Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

April 10, 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 Ground Flares #1 and #2 (Source IDs C205A and B) Visible and Excess Emissions and Ethane Cracking Furnaces #1 (Source ID 031), #2 (Source ID 032), #3 (Source ID 033), #4 (Source ID 034), and #5 (Source ID 035) Visible Emissions and National Response Center Incident ID #1425737 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 the following deviations that occurred on March 13, 2025, during planned Ethane Cracking Unit maintenance activities: HP Ground Flares #1 (Source ID C205A) and #2 (Source ID C205B) visible and excess emissions and Ethane Cracking Furnaces #1 (Source ID 031), #2 (Source ID 032), #3 (Source ID 033), #4 (Source ID 034), and #5 (Source ID 035) visible emissions. This event triggered notification to the National Response Center (NRC Incident ID # 1425737).

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 March 13, 2025, during planned Ethane Cracking Unit (ECU) maintenance activities that required intermittent venting to the HP flare system, visible emissions (VE) were present at HP Ground Flares #1 and #2 (Totally Enclosed Ground Flares A and B/TEGF A and B) starting at 7:54. The VE were intermittent and exceeded 5 minutes in a consecutive 2-hour period.

  Later that day, also during the planned maintenance activities, the ECU Propane Refrigeration Compressor (PRC) tripped at approximately 11:31. The compressor trip resulted in transient unit operations and yielded VE from ECU Furnace #1-#5 stacks in addition to flaring to the HP flare system (TEGF A/B and HP Elevated Flare).

- **Time when the malfunction or breakdown was first observed**
  - TEGF A VE: 3/13/25, 7:54
  - TEGF B VE: 3/13/25, 8:05
  - ECU Furnace #1-#5 VE: 3/13/25, 11:33
  - ECU flaring event: 3/13/25, 11:34

- **The date and time that the malfunction started and ended**
  - TEGF A VE: 3/13/25 7:54-8:29
  - TEGF B VE: 3/13/25 8:05-8:29
  - ECU Furnace #1-#5 VE: 3/13/25 11:33-11:36
  - ECU flaring event: 3/13/25 11:34- 3/14/25 14:30 (ended when ECU product was on spec and excess flaring ceased)

- **An estimate of the emissions associated with the malfunction**
  Excess flaring emissions are captured in the table below. Note that these emissions exceeded the reportable quantity for both 1,3-Butadiene and Benzene, hence triggering the NRC notification.

Pollutant	Emissions (tons)
CO2e	11513.77
CO	8.72
NOx	6.35
PM (filt)	0.17
PM 10	0.70
PM 2.5	0.70
VOC	23.46
HAP (total)	2.27
1,3-Butadiene	1.21
Benzene	1.03

- **The calculations that were used to determine that quantity**
  The flaring excess emissions associated with this event were calculated using the measured vent gas flow rate and composition, engineering estimates for any non-measured constituents, application of accepted hydrocarbon destruction efficiencies, and application of emission factors for products of combustion. In addition, a representative flaring baseline rate and composition for the time leading up to the compressor trip was established and subtracted from the totals to calculate the excess emissions. The flaring event gas chromatograph (GC) and flow data is included in Appendix A.

  Summary of VE elapsed time from TEGF A/B as determined by review of flare camera footage is captured below.

  - TEGF A: 7 minutes and 50 seconds of intermittent VE observed between 7:54:52 and 8:29:29
  - TEGF B: 8 minutes and 50 seconds of intermittent VE observed between 8:05:53 and 8:29:46

Method 22 observations were performed by operations, and the form is included as Attachment B. Note that VE had ended by the time the observer was able to get into place due to the overall short duration of the VE. The observations were conducted on just TEGF B as that is where the VE was first identified and thought to be only source of VE during the beginning stages of the event. Further review of the flare camera footage showed that TEGF A was also intermittently smoking.

- **The steps, if any, that the facility took to limit the duration and/or quantity of emissions associated with the malfunction**
  In response to the TEGF A/B VE, supplemental natural gas flow was increased to change the TEGF staging configuration and vent gas composition, which helped mitigate the smoking.

  In response to the PRC trip, the operations team initiated a control module designed to reduce the furnace feed by 70% within a specified time frame.

- **A detailed analysis that sets forth the Root Cause of the malfunction, to the extent determinable**
  TEGF A/B VE Root Cause
  The cause of TEGF A/B VE is still under investigation.

