AP-42 Section 11.23
Reference 34
Report Sect. 4
Reference 34

(34)

PARTICULATE EMISSIONS TESTING

FOR

NATIONAL STEEL PELLET COMPANY

MAY, 1990

Shell Engineering & Associates, Inc.
2503 West Ash
Columbia, Missouri 65203
May 30, 1990

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I. INTRODUCTION

National Steel Pellet Company, which is wholly-owned by National Steel Corporation, has contracted with Shell Engineering & Associates, Inc., of Columbia, Missouri, to determine the particulate emissions from one of the two waste gas stacks at their iron ore pelletizing facility near Keewatin, Minnesota. The NSPC mine and plant complex is located northeast of Keewatin, approximately two miles north of US Highway 169. The source tested is located in St. Louis County, although portions of the mining area and the primary crusher are located in Itasca County.

According to the conditions of the 5-year air operating permit issued to National Steel Pellet Company by the Minnesota Pollution Control Agency, performance testing is required on an annual basis. The particulate emissions from one of the two Waste Gas stacks is to be determined every year, on an alternating basis. (The particulate emissions from the #2B Waste Gas stack have been determined to satisfy these requirements for 1990, as the #2A Waste Gas emissions were determined during the 1989 testing program.)

The emissions were evaluated through application of the United States Environmental Protection Agency's Reference Methods 1-5 for determination of particulate emissions from stationary sources (as published in 40 CFR, Part 60, Appendix A, and the Minnesota rules). A series of three individual test runs was used for this evaluation, as required by Method 5.

The performance tests reported here include a determination of the efficiency of the control equipment. Compliance can be demonstrated in Minnesota in several ways, i.e. by meeting the source gas-volume limitations, the process weight limitations, or the collection efficiency requirements.

The performance tests were conducted on Wednesday, May 16, 1990. There were no delays due to weather during the day. The skies were generally cloudy and the temperature was in the range of 45-50°F.

The Engineer in charge of the test program for Shell Engineering & Associates was Donald G. Oss. The test team was provided to Shell

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Engineering by Total Source Analysis, Inc., of Wellington, Ohio, and consisted of Team Leader Terry Shackelford, assisted by John Sutton. The opacity measurements were made by Mr. Sutton, who is certified in the State of Ohio.

Pre-test planning was accomplished by telephone, and consisted primarily of telephone conversations between Mr. George Krouse of NSPC and Mr. Dave Beil of the Division of Air Quality of the MPCA. Mr. Robert Beresford from the Duluth Regional Office observed the tests for the MPCA.

Mr. Krouse provided assistance and liaison with plant operations during the test program. Plant operating and maintenance supervisors, plant laboratory personnel, and others also graciously provided assistance as needed during the day.

II. SUMMARY OF TEST RESULTS

The results of the test program are summarized on Table I. Included are stack gas temperatures, volumes, and emission rates for each of the required three runs, plus the averages of the data from the three runs. Also included on Table I are a one-hour average opacity (Method 9), and the calculated efficiency of the process dust collection system, which is required for the pelletizer Waste Gas emissions. (In outstate-Minnesota, compliance can be demonstrated for sources more than 1/4 mile from a residence or public roadway if the efficiency of the emission control equipment exceeds 85%, emissions do not exceed 0.3 grains per standard cubic foot, and the source does not cause a violation of ambient standards).

The average particulate emissions for the three runs was 0.141 grains/dry standard cubic foot. The average flow rate was 257,579 dry standard cubic feet per minute. The average efficiency of the process dust collection system was determined to be 85.98%. (A possible explanation for a lower efficiency than in previous years can be found in Appendix D).

III. DESCRIPTION OF THE PROCESS

National Steel Pellet Company produces iron ore pellets for use in the steel industry. Crude ore is mined by conventional open pit methods

TABLE I

SUMMARY OF PARTICULATE EMISSIONS TESTS FOR
NATIONAL STEEL PELLET COMPANY
May 16, 1990

RUN NO.	T_S, °F	ACFM	DRY SCFM	EMISSIONS GR/DSCF	EMISSIONS LBS/HR	OPACITY %	COLLECTION EFFICIENCY %	% ISOKINETIC
Waste Gas Stack #2B, Source No. 31								
1	241	415,175	260,322	0.175	389.51		83.43	99.5
2	241	408,098	256,219	0.106	232.12		89.61	100.0
3	241	406,901	256,196	0.143	314.06		84.90	98.9
AVGS	241	410,058	257,579	0.141	311.90	6.29	85.98	99.5

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and, after primary crushing, is conveyed to covered ore storage at the plant site. The ore is recovered from storage by pan feeders and conveyors for primary grinding in wet semi-autogenous grinding mills. Following primary magnetic concentration, secondary grinding in ball mills, and secondary concentration by magnetic and hydraulic methods, a final concentrate slurry is forwarded to the pelletizing plant for agglomeration. The tailing produced is pumped to a tailing basin for disposal and recovery of process water.

