AP32 Section:	12.5.1
Background Chapter	3
Reference:	25
Title:	Report on NOx and CO Emissions. Annealing Furnace. Performed for: Nucor Steel, Crawfordsville, IN. June 6, 2001.

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
Indianapolis

OFFICE MEMORANDUM

To: Jay Patterson

Date: December 17, 2001

From: Jarrod Fisher JCF
Marie Luce AML

Thru: Ed Surla

Subject: Nucor Steel
Crawfordsville, Indiana
Source ID No. 107-00038
Permit ID No. SSM 107-12143-00038

The subject company has submitted a report concerning the stack emissions testing at the subject source. The tests were conducted by Sesco Group, Inc. The purpose of the testing was to determine compliance status of the batch annealing furnaces with regards to the emission limitations stated below. The protocols were approved by Quentin Flory and Marie Luce and the field tests were observed by Marie Luce and Jed Wolkins. I have reviewed this report and found the sampling procedures used and results to be acceptable to this Office A copy of the test report is filed in the Compliance Data Section. The following is a summary of the test results:

Annealing Furnace #1
Date of test: June 6, 2001
Identification and Unit No. of Facilities Tested: Batch Annealing Furnace #1
Pollution Control Equipment: Natural Gas fired burners use low-NOx technology
Operating Parameters: N/A
Pollutants: NOx, CO
Test methods: 1-4, 7E, 10

Maximum Rated Capacity: 4.8 MMBtu/hr
CP #107-12143 Condition No. D.6.7 (c) NOx Limit (326 IAC 2-2): 0.10 lbs/MMBtu
CP #107-12143 Condition No. D.6.7 (d) CO Limit (326 IAC 2-2): 0.084 lbs/MMBtu

	NOx Emissions (lb/MMBtu)	CO Emissions (lb/MMBtu)	Heat Input Rate (MMBtu/hr)
Run 1	0.0731	0.0035	3.77
Run 2	0.0837	0.0035	3.61
Run 3	0.0895	0.0029	3.21
Average	0.0821	0.0033	3.53

Annealing Furnace #9
Date of test: August 24, 2001
Identification and Unit No. of Facilities Tested: Batch Annealing Furnace #9
Pollution Control Equipment: Natural Gas fired burners use low-NOx technology
Operating Parameters: N/A
Pollutants: NOx, CO
Test methods: 1-4, 7E, 10

Maximum Rated Capacity: 4.8 MMBtu/hr
CP #107-12143 Condition No. D.6.7 (c) NOx Limit (326 IAC 2-2): 0.10 lbs/MMBtu
CP #107-12143 Condition No. D.6.7 (d) CO Limit (326 IAC 2-2): 0.084 lbs/MMBtu

	NOx Emissions (lb/MMBtu)	CO Emissions (lb/MMBtu)	Heat Input Rate (MMBtu/hr)
Run 1	0.0800	0.0027	3.85
Run 2	0.1083	0.0015	2.94
Run 3	0.0915	0.0030	2.02
	0.0932	0.0024	2.94

Annealing Furnace #13
Date of test: August 24, 2001
Identification and Unit No. of Facilities Tested: Batch Annealing Furnace #13
Pollution Control Equipment: Natural Gas fired burners use low-NOx technology
Operating Parameters: N/A
Pollutants: NOx, CO
Test methods: 1-4, 7E, 10

Maximum Rated Capacity: 4.8 MMBtu/hr
CP #107-12143 Condition No. D.6.7 (c) NOx Limit (326 IAC 2-2): 0.10 lbs/MMBtu
CP #107-12143 Condition No. D.6.7 (d) CO Limit (326 IAC 2-2): 0.084 lbs/MMBtu

	NOx Emissions (lb/MMBtu)	CO Emissions (lb/MMBtu)	Heat Input Rate (MMBtu/hr)
Run 1	0.0670	0.0008	4.00
Run 2	0.0636	0.0001	3.67
Run 3	0.0756	0.0008	2.98
Average	0.0687	0.0006	3.55

Annealing Furnace #15
Date of test: August 23, 2001
Identification and Unit No. of Facilities Tested: Batch Annealing Furnace #15
Pollution Control Equipment: Natural Gas fired burners use low-NOx technology
Operating Parameters: N/A
Pollutants: NOx, CO
Test methods: 1-4, 7E, 10

Maximum Rated Capacity: 4.8 MMBtu/hr
CP #107-12143 Condition No. D.6.7 (c) NOx Limit (326 IAC 2-2): 0.10 lbs/MMBtu
CP #107-12143 Condition No. D.6.7 (d) CO Limit (326 IAC 2-2): 0.084 lbs/MMBtu

