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/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

1990

USS CLAIRTON WORKS
RESULTS OF THE
COMPLIANCE DEMONSTRATION
OF THE #3 BATTERY COMBUSTION STACK

Prepared for:

1990

USS CLAIRTON WORKS
A DIVISION OF THE USX CORPORATION
CLAIRTON, PA

Prepared by:

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
3000 TECH CENTER DRIVE
MONROEVILLE, PA 15145

PROJECT NO. 601050-06

SEPTEMBER 1990

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ABSTRACT

On August 1, 1990, a compliance test program was conducted for USS Clairton Works, Clairton, PA, on the #3 Battery Combustion Stack operated at the Clairton Coke and Coal Chemical Works. The purpose of the testing was to determine the (1) concentration and mass emissions of particulate matter, and (2) presence of visible emissions from the stack as required by the Amended Mon Valley Consent Decree, Paragraph V.A.(6) and Appendix 4.A. The results of the testing showed an average particulate matter concentration and emission rate of 0.012 gr/scfd and 3.86 lb/hr, respectively. The allowable concentration is 0.030 gr/scfd. Thus, the emissions from the stack are in compliance. No visible emissions were observed from the stack during any of the tests.

1.0 INTRODUCTION

On August 1, 1990, a compliance test program was conducted for USS Clairton Works, Clairton, PA, on the #3 Battery Combustion Stack operated at the Clairton Coke and Coal Chemical Works. The purpose of the testing was to determine the (1) concentration and mass emissions of particulate matter, and (2) presence of visible emissions from the stack as required by the Amended Mon Valley Consent Decree, Paragraph V.A.(6) and Appendix 4.A.

Testing was performed by the Air Quality Engineering Division of Keystone Environmental Resources, Inc. (Keystone). The test crew was comprised of Mark Grunebach, Manager of the Monitoring Services Department, and Richard Casselberry. Visible emissions determinations were performed by Ken Kuiros and Jim McKoy of Environmental Technical Services (ETS). Keystone and ETS are sister companies under the Chester Environmental Group. All test procedures were witnessed by Phil Lawrence of the Allegheny County Health Department.

cc: W. CLARK

USS
Clairton Works
400 State Street
Clairton, PA 15025

October 9, 1990

Allegheny County Health Department
Bureau of Air Pollution Control
301 Thirty-ninth Street
Pittsburgh, PA 15201

ATTN: Mr R. C. Westman, Ph.D.:

Dear Dr. Westman:

Subject: Compliance Demonstration
Clairton Battery #3

Please find enclosed with this letter the report on Battery #3 compliance mass emission stack test, conducted at USS Clairton Works, Division of USX Corporation, on August 1, 1990.

In addition, please find attached an operating permit application (Complying Source) for Batteries 1-3 to include the Pushing Emission Control (PEC) system. Batteries 1-3 have demonstrated compliance with regards to combustion stack emissions (8/1/90), PEC emissions (3/27-29/90), and all other source emissions (12/4-13/89), as required by the Amended Mon Valley Consent Decree.

For further details on this report, please contact Paul Kiswardy at 233-1046.

Very truly yours,

G. T. Weber, Jr.
General Manager
Clairton Works

GTW/BAC-nt
Attachment

ENGINEERING 10-25-1990

2.0 METHODOLOGIES

Particulate matter sampling was performed in accordance with EPA Stationary Source Sampling Methods 1 through 5. The gas volume sampled for each 120 minute test was greater than 50 dry standard cubic feet.

The process exhaust exited through a 114" diameter stack. A total of 24 traverse points (12 per diameter) were sampled; the traverse points were calculated in accordance with EPA Method 1. Sampling was conducted through 4 equally spaced ports, with each traverse point sampled for 5 minutes. A schematic diagram of the stack and traverse points is presented in Figure 2-1.

A total of three test runs were performed. During each test, gas concentrations of CO_2, O_2, and N_2 (by difference) were determined with the use of a Fyrite apparatus as specified by EPA Method 3.

Clean up of the sampling train included an acetone rinse of the front-half components. The water soluble and water insoluble portions of the front-half of the sampling train were determined as a total. The rinses were dried, desiccated, and weighed to a constant weight. These weights were added to the filter weights to determine the total catch. These procedures followed the methodology of EPA Method 5.

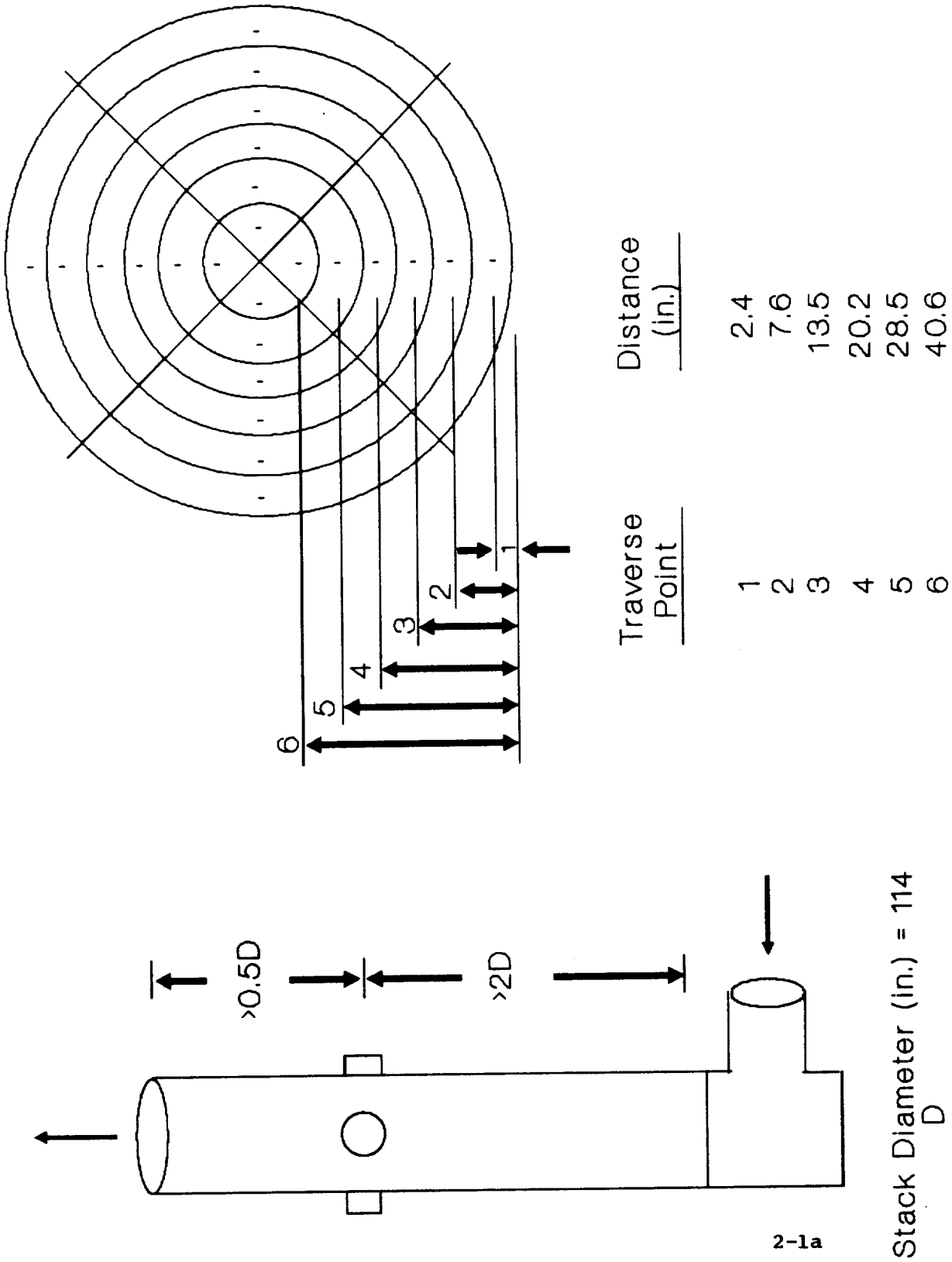
All visible emissions determinations were performed in accordance with EPA Stationary Source Sampling Method 9. Visible emissions were recorded for the duration of each particulate matter test.

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

3000 TECH CENTER DRIVE
MONROEVILLE, PA 15146

SKETCH SHEET

	NAME	DATE
DRAWN		
CHECKED		



ACTIVITY No.

REVISION

TLE

SCHEMATIC DIAGRAM OF THE STACK AND TRAVERSE POINTS

FIGURE 2-1

RD-187 REV. 2 #17-0493 PHOENIX TRACING CLOTH 8-73

3.0 RESULTS

All testing was performed during periods of normal plant operation. To validate this, copies of the operational data can be found in Appendix A.

The probes and sampling trains were operate in accordance with EPA Stationary Source Sampling Methods 1 through 5. Copies of the pre-test calibration results, post-test calibration results, and the results of an audit conducted with a critical orifice provided by the Allegheny County Health Department can be found in Appendix B.

Copies of the field data sheets for the particulate matter sampling can be found in Appendix C. The emissions calculations for each test can be found in Appendix D. The results have been summarized in Table 3-1. The average particulate matter concentration and emission rate are 0.012 grains per standard cubic foot dry (gr/scfd) and 3.86 pounds per hour (lb/hr), respectively.

As promulgated by the Amended Mon Valley Consent Decree, Paragraph V.A.(6), the particulate matter standard for #3 Battery Combustion Stack is 0.030 gr/scfd. Thus, the emissions from the stack are in compliance.

Table 3-1 also lists other pertinent stack and sampling parameters including the stack gas flow rate in units of actual cubic feet per minute (acfm) and standard cubic feet per minute (scfm), moisture content of the stack gas, stack gas temperature, gas volume sampled for each test (scfd), and the isokinetics value for each test. The isokinetics value is equal to the ratio of the average linear gas velocity sampled through the probe nozzle to the average stack gas velocity. An isokinetics value between 90% and 110% is considered acceptable.

Copies of the field data sheets for the visible emissions determinations can be found in Appendix E. No visible emissions were observed during any of the three tests. As promulgated by the Amended Mon Valley Consent Decree, Paragraph V.A.(6), the visible emissions shall not equal or exceed 20% opacity for a period or periods

USS CLAIRTON WORKS
CLAIRTON, PA

TABLE 3-1

PARTICULATE MATTER EMISSIONS DATA

EMISSIONS	TEST #1	TEST #2	TEST #3	AVERAGE
gr/dscf	0.011	0.010	0.014	0.012
lb/hr	3.41	3.09	5.08	3.86
STACK CONDITIONS				
Flow (acfm)	80021	84075	91948	85348
Flow (scfm)	41492	43398	47781	44224
Moisture Content (%)	14.16	14.14	13.36	13.89
Stack Temp. (^{o}F)	541	545	539	542
SAMPLING CONDITIONS				
Sampling Time (min)	120	120	120	
Sample Volume (scfd)	75.613	79.819	88.581	
Isokinetics (%)	92.33	93.16	93.07	

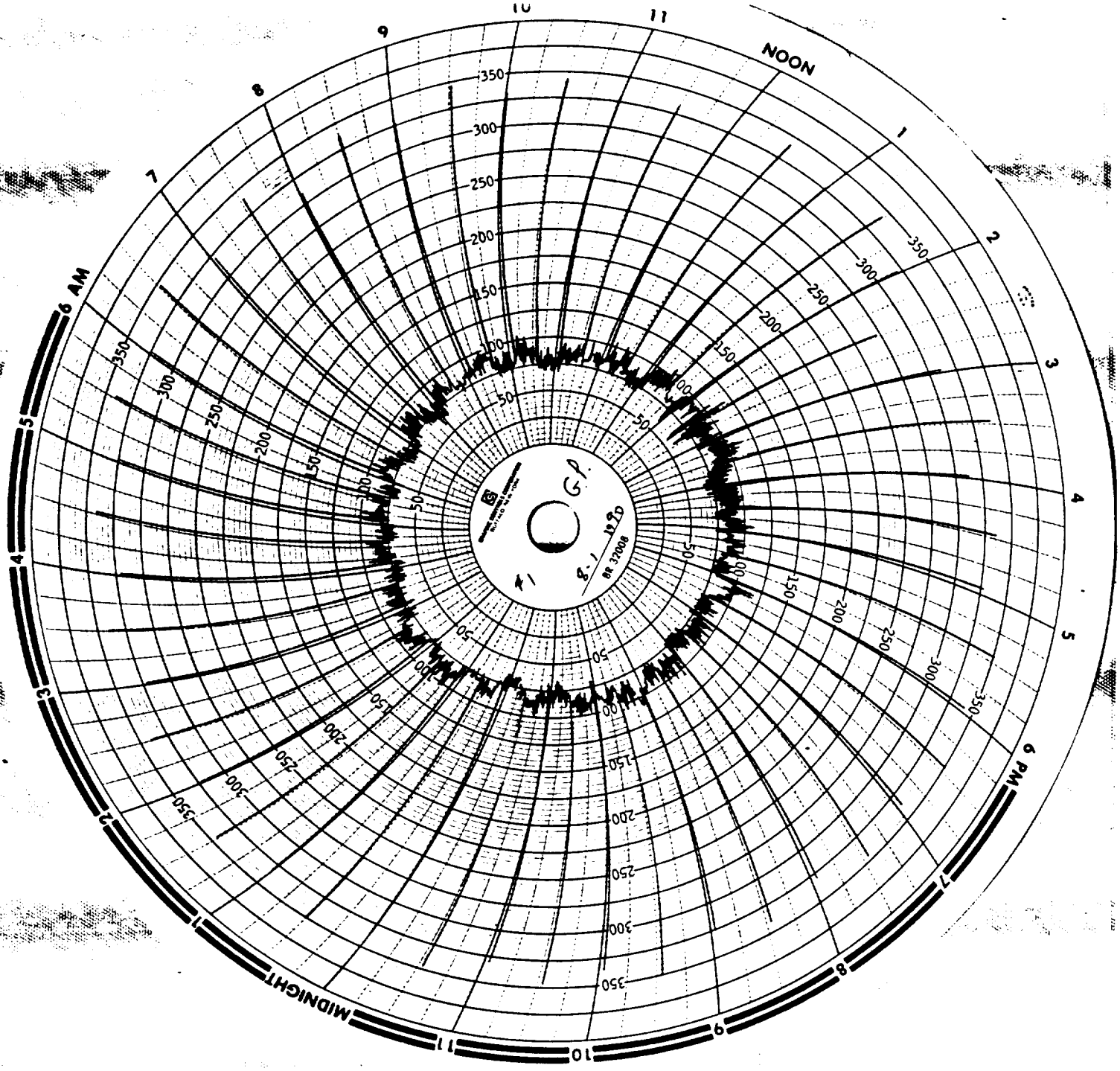
aggregating in excess of 3 minutes in any 60-minute period and shall never equal or exceed 60% opacity. Thus, the emissions are in compliance.

