DONNER-HANNA PECT SYSTEM

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ENTROPY
ENVIRONMENTALISTS, INC

SPECIALISTS IN
SOURCE
SAMPLING

October 21, 1976

Mr. Tom Voltaggio
U.S. EPA
230 South Dearborn Street
Chicago, Illinois 60604

Dear Tom:

I finally received (last Thursday) the report from Donner Hanna on the July, August, and September testing. I have reviewed it and discussed it with Lou Paley (who also got a copy), and have relayed my comments to Andy Bhattacharyya this morning. The fact that you are the last one to receive my comments was certainly not intentional.

While the report lacks polish, it definitely presents all of the data one might ever want, at least on the sampling. The only general criticism I have is that there is no introduction and no summary of all the results, but then I don't imagine that the report is intended to stand on its own.

An error was made in the calculation step for the summarization page on the August testing. The reported average emission rate is 0.0313 (page 57), and it should be 0.0324. Andy says he will amend that page.

Lou Paley brought up the fact that the impinger catch in August and September averaged less than 10% of the total, while in July it averaged 25%. Andy could not come up with an explanation, and neither can I. It may indicate a problem, or it may just be another inexplicable sampling phenomenon. (It does indicate the importance of measuring the total catch, and not just that caught by the filter.)

P.O. Box 12291, Research Triangle Park, North Carolina 27709
Phone 919-781-3550

The only other comment I have is that instead of reporting one result for August and one for September, the data could be presented as two shorter runs each month. Based on the five results, the average emission rate is 0.0306 pounds per ton, and the consistency of the results implies a precision of maybe ± 50%.

There were no significant departures from the proposed test protocol, and I think the test crew should be commended for their efforts. Let me know if you have any questions.

Sincerely,

Jim

D. James Grove
Vice President

cc : Lou Paley

DJG/mwu

DONNER-HANNA COKE CORPORATION
BOX A - SOUTH PARK STATION BUFFALO, NEW YORK 14220
TELEPHONE 716/822-1600

September 23, 1976

Mr. Louis R. Paley
Environmental Engineer
U.S. Environmental Protection Agency
Division of Stationary Source Enforcement
Technical Support Branch - Room 3202
Washington, D.C. EN341

Dear Mr. Paley:

Please be aware that this report and all information associated with the design and operation of this production prototype are made available to EPA for in-house use only and are protected from public disclosure by Section 114c of the Clean Air Act. The City of Cleveland and US-EPA-V pressed Donner-Hanna to sample residual emissions for their benefit in evaluating a Republic Steel proposal to build a pushing emissions control installation similar to the production prototype which began operation here in June. Transmitted herewith is a report of some initial sampling, along with the associated operational information requested.

Because of an inability to progress to the question of out-of-duct emissions in the time available, a complete testing protocol was not agreed to. However, there was agreement about in-duct testing which is reported herein at the request of the City of Cleveland which has asked US-EPA to participate.

The emission control system reported herein has not been permitted to progress through a stage of optimization and shakedown operation. This freeze on the development was imposed to provide an unchanged entity for this initial sampling. Despite restraint which prevents reacting to some recognized need for enhanced operation by methods anticipating such enhancement, the device is providing control at or near best available technology levels.

Once again this is a developmental project not available for discussions between EPA and other coke producers or engineering companies. Such information transmittal will be undertaken directly by Donner-Hanna at an appropriate time not too far hence. Work on out-of-duct testing is being progressed and will be discussed with government agencies when a program can be detailed.

Very truly yours,

DONNER-HANNA COKE CORPORATION

Kevin D. Mahar
Environmental Control Manager

Enclosure

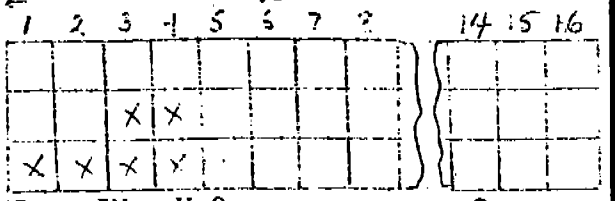
BY _____ DATE 7.21.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Velocity & Temperature Data Particulate In Duct Emissions

CHKD. BY AA DATE 9.21.76

SHEET NO. 4 OF 135

JOB NO. Donner-Hanna Coke Corp. PECT System

Date Sampled: 7.21.76
Train & Operator: G.T. - SKM.JF
Barometric Pressure: 29.34
Static Pressure: Atms.
Wind Direction & Speed: N.E - 5-15 m.p.h.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
1N	10	190		.05	.2236		.9	15.79	5
	20	204		.04	.20		.7	14.28	6
	30	201		.04	.20		.7	14.24	7.5
93	40	209	199.3	.03	.1732	.1617	.5	12.41	7.5
	50	206		.03	.1732		.5	12.38	7.5
	60	186		.00	.00		0.0	—	0
	70								
2N	10	189		.01	.10		.2	9.06	9
	20	196		.02	.1732		.3	10.03	13
	30	204		.01	.10		.2	9.14	15
109	40	165	181.3	.01	.10	.0955	.2	6.93	15.0
	50	171		.01	.10		.2	6.96	14.5
	60	163		.00	.00		0.0	.0	0
	70								
3N	10	198		.03	.1732		.5	12.31	10
	20	206		.04	.20		.7	14.30	14
	30	221		.03	.1732	.1602	.5	12.52	16
119	40	184	196.8	.01	.10		.2	7.03	17
	50	203		.03	.1732		.5	12.35	16
	60	169		.02	.1414		.3	9.52	16
	70								
4N	10	178		.03	.1732		.5	12.12	15
	20	193		.04	.20		.7	14.16	19
	30	215		.02	.1414	.0858	.3	10.18	18.5
129	40	198	184.3	.00	.00		0	0	0
	50	171		.00	.00		0	0	0
	60	151		.00	.00		0	0	0
	70								
4C	10	184		.04	.20		.7	14.06	11
	20	206		.06	.2449		1.0	17.51	17
	30	209		.07	.2646		1.2	19.07	18.5
102	40	215	208.8	.06	.2449	.2388	1.0	17.63	18.5
	50	218		.06	.2449		1.0	17.67	19.0
	60	221		.03	.1732		0.5	12.52	—
	70								
3C	10	183		.05	.2236		0.9	15.71	16
	20	206		.05	.2236		0.9	15.98	18
	30	207		.05	.2236		0.9	15.98	19
112	40	207	205.3	.05	.2236	.2265	0.9	15.98	18.5
	50	217		.07	.2646		1.2	19.07	18
	60	230		.04	.20		.70	14.55	18
	70								

BY _____ DATE 7.21.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

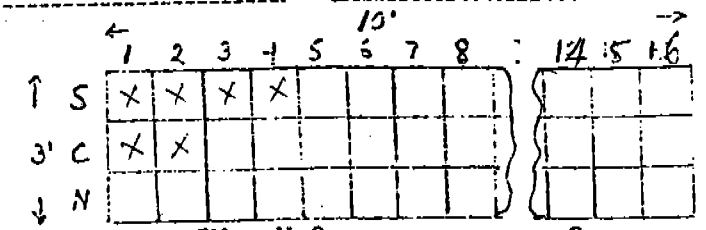
CHKD. BY AA DATE 7.21.76

SHEET NO. 5 OF 135

JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

Date Sampled: 7.21.76
Train & Operator: G.I. - SKH & JK
Barometric Pressure: 29.34
Static Pressure: Atms
Wind Direction & Speed: N.E. - 5-15 mph.



Centroid, Oven No. & Time Pushed	Sec.	Probe Tip Temperatures Read	Average °F	Pressures IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
2C	10	198		.03	.1732		.5	12.31	15.5
	20	204		.02	.1414		.3	10.09	18.5
	30	201		.02	.1414		.3	10.07	18.5
8S	40	184	195.8	.03	.1732	.1520	.5	12.18	17.0
	50	198		.02	.1414		.3	10.05	16
	60	190		.02	.1414		.3	9.99	15
	70								
1C	10	189		.01	.10		.2	7.05	14
	20	199		.02	.1414		.3	10.06	14
	30	189		.02	.1414		.3	9.98	16.5
	40	181	185.0	.01	.10	.1276	.2	7.01	16
12S	50	173		.02	.1414		.3	9.85	15
	60	179		.02	.1414		.3	9.90	–
	70								
1S	10	187		.04	.20		.7	14.09	13
	20	193		.04	.20		.7	14.16	16
	30	187		.05	.2236		.9	15.75	18
	40	182	192.2	.02	.1414	.1897	.3	9.93	17.5
13S	50	206		.04	.20		.7	14.30	19
	60	198		.03	.1732		.5	12.31	18
	70								
2S	10	181		.02	.1414		.3	9.92	13
	20	200		.04	.20		.7	14.23	16
	30	184		.05	.2236		.9	15.72	18
	40	190	199.8	.05	.2236	.2020	.9	15.79	19
9S	50	214		.05	.2236		.9	16.08	20
	60	230		.04	.20		.7	14.55	18
	70								
3S	10	184		.03	.1732		.5	12.18	16
	20	157		.01	.10		.2	6.88	18
	30	154		.01	.10		.2	6.86	12.5
10 4	40	176	165.0	.01	.10	.0955	.2	6.99	16.5
	50	161		.01	.10		.2	6.90	16.5
(Stick on Oven)	60	158		0.0	.00		0		0
	70								
4S	10	176		.05	.2236		.9	15.64	15
	20	201		.05	.2236		.9	15.92	18.5
	30	219		.08	.2828		1.4	20.42	17
11 4	40	216	207.3	.07	.2646	.2471	1.2	19.05	12.5
	50	209		.05	.2236		0.9	16.02	18
	60	223		.07	.2646		1.2	19.05	21
	70								

DATE	SOURCE	TESTED BY
7/21/76	PECT	STAFF OF

SAMPLER	SAMPLE BOX NO.	BAR. PRESS.	WEATHER CONDITION
GF	—	29.34	Cloudy Cold NE 5-15 mph

ASSUMED MOISTURE	C FACTOR	METER BOX SETTING
75	1	125-150

PROBE LENGTH	NOZZLE DIAMETER	PROBE SETTING
30"	11/16"	No Heat

DRY COLLECTED WEIGHT MILLIGRAMS	INITIAL	FINAL	NET
FILTER NO. 18	0.73852	0.76910	0.03058
ACETONE WASH	96.00515	96.02530	0.02015
WATER WASH	Not	done	
FRONT TOTAL			0.15073
IMPINGER	92.64753	92.72216	0.07463
TRAIN TOTAL			0.22536

CONDENSATE COLLECTED . ml - Gms	INITIAL	FINAL	NET
IMP. I	100	339	239
IMP. II	100	163	63
IMP. III	0	0	
SILICA GEL	200	203	3
TOTAL			295
CYCLONE	0	110	110

CENTROID NO.	CLOCK TIME	SECONDS SAMPLED	DRY GAS METER READ OF 155.32.	ORIFICE ΔH	PUMP IN. HG.	DRY GAS METER IN °F	DRY GAS METER OUT °F	STACK °F	SAMPLE BOX °F	IMPINGER °F	√Δ P	STACK IN. HG.	STACK FPS	
1N 93		50	155.82	.3-.5	0-2.5	70	70	199.3	125-150	92	.1617	Atms	11.50	
2N 109		60	156.27	.2-.3	0-15	70	70	181.3		92	.0955		6.70	
3N 119		60	157.06	.3-.9	10-17	70	69	196.8		98	.1602		11 37	
4N 129		60	157.62	.3-.9	0-18.5	75	74	184.3		108	.0858		6.03	
4C 102		60	158.13	0-.5	11-19	75	75	208.8		102	.2288		16.39	
3C 112		60	158.68	.9-1.4	16-19	72	72	208.3		105	.2265		16.22	
2C 85		60	159.27	0-0.9	15-18.5	75	74	195.8		112	.1520		10.78	
1C 122		60	159.85	0-0.3	14-16.5	75	75	185.0		100	.1276		8 98	
1S 132		60	160.39	.2-0.9	13-19	78	77	192.2		110	.1897		13.72	
2S 95		60	160.88	0-.7	13-20	78	76	199.8		110	.2020		14 37	
3S 104		60	161.38	0.5-1.2	0-18	80	80	165.0		95	.0955		6.61	Almost Stuck = Pushed
4S 114		60	161.91	0.9-1.2	15-21	80	80	209.3		97	.2471		17.68	
TOT		TOT	TOT		AVG	AVG		AVG				AVG	AVG	
12 pts		710 sec	6.59	0.6		74.6		193.7				.1644	11.66	

BY _____ DATE 7/21/76

CHKD. BY _____ DATE 8/21/76

Data Collection Sheet

SUBJECT Air Pollution Control

Source Sampling of Residual

Particulate In Duct Emissions

SHEET NO. 6 OF 13

JOB NO. Donner-Hanna Coke

Corp. PECT System

SAMPLER SUBSET - I = 9.I = 7.21.76

1. Volume of gas sampled - (std cuft dry)

$$Vmstd = 17.71 \cdot Vm \cdot \frac{(Pbar + \Delta H/13.6)}{Tm}$$

$$= 17.71 \times 6.59 \times \frac{(29.34 + 0.6/13.6)}{460+}$$

$$= 6.41 \text{ std cuft dry}$$

2. Water collection -

(a) Total impinger collection (Vlc) 305 ml

(b) Cyclone water collection (Vcc) 110 ml (Particulate water)

3. Volume of water vapor in gas sampled

$$Vwstd = .0474 \times Vlc = .0474 \times 305 = 14.46 \text{ cuft in}$$

4. % Moisture

$$\frac{Vwstd}{Vmstd + Vwstd} \times 100 = \frac{14.46}{6.42 + 14.46} \times 100 = 69.24\ \%$$

5. Mole fraction dry (M_D)

$$1 - \frac{\%\ Moisture}{100} = 1 - 0.6924 = 0.3076$$

6. Molecular wt dry (Md)

(a) Gas composition - H_2 - 2.5 % vol

CO_2 - 2.5 "

CO - 1.0 "

O_2 - 19.74 "

N_2 - 74.26 "

(b) $Md = \%\ H_2 \times .02 + \%\ CO_2 \times .44 + \%\ CO \times .28 + \%\ O_2 \times .32 + \%\ H_2 \times .28$

$= 2.5 \times .02 + 2.5 \times 0.44 + 1.0 \times .28 + 19.74 \times .32 + 74.26 \times .28 = 28.54$

7. Molecular wt wet (Ms)

M_D X Md + 18 $(1-M_D)$ = 28.54 × .3076 + 18 × .6924 = 21.24.

8. Vcc percentage of total water vapor

$$= \frac{Vcc}{Vlc + Vcc} \times 100 = \frac{110}{110 + 305} \times 100 = 26.51 \%$$

9. Stack gas velocity stack condition

$$Vs = 85.48 \times Cp \times \sqrt{\Delta p} \sqrt{\frac{460+Ts}{Ps \times Ms}}$$

$$= 85.48 \times .81 \times .1644 \times \sqrt{\frac{460+193.7}{29.34 + 21.24}}$$

$= 11.66$ fps

10. Actual stack gas flow through the sampled area

$$Qs = Vs \times 30 \times \frac{\text{Points sampled}}{\text{Total points}} \times 60 \text{ ACFM}$$

$$= 11.66 \times 30 \times \frac{12}{48} \times 60 = 5247$$

ACFM through sample area

11. Emission rate

A. Concentration method:

(a) Actual cuft sampled through nozzle

$$Q_{ACF} = \frac{Vmstd}{M_D} \times \frac{460 + Ts}{460 + 70} \times \frac{29.92}{Ps}$$

$$= \frac{6.42}{.3076} \times \frac{460 + 193.7}{530} \times \frac{29.92}{29.34}$$

= 26.25 ACF

(b) Total wt collected (Mp gms)

Filter .03058

Front half acetone - .12015

Front half water -

Back half - .07463

TOTAL .22536

Contd (9/24/76)

(c) Lbs/ton of coal (12 tons per charge
60 secs per push)

$$Pmrc = \frac{Mp \times Qs}{453.6 \times Q_{ACF} \times 12} = \frac{.22536 \times 52.49}{453.6 \times 2625 \times 12}$$

.008276 = Lbs/ton of coal through sample area

Pmrc = .008276

B. Area ratio:

An = Area Nozzle = .0025779 sq ft

As = Area stack sampled = 7.5 sq ft

θ = Minutes sampled 11.83

$$Pmra = \frac{As}{An} \times \frac{Mp}{453.6} \times \frac{1}{\theta} \times \frac{1}{12}$$

$$= \frac{7.5}{.0025779} \times \frac{.22536}{453.6} \times \frac{1}{11.83} \times \frac{1}{12}$$

= .01018 lbs/ton of coal through sample area

Average emission - $\frac{Pmra + Pmrc}{2} = \frac{.008276 + .01018}{2} = .00923$

12. Percentage Isokienetics

$$I = \frac{1.667 \left[.00267\ Vlc + \frac{Vm}{Tm} \left(Pbar + \frac{\Delta H}{13.6} \right) \right] Ts}{\theta \times Vs \times P \times An}$$

$$= \frac{1.667 \left[.00267 \times 305 + \frac{6.59}{534.6} \left(29.34 + \frac{0.6}{13.6} \right) \right] (460 + 193.7)}{11.83 \times 11.06 \times 29.34 \times .0025729}$$

= 122.9 %

BY ______ DATE 7/21/76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

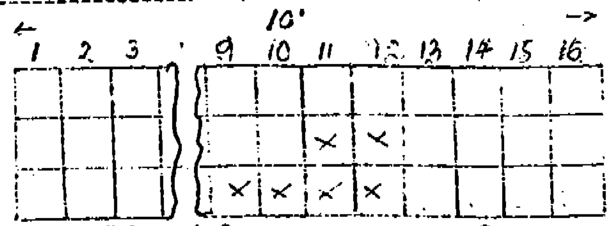
SHEET NO. 10 OF 135

CHKD. BY ?? DATE 7/21/76

JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

Date Sampled: 7/21/76
Train & Operator: Tom & Rick
Barometric Pressure: 29.34
Static Pressure:
Wind Direction & Speed: NE – 5-15 mph



Centroid, Oven No. & Time Pushed	Sec.	Probe Tip Temperatures Read	Average °F	Pressures In. H_2O Read ΔP	Plot √ΔP	Avge. √ΔP	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
9 N.	10	187		0.03	0.1732		0.82	13.75	
	20	200		0.05	0.2236		1.36	17.92	
	30	187	184.7	0.03	0.1732	0.1527	0.82	13.75	
	40	182		0.03	0.1732		0.82	13.69	
Oven no. 93.	50	176		0.03	0.1732		0.82	13.63	
	60	176							
	70								
10 N.	10	177		0.02	0.1414		0.56	11.14	
	20	181		0.03	0.1732		0.82	13.68	
	30	181	161.7	0.02	0.1414	0.1260	0.54	11.17	
	40	152		0.01	0.1000		0.27	7.72	
Oven no 109	50	138		0.01	0.1000		0.27	7.63	
	60	141		0.01	0.1000		0.27	7.65	
	70								
11 N.	10	172		0.02	0.1414		0.54	11.09	
	20	182		0.02	0.1414		0.54	11.18	
	30	176	169.8	0.02	0.1414	0.1207	0.54	11.13	
	40	173		0.01	0.1000		0.27	7.85	
Oven no. 119	50	167		0.01	0.1000		0.27	7.81	
	60	149		0.01	0.1000		0.27	7.70	
	70								
12 N.	10	173		0.03	0.1732		0.82	13.60	
	20	184		0.035	0.1871		0.95	14.81	
	30	193	153.8	0.02	0.1414	0.0836	0.54	11.28	
	40	149		0.00	0.000		0.0	0.00	
Oven no. 129.	50	112		0.00	0.000		0.0	0.00	
	60	112.		0.00.	0.00.		0.0.	0.00	
	70								
12 C.	10	190		0.02	0.1414		0.54	11.25	
	20	200		0.03	0.1732		0.82	13.88	
	30	211	202.7	0.04	0.2000	0.1936	1.09	16.16	
	40	198		0.05	0.2236		1.36	17.90	
Oven no. 102	50	216		0.05	0.2236		1.36	18.14	
	60	201		0.04	0.2000		1.09	16.04	
	70								
11 C.	10	176		0.02	0.1414		0.54	11.13	
	20	204		0.03	0.1732		0.82	13.93	
	30	180	191.0	0.04	0.2000	0.1813	1.09	15.79	
	40	193		0.04	0.2000		1.09	15.95	
Oven no. 112.	50	186		0.03	0.1732		0.82	13.74	
	60	201		0.04	0.2000		1.09	16.04	
	70								

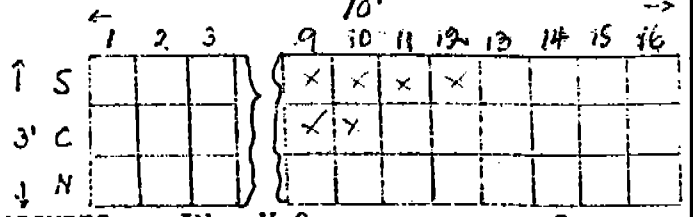
BY _____ DATE 7/21/76 SUBJECT Air Pollution Controlled Source Sampling of Residual Velocity & Temperature Data Particulate In Duct Emissions

SHEET NO. 18 OF 135

CHKD. BY AA DATE 9/21/76

JOB NO. Donner-Hanna Coke Corp. PECT System

Date Sampled: 7/21/76
Train & Operator: Tom & Ron
Barometric Pressure: 29.34"
Static Pressure:
Wind Direction & Speed: N.E - 5-15 mph.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
10 C. Oven no. 95.	10	185	175.2	0.03	0.1732	0.1451	0.82	13.97	
	20	203		0.03	0.1732		0.82	13.91	
	30	181		0.02	0.1414		0.54	11.17	
	40	166		0.01	0.1000		0.27	7.81	
	50	157		0.02	0.1414		0.54	10.96	
	60	159		0.02	0.1414		0.54	10.98	
	70								
9 C. Oven no. 122.	10	201	189.7	0.03	0.1732	0.1905	0.82	13.89	
	20	198		0.04	0.2000		1.01	16.01	
	30	190		0.05	0.2236		1.31	17.79	
	40	184		0.03	0.1732		0.82	13.71	
	50	175		0.04	0.2000		1.09	15.72	
	60	196		0.03	0.1732		0.82	13.78	
	70								
9 S. Oven no. 132.	10	201	201.3	0.03	0.1732	0.2294	0.82	13.89	
	20	203		0.05	0.2236		1.31	17.96	
	30	190		0.06	0.2449		1.63	19.48	
	40	207		0.06	0.2449		1.63	19.94	
	50	217		0.06	0.2449		1.63	19.88	
	60	190		0.06	0.2449		1.63	19.48	
	70								
10 S. Oven no. 95.	10	192	192.3	0.01	0.1000	0.1912	0.27	7.99	
	20	199		0.04	0.2000		1.09	15.96	
	30	198		0.05	0.2236		1.36	17.90	
	40	182		0.04	0.2000		1.09	15.81	
	50	203		0.05	0.2236		1.36	17.96	
	60	190		0.04	0.2000		1.09	15.91	
	70								
11 S. Oven no 104	10	189	183.8	0.02	0.1414	0.1069	0.54	11.24	
	20	161		0.01	0.1000		0.27	7.77	
	30	155		0.01	0.1000		0.27	7.74	
	40	130		0.01	0.1000		0.27	7.89	
	50	159		0.01	0.1000		0.27	7.76	
	60	159		0.01	0.1000		0.27	7.76	
	70								
12 S. Oven no 114	10	163	188.5	0.01	0.1000	0.2062	0.27	7.79	
	20	181		0.04	0.2000		1.09	15.8	
	30	192		0.06	0.2449		1.63	19.51	
	40	195		0.05	0.2236		1.36	17.86	
	50	186		0.05	0.2236		1.36	17.73	
	60	214		0.06	0.2449		1.63	19.84	
	70								

DATE	SOURCE	TESTED BY
7/21/76.	PECT.	Tom & Rich.

SAMPLER	SAMPLE BOX NO.	BAR. PRESS.	WEATHER CONDITION
RAC.	1.	29.34"	Cloudy N.E Wind

ASSUMED MOISTURE	C FACTOR	METER BOX SETTING
6.2%	—	130°F.

PROBE LENGTH	NOZZLE DIAMETER	PROBE SETTING
30"	11/16"	no heat.

DRY COLLECTED WEIGHT MILLIGRAMS	INITIAL	FINAL	NET
FILTER NO. 19.	0.73317	0.80224	0.06907
ACETONE WASH	94.89102	94.95614	0.06512
WATER WASH	Not	done	
FRONT TOTAL			.12779
IMPINGER	94.8945	94.9111	0.01661
TRAIN TOTAL			0.14440

CONDENSATE COLLECTED . ml - Gms	INITIAL	FINAL	NET
IMP. I	100	220	120c.c.
IMP. II	100	205	105 "
IMP. III	0.0	0.0	0.0 "
SILICA GEL	200	205	5
TOTAL			230c.c
CYCLONE	0.0	39.0	39.0.

CENTROID NO.	CLOCK TIME	SECONDS SAMPLED	DRY GAS METER READ OF	ORIFICE ΔH	PUMP IN. HG.	DRY GAS METER IN °F	DRY GAS METER OUT °F	STACK °F	SAMPLE BOX °F	IMPINGER °F	√Δ P	STACK IN. HG.	STACK FPS
9N	8:10 AM	60	668.991	.8-1.36	< 5	71	71	184.7	120-130	70°F	0.1527	< 0.01"	12.10
10N		60	669.1184	.29-.82	< 5	72	72	161.7	"	"	0.1260	"	9.80
11N	8:55 "	60	670.018	.27-.57	< 5	74	74	169.8	"	"	0.1207	"	9.45
12N	9:16 "	60	670.556	0-.25	< 5	74	74	153.8	"	"	0.0836	"	6.46
12C	10:20 "	60	670.947	0.5-1.36	< 5	75	75	202.7	"	"	0.1936	"	15.55
11C	10:35 "	60	671.558	0.5-1.1	< 5	74	74	191.0	"	"	0.1813	"	14.43
10C	10:48 "	60	672.161	0.27-.82	< 5	74	74	175.2	"	"	0.1451	"	11.41
9C	11:05 "	60	672.748	0.82-1.36	< 5	76	76	199.7	"	"	0.1905	"	15.15
9S	11:15 "	60	673.462	0.82-1.63	15	76	76	201.3	"	"	0.2294	"	18.41
10S	11:38 "	60	674.071	.27-1.36	10	76	77	192.3	"	"	0.1912	"	15.24
11S	12:21 PM	60	674.661	.27-0.54	10	78	78	163.8	"	"	0.1069	"	8.33
12S	12:41 "	60	675.153	.27-1.63	15	79	79	188.5	"	"	0.2062	"	16.38
			675.775										
TOT 12 pts		TOT 7/10 Sec	TOT 6.784	0.80	AVG	AVG 75°F.		AVG 181.2.			AVG .1606		AVG 12.68

BY _____ DATE 7/21/76 SUBJECT Air Pollution Control

CHKD. BY AA DATE 9/21/76 Source Sampling of Residual

Data Collection Sheet Particulate In Duct Emissions

JOB NO. Donner-Hanna Coke

Corp. PECT System

SHEET NO. 19 OF 135

SAMPLER SUBSET - II = RAC - 7-21-76

1. Volume of gas sampled - (std cuft dry)

$$Vmstd = 17.71 \cdot Vm \cdot \frac{(Pbar + \Delta H/13.6)}{Tm}$$

$$= 17.71 \times 6.784 \times \frac{(29.34 + 0.8/13.6)}{460 + 95}$$

$$= 6.60 \text{ std cuft dry}$$

2. Water collection -

(a) Total impinger collection (Vlc) 230 ml

(b) Cyclone water collection (Vcc) 39 ml (Particulate water)

3. Volume of water vapor in gas sampled

$$Vwstd = .0474 \times Vlc = .0474 \times 230 = 10.90 \text{ cuft in}$$

4. % Moisture

$$\frac{Vwstd}{Vmstd + Vwstd} \times 100 = \frac{10.9}{6.6 + 10.9} \times 100 = 62.3\ \%$$

5. Mole fraction dry (M_D)

$$1 - \frac{\%\ Moisture}{100} = 1 - .623 = .377$$

6. Molecular wt dry (Md)

(a) Gas composition - H_2 - 2.5 % vol

CO_2 - 2.5 "

CO - 1.0 "

O_2 - 19.74 "

N_2 - 74.26 "

(b) $Md = \%\ H_2 \times .02 + \%\ CO_2 \times .44 + \%\ CO \times .28 + \%\ O_2 \times .32 + \%\ H_2 \times .28$

$= 28.54$

Cont'd (7-21-26)

7. Molecular wt wet (Ms)

M_D X Md + 18 (1-M_D) = 28.54 x .377 + 18 x .623 = 21.97

8. Vcc percentage of total water vapor

$$= \frac{Vcc}{Vlc + Vcc} \times 100 = \frac{39}{39 + 230} \times 100 = 14.5 \%$$

9. Stack gas velocity stack condition

$$Vs = 85.48 \times Cp \times \sqrt{\Delta p} \sqrt{\frac{460+Ts}{Ps \times Ms}}$$

$$= 85.48 \times .1606 \times .926 \times \sqrt{\frac{460+181.2}{21.97 \times 29.34}}$$

= 12.68 fps

10. Actual stack gas flow through the sampled area

$$Qs = Vs \times 30 \times \frac{\text{Points sampled}}{\text{Total points}} \times 60 \text{ ACFM}$$

$$= 12.68 \times 30 \times \frac{12}{48} \times 60 = 5706$$

5706 ACFM through sample area

11. Emission rate

A. Concentration method:

(a) Actual cuft sampled through nozzle

$$Q_{ACF} = \frac{Vmstd}{M_D} \times \frac{460 + Ts}{460 + 70} \times \frac{29.92}{Ps}$$

$$= \frac{6.60}{.377} \times \frac{460 + 181.2}{530} \times \frac{29.92}{29.34}$$

= 21.60 ACF

(b) Total wt collected (Mp gms)

Filter .06907

Front half acetone - .05872

Front half water -

Back half - .01661

TOTAL .14440

(c) Lbs/ton of coal (12 tons per charge
60 secs per push)

$$Pmrc = \frac{Mp \times Qs}{453.6 \times Q_{ACF} \times 12} = \frac{.1444 \times 5706}{453.6 \times 21.68 \times 12}$$

.006982 = Lbs/ton of coal through sample area

Pmrc = .006982

B. Area ratio:

An = Area Nozzle = .0025779 sq ft

As = Area stack sampled = 9.5 sq ft

θ = Minutes sampled 11.83

$$Pmra = \frac{As}{An} \times \frac{Mp}{453.6} \times \frac{1}{\theta} \times \frac{1}{12}$$

$$= \frac{9.5}{.0025779} \times \frac{.1444}{453.6} \times \frac{1}{11.83} \times \frac{1}{12}$$

= .006524 lbs/ton of coal through sample area

Average emission - $\frac{Pmra + Pmrc}{2} = \frac{.006982 + .006524}{2} = .006753$

12. Percentage Isokienetics

$$I = \frac{1.667 \left[.00267\ Vlc + \frac{Vm}{Tm} \left(Pbar + \frac{\Delta H}{13.6} \right) \right] Ts}{\theta \times Vs \times P \times An}$$

$$= \frac{1.667 \left[.00267 \times 230 + \frac{6.784}{460+75} \left(29.34 + \frac{.8}{13.6} \right) \right] (460+181.2)}{11.83 \times 12.68 \times 29.34 \times .0025779}$$

= 93.0 %

BY _____ DATE 7.22.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

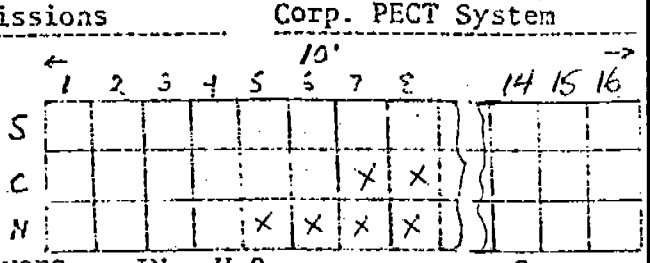
CHKD. BY AO DATE 8.2.76

SHEET NO. 16 OF 135

JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

Date Sampled: 7.22.76
Train & Operator: 4 I . SKN
Barometric Pressure: 29.55
Static Pressure: Atmos
Wind Direction & Speed: S.E - 10 mph.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
5 N	10	206		.03	.1732		.5	12.61	10
	20	218		.04	.20		.7	14.69	8
	30	226		.06	.2449		1.0	18.09	10
94	40	237	229.3	.07	.2646	.2288	1.2	19.70	19.5
	50	240		.06	.2449		1.0	18.38	23
	60	249		.06	.2449		1.0	18.39	24
	70								
	10	212		.05	.2236		0.9	16.35	8
6 N	20	218		.04	.20		0.7	14.69	14.5
	30	220	218.3	.03	.1732	.1755	0.5	12.74	13
	40	221		.03	.1732		0.5	12.75	15
125	50	218		.02	.1414		0.3	10.38	18
	60	221		.02	.1414		0.3	10.41	18
	70								
	10	193		.03	.1732		0.5	12.48	16
7 N	20	207		.03	.1732		0.5	12.61	18.5
	30	220	210.8	.03	.1732	.1861	0.5	12.74	19
	40	215		.05	.2236		0.9	16.38	18.5
135	50	211		.04	.20		0.7	14.61	18.5
	60	219		.03	.1732		0.5	12.73	18
	70								
	10	184		.03	.1732		0.5	12.40	17.5
8 N	20	193		.03	.1732		0.5	12.48	18
	30	192	188	.03	.1732	.1679	0.5	12.48	18.5
	40	190		.03	.1732		0.5	12.45	18.5
107	50	184		.03	.1732		0.5	12.40	18.5
	60	184		.02	.1414		0.3	10.12	18.0
	70								
	10	187		.02	.1414		0.3	10.14	16
8 C	20	203		.05	.2236		0.9	16.24	18
	30	209	205.5	.05	.2236	.2060	0.9	16.31	18.5
	40	209		.05	.2236		0.9	16.31	19.5
117	50	209		.04	.20		0.7	14.59	18
	60	216		.05	.2236		0.9	16.39	19
	70								
	10	190		.05	.2236		0.9	16.08	17
9 C	20	206		.06	.2449		1.0	17.83	18.5
	30	206	194	.03	.1732	.1830	0.5	12.61	17
	40	192		.02	.1414		0.3	10.18	17
129	50	183		.02	.1414		0.3	10.11	15
	60	197		.03	.1732		0.5	13.42	14
	70								

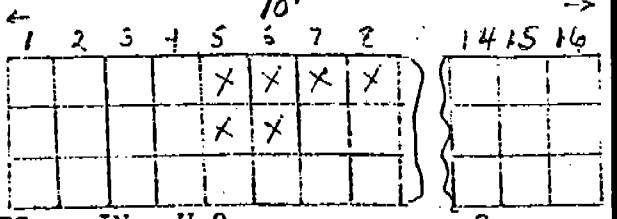
BY _____ DATE 7.22.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Velocity & Temperature Data Particulate In Duct Emissions

SHEET NO. 17 OF 135

CHKD. BY AB DATE 9.21.76

JOB NO. Donner-Hanna Coke Corp. PECT System

Date Sampled: 7.22.76
Train & Operator: 4.I - SKN
Barometric Pressure: 29.55
Static Pressure: Atmos.
Wind Direction & Speed: S.E - 10 mph



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
6C	10	195	215.2	.03	.1732	.1777	0.5	12.50	14
	20	204		.03	.1732		0.5	12.59	17
	30	221		.04	.20		0.7	14.72	19
	40	219		.03	.1732		0.5	12.73	18.5
86	50	217		.03	.1732		0.5	14.72	16.5
	60	236		.03	.1732		0.5	12.88	17
	70								
5C	10	190	215.7	.05	.2236	.2181	0.9	16.08	17
	20	222		.07	.2646		1.2	17.48	19
	30	235		.05	.2236		0.9	16.62	20.5
	40	223		.05	.1732		0.9	16.48	18
127	50	214		.03	.20		0.5	12.38	17.5
	60	210		.04			0.7	14.60	18
	70								
5S	10	206	225.7	.04	.20	.1972	0.7	14.56	18
	20	218		.06	.2449		1.0	17.99	19.5
	30	236		.05	.2236		0.9	16.64	22
	40	229		.04	.20		0.7	14.80	20
96	50	239		.03	.1732		0.5	12.91	20
	60	226		.02	.1414		0.3	10.45	18
	70								
6S	10	206	168.3	.04	.20	.1191	0.7	14.56	16
	20	203		.03	.1732		0.5	12.58	18
	30	172		.02	.1414		0.3	10.03	17.5
	40	158		.01	.10		0.2	6.98	17.5
88	50	138		.01	.10		0.2	6.90	17
	60	139		0.0	0.0		0.0		0
	70								
7S	10	189	199.7	.05	.2236	.2859	0.9	16.06	16
	20	201		.06	.2449		1.0	17.76	18
	30	190		.05	.2236		0.9	16.08	18.5
	40	183		.06	.2449		1.0	17.52	19
109	50	206		.03	.1732		0.5	12.61	19
	60	217		.06	.2449		1.0	17.99	19
	70								
8S	10	183	199.7	.04	.20	.2154	0.7	14.30	18
	20	198		.05	.2236		0.9	16.18	19
	30	207		.06	.2449		1.0	17.84	19.5
	40	204		.05	.2236		0.9	16.25	19.5
119	50	196		.04	.20		0.7	14.45	20
	60	210		.04	.20		0.7	14.60	20
	70								

DATE	SOURCE	TESTED BY	
7/22/76	PECT	SKM + J.F	

SAMPLER	SAMPLE BOX NO.	BAR. PRESS.	WEATHER CONDITION
G.T	—	29.55	Sunny 80°F Amb.

