

Note: This is a reference cited in AP 42, *Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources*. AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

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AP-42 Section 12.2

Reference

Report Sect. 4

Reference 199

EMISSION TESTING

#15 Bat Stack

FOR

U. S. STEEL
GARY, INDIANA

FEBRUARY 1, 1980

BY

KEMRON ENVIRONMENTAL SERVICES
16550 HIGHLAND ROAD
BATON ROUGE, LOUISIANA 70808

80-15183-08

510973

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EMISSION TESTING
FOR
UNITED STATES STEEL

Abstract

On September 31, 1979 KEMRON Environmental Services began emission tests for front half particulate and sulfate matter on the number fifteen coke battery exhaust stack servicing United States Steel, Gary, Indiana.

Under coke oven gas firing conditions the test results indicate an average grain loading of 0.0871 GR/DSCF and 26.5 LBS/HR for total particulate. The particulate minus sulfate grain loading is 0.0745 GR/DSCF and the emission rate is 22.8 LB/HR.

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TABLESUMMARY OF RESULTSCOKE BATTERY COMBUSTION STACK TESTSBATTERY NUMBER FIFTEEN, FIRING COKE OVEN GAS

RUN #	1	2	3
DATE	10/31/79	11/01/79	11/01/79
TIME (APPROX)	1418-1606	0830-1022	1310-1500
GAS TEMPERATURE (°F)	524	511	514
MOISTURE CONTENTS (% By Volume)	16	13.1	13.7
GAS VOLUME ACFM	68258	77107	81688
DSCFM	30705	36404	38113
PARTICULATE CONCENTRATION FRONT CATCH			
GR/DSCF	0.0665	0.112	0.0828
LB/HR	17.5	34.9	27.1
TOTAL CATCH - Sulfates			
GR/DSCF	0.0513	0.0973	0.075
LB/HR	13.5	30.3	24.5
%O ₂	9	7.8	9.2
%CO ₂	5.7	6.2	5.6
% Isokinetic	99.8	95.7	95.7

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APPENDIX

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ΔH

- Pressure differential across orifice,
(" H₂O)

 P_M

- Pressure at meter ($\frac{\Delta H_{avg}}{13.6} + P_B$),
(" Hg)

 P_S

- Average static stack pressure, " Hg)

 V_S

- Velocity of stack gas, (fps)

 ΔP

- Velocity head, (" H₂O)

 $V_M \text{ STD}$

- Volume through dry gas meter, corrected
to standard conditions, (DSCF)

 $V_W \text{ STD}$

- Volume of water collected, corrected
to standard conditions, (DSCF)

 V_{lc}

- Volume of water collected, (ml)

 B_{ws}

- Moisture in stack gas fraction

 $1-B_{ws}$

- Dry gas fraction in stack gas

 M_S

- Average molecular weight of stack
gas (wet), (lb/lb-mole)

 Q_{SD}

- Average stack gas dry volumetric
flow rate, (DSCFH)

 A

- Area of stack, (ft.²)

 θ

- Total sampling time, (min.)

 I

- Isokinetic ratio, (%)

 C_{SO_2}

- Concentration of sulfur dioxide,
dry basis corrected to standard
condition, (lb/DSCF)

 V_t

- Volume of barium perchlorate titrant
used for sample, (ml)

 V_{tb}

- Volume of barium perchlorate titrant
used for blank, (ml)

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GLOSSARY

P_B	- Barometric Pressure, (" Hg.)
d_N	- Diameter of Nozzle, (")
A_N	- Area of Nozzle, (ft. ²)
C_p	- Calibration factor for pitot tube
Equivalent Diameter	- Adjusted diameter for rectangular ducts
Upstream Disturbance	- Location of sampling ports from nearest upstream disturbance (in terms of equivalent diameter)
Downstream Disturbance	- Location of sampling ports from nearest downstream disturbance (in terms of equivalent diameter)
T_{STD}	- Standard Temperature (528° R)
P_{STD}	- Standard Pressure (29.92 " Hg)
T_s Avg	- Average Stack Temperature, (° R)
✓ K Factor	- Correction factor for nomograph setting
V_M	- Volume through meter at meter conditions, (SCF)
Y	- Dry gas meter correction factor
T_i	- Inlet temperature at dry gas meter, (° R)
T_o	- Outlet temperature at dry gas meter, (° R)
✓ T_m	- Temperature of meter (average of T_i and T_o), (° R)

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N	- Normality of barium perchlorate titrant.
V _{solu}	- Total volume of solution in which sulfur dioxide sample is contained, (ml)
V _a	- Volume of sample aliquot titrated, (ml)
V _{SC}	- Sample volume at standard conditions (dry basis), (ml)
V _f	- Volume of flask and valve, (ml)
P _i	- Initial absolute pressure of flask, (" Hg)
P _f	- Final absolute pressure of flask, (" Hg)
T _{if}	- Initial absolute temperature of flask, (° R)
T _{ff}	- Final absolute temperature of flask, (° R)
M	- Total milligrams NO ₂ per sample
A _s	- Absorbance of sample
F	- Dilution factor
C _{H2SO4}	- Concentration of sulfuric acid mist, (lb/DSCF)
K _C	- Spectrophotometer calibration factor

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EQUATIONS

Sample gas volume corrected to standard conditions (ft³)

$$V_{M \text{ STD}} = \frac{K_M Y V_M P_M}{T_M}$$

Volume of water vapor condensed corrected to standard conditions (ft³)

$$V_{W \text{ STD}} = K_W V_{lc}$$

Percent moisture of stack gas (%)

$$B_{WS} = \frac{V_{W \text{ STD}}}{V_{W \text{ STD}} + V_{M \text{ STD}}}$$

Average molecular weight of stack gas (lb/lb mole)

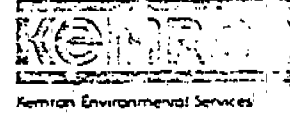
$$M_S = 0.44 (\%CO_2)(1-B_{WS}) + 0.32 (\%O_2)(1-B_{WS}) \\ + 0.28 (\%N_2 + \%CO)(1-B_{WS}) + 18 (B_{WS})$$

Average stack velocity (fps)

$$V_S = K_P C_P (\Delta P)_{Avg}^{1/2} \left[\frac{T_S (Avg)}{P_S M_S} \right]^{1/2}$$

Dry volumetric flow rate (DSCFH)

$$Q_{SD} = 3600 (1-B_{WS}) V_S A \left[\frac{T_{STD}}{T_S} \right] \left[\frac{P_S}{P_{STD}} \right]$$



Isokinetic Ratio (%)

$$I = \frac{K_i V_M \text{ STD } T_s}{P_s V_s A_N \theta (1-B_{ws})}$$

Sulfur dioxide concentration (lb/DSCF)

$$C_{SO_2} = K_s \frac{(V_t - V_{tb}) N (V_{solu}/V_a)}{V_M \text{ STD}}$$

Sample volume for NO₂ (ml³)

$$V_{SC} = K_M (V_f - 25 \text{ ml}) \left[\frac{P_f}{T_{ff}} - \frac{P_i}{T_{if}} \right]$$

Total milligrams NO₂ per sample (mg)

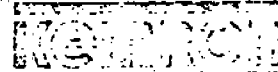
$$M = 2 K_C A_s F$$

Sample concentration for NO₂ (lb/DSCF)

$$C = K_N \frac{M}{V_{SC}}$$

Concentration of sulfuric acid mist (lb/DSCF)

$$C_{H_2SO_4} = K_H N \frac{(V_t - V_{tb}) (V_{solu}/V_a)}{V_M \text{ STD}}$$



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Total Flow Of Stack Gas

$$Qa = As \times Vs \times 60$$

Particulate Concentration, Front Catch

$$GR/DSCF = \frac{(15.43) \text{ (Mn Front)}}{Vmstd}$$

$$LB/HR = \# / DSCF * QSD$$

Particulate Concentration, Total Catch Minus Sulfates

$$GR/DSCF = \frac{(15.43) \text{ (Mn Total-S)}}{Vmstd}$$

$$LB/HR = \# / DSCF * QSD$$

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CONSTANTS

K_P - Constant in velocity equation

$$85.49 \frac{\text{ft.}}{\text{sec.}} \left[\frac{(\text{lb/lb mole}) (\text{"Hg})}{(^{\circ} \text{R}) (\text{"H}_2\text{O})} \right]^{\frac{1}{2}}$$

K_M - Constant in meter volume equation

$$17.64 \frac{^{\circ} \text{R}}{\text{"Hg}}$$

K_W - Constant in water volume equation

$$0.04707 \frac{\text{ft.}^3}{\text{ml}}$$

K_i - Constant in isokinetic equation

$$0.09450 \frac{\text{"Hg}}{^{\circ} \text{R}}$$

K_S - Constant in sulfur dioxide equation

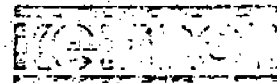
$$7.061 \times 10^{-5} \frac{\text{lb}}{\text{meg}}$$

K_N - Constant in NO_2 equation

$$6.243 \times 10^{-5} \frac{\text{lb/scf}}{\text{mg/ml}}$$

K_H - Constant in sulfuric acid mist equation

$$1.081 \times 10^{-4} \frac{\text{lb}}{\text{meg}}$$



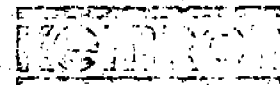
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PARAMETER SHEET
COKE BATTERY COMBUSTION STACK TEST

BATTERY NUMBER FIFTEEN, FIRING COKE OVEN GAS

RUN #	1	2	3
Pb	29.93	29.94	29.94
Ps	29.83	29.83	29.83
Vlc	142	127	141
M Front	0.1513	0.2886	0.1672
M Sulfate	0.03459	0.03819	0.02119
θ	96	96	96
% O ₂	9	7.8	9.2
% CO ₂	5.7	6.2	5.6
ΔH	0.44	0.576	0.626
Cp	0.84	0.84	0.84
Tm	559	542	542
Δ P	0.0049	0.0065	0.0072
Ts	984	971	974
Vm	37.03	40.81	42.75
Dn	0.67	0.67	0.67
Vmstd	35.09	39.9	41.77
Vwstd	6.68	5.98	6.64
Bwo	0.160	0.130	0.137
Md	29.27	29.3	29.26
Ms	27.47	27.83	27.72
Vs	5.54	6.26	6.63
An	0.002448	0.002448	0.002448

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PARTICULATES

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STACK SAMPLING DATA REDUCTION
FOR REFERENCE METHOD 5UNITED STATES STEEL
GARY, INDIANA
#15 BATTERY UNDERFIRE

OPERATORS	: LARIMORE - MEYER
DATE OF THIS SAMPLE	: 103179
TODAY'S DATE	: 112679
RUN #	: 1
FILE NAME	: USTEL1
AMBIENT TEMPERATURE (DEG F)	: 75
BAROMETRIC PRESS. (IN. HG.)	: 29.93

GAS ANALYSIS AT SAMPLING POINT
(DRY BASIS)

% CARBON DIOXIDE	: 5.7
% CARBON MONOXIDE	: 0
% OXYGEN	: 9
% NITROGEN	: 85.3
MOLECULAR WEIGHT (DRY)	: 29.27
% MOISTURE THIS RUN	: 16
% MOIST. @ SATURATION	: 100

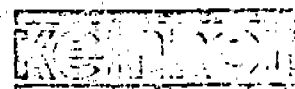
# MLS OF H2O IN IMPINGERS	: 128
WT INCREASE OF SILICA GEL (G)	: 13.2
VOLUME OF GAS SAMPLE (DSCF)	: 35.06

FILTERABLE PARTICULATE

WEIGHT INCREASE OF FILTER (GRM)	: 0.0758
PROBE RESIDUE (GM)	: 0.0756
TOTAL MASS OF PROBE SAMPLE (GM)	: 163.25
BLANK RESIDUE (GM)	: 1.00000E-04
TOTAL MASS OF BLANK (GM)	: 171.81
PROBE CATCH	: 0.075504982
FILTER CATCH	: 0.0758

PROBE LENGTH (IN)	: 96
NOZZLE DIAMETER (IN.)	: 0.67
DRY GAS METER CORRECTION FACTOR	: 1.001
PITOT TUBE CALIB. COEF.	: 0.84

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16550 Highland Road
Darien, P.O. Box 1000, Darien, PA 19038

CLOCK TIME (H.M)	STATIC PRESS (IN H2O)	STACK TEMP (F)	VELOCITY HEAD (IN H2O)	ORIFICE PRES DPOP (IN H2O)	DPY GAS VOLUME (F ³)	TEMP INLET (F)	TEMP OUTLET (F)	TEMP INP (F)
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PORT # 1

1418	-1.40	505	0.01	0.68	893.10	79	77	57
1420	-1.40	555	0.01	0.84	894.05	83	78	57
1422	-1.40	547	0.01	0.76	895.08	86	78	56
1424	-1.40	541	0.01	0.68	896.05	87	78	57
1426	-1.40	540	0.01	0.52	896.99	88	78	59
1428	-1.40	540	0.01	0.52	897.83	90	79	60
1430	-1.40	539	0.01	0.60	898.66	92	80	64
1432	-1.40	534	0.01	0.44	899.54	92	81	64
1434	-1.40	503	0.00	0.34	900.34	92	82	62
1436	-1.40	492	0.00	0.34	901.03	93	83	56
1438	-1.40	481	0.00	0.17	901.74	92	84	51
1440	-1.40	465	0.00	0.17	902.28	92	84	51
FINAL DRY GAS VOLUME					902.74			

PORT # 2

1446	-1.40	485	0.01	0.44	902.74	94	86	44
1448	-1.40	543	0.01	0.44	903.58	98	87	44
1450	-1.40	555	0.00	0.34	904.34	99	88	46
1452	-1.40	551	0.00	0.26	905.05	99	89	46
1454	-1.40	536	0.00	0.26	905.65	98	90	48
1456	-1.40	538	0.01	0.44	906.25	102	92	47
1458	-1.40	539	0.01	0.44	907.02	104	92	46
1500	-1.40	525	0.01	0.44	907.79	105	94	51
1502	-1.40	525	0.01	0.52	908.56	108	95	49
1504	-1.40	513	0.00	0.34	909.39	107	96	49
1506	-1.40	500	0.00	0.26	910.11	105	97	49
1508	-1.40	429	0.00	0.26	910.71	105	97	48
FINAL DRY GAS VOLUME					911.33			

PORT # 3

1514	-1.40	530	0.01	0.68	911.33	103	100	46
1516	-1.40	542	0.01	0.68	912.32	109	99	49
1518	-1.40	545	0.01	0.84	913.32	112	100	53
1520	-1.40	551	0.01	0.76	914.37	113	100	53
1522	-1.40	542	0.01	0.42	915.39	111	101	54
1524	-1.40	535	0.01	0.42	916.18	111	101	53
1526	-1.40	533	0.01	0.42	916.95	111	102	51
1528	-1.40	528	0.00	0.26	917.70	109	103	53

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W. S. WARD
Environmental Services Division
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Baton Rouge, Louisiana 70808
103 51
104 51
104 51

1530	-1.40	521	0.00	0.26	918.31	109
1532	-1.40	502	0.01	0.42	918.94	111
1534	-1.40	481	0.00	0.34	919.70	111
1536	-1.40	465	0.00	0.34	920.39	111
FINAL DRY GAS VOLUME					921.08	

PORT # 4

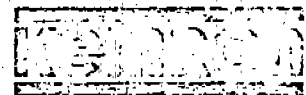
1544	-1.40	519	0.01	0.42	921.08	105	104	49
1546	-1.40	552	0.01	0.42	921.88	108	103	48
1548	-1.40	549	0.01	0.42	922.68	109	104	51
1550	-1.40	559	0.00	0.34	923.45	109	104	52
1552	-1.40	562	0.01	0.42	924.15	110	103	51
1554	-1.40	544	0.01	0.52	924.93	112	104	49
1556	-1.40	541	0.01	0.52	925.80	114	104	48
1558	-1.40	532	0.01	0.52	926.65	114	105	51
1600	-1.40	536	0.00	0.34	927.50	112	104	55
1602	-1.40	520	0.00	0.34	928.23	112	105	54
1604	-1.40	491	0.00	0.26	928.90	110	105	54
1606	-1.40	485	0.00	0.26	929.52	110	105	54
FINAL DRY GAS VOLUME					930.13			

AVG OPIFICE DPOP (IN H2O) : 0.44
TEMP OF METER (DEGREES R) : 558.6
AVG. STATIC STK PRESS (IN H2O) : -1.4
AVG STACK PRESSURE (IN HG.) : 29.827
TOTAL SAMPLING TIME THIS SAMPLE : 96
AVG TEMP OF STK GAS (DEGREES F) : 983.8
AVG VELOCITY HEAD (IN H2O) : 4.90000E-03
AVG VELOCITY (FPS) : 5.54
DIAMETER OF STACK (IN.) : 194.04
CROSS-SECT AREA OF STACK (SF) : 205.35
VOLUMETRIC FLOW OF STK (DSCF/HR) : 1842315

CONC. OF FILT. PART. IN STK (GR/DSCF) : 0.0665
CONC. OF FILT. PART. IN STK (#/DSCF) : 9.51358E-06
#/HP OF FILT. PART (DRY BASIS) : 17.527

ISOKINETIC VARIATION (%) : 99.82

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Baton Rouge, Louisiana 70808

EMISSION TESTING
FOR
UNITED STATES STEEL

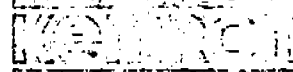
RESULTS

SAMPLING METHOD : 1
RUN NUMBER : 1
UNIT DESCRIPTION : #15 BATTERY UNDERFIRE

PHYSICAL CONSTANTS
OF
STACK

DATE OF SAMPLING	103179
TEMPERATURE OF STACK (F)	983.8
VELOCITY OF STACK GAS (FPS)	5.54
CROSS-SECTIONAL AREA OF STACK (SF)	205.35
VOLUMETRIC FLOW (DSCFH)	1842315
STATIC PRESSURE (INCHES OF H2O)	-1.4
MOISTURE CONTENT (% VOLUME)	16
MOLECULAR WEIGHT OF STACK GAS (#/#-MOLE, DPY)	29.27
ISOKINETIC RATIO (%)	99.82
FILTERABLE PARTICULATE EMISSION RATE (#/HOUR)	17.527
FILTERABLE PARTICULATE CONCENTRATION (GR/DSCF)	0.0665

510930



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Baton Rouge, Louisiana 70808

STACK SAMPLING DATA REDUCTION FOR REFERENCE METHOD 5

UNITED STATES STEEL
GARY, INDIANA
#15 BATTERY UNDERFIRE

OPERATORS	: LARIMORE - MEYER
DATE OF THIS SAMPLE	: 110179
TODAY'S DATE	: 112679
RUN #	: 2
FILE NAME	: USTell
AMBIENT TEMPERATURE (DEG F)	: 59
BAROMETRIC PRESS. (IN. HG.)	: 29.94

GAS ANALYSIS AT SAMPLING POINT (DRY BASIS)

