

Velocity Calculation (USEPA Method 2, Eq. 2-7)

Average Pitot differential pressure (Δp):	<u>1.31 in.H₂O</u>
Average stack temperature (T_s):	<u>741 °R</u>
Measured Stack Static Pressure (P_g):	<u>0.5 in.H₂O</u>
Barometric Pressure (P_{bar}):	<u>29.85 in.Hg</u>

$$V_S = K_p C_p \sqrt{\Delta p_{avg}} \sqrt{\frac{T_{s(abs)}}{P_S M_S}}$$

$$P_S = P_{bar} + P_g$$

Where:

$$V_s = \text{Velocity, } \frac{ft}{sec}$$

$$K_p = \text{Velocity equation constant } 85.49 \frac{ft}{sec} \left[\frac{\left(\frac{lb}{lb-mole} \right) (in.Hg)}{(^{\circ}R)(in.H_2O)} \right]^{\frac{1}{2}}$$

C_p = Pitot tube coefficient = 0.84 (dimensionless)

Δp = Measured velocity head in.H₂O

T_s = Average Stack temperature, °R

P_s = Absolute Stack Pressure, in.Hg

M_s = Molecular weight of the Stack gas (wet)

P_{bar} = Barometric Pressure in inches of Hg

P_g = Static Pressure of stack, in.H₂O

$$1 \text{ in.H}_2\text{O} = 0.0736 \text{ in.Hg}$$

$$P_S = 29.85 \text{ in.Hg} + \left(0.5 \text{ in.H}_2\text{O} \left(0.0736 \frac{\text{in.Hg}}{\text{in.H}_2\text{O}} \right) \right) = 29.887 \text{ in.Hg}$$

$$V_S = 85.49 \frac{ft}{sec} \left[\frac{\left(\frac{lb}{lb-mole} \right) (in.Hg)}{(^{\circ}R)(in.H_2O)} \right]^{\frac{1}{2}} 0.84 \sqrt{1.31 \text{ in.H}_2\text{O}} \sqrt{\frac{741^{\circ}R}{(29.887 \text{ in.Hg}) \left(28.5783 \frac{lb}{lb-mole} \right)}}$$

$$V_S = 76.569 \frac{ft}{sec}$$

Note: Any small differences between the example calculations and the spreadsheets are due to rounding.

Example Calculations | 5

Volumetric Calculation (USEPA Method 2, Eq. 2-8)

Stack Diameter: 8.00 ft
Stack Area: 50.27 ft²
Absolute stack temperature: 741.04 °R

$$Q_{sd} = 60(1 - B_{ws})V_s A \left[\frac{T_{std}P_s}{T_{s(abs)}P_{std}} \right]$$

Where:

Q_{sd} = Dry volumetric stack gas flow rate corrected to standard conditions (dscf/min)
 B_{ws} = Volume of water vapor in stack gas
 V_s = Average velocity (ft/sec)
 A = Stack cross sectional area (ft²)
 T_{STD} = Standard absolute temperature, 530°R
 P_{STD} = Standard absolute pressure, 29.92 in Hg
 $T_{S(abs)}$ = Absolute stack temperature, °R

$$Q_{sd} = 60(1 - 0.1018) \left(76.569 \frac{ft}{sec} \right) (50.27 ft^2) \left[\frac{(530^\circ R)(29.887 in. Hg)}{(741.04^\circ R)(29.92 in. Hg)} \right]$$

$$Q_{sd} = 148,197.58 \frac{dscf}{min}$$

Emission Calculations

SO₂ dry volumetric Concentration ($C_{D(NO_x)}$): 60.214 dppmv
Fuel Consumption (FC_{gal} or FC_{MMBtu}): 528.18 MMBtu/hr

$$E_{SO_2} = \frac{Q_{sd}}{386.3} (C_{D(SO_2)} * 1 \times 10^{-6}) MW_{SO_2} * 60 \frac{hr}{min}$$

$$E_{SO_2} = \frac{148197.58 \frac{dscf}{min}}{386.3} (60.214 dppmv * 1 \times 10^{-6} Btu) 64 \frac{g}{mol} * 60 \frac{hr}{min} = 88.7 \frac{lb}{hr}$$

Conversions:

$$\frac{E_{SO_2}}{FC_{MMBtu}} = \frac{88.7 \frac{lb}{hr}}{528.18 \frac{MMBTU}{hr}} = 0.167 \frac{lb}{MMBTU}$$

Note: Any small differences between the example calculations and the spreadsheets are due to rounding.

Example Calculations | 6

Mass Emissions Estimates
From 40 CFR 60, App. A-7, Method 19
Aurora Energy, LLC
Common Stack, Run 1

SO2 dry volumetric Concentration ($C_{D(SO_2)}$):	<u>60.214 dppmv</u>
Fuel Consumption (FC_{gal} or FC_{MMBtu}):	<u>528.18 MMBtu/hr</u>
Stack Oxygen ($\%O_{2d}$):	<u>8.622 %</u>
Table 19-2, F factor for Bituminous Coal, (F_d):	<u>9656 dscf/ 10^6 Btu</u>

Pollutant concentration, dry basis, conversion to lb/scf (USEPA Method 19, Table 19-1):

$$C_d = C_{D(SO_2)} * 1.194 \times 10^{-7}$$

$$C_d = 60.214 dppmv * 1.660 \times 10^{-7} = 9.996 \times 10^{-6} \frac{lb}{scf}$$

Emission Calculations: Oxygen-Based F Factor (USEPA Method 19, Eq. 19-1)

$$E_{SO_2} = C_d F_d \frac{20.9}{(20.9 - \%O_{2d})} * FC_{MMBtu}$$

$$E_{SO_2} = 9.996 \times 10^{-6} \frac{lb}{scf} \left(9656 \frac{dscf}{1 \times 10^6 Btu} \right) \frac{20.9}{20.9 - 8.622\%} * \left(528.18 \frac{MMBtu}{hr} \right)$$

$$E_{SO_2} = 86.777 \frac{lb}{hr}$$

Conversions:

$$\frac{E_{SO_2}}{FC_{MMBtu}} = \frac{86.777 \frac{lb}{hr}}{528.18 \frac{MMBtu}{hr}} = 0.164 \frac{lb}{MMBtu}$$

Note: Any small differences between the example calculations and the spreadsheets are due to rounding.

Example Calculations | 7

Appendix B

Analyzer Data and Bias Corrections

aurora 2021 so2.csv "MDY4c./:"

10/12/2021 15:13

; 10/12/2021 10:33:04 ""

1

TIME	CO2	O2	SO2		
10/12/2021 10:56	-0.0355	0.019849	95.5759		
10/12/2021 10:56	-0.06523	-0.01209	98.5815		
10/12/2021 10:57	-0.064	-0.02109	98.0695		
10/12/2021 10:57	-0.06312	-0.02286	99.0813	CO2 Zero	O2 Zero
10/12/2021 10:58	-0.06646	-0.02692	98.0736		
10/12/2021 10:58	-0.06681	-0.03451	101.07	SO2 Span	
10/12/2021 10:59	-0.06576	-0.03963	100.08		
10/12/2021 10:59	-0.06417	-0.04351	100.081		
10/12/2021 11:00	1.23129	5.2601	81.0546		
10/12/2021 11:00	9.90136	10.0108	12.4964		
10/12/2021 11:01	9.95766	10.0463	3.49962		
10/12/2021 11:01	9.96329	10.0491	1.99099	O2 Span	
10/12/2021 11:02	9.97649	10.0542	1.49179		
10/12/2021 11:02	9.99215	10.0533	0.992329		
10/12/2021 11:03	9.9969	10.0526	0.990982	CO2 Span	
10/12/2021 11:03	6.4573	12.4709	0.990443	SO2 Zero	
10/12/2021 11:04	0.077811	20.9256	9.99387		
10/12/2021 11:04	0.033121	20.9788	13.4956		
10/12/2021 11:05	0.031714	20.9912	7.99709		
10/12/2021 11:05	0.022741	20.9894	4.99087		
10/12/2021 11:06	0.010249	20.993	4.00003		
10/12/2021 11:14	10.7151	9.91073	8.49467		
10/12/2021 11:14	10.9253	8.98967	69.5456		
10/12/2021 11:15	11.1606	8.7013	59.5468		
10/12/2021 11:15	11.1542	8.77895	54.5407		
10/12/2021 11:19	10.9545	8.86031	52.1831		
Run 1					
10/12/2021 11:20	11.2917	8.51441	54.9395		
10/12/2021 11:20	11.3802	8.37305	55.5659		
10/12/2021 11:21	11.431	8.34763	56.0388		
10/12/2021 11:21	11.3094	8.66971	54.0315		
10/12/2021 11:22	11.0001	8.80207	53.5317		
10/12/2021 11:22	11.0847	8.68648	55.0405		
10/12/2021 11:23	11.1972	8.82095	55.5417		
10/12/2021 11:23	11.1027	8.81178	55.5417		
10/12/2021 11:24	11.0749	8.76942	56.5372		
10/12/2021 11:24	11.1731	8.82184	56.5372		
10/12/2021 11:25	11.4162	8.40499	58.5459		
10/12/2021 11:25	11.4166	8.52888	58.5459		
10/12/2021 11:26	11.3422	8.43234	59.5455		
10/12/2021 11:26	11.3318	8.7066	57.5382		
10/12/2021 11:27	11.2202	8.81901	57.0384		

TIME	CO2	O2	SO2
10/12/2021 11:27	11.1203	8.84249	56.5386
10/12/2021 11:28	11.08	8.85113	57.0397
10/12/2021 11:28	11.2341	8.54158	58.5459
10/12/2021 11:29	11.3729	8.39705	60.5384
10/12/2021 11:29	11.4792	8.62506	59.0443
10/12/2021 11:30	11.193	8.75177	57.5368
10/12/2021 11:30	11.1713	8.81548	57.0384
10/12/2021 11:31	11.089	8.91996	57.5382
10/12/2021 11:31	11.2734	8.531	60.048
10/12/2021 11:32	11.3939	8.40975	60.5424
10/12/2021 11:32	11.4307	8.33916	62.0418
10/12/2021 11:33	11.5024	8.24316	62.5497
10/12/2021 11:33	11.5851	8.4747	61.0395
10/12/2021 11:34	11.4438	8.49623	61.5393
10/12/2021 11:34	11.3904	8.63636	61.0382
10/12/2021 11:35	11.232	8.80913	60.0453
10/12/2021 11:35	11.1432	8.87955	60.0453
10/12/2021 11:36	11.0295	8.89049	60.0453
10/12/2021 11:36	11.2551	8.53947	61.542
10/12/2021 11:37	11.2869	8.54653	61.0409
10/12/2021 11:37	11.3073	8.52923	60.5397
10/12/2021 11:38	11.3397	8.43781	62.0418
10/12/2021 11:38	11.4007	8.64871	60.5397
10/12/2021 11:39	11.2579	8.73289	60.0466
10/12/2021 11:39	11.1741	8.87531	59.5468
10/12/2021 11:40	11.0811	8.62189	60.5397
10/12/2021 11:40	11.3376	8.51688	62.0418
10/12/2021 11:41	11.3532	8.34622	61.0422
10/12/2021 11:41	11.4183	8.38346	62.0405
10/12/2021 11:42	11.2091	8.76342	59.5455
10/12/2021 11:42	10.9931	8.93514	58.038
10/12/2021 11:43	10.9843	8.85537	58.5445
10/12/2021 11:43	11.0714	8.96902	59.5468
10/12/2021 11:44	11.0394	8.64677	60.541
10/12/2021 11:44	11.1521	8.75054	59.5468
10/12/2021 11:45	11.1347	8.76995	59.5468
10/12/2021 11:45	11.1398	8.72195	60.0453
10/12/2021 11:46	11.1534	8.75848	60.0453
10/12/2021 11:46	11.3751	8.39758	63.0482
10/12/2021 11:47	11.4315	8.30951	63.0482
10/12/2021 11:47	11.4984	8.40093	62.547
10/12/2021 11:48	11.4437	8.51741	62.0418
10/12/2021 11:48	11.3726	8.43764	63.0482
10/12/2021 11:49	11.4169	8.3734	62.5511
10/12/2021 11:49	11.4836	8.4357	62.5497
10/12/2021 11:50	11.4271	8.53311	62.0432

TIME	CO2	O2	SO2
10/12/2021 11:50	11.3455	8.40534	63.0482
10/12/2021 11:51	11.4664	8.26875	65.5472
10/12/2021 11:51	11.538	8.32663	64.5462
10/12/2021 11:52	11.4903	8.57265	63.0495
10/12/2021 11:52	11.3606	8.6083	61.0409
10/12/2021 11:53	11.4358	8.30051	62.0418
10/12/2021 11:53	11.6261	8.23345	64.5462
10/12/2021 11:54	11.2218	8.5707	62.5497
10/12/2021 11:54	11.2744	8.80242	60.5384
10/12/2021 11:55	10.9116	9.07668	58.5472
10/12/2021 11:55	10.8613	8.99514	59.5468
10/12/2021 11:56	10.8872	8.8739	59.5482
10/12/2021 11:56	11.0202	8.69654	59.5482
10/12/2021 11:57	11.3342	8.47452	62.0445
10/12/2021 11:57	11.3529	8.49499	62.0432
10/12/2021 11:58	11.3726	8.3974	61.542
10/12/2021 11:58	11.4419	8.37975	63.552
10/12/2021 11:59	11.3374	8.60882	62.0391
10/12/2021 11:59	11.2484	8.579	62.0391
10/12/2021 12:00	11.2809	8.67218	62.0391
10/12/2021 12:00	11.2507	8.57265	62.0418
10/12/2021 12:01	11.2859	8.56965	61.5393
10/12/2021 12:01	11.2948	8.63547	61.0422
10/12/2021 12:02	11.2473	8.55447	61.0409
10/12/2021 12:02	11.2772	8.5287	61.0409
10/12/2021 12:03	11.3534	8.68559	61.0382
10/12/2021 12:03	11.1801	8.85784	61.0422
10/12/2021 12:04	11.0619	8.9729	59.0443
10/12/2021 12:04	10.9771	8.75019	60.5384
10/12/2021 12:05	11.1697	8.62912	61.0395
10/12/2021 12:05	11.2767	8.43711	63.0509
10/12/2021 12:06	11.3867	8.50699	63.0495
10/12/2021 12:06	11.1567	8.81725	60.5424
10/12/2021 12:07	11.042	8.94855	59.5468
10/12/2021 12:07	10.9823	8.9782	59.5468
10/12/2021 12:08	10.9637	8.79731	61.0409
10/12/2021 12:08	11.1405	8.63724	62.0418
10/12/2021 12:09	11.2653	8.42423	63.0495
10/12/2021 12:09	11.3654	8.45123	63.5493
10/12/2021 12:10	11.4152	8.52164	62.5497
10/12/2021 12:10	11.3335	8.42175	62.5497
10/12/2021 12:11	11.424	8.52006	62.0418
10/12/2021 12:11	11.3641	8.51088	63.5507
10/12/2021 12:12	11.3437	8.55182	63.5493
10/12/2021 12:12	11.3311	8.43905	63.5507
10/12/2021 12:13	11.0388	8.7643	60.541

TIME	CO2	O2	SO2
10/12/2021 12:13	11.3147	8.45352	61.5434
10/12/2021 12:14	11.3657	8.57317	62.0432
10/12/2021 12:14	11.3017	8.63318	61.5434
10/12/2021 12:15	11.2303	8.82625	61.0422
10/12/2021 12:15	11.0751	8.82484	59.047
10/12/2021 12:16	11.027	8.71895	59.5468
10/12/2021 12:16	11.1157	8.62559	61.5407
10/12/2021 12:17	11.2976	8.43128	63.5493
10/12/2021 12:17	11.3909	8.43058	63.0495
10/12/2021 12:18	11.4194	8.5107	61.0422
10/12/2021 12:18	11.3478	8.49129	61.542
10/12/2021 12:19	11.3566	8.32751	62.5524
10/12/2021 12:19	11.674	8.0965	65.5512
10/12/2021 12:20	11.6946	8.19956	64.5489
10/12/2021 12:20	11.4027	8.51353	63.0495
End Run 1	11.272	8.600	60.641
10/12/2021 12:21	11.3756	8.51794	62.5524
10/12/2021 12:21	5.55242	8.81848	55.5417
10/12/2021 12:22	0.073237	0.01332	210.65
10/12/2021 12:22	0.021685	-0.01827	229.14
10/12/2021 12:23	1.66252	2.41505	158.092
10/12/2021 12:23	2.20E-04	-0.03998	103.08
10/12/2021 12:24	-0.01685	-0.05021	100.573
10/12/2021 12:24	-0.01579	-0.05674	100.577
10/12/2021 12:25	-0.02459	-0.05798	101.075
10/12/2021 12:25	-0.03268	-0.05816	101.075
10/12/2021 12:26	6.86302	3.70371	116.096
10/12/2021 12:26	9.86177	9.74113	29.0183
10/12/2021 12:27	9.9647	10.0113	5.99492
10/12/2021 12:27	9.97385	10.0198	3.50339
10/12/2021 12:28	9.97807	10.0258	2.50379
10/12/2021 12:28	9.99004	10.027	1.99786
10/12/2021 12:29	10.0004	10.0249	1.49651
10/12/2021 12:29	10.0113	10.0316	1.49732
Run 2			
10/12/2021 12:30	11.4319	8.44576	52.5388
10/12/2021 12:30	11.3833	8.4717	64.5503
10/12/2021 12:31	11.3805	8.47929	67.0574
10/12/2021 12:31	11.3765	8.40499	66.5576
10/12/2021 12:32	11.4282	8.39228	67.5585
10/12/2021 12:32	11.459	8.57035	66.0497
10/12/2021 12:33	11.345	8.65736	63.0549
10/12/2021 12:33	11.1796	8.85043	61.5461
10/12/2021 12:34	11.0682	8.92649	60.0507
10/12/2021 12:34	10.979	8.79519	61.5447

TIME	CO2	O2	SO2
10/12/2021 12:35	11.0464	8.8169	63.5534
10/12/2021 12:35	11.0925	8.70024	65.5512
10/12/2021 12:36	11.1523	8.81248	62.0445
10/12/2021 12:36	11.1136	8.59276	63.0549
10/12/2021 12:37	11.2171	8.54741	63.5547
10/12/2021 12:37	11.2999	8.42387	64.553
10/12/2021 12:38	11.3997	8.49517	64.5543
10/12/2021 12:38	11.0457	8.9272	62.0499
10/12/2021 12:39	10.8041	9.18468	60.0507
10/12/2021 12:39	10.7374	9.04297	59.0511
10/12/2021 12:40	10.9275	8.85519	60.5438
10/12/2021 12:40	11.0754	8.67624	61.5461
10/12/2021 12:41	11.2647	8.4717	62.5537
10/12/2021 12:41	11.4199	8.35522	63.5547
10/12/2021 12:42	11.0014	9.00679	62.0485
10/12/2021 12:42	10.8974	8.9279	60.052
10/12/2021 12:43	10.8937	9.18009	59.5522
10/12/2021 12:43	10.7135	9.26763	57.5449
10/12/2021 12:44	10.8122	8.96443	58.5499
10/12/2021 12:44	11.1467	8.65065	61.5447
10/12/2021 12:45	11.4099	8.38805	62.5537
10/12/2021 12:45	11.4264	8.39669	64.5503
10/12/2021 12:46	11.4324	8.56453	62.5551
10/12/2021 12:46	11.317	8.62488	62.0472
10/12/2021 12:47	11.1567	8.86049	60.5464
10/12/2021 12:47	11.0913	8.62753	63.0549
10/12/2021 12:48	11.1521	8.62524	66.0524
10/12/2021 12:48	11.2304	8.55606	67.0587
10/12/2021 12:49	11.2577	8.50117	69.0472
10/12/2021 12:49	11.3122	8.53965	68.0583
10/12/2021 12:50	11.2547	8.47947	67.5585
10/12/2021 12:50	11.2941	8.49482	65.0528
10/12/2021 12:51	11.3545	8.42123	65.5526
10/12/2021 12:51	11.3923	8.636	64.0545
10/12/2021 12:52	11.1384	8.79889	62.0459
10/12/2021 12:52	10.6685	9.22757	59.0497
10/12/2021 12:53	10.6884	9.15274	58.5499
10/12/2021 12:53	10.8843	8.89525	58.5499
10/12/2021 12:54	11.1813	8.59877	60.5464
10/12/2021 12:54	11.5243	8.27669	64.553
10/12/2021 12:55	11.5487	8.17962	65.5526
10/12/2021 12:55	11.6098	8.15439	65.5539
10/12/2021 12:56	11.6692	8.37164	64.0532
10/12/2021 12:56	11.4067	8.58624	61.5461
10/12/2021 12:57	11.307	8.69159	61.5461
10/12/2021 12:57	11.1481	8.85325	61.0436

TIME	CO2	O2	SO2
10/12/2021 12:58	11.0371	9.07968	61.5461
10/12/2021 12:58	10.8902	9.13509	59.5509
10/12/2021 12:59	10.9938	8.78636	60.0507
10/12/2021 12:59	11.1683	8.62506	60.5464
10/12/2021 13:00	11.2735	8.44134	64.0545
10/12/2021 13:00	11.3648	8.48141	66.051
10/12/2021 13:01	11.3942	8.53117	66.051
10/12/2021 13:01	11.0631	8.93602	62.5524
10/12/2021 13:02	10.9517	9.03344	61.5447
10/12/2021 13:02	10.9074	9.1628	59.0511
10/12/2021 13:03	10.7751	9.03838	59.0511
10/12/2021 13:03	11.0717	8.73236	61.5474
10/12/2021 13:04	11.1636	8.58235	61.5474
10/12/2021 13:04	11.4072	8.33175	64.0545
10/12/2021 13:05	11.4734	8.36863	65.0514
10/12/2021 13:05	11.3657	8.61271	62.5537
10/12/2021 13:06	11.1734	8.79289	60.5438
10/12/2021 13:06	11.1059	8.81072	60.0493
10/12/2021 13:07	11.1099	8.61412	62.5537
10/12/2021 13:07	11.326	8.42828	65.5499
10/12/2021 13:08	11.3839	8.40058	66.0497
10/12/2021 13:08	11.4595	8.45052	64.5516
10/12/2021 13:09	11.3951	8.585	62.0445
10/12/2021 13:09	10.938	9.0052	59.5495
10/12/2021 13:10	10.9929	8.72989	61.5447
10/12/2021 13:10	11.1861	8.71401	62.0432
10/12/2021 13:11	11.1998	8.7546	61.5434
10/12/2021 13:11	11.1528	8.91784	60.5438
10/12/2021 13:12	10.9663	9.05832	59.0511
10/12/2021 13:12	10.8861	9.02267	58.5513
10/12/2021 13:13	10.8727	9.03132	59.0524
10/12/2021 13:13	11.0853	8.67095	60.5424
10/12/2021 13:14	11.2197	8.64659	61.0436
10/12/2021 13:14	11.2229	8.72354	61.0436
10/12/2021 13:15	11.1669	8.62665	61.5434
10/12/2021 13:15	11.1755	8.88943	59.5482
10/12/2021 13:16	11.0462	8.96073	58.5486
10/12/2021 13:16	10.9588	8.99655	59.0497
10/12/2021 13:17	11.181	8.62082	60.5451
10/12/2021 13:17	11.2415	8.60388	61.0462
10/12/2021 13:18	11.2598	8.56788	61.5447
10/12/2021 13:18	11.282	8.72883	60.0493
10/12/2021 13:19	11.1497	8.83454	60.541
10/12/2021 13:19	11.1291	8.60777	61.0422
10/12/2021 13:20	11.2223	8.62506	62.0445
10/12/2021 13:20	11.2218	8.81443	59.5495

TIME	CO2	O2	SO2
10/12/2021 13:21	11.1263	8.86137	59.0497
10/12/2021 13:21	10.6123	9.36099	59.5522
10/12/2021 13:22	10.7791	9.0495	59.0538
10/12/2021 13:22	10.8463	8.95614	59.0484
10/12/2021 13:23	10.9502	8.77489	59.5482
10/12/2021 13:23	11.1159	8.59947	61.0422
10/12/2021 13:24	11.2389	8.52235	62.5497
10/12/2021 13:24	11.6763	8.06491	65.0487
10/12/2021 13:25	11.7609	8.12492	66.5562
10/12/2021 13:25	11.5814	8.42034	64.0505
10/12/2021 13:26	11.212	8.72654	61.5434
10/12/2021 13:26	11.0239	9.01738	60.5424
10/12/2021 13:27	10.9477	8.84866	59.0497
10/12/2021 13:27	11.0767	8.69724	60.5424
10/12/2021 13:28	11.2294	8.48194	62.0418
10/12/2021 13:28	11.4987	8.30175	63.5507
10/12/2021 13:29	11.5294	8.3261	63.552
10/12/2021 13:29	11.5366	8.38222	64.0518
10/12/2021 13:30	11.4797	8.543	63.0522
10/12/2021 13:30	11.364	8.60865	61.5447
End Run 2	11.185	8.690	62.107
10/12/2021 13:31	11.2792	8.51935	63.0509
10/12/2021 13:41	0.083969	0.010849	84.564
10/12/2021 13:41	0.028899	-0.03398	94.0711 O2 Zero
10/12/2021 13:42	0.023445	-0.04474	97.5765
10/12/2021 13:42	0.012537	-0.04315	99.084
10/12/2021 13:43	-1.36E-03	-0.04633	99.5838
10/12/2021 13:43	-0.01069	-0.05074	100.575
10/12/2021 13:44	-0.0172	-0.05657	101.075
10/12/2021 13:44	-0.02512	-0.06133	100.575 CO2 Zero
10/12/2021 13:45	-0.02652	-0.06116	101.076 SO2 Span
10/12/2021 13:45	-0.03127	-0.05692	101.072
10/12/2021 13:46	9.16241	5.8049	113.085
10/12/2021 13:46	9.87251	9.78701	35.5346
10/12/2021 13:47	9.9654	10.0051	6.99937
10/12/2021 13:47	9.97579	10.0186	3.50487
10/12/2021 13:48	9.98405	10.0175	2.50433
10/12/2021 13:48	10.0001	10.0207	1.99503 CO2 Span
10/12/2021 13:49	10.011	10.0253	1.49408 O2 Span
10/12/2021 13:49	10.0141	10.0242	1.49395 SO2 Zero
Run 3			
10/12/2021 13:50	11.1331	8.77648	29.5222
10/12/2021 13:50	11.4342	8.40269	63.5507
10/12/2021 13:51	11.7199	8.02714	69.5483
10/12/2021 13:51	11.9477	7.85031	72.0554

TIME	CO2	O2	SO2
10/12/2021 13:52	11.5635	8.3314	69.0472
10/12/2021 13:52	10.9354	8.9782	63.0535
10/12/2021 13:53	10.707	9.2288	60.0507
10/12/2021 13:53	10.6919	9.04862	59.0511
10/12/2021 13:54	11.2359	8.60035	62.0432
10/12/2021 13:54	11.3745	8.41611	63.0509
10/12/2021 13:55	11.4014	8.44752	65.0487
10/12/2021 13:55	11.1236	8.84478	63.552
10/12/2021 13:56	10.5969	9.31157	60.5438
10/12/2021 13:56	10.6189	9.24627	60.052
10/12/2021 13:57	10.6475	9.14391	61.0462
10/12/2021 13:57	11.0865	8.70501	62.5524
10/12/2021 13:58	11.5652	8.22639	65.5499
10/12/2021 13:58	11.6173	8.2098	69.0445
10/12/2021 13:59	11.403	8.53965	67.5572
10/12/2021 13:59	11.1637	8.76766	65.0487
10/12/2021 14:00	11.1303	8.76201	63.5534
10/12/2021 14:00	11.105	8.68771	63.0522
10/12/2021 14:01	11.1579	8.56965	63.5534
10/12/2021 14:01	11.3701	8.31446	63.5534
10/12/2021 14:02	11.498	8.30951	66.5576
10/12/2021 14:02	11.5338	8.47788	65.5512
10/12/2021 14:03	11.4095	8.63547	65.5499
10/12/2021 14:03	11.152	8.85043	62.5511
10/12/2021 14:04	11.0863	8.79572	61.5447
10/12/2021 14:04	11.0809	8.74066	62.0445
10/12/2021 14:05	11.1317	8.68948	62.0459
10/12/2021 14:05	11.2473	8.52588	64.5516
10/12/2021 14:06	11.3244	8.50329	65.5485
10/12/2021 14:06	11.3749	8.57812	65.0487
10/12/2021 14:07	11.3745	8.31745	65.0487
10/12/2021 14:07	11.6532	8.16462	66.0483
10/12/2021 14:08	11.6724	8.37746	65.5499
10/12/2021 14:08	11.5529	8.44699	65.0501
10/12/2021 14:09	11.4576	8.59577	64.5503
10/12/2021 14:09	11.3568	8.52447	65.5499
10/12/2021 14:10	11.4014	8.49323	68.546
10/12/2021 14:10	11.5135	8.28251	70.0468
10/12/2021 14:11	11.5464	8.2068	70.0454
10/12/2021 14:11	11.6189	8.39617	69.547
10/12/2021 14:12	11.1616	8.80842	68.0556
10/12/2021 14:12	10.9118	9.07085	64.5489
10/12/2021 14:13	10.8002	9.16633	66.0497
10/12/2021 14:13	10.7586	8.99814	66.0483
10/12/2021 14:14	11.2114	8.59947	66.051
10/12/2021 14:14	11.3233	8.56929	66.5589

TIME	CO2	O2	SO2
10/12/2021 14:15	11.239	8.79872	63.5534
10/12/2021 14:15	11.1307	8.73871	62.5524
10/12/2021 14:16	11.1477	8.76466	62.0432
10/12/2021 14:16	11.1368	8.66653	63.5507
10/12/2021 14:17	11.2028	8.81107	62.0459
10/12/2021 14:17	11.1016	8.8559	62.0445
10/12/2021 14:18	11.0596	8.88272	61.4814
10/12/2021 14:18	11.0038	8.68507	61.7993
10/12/2021 14:19	11.3631	8.46835	63.5534
10/12/2021 14:19	11.3714	8.58129	62.6669
10/12/2021 14:20	10.7274	9.20445	59.1373
10/12/2021 14:20	10.8039	9.00308	60.048
10/12/2021 14:21	10.8747	8.93708	60.048
10/12/2021 14:21	10.9646	8.93743	60.5438
10/12/2021 14:22	10.9633	8.90743	60.0493
10/12/2021 14:22	10.9811	8.74172	61.5461
10/12/2021 14:23	11.2313	8.59206	63.0535
10/12/2021 14:23	11.2229	8.82854	61.5447
10/12/2021 14:24	11.114	8.82325	61.0422
10/12/2021 14:24	11.0578	8.91255	60.048
10/12/2021 14:25	11.0057	8.96161	60.048
10/12/2021 14:25	11.141	8.59435	62.5511
10/12/2021 14:26	11.4359	8.36281	63.5534
10/12/2021 14:26	11.4708	8.57388	63.5534
10/12/2021 14:27	11.3541	8.56523	62.5551
10/12/2021 14:27	11.1282	8.9046	60.5464
10/12/2021 14:28	10.9366	9.00908	60.0507
10/12/2021 14:28	11.0589	8.70095	62.5537
10/12/2021 14:29	11.3179	8.46023	63.552
10/12/2021 14:29	11.4873	8.29345	65.0487
10/12/2021 14:30	11.5271	8.42299	64.0518
10/12/2021 14:30	11.2697	8.7313	63.0522
10/12/2021 14:31	10.8117	9.11727	59.0511
10/12/2021 14:31	10.8096	8.99514	59.5522
10/12/2021 14:32	10.9711	8.79854	61.5461
10/12/2021 14:32	11.1261	8.62859	63.5534
10/12/2021 14:33	11.2033	8.69565	61.0449
10/12/2021 14:33	11.1847	8.70236	62.0432
10/12/2021 14:34	11.1901	8.59718	62.5511
10/12/2021 14:34	11.2588	8.45193	64.5489
10/12/2021 14:35	11.3648	8.3854	64.0532
10/12/2021 14:35	11.4574	8.43023	64.5503
10/12/2021 14:36	11.4277	8.58112	64.5516
10/12/2021 14:36	11.3244	8.59453	62.5537
10/12/2021 14:37	11.2357	8.76377	63.0535
10/12/2021 14:37	11.1657	8.89349	61.5447

TIME	CO2	O2	SO2
10/12/2021 14:38	11.0385	8.8889	61.5447
10/12/2021 14:38	11.0244	8.68683	62.5511
10/12/2021 14:39	11.0865	9.02585	62.0445
10/12/2021 14:39	10.9484	8.90531	61.0449
10/12/2021 14:40	10.9556	9.01861	61.0449
10/12/2021 14:40	10.9113	9.12644	60.5451
10/12/2021 14:41	10.8117	9.12627	61.0449
10/12/2021 14:41	10.7957	9.05003	61.5447
10/12/2021 14:42	10.8458	9.07985	60.048
10/12/2021 14:42	10.8636	9.11744	60.5424
10/12/2021 14:43	10.7709	8.96196	62.0445
10/12/2021 14:43	10.897	8.82078	61.5461
10/12/2021 14:44	11.033	8.81054	63.5534
10/12/2021 14:44	11.099	8.86013	62.0459
10/12/2021 14:45	11.0172	9.03044	62.0472
10/12/2021 14:45	10.6642	9.35022	59.5522
10/12/2021 14:46	10.561	9.48382	59.5509
10/12/2021 14:46	10.4997	9.60082	58.042
10/12/2021 14:47	10.3718	9.43299	59.0484
10/12/2021 14:47	10.4635	9.38764	58.5486
10/12/2021 14:48	10.5413	9.45435	57.5422
10/12/2021 14:48	10.4867	9.59324	57.5422
10/12/2021 14:49	10.3877	9.65942	57.5449
10/12/2021 14:49	10.2314	9.70654	57.5449
10/12/2021 14:50	10.2138	9.64671	56.5426
10/12/2021 14:50	10.3104	9.53659	58.0434
End Run 3	11.107	8.781	62.568
10/12/2021 14:51	10.3915	9.42187	59.5495
10/12/2021 14:56	9.25E-04	-0.04704	100.575
10/12/2021 14:57	-5.41E-03	-0.05074	101.575 O2 Zero
10/12/2021 14:57	-9.63E-03	-0.05251	101.072
10/12/2021 14:58	-0.01614	-0.05533	100.575
10/12/2021 14:58	-0.01966	-0.05551	100.578
10/12/2021 14:59	-0.01984	-0.05851	101.074
10/12/2021 14:59	-0.02089	-0.05904	101.074 SO2 Span
10/12/2021 15:00	-0.02318	-0.05851	101.574 CO2 Zero
10/12/2021 15:00	10.4135	8.88484	79.0608
10/12/2021 15:01	9.72032	9.32816	33.0262
10/12/2021 15:03	10.0115	10.0191	1.49678
10/12/2021 15:04	10.0191	10.0228	0.999333
10/12/2021 15:04	10.0263	10.0267	1.50001 CO2 Span
10/12/2021 15:05	10.0323	10.0247	0.995293 O2 Span
10/12/2021 15:05	10.0323	10.0237	0.996101 SO2 Zero
10/12/2021 15:06	10.0321	10.0247	0.997043

Aurora Energy
EU 5 SO2 Bias Correction

August 19, 2024
2021

SO2		SPAN		241.3	Upscale gas	101.20				
Run No.		Analyzer Calibration Response	System Calibration Response	System Cal. Bias (% span)	Drift (% Span)	Gas Concentration ppm	Co	Cm	Gas Concentration Corrected	
Initial		Zero 0.49	0.99	0.21%						
		Upscale 102.58	101.07	-0.62%						
1	Start	Zero 0.49	0.99	0.21%	0.21%	60.64	1.243	101.073	60.2	
		Upscale 102.58	101.07	-0.62%	0.00%					
2	Finish	Zero 0.49	1.50	0.42%						
		Upscale 102.58	101.08	-0.62%						
	Start	Zero 0.49	1.50	0.42%	0.00%	62.11	1.495	101.076	61.6	
		Upscale 102.58	101.08	-0.62%	0.00%					
3	Finish	Zero 0.49	1.49	0.42%						
		Upscale 102.58	101.08	-0.62%						
	Start	Zero 0.49	1.49	0.42%	-0.21%	62.57	1.245	101.075	62.2	
		Upscale 102.58	101.08	-0.62%	0.00%					
	Finish	Zero 0.49	1.00	0.21%						
		Upscale 102.58	101.07	-0.62%						

Aurora Energy
EU 5 CO2 Bias Correction

CO2		SPAN		13.9	Upscale gas	10.090					
Run No.			Analyzer Calibration Response	System Calibration Response	System Cal. Bias (% span)	Drift (% Span)	Gas Concentration %	Co	Cm	Gas Concentration Corrected	
Initial		Zero	-0.06	-0.063	0.00%						
		Upscale	10.08	9.997	-0.62%						
1	Start	Zero	-0.06	-0.063	0.00%	0.28%	11.27	-0.044	9.999	11.4	
		Upscale	10.08	9.997	-0.62%	0.03%					
	Finish	Zero	-0.06	-0.025	0.28%						
		Upscale	10.08	10.000	-0.59%						
	2	Start	Zero	-0.06	-0.025	0.28%	0.00%	11.18	-0.025	10.000	11.3
			Upscale	10.08	10.000	-0.59%	0.00%				
	Finish	Zero	-0.06	-0.025	0.28%						
		Upscale	10.08	10.000	-0.60%						
	3	Start	Zero	-0.06	-0.025	0.28%	0.01%	11.11	-0.024	10.013	11.2
			Upscale	10.08	10.000	-0.60%	0.19%				
	Finish	Zero	-0.06	-0.023	0.29%						
		Upscale	10.08	10.026	-0.41%						

Aurora Energy
EU 5 O2 Bias Correction

O2		SPAN	20.9	Upscale gas	10.060					
Run No.			Analyzer Calibration Response	System Calibration Response	System Cal. Bias (% span)	Drift (% Span)	Gas Concentration %	Co	Cm	Gas Concentration Corrected %
Initial		Zero	-0.0920	-0.0229	0.33%					
		Upscale	10.05	10.0491	-0.01%					
1	Start	Zero	-0.0920	-0.0229	0.33%	0.02%	8.60	-0.0206	10.0375	8.62
		Upscale	10.05	10.0491	-0.01%	-0.11%				
	Finish	Zero	-0.0920	-0.0183	0.35%					
		Upscale	10.05	10.0258	-0.12%					
2	Start	Zero	-0.0920	-0.0183	0.35%	-0.08%	8.69	-0.0261	10.0256	8.72
		Upscale	10.05	10.0258	-0.12%	0.00%				
	Finish	Zero	-0.0920	-0.0340	0.28%					
		Upscale	10.05	10.0253	-0.13%					
3	Start	Zero	-0.0920	-0.0340	0.28%	-0.08%	8.78	-0.0424	10.0250	8.82
		Upscale	10.05	10.0253	-0.13%	0.00%				
	Finish	Zero	-0.0920	-0.0507	0.20%					
		Upscale	10.05	10.0247	-0.13%					

Appendix C

Field Data

CYCLONIC FLOW CHECK

August 19, 2024

Client: AURORATest Date: 10/12/21Performed By: Hudson / Aikens

Alaska Source Testing, LLC



Port 1	
Point	Null Angle
1	+2°
2	0
3	0
4	0
5	0
6	0
7	0
8	-1°
9	0
10	0

11 0

12 +1

Port 2	
Point	Null Angle
1	0
2	+1
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	+1°

11 +1

12 0

Aurora SO₂ Test 10/12/21

SO ₂	High 241.3	M.I. 101.2	Rep 2.5min ✓
O ₂	20.9	10.0	
CO ₂	10.0	10.0	(see QA)

	start	End	SO ₂	O ₂	CO ₂
R1	11:20	12:20	58	9.0	11.0
R2	12:30	13:30			
R3	13:50	14:50			

PRELIMINARY VELOCITY TRAVERSE

Plant Aurora
 Date 10/12/21
 Location FBV
 Stack I.D. 5
 Barometric Pressure, in. Hg +0.5 29.85
 Stack Gauge Pressure, in. H2O +0.5"
 Operators Hudson Aiken



Alaska Source Testing, LLC

R1

Traverse Point Number	Velocity Head (Δps), in. H2O	Stack Temperature (Ts), °F
1	1.7	280
2	1.5	✓
3	1.6	280
4	1.6	✓
5	1.7	✓
6	1.6	✓
7	1.2	✓
8	1.0	281
9	0.8	281
10	0.9	281
11	1.3	✓
12	1.5	280
1	0.6	282
2	0.7	✓
3	0.7	✓
4	0.7	✓
5	0.8	✓
6	1.5	282
7	1.6	✓
8	1.7	✓
9	1.6	✓
10	1.7	✓
11	1.8	✓
12	1.8	279
Average		

0.7.
 0.7
 0.7
 0.75
 0.75
 0.7
 1.1
 1.1

R2

Traverse Point Number	Velocity Head (Δps), in. H2O	Stack Temperature (Ts), °F
1	1.50	279
2	1.60	282
3	1.65	✓
4	1.85	✓
5	1.2	✓
6	1.5	✓
7	1.65	282
8	1.8	✓
9	1.8	✓
10	1.95	✓
11	1.5	✓
12	1.5	279
1	1.0	277
2	1.9	280
3	1.25	✓
4	1.25	✓
5	1.3	✓
6	1.4	280
7	2.0	✓
8	2.0	✓
9	2.1	✓
10	2.1	✓
11	2.1	✓
12	1.75	280
Average		

~~PRELIMINARY~~ VELOCITY TRAVERSE

Plant Aurora
 Date 10/12/21
 Location _____
 Stack I.D. 5
 Barometric Pressure, in. Hg 29.85
 Stack Gauge Pressure, in. H₂O +0.5"
 Operators H A

Alaska Source Testing, LLC



R3

Traverse Point Number	Velocity Head (Δps), in. H ₂ O	Stack Temperature (Ts), °F
1	0.55	280
2	.65	✓
3	.75	✓
4	0.90	✓
5	1.25	✓
6	1.5	✓
7	1.7	✓
8	1.7	✓
9	1.8	✓
10	1.85	✓
11	1.6	✓
12	1.45	✓
1	.95	278
2	1.0	281
3	1.3	✓
4	1.25	✓
5	1.3	✓
6	1.4	✓
7	2.1	280
8	2.0	✓
9	1.9	✓
10	2.1	✓
11	2.0	280
12	1.7	280
Average		

Traverse Point Number	Velocity Head (Δps), in. H ₂ O	Stack Temperature (Ts), °F
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
Average		

Client / Source: *Aurora Energy*

Run 1																			
Date / Time		10/12/21 11:44						0.29 5"						13:40 5"					
Vacuum, in. Hg		5"						5"						5"					
Pre-leak test, cfm		0						0						0					
Post-leak test, cfm		0						0						0					
Baro Press, in. Hg		24.85						24.85						24.85					
Traverse Point	Time (min)	Delta H, in.H2O	DGM Reading, scf	DGM Temp		Gas Temp leaving condenser or last impinger	Delta H, in.H2O	DGM Reading, scf	DGM Temp		Gas Temp leaving condenser or last impinger	DGM Temp Delta H	DGM Reading, scf	DGM Temp		Gas Temp leaving condense or last impinger			
				Inlet, °F	Outlet, °F				Inlet, °F	Outlet, °F				Inlet, °F	Outlet, °F				
	0	1.5	650.640	53	53	42	0					0							
1	5	1.5	654.7	62	55	✓	1.5	680.9	64	65	43	1.5	706.6	67	67	42			
2	10	1.5	658.3	63	55	✓	1.5	683.5	71	64	✓	1.5	710.2	73	67	✓			
3	15	1.5	661.4	64	55	✓	1.5	687.2	72	65	✓	1.5	713.8	74	67	✓			
4	20	1.5	664.9	65	56	✓	1.5	690.8	73	65	✓	1.5	717.5	75	67	✓			
5	25	1.5	668.5	66	57	✓	1.5	693.2	73	66	✓	1.5	721.1	75	68	✓			
6	30	1.5	672.2	68	58	✓	1.5	697.3	74	66	✓	1.5	724.6	75	68	✓			
7	35	1.5	675.7	65	59	42	1.5	700.6	73	66	43	1.5	728.3	76	68	✓			
8							1.5	703.4	73	66	✓	1.5	731.9						
9																			
10																			
11																			
Ave																			
				+ 460=		°R					+ 460=		°R	+ 460=		°R	+ 460=		°R

DGM Volume	cubic ft	Initial	Final	Net gain/loss	
		650.640	675.779		
Impinger 1	grams	747	700.748	634	840
Impinger 2	grams	700.729	731		
Impinger 3	grams	634	636		
Impinger 4	grams	840	846		
Total Water, grams					

Initial	Final	Net gain/loss	
676.210	703.220		
748	852		
731	733		
636	638		
846	851		
Total Water			

Initial	Final	Net gain/loss	
703.404	731.901		
852	908		
733	731		
638	637		
851	854		
Total Water			

Appendix D

Operational Data

Coal Barn Fill Report 10/12 07:30 - 14:45 (lbs)
Oldside lbs coal/lbs steam183,550.00
0.26