  Furnace VE and Flaring Event Root Cause
  On March 13, 2025, at approximately 11:31, during planned ECU maintenance activities, the PRC tripped. Consequently, tail gas flow to the ECU furnaces was lost. This caused the furnace fuel gas header pressure to decrease, prompting the natural gas makeup valves to open to compensate for the loss of tail gas. As the natural gas began to recover the header pressure, the fuel gas density changed significantly, leading to a decrease in furnace firebox oxygen levels. This resulted in a brief period of incomplete combustion and visible emissions from the furnace stacks. When the PRC tripped, flaring to the HP flare system also occurred. As mentioned, a control module to reduce furnace feed rate by 70% was initiated to mitigate the impact of the event. The investigation revealed that the timeframe was set at 5 hours instead of the intended 5 minutes. This discrepancy was caused by an update to the module that changed the unit of measurement without adjusting the entered value.

- **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**
  TEGF A/B VE Corrective Actions
  Once the cause of the TEGFA/B VE is determined, corrective actions, if applicable, will be assigned.

  Furnace VE and Flaring Event Corrective Actions
  1. Disseminate Findings and Enhance Training: Share the investigation results with the furnace operations team. Implement refresher training focused on managing low oxygen scenarios within the furnace fireboxes to ensure operational readiness and compliance.
  2. Rectify Time Unit Discrepancy: Correct the discrepancy in the time unit within the module responsible for regulating furnace feed to ensure accurate and consistent operation. This is complete.
- **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 to the Department on or before June 17, 2025, to provide a status update on any TBD items noted in Table 1 below.

- **Corrective action is final or timeline for implementation**

Table 1: Root Causes and Corrective Actions

Event	Root Cause	Corrective Action	Timing
Furnace Stack VE	PRC Trip	Disseminate findings and enhanced training	Q3-2025
		Rectify time unit discrepancy in feed rate control module	Complete
TEGFA/B VE	TBD	TBD	TBD

If you have any questions regarding this matter, please contact Kimberly Kaal at kimberly.kaal@shell.com or myself at James.Howell@shell.com.

Sincerely,

James R. Howell
Production Manager

CC:
Scott Beaudway, Air Quality Specialist
Beth Speicher, Environmental Group Manage

Attachment A

HP Flare GC and Flow Data

Attachment B

Method 22 Observations Form

HP Flare System GC Hourly Average Mol% Compositions, Wt % Compositions, Flow, and NHV

