AP-42 Section 11.23
Reference 32
Report Sect. 4
Reference 32

(32)

PARTICULATE EMISSIONS TESTING

FOR

NATIONAL STEEL PELLET COMPANY

JUNE 17, 1992

Shell Engineering & Associates, Inc.
2403 West Ash
Columbia, Missouri 65203
July 17, 1992

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1992

shell engineering and associates, inc.

2403 west ash columbia, mo 65203 314-445-0106 314-445-0137 fax

July 17, 1992

Mr. George F. Krouse
Environmental Engineer
National Steel Pellet Company
P.O. Box 217
Keewatin, Minnesota 55753

Dear Mr. Krouse:

The attached report entitled "Particulate Emissions Testing for National Steel Pellet Company, June 17, 1992" is respectfully submitted. Also reported are the results of a visible emissions test by USEPA Method 9, and the calculated efficiency of the 2B Waste Gas particulate control system. The results of the tests are summarized on Tables I of the report.

If you have any questions about the testing or the contents of this report, please feel free to contact us.

Sincerely,

SHELL ENGINEERING & ASSOCIATES, INC.

H D Shell

Harvey D. Shell, P.E.
President

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TEST CERTIFICATION

We certify that the enclosed test results are true, accurate, and authentic. We were personally responsible for determining the particulate emissions from National Steel Pellet Company Source No. 31 as reported here.

SHELL ENGINEERING & ASSOCIATES, INC.

Harvey D. Shell, P.E.
President
Minnesota License #013275-8

Donald G. Oss
Project Engineer

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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 emissions of particulates 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 north-east 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 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 and visible emissions (opacity) of one of the two Waste Gas stacks is to be determined every year on an alternating basis. The emissions from the 2B Waste Gas stack have been determined to satisfy these requirements for 1992, as the 2A Waste Gas emissions were measured during a 1991 testing program.

Particulate 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 opacity of the visible emissions was evaluated in a one-hour test using USEPA Method 9.

The performance tests reported here include a determination of the efficiency of the particulate 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 compliance tests for particulates and opacity were conducted on Wednesday, June 17, 1992. There were no delays due to weather, although the skies were threatening. Ambient temperatures were generally in the range of 50-60 degrees F.

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

Engineering by Total Source Analysis, Inc., of Wellington, Ohio, and consisted of Team Leader Al Bradley, assisted by George Edgel and Scott Teague. The opacity measurements were made by Mr. Bradley, who was last certified as a visible emissions tester on May 15, 1992, in USEPA Region 9. He was previously certified to June 24, 1992. (Appendix F)

Pre-test planning was accomplished by telephone, and consisted primarily of conversations between Mr. George Krouse of NSPC, Mr. Patrick O' Neill of the Minnesota Pollution Control Agency's Air Quality Division, and Mr. Harvey D. Shell of Shell Engineering and Associates. Mr. O'Neill provided a test plan, including Exhibit C, detailing the requirements of the performance testing program. Mr. Robert Beresford from the Duluth Regional Office of the MPCA observed the particulate tests as part of an annual inspection at NSPC. Mr. O'Neill was present during the latter portions of the particulate testing.

Mr. Krouse provided assistance and liaison with plant operations during the testing. Plant operating and maintenance supervisors, plant laboratory personnel, the control room operators, 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 0.053 grains/dry standard cubic foot. The average flow rate was 227,956 dry standard cubic feet per minute. The average efficiency of the process dust collection system was determined to be 92.71%, and the opacity averaged 5.2% as measured during the first particulate run.

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TABLE I

SUMMARY OF PARTICULATE EMISSIONS TESTS FOR
NATIONAL STEEL PELLET COMPANY
June 17, 1992

RUN NO.	T_S, ^oF	ACFM	DRY SCFM	EMISSIONS GR/DSCF	EMISSIONS LBS/HR	OPACITY %	COLLECTION EFFICIENCY %	% ISOKINETIC
Waste Gas Stack #2B, Source No. 31								
1	240	355,620	231,216	0.062	123.34		90.93	97.2
2	250	355,448	225,815	0.057	110.17		93.00	96.8
3	251	358,032	226,838	0.039	75.27		94.21	98.9
AVGS	247	356,367	227,956	0.053	102.93	5.2	92.71	97.6

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 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^{o}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 the hottest of the remaining cooler gases to the grate in a separate duct.

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

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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 (see Appendix D).

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

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

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 across the 2B Waste Gas collector was 8.0-8.1" W.G. during the emissions and opacity tests on June 17. 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 1512 KW during the time of testing for particulates.