Time	M_112-LIC-26/A11/PV.CV Boiler 1 lb/hour	M_212-LIC-26/A11/PV.CV Boiler 1 lbs coal/hour	M_212-LIC-26/A11/PV.CV Boiler 2 lb/hour	M_312-LIC-26/A11/PV.CV Boiler 2 lbs coal/hour	Boiler 3 lb/hour	Boiler 3 lbs coal/hour	Oldside Cumulative lbs-steam	Oldside Cumulative lbs-coal
10/12/21 7:30	36,932.64	9,530.83	40,640.59	10,487.71	24,073.10	6,212.30	1,694.11	437.18
10/12/21 7:31	34,987.12	9,028.77	39,989.70	10,319.74	25,439.83	6,565.00	3,367.72	869.07
10/12/21 7:32	34,874.11	8,999.61	39,531.93	10,201.61	26,668.98	6,882.19	5,052.30	1,303.80
10/12/21 7:33	34,107.34	8,801.74	39,497.60	10,192.75	27,754.83	7,162.41	6,741.63	1,739.74
10/12/21 7:34	33,735.41	8,705.76	39,224.36	10,122.24	27,143.79	7,004.72	8,410.02	2,170.29
10/12/21 7:35	33,623.82	8,676.96	40,613.41	10,480.69	26,814.23	6,919.68	10,094.21	2,604.91
10/12/21 7:36	34,186.02	8,822.04	41,089.77	10,603.62	27,204.05	7,020.28	11,802.21	3,045.68
10/12/21 7:37	33,658.16	8,685.82	41,141.28	10,616.92	26,160.27	6,750.92	13,484.87	3,479.91
10/12/21 7:38	34,110.20	8,802.48	41,700.62	10,761.26	27,119.94	6,998.57	15,200.39	3,922.61
10/12/21 7:39	33,652.43	8,684.34	41,599.05	10,735.05	27,118.80	6,998.28	16,906.56	4,362.90
10/12/21 7:40	33,623.82	8,676.96	41,530.38	10,717.33	26,869.09	6,933.84	18,606.94	4,801.71
10/12/21 7:41	28,722.82	7,412.21	41,151.29	10,619.50	27,059.80	6,983.05	20,222.51	5,218.62
10/12/21 7:42	29,144.82	7,521.11	41,603.34	10,736.15	26,411.46	6,815.74	21,841.84	5,636.50
10/12/21 7:43	30,387.96	7,841.91	41,700.62	10,761.26	25,934.14	6,692.56	23,475.55	6,058.10
10/12/21 7:44	32,616.73	8,417.07	40,739.30	10,513.18	24,536.54	6,331.90	25,107.09	6,479.13
10/12/21 7:45	35,420.57	9,140.63	40,096.99	10,347.43	24,070.92	6,211.74	26,766.90	6,907.46
10/12/21 7:46	35,486.38	9,157.61	37,835.31	9,763.78	24,520.43	6,327.74	28,397.60	7,328.28
10/12/21 7:47	36,926.93	9,529.36	40,262.93	10,390.25	26,530.37	6,846.42	30,126.27	7,774.38
10/12/21 7:48	36,007.09	9,291.49	40,498.97	10,451.16	24,941.72	6,436.46	31,817.07	8,210.71
10/12/21 7:49	35,532.16	9,169.43	40,856.60	10,543.45	24,803.47	6,400.78	33,503.61	8,645.94
10/12/21 7:50	37,243.07	9,610.94	45,337.03	11,699.67	23,521.60	6,069.98	35,271.97	9,102.28
10/12/21 7:51	37,861.06	9,770.42	45,299.84	11,690.07	21,731.41	5,608.01	37,020.17	9,553.42
10/12/21 7:52	36,828.22	9,503.89	43,301.38	11,174.35	23,803.33	6,142.69	38,752.39	10,000.44
10/12/21 7:53	35,796.80	9,237.72	41,616.21	10,739.48	22,540.90	5,816.90	40,418.29	10,430.34
10/12/21 7:54	36,158.73	9,331.12	41,587.60	10,732.09	24,878.80	6,420.22	42,128.71	10,871.73
10/12/21 7:55	36,364.73	9,384.28	41,184.20	10,627.99	26,197.85	6,760.61	43,857.82	11,317.95
10/12/21 7:56	34,794.00	8,978.94	39,949.64	10,309.40	24,917.02	6,430.08	45,518.83	11,746.59
10/12/21 7:57	35,027.18	9,039.11	41,375.88	10,677.46	26,014.02	6,713.18	47,225.78	12,187.08
10/12/21 7:58	35,088.69	9,054.98	41,649.12	10,747.97	25,728.23	6,639.43	48,933.55	12,627.79
10/12/21 7:59	35,025.75	9,038.74	42,506.00	10,969.09	25,983.81	6,705.38	50,658.81	13,073.01
10/12/21 8:00	34,380.58	8,872.25	41,915.20	10,816.63	24,629.96	6,356.01	52,340.90	13,507.09
10/12/21 8:01	34,485.00	8,899.20	41,727.79	10,768.27	25,034.98	6,460.53	54,028.37	13,942.56
10/12/21 8:02	35,291.82	9,107.40	42,691.97	11,017.09	25,678.74	6,626.65	55,756.07	14,388.41
10/12/21 8:03	34,838.34	8,990.38	41,893.74	10,811.09	24,534.62	6,331.40	57,443.85	14,823.96
10/12/21 8:04	35,240.32	9,094.11	41,863.70	10,803.34	25,290.82	6,526.55	59,150.43	15,264.36
10/12/21 8:05	35,625.14	9,193.42	41,254.29	10,646.08	25,396.52	6,553.82	60,855.03	15,704.24
10/12/21 8:06	32,851.34	8,477.61	38,996.91	10,063.54	23,258.66	6,002.13	62,440.15	16,113.30
10/12/21 8:07	32,196.15	8,308.54	38,670.75	9,979.37	23,737.97	6,125.82	64,016.90	16,520.19
10/12/21 8:08	32,580.97	8,407.84	38,634.98	9,970.14	24,459.07	6,311.91	65,611.48	16,931.69
10/12/21 8:09	32,477.96	8,381.26	38,158.62	9,847.21	24,504.18	6,323.55	67,197.16	17,340.89
10/12/21 8:10	35,248.91	9,096.33	39,885.27	10,292.79	26,639.68	6,874.63	68,893.39	17,778.62
10/12/21 8:11	36,060.02	9,305.65	40,065.52	10,339.65	25,807.65	6,659.92	70,592.28	18,217.04
10/12/21 8:12	35,582.23	9,182.35	39,725.05	10,251.44	24,801.98	6,400.40	72,260.76	18,647.61
10/12/21 8:13	36,685.16	9,466.97	39,574.84	10,212.68	24,503.23	6,323.30	73,940.15	19,080.99
10/12/21 8:14	36,599.33	9,444.82	39,699.30	10,244.80	24,454.82	6,310.81	75,619.38	19,514.33
10/12/21 8:15	36,942.66	9,533.42	39,723.62	10,251.07	24,682.63	6,369.60	77,308.52	19,950.23
10/12/21 8:16	36,668.00	9,462.54	39,870.96	10,289.10	24,941.02	6,436.28	78,999.86	20,386.70
10/12/21 8:17	36,413.37	9,396.83	40,158.50	10,363.30	24,629.72	6,355.94	80,686.55	20,821.96
10/12/21 8:18	36,882.58	9,517.92	41,247.14	10,644.23	26,125.51	6,741.95	82,424.14	21,270.37
10/12/21 8:19	36,354.71	9,381.69	39,428.92	10,175.02	25,459.47	6,570.07	84,111.52	21,705.81
10/12/21 8:20	36,615.07	9,448.88	39,820.89	10,276.18	26,235.27	6,770.27	85,822.71	22,147.40
10/12/21 8:21	35,832.57	9,268.79	39,792.29	10,268.79	25,337.52	6,538.60	87,505.42	22,581.64
10/12/21 8:22	34,645.23	8,940.55	39,895.28	10,295.37	25,834.37	6,666.82	89,178.33	23,013.35
10/12/21 8:23	35,592.24	9,184.93	41,397.35	10,683.00	24,865.10	6,416.69	90,875.91	23,451.43
10/12/21 8:24	35,240.32	9,094.11	41,111.23	10,609.16	23,642.25	6,101.12	92,542.47	23,881.50
10/12/21 8:25	34,947.07	9,018.44	41,280.04	10,652.72	23,058.64	5,950.51	94,197.23	24,308.53
10/12/21 8:26	34,691.00	8,952.36	41,564.71	10,726.19	22,588.58	5,829.21	95,844.64	24,733.66
10/12/21 8:27	34,575.13	8,922.45	41,393.05	10,681.89	22,110.78	5,705.91	97,479.29	25,155.50
10/12/21 8:28	35,454.91	9,149.49	42,965.21	11,087.60	23,075.95	5,954.98	99,170.89	25,592.03
10/12/21 8:29	35,224.59	9,090.05	42,382.98	10,937.35	22,344.61	5,766.25	100,836.76	26,021.93
10/12/21 8:30	35,582.23	9,182.35	42,350.07	10,928.86	23,011.55	5,938.36	102,519.16	26,456.09
10/12/21 8:31	35,945.58	9,276.11	41,815.05	10,790.79	22,989.70	5,932.72	104,198.33	26,889.41
10/12/21 8:32	37,027.06	9,555.20	41,182.76	10,627.62	24,238.91	6,255.09	105,905.81	27,330.04
10/12/21 8:33	36,386.18	9,389.81	40,315.86	10,403.91	23,640.41	6,100.64	107,578.18	27,761.62
10/12/21 8:34	36,337.55	9,373.27	40,197.13	10,352.75	23,625.75	6,103.83	109,247.97	28,192.52
10/12/21 8:35	36,630.80	9,452.94	41,085.48	10,602.52	24,236.45	6,254.46	110,947.18	28,631.02
10/12/21 8:36	35,808.25	9,240.67	40,451.76	10,438.98	23,397.93	6,038.07	112,608.15	29,059.65
10/12/21 8:37	36,657.98	9,459.96	40,953.88	10,568.55	24,255.15	6,259.28	114,305.93	29,497.78
10/12/21 8:38	36,659.41	9,460.32	40,250.06	10,386.93	24,255.36	6,259.34	115,992.01	29,932.89
10/12/21 8:39	37,403.29	9,652.29	41,540.40	10,719.91	25,587.18	6,603.03	117,734.20	30,382.48
10/12/21 8:40	36,071.47	9,308.60	40,743.59	10,514.29	24,108.07	6,221.33	119,416.25	30,816.55
10/12/21 8:41	35,795.37	9,237.35	40,576.21	10,471.09	23,672.31	6,108.87	121,083.65	31,246.84
10/12/21 8:42	36,082.91	9,311.55	40,968.18	10,572.25	24,108.61	6,221.47	122,769.64	31,681.92
10/12/21 8:43	36,095.79	9,314.88	41,006.81	10,582.21	24,514.28	6,326.15	124,463.26	32,118.98
10/12/21 8:44	35,379.09	9,129.93	40,375.94	10,419.41	23,491.27	6,062.16	126,117.36	32,545.84
10/12/21 8:45	35,567.92	9,178.66	40,713.55	10,506.54	23,978.23	6,187.82	127,788.36	32,977.05
10/12/21 8:46	35,954.16	9,278.33	40,600.54	10,477.37	24,782.59	6,395.39	129,477.31	33,412.90
10/12/21 8:47	35,403.41	9,136.20	40,141.34	10,358.87	24,463.67	6,313.09	131,144.12	33,843.04
10/12/21 8:48	36,160.16	9,331.49	41,165.59	10,623.19	25,710.37	6,634.82	132,861.39	34,286.20
10/12/21 8:49	36,663.71	9,461.43	41,039.71	10,590.70	25,770.77	6,650.40	134,585.96	34,731.24
10/12/21 8:50	36,979.85	9,543.02	41,729.23	10,768.64	25,701.02	6,632.40	136,326.12	35,180.31
10/12/21 8:51	36,793.89	9,495.03	41,770.72	10,779.35	25,389.85	6,552.10	138,058.70	35,627.42
10/12/21 8:52	35,788.22	9,235.50	41,822.21	10,792.64	25,030.13	6,459.27	139,769.37	36,068.87
10/12/21 8:53	36,111.52	9,318.94	41,730.65	10,769.01	25,559.87	6,595.98	141,492.74	36,513.61
10/12/21 8:54	36,032.84	9,298.63	41,523.23	10,715.48	25,223.63	6,509.21	143,205.74	36,955.66
10/12/21 8:55	36,117.24	9,320.41	41,929.50	10,820.32	25,397.46	6,554.07	144,929.81	37,400.57
10/12/21 8:56	36,191.63	9,339.61	41,912.34	10,815.90	25,390.19	6,552.19	146,654.71	37,845.70
10/12/21 8:57	36,346.13	9,379.48	41,393.05	10,681.89	25,613.42	6,609.80	148,377.25	38,290.22
10/12/21 8:58	36,154.44	9,330.01	41,074.04	10,599.56	25,672.02	6,624.92	150,092.26	38,732.80
10/12/21 8:59	36,160.16	9,331.49	41,208.51	10,634.27	26,284.46	6,782.97	151,819.81	39,178.6

Time	Boiler 1 lb/hour	Boiler 1 lbs coal/hour	Boiler 2 lb/hour	Boiler 2 lbs coal/hour	Boiler 2 lb/hour	Boiler 2 lbs coal/hour	Boiler 3 lb/hour	Boiler 3 lbs coal/hour	Cumulative lbs-steam	Cumulative lbs-coal	Time	Boiler 5 lb/hour	Boiler 5 lbs coal/hour	Cumulative lbs-steam	Cumulative lbs-coal
10/12/21 9:13	38,035.59	9,815.46	43,271.34	11,166.60	25,270.21	6,521.23	176,654.90	45,587.55			10/12/21 12:33	175,877.70	42,382.70	305,371.42	73,587.87
10/12/21 9:14	37,865.36	9,771.53	42,739.18	11,029.27	25,103.98	6,478.33	178,416.71	46,042.20			10/12/21 12:34	175,755.41	42,353.23	308,300.68	74,293.76
10/12/21 9:15	37,666.51	9,720.22	43,317.11	11,178.41	25,456.27	6,569.24	180,190.70	46,500.00			10/12/21 12:35	174,986.59	42,167.96	311,217.12	74,996.56
10/12/21 9:16	37,451.93	9,664.84	43,294.23	11,172.51	25,960.56	6,699.38	181,969.15	46,958.94			10/12/21 12:36	175,637.80	42,324.89	314,144.42	75,701.98
10/12/21 9:17	37,510.58	9,679.98	43,019.57	11,101.63	26,782.12	6,911.39	183,757.69	47,420.49			10/12/21 12:37	175,915.80	42,391.88	317,076.35	76,408.51
10/12/21 9:18	37,320.32	9,630.88	42,148.37	10,876.81	26,474.39	6,831.98	185,523.40	47,876.15			10/12/21 12:38	176,043.91	42,422.75	320,010.41	77,115.55
10/12/21 9:19	37,237.35	9,609.47	42,691.97	11,017.09	26,813.67	6,919.53	187,302.45	48,335.26			10/12/21 12:39	176,136.20	42,445.00	322,946.02	77,822.97
10/12/21 9:20	36,543.54	9,394.42	42,866.54	11,069.88	26,577.66	6,858.63	189,069.42	48,791.24			10/12/21 12:40	175,198.59	42,219.05	325,865.99	78,526.62
10/12/21 9:21	36,866.84	9,513.85	42,999.54	11,096.46	27,028.65	6,975.01	190,851.00	49,250.99			10/12/21 12:41	175,650.41	42,327.93	328,793.50	79,232.09
10/12/21 9:22	36,871.13	9,514.96	44,036.68	11,364.10	26,721.60	6,895.77	192,644.82	49,713.91			10/12/21 12:42	177,163.41	42,692.25	331,746.23	79,943.63
10/12/21 9:23	35,822.55	9,244.36	44,361.41	11,447.90	26,742.60	6,901.19	194,426.93	50,173.80			10/12/21 12:43	176,311.09	42,487.14	334,684.74	80,651.75
10/12/21 9:24	33,043.03	8,527.08	42,272.83	10,908.92	24,280.54	6,265.83	196,086.87	50,602.16			10/12/21 12:44	174,908.00	42,149.03	337,599.88	81,354.23
10/12/21 9:25	34,442.09	8,888.12	43,995.19	11,353.40	26,383.11	6,808.42	197,833.88	51,053.00			10/12/21 12:45	175,896.91	42,387.33	340,531.49	82,060.69
10/12/21 9:26	35,643.74	9,198.22	45,407.13	11,717.76	27,643.10	7,133.58	199,645.45	51,520.49			10/12/21 12:46	175,794.70	42,362.70	343,461.40	82,766.73
10/12/21 9:27	35,253.20	9,097.44	44,515.90	11,487.77	26,458.07	6,827.77	201,415.90	51,977.37			10/12/21 12:47	175,193.00	42,217.70	346,381.29	83,470.36
10/12/21 9:28	35,769.62	9,230.71	44,541.65	11,494.41	26,793.20	6,914.25	203,200.97	52,438.03			10/12/21 12:48	174,998.50	42,170.83	349,297.93	84,173.21
10/12/21 9:29	36,371.88	9,386.12	43,829.25	11,310.57	26,517.13	6,843.01	204,979.61	52,897.02			10/12/21 12:49	175,089.80	42,192.83	352,216.09	84,876.42
10/12/21 9:30	36,803.90	9,497.61	42,227.05	10,897.11	25,964.61	6,700.43	206,729.54	53,348.61			10/12/21 12:50	174,639.59	42,084.35	355,126.75	85,577.83
10/12/21 9:31	37,201.59	9,600.24	40,915.25	10,558.59	25,568.04	6,598.09	208,457.62	53,794.56			10/12/21 12:51	174,827.00	42,129.51	358,040.53	86,279.98
10/12/21 9:32	37,637.90	9,712.83	40,792.22	10,526.84	26,239.70	6,771.41	210,202.12	54,244.74			10/12/21 12:52	175,041.50	42,181.20	360,957.89	86,983.00
10/12/21 9:33	37,453.36	9,665.21	41,282.89	10,653.46	25,296.12	6,527.91	211,935.99	54,692.18			10/12/21 12:53	174,451.91	42,039.12	363,865.43	87,683.66
10/12/21 9:34	36,975.56	9,541.91	41,553.27	10,723.23	23,966.52	6,184.80	213,644.24	55,133.02			10/12/21 12:54	174,735.70	42,107.51	366,777.67	88,385.45
10/12/21 9:35	36,872.57	9,515.33	41,832.22	10,795.22	23,771.99	6,134.60	215,352.19	55,573.77			10/12/21 12:55	176,395.70	42,507.53	369,717.62	89,093.91
10/12/21 9:36	36,918.34	9,527.14	42,920.86	11,076.15	23,337.91	6,022.58	217,071.81	56,017.53			10/12/21 12:56	177,189.91	42,698.91	372,670.78	89,805.56
10/12/21 9:37	36,576.45	9,438.92	42,884.84	10,964.67	23,548.95	6,077.04	218,782.05	56,458.88			10/12/21 12:57	176,120.20	42,441.14	375,606.12	90,512.91
10/12/21 9:38	36,686.59	9,467.34	42,114.04	10,867.95	24,326.63	6,277.73	220,500.83	56,902.43			10/12/21 12:58	174,954.09	42,160.13	378,522.02	91,215.58
10/12/21 9:39	36,868.27	9,514.22	42,358.66	10,931.07	24,826.14	6,406.63	222,235.05	57,349.96			10/12/21 12:59	175,024.50	42,177.10	381,439.09	91,918.53
10/12/21 9:40	36,140.13	9,326.32	42,566.09	10,984.60	24,618.87	6,353.14	223,957.14	57,794.36			10/12/21 13:00	174,997.00	42,170.47	384,355.71	92,621.37
10/12/21 9:41	35,663.77	9,203.39	43,428.70	11,207.21	24,256.87	6,259.73	225,679.63	58,238.87			10/12/21 13:01	175,867.80	42,380.32	387,286.84	93,327.71
10/12/21 9:42	35,957.03	9,279.07	43,610.38	11,254.09	24,093.06	6,217.45	227,407.30	58,684.71			10/12/21 13:02	174,399.09	42,026.39	390,193.49	94,028.15
10/12/21 9:43	35,693.80	9,211.14	43,289.94	11,171.40	23,266.91	6,004.26	229,111.48	59,124.49			10/12/21 13:03	175,562.70	42,306.79	393,116.54	94,733.26
10/12/21 9:44	35,763.90	9,229.23	43,713.38	11,280.67	23,416.37	6,042.83	230,826.37	59,567.03			10/12/21 13:04	176,569.00	42,549.29	396,062.35	95,442.42
10/12/21 9:45	36,037.14	9,299.74	43,149.75	11,135.22	23,061.92	5,951.36	232,530.52	60,006.81			10/12/21 13:05	175,865.41	42,379.74	398,993.44	96,148.74
10/12/21 9:46	36,869.70	9,514.59	43,332.86	11,182.47	23,493.31	6,062.68	234,258.78	60,452.80			10/12/21 13:06	176,062.70	42,427.28	401,927.82	96,855.87
10/12/21 9:47	39,686.42	10,241.47	43,773.46	11,296.18	25,797.16	6,657.21	236,079.73	60,922.72			10/12/21 13:07	176,895.30	42,627.92	404,876.08	97,566.33
10/12/21 9:48	39,736.50	9,736.50	42,365.81	10,932.92	24,256.31	6,259.58	237,852.38	61,380.17			10/12/21 13:08	176,476.00	42,526.88	407,817.34	98,275.11
10/12/21 9:49	41,042.57	10,591.44	41,666.29	10,752.40	25,209.53	6,505.57	239,651.02	61,844.32			10/12/21 13:09	176,156.09	42,449.79	410,753.28	98,982.61
10/12/21 9:50	40,958.16	10,569.66	40,132.76	10,356.66	24,296.98	6,270.08	241,407.48	62,297.60			10/12/21 13:10	176,093.80	42,434.78	413,688.18	99,689.86
10/12/21 9:51	41,377.31	10,677.82	40,091.27	10,345.95	25,781.59	6,653.20	243,194.98	62,758.88			10/12/21 13:11	176,887.09	42,625.94	416,636.29	100,400.29
10/12/21 9:52	40,591.95	10,475.16	38,901.06	10,038.80	24,858.19	6,414.90	244,934.17	63,207.69			10/12/21 13:12	175,715.70	42,343.66	419,516.89	101,106.02
10/12/21 9:53	39,347.39	10,153.98	38,127.14	9,839.09	25,342.02	6,539.76	246,647.78	63,649.91			10/12/21 13:13	175,915.91	42,391.91	422,496.82	101,812.55
10/12/21 9:54	38,939.69	10,048.77	39,956.80	10,311.25	25,686.72	6,628.71	248,390.83	64,099.72			10/12/21 13:14	174,504.50	42,051.79	425,405.23	102,513.41
10/12/21 9:55	38,657.87	9,976.05	41,694.89	10,759.78	26,053.04	6,723.25	250,164.26	64,557.37			10/12/21 13:15	175,586.70	42,312.58	428,331.67	103,218.62
10/12/21 9:56	35,955.60	9,278.70	40,404.55	10,426.80	24,132.53	6,227.64	251,839.14	64,989.59			10/12/21 13:16	175,446.09	42,278.69	431,255.78	103,923.27
10/12/21 9:57	35,793.94	9,236.98	41,674.87	10,754.61	25,021.30	6,456.99	253,547.31	65,430.40			10/12/21 13:17	175,118.91	42,199.85	434,174.42	104,626.60
10/12/21 9:58	35,955.60	9,278.70	42,292.86	10,914.09	24,642.13	6,359.15	255,262.15	65,872.93			10/12/21 13:18	175,632.91	42,323.71	437,101.64	105,331.99
10/12/21 9:59	36,359.00	9,382.80	42,855.05	11,059.17	23,775.05	6,135.39	256,978.64	66,315.89			10/12/21 13:19	174,643.80	42,085.36	440,012.37	106,033.41
10/12/21 10:00	35,816.83	9,242.89	43,324.27	11,180.26	23,906.90	6,169.41	258,696.11	66,759.10			10/12/21 13:20	175,327.00	42,250.00	442,934.49	106,737.58
10/12/21 10:01	35,988.50	9,287.19	43,563.17	11,241.91	23,132.85	5,969.66	260,407.51	67,200.74			10/12/21 13:21	176,872.50	42,381.45	445,865.69	107,443.94
10/12/21 10:02	36,796.75	9,495.77	43,962.29	11,344.90	23,773.94	6,135.10	262,149.73	67,650.34			10/12/21 13:22	174,340.70	42,012.32	448,771.37	108,144.14
10/12/21 10:03	37,659.36	9,718.37	43,970.88	11,347.12	23,537.43	6,074.07	263,902.53	68,102.66			10/12/21 13:23	175,106.30	42,196.81	451,689.81	108,847.42
10/12/21 10:04	38,021.28	9,811.77	43,338.57	11,183.95	23,639.72	6,100.46	265,652.52	68,554.27			10/12/21 13:24	175,390.80	42,265.37	454,612.92	109,551.85
10/12/21 10:05	38,018.42	9,811.03	42,982.37	11,092.03	24,143.42	6,230.45	267,404.92	69,006.49			10/12/21 13:25	175,472.91	42,285.16	457,537.54	110,256.60
10/12/21 10:06	36,497.77	9,418.61	40,673.49	10,496.20	23,154.40	5,975.22	269,077.02	69,437.99			10/12/21 13:26	175,606.00	42,317.23	460,464.31	110,961.89
10/12/21 10:07	37,326.04	9,632.35	41,055.45	10,594.77	24,906.07	6,427.26	270,798.48	69,882.23			10/12/21 13:27				

Time	Boiler 1 lb/hour	Boiler 1 lbs coal/hour	Boiler 2 lb/hour	Boiler 2 lbs coal/hour	Boiler 3 lb/hour	Boiler 3 lbs coal/hour	Cumulative lbs-steam	Cumulative lbs-coal	Time	Boiler 5 lb/hour	Boiler 5 lbs coal/hour	Cumulative lbs-steam	Cumulative lbs-coal
10/12/21 11:01	36,513.50	9,422.67	36,607.92	9,447.04	25,372.24	6,547.56	359,022.64	92,649.35	10/12/21 14:21	175,169.70	42,212.09	621,099.59	149,671.50
10/12/21 11:02	35,037.19	9,033.94	35,007.15	9,033.94	23,192.61	5,985.08	360,576.59	93,050.37	10/12/21 14:22	175,396.09	42,266.65	624,022.86	150,375.94
10/12/21 11:03	34,572.27	8,921.72	34,443.52	8,888.49	24,616.92	6,352.64	362,137.13	93,453.08	10/12/21 14:23	175,682.00	42,335.54	626,950.89	151,081.53
10/12/21 11:04	35,925.55	9,270.94	35,357.63	9,124.39	26,757.99	6,905.16	363,771.15	93,874.75	10/12/21 14:24	176,123.80	42,442.01	629,886.29	151,788.90
10/12/21 11:05	36,925.49	9,528.99	35,251.77	9,097.07	26,072.75	6,728.33	365,408.65	94,297.33	10/12/21 14:25	175,169.59	42,212.06	632,805.78	152,492.43
10/12/21 11:06	34,968.52	9,023.97	33,919.95	8,753.38	25,399.54	6,554.60	366,980.12	94,702.86	10/12/21 14:26	174,208.80	41,980.53	635,709.26	153,192.11
10/12/21 11:07	35,683.79	9,208.56	34,806.88	8,982.26	27,833.14	7,182.62	368,618.85	95,125.75	10/12/21 14:27	175,276.80	42,237.90	638,630.54	153,896.08
10/12/21 11:08	35,756.75	9,227.38	34,994.27	9,030.62	27,558.26	7,111.68	370,257.34	95,548.58	10/12/21 14:28	174,988.30	42,168.37	641,547.01	154,598.88
10/12/21 11:09	34,542.23	8,913.97	34,879.83	9,001.09	25,689.35	6,629.39	371,842.53	95,957.65	10/12/21 14:29	174,420.20	42,031.48	644,454.02	155,299.41
10/12/21 11:10	34,068.72	8,791.77	35,523.57	9,167.21	26,355.87	6,801.39	373,441.66	96,370.33	10/12/21 14:30	174,529.80	42,057.89	647,362.85	156,000.37
10/12/21 11:11	34,958.51	9,021.39	35,579.36	9,181.61	25,237.94	6,512.90	375,037.93	96,782.26	10/12/21 14:31	173,848.30	41,893.66	650,260.32	156,698.60
10/12/21 11:12	33,330.57	8,601.28	34,537.93	8,912.86	22,983.12	5,931.02	376,552.12	97,173.01	10/12/21 14:32	173,654.30	41,846.91	653,154.56	157,396.05
10/12/21 11:13	34,746.79	8,966.75	35,854.03	9,252.49	24,485.81	6,318.81	378,136.90	97,581.98	10/12/21 14:33	174,570.59	42,067.72	656,064.07	158,097.18
10/12/21 11:14	36,507.78	9,421.20	37,012.76	9,551.51	24,178.19	6,239.42	379,765.21	98,002.18	10/12/21 14:34	174,736.00	42,107.58	658,976.33	158,798.97
10/12/21 11:15	35,891.22	9,262.09	36,426.24	9,400.15	22,601.24	5,832.47	381,347.19	98,410.42	10/12/21 14:35	175,922.00	42,393.38	661,908.37	159,505.52
10/12/21 11:16	36,337.55	9,377.27	37,576.39	9,696.96	24,205.01	6,246.34	382,982.50	98,832.43	10/12/21 14:36	176,546.91	42,543.97	664,850.81	160,214.59
10/12/21 11:17	36,866.84	9,513.85	38,161.48	9,847.95	23,895.05	6,166.35	384,631.23	99,257.90	10/12/21 14:37	176,508.50	42,543.71	667,792.62	160,923.50
10/12/21 11:18	34,735.35	8,963.80	37,294.57	9,624.23	22,697.86	5,857.41	386,210.02	99,665.33	10/12/21 14:38	175,769.09	42,356.53	670,722.11	161,629.44
10/12/21 11:19	34,838.34	8,990.38	37,858.20	9,769.68	23,860.70	6,157.49	387,819.31	100,080.62	10/12/21 14:39	175,431.70	42,275.23	673,645.97	162,334.03
10/12/21 11:20	33,681.04	8,691.73	37,680.82	9,723.91	23,658.57	6,105.33	389,402.98	100,489.30	10/12/21 14:40	176,536.50	42,541.46	676,588.24	163,043.06
10/12/21 11:21	32,227.63	8,316.66	36,901.18	9,522.72	23,855.11	6,156.05	390,952.72	100,889.23	10/12/21 14:41	176,665.70	42,572.59	679,532.67	163,752.60
10/12/21 11:22	33,005.84	8,517.48	37,655.07	9,717.26	26,416.10	6,816.94	392,570.67	101,306.75	10/12/21 14:42	177,094.59	42,675.95	682,484.25	164,463.87
10/12/21 11:23	33,496.51	8,644.11	38,065.63	9,823.21	26,505.07	6,839.90	394,205.12	101,728.54	10/12/21 14:43	176,418.50	42,513.02	685,424.56	165,172.42
10/12/21 11:24	32,622.45	8,418.55	37,544.91	9,688.84	25,685.13	6,628.30	395,802.66	102,140.80	10/12/21 14:44	176,603.59	42,557.63	688,367.95	165,881.71
10/12/21 11:25	32,467.95	8,378.68	37,373.25	9,644.54	26,080.49	6,730.33	397,401.36	102,553.36	10/12/21 14:45	176,107.80	42,438.15	691,303.08	166,589.01
10/12/21 11:26	32,509.44	8,389.38	37,331.77	9,633.83	26,534.15	6,847.40	399,007.61	102,967.87	10/12/21 14:46	175,916.00	42,391.93	694,235.01	167,295.54
10/12/21 11:27	31,845.67	8,218.09	36,164.45	9,332.59	25,932.42	6,692.12	400,573.32	103,371.92	10/12/21 14:47	176,008.59	42,414.24	697,168.49	168,002.45
10/12/21 11:28	32,924.29	8,496.44	36,457.71	9,408.27	27,835.24	7,183.16	402,193.61	103,790.05	10/12/21 14:48	175,380.20	42,262.82	700,091.49	168,706.83
10/12/21 11:29	33,174.64	8,561.05	36,055.73	9,304.54	27,067.43	6,985.02	403,798.57	104,204.23	10/12/21 14:49	175,521.09	42,296.77	703,016.85	169,411.77
10/12/21 11:30	32,739.76	8,448.82	35,201.70	9,084.15	26,418.35	6,817.52	405,371.24	104,610.07	10/12/21 14:50	176,762.20	42,595.85	705,962.88	170,121.71
10/12/21 11:31	34,221.79	8,831.27	35,347.61	9,121.80	28,126.21	7,258.25	406,999.50	105,030.26	10/12/21 14:51	177,487.80	42,770.70	708,921.01	170,834.55
10/12/21 11:32	35,839.72	9,248.79	35,411.99	9,138.41	28,426.40	7,335.71	408,660.80	105,458.97	10/12/21 14:52	177,434.50	42,757.86	711,878.25	171,547.18
10/12/21 11:33	34,952.79	9,019.91	34,306.19	8,853.05	26,737.93	6,899.99	410,260.75	105,871.86	10/12/21 14:53	177,575.20	42,791.76	714,837.84	172,260.38
10/12/21 11:34	36,513.50	9,422.67	34,406.33	8,878.89	27,446.37	7,082.81	411,900.18	106,294.93	10/12/21 14:54	177,091.70	42,675.25	717,789.37	172,971.63
10/12/21 11:35	36,632.23	9,453.31	34,052.98	8,787.71	26,648.75	6,876.97	413,522.42	106,713.54	10/12/21 14:55	176,310.50	42,487.00	720,727.88	173,679.75
10/12/21 11:36	34,849.79	8,993.33	33,638.13	8,680.65	23,866.50	6,158.99	415,061.66	107,110.78	10/12/21 14:56	176,179.20	42,455.36	723,664.72	174,387.34
10/12/21 11:37	36,503.49	9,420.09	35,191.69	9,081.57	25,423.78	6,560.86	416,680.30	107,528.49	10/12/21 14:57	176,297.59	42,483.89	726,602.49	175,095.40
10/12/21 11:38	36,230.25	9,349.58	35,226.02	9,090.42	24,195.28	6,243.83	418,274.50	107,939.88	10/12/21 14:58	178,285.09	42,962.83	729,573.91	175,811.45
10/12/21 11:39	34,304.76	8,852.68	34,397.74	8,876.68	23,242.81	5,998.04	419,806.92	108,335.34	10/12/21 14:59	178,278.20	42,961.17	732,545.21	176,527.47
10/12/21 11:40	36,698.04	9,470.29	35,828.28	9,245.84	24,927.21	6,432.71	421,431.14	108,754.49	10/12/21 15:00	177,261.70	42,716.22	735,499.57	177,239.41
10/12/21 11:41	36,105.80	9,317.46	35,549.32	9,173.85	23,836.71	6,151.30	423,022.68	109,165.20	10/12/21 15:01	179,547.41	43,267.02	738,492.03	177,960.52
10/12/21 11:42	34,223.22	8,831.64	35,187.40	9,080.46	22,987.72	5,932.21	424,562.65	109,562.60	10/12/21 15:02	178,537.30	43,023.61	741,467.65	178,677.58
10/12/21 11:43	36,233.11	9,350.31	36,971.27	9,540.80	25,591.64	6,604.18	426,209.25	109,987.52	10/12/21 15:03	178,084.59	42,914.52	744,435.73	179,392.83
10/12/21 11:44	34,313.34	8,854.90	35,658.04	9,201.91	24,141.13	6,229.86	427,777.79	110,392.30	10/12/21 15:04	177,913.91	42,873.38	747,400.96	180,107.38
10/12/21 11:45	34,981.40	9,027.30	36,005.66	9,291.62	25,223.12	6,509.08	429,381.29	110,806.10	10/12/21 15:05	178,661.59	43,053.56	750,378.65	180,824.94
10/12/21 11:46	34,898.43	9,005.89	36,203.07	9,342.56	24,665.10	6,365.07	430,977.40	111,217.99	10/12/21 15:06	177,837.80	42,855.04	753,342.62	181,539.19
10/12/21 11:47	35,072.96	9,050.93	35,959.89	9,279.81	24,792.54	6,397.96	432,574.49	111,630.14	10/12/21 15:07	177,705.41	42,823.14	756,304.37	182,252.91
10/12/21 11:48	36,283.19	9,363.24	36,293.20	9,365.82	25,912.27	6,686.92	434,215.97	112,053.74	10/12/21 15:08	177,379.30	42,744.55	759,260.70	182,965.32
10/12/21 11:49	35,180.25	9,131.40	35,384.81	9,131.40	25,114.31	6,481.00	435,810.63	112,465.26	10/12/21 15:09	178,640.09	43,048.38	762,238.03	183,682.79
10/12/21 11:50	36,493.48	9,417.50	36,007.09	9,291.99	27,248.16	7,031.66	437,473.11	112,894.27	10/12/21 15:10	177,213.20	42,704.53	765,191.58	184,394.53
10/12/21 11:51	37,463.38	9,667.80	36,577.88	9,439.28	27,080.72	6,988.45	439,158.47	113,329.20	10/12/21 15:11	179,770.09	43,320.68	768,187.75	185,116.55
10/12/21 11:52	34,629.49	8,936.48	34,400.61	8,877.42	24,795.79	6,398.80	440,722.24	113,732.74	10/12/21 15:12	178,738.80	43,072.16	771,166.73	185,834.42
10/12/21 11:53	35,935.57	9,273.53	35,563.63	9,177.55	25,436.16	6,564.05	442,337.83	114,149.66	10/12/21 15:13	177,243.00	42,711.71	774,120.78	186,546.28
10/12/21 11:54	36,068.61	9,307.86	35,813.97	9,242.15	24,449.32	6,309.39	443,943.36	114,563.99	10/12/21 15:14	178,444.50	43,001.24	777,094.86	187,262.96
10/12/21 11:55	34,585.14	8,925.04	35,281.81	9,104.82	23,236.50	5,966.41	445,495.08	114,964.42	10/12/21 15:15	178,417.09	42,994.64	780,068.47	187,979.54
10/12/21 11:56	35,896.94	9,263.56	36,839.66	9,506.84	24,962.77	6,441.89	447,123.40	115,384.63	10/12/21 15:16	179,276.80	43,201.81	783,056.42	188,699.57
10/12/21 11:57	36,161.59	9,331.86	36,217.38	9,346.25	24,198.75	6,244.73	448,733.03	115,800.01	10/				

Time	Boiler 1 lb/hour	Boiler 1 lbs coal/hour	Boiler 2 lb/hour	Boiler 2 lbs coal/hour	Boiler 3 lb/hour	Boiler 3 lbs coal/hour	Cumulative lbs-steam	Cumulative lbs-coal	Time	Boiler 5 lb/hour	Boiler 5 lbs coal/hour	Cumulative lbs-steam	Cumulative lbs-coal
10/12/21 12:49	32,613.87	8,416.33	40,436.03	10,434.92	22,769.16	5,875.81	530,529.51	136,908.40	10/12/21 16:09	183,208.50	44,149.27	941,137.16	226,793.59
10/12/21 12:50	31,157.58	8,040.52	40,252.92	10,387.67	22,676.72	5,851.95	532,097.63	137,313.07	10/12/21 16:10	184,644.91	44,495.41	944,214.57	227,535.18
10/12/21 12:51	31,230.54	8,059.35	40,197.13	10,373.27	23,077.64	5,955.41	533,672.72	137,719.54	10/12/21 16:11	183,765.30	44,283.44	947,277.33	228,273.24
10/12/21 12:52	30,452.33	7,858.53	39,228.65	10,123.34	21,766.35	5,617.02	535,196.84	138,112.85	10/12/21 16:12	183,335.20	44,179.80	950,332.92	229,009.57
10/12/21 12:53	30,699.81	7,922.39	38,449.01	9,922.15	21,975.90	5,671.10	536,715.58	138,504.78	10/12/21 16:13	183,841.91	44,301.90	953,396.95	229,747.94
10/12/21 12:54	33,955.71	8,762.61	39,499.02	10,193.11	23,479.52	6,059.12	538,331.15	138,921.69	10/12/21 16:14	183,296.50	44,170.47	956,451.89	230,484.11
10/12/21 12:55	34,482.14	8,898.46	37,271.68	9,618.33	22,470.45	5,798.72	539,901.56	139,326.95	10/12/21 16:15	184,470.50	44,453.38	959,526.40	231,225.00
10/12/21 12:56	34,085.89	8,796.20	35,577.93	9,181.24	22,020.10	5,682.51	541,429.62	139,721.29					
10/12/21 12:57	37,217.32	9,604.30	35,361.92	9,125.49	23,514.56	6,068.17	543,031.19	140,134.58					
10/12/21 12:58	37,190.14	9,597.28	33,207.54	8,569.53	22,009.20	5,679.69	544,571.30	140,532.03					
10/12/21 12:59	36,437.68	9,403.10	32,427.90	8,368.34	21,838.16	5,635.55	546,083.03	140,922.14					
10/12/21 13:00	39,384.58	10,163.58	33,045.89	8,527.82	22,780.60	5,878.76	547,669.88	141,331.65					
10/12/21 13:01	39,214.35	10,119.65	32,244.79	8,321.09	20,995.91	5,418.20	549,210.80	141,729.29					
10/12/21 13:02	37,373.25	9,644.54	32,367.81	8,352.83	20,625.02	5,322.49	550,716.90	142,117.96					
10/12/21 13:03	38,564.88	9,952.05	34,266.13	8,842.71	22,287.53	5,751.52	552,302.21	142,527.06					
10/12/21 13:04	38,856.71	10,027.36	35,187.40	9,080.46	21,683.76	5,595.71	553,897.67	142,938.79					
10/12/21 13:05	37,660.79	9,718.74	33,972.88	8,767.04	20,148.49	5,199.52	555,427.38	143,333.54					
10/12/21 13:06	39,032.67	10,072.77	35,296.12	9,108.51	22,334.35	5,763.60	557,038.43	143,749.29					
10/12/21 13:07	40,920.97	10,560.06	35,416.28	9,139.52	21,770.94	5,618.21	558,673.57	144,171.26					
10/12/21 13:08	40,208.57	10,376.22	34,612.32	8,932.05	20,515.79	5,294.30	560,262.51	144,581.30					
10/12/21 13:09	38,420.40	9,914.76	33,579.48	8,665.52	19,888.84	5,132.51	561,793.99	144,976.51					
10/12/21 13:10	39,810.88	10,273.59	34,899.86	9,006.25	21,107.42	5,446.98	563,390.96	145,388.63					
10/12/21 13:11	38,968.30	10,056.16	34,652.38	8,942.39	20,514.84	5,294.06	564,959.88	145,793.50					
10/12/21 13:12	36,430.53	9,401.26	34,204.62	8,826.84	20,229.29	5,220.37	566,474.29	146,184.31					
10/12/21 13:13	36,775.29	9,490.23	36,253.14	9,355.48	23,698.92	6,115.74	568,086.41	146,600.33					
10/12/21 13:14	36,338.98	9,377.63	36,562.14	9,435.22	22,959.89	5,925.03	569,684.10	147,012.63					
10/12/21 13:15	33,738.27	8,706.50	35,399.12	9,135.09	21,818.10	5,630.38	571,200.02	147,403.83					
10/12/21 13:16	32,698.27	8,438.11	34,709.60	8,957.16	22,750.83	5,871.08	572,702.67	147,791.60					
10/12/21 13:17	33,799.78	8,722.37	35,929.84	9,272.05	24,519.27	6,327.44	574,273.48	148,196.97					
10/12/21 13:18	33,460.75	8,634.88	35,034.33	9,040.96	23,867.75	6,159.31	575,812.86	148,594.22					
10/12/21 13:19	31,848.53	8,218.83	33,808.36	8,724.58	24,401.19	6,296.97	577,313.83	148,981.56					
10/12/21 13:20	32,499.43	8,386.80	34,479.29	8,897.72	25,924.13	6,689.98	578,862.21	149,381.14					
10/12/21 13:21	32,250.51	8,322.56	34,372.00	8,870.04	25,300.93	6,529.16	580,394.27	149,776.50					
10/12/21 13:22	30,728.43	7,929.78	34,675.27	8,948.30	24,623.08	6,354.23	581,894.71	150,163.70					
10/12/21 13:23	30,207.71	7,795.40	35,444.89	9,146.91	24,816.39	6,404.12	583,402.53	150,552.81					
10/12/21 13:24	32,153.24	8,297.46	37,533.47	9,685.88	26,836.03	6,925.30	585,011.24	150,967.95					
10/12/21 13:25	31,458.00	8,118.05	36,809.62	9,499.09	25,166.14	6,494.37	586,568.47	151,369.81					
10/12/21 13:26	30,466.64	7,862.22	36,357.57	9,382.43	24,653.02	6,361.96	588,093.09	151,763.26					
10/12/21 13:27	31,370.74	8,095.53	37,170.12	9,592.12	25,808.81	6,660.22	589,665.59	152,169.05					
10/12/21 13:28	33,128.86	8,549.23	37,742.33	9,739.78	26,207.26	6,763.04	591,283.56	152,586.59					
10/12/21 13:29	34,143.11	8,810.97	37,669.38	9,720.96	25,897.66	6,683.15	592,912.06	153,006.84					
10/12/21 13:30	34,911.30	9,009.21	37,459.09	9,666.69	25,932.44	6,692.12	594,550.45	153,429.64					
10/12/21 13:31	36,401.92	9,393.88	36,622.22	9,450.73	25,104.84	6,478.55	596,185.93	153,851.69					
10/12/21 13:32	35,908.39	9,266.52	35,155.93	9,072.34	23,512.10	6,067.53	597,762.20	154,258.47					
10/12/21 13:33	34,832.63	8,988.91	33,104.54	8,542.95	22,479.28	5,801.00	599,269.14	154,647.35					
10/12/21 13:34	37,500.57	9,677.39	34,115.93	8,803.95	23,507.68	6,066.39	600,854.55	155,056.48					
10/12/21 13:35	38,490.50	9,932.86	33,497.94	8,644.48	22,882.55	5,905.07	602,435.73	155,464.52					
10/12/21 13:36	36,862.55	9,512.75	32,908.56	8,492.38	22,079.47	5,697.83	603,966.57	155,859.56					
10/12/21 13:37	38,513.39	9,938.76	34,456.39	8,891.81	24,138.88	6,229.28	605,585.05	156,277.23					
10/12/21 13:38	38,945.41	10,050.25	34,959.94	9,021.76	23,085.61	5,957.47	607,201.57	156,694.39					
10/12/21 13:39	35,862.61	9,254.70	33,728.25	8,703.91	21,267.14	5,488.20	608,715.87	157,085.17					
10/12/21 13:40	35,899.80	9,264.30	34,794.00	8,978.94	22,959.10	5,924.82	610,276.75	157,487.97					
10/12/21 13:41	36,348.99	9,380.22	35,751.03	9,225.91	23,081.14	5,956.32	611,863.10	157,897.34					
10/12/21 13:42	33,978.60	8,768.52	34,280.44	8,846.41	21,799.99	5,625.70	613,364.08	158,284.69					
10/12/21 13:43	33,120.28	8,547.02	34,360.55	8,867.08	21,925.69	5,658.14	614,854.19	158,669.22					
10/12/21 13:44	35,394.82	9,133.98	36,031.41	9,298.26	23,791.95	6,139.75	616,441.16	159,078.76					
10/12/21 13:45	34,989.98	9,029.51	36,992.84	9,030.25	22,267.68	5,746.40	617,978.67	159,475.53					
10/12/21 13:46	33,811.22	8,725.32	33,754.00	8,710.55	22,603.57	5,833.08	619,481.48	159,863.34					
10/12/21 13:47	35,607.97	9,188.99	34,829.76	8,988.17	25,720.36	6,637.39	621,084.12	160,276.92					
10/12/21 13:48	37,061.39	9,564.06	34,045.83	8,785.86	25,354.27	6,542.92	622,691.81	160,691.80					
10/12/21 13:49	36,244.56	9,353.27	32,699.70	8,438.48	24,425.87	6,303.34	624,247.98	161,093.38					
10/12/21 13:50	35,815.40	9,242.52	32,518.02	8,391.60	24,558.96	6,337.68	625,796.19	161,492.91					
10/12/21 13:51	38,380.35	9,904.43	33,743.99	8,707.97	25,111.54	6,480.28	627,416.78	161,911.12					
10/12/21 13:52	37,367.53	9,643.06	33,875.60	8,741.94	24,079.06	6,213.84	629,005.49	162,321.11					
10/12/21 13:53	35,220.30	9,088.95	33,745.42	8,708.34	23,477.68	6,058.65	630,546.21	162,718.70					
10/12/21 13:54	35,429.16	9,142.85	35,493.53	9,159.46	25,503.91	6,581.54	632,153.32	163,133.43					
10/12/21 13:55	34,107.34	8,801.74	35,816.83	9,242.89	23,556.80	6,079.07	633,711.34	163,535.50					
10/12/21 13:56	31,632.53	8,163.05	35,748.16	9,225.17	23,038.92	5,945.42	635,218.33	163,924.39					
10/12/21 13:57	30,575.36	7,890.27	37,047.09	9,560.37	24,506.66	6,324.19	636,753.81	164,320.64					
10/12/21 13:58	32,390.71	8,358.74	38,331.71	9,891.88	25,715.38	6,636.11	638,361.11	164,735.42					
10/12/21 13:59	29,669.83	7,656.59	37,502.00	9,677.76	23,862.84	6,158.04	639,878.36	165,126.96					
10/12/21 14:00	28,845.84	7,443.96	37,356.09	9,640.11	23,947.01	6,179.76	641,380.84	165,514.69					
10/12/21 14:01	30,938.72	7,984.04	38,883.89	10,034.37	26,661.04	6,880.15	642,988.90	165,929.66					
10/12/21 14:02	32,323.47	8,341.39	38,190.09	9,855.33	24,935.44	6,434.84	644,579.72	166,340.19					
10/12/21 14:03	30,232.03	7,801.68	36,185.91	9,338.13	23,107.98	5,963.24	646,071.81	166,725.24					
10/12/21 14:04													

Time	Boiler 1 lb/hour	Boiler 1 lbs coal/hour	Boiler 2 lb/hour	Boiler 2 lbs coal/hour	Boiler 3 lb/hour	Boiler 3 lbs coal/hour	Cumulative lbs-steam	Cumulative lbs-coal	Time	Boiler 5 lb/hour	Boiler 5 lbs coal/hour	Cumulative lbs-steam	Cumulative lbs-coal
10/12/21 14:37	38,511.96	9,938.39	28,937.40	7,467.58	22,717.04	5,862.36	699,007.20	180,385.74					
10/12/21 14:38	40,344.47	10,411.29	28,305.10	7,304.41	25,783.45	6,653.67	700,581.08	180,791.90					
10/12/21 14:39	41,292.91	10,656.05	26,877.43	6,935.99	26,487.58	6,835.38	702,158.72	181,199.02					
10/12/21 14:40	40,284.39	10,395.79	24,436.94	6,306.19	25,569.51	6,598.47	703,663.56	181,587.36					
10/12/21 14:41	41,038.27	10,590.33	23,886.19	6,164.07	26,987.11	6,964.29	705,195.42	181,982.67					
10/12/21 14:42	41,970.99	10,831.03	22,664.51	5,848.80	29,545.26	7,624.45	706,765.10	182,387.75					
10/12/21 14:43	40,437.45	10,435.28	20,136.76	5,196.49	27,913.15	7,203.27	708,239.89	182,768.33					
10/12/21 14:44	40,755.03	10,517.24	20,221.16	5,218.27	27,889.43	7,197.14	709,720.99	183,150.54					
10/12/21 14:45	42,490.27	10,965.04	20,724.71	5,348.22	29,661.02	7,654.32	711,268.92	183,550.00					

Sample ID	Moisture	Ash	Ash-Dry	Volatile Matter	Volatile Matter-Dry	Fixed Carbon	Fixed Carbon-Dry	GCV	GCV-Dry	Sulfur	Sulfur-Dry	Carbon	Carbon-Dry	Hydrogen	Hydrogen-Dry	Nitrogen	Nitrogen-Dry	Oxygen	Oxygen-Dry	Density (lbs/ft^3)	lbs-ash/MMBtu	lbs-S/MMBtu	lbs-SO2/MMBtu	M19 F-Factor (Fd)
AE101221B1 - 12PM	30.96	5.36	7.76	34.44	49.89	29.24	42.35	7697	11148	0.14	0.20	45.65	66.12	3.30	4.79	0.52	0.76	14.07	20.37		6.96	0.18	0.36	9818.14
AE101221B1 - 1PM	30.41	5.44	7.82	34.96	50.24	29.19	41.94	7691.00	11052	0.13	0.18	44.91	64.54	3.34	4.80	0.53	0.75	15.24	21.91	47.3	7.08	0.16	0.33	9622.17
AE101221B1 - 2PM	30.68	5.12	7.39	34.73	50.11	29.47	42.50	7722.00	11139	0.13	0.18	45.06	65.00	3.33	4.81	0.53	0.76	15.15	21.85	48.3	6.63	0.16	0.33	9616.29
AE101221B2 - 12PM	31.49	4.47	6.52	33.58	49.02	30.46	44.46	7712.00	11257	0.13	0.19	45.09	65.82	3.28	4.79	0.56	0.82	14.98	21.86	42.9	5.79	0.17	0.33	9620.11
AE101221B2 - 1PM	29.32	4.61	6.52	34.76	49.18	31.31	44.30	7907.00	11188	0.14	0.20	46.12	65.26	3.39	4.80	0.57	0.81	15.85	22.41	48.7	5.83	0.18	0.36	9583.79
AE101221B2 - 2PM	28.88	4.84	6.81	34.77	48.90	31.51	44.29	7906.00	11117	0.13	0.18	46.40	65.24	3.38	4.76	0.57	0.80	15.80	22.21	43.2	6.13	0.16	0.32	9638.05
AE101221B3 - 12PM	31.30	4.32	6.29	34.80	50.66	29.58	43.05	7791.00	11341	0.12	0.18	45.92	66.84	3.37	4.90	0.51	0.75	14.46	21.04		5.55	0.16	0.32	9755.42
AE101221B3 - 1PM	28.34	4.39	6.13	35.03	48.88	32.24	44.99	8124.00	11336	0.22	0.31	47.34	66.06	3.42	4.78	0.60	0.84	15.69	21.88	44.2	5.40	0.27	0.55	9589.04
AE101221B3 - 2PM	29.28	4.12	5.82	35.80	50.62	30.80	43.56	7924.00	11204	0.13	0.18	46.59	65.87	3.39	4.79	0.54	0.77	15.95	22.57	42.2	5.20	0.16	0.32	9644.77
AE101221B5 - 12PM	27.67	4.59	6.34	35.75	49.42	31.99	44.24	8081.00	11172	0.14	0.19	47.25	65.32	3.46	4.78	0.60	0.83	16.29	22.54	44.2	5.68	0.17	0.34	9595.97
AE101221B5 - 1PM	27.97	4.48	6.22	36.60	50.82	30.95	42.96	8082.00	11220	0.14	0.19	47.27	65.63	3.53	4.91	0.56	0.78	16.05	22.27	44.3	5.55	0.17	0.34	9648.09
AE101221B5 - 2PM	29.83	4.65	6.62	35.75	50.95	29.77	42.43	7857.00	11197	0.13	0.19	46.03	65.60	3.44	4.90	0.55	0.78	15.37	21.91	45.6	5.91	0.17	0.34	9676.27
Average	29.68	4.70	6.69	35.08	49.89	30.54	43.42	7874.50	11197.59	0.14	0.20	46.14	65.61	3.39	4.82	0.55	0.79	15.41	21.90	45.09	5.98	0.18	0.35	9650.68