	NOx Emissions (lb/MMBtu)	CO Emissions (lb/MMBtu)	Heat Input Rate (MMBtu/hr)
Run 1	0.0820	0.0006	3.64
Run 2	0.0925	0.0005	3.31
Run 3	0.0793	0.0010	1.79
Average	0.0846	0.0007	2.92

STATUS: **In Compliance**

Note: There are 18 identical natural gas-fired batch annealing furnaces at Nucor Steel in Crawfordsville. Permit Condition D.6.4 (a) requires Nucor to perform NOx and CO testing on "at least four (4) batch annealing furnaces within 60 days after achieving maximum capacity, but no later than 180 days after initial start-up".

cc: J. Fisher, IDEM
M. Luce, IDEM
D. Sekula, IDEM
M. Stuckey- IDEM Office of Enforcement
WPS/General Files, Montgomery Co.

Supreme
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REPORT on
NO_x and CO EMISSIONS
Performed for:
Nucor Steel
Crawfordsville, IN
Annealing Furnace
on 06/06/01

To the best of our knowledge, the data presented in this report is accurate and complete.

Respectfully Submitted by:

Michael Dicen, Division Manager

STACK EMISSION SUMMARY

SOURCE TESTED:	**Annealing Furnace**
COMPANY NAME:	Nucor Steel
DATE OF TEST:	06/06/2001

NOx Emissions	Run 1	Run 2	Run 3	Average
PPM	47.11	53.95	57.69	52.91
lbs/hr	0.3749	0.3500	0.3520	0.3590
lbs/MMbtu	0.0731	0.0837	0.0895	0.0821
CO Emissions				
PPM	3.70	3.70	3.10	3.50
lbs/hr	0.0179	0.0146	0.0115	0.0147
lbs/MMbtu	0.0035	0.0035	0.0029	0.0033
Avg. Stack Vol. Flow Rate				
ACFM	2977.13	2457.27	2284.21	2572.87
DSCFM	1111.03	905.65	851.70	956.13
Avg. Stack Temp.	757.50	781.31	754.69	764.50
Stack Gas Velocity	53.83	44.43	41.30	46.52
Avg. Velocity Head	0.3865	0.2589	0.2279	0.2911
Avg. Sq. Rt of Delta P	0.6217	0.5088	0.4774	0.5360
% Moisture of Stack Gas	14.58%	13.99%	14.85%	14.48%
Sample Volume	21.110	21.466	21.555	21.377

2-1 RESULTS

Table 2-1:
Annealing Furnace Emissions

Gas Conditions		1	2	3	Avg
Ts	Stack Temperature (°F)	757.50	781.31	754.69	764.50
Bwo	Moisture (volume %)	14.58	13.99	14.85	14.48
O2	Oxygen (dry volume %)	7.0	7.0	7.5	7.2
CO2	Carbon Dioxide (dry volume %)	8.0	8.0	8.0	8.0
Volumetric Flow Rate					
Qa	Actual Conditions (acfm)	2977.13	2457.27	2284.21	2572.87
Qstd	Standard Conditions (dscfm)	1111.03	905.65	851.70	956.13
NITROGEN OXIDES					
E_T	Emission Rate (PPM)	47.11	53.95	57.69	52.91
E_T	Emission Rate (lbs/hr)	0.3749	0.3500	0.3520	0.3590
CARBON MONOXIDE					
E_T	Emission Rate (PPM)	3.70	3.70	3.10	3.50
E_T	Emission Rate (lbs/hr)	0.0179	0.0146	0.0115	0.0147

3-1 METHODOLOGY

The sampling followed procedures as detailed in U.S. Environmental Protection Agency (EPA) Methods 1-4, 7E, 10. The following table summarizes the methods:

Summary of Sampling Procedures

Title 40 CFR Part 60 Appendix A

Method 1	"Sampling of Velocity Traverses for Stationary Sources"
Method 2	"Determination of Stack Gas Velocity and Volumetric Flow Rate"
Method 3	"Gas Analysis for the Determination of Molecular Weight"
Method 4	"Determination of Moisture Content in Stack Gas"
Method 7E	"Determination of Nitrogen Oxide Emissions from Stationary Sources"
Method 10	"Determination of Carbon Monoxide Emissions from Stationary Sources"

SAMPLE POINT DETERMINATION

Sampling point locations were determined according to EPA Reference Method 1.

