



# **Results of the March 24-25, 2021 Mercury Emissions Tests at the U. S. Steel Corporation - Keetac Agglomerator Facility Located in Keewatin Minnesota**

Phase II Waste Gas Stack

SV051

***Agency Interest ID: 142828***

***Air Emissions Permit No. 13700063***

***Barr Project No. 23311210.21***

Prepared for  
U. S. Steel Corporation – Keetac  
Keewatin, Minnesota

April 2021

# Results of the March 24-25, 2021 Mercury Emissions Tests at the U. S. Steel Corporation - Keetac Agglomerator Facility Located in Keewatin Minnesota

April 2021

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## Report Certification

### Certification of Sampling Procedures:

I certify under penalty of law that the sampling procedures were performed in accordance with the approved test plan and that the data presented in this test report are, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below



Tom Kuchinski  
Stack Testing Services Coordinator  
Barr Engineering Co.

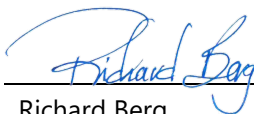
5/03/2021

Date

### Certification of Analytical Procedures:

I certify under penalty of law that the analytical procedures were performed in accordance with the requirements of the test methods and that the data presented for use in the test report were, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below

1. Element One, Inc. analyzed metals samples. A signed laboratory report is provided in this report.



Richard Berg  
Sr. Air Quality Technician  
Barr Engineering Co.

April 23, 2021

Date

### Certification of Test Report by Testing Company:

I certify under penalty of law that this test report and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the test information submitted. Based on my inquiry of the person or persons who performed sampling and analysis relating to the performance test, the information submitted in this test report is, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below.



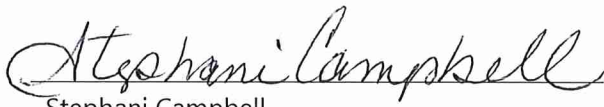
Tom Kuchinski  
Stack Testing Services Coordinator  
Barr Engineering Company

5/03/2021

Date

**Certification of Test Report by Owner or Operator of Emission Facility:**

I certify under penalty of law that the information submitted in this test report accurately reflects the operating conditions at the emission facility during this performance test and describes the date and nature of all operational and maintenance activities that were performed on the process and control equipment during the month prior to the performance test. Based on my inquiry of the person or persons who performed the operational and maintenance activities, the information submitted in this test report is, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below.



Stephani Campbell

Environmental Control Engineer

U. S. Steel Corporation – Keetac



Date

## Executive Summary

Barr Engineering Co. performed mercury emissions testing at the U. S. Steel Corporation Keetac Agglomerator facility located in Keewatin, Minnesota. Testing was performed to satisfy the Minnesota Rule 7019.3050 mercury emission inventory testing requirement. The mercury (Hg) testing was performed March 24-25, 2021 on the Phase II Waste Gas Stack (SV051). There are no emission limits in the facility permit for Hg. Test results are provided in the Executive Summary Table (Table ES-1).

**Table ES-1 Executive Summary Table**

Average Test Results	
Test Parameter Methods 1-4, 29	Phase II Waste Gas Stack
Stack Vent Number	SV051
Test Date	3/24-25/2021
Total Mercury Emission Rate, lb/hr	0.017

## 1.0 Introduction

Barr Engineering Co. (Barr) performed mercury emissions testing at the U. S. Steel Corporation Keetac Agglomerator facility located in Keewatin, Minnesota. Testing was performed to satisfy the Minnesota Rule 7019.3050 mercury emission inventory testing requirement. The Hg testing was performed March 24-25, 2021 on the Phase II Waste Gas Stack (SV051).

A test plan dated January 17, 2020 was submitted to the Minnesota Pollution Control Agency (MPCA) on January 24, 2020. A pretest meeting between Stephani Campbell of U.S. Steel Corporation-Keetac (Keetac), Andy Place of the MPCA, and Tom Kuchinski of Barr Engineering Co. was held on March 17, 2020. The test plan and relevant correspondence are provided in Appendix F. The mercury testing was delayed due to facility idling in March of 2020.

Tom Kuchinski led the Barr test team. Stephani Campbell of Keetac provided coordination of the test team with facility operations. The performance tests were not witnessed by a representative of the MPCA. A list of project participants is provided in Appendix G.

The testing consisted of four 2-hour test runs using EPA Method 29 to determine mercury emissions. A fourth run was performed due to sample contamination concerns during test run two. Test runs one, three and four were used to determine emission results.

A list of the emissions units tested with target process operating rate ranges and applicable rules are presented in Table 1 below. Production rates during the testing were at or above 90 percent of maximum throughput. The Phase II furnace was fired on natural gas.

**Table 1-1 Emission Source Information**

Source	Emissions Unit	Control Equipment	Stack Vent	Permit Group	Greenball Feed Rate (LTPH)	Applicable Rule
Phase II Waste Gas Stack	EU030	CE110/CE111	SV051	none	0-950	Minn. R. 7019.3050

---

## 2.0 Results

### 2.1 Phase II Waste Gas Stack (SV051)

Results of the Phase II Waste Gas Stack (SV051) test performed March 24-25, 2021 are provided in Table 1. The average emission rate of total mercury is 0.017 pounds per hour (lb/hr).

It was discovered at the conclusion of test run two that the sample was accidentally contaminated and determined to be invalid. Consequently, a fourth run was performed the morning of March 25. Run 3 was paused after 20 minutes and completed after a process delay. Runs one, three and four are reported. No other testing difficulties were noted.



---

## 3.0 Process Description

The Keetac Phase II indurating furnace (EU030) is an Allis Chalmers model 48-30-3 Grate Kiln Pelletizing system. The green ball feed is dried and preheated on a traveling grate by down draft drying to develop mechanical strength prior to entering a rotary kiln for high temperature induration. The kiln product drops into an annular cooler for cooling and heat recovery by ambient air driven by two stages of cooling fans. Hot gases from the first stage of cooling pass through the kiln as secondary air to the preheat section of the grate. A heat recoup system draws air from the cooler for second down draft drying section.

The furnace particulate emissions are controlled by two Zurn MTSA-288-11.5 CXT-TA multiclones one serving each side of the kiln (CE030-031 and CE035-036) (A and B side). Two wet scrubbers (CE110 and CE111) provide additional emission control after each of the multiclones. The scrubbers are venturi type designed by STS. The exhausts of the two scrubbers are vented to the atmosphere through a common waste gas stack (SV051).

The process was operating at greater than 90 percent of maximum production. The kiln system was firing on natural gas for the test. Process rate parameters recorded and summarized for each run include green ball feed rate and fired pellet production rate. Scrubber water flow rate and pressure drop were recorded. The process operating data are summarized in Table 2. Detailed process data along with completed MPCA Operating Data Summary for Process Sources forms are located in Appendix E.

## 4.0 Stack Testing Procedures and Methods

Testing was performed at locations meeting EPA method 1 criteria. Method criteria are listed below in Table 4-1. Sample port locations and traverse points are provided in Figures 1-2.

**Table 4-1 EPA Method 1 Criteria**

<b>Stack Vent Number</b>	<b>Distance to Upstream Disturbances (Diameters)</b>	<b>Distance to Downstream Disturbances (Diameters)</b>	<b>Number of Ports</b>	<b>Number of Points</b>
SV051	3.6	2.2	4	24

Volumetric airflow determinations were performed in accordance with EPA Method 2 using an S-type pitot tube. Airflows were determined in conjunction with the EPA Method 29 tests.

Oxygen and carbon dioxide concentrations at the waste gas stacks were determined from integrated stack gas samples collected with each test run and analyzed by modified EPA Method 3A. Results of those analyses are in Appendix B. Gas calibration certifications are provided in Appendix D.

Stack gas moistures were determined by performing EPA Method 4 in conjunction with the EPA Method 29 test.

Mercury emissions were determined following EPA Method 29. All glassware used for the testing was prepared as directed by the method. All reagents were prepared at Barr's laboratory except for the acidified potassium permanganate solution which was prepared on-site daily prior to sampling. Sample recovery was performed in Barr's recovery trailer to minimize potential for sample contamination. Samples were analyzed by Element One, Inc. of Wilmington, North Carolina. A complete laboratory report along with chain of custody is located in Appendix C.

Mercury levels in all reagent blanks were below analytical detection limits. No blank corrections were performed. Mercury sample fractions reported at the analytical detection limit are included in the total mass of the sample using the full detection limit value.

The test methods referenced above are found in 40 CFR Part 60, Appendix A.

## Tables

**TABLE 1**

**EPA METHOD 29 METALS EMISSION RATE RESULTS**

**Phase II Waste Gas Stack (SV051)**

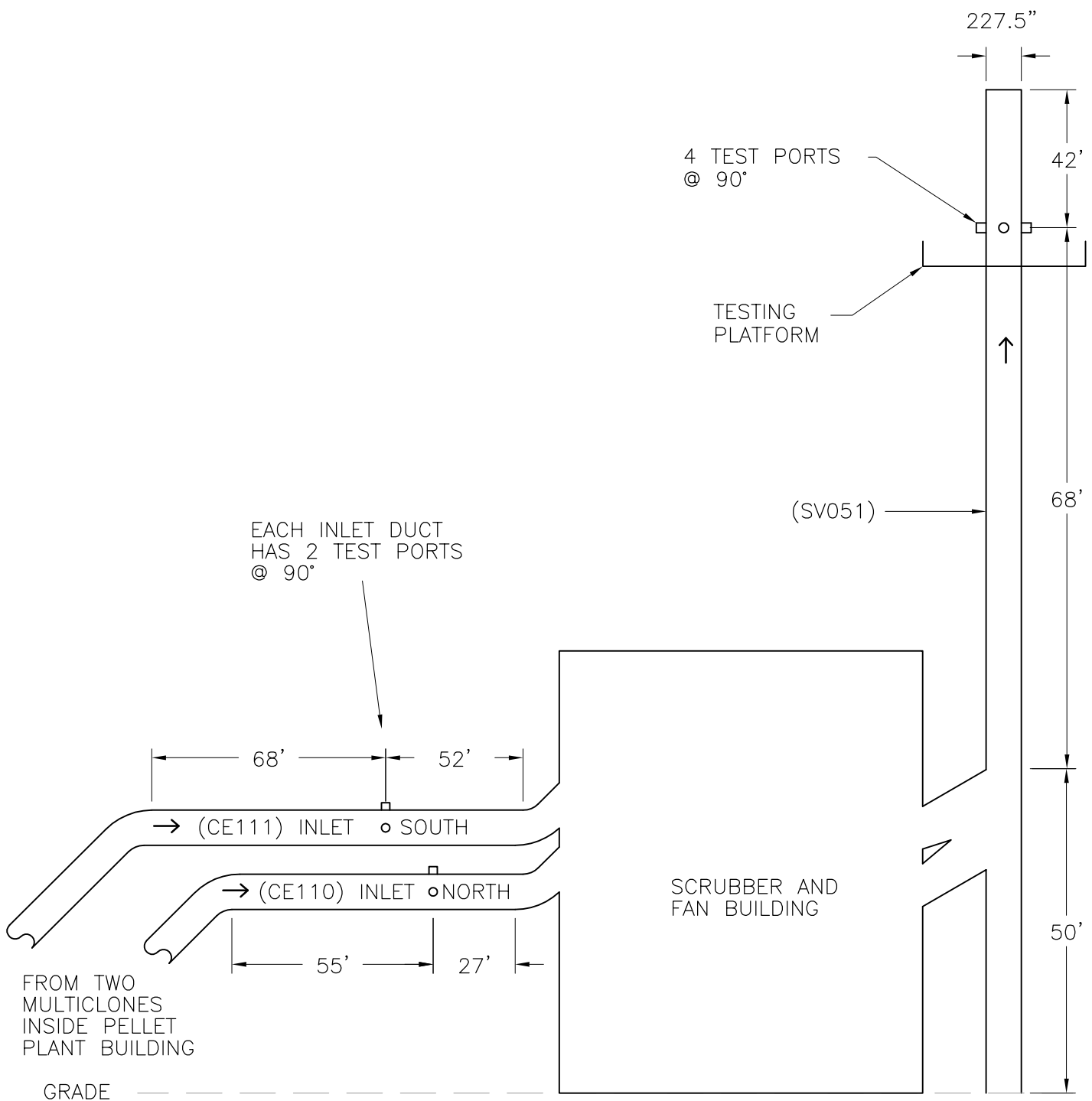
Parameter	Run 1	Run 3	Run 4	Average
Test Date	3/24/2021	3/24/2021	3/25/2021	-
Test Period	0805 - 1015	1336-1356, 1536-1722	0815 - 1023	-
Test Duration, min	120	120	120	120
Average Stack Temperature, °F	124	126	125	125
Average Moisture Content, %V/V	13.59	14.24	14.01	13.95
Air Flow Rate				
acfm	854,000	834,000	834,000	841,000
scfm	727,000	707,000	713,000	716,000
dscfm	628,000	607,000	613,000	616,000
Front Half Metals Concentration, ug/dscm				
Mercury (Hg)	<0.040	<0.041	<0.041	<0.041
Back Half Metals Concentration, ug/dscm				
Mercury (Hg)	6.98	8.09	6.52	7.20
Total Metals Concentration, ug/dscm				
Mercury (Hg)	7.02	8.13	6.56	7.24
Filterable Metals Emission Rate, lb/hr				
Mercury (Hg)	<0.00009	<0.00009	<0.00009	<0.00009
Condensable Metals Emission Rate, lb/hr				
Mercury (Hg)	0.016	0.018	0.015	0.017
Total Metals Emission Rate, lb/hr				
Mercury (Hg)	0.017	0.018	0.015	0.017

<= Non detect, below detection limit.

TABLE 2

Date	Run Time	Feed Rates LTPH		Prod. Rate LTPH	Kiln Gas MBTUH	Total MBTUH	4A-04-62			4A-04-63		
		Green ball	To Grate				Lower dP	Upper dP	GPM	Lower dP	Upper dP	GPM
3/24/2021	0805-1015	930	769	647	271	271	10.6	11.3	2201	14.0	14.1	2201
3/24/2021	1336-1356, 1536-1722	975	817	678	315	315	10.3	11.0	2200	13.5	13.7	2200
3/25/2021	0815-1023	974	824	677	309	309	10.3	11.0	2199	13.6	13.7	2200

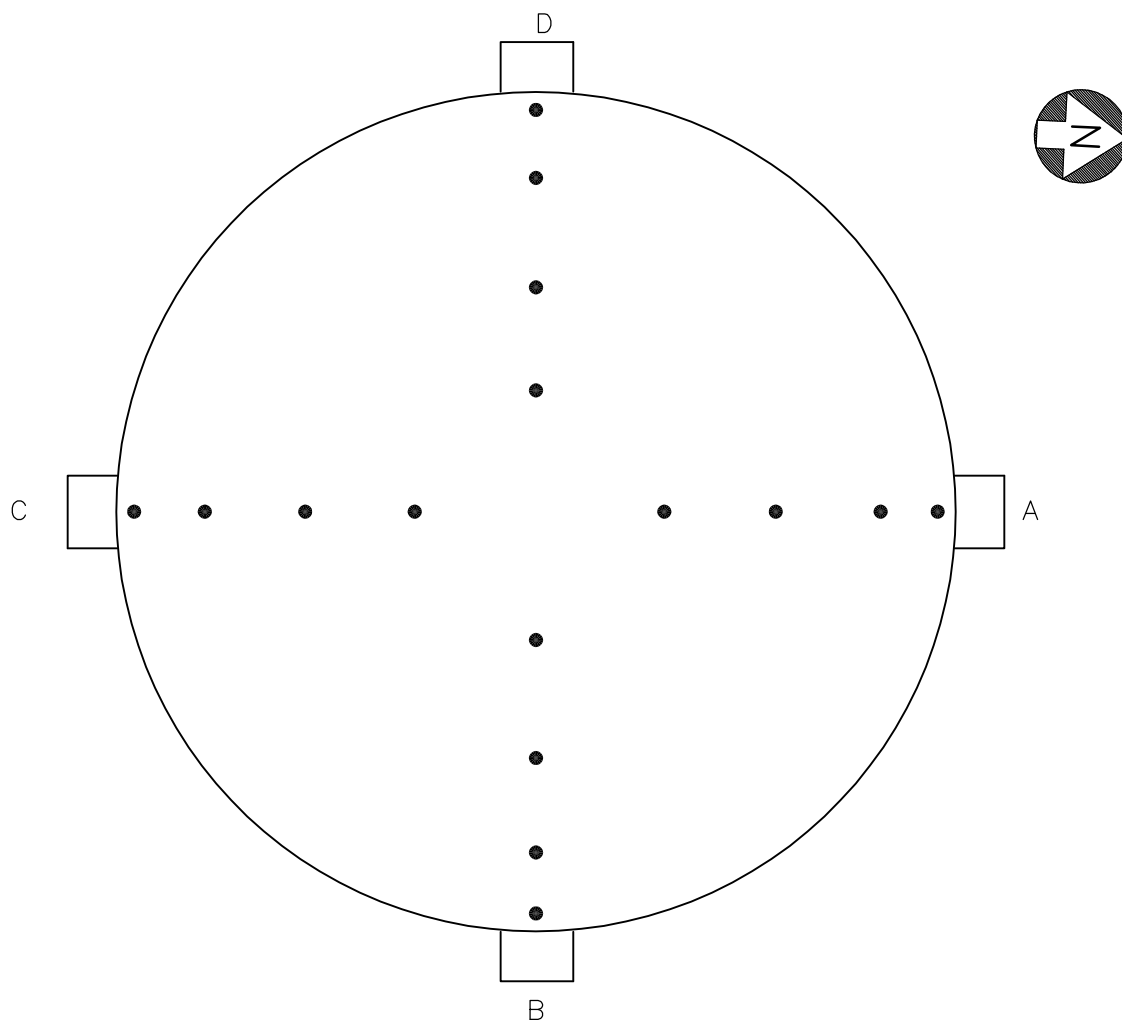
## Figures



TEST PORT LOCATIONS  
KEEWATIN TACONITE  
KEEWATIN, MINNESOTA  
PHASE II WASTE GAS STACK (SV051)

NOT TO SCALE

FIGURE 1



NO. OF TEST PORTS	4
PORT LENGTH	6.25"
PORT DIAMETER	6"
NO. OF TRAVERSE POINTS	16
DUCT DIAMETER	227.5"

● M2 POINTS

POINT	INSERTION DEPTH IN "
1	7.35
2	23.82
3	44.09
4	73.53

TRAVERSE POINT LOCATIONS  
KEEWATIN TACONITE  
KEEWATIN, MINNESOTA  
PHASE II WASTE GAS STACK (SV051)

NOT TO SCALE

FIGURE 2



## Appendices

## Appendix A

### Report Calculations and Nomenclature

EPA Method 29 Metals Calculation Summary  
Determination of Metal Emissions  
EPA Method 29

Phase II Waste Gas Stack (SV051)

Input Data	Symbol	Units	Run 1	Run 3	Run 4	Average
Test Date	-	-	3/24/2021	3/24/2021	3/25/2021	--
Test Period	-	-	0805 - 1015	1336-1356, 1536-1722	0815 - 1023	--
Run Time	theta	min	120	120	120	
Meter Volume at Standard Conditions Vmstd	Vmstd-ft3	cubic feet	88.97	86.28	86.35	87.20
Meter Volume at Standard Conditions Vmstd	Vmstd-m3	cubic meter	2.52	2.44	2.45	2.47
Conditions (M2,M4, ISO Calcs)	Qd	DSCFM	627,766	606,723	612,899	615,796
<b>Laboratory Results</b>						
Metals Loading, Filterable Analysis, ug			Front Half	Front Half	Front Half	--
Mercury (Hg)	Hg-ug	FH-ug	<0.1	<0.1	<0.1	<0.1
Metals Loading, Condensable Analysis, ug			Back-Half	Back-Half	Back-Half	--
Mercury (Hg)	Hg-ug	BH-ug	17.60	19.76*	15.94	17.77
<b>Calculated Data</b>						
<b>Filterable Metals Concentration, ug/dscm</b>						
ug/dscm = FH ug / Vmstd-m3			Front Half	Front Half	Front Half	--
Mercury (Hg)	Hg	ug/dscm	<0.040	<0.041	<0.041	<0.041
<b>Condensable Metals Concentration, ug/dscm</b>						
ug/dscm = BH ug / Vmstd-m3			Back-Half	Back-Half	Back-Half	--
Mercury (Hg)	Hg	ug/dscm	6.98	8.09	6.52	7.20
<b>Total Metals Concentration, ug/dscm</b>						
Total ug/dscm = (FH ug + BH ug) / Vmstd m3 x 0.001			Total	Total	Total	--
Mercury (Hg)	Hg	ug/dscm	7.02	8.13	6.56	7.24
<b>Front Half Metals Emission Rate, lb/hr</b>						
Metal-E = FH ug x 2.2046e-9/vstd ft3 x Qd x 60			Front Half	Front Half	Front Half	--
Mercury (Hg)	Hg	lb/hr	<0.00009	<0.00009	<0.00009	<0.00009
<b>Back Half Metals Emission Rate, lb/hr</b>						
Metal-E = BH ug x 2.2046e-9/vstd ft3 x Qd x 60			Back Half	Back Half	Back Half	--
Mercury (Hg)	Hg	lb/hr	0.016	0.018	0.015	0.017
<b>Total Metals Emission Rate, lb/hr</b>						
Metal-E = Front half lb/hr + Back Half lb/hr			Total	Total	Total	--
Mercury (Hg)	Hg	lb/hr	0.017	0.018	0.015	0.017

\*Results are the average of Run 3 and Run 3 Duplicate.

<= Non detect, below detection limit.