K 1000000
Ks 0.57
Kc 1.53
Khd 3.64
Kn 0.14
Ko 0.46

Address	M_312-LIC-26/A11/PV.CV			M_113-O2/A11/PV.CV			M_212-LIC-26/A11/PV.CV			M_213-O2/A11/PV.CV			M_112-LIC-26/A11/PV.CV			M_313-O2/A11/PV.CV			M_521-FT-06/A11/PV.CV			M_513-AT_02-A11/PV.CV			M_513-AT_03/A11/PV.CV			M_513-AT_05/A11/PV.CV			M_513-OT-53/A11/PV.CV		
Parameter	Steamflow Boiler 1	Coal Feed B1	O2 Boiler 1	Steamflow Boiler 2	Coal Feed B2	O2 Boiler 2	Steamflow Boiler 3	Coal Feed B3	O2 Boiler 3	Steamflow B5	Coal Feed B5	Boiler 5 O2 - 2 (Economizer)	Boiler 5 O2 - 3 (Economizer)	Total plant steamflow	Coal Feed Plant Total	MMBtu Input (MMBtu/hr)	O2 - 5 (Common Stack)	Opacity															
units	(lbs/hr)	(lbs/hr)	(%)	(lbs/hr)	(lbs/hr)	(%)	(lbs/hr)	(lbs/hr)	(%)	(lbs/hr)	(lbs/hr)	(%)	(%)	(lbs/hr)	(lbs/hr)		(%)	(%)															
Run 1																																	
10/12/21 11:30	26,418.35	6,817.52	7.22	35,201.70	9,084.15	5.56	32,739.76	8,448.82	9.63	177,011.41	42,655.90	3.59	4.53	271,371.21	67,006.38	527.64	7.11	7.11															
10/12/21 11:30	27,160.44	7,009.02	7.33	34,503.60	8,904.00	5.76	32,631.03	8,420.76	9.72	177,061.80	42,668.04	3.73	4.63	271,356.87	67,001.82	527.61	7.28	6.71															
10/12/21 11:31	28,126.21	7,258.25	7.44	35,247.61	9,121.80	5.90	34,221.79	8,831.27	9.68	177,121.41	42,682.41	3.79	4.72	274,817.02	67,893.73	534.63	7.39	6.73															
10/12/21 11:31	28,382.69	7,324.43	7.03	35,401.98	9,135.83	5.75	35,278.95	9,104.08	9.52	177,224.09	42,707.15	3.81	4.67	276,287.71	68,211.50	537.60	7.50	6.75															
10/12/21 11:32	28,426.40	7,335.71	6.61	35,411.99	9,138.41	5.67	35,839.72	9,248.79	9.44	177,333.50	42,733.52	3.79	4.62	277,011.61	68,456.44	539.06	7.41	6.76															
10/12/21 11:32	27,768.49	7,165.93	6.24	35,331.88	9,117.74	5.55	36,433.39	9,402.00	9.47	177,474.80	42,767.57	3.75	4.52	277,008.56	68,453.24	539.04	7.22	6.78															
10/12/21 11:33	26,737.93	6,899.99	6.10	34,306.19	8,853.05	5.56	34,952.79	9,019.91	9.46	177,609.91	42,800.13	3.66	4.42	273,606.82	67,573.08	532.10	7.11	6.80															
10/12/21 11:33	26,824.25	6,922.26	6.28	34,882.69	9,001.82	5.68	36,586.46	9,441.50	9.67	177,716.09	42,825.71	3.54	4.32	276,009.50	68,191.30	536.97	7.01	7.62															
10/12/21 11:34	27,446.37	7,082.81	6.19	34,406.33	8,878.89	5.82	36,513.50	9,422.67	9.75	177,676.59	42,816.20	3.59	4.36	276,042.79	68,200.57	537.05	7.05	7.09															
10/12/21 11:34	27,255.21	7,033.48	6.07	33,859.86	8,737.87	6.16	37,134.35	9,582.89	9.66	176,949.50	42,640.98	3.74	4.47	275,198.92	67,995.22	535.43	7.12	7.02															
10/12/21 11:35	26,648.75	6,876.97	5.94	34,052.98	8,787.71	6.41	36,632.23	9,453.31	9.78	176,400.41	42,508.66	3.90	4.62	273,734.37	67,626.66	532.53	7.20	6.95															
10/12/21 11:35	26,053.31	6,723.32	5.88	33,732.55	8,705.02	6.51	36,496.34	9,418.24	9.80	176,690.00	42,578.45	4.10	4.83	272,972.20	67,425.03	530.94	7.31	6.87															
10/12/21 11:36	23,866.50	6,158.99	5.87	33,638.13	8,680.65	6.76	34,849.79	8,993.33	9.98	176,934.70	42,637.42	4.18	4.94	269,289.12	66,470.39	523.42	7.44	7.96															
10/12/21 11:36	24,749.57	6,386.87	6.14	34,513.62	8,906.58	6.50	35,044.34	9,043.54	10.15	176,967.59	42,645.34	3.90	4.71	271,275.13	66,982.34	527.45	7.51	7.10															
10/12/21 11:37	25,423.78	6,560.86	6.43	35,191.69	9,081.57	6.42	36,503.49	9,420.09	10.24	176,997.20	42,652.48	3.49	4.34	274,116.16	67,714.99	533.22	7.38	7.02															
10/12/21 11:37	25,241.18	6,513.74	6.37	35,669.49	9,204.87	6.17	36,273.17	9,360.65	10.27	177,010.80	42,655.75	3.44	4.22	274,194.64	67,735.01	533.38	7.25	6.94															
10/12/21 11:38	24,195.28	6,243.83	6.18	35,226.02	9,090.42	5.96	36,230.25	9,349.58	10.26	176,907.91	42,630.96	3.46	4.21	272,559.46	67,314.79	530.07	7.21	6.91															
10/12/21 11:38	22,723.90	5,864.13	6.20	34,739.64	8,964.91	5.88	34,240.38	8,836.07	10.35	176,255.70	42,473.79	3.55	4.34	267,959.62	66,138.90	520.81	7.14	7.10															
10/12/21 11:39	23,242.81	5,998.04	6.34	34,397.74	8,876.68	5.91	34,304.76	8,852.68	10.40	175,821.30	42,369.11	3.63	4.47	267,766.61	66,096.51	520.48	7.20	6.92															
10/12/21 11:39	24,633.67	6,356.96	6.58	35,949.87	9,277.22	5.98	35,153.07	9,071.60	10.46	176,413.30	42,511.77	3.77	4.59	272,149.91	67,217.55	529.30	7.29	6.89															
10/12/21 11:40	24,927.21	6,432.71	6.52	35,828.28	9,245.84	5.81	36,698.04	9,470.29	10.40	176,698.00	42,628.57	3.77	4.67	274,351.53	67,777.42	533.71	7.39	6.86															
10/12/21 11:40	23,747.34	6,128.24	6.12	36,128.69	9,323.37	5.63	36,092.93	9,314.14	10.26	176,876.59	42,623.41	3.66	4.62	272,845.55	67,389.16	530.66	7.42	6.84															
10/12/21 11:41	23,836.71	6,151.30	6.01	35,549.32	9,173.85	5.48	36,105.80	9,317.46	10.31	176,703.00	42,581.58	3.67	4.57	272,194.83	67,224.20	529.36	7.23	6.81															
10/12/21 11:41	23,042.25	5,946.28	5.96	34,844.07	8,991.86	5.48	34,500.74	8,903.26	10.23	175,811.30	42,366.70	3.65	4.52	268,198.36	66,208.10	521.36	7.17	6.71															
10/12/21 11:42	22,987.72	5,932.21	6.27	35,187.40	9,080.46	5.55	34,223.22	8,831.64	10.36	175,057.50	42,185.05	3.75	4.59	267,455.84	66,029.36	519.95	7.06	6.73															
10/12/21 11:42	25,154.21	6,491.29	6.46	35,878.34	9,258.76	5.65	35,502.12	9,161.67	10.35	174,953.50	42,159.99	4.03	4.82	271,488.17	67,071.72	528.16	7.18	6.75															
10/12/21 11:43	25,591.64	6,604.18	6.45	36,971.27	9,540.80	5.53	36,233.11	9,350.31	10.18	174,929.09	42,154.11	4.23	5.10	273,725.11	67,649.40	532.71	7.41	6.78															
10/12/21 11:43	24,360.82	6,286.55	6.24	35,992.79	9,288.30	5.37	35,619.42	9,191.95	10.14	175,279.80	42,238.62	4.26	5.16	271,252.83	67,005.41	527.63	7.49	6.80															
10/12/21 11:44	24,141.13	6,229.86	6.21	35,684.04	9,201.91	5.30	34,313.34	8,854.90	10.03	175,642.30	42,325.97	4.11	5.03	269,754.81	66,612.64	524.54	7.46	6.77															
10/12/21 11:44	24,878.62	6,420.17	6.43	36,080.05	9,310.82	5.34	35,383.38	9,131.03	10.14	176,059.80	42,426.58	3.98	4.87	272,401.85	67,288.60	529.86	7.44	6.70															
10/12/21 11:45	25,223.12	6,509.08	6.43	36,005.66	9,291.62	5.38	34,981.40	9,027.30	10.07	176,320.91	42,489.50	3.91	4.88	272,531.08	67,317.50	530.09	7.38	6.63															
10/12/21 11:45	25,050.65	6,464.57	6.42	36,679.44	9,465.49	5.30	35,743.88	9,224.06	10.04	175,844.70	42,374.75	3.92	4.94	273,318.67	67,528.88	531.76	7.40	6.60															
10/12/21 11:46	24,665.10	6,365.07	6.34	36,203.07	9,342.56	5.26	34,898.43	9,005.89	10.05	175,556.59	42,305.32	4.04	4.98	271,323.19	67,018.84	527.74	7.38	6.60															
10/12/21 11:46	24,544.73	6,334.01	6.38	35,906.95	9,266.14	5.22	34,856.94	8,995.18	9.97	176,155.30	42,449.60	3.92	4.85	271,463.92	67,044.93	527.95	7.40	7.04															
10/12/21 11:47	24,792.54	6,397.96	6.43	35,959.89	9,279.81	5.33	35,072.96	9,050.93	10.06	176,744.20	42,591.51	3.56	4.52	272,569.59	67,320.20	530.11	7.25	6.70															
10/12/21 11:47	25,273.97	6,522.20	6.49	35,633.72	9,195.63	5.38	34,745.36	8,966.38	9.98	177,286.70	42,722.24	3.34	4.30	272,938.75	67,406.46	530.79	7.08	6.70															
10/12/21 11:48	25,912.27	6,686.92	6.46	36,293.20	9,365.82	5.41	36,283.10	9,363.24	9.96	177,620.00	42,802.56	3.41	4.42	276,108.66	68,218.53	537.19	7.07	6.82															
10/12/21 11:48	25,374.77	6,545.63	6.32	35,692.38	9,210.77	5.30	34,884.12	9,002.19	9.91	176,966.50	42,645.08	3.48	4.60	272,907.77	67,403.68	530.77	7.12	6.70															
10/12/21 11:49	25,114.31	6,481.00	6.29	35,384.81	9,131.40	5.30	35,180.25	9,078.61	9.84	176,500.20	42,532.71	3.44	4.59	272,179.57	67,223.72	529.35	7.14	7.12															
10/12/21 11:49	25,256.58	6,517.71	6.32	35,135.90	9,067.17	5.42	34,826.90	8,987.43	9.98	176,915.70	42,632.8																						

Parameter	Steamflow Boiler 1	Coal Feed B1	O2 Boiler 1	Steamflow Boiler 2	Coal Feed B2	O2 Boiler 2	Steamflow Boiler 3	Coal Feed B3	O2 Boiler 3	Steamflow B5	Coal Feed B5	Boiler 5 O2 - 2 (Economizer)	Boiler 5 O2 - 3 (Economizer)	Total plant steamflow	Coal Feed Plant Total	MMBtu input	O2 - 5 (Common Stack)	Opacity
units	(lbs/hr)	(lbs/hr)	(%)	(lbs/hr)	(lbs/hr)	(%)	(lbs/hr)	(lbs/hr)	(%)	(lbs/hr)	(lbs/hr)	(%)	(%)	(lbs/hr)	(lbs/hr)	(MMBtu/hr)	(%)	(%)
10/12/21 12:12	23,103.60	5,962.11	5.52	36,175.89	9,335.55	5.01	35,327.59	9,116.63	10.33	174,923.80	42,152.83	3.93	3.93	4.81	269,530.88	66,567.13	524.18	6.71
10/12/21 12:13	24,782.50	6,395.37	5.89	36,902.61	9,523.08	5.13	35,549.32	9,173.85	10.34	175,096.91	42,194.55	3.80	3.80	4.63	272,331.34	67,286.86	529.85	7.13
10/12/21 12:13	24,337.50	6,280.53	5.93	37,407.58	9,653.40	5.02	35,123.02	9,063.84	10.25	175,420.00	42,272.41	3.74	3.74	4.56	272,288.10	67,270.18	529.72	6.70
10/12/21 12:14	24,389.12	6,293.85	5.96	37,358.95	9,640.85	4.87	34,489.30	8,900.31	10.21	175,670.41	42,332.75	3.79	3.79	4.61	271,907.78	67,167.76	528.91	6.61
10/12/21 12:14	22,402.80	5,781.26	6.03	36,350.42	9,380.59	4.73	32,731.18	8,444.61	10.15	175,578.50	42,310.60	3.98	3.98	4.77	267,062.90	65,919.06	519.08	6.57
10/12/21 12:15	23,013.49	5,938.65	6.25	35,376.17	9,330.23	4.86	31,655.71	8,710.10	10.32	175,455.41	42,280.94	4.09	4.09	4.84	266,504.78	65,771.13	517.96	7.27
10/12/21 12:15	24,881.47	6,420.91	6.74	37,752.34	9,742.37	5.02	32,726.88	8,445.50	10.34	175,185.00	42,215.78	4.12	4.12	4.86	270,545.69	66,824.55	526.21	7.74
10/12/21 12:16	24,159.56	6,234.61	6.75	37,786.68	9,751.23	4.90	32,755.49	8,452.88	10.26	175,003.09	42,171.94	4.11	4.11	4.87	269,704.82	66,610.66	524.53	6.78
10/12/21 12:16	23,724.38	6,122.31	6.72	37,786.68	9,751.23	4.77	31,201.93	8,051.97	10.22	175,238.20	42,228.60	3.99	3.99	4.80	267,951.19	66,154.10	520.93	7.43
10/12/21 12:17	22,760.85	5,873.66	6.69	36,868.27	9,514.22	4.61	31,014.53	8,003.61	10.17	175,488.59	42,288.94	3.89	3.89	4.65	266,132.24	65,680.43	517.20	7.36
10/12/21 12:17	23,041.30	5,946.04	6.81	37,027.06	9,555.20	4.71	30,563.91	7,887.32	10.22	175,811.00	42,366.63	3.68	3.68	4.41	266,443.27	65,755.18	517.79	7.22
10/12/21 12:18	23,230.68	5,994.91	6.88	36,825.36	9,503.15	4.75	30,416.57	7,849.30	10.27	176,052.70	42,424.87	3.52	3.52	4.25	266,525.31	65,772.23	517.92	7.13
10/12/21 12:18	25,305.64	6,530.37	6.90	38,414.68	9,913.29	4.78	32,746.91	8,450.67	10.17	175,914.09	42,391.47	3.62	3.62	4.38	272,381.32	67,285.80	529.84	7.16
10/12/21 12:19	24,650.22	6,361.23	6.63	38,105.69	9,833.55	4.64	33,100.25	8,541.85	10.05	175,852.70	42,376.68	3.68	3.68	4.49	271,708.87	67,113.31	528.48	7.17
10/12/21 12:19	24,539.02	6,332.54	6.14	37,851.05	9,767.84	4.49	32,855.63	8,478.72	9.92	176,154.91	42,449.50	3.63	3.63	4.49	271,400.61	67,028.60	527.82	7.15
10/12/21 12:20	23,362.39	6,028.90	6.17	37,338.92	9,635.68	4.46	31,930.07	8,239.87	9.95	176,295.91	42,483.48	3.53	3.53	4.41	268,927.29	66,387.93	522.77	6.96
10/12/21 12:20	22,992.22	5,933.37	6.30	36,215.95	9,345.88	4.43	31,679.73	8,175.27	9.95	175,676.70	42,334.27	3.57	3.57	4.50	266,564.60	65,788.79	518.05	6.60
End Run 1	24,796.30	6,398.93	6.30	35,636.37	9,196.32	5.45	35,006.20	9,033.70	10.08	176,137.64	42,445.34	3.75	3.75	4.68	271,576.51	67,074.29	528.18	6.86
Run 2																		
10/12/21 12:30	22,859.47	5,899.11	5.50	36,855.40	9,510.90	5.09	37,261.67	9,615.74	10.38	175,080.09	42,190.50	3.68	3.68	4.39	272,056.63	67,216.25	529.29	7.14
10/12/21 12:30	23,354.63	6,026.89	5.33	36,603.63	9,445.93	5.08	38,004.12	9,807.34	10.39	175,643.41	42,326.24	3.79	3.79	4.51	273,605.79	67,606.41	532.37	7.12
10/12/21 12:31	23,435.46	6,047.75	5.08	36,779.58	9,491.33	5.15	38,982.60	10,059.85	10.40	176,040.70	42,421.98	3.91	3.91	4.61	275,238.34	68,030.92	535.63	7.13
10/12/21 12:31	23,209.26	5,989.38	4.88	36,416.23	9,397.57	5.14	39,373.14	10,160.63	10.42	175,655.80	42,329.23	4.01	4.01	4.66	274,654.43	67,876.81	534.50	7.16
10/12/21 12:32	21,317.75	5,501.26	4.67	35,065.80	9,049.08	5.28	37,975.51	9,799.96	10.46	175,385.91	42,264.19	3.96	3.96	4.52	269,744.97	66,614.48	524.56	7.15
10/12/21 12:32	21,089.83	5,442.44	4.94	33,798.35	8,722.00	5.49	37,512.02	9,680.35	10.65	175,657.59	42,329.66	3.97	3.97	4.48	268,057.79	66,174.45	521.09	7.09
10/12/21 12:33	21,142.83	5,456.12	5.34	33,236.15	8,576.92	5.85	36,848.25	9,509.06	10.76	175,877.70	42,382.70	3.81	3.81	4.39	267,104.93	65,924.79	519.12	7.14
10/12/21 12:33	21,676.39	5,593.81	5.67	32,788.39	8,461.37	6.16	36,898.31	9,521.97	10.84	175,854.30	42,377.06	3.80	3.80	4.40	267,217.39	65,954.21	519.36	7.23
10/12/21 12:34	23,976.77	6,187.44	5.77	33,409.25	8,621.59	6.41	38,929.67	10,046.19	10.84	175,755.41	42,353.23	3.93	3.93	4.53	272,071.10	67,208.45	529.23	7.36
10/12/21 12:34	22,875.58	5,903.27	5.47	32,918.57	8,494.96	6.42	39,983.97	10,318.26	10.76	175,301.30	42,243.80	4.08	4.08	4.65	271,079.42	66,960.29	527.28	7.50
10/12/21 12:35	22,301.46	5,755.11	5.06	32,405.07	8,372.77	6.35	40,493.25	10,449.68	10.74	174,986.59	42,167.96	4.25	4.25	4.79	270,226.38	66,745.53	525.59	7.52
10/12/21 12:35	21,574.42	5,567.49	4.85	31,625.37	8,161.24	6.38	39,101.34	10,090.49	10.72	175,329.41	42,250.57	4.22	4.22	4.83	267,630.54	66,069.80	520.27	7.48
10/12/21 12:36	21,626.26	5,580.87	5.12	31,267.73	8,068.95	6.54	38,998.33	10,063.91	10.81	175,637.80	42,324.89	4.04	4.04	4.73	267,530.12	66,038.61	520.02	7.42
10/12/21 12:36	22,561.66	5,822.26	5.29	31,606.77	8,156.44	6.68	38,556.30	9,949.84	10.82	175,784.30	42,360.19	3.86	3.86	4.56	268,509.03	66,288.73	521.99	7.42
10/12/21 12:37	22,992.42	5,933.42	5.51	32,044.51	8,269.40	6.74	39,514.76	10,197.18	10.80	175,915.80	42,391.88	3.48	3.48	4.22	270,467.49	66,791.88	525.95	7.37
10/12/21 12:37	23,368.02	6,030.35	5.43	32,698.27	8,438.11	6.70	39,726.48	10,251.81	10.77	175,976.30	42,406.46	3.28	3.28	4.03	271,769.07	67,126.74	528.59	7.28
10/12/21 12:38	22,338.16	5,764.58	5.35	31,887.16	8,228.80	6.53	39,403.18	10,168.38	10.67	176,043.91	42,422.75	3.31	3.31	4.09	269,672.41	66,584.52	524.32	7.19
10/12/21 12:38	21,811.45	5,628.66	5.29	31,413.65	8,106.60	6.42	38,178.64	9,852.38	10.73	176,145.30	42,447.19	3.63	3.63	4.40	267,549.04	66,034.83	519.99	7.15
10/12/21 12:39	21,861.68	5,641.62	5.61	31,216.23	8,055.66	6.48	36,949.81	9,516.20	10.80	176,136.20	42,401.00	4.87	4.87	4.60	266,163.92	65,677.54	517.84	7.32
10/12/21 12:39	21,696.93	5,599.11	5.88	30,895.80	7,972.97	6.63	36,440.55	9,403.85	10.78	175,606.70	42,317.40	4.39	4.39	5.09	264,639.98	65,293.32	514.15	7.58
10/12/21 12:40	22,348.53	5,767.26	6.19	31,396.48	8,102.17	6.61	35,891.22	9,262.09	10.77	175,198.59	42,219.05	4.25	4.25	5.07	264,834.82	65,350.57	514.60	7.64
10/12/21 12:40	24,325.97	6,277.56	6.45	33,467.90	8,636.72	6.78	37,838.18	9,764.52	10.73	175,363.09	42,258.69	3.83	3.83	4.61	270,995.14	66,937.49	527.10	7.73
10/12/21 12:41	24,018.18	6,198.13	6.35	33,613.81	8,674.38	6.48	37,303.16	9,626.45	10.65	175,650.41	42,327.93	3.53	3.53	4.27	270,585.55	66,826.89	526.23	7.45
10/12/21 12:41	22,577.36	5,826.31	6.12	33,088.80	8,538.89	6.23	37,039.94	9,558.52	10.52	176,516.59	42,536.66	3.41	3.41	4.09	269,222.70	66,460.39	523.34	7.30
10/12/21 12:42	23,278.51	6,007.25	6.02	34,314.77	8,855.27	6.03	36,775.29	9,490.23	10.61	177,163.41	42,692.53	3.48	3.48	4.13	271,531.97	67,045.27	527.95	7.13
10/12/21 12:42	21,778.59	5,620.18	6.15	33,206.11	8,569.17	5.89	35,170.23	9,076.03	10.59	176,775.09	42,598.95	3.81	3.81	4.51	266,930.02	65,864.33	518.65	7.17
10/12/21 12:43	22,764.81	5,874.69	6.38	34,691.00	8,952.36	5.15	35,616.56	9,191.21	10.69	176,311.09	42,487.14	4.09	4.09	4.85	269,383.46	66,505.39	523.70	7.49
10/12/21 12:43	23,268.53	6,004.67	6.56	35,052.93	9,045.76	5.72	35,592.24	9,184.93	10.68	175,490.09	42,289.30	4.45	4.45	5.20	269,403.79	66,524.66	523.85	7.63
10/12/21 12:44	23,407.60	6,040.56	6.54	36,507.78	9,421.20	5.49	35,849.73	9,251.38	10.57	174,908.00	42,149.03	4.55	4.55	5.31	270,673.11	66,862.16	526.51	7.80
10/12/21 12:44	22,975.66	5,929.10	6.44	36,517.79	9,423.78	5.13	35,530.73	9,169.06	10.55	175,452.30	42,280.19	4.30	4.30	5.08	270,476.48	66,802.12	526.03	7.76
10/12/21 12:45	22,311.85	5,757.79	6.44	37,154.38	9,588.06	4.89	34,822.61	8,986.32	10.55	175,896.91	42,387.33	3.88	3.88	4.69	270,185.74	66,719.50	525.38	7.53
10/12/21 12:45	21,209.75	5,473.39	6.61	36,294.63	9,366.19	4.73	32,798.41	8,463.96	10.56	175,8								

Parameter	Steamflow Boiler 1	Coal Feed B1	O2 Boiler 1	Steamflow Boiler 2	Coal Feed B2	O2 Boiler 2	Steamflow Boiler 3	Coal Feed B3	O2 Boiler 3	Steamflow B5	Coal Feed B5	Boiler 5 O2 - 2 (Economizer)	Boiler 5 O2 - 3 (Economizer)	Total plant steamflow	Coal Feed Plant Total	MMBtu input (MMBtu/hr)	O2 - 5 (Common Stack)	Opacity
units	(lbs/hr)	(lbs/hr)	(%)	(lbs/hr)	(lbs/hr)	(%)	(lbs/hr)	(lbs/hr)	(%)	(lbs/hr)	(lbs/hr)	(%)	(%)	(lbs/hr)	(lbs/hr)		(%)	(%)
10/12/21 13:03	21,795.83	5,624.63	5.84	34,788.28	8,977.46	6.07	38,260.18	9,873.42	10.87	176,151.59	42,448.70	4.04	4.81	270,995.88	66,924.21	526.99	7.70	6.83
10/12/21 13:04	21,683.76	5,595.71	5.70	35,187.40	9,080.46	5.86	38,856.71	10,027.36	10.91	176,569.00	42,549.29	3.76	4.59	272,296.87	67,252.82	529.58	7.54	7.42
10/12/21 13:04	19,899.95	5,135.38	5.49	34,157.41	8,814.66	5.75	37,386.13	9,647.86	10.87	176,177.50	42,454.95	3.56	4.35	267,620.99	66,052.85	520.13	7.37	6.99
10/12/21 13:05	20,148.49	5,199.52	5.61	33,972.88	8,767.04	5.80	37,660.79	9,718.74	11.03	175,865.41	42,379.74	3.30	4.08	267,647.56	66,065.04	520.23	7.19	6.94
10/12/21 13:05	20,769.44	5,357.44	5.82	34,206.05	8,827.21	6.00	37,251.66	9,613.16	11.17	175,927.80	42,394.77	3.18	3.96	268,145.95	66,192.58	521.23	7.05	6.89
10/12/21 13:05	22,334.35	5,763.60	5.96	35,296.12	9,108.51	6.07	39,023.67	10,427.77	11.16	176,062.70	42,427.28	3.37	4.17	272,725.85	67,372.17	530.52	7.13	6.83
10/12/21 13:06	22,017.41	5,681.81	5.67	35,283.24	9,105.19	6.05	40,022.60	10,328.23	11.14	176,539.41	42,542.16	3.65	4.47	273,862.66	67,657.39	532.77	7.31	7.18
10/12/21 13:07	21,770.94	5,618.21	5.30	35,416.28	9,139.52	5.91	40,920.97	10,560.06	10.97	176,895.30	42,627.92	3.82	4.69	275,003.49	67,945.71	535.04	7.44	6.95
10/12/21 13:07	20,723.85	5,347.99	4.92	34,789.71	8,977.83	5.84	40,694.95	10,501.74	11.03	176,681.59	42,576.42	3.71	4.67	272,890.10	67,403.98	530.77	7.40	6.89
10/12/21 13:08	20,515.79	5,294.30	4.93	34,612.32	8,932.05	5.81	40,208.57	10,376.22	11.07	176,476.00	42,526.88	3.47	4.41	271,812.68	67,129.45	528.61	7.25	6.86
10/12/21 13:08	19,625.38	5,064.52	5.04	33,909.93	8,750.79	5.90	39,368.85	10,159.52	11.20	176,308.50	42,486.52	3.30	4.27	269,212.66	66,461.36	523.35	7.11	6.83
10/12/21 13:09	19,888.84	5,132.51	5.35	33,579.48	8,665.52	5.98	38,420.40	9,914.76	11.25	176,156.09	42,449.79	3.31	4.28	268,044.81	66,162.58	521.00	7.11	6.95
10/12/21 13:09	22,014.10	5,680.96	5.68	35,268.94	9,101.50	6.16	40,696.38	10,502.10	11.29	176,074.20	42,430.05	3.65	4.54	274,053.62	67,714.62	533.22	7.14	6.77
10/12/21 13:10	21,107.42	5,446.98	5.59	34,899.86	9,006.25	5.99	39,810.88	10,273.59	11.19	176,093.80	42,434.78	3.93	4.81	271,911.96	67,161.60	528.86	7.37	6.76
10/12/21 13:10	21,572.64	5,567.03	5.51	35,553.61	9,174.96	5.83	40,234.32	10,382.87	11.08	176,591.80	42,554.78	3.93	4.78	273,952.37	67,679.64	532.94	7.49	6.78
10/12/21 13:11	20,514.84	5,294.06	5.55	34,652.38	8,942.39	5.68	38,968.30	10,056.16	11.08	176,887.09	42,625.94	3.95	4.79	271,022.61	66,918.55	526.95	7.37	6.79
10/12/21 13:11	20,341.19	5,249.25	5.60	34,444.95	8,888.86	5.59	37,484.84	9,673.33	10.99	176,227.09	42,466.90	3.94	4.80	268,498.07	66,278.34	521.91	7.38	6.86
10/12/21 13:12	20,229.29	5,220.37	6.07	34,204.62	8,826.84	5.70	36,430.53	9,401.26	11.09	175,715.70	42,343.66	4.02	4.81	266,580.14	65,792.13	518.08	7.46	6.63
10/12/21 13:12	20,722.70	5,347.70	6.45	33,869.88	8,740.46	5.82	35,061.51	9,047.97	11.09	175,905.09	42,389.30	4.06	4.84	265,559.18	65,525.43	515.98	7.56	6.60
10/12/21 13:13	23,698.92	6,115.74	6.89	36,253.14	9,355.48	5.94	36,775.29	9,490.23	11.06	175,915.91	42,391.91	3.98	4.78	272,643.26	67,353.36	530.37	7.62	6.60
10/12/21 13:13	22,647.06	5,844.30	6.79	35,444.89	9,146.91	5.78	36,170.17	9,334.07	10.84	175,085.20	42,191.73	3.85	4.61	269,347.33	66,517.00	525.79	7.63	6.60
10/12/21 13:14	22,959.89	5,925.03	6.66	36,562.14	9,435.22	5.61	36,338.98	9,377.63	10.67	174,504.50	42,051.79	3.78	4.53	270,365.51	66,789.68	523.94	7.53	7.82
10/12/21 13:14	21,725.36	5,606.44	6.66	35,573.64	9,180.13	5.43	35,250.34	9,096.70	10.63	175,102.91	42,195.99	3.82	4.58	267,652.25	66,079.27	520.34	7.36	6.88
10/12/21 13:15	21,818.10	5,630.38	6.71	35,399.12	9,135.09	5.37	33,738.27	8,706.50	10.57	175,586.70	42,312.58	3.73	4.56	266,542.19	65,784.54	518.02	7.35	6.70
10/12/21 13:15	21,905.87	5,653.03	7.09	34,620.91	8,934.27	5.53	33,316.26	8,597.59	10.64	175,529.91	42,298.89	3.72	4.51	265,372.95	65,483.78	515.65	7.30	6.70
10/12/21 13:16	22,750.83	5,871.08	7.33	34,709.60	8,957.16	5.73	32,698.27	8,438.11	10.60	175,446.09	42,278.69	3.79	4.55	265,604.79	65,545.04	516.13	7.38	6.70
10/12/21 13:16	24,819.79	6,404.99	7.56	35,909.82	9,266.89	5.77	34,100.19	8,799.89	10.48	175,234.50	42,227.70	3.88	4.66	270,064.30	66,699.48	525.23	7.50	7.62
10/12/21 13:17	24,519.27	6,327.44	7.29	35,929.84	9,272.05	5.64	33,799.78	8,722.37	10.28	175,118.91	42,199.85	3.86	4.66	269,367.80	66,521.71	523.83	7.59	6.79
10/12/21 13:17	25,164.64	6,493.99	7.16	36,154.44	9,330.01	5.49	33,629.55	8,678.44	10.08	175,455.59	42,280.98	3.83	4.60	270,404.23	66,783.42	525.89	7.47	6.75
10/12/21 13:18	23,867.75	6,159.31	6.94	35,034.33	9,040.96	5.40	33,460.75	8,634.88	10.03	175,632.91	42,323.71	3.84	4.64	267,995.73	66,158.86	520.97	7.32	6.70
10/12/21 13:18	24,303.42	6,271.74	6.97	34,472.13	8,895.87	5.44	32,080.28	8,278.63	10.01	175,058.50	42,185.29	3.92	4.71	265,914.33	65,631.54	516.82	7.26	6.65
10/12/21 13:19	24,401.19	6,296.97	7.24	33,808.36	8,724.58	5.59	31,848.53	8,218.83	10.01	174,643.80	42,085.36	3.89	4.69	264,701.88	65,325.74	514.41	7.30	6.68
10/12/21 13:19	24,915.57	6,429.71	7.42	34,236.09	8,834.96	5.70	31,724.08	8,186.71	10.01	174,981.41	42,166.71	3.72	4.58	265,857.15	65,618.10	516.71	7.39	6.61
10/12/21 13:20	25,924.13	6,689.98	7.58	34,479.29	8,897.72	5.78	32,499.43	8,386.80	9.86	175,327.00	42,250.00	3.56	4.43	268,229.85	66,224.50	521.48	7.35	6.61
10/12/21 13:20	26,220.34	6,766.42	7.42	35,281.81	9,104.82	5.66	33,347.73	8,605.71	9.77	175,710.09	42,342.31	3.65	4.58	270,559.97	66,819.26	526.17	7.26	6.62
10/12/21 13:21	25,300.93	6,529.16	7.26	34,372.00	8,870.04	5.47	32,250.51	8,322.56	9.68	175,872.50	42,381.45	3.96	5.02	267,795.94	66,103.20	520.53	7.32	6.63
10/12/21 13:21	25,076.88	6,471.34	7.17	34,517.91	8,907.69	5.34	31,993.02	8,256.12	9.61	174,994.30	42,169.82	4.20	5.22	266,582.11	65,804.96	518.18	7.45	6.64
10/12/21 13:22	24,623.08	6,354.23	7.37	34,675.27	8,948.30	5.27	30,728.43	7,929.78	9.72	174,340.70	42,012.32	4.38	5.35	264,367.48	65,244.62	513.77	7.58	6.77
10/12/21 13:22	24,672.87	6,367.08	7.62	34,972.82	9,025.05	5.27	30,894.24	7,949.38	9.74	174,745.50	42,075.50	4.32	5.26	265,195.43	65,451.37	515.40	7.71	6.67
10/12/21 13:23	24,816.39	6,404.12	7.77	35,444.89	9,146.91	5.19	30,207.71	7,795.40	9.72	175,106.30	42,196.81	4.13	5.09	265,575.29	65,543.23	516.12	7.65	6.57
10/12/21 13:23	25,049.90	6,464.38	7.91	35,454.91	9,149.49	5.11	30,127.61	7,774.73	9.74	175,259.20	42,233.66	3.85	4.80	265,891.62	65,622.25	516.74	7.55	6.50
10/12/21 13:24	26,836.03	6,925.30	7.91	37,533.47	9,685.88	5.01	32,153.24	8,297.46	9.65	175,390.80	42,265.37	3.59	4.50	271,913.54	67,174.02	528.96	7.40	6.50
10/12/21 13:24	25,924.92	6,690.18	7.59	37,343.21	9,636.79	4.71	31,829.94	8,214.03	9.50	175,422.09	42,272.91	3.36	4.28	270,520.16	66,813.91	526.13	7.25	6.61
10/12/21 13:25	25,166.14	6,494.37	7.28	36,809.62	9,499.09	4.51	31,458.00	8,118.05	9.37	175,472.91	42,285.16	3.17	4.14	268,906.67	66,396.66	522.84	7.05	6.58
10/12/21 13:25	24,857.43	6,414.71	7.30	36,908.33	9,524.56	4.47	30,696.95	7,921.65	9.47	175,615.59	42,319.54	3.30	4.26	268,078.30	66,180.46	521.14	6.86	6.55
10/12/21 13:26	24,653.02	6,361.96	7.44	36,357.57	9,382.43	4.57	30,466.64	7,862.22	9.57	175,606.00	42,317.23	3.60	4.57	267,083.23	65,923.83	519.12	6.91	6.53
10/12/21 13:26	25,724.44	6,638.45	7.62	36,961.26	9,538.22	4.65	30,855.74	7,962.63	9.58	174,878.20	42,141.84	3.93	4.90	268,419.64	66,281.14	521.93	7.15	6.50
10/12/21 13:27	25,808.81	6,660.22	7.77	37,170.12	9,592.12	4.75	31,370.74	8,095.53	9.59	174,341.00	42,012.39	4.00	5.06	268,690.67	66,360.26	522.55	7.37	6.95
10/12/21 13:27	27,334.42	7,053.92	7.64	37,986.95	9,802.91	4.73	32,536.62	8,396.40	9.53	174,702.80	42,099.58	3.94	4.99	272,560.79	67,352.80	530.37	7.52	6.60
10/12/21 13:28	26,207.26	6,763.04	7.35	37,742.33	9,739.78	4.61	33,128.86	8,549.23	9.49	175,185.50	42,215.90	3.83	4.84	272,263.95	67,267.95	529.70	7.4	

Parameter	Steamflow Boiler 1	Coal Feed B1	O2 Boiler 1	Steamflow Boiler 2	Coal Feed B2	O2 Boiler 2	Steamflow Boiler 3	Coal Feed B3	O2 Boiler 3	Steamflow B5	Coal Feed B5	Boiler 5 O2 - 2 (Economizer)	Boiler 5 O2 - 3 (Economizer)	Total plant steamflow	Coal Feed Plant Total	MMBtu input	O2 - 5 (Common Stack)	Opacity	
units	(lbs/hr)	(lbs/hr)	(%)	(lbs/hr)	(lbs/hr)	(%)	(lbs/hr)	(lbs/hr)	(%)	(lbs/hr)	(lbs/hr)	(%)	(%)	(lbs/hr)	(lbs/hr)	(MMBtu/hr)	(%)	(%)	
10/12/21 14:04	26,209.52	6,763.63	7.68	36,692.32	9,468.82	4.86	32,509.44	8,389.38	9.75	174,123.30	41,959.93	3.91	3.91	4.71	269,534.58	66,581.76	524.30	7.45	6.73
10/12/21 14:05	25,420.85	6,560.10	7.37	37,021.34	9,553.72	4.85	33,173.20	8,560.67	9.67	174,348.70	42,014.25	3.88	3.88	4.69	269,964.09	66,688.75	525.14	7.43	7.14
10/12/21 14:06	25,282.65	6,524.44	6.83	36,188.77	9,338.87	4.71	34,618.05	8,933.53	9.61	174,641.70	42,084.85	3.95	3.95	4.73	270,731.17	66,881.69	526.66	7.43	6.81
10/12/21 14:06	23,610.55	6,092.94	6.30	35,061.51	9,047.97	4.74	34,113.07	8,803.22	9.62	175,037.91	42,180.33	4.00	4.00	4.77	267,823.04	66,124.45	520.70	7.32	6.81
10/12/21 14:06	23,235.29	5,995.10	6.19	34,499.31	8,802.89	4.93	34,052.98	8,787.71	9.83	175,920.80	42,393.09	3.99	3.99	4.75	267,708.38	66,079.78	520.35	7.24	6.81
10/12/21 14:07	22,619.93	5,837.30	6.13	33,510.81	8,647.80	5.35	33,929.96	8,745.96	9.66	175,602.20	42,557.29	4.53	4.53	4.79	266,662.90	65,798.35	518.13	7.24	6.81
10/12/21 14:07	22,513.13	5,809.74	6.21	32,982.95	8,511.58	5.66	34,203.19	8,826.47	10.10	176,233.59	42,492.56	3.38	3.38	4.10	266,032.87	65,640.35	516.88	7.20	7.02
10/12/21 14:08	24,161.91	6,235.22	6.31	33,595.21	8,669.58	5.97	36,210.23	9,344.41	10.22	176,079.91	42,431.43	3.15	3.15	3.93	270,047.26	66,680.64	525.08	6.99	6.80
10/12/21 14:08	23,890.19	6,165.10	6.08	33,105.97	8,543.32	6.09	37,549.21	9,689.95	10.21	175,896.41	42,387.21	3.22	3.22	4.05	270,441.78	66,785.58	525.90	6.98	6.79
10/12/21 14:09	24,412.14	6,299.80	5.60	33,517.96	8,649.64	6.14	39,617.76	10,223.76	10.25	175,756.41	42,353.47	3.51	3.51	4.34	273,304.27	67,526.67	531.74	7.08	6.77
10/12/21 14:09	22,993.08	5,933.59	4.98	33,098.82	8,541.48	6.12	39,471.84	10,186.10	10.25	175,820.80	42,368.99	3.77	3.77	4.65	271,384.54	67,030.16	527.83	7.17	6.78
10/12/21 14:10	22,016.79	5,681.65	4.60	32,098.88	8,283.43	6.14	40,313.00	10,403.17	10.39	175,841.20	42,373.91	3.70	3.70	4.61	270,269.87	66,742.16	525.56	7.23	6.88
10/12/21 14:10	22,082.93	5,698.72	4.42	31,718.35	8,185.23	6.28	40,454.62	10,439.72	10.53	175,653.59	42,328.70	3.44	3.44	4.28	269,909.49	66,652.37	524.85	7.25	6.93
10/12/21 14:11	21,105.80	5,446.56	4.43	31,444.71	8,037.20	6.44	40,158.50	10,363.30	10.64	175,436.00	42,276.26	3.27	3.27	4.09	267,845.01	66,123.32	520.69	7.10	6.95
10/12/21 14:11	23,075.56	5,954.88	4.57	32,030.21	8,265.71	6.63	41,795.03	10,785.62	10.81	175,077.30	42,189.82	3.16	3.16	3.87	271,978.10	67,196.04	529.14	6.99	6.98
10/12/21 14:12	22,161.04	5,718.88	4.52	32,114.61	8,287.49	6.68	42,720.59	11,024.47	10.77	174,753.80	42,111.87	3.49	3.49	4.03	271,750.04	67,142.71	528.72	6.97	7.00
10/12/21 14:12	22,155.32	5,717.40	4.23	31,573.87	8,147.95	6.64	43,278.50	11,168.45	10.82	174,596.50	42,073.96	4.19	4.19	4.76	271,604.19	67,107.76	528.44	7.17	8.12
10/12/21 14:13	21,669.01	5,591.90	4.13	31,143.28	8,036.83	6.72	43,168.34	11,140.02	10.83	174,522.41	42,056.11	4.69	4.69	5.34	270,503.04	66,824.86	526.21	7.48	7.24
10/12/21 14:13	20,908.78	5,395.72	4.20	30,513.85	7,874.40	6.82	42,128.34	10,871.64	10.94	174,840.59	42,132.78	4.62	4.62	5.41	268,391.56	66,274.54	521.88	7.69	7.01
10/12/21 14:14	21,014.73	5,423.06	4.41	29,892.99	7,714.18	6.87	40,028.32	10,329.71	10.66	175,148.41	42,206.96	4.21	4.21	5.10	266,084.45	65,673.91	517.15	7.71	6.98
10/12/21 14:14	20,600.56	5,316.18	4.86	29,400.95	7,597.53	6.91	39,586.29	10,215.63	10.72	175,406.80	42,269.22	3.69	3.69	4.60	265,034.60	65,398.57	514.98	7.53	6.94
10/12/21 14:15	22,706.54	5,895.65	5.44	31,181.90	8,046.60	7.10	39,888.13	10,233.53	10.86	175,606.00	42,317.23	3.46	3.46	4.26	269,382.57	66,517.20	523.79	7.31	7.86
10/12/21 14:15	22,222.42	5,734.72	5.65	31,446.55	8,115.09	6.99	39,942.49	10,307.56	9.46	175,325.80	42,297.90	3.52	3.52	4.25	269,137.26	66,455.27	523.30	7.35	7.11
10/12/21 14:16	22,663.43	5,848.52	5.69	32,409.30	8,363.54	6.76	39,657.81	10,234.09	10.70	175,476.41	42,286.00	3.70	3.70	4.46	270,206.95	66,732.15	525.48	7.39	7.06
10/12/21 14:16	20,980.56	5,414.24	5.61	31,902.89	8,232.86	6.45	38,833.82	10,021.45	10.52	175,572.20	42,309.08	3.86	3.86	4.62	267,289.47	65,977.64	519.54	7.41	7.01
10/12/21 14:17	20,544.89	5,301.81	5.84	31,971.56	8,250.58	6.30	37,218.75	9,604.67	10.63	175,578.30	42,310.55	3.97	3.97	4.74	265,313.50	65,467.61	515.52	7.37	6.96
10/12/21 14:17	20,921.50	5,399.00	6.19	32,090.29	8,281.22	6.49	36,454.85	9,407.54	10.64	175,161.00	42,209.99	3.84	3.84	4.63	264,627.64	65,297.75	514.19	7.40	6.96
10/12/21 14:18	21,926.77	5,658.42	6.66	33,299.09	8,593.16	6.47	35,921.26	9,269.84	10.66	174,799.80	42,122.95	3.75	3.75	4.52	265,946.92	65,644.37	516.92	7.45	6.88
10/12/21 14:18	23,059.57	5,989.46	6.87	34,513.62	8,906.58	6.31	36,915.48	9,526.41	10.52	174,703.50	42,099.75	3.78	3.78	4.53	269,342.17	66,522.19	523.83	7.45	6.89
10/12/21 14:19	22,214.54	5,732.68	6.71	34,163.14	8,816.14	6.01	36,665.14	9,461.80	10.29	174,615.09	42,078.44	3.67	3.67	4.43	267,657.91	66,089.06	520.42	7.48	6.90
10/12/21 14:19	22,078.18	5,697.49	6.66	33,693.92	8,695.05	5.89	35,587.95	9,183.82	10.23	174,564.00	42,066.13	3.61	3.61	4.38	265,924.05	65,642.50	516.90	7.28	6.91
10/12/21 14:20	21,730.00	5,607.64	6.84	33,653.86	8,684.71	5.98	34,649.52	8,941.65	10.17	174,576.80	42,069.21	3.76	3.76	4.52	264,610.18	65,303.22	514.23	7.21	6.92
10/12/21 14:20	21,863.79	5,642.17	7.10	33,605.23	8,672.16	5.90	34,128.80	8,807.28	10.27	174,891.00	42,144.93	3.94	3.94	4.73	264,488.82	65,266.53	513.94	7.39	7.06
10/12/21 14:21	23,110.58	5,963.91	7.26	33,695.35	8,695.42	6.12	34,164.57	8,816.51	10.18	175,169.70	42,212.09	3.93	3.93	4.78	266,140.21	65,687.93	517.26	7.62	6.91
10/12/21 14:21	23,104.98	5,962.47	7.40	33,606.66	8,672.53	6.22	34,552.24	8,916.55	10.12	175,281.41	42,239.01	3.84	3.84	4.70	266,545.29	65,790.56	518.07	7.58	6.88
10/12/21 14:22	25,759.24	6,647.43	7.29	35,092.98	9,056.09	6.13	36,404.79	9,394.62	9.92	175,396.09	42,266.65	3.83	3.83	4.76	272,653.10	67,364.78	530.46	7.57	6.85
10/12/21 14:22	24,834.92	6,152.39	7.04	34,155.98	8,814.29	5.93	35,856.89	9,253.23	9.61	175,525.30	42,297.78	3.92	3.92	4.84	269,379.09	66,517.68	523.79	7.56	6.81
10/12/21 14:23	23,536.97	6,073.95	6.79	33,183.22	8,563.26	5.80	34,951.36	9,019.54	9.60	175,682.00	42,335.54	3.86	3.86	4.72	267,353.55	65,992.29	519.66	7.49	7.00
10/12/21 14:23	23,405.66	6,039.03	6.89	32,881.38	8,485.37	6.04	34,978.54	9,045.98	9.67	175,681.60	42,337.63	3.85	3.85	4.66	267,230.38	65,995.61	519.37	7.33	6.90
10/12/21 14:24	23,190.80	5,984.62	6.92	31,653.98	8,168.62	6.20	34,379.15	8,871.88	9.60	176,123.80	42,442.01	3.79	3.79	4.65	265,347.73	65,467.13	515.52	7.35	6.80
10/12/21 14:24	23,786.14	6,138.25	7.12	31,307.79	8,079.29	6.45	34,729.63	8,962.33	9.75	175,656.91	42,329.50	3.85	3.85	4.75	265,480.46	65,509.36	515.85	7.43	6.71
10/12/21 14:25	25,397.11	6,553.98	7.10	32,646.77	8,424.82	6.57	36,657.98	9,459.96	9.70	175,169.59	42,212.06	3.82	3.82	4.69	269,871.45	66,650.82	524.84	7.48	6.79
10/12/21 14:25	26,135.72	6,744.58	6.83	32,485.12	8,383.11	6.55	37,208.74	9,602.08	9.42	174,585.91	42,071.41	3.72	3.72	4.62	270,415.48	66,801.18	526.03	7.50	7.12
10/12/21 14:26	24,685.54	6,370.35	6.54	32,210.46	8,312.23	6.47	37,410.45	9,654.14	9.36	174,208.80	41,980.53	3.41	3.41	4.51	268,515.25	66,317.25	522.22	7.46	6.94
10/12/21 14:26	24,885.13	6,421.85	6.41	31,458.00	8,118.05	6.50	36,576.45	9,438.92	9.42	174,806.20	42,124.49	3.29	3.29	4.33	267,725.78	66,103.31	520.53	7.23	6.82
10/12/21 14:27	23,816.81	6,146.16	6.43	30,725.57	7,929.04	6.55	36,423.38	9,399.41	9.43	175,276.80	42,237.90	3.39	3.39	4.32	266,242.56	65,712.51	517.45	7.16	6.85
10/12/21 14:27	24,180.54	6,240.03	6.45	30,257.78	7,808.32	6.58	35,517.85	9,165.73	9.53	175,149.41	42,207.20	3.59	3.59	4.46	265,105.58	65,421.28	515.16	7.21	6.88
10/12/21 14:28	26,632.51	6,872.78	6.58	31,871.42	8,224.74	6.79	38,125.71	9,838.72	9.51	173,617.94	42,168.37	3.89	3.89	4.83	271,617.94	67,104.61	528.42	7.32	6.91
10/12/21 14:28	26,1																		

Public Review Draft

August 19, 2024

Parameter units	Steamflow Boiler 1 (lbs/hr)	Coal Feed B1 (lbs/hr)	O2 Boiler 1 (%)	Steamflow Boiler 2 (lbs/hr)	Coal Feed B2 (lbs/hr)	O2 Boiler 2 (%)	Steamflow Boiler 3 (lbs/hr)	Coal Feed B3 (lbs/hr)	O2 Boiler 3 (%)	Steamflow B5 (lbs/hr)	Coal Feed B5 (lbs/hr)	Boiler 5 O2 - 2 (Economizer) (%)	Boiler 5 O2 - 3 (Economizer) (%)	Total plant steamflow (lbs/hr)	Coal Feed Plant Total (lbs/hr)	MMBtu input (MMBtu/hr)	O2 - 5 (Common Stack) (%)	Opacity (%)
10/12/21 14:48	27,700.40	7,148.36	6.15	18,165.48	4,687.78	12.64	39,653.53	10,232.99	9.46	175,380.20	42,262.82	3.79	4.69	260,899.62	64,331.95	506.58	8.02	6.92
10/12/21 14:48	27,536.09	7,105.96	6.24	17,807.85	4,595.49	12.79	40,005.43	10,323.80	9.39	175,395.80	42,266.57	3.88	4.79	260,745.17	64,291.82	506.27	8.02	6.92
10/12/21 14:49	28,512.45	7,357.92	6.21	17,292.86	4,462.59	12.95	39,563.40	10,209.73	9.31	175,521.09	42,296.77	3.99	4.91	260,889.80	64,327.01	506.54	8.09	6.92
10/12/21 14:49	28,428.65	7,336.30	6.23	16,859.41	4,350.74	13.11	39,852.37	10,284.30	9.13	176,162.70	42,451.38	4.00	4.99	261,303.13	64,422.71	507.30	8.18	7.71
10/12/21 14:50	29,093.06	7,507.75	6.24	16,493.19	4,256.23	13.29	39,693.58	10,243.32	9.15	176,762.20	42,595.85	3.93	4.92	262,042.03	64,603.15	508.72	8.30	6.97
10/12/21 14:50	29,358.82	7,576.33	6.27	16,105.52	4,156.19	13.46	39,679.28	10,239.63	9.01	177,163.50	42,692.55	3.82	4.79	262,307.12	64,664.71	509.20	8.27	6.94
End Run 3	24,699.31	6,373.90	6.23	30,837.46	7,957.91	6.99	37,085.06	9,570.17	9.85	175,356.15	42,257.02	3.75	4.63	267,977.98	66,159.00	520.97	7.41	7.02

Public Review Draft

Logsheet: Barn Fill Tuesday, 10-12-2021

August 19, 2024

Date Tuesday, 10-12-2021

Nav links

This day's Logsheets: [Tie Log \(chart\)](#) | [C5 Log](#) | [District Heat](#) | [Fireman Log](#) | [Turb Gen](#) | [Boilers](#) | [Baghouse](#) | [Old Plant](#) | [Barn Fill](#)

Chena 5, oldside, stockpile

Chena 5										Oldside										Stockpile									
Spot	Run	Car	Weighbill	Date1	Ash	Weight	Start Time	Stop Time	Topped	Spot	Run	Car	Weighbill	Date1	Ash	Weight	Start Time	Stop Time	Topped	Spot	Run	Car	Weighbill	Date1	Ash	Weight	Start Time	Stop Time	Topped
2	25%	16319	94966	10/7/21	4.9%	44,650	7:30AM	7:50AM		1	100%	16339	94966	10/7/21	4.9%	182,800	5:45AM	6:50AM		No barn fill stockpiles found									
3	100%	16203	94965	10/7/21	4.9%	189,800	7:50AM	8:55AM		2	75%	16319	94966	10/7/21	4.9%	133,950	6:50AM	7:30AM	x										
4	100%	16334	94965	10/7/21	4.9%	188,500	8:55AM	10:00AM		5	25%	16472	94965	10/7/21	4.9%	45,475	1:40PM	2:00PM											
5	75%	16472	94965	10/7/21	4.9%	136,425	10:00AM	10:50AM	x	6	75%	16337	94965	10/7/21	4.9%	138,075	2:00PM	2:45PM	x										
6	25%	16337	94965	10/7/21	4.9%	46,025	2:45PM	3:00PM																					
7	100%	16211	94965	10/7/21	4.9%	185,200	3:00PM	4:15PM	x																				

Coal Tons Chena 5 395.3

Coal Tons Oldside 250.2

Coal Tons Total 645.5

Coal Tons Stockpile 0.0

Barn spot, operator

Yesterday Barn Spot				Today Barn Spot										Operators	
Spot	Left	Car		Spot	Left	Car	Weighbill	Date1	BTU	Moisture	Ash	Sulfur	Weight	Operator	
	1 mt	16326		1	mt	16339	94966	10/7/21	7652	31.61	4.9%	0.1	182,800	Ken	
	2 mt	62032		2	mt	16319	94966	10/7/21	7652	31.61	4.9%	0.1	178,600		
	3 mt	16411		3	mt	16203	94965	10/7/21	7652	31.61	4.9%	0.1	189,800		
	4 mt	16416		4	mt	16334	94965	10/7/21	7652	31.61	4.9%	0.1	188,500		
	5 mt	62017		5	mt	16472	94965	10/7/21	7652	31.61	4.9%	0.1	181,900		
	6 mt	62055		6	mt	16337	94965	10/7/21	7652	31.61	4.9%	0.1	184,100		
	7 mt	61998		7	mt	16211	94965	10/7/21	7652	31.61	4.9%	0.1	185,200		
	8 75%	62038		8	75%	62038	94961	10/5/21	7607	32.81	4.4%	0.11	189,800		
	9			9											
	10			10											

Note: 10th spot is stockpile; leave its Car and Weighbill fields blanks.