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Date and Time	Elemental Hydrogen % mol	Nitrogen % mol	Methane % mol	Ethane % mol	Acetylene % mol	Ethylene % mol	C3 % mol	C4 % mol	C4 Olefins % mol	C5 % mol	C6+ % mol	1,3-Butadiene* %mol	Benzene* % mol	Elemental Hydrogen % wt	Nitrogen % wt	Methane % wt	Ethane % wt	Acetylene % wt	Ethylene % wt	C3 % wt	C4 % wt	C4 Olefins % wt	C5 % wt	C6+ % wt	1,3-Butadiene* % wt	Benzene* % wt	Actual Flow Rate m3/hr	Flow Density kg/m3	Mass Rate ton/hr	NHVcz Btu/scf
13-Mar-25 11:30:00	25.54	3.08	13.60	19.04	0.21	37.26	0.47	0.07	0.39	0.07	0.27	0.38	0.40	2.52	4.23	10.67	28.03	0.27	51.15	1.02	0.20	1.04	0.25	1.02	1.00	1.51	221,401	1.07	236.46	1,336.28
13-Mar-25 12:30:00	33.82	0.42	5.93	25.88	0.23	32.31	0.56	0.08	0.46	0.07	0.24	0.46	0.32	3.52	0.61	4.90	40.06	0.31	46.66	1.27	0.25	1.28	0.25	0.96	1.29	1.30	215,554	0.92	197.41	1,402.24
13-Mar-25 13:30:00	32.79	0.51	5.55	27.74	0.22	31.81	0.55	0.09	0.43	0.06	0.26	0.42	0.34	3.35	0.73	4.51	42.22	0.29	45.16	1.22	0.26	1.16	0.22	1.01	1.17	1.36	195,262	0.92	178.99	1,407.77
13-Mar-25 14:30:00	31.22	0.71	5.45	26.77	0.17	34.21	0.61	0.09	0.43	0.06	0.28	0.42	0.36	3.12	0.98	4.33	39.88	0.22	47.54	1.33	0.25	1.14	0.23	1.08	1.12	1.38	207,380	0.94	195.25	1,409.49
13-Mar-25 15:30:00	30.37	0.73	5.35	24.38	0.16	37.68	0.53	0.08	0.41	0.06	0.27	0.39	0.36	3.02	1.01	4.22	36.05	0.20	51.97	1.14	0.23	1.08	0.20	1.03	1.00	1.32	210,412	0.95	199.02	1,407.92
13-Mar-25 16:30:00	31.94	0.56	5.53	22.52	0.19	37.88	0.51	0.08	0.44	0.07	0.28	0.43	0.36	3.24	0.78	4.46	34.03	0.25	53.40	1.14	0.22	1.19	0.25	1.10	1.11	1.35	209,343	0.93	193.99	1,404.05
13-Mar-25 17:30:00	30.68	0.70	5.80	23.08	0.21	37.62	1.06	0.07	0.44	0.07	0.27	0.45	0.36	3.06	0.96	4.59	34.23	0.27	52.05	2.31	0.20	1.17	0.24	1.02	1.17	1.36	219,979	0.96	212.21	1,407.81
13-Mar-25 18:30:00	31.83	0.37	5.79	21.89	0.24	38.44	0.54	0.07	0.47	0.07	0.28	0.47	0.36	3.23	0.53	4.67	33.08	0.31	54.18	1.19	0.19	1.27	0.27	1.12	1.24	1.38	212,756	0.95	202.08	1,405.56
13-Mar-25 19:30:00	32.72	0.52	6.13	19.79	0.26	39.09	0.56	0.07	0.49	0.08	0.29	0.48	0.36	3.37	0.74	5.02	30.38	0.34	55.97	1.25	0.20	1.36	0.29	1.17	1.24	1.35	209,027	0.94	197.40	1,397.14
13-Mar-25 20:30:00	32.88	0.59	6.31	19.33	0.27	39.12	0.55	0.07	0.51	0.08	0.29	0.50	0.36	3.40	0.85	5.18	29.77	0.36	56.20	1.25	0.20	1.41	0.30	1.17	1.34	1.38	208,654	0.94	196.85	1,394.80
13-Mar-25 21:30:00	33.13	0.59	6.36	19.10	0.28	39.04	0.54	0.06	0.51	0.08	0.30	0.51	0.36	3.44	0.85	5.25	29.53	0.37	56.30	1.22	0.19	1.41	0.31	1.20	1.36	1.39	209,721	0.95	198.21	1,393.23
13-Mar-25 22:30:00	33.82	0.56	6.49	19.29	0.29	38.03	0.55	0.06	0.52	0.08	0.30	0.52	0.36	3.55	0.82	5.41	30.13	0.39	55.40	1.25	0.19	1.45	0.31	1.23	1.43	1.44	195,062	0.93	182.22	1,391.41
13-Mar-25 23:30:00	35.81	0.47	6.80	20.13	0.30	34.96	0.55	0.06	0.52	0.09	0.30	0.52	0.36	3.86	0.71	5.82	32.32	0.41	52.36	1.30	0.20	1.50	0.34	1.26	1.48	1.47	186,165	0.91	169.53	1,387.08
14-Mar-25 00:30:00	35.47	0.47	6.76	21.45	0.31	33.87	1.11	0.05	0.44	0.03	0.03	0.46	0.36	3.83	0.70	5.79	34.45	0.43	50.74	2.62	0.16	1.27	0.13	0.13	1.30	1.48	219,020	0.88	192.66	1,382.09
14-Mar-25 01:30:00	35.37	0.55	7.94	23.40	0.08	30.61	0.98	0.11	0.89	0.03	0.05	0.72	0.08	3.83	0.83	6.83	37.74	0.11	46.05	2.31	0.34	2.57	0.12	0.23	2.06	0.33	202,521	0.86	174.50	1,381.62
14-Mar-25 02:30:00	38.59	0.47	7.64	18.75	0.00	32.71	0.80	0.10	0.87	0.00	0.07	0.71	0.10	4.36	0.73	6.86	31.56	0.00	51.37	1.96	0.34	2.62	0.00	0.32	2.04	0.41	194,848	0.82	160.70	1,371.19
14-Mar-25 03:30:00	38.59	0.47	7.64	18.75	0.00	32.71	0.80	0.10	0.87	0.00	0.07	0.37	0.10	4.36	0.73	6.86	31.56	0.00	51.37	1.97	0.34	2.62	0.00	0.32	1.17	0.46	174,031	0.82	141.80	1,371.19
14-Mar-25 04:30:00	20.57	44.46	4.45	8.31	0.00	21.09	0.43	0.06	0.49	0.05	0.10	0.91	0.20	1.85	55.41	3.18	11.12	0.00	26.32	0.84	0.15	1.17	0.16	0.34	2.80	0.89	187,848	1.04	157.68	777.56
14-Mar-25 05:30:00	38.32	0.76	8.31	15.10	0.00	36.65	0.33	0.04	0.33	0.04	0.12	0.27	0.10	4.53	1.25	7.80	26.56	0.00	60.13	0.84	0.13	1.04	0.17	0.55	0.90	0.48	176,459	0.78	138.82	1,342.71
14-Mar-25 06:30:00	48.78	1.33	12.21	5.46	0.00	29.48	1.24	0.13	1.09	0.09	0.20	0.48	0.10	6.56	2.47	13.05	10.94	0.00	55.09	3.65	0.50	3.95	0.42	1.02	1.89	0.57	144,093	0.68	97.88	1,311.09
14-Mar-25 07:30:00	51.47	1.36	12.46	5.00	0.00	27.14	1.10	0.14	1.04	0.09	0.20	0.77	0.34	7.76	2.84	14.93	11.21	0.00	56.85	3.63	0.59	4.19	0.49	1.16	3.84	2.46	112,769	0.62	75.78	1,283.85
14-Mar-25 08:30:00	47.24	0.58	9.06	26.16	0.06	15.15	0.54	0.10	0.67	0.13	0.31	0.68	0.34	7.08	1.21	10.78	58.34	0.11	31.51	1.78	0.42	2.67	0.67	1.78	2.49	1.79	141,950	0.62	96.75	1,310.22
14-Mar-25 09:30:00	60.74	0.95	12.17	11.33	0.05	13.57	0.42	0.07	0.51	0.08	0.12	0.55	0.34	10.85	2.35	17.27	30.14	0.13	33.68	1.63	0.34	2.45	0.49	0.82	2.29	2.03	149,076	0.51	88.87	1,265.34
14-Mar-25 10:30:00	63.59	0.95	12.27	6.33	0.05	16.52	0.08	0.02	0.14	0.00	0.05	0.16	0.08	12.61	2.62	19.33	18.68	0.13	45.48	0.34	0.10	0.75	0.03	0.37	0.62	0.44	127,260	0.46	58.31	1,238.86
14-Mar-25 11:30:00	72.65	1.16	13.84	2.24	0.01	10.02	0.01	0.00	0.05	0.00	0.02	0.00	0.08	19.54	4.34	29.56	8.96	0.04	37.44	0.05	0.04	0.35	0.00	0.17	0.01	0.62	102,230	0.34	34.80	1,195.30
14-Mar-25 12:30:00	80.46	1.30	14.58	0.69	0.00	2.90	0.01	0.01	0.05	0.00	0.00	0.00	0.01	30.66	6.85	44.12	3.92	0.00	15.36	0.10	0.06	0.49	0.00	0.00	0.00	0.05	104,218	0.24	24.56	1,166.53
14-Mar-25 13:30:00	65.09	2.93	27.86	1.41	0.00	2.43	0.06	0.02	0.11	0.08	0.00	0.01	0.01	16.84	10.52	57.22	5.45	0.00	8.74	0.36	0.14	0.77	0.71	0.02	0.04	0.04	39,144	0.33	11.66	1,109.43
14-Mar-25 14:30:00	43.88	15.65	30.84	2.89	0.01	5.43	0.10	0.06	0.65	0.49	0.02	0.05	0.01	6.69	33.09	37.35	6.56	0.01	11.49	0.32	0.25	2.67	2.66	0.11	0.19	0.03	10,178	0.57	6.63	984.78