In the pellet plant, the high-grade magnetic concentrate is filtered to about 9% moisture, blended with bentonite clay as a binder, and rolled into 1/2 inch "green balls" for induration in an Allis-Chalmers Grate-Kiln Pelletizing System.

The green balls are dried and pre-heated on a traveling grate by down-draft gases to develop mechanical strength prior to entering a rotary kiln for high-temperature (2400°F) induration. The kiln product drops into an annular cooler for cooling and heat-recovery, with ambient air provided by two stages of cooling fans. Hot gases from the first stage of cooling pass through the kiln (as secondary air) to the preheat section of the grate. A heat-recoup system also returns hot cooler gases to the grate in a separate duct. Excess cooling air passes up the cooler exhaust stack.

Pellets are discharged to a bin by a pallet-dumping system. The product handling system consists of vibrating feeders, a metal pan-conveyor, and a series of belt conveyors ending with a stacker conveyor. The pellets are discharged to stockpile, which is periodically loaded-out to a unit train for haulage to the iron ore docks at Allouez, Wisconsin.

IV. SOURCE DESCRIPTION

A counter-current flow of hot gases from the cooler to the grate is used to dry and pre-heat the "green balls" prior to induration in the rotary kiln. Hot gases from the kiln are passed through the bed of pellets in the preheat zone, through the preheat dust collectors and preheat fans (two parallel), and then on to the drying zone of the grate. The recoup gases from the cooler are also directed to the drying zone of the grate. The waste gas fans (two in parallel) pull the drying zone gases through the bed of drying pellets and waste gas dust collectors and discharge to atmosphere through the waste gas stacks. The 2A and 2B waste gas systems are identical. Each is tested in alternate years to demonstrate compliance at NSPC.

It is necessary to determine the collection efficiency, as well, and the "catch" of the process dust collectors is determined by sampling the double-dump dust valves of the preheat and waste gas dust collectors (also known as "first-pass" and "second-pass" process dust collectors, respectively). Determining the "catch" is relatively easy, as the double-dump valves are activated by electric timers. In brief, tared boxes designed to fit the launder under the double-dump valves are used to catch the dust product from several timed dump cycles. The gross weight is determined with a laboratory platform balance, and tare subtracted to determine dump-valve catch weight. A stop watch is used to determine the cycle time, and it is a relatively easy matter to calculate the total catch of each of the process dust collectors in pounds per hour. Plant laboratory personnel were used to determine the catch during each run of the Method 5 test on the Waste Gas stack. D. G. Oss, of Shell Engineering, observed the process, checked the cycle-time, and performed the calculation of pounds per hour for each of the runs.

The efficiency of the process dust collectors is determined from the following equation, with weights expressed in pounds per hour.

$$\% \text{ Efficiency} = \frac{100 \text{ (Weight of Catch)}}{\text{Weight of Catch + Weight of Emissions}}$$

The Waste Gas Dust Collectors (second pass) were built by the Zurn Company. These are multitube collectors (two in parallel), Model No. MTSA-288-11.5-CTY-TA. The pressure-drop of the collector was 6.2" W.G. during the emissions and opacity tests on May 16. The waste gas fan powers the off-gases from the drying zone of the grate through the waste gas dust collector and into the stack. The 2B waste gas fan power averaged 1603 KW at the time of testing.

The Preheat Dust Collectors (first pass) were built by Barron/ASE Industries. These are multiclone-type collectors which clean the off-gases from the preheat zone of the grate. The cleaned gases then pass through the preheat fans and into the drying zone of the grate.

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V. PLANT OPERATING CONDITIONS

The pelletizing rate was considered to be normal, and near capacity throughout the test program. The grate feed tonnage (green ball rate) was 710 Long Tons per Operating Hour, which was the same as the Year-to-Date average operating rate at the time of sampling.

Appendix C contains the shift reports and special reports prepared by the control room operator during the test program.

VI. TESTING EQUIPMENT AND METHODS

The test procedures and equipment used to determine the particulate emissions from the various sources at NSPC are included in Appendix E of this report. In brief, an Acurex Corporation Aerotherm High-Volume Stack Sampler was used to determine the emissions according to the procedures described in EPA's Reference Method 5, as published in 40 CFR, Part 60, Appendix A.

