Background Report Reference

AP-42 Section Number: 11.23

Background Chapter: 4

Reference Number: 36

Title: Particulate Emission Testing for National Steel Pellet Company

Shell Engineering and Associates, Inc.

Shell Engineering and Associates, Inc.

July/August 1988

AP-42 Section 11.23
Reference —
Report Sect. 4
Reference 36

PARTICULATE EMISSIONS TESTING

FOR

NATIONAL STEEL PELLET COMPANY

July and August, 1988

AP-42 Section 11.23
Reference
Report Sect. 4
Reference 36

PARTICULATE EMISSIONS TESTING

FOR

NATIONAL STEEL PELLET COMPANY

July and August, 1988

1988

TABLE I

SUMMARY OF PARTICULATE EMISSIONS TESTS FOR
NATIONAL STEEL PELLET COMPANY

RUN NO.	T_s, °F	ACFM	DRY SCFM	EMISSIONS GR/DSCF	EMISSIONS LBS/HR	OPACITY %	COLLECTION EFFICIENCY %	% ISOKINETIC
Drive House Dust Collector, Source No. 4, July 26, 1988						Ore Transfer 0		
1	80	15458	14931	.0284	3.63		N.A.	98.5
2	81	15309	14713	.0198	2.50		N.A.	100.1
3	81	15325	14713	.0109	1.37		N.A.	100.0
AVG	80.7	15364	14786	.0197	2.50			99.5
Allowable Emissions*				.080				
Reclaim Tunnel Dust Collector, Source No. 14, July 27, 1988						Ore Transfer 0		
1	80	10014	9569	.0074	0.61		N.A.	99.3
2	81	10275	9760	.0068	0.57		N.A.	98.3
3	81	9954	9542	.0068	0.56		N.A.	95.4
AVG	80.7	10081	9624	.0070	0.58			97.7
Allowable Emissions*				.090				
Additive Blending Dust Collector, Source No. 16, July 24, 1988						Concentrate (9% H_2O) Transfer + Bentonite Additive. 0		
1	77	15853	15114	.0088	1.14		N.A.	102.0
2	75	16519	15746	.0096	1.30		N.A	99.9
3	74	16362	15703	.0062	0.83		N.A.	99.6
AVG	75.3	16245	15521	.0082	1.09			100.5
Allowable Emissions*				.080				

* From Table 2 (Source Gas-Volume Table) of the Minnesota Rules.

1988

TABLE 1

SUMMARY OF PARTICULATE EMISSIONS TESTS FOR
NATIONAL STEEL PELLET COMPANY
(Cont.)

RUN NO.	T_s, °F	ACFM	DRY SCFM	EMISSIONS GR/DSCF	EMISSIONS LBS/HR	OPACITY %	COLLECTION EFFICIENCY %	% ISOKINETIC
Vibrating Feeders Dust Collector, Fired Pellet Transfer.								
Source No. 24, July 24, 1988						0		
1	79	55605	53313	.0032	1.46		N.A.	100.8
2	80	49176	46943	.0032	1.29		N.A.	101.8
3	79	48698	46684	.0031	1.24		N.A.	101.1
AVG	79.3	51160	48980	.0032	1.34			101.2
Allowable Emissions*				.053				
Cooler Stack Pellet Cooling								
Source No. 26, August 19, 1988						0		
1	592	386334	179549	.0303	46.63		N.A.	98.8
2	591	390864	183038	.0374	58.68***		N.A.	98.0
3	584	389213	184368	.0265	41.88		N.A.	97.6
AVG	589	388804	182318	.0314	49.06			
Allowable Emissions*				.0349				
Waste Gas Stack #2B Pellet Induration - Waste Gas - Gas Fired								
Source No. 31, July 25, 1988						12.65		
1	277	338488	227925	.1636	319.62		90.26	97.4
2	278	339140	225964	.1340	259.54		91.54	98.1
3	279	345698	231392	.1386	274.89		90.13	97.9
AVG	278	341109	228760	.1452	284.68		90.64	97.8
Allowable Emissions*				.033**				

* From Table 2 (Source Gas-Volume Table) of the Minnesota Rules.
** 0.3 Allowable if collection efficiency exceeds 85%.

