Report to

SCIENTIFIC CONTROL LABORATORIES, INC.
Chicago, Illinois

for

TOTAL CHROMIUM AIR EMISSIONS TESTING

of the

CHROME PLATING TANKS & CHROME ETCH TANK (MP1)
with
EMISSIONS CONTROL SYSTEM

PLASTIC PLATE, INC. (SRN No. ~~6318~~ B6138)
LACKS ENTERPRISES, INC. - MONROE AVE PLANT
Grand Rapids, Michigan

August 11, 2022

ETE

B6138
~~B6318~~_test_20220811

KEY PROJECT PERSONNEL

Source Contact:

Ms. Karen Baweja, Environmental Manager (616-956-7259)
kbaweja@lacksenterprises.com

Lacks Enterprises, Inc.
5460 Cascade Road SE
Grand Rapids, MI 49546

Environmental Consultant:

Mr. Jeff Zak, CEF, P.E. (773-254-2406, X26)
jzak@sclweb.com

Scientific Control Laboratories, Inc.
3158 S. Kolin Avenue
Chicago, IL 60623

Test Team Leader:

Mr. Michael Huenink (262-784-2434)
ete4mjh@wi.rr.com

Environmental Technology & Engineering Corp
13000 W. Bluemound Road
Elm Grove, WI 53122

Report to

SCIENTIFIC CONTROL LABORATORIES, INC.
Chicago, Illinois

for

TOTAL CHROMIUM AIR EMISSIONS TESTING

of the

CHROME PLATING TANKS & CHROME ETCH TANK (MP1)
with
EMISSIONS CONTROL SYSTEM

PLASTIC PLATE, INC. (SRN No. 6318)
LACKS ENTERPRISES, INC. - MONROE AVE PLANT
Grand Rapids, Michigan

August 11, 2022

Michael J. Huenink
Industrial Hygienist
October 3, 2022

ENVIRONMENTAL TECHNOLOGY & ENGINEERING CORP
13000 W. Bluemound Road Elm Grove, Wisconsin 53122
Phone: (262) 784-2434

EXECUTIVE SUMMARY

On August 11, 2022, Environmental Technology & Engineering Corp (ETE) personnel visited the Plastic Plate, Inc. (of Lacks Enterprises) facility located at 1648 Monroe Avenue in Grand Rapids, Michigan (SRN No. 6318). The purpose of the visit was to perform air emissions testing for compliance demonstration with the total chromium air emissions limits for process MP1 which is comprised of two chrome plating tanks and a chromium etch tank. The emissions from these processes are controlled by a common emissions control system. The limits were contained in a Michigan Dept. of Environmental, Great Lakes, & Energy Air Quality Division permit.

The results of the testing of MP1 indicated total chromium levels well below (in compliance with) the total chromium air emissions limits as shown below:

Process Tested	Control System	Test Date	Test	Total Chromium Concentration	Total Chromium Emissions Rate
MP1	3 stage composite mesh pad	8/11	1	0.00078 mg/dscm	0.000067 lb/hr
			2	0.00073 mg/dscm	0.000063 lb/hr
			3	0.00078 mg/dscm	0.000066 lb/hr
			AVG	**0.00076 mg/dscm**	**0.000065 lb/hr**
Applicable Air Emissions Limits -				**-**	**0.0005 lb/hr**
Results % of Limit -					**13.0 %**

Notes: **mg/dscm** means milligrams of total chromium per dry standard cubic meter of exhaust

1.0 GENERAL BACKGROUND

On August 11, 2022, Environmental Technology & Engineering Corp (ETE) personnel visited the Plastic Plate, Inc. (of Lacks Enterprises) facility located at 1648 Monroe Avenue in Grand Rapids, Michigan (SRN No. 6318). The purpose of the visit was to perform air emissions testing for compliance demonstration with the total chromium air emissions limits for process MP1 which is comprised of two chrome plating tanks and a chromium etch tank. The emissions from these processes are controlled by a common emissions control system. The chromium air emissions limits were contained in a Michigan Dept. of Environmental, Great Lakes, & Energy Air Quality Division permit.

Plastic Plate, Inc. is an electroplating facility specializing in copper, nickel, and chromium plating for the automotive industry. The operations targeted for testing in this project involved a chromium plating process (two tanks) and a chromium etch process. Various sizes and shapes of plastic parts are etched in an acidic solution and then are plated with chromium. The parts are placed on bars as part of the production process; bar count is the common means to quantify production rates. Emissions from the process exhausts are captured through a common ventilation system. The exhaust gas is drawn through a three stage composite mesh pad control system (CMP) which serves as the emissions control device. The control system is exhausted through a single stack to atmosphere.

Plastic Plate and Lacks personnel monitored the operations and emissions control device parameters throughout the test efforts. Those detailed notes are included in Appendix A of this report. The test times and associated data are summarized as follows:

Process Tested	Test	Test Period	Process Bar Count	CMP Scrubber Pressure Drop	Surface Tensions, Etch / Cr 1 / Cr 2
MP1	1	08:30 - 10:33	43	3.5 in. H_2O	52.8/25.5/30 dynes/cm
	2	10:55 - 12:57	44	3.5 in. H_2O	58.5/26.5/35.5 dynes/cm
	3	13:13 - 15:15	45	3.5 in. H_2O	55.5/27/37 dynes/cm

Ms. Karen Baweja of Lacks Enterprises and Mr. Jeff Zak of Scientific Control Laboratories facilitated in the coordination of the process activities and field test efforts. Mr. Trevor Drost and Ms. April Lazzaro of Michigan EGLE-AQD witnessed the test efforts and production activities. The field test efforts were performed by ETE personnel; Michael Huenink was the test team leader. The analysis for total chromium content in the sample solutions was performed by Element One, Inc. (Wilmington, NC).

2.0 RESULTS

Testing to determine total chromium "Cr" levels in the stack exhaust was performed isokinetically using EPA Methods 1 through 4 and 306. A brief description of the method is included in Section 3.0 of this report. Sketches showing the sampling port and point locations at the test location are included as Figure 2-1.

The stack flow parameters measured during testing and the weights of the total Cr collected were used to determine the emissions for each test. Three separate 120 minute tests were performed on the stack. The chromium emission results are included as Table 2-1; the detailed isokinetic data and calculations for the runs are included in Appendix B of this report. The full analytical report is included as Appendix C of this report; however, the best results summary can be observed on page 4 of that lab report.