Determination of Volumetric Air Flow Rate, Gas Composition, Moisture Content, Meter Volume and Isokinetic Sampling  
EPA Methods 2, 3, 4 and Isokinetics by Method  
Phase II Waste Gas Stack (SV051)

Input Data	Symbol	Units	Run 1	Run 3	Run 4
Test Date	-	-	3/24/2021	3/24/2021	3/25/2021
Test Period	-	-	0805 - 1015	1336-1356, 1536-1722	0815 - 1023
Number of Sample Ports	-	-	4	4	4
Number of Traverse Points	-	-	24	24	24
Duct Dimensions (diameter or Length x Width)	D, L X W	inches	227.50	227.50	227.50
Barometric Pressure	Pbar	in. Hg	28.20	28.20	28.40
Stack Static Pressure	Pg	in. H <sub>2</sub> O	-0.50	-0.50	-0.50
Average Stack Temperature	Tsf	degrees F	124	126	125
Actual Dry Gas Meter Volume	Vm	cubic feet	92.59	89.45	89.42
Dry Gas Meter Calibration Factor	Y	-	1.0080	1.0080	1.0080
Average Orifice Meter Pressure Drop	DH	in H <sub>2</sub> O	2.07	1.95	1.95
Average Meter Temperature	Tmf	degrees F	65	63	66
Pitot Tube Coefficient	Cp	-	0.84	0.84	0.84
Average Square Root of Velocity Head	(DP) <sup>0.5</sup>	-	0.808	0.787	0.790
Mass of Water Vapor Condensed in Impingers	Vwc	g	313	315	312
Mass of Water Vapor Collected in Desiccant	Vwsg	g	16	3	15
Orsat Results, Dry Basis					
Oxygen	%O <sub>2</sub>	%v/v	17.9	17.8	18.2
Carbon Dioxide	%CO <sub>2</sub>	%v/v	1.4	1.5	1.2
Nitrogen + Carbon Monoxide	%N <sub>2</sub> + %CO	%v/v	80.7	80.7	80.6
Nozzle Diameter	Dn	inches	0.247	0.247	0.247
Run Time	theta	minutes	120	120	120
Calculated Data	Symbol	Units	Run 1	Run 3	Run 4
Average Absolute Stack Temperature Tsr = Tsf + 460	Tsr	degrees R	584	586	585
Stack Pressure Ps = Pbar + Pg / 13.6	Ps	in. Hg	28.16	28.16	28.36
Duct Area A = PI x D <sup>2</sup> / (4 x 144) or A = L x W / 144	A	Sq. ft	282.287	282.287	282.287
Meter Volume at Standard Conditions Vmstd = 17.64 x Vm x Y x ((Pbar + (DH / 13.6)) / (Tmf + 460))	Vmstd-ft3	cubic feet	88.97	86.28	86.35
Meter Volume at Standard Conditions Vmstd-m3 = Vmstd-ft3 x 0.02832	Vmstd-m3	cubic meter	2.52	2.44	2.45
Average Moisture Content of Stack Gas MC = ((0.04175 x Vwc + 0.04715 x Vwsg) / ((0.04715 x Vwc + 0.04715 x Vwsg) + (Vmstd))) x 100	MC	% Vol	13.59 see note	14.24 see note	14.01 see note
Molecular Weight of Stack Gas, dry Md = (0.44 x %CO <sub>2</sub> ) + (0.32 x %O <sub>2</sub> ) + (0.28 x (%N <sub>2</sub> + %CO))	Md	lb/lbmol	28.94	28.95	28.92
Molecular Weight of Stack Gas, wet Ms = Md x (1-(MC/100))+18 x (MC/100)	Ms	lb/lbmol	27.45	27.39	27.39
Average Stack Gas Velocity Vs = 85.49 x Cp x (dP) <sup>0.5</sup> x ((Tsr/(Ps x Ms)) <sup>0.5</sup> )	Vs	ft/sec	50.40	49.22	49.21
Actual Volumetric Air Flow Rate Qa = 60 x Vs x A	Qa	acfm	853,650	833,699	833,520
Volumetric Air Flow Rate at Standard Conditions Qs = Qa x (528 / (Ts + 460)) x (Ps / 29.92)	Qs	scfm	726,529	707,479	712,756
Dry Volumetric Air Flow Rate at Standard Conditions Qd = Qa x (1 - (MC / 100)) x (528 / Tsr) x (Ps / 29.92)	Qd	dscfm	627,766	606,723	612,899
Nozzle Cross-Sectional Area An = ( 3.14 x Dn <sup>2</sup> ) / (4 x 144)	An	sq. ft	0.000333	0.000333	0.000333
Isokinetic Variation I = (0.0945 x Tsr x Vmstd) / (Ps x Vs x An x theta x (1 - (MC / 100)))	I	%	100.3	100.6	99.7

Note: Moisture Content limited to moisture at saturation

## Appendix B

### Field Data Sheets



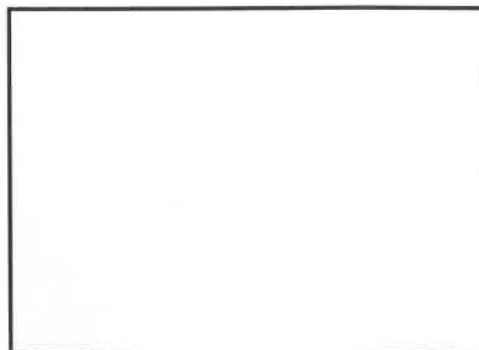
# EPA METHOD 2 FIELD DATA SHEET

Project US5/Kcetac  
Sample Location LINE 540 645 STACK  
Date 3-24-21  
Operators TAK/BJK/RMP  
Duct Dimensions 22.5 inches  
Port Length 6.5 inches  
Pitot Tube No. 7-4 Cp 0.84  
Manometer ID E-14 Bar. ID BA-09  
Digital Therm ID C-14 T.C. ID 7-4

	Run 1	Run 2	Run 3	Run 4
Bar Press (In Hg)				
Stat. Press (In H <sub>2</sub> O)				
Temp - Dry Bulb °F				
Temp - Wet Bulb °F				
Moist Content - %				
O <sub>2</sub> %				
Time of Meas.				

Pitot Leak Check Positive: \_\_\_\_\_ Negative: \_\_\_\_\_

Traverse Point Information			Cyclonic Flow ∠°	Velocity Head - Inches H <sub>2</sub> O				Stack Temperature - °F			
Point Number	Inches From:			Run 1 ΔP	Run 2 ΔP	Run 3 ΔP	Run 4 ΔP	Run 1 Temp.	Run 2 Temp.	Run 3 Temp.	Run 4 Temp.
	Wall	Port									
A 1	4.84	11.34									
2	15.24	21.74									
3	26.87	33.37									
4	42.32	46.82									
5	56.88	63.38									
6	80.91	82.41									
B 1											
2											
3											
4											
5											
6											
C 1											
2											
3											
4											
5											
6											
D 1											
2											
3											
4											
5											
6											



Schematic of Duct Cross-Section

	Run 1	Run 2	Run 3	Run 4
Stack Pres. - In Hg				
Duct Area - Sq Ft.				
Mole Weight - Md				
Mole Weight - Ms				
Avg. Temp. - °F				
Average $\sqrt{\Delta P}$				
Gas Vel - Ft/Sec				
ACFM				
SCFM				
DSCFM				



EPA METHOD 29  
FIELD DATA SHEET

Project WSS Katalac Meter ID C-14 Probe ID 7-4 Bar. Pres 28.20 in Hg  
Smpl Loc Waste Gas SUOSI Meter Y 1.008 Pitot No. 7-4 Stat. Pres -0.50 in H<sub>2</sub>O  
Test No. 1 Run 1 Orifice H@ 2.0119 Pitot Cp 0.84 Probe Lgth 7 ft  
Date 3/24/21 Operators TAL, DSK, RMD Liner Type: ☒ Glass ☐ S.S. ☐ Other — Imp TC 8560

Sample Train Leak Rate (cfm)		
Pretest	<u>0.54</u> at <u>15</u>	in Hg
Posttest	<u>0.0</u> at <u>7</u>	in Hg
Pitot (3 in.)	Pos. <input checked="" type="checkbox"/> Neg. <input checked="" type="checkbox"/>	

Sample Point	Sample Time $\Delta t$	Meter Volume Vm, ft <sup>3</sup>	Velocity $\Delta P$ , in H <sub>2</sub> O	Orifice $\Delta H$ , in H <sub>2</sub> O	Sample Vacuum, in Hg	Stack Temp. Ts, °F	Sample Train Temperatures, °F					Oxygen Content, %
							Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
A 6	0805	533.50										
5	5	536.84	0.50	1.56	2.0	124	246	257	39	59	59	17.4
4	10	540.70	0.53	1.66	2.5	124	251	251	39	60	60	
3	15	543.64	0.60	1.83	2.5	124	250	251	39	61	61	
2	20	547.62	0.60	1.83	2.5	124	250	251	37	61	61	
1	25	551.120	0.520	1.82	2.5	124	250	251	36	61	61	
B 6	30	554.70	0.55	1.73	2.5	124	250	249	36	62	62	
5	35	558.16	0.64	2.01	3.0	124	244	249	35	63	63	
4	40	562.53	0.70	2.21	3.0	124	244	251	35	63	63	
3	45	566.56	0.72	2.27	3.5	124	242	252	35	64	64	
2	50	570.12	0.905	2.66	3.5	124	232	239	35	65	65	
1	55	575.21	0.92	2.59	3.5	124	230	246	35	65	65	
C 6	60	579.55	0.91	2.56	3.5	124	253	244	36	66	66	
5	65	583.29	0.50	1.84	3.0	124	251	252	34	66	66	
4	70	587.15	0.60	2.15	3.0	124	250	242	35	66	66	
3	75	591.19	0.72	2.20	3.5	124	250	249	35	66	66	
2	80	595.34	0.70	2.47	3.5	124	250	255	36	67	67	
1	85	599.76	0.83	2.63	3.5	124	250	253	36	67	67	
D 6	90	603.97	0.75	2.36	3.5	124	250	250	37	67	67	
5	95	607.60	0.55	1.75	3.0	124	246	246	32	67	67	
4	100	611.10	0.55	1.75	3.0	124	249	242	34	67	67	
3	105	614.17	0.60	1.90	3.0	124	250	251	36	67	67	
2	110	616.55	0.64	2.03	3.0	124	250	249	37	67	67	
1	115	622.31	0.62	1.97	3.0	124	250	249	37	67	67	
	120	626.09	0.55	1.75	3.0	124	250	249	37	67	67	
Σ = 1015		Vm = 12.59		ΔH = 2.07		Ts = 123.96					Tm = 64.63	

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech. <u>TAL</u>	Date <u>3/23/21</u>
Run 1	53	17.4	805	1015	1	15	0.0	400852	6451	0.247		
Run 2												
										Avg. In.	0.247	

Moisture Recovery Data:

Impinger	1	2	3	4	5	6	Desiccant	Total
Final wt., g	900.0	449.3	652.8	76.1	769.0		1060.3	
Initial wt., g	744.9	746.6	647.0	759.1	766.9		1044.1	
Difference	155.1	142.7	5.8	2.0	1.1		16.2	324.9

Air Flows	
ACFM	DSCFM
453.704	627.606



EPA METHOD 29  
FIELD DATA SHEET

Project USS Kaituc Meter ID C-14 Probe ID 7-4 Bar. Pres 240.20 in Hg  
Smpl Loc Waste Gas SVO51 Meter Y 10000 Pitot No. 74 Stat. Pres -0.50 in H<sub>2</sub>O  
Test No. 1 Run 3 Orifice H@ 2019 Pitot Cp 0.64 Probe Lgth 7 ft  
Date 3/24/21 Operators Tak, Dsk, Bar Liner Type: ☒ Glass ☐ S.S. ☐ Other \_\_\_\_\_ Imp TC 4560

Sample Train Leak Rate (cfm)		
Pretest	<u>0.0</u>	at <u>15</u> in Hg
Posttest	<u>0.0</u>	at <u>11</u> in Hg
Pitot (3 in.)	Pos. <input checked="" type="checkbox"/> Neg. <input checked="" type="checkbox"/>	

Sample Point	Sample Time $\Delta t$	Meter Volume Vm, ft <sup>3</sup>	Velocity $\Delta P$ , in H <sub>2</sub> O	Orifice $\Delta H$ , in H <sub>2</sub> O	Sample Vacuum, in Hg	Stack Temp. Ts, °F	Sample Train Temperatures, °F					Oxygen Content, %
							Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
A-6	1336	716.45										
5	5	721.74	0.52	1.62	4.0	123	260	252	26	57	57	
4	10	725.06	0.52	1.62	4.0	124	250	251	36	57	57	
3	15	726.40	0.60	1.47	10.0	124	250	250	40	57	57	
2	20	732.54	0.60	1.47	10.0	124	250	251	42	57	57	
1	25	736.05	0.53	1.65	2.5	124	250	249	38	59	59	
B-6	30	734.40	0.52	1.61	2.5	126	246	250	38	57	57	
5	35	740.76	0.53	1.64	2.5	126	247	245	38	58	58	
4	40	746.36	0.60	1.80	2.5	126	250	251	40	59	59	
3	45	750.29	0.71	2.21	3.0	126	250	252	40	60	60	
2	50	754.34	0.76	2.37	3.5	126	250	251	41	61	61	
1	55	758.45	0.75	2.34	3.5	126	250	251	41	62	62	
C-6	60	762.48	0.73	2.20	3.5	126	250	251	42	63	63	
5	65	766.62	0.55	1.72	3.0	126	251	246	40	65	65	
4	70	769.86	0.56	1.76	3.0	126	250	247	40	65	65	
3	75	773.41	0.60	2.14	3.5	126	250	250	41	66	66	
2	80	777.10	0.67	2.11	3.5	126	250	252	42	67	67	
1	85	781.58	0.76	2.40	3.5	127	251	250	42	67	67	
D-6	90	785.79	0.76	2.40	4.0	127	250	251	43	68	68	
5	95	789.31	0.53	1.47	3.0	127	250	261	39	67	67	
4	100	792.92	0.54	1.43	3.0	126	250	250	41	67	67	
3	105	796.67	0.64	2.02	3.5	126	250	249	42	66	66	
2	110	800.43	0.65	1.99	3.5	126	250	252	44	66	66	
1	115	804.26	0.61	1.92	3.5	126	250	249	44	65	65	
	120	807.90	0.50	1.93	3.5	126	250	249	44	65	65	
0=1722		Vm=101.45	$\Delta H=1.95$		$T_s=125.67$		$T_m=12.50$					

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date
57	17.4	13.6	1336	1722	3	15	0.0	1100651	Glass	0247	1	See
											2	
											3	21
											Avg. in.	

Moisture Recovery Data:

Impinger	1	2	3	4	5	6	Desiccant	Total
Final wt., g	4053.1	490.4	715.5	765.8	767.1		1047.1	
Initial wt., g	7415.4	750.4	644.3	761.5	767.7		1044.5	
Difference	107.7	139.6	67.2	1.3	-0.6		2.6	317.4

Air Flows	
ACFM	DSCFM
433.904	606.475

Pause 1356, Process Restart 1536





EPA METHOD 29  
FIELD DATA SHEET

Project JSS Mutual Meter ID C-14 Probe ID 7-4 Bar. Pres 28.40 in Hg  
Smpl Loc waste gas SIOSI Meter Y 1.0040 Pitot No. 7-4 Stat. Pres 0.0 in H<sub>2</sub>O  
Test No. 1 Run 4 Orifice H<sub>2</sub>O @ 2.014 Pitot Cp 0.0041 Probe Lgth 7 ft  
Date 3/25/21 Operators JAK, DSK, RMP Liner Type: ☒ Glass ☐ S.S. ☐ Other Imp TC 49.0  
Sample Train Leak Rate (cfm)  
Pretest 0.0 at 15 in Hg  
Posttest 0.0 at 10 in Hg  
Pitot (3 in.) Pos. ☒ Neg. ☒

Sample Point	Sample Time $\Delta t$	Meter Volume Vm, ft <sup>3</sup>	Velocity $\Delta P$ , in H <sub>2</sub> O	Orifice $\Delta H$ , in H <sub>2</sub> O	Sample Vacuum, in Hg	Stack Temp. Ts, °F	Sample Train Temperatures, °F					Oxygen Content, %
							Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
D-6	0615	614.71										
5	5	614.03	0.50	1.56	4.0	125	249	254	37	67	67	
4	10	621.56	0.54	1.81	4.0	126	249	251	39	69	69	
3	15	625.14	0.53	1.72	4.0	126	250	252	41	71	71	
2	20	628.93	0.62	1.95	5.0	126	249	250	43	70	70	
1	25	632.62	0.60	1.89	5.0	125	249	250	45	68	68	
L-6	30	636.16	0.55	1.72	4.5	126	249	248	44	67	67	
5	35	639.51	0.53	1.66	4.0	126	249	246	37	66	66	
4	40	643.19	0.60	1.87	5.0	126	250	250	41	65	65	
3	45	646.74	0.64	1.99	5.0	126	251	253	40	66	66	
2	50	650.93	0.70	2.19	5.5	125	249	250	39	65	65	
1	55	654.96	0.74	2.31	6.0	125	249	251	39	65	65	
B-6	60	659.14	0.76	2.36	6.0	124	251	250	41	65	65	
5	65	662.71	0.55	1.71	5.0	125	250	251	39	65	65	
4	70	666.29	0.58	1.81	5.0	125	253	251	39	64	64	
3	75	670.19	0.70	2.18	6.5	125	249	251	42	64	64	
2	80	674.21	0.72	2.24	6.5	125	250	249	44	64	64	
1	85	678.35	0.75	2.33	6.0	125	251	247	45	63	63	
A-6	90	682.30	0.67	2.06	5.5	125	250	243	43	62	62	
5	95	686.90	0.55	1.70	5.0	125	248	251	37	63	63	
4	100	689.31	0.56	1.74	5.0	125	251	250	39	64	64	
3	105	692.87	0.64	1.99	5.5	125	247	247	39	64	64	
2	110	696.52	0.64	1.99	5.5	125	250	250	40	65	65	
1	115	700.20	0.65	2.03	6.0	125	252	250	41	66	66	
	120	704.13	0.63	1.97	6.0	125	250	249	42	66	66	
Σ=		Vm=694.42	ΔH=1.95		Ts=725.33		Tm=65.50					

Initialization Values			Test Run Times		ORSAT System			Sample Train Components			Nozzle Calibration	
Meter Temp	Oxygen Content	Moisture Content	Start Time	End Time	Bag No.	Bag Vol	cc/min * at 15 in Hg	Filter No.	Nozzle No.	Nozzle Dn	Tech.	Date
67	17.0	16.2	0615	1023	4	15	0.0	400056	6140	0.247	1	See
Run 2											2	
											3	FI
Avg. in.												

Moisture Recovery Data:

Impinger	1	2	3	4	5	6	Desiccant	Total
Final wt., g	903.4	670.9	655.2	771.4	776.1		990.2	
Initial wt., g	753.1	772.3	643.4	747.9	746.5		975.6	
Difference	150.3	90.4	111.8	223.6	229.6		14.6	324.6

90.6

Air Flows	
ACFM	DSCFM
433.106	612.572



## EPA Method 29 - Field Data Sheet - Run 1

Project	U.S. Steel Corporation	Meter ID	C-14	Probe ID	7-4	Bar.Press.	28.20	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Phase II Waste Gas Stack SV051	Meter Y	1.0080	Pitot Tube No.	7-4	Stat Press.	-0.5	in. H2O	Pretest 0.000 at 15 in. Hg
Date	03/24/21	Orifice dH@	2.0119	Pitot Cp	0.84	CPM TC	NA	Posttest 0.000 at 7 in. Hg	
Test	1	Run #	1	Liner Type:	Glass	IMP Out TC	TIO-8560	Pretest Pitot leak Check Pos	PASS @ >3" w.c
Operators	TAK/DJK							Posttest Pitot leak Check Neg	PASS @ >3" w.c

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft3	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					
									Probe	Filter	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	0805													
1	5.0	536.84	0.500	1.56	3.33	536.83	*	124	*	*	*	59	59	---
2	10.0	540.70	0.530	1.66	3.44	540.26	*	124	*	*	*	60	60	---
3	15.0	543.94	0.600	1.88	3.66	543.92	*	124	*	*	*	61	61	---
4	20.0	547.62	0.600	1.88	3.67	547.59	*	124	*	*	*	61	61	---
5	25.0	551.20	0.580	1.82	3.61	551.20	*	124	*	*	*	61	61	---
6	30.0	554.70	0.550	1.73	3.51	554.71	*	124	*	*	*	62	62	---
7	35.0	558.60	0.640	2.01	3.79	558.51	*	124	*	*	*	63	63	---
8	40.0	562.53	0.700	2.21	3.98	562.48	*	123	*	*	*	63	63	---
9	45.0	566.56	0.720	2.27	4.03	566.51	*	124	*	*	*	64	64	---
10	50.0	570.92	0.850	2.68	4.38	570.90	*	124	*	*	*	65	65	---
11	55.0	575.21	0.820	2.59	4.31	575.21	*	124	*	*	*	65	65	---
12	60.0	579.55	0.810	2.56	4.29	579.50	*	124	*	*	*	66	66	---
13	65.0	583.29	0.580	1.84	3.64	583.14	*	124	*	*	*	66	66	---
14	70.0	587.15	0.680	2.15	3.94	587.08	*	124	*	*	*	66	66	---
15	75.0	591.19	0.720	2.28	4.05	591.13	*	124	*	*	*	66	66	---
16	80.0	595.34	0.780	2.47	4.22	595.35	*	124	*	*	*	67	67	---
17	85.0	599.76	0.830	2.63	4.36	599.70	*	124	*	*	*	67	67	---
18	90.0	603.97	0.750	2.38	4.14	603.85	*	124	*	*	*	67	67	---
19	95.0	607.60	0.550	1.75	3.55	607.40	*	124	*	*	*	67	67	---
20	100.0	611.10	0.550	1.75	3.55	610.95	*	124	*	*	*	67	67	---
21	105.0	614.77	0.600	1.90	3.71	614.66	*	124	*	*	*	67	67	---
22	110.0	618.55	0.640	2.03	3.83	618.49	*	124	*	*	*	67	67	---
23	115.0	622.31	0.620	1.97	3.77	622.26	*	124	*	*	*	67	67	---
24	120.0	626.09	0.550	1.75	3.55	625.82	*	124	*	*	*	67	67	---
End Time	1015													
Run Time	120		Avg DH=	2.07			Avg Ts=	123.96				Avg Tm=	64.63	