1988

TOTAL SOURCE ANALYSIS
PARTICULATE TEST RESULTS

NATIONAL STEEL

Keewatin, MN
DRIVE HOUSE(#4) Dust Collector Ore Transfer
88-071 Source #4
7-26-88

RUN NUMBER			1	2	3
BAROMETRIC PRESSURE	IN. HG		30.02	30.02	30.02
STATIC PRESSURE	IN. H2O		0.5	0.5	0.5
VOLUME OF CONDENSATE	MLS		26	31.2	32.8
VOLUME SAMPLED	DCF		79.583	79.369	79.69
METER CORRECTION FACTOR			0.98	0.98	0.98
SQUARE ROOT OF DELTA P			1.168	1.155	1.156
ORIFICE PRESSURE	IN. H2O		0.657	0.702	0.703
METER TEMPERATURE	DEG. F		97	94	97
FLUE TEMPERATURE	DEG. F		80	81	81
PRECENT CO2	%		0	0	0
PERCENT O2	%		20.9	20.9	20.9
DIAMETER OF NOZZLE	IN.		0.251	0.251	0.251
AREA OF FLUE	SQ. FT.		4.125	4.125	4.125
SAMPLE TIME	MIN.		60	60	60
F FACTOR	DSCF/MBTU		0	0	0
WEIGHT GAIN	GRAMS		0.1367	0.0957	0.0524
ABSOLUTE FLUE PRESSURE	IN. HG		30.06	30.06	30.06
CORRECTED SAMPLE VOLUME	DSCF		74.27	74.48	74.38
MOISTURE IN FLUE GAS	%		1.6	1.9	2
MOLECULAR WEIGHT	LB/LBMOLE		28.66	28.63	28.62
VELOCITY OF FLUE GAS	FPS	3725fpm	62.46	61.85	61.92
VOLUME OF FLUE GAS	ACFM		15458	15309	15325
VOLUME OF FLUE GAS	DSCFM		14931	14713	14713
DUST CONCENTRATION	LB/DSCF		4.1E-06	2.8E-06	1.6E-06
DUST CONCENTRATION	LBS/HOUR		3.6	2.5	1.4
DUST CONCENTRATION	GRS/ACF		0.0278	0.0193	0.0106
DUST CONCENTRATION	GRS/DSCF		0.0284	0.0198	0.0109
ISOKINETIC RATE	%		99.4	101.1	101
PARTICULATE EMISSIONS	LBS/MBTU		0	0	0

62.08

1988

TOTAL SOURCE ANALYSIS
PARTICULATE TEST RESULTS

NATIONAL STEEL
Keewatin, MN
RECLAIM TUNNEL Line (#10) Dust Collector (Source 14) Ore Transfer
88-071
7-27-88
Source #10

RUN NUMBER			1	2	3
BAROMETRIC PRESSURE	IN. HG		29.92	29.92	29.92
STATIC PRESSURE	IN. H2O		-0.4	-0.4	0.4
VOLUME OF CONDENSATE	MLS		31	37	25
VOLUME SAMPLED	DCF		69.791	72.017	69.294
METER CORRECTION FACTOR			0.98	0.97	0.97
SQUARE ROOT OF DELTA P			1.04	1.065	1.034
ORIFICE PRESSURE	IN. H2O		0.543	0.578	0.543
METER TEMPERATURE	DEG. F		81	93	103
FLUE TEMPERATURE	DEG. F		80	81	81
PRECENT CO2	%		0	0	0
PERCENT O2	%		20.9	20.45	20.3
DIAMETER OF NOZZLE	IN.		0.251	0.251	0.251
AREA OF FLUE	SQ. FT.		2.99	2.99	2.99
SAMPLE TIME	MIN.		60	60	60
F FACTOR	DSCF/MBTU		0	0	0
WEIGHT GAIN	GRAMS		0.0321	0.0293	0.0277
ABSOLUTE FLUE PRESSURE	IN. HG		29.89	29.89	29.95
CORRECTED SAMPLE VOLUME	DSCF		66.81	66.77	63.1
MOISTURE IN FLUE GAS	%		2.1	2.5	1.8
MOLECULAR WEIGHT	LB/LBMOLE		28.6	28.54	28.61
VELOCITY OF FLUE GAS	FPS	3372fpm	55.82	57.28	55.49
VOLUME OF FLUE GAS	ACFM		10014	10275	9954
VOLUME OF FLUE GAS	DSCFM		9569	9760	9542
DUST CONCENTRATION	LB/DSCF		1.1E-06	1E-06	1E-06
DUST CONCENTRATION	LBS/HOUR		0.6	0.6	0.6
DUST CONCENTRATION	GRS/ACF		7.2E-03	6.5E-03	6.5E-03
DUST CONCENTRATION	GRS/DSCF		7.4E-03	6.8E-03	6.8E-03
ISOKINETIC RATE	%		101.1	99.1	95.7
PARTICULATE EMISSIONS	LBS/MBTU		0	0	0

1988

TOTAL SOURCE ANALYSIS
PARTICULATE TEST RESULTS

NATIONAL STEEL
Keewatin, MN
ADDITIVE BLENDER(#16) Dust Collector
88-071 Source #16
7-24-88

