



Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

February 19, 2024

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 #1 (Source ID 031) and Furnace #2 (Source ID 032)
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 Unit (ECU) Furnace #1 and Furnace #2 on January 20, 2024.

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 January 20, 2024, beginning at 07:32, Ethane Cracking Furnace #1 stack’s NOx emissions exceeded the permit limit of 6.20 lb/hr while in hot steam standby (HSS) mode for approximately 1 hour.

On January 20, 2024, beginning at 00:51, Ethane Cracking Furnace #2 stack’s NOx emissions exceeded the permit limit of 0.015 lb/MMBtu while in normal/cracking mode for approximately 2 hours.

The cause of the NOx mass and NOx rate emissions exceedance was determined to be a temporary loss of ammonia injection.

- **Time when the malfunction or breakdown was first observed**

January 20, at 00:51 in Furnace #2 and January 20, at 07:32 in Furnace #1.

- **The date and time that the malfunction started and ended**

Furnace #1 started on January 20, 2024, at 07:32 and ended on January 20, at 07:41
Furnace #2 started on January 20, 2024, at 01:51 and ended on January 20, at 02:15

- **An estimate of the emissions associated with the malfunction**

Furnace #1: 3.446 lb of excess NOx mass emissions over the duration of the event
Furnace #2: 5.341 lb of excess NOx mass emissions over the duration of the event

Furnace (source ID)	Mode / hr	Limit (lb/hr)	Exceedance (lb/hr)	Limit (lb/MMBtu)	Exceedance (lb/MMBtu)	Excess Emissions (lbs)
031	Hot Steam Standby/(07:00–08:00)	6.2	9.646 ^(a)	NA	NA	3.446
032	Cracking/(01:00– 02:00)	NA	NA	0.015	0.017 ^(b)	1.076
032	Cracking/(02:00– 03:00)	NA	NA	0.015	0.023 ^(b)	4.265

(a) Attachment A: Furnace #1 NOx mass Excess Emissions, lb/h

(b) Attachment B: Furnace #2 NOx firing rate (lb/MMBtu) and HI Total (MMBtu/h) to determine NOx mass Excess Emissions, lb/h

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

The calculation is based on the ECU Furnace # 1 and #2 CEMs analyzer readings over the period of the malfunction window.

Furnace #1, the NOx (mass) excess emissions were calculated as follows: (Sum NOx lb/hr emission rates for 07:00 hour exceeding 6.20 lb/hr) minus (NOx permit limit of 6.20 lb/hr).

Furnace #2, the NOx (rate) excess emissions were calculated as follows: (NOx lb/MMBtu firing rates for 01:00 and 02:00 hours exceeding 0.015 lb/MMBtu) minus (NOx permit limit of 0.015 lb/MMBtu) times (Heat Input, MMBtu/hr).

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

Once the zero flow condition of the ammonia injection system was discovered, the ECU Console Operator restored the ammonia flow to bring the NOx back under control below the 6.2 lb/hr limit and 0.015 lb/MMBtu limit for Furnace #1 and Furnace #2 respectively and communicated with Shell's Process Automation, Control and Optimization team to investigate the reason for unreliable injection of ammonia. Freezing transmitters was identified as the root cause of loss of NOx control of the furnaces #1 and #2. When ECU Operations noticed the plugging transmitters problem a bypass was applied to affected transmitters on all running furnaces to prevent another NOx emissions exceedance incident.

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

Following the event, the cause of the Furnace #1 and #2 NOx control system malfunction was investigated by the process control team and found to be related to plugged tubing in ammonia skid fan differential pressure transmitters due to sub-freezing conditions that resulted in ammonia process control logic interlock activation which halted ammonia injection to properly control NOx emissions in the Furnaces #1 and #2 flue gas.

- **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**

A mitigation plan is for ECU Operations to implement Console Operator awareness that identifies potential freezing conditions and to take actions earlier to avoid NOx mass related emissions exceedances.