ASSUMED MOISTURE	C FACTOR	METER BOX SETTING
75%	—	125 - 150°F

PROBE LENGTH	NOZZLE DIAMETER	PROBE SETTING
30"	11/16"	no heat.

DRY COLLECTED WEIGHT MILLIGRAMS

	INITIAL	FINAL	NET
FILTER NO. 19	.74103	.85762	0.11659
ACETONE WASH	96.77840	96.90372	0.12532
WATER WASH	NOT	DONE	—
FRONT TOTAL			0.24191
IMPINGER	95.41117	95.47825	.06708
TRAIN TOTAL			0.30899

CONDENSATE COLLECTED . ml - Gms

	INITIAL	FINAL	NET
IMP. I	100	394	294
IMP. II	100	193	93
IMP. III	0	0	0
SILICA GEL	200	207	7
TOTAL			394
CYCLONE	0	101	101

CENTROID NO.	CLOCK TIME	SECONDS SAMPLED	DRY GAS METER READ OF 161.91	ORIFICE ΔH	PUMP IN. HG.	DRY GAS METER IN °F	DRY GAS METER OUT °F	STACK °F	SAMPLE BOX °F	IMPINGER °F	$\sqrt{\Delta P}$	STACK IN. HG.	STACK FPS
5N 94	12.30PM	60	162.49	.5-1.0	8-24	81	81	229.3	125-150	95	.2288	Atms	16.94
6N 125	12.55	60	163.14	.3-0.9	8-18	84	82	218.3		97	.1755		12.89
7N 135	1.10	60	163.68	.5-0.9	16-18.5	84	84	210.8		95	.1861		13.59
8N 107	1.45	60	164.25	.3-0.5	12.5-18.5	85	84	188.0		98	.1679		12.05
8E 119	2.05	60	164.82	.3-0.9	16-19.5	85	84	205.5		98	.2060		14.99
7E 129	2.40	60	165.38	.3-1.0	14-19.0	88	88	194.0		97	.1830		13.20
6E 86	3.0	60	165.89	.5-.7	14-19.0	80	80	215.2		95	.1777		13.02
5E 129	3.25	60	166.45	.5-1.2	17-20.5	92	92	215.7		95	.2181		15.99
5S 96	4.0	60	166.96	.3-1.0	18-22	95	95	225.7		105	.1972		14.56
6S 88	4.20	55	167.50	0-0.7	0-18	92	90	168.3		95	.1191		8.42
7S 109	4.35	60	168.03	.5-1.0	16-19	90	90	197.7		95	.2259		16.34
8S 119	4.55P.M.	60	168.54	.7-1.0	19-20	92	92	199.7		99	.2154		15.60
TOT 12 pts		TOT 715 Sec.	TOT 6.63	0.70	AVG	AVG 87.1		AVG 205.7			AVG .1917		AVG 13.85

SAMPLER SUBSET - III = 9.I = 9.22.76

1. Volume of gas sampled - (std cuft dry)

$$Vmstd = 17.71 \cdot Vm \cdot \frac{(Pbar + \Delta H/13.6)}{Tm}$$

$$= 17.71 \cdot 6.63 \times \frac{(29.55 + \frac{0.7}{13.6})}{460+87.1}$$

$$= 6.35 \text{ std cuft dry}$$

2. Water collection -

(a) Total impinger collection (Vlc) 394 ml

(b) Cyclone water collection (Vcc) 101 ml (Particulate water)

3. Volume of water vapor in gas sampled

$Vwstd = .0474 \times Vlc = .0474 \times 394 = 18.68$ cuft in

4. % Moisture

$$\frac{Vwstd}{Vmstd + Vwstd} \times 100 = \frac{18.68}{6.35 + 18.68} \times 100 = 74.63\ \%$$

5. Mole fraction dry (M_D)

$$1 - \frac{\%\ Moisture}{100} = 1 - 0.7463 = 0.2537$$

6. Molecular wt dry (Md)

(a) Gas composition - H_2 - 2.5 % vol

CO_2 - 2.5 "

CO - 1.0 "

O_2 - 19.74 "

N_2 - 74.26 "

Taken from 7/21 test.

(b) $Md = \%\ H_2 \times .02 + \%\ CO_2 \times .44 + \%\ CO \times .28 + \%\ O_2 \times .32 + \%\ H_2 \times .28$

$= 28.5$*

7. Molecular wt wet (Ms)

M_D X Md + 18 (1-M_D) = 28.54 x .2537 + 18 x .7467 = 20.68

8. Vcc percentage of total water vapor

$$= \frac{Vcc}{Vlc + Vcc} \times 100 = \frac{101}{.394 + 101} \times 100 = 20.40 \%$$

9. Stack gas velocity stack condition

$$Vs = 85.48 \times Cp \times \sqrt{\Delta p} \sqrt{\frac{460+Ts}{Ps \times Ms}}$$

$$= 85.48 \times .81 \times .1917 \times \sqrt{\frac{460+205.9}{29.55 \times 20.68}}$$

= 13.85 fps

10. Actual stack gas flow through the sampled area

$$Qs = Vs \times 30 \times \frac{\text{Points sampled}}{\text{Total points}} \times 60 \text{ ACFM}$$

$$= 13.85 \times 30 \times \frac{12}{48} \times 60 = 6232.5$$

ACFM through sample area

11. Emission rate

A. Concentration method:

(a) Actual cuft sampled through nozzle

$$Q_{ACF} = \frac{Vmstd}{M_D} \times \frac{460 + Ts}{460 + 70} \times \frac{29.92}{Ps}$$

$$= \frac{6.35}{0.2537} \times \frac{460 + 205.7}{530} \times \frac{29.92}{29.55}$$

= 31.83 ACF

(b) Total wt collected (Mp gms)

Filter .11659

Front half acetone - .12532

Front half water - 0.06708

Back half -

TOTAL 0.30899

Contd (9/22/76)

(c) Lbs/ton of coal (12 tons per charge
60 secs per push)

$$Pmrc = \frac{Mp \times Qs}{453.6 \times Q_{ACF} \times 12} = \frac{0.30899 \times 6232.5}{453.6 \times 31.83 \times 12}$$

.011115 = Lbs/ton of coal through sample area

Pmrc = .011115

B. Area ratio:

An = Area Nozzle = .0025799 sq ft

As = Area stack sampled = 7.5 sq ft

θ = Minutes sampled 11.92 min.

$$Pmra = \frac{As}{An} \times \frac{Mp}{453.6} \times \frac{1}{\theta} \times \frac{1}{12}$$

$$= \frac{7.5}{.0025799} \times \frac{.30899}{453.6} \times \frac{}{11.92} \times \frac{1}{12}$$

= .013855 lbs/ton of coal through sample area

Average emission - $\frac{Pmra + Pmrc}{2} = \frac{.013855 + .011115}{2} = .01249$

12. Percentage Isokienetics

$$I = \frac{1.667 \left[.00267\ Vlc + \frac{Vm}{Tm} \left(Pbar + \frac{\Delta H}{13.6} \right) \right] Ts}{\theta \times Vs \times P \times An}$$

$$= \frac{1.667 \left[.00267 \times 394 + \frac{6.63}{460+87.1} \left(29.55 + \frac{0.7}{13.6} \right) \right] (460+205.7)}{11.92 \times 13.85 \times 29.55 \times .002578}$$

= 124.5 %

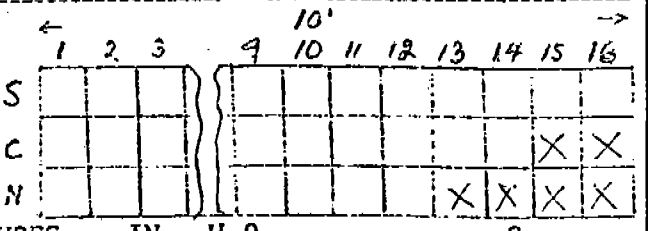
BY _____ DATE 9.22.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Velocity & Temperature Data Particulate In Duct Emissions

SHEET NO. 22 OF 135

JOB NO. Donner-Hanna Coke Corp. PECT System

CHKD. BY AA DATE 9.27.76

Date Sampled: 9/22/76
Train & Operator: Tom & Rich.
Barometric Pressure: 29.55"
Static Pressure:
Wind Direction & Speed: SE - 10 m.p.h.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
13N	10	189		0.02	0.1414		.5	11.24	
	20	206		0.04	0.2000		1.1	16.10	
	30	219		0.06	0.2449		1.6	19.91	
	40	223	215.0.	0.06	0.2449	0.2202	1.6	19.97	
OVEN NO. 94.	50	223		0.06	0.2449		1.6	19.17	
	60	230		0.06	0.2449		1.6	20.07	
	70								
14N.	10	181		0.04	0.2000		1.1	15.80	
	20	212		0.05	0.2236		1.35	18.09	
	30	217		0.04	0.2000		1.1	16.24	
	40	216	204.3	0.03	0.1732	0.1799	0.8	14.05	
OVEN NO. 125.	50	196		0.02	0.1414		0.5	11.30	
	60	204		0.02	0.1414		0.5	11.37	
	70								
15N.	10	181		0.01	0.1000		0.3	7.96	
	20	200		0.02	0.1414		0.5	11.34	
	30	198		0.02	0.1414		0.5	11.32	
	40	215	205.7	0.04	0.2000	0.1638	1.1	16.21	
Oven no. 135	50	220		0.04	0.2000		1.1	16.27	
	60	220.		0.04	0.2000		1.1	16.27	
	70								
16N.	10	176		0.01	0.1000		0.3	7.37	
	20	193		0.01	0.1000		0.3	7.97	
	30	193		0.01	0.1000		0.3	7.97	
	40	189	198.8	0.01	0.1000	0.1000.	0.3	7.95	
Oven no. 107	50	190		0.01	0.1000		0.3	7.95	
	60	192		0.01	0.1000		0.3	7.97	
	70								
16C	10	187		0.02	0.1414		0.5	11.22	
	20	203		0.02	0.1414		0.5	11.36	
	30	217		0.02	0.1414		0.5	11.48	
	40	218	210.5.	0.03	0.1732	0.1467	0.8	14.07	
Oven no. 117	50	217		0.02	0.1414		0.5	11.49	
	60	221		0.02	0.1414		0.5	11.51	
	70								
15C	10	206		0.03	0.1732		0.8	13.95	
	20	206		0.04	0.2000		1.1	16.10	
	30	206		0.03	0.1732		0.8	17.95	
	40	206	203.8	0.02	0.1414	0.1671	0.5	11.39	
Oven no. 129	50	203		0.02	0.1414		0.5	11.36	
	60	196		0.03	0.1732		0.8	13.84	
	70								

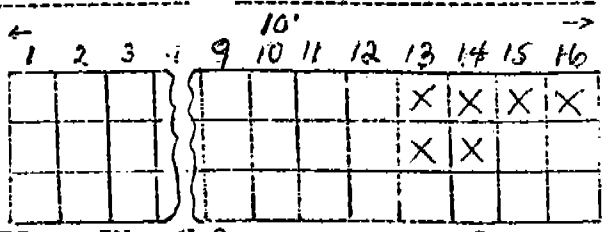
BY _____ DATE 7/23/76 SUBJECT Air Pollution Controlled Source Sampling of Residual Velocity & Temperature Data Particulate In Duct Emissions

SHEET NO. 3 OF 35

CHKD. BY AB DATE 9-21-76

JOB NO. Donner-Hanna Coke Corp. PECT System

Date Sampled: 7/22/76
Train & Operator: Tom & Rich.
Barometric Pressure: 29.55"
Static Pressure:
Wind Direction & Speed: SE - 10 mph.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
14 C.	10	180		0.03	0.1732		0.8	13.67	
	20	205		0.03	0.1732		0.8	13.94	
	30	195		0.03	0.1732		0.8	13.83	
	40	217	200.0.	0.03	0.1732	0.1732	0.8	14.06	
Oven no. 86	50	192		0.03	0.1732		0.8	13.80	
	60	211.		0.03	0.1732		0.8	14.00.	
	70								
13 C.	10	192		0.03	0.1732		0.8	13.80	
	20	203		0.05	0.2236		1.35	17.96	
	30	202		0.05	0.2236		1.35	17.95	
	40	192	194.2	0.04	0.2000	0.1892	1.1	15.93	
Oven no. 127.	50	180		0.02	0.1414		0.5	11.16	
	60	196		0.03	0.1732		0.8	13.84	
	70								
13S	10	178		0.02	0.1414		0.5	11.14	
	20	214		0.05	0.2236		1.4	18.11	
	30	207		0.04	0.2000		1.1	16.12	
	40	207	203.5	0.03	0.1732	0.1799	0.8	13.96	
Oven no. 96	50	219		0.04	0.2000		1.1	16.26	
	60	196		0.02	0.1414		0.5	11.30	
	70								
12S	10	184		0.02	0.1414		0.5	11.20	
	20	184		0.01	0.1000.		0.3	7.92	
	30	169		0.01	0.1000		0.3	7.82	
	40	150	160.8	0.01	0.1000	0.0736	0.3	7.71	
Oven no. 88	50	139		0.00	0.000		0.0	0.0	
	60	139		0.00.	0.000.		0.0	0.0.	
	70								
15 S	10	180		0.02	0.1414		0.5	11.16	
	20	189		0.02	0.1414		0.5	11.24	
	30	193		0.02	0.1414		0.5	11.28	
	40	184	193.8	0.03	0.1732	0.1520	0.8	13.71	
Oven no. 109	50	211		0.03	0.1732		0.8	14.00	
	60	206		0.02	0.1414		0.5	11.39	
	70								
16 S.	10	173		0.02	0.1414		0.5	11.10	
	20	195		0.02	0.1414		0.5	11.29	
	30	200		0.03	0.1732		0.8	13.38	
	40	217	202.7	0.02	0.1414	0.1398	0.5	11.48	
Oven no. 119.	50	214		0.01	0.1000.		0.3	8.10	
	60	217		0.02	0.1414		0.5	11.48.	
	70								

DATE	SOURCE	TESTED BY
7/22/76	P.E.C.T	Tom + Rich

SAMPLER	SAMPLE BOX NO.	BAR. PRESS.	WEATHER CONDITION
RAC	—	29.55	clear Sunny S.E - 10 mph.

ASSUMED MOISTURE	C FACTOR	METER BOX SETTING
7%	—	125-150

PROBE LENGTH	NOZZLE DIAMETER	PROBE SETTING
30"	11/16	No Heat

DRY COLLECTED WEIGHT MILLIGRAMS

	INITIAL	FINAL	NET
FILTER NO. 20	.73074	.80057	.06983
ACETONE WASH	97.93706	98.02625	.08919
WATER WASH	not	done	
FRONT TOTAL			.15902
IMPINGER	96.98908	97.04407	0.05499
TRAIN TOTAL			0.21401

CONDENSATE COLLECTED ml - Gms

	INITIAL	FINAL	NET
IMP. I	100	347	247
IMP. II	100	179	79
IMP. III	0	0	0
SILICA GEL	200	206.5	6.5
TOTAL			332.5
CYCLONE	0	63	63

CENTROID NO.	CLOCK TIME	SECONDS SAMPLED	DRY GAS METER READ OF 675.725	ORIFICE ΔH	PUMP IN. HG.	DRY GAS METER IN °F	DRY GAS METER OUT °F	STACK °F	SAMPLE BOX °F	IMPINGER °F	√Δ P	STACK IN. HG.	STACK FPS
13N 94		60	676.167	.5-1.6	25	82	82	215	150	70	.2202	Atms	18.19
14N 125		60	676.799	.5-1.35	10	82	82	204.3	150	70	.1799		14.74
15N 135		60	677.327	0.3-1.1	25	82	82	205.7	150	70	.1638		13.44
16N 107		60	677.818	0.3	12	82	82	188.8	150	70	.100		8.10
16C 117		60	678.358	0.6-.8	20	82	82	210.5	150	70	.1469		12.08
15C 129		60	678.910	0.8-1.1	20	83	83	203.8	150	70	.1691		13.68
14C 86		60	679.470	0.8	20	83	83	200.0	135	92	.1732		14.14
13C 129		60	680.086	0.5-1.35	18	84	84	194.2	139	92	.1892		15.38
13S 96		60	680.676	0.5-1.4	18	86	86	203.5	124	93	.1799		14.73
14S 88		60	681.112	0-0.5	25	85	85	160.8	124	93	.0936		5.83
15S 109		60	681.656	0.5-0.8	25	85	85	193.8	124	93	.1520		12.35
16S 119		60	682.199	0.3-0.8	18	84	84	202.7	124	93	.1398		11.44
TOT 12 pts		TOT 720 secs	TOT 6.422	0.7	AVG	AVG 83.3		AVG 198.6			AVG 0.1571		AVG 12.81

Data Collection Sheet

CHKD. BY AA DATE 9/21/76

Source Sampling of Residual Particulate In Duct Emissions

JOB NO. Donner-Hanna Coke Corp. PECT System

SAMPLER SUBSET - IV = R.A.C = 7.22.76

1. Volume of gas sampled - (std cuft dry)

$$Vmstd = 17.71 \cdot Vm \cdot \frac{(Pbar + \Delta H/13.6)}{Tm}$$

$$= 17.71 \cdot 6.422 \times \frac{(29.55 + 0.7/13.6)}{460 + 83.3}$$

$$= 6.20 \text{ std cuft dry}$$

2. Water collection -

(a) Total impinger collection (Vlc) 332.5 ml

(b) Cyclone water collection (Vcc) 63 ml (Particulate water)

3. Volume of water vapor in gas sampled

$$Vwstd = .0474 \times Vlc = .0474 \times 332.5 = 15.76 \text{ cuft in}$$

4. % Moisture

$$\frac{Vwstd}{Vmstd + Vwstd} \times 100 = \frac{15.76}{6.2 + 15.76} \times 100 = 71.77\ \%$$

5. Mole fraction dry (M_D)

$$1 - \frac{\%\ Moisture}{100} = 1 - .7177 = 0.2823$$

6. Molecular wt dry (Md)

(a) Gas composition - H_2 - 2.5 % vol

CO_2 - 2.5 "

CO - 1.0 " Taken from 7/21 test.

O_2 - 19.74 "

N_2 - 74.26 "

(b) $Md = \%\ H_2 \times .02 + \%\ CO_2 \times .44 + \%\ CO \times .28 + \%\ O_2 \times .32 + \%\ H_2 \times .28$

$= 28.54$

7. Molecular wt wet (Ms)

M_D X Md + 18 (1-M_D) = 28.54 x .2823 + 18 x .7177 = 20.98

8. Vcc percentage of total water vapor

$$= \frac{Vcc}{Vlc + Vcc} \times 100 = \frac{63}{332.8 + 63} \times 100 = 15.93 \%$$

9. Stack gas velocity stack condition

$$Vs = 85.48 \times Cp \times \sqrt{\Delta p} \sqrt{\frac{460+Ts}{Ps \times Ms}}$$

$$= 85.48 \times .926 \times .1571 \times \sqrt{\frac{460+198.6}{29.55 \times 20.98}}$$

$$= 12.81 \text{ fps}$$

10. Actual stack gas flow through the sampled area

$$Qs = Vs \times 30 \times \frac{\text{Points sampled}}{\text{Total points}} \times 60 \text{ ACFM}$$

$$= 12.81 \times 30 \times \frac{12}{48} \times 60 = 5764.5$$

5764.5 ACFM through sample area

11. Emission rate

A. Concentration method:

(a) Actual cuft sampled through nozzle

$$Q_{ACF} = \frac{Vmstd}{M_D} \times \frac{460 + Ts}{460 + 70} \times \frac{29.92}{Ps}$$

$$= \frac{6.2}{.2823} \times \frac{460 + 198.6}{530} \times \frac{29.92}{29.55}$$

$$= 27.63 \text{ ACF}$$

(b) Total wt collected (Mp gms)

Filter .06983

Front half acetone - .08919

Front half water -

Back half - .05499

TOTAL .21401

(c) Lbs/ton of coal (12 tons per charge
60 secs per push)

$$Pmrc = \frac{Mp \times Qs}{453.6 \times Q_{ACF} \times 12} = \frac{.21401 \times 5764.5}{453.6 \times 27.63 \times 12}$$

.00820 = Lbs/ton of coal through sample area

Pmrc = .00820

B. Area ratio:

An = Area Nozzle = .0025779 sq ft

As = Area stack sampled = 7.5 sq ft

θ = Minutes sampled 12

$$Pmra = \frac{As}{An} \times \frac{Mp}{453.6} \times \frac{1}{\theta} \times \frac{1}{12}$$

$$= \frac{7.5}{.0025779} \times \frac{.21401}{453.6} \times \frac{1}{12} \times \frac{1}{12}$$

= .009532 lbs/ton of coal through sample area

Average emission - $\frac{Pmra + Pmrc}{2} = \frac{.00820 + .009532}{2} = .00887$

12. Percentage Isokienetics

$$I = \frac{1.667 \left[.00267\ Vlc + \frac{Vm}{Tm} \left(Pbar + \frac{\Delta H}{13.6} \right) \right] Ts}{\theta \times Vs \times P \times An}$$

$$= \frac{1.667 \left[.00267 \times 332.5 + \frac{6.422}{460+83.3} \left(29.55 + \frac{.7}{13.6} \right) \right] (460+198.6)}{12 \times 12.81 \times 29.55 \times .0025779}$$

= 116.04 %

BY _____ DATE 7 _____ SUBJECT Air Pollution Controlled _____ SHEET NO. 28 OF 135

CHKD. BY _____ DATE _____ Source Sampling of Residual _____ JOB NO. Donner-Hanna

Total In-duct Emission _____ Particulate In-duct Emission _____ Coke Corp. PECT System

RESULT-
PECT TOTAL IN-DUCT EMISSION
LBS./TON OF COAL CHARGE

DATE AND SAMPLER	SET	AREA SAMPLED "α" SQ. FT.	VOLUME SAMPLED 'Q' ACF	STACK VELOCITY LBS.	FLOW THROUGH SAMPLE AREA Qs ACFM	WEIGHT COLLECTED GMS.	EMISSION OVER SAMPLING AREA LBS/TON OF COAL			TOTAL STACK AREA A SQ. FT.	TOTAL IN-DUCT EMISSION $E=\frac{\Sigma\omega}{\Sigma\alpha} \times A$ LBS/TON COAL
							CONC. PMRC	AREA RATIO PMRA	AVERAGE "ω"		
7.21.76 GI		7.5	26.25	11.66	5247	.22536	.008276	.01018	.00923		
7.21.76 RAC		7.5	21.60	12.68	5706	.14440	.006982	.006524	.006753		
7.22.76 G.I		7.5	31.83	13.85	6232.5	0.30899	.011115	.013855	.01249	30	0.03734
7.22.76 RAC		7.5	27.63	12.81	5764.5	0.21401	.00820	.009532	.00887		
		CUMULATIVE SAMPLE AREA $\Sigma\alpha$ sq ft 30							CUMULATIVE EMISSION $\Sigma\omega$ g .037343		

BY _____ DATE 8/3/76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

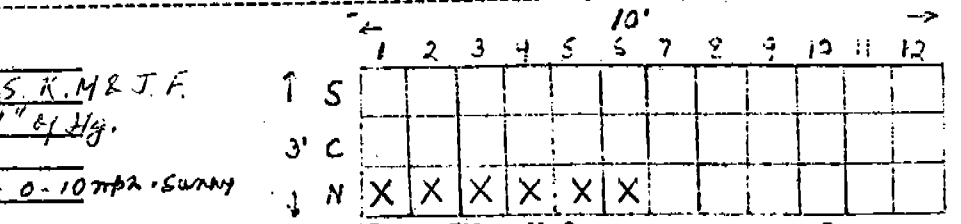
CHKD. BY AD DATE 9-21-76

SHEET NO. 29 OF 135

JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

Date Sampled: 8/3/76
Train & Operator: G. I. S. K. M & J. F.
Barometric Pressure: 29.71" of Hg.
Static Pressure: Atms.
Wind Direction & Speed: West - 0-10 mph, Sunny



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
1 'N' Oven no. 106.	10	198	217	0.02	0.1414	0.1276	.4	10.01	4
	20	212		0.02	0.1414		.4	10.12	0
	30	218		0.02	0.1414		.4	10.16	4
	40	221		0.02	0.1414		.4	10.19	1
	50	223		0.01	0.1000		.2	7.21	0
	60	232		0.01	0.1000		.2	7.26.	0
	70								
2 N OVEN NO. 116	10	210	219	0.04	0.2000	0.1945.	.7	14.29	3
	20	226		0.05	0.2236		.9	16.16	4
	30	227		0.03	0.1732		.5	12.53	6
	40	221		0.03	0.1732		.5	12.48	4
	50	212		0.03	0.1732		.5	12.39	3.5
	60	220.		0.05.	0.2236		.9	16.09	3.5.
	70								
3N OVEN NO. 126	10	203	217	0.02	0.1414	0.1892	.4	10.05	2
	20	217		0.05	0.2236		.9	16.06	3
	30	225		0.05	0.2236		.9	16.15	5
	40	219		0.03	0.1732		.5	12.45	3
	50	219		0.04	0.2000		.7	14.38	3
	60	219.		0.03	0.1732		.5	12.46	3
	70								
4N OVEN NO. 136.	10	206	215.	0.04	0.2000	0.1936	.7	14.25	5
	20	215		0.05	0.2236		.9	16.03	5
	30	223		0.03	0.1732		.5	12.49	10
	40	219		0.04	0.2000		.7	14.38	3
	50	209		0.02	0.1414		.4	10.10	3.5
	60	219		0.05	0.2236		.9	16.08	3
	70								
5N OVEN NO. 95	10	184	204.	0.02	0.1414	0.1858	.3	9.91	0
	20	206		0.04	0.2000		.7	14.25	3
	30	206		0.04	0.2000		.7	14.25	3
	40	201		0.04	0.2000		.7	14.19	3
	50	201		0.03	0.1732		.5	12.29	2
	60	228		0.04	0.2000		.7	14.48	3.5.
	70								
6N OVEN NO. 108.	10	193	204.	0.03	0.1732	0.1950	.5	12.22	4
	20	198		0.04	0.2000		.7	14.16	3
	30	209		0.04	0.2000		.7	14.28	2.5
	40	203		0.05	0.2236		.9	15.89	3.5
	50	193		0.03	0.1732		.5	12.22	3
	60	228.		0.04.	0.2000.		.7	14.48	4.0.
	70								

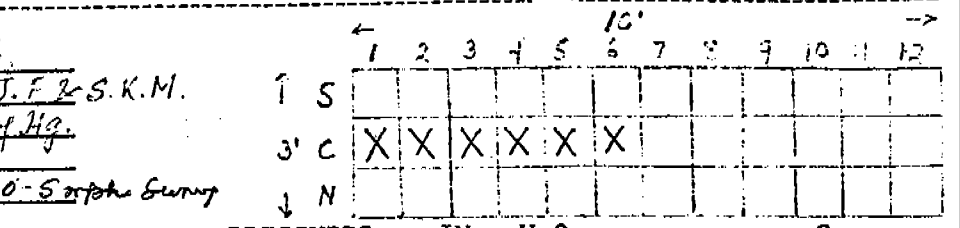
BY _____ DATE 8/3/76 SUBJECT Air Pollution Controlled Source Sampling of Residual Velocity & Temperature Data Particulate In Duct Emissions

SHEET NO 30 OF 175

CHKD. BY AG DATE 9.31.76

JOB NO. Donner-Hanna Coke Corp. PECT System

Date Sampled: 8/3/76
Train & Operator: G.D. J.F.L. S.K.M.
Barometric Pressure: 29.71" of Hg.
Static Pressure: Atm.
Wind Direction & Speed: West 0-5 mph Gusty



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
6C	10	203		0.04	0.2000		.7	14.21	9
	20	212		0.05	0.2236		.9	16.00	12
	30	196	199	0.05	0.2236		.9	15.81	13
	40	190		0.03	0.1732	0.1892	.5	12.19	13
OVEN No. 118	50	179		0.02	0.1414		.3	9.89	10
	60	215		0.03	0.1732		.5	12.42	11.
	70								
5C	10	201		0.04	0.2000		.7	14.19	8
	20	210		0.05	0.2236		.9	15.97	12
	30	210		0.03	0.1732		.5	12.97	14
	40	192	201.	0.04	0.2000	0.1897	.7	14.09	12
OVEN NO. 128.	50	181		0.02	0.1414		.3	9.88	8
	60	209		0.04.	0.2000.		.7	14.29	11.
	70								
4C	10	196		0.04	0.2000		.7	14.14	9.5
	20	227		0.05	0.2236		.9	16.18	13.5
	30	227		0.06	0.2449		1.05	17.72	16.5
	40	229	221	0.07	0.2646	0.2222	1.2	19.17	18.5
OVEN NO. 138.	50	225		0.04	0.2000		.7	14.45	15.0
	60	221.		0.04	0.2000		.7	14.40.	13.5.
	70								
3C	10	193		0.05	0.2236		.9	15.50	11
	20	211		0.05	0.2236		.9	15.99	15
	30	210		0.04	0.2000		.7	14.29	15
	40	181	187.	0.02	0.1414	0.1648	.3	9.88	9
OVEN NO. 87	50	168		0.01	0.1000		.2	6.92	7
	60	159.		0.01.	0.1000		.2	6.87.	7.
	70								
2C	10	207		0.05	0.2236		.9	15.94	10
	20	212		0.04	0.2000		.7	14.31	14
	30	215		0.06	0.2449		1.05	17.56	17
	40	216	212.	0.07	0.2646	0.2336.	1.2	18.99	19.5
OVEN NO. 97.	50	219		0.06	0.2449		1.05	17.62	19
	60	203		0.05.	0.2236		.9	15.89	17.5
	70								
1C.	10	203		0.02	0.1414		.3	10.05	7
	20	209		0.03	0.1732		.5	12.36	12
	30	200		0.02	0.1414		.3	10.03	11
	40	196	200.	0.01	0.1000	0.1382.	.2	7.07	9
OVEN NO. 101	50	190		0.01	0.1000.		.2	7.04	8
	60	203		0.03	0.1732		.5	12.31.	10.
	70								

BY _____ DATE 8/8/76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

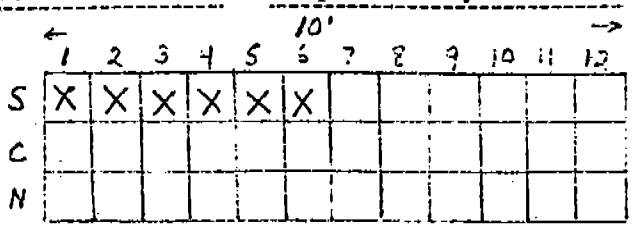
SHEET NO. 31 OF 135

CHKD. BY AO DATE 9-21-76

JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

Date Sampled: 8/3/76.
Train & Operator: G.S. J.F&S.K.M.
Barometric Pressure: 29.71" of Hg.
Static Pressure: Atmos
Wind Direction & Speed: West - 0-5 mph.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
1S	10	210		0.05	0.2236		.9	15.97	10
	20	214		0.04	0.2000.		.7	14.33	15.5
	30	203	196.	0.02	0.1414		.3	10.05	15.5
	40	180		0.02	0.1414	0.1702	.3	9.87	11.0
OVEN NO. 121	50	185		0.03	0.1732		.5	12.14	11.5
	60	182.		0.02.	0.1414		.3	9.89	10
	70								
2S	10	198		0.05	0.2236		.9	15.83	9
	20	215		0.06	0.2449		1.05	17.56	15
	30	217		0.05	0.2236		.9	16.06	18
	40	205	205.	0.05	0.2236	0.2095.	.9	15.91	14
OVEN NO. 131.	50	204		0.02	0.1414		.3	10.06	9
	60	190.		0.04	0.2000.		.7	14.07	12
	70								
3S	10	172		0.01	0.1000		.2	6.94	4
	20	184		0.03	0.1732		.5	12.13	13
	30	198		0.04	0.2000.		.7	14.16	14.5
	40	167	165.	0.02	0.1414	0.1358.	.3	9.77	12
OVEN NO. 99.	50	146		0.01	0.1000		.2	6.79	8.5
	60	123		0.01.	0.1000.		.2	6.66.	9
	70								
4S	10	209		0.05	0.2236		.9	15.96	7
	20	217		0.05	0.2236		.9	16.01	14
	30	220		0.06	0.2449		1.05	16.09	18
	40	215	214	0.07	0.2646	0.2217	1.2	18.97	18
OVEN NO. 103.	50	204		0.03	0.1732		.5	12.32	16
	60	217		0.04	0.2000		.7	14.96	14
	70								
5S	10	192		0.04	0.2000.		.7	14.09	12
	20	206		0.05	0.2236		.9	15.93	15.5
	30	206		0.06	0.2449		1.05	17.45	17
	40	200	195.	0.07	0.2646	0.2222	1.2	18.76	18
OVEN NO. 113.	50	180		0.04	0.2000		.7	13.95	14
	60	184		0.04	0.2000		.9	14.01	12
	70								
6S	10	203		0.05	0.2236		.9	15.89	11
	20	209		0.06	0.2449		1.05	17.49	15.5
	30	180		0.04	0.2000.		.7	13.96	16
	40	181	183.	0.05	0.2236	0.1881	.9	15.63	16
OVEN NO. 123.	50	171		0.02	0.1414		.3	9.80	12
	60	155.		0.01.	0.1000.		.2	6.84	9
	70								

DATE	SOURCE	TESTED BY
8/3/76.	PEC	S. K. M.

SAMPLER	SAMPLE BOX NO.	BAR. PRESS.	WEATHER CONDITION
G. 9.	–	29.71".	Clear Sunny day. 0-5 mph. West.

ASSUMED MOISTURE	C FACTOR	METER BOX SETTING
75	–	120-150.

PROBE LENGTH	NOZZLE DIAMETER	PROBE SETTING
30"	11/16"	No. heat.

DRY COLLECTED WEIGHT MILLIGRAMS	INITIAL	FINAL	NET
FILTER NO. 24.	0.73393	0.78941	0.05548.
ACETONE WASH	96.14504	96.27477	0.12973.
WATER WASH	96.11754	96.12013	0.00259
FRONT TOTAL			0.18780
IMPINGER	98.29395	98.31913	0.02518
TRAIN TOTAL			0.21298

CONDENSATE COLLECTED ml - Gms	INITIAL	FINAL	NET
IMP. I	100	264	164 C.C.
IMP. II	100.	281	181 C.C.
IMP. III	0	0	0 C.C.
SILICA GEL	200.0	203.3	3.3 C.C.
TOTAL			348.3
CYCLONE	0.0	138 C.C.	138 C.C.