The results of the testing of MP1 indicated total chromium levels below (in compliance with) the total chromium air emissions limits as shown below:

Process Tested	Control System	Test Date	Test	Total Chromium Concentration	Total Chromium Emissions Rate
MP1	3 stage composite mesh pad	8/11	1	0.00078 mg/dscm	0.000067 lb/hr
			2	0.00073 mg/dscm	0.000063 lb/hr
			3	0.00078 mg/dscm	0.000066 lb/hr
			AVG	**0.00076 mg/dscm**	**0.000065 lb/hr**
Applicable Air Emissions Limits -				-	**0.0005 lb/hr**
Results % of Limit -					**13.0 %**

Notes: **mg/dscm** means milligrams of total chromium per dry standard cubic meter of exhaust

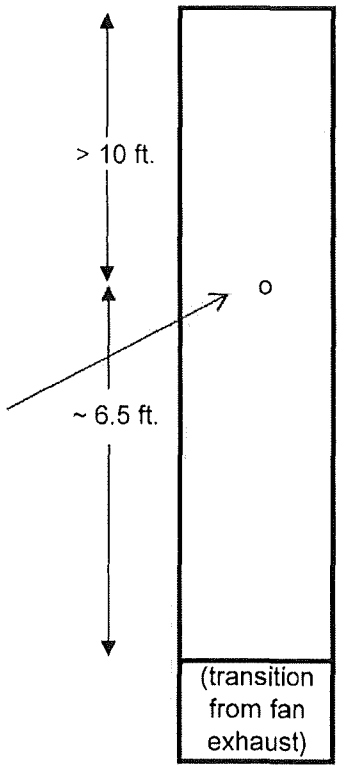
CHROMIUM PLATE & ETCH PROCESSES (MP1)
PLASTIC PLATE - LACKS ENT (MONROE PLANT)

FIGURE 2-1

TEST POINT LOCATIONS

Point	Distance (in.) from back wall
1	1.0
2	2.4
3	4.2
4	6.4
5	9.0
6	12.8
7	23.2
8	27.0
9	29.6
10	31.8
11	33.6
12	35.0

SAMPLE PORT LOCATION



Stack Diameter: 36 inch (stack runs vertically at sampling location)

Notes: 24 isokinetic sampling points used on this round stack; 12 points along each of 2 perpendicular traverses. All other gas sampling performed at a single point in the center third of the duct.

CR TEST RESULTS **TABLE 2-1**
Chromium Control System Stack (MP1)
Plastic Plate - Monroe Ave
08/11/22

Sample Location	Test	Sample Total Cr Amount (mg)	Standard Sample Volume (ft3)	Standard Sample Volume (dscm)	Corrected Total Cr Concen. (mg/dscm)	Standard Exhaust Flow Rate (m3/hr)	Total Cr Emission Rate (lb/hr)
MP1	1	0.00277	125.07	3.542	0.00078	38853	0.000067
	2	0.00255	123.47	3.496	0.00073	38996	0.000063
	3	0.00270	122.31	3.463	0.00078	38496	0.000066
				3 Test AVG -	**0.00076**	38782	**0.000065**
		Applicable Permit Limits -					**0.0005** **lb/hr**

Notes: Std. Sample Vol (dscm) = Std. Sample Vol (ft3) x 0.028317
Total Cr Conc. (mg/dscm) = Sample Total Cr Amount (mg) / Std. Sample Vol. (dscm)
Emission Rate = [Conc.(mg/m3) x Exhaust Flow(mg/m3)] x [1 lb / 453600 mg]

3.0 TEST METHODS

The equipment used to sample total chromium was the Western Precipitation Division of the Joy Manufacturing Company Emission Parameter Analyzer (Method 5 sample train). Samples were collected and analyzed in accordance with procedures outlined in EPA Method 306.

The sampling train consisted of a glass probe tip, a glass lined probe, and PVC connective tubing. A series of four impingers followed in an ice bath. The first was a modified Greenburg-Smith impinger with 100 ml of 0.1 N sodium hydroxide (NaOH); the second was a Greenburg-Smith impinger with 100 ml of 0.1 N NaOH; the third was a modified Greenburg-Smith impinger dry; the fourth was also a modified Greenburg-Smith impinger containing a tared quantity of Silica Gel. The gas then passed through a vacuum pump, calibrated dry gas meter, and a calibrated orifice. A schematic drawing of the sampling train is included.

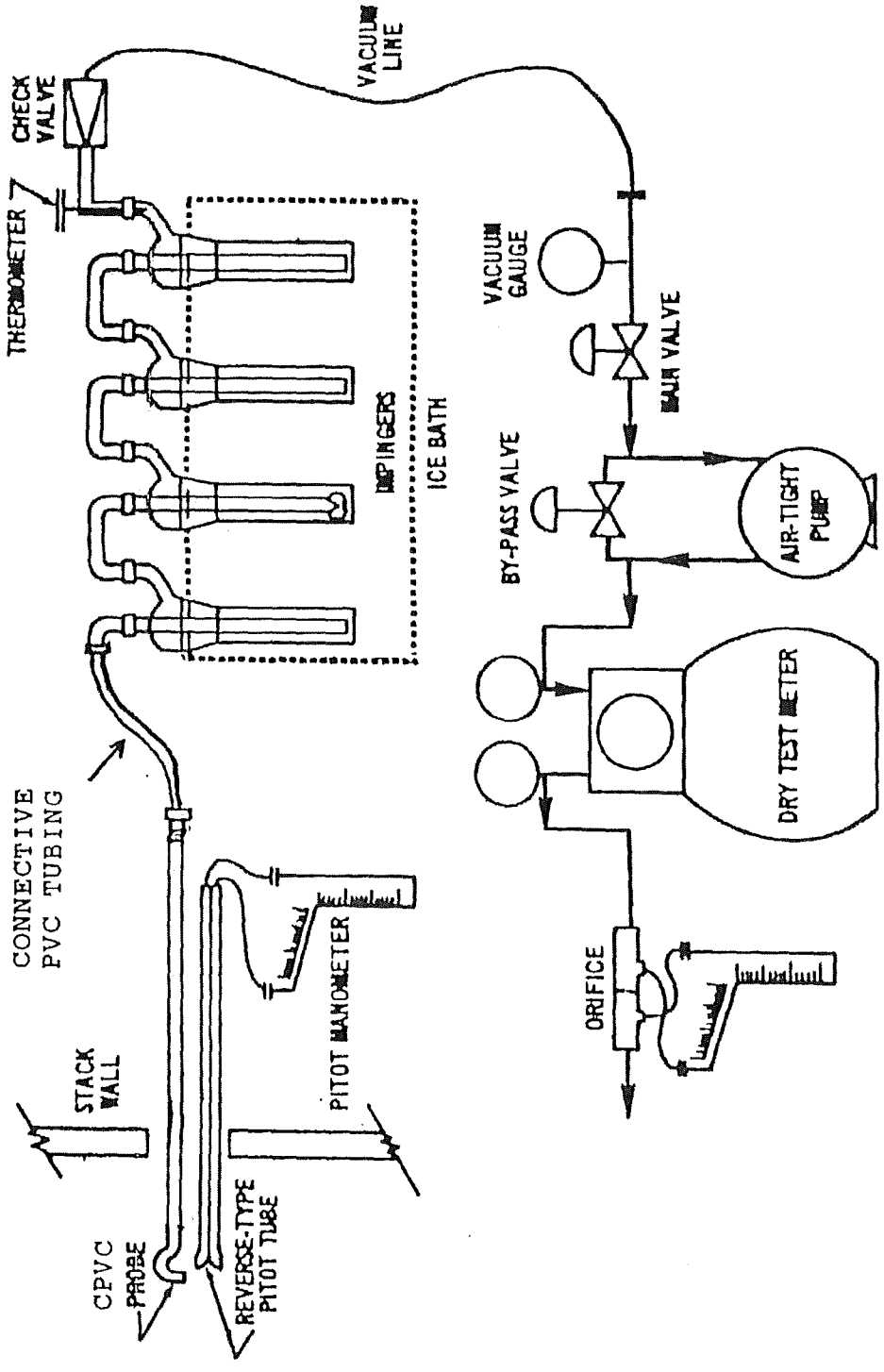
The temperatures of the stack gas stream, as well as strategic locations within the sampling devices, were monitored by RTDs and read directly from a gauge on the control unit. The initial gas stream velocity was obtained from a preliminary traverse using a Pitot tube. The initial moisture was estimated from previous tests of similar processes. This data, along with the stack temperature, was used to set a nomograph so that rapid calculations of isokinetic sampling conditions could be made.