USS CLAIRTON WORKS
RESULTS OF THE
COMPLIANCE DEMONSTRATION OF THE
#3 BATTERY COMBUSTION STACK

APPENDIX A

OPERATIONAL RECORDS

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.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6 PM
MIDNIGHT
6 AM
1
2
3
4
5
6
7
8
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10
11
50
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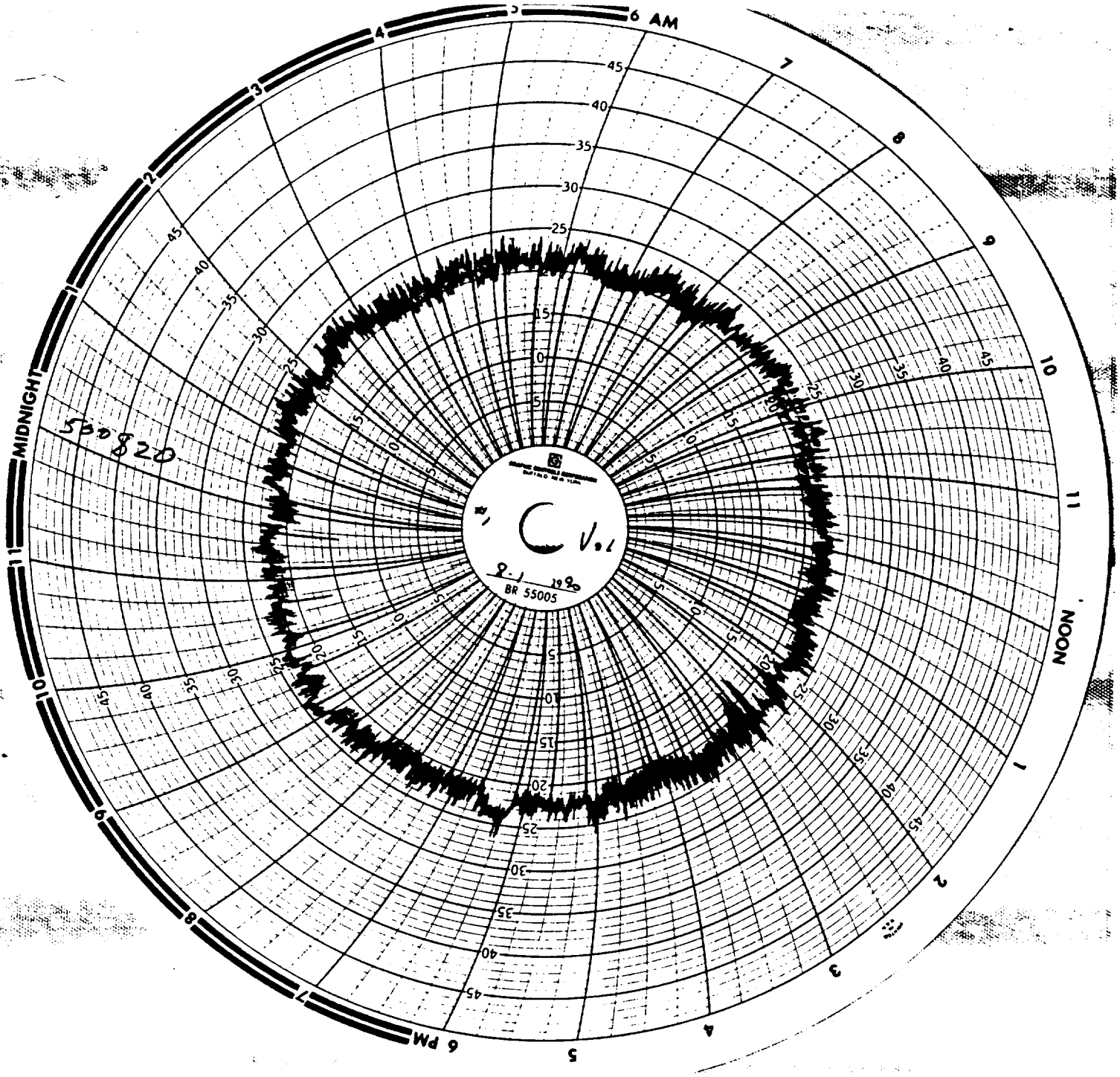
150
200
250
300
350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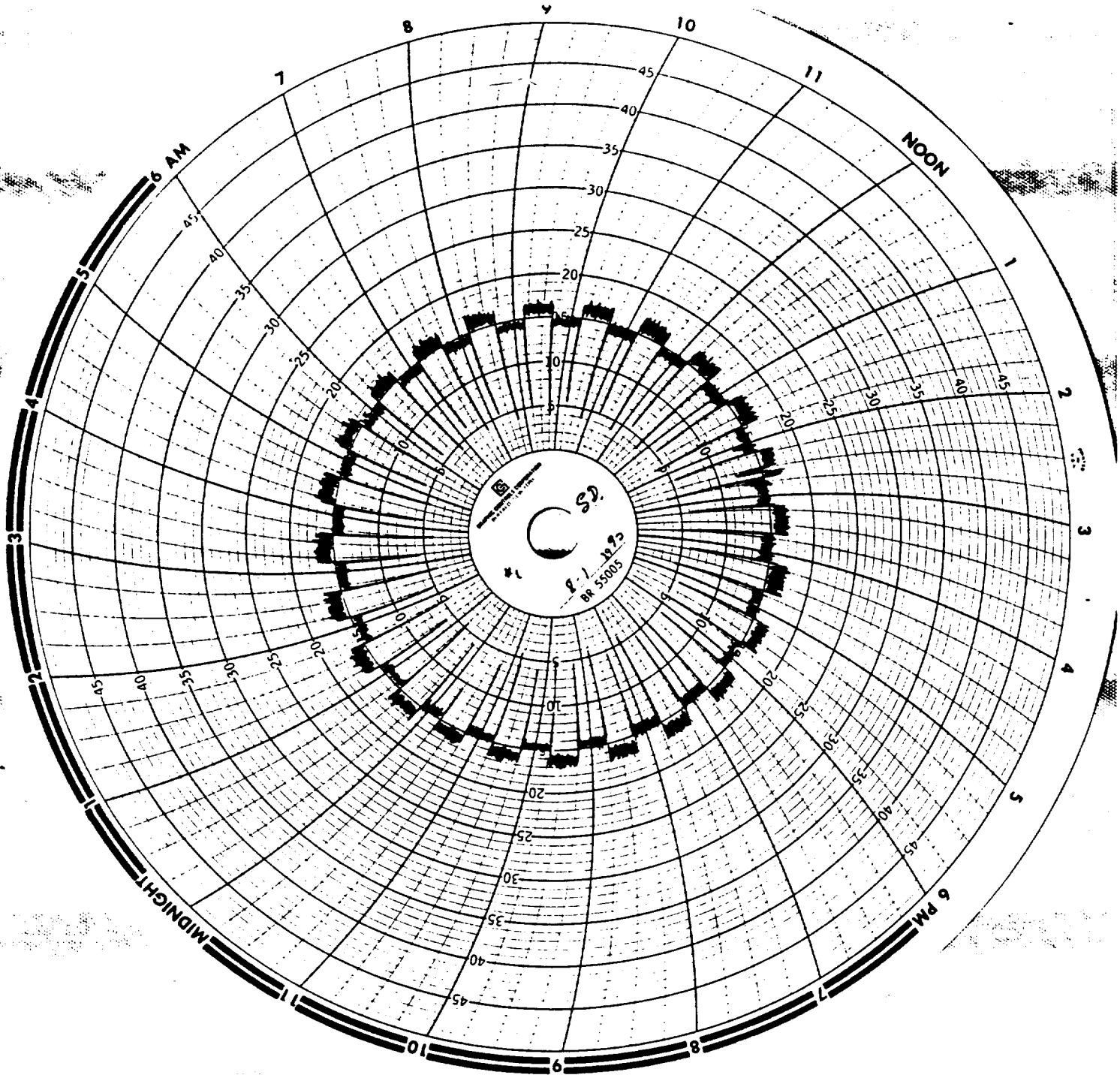
6 PM
MIDNIGHT
BR 55005
530820


NOON
6 PM
MIDNIGHT
6 AM
BR 55005

PUSHING SCHEDULE FOR BATTERIES 1-5

SEQ #	PUSH	CHARGE	STATION	EARLIEST	DESIRED	LATEST
1	A23/ 1	A21/ 1		11:45	12: 0	12:20
2	B23/ 2	B21/ 3		11:51	12: 6	12:26
3	B23/ 1	B21/ 2		11:57	12:12	12:32
4	A23/ 3	A21/ 3		12: 3	12:18	12:38
5	A23/ 2	A21/ 2		12: 9	12:24	12:44
6	B23/ 3	B21/ 3		12:15	12:30	12:50
7	A25/ 1	A23/ 1		12:21	12:36	12:56
8	B25/ 2	B23/ 2		12:28	12:43	1: 3
9	B25/ 1	B23/ 1		12:34	12:49	1: 9
10	A25/ 3	A23/ 3		12:40	12:55	1:15
11	A25/ 2	A23/ 2		12:46	1: 1	1:21
12	B25/ 3	B23/ 3		12:52	1: 7	1:27
13	A27/ 1	A25/ 1		12:58	1:13	1:33
14	B27/ 2	B25/ 2		1: 4	1:19	1:40
15	B27/ 1	B25/ 1		1:11	1:26	1:46
16	A27/ 3	A25/ 3		1:17	1:32	1:52
17	A27/ 2	A25/ 2		1:23	1:38	1:58
18	B27/ 3	B25/ 3		1:29	1:44	2: 4
19	A29/ 1	A27/ 1		1:35	1:50	2:10
20	B29/ 1	B27/ 2		1:41	1:56	2:16
21	A29/ 3	B27/ 1		1:48	2: 3	2:23
22	A29/ 2	A27/ 3		1:54	2: 9	2:29
23	B29/ 3	A27/ 2		2: 0	2:15	2:35
24	A31/ 1	B27/ 3		2: 6	2:21	2:41
25	B31/ 2	A29/ 1		2:12	2:27	2:47
26	B31/ 1	B29/ 1		2:18	2:33	2:53
27	A31/ 3	A29/ 3		2:25	2:40	3: 0
28	A31/ 2	A29/ 2		2:31	2:46	3: 6
29	B31/ 3	B29/ 3		2:37	2:52	3:12
30	A 2/ 1	B31/ 1		2:43	2:58	3:18
31	B 2/ 2	A31/ 2		2:49	3: 4	3:24
32	C 2/ 2	B31/ 2		2:55	3:10	3:30
33	B 2/ 1	A31/ 1		3: 1	3:16	3:36
34	A 2/ 3	B31/ 3		3: 8	3:23	3:43
35	C 2/ 1	A 2/ 1		3:14	3:29	3:49
36	B 2/ 3	A31/ 3		3:20	3:35	3:55
37	A 2/ 2	B 2/ 2		3:26	3:41	4: 1
38	C 2/ 3	A 2/ 3		3:32	3:47	4: 7
39	A 4/ 1	C 2/ 1		3:38	3:53	4:13
40	B 4/ 2	C 2/ 2		3:45	4: 0	4:20
41	B 4/ 1	B 2/ 1		3:51	4: 6	4:26
42	A 4/ 3	C 2/ 3		3:57	4:12	4:32
43	A 4/ 2	A 2/ 2		4: 3	4:18	4:38
44	B 4/ 3	B 2/ 3		4: 9	4:24	4:44
45	A 6/ 1	A 4/ 1		4:15	4:30	4:50
46	B 6/ 2	B 4/ 2		4:21	4:36	4:56
47	B 6/ 1	B 4/ 1		4:28	4:43	5: 3
48	A 6/ 3	A 4/ 3		4:34	4:49	5: 9
49	A 6/ 2	A 4/ 2		4:40	4:55	5:15
50	B 6/ 3	B 4/ 3		4:46	5: 1	5:21
51	A 8/ 1	A 6/ 1		4:52	5: 7	5:27
52	B 8/ 2	B 6/ 2		4:58	5:13	5:33
53	B 8/ 1	B 6/ 1		5: 5	5:20	5:40
54	A 8/ 2	A 6/ 3		5:11	5:26	5:46
55	B 8/ 3	A 6/ 2		5:17	5:32	5:52
56	A10/ 1	B 6/ 3		5:23	5:38	5:58
57	B10/ 2	A 8/ 1		5:29	5:44	6: 4
58	B10/ 1	B 8/ 2		5:35	5:50	6:10
59	A10/ 3	B 8/ 1		5:41	5:56	6:16
60	A10/ 2	A 8/ 2		5:48	6: 3	6:23
61	B10/ 3	B 8/ 3		5:54	6: 9	6:29
62	A12/ 1	A10/ 1		6: 0	6:15	6:35
63	B12/ 2	B10/ 2		6: 6	6:21	6:41
64	B12/ 1	B10/ 1		6:12	6:27	6:47
65	A12/ 3	A10/ 3		6:18	6:33	6:53
66	A12/ 2	A10/ 2		6:25	6:40	7: 0
67	B12/ 3	B10/ 3		6:31	6:46	7: 6
68	A14/ 1	A12/ 1		6:37	6:52	7:12
69	B14/ 2	B12/ 2		6:43	6:58	7:18
70	B14/ 1	B12/ 1		6:49	7: 4	7:24
71	A14/ 3	A12/ 3		6:55	7:10	7:30
72	A14/ 2	A12/ 2		7: 1	7:16	7:36
73	B14/ 3	B12/ 3		7: 8	7:23	7:43
74	A16/ 1	A14/ 1		7:14	7:29	7:49
75	B16/ 2	B14/ 2		7:20	7:35	7:55
76	B16/ 1	B14/ 1		7:26	7:41	8: 1
77	A16/ 3	A14/ 3		7:32	7:47	8: 7
78	A16/ 2	A14/ 2		7:38	7:53	8:10

WED AUG 1 1990 12X 8 TURN

-B29/2 -A8/3

SEQ #	PUSH	CHARGE	STATION	EARLIEST	DESIRED	LATEST
1	B16/ 3	B14/ 3		7:45	8: 0	8:20
2	A18/ 1	A16/ 1		7:51	8: 6	8:26
3	B18/ 2	B16/ 2		7:57	8:12	8:32
4	B18/ 1	B16/ 1		8: 3	8:18	8:38
5	A18/ 3	A16/ 3		8: 9	8:24	8:44
6	A18/ 2	A16/ 2		8:15	8:30	8:50
7	B18/ 3	B16/ 3		8:21	8:36	8:56
8	A20/ 1	A18/ 1		8:28	8:43	9: 3
9	B20/ 2	B18/ 2		8:34	8:49	9: 9
10	B20/ 1	B18/ 1		8:40	8:55	9:15
11	A20/ 3	A18/ 3		8:46	9: 1	9:21
12	A20/ 2	A18/ 2		8:52	9: 7	9:27
13	B20/ 3	B18/ 3		8:58	9:13	9:33
14	A22/ 1	A20/ 1		9: 4	9:19	9:40
15	B22/ 2	B20/ 2		9:11	9:26	9:46
16	B22/ 1	B20/ 1		9:17	9:32	9:52
17	A22/ 3	A20/ 3		9:23	9:38	9:58
18	A22/ 2	A20/ 2		9:29	9:44	10: 4
19	B22/ 3	B20/ 3		9:35	9:50	10:10
20	A24/ 1	A22/ 1		9:41	9:56	10:16
21	B24/ 2	B22/ 2		9:48	10: 3	10:23
22	B24/ 1	B22/ 1		9:54	10: 9	10:29
23	A24/ 3	A22/ 3		10: 0	10:15	10:35
24	A24/ 2	A22/ 2		10: 6	10:21	10:41
25	B24/ 3	B22/ 3		10:12	10:27	10:47
26	A26/ 1	A24/ 1		10:18	10:33	10:53
27	B26/ 2	B24/ 2		10:25	10:40	11: 0
28	B26/ 1	B24/ 1		10:31	10:46	11: 6
29	A26/ 3	A24/ 3		10:37	10:52	11:12
30	A26/ 2	A24/ 2		10:43	10:58	11:18
31	B26/ 3	B24/ 3		10:49	11: 4	11:24
32	A28/ 1	A26/ 1		10:55	11:10	11:30
33	B28/ 2	B26/ 2		11: 1	11:16	11:36
34	B28/ 1	B26/ 1		11: 8	11:23	11:43
35	A28/ 3	A26/ 3		11:14	11:29	11:49
36	A28/ 2	A26/ 2		11:20	11:35	11:55
37	B28/ 3	B26/ 3		11:26	11:41	12: 1
38	A30/ 1	A28/ 1		11:32	11:47	12: 7
39	B30/ 2	B28/ 2		11:38	11:53	12:13
40	B30/ 1	B28/ 1		11:45	12: 0	12:20
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46	C 1/ 2	B30/ 2		12:21	12:36	12:56
47	C 1/ 1	A 1/ 1		12:28	12:43	1: 3
48	A 1/ 3	B30/ 3		12:34	12:49	1: 9
49	A 1/ 2	A 1/ 3		12:40	12:55	1:15
50	B 1/ 3	A30/ 3		12:46	1: 1	1:21
51	B 1/ 2	B 1/ 3		12:52	1: 7	1:27
52	C 1/ 3	A30/ 2		12:58	1:13	1:33
53	A 3/ 1	B 1/ 1		1: 5	1:20	1:40
54	B 3/ 2	B 1/ 2		1:11	1:26	1:46
55	B 3/ 1	C 1/ 1		1:17	1:32	1:52
56	A 3/ 3	C 1/ 2		1:23	1:38	1:58
57	A 3/ 2	A 1/ 2		1:29	1:44	2: 4
58	B 3/ 3	C 1/ 3		1:35	1:50	2:10
59	A 5/ 1	A 3/ 1		1:41	1:56	2:16
60	B 5/ 2	B 3/ 2		1:48	2: 3	2:23
61	B 5/ 1	B 3/ 1		1:54	2: 9	2:29
62	A 5/ 3	A 3/ 3		2: 0	2:15	2:35
63	A 5/ 2	A 3/ 2		2: 6	2:21	2:41
64	B 5/ 3	B 3/ 3		2:12	2:27	2:47
65	A 7/ 1	A 5/ 1		2:18	2:33	2:53
66	B 7/ 2	B 5/ 2		2:25	2:40	3: 0
67	B 7/ 1	B 5/ 1		2:31	2:46	3: 6
68	A 7/ 3	A 5/ 3		2:37	2:52	3:12
69	A 7/ 2	A 5/ 2		2:43	2:58	3:18
70	B 7/ 3	B 5/ 3		2:49	3: 4	3:24
71	A 9/ 1	A 7/ 1		2:55	3:10	3:30
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73	B 9/ 1	B 7/ 1		3: 8	3:23	3:43
74	A 9/ 3	A 7/ 3		3:14	3:29	3:49
75	A 9/ 2	A 7/ 2		3:20	3:35	3:55
76	B 9/ 3	B 7/ 3		3:26	3:41	4: 1
77	A11/ 1	A 9/ 1		3:32	3:47	4: 7
78	B11/ 2	B 9/ 2		3:38	3:53	4:10

