BTEC Inc.

SCR
Emissions Test Report

Prepared for:

AK Steel Corporation – Dearborn Works

Dearborn, Michigan

AK Steel Corporation – Dearborn Works
4001 Miller Road
Dearborn, Michigan 48120

Project No. 049AS-259123
January 9, 2018

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
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EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by AK Steel Corporation – Dearborn Works (AK Steel) to evaluate emissions on one source at the AK Steel facility in Dearborn, Michigan, The purpose of the project was to evaluate ammonia and oxides of nitrogen (NOx) at the SCR exhaust stack.

Testing of the SCR exhaust consisted of triplicate 60-minute test runs for ammonia and NOx. The emissions test program was required by MDEQ Air Quality Division Facility SRN A8640, PTI-120-16. The results of the emission test program are summarized by Table 1.

Table I
SCR Overall Emission Summary
Test Date: November 16, 2017

Pollutant	Average Emission Rate	Emission Limit
Ammonia	0.31 lbs/hr	2.19 lbs/hr
Oxides of Nitrogen	1.19 lbs/hr	3.21 lbs/hr

1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by AK Steel Corporation – Dearborn Works (AK Steel) to evaluate emissions on one source at the AK Steel facility in Dearborn, Michigan. The purpose of the project was to evaluate Ammonia and Oxides of Nitrogen (NOx) emissions at the SCR exhaust stack. The purpose of this report is to document the results of the test program.

AQD has published a guidance document entitled "Format for Submittal of Source Emission Test Plans and Reports" (December 2013). The following is a summary of the emissions test program and results in the format suggested by the aforementioned document.

1.a Identification, Location, and Dates of Test

Sampling and analysis for the emission test program was conducted on November 16, 2017 at the AK Steel facility located in Dearborn, Michigan. The test program included evaluation of Ammonia and NOx emissions from the SCR exhaust stack.

1.b Purpose of Testing

AQD issued Permit to Install 120-16 to AK Steel. The permit condition requires verification of NOx and ammonia emissions rates from FGHDGLSCR once every ROP permit term. The permit limits are summarized by Table 1.

Table 1
Emission Limitations
AK Steel Corporation – Dearborn Works
MI-ROP-A8640-2016a Emission Limitations

Pollutant	Emission Limit
Ammonia	2.19 lbs/hr
Oxides of Nitrogen	3.21 lbs/hr

1.c Source Description

The sampling program included the Hot Dip Galvanizing Line (HDGL) SCR exhaust stack. The exhaust stack for the SCR is also the exhaust for the Hot Water Heaters used in the HDGL process. The following is a description of the process.

Coils of steel are loaded into the entry end of the process and are uncoiled and straightened. Each leading edge of the next coil is welded to the preceding coil in order to allow the process to run continuously while production is occurring. In the Pre-Cleaner

section of the HDGL process, the straightened coils are cleaned within caustic solution tanks, which are heated by a hot water and heat exchanger system. Emissions of dilute caustic generated in the cleaning process tanks are controlled by a scrubber and a mist eliminator that exhausts to the outer atmosphere through the Pre-Cleaner stack.

After cleaning and rinsing, the coil is then dried with hot air. After drying, the coil enters the Annealing Furnace. The coil is heated according to required specifications within the Annealing Furnace and then proceeds to the zinc pot where the steel is given a zinc coating (i.e. galvanized). Excess zinc is removed immediately upon exit of the molten zinc pot, and the zinc-coated steel strip is allowed to dry as it travels in a vertical direction. After air cooling, the strip is quenched in water, dried, inspected, and packaged for customer delivery.

The emissions from the Annealing Furnace are controlled by a Selective Catalytic Reduction (SCR) control device. Emissions exiting the SCR are exhausted through an exhaust stack. Uncontrolled combustion by-products from the HDGL hot water heating system are exhausted through the same stack. Emissions from both processes are measured at the sampling point and the combined emissions are subject to the applicable emission limit.

1.d Test Program Contacts

The contacts for the source and test report are:

Mr. David Pate
Senior Environmental Engineer
AK Steel Dearborn Works
4001 Miller Road
Dearborn, Michigan 48120
(313) 323-1261

Mr. Barry P. Boulianne
Senior Project Manager
BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, MI 48073
313-449-2361

Names and affiliations for personnel who were present during the testing program are summarized by Table 2.