Integrated Gas Sampling Data :

Bag No.	1
Bag Vol.	15 liters
Leak Rate	0 cc/min

Filter No.	4Q0852
Nozzle No.	Glass
Nozzle Dn.	0.247

MOISTURE RECOVERY DATA :

Impinger
Final wt., g
Initial wt., g
Difference

1	2	3	4	5	Desiccant	Total		
906.0	889.3	652.8	761.1	768.0	1060.3			
744.9	746.6	647.0	759.1	766.9	1044.1			
161.1	142.7	5.8	2.0	1.1	16.2	328.9		

\* Data Recorded on Field Data Sheet



## EPA Method 29 - Field Data Sheet - Run 3

Project	U.S. Steel Corporation	Meter ID	C-14	Probe ID	7-4	Bar.Press.	28.20	in. Hg	Sample Train Leak Rate, cfm:
Sample Location	Phase II Waste Gas Stack SV051	Meter Y	1.0080	Pitot Tube No.	7-4	Stat Press.	-0.5	in. H <sub>2</sub> O	Pretest 0.000 at 15 in. Hg
Date	03/24/21	Orifice dH@	2.0119	Pitot Cp	0.84	CPM TC	NA		Posttest 0.000 at 11 in. Hg
Test	1	Run #	3	Liner Type:	Glass	IMP Out TC	TIO-8560		Pretest Pitot leak Check Pos PASS @ >3" w.c
Operators	TAK /DJK								Posttest Pitot leak Check Neg PASS @ >3" w.c

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft <sup>3</sup>	Velocity Head DP, in. H <sub>2</sub> O	Orifice DH in. H <sub>2</sub> O	Ideal Point Volume Vm, ft <sup>3</sup>	Ideal Meter Vol Vm, ft <sup>3</sup>	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	1336													
1	5.0	721.74	0.520	1.62	3.39	721.84	*	123	*	*	*	57	57	---
2	10.0	725.06	0.520	1.62	3.39	725.23	*	124	*	*	*	57	57	---
3	15.0	728.80	0.600	1.87	3.64	728.87	*	124	*	*	*	57	57	---
4	20.0	732.54	0.600	1.87	3.64	732.51	*	124	*	*	*	57	57	---
5	25.0	736.05	0.530	1.65	3.42	735.93	*	124	*	*	*	58	58	---
6	30.0	739.40	0.520	1.61	3.39	739.32	*	126	*	*	*	57	57	---
7	35.0	742.78	0.530	1.64	3.42	742.74	*	126	*	*	*	58	58	---
8	40.0	746.36	0.600	1.86	3.64	746.38	*	126	*	*	*	59	59	---
9	45.0	750.29	0.710	2.21	3.96	750.34	*	126	*	*	*	60	60	---
10	50.0	754.38	0.760	2.37	4.11	754.45	*	126	*	*	*	61	61	---
11	55.0	758.45	0.750	2.34	4.09	758.54	*	126	*	*	*	62	62	---
12	60.0	762.48	0.730	2.28	4.04	762.58	*	126	*	*	*	63	63	---
13	65.0	766.02	0.550	1.72	3.52	766.10	*	126	*	*	*	65	65	---
14	70.0	769.56	0.560	1.76	3.56	769.66	*	126	*	*	*	65	65	---
15	75.0	773.44	0.680	2.14	3.92	773.59	*	126	*	*	*	66	66	---
16	80.0	777.40	0.670	2.11	3.90	777.49	*	126	*	*	*	67	67	---
17	85.0	781.58	0.760	2.40	4.16	781.65	*	127	*	*	*	67	67	---
18	90.0	785.79	0.760	2.40	4.16	785.80	*	127	*	*	*	68	68	---
19	95.0	789.31	0.530	1.67	3.49	789.29	*	127	*	*	*	67	67	---
20	100.0	792.92	0.580	1.83	3.64	792.93	*	126	*	*	*	67	67	---
21	105.0	796.67	0.640	2.02	3.82	796.75	*	126	*	*	*	66	66	---
22	110.0	800.43	0.630	1.99	3.79	800.54	*	126	*	*	*	66	66	---
23	115.0	804.26	0.610	1.92	3.73	804.27	*	126	*	*	*	65	65	---
24	120.0	807.90	0.580	1.83	3.63	807.89	*	126	*	*	*	65	65	---
End Time	1722													
Run Time	120		Avg DH=	1.95			Avg Ts=	125.67				Avg Tm=	62.50	

## Integrated Gas Sampling Data :

Bag No. 3  
Bag Vol. 15 liters  
Leak Rate 0 cc/min

Filter No. 4Q0854  
Nozzle No. Glass  
Nozzle Dn. 0.247

## MOISTURE RECOVERY DATA :

Impinger  
Final wt., g  
Initial wt., g  
Difference

1	2	3	4	5	Desiccant	Total		
853.1	890.4	715.5	765.8	767.1	1047.1			
745.4	750.8	648.3	764.5	767.7	1044.5			
107.7	139.6	67.2	1.3	-0.6	2.6	317.8		

\* Data Recorded on Field Data Sheet



## EPA Method 29 - Field Data Sheet - Run 4

Project	U.S. Steel Corporation			Meter ID	C-14	Probe ID	7-4	Bar.Press.	28.40	in. Hg	Sample Train Leak Rate, cfm:		
Sample Location	Phase II Waste Gas Stack SV051			Meter Y	1.0080	Pitot Tube No.	7-4	Stat Press.	-0.5	in. H2O	Pretest	0.000	at 15 in. Hg
Date	03/25/21			Orifice dH@	2.0119	Pitot Cp	0.84	CPM TC	NA		Posttest	0.000	at 10 in. Hg
Test	1	Run #	4	Liner Type: Glass		IMP Out TC TIO-8560				Pretest Pitot leak Check Pos		15	@ >3" w.c
Operators	TAK /DJK											Posttest Pitot leak Check Neg	

Sample Point	Sample Time DT	Actual Meter Vol Vm, ft3	Velocity Head DP, in. H2O	Orifice DH in. H2O	Ideal Point Volume Vm, ft3	Ideal Meter Vol Vm, ft3	Sample Train Vacuum in. Hg	Stack Temp Ts, °F	Sample Train Temperatures, °F					
									Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	
Start Time	0815	814.71												
1	5.0	818.03	0.500	1.56	3.35	818.06	*	125	*	*	*	67	67	---
2	10.0	821.56	0.580	1.81	3.61	821.67	*	126	*	*	*	69	69	---
3	15.0	825.14	0.550	1.72	3.53	825.20	*	126	*	*	*	71	71	---
4	20.0	828.93	0.620	1.95	3.76	828.95	*	126	*	*	*	70	70	---
5	25.0	832.62	0.600	1.89	3.69	832.64	*	125	*	*	*	68	68	---
6	30.0	836.16	0.550	1.72	3.52	836.16	*	126	*	*	*	67	67	---
7	35.0	839.51	0.530	1.66	3.45	839.61	*	126	*	*	*	66	66	---
8	40.0	843.19	0.600	1.87	3.66	843.27	*	126	*	*	*	65	65	---
9	45.0	846.94	0.640	1.99	3.77	847.05	*	126	*	*	*	66	66	---
10	50.0	850.93	0.700	2.19	3.95	851.00	*	125	*	*	*	65	65	---
11	55.0	854.96	0.740	2.31	4.06	855.06	*	125	*	*	*	65	65	---
12	60.0	859.14	0.760	2.36	4.11	859.16	*	126	*	*	*	65	65	---
13	65.0	862.71	0.550	1.71	3.50	862.67	*	125	*	*	*	65	65	---
14	70.0	866.29	0.580	1.81	3.60	866.26	*	125	*	*	*	64	64	---
15	75.0	870.19	0.700	2.18	3.94	870.20	*	125	*	*	*	64	64	---
16	80.0	874.21	0.720	2.24	3.99	874.20	*	125	*	*	*	64	64	---
17	85.0	878.35	0.750	2.33	4.08	878.27	*	125	*	*	*	63	63	---
18	90.0	882.30	0.670	2.08	3.85	882.12	*	125	*	*	*	62	62	---
19	95.0	885.96	0.550	1.70	3.48	885.60	*	125	*	*	*	63	63	---
20	100.0	889.31	0.560	1.74	3.52	889.12	*	125	*	*	*	64	64	---
21	105.0	892.87	0.640	1.99	3.77	892.89	*	125	*	*	*	64	64	---
22	110.0	896.52	0.640	1.99	3.77	896.66	*	125	*	*	*	65	65	---
23	115.0	900.30	0.650	2.03	3.80	900.46	*	125	*	*	*	66	66	---
24	120.0	904.13	0.630	1.97	3.75	904.22	*	125	*	*	*	66	66	---
End Time	1023													
Run Time	120		Avg DH=	1.95			Avg Ts=	125.33				Avg Tm=	65.58	

## Integrated Gas Sampling Data :

Bag No. 4  
Bag Vol. 15 liters  
Leak Rate 0 cc/min

Filter No. 4Q0856  
Nozzle No. Glass  
Nozzle Dn. 0.247

## MOISTURE RECOVERY DATA :

Impinger  
Final wt., g  
Initial wt., g  
Difference

1	2	3	4	5	Desiccant	Total		
903.4	870.9	655.2	771.6	776.1	990.2			
753.1	772.3	643.4	747.9	748.5	975.6			
150.3	98.6	11.8	23.7	27.6	14.6	326.6		

\* Data Recorded on Field Data Sheet

**EPA METHOD 3A -- Instrument Analysis Data Sheet**

Project	U.S. Steel Corporation
Sample Location(s):	Phase II Waste Gas Stack
Test No:	1
Date:	03/24/21
Operators:	RMP

Analyzer Make / Model	Servomex 1440
Analyzer O <sub>2</sub> Range (span), %:	0- 22.5
Analyzer CO <sub>2</sub> Range (span), %:	0- 9.5

**GAS CONCENTRATION AND IDENTIFICATION**

Calibration Level	Cylinder Serial No.		
		O <sub>2</sub> Cert. Conc.	CO <sub>2</sub> Cert. Conc.
Zero Gas	CEMs Nitrogen	0.0	0.0
CO <sub>2</sub> Mid	EB0097822	-	5.0
O <sub>2</sub> Mid/CO <sub>2</sub> High	EB0098396	9.5	9.5
O <sub>2</sub> High	EB0097822	22.5	-

**PRETEST ANALYZER CALIBRATION DATA**

Calibration Level	O <sub>2</sub>		CO <sub>2</sub>	
	Cylinder Value, %	Analyzer Calibration Response, %	Cylinder Value, %	Analyzer Calibration Response, %
Zero Gas	0.0	0.0	0.0	0.0
Mid-Gas:	9.5	9.5	5.0	4.9
High-Gas:	22.5	22.5	9.5	9.5

Time of Calibration Start 1100

Time of Calibration End 1114

**INTEGRATED BAG ANALYSIS**

Location/Test No.	Phase II Waste Gas Stack		
Run No.	1	2	3
Time Sampled	0805 - 1015	1053 - 1302	1336 - 1722
Time Analyzed	1135	1306	1735
O <sub>2</sub> , %	17.9	18.0	17.8
CO <sub>2</sub> , %	1.4	1.3	1.5

**POSTTEST ANALYZER CALIBRATION DATA**

Calibration Level	O <sub>2</sub>		CO <sub>2</sub>	
	Cylinder Value, %	Analyzer Calibration Response, %	Cylinder Value, %	Analyzer Calibration Response, %
Zero Gas	0.0	0.0	0.0	0.0
Mid-Gas:	9.5	9.5	5.0	4.9
High-Gas:	22.5	22.5	9.5	9.3

**EPA METHOD 3A -- Instrument Analysis Data Sheet**

Project	U.S. Steel Corporation
Sample Location(s):	Phase II Waste Gas Stack
Test No:	1
Date:	03/25/21
Operators:	RMP

Analyzer Make / Model	Servomex 1440
Analyzer O <sub>2</sub> Range (span), %:	0- 22.5
Analyzer CO <sub>2</sub> Range (span), %:	0- 9.5

**GAS CONCENTRATION AND IDENTIFICATION**

Calibration Level	Cylinder Serial No.		
		O <sub>2</sub> Cert. Conc.	CO <sub>2</sub> Cert. Conc.
Zero Gas	CEMs Nitrogen	0.0	0.0
CO <sub>2</sub> Mid	EB0097822	-	5.0
O <sub>2</sub> Mid/CO <sub>2</sub> High	EB0098396	9.5	9.5
O <sub>2</sub> High	EB0097822	22.5	-

**PRETEST ANALYZER CALIBRATION DATA**

Calibration Level	O <sub>2</sub>		CO <sub>2</sub>	
	Cylinder Value, %	Analyzer Calibration Response, %	Cylinder Value, %	Analyzer Calibration Response, %
Zero Gas	0.0	0.0	0.0	0.0
Mid-Gas:	9.5	9.5	5.0	4.8
High-Gas:	22.5	22.5	9.5	9.5

Time of Calibration Start 0707

Time of Calibration End 0713

**INTEGRATED BAG ANALYSIS**

Location/Test No.	Phase II Waste Gas Stack		
Run No.	4		
Time Sampled	0815 - 1023		
Time Analyzed			
O <sub>2</sub> , %	18.2		
CO <sub>2</sub> , %	1.2		

**POSTTEST ANALYZER CALIBRATION DATA**

Calibration Level	O <sub>2</sub>		CO <sub>2</sub>	
	Cylinder Value, %	Analyzer Calibration Response, %	Cylinder Value, %	Analyzer Calibration Response, %
Zero Gas	0.0	0.0	0.0	0.0
Mid-Gas:	9.5	9.5	5.0	4.8
High-Gas:	22.5	22.5	9.5	9.3

## Appendix C

### Laboratory Reports and Sample Chain of Custody

# **Barr Engineering**

5150 West 76<sup>th</sup> Street  
Edina, MN 55439

Project Number: 23/31-1210.21 100 002

Mercury

EPA Method 29 Analysis

Analytical Report  
36437



Element One, Inc.

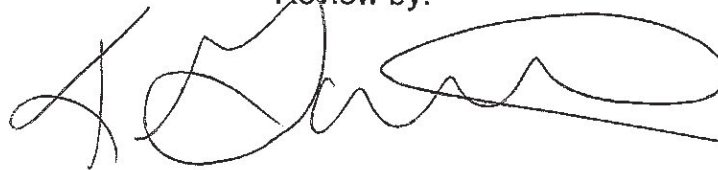
6319-D Carolina Beach Rd., Wilmington, NC 28412

910-793-0128 FAX: 910-792-6853 [e1lab@e1lab.com](mailto:e1lab@e1lab.com)



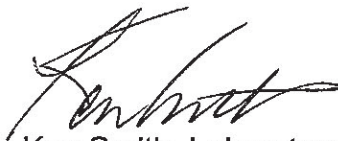
The following data for Analytical Report 36437  
has been reviewed for completeness, accuracy,  
adherence to method protocol,  
and compliance with quality assurance guidelines.

Review by:

A handwritten signature in black ink, appearing to read 'Katie Gattis', with a long horizontal line extending to the right.

Katie Gattis, Quality Assurance Officer  
April 7, 2021

Report Reviewed and Finalized By:

A handwritten signature in black ink, appearing to read 'Ken Smith', with a long horizontal line extending to the right.

Ken Smith, Laboratory Director  
April 7, 2021

# SUMMARY OF RESULTS

## Summary of Analysis

### Summary of Method 29 Mercury Analysis

Run Number		Average Total Catch, µg	Front Half µg	H <sub>2</sub> O <sub>2</sub> /HNO <sub>3</sub> µg	Empty Impinger µg	KMnO <sub>4</sub> µg	HCl µg
-----	---	-----	-----	-----	-----	-----	-----
Waste Gas Stack-T1-M29-R1	#1	17.4	< 0.1	1.08	< 0.2	7.91	8.50
	#2		< 0.1	1.10	< 0.2	8.04	8.17
Waste Gas Stack-T1-M29-R3	#1	19.8	< 0.1	1.75	< 0.2	9.59	8.35
	#2		< 0.1	1.73	< 0.2	9.56	8.56
Waste Gas Stack-T1-M29-R3 dup	#1	19.3	< 0.1	1.91	< 0.2	9.11	8.18
	#2		< 0.1	1.82	< 0.2	9.12	8.54
Waste Gas Stack-T1-M29-R4	#1	15.8	< 0.1	0.843	< 0.2	11.3	3.63
	#2		< 0.1	0.821	< 0.2	11.3	3.59
Reagent Blank-T1-M29-R0	#1	< 0.5	< 0.1	< 0.2	< 0.2	< 0.5	< 0.4
	#2		< 0.1	< 0.2	< 0.2	< 0.5	< 0.4

# ANALYTICAL NARRATIVE

## Element One Analytical Narrative

Client:	Barr Engineering	Element One #:	36437
Client ID:	23/31-1210.21 100 002	Analyst:	RMH
Method:	Method 29	Dates Received:	03/31/21
Analytes:	Hg	Dates Analyzed:	04/02-06/21

### Summary of Analysis

The Method 29 samples were digested, prepared, and analyzed according to Method 29 protocol. Samples were analyzed for mercury on a PerkinElmer FIMS-100 CVAA mercury analyzer.

### Detection Limits

The FIMS-100 CVAA instrument reporting limit for mercury was 0.004 µg per aliquot analyzed.

### Analysis QA/QC

Duplicate analyses relative percent difference (RPD) and spike sample recovery data are summarized in the Quality Control Section. All QA/QC data was within the criteria of the method.

### Additional Comments

The reported results have not been corrected for any blank values or spike recovery values. The reported results relate only to the items tested or calibrated.

# QUALITY CONTROL SUMMARY

## Summary of Quality Control Data

### Mercury Duplicate Injection RPD

(Method 29 QC limits: < 10% for RPD)

Run Number	Front Half	H <sub>2</sub> O <sub>2</sub> /HNO <sub>3</sub>	Empty Imp	KMnO <sub>4</sub>	HCl
Waste Gas Stack-T1-M29-R1	NA	1.7%	NA	1.6%	4.0%
Waste Gas Stack-T1-M29-R3	NA	1.5%	NA	0.3%	2.4%
Waste Gas Stack-T1-M29-R3 dup	NA	4.9%	NA	0.2%	4.3%
Waste Gas Stack-T1-M29-R4	NA	2.7%	NA	0.1%	1.2%
Reagent Blank-T1-M29-R0	NA	NA	NA	NA	NA

### Mercury Duplicate Analysis RPD

(Method 29 QC limits: < 20% for RPD)

Run Number	Front Half	H <sub>2</sub> O <sub>2</sub> /HNO <sub>3</sub>	Empty Imp	KMnO <sub>4</sub>	HCl
Waste Gas Stack-T1-M29-R3 dup	NA	7.2%	NA	4.9%	1.1%

### Mercury Spike Recoveries

(Method 29 QC limits: 75-125% for Spike Recoveries)

Run Number		Front Half	H <sub>2</sub> O <sub>2</sub> /HNO <sub>3</sub>	Empty Imp	KMnO <sub>4</sub>	HCl
Waste Gas Stack-T1-M29-R4	#1	111%	102%	103%	102%	97%
	#2	109%	105%	101%	104%	97%

# SAMPLE CUSTODY



# Barr Engineering Co. Chain of Custody

## Request for Laboratory Analytical Services

Sample Origination State:  
☐ IA ☐ ND ☐ WI  
☐ MI ☐ SD ☐ Other: ☒ MN ☐ VT

COC Number: 10471  
 COC 1 of 2

### Report Results To

Check One:  
☐ Barr Engineering Company  
 3128 14th Avenue East  
 Hibbing, MN 55435-4803  
 (218) 262-8600  
 Project Contact: Tom Kuchinski  
 (Print Name)  
☒ Barr Engineering Company  
 5150 West 76th Street  
 Edina, MN 55439-2330  
 (952) 832-2600  
 Project Contact: Tom Kuchinski  
 (Print Name)

### Send Invoice To

Project Number: 231-1210.21-100 002  
 Barr Engineering Company  
 Attn: Accounts Payable  
 4300 Marketplace Drive  
 Minneapolis, MN 55435-4803  
 Ph. (952) 832-2600 Fax (952) 832-2601

Special Instructions and/or specific regulatory requirements:  
 (method, limit of detection, etc.)

Requested Due Date:  
☒ Standard Turn  
☐ Rush (available 1999)

Sample Identification	Date/Time Collected	Media ID #	Type			METH	SAMPLE FRACTION										Total No. of Containers	Remarks	
			Grab	Comp.	QC		1	2	3	4	5	6	7	8	9	10			
1. Waste Gas Stack TIR 1	3-24-21	QWRT2	X																
2. " " TIR 2	3-24-21	QWRT2	X																
3. " " TIR 3	3-24-21	QWRT2	X																
4. " " TIR 4	3-25-21	QWRT2	X																
5.																			
6.																			
7.																			
8.																			
9.																			
10.																			