CENTROID NO.	CLOCK TIME	SECONDS SAMPLED	DRY GAS METER READ OF	ORIFICE ΔH	PUMP IN. HG.	DRY GAS METER IN °F	DRY GAS METER OUT °F	STACK °F	SAMPLE BOX °F	IMPINGER °F	√Δ P	STACK IN. HG.	STACK FPS	
1N 106	8:20 A.M.	60	172.29 172.60.	.2-.4	0-4	80	78	217.	180-150	85	0.1276		9.16	
2N 116	8:30 A.M	60.	173.03	.5-.9	3-6	82	79	219		95	0.1945		13.99	
3N 126	9:20 A.M.	60.	173.43	.5-.9	2-5	79	75	217		75	0.1892		13.59	
4N 136	9:30 A.M	60	173.94	.4-.9	5-10	80	78	215		80	0.1936		13.88	
5N 95	9:40 A.M	60	174.36	.3-.7	0-3.5	80	78	204		80	0.1858		13.21	COFFEE BREAK
6N 108	10:05 A.M	60	174.78	.5-.9	2.5-40	82	80.	204		78	0.1950.		13.87	
6C 118	10:25 A.M	60.	175.20.	.3-.9	9-13	82	80.	199.		81	0.1892.		13.41	
5C 108	10:35 A.M	60.	175.60.	.3-.9	8-14	85	82.	201.		82	0.1897.		13.46	
4C 138	10.50 A.M	60.	176.10.	.7-1.2	9.5-18.5	86	85	221.		88	0.2222.		16.00	
3C 97	11:00 A.M	60	176.45	.2-.9	7.0-15	88	85.	187.		85	0.1648		11.57	
2C 97	11:12 A.M	60	176.95	.7-1.2	10-19.5	88	84	212		88	0.2336		16.71.	
1C 107	11:22 A.M	60.	177.20.	.2-.5	7-11.0	88	85.	200.		100	0.1382.		9.80	LUNCH BREAK
1S 121	12:30 P.M	60	177.57	.3-.9	10-15.5	85	84	196		90	0.1702.		12.03	
2S 131	12:50 P.M	60	178.01	.3-1.05	9-18	85	84	205		90	0.2095		14.91.	
3S 99	1:00 P.M.	60	178.26	.2-.7	4-14.5	88	85	165		82	0.1358		9.37	
4S. 103	1:15 P.M	60	178.73	.7-1.2	7-18	85	82	214		85	0.2217		15.89	
5S. 112	1:25 P.M	60	179.21	.7-1.2	12-18	85	82	195		82	0.2222		15.70	COFFEE BREAK.
6S. 123	2:05 P.M	60.	179.62.	.2-1.05	9-16	88	85.	183.		80	0.1881.		13.16	
TOT 18 POINTS		TOT 1080 Secs	TOT 7.33 cft.	0.7	AVG	AVG 83°F.		AVG 203°F.			AVG 0.1873.		AVG 13.32	

BY _____ DATE 8/3/76 SUBJECT Air Pollution Control

CHKD. BY AA DATE 9.21.76 Source Sampling of Residual

Data Collection Sheet Particulate In Duct Emissions

JOB NO. Donner-Hanna Coke Corp. PECI System

SHEET NO. 9.2 OF 12.5

SAMPLER SUBSET - I , 4.I 8.3.76

1. Volume of gas sampled - (std cuft dry)

$$Vmstd = 17.71 \cdot Vm \cdot \frac{(Pbar + \Delta H/13.6)}{Tm}$$

$$= 17.71 \times 7.33 \times \frac{(29.71 + {}^{17}/_{13.6})}{460+}$$

$$= 7.12 \text{ std cuft dry}$$

2. Water collection -

(a) Total impinger collection (Vlc) 348.3 ml

(b) Cyclone water collection (Vcc) 138 ml (Particulate water)

3. Volume of water vapor in gas sampled

$Vwstd = .0474 \times Vlc = .0474 \times 348.3 = 16.51$ cuft in

4. % Moisture

$$\frac{Vwstd}{Vmstd + Vwstd} \cdot X\ 100 = \frac{16.51}{7.12 + 16.51} \times 100 = 69.87\ \%$$

5. Mole fraction dry (MD)

$$1 - \frac{\%\ Moisture}{100} = 1 - 0.6987 = 0.3013$$

6. Molecular wt dry (Md)

(a) Gas composition - H_2- 2.5 % vol

CO_2- 2.5 "

CO- 1.0 "

O_2- 19.74 "

N_2- 74.26 "

Taken from 7/21 test.

(b) $Md = \%\ H_2 \times .02 + \%\ CO_2 \times .44 + \%\ CO \times .28 + \%\ O_2 \times .32 + \%\ H_2 \times .28$

$= 28.54$

Contd (8/3/78)

7. Molecular wt wet (Ms)

M_D X Md + 18 $(1-M_D)$ = 28.54 X .3013 + 18 X .6987 = 21.16

8. Vcc percentage of total water vapor

$$= \frac{Vcc}{Vlc + Vcc} \times 100 = \frac{138}{348.3 + 138.0} \times 100 = 28.38 \%$$

9. Stack gas velocity stack condition

$$Vs = 85.48 \times Cp \times \sqrt{\Delta\rho} \sqrt{\frac{460+Ts}{Ps \times Ms}}$$

$$= 85.48 \times .81 \times .1873 \times \sqrt{\frac{460+203}{29.71 \times 21.16}}$$

$$= 13.32 \text{ fps}$$

10. Actual stack gas flow through the sampled area

$$Qs = Vs \times 30 \times \frac{\text{Points sampled}}{\text{Total points}} \times 60 \text{ ACFM}$$

$$= 13.32 \times 30 \times \frac{18}{36} \times 60 = 11,988$$

ACFM through sample area

11. Emission rate

A. Concentration method:

(a) Actual cuft sampled through nozzle

$$Q_{ACF} = \frac{Vmstd}{M_D} \times \frac{460 + Ts}{460 + 70} \times \frac{29.92}{Ps}$$

$$= \frac{7.12}{.3013} \times \frac{460 + 203}{530} \times \frac{29.92}{29.71}$$

$$= 29.77 \text{ ACF}$$

(b) Total wt collected (Mp gms)

Filter	.05548
Front half acetone -	.12973
Front half water -	.00259
Back half -	.02518
TOTAL	.21898

Contd (8/3/76)

(c) Lbs/ton of coal (12 tons per charge 60 secs per push)

$$Pmrc = \frac{Mp \times Qs}{453.6 \times Q_{ACF} \times 12} = \frac{.21298 \times 11,938}{453.6 \times \quad \times 12} = .01576$$

.01576 = Lbs/ton of coal through sample area

Pmrc = .01576

B. Area ratio:

An = Area Nozzle = .0025779 sq ft

As = Area stack sampled = 15 sq ft

θ = Minutes sampled 18

$$Pmra = \frac{As}{An} \times \frac{Mp}{453.6} \times \frac{1}{\theta} \times \frac{1}{12}$$

$$= \frac{15}{.0025779} \times \frac{.21298}{453.6} \times \frac{1}{18} \times \frac{1}{12}$$

= .012648 lbs/ton of coal through sample area

Average emission - $\frac{Pmra + Pmrc}{2} = \frac{.01576 + .012648}{2} = .0142$

12. Percentage Isokienetics

$$I = \frac{1.667 \left[.00267\ Vlc + \frac{Vm}{Tm} \left(Pbar + \frac{\Delta H}{13.6} \right) \right] Ts}{\theta \times Vs \times P \times An}$$

$$= \frac{1.667 \left[.00267 \times 348.3 + \frac{7.33}{460+83} \left(29.71 + \frac{0.7}{13.6} \right) \right] (460+303)}{18 \times 13.32 \times 29.71 \times .0025779}$$

= 80.05 %

BY________ DATE 8/3/76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions SHEET NO. [illegible] OF [illegible]

CHKD. BY A.B. DATE 9/21/76 JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

Date Sampled: 8/3/76
Train & Operator: Rich & Tom. 'RAC'
Barometric Pressure: 29.71" of Hg.
Static Pressure: Atmos.
Wind Direction & Speed: West 0-5 mph.

← 10' →

	1	2	3	4	5	6	7	8	9	10	11	12
↑ S												
3' C												
↓ N							X	X	X	X	X	X

Centroid, Oven No. & Time Pushed	Sec.	Probe Tip Temperatures Read	Probe Tip Temperatures Average °F	Pressures IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
'7N'	10	176	191	0.02	0.1414	0.1601	.5	11.02	1
	20	201		0.03	0.1732		.8	13.76	1
	30	193		0.03	0.1732		.8	13.68	1
	40	190		0.02	0.1414		.5	11.14	1
OVEN NO. 106	50	178		0.025	0.1581		.7	12.34	1
	60	207		0.03	0.1732		.8	13.82	1
	70								
'8N'	10	178	191.	0.02	0.1414	0.1601	.5	11.04	1
	20	192		0.03	0.1732		.8	13.67	1
	30	187		0.025	0.1581		.7	12.43	1
	40	203		0.03	0.1732		.8	13.78	2
OVEN NO. 116	50	184		0.02	0.1414		.5	11.09	2
	60	200.		0.03	0.1732		.8	13.75	2.
	70								
'9N'	10	166	188.	0.01	0.1000	0.1507	.3	7.73	10
	20	203		0.03	0.1732		.8	13.78	12
	30	190		0.03	0.1732		.8	13.65	12
	40	198		0.025	0.1581		.7	12.59	12
OVEN NO. 126	50	179		0.025	0.1581		.7	12.35	10
	60	190.		0.02	0.1414		.5	11.14	10.
	70								
'10N'	10	178	193.	0.02	0.1414	0.1463	.5	11.04	10
	20	203		0.03	0.1732		.8	13.79	12
	30	195.		0.02	0.1414		.5	11.18	12
	40	201.		0.02	0.1414		.5	11.24	12
OVEN NO. 136.	50	182		0.015	0.1225		.4	9.59	10
	60	196.		0.025.	0.1581.		.7	12.51	10.
	70								
'11N'	10	169	201.	0.01	0.1000	.1530	.3	6.76	10
	20	187		0.03	0.1732		.8	13.61	12
	30	215		0.035	0.1871		.95	15.02	15
	40	206		0.025	0.1581		.70	12.61	15
OVEN NO. 95.	50	206		0.02	0.1414		.5	11.28	10
	60	223.		0.025.	0.1581.		.7	12.77	10.
	70								
'12N'	10	176	190.	0.005.	0.0710	0.1165.	.2	5.51	8
	20	187		0.01	0.1000.		.3	7.86	10
	30	196		0.02	0.1414		.5	11.19	10
	40	184		0.02	0.1414		.5	11.09	10.
OVEN NO. 108	50	190		0.015	0.1225		.4	9.65	10
	60	209.		0.015.	0.1225		.4	9.79	10.
	70								

BY _____ DATE 8/3/76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

CHKD. BY AG DATE 9-21-76

SHEET NO. 2 OF 15

JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

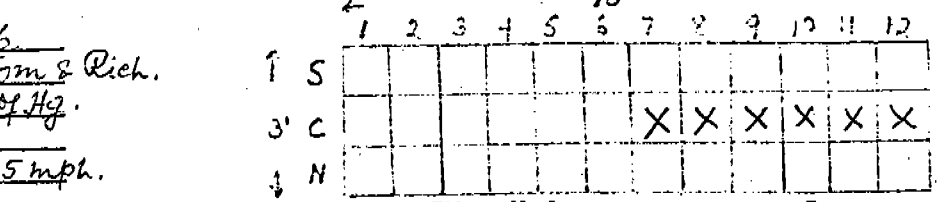
Date Sampled: 8/3/76

Train & Operator: 'RAC' - Tom & Rich.

Barometric Pressure: 29.71" of Hg.

Static Pressure: Atmos.

Wind Direction & Speed: West, 0-5 mph.



Centroid, Oven No. & Time Pushed	PROBE TIP TEMPERATURES Sec.	Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
'12C'	10	196	198.	0.02	0.1414	.1298	.5	11.19	8
	20	204		0.03	0.1732		.8	13.79	12
	30	209		0.02	0.1414		.5	11.30	12
	40	195.		0.015.	0.1225		.4	9.69	12
OVEN NO. 118.	50	180		0.01	0.1000		.3	7.82	8
	60	206.		0.01.	0.1000.		.3	7.97	8
	70								
'11C'	10	190	194.	0.04	0.2000	0.1905	1.1	15.76	12
	20	200		0.05	0.2236		1.4	17.75	14
	30	190		0.03	0.1732		.8	13.65	12
	40	200.		0.04	0.2000		1.1	15.88	12
OVEN NO. 128.	50	185		0.03	0.1732		0.8	13.59	10
	60	200.		0.03.	0.1732		0.8	13.75	10.
	70								
'10C'	10	179	198.	0.02	0.1414	0.1892	.5	11.05	12
	20	203		0.04	0.2000		1.1	15.91	14
	30	209		0.05	0.2236		1.4	13.65	12
	40	209		0.05	0.2236		1.4	15.88	12
OVEN NO. 138.	50	177		0.03	0.1732		0.8	13.59	10
	60	209.		0.03.	0.1732		0.8	13.75.	10.
	70								
'9C'	10	177	172.	0.02	0.1414	0.0878	0.5	11.03	8
	20	196		0.03	0.1732		0.8	13.71	12
	30	192		0.02	0.1414		0.5	11.16	10
	40	172		0.005	0.0710		0.2	5.49	5
OVEN NO. 87.	50	139		0.0	0.0		0.0	0.0	0
	60	152		0.0.	0.0.		0.0	0.0.	0.
	70								
'8C'	10	190	211.	0.02	0.1414	0.2002	0.3	11.14	10
	20	204		0.03	0.1732		0.8	13.79	12
	30	217		0.065.	0.2550		1.7	20.50	25
	40	217		0.055	0.2345		1.5	18.86	20
OVEN NO. 97.	50	217		0.05.	0.2236		1.4	17.98	20
	60	224.		0.03.	0.1732		0.8	13.97	20.
	70								
'7C'	10	200	194.	0.02	0.1414	0.1671	0.5	11.23	10
	20	209		0.03	0.1732		0.8	13.84	12
	30	200		0.04	0.2000		1.1	15.88	17
	40	196		0.03	0.1732		0.8	13.71	15
OVEN NO. 101.	50	184		0.02	0.1414		0.5	11.09	12
	60	176.		0.03	0.1732		0.8	13.50.	15.
	70								

BY _____ DATE 8/3/76 SUBJECT Air Pollution Controlled Source Sampling of Residual Velocity & Temperature Data Particulate In Duct Emissions

SHEET NO. 39 OF 185

CHKD. BY _____ DATE 9/21/76

JOB NO. Donner-Hanna Coke Corp. PECT System

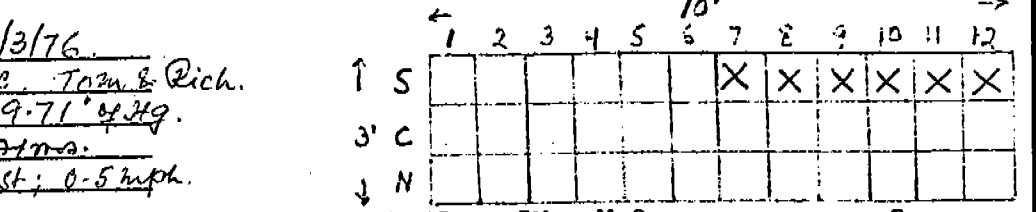
Date Sampled: 8/3/76

Train & Operator: RAC. Tom & Rich.

Barometric Pressure: 29.71" of Hg.

Static Pressure: Atms.

Wind Direction & Speed: West; 0-5 mph.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
'7S'	10	192		0.04	0.2000		1.1	15.78	15
	20	212		0.05	0.2236		1.4	17.91	17
	30	204	196.	0.05.	0.2236	0.1936	1.4	17.87	20
	40	195.		0.04	0.2000.		1.1	15.82	17
OVEN NO. 131.	50	184		0.02	0.1414		0.5	11.07	15
	60	198.		0.03.	0.1732		0.8	13.73	10.
	70								
'8S'	10	169		0.01	0.1000.		0.3	7.75	10
	20	179		0.02	0.1414		0.5	11.05	15
	30	196		0.02	0.1414		0.5	11.19	20
	40	176	168.	0.01	0.1000	0.0971.	0.3	7.79	15
OVEN NO. 99.	50	154		0.01	0.1000.		0.3	7.66	15
	60	131.		0.0.	0.000		0.0	0.0.	10.
	70								
'9S'	10	NO		0.02	0.1414		0.5	10.96	12
	20	RECORD		0.04	0.2000		0.1	15.62	22
	30	BY		0.04	0.2000		1.1	15.83	23
	40	RECORDER	(168)	0.06	0.2449	0.1888.	1.6	19.09	23
OVEN NO. 103.	50	USED		0.03	0.1732		0.8	13.26	23
	60	85 FIGURES		0.03.	0.1732		0.8	13.01.	23.
	70								
'10S'	10	181		0.02	0.1414		0.5	11.06	10
	20	196		0.03	0.1732		0.8	13.71	20
	30	206		0.05	0.2236		1.4	17.87	17
	40	200	192.	0.05	0.2236	0.1847.	1.4	17.75	12
OVEN NO. 113.	50	180		0.03	0.1732		0.8	13.54	10
	60	184.		0.03	0.1732		0.8	13.58	10.
	70								
'11S'	10	176		0.03	0.1732		0.8	13.50	5
	20	196		0.04	0.2000		1.1	15.83	6
	30	182		0.04	0.2000		1.1	15.66	10
	40	212	186.	0.02	0.1414	0.1427	0.5	11.33	10
OVEN NO. 123.	50	178		0.02	0.1414		0.5	11.04	5
	60	169		0.00.	0.000.		0.0	0.00	0
	70								
'12S'	10	196		0.03	0.1732		0.8	13.71	8
	20	195		0.04	0.2000		1.1	15.82	8
	30	190		0.03	0.1732		0.8	13.65	8
	40	192	192.	0.03	0.1732	.1671	0.8	13.67	8
OVEN NO. 133.	50	186		0.02	0.1414		0.5	11.11	8
	60	192.		0.02	0.1414		0.5	11.16.	8
	70								

DATE	SOURCE	TESTED BY
8/3/76.	PEC.	Rich.

SAMPLER	SAMPLE BOX NO.	BAR. PRESS.	WEATHER CONDITION
RAC.	1.	29.71".	Clear Sunny day 0-5 mph. West.

ASSUMED MOISTURE	C FACTOR	METER BOX SETTING
	—	120-150.

PROBE LENGTH	NOZZLE DIAMETER	PROBE SETTING
30".	11/16"	no heat.

DRY COLLECTED WEIGHT MILLIGRAMS	INITIAL	FINAL	NET
FILTER NO. 25.	0.73907	0.80395	0.07488.
ACETONE WASH	99.93692 / 99.74654	98.00574 / 98.82364	0.06887 / 0.02710.
WATER WASH	97.06456	97.06762	0.00306.
FRONT TOTAL			0.17391
IMPINGER	95.43628	95.45061	.01433
TRAIN TOTAL			0.18824

CONDENSATE COLLECTED ml - Gms	INITIAL	FINAL	NET
IMP. I	100.	184	84 c.c.
IMP. II	100.	250	150 c.c.
IMP. III	0	36	36 c.c.
SILICA GEL	200.	216	16 c.c.
TOTAL			286 c.c.
CYCLONE	0	85 c.c.	85 c.c.

CENTROID NO.	CLOCK TIME	SECONDS SAMPLED	DRY GAS METER READ OF	ORIFICE ΔH	PUMP IN. HG.	DRY GAS METER IN °F	DRY GAS METER OUT °F	STACK °F	SAMPLE BOX °F	IMPINGER °F	√Δ P	STACK IN. HG.	STACK FPS	
7N 106	8:20 A.M.	60 Sec.	687.967	.5-.8	L	65	65	191	148	70	0.1601	Atmospheric	12.62	
8N 116	8:30 A.M.	60	688.470	.5-.8	1-2	65	65	191	148	80	0.1601		12.62	
9N 126	9:20 A.M.	60	688.966	.3-.8	10<12	71	71	188	140	80	.1507		11.85	
10N 136	9:30 A.M.	60	689.510	.4-.8	10-15	72	72	193	128	76	0.1463		11.55	
11N 95	9:40 A.M.	60	690.048	.3-.95	8-10	73	73	201	133	74	0.1530		12.15	COFFEE BREAK
12N 109	10:05 A.M.	60	690.573	.2-.5	8-10	76	76	190.	138	72	0.1165		9.18	
12C 118	10:25 A.M.	60	690.954	.5-.8	8-12	76	76	198	120	92	0.1298		10.29	
11C 128	10:35 A.M.	60	691.347	.8-1.4	10-14	77	77	194	120	84	0.1905		15.05	
10C 138	10:50 A.M.	60	691.897	.5-1.4	10-14	76	76	198	122	80	0.1892		15.00	
9C 87	11:00 A.M.	60	692.468	0-.8	0-12	77	77	172	118	78	0.0878		6.82	
8C 97	11:10 A.M.	60	692.772	.3-1.7	10-25	77	77	211	120	80	0.2002		16.02	
7C 107	11:20 A.M.	60	693.332	.5-1.1	10-17	77	77	194	120.	80.	0.1671.		13.20	
7S 131	12:50 P.M.	60	693.837	.5-1.4	15-20	77	77	196	120	80	0.1936		15.32	LUNCH BREAK MISSED OVEN 121
8S 99	1:00 "	60	694.437	0-0.5	10-20	77	77	168	130	78	0.0971		7.52	
9S 103	1:15 "	60	694.778	.5-1.1	12-23	77	77	168	122	84	0.1888.		14.62	
10S 113	1:25 "	60	695.207	.5-1.4	10-17	77	77	192	134	78	0.1847		14.59	COFFEE BREAK.
11S 123	2:05 "	60	695.717	0-1.1	0-10	77	77	186	128	80.	0.1427		11.21	
12S 133	2:17 "	60.	696.205 / 696.708	0.5-1.1	8-8.	77	77	192.	128	80	0.1671.		13.18	
TOT 18 POINTS		TOT 1080.	TOT 8.741 Cft	.72	AVG	AVG 75° F.		AVG 190.2.			AVG 0.1570		AVG 12.37	

BY DATE 8/8/76
CHKD. BY DATE 8/21/76
Data Collection Sheet
SUBJECT Air Pollution Control
Source Sampling of Residual
Particulate In Duct Emissions
SHEET NO. 29 OF 45
JOB NO. Donner-Hanna Coke Corp. PECT System

SAMPLER SUBSET - II , RAC = 8/3/76

1. Volume of gas sampled - (std cuft dry)

$$Vmstd = 17.71 \cdot Vm \cdot \frac{(Pbar + \Delta H/13.6)}{Tm}$$

$$= 17.71 \cdot 8.741 \times \frac{(29.71 + 0.72/13.6)}{460+75}$$

$$= 8.61 \text{ std cuft dry}$$

2. Water collection -

(a) Total impinger collection (Vlc) 286 ml

(b) Cyclone water collection (Vcc) 85 ml (Particulate water)

3. Volume of water vapor in gas sampled

$$Vwstd = .0474 \times Vlc = .0474 \times 286 = 13.56 \text{ cuft in}$$

4. % Moisture

$$\frac{Vwstd}{Vmstd + Vwstd} \times 100 = \frac{13.56}{8.61 + 13.56} \times 100 = 61.15\ \%$$

5. Mole fraction dry (M_D)

$$1 - \frac{\%\ Moisture}{100} = 1 - .6115 = 0.3885$$

6. Molecular wt dry (Md)

(a) Gas composition - H_2- 2.5 % vol

CO_2- 2.5 "

CO- 1.0 "

O_2- 19.74 "

N_2- 74.26 "

from 7/21 test.

(b) $Md = \%\ H_2 \times .02 + \%\ CO_2 \times .44 + \%\ CO \times .28 + \%\ O_2 \times .32 + \%\ H_2 \times .28$

$= 28.54$

7. Molecular wt wet (Ms)

M_D X Md + 18 $(1-M_D)$ = 28.54 x .3885 + 18 x .6115 = 22.08

8. Vcc percentage of total water vapor

$= \frac{Vcc}{Vlc + Vcc}$ X 100 = $\frac{85}{286 + 85}$ X 100 = 22.91 %

9. Stack gas velocity stack condition

$Vs = 85.48 \times Cp \times \sqrt{\Delta p} \sqrt{\frac{460+Ts}{Ps \times Ms}}$

$= 85.48 \times .926 \times .1570 \times \sqrt{\frac{460+190.2}{22.08 \times 29.71}}$

= 12.37 fps

10. Actual stack gas flow through the sampled area

$Qs = Vs \times 30 \times \frac{\text{Points sampled}}{\text{Total points}} \times 60$ ACFM

$= 12.37 \times 30 \times \frac{18}{36} \times 60 = 11,135$ ACFM through sample area

11. Emission rate

A. Concentration method:

(a) Actual cuft sampled through nozzle

$Q_{ACF} = \frac{Vmstd}{M_D} \times \frac{460 + Ts}{460 + 70} \times \frac{29.92}{Ps}$

$= \frac{8.61}{.3885} \times \frac{460 + 190.2}{530} \times \frac{29.92}{29.71}$

= 27.38 ACF

(b) Total wt collected (Mp gms)

Filter .07488

Front half acetone - .09597

Front half water - .00306

Back half - .01433

TOTAL .018824

Contd (8/3/76)

(c) Lbs/ton of coal (12 tons per charge
60 secs per push)

$$Pmrc = \frac{Mp \times Qs}{453.6 \times Q_{ACF} \times 12} = \frac{.18824 \times 11,135}{453.6 \times 27.33 \times 12}$$

.01406 = Lbs/ton of coal through sample area

Pmrc = .01406

B. Area ratio:

An = Area Nozzle = .0025779 sq ft

As = Area stack sampled = 15 sq ft

θ = Minutes sampled 18

$$Pmra = \frac{As}{An} \times \frac{Mp}{453.6} \times \frac{1}{\theta} \times \frac{1}{12}$$

$$= \frac{15}{.0025779} \times \frac{.18824}{453.6} \times \frac{1}{18} \times \frac{1}{12}$$

= 0.01179 lbs/ton of coal through sample area

Average emission - $\frac{Pmra + Pmrc}{2} = \frac{.01406 + .01179}{2} = .01293$

12. Percentage Isokienetics

$$I = \frac{1.667 \left[.00267\ Vlc + \frac{Vm}{Tm} \left(Pbar + \frac{\Delta H}{13.6} \right) \right] Ts}{\theta \times Vs \times P \times An}$$

$$= \frac{1.667 \left[.00267 \times 286 + \frac{8.741}{460+75} \left(29.91 + \frac{0.72}{13.6} \right) \right] (460+190.2)}{18 \times 12.37 \times 29.91 \times .0025779}$$

= 79.44 %

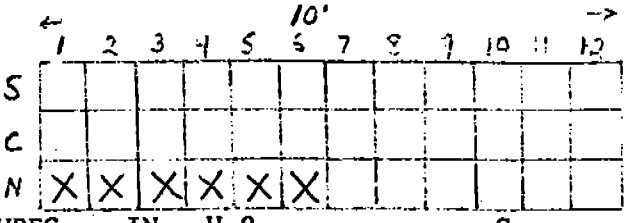
BY _____ DATE 8/4/76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

CHKD. BY AB DATE 9/21/76 Velocity & Temperature Data

SHEET NO. 29 OF 155

JOB NO. Donner-Hanna Coke Corp. PECT System

Date Sampled: 8/4/76.
Train & Operator: G. J. F & S. K. M.
Barometric Pressure: 29.62" of Hg.
Static Pressure: Almost Atm.
Wind Direction & Speed: West 0-10 mph.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
'1N'	10	196	209.5	0.04	0.2000	0.1662	0.7	14.45	0
	20	207		0.02	0.1414		0.3	10.30	5
	30	208		0.03	0.1732		0.5	12.62	2
	40	211		0.04	0.2000		0.7	14.61	2
OVEN NO. 109.	50	217		0.02	0.1414		0.3	10.38	2
	60	218		0.02	0.1414		0.3	10.38	2
	70								
'2N'	10	206	231.7	0.03	0.1732	0.2210	0.5	12.61	2
	20	211		0.04	0.2000		0.7	14.61	2
	30	235		0.07	0.2646		1.2	19.67	3
	40	247		0.07	0.2646		1.2	19.84	6
OVEN NO. 119.	50	247		0.05	0.2236		0.9	16.77	6
	60	244		0.04	0.2000		0.7	14.95	3
	70								
'3N'	10	199	211.2	0.05	0.2236	0.2228	0.9	16.19	2
	20	210		0.06	0.2449		1.0	17.88	3
	30	210		0.06	0.2449		1.0	17.88	0
	40	212		0.05	0.2236		0.9	16.35	4
OVEN NO. 129.	50	215		0.04	0.2000		0.7	14.65	2
	60	221		0.04	0.2000		0.7	14.72	3
	70								
'4N'	10	197	209.7	0.04	0.2000	0.2118	0.7	14.46	2
	20	209		0.05	0.2236		0.9	16.31	3
	30	211		0.05	0.2236		0.9	16.33	2.5
	40	209		0.05	0.2236		0.9	16.31	3
OVEN NO. 139.	50	210		0.04	0.2000		0.7	14.60	2
	60	222		0.04	0.2000		0.7	14.73	2.5
	70								
'5N'	10	195	205.3	0.04	0.2000	0.2025	0.7	14.43	2
	20	207		0.05	0.2236		0.9	16.29	3
	30	208		0.06	0.2449		1.0	17.85	3
	40	208		0.04	0.2000		0.7	14.58	3
OVEN NO. 86.	50	206		0.03	0.1732		0.5	12.61	2
	60	208		0.03	0.1732		0.5	12.62	2
	70								
'6N'	10	199	207.5	0.03	0.1732	0.2073	0.5	12.54	2
	20	199		0.05	0.2236		0.9	16.19	2
	30	211		0.05	0.2236		0.9	16.33	3
	40	218		0.05	0.2236		0.9	16.42	4
OVEN NO. 102.	50	214		0.04	0.2000		0.7	14.64	3
	60	204		0.04	0.2000		0.9	14.53	2
	70								

BY _____ DATE 8-4-76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

CHKD. BY AA DATE 8-24-76

SHEET NO. 22 OF 155

JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

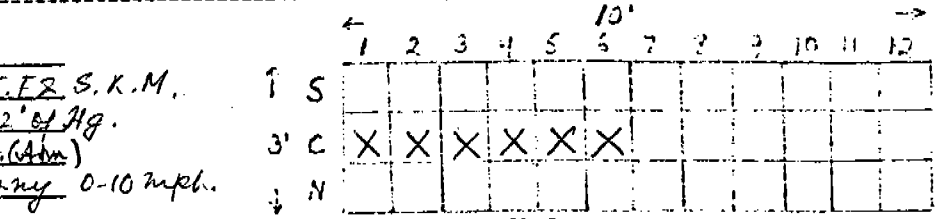
Date Sampled: 8/4/76

Train & Operator: G.J. J.F.E. S.K.M.

Barometric Pressure: 29.62" of Hg.

Static Pressure: Atmospheric (Atm)

Wind Direction & Speed: West Sunny 0-10 mph.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
'6C'	10	211	206.3	0.05	0.2236	0.1776	0.9	16.33	3
	20	216		0.06	0.2449		1.0	17.96	3
	30	218		0.05	0.2236		0.9	15.29	4
	40	212		0.03	0.1732		0.5	12.66	3
OVEN NO. 112.	50	199		0.01	0.1000		0.2	7.24	0
	60	182.		0.01	0.1000		0.2	7.15.	0
	70								
'5C'	10	214	212.8	0.05	0.2236	0.1270.	0.9	16.37	3
	20	222		0.05	0.2236		0.9	16.47	4
	30	227		0.03	0.1732		0.5	12.80	3
	40	217		0.02	0.1414		0.3	10.38	2
OVEN NO. 122.	50	199		0.00	0.000		0.0	0.00	0
	60	198		0.00.	0.000.		0.0	0.00.	0.
	70								
'4C'	10	210	226.3	0.05	0.2236	0.1736.	0.9	16.32	3
	20	225.		0.06	0.2449		1.0	18.08	6
	30	252		0.04	0.2000		0.7	15.05	6
	40	245.		0.03	0.1732		0.5	12.97	3
OVEN NO. 132.	50	227		0.01	0.1000		0.2	7.39	0
	60	199.		0.01.	0.1000		0.2	7.24.	0
	70								
'3C'	10	215	241.3	0.07	0.2646	0.2101.	1.2	19.38	3
	20	250		0.06	0.2449		1.0	18.41	7
	30	255.		0.06	0.2449		1.0	18.47	6
	40	251.		0.05	0.2236		0.9	16.81	4
OVEN NO. 104.	50	244		0.02	0.1414		0.3	10.58	2
	60	233.		0.02	0.1414		0.3	10.50.	0
	70								
'2C'	10	218	233.2	0.05	0.2236	0.1741.	0.9	16.42	3
	20	252		0.05	0.2236		0.9	16.83	8
	30	255		0.03	0.1732		0.5	13.06	4
	40	250		0.02	0.1414		0.3	10.63	2
OVEN NO. 114.	50	223		0.02	0.1414		0.3	10.50.	1
	60	201.		0.02	0.1414		0.3	10.25.	3
	70								
'1C'	10	215	202.8	0.02	0.1414	0.1207	0.3	10.36	0
	20	210		0.02	0.1414		0.3	10.32	1
	30	206		0.02	0.1414		0.3	10.29	2.5
	40	199		0.01	0.1000		0.2	7.24	3
OVEN NO. 88.	50	198		0.01	0.1000.		0.2	7.23	3
	60	189.		0.01.	0.1000		0.2	7.18	3
	70								

BY _____ DATE 8.4.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

CHKD. BY CB DATE 9.21.76

SHEET NO. 45 OF 135

JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

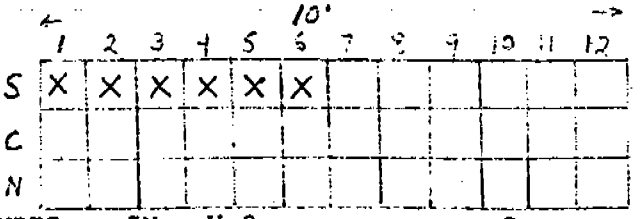
Date Sampled: 8/4/76

Train & Operator: G.9. J.F & S.K.M.

Barometric Pressure: 29.62" of Hg.

Static Pressure: Atmos (Atm)

Wind Direction & Speed: West wind 0-10 mph.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
'1 S'	10	220	233.0	0.05	0.2236	0.2064.	0.9	16.44	8
	20	227		0.06	0.2449		1.0	18.11	14
	30	241		0.05	0.2236		0.9	16.70	13
	40	238		0.04	0.2000		0.7	14.90.	11
OVEN NO. 124.	50	240		0.03	0.1732		0.5	12.92	8
	60	232.		0.03	0.1732		0.5	12.85.	8.
	70								
'2 S'	10	220	242.2	0.07	0.2646	0.2332	1.2	19.46	9
	20	244		0.06	0.2449		1.0	18.39	16
	30	255.		0.06	0.2449		1.0	18.47	18
	40	255.		0.06	0.2449		1.0	18.47	13
OVEN NO. 134.	50	247.		0.04	0.2000		0.7	15.00.	4
	60	232.		0.04	0.2000.		0.7	14.84	3.
	70								
'3 S'	10	208	223.7	0.03	0.1732	0.2133	0.5	12.62	3
	20	218		0.05	0.2236		0.9	16.42	4
	30	230		0.06	0.2449		1.0	18.14.	7
	40	234		0.07	0.2646		1.2	19.66	8
OVEN NO. 98.	50	225.		0.04	0.2000		0.7	14.76	7
	60	227.		0.03	0.1732		0.5	12.80.	3
	70								3
'4 S'	10	213	222.7	0.06	0.2449	0.2320.	1.0	17.92	5
	20	227		0.07	0.2646		1.2	19.56	12
	30	236.		0.07	0.2646		1.2	19.68	12
	40	232		0.04	0.2000		0.7	14.84	6
OVEN NO. 106.	50	208		0.03	0.1732		0.5	12.62	4
	60	220.		0.06.	0.2449		1.0	18.01.	3.
	70								
'5 S'	10	214	221.0	0.06	0.2449	0.2441.	1.0	17.93	10
	20	221		0.06	0.2449		1.0	18.03	16
	30	223		0.08	0.2828		1.4	20.85.	17
	40	218		0.05	0.2236		0.9	16.42	17
OVEN NO. 116.	50	208		0.05	0.2236		0.9	16.30.	14
	60	242		0.06	0.2449		1.0	18.30	16.
	70								
'6 S'	10	212	213.0	0.08	0.2828	0.2393	1.4	20.68	16
	20	219		0.07	0.2646		1.2	19.44	16
	30	217		0.07	0.2646		1.2	19.44	12
	40	214		0.05	0.2236		0.9	16.37	12
OVEN NO. 126.	50	208		0.04	0.2000		0.7	14.58	12
	60	208		0.04	0.2000.		0.7	14.58.	12.
	70								

DATE	SOURCE	TESTED BY
8/4/76.	PEC.	S.K.M & J.F.

SAMPLER	SAMPLE BOX NO.	BAR. PRESS.	WEATHER CONDITION
G.S.	—	24.62	Sunny, Wind 5-10 mph

ASSUMED MOISTURE	C FACTOR	METER BOX SETTING
7%	1	120 - 150

PROBE LENGTH	NOZZLE DIAMETER	PROBE SETTING
30"	11/16"	No heat

DRY COLLECTED WEIGHT MILLIGRAMS	INITIAL	FINAL	NET
FILTER NO. 26	0.72823	0.84113	0.11290
ACETONE WASH	98.24588	98.40211	0.15623
WATER WASH	92.65067	92.65624	0.00557
FRONT TOTAL			0.27470
IMPINGER	95.94553	95.98396	0.03843
TRAIN TOTAL			0.31313.