% CARBON DIOXIDE	: 6.2
% CARBON MONOXIDE	: 0
% OXYGEN	: 7.8
% NITROGEN	: 86
MOLECULAR WEIGHT (DRY)	: 29.3
% MOISTURE THIS RUN	: 13.02
% MOIST. @ SATURATION	: 100

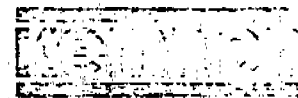
# MLS OF H2O IN IMPINGERS	: 115
WT INCREASE OF SILICA GEL (G)	: 11.1
VOLUME OF GAS SAMPLE (DSCF)	: 39.86

FILTERABLE PARTICULATE

WEIGHT INCREASE OF FILTER (GRM)	: 0.1885
PROBE RESIDUE (GM)	: 0.1003
TOTAL MASS OF PROBE SAMPLE (GM)	: 191.26
BLANK RESIDUE (GM)	: 1.00000E-04
TOTAL MASS OF BLANK (GM)	: 171.81
PROBE CATCH	: 0.100188679
FILTER CATCH	: 0.1885

PROBE LENGTH (IN)	: 96
NOZZLE DIAMETER (IN.)	: 0.67
DRY GAS METER CORRECTION FACTOR	: 1.001
PITOT TUBE CALIB. COEF.	: 0.84

510991



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Baton Rouge, Louisiana 70808

CLOCK TIME (H.M)	STATIC PRESS (IN H2O)	STACK TEMP (F)	VELOCITY HEAD (IN H2O)	ORIFICE PRES DROP (IN H2O)	DRY GAS VOLUME (F ³)	TEMP INLET (F)	TEMP OUTLET (F)	TEMP IMP (F)
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PORT # 1

830	-1.50	502	0.01	0.76	930.35	58	55	30
832	-1.50	530	0.01	0.76	931.33	62	53	29
834	-1.50	542	0.01	0.68	932.30	64	56	29
836	-1.50	544	0.01	0.68	933.20	67	56	29
838	-1.50	543	0.01	0.84	934.13	70	57	28
840	-1.50	547	0.01	0.84	935.13	72	58	28
842	-1.50	546	0.01	0.76	936.12	73	59	28
844	-1.50	542	0.01	0.76	937.09	75	59	29
846	-1.50	529	0.01	0.60	938.05	77	62	29
848	-1.50	492	0.01	0.42	938.94	76	63	29
850	-1.50	465	0.00	0.26	934.69	74	64	30
852	-1.50	460	0.00	0.26	940.30	75	64	30
FINAL DRY GAS VOLUME					940.88			

PORT # 2

900	-1.50	526	0.01	0.68	940.88	75	67	29
902	-1.50	538	0.01	0.84	941.85	81	69	29
904	-1.50	540	0.01	0.84	942.85	84	69	29
906	-1.50	543	0.01	0.84	943.88	86	71	30
908	-1.50	544	0.01	0.84	944.92	88	72	30
910	-1.50	544	0.01	0.92	945.95	90	73	30
912	-1.50	545	0.01	0.92	947.05	92	75	33
914	-1.50	547	0.01	0.84	948.14	93	75	33
916	-1.50	542	0.01	0.84	949.18	93	77	33
918	-1.50	518	0.01	0.76	950.20	95	77	34
920	-1.50	492	0.00	0.26	951.20	94	78	34
922	-1.50	481	0.00	0.17	951.82	94	78	34
FINAL DRY GAS VOLUME					952.30			

PORT # 3

930	-1.50	495	0.00	0.34	952.30	84	83	31
932	-1.50	517	0.00	0.34	952.99	87	81	31
934	-1.50	537	0.00	0.34	953.65	88	82	31
936	-1.50	541	0.01	0.42	954.34	92	82	30
938	-1.50	544	0.00	0.34	955.09	92	83	30
940	-1.50	543	0.00	0.34	955.15	92	83	30
942	-1.50	538	0.01	0.42	956.43	94	84	29
944	-1.50	530	0.01	0.42	957.18	95	84	29

510992

Environmental Services Division

16550 Highland Road, P.
Darien, Ga., 30128

946	-1.50	515	0.00	0.34	957.94	95	86	28
948	-1.50	471	0.00	0.26	958.62	94	86	28
950	-1.50	461	0.00	0.26	959.23	94	86	28
952	-1.50	450	0.00	0.26	959.82	94	87	28
FINAL DRY GAS VOLUME					960.42			

PORT # 4

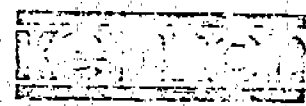
1000	-1.50	491	0.01	0.68	960.42	91	87	26
1002	-1.50	496	0.01	0.68	961.38	96	89	26
1004	-1.50	504	0.01	0.76	962.33	99	88	28
1006	-1.50	505	0.01	0.76	963.33	100	89	29
1008	-1.50	506	0.01	0.68	964.33	100	88	29
1010	-1.50	500	0.01	0.76	965.29	101	89	29
1012	-1.50	488	0.01	0.60	966.29	101	89	30
1014	-1.50	473	0.01	0.60	967.20	102	90	30
1016	-1.50	455	0.01	0.50	968.12	102	89	31
1018	-1.50	458	0.01	0.50	968.95	102	90	31
1020	-1.50	450	0.00	0.34	969.78	100	90	32
1022	-1.50	448	0.00	0.34	970.48	100	91	32
FINAL DRY GAS VOLUME					971.16			

AVG ORIFICE DROP (IN H₂O) : 0.576
 TEMP OF METER (DEGREES R) : 541.9
 AVG. STATIC STK PRESS (IN H₂O) : -1.5
 AVG STACK PPRESSURE (IN HG.) : 29.829
 TOTAL SAMPLING TIME THIS SAMPLE : 96
 AVG TEMP OF STK GAS (DEGREES R) : 970.7
 AVG VELOCITY HEAD (IN H₂O) : 6.50000E-03
 AVG VELOCITY (FPS) : 6.26
 DIAMETER OF STACK (IN.) : 194.01
 CROSS-SECT AREA OF STACK (SF) : 205.29
 VOLUMETRIC FLOW OF STK (DSCF/HR) : 2184253

CONC. OF FILT. PART. IN STK (GR/DSCF) : 0.1117
 CONC. OF FILT. PART. IN STK (#/DSCF) : 1.59667E-05
 #/HR OF FILT. PART (DRY BASIS) : 34.8752

ISOKINETIC VARIATION (%) : 95.69

510993



Environmental Services Division
16550 Highland Road
Baton Rouge, Louisiana 70806

EMISSION TESTING
FOR
UNITED STATES STEEL

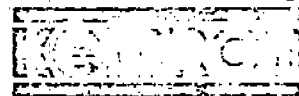
RESULTS

SAMPLING METHOD : 1
RUN NUMBER : 2
UNIT DESCRIPTION : #15 BATTERY UNDERFIRE

PHYSICAL CONSTANTS
OF
STACK

DATE OF SAMPLING	110179
TEMPERATURE OF STACK (R)	970.7
VELOCITY OF STACK GAS (FPS)	6.26
CROSS-SECTIONAL AREA OF STACK (SF)	205.29
VOLUMETRIC FLOW (DSCFH)	2184253
STATIC PRESSURE (INCHES OF H2O)	-1.5
MOISTURE CONTENT (% VOLUME)	13.02
MOLECULAR WEIGHT OF STACK GAS (#/#-MOLE, DRY)	29.3
ISOKINETIC RATIO (%)	95.69
FILTERABLE PARTICULATE EMISSION RATE (#/HOUR)	34.8752
FILTERABLE PARTICULATE CONCENTRATION (GR/DSCF)	0.1117

510994



Environmental Services Division
16550 Highland Road
Baton Rouge, Louisiana 70806

STACK SAMPLING DATA REDUCTION
FOR REFERENCE METHOD 5

UNITED STATES STEEL
GARY, INDIANA
#15 PATTERY UNDERFIRE

OPERATORS : LARIMORE - MEYER
DATE OF THIS SAMPLE : 110179
TODAY'S DATE : 112679
PUN # : 3
FILE NAME : USTE12
AMBIENT TEMPERATURE (DEG F) : 51
BAROMETRIC PRESS. (IN. HG.) : 29.94

GAS ANALYSIS AT SAMPLING POINT
(DRY BASIS)

% CARBON DIOXIDE : 5.6
% CARBON MONOXIDE : 0
% OXYGEN : 9.2
% NITROGEN : 85.2
MOLECULAR WEIGHT (DRY) : 29.26
% MOISTURE THIS RUN : 13.74
% MOIST. @ SATURATION : 100

MLS OF H2O IN IMPINGERS : 131
WT INCREASE OF SILICA GEL (G) : 9.9
VOLUME OF GAS SAMPLE (DSCF) : 41.73

FILTERABLE PARTICULATE

WEIGHT INCREASE OF FILTER (GRM) : 0.1672
PROBE RESIDUE (GM) : 0.0569
TOTAL MASS OF PROBE SAMPLE (GM) : 202.4
BLANK RESIDUE (GM) : 1.00000E-04
TOTAL MASS OF BLANK (GM) : 171.81
PROBE CATCH : 0.056782195
FILTER CATCH : 0.1672

PROBE LENGTH (IN) : 96
NOZZLE DIAMETER (IN.) : 0.67
DRY GAS METER CORRECTION FACTOR : 1.001
PITOT TUBE CALIB. COEF. : 0.84

510995

Environmental Services Division

16550 Highland Road
Baton Rouge, Louisiana 70802

CLOCK TIME (H.M)	STATIC PRESS (IN H2O)	STACK TEMP (F)	VELOCITY HEAD (IN H2O)	ORIFICE PRES DROP (IN H2O)	DRY GAS VOLUME (F ³)	TEMP INLET (F)	TEMP OUTLET (F)	TEMP IMP (F)
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PORT # 1

1310	-1.50	483	0.01	0.50	971.70	60	58	43
1312	-1.50	523	0.01	0.84	972.52	66	59	40
1314	-1.50	528	0.01	1.10	973.49	69	59	38
1316	-1.50	528	0.01	0.84	974.63	71	60	37
1318	-1.50	529	0.01	0.84	975.64	73	60	36
1320	-1.50	530	0.01	0.84	976.66	75	61	36
1322	-1.50	521	0.01	0.84	977.70	77	62	34
1324	-1.50	514	0.01	0.50	978.73	78	62	35
1326	-1.50	523	0.01	0.42	979.55	76	64	36
1328	-1.50	498	0.00	0.25	980.29	75	65	36
1330	-1.50	471	0.00	0.25	980.89	75	66	36
1332	-1.50	471	0.00	0.25	981.47	76	66	36

FINAL DRY GAS VOLUME 982.05

PORT # 2

1340	-1.50	525	0.01	0.84	982.05	78	69	32
1342	-1.50	544	0.01	0.84	983.13	82	69	32
1344	-1.50	547	0.01	0.84	984.15	85	70	32
1346	-1.50	550	0.01	0.84	985.19	87	71	33
1348	-1.50	553	0.01	0.92	986.21	89	72	33
1350	-1.50	554	0.01	0.84	987.28	90	73	34
1352	-1.50	529	0.01	0.76	988.33	90	74	34
1354	-1.50	522	0.01	0.68	989.31	91	75	34
1356	-1.50	518	0.01	0.68	990.25	92	76	33
1358	-1.50	506	0.01	0.58	991.18	92	76	34
1400	-1.50	500	0.00	0.34	992.05	92	76	34
1402	-1.50	491	0.00	0.34	992.75	92	77	35

FINAL DRY GAS VOLUME 993.44

PORT # 3

1410	-1.50	517	0.01	0.74	993.44	87	79	36
1412	-1.50	525	0.01	0.74	994.44	90	80	34
1414	-1.50	526	0.01	0.84	995.40	93	79	33
1416	-1.50	528	0.01	0.74	996.44	94	80	34
1418	-1.50	527	0.01	0.66	997.40	95	81	34
1420	-1.50	523	0.01	0.66	998.33	96	82	35
1422	-1.50	522	0.01	0.66	999.25	97	82	35
1424	-1.50	511	0.01	0.58	1000.19	97	82	35

510998

Environmental Services Division

16550 Highland Road
Baton Rouge, Louisiana 70808

1426	-1.50	498	0.01	0.58	1001.07	98	84	35
1428	-1.50	471	0.01	0.58	1001.95	99	84	35
1430	-1.50	455	0.01	0.42	1002.83	97	85	35
1432	-1.50	450	0.01	0.42	1003.60	97	85	35
FINAL DRY GAS VOLUME					1004.37			

PORT # 4

1438	-1.50	499	0.01	0.74	1004.37	92	86	38
1440	-1.50	531	0.01	0.74	1005.38	96	86	38
1442	-1.50	535	0.01	0.68	1006.37	97	86	38
1444	-1.50	536	0.01	0.68	1007.30	98	87	37
1446	-1.50	540	0.01	0.68	1008.25	100	86	37
1448	-1.50	538	0.01	0.58	1009.18	100	88	37
1450	-1.50	528	0.01	0.58	1010.03	101	88	37
1452	-1.50	513	0.01	0.42	1010.94	99	89	37
1454	-1.50	496	0.01	0.42	1011.69	100	89	38
1456	-1.50	487	0.00	0.34	1012.46	99	90	38
1458	-1.50	480	0.00	0.34	1013.15	99	90	38
1500	-1.50	476	0.00	0.25	1013.25	99	90	38
FINAL DRY GAS VOLUME					1014.45			

AVG OPIFICE DROP (IN H2O) : 0.6258
 TEMP OF METER (DEGREES R) : 542.3
 AVG. STATIC STK PRESS (IN H2O) : -1.5
 AVG STACK PPESSURE (IN HG.) : 29.829
 TOTAL SAMPLING TIME THIS SAMPLE : 96
 AVG TEMP OF STK GAS (DEGREES R) : 973.9
 AVG VELOCITY HEAD (IN H2O) : 7.20000E-03
 AVG VELOCITY (FPS) : 6.63
 DIAMETER OF STACK (IN.) : 194.04
 CROSS-SECT AREA OF STACK (SF) : 205.35
 VOLUMETRIC FLOW OF STK (DSCF/HR) : 2286791

CONC. OF FILT. PART. IN STK (GR/DSCF) : 0.0828
 CONC. OF FILT. PART. IN STK (#/DSCF) : 1.18343E-05
 #/HR OF FILT. PART (DRY BASIS) : 27.0625

ISOKINETIC VARIATION (%) : 95.7

510997

Environmental Services Division

16550 Highland Road
Baton Rouge, Louisiana 70808EMISSION TESTING
FOR
UNITED STATES STEEL

RESULTS

SAMPLING METHOD : 1
RUN NUMBER : 3
UNIT DESCRIPTION : #15 BATTERY UNDERFIREPHYSICAL CONSTANTS
OF
STACK

DATE OF SAMPLING	110179
TEMPERATURE OF STACK(R)	973.9
VELOCITY OF STACK GAS(FPS)	6.63
CROSS-SECTIONAL AREA OF STACK(SF)	205.35
VOLUMETRIC FLOW(DSCFH)	2286791
STATIC PRESSURE(INCHES OF H2O)	-1.5
MOISTURE CONTENT(% VOLUME)	13.74
MOLECULAR WEIGHT OF STACK GAS(#/#-MOLE,DPY)	29.26
ISOKINETIC RATIO(%)	95.7
FILTEPABLE PARTICULATE EMISSION RATE(#/HOUR)	27.0625
FILTERABLE PARTICULATE CONCENTRATION(GR/DSCF)	0.0828

510998



Kemtron Environmental Services

SULFATES

510999

Environmental Services Division

16550 Highland Road
Baton Rouge, Louisiana 70808STACK SAMPLING DATA REDUCTION
FOR REFERENCE METHOD 5UNITED STATES STEEL
GAFY, INDIANA
#15 BATTERY UNDERFIRE

OPERATORS	: LARIMORE - MEYER
DATE OF THIS SAMPLE	: 103179
TODAY'S DATE	: 112679
RUN #	: 1
FILE NAME	: USTELL
AMBIENT TEMPERATURE (DEG F)	: 75
BAROMETRIC PRESS. (IN. HG.)	: 29.93

GAS ANALYSIS AT SAMPLING POINT
(DRY BASIS)

% CARBON DIOXIDE	: 5.7
% CARBON MONOXIDE	: 0
% OXYGEN	: 9
% NITROGEN	: 85.3
MOLECULAR WEIGHT (DRY)	: 29.27
% MOISTURE THIS RUN	: 16
% MOIST. & SATURATION	: 100

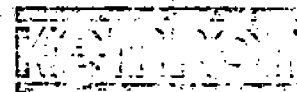
# MLS OF H2O IN IMPINGERS	: 128
WT INCREASE OF SILICA GEL (G)	: 13.2
VOLUME OF GAS SAMPLE (ESCF)	: 35.06

FILTERABLE PARTICULATE

WEIGHT INCREASE OF FILTER (GRM)	: 0.01691
PROBE RESIDUE (GM)	: 0.0186
TOTAL MASS OF PROBE SAMPLE (GM)	: 100
BLANK RESIDUE (GM)	: 9.20000E-04
TOTAL MASS OF BLANK (GM)	: 100
PROBE CATCH	: 0.01768
FILTER CATCH	: 0.01691

PROBE LENGTH (IN)	: 96
NOZZLE DIAMETER (IN.)	: 0.67
DRY GAS METER CORRECTION FACTOR	: 1.001
PITOT TUBE CALIB. COEF.	: 0.84

511000



Environmental Services Division

16550 Highland Road
Darien, Georgia, 30126-1508

CLOCK TIME	STATIC PRESS (H.M) : (IN H2O)	STACK TEMP (F)	VELOCITY HEAD (IN H2O)	ORIFICE PRES DROP (IN H2O)	DRY GAS VOLUME (F ³)	TEMP INLET (F)	TEMP OUTLET (F)	TEMP IMP (F)
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PORT # 1

1418	-1.40	505	0.01	0.68	893.10	79	77	57
1420	-1.40	555	0.01	0.84	894.05	83	78	57
1422	-1.40	547	0.01	0.76	895.08	86	78	56
1424	-1.40	541	0.01	0.68	896.05	87	78	57
1426	-1.40	540	0.01	0.52	896.99	88	78	59
1428	-1.40	540	0.01	0.52	897.83	90	79	60
1430	-1.40	539	0.01	0.60	898.66	92	80	64
1432	-1.40	534	0.01	0.44	899.54	92	81	64
1434	-1.40	503	0.00	0.34	900.34	92	82	62
1436	-1.40	492	0.00	0.34	901.03	93	83	56
1438	-1.40	481	0.00	0.17	901.74	92	84	51
1440	-1.40	465	0.00	0.17	902.28	92	84	51
FINAL DRY GAS VOLUME					902.74			