The principle of the method was to collect the sample representative of the exhaust by adjusting the sample collection velocity to match the exhaust gas stream velocity at the point of collection. The velocity at the point of collection was measured with an "S" type Pitot tube and the collection velocity was matched to the stack gas velocity by adjusting the flow as indicated by the calibrated orifice.

To determine the molecular weight of the stack gas, samples were drawn into an Orsat analyzer and analyzed for percentage CO2, O2, CO, and N2.

At the completion of the test, the impinger contents were measured and weighed for determination of the actual moisture content of the exhaust gas stream. The impinger contents were then placed in a clean glass jar with Teflon-lined cap. The probe tip, probe, and connective tubing were then rinsed with 0.1 N NaOH (100 ml total) into the sampling train. That rinse was also placed in the sample jar. The impingers were then rinsed twice more with 0.1 N NaOH (100 ml) and the rinses were also added to the sample jar. The samples were refrigerated prior to analysis.

The sample solutions were analyzed for total Cr content by ICP-MS using the analytical methods contained in EPA Method 306. Field blanks of the sample solutions were also analyzed and all results were blank corrected. For those samples analyzed in duplicate, the average of the two results was used in the final emissions calculations.



EPA METHOD 306

TOTAL CHROMIUM EMISSIONS
SAMPLING TRAIN

4.0 CALIBRATION DATA

The probe tips, Pitot tubes, dry gas meters, and sample box orifices were calibrated prior to the testing in accordance with the procedures outlined in the Maintenance, Calibration, and Operation of Isokinetic Source-Sampling Equipment as published by the US EPA. The values obtained were:

Stack/ Test Location	Date	Control Box ID	Orifice Coeff. ($\Delta H@$)	Dry Gas Meter Coeff. (γ)	Probe Tip Diameter
MP1	8/11	3	0.949	0.993	0.250 in.

The flow measurements were made with an S-type Pitot tube which had a verified Pitot tube coefficient (C_p) of 0.84. Prior to the sampling efforts on the stack, the "null" angles were measured for a determination of the absence or presence of cyclonic flow. Those measurements indicated null angles in the range of 0 to 5 percent, with the average of 2.3 degrees falling well within the 20 percent criteria for acceptable sampling locations.

The dry gas meter installed in the control box was a temperature compensating meter. The correction factor (gamma) for the meter could best be described by the equations:

Box 3 $\gamma = 0.993 + [(T_M - 70) \times 0.00012]$

The most recent calibrations on the sampling equipment were performed on July 8, 2022.

The isokinetic ratios for the test runs were in the range of 93.0 to 94.5 percent, within the acceptable range of 90 to 110 percent.

The quality control data from the sample analysis is included in the detailed analytical report.

APPENDIX A

Process & Control Equipment Data

Monroe
Chrome Scrubber Test 2022

8/30/2022

Bar Loads Processed

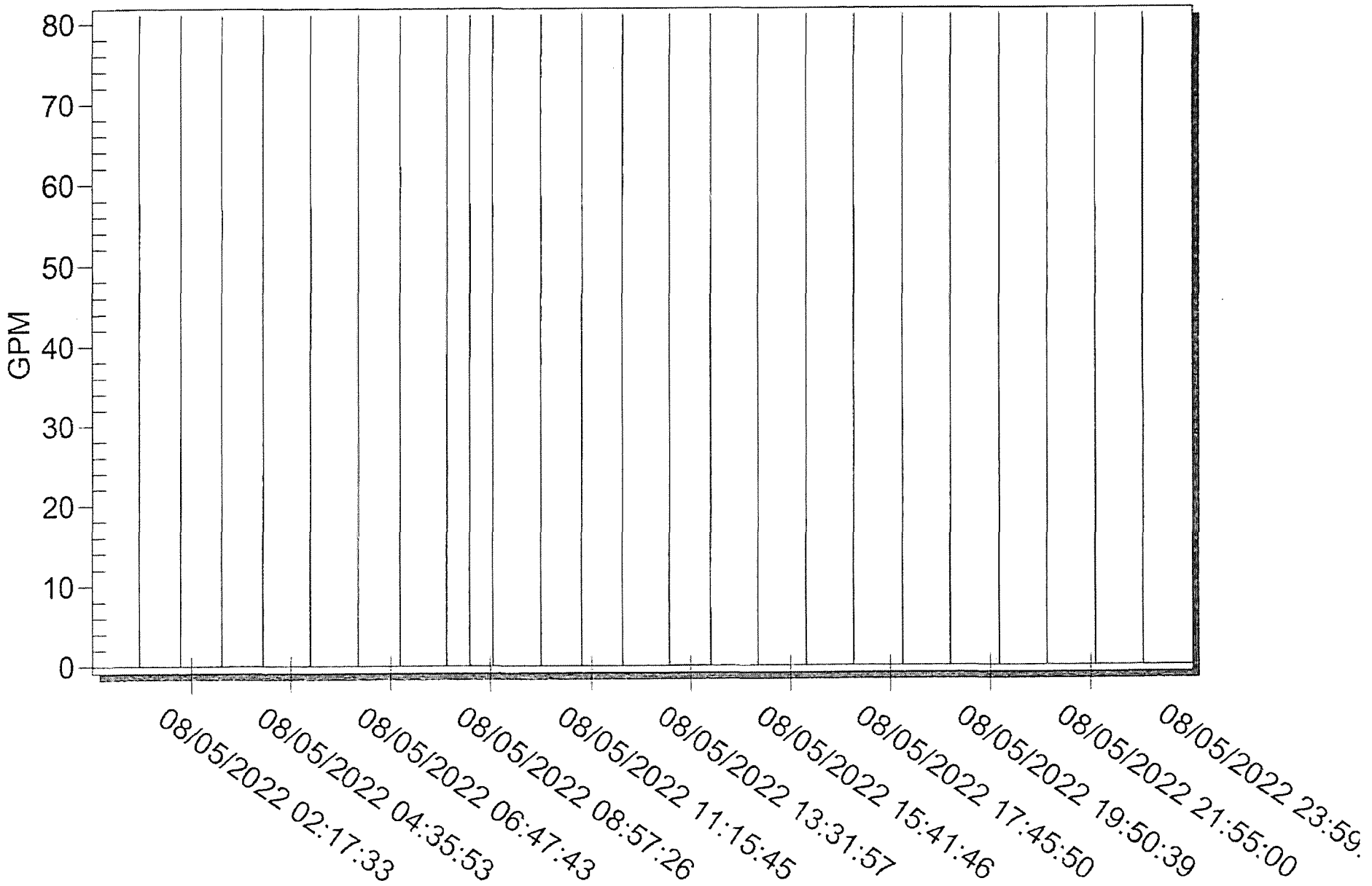
Process/Tank	Stack No.	Sample Run No.	Pollutant	Date	Time	Bar count	Surface Tension		
							Etch	Cr 1	Cr 2
Chrome & Etch	MP1	#1	chromium	8/11/2022	8:30-10:33	**43**	**52.8**	**25.5**	**30**
Chrome & Etch	MP1	#2	chromium	8/11/2022	10:55-12:57	**44**	**58.5**	**26.5**	**35.5**
Chrome & Etch	MP1	#3	chromium	8/11/2022	13:13-15:15	**45**	**55.5**	**27**	**37**