Chain of Custody  
 Collected by (Print Name): Tom Kuchinski  
 Collector's Signature: [Signature] Date/Time: 3-25-21  
 Laboratory: Element One  
 Method of Shipment: ☐ Fedex ☐ UPS ☐ Other:  
 Sample Condition upon Receipt: ☒ Acceptable ☐ Other (explain):  
 Samples received in good condition. No safety concerns.  
 Relinquished by: [Signature] Received by: [Signature] Date/Time: 3/30/21 0900  
 Received at Lab by: Tom Borton Date/Time: 3/31/21 1210  
 Distribution: White-Original Accompanied Shipment to Lab; Yellow - Field Copy for Tom via email; hold of R2 - R25 3.31.21

# Barr Engineering Co. Chain of Custody

## Request for Laboratory Analytical Services

Sample Origination State:  
☐ IA ☐ ND ☐ WI  
☐ MI ☐ SD ☐ Other: ☒ MN ☐ WI

COC Number: **10472**  
 COC 2 of 2

### Report Results To

Check One:  
☐ Barr Engineering Company  
 3128 14th Avenue East  
 Hibbing, MN 55435-4803  
 (218) 262-8600  
☒ Barr Engineering Company  
 5150 West 76th Street  
 Edina, MN 55439-2330  
 (952) 832-2600  
 Project Contact: Tom Kucharski TKucharski@barr.com  
 (Print Name) (email)

Send Invoice To  
 Barr Engineering Company  
 Attn: Accounts Payable  
 4300 Marketplace Drive  
 Minneapolis, MN 55435-4803  
 Ph. (952) 832-2600 Fax (952) 832-2601

36437

### Special Instructions and/or specific regulatory requirements:

(method, limit of detection, etc.)

Requested Due Date:  
☒ Standard Turn Around Time  
☐ Rush (method/yy)

Sample Identification	Date/Time Collected	Media ID, #	Type		METHOD	SAMPLE FRACTION		Total No. of Containers	Remarks
			Grab	Comp.					
1. <u>Leugast Blank T1R0</u>	<u>3-24-21</u>			<input checked="" type="checkbox"/>				<u>6</u>	
2. <u>Leugast Blank T1R00</u>	<u>3-25-21</u>			<input checked="" type="checkbox"/>				<u>1</u>	<u>161d</u>
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									

### Chain of Custody

Collected by (Print Name): Tom Kucharski (BARR)

Collector's Signature: [Signature] Date/Time: 3-25-21

Laboratory: Element One

Method of Shipment: ☐ Sampler ☒ FedEx ☐ UPS ☐ Other (explain)

Sample Condition upon Receipt: ☒ Acceptable ☐ Other (explain)

Relinquished by: [Signature] Received by: [Signature] Date/Time: 3/30/21 0900

Received at Lab by: [Signature] Date/Time: 3/31/21 1210

## Appendix D

### Calibration Data



# Routine Dry Gas Meter Calibration

Control Module: C-14  
DGM S/N :   
Date : 3/17/2021  
Technician : DJK

Leak checks  
Negative 0.0 15 in. Hg  
Positive : 0.0 > 5 in. W.C

Barometric Press. : 28.61  
Previous Y : 1.0341  
Previous dH@ : 2.0672

Orifice Diff Pressure, in. W.C.	Wet Test Volume, Ft <sup>3</sup>	Dry Gas Meter Temp, °F		Wet Test Meter Temp, °F	Dry Gas Volume Ft <sup>3</sup>	Elapsed Time of Cal. Point		Meter Coefficient Y	Orifice Coefficient dH@
		Inlet	Outlet						
Nominal 0.50	Initial 281.00	Initial 68.0	Initial 68.0	Initial 69.0	Initial 320.760				
Actual  0.50	Final 287.00	Final 69.0	Final 69.0	Final 69.0	Final 326.680	Minutes 15	Sec. 23		
	Total 6.00	Average 68.5	Average 68.5	Average 69.0	Total 5.920	Minutes 15.38		1.0113	1.9405
		68.5	Tm						
Nominal 1.00	Initial 288.00	Initial 69.0	Initial 69.0	Initial 69.0	Initial 327.670				
Actual  1.00	Final 293.00	Final 70.0	Final 70.0	Final 69.0	Final 332.600	Minutes 9	Sec. 8		
	Total 5.00	Average 69.5	Average 69.5	Average 69.0	Total 4.930	9.13		1.0126	1.9662
		69.5	Tm						
Nominal 2.00	Initial 265.00	Initial 67.0	Initial 67.0	Initial 69.0	Initial 305.020				
Actual  2.00	Final 280.00	Final 68.0	Final 68.0	Final 69.0	Final 319.780	Minutes 19	Sec. 53		
	Total 15.00	Average 67.5	Average 67.5	Average 69.0	Total 14.760	19.88		1.0082	2.0787
		67.5	Tm						
Nominal 3.00	Initial 294.00	Initial 70.0	Initial 70.0	Initial 69.0	Initial 333.580				
Actual  3.00	Final 306.00	Final 70.0	Final 70.0	Final 69.0	Final 345.450	Minutes 12	Sec. 59		
	Total 12.00	Average 70.0	Average 70.0	Average 69.0	Total 11.870	12.98		1.0051	2.0675
		70.0	Tm						
Nominal 4.00	Initial 307.00	Initial 71.0	Initial 71.0	Initial 69.0	Initial 346.450				
Actual  4.00	Final 323.00	Final 71.0	Final 71.0	Final 69.0	Final 362.300	Minutes 14	Sec. 47		
	Total 16.00	Average 71.0	Average 71.0	Average 69.0	Total 15.850	14.78		1.0030	2.0066
		71.0	Tm						
Average								1.0080	2.0119

Reviewed By:

Emission Measurement Center (EMC) Approved Alternate Method (ALT-009)  
Alternative Method 5 Post-Test Calibration  
Phase II Waste Gas Stack (SV051)  
Control Module C-14

Input Data	Symbol	Units	Run 1	Run 2	Run 3	Run 4
Test date	-	-	3/24/2021	3/24/2021	3/24/2021	3/25/2021
Test period	-	-	0805 - 1015	1053 - 1302	1336 - 1722	0815 - 1023
Total run time	t	min	120	120	120	120
Total sample volume measured by dry gas meter	V <sub>m</sub>	acf	92.6	91.7	89.4	89.4
Average dry gas meter temp	T <sub>m</sub>	°F	64.6	65.2	62.5	65.6
Absolute average dry gas meter temp	T <sub>m</sub>	°R	524.3	524.9	522.2	525.3
Barometric pressure	P <sub>b</sub>	inches Hg	28.2	28.2	28.2	28.4
Conversion factor (29.92/528)(0.75) <sup>2</sup>	---	(in Hg/°R) cfm <sup>2</sup>	0.0319	0.0319	0.0319	0.0319
Average orifice meter differential	Δ H <sub>avg</sub>	in. H <sub>2</sub> O	2.07	2.04	1.95	1.95
Orifice meter calibration coefficient	Δ H <sub>@</sub>	in. H <sub>2</sub> O	2.01	2.01	2.01	2.01
Dry molecular weight of stack gas	M <sub>d</sub>	lb/lb-mole	28.94	28.93	28.95	28.95
Dry molecular weight of air	---	lb/lb-mole	29.00	29.00	29.00	29.00
Specific gravity of mercury	---	Dimensionless	13.60	13.60	13.60	13.60
Average of the Sq. Root of the Δ H's	(√ΔH) <sub>avg</sub>	---	1.43	1.42	1.39	1.39

$$Y_{qa} = \frac{t}{V_m} \sqrt{\frac{0.0319 T_m}{\Delta H @ \left( P_b + \frac{\Delta H_{avg}}{13.6} \right) P_b} \left( \frac{29}{M_d} \right) (\sqrt{\Delta H})_{avg}}$$

Method 5 Eq.5-15

Dry gas meter calibration check value	Y <sub>qa</sub>	Dimensionless	1.0080	1.0112	1.0104	1.0115
Dry gas meter calibration factor	Y	Dimensionless	1.0080	1.0080	1.0080	1.0080

Average of Y <sub>qa</sub> 's from test run series	<b>1.0103</b>
Dry gas meter calibration factor	<b>1.0080</b>
% difference between average Y <sub>qa</sub> 's and Y (must be within ± 5%)	<b>-0.23%</b>

# **Meter Pyrometer Calibration**

<b>Meter I.D.</b>		C-14					
<b>Temperature Calibrator Used</b>	CL-3512-A	TC SIM #3					
<b>DATE</b>		1/19/2021					
<b>TECHNICIAN</b>		DJK					
<b>Thermocouple I.D.</b>		T.C. 1	T.C. 2	T.C. 3	T.C. 4	T.C. 5	T.C. 6
<b>Reference °F</b>	<b>Acceptable Range</b>	** If not within Acceptable Range, unit not to be used within range at which failure occurred.					
1950	1932 to 1968	1954	1954	1953	1953	1953	1953
1800	1784 to 1816	1802	1802	1802	1801	1802	1802
1600	1585 to 1615	1604	1604	1604	1603	1603	1604
1400	1387 to 1413	1399	1400	1399	1399	1399	1400
1200	1188 to 1212	1200	1200	1200	1201	1202	1202
1000	990 to 1010	1002	1002	1002	1001	1001	1002
900	890 to 910	901	903	901	900	901	900
800	791 to 809	800	801	801	799	800	801
700	692 to 708	701	702	701	700	701	702
600	593 to 607	600	600	600	598	599	601
500	493 to 507	499	499	498	496	497	500
400	394 to 406	399	400	400	397	398	400
300	295 to 305	300	301	301	299	300	300
200	196 to 204	200	200	202	199	199	200
150	146 to 154	150	151	150	149	149	150
100	96 to 104	98	98	98	97	98	98
50	47 to 53	48	49	48	48	48	48
0	-3 to 3	1	1	0	0	1	0

Pass/Fail based on +/- 0.75% of Rankine value

Fail indicated by cell highlighting

Reviewed By: *Tom Kulinski*



## THERMOCOUPLE CALIBRATION

Meter Out

THERMOCOUPLE ID C14-O

Cal Date: 1/19/2021

CALIBRATION TECHNICIAN: MJN

### REFERENCE STANDARDS

Hart Scientific 9103-A s/n A1B289

Fluke 9144 s/n B5A077

### TRACEABILITY

Report No. T19-1212-TN-2

Report No. T19-1212-TN-3

### DATE

12/12/2019

12/12/2019

### LABORATORY

NBS Calibrations

NBS Calibrations

Temperature Calibration Points	20	70	150
Reference Deg F (To)	20	70	150
Probe Temp (deg F)	21.0	70.0	148.0
Difference (degrees)	1.0	0.0	2.0

TC Meets Method 5 Specifications: ( $\pm 2.0$ °F)	YES	YES	YES
---	-----	-----	-----

Reviewed by:



# THERMOCOUPLE CALIBRATION

THERMOCOUPLE ID 7-4

Cal Date: 1/15/2021

Method 5 Probe

CALIBRATION TECHNICIAN: MTP

## REFERENCE STANDARDS

Hart Scientific 9103-A s/n A1B289

Fluke 9144 s/n B5A077

## TRACEABILITY

Report No. T19-1212-TN-2

Report No. T19-1212-TN-3

## DATE

12/12/2019

12/12/2019

## LABORATORY

NBS Calibrations

NBS Calibrations

## Temperature Calibration Points

32

212

400

650

Ambient

Reference Deg F (To)

32

212

400

650

70

Probe Temp (deg F)

32.3

212

403

653

68.7

Reference Temp (deg R) deg F + 460

492

672

860

1110

530

Probe Temp (deg R), deg F + 460

492.3

672

863

1113

528.7

Difference (degrees)

-0.3

0

-3

-3

1.3

% Diff Abs. T

0.1%

0.0%

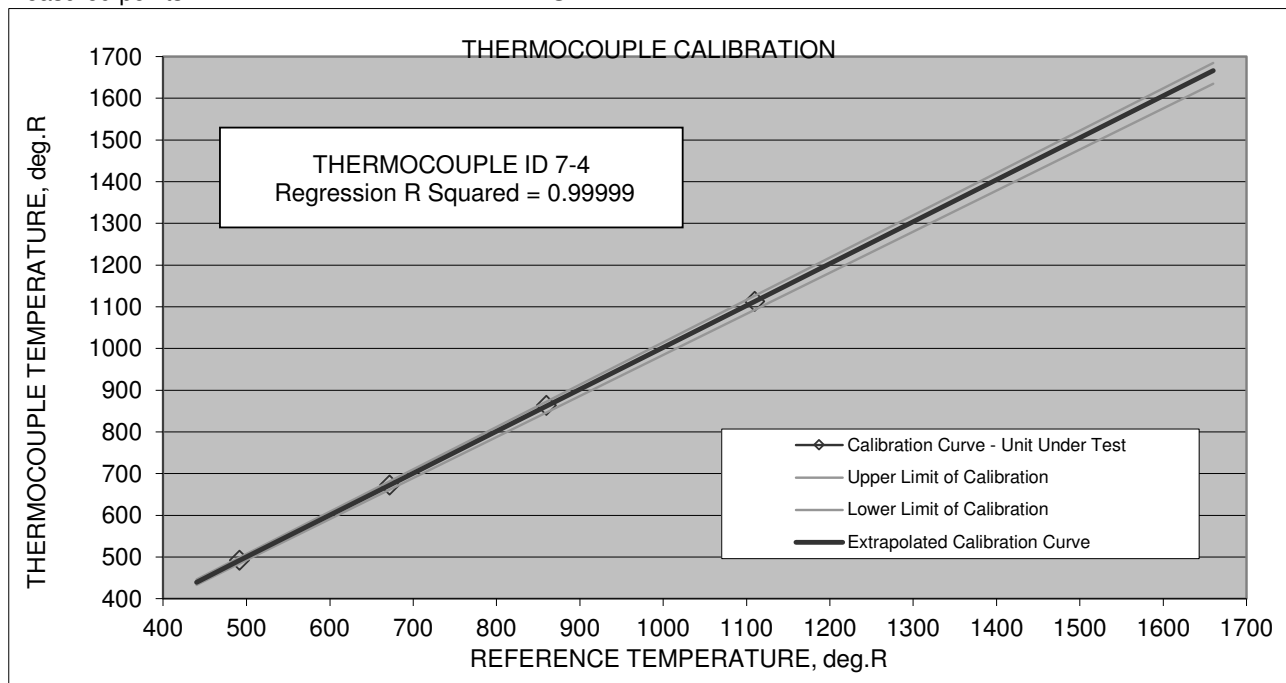
0.3%

0.3%

0.2%

Is difference less than 1.5% at all measured points?

YES



Are extrapolated limits less than 1.5%?

YES

FAHRENHEIT  
CALIBRATION RANGE

-20 1200

If not acceptable, describe corrective action:

Reviewed by:





## THERMOCOUPLE CALIBRATION

Impinger Outlet

THERMOCOUPLE ID TIO-8560

Cal Date: 1/19/2021

Umbilical 200-1

CALIBRATION TECHNICIAN: MJN

### REFERENCE STANDARDS

Hart Scientific 9103-A s/n A1B289

Fluke 9144 s/n B5A077

### TRACEABILITY

Report No. T19-1212-TN-2

Report No. T19-1212-TN-3

### DATE

12/12/2019

12/12/2019

### LABORATORY

NBS Calibrations

NBS Calibrations

Temperature Calibration Points	20	70	150
Reference Deg F (To)	20	70	150
Probe Temp (deg F)	20.0	70.0	149.0
Difference (degrees)	0.0	0.0	1.0
TC Meets Method 5 Specifications: ( $\pm 2.0$ °F)	YES	YES	YES

Reviewed by:



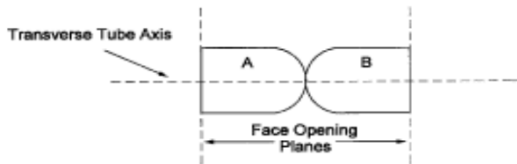
## S-Type Pitot Tube Geometry Check

Pitot Tube  
Number: 7-4  
Length: 7 ft.  
Function: M-5 Probe

Inspection Date: 1-15-2021  
Technician: M. Petersen

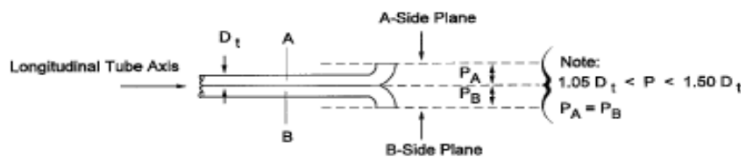
1. Are face openings perpendicular to tube axis?

☒ YES ( go to 2) ☐ NO (go to 1a)



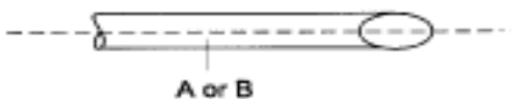
2. Are face openings parallel to longitudinal axis?

☒ YES ( go to 3) ☐ NO (go to 2a)



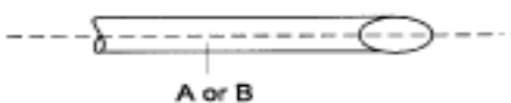
3. Are legs of equal length?

☒ YES ( go to 4) ☐ NO (go to 3a)



4. Are center-lines of legs coincident?

☒ YES ( go to 5) ☐ NO (go to 4a)

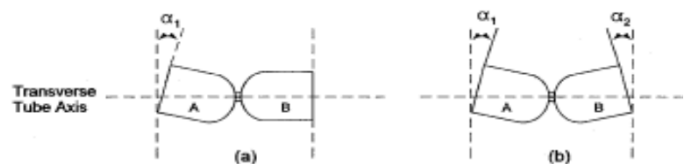


5. Does this pitot tube pass all of the above criteria?

☒ YES ☐ NO

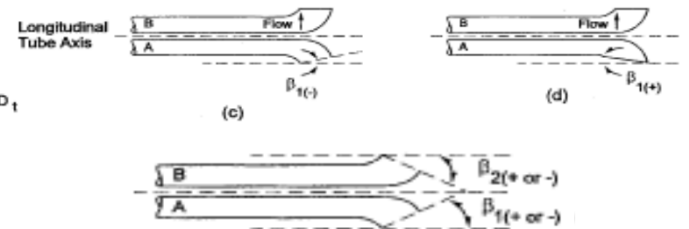
1a. If NO, is angle less than 10°?

☐ YES ( go to 2) ☐ NO (discontinue use)



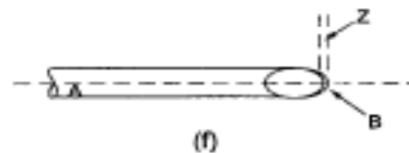
2a. If NO, is angle less than 5°?

☐ YES ( go to 3) ☐ NO (discontinue use)



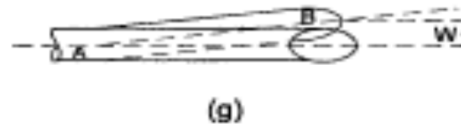
3a. If NO, is difference less than 1/8 inch?

☐ YES ( go to 4) ☐ NO (discontinue use)



4a. If NO, are center-lines of face openings less than 1/32 inch?

☐ YES ( go to 5) ☐ NO (discontinue use)



I certify that the pitot tube meets or exceeds all specifications and criteria listed in 40 CFR Part 60, Appendix A, EPA Method 2, and is assigned a pitot tube certification factor of 0.84.

Technician Signature: Mark Petersen

Reviewed by: Tom Kukulinski

U.S. Steel Corporation  
Keetac  
Keewatin, Minnesota

Barr Engineering Co.  
April 20, 2021

Nozzle Calibration  
Phase II Waste Gas Stack (SV051)

Nozzle Calibration

Nozzle No. 

Glass
-------

Used for Runs: 

1
---

 - 

4
---

Point Measurement, inches

1	0.247
2	0.247
3	0.247
Average	0.247

Test Date 3/24-25/2021

Date Measured: 3/23/2021

Technician: TAK

U.S. Steel Corporation  
Keetac  
Keewatin, Minnesota

Barr Engineering Co.  
April 20, 2021

Method 4 Balance Check  
Phase II Waste Gas Stack (SV051)

EPA Method 4 Balance Check

Class II Weight Amount =	1000.0
Balance Response=	1000.1
Difference	-0.1
Pass	PASS

Test Date            3/24-25/2021  
Date Measured:    3/24-25/2021  
Technician:        TAK



**Field Barometer Calibration**  
Calibration to PRINCO Mercury Barometer  
Barr Engineering Co. Edina Field Office

			Reference, PRINCO	Field Barometer				
Date	Technician	Observation Time	Station Pressure	ID	Barometric Pressure	Condition	Remarks	Offset tolerance +/- 0.10
3/8/21	TAK	0845	29.10	BA-09	29.15	In Calibration	As Found	0.05
3/31/21	TAK	1140	29.41	BA-09	29.45	In Calibration	As Found	0.04



Red Ball Technical Gas Service  
555 Craig Kennedy Way  
Shreveport, LA 71107  
800-551-8150  
PGVP Vendor ID # G12019

## EPA PROTOCOL GAS CERTIFICATE OF ANALYSIS

Cylinder Number: EB0097822  
Product ID Number: 127199  
Cylinder Pressure: 1900 PSIG  
COA #: EB0097822.20190305-0  
Customer PO. NO.:  
Customer:

Certification Date: 03/13/2019  
Expiration Date: 03/11/2027  
MFG Facility: - Shreveport - LA  
Lot Number: EB0097822.20190305  
Tracking Number: B1945932  
Previous Certification Dates:

This calibration standard has been certified per the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531, using procedure G1.

Do Not Use This Cylinder Below 100 psig (0.7 Megapascal).

### Certified Concentration(s)

Component	Concentration	Uncertainty	Analytical Principle	Assayed On
Carbon Dioxide	4.94 %	±0.04 %	NDIR	03/13/2019
Oxygen	22.5 %	±0.11 %	MPA	03/11/2019
Nitrogen	Balance			

Analytical Measurement Data Available Online.

### Reference Standard(s)

Serial Number	Lot	Expiration	Type	Balance	Component	Concentration	Uncertainty(%)	NIST Reference
EB0032246	EB0032246.20170209	08/05/2025	GMIS	N2	O2	24 %	0.502	071001
EB0087453	EB0087453.20170424	11/25/2025	GMIS	N2	CO2	9.51 %	0.724	C1309410.01
EB0087609	EB0087609.20170424	05/14/2026	GMIS	N2	CO2	5.01 %	0.778	101001

### Analytical Instrumentation

Component	Principle	Make	Model	Serial	MPC Date
O2	MPA	Thermo	410i	1162980025	02/11/2019
CO2	NDIR	Thermo	410i	1162980025	03/04/2019

### SMART-CERT



This is to certify the gases referenced have been calibrated/tested, and verified to meet the defined specifications. This calibration/test was performed using Gases or Scales that are traceable through National Institute of Standards and Technology (NIST) to the International System of Units (SI). The basis of compliance stated is a comparison of the measurement parameters to the specified or required calibration/testing process. The expanded uncertainties use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from Red Ball Technical Gas Services. If not included, the uncertainty of calibrations are available upon request and were taken into account when determining pass or fail.