WED AUG 1 1990 8X 4 TURN

SEQ #	PUSH	CHARGE	STATION	EARLIEST	DESIRED	LATEST
1	B11/ 1	B 0/ 0		3:45	4: 0	4:20
2	A11/ 3	A 9/ 1		3:51	4: 6	4:26
3	A11/ 2	A 9/ 3		3:57	4:12	4:32
4	B11/ 3	B 9/ 2		4: 3	4:18	4:38
5	A13/ 1	A 9/ 3		4: 9	4:24	4:44
6	B13/ 2	B11/ 2		4:15	4:30	4:50
7	B13/ 1	B11/ 1		4:21	4:36	4:56
8	A13/ 3	A11/ 3		4:27	4:42	5: 2
9	A13/ 2	A11/ 2		4:33	4:48	5: 8
10	B13/ 3	B11/ 3		4:39	4:54	5:14
1	A15/ 1	A13/ 1		4:45	5: 0	5:20
2	B15/ 2	B13/ 2		4:51	5: 6	5:26
13	B15/ 1	B13/ 1		4:57	5:12	5:32
14	A15/ 3	A13/ 3		5: 3	5:18	5:38
15	A15/ 2	A13/ 2		5:10	5:25	5:45
6	B15/ 3	B13/ 3		5:16	5:31	5:51
7	A17/ 1	A15/ 1		5:22	5:37	5:57
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21	A17/ 2	A15/ 2		5:46	6: 1	6:21
22	B17/ 3	B15/ 3		5:52	6: 7	6:27
23	A19/ 1	A17/ 1		5:58	6:13	6:33
24	B19/ 2	B17/ 2		6: 4	6:19	6:39
25	B19/ 1	B17/ 1		6:10	6:25	6:45
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27	A19/ 2	A17/ 2		6:22	6:37	6:57
28	B19/ 3	B17/ 3		6:29	6:44	7: 4
29	A21/ 1	A19/ 1		6:35	6:50	7:10
0	B21/ 2	B19/ 2		6:41	6:56	7:16
31	B21/ 1	B19/ 1		6:47	7: 2	7:22
32	A21/ 3	A19/ 3		6:53	7: 8	7:28
33	A21/ 2	A19/ 2		6:59	7:14	7:34
4	B21/ 3	B19/ 3		7: 5	7:20	7:40
35	A23/ 1	A21/ 1		7:11	7:26	7:46
36	B23/ 2	B21/ 2		7:17	7:32	7:52
37	B23/ 1	B21/ 1		7:23	7:38	7:58
8	A23/ 3	A21/ 3		7:29	7:44	8: 4
39	A23/ 2	A21/ 2		7:35	7:50	8:10
40	B23/ 3	B21/ 3		7:41	7:56	8:16
41	A25/ 1	A23/ 1		7:48	8: 3	8:23
42	B25/ 2	B23/ 2		7:54	8: 9	8:29
3	B25/ 1	B23/ 1		8: 0	8:15	8:35
4	A 8/ 3	A23/ 3		8: 6	8:21	8:41
45	A25/ 3	A23/ 2		8:12	8:27	8:47
46	A25/ 2	B23/ 3		8:18	8:33	8:53
7	B25/ 3	A25/ 1		8:24	8:39	8:59
8	A27/ 1	B25/ 2		8:30	8:45	9: 5
49	B27/ 2	B25/ 1		8:36	8:51	9:11
50	B27/ 1	A 8/ 3		8:42	8:57	9:17
1	A27/ 3	A25/ 3		8:48	9: 3	9:23
2	A27/ 2	A25/ 2		8:54	9: 9	9:29
3	B27/ 3	B25/ 3		9: 0	9:15	9:35
54	A29/ 1	A27/ 1		9: 7	9:22	9:42
55	B29/ 2	B27/ 2		9:13	9:28	9:48
6	B29/ 1	B27/ 1		9:19	9:34	9:54
7	A29/ 3	A27/ 3		9:25	9:40	10: 0
58	A29/ 2	A27/ 2		9:31	9:46	10: 6
59	B29/ 3	B27/ 3		9:37	9:52	10:12
0	A31/ 1	A29/ 1		9:43	9:58	10:18
1	B31/ 2	B29/ 2		9:49	10: 4	10:24
2	B31/ 1	B29/ 1		9:55	10:10	10:30
63	A31/ 3	A29/ 3		10: 1	10:16	10:36
64	A31/ 2	A29/ 2		10: 7	10:22	10:42
5	B31/ 3	B29/ 3		10:13	10:28	10:48
6	A 2/ 1	B31/ 1		10:19	10:34	10:54
67	B 2/ 2	A31/ 2		10:26	10:41	11: 1
68	C 2/ 2	B31/ 2		10:32	10:47	11: 7
9	B 2/ 1	A31/ 1		10:38	10:53	11:13
0	A 2/ 3	B31/ 3		10:44	10:59	11:19
1	C 2/ 1	A 2/ 1		10:50	11: 5	11:25
72	B 2/ 3	A31/ 3		10:56	11:11	11:31
73	A 2/ 2	B 2/ 2		11: 2	11:17	11:37
4	C 2/ 3	A 2/ 3		11: 8	11:23	11:43
5	A 4/ 1	C 2/ 1		11:14	11:29	11:49
76	B 4/ 2	C 2/ 2		11:20	11:35	11:55
77	B 4/ 1	B 2/ 1		11:26	11:41	12: 1
8	A 4/ 3	C 2/ 3		11:32	11:47	12: 7
9	A 4/ 2	A 2/ 2		11:38	11:53	12:10

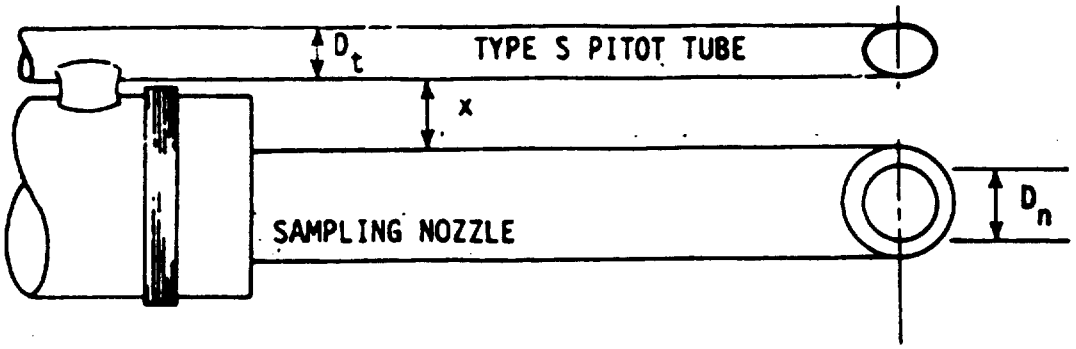
WED AUG 1 1990 4X12 TURN

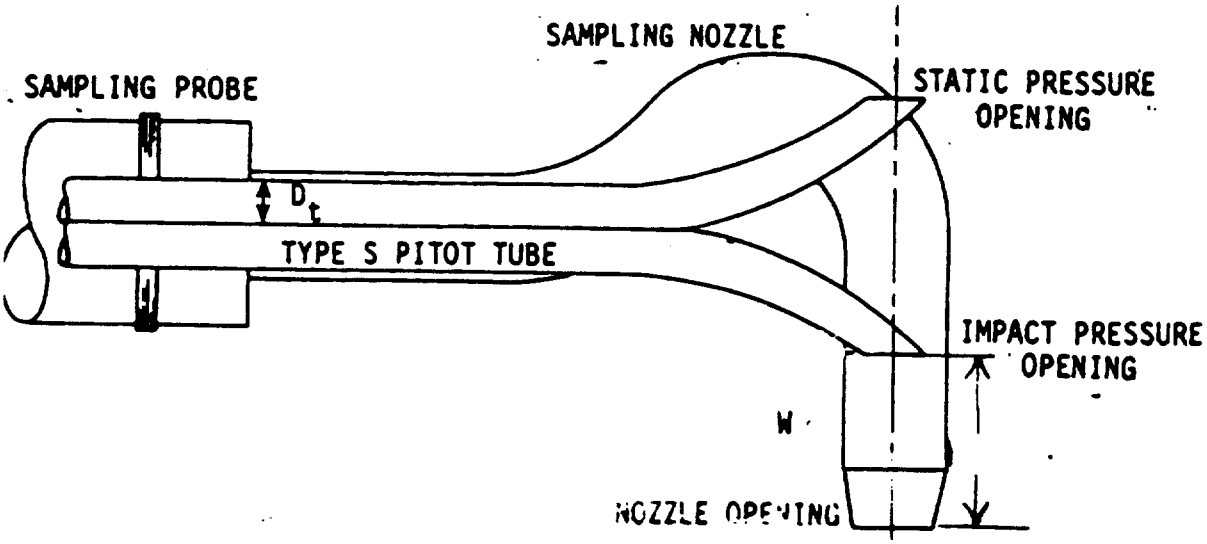
USS CLAIRTON WORKS
RESULTS OF THE
COMPLIANCE DEMONSTRATION OF THE
#3 BATTERY COMBUSTION STACK

APPENDIX B

PRE-TEST AND POST-TEST
CALIBRATION AND AUDIT RESULTS

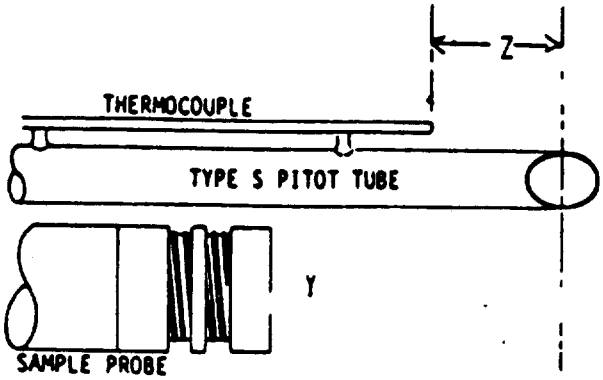
KEYSTONE
ENVIRONMENTAL RESOURCES, INC.





D_n = Nozzle diameter

D_t = 3/16 to 3/8"



$W \geq 0$

$X \geq 3/4"$ for 1/2" Nozz

$Y \geq 3"$

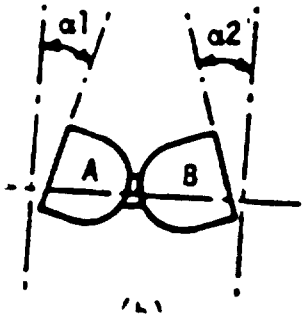
$Z \geq 2"$

GEOMETRIC PITOT CALIBRATION

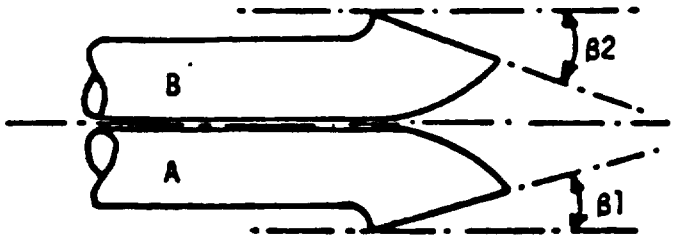
Probe No. 7-1
Date 6/29/90
Initials MTS

pre-test

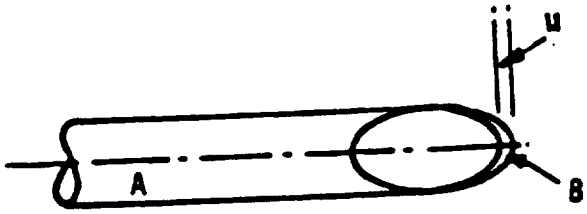
α1 =	2°
α2 =	1°
β1 =	2°
β2 =	4°
A =	1.059
μ =	.018
V =	0
W =	>0
X =	>3/4"
Y =	>3"
Z =	>2"
D_t =	380



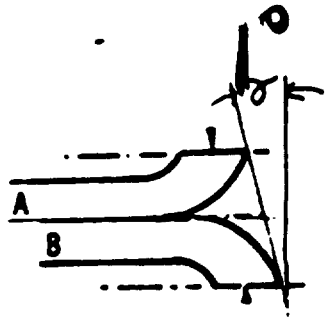
α1, α2 <10°



β1, β2 <5

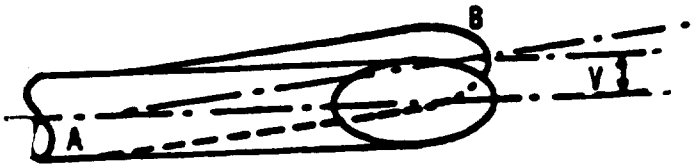


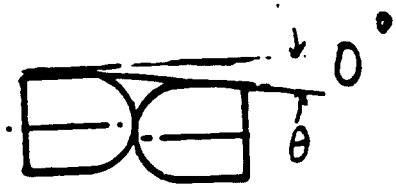
(f)



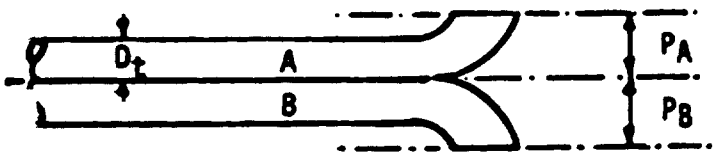
μ = A SIN γ

V = A SIN θ





A-SIDE PLANE



B-SIDE PLANE

.399 .570

$1.05\ D_t < P < 1.50\ D_t$

$P_A = P_B$

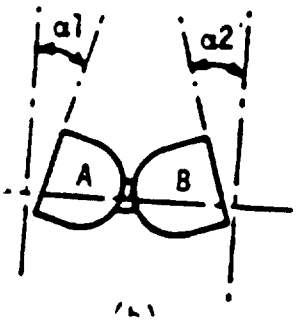
$2.10\ D_t < A < 3.00\ D_t$

.798 1.14

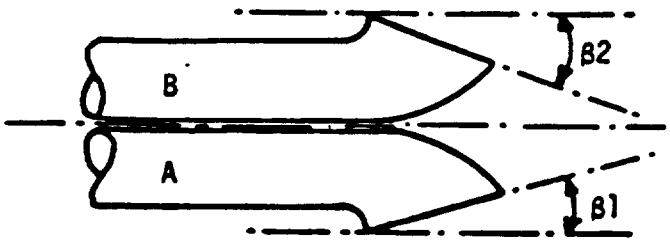
GEOMETRIC PITOT CALIBRATION

Probe No. 7-1
Date 8-20-96
Initials GM
post-check

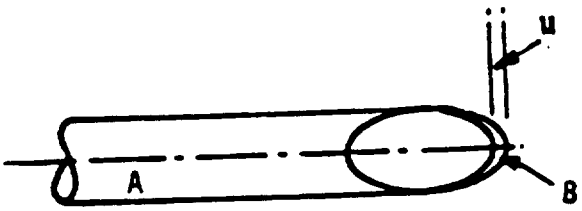
α1 = 4°
α2 = 1°
β1 = 3°
β2 = 0°
A = 1.055
μ = .036
V = .036
W = ≥0
X = .828
Y = ≥3
Z = ≥2
D_t = 38



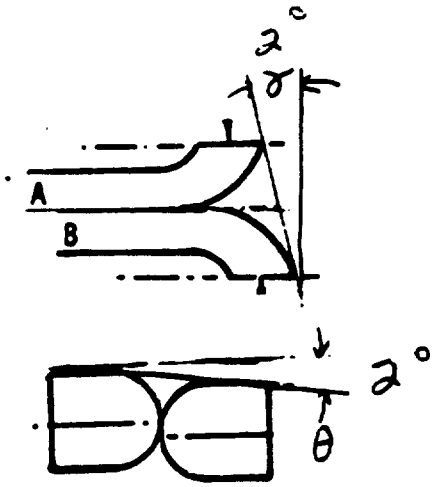
α1, α2 <10°



β1, β2 <5



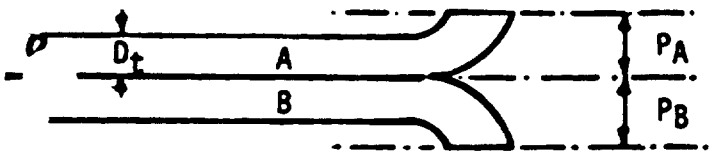
(f)