CONDENSATE COLLECTED . ml - Gms	INITIAL	FINAL	NET
IMP. I	100	340	240 c.c
IMP. II	100	350	250 "
IMP. III	0	60	60 "
SILICA GEL	200	203	3 "
TOTAL			553 "
CYCLONE	0	98	98 "

BY _____ DATE 8.4.76
CHKD. BY AB DATE 9/21/76
Data Collection Sheet

SUBJECT Air Pollution Control
Source Sampling of Residual
Particulate In Duct Emissions

SHEET NO. 4/2 OF 4/5
JOB NO. Donner-Hanna Coke
Corp. PECT System

CENTROID NO.	CLOCK TIME	SECONDS SAMPLED	DRY GAS METER READ OF 179.62	ORIFICE ΔH	PUMP IN. HG.	DRY GAS METER IN °F	DRY GAS METER OUT °F	STACK °F	SAMPLE BOX °F	IMPINGER °F	√ΔP	STACK IN. HG.	STACK FPS	
1N 109	10.45 A.M	60	180.05	0.3-0.7	10-15	78	76	209.5	120-150	75	0.1662	Atmosph. (almost)	12.13	
2N 119	10.53 "	60	180.49	0.5-1.2	12-20	81	79	231.7		80	0.2210		16.39	
3N 129	11.05 "	60	180.97	0.7-1.0	14-18	82	80	211.2		88	0.2228		16.28	
4N 139	11.20 "	60	181.43	0.7-0.9	14-16	84	81	209.7		85	0.2118		15.46	
5N 86	11.35 "	60	181.88	0.5-1.0	12-18	85	82	205.3		82	0.2025		14.93	
6N 102	11.50 "	60	182.30	0.5-0.9	12-17	88	85	207.5		80	0.2073		15.10	
6C 112	12.30 PM	60	182.68	0.2-1.0	7-17	85	82	206.3		78	0.1776		12.93	LUNCH BREAK.
5C 122	12.55 "	60	182.98	0-0.9	0-16	85	82	212.8		82	0.1270		9.29	
4C 132	1.05 "	60	183.39	0.2-1.0	7-18	88	84	226.3		85	0.1736		12.82	
3C 104	1.15 "	60	183.88	0.3-1.2	10-20	88	84	241.3		84	0.2100		15.68	
2C 114	1.25 "	60	184.24	0.3-0.9	10-17	88	84	233.2		84	0.1741		12.93	
1C 88	1.35 "	60	184.46	0.2-0.3	7-11	89	85	202.8		85	0.1207		8.76	
1S 124	1.55 "	60	184.92	0.5-1.0	12-19	90	88	233.0		92	0.2064		15.32	
2S 134	2.06 "	60	185.40	0.7-1.2	14-20	90	88	242.2		95	0.2332		17.44	
3S 98	2.16 "	60	185.88	0.5-1.2	12-20	92	89	223.7		95	0.2133		15.73	
4S 106	2.30 "	60	186.39	0.5-1.2	17-20	92	90	222.7		90	0.2320		17.09	
5S 116	2.40 "	60	186.94	0.9-1.4	16-21	91	90	221.0		89	0.2441		17.96	
6S 126	2.55 "	60	187.49	0.7-1.4	14-21	92	90	213.0		90	0.2393		17.52	
TOT		TOT 1080 Secs	TOT 7.87	0.7	AVG	AVG 85.7°F.		AVG 219.6			AVG 0.1991		AVG 14.63 fps	

SAMPLER SUBSET - III G.I 8.4.76

1. Volume of gas sampled - (std cuft dry)

$$Vmstd = 17.71 \cdot Vm \cdot \frac{(Pbar + \Delta H/13.6)}{Tm}$$

$$= 17.71 \times 7.87 \times \frac{(29.624 + .7/13.6)}{460 + 85.7}$$

$$= 7.58 \text{ std cuft dry}$$

2. Water collection -

(a) Total impinger collection (Vlc) 553 ml

(b) Cyclone water collection (Vcc) 98 ml (Particulate water)

3. Volume of water vapor in gas sampled

$$Vwstd = .0474 \times Vlc = .0474 \times 553 = 26.21 \text{ cuft in}$$

4. % Moisture

$$\frac{Vwstd}{Vmstd + Vwstd} \times 100 = \frac{26.21}{7.58 + 26.21} \times 100 = 77.6\ \%$$

5. Mole fraction dry (M_D)

$$1 - \frac{\%\ Moisture}{100} = 1 - .776 = 0.224$$

6. Molecular wt dry (Md)

(a) Gas composition - H_2 - 2.6 % vol

CO_2 - 2.5 "

CO - 1.0 " Taken from 7/21 test.

O_2 - 19.74 "

N_2 - 74.26 "

(b) $Md = \%\ H_2 \times .02 + \%\ CO_2 \times .44 + \%\ CO \times .28 + \%\ O_2 \times .32 + \%\ H_2 \times .28$

$= 28.54$

7. Molecular wt wet (Ms)

M_D X Md + 18 (1-M_D) = 28.54x.224 + 18x.776 = 20.36

8. Vcc percentage of total water vapor

$$= \frac{Vcc}{Vlc + Vcc} \times 100 = \frac{98}{553+98} \times 100 = 15.05 \%$$

9. Stack gas velocity stack condition

$$Vs = 85.48 \times Cp \times \sqrt{\Delta p} \sqrt{\frac{460+Ts}{Ps \times Ms}}$$

$$= 85.48 \times .817 \times .1991 \times \sqrt{\frac{460+29.6}{29.62 \times 20.36}}$$

= 14.63 fps

10. Actual stack gas flow through the sampled area

$$Qs = Vs \times 30 \times \frac{\text{Points sampled}}{\text{Total points}} \times 60 \text{ ACFM}$$

$$= 14.63 \times 30 \times \frac{18}{36} \times 60 = 13,163$$

ACFM through sample area

11. Emission rate

A. Concentration method:

(a) Actual cuft sampled through nozzle

$$Q_{ACF} = \frac{Vmstd}{M_D} \times \frac{460 + Ts}{460 + 70} \times \frac{29.92}{Ps}$$

$$= \frac{7.58}{.294} \times \frac{460 + 219.6}{530} \times \frac{29.92}{29.62}$$

= 43.42 ACF

(b) Total wt collected (Mp gms)

Filter	0.11290
Front half acetone -	0.15623
Front half water -	0.00557
Back half -	0.03843
TOTAL	0.31313

(c) Lbs/ton of coal (12 tons per charge
60 secs per push)

$$Pmrc = \frac{Mp \times Qs}{453.6 \times Q_{ACF} \times 12} = \frac{.31313 \times 13.163}{453.6 \times 43.41 \times 12}$$

0.01744 = Lbs/ton of coal through sample area

Pmrc = 0.01744

B. Area ratio:

An = Area Nozzle = 0.0025779 sq ft

As = Area stack sampled = 15 sq ft

θ = Minutes sampled 18

$$Pmra = \frac{As}{An} \times \frac{Mp}{453.6} \times \frac{1}{\theta} \times \frac{1}{12}$$

$$= \frac{15}{.0025779} \times \frac{.31313}{453.6} \times \frac{\quad}{18} \times \frac{1}{12}$$

= 0.01860 lbs/ton of coal through sample area

Average emission - $\frac{Pmra + Pmrc}{2} = \frac{.01744 + .01860}{2} = .01802$

12. Percentage Isokienetics

$$I = \frac{1.667 \left[.00267\ Vlc + \frac{Vm}{Tm} \left(Pbar + \frac{\Delta H}{13.6} \right) \right] Ts}{\theta \times Vs \times P \times An}$$

$$= \frac{1.667 \left[.00267 \times 553 + \frac{7.87}{460+85.7} \left(29.62 + \frac{0.7}{13.6} \right) \right] (460+219.6)}{18 \times 14.63 \times 29.62 \times .0025779}$$

= 107.3 %

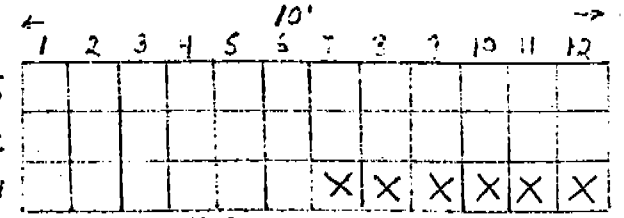
BY _____ DATE 8.4.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

CHKD. BY AB DATE 9.21.76 Velocity & Temperature Data

SHEET NO. 82 OF 185.

JOB NO. Donner-Hanna Coke Corp. PECT System

Date Sampled: 8/4/76
Train & Operator: RAC. J.F&S K.M.
Barometric Pressure: 29.62" Hg.
Static Pressure:
Wind Direction & Speed: West-Sunny- 5-10 mph.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
'7N'	10	187		0.025	0.1581		0.9	12.75	2
	20	191		0.03	0.1732		0.8	14.01	2
	30	199	198.8	0.045	0.2121	0.1902.	1.2	17.26	3
	40	208		0.05	0.2236		1.4	18.32	4
OVEN NO. 109.	50	202		0.035.	0.1871		0.95	15.26	3
	60	206		0.035.	0.1871		0.95	15.30	3
	70								
8N.	10	176		0.025	0.1581		0.9	12.64	2
	20	190		0.03	0.1732		0.8	14.00	2
	30	212		0.06	0.2449		1.6	20.13	6
	40	212	201.0	0.06	0.2449	0.2075.	1.6	20.13	8
OVEN NO. 119.	50	211		0.05.	0.2236		1.4	18.36	8
	60	205.		0.04.	0.2000		1.1	16.35.	7
	70								
'9N'	10	189		0.03	0.1732		0.8	13.99	3
	20	201		0.045.	0.2121		1.2	17.29	3
	30	207		0.05	0.2236		1.4	18.31	5
	40	211	204.7	0.06	0.2449	0.2090.	1.6	20.11.	6
OVEN NO. 129.	50	209		0.04	0.2000		1.1	16.40	4
	60	211.		0.04.	0.2000		1.1	16.42.	4.
	70								
'10N'	10	196		0.02	0.1414		0.5	11.48	2
	20	197		0.04	0.2000		1.1	16.25	2
	30	206		0.045	0.2121		1.2	17.35	3
	40	225	212.3	0.05	0.2236	0.1982	1.4	18.55	6
OVEN NO. 139.	50	225		0.045	0.2121		1.2	17.60	5
	60	225		0.04	0.2000		1.1	16.59	3
	70								
'11N'	10	183		0.02	0.1414		0.5	11.37	2
	20	199		0.03	0.1732		0.8	14.09	2
	30	206		0.05	0.2236		0.4	18.29	4
	40	194	193	0.02	0.1414	0.1466	0.5	11.45	5
OVEN NO. 86.	50	185		0.01	0.1000		0.3	8.05	2
	60	191		0.01	0.1000		0.3	8.09	2
	70								
'12N'	10	175		0.005	0.0707		0.2	5.65	1
	20	204		0.015	0.1225		0.4	10.00.	2
	30	208		0.02	0.1414		0.5	11.59	8
	40	211	207	0.015	0.1225	0.1095.	0.4	18.36	8
OVEN NO. 102.	50	221		0.01	0.1000		0.3	8.27	7
	60	223.		0.01	0.1000.		0.3	8.28	5.
	70								

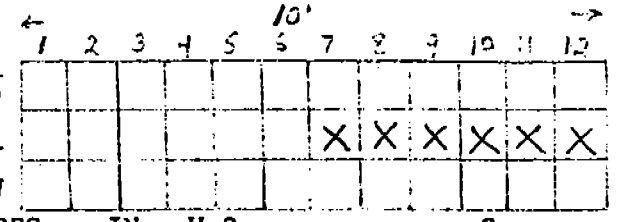
BY _____ DATE 8.4.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Velocity & Temperature Data Particulate In Duct Emissions

CHKD. BY RR DATE 9.21.76

SHEET NO. 58 OF 135

JOB NO. Donner-Hanna Coke Corp. PECT System

Date Sampled: 8/4/76
Train & Operator: RAC. Tom & Rich.
Barometric Pressure: 29.62" of Hg.
Static Pressure:
Wind Direction & Speed: West. 5-10 mph.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
'12 C'	10	175.	187.5.	0.01	0.1000.	0.0736.	.3	7.99	
	20	208		0.01	0.1000.		.3	8.19	
	30	202		0.02	0.1414		.5	11.53	
	40	192		0.01	0.1000		.3	8.09	
OVEN NO. 112.	50	183		0.00	0.000.		.0	0.00	
	60	165		0.00	0.000.		0.0	0.00.	
	70								
'11 C'	10	174	183.0	0.03	0.1732	0.1077	0.8	13.82	10
	20	198		0.04	0.2000.		1.1	16.26	15
	30	197		0.03	0.1732		08	14.07	15
	40	188		0.01	0.1000.		0.3	8.07	12
OVEN NO. 122.	50	175		0.00	0.000.		0.0	0.00	3
	60	166.		0.00.	0.000		0.0	0.00.	1
	70								
'10 C'	10	190	188.5	0.05	0.2236	0.1590	1.4	18.07	10
	20	204		0.06	0.2449		1.6	20.01	17
	30	200		0.045	0.2121		1.2	17.28	20
	40	192		0.03	0.1732		0.8	14.02	14
OVEN NO. 132.	50	179		0.01	0.1000.		0.3	8.01	5
	60	166.		0.00.	0.000		0.0	0.0.	0
	70								
'9 C'	10	197	197.	0.04	0.2000.	0.1760.	1.1	16.25	12
	20	205		0.04	0.2000.		1.1	16.35	17
	30	200		0.04	0.2000		1.1	16.29	23
	40	200.		0.03	0.1732		0.8	14.11.	23
OVEN NO. 104	50	183		0.02	0.1414		0.5	11.37	15
	60	197		0.02.	0.1414		0.5	11.49	12
	70								
'8 C'	10	199	187.8	0.05	0.2236	0.1148	1.4	18.20.	15
	20	210		0.05	0.2236		1.4	18.35	23
	30	197		0.02	0.1414		0.5	11.49	20
	40	188		0.01	0.1000.		0.3	8.07	20
OVEN NO. 114.	50	171		0.00	0.000.		0.0	0.00	10
	60	162		0.00.	0.000.		0.0	0.00.	1
	70								
'7 C'	10	205	187.2	0.03	0.1732	0.1233.	0.8	14.15	15
	20	185		0.03	0.1732		0.8	13.94	23
	30	185		0.01	0.1000		0.3	8.05	25
	40	186		0.015	0.1225		0.4	9.87	25
OVEN NO. 88.	50	191		0.01	0.1000.		0.3	8.09	25
	60	171.		0.005.	0.0707		0.2	5.63	25
	70								

BY________ DATE 8-4-76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

SHEET NO. 29 OF 135

CHKD. BY AD DATE 9-24-76

JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

Date Sampled: 8/4/76.
Train & Operator: RAC. Tom & Rich.
Barometric Pressure: 29.62" of Hg.
Static Pressure:
Wind Direction & Speed: West, - 5-10 mph.

← 10' →, ↕ 3'

	1	2	3	4	5	6	7	8	9	10	11	12
S							X					
C												
N												

Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot √ΔP	Avge. √ΔP	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
'7S'	10	209	206.8	05	0.2236	0.2133.	1.4	18.33	15
	20	212		06	0.2449		1.6	20.13	20
	30	213		07	0.2646		1.9	21.76	25
	40	208		04	0.2000.		1.1	16.39	20
	50	204		03	0.1732		0.8	14.15	15
	60	195		03	0.1732.		0.8	14.05	15.
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BY ______ DATE 8-4-76 SUBJECT Air Pollution Control SHEET NO. 38 OF 135

CHKD. BY AB DATE 9-21-76 Source Sampling of Residual JOB NO. Donner-Hanna Coke

Data Collection Sheet Particulate In Duct Emissions Corp. PECT System

DATE	SOURCE		TESTED BY	
8/4/76.	PECT.		Tom & Rich.	
SAMPLER	SAMPLE BOX NO.	BAR. PRESS.	WEATHER CONDITION	
RAC.	1	29.62"	Sunny wind 5-10 mph.	
ASSUMED MOISTURE	C FACTOR		METER BOX SETTING	
70%.	—		120-150°F	
PROBE LENGTH	NOZZLE DIAMETER		PROBE SETTING	
30"	11/16"		No heat	

DRY COLLECTED WEIGHT MILLIGRAMS	INITIAL	FINAL	NET
FILTER NO. 27	0.72622	0.84731	0.12109
ACETONE WASH	~~96.85102~~ 94.89151	~~96.77954~~ 94.91818	~~0.07280~~ 0.02661
WATER WASH	96.58810	96.59202	0.00392
FRONT TOTAL			0.22442
IMPINGER	97.24579	97.25447	0.00868
TRAIN TOTAL			0.23310

CONDENSATE COLLECTED . ml - Gms	INITIAL	FINAL	NET
IMP. I	100	292	192 c.c.
IMP. II	100	177	77 "
IMP. III	0	12	12 "
SILICA GEL	200	206.5	6.5 gms
TOTAL			287.5
CYCLONE	0	52	52 c.c.

CENTROID NO.	CLOCK TIME	SECONDS SAMPLED	DRY GAS METER READ OF	ORIFICE ΔH	PUMP IN. HG.	DRY GAS METER IN °F	DRY GAS METER OUT °F	STACK °F	SAMPLE BOX °F	IMPINGER °F	$\sqrt{\Delta P}$	STACK IN. HG.	STACK FPS	
7N	10.45 AM	60	698.708	0.7-1.4	2-4	77	77	199	150	76	0.1902		15.48	
8N	10.53 "	60	697.267	0.7-1.6	2-8	78	78	166	148	78	0.2075		16.94	
9N	11.05 "	60	697.885	0.8-1.6	3-6	80	80	205	147.	82	0.2090		17.09	
10N	11.20 "	60	698.520	0.5-1.4	2-6	80	80	242	154	80	0.1982		16.30	
11N	11.35 "	60	699.093	0.3-0.8	2-5	81	81	225	152	84	0.1466		11.89	
12N	11.50 "	60	699.551	0.2-0.5	1-8	81	81	207	158	88	0.1095		10.36	LUNCH BREAK
12C	12.30 P.M.	60	699.927	0-0.5	–	81	81	187.5	154	82	0.0736		5.97	
11C	12.55 "	60	700.209	0-1.1	1-15	81	81	183	142	84	0.1077		8.70	
10C	1.05 "	60	700.593	0-1.6	0-20	81	81	188.5	166	90	0.1590		12.90	
9C	1.15 "	60	701.076	0.5-1.1	12-23	81	81	197	142	84	0.1760		14.31	
8C	1.25 "	60	701.599	0.0-1.4	1-23	81	81	188	148	78	0.1148		9.36	
7C	1.35 "	60	701.963	0.2-0.8	15-25	81	81	187	148	78	0.1233		9.96	(1) Sampling Discontinued - high vacuum
7S	1.55 "	60	702.246	0.8-1.9	15-25	81	81	207	148.	84.	0.2133		17.47	(2) 2 Beakers used for Acetone wash.
8S			702.504											
TOT 13		TOT 780 secs	TOT 5.796	0.8	AVG	AVG 80.3		AVG 196.5			AVG 0.1561		AVG 12.67	

SAMPLER SUBSET - IV = RAC = 8.4.76

1. Volume of gas sampled - (std cuft dry)

$$Vmstd = 17.71 \cdot Vm \cdot \frac{(Pbar + \Delta H/13.6)}{Tm}$$

$$= 17.71 \times 5.796 \times \frac{(29.624 \overset{0.8}{/13.6})}{460+80.3}$$

$$= 5.64 \text{ std cuft dry}$$

2. Water collection -

(a) Total impinger collection (Vlc) 287.5 ml

(b) Cyclone water collection (Vcc) 52 ml (Particulate water)

3. Volume of water vapor in gas sampled

$Vwstd = .0474 \times Vlc = .0474 \times 287.5 = 13.63$ cuft in

4. % Moisture

$$\frac{Vwstd}{Vmstd + Vwstd} \times 100 = \frac{13.63}{5.64 + 13.63} \times 100 = 70.74 \%$$

5. Mole fraction dry (M_D)

$$1 - \frac{\% \text{ Moisture}}{100} = 1 - .7074 = 0.2926$$

6. Molecular wt dry (Md)

(a) Gas composition - H_2 - 2.5 % vol

CO_2 - 2.5 "

CO - 1.0 " Taken from 7/21 test.

O_2 - 19.74 "

N_2 - 74.26 "

(b) $Md = \%\ H_2 \times .02 + \%\ CO_2 \times .44 + \%\ CO \times .28 + \%\ O_2 \times .32 + \%\ H_2 \times .28$

$= 28.54$

Contd. (8/4/76)

7. Molecular wt wet (Ms)

M_D X Md + 18 $(1-M_D)$ = 28.54 × .2926 + 18 × .7074 = 21.08

8. Vcc percentage of total water vapor

$$= \frac{Vcc}{Vlc + Vcc} \times 100 = \frac{52}{2875 + 52} \times 100 = 1.8.32 \%$$

9. Stack gas velocity stack condition

$$Vs = 85.48 \times Cp \times \sqrt{\Delta p} \sqrt{\frac{460+Ts}{Ps \times Ms}}$$

$$= 85.48 \times .926 \times .1561 \times \sqrt{\frac{460+196.5}{29.62+21.08}}$$

$$= 12.69 \text{ fps}$$

10. Actual stack gas flow through the sampled area

$$Qs = Vs \times 30 \times \frac{\text{Points sampled}}{\text{Total points}} \times 60 \text{ ACFM}$$

$$= 12.69 \times 30 \times \frac{13}{36} \times 60 = 8235.5$$

ACFM through sample area (13 pts)

11. Emission rate

A. Concentration method:

(a) Actual cuft sampled through nozzle

$$Q_{ACF} = \frac{Vmstd}{M_D} \times \frac{460 + Ts}{460 + 70} \times \frac{29.92}{Ps}$$

$$= \frac{5.64}{.2926} \times \frac{460 + 196.5}{530} \times \frac{29.92}{29.62}$$

$$= 24.12 \text{ ACF}$$

(b) Total wt collected (Mp gms)

Filter .12109

Front half acetone - .09941

Front half water - .00392

Back half - .00868

TOTAL .23310

Contd (8/4/76)

(c) Lbs/ton of coal (12 tons per charge
60 secs per push)

$$Pmrc = \frac{Mp \times Qs}{453.6 \times Q_{ACF} \times 12} = \frac{.23310 \times 8235.5}{453.6 \times 3412 \times 12}$$

= Lbs/ton of coal through sample area (13 points)

Pmrc = 0.01462

B. Area ratio:

An = Area Nozzle = 0.0025779 sq ft

As = Area stack sampled = 10.83 sq ft (13 pts)

θ = Minutes sampled = 13.00

$$Pmra = \frac{As}{An} \times \frac{Mp}{453.6} \times \frac{1}{\theta} \times \frac{1}{12}$$

$$= \frac{10.83}{.0025779} \times \frac{.23310}{453.6} \times \frac{\quad}{13} \times \frac{1}{12}$$

= 0.01384 lbs/ton of coal through sample area

Average emission - (13 pts) $\frac{Pmra + Pmrc}{2} = \frac{.01462 + .01384}{2} = .01423$

12. Percentage Isokienetics

$$I = \frac{1.667 \left[.00267\ Vlc + \frac{Vm}{Tm} \left(Pbar + \frac{\Delta H}{13.6} \right) \right] Ts}{\theta \times Vs \times P \times An}$$

$$= \frac{1.667 \left[.00267 \times 287.5 + \frac{5.796}{460 + 80.3} \left(29.62 + \frac{0.8}{13.6} \right) \right] (460 + 196.5)}{13 \times 12.77 \times 29.62 \times .0025779}$$

= 93.76 %

BY _____ DATE _____ SUBJECT Air Pollution Controlled _____ SHEET NO. 57 OF 135

CHKD. BY _____ DATE _____ JOB NO. Donner-Hanna

Total In-duct Emission _____ Source Sampling of Residual _____ Coke Corp. PECT System

Particulate In-duct Emission

RESULT-
PECT TOTAL IN-DUCT EMISSION
LBS./TON OF COAL CHARGE

DATE AND SAMPLER	SET	AREA SAMPLED "α" SQ. FT.	VOLUME SAMPLED 'Q' ACF	STACK VELOCITY LBS.	FLOW THROUGH SAMPLE AREA Qs ACFM	WEIGHT COLLECTED GMS.	EMISSION OVER SAMPLING AREA LBS/TON OF COAL			TOTAL STACK AREA A SQ. FT.	TOTAL IN-DUCT EMISSION $E=\frac{\Sigma\omega}{\Sigma\alpha} \times A$ LBS/TON COAL
							CONC. PMRC	AREA RATIO PMRA	AVERAGE "ω"		
8.3.76 4-I		15	29.77	13.32	11,988	.21298	.01576	.012648	.0142	30.0	0.0313.
8.3.76 RAC		15	27.38	12.37	11,135	0.18824	.01406	.01179	.01293		
8.4.76 4-I		15	43.42	14.63	13,163	0.31313	0.01744	0.01860	.01802		
8.4.76 RAC		10.83	24.12	12.67	8235.5	0.23310	.01462	0.01384	.01423		
		CUMULATIVE SAMPLE AREA $\Sigma\alpha$ Sq ft 55.83							CUMULATIVE EMISSION $\Sigma\omega$ 0.0582		

BY _____ DATE 9.8.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

CHKD. BY AB DATE 9.21.76 Velocity & Temperature Data

SHEET NO. 58 OF 135

JOB NO. Donner-Hanna Coke Corp. PECT System

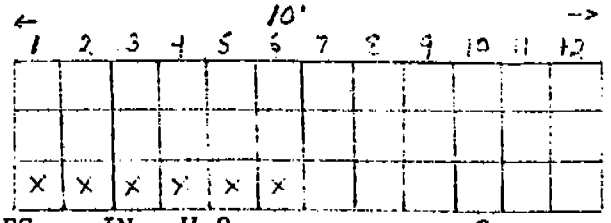
Date Sampled: 9.8.76

Train & Operator: G.I. + J.F. + S.K.N

Barometric Pressure: 29.51

Static Pressure: ~ Atm (almost)

Wind Direction & Speed: West, 8 mph. clear sunny day. 80°F Amb.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
1 N	10	200.3	221.9	.02	.1414	.1759	0.34	10.25	2
	20	216.7		.04	.20		0.69	14.67	0
11B	30	221		.03	.1732		0.51	12.75	5
	40	238.3		.035	.1871		0.60	13.94	4
9.49 A.M	50	236.1		.045	.2121		0.77	15.78	3
	60	218.8		.02	.1414		0.34	10.39	0
	70								
2 N	10	216.7	227.6	.04	.20	.1740	0.69	14.67	3
	20	250.2		.07	.2646		1.2	19.88	4
12B	30	251.3		.035	.1871		0.60	14.07	5
	40	243.7		.045	.2121		0.77	15.87	3.5
10.0 A.M	50	226.3		neg.	—		—		0
	60	197.5		neg	—		-		0
	70								
3N	10	208.1	207.9	.03	.1732	.1077	.51	12.62	1
	20	214.5		.04	.20		.69	14.65	3
13B	30	224.2		.03	.1732		.51	12.79	3
	40	219.9		.01	.10		.17	7.35	2
10-12 A.M	50	193.6		.00	.00		0.0	0.0	0
	60	187.0		.00	.00		0.0	0.0	0
	70								
4 N	10	203.6	209.7	.025	.1581	.1808	.42	11.49	1
	20	211.3		.045	.2121		.60	15.50	3
8A	30	208.1		.04	.20		.69	14.58	3
	40	211.3		.04	.20		.69	14.61	3
10-50 A.M	50	215.6		.03	.1732		.51	12.70	3
	60	208.1		.02	.1414		.34	10.31	2.5
	70								
5 N	10	203.6	209.2	.03	.1732	.2092	0.51	12.58	2
	20	198.1		.04	.20		0.69	14.47	2
9A	30	208.1		.04	.20		0.69	14.58	2.5
	40	213.4		.05	.2236		0.86	16.36	3
11-15 A.M	50	213.4		.05	.2236		0.86	16.36	4
	60	218.8		.055	.2345		0.95	17.23	4.5
	70								
6 N	10	189.2	182.5	.035	.1871	.1283	0.60	13.44	10
	20	193.6		.04	.20		0.69	14.42	12
8B	30	202.5		.02	.1414		0.34	10.26	11.5
	40	192.5		.02	.1414		0.34	10.19	10
11 35 A.M	50	152.7		.01	.10		0.17	7.15	8.5
	60	134.7		.00	0.0		0.00	0.0	5.5
	70								

BY _____ DATE 9.8.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

SHEET NO. 24 OF 125

CHKD. BY AB DATE 9.21.76

JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

Date Sampled: 9.8.76

Train & Operator: G.T - J.F & SKM

Barometric Pressure: 29.51

Static Pressure: almost Atmospheric

Wind Direction & Speed: West, 8-10 mph. clear Sunny - about 80° ambient

10'

	1	2	3	4	5	6	7	8	9	10	11	12
S												
3' C	×	×	×	×	×	×						
N												

Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
6C	10	199.2	206.8	.03	.1732	.1768	0.51	12.54	7.5
	20	219.9		.04	.20		0.69	14.71	12
101	30	202.5		.02	.1414		0.34	10.76	13
	40	200.3		.03	.1732		0.51	12.55	12
	50	201.4		.03	.1732		0.51	12.56	13
12.15 P.M	60	217.7		.04	.20		0.69	14.68	14
	70								
5C	10	199.2	217.9	.045	.2121	.1937	0.77	15.36	8
	20	214.5		.045	.2121		0.77	15.54	14
111	30	240.4		.05	.2236		0.86	16.69	12.5
	40	237.4		.04	.20		0.69	14.79	15
	50	221.0		.03	.1732		0.51	12.75	9
12.35 P.M	60	204.7		.02	.1414		0.34	10.28	7
	70								
4C	10	219.8	216.8	.05	.2236	.1450	0.86	16.43	13
	20	226.3		.055	.2345		0.95	17.32	16
121	30	239.3		.045	.2121		0.77	15.82	19
	40	219.9		.01	.10		0.17	7.35	6
	50	203.6		.01	.10		0.17	7.20	0
12.49 P.M	60	187.0		.00	.00		0.00	0.0	0
	70								
3C	10	219.9	231.5	.06	.2449	.1823	1.03	18.01	10
	20	247.0		.06	.2449		1.03	18.37	18.5
131	30	251.3		.05	.2236		0.86	16.82	19
	40	239.3		.015	.1225		0.26	9.13	12
	50	218.9		.01	.10		0.17	7.35	4
1-10 P.M	60	212.4		.025	.1581		0.42	11.56	3.5
	70								
2C	10	214.5	223.2	.045	.2121	.1933	0.77	15.54	4
	20	224.2		.035	.1871		0.60	13.80	12
103	30	232.8		.04	.20		0.69	14.84	15
	40	236.1		.03	.1732		0.51	12.89	15
	50	232.8		.035	.1871		0.60	13.89	14
1-28 P.M	60	228.5		.04	.20		0.69	14.80	14
	70								
1C	10	218.8	215.3	.03	.1732	.1121	0.51	12.73	7
	20	235.0		.035	.1871		0.64	13.91	12
113	30	250.9		.02	.1414		0.34	10.63	16
	40	229.6		.01	.10		0.17	7.41	6
	50	195.8		.005	.0707		0.09	5.07	7
1-48 P.M	60	162.5		.00	0.0		0.00	0.0	0
	70								

BY______ DATE 9.8.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

SHEET NO 63 OF 173

CHKD. BY AG DATE 9.21.76

JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

Date Sampled: 9.8.76
Train & Operator: G.T + J.F + SKN
Barometric Pressure: 29.51
Static Pressure: Almost Atmospheric
Wind Direction & Speed: West, 8-10mph, clear sunny sky, 80°F ambient.

10'

	1	2	3	4	5	6	7	8	9	10	11	12
S	x	x	x	x	x	x						
3' C												
N												

Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot √ΔP	Avge. √ΔP	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
1 S	10	218.8		.04	.20		.69	14.69	7
	20	230.6		.06	.2449		1.03	18.15	19
	30	243.7		.04	.20		0.69	14.96	18.5
123	40	231.7	225.6	.035	.1871	.1886	0.60	13.87	12
	50	218.8		.025	.1581		0.42	11.62	10
	60	210.2		.02	.1414		0.34	10.32	8
2.04 P.M	70								
2 S	10	208.1		.06	.2449		1.03	17.85	10
	20	225.3		.06	.2449		1.03	18.08	19
	30	250.2		.05	.2236	.1951	0.86	16.80	20.5
133	40	251.3	231.3	.045	.2121		0.77	15.95	16
	50	240.4		.015	.1225		0.26	9.14	7
	60	212.4		.015	.1225		0.26	8.96	3
2.18 P.M	70								
3 S	10	217.7		.05	.0707		0.86	16.41	10
	20	227.4		.035	.1871		0.60	13.83	16.5
	30	243.7		.015	.1225		0.26	9.16	15
86	40	212.4	209.1	.01	.10	.0969	0.17	7.31	8
	50	193.6		.01	.10		0.17	7.31	7
	60	60.0		.00	.00		0.0	0.0	5
2.39 P.M	70								
4 S	10	212.4		.04	.20		0.69	14.64	12
	20	217.7		.05	.2236		0.86	16.41	14.5
	30	214.5		.04	.20		0.69	14.65	15
96	40	216.7	213.1	.045	.2121	.1920	0.77	15.56	15.5
	50	208.1		.025	.1581		0.42	11.52	14
	60	208.1		.025	.1581		0.42	11.52	10
2.57 P.M	70								
5 S	10	209.1		.035	.1871		0.60	13.65	7.5
	20	214.5		.045	.2121		0.77	15.54	14.5
	30	216.7		.065	.2550		1.12	18.70	15.5
105	40	217.7	217.7	.075	.2739	.2413	1.2	20.10	18.5
	50	219.9		.065	.2550		1.12	19.75	18.5
	60	228.5		.07	.2646		1.2	19.55	21.0
3.13 P.M	70								
6 S	10	213.4		.045	.2121		0.77	15.52	12
	20	215.7		.06	.2449		1.03	17.96	17
	30	214.7		.035	.1871	.1971	0.60	13.70	17
115	40	211.3	212.8	.05	.2236		0.86	16.34	13.5
	50	209.1		.02	.1414		0.34	10.31	9
	60	212.4		.03	.1732		0.51	12.67	11
3.29 P.M	70								

DATE	SOURCE	TESTED BY
9.8.76	P.E.C.T	J.F.H SWM

SAMPLER	SAMPLE BOX NO.	BAR. PRESS.	WEATHER CONDITION
G.I	—	29.51	West wind 8-10 mph Sunny - 85°F amb.

