Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

August 8, 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-04-00740C Source ID 204 Low Pressure (LP) Header System Visible Emissions Malfunction and Notice of Violation (NOV) Final Report

Dear Mr. Gorog,

Shell Chemical Appalachia LLC ("Shell") is submitting this final (follow up) malfunction report to the Pennsylvania Department of Environmental Protection (PADEP) for visible emissions from the multipoint ground flare (MPGF) [1] on June 23, 2022. This letter is also being sent in response to the NOV letter for visible emissions exceedance dated July 21, 2022.

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

- **Nature and cause of the incident**
  On June 23 a butene railcar was being offloaded to the butene storage vessel in order to fill it prior to facility startup. At 13:30, following line-purging with nitrogen, this railcar was being depressured to the LP Header System. Butene remaining in this railcar was heard flowing out through the line and action was taken to close the valve and re-isolate the railcar. At 13:32 the continuous vent thermal oxidizer (CVTO)[2] tripped offline due to a high temperature spike in the combustion zone. Vent gas was rerouted to the MPGF.

  At 13:35 visible emissions were observed at the MPGF coming up over the heat shield wall in a generally south-southwest direction towards the interior of the facility. Visible emissions were black and nearly continuous for approximately 11 minutes until 13:46. Corrective action included Operations taking manual control of the MPGF assist air fans and increasing fan speed to eliminate the visible emissions.

  At 13:45 the CVTO burner was restored and began ramping up temperature to reach the minimum setpoint before switching back over to the CVTO. Setpoint temperature was reached on June 24 at ~3:35 at which time vent gas flow was switched back to the

[1] Identified as the LP Multipoint Ground Flare (MPGF), Control ID C204B in PA-04-00740C, and part of the LP Header System.
[2] Identified as the LP Incinerator, Control ID C204A in PA-04-00740C, and part of the LP Header System.

CVTO and the MPGF was isolated.

- **Cause and Corrective actions**
  Cause 1 (Air Assist Fan) – The MPGF air assist blower did not provide sufficient perimeter air to prevent visible emissions.

  Cause 1 Corrective Action(s) – Operations was notified of visible emissions from the MPGF within minutes from on the ground observations, and monitored from cameras displaying in the control room. Quick action by the console operator to take manual control of the blower and increase speed minimized the duration of visible emissions from the MPGF. Communications and work processes functioned as-intended to take corrective actions in a timely manner.

  MPGF blower speed control has been updated with smooth ramping from minimum speed to maximum speed. The speed setpoint is still based on flare flow and net heating value and follows the curve provided by the flare vendor. However, the discrete steps have been removed and replaced with continuous speed control. Two additional handles have been added - gain and bias. The speed setpoint is referenced from the curve and then calculated as (referenced_speed) * (gain) + (bias). These long term improvements will increase the blower responsiveness and reduce the likelihood of future visible emissions from incidents.

  Cause 2 (Butene Railcar Depressure) – The butene railcar was not empty when it was depressured to the LP Header System. Multiple trips of the unloading sequence after sustained unloading of butene led Operations to believe the unload was complete and the railcar was empty. DCS trends have been analyzed and confirmed that multiple trips of the unloading sequence were caused by a flow transmitter. A five-second bad signal / trip delay had been implemented but all trips occurred after five seconds elapsed.

  Cause 2 Corrective Action – The operations team unloading the railcar quickly identified an abnormal situation upon depressurizing the railcar which was not empty and took action to manually close the valve, and re-isolate the railcar. This minimized the amount of butene sent to the MPGF and minimized duration and impact of the event.

  The flow transmitter has been evaluated and time delay on the trip for the unloading sequence has been extended from five (5) to sixty (60) seconds . Multiple butene unloading sequences have been completed since this event without incident.

  Unload procedures have been reviewed and updated to include:
  - Criteria for determining if a railcar is ‘empty’ (e.g. density, totalizer, flowrate, etc.)
  - Additional steps for de-pressuring a railcar that is suspected to have a residual heel (e.g. cracking the valve, continuous comms with console for feedback on temp, etc.)
  - A precaution in the procedure regarding what is meant by “slowly” opening the flow / “cracking” open the valve for de-pressuring a railcar post-unload.