*Amisha Jewitt*

Amisha Jewitt  
Analytical Chemist  
Assay Laboratory: Red Ball TGS  
Version 02-J, Revised on 2018-09-17



Red Ball Technical Gas Service  
555 Craig Kennedy Way  
Shreveport, LA 71107  
800-551-8150  
PGVP Vendor ID # G12018

## EPA PROTOCOL GAS CERTIFICATE OF ANALYSIS

Cylinder Number: EB0098396  
Product ID Number: 126786  
Cylinder Pressure: 1900 PSIG  
COA #: EB0098396.20180416-0  
Customer PO. NO.:  
Customer:

Certification Date: 04/25/2018  
Expiration Date: 04/23/2026  
MFG Facility: - Shreveport - LA  
Lot Number: EB0098396.20180416  
Tracking Number: B1944959  
Previous Certification Dates:

This calibration standard has been certified per the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531, using procedure G1.

Do Not Use This Cylinder Below 100 psig (0.7 Megapascal).

### Certified Concentration(s)

Component	Concentration	Uncertainty	Analytical Principle	Assayed On
Carbon Dioxide	9.46 %	±0.09 %	NDIR	04/25/2018
Oxygen	9.49 %	±0.05 %	MPA	04/20/2018
Nitrogen	Balance			

Analytical Measurement Data Available Online.

### Reference Standard(s)

Serial Number	Lot	Expiration	Type	Balance	Component	Concentration	Uncertainty(%)	NIST Reference
EB0019964	EB0019964.20170209	08/05/2025	GMIS	N2	O2	24 %	0.502	071001
EB0072967	EB0072967.20170424	11/25/2025	GMIS	N2	CO2	9.52 %	0.753	C1309410.01
SG9916836	SG-9916836	06/06/2022	NTRM	N2	CO2	19.98 %	0.7	101001

### Analytical Instrumentation

Component	Principle	Make	Model	Serial	MPC Date
O2	MPA	Thermo	410i	1162980025	04/19/2018
CO2	NDIR	Thermo	410i	1162980025	04/12/2018

### SMART-CERT



This is to certify the gases referenced have been calibrated/tested, and verified to meet the defined specifications. This calibration/test was performed using Gases or Scales that are traceable through National Institute of Standards and Technology (NIST) to the International System of Units (SI). The basis of compliance stated is a comparison of the measurement parameters to the specified or required calibration/testing process. The expanded uncertainties use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from Red Ball Technical Gas Services. If not included, the uncertainty of calibrations are available upon request and were taken into account when determining pass or fail.

*B. Theus*

Brandon Theus  
Analytical Chemist  
Assay Laboratory: Red Ball TGS  
Version 02-1, Revised on 2017-09-07

## Appendix E

### Process Operating Data



# Air Performance Test Form

## Operating Data Summary for Process Sources

### Facility Information (please print)

Company Name: U.S. Steel Corporation

Test date(s): 03/24/21

Equipment ID No: SV051

### Equipment and Operating Data

- Process Equipment Description: Phase II Waste Gas Stack
- Were the process and control equipment operated consistent with normal procedures? ☒ Yes ☐ No If no, explain: \_\_\_\_\_
- Include copy of production records or instrumentation which indicates rate of production or operation of the equipment, i.e. units per hour, pounds per hour, pressure, air flow, etc.
- Date(s) and procedure(s) of last maintenance/cleaning within 6 months:  
☒ Remains unchanged from info. provided in test plan
- Process rate (amount of raw material or finished product per hour, wet or dry basis) while combusting (list fuel type(s) and ratios as appropriate \_\_\_\_\_)

Process Parameter: list type and units	Run 1	Run 2	Run 3	Run 4	Average
Greenball Feed Rate, LTPH	930	975	Voided	974	960
Fired Pellet Feed Rate, LTPH	769	817		824	803
<b>Fuel Input (list units)</b>					
<b>Heat Input (10<sup>6</sup> British thermal units/hour)</b>	271	315		309	293

- Summarize control equipment operating data documented during testing. Values reported should reflect maximum, minimum, averages, or as approved in the test plan. (See test plan and approval letter)

### Examples of APC equipment and parameters generally monitored. Monitor as in test plan and/or approval letter.

- Scrubber (list type of scrubber): DP (in. w.c.) and feed rate (gpm and psig)
- Baghouse, Cyclone, and Multi-clone: DP (in. w.c.)
- Catalytic Incinerator: (°F<sub>in</sub>, °F<sub>out</sub>) and Thermal Incinerator: (°F<sub>temperature</sub>)
- ESP: Number and identity of operating field(s)

APC and parameter monitored	Run 1	Run 2	Run 3	Run 4	Average
CE110 Lower dP, in. w.c.	10.6	10.3	Voided	10.3	10.4
CE110 Upper dP, in. w.c.	11.3	11.0		11.0	11.1
CE110 Scrubber Water Flow Rate, gpm	2201	2200		2199	2200
CE111 Lower dP, in. w.c.	14.0	13.5		13.6	13.7
CE111 Upper dP, in. w.c.	14.1	13.7		13.7	13.8
CE111 Scrubber Water Flow Rate, gpm	2201	2200		2200	2200
List pollutant & averaging basis.--should reflect permit	Run 1	Run 2	Run 3	Run 4	Average
Continuous Opacity Monitor(list hourly average)					
Monitor (list averaging basis):					
Monitor (list averaging basis):					

Abbreviations: APC=air pollution control  
lbs.-pounds

gpm.=gallons per minute  
psig=pressure per square inch gauge

in. w.c.=inches of water column  
ΔP=pressure drop

**Note:** This form provides only a summary of the operating conditions during the performance test. Additional and more detailed records are required to meet the requirements of Minn. R. 7017.2035, subp. 3. This form is to be submitted as part of the performance test report

	GREEN BALL			4A			4B		
	FEED RATE	FINES	GAS FLOW	(North)Tota	4A (North)	4A (North)	(South)Tota	4B (South)	4B (South)
				I Venturi	Venturi Diff	Venturi Diff	I Venturi	Ventru Diff	Ventru Diff
				Flow	Press Upper	Press Lower	Flow	Press Upper	Press Lower
				Q4-SC10- N_VENTURI	Q4-SC10- PDT_5022	Q4-SC10- PDT_5023	Q4-SC10- S_VENTURI	Q4-SC10- PDT_5026	Q4-SC10- PDT_5027
3/24/21 8:00	935	159	275	2204	11.3	10.6	2192	14.2	14.1
3/24/21 8:01	916	160	276	2204	11.4	10.6	2199	14.2	14.1
3/24/21 8:02	931	161	277	2204	11.4	10.6	2206	14.3	14.1
3/24/21 8:03	921	162	276	2204	11.4	10.6	2194	14.3	14.1
3/24/21 8:04	934	160	276	2203	11.3	10.6	2196	14.2	14.1
3/24/21 8:05	932	162	276	2203	11.4	10.7	2200	14.3	14.1
3/24/21 8:06	924	160	276	2203	11.4	10.7	2199	14.3	14.1
3/24/21 8:07	927	164	275	2200	11.3	10.6	2199	14.2	14.1
3/24/21 8:08	949	166	274	2201	11.3	10.6	2198	14.2	14.1
3/24/21 8:09	939	162	272	2206	11.3	10.6	2198	14.2	14.1
3/24/21 8:10	937	164	272	2201	11.4	10.6	2197	14.2	14.1
3/24/21 8:11	944	165	272	2199	11.4	10.6	2197	14.3	14.1
3/24/21 8:12	937	166	271	2201	11.3	10.5	2197	14.2	14.1
3/24/21 8:13	935	163	270	2201	11.3	10.6	2198	14.2	14.0
3/24/21 8:14	935	168	269	2201	11.3	10.6	2199	14.1	14.0
3/24/21 8:15	925	167	267	2201	11.3	10.6	2200	14.1	14.0
3/24/21 8:16	934	165	267	2201	11.3	10.6	2200	14.2	14.1
3/24/21 8:17	933	169	265	2201	11.3	10.6	2201	14.2	14.0
3/24/21 8:18	937	165	266	2201	11.3	10.6	2201	14.2	14.0
3/24/21 8:19	930	168	266	2201	11.3	10.6	2203	14.1	14.0
3/24/21 8:20	932	165	266	2201	11.3	10.5	2203	14.1	14.0
3/24/21 8:21	931	169	264	2201	11.3	10.6	2202	14.1	14.0
3/24/21 8:22	939	167	264	2201	11.3	10.6	2202	14.2	14.0
3/24/21 8:23	924	164	265	2202	11.3	10.6	2201	14.2	14.0
3/24/21 8:24	942	163	264	2203	11.3	10.6	2201	14.1	14.0
3/24/21 8:25	921	166	264	2203	11.3	10.6	2200	14.1	14.0

3/24/21 8:26	922	166	265	2204	11.3	10.6	2209	14.1	14.0
3/24/21 8:27	917	163	265	2198	11.3	10.6	2202	14.1	14.0
3/24/21 8:28	921	161	265	2194	11.3	10.5	2198	14.1	14.0
3/24/21 8:29	917	160	267	2197	11.3	10.6	2199	14.2	14.0
3/24/21 8:30	925	160	268	2201	11.3	10.6	2199	14.2	14.0
3/24/21 8:31	927	158	269	2202	11.3	10.6	2200	14.2	14.0
3/24/21 8:32	934	158	268	2201	11.4	10.6	2200	14.1	14.0
3/24/21 8:33	937	159	268	2197	11.3	10.6	2200	14.2	14.1
3/24/21 8:34	930	163	268	2204	11.3	10.6	2200	14.1	14.0
3/24/21 8:35	927	160	268	2197	11.3	10.6	2201	14.2	14.0
3/24/21 8:36	935	164	269	2197	11.3	10.5	2201	14.1	14.0
3/24/21 8:37	930	161	270	2207	11.2	10.5	2201	14.1	14.0
3/24/21 8:38	939	161	270	2198	11.3	10.5	2201	14.1	14.0
3/24/21 8:39	921	160	270	2199	11.3	10.6	2195	14.1	14.0
3/24/21 8:40	945	162	270	2199	11.3	10.6	2206	14.0	14.0
3/24/21 8:41	933	161	270	2200	11.3	10.6	2204	14.1	13.9
3/24/21 8:42	941	160	269	2200	11.3	10.6	2202	14.1	14.0
3/24/21 8:43	933	162	269	2200	11.3	10.5	2201	14.1	14.0
3/24/21 8:44	940	162	269	2208	11.3	10.5	2200	14.1	13.9
3/24/21 8:45	932	162	269	2199	11.2	10.5	2199	14.1	14.0
3/24/21 8:46	944	164	269	2196	11.3	10.6	2209	14.1	13.9
3/24/21 8:47	931	166	269	2199	11.3	10.6	2199	14.1	14.0
3/24/21 8:48	935	161	269	2202	11.2	10.5	2203	14.1	14.0
3/24/21 8:49	932	164	270	2203	11.2	10.5	2197	14.1	13.9
3/24/21 8:50	928	161	272	2205	11.2	10.5	2197	14.0	13.9
3/24/21 8:51	921	161	272	2198	11.2	10.5	2198	14.0	13.9
3/24/21 8:52	933	160	272	2198	11.2	10.5	2199	14.0	13.9
3/24/21 8:53	917	159	274	2199	11.3	10.6	2200	14.1	14.0
3/24/21 8:54	917	161	276	2199	11.3	10.6	2201	14.2	14.0
3/24/21 8:55	926	162	275	2200	11.2	10.5	2202	14.1	13.9
3/24/21 8:56	919	156	276	2200	11.2	10.5	2204	14.1	14.0
3/24/21 8:57	937	157	277	2201	11.3	10.6	2204	14.2	14.0
3/24/21 8:58	906	158	275	2201	11.3	10.6	2203	14.1	14.0

3/24/21 8:59	920	158	276	2202	11.4	10.6	2202	14.1	14.0
3/24/21 9:00	913	162	276	2202	11.4	10.6	2202	14.1	14.0
3/24/21 9:01	926	155	275	2203	11.3	10.6	2201	14.2	14.0
3/24/21 9:02	925	157	275	2203	11.3	10.6	2203	14.2	14.1
3/24/21 9:03	927	158	274	2202	11.3	10.6	2205	14.1	14.0
3/24/21 9:04	923	160	273	2199	11.3	10.6	2206	14.2	14.0
3/24/21 9:05	926	160	271	2198	11.3	10.5	2206	14.2	14.1
3/24/21 9:06	924	158	273	2197	11.3	10.6	2205	14.2	14.1
3/24/21 9:07	920	159	273	2197	11.3	10.6	2204	14.2	14.1
3/24/21 9:08	906	159	272	2198	11.3	10.6	2203	14.2	14.1
3/24/21 9:09	922	157	272	2199	11.3	10.6	2202	14.2	14.0
3/24/21 9:10	916	157	273	2200	11.3	10.6	2200	14.2	14.0
3/24/21 9:11	916	157	272	2201	11.4	10.6	2209	14.1	14.0
3/24/21 9:12	924	161	272	2202	11.3	10.6	2208	14.2	14.1
3/24/21 9:13	929	158	271	2203	11.3	10.6	2207	14.2	14.0
3/24/21 9:14	930	159	270	2204	11.3	10.6	2206	14.1	14.0
3/24/21 9:15	922	160	269	2210	11.3	10.6	2204	14.1	14.0
3/24/21 9:16	916	159	268	2208	11.3	10.6	2209	14.1	14.0
3/24/21 9:17	923	160	270	2207	11.3	10.6	2207	14.1	14.0
3/24/21 9:18	927	155	271	2205	11.3	10.6	2205	14.1	14.0
3/24/21 9:19	926	156	272	2203	11.3	10.6	2204	14.1	14.0
3/24/21 9:20	918	157	272	2202	11.3	10.6	2202	14.1	14.0
3/24/21 9:21	931	164	272	2201	11.3	10.5	2201	14.1	14.0
3/24/21 9:22	915	160	273	2200	11.3	10.6	2201	14.1	14.0
3/24/21 9:23	935	160	273	2200	11.3	10.6	2201	14.1	14.0
3/24/21 9:24	925	158	274	2200	11.3	10.6	2200	14.2	14.0
3/24/21 9:25	939	159	273	2200	11.3	10.6	2200	14.1	14.0
3/24/21 9:26	928	161	273	2201	11.3	10.6	2199	14.0	13.9
3/24/21 9:27	946	161	274	2206	11.3	10.6	2198	14.1	14.0
3/24/21 9:28	924	159	272	2221	11.3	10.6	2210	14.1	14.0
3/24/21 9:29	933	161	272	2205	11.3	10.6	2199	14.1	14.0
3/24/21 9:30	934	162	272	2190	11.3	10.6	2194	14.1	14.0
3/24/21 9:31	933	160	271	2190	11.3	10.6	2209	14.1	14.0

3/24/21 9:32	951	162	269	2202	11.2	10.6	2196	14.1	14.0
3/24/21 9:33	936	162	269	2192	11.3	10.5	2194	14.2	14.0
3/24/21 9:34	930	164	269	2200	11.3	10.6	2203	14.1	14.0
3/24/21 9:35	944	165	268	2198	11.3	10.6	2202	14.1	14.0
3/24/21 9:36	932	160	268	2196	11.3	10.6	2200	14.1	14.0
3/24/21 9:37	951	163	267	2195	11.3	10.6	2197	14.1	14.0
3/24/21 9:38	934	163	267	2202	11.3	10.6	2195	14.1	14.0
3/24/21 9:39	940	166	267	2201	11.3	10.6	2197	14.1	14.0
3/24/21 9:40	939	164	267	2200	11.3	10.6	2199	14.1	13.9
3/24/21 9:41	933	165	269	2199	11.3	10.5	2202	14.0	13.9
3/24/21 9:42	948	163	268	2198	11.3	10.5	2205	14.1	13.9
3/24/21 9:43	934	163	269	2198	11.2	10.5	2203	14.1	14.0
3/24/21 9:44	918	165	269	2200	11.3	10.5	2195	14.1	13.9
3/24/21 9:45	928	161	270	2203	11.2	10.5	2195	14.1	13.9
3/24/21 9:46	930	163	271	2205	11.2	10.5	2196	14.1	13.9
3/24/21 9:47	926	158	271	2203	11.3	10.6	2197	14.1	14.0
3/24/21 9:48	928	160	271	2201	11.3	10.6	2202	14.1	14.0
3/24/21 9:49	935	165	271	2201	11.3	10.6	2197	14.1	14.0
3/24/21 9:50	936	162	270	2201	11.3	10.6	2197	14.1	14.0
3/24/21 9:51	946	158	272	2201	11.3	10.6	2198	14.1	14.0
3/24/21 9:52	925	162	272	2201	11.3	10.6	2200	14.1	14.0
3/24/21 9:53	934	162	274	2201	11.3	10.5	2202	14.1	14.0
3/24/21 9:54	949	163	274	2201	11.2	10.5	2201	14.0	13.9
3/24/21 9:55	921	162	273	2201	11.2	10.5	2198	14.1	13.9
3/24/21 9:56	923	165	273	2201	11.3	10.6	2195	14.0	13.9
3/24/21 9:57	935	165	274	2194	11.2	10.5	2191	14.0	13.9
3/24/21 9:58	932	163	274	2198	11.2	10.5	2199	14.0	13.9
3/24/21 9:59	937	160	272	2202	11.3	10.5	2196	14.1	14.0
3/24/21 10:00	925	162	270	2206	11.3	10.6	2197	14.1	13.9
3/24/21 10:01	942	164	270	2207	11.3	10.5	2200	14.0	13.9
3/24/21 10:02	932	163	269	2199	11.2	10.6	2200	14.1	14.0
3/24/21 10:03	942	163	270	2196	11.2	10.5	2200	14.1	13.9
3/24/21 10:04	930	163	270	2194	11.3	10.5	2199	14.0	13.9

3/24/21 10:05	945	164	270	2203	11.3	10.5	2199	14.1	13.9
3/24/21 10:06	932	163	270	2204	11.2	10.5	2199	14.1	13.9
3/24/21 10:07	933	169	270	2204	11.2	10.5	2199	14.0	13.9
3/24/21 10:08	931	166	270	2204	11.2	10.5	2199	14.0	13.9
3/24/21 10:09	937	168	271	2204	11.2	10.5	2200	14.0	13.9
3/24/21 10:10	925	164	272	2204	11.2	10.5	2201	14.1	14.0
3/24/21 10:11	944	162	273	2204	11.3	10.5	2210	14.0	13.9
3/24/21 10:12	926	164	273	2204	11.3	10.6	2207	14.1	13.9
3/24/21 10:13	939	163	273	2204	11.3	10.6	2202	14.0	13.9
3/24/21 10:14	930	161	273	2204	11.3	10.5	2198	14.1	13.9
3/24/21 10:15	923	166	274	2205	11.3	10.5	2198	14.0	13.9
3/24/21 10:16	945	161	276	2198	11.2	10.5	2198	14.0	13.9
3/24/21 10:17	915	162	276	2200	11.2	10.5	2199	14.0	13.9
3/24/21 10:18	921	161	276	2202	11.3	10.5	2199	14.0	13.9
3/24/21 10:19	916	163	277	2205	11.3	10.5	2199	14.0	13.9
3/24/21 10:20	925	161	278	2200	11.2	10.5	2204	14.1	13.9
3/24/21 10:21	930	162	276	2196	11.3	10.5	2200	14.0	13.9
3/24/21 10:22	927	159	275	2196	11.2	10.6	2196	14.1	14.0
3/24/21 10:23	929	163	276	2198	11.3	10.6	2197	14.1	14.0
3/24/21 10:24	940	162	276	2198	11.2	10.6	2198	14.0	14.0
3/24/21 10:25	936	165	276	2206	11.3	10.5	2199	14.1	13.9
3/24/21 10:26	952	162	276	2198	11.2	10.5	2199	14.0	13.9
3/24/21 10:27	924	164	275	2205	11.2	10.5	2199	14.0	13.9
3/24/21 10:28	933	167	274	2199	11.2	10.5	2200	14.0	13.9
3/24/21 10:29	914	168	272	2200	11.2	10.5	2200	14.0	13.8
3/24/21 10:30	926	165	273	2200	11.1	10.5	2200	13.9	13.8
3/24/21 10:31	931	161	274	2201	11.2	10.5	2201	14.0	13.8
3/24/21 10:32	947	160	273	2201	11.2	10.5	2203	14.0	13.9
3/24/21 10:33	935	159	271	2201	11.2	10.5	2204	14.1	13.9
3/24/21 10:34	935	159	271	2201	11.3	10.6	2204	14.1	13.9
3/24/21 10:35	933	163	270	2201	11.2	10.6	2198	14.1	13.9
3/24/21 10:36	918	166	269	2199	11.2	10.5	2199	14.0	13.9
3/24/21 10:37	928	161	268	2197	11.3	10.5	2200	14.1	13.9