ASSUMED MOISTURE	C FACTOR	METER BOX SETTING
4%	—	125° - 150°F

PROBE LENGTH	NOZZLE DIAMETER	PROBE SETTING
30"	1/16"	No heat

DRY COLLECTED WEIGHT MILLIGRAMS	INITIAL	FINAL	NET
FILTER NO. 30	0.73316	0.74565	0.01249
ACETONE WASH	95.35154	95.46122	0.10969
WATER WASH	97.07431	97.07862	0.00431
FRONT TOTAL			0.12648
IMPINGER	96.47561	96.48802	0.01241
TRAIN TOTAL			0.13889

CONDENSATE COLLECTED ml - Gms	INITIAL	FINAL	NET
IMP. I	100	223	123
IMP. II	100	345	245
IMP. III	0	96	96
SILICA GEL gms	200	205	5
TOTAL			469
CYCLONE	0	9.3	9.3

CENTROID NO.	CLOCK TIME	SECONDS SAMPLED	DRY GAS METER READ OF 199.334	ORIFICE ΔH	PUMP IN. HG.	DRY GAS METER IN °F	DRY GAS METER OUT °F	STACK °F	SAMPLE BOX °F	IMPINGER °F	√Δ P	STACK IN. HG.	STACK FPS	
1N 118	9:40 A.M	60	199.571	.4-.8	0-5	82	80	221.9	125-150	84	.1759	Almost Atmos.	12.95	LATE START PUSHER DERAILED.
2N 128	10:00	60	199.990	.7-1.2	0-5	84	81	229.6		85	.1440		10.65	
3N 138	10:12	60	200.139	0-0.7	0-3	85	81	209.9		85	.1097		7.85	
4N 84	10:50	60	200.529	.4-0.7	1-3	86	82	209.7		85	.1808		13.19	① PUSHER TROUBLE, ② GAS SAMPLED.
5N 94	11:15	60	200.960	.5-1.0	2-4.5	91	84	209.2		80	.2092		15.26	
6N 89	11:35	60	201.377	0-0.7	5.5-12	85	82	162.5		80	.1283		9.17	
6C 101	12:15 P.M	60	201.623	0.4-0.9	9.5-14	85	83	206.8		80	.1768		12.87	LUNCH BREAK
5C 111	12:35	60	202.065	0.4-0.9	7-17.5	86	82	219.9		80	.1939		14.22	① WATER FLOW CHECKED: WEST - 70" H_2O EAST - 83.5" " ② GAS SAMPLED.
4C 121	12:49	60	202.489	0.0-1.0	0-19.0	83	81	215.8		82	.1450		10.63	
3C 131	1:10	60	202.917	0.2-1.1	3.5-19	84	82	231.5		92	.1823		13.52	② WATER FLOW CHECKED: WEST - 70" H_2O EAST - 85" H_2O
2C 103	1:28	60	203.286	0.5-0.8	4-15	85	82	228.2		95	.1933		14.30	
1C 113	1:48	60	203.529	0.0-0.6	5-16	85	84	215.3		100	.1121		9.21	
1S 123	2:04	60	203.951	0.4-1.1	7-18.5	85	83	225.6		110	.1886		13.93	WATER PUMP ON TIME RECORD ON STRIP CHART RECORDER.
2S 133	2:18	60	204.388	0.3-1.1	3-20.5	88	85	231.3		118	.1951		14.47	
3S 86	2:37	60	204.693	0.0-0.9	5-17	88	86	209.1		90	.0967		7.05	
4S 96	2:57	60	205.146	0.5-0.9	12-16	88	87	213.1		85	.1920		14.05	
5S 105	3:13	60	205.609	0.6-1.2	7.5-21	89	88	217.7		85	.2413		17.71	
6S 115	3:29	60	206.030	0.4-1.1	8-17	92	90	212.8		88	.1971		14.42	
TOT 18 PTS		TOT 1080 sec	TOT 6.806	0.59	AVG	AVG 84.4		AVG 215.8			AVG 0.1700		AVG	

Data Collection Sheet

Source Sampling of Residual Particulate In Duct Emissions

Corp. PECT System

JOB NO. Donner-Hanna Coke

SAMPLER SUBSET -I, 4. I - 9.8.76

1. Volume of gas sampled - (std cuft dry)

$$Vmstd = 17.71 \cdot Vm \cdot \frac{(Pbar + \Delta H/13.6)}{Tm}$$

$$= 17.71 \cdot 6.800 \times \frac{(29.51 + \frac{.59}{13.6})}{460 + 94.7}$$

$$= 6.54 \text{ std cuft dry}$$

2. Water collection -

(a) Total impinger collection (Vlc) = 462 ml

(b) Cyclone water collection (Vcc) - 93 ml (Particulate water)

3. Volume of water vapor in gas sampled

$Vwstd = .0474 \times Vlc = .0474 \times 462 =$ 21.90 cuft in

4. % Moisture

$$\frac{Vwstd}{Vmstd + Vwstd} \times 100 = \frac{21.90}{6.54 + 21.90} \times 100 = 77.00 \%$$

5. Mole fraction dry (MD)

$$1 - \frac{\% \text{ Moisture}}{100} = 1 - 0.77 = 0.23$$

6. Molecular wt dry (Md)

(a) Gas composition -

		Vol	No 2	Avg.
H_2-	% vol	2.8	0.5	1.65
CO_2-	"	1.7	1.2	1.45
CO-	"	1.7	0.6	1.15
O_2-	"	18.7	19.3	19.00
N_2-	"	75.1	78.4	76.75
		100.00	100.00	100.00

(b) $Md = \%\ H_2 \times .02 + \%\ CO_2 \times .44 + \%\ CO \times .28 + \%\ O_2 \times .32 + \%\ N_2 \times .28$

$= 1.65 \times .02 + 1.45 \times .44 + 1.15 \times .28 + 19.00 \times .32 + 76.75 \times .28$

$= 28.56$

(Second 9/8/76)

7. Molecular wt wet (Ms)

M_D X Md + 18 (1-M_D) = 0.23 × 29.56 + 18 × 0.77 = 20.43

8. Vcc percentage of total water vapor

$$= \frac{Vcc}{Vlc + Vcc} \times 100 = \frac{13}{93 + 13} \times 100 = 16.8 \%$$

9. Stack gas velocity stack condition

$$Vs = 85.48 \times Cp \times \sqrt{\Delta p} \sqrt{\frac{460+Ts}{Ps \times Ms}}$$

$$= 85.48 \times .81 \times .1702 \times \sqrt{\frac{460+215.3}{29.51 \times 20.43}}$$

= 12.46 fps

10. Actual stack gas flow through the sampled area

$$Qs = Vs \times 30 \times \frac{\text{Points sampled}}{\text{Total points}} \times 60 \text{ ACFM}$$

$$= 12.46 \times 30 \times \frac{18}{36} \times 60 = 11,214$$

ACFM through sample area

11. Emission rate

A. Concentration method:

(a) Actual cuft sampled through nozzle

$$Q_{ACF} = \frac{Vmstd}{M_D} \times \frac{460 + Ts}{460 + 70} \times \frac{29.92}{Ps}$$

$$= \frac{6.54}{.23} \times \frac{460 + 215.3}{530} \times \frac{29.92}{29.51}$$

= 36.72 ACF

(b) Total wt collected (Mp gms)

Filter .012449

Front half acetone - .10968

Front half water - .00431

Back half - .01341

TOTAL .13989

Contd (9/8/76)

(c) Lbs/ton of coal (12 tons per charge
60 secs per push)

$$Pmrc = \frac{Mp \times Qs}{453.6 \times Q_{ACF} \times 12} = \frac{0.13889 \times 11.214}{453.6 \times 36776 \times 12}$$

0.007784 = Lbs/ton of coal through sample area

Pmrc = 0.007784

B. Area ratio:

An = Area Nozzle = 0.0025779 sq ft

As = Area stack sampled = 15.0 sq ft

θ = Minutes sampled 18.0

$$Pmra = \frac{As}{An} \times \frac{Mp}{453.6} \times \frac{1}{\theta} \times \frac{1}{12}$$

$$= \frac{15.0}{.0025779} \times \frac{0.13889}{453.6} \times \frac{1}{18} \times \frac{1}{12}$$

= 0.008248 lbs/ton of coal through sample area

Average emission - $\frac{Pmra + Pmrc}{2} = \frac{.008248 + .007784}{2} = 0.008016$

12. Percentage Isokienetics

$$I = \frac{1.667 \left[.00267\ Vlc + \frac{Vm}{Tm} \left(Pbar + \frac{\Delta H}{13.6} \right) \right] Ts}{\theta \times Vs \times P \times An}$$

$$= \frac{1.667 \left[.00267 \times 462 + \frac{6.806}{(460+84.7)} \left(29.51 + \frac{0.59}{13.6} \right) \right] (460+215.8)}{18 \times 12.46 \times 29.51 \times .0025779}$$

= 105.8 %

BY _____ DATE 9.9.76
CHKD. BY AB DATE 9.21.76

SUBJECT Air Pollution Control
Source Sampling of Residual
Particulate In Duct Emissions

JOB NO. Donner-Hanna Coke
Corp. PECT System

Velocity & Temperature Data

Date Sampled: 9/8/76
Train & Operator: RAC - Tom Rich
Barometric Pressure: 29.51
Static Pressure: Atm (Almost)
Wind Direction & Speed: West 8mph Clear, Sunny day 80° Ambient.

10'

	1	2	3	4	5	6	7	8	9	10	11	12
↑ S												
3' C												
↓ N							x	x	x	x	x	x

Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
7 N	10	190.3	196.8	.035	.1871	.2029	0.9	15.12	3
	20	203.6		.045	.2121		1.2	17.32	3
	30	209.1		.055	.2345		1.5	19.23	3
11R	40	205.8		.050	.2236		1.4	18.27	3
	50	187.0		.030	.1732		0.8	13.96	3
	60	184.8		.035	.1871		0.9	15.06	3
9.49 A.M	70								
8 N	10	194.7	189.0	.03	.1732	.1401	0.8	14.05	3
	20	212.4		.05	.2236		1.4	18.38	4
	30	197.0		.04	.20		1.1	16.25	3
12R	40	197.0		.03	.1732		0.8	14.07	3
	50	181.7		.005	.0707		0.2	5.68	1
	60	151.4		.00	0.0		0.0	0.0	0
10.0 A.M	70								
9 N	10	198.1	193.3	.025	.1581	.1446	0.7	12.85	2
	20	205.8		.04	.20		1.1	16.36	3
	30	197.0		.035	.1871		0.9	15.20	2
13R	40	192.5		.015	.1225		0.4	9.91	1
	50	184.5		.010	.10		0.3	8.05	1
	60	181.7		.01	.10		0.3	8.03	1
10.12 A.M	70								
10 N	10	182.7	203.1	.01	.10	.1533	0.3	8.03	1
	20	203.6		.03	.1732		0.8	14.14	2
	30	209.1		.03	.1732		0.8	14.20	2
8A	40	215.6		.04	.20		1.1	16.48	3
	50	207.0		.03	.1732		0.8	14.18	2
	60	200.3		.01	.10		0.3	8.14	1
10.50 A.M	70								
11 N	10	170.2	208.7	.01	.10	.1884	0.3	7.96	1
	20	207.0		.03	.1732		0.8	14.18	2
	30	204.7		.035	.1871		0.9	15.29	3
9A	40	219.9		.046	.2121		1.2	17.51	7
	50	221.0		.05	.2236		1.4	18.49	6
	60	229.6		.055	.2348		1.5	19.32	6
11.15 A.M	70								
12 N	10	189.2	181.7	.005	.0707	.0236	0.2	5.71	0
	20	200.3		.005	.0707		0.2	5.75	0
	30	189.2		0	0		0	0	0
9A	40	191.4		0	0		0	0.0	0
	50	169.2		.0	0		0	0.0	0
	60	150.6		0	0		0	0.0	0
11.35 A.M	70								

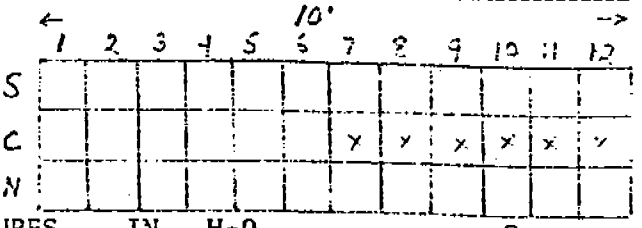
BY _____ DATE 9.8.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Velocity & Temperature Data Particulate In Duct Emissions

SHEET NO. 86 OF 135

CHKD. BY AC DATE 9.21.76

JOB NO. Donner-Hanna Coke Corp. PECT System

Date Sampled: 9/8/76
Train & Operator: RAC - Tom + Rich
Barometric Pressure: 29.51
Static Pressure: Atm (+1mot)
Wind Direction & Speed: West - 8-10 mph. clear, sunny day - 80° F Ambient.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
12 C	10	172.3		.01	.10		0.2	7.97	1
	20	201.4		.015	.1225		0.4	9.98	2
	30	199.0	199.1	.01	.10		0.3	8.12	1
101	40	208.1		.005	.0707	.0891	0.2	5.79	0
	50	204.9		.005	.0707		0.2	5.78	0
	60	211.3		.005	.0709		0.2	5.81	0
12.15 P.N	70								
	10	185.9		.01	.10		0.3	8.05	2
11 C	20	221.0		.05	.2236		1.4	18.49	6
	30	216.7		.035	.1871		0.9	15.42	4
111	40	226.3	216.9	.02	.1414	.1468	0.50	11.94	3
	50	227.2		.025	.1581		0.40	13.23	4
	60	214.5		.005	.0707		0.20	5.82	1
12.35 P.N	70								
	10	197		.03	.1732		0.80	14.07	2
10 C	20	213.4		.04	.20		1.1	16.45	5
	30	192.1		.035	.1871		0.9	15.14	6
	40	212.4	202.8	.02	.1414	.1717	0.5	11.62	3
121	50	209.1		.035	.1871		0.9	15.34	7
	60	192.5		.02	.1414		0.5	11.45	3
12.49 P.N	70								
	10	204.7		.025	.1581		0.7	12.92	2
9 C	20	208.1		.045	.2121		1.2	17.38	6
	30	198.1		.04	.20		1.1	16.26	7
	40	178.6	203.0	.01	.10	.1585	0.2	8.01	2
131	50	211.3		.015	.1225		0.4	10.06	3
	60	211.8		.025	.1581		0.7	12.98	5
1-10 P.N	70								
	10	197.0		.02	.1414		0.5	11.49	3
8 C	20	204.7		.025	.1581		0.7	12.92	5
	30	209.1		.03	.1732		0.8	14.20	6
	40	209.1	207.1	.03	.1732	.1743	0.8	14.20	8
103	50	211.3		.04	.20		1.1	16.42	10
	60	211.3		.04	.20		1.1	16.42	10
1-28 P.N	70								
	10	200.3		.04	.20		1.1	16.29	8
7 C	20	213.4		.055	.2345		1.4	19.29	14
	30	204.7		.03	.1732		0.8	14.15	8
	40	185.9	187.1	.01	.10	.1180	0.3	8.05	1
113	50	167.1		0.0	0		0.0	0.0	0
	60	151.4		0.0	0		0.0	0.0	0
1-48 P.N	70								

BY _____ DATE 9.8.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

SHEET NO. 607 OF 185

CHKD. BY AB DATE 9.21.76 Velocity & Temperature Data

JOB NO. Donner-Hanna Coke Corp. PECT System

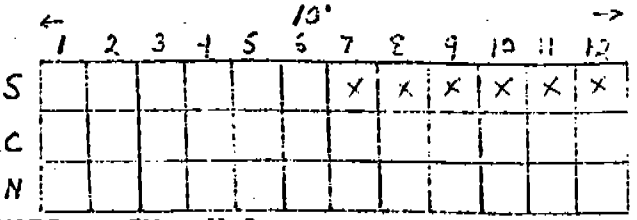
Date Sampled: 9.8.76

Train & Operator: RAC = Tom + Rich

Barometric Pressure: 29.51

Static Pressure: Atm (Almost)

Wind Direction & Speed: West - 8-10 mph, clear sunny day = 80°F Ambient.



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
7S	10	204.7		.05	.2236		1.4	18.27	10
	20	214.5		.065	.2550		1.7	20.98	15
	30	213.4	205.4	.04	.20	.1989	1.1	16.45	15
12S	40	202.5		.04	.20		1.1	16.31	10
	50	201.4		.03	.1732		0.8	14.12	9
	60	195.8		.02	.1414		0.5	11.48	7
2.04 P.M	70								
8S	10	201.4		.035	.1871		0.9	15.25	8
	20	214.5		.06	.2236		1.4	18.40	14
	30	213.4	201.1	.045	.2121	.1672	1.3	17.45	17
	40	210.2		.035	.1871		0.9	15.35	12
13S	50	194.7		.015	.1225		0.4	9.93	6
	60	192.4		.005	.0707		0.2	5.64	3
2.18 P.M	70								
9S	10	208.6		.03	.1732		0.8	14.14	10
	20	208.1		.025	.1581		0.7	12.95	10
	30	183.8		.01	.10	.0719	0.3	8.04	7
	40	173.3	179.2	.0	0		0.0	0.0	0
8S	50	160.8		.0	0		0	0.0	0
	60	145.4		.0	0		0	0.0	0
2.37 P.M	70								
10S	10	202.5		.02	.1414		0.5	11.54	10
	20	209.0		.035	.1871		0.9	15.31	12
	30	211.3	208.3	.03	.1732	.1689	0.8	14.22	12
	40	209.0		.045	.2121		1.2	17.36	15
9S	50	190.3		.025	.1581		0.7	12.78	12
	60	201.4		.02	.1414		0.5	11.53	7
2.59 P.M	70								
11S	10	200.3		.015	.1225		0.4	9.97	9
	20	208.1		.04	.20		1.1	16.38	14
	30	216.7		.055	.2345		1.4	19.33	17
	40	223.1	218.3	.07	.2646	.2185	1.9	21.91	22
10S	50	226.3		.065	.2550		1.8	21.17	20
	60	235.0		.055	.2345		1.4	19.59	20
3.13 P.M	70								
12S	10	205.8		.035	.1871		0.9	15.30	12
	20	209.1		.045	.2121		1.1	17.39	16
	30	200.3		.045	.2121		1.1	17.28	17
	40	213.4	206.0	.035	.1871	.1771	0.9	15.39	17
11S	50	200.3		.02	.1414		0.5	11.52	12
	60	209.0		.015	.1225		0.3	10.02	7
3.29 P.M	70								

DATE	SOURCE	TESTED BY
9.8.76	P.E.C.T	TOM + RICH

SAMPLER	SAMPLE BOX NO.	BAR. PRESS.	WEATHER CONDITION
RAC	—	29.51	Clear Sunny 80°F Ambient

ASSUMED MOISTURE	C FACTOR	METER BOX SETTING
7%	—	125 - 160

PROBE LENGTH	NOZZLE DIAMETER	PROBE SETTING
30"	11/16"	No Heat

DRY COLLECTED WEIGHT MILLIGRAMS	INITIAL	FINAL	NET
FILTER NO. 31	0.72700	0.76732	0.04032
ACETONE WASH 47 + 49	97.19089 94.62503	97.25368 94.65718	0.06329 0.03215
WATER WASH 50	97.00580	97.00872	0.00292
FRONT TOTAL			0.13868
IMPINGER	93.86063	93.88732	0.02690
TRAIN TOTAL			0.16558

CONDENSATE COLLECTED ml - Gms	INITIAL	FINAL	NET
IMP. I	100	137	37
IMP. II	100	145	45
IMP. III	—	310	310
SILICA GEL	200	208.5	8.5
TOTAL			410.5
CYCLONE		84	84

CENTROID NO.	CLOCK TIME	SECONDS SAMPLED	DRY GAS METER READ OF 704.265	ORIFICE ΔH	PUMP IN. HG.	DRY GAS METER IN °F	DRY GAS METER OUT °F	STACK °F	SAMPLE BOX °F	IMPINGER °F	√Δ P	STACK IN. HG.	STACK FPS	
7 N_{108}	9.40	60	704.909	0.8-1.5	3	76	76	196.8	163	92	.2029	Atm (almost)	16.48	LATE START PUSHER DERAILED
8 N_{128}	10.0	60	705.40	0.0-1.4	0-4	77	77	189	148	78	.1401		11.31	
9 N_{138}	10.12	60	705.899	0.3-1.1	1-3	77	77	193.3	164	78	.1446		11.71	
10 N_{54}	10.50	60	706.394	0.3-1.1	1-3	76	76	203.1	160	77	.1533		12.51	
11 N_{94}	11.15	60	706.948	0.3-1.5	1-7	77	77	208.7	155	79	.1884		15.44	
12 N_{89}	11.35	60	707.048	0.0-0.2	0-	78	78	181.7	148	78	.0236		18.95	
12 C_{101}	12.16	60	707.334	0.2-0.4	0-2	77	77	199.1	164	80	.0891		7.25	
11 C_{111}	12.35	60	707.80	0.3-1.4	1-6	78	78	216.9	158	80	.1468		12.10	
10 C_{121}	12.49	60	708.326	0.5-1.1	2-7	77	77	202.8	163	90	.1717		14.01	
9 C_{131}	1.10	60	708.797	0.3-1.1	2-7	77	77	202.0	154	92	.1585		12.92	
8 C_{103}	1.28	60	709.294	0.5-1.1	3-10	78	78	207.1	163	80	.1743		14.27	
7 C_{113}	1.48	60	709.726	0.0-1.4	0-14	78	78	187.1	150	80	.1180		9.51	
7 S_{133}	2.04	60	710.339	0.5-1.7	7-15	78	78	205.4	159	80	.1989		16.26	
8 S_{123}	2.18	60	710.866	0.3-1.4	3-17	78	78	201.1	168	96	.1672		13.62	
9 S_{86}	2.36	60	711.30	0.0-0.8	0-10	77	77	179.2	160	80	.0719		5.76	
10 S_{96}	2.50	60	711.713	0.5-1.2	7-15	78	78	203.3	154	83	.1689		13.79	
11 S_{105}	3.13	60	712.192	0.4-1.9	9-20	78	78	218.3	154	90	.2185		18.03	
12 S_{115}	3.29	60	712.713	0.3-1.1	7-17	79	79	206.0	160	83	.1771		14.48	
TOT 18 pts.		TOT 1080 Secs	TOT 8.448	.78	AVG	AVG 77.4		AVG 200.0			AVG .1508		AVG 12.24	

DATE 9.8.76 SUBJECT Air Pollution Control
CHKD. BY A.D. DATE 9.21.76 Source Sampling of Residual
Particulate In Duct Emissions
Data Collection Sheet
JOB NO. Donner-Hanna Coke
Corp. PECT System
SHEET NO. 1 OF 1

SAMPLER SUBSET -II RAC = 9.8.76

1. Volume of gas sampled - (std cuft dry)

$$Vmstd = 17.71 \cdot Vm \cdot \frac{(Pbar + \Delta H/13.6)}{Tm}$$

$$= 17.71 \cdot .8448 \times \frac{(29.51 + .773/13.6)}{460 + 77.4}$$

$$= 8.23 \text{ std cuft dry}$$

2. Water collection -

(a) Total impinger collection (Vlc) 410.5 ml

(b) Cyclone water collection (Vcc) 84.0 ml (Particulate water)

3. Volume of water vapor in gas sampled

$$Vwstd = .0474 \times Vlc = .0474 \times 410.5 = 19.46 \text{ cuft in}$$

4. % Moisture

$$\frac{Vwstd}{Vmstd + Vwstd} \times 100 = \frac{19.46}{8.23 + 19.46} \times 100 = 70.28\ \%$$

5. Mole fraction dry (M_D)

$$1 - \frac{\%\ Moisture}{100} = 1 - .7028 = 0.2972$$

6. Molecular wt dry (Md)

(a) Gas composition - 9.3

H_2-	% vol	1.65
CO_2-	"	1.45
CO-	"	1.15 Same as in G.T.
O_2-	"	19.0
N_2-	"	76.75

(b) $Md = \%\ H_2 \times .02 + \%\ CO_2 \times .44 + \%\ CO \times .28 + \%\ O_2 \times .32 + \%\ H_2 \times .28$

$$= 28.56$$

Contd (9.8.76)

7. Molecular wt wet (Ms)

$M_D \times Md + 18 (1-M_D)$ = .2972 × 29.56 + 18 × .7028 = 21.14

8. Vcc percentage of total water vapor

$$= \frac{Vcc}{Vlc + Vcc} \times 100 = \frac{84}{410.5 + 84} \times 100 = 17.0 \%$$

9. Stack gas velocity stack condition

$$Vs = 85.48 \times Cp \times \sqrt{\Delta p} \sqrt{\frac{460+Ts}{Ps \times Ms}}$$

$$= 85.48 \times .926 \times .504 \times \sqrt{\frac{460+200}{29.51 \times 21.14}}$$

= 12.24 fps

10. Actual stack gas flow through the sampled area

$$Qs = Vs \times 30 \times \frac{\text{Points sampled}}{\text{Total points}} \times 60 \text{ ACFM}$$

$$= 12.24 \times 30 \times \frac{18}{36} \times 60 = 11,016$$ ACFM through sample area

11. Emission rate

A. Concentration method:

(a) Actual cuft sampled through nozzle

$$Q_{ACF} = \frac{Vmstd}{M_D} \times \frac{460 + Ts}{460 + 70} \times \frac{29.92}{Ps}$$

$$= \frac{8.23}{.2972} \times \frac{460 + 200}{530} \times \frac{29.92}{29.51}$$

= 34.96 ACF

(b) Total wt collected (Mp gms)

Filter .04032

Front half acetone - .09544

Front half water - .00292

Back half - .02690

TOTAL .16558

(c) Lbs/ton of coal (12 tons per charge
60 secs per push)

$$Pmrc = \frac{Mp \times Qs}{453.6 \times Q_{ACF} \times 12} = \frac{.16558 \times 11,016}{453.6 \times 3496 \times 12}$$

= Lbs/ton of coal through sample area

Pmrc = 0.009585

B. Area ratio:

An = Area Nozzle = 0.0025779 sq ft

As = Area stack sampled = 15 sq ft

θ = Minutes sampled 18

$$Pmra = \frac{As}{An} \times \frac{Mp}{453.6} \times \frac{1}{\theta} \times \frac{1}{12}$$

$$= \frac{15}{.0025779} \times \frac{.16558}{453.6} \times \frac{1}{18} \times \frac{1}{12}$$

= 0.009833 lbs/ton of coal through sample area

Average emission - $\frac{Pmra + Pmrc}{2} = \frac{.009585 + .009833}{2} = 0.009709$

12. Percentage Isokienetics

$$I = \frac{1.667 \left[.00267\ Vlc + \frac{Vm}{Tm} \left(Pbar + \frac{\Delta H}{13.6} \right) \right] Ts}{\theta \times Vs \times P \times An}$$

$$= \frac{1.667 \left[.00267 \times 410.5 + \frac{8.448}{460+77.4} \left(29.51 + \frac{0.73}{13.6} \right) \right] (460+200)}{18 \times 12.24 \times 29.51 \times .0025779}$$

= 102.5 %

BY ______ DATE 9.9.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

SHEET NO. 72 OF 135

CHKD. BY [illegible] DATE 9.21.76

JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

Sheet #1

Date Sampled: 9/9/76.
Train & Operator: J.F. & S.K. M.
Barometric Pressure: 29.44
Static Pressure:
Wind Direction & Speed: SW occasional 12.5mph after initial south wind

Centroid, Oven No. & Time Pushed	Sec.	Probe Tip Temperatures Read	Average °F	Pressures In. H_2O Read ΔP	Plot √ΔP	Avge. √ΔP	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
1N	10	202.5		.1414	.02		0.34	10.05	5
	20	209.1		.1414	.02		0.34	10.10	10
	30	207		.1414	.02	~~.1394~~	0.34	10.08	9
	40	203.6	198.7	.1000	.01	0.1158	0.17	7.11	8.5
96	50	157		.1000	.01		0.17	7.02	7
	60	182.7		.0707	.005		0.09	4.95	6
8:28AM	70								
2N (circled: oil sticker)	10	207		.1732	.03		0.51	12.35	5
	20	207		.1732	.03		0.51	12.35	11
	30	204.7		.1581	.025	.1163	0.42	11.25	7
	40	192.5	190.9	.1225	.015		0.26	8.64	7.5
~~[illegible]~~ 89	50	177.5		.0707	.005		0.09	4.93	6.5
	60	156.5		.0	00		0.0	0.0.	3.5
9:16 AM	70								
3N	10	204.7		.2000	.04		0.69	14.23	7
	20	225.3		.2236	.05		0.86	16.16	12.5
	30	235.3		.2236	.05	.2115	0.86	16.32	14
	40	[illegible]	226.0	.2345	.055		0.95	17.13	15.5
117	50	237.2		.2000	.04		0.69	14.58	14
	60	209.1		.1871	.035		0.60	13.36	10
9:29 AM	70								
4N	10	198.1		.045	.2121		0.77	15.02	9
	20	208.1		.055	.2345		0.95	16.73	12
	30	205.1		.045	.2121	.1887	0.77	15.13	13
	40	215.6	204.5	.04	.2000		0.69	14.35	13
137	50	211.3		.03	.1732		0.51	12.38	12
	60	185.5		.01	.1000		0.17	7.01	7.5
10:07AM	70								
5N (circled: 5N green haze 88 stopped @ 20 sec)	10	197		.035	.1871		0.60	13.13	8.5
	20	201.4		.05	.2236		0.86	15.87	10.5
	30	192.5		.035	.1871	.2094	0.60	13.19	10
	40	193.2	198.2	.045	.2121		0.77	14.97	11
109	50	197		.045	.2121		0.77	15.01	12
	60	217.7		.055	.2345		0.95	16.85	17
10:51AM	70								
6N	10	178.6		.03	.1732		0.51	12.08	11
	20	194.7		.05	.2236		0.86	15.79	11.5
	30	200.3		.06	.2449	.2310	1.03	17.37	11.5
119	40	204.7	199.1	.065	.2549		1.12	18.18	12
	50	205.1		.065	.2549		1.12	18.19	16.5
11:06	60	208.1		.055	.2345		0.95	16.73	11.5
	70								

BY _____ DATE 9.9.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

CHKD. BY AG DATE 9.21.76

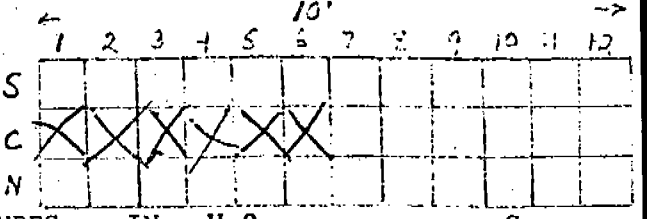
SHEET NO. 13 OF 155

JOB NO. Donner-Hanna Coke Corp. PECT System

Velocity & Temperature Data

Fleet #2

Date Sampled: 9-9-76
Train & Operator: J.F & S.K.M.
Barometric Pressure: 29.44"
Static Pressure: Atms (zero)
Wind Direction & Speed: S.W occasional 0.5 mph after initial build up



Centroid, Oven No. & Time Pushed	Sec.	Probe Tip Temperatures Read	Average °F	Pressures IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq.
6C	10	193.6		.035	.1871		0.60	13.20	10
	20	198.1		.05	.2236		0.86	15.83	16
	30	190.3	191.1	.03	.1732	.1709	0.51	12.19	12.5
129	40	192.5		.04	.2000		0.69	14.10	12
	50	188.1		.02	.1414		0.34	9.94	8.5
11:25AM	60	183.8		.01	.1000		0.17	7.00	7
	70								
5C	10	195.8		.04	.2000		0.69	14.14	9
	20	208.1		.05	.2236		0.86	15.95	14
	30	199.2		.035	.1871		0.60	13.26	13.5
139	40	195.2	197.7	.03	.1732	.1715	0.69	12.27	12.5
	50	195.8		.015	.1225		0.26	8.66	7.5
11:37AM	60	188.1		.015	.1225		0.26	8.66	7
	70								
4C	10	198.1		.03	.1732		0.51	12.26	9
	20	204.7		.045	.2121		0.77	15.10	14
	30	199.2	194.4	.035	.1871	.1576	0.60	13.26	13
98	40	204.7		.03	.1732		0.51	12.39	13
	50	194.7		.01	.1000	0.1419	0.17	7.06	11
12:28PM	60	165		00	.0000		0.0	0.0	6
	70								
3C	10	209.1		.06	.2449		0.03	17.49	12
	20	232.8		.055	.2345		0.95	17.04	15
	30	233.9	213.0	.04	.2000	.1705	0.69	14.54	13
122	40	230.6		.03	.1732		0.51	12.50	12
	50	204.7		.01	.1000	.1906	0.17	7.12	6.5
12:47PM	60	167.1		.005	.0707		0.09	4.89	6
	70							H.P.6	
2C	10	202.5		.035	.1871		0.60	13.39	13
	20	208.1		.045	.2121		0.77	15.13	14
	30	212.4	210.5	.05	.2236	.2024	0.86	16.00	15.5
102	40	219.9		.055	.2345		0.95	16.88	15.5
	50	222.0		.055	.2345		0.95	16.90	16
1:05PM	60	198.1		.015	.1225		0.26	8.67	11
	70								
1C	10	208.1		.025	.1581		0.42	11.28	10
	20	210.2		.025	.1581		0.42	11.30	12.5
	30	205.8	196.4	.02	.1414	.0881	0.34	10.07	12.5
132	40	195.8		.005	.0707		0.09	5.00	9.5
	50	190.3		00	.000		0.0	0.0	7
1:20PM	60	168.1		00	.000		0.0	0.0	5
	70								

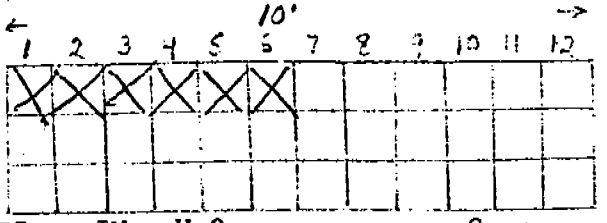
BY _____ DATE 9.9.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

CHKD. BY AB DATE 9.21.76 Velocity & Temperature Data

SHEET NO. 34 OF 135

JOB NO. Donner-Hanna Coke Corp. PECT System

Date Sampled: 9/9/76.
Train & Operator: J.F.B.S.K.M.
Barometric Pressure: 29.44"
Static Pressure: _____
Wind Direction & Speed: South West occasional gusts in the South area.



Test #3

Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
1S	10	212.2	180.8	.04	.2000	.0687	0.69	14.29	10.5
112	20	201.4		.02	.1414		0.34	10.04	14
1:33PM	30	184.7		.005	.0707		0.09	4.99	13
	40	183.8		0.00	.0000		0.0	0.0	8
	50	166.0		0.00	.0000		0.0	0.0	3.5
	60	138.1		0.00	.0000		0.0.	0.0	3
	70								
2S	10	210.2	197.1	.05	.2236	.0930	0.86	15.98	11
91	20	231.7		.045	.2121		0.77	15.40	14
1:54PM	30	218.8		.015	.1225		0.26	8.81	14
	40	202.5		0.00	.0000		0.0	0.0	4
	50	179.6		0.00	.0000		0.0	0.0	2.5
	60.	140.0		0.00	.0000		0.0.	0.0	2
	70								
3S	10	202.5	214.8	.045	.2121	.2042	0.77	15.08	10
104	20	219.9		.05	.2236		0.86	16.09	13.5
2:09 PM	30	224.2		.06	.2449		1.03	17.68	16.5
	40	224.2		.06	.2449		1.03	17.68	17
	50	215.6		.025	.1581		0.42	11.35	14
	60	202.5		.02	.1414		0.34	10.05	8
	70								
4S	10	202.5	201.8	.045	.2121	.1782	0.77	15.08	12
114	20	218.8		.04	.2000		0.69	14.38	14.5
2:23 PM	30	216.7		.055	.2345		0.95	16.84	15.5
	40	208.1		.04	.2000		0.69	14.27	15
	50	193.6		.015	.1225		0.26	8.64	9
	60	171.3		.01	.1000		0.17	6.92	6
	70								
5S	10	200.3	192.8	.045	.2121	.1561	0.77	15.04	12
124	20	201.4		.04	.2000		0.69	14.29	14.5
2:39 PM	30	201.4		.045	.2121		0.77	15.06	15
	40	199.2		.02	.1414		0.34	10.02	12.5
	50	184.5		.01	.1000		0.17	7.01	8
	60	170.2		.005	.0707		0.09	4.90	6
	70								
6S	10	190.3	183.0	.035	.1871	.1574	0.60	13.18	11
134	20	200.3		.035	.1871		0.60	13.27	13
3:54 PM	30	185.9		.04	.2000		0.69	14.03	13
	40	181.7		.025	.1581		0.42	11.06	12.5
	50	177.5		.02	.1414		0.34	9.86	10.5
	60	162.5		.005	.0707		0.09	4.87	8
	70								

134 Stickers

DATE	SOURCE	TESTED BY
9/9/76	PEC.	J. F & S. K. M.

SAMPLER	SAMPLE BOX NO.	BAR. PRESS.	WEATHER CONDITION
G. D.	—	29.44"	Sunny - 85°F ambient

ASSUMED MOISTURE	C FACTOR	METER BOX SETTING
7%	—	125-150

PROBE LENGTH	NOZZLE DIAMETER	PROBE SETTING
30"	11/16"	No heat

DRY COLLECTED WEIGHT MILLIGRAMS	INITIAL	FINAL	NET
FILTER NO. 32	0.72777	0.78244	.05467
ACETONE WASH B.NO. 52253.	95.35098 97.33091	95.48871 97.46823	.13793 .13732
WATER WASH No. 56	95.48413	95.48629	.00216
FRONT TOTAL			.27208
IMPINGER	96.26882	96.29291	0.00389
TRAIN TOTAL			0.27597

CONDENSATE COLLECTED ml - Gms	INITIAL	FINAL	NET
IMP. I	100 c.c.	320	220
IMP. II	100 "	168	68
IMP. III	0 "		
SILICA GEL	200 gms	207	7.0
TOTAL			295.0
CYCLONE	0 c.c.	146+10 c.c	156

CENTROID NO.	CLOCK TIME	SECONDS SAMPLED	DRY GAS METER READ OF 206,031	ORIFICE ΔH	PUMP IN. HG.	DRY GAS METER IN °F	DRY GAS METER OUT °F	STACK °F	SAMPLE BOX °F	IMPINGER °F	√Δ P	STACK IN. HG.	STACK FPS	
1N 96	8:28AM	60	206.267	.09-.34	5-10	72	70	198.7	125-150	90	0.1394	Atm	8.20	
2N 89	9:16AM	60	206.504	0-.151	5-11	78	72	190.9		90	0.1163		8.19	107 sticker
3N 110	9:29AM	60	206.994	.60-.95	7-15.5	80	79	226		98	0.2115		15.29	gas sampled.
4N 137	10:13AM	60	207.423	.17-.95	9-13	85	83	204.5		90	0.1887		13.43	oven 88 sampled
5N 88	10:35AM	20	207.518											20 sec only
5N 109	10:57AM	60	207.990	.60-.95	8.5-17	88	86	198.2		88	0.2094		14.83	oven charged
6N 119	11:06AM	60	208.540	.51-1.12	11-18.5	88	87	199.1		85	0.2310		16.37	just before
6C 129	11:25AM	60	208.942	.17-.86	7-16	90	88	191.1		88	0.1709		12.04	push.
5C 139	11:37AM	60	209.325	.26-.86	7-14	91	89	199.7		89	0.1715		12.14	
4C 98	12:28PM	60	209.640	0-.77	6-14	92	90	194.4		85	0.1576		10.02	
3C 122	12:47PM	60	210.013	.09-.95	6-15	90	89	213		95	0.1705		12.22	
2C 102	1:05PM	60	210.511	.26-.95	11-16	92	90	210.5		120	0.2024		14.47	
1C 132	1:20PM	60	210.724	0-.42	5-12.5	95	92	196.4		142	0.0880		6.23	water pump checked
1S 112	1:33PM	60	210.991	.09-.69	3-14.0	95	94	180.8		142	0.0687		4.80	west - 68" H_2O
2S 91	1:54PM	60	211.243	0-.86	2-14.0	95	94	197.1		115	0.0930		6.58	east - 85" H_2O
3S 104	2:09PM	60	211.737	.34-1.03	8-16.5	95	92	214.8		115	0.2042		14.64	
4S 114	2:23PM	60	212.108	.17-.95	6-15.5	96	95	207.8		100	0.1782		12.65	gas sampled
5S 124	2:37PM	60	212.439	.09-.77	6-15.0	98	95	198.8		95	0.1560		11.00	
6S 93	3:03PM	60	212.796	.09-.60	8-13.0	99	98	183		95	0.1574		11.02	104 oven
TOT		TOT ~~18.33~~ Min: 18.00	TOT 6.765	.52	AVG		AVG 88.9	AVG ~~200~~ °F. 199.5			AVG .1598		AVG 11.34	sticker.