Other

Predominant Weighbill	Shutdown Shaker Up	Shutdown Stowed	Shutdown Wheel	Bearing Upper	Bearing Lower	Bearing Bucket	Bearing Crusher	Visual Plan	Visual Coal	Spot Empty Cars	Spot Unused Cars	Spot Requested	Reading Electric	Reading Water Start	Reading Water End	Water Total Usage (Gal)	Comments
													1,665,271	1,507,800	1,508,345	545	

Nav links

This day's Logsheets: [Tie Log \(chart\)](#) | [C5 Log](#) | [District Heat](#) | [Fireman Log](#) | [Turb Gen](#) | [Boilers](#) | [Baghouse](#) | [Old Plant](#) | [Barn Fill](#)



Analysis Report

November 19, 2021

Page 1 of 1

Usibelli Coal Mine, Inc.
P.O. Box 1000
Healy, AK 99743
USA

Client Sample ID: AE101221B1 - 12PM
Date Received: 11/12/2021
Matrix: Coal

Sample ID By : Usibelli Coal Co.
Sample Taken At : Usibelli Coal Mine
Sample Taken By : Usibelli Coal Co.
Sample Type : -4 mesh

SGS Minerals Sample ID: 072-123129-001

		<u>As Received</u>	<u>Dry</u>	<u>MAF</u>
% Moisture, Total	[ASTM D 3302]	30.96		
% Ash	[ASTM D 7582]	5.36	7.76	
% Volatile Matter	[ASTM D 7582]	34.44	49.89	54.09
% Fixed Carbon	[ASTM D 3172]	29.24	42.35	45.91
Gross Calorific Value (Btu/lb)	[ASTM D 5865]	7697	11148	12086
% Sulfur	[ASTM D 4239]	0.14	0.20	
% Carbon	[ASTM D 5373]	45.65	66.12	
% Hydrogen	[ASTM D 5373]	3.30	4.79	
% Nitrogen	[ASTM D 5373]	0.52	0.76	
% Oxygen (Calc)	[ASTM D 3176]	14.07	20.37	
<u>Tests</u>		<u>Result</u>	<u>Unit</u>	<u>Method</u>
Pounds of Ash/mm Btu		6.96	lb	
Pounds of Sulfur/mm Btu		0.18	lb	
Pounds of SO2/mm Btu		0.36	lb	

SGS North America Inc.

Minerals Services Division
4665 Paris St Suite B-200 Denver CO 80239

Byron C. Caton, Branch Manager

t (303) 373-4772 f (303) 373-4791 www.sgs.com/minerals

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Analysis Report

November 15, 2021

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Usibelli Coal Mine, Inc.
P.O. Box 1000
Healy, AK 99743
USA

Client Sample ID: AE101221B1 - 1PM
Date Received: 11/08/2021
Matrix: Coal

Sample ID By : Usibelli Coal Co.
Sample Taken At : Usibelli Coal Mine
Sample Taken By : Usibelli Coal Co.
Sample Type : -4 mesh

SGS Minerals Sample ID: 072-123049-002

		<u>As Received</u>	<u>Dry</u>	<u>MAF</u>
% Moisture, Total	[ASTM D 3302]	30.41		
% Ash	[ASTM D 7582]	5.44	7.82	
% Volatile Matter	[ASTM D 7582]	34.96	50.24	54.51
% Fixed Carbon	[ASTM D 3172]	29.19	41.94	45.49
Gross Calorific Value (Btu/lb)	[ASTM D 5865]	7691	11052	11989
% Sulfur	[ASTM D 4239]	0.13	0.18	
% Carbon	[ASTM D 5373]	44.91	64.54	
% Hydrogen	[ASTM D 5373]	3.34	4.80	
% Nitrogen	[ASTM D 5373]	0.53	0.75	
% Oxygen (Calc)	[ASTM D 3176]	15.24	21.91	
<u>Tests</u>		<u>Result</u>	<u>Unit</u>	<u>Method</u>
Density, Bulk		47.3	lbs/ft ³	SGS Method
Pounds of Ash/mm Btu		7.08	lb	
Pounds of Sulfur/mm Btu		0.16	lb	
Pounds of SO ₂ /mm Btu		0.33	lb	

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Usibelli Coal Mine, Inc.
P.O. Box 1000
Healy, AK 99743
USA

Client Sample ID: AE101221B1- 2PM
Date Received: 11/08/2021
Matrix: Coal

Sample ID By : Usibelli Coal Co.
Sample Taken At : Usibelli Coal Mine
Sample Taken By : Usibelli Coal Co.
Sample Type : -4 mesh

SGS Minerals Sample ID: 072-123049-001

		<u>As Received</u>	<u>Dry</u>	<u>MAF</u>
% Moisture, Total	[ASTM D 3302]	30.68		
% Ash	[ASTM D 7582]	5.12	7.39	
% Volatile Matter	[ASTM D 7582]	34.73	50.11	54.11
% Fixed Carbon	[ASTM D 3172]	29.47	42.50	45.89
Gross Calorific Value (Btu/lb)	[ASTM D 5865]	7722	11139	12028
% Sulfur	[ASTM D 4239]	0.13	0.18	
% Carbon	[ASTM D 5373]	45.06	65.00	
% Hydrogen	[ASTM D 5373]	3.33	4.81	
% Nitrogen	[ASTM D 5373]	0.53	0.76	
% Oxygen (Calc)	[ASTM D 3176]	15.15	21.86	
<u>Tests</u>		<u>Result</u>	<u>Unit</u>	<u>Method</u>
Density, Bulk		48.3	lbs/ft ³	SGS Method
Pounds of Ash/mm Btu		6.63	lb	
Pounds of Sulfur/mm Btu		0.16	lb	
Pounds of SO ₂ /mm Btu		0.33	lb	

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Analysis Report

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Usibelli Coal Mine, Inc.
P.O. Box 1000
Healy, AK 99743
USA

Client Sample ID: AE101221B2-12PM
Date Received: 11/18/2021
Matrix: Coal

Sample ID By : Usibelli Coal Co.
Sample Taken At : Usibelli Coal Mine
Sample Taken By : Usibelli Coal Co.
Sample Type : -4 mesh

SGS Minerals Sample ID: 072-123222-001

		<u>As Received</u>	<u>Dry</u>	<u>MAF</u>
% Moisture, Total	[ASTM D 3302]	31.49		
% Ash	[ASTM D 7582]	4.47	6.52	
% Volatile Matter	[ASTM D 7582]	33.58	49.02	52.44
% Fixed Carbon	[ASTM D 3172]	30.46	44.46	47.56
Gross Calorific Value (Btu/lb)	[ASTM D 5865]	7712	11257	12042
% Sulfur	[ASTM D 4239]	0.13	0.19	
% Carbon	[ASTM D 5373]	45.09	65.82	
% Hydrogen	[ASTM D 5373]	3.28	4.79	
% Nitrogen	[ASTM D 5373]	0.56	0.82	
% Oxygen (Calc)	[ASTM D 3176]	14.98	21.86	
<u>Tests</u>		<u>Result</u>	<u>Unit</u>	<u>Method</u>
Density, Bulk		42.9	lbs/ft ³	SGS Method
Pounds of Ash/mm Btu		5.79	lb	
Pounds of Sulfur/mm Btu		0.17	lb	
Pounds of SO ₂ /mm Btu		0.33	lb	

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November 30, 2021

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Usibelli Coal Mine, Inc.
P.O. Box 1000
Healy, AK 99743
USA

Client Sample ID: AE101221B2-1PM
Date Received: 11/19/2021
Matrix: Coal

Sample ID By : Usibelli Coal Co.
Sample Taken At : Usibelli Coal Mine
Sample Taken By : Usibelli Coal Co.
Sample Type : -4 mesh

SGS Minerals Sample ID: 072-123240-001

		<u>As Received</u>	<u>Dry</u>	<u>MAF</u>
% Moisture, Total	[ASTM D 3302]	29.32		
% Ash	[ASTM D 7582]	4.61	6.52	
% Volatile Matter	[ASTM D 7582]	34.76	49.18	52.61
% Fixed Carbon	[ASTM D 3172]	31.31	44.30	47.39
Gross Calorific Value (Btu/lb)	[ASTM D 5865]	7907	11188	11969
% Sulfur	[ASTM D 4239]	0.14	0.20	
% Carbon	[ASTM D 5373]	46.12	65.26	
% Hydrogen	[ASTM D 5373]	3.39	4.80	
% Nitrogen	[ASTM D 5373]	0.57	0.81	
% Oxygen (Calc)	[ASTM D 3176]	15.85	22.41	
<u>Tests</u>		<u>Result</u>	<u>Unit</u>	<u>Method</u>
Density, Bulk		48.7	lbs/ft^3	SGS Method
Pounds of Ash/mm Btu		5.83	lb	
Pounds of Sulfur/mm Btu		0.18	lb	
Pounds of SO2/mm Btu		0.36	lb	

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Analysis Report

November 30, 2021

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Usibelli Coal Mine, Inc.
P.O. Box 1000
Healy, AK 99743
USA

Client Sample ID: AE101221B2-2PM
Date Received: 11/19/2021
Matrix: Coal

Sample ID By : Usibelli Coal Co.
Sample Taken At : Usibelli Coal Mine
Sample Taken By : Usibelli Coal Co.
Sample Type : -4 mesh

SGS Minerals Sample ID: 072-123240-002

		<u>As Received</u>	<u>Dry</u>	<u>MAF</u>
% Moisture, Total	[ASTM D 3302]	28.88		
% Ash	[ASTM D 7582]	4.84	6.81	
% Volatile Matter	[ASTM D 7582]	34.77	48.90	52.47
% Fixed Carbon	[ASTM D 3172]	31.51	44.29	47.53
Gross Calorific Value (Btu/lb)	[ASTM D 5865]	7906	11117	11929
% Sulfur	[ASTM D 4239]	0.13	0.18	
% Carbon	[ASTM D 5373]	46.40	65.24	
% Hydrogen	[ASTM D 5373]	3.38	4.76	
% Nitrogen	[ASTM D 5373]	0.57	0.80	
% Oxygen (Calc)	[ASTM D 3176]	15.80	22.21	
<u>Tests</u>		<u>Result</u>	<u>Unit</u>	<u>Method</u>
Density, Bulk		43.2	lbs/ft ³	SGS Method
Pounds of Ash/mm Btu		6.13	lb	
Pounds of Sulfur/mm Btu		0.16	lb	
Pounds of SO ₂ /mm Btu		0.32	lb	

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November 19, 2021

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Usibelli Coal Mine, Inc.
P.O. Box 1000
Healy, AK 99743
USA

Client Sample ID: AE101221B3 - 12PM
Date Received: 11/12/2021
Matrix: Coal

Sample ID By : Usibelli Coal Co.
Sample Taken At : Usibelli Coal Mine
Sample Taken By : Usibelli Coal Co.
Sample Type : -4 mesh

SGS Minerals Sample ID: 072-123129-002

		<u>As Received</u>	<u>Dry</u>	<u>MAF</u>
% Moisture, Total	[ASTM D 3302]	31.30		
% Ash	[ASTM D 7582]	4.32	6.29	
% Volatile Matter	[ASTM D 7582]	34.80	50.66	54.06
% Fixed Carbon	[ASTM D 3172]	29.58	43.05	45.94
Gross Calorific Value (Btu/lb)	[ASTM D 5865]	7791	11341	12102
% Sulfur	[ASTM D 4239]	0.12	0.18	
% Carbon	[ASTM D 5373]	45.92	66.84	
% Hydrogen	[ASTM D 5373]	3.37	4.90	
% Nitrogen	[ASTM D 5373]	0.51	0.75	
% Oxygen (Calc)	[ASTM D 3176]	14.46	21.04	
<u>Tests</u>		<u>Result</u>	<u>Unit</u>	<u>Method</u>
Pounds of Ash/mm Btu		5.55	lb	
Pounds of Sulfur/mm Btu		0.16	lb	
Pounds of SO ₂ /mm Btu		0.32	lb	

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4665 Paris St Suite B-200 Denver CO 80239

Byron C. Caton

Byron C. Caton, Branch Manager

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Analysis Report

November 23, 2021

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Usibelli Coal Mine, Inc.
P.O. Box 1000
Healy, AK 99743
USA

Client Sample ID: AE101221B3-1PM
Date Received: 11/18/2021
Matrix: Coal

Sample ID By : Usibelli Coal Co.
Sample Taken At : Usibelli Coal Mine
Sample Taken By : Usibelli Coal Co.
Sample Type : -4 mesh

SGS Minerals Sample ID: 072-123222-002

		<u>As Received</u>	<u>Dry</u>	<u>MAF</u>
% Moisture, Total	[ASTM D 3302]	28.34		
% Ash	[ASTM D 7582]	4.39	6.13	
% Volatile Matter	[ASTM D 7582]	35.03	48.88	52.07
% Fixed Carbon	[ASTM D 3172]	32.24	44.99	47.93
Gross Calorific Value (Btu/lb)	[ASTM D 5865]	8124	11336	12076
% Sulfur	[ASTM D 4239]	0.22	0.31	
% Carbon	[ASTM D 5373]	47.34	66.06	
% Hydrogen	[ASTM D 5373]	3.42	4.78	
% Nitrogen	[ASTM D 5373]	0.60	0.84	
% Oxygen (Calc)	[ASTM D 3176]	15.69	21.88	

Tests

	<u>Result</u>	<u>Unit</u>
Density, Bulk	44.2	lbs/ft ³
Pounds of Ash/mm Btu	5.40	lb
Pounds of Sulfur/mm Btu	0.27	lb
Pounds of SO ₂ /mm Btu	0.55	lb

Method

SGS Method

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November 15, 2021

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Usibelli Coal Mine, Inc.
P.O. Box 1000
Healy, AK 99743
USA

Client Sample ID: AE101221B3 - 2PM
Date Received: 11/08/2021
Matrix: Coal

Sample ID By : Usibelli Coal Co.
Sample Taken At : Usibelli Coal Mine
Sample Taken By : Usibelli Coal Co.
Sample Type : -4 mesh

SGS Minerals Sample ID: 072-123049-003

		<u>As Received</u>	<u>Dry</u>	<u>MAF</u>
% Moisture, Total	[ASTM D 3302]	29.28		
% Ash	[ASTM D 7582]	4.12	5.82	
% Volatile Matter	[ASTM D 7582]	35.80	50.62	53.75
% Fixed Carbon	[ASTM D 3172]	30.80	43.56	46.25
Gross Calorific Value (Btu/lb)	[ASTM D 5865]	7924	11204	11897
% Sulfur	[ASTM D 4239]	0.13	0.18	
% Carbon	[ASTM D 5373]	46.59	65.87	
% Hydrogen	[ASTM D 5373]	3.39	4.79	
% Nitrogen	[ASTM D 5373]	0.54	0.77	
% Oxygen (Calc)	[ASTM D 3176]	15.95	22.57	

Tests

	<u>Result</u>	<u>Unit</u>
Density, Bulk	42.2	lbs/ft^3
Pounds of Ash/mm Btu	5.20	lb
Pounds of Sulfur/mm Btu	0.16	lb
Pounds of SO2/mm Btu	0.32	lb

Method

SGS Method

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Usibelli Coal Mine, Inc.
P.O. Box 1000
Healy, AK 99743
USA

Client Sample ID: AE101221B5-12PM
Date Received: 11/18/2021
Matrix: Coal

Sample ID By : Usibelli Coal Co.
Sample Taken At : Usibelli Coal Mine
Sample Taken By : Usibelli Coal Co.
Sample Type : -4 mesh

SGS Minerals Sample ID: 072-123222-003

		<u>As Received</u>	<u>Dry</u>	<u>MAF</u>
% Moisture, Total	[ASTM D 3302]	27.67		
% Ash	[ASTM D 7582]	4.59	6.34	
% Volatile Matter	[ASTM D 7582]	35.75	49.42	52.77
% Fixed Carbon	[ASTM D 3172]	31.99	44.24	47.23
Gross Calorific Value (Btu/lb)	[ASTM D 5865]	8081	11172	11929
% Sulfur	[ASTM D 4239]	0.14	0.19	
% Carbon	[ASTM D 5373]	47.25	65.32	
% Hydrogen	[ASTM D 5373]	3.46	4.78	
% Nitrogen	[ASTM D 5373]	0.60	0.83	
% Oxygen (Calc)	[ASTM D 3176]	16.29	22.54	
<u>Tests</u>		<u>Result</u>	<u>Unit</u>	<u>Method</u>
Density, Bulk		44.2	lbs/ft ³	SGS Method
Pounds of Ash/mm Btu		5.68	lb	
Pounds of Sulfur/mm Btu		0.17	lb	
Pounds of SO ₂ /mm Btu		0.34	lb	

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Usibelli Coal Mine, Inc.
P.O. Box 1000
Healy, AK 99743
USA

Client Sample ID: AE101221B51PM
Date Received: 11/08/2021
Matrix: Coal

Sample ID By : Usibelli Coal Co.
Sample Taken At : Usibelli Coal Mine
Sample Taken By : Usibelli Coal Co.
Sample Type : -4 mesh

SGS Minerals Sample ID: 072-123048-001

		<u>As Received</u>	<u>Dry</u>	<u>MAF</u>
% Moisture, Total	[ASTM D 3302]	27.97		
% Ash	[ASTM D 7582]	4.48	6.22	
% Volatile Matter	[ASTM D 7582]	36.60	50.82	54.19
% Fixed Carbon	[ASTM D 3172]	30.95	42.96	45.81
Gross Calorific Value (Btu/lb)	[ASTM D 5865]	8082	11220	11965
% Sulfur	[ASTM D 4239]	0.14	0.19	
% Carbon	[ASTM D 5373]	47.27	65.63	
% Hydrogen	[ASTM D 5373]	3.53	4.91	
% Nitrogen	[ASTM D 5373]	0.56	0.78	
% Oxygen (Calc)	[ASTM D 3176]	16.05	22.27	
<u>Tests</u>		<u>Result</u>	<u>Unit</u>	<u>Method</u>
Density, Bulk		44.3	lbs/ft ³	SGS Method
Pounds of Ash/mm Btu		5.55	lb	
Pounds of Sulfur/mm Btu		0.17	lb	
Pounds of SO ₂ /mm Btu		0.34	lb	

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Usibelli Coal Mine, Inc.
P.O. Box 1000
Healy, AK 99743
USA

Client Sample ID: AE101221B52PM
Date Received: 11/08/2021
Matrix: Coal

Sample ID By : Usibelli Coal Co.
Sample Taken At : Usibelli Coal Mine
Sample Taken By : Usibelli Coal Co.
Sample Type : -4 mesh

SGS Minerals Sample ID: 072-123048-002

		<u>As Received</u>	<u>Dry</u>	<u>MAF</u>
% Moisture, Total	[ASTM D 3302]	29.83		
% Ash	[ASTM D 7582]	4.65	6.62	
% Volatile Matter	[ASTM D 7582]	35.75	50.95	54.56
% Fixed Carbon	[ASTM D 3172]	29.77	42.43	45.44
Gross Calorific Value (Btu/lb)	[ASTM D 5865]	7857	11197	11991
% Sulfur	[ASTM D 4239]	0.13	0.19	
% Carbon	[ASTM D 5373]	46.03	65.60	
% Hydrogen	[ASTM D 5373]	3.44	4.90	
% Nitrogen	[ASTM D 5373]	0.55	0.78	
% Oxygen (Calc)	[ASTM D 3176]	15.37	21.91	
<u>Tests</u>		<u>Result</u> <u>Unit</u>	<u>Method</u>	
Density, Bulk		45.6 lbs/ft ³	SGS Method	
Pounds of Ash/mm Btu		5.91 lb		
Pounds of Sulfur/mm Btu		0.17 lb		
Pounds of SO ₂ /mm Btu		0.33 lb		

SGS North America Inc.

Minerals Services Division
4665 Paris St Suite B-200 Denver CO 80239

Byron C. Caton, Branch Manager

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Member of SGS Group

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Appendix E

Quality Assurance Data

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0032	Reference Number:	48-401930752-1
Cylinder Number:	EB0082097	Cylinder Volume:	144.4 CF
Laboratory:	124 - Los Angeles (SAP) - CA	Cylinder Pressure:	2015 PSIG
PGVP Number:	B32020	Valve Outlet:	660
Gas Code:	SO2,BALN	Certification Date:	Oct 23, 2020

Expiration Date: Oct 23, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
SULFUR DIOXIDE	100.0 PPM	101.2 PPM	G1	+/- 0.9% NIST Traceable	10/10/2020, 10/23/2020
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	17060445	CC486705	98.32 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8	Dec 07, 2022

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801551 SO2	FTIR	Oct 21, 2020

Triad Data Available Upon Request



[Signature]

Approved for Release Appendix III.D.7.7-875

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E02NI99E15A0262
Cylinder Number: CC84450
Laboratory: 124 - Los Angeles (SAP) - CA
PGVP Number: B32019
Gas Code: SO2,BALN

Reference Number: 48-401394066-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Jan 21, 2019

Expiration Date: Jan 21, 2027

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
SULFUR DIOXIDE	240.0 PPM	241.3 PPM	G1	+/- 1.0% NIST Traceable	01/14/2019, 01/21/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	10010227	AAL072906	255.3 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Apr 25, 2022

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AMP0900118 SO2	FTIR	Jan 11, 2019

Triad Data Available Upon Request



[Signature]

Approved for Release

Appendix III.D.7.7-876

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI80E15A0138	Reference Number:	48-401847006-1
Cylinder Number:	ALM052976	Cylinder Volume:	150.9 CF
Laboratory:	124 - Los Angeles (SAP) - CA	Cylinder Pressure:	2015 PSIG
PGVP Number:	B32020	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Jul 01, 2020

Expiration Date: Jul 01, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	10.00 %	10.09 %	G1	+/- 0.6% NIST Traceable	07/01/2020
OXYGEN	10.00 %	10.06 %	G1	+/- 0.7% NIST Traceable	07/01/2020
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010611	K005428	13.94 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 30, 2024
NTRM	98051002	SG9150866BAL	12.05 % OXYGEN/NITROGEN	+/- 0.7%	Dec 14, 2023

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS 6E CO2	NDIR	Jun 11, 2020
SIEMENS OXYMAT 6	PARAMAGNETIC	Jun 05, 2020

Triad Data Available Upon Request



Approved for Release

Appendix III.D.7.7-877

Page 1 of 48-401847006-1

AIR LIQUIDE		Certificate of Accuracy	
AIR LIQUIDE AMERICA LP		PO NO. 45964	
CAS REG.	COMPONENT	CERTIFIED	
COMPONENT NO.		ANALYSIS	
124-38-9	CARBON DIOXIDE	13.9 %	
7782-44-7	OXYGEN	4.11 %	
7727-37-9	NITROGEN	BALANCE	
LOT NUMBER 8222			
ANALYSIS DATE 21SEP2015		Sales Order # 52016	
Cylinder # ALM003704		ANALYST David Connolly	
Expires 22SEP2023		ITEM NO. 14% CO2/4% O2	
EPA Protocol Gas			

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI86E15A75F6	Reference Number:	48-401334047-1
Cylinder Number:	CC189851	Cylinder Volume:	148.8 CF
Laboratory:	124 - Los Angeles (SAP) - CA	Cylinder Pressure:	2015 PSIG
PGVP Number:	B32018	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Oct 23, 2018

Expiration Date: Oct 23, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	7.000 %	7.055 %	G1	+/- 0.7% NIST Traceable	10/23/2018
OXYGEN	7.000 %	6.977 %	G1	+/- 0.6% NIST Traceable	10/23/2018
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060432	CC413737	7.489 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 14, 2019
NTRM	98051209	SG9168777	7.015 % OXYGEN/NITROGEN	+/- 0.6%	Mar 07, 2019

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS 6E CO2	NDIR	Sep 26, 2018
SIEMENS OXYMAT 6	PARAMAGNETIC	Sep 24, 2018

Triad Data Available Upon Request



QA

CO₂ linearity

10/17/21

Analyzer Resp.

13.96 %

7.1 %

0

CAL gas

13.92

7.05 %

0

AST #

AZM03704
(13)CC189851
(25)

CC66258

(6)

~~W~~ 10/14/21

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES



- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 8/25/2021		METER SERIAL #: M1		BAROMETRIC PRESSURE (in Hg):		INITIAL	FINAL	AVG (P _{bar})	IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED									
METER PART #:		CRITICAL ORIFICE SET SERIAL #:				29.88	29.88	29.88										
ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT ³)			TEMPERATURES °F				ELAPSED TIME (MIN) θ	DGM ΔH (in H ₂ O)	(1) V _m (STD)	(2) V _{cr} (STD)	(3) Y	Y VARIATION (%)	ΔH _@	
				INITIAL	FINAL	NET (V _m)	AMBIENT	DGM INLET INITIAL FINAL	DGM OUTLET INITIAL FINAL	DGM AVG								
23	1	0.6384	17	450.0	458.521	8.521	67	66	67	68	68	67.25	10.00	2.6	8.5778	8.3118	0.9690	2.1169
23	2	0.6384	17	458.521	466.856	8.335	67	66	67	68	68	67.25	10.00	2.6	8.3906	8.3118	0.9906	2.1169
23	3	0.6384	17	466.856	475.188	8.332	67	67	67	68	66	67	10.00	2.6	8.3916	8.3118	0.9905	2.1169
AVG = 0.9834 -0.67																		
19	1	0.5032	19	475.188	481.740	6.552	67	66	67	68	69	67.5	10.00	1.7	6.5781	6.5515	0.9960	2.2278
19	2	0.5032	19	481.740	488.290	6.550	67	67	67	68	68	67.5	10.00	1.7	6.5761	6.5515	0.9963	2.2278
19	3	0.5032	19	488.290	494.788	6.498	67	67	67	68	68	67.5	10.00	1.7	6.5239	6.5515	1.0042	2.2278
AVG = 0.9988 0.89																		
16	1	0.4208	20	494.788	500.315	5.527	67	67	67	68	68	67.5	10.00	1.15	5.5415	5.4787	0.9887	2.1551
16	2	0.4208	20	500.315	505.846	5.531	67	67	67	68	68	67.5	10.00	1.15	5.5455	5.4787	0.9880	2.1551
16	3	0.4208	20	505.846	511.382	5.536	67	66	67	68	68	67.25	10.00	1.15	5.5532	5.4787	0.9866	2.1551
AVG = 0.9877 -0.23																		

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.990

$$(1) \quad V_m (\text{std}) = K_1 V_m \frac{P_{\text{bar}} + (\Delta H/13.6)}{T_m} = \text{Net volume of gas sample passed through DGM, corrected to standard conditions}$$

$$K_1 = 17.64 \text{ } ^\circ\text{R/in. Hg (English), } 0.3858 \text{ } ^\circ\text{K/mm Hg (Metric)}$$

$$T_m = \text{Absolute DGM avg. temperature (} ^\circ\text{R - English, } ^\circ\text{K - Metric)}$$

$$(2) \quad V_{cr} (\text{std}) = K' \sqrt{\frac{P_{\text{bar}} \theta}{T_{\text{amb}}}} = \text{Volume of gas sample passed through the critical orifice, corrected to standard conditions}$$

$$T_{\text{amb}} = \text{Absolute ambient temperature (} ^\circ\text{R - English, } ^\circ\text{K - Metric)}$$

$$K' = \text{Average K' factor from Critical Orifice Calibration}$$

$$(3) \quad Y = \frac{V_{cr} (\text{std})}{V_m (\text{std})} = \text{DGM calibration factor}$$

$$\text{AVERAGE } \Delta H_{@} = 2.1666$$

$$\Delta H_{@} = \left(\frac{0.75 \theta}{V_{cr} (\text{std})} \right)^2 \Delta H$$

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES



- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 10/17/2021		METER SERIAL #: M1		BAROMETRIC PRESSURE (in Hg):		INITIAL 29.82		FINAL 29.82		AVG (P _{bar}) 29.82		IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED						
METER PART #:		CRITICAL ORIFICE SET SERIAL #:																
ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT ³)			TEMPERATURES °F				ELAPSED TIME (MIN) θ	DGM ΔH (in H ₂ O)	(1) V _m (STD)	(2) V _{cr} (STD)	(3) Y	Y VARIATION (%)	ΔH _@	
				INITIAL	FINAL	NET (V _m)	AMBIENT	DGM INLET INITIAL FINAL	DGM OUTLET INITIAL FINAL	DGM AVG								
23	1	0.6384	17	900.0	908.340	8.340	66	66	67	68	68	67.25	10.00	2.6	8.3789	8.3030	0.9909	2.1214
23	2	0.6384	17	908.340	916.674	8.334	66	66	66	68	67	66.75	10.00	2.5	8.3788	8.3030	0.9910	2.0398
23	3	0.6384	17	916.674	925.034	8.360	66	66	67	68	66	66.75	10.00	2.6	8.4070	8.3030	0.9876	2.1214
															AVG =	0.9898	-0.15	
19	1	0.5032	19	925.034	931.587	6.553	66	67	67	68	69	67.75	10.00	1.7	6.5628	6.5446	0.9972	2.2326
19	2	0.5032	19	931.587	938.132	6.545	66	67	67	68	67	67.25	10.00	1.7	6.5610	6.5446	0.9975	2.2326
19	3	0.5032	19	938.132	944.687	6.555	67	66	67	68	68	67.25	10.00	1.7	6.5710	6.5384	0.9950	2.2368
															AVG =	0.9966	0.53	
16	1	0.4208	20	944.315	949.846	5.531	67	67	68	68	67	67.5	10.00	1.2	5.5351	5.4677	0.9878	2.2578
16	2	0.4208	20	949.846	955.379	5.533	67	67	67	68	68	67.5	10.00	1.2	5.5371	5.4677	0.9875	2.2578
16	3	0.4208	20	955.379	960.912	5.533	68	67	68	68	68	67.75	10.00	1.2	5.5345	5.4625	0.9870	2.2621
															AVG =	0.9874	-0.39	

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.9913

$$(1) \quad V_m (\text{std}) = K_1 V_m \frac{P_{\text{bar}} + (\Delta H/13.6)}{T_m} = \text{Net volume of gas sample passed through DGM, corrected to standard conditions}$$

$K_1 = 17.64 \text{ } ^\circ\text{R/in. Hg (English), } 0.3858 \text{ } ^\circ\text{K/mm Hg (Metric)}$
 $T_m = \text{Absolute DGM avg. temperature (} ^\circ\text{R - English, } ^\circ\text{K - Metric)}$

$$(2) \quad V_{cr} (\text{std}) = K' \sqrt{\frac{P_{\text{bar}} \theta}{T_{\text{amb}}}} = \text{Volume of gas sample passed through the critical orifice, corrected to standard conditions}$$

$T_{\text{amb}} = \text{Absolute ambient temperature (} ^\circ\text{R - English, } ^\circ\text{K - Metric)}$
 $K' = \text{Average K' factor from Critical Orifice Calibration}$

$$(3) \quad Y = \frac{V_{cr} (\text{std})}{V_m (\text{std})} = \text{DGM calibration factor}$$

$$\text{AVERAGE } \Delta H_{@} = 2.1958$$

$$\Delta H_{@} = \left(\frac{0.75 \theta}{V_{cr} (\text{std})} \right)^2 \Delta H$$

TIME	CO2	O2	SO2
10/12/2021 10:33	0.114055	20.4677	6.60E-03
10/12/2021 10:33	0.114758	20.4677	0.010237
10/12/2021 10:34	0.118102	20.4642	0.010507
10/12/2021 10:34	0.11599	20.4624	-3.49733
10/12/2021 10:35	0.118102	20.4606	258.683
10/12/2021 10:35	0.119861	20.4589	267.176
10/12/2021 10:36	0.124435	20.4571	241.656 SO2 High (241.3 ppm)
10/12/2021 10:36	0.1225	20.4571	242.658
10/12/2021 10:37	0.127075	20.4518	242.658
10/12/2021 10:37	0.126019	20.4518	242.658
10/12/2021 10:38	0.123908	20.4518	241.656
10/12/2021 10:38	0.127427	20.4464	22.0035
10/12/2021 10:39	0.128482	20.812	7.99251
10/12/2021 10:39	0.132353	20.8138	20.5082
10/12/2021 10:40	0.134464	20.8013	100.569 O2 High (Ambient 20.9%)
10/12/2021 10:40	0.133233	20.8013	102.576 SO2 Mid (101.2 ppm)
10/12/2021 10:41	0.129889	20.8031	102.575
10/12/2021 10:41	0.131122	20.8013	102.068
10/12/2021 10:42	0.132705	20.7942	102.576
10/12/2021 10:42	0.136224	20.796	102.577
10/12/2021 10:43	0.137983	20.7889	3.99747
10/12/2021 10:43	0.136048	20.7871	0.490844
10/12/2021 10:44	5.29309	16.6881	2.49921
10/12/2021 10:44	10.0652	10.0438	0.490844 SO2 Zero
10/12/2021 10:45	10.0829	10.0457	0.488823
10/12/2021 10:45	10.0829	10.047	-7.81E-03
10/12/2021 10:46	10.0857	10.0429	-7.27E-03
10/12/2021 10:46	10.0875	10.0461	-6.87E-03
10/12/2021 10:47	10.0917	10.0517	-5.39E-03 O2 Mid (10.06%)
10/12/2021 10:47	10.0986	10.0563	0.492326
10/12/2021 10:48	10.1012	10.057	-6.73E-03
10/12/2021 10:48	10.1	10.056	0.49017
10/12/2021 10:49	10.1	10.0586	-8.49E-03
10/12/2021 10:49	1.15176	1.07432	119.095
10/12/2021 10:50	-0.06083	-0.09627	242.672
10/12/2021 10:50	-0.06365	-0.09451	243.173
10/12/2021 10:51	-0.06241	-0.09204	243.661 O2 Zero
10/12/2021 10:51	-0.06136	-0.09327	244.162
10/12/2021 10:52	-0.064	-0.09451	243.173
10/12/2021 10:52	-0.06629	-0.09716	32.5196
10/12/2021 10:53	-0.0647	11.4382	11.5002
10/12/2021 10:53	-0.01984	20.9149	0.993407
10/12/2021 10:54	0.085904	20.8883	0.487881
10/12/2021 10:54	0.11212	21.0959	0.488823

Appendix F

Project Participants

Project Participant	Role
Bill Hudson	AST Overall Project Manager
Chase Aikey	AST Technician
Sarah Clift	Technical Writer
David Fish	Aurora Project Manager

Appendix G

Project Correspondence

ADEC Source Test Plan Summary Form

For EACH source being tested, attach a completed version of this form to the source test plans that are submitted to ADEC within 30 to 60 days prior to testing.

Name of Permittee Aurora Energy, LLC

Facility Name Chena Power Plant

1. Reason for the Source Test:

Permit Requirement: provide the following information.

Permit # AQ0315MSS02

Condition: Condition 6.1.

Deadline for Completion of Source Testing: September , 2021.

ADEC Request: provide the following information.

Type of request: circle one of the following.

COBC NOV Letter Email Verbal Other (describe below)

If COBC or NOV, provide # _____

Date of the Request: _____

Deadline for Completion of Source Testing: _____

2. Source Test Information:

Source ID No.	EU 4, 5, 6, & 7 (combined stack)
Source Name	Chena Coal-Fired Boilers 1, 2, 3, and 5
Air Pollution Control Device Being Tested	
Scheduled Testing Dates	October 11-16, 2021
Pollutants Measured	SO2
Reference Methods	Methods 1, 2, 3A, 4, 6C, 19
Number of Tests	1
Test Conditions (Operational Loads)	At maximum achievable load
Number of Runs per Test Condition	3
Duration of Each Test Run	60 minutes

3. Alternative Test Plans (these require administrator approval):**4. Sample Port Location: See test plan****5. Traverse Point Locations for Velocity, Particulate, and Other Sampling:**

Based on information and belief formed after reasonable inquiry, I certify that the statements and information in and attached to this document are true, accurate, and complete.

Printed Name

Signature

Date

**Source Test Plan
Chena River Power Plant
Sulfur Dioxide
Chena 1,2,3, and 5
Emissions Test**

Prepared for:

Aurora Energy, LLC
100 Cushman Street, Suite 210
Fairbanks, Alaska 99701-4659

Prepared by:

Alaska Source Testing LLC
520 W 58th Unit A
Anchorage, Alaska 99518

August 27, 2021

1. INTRODUCTION

Aurora Energy LLC (Aurora) operates a power generation facility located on the Chena River in Fairbanks, Alaska. The facility is required to perform a sulfur dioxide source test per Air Quality Permit No. AQ0315MSS02. The minor permit addresses and contains Aurora's requirements as referenced in the Fairbanks PM_{2.5} State Implementation Plan. The emissions being tested will be from four coal-fired boilers; Chena 1, 2, 3, and 5 (EU ID 4, 5, 6, & 7), which are included in the scope of this test. Chena 1, 2, 3 and 5 all exhaust into a shared bag-house. The baghouse exhausts into the existing stack formerly used only by Chena 5 (EU 7). This test is being performed to demonstrate compliance with a 0.301 pound per million British Thermal Unit (lb/MMBtu) threshold emission limit.

Per Condition 6.1, Sulfur Dioxide (SO₂) emission factors will be determined by sampling from the combined 96-inch diameter stack. The compliance testing must be performed prior to September 7, 2021.

In conjunction with the emissions testing, Aurora will obtain representative samples of the fuel burned in each boiler during the source test and conduct an ultimate analyses on the collected samples.

Aurora has engaged Alaska Source Testing LLC (AST) to perform this source test program.

William Hudson will be the AST Project Manager and David Fish will be the Aurora test manager.

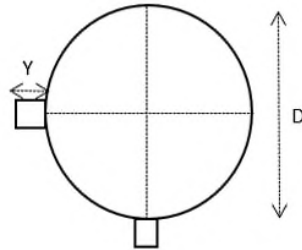
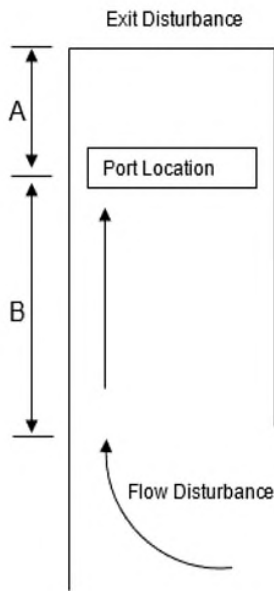
The SO₂ testing program will be performed in accordance with the *Code of Federal Regulations Title 40 Part 60* (40 CFR 60), Methods 1, 2, 3A, 4, 6C, and 19. The boilers will be operated at the maximum achievable site load.

2. SOURCE DESCRIPTIONS

ID	Source Name	Current Rating/size	Permit Rating/size
4	Chena 1 Coal-fired Boiler	50 Mlb/hr steam	76 MMBtu/hr
5	Chena 2 Coal-fired Boiler	50 Mlb/hr steam	76 MMBtu/hr
6	Chena 3 Coal-fired Boiler	50 Mlb/hr steam	76 MMBtu/hr
7	Chena 5 Coal-fired Boiler	220 Mlb/hr steam	269 MMBtu/hr

All of the boilers exhaust into a single combined baghouse. The baghouse exhausts into a single stack (formerly the Chena 5 stack).

Port and Traverse Locations for Combined Stack



Sample Ports, Y: 3 inches
Stack Diameter, D: 96 inches
Distance A, upstream: 90 feet
Distance B, downstream: 65 feet

*Traverse locations 1 & 12 were not adjusted per Method 1-11.3.2.1. Points met criteria set forth in Method 1 - 11.3.1.4

11.25	Duct Diameters that measurement site is upstream from flow disturbance (A)
8.13	Duct Diameters that measurement site is upstream from flow disturbance (B)

Referencing Figure 1-2: 12 traverse points per port

Traverse points: Table 1-2 (percent of stack diameter from inside wall to traverse point)

Traverse point	% of Stack Dia	Location in stack, inches from port (includes port length)
1*	2.1	5.02
2	6.7	9.43
3	11.8	14.33
4	17.7	19.99
5	25	27.00
6	35.6	37.18
7	64.4	64.82
8	75	75.00
9	82.3	82.01
10	88.2	87.67
11	93.3	92.57
12*	97.9	96.98

3. SOURCE TEST DESCRIPTION

3.1. Test Objectives

For boilers 1,2, 3, and 5 measure, SO₂, O₂, and CO₂ in the combined stack with the units operating at maximum achievable site load. SO₂ emissions will be reported in dppmv, lbs/hr, and lbs/MMBtu.

3.2. Description of Reference Methods Used

The emission-testing program will be performed in accordance with U.S. EPA Reference Methods as prescribed in 40 *CFR* 60, Appendix A. The specific methods are listed below.

- Method 1 Sample and Velocity Traverses for Stationary Sources
- Method 2 Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot tube)
- Method 3A Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)
- Method 4 Determination of Moisture Content in Stack Gases

- Method 6C Determination of Sulfur Dioxides from Stationary Sources (Analyzer Method)
- Method 19 Determination of Sulfur Dioxide Removal Efficiency and Particulate, Sulfur Dioxide and Nitrogen Oxides Emissions Rates

3.3. Description of Field Procedures

SO₂, O₂, and CO₂ concentrations will be measured according to Methods 6C, and 3A on a dry basis. Sample gas will be extracted through a stainless steel probe equipped with a filter and inserted into the sample port. The sample gas will be drawn through a 100-foot heated Teflon sample line and into a sample conditioner. The sample conditioner is designed to condense and remove moisture from the sample gas while minimizing any water/gas contact. This minimizes any sample gas loss due to solubility. Dry gas from the conditioner then enters a Teflon-lined head sample pump and then the sample flow is distributed to the individual gas analyzers. Each instrument sends an output signal to a data recorder, which will capture the instrument readings once every 30 seconds.

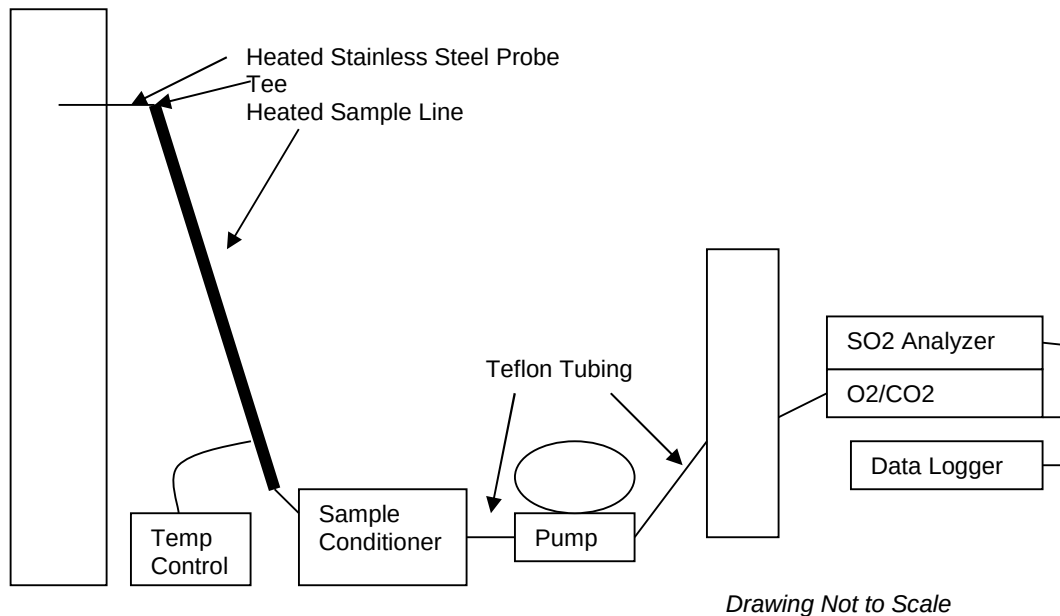
Stack moisture will be measured using a second dedicated probe. Stack gas will be drawn through the probe then into through an impinger train in accordance with Method 4. For each boiler and the combined stack, three moisture runs will be performed.

All of the instruments will be zeroed, calibrated, and span checked in accordance with the revised EPA Reference Methods, as applicable. System integrity and response time checks will also be performed according to the appropriate EPA Method. The existing oxygen monitoring system will be calibrated during the tests as necessary.

The calibration gases will be equivalent to the following percentages of span value: high-range gas, 80 to 100 percent of the calibration span; mid-range gas, 40-60 percent of the calibration span; and the low-range gas, less than 20 percent of the calibration span (and may be a zero gas). The high-range calibration gas for SO₂ will be set at approximately 500 ppmv; a mid-range gas of 250 ppmv will be used.

For diluent O₂ calibration gases, the high-range gas will be purified air at 20.9 percent O₂. A gas concentration between 8 and 12 percent O₂ in nitrogen will be used for the mid-level gas, and purified nitrogen will be used for the zero gas.

Method 3A, 6C Stack Sampling System



3.4. List of the Field Testing Equipment

The Method 1-4, and 6C testing will consist of three one-hour individual sample runs. Velocity measurements will be determined using an 8 foot “S” type Pitot tube. A velocity/temperature profile will be performed for each run.

Method 4 equipment is described below. AST utilizes a ESC-model C-5000 source sampling system for the moisture determination.

Impinger Train and Ice Bath: The impinger train and ice bath tray serves to collect and quantify sample gas moisture. The impinger train consists of four impingers connected by glass U-tubes with ball/socket connectors. The first two impingers are setup with 100 ml of distilled water. The third impinger is left empty and the fourth impinger contains a silica gel desiccant to further enhance capture of sample moisture. The fourth impinger attaches to an exit connector with a K-type thermocouple to monitor the sample gas temperature. The connector attaches to the sample system by a 100 foot hose. The ice bath tray is simply an insulated container to hold the impinger train and the surrounding ice water.

Note: To facilitate leak-free operations, all sample train connections from the probe liner to filter assembly and impinger train are made with ball and socket joints equipped with either Viton or Teflon O-rings.

Control Console: The control console is the heart of the sample system. Components include a rotary vane vacuum pump with valves to draw and control the flow of sample gases through the system. The sample gas passes from the sample pump through a DGM that measures the sample volume to an accuracy of 0.001 cubic feet. K-type thermocouples are located on the DGM inlet and outlet to monitor average temperature. A flow orifice is attached to the outlet of the DGM. The console is equipped with a gauge to monitor system vacuum. Two digital temperature controllers are included to maintain probe and sample box temperatures. Double incline oil-filled manometers (0-10" H₂O) are located on the console front panel to indicate the differential pressures from the flow orifice (ΔH) and the Pitot measurement of stack gas velocity head (ΔP). A digital thermocouple readout is located on the panel. Quick-connect connectors are provided for sample. Connections for the umbilical electrical line and thermocouple inputs are also provided in the front panel.

Method 3A equipment is described below. O₂/CO₂ analysis for the combustion gas sample will be performed using a Servomex 4900C1 Analyzer. The instrument specifications are listed below.

Oxygen Analyzer Components	Carbon Dioxide Components
Principle of Operation: Paramagnetic	Principle of Operation: NDIR
Span: 0-5%, 0-10%, 0-25%	Span: 0-10%, 0-20%
Linearity: Better than + 1 % full scale	Linearity: Better than + 1 % full scale
Zero/Span Drift: Less than + 0.01 % full scale in week	Zero/Span Drift: Less than + 1 % full scale in 24 hours

The SO₂ analysis for the combustion gas sample will be performed using a Thermo Environmental Instrument Inc. Model 43C-HL pulsed fluorescent analyzer. The instrument specifications are listed below.

Sulfur Dioxide Components
Principle of Operation: Pulsed Fluorescence
Span: 0-100, 200, 500, 2000, 5000 and 10000 ppm
Linearity: Better than + 1 % full scale
Zero/Span Drift: Less than + 1 % full scale per day

The sample conditioning system that will be used is an Alfa Laval MAK 6-2.