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3/24/21 10:38	930	162	269	2206	11.2	10.5	2201	14.1	13.9
3/24/21 10:39	919	162	269	2201	11.3	10.5	2202	14.1	13.9
3/24/21 10:40	921	163	271	2198	11.2	10.5	2203	14.0	13.9
3/24/21 10:41	929	160	272	2198	11.2	10.5	2200	14.1	13.9
3/24/21 10:42	943	161	273	2199	11.3	10.6	2198	14.1	14.0
3/24/21 10:43	935	159	273	2200	11.2	10.5	2199	14.1	14.0
3/24/21 10:44	927	164	274	2201	11.3	10.5	2200	14.1	14.0
3/24/21 10:45	931	160	274	2202	11.2	10.5	2201	14.1	13.9
3/24/21 10:46	928	161	275	2203	11.2	10.5	2201	14.0	13.9
3/24/21 10:47	940	161	277	2204	11.2	10.6	2200	14.1	13.9
3/24/21 10:48	925	160	276	2203	11.3	10.5	2195	14.1	13.9
3/24/21 10:49	935	160	277	2202	11.2	10.5	2204	14.1	14.0
3/24/21 10:50	930	160	276	2209	11.3	10.5	2212	14.1	13.9
3/24/21 10:51	934	159	276	2203	11.2	10.5	2202	14.1	13.9
3/24/21 10:52	937	163	276	2202	11.3	10.6	2195	14.1	13.9
3/24/21 10:53	933	162	274	2201	11.3	10.5	2196	14.1	13.9
3/24/21 10:54	933	161	273	2200	11.2	10.5	2197	14.0	13.9
3/24/21 10:55	934	165	272	2200	11.2	10.5	2198	14.1	13.9
3/24/21 10:56	935	160	272	2199	11.2	10.5	2198	14.0	13.9
3/24/21 10:57	927	158	272	2199	11.2	10.5	2197	14.1	13.9
3/24/21 10:58	924	160	272	2198	11.2	10.5	2197	14.0	13.9
3/24/21 10:59	920	160	272	2197	11.3	10.5	2197	14.1	13.9
3/24/21 11:00	933	157	271	2196	11.3	10.6	2197	14.1	14.0
3/24/21 11:01	932	159	271	2195	11.3	10.6	2199	14.1	14.0
3/24/21 11:02	930	161	272	2194	11.3	10.5	2200	14.1	13.9
3/24/21 11:03	919	160	271	2199	11.3	10.5	2200	14.1	13.9
3/24/21 11:04	934	159	270	2204	11.2	10.6	2200	14.1	14.0
3/24/21 11:05	925	158	268	2203	11.2	10.5	2202	14.1	14.0
3/24/21 11:06	938	158	271	2196	11.2	10.5	2196	14.1	13.9
3/24/21 11:07	916	162	271	2199	11.3	10.5	2199	14.1	14.0
3/24/21 11:08	941	158	270	2203	11.2	10.5	2197	14.1	14.0
3/24/21 11:09	926	160	270	2201	11.3	10.5	2197	14.1	14.0
3/24/21 11:10	942	163	272	2197	11.3	10.5	2198	14.1	14.0

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Barr Engineering Co.  
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3/24/21 11:11	917	163	274	2198	11.3	10.6	2199	14.1	14.0
3/24/21 11:12	934	160	274	2200	11.3	10.6	2200	14.1	14.0
3/24/21 11:13	922	161	276	2202	11.2	10.5	2199	14.1	14.0
3/24/21 11:14	931	159	276	2203	11.3	10.5	2199	14.1	13.9
3/24/21 11:15	915	161	276	2203	11.3	10.5	2201	14.1	14.0
3/24/21 11:16	935	161	275	2203	11.3	10.6	2203	14.1	14.0
3/24/21 11:17	920	162	274	2203	11.2	10.5	2204	14.1	14.0
3/24/21 11:18	939	161	275	2203	11.2	10.5	2194	14.1	14.0
3/24/21 11:19	915	161	275	2202	11.3	10.5	2198	14.1	14.0
3/24/21 11:20	935	160	275	2202	11.3	10.5	2199	14.1	14.0
3/24/21 11:21	936	160	275	2205	11.2	10.6	2200	14.1	14.0
3/24/21 11:22	946	159	274	2195	11.3	10.6	2200	14.1	14.0
3/24/21 11:23	928	163	274	2195	11.3	10.6	2201	14.1	14.0
3/24/21 11:24	942	164	273	2196	11.3	10.6	2201	14.1	14.0
3/24/21 11:25	919	163	273	2197	11.3	10.6	2202	14.1	14.0
3/24/21 11:26	949	163	271	2197	11.2	10.5	2194	14.1	13.9
3/24/21 11:27	906	161	271	2198	11.2	10.5	2205	14.0	13.9
3/24/21 11:28	919	159	271	2204	11.2	10.5	2207	14.0	13.9
3/24/21 11:29	924	163	272	2200	11.2	10.5	2208	14.1	14.0
3/24/21 11:30	923	155	272	2200	11.3	10.5	2200	14.1	13.9
3/24/21 11:31	923	158	272	2200	11.3	10.6	2199	14.1	14.0
3/24/21 11:32	919	159	272	2200	11.3	10.6	2198	14.2	14.0
3/24/21 11:33	927	161	272	2200	11.3	10.6	2196	14.2	14.0
3/24/21 11:34	937	162	273	2200	11.3	10.6	2194	14.1	14.0
3/24/21 11:35	942	161	274	2200	11.3	10.6	2198	14.1	14.0
3/24/21 11:36	938	161	275	2200	11.3	10.6	2202	14.2	14.0
3/24/21 11:37	932	162	276	2199	11.3	10.5	2212	14.1	14.0
3/24/21 11:38	936	163	277	2199	11.3	10.6	2214	14.1	14.0
3/24/21 11:39	941	164	278	2200	11.2	10.5	2213	14.1	13.9
3/24/21 11:40	928	165	278	2213	11.2	10.5	2212	14.0	13.9
3/24/21 11:41	942	162	280	2207	11.3	10.5	2211	14.0	13.9
3/24/21 11:42	922	160	282	2202	11.2	10.5	2202	14.1	13.9
3/24/21 11:43	943	162	283	2206	11.2	10.5	2200	14.0	13.9



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Barr Engineering Co.  
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3/24/21 11:44	924	162	281	2205	11.3	10.5	2199	14.0	13.9
3/24/21 11:45	923	164	280	2197	11.2	10.5	2198	14.0	13.9
3/24/21 11:46	921	159	278	2198	11.2	10.5	2197	14.0	13.9
3/24/21 11:47	933	161	277	2199	11.2	10.5	2196	14.0	13.9
3/24/21 11:48	923	158	275	2194	11.3	10.5	2195	14.0	13.9
3/24/21 11:49	931	158	275	2204	11.3	10.5	2199	14.0	13.9
3/24/21 11:50	919	158	274	2204	11.3	10.5	2192	14.1	14.0
3/24/21 11:51	946	160	274	2205	11.3	10.5	2197	14.1	13.9
3/24/21 11:52	924	158	274	2205	11.3	10.5	2202	14.1	14.0
3/24/21 11:53	939	158	274	2205	11.3	10.5	2198	14.1	14.0
3/24/21 11:54	928	164	273	2206	11.2	10.5	2200	14.0	13.9
3/24/21 11:55	937	161	273	2206	11.2	10.5	2199	14.0	13.9
3/24/21 11:56	925	161	274	2196	11.3	10.5	2200	14.1	13.9
3/24/21 11:57	938	161	274	2200	11.2	10.5	2200	14.1	13.9
3/24/21 11:58	925	159	274	2200	11.2	10.5	2201	14.1	13.9
3/24/21 11:59	929	163	274	2197	11.2	10.5	2201	14.1	13.9
3/24/21 12:00	935	161	275	2202	11.2	10.5	2194	14.0	13.9
3/24/21 12:01	925	162	273	2202	11.3	10.6	2197	14.1	14.0
3/24/21 12:02	932	162	272	2202	11.4	10.6	2201	14.1	14.0
3/24/21 12:03	933	161	273	2201	11.3	10.6	2201	14.1	14.0
3/24/21 12:04	941	164	274	2201	11.3	10.6	2200	14.1	14.0
3/24/21 12:05	936	163	275	2201	11.3	10.6	2200	14.1	14.0
3/24/21 12:06	940	163	275	2200	11.2	10.5	2200	14.1	14.0
3/24/21 12:07	925	162	276	2200	11.3	10.5	2200	14.1	14.0
3/24/21 12:08	932	162	276	2199	11.2	10.5	2199	14.1	13.9
3/24/21 12:09	928	164	276	2198	11.2	10.5	2199	14.0	13.9
3/24/21 12:10	949	161	276	2197	11.2	10.5	2199	14.0	13.9
3/24/21 12:11	932	161	280	2196	11.3	10.5	2205	14.1	14.0
3/24/21 12:12	942	162	279	2195	11.3	10.6	2196	14.0	13.9
3/24/21 12:13	939	163	278	2194	11.2	10.5	2200	14.0	13.9
3/24/21 12:14	939	165	277	2194	11.3	10.5	2196	14.0	13.9
3/24/21 12:15	942	165	276	2193	11.2	10.5	2197	14.0	13.9
3/24/21 12:16	939	162	275	2198	11.2	10.5	2199	14.0	13.9

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3/24/21 12:17	928	161	275	2205	11.2	10.5	2200	14.0	13.9
3/24/21 12:18	939	159	274	2203	11.2	10.5	2202	14.0	13.9
3/24/21 12:19	939	161	274	2199	11.2	10.5	2197	14.0	13.9
3/24/21 12:20	931	161	273	2196	11.2	10.5	2197	14.1	13.9
3/24/21 12:21	940	164	275	2198	11.2	10.5	2197	14.1	13.9
3/24/21 12:22	919	162	274	2200	11.2	10.5	2196	14.1	13.9
3/24/21 12:23	924	166	272	2203	11.2	10.5	2196	14.0	14.0
3/24/21 12:24	919	165	271	2195	11.2	10.5	2196	14.0	13.9
3/24/21 12:25	914	162	272	2197	11.2	10.5	2197	14.1	14.0
3/24/21 12:26	919	161	274	2199	11.3	10.6	2198	14.1	14.0
3/24/21 12:27	921	165	275	2199	11.3	10.6	2199	14.1	14.0
3/24/21 12:28	935	160	274	2198	11.3	10.5	2200	14.1	14.0
3/24/21 12:29	937	162	274	2204	11.3	10.5	2201	14.1	14.0
3/24/21 12:30	916	163	277	2201	11.3	10.6	2200	14.1	14.0
3/24/21 12:31	931	166	279	2195	11.3	10.5	2197	14.1	13.9
3/24/21 12:32	947	164	280	2199	11.2	10.5	2195	14.1	14.0
3/24/21 12:33	930	164	281	2196	11.2	10.5	2194	14.1	14.0
3/24/21 12:34	929	167	281	2198	11.3	10.5	2197	14.1	14.0
3/24/21 12:35	935	165	282	2201	11.2	10.5	2201	14.1	13.9
3/24/21 12:36	911	164	282	2200	11.3	10.5	2197	14.1	14.0
3/24/21 12:37	931	162	282	2197	11.3	10.5	2194	14.1	13.9
3/24/21 12:38	931	166	281	2201	11.2	10.5	2204	14.1	13.9
3/24/21 12:39	922	158	282	2198	11.3	10.6	2200	14.1	13.9
3/24/21 12:40	926	164	280	2202	11.3	10.5	2195	14.1	14.0
3/24/21 12:41	923	165	278	2198	11.2	10.5	2194	14.0	13.9
3/24/21 12:42	930	161	277	2201	11.2	10.5	2199	14.1	14.0
3/24/21 12:43	916	164	275	2200	11.2	10.5	2199	14.1	14.0
3/24/21 12:44	929	162	274	2198	11.2	10.5	2196	14.1	14.0
3/24/21 12:45	925	163	273	2197	11.2	10.5	2198	14.2	14.0
3/24/21 12:46	938	163	273	2195	11.3	10.5	2200	14.1	14.0
3/24/21 12:47	918	164	273	2198	11.2	10.5	2202	14.1	14.0
3/24/21 12:48	920	165	275	2201	11.2	10.6	2203	14.1	14.0
3/24/21 12:49	921	161	275	2196	11.3	10.6	2205	14.1	14.0

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Barr Engineering Co.  
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3/24/21 12:50	933	162	275	2200	11.3	10.6	2198	14.1	14.0
3/24/21 12:51	918	164	278	2200	11.3	10.6	2198	14.1	14.0
3/24/21 12:52	919	163	278	2201	11.2	10.6	2198	14.1	14.0
3/24/21 12:53	912	161	278	2201	11.3	10.6	2198	14.1	14.0
3/24/21 12:54	924	162	278	2201	11.3	10.5	2198	14.1	14.0
3/24/21 12:55	915	157	278	2202	11.3	10.6	2199	14.2	14.0
3/24/21 12:56	923	157	278	2201	11.3	10.6	2199	14.1	14.0
3/24/21 12:57	923	161	278	2200	11.3	10.6	2199	14.2	14.0
3/24/21 12:58	929	158	279	2201	11.2	10.5	2199	14.1	14.0
3/24/21 12:59	923	160	280	2203	11.3	10.6	2200	14.2	14.1
3/24/21 13:00	941	160	278	2204	11.3	10.5	2192	14.2	14.1
3/24/21 13:01	931	159	279	2205	11.3	10.6	2201	14.2	14.1
3/24/21 13:02	920	162	280	2198	11.3	10.6	2193	14.2	14.1
3/24/21 13:03	927	162	278	2207	11.3	10.6	2208	14.1	14.0
3/24/21 13:04	931	163	278	2204	11.2	10.5	2209	14.1	14.0
3/24/21 13:05	928	161	278	2201	11.2	10.5	2201	14.1	14.0
3/24/21 13:06	932	162	277	2199	11.2	10.5	2200	14.1	14.0
3/24/21 13:07	937	163	276	2198	11.2	10.5	2201	14.1	14.0
3/24/21 13:08	927	165	275	2197	11.2	10.5	2202	14.1	14.0
3/24/21 13:09	929	164	273	2196	11.3	10.5	2203	14.2	14.0
3/24/21 13:10	922	164	273	2195	11.3	10.6	2204	14.1	14.0
3/24/21 13:11	939	167	273	2195	11.2	10.5	2199	14.1	14.0
3/24/21 13:12	928	164	272	2194	11.3	10.5	2200	14.1	14.0
3/24/21 13:13	934	163	270	2196	11.3	10.6	2197	14.2	14.0
3/24/21 13:14	934	167	270	2199	11.3	10.5	2201	14.2	14.0
3/24/21 13:15	938	166	270	2202	11.3	10.6	2199	14.1	14.0
3/24/21 13:16	941	165	269	2200	11.2	10.5	2202	14.1	14.0
3/24/21 13:17	952	163	269	2202	11.3	10.5	2195	14.1	14.0
3/24/21 13:18	935	167	268	2201	11.3	10.5	2206	14.1	14.0
3/24/21 13:19	933	165	269	2200	11.2	10.5	2205	14.1	13.9
3/24/21 13:20	934	169	271	2199	11.2	10.5	2204	14.0	13.9
3/24/21 13:21	941	165	271	2199	11.2	10.5	2203	14.1	13.9
3/24/21 13:22	921	165	272	2198	11.2	10.5	2203	14.1	14.0

3/24/21 13:23	934	166	272	2198	11.2	10.5	2202	14.1	14.0
3/24/21 13:24	936	167	273	2197	11.3	10.5	2201	14.1	14.0
3/24/21 13:25	931	166	272	2199	11.3	10.6	2200	14.1	14.0
3/24/21 13:26	936	165	272	2196	11.3	10.6	2193	14.1	14.0
3/24/21 13:27	940	163	272	2203	11.3	10.5	2194	14.1	14.0
3/24/21 13:28	927	166	273	2202	11.3	10.5	2196	14.1	13.9
3/24/21 13:29	935	167	274	2201	11.3	10.5	2197	14.1	13.9
3/24/21 13:30	923	167	274	2198	11.2	10.5	2197	14.1	13.9
3/24/21 13:31	936	163	273	2195	11.2	10.5	2198	14.1	13.9
3/24/21 13:32	930	165	272	2196	11.2	10.6	2197	14.1	14.0
3/24/21 13:33	932	163	272	2198	11.3	10.5	2201	14.1	14.0
3/24/21 13:34	915	167	274	2199	11.2	10.5	2200	14.1	13.9
3/24/21 13:35	937	162	274	2200	11.2	10.5	2200	14.1	13.9
3/24/21 13:36	928	162	274	2201	11.2	10.5	2200	14.1	14.0
3/24/21 13:37	939	163	273	2202	11.3	10.5	2200	14.1	14.0
3/24/21 13:38	931	167	273	2199	11.2	10.5	2197	14.1	14.0
3/24/21 13:39	937	163	273	2194	11.2	10.5	2193	14.1	13.9
3/24/21 13:40	932	164	272	2196	11.3	10.5	2201	14.1	13.9
3/24/21 13:41	939	165	272	2199	11.2	10.5	2196	14.0	13.9
3/24/21 13:42	931	163	272	2198	11.2	10.5	2204	14.0	13.9
3/24/21 13:43	931	164	271	2198	11.2	10.5	2203	14.0	13.9
3/24/21 13:44	937	162	271	2198	11.2	10.5	2201	14.0	13.9
3/24/21 13:45	929	164	272	2198	11.2	10.5	2201	14.0	13.9
3/24/21 13:46	932	164	273	2198	11.2	10.5	2201	14.0	13.9
3/24/21 13:47	923	162	273	2198	11.2	10.5	2201	14.0	13.9
3/24/21 13:48	932	165	273	2204	11.2	10.5	2201	14.0	13.9
3/24/21 13:49	922	166	273	2202	11.2	10.5	2201	14.0	13.9
3/24/21 13:50	940	160	273	2197	11.2	10.5	2201	14.0	13.9
3/24/21 13:51	915	165	273	2197	11.2	10.5	2201	14.0	13.9
3/24/21 13:52	931	164	274	2199	11.2	10.5	2201	14.0	13.9
3/24/21 13:53	934	165	276	2200	11.2	10.5	2201	14.0	13.8
3/24/21 13:54	932	160	276	2201	11.2	10.5	2201	14.0	13.9
3/24/21 13:55	930	160	278	2199	11.2	10.5	2201	14.0	13.9

3/24/21 13:56	934	160	280	2199	11.2	10.5	2201	14.0	13.8
3/24/21 13:57	926	163	280	2199	11.2	10.5	2201	14.0	13.8
3/24/21 13:58	934	161	280	2200	11.2	10.5	2201	14.0	13.9
3/24/21 13:59	931	160	280	2200	11.1	10.4	2201	14.0	13.9
3/24/21 14:00	926	160	281	2200	11.2	10.5	2201	14.0	13.9
3/24/21 14:01	924	163	280	2200	11.2	10.5	2201	13.9	13.8
3/24/21 14:02	917	160	278	2200	11.2	10.5	2201	14.0	13.8
3/24/21 14:03	924	161	276	2200	11.2	10.5	2200	14.0	13.8
3/24/21 14:04	934	158	275	2205	11.2	10.5	2200	14.0	13.9
3/24/21 14:05	925	159	274	2201	11.2	10.5	2200	14.1	13.9
3/24/21 14:06	948	156	273	2199	11.3	10.5	2200	14.1	13.9
3/24/21 14:07	961	159	274	2199	11.2	10.5	2200	14.1	13.9
3/24/21 14:08	979	158	273	2199	11.3	10.5	2200	14.1	13.9
3/24/21 14:09	987	166	272	2198	11.2	10.5	2200	14.1	13.9
3/24/21 14:10	968	163	276	2198	11.1	10.4	2199	13.9	13.8
3/24/21 14:11	970	164	283	2198	11.0	10.3	2199	13.8	13.7
3/24/21 14:12	969	167	282	2199	11.0	10.3	2199	13.8	13.6
3/24/21 14:13	957	162	285	2201	11.0	10.3	2199	13.7	13.6
3/24/21 14:14	965	157	293	2196	11.0	10.3	2199	13.7	13.6
3/24/21 14:15	949	159	293	2200	11.1	10.4	2199	13.8	13.6
3/24/21 14:16	962	157	295	2197	11.1	10.4	2198	13.8	13.7
3/24/21 14:17	941	154	297	2204	11.1	10.3	2198	13.8	13.7
3/24/21 14:18	939	157	298	2203	11.1	10.3	2198	13.8	13.6
3/24/21 14:19	943	154	301	2203	11.1	10.4	2198	13.8	13.7
3/24/21 14:20	940	154	305	2199	11.1	10.4	2198	13.8	13.7
3/24/21 14:21	933	156	307	2198	11.1	10.4	2198	13.9	13.7
3/24/21 14:22	938	151	309	2199	11.1	10.4	2199	13.9	13.7
3/24/21 14:23	869	151	310	2199	11.2	10.4	2202	13.9	13.8
3/24/21 14:24	872	155	312	2199	11.2	10.5	2197	14.0	13.9
3/24/21 14:25	871	152	315	2199	11.3	10.6	2200	14.0	13.9
3/24/21 14:26	867	144	317	2198	11.4	10.7	2201	14.2	14.1
3/24/21 14:27	884	145	315	2198	11.5	10.8	2197	14.3	14.2
3/24/21 14:28	874	146	312	2203	11.5	10.8	2199	14.3	14.2

