compressor was restarted thus preventing pressure build up in the ethylene product tank and the valve to the MPGF ethylene storage tank vent header was closed.

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

The cause of the initiating trip was identified and is known to be the result of a SIS command failure because of a loose wiring between the DCS cabinet and the VFD.

The cause of the VE has been identified as the inability of the MPGF ethylene storage tank vent header blower to ramp up fast enough in CAS (cascade) mode to provide air for proper combustion to prevent smoking without the board operator taking manual control during high flow flaring events.

- **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 action will be implemented to prevent future Ethylene BOG Compressor trips due to SIS command failure:

- **Pending**- Execute planned maintenance to address any other loose wiring as well as a wiring change that will allow operations to quickly restart the BOG Compressor during process stops without the need of timely maintenance responses.

The following corrective action will be implemented to further investigate the MPGF air blower response/control scheme:

- **Pending**- Possible long-term improvements to the perimeter air assist blowers automatic response and speed control remain under investigation. The current mitigation remains taking manual control of the blower speed in response to events which result in VE from the MPGF.

- **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 (reference follow up report for PA-04-00740C LP Multipoint Ground Flare Visible and Excess Emissions Malfunction Report) which is to be submitted on or before October 30,2023.

- **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.

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
HP Flare GC and Flow Data

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
03-Aug-23 12:00:00	28.17	71.83	100.00	28.00	72.00	100.00	729.53	1060.92
03-Aug-23 13:00:00	19.20	80.80	100.00	19.07	80.93	100.00	1071.12	1193.39
03-Aug-23 14:00:00	12.68	87.32	100.00	12.58	87.42	100.00	1623.14	1289.74
03-Aug-23 15:00:00	12.43	87.57	100.00	12.34	87.66	100.00	1655.00	1293.34
03-Aug-23 16:00:00	11.16	88.84	100.00	11.08	88.92	100.00	1843.87	1312.14
03-Aug-23 17:00:00	10.74	89.26	100.00	10.66	89.34	100.00	1916.72	1318.40
03-Aug-23 18:00:00	12.01	87.99	100.00	11.92	88.08	100.00	1714.10	1299.67
03-Aug-23 19:00:00	11.71	88.29	100.00	11.62	88.38	100.00	1757.96	1304.09
03-Aug-23 20:00:00	11.41	88.59	100.00	11.32	88.68	100.00	1803.98	1308.49
03-Aug-23 21:00:00	11.45	88.55	100.00	11.36	88.64	100.00	1797.76	1307.91
03-Aug-23 22:00:00	11.39	88.61	100.00	11.30	88.70	100.00	1807.65	1308.84
03-Aug-23 23:00:00	11.10	88.90	100.00	11.01	88.99	100.00	1854.52	1313.08
04-Aug-23 00:00:00	10.66	89.34	100.00	10.58	89.42	100.00	1931.16	1319.58
04-Aug-23 01:00:00	11.26	88.74	100.00	11.18	88.82	100.00	1827.45	1310.66
04-Aug-23 02:00:00	10.17	89.83	100.00	10.09	89.91	100.00	2024.24	1326.81
04-Aug-23 03:00:00	11.02	88.98	100.00	10.93	89.07	100.00	1868.34	1314.29
04-Aug-23 04:00:00	10.10	89.90	100.00	10.02	89.98	100.00	2038.06	1327.83
04-Aug-23 05:00:00	10.15	89.85	100.00	10.07	89.93	100.00	2028.34	1327.12
04-Aug-23 06:00:00	10.38	89.62	100.00	10.30	89.70	100.00	1982.68	1323.67
04-Aug-23 07:00:00	10.20	89.80	100.00	10.12	89.88	100.00	2018.45	1326.38
04-Aug-23 08:00:00	9.94	90.06	100.00	9.86	90.14	100.00	2070.50	1330.17
04-Aug-23 09:00:00	9.64	90.36	100.00	9.57	90.43	100.00	2134.22	1334.55
04-Aug-23 10:00:00	9.56	90.44	100.00	9.49	90.51	100.00	2152.98	1335.79
04-Aug-23 11:00:00	8.68	91.32	100.00	8.61	91.39	100.00	2371.79	1348.80
04-Aug-23 12:00:00	8.88	91.12	100.00	8.81	91.19	100.00	2317.98	1345.83
04-Aug-23 13:00:00	30.03	69.97	100.00	29.85	70.15	100.00	684.30	1033.49

Constants

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

Attachment B
Visible Emission Documentation Form

LP Flare / MPGF Ethylene header Visible Emission Form (FVE Form)					
Date of Assessment: 08/07/2023					
Assessor: ENV Engineer					
Incident Date and Description: 08/03/2023 BOG A compressor trip from ECU					
LP Flaring Duration: ~ 12:09 to ~ 12:16					
<p>Applicable Requirement: 40 CFR 63.670(c) via EMACT and MON - SPM must specify the smokeless design capacity of each flare and operate with no visible emissions, except for periods not to exceed a total of 5 minutes during any 2 consecutive hours, when regulated material is routed to the flare and the flare vent gas flow rate is less than the smokeless design capacity of the flare. SPM shall monitor for visible emissions from the flare using a video surveillance camera [63.670(h)(2)]. Per 63.670(h) and Section D.Source ID 204.I.001 [25PAC 127.12b], SPM must record and report any instances where visible emissions are observed for more than 5 minutes during any 2 consecutive hours in the semiannual periodic report [63.655(g)(11)(ii)].</p>					
Visible Emission Documentation					
Start Time	End Time	Duration	FL Flow > Smokeless Capacity (Y/N)*	Vtip > Vmax (Y/N)	Notes
12:09:40	12:15:37	0:05:57	N	N/A	For Flares: *When FL flow > smokeless capacity, the emergency work practice standards of RMACT 1 apply. Any VE observed should be omitted when calculating the total" VE duration" that will be used to compare to the 5 minute VE/2hrs limit at 63.670(c). Any such aforementioned periods are accessed separately for compliance as described at 63.670(o)(7) and to be reported in the next Period Report.
Total Minutes of VE/2-hr:		0:05:57			
VE Limit Exceeded (Yes/No): Yes					

