



Shell Chemical Appalachia LLC  
300 Frankfort Rd  
Monaca, PA 15061

October 7, 2022

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-04-00740A & C Source IDs 201 Ethylene Manufacturing Line and 205 High Pressure (HP) Header System Excess Emissions Malfunction Report– Ethylene Refrigeration Compressor Trip / V-19031 Inlet Flange Leak**

Dear Mr. Gorog,

Shell Chemical Appalachia LLC (“Shell”) is submitting this malfunction report to the Pennsylvania Department of Environmental Protection (PADEP) for an Ethylene Refrigeration Compressor (ERC) trip and vapor leak that developed on the ethane cracking unit (ECU) cold flare drum (V-19031) inlet nozzle flange that occurred starting on September 8, 2022.

- **Name and location of the facility**

Shell Polymers Monaca  
300 Frankfort Road, Monaca PA, 15061

- **Nature and cause of the incident**

On September 8, 2022 at approximately 23:55 Shell was bringing feed into the C2 Splitter for the first time per the start-up and commissioning procedures. Start-up of the C2 splitter was progressing when the Ethylene Refrigeration Compressor (ERC) tripped on a high dew point temperature setting (144KS370) in this unit. The unit safety systems worked as designed, the automatic isolations worked correctly, and the unit was isolated. Operations took immediate actions to depressurize equipment including the discharge of the Cracked Gas Compressor and to route the process hydrocarbons to the HP Header System. Due to the sudden nature of the trip, some hydrocarbons went to the HP Elevated Flare (HPEF) for several minutes to control the resulting emissions. Related to the automatic shutdown, extremely cold hydrocarbon liquid and vapor entered the cold flare drum (V-19031) in the ECU unit under the process conditions for first time. That same night, Operations noted ice forming on the inlet flange of the cold flare drum during visual inspection of lines indicating a small hydrocarbon vapor leak had occurred. A leak review meeting was held per policy, and it was determined to be safe to attempt a direct repair of the flange leak by increasing torque on the flange bolts above the original installed values for this flange at installation. Scaffold was required to be erected to access the overhead flange and attempt the repair.

The cause of the original ERC trip was due to an elevated dew point reading experienced during the initial start-up of the unit meant to protect other downstream

process units. Start-up procedures were reviewed by Operations to avoid future trips.

Once a cause was determined for the cold drum inlet flange leak and a solution was identified to prevent further leakage at the cold drum inlet flange; maintenance erected scaffold and executed the increased torque recommendations to tighten the flange bolts further which was successful in stopping the leak. Operating furnaces at the time automatically turned down feed rates to minimize emissions during this event. The HP flares worked as designed to control resulting emissions from isolating and depressurizing the unit.

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

The trip occurred on September 8, 2022 beginning at approximately 23:55 and the related flange leak on the vessel inlet nozzle was repaired by 00:20 on September 10, 2022. The ECU was restarted upon repair of the flange leak.
- **Estimated rate of excess emissions**
  - The incident resulted in use of the HPEF for approximately 9 minutes. Direct Method 22 observations were not performed at night. Flare camera the duration of HPEF use and resulting visible emissions.
  - Estimated direct emissions from flange leak as calculated with the leak estimation tool for a line leak, estimation method 1:
    - VOC: 0.11 tons
    - HAP (1,3 Butadiene): 0.002 tons
    - CH4: 0.01 tons
    - CO2e: 0.31 tons
  - Preliminary estimated excess emissions flared at the HP flares until the ERC was restarted after the flange was repaired. Note, this estimate does not account for emissions associated with ECU repeated start-up steps to get back to the original ECU start-up progression:
    - VOC: 33.74 tons
    - HAP: 0.32 tons
    - NOx: 11.80 tons
    - CO: 49.09 tons
    - PM10: 1.29 tons
    - PM2.5: 1.29 tons
    - CO2e: 21,782 tons

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*

Kimberly Kaal  
Environmental Manager, Attorney-in-Fact

CC:

Scott Beudway, Air Quality Specialist  
Anna Hensel, District Supervisor