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3/24/21 14:29	872	144	311	2204	11.5	10.8	2200	14.4	14.2
3/24/21 14:30	872	147	307	2201	11.5	10.7	2202	14.3	14.2
3/24/21 14:31	880	145	301	2199	11.5	10.8	2203	14.3	14.2
3/24/21 14:32	882	149	298	2200	11.5	10.8	2205	14.4	14.2
3/24/21 14:33	881	146	293	2201	11.5	10.7	2206	14.4	14.2
3/24/21 14:34	882	146	292	2204	11.4	10.7	2210	14.3	14.2
3/24/21 14:35	898	149	292	2205	11.4	10.7	2206	14.3	14.2
3/24/21 14:36	929	147	293	2203	11.4	10.7	2211	14.3	14.1
3/24/21 14:37	910	149	291	2201	11.4	10.7	2210	14.3	14.1
3/24/21 14:38	938	149	289	2206	11.4	10.7	2204	14.2	14.1
3/24/21 14:39	935	152	289	2196	11.3	10.6	2204	14.1	13.9
3/24/21 14:40	933	153	290	2197	11.2	10.5	2210	14.0	13.9
3/24/21 14:41	935	154	290	2198	11.3	10.5	2198	14.0	13.8
3/24/21 14:42	934	154	288	2194	11.2	10.5	2207	13.9	13.8
3/24/21 14:43	929	156	288	2197	11.1	10.4	2201	13.9	13.7
3/24/21 14:44	942	153	289	2202	11.1	10.4	2199	13.9	13.7
3/24/21 14:45	933	150	289	2202	11.1	10.4	2202	13.9	13.8
3/24/21 14:46	954	155	290	2202	11.1	10.4	2199	13.9	13.7
3/24/21 14:47	956	153	289	2201	11.1	10.3	2199	13.8	13.7
3/24/21 14:48	958	155	287	2201	11.0	10.3	2199	13.8	13.6
3/24/21 14:49	961	156	286	2202	11.0	10.3	2198	13.7	13.5
3/24/21 14:50	954	156	284	2203	11.0	10.3	2198	13.6	13.5
3/24/21 14:51	957	157	283	2204	10.9	10.3	2204	13.6	13.5
3/24/21 14:52	963	158	287	2205	10.9	10.2	2203	13.6	13.5
3/24/21 14:53	957	161	291	2206	10.9	10.2	2200	13.5	13.4
3/24/21 14:54	967	157	295	2201	10.9	10.2	2199	13.5	13.4
3/24/21 14:55	967	160	298	2205	10.9	10.2	2199	13.6	13.4
3/24/21 14:56	964	159	300	2205	10.9	10.2	2198	13.6	13.4
3/24/21 14:57	972	161	302	2205	10.9	10.2	2199	13.6	13.4
3/24/21 14:58	962	159	305	2199	10.9	10.2	2201	13.5	13.4
3/24/21 14:59	968	161	305	2203	10.9	10.2	2202	13.6	13.4
3/24/21 15:00	971	160	305	2205	10.9	10.2	2203	13.6	13.4
3/24/21 15:01	981	161	309	2200	10.9	10.2	2203	13.5	13.4

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Barr Engineering Co.  
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3/24/21 15:02	973	161	309	2197	10.9	10.2	2204	13.5	13.4
3/24/21 15:03	970	161	307	2198	10.9	10.2	2204	13.6	13.4
3/24/21 15:04	959	161	305	2199	10.9	10.2	2202	13.6	13.4
3/24/21 15:05	969	159	305	2200	10.9	10.2	2199	13.6	13.4
3/24/21 15:06	975	160	304	2201	11.0	10.2	2202	13.6	13.4
3/24/21 15:07	977	161	302	2201	11.0	10.2	2202	13.6	13.5
3/24/21 15:08	984	160	300	2202	11.0	10.3	2199	13.7	13.5
3/24/21 15:09	987	159	300	2203	10.9	10.2	2200	13.6	13.5
3/24/21 15:10	972	163	298	2203	11.0	10.2	2202	13.6	13.5
3/24/21 15:11	982	161	300	2202	10.9	10.3	2204	13.6	13.5
3/24/21 15:12	987	162	303	2200	11.0	10.2	2205	13.6	13.5
3/24/21 15:13	984	158	304	2198	11.0	10.3	2201	13.6	13.5
3/24/21 15:14	988	163	304	2204	11.0	10.3	2198	13.6	13.5
3/24/21 15:15	990	164	303	2198	10.9	10.3	2199	13.6	13.5
3/24/21 15:16	991	161	305	2201	10.9	10.2	2199	13.6	13.5
3/24/21 15:17	999	164	306	2198	10.9	10.2	2200	13.6	13.4
3/24/21 15:18	984	165	308	2196	10.9	10.2	2201	13.5	13.4
3/24/21 15:19	991	165	314	2198	10.8	10.1	2206	13.5	13.3
3/24/21 15:20	981	165	315	2202	10.8	10.1	2202	13.4	13.3
3/24/21 15:21	992	164	318	2204	10.9	10.1	2196	13.5	13.4
3/24/21 15:22	979	165	321	2201	10.8	10.2	2199	13.5	13.4
3/24/21 15:23	987	161	319	2206	10.8	10.1	2200	13.5	13.4
3/24/21 15:24	989	161	317	2201	10.9	10.2	2200	13.5	13.4
3/24/21 15:25	984	163	314	2197	10.9	10.2	2200	13.5	13.4
3/24/21 15:26	984	162	310	2197	10.9	10.2	2200	13.6	13.5
3/24/21 15:27	988	160	310	2198	10.9	10.2	2200	13.6	13.4
3/24/21 15:28	988	160	308	2199	10.9	10.2	2200	13.6	13.4
3/24/21 15:29	1001	162	308	2200	10.9	10.2	2200	13.5	13.4
3/24/21 15:30	993	159	307	2202	10.9	10.2	2200	13.6	13.5
3/24/21 15:31	990	159	307	2203	10.9	10.2	2199	13.6	13.4
3/24/21 15:32	993	163	307	2204	10.9	10.2	2196	13.5	13.4
3/24/21 15:33	998	161	308	2203	10.9	10.2	2198	13.5	13.4
3/24/21 15:34	1003	160	309	2201	10.9	10.2	2205	13.5	13.4

3/24/21 15:35	1011	163	310	2200	10.9	10.2	2200	13.5	13.4
3/24/21 15:36	1002	161	310	2202	10.9	10.2	2199	13.5	13.4
3/24/21 15:37	991	163	308	2199	10.9	10.2	2198	13.5	13.4
3/24/21 15:38	999	160	308	2201	10.9	10.2	2200	13.5	13.4
3/24/21 15:39	989	163	309	2199	10.9	10.2	2199	13.5	13.4
3/24/21 15:40	991	164	311	2199	10.8	10.1	2198	13.5	13.3
3/24/21 15:41	987	162	310	2201	10.8	10.1	2198	13.4	13.3
3/24/21 15:42	987	161	311	2201	10.8	10.1	2199	13.4	13.3
3/24/21 15:43	993	161	315	2202	10.8	10.2	2199	13.4	13.3
3/24/21 15:44	985	163	314	2202	10.8	10.2	2200	13.4	13.3
3/24/21 15:45	983	162	312	2202	10.9	10.2	2200	13.5	13.4
3/24/21 15:46	987	161	313	2203	10.9	10.2	2201	13.5	13.4
3/24/21 15:47	983	163	314	2203	10.9	10.1	2201	13.5	13.4
3/24/21 15:48	987	158	314	2203	10.9	10.2	2202	13.5	13.4
3/24/21 15:49	984	156	317	2203	10.9	10.2	2202	13.6	13.5
3/24/21 15:50	983	158	317	2200	11.0	10.2	2203	13.6	13.5
3/24/21 15:51	989	161	317	2200	10.9	10.2	2203	13.6	13.5
3/24/21 15:52	983	158	316	2200	10.9	10.2	2203	13.6	13.4
3/24/21 15:53	990	162	318	2200	10.9	10.2	2204	13.6	13.5
3/24/21 15:54	985	156	319	2201	10.9	10.2	2204	13.6	13.5
3/24/21 15:55	992	160	323	2201	10.9	10.2	2201	13.6	13.5
3/24/21 15:56	979	159	326	2202	10.9	10.2	2202	13.5	13.4
3/24/21 15:57	987	159	326	2202	10.8	10.2	2200	13.5	13.4
3/24/21 15:58	973	159	331	2198	10.9	10.1	2197	13.5	13.4
3/24/21 15:59	978	158	333	2200	10.8	10.2	2195	13.5	13.4
3/24/21 16:00	982	161	334	2200	10.9	10.2	2203	13.6	13.5
3/24/21 16:01	979	158	335	2199	10.9	10.2	2196	13.6	13.5
3/24/21 16:02	984	154	333	2198	10.9	10.3	2200	13.6	13.5
3/24/21 16:03	986	156	333	2199	11.0	10.2	2203	13.6	13.5
3/24/21 16:04	975	157	336	2203	10.9	10.2	2201	13.6	13.5
3/24/21 16:05	982	158	337	2206	10.9	10.2	2198	13.6	13.5
3/24/21 16:06	980	160	336	2198	10.9	10.2	2202	13.6	13.4
3/24/21 16:07	984	153	338	2200	10.9	10.2	2198	13.6	13.5



3/24/21 16:08	980	155	340	2196	10.9	10.2	2201	13.6	13.5
3/24/21 16:09	989	155	343	2196	10.9	10.2	2197	13.6	13.5
3/24/21 16:10	975	159	341	2198	10.9	10.2	2197	13.6	13.5
3/24/21 16:11	985	158	344	2201	10.9	10.2	2198	13.6	13.5
3/24/21 16:12	987	158	346	2198	11.0	10.2	2199	13.6	13.5
3/24/21 16:13	988	157	343	2206	10.9	10.2	2203	13.6	13.5
3/24/21 16:14	988	157	344	2204	11.0	10.3	2198	13.6	13.5
3/24/21 16:15	986	159	344	2198	10.9	10.2	2200	13.5	13.4
3/24/21 16:16	980	157	344	2197	10.9	10.2	2197	13.5	13.4
3/24/21 16:17	981	157	344	2197	10.9	10.2	2203	13.5	13.4
3/24/21 16:18	988	157	344	2197	10.8	10.2	2199	13.5	13.4
3/24/21 16:19	981	155	343	2197	10.9	10.2	2204	13.6	13.4
3/24/21 16:20	976	155	341	2197	10.9	10.2	2203	13.5	13.4
3/24/21 16:21	985	157	341	2201	10.9	10.2	2197	13.6	13.4
3/24/21 16:22	991	156	337	2203	10.9	10.2	2197	13.5	13.5
3/24/21 16:23	985	154	334	2198	11.0	10.3	2198	13.7	13.5
3/24/21 16:24	975	160	330	2199	11.0	10.3	2194	13.6	13.5
3/24/21 16:25	986	156	326	2201	11.0	10.3	2199	13.6	13.5
3/24/21 16:26	976	155	324	2200	11.0	10.2	2196	13.6	13.5
3/24/21 16:27	978	156	324	2198	10.9	10.2	2200	13.6	13.5
3/24/21 16:28	981	157	322	2198	11.0	10.3	2208	13.7	13.5
3/24/21 16:29	990	155	321	2197	11.0	10.3	2206	13.6	13.6
3/24/21 16:30	993	153	322	2202	11.0	10.3	2203	13.6	13.5
3/24/21 16:31	980	154	323	2207	10.9	10.3	2200	13.6	13.5
3/24/21 16:32	986	156	321	2205	10.9	10.2	2198	13.6	13.5
3/24/21 16:33	991	155	323	2197	11.0	10.2	2205	13.6	13.5
3/24/21 16:34	987	158	326	2204	10.9	10.2	2204	13.6	13.5
3/24/21 16:35	984	156	327	2198	10.9	10.2	2197	13.6	13.4
3/24/21 16:36	987	160	326	2200	10.9	10.2	2198	13.6	13.5
3/24/21 16:37	984	157	325	2200	10.9	10.2	2191	13.6	13.5
3/24/21 16:38	984	158	322	2199	10.9	10.2	2203	13.6	13.5
3/24/21 16:39	989	155	321	2203	10.9	10.2	2200	13.5	13.4
3/24/21 16:40	986	155	321	2202	10.9	10.2	2198	13.6	13.5

3/24/21 16:41	978	161	320	2203	10.9	10.2	2199	13.6	13.5
3/24/21 16:42	976	156	318	2202	10.9	10.2	2205	13.6	13.5
3/24/21 16:43	983	153	316	2201	10.9	10.2	2195	13.6	13.5
3/24/21 16:44	975	154	313	2205	10.9	10.2	2195	13.6	13.5
3/24/21 16:45	983	157	312	2197	11.0	10.2	2203	13.6	13.5
3/24/21 16:46	979	155	311	2197	10.9	10.2	2207	13.6	13.5
3/24/21 16:47	993	156	309	2197	11.0	10.3	2204	13.6	13.5
3/24/21 16:48	974	155	307	2197	11.0	10.3	2189	13.7	13.5
3/24/21 16:49	977	157	305	2198	11.0	10.3	2198	13.7	13.6
3/24/21 16:50	981	155	305	2194	11.0	10.3	2199	13.7	13.5
3/24/21 16:51	979	153	308	2199	11.0	10.3	2204	13.7	13.5
3/24/21 16:52	981	156	312	2199	11.0	10.3	2206	13.7	13.6
3/24/21 16:53	983	156	312	2196	11.0	10.3	2203	13.7	13.5
3/24/21 16:54	985	158	313	2199	11.0	10.3	2203	13.6	13.5
3/24/21 16:55	991	157	313	2200	11.0	10.3	2207	13.7	13.5
3/24/21 16:56	983	156	312	2204	10.9	10.2	2204	13.6	13.5
3/24/21 16:57	972	155	312	2205	10.9	10.2	2201	13.6	13.5
3/24/21 16:58	985	158	313	2202	11.0	10.3	2198	13.7	13.5
3/24/21 16:59	985	159	316	2200	11.0	10.3	2195	13.7	13.5
3/24/21 17:00	979	156	316	2204	11.1	10.3	2198	13.7	13.6
3/24/21 17:01	987	157	318	2203	11.1	10.3	2202	13.8	13.6
3/24/21 17:02	987	157	319	2203	11.0	10.3	2196	13.7	13.6
3/24/21 17:03	990	157	323	2200	11.1	10.3	2204	13.7	13.6
3/24/21 17:04	987	157	323	2202	11.0	10.3	2201	13.7	13.6
3/24/21 17:05	989	158	323	2201	11.0	10.3	2202	13.7	13.6
3/24/21 17:06	982	157	326	2199	11.0	10.3	2202	13.7	13.5
3/24/21 17:07	989	158	327	2197	11.0	10.2	2207	13.7	13.6
3/24/21 17:08	985	155	324	2199	10.9	10.2	2203	13.6	13.5
3/24/21 17:09	982	157	324	2208	10.9	10.2	2200	13.6	13.4
3/24/21 17:10	983	158	325	2192	10.9	10.2	2196	13.6	13.5
3/24/21 17:11	979	156	326	2189	10.9	10.2	2193	13.6	13.5
3/24/21 17:12	985	154	325	2199	11.0	10.3	2202	13.7	13.5
3/24/21 17:13	980	158	325	2200	11.0	10.3	2203	13.7	13.5

3/24/21 17:14	984	157	326	2201	10.9	10.2	2205	13.6	13.5
3/24/21 17:15	980	154	327	2198	11.0	10.3	2198	13.7	13.5
3/24/21 17:16	984	160	326	2196	10.9	10.3	2202	13.6	13.5
3/24/21 17:17	977	159	323	2195	10.9	10.3	2204	13.6	13.5
3/24/21 17:18	986	155	322	2206	10.9	10.2	2195	13.6	13.5
3/24/21 17:19	980	157	322	2202	10.9	10.2	2197	13.6	13.5
3/24/21 17:20	991	157	318	2198	10.9	10.2	2208	13.6	13.5
3/24/21 17:21	979	155	317	2197	10.9	10.2	2198	13.6	13.5
3/24/21 17:22	984	155	317	2203	11.0	10.2	2204	13.6	13.5
3/24/21 17:23	981	158	316	2204	11.0	10.2	2205	13.6	13.5
3/24/21 17:24	975	155	314	2206	10.9	10.2	2207	13.6	13.5
3/24/21 17:25	981	155	312	2203	10.9	10.3	2201	13.6	13.5
3/24/21 17:26	983	155	309	2198	10.9	10.2	2205	13.6	13.5
3/24/21 17:27	985	155	308	2198	11.0	10.2	2195	13.6	13.5
3/24/21 17:28	980	156	307	2208	10.9	10.3	2205	13.6	13.5
3/24/21 17:29	977	154	308	2208	11.0	10.2	2202	13.6	13.5
3/24/21 17:30	978	156	305	2190	11.0	10.2	2205	13.6	13.5
3/25/21 8:10	986	151	307	2201	11.0	10.3	2210	13.7	13.6
3/25/21 8:11	970	152	306	2199	11.0	10.3	2200	13.7	13.6
3/25/21 8:12	970	149	305	2198	11.0	10.3	2183	13.7	13.6
3/25/21 8:13	967	157	306	2196	11.1	10.3	2211	13.7	13.6
3/25/21 8:14	976	152	307	2193	11.0	10.3	2199	13.7	13.6
3/25/21 8:15	976	148	311	2195	11.1	10.3	2200	13.7	13.6
3/25/21 8:16	976	154	310	2201	11.0	10.3	2195	13.7	13.6
3/25/21 8:17	973	148	311	2194	11.0	10.3	2200	13.7	13.6
3/25/21 8:18	978	149	311	2224	11.0	10.3	2192	13.7	13.6
3/25/21 8:19	973	147	311	2206	11.1	10.4	2217	13.8	13.6
3/25/21 8:20	974	150	311	2209	11.1	10.4	2199	13.8	13.6
3/25/21 8:21	978	150	312	2198	11.0	10.3	2203	13.7	13.6
3/25/21 8:22	977	148	311	2202	11.0	10.3	2186	13.7	13.6
3/25/21 8:23	962	148	308	2201	11.1	10.3	2209	13.7	13.6
3/25/21 8:24	971	151	309	2199	11.0	10.3	2198	13.7	13.6

3/25/21 8:25	968	152	311	2197	11.0	10.3	2198	13.7	13.6
3/25/21 8:26	971	149	311	2191	11.0	10.4	2197	13.8	13.6
3/25/21 8:27	972	151	310	2198	11.1	10.3	2197	13.8	13.6
3/25/21 8:28	969	150	310	2202	11.0	10.4	2198	13.7	13.6
3/25/21 8:29	977	147	307	2199	11.1	10.4	2203	13.8	13.7
3/25/21 8:30	976	147	304	2201	11.1	10.4	2205	13.8	13.7
3/25/21 8:31	977	150	304	2196	11.1	10.4	2211	13.8	13.7
3/25/21 8:32	973	151	304	2201	11.1	10.4	2207	13.8	13.7
3/25/21 8:33	980	148	305	2202	11.1	10.4	2203	13.8	13.7
3/25/21 8:34	977	149	305	2204	11.1	10.4	2202	13.8	13.7
3/25/21 8:35	983	150	305	2202	11.0	10.3	2189	13.7	13.6
3/25/21 8:36	984	151	306	2201	11.0	10.3	2206	13.7	13.6
3/25/21 8:37	976	152	306	2201	11.0	10.3	2193	13.7	13.6
3/25/21 8:38	977	156	306	2196	11.0	10.3	2201	13.7	13.5
3/25/21 8:39	973	151	306	2203	11.0	10.3	2205	13.6	13.5
3/25/21 8:40	972	148	306	2203	11.0	10.3	2205	13.7	13.5
3/25/21 8:41	983	149	308	2198	11.0	10.3	2195	13.7	13.6
3/25/21 8:42	980	151	310	2201	11.0	10.3	2199	13.7	13.6
3/25/21 8:43	978	151	313	2200	11.0	10.4	2203	13.7	13.6
3/25/21 8:44	979	151	313	2202	11.1	10.3	2205	13.7	13.6
3/25/21 8:45	990	153	313	2200	11.0	10.3	2204	13.6	13.5
3/25/21 8:46	982	152	313	2198	11.0	10.3	2204	13.6	13.5
3/25/21 8:47	978	151	312	2196	10.9	10.2	2202	13.6	13.5
3/25/21 8:48	980	153	314	2196	10.9	10.2	2180	13.6	13.5
3/25/21 8:49	977	152	313	2196	10.9	10.2	2206	13.6	13.4
3/25/21 8:50	965	156	311	2199	10.9	10.2	2202	13.5	13.4
3/25/21 8:51	981	154	310	2196	10.9	10.2	2204	13.5	13.4
3/25/21 8:52	980	150	310	2194	10.9	10.2	2192	13.6	13.4
3/25/21 8:53	975	151	309	2199	11.0	10.3	2193	13.6	13.5
3/25/21 8:54	977	151	308	2200	11.0	10.3	2193	13.6	13.5
3/25/21 8:55	976	151	308	2201	11.0	10.3	2195	13.6	13.5
3/25/21 8:56	969	150	306	2202	11.0	10.3	2198	13.7	13.5
3/25/21 8:57	977	150	303	2202	11.0	10.3	2191	13.6	13.5

3/25/21 8:58	960	151	303	2197	11.0	10.3	2191	13.7	13.5
3/25/21 8:59	968	150	303	2196	11.0	10.3	2189	13.6	13.5
3/25/21 9:00	975	150	302	2197	11.0	10.3	2188	13.6	13.6
3/25/21 9:01	968	150	303	2209	11.0	10.3	2206	13.7	13.6
3/25/21 9:02	963	150	304	2194	11.1	10.3	2210	13.7	13.6
3/25/21 9:03	984	150	306	2203	11.0	10.3	2200	13.7	13.6
3/25/21 9:04	966	151	308	2204	11.0	10.3	2202	13.7	13.6
3/25/21 9:05	977	149	307	2199	11.1	10.4	2197	13.7	13.6
3/25/21 9:06	977	151	309	2197	11.1	10.4	2201	13.7	13.6
3/25/21 9:07	964	149	312	2199	11.1	10.4	2193	13.7	13.6
3/25/21 9:08	987	153	311	2200	11.1	10.3	2198	13.7	13.6
3/25/21 9:09	975	151	311	2201	11.0	10.3	2205	13.7	13.6
3/25/21 9:10	967	152	314	2202	11.0	10.3	2202	13.7	13.6
3/25/21 9:11	972	152	314	2200	11.0	10.3	2204	13.6	13.5
3/25/21 9:12	982	149	313	2198	11.0	10.3	2190	13.6	13.5
3/25/21 9:13	971	148	314	2195	11.0	10.3	2208	13.7	13.5
3/25/21 9:14	966	149	315	2193	11.0	10.3	2193	13.6	13.5
3/25/21 9:15	961	153	317	2203	10.9	10.3	2214	13.6	13.5
3/25/21 9:16	969	151	316	2209	11.0	10.3	2206	13.6	13.5
3/25/21 9:17	968	149	317	2201	11.0	10.3	2201	13.6	13.5
3/25/21 9:18	969	149	316	2202	11.1	10.3	2197	13.7	13.5
3/25/21 9:19	974	150	315	2201	11.1	10.3	2205	13.7	13.5
3/25/21 9:20	974	151	314	2205	11.0	10.3	2198	13.6	13.5
3/25/21 9:21	978	149	313	2206	11.1	10.3	2200	13.6	13.5
3/25/21 9:22	971	149	312	2202	11.0	10.3	2202	13.6	13.5
3/25/21 9:23	975	152	310	2201	11.0	10.2	2199	13.6	13.5
3/25/21 9:24	983	154	309	2196	11.0	10.3	2208	13.6	13.5
3/25/21 9:25	975	151	308	2202	11.0	10.3	2194	13.6	13.5
3/25/21 9:26	979	149	305	2204	11.0	10.3	2207	13.5	13.4
3/25/21 9:27	974	150	306	2197	11.0	10.3	2194	13.5	13.4
3/25/21 9:28	969	152	304	2198	11.0	10.3	2203	13.6	13.5
3/25/21 9:29	965	152	304	2200	11.0	10.3	2199	13.6	13.5
3/25/21 9:30	972	152	304	2201	11.1	10.3	2201	13.7	13.5