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.

V. PLANT OPERATING CONDITIONS

The pelletizing rate was considered to be near maximum throughout the test program. The grate feed tonnage (green ball rate) was 810 Long Tons per Hour, which was within 10% of the rate considered to be the absolute maximum for the NSPC pelletizing system under the most ideal conditions.

Appendix C contains the shift reports and special reports prepared by the control room operator during the test program. The special report included green ball feed rate (controlled at 810 LTPH) and a reading of the kiln gas fuel totalizer at 15 minute intervals throughout the test period. The average natural gas fuel consumption for the period of the tests was 184.6 million BTU/hr.

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.

The nomenclature and calculation methods for particulate emissions testing can be found in Appendix H.

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Total Source Analysis, Inc.
Particulate Test Analysis

SHELL
NATIONAL STEEL

92-148

Run Number		1	2	3
Data set		(01)	(02)	(03)
Date		6-17-92	6-17-92	6-17-92
Location		#2 WASTE STACK	#2 WASTE STACK	#2 WASTE STACK
Start time		08:10	10:00	11:40
End time		09:21	12:06	12:48
Barometric Pressure	In. Hg	29.16	29.16	29.16
Static Pressure	In. H2O	-0.52	-0.52	-0.52
Volume of Condensate	Mls	149	156	162
Volume Sampled	DCF	57.948	56.551	58.240
Meter Correction Factor		0.97	0.97	0.97
Square Root of Delta P		0.709	0.703	0.707
Orifice Pressure	In. H2O	3.28	3.26	3.31
Meter Temperature	Deg. F	76	78	80
Flue Temperature	Deg. F	240	250	251
Percent CO2	%	1.00	1.20	1.00
Percent O2	%	18.00	18.20	18.00
Diameter of Nozzle	In	0.313	0.313	0.313
Area of Flue	Sq Ft	132.73	132.73	132.73
Sample Time	Min	60	60	60
Weight Gain	Grams	0.2193	0.1960	0.1361
Absolute Flue Pressure	In. Hg	29.12	29.12	29.12
Corrected Sample Volume	DSCF	54.39	52.88	54.26
Moisture in Flue Gas	%	11.4	12.2	12.3
Molecular Weight	Lb/LbMole	27.64	27.59	27.54
Velocity of Flue Gas	FpS	44.65	44.63	44.96
Volume of Flue Gas	ACFM	355,620	355,448	358,032
Volume of Flue Gas	DSCFM	231,216	225,815	226,838
Dust Concentration	Lb/DSCF	8.89E-06	8.17E-06	5.53E-06
Dust Concentration	Lbs/Hour	123.34	110.73	75.27
Dust Concentration	Grs/ACF	4.10E-02	3.68E-02	2.49E-02
Dust Concentration	Grs/DSCF	6.22E-02	5.72E-02	3.87E-02
Isokinetic Rate	%	97.2	96.8	98.9

Averages:

Stack Temperature	: 247.0		Percent O2	: 18.1
Vol Flue Gas	ACFM : 356,367		DSCFM	: 227,956
Part Emis	Lb/DSCF : 7.53E-06		Lb/Hour	: 103.11
	Grs/ACF : 3.42E-02		Grs/DSCF	: 5.27E-02
	Lbs/MBtu : 0			

Source category:	Taconite Ore Processing	Filename:	TAC4-32.WQ1	Date:	10/11/96
Plant name :	National Steel Pellet Co.	Location:	Keewatin, MN	Ref. No.:	4-32
Process :	Indurating furnace	Test date:	6/7/92	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	Emission factor Rat.
Natural gas-fired	Multiclone	filterable PM	1	EPA 5	97.2	54.39	231,216	0.219	0.062	247	671	0.18	0.37	
grate/kiln,		filterable PM	2		96.8	52.88	225,815	0.196	0.057	221	671	0.16	0.33	
(acid pellets)		filterable PM	3		98.9	54.26	226,838	0.136	0.039	151	671	0.11	0.22	
									%		Average	0.15	0.31	C
		CO2	1	EPA 3A	NA	NA	231,216	NA	1.0	31,741	671	24	47	
		CO2	2		NA	NA	225,815	NA	1.2	37,200	671	28	55	
		CO2	3		NA	NA	226,838	NA	1.0	31,140	671	23	46	
											Average	25	50	C

Basis for rating: Incomplete documentation; only one of two stacks measured.

Problems noted:

Other notes: Emissions doubled because only one of two stacks tested.
Additional information provided in Attachment 2 of Reference 53.