PORT # 2

1446	-1.40	485	0.01	0.44	902.74	94	86	44
1448	-1.40	543	0.01	0.44	903.58	98	87	44
1450	-1.40	555	0.00	0.34	904.34	99	88	46
1452	-1.40	551	0.00	0.26	905.05	99	89	46
1454	-1.40	536	0.00	0.26	905.65	98	90	48
1456	-1.40	538	0.01	0.44	906.25	102	92	47
1458	-1.40	539	0.01	0.44	907.02	104	92	46
1500	-1.40	525	0.01	0.44	907.79	105	94	51
1502	-1.40	525	0.01	0.52	908.56	108	95	49
1504	-1.40	513	0.00	0.34	909.39	107	96	49
1506	-1.40	500	0.00	0.26	910.11	105	97	49
1508	-1.40	429	0.00	0.26	910.71	105	97	48
FINAL DRY GAS VOLUME					911.33			

PORT # 3

1514	-1.40	530	0.01	0.68	911.33	103	100	46
1516	-1.40	542	0.01	0.68	912.32	109	99	49
1518	-1.40	545	0.01	0.84	913.32	112	100	53
1520	-1.40	551	0.01	0.76	914.37	113	100	53
1522	-1.40	542	0.01	0.42	915.39	111	101	54
1524	-1.40	535	0.01	0.42	916.18	111	101	53
1526	-1.40	533	0.01	0.42	916.95	111	102	51
1528	-1.40	528	0.00	0.26	917.70	109	103	53

511001



Environmental Services Division

1250 Highland Road 53

Baton Rouge, Louisiana 70803

1530	-1.40	521	0.00	0.26	918.31	109
1532	-1.40	502	0.01	0.42	918.94	111
1534	-1.40	481	0.00	0.34	919.70	111
1536	-1.40	465	0.00	0.34	920.39	111
FINAL DRY GAS VOLUME					921.08	

103	51
104	51
104	51

PORT # 4

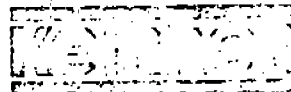
1544	-1.40	519	0.01	0.42	921.08	105	104	49
1546	-1.40	552	0.01	0.42	921.88	108	103	48
1548	-1.40	549	0.01	0.42	922.68	109	104	51
1550	-1.40	559	0.00	0.34	923.45	109	104	52
1552	-1.40	562	0.01	0.42	924.15	110	103	51
1554	-1.40	544	0.01	0.52	924.93	112	104	49
1556	-1.40	541	0.01	0.52	925.80	114	104	48
1558	-1.40	532	0.01	0.52	926.65	114	105	51
1600	-1.40	536	0.00	0.34	927.50	112	104	55
1602	-1.40	520	0.00	0.34	928.23	112	105	54
1604	-1.40	491	0.00	0.26	928.90	110	105	54
1606	-1.40	485	0.00	0.26	929.52	110	105	54
FINAL DRY GAS VOLUME					930.13			

AVG OPIFICE DROP (IN H2O) : 0.44
 TEMP OF METER (DEGREES R) : 558.6
 AVG. STATIC STK PRESS (IN H2O) : -1.4
 AVG STACK PRESSURE (IN HG.) : 29.827
 TOTAL SAMPLING TIME THIS SAMPLE : 96
 AVG TEMP OF STK GAS (DEGREES R) : 983.8
 AVG VELOCITY HEAD (IN H2O) : 4.90000E-03
 AVG VELOCITY (FPS) : 5.54
 DIAMETER OF STACK (IN.) : 194.04
 CROSS-SECT AREA OF STACK (SF) : 205.35
 VOLUMETRIC FLOW OF STK (DSCF/HR) : 1842315

CONC. OF FILT. PART. IN STK (GF/DSCF) : 0.0152
 CONC. OF FILT. PART. IN STK (G/DSCF) : 2.17491E-06
 #/HP OF FILT. PART (DRY BASIS) : 4.0068

ISOKINETIC VARIATION (%) : 99.82

511002



Environmental Services Division

10550 Highland Road
Baton Rouge, Louisiana 70808

EMISSION TESTING FOR UNITED STATES STEEL

RESULTS

SAMPLING METHOD : 1
 RUN NUMBER : 1
 UNIT DESCRIPTION : #15 BATTERY UNDEFFIPE

PHYSICAL CONSTANTS OF STACK

DATE OF SAMPLING	103179
TEMPERATURE OF STACK (F)	983.8
VELOCITY OF STACK GAS (FPS)	5.54
CROSS-SECTIONAL AREA OF STACK (SF)	205.35
VOLUME FLOW (DSCFH)	1842315
STATIC PRESSURE (INCHES OF H ₂ O)	-1.4
MOISTURE CONTENT (% VOLUME)	16
MOLECULAR WEIGHT OF STACK GAS (#/#-MOLE, DRY)	29.27
DYNAMIC RATIO (M)	99.82
FILTERABLE PARTICULATE EMISSION RATE (#/HOUR)	4.0068
FILTERABLE PARTICULATE CONCENTRATION (GR/DSCFH)	0.0152

511003

Environmental Services Division
16550 Highland Road
Baton Rouge, Louisiana 70808

STACK SAMPLING DATA REDUCTION
FOR REFERENCE METHOD 5

UNITED STATES STEEL
GARY, INDIANA
#15 BATTERY UNDEFFIRE

OPERATORS : LARIMORE - MEYER
DATE OF THIS SAMPLE : 110179
TODAY'S DATE : 112679
RUN # : 2
FILE NAME : USTell
AMBIENT TEMPERATURE (DEG F) : 59
BAROMETRIC PRESS. (IN. HG.) : 29.94

GAS ANALYSIS AT SAMPLING POINT
(DRY BASIS)

% CARBON DIOXIDE : 6.2
% CARBON MONOXIDE : 0
% OXYGEN : 7.8
% NITROGEN : 86
MOLECULAR WEIGHT (DRY) : 29.3
% MOISTURE THIS RUN : 13.02
% MOIST. @ SATURATION : 100

MLS OF H2O IN IMPINGERS : 115
WT INCREASE OF SILICA GEL(G) : 11.1
VOLUME OF GAS SAMPLE (DSCF) : 39.86

FILTEPALE PARTICULATE

WEIGHT INCREASE OF FILTER(GRM) : 0.01431
PROBE RESIDUE(GM) : 0.0248
TOTAL MASS OF PROBE SAMPLE(GM) : 100
BLANK RESIDUE(GM) : 9.20000E-04
TOTAL MASS OF BLANK(GM) : 100
PROBE CATCH : 0.02388
FILTER CATCH : 0.01431

PROBE LENGTH (IN) : 96
NOZZLE DIAMETER (IN.) : 0.67
DRY GAS METER CORRECTION FACTOR : 1.001
PITOT TUBE CALIB. COEF. : 0.84

511004

Environmental Services Division

14550 Highland Road, N.W.
Baton Rouge, Louisiana 70802

CLOCK TIME (H.M)	STATIC PRESS (IN H ₂ O)	STACK TEMP (F)	VELOCITY HEAD (IN H ₂ O)	ORIFICE PRES DROP (IN H ₂ O)	DRY GAS VOLUME (F ³)	TEMP INLET (F)	TEMP OUTLET (F)	TEMP IMP (F)
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PORT # 1

830	-1.50	502	0.01	0.76	930.35	58	55	30
832	-1.50	530	0.01	0.76	931.33	62	53	29
834	-1.50	542	0.01	0.68	932.30	64	56	29
836	-1.50	544	0.01	0.68	933.20	67	56	29
838	-1.50	543	0.01	0.84	934.13	70	57	28
840	-1.50	547	0.01	0.84	935.13	72	58	28
842	-1.50	546	0.01	0.76	936.12	73	59	28
844	-1.50	542	0.01	0.76	937.09	75	59	29
846	-1.50	529	0.01	0.60	938.05	77	62	29
848	-1.50	492	0.01	0.42	938.94	76	63	29
850	-1.50	465	0.00	0.26	934.69	74	64	30
852	-1.50	460	0.00	0.26	940.30	75	64	30

FINAL DRY GAS VOLUME 940.88

PORT # 2

900	-1.50	526	0.01	0.68	940.88	75	67	29
902	-1.50	538	0.01	0.84	941.85	81	69	29
904	-1.50	540	0.01	0.84	942.85	84	69	29
906	-1.50	543	0.01	0.84	943.88	86	71	30
908	-1.50	544	0.01	0.84	944.92	88	72	30
910	-1.50	544	0.01	0.92	945.95	90	73	30
912	-1.50	545	0.01	0.92	947.05	92	75	33
914	-1.50	547	0.01	0.84	948.14	93	75	33
916	-1.50	542	0.01	0.84	949.18	93	77	33
918	-1.50	518	0.01	0.76	950.20	95	77	34
920	-1.50	492	0.00	0.26	951.20	94	78	34
922	-1.50	481	0.00	0.17	951.82	94	78	34

FINAL DRY GAS VOLUME 952.30

PORT # 3

930	-1.50	495	0.00	0.34	952.30	84	83	31
932	-1.50	517	0.00	0.34	952.99	87	81	31
934	-1.50	537	0.00	0.34	953.65	88	82	31
936	-1.50	541	0.01	0.42	954.34	92	82	30
938	-1.50	544	0.00	0.34	955.09	92	83	30
940	-1.50	543	0.00	0.34	955.15	92	83	30
942	-1.50	538	0.01	0.42	956.43	94	84	29
944	-1.50	530	0.01	0.42	957.18	95	84	29

511005

946	-1.50	515	0.00	0.34	957.94	95
948	-1.50	471	0.00	0.26	958.62	94
950	-1.50	461	0.00	0.26	959.23	94
952	-1.50	450	0.00	0.26	959.82	94
FINAL DRY GAS VOLUME					960.42	

Environmental Services Division
 16552 Highland Road
 Baton Rouge, Louisiana 70804

85	28
86	28
87	28

PORT # 4

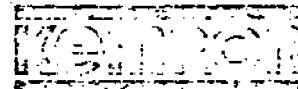
1000	-1.50	491	0.01	0.68	960.42	91	87	26
1002	-1.50	496	0.01	0.68	961.38	96	89	26
1004	-1.50	504	0.01	0.76	962.33	99	88	28
1006	-1.50	505	0.01	0.76	963.33	100	89	29
1008	-1.50	506	0.01	0.68	964.33	100	88	29
1010	-1.50	500	0.01	0.76	965.29	101	89	29
1012	-1.50	488	0.01	0.60	966.29	101	89	30
1014	-1.50	473	0.01	0.60	967.20	102	90	30
1016	-1.50	455	0.01	0.50	968.12	102	89	31
1018	-1.50	458	0.01	0.50	968.95	102	90	31
1020	-1.50	450	0.00	0.34	969.78	100	90	32
1022	-1.50	448	0.00	0.34	970.48	100	91	32
FINAL DRY GAS VOLUME					971.16			

AVG ORIFICE DROP (IN H2O) : 0.576
 TEMP OF METER (DEGFEES R) : 541.9
 AVG. STATIC STK PRESS (IN H2O) : -1.5
 AVG STACK PRESSURE (IN HG.) : 29.829
 TOTAL SAMPLING TIME THIS SAMPLE : 96
 AVG TEMP OF STK GAS (DEGFEES R) : 970.7
 AVG VELOCITY HEAD (IN H2O) : 6.50000E-03
 AVG VELOCITY (FPS) : 6.26
 DIAMETER OF STACK (IN.) : 194.01
 CROSS-SECT AREA OF STACK (SF) : 205.29
 VOLUMETRIC FLOW OF STK (DSCF/HR): 2184253

CONC. OF FILT. PART. IN STK (GR/DSCF) : 0.0147
 CONC. OF FILT. PART. IN STK (#/DSCF) : 2.11220E-06
 #/HR OF FILT. PART (DRY BASIS) : 4.6135

ISOKINETIC VARIATION (%) : 95.69

511006



Environmental Services Division

16550 Highland Road
Baton Rouge, Louisiana 70808EMISSION TESTING
FOR
UNITED STATES STEELRESULTSSAMPLING METHOD : 1
RUN NUMBER : 2
UNIT DESCRIPTION : #15 BATTERY UNDERFIREPHYSICAL CONSTANTS
OF
STACKDATE OF SAMPLING 110179
TEMPERATURE OF STACK (F) 970.7
VELOCITY OF STACK GAS (FPS) 6.26
CROSS-SECTIONAL AREA OF STACK (SF) 205.29
VOLUMETRIC FLOW (DSCFH) 2184253
STATIC PRESSURE (INCHES OF H2O) -1.5
MOISTURE CONTENT (% VOLUME) 13.02
MOLECULAR WEIGHT OF STACK GAS (#/#-MOLE, DRY) 29.3
ISOKINETIC RATIO (%) 95.69
FILTERABLE PARTICULATE EMISSION RATE (#/HOUR) 4.6135
FILTERABLE PARTICULATE CONCENTRATION (GR/DSCF) 0.0147

511007



Environmental Services Division

16550 Highland Road
Baton Rouge, Louisiana 70806STACK SAMPLING DATA REDUCTION
FOR REFERENCE METHOD 5UNITED STATES STEEL
GARY, INDIANA
#15 BATTERY UNDERFIRE

OPERATORS	:	LARIMORE - MEYER
DATE OF THIS SAMPLE	:	110179
TODAY'S DATE	:	112679
RUN #	:	3
FILE NAME	:	USTE12
AMBIENT TEMPERATURE (DEG F)	:	51
BAROMETRIC PRESS. (IN. HG.)	:	29.94

GAS ANALYSIS AT SAMPLING POINT
(DRY BASIS)

% CARBON DIOXIDE	:	5.6
% CARBON MONOXIDE	:	0
% OXYGEN	:	9.2
% NITROGEN	:	85.2
MOLECULAR WEIGHT (DRY)	:	29.26
% MOISTURE THIS RUN	:	13.74
% MOIST. @ SATURATION	:	100

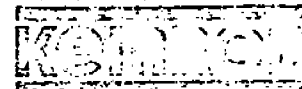
# MLS OF H2O IN IMPINGERS	:	131
WT INCREASE OF SILICA GEL (G)	:	9.9
VOLUME OF GAS SAMPLE (DSCF)	:	41.73

FILTERABLE PARTICULATE

WEIGHT INCREASE OF FILTER (GRM)	:	0.01131
PROBE RESIDUE (GM)	:	0.0108
TOTAL MASS OF PROBE SAMPLE (GM)	:	100
BLANK RESIDUE (GM)	:	9.20000E-04
TOTAL MASS OF BLANK (GM)	:	100
PROBE CATCH	:	9.88000E-03
FILTER CATCH	:	0.01131

PROBE LENGTH (IN)	:	96
NOZZLE DIAMETER (IN.)	:	0.67
DRY GAS METER CORRECTION FACTOR	:	1.001
PITOT TUBE CALIB. COEF.	:	0.84

511008



Environmental Services Division

16550 Highland Road
Baton Rouge, Louisiana 70808

CLOCK TIME (H.M)	STATIC PRESS (IN H2O)	STACK TEMP (F)	VELOCITY HEAD (IN H2O)	ORIFICE PRES DROP (IN H2O)	DRY GAS VOLUME (F ³)	TEMP INLET (F)	TEMP OUTLET (F)	TEMP IMP (F)
------------------------	-----------------------------	----------------------	------------------------------	----------------------------------	--	----------------------	-----------------------	--------------------

PORT # 1

1310	-1.50	483	0.01	0.50	971.70	60	58	43
1312	-1.50	523	0.01	0.84	972.52	66	59	40
1314	-1.50	528	0.01	1.10	973.49	69	59	38
1316	-1.50	528	0.01	0.84	974.63	71	60	37
1318	-1.50	529	0.01	0.84	975.64	73	60	36
1320	-1.50	530	0.01	0.84	976.66	75	61	36
1322	-1.50	521	0.01	0.84	977.70	77	62	34
1324	-1.50	514	0.01	0.50	978.73	78	62	35
1326	-1.50	523	0.01	0.42	979.55	76	64	36
1328	-1.50	498	0.00	0.25	980.29	75	65	36
1330	-1.50	471	0.00	0.25	980.89	75	66	36
1332	-1.50	471	0.00	0.25	981.47	76	66	36

FINAL DRY GAS VOLUME

982.05

PORT # 2

1340	-1.50	525	0.01	0.84	982.05	78	69	32
1342	-1.50	544	0.01	0.84	983.13	82	69	32
1344	-1.50	547	0.01	0.84	984.15	85	70	32
1346	-1.50	550	0.01	0.84	985.19	87	71	33
1348	-1.50	553	0.01	0.92	986.21	89	72	33
1350	-1.50	554	0.01	0.84	987.28	90	73	34
1352	-1.50	529	0.01	0.76	988.33	90	74	34
1354	-1.50	522	0.01	0.68	989.31	91	75	34
1356	-1.50	518	0.01	0.68	990.25	92	76	33
1358	-1.50	506	0.01	0.58	991.18	92	76	34
1400	-1.50	500	0.00	0.34	992.05	92	76	34
1402	-1.50	491	0.00	0.34	992.75	92	77	35

FINAL DRY GAS VOLUME

993.44

PORT # 3

1410	-1.50	517	0.01	0.74	993.44	87	79	36
1412	-1.50	525	0.01	0.74	994.44	90	80	34
1414	-1.50	526	0.01	0.84	995.40	93	79	33
1416	-1.50	528	0.01	0.74	996.44	94	80	34
1418	-1.50	527	0.01	0.66	997.40	95	81	34
1420	-1.50	523	0.01	0.66	998.33	96	82	35
1422	-1.50	522	0.01	0.66	999.25	97	82	35
1424	-1.50	511	0.01	0.58	1000.19	97	82	35

Environmental Services Division

16550 Highland Road
Baton Rouge, Louisiana 70808

1426	-1.50	498	0.01	0.58	1001.07	98	84	35
1428	-1.50	471	0.01	0.58	1001.95	99	84	35
1430	-1.50	455	0.01	0.42	1002.83	97	85	35
1432	-1.50	450	0.01	0.42	1003.60	97	85	35

FINAL DRY GAS VOLUME 1004.37

PORT # 4

1438	-1.50	499	0.01	0.74	1004.37	92	86	38
1440	-1.50	531	0.01	0.74	1005.38	96	86	38
1442	-1.50	535	0.01	0.68	1006.37	97	86	38
1444	-1.50	536	0.01	0.68	1007.30	98	87	37
1446	-1.50	540	0.01	0.68	1008.25	100	86	37
1448	-1.50	538	0.01	0.58	1009.18	100	88	37
1450	-1.50	528	0.01	0.58	1010.03	101	88	37
1452	-1.50	513	0.01	0.42	1010.94	99	89	37
1454	-1.50	496	0.01	0.42	1011.69	100	89	38
1456	-1.50	487	0.00	0.34	1012.46	99	90	38
1458	-1.50	480	0.00	0.34	1013.15	99	90	38
1500	-1.50	476	0.00	0.25	1013.25	99	90	38

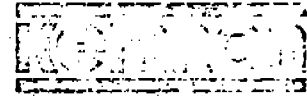
FINAL DRY GAS VOLUME 1014.45

AVG ORIFICE DROP (IN H2O) : 0.6258
 TEMP OF METER (DEGREES F) : 542.3
 AVG. STATIC STK PRESS (IN H2O) : -1.5
 AVG STACK PRESSURE (IN HG.) : 29.829
 TOTAL SAMPLING TIME THIS SAMPLE : 96
 AVG TEMP OF STK GAS (DEGREES R) : 973.9
 AVG VELOCITY HEAD (IN H2O) : 7.20000E-03
 AVG VELOCITY (FPS) : 6.63
 DIAMETER OF STACK (IN.) : 194.04
 CROSS-SECT AREA OF STACK (SF) : 205.35
 VOLUMETRIC FLOW OF STK (DSCF/HR) : 2286791