4. Operational and Process Data to be Collected

The following operational data will be recorded during each test run:

- Steam production rate
- Flue gas oxygen content
- Percent opacity from the unit's continuous opacity monitoring system

Operational strip chart records and data sheets will be appropriately labeled with sample date run start/stop times and included in the report appendices.

5. QA/QC REQUIREMENTS

The activities of this project will be conducted in accordance with the EPA *Quality Assurance Handbook for Air Pollution Measurement Systems Vol. III* and the AST Quality Program Manual QPM-1. Quality control and quality assurance for all sampling and analytical procedures will be performed as required by the appropriate USEPA Reference Methods. Data quality objectives are to measure SO₂ expressed as dppmv, lbs/hr, and lbs/MMBtu.

6. REPORT PREPARATION

The Final Report will include the following sections:

Note: To the extent practical the format given in the Source Test Report Outline in Vol. III, section IV.3 of the state Air Quality Control Plan will be followed.

- a) Test rationale;
- b) Test objectives;
- c) Description of test location and testing condition;
- d) Description of sampling procedures and analytical methods, detailing any exceptions to established reference methods and procedures;
- e) Summary of test results; and
- f) Description of QA/QC methods and results.

Report appendices will include the following elements:

- a) Tabulation of all reduced test results;
- b) Example calculations for all test and emission determinations;
- c) Raw test data including field data sheets, operational data sheets, strip charts, analytical data sheets, and computer printouts;

- d) QA/QC documentation including analyzer response and performance checks, sensor calibration sheets, results of analytical spikes and blanks, traceability certificates of calibration standards, and opacity reader certification;
- e) Relevant agency correspondence; and
- f) Listing of project personnel, affiliation, and role.

7. TENTATIVE TEST SCHEDULE

The testing is tentatively scheduled for the week of October 11, 2021 after 08:00am.

- Preliminary Results will be available on-site.
- A Draft Report will be submitted electronically to Aurora within 30 days of test completion.
- A Final Report will be sent to Aurora electronically within 10 days of receiving comments. Hardcopies will be provided upon request.

Aurora Energy PM Investigative Study

Preliminary Results, 12/20/23

Prepared by Alliance Technical Group
For Aurora Energy, Fairbanks, AK

Parameters	Sources		
	Boiler 5	Boilers 1-3 (2 run average)	Boilers 1-3 (includes run 3 soot blow)
VFR at stack (acfm)	116,670	83,887	84,417
VFR standard (scfm)	76,741	55,921	56,273
VFR dry (dscfm)	66,656	50,346	50,519
VFR at stack (lb/hr) *	336,010	241,595	243,121
Moisture Content	13.1	10	10.2
Stack Temperature	316.3	298.7	298.7
O2%	5.97	10.6	10.53
CO2%	13.17	8.95	8.97
Particulate Concentration (grain/dscf)	0.1723	0.0375	0.0498
Particulate Emission (lb/hr)	98.4	16.16	21.59

* using density of 0.048 lb/cf and acfm

Date	Steam Load Daily Averages			
	Boiler 1	Boiler 2	Boiler 3	Boiler 5
	klbs/hr	klbs/hr	klbs/hr	klbs/hr
12/19/2023	33.8	33.4	32.6	189.3
12/20/2023	34.6	35	34.1	188.6

"Maximum Load" Design Case - At Fabric Filter Inlet

Section IX. Flue Gas Composition Calculation

	MW	Flow Rate						Concentration		
		lb/hr	lb/lb fuel	scfm	mol/hr	wt%	mol%	ppm/ppb	Heat Input Basis	mg/Nm3
Carbon Dioxide	44.0	112064.2	1.687	16351.8	2546.35	15.14%	9.99%	n/a	213.7 lb/MMBTU	196502
Sulfur Dioxide	64.1	181.0	0.003	18.1	2.83	0.024%	0.011%	111 ppm	.3452 lb/MMBTU	317
Nitrogen	28.0	519955.2	7.828	119191.8	18560.88	70.24%	72.85%	n/a	991.7 lb/MMBTU	911731
Oxygen	32.0	67020.6	1.009	13450.0	2094.47	9.05%	8.22%	n/a	127.8 lb/MMBTU	117519
NO	30.0	162.4	0.002	34.8	5.41	0.022%	0.021%	212 ppm	.3098 lb/MMBTU	285
NO2	46.0	13.1	0.000	1.8	0.28	0.002%	0.001%	11.2 ppm	.025 lb/MMBTU	23
NOx <SEE NOTE >	46.0	262.1	0.004	n/a	5.70	n/a	0.022%	223.6 ppm	.5 lb/MMBTU	
Water	18.0	40855.9	0.615	14563.3	2267.84	5.52%	8.90%	n/a	77.9261 lb/MMBTU	71640
Sulfur Trioxide	80.1	0.5	0.000	0.0	0.01	0.000%	0.000%	.2 ppm	.0009 lb/MMBTU	0.8
HCl	36.5	2.5	0.000	0.4	0.07	0.000%	0.000%	2.6 ppm	.0047 lb/MMBTU	4.3
Mercury	200.6	0.010	0.000	0.0	0.00005	0.000%	0.000%	1.9 ppb	19.0044 lb/MMBTU	0.0175
Total		740,255	11.1	163612	25478	100.0%	100.0%			

NOx NOTE: NOx values are a subtotal of the NO and NO2 values, and are not included in the overall totals - expressed as NO2 equivalent

Total Flow Summary

740,255 lb/hr
 163,612 scfm
 259,225 Nm3/hr
 249,330 acfm
 384.2 "WC
 300.0 °F

"Maximum Load" Design Case - at Stack

Section IX. Flue Gas Composition Calculation

	MW	Flow Rate						Concentration		
		lb/hr	lb/lb fuel	scfm	mol/hr	wt%	mol%	ppm/ppb	Heat Input Basis	mg/Nm3
Carbon Dioxide	44.0	112064	1.687	16352	2546.3	14.54%	9.60%	n/a	213.7 lb/MMBTU	188689
Sulfur Dioxide	64.1	181	0.003	18	2.8	0.02%	0.01%	106 ppm	.3 lb/MMBTU	305
Nitrogen	28.0	543274	8.179	124537	19393.3	70.50%	73.09%	n/a	1036.2 lb/MMBTU	914742
Oxygen	32.0	74041	1.115	14859	2313.9	9.61%	8.72%	n/a	141.2 lb/MMBTU	124667
NO	30.0	162	0.002	35	5.4	0.02%	0.02%	204 ppm	0.31 lb/MMBTU	273
NO2	46.0	13	0.000	2	0.3	0.00%	0.00%	10.7 ppm	0.03 lb/MMBTU	22
NOx <SEE NOTE >	46.0	262	0.004	n/a	5.7	n/a	0.02%	214.8 ppm	0.5 lb/MMBTU	
Water	18.0	40914	0.616	14584	2271.1	5.31%	8.56%	n/a	78. lb/MMBTU	68889
Sulfur Trioxide	80.1	0	0.000	0	0.0	0.00%	0.0000%	.2 ppm	0. lb/MMBTU	1
HCl	36.5	2	0.000	0	0.1	0.00%	0.0003%	2.5 ppm	0. lb/MMBTU	4
Mercury	200.6	0.010	0.000	0	0.00005	0.00%	0.0000%	1.9 ppb	19.0 lb/TBTU	0.0168
Total		770,652	11.6	170387	26533	100.0%	100.0%			

NOx NOTE: NOx values are a subtotal of the NO and NO2 values, and are not included in the overall totals - expressed as NO2 equivalent

Total Flow Summary

770,652 lb/hr
 170,387 scfm
 269,959 Nm3/hr
 247,684 acfm
 392.7 °WC
 281.0 °F

R. J. REYNOLDS TOBACCO COMPANY
BAILEY UTILITY PLANT
WINSTON-SALEM, N.C.

FLAKT BAGHOUSE INSTALLATION
11 SECTION HP-266-14 COLLECTOR

Project 44

CUSTOMER ORDER NO.:
86-24047

FLAKT, INC. JOB NO..
615

OPERATION AND MAINTENANCE
MANUAL

March 31, 1987



R. J. REYNOLDS TOBACCO COMPANY
BAILEY UTILITY PLANT

OPERATION AND MAINTENANCE MANUAL
GENERAL SYSTEM DESCRIPTION

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2.0 General System Description

- 2.1 The Flakt Fabric Filter Dust Collector is engineered and constructed to specifications shown in DESIGN DATA, SECTION 3.
- 2.2 This high energy collector is intended for continuous automatic service at high air-to-cloth ratios. It consists essentially of an airtight housing containing filter bags, bag cages, hopper (for specific items furnished see General Arrangement Drawing), control panel and a compressed air cleaning system. The compressed air cleaning system consists of a main header and branch headers, each with a piloted diaphragm valve and openings over each bag.
- 2.3 A horizontal plate (grid sheet) with openings divides the housing into a large lower portion and an upper chamber called a clean air plenum. The filter bags are supported by cylindrical wire bag cages inserted into the bags, through the openings in this plate. The upper ends of the bags snap into this divider sheet to form gas tight joints while their lower, blanked-off ends protrude into the lower chamber of the housing. There are rows of fourteen (14) bags each. A branch header is positioned parallel to, and directly above each row of bags so that its openings are aligned with the bag center. One end of each branch header is capped off while the other is connected through an intervening diaphragm valve to the compressed air main header which is common to all branch headers. A pipe union is provided between the open end of each branch header and its diaphragm valve so that the header may be easily disconnected and removed for filter bag installation and servicing.
- 2.4 Dust collector maintenance activities are to be performed from the plenum area. Access is through top access hatches inside the penthouse. Dust laden gas is introduced into the collector through a duct system originating at the fume source and proceeding on to the flanged collector inlet. The flow of gas is caused by maintaining negative pressure inside the collector. The negative pressure is produced by a suitably sized fan located downstream from the collector. As the gas stream enters the unit, it is deflected by a baffle plate and flow is distributed around the baffle to the exterior surface of the filter bags. Cleaned and filtered gas continues through the filter bags, to the outlet plenum, and exits the dust collector.



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2.5 The filter bags are cleaned periodically by the compressed air cleaning system. The overall operation of the cleaning system is controlled by the PLC. The firing of the pilot valve, located above the diaphragm valve, is sequenced by the pulse timer board. When the pilot valve opens, pressure along the main diaphragm is released allowing main line pressure to act against the underside of the diaphragm opening the main valve orifice. This allows a specified quantity of compressed air to pass from the air main header into the branch header discharging into the fourteen (14) bags in each row. On leaving the pipe opening, the compressed air expands to form a bubble which travels down the length of the bags. The bubble disturbs the cloth with sufficient force to break up the dust cake on the outside of the bag, knocking the dust particles into the hopper.

2.6 This same sequence is repeated every few seconds for each branch header in turn, so that compartment cleaning is assured. The duration of compressed airflow through a branch header, "ON TIME", and the time interval between cleaning successive rows of bags, "OFF TIME", can be adjusted within wide limits on the pulse timer card. Also, the pressure of the compressed air in the compressed air main header can be adjusted to any value up to 50 PSIG. Thus, the energy expended in cleaning the filter cloth and the frequency and time duration of cleaning can be varied to accommodate the needs of any particular application.

2.7 General

This manual provides operating and maintenance instructions for Flakt High Ratio Fabric Filters designed and manufactured by Flakt, Inc., Environmental Systems Division, Knoxville, Tennessee.

2.8 Description

The system consists of one (1) baghouse unit with eleven (11) modules, inlet and outlet manifolds, bypass dampers, support structures, penthouse, necessary access stairs, ladders and walkways, controls and dampers.



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2.8.1 Collector Module

2.8.1.1 Each module is stringently designed as a gas-tight compartment which houses the filter bags, bag cages, tube sheet and bag cleaning system.

2.8.1.2 One pyramidal hopper at the base of each compartment collects the particulate as it is removed from the bags and provide a means of connection to the ash removal system.

2.8.2 Filter Bag

There are two hundred sixty-six (266) bags in each compartment. Each bag is fourteen (14) feet long and six (6) inches in diameter. The bags are made from woven fiberglass, 10% teflon coating B finish, sixteen (16) ounces per square yard. The bag cages provide the correct tension to each bag.

2.8.3 Bag Cleaning System

The bag cleaning system uses clean, dry, instrument grade, compressed air supplied from the compressor. The air enters a header located on top of the compartment and is distributed to each row of bags via a Flakt Pulse Valve. Each pulse valve supplies air to fourteen (14) bags.

2.8.4 Hopper

Each hopper is designed to maintain a temperature sufficient to prevent flyash from exhibiting hygroscopic properties. Each hopper is provided with heaters, high level alarm, poke holes, inspection hatch, strike anvil and vibrator.

2.8.5 Controls

The system contains controls necessary for automatic cleaning of each compartment. For complete description, refer to the section dealing with operation and controls.



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2.8.6 Dampers

2.8.6.1 Each compartment is provided with one inlet damper of butterfly type and one outlet damper of poppet type. There are two (2) bypass dampers, of poppet type, for bypassing the gas from the baghouse inlet manifold to the outlet manifold.

2.8.6.2 All dampers are equipped with pneumatic operators. The dampers are operated when the compartment is to be isolated for maintenance access.

CAUTION: IF THE SYSTEM GOES ON BY-PASS DUE TO HIGH TEMPERATURE, INLET DAMPERS SHOULD BE MANUALLY CLOSED TO KEEP RADIANT HEAT IN THE INLET FROM DAMAGING BAGS.

2.9 General Control

The high ratio fabric filter utilizes a programmable computer to provide automatic cleaning. The following paragraphs describe sequences for one module and is typical for all modules.

2.9.1 Module Operation

2.9.1.1 Dust laden gases enters the module through the top of the hopper via ductwork from exiting boilers 7, 8 and 9. The gases are dispersed in even distribution to the filter bags. Heavy particles settle out into the hopper before entering the bag area. The gas continues through the compartment, depositing dust particles on the filter bag as it passes through and out the outlet poppet damper into an exhaust manifold. The exhaust manifold carries the cleaned gas via a fan to the exhaust stack.

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2.9.1.2 The bag filter system operates under negative pressure.

2.9.1.3 Dust Removal

Dust collection on the outside of the bags as a result of a dirty gas flowing through the filter bags, causes a reduction in porosity of the bag. The result is a pressure differential between the dirty and clean gas sides of the compartment. Control of this differential is accomplished by introducing a momentary pulse of clean pressurized air in a reverse direction to normal gas flow. The pulse air travels the entire length of the bag and thus cleaning off the collected particles.

NOTE: THE SEQUENCE OF OPERATION IS DESCRIBED IN THE SECTION DEALING WITH THE PROGRAMMABLE CONTROLLER.

2.9.2 Hoppers

2.9.2.1 Heating Circuit

The hopper heaters are provided with thermostats to keep the hopper skin temperature in the hopper at 300°F with the baghouse is in service at all loads. Each hopper has separate controls.

2.9.2.2 Level Control

When the ash in the hopper reaches a level corresponding to hopper dust capacity, a high ash level switch will actuate a high level alarm.



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3.0 DESIGN DATA

3.1	Gas Flow Capacity, ACFM	-	250,000
3.2	Temperature of Dust Laden Gases, °F	-	350
3.3	Type of Filter Bag	-	Woven Fiberglass FMD-648E
3.4	Number of Modules	-	11
3.5	Number of Branch Headers per Module	-	19
3.6	Number of Bags per Branch Header	-	14
3.7	Total Number of Bags per Module	-	266
3.8	Total Square Feet of Filter Cloth	-	61,153
3.9	Air-to-Cloth Ratio:		
3.9.1	All Modules On Line	-	4.09:1
3.9.2	One Module Off Line for Cleaning	-	4.50:1
3.10	Recommended Pressure Drop Across Cloth, Inches of W.G.	-	3 - 6
3.11	Type of Dust	-	Fly Ash
3.12	Design Pressure Inches of W.G.	-	± 25
3.13	Dry Compressed Air Pressure PSIG	-	100



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- | | |
|--------------------------------|--|
| 3.14 Insulation | - Five (5) inch thick mineral wool with 0.040 inch aluminum ribbed lagging. |
| 3.16 Ductwork | - Inlet and outlet plenums made from 3/16 inch M.S. plate. |
| 3.17 Dampers | - Eleven (11) - forty-two (42) inch diameter poppet outlet dampers;
Eleven (11) - 7' x 2" butterfly inlet dampers;
Two (2) - sixty-six (66) inch poppet bypass dampers |
| 3.18 Damper Operators | - Pneumatic cylinders. |
| 3.19 Penthouse | - Uninsulated .040 inch aluminum ribbed siding. |
| 3.10 Ventilation Fan Penthouse | - Two (2) - 24" x 10'0" ridge vents |



Sodium Bicarbonate Flow Rate Estimate



DR 014 - VERSION 1.92 - 03/2020

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PROJECT

Project : P23-32 ANDR AK Aur
 Requested by customer : Andritz
 Requested internally by : XXX
 Date : 12/21/2023
 Reference : 90% removal
 Revision : 0
 Estimate done by : XXX
 Comments : Sodium bicarbonate milled onsite d90<25um, perfect duct coverage and mixing, reactor recommended

PROCESS

Process family : POWERPLANT
 Filter : BF/FF
 Residence time (seconds) : 2 (between the injection point and the filter inlet)
 Process specifications : DR200 / DR220 (RtU)

RAW AND CLEAN GAS PROPERTIES

Raw gas properties		Clean gas properties	
Flowrate (pph)	740,241	Flowrate (pph)	740,241
Temperature (°F)	280	Temperature (°F)	280
O ₂ (% vol. dry)	9.0	O ₂ (% vol. dry)	9.0
H ₂ O (% vol.)	9.0	H ₂ O (% vol.)	9.0
Raw gas composition (pph)		With Sorbent Injection pph	
HCl	3	HCl	1
SO ₂	180	SO ₂	9
		Requirements at Stack pph	
		HCl	1
		SO ₂	16

SODIUM BICARBONATE FLOW RATE

Estimated sodium bicarbonate flow rate (pph)		Acid flow rate eliminated (pph)		Obtained removal (%)
HCl	6	HCl	2	80.0
SO ₂	567	SO ₂	165	91.6
Total	628			

RESIDUE PRODUCTION

Estimated residue production (pph)		Estimated residue composition (% weight)	
NaCl	3	NaCl	0.6%
Na ₂ SO ₄	366	Na ₂ SO ₄	62.9%
Na ₂ CO ₃	94	Na ₂ CO ₃	16.2%
Total salts	505	Total Salts	86.9%
Non Soluble	76	Non soluble	13.1%
Total	581	Total	100%

This estimate is based on the information available in this document and is valid only if the requirements for this project are followed. The influence of other acids in the raw gas and of the sodium bicarbonate transportation to the injection point is not taken into account.

The information contained in this document is given in good faith and by way of information at the time of publishing. SOLVAY does not engage its responsibility. The use of our products is for the treatment of flue gases, excluding all others uses and applications. The buyer is required to monitor and respect, in its sole liability, the conditions under which our products are stored and used in its territory, to provide all required information to the user, and to respect all existing patents and all regulations applicable to our products and to its activity.



Sodium Bicarbonate Flow Rate Estimate



DR 014 - VERSION 1.92 - 03/2020

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PROJECT

Project : P23-32 ANDR AK Aur
 Requested by customer : Andritz
 Requested internally by : XXX
 Date : 12/21/2023
 Reference : 95% removal
 Revision : 0
 Estimate done by : XXX
 Comments : Sodium bicarbonate milled onsite d90<25um, perfect duct coverage and mixing, reactor recommended

PROCESS

Process family : POWERPLANT
 Filter : BF/FF
 Residence time (seconds) : 2 (between the injection point and the filter inlet)
 Process specifications : DR200 / DR220 (RtU)

RAW AND CLEAN GAS PROPERTIES

Raw gas properties		Clean gas properties	
Flowrate (pph)	740,241	Flowrate (pph)	740,241
Temperature (°F)	280	Temperature (°F)	280
O ₂ (% vol. dry)	9.0	O ₂ (% vol. dry)	9.0
H ₂ O (% vol.)	9.0	H ₂ O (% vol.)	9.0
Raw gas composition (pph)		With Sorbent Injection	
HCl	3	HCl	1
SO ₂	180	SO ₂	5
		Requirements at Stack	
		HCl	1
		SO ₂	8

SODIUM BICARBONATE FLOW RATE

Estimated sodium bicarbonate flow rate (pph)		Acid flow rate eliminated (pph)		Obtained removal (%)
HCl	7	HCl	2	80.0
SO ₂	710	SO ₂	172	95.6
Total	782			

RESIDUE PRODUCTION

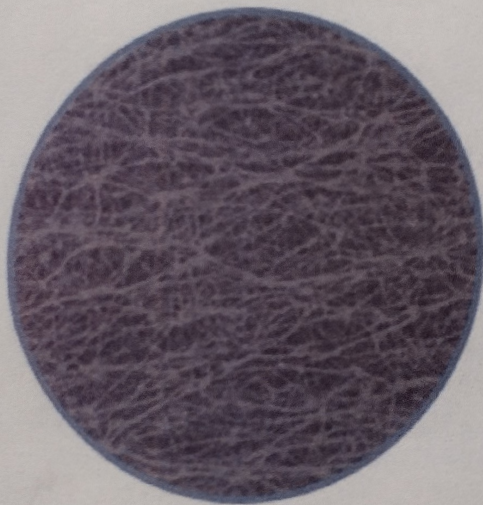
Estimated residue production (pph)		Estimated residue composition (% weight)	
NaCl	3	NaCl	0.5%
Na ₂ SO ₄	382	Na ₂ SO ₄	55.9%
Na ₂ CO ₃	180	Na ₂ CO ₃	26.3%
Total salts	606	Total Salts	88.9%
Non Soluble	76	Non soluble	11.1%
Total	682	Total	100%

This estimate is based on the information available in this document and is valid only if the requirements for this project are followed. The influence of other acids in the raw gas and of the sodium bicarbonate transportation to the injection point is not taken into account.

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AFTm™-RD ePTFE Membrane

AFTm™-RD membrane is based upon the concept of being the heaviest and toughest membrane which utilizes a minimal dust cake which does not contaminate during long term use even under high peak usage conditions.



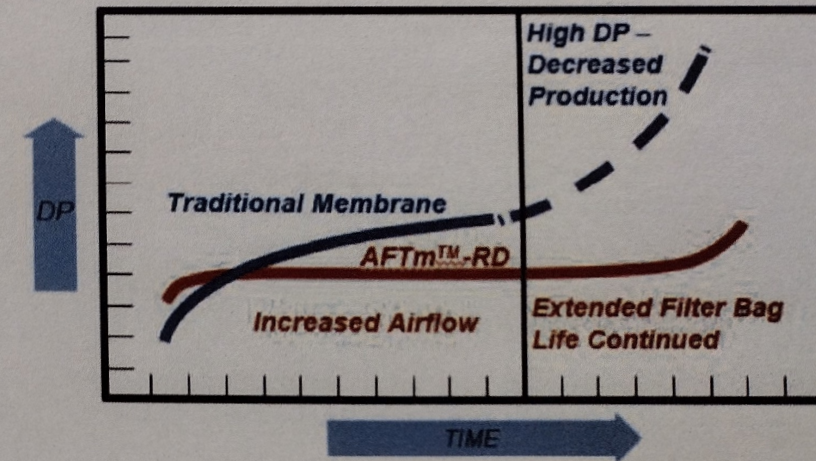
AFTm™-RD



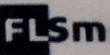
Traditional

Benefits:

- Dust cake formation begins and stays on the surface
- Tight, consistent pore structure leads to excellent dust cake shed
- Minimal particulate retention after prolonged use
- Excellent for the Electric Arc Furnace – EAF, Ferro Silica Furnace, and Primary and Secondary Alloy Smelting applications



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Trip Report: Aurora Energy, Fairbanks, AK**Date: December 14-15, 2023****Mark Fiedler, Consultant to Andritz Inc.****Email: Engineer36r@gmail.com****865-603-0084****Overview**

The Aurora facility burns coal and produces steam and hot water for district heating within Fairbanks, along with up to 12 MW of electricity sold to the local electrical Coop.

The writer was invited to visit the plant as an Original Equipment Manufacturer representative to inspect equipment and review operational data to evaluate the performance of the Pulse Jet Fabric Filter (PJFF) installed at the Aurora Energy Cogeneration Plant. The PJFF provides particulate control of the flue gas from four coal fired boilers. The performance evaluation was requested in consideration of future decisions regarding possible improvements to reduce plant air emissions.

Discussions were held with Chilkoot Ward (Plant Superintendent), Chung Brown (Assistant Superintendent), and Ted Baysinger (Shift Engineer) at the plant to evaluate the PJFF operating conditions, maintenance requirements, along with specific information related to performance of the PJFF. Internal inspection of the on-line equipment was not possible, but an external inspection was made. Plant personnel provided excellent information regarding the operational history of the equipment.

History

The PJFF installed and operating at Aurora Energy was designed and manufactured by Flakt, Inc. during the late 1980's. The Fabric Filter was designed as a modular unit that is factory assembled in truck-shippable modules and then installed at the customer's location, in this case, a tobacco product plant in N. Carolina. After the closure of that plant, the modular PJFF was sold and moved to the Aurora Energy facility in the City of Fairbanks next to the Chena River. The modular PJFF was reassembled and integrated into the existing plant site to supply improved particulate control. Existing equipment in a limited plant area required new ductwork connections to the 3 existing 50,000 lb/hr boilers, (Chena 1,2, and 3) and 1 existing 200,000 lb/hr boiler, Chena 5. Three variable speed ID fans provide removal of PJFF discharge gas, sending the treated gas discharge to a common stack.

Filter Design

Modular Fabric Filters are available in a range of sizes with shipping limitations being the practical maximum size of these units. The economic advantages of modular units are the repetitive design of components and the maximum utilization of shop manufacturing conditions. Most modular units use an outside to inside the bag filtration method where a wire cage is inserted into a filter bag to maintain filter bag shape. The design of this PJFF module has 266 filter bags per module. A sealed metal casing with a bottom dust hopper and a tube sheet, separating dusty gas from clean gas divides the casing. Bags and cages are suspended vertically from the tube sheet. Gas or air containing dust particles are drawn

into the lower half of the casing and particulate matter is collected on the exterior of multiple filter bags while negative (air or flue gas) pressure at the outlet of the module (from the ID Fans) draws flow from the inlet to the outlet. Filter bags are cleaned, when indicated by increasing flue gas pressure differential pressure across the filter, by a strong pulse of dry instrument quality air directed downward into the clean gas exit at the top of the filter bag. This pulse of air creates a shock wave that travels the length of the bag, momentarily reversing the inward flow of gas and expelling the dust cake that has accumulated on the bag exterior. The expelled dust cake falls into the casing hopper by gravity. One row of bags is cleaned (14 bags in this design) with one pulse of instrument air. The installed PJFF compartments have 19 rows of bags and 19 pulse valves. It is possible to clean most PJFF compartments installed around the power industry on-line (without isolation from the flue gas flow) or off-line where each compartment is periodically isolated for 4-6 minutes for pulse cleaning without gas flow and then returned to service. The 11 module PJFF installed at Aurora Energy is currently configured for off-line cleaning only. In normal operation, 10 modules will remain on-line while one module is cleaned. This is known as the Net-1 condition. If off-line maintenance requires removing a second module from service for safe worker access, this creates a Net-2 condition, leaving 9 modules filtering flue gas while off-line cleaning the 10th module.

Operational Observations

The Aurora plant was operating only the three smaller boilers at nominal 100% output during the writer's time on site, Dec 14-15, 2023. Six of the 11 PJFF compartments were in service. Indicated Dp's: 5.3, 7.4, 3.8, 3.9, 7.6, 3.9" WG, Indicated average 5.1" WG pressure loss across the modules. Measured total Dp (across total PJFF casing 6.5" WG. (Different taps, likely different calibration accuracy.)

Reviewing a recent period of steady full load with all boilers on-line, nominally Dec. 2-6, 2023, gives a good representation of steady state PJFF performance. A chart of differential pressure readings is attached. Note the regular up and down differential traces indicate single compartment cleaning intervals during that period (one compartment at a time). the observed PJFF conditions, 11 compartments in service were as follows:

Individual compartment Dp's averaged between approximately 4.2 and 5.8" WG. The measured total Dp across the PJFF casing varied between 5.6 and 7.0" WG. The number of off-line cycles detected average approximately 26 per day, or about 2.4 off-line cycles per compartment per day.

The plant operators noted that before the change to new membrane bags in 10 compartments (so far), that total Dp's with all non-membrane bags typically spiked up into the 9-10" WG range at full plant load.

Operating the system in the 9-10" WG range, the three ID fan motors were at maximum load and in danger of tripping off. The new membrane bags have created a small zone of system operational comfort. It was also reported that station electrical consumption had reduced with the new bags but was still in the danger zone regarding exceeding installed station service transformer capacity.

Equipment Inspections

Walking down the equipment with Aurora Energy personnel it was possible to assess only the exterior of the PJFF.

The lower section of the unit at ground level was found to be generally clean, with minimal evidence of dust leaks from the compartment hoppers and from the Allen Sherman Hoff vacuum pneumatic ash conveying system. Insulated covers were in place on hopper access doors. Operators reported that hopper heater functionality was questionable, and that heater inspection and maintenance was needed.

At the top access area of the PJFF, it was reported that many of the top door seals (always a problem area) had been replaced. No obvious compressed air leaks could be heard in the top enclosure. The plant had recently replaced the compressed air dryer with a new, much larger dryer. The area where the pulse pipes penetrate the top door has received many corrosion repairs over the history of the equipment. Plant personnel stated that the casing below the pulse header area also suffered from significant corrosion and subsequent repairs due to cold steel corrosion from inadequate thermal insulation. The entire casing was not protected sufficiently for the cold environment in Alaska, with minimal heat retention in the top and bottom enclosures.

The design of the PJFF top door includes the pulse pipes permanently attached to the bottom side of the door and are extracted from the compartment top area when a door is lifted off by the installed hoist. Due to this design, the area around the pulse air header is very crowded with minimal area to maintain the pulse air valves. Numerous coupling designs had been used in the original manufacturing of the modules. The couplings on this unit had mostly failed over time. Many couplings had been replaced by heavy hose and hose clamps. It was noted that even though they did not leak compressed air, some of the pulse energy was being lost in flexing of the hose. Keeping up with pulse valve maintenance is a known activity at the facility. Brief discussion of upgrading the pulse air system indicates that it would be expensive and possibly damaging to the current fiberglass bags.

The plant personnel reported that some of the original bag cage venturis had broken loose and were removed from the bag and cage top opening. Due to the inherent manufacturing tolerances of the fixed pulse pipe arrangement, the pulse pipe discharge nozzles are often not properly centered over filter bag top opening. This misalignment can dissipate significant pulse air cleaning energy and especially in the case if fiberglass filter bags can erode holes in the bags. Installation of venturis in all bag inlets will not only draw more clean gas into the bag interior when pulsed, but the metal venturi will also protect the bag fabric from premature failure. It is strongly recommended to obtain proper replacement venturis and install them in all top openings of the filter bags.

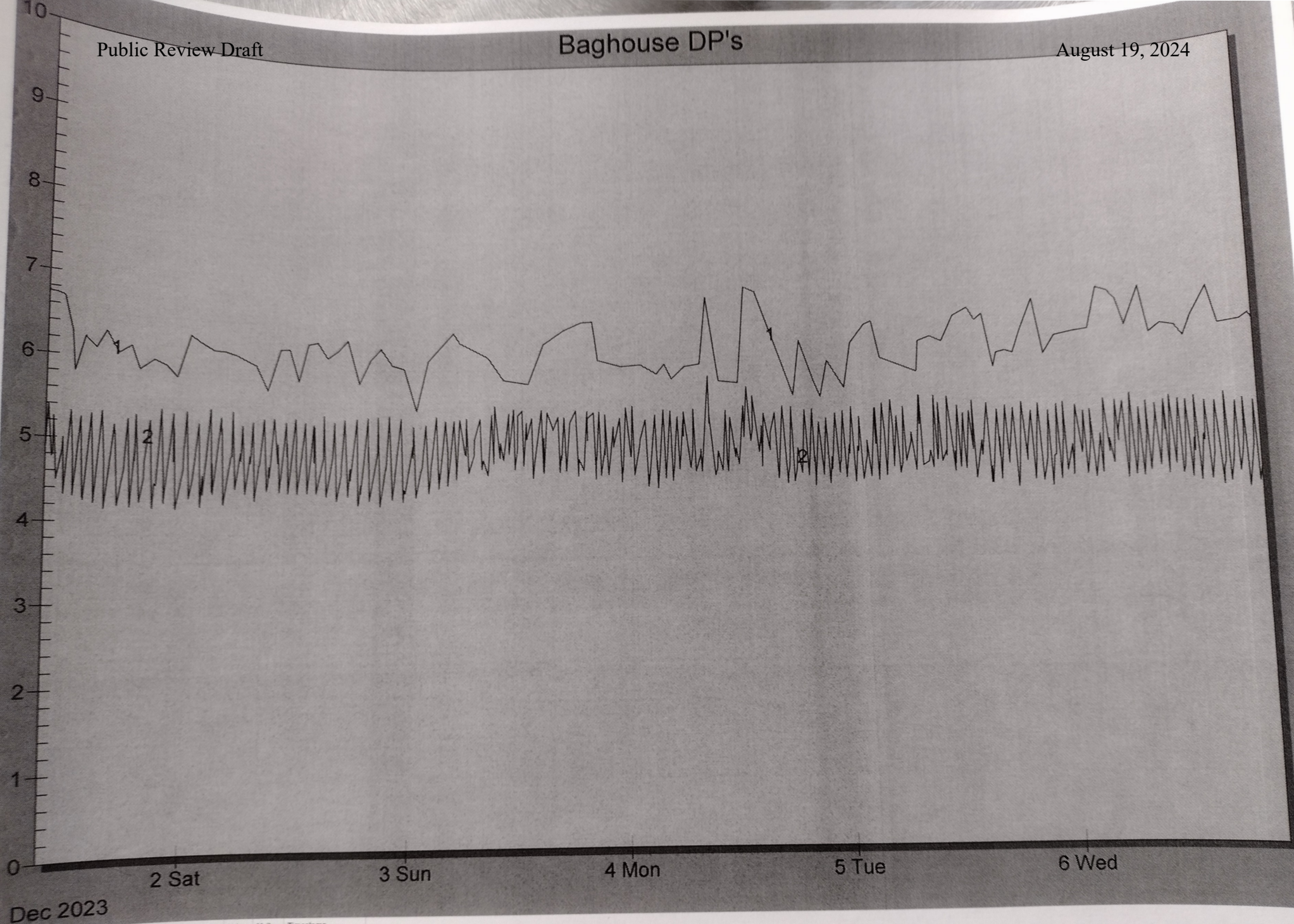
As part of the equipment inspection, the ID fan enclosure was found to be clean and quiet, 2 fans on at low load conditions, 694 RPM out of 925 RPM maximum speed capability. Three variable speed fans serve the four boilers. The off-line condition of the larger boiler (Chena 5) needed ventilation for workers inside the boiler, resulting in an unknown flow of cool ambient air being mixed with the discharge from the three active boilers. Observed PJFF outlet gas /air mix was 219°F. Normal full load (all boilers) gas to the stack was reported to average 295-300°F.

Air in-leakage to the flu gas system was reportedly an ongoing maintenance issue. Significant effort had been made to reduce PJFF top door seal leaks which currently seems to be controlled. Casing sidewall corrosion is not well known but suspected. Ductwork cracking has previously required repairs and may be ongoing.

Ash/Dust Quantity

The ash system gathers mixed waste solids from multiple points on each boiler and from the 11 PJFF hoppers. Each boiler has multiclones installed at the boiler exit. The actual flyash quantity and particle size is not known but particle size exiting the multiclones and carried by the flue gas to the PJFF is assumed to be small. A small pile of dust found in the hopper enclosure interior was similar to fine talcum powder or cement dust. The reported elevated level of LOI (Loss on Ignition) in the bulk ash is believed to be largely removed at the boiler ash drop-out locations. No significant evidence of black carbon dust was noticed in the dust pile found.

Daily ash disposal quantity is 7 truckloads. One Dry Sorbent Injection (DSI) proposal received by Aurora Energy calls for the injection of 8.7 tons/day of sodium bicarbonate to achieve 95% SO₂ removal. Typical DSI injection points are near the boiler flue gas exit point to allow maximum mixing and reaction time. After reaction and capture of SO₂, this reaction product would add another 5,000 lbs. of waste ash, for about 11 tons per day of additional particulate matter to be filtered out by the PJFF. The potential impact of this quantity of particulate matter is currently unknown.



Dec 2023

2 Sat

3 Sun

4 Mon

5 Tue

6 Wed

January 23, 2024

Mr. David Fish
Aurora Energy, LLC
Chena Power Plant
Anchorage, Alaska

**RE: Engineering PM Test Results Baghouse Inlets
Project No. AST-2024-4844
Boiler 1-3 & 5**

Dear Mr. Fish,

Alliance Technical Group, LLC (Alliance) is providing test results for the testing conducted at the Aurora Energy, LLC Chena Power Plant located in Anchorage, Alaska. Testing was conducted to determine the emission rates of particulate matter (PM10) at the baghouse inlets of the Boiler 1-3 & 5.

The test results including supporting lab data are included in this data package.

Please contact me at (801) 269-0550 or via email at shamit.nakra@alliancetg.com if you have any questions or need additional information.

Sincerely,



Shamit Nakra
VP, Technical Operations

Enclosure

SUMMARY OF TEST RESULTS & CALCULATIONS

Location: Aurora Energy - Anchorage, AK

Source: Baghouse Inlet - Boiler 5

Project No.: AST-2023-4844

Run No.: 1

Parameter: PM

Meter Pressure (Pm), in. Hg

$$P_m = P_b + \frac{\Delta H}{13.6}$$

where,

P_b	$\frac{28.92}{13.6}$	= barometric pressure, in. Hg
ΔH	$\frac{1.425}{13.6}$	= pressure differential of orifice, in. H ₂ O
P_m	$\frac{29.02}{13.6}$	= in. Hg

Absolute Stack Gas Pressure (Ps), in. Hg

$$P_s = P_b + \frac{P_g}{13.6}$$

where,

P_b	$\frac{28.92}{13.6}$	= barometric pressure, in. Hg
P_g	$\frac{1.00}{13.6}$	= static pressure, in. H ₂ O
P_s	$\frac{28.99}{13.6}$	= in. Hg

Standard Meter Volume (Vmstd), dscf

$$Vmstd = \frac{17.636 \times Y \times V_m \times P_m}{T_m}$$

where,

Y	$\frac{0.95}{17.636}$	= meter correction factor
V_m	$\frac{40.530}{17.636}$	= meter volume, cf
P_m	$\frac{29.02}{17.636}$	= absolute meter pressure, in. Hg
T_m	$\frac{499.5}{17.636}$	= absolute meter temperature, °R
$Vmstd$	$\frac{39.455}{17.636}$	= dscf

Standard Wet Volume (Vwstd), scf

$$Vwstd = 0.04716 \times Vlc$$

where,

Vlc	$\frac{126.9}{5.985}$	= weight of H ₂ O collected, g
$Vwstd$	$\frac{5.985}{5.985}$	= scf

Moisture Fraction (BWSsat), dimensionless (theoretical at saturated conditions)

$$BWS_{sat} = \frac{10^{6.37 - \left(\frac{2,827}{T_s + 365}\right)}}{P_s}$$

where,

T_s	$\frac{316.3}{5.692}$	= stack temperature, °F
P_s	$\frac{28.99}{5.692}$	= absolute stack gas pressure, in. Hg
BWS_{sat}	$\frac{5.692}{5.692}$	= dimensionless

Moisture Fraction (BWS), dimensionless (measured)

$$BWS = \frac{Vwstd}{(Vwstd + Vmstd)}$$

where,

$Vwstd$	$\frac{5.985}{0.132}$	= standard wet volume, scf
$Vmstd$	$\frac{39.455}{0.132}$	= standard meter volume, dscf
BWS	$\frac{0.132}{0.132}$	= dimensionless

Moisture Fraction (BWS), dimensionless

$$BWS = BWS_{msd} \text{ unless } BWS_{sat} < BWS_{msd}$$

where,

BWS_{sat}	$\frac{5.692}{0.132}$	= moisture fraction (theoretical at saturated conditions)
BWS_{msd}	$\frac{0.132}{0.132}$	= moisture fraction (measured)
BWS	$\frac{0.132}{0.132}$	

Location: Aurora Energy - Anchorage, AK

Source: Baghouse Inlet - Boiler 5

Project No.: AST-2023-4844

Run No.: 1

Parameter: PM

Molecular Weight (DRY) (Md), lb/lb-mole

$$Md = (0.44 \times \% CO_2) + (0.32 \times \% O_2) + (0.28 (100 - \% CO_2 - \% O_2))$$

where,

CO_2	<u>12.6</u>	= carbon dioxide concentration, %
O_2	<u>6.4</u>	= oxygen concentration, %
Md	<u>30.27</u>	= lb/lb mol

Molecular Weight (WET) (Ms), lb/lb-mole

$$Ms = Md (1 - BWS) + 18.015 (BWS)$$

where,

Md	<u>30.27</u>	= molecular weight (DRY), lb/lb mol
BWS	<u>0.132</u>	= moisture fraction, dimensionless
Ms	<u>28.66</u>	= lb/lb mol

Average Velocity (Vs), ft/sec

$$Vs = 85.49 \times Cp \times (\Delta P^{1/2})_{avg} \times \sqrt{\frac{Ts}{Ps \times Ms}}$$

where,

Cp	<u>0.840</u>	= pitot tube coefficient
$\Delta P^{1/2}$	<u>0.780</u>	= velocity head of stack gas, (in. H_2O) ^{1/2}
Ts	<u>776.0</u>	= absolute stack temperature, °R
Ps	<u>28.99</u>	= absolute stack gas pressure, in. Hg
Ms	<u>28.66</u>	= molecular weight of stack gas, lb/lb mol
Vs	<u>54.1</u>	= ft/sec

Average Stack Gas Flow at Stack Conditions (Qa), acfm

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

where,

Vs	<u>54.1</u>	= stack gas velocity, ft/sec
As	<u>35.87</u>	= cross-sectional area of stack, ft ²
Qa	<u>116,509</u>	= acfm

Average Stack Gas Flow at Standard Conditions (Qs), dscfm

$$Qs = 17.636 \times Qa \times (1 - BWS) \times \frac{Ps}{Ts}$$

where,

Qa	<u>116,509</u>	= average stack gas flow at stack conditions, acfm
BWS	<u>0.132</u>	= moisture fraction, dimensionless
Ps	<u>28.99</u>	= absolute stack gas pressure, in. Hg
Ts	<u>776.0</u>	= absolute stack temperature, °R
Qs	<u>66,660</u>	= dscfm

Dry Gas Meter Calibration Check (Yqa), dimensionless

$$Y_{qa} = \frac{Y - \left(\frac{\Theta}{V_m} \sqrt{\frac{0.0319 \times T_m \times 29}{\Delta H_{@} \times \left(P_b + \frac{\Delta H_{avg.}}{13.6} \right) \times Md}} \sqrt{\Delta H_{avg.}} \right)}{v} \times 100$$

where,

Y	<u>0.95</u>	= meter correction factor, dimensionless
Θ	<u>60</u>	= run time, min.
V_m	<u>40.53</u>	= total meter volume, dcf
T_m	<u>499.5</u>	= absolute meter temperature, °R
$\Delta H_{@}$	<u>1.842</u>	= orifice meter calibration coefficient, in. H_2O
P_b	<u>28.92</u>	= barometric pressure, in. Hg
ΔH_{avg}	<u>1.425</u>	= average pressure differential of orifice, in. H_2O
Md	<u>30.27</u>	= molecular weight (DRY), lb/lb mol
$(\Delta H)^{1/2}$	<u>1.186</u>	= average squareroot pressure differential of orifice, (in. H_2O) ^{1/2}
Y_{qa}	<u>1.2</u>	= percent

Location: Aurora Energy - Anchorage, AK

Source: Baghouse Inlet - Boiler 5

Project No.: AST-2023-4844

Run No.: 1

Parameter: PM

Volume of Nozzle (V_n), ft^3

$$V_n = \frac{T_s}{P_s} \left(0.002669 \times V_{lc} + \frac{V_m \times P_m \times Y}{T_m} \right)$$

where,

T_s	<u>776.0</u>	= absolute stack temperature, °R
P_s	<u>28.99</u>	= absolute stack gas pressure, in. Hg
V_{lc}	<u>126.9</u>	= volume of H_2O collected, ml
V_m	<u>40.530</u>	= meter volume, cf
P_m	<u>29.02</u>	= absolute meter pressure, in. Hg
Y	<u>0.950</u>	= meter correction factor, unitless
T_m	<u>499.5</u>	= absolute meter temperature, °R
V_n	<u>68.943</u>	= volume of nozzle, ft^3

Isokinetic Sampling Rate (I), %

$$I = \left(\frac{V_n}{\theta \times 60 \times A_n \times V_s} \right) \times 100$$

where,

V_n	<u>68.943</u>	= nozzle volume, ft^3
θ	<u>60.0</u>	= run time, minutes
A_n	<u>0.00033</u>	= area of nozzle, ft^2
V_s	<u>54.1</u>	= average velocity, ft/sec
I	<u>106.3</u>	= %

Filterable PM Concentration (C_s), grain/dscf

$$C_s = \frac{M_n \times 0.0154}{V_{mstd}}$$

where,

M_n	<u>414.8</u>	= filterable PM mass, mg
V_{mstd}	<u>39.455</u>	= standard meter volume, dscf
C_s	<u>0.16</u>	= grain/dscf

Filterable PM Emission Rate (PMR), lb/hr

$$\text{PMR} = \frac{C_s \times Q_s \times 60}{7.0\text{E} + 03}$$

where,

C_s	<u>0.16</u>	= filterable PM concentration, grain/dscf
Q_s	<u>66,660</u>	= average stack gas flow at standard conditions, dscfm
PMR	<u>92.7</u>	= lb/hr

Filterable PM Emission Rate (ER_{PMTPY}), ton/yr

$$\text{ER}_{\text{PMTPY}} = \frac{\text{PMR} \times 8,760}{2.0\text{E} + 03}$$

where,

PMR	<u>92.7</u>	= filterable PM emission rate, lb/hr
ER_{PMTPY}	<u>406.0</u>	= ton/yr

Location Aurora Energy - Anchorage, AK

Source Baghouse Inlet - Boiler 5

Project No. AST-2023-4844

Parameter PM

Run Number		Run 1	Run 2	Run 3
Date		12/19/23	12/19/23	12/20/23
Start Time		17:25	19:25	8:34
Stop Time		18:38	20:40	9:45
Run Time, min	(θ)	60.0	60.0	60.0
INPUT DATA				
Steam Production, lb/hr	(FR)	189,670	190,527	185,719
Barometric Pressure, in. Hg	(Pb)	28.92	28.92	28.76
Meter Correction Factor	(Y)	0.95	0.95	0.95
Orifice Calibration Value	($\Delta H @$)	1.842	1.842	1.842
Meter Volume, ft ³	(Vm)	40.530	36.400	36.200
Meter Temperature, °F	(Tm)	39.9	42.9	36.8
Meter Temperature, °R	(Tm)	499.5	502.6	496.5
Meter Orifice Pressure, in. WC	(ΔH)	1.425	1.289	1.283
Volume H ₂ O Collected, mL	(Vlc)	126.9	109.9	116.0
Nozzle Diameter, in	(Dn)	0.247	0.247	0.247
Area of Nozzle, ft ²	(An)	0.0003	0.0003	0.0003
Filterable PM Mass, mg	(Mn)	414.8	340.6	532.4
ISOKINETIC DATA				
Standard Meter Volume, ft ³	(Vmstd)	39.455	35.207	35.248
Standard Water Volume, ft ³	(Vwstd)	5.985	5.183	5.471
Moisture Fraction Measured	(BWSmsd)	0.132	0.128	0.134
Moisture Fraction @ Saturation	(BWSsat)	5.692	5.677	5.732
Moisture Fraction	(BWS)	0.132	0.128	0.134
Meter Pressure, in Hg	(Pm)	29.02	29.01	28.85
Volume at Nozzle, ft ³	(Vn)	68.943	61.266	62.132
Isokinetic Sampling Rate, (%)	(I)	106.3	94.9	95.2
DGM Calibration Check Value, (+/- 5%)	(Y _{qa})	1.2	-4.7	-4.8
EMISSION CALCULATIONS				
Filterable PM Concentration, grain/dscf	(C _s)	0.16	0.15	0.23
Filterable PM Loading Rate, lb/hr	(PMR)	92.7	85.3	132.9
Filterable PM Loading Rate, ton/yr	(ER _{FPM})	406.0	373.7	582.2

Location **Aurora Energy - Anchorage, AK**
 Source **Baghouse Inlet - Boiler 5**
 Project No. **AST-2023-4844**
 Parameter **PM**

Run Number		Run 1	Run 2	Run 3
Date		12/19/23	12/19/23	12/20/23
Start Time		17:25	19:25	8:34
Stop Time		18:38	20:40	9:45
Run Time, min		60.0	60.0	60.0
VELOCITY HEAD, in. WC				
Point 1		0.71	0.73	0.77
Point 2		0.81	0.80	0.85
Point 3		0.80	0.80	0.78
Point 4		0.68	0.63	0.65
Point 5		0.54	0.55	0.58
Point 6		0.55	0.55	0.57
Point 7		0.56	0.58	0.54
Point 8		0.53	0.53	0.52
Point 9		0.37	0.38	0.35
Point 10		0.71	0.69	0.71
Point 11		0.80	0.80	0.80
Point 12		0.82	0.80	0.83
Point 13		0.72	0.72	0.75
Point 14		0.55	0.55	0.55
Point 15		0.53	0.53	0.55
Point 16		0.56	0.55	0.58
Point 17		0.56	0.57	0.55
Point 18		0.38	0.38	0.40
Point 19		0.70	0.70	0.68
Point 20		0.78	0.77	0.80
Point 21		0.82	0.80	0.80
Point 22		0.70	0.71	0.70
Point 23		0.53	0.53	0.55
Point 24		0.50	0.52	0.52
CALCULATED DATA				
Square Root of ΔP , (in. WC) ^{1/2}	(ΔP)	0.780	0.779	0.783
Pitot Tube Coefficient	(Cp)	0.840	0.840	0.840
Barometric Pressure, in. Hg	(Pb)	28.92	28.92	28.76
Static Pressure, in. WC	(Pg)	1.00	1.00	1.00
Stack Pressure, in. Hg	(Ps)	28.99	28.99	28.83
Stack Cross-sectional Area, ft ²	(As)	35.87	35.87	35.87
Temperature, °F	(Ts)	316.3	316.1	316.4
Temperature, °R	(Ts)	776.0	775.8	776.1
Moisture Fraction Measured	(BWSmsd)	0.132	0.128	0.134
Moisture Fraction @ Saturation	(BWSsat)	5.692	5.677	5.732
Moisture Fraction	(BWS)	0.132	0.128	0.134
O ₂ Concentration, %	(O ₂)	6.4	5.5	6.0
CO ₂ Concentration, %	(CO ₂)	12.6	13.6	13.2
Molecular Weight, lb/lb-mole (dry)	(Md)	30.27	30.40	30.35
Molecular Weight, lb/lb-mole (wet)	(Ms)	28.66	28.81	28.69
Velocity, ft/sec	(Vs)	54.1	53.9	54.5
VOLUMETRIC FLOW RATE				
At Stack Conditions, acfm	(Qa)	116,509	116,048	117,294
At Standard Conditions, scfm	(Qsw)	76,771	76,485	76,851
At Standard Conditions, dscfm	(Qs)	66,660	66,671	66,526