2° μ = A SIN γ

2° V = A SIN θ

A-SIDE PLANE



B-SIDE PLANE

405 .579

$1.05\ D_t < P < 1.50\ D_t$

$P_A = P_B$

$2.10\ D_t < A < 3.00\ D_t$

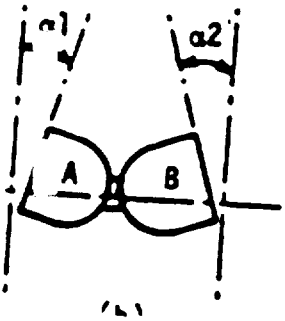
.811 1.16

GEOMETRIC PITOT CALIBRATION

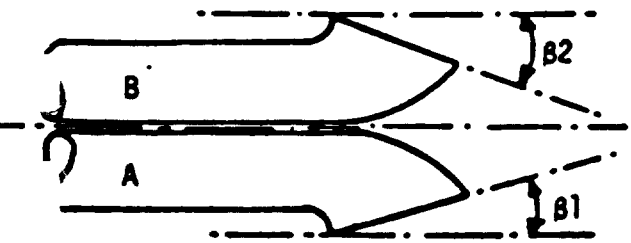
Probe No. 1-6
Date 6-29-90
Initials ATS

pre test

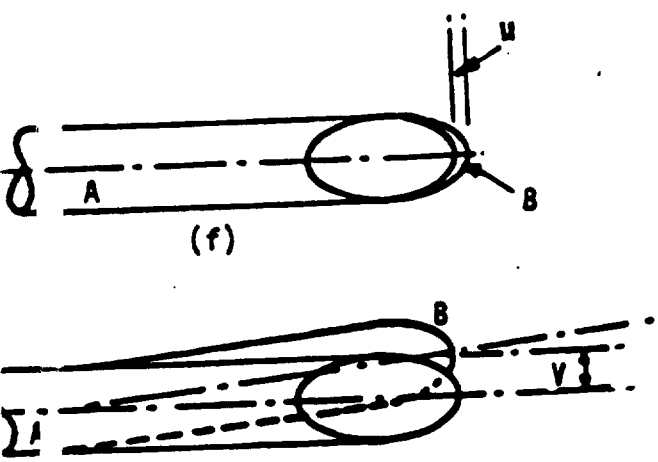
α1 = 4°
α2 = 3°
β1 = 1°
β2 = 3°
A = .988
μ = .034
V = .069
W = >0
X = >3/4"
Y = >3"
Z = >2"
D_t = .385

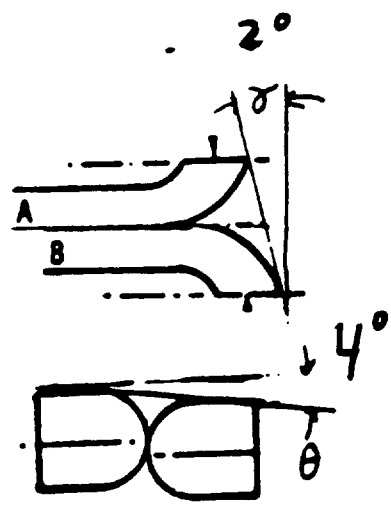


α1, α2 <10°



β1, β2 <5

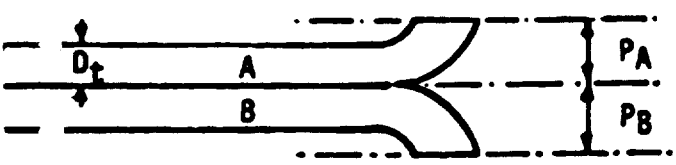




μ = A SIN γ

V = A SIN θ

A-SIDE PLANE



B-SIDE PLANE

.404 .5775

1.05 D_t <P <1.50 D_t

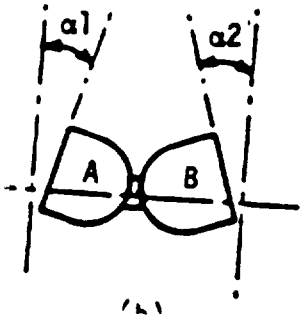
$P_A = P_B$

2.10 D_t <A <3.00 D_t

.808 1.155

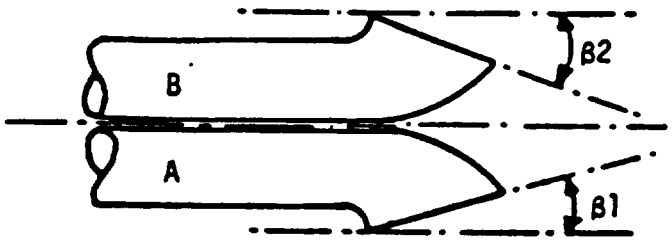
GEOMETRIC PITOT CALIBRATION

Probe No. 7-2
Date 8-20-90
Initials [illegible]
post check

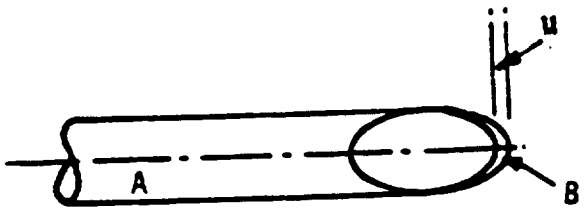


α1, α2 <10°

α1 = 1°
α2 = 3°
β1 = 4°
β2 = 1°
A = .962
μ = .067
V = .033
W = ≥0
X = .989
Y = ≥ 3"
Z = ≥ 2"
D_t = .376



β1, β2 <5



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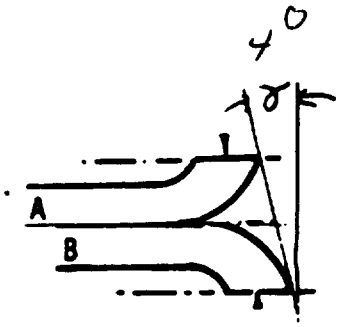
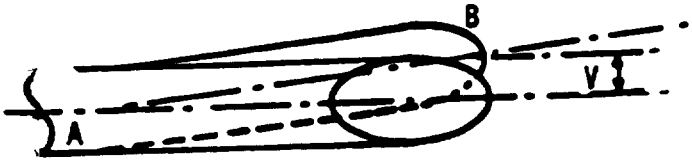
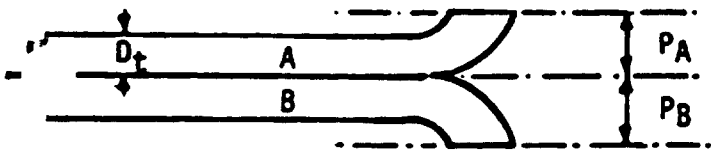


μ = A SIN γ

V = A SIN θ



A-SIDE PLANE



B-SIDE PLANE

.394 .564

$1.05\ D_t < P < 1.50\ D_t$

$P_A = P_B$

$2.10\ D_t < A < 3.00\ D_t$

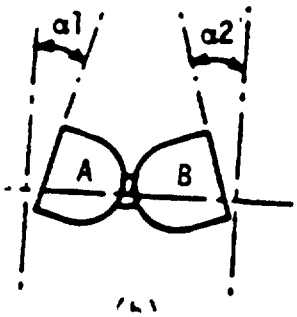
.789 1.128

GEOMETRIC PITOT CALIBRATION

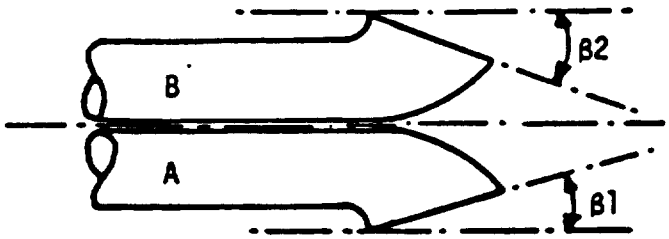
Probe No. 7-3
Date 6/29/90
Initials ATS

Pre-test

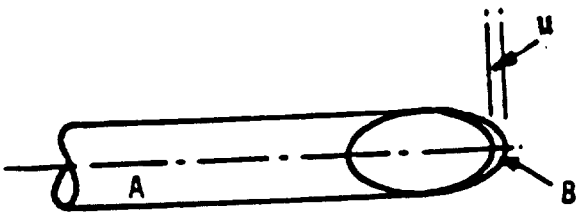
α1 = 4°
α2 = 2°
β1 = 0°
β2 = 0°
A = .954
μ = 0°
V = ~~.004~~ .050
W = >0
X = >3/4"
Y = 73"
Z = 52"
D_t = .376



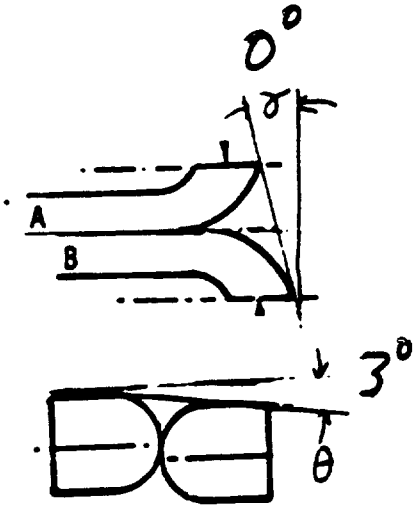
α1, α2 <10°



β1, β2 <5

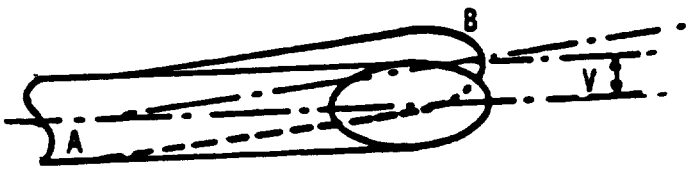


(f)

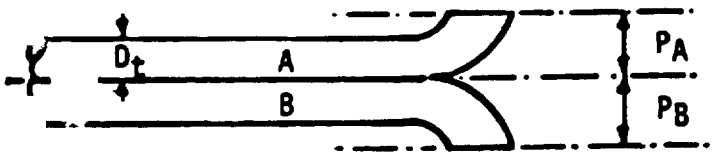


μ = A SIN γ

V = A SIN θ



A-SIDE PLANE



B-SIDE PLANE

.395 .564

1.05 D_t <P <1.50 D_t

$P_A = P_B$

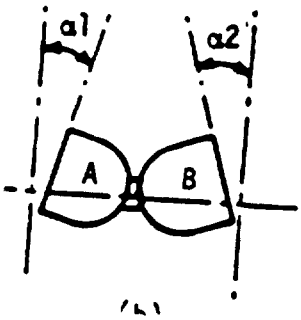
2.10 D_t <A <3.00 D_t

.799 1.128

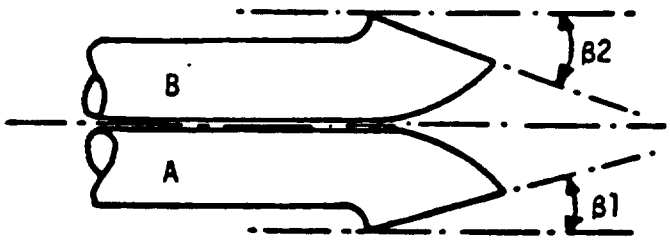
GEOMETRIC PITOT CALIBRATION

Probe No. 2-3
Date 8-20-90
Initials [illegible]
post-check

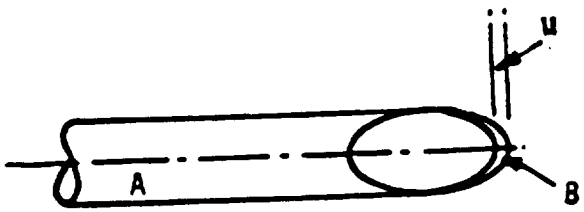
$\alpha 1$ = 2°
$\alpha 2$ = 2°
$\beta 1$ = 1°
$\beta 2$ = 0°
A = .961
μ = .016
V = .067
W = ≥0
X = .945
Y = ≥3"
Z = ≥2"
D_t = .327



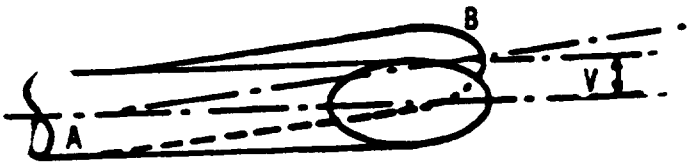
$\alpha 1, \alpha 2 < 10°$

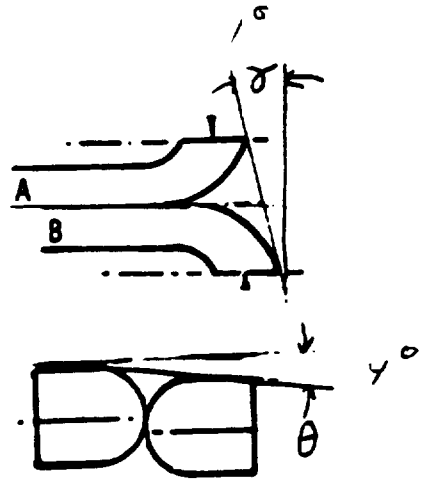


$\beta 1, \beta 2 < 5$



(f)

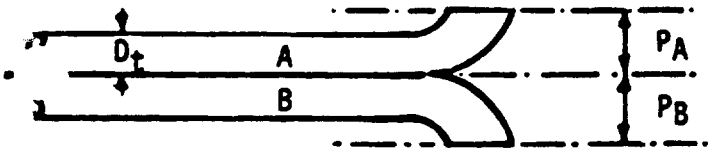




$\mu = A \sin \gamma$

$V = A \sin \theta$

A-SIDE PLANE



B-SIDE PLANE

.325 .565

$1.05\ D_t < P < 1.50\ D_t$

$P_A = P_B$

$2.10\ D_t < A < 3.00\ D_t$

.791 1.13

CONTROL BOX CALIBRATION

THREE POINT CALIBRATION

BOX NO. 1
DATE 6-12-90
BP 29.1
OPERATOR TJM

	TIME	WET TEST METER TEMP T_W	WET TEST METER VOLUME V_M	PRESSURE P_W	PRESSURE T_I	PRESSURE T_O	DRY TEST METER TEMP IN T_A	DRY TEST METER TEMP OUT P_D	DRY TEST METER TEMP AVG V_D	ORIFICE Y	ORIFICE $H_@$	VOLUME	METER CORRECT	ORIFICE COEIFFICE
START				0.000		29.10					0.50	464.200		
HALF			78.0				94.0	92.0	93.0					
STOP	11.50			5.000								469.118		
CALCULATION	11.50		538.0	5.057		29.10				553.0	29.14	4.918	1.0555	1.475
START				0.000		29.10					1.00	470.000		
HALF			78.0				98.0	91.0	94.5					
STOP	8.43			5.000								474.977		
CALCULATION	8.43		538.0	5.057		29.10				554.5	29.17	4.977	1.0445	1.580
START				0.000		29.10					2.00	476.000		
HALF			78.0				99.0	92.0	95.5					
STOP	6.12			5.000								480.920		
CALCULATION	6.12		538.0	5.057		29.10				555.5	29.25	4.920	1.0558	1.663
AVERAGE													1.0519	1.573

POST TEST

BOX NO. 1
DATE 8-15-90
BP 29.03
OPERATOR MGG

	TIME	WET TEST METER TEMP T_W	VOLUME V_M	P_W	PRESSURE T_I	T_O	DRY TEST METER TEMP IN T_A	TEMP OUT P_D	V_D	TEMP AVG Y	ORIFICE $H_@$	VOLUME	METER CORRECT	ORIFICE COEIFFICE
START				0.000		29.03					1.50	139.400		
HALF			77.0				94.0		85.0	89.5				
STOP	7.22			5.000								144.422		
CALCULATION	7.22		537.0	5.057		29.03				549.5	29.14	5.022	1.0264	1.753
START				0.000		29.03					1.50	145.600		
HALF			77.0				94.0		84.0	89.0				
STOP	7.18			5.002								150.643		
CALCULATION	7.18		537.0	5.059		29.03				549.0	29.14	5.043	1.0216	1.733
START				0.000		29.03					1.50	152.700		
HALF			77.0				94.0		83.0	88.5				
STOP	7.12			5.001								157.744		
CALCULATION	7.12		537.0	5.058		29.03				548.5	29.14	5.044	1.0203	1.707
AVERAGE													1.0228	1.731
DIFFERENCE													2.85%	-9.14%