CONC. OF FILT. PART. IN STK (GR/DSCF) : 7.80000E-03
 CONC. OF FILT. PART. IN STK (#/DSCF) : 1.11959E-06
 #/HR OF FILT. PART (DRY BASIS) : 2.5602

ISOKINETIC VARIATION (%) : 95.7

511010



Environmental Services Division
16550 Highland Road
Baton Rouge, Louisiana 70808

EMISSION TESTING
FOR
UNITED STATES STEEL

RESULTS

SAMPLING METHOD : 1
RUN NUMBER : 3
UNIT DESCRIPTION : #15 BATTERY UNDERFIRE

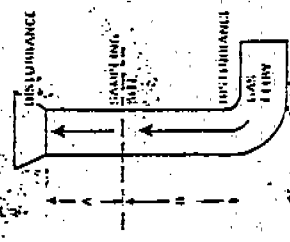
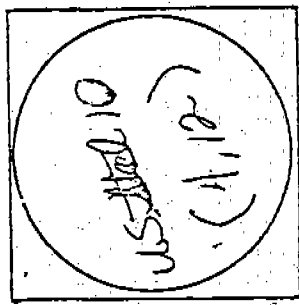
PHYSICAL CONSTANTS
OF
STACK

DATE OF SAMPLING	110179
TEMPERATURE OF STACK (R)	973.9
VELOCITY OF STACK GAS (FPS)	6.63
CROSS-SECTIONAL AREA OF STACK (SF)	205.35
VOLUMETRIC FLOW (DSCFH)	2286791
STATIC PRESSURE (INCHES OF H2O)	-1.5
MOISTURE CONTENT (% VOLUME)	13.74
MOLECULAR WEIGHT OF STACK GAS (#/#-MOLE, DRY)	29.26
ISOKINETIC RATIO (%)	95.7
FILTERABLE PARTICULATE EMISSION RATE (#/HOUR)	2.5602
FILTERABLE PARTICULATE CONCENTRATION (GR/DSCF)	7.80000E-03

511011

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



Sp = 184
Y = 1.001

CROSS SECTION

PLANT U.S. Steel
DATE 10-31-79
LOCATION Cape Fear, Del.
OPERATOR Lacimpert-Meyce
STACK NO. 11-15 Battery
RUN NO. #1 Port

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg
SAMPLE FILTER PROBE WASH
FINAL WEIGHT
TARE WEIGHT
WEIGHT GAIN
TOTAL

PROBE HEATER SETTING
HEATER BOX SETTING

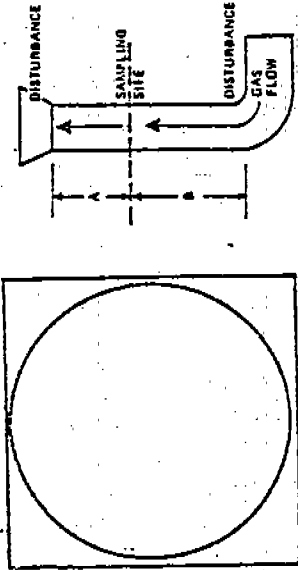
SAMPLE BOX NO.
METER BOX NO. 4812

TRAVERSE POINT NUMBER	SAMPLING TIME (s), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (ΔP), (in. H ₂ O)	DIFFERENTIAL PRESSURE ACROSS ORIFICE METER (in. H ₂ O)	GAS SAMPLE VOLUME (V _{std}), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (T _{m,in}), °F	GAS SAMPLE TEMPERATURE OUTLET (T _{m,out}), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY f/s
1	14.18	-1.4	505	.008	.089	893.10	79	77	224	57	3	
2	14.20		555	.01	.184	894.05	83	78	228	57	4	
3	14.22		547	.009	.075	895.08	86	78	230	56	4	
4	14.24		541	.008	.089	896.05	87	78	227	57	3	
5	14.26		540	.006	.077	896.19	88	78	225	59	3	
6	14.28		540	.006	.077	897.83	90	79	240	60	3	
7	14.30		539	.007	.084	898.66	92	80	228	64	3	
8	14.32		534	.005	.071	899.34	92	81	231	64	3	
9	14.34		503	.004	.063	900.34	92	82	226	62	2	
10	14.26		492	.004	.063	901.03	93	83	226	56	2	
11	14.38		481	.002	.045	901.74	92	84	225	51	2	
12	14.10		465	.002	.045	902.28	92	84	230	51	2	
1	14.16		485	.005	.071	902.74	94	86	272	44	3	
2	14.18		547	.005	.071	902.74	98	87	274	44	3	
TOTAL						903.58						
AVERAGE												

VOLUME OF LIQUID WATER COLLECTED		IMPINGER VOLUME ml		SILICA GEL WEIGHT, g		ORSAT READING, %		TIME		CO, O, CO ₂		H ₂	
1	2135	6322	4384										
2	562	463	4183										
3	1172	1694	16										
TOTAL	3869	1094	16										
FINAL													
DETAIL													
LIQUID COLLECTED													
TOTAL LIQUID COLLECTED													

COMMENTS
0300
96 min

PARTICULATE FILTER DATA



SCHEMATIC OF STACK

PLANT U.S. Steel
 DATE 10-31-79
 LOCATION Gray Edd.
 OPERATOR Laboratory - Meyer
 STACK NO. 11-15 Bailey
 RUN NO. 41 Part.
 SAMPLE BOX NO. _____
 METER BOX NO. _____
 HEATER BOX SETTING _____

AMBIENT TEMPERATURE _____
 BAROMETRIC PRESSURE _____
 ASSUMED MOISTURE, % _____
 PROBE LENGTH, in. _____
 NOZZLE DIAMETER, in. _____
 STACK DIAMETER, in. _____
 PROBE HEATER SETTING _____

WEIGHT OF PARTICULATE COLLECTED, mg			
SAMPLE	FILTER	PRONE	WASH
FINAL WEIGHT			
TARE WEIGHT			
WEIGHT GAIN			

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (n), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY (AP _s) (VAP _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔP) in. H ₂ O	GAS SAMPLE VOLUME (V _m), (l)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY lps
							INLET (T _{m in}), °F	OUTLET (T _{m out}), °F				
3	1450		555	1007	15.3	904.34	99	88	271	46	2	
4	1452		551	1003	15.5	905.05	99	89	279	46	2	
5	1454		536	1003	15.5	905.65	98	90	258	48	2	
6	1456		538	1005	14.4	906.25	102	92	268	47	3	
7	1458		539	1005	14.4	907.02	104	92	276	46	3	
8	1500		525	1005	14.4	907.79	105	94	233	51	3	
9	1502		521	1006	15.2	908.56	108	95	253	49	3	
10	1504		513	1004	13.4	909.39	107	96	261	49	2	
11	1506		500	1003	12.6	910.11	105	97	266	49	2	
12	1508		429	1003	12.6	910.71	105	97	321	48	2	
1	1514		530	1008	16.8	911.33						
2	1516		1542	1008	16.8	912.32	103	100	280	46	3	
3	1518		545	101	18.4	913.32	109	99	251	49	3	
4	1520		551	1009	17.6	914.37	112	100	221	53	3	
TOTAL				1009	17.6		113	100	222	50	3	

AVERAGE

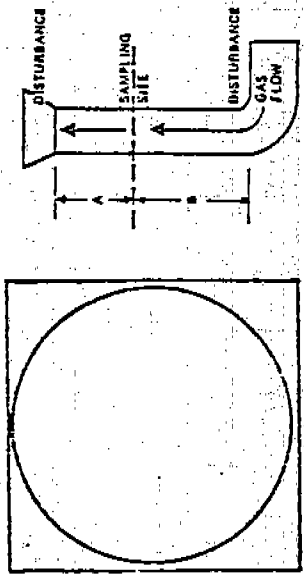
511013

VOLUME OF LIQUID WATER COLLECTED		IMPINGER VOLUME ml		SILICA GEL WEIGHT, g	
1	2	3	4		
FINAL					
INITIAL					
WEIGHT COLLECTED					

COMMENTS:

ORSAT MEASUREMENT		TIME		CO ₂		O ₂		CO		N ₂	
1	2	3	4								

SCHEMATIC OF STACK



CROSS SECTION

PLANT US, steel

AMBIENT TEMPERATURE _____

METER AND _____

DATE 10-31-79

BAROMETRIC PRESSURE _____

C FACTOR _____

LOCATION _____

PROCESS WEIGHT RATE _____

OPERATOR LArimore

PROBE LENGTH, in. _____

STACK NO. #15 - Battery

NOZZLE DIAMETER, in. _____

RUN NO. #1 Prod

STACK DIAMETER, in. _____

SAMPLE BOX NO. _____

PROBE HEATER SETTING _____

METER BOX NO. _____

HEATER BOX SETTING _____

TRAVERSE POINT NUMBER	SAMPLING TIME (t), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY (AP _s) (√AP _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔP) in. H ₂ O	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
							INLET (T _{m, in}), °F	OUTLET (T _{m, out}), °F				
5	15.22		542	.005	.071	915.39	111	101	226	54	2	
6	15.24		535	.005	.071	916.18	111	101	231	53	2	
7	15.26		533	.005	.071	916.95	111	102	236	51	2	
8	15.28		528	.003	.055	917.70	109	103	230	53	2	
9	15.30		521	.003	.055	918.31	109	103	228	53	2	
10	15.32		502	.005	.071	918.74	111	103	229	51	2	
11	15.34		481	.004	.063	919.20	111	104	225	51	2	
12	15.36		465	.004	.063	920.39	111	104	227	51	2	
1	15.44		519	.005	.071	921.08	105	104	262	49	3	
2	15.46		552	.005	.071	921.88	108	103	276	48	3	
3	15.48		549	.005	.071	922.68	109	104	239	51	3	
4	15.50		539	.004	.063	923.45	109	104	252	52	3	
5	15.52		562	.005	.071	924.15	110	103	268	51	3	
6	15.54		544	.006	.071	924.93	112	104	267	49	3	
TOTAL												
AVERAGE												

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml				SILICA GEL WEIGHT, g
	1	2	3	4	
5					
11					
10					
1					
4					
TOTAL VOLUME COLLECTED					

CURRENTS:

ORSAT MEASUREMENT	TIME				CO ₂ O ₂ CO N ₂			
	1	2	3	4				
1								
2								
3								
4								

CCCCC

100

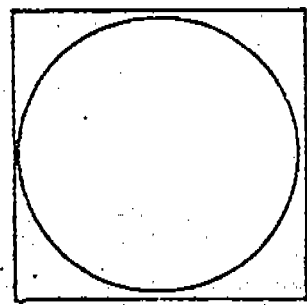
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AVERAGE

VOLUME OF LIQUID WATER COLLECTED		IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	ORSAT MEASUREMENT				TIME	CO ₂	O ₂	CO	H ₂
1	2	3	4												
FINAL											1				
INITIAL											2				
LIQUOR COLLECTED											3				
TOTAL VOLUME COLLECTED											4				

COMMENTS:

U.S. Steel

#15 Battery Underfire

#1 PART.



Isokinetic Field Calculations

Ts (°R) <u>984</u>	Vm <u>37.03</u>	δ <u>1.001</u>	CO ₂ <u>.057</u>
Tm (°R) <u>599</u>	Vw <u>142.0</u>	Cp <u>.84</u>	O ₂ <u>.090</u>
Ps ("Hg) <u>29.83</u>	Pb <u>29.93</u>	θ <u>96</u>	CO <u>0</u>
Pm ("Hg) <u>29.96</u>	(ΔP) ^{1/2} <u>.0695</u>	An <u>.00245</u>	N ₂ <u>.853</u>

$$V_{m_{std}} = (17.64)(\delta)(V_m) \left(\frac{P_m}{P_s} \right)^{\frac{T_m}{T_s}} = (17.64)(37.03)(1.001) \left(\frac{29.96}{29.83} \right)^{\frac{599}{984}} = \underline{35.04}$$

$$V_{w_{std}} = (0.04707)(V_w) = (0.04707)(142.0) = \underline{6.684}$$

$$ZH_2O = V_{w_{std}} / V_{m_{std}} + V_{w_{std}} = (6.684) / (35.04) + (6.684) = \underline{.160}$$

$$DGF = 1 - ZH_2O = 1 - (.160) = \underline{.840}$$

$$M_w = [(44)(CO_2)(DGF) + (32)(O_2)(DGF) + (28)(CO)(DGF) + (28)(N_2)(DGF) + (18)(ZH_2O)] =$$

$$[(44)(.057)(.840) + (32)(.090)(.840) + (28)(.853)(.840) + (28)(0)(.840) + (18)(.160)] = \underline{27.47}$$

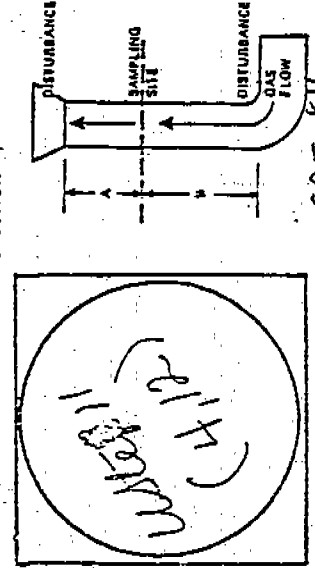
$$V_s = (85.49)(C_p)(\Delta P)^{\frac{1}{2}} \left[\frac{T_s}{M_w P_s} \right]^{\frac{1}{2}} = (85.49)(.84) \left(\frac{.0695}{27.47} \right)^{\frac{1}{2}} \left[\frac{(984)}{(27.47)(29.83)} \right]^{\frac{1}{2}} = \underline{5.47}$$

$$ZI = \frac{(0.0945)(V_{m_{std}})(T_s)}{(P_s)(V_s)(An)(\theta)(DGF)} = \frac{(0.0945)(35.04)(984)}{(29.83)(5.47)(.00245)(96)(.840)} = \underline{101.07}$$

511016

PARTIAL FIELD DATA

SCHEMATIC OF STACK



CROSS SECTION

$\rho = 0.84$
 $\mu = 1.001$

PLANT U.S. Steel
 DATE 11-1-79
 LOCATION GARY, Ind.
 OPERATOR Larimore & McPhee
 STACK NO. #15 Battery Unit
 RUN NO. #12 part
 SAMPLE BOX NO. _____
 METER BOX NO. 481
 AMBIENT TEMPERATURE 57
 BAROMETRIC PRESSURE 29.94
 ASSUMED MOISTURE, % 15.0
 PROBE LENGTH, in. 96
 NOZZLE DIAMETER, in. .670
 STACK DIAMETER, in. 186
 PROBE HEATER SETTING _____
 HEATER BOX SETTING _____

METER AM, 1774
 C FACTOR 84

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg			
SAMPLE	FILTER	PROBE WASH	
FINAL WEIGHT			
TARE WEIGHT			
WEIGHT GAIN			
TOTAL			

TRAVERSE POINT NUMBER	SAMPLING TIME (H), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (AP _s) (√AP _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (T _{m in}), °F	OUTLET (T _{m out}), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fpm
1	8.30	-1.5	502	.009	.76	930.35	58	55	217	30	4	
2	8.32		530	.009	.76	931.33	62	56	225	29	4	
3	8.34		542	.008	.68	932.30	64	56	228	29	4	
4	8.36		544	.008	.68	933.20	67	56	228	29	4	
5	8.38		546	.01	.84	934.13	70	57	226	28	4	
6	8.40		547	.01	.84	935.13	72	58	225	28	4	
7	8.42		546	.009	.76	936.12	73	59	229	28	4	
8	8.44		542	.009	.76	937.09	75	59	232	29	4	
9	8.46		529	.007	.60	938.05	77	62	235	29	4	
10	8.48		492	.005	.42	938.94	76	63	238	30	3	
11	8.50		465	.003	.26	939.69	74	64	240	30	2	
12	8.52		460	.003	.26	940.50	75	64	241	30	2	
TOTAL												
AVERAGE												

VOLUME OF LIQUID WATER COLLECTED		IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	
FINAL	INITIAL	1	2	3	4		
51101	51101	62.5	62.5	62.5	62.5	62.5	62.5
		61.8	61.8	61.8	61.8	61.8	61.8
		60.3	60.3	60.3	60.3	60.3	60.3
		115.7	115.7	115.7	115.7	115.7	115.7

COMMENTS:

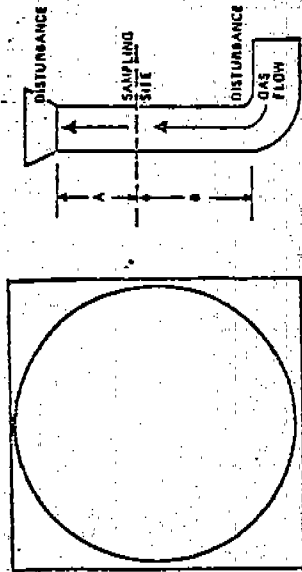
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72

SCHEMATIC OF STACK



CROSS SECTION

PLANT

U.S. Steel

DATE 11-1-79

LOCATION Gary, Ind.

OPERATOR Lapierre & Hayes

STACK NO. H-15 Battery

RUN NO. H-2 Post

SAMPLE BOX NO.

METER BOX NO.

AMBIENT TEMPERATURE

BAROMETRIC PRESSURE

ASSUMED MOISTURE, %

PROBE LENGTH, in.

NOZZLE DIAMETER, in.

STACK DIAMETER, in.