Table 2
Test Personnel

Name and Title	Affiliation	Telephone
Mr. David Pate Environmental Engineer	AK Steel Corporation Dearborn Works 4001 Miller Road Dearborn, Michigan 48120	(313) 323-1261
Mr. Paul Diven Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Mike Nummer Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Mason Sakshaug Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Jake Zott Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070

2. Summary of Results

Sections 2.a through 2.d summarize the results of the emissions compliance test program.

2.a Operating Data

Line speed, tons of steel processed, amount of urea injected, SCR temperature, and SCR outlet NOx concentration, and gas consumption for the furnace and hot water heaters were recorded during each run and can be found in Appendix E.

2.b Applicable Permit

The applicable permit for this emissions test program is Permit to Install 120-16

2.c Results

The overall results of the emission test program are summarized by Table 3 (see Section 5.a). Detailed results for each run are summarized by Table 4.

3. Source Description

Sections 3.a through 3.e provide a detailed description of the process.

3.a Process Description

See section 1.c.

3.b Process Flow Diagram

A process flow diagram is available upon request.

3.c Raw and Finished Materials

The raw material used for coating the strip is zinc. Natural gas is used to fire the annealing furnace and the hot water heaters.

3.d Process Capacity

The annual capacity of the HDGL is approximately 500,000 tons of final product. Because the mill is designed to operate continuously when running, hourly capacity is very dependent upon the products being made. Hourly production can range from 2 to 5 coils and approximately 30 to 80 tons per hour depending on the final product.

3.e Process Instrumentation

Line speed, zinc coating thickness, furnace temperature, and final process/inspection steps regulate how the process is fed through the continuous operation and are closely regulated during the coating of each steel coil.

4. Sampling and Analytical Procedures

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used.

4.a Sampling Train and Field Procedures

The emissions test program utilized the following test methods codified at Title 40, Part 60, Appendix A (40 CFR 60, Appendix A) and Title 40, Part 51, Appendix M (40 CFR 51, Appendix M) of the Code of Federal Regulations:

- Method 1 - *"Sample and Velocity Traverses for Stationary Sources"*
- Method 2 - *"Determination of Stack Gas Velocity and Volumetric Flowrate"*

- Method 3 - *"Determination of Molecular Weight of Dry Stack Gas" (Fyrite)*
- Method 320 - *"Vapor Phase Organic and Inorganic Emissions by Extractive FTIR"*

USEPA Methods 1-3

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Method 1 and Method 2. S-type pitot tubes with thermocouple assemblies, calibrated in accordance with Method 2, Section 4.1.1, were used to measure exhaust gas velocity pressures (using a manometer) and temperatures during testing. The S-type pitot tube dimensions outlined in Sections 2-6 through 2-8 are within specified limits, therefore, a baseline pitot tube coefficient of 0.84 (dimensionless) is assigned. A diagram of the sample points is provided in Figure 2.

Cyclonic flow checks were performed at the sampling location. The existence of cyclonic flow is determined by measuring the flow angle at each sample point. The flow angle is the angle between the direction of flow and the axis of the stack. If the average of the absolute values of the flow angles is greater than 20 degrees, cyclonic flow exists. Cyclonic flow was confirmed to not exist at the machine scarfing baghouse sampling location.

The Molecular Weight of the gas stream was evaluated according to procedures outlined in Title 40, Part 60, Appendix A, Method 3. The O_2 /CO_2 content of the gas stream was measured using a Fyrite combustion analyzer.

Exhaust gas was extracted as part of the Method 320 sampling train. Exhaust gas moisture content was then determined by method 320.

Vapor Phase Organic and Inorganic Emissions (USEPA Method 320)

Extractive Fourier transform infrared (FTIR) spectrometry following US EPA Method 320 was conducted to quantify the concentration levels of gaseous Ammonia, and NOx emissions from the SCR exhaust stack. FTIR data was collected using an MKS MultiGas 2030 FTIR spectrometer. The FTIR was equipped with a temperature-controlled, 5.11 meter multipass gas cell maintained at 191°C. Gas flows and sampling system pressures were monitored using a rotameter and pressure transducer. All data was collected at 0.5 cm-1 resolution. Each spectrum was derived from the coaddition of 64 scans, with a new data point generated approximately every one minute. A drawing of the sampling train used for the testing program is presented as Figure 1.

