



Shell Chemical Appalachia LLC  
300 Frankfort Rd  
Monaca, PA 15061

April 11, 2023

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 Ethylene Manufacturing Unit (Source ID 201) Cracked Gas Compressor (CGC) Flaring Event and High-Pressure (HP) Header System (Source ID 205) Excess Emission Malfunction Report**

Dear Mr. Gorog,

Shell Chemical Appalachia LLC (“Shell”) is submitting this Malfunction Report to the Pennsylvania Department of Environmental Protection (PADEP) for excess emissions from flaring Ethane Cracking Unit (ECU) process gas to stabilize unit operations.

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**

At approximately 16:00 on 3/14/23, the pressure indication on the ECU spent caustic stripper, C-13501, began to rise. Approximately two and half hours later levels began to climb in the ECU quench tower. At approximately 21:22 PM the level in several Cracked Gas Compressor (CGC) knock out drums began to rise. The ECU CGC then tripped following a high level in the 3rd stage compressor knock out drum at approximately 21:50. The immediate shutoff of the CGC resulted in process gases being routed to the HP flare system for destruction.

- **Time when the malfunction or breakdown was first observed**  
March 14, 2023 at 21:50
- **The date and time that the malfunction started and ended**  
March 14, 2023 beginning at 21:50 and ending on March 17, 2023 at 15:30
- **An estimate of the emissions associated with the malfunction**

Pollutant	Emission Rate (tons)
NOx	2.065

CO	8.366
PM (filt)	0.057
PM10	0.226
PM2.5	0.226
CO2e	3,269.4
VOC	2.7
HAP (Total)	0.081

- **The calculations that were used to determine that quantity**

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. See attached representative GC analysis used for these calculations.

- **The steps, if any, that the facility took to limit the duration and/or quantity of emissions associated with the malfunction**

Furnace feed was immediately reduced, and then backed out completely to stabilize unit operations and cease flaring.

- **A detailed analysis that sets forth the Root Cause of the malfunction, to the extent determinable**

There are two level indications on the Gasoline/Water separator: one “narrow range” and one “wide range” indicator. The narrow indicator is designed and properly calibrated to detect water and the wide level indicator utilizes a Guided Wave Radar (GWR) technology and is specifically calibrated to detect hydrocarbons. While guided wave radar works in many conditions, during the day of the event there was presence of an emulsified type of material that the GWR probe is not suitable to detect causing erroneous level readings in the separator. This resulted in gasoline navigation back to the top of the quench tower, resulting in elevated C4+ hydrocarbons reading in the first stage of suction of the CGC causing the CGC to trip.

- **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**

To prevent re-occurrence of an identical incident in the future, Shell will implement the following corrective actions:

- 1) Train operators on updated control strategy for the "wide" range indication of the Gasoline/Water separator -hydrocarbon service - (i.e. operating at set point of 25%) so both level instruments are in range on the gasoline chamber.
- 2) Update the ECU spent caustic stripper (C-13501) high pressure alarm to state that elevated C-13501 pressure could be a result of elevated level in the Gasoline/Water separator and thus the separator level should be validated and lowered if needed.

- **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**

Investigation is complete and no follow-up report is planned to be submitted

- **Corrective action is final or timeline for implementation**
  - Corrective action #1 - The operators will be trained on updated control strategy and the ECU spent caustic stripper HP alarm by April 21 2023
  - Corrective action #2 - expected to be completed by 04/21/2023.