BY _____ DATE 9/9/76 SUBJECT Air Pollution Control

CHKD. BY _____ DATE 9/21/76 Source Sampling of Residual Particulate In Duct Emissions

Data Collection Sheet Corp. PECT System

SHEET NO. 145 OF 152

JOB NO. Donner-Hanna Coke

SAMPLER SUBSET - III = 9.I 9.9.76

1. Volume of gas sampled - (std cuft dry)

$$Vmstd = 17.71 \cdot Vm \cdot \frac{(Pbar + \Delta H/13.6)}{Tm}$$

$$= 17.71 \cdot 6.765 \times \frac{(29.44 + \frac{0.52}{13.6})}{460+88.9}$$

$$= 6.43 \text{ std cuft dry}$$

2. Water collection -

(a) Total impinger collection (Vlc) 295 ml

(b) Cyclone water collection (Vcc) 156 ml (Particulate water)

3. Volume of water vapor in gas sampled

$$Vwstd = .0474 \times Vlc = .0474 \times 295 = 13.983 \text{ cuft in}$$

4. % Moisture

$$\frac{Vwstd}{Vmstd + Vwstd} \times 100 = \frac{13.983}{295+13.983} \times 100 = 68.5 \%$$

5. Mole fraction dry (M_D)

$$1 - \frac{\% \text{ Moisture}}{100} = 1 - .685 = 0.315$$

6. Molecular wt dry (Md)

(a) Gas composition -

H_2-	% vol	2.25
CO_2-	"	2.45
CO-	"	0.93
O_2-	"	19.82
N_2-	"	74.55

(b) $Md = \%\ H_2 \times .02 + \%\ CO_2 \times .44 + \%\ CO \times .28 + \%\ O_2 \times .32 + \%\ H_2 \times .28$

$$= 28.60$$

Contd (9.9.76)

7. Molecular wt wet (Ms)

M_D X Md + 18 $(1-M_D)$ = 28.6 x 0.315 + 18 x 0.685 = 21.34

8. Vcc percentage of total water vapor

$$= \frac{Vcc}{Vlc + Vcc} \times 100 = \frac{156}{295+156} \times 100 = 34.59\ \%$$

9. Stack gas velocity stack condition

$$Vs = 85.48 \times Cp \times \sqrt{\Delta\rho} \sqrt{\frac{460+Ts}{Ps \times Ms}}$$

$$= 85.48 \times .81 \times .1598 \times \sqrt{\frac{460+199.5}{29.44 \times 21.34}}$$

$$= 11.34 \text{ fps}$$

10. Actual stack gas flow through the sampled area

$$Qs = Vs \times 30 \times \frac{\text{Points sampled}}{\text{Total points}} \times 60 \text{ ACFM}$$

$$= 11.34 \times 30 \times \frac{18}{36} \times 60 = 10,206$$

ACFM through sample area

11. Emission rate

A. Concentration method:

(a) Actual cuft sampled through nozzle

$$Q_{ACF} = \frac{Vmstd}{M_D} \times \frac{460 + Ts}{460 + 70} \times \frac{29.92}{Ps}$$

$$= \frac{6.43}{0.315} \times \frac{460 + 199.5}{530} \times \frac{29.92}{29.44}$$

$$= 25.81 \text{ ACF}$$

(b) Total wt collected (Mp gms)

Filter .05467

Front half acetone - .21525

Front half water - .00216

Back half - .00389

TOTAL .027597

Contd (9/9/76)

(c) Lbs/ton of coal (12 tons per charge
60 secs per push)

$$Pmrc = \frac{Mp \times Qs}{453.6 \times Q_{ACF} \times 12} = \frac{.27597 \times 10206}{453.6 \times 25.81 \times 12}$$

= Lbs/ton of coal through sample area

Pmrc = 0.02005

B. Area ratio:

An = Area Nozzle = 0.0025779 sq ft

As = Area stack sampled = 15 sq ft

θ = Minutes sampled 18

$$Pmra = \frac{As}{An} \times \frac{Mp}{453.6} \times \frac{1}{\theta} \times \frac{1}{12}$$

$$= \frac{15}{.0025779} \times \frac{.27597}{453.6} \times \frac{1}{18} \times \frac{1}{12}$$

= .01639 lbs/ton of coal through sample area

Average emission - $\frac{Pmra + Pmrc}{2} = \frac{.01639 + .02005}{2} = .01822$

12. Percentage Isokienetics

$$I = \frac{1.667 \left[.00267\ Vlc + \frac{Vm}{Tm} \left(Pbar + \frac{\Delta H}{13.6} \right) \right] Ts}{\theta \times Vs \times P \times An}$$

$$= \frac{1.667 \left[.00267 \times 295 + \frac{6.765}{460+88.9} \left(29.44 + \frac{.52}{13.6} \right) \right] (460+99.5)}{18 \times 11.34 \times 29.44 \times .0025779}$$

= 51.7 %

- 20 SECS SAMPLING OF "OVEN 88" IS NOT TAKEN INTO CONSIDERATION EITHER IN VOLUME FLOW OR IN ARREA SAMPLED. THE WEIGHT COLLECTED, HOWEVER, INCLUDES '88' SAMPLING WEIGHT.

BY _____ DATE 9.9.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Particulate In Duct Emissions

CHKD. BY AC DATE 9.21.76 Velocity & Temperature Data

SHEET NO. 78 OF 135

JOB NO. Donner-Hanna Co Corp. PECT System

Date Sampled: 9/9/76
Train & Operator: RAC. Tom & Rich.
Barometric Pressure: 29.44" of Hg
Static Pressure: Atmospheric (Above)
Wind Direction & Speed: S. West - 0-2.5 mph after initial southwind

10'

	1	2	3	4	5	6	7	8	9	10	11	12
1' S												
3' C												
↓ N							X	X	X	X	X	X

1/3 Centroid, Oven No. & Time Pushed

PROBE TIP TEMPERATURES

PRESSURES IN. H_2O

Sec.	Read	Average °F	Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
7N								
713.002								
oven # 96								
Tm = 70 60 sec								
10	185.9	181.	.015	.1225	.1417	.40	9.71	1
20	191.9		.015	.1225		.40	9.75	1
30	193.8		.03	.1732		.80	13.71	2
40	194.7		.035	.1871		.95	14.94	2
50	160		.015	.1225		.40	9.51	1
60	170.2		.015	.1225		.40	9.59	1
70								
8N								
713.416								
oven # ~~107~~ 89								
Tm = 74 60 sec								
10	168.1	165.4	.02	.1414	.1085	.50	11.06	1
20	190.3		.025	.1581		.70	12.58	2
30	179.9		.025	.1581		.70	12.43	2
40	153.8		.015	.1225		.40	9.70	1
50	160.8		.005	.0707		.20	5.50	1
60	114.5		0	0		0.0	0.0	0
70								
9N								
713.792								
oven # 117								
Tm = 77 60 sec								
10	191.4	206.	.03	.1732	.1939	.8	13.79	2
20	189.2		.035	.1871		.95	14.87	2
30	205.8		.04	.200		1.1	16.10	4
40	218.8		.06	.2449		1.6	19.91	14
50	215.8		.04	.2000		1.1	16.26	12
60	212.4		.025	.1581		0.70	12.79	5
70								
10N								
714.380								
oven # 137								
Tm = 82 60 sec								
10	191.4	203.5	.03	.1732	.1805	.8	13.79	12
20	194.7		.05	.2236		1.4	17.85	15
30	197		.035	.1871		.95	14.96	12
40	219.9		.045	.2121		1.2	17.26	15
50	218.8		.035	.1871		.95	15.21	13
60	199.2		.01	.1000		.3	8.01	3
70								
11N								
714.924								
oven # 109								
Tm = 84 60 sec								
10	185.9	206.0	.015	.1225	.1890	.40	9.71	10
20	190.3		.04	.2000		1.1	15.91	13
30	191.4		.02	.1414		0.5	11.26	12
40	210.2		.045	.2121		1.2	17.13	12
50	223.1		.055	.2345		1.5	19.12	22
60	235		.05	.2236		1.4	18.39	20
70								
12N								
715.521								
oven # 119								
Tm = 84 60 sec								
10	175.4	212.4	.005	.0707	.1150	.2	5.56	10
20	194.7		.010	.1000		.3	7.98	10
30	211.3		.015	.1225		.4	9.90	13
40	220.6		.03	.1732		.8	14.20	20
50	235		.02	.1414		.5	11.63	20
60	227.4		.01	.1000		.3	8.18	10
70								

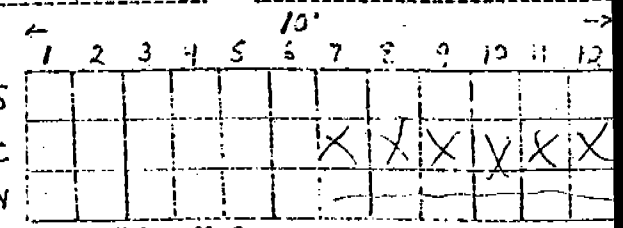
BY _____ DATE 9.9.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Velocity & Temperature Data Particulate In Duct Emissions

SHEET NO. 29 OF 125

CHKD. BY AC DATE 9.21.76

JOB NO. Donner-Hanna Co Corp. PECT System

Date Sampled: 9/9/76
Train & Operator: RAC = Tom & Rich
Barometric Pressure: 29.44"
Static Pressure: Atmospheric (Hwr2)
Wind Direction & Speed: South West 0-2 Switch after initial South wind



Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hq
12C	10	193.6		.015	.1225		.4	9.77	7
715.943	20	195.8		.02	.1414		.6	11.30	12
oven #129	30	203.6	198.6	.015	.1225	.1046	.4	9.84	12
T_m = 84 60 sec	40	208.1		.01	.1000		.3	8.06	12
	50	199.2		.005	.0707		.2	5.66	12
	60	191.4		.005	.0707		.2	5.63	5
	70								
11C	10	195.8		.03	.1732		.8	13.84	10
716.278	20	193.6		.04	.2000		1.1	15.95	15
oven #139	30	209.1	199.3	.025	.1581	.1524	.20	12.96	12
T_m = 84 60 sec	40	205.8		.02	.1414		.5	11.39	15
	50	199.2		.02	.1414		.5	11.33	10
	60	192.5		.01	.1000		.3	7.97	10
	70								
10C	10	187		.02	.1414		.5	11.22	8
716.715	20	183.8		.035	.1871		.95	14.81	15
oven #98	30	201.4	181.2	.04	.2000	.1477	1.1	16.05	15
T_m = 86 60 sec	40	182.7		.035	.1871		.95	14.80	15
	50	168.1		.01	.1006		.3	7.82	10
	60	164.2		.005	.0707		.2	5.51	8
	70								
9C	10	194.7		.03	.1732		.8	13.83	2 *
717.129	20	180.6		.04	.2000		1.1	15.79	2
oven #122	30	185.9	172.9	.025	.1581	.1239	.7	12.54	2
T_m = 87 60 sec	40	173.3		.02	.1414		.5	11.10	2
	50	157.4		.005	.0707		.2	4.81	0
	60	145.4		0.0	0.0		0.0	0.0	0
	70								
8C	10	178.6		.025	.1581		.7	12.47	2
717.568	20	199.2		.04	.2000		1.1	16.02	2
oven #102	30	198.1	198.3	.035	.1871	.1859	.95	14.97	3
T_m = 87 60 sec	40	213.4		.055	.2345		1.5	18.99	5
	50	210.2		.045	.2121		1.2	17.13	8
	60	190.3		.020	.1414		.5	11.25	2
	70								
7C	10	197.0		.03	.1732		.8	13.85	5
718.139	20	198.1		.04	.2000		1.1	16.01	10
oven #132	30	182.7	171.1	.02	.1414	.1062	.5	11.19	8
T_m = 88 sec	40	173.3		.015	.1225		.4	9.62	5
	50	165.0		0	0		0	0.0	1
	60	146.1		0	0		0	0.0	0
	70								

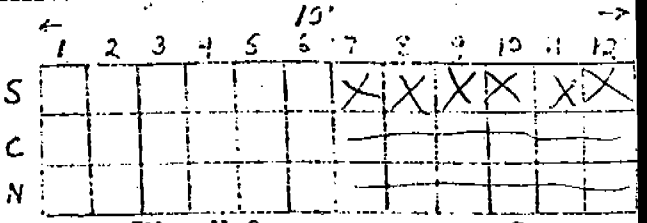
BY _____ DATE 9.9.76 SUBJECT Air Pollution Controlled Source Sampling of Residual Velocity & Temperature Data Particulate In Duct Emissions

SHEET NO. 91 OF 135

CHKD. BY RC DATE 9.21.76

JOB NO. Donner-Hanna Coke Corp. PECT System

Date Sampled: 9/9/76
Train & Operator: RAC
Barometric Pressure: 29.44" of Hg
Static Pressure: Atmospheric (almost)
Wind Direction & Speed: S.W - 0-2.5 mph after initial South wind.



3/3

Centroid, Oven No. & Time Pushed	Sec.	PROBE TIP TEMPERATURES Read	Average °F	PRESSURES IN. H_2O Read ΔP	Plot $\sqrt{\Delta P}$	Avge. $\sqrt{\Delta P}$	Req. ΔH	Cal. Vel. fps	Samp. Pump Pres. Inch Hg.
7S	10	203.6		.04	.2000		1.1	16.25	12
718.509	20	194.7		.03	.1732		.8	13.83	12
oven # 112	30	171.3		.02	.1414		.5	11.09	10
	40	182.7	178.6	.01	.1000	.1024	.3	7.91	7
	50	170.2		0	0.0		0	0.0	0
Tm = 88 60 sec	60	148.9		0	0.0		0	0.0	0
	70								
8S	10	205.8		.055	.2345		1.5	18.88	13
718.906	20	202.5		.04	.2000		1.1	16.06	13
oven # 91	30	177.3		.02	.1414		.5	11.14	5
	40	161.6	169.9	.005	.0707	.1078	.2	5.50	1
	50	144.0		0	0		0	0.0	0
Tm = 87 60 sec	60	116.1		0	0		0	0.0	0
	70								
9S	10	195.8		.02	.1414		.5	11.30	5
719.280	20	201.3		.035	.1871		.95	15.00	8
oven # 104	30	214.5		.07	.2646		1.9	21.44	15
	40	199.2	199.7	.055	.2345	.1904	1.5	18.79	13
	50	185.9		.03	.1732		.8	13.73	5
Tm = 88 60 sec	60	202.5		.02	.1414		.5	11.36	3
	70								
10S	10	194.1		.025	.1581		.7	12.62	2
719.833	20	169.2		.03	.1732		.8	13.56	5
oven # 114	30	157.0		.05	.2236		1.4	17.88	8
	40	177.5	176.2	.04	.2000	.1688	1.1	15.76	8
	50	168.1		.025	.1581		.7	12.36	4
Tm = 88 60 sec	60	150.6		.010	.1000		.3	7.71	1
	70								
11S	10	195.8		.035	.1871		.95	14.15	3
720.365	20	187.0		.04	.2000		1.1	15.82	5
oven # 124	30	199.2		.05	.2236		1.4	17.91	7
	40	184.8	183.9	.025	.1581	.1566	.7	12.5	4
	50	169.2		.005	.0707		.7	5.53	2
Tm = 88 60 sec	60	167.1		.01	.1000		.3	7.81	3
	70								
12S	10	183.8		.035	.1871		.95	14.81	5
720.852	20	197.0		.04	.2000		1.1	15.99	5
oven # 93	30	194.7		.035	.1871		.95	14.94	6
	40	191.4	186.9	.02	.1414	.1526	.5	11.26	5
	50	188.1		.01	.1000		.3	7.94	2
Tc = sec	60	162.5		.01	.100		.3	7.78	2
721.350	70								

DATE	SOURCE	TESTED BY
9/9/76	PEC.	Tom & Rich.

SAMPLER	SAMPLE BOX NO.	BAR. PRESS.	WEATHER CONDITION
RAC.	-	29.44"	Sunny 85°F ambient

ASSUMED MOISTURE	C FACTOR	METER BOX SETTING
70	—	125-160

PROBE LENGTH	NOZZLE DIAMETER	PROBE SETTING
30"	11/16"	No Heat.

DRY COLLECTED WEIGHT MILLIGRAMS

	INITIAL	FINAL	NET
FILTER NO. 33	0.72538	0.96658	.04120
34	0.72163	0.74918	.02755
ACETONE WASH 54 55 57 (54)	96.85580	96.91820	.06260
WATER WASH (55)	96.34921	96.45282	.05361
58 (58)	94.32546	94.34955	.02409
FRONT TOTAL	98.92911	98.93427	.00456
			.21367
IMPINGER	96.47725	95.49845	.02120
TRAIN TOTAL			.23481

CONDENSATE COLLECTED . ml - Gms

	INITIAL	FINAL	NET
IMP. I ~~243~~	100 c.c	243	143
IMP. II	100 "	236	136
IMP. III	0 "	2	2
SILICA GEL	200 gms	205	5
TOTAL			286
CYCLONE	O C.C.	77	15 301

CENTROID NO.	CLOCK TIME	SECONDS SAMPLED	DRY GAS METER READ OF 713 00 2	ORIFICE ΔH	PUMP IN. HG.	DRY GAS METER IN °F	DRY GAS METER OUT °F	STACK °F	SAMPLE BOX °F	IMPINGER °F	√ΔP	STACK IN. HG.	STACK FPS	
7N96	8:28	60	713.416	.4-.95	1-2	70	70	181	154	78	0.1417	Atms	11.19	
8N89	9:16	60	713.792	0-.90	0-1	74	74	165.4	150	82	0.1085		8.47	109 Stickers
9N117	9:29	60	714.380	.7-1.6	2-14	77	77	206	150	85	0.1939		15.61	
10N137	10:07	60	714.924	.8-1.4	3-15	82	82	209.5	150	90	0.1972		15.85	
(84) 11N109	10:52	60	715.521	.5-1.5	10-22	84	84	206	166	85	0.1890		15.22	88 Sampled for 20 seconds only.
12N119	11:12	60	715.943	.2-.8	10-20	84	84	212.4	152	86	0.1180		9.55	
12C114	11:26	60	716.278	.2-.5	5-12	84	84	198.6	155	90	0.1213		9.71	
11C129	11:37	60	716.715	.3-1.1	5-15	84	84	199.3	152	84	0.1523		12.2	
10C98	12:29	60	717.129	.2-1.1	8-15	86	86	181.2	155	82	0.1477		11.61	
9C122	12:49	60	717568	.8-1.1	0-2	87	87	178.9	155	85	0.1239		9.93	Filter changed started with new filter
8C107	1:05	60	718.139	.5-1.5	2-8	87	87	198.3	139	85	0.1889		15.12	
7C132	1:20	60	718.509	0-1.1	0-10	88	88	177.1	132	94	0.1062		8.36	
~~8~~S111	1:32	60	718.906	0-1.1	0-12	88	88	178.6	132	80	0.1024		8.07	
8S91	1:54	60	719.280	0-1.5	0-13	87	87	167.9	126	90	0.1078		8.43	
9S104	2:08	60	719833	.5-1.9	3-15	88	88	199.7	130	88	0.1904		15.26	
10S114	2:24	60	720.365	.3-1.4	1-8	88	88	176.2	128	92	0.1522		11.98	
11S124	2:38	60	720.852	.3-1.4	2-7	88	88	188.9	128	90	0.1566		12.40	
12S93	3:02	60	721.350	.3-1.1	2-6	88	88	186.3	128	92	0.1532		12.15	134 even Stickers
TOT 18 pts		TOT (18.33 hrs) 18.0 mins	TOT 8.948	.69	AVG	AVG 83.9		AVG ~~189~~ °F. 188.6			AVG .1463		AVG	

DATE 9.21.76 SUBJECT Air Pollution Control
CHKD. BY A.C. DATE 9.21.76 Source Sampling of Residual
Data Collection Sheet Particulate In Duct Emissions
BY JOB NO. Donner-Hanna Coke
Corp. PECT System SHEET NO.

SAMPLER SUBSET - IV = RAC - 9.9.76

1. Volume of gas sampled - (std cuft dry)

$$Vmstd = 17.71 \cdot Vm \cdot \frac{(Pbar + \Delta H/13.6)}{Tm}$$

$$= 17.71 \times .8348 \times \frac{(29.44 + \frac{.69}{13.6})}{460 + 83.9}$$

$$= 8.02 \text{ std cuft dry}$$

2. Water collection -

(a) Total impinger collection (Vlc) 301 ml

(b) Cyclone water collection (Vcc) 77 ml (Particulate water)

3. Volume of water vapor in gas sampled

$Vwstd = .0474 \times Vlc = .0474 \times 301 = 14.27$ cuft in

4. % Moisture

$$\frac{Vwstd}{Vmstd + Vwstd} \times 100 = \frac{14.27}{8.02 + 14.27} \times 100 = 64.03\ \%$$

5. Mole fraction dry (M_D)

$$1 - \frac{\%\ Moisture}{100} = 1 - .6403 = 0.3597$$

6. Molecular wt dry (Md)

(a) Gas composition -

H_2-	% vol	2.25
CO_2-	"	2.45
CO-	"	0.93
O_2-	"	19.82
N_2-	"	74.55

(b) $Md = \%\ H_2 \times .02 + \%\ CO_2 \times .44 + \%\ CO \times .28 + \%\ O_2 \times .32 + \%\ H_2 \times .28$

$= 28.60$

Contd (9/9/76)

7. Molecular wt wet (Ms)

M_D X Md + 18 (1-M_D) = 0.3597×28.6 + 18×.6403 = 21.81

8. Vcc percentage of total water vapor

$$= \frac{Vcc}{Vlc + Vcc} \times 100 = \frac{77}{301+77} \times 100 = 20.39 \%$$

9. Stack gas velocity stack condition

$$Vs = 85.48 \times Cp \times \sqrt{\Delta p} \sqrt{\frac{460+Ts}{Ps \times Ms}}$$

$$= 85.48 \times .926 \times .1463 \times \sqrt{\frac{460+188.6}{29.44 \times 21.82}}$$

= 11.64 fps

10. Actual stack gas flow through the sampled area

$$Qs = Vs \times 30 \times \frac{\text{Points sampled}}{\text{Total points}} \times 60 \text{ ACFM}$$

$$= 11.64 \times 30 \times \frac{18}{36} \times 60 = 10,476$$

ACFM through sample area

11. Emission rate

A. Concentration method:

(a) Actual cuft sampled through nozzle

$$Q_{ACF} = \frac{Vmstd}{M_D} \times \frac{460 + Ts}{460 + 70} \times \frac{29.92}{Ps}$$

$$= \frac{8.02}{.3597} \times \frac{460 + 188.6}{530} \times \frac{29.92}{29.44}$$

= 27.73 ACF

(b) Total wt collected (Mp gms)

Filter .06975

Front half acetone - .14030

Front half water - .00456

Back half - .02120

TOTAL 0.23481

(c) Lbs/ton of coal (12 tons per charge
60 secs per push)

$$Pmrc = \frac{Mp \times Qs}{453.6 \times Q_{ACF} \times 12} = \frac{.23481 \times 10,476}{453.6 \times 27.73 \times 12}$$

0.01629 = Lbs/ton of coal through sample area

Pmrc = .016297

B. Area ratio:

An = Area Nozzle = .0025779 sq ft

As = Area stack sampled = 15 sq ft

θ = Minutes sampled 18

$$Pmra = \frac{As}{An} \times \frac{Mp}{453.6} \times \frac{1}{\theta} \times \frac{1}{12}$$

$$= \frac{15}{.0025779} \times \frac{0.23481}{453.6} \times \frac{1}{18} \times \frac{1}{12}$$

= 0.01394 lbs/ton of coal through sample area

Average emission - $\frac{Pmra + Pmrc}{2} = \frac{.01394 + .016297}{2} = .01512$

12. Percentage Isokienetics

$$I = \frac{1.667 \left[.00267\ Vlc + \frac{Vm}{Tm} \left(Pbar + \frac{\Delta H}{13.6} \right) \right] Ts}{\theta \times Vs \times P \times An}$$

$$= \frac{1.667 \left[.00267 \times 301 + \frac{8.348}{460+83.9} \left(29.44 + \frac{.69}{13.6} \right) \right] [460+188.6]}{18 \times 11.64 \times 29.44 \times .0025779}$$

= 85.4 %

BY AB DATE
CHKD. BY DATE 9.21.76
Total In-duct Emission

SUBJECT Air Pollution Controlled
Source Sampling of Residual
Particulate In-duct Emission

JOB NO. Donner-Hanna
Coke Corp. PECT System

SHEET NO. 16 OF 155

RESULT-
PECT TOTAL IN-DUCT EMISSION
LBS./TON OF COAL CHARGE

DATE AND SAMPLER	SET	AREA SAMPLED "α" SQ. FT.	VOLUME SAMPLED 'Q' ACF	STACK VELOCITY LBS.	FLOW THROUGH SAMPLE AREA Qs ACFM	WEIGHT COLLECTED GMS.	EMISSION OVER SAMPLING AREA LBS/TON OF COAL			TOTAL STACK AREA A SQ. FT.	TOTAL IN-DUCT EMISSION $E=\frac{\Sigma\omega}{\Sigma\alpha} \times A$ LBS/TON COAL
							CONC. PMRC	AREA RATIO PMRA	AVERAGE "ω"		
9.8.76 4.I		15	36.96	12.46	11,214	0.13889	.007784	1.008248	.008016		
9.8.76 RAC		15	34.96	12.24	11,016	0.16558	0.009585	0.009833	0.009709		
9.9.76 4.I		15	25.81	11.34	10,206	0.27597	.02005	.01639	.01822	30	0.0256
9.9.76 RAC		15	27.73	11.64	10,476	0.23481	.016297	.01394	.01512		
		CUMULATIVE SAMPLE AREA $\Sigma\alpha$ sq ft 60							CUMULATIVE EMISSION $\Sigma\omega$ 0.051189		

This is a report of three two-day samplings of residual, in-duct emissions in the Donner-Hanna PECT System.

The July tests were programmed for 48-point sampling at a time when the protocol for the testing was being developed. In that test a Smith Greenberg impinger was used and there was no water wash. Aside from these three differences, the protocol was followed in the July test and there were no deviations from the protocol in the August and September tests. The July tests are reported as a matter of interest despite their high isokinesis.

Participating in the sampling and working under my direction and supervision were:

Thomas Harlan	of Republic Steel Corporation
Richard Vicchiarelli	of Republic Steel Corporation
James Ferrel	of Donner-Hanna Coke Corporation
Sukhendu Majumder	of Donner-Hanna Coke Corporation.

US-EPA observers were on hand on September 8 in the person of Mr. D.J. Grove of Entropy Environmentalists and on September 9 in the person of Mr. L.R. Paley. On September 10, a Mr. Dennis Santillo was on hand but no testing could be conducted because of northwest winds.

This certifies that the testing reported herein is an accurate and complete description of work conducted under my supervision.

A. BHATTACHARYYA, P.E.
N.Y.S. License No. 051636

17C 5M 3-73 AB

8-4

TEMPERATURES

88 of 135

DATE 9-9-76

"B" BATTERY

P. S. FLUE #1	P. S. FLUE #6	WALLS	C. S. FLUE #1	C. S. FLUE #6
	8	101		2
	8	102		3
	45	103		9
	40	104		6
	3	105		9
	8	106		8
	6	107		6
	46	108		54
	5	109		4
38	41	111	34	5
20	29	112	32	31
—	36	113	28	33
30	8	114	24	0
34	40	115	37	7
30	7	116	42	56
55	7	117	31	3
26	40	118	35	9
34	8	119	38	6
	7	121		2
	5	122		0
	7	123		1
	9	124		6
	3	125		6
	0	126		54
	7	127		59
	25	128		52
	2	129		4
	4	131		2
	3	132		38
	6	133		3
	0	134		4
	2	135		2
	3	136		2
	1	137		4
	7	138		5
	25	139		1
	8	141		6

"B" BATTERY "A"

"A" BATTERY

P. S. FLUE #1	P. S. FLUE #7	WALLS	C. S. FLUE #1	C. S. FLUE #6
	32	84		43
	27	85		42
	33	86		34
	30	87		33
	22	88	29	36
	20	89	33	51
	16	91	29	42
	14	92		30
	29	93		38
	35	94		38
	27	95		40
	31	96		10
	31	97		30
	30	98		26
	32	99		16
	32	101		20

"B" BATTERY "A"

95-110	PRESS.	253	
160-170	VOL.	67	
24-24	STACK	17	
	W.H.	275-300	
40	GAS TEMP.	40	
	A.B.O.		
135	SERIES	96	

2360-2447	AVE.	2276 - 2324	
2460-2540	MAX.	2350 - 2510	
2250-2380	LOW	2140 - 2100	
16.94	C.T.	17.14	
17	SCH	7	
C.O.	GAS		

17C 5M 3-73 AB

890/135

TEMPERATURES

8-4 ACE

DATE 9-8-76

"B" BATTERY

P. S. FLUE #1	P. S. FLUE #6	WALLS	C. S. FLUE #1	C. S. FLUE #6
	9	101		6
	6	✓102 S		33
	3	✓103		0 ✓
	9	104		52
	1	105		5
	7	106		54 ✓
	6	107		50
	46	✓108		53 ✓
	9	109		51 ✓
	40	111		8
	31	112 S		35
	27	113		30
	8	114		3
	4	115		5
	9	116		52 ✓
	43	117		50
	47	✓118		52 ✓
	40	119		53 ✓
	5	121		1
	7	122		7
	2	123		1
	3	124		7
	1	125		5
	1	126		8
	7	127		6
	5	128		50
	4	129		50
	1	131		39
	2	132		4
	1	133		1
	1	134 S		38
	4	135		36
	44	136		8
	42	137		8
	3	138		34
	7	✓139		7 ✓
	5	✓141		3

"B" BATTERY "A"

"A" BATTERY

P. S. FLUE #1	P. S. FLUE #7	WALLS	C. S. FLUE #1	C. S. FLUE #6
	31	84		47
	30	85		41
	28	86		31
	25	87		32
	18	88		33
	25	89		49 ✓
	27	91		38 ✓
	15	92		27
—	32	93	30	41
—	34	94		41
—	27	95		40
—	26	96	22	36
	33	97		29
	27	98		29
	31	99		26
	39	101		33

"B" BATTERY "A"

—	—	PRESS.	240
160 - 170		VOL.	67
24 - 24		STACK	17
—		W.H.	280 - 310
40		GAS TEMP.	40
		A.B.O.	
10 C		SERIES	84

2367 - 2470	AVE.	2280 - 2358
2470 - 2540	MAX.	2390 - 2490
2310 - 2350	LOW	2150 - 2260
	C.T.	
	SCH	
	GAS	

17C 5M 3-73 AB

90 & 135

TEMPERATURES

DATE 9-7-76

8-4 Ace

"B" BATTERY

P. S. FLUE #1	P. S. FLUE #6	WALLS	C. S. FLUE #1	C. S. FLUE #6
	8	101		2
	9	102		9
	43	103		50
	7	104		51
	4	105		7
	4	106		8
	7	107		50
	40	108		54
	7	109		50
	42	111		51
	9	112		5
	6	113		2
	5	114		2
	8	115		5
	6	116		7
	46	117		8
	47	118		51
	40	119		9
30	8	121	40	6
23	7	122	38	5
12	5	123	37	3
11	3	124	38	5
11	7	125	40	6
20	6	126	40	7
25	9	127	39	6
23	6	128	37	7
22	5	129	—	5
	7	131		4
	6	132		3
	5	133		4
	3	134		3
	45	135		9
	42	136		6
	41	137		6
	45	138		9
	41	139		50
	41	141		9

"A" BATTERY

P. S. FLUE #1	P. S. FLUE #7	WALLS	C. S. FLUE #1	C. S. FLUE #6
	27	84		36
	32	85		40
	35	86		36
	24	87		30
	22	88		38
	21	89		45
	25	91		32
	23	92		30
	43	93		50
	44	94		45
	37	95		53
	34	96		45
	36	97		33
	38	98		32
	36	99		26
	34	101		35

"B" BATTERY "A"

"B"		"A"
97-106	PRESS.	268
160-170	VOL.	67
14-24	STACK	17
—	W.H.	285-300
40	GAS TEMP.	40
75-75	A.B.O.	72½-72½
#137	SERIES	#85

"B"		"A"
2384-2469	AVE.	2322-2379
2470-2540	MAX.	2440-2530
2330 2420	LOW	2210 2260
15.16	C.T.	12.14
	SCH	78
	GAS	CO

17C 5M 3-73 AB

TEMPERATURES

8-4

DATE 8-4-76

"B" BATTERY

P. S. FLUE #1	P. S. FLUE #6	WALLS	C. S. FLUE #1	C. S. FLUE #6	
	8	101		4	
	7	102		6	
	40	103		9	
	6	104		7	
	29	105		6	
	4	106		8	
	5	107		7	
	44	108		53	
	0	109		4	
25	5	111	23	6	
20	8	112	27	4	G.L.
—	5	113	18	0	G.L.
12	7	114	—	0	G.L.
22	6	115	21	6	
30	5	116	25	5	
—	42	117	—	7	
13	46	118	—	53	G.L.
Fire	6	119	20	8	
	8	121		3	
	5	122		3	
	2	123		0	
	5	124		4	
	8	125		4	
	6	126		3	
	40	127		6	
	7	128		9	
	3	129		58	
	6	131		4	
	2	132		0	
	4	133		2	
	4	134		3	
	42	135		6	
	44	136		7	
	7	137		7	
	43	138		9	
	8	139		52	
	8	141		7	

G.L. = gas leak

"B" BATTERY "A"

"A" BATTERY

P. S. FLUE #1	P. S. FLUE #7	WALLS	C. S. FLUE #1	C. S. FLUE #6	
V	51	84		40	
	38	85		35	
	28	86		35	
	34	87		30	
	—	88		20	
	—	89		37	
	20	91		32	
	28	92		34	
	28	93		47	
	29	94		30	
	33	95		35	
	27	96		20	
	35	97		42	G.L.
	26	98		20	G.L.
	43	99		31	G.L.
	40	100		34	

"B" BATTERY "A"

91-102	PRESS.	300	
155-165	VOL.	65	
21-24	STACK	17	
—	W.H.	310-335	
40	GAS TEMP.	40	
	A.B.O.		
117	SERIES	92	

2369-2457	AVE.	2321-2328
2460-2530	MAX.	2510-2415
2290-2400	LOW	2200-2220
	C.T.	
	SCH	
C.O.	GAS	C.O.

17C 5M 3-73 AB

TEMPERATURES

8-4

DATE 8-3-76

"B" BATTERY

P. S. FLUE #1	P. S. FLUE #6	WALLS	C. S. FLUE #1	C. S. FLUE #6
	5	101		5
	40	102		50
	40	103		9
	5	104		53 ✓
	0	105		8
	1	106		9
	2	107		8
	40	108		51
	3	109		6
	8	111		7
	42	112		9
	7	113		4
	8	114		4
	5	115		7
	3	116		7
✓	44	117		8
	42	118		50
	6	119		7
	5	121		2
	8	122		6
	2	123		0
	6	124		7
	4	125		1
	3	126		4
	7	127		3
	1	128		4
	7	129		8
	3	131		4
	6	132		3
	6	133		4
	5	134		6
	8	135		6
	4	136		4
	7	137		5
	7	138		6
	40	139		55 ✓
✓	42	141		50 ✓

"A" BATTERY

P. S. FLUE #1	P. S. FLUE #7	WALLS	C. S. FLUE #1	C. S. FLUE #6
	44	~~84~~		34
	37	85		30
	34	86		39
	29	~~87~~		35
	—	~~88~~		18
	—	89		30
	22	91		28
	24	~~92~~		32
	31	~~93~~		46
	35	94		38
	33	95		34
	38	~~96~~		—
	38	~~97~~		41
	25	98		27
	35	99		23
	33	~~100~~		32

"B" BATTERY "A"

"B"		"A"
90-100	PRESS.	300
155-165	VOL.	65
24-24	STACK	17
—	W.H.	315-330
40	GAS TEMP.	40
	A.B.O.	
10%	SERIES	85

"B"		"A"
2364-2469	AVE.	2327-2331
2440-2550	MAX.	2440-2460
2300-2400	LOW	2220-2180
15.14	C.T.	17.14
	SCH	78
C.O.	GAS	C.O.

17C 5M 3-73 AB

93-7135

TEMPERATURES

8-4

DATE 8/2/76

"B" BATTERY

P. S. FLUE #1	P. S. FLUE #6	WALLS	C. S. FLUE #1	C. S. FLUE #6
	8	101		5
	6	102		7
	41	103		7
	3	104		8
	3	105		7
	0	106		8
	0	107		3
	41	108		8
	29	109		6
	40	111		7
	9	112		7
	6	113		6
	9	114		4
	3	115		5
	2	116		4
	40	117		3
	8	118		6
	5	119		5
	5	121		3
	8	122		1
	3	123		4
	0	124		8
	2	125		0
	4	126		2
	6	127		3
	4	128		4
	2	129		5
	3	131		4
	3	132		0
	5	133		6
	5	134		7
	7	135		5
	6	136		0
	3	137		2
	8	138		5
	6	139		4
	5	141		7

"B" BATTERY "A"

"A" BATTERY

P. S. FLUE #1	P. S. FLUE #7	WALLS	C. S. FLUE #1	C. S. FLUE #6
	52	~~84~~		42
	43	85		44
	38	86		46
	37	~~87~~		42
	—	~~88~~		18
	—	89		34
	20	91		31
	20	~~92~~		36
	30	~~93~~		41
	30	94		40
	40	95		44
	34	~~96~~		22
	38	~~97~~		43
	23	98		24
	37	99		21
	38	~~101~~		27

"B" BATTERY "A"

92-102	PRESS.	2.99
155-165	VOL.	65
24-24	STACK	17
<	W.H.	315-330
46	GAS TEMP.	40
	A.B.O.	
#133	SERIES	#56

2352-2448	AVE.	2341-2347
2410-2450	MAX.	2520-2460
2290-2400	LOW	2200-2150
15.46	C.T.	17.11
7.	SCH	
C.G.	GAS	C.G.