Concentrate (9% H_2O) Transfer + Bentonite addition

RUN NUMBER			1	2	3	
BAROMETRIC PRESSURE	IN. HG		29.82	29.82	29.82	
STATIC PRESSURE	IN. H2O		-0.15	-0.15	-0.15	
VOLUME OF CONDENSATE	MLS		23.2	27.2	22.6	
VOLUME SAMPLED	DCF		41.363	42.842	43.078	
METER CORRECTION FACTOR			0.97	0.97	0.97	
SQUARE ROOT OF DELTA P			0.625	0.652	0.647	
ORIFICE PRESSURE	IN. H2O		1.82	1.96	1.97	
METER TEMPERATURE	DEG. F		65	73	79	
FLUE TEMPERATURE	DEG. F		77	75	74	
PRECENT CO2	%		0	0	0	
PERCENT O2	%		20.9	20.9	20.9	
DIAMETER OF NOZZLE	IN.		0.251	0.251	0.251	
AREA OF FLUE	SQ. FT.		7.88	7.88	7.88	
SAMPLE TIME	MIN.		60	60	60	
F FACTOR	DSCF/MBTU		0	0	0	
WEIGHT GAIN	GRAMS		0.023	0.0257	0.0164	
ABSOLUTE FLUE PRESSURE	IN. HG		29.81	29.81	29.81	
CORRECTED SAMPLE VOLUME	DSCF		40.38	41.21	40.98	
MOISTURE IN FLUE GAS	%		2.6	3	2.5	
MOLECULAR WEIGHT	LB/LBMOLE		28.55	28.51	28.56	
VELOCITY OF FLUE GAS	FPS	2062	33.53	34.94	34.61	34.4
VOLUME OF FLUE GAS	ACFM		15853	16519	16362	
VOLUME OF FLUE GAS	DSCFM		15114	15746	15703	
DUST CONCENTRATION	LB/DSCF		1.3E-06	1.4E-06	9.0E-07	
DUST CONCENTRATION	LBS/HOUR		1.1	1.3	0.8	
DUST CONCENTRATION	GRS/ACF		8.5E-03	9.3E-03	6.0E-03	
DUST CONCENTRATION	GRS/DSCF		8.8E-03	9.6E-03	6.2E-03	
ISOKINETIC RATE	%		102	99.9	99.6	
PARTICULATE EMISSIONS	LBS/MBTU		0	0	0	

1988

TOTAL SOURCE ANALYSIS
PARTICULATE TEST RESULTS

NATIONAL STEEL
Keewatin, MN
STACK #24 (Vibrating Feeders Dust Collector) Fired Pellet Transfer
88-071
Source #24
7-24-88

RUN NUMBER		4	5	6
BAROMETRIC PRESSURE	IN. HG	29.82	29.82	29.82
STATIC PRESSURE	IN. H2O	-0.48	-0.48	-0.48
VOLUME OF CONDENSATE	MLS	18.5	19	16.4
VOLUME SAMPLED	DCF	56.246	49.841	49.175
METER CORRECTION FACTOR		0.97	0.97	0.97
SQUARE ROOT OF DELTA P		0.813	0.718	0.712
ORIFICE PRESSURE	IN. H2O	3.25	2.55	2.49
METER TEMPERATURE	DEG. F	94	91	90
FLUE TEMPERATURE	DEG. F	79	80	79
PRECENT CO2	%	0	0	0
PERCENT O2	%	20.9	20.9	20.9
DIAMETER OF NOZZLE	IN.	0.251	0.251	0.251
AREA OF FLUE	SQ. FT.	21.24	21.24	21.24
SAMPLE TIME	MIN.	60	60	60
F FACTOR	DSCF/MBTU	0	0	0
WEIGHT GAIN	GRAMS	0.0109	9.7E-03	9.2E-03
ABSOLUTE FLUE PRESSURE	IN. HG	29.78	29.78	29.78
CORRECTED SAMPLE VOLUME	DSCF	52.22	46.44	45.9
MOISTURE IN FLUE GAS	%	1.6	1.9	1.7
MOLECULAR WEIGHT	LB/LBMOLE	28.66	28.63	28.66
VELOCITY OF FLUE GAS	FPS (2409 l/m)	43.63	38.59	38.21 40.1
VOLUME OF FLUE GAS	ACFM	55605	49176	48698
VOLUME OF FLUE GAS	DSCFM	53313	46943	46684
DUST CONCENTRATION	LB/DSCF	5.0E-07	5.0E-07	4.0E-07
DUST CONCENTRATION	LBS/HOUR	1.5	1.3	1.2
DUST CONCENTRATION	GRS/ACF	3.1E-03	3.1E-03	3.0E-03
DUST CONCENTRATION	GRS/DSCF	3.2E-03	3.2E-03	3.1E-03
ISOKINETIC RATE	%	100.8	101.8	101.1
PARTICULATE EMISSIONS	LBS/MBTU	0	0	0