Method 320 Ammonia, and NOx concentrations were measured by BTEC and the data was validated by Prism Analytical Technologies, Inc. of Mount Pleasant, Michigan. Additional details regarding the Method 320 measurements of ammonia and NOx concentrations are included in the Prism Analytical Technologies, Inc. validation report in Appendix D

4.b Recovery and Analytical Procedures

Recovery and analytical procedures were described in Section 4.a.

4.c Sampling Ports

A diagram of the stack showing sampling ports in relation to upstream and downstream disturbances is included as Figure 2.

4.d Traverse Points

A diagram of the stack indicating traverse point locations and stack dimensions is included as Figure 2

5. Test Results and Discussion

Sections 5.a through 5.k provide a summary of the test results.

5.a Results Tabulation

The overall results of the emissions test program are summarized by Table 3. Detailed results for the emissions test program are summarized by Table 4.

Table 3
SCR Overall Emission Summary
Test Date: November 16, 2017

Pollutant	Average Emission Rate	Emission Limit
Ammonia	0.31 lbs/hr	2.19 lbs/hr
Oxides of Nitrogen	1.19 lbs/hr	3.21 lbs/hr

5.b Discussion of Results

Test results were below emission limits.

5.c Sampling Procedure Variations

There were no sampling variations used during the emission compliance test program.

5.d Process or Control Device Upsets

During run 2 a line stop occurred. Testing was paused until the line was restored to normal operating conditions.

5.e Control Device Maintenance

The NOx measurement system is maintained and inspected on a quarterly basis. Inspection of the remainder of the SCR system is performed semi-annually. The last quarterly and semi-annual inspections were conducted on 10/23/17.

5.f Re-Test

The emissions test program was not a re-test.

5.g Audit Sample Analyses

No audit samples were collected as part of the test program.

5.h Calibration Sheets

Relevant equipment calibration documents are provided in Appendix B.

5.i Sample Calculations

Sample calculations are provided in Appendix C.

5.j Field Data Sheets

Field documents relevant to the emissions test program are presented in Appendix A

5.k Laboratory Data

No laboratory data for this test program.

Table 4
SCR Exhaust Emission Rates
AK Steel- Dearborn Works
Dearborn, Michigan
BTEC Project No. 049AS-259123
Sampling Dates: 11/16/2017

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	11/16/2017	11/16/2017	11/16/2017	
Sampling Time	12:55-13:55	14:10-14:44 15:16-15:40	16:00-17:00	
Outlet Flowrate (scfm)	17,437	19,609	21,761	**19,602**
Outlet NOx concentrations (ppmv)	8.67	9.33	7.65	**8.55**
Outlet NH_3 concentration (ppmv)	3.60	5.54	8.31	**5.82**
Outlet NOx (lb/Hr)	1.08	1.31	1.19	**1.19**
Outlet NH_3 (lb/hr)	0.17	0.29	0.48	**0.31**

scfm: standard cubic feet per minute
ppmv: parts per million on a volume to volume basis
lb/hr: pounds per hour

MW = molecular weight (NH3 = 17.031, NOx = 46.01)
24.14: molar volume of air at standard conditions (70°F, 29.92" Hg)
35.31: ft^3 per m^3
453600: mg per lb