PROBE HEATER SETTING

HEATER BOX SETTING

METER ΔH_0

C FACTOR

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		

TOTAL

TRAVERSE POINT NUMBER	SAMPLING TIME (n), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (AP), (√AP) ²	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔP) in. H ₂ O	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY f/s
1	960	-1.5	526	.008	.84	940.88	INLET (T _{m, in}), °F	OUTLET (T _{m, out}), °F	233	29	4	
2	902		538	.01	.84	941.85	81	69	237	29	5	
3	904		540	.01	.84	942.85	84	69	243	29	5	
4	905		543	.01	.84	943.88	86	71	241	30	5	
5	908		544	.01	.84	944.92	88	72	243	30	5	
6	910		544	.011	.92	945.95	90	73	244	30	5	
7	912		545	.011	.92	947.05	92	75	245	33	5	
8	917		547	.01	.84	948.14	93	75	245	33	5	
9	916		542	.01	.84	949.18	93	77	248	33	5	
10	916		518	.009	.76	950.20	95	77	251	34	4	
11	920		492	.003	.26	956.20	94	78	248	34	3	
12	922		481	.002	.17	951.82	94	78	246	34	3	
						952.30						
TOTAL												
AVERAGE												

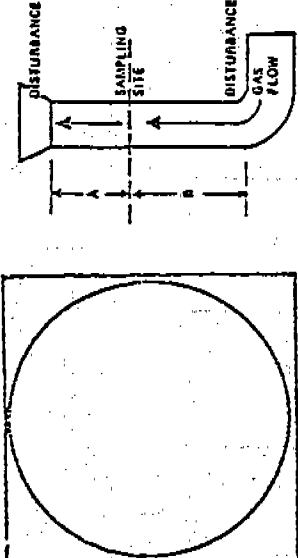
COMMENTS:

VOLUME OF LIQUID WATER COLLECTED		IMPINGER VOLUME ml				SILICA GEL WEIGHT, g	
1	2	3	4	5	6	7	8
FINAL							
INITIAL							
100% COLLECTED							
100% COLLECTED							

ORSAT MEASUREMENT	TIME	CO ₂	O ₂	CO	N ₂
1					
2					
3					
4					

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



PLANT O.S. Steel DATE 11-1-79
 AMBIENT TEMPERATURE _____
 BAROMETRIC PRESSURE _____
 ASSUMED MOISTURE, % _____
 PROBE LENGTH, in. _____
 NOZZLE DIAMETER, in. _____
 STACK DIAMETER, in. _____
 PROBE HEATER SETTING _____
 HEATER BOX SETTING _____

METER AM _____
 C FACTOR _____

PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg			
SAMPLE	FILTER	PHONE	WASH
FINAL WEIGHT			
TAKE WEIGHT			
WEIGHT GAIN			
TOTAL			

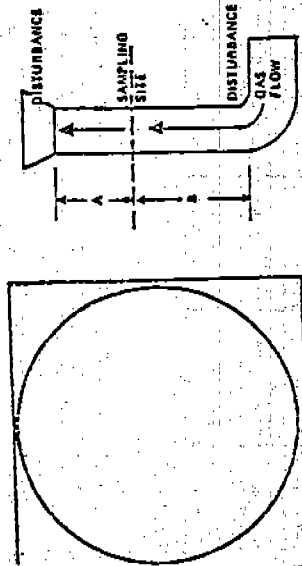
CROSS SECTION

TRAVERSE POINT NUMBER	SAMPLING TIME (M), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (AP ₃) (VAP ₃)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O) ACTUAL DESIRED	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY f/s
1	9.30	-1.5	495	.004	.34	952.30	84	83	257	31	3	
2	9.32		517	.004	.34	952.99	87	81	257	31	3	
3	9.34		537	.004	.34	953.65	88	82	260	31	3	
4	9.36		541	.005	.42	954.34	92	82	261	30	3	
5	9.38		544	.004	.34	955.09	92	83	259	30	3	
6	9.40		543	.004	.34	955.75	92	83	259	30	3	
7	9.42		538	.005	.42	956.43	94	84	257	29	3	
8	9.44		530	.005	.42	957.18	95	84	256	29	3	
9	9.46		515	.004	.34	957.94	95	85	257	28	3	
10	9.48		471	.003	.26	958.62	94	86	258	28	3	
11	9.50		446	.003	.26	959.23	94	86	255	28	3	
11	9.52		450	.002	.26	959.82	94	87	251	28	3	
						960.42						
TOTAL												
AVERAGE												

CORRECTIONS:

VOLUME OF LIQUID WATER COLLECTED		IMPINGER VOLUME ml				SILICA GEL WEIGHT, g		ORSAT MEASUREMENT				TIME			
1	2	3	4	5	6	7	8	CO ₂	O ₂	CO	H ₂	1	2	3	4
FINAL															
INITIAL															
WATER COLLECTED															
TOTAL WATER COLLECTED															

SCHEMATIC OF STACK



CROSS SECTION

METER ΔH_g _____
 C FACTOR _____
 PROCESS WEIGHT RATE _____

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE	FILTER	PROBE WASH
FINAL WEIGHT		
TARE WEIGHT		
WEIGHT GAIN		
TOTAL		

AMBIENT TEMPERATURE _____
 BAROMETRIC PRESSURE _____
 ASSUMED MOISTURE, % _____
 PROBE LENGTH, in. _____
 NOZZLE DIAMETER, in. _____
 STACK DIAMETER, in. _____
 PROBE HEATER SETTING _____
 HEATER BOX SETTING _____

TRAVERSE POINT NUMBER	SAMPLING TIME (a), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (AP ₃) (1/AP ₃)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) (in. H ₂ O)	ACTUAL DESIRED	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fps
1	10.00	-1.5	491	.008	.68		960.42	91	87	262	26	4	
2	10.02		496	.008	.68		961.38	96	89	265	26	4	
3	10.04		504	.009	.76		962.33	99	88	261	28	4	
4	10.06		505	.009	.76		963.33	100	89	260	29	4	
5	10.08		506	.008	.68		964.33	100	88	260	29	4	
6	10.10		500	.009	.76		965.29	101	89	258	29	4	
7	10.12		488	.007	.60		966.29	101	89	258	30	4	
8	10.14		473	.007	.60		967.20	102	90	259	30	4	
9	10.16		455	.006	.50		968.12	102	89	261	31	3	
10	10.18		458	.006	.50		968.95	102	90	263	31	3	
11	10.20		450	.004	.34		969.78	100	90	261	32	3	
12	10.22		448	.004	.34		970.48	100	91	265	32	3	
							971.16						
TOTAL													
AVERAGE													

COMMENTS:

VOLUME OF LIQUID WATER COLLECTED		IMPINGER VOLUME ml		SILICA GEL WEIGHT, g		ORSAT MEASUREMENT		TIME		CO ₂ , O ₂ , CO, N ₂	
1	2	3	4	1	2	3	4	1	2	3	4
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
TOTAL											
AVERAGE											

U.S. Steel

#15 Battery Underfire

#2 PART

Isokinetic Field Calculations

T_s ($^{\circ}R$) <u>971</u>	V_m <u>40.81</u>	δ <u>1.001</u>	CO_2 <u>.062</u>
T_m ($^{\circ}R$) <u>542</u>	V_w <u>126.8</u>	C_p <u>.84</u>	O_2 <u>.078</u>
P_s ("Hg) <u>29.83</u>	P_b <u>29.94</u>	θ <u>96</u>	CO <u>0</u>
P_m ("Hg) <u>29.98</u>	$(\Delta P)^{\frac{1}{2}}$ <u>.0807</u>	An <u>.00245</u>	N_2 <u>.860</u>

$$V_{m_{std}} = (17.64)(\delta)(V_m)\left(\frac{P_m}{P_s}\right)^{\frac{1}{2}}\left(\frac{T_m}{T_s}\right)^{\frac{1}{2}} = (17.64)(1.001)(40.81)(29.98)/(542) = \underline{39.86}$$

$$V_{w_{std}} = (0.04707)(V_w) = (0.04707)(126.8) = \underline{5.968}$$

$$ZH_2O = V_{w_{std}} / V_{m_{std}} + V_{w_{std}} = (5.968) / (39.86) + (5.968) = \underline{.130}$$

$$DGF = 1 - ZH_2O = 1 - (.130) = \underline{.870}$$

$$M_w = [(44)(CO_2)(DGF) + (32)(O_2)(DGF) + (28)(CO)(DGF) + (28)(N_2)(DGF) + (18)(ZH_2O)] =$$

$$[(44)(.062)(.870) + (32)(.078)(.870) + (28)(.860)(.870) + (28)(0)(.870) + (18)(.130)] = \underline{27.83}$$

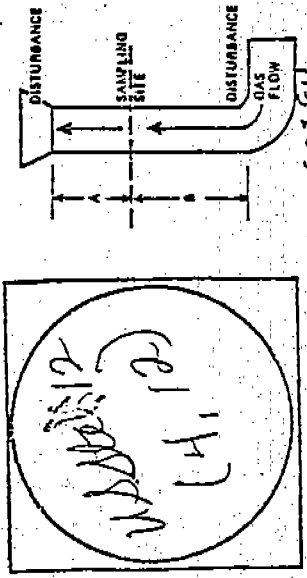
$$V_s = (85.49)(C_p)(\Delta P)^{\frac{1}{2}}\left[\frac{T_s}{M_w P_s}\right]^{\frac{1}{2}} = (85.49)(.84)(.0807)^{\frac{1}{2}}\left[\frac{(971)}{(27.83)(29.83)}\right]^{\frac{1}{2}} = \underline{6.268}$$

$$ZI = \frac{(0.0945)(V_{m_{std}})(T_s)}{(P_s)(V_s)(An)(\theta)(DGF)} = \frac{(0.0945)(39.86)(971)}{(29.83)(6.268)(.00245)(96)(.870)} = \underline{95.60}$$

511021

PARTIAL FIELD DATA

SCHEMATIC OF STACK



PLANT U.S. Steel
DATE 11-1-79
LOCATION Gray, Ind.
OPERATOR Lacina, Mace - Mace
STACK NO. #15 Battery Under S.
RUH NO. #3 Diet
SAMPLE BOX NO. 481
METER BOX NO. 481
PROBE LENGTH, in. 96
NOZZLE DIAMETER, in. 1.670
STACK DIAMETER, in. 188
PROBE HEATER SETTING
HEATER BOX SETTING

METER AN, 1.777
C FACTOR 84
PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg			
SAMPLE	FILTER	PROBE WASH	
FINAL WEIGHT			
TARE WEIGHT			
WEIGHT GAIN			
TOTAL			

TRAVERSE POINT NUMBER	SAMPLING TIME (u), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (ΔP _s) (√AP)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (in. H ₂ O)		GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY f/s
					ACTUAL	DESIRED		INLET (T _m), °F	OUTLET (T _m), °F				
1	13.10	-1.5	483	.006	.50	.150	971.70	60	58	215	43	3	
2	13.12		523	.01	.84	.184	972.52	66	59	223	40	4	
3	13.14		528	.018	.11	.11	973.49	69	54	228	38	5	
4	13.16		528	.01	.84	.184	974.63	71	60	229	32	4	
5	13.18		529	.01	.84	.184	975.64	73	60	230	36	4	
6	13.20		530	.01	.84	.184	976.66	75	61	230	36	4	
7	13.22		521	.01	.84	.184	977.70	77	62	233	34	4	
8	13.24		514	.006	.50	.150	978.73	78	62	234	35	43	
9	13.26		523	.005	.42	.125	979.55	76	64	236	36	3	
10	13.28		498	.003	.25	.125	980.29	75	65	240	36	2	
11	13.30		471	.003	.25	.125	980.89	75	66	244	36	2	
12	13.32		471	.003	.25	.125	981.77	76	66		36	2	
							982.05						
TOTAL													

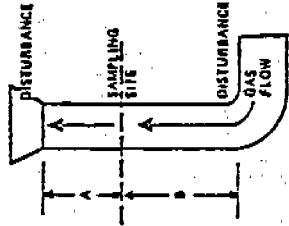
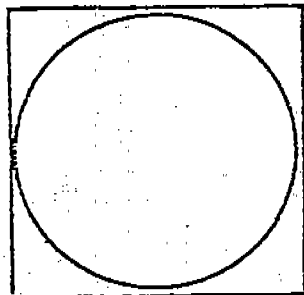
COMMENTS:

IMPINGER VOLUME, ml		SILICA GEL WEIGHT, g		ORSAT MEASUREMENT		TIME		CO ₂		O ₂		CO		N ₂	
1	574.1	13.0		1				5.6	9.2	0					
2	572.2	420.5		2											
3	55.1	2.5		3											
4				4											

0082

9

SCHEMATIC OF STACK



CROSS SECTION

PLANT WABASH STEEL METER AM

DATE 11-1-79 C FACTOR 11

LOCATION Gray Rd PROCESS WEIGHT RATE _____

OPERATOR _____ WEIGHT OF PARTICULATE COLLECTED, mg

STACK NO. #15 Baddeley FINAL WEIGHT _____

RUN NO. #13 Post TARE WEIGHT _____

SAMPLE BOX NO. _____ WEIGHT GAIN _____

METER BOX NO. _____ TOTAL _____

BAROMETRIC PRESSURE _____

ASSUMED MOISTURE, % _____

PROBE LENGTH, in. _____

NOZZLE DIAMETER, in. _____

STACK DIAMETER, in. _____

PROBE HEATER SETTING _____

HEATER BOX SETTING _____

TRAVERSE POINT NUMBER	SAMPLING TIME (s), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY HEAD (AP ₃) (√AP ₃)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔP) in. H ₂ O	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg gauge	VELOCITY fpm
					ACTUAL DESIRED		INLET (T _{m, in}), °F	OUTLET (T _{m, out}), °F				
1	13.40		525	.01	.84	982.05	78	69	230	32	4	
2	13.42		544	.01	.84	983.13	82	69	231	32	4	
3	13.44		547	.01	.84	984.15	85	70	234	32	4	
4	13.46		550	.01	.84	985.19	87	71	239	33	4	
5	13.48		551	.01	.84	986.21	89	72	241	33	4	
6	13.50		554	.01	.84	987.28	90	73	244	33	4	
7	13.52		529	.009	.76	988.33	90	74	250	34	4	
8	13.54		522	.008	.68	989.31	91	75	251	34	4	
9	13.56		518	.008	.68	990.25	92	76	252	33	4	
10	13.58		506	.007	.58	991.18	92	76	255	34	3	
11	14.00		502	.004	.34	992.05	92	76	258	74	2	
12	14.02		491	.004	.34	992.25	92	77	260	55	2	
TOTAL						992.44						
AVERAGE												

COMMENTS:

IMPINGER VOLUME ml		TIME		ORSAT MEASUREMENT		CO ₂		O ₂		CO		H ₂	
1	2	3	4	1	2	3	4	1	2	3	4	1	2
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
TOTAL													

PARTICULAR FIELD DATA

SCHEMATIC OF STACK

PLANT 6.2.2.ee

AMBIENT TEMPERATURE

METER ΔH₁₃

A diagram illustrating a transect line. A horizontal line represents the transect, with a vertical dashed line intersecting it at a point labeled "SAMPLING SITE". To the left of the sampling site, a horizontal line segment is labeled "DISTANCE". To the right of the sampling site, a horizontal line segment is labeled "DISTANCE". Below the transect line, a series of points are marked, with arrows indicating distances between them. The points are labeled "100", "50", "0", "50", and "100".

DATE _____

LOCATION

OPERATOR

STACK NO:

RUN NO. 7

SAMPLE BOX NO.

NETER BOX NO.

BAROMETRIC PRESSURE

ASSUMED MOISTURE, %

PRODEL ENGTIL, Inc.

NOZZLE DIAMETER, IN.

STACK DIAMETER, in. —

PROBE HEATER SETTING

HEATER BOX SETTING

C FACTOR

PROCESS WEIGHT RATE

WEIGHT OF PARTICULATE COLLECTED, mg

SAMPLE

FINAL WEIGHT

WEIGHT GAIN

TOTAL

[illegible]

Twelve

**VOLUME OF LIQUID
WATER COLLECTED**

FINAL

744

RAMPINGER VOL 111E

**SILICA GEL
WEIGHT,**

10

ORSAT MEASUREMENT

TIME

CO₂

Q

U1

1

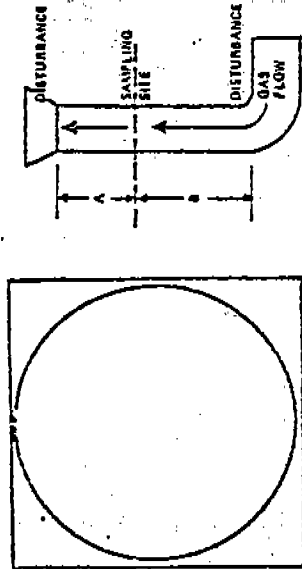
COMMENTS:

79

May 1944

PARTICULATE FIELD DATA

SCHEMATIC OF STACK



PLANT O.S. Stee METER AH₉

DATE _____ C FACTOR _____

LOCATION _____ PROCESS WEIGHT RATE _____

OPERATOR #15 Battery

STACK NO. #3 Part

RUN NO. _____

SAMPLE BOX NO. _____

METER BOX NO. _____

BAROMETRIC PRESSURE _____

ASSUMED MOISTURE, % _____

PROBE LENGTH, in. _____

NOZZLE DIAMETER, in. _____

STACK DIAMETER, in. _____

PROBE HEATER SETTING _____

HEATER BOX SETTING _____

WEIGHT OF PARTICULATE COLLECTED, mg			
SAMPLE	FILTER	PROBE WASH	
FINAL WEIGHT			
TARE WEIGHT			
WEIGHT GAIN			
TOTAL			

CROSS SECTION

TRAVERSE POINT NUMBER	SAMPLING TIME (t), min.	STATIC PRESSURE (in. H ₂ O)	STACK TEMPERATURE (T _s), °F	VELOCITY (AP _s) (√AP _s)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H ₂ O	GAS SAMPLE VOLUME (V _m), ft ³	GAS SAMPLE TEMPERATURE AT DRY GAS METER		SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °F	PUMP VACUUM in. Hg	VELOCITY ft/s
					ACTUAL DESIRED		INLET (T _{m,in}), °F	OUTLET (T _{m,out}), °F				
1	14.38		499	0.07	.74	1004.37	92	86	225	38	4	
2	14.46		531	0.07	.74	1005.38	96	86	226	38	4	
3	14.48		535	0.08	.68	1006.37	97	86	230	38	4	
4	14.52		536	0.08	.68	1007.30	98	87	231	37	4	
5	14.54		540	0.08	.68	1008.25	100	86	232	37	4	
6	14.42		538	0.07	.58	1009.18	100	88	233	37	4	
7	14.50		528	0.07	.58	1010.03	101	88	236	37	4	
8	14.50		513	0.05	.42	1010.94	99	89	239	37	3	
9	14.55		496	0.05	.42	1011.07	100	89	242	38	3	
10	14.56		487	0.04	.34	1012.46	99	90	248	38	3	
11	14.58		480	0.04	.34	1013.15	99	90	251	38	3	
12	14.50		476	0.03	.25	1013.85	99	90	252	38	2	
						1014.45						
TOTAL												
AVERAGE												

COMMENTS:

VOLUME OF LIQUID WATER COLLECTED		IMPINGER VOLUME ml				SILICA GEL WEIGHT, g		ORSAT MEASUREMENT				TIME				CO ₂ O ₂ CO N ₂			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	8122																		
2																			
3																			
4																			
TOTAL																			

