



Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

August 2, 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 Ethane Cracking Furnace #5 (Source ID 035) NOx Excess Emissions
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 Ethane Cracking Furnace #5 on July 3, 2023.

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**
On July 3, 2023, beginning at 04:00, Ethane Cracking Furnace #5 stack’s NOx emissions exceeded the permit limit of 6.20 lb/hr while in hot steam standby mode for approximately 1 hour. Note that the 04:00 exceedance represented the previous hour average, so 03:00-04:00.

Furnace #5 was in the initial phase of the transition from hot steam standby mode to feed in mode, resulting in an increase in stack NOx levels; however, the ammonia injection flow control valve did not respond to lower the NOx due to the controller being in “manual” mode versus “control” mode. Prior to the lb/hr exceedance, the console operator manually increased the ammonia flow in response to spikes in the stack NOx ppm concentration, but the response of the system was not quick enough to avoid exceeding the permit lb/hr limit.
- **Time when the malfunction or breakdown was first observed**
July 3, 2023 at 03:00
- **The date and time that the malfunction started and ended**
Started on July 3, 2023 at 03:00 and ended on July 3, 2023 at 04:00
- **An estimate of the emissions associated with the malfunction**
3.02 lb of excess NOx emissions over the duration of the event
- **The calculations that were used to determine that quantity**
The calculation is based on the ECU Furnace #5 CEMS analyzer readings over the period of the malfunction window.

NOx (mass) excess emissions were calculated as follows: (Sum NOx lb/hr emission rates for each hour exceeding 6.20 lb/hr) minus (NOx permit limit of 6.20 lb/hr) times (Total number of hours exceeding 6.20 lb/hr)

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

Once Furnace #5 stack NOx levels were noted to spike, ammonia flow was increased, and the controller was then put into cascade mode, thus minimizing the duration of the exceedance.

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

Following the event, the reason why the ammonia controller defaulted to manual mode was investigated by the process controls department. It was determined that, on night of July 2, 2023, erratic readings of one of Furnace #5's fuel gas flow meters resulted in the ammonia controller to be changed to manual due to some built-in conditioning logic. Due to this, the ammonia injection control valve remained in the last position, which was essentially closed. The stack NOx levels did not start to increase until early morning on July 3, 2023, when the steam in the furnace tubes being returned to the firebox was redirected to the downstream quench tower per the procedure to take the furnace out of hot steam standby. This shift in operations caused an expected increase in NOx levels but, with the ammonia controller in manual, the system did not respond accordingly.

- **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**

1. The logic of the ammonia controller was changed such that it will not default to manual mode in the event of erratic fuel gas flow meter readings
2. The operating procedure associated with the furnace transition out of hot steam standby mode was updated to include a step to proactively increase the ammonia injection since there is typically a NOx spike during this transition.

- **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**

No follow-up report is anticipated.

- **Corrective action is final or timeline for implementation**

Both corrective actions identified above have already been completed.

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

Sincerely,



Kimberly Kaal
Environmental Manager, Attorney-in-Fact

CC:

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

Attachment A

ECU Furnace #5 CEMS Output Data

Data Summary Report

Company: Pennsylvania Chemicals
300 Frankfort Road
Monaca, PA 15061

NOTE: CEMS software does not adjust for daylight savings, so timestamps below are 1 hour earlier than plant DCS data

Source:

Data Group: F5>1-Hr Calcs

Report Name: F5 NOx 1hr validation

Start of Report: 07/03/2023 00:00

End of Report: 07/05/2023 00:00

Validation: All Available Data

Group#-Channel#	G89-C23	G89-C24	G89-C45	G89-C12	G89-C14
Long Descrip.	5>NOx Rat	5>NOx Mas	5>Oper Mo	5>HSS Sta	5>NormOps
Short Descrip.	NOx Rate	NOx Mass	OperMode	HSS Stat	NormOpStat
Units	lb/mmBtu	lb/hr	Value	ON/OFF	ON/OFF
Range	0-2	0-1000	0-10	0-1	0-1