MAGNAHELIC CALIBRAATION

DATE 8-15-90

OPERATOR MGG

P 0-10		P 0-.5		H	
MAGNEHILIC	MANOMETER	MAGNEHILIC	MANOMETER	MAGNEHILIC	MANOMETER
0.50	0.50	0.50	0.50	4.00	4.00
1.00	1.00	0.40	0.40	3.00	3.00
2.00	2.00	0.30	0.30	2.00	2.00
4.00	4.00	0.20	0.20	1.00	1.00
6.00	6.00	0.10	0.10	0.50	0.50
8.00	8.00				

LEAK CHECK

DATE 8-15-90

OPERATOR MGG

	START CF	STOP CF	VOL	TIME	LEAK RATE
DRY	138.270	138.413	0.143	10.000	0.023
WET	0.000	0.371	0.371		

PYROMETER CALIBRATION

DATE 04-28-88

OPERATOR AGL

mV input	temp °F	temp rdg °F
0.18	40	40.0
0.40	50	50.0
0.84	70	70.0
1.29	90	90.0
1.74	110	110.0
2.66	150	150.0
3.82	200	200.0
6.09	300	301.0
8.31	400	400.0
10.57	500	500.0

PYROMETER CHECK

DATE 8-6-90

OPERATOR TM

mV input °F	temp °F	temp rdg
0.18	40	40.0
0.40	50	50.0
0.84	70	70.0
1.29	90	90.0
1.74	110	110.0
2.66	150	150.0
3.82	200	200.0
6.09	300	300.0
8.31	400	400.0
10.57	500	500.0

Name: KEYSTONE ENV. RES. Phone: 825-976

Date 8/21/90 Train ID BOX 1 DGM Cal. Factor, Y 1.0519 Orifice No. BAPC-

Type of Meter Box NAPP 100 Type of Pump DIAPHRAM

		Example	Run Number 1	2	3
DGM					
Final reading	ft^3	966.461	338.857	345.980	353.06
Initial reading	ft^3	946.602	331.900	339.000	346.10
Difference, V_m	ft^3	9.859	6.957	6.980	6.966
Percent Accuracy, %A					
Inlet/Outlet temperatures					
Initial	°F.	108/88	77/74	78/76	77/75
After 5 minutes		110/88	77/74	78/75	78/7
After 10 minutes		111/88	77/74	78/75	78/75
Final		112/89	76/74	77/75	77/75
Avg. temperature, t_d	°F/°R	99.3/559.3	75.4 535.4	76.5/536.5	76.3/536
Time, θ	min	15.0	15.0	15.0	15.0
Orifice man. rdg., delta H		1.35	0.65	0.65	0.65
Bar. pressure, P_{bar}		29.75	28.981	28.98	28.98
Ambient temperature, t_i	°F/°C	74/23.3	82/27.8	82/27.8	82/27
Pump vacuum	in. Hg	18.8	19.5	19.5	19.5
$V_{m(std)}$'	ft^3	9.2815			
DGM cal. factor, Y_c		1.0593			
*$V_m(std)$ (M)	m^3	0.2629			

*If you calculate dry gas volume in English Units, use the conversion factor of 0.02832 m^3/ft^3 to obtain the volume in metric units.

Data Sheet

Box 1 8-21-90

VOLUMETRIC FLOW DEVICE CALCULATION SHEET

Eq. 8-1 $$Vm(std) = VmY \left(\frac{Tstd}{Tm}\right) \left(\frac{Pbar + \frac{Delta\ H}{13.6}}{Pstd}\right)$$

Run #1 $$Vm(std)' = Vm \times Y \times \frac{528}{Tm} \times \left(\frac{Pbar + \frac{Delta\ H}{13.6}}{29.92}\right)$$

Vm(std)' = (6.957)(~~1.011~~ 1.0519)(0.9862)(0.9704)

Vm(std)' = ~~6.731~~ 7.002 ft³ (round to 3 decimals)

Run #2 Vm(std)' = (6.980)(~~1.011~~ 1.0519)(0.9842)(0.9704)

Vm(std)' = ~~6.740~~ 7.011 ft³

Run #3 Vm(std)' = (6.966)(~~1.011~~ 1.0519)(0.9845)(0.9704)

Vm(std)' = ~~6.728~~ 6.999 ft³

$$Vstd(M) = \frac{Vm(std)'\ Run\ \#1 + Vm(std)'\ Run\ \#2 + Vm(std)'\ Run\ \#3}{3}$$

Vstd(M) = ~~6.733~~ 7.004 ft³

- -

(To Be Completed By Auditor)

$$\%\ A = \frac{Vstd(M) - Vstd(A)}{Vstd(A)} \times 100 \leq \pm 3\%$$

% A = _____ x 100

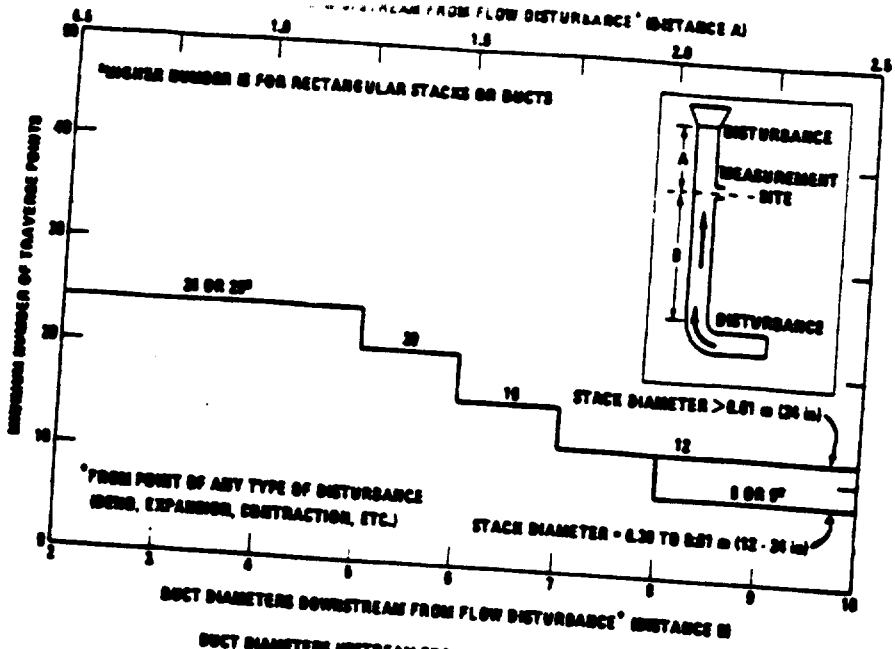
% A = _____ %

USS CLAIRTON WORKS
RESULTS OF THE
COMPLIANCE DEMONSTRATION OF THE
#3 BATTERY COMBUSTION STACK

APPENDIX C

FIELD DATA SHEETS FOR
PARTICULATE MATTER EMISSIONS

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.



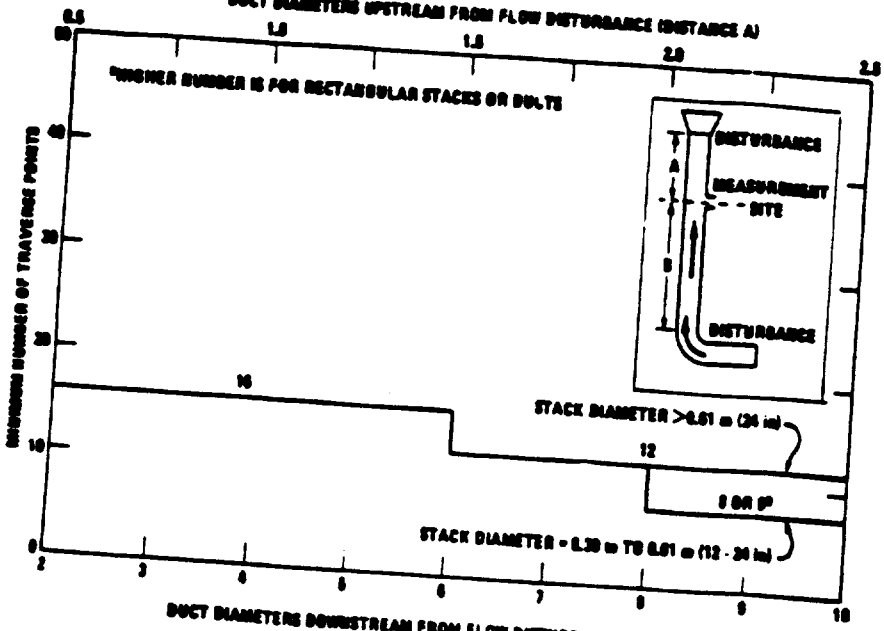


TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

[Percent of stack diameter from inside wall to traverse point]

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.8	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	38.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	38.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								96.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.6
24												98.9

TABLE 1-1. CROSS-SECTION LAYOUT FOR RECTANGULAR STACKS

Number of traverse points	Matrix layout
9	3x3
12	4x3
16	4x4
20	5x4
25	5x5
30	6x5
36	6x6
42	7x6
49	7x7

CLR-CS3-1

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: Clairton
LOCATION: Battery/Stack #3
ACTIVITY NO:
CONTROL BOX OPERATOR
PROBE HANDLER
CLEAN UP

DATE: 8-1-90
TEST NO.: CLR-CS3-1
NOZZLE: (.499) #55
STATIC PRESSURE Ps: -1.2
PORT DIRECTION: 29 A,B
BAROMETRIC PRESSURE 29.49

ΔH@: 1.573
METER CORRECTION: 1.0519
PITOT CORRECTION: .84
CONTROL BOX NO.: 1
NOMOGRAPH SET POINT:
LENGTHS OF UMBILICAL ____ x 25' ____ x 50'

HOT BOX NO.: 6
COLD BOX NO.: 6
PROBE NO.: 37-3
FILTER NO.: 452
STACK DIA.: 114"

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp. T_m °F In	Meter Temp. T_m °F Out	Vacuum V_m in. Hg	Stack Temp. T_s °F	Probe Temp. T_p °F	Imp. Temp. T_I °C/°F	Hot Box Temp. T_H °F	Comments
40.6	0948	638.907	.07	1.73	1.73	70	75	8.0	527	260	Iced down 468	250	Sm/PT
28.5			.065	1.60	1.60	82	73	7.5	522	260			
20.2			.07	1.73	1.73	84	74	8.0	530				
13.5			.06	1.48	1.48	89	79	7.5	525		57		
7.6			.045	1.11	1.11	89	78	5.0	522				
2.4	1018	657.431	.035	0.86	0.86	89	79	4.5	519				
Port B													
40.6	1020	657.431	.065	1.60	1.60	88	82	7.5	545	260		260	
28.5			.07	1.73	1.73	94	83	8.0	550				
20.2			.07	1.74	1.74	95	85	8.0	565		56		
13.5			.07	1.74	1.74	96	86	8.0	545				
7.6			.05	1.24	1.24	97	87	6.0	535				
2.4	1050	677.358	.04	1.0	1.0	97	88	5.0	530				

C-2

LEAK CHECK

	in Hg	Rate
Before	6.0	<.02 CFM
After	9.0	<.005 CFM

ORSAT

	1	2	3
CO_2	4.0	3.5	
O_2	12.5	12.5	
CO			
N			

Pitot check
Red = O.K
Green = O.K
15 sec

Impinger No.	Final	Initial	Difference
1 100ml	748.9	548.5	200.4
2 100ml	538.1	494.0	44.1
3 DRY	457.7	453.4	4.3
4 Silica	676.2	660.5	15.7
5			

(7.)

CLR-CS3-1

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: CLAIRTON
LOCATION: BATTERY STACK #3
ACTIVITY NO:
CONTROL BOX OPERATOR
PROBE HANDLER
CLEAN UP

DATE: 8-1-90
TEST NO.: CLR-CS3-1
NOZZLE:
STATIC PRESSURE Ps: -1.2
PORT DIRECTION: C, D
BAROMETRIC PRESSURE

ΔH@:
METER CORRECTION:
PITOT CORRECTION:
CONTROL BOX NO.:
NOMOGRAPH SET POINT:
LENGTHS OF UMBILICAL ____ x 25' ____ x 50'

HOT BOX NO.:
COLD BOX NO.:
PROBE NO.:
FILTER NO.:
STACK DIA.:

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp. T_m °F In	Meter Temp. T_m °F Out	Vacuum V_m in. Hg	Stack Temp. T_s °F	Probe Temp. T_p °F	Imp. Temp. T_I °C/°F	Hot Box Temp. T_H °F	Comments
40.6	1055	677.358	.06	1.49	1.49	96	90	7.3	525	260	Ice & down <68	255	5-/PT
28.5			.065	1.62	1.62	100	91	7.5	536				
20.2			.065	1.62	1.62	101	91	7.5	542		58		
13.5			.06	1.49	1.49	101	92	7.3	530				
7.6			.045	1.11	1.11	102	93	5.0	532				
2.4	1125	696.413	.04	1.00	1.00	103	94	5.0	525				
PORT-D													
40.6	1128	696.413	.065	1.62	1.62	101	96	7.5	550	260	Ice & down <68	255	
28.5			.06	1.49	1.49	108	98	7.3	562				
20.2			.05	1.25	1.25	108	98	6.0	570				
13.5			.055	1.38	1.38	109	99	6.6	571				
7.6			.04	1.00	1.00	109	99	5.0	560				
2.4	1158	714.868	.04	1.00	1.00	109	100	5.0	558				

C-3

LEAK CHECK

	in Hg	Rate
Before		
After		

ORSAT

	1	2	3
CO_2	4.0		
O_2	12.5		
CO			
N			

Impinger No.	Final	Initial	Difference
1			
2			
3			
4			
5			

(3)

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: CLAIRTON
LOCATION: BATTERY STACK #3
ACTIVITY NO:
CONTROL BOX OPERATOR
PROBE HANDLER
CLEAN UP

DATE: 8-1-90
TEST NO.: CLR-CS3-2
NOZZLE: .499 #55
STATIC PRESSURE Ps: -1.2
PORT DIRECTION: A, B
BAROMETRIC PRESSURE 29.49

ΔH@: 1.573
METER CORRECTION: 1.0519
PITOT CORRECTION: .84
CONTROL BOX NO.: 1
NOMOGRAPH SET POINT:
LENGTHS OF UMBILICAL ____ x 25' ____ x 50'

HOT BOX NO.: 5
COLD BOX NO.: 5
PROBE NO.: 7-1
FILTER NO.: 463
STACK DIA.: 114

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp. T_m °F In	Meter Temp. T_m °F Out	Vacuum V_m in. Hg	Stack Temp. T_s °F	Probe Temp. T_p °F	Imp. Temp. T_I °C/°F	Hot Box Temp. T_H °F	Comments
40.6	1228	715.137	.065	1.65	1.65	103	100	7.0	561	260	Iced down 68	255	Sm/PT
28.5			.075	1.90	1.90	108	101	8.0	570				
20.2			.075	1.85	1.85	110	100	8.0	579		58		
13.5			.08	1.97	1.97	110	101	8.5	583				
7.6			.065	1.60	1.60	111	100	7.0	577				
2.4	1258	736.668	.05	1.23	1.23	111	102	6.0	575				
PORT-B													
40.6	1300	736.668	.065	1.60	1.60	108	101	7.0	530	200	Iced down 68	255	
28.5			.065	1.60	1.60	113	103	7.0	536				
20.2			.075	1.85	1.85	114	103	8.0	549				
13.5			.075	1.85	1.85	115	104	8.0	545		56		
7.6			.06	1.48	1.48	114	104	6.5	542				
2.4	1330	758.048	0.055	1.36	1.36	114	105	6.0	540				

LEAK CHECK

	in Hg	Rate
Before	5.0	0.02 CFM
After	[illegible]	0.008

ORSAT

	1	2	3
CO_2	4.0	3.5	3.25
O_2	12.5	13.5	13.0
CO			
N			

PITOT Check
Red = OK 2.15 Sec
GREEN = OK 5 Sec

Impinger No.	Final	Initial	Difference
1 100 ml	727.8 g	538.9 g	188.9
2 100 ml	545.0	501.3	~~44.7~~ 43.7
3 Dry	472.7	446.1	26.6
4 Silica	677.2	657.7	19.5
5			

(4)

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: Clinton
DATE: 8-1-90
ΔH@:
HOT BOX NO.:
LOCATION: Battery Stack #3
TEST NO.: CLR-CS3-2
METER CORRECTION:
COLD BOX NO.:
ACTIVITY NO:
NOZZLE:
PITOT CORRECTION:
PROBE NO.:
CONTROL BOX OPERATOR
STATIC PRESSURE Ps:
CONTROL BOX NO.:
FILTER NO.:
PROBE HANDLER
PORT DIRECTION: E, D
NOMOGRAPH SET POINT:
STACK DIA.:
CLEAN UP
BAROMETRIC PRESSURE 29.49
LENGTHS OF UMBILICAL ____ x 25' ____ x 50'