- **Time when the incident was first observed, and duration of excess emissions**
  June 23, 2022 at 13:35 for 11 minutes until 13:46 for visible emissions, and for 14 hours

until June 24 at 3:35 for use of the MPGF until the CVTO was restored.

- **Final emissions and calculations (See Attachment 1)**

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 Beaudway, Air Quality Specialist
Anna Fabrizi, District Supervisor

Attachment 1 - Emission Calculations				
Emission Unit(s) ID	=	***204, C204B***		***Multipoint Ground Flare***
Parameter		***Value***		***Source / Basis***
Calculation Inputs:				
Heat Input [HHV]	=	150.9	MMBtu	Measured and calculated heat input June 23 13:30 to June 24 03:35
Material Flow	=	5903.1	lbs	Measured and calculated total input June 23 13:30 to June 24 03:35
CH4 Input	=	5033.8	lbs	Measured and calculated CH4 June 23 13:30 to June 24 03:35
C3- VOC Input	=	14.5	lbs	Measured and calculated C3- VOC June 23 13:30 to June 24 03:35
C4+ VOC Input	=	894.5	lbs	Measured and calculated C4+ VOC June 23 13:30 to June 24 03:35
Carbon %	=	74.1	wt %	Measured carbon content June 23 13:30 to June 24 03:35
Sulfur %	=	0.0000	wt %	Measured sulfur content June 23 13:30 to June 24 03:35
PM (filterable) EF	=	0.0019	lb/MMBtu	AP-42, 1.4-2 (filterable only)
PM10 EF	=	0.0075	lb/MMBtu	AP-42, 1.4-2
PM2.5 EF	=	0.0075	lb/MMBtu	AP-42, 1.4-2
C3- DRE	=	99.00000	%	Light hydrocarbon destruction efficiency consistent with TCEQ guidance
C4+ DRE	=	98.00000	%	Heavy hydrocarbon destruction efficiency consistent with TCEQ guidance
NOx EF	=	0.06800	lb/MMBtu	AP-42, 13.5-1
CO EF	=	0.31000	lb/MMBtu	AP-42, 13.5-2
N2O EF	=	1.3E-03	lb/MMBtu	40 CFR 98, Table C-2; EF for fuel gas.
H2SO4 Ratio	=	4.0E-02	SO3/SO2	AP-42, Table 1.3-1; estimated based on SO3-to-SO2 emissions ratio for distillate oil.
HAP EF	=	1.9E-03	lb/MMBtu	AP-42, 1.4-3
MW C	=	1.2E+01	lb/lb-mol	Constant
MW CO2	=	4.4E+01	lb/lb-mol	Constant
MW S	=	3.2E+01	lb/lb-mol	Constant
MW SO2	=	6.4E+01	lb/lb-mol	Constant
Total Hours	=	14	hr	June 23 13:30 to June 24 03:35
Emissions Calculations:				
PM (filterable) Emissions	=	0.28	lb	= (Heat Input [HHV]) x (PM (filterable) EF)
PM10 Emissions	=	1.12	lb	= (Heat Input [HHV]) x (PM10 EF)
PM2.5 Emissions	=	1.12	lb	= (Heat Input [HHV]) x (PM2.5 EF)
VOC Emissions	=	18.04	lb	= (C3- VOC Input) x (100 - C3- DRE)/100 + (C4+ VOC Input) x (100 - C4+ DRE)/100
NOx Emissions	=	10.3	lb	= (Heat Input [HHV]) x (NOx EF)
SO2 Emissions	=	0.00	lb	= (Material Flow) x (Sulfur %) x (MW SO2) / (MW S)
CO Emissions	=	46.8	lb	= (Heat Input [HHV]) x (CO EF)
CO2 Emissions	=	16,038	lb	= (Material Flow) x (Carbon %) x (MW CO2) / (MW C)
N2O Emissions	=	0.20	lb	= (Heat Input [HHV]) x (N2O EF)
CH4 Emissions	=	50.34	lb	= (CH4 Input) x (100 - C3- DRE)/100
H2SO4 Emissions	=	0.00	lb	= (SO2 Emissions) x (H2SO4 Ratio)
HAP Emissions	=	0.28	lb	= (Heat Input [HHV]) x (HAP EF)
CO2e Emissions	=	17,356	lb	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs of 298 and 25.