*New GC data

Constants

Property	Hydrogen (H2)	Nitrogen (N2)	Methane (CH4)	Ethane (C2H6)	Acetylene (C2H2)	Ethylene (C2H4)	C3	C4	C4 Olefins	C5	C6+	1,3-Butadiene	Benzene
MW (lb/lb-mol)	2.02	28.01	16.04	30.07	26.04	28.05	44.1	58.12	54.09	72.15	78.11	54.09	78.11

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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):	3/13/25 8:30	
Sky Conditions:	Clear	
Precipitation:	None	
Wind Direction (direction from):	N	0.1
Wind Speed (m/s):	0.13	
	Site MET Data (Wind Direction 500QT-060A and Speed 500QT-050A)	
Visible Emissions Source:	High Pressure Ground Flare B (A-59001B)	
Observation Location:	O (HPEF)	
Observation Picture:		

Observations

		Clock Time	Observation Period (when you are actually looking at stack)	Emissions Observed (when you actually see smoke)
Begin	3/13/2025 8:30	8:30		0:00:00
			15 minute intervals	0:00:00
				0:00:00
				0:00:00
				0:00:00
				0:00:00
				0:00:00
				0:00:00
				0:00:00
End	3/13/2025 11:05	11:05		0:00:00
Compliant? (Y/N)		Y	**Y**	

General Notes

Short flaring event, no smoke observed after event.