Location: Aurora Energy - Anchorage, AK				Start Time: 17:25				Source: Baghouse Inlet - Boiler 5							
Date: 12/19/23		Run 1		VALID		End Time: 18:38		Project No.: AST-2023-4844		Parameter: PM					
STACK DATA (EST)			EQUIPMENT			STACK DATA (EST)			FILTER NO.		STACK DATA (FINAL)		MOIST. DATA		
Moisture: 13.0 % est.			Meter Box ID: 2386			Est. Tm: 35 °F			22170-A		Pb: 28.92 in. Hg		Vlc (ml)		
Barometric: 28.92 in. Hg			Y: 0.950			Est. Ts: 316 °F					Pg: 1.00 in. WC		126.9		
Static Press: 1.00 in. WC			ΔH @ (in.WC): 1.842			Est. AP: 0.62 in. WC					O ₂ : 6.4 %		K-FACTOR		
Stack Press: 28.99 in. Hg			Probe ID: PR-84			Est. Dn: 0.276 in.					CO ₂ : 12.6 %		2.083		
CO ₂ : 12.6 %			Liner Material: glass			Target Rate: 0.75 scfm					Check Pt.		Initial	Final	Corr.
O ₂ : 6.4 %			Pitot ID: P-84			LEAK CHECK: Pre		Mid 1	Mid 2	Mid 3	Post	Mid 1 (cf)		--	
N ₂ /CO: 81.0 %			Pitot Cp/Type: 0.840		S-type	Leak Rate (cfm): 0.000		--	--	--	0.000	Mid 2 (cf)		--	
Md: 30.27 lb/lb-mole			Nozzle ID: SS-248		SS	Vacuum (in Hg): 15		--	--	--	15	Mid 3 (cf)		--	
Ms: 28.68 lb/lb-mole			Nozzle Dn (in.): 0.247			Pitot Tube: Pass		--	--	--	Pass	Mid-Point Leak Check Vol (cf): --			

Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft ³)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)
					DGM Average	Stack	Ideal	Actual		Probe	Filter	Imp Exit	Aux		
					Amb.	Amb.				Amb.	Amb.	Amb.	Amb.		
	Begin	End			35	35				35	35	35	-		
A1	0.00	2.22	788.983	0.71	36	319	1.48	1.60	4	250	250	42	-	101.0	58.56
2	2.22	4.44	790.510	0.81	37	320	1.68	1.90	5	250	250	41	-	109.5	62.59
3	4.44	6.67	792.280	0.80	37	320	1.66	1.80	5	251	251	41	-	104.6	62.20
4	6.67	8.89	793.960	0.68	37	321	1.41	1.60	5	250	250	40	-	109.4	57.38
5	8.89	11.11	795.580	0.54	38	318	1.13	1.20	4	250	250	42	-	108.6	51.04
6	11.11	13.33	797.020	0.55	38	312	1.16	1.30	4	252	252	42	-	102.7	51.31
7	13.33	15.56	798.400	0.56	38	310	1.18	1.30	4	250	250	42	-	109.0	51.70
8	15.56	17.78	799.880	0.53	38	313	1.12	1.20	4	250	250	40	-	105.4	50.40
9	17.78	20.00	801.270	0.37	39	310	0.78	0.87	3	252	252	41	-	103.9	42.03
B1	20.00	22.22	802.420	0.71	39	318	1.49	1.60	4	252	252	42	-	103.8	58.52
2	22.22	24.44	804.000	0.80	39	318	1.68	1.90	5	250	250	42	-	107.1	62.12
3	24.44	26.67	805.730	0.82	39	320	1.71	1.90	5	250	250	42	-	102.9	62.97
4	26.67	28.89	807.410	0.72	39	321	1.50	1.60	4	250	251	42	-	103.9	59.04
5	28.89	31.11	809.000	0.55	40	320	1.15	1.30	4	251	251	41	-	108.1	51.57
6	31.11	33.33	810.450	0.53	40	318	1.11	1.20	4	250	250	42	-	109.1	50.56
7	33.33	35.56	811.890	0.56	40	316	1.18	1.30	4	252	252	42	-	106.1	51.91
8	35.56	37.78	813.330	0.56	40	312	1.19	1.30	4	250	250	41	-	109.5	51.77
9	37.78	40.00	814.820	0.38	40	310	0.81	0.90	3	250	250	42	-	109.5	42.59
C1	40.00	42.22	816.050	0.70	40	319	1.47	1.60	4	253	253	42	-	108.3	58.14
2	42.22	44.44	817.690	0.78	40	319	1.63	1.80	5	250	250	40	-	104.6	61.38
3	44.44	46.67	819.360	0.82	40	321	1.71	1.90	5	250	250	42	-	108.3	63.01
4	46.67	48.89	821.130	0.70	41	322	1.47	1.60	4	252	250	42	-	108.3	58.26
5	48.89	51.11	822.770	0.53	41	318	1.12	1.20	4	250	250	42	-	102.9	50.56
6	51.11	53.33	824.130	0.50	41	312	1.06	1.20	4	250	250	43	-	106.3	48.92
7	53.33	55.56	825.500	0.55	41	312	1.17	1.30	4	251	250	41	-	108.0	51.31
8	55.56	57.78	826.960	0.50	41	311	1.06	1.20	4	250	250	42	-	105.4	48.89
9	57.78	60.00	828.320	0.38	41	311	0.81	0.90	3	250	250	40	-	106.0	42.62
Final DGM:			829.513												

RESULTS	Run Time		Vm	ΔP		Tm	Ts		Max Vac	ΔH		%ISO	BWS	Y _{qa}	
	60.0	min	40.530	ft ³	0.62	in. WC	39.9	°F	316.3	°F	5	1.425	in. WC	106.3	0.132

Location: Aurora Energy - Anchorage, AK				Start Time: 19:25				Source: Baghouse Inlet - Boiler 5							
Date: 12/19/23		Run 2		VALID		End Time: 20:40		Project No: AST-2023-4844		Parameter: PM					
STACK DATA (EST)			EQUIPMENT			STACK DATA (EST)			FILTER NO.		STACK DATA (FINAL)		MOIST. DATA		
Moisture: 13.0 % est.			Meter Box ID: 2386			Est. Tmr: 40 °F			22171-A		Pb: 28.92 in. Hg		Vlc (ml)		
Barometric: 28.92 in. Hg			Y: 0.950			Est. Ts: 316 °F					Pg: 1.00 in. WC		109.9		
Static Press: 1.00 in. WC			ΔH @ (in.WC): 1.842			Est. AP: 0.62 in. WC					O ₂ : 5.5 %		K-FACTOR		
Stack Press: 28.99 in. Hg			Probe ID: PR-84			Est. Dn: 0.275 in.					CO ₂ : 13.6 %		2.10		
CO ₂ : 12.6 %			Liner Material: glass			Target Rate: 0.75 scfm					Check Pt.		Initial	Final	Corr.
O ₂ : 6.4 %			Pitot ID: P-84			LEAK CHECK:		Pre	Mid 1	Mid 2	Mid 3	Post	Mid 1 (cf) --		
N ₂ /CO: 81.0 %			Pitot Cp/Type: 0.840		S-type	Leak Rate (cfm):		0.000	--	--	--	0.000	Mid 2 (cf) --		
Md: 30.27 lb/lb-mole			Nozzle ID: SS-248		SS	Vacuum (in Hg):		15	--	--	--	15	Mid 3 (cf) --		
Ms: 28.68 lb/lb-mole			Nozzle Dn (in.): 0.247			Pitot Tube:		Pass	--	--	--	Pass	Mid-Point Leak Check Vol (cf): --		

Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft ³)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)		
	Begin	End			DGM Average	Stack	Ideal	Actual		Probe	Filter	Imp Exit	Aux				
					Amb.	Amb.				Amb.	Amb.	Amb.	Amb.			Amb.	Amb.
					--	--				--	--	--	--			--	--
A1	0.00	2.22	829.753	0.73	41	318	1.54	1.50	4	250	250	40	-	91.4	59.34		
2	2.22	4.44	831.170	0.80	41	318	1.68	1.70	4	250	250	40	-	93.1	62.12		
3	4.44	6.67	832.680	0.80	41	320	1.68	1.70	4	250	250	40	-	90.7	62.20		
4	6.67	8.89	834.150	0.63	41	320	1.32	1.30	4	251	251	42	-	93.1	55.20		
5	8.89	11.11	835.490	0.55	42	320	1.16	1.10	3	250	250	40	-	92.0	51.57		
6	11.11	13.33	836.730	0.55	42	311	1.17	1.10	3	250	250	40	-	90.7	51.27		
7	13.33	15.56	837.960	0.58	42	310	1.24	1.20	3	251	252	42	-	90.5	52.62		
8	15.56	17.78	839.220	0.53	42	309	1.13	1.10	3	250	250	40	-	92.3	50.27		
9	17.78	20.00	840.450	0.38	42	309	0.81	0.81	3	250	250	42	-	91.2	42.56		
B1	20.00	22.22	841.480	0.69	42	318	1.46	1.40	4	251	251	40	-	90.0	57.69		
2	22.22	24.44	842.840	0.80	42	320	1.68	1.70	4	250	250	42	-	97.3	62.20		
3	24.44	26.67	844.420	0.80	42	319	1.68	1.70	4	250	250	40	-	97.3	62.16		
4	26.67	28.89	846.000	0.72	42	320	1.51	1.50	4	250	251	42	-	90.2	59.01		
5	28.89	31.11	847.390	0.55	43	320	1.16	1.20	4	251	252	40	-	91.8	51.57		
6	31.11	33.33	848.630	0.53	43	319	1.12	1.10	3	250	250	42	-	92.7	50.59		
7	33.33	35.56	849.860	0.55	43	315	1.17	1.20	3	251	251	40	-	90.1	51.41		
8	35.56	37.78	851.080	0.57	43	312	1.21	1.20	4	250	250	42	-	92.6	52.23		
9	37.78	40.00	852.360	0.38	43	313	0.81	0.81	3	252	250	40	-	92.1	42.67		
C1	40.00	42.22	853.400	0.70	44	319	1.48	1.50	4	250	250	42	-	105.5	58.14		
2	42.22	44.44	855.010	0.77	44	319	1.63	1.60	4	251	251	42	-	105.0	60.98		
3	44.44	46.67	856.690	0.80	44	320	1.69	1.70	4	250	250	40	-	101.2	62.20		
4	46.67	48.89	858.340	0.71	45	322	1.50	1.50	4	250	250	42	-	102.8	58.67		
5	48.89	51.11	859.920	0.53	45	318	1.13	1.10	4	251	252	40	-	96.0	50.56		
6	51.11	53.33	861.200	0.52	45	312	1.11	1.10	4	250	250	40	-	100.3	49.89		
7	53.33	55.56	862.530	0.56	45	312	1.20	1.20	4	247	250	42	-	99.6	51.77		
8	55.56	57.78	863.900	0.50	45	311	1.07	1.00	3	250	249	42	-	93.0	48.89		
9	57.78	60.00	865.110	0.36	45	312	0.77	0.77	3	253	250	41	-	94.5	41.51		
Final DGM:			866.153														

RESULTS	Run Time		Vm	ΔP		Tm	Ts		Max Vac	ΔH		%ISO	BWS	Y _{qa}	
	60.0	min	36.400	ft ³	0.61	in. WC	42.9	°F	316.1	°F	4	1.289	in. WC	94.9	0.128

Location: Aurora Energy - Anchorage, AK				Start Time: 8:34		Source: Baghouse Inlet - Boiler 5			
Date: 12/20/23		Run 3		End Time: 9:45		Project No.: AST-2023-4844		Parameter: PM	

STACK DATA (EST)	EQUIPMENT	STACK DATA (EST)	FILTER NO.	STACK DATA (FINAL)	MOIST. DATA
Moisture: 13.0 % est.	Meter Box ID: 2386	Est. Tm: 43 °F	22172-A	Pb: 28.76 in. Hg	Vlc (ml)
Barometric: 28.92 in. Hg	Y: 0.950	Est. Ts: 316 °F		Pg: 1.00 in. WC	116.0
Static Press: 1.00 in. WC	ΔH @ (in.WC): 1.842	Est. ΔP: 0.61 in. WC		O ₂ : 6.0 %	K-FACTOR
Stack Press: 28.99 in. Hg	Probe ID: PR-84	Est. Dn: 0.274 in.		CO ₂ : 13.2 %	2.116
CO ₂ : 12.6 %	Liner Material: glass	Target Rate: 0.75 scfm		Check Pt. Initial Final Corr.	
O ₂ : 6.4 %	Pitot ID: P-84	LEAK CHECK: Pre Mid 1 Mid 2 Mid 3 Post		Mid 1 (cf)	--
N ₂ /CO: 81.0 %	Pitot Cp/Type: 0.840 S-type	Leak Rate (cfm): 0.000 -- -- -- 0.000		Mid 2 (cf)	--
Md: 30.27 lb/lb-mole	Nozzle ID: SS-248 SS	Vacuum (in Hg): 15 -- -- -- 15		Mid 3 (cf)	--
Ms: 28.68 lb/lb-mole	Nozzle Dn (in.): 0.247	Pitot Tube: Pass -- -- -- Pass		Mid-Point Leak Check Vol (cf):	--

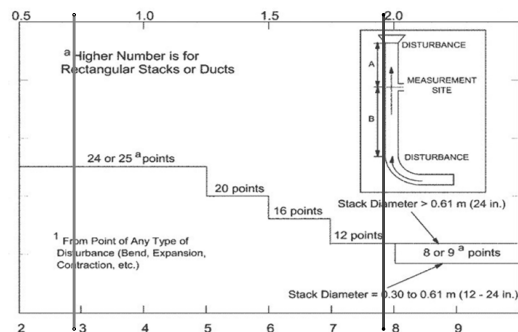
Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft ³)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)
					DGM Average	Stack				Probe	Filter	Imp Exit	Aux		
	Amb.	Amb.			Amb.	Amb.	Amb.	Amb.							
	Begin	End			--	--	Ideal	Actual		--	--	--	--		
A1	0.00	2.22	866.455	0.77	37	322	1.60	1.60	4	250	250	40	-	99.4	61.10
2	2.22	4.44	868.020	0.85	37	320	1.77	1.70	5	250	250	40	-	104.4	64.11
3	4.44	6.67	869.750	0.78	37	319	1.63	1.60	4	248	250	40	-	105.8	61.38
4	6.67	8.89	871.430	0.65	37	320	1.35	1.30	4	250	250	40	-	101.4	56.07
5	8.89	11.11	872.900	0.58	36	319	1.21	1.20	4	251	250	40	-	107.4	52.93
6	11.11	13.33	874.370	0.57	36	311	1.20	1.20	4	250	250	40	-	91.7	52.20
7	13.33	15.56	875.620	0.54	37	310	1.14	1.10	3	250	250	40	-	92.4	50.77
8	15.56	17.78	876.850	0.52	37	313	1.09	1.10	3	251	250	40	-	90.5	49.92
9	17.78	20.00	878.030	0.35	37	310	0.74	0.74	3	250	250	40	-	90.4	40.88
B1	20.00	22.22	879.000	0.71	37	318	1.48	1.50	4	251	251	41	-	93.0	58.52
2	22.22	24.44	880.410	0.80	37	320	1.67	1.60	4	251	251	41	-	90.8	62.20
3	24.44	26.67	881.870	0.83	37	320	1.73	1.70	4	251	252	41	-	92.2	63.35
4	26.67	28.89	883.380	0.75	36	321	1.56	1.50	4	255	250	41	-	90.2	60.26
5	28.89	31.11	884.780	0.55	37	320	1.15	1.20	3	250	250	41	-	91.4	51.57
6	31.11	33.33	886.000	0.55	37	318	1.15	1.20	3	248	250	41	-	94.3	51.51
7	33.33	35.56	887.260	0.58	37	317	1.21	1.20	3	248	250	41	-	94.7	52.86
8	35.56	37.78	888.560	0.55	36	315	1.15	1.10	3	248	250	41	-	93.6	51.41
9	37.78	40.00	889.810	0.40	37	310	0.85	0.85	3	250	250	41	-	94.2	43.70
C1	40.00	42.22	890.890	0.68	37	318	1.42	1.40	4	250	250	41	-	91.6	57.27
2	42.22	44.44	892.250	0.80	37	318	1.67	1.60	4	247	250	42	-	90.7	62.12
3	44.44	46.67	893.710	0.80	37	320	1.67	1.60	4	252	252	42	-	93.9	62.20
4	46.67	48.89	895.220	0.70	36	322	1.45	1.40	4	252	250	42	-	99.4	58.26
5	48.89	51.11	896.710	0.55	37	317	1.15	1.10	4	250	250	40	-	91.2	51.47
6	51.11	53.33	897.930	0.52	37	311	1.10	1.10	4	250	250	40	-	94.2	49.86
7	53.33	55.56	899.160	0.56	37	312	1.18	1.20	4	246	250	41	-	92.4	51.77
8	55.56	57.78	900.410	0.50	37	311	1.05	1.10	3	245	250	41	-	91.4	48.89
9	57.78	60.00	901.580	0.36	37	312	0.76	0.76	3	251	250	40	-	99.0	41.51
Final DGM:			902.655												

RESULTS	Run Time		Vm	ΔP	Tm	Ts	Max Vac	ΔH	%ISO	BWS	Y _{qa}				
	60.0	min	36.200	ft ³	0.62	in. WC	36.8	°F	316.4	°F	5	1.283	in. WC	95.2	0.134

Location Aurora Energy - Anchorage, AK
 Source Baghouse Inlet - Boiler 5
 Project No. AST-2023-4844
 Date: 12/19/23

Stack Parameters

Duct Orientation: Horizontal
 Duct Design: Rectangular
 Distance from Far Wall to Outside of Port: 78.50 in
 Nipple Length: 6.25 in
 Depth of Duct: 72.25 in
 Width of Duct: 71.50 in
 Cross Sectional Area of Duct: 35.87 ft²
 Equivalent Diameter: 71.87 in
 No. of Test Ports: 3
 Distance A: 11.7 ft
 Distance A Duct Diameters: 2.0 (must be ≥ 0.5)
 Distance B: 17.3 ft
 Distance B Duct Diameters: 2.9 (must be ≥ 2)
 Minimum Number of Traverse Points: 25
 Actual Number of Traverse Points: 27
 Number of Readings per Point: 1
 Measurer (Initial and Date): JCA12/19/23
 Reviewer (Initial and Date): LAB12/19/23

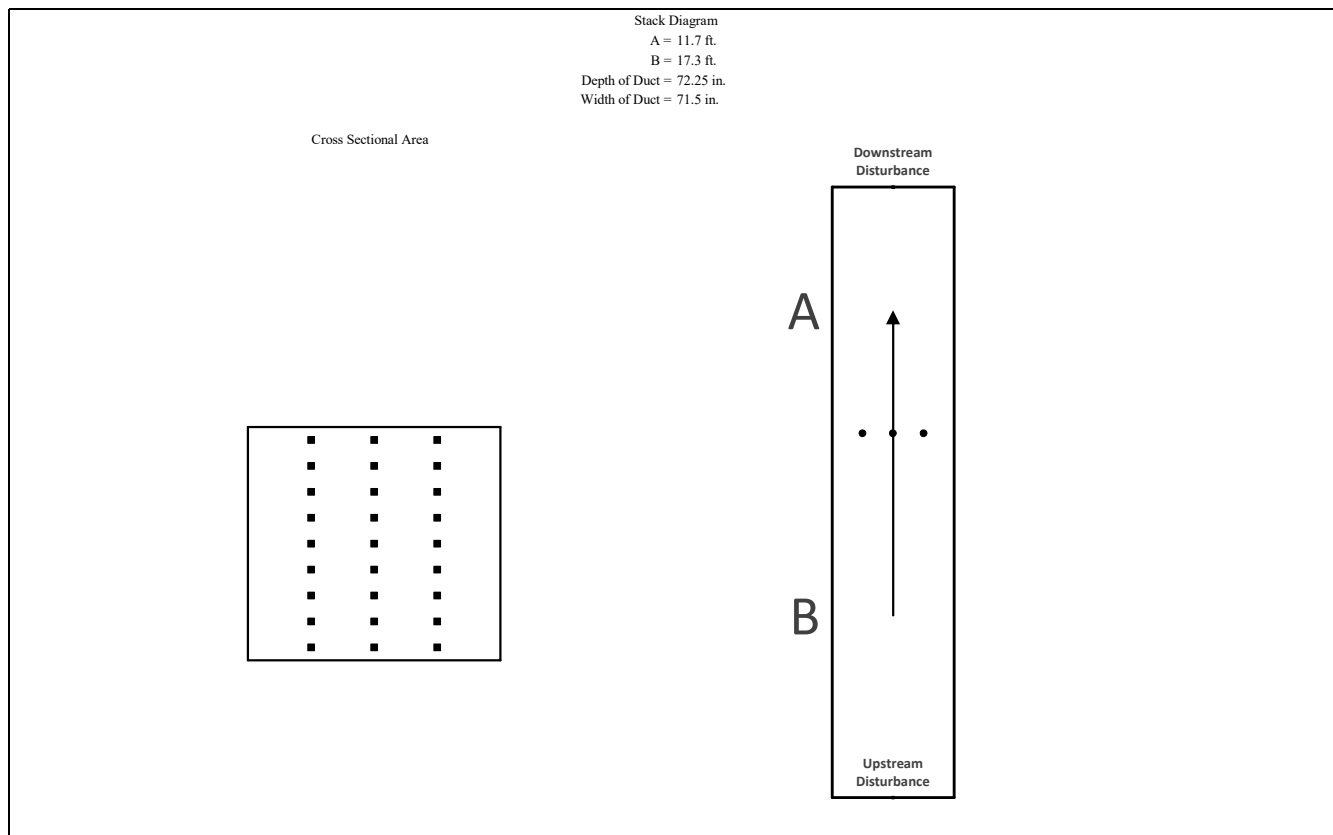


RECTANGULAR DUCT

LOCATION OF TRAVERSE POINTS											
Number of traverse points on a diameter											
	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3	--	83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	31.8	20.8
4	--	--	87.5	70.0	58.3	50.0	43.8	38.9	35.0	22.7	29.2
5	--	--	--	90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6	--	--	--	--	91.7	78.6	68.8	61.1	55.0	50.0	45.8
7	--	--	--	--	--	92.9	81.3	72.2	65.0	59.1	54.2
8	--	--	--	--	--	--	93.8	83.3	75.0	68.2	62.5
9	--	--	--	--	--	--	--	94.4	85.0	77.3	70.8
10	--	--	--	--	--	--	--	--	95.0	86.4	79.2
11	--	--	--	--	--	--	--	--	--	95.5	87.5
12	--	--	--	--	--	--	--	--	--	--	95.8

*Percent of stack diameter from inside wall to traverse point.

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	5.6	4.05	10 5/16
2	16.7	12.07	18 5/16
3	27.8	20.09	26 5/16
4	38.9	28.11	34 3/8
5	50.0	36.13	42 3/8
6	61.1	44.14	50 3/8
7	72.2	52.16	58 7/16
8	83.3	60.18	66 7/16
9	94.4	68.20	74 7/16
10	--	--	--
11	--	--	--
12	--	--	--



Location **Aurora Energy - Anchorage, AK**

Source **Baghouse Inlet - Boiler 5**

Project No. **AST-2023-4844**

	O ₂ Data			CO ₂ Data		
	Date/Time	12/19/23	17:00	Date/Time	12/19/23	17:00
Make/Model/SN	Servomex	1420C	1420C-4	Servomex	1420C	1415C-9
Parameter	Cylinder ID	Cylinder Concentration, %	Analyzer Concentration, %	Cylinder ID	Cylinder Concentration, %	Analyzer Concentration, %
Zero Gas		0.00	0.00		0.00	0.00
High Range Gas	EB0083005	23.03	23.00	EB0083005	23.69	23.70
Mid Range Gas	CC323054	11.53	11.60	CC323054	11.65	11.70
Concentration Span, %	23.0			23.7		
Required Accuracy, %	0.46			0.47		
Run No.	Run 1		Run 2		Run 3	
Analysis Date/Time	12/19/2023	17:55	12/19/2023	17:40	12/20/2023	9:05
Parameter	O ₂ %	CO ₂ %	O ₂ %	CO ₂ %	O ₂ %	CO ₂ %
Analysis #1	6.40	12.60	5.50	13.60	6.00	13.20
Analysis #2	6.40	12.60	5.60	13.50	6.00	13.20
Analysis #3	6.40	12.60	5.50	13.60	6.00	13.20
Average	6.4	12.6	5.5	13.6	6.0	13.2

The remaining constituent is assumed to be nitrogen.

Location Aurora Energy - Anchorage, AK

Source Baghouse Inlet - Boiler 5

Project No. AST-2023-4844

Parameter PM

Analysis Gravimetric

Run 1	Date: 12/19/23				
Impinger No.	1	2	3	4	Total
Contents	H2O	H2O	Empty	Silica	--
Initial Mass, g	498.4	467.9	296.4	589.2	1851.9
Final Mass, g	476.5	480.1	424.8	597.4	1978.8
Gain	-21.9	12.2	128.4	8.2	126.9
Run 2	Date: 12/19/23				
Impinger No.	1	2	3	4	Total
Contents	H2O	H2O	Empty	Silica	--
Initial Mass, g	457.0	448.8	297.1	597.4	1800.3
Final Mass, g	512.3	494.2	299.5	604.2	1910.2
Gain	55.3	45.4	2.4	6.8	109.9
Run 3	Date: 12/20/23				
Impinger No.	1	2	3	4	Total
Contents	H2O	H2O	Empty	Silica	--
Initial Mass, g	458.5	452.8	299.5	604.2	1815.0
Final Mass, g	491.2	526.6	302.0	611.2	1931.0
Gain	32.7	73.8	2.5	7.0	116.0

Location Aurora Energy - Anchorage, AK
 Source Baghouse Inlet - Boiler 5
 Project No. AST-2023-4844
 Date 12/19/23

Sample Point	Angle ($\Delta P=0$)
1	15
2	3
3	12
4	5
5	9
6	5
7	8
8	3
9	2
10	8
11	4
12	7
13	12
14	9
15	4
16	2
17	3
18	0
19	11
20	13
21	7
22	7
23	3
24	5
25	3
26	2
27	6
Average	6

Location Aurora Energy - Anchorage, AK
 Source Baghouse Inlet - Boilers 1-3
 Project No. AST-2023-4844
 Parameter PM

Run Number		Run 1	Run 2	Run 3
Date		12/20/23	12/20/23	12/20/23
Start Time		14:20	15:50	17:25
Stop Time		15:32	17:10	18:35
Run Time, min	(θ)	60.0	60.0	60.0
INPUT DATA				
Steam Production Boiler 1, lb/hr	(FR)	34,581	35,721	34,744
Steam Production Boiler 2, lb/hr	(FR)	35,923	34,675	34,752
Steam Production Boiler 3, lb/hr	(FR)	35,297	34,998	34,167
Barometric Pressure, in. Hg	(Pb)	28.85	28.85	28.85
Meter Correction Factor	(Y)	0.95	0.95	0.95
Orifice Calibration Value	($\Delta H @$)	1.842	1.842	1.842
Meter Volume, ft ³	(Vm)	35.767	35.464	36.689
Meter Temperature, °F	(Tm)	10.3	12.5	15.4
Meter Temperature, °R	(Tm)	470.0	472.2	475.1
Meter Orifice Pressure, in. WC	(ΔH)	1.164	1.217	1.143
Volume H ₂ O Collected, mL	(Vlc)	83.3	88.8	95.4
Nozzle Diameter, in	(Dn)	0.260	0.260	0.260
Area of Nozzle, ft ²	(An)	0.0004	0.0004	0.0004
Filterable PM Mass, mg	(Mn)	101.2	81.6	182.3
ISOKINETIC DATA				
Standard Meter Volume, ft ³	(Vmstd)	36.892	36.418	37.434
Standard Water Volume, ft ³	(Vwstd)	3.928	4.188	4.499
Moisture Fraction Measured	(BWSmsd)	0.096	0.103	0.107
Moisture Fraction @ Saturation	(BWSsat)	4.421	4.509	4.470
Moisture Fraction	(BWS)	0.096	0.103	0.107
Meter Pressure, in Hg	(Pm)	28.94	28.94	28.93
Volume at Nozzle, ft ³	(Vn)	61.170	60.954	62.897
Isokinetic Sampling Rate, (%)	(I)	99.8	98.7	100.3
DGM Calibration Check Value, (+/- 5%)	(Y _{qa})	0.7	-2.7	3.5
EMISSION CALCULATIONS				
Filterable PM Concentration, grain/dscf	(C _s)	0.042	0.035	0.075
Filterable PM Loading Rate, lb/hr	(PMR)	18.3	14.9	32.8
Filterable PM Loading Rate, ton/yr	(ER _{FPM})	80.1	65.3	143.5

Location Aurora Energy - Anchorage, AK
 Source Baghouse Inlet - Boilers 1-3
 Project No. AST-2023-4844
 Parameter PM

Run Number		Run 1	Run 2	Run 3
Date		12/20/23	12/20/23	12/20/23
Start Time		14:20	15:50	17:25
Stop Time		15:32	17:10	18:35
Run Time, min		60.0	60.0	60.0
VELOCITY HEAD, in. WC				
Point 1		0.46	0.50	0.55
Point 2		0.52	0.50	0.55
Point 3		0.51	0.50	0.54
Point 4		0.50	0.51	0.53
Point 5		0.48	0.45	0.50
Point 6		0.46	0.45	0.45
Point 7		0.39	0.39	0.45
Point 8		0.35	0.36	0.34
Point 9		0.31	0.32	0.32
Point 10		0.50	0.50	0.52
Point 11		0.52	0.50	0.50
Point 12		0.45	0.48	0.50
Point 13		0.48	0.48	0.51
Point 14		0.45	0.50	0.44
Point 15		0.42	0.45	0.46
Point 16		0.41	0.40	0.40
Point 17		0.40	0.40	0.40
Point 18		0.40	0.40	0.42
Point 19		0.53	0.55	0.51
Point 20		0.44	0.55	0.49
Point 21		0.54	0.53	0.56
Point 22		0.45	0.44	0.50
Point 23		0.51	0.49	0.50
Point 24		0.50	0.50	0.52
Point 25		0.45	0.45	0.45
Point 26		0.43	0.43	0.43
Point 27		0.33	0.30	0.35
CALCULATED DATA				
Square Root of ΔP , (in. WC) ^{1/2}	(ΔP)	0.670	0.674	0.684
Pitot Tube Coefficient	(Cp)	0.840	0.840	0.840
Barometric Pressure, in. Hg	(Pb)	28.85	28.85	28.85
Static Pressure, in. WC	(Pg)	-2.50	-2.50	-2.50
Stack Pressure, in. Hg	(Ps)	28.67	28.67	28.67
Stack Cross-sectional Area, ft ²	(As)	30.15	30.15	30.15
Temperature, °F	(Ts)	298.0	299.4	298.8
Temperature, °R	(Ts)	757.7	759.0	758.4
Moisture Fraction Measured	(BWSmsd)	0.096	0.103	0.107
Moisture Fraction @ Saturation	(BWSsat)	4.421	4.509	4.470
Moisture Fraction	(BWS)	0.096	0.103	0.107
O ₂ Concentration, %	(O ₂)	10.5	10.7	10.4
CO ₂ Concentration, %	(CO ₂)	9.0	8.9	9.0
Molecular Weight, lb/lb-mole (dry)	(Md)	29.86	29.85	29.86
Molecular Weight, lb/lb-mole (wet)	(Ms)	28.72	28.63	28.59
Velocity, ft/sec	(Vs)	46.2	46.5	47.2
VOLUMETRIC FLOW RATE				
At Stack Conditions, acfm	(Qa)	83,557	84,216	85,479
At Standard Conditions, scfm	(Qsw)	55,751	56,092	56,977
At Standard Conditions, dscfm	(Qs)	50,386	50,307	50,864

Location: Aurora Energy - Anchorage, AK				Start Time: 14:20		Source: Baghouse Inlet - Boilers 1-3						
Date: 12/20/23		Run 1	VALID	End Time: 15:32		Project No.: AST-2023-4844		Parameter: PM				
STACK DATA (EST)			EQUIPMENT		STACK DATA (EST)			FILTER NO.	STACK DATA (FINAL)		MOIST. DATA	
Moisture: 10.0 % est.			Meter Box ID: 2386		Est. Tm: 10 °F			22173-A	Pb: 28.85 in. Hg		Vlc (ml)	
Barometric: 28.85 in. Hg			Y: 0.95		Est. Ts: 291 °F				Pg: -2.50 in. WC		83.3	
Static Press: -2.50 in. WC			ΔH @ (in.WC): 1.842		Est. AP: 0.44 in. WC				O ₂ : 10.5 %		K-FACTOR	
Stack Press: 28.67 in. Hg			Probe ID: PR-84		Est. Dn: 0.301 in.				CO ₂ : 9.0 %		2.626	
CO ₂ : 9.0 %			Liner Material: glass		Target Rate: 0.75 scfm						Check Pt. Initial Final Corr.	
O ₂ : 10.5 %			Pitot ID: P-84		LEAK CHECK: Pre Mid 1 Mid 2 Mid 3 Post				Mid 1 (cf)		--	
N ₂ /CO: 80.5 %			Pitot Cp/Type: 0.840 S-type		Leak Rate (cfm): 0.000 -- -- -- 0.000				Mid 2 (cf)		--	
Md: 29.86 lb/lb-mole			Nozzle ID: SS-260 SS		Vacuum (in Hg): 15 -- -- -- 15				Mid 3 (cf)		--	
Ms: 28.67 lb/lb-mole			Nozzle Dn (in.): 0.260		Pitot Tube: Pass -- -- -- Pass				Mid-Point Leak Check Vol (cf):		--	

Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft ³)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)		
	Begin	End			DGM Average	Stack	Ideal	Actual		Probe	Filter	Imp Exit	Aux				
					Amb.	Amb.				Amb.	Amb.	Amb.	Amb.			Amb.	Amb.
					--	--				--	--	--	--			--	--
A1	0.00	2.22	903.789	0.46	11	298	1.20	1.20	5	250	250	34	-	98.6	46.76		
A2	2.22	4.44	905.110	0.52	10	295	1.36	1.40	5	250	250	34	-	98.3	49.62		
A3	4.44	6.67	906.510	0.51	11	290	1.35	1.30	5	250	250	35	-	98.0	48.98		
A4	6.67	8.89	907.900	0.50	11	290	1.32	1.30	5	250	250	35	-	101.1	48.49		
A5	8.89	11.11	909.320	0.48	11	291	1.26	1.30	5	250	250	35	-	93.1	47.55		
A6	11.11	13.33	910.600	0.46	10	298	1.20	1.20	5	250	250	35	-	96.5	46.76		
A7	13.33	15.56	911.890	0.39	10	295	1.02	1.00	5	250	250	35	-	98.8	42.97		
A8	15.56	17.78	913.110	0.35	10	300	0.91	0.91	5	250	250	35	-	92.6	40.84		
A9	17.78	20.00	914.190	0.31	10	300	0.81	0.81	5	250	250	35	-	91.1	38.44		
B1	20.00	22.22	915.190	0.50	10	305	1.29	1.30	5	250	250	36	-	95.9	48.98		
B2	22.22	24.44	916.520	0.52	11	300	1.35	1.30	5	250	250	36	-	97.0	49.78		
B3	24.44	26.67	917.900	0.45	11	299	1.17	1.20	5	250	249	36	-	96.6	46.28		
B4	26.67	28.89	919.180	0.48	10	300	1.25	1.20	5	250	250	36	-	107.0	47.83		
B5	28.89	31.11	920.640	0.45	10	300	1.17	1.20	5	250	250	36	-	103.0	46.31		
B6	31.11	33.33	922.000	0.42	10	300	1.09	0.99	5	250	250	36	-	94.0	44.74		
B7	33.33	35.56	923.200	0.41	10	301	1.06	1.00	5	250	250	36	-	103.9	44.23		
B8	35.56	37.78	924.510	0.40	10	297	1.04	0.97	5	250	250	36	-	103.3	43.58		
B9	37.78	40.00	925.800	0.40	10	296	1.05	1.00	5	251	250	36	-	96.0	43.55		
C1	40.00	42.22	927.000	0.53	10	302	1.37	1.40	5	251	250	36	-	96.4	50.33		
C2	42.22	44.44	928.380	0.44	10	299	1.14	1.10	5	251	250	36	-	100.2	45.76		
C3	44.44	46.67	929.690	0.54	10	298	1.41	1.40	5	250	250	36	-	105.0	50.66		
C4	46.67	48.89	931.210	0.45	11	299	1.17	1.20	5	250	250	36	-	109.5	46.28		
C5	48.89	51.11	932.660	0.51	11	301	1.33	1.30	5	250	250	36	-	106.5	49.33		
C6	51.11	53.33	934.160	0.50	10	300	1.30	1.30	5	250	250	35	-	109.9	48.82		
C7	53.33	55.56	935.690	0.45	10	299	1.17	1.20	5	250	250	35	-	105.2	46.28		
C8	55.56	57.78	937.080	0.43	10	298	1.12	1.10	5	250	250	36	-	101.3	45.21		
C9	57.78	60.00	938.390	0.33	11	296	0.86	0.86	5	250	250	36	-	102.5	39.55		
Final DGM:			939.556														

RESULTS	Run Time		Vm	ΔP		Tm	Ts		Max Vac	ΔH		%ISO	BWS	Y _{qa}	
	60.0	min	35.767	ft ³	0.45	in. WC	10.3	°F	298.0	°F	5	1.164	in. WC	99.8	0.096

Location: Aurora Energy - Anchorage, AK				Start Time: 15:50		Source: Baghouse Inlet - Boilers 1-3									
Date: 12/20/23		Run 2		VALID		End Time: 17:10		Project No: AST-2023-4844		Parameter: PM					
STACK DATA (EST)			EQUIPMENT			STACK DATA (EST)			FILTER NO.		STACK DATA (FINAL)		MOIST. DATA		
Moisture: 10.0 % est.			Meter Box ID: 2386			Est. Tm: 10 °F			22174-A		Pb: 28.85 in. Hg		Vlc (ml)		
Barometric: 28.85 in. Hg			Y: 0.95			Est. Ts: 298 °F					Pg: -2.50 in. WC		88.8		
Static Press: -2.50 in. WC			ΔH @ (in.WC): 1.842			Est. AP: 0.45 in. WC					O ₂ : 10.7 %		K-FACTOR		
Stack Press: 28.67 in. Hg			Probe ID: PR-84			Est. Dn: 0.300 in.					CO ₂ : 8.9 %		2.60		
CO ₂ : 9.0 %			Liner Material: glass			Target Rate: 0.75 scfm					Check Pt.		Initial	Final	Corr.
O ₂ : 10.5 %			Pitot ID: P-84			LEAK CHECK: Pre		Mid 1	Mid 2	Mid 3	Post	Mid 1 (cf)		--	
N ₂ /CO: 80.5 %			Pitot Cp/Type: 0.840		S-type	Leak Rate (cfm): 0.000		--	--	--	0.000	Mid 2 (cf)		--	
Md: 29.86 lb/lb-mole			Nozzle ID: SS-260		SS	Vacuum (in Hg): 15		--	--	--	15	Mid 3 (cf)		--	
Ms: 28.67 lb/lb-mole			Nozzle Dn (in.): 0.260			Pitot Tube: Pass		--	--	--	Pass	Mid-Point Leak Check Vol (cf): --			

Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft ³)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)				
	Begin	End			DGM Average		Stack			Probe	Filter	Imp Exit	Aux						
					Amb.		Amb.												
					--		--									Ideal		Actual	
					--		--									--		--	
A1	0.00	2.22	940.025	0.50	10	303	1.29	1.30	4	239	250	32	-	106.2	48.91				
A2	2.22	4.44	941.500	0.50	10	300	1.30	1.30	4	252	250	32	-	97.0	48.82				
A3	4.44	6.67	942.850	0.50	10	302	1.30	1.30	4	250	250	32	-	107.2	48.88				
A4	6.67	8.89	944.340	0.51	10	301	1.32	1.30	4	250	250	32	-	105.3	49.33				
A5	8.89	11.11	945.820	0.45	10	300	1.17	1.20	4	250	250	34	-	107.5	46.31				
A6	11.11	13.33	947.240	0.45	11	299	1.17	1.20	4	246	249	34	-	102.7	46.28				
A7	13.33	15.56	948.600	0.39	11	297	1.02	1.00	4	250	250	34	-	103.6	43.03				
A8	15.56	17.78	949.880	0.36	11	296	0.94	1.00	4	251	250	34	-	109.4	41.31				
A9	17.78	20.00	951.180	0.32	11	289	0.85	0.86	3	252	250	34	-	96.0	38.77				
B1	20.00	22.22	952.260	0.50	11	304	1.29	1.30	5	250	250	34	-	106.4	48.94				
B2	22.22	24.44	953.740	0.50	11	303	1.30	1.30	5	250	250	34	-	106.3	48.91				
B3	24.44	26.67	955.220	0.48	13	303	1.25	1.30	5	250	250	34	-	96.4	47.92				
B4	26.67	28.89	956.540	0.48	13	302	1.25	1.30	5	247	250	34	-	98.5	47.89				
B5	28.89	31.11	957.890	0.50	13	300	1.31	1.30	5	248	250	34	-	92.1	48.82				
B6	31.11	33.33	959.180	0.45	14	300	1.18	1.20	5	250	250	34	-	91.6	46.31				
B7	33.33	35.56	960.400	0.40	14	300	1.05	1.10	4	250	250	34	-	95.5	43.66				
B8	35.56	37.78	961.600	0.40	14	294	1.06	1.10	4	252	249	34	-	91.2	43.49				
B9	37.78	40.00	962.750	0.40	14	292	1.06	1.10	4	250	250	34	-	94.2	43.43				
C1	40.00	42.22	963.940	0.55	14	301	1.44	1.50	5	248	250	34	-	92.5	51.23				
C2	42.22	44.44	965.300	0.55	14	300	1.44	1.50	5	248	250	35	-	93.8	51.20				
C3	44.44	46.67	966.680	0.53	14	301	1.39	1.40	5	250	250	35	-	91.4	50.29				
C4	46.67	48.89	968.000	0.44	14	302	1.15	1.20	4	252	250	35	-	91.2	45.85				
C5	48.89	51.11	969.200	0.49	14	301	1.28	1.30	5	253	250	35	-	93.6	48.36				
C6	51.11	53.33	970.500	0.50	14	301	1.31	1.30	5	250	250	35	-	102.6	48.85				
C7	53.33	55.56	971.940	0.45	14	300	1.18	1.20	4	248	250	35	-	91.6	46.31				
C8	55.56	57.78	973.160	0.43	14	297	1.13	1.20	4	250	250	35	-	93.5	45.18				
C9	57.78	60.00	974.380	0.30	14	295	0.79	0.81	4	248	250	35	-	101.5	37.69				
Final DGM:			975.489																

RESULTS	Run Time		Vm	ΔP		Tm	Ts		Max Vac	ΔH		%ISO	BWS	Y _{qa}	
	60.0	min	35.464	ft ³	0.46	in. WC	12.5	°F	299.4	°F	5	1.217	in. WC	98.7	0.103

Location: Aurora Energy - Anchorage, AK				Start Time: 17:25		Source: Baghouse Inlet - Boilers 1-3					
Date: 12/20/23		Run 3		VALID		End Time: 18:35		Project No.: AST-2023-4844		Parameter: PM	

STACK DATA (EST)			EQUIPMENT		STACK DATA (EST)			FILTER NO.		STACK DATA (FINAL)			MOIST. DATA	
Moisture:	10.0	% est.	Meter Box ID:	2386	Est. Tm:	12	°F	22175-A	Pb:	28.85	in. Hg	Vlc (ml)		
Barometric:	28.85	in. Hg	Y:	0.95	Est. Ts:	299	°F		Pg:	-2.50	in. WC	95.4		
Static Press:	-2.50	in. WC	AH @ (in.WC):	1.842	Est. ΔP:	0.46	in. WC		O ₂ :	10.4	%	K-FACTOR		
Stack Press:	28.67	in. Hg	Probe ID:	PR-84	Est. Dn:	0.298	in.		CO ₂ :	9.0	%	2.610		
CO ₂ :	9.0	%	Liner Material:	glass	Target Rate:	0.75	scfm		Check Pt. Initial Final Corr.					
O ₂ :	10.5	%	Pitot ID:	P-84	LEAK CHECK:			Pre	Mid 1	Mid 2	Mid 3	Post	Mid 1 (cf)	--
N ₂ /CO:	80.5	%	Pitot Cp/Type:	0.840 S-type	Leak Rate (cfm):			0.000	--	--	--	0.000	Mid 2 (cf)	--
Md:	29.86	lb/lb-mole	Nozzle ID:	SS-260 SS	Vacuum (in Hg):			15	--	--	--	15	Mid 3 (cf)	--
Ms:	28.67	lb/lb-mole	Nozzle Dn (in.):	0.260	Pitot Tube:			Pass	--	--	--	Pass	Mid-Point Leak Check Vol (cf):	--

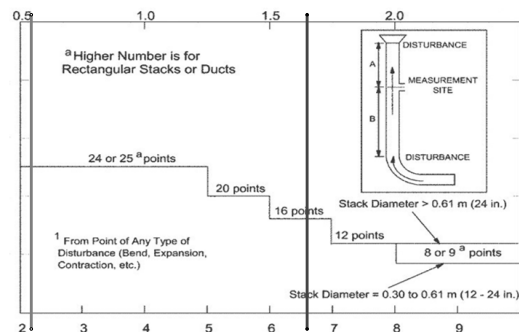
Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft ³)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)				
	Begin	End			DGM Average	Stack	Ideal	Actual		Probe	Filter	Imp Exit	Aux						
																Amb.	Amb.	Amb.	Amb.
																--	--	--	--
A1	0.00	2.22	976.796	0.55	15	303	1.44	1.20	4	250	250	33	-	96.7	51.30				
A2	2.22	4.44	978.220	0.55	15	300	1.44	1.40	4	250	250	34	-	96.9	51.20				
A3	4.44	6.67	979.650	0.54	15	300	1.42	1.30	4	258	250	34	-	101.9	50.73				
A4	6.67	8.89	981.140	0.53	15	301	1.39	1.30	4	255	250	34	-	94.0	50.29				
A5	8.89	11.11	982.500	0.50	15	300	1.31	1.20	4	250	250	34	-	96.6	48.82				
A6	11.11	13.33	983.860	0.45	15	300	1.18	1.00	3	242	250	34	-	98.1	46.31				
A7	13.33	15.56	985.170	0.45	15	300	1.18	1.00	3	250	250	34	-	94.3	46.31				
A8	15.56	17.78	986.430	0.34	15	296	0.90	0.79	3	250	250	34	-	100.5	40.15				
A9	17.78	20.00	987.600	0.32	15	289	0.85	0.82	3	249	250	34	-	103.1	38.77				
B1	20.00	22.22	988.770	0.52	15	300	1.36	1.30	4	250	250	34	-	92.7	49.78				
B2	22.22	24.44	990.100	0.50	15	300	1.31	1.30	4	250	250	34	-	101.6	48.82				
B3	24.44	26.67	991.530	0.50	16	304	1.31	1.20	4	250	250	34	-	101.0	48.94				
B4	26.67	28.89	992.950	0.51	16	300	1.34	1.30	4	249	250	34	-	94.1	49.30				
B5	28.89	31.11	994.290	0.44	16	300	1.16	1.10	3	250	250	35	-	103.5	45.79				
B6	31.11	33.33	995.660	0.46	16	299	1.21	1.10	3	250	250	35	-	99.0	46.79				
B7	33.33	35.56	997.000	0.40	15	300	1.05	1.00	3	256	250	35	-	106.4	43.66				
B8	35.56	37.78	998.340	0.40	15	294	1.06	0.97	3	254	251	35	-	100.4	43.49				
B9	37.78	40.00	999.610	0.42	15	290	1.12	1.00	3	251	251	35	-	92.4	44.45				
C1	40.00	42.22	1000.810	0.51	15	301	1.34	1.20	3	251	251	35	-	91.5	49.33				
C2	42.22	44.44	1002.110	0.49	16	301	1.29	1.20	3	244	251	35	-	103.9	48.36				
C3	44.44	46.67	1003.560	0.56	16	301	1.47	1.40	4	251	251	35	-	103.3	51.70				
C4	46.67	48.89	1005.100	0.50	16	303	1.31	0.98	3	250	250	35	-	93.7	48.91				
C5	48.89	51.11	1006.420	0.50	16	302	1.31	1.30	4	251	250	35	-	107.2	48.88				
C6	51.11	53.33	1007.930	0.52	16	300	1.37	1.30	4	251	250	35	-	106.4	49.78				
C7	53.33	55.56	1009.460	0.45	16	300	1.18	1.20	3	256	249	35	-	104.6	46.31				
C8	55.56	57.78	1010.860	0.43	16	294	1.14	1.10	4	250	250	35	-	103.6	45.09				
C9	57.78	60.00	1012.220	0.35	16	289	0.94	0.90	3	247	250	35	-	106.4	40.55				
Final DGM:			1013.485																

RESULTS	Run Time		Vm	ΔP	Tm	Ts	Max Vac	ΔH	%ISO	BWS	Y _{qa}				
	60.0	min	36.689	ft ³	0.47	in. WC	15.4	°F	298.8	°F	4	1.143	in. WC	100.3	0.107

Location Aurora Energy - Anchorage, AK
 Source Baghouse Inlet - Boilers 1-3
 Project No. AST-2023-4844
 Date: 12/20/23

Stack Parameters

Duct Orientation: Vertical
 Duct Design: Rectangular
 Distance from Far Wall to Outside of Port: 66.13 in
 Nipple Length: 5.50 in
 Depth of Duct: 60.63 in
 Width of Duct: 71.63 in
 Cross Sectional Area of Duct: 30.15 ft²
 Equivalent Diameter: 65.67 in
 No. of Test Ports: 3
 Distance A: 9.0 ft
 Distance A Duct Diameters: 1.6 (must be ≥ 0.5)
 Distance B: 12.0 ft
 Distance B Duct Diameters: 2.2 (must be ≥ 2)
 Minimum Number of Traverse Points: 25
 Actual Number of Traverse Points: 27
 Number of Readings per Point: 1
 Measurer (Initial and Date): JCA 12/20/23
 Reviewer (Initial and Date): LAB 12/20/23

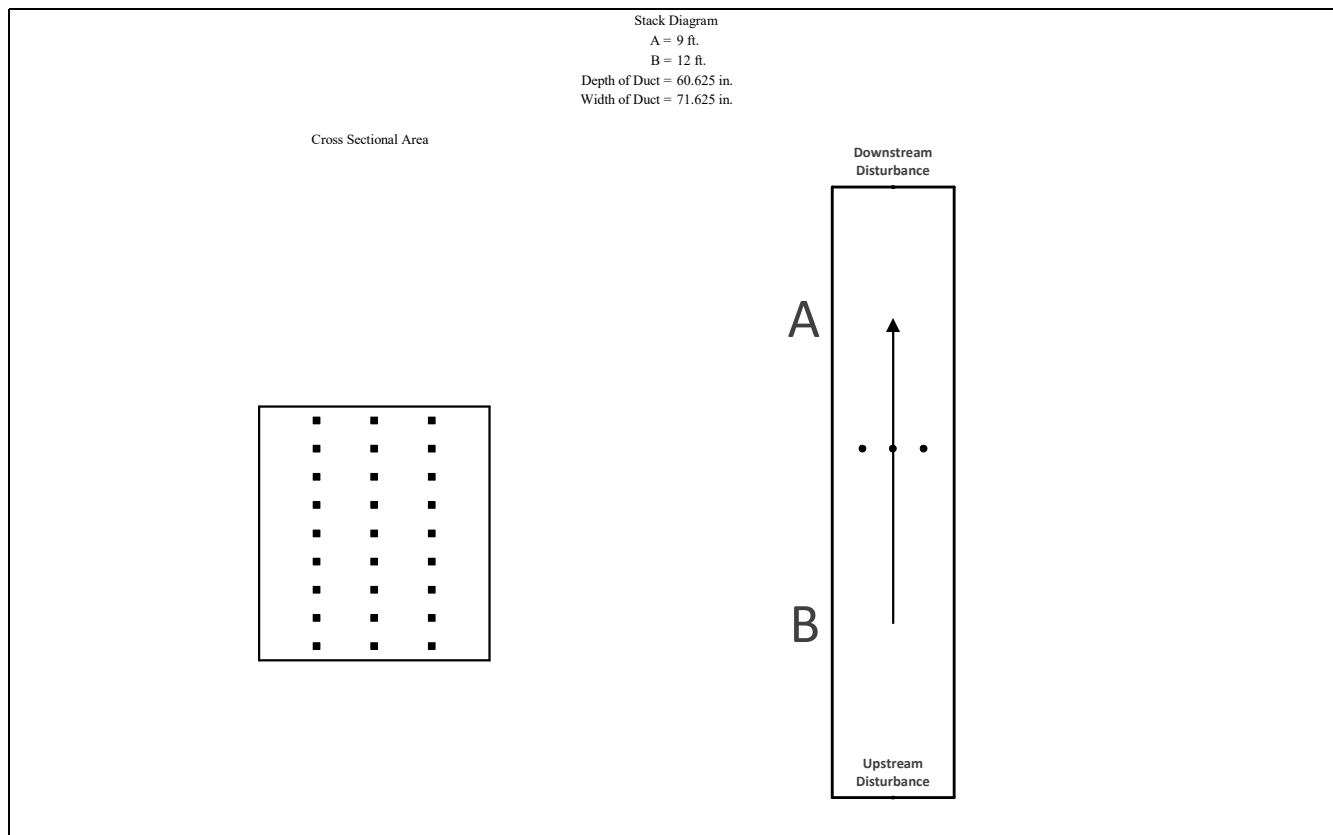


RECTANGULAR DUCT

LOCATION OF TRAVERSE POINTS											
Number of traverse points on a diameter											
	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3	--	83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	31.8	20.8
4	--	--	87.5	70.0	58.3	50.0	43.8	38.9	35.0	22.7	29.2
5	--	--	--	90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6	--	--	--	--	91.7	78.6	68.8	61.1	55.0	50.0	45.8
7	--	--	--	--	--	92.9	81.3	72.2	65.0	59.1	54.2
8	--	--	--	--	--	--	93.8	83.3	75.0	68.2	62.5
9	--	--	--	--	--	--	--	94.4	85.0	77.3	70.8
10	--	--	--	--	--	--	--	--	95.0	86.4	79.2
11	--	--	--	--	--	--	--	--	--	95.5	87.5
12	--	--	--	--	--	--	--	--	--	--	95.8

*Percent of stack diameter from inside wall to traverse point.