Scrubber Pressure Drop Readings

Hour	1st Stage	2nd Stage	3rd Stage	Overall
9:07	1.3	1.8	0.4	3.5
11:15	1.2	1.8	0.4	3.5
13:50	1.3	1.8	0.3	3.5

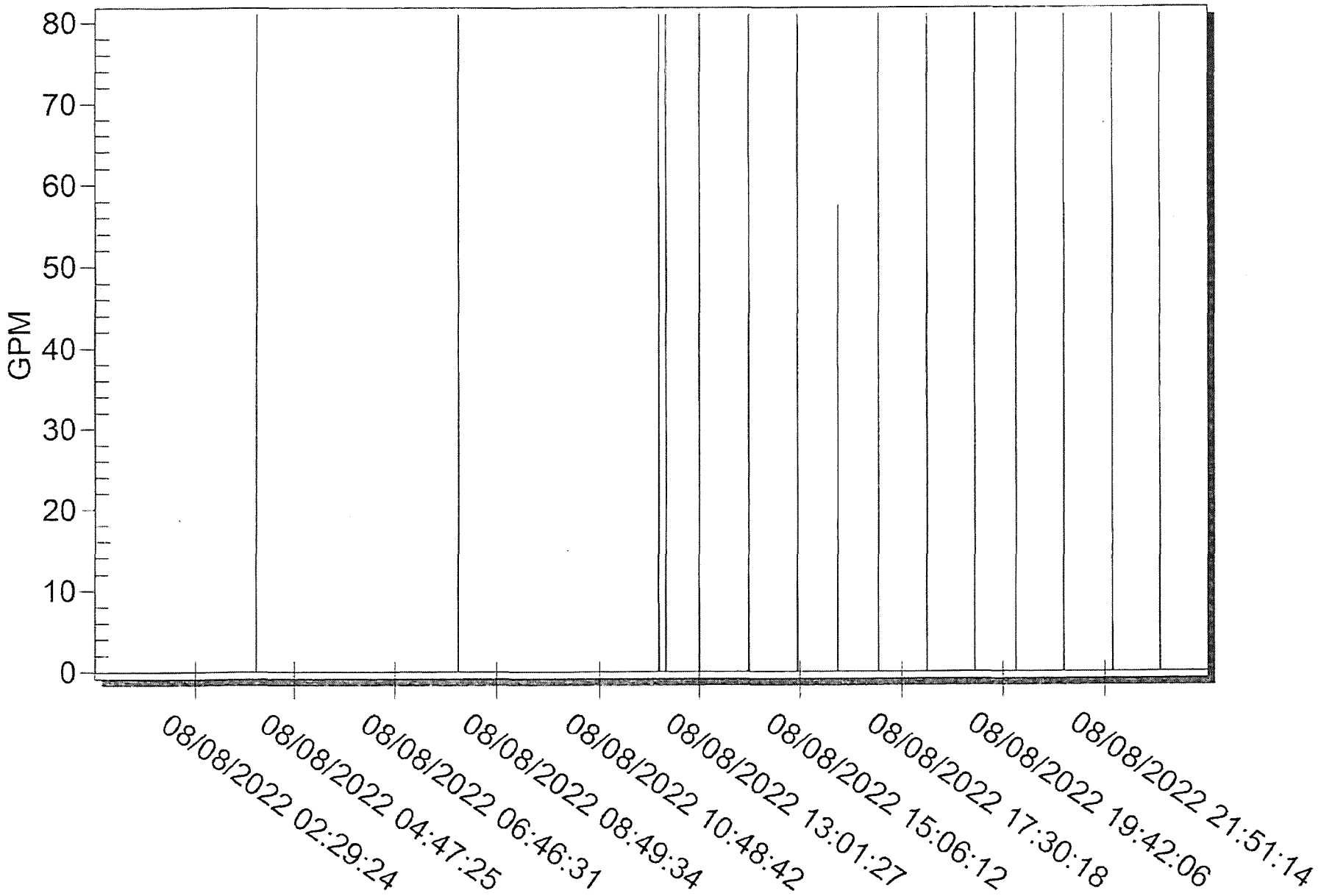
Monroe Cr Scrubber MP1

Washdown Frequency & Flow Rates Stage 1 & 2



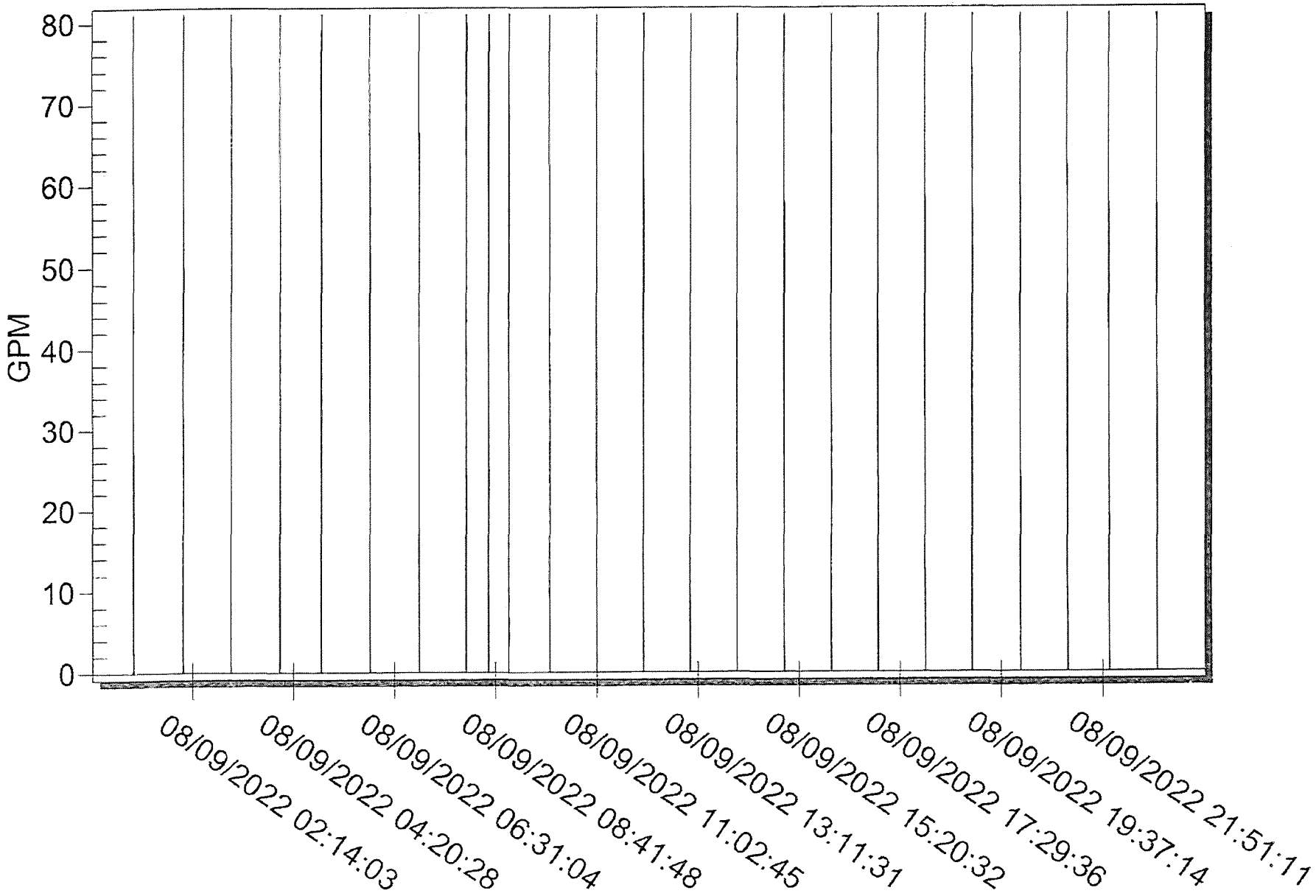
Monroe Cr Scrubber MP1

Washdown Frequency & Flow Rates Stage 1 & 2



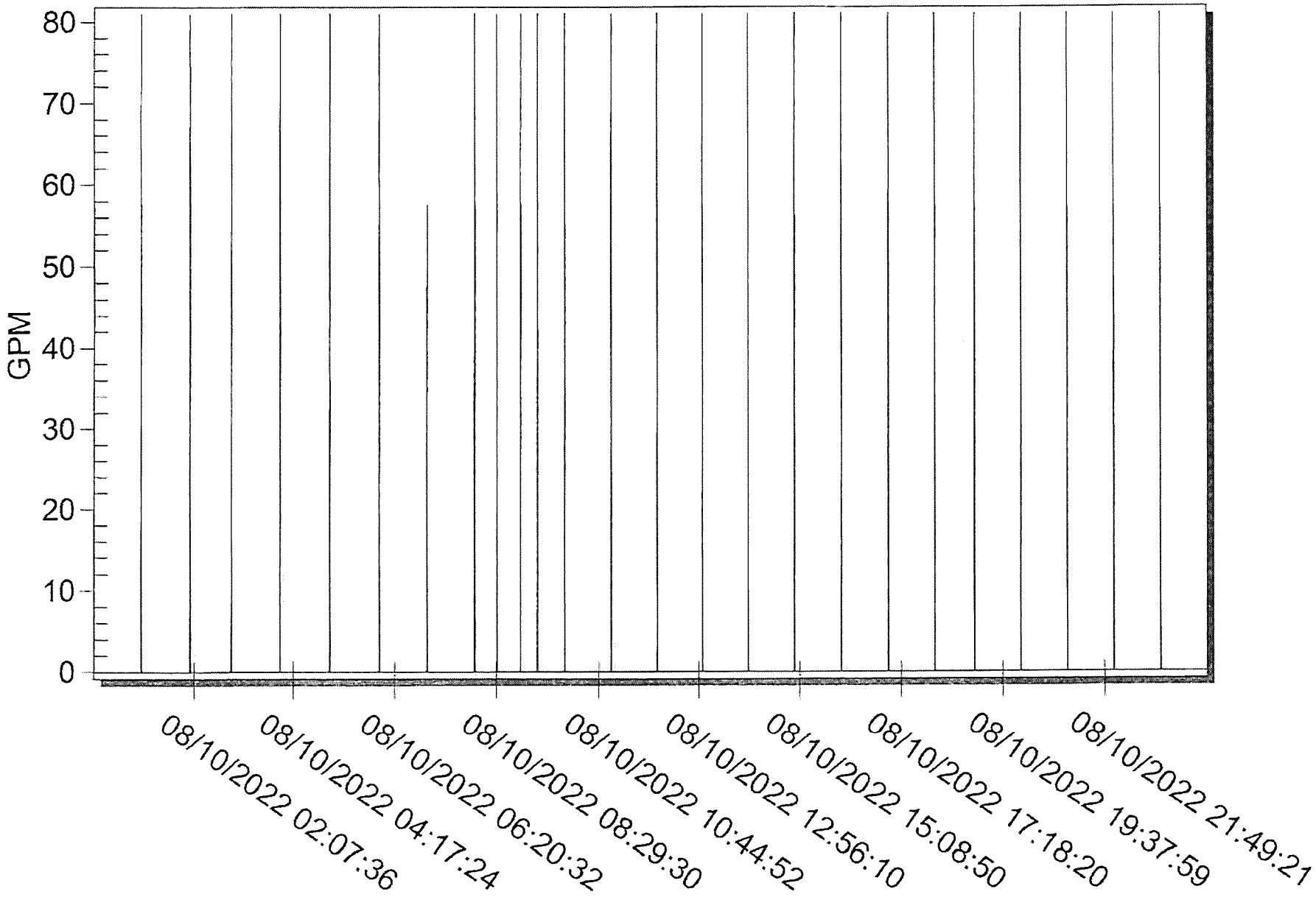
Monroe Cr Scrubber MP1

Washdown Frequency & Flow Rates Stage 1 & 2



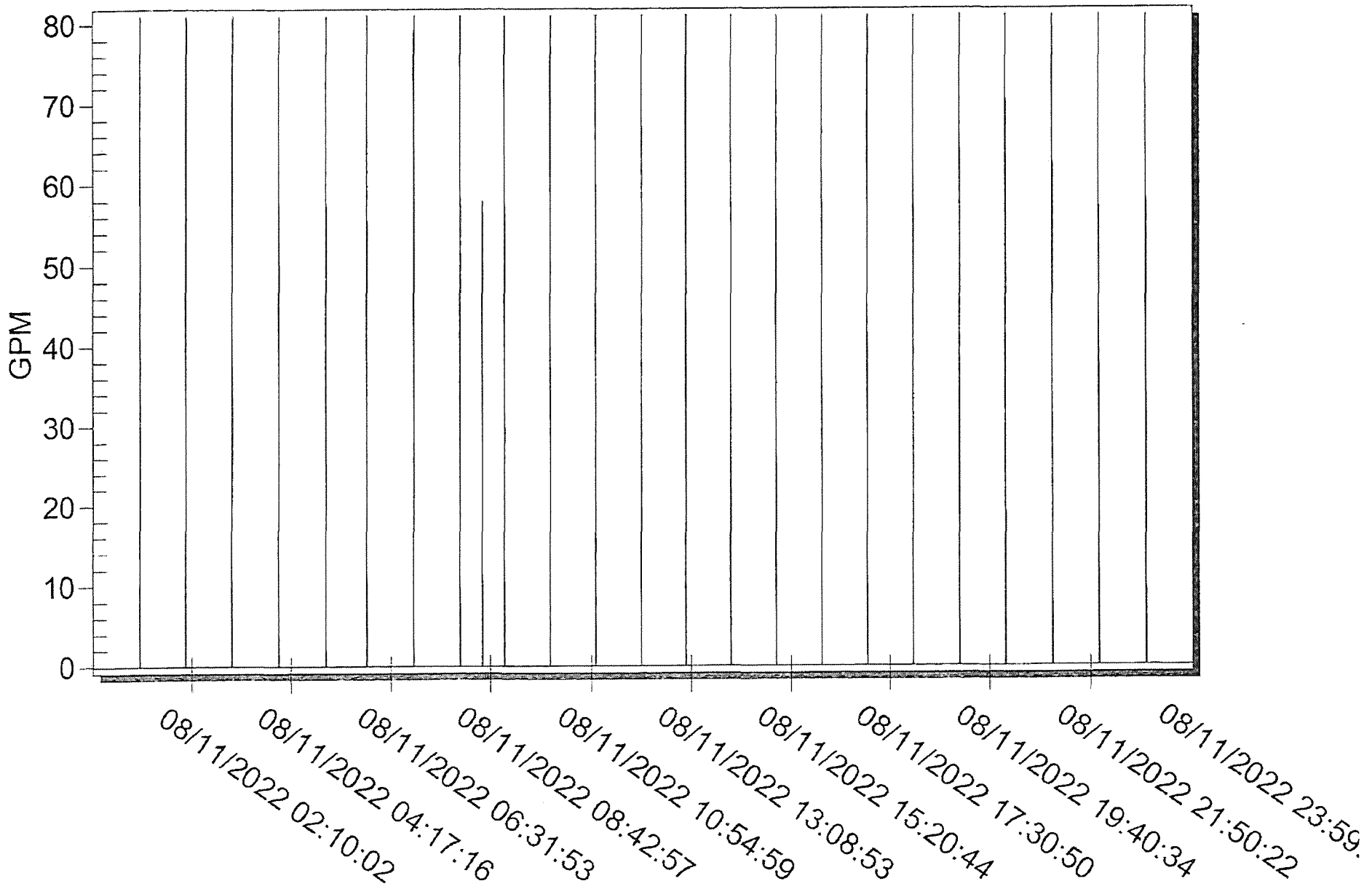
Monroe Cr Scrubber MP1

Washdown Frequency & Flow Rates Stage 1 & 2



Monroe Cr Scrubber MP1

Washdown Frequency & Flow Rates Stage 1 & 2



Environmental PM's

1689325

Composite Mesh Pad Scrubber System - Weekly PM's

System Name: Chrome Equipment #: MP1 Plant: Monroe

Any reading or finding out of range **MUST** have a Work Order filled out for corrective action and the Maintenance Manager / Designated Employee Must Be Notified Immediately!

1	***Check the fresh water fill valve components on the wash down tank for proper operation, secure fitment, and damage.***
	Any problems found? No If so, Work Order No. generated: Date: 8/10 Signed by:
	Comments:
2	***Check the wash down pump for leaks, secure fitment, damage, and any abnormal vibration or noise.***
	Any problems found? No If so, Work Order No. generated: Date: 8/10 Signed by:
	Comments:
3	***Visually inspect all ductwork for any leaks, cracks, gaps, damage and missing components (supports, sleeves, transitions). Check ductwork and conduit for secure and proper support.***
	Any problems found? No If so, Work Order No. generated: Date: 8/10 Signed by:
	Comments:
4	***Visually inspect internal evaporator ball packings are at proper levels above the unit's roofline, inside the top doghouse structures.***
	Any problems found? No If so, Work Order No. generated: Date: 8/10 Signed by:
	Comments:
5	***Visually observe the exhaust stack for any visible emissions (0% opacity), other than uncombined water vapor.***
	Any problems found? No If so, Work Order No. generated: Date: 8/10 Signed by:
	Comments:
6	***Record the differential pressure readings on the Magnehelic gauges:***
	A. Scrubber Pressure Overall: 3.6
	B. Evaporator Pressure (If unit is present on system): N/A
	C. Scrubber Pressure Stage #1 (Reference Only): 1.4
	D. Scrubber Pressure Stage #2 (Reference Only): 1.8
	E. Scrubber Pressure Stage #3 (Reference Only): 1.2
	F. Scrubber Pressure Stage HEPA (If applicable) (Reference Only): N/A
	Any problems found? No If so, Work Order No. generated: Date: 8/10 Signed by:
	Comments:
7	***Record the differential pressure values shown on the iPod and/or line computer:***