U.S. Steel

#15 Battery Underfire

#3 Part

Isokinetic Field Calculations

Ts (°R) <u>974</u>	Vm <u>42.75</u>	δ <u>1.001</u>	CO ₂ <u>.056</u>
Tm (°R) <u>543</u>	Vw <u>141.3</u>	Cp <u>.84</u>	O ₂ <u>.092</u>
Ps ("Hg) <u>29.83</u>	Pb <u>29.94</u>	θ <u>96</u>	CO <u>0</u>
Pm ("Hg) <u>29.99</u>	(ΔP) ^{1/2} <u>.0852</u>	An <u>.00245</u>	N ₂ <u>.852</u>

$$V_{m\text{std}} = (17.64)(\delta)(V_m) \left(\frac{P_m}{P_s} \right)^{\frac{T_m}{T_s}} = (17.64)(1.001)(42.75) \left(\frac{29.99}{29.83} \right)^{\frac{543}{974}} = \underline{41.69}$$

$$V_{w\text{std}} = (0.04707)(V_w) = (0.04707)(141.3) = \underline{6.651}$$

$$ZH_2O = V_{w\text{std}} / V_{m\text{std}} + V_{w\text{std}} = (6.651) / (41.69) + (6.651) = \underline{.138}$$

$$DGF = 1 - ZH_2O = 1 - (.138) = \underline{.862}$$

$$M_w = [(44)(CO_2)(DGF) + (32)(O_2)(DGF) + (28)(CO)(DGF) + (28)(N_2)(DGF) + (18)(ZH_2O)] =$$

$$[(44)(.056)(.862) + (32)(.092)(.862) + (28)(.852)(.862) + (28)(0)(0) + (18)(.138)] = \underline{27.71}$$

$$V_s = (85.49)(C_p)(\Delta P)^{\frac{1}{2}} \left[\frac{T_s}{M_w P_s} \right]^{\frac{1}{2}} = (85.49)(.84)(.0852)^{\frac{1}{2}} \left[\frac{(974)}{(27.71)(29.83)} \right]^{\frac{1}{2}} = \underline{6.642}$$

$$ZI = \frac{(0.0945)(V_{m\text{std}})(T_s)}{(P_s)(V_s)(An)(\theta)(DGF)} = \frac{(0.0945)(41.69)(974)}{(29.83)(6.642)(.00245)(96)(.862)} = \underline{95.53}$$

511026

Date: 9-19-79

Box No. 482N

Barometric Pressure, Pb = 30.04 in. Hg

Orifice Manometer Setting ΔH In. H ₂ O	Gas Volume Wet Test Meter VW, ft ³ (Int)	Gas Volume Dry Gas Meter V, d. ft ³ (Final)	WET TEST		DRY GAS METER					Time 0: Min.	γ	Ave	
			Wet Test Meter °F TW	Inlet tdl °F (Int)	Inlet tdl °F (Final)	Outlet tdl °F (Int)	Outlet tdl °F (Final)	Average Td, °F					
0.5	5	$\frac{319.015}{313.885}$	70.5	88	91	84	85	87	1937	1.008	2.245		
0.8	5	$\frac{306.665}{301.58}$	70	81	88	79	79	81.75	10.87	1.003	2.071		
1.0	5	$\frac{259.325}{254.280}$	67.5	73	80	69	70	73	983	.999	2.131		
1.5	5	$\frac{288.155}{282.995}$	67	87	93	79	80	84.75	8.27	.998	2.210		
2.0	10	$\frac{299.55}{289.195}$	67	87	97	79	81	86	1458	.995	2.284		
3.0	10	$\frac{270.585}{260.35}$	67.5	81	94	73	76	81	1186	.995	2.289		
Average												.999	2.205

CALCULATIONS

ΔH	γ	$\Delta H @$
13.6	$\frac{Vw Pb (td + 460)}{Vd [Pb + (\Delta H + 13.6)]}$	$\frac{0.0317 \Delta H}{Pb (td + 460)} \left[\frac{(tw + 460)}{Vw} \right] 2$
0.0360		
0.0500		
0.0737		
0.110		
0.167		
0.221		

Accuracy of wet test meter to dry test meter. Tolerance = ± 0.01
 Accuracy differential that a given 0.75 cfm of air at 70°F and 30 in Hg

Date: 9-20-79

Box No. 481N

Darometric Pressure, Pb = 29.73 In. Hg

Orifice Manometer Setting ΔH In. H ₂ O	Gas Volume Wet Test Motor Vw, ft ³ (Int)	Gas Volume Dry Gas Meter Vd, ft ³ (Final)	WET TEST		DRY GAS METER				γ	Time θ , Min.	ΔH	
			Wet Test Motor °F TW	Inlet tdl °F (Int)	Inlet tdl °F (Final)	Outlet tdl °F (Int)	Outlet tdl °F (Final)	Average tdl °F				
0.5	5	586.83 581.36	70.5	127	130	115	120	123	1.003	11.92	1.46	
0.8	5	590.27 574.835	70.5	124	128	110	115	119.25	1.003	10.35	1.72	
1.0	5	541.97 536.25	70.5	70	90	77	73	77.5	1.007	8.83	1.74	
1.5	0.7	550.175 542.98	70.5	89	108	78	84	89.75	1.004	10.60	1.87	
2.0	10	541.815 551.22	70.5	107	123	87	97	103.50	.998	13.42	1.91	
3.0	10	571.75 562.885	70.5	121	135	100	110	116.50	.993	16.93	1.86	
Average											1.001	1.774

CALCULATIONS

H	ΔH	Y		ΔH	
		$\frac{V_w P_b (t_d + 460)}{V_d [P_b + (\Delta H \div 13.6)]}$	$\frac{0.0117 \Delta H}{P_b (t_d + 460)}$	$\frac{(LW + 460)}{V_w}$	θ
5	0.0360				
0	0.0508				
0	0.0737				
5	0.110				
0	0.147				
0	0.221				

Method of accuracy of wet test meter to dry test meter. Tolerance = + 0.01

Orifice pressure differential that gives 0.75 cfm of air at 70°F and 29.92 In. of mercury, In H₂O Tolerance = + 0.1

TABLE

GRAVIMETRIC ANALYSIS BREAKDOWN - FRONT CATCH
(ALL WEIGHTS ARE NET, CORRECTED FOR BLANKS)

<u>TEST</u>	<u>FILTER</u>	<u>PROBE WASH</u>	<u>TOTAL FRONT</u>
# 15			
Coke Oven Gas			
1	0.0758	0.07550	0.1513
2	0.1885	0.1002	0.2887
3	0.1672	0.05678	0.2240

511029

TABLE

GRAVIMETRIC ANALYSIS BREAKDOWN - TOTAL CATCH
(ALL WEIGHTS ARE NET, CORRECTED FOR BLANK)

<u>TEST</u>	<u>TOTAL FRONT</u>	<u>- SULFATES</u>	<u>=</u>	<u>TOTAL CATCH MINUS SULFATES</u>
# 15				
Coke Oven Gas				
1	0.1513	0.03459		0.1167
2	0.2887	0.03819		0.2505
3	0.2240	0.02119		0.2028

From Page No.

Run No.	Stack No.	Final Wt.	Initial Wt.	Net Gain
1	#15 Battery	7.1119 .6690	.5932	0.0758
2	"	7.1117 .7933	.6048	0.1885
3	"	6.9662 .7323	.5651	0.1672
1	#7 Battery Condition 1	7.1207 .6155	.5934	0.0221
2	"	7.8103 .5956	.5729	0.0227
3	"	7.4516 .6239	.5694	0.0545
1	#7 Battery Condition 2	.7870	.6467	0.1403
2	"	.6922	.5649	0.1273
3	"	.6787	.5519	0.1268

511032

Witnessed & Understood by me

Date 0. 17

Invented by

In

To Page



16550 Highland Road • Baton Rouge, Louisiana 70808 • (504) 293-8650

Name of Company U.S. Steel Corp.
Mr. Randy Craigston

Sample Source See below.Collected By Air Group.Date Collected 11/8 - 11/31/79.Date Received 11/28/79Date(s) Analyzed 11/29/79 D.A.R.

Cost _____

Data No. _____

P.O. No. _____

SO₄ Analysis

Filter # Run # Stack # Total on 1000 mg Sulfate

1 1 #15 Battery 17,000

2 2 ↓ 14,400

3 3 ↓ 11,400

4 1 #7 Battery Cond-1 2820

5 2 ↓ 21,600

6 3 ↓ 2350

7 1 Cont-2 17,800

8 2 ↓ 14,200

9 3 ↓ 21,700

10 Blank 90

511033

Cont. on page 2



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89

Page 2

Name of Company Air Group

Sample Source U.S. Steel, Gary, Indiana

Mr. Randy Craggion

Collected By Air Group

Date Collected 11/8 - 11/3/79

Date Received _____

Date(s) Analyzed 11/29/79 D.A.S.

Cost _____

Data No. _____

P.O. No. _____

SO₂ Analysis

Bottle #

Source (FHA)

Total ~~inorganic~~
Sulfate

35

± 15 Battery Run-1

18,600

36

-2

24,800

37

-3

10,800

38

± 7 Battery Cond-1, Run-1

1140

39

2

2220

40

3

1500

41

3

910

42

Cond-2 Run-1

18800

43

-2

14200

44

-2

32,000

45

-3

13,400

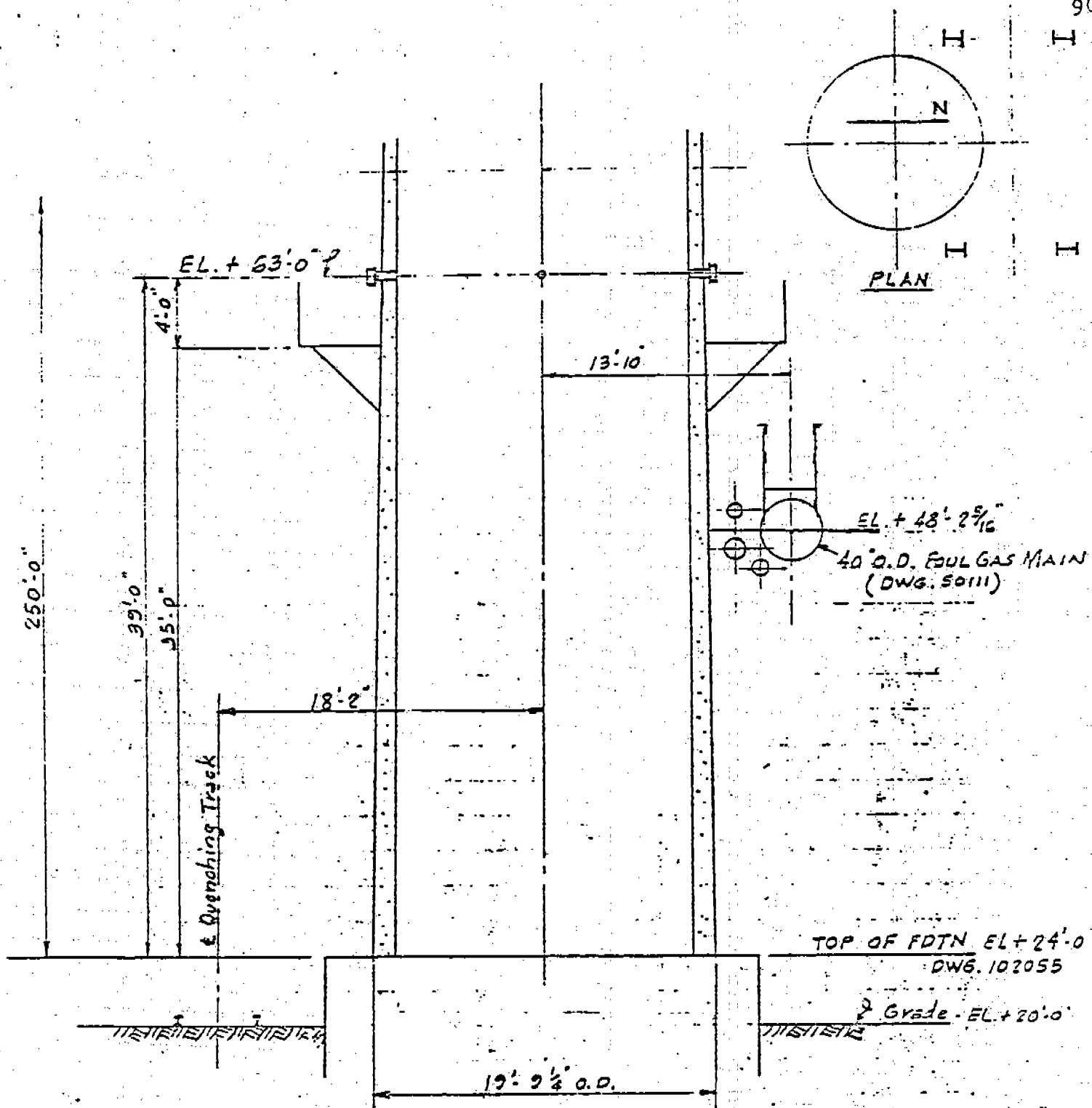
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Airflow Blank

920

MIA

511034



NO. 15 COKE BATTERY STACK
KEY NO. 115
LOOKING WEST

511035

COKE OVEN GAS CONSUMPTION

BATTERY NO. 15

MONTH OF NOVEMBER 1979

DATE	NON-CORRECTED		FACTORS				CORRECTED MOFD
	INTEGRATOR	PCFD x 1000	TEMP.	BTU	SP. GR.	TOTAL	
31	082313	5268	40 9602	1.014	.9638	1.9384	4943
1	083630	4576	40 9602	1.014	.9638	1.9384	4294
2	084774	5496	38 9533	1.016	.9612	1.9407	5170
3	086148	5592	38 9533	1.016	.9612	1.9407	5260
4	087546	5304	38 9533	1.016	.9612	1.9407	4989
5	088872	5568	38 9633	1.028	.941	.9318	5188
6	090264	5208	38 9633	1.028	.941	.9318	4853
7	091566	5464	38 9633	1.028	.941	.9318	5091
8	092932	5484	38 9633	1.028	.941	.9318	5110
9	094303	5432	40 9602	.994	.9174	.8752	4752
10	095661	5672	40 9602	.994	.9174	.8752	4966
11	097079	5536	40 9602	.994	.9174	.8752	4847
12	098463	5524	40 9602	1.01	.9522	.8715	4814
13	099844	5546	40 9602	1.01	.9522	.8715	4835
14	101231	5532	40 9602	1.01	.9522	.8715	4821
15	102614	5420	40 9602	.988	.9422	.8436	4572
16	103969	4668	41 9558	.988	.9422	.8925	4166
17	105136	4696	41 9558	.988	.9422	.8925	3652
18	106160	3868	42 9572	.988	.9422	.8911	3447
19	107127	4004	42 9572	.988	.9422	.8911	3568
20	108128	3984	42 9572	1.028	.9535	.9382	3738
21	109124	4000	42 9572	1.028	.9535	.9382	3753
22	110124	4012	42 9572	1.028	.9535	.9382	3764
23	111127	4004	42 9572	.972	.9434	.8777	3514
24	112128	4020	42 9572	.972	.9434	.8777	3528
25	113133	3964	42 9572	.972	.9434	.8777	3479
26	114124	4084	40 9602	.972	.9434	.880	3524
27	115125	3992	40 9602	1.016	.9501	.907	3621
28	116123	4012	40 9602	1.016	.9501	.907	3639
29	117126	3848	40 9602	1.016	.9501	.907	3490
30	118088						

511036

COKE OVEN GAS CONSUMPTION

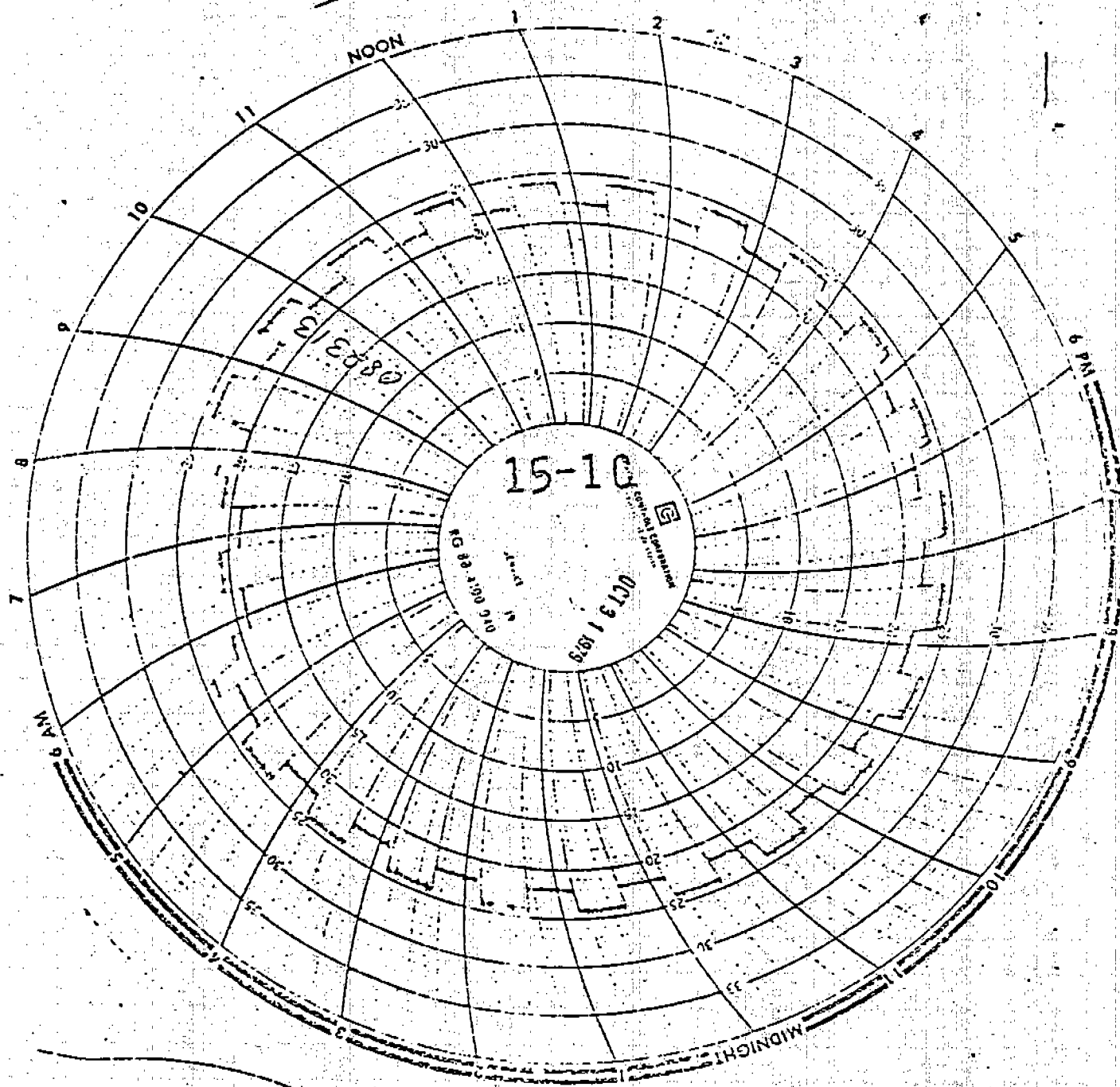
BATTERY NO. 15

MONTH OF OCTOBER 1979

DATE	INTEGRATOR	NO. OF COKE	SP. GR.	TOTAL	CORRECTED FLD
30	039748	55500	9494	2475	5242
1	041158	55500	9494	2475	5246
2	042549	55532	9494	2475	5216
3	043932	55500	9494	2475	5250
4	045324	55500	9494	2475	5207
5	046724	54912	9494	2475	5110
6	048099	5516	9494	2475	5129
7	049477	5528	9494	2475	5140
8	050859	5552	9494	2475	5162
9	052247	5572	9494	2475	5174
10	053640	5528	9494	2475	5133
11	055022	5556	9494	2475	5159
12	056411	5624	9494	2475	5181
13	057817	5528	9494	2475	5089
14	059199	5600	9494	2475	5151
15	060598	5612	9494	2475	5014
16	062001	5588	9494	2475	4993
17	063398	5640	9494	2475	5039
18	064808	5588	9494	2475	4993
19	066205	5592	9494	2475	5210
20	067603	5580	9494	2475	5199
21	068998	5372	9494	2475	5005
22	070341	5612	9494	2475	5229
23	071774	5688	9494	2475	5215
24	073166	4984	9494	2475	4569
25	074412	5352	9494	2475	4907
26	075750	4584	9494	2475	4203
27	076896	5004	9494	2475	4588
28	078147	5596	9494	2475	5130
29	079546	5516	9494	2475	5128
30	080925	5552	9494	2475	5162