07/03/2023 00:00	0.024	4.335	2	1	0
07/03/2023 01:00	0.029	5.951	2	1	0
07/03/2023 02:00	0.054	9.219	2	1	0
07/03/2023 03:00	0.022	3.331	2	1	0
07/03/2023 04:00	0.031	4.585	2	1	0
07/03/2023 05:00	0.033	4.809	2	1	0
07/03/2023 06:00	0.030	4.357	2	1	0
07/03/2023 07:00	0.028	4.018	2	1	0
07/03/2023 08:00	0.028	3.987	2	1	0
07/03/2023 09:00	0.025	3.548	2	1	0
07/03/2023 10:00	0.026	3.748	2	1	0
07/03/2023 11:00	0.025	3.612	2	1	0
07/03/2023 12:00	0.025	3.607	2	1	0
07/03/2023 13:00	0.026	3.641	2	1	0
07/03/2023 14:00	0.025	3.634	2	1	0
07/03/2023 15:00	0.025	3.588	2	1	0
07/03/2023 16:00	0.016	2.232	2	1	0
07/03/2023 17:00	0.023	3.253	2	1	0
07/03/2023 18:00	0.025	3.576	2	1	0
07/03/2023 19:00	0.025	3.592	2	1	0
07/03/2023 20:00	0.025	3.672	2	1	0
07/03/2023 21:00	0.025	3.586	2	1	0
07/03/2023 22:00	0.022	3.482	2	1	0

Group#-Channel#	G89-C23	G89-C24	G89-C45	G89-C12	G89-C14
Long Descrip.	5>NOx Rat	5>NOx Mas	5>Oper Mo	5>HSS Sta	5>NormOps
Short Descrip.	NOx Rate	NOx Mass	OperMode	HSS Stat	NormOpStat
Units	lb/mmBtu	lb/hr	Value	ON/OFF	ON/OFF
Range	0-2	0-1000	0-10	0-1	0-1

07/03/2023 23:00	0.015	3.699	3	0	0
07/04/2023 00:00	0.013	3.780	3	0	0
07/04/2023 01:00	0.011	3.833	3	0	0
07/04/2023 02:00	0.010	3.970	3	0	0
07/04/2023 03:00	0.010	4.667	4	0	1
07/04/2023 04:00	0.010	5.170	4	0	1
07/04/2023 05:00	0.010	5.348	4	0	1
07/04/2023 06:00	0.010	5.735	4	0	1
07/04/2023 07:00	0.010	5.753	4	0	1
07/04/2023 08:00	0.010	5.859	4	0	1
07/04/2023 09:00	0.010	5.974	4	0	1
07/04/2023 10:00	0.010	6.039	4	0	1
07/04/2023 11:00	0.010	6.105	4	0	1
07/04/2023 12:00	0.010	6.103	4	0	1
07/04/2023 13:00	0.010	6.053	4	0	1
07/04/2023 14:00	0.010	6.090	4	0	1
07/04/2023 15:00	0.010	6.078	4	0	1
07/04/2023 16:00	0.010	6.111	4	0	1
07/04/2023 17:00	0.010	6.076	4	0	1
07/04/2023 18:00	0.010	6.118	4	0	1
07/04/2023 19:00	0.010	6.016	4	0	1
07/04/2023 20:00	0.010	6.036	4	0	1
07/04/2023 21:00	0.010	6.039	4	0	1
07/04/2023 22:00	0.010	6.074	4	0	1
07/04/2023 23:00	0.010	6.071	4	0	1
07/05/2023 00:00	0.010	6.094	4	0	1

Period Average=	0.018	4.862	3	1	1
Period Max Value=	0.054	9.219	4	1	1
Period Min Value=	0.010	2.232	2	1	1
Period Totals=	8.8600E-1	2.3825E+2	1.4600E+2	2.3000E+1	2.2000E+1
Period%Recovery=	100.0	100.0	100.0	100.0	100.0