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	5.6	3.40	8 7/8
2	16.7	10.12	15 5/8
3	27.8	16.85	22 3/8
4	38.9	23.58	29 1/16
5	50.0	30.31	35 13/16
6	61.1	37.04	42 9/16
7	72.2	43.77	49 1/4
8	83.3	50.50	56
9	94.4	57.23	62 3/4
10	--	--	--
11	--	--	--
12	--	--	--



Location **Aurora Energy - Anchorage, AK**

Source **Baghouse Inlet - Boilers 1-3**

Project No. **AST-2023-4844**

	O ₂ Data			CO ₂ Data		
	Date/Time	12/20/23	8:05	Date/Time	12/20/23	8:05
Make/Model/SN	Servomex	1420C	1420C-4	Servomex	1420C	1415C-9
Parameter	Cylinder ID	Cylinder Concentration, %	Analyzer Concentration, %	Cylinder ID	Cylinder Concentration, %	Analyzer Concentration, %
Zero Gas		0.00	0.00		0.00	0.00
High Range Gas	EB0083005	23.03	23.00	EB0083005	23.69	23.70
Mid Range Gas	CC323054	11.53	11.60	CC323054	11.65	11.70
Concentration Span, %	23.0			23.7		
Required Accuracy, %	0.46			0.47		
Run No.	Run 1		Run 2		Run 3	
Analysis Date/Time	12/20/2023	15:00	12/20/2023	16:00	12/20/2023	18:00
Parameter	O ₂ %	CO ₂ %	O ₂ %	CO ₂ %	O ₂ %	CO ₂ %
Analysis #1	10.50	9.00	10.70	8.90	10.40	9.00
Analysis #2	10.50	9.00	10.70	8.90	10.40	9.00
Analysis #3	10.50	9.00	10.70	8.90	10.40	9.00
Average	10.5	9.0	10.7	8.9	10.4	9.0

The remaining constituent is assumed to be nitrogen.

Location Aurora Energy - Anchorage, AK

Source Baghouse Inlet - Boilers 1-3

Project No. AST-2023-4844

Parameter PM

Analysis Gravimetric

Run 1	Date: 12/20/23				
Impinger No.	1	2	3	4	Total
Contents	H2O	H2O	Empty	Silica	--
Initial Mass, g	487.4	487.3	297.3	603.8	1875.8
Final Mass, g	489.2	491.0	369.0	609.9	1959.1
Gain	1.8	3.7	71.7	6.1	83.3
Run 2	Date: 12/20/23				
Impinger No.	1	2	3	4	Total
Contents	H2O	H2O	Empty	Silica	--
Initial Mass, g	463.8	452.3	299.4	609.9	1825.4
Final Mass, g	489.1	496.3	313.9	614.9	1914.2
Gain	25.3	44.0	14.5	5.0	88.8
Run 3	Date: 12/20/23				
Impinger No.	1	2	3	4	Total
Contents	H2O	H2O	Empty	Silica	--
Initial Mass, g	460.5	462.3	313.9	614.9	1851.6
Final Mass, g	528.1	473.4	326.5	619.0	1947.0
Gain	67.6	11.1	12.6	4.1	95.4

Location Aurora Energy - Anchorage, AK
Source Baghouse Inlet - Boilers 1-3
Project No. AST-2023-4844
Date 12/20/23

Sample Point	Angle ($\Delta P=0$)
1	5
2	7
3	9
4	2
5	8
6	11
7	5
8	7
9	4
10	6
11	4
12	6
13	1
14	7
15	8
16	3
17	4
18	6
19	10
20	6
21	10
22	5
23	8
24	5
25	6
26	4
27	4
Average	6

LABORATORY DATA

Alliance Technical Group, LLC
Analytical Services
5530 Marshall St.
Arvada, CO 80002
(720) 457-9504
www.alliancetg.com

Analytical Laboratory Report

Aurora Energy, LLC
100 Cushman Street, Suite 100
Fairbanks, AK 99701

Project No. AST-2023-4844



Certification Statement

Alliance Source Testing, LLC (AST) has completed the analysis as described in this report. Results apply only to the source(s) tested and operating condition(s) for the specific test date(s) and time(s) identified within this report. All results are intended to be considered in their entirety, and AST is not responsible for use of less than the complete test report without written consent. This report shall not be reproduced in full or in part without written approval from the customer.

To the best of my knowledge and abilities, all information, facts and test data are correct. Data presented in this report has been checked for completeness and is accurate, error-free and legible. Any deviations or problems are detailed in the relevant sections on the test report.

This document was prepared in portable document format (.pdf) and contains pages as identified in the bottom footer of this document.

Validation Signature

The analytical data and all QC contained within this report was reviewed and validated by the following individual.

James Davidson

James Davidson
Quality Assurance Associate

Digitally signed by James Davidson
DN: C=US, CN=James Davidson, E=james.davidson@stacktest.com
Reason: I attest to the accuracy and integrity of this document
Location: your signing location here
Date: 2024.01.11 13:10:28-06'00'
Foxit PDF Editor Version: 11.2.7

Date

Project Narrative

Analytical Method(s):	Method 5 - Determination of Particulate Matter Emissions From Stationary Sources
Filterable	The filter(s) were either oven dried and/or desiccated per the method until a final weight was obtained. The liquid fractions were extracted if required, evaporated and cooled until a final weight was obtained. These fractions were summed together to provide the total Particulate Matter collected.
MDL	The Minimum Detection Level (MDL) is 0.5 mg per fraction. If the measured result for a fraction is less than the MDL, the MDL was used in ensuing calculations.
Blank Correction	If blank correction is performed, only blank values returned higher than the MDL are used. If a blank returns a value less than the MDL, no correction is included.
Custody:	The samples were received by Carson Williamson on 12/28/23 in Arvada, CO. The samples were received in good condition with proper Chain-of-Custody documentation. No apparent container problems were noted upon receipt. Prior to analysis, the samples were kept secure with access limited to authorized personnel of AST.
Number of Samples:	13
Labeling:	Acceptable
Analyst:	Ryan Gillett - Laboratory Analyst II Carson Williamson - Laboratory Analyst I Cory Manshack - Laboratory Analyst II
Equipment:	Mettler Toledo Balance ML-104, SN B217893065. This scale was used for analytical determinations of filters and rinse vessels. Denver Instruments Balance TB-6201, SN 17904189. This scale was used to measure the total mass of rinse collected for blank correction. Analysis was performed on the same balance as the associated tare. Quincy Lab Inc oven, 30CG, SN G3-012673.
Lab Reagents:	Acetone Lot Number: 232060
QC Notes:	The samples met the minimum criteria established by the relevant method. A blank correction was applied per the method.
Reporting Notes:	The Filter numbers on the COC did not match those on the labels so we used the ones on the labels and updated the COC accordingly.

	Client	Aurora Energy, LLC
	City, State	Fairbanks, AK 99701
	Project No.	AST-2023-4844
	Method	EPA Method 5

Front Half Filter							
Lab ID	D39188		D39190		D39192		
Field ID	M5-Baghouse Inlet-Boilers 1-3 Run 1 Cont. 1		M5-Baghouse Inlet-Boilers 1-3 Run 2 Cont. 1		M5-Baghouse Inlet-Boilers 1-3 Run 3 Cont. 1		
Filter ID	22173 - A		22174 - A		22175 - A		
Filter Tare Weight, g	0.5215		0.5194		0.5207		
Date - Desiccator	12/28/23		12/28/23		12/28/23		
Time - Desiccator	13:35		13:35		13:35		
Date of Weighing	1/2/24	1/2/24	1/2/24	1/2/24	1/2/24	1/2/24	
Time of Weighing	8:12	14:41	8:12	14:41	8:12	14:41	
Filter Weight, g	0.6014	0.6014	0.5811	0.5813	0.6493	0.6495	
Filter PM Mass, mg*	79.9		61.8		128.7		
Front Half Rinse							
Lab ID	D39189		D39191		D39193		
Field ID	M5-Baghouse Inlet-Boilers 1-3 Run 1 Cont. 2		M5-Baghouse Inlet-Boilers 1-3 Run 2 Cont. 2		M5-Baghouse Inlet-Boilers 1-3 Run 3 Cont. 2		
Media ID	32622		32590		32611		
Beaker tare, g	3.8762		3.9538		3.8671		
Beaker with Acetone, g	85.3		81.7		99.6		
Acetone Mass, g	81.4		77.7		95.7		
Date - Desiccator	12/29/23		12/29/23		12/29/23		
Time - Desiccator	4:17		4:17		4:17		
Date of Weighing	1/2/24	1/2/24	1/2/24	1/2/24	1/2/24	1/2/24	
Time of Weighing	8:22	14:42	8:22	14:42	8:22	14:42	
Weight, g	3.8982	3.8984	3.9745	3.9745	3.9218	3.9216	
Rinse PM Mass, mg*	22.1		20.7		54.7		
Blank Corrected	Yes						
Amount Subtracted for Blank (mg)	0.8		0.8		1.0		
Total PM Mass, mg	101.2		81.6		182.3		

*All fractions were analyzed and returned values greater than the MDL of 0.5 mg.

	Client	Aurora Energy, LLC
	City, State	Fairbanks, AK 99701
	Project No.	AST-2023-4844
	Method	EPA Method 5

Front Half Filter							
Lab ID	D39194		D39196		D39198		
Field ID	M5-Baghouse Inlet-Boiler 5 Run 1 Cont. 1		M5-Baghouse Inlet-Boiler 5 Run 2 Cont. 1		M5-Baghouse Inlet-Boiler 5 Run 3 Cont. 1		
Filter ID	22170 - A		22171 - A		22172 - A		
Filter Tare Weight, g	0.5126		0.5113		0.5189		
Date - Desiccator	12/28/23		12/28/23		12/28/23		
Time - Desiccator	13:35		13:35		13:35		
Date of Weighing	1/2/24	1/2/24	1/2/24	1/2/24	1/2/24	1/2/24	
Time of Weighing	8:15	14:34	8:15	14:34	8:15	14:34	
Filter Weight, g	0.8194	0.8191	0.7153	0.7150	0.6545	0.6546	
Filter PM Mass, mg*	306.7		203.9		135.7		
Front Half Rinse							
Lab ID	D39195		D39197		D39199		
Field ID	M5-Baghouse Inlet-Boiler 5 Run 1 Cont. 2		M5-Baghouse Inlet-Boiler 5 Run 2 Cont. 2		M5-Baghouse Inlet-Boiler 5 Run 3 Cont. 2		
Media ID	32615		32620		32592		
Beaker tare, g	3.8610		3.8933		3.9474		
Beaker with Acetone, g	95.4		73.5		120.7		
Acetone Mass, g	91.5		69.6		116.8		
Date - Desiccator	12/29/23		12/29/23		12/29/23		
Time - Desiccator	4:17		4:17		4:17		
Date of Weighing	1/2/24	1/2/24	1/2/24	1/2/24	1/2/24	1/2/24	
Time of Weighing	8:24	14:47	8:24	14:47	8:24	14:47	
Weight, g	3.9701	3.9700	4.0306	4.0309	4.3454	4.3453	
Rinse PM Mass, mg*	109.1		137.5		398.0		
Blank Corrected	Yes						
Amount Subtracted for Blank (mg)	0.9		0.7		1.2		
Total PM Mass, mg	414.8		340.6		532.4		

*All fractions were analyzed and returned values greater than the MDL of 0.5 mg.

	Client	Aurora Energy, LLC
	City, State	Fairbanks, AK 99701
	Project No.	AST-2023-4844
	Method	EPA Method 5

Acetone Blank		
Lab ID	D39200	
Field ID	M5 Acetone Blank	
Media ID	32632	
Beaker tare, g	3.9126	
Beaker with Acetone, g	76.31	
Acetone Mass, g	72.40	
Date - Desiccator	12/29/23	
Time - Desiccator	4:17	
Date of Weighing	1/2/24	12/2/24
Time of Weighing	8:22	14:42
Weight, g	3.9134	3.9134
Blank Mass, mg*	0.8	
Blank Mass, mg/g	0.0110	

Chain-Of-Custody

Version No. LT 2019-01_19.0

Alliance Source Testing, LLC - Lab Services
5530 Marshall St. Arvada, CO 80002
Phone (720) 457-9504

Client Name AURORA

Turn Around Time: ☒ Standard ☐ Expedited _____ Number of Business Days

City, State Fairbanks, AK

Blank Manuf/Lot # Acetone - Thermo Scientific B0545014B

Source: BAGHOUSE INLET, Boilers 1-3 and Boiler 5

Project No. 2023-4844

[illegible]

Relinquished By _____

Received By

Sample Container Received Temperature (°F)

Date 12/26/23

Date 12/28/23 @ 12:23

Notes

Page 1 of 1

7 of 20

Mettler Toledo, LLC
1900 Polaris Parkway
Columbus, OH 43240
1.800.METTLER



Accredited by the American Association
for Laboratory Accreditation (A2LA)
CALIBRATION CERT #1788.01

ISO 17025 Accredited
ANSI/NCSL Z540-1 Accredited

Accuracy Calibration Certificate

Customer

Company: Alliance Source Testing
Address: 5530 Marshall St
City: Arvada **Contact:** Eric Grosjean
Zip / Postal: 80002-3108
State / Province: Colorado

Weighing Device

Manufacturer: Mettler Toledo **Instrument Type:** Weighing Instrument
Model: ML104/03 **Asset Number:** N/A
Serial No.: B217893065 **Terminal Model:** N/A
Building: 5520 **Terminal Serial No.:** N/A
Floor: 1 **Terminal Asset No.:** N/A
Room: Lab

Range	Max. Capacity	Readability (d)
1	120 g	0.0001 g

Procedure

Calibration Guideline: ASTM E898 - 20
METTLER TOLEDO Work Instruction: 30260953 v1.61

This calibration certificate including procedures and uncertainty estimation also complies with EURAMET cg-18 v 4.0.

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Left calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 21.1 °C	End: 20.9 °C	Start: 21.0 %	End: 21.0 %
As Left	Start: 20.8 °C	End: 20.7 °C	Start: 21.0 %	End: 20.0 %

Environmental conditions have been verified to ensure the accuracy of the calibration.

This certificate is issued in accordance with the conditions of accreditation granted by A2LA, which is based on ISO/IEC 17025. A2LA has assessed the measurement capability of the laboratory and its traceability to recognized national standards.

As Found Calibration Date: 08-Mar-2023
As Left Calibration Date: 08-Mar-2023
Issue Date: 08-Mar-2023
Requested Next Calibration Date: 31-Mar-2024

Authorized A2LA Signatory:

Chris Carson

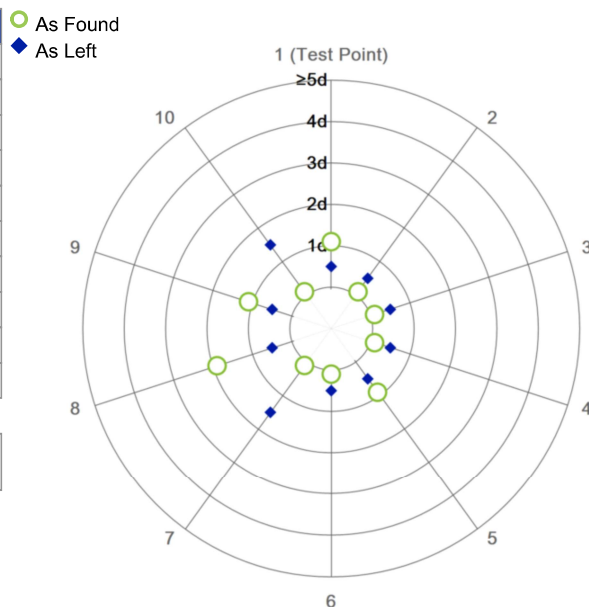
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0003 g	100.0001 g
2	100.0002 g	100.0000 g
3	100.0002 g	100.0000 g
4	100.0002 g	100.0000 g
5	100.0001 g	100.0001 g
6	100.0002 g	100.0000 g
7	100.0002 g	99.9999 g
8	100.0000 g	100.0001 g
9	100.0003 g	100.0001 g
10	100.0002 g	100.0002 g

Standard Deviation	0.00009 g	0.00008 g
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The "d" in the graph represents the readability of the range/interval in which the test was performed.

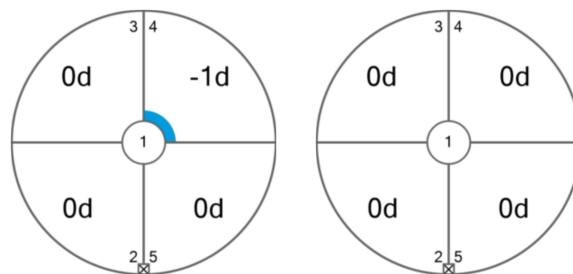
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 50 g

Position	As Found	As Left
1	0.0000 g	0.0000 g
2	0.0000 g	0.0000 g
3	0.0000 g	0.0000 g
4	-0.0001 g	0.0000 g
5	0.0000 g	0.0000 g

Maximum Deviation	0.0001 g	0.0000 g
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As Found

As Left

The "d" in the graph represents the readability of the range/interval in which the test was performed.

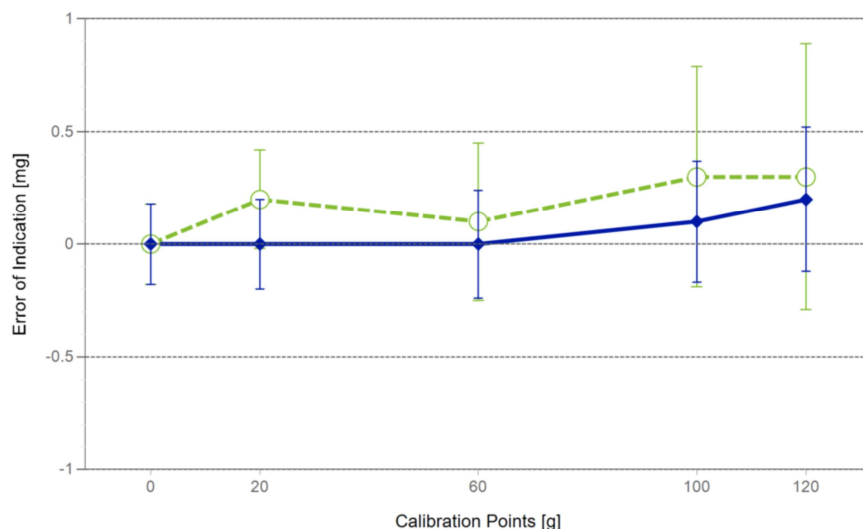
Error of Indication

As Found

	Tare Load	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	N/A	0.0000 g	0.0000 g	0.0000 g	0.18 mg	2
2	N/A	20.0000 g	20.0002 g	0.0002 g	0.22 mg	2
3	20 g	20.0000 g	20.0002 g	0.0002 g	0.22 mg	2
4	40 g	20.0000 g	20.0001 g	0.0001 g	0.22 mg	2
5	60 g	20.0000 g	20.0001 g	0.0001 g	0.22 mg	2
6	80 g	20.0000 g	20.0001 g	0.0001 g	0.22 mg	2
7	N/A	60.0000 g	60.0001 g	0.0001 g	0.35 mg	2
8	N/A	100.0000 g	100.0003 g	0.0003 g	0.49 mg	2
9	N/A	119.9999 g	120.0002 g	0.0003 g	0.59 mg	2

As Left

	Tare Load	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	N/A	0.0000 g	0.0000 g	0.0000 g	0.18 mg	2
2	N/A	20.0000 g	20.0000 g	0.0000 g	0.20 mg	2
3	20 g	20.0000 g	20.0000 g	0.0000 g	0.20 mg	2
4	40 g	20.0000 g	20.0000 g	0.0000 g	0.20 mg	2
5	60 g	20.0000 g	20.0000 g	0.0000 g	0.20 mg	2
6	80 g	20.0000 g	20.0000 g	0.0000 g	0.20 mg	2
7	N/A	60.0000 g	60.0000 g	0.0000 g	0.24 mg	2
8	N/A	100.0000 g	100.0001 g	0.0001 g	0.27 mg	2
9	N/A	119.9999 g	120.0001 g	0.0002 g	0.32 mg	2



○ As Found

◆ As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k - which can be larger than 2 according to ASTM E898 and EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	421	Date of Issue:	07-Dec-2022
Certificate Number:	220635345-1	Calibration Due Date:	31-Dec-2023

Remarks

Value of the built-in weight adjusted
Performed a linearity adjustment

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: 2.0 · 10⁻⁶ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 4 K

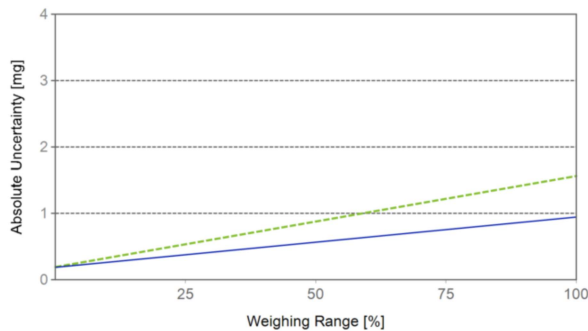
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.0001 g	120 g	$U_1 = 0.19 \text{ mg} + 0.0114 \text{ mg/g} \cdot R$	$U_1 = 0.19 \text{ mg} + 0.00631 \text{ mg/g} \cdot R$

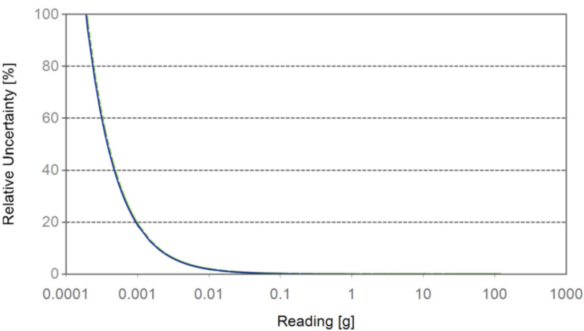
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0120 g	0.19 mg	1.6%	0.19 mg	1.6%
0.1200 g	0.19 mg	0.16%	0.19 mg	0.16%
1.2000 g	0.20 mg	0.017%	0.20 mg	0.016%
12.0000 g	0.33 mg	0.0027%	0.27 mg	0.0022%
120.0000 g	1.6 mg	0.0013%	0.95 mg	0.00079%



As Found



As Left

Manufacturer Tolerance Assessment

Assessment done without considering measurement uncertainty.

The measurements from the attached calibration certificate were assessed against METTLER TOLEDO tolerances defined in SOP 'Test and Measurement Procedures for METTLER TOLEDO balances, Document: 10000018502.

	As Found	As Left
Overall	✓	✓
Repeatability	✓	✓
Eccentricity	✓	✓
Linearity	✓	✓
Sensitivity	N/A	✓

Measurement Results

Repeatability

Test Load: 100 g		
	As Found	As Left
1	100.0003 g	100.0001 g
2	100.0002 g	100.0000 g
3	100.0002 g	100.0000 g
4	100.0002 g	100.0000 g
5	100.0001 g	100.0001 g
6	100.0002 g	100.0000 g
7	100.0002 g	99.9999 g
8	100.0000 g	100.0001 g
9	100.0003 g	100.0001 g
10	100.0002 g	100.0002 g
Standard Deviation	0.00009 g	0.00008 g
Tolerance	0.00010 g ✓	0.00010 g ✓

Eccentricity

Test Load: 50 g

Position	As Found	As Left
1	0.0000 g	0.0000 g
2	0.0000 g	0.0000 g
3	0.0000 g	0.0000 g
4	-0.0001 g	0.0000 g
5	0.0000 g	0.0000 g

Maximum Deviation	0.0001 g	0.0000 g
Tolerance	0.00030 g ✓	0.00030 g ✓

The maximum deviation is determined as the absolute value of the largest deviation from the center.

Linearity - Differential Method

As Found

	Preload	Reference Value	Indication	Deviation
2	N/A	20.0000 g	20.0002 g	0.00006 g
3	20 g	20.0000 g	20.0002 g	0.00012 g
4	40 g	20.0000 g	20.0001 g	0.00008 g
5	60 g	20.0000 g	20.0001 g	0.00004 g
6	80 g	20.0000 g	20.0001 g	0.00000 g
8	N/A	100.0000 g	100.0003 g	N/A

Linearity Deviation	0.00012 g
Linearity Tolerance	0.0002 g ✓

Sensitivity Deviation	0.0003 g
Sensitivity Tolerance	N/A

The As Found Sensitivity Tolerance is only valid if the device has been adjusted before the test.

As Left

	Preload	Reference Value	Indication	Deviation
2	N/A	20.0000 g	20.0000 g	0.00000 g
3	20 g	20.0000 g	20.0000 g	0.00000 g
4	40 g	20.0000 g	20.0000 g	0.00000 g
5	60 g	20.0000 g	20.0000 g	0.00000 g
6	80 g	20.0000 g	20.0000 g	0.00000 g
8*	N/A	100.0000 g	100.0001 g	N/A

Linearity Deviation	0.00000 g
Linearity Tolerance	0.0002 g ✓

Sensitivity Deviation	0.0001 g
Sensitivity Tolerance	0.0008 g ✓

The values in column "Deviation" and the "Linearity Deviation" are zero point offset and sensitivity error compensated.

* This point was used to satisfy the sensitivity requirement.

Mettler Toledo, LLC
1900 Polaris Parkway
Columbus, OH 43240
1.800.METTLER



Accredited by the American Association
for Laboratory Accreditation (A2LA)
CALIBRATION CERT #1788.01

ISO 17025 Accredited
ANSI/NCSL Z540-1 Accredited

Accuracy Calibration Certificate

Customer

Company: Alliance Source Testing
Address: 5530 Marshall St
City: Arvada **Contact:** Eric Grosjean
Zip / Postal: 80002-3108
State / Province: Colorado

Weighing Device

Manufacturer: Denver **Instrument Type:** Weighing Instrument
Model: TB-6201 **Asset Number:** N/A
Serial No.: 17904189 **Terminal Model:** N/A
Building: 5520 **Terminal Serial No.:** N/A
Floor: 1 **Terminal Asset No.:** N/A
Room: Lab

Range	Max. Capacity	Readability (d)
1	6200 g	0.1 g

Procedure

Calibration Guideline: ASTM E898 - 20
METTLER TOLEDO Work Instruction: 30260953 v1.61

This calibration certificate including procedures and uncertainty estimation also complies with EURAMET cg-18 v 4.0.

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Left calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 20.8 °C	End: 20.5 °C	Start: 20.0 %	End: 21.0 %
As Left	Start: 20.1 °C	End: 20.1 °C	Start: 20.9 %	End: 21.0 %

Environmental conditions have been verified to ensure the accuracy of the calibration.

This certificate is issued in accordance with the conditions of accreditation granted by A2LA, which is based on ISO/IEC 17025. A2LA has assessed the measurement capability of the laboratory and its traceability to recognized national standards.

As Found Calibration Date: 08-Mar-2023
As Left Calibration Date: 08-Mar-2023
Issue Date: 08-Mar-2023
Requested Next Calibration Date: 31-Mar-2024

Authorized A2LA Signatory:

Chris Carson

Measurement Results

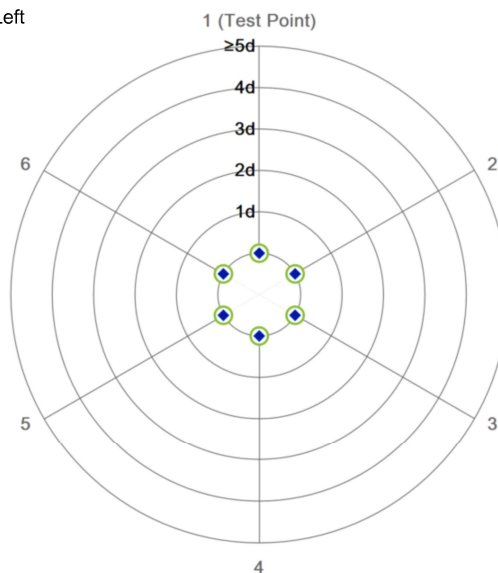
Repeatability

Test Load: 2000 g

	As Found	As Left
1	1999.9 g	2000.0 g
2	1999.9 g	2000.0 g
3	1999.9 g	2000.0 g
4	1999.9 g	2000.0 g
5	1999.9 g	2000.0 g
6	1999.9 g	2000.0 g

Standard Deviation	0.00 g	0.00 g
--------------------	--------	--------

● As Found
◆ As Left



The "d" in the graph represents the readability of the range/interval in which the test was performed.

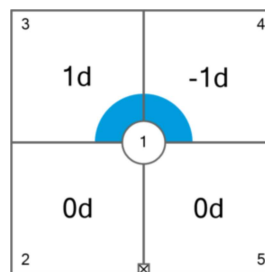
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

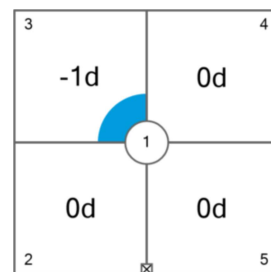
Test Load: 2000 g

Position	As Found	As Left
1	0.0 g	0.0 g
2	0.0 g	0.0 g
3	0.1 g	-0.1 g
4	-0.1 g	0.0 g
5	0.0 g	0.0 g

Maximum Deviation	0.1 g	0.1 g
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As Found



As Left

The "d" in the graph represents the readability of the range/interval in which the test was performed.

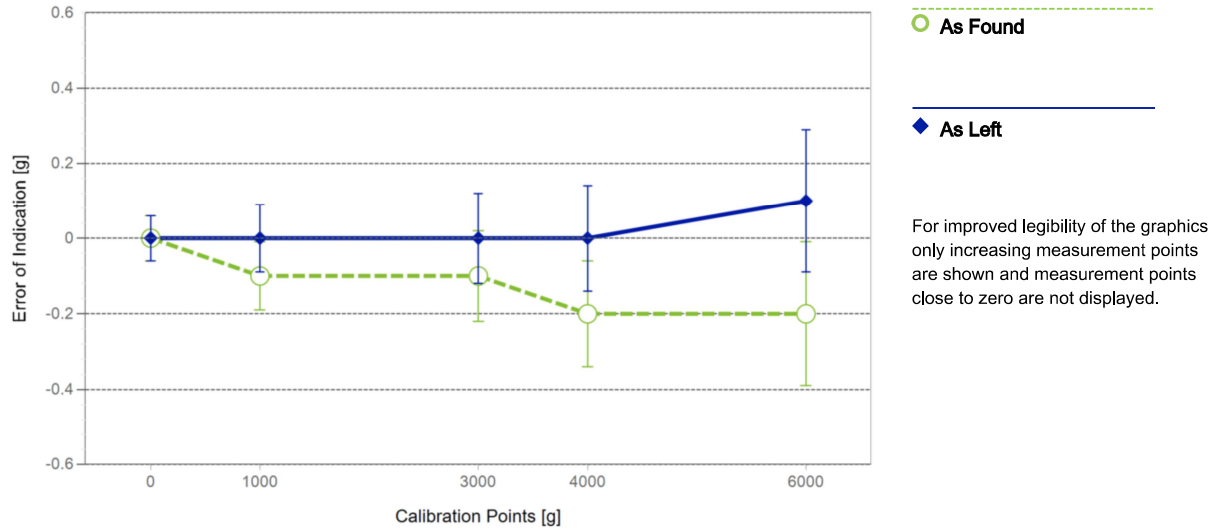
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0 g	0.0 g	0.0 g	0.06 g	2
2	1000.0 g	999.9 g	-0.1 g	0.09 g	2
3	3000.0 g	2999.9 g	-0.1 g	0.12 g	2
4	4000.0 g	3999.8 g	-0.2 g	0.14 g	2
5	6000.0 g	5999.8 g	-0.2 g	0.19 g	2

As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0 g	0.0 g	0.0 g	0.06 g	2
2	1000.0 g	1000.0 g	0.0 g	0.09 g	2
3	3000.0 g	3000.0 g	0.0 g	0.12 g	2
4	4000.0 g	4000.0 g	0.0 g	0.14 g	2
5	6000.0 g	6000.1 g	0.1 g	0.19 g	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k - which can be larger than 2 according to ASTM E898 and EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML F1

Weight Set No.:	685	Date of Issue:	12-Jan-2023
Certificate Number:	220642893-1	Calibration Due Date:	31-Jan-2025

Remarks

N/A

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $6.0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 6 K

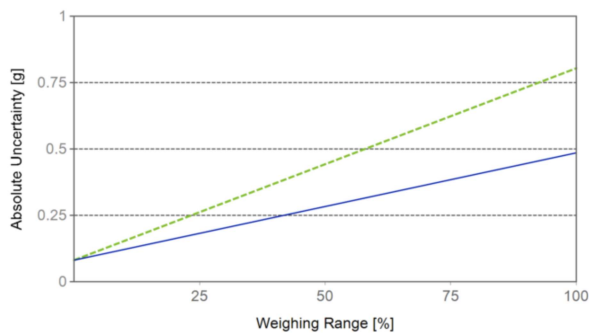
Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.1 g	6200 g	$U_1 = 82 \text{ mg} + 0.117 \text{ mg/g} \cdot R$	$U_1 = 82 \text{ mg} + 0.0652 \text{ mg/g} \cdot R$

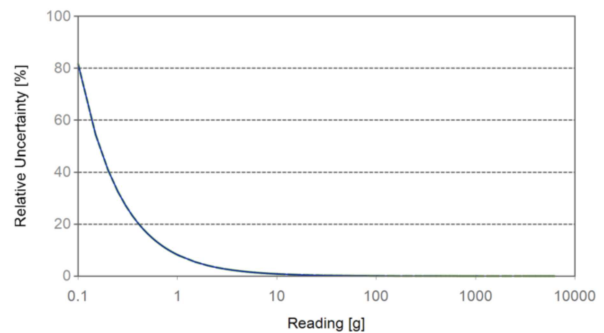
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
6.2 g	0.083 g	1.3%	0.082 g	1.3%
62.0 g	0.089 g	0.14%	0.086 g	0.14%
620.0 g	0.15 g	0.025%	0.12 g	0.020%
3100.0 g	0.44 g	0.014%	0.28 g	0.0092%
6200.0 g	0.81 g	0.013%	0.49 g	0.0078%



As Found



As Left

Custom Tolerance Assessment

Assessment done without considering measurement uncertainty.

One or more of the measurements from the attached calibration certificate were assessed against customer-defined tolerances.

	As Found	As Left
Overall	✓	✓
Repeatability	✓	✓
Eccentricity	✓	✓
Error of Indication	✓	✓

Measurement Results

Repeatability

Test Load: 2000 g

	As Found	As Left
1	1999.9 g	2000.0 g
2	1999.9 g	2000.0 g
3	1999.9 g	2000.0 g
4	1999.9 g	2000.0 g
5	1999.9 g	2000.0 g
6	1999.9 g	2000.0 g

Standard Deviation	0.00 g	0.00 g
Tolerance	0.10 g ✓	0.10 g ✓

Eccentricity

Test Load: 2000 g

Position	As Found	As Left
1	0.0 g	0.0 g
2	0.0 g	0.0 g
3	0.1 g	-0.1 g
4	-0.1 g	0.0 g
5	0.0 g	0.0 g

Maximum Deviation	0.1 g	0.1 g
Tolerance	0.3 g ✓	0.3 g ✓

Error of Indication**As Found**

	Reference Value	Indication	Error of Indication	Tolerance	
1	0.0 g	0.0 g	0.0 g	0.1 g	✓
2	1000.0 g	999.9 g	-0.1 g	0.4 g	✓
3	3000.0 g	2999.9 g	-0.1 g	1.2 g	✓
4	4000.0 g	3999.8 g	-0.2 g	1.6 g	✓
5	6000.0 g	5999.8 g	-0.2 g	2.4 g	✓

As Left

	Reference Value	Indication	Error of Indication	Tolerance	
1	0.0 g	0.0 g	0.0 g	0.1 g	✓
2	1000.0 g	1000.0 g	0.0 g	0.4 g	✓
3	3000.0 g	3000.0 g	0.0 g	1.2 g	✓
4	4000.0 g	4000.0 g	0.0 g	1.6 g	✓
5	6000.0 g	6000.1 g	0.1 g	2.4 g	✓

QUALITY ASSURANCE DATA

Location **Aurora Energy - Anchorage, AK**
 Source **Baghouse Inlet - Boiler 5**
 Project No. **AST-2023-4844**
 Parameter **PM**

Date	Nozzle ID	#1	#2	#3	Dn (Average)	Difference	Criteria	Material
12/19/23	SS-248	0.247	0.247	0.248	0.247	0.001	≤ 0.004 in.	SS
Date	Pitot ID	Evidence of damage?	Evidence of mis-alignment?	Calibration or Repair required?				
12/19/23	P-84	no	no	no				
Date	Probe or Thermocouple ID	Reference Temp. (°F)	Indicated Temp. (°F)	Difference	Criteria	Probe Length		
12/19/23	PR-84	317.0	318.0	0.1%	± 1.5 % (absolute)	7'		
Field Balance Check								
Date	12/19/23	12/20/23						
Balance ID:	5A2835583	5A2835583						
Certified Weight ID:	ANC-KG-1	ANC-KG-1						
Certified Weight (g):	1000.0	1000.0						
Measured Weight (g):	1000.0	999.9						
Weight Difference (g):	0.0	0.1	--	--	--	--		
Date	Barometric Pressure	Evidence of damage?	Reading Verified	Calibration or Repair required?	Weather Station Location			
12/19/23	Weather Station	NA	NA	NA	Fairbanks,AK			
Date	Meter Box ID	Positive Pressure Leak Check						
12/16/23	2386	Pass						
Reagent	Lot#	Field Prep performed	Field Lot	Date	By			
Acetone	B0545014B	No	NA	NA	NA			

Location **Aurora Energy - Anchorage, AK**

Source **Baghouse Inlet - Boilers 1-3**

Project No. **AST-2023-4844**

Parameter **PM**

Nozzle Diameter (in.)								
Date	Nozzle ID	#1	#2	#3	Dn (Average)	Difference	Criteria	Material
12/20/23	SS-260	0.261	0.261	0.259	0.260	0.002	≤ 0.004 in.	SS
Date	Pitot ID	Evidence of damage?	Evidence of mis-alignment?	Calibration or Repair required?				
12/20/23	P-84	no	no	no				
Date	Probe or Thermocouple ID	Reference Temp. (°F)	Indicated Temp. (°F)	Difference	Criteria	Probe Length		
12/20/23	PR-84	248.0	248.0	0.0%	± 1.5 % (absolute)	7 '		
Field Balance Check								
Date	12/20/23							
Balance ID:	5A2835583							
Certified Weight ID:	ANC-KG-1							
Certified Weight (g):	1000.0							
Measured Weight (g):	1000.0							
Weight Difference (g):	0.0	--	--	--	--	--		
Date	Barometric Pressure	Evidence of damage?	Reading Verified	Calibration or Repair required?	Weather Station Location			
12/20/23	Weather Station	No	NA	No	Fairbanks, AK			
Date	Meter Box ID	Positive Pressure Leak Check						
12/20/23	2386	Pass						
Reagent	Lot#	Field Prep performed	Field Lot	Date	By			
Acetone	B0545014B	No	NA	NA	NA			

	DGM Calibration-Orifices	Document ID	620.004
		Revision	23.0
		Effective Date	1/25/23
Issuing Department	Tech Services	Page	1 of 1

Equipment Detail - Dry Gas Meter

Console ID: 2386
Meter S/N: 18100284
Critical Orifice S/N: 1498

Calibration Detail

Initial Barometric Pressure, in. Hg	(P _b)	29.74					
Final Barometric Pressure, in. Hg	(P _{bF})	29.74					
Average Barometric Pressure, in. Hg	(P _b)	29.74					
Critical Orifice ID	(Y)	29	29	18	18	11	11
K' Factor, ft ³ ·R ^{1/2} / in. WC·min	(K')	0.8141	0.8141	0.5071	0.5071	0.3192	0.3192
Vacuum Pressure, in. Hg	(V _p)	15.0	15.0	19.5	19.5	21.5	21.5
Initial DGM Volume, ft ³	(V _m)	234.953	240.406	245.886	252.764	222.026	228.489
Final DGM Volume, ft ³	(V _{mF})	240.406	245.886	252.764	259.637	228.489	234.953
Total DGM Volume, ft ³	(V _m)	5.453	5.480	6.878	6.873	6.463	6.464
Ambient Temperature, °F	(T _a)	58	58	58	59	57	57
Initial DGM Temperature, °F	(T _m)	57	57	57	58	58	57
Final DGM Temperature, °F	(T _{mF})	57	57	57	58	57	57
Average DGM Temperature, °F	(T _m)	57	57	57	58	58	57
Elapsed Time	(Θ)	5.00	5.00	10.00	10.00	15.00	15.00
Meter Orifice Pressure, in. WC	(ΔH)	3.60	3.60	1.45	1.45	0.55	0.55
Standard Meter volume, ft ³	(V _{mstd})	5.5859	5.6136	7.0085	6.9899	6.5647	6.5721
Standard Critical Orifice Volume, ft ³	(V _{cr})	5.3221	5.3195	6.6263	6.6231	6.2644	6.2632
Meter Correction Factor	(Y)	0.953	0.948	0.945	0.948	0.954	0.953
Tolerance	--	0.003	0.002	0.005	0.003	0.004	0.003
Orifice Calibration Value	(ΔH @)	1.831	1.833	1.893	1.891	1.802	1.804
Tolerance	--	0.011	0.010	0.051	0.049	0.040	0.038
Orifice Cal Check	--	0.39		0.75		0.75	
Meter Correction Factor	(Y)	0.950					
Orifice Calibration Value	(ΔH @)	1.842					
Positive Pressure Leak Check		Yes					

Equipment Detail - Thermocouple Sensor

Reference Calibrator Make: Omega
Reference Calibrator Model: CL23A
Reference Calibrator S/N: T-239650

Calibration Detail

Reference Temp.		Display Temp.		Accuracy	Difference
°F	°R	°F	°R	%	°F
0	460	2	462	-0.4	2
68	528	68	528	0.0	0
100	560	100	560	0.0	0
223	683	224	684	-0.1	1
248	708	249	709	-0.1	1
273	733	274	734	-0.1	1
300	760	301	761	-0.1	1
400	860	399	859	0.1	1
500	960	498	958	0.2	2
600	1,060	598	1,058	0.2	2
700	1,160	700	1,160	0.0	0
800	1,260	799	1,259	0.1	1
900	1,360	898	1,358	0.1	2
1,000	1,460	998	1,458	0.1	2
1,100	1,560	1,098	1,558	0.1	2
1,200	1,660	1,197	1,657	0.2	3

Personnel

Calibration By: Lee Borghi
Calibration Date: 12/8/2023
Reviewed By: Stacey Cunningham

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Part Number: E03NI54E15A3808 Reference Number: 48-402563457-1
Cylinder Number: EB0083005 Cylinder Volume: 163.0 CF
Laboratory: 124 - Los Angeles (SAP) - CA Cylinder Pressure: 2015 PSIG
PGVP Number: B32022 Valve Outlet: 590
Gas Code: CO2,O2,BALN Certification Date: Oct 12, 2022

Expiration Date: Oct 12, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	23.00 %	23.69 %	G1	+/- 0.6% NIST Traceable	10/12/2022
OXYGEN	23.00 %	23.03 %	G1	+/- 0.7% NIST Traceable	10/12/2022
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061520	CC354777	19.87 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 11, 2024
NTRM	12062020	CC367607	22.883 % OXYGEN/NITROGEN	+/- 0.2%	May 14, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS 6E CO2	NDIR	Sep 16, 2022
SIEMENS OXYMAT 6	PARAMAGNETIC	Sep 12, 2022

Triad Data Available Upon Request




Approved for Release

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Appendix III.D.7.7-964

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Part Number: E03NI77E15A0043 Reference Number: 48-402563655-1
Cylinder Number: CC323054 Cylinder Volume: 152.0 CF
Laboratory: 124 - Los Angeles (SAP) - CA Cylinder Pressure: 2015 PSIG
PGVP Number: B32022 Valve Outlet: 590
Gas Code: CO2,O2,BALN Certification Date: Oct 12, 2022

Expiration Date: Oct 12, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	11.50 %	11.65 %	G1	+/- 0.6% NIST Traceable	10/12/2022
OXYGEN	11.50 %	11.53 %	G1	+/- 0.7% NIST Traceable	10/12/2022
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010611	K005428	13.94 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 30, 2024
NTRM	98051113	SG9163010BAL	9.507 % OXYGEN/NITROGEN	+/- 0.7%	Mar 22, 2030

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS 6E CO2	NDIR	Sep 16, 2022
SIEMENS OXYMAT 6	PARAMAGNETIC	Sep 12, 2022

Triad Data Available Upon Request



[Handwritten Signature]

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PROCESS DATA

Boiler 5

Address	M_512-FT-05/OUT.CV	M_513-AT-12/AI1/PV.CV
Parameter	Steam Production	Oxygen Sensor 12 (ID Fan)
Units	(lbs/hour)	(%)
12/19/23 17:00	189,160.50	5.51
12/19/23 17:00	188,784.50	5.41
12/19/23 17:01	188,739.20	5.27
12/19/23 17:01	188,871.91	5.17
12/19/23 17:02	189,173.00	5.07
12/19/23 17:02	189,564.80	5.00
12/19/23 17:03	189,694.91	4.94
12/19/23 17:03	189,684.00	4.92
12/19/23 17:04	189,739.91	4.99
12/19/23 17:04	189,831.80	5.13
12/19/23 17:05	189,514.09	5.31
12/19/23 17:05	188,967.80	5.46
12/19/23 17:06	188,805.00	5.53
12/19/23 17:06	188,848.59	5.55
12/19/23 17:07	188,853.30	5.54
12/19/23 17:07	188,836.91	5.47
12/19/23 17:08	188,838.30	5.43
12/19/23 17:08	188,849.20	5.40
12/19/23 17:09	189,028.80	5.40
12/19/23 17:09	189,299.30	5.39
12/19/23 17:10	189,328.00	5.36
12/19/23 17:10	189,226.41	5.30
12/19/23 17:11	189,283.59	5.22
12/19/23 17:11	189,426.30	5.13
12/19/23 17:12	189,167.20	5.09
12/19/23 17:12	188,683.80	5.09
12/19/23 17:13	188,842.80	5.14
12/19/23 17:13	189,347.80	5.19
12/19/23 17:14	189,663.30	5.26
12/19/23 17:14	189,876.80	5.29
12/19/23 17:15	189,835.09	5.29
12/19/23 17:15	189,656.00	5.29
12/19/23 17:16	189,441.30	5.29
12/19/23 17:16	189,207.41	5.26
12/19/23 17:17	189,201.00	5.24
12/19/23 17:17	189,317.09	5.24
12/19/23 17:18	189,449.59	5.27
12/19/23 17:18	189,590.91	5.29
12/19/23 17:19	189,421.09	5.32
12/19/23 17:19	189,083.80	5.34
12/19/23 17:20	189,154.41	5.39
12/19/23 17:20	189,444.59	5.44
12/19/23 17:21	189,475.80	5.52
12/19/23 17:21	189,367.50	5.53
12/19/23 17:22	189,381.30	5.52
12/19/23 17:22	189,463.20	5.47
12/19/23 17:23	189,535.50	5.40
12/19/23 17:23	189,602.50	5.34
12/19/23 17:24	189,519.91	5.27
12/19/23 17:24	189,356.80	5.22
12/19/23 17:25	189,443.41	5.17
12/19/23 17:25	189,664.41	5.09
12/19/23 17:26	189,882.70	5.03
12/19/23 17:26	190,099.59	5.02
12/19/23 17:27	189,920.30	5.02
12/19/23 17:27	189,527.80	5.03
12/19/23 17:28	189,605.91	5.10