	A. Scrubber Pressure Overall: 3.6 Is it within +/- 10% of the meter reading recorded in previous step? Yes
	B. Evaporator Pressure (If unit is present on system): N/A Is it within +/- 10% of the meter reading recorded in previous step?
	Any problems found? No If so, Work Order No. generated: Date: 8/10 Signed by:
	Comments:

PM Continued On Page 2

8	*Weekend mesh pad wash down procedure (2 people required):*

A. Manually do Stage #1 wash down for 4 minutes.
- Visually confirm through the scrubber window port that all nozzles are spraying with equal pressure and uniform pattern.
- Visually confirm water drains out of the bottom mesh pad retaining trough through the weeping holes, and that there is no standing water that remains.

B. During Stage #1 wash down cycle, record water flow rate shown on flow meter: 57 and also the value shown on iPod and/or line computer: 57
- Is the flow meter value within +/- 10% of the iPod and/or line computer value? Yes

C. Manually do Stage #2 wash down for 4 minutes. **[KRAFT K2 UNIT ONLY- Single wash down for 30 seconds]**
- Visually confirm through the scrubber window port that all nozzles are spraying with equal pressure and uniform pattern.
- Visually confirm water drains out of the bottom mesh pad retaining trough through the weeping holes, and that there is no standing water that remains.