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 J. Kaal*

Kimberly Kaal  
Environmental Manager, Attorney-in-Fact

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

**Attachment A**  
**GC Analysis**

**GC Analysis During Malfunction**

Date/Starttime	Elemental Hydrogen % mol	Nitrogen % mol	Methane % mol	Ethane % mol	Acetylene % mol	Ethylene % mol	C3 % mol	C4 % mol	C4 Olefins % mol	C5 % mol	C6+ % mol	Total % mol
14-Mar-23 21:00:00	43.229	18.826	34.056	1.186	0.000	2.623	0.028	0.012	0.001	0.000	0.041	100.000
14-Mar-23 22:00:00	36.369	2.029	9.489	19.694	0.219	31.162	0.439	0.014	0.448	0.092	0.046	100.000
14-Mar-23 23:00:00	30.766	8.462	8.332	16.084	0.450	34.846	0.437	0.017	0.491	0.073	0.042	100.000
15-Mar-23 00:00:00	9.064	18.834	13.805	23.268	0.207	32.932	1.691	0.020	0.144	0.000	0.037	100.000
15-Mar-23 01:00:00	12.568	30.125	38.854	4.912	0.341	12.515	0.306	0.022	0.259	0.066	0.032	100.000
16-Mar-23 07:00:00	0.641	18.239	75.264	4.028	0.006	1.565	0.067	0.026	0.109	0.035	0.019	100.000
16-Mar-23 08:00:00	0.681	17.103	76.708	3.680	0.006	1.552	0.067	0.031	0.115	0.040	0.018	100.000
16-Mar-23 09:00:00	0.720	19.552	74.313	3.544	0.008	1.542	0.067	0.037	0.141	0.060	0.017	100.000
16-Mar-23 10:00:00	0.281	12.209	78.955	4.214	0.000	4.168	0.066	0.043	0.049	0.000	0.016	100.000
16-Mar-23 11:00:00	5.235	8.592	60.364	17.073	0.033	8.264	0.197	0.049	0.164	0.016	0.014	100.000
16-Mar-23 12:00:00	1.808	12.490	53.310	28.589	0.013	3.398	0.183	0.055	0.111	0.029	0.013	100.000
16-Mar-23 13:00:00	12.146	12.879	46.491	13.488	0.147	13.949	0.261	0.061	0.419	0.115	0.043	100.000
16-Mar-23 14:00:00	27.436	4.378	28.607	12.835	0.360	25.277	0.328	0.112	0.497	0.143	0.028	100.000
16-Mar-23 15:00:00	33.519	1.772	12.430	18.046	0.336	32.071	1.173	0.142	0.444	0.044	0.024	100.000
16-Mar-23 16:00:00	36.805	0.883	8.691	20.996	0.281	31.440	0.465	0.124	0.263	0.032	0.020	100.000
16-Mar-23 17:00:00	34.960	0.795	8.125	23.639	0.216	31.154	0.621	0.106	0.340	0.028	0.016	100.000
16-Mar-23 18:00:00	34.414	2.337	8.216	22.631	0.015	30.895	0.858	0.088	0.511	0.023	0.012	100.000
16-Mar-23 19:00:00	33.760	3.466	7.944	20.546	0.000	33.116	0.709	0.067	0.367	0.018	0.008	100.000
16-Mar-23 20:00:00	40.290	2.372	9.095	16.876	0.000	30.240	0.592	0.042	0.476	0.014	0.004	100.000
16-Mar-23 21:00:00	67.800	2.823	10.597	4.497	0.000	13.715	0.305	0.049	0.197	0.009	0.009	100.000
16-Mar-23 22:00:00	69.455	3.697	11.830	2.542	0.000	11.122	0.647	0.109	0.560	0.004	0.033	100.000
16-Mar-23 23:00:00	73.510	3.149	11.719	1.346	0.000	8.878	0.554	0.141	0.640	0.005	0.057	100.000
17-Mar-23 00:00:00	64.434	12.775	14.325	0.990	0.000	6.088	0.436	0.152	0.675	0.044	0.081	100.000
17-Mar-23 01:00:00	35.374	23.655	32.504	1.819	0.000	2.956	1.320	0.296	1.809	0.178	0.089	100.000
17-Mar-23 02:00:00	46.467	12.349	34.256	1.614	0.000	4.494	0.209	0.079	0.426	0.025	0.082	100.000
17-Mar-23 03:00:00	43.586	11.595	39.055	1.689	0.000	3.556	0.087	0.041	0.314	0.004	0.075	100.000
17-Mar-23 04:00:00	40.849	18.483	35.995	1.545	0.000	2.666	0.084	0.044	0.257	0.009	0.068	100.000
17-Mar-23 05:00:00	38.267	21.297	36.063	1.575	0.000	2.392	0.074	0.047	0.210	0.014	0.061	100.000
17-Mar-23 06:00:00	43.542	12.429	39.551	1.706	0.000	2.432	0.064	0.050	0.154	0.019	0.054	100.000
17-Mar-23 07:00:00	39.472	20.520	35.853	1.523	0.000	2.303	0.054	0.053	0.150	0.024	0.047	100.000
17-Mar-23 08:00:00	45.332	11.615	38.088	1.727	0.001	2.589	0.190	0.083	0.287	0.049	0.041	100.000
17-Mar-23 09:00:00	44.630	9.875	40.406	1.881	0.000	2.532	0.260	0.182	0.187	0.010	0.035	100.000
17-Mar-23 10:00:00	45.234	9.110	40.131	1.891	0.000	2.883	0.311	0.225	0.184	0.000	0.032	100.000
17-Mar-23 11:00:00	44.617	9.349	40.283	1.935	0.000	2.985	0.379	0.227	0.198	0.000	0.028	100.000
17-Mar-23 12:00:00	45.110	9.422	39.811	1.985	0.000	2.642	0.564	0.213	0.229	0.000	0.024	100.000
17-Mar-23 13:00:00	40.354	11.855	35.406	1.862	0.000	9.436	0.660	0.186	0.223	0.000	0.020	100.000
17-Mar-23 14:00:00	43.160	11.378	34.075	1.866	0.000	8.440	0.640	0.194	0.230	0.000	0.016	100.000
17-Mar-23 15:00:00	55.648	12.128	24.723	1.546	0.000	4.613	0.821	0.184	0.325	0.000	0.012	100.000