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp., T_m °F In	Meter Temp., T_m °F Out	Vacuum V_m in. Hg	Stack Temp. T_s °F 530	Probe Temp. T_p °F	Imp. Temp. T_I °C/°F	Hot Box Temp. T_H °F	Comments
40.6	1335	758.048	.055	1.36	1.36	106	102	6.0	530	260	Iced down <68	255	5m/PT
28.5			.07	1.73	1.73	103	105	8.0	533				
20.2			.07	1.73	1.73	116	105	8.0	525				
13.5			.065	1.60	1.60	116	107	7.0	527		59		
7.6			.05	1.23	1.23	115	105	6.0	524				
2.4	1405	778.208	.04	.99	.99	114	106	4.5	523				
PORT-D													
40.6	1413	778.208	.065	1.60	1.60	112	104	7.0	535	260	Iced down <68	250	
28.5			.065	1.60	1.60	115	106	7.0	535				
20.2			.06	1.48	1.48	115	105	7.0	545				
13.5			.055	1.36	1.36	114	105	6.0	551				
7.6			.045	1.11	1.11	113	104	5.0	539		60		
2.4	1443	797.565	.04	.99	.99	113	104	5.0	532				

LEAK CHECK

	in Hg	Rate
Before		
After		

ORSAT

	1	2	3
CO_2			
O_2			
CO			
N			

Impinger No.	Final	Initial	Difference
1			
2			
3			
4			
5			

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: CLAIRTON
LOCATION: BATTERY/STACK #3
ACTIVITY NO:
CONTROL BOX OPERATOR
PROBE HANDLER
CLEAN UP

DATE: 8-1-90
TEST NO.: CLR-CS3-3
NOZZLE: .499 #55
STATIC PRESSURE Ps: -1.2
PORT DIRECTION: A, B
BAROMETRIC PRESSURE 29.49

ΔH@: 1.573
METER CORRECTION: 1.0519
PITOT CORRECTION: .84
CONTROL BOX NO.: 1
NOMOGRAPH SET POINT:
LENGTHS OF UMBILICAL ____ x 25' ____ x 50'

HOT BOX NO.: 2
COLD BOX NO.: 2
PROBE NO.: 2-2
FILTER NO.: 454
STACK DIA.: 114

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Req.	Orifice ΔH in. H_2O Act.	Meter Temp., T_m °F In	Meter Temp., T_m °F Out	Vacuum V_m in. Hg	Stack Temp. T_s °F	Probe Temp. T_p °F	Imp. Temp. T_I °C/°F	Hot Box Temp. T_H °F	Comments
40.6	1512	798.025	.075	1.85	1.85	112	105	6.0	549	260	Iced down 68	255	Sm/PT
28.5			.08	1.97	1.97	117	107	6.0	539				
20.2			.09	2.22	2.22	118	108	7.5	546		61		
13.5			.085	2.10	2.10	118	107	6.5	554				
7.6			.085	2.10	2.10	118	107	6.5	547				
2.4	1542	820.115	.07	1.73	1.73	118	107	5.5	545				
Port-B													
40.6	1544	820.115	.09	2.22	2.22	113	107	7.5	527	260	Iced down 68	250	
28.5			.085	2.10	2.10	117	107	6.5	521				
20.2			.09	2.22	2.22	116	106	7.5	518				
13.5			.09	2.22	2.22	117	106	7.5	521		62		
7.6			.075	1.95	1.95	117	106	6.0	523				
2.4	1614	844.806	.07	1.82	1.82	117	107	6.0	518				

C-6

LEAK CHECK

	in Hg	Rate
Before	5.0	1.002 CFM
After		1.002

ORSAT

	1	2	3
CO_2	4.0	4.0	
O_2	12.0	12.0	
CO			
N			

Pitot Check
Red = O.K
Green = O.K 15sec

Impinger No.	Final	Initial	Difference
1 100ml	779.4	557.8	221.6
2 100ml	594.8	549.0	45.8
3 Dry	450.4	445.4	5.0
4 Silica	712.3	695.0	17.3
5			

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

PLANT: Clairton
LOCATION: Battery/Stack #3
ACTIVITY NO:
CONTROL BOX OPERATOR
PROBE HANDLER
CLEAN UP

DATE: 8-1-90
TEST NO.: CLR-CS3-3
NOZZLE: .499 #55
STATIC PRESSURE Ps: -1.2
PORT DIRECTION: C, B C,D
BAROMETRIC PRESSURE 29.49

ΔH@:
METER CORRECTION:
PITOT CORRECTION:
CONTROL BOX NO.:
NOMOGRAPH SET POINT:
LENGTHS OF UMBILICAL ____ x 25' ____ x 50'

HOT BOX NO.:
COLD BOX NO.:
PROBE NO.:
FILTER NO.:
STACK DIA.:

Point	Time	Meter Reading (dry) CF	Velocity HD in. H_2O	Orifice ΔH in. H_2O Reg.	Orifice ΔH in. H_2O Act.	Meter Temp. T_m °F In	Meter Temp. T_m °F Out	Vacuum V_m in. Hg	Stack Temp. T_s °F	Probe Temp. T_p °F	Imp. Temp. T_I °C/°F	Hot Box Temp. T_H °F	Comments
40.6	1617	844.806	.08	2.10	2.10	110	105	6.5	540	260	Iced down 68	255	
28.5			.08	2.10	2.10	116	105	6.5	545				
20.2			.075	1.94	1.94	115	105	6.0	555				
13.5			.07	1.81	1.81	115	106	5.5	561		62		
7.6			.06	1.55	1.55	114	105	5.0	553				
2.4	1647	867.247	.05	1.29	1.29	114	105	5.0	545				
Port-D													
40.6	1650	867.247	.07	1.81	1.81	108	104	6.0	526	260		255	
28.5			.08	2.08	2.08	114	104	6.5	528				
20.2			.065	1.68	1.68	114	105	5.5	533				
13.5			.065	1.68	1.68	114	105	5.5	535		63		
7.6			.065	1.68	1.68	113	104	5.5	537				
2.4	1720	889.803	.06	1.55	1.55	113	103	5.5	540				

C-7

LEAK CHECK

	in Hg	Rate
Before		
After		

ORSAT

	1	2	3
CO_2			
O_2			
CO			
N			

Impinger No.	Final	Initial	Difference
1	779.4	557.8	221.6
2	594.8	549.0	45.8
3	450.4	445.4	5.0
4	712.3	695.0	17.3
5			

USS CLAIRTON WORKS
RESULTS OF THE
COMPLIANCE DEMONSTRATION OF THE
#3 BATTERY COMBUSTION STACK

APPENDIX D

PARTICULATE MATTER
EMISSIONS CALCULATIONS

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

Plant: Clairton Steel **Date:** 8/3/90

Activity No. 601050-06

PARTICULATE REPORTING FORM

Test Number	Component	Molecular Weight	Cyclone Weight	Particulate Filter Weight (g)	Insol. Part. in Front Half	Insol. Part. in Back Half	Soluble Part. in Back Half	Soluble Part. in Front Half (g)
CLR-CS3-1				0.0480				0.0069
CLR-CS3-2				0.0431				0.0071
CLR-CS3-3				0.0680				0.0144

AIR QUALITY ENGINEERING

USX CLAIRTON COKE WORKS
CLAIRTON
COMBUSTION STACK 3

DATE: 8-1-90
CHARGE #: ...150-601050
TEST #: CLR-CS3-1

1. EMISSION RESULTS

PARAMETER	GR/SCFD	LB/HR
PARTICULATE	.01118	3.41358

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2. STACK CONDITIONS

FLOW (ACFM)	80021.
(SCFM)	41492.
MOISTURE CONTENT (%)	14.16
STACK TEMPERATURE (F)	540.7

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3. SAMPLING CONDITIONS

SAMPLE TIME (MIN.)	120.0
SCFD GAS SAMPLED	75.613
PERCENT ISOKINETIC	92.33

AIR QUALITY ENGINEERING

USX CLAIRTON COKE WORKS

CLAIRTON COMBUSTION

CLR-CS3-1 8-1-90

FIELD DATA AND VELOCITY CALCULATIONS

POINT	TIME	METER READING (DRY)CF	DELTA P IN.H2O	ORIFICE DELTA H REQ	ORIFICE DELTA H ACT	METER TEMP DEG F IN	METER TEMP DEG F OUT	VACUUM IN.HG.	STACK TEMP DEG F	CORRECTED VELOCITY FT/SEC
40.6A	948.0	638.907	.070	1.73	1.73	70.	75.	8.0	527.	20.9
28.5			.065	1.60	1.60	82.	73.	7.5	522.	20.1
20.2			.070	1.73	1.73	84.	74.	8.0	530.	21.0
13.5			.060	1.48	1.48	89.	79.	7.5	525.	19.4
7.6			.045	1.11	1.11	89.	78.	5.0	522.	16.7
2.4A	1018.0	657.431	.035	.86	.86	89.	79.	4.5	519.	14.7
40.6B	1020.0	657.431	.065	1.60	1.60	88.	82.	7.5	545.	20.3
28.5			.070	1.73	1.73	94.	83.	8.0	550.	21.2
20.2			.070	1.74	1.74	95.	85.	8.0	565.	21.3
13.5			.070	1.74	1.74	96.	86.	8.0	545.	21.1
7.6			.050	1.24	1.24	97.	87.	6.0	535.	17.8
2.4B	1050.0	677.358	.040	1.00	1.00	97.	88.	5.0	530.	15.8
40.6C	1055.0	677.358	.060	1.49	1.49	96.	90.	7.3	525.	19.4
28.5			.065	1.62	1.62	100.	91.	7.5	536.	20.3
20.2			.065	1.62	1.62	101.	91.	7.5	542.	20.3
13.5			.060	1.49	1.49	101.	92.	7.3	530.	19.4
7.6			.045	1.11	1.11	102.	93.	5.0	532.	16.8
2.4C	1125.0	696.413	.040	1.00	1.00	103.	94.	5.0	525.	15.8
40.6D	1128.0	696.413	.065	1.62	1.62	101.	96.	7.5	550.	20.4
28.5			.060	1.49	1.49	108.	98.	7.3	562.	19.7
20.2			.050	1.25	1.25	108.	98.	6.0	570.	18.1
13.5			.055	1.38	1.38	109.	99.	6.6	571.	19.0
7.6			.040	1.00	1.00	109.	99.	5.0	560.	16.1
2.4D	1158.0	714.868	.040	1.00	1.00	109.	100.	5.0	558.	16.1

O R S A T	
CO2	3.8
O2	12.5
CO	.0
N	83.8

IMPINGER NO.	1	200.4
	2	44.1
	3	4.3
	4	.0
ABSORBED H2O		15.7

CONTROL BOX CALIBRATIONS

	FACTOR	DATE
ORIFICE	1.573	6-12-90
METER	1.0519	6-12-90
PITOT	0.84	6-29-90

LEAK CHECK

	RATE	IN.HG
INITIAL	LT 0.02CFM	6.0
FINAL	0.005CFM	9.0

CONTROL BOX NO. 1 PROBE NO. 7-3 NOZZLE NO. 55

AIR QUALITY ENGINEERING

USX CLAIRTON COKE WORKS

CLAIRTON COMBUSTION

CLR-CS3-1 8-1-90

STACK SAMPLING CALCULATIONS

A.	BAROMETRIC PRESSURE IN. HG.....	29.49
B.	AVG. DELTA H (IN H2O).....	1.40
C.	METER PRESSURE (IN. HG.).....	29.59
D.	STATIC PRESSURE (IN. H2O).....	-1.20
E.	STATIC PRESSURE (IN. HG.).....	-.088
F.	STACK PRESSURE (IN. HG.) (A+E).....	29.40
G.	STACK DIAMETER (IN.).....	114.00
H.	STACK AREA (SQ. FT.).....	70.88
	NOZZLE DIAMETER.....	.4990
I.	NOZZLE AREA (SQ. FT.).....	.001358
J.	AVG. STACK TEMP (DEG. R.).....	1000.7
K.	AVG. METER TEMP (DEG. R.).....	552.2
L.	CONDENSATE VOL. (ML).....	248.8
M.	ABSORBED H2O (ML).....	15.7
N.	TOTAL H2O (ML).....	264.5
O.	METERED GAS (CF).....	75.961
P.	GAS METER CORRECTION.....	1.0519
Q.	CORRECTED METERED GAS (CF).....	79.903
R.	H2O GAS VOLUME (CF) (0.00267N(K/C).....	13.179
S.	TOTAL SAMPLED VOLUME (CF) (Q+R).....	93.082
T.	PERCENT H2O (100R/S).....	14.16
	THEORETICAL MAXIMUM.....	100.00
	PERCENT WATER USED.....	14.16
U.	SCFD GAS SAMPLED (528*Q*C/(29.9*K)).....	75.613

V. MOLECULAR WEIGHT OF STACK GAS

COMPONENT	ORSAT-DRY VOL.PCT./100	X	MOISTURE CORRECTION (1-T/100)	X	MOLECULAR WEIGHT	=	WEIGHT PER MOLE
CO2	.038	X	.8584	X	44.0	=	1.42
CO	.000	X	.8584	X	28.0	=	.00
O2	.125	X	.8584	X	32.0	=	3.43
N2	.838	X	.8584	X	28.2	=	20.27
H2O		X	T/100= .1416	X	18.0	=	2.55
					MOLECULAR WEIGHT OF STACK GAS	=	27.67

W.	PITOT CORRECTION.....	.840
X.	AVERAGE CORRECTED VELOCITY (FPS).....	18.82
	[85.49*W*SQRT{(J*DELTA P)/(V*F)}]	
Y.	AVG. FLOW RATE (CFM) (X*H*60).....	80021.
Z.	STACK FLOW RATE (SCFM) (528*Y/J*F/29.92).....	41492.
	STACK FLOW RATE (DRY).....	35617.
AA.	SAMPLE TIME (SEC).....	7200.
BB.	PERCENT ISOKINETIC.....	92.33
	(J*100*U*29.92)/(528*X*AA*I*F*(1-T/100))	

AIR QUALITY ENGINEERING

USX CLAIRTON COKE WORKS

CLAIRTON COMBUSTION

CLR-CS3-1 8-1-90

PARAMETER	CYCLONE WT. (G)	MATL.ON FILTER(G)	INSOL.MATL. IN PROBE(G)	SOL.MATL. IN PROBE(G)
PARTICULATE	.00000	.04800	.00000	.00690

PARAMETER	INSOL.MATL. IN IMP.(G)	SOLUBLE MATL. IN IMP.(G)
PARTICULATE	.00000	.00000
PARTICULATE	.05490	
ALL MATLS.	.05490	

PARAMETER	GR/SCFD	LB/HR
PARTICULATE	.01118	3.41358

Emission rates are based on EPA Method 5.