17C 5M 3-73 AB

TEMPERATURES

P-4

DATE 7-22-76

"B" BATTERY				
P. S. FLUE #1	P. S. FLUE #6	WALLS	C. S. FLUE #1	C. S. FLUE #6
	37	101		45
	38	102		45
	36	103		45
	39	104		46
	32	105		42
	35	106		45
	33	107		41
	37	108		44
	31	109		44
	39	111		45
	41	112		47
	34	113		42
	37	114		42
	33	115		42
	35	116		43
	41	117		49
	42	118		49
	39	119		47
	38	121		45
	37	122		44
	31	123		38
	35	124		43
	31	125		37
	36	126		42
	36	127		42
	36	128		48
	34	129		47
	37	131		43
	32	132		44
	32	133		41
	35	134		42
	37	135		43
	40	136		44
	36	137		44
	41	138		50
	41	139		52
	33	141		45

"A" BATTERY				
P. S. FLUE #1	P. S. FLUE #7	WALLS	C. S. FLUE #1	C. S. FLUE #6
	37	84		52
	34	~~85~~		42
	32	~~86~~		37
	26	87		37
	—	88		30
	—	~~89~~		45
	33	91		30
		92		46
	32	93		38
	36	~~94~~		35
	40	~~95~~		18
	35	96		—
	33	97		38
	32	~~98~~		25
	33	~~99~~		27
	46	101		18

"B"	BATTERY	"A"
99/138	PRESS.	285
155/165	VOL.	65
2421	STACK	17
—	W.H.	325 316
40	GAS TEMP.	40
1515	A.B.O.	4534 1214
	SERIES	

"B"	BATTERY	"A"
2316 2442	AVE.	2398 2306
2420 2520	MAX.	2420 2460
2310 2370	LOW	2230 2180
	C.T.	
	SCH	
	GAS	Coke Oven Gas

TEMPERATURES

DATE 7-21-76

8-4

"B" BATTERY				
P. S. FLUE		WALLS	C. S. FLUE	
#1	#6		#1	#6
	31	101		37
	30	102		39
	34	103		40
	27	104		40
	36	105		41
	35	106		40
	37	107		40
	35	108		41
	36	109		41
	32	111		42
	30	112		40
	25	113		35
	35	114		34
	37	115		40
	34	116		41
	35	117		43
	40	118		47
	36	119		41
	30	121		38
	36	122		37
	34	123		33
	33	124		37
	32	125		37
	33	126		35
	34	127		40
	37	128		43
	33	129		45
	37	131		37
	33	132		36
	31	133		38
	35	134		34
	30	135		41
	32	136		39
	35	137		44
	34	138		35
	28	139		45
	31	141		45

"A" BATTERY				
P. S. FLUE		WALLS	C. S. FLUE	
#1	#7		#1	#6
	36	84		33
	32	85		37
	32	86		40
	28	87		35
	—	88		30
	—	89		32
	35	91		37
		92		29
	42	93		34
	42	94		41
	37	95		30
	37	96		37
	32	97		36
	30	98		34
	39	99		30
	36	101		12

"B" BATTERY "A" [illegible] 2000 [illegible] 1515

"B"		"A"
8-104	PRESS.	26
155/165	VOL.	65
2024	STACK	17
	W.H.	335 325
10	GAS TEMP	76
	A.B.O.	
	SERIES	

"B"		BATTERY	"A"
2285 2398	AVE.	2346	2310
2450 2450	MAX.	2420	2400
2200 2374	LOW	2250	2150
	C.T.		
	SCH		
	GAS	[illegible]	

17C 5M 3-73 AB

TEMPERATURES

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DATE 7-20-76

"B" BATTERY

P. S. FLUE		WALLS	C. S. FLUE	
#1	#6		#1	#6
	37	101		40
	31	102		39
	32	103		40
	31	104		42
	30	105		40
	32	106		42
	28	107		38
	33	108		40
	26	109		40
	33	111		42
	36	112		41
	30	113		37
	32	114		36
	30	115		39
	31	116		42
	37	117		41
	40	118		46
	33	119		44
	31	121		36
	33	122		48
	28	123		35
	32	124		42
	30	125		36
	33	126		41
	34	127		41
	31	128		42
	30	129		42
	30	131		36
	28	132		38
	30	133		37
	33	134		42
	35	135		42
	38	136		43
	39	137		43
	37	138		43
	35	139		45
	36	141		42

"A" BATTERY

P. S. FLUE		WALLS	C. S. FLUE	
#1	#7		#1	#6
	41	84		41
	31	~~85~~		32
	36	~~86~~		41
	30	87		39
	—	88		22
	—	~~89~~		40
	21	~~91~~		22
	—	92		22
	25	93		33
	35	~~94~~		31
	42	~~95~~		46
	36	96		35
	30	97		40
	25	~~98~~		21
	36	~~99~~		22
	38	101		10

"B" BATTERY "A"

86-99	PRESS.	280	
153-163	VOL.	65	
24-24	STACK	17	
—	W.H.	345-375	
40	GAS TEMP.	40	
	A.B.O.		
	SERIES		

2324-2404	AVE.	2322-	2316
2400-2460	MAX.	2420-	2460
2260-2350	LOW	2210-	2100
	C.T.		
	SCH		
	GAS		

17C 5M 3-73 AB

TEMPERATURES

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DATE 11-12-75

Ac

"B" BATTERY

P. S. FLUE #1	P. S. FLUE #6	WALLS	C. S. FLUE #1	C. S. FLUE #6
	36	101		40
	33	102		41
	33	103		40
	27	104		41
	30	105		40
	34	106		41
	34	107		43
	35	108		44
	33	109		43
	36	111		41
	36	112		34
	34	113		40
	37	114		36
	32	115		40
	37	116		38
	35	117		41
	32	118		40
	35	119		44
30	40	121	38	43
27	36	122	27	43
30	37	123	30	42
30	40	124	36	45
28	43	125	33	38
21	37	126	25	42
29	38	127	32	46
24	39	128	33	44
27	38	129	30	44
	40	131		43
	38	132		44
	40	133		43
	38	134		43
	41	135		43
	37	136		41
	44	137		40
	36	138		44
	40	139		43
	45	141		46

"B" 163 BATTERY "A" 109

"A" BATTERY

P. S. FLUE #1	P. S. FLUE #7	WALLS	C. S. FLUE #1	C. S. FLUE #6
	32	84		37
	30	85		27
	28	86		30
	24	87		24
	10	88		28
	00	89		20
	21	91		20
	25	92		28
	28	93	21	34
	23	94	16	31
	17	95	29	23
	12	96	23	15
	27	97		23
	25	98		27
	35	99		28
	39	101		40
	66			66

"B" BATTERY "A"

		"B"	"A"
90-131	PRESS.	220	
148-156	VOL.	67	
23.5-23.5	STACK	18	
370-455	W.H.	310-320	
40	GAS TEMP.	40	
75-75	A.B.O.	42.75-72.25	
#137	SERIES	#99	
2346 2419	AVE.	2235	2263
2450 2460	MAX.	2390	2400
2290 2360	LOW	2000	2150
15.16	C.T.	17.14	
	SCH	78	
	GAS	C.O.	

DATE 11-13-75

"B" BATTERY

P. S. FLUE #1	P. S. FLUE #6	WALLS	C. S. FLUE #1	C. S. FLUE #6
[illegible]	40	101	24	42
20	38	102	24	42
22	34	103	33	40
[illegible]	50	104	25	43
[illegible]	33	105	41	41
	37	105	22	41
[illegible]	35	107	24	42
14	33	103	20	47
12	37	109	40	49
	36	111		43
	40	112		40
	35	113		41
	37	114		38
	32	115		41
	34	116		42
	36	117		42
	34	118		45
	36	119		48
30	39	121	35	45
22	37	122	31	47
18	34	123	30	41
15	40	124	41	44
26	44	125	36	38
20	39	126	33	46
25	38	127	34	42
23	36	128	37	43
26	38	129	36	49
	40	131		44
	37	132		43
	34	133		40
	38	134		40
	40	135		44
	38	136		43
	39	137		44
	34	138		46
	40	139		47
	41	141		45
	135			163

"A" BATTERY

P. S. FLUE #1	P. S. FLUE #7	WALLS	C. S. FLUE #6	C. S. FLUE #5
17	32	84	34	12
—	27	85	24	22
—	30	86	36	[illegible]
12	31	87	31	24
	15	88	36	
	20	89	29	
	32	91	24	
	25	92	30	
	27	93	34	24
	24	94	31	20
	27	95	26	32
	26	96	29	39
	30	97	22	
	31	98	33	
	32	99	26	
	32	101	34	
	53		77	

"B"	BATTERY	"A"
91 136	PRESS.	224
148 158	VOL.	68
2¾ 2¾	STACK	18
3½ 4½	W.H.	315 325
44	GAS TEMP.	42
75-75	A.B.O.	42 3/4 72 1/4
	SERIES	

"B"	BATTERY	"A"
2329 2439	AVE.	2258 2300
2440 2490	MAX.	2300 2390
2300 2330	LOW	2000 2220
	C.T.	
	SCH	
	GAS	Coke Oven Gas

BY KDM DATE 9-22-76
CHKD. BY _____ DATE _____
Analytical Records

SUBJECT Air Pollution Control
Source Sampling of Residual
Emissions

JOB NO. Donner-Hanna
Coke PECT System

Sampling Dates →

	Date	7/21/76	7/22/76	8/3/76	8/4/76	9/8/76	9/9/76
COAL							
	H_2O	5.50	5.20	6.30	4.80	5.00	4.90
	Volatile	30.33	31.46	33.19	31.23	31.88	31.93
	Fixed Carbon	63.03	61.73	59.43	61.98	61.46	61.70
	Ash	6.64	6.81	7.38	6.79	6.66	6.37
	Sulfur	.96	.72	.92	.88	.90	.94
	Button	7½	7	7½	7½	7½	7
	Thru 1/8"	74.0	75.1	73.9	76.1	76.3	79.3
	On 1/4"	9.6	8.6	8.2	8.0	8.3	5.3
	On 3/16"	7.8	7.2	8.6	7.3	7.7	6.9
	On 1/8"	8.6	9.1	9.3	8.6	7.7	8.5
	On 1/16"	22.2	23.2	23.4	22.2	19.8	22.6
	Thru 1/16"	51.8	51.9	50.5	53.9	56.5	56.7
	Lbs. Cu. Ft.	45.00	44	44	45.50	45.60	44.00
	Oil (Gals. Min.)	3	3	3	3	3	3
COKE							
	H_2O	6.00	5.60	5.60	6.00	5.20	5.60
	Volatile	.99	.83	.86	.52	.33	.35
	Fixed Carbon	89.41	89.49	89.59	90.23	90.89	90.99
	Ash	9.60	9.68	9.55	9.25	8.78	8.66
	Sulfur	.76	.82	.66	.94	.82	.82
	On 3"	2.7	2.1	.7		0.7	
	On 2"	38.9	31.9	33.1		34.7	
	On 1-1/2"	34.7	34.5	35.3		34.0	
	On 1"	15.5	24.7	20.8		23.5	
	On 3/4"	2.3	4.5	6.7		4.5	
	Thru 3/4"	2.9	2.3	3.4		2.6	
	Stability	52	53	54	50	50	50
	Hardness	67	68	65	68	67	68
GAS							
	Btu Cu. Ft.	537.9	536.3	543.0	542.0	525.0	527.4

NOTE: Both Coal and Coke Analyses are plantwide - not indigenous to AB Battery.
Coke Lump Size Analyses are for Furnace Coke and for the week in question.

BY KDM DATE 9-22-76	SUBJECT Air Pollution Control	SHEET NO. 100 OF 132
CHKD. BY ____ DATE ____	Source Sampling of Residual	JOB NO. Donner-Hanna
Analytical Records	Emissions	Coke PECT System

	Smoke Base				Heating Base	
Date	10/15/74	10/16/74	10/17/74		11/12/75	11/13/75
COAL						
H_2O	7.2	4.8	5.8		4.90	4.80
Volatile		31.74	30.30		31.31	32.83
Fixed Carbon		61.09	62.51		61.24	59.88
Ash		7.17	7.19		7.45	7.29
Sulfur		.86	1.04		.95	.94
Button		7.5	7.0		8.	7 1/2
Thru 1/8"	66.3	67.6	71.2		67.0	69.1
On 1/4"	13.7	12.3	11.5		13.5	12.2
On 3/16"	9.5	10.3	8.6		9.9	8.8
On 1/8"	10.5	9.8	8.7		9.6	9.9
On 1/16"	23.4	23.0	21.4		24.2	26.1
Thru 1/16"	42.9	44.6	49.8		42.8	43.0
Lbs. Cu. Ft.	43.5	43.7	45.2		45.50	44.50
Oil (Gals. Min.)	0	0	0		3	3.
COKE						
H_2O	6.00	5.60	5.2		6.00	5.60
Volatile	0.65	.61	.55		1.00	.94
Fixed Carbon	88.59	88.70	89.48		89.26	89.22
Ash	10.76	10.69	9.97		9.74	9.84
Sulfur	.78	.80	.90		.92	.79
On 3"	2.4					0.0
On 2"	34.5					33.5
On 1-1/2"	31.7					36.1
On 1"	24.0					19.7
On 3/4"	5.1					4.4
Thru 3/4"	7.1					6.3
Stability	48	49	49		51	52
Hardness	64	65	66		66	67
GAS						
Btu Cu. Ft.	542.1	537.3	537.9		563.[illegible]	546.8

NOTE: Both Coal and Coke Analyses are plantwide - not indigenous to AB Battery.
Coke Lump Size Analyses are for Furnace Coke and for the week in question.

On July 22 (days) ovens 84, 125, 135, and 117 were pushed on a 0.85 hr. delay. Ovens 86, 96, 127 and 137 were on a 1.58 hr. delay. Oven 92 was pushed on a 1.10 hr. delay. Oven 99 was a sticker dug out after a 4.33 hr. delay. These were occasioned by pusher machine problems including a lost tip and a broken pinion gear. Eleven ovens on B and two on A were pushed on schedule.

On September 7 a sticker was encountered on the day shift. It was pushed in step on the afternoon shift of the 8th with no effect on sampling (other than foreboding more of the same).

On the 12-8 shift September 8, four stickers were encountered, and a pusher machine was damaged. Of these ovens, only 89 was pushed after a 6.10 hr. delay. Others were pushed or dug off the day shift.

On the 8-4 shift September 8 the second oven (which was to be the first sampled) was a sticker which damaged the backup pusher. All ovens sampled were delayed 1.55 hrs. Sampling temperatures were higher and particulate residual emission rates were diminished.

On the afternoon shift September 8, two stickers were pushed but a new one was encountered and still another was encountered on the subsequent shift.

On the day shift September 9, oven 112 was pushed through PECT system and sampled having been delayed 26.30 hrs. because it was a sticker. Oven 88, though pushed on schedule, had fresh coal dropped on the coke cake immediately before charging as a result of confusion because of the out-of-step ovens. The number of ovens available for pushing was reduced because of stickers which were unavailable for normal cycling. Ovens 104 and 107 became stickers at the time they were schedule for pushing on the day shift September 9. Those ovens (other than 88 and 112) which were pushed and sampled on schedule appeared to be a very small lump size coke. The small lump size was a problem with the same origins as the sticker ovens in that the cake wasn't sufficiently intact to extrude normally.

On September 11 the last out-of-step oven (former stickers) was pushed in sequence.

As of the date of this report (9/22), there have been a total of 31 stickers -- in sharp contract with August 1976 when the normal experience is and was not to see any.

Donner-Hanna has no ovens empty and out-of-service. Normally no ovens are operated out of their normal sequence (out of step). Should an oven get out of step (for instance as a result of having been a sticker), it is similar to an out-of-service oven in that subsequent pushing schedules reflect its absence. Having lost part of a full cycle, out of step ovens are run on one to three successive, subsequent cycles sufficiently elongated so as to reestablish the expected sequence at the earliest possible date.

When scheduled ovens are delayed or become out of step, the battery is eventually committed to a pickup schedule to regain lost production. Such a schedule is limited to one-half an oven per shift (one oven every other shift). Such a pickup schedule usually cannot be instituted immediately after lost production because of the imminent risk of exacerbating the original problem (again as with stickers). Pickup schedules lag some number of shifts and a deficit may carry over into a subsequent month.

Since schedules are managed by sequence, the following table establishes the normal and pickup coking rates for all in-step ovens:

NORMAL	A	B	3	4
Ovens in Battery	15	36	50	50
Pushes per Shift	7	19	27	27
Pushes per Day	21	57	81	81
Cycles per Day	1.400	1.583	1.620	1.620
Gross Hours	17.143	15.16	14.815	14.815
Push-to-Push Interval	0.27		0.25	0.25
Empties Carried	2		2	2
Deduction-Gross to Net Hrs.	0.541		0.50	0.50
Net Hrs./Cycle	16.602	14.619	14.315	14.315
Oven Width-Inches	17	17	17	17
Inches/Hr. Rate Gross	0.992	1.121	1.147	1.147
Inches/Hr. Rate Net	1.024	1.163	1.188	1.188

PICKUP				
Pushes per Shift	7	19-1/2	27-1/2	27-1/2
Pushes per Day	21	58-1/2	82-1/2	82-1/2
Cycles per Day	1.400	1.625	1.650	1.650

PICKUP (continued)	A	B	3	4
Gross Hours	17.143	14.77	14.545	14.545
Net Hrs./Cycle	16.602	14.229	14.045	14.045
Inches/Hr. Rate Gross	0.992	1.151	1.169	1.169
Inches/Hr. Rate Net	1.024	1.195	1.210	1.210

Delayed ovens are related to normal in terms of delay, with an hour representing 5.67% reduction in coking rate for A, 6.45% for B, and 6.57% for 3 and 4.

Period Sampled		7/16-31/76	8/1-31/76			9/1-7/76
No. of Shifts @ Pushes/Shift						
Delay 21-22		1				
Delay 23-24		4	1			
Delay 25		4	3			1
Normal 26		39	81			19
Pickup 27		0	8			1
Date Sampled	7/21/76	7/22/76	8/3/76	8/4/76	9/8/76	9/9/76
Pushes/Shift						
Samp. Shift	26	23				
Prior Shift	26	26				
2nd Prior	26	26				
Delay Factor						
Ovens out Step	0	0	0	0	4	6
Reason	-	-	-	-	stickers	stickers
Delay Hours	0	see incident	0	0	1.55	0
Delay Reason	-	push. mach.	-	-	push. mach.	-
Coking In./Hr. Net						
Normal A	1.024	1.195	1.024	1.024	-	1.024
Normal B	1.163	1.163	1.163	1.163	-	1.163
Delay A		.948			0.937	-
Delay B		1.079			1.051	0.415
Pickup A						
Pickup B						
Plant Tons/Day						
Coal Charge	3844	3784	3806	3806	3649	3721
Coke Prod.	2908	2758	2874	2800	2686	2811
Yield %	75.65	72.88	75.51	73.57	73.61	75.54
AB Tons/Day						
Ovens Pushed	78	73	78	78	68	74
Tons Charged	936	876	936	936	816	888
Tons Pushed	708	638	707	689	601	671
Dry NT Pushed	666	609	674	648	576	640
mmH_2O Cross.Press.	10	10	10	8	10	10

Railroad scale weights of coal received and furnace coke shipped are the basis for computing plantwide production and yield rates. There are no scale weights to provide any record indigenous to individual batteries or ovens. AB battery pushes are extrapolated at empirically derived 12 NT per average charge.

Period Sampled					11/1-19/75	
No. of Shifts @ Pushes/Shift						
Delay 21-22						
Delay 23-24					1	
Delay 25					1	
Normal 26					50	
Pickup 27					5	
Date Sampled	10/15/74	10/16/74	10/17/74		11/12/75	11/13/75
Pushes/Shift						
Samp. Shift	26	26	26		26	23
Prior Shift	26	26	26		26	26
2nd Prior	26	26	26		26	26
Delay Factor						
Ovens out Step	0	0	0		0	0
Reason	—	—	—		—	—
Delay Hours	0	0	0		0	0.75
Delay Reason	—	—	—		—	push on Mach.
Coking In./Hr. Net						
Normal A	1.024	1.024	1.024		1.024	1.024
Normal B	1.163	1.163	1.163		1.163	1.163
Delay A						
Delay B						1.106
Pickup A						
Pickup B						
Plant Tons/Day						
Coal Charge	3788	3788	3788		3846	3810
Coke Prod.	2814	2801	2764		2775	2750
Yield %	74.29	73.94	72.96		72.15	72.17
AB Tons/Day						
Ovens Pushed	78	78	78		78	75
Tons Charged	936	936	936		936	900
Tons Pushed	695	692	683		675	650
Dry NT Pushed	653	660	654			
mmH_2O Cross.Press.	?	?	?		5	5

Railroad scale weights of coal received and furnace coke shipped are the basis for computing plantwide production and yield rates. There are no scale weights to provide any record indigenous to individual batteries or ovens. AB battery pushes are extrapolated at empirically derived 12 NT per average charge.

Attached are copies of records of qualified observer readings of smoke on September 8 and 9. There were no observations recorded in August or July though some photographic records are available in lieu of such observations. As a before-control base of information, there is a tabulation of NYS-DEC observations from a three-day period in 1974.

All observations were made from the long, parallel roof of a thaw shed at battery-top height 120' south of AB battery, generally with the plume deployed across the field of vision.

Records of the plume at the time doors come off is the only pre-push indication of relative greenness since the hood dims access once in place. The occasional discoloration of the steam plume is noted and on such occasions the opacity was read. In the absence of steam plume discoloration, there has been little, if any, perceptible opacity. Most often the transiting hot car will emit nothing but steam and not always that.

In the event that the transiting hot car has a steam plume, it may be difficult to distinguish what may or may not be smoke. If a transiting hot car has a discolored steam plume, a positive smoke reading is to be expected. If there is an uncolored steam plume, a negative reading is to be expected. Positive smoke observations are usually associated either with no steam plume or with a discolored steam plume. Such plumes are expected to be the subject of out-of-duct testing.

As presently operated, the east end of the hot car (near the locomotive) receives the coke side end and moves to catch the pusher side end in the western end of the car. The car being used is beyond scheduled retirement for replacement or overhaul.

BY KF DATE 9-9-76 SUBJECT Air Pollution Control

CHKD. BY _____ DATE _____ Source Sampling of Residual Particulate In Duct Emissions

SHEET NO. 107 OF 135

JOB NO. Donner Hanna Coke PECT System

SMOKE Observer Record

Readings in Seconds and % opacity

Oven No. & Clock Time	Door Off C.S. Plume	Door Off P.S. Plume	Duct Plume Opacity at Stack None Slight	Plume Discoloration Steam Dissipation Heavy	Transition Hot Car Steam Plume E End	Hot Car Discharged W. End	Transiting Hot Car % Opacity E End	Transiting Hot Car Smoke W. End
Comment →			15 @ 10%				15 @ 30 20 @ 15 @	QT
Comment →								QT
Comment →								QT
Comment →								QT
Comment →								QT
Comment →								QT
Comment →								QT

BY AK DATE 9/9/96 SUBJECT Air Pollution Control — Source Sampling of Residual Particulate 'In Duct' Emissions

SHEET NO. 108 OF 135

JOB NO. Donner Hanna Coke PECT System

CHKD. BY ____ DATE ____

Smoke Observer Record

Readings in Seconds and % Opacity

Oven No. & Clock Time	Door Off C.S. Plume	Door Off PS Plume	Duct Plume Discoloration + Opacity at Steam Dissipation: None	Slight	Heavy	Transiting Hot Car Steam Plume Discolored: E. End	W. End	Transiting Hot Car % Opacity of Smoke: C. End	W. End
132 1:20 PM	10 @ 15 15 @ 5 @	0 @ 0 @ @	@ @ @	0 @ 0 @ @	@ @ @	0 0 [illegible]	0 0	@ @ @ QT	@ 0 @ @ QT
Comment →			smokin 20 [illegible]						
112 1:30 PM	40 @ @ @	@ @ @	@ @ @	15 @ 15% @ @	40 @ 20% @ @			29 @ 20% @ @ 0 QT 0	0 @ 0 @ @ 0 QT 0
Comment →	111-112 wall [illegible] open ends [illegible]								
91 1:50	22 @ 25 20 @ 15 @	15 @ 20 5 @ 40 10 @ 10	@ @ @	@ @ @	@ @ @	[illegible]		10 @ 10% @ @	@ @ @ QT
Comment →	[illegible] not close [illegible] 20 secs + 20% [illegible]								
104 2:05	0 @ 0 @ @	0 @ 0 @ @	10 @ 10% @ @	@ @ @	@ @ @			@ @ @ QT	10 @ 10% @ @ QT
Comment →									
114 2:20	0 @ 0 @ @	0 @ 0 @ @	10 @ 10% @ @	@ @ @	@ @ @			9 @ 30% 9 @ 10% @ QT	@ @ @ QT
Comment →									
124 2:35	0 @ 0 @ @	0 @ 0 @ @	10 @ 10% @ @	@ @ @	@ @ @			48 @ 40% @ @ QT	@ @ @ QT
Comment →									
134 2:50	@ @ @	@ @ @	@ @ @	@ @ @	@ @ @			@ @ @ QT	@ @ @ QT
Comment →			Stickca						

BY A B DATE 9-9-76 SUBJECT Air Pollution Control Source Sampling of Residual Particulate in Duct Emissions

CHKD. BY ____ DATE ____

Smoke Observer Record

SHEET NO. 109 OF 135

JOB NO. Donner Hanna Coke PECT System

[redacted] Readings in Seconds and % Opacity

Oven No. & Clock Time	Door Off C.S. Plume	Door Off PS Plume	Duct Opacity None	Plume Discoloration at Steam Dissipation Slight	Discoloration + Dissipation Heavy	Transiting Steam Plume E. End	Hot Car Plume Discolored W. End	Transiting % Opacity E. End	Hot Car of Smoke W. End
109 10:45	25 0 15s 0 0	0 0 0 0 0	0 0 0	10 0 10% 0 0	0 0 0	0 – 0	0 – 0	0 0 0 0 0 QT	0 0 0 0 0 QT
Comment →									
111 10:56	10 0 10% 0 0	0 0 0 0 0	0 0 0	0 0 0 0 0	0 0 0	0 – 0	0 – 0	0 0 0 0 0 QT	0 0 0 0 0 QT
Comment →									
129 11:20	5 0 25, 15 0 20, 10 0 10	0 0 0 0 0	0 0 0	0 0 0 0 0	0 0 0	0 – 0	80 – 40%	0 0 0 0 0 QT	20 0 40% 0 0 QT
Comment →									
39 11:36	5 0 5 0 0	0 0 0 0 0	0 0 0	0 0 0 0 0	0 0 0	0 – 0	15 – 10%	0 0 0 0 0 QT	20 0 60% 0 0 QT
Comment →									
96 12:25	5 0 5 0 0	0 0 0 0 0	0 0 0	10 0 10% 0 0	0 0 0	0 – 0	0 – 0	0 0 0 0 0 QT	0 0 0 0 0 QT
Comment →									
[illegible] 12:40	15 0 20, 5 0 0	0 0 0 0 0	0 0 0	0 0 0 0 0	0 0 0 0	0 0	0 0	0 0 0 0 0 QT	0 0 0 0 0 QT
Comment →									
101 1:05	0 0 0 0 0	0 0 0 0 0	0 0 0	0 0 0 0 0	0 0 0	0 0	0 0	0 0 0 0 0 QT	0 0 0 0 0 QT
Comment →									

BY KDM DATE 9-9-76 SUBJECT Air Pollution Control
CHKD. BY ______ DATE ______ Source Sampling of Residual
Smoke Observer Record — Particulate in Duct Emissions

SHEET NO. 110 OF 135
JOB NO. Donner Hanna
Coke PECT System

6:25

Readings in Seconds and % Opacity

Oven No. & Check Time	Door Off C.S. Plume	Door Off PS Plume	Duct Plume Discoloration + Opacity at Steam Dissipation: None	Slight	Heavy	Transiting Steam Plume E. End	Hot Car Discolored W. End	Transiting % Opacity C. End	Hot Car of Smoke W. End
96 8:25a	0 @ 0 @ @	0 @ 0 @ @	@ @ @	0 @ 0 @ @	@ @ @	15 sec at 20 5 sec at 15	[illegible] 10x10 no smoke	@ @ @ 0 QT 0	10 @ 5% @ @ 0 QT 0
Comment →	[illegible]								
107 9:55	0 @ 0 @ @	@ @ @	@ @ @	@ @ @	@ @ @			@ @ @ QT	@ @ @ QT
Comment →	[illegible] off C.S. end		Not Pushed + Sticker						
89 9:10am	@ @ @	12 @ 30% @ @	0 @ 0 @ @	20 @ 40% @ @	@ @ @	nothing	20 secs of plume of smoke of above 30%	30% @ 20 @ @ QT	@ @ @ QT
Comment →									
117	5 sec @ 10% 8 sec @ 5% @	0 @ 0 @ @	@ - @ @	0 @ 0 @ @	@ @ @	nothing		@ no T/A @ @ QT	5 @ 5% @ @ QT
Comment →	5 secs 10% [illegible]								
127	@ @ @	@ @ @	@ @ @	@ @ @	@ @ @			@ @ @ QT	@ @ @ QT
Comment →			NOT Pushed ?						
137 10:05	0 @ 0 @ @	15 @ 15% @ @	5 @ 5% 20 @ 5% @	@ @ @	@ @ @	nothing		10 @ 30% @ @ QT	@ @ @ QT
Comment →									
[illegible] 10:25	12 @ 20% 25 @ 15 @	@ @ @	@ @ @	@ @ @	[illegible] @	high flames [illegible]	high flames	35 @ 10% @ @ QT	35 @ [illegible] @ @ QT
Comment →									

BY KDM DATE 9-8-76 SUBJECT Air Pollution Control SHEET NO. 111 OF 153

CHKD. BY ____ DATE ____ Source Sampling of Residual JOB NO. Donner Hanna

Smoke Observer Record Particulate In Duct Emissions Coke PECT System

Readings in Seconds and % Opacity

Oven No. & Clock Time	Door Off C.S. Plume	Door Off PS Plume	Duct Plume Discoloration + Opacity at Steam Dissipation: None	Slight	Heavy	Transiting Steam Plume E. End	Hot Car Plume Discolored W. End	Transiting % Opacity E. End	Hot Car of Smoke W. End
86 2:30P	0 @ 0; @; @	– @ –; @; @	@; @; @	15 @ 15%; @; @	@; @; @	no	yes	@; @; @; QT	5 @ 10%; @; @; QT
Comment → neg oven top + bottom pen									
96 2:55P	0 @ 0; @; @	5 @ 10%; @; @	0 @ 0; @; @	@; @; @	@; @; @	no	yes 5x5	0 @ 0; @; @; QT	0 @ 0; @; @; QT
Comment →									
105 3:10P	0 @ 0; @; @	0 @ 0; @; @	0 @ 0; @; @	@; @; @	@; @; @	neg	neg	0 @ 0; @; @; QT	0 @ 0; @; @; QT
Comment →									
115 3:25P	5 @ 10%; @; @	15 @ 5%; @; @	0 @ 0; @; @	@; @; @	@; @; @	neg	half + half steam + smoke yellow	0 @ 0; @; @; QT	10 @ 15; 10 @ 25; 10 @ 20; QT
Comment →									
	@; @; @	@; @; @	@; @; @	@; @; @	@; @; @			@; @; @; QT	@; @; @; QT
Comment →									
	@; @; @	@; @; @	@; @; @	@; @; @	@; @; @			@; @; @; QT	@; @; @; QT
Comment →									
	@; @; @	@; @; @	@; @; @	@; @; @	@; @; @			@; @; @; QT	@; @; @; QT
Comment →									

BY RDM DATE 9-8-76 SUBJECT Air Pollution Control SHEET NO. 112 OF 135

CHKD. BY ______ DATE ______ Source Sampling of Residual JOB NO. Donner Hanna

Smoke Observer Record Particulate in Duct Emissions Coke PECT System

Readings in Seconds and % Opacity

Oven No. & Clock Time	Door Off C.S. Plume	Door Off PS Plume	Duct Opacity None	Plume Discoloration + Opacity of Steam Dissipation Slight	Heavy	Transiting Hot Car Steam Plume Discolored E. End	W. End	Transiting Hot Car % Opacity of Smoke E. End	W. End
111 12:20	0 @ 0 @ @	0 @ 0 @ @	0 @ 0 @ @	@ @ @	@ 65 @ @	neg	yes	0 @ 0 @ @ QT	12 @ 20% @ @ QT
COMMENT → neg overtop & neg lit [illegible]									
121 12:424	0 @ 0 @ @	0 @ 0 @ @	0 @ 0 @ @	@ @ @	@ @ @	neg	neg	0 @ 0 @ @ 0 QT 0	0 @ 0 @ @ 0 QT 0
COMMENT → neg overtop neg lit [illegible]									
131 1:05	0 @ 0 @ @	0 @ 0 @ @	0 @ 0 @ @	@ @ @	@ @ @	neg	neg	@ @ @ 0 QT 0	20 @ 15% @ @ 0 QT 0
COMMENT → low CS end to cake									
103 1:25	10 @ 15% @ @	0 @ 0 @ @	0 @ 0 @ @	@ @ @	@ @ @	neg	yes 5x5	0 @ 0 @ @ QT	0 @ 0 @ @ QT
COMMENT → neg overtop neg lit [illegible]									
113 1:45	25 @ 5% @ @	@ @ @	0 @ 0 @ @	@ @ @	@ @ @	neg	yes 5x5	0 @ 0 @ @ QT	0 @ 0 @ @ QT
COMMENT →									
123 1:55	10 @ 5% @ @	- @ - @ @	0 @ 0 @ @	@ @ @	@ @ @	neg	yes 5x5	0 @ 0 @ @ 0 QT 0	0 @ 0 @ @ 0 QT 0
COMMENT → low CS end of cake									
133 2:15	5 @ 10% @ @	- @ @ @	0 @ 0 @ @	@ @ @	@ @ @	neg	neg	0 @ 0 @ @ BQT 0	0 @ 0 @ @ BQT 0
COMMENT →									

BY KDM DATE 9-9-76 SUBJECT Air Pollution Control SHEET NO. 113 OF 135

CHKD. BY ______ DATE ______ Source Sampling of Residual JOB NO. Donner Hanna

Smoke Observer Record Particulate in Duct Emissions Coke PECT System

Readings in Seconds and % Opacity

Oven No. & Charge Time	Door Off C.S. Plume	Door Off PS Plume	Duct Opacity None	Plume Discoloration + Opacity at Steam Dissipation Slight	Heavy	Transiting Hot Car Steam Plume Dissolved E. End	W. End	Transiting Hot Car % Opacity of Smoke E. End	W. End
118 9:45am	0 @ 0 @ @	0 @ 0 @ @	0 @ 0 @ @	– @ – @ @	– @ – @ @	80 no steam	no steam	0 @ 0 @ @ 0 QT 0	0 @ 0 @ @ 0 QT 0
Comment → nothing from oven top or bottom periphery									
128 9:55am	0 @ 0 @ @	3 @ 5% @ @	0 @ 0 @ @	@ @ @	@ @ @	70 No steam	No steam	0 @ 0 @ @ 0 QT 0	0 @ 0 @ @ 0 QT 0
Comment → 3 secs 10% bottom per. nothing from top									
138 10:10am	11 @ 25% 30 @ 15% 5 @ 5%	0 @ 0 @ @	0 @ 0 @ @	@ @ @	@ @ @	none	none	0 @ 0 @ @ 0 QT 0	10 @ 5% @ @ 0 QT 0
Comment → 5 secs 15% bot per. – neg [illegible] top									
84 10:48am	6 @ 10% 10 @ 5% 10 @	0 @ 0 @ @	0 @ 0 @ @	@ @ @	@ @ @	65 neg	neg	0 @ 0 @ @ 0 QT 0	0 @ 0 @ @ QT 0
Comment → neg both top + bottom per.									
94 11:15am	0 @ 0 @ @	0 @ 0 @ @	0 @ 0 @ @	@ @ @	@ @ @	85 neg	neg	0 @ 0 @ @ QT	20 @ 5% @ @ QT
Comment → neg both top + bottom									
89 11:33am	20 @ 5% @ @	37 @ 15 @ @	0 @ 0 @ @	@ @ @	@ @ @	65 neg	none	0 @ @ @ QT	20 @ 10% @ @ QT
Comment →									
101 12:12	0 @ 0 @ @	0 @ 0 @ @	0 @ 0 @ @	@ @ @	@ @ @	neg	neg	@ @ @ QT	20 @ 10% @ @ QT
Comment →									

Oven numbers are generally correct but there are some obviously mistaken recordings of numbers. Westerly winds prevailed. Skies were generally clear. Readings were done from roof of thaw shed 150' south of battery.