082313

511037



511038

GA 4/29/79 M2-1.69

COKE WORKS

RECORD OF OVENS PUSHED & CHARGED

10-31-79

TURN 7/3

BATTERY NO. 13 NO. OF OVENS 27 BATTERY NO. 15 NO. OF OVENS 27

OVEN NO	TIME PUSHED	TIME CHARGED	REMARKS	OVEN NO	TIME PUSHED	TIME CHARGED	REMARKS
1 24	7:18	7:23	23 check	1 45	7:15	7:30	762 empty - cupin
2 10	32	49		2 55	25	42	685
3 20	46	8:17		3 65	40	50	
4 30	8:14	25		4 25	8:21	8:05	562 empty - carbin
5 40	22	38		5 9	25	45	745
6 50	35	57		6 19	40	9:05	
7 60	54	9:03		7 29	9:01	10	
8 70	9:10	13		8 39	15	45	
9 6	22	36		9 49	30	55	
10 16	42	52		10 59	56	10:10	
11 26	10:00	10:06		11 69	10:07	25	
12 36	30	53		12 7	35	45	
13 46	56	11:00		13 17	11:00	11:15	
14 56	11:08	11		14 27	10	20	
15 66	12:12	12:16		15 37	20	32	
16 76	21	25		16 47	31	40	
17 8	36	48		17 57	45	50	
18 18	45	1:13		18 67	55	59	
19 28	53	21		19 77	12:00		
20 38	1:05	27		20 2	2:01	2:19	TEST 1 RUN 1
21 48	16	33		21 12	12	30	
22 58	30	39		22 22	25	40	
23 68	42	46		23 32	35	45	
24 3	55	2:05		24 42	50		
25 13	2:08	15		25			
26 33	20	26		26			
27 43	32	38	29.5 check	27			
28 53	45	52		28			
29 63	57			29			
30				30			
31				31			
32				32			
33				33			
34				34			
35				35			
36				36			
37			29.5 checked heat 24	37			
38			29 Heat pushed 24	38			
39			29 Heat pushed 24	39			
40			27 Ovens in use 74	40			
41				41			

511039

CG 32/79 REV. 12/6

COKE WORKS

RECORD OF OVENS PUSHED & CHARGED

10-31-79

TURN 3-11

BATTERY NO. 13 NO. OF OVENS 77 BATTERY NO. 15 NO. OF OVENS 77

OVEN NO.	TIME PUSHED	TIME CHARGED	REMARKS	OVEN NO.	TIME PUSHED	TIME CHARGED	REMARKS
1	23:32	40		1	52:31	26	TEST 1
2	44	4:04		2	62	44	RUN 1
3	4:02	24		3	41	50	
4	21	27	45	4	14	4:34	4:50
5	31	43	59	5	24	48	5:06
6	41	57	5:14	6	34	5:23	25
7	51	5:12	32	7	44	20	39
8	61	30	46	8	54	35	52
9	71	44	52	9	64	49	6:08
10	5	57	6:30	10	74	5:59	74 charged in series II
11	15	6:12	45	11	10	6:25	22
12	25	26	57	12	20	18	35
13	35	40	7:00	13	30	31	50
14	45	55	25	14	40	46	7:16
15	55	7:11	7:38	15	50	7:02	19
16	65		65 start in II	16	60	15	48
17	75	52	9:11	17	70	44	53
18	8	9:00	25	18	6	59	8:04
19	19	29	39	19	16	8:42	9:23
20	29	23	40	20	26	9:14	47
21	39	37	55	21	36	29	55
22	49	53	10:12	22	46	43	1:06
23	59	10:10	26	23	56	9:32	56 charged in series II
24	69	24	35	24	66	11:01	17
25	7	39	45	25	8	15	30
26	17	52	56	26	18	24	39
27				27	28	43	55
28				28	38	56	
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83				83			
84				84			
85				85			
86				86			
87				87			
88				88			
89				89			
90				90			
91				91			
92				92			
93				93			
94				94			
95				95			
96				96			
97				97			
98				98			
99				99			
100				100			

26 Thru's school 26

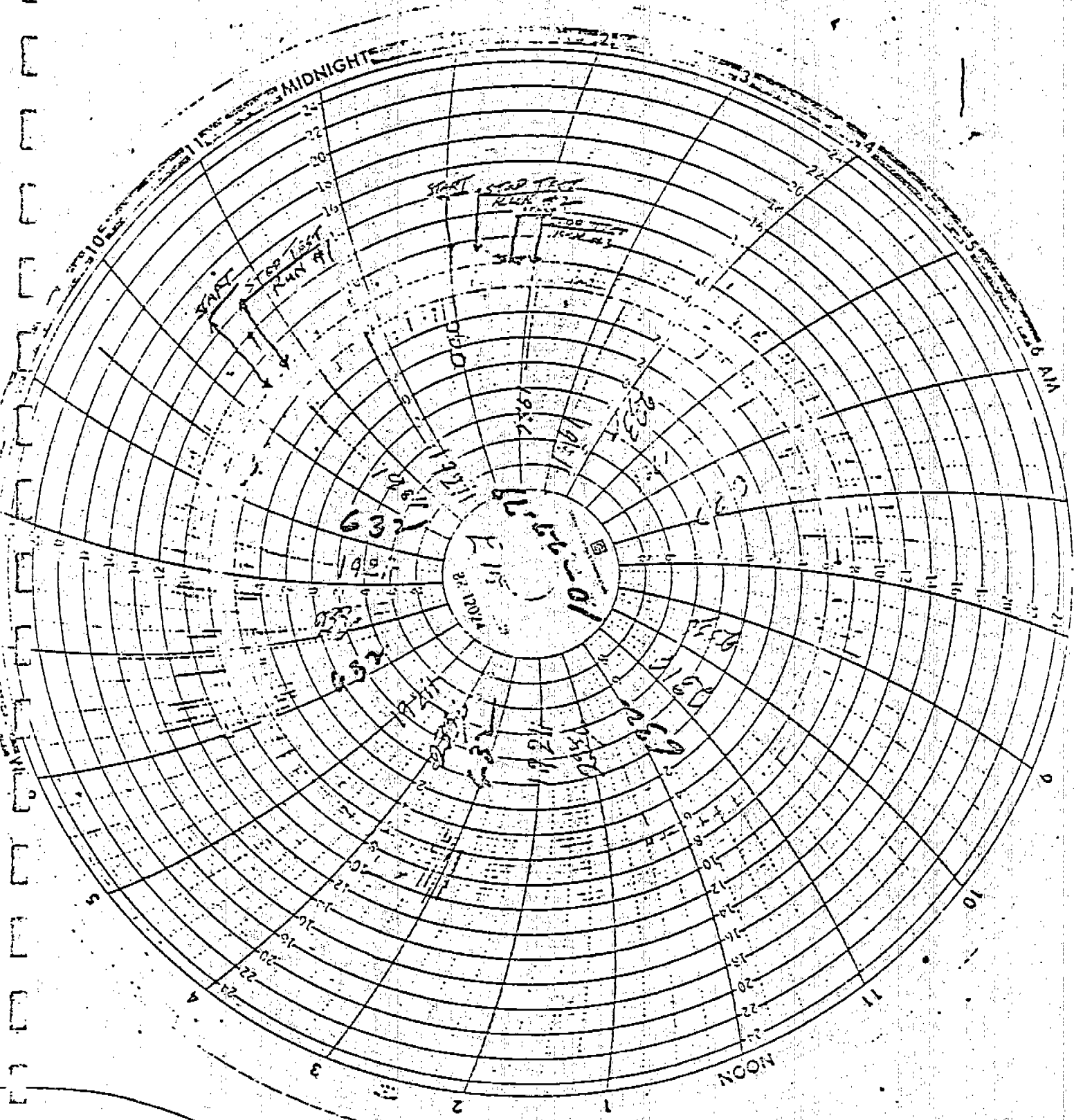
26 Thru's school 26

77 Thru's in use 77

511040

CELL. MAIN BACK PRESS.
ALL 24HS.

97



511042

GARY COKE AND CHEMICALS DIVISION

DAILY COAL AND COKE
QUALITY REPORT

DATE SAMPLED: 10-31-

DATE REPORT ISSUED: 11-1-

PROPERTY COALS	11-7 TURN		7-3 TURN		DAILY AVERAGE	
	Alpheus	Corbin	Alpheus	Corbin	Alpheus	Corbin
% Moisture	5.65	6.68	5.97	6.24	5.82	6.46
% Ash	6.74	6.56	6.50	6.64	6.62	6.60
% Volatile Matter	17.93	33.78	17.55	34.95	17.65	34.37
% Sulfur					0.67	0.85

BLENDED COAL	32	9P	3-11	1A	1A	11-7	DAILY	
	AVG.	AVG.	AVG.	AVG.	AVG.	AVG.	AVG.	AVG.
Bulk Density	45.4	45.7	45.1	45.0	48.1	45.6		45.8
% Moisture			5.45			5.24		5.35
% Ash			6.40			6.95		6.68
% Volatile Matter			27.61			27.40		27.51
% Sulfur								0.77
Calc. B.F. Coke Ash								
Pulverization % +1"								
" % +1/2"			0.1			0.1		0.1
" % +1/4"			6.6			8.0		7.3
" % -1/8"			73.2			80.6		76.9
" % -100 Mesh			5.7			7.7		6.7
" % -200 Mesh			4.0			4.4		4.2

PULVERIZERS	X-1	X-3	X-5	Ag 2	Ag 1	Ab 5	Ab 3	Ab 1	Coal as received	
	Alpheus			Blend of High Volatile						
Pulverization % +1"										
" % +1/2"				0.2		0.2	0.6	0.1		
" % +1/4"	4.6	4.3		7.3		5.3	13.3	5.1		
" % -1/8"	77.7	78.6		72.4		70.7	60.2	75.8		
" % -100 Mesh	15.6	14.6		9.0		9.3	7.3	11.3		

PLAST FURNACE COKE													
SCREENING STATION	+3"	+2"	+2"	+1 1/2"	+1"	+3/4"	-3/4"	Stab.	Hard.	Moist	Ash	V.M.	S
2	19.7	33.9	53.1	80.3	95.4	98.1	1.9	54	74	10.3	13.92	1.40	0.1
3	18.7	33.0	55.3	80.1	94.9	97.6	2.4	54	74	12.3	11.57	1.18	0.1
5-6	1.0	7.7	23.3	51.1	82.6	94.6	5.4	48	72	16.7	8.94	0.28	0.1
8	4.8	8.5	23.1	52.3	87.6	93.4	1.6	49	72	8.2	9.09	0.47	0.1
9	13.5	35.1	56.5	82.3	96.0	93.6	1.4	46	72	9.6	8.49	0.37	0.1
Avg.													0.1
												511043	

511043

2. 199

SMOKE EVALUATION FORM U.S. STEEL CORP. GARY WORKS

STACK TEST

ACTIVITY: #15 BATTERY
STACK.
RUN #1 TEST #1
C.O.G

DATE: 10/31/79
U.S.S.C. OBSERVER: MURPHY
INSPECTING AGENCY: _____

OBSERVATION POINT N/E OF
STACK.

DISTANCE FROM STACK: 200 yds.

STACK HEIGHT: 210'

COLOR OF EMISSION: _____

OBSERVATION BEGAN: 2:10

ENDED: 4:05

BACKGROUND: SKY

SKY CONDITION: CLOUDY

SUN POSITION: _____

TEMPERATURE: 70 WIND: SO 30

HUMIDITY: _____

REGULATORY PERSONNEL: _____

COMMENTS: Battery had been
down from 11 AM to alt
130PM to replace a door jamb.

SIGNATURE: _____

D K Murphy

TIME	0	15	30	45		0	15	30	45	TIME
	5	5	5	5	0	30	15	20	20	15
	5	5	5	5	1	31	20	25	25	30
	5	5	5	5	2	32	30	30	30	30
	5	5	5	5	3	33	30	30	35	30
	5	5	5	5	4	34	25	20	25	25
	5	5	5	5	5	35	30	35	35	30
	5	5	5	5	6	36	30	30	30	30
	5	10	10	10	7	37	25	20	25	30
	10	10	10	10	8	38	25	25	25	25
	10	10	10	10	9	39	25	25	25	25
	10	15	15	15	10	40	25	20	20	20
	20	20	25	25	11	41	20	20	20	15
	15	5	5	5	12	42	15	15	15	15
	5	5	5	5	13	43	15	15	15	15
	5	5	5	5	14	44	15	15	20	20
	5	5	5	5	15	45	20	20	20	20
	5	5	5	5	16	46	20	20	20	20
	5	5	5	5	17	47	20	20	20	20
	5	5	5	20	18	48	20	20	20	20
	20	25	25	30	19	49	20	20	15	15
	30	30	25	30	20	50	20	20	20	20
	20	20	20	30	21	51	20	20	15	15
	20	20	20	20	22	52	15	15	15	15
	20	20	20	20	23	53	15	15	15	15
	15	15	10	10	24	54	15	15	15	15
	10	10	10	10	25	55	15	15	15	15
	10	10	10	10	26	56	15	15	15	15
	10	10	10	10	27	57	15	15	15	15
	10	10	10	10	28	58	15	15	15	15
	10	10	10	10	29	59	15	15	15	15
	10	10	10	10	30	60	15	15	15	15

511044

P. 2

SMOKE EVALUATION FORM
U.S. STEEL CORP.
GARY WORKS

STACK TEST

FACILITY: #15 BATTERY
STACK
TEST 1 TEST RUN = 31

DATE: 10/31/79
U.S.S.C. OBSERVER: MURRAY
INSPECTING AGENCY: _____

	TIME					TIME				
	0	15	30	45		0	15	30	45	TIME
OBSERVATION POINT _____	15	15	10	10	0	30	15	15	30	45
	10	10	12	15	1	31	45	45	45	45
	10	10	10	15	2	32	45	45	45	50
	15	15	15	15	3	33	50	50	45	50
	15	15	15	15	4	34	50	50	50	50
	15	15	15	15	5	35	50	50	50	45
	15	15	15	15	6	36	45	45	50	45
	15	20	20	20	7	37	45	40	40	40
	20	20	20	20	8	38	40	35	35	35
	20	20	20	20	9	39	40	45	40	40
	20	20	20	20	10	40	40	45	45	45
	15	15	15	15	11	41	40	35	35	35
	15	10	10	10	12	42	35	30	30	30
	5	5	5	5	13	43	30	30	30	30
	5	5	5	5	14	44	30	35	35	35
	5	5	5	5	15	45	45	50	50	45
	0	0	0	0	16	46	45	50	45	45
	0	0	0	0	17	47	45	45	45	45
	0	0	0	0	18	48	35	30	35	35
	0	0	0	0	19	49	35	35	35	35
	0	0	0	0	20	50	35	35	35	35
	5	5	5	5	21	51	35	35	35	35
	5	5	5	5	22	52	35	35	35	35
	5	5	5	5	23	53	35	35	35	35
	5	5	5	5	24	54	35	35	35	35
	5	5	5	5	25	55	35	35	35	35
	15	15	20	25	26	56				57
	15	20	15	15	27	57				58
	15	15	15	15	28	58				59
	15	15	15	15	29	59				60

