



Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

October 21, 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 – Acetylene Reactor Unit Trip

Dear Mr. Gorog,

Shell Chemical Appalachia LLC (“Shell”) is submitting this Malfunction Report to the Pennsylvania Department of Environmental Protection (PADEP) relating to excess emissions to the HP Flares following a level transmitter trip of the Acetylene (AC) Reactor on September 21, 2022.

- **Name and location of the facility**
Shell Polymers Monaca
300 Frankfort Road, Monaca PA, 15061
- **Nature and cause of the incident**

On September 21, 2022 during commissioning activities, Shell experienced a trip of the AC Reactor at approximately 02:01 that paused the start-up of the ECU. Feed was going into the ECU in accordance with start-up procedures. Prior to the trip of the AC Reactor, operations noted the AC Reactor outlet temperature increasing as well as the methanol cooling system drum pressure. Operations took appropriate actions to reduce the AC Reactor’s inlet temperature to maintain/decrease the temperature of the reactor’s methanol cooling bath. The process design uses a nitrogen gas and ejector system to maintain the methanol cooling system pressure at a steady level to control and maintain safe temperatures in the AC Reactor. At approximately 02:01 the reactor tripped on “fail state” readings when the methanol drum level transmitters read high methanol levels in the drum. The safety shutdown system applies 2 out of 3 voting as part of the safety shutdown system logic. The trip of the AC Reactor resulted in feed being sent to the HP Header System to be controlled at the HP Ground Flares and HP Elevated Flare.

While the unit’s methanol cooling safety controls shut down the AC Reactor as designed, the operational issues noted before the malfunction were reviewed to find a cause and to make any necessary changes. After troubleshooting the malfunction and operational conditions leading up to the trip, it was determined that the likely cause of the pressure swings in the methanol system were due to unsteady amounts of non-condensable gases in the methanol drum vapor space. Operating adjustments were made to the nitrogen ejector system to allow for more steady operation of the methanol cooling system for the AC Reactor.

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

The incident occurred on September 21, 2022, beginning at 02:01 and concluded when the unit was ready to restart the evening of September 22, 2022 at 10:15, lasting approximately 32.23 hours.

Emissions were reduced by quickly trouble shooting the cause of the AC Reactor trip and operational issues with the methanol cooling system, making necessary adjustments to the pressure control system, and maintaining furnace feed at minimal levels to proceed with restarting the units when ready. Since implementing the corrective actions, operations have restarted the AC Reactor successfully without significant further control oscillations.

Estimated rate of excess emissions

- The incident resulted in use of the HP elevated flare for approximately 8 minutes with visible emissions noted from the high-pressure elevated flare for approximately 7.5 minutes upon review of the flare video footage. Method 22 observations were not attempted due to the short duration of the flaring event and that it occurred at night.
- The following emissions are the preliminary estimated excess emissions flared at the HP Flares during this event until the restart of the AC Reactor. 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. Emission estimates are based on the HP header vent gas flow meter readings and gas chromatograph composition data at the time:
 - VOC: 31.14 tons
 - HAP: 0.27 tons
 - NOx: 9.94 tons
 - CO: 41.26 tons
 - SO2: 0.0 tons
 - PM10/2.5: 1.09 tons
 - CO2e: 18,380.3 tons

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

Sincerely,

Kimberly Kaal

Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:

Scott Beudway, Air Quality Specialist
Anna Hensel, District Supervisor