OCTOBER 15, 1974	Oven Number	Time	Reading
	126	10:08 a.m.	#1 Ringelmann- 2 mins. 45 secs.
			#2 - 15 secs.
			#3/4 to #1/4 - 8 mins.
			#3 - 15 secs.
			#1 - 45 secs.
	136	10:22 a.m.	#1/4 - 7 mins.
			#3 - 10 secs.
			#5 - 25 secs.
			#4 - 10 secs.
			#3 - 30 secs.
	89	10:36 a.m.	#5 - 25 secs.
			#4 - 20 secs.
			#3 - 40 secs.
	108	10:55 a.m.	#3 - 15 secs.
			#2 - 15 secs.
			#3 - 10 secs.
			#5 - 5 secs.
			#4 - 5 secs.
			#2 - 20 secs.
	118	11:09 a.m.	#5 - 25 secs.
			#4 - 5 secs.
			#3 - 30 secs.
			#2 - 10 secs.
	128	11:25 a.m.	#3 - 5 secs.
			#4 - 15 secs.
			#3 - 20 secs.
			#2 - 20 secs.
	84	1:38 p.m.	#2 -15 secs.
	103	1:51 p.m.	#2 - 5 secs.
			#3 - 10 secs.
			#2 - 35 secs.
	113	2:06 p.m.	#2 - 5 secs.
			#3 - 5 secs.
			#2 - 20 secs.
			#3 - 5 secs.
			#2 - 15 secs.
	94	2:26 p.m.	#2 - 35 secs.
	123	2:40 p.m.	#2 - 5 secs.
			#5 - 15 secs.
			#4 - 20 secs.
			#3 - 20 secs.
			#2 - 30 secs.

	Oven Number	Time	Reading
OCTOBER 15, 1974 continued	133	2:54 p.m.	#2 Ringelmann - 5 secs.
			#3 - 10 secs.
			#2 - 20 secs.
	105	3:12 p.m.	#2 - 5 secs.
			#3 - 5 secs.
			#5 - 10 secs.
			#4 - 10 secs.
			#5 - 10 secs.
	115	3:33 p.m.	#2 - 20 secs.
			#3 - 5 secs.
			#4 - 15 secs.
			#2 - 15 secs.
OCTOBER 16, 1974	96	9:59 a.m.	#1/2 - 3 mins.
			#2 - 35 secs.
			#3 - 15 secs.
			#1 - 15 secs.
	109	10:16 a.m.	#1/4 - 2 mins.
			#3 - 30 secs.
			#2 - 5 secs.
			#1 - 32 secs.
	119	10:34 a.m.	#1/2 - 45 secs.
			#2 - 20 secs.
			#1 - 15 secs.
	88	10:57 a.m.	#1/2 - 45 secs.
			#4 - 15 secs.
			#3 - 30 secs.
			#2 - 15 secs.
	129	11:16 a.m.	#1/4 - 1 min.
			#2 - 15 secs.
			#1 - 20 secs.
	139	11:26 a.m.	#2 - 20 secs.
			#1 - 30 secs.
			#2 - 20 secs.
			#3 - 10 secs.
			#4 - 10 secs.
	104	1:54 p.m.	#1/2 - 1 min.
			#1 - 10 secs.
			#3 - 10 secs.
			#2 - 20 secs.
			#1 - 20 secs.
	114	2:16 p.m.	#1/2 - 17 secs.
			#3 - 10 secs.
			#1 - 20 secs.
			#2 - 20 secs.

OCTOBER 16, 1974
continued

Oven Number	Time	Reading	
124	2:35 p.m.	#1/2 Ringelmann	- 10 secs.
		#3	- 5 secs.
		#2	- 15 secs.
		#1	- 33 secs.
134	2:50 p.m.	#1/2	- 12 secs.
		#3	- 15 secs.
		#2	- 15 secs.
		#1	- 25 secs.
93	3:06 p.m.	#1/2	- 1 min.
		#3	- 15 secs.
		#2	- 11 secs.
		#1	- 25 secs.
106	3:21 p.m.	#4	- 5 secs.
		#3	- 25 secs.
		#2	- 5 secs.
		#1	- 30 secs.
116	3:32 p.m.	#1	- 15 secs.
		#4	- 15 secs.
		#3	- 10 secs.
		#2	- 25 secs.
		#1	- 20 secs.
126	3:53 p.m.	#1	- 45 secs.
		#3	- 5 secs.
		#2	- 25 secs.
		#1	- 25 secs.

OCTOBER 17, 197

101	9:55 a.m.	#1/2	- 15 secs.
		#1	- 1 min.
		#2	- 15 secs.
		#2-1/2	- 30 secs.
		#2	- 15 secs.
		#1	- 1 min.
111	10:14 a.m.	#1/2	- 1 min.
		#1/4	- 15 secs.
		#1-1/2	- 5 secs.
		#1	- 45 secs.
		#1/2	- 10 secs.
		#1/4	- 35 secs.
121	10:24 a.m.	#1	- 15 secs.
		#1/2	- 1 min. 15 secs.
		#1	- 5 secs.
		#2	- 20 secs.
		#1	- 20 secs.

OCTOBER 17, 1974
continued

Oven Number	Time	Reading	
131	10:41 a.m.	#3/4 Ringelmann	- 1 min.
		#1/2	- 50 secs.
		#2	- 25 secs.
		#1	- 15 secs.
		#1/2	- 5 secs.
		#1/4	- 1 min. 40 secs.
89	10:56 a.m.	#1/2	- 30 secs.
		#1	- 30 secs.
		#1-1/2	- 15 secs.
		#2	- 10 secs.
		#3	- 20 secs.
		#4	- 20 secs.
		#2	- 10 secs.
		#1	- 35 secs.
103	11:17 a.m.	#1	- 1 min.
		#1-1/2	- 15 secs.
		#2	- 15 secs.
		#4	- 10 secs.
		#2	- 10 secs.
		#3	- 5 secs.
		#1	- 15 secs.
		#1/2	- 30 secs.
113	11:28 a.m.	#1/2	- 1 min. 30 secs.
		#2	- 10 secs.
		#4	- 10 secs.
		#3	- 15 secs.
		#2	- 10 secs.
		#4	- 15 secs.
		#2	- 15 secs.
		#1	- 15 secs.
135	2:08 p.m.	#2	- 25 secs.
		#1	- 15 secs.
		#1/2	- 10 secs.
89	2:20 p.m.	#1/2	- 1 min.
		#1	- 15 secs.
		#1/2	- 45 secs.
		#3	- 15 secs.
		#4	- 30 secs.
		#3	- 20 secs.
		#2	- 20 secs.
107	2:40 p.m.	#1/2	- 1 min.
		#2	- 10 secs.
		#3	- 5 secs.
		#4	- 15 secs.
		#3	- 10 secs.
		#4	- 15 secs.
		#3	- 5 secs.
		#1	- 15 secs.
		#1/2	- 15 secs.

OCTOBER 17, 1974 continued	Oven Number	Time	Reading
	117	2:58 p.m.	#1 Ringelmann - 1 min. 45 secs.
			#3 - 10 secs.
			#4 - 15 secs.
			#3 - 20 secs.
			#4 - 15 secs.
			#3 - 10 secs.
			#2 - 5 secs.
	127	3:17 p.m.	#1/2 - 30 secs.
			#1 - 15 secs.
			#3 - 10 secs.
			#4 - 15 secs.
			#3 - 15 secs.
			#2 - 15 secs.
			#1 - 15 secs.
	137	3:31 p.m.	#3/4 - 30 secs.
			#1 - 30 secs.
			#3/4 - 15 secs.
			#2 - 15 secs.
			#3 - 15 secs.
			#2 - 15 secs.
			#4 - 5 secs.
			#3 - 10 secs.
			#2 - 15 secs.
			#1 - 15 secs.

There are no experimental doors in use on AB battery. Rather AB battery is equipped with an outdated type of hand-luted door, which may not be compared directly to self-sealing doors employed elsewhere at Donner -Hanna and in most other plants.

Door leaks during the test period were not the subject of extended observations but were at any given time minimal, a fact which may be confirmed by available photographic records.

To the extent luted doors leak, it is closely related to the time during charging when the practice is to tamp and/or relute leaks as they appear. Continuing leaks are not a problem.

On the smoke observation records elsewhere reported herein, there is a record of observations of smoke from the coke face subsequent to door removal. This is, in part, a reflection of the condition of the door refractories which is always a transitory situation. In mid-September the following doors were in need of refractory repair:

Coke side:

103, 105

Pusher side:

99, 107, 112, 114, 118, 122, 125, 134, 135, 137, 139

The device being tested neither ameliorates or exacerbates door leakage. Door leakage is not a factor in in-duct testing.

Republicsteel

Republic Steel Corporation
General Offices: Republic Building
Environmental Control
PO Box 6778
Cleveland OH 44101

August 5, 1976

GA Johnson
Director
WL West
Associate Director
LF Birkel
Assistant Director–Water
CM Brown
Assistant Director–Air
JB Bailey
Administrator
Environmental Procedures

Mr. N.E. Williams
Director
Ohio EPA
361 E. Broad Street
Columbus, Ohio 43216

Mr. Howard G. Bergman
Commissioner
Div. of Air Pollution Control
City of Cleveland
2735 Broadway Avenue
Cleveland, Ohio 44115

Gentlemen:

Enclosed is the revised test protocol, referenced in Mr. G.A. Johnson's letter of August 2, 1976, for the Donner-Hanna System for control of coke pushing emissions relevant to the recently executed Consent and Abatement Orders for Republic's Cleveland District No. 1 Coke Battery. This revision is the result of discussions and meetings in our efforts to resolve this subject with the several parties involved.

Hopefully this submittal will receive your approval and thus conclude this phase of the overall program.

Sincerely,

C. M. Brown

C.M. Brown

CMB:EJP
Enc.

c.c. - Messrs. J.A. Wunderle, Ohio EPA
T.C. Voltaggio, US-EPA, Region V
L.R. Paley, US-EPA, Washington
Carl Edlund, US-EPA, Washington
D.J. Grove, Entropy Environmentalists, Inc.
√K.D. Mahar, Donner-Hanna Coke Corporation

Enc.

AIR POLLUTION CONTROLLED SOURCE

PARTICULATE MATTER

REVISED SAMPLING PROTOCOL

This updated protocol is based upon four weeks of intensive preliminary testing. The main area of this preliminary work has been in the determination of stack velocity profiles, stack flow rates, stack temperatures, stack gas composition (including moisture) and possible stack sampling techniques. The associated tasks of devising methods for measuring fugitive emissions and of relating these emissions to the Cleveland No. 1 Coke Battery are presented in the appropriate sections of this protocol.

EMISSION SOURCE: Donner-Hanna Battery AB pushing emissions control designated "PECT System", Patent Application No. 635,594 dated November 28, 1975.

AUSPICES FOR TESTING: NYS-DEC Order to meet requirements of 40CFR51.4 and reviewed at Public Hearing June 26, 1975.

EMISSION CHARACTERIZATION: Opaque steam plume containing water droplets and particulate residuals, functioning for slightly more than 60 seconds during each of the three or four oven pushes each hour.

EMISSION CAPTURE: The total system emissions are carried by low velocity fugitive emissions and higher velocity stack emissions. Stack emissions will be determined directly by testing. Fugitive emissions will be estimated as explained later.* Suppressed ignition effects minimize emissions during quench car travel.

STACK EMISSION TEST POINT: Stub stack on moveable equipment. Equipment will be immobile during actual data and sample collection. The stack cross section measures 3' x 10'. The sample test ports are located 4 feet upstream in a 6-ft. length of unobstructed vertical duct. This is immediately above a demister (parallel corrugated plates) which functions as a flow distributor and equalizer, as well as a remover of liquid and solid particulates.

PURPOSE OF SAMPLING: Isokinetically quantify particulate residual in the exhaust stack gas.

FLOW CHARACTERIZATION: The design and operation of the PECT System results in laminar flow. No large variations in flow over the duct cross section and no evidence of skewed flow has been experienced.

PARTICULATE CHARACTERIZATION: US-EPA Method 5 for sampling as well as laboratory procedures as discussed subsequently herein.

* See attached letters both dated July 30, 1976 from Kevin D. Mahar to Glenn Johnson.

FLOW RATE DATA: Differential pressures are determined with precalibrated "S" type pitot tubes and 0-0.25" H_2O (0.005" H_2O increment) inclined manometers. The pitot tubes have been calibrated at the low flow ranges encountered. Stack temperatures are determined with calibrated type K thermocouples and strip chart recorders to within $\pm 5^{\circ}F$. The pitot tubes and thermocouples are attached to the sampling probes.

GAS ANALYSIS: Dry molecular weight of the stack gas has been determined by Gas Chromatography on grab samples and on samples integrated over several oven pushes. These samples have been removed directly from the stack by squeeze bulb. Included in the gas analysis is a moisture determination. This has been accomplished using the impinger catch and dry gas meter readings in preliminary testing. It was found that the moisture content of the gas in the stack varies over the cross section of the stack, probably due to system operation and engineering design.

SAMPLE AND ACCESS: Two sampling train consoles will be mounted on a moveable bridge and connected by up to 100 ft. of umbilical cord to sampling boxes and probes positioned on a moveable support from which they can be manually manipulated from centroid to centroid between operational periods. Safety considerations require the separation of consoles and sample boxes.

SAMPLER TRAIN MANUFACTURER: EPA Method 5 type. Glass Innovations, Inc., Model G11-200 Source Sampler and/or RAC Model No. 2343. A diagram of the sampling train is attached.

PARTICULATE FILTER: 4-inch size G.F.A. 1 or Gelman A filters will be desiccated to constant weight and tared for particulate collection.

SAMPLE TRAIN SETUP: The condenser system will be set up as follows: Impingers one and two each with 100 ml of distilled water. Impinger three is empty and impinger four contains 200 grams of pre-weighed silica gel. A cyclone is used in the heated compartment.

SAMPLING RATE AND ISOKINESIS: Due to the high moisture content of the stack gas and to the short cyclic operation of the PECT System, certain optimizations must be made in the sampling procedure. In order to obtain a representative sample volume in a reasonable time, the gas meter sampling rate must be maximized. A second consideration is in maintaining the orifice meter ΔH value in the "straight line" region of its calibration. Thirdly, since the stack gas is largely condensable steam, the nozzle flow rate will be approximately two or three times the orifice flow rate. This creates potential system vacuum problems in moving these large moisture laden volumes through the cyclone, filter and impingers. The relation of flow through the dry gas meter and the orifice pressure drop has been determined using the orifice equation $Q_m = K_m \sqrt{\frac{T_m \ \Delta H}{P_m \ M_m}}$. Also, the relation of nozzle

flow and gas meter flow for an experimental moisture content has been found. Equating these, the relationship between nozzle flow and orifice pressure drop is found. The nozzle velocity is determined for a given nozzle diameter and this is also proportional to the orifice pressure drop. Equating the nozzle velocity with stack velocity (for isokinesis) gives a relationship between the pitot reading (Δp) and the orifice pressure drop (ΔH). The variables used in obtaining this relationship are nozzle size, stack moisture, stack temperature and pitot tube coefficient. Tables have been prepared using these variables in the ranges encountered and are used in maintaining isokinesis. For example, at the stack conditions encountered, a nozzle of 11/16" diameter when sampling isokinetically, gives a dry gas meter flow rate of about 0.5 SCFM and an average ΔH of about 1" H_2O. A total sample consisting of 72 separate sixty second (approximate) sections will therefore result in about 30 DSCF at the gas meter and from preliminary data in excess of 150 mg of collected residual particulate.

In order to sample at this rate, it has been found useful to replace the Greenberg-Smith impinger with a modified Greenberg-Smith to reduce the system pressure drop. No change in condensing efficiency has been found in preliminary tests as a result of this modification. Also, since the back half particulate catch has been found to be less than 5% of this total catch, no difficulties are expected in this regard as a result of the Greenberg-Smith impinger modification.

PARTICULATE MOISTURE: A volume of approximately 15% of the volume of moisture condensed in the impingers is collected in the cyclone. It is felt that this moisture is particulate water at the time the sample enters the sampling nozzle and as such should not be included in the gas flow volume. By maintaining the probe and sampling box at a temperature below 200°F between sampling cycles, undue condensation will be avoided and no collected particulate water will be re-evaporated, thereby providing a representative sample.

MECHANICS OF SAMPLING SYSTEM OPERATIONS: It is anticipated that both sampling systems that will be used for the simultaneous testing will be positioned in the stack the night before the sampling begins in an effort to be prepared for an early start. Leak checks will be run in the laboratory before positioning the equipment on the stack and again before the actual sampling begins. The rectangular duct has been divided into three rows or ranks labeled north, center and south; and twelve files - No. 1 being on the east side running to 12 on the extreme west side. There are 36 sampling centroids in all. One test will consist of sampling the set of 36 centroids - twice.

For instance, the Glass Innovations system will traverse the north, center, and south centroids on the files numbered 4 through 6. The Research Appliance system will traverse the north, center and south centroids on the files numbered 7 through 12. In effect the G.I. system may cover the eastern half of the duct and the R.A.C. system the western half. The G.I. system begins on the north No. 1 centroid and moves along that rank to the north No. 6 centroid, then inward to the center rank No. 6 centroid

and along that rank back to center rank No. 1 centroid and so on. The R.A.C. system will begin on north No. 7 centroid and move along the north rank to the No. 12 file at the same time theG.I. system is moving from No. 1 - 6 on the north rank. Then the R.A.C. system moves inward to the center rank No. 12 and traverses through the No. 7 file center rank and so on with this system.

The sample pump will be energized when the PECT system water pump is started. Sampling will begin when the temperature recorder responds to a rapid increase in stack temperature, indicating that the steam has reached the thermocouple attached to the sample probe. At this time the coarse adjust valve on the console will be opened and adjusted to the required ΔH setting dictated by the appropriate operating "nomograph" and the Δp reading. Recording of the Δp will be made every ten seconds; however, the operator of the console will make necessary adjustments whenever required -- "riding" the Δp with the required ΔH, as soon as he observes any change in Δp .

The sampling will be continued for approximately 60 seconds, terminating when the PECT hood has been removed from the hot car, at which time the coarse adjust valve will be turned off, cutting off the entire flow through the dry gas meter.

Dry gas meter inlet and outlet temperatures will be read immediately after the sampling system has been turned off. Sample box temperatures will also be recorded.

During the interim between pushes, the sample boxes will be moved along the plotted course to the next sampling port. Also during this period, pitot tube lines will be blown out to remove any moisture condensed during the push.

After sampling has been completed the sample boxes will be removed from the stack, nozzles covered and the system as a whole will be moved to the laboratory for clean up and analysis.

DATA ANALYSIS: Each sampling train will be broken down after 18 pushes are sampled to remove the water collected in the cyclone and the impingers. Both of these volumes will be measured. The silica gel will be reweighed and the weight increase added to the impinger catch. The probe, nozzle, cyclone and front half of the filter holder will be rinsed with acetone and the washings added to the cyclone water. This will be placed in a desiccated and tared beaker and evaporated to constant weight at room temperature. The same pieces will subsequently be washed with distilled water in addition to the standard Method 5 cleanup and this will also be evaporated to dryness. The filter will be desiccated to constant weight along with the acetone wash and water rinse residuals and the net increases in weight will be reported as components of the total residual particulate catch. The impinger water and water rinses from the back half glassware will be combined and evaporated to dryness. This weight will be reported as an adjunct to the test results. The cyclone water content will also be reported.

The results of four such sets of 18-push samples will be combined to constitute one replicate. This will probably be two sets from each train but will definitely be two pushes at each of the 36 centroids. Each set of 18 pushes sampled must be under 110% isokinetic. If one set is beyond this range, it will be repeated until an acceptable test is made. Three replicates will constitute a test.

Beyond the laboratory processing that is normally mandated by Method 5, some collected material will be further processed. The purpose for this will be to provide a set of filters for particulate counting using a scanning electron microscope to determine size distribution. This will be done with the Method 5 filter. Also, the probe washings and the cyclone catch will be redissolved and filtered, dried, reweighed and analyzed by scanning electron microscope methods.

TEST ENGINEER: The tests will be conducted and supervised by, and reported over the signature of Mr. A. Bhattacharyya, P.E. No. 0151636 (NYS), Donner-Hanna Coke Corporation, Buffalo, N.Y.

SOURCE OWNER REPRESENTATIVE: All questions and arrangements concerning tests, including process parameters, will be addressed to Kevin D. Mahar, Environmental Control Manager for Donner-Hanna Coke Corporation, Box A - South Park Station, Buffalo, New York 14220.

DONNER-HANNA COKE CORPORATION
BOX A - SOUTH PARK STATION BUFFALO, NEW YORK 14220
TELEPHONE 716/822-1600

July 30, 1976

Mr. Glenn Johnson
Director - Environmental Control
Republic Steel Corporation
Republic Building - P.O. Box 6778
Cleveland, Ohio 44101

Dear Glenn,

In discussions of sampling, the Donner-Hanna PECT system as first built on our battery AB, EPA has indicated a need to relate battery AB conditions to those which will be encountered on your #1 battery, where such a system is next expected to operate. This letter is to outline what information is available for use in that task. Also, it should serve to suggest to EPA what may be of interest because the PECT system is applied to batteries like our AB in that they are operating in their "twilight" years.

As indicated to EPA, Donner-Hanna eschews simplistic use of coking times as a means of suggesting how clean to expect pushing to be. However, unrealistically slow coking rates must be dismissed as a factor in achieving a lower emission rate. Clean pushing is accomplished on Donner-Hanna batteries 3 and 4 despite the fact that coke is accomplished at 1.15 inches per hour, a rate which is relatively fast even for relatively new batteries. This suggests that your Cleveland #1 battery should be operable at a minimal potential emission rate even if the anticipated pushing controls were not going to be added to #1 battery. The cleanliness of pushing from Donner-Hanna batteries 3 and 4 is documented in two ways. Source sampling has been conducted and indicates a rate of .086 to .133 pounds per ton of dry coal charged even without the benefit of an add-on such as our PECT system. Secondly, a sustained three-day observation of batteries 3 and 4 documented the fact that the transiting hot car seldom issued any plume above a #1 Ringelmann. Also, this same smoke observation established that the pushing from batteries 3 and 4 averaged 25 seconds per push when the plume was slightly over a #1 Ringelmann and generally less than #2. These should serve to very effectively predict what the PECT system will have to deal with when it is applied to your Cleveland #1 battery. Our 3 and 4 batteries take 18-ton wet charge and yours will take only slightly less by virtue of the fact that your length may be a few feet less than our 45+ length. We have submitted to EPA records of flue temperatures and they can be duplicated for purposes of comparison with your Cleveland #1 operation.

The PECT system was a necessity for our battery AB because it pushes coke which was a great deal dirtier than our experience with our

own 3 and 4 batteries. In the aforementioned sustained smoke observations, battery AB produced a plume that exceeded a #1 Ringelmann for an average of 71 seconds and in many instances, that plume reached or approached a #4 Ringelmann. Our battery AB was, and is, operated at a very brisk coking rate considering its operating lifetime. That is to say, at .98 inches per hour on the A section and 1.1 inches per hour on the B section, our battery AB operates with the alacrity encountered on most operating batteries that are relatively new. Again, typical flue temperatures are already on record with EPA and can be duplicated as an adjunct to the source testing of the PECT system. As was done on our 3 and 4 batteries, our battery AB pushing emissions were sampled using high volume sampling techniques similar to those reported by Dr. Jocko. They indicated an emission rate of 1.2 pounds per ton of dry coal charged. This level of emission confirms what would be inferred from the earlier reported smoke observations.

In speaking of batteries 3 and 4 or our battery AB, they are normally run at a constant rate near a level saturating their ability to produce coke. At the time of sampling, the PECT system on AB, we will certify that it is also run at this expected rate and that the aforementioned smoke observations and pre-existing sampling data are a basis for valid comparisons in that they represent the same level of operation in all cases.

It is not within our ability to suggest to EPA what might be encountered at any given battery at any given plant because in many cases we would be totally lacking in familiarity. However, based on our observations of other firms batteries and such sampling data as is available, the poorest pushing from batteries which are in poor shape and/or poorly operated produces a level of 1-1/2 to 2 pounds of pushing emissions per ton of coal charged. That is to say that our battery AB is not the worst but is significantly poorer than what should be expected of a 13-foot battery of a tried and true design in the hands of reasonably competent operators.

There are three size categories which are of interest to EPA. The 12-ton charge in our battery AB places it in the smallest of the three categories. The 18-ton charge of our batteries 3 and 4 is the middle size and the commonest size battery in operation in the United States. Some of the high batteries which have been built in recent years have built-in vertical temperature differential problems (jokingly referred to a "VD") which cause them to push relatively green coke early in their lifetime. While we have no first-hand experience with such high batteries, the literature suggests that they are analogous to our small battery operated at a brisk pace in its twilight years.

There have been, and will continue to be, questions relative to how much water is required to make our PECT system effective. At the time source sampling is conducted, we would expect to be in a position to

to record the typical water used per push but we probably will not yet be in a position to evaluate that number in relation to optimized operation. As stated, optimized operation has been deferred so as to permit the earliest possible testing of an operating entity which only just came into being. For the time being, we expect only to be able to relate PECT system water usage to the level of evaporation in the unchanged quenching operation that is associated with those same ovens.

We hope this strongly addresses itself to the area of interest outlined by Mr. Voltaggio as EPA's interest primarily in the #1 battery and secondly, at other batteries where a PECT system may be considered as an emission control candidate. As indicated, it may be necessary for us to provide information of significance in a form more appropriate than the specific form in which EPA might otherwise ask for it. This should not present any untoward difficulty.

Cordially yours,

DONNER-HANNA COKE CORPORATION

Kevin D. Mahar

Kevin D. Mahar
Environmental Control Manager

DONNER-HANNA COKE CORPORATION
BOX A - SOUTH PARK STATION BUFFALO, NEW YORK 14220
TELEPHONE 716/822-1600

July 30, 1976

Mr. Glenn Johnson
Director - Environmental Control
Republic Steel Corporation
Republic Building
Cleveland, Ohio 44101

Dear Glenn,

As we progress with the question of sampling our PECT pushing emission control system, the question of fugitive emissions must have such answers as can be provided for initial evaluation of the system by the several control agencies with which you are dealing in relation to your #1 battery. At a later date, we would hope to offer something more objective to identify the proportion of emission which is not subject to sampling by "in duct" sampling.

Because the initial evaluation will be more or less subjective, it will be necessary for us to provide a film record of a large number of pushes under varying atmospheric conditions. To date, observers of our PECT system have stood at ground level relatively close to the equipment and observed that the "out of duct" emanations of steam may be as much as those issuing from the duct where sampling is in progress. We know for a fact that this is a very poor vantage point and that such a judgment is much more difficult to make in the absence of a movie film record from a suitable vantage point.

The PECT system in operation on our battery AB includes a duct that is just below the level of two bridge crane rails, one of which is normally upwind and one which is normally downwind. These are to the immediate east and west of a duct that is three feet on a north-south line and ten feet on an east-west line. To the north of the PECT system, the battery itself denies observer-access to some of the fugitive emissions from the PECT system. To the south of the PECT system duct, a square water tank projects upward 3-4 feet above the bridge rails. It has been our experience that an observer is in the best position to make a record and/or an on-the-spot subjective judgment if positioned at a height about ten feet higher than the top of the PECT system from a building some 150 feet to the south. Under the most common wind conditions, this will move steam from left to right across the observer's view and down the length of the hot car track. It will be necessary to identify wind speed at the time of observations and make that a part of a photographic record.

Super 8 mm colored movie film will be used and the footage on an individual roll will be slightly more than adequate for each push. We would expect to use a Bell and Howell Focus-tronic Model 432 which has its own light compensation capability and a zoom lens. Film developing will be done by a commercial laboratory with no specific instructions to modify their normal responsive service. We will photograph an identifying plate at the beginning of each push. If necessary, we will request duplicate prints. We expect that the stop-action capability of a movie projector will prove less valuable than the ability of a movie projector to be run in reverse. Also, the slow motion and fast motion capability of a projector will prove useful. We will record filming time so as to gauge the projection speed.

It will be necessary to observe approximately four exit points for fugitive emissions. The largest of these will be the steam which comes out from under the hood along the coupler-to-coupler axis of the hot car, from the side of the hood which is remote from the already filled portion of the car. Also of interest will be the steam which comes through the hot car gates and rises from the drainage trough parallel to the hot car track. The third area of interest will be the steam coming from under the hood and from the filled portion of the car as it comes out from under the hood. The fourth area of interest will be steam arising from the hot car while it is in transit to the quenching station after having come from under the PECT hood. The duct steam and the first area outlined above are capable of moving at speeds in the 10-20 feet per second range. The steam from the other categories moves in a lazy fashion with the ambient wind. It will be of utmost significance to judge how far the duct steam moves before dissipating. In the writer's observations to date, duct steam is capable of being observed for several hundred feet while the other sources of steam are likely to dissipate within a hundred feet.

Even though of many pushes, we do not expect the making of a movie record to obviate the active presence of a qualified smoke observer, although the same vantage point will, under most atmospheric conditions, be useful to both the photographer and the smoke observer. The Government smoke observer will be working in parallel with a Donner-Hanna observer. To the extent that steam does not obviate Ringelmann readings, the smoke observers will report them as such and the time duration thereof. These may be from the coke face before hood placement, from the steam plume where it dissipates some distance away, from the transiting hot car, or from the quench tower before steam arises. All but the first of these should be minimal or nonexistent. The smoke observers will also record occasional, slight discoloration of the steam plume either during pushing or during hot car travel.

We believe that a subjective evaluation of fugitive emissions will prove useful even though other methods may subsequently be devised to avoid reliance on subjective judgment.

Cordially yours,

DONNER-HANNA COKE CORPORATION

Kevin D. Mahar

Kevin D. Mahar
Environmental Control Manager

Operational Data

The subject of this report is a developmental and conceptually innovative means of controlling pushing emissions. The device being tested is a production prototype which follows an earlier developmental step where a full-scale, immobile prototype was available only for very limited scope appraisal and no substantive emission testing.

Because of interest of others, the developmental progress with the installation was HALTED once it had demonstrated that it is an operational entity. This was so that initial emission testing could be done under unchanging conditions.

At the time of this reporting, the device has proven to be an operational entity capable of handling numerous successive pushes including upsets which would be expected to imperil such equipment. Because it must be protected for testing purposes and there is no inventory of spare parts, it is being operated by an engineering department staff member on the day shift only and principally for residual emission testing to the exclusion of other purposes. It is amenable to operation by the battery crew and doesn't appear to benefit by the selective staffing.

The device is susceptible to manual control of the water flow rate but only between cycles. Therefore, meters have been used to determine the flow rate which in all instances to date have been at wide-open throttle valve settings and a meter-indicated rate of 1095 gpm. There is some push-to-push variation in the time and a recorder was recently added to quantify the fact of how long pumps are on. The principal push-to-push time variation is after the ram has reversed (approximately 40 seconds) but before the hood is raised and withdrawn. The operator is capable of addressing the operation to deal with a green pusher side end if there is any perception that it is in need of additional effort. The pumps tend to be on less than 68 seconds, and can be run an additional period if there is an apparent need. At the conclusion of this section is a tabulation of records for 9/8 and 9/9.

We have no record of why the water delivery time was short on Oven 115, the last oven sampled on September 8. A sequence of pictures at 5-second intervals reveals that the hot car did not pull out from under the hood but rather that the hood was up and off early -- possibly because of operator impatience to be finished with the day's work. This push did indicate that the meter reading is substantially correct in that it indicated 839 gallons delivered while the timed rate of static tank emptying (19.52 gals./sec.) extrapolates to 897 gallons. While the time and rate extrapolations would indicate more water used, the fact is that the PECT System on AB runs out of water after 68 seconds.

Because the tank refilling pump comes on (while the hood pumps are on) when signalled by a float, the contents of the 976 gallon tank are augmented by something less than the 400 gallons pumped by the filling pump which operates most but not quite all of the 68 seconds when the hood pumps are running. Beyond 68 seconds only 5.88 gallons per second is being delivered the way the device is presently operated (with the filling pump supplying water through the surge tank and to the hood pumps). However, the hood pumps cavitate and deliver water into the hood only erratically, if at all, after 68 seconds.

It had been found necessary to appraise the manner in which the electrical controls for the pusher ram are set up. Involved are both dynamic braking and the automatic end stop. The normal inclination is to be conservative and avoid any possibility of ram overextension which may leave a ram immobile in a hot oven. This practice leaves unwanted coke in the guide which will teeter for some period of time and extend the time when the steam enveloping atmosphere is expected to control green pusher side end emissions. A backup pusher was pressed into service when the prime pusher broke down dealing with stickers. No effort was possible and no effort was made to obviate this source of interference with better operation of the PECT System on two days in September.

The PECT pumping system is capable of being segmented, programmed and made automatically responsive to sensors. None of this capability has yet been employed. Among the purposes for such adjusting may be a desire to postpone the time at which water delivery rate is expended.

Oven	Seconds of Water	Seconds of Sampling	Indicated Gals. Water	Incremental Gals. Water	Transiting Steam	Hot Car Observations Secs. @ Smoke Opacity
118	73	60		29	yes	negative
128	75	60		41	no	negative
138	80	60		71	no	10 @ 5%
84	70	60		12	no	negative
94	92-1/2	60		144	no	20 @ 5%
89	105	60		218	yes	20 @ 10%
101	72-1/2	60		26	no	20 @ 10%
111	105	60		218	yes	12 @ 20%
121	72	60		423		negative
131	78	60		59		20 @ 15%
103	70	60		12	yes	negative
113	67	60	1223		yes	negative
123	65	60	1186		yes	negative
133	63	60	1150		no	negative
86	55	60	1004		yes	5 @ 10%
96	60	60	1095		yes	negative
105	70	60		12	no	negative
115	46	60	839		half&half.	10@15%, 10@25%, 10@20%

Last of the day on September 9th (chart drive stuck earlier)

104	67		1222		?	10 @ 10%
114	64		1168		?	9@30%, 9@10%
124	70			12	?	40 @ 40%
stick - 134	15		274		?	---
93	66		1204		?	15@30%, 26@10%

BY_____DATE_____ SUBJECT Air Pollution Control SHEET NO. 134 OF 135

CHKD. BY_____DATE_____

Calculations

Source Sampling of Residual Particulate In Duct Emissions

JOB NO. Donner-Hanna Coke

Corp. DEPT.

RESULT TABULATION
PECT
PARTICULATE

SET NO.	SUBSET NO.	DATE	VOL. SAMPLED STD CUFT	SAMPLE AREA SQFT	% MOISTURE	% PARTICULATE MOISTURE	VELOCITY STACK FPS	VOLUME FLOW SAMPLE AREA ACFM	WEIGHT COLLECTED GMS	EMISSION SAMPLE AREA LBS/TON OF COAL			% ISO-KINETICS	LBS/TON COAL TOTAL	LBS/TON COAL AVERAGE
										CONC. PMRC	AREA RATIO PMRA	AVER. LBS/TON			
	I 4.I	9.8.76	6.54	15	77.0	16.8	12.46	11,214	0.13889	.007784	.008245	.008016	105.8		
	II RAC	9.8.76	8.23	15	70.28	17.0	12.24	11,016	0.16558	.009585	.009833	.009709	102.5	0.0256	
	III 4.I	9.9.76	6.43	15	68.5	34.59	11.34	10,206	0.27597	.02005	.01639	.01822	81.7		
	IV RAC	9.9.76	8.02	15	64.03	20.37	11.64	10,476	0.23481	.016297	.01394	.01512	85.4		
	I 9.I	8.3.76	7.12	15	69.87	28.38	13.32	11,988	0.21298	.01576	.01265	.0142	80.05		
	II RAC	8.3.76	8.61	15	61.15	22.91	12.37	11,135	0.18824	0.01406	.01279	.01293	79.44	0.0313	
	III 9.I	8.4.76	7.58	15	77.6	15.05	14.63	13,163	0.31313	0.01744	.01860	.0180	107.3		
	IV RAC	8.4.76	5.64	13	70.74	15.32	12.67	8235.5	0.23310	.01462	.01384	.01423	93.76		
	I 9.I	7.21.76	6.41	7.5	69.24	26.5	11.66	5247	0.22536	.00828	.01018	.00923	122.9		
	II RAC	7.21.76	6.6	9.5	62.3	14.5	12.68	5706	0.1444	.00698	.00652	.00675	93	0.0373	
	III 9.I	7.22.76	6.35	7.5	74.63	20.4	13.85	6232.5	0.30899	.01111	.01389	.01249	124.5		
	IV RAC	7.22.76	6.2	7.5	71.7	15.9	12.81	5764.5	.21401	.00820	.00953	.00887			

BY _____ DATE _____
CHKD. BY _____ DATE _____
Calculations

SUBJECT Air Pollution Control
Source Sampling of Residual
Particulate In Duct Emissions

SHEET NO. 1 OF 12
JOB NO. Donner-Hanna Coke
Corp. PECT System

THIS COPY PREPARED FOR:

J. Voltaggio

E.P.A. - Region 5