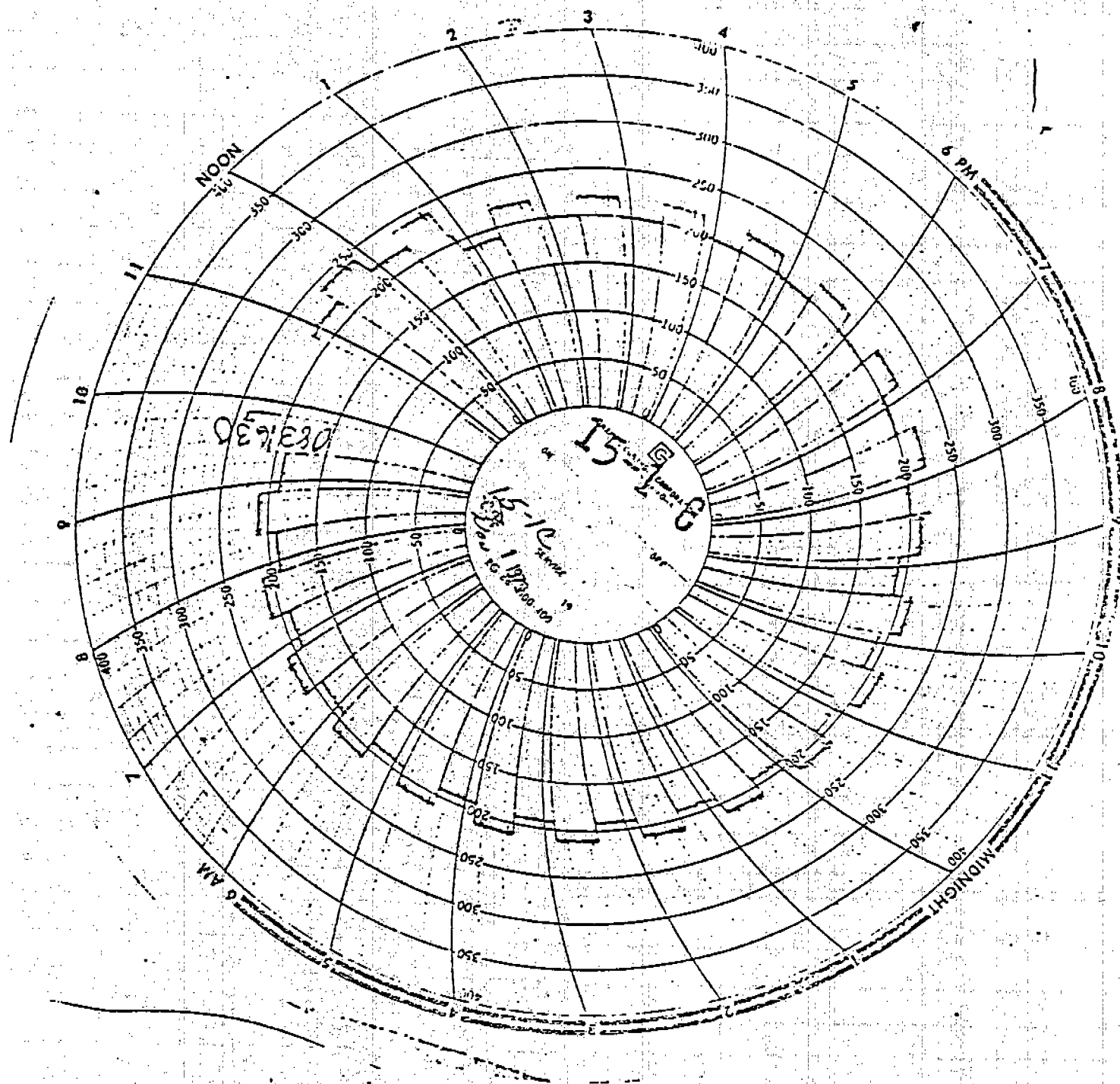
REGULATORY PERSONNEL: _____

COMMENTS: _____

SIGNATURE: U.S. Steel

511045

C.O.G. FLOW
Nov 1



511046

COKE WORKS

RECORD OF OVENS PUSHED & CHARGED

11-1-79

TURN

7-3

BATTERY NO. 13 NO. OF OVENS 77 BATTERY NO. 15 NO. OF OVENS 77

OVEN NO.	TIME PUSHED	TIME CHARGED	REMARKS	OVEN NO.	TIME PUSHED	TIME CHARGED	REMARKS
1	50	717		1	9	730	
2	60	715	33	2	19	713	37
3	70	31	38	3	29	35	45
4	6	800	818	4	39	50	817
5	15	15	35	5	49	815	20
6	26	32	48	6	59	25	31
7	23	55	23 my Patch. T.T.	7	69	41	69 my Patch. T.T.
8	65	915	65 my Patch. T.T.	8	7	55	925
9	36	34	1053	9	17	910	35
10	46	57	57	10	27	20	41
11	56	1011	1102	11	37	42	1109
12	66	35	01	12	47	1002	15
13	76	1118	27	13	57	15	21
14	8	1210	1232	14	67	1125	30
15	18	35	45	15	2	40	45
16	28	50	100	16	12	50	52
17	38	107	10	17	22	1215	1224
18	48	17	28	18	32	25	38
19	58	25	37	19	42	41	50
20	68	34	40	20	52	55	100
21	3	48	200	21	62	105	15
22	13	205	14	22	72	55	205
23	23	15	24	23	82	215	24
24	33	27	34	24	92	30	40
25	43	42	48	25	102	45	59
26	53	58		26	112	53	
27				27			
28				28			
29				29			
30				30			
31				31			
32				32			
33				33			
34				34			
35				35			
36				36			
37				37			
38				38			
39				39			
40				40			
41				41			
42				42			
43				43			
44				44			
45				45			
46				46			
47				47			
48				48			
49				49			
50				50			
51				51			
52				52			
53				53			
54				54			
55				55			
56				56			
57				57			
58				58			
59				59			
60				60			
61				61			
62				62			
63				63			
64				64			
65				65			
66				66			
67				67			
68				68			
69				69			
70				70			
71				71			
72				72			
73				73			
74				74			
75				75			
76				76			
77				77			

69 my Patch. T.T.

TEST #1
RUN #2

77 changed in
Series T.T.

TEST #1
RUN #3

76 my Rep.
63 my Rep.

23 & 65 STICKERS Pushed
After 26 & Left my T.T.

25 HEATS Sched. 25

25 HEATS Push 25

25 HEATS In use 74

511047

DAILY COKE AND COKE QUALITY REPORT

DAILY COKE AND COKE QUALITY REPORT

DATE SAMPLED: 11-1-57

DATE REPORT ISSUED: 11-1-57

ITEM	5-1/2" TURN			11-7/8" TURN			DAILY AVERAGE		
	Alpha	Corbin		Alpha	Corbin		Alpha	Corbin	
% Moisture	5.85	5.45		5.39	6.96		5.62	5.41	4.87
% Ash	6.35	7.25		6.24	7.61		6.30	7.43	5.74
% Volatile Matter	17.27	33.75		17.37	31.51		17.32	32.63	32.72
% Sulfur							0.65	0.93	0.82

FLEADED COAL	3P	9:50P	3-11	11P	11P	11-7				DAILY
			AVR.	LA	LA	AVR.				AVR.
Bulk Density	45.2	46.2	45.7	42.9	44.9	43.9				44.8
% Moisture			5.73			5.74				5.74
% Ash			6.33			6.66				6.50
% Volatile Matter			30.72			29.68				30.20
% Sulfur										0.78
Calc. B.F. Coke Ash										
Pulverization % +1"										
" % +1/2"			0.1			0.1				0.1
" % +1/4"			7.8			5.6				6.7
" % -1/8"			71.8			75.0				73.4
" % -100 Mesh			15.2			12.6				13.9
" % -200 Mesh			7.7			7.1				7.4

FULVERIZERS	X-1	T-3	X-5	Ag 2	Ag 1	Ab 5	Ab 3	Ab 1	Coal as received		
Pulverization % +1"											
" % +1/2"											
" % +1/4"											
" % -1/8"											
" % -100 Mesh											

BLAST FURNACE COKE

SCREENING STATION	+3"	+2 1/2"	+2"	+1 1/2"	+1"	+3/4"	+5/8"	Stab.	Hard.	Moist	Ash	V.M.	Sul.
2	8.4	20.7	41.5	74.0	93.4	97.0	3.0	57	75	13.2	9.31	0.70	0.60
3	7.2	20.5	39.5	70.1	92.7	93.3	1.7	55	74	20.2	9.85	0.45	0.70
5-6	2.9	10.5	29.2	60.7	91.9	93.1	1.9	52	71	6.8	8.22	0.25	0.70
8	4.5	11.8	35.3	64.2	88.4	95.5	3.5	54	71	23.3	11.83	1.20	0.70
9	10.3	24.9	44.4	68.2	90.6	95.3	4.7	53	72	9.3	8.81	0.21	0.70
Avg.													

511048

SMOKE EVALUATION FORM U.S. STEEL CORP. GARY WORKS

STACK TEST

FACILITY: # 15 BATTERY
STACK
TEST RUN # 2
C.O.G.

DATE: 11/1/79
U.S.S.C. OBSERVER: MURPHY
INSPECTING AGENCY: _____

OBSERVATION POINT N.E. OF
STACK

DISTANCE FROM STACK: 200 FT

STACK HEIGHT: 210'

COLOR OF EMISSION: _____

OBSERVATION BEGAN: 8:25
ENDED: 10:25

BACKGROUND: SKY

SKY CONDITION: CLOUDY

SUN POSITION: _____

TEMPERATURE: 45 WIND: SW 15-20

HUMIDITY: _____

REGULATORY PERSONNEL: _____

COMMENTS: _____

SIGNATURE: _____

TIME	0	15	30	45		0	15	30	45	TIME
	65	60	60	40	0	30	40	40	40	
	70	70	75	70	1	31	40	40	40	
	55	50	50	45	2	32	40	35	35	
	90	80	80	80	3	33	30	30	25	
	90	85	90	90	4	34	25	20	20	
	75	80	75	75	5	35	25	30	25	
	70	75	70	70	6	36	25	25	25	
	70	70	70	70	7	37	25	20	20	
	70	65	60	60	8	38	20	20	20	
	60	60	60	60	9	39	20	20	15	
	60	55	55	50	10	40	15	15	15	
	55	50	50	50	11	41	15	15	15	
	50	50	50	50	12	42	15	15	15	
	50	45	45	45	13	43	15	15	15	
	40	40	40	40	14	44	15	15	10	
	40	45	50	45	15	45	10	10	15	
	45	45	45	50	16	46	15	15	15	
	40	40	45	45	17	47	15	15	15	
	45	45	45	45	18	48	15	15	15	
	40	40	35	35	19	49	15	15	15	
	35	40	40	40	20	50	15	15	15	
	40	35	35	35	21	51	15	15	15	
	40	40	40	40	22	52	15	15	15	
	40	40	40	40	23	53	15	15	15	
	40	40	40	40	24	54	15	15	15	
	30	30	25	25	25	55	10	10	10	
	35	40	40	40	26	56	10	10	10	
	40	40	40	40	27	57	10	10	10	
	40	40	40	40	28	58	10	10	15	

511049

P. 2

SMOKE EVALUATION FORM U.S. STEEL CORP. GARY WORKS

STACK TEST

FACILITY: 15 BATTERY
STACK
TEST/PLAN # 20

DATE: 11/1/79U.S.S.C. OBSERVER: HURLEY

INSPECTING AGENCY: _____

C.O.G.

OBSERVATION POINT _____

DISTANCE FROM STACK: _____

STACK HEIGHT: _____

COLOR OF EMISSION: _____

OBSERVATION BEGAN: _____

ENDED: _____

BACKGROUND: _____

SKY CONDITION: _____

SUN POSITION: _____

TEMPERATURE: _____ WIND: ③

HUMIDITY: _____

REGULATORY PERSONNEL: _____

COMMENTS: _____

SIGNATURE: _____

TIME	0	15	30	45			0	15	30	45	TIME
	20	15	15	15	0	30	0	0	0	0	
	15	15	15	15	1	31	0	0	0	0	
	15	10	10	10	2	32	0	0	0	0	
	10	10	10	10	3	33	0	0	0	0	
	10	10	10	10	4	34	0	0	0	0	
	10	10	10	10	5	35	0	0	0	0	
	10	12	10	10	6	36	0	0	0	0	
	10	10	10	10	7	37	0	0	0	0	
	10	10	10	10	8	38	0	0	0	0	
	10	10	15	15	9	39	0	0	0	0	
	25	25	20	25	10	40	0	0	0	0	
	25	25	30	25	11	41	0	0	0	0	
	20	20	20	20	12	42	0	0	0	0	
	20	20	20	20	13	43	0	0	0	0	
	20	25	25	25	14	44	0	0	0	0	
	20	20	20	20	15	45	0	0	0	0	
	20	20	20	20	16	46	0	0	0	0	
	20	20	20	20	17	47	0	0	0	0	
	20	20	20	20	18	48	0	0	0	0	
	20	20	20	20	19	49	0	0	0	0	
	15	15	15	15	20	50	0	0	0	0	
	15	15	15	15	21	51	0	0	0	0	
	15	15	15	15	22	52	0	0	0	0	
	5	5	5	5	23	53	0	0	0	0	
	5	5	5	5	24	54	0	5	5	5	
	5	5	5	5	25	55	5	5	5	5	
	5	5	5	5	26	56	5	5	5	5	
	5	0	0	0	27	57	5	5	5	5	
	0	0	0	0	28	58	5	5	5	5	

11050

SMOKE EVALUATION FORM U.S. STEEL CORP. GARY WORKS

STACK TEST

FACILITY: # 15 BATTERY
STACK
TEST RUN # 2
C.O.G.

DATE: 11/1/79
U.S.S.C. OBSERVER: MURPHY
INSPECTING AGENCY: _____

OBSERVATION POINT NE. OF
STACK

DISTANCE FROM STACK: 200 yds
STACK HEIGHT: _____

COLOR OF EMISSION: _____

OBSERVATION BEGAN: 1:07
ENDED: 3:02

BACKGROUND: SKY

SKY CONDITION: CLOUDY

SUN POSITION: _____

TEMPERATURE: 45 WIND: SW @ 10

HUMIDITY: _____

REGULATORY PERSONNEL: _____

COMMENTS: _____

SIGNATURE: _____

TIME	0	15	30	45		0	15	30	45	TIME
	20	20	20	20	0	20	20	15	15	15
	25	20	25	25	1	31	15	20	15	15
	20	20	20	20	2	32	15	15	15	15
	20	25	30	20	3	33	15	20	20	20
	20	25	25	25	4	34	20	20	20	20
	20	20	20	20	5	35	20	20	20	20
	10	20	20	20	6	36	20	20	20	20
	20	20	20	20	7	37	20	25	25	25
	20	20	20	20	8	38	20	25	25	25
	20	25	25	25	9	39	25	20	20	20
	25	25	30	25	10	40	20	20	20	20
	25	30	25	25	11	41	20	20	20	20
	25	25	25	25	12	42	20	20	20	20
	25	20	20	20	13	43	20	20	20	20
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	20	20	20	25	15	45	20	15	15	15
	20	25	25	25	16	46	15	15	15	15
	20	20	20	20	17	47	15	15	15	20
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	20	20	20	20	21	51	20	20	20	20
	20	20	20	20	22	52	20	20	20	20
	20	20	20	20	23	53	20	20	20	20
	20	20	20	20	24	54	20	20	25	25
	20	20	20	20	25	55	25	20	20	25
	20	20	20	20	26	56	25	25	25	25
	20	20	20	20	27	57	25	25	25	25
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	20	20	20	20	29	59	25	25	25	25
	20	20	20	20	30	60	25	25	25	25
	20	20	20	20	31	61	25	25	25	25
	20	20	20	20	32	62	25	25	25	25
	20	20	20	20	33	63	25	25	25	25
	20	20	20	20	34	64	25	25	25	25
	20	20	20	20	35	65	25	25	25	25
	20	20	20	20	36	66	25	25	25	25
	20	20	20	20	37	67	25	25	25	25
	20	20	20	20	38	68	25	25	25	25
	20	20	20	20	39	69	25	25	25	25
	20	20	20	20	40	70	25	25	25	25
	20	20	20	20	41	71	25	25	25	25
	20	20	20	20	42	72	25	25	25	25
	20	20	20	20	43	73	25	25	25	25
	20	20	20	20	44	74	25	25	25	25
	20	20	20	20	45	75	25	25	25	25
	20	20	20	20	46	76	25	25	25	25
	20	20	20	20	47	77	25	25	25	25
	20	20	20	20	48	78	25	25	25	25
	20	20	20	20	49	79	25	25	25	25
	20	20	20	20	50	80	25	25	25	25
	20	20	20	20	51	81	25	25	25	25
	20	20	20	20	52	82	25	25	25	25
	20	20	20	20	53	83	25	25	25	25
	20	20	20	20	54	84	25	25	25	25
	20	20	20	20	55	85	25	25	25	25
	20	20	20	20	56	86	25	25	25	25
	20	20	20	20	57	87	25	25	25	25
	20	20	20	20	58	88	25	25	25	25
	20	20	20	20	59	89	25	25	25	25
	20	20	20	20	60	90	25	25	25	25
	20	20	20	20	61	91	25	25	25	25
	20	20	20	20	62	92	25	25	25	25
	20	20	20	20	63	93	25	25	25	25
	20	20	20	20	64	94	25	25	25	25
	20	20	20	20	65	95	25	25	25	25
	20	20	20	20	66	96	25	25	25	25
	20	20	20	20	67	97	25	25	25	25
	20	20	20	20	68	98	25	25	25	25
	20	20	20	20	69	99	25	25	25	25
	20	20	20	20	70	100	25	25	25	25

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P. 2

SMOKE EVALUATION FORM U.S. STEEL CORP. GARY WORKS

FACILITY: #5 BATTERY
STACK
TEST RUN #2

DATE: 11/1/79
U.S.S.C. OBSERVER: MURPHY
INSPECTING AGENCY: _____

OBSERVATION POINT N.E. OF
STACK

DISTANCE FROM STACK: _____

STACK HEIGHT: _____

COLOR OF EMISSION: _____

OBSERVATION BEGAN: _____
ENDED: _____

BACKGROUND: _____

SKY CONDITION: _____

SUN POSITION: _____

TEMPERATURE: _____ WIND: 0

HUMIDITY: _____

REGULATORY PERSONNEL: _____

COMMENTS: _____

SIGNATURE: _____

TIME	0	15	30	45		0	15	30	45	TIME
	65	60	60	65	0	30	40	40	40	
	65	70	70	65	1	31	35	35	30	
	65	60	60	60	2	32	35	35	30	
	65	70	60	60	3	33	30	30	30	
	60	60	60	60	4	34	30	30	30	
	55	60	55	55	5	35	35	30	30	
	55	55	55	50	6	36	30	30	30	
	50	45	45	50	7	37	30	30	30	
	50	50	50	45	8	38	30	30	30	
	45	45	45	45	9	39	30	30	30	
	45	45	45	45	10	40	30	30	30	
	45	45	50	45	11	41	30	30	30	
	45	50	50	50	12	42	30	30	30	
	45	60	60	60	13	43	30	30	30	
	45	60	60	60	14	44	30	30	30	
	45	60	60	60	15	45	30	30	30	
	45	60	60	60	16	46	30	30	30	
	45	60	60	60	17	47	30	30	30	
	45	60	60	60	18	48	30	30	30	
	45	60	60	60	19	49	30	25	25	
	45	60	60	60	20	50	25	25	25	
	45	60	60	60	21	51	25	20	25	
	45	60	60	60	22	52	20	20	20	
	45	60	60	60	23	53	25	20	20	
	45	60	60	60	24	54	5	5	5	
	45	60	60	60	25	55	10	10	10	
	45	60	60	60	26	56				
	45	60	60	60	27	57				
	45	60	60	60	28	58				
	45	60	60	60	29	59				
	45	60	60	60	30	60				

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EMISSION TESTING

FOR

U. S. STEEL

Equipment

Sampling Train: NAPP 21/Lear-Siegler PM100

Orsat Analyzer: Burrell Industro Gas Analyzer Model

The stack sampling system consists of two major units - the control unit and the sampling train unit; electrically and pneumatically connected by an umbilical cord. The sampling train unit can be broken down into three sub-units; (1) the probe with a heated pyrex liner, (2) the hot box assembly thermostatically controlled to maintained 250° F during the sampling, and (3) the cold box assembly to hold four 500 ml glass impingers in an ice bath.

The control unit contains gauges and meters to measure all parameters necessary for sampling calculations. A dry gas meter (recently calibrated to EPA specifications) is used to measure the volume of sample removed from the stack. A thermometer or thermocouple on the inlet and exit sides of the meter are

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used to determine the meter temperature. A magnehelic gauge or inclined manometer is available on the control box for measuring velocity heads in inches of water from 0.0 - 10.0 inches. An inclined manometer is also available for lower velocity heads in the range of 0.0 - 0.5 inches of water. The amount of heat to the probe liner is controlled by an adjustment on the control box. The vacuum at the inlet to the dry gas meter is monitored by another gauge in inches of mercury. The stack temperature is monitored by a digital temperature indicator (0 - 2000° F) on the control box connected to the thermocouple on the probe by two chromel-alumel wires in the umbilical cord. The orifice pressure differential is indicated by another magnehelic or manometer (0 - 10 of H₂O).

The particulate-laden flue gas is vacuumed into the nozzle (stainless steel 316) at isokinetic conditions. It then passes through the heated pyrex liner (heated to prevent condensation of water vapor) into the hot box assembly. The hot box, maintained at 250 ° F, contains a 4" Type A glass fiber filter where the particulate is removed from the gas. The gas, after passing through the filter and into the cold box, is bubbled through a series

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of four glass impingers submerged in an ice bath to condense any water vapor in the flue gas. The dry gas is then passed through the umbilical cord into the control unit where the gas volume is measured by the dry gas meter. Thermocouples on the inlet and exit sides of the meter determine the meter temperature. Leaving the dry gas meter, the sample is exhausted through an orifice to the atmosphere. The differential orifice pressure is read directly on the orifice pressure meter (necessary for calculating isokinetics).

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