The following evaluation plan will be conducted by ECU Electrical team to prevent future NOx

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control transmitters failures due to sub-freezing conditions.

Electrical Engineering will conduct a feasibility evaluation for the implementation of EHT (Electrical Heat Tracing) system on all seven ECU furnaces to avoid tubing freezing in the instrumentation that controls the ammonia injection system.

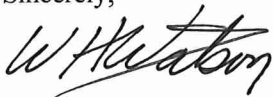
- **To the extent that investigations of the causes and/or possible corrective action(s) still are underway on the due date of the report, a statement of the anticipated date by which a follow-up report will be submitted**

A follow-up report from the outcome of the EHT feasibility evaluation is expected to be finalized by Q3/2024.

- **Corrective action is final or timeline for implementation**
N/A- corrective actions are being evaluated as per timeline above.

If you have any questions regarding this matter, please contact me at (724) 709-2825 or william.watson@shell.com.

Sincerely,



William Watson
Operations Manager

CC:

Scott Beaudway, Air Quality Specialist
Kristin Goddard, Environmental Compliance Specialist
Beth Speicher, Environmental Group Manager

Attachments:

A - Furnace #1 NOx mass Excess Emissions, lb/h
B - Furnace #2 NOx firing rate (lb/MMBtu) and HI Total (MMBtu/h) to determine NOx mass Excess Emissions, lb/h

Data Summary Report

Company: Pennsylvania Chemicals
300 Frankfort Road
Monaca, PA 15061

Data Group: F1>1-Hr Calcs

Report Name: No Title

Start of Report: 01/20/2024 00:00

End of Report: 01/20/2024 12:00

Validation: Valid Data Only

Group#-Channel#	G71-C24
Long Descrip.	1>NOx Mas
Short Descrip.	NOx Mass
Units	lb/hr
Range	0-1000

01/20/2024 00:00	5.265
01/20/2024 01:00	5.243
01/20/2024 02:00	5.655
01/20/2024 03:00	4.906
01/20/2024 04:00	5.283
01/20/2024 05:00	5.136
01/20/2024 06:00	5.020
01/20/2024 07:00	9.646
01/20/2024 08:00	3.225
01/20/2024 09:00	5.269
01/20/2024 10:00	5.263
01/20/2024 11:00	5.226
01/20/2024 12:00	5.249

Period Average	=	5.414
Period Max Value	=	9.646
Period Min Value	=	3.225
Period Totals	=	7.0386E+1
Period % Recovery	=	100.0

Data Summary Report

Company: Pennsylvania Chemicals
300 Frankfort Road
Monaca, PA 15061

Data Group: F2>1-Hr Calcs

Report Name: No Title

Start of Report: 01/19/2024 20:00

End of Report: 01/20/2024 10:00

Validation: Valid Data Only

Group#-Channel#	G83-C23	G83-C29
Long Descrip.	2>NOx Rat	2>HI Tota
Short Descrip.	NOx Rate	HI Total
Units	lb/mmBtu	MMBtu/hr
Range	0-2	0-700

01/19/2024 20:00	0.008	539.3
01/19/2024 21:00	0.008	539.4
01/19/2024 22:00	0.008	538.4
01/19/2024 23:00	0.008	535.4
01/20/2024 00:00	0.008	537.1
01/20/2024 01:00	0.017	537.8
01/20/2024 02:00	0.023	533.1
01/20/2024 03:00	0.007	527.1
01/20/2024 04:00	0.008	527.2
01/20/2024 05:00	0.008	528.2
01/20/2024 06:00	0.008	529.3
01/20/2024 07:00	0.008	529.3
01/20/2024 08:00	0.008	528.7
01/20/2024 09:00	0.008	528.6
01/20/2024 10:00	0.008	525.7

Period Average =	0.010	532.3
Period Max Value =	0.023	539.4
Period Min Value =	0.007	525.7
Period Totals =	1.4300E-1	7.9846E+3
Period % Recovery=	100.0	100.0