AIR QUALITY ENGINEERING

USX CLAIRTON COKE WORKS
CLAIRTON
COMBUSTION STACK 3

DATE: 8-1-90
CHARGE #: ...150-601050
TEST #: CLR-CS3-2

1. EMISSION RESULTS

PARAMETER	GR/SCFD	LB/HR
PARTICULATE	.00969	3.09353

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2. STACK CONDITIONS

FLOW (ACFM)	84075.
(SCFM)	43398.
MOISTURE CONTENT (%)	14.14
STACK TEMPERATURE (F)	545.2

---

3. SAMPLING CONDITIONS

SAMPLE TIME (MIN.)	120.0
SCFD GAS SAMPLED	79.819
PERCENT ISOKINETIC	93.16

AIR QUALITY ENGINEERING

USX CLAIRTON COKE WORKS

CLAIRTON COMBUSTION

CLR-CS3-2 8-1-90

FIELD DATA AND VELOCITY CALCULATIONS

POINT	TIME	METER READING (DRY) CF	DELTA P IN.H2O	ORIFICE DELTA H REQ	ORIFICE DELTA H ACT	METER TEMP DEG F IN	METER TEMP DEG F OUT	VACUUM IN.HG.	STACK TEMP DEG F	CORRECTED VELOCITY FFT/SEC
40.6A	1228.0	715.137	.065	1.65	1.65	103.	100.	7.0	561.	20.5
28.5			.075	1.90	1.90	108.	101.	8.0	570.	22.1
20.2			.075	1.85	1.85	110.	100.	8.0	579.	22.2
13.5			.080	1.97	1.97	110.	101.	8.5	583.	23.0
7.6			.065	1.60	1.60	111.	100.	7.0	577.	20.7
2.4A	1258.0	736.668	.050	1.23	1.23	111.	102.	6.0	575.	18.1
40.6B	1300.0	736.668	.065	1.60	1.60	108.	101.	7.0	530.	20.2
28.5			.065	1.00	1.00	113.	103.	7.0	536.	20.2
20.2			.075	1.85	1.85	114.	103.	8.0	549.	21.9
13.5			.075	1.85	1.85	115.	104.	8.0	545.	21.8
7.6			.060	1.48	1.48	114.	104.	6.5	542.	19.5
2.4B	1330.0	758.048	.055	1.36	1.36	114.	105.	6.0	540.	18.7
40.6C	1335.0	758.048	.055	1.36	1.36	106.	102.	6.0	530.	18.6
28.5			.070	1.73	1.73	113.	105.	8.0	533.	21.0
20.2			.070	1.73	1.73	116.	105.	8.0	525.	20.9
13.5			.065	1.60	1.60	116.	107.	7.0	527.	20.2
7.6			.050	1.23	1.23	115.	105.	6.0	524.	17.7
2.4C	1405.0	778.208	.040	.99	.99	114.	106.	4.5	523.	15.8
40.6D	1413.0	778.208	.065	1.60	1.60	112.	104.	7.0	535.	20.2
28.5			.065	1.60	1.60	115.	106.	7.0	535.	20.2
20.2			.060	1.48	1.48	115.	105.	7.0	545.	19.5
13.5			.055	1.36	1.36	114.	105.	6.0	551.	18.8
7.6			.045	1.11	1.11	113.	104.	5.0	537.	16.9
2.4D	1443.0	797.565	.040	.99	.99	113.	104.	5.0	532.	15.9

O R S A T	
CO2	3.8
O2	13.0
CO	.0
N	83.3

IMPINGER NO.	
1	188.9
2	43.7
3	26.6
4	.0
ABSORBED H2O	19.5

CONTROL BOX CALIBRATIONS

	FACTOR	DATE
ORIFICE	1.573	6-12-90
METER	1.0519	6-12-90
PITOT	0.84	6-29-90

LEAK CHECK

	RATE	IN.HG
INITIAL LT	0.02CFM	5.0
FINAL LT	.008CFM	10.0

CONTROL BOX NO. 1 PROBE NO. 7-1 NOZZLE NO. 55

AIR QUALITY ENGINEERING

USX CLAIRTON COKE WORKS

CLAIRTON COMBUSTION

CLR-CS3-2 8-1-90

STACK SAMPLING CALCULATIONS

A.	BAROMETRIC PRESSURE IN. HG.....	29.49
B.	AVG. DELTA H (IN H2O).....	1.51
C.	METER PRESSURE (IN. HG.).....	29.60
D.	STATIC PRESSURE (IN. H2O).....	-1.20
E.	STATIC PRESSURE (IN. HG.).....	-.088
F.	STACK PRESSURE (IN. HG.) (A+E).....	29.40
G.	STACK DIAMETER (IN.).....	114.00
H.	STACK AREA (SQ. FT.).....	70.88
	NOZZLE DIAMETER.....	.4990
I.	NOZZLE AREA (SQ. FT.).....	.001358
J.	AVG. STACK TEMP (DEG. R.).....	1005.2
K.	AVG. METER TEMP (DEG. R.).....	567.8
L.	CONDENSATE VOL. (ML).....	259.2
M.	ABSORBED H2O (ML).....	19.5
N.	TOTAL H2O (ML).....	278.7
O.	METERED GAS (CF).....	82.428
P.	GAS METER CORRECTION.....	1.0519
Q.	CORRECTED METERED GAS (CF).....	86.706
R.	H2O GAS VOLUME (CF) (0.00267N(K/C).....	14.274
S.	TOTAL SAMPLED VOLUME (CF) (Q+R).....	100.980
T.	PERCENT H2O (100R/S).....	14.14
	THEORETICAL MAXIMUM.....	100.00
	PERCENT WATER USED.....	14.14
U.	SCFD GAS SAMPLED (528*Q*C/(29.9*K)).....	79.819

V. MOLECULAR WEIGHT OF STACK GAS

COMPONENT	ORSAT-DRY VOL.PCT./100	X	MOISTURE CORRECTION (1-T/100)	X	MOLECULAR WEIGHT	=	WEIGHT PER MOLE
CO2	.038	X	.8586	X	44.0	=	1.42
CO	.000	X	.8586	X	28.0	=	.00
O2	.130	X	.8586	X	32.0	=	3.57
N2	.832	X	.8586	X	28.2	=	20.16
H2O		X	T/100= .1414	X	18.0	=	2.54
					MOLECULAR WEIGHT OF STACK GAS	=	27.69

W.	PITOT CORRECTION.....	.840
X.	AVERAGE CORRECTED VELOCITY (FPS).....	19.77
	[85.49*W*SQRT{(J*DELTA P)/(V*F)}]	
Y.	AVG. FLOW RATE (CFM) (X*H*60).....	84075.
Z.	STACK FLOW RATE (SCFM) (528*Y/J*F/29.92).....	43398.
	STACK FLOW RATE (DRY).....	37264.
AA.	SAMPLE TIME (SEC).....	7200.
BB.	PERCENT ISOKINETIC.....	93.16
	(J*100*U*29.92)/(528*X*AA*I*F*(1-T/100))	

AIR QUALITY ENGINEERING

USX CLAIRTON COKE WORKS

CLAIRTON COMBUSTION

CLR-CS3-2 8-1-90

PARAMETER	CYCLONE WT. (G)	MATL.ON FILTER(G)	INSOL.MATL. IN PROBE(G)	SOL.MATL. IN PROBE(G)
PARTICULATE	.00000	.04310	.00000	.00710

PARAMETER	INSOL.MATL. IN IMP.(G)	SOLUBLE MATL. IN IMP.(G)
PARTICULATE	.00000	.00000
PARTICULATE	.05020	
ALL MATLS.	.05020	

PARAMETER	GR/SCFD	LB/HR
PARTICULATE	.00969	3.09353

Emission rates are based on EPA Method 5.

AIR QUALITY ENGINEERING

USX CLAIRTON COKE WORKS
CLAIRTON
COMBUSTION STACK 3

DATE: 8-1-90
CHARGE #: ...150-601050
TEST #: CLR-CS3-3

1. EMISSION RESULTS

PARAMETER	GR/SCFD	LB/HR
PARTICULATE	.01433	5.08315

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2. STACK CONDITIONS

FLOW (ACFM)	91948.
(SCFM)	47781.
MOISTURE CONTENT (%)	13.36
STACK TEMPERATURE (F)	538.5

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3. SAMPLING CONDITIONS

SAMPLE TIME (MIN.)	120.0
SCFD GAS SAMPLED	88.581
PERCENT ISOKINETIC	93.07

AIR QUALITY ENGINEERING

USX CLAIRTON COKE WORKS

CLAIRTON COMBUSTION

CLR-CS3-3 8-1-90

FIELD DATA AND VELOCITY CALCULATIONS

POINT	TIME	METER READING (DRY) CF	DELTA P IN.H2O	ORIFICE DELTA H REQ	ORIFICE DELTA H ACT	METER TEMP DEG F IN	METER TEMP DEG F OUT	VACUUM IN.HG.	STACK TEMP DEG F	CORRECTED VELOCITY FT/SEC
40.6A	1512.0	798.025	.075	1.85	1.85	112.	105.	6.0	549.	21.9
28.5			.080	1.97	1.97	117.	107.	6.0	539.	22.5
20.2			.090	2.22	2.22	118.	108.	7.5	546.	23.9
13.5			.085	2.10	2.10	118.	107.	6.5	554.	23.3
7.6			.085	2.10	2.10	118.	107.	6.5	547.	23.2
2.4A	1542.0	820.115	.070	1.73	1.73	118.	107.	5.5	545.	21.1
40.6B	1544.0	820.115	.090	2.22	2.22	113.	107.	7.5	527.	23.7
28.5			.085	2.10	2.10	117.	107.	6.5	521.	22.9
13.5			.090	2.22	2.22	116.	106.	7.5	518.	23.6
7.6			.075	1.95	1.95	117.	106.	6.0	523.	21.6
2.4B	1614.0	844.806	.070	1.82	1.82	117.	107.	6.0	518.	20.8
40.6C	1617.0	844.806	.080	2.10	2.10	110.	105.	6.5	540.	22.5
28.5			.080	2.10	2.10	116.	105.	6.5	545.	22.5
20.2			.075	1.94	1.94	115.	105.	6.0	555.	21.9
13.5			.070	1.81	1.81	115.	106.	5.5	561.	21.2
7.6			.060	1.55	1.55	114.	105.	5.0	553.	19.6
2.4C	1647.0	867.247	.050	1.29	1.29	114.	105.	5.0	545.	17.8
40.6D	1650.0	867.247	.070	1.81	1.81	108.	104.	6.0	526.	20.9
28.5			.080	2.08	2.08	114.	104.	6.5	528.	22.3
20.2			.065	1.68	1.68	114.	105.	5.5	533.	20.2
13.5			.065	1.68	1.68	114.	105.	5.5	535.	20.2
7.6			.065	1.68	1.68	113.	104.	5.5	537.	20.2
2.4D	1720.0	889.803	.060	1.55	1.55	113.	103.	5.5	540.	19.5

O R S A T

CO2	4.0
O2	12.0
CO	.0
N	84.0

IMPINGER NO. 1	221.6
2	45.8
3	5.0
4	.0
ABSORBED H2O	17.3

CONTROL BOX CALIBRATIONS

	FACTOR	DATE
ORIFICE	1.573	6-12-90
METER	1.0519	6-12-90
PITOT	0.84	6-29-90

LEAK CHECK

	RATE	IN.HG
INITIAL LT	0.02CFM	5.0
FINAL LT	.005CFM	8.0

CONTROL BOX NO. 1 PROBE NO. 7-2 NOZZLE NO. 55

AIR QUALITY ENGINEERING

USX CLAIRTON COKE WORKS

CLAIRTON COMBUSTION

CLR-CS3-3 8-1-90

STACK SAMPLING CALCULATIONS

A.	BAROMETRIC PRESSURE IN. HG.....	29.49
B.	AVG. DELTA H (IN H2O).....	1.89
C.	METER PRESSURE (IN. HG.).....	29.63
D.	STATIC PRESSURE (IN. H2O).....	-1.20
E.	STATIC PRESSURE (IN. HG.).....	-.088
F.	STACK PRESSURE (IN. HG.) (A+E).....	29.40
G.	STACK DIAMETER (IN.).....	114.00
H.	STACK AREA (SQ. FT.).....	70.88
	NOZZLE DIAMETER.....	.4990
I.	NOZZLE AREA (SQ. FT.).....	.001358
J.	AVG. STACK TEMP (DEG. R.).....	998.5
K.	AVG. METER TEMP (DEG. R.).....	570.2
L.	CONDENSATE VOL. (ML).....	272.4
M.	ABSORBED H2O (ML).....	17.3
N.	TOTAL H2O (ML).....	289.7
O.	METERED GAS (CF).....	91.778
P.	GAS METER CORRECTION.....	1.0519
Q.	CORRECTED METERED GAS (CF).....	96.541
R.	H2O GAS VOLUME (CF) (0.00267N(K/C).....	14.887
S.	TOTAL SAMPLED VOLUME (CF) (Q+R).....	111.428
T.	PERCENT H2O (100R/S).....	13.36
	THEORETICAL MAXIMUM.....	100.00
	PERCENT WATER USED.....	13.36
U.	SCFD GAS SAMPLED (528*Q*C/(29.9*K)).....	88.581

V. MOLECULAR WEIGHT OF STACK GAS

COMPONENT	ORSAT-DRY VOL.PCT./100	X	MOISTURE CORRECTION (1-T/100)	X	MOLECULAR WEIGHT	=	WEIGHT PER MOLE
CO2	.040	X	.8664	X	44.0	=	1.52
CO	.000	X	.8664	X	28.0	=	.00
O2	.120	X	.8664	X	32.0	=	3.33
N2	.840	X	.8664	X	28.2	=	20.52
H2O		X	T/100= .1336	X	18.0	=	2.40
					MOLECULAR WEIGHT OF STACK GAS	=	27.78

W.	PITOT CORRECTION.....	.840
X.	AVERAGE CORRECTED VELOCITY (FPS).....	21.62
	[85.49*W*SQRT{(J*DELTA P)/(V*F)}]	
Y.	AVG. FLOW RATE (CFM) (X*H*60).....	91948.
Z.	STACK FLOW RATE (SCFM) (528*Y/J*F/29.92).....	47781.
	STACK FLOW RATE (DRY).....	41397.
AA.	SAMPLE TIME (SEC).....	7200.
BB.	PERCENT ISOKINETIC.....	93.07
	(J*100*U*29.92)/(528*X*AA*I*F*(1-T/100))	

AIR QUALITY ENGINEERING

USX CLAIRTON COKE WORKS

CLAIRTON COMBUSTION

CLR-CS3-3 8-1-90

PARAMETER	CYCLONE WT. (G)	MATL.ON FILTER(G)	INSOL.MATL. IN PROBE(G)	SOL.MATL. IN PROBE(G)
PARTICULATE	.00000	.06800	.00000	.01440

PARAMETER	INSOL.MATL. IN IMP.(G)	SOLUBLE MATL. IN IMP.(G)
PARTICULATE	.00000	.00000

PARTICULATE	.08240
ALL MATLS.	.08240

PARAMETER	GR/SCFD	LB/HR
PARTICULATE	.01433	5.08315

Emission rates are based on EPA Method 5.

USS CLAIRTON WORKS
RESULTS OF THE
COMPLIANCE DEMONSTRATION OF THE
#3 BATTERY COMBUSTION STACK

APPENDIX E

FIELD DATA SHEETS
FOR VISIBLE EMISSIONS

KEYSTONE
ENVIRONMENTAL RESOURCES, INC.

(1)

VISIBLE EMISSIONS OBSERVATIONS FORM

Test: 1st

CLR-CS3-1

3

OBSERVER: K. Kuiros

DATE: 8/1/90

FACILITY: USX Clairton

OBSERVATION: START TIME: 9 48 A

END TIME: 10 48 A

OBSERVATION POINT: Maple Park Lot

SOURCE: #3 - Stack

DISTANCE: 950'

DIRECTION FROM: S/W

HEIGHT: 200'

WIND:

SPEED: 7 MPH

DIRECTION: N

TEMPERATURE: 68

SKY CONDITION: HAZY

BACKGROUND: SKY

READING CONDITIONS: Fair

COLOR OF EMISSION: —

TOTAL No. OF READINGS: 240

No. READINGS >= 20% 0

No. READINGS >= 60% 0

GREATEST OPACITY: 0

CREW: C FOREMAN: Shelton

COMMENTS:

START 1st Test

9 48	0	0	0	0	0	30	0	0	0	0
	1	0	0	0	0	31	0	0	0	0
50	2	0	0	0	0	20 32	0	0	0	0
	3	0	0	0	0	33	0	0	0	0
	4	0	0	0	0	34	0	0	0	0
	5	0	0	0	0	35	0	0	0	0
	6	0	0	0	0	36	0	0	0	0
55	7	0	0	0	0	25 37	0	0	0	0
	8	0	0	0	0	38	0	0	0	0
	9	0	0	0	0	39	0	0	0	0
	10	0	0	0	0	40	0	0	0	0
	11	0	0	0	0	41	0	0	0	0
10 00	12	0	0	0	0	30 42	0	0	0	0
	13	0	0	0	0	43	0	0	0	0
	14	0	0	0	0	44	0	0	0	0
	15	0	0	0	0	45	0	0	0	0
	16	0	0	0	0	46	0	0	0	0
5	17	0	0	0	0	35 47	0	0	0	0
	18	0	0	0	0	48	0	0	0	0
	19	0	0	0	0	49	0	0	0	0
	20	0	0	0	0	50	0	0	0	0
	21	0	0	0	0	51	0	0	0	0
10	22	0	0	0	0	40 52	0	0	0	0
	23	0	0	0	0	53	0	0	0	0
	24	0	0	0	0	54	0	0	0	0
	25	0	0	0	0	55	0	0	0	0
	26	0	0	0	0	56	0	0	0	0
15	27	0	0	0	0	45 57	0	0	0	0
	28	0	0	0	0	58	0	0	0	0
	29	0	0	0	0	59	0	0	0	0

(2)

VISIBLE EMISSIONS OBSERVATIONS FORM

3

Test: 1st
CLR-CS3-1

OBSERVER: K. Kuiros

DATE: 8/1/90

FACILITY: USX-Clairton

OBSERVATION: START TIME: 10:45 A

END TIME: 11:45 A

OBSERVATION POINT: Maple Park Lot

SOURCE: #3-STACK

DISTANCE: 950'

DIRECTION FROM: S/W

HEIGHT: 200'

WIND:

SPEED: 12 MPH

DIRECTION: S/W

TEMPERATURE: 68

SKY CONDITION: Pt Cloudy

BACKGROUND: STY

READING CONDITIONS: Fair

COLOR OF EMISSION: —

TOTAL No. OF READINGS: 240

No. READINGS >= 20% 0

No. READINGS >= 60% 0

GREATEST OPACITY: 0

CREW: C FOREMAN: Shelton

COMMENTS:

10:45 A	0	0	0	0	0		30	0	0	0	0
	1	0	0	0	0		31	0	0	0	0
50	2	0	0	0	0	20	32	0	0	0	0
	3	0	0	0	0		33	0	0	0	0
	4	0	0	0	0		34	0	0	0	0
	5	0	0	0	0		35	0	0	0	0
	6	0	0	0	0		36	0	0	0	0
55	7	0	0	0	0	25	37	0	0	0	0
	8	0	0	0	0		38	0	0	0	0
	9	0	0	0	0		39	0	0	0	0
	10	0	0	0	0		40	0	0	0	0
	11	0	0	0	0		41	0	0	0	0
11:00 A	12	0	0	0	0	30	42	0	0	0	0
	13	0	0	0	0		43	0	0	0	0
	14	0	0	0	0		44	0	0	0	0
	15	0	0	0	0		45	0	0	0	0
	16	0	0	0	0		46	0	0	0	0
5	17	0	0	0	0	35	47	0	0	0	0
	18	0	0	0	0		48	0	0	0	0
	19	0	0	0	0		49	0	0	0	0
	20	0	0	0	0		50	0	0	0	0
	21	0	0	0	0		51	0	0	0	0
10	22	0	0	0	0	40	52	0	0	0	0
	23	0	0	0	0		53	0	0	0	0
	24	0	0	0	0		54	0	0	0	0
	25	0	0	0	0		55	0	0	0	0
	26	0	0	0	0		56	0	0	0	0
15	27	0	0	0	0	45	57	0	0	0	0
	28	0	0	0	0		58	0	0	0	0
	29	0	0	0	0		59	0	0	0	0

(3)

VISIBLE EMISSIONS OBSERVATIONS FORM

3 Test. 1st & 2nd Test-CLR-CS3-2
CLR-CS3-1

OBSERVER: K. Kuchas

DATE: 8/1/90

FACILITY: USX-Clairton

OBSERVATION: START TIME: 11:45 A

END TIME: 12:45 P

OBSERVATION POINT: Maple Grove Lot

SOURCE: #3-STACK

DISTANCE: 950'

DIRECTION FROM: S/W

HEIGHT: 400'

WIND:

SPEED: 9 MPH

DIRECTION: N/W

TEMPERATURE: 68

SKY CONDITION: Pt. Cloudy

BACKGROUND: SKY

READING CONDITIONS: Fair

COLOR OF EMISSION: —

TOTAL No. OF READINGS: 240

No. READINGS >= 20% 0

No. READINGS >= 60% 0

GREATEST OPACITY: 0

CREW: C FOREMAN: SHELTON

COMMENTS:

11:45 A	0	0	0	0		30	0	0	0	0
	1	0	0	0	0		31	0	0	0	0
50	2	0	0	0	0	20	32	0	0	0	0
	3	0	0	0	0		33	0	0	0	0
	4	0	0	0	0		34	0	0	0	0
	5	0	0	0	0		35	0	0	0	0
	6	0	0	0	0		36	0	0	0	0
55	7	0	0	0	0	25	37	0	0	0	0
	8	0	0	0	0		38	0	0	0	0
	9	0	0	0	0		39	0	0	0	0
	10	0	0	0	0		40	0	0	0	0
END 1st Test	11	0	0	0	0		41	0	0	0	0
12:00 M	12	0	0	0	0	30	42	0	0	0	0
	13	0	0	0	0		43	0	0	0	0
	14	0	0	0	0		44	0	0	0	0
	15	0	0	0	0		45	0	0	0	0
	16	0	0	0	0		46	0	0	0	0
5	17	0	0	0	0	35	47	0	0	0	0
	18	0	0	0	0		48	0	0	0	0
	19	0	0	0	0		49	0	0	0	0
	20	0	0	0	0		50	0	0	0	0
	21	0	0	0	0		51	0	0	0	0
10	22	0	0	0	0	40	52	0	0	0	0
	23	0	0	0	0		53	0	0	0	0
	24	0	0	0	0		54	0	0	0	0
	25	0	0	0	0		55	0	0	0	0
	26	0	0	0	0		56	0	0	0	0
15	27	0	0	0	0	45	57	0	0	0	0
	28	0	0	0	0		58	0	0	0	0
	29	0	0	0	0		59	0	0	0	0

START Test-2 CLR-CS3-2

(4)

VISIBLE EMISSIONS OBSERVATIONS FORM

3 TEST-CLR-CS3-2

OBSERVER: K. Kuiros CLR-CS3-2 Cont'd 2nd Test

DATE: 8/1/90

FACILITY: USX-Clairton

OBSERVATION: START TIME: 12:48 P

END TIME: 1:35 P

OBSERVATION POINT: Maple Park Lot

SOURCE: #3-STACK

DISTANCE: 950'

DIRECTION FROM: S/W

HEIGHT: 200'

WIND:

SPEED: 6 MPH

DIRECTION: N

TEMPERATURE: 71

SKY CONDITION: Clear-Partly Cloudy

BACKGROUND: SKY

READING CONDITIONS: Good

COLOR OF EMISSION: —

TOTAL No. OF READINGS: 240

No. READINGS >= 20% 0

No. READINGS >= 60% 0

GREATEST OPACITY: 0

CREW: C FOREMAN: SHELTON

COMMENTS:

12:48	0	0	0	0	0		30	0	0	0	0
	1	0	0	0	0		31	0	0	0	0
50	2	0	0	0	0	20	32	0	0	0	0
	3	0	0	0	0		33	0	0	0	0
	4	0	0	0	0		34	0	0	0	0
	5	0	0	0	0		35	0	0	0	0
	6	0	0	0	0		36	0	0	0	0
55	7	0	0	0	0	25	37	0	0	0	0
	8	0	0	0	0		38	0	0	0	0
	9	0	0	0	0		39	0	0	0	0
	10	0	0	0	0		40	0	0	0	0
	11	0	0	0	0		41	0	0	0	0
1:00 P	12	0	0	0	0	30	42	0	0	0	0
	13	0	0	0	0		43	0	0	0	0
	14	0	0	0	0		44	0	0	0	0
	15	0	0	0	0		45	0	0	0	0
	16	0	0	0	0		46	0	0	0	0
5	17	0	0	0	0	35	47	0	0	0	0
	18	0	0	0	0		48	0	0	0	0
	19	0	0	0	0		49	0	0	0	0
	20	0	0	0	0		50	0	0	0	0
	21	0	0	0	0		51	0	0	0	0
10	22	0	0	0	0	40	52	0	0	0	0
	23	0	0	0	0		53	0	0	0	0
	24	0	0	0	0		54	0	0	0	0
	25	0	0	0	0		55	0	0	0	0
	26	0	0	0	0		56	0	0	0	0
15	27	0	0	0	0	45	57	0	0	0	0
	28	0	0	0	0		58	0	0	0	0
	29	0	0	0	0		59	0	0	0	0

(5)

VISIBLE EMISSIONS OBSERVATIONS FORM

3 TEST-CLR-CS-3-2

OBSERVER: K. Kuiros

DATE: 8/1/90

FACILITY: USX-Clairton

OBSERVATION: START TIME: 1:48 P

END TIME: 2:48 P

OBSERVATION POINT: Maple Park Lot

SOURCE: #3-STACK

DISTANCE: 950'

DIRECTION FROM: S/W

HEIGHT: 200'

WIND:

SPEED: 6 MPH

DIRECTION: N

TEMPERATURE: 74

SKY CONDITION: PT. Cloudy/Clear

BACKGROUND: SKY

READING CONDITIONS: Good

COLOR OF EMISSION: —

TOTAL No. OF READINGS: 240

No. READINGS >= 20% 0

No. READINGS >= 60% 0

GREATEST OPACITY: 0

CREW: C FOREMAN: Shelton

COMMENTS:

1:48 P	0	0	0	0	0		30	0	0	0	0
	1	0	0	0	0		31	0	0	0	0
50	2	0	0	0	0	20	32	0	0	0	0
	3	0	0	0	0		33	0	0	0	0
	4	0	0	0	0		34	0	0	0	0
	5	0	0	0	0		35	0	0	0	0
	6	0	0	0	0		36	0	0	0	0
55	7	0	0	0	0	25	37	0	0	0	0
	8	0	0	0	0		38	0	0	0	0
	9	0	0	0	0		39	0	0	0	0
	10	0	0	0	0		40	0	0	0	0
	11	0	0	0	0		41	0	0	0	0
2:00 P	12	0	0	0	0	30	42	0	0	0	0
	13	0	0	0	0		43	0	0	0	0
	14	0	0	0	0		44	0	0	0	0
	15	0	0	0	0		45	0	0	0	0
	16	0	0	0	0		46	0	0	0	0
5	17	0	0	0	0	35	47	0	0	0	0
	18	0	0	0	0		48	0	0	0	0
	19	0	0	0	0		49	0	0	0	0
	20	0	0	0	0		50	0	0	0	0
	21	0	0	0	0		51	0	0	0	0
10	22	0	0	0	0	40	52	0	0	0	0
	23	0	0	0	0		53	0	0	0	0
	24	0	0	0	0		54	0	0	0	0
	25	0	0	0	0		55	0	0	0	0
	26	0	0	0	0		56	0	0	0	0
15	27	0	0	0	0	45	57	0	0	0	0
	28	0	0	0	0		58	0	0	0	0
	29	0	0	0	0		59	0	0	0	0

END TEST #2

(5)

VISIBLE EMISSIONS OBSERVATIONS FORM

3 Test-CLR-CS-3-3

OBSERVER: Mc Koy

DATE: 8/1/90

FACILITY: USX-CLAIRTON

OBSERVATION: START TIME: 2 48 P

END TIME: 3 48 P

OBSERVATION POINT: Maple Ave Parking lot #3

SOURCE: Battery-Exit Stack

DISTANCE: 950'

DIRECTION FROM: S/W

HEIGHT: 200'

WIND:

SPEED: 7-m MPH

DIRECTION: → East

TEMPERATURE: 75°-77

SKY CONDITION: P. Cloudy

BACKGROUND: SKY

READING CONDITIONS: Good

COLOR OF EMISSION: Black

TOTAL No. OF READINGS 240

No. READINGS >= 20% 0

No. READINGS >= 60% 0

GREATEST OPACITY: 10%

CREW: C FOREMAN: R. Shelton

COMMENTS:

2 48 P	0	0	0	0	0		30	0	0	0	0
	1	0	0	0	0		31	0	0	0	0
50	2	0	0	0	0	20	32	0	0	0	0
	3	0	0	0	0		33	0	0	0	0
	4	0	0	0	0		34	0	0	0	0
	5	0	0	0	0		35	0	0	0	0
	6	0	0	0	0		36	0	0	0	0
55	7	0	0	0	0	25	37	0	0	0	0
	8	0	0	0	0		38	0	0	0	0
	9	0	0	0	0		39	0	0	0	0
	10	0	0	0	0		40	0	0	0	0
	11	0	0	0	0		41	0	0	0	0
3 02 P	12	0	0	0	0	30	42	0	0	0	0
	13	0	0	0	0		43	0	0	0	0
	14	0	0	0	0		44	0	0	0	0
	15	0	0	0	0		45	0	0	0	0
	16	0	0	0	0		46	0	0	0	0
5	17	0	0	0	0	35	47	0	0	0	5
	18	0	0	0	0		48	5	10	5	5
	19	0	0	0	0		49	5	5	0	0
	20	0	0	0	0		50	0	0	0	0
	21	0	0	0	0		51	0	0	0	0
10	22	0	0	0	0	40	52	0	0	0	0
	23	0	0	0	0		53	0	0	0	0
3 12 Start Test #3	24	0	0	0	0		54	0	0	0	0
	25	0	0	0	0		55	0	0	0	0
	26	0	0	0	0		56	0	0	0	0
15	27	0	0	0	0	45	57	0	0	0	0
	28	0	0	0	0		58	0	0	0	0
	29	0	0	0	0		59	0	0	0	0

(7)

VISIBLE EMISSIONS OBSERVATIONS FORM

OBSERVER: McKoy

DATE: 1 August 1990

FACILITY: USX Clairton works

OBSERVATION: START TIME: 3:48 PM

END TIME: 4:48 PM

OBSERVATION POINT: Maple Ave Parking lot #3

SOURCE: Battery Shaft Stack

DISTANCE: @ 950'

DIRECTION FROM: SW of "

HEIGHT: @ 200'

WIND:

SPEED: 7-mph

DIRECTION: > E

TEMPERATURE: 75-77°

SKY CONDITION: P. Cloudy

BACKGROUND: Sky

READING CONDITIONS: Good

COLOR OF EMISSION: N/A

TOTAL No. OF READINGS: 240

No. READINGS >= 20% 0

No. READINGS >= 60% 0

GREATEST OPACITY: 0

CREW: D FOREMAN: Kaspeal

COMMENTS:

#3 Stack — Test-CLR-CS-3-3

3:48	0	0	0	0	0		30	0	0	0	0
	1	0	0	0	0		31	0	0	0	0
:50	2	0	0	0	0	:20	32	0	0	0	0
	3	0	0	0	0		33	0	0	0	0
	4	0	0	0	0		34	0	0	0	0
	5	0	0	0	0		35	0	0	0	0
	6	0	0	0	0		36	0	0	0	0
:55	7	0	0	0	0	:25	37	0	0	0	0
	8	0	0	0	0		38	0	0	0	0
	9	0	0	0	0		39	0	0	0	0
	10	0	0	0	0		40	0	0	0	0
	11	0	0	0	0		41	0	0	0	0
4:00p	12	0	0	0	0	:30	42	0	0	0	0
	13	0	0	0	0		43	0	0	0	0
	14	0	0	0	0		44	0	0	0	0
	15	0	0	0	0		45	0	0	0	0
	16	0	0	0	0		46	0	0	0	0
:05	17	0	0	0	0	:35	47	0	0	0	0
	18	0	0	0	0		48	0	0	0	0
	19	0	0	0	0		49	0	0	0	0
	20	0	0	0	0		50	0	0	0	0
	21	0	0	0	0		51	0	0	0	0
:10	22	0	0	0	0	14 d	52	0	0	0	0
	23	0	0	0	0		53	0	0	0	0
	24	0	0	0	0		54	0	0	0	0
	25	0	0	0	0		55	0	0	0	0
	26	0	0	0	0		56	0	0	0	0
:15	27	0	0	0	0	:45	57	0	0	0	0
	28	0	0	0	0		58	0	0	0	0
	29	0	0	0	0		59	0	0	0	0

(B)

VISIBLE EMISSIONS OBSERVATIONS FORM

OBSERVER: McKoy

DATE: 1 August, 1990

FACILITY: US4 Clairton

OBSERVATION: START TIME: 4:48 pm

END TIME: 5:20 pm

OBSERVATION POINT: Central Engr Trailer Area

SOURCE: #3 Battery Draft Stack

DISTANCE: a 400'

DIRECTION FROM: NW "OF"

HEIGHT: a 200'

WIND:

SPEED: 12 MPH

DIRECTION: → N

TEMPERATURE: 76°

SKY CONDITION: P. Cloudy

BACKGROUND: SKY

READING CONDITIONS: Good

COLOR OF EMISSION: N/A

TOTAL No. OF READINGS: 132

No. READINGS >= 20% 0

No. READINGS >= 60% 0

GREATEST OPACITY: 0

CREW: 20 FOREMAN: Korpeul

COMMENTS:

#3 Stack

4:48	0	0	0	0	0
	1	0	0	0	0
:50	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0
	5	0	0	0	0
	6	0	0	0	0
:55	7	0	0	0	0
	8	0	0	0	0
	9	0	0	0	0
	10	0	0	0	0
	11	0	0	0	0
5:00	12	0	0	0	0
	13	0	0	0	0
	14	0	0	0	0
	15	0	0	0	0
	16	0	0	0	0
1:05	17	0	0	0	0
	18	0	0	0	0
	19	0	0	0	0
	20	0	0	0	0
	21	0	0	0	0
1:10	22	0	0	0	0
	23	0	0	0	0
	24	0	0	0	0
	25	0	0	0	0
	26	0	0	0	0
:15	27	0	0	0	0
	28	0	0	0	0
	29	0	0	0	0

Test-C/R-CS-3-3

	30	0	0	0	0
	31	0	0	0	0
:20	32	0	0	0	0
	33				
	34				
	35				
	36				
:25	37				
	38				
	39				
	40				
	41				
1:30	42				
	43				
	44				
	45				
	46				
:35	47				
	48				
	49				
	50				
	51				
:40	52				
	53				
	54				
	55				
	56				
:45	57				
	58				
	59				

#3 Test ended