Prior to sampling, the dry gas meter, S-tube pitot, thermocouples, and nozzles were calibrated in the laboratory. The calibration data is included in Appendix F.

Analytical data, including filter weights and a summary of the volume of water collected in the impingers and by the silica gel, is included in Appendix G of this report.

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Total Source Analysis, Inc.
Particulate Test Analysis

NSPC
KEEWATIN, MN
2B WASTE GAS - Pellet Induration - Gas Fired
90-074
COMPLIANCE TEST

Run Number		1	2	3
Data set		(01)	(02)	(03)
Date		5-16-90	5-16-90	5-16-90
Location		STACK METHOD 5	STACK METHOD 5	STACK METHOD 5
Start time		08:45	10:40	12:37
End time		09:53	11:51	13:49
Barometric Pressure	In. Hg	28.19	28.19	28.19
Static Pressure	In. H2O	-0.52	-0.52	-0.52
Volume of Condensate	Mls	167	164	158
Volume Sampled	DCF	63.393	63.082	62.372
Meter Correction Factor		0.98	0.98	0.98
Square Root of Delta P		0.814	0.800	0.798
Orifice Pressure	In. H2O	3.58	3.50	3.47
Meter Temperature	Deg. F	54	57	57
Flue Temperature	Deg. F	241	241	241
Percent CO2	%	1.20	1.20	1.10
Percent O2	%	18.90	18.30	18.60
Diameter of Nozzle	In	0.308	0.308	0.308
Area of Flue	Sq Ft	132.73	132.73	132.73
Sample Time	Min	60	60	60
Weight Gain	Grams	0.6861	0.4109	0.5497
Absolute Flue Pressure	In. Hg	28.15	28.15	28.15
Corrected Sample Volume	DSCF	60.66	60.00	59.32
Moisture in Flue Gas	%	11.5	11.4	11.1
Molecular Weight	Lb/LbMole	27.69	27.68	27.71
Velocity of Flue Gas	FpS	52.13	51.24	51.09
Volume of Flue Gas	ACFM	415,175	408,098	406,901
Volume of Flue Gas	DSCFM	260,322	256,219	256,196
Dust Concentration	Lb/DSCF	2.49E-05	1.50E-05	2.04E-05
Dust Concentration	Lbs/Hour	389.51	232.12	314.06
Dust Concentration	Grs/ACF	.10	6.65E-02	9.01E-02
Dust Concentration	Grs/DSCF	.17	.10	.14
Isokinetic Rate	%	99.5	100.0	98.9

Averages:

Stack Temperature		241.0	Percent O2	18.6
Vol Flue Gas	ACFM	410,058	DSCFM	257,579
Part Emis	Lb/DSCF	2.01E-05	Lb/Hour	311.90
	Grs/ACF	8.87E-02	Grs/DSCF	.14
	Lbs/MBtu	0		

Source category: Taconite Ore Processing
Plant name : National Steel Pellet Co.
Process : Indurating furnace

Filename: TAC4-34.WQ1
Location: Keewatin, MN
Test date: 5/16/90

Date: 10/11/96
Ref. No.: 4-34
Process rate basis: Production

Source	Type of control	Pollutant	Run No.	Test Method	Isokinetic, %	Gas volume, DSCF	Volum. flow rate, DSCFM	Mass, g	Concen., gr/DSCF	Emission rate, lb/hr	Process rate, ton/hr	Emission factor kg/Mg	Emission factor lb/ton	Rat.
Natural gas-fired	Multiclone	filterable PM	1	EPA 5	99.5	60.66	260,322	0.686	0.175	779	588	0.66	1.3	
grate/kiln,		filterable PM	2		100.0	60.00	256,219	0.411	0.106	464	588	0.39	0.79	
(acid pellets)		filterable PM	3		98.9	59.32	256,196	0.550	0.143	628	588	0.53	1.1	
											Average	0.53	1.1	C
		CO2	1	EPA 3A	NA	NA	260,322	NA	1.2	42,884	588	36	73	
		CO2	2		NA	NA	256,219	NA	1.2	42,208	588	36	72	
		CO2	3		NA	NA	256,196	NA	1.1	38,688	588	33	66	
											Average	35	70	C

Basis for rating: Incomplete documentation; only one of two stacks measured.
Problems noted:
Other notes: Emissions doubled because only one of two stacks measured.
Additional information provided in Attachment 2 of Reference 53.