



Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

March 15, 2023

Mark Gorog P.E., Regional Manager Air Quality Program
Pennsylvania Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: PA-04-00740C Ethane Cracking Unit (Source ID 201) Cracked Gas Compressor Upset Event and High-Pressure (HP) Header System (Source ID 205) Excess Emission Report

Dear Mr. Gorog,

Shell Chemical Appalachia LLC (“Shell”) is submitting this Malfunction Report to the Pennsylvania Department of Environmental Protection (PADEP) for excess flaring and visible emissions at the high-pressure (HP) flares due to a process upset in the Ethane Cracking Unit (ECU).

- **Name and location of the facility**

Shell Polymers Monaca
300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**

During a process unit upset on February 13, 2023, process flows from the ECU were diverted to the HP flare system to safely control emissions until the ECU recovered and was returned to on specification ethylene on February 18, 2023. Flaring at the HP Elevated Flare (Source ID 205C) occurred from approximately 15:26 to 18:13 and excess emissions were combusted at the HP Ground Flare (Source ID 205B) until the end of the event and successful restart of the ECU and Polyethylene Units (PE1 and PE2).

- **Time when the incident was first observed, and duration of excess emissions**

Excess emission from ECU upset event occurred beginning on February 13, 2023, at approximately 15:26 and ending with the successful restart and re-establishing on specification ethylene and tail gas removal from the flare at approximately 03:15 on February 18, 2023. Calculated excess emissions also includes an attempted restart of the ECU on February 15, 2023.

The visible emissions from HP header system, elevated flare, occurred to varying degrees between 15:26 and 18:13 for an estimated two hours and forty-five minutes on February 13, 2023. Visible emissions were documented by direct Method 22 monitoring and review of flare video after the event. As noted above, an ongoing investigation of the elevated flare tip steam supply pressure and availability is underway.

- **The calculations that were used to determine excess emissions**

Estimated emissions from the flaring vent gas combustion were based on measured flow rates, measured vent gas compositions and engineering material balance, and application of expected or tested hydrocarbon destruction efficiencies, and the application of emission factors for products of combustion. Estimated emissions from the elevated flare liquid seal release were calculated based on application of the heat release at the flare tip to the mass and heat of vaporization of ethylene glycol through the combustion zone during the event.

- **Estimated rate of excess emissions**

Preliminary total estimated excess emissions for this event have been calculated as:

CO₂e: 7,070.09 tons
CO: 16.91 tons
NO_x: 4.12 tons
SO₂: 0.00 tons
PM(filt): 0.11 tons
PM₁₀: 0.45
PM_{2.5}: 0.45
VOC: 6.41 tons
HAP: 0.17 tons

- **Steps taken to limit duration and/or quantity of excess emissions**

Emissions were reduced by safely flaring the upset event emissions in the HP flares. In addition, the restart of the ECU starting on February 17, 2023 quickly brought the unit back up to on specification thereby reducing the amount of flaring emissions and a substantial improvement on previous restarts of the ECU. Improvement learnings and additional flare reduction opportunities will be utilized in the operations going forward to support flare minimization.

- **Root cause of the malfunction and steps taken to reduce the likelihood of recurrence**

Based on the incident investigation, it was determined that the Cracked Gas Compressor slowed to minimum governor speed resulting in ECU feed unable to progress forward into the unit and the eventual upset and flaring in ECU followed the PE1 and PE2 units shutting down. A reduction of communication capacity in the

primary data control system due to heavy network looping activity led to the Cracked

Gas Compressor redundant local control system going to minimum governor speed due to an error in the control logic for this equipment. The control logic switch error has since been corrected and an audit of similar logic controls in other areas was actioned.

At the time of the HP flare event, only one HP Ground Flare (Source ID 205B) was being operated. HP Ground Flare, Source ID 205A, was out of service for inspection and maintenance of internal refractory material. Shortly into the HP flare event, vent gas pressure exceeded the designed backpressure of the liquid seal in the flare seal drum (V-59003). This caused the liquid seal mixture of ethylene glycol and water to be pushed by the vent gas to the elevated flare at approximately 15:38.

When the HP flare event occurred, the elevated flare flame varied from being smokeless to having visible emissions. Initial investigation indicated a steam supply pressure to the flare tip correlation to flare visible emissions as well as fuel supply pressure trips with the HRSG units as factors contributing to visible emissions during this event.

- **Corrective actions underway**

Further investigation regarding the elevated flare tip steam supply pressure / availability and the flare seal drum issue are underway and additional information will be provided once available.

- **Additional information**

Onsite and offsite air monitoring on February 13, 2023 did not detect compounds of concern at the fence line related to this event or during offsite monitoring by a contractor downwind at the time. Based on this monitoring data, Shell does not believe the event referenced above posed an imminent or substantial danger to the public health and safety or environment.

If you have any questions regarding this matter, please contact me at (724) 709-2467 or at kimberly.kaal@shell.com.

Sincerely,

Kimberly J. Kaal

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:
Beth Speicher, District Supervisor
Scott Beudway, Air Quality Specialist