D. During Stage #2 wash down cycle, record water flow rate shown on flow meter: 57 and also the value shown on iPod and/or line computer 57
- Is the flow meter value within +/- 10% of the iPod and/or line computer value? Yes

E. Manually do Stage #3 wash down until drain water is clear (Confirm blower is off before starting the process). **[NOT APPLICABLE FOR KRAFT K2 UNIT- No third stage wash down]**
- Visually confirm through the scrubber window port that all nozzles are spraying with equal pressure and uniform pattern.
- Visually confirm water drains out of the bottom mesh pad retaining trough through the weeping holes, and that there is no standing water that remains.

F. During Stage #3 wash down cycle, record water flow rate shown on flow meter: N/A and also the value shown on iPod and/or line computer _____
- Is the flow meter value within +/- 10% of the iPod and/or line computer value? N/A

G. Make sure switches for all wash down stages are set back to "Auto" upon completion.

Any problems found? No If so, Work Order No. generated: _____ Date: 8/10 Signed by: [signature]

Comments:

9	*Maintenance Manager must contact appropriate personnel to calibrate any devices which were found not to be within +/- 10%*

Any problems found? NO If so, Work Order No. generated: _____ Date: 8/10/22 Signed by: Jeff Meng

Comments:

10	*Compare the pressure/flow values recorded in Steps # 5 & 6 with the "Exhaust System Monitoring Devices" document (This step must be completed by Maintenance Manager):*

A. Scrubber Pressure Overall, is it within range? yes

B. Evaporator Pressure (If unit is present on system), is it within range? N/A

C. Mesh Pad Wash Down Stage #1 Flow Spray, is it within range? yes

D. Mesh Pad Wash Down Stage #2 Flow Spray, is it within range? yes

E. Mesh Pad Wash Down Stage #3 Flow Spray, is it within range? N/A **[NOT APPLICABLE FOR KRAFT K2 UNIT- No third stage wash down]**

Any problems found? NO If so, Work Order No. generated: _____ Date: 8/10/22 Signed by: Jeff Meng

Comments:

Maintenance Manager or Designated Employee must sign this PM!

Date: 8/10/22 **Signature:** Jeff Meng

APPENDIX B

Isokinetic Data & Calculations for Cr Test Runs

PLASTIC PLATE | STACK MP1 | 8/11/22

TEST NO.	1	
BAROMETRIC PRESSURE	29.44	IN HG
TIP DIAMETER	0.250	IN
STACK DIMENSIONS	36	IN
STACK AREA	7.069	FT2
SAMPLING TIME PER POINT	5.0	MIN
NUMBER OF POINTS	24	
METER VOLUME	126.94	FT3
PITOT COEFFICIENT	0.84	
METER COEFFICIENT	0.993	
PARTICULATE COLLECTED	0.0001	GRAMS
WATER COLLECTED	54	ML
STATIC PRESSURE	-0.79	IN H2O

ORSAT RESULTS

CO2	O2	CO	N2
0.00%	20.90%	0.00%	79.10%

TEST POINT	STACK TEMP DEG F	PITOT DEL P IN H2O	ORIFICE DEL H IN H2O	METER TEMP DEG F	STACK VELOCITY AFPS
1	82	0.93	1.86	68	55.60
2	82	0.94	1.88	69	55.90
3	83	0.92	1.84	71	55.35
4	83	0.92	1.84	73	55.35
5	86	1.02	2.04	77	58.44
6	86	1.04	2.08	82	59.01
7	87	0.98	1.96	86	57.34
8	84	1.07	2.14	90	59.75
9	81	1.03	2.06	92	58.46
10	83	1.27	2.54	96	65.03
11	85	1.33	2.66	98	66.67
12	86	1.35	2.70	101	67.23
13	86	1.29	2.58	104	65.72
14	87	1.23	2.46	107	64.23
15	87	1.14	2.28	109	61.84
16	87	1.09	2.18	109	60.47
17	88	1.07	2.14	110	59.97
18	87	0.96	1.92	111	56.75
19	80	0.92	1.84	114	55.20
20	82	0.82	1.64	113	52.21
21	86	0.77	1.54	115	50.78
22	87	0.76	1.52	118	50.49
23	87	0.73	1.46	118	49.48
24	87	0.64	1.28	118	46.33
AVERAGE	85		2.02	98	57.82

DRY STANDARD VOLUME	125.07	SCF
PERCENT WATER VAPOR	1.99	% VOL
FLOW RATE	24521	ACFM
	22866	DSCFM
	38853	M3/HR
PARTICULATE CONCENTRATION	0.0000	GR/DSCF
	0.0000	GR/ACF
PARTICULATE EMISSION RATE	0.00	LB/HR
LB PART PER 1000 LB GAS	0.0000	
ISOKINETIC PERCENT	94.5	

PLASTIC PLATE | STACK MP1 | 8/11/22

TEST NO.	2	
BAROMETRIC PRESSURE	29.45	IN HG
TIP DIAMETER	0.250	IN
STACK DIAMETER	36	IN
STACK AREA	7.069	FT2
SAMPLING TIME PER POINT	5.0	MIN
NUMBER OF POINTS	24	
METER VOLUME	124.98	FT3
PITOT COEFFICIENT	0.84	
METER COEFFICIENT	0.993	
PARTICULATE COLLECTED	0.0001	GRAMS
WATER COLLECTED	51	ML
STATIC PRESSURE	-0.79	IN H2O

ORSAT RESULTS

CO2	O2	CO	N2
0.00%	20.90%	0.00%	79.10%

TEST POINT	STACK TEMP DEG F	PITOT DEL P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	STACK VELOCITY AFPS
1	87	0.93	1.86	110	55.84
2	86	0.97	1.94	109	56.97
3	80	0.98	1.96	109	56.95
4	81	0.98	1.96	110	57.00
5	84	1.04	2.08	111	58.88
6	85	1.07	2.14	113	59.78
7	86	1.06	2.12	115	59.56
8	87	1.02	2.04	117	58.47
9	88	1.07	2.14	118	59.95
10	87	1.18	2.36	118	62.89
11	88	1.24	2.48	118	64.53
12	87	1.29	2.58	119	65.76
13	88	1.24	2.48	119	64.53
14	83	1.29	2.58	119	65.52
15	82	1.03	2.06	119	58.49
16	85	1.06	2.12	119	59.50
17	88	1.06	2.12	120	59.66
18	88	0.97	1.94	119	57.08
19	88	0.92	1.84	120	55.59
20	89	0.82	1.64	121	52.53
21	89	0.76	1.52	122	50.57
22	86	0.79	1.58	122	51.41
23	89	0.76	1.52	122	50.57
24	88	0.81	1.62	122	52.16
AVERAGE	86		2.03	117	58.09