3/25/21 9:31	976	151	301	2203	11.1	10.3	2209	13.7	13.6
3/25/21 9:32	977	150	301	2202	11.0	10.3	2196	13.7	13.6
3/25/21 9:33	966	151	304	2192	11.0	10.3	2193	13.7	13.6
3/25/21 9:34	973	154	304	2203	11.0	10.3	2202	13.7	13.6
3/25/21 9:35	974	150	302	2196	11.0	10.3	2202	13.7	13.6
3/25/21 9:36	970	154	305	2193	11.0	10.3	2210	13.7	13.6
3/25/21 9:37	971	152	306	2198	11.0	10.3	2208	13.7	13.6
3/25/21 9:38	967	149	307	2197	11.0	10.3	2200	13.7	13.6
3/25/21 9:39	973	150	309	2192	11.0	10.4	2206	13.7	13.6
3/25/21 9:40	973	150	311	2197	11.0	10.3	2202	13.7	13.6
3/25/21 9:41	983	150	311	2194	11.1	10.4	2197	13.7	13.6
3/25/21 9:42	978	150	312	2201	11.1	10.4	2206	13.8	13.6
3/25/21 9:43	981	152	313	2197	11.1	10.4	2199	13.7	13.6
3/25/21 9:44	974	154	313	2194	11.0	10.3	2208	13.6	13.5
3/25/21 9:45	976	148	313	2208	11.0	10.3	2200	13.7	13.5
3/25/21 9:46	983	149	313	2211	11.0	10.3	2202	13.7	13.5
3/25/21 9:47	972	150	315	2204	10.9	10.2	2211	13.6	13.5
3/25/21 9:48	976	149	314	2206	10.9	10.2	2217	13.5	13.5
3/25/21 9:49	980	148	313	2198	10.9	10.2	2209	13.6	13.5
3/25/21 9:50	966	150	312	2184	10.9	10.3	2208	13.6	13.5
3/25/21 9:51	971	149	313	2193	11.0	10.3	2191	13.6	13.5
3/25/21 9:52	971	151	312	2197	11.0	10.3	2196	13.6	13.5
3/25/21 9:53	975	148	309	2198	11.0	10.3	2192	13.6	13.5
3/25/21 9:54	962	146	309	2197	11.0	10.3	2203	13.7	13.6
3/25/21 9:55	968	150	308	2201	11.0	10.3	2196	13.6	13.5
3/25/21 9:56	980	148	308	2203	11.1	10.4	2199	13.7	13.6
3/25/21 9:57	974	148	308	2202	11.0	10.3	2195	13.7	13.6
3/25/21 9:58	970	148	307	2198	11.0	10.3	2211	13.7	13.5
3/25/21 9:59	969	148	307	2206	11.0	10.3	2200	13.7	13.6
3/25/21 10:00	977	148	309	2199	11.0	10.3	2198	13.7	13.6
3/25/21 10:01	966	150	310	2188	11.0	10.3	2194	13.7	13.6
3/25/21 10:02	980	149	310	2196	11.0	10.3	2197	13.7	13.5
3/25/21 10:03	970	147	312	2196	11.0	10.3	2201	13.7	13.6

3/25/21 10:04	971	149	312	2194	11.0	10.3	2209	13.7	13.6
3/25/21 10:05	964	151	312	2204	11.1	10.3	2200	13.7	13.6
3/25/21 10:06	968	149	313	2198	11.0	10.4	2213	13.7	13.6
3/25/21 10:07	967	149	314	2193	11.0	10.3	2197	13.7	13.6
3/25/21 10:08	962	147	314	2201	11.1	10.4	2194	13.7	13.6
3/25/21 10:09	966	148	311	2199	11.0	10.4	2195	13.7	13.6
3/25/21 10:10	980	150	311	2200	11.0	10.3	2195	13.7	13.6
3/25/21 10:11	967	146	311	2200	11.1	10.4	2199	13.7	13.6
3/25/21 10:12	976	148	312	2198	11.1	10.4	2208	13.8	13.7
3/25/21 10:13	969	150	310	2197	11.0	10.3	2198	13.7	13.6
3/25/21 10:14	979	149	310	2196	11.1	10.3	2202	13.8	13.6
3/25/21 10:15	980	148	307	2198	11.1	10.4	2199	13.8	13.6
3/25/21 10:16	963	149	308	2202	11.1	10.4	2195	13.8	13.7
3/25/21 10:17	982	149	307	2187	11.1	10.4	2202	13.8	13.7
3/25/21 10:18	965	149	308	2203	11.1	10.4	2195	13.7	13.6
3/25/21 10:19	974	145	307	2206	11.1	10.4	2202	13.7	13.6
3/25/21 10:20	959	147	307	2194	11.1	10.4	2200	13.8	13.6
3/25/21 10:21	977	147	306	2202	11.1	10.4	2200	13.8	13.7
3/25/21 10:22	966	145	306	2200	11.1	10.4	2199	13.7	13.6
3/25/21 10:23	980	145	305	2198	11.1	10.4	2197	13.8	13.7
3/25/21 10:24	974	149	306	2203	11.1	10.4	2199	13.8	13.7
3/25/21 10:25	977	149	308	2205	11.1	10.4	2199	13.8	13.7

## Appendix F

### Stack Test Plan



## Tom Kuchinski

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**From:** Place, Andrew (MPCA) <andrew.place@state.mn.us>  
**Sent:** Tuesday, March 24, 2020 9:16 AM  
**To:** Campbell, Stephani L  
**Cc:** Tom Kuchinski; Palzkill, Steven (MPCA)  
**Subject:** Test Plan Approval - SV051

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

**Include a copy of the Test Plan and this Test Plan Approval Email in the Final Report**

### Test Plan Approval Letter

Facility: US Steel – Keetac  
Address: PO Box 217, 1 Mine Road, Keewatin, MN 55753  
Contact Person/Phone: Stephani Campbell, Environmental Control (218-778-8684)  
Test Date: March 23, 2020  
Test Plan Submittal Date: January 24, 2020  
Pretest Meeting Date: March 17, 2020  
Units to be Tested: Waste Gas Stack (SV051/STRU 8) with scrubbers (CE110&111 / TREA 61&62) for PM, Opacity, CO, VOC, NOx and SO2  
Agency Interest ID: 142828

**Your test plan has been approved by the Minnesota Pollution Control Agency (MPCA) as follows:**

Test plan approved with the following provisions:

1. Testing requirements are not being waived at this time due to the pandemic. Facilities should submit administrative amendments for a deadline extension to comply with rule to the extent possible. Future policy or administrative direction may supersede current requirements and will be applied as directed.
2. In the event a test deadline cannot be met due to circumstances of the pandemic, please contact the MPCA to discuss and submit explanation of the details of the delay. The MPCA will review and provide further guidance based on the situation at the time. Additional information or documentation may be requested. Upon the underlying issue being resolved, testing shall be completed as approved.
3. US Steel has no intention to adjust operating limits based on the test. If operations fall outside the established range, contact the MPCA to discuss the situation. If US Steel determines it would like to adjust operating limits after the test is complete, please note within the test report and include the new rate on the summary referenced below.
4. Include in the executive summary of the test report an updated calculation of the affected source groups' flow weighted averages based on the results of this test.
5. Within the test report, supply a summary of the tested units current MACT operating limits either as a result of this test or based on previous testing
6. Include in the final test report all process and pollution control equipment operating data collected at 15 minute intervals (minimum) and averaged for each test run and test. This information must be clear easily understood by individuals not familiar with the process. All information needed to show process

operating rate and pollution control equipment compliant operation must be included. A link to reporting forms can be found below.

7. An acceptable report must comply with Minn. Rule 7017.2035 PERFORMANCE TEST REPORTING REQUIREMENTS. Use of the PTRCC form will help assure that a complete test report is submitted to the MPCA.

**In the event of a failure:**

**Please be aware that enforcement action will be taken for performance test failures, indicating emissions above applicable limits, which can include a monetary penalty. Upon discovery of the test failure, the Regulated Party must take immediate action to reduce emissions to remain in compliance with its permitted limits. The actions taken should be documented, as they will become part of the record of corrective actions. If a monetary penalty is required, the amount of time from the date of the failed test to the date of the passed test, or other compliance demonstration, will be taken into consideration. It is in the Regulated Party's best interest to demonstrate compliance with its permitted emissions limits through a passed retest or other compliance demonstration as soon as possible after a failed test.**

**All periods of noncompliance with emission limits must be reported to the MPCA, this includes any periods of engineering tests. The requirements outlined under the Notification of Deviations Endangering Human Health or the Environment, Minn. R. 7019.1000, subp. 1., shall be followed. This information should also be clearly stated and readily available in the executive summary of the test report.**

The following forms are available at <http://www.pca.state.mn.us/jsrid16>

Operating Data Summary – Combustion Sources

Operating Data Summary – Process Sources

Operating Data Summary – Asphalt Plants

Report Certifications Form

Performance Test Report Completeness Criteria (PTRCC)

**(Preferred)** Electronic copies of the test report submitted to [SubmitStackTest.PCA@state.mn.us](mailto:SubmitStackTest.PCA@state.mn.us)

**If an electronic copy of the complete test report is submitted the paper and CD copies are not required. Please follow requirements outlined in Method 1 of the document found at this link:**

**<https://www.pca.state.mn.us/sites/default/files/aq1-39.pdf>**

Hard Copy Performance Test Reports and Microfiche or CD Copy submittals will be addressed to:

Air Quality Compliance Tracking Coordinator

Industrial Division

Minnesota Pollution Control Agency

520 Lafayette Road North

St. Paul, Minnesota 55155-4194

**Andy Place** | State Program Administrator

Minnesota Pollution Control Agency (MPCA)

Industrial Division

520 Lafayette Road No. | St. Paul, Minnesota | 55155-4194

651-757-2652

Email | [andrew.place@state.mn.us](mailto:andrew.place@state.mn.us)

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U. S. Steel Corporation  
Keetac  
P. O. Box 217  
Keewatin, MN 55753  
218-778-8700

CERTIFIED MAIL # 7009 0820 0001 3944 5495

January 24, 2020

Andy Place  
North District, Major Facilities  
Minnesota Pollution Control Agency  
520 Lafayette Road  
St. Paul, Minnesota 55155-4194

Re: **U. S. Steel – Keetac**  
**Notification of Testing and Test Plan**

Dear Mr. Place,

This document is the Notification of Testing and Test Plan for a performance tests to be conducted on the Waste Gas (SV051).

The initial compliance determination for MACT has been conducted for the collectors. These performance tests are related to Air Emission Permit No. 13700063 (Title V permit).

## **TEST PLAN**

### **Part I. General Information**

(1) Name and address of the emission facility.

U. S. Steel – Keetac  
P.O. Box 217  
1 Mine Road  
Keewatin, Minnesota 55753

(2) Name, title, telephone and fax number of contact person at the emission facility.

Stephani Campbell  
Environmental Control  
Voice (218) 778-8684 Fax (218) 749-7360  
Electronic mail: scampbell@uss.com

(3) Permit number of name or other applicable document.

Title V Air Emissions Permit 13700063  
40 CFR Part 63 Subpart RRRRR – National Emission Standards for Hazardous Air  
Pollutants: Taconite Iron Ore Processing

(4) Reasons for testing.

For SV051 determination of PM, PM10, NOx, SO2, CO, VOC and Opacity for the Title V Permit and Hg for MN Rule MN 7019.3050

(5) Schematic drawing of the stacks and sample ports.

Enclosed herein.

(6) Location of Plant

Within the corporate limits of the city of Keewatin, MN.

(7) Name, contact person, telephone and fax number for testing company

Barr Engineering, Minneapolis, MN.  
Tom Kuchinski  
Voice (952) 832-2727 Fax (952) 832-2996

**Part II. Testing Requirements**

- (1) List of emission unit, pollutants to be tested, the emission limit for each pollutant and the applicable rule or regulation for the emission limit.

**Waste Gas Stack (SV051)**

**Particulate Matter**

Emission limit Minn. R 7011.0715 subp. 1(A)  
0.3 grains/dscf or the less stringent of 7011.0730 or 7011.0735

**Opacity**

Less than or equal to 20%. Minn. R 7011.0715 subp. 1(B)

Filterable portion PM limit of 0.01 gr/dscf from 40 CFR Part 63 Subpart RRRRR Table 1

**Carbon monoxide:**

Less than or equal to 123 tons/yr using a 12-month rolling sum.

**Volatile organic compounds:**

Less than or equal to 75 tons/yr using a 12-month rolling sum.

**Nitrogen oxides:**

Less than or equal to 6076 tons/year using a 12-month rolling

**Sulfur dioxides:**

Less than or equal to 951 tons/yr using a 12-month rolling sum.

- (2) Description of procedure for fuel sampling and analysis, where applicable.

Fuel will likely be natural gas for SV051.

**Part III. Operating Conditions**

- (1) List the process or operating rate and conditions of the process equipment and the air pollution control equipment for the test.

All tests will be performed while the associated process equipment is operating normally. All control equipment will be operated normally and greater than 90 percent of maximum throughput.

- (2) Explanation of why the proposed conditions are considered to be in accordance with Part 7017.2025, Subpart 2, for required testing conditions.

The statement about the assumption of worst-case conditions in the cited subpart applies.

- (3) List the range of process or operating rates for the emission units.

Dust Collector	CE#	SV#	Process Description	Estimated Process Rate (LTPH)
4A-04-62/4A-04-63	110/111	051	Waste Gas	0-950 (Greenballs)

- (4) Descriptions of how air pollution control and process equipment will be monitored.

The dust collectors will be monitored for pressure drop and water flow during all three runs. Process rates will be monitored during all three test runs at each location.

**Part IV. Test Methods**

- (1) List of the methods to be used to determine the emission rate of each pollutant.

Test Port Location	EPA Method 1
Determination of velocity and volumetric flow	EPA Method 2
Determination of gas molecular weight	EPA Method 3
Determination of moisture content	EPA Method 4
Determination of PM	EPA Method 5
Determination of Condensable PM	EPA Method 202*
Opacity	EPA Method 9

Determination of SO<sub>2</sub>  
Determination of NO<sub>x</sub>  
Determination of CO  
Determination of VOC  
Determination of Hg  
\*Original Method

CEMS / RATA Results  
CEMS / RATA Results  
EPA Method 10  
EPA Method 25A  
Method 29

- (2) Number of test runs, length of the test runs, and sampling rate for each method.

Tests will be performed in accordance with the EPA Methods given above, three two-hour runs will be conducted for PM.

- (3) Reference to any compliance document, federal regulation, or Minnesota rule or statute requiring use of specific methods or procedures.

Applicable test methods are listed above.

- (4) Summary of reasons for proposing to use alternative or equivalent method.

For EPA Method 202, propose using original method, with the exception of using hexane instead of the methylene chloride.

The post test dry gas meter calibration check will be done using the alternative approach listed in EPA Method 5.

- (5) For test methods other than reference methods, statement of the detection limit and the degree of accuracy of that method at the expected emission rate and under the conditions of the performance test.

Not applicable

#### **Test Schedule and Pretest Meeting**

Testing for SV051 will occur the week of March 23, 2020. At the preference of the MPCA, we would suggest the pretest meeting could occur the week prior to when the testing begins and be conducted via telephone.

### Closing Remarks

If there are any questions or comments on the information given in this document, please contact me at the telephone number listed above.



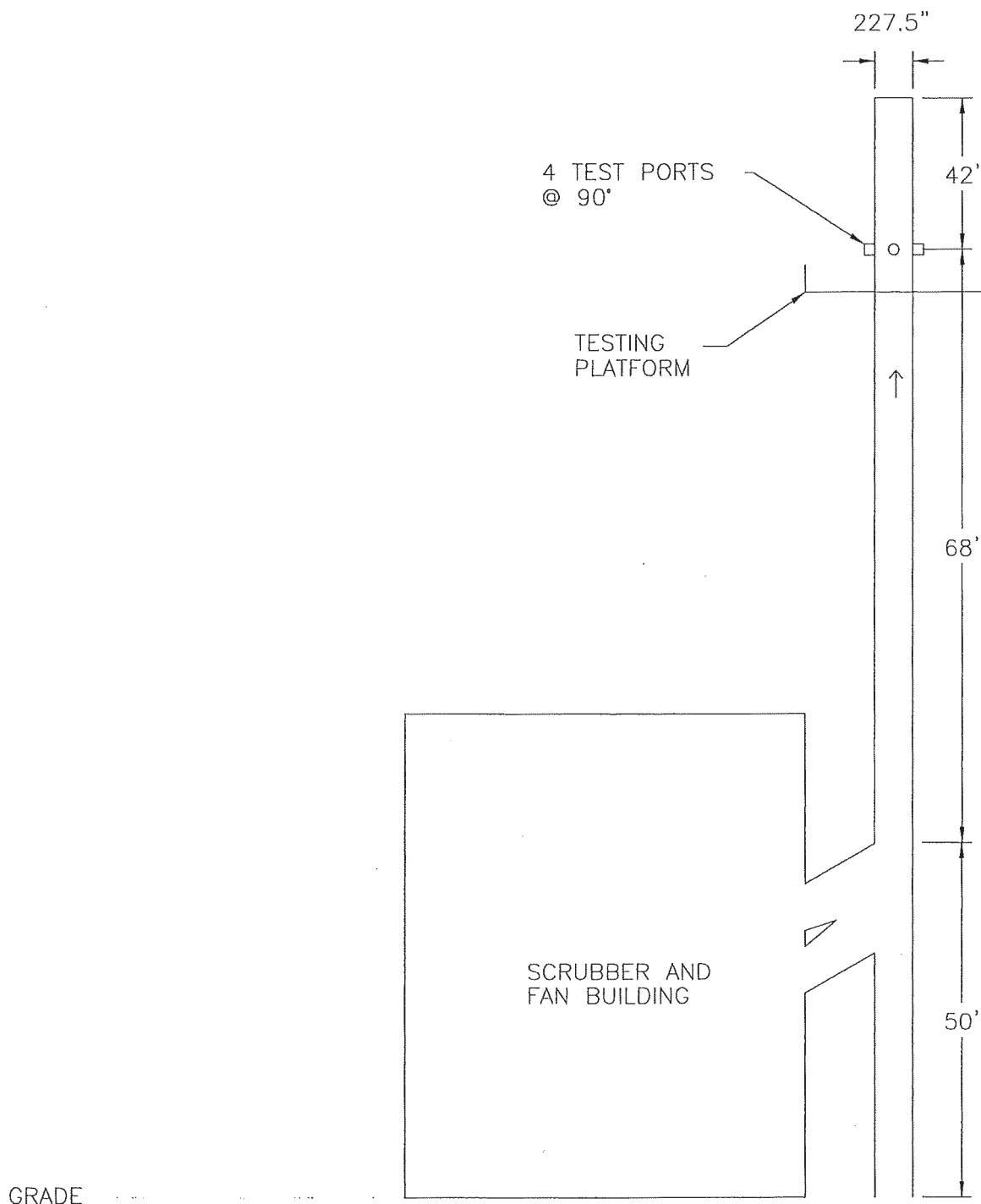
Stephani Campbell  
Environmental Control  
U. S. Steel – Minnesota Ore Operations

### Enclosures:

Waste Gas (SV051)

cc: Steve Palzkill – MPCA  
Tom Kuchinski – Barr Engineering





TEST PORT LOCATIONS  
KEEWATIN TACONITE  
KEEWATIN, MINNESOTA  
PHASE II WASTE GAS STACK (SV051)

NOT TO SCALE

FIGURE 3

## Appendix G

### Project Participants and Contact Information

# Project Participants and Contact Information

## Minnesota Pollution Control Agency

Andrew Place – State Program Administrator Principal

## U.S. Steel Corporation – Keewatin Taconite

Stephani Campbell – Environmental Control Engineer

## Barr Engineering Co.

Tom Kuchinski – Vice President/Stack Testing Services Coordinator

Dan Koschak – Senior Air Quality Technician/Project Manager

Ryan Pantzke – Air Quality Technician

## CONTACT INFORMATION

<b>MPCA</b> Andrew Place State Program Administrator Principal Minnesota Pollution Control Agency 520 Lafayette Rd. N. Saint Paul, Minnesota 55155 (651) 757-2757 <a href="mailto:Andrew.Place@state.mn.us">Andrew.Place@state.mn.us</a>	<b>U. S. Steel Corporation —Keetac</b> Stephani Campbell Environmental Control Engineer U. S. Steel—Keetac P.O. Box 217 Keewatin, MN 55753 (218) 778-8684 <a href="mailto:scampbell@uss.com">scampbell@uss.com</a>	<b>Barr Engineering Co.</b> Tom Kuchinski Stack Testing Services Coordinator Barr Engineering Co. 4300 MarketPointe Dr. Minneapolis, MN 55435 (952) 832-2727 <a href="mailto:tkuchinski@barr.com">tkuchinski@barr.com</a>
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