Equations

lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * scfm* 60

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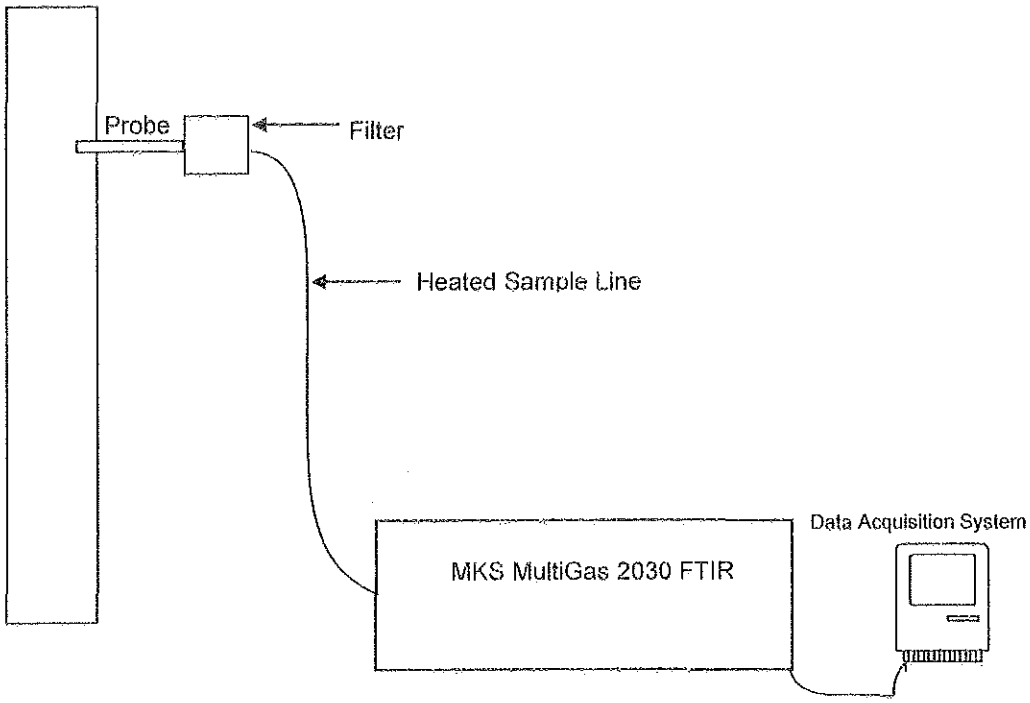

Figure No. 1

Site: USEPA Method 320 AK Steel Dearborn, Michigan	Sampling Date: November 16, 2017	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

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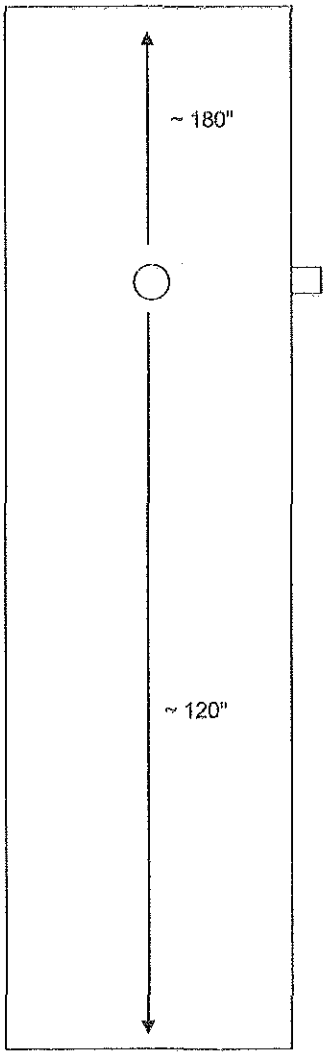
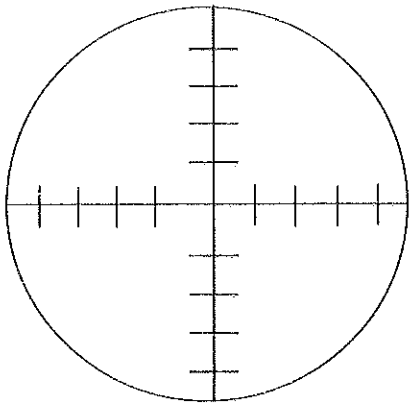
diameter = 48"





Not to Scale

Points	Distance "
1	1.54
2	5.04
3	9.31
4	15.50
5	32.50
6	38.69
7	42.96
8	46.46

Figure No. 2

Site: SCR Exhaust AK Steel Dearborn, Michigan	Sampling Date: November 16, 2017	BT Environmental Consulting, Inc. 4949 Fernlee Royal Oak, Michigan