1988

TOTAL SOURCE ANALYSIS
PARTICULATE TEST RESULTS

NATIONAL STEEL
#26 COOLER EXHAUST
STACK
88-082
8-19-88

Pellet Cooling
Source # 26

RUN NUMBER		1	2	3
BAROMETRIC PRESSURE	IN. HG	28.46	28.46	28.46
STATIC PRESSURE	IN. H2O	-0.3	-0.28	-0.28
VOLUME OF CONDENSATE	MLS	32	24	18
VOLUME SAMPLED	DCF	60.852	62.691	64.135
METER CORRECTION FACTOR		0.99	0.99	0.99
SQUARE ROOT OF DELTA P		0.594	0.602	0.602
ORIFICE PRESSURE	IN. H2O	3.78	4.01	4.2
METER TEMPERATURE	DEG. F	67	77	88
FLUE TEMPERATURE	DEG. F	592	591	584
PRECENT CO2	%	0	0	0
PERCENT O2	%	20.9	20.9	20.9
DIAMETER OF NOZZLE	IN.	0.375	0.375	0.375
AREA OF FLUE	SQ. FT.	141.03	141.03	141.03
SAMPLE TIME	MIN.	60	60	60
F FACTOR	DSCF/MBTU	0	0	0
WEIGHT GAIN	GRAMS	0.1136	0.1421	0.1011
ABSOLUTE FLUE PRESSURE	IN. HG	28.44	28.44	28.44
CORRECTED SAMPLE VOLUME	DSCF	57.95	58.62	58.8
MOISTURE IN FLUE GAS	%	2.5	1.9	1.4
MOLECULAR WEIGHT	LB/LBMOLE	28.56	28.63	28.68
VELOCITY OF FLUE GAS	FPS	27574 45.66	46.19	46
VOLUME OF FLUE GAS	ACFM	386334	390864	389213
VOLUME OF FLUE GAS	DSCFM	179549	183038	184368
DUST CONCENTRATION	LB/DSCF	4.3E-06	5.3E-06	3.8E-06
DUST CONCENTRATION	LBS/HOUR	46.6	58.7	41.9
DUST CONCENTRATION	GRS/ACF	0.0144	0.0178	0.0127
DUST CONCENTRATION	GRS/DSCF	0.0303	0.0374	0.0265
ISOKINETIC RATE	%	98.8	98	97.6
PARTICULATE EMISSIONS	LBS/MBTU	0	0	0

45.95
388,800
182,318

1988

TOTAL SOURCE ANALYSIS
PARTICULATE TEST RESULTS

NATIONAL STEEL
Keewatin, MN
WASTE GAS #31 Waste Gas - Pellet Induration - Gas Fired
88-071
7-25-88 Source #31

RUN NUMBER			4	5	6
BAROMETRIC PRESSURE	IN. HG		30.18	30.18	30.18
STATIC PRESSURE	IN. H2O		-0.3	-0.3	-0.3
VOLUME OF CONDENSATE	MLS		52.8	60	56.5
VOLUME SAMPLED	DCF		37.127	37.41	38.01
METER CORRECTION FACTOR			0.97	0.97	0.97
SQUARE ROOT OF DELTA P			0.674	0.674	0.687
ORIFICE PRESSURE	IN. H2O		1.41	1.41	1.46
METER TEMPERATURE	DEG. F		97	102	99
FLUE TEMPERATURE	DEG. F		277	278	279
PRECENT CO2	%		0.5	0.6	0.45
PERCENT O2	%		16.8	17	16.95
DIAMETER OF NOZZLE	IN.		0.251	0.251	0.251
AREA OF FLUE	SQ. FT.		132.73	132.73	132.73
SAMPLE TIME	MIN.		60	60	60
F FACTOR	DSCF/MBTU		0	0	0
WEIGHT GAIN	GRAMS		0.3662	0.2995	0.3164
ABSOLUTE FLUE PRESSURE	IN. HG		30.16	30.16	30.16
CORRECTED SAMPLE VOLUME	DSCF		34.54	34.49	35.24
MOISTURE IN FLUE GAS	%		6.7	7.6	7
MOLECULAR WEIGHT	LB/LBMOLE		28.03	27.96	28
VELOCITY OF FLUE GAS	FPS	2570 fpm	42.5	42.59	43.41 42.8
VOLUME OF FLUE GAS	ACFM		338488	339140	345698
VOLUME OF FLUE GAS	DSCFM		227925	225964	231392
DUST CONCENTRATION	LB/DSCF		2.34E-05	1.91E-05	1.98E-05
DUST CONCENTRATION	LBS/HOUR		319.7	259.6	274.9
DUST CONCENTRATION	GRS/ACF		0.1113	0.09	0.0935
DUST CONCENTRATION	GRS/DSCF		0.1636	0.134	0.1386
ISOKINETIC RATE	%		97.4	98.1	97.9
PARTICULATE EMISSIONS	LBS/MBTU		0	0	0