Table 3-1:
Sampling Points

Location	Dimensions	Ports	Points per Port	Total Points
Annealing Furnace	13" ID	2	8	16

3-2 METHODOLOGY

SAMPLE AND VELOCITY TRAVERSE - EPA METHOD 1

Method 1 was used for the representative measurement of pollutant emissions and/or total volumetric flow rate. A measurement site where the effluent gas stream, flowing in a known direction is selected and divided into a equal number of areas. A traverse point is then located within each of these equal areas. Sampling or velocity measurement is performed at a site located at least eight stack or duct diameters downstream and two diameters up stream from any flow disturbance such as a bend, expansion, contraction, or visible flame. If necessary, an alternative location may be selected at a position at least two stack or duct diameters downstream and one half diameter upstream from any flow disturbance.

VELOCITY AND VOLUMETRIC FLOW RATE - EPA METHOD 2

EPA Method 2 was used to determine the gas velocity and flow rate at both the inlet and outlet locations. Each set of velocity determinations included the measurement of gas velocity pressure and gas temperature at each of the Method 1 determined traverse points. The velocity pressures were measured with a Type S pitot tube. Gas temperature measurements were made with a Type K thermocouple and digital pyrometer.

GAS COMPOSITION AND MOLECULAR WEIGHT - EPA METHOD 3

In order to determine the oxygen and carbon dioxide concentrations, a sample of gas was obtained and analyzed in accordance with EPA Method 3. The gas sample was collected using an Orsat analyzer. The results were used to determine gas molecular weight.

MOISTURE CONTENT - EPA METHOD 4

The flue gas moisture content at the testing locations was determined in accordance with EPA Method 4. The moisture was determined by quantitatively condensing moisture in the chilled impingers and silica absorbtion. The amount of moisture condensed was determined gravimetrically. A dry gas meter was used to measure the volume of gas sampled. Moisture content is used to determine stack gas velocity.

NITROGEN OXIDE CONCENTRATION - EPA METHOD 7E

A gas sample is continuously drawn from the stack and a portion of the sample is conveyed to a chemiluminescent analyzer for NOx concentration determination. The wet stack gas is "dried," before analysis, by a chilled condenser. EPA protocol 1 gases are used to calibrate the instrument, as well as run system checks.

CARBON MONOXIDE CONCENTRATION - EPA METHOD 10

A continuous gas sample is drawn from the stack and a portion is conveyed to a tedlar bag for carbon monoxide concentration determination at a laboratory. The wet stack gas is "dried," before analysis, by a chilled condenser. EPA protocol 1 gases are used to calibrate the laboratory instrument.

SECTION D.6 FACILITY OPERATION CONDITIONS

Facility Description [326 IAC 2-7-5(15)]

(f) Eighteen (18) natural gas-fired batch annealing furnaces, utilizing propane as a backup fuel. Each batch annealing furnace shall be equipped with low-NOx burners and shall not exceed a maximum heat input rate of 4.8 MMBtu per hour. These units can handle the product from both the existing continuous caster line and the continuous strip caster line to be installed as described above.

(The information describing the process contained in this facility description box is descriptive information and does not constitute enforceable conditions.)

Emission Limitations and Standards

D.6.1 Nitrogen Oxides (NO_x) and CO Emission Limitations

Pursuant to 326 IAC 2-2 (PSD Requirements), the eighteen (18) batch annealing furnaces shall comply with the following requirements:

(a) Each batch annealing furnace shall be equipped with low-NOx burners;

(b) Each batch annealing furnace shall utilize natural gas as the primary fuel and may utilize propane as a backup fuel;

(c) The NOx emissions from each batch annealing furnace shall not exceed 0.10 pounds per MMBtu; and

(d) The CO emissions from each batch annealing furnace shall not exceed 0.084 pound per MMBtu.

D.6.2 Sulfur Dioxide (SO_2) Emission Limitations

Pursuant to 326 IAC 2-2 (PSD Requirements), the above-mentioned additional batch annealing furnaces shall utilize natural gas as the primary fuel and may utilize propane as a backup fuel.

Compliance Determination and Monitoring

D.6.4 Performance Testing

(a) Pursuant to 326 IAC 2-1.1-11 and 326 IAC 2-2, the Permittee shall perform NOx and CO compliance stack tests on at least four (4) batch annealing furnaces within 60 days after achieving maximum capacity, but no later than 180 days after initial start-up.

(b) All compliance stack tests shall be repeated at least annually until such time that the Part 70 permit for this source is in effect.

(c) IDEM, OAQ retains the authority under 326 IAC 2-1-4(f) to require the Permittee to perform additional and future compliance testing as necessary.

D.6.5 Vendor Certification

The Permittee shall submit with the affidavit of construction (Condition B.5(a)) the vendor guarantees for the above-mentioned batch annealing furnaces to demonstrate compliance with