DRY STANDARD VOLUME	123.47	SCF
PERCENT WATER VAPOR	1.91	% VOL
FLOW RATE	24637	ACFM
	22949	DSCFM
	38996	M3/HR
PARTICULATE CONCENTRATION	0.0000	GR/DSCF
	0.0000	GR/ACF
PARTICULATE EMISSION RATE	0.00	LB/HR
LB PART PER 1000 LB GAS	0.0000	
ISOKINETIC PERCENT	93.0	

PLASTIC PLATE | STACK MP1 | 8/11/22

TEST NO.	3	
BAROMETRIC PRESSURE	29.43	IN HG
TIP DIAMETER	0.250	IN
STACK DIAMETER	36	IN
STACK AREA	7.069	FT2
SAMPLING TIME PER POINT	5.0	MIN
NUMBER OF POINTS	24	
METER VOLUME	123.79	FT3
PITOT COEFFICIENT	0.84	
METER COEFFICIENT	0.993	
PARTICULATE COLLECTED	0.0001	GRAMS
WATER COLLECTED	51	ML
STATIC PRESSURE	-0.78	IN H2O

ORSAT RESULTS

CO2	O2	CO	N2
0.00%	20.90%	0.00%	79.10%

TEST POINT	STACK TEMP DEG F	PITOT DEL P IN H2O	ORIFICE DEL P IN H2O	METER TEMP DEG F	STACK VELOCITY AFPS
1	89	0.93	1.86	118	55.96
2	92	0.91	1.82	118	55.50
3	93	0.89	1.78	119	54.94
4	93	0.93	1.86	119	56.16
5	92	1.01	2.02	119	58.47
6	92	1.08	2.16	120	60.47
7	93	1.03	2.06	120	59.10
8	94	1.03	2.06	122	59.16
9	94	1.08	2.16	122	60.58
10	94	1.31	2.62	124	66.71
11	94	1.32	2.64	125	66.97
12	94	1.34	2.68	126	67.47
13	92	1.33	2.66	127	67.10
14	92	1.16	2.32	126	62.67
15	92	1.06	2.12	126	59.90
16	92	0.92	1.84	126	55.81
17	93	0.93	1.86	127	56.16
18	93	0.82	1.64	126	52.74
19	92	0.89	1.78	127	54.89
20	92	0.88	1.76	128	54.58
21	91	0.83	1.66	128	52.96
22	91	0.81	1.62	128	52.32
23	88	0.83	1.66	128	52.82
24	88	0.71	1.42	128	48.85
AVERAGE	92		2.00	124	58.01

DRY STANDARD VOLUME	122.31	SCF
PERCENT WATER VAPOR	1.92	% VOL
FLOW RATE	24604	ACFM
	22655	DSCFM
	38496	M3/HR
PARTICULATE CONCENTRATION	0.0000	GR/DSCF
	0.0000	GR/ACF
PARTICULATE EMISSION RATE	0.00	LB/HR
LB PART PER 1000 LB GAS	0.0000	
ISOKINETIC PERCENT	93.3	

PARTICULATE SAMPLE CALCULATION FORMULA

1. **DRY MOLECULAR WEIGHT (Md)** lb/lb-mole

Md = .44*% CO2 + .32*%O2 + .28*%N2 + .28*%CO

2. **WATER VAPOR PERCENT (%H2O)**

Vw std = 0.04707*(Vf - Vi)

where: Vw std = standard cubic feet of water vapor
Vf = Final volume of impingers, ml
Vi = Initial volume of impingers, ml

%H2O = Vw std * 100/(Vm std + Vw std)

where Vm std = standard cubic feet of gas sampled

3. **WET MOLECULAR WEIGHT (Ms)** lb/lb-mole

Ms = Md*(1 - %H2O/100) + 18*%H2O/100

4. **STACK PRESSURE (Ps)** in. Hg.

Ps = Pb + Pg/13.6

where: Pb = barometric pressure (uncorrected), in. Hg
Pg = stack gauge pressure, in. H2O
13.6 = specific gravity of mercury (Hg)

5. **AVERAGE STACK VELOCITY (vs)** feet per second

Vs = Kp*Cp*DELP * (Tsavg/(Ps*Ms))^0.5

where: Kp = 85.49 unit conversion
Cp = 0.84, pitot tube calibration factor
DELP = average of square root of velocity head, in. H2O
Tsavg = average stack temperature, deg R (460+F)
Ps = stack pressure
Ms = wet molecular weight

6. **STACK GAS FLOW RATE (Qs)** std. cubic feet per minute

Qs = 60*(1 - %H2O/100)*Vs*A*(528*Ps/Tsavg/29.92)

where: A = stack area, ft2
528 = std temperature, deg R
29.92 = std pressure, in. Hg

7. **DRY GAS VOLUME (Vmstd)** dry std. cubic feet

Vm std = (GAMAC*(Pb+ DELH/13.6)/29.92) * Vm

where: GAMAC = dry gas meter calibration factor corrected for meter temperature (GAMA+(Tm-70)*.00012)
Vm = volume of dry gas metered, cubic feet
Tm = average meter temperature, degrees F
DELH = average orifice pressure drop, in.H2O

8. **PARTICULATE CONCENTRATION (cs)** grains per dry standard cubic foot

Cs = Mn * 15.43/Vm std
where: Mn = particulate captured, grams
15.43 = grains per gram

9. **EMISSION RATE (ER)** pounds per hour

PMRA = Mn*A*60/(t*An*453.6) AREA METHOD lb/hr

PMRC = Cs*Qs*60/(15.43*453.6) CONC. METHOD lb/hr

ER = (PMRA + PMRC)/2

where: An = area of sampling nozzle, square feet

10. **EMISSION CONCENTRATION (EC)** lb/1000 lb exhaust gas

EC = ER * 386700 * (1-%H2O/100)/(Qs*60*Ms)

where: 386700 = cubic feet per lb mole * 1000

11. **ISOKINETIC SAMPLING PERCENTAGE (I)**

I = PMRA/PMRC

APPENDIX C

Element One Lab Report

Environmental Technology & Engineering Corporation

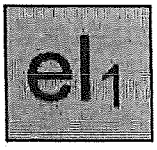
13000 W. Bluemound Rd., Ste. 109
Elm Grove, WI 53122

Project ID: 4984-LACKS

Total Chromium

EPA Method 306 Analysis

Analytical Report
39142



Element One, Inc.
6319-D Carolina Beach Rd., Wilmington, NC 28412
910-793-0128 FAX: 910-792-6853 e1lab@e1lab.com

The following data for Analytical Report 39142
has been reviewed for completeness, accuracy,
adherence to method protocol,
and compliance with quality assurance guidelines.

Review by:

Daphne Woodman, B.S. Chemist
August 24, 2022

Report Reviewed and Finalized by:

Ken Smith, Laboratory Director
August 24, 2022

SUMMARY OF RESULTS