Boiler 5

Address	M_512-FT-05/OUT.CV	M_513-AT-12/AI1/PV.CV
Parameter	Steam Production	Oxygen Sensor 12 (ID Fan)
Units	(lbs/hour)	(%)
12/19/23 17:28	189,937.50	5.22
12/19/23 17:29	189,861.59	5.35
12/19/23 17:29	189,558.20	5.44
12/19/23 17:30	189,400.20	5.37
12/19/23 17:30	189,320.41	5.30
12/19/23 17:31	189,527.80	5.26
12/19/23 17:31	189,889.91	5.23
12/19/23 17:32	189,987.20	5.21
12/19/23 17:32	189,942.00	5.26
12/19/23 17:33	190,057.70	5.32
12/19/23 17:33	190,259.91	5.35
12/19/23 17:34	190,100.50	5.38
12/19/23 17:34	189,746.30	5.36
12/19/23 17:35	189,460.80	5.28
12/19/23 17:35	189,212.41	5.18
12/19/23 17:36	189,332.80	5.11
12/19/23 17:36	189,651.80	5.06
12/19/23 17:37	189,755.20	5.01
12/19/23 17:37	189,742.50	4.98
12/19/23 17:38	189,720.50	5.01
12/19/23 17:38	189,693.30	5.12
12/19/23 17:39	189,540.70	5.25
12/19/23 17:39	189,320.59	5.35
12/19/23 17:40	189,148.09	5.44
12/19/23 17:40	189,002.30	5.49
12/19/23 17:41	189,079.80	5.54
12/19/23 17:41	189,277.70	5.51
12/19/23 17:42	189,184.00	5.42
12/19/23 17:42	188,933.41	5.25
12/19/23 17:43	189,203.91	5.06
12/19/23 17:43	189,755.00	4.93
12/19/23 17:44	190,257.30	4.85
12/19/23 17:44	190,733.30	4.82
12/19/23 17:45	190,457.59	4.87
12/19/23 17:45	189,777.20	5.06
12/19/23 17:46	189,660.80	5.27
12/19/23 17:46	189,848.30	5.50
12/19/23 17:47	189,865.30	5.65
12/19/23 17:47	189,787.09	5.76
12/19/23 17:48	189,618.50	5.84
12/19/23 17:48	189,401.20	5.79
12/19/23 17:49	189,281.59	5.62
12/19/23 17:49	189,214.80	5.47
12/19/23 17:50	189,186.09	5.35
12/19/23 17:50	189,178.80	5.25
12/19/23 17:51	189,263.20	5.09
12/19/23 17:51	189,396.91	4.95
12/19/23 17:52	189,572.50	4.93
12/19/23 17:52	189,771.70	4.97
12/19/23 17:53	189,870.80	5.04
12/19/23 17:53	189,914.30	5.13
12/19/23 17:54	189,743.91	5.25
12/19/23 17:54	189,454.30	5.39
12/19/23 17:55	189,279.50	5.50
12/19/23 17:55	189,168.80	5.59
12/19/23 17:56	188,803.30	5.60
12/19/23 17:56	188,295.50	5.55

Boiler 5

Address	M_512-FT-05/OUT.CV	M_513-AT-12/AI1/PV.CV
Parameter	Steam Production	Oxygen Sensor 12 (ID Fan)
Units	(lbs/hour)	(%)
12/19/23 17:57	188,531.30	5.45
12/19/23 17:57	189,182.41	5.34
12/19/23 17:58	189,689.59	5.22
12/19/23 17:58	190,116.41	5.10
12/19/23 17:59	191,052.80	5.05
12/19/23 17:59	192,273.80	5.02
12/19/23 18:00	191,724.91	4.98
12/19/23 18:00	190,187.59	4.95
12/19/23 18:01	189,754.00	4.95
12/19/23 18:01	189,936.59	5.04
12/19/23 18:02	189,791.91	5.18
12/19/23 18:02	189,464.30	5.34
12/19/23 18:03	189,550.20	5.45
12/19/23 18:03	189,866.91	5.54
12/19/23 18:04	189,713.09	5.54
12/19/23 18:04	189,296.59	5.49
12/19/23 18:05	189,560.50	5.44
12/19/23 18:05	190,204.50	5.38
12/19/23 18:06	190,200.00	5.30
12/19/23 18:06	189,833.30	5.19
12/19/23 18:07	189,489.00	5.09
12/19/23 18:07	189,157.30	4.99
12/19/23 18:08	189,138.50	4.95
12/19/23 18:08	189,294.59	5.02
12/19/23 18:09	189,692.80	5.13
12/19/23 18:09	190,226.20	5.25
12/19/23 18:10	190,215.70	5.37
12/19/23 18:10	189,901.41	5.42
12/19/23 18:11	189,766.70	5.35
12/19/23 18:11	189,732.30	5.26
12/19/23 18:12	189,630.50	5.24
12/19/23 18:12	189,491.09	5.25
12/19/23 18:13	189,398.09	5.29
12/19/23 18:13	189,331.00	5.35
12/19/23 18:14	189,237.09	5.43
12/19/23 18:14	189,128.20	5.50
12/19/23 18:15	188,977.30	5.52
12/19/23 18:15	188,802.80	5.50
12/19/23 18:16	188,880.20	5.43
12/19/23 18:16	189,098.20	5.32
12/19/23 18:17	189,156.50	5.17
12/19/23 18:17	189,125.70	5.06
12/19/23 18:18	189,105.30	4.98
12/19/23 18:18	189,090.80	5.02
12/19/23 18:19	189,157.80	5.13
12/19/23 18:19	189,270.30	5.29
12/19/23 18:20	189,461.70	5.39
12/19/23 18:20	189,697.09	5.48
12/19/23 18:21	189,726.91	5.52
12/19/23 18:21	189,641.91	5.52
12/19/23 18:22	189,924.30	5.41
12/19/23 18:22	190,412.00	5.27
12/19/23 18:23	190,587.91	5.12
12/19/23 18:23	190,589.70	4.97
12/19/23 18:24	190,421.30	4.87
12/19/23 18:24	190,157.91	4.85
12/19/23 18:25	189,777.70	4.87

Boiler 5

Address	M_512-FT-05/OUT.CV	M_513-AT-12/AI1/PV.CV
Parameter	Steam Production	Oxygen Sensor 12 (ID Fan)
Units	(lbs/hour)	(%)
12/19/23 18:25	189,332.30	4.91
12/19/23 18:26	189,611.30	4.98
12/19/23 18:26	190,294.91	5.06
12/19/23 18:27	190,188.50	5.16
12/19/23 18:27	189,641.00	5.22
12/19/23 18:28	189,725.59	5.35
12/19/23 18:28	190,163.09	5.51
12/19/23 18:29	189,987.91	5.65
12/19/23 18:29	189,470.59	5.71
12/19/23 18:30	189,572.00	5.72
12/19/23 18:30	190,018.91	5.62
12/19/23 18:31	189,957.41	5.46
12/19/23 18:31	189,612.00	5.26
12/19/23 18:32	189,591.59	5.09
12/19/23 18:32	189,752.80	4.95
12/19/23 18:33	189,748.91	4.87
12/19/23 18:33	189,653.00	4.90
12/19/23 18:34	189,760.20	4.97
12/19/23 18:34	189,980.80	5.04
12/19/23 18:35	189,921.80	5.11
12/19/23 18:35	189,706.59	5.14
12/19/23 18:36	189,877.59	5.17
12/19/23 18:36	190,264.30	5.13
12/19/23 18:37	189,938.20	5.11
12/19/23 18:37	189,214.20	5.11
12/19/23 18:38	189,237.50	5.14
12/19/23 18:38	189,678.00	5.16
12/19/23 18:39	189,944.80	5.18
12/19/23 18:39	190,114.59	5.19
12/19/23 18:40	189,816.50	5.18
12/19/23 18:40	189,257.00	5.20
12/19/23 18:41	189,489.59	5.25
12/19/23 18:41	190,164.59	5.30
12/19/23 18:42	189,927.91	5.32
12/19/23 18:42	189,182.09	5.24
12/19/23 18:43	189,122.00	5.13
12/19/23 18:43	189,445.00	5.05
12/19/23 18:44	189,717.41	5.00
12/19/23 18:44	189,961.59	4.95
12/19/23 18:45	189,783.09	4.95
12/19/23 18:45	189,368.50	5.05
12/19/23 18:46	189,446.50	5.10
12/19/23 18:46	189,799.70	5.14
12/19/23 18:47	190,391.91	5.19
12/19/23 18:47	191,117.50	5.24
12/19/23 18:48	190,748.20	5.30
12/19/23 18:48	189,767.20	5.33
12/19/23 18:49	189,704.59	5.32
12/19/23 18:49	190,154.91	5.29
12/19/23 18:50	190,104.09	5.26
12/19/23 18:50	189,773.41	5.24
12/19/23 18:51	190,235.20	5.22
12/19/23 18:51	191,139.59	5.20
12/19/23 18:52	190,797.30	5.16
12/19/23 18:52	189,758.80	5.07
12/19/23 18:53	189,556.30	4.99
12/19/23 18:53	189,820.70	5.03

Appendix III.D.7.7-970

Boiler 5

Address	M_512-FT-05/OUT.CV	M_513-AT-12/AI1/PV.CV
Parameter	Steam Production	Oxygen Sensor 12 (ID Fan)
Units	(lbs/hour)	(%)
12/19/23 18:54	189,951.30	5.10
12/19/23 18:54	190,007.30	5.23
12/19/23 18:55	189,986.80	5.36
12/19/23 18:55	189,923.59	5.45
12/19/23 18:56	189,621.80	5.47
12/19/23 18:56	189,186.91	5.36
12/19/23 18:57	189,289.30	5.24
12/19/23 18:57	189,691.59	5.15
12/19/23 18:58	190,124.09	5.04
12/19/23 18:58	190,573.30	4.94
12/19/23 18:59	190,285.70	4.85
12/19/23 18:59	189,586.50	4.76
12/19/23 19:00	189,642.41	4.73
12/19/23 19:00	190,119.91	4.81
12/19/23 19:01	190,587.80	4.97
12/19/23 19:01	191,050.30	5.08
12/19/23 19:02	190,831.30	5.12
12/19/23 19:02	190,231.50	5.16
12/19/23 19:03	189,883.09	5.21
12/19/23 19:03	189,675.00	5.29
12/19/23 19:04	190,199.41	5.36
12/19/23 19:04	191,132.80	5.32
12/19/23 19:05	190,857.91	5.24
12/19/23 19:05	189,908.20	5.10
12/19/23 19:06	190,207.20	4.99
12/19/23 19:06	191,203.59	4.97
12/19/23 19:07	191,057.09	5.03
12/19/23 19:07	190,272.50	5.06
12/19/23 19:08	189,841.50	5.11
12/19/23 19:08	189,608.09	5.18
12/19/23 19:09	189,696.30	5.25
12/19/23 19:09	189,964.00	5.35
12/19/23 19:10	189,976.41	5.45
12/19/23 19:10	189,846.20	5.49
12/19/23 19:11	189,904.00	5.44
12/19/23 19:11	190,066.70	5.38
12/19/23 19:12	190,258.09	5.28
12/19/23 19:12	190,465.50	5.14
12/19/23 19:13	190,851.20	5.02
12/19/23 19:13	191,336.50	4.95
12/19/23 19:14	191,100.70	4.96
12/19/23 19:14	190,462.09	5.07
12/19/23 19:15	190,052.30	5.28
12/19/23 19:15	189,770.30	5.56
12/19/23 19:16	189,836.30	5.83
12/19/23 19:16	190,096.59	5.91
12/19/23 19:17	189,764.50	5.76
12/19/23 19:17	189,101.50	5.51
12/19/23 19:18	189,506.70	5.26
12/19/23 19:18	190,508.50	4.99
12/19/23 19:19	190,562.00	4.86
12/19/23 19:19	190,086.00	4.84
12/19/23 19:20	189,859.70	4.94
12/19/23 19:20	189,772.80	5.13
12/19/23 19:21	190,086.70	5.35
12/19/23 19:21	190,624.41	5.50
12/19/23 19:22	192,078.70	5.61

Appendix III.D.7.7-971

Boiler 5

Address	M_512-FT-05/OUT.CV	M_513-AT-12/A11/PV.CV
Parameter	Steam Production	Oxygen Sensor 12 (ID Fan)
Units	(lbs/hour)	(%)
12/19/23 19:22	194,044.80	5.63
12/19/23 19:23	193,054.41	5.59
12/19/23 19:23	190,413.00	5.46
12/19/23 19:24	189,168.09	5.29
12/19/23 19:24	188,703.00	5.19
12/19/23 19:25	189,803.80	5.21
12/19/23 19:25	191,778.91	5.25
12/19/23 19:26	191,581.59	5.26
12/19/23 19:26	190,171.09	5.22
12/19/23 19:27	190,057.00	5.16
12/19/23 19:27	190,667.00	5.15
12/19/23 19:28	190,227.59	5.16
12/19/23 19:28	189,202.20	5.17
12/19/23 19:29	189,556.20	5.20
12/19/23 19:29	190,680.41	5.27
12/19/23 19:30	190,470.30	5.33
12/19/23 19:30	189,515.00	5.32
12/19/23 19:31	189,411.00	5.27
12/19/23 19:31	189,782.30	5.23
12/19/23 19:32	189,800.50	5.22
12/19/23 19:32	189,621.30	5.22
12/19/23 19:33	189,639.50	5.22
12/19/23 19:33	189,768.00	5.25
12/19/23 19:34	190,149.80	5.24
12/19/23 19:34	190,672.91	5.16
12/19/23 19:35	190,713.50	5.03
12/19/23 19:35	190,484.80	4.89
12/19/23 19:36	190,429.41	4.79
12/19/23 19:36	190,470.91	4.76
12/19/23 19:37	190,529.70	4.79
12/19/23 19:37	190,598.20	4.89
12/19/23 19:38	190,907.50	4.99
12/19/23 19:38	191,351.41	5.05
12/19/23 19:39	191,441.30	5.10
12/19/23 19:39	191,333.70	5.11
12/19/23 19:40	191,308.91	5.11
12/19/23 19:40	191,330.50	5.12
12/19/23 19:41	191,213.70	5.13
12/19/23 19:41	191,019.70	5.09
12/19/23 19:42	190,750.30	5.05
12/19/23 19:42	190,438.70	5.02
12/19/23 19:43	190,651.50	5.06
12/19/23 19:43	191,157.00	5.13
12/19/23 19:44	190,566.50	5.22
12/19/23 19:44	189,363.91	5.26
12/19/23 19:45	189,659.80	5.30
12/19/23 19:45	190,792.41	5.34
12/19/23 19:46	191,002.00	5.35
12/19/23 19:46	190,696.30	5.32
12/19/23 19:47	190,477.91	5.27
12/19/23 19:47	190,308.41	5.24
12/19/23 19:48	189,970.30	5.21
12/19/23 19:48	189,538.00	5.20
12/19/23 19:49	189,299.30	5.24
12/19/23 19:49	189,168.70	5.24
12/19/23 19:50	189,849.09	5.23
12/19/23 19:50	190,982.30	5.23

Appendix III.D.7.7-972

Boiler 5

Address	M_512-FT-05/OUT.CV	M_513-AT-12/AI1/PV.CV
Parameter	Steam Production	Oxygen Sensor 12 (ID Fan)
Units	(lbs/hour)	(%)
12/19/23 19:51	190,914.70	5.16
12/19/23 19:51	190,176.41	5.08
12/19/23 19:52	189,794.50	5.04
12/19/23 19:52	189,611.70	5.02
12/19/23 19:53	189,455.50	5.01
12/19/23 19:53	189,314.09	5.03
12/19/23 19:54	189,921.00	5.06
12/19/23 19:54	190,945.91	5.08
12/19/23 19:55	190,878.59	5.07
12/19/23 19:55	190,201.41	5.03
12/19/23 19:56	189,979.59	5.00
12/19/23 19:56	190,012.09	4.98
12/19/23 19:57	189,999.50	5.02
12/19/23 19:57	189,961.50	5.07
12/19/23 19:58	189,958.30	5.13
12/19/23 19:58	189,974.59	5.19
12/19/23 19:59	190,604.50	5.21
12/19/23 19:59	191,577.30	5.25
12/19/23 20:00	191,557.41	5.19
12/19/23 20:00	190,983.20	5.04
12/19/23 20:01	190,571.59	4.85
12/19/23 20:01	190,250.80	4.75
12/19/23 20:02	190,359.00	4.73
12/19/23 20:02	190,706.91	4.78
12/19/23 20:03	190,394.70	4.92
12/19/23 20:03	189,714.00	5.11
12/19/23 20:04	190,198.30	5.31
12/19/23 20:04	191,333.09	5.49
12/19/23 20:05	191,394.00	5.64
12/19/23 20:05	190,855.30	5.65
12/19/23 20:06	190,255.41	5.57
12/19/23 20:06	189,621.20	5.42
12/19/23 20:07	189,558.91	5.24
12/19/23 20:07	189,816.00	5.08
12/19/23 20:08	190,135.00	4.99
12/19/23 20:08	190,488.80	4.91
12/19/23 20:09	190,446.50	4.89
12/19/23 20:09	190,183.20	4.94
12/19/23 20:10	190,634.50	5.01
12/19/23 20:10	191,485.00	5.13
12/19/23 20:11	191,416.50	5.26
12/19/23 20:11	190,834.80	5.32
12/19/23 20:12	190,481.70	5.33
12/19/23 20:12	190,256.30	5.30
12/19/23 20:13	190,037.50	5.28
12/19/23 20:13	189,822.41	5.28
12/19/23 20:14	189,883.30	5.24
12/19/23 20:14	190,098.41	5.19
12/19/23 20:15	190,049.09	5.15
12/19/23 20:15	189,852.09	5.13
12/19/23 20:16	190,542.91	5.12
12/19/23 20:16	191,729.50	5.17
12/19/23 20:17	191,805.20	5.24
12/19/23 20:17	191,260.50	5.19
12/19/23 20:18	191,144.80	5.10
12/19/23 20:18	191,268.70	5.03
12/19/23 20:19	190,812.41	4.99

Boiler 5

Address	M_512-FT-05/OUT.CV	M_513-AT-12/AI1/PV.CV
Parameter	Steam Production	Oxygen Sensor 12 (ID Fan)
Units	(lbs/hour)	(%)
12/19/23 20:19	190,032.20	5.02
12/19/23 20:20	190,743.00	5.16
12/19/23 20:20	192,286.41	5.32
12/19/23 20:21	192,183.70	5.36
12/19/23 20:21	191,161.70	5.31
12/19/23 20:22	190,579.20	5.17
12/19/23 20:22	190,242.09	5.07
12/19/23 20:23	190,150.30	5.03
12/19/23 20:23	190,195.41	5.01
12/19/23 20:24	190,131.59	5.01
12/19/23 20:24	190,007.00	5.05
12/19/23 20:25	190,303.50	5.08
12/19/23 20:25	190,835.20	5.12
12/19/23 20:26	191,167.41	5.16
12/19/23 20:26	191,388.20	5.09
12/19/23 20:27	191,008.80	5.01
12/19/23 20:27	190,294.30	5.09
12/19/23 20:28	190,157.59	5.24
12/19/23 20:28	190,343.50	5.48
12/19/23 20:29	190,666.41	5.70
12/19/23 20:29	191,065.80	5.79
12/19/23 20:30	190,622.00	5.72
12/19/23 20:30	189,707.30	5.56
12/19/23 20:31	189,690.50	5.32
12/19/23 20:31	190,175.00	5.07
12/19/23 20:32	190,219.00	4.86
12/19/23 20:32	190,016.80	4.72
12/19/23 20:33	190,056.70	4.64
12/19/23 20:33	190,231.80	4.67
12/19/23 20:34	190,739.80	4.80
12/19/23 20:34	191,433.80	5.01
12/19/23 20:35	191,643.30	5.18
12/19/23 20:35	191,582.41	5.26
12/19/23 20:36	191,500.80	5.30
12/19/23 20:36	191,407.50	5.24
12/19/23 20:37	191,295.80	5.11
12/19/23 20:37	191,173.70	4.98
12/19/23 20:38	191,372.59	4.92
12/19/23 20:38	191,750.91	4.91
12/19/23 20:39	191,281.91	4.90
12/19/23 20:39	190,339.70	4.92
12/19/23 20:40	190,847.30	4.91
12/19/23 20:40	192,164.50	4.89
12/19/23 20:41	192,806.70	4.89
12/19/23 20:41	193,071.91	4.89
12/19/23 20:42	192,209.50	4.93
12/19/23 20:42	190,717.41	4.99
12/19/23 20:43	190,787.91	5.10
12/19/23 20:43	191,731.00	5.25
12/19/23 20:44	191,359.41	5.42
12/19/23 20:44	190,253.70	5.49
12/19/23 20:45	189,928.30	5.49
12/19/23 20:45	190,038.50	5.40
12/19/23 20:46	190,427.00	5.19
12/19/23 20:46	190,970.91	4.92
12/19/23 20:47	190,733.30	4.71
12/19/23 20:47	190,059.20	4.58

Appendix III.D.7.7-974

Boiler 5

Address	M_512-FT-05/OUT.CV	M_513-AT-12/AI1/PV.CV
Parameter	Steam Production	Oxygen Sensor 12 (ID Fan)
Units	(lbs/hour)	(%)
12/19/23 20:48	190,545.70	4.56
12/19/23 20:48	191,680.30	4.63
12/19/23 20:49	192,014.50	4.76
12/19/23 20:49	191,901.80	4.95
12/19/23 20:50	192,327.00	5.20
12/19/23 20:50	193,052.50	5.42
12/19/23 20:51	193,312.50	5.49
12/19/23 20:51	193,312.50	5.40
12/19/23 20:52	193,256.59	5.19
12/19/23 20:52	193,169.59	4.96
12/19/23 20:53	192,837.70	4.69
12/19/23 20:53	192,369.00	4.44
12/19/23 20:54	192,183.91	4.28
12/19/23 20:54	192,157.09	4.22
12/19/23 20:55	191,828.00	4.24
12/19/23 20:55	191,330.00	4.38
12/19/23 20:56	191,266.70	4.63
12/19/23 20:56	191,446.09	4.94
12/19/23 20:57	192,005.41	5.25
12/19/23 20:57	192,776.70	5.51
12/19/23 20:58	192,733.91	5.71
12/19/23 20:58	192,236.50	5.79
12/19/23 20:59	192,061.59	5.75
12/19/23 20:59	192,067.00	5.58
12/19/23 21:00	192,636.33	5.33
12/20/23 8:00	189,555.20	5.19
12/20/23 8:00	189,998.59	5.24
12/20/23 8:01	190,020.59	5.23
12/20/23 8:01	189,807.30	5.19
12/20/23 8:02	189,714.59	5.11
12/20/23 8:02	189,689.30	5.08
12/20/23 8:03	189,239.59	5.10
12/20/23 8:03	188,552.91	5.11
12/20/23 8:04	188,795.00	5.11
12/20/23 8:04	189,555.91	5.16
12/20/23 8:05	189,814.59	5.23
12/20/23 8:05	189,792.91	5.31
12/20/23 8:06	189,556.00	5.33
12/20/23 8:06	189,198.91	5.33
12/20/23 8:07	189,164.20	5.32
12/20/23 8:07	189,309.41	5.28
12/20/23 8:08	189,598.30	5.19
12/20/23 8:08	189,967.41	5.20
12/20/23 8:09	189,987.20	5.20
12/20/23 8:09	189,811.80	5.20
12/20/23 8:10	189,452.20	5.17
12/20/23 8:10	188,989.70	5.11
12/20/23 8:11	188,820.41	5.10
12/20/23 8:11	188,815.00	5.13
12/20/23 8:12	188,979.59	5.15
12/20/23 8:12	189,239.30	5.20
12/20/23 8:13	189,332.41	5.26
12/20/23 8:13	189,332.41	5.34
12/20/23 8:14	189,348.70	5.44
12/20/23 8:14	189,374.20	5.48
12/20/23 8:15	189,125.70	5.47

Appendix III.D.7.7-975

Boiler 5

Address	M_512-FT-05/OUT.CV	M_513-AT-12/AI1/PV.CV
Parameter	Steam Production	Oxygen Sensor 12 (ID Fan)
Units	(lbs/hour)	(%)
12/20/23 8:15	188,729.59	5.41
12/20/23 8:16	188,810.70	5.32
12/20/23 8:16	189,148.70	5.24
12/20/23 8:17	189,053.30	5.11
12/20/23 8:17	188,724.41	4.96
12/20/23 8:18	188,413.80	4.89
12/20/23 8:18	188,112.91	4.91
12/20/23 8:19	188,128.59	5.09
12/20/23 8:19	188,314.70	5.31
12/20/23 8:20	188,448.20	5.53
12/20/23 8:20	188,553.30	5.66
12/20/23 8:21	188,475.30	5.65
12/20/23 8:21	188,294.91	5.63
12/20/23 8:22	188,082.00	5.55
12/20/23 8:22	187,850.91	5.37
12/20/23 8:23	187,873.30	5.13
12/20/23 8:23	188,032.30	4.87
12/20/23 8:24	188,505.30	4.65
12/20/23 8:24	189,147.50	4.52
12/20/23 8:25	189,561.59	4.46
12/20/23 8:25	189,853.09	4.54
12/20/23 8:26	190,180.30	4.74
12/20/23 8:26	190,526.70	4.98
12/20/23 8:27	190,745.80	5.24
12/20/23 8:27	190,896.30	5.48
12/20/23 8:28	190,468.70	5.64
12/20/23 8:28	189,718.30	5.70
12/20/23 8:29	189,149.80	5.68
12/20/23 8:29	188,679.30	5.61
12/20/23 8:30	188,590.30	5.49
12/20/23 8:30	188,706.70	5.31
12/20/23 8:31	189,056.50	5.16
12/20/23 8:31	189,531.91	5.07
12/20/23 8:32	189,286.41	5.00
12/20/23 8:32	188,652.59	4.95
12/20/23 8:33	188,835.70	4.93
12/20/23 8:33	189,458.59	4.97
12/20/23 8:34	189,182.50	5.11
12/20/23 8:34	188,422.41	5.25
12/20/23 8:35	188,773.50	5.30
12/20/23 8:35	189,745.09	5.30
12/20/23 8:36	189,750.91	5.31
12/20/23 8:36	189,236.50	5.28
12/20/23 8:37	188,990.59	5.16
12/20/23 8:37	188,889.30	5.04
12/20/23 8:38	189,231.41	4.98
12/20/23 8:38	189,821.00	4.99
12/20/23 8:39	189,191.50	5.07
12/20/23 8:39	187,905.41	5.17
12/20/23 8:40	188,006.41	5.24
12/20/23 8:40	188,854.20	5.37
12/20/23 8:41	188,958.30	5.46
12/20/23 8:41	188,662.00	5.44
12/20/23 8:42	188,750.91	5.34
12/20/23 8:42	189,047.20	5.25
12/20/23 8:43	189,220.50	5.17
12/20/23 8:43	189,327.50	5.10

Boiler 5

Address	M_512-FT-05/OUT.CV	M_513-AT-12/AI1/PV.CV
Parameter	Steam Production	Oxygen Sensor 12 (ID Fan)
Units	(lbs/hour)	(%)
12/20/23 8:44	189,362.59	5.02
12/20/23 8:44	189,359.00	4.98
12/20/23 8:45	189,649.09	4.98
12/20/23 8:45	190,103.20	5.03
12/20/23 8:46	189,627.80	5.07
12/20/23 8:46	188,652.00	5.04
12/20/23 8:47	188,643.80	4.99
12/20/23 8:47	189,156.50	4.90
12/20/23 8:48	188,074.91	4.83
12/20/23 8:48	186,134.70	4.72
12/20/23 8:49	185,738.91	4.57
12/20/23 8:49	186,174.80	4.56
12/20/23 8:50	185,681.91	4.67
12/20/23 8:50	184,689.00	4.88
12/20/23 8:51	184,402.00	5.15
12/20/23 8:51	184,495.00	5.49
12/20/23 8:52	184,147.91	5.91
12/20/23 8:52	183,563.70	6.24
12/20/23 8:53	183,144.59	6.39
12/20/23 8:53	182,814.50	6.43
12/20/23 8:54	183,200.41	6.35
12/20/23 8:54	183,971.80	6.18
12/20/23 8:55	184,072.80	6.00
12/20/23 8:55	183,799.20	5.73
12/20/23 8:56	183,494.09	5.45
12/20/23 8:56	183,172.09	5.26
12/20/23 8:57	183,199.41	5.11
12/20/23 8:57	183,414.80	5.03
12/20/23 8:58	183,485.41	4.98
12/20/23 8:58	183,477.91	4.91
12/20/23 8:59	184,002.09	4.93
12/20/23 8:59	184,812.50	5.04
12/20/23 9:00	184,439.00	5.20
12/20/23 9:00	183,428.20	5.35
12/20/23 9:01	183,601.30	5.43
12/20/23 9:01	184,411.91	5.47
12/20/23 9:02	183,944.20	5.37
12/20/23 9:02	182,762.59	5.11
12/20/23 9:03	183,051.09	4.87
12/20/23 9:03	184,131.00	4.71
12/20/23 9:04	183,532.30	4.59
12/20/23 9:04	182,029.50	4.49
12/20/23 9:05	182,199.09	4.32
12/20/23 9:05	183,269.09	4.27
12/20/23 9:06	183,677.59	4.29
12/20/23 9:06	183,730.00	4.16
12/20/23 9:07	183,944.70	4.18
12/20/23 9:07	184,246.91	4.29
12/20/23 9:08	184,046.80	4.42
12/20/23 9:08	183,576.30	4.78
12/20/23 9:09	183,209.30	5.19
12/20/23 9:09	182,898.00	5.41
12/20/23 9:10	182,794.00	5.53
12/20/23 9:10	182,801.50	5.57
12/20/23 9:11	183,144.70	5.47
12/20/23 9:11	183,668.80	5.25
12/20/23 9:12	183,646.91	4.92

Appendix III.D.7.7-977

Boiler 5

Address	M_512-FT-05/OUT.CV	M_513-AT-12/AI1/PV.CV
Parameter	Steam Production	Oxygen Sensor 12 (ID Fan)
Units	(lbs/hour)	(%)
12/20/23 9:12	183,320.00	4.56
12/20/23 9:13	183,576.00	4.32
12/20/23 9:13	184,145.80	4.04
12/20/23 9:14	184,128.09	3.94
12/20/23 9:14	183,794.20	3.90
12/20/23 9:15	183,755.00	4.00
12/20/23 9:15	183,874.59	4.22
12/20/23 9:16	184,329.91	4.53
12/20/23 9:16	184,966.09	5.00
12/20/23 9:17	184,557.59	5.44
12/20/23 9:17	183,586.59	5.74
12/20/23 9:18	183,378.80	5.91
12/20/23 9:18	183,582.00	5.95
12/20/23 9:19	183,322.59	5.94
12/20/23 9:19	182,804.91	5.80
12/20/23 9:20	182,826.20	5.60
12/20/23 9:20	183,137.80	5.40
12/20/23 9:21	183,082.91	5.08
12/20/23 9:21	182,830.70	4.87
12/20/23 9:22	182,491.59	4.68
12/20/23 9:22	182,104.00	4.49
12/20/23 9:23	182,266.80	4.44
12/20/23 9:23	182,726.09	4.40
12/20/23 9:24	183,303.80	4.34
12/20/23 9:24	183,945.41	4.26
12/20/23 9:25	183,726.70	4.26
12/20/23 9:25	183,044.80	4.39
12/20/23 9:26	183,320.91	4.61
12/20/23 9:26	184,132.09	4.95
12/20/23 9:27	184,286.41	5.36
12/20/23 9:27	184,086.91	5.73
12/20/23 9:28	183,164.41	6.04
12/20/23 9:28	181,852.59	6.30
12/20/23 9:29	182,074.80	6.55
12/20/23 9:29	183,153.80	6.71
12/20/23 9:30	183,062.59	6.75
12/20/23 9:30	182,341.41	6.58
12/20/23 9:31	182,479.91	6.24
12/20/23 9:31	183,081.30	5.89
12/20/23 9:32	183,939.41	5.61
12/20/23 9:32	184,935.59	5.35
12/20/23 9:33	186,113.09	5.10
12/20/23 9:33	187,391.91	4.88
12/20/23 9:34	188,177.20	4.70
12/20/23 9:34	188,696.70	4.63
12/20/23 9:35	189,228.09	4.60
12/20/23 9:35	189,766.00	4.67
12/20/23 9:36	189,940.09	4.79
12/20/23 9:36	189,911.09	4.91
12/20/23 9:37	189,697.30	5.02
12/20/23 9:37	189,384.00	5.13
12/20/23 9:38	189,199.09	5.21
12/20/23 9:38	189,083.50	5.26
12/20/23 9:39	189,230.09	5.23
12/20/23 9:39	189,523.30	5.19
12/20/23 9:40	189,569.41	5.18
12/20/23 9:40	189,482.41	5.22

Boiler 5

Address	M_512-FT-05/OUT.CV	M_513-AT-12/AI1/PV.CV
Parameter	Steam Production	Oxygen Sensor 12 (ID Fan)
Units	(lbs/hour)	(%)
12/20/23 9:41	189,720.00	5.26
12/20/23 9:41	190,132.30	5.28
12/20/23 9:42	190,040.20	5.32
12/20/23 9:42	189,676.50	5.34
12/20/23 9:43	189,176.30	5.26
12/20/23 9:43	188,599.80	5.13
12/20/23 9:44	189,049.59	5.00
12/20/23 9:44	190,052.00	4.93
12/20/23 9:45	190,259.09	4.95
12/20/23 9:45	190,037.91	4.98
12/20/23 9:46	189,582.59	5.03
12/20/23 9:46	188,996.41	5.08
12/20/23 9:47	188,584.00	5.14
12/20/23 9:47	188,265.20	5.25
12/20/23 9:48	188,471.80	5.43
12/20/23 9:48	188,961.41	5.61
12/20/23 9:49	188,853.70	5.70
12/20/23 9:49	188,424.30	5.69
12/20/23 9:50	188,311.91	5.62
12/20/23 9:50	188,370.30	5.47
12/20/23 9:51	188,663.70	5.34
12/20/23 9:51	189,083.80	5.25
12/20/23 9:52	189,365.70	5.17
12/20/23 9:52	189,573.20	5.13
12/20/23 9:53	189,763.00	5.13
12/20/23 9:53	189,942.80	5.12
12/20/23 9:54	189,875.20	5.12
12/20/23 9:54	189,674.50	5.23
12/20/23 9:55	189,413.20	5.36
12/20/23 9:55	189,119.41	5.51
12/20/23 9:56	189,093.30	5.65
12/20/23 9:56	189,211.20	5.69
12/20/23 9:57	189,056.50	5.61
12/20/23 9:57	188,754.91	5.50
12/20/23 9:58	188,616.09	5.36
12/20/23 9:58	188,565.09	5.23
12/20/23 9:59	188,672.70	5.08
12/20/23 9:59	188,865.50	4.96
12/20/23 10:00	189,164.08	4.93

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	Steamflow (lbs/hr)	O ₂ (%)
12/20/23 14:00	33,080.93	10.91		36,958.03	8.32		34,978.48	8.81	
12/20/23 14:00	33,122.18	10.93		37,131.02	8.34		35,227.02	8.81	
12/20/23 14:01	33,935.68	10.91		37,079.99	8.40		34,534.45	8.85	
12/20/23 14:01	34,239.67	10.88		36,984.14	8.40		34,590.76	8.94	
12/20/23 14:02	34,130.95	10.83		36,954.82	8.45		34,607.96	8.96	
12/20/23 14:02	33,876.31	10.78		36,504.92	8.44		34,873.44	8.91	
12/20/23 14:03	34,048.70	10.73		36,349.70	8.53		34,672.13	8.88	
12/20/23 14:03	34,448.89	10.69		35,864.40	8.62		34,870.51	8.92	
12/20/23 14:04	34,151.69	10.65		36,324.67	8.74		35,265.66	9.04	
12/20/23 14:04	34,401.32	10.62		35,995.64	8.79		35,371.37	9.21	
12/20/23 14:05	34,267.56	10.57		36,254.58	8.84		35,166.94	9.33	
12/20/23 14:05	34,508.61	10.53		36,156.59	8.86		35,081.70	9.48	
12/20/23 14:06	34,080.16	10.49		36,321.09	8.92		35,162.37	9.61	
12/20/23 14:06	34,605.88	10.44		35,668.05	8.97		34,791.75	9.70	
12/20/23 14:07	34,515.76	10.39		35,316.14	9.05		34,655.54	9.85	
12/20/23 14:07	34,796.14	10.32		35,016.45	9.10		34,840.56	9.96	
12/20/23 14:08	34,712.46	10.24		34,871.96	9.15		34,991.65	10.05	
12/20/23 14:08	35,329.02	10.16		34,799.72	9.19		34,698.88	10.14	
12/20/23 14:09	35,296.12	10.08		34,824.76	9.21		34,641.58	10.27	
12/20/23 14:09	34,984.98	9.99		34,802.59	9.24		34,732.04	10.38	
12/20/23 14:10	34,562.98	9.89		34,865.52	9.27		34,299.93	10.51	
12/20/23 14:10	34,830.48	9.84		34,896.64	9.31		34,820.64	10.59	
12/20/23 14:11	35,255.34	9.85		35,035.05	9.34		35,118.79	10.67	
12/20/23 14:11	35,134.47	9.87		35,339.75	9.35		35,494.20	10.72	
12/20/23 14:12	35,309.71	9.90		35,591.52	9.31		35,220.70	10.72	
12/20/23 14:12	35,600.11	9.91		35,222.45	9.28		35,120.96	10.76	
12/20/23 14:13	35,062.94	9.88		35,201.70	9.27		35,171.60	10.78	
12/20/23 14:13	34,345.53	9.85		35,221.73	9.29		35,135.40	10.75	
12/20/23 14:14	34,066.57	9.81		35,281.46	9.27		35,405.13	10.66	
12/20/23 14:14	34,122.37	9.84		35,592.95	9.25		35,292.52	10.56	
12/20/23 14:15	34,261.13	9.94		36,009.95	9.20		35,603.77	10.42	
12/20/23 14:15	33,829.11	10.03		36,062.88	9.15		35,881.81	10.30	
12/20/23 14:16	34,057.27	10.11		36,045.00	9.07		35,613.29	10.15	
12/20/23 14:16	33,862.01	10.16		36,291.77	9.07		35,496.23	10.06	
12/20/23 14:17	33,822.96	10.19		35,991.08	8.99		35,673.65	9.98	
12/20/23 14:17	33,136.96	10.22		36,154.44	8.95		35,687.23	9.90	
12/20/23 14:18	33,180.36	10.25		36,195.20	8.94		35,691.99	9.85	
12/20/23 14:18	32,937.88	10.30		36,296.77	8.95		35,786.53	9.84	
12/20/23 14:19	33,077.36	10.38		35,986.36	8.95		36,028.52	9.81	

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	Steamflow (lbs/hr)	O ₂ (%)
12/20/23 14:19	33,067.35	10.44		36,114.38	8.95		36,091.39		9.76
12/20/23 14:20	33,337.00	10.48		36,218.81	8.89		36,023.79		9.69
12/20/23 14:20	33,033.73	10.51		36,232.76	8.92		36,016.22		9.66
12/20/23 14:21	32,492.27	10.52		36,235.27	8.95		35,843.93		9.62
12/20/23 14:21	32,294.86	10.53		36,455.56	8.99		35,370.02		9.57
12/20/23 14:22	32,633.18	10.56		36,665.14	9.01		35,554.77		9.61
12/20/23 14:22	33,103.11	10.58		37,295.29	9.04		35,432.73		9.63
12/20/23 14:23	33,172.49	10.59		37,472.68	9.01		35,537.75		9.67
12/20/23 14:23	33,276.20	10.57		37,916.13	8.99		34,960.35		9.67
12/20/23 14:24	33,400.30	10.51		37,891.82	8.97		34,829.34		9.69
12/20/23 14:24	33,437.14	10.45		37,922.58	8.97		34,550.00		9.70
12/20/23 14:25	33,584.48	10.40		37,797.41	8.99		34,671.64		9.74
12/20/23 14:25	33,673.18	10.36		37,863.93	9.01		34,619.42		9.72
12/20/23 14:26	33,641.70	10.33		37,835.31	9.01		34,774.88		9.73
12/20/23 14:26	33,879.89	10.32		37,537.77	9.00		34,606.13		9.70
12/20/23 14:27	33,995.05	10.31		37,095.02	8.98		35,008.61		9.70
12/20/23 14:27	34,609.46	10.30		36,516.72	8.97		34,961.23		9.65
12/20/23 14:28	34,736.06	10.29		36,205.93	8.97		35,065.67		9.63
12/20/23 14:28	34,944.20	10.25		35,784.64	8.99		34,646.92		9.59
12/20/23 14:29	34,694.58	10.19		35,874.77	8.98		34,472.87		9.62
12/20/23 14:29	34,932.05	10.13		36,202.36	8.96		34,041.05		9.68
12/20/23 14:30	34,763.95	10.09		36,601.48	8.89		34,253.68		9.77
12/20/23 14:30	34,640.21	10.06		37,125.05	8.80		34,042.98		9.82
12/20/23 14:31	34,623.29	10.07		37,354.65	8.68		33,889.39		9.83
12/20/23 14:31	34,304.05	10.08		37,308.16	8.59		33,316.98		9.82
12/20/23 14:32	33,704.65	10.11		37,625.74	8.50		32,955.80		9.89
12/20/23 14:32	34,055.84	10.15		37,677.96	8.42		33,158.77		9.92
12/20/23 14:33	34,565.12	10.19		38,112.84	8.36		33,414.80		9.97
12/20/23 14:33	34,896.29	10.21		38,314.55	8.27		33,129.33		9.97
12/20/23 14:34	34,760.38	10.21		38,557.02	8.19		32,912.80		9.97
12/20/23 14:34	34,922.39	10.18		38,431.85	8.07		32,648.88		9.95
12/20/23 14:35	34,566.55	10.11		38,263.75	8.01		32,574.62		9.97
12/20/23 14:35	34,628.77	10.08		37,617.88	7.99		32,353.00		9.93
12/20/23 14:35	34,582.99	10.10		37,697.98	8.05		33,102.47		9.94
12/20/23 14:36	35,166.66	10.12		37,188.71	8.06		33,611.34		9.88
12/20/23 14:36	35,377.66	10.14		37,070.69	8.08		33,998.41		9.81
12/20/23 14:37	35,386.24	10.13		37,123.26	8.10		34,233.14		9.64
12/20/23 14:38	35,162.37	10.10		36,979.14	8.13		34,659.70		9.51
12/20/23 14:38	34,937.05	10.09		36,897.60	8.14		35,003.91		9.36

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	M_313-O2/AI1/PV.CV	O ₂ (%)
	Steamflow (lbs/hr)			Steamflow (lbs/hr)			Steamflow (lbs/hr)		
12/20/23 14:39	34,790.43	10.09		36,120.10	8.20		35,485.55		9.26
12/20/23 14:39	34,668.11	10.11		35,809.67	8.29		35,579.69		9.11
12/20/23 14:40	34,770.40	10.17		35,241.76	8.37		36,176.45		9.01
12/20/23 14:40	34,912.73	10.22		34,724.62	8.47		36,506.76		8.90
12/20/23 14:41	34,735.34	10.25		34,714.96	8.53		36,962.86		8.78
12/20/23 14:41	34,661.68	10.29		34,440.66	8.63		37,623.57		8.68
12/20/23 14:42	34,571.55	10.34		33,786.19	8.71		37,685.77		8.52
12/20/23 14:42	34,616.62	10.36		33,512.24	8.79		37,949.03		8.44
12/20/23 14:43	34,309.77	10.37		33,436.43	8.82		38,024.13		8.32
12/20/23 14:43	34,746.80	10.37		32,883.52	8.87		38,413.20		8.27
12/20/23 14:44	35,048.63	10.37		32,834.88	8.95		38,510.96		8.17
12/20/23 14:44	34,832.98	10.37		32,884.59	8.99		38,501.45		8.16
12/20/23 14:45	34,634.49	10.38		33,254.75	9.02		38,278.60		8.14
12/20/23 14:45	34,993.56	10.40		33,326.98	9.02		38,197.09		8.18
12/20/23 14:46	34,679.56	10.42		33,475.05	9.01		37,498.62		8.21
12/20/23 14:46	34,541.51	10.42		33,278.35	9.01		36,888.98		8.32
12/20/23 14:47	34,900.57	10.40		33,437.14	9.02		36,750.24		8.50
12/20/23 14:47	35,166.66	10.39		33,662.45	9.02		36,505.07		8.66
12/20/23 14:48	35,554.09	10.39		34,037.25	9.02		36,451.67		8.78
12/20/23 14:48	35,741.01	10.35		33,985.75	9.00		36,248.14		8.93
12/20/23 14:49	35,881.21	10.27		34,399.89	8.99		36,020.63		9.03
12/20/23 14:49	35,716.70	10.20		34,140.24	8.99		36,230.00		9.15
12/20/23 14:50	35,753.88	10.12		34,433.50	9.05		36,033.48		9.22
12/20/23 14:50	35,525.01	10.06		34,213.92	9.09		36,540.27		9.33
12/20/23 14:51	35,455.27	10.03		34,133.09	9.14		36,533.55		9.35
12/20/23 14:51	35,270.37	10.01		33,936.39	9.18		36,987.04		9.39
12/20/23 14:52	35,496.39	10.01		33,830.54	9.25		36,790.80		9.41
12/20/23 14:52	35,546.46	10.00		33,438.57	9.29		37,089.94		9.46
12/20/23 14:53	35,288.24	10.00		33,542.29	9.34		36,613.36		9.48
12/20/23 14:53	34,973.53	9.99		33,520.82	9.39		36,560.57		9.54
12/20/23 14:54	34,851.23	9.99		34,068.00	9.40		36,055.70		9.61
12/20/23 14:54	34,928.47	9.98		34,049.41	9.36		36,013.35		9.72
12/20/23 14:55	34,647.37	9.99		34,796.86	9.30		35,969.95		9.80
12/20/23 14:55	34,658.82	9.99		35,189.54	9.21		36,061.62		9.82
12/20/23 14:56	34,395.59	9.99		35,685.94	9.13		35,822.99		9.88
12/20/23 14:56	33,818.38	10.01		36,272.45	9.03		35,286.23		9.90
12/20/23 14:57	33,334.14	10.04		36,352.57	8.91		34,830.34		9.98
12/20/23 14:57	33,301.95	10.08		36,774.57	8.84		34,528.91		10.04
12/20/23 14:58	33,484.70	10.15		37,416.53	8.79		34,951.70		10.15

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	M_313-O2/AI1/PV.CV	O ₂ (%)
	Steamflow (lbs/hr)			Steamflow (lbs/hr)			Steamflow (lbs/hr)		
12/20/23 14:58	33,750.43	10.22		37,906.84	8.71		34,615.71	10.21	
12/20/23 14:59	33,543.71	10.29		38,358.18	8.60		34,305.30	10.27	
12/20/23 14:59	33,638.84	10.33		38,438.29	8.50		33,838.07	10.29	
12/20/23 15:00	34,129.52	10.33		38,324.55	8.44		33,671.99	10.36	
12/20/23 15:00	34,004.34	10.32		38,220.84	8.41		33,350.99	10.40	
12/20/23 15:01	34,364.84	10.29		38,485.49	8.41		33,294.20	10.47	
12/20/23 15:01	34,510.76	10.26		38,158.62	8.45		33,358.84	10.51	
12/20/23 15:02	34,285.45	10.25		38,183.65	8.45		33,747.67	10.55	
12/20/23 15:02	34,232.52	10.23		38,073.50	8.47		33,992.38	10.51	
12/20/23 15:03	34,232.52	10.23		37,837.46	8.52		34,179.91	10.45	
12/20/23 15:03	34,034.38	10.25		37,613.58	8.60		34,521.34	10.40	
12/20/23 15:04	34,288.30	10.31		36,946.95	8.67		34,421.32	10.34	
12/20/23 15:04	34,045.83	10.34		36,249.57	8.75		34,584.17	10.30	
12/20/23 15:05	34,154.55	10.35		36,137.75	8.82		34,570.20	10.25	
12/20/23 15:05	34,050.84	10.35		35,806.10	8.92		35,120.73	10.24	
12/20/23 15:06	34,119.51	10.35		35,705.96	9.00		35,143.98	10.19	
12/20/23 15:06	34,216.78	10.35		35,633.73	9.07		35,514.88	10.20	
12/20/23 15:07	34,191.75	10.36		35,798.23	9.12		35,462.68	10.17	
12/20/23 15:07	34,063.71	10.36		35,370.50	9.17		35,620.91	10.18	
12/20/23 15:08	34,133.09	10.36		35,158.79	9.22		35,129.87	10.15	
12/20/23 15:08	34,215.35	10.37		35,063.66	9.27		35,619.30	10.18	
12/20/23 15:09	34,725.34	10.36		35,240.32	9.30		35,683.97	10.19	
12/20/23 15:09	34,787.56	10.36		35,497.11	9.34		35,850.89	10.25	
12/20/23 15:10	34,820.46	10.35		35,184.54	9.36		35,740.27	10.26	
12/20/23 15:10	34,837.63	10.35		35,379.80	9.41		35,594.05	10.31	
12/20/23 15:11	34,861.23	10.35		34,979.26	9.43		35,529.84	10.34	
12/20/23 15:11	34,807.95	10.35		35,186.32	9.46		35,419.39	10.38	
12/20/23 15:12	34,591.58	10.34		34,977.82	9.46		35,733.21	10.43	
12/20/23 15:12	34,580.13	10.34		35,477.09	9.45		35,362.84	10.40	
12/20/23 15:13	34,399.18	10.33		35,289.68	9.40		35,716.41	10.42	
12/20/23 15:13	34,628.77	10.33		35,624.43	9.41		35,081.58	10.42	
12/20/23 15:14	34,362.70	10.35		35,600.11	9.38		35,299.72	10.45	
12/20/23 15:14	34,515.05	10.36		35,741.73	9.33		35,197.52	10.42	
12/20/23 15:15	34,265.06	10.35		35,815.40	9.28		35,323.97	10.41	
12/20/23 15:15	34,185.31	10.34		35,916.97	9.25		35,089.84	10.39	
12/20/23 15:16	34,346.96	10.30		35,846.16	9.20		35,168.71	10.35	
12/20/23 15:16	34,211.77	10.27		36,034.27	9.15		35,046.32	10.33	
12/20/23 15:17	34,520.05	10.25		36,061.45	9.10		35,023.91	10.32	
12/20/23 15:17	34,351.96	10.23		35,710.25	9.08		35,451.24	10.31	

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	M_313-O2/AI1/PV.CV	O ₂ (%)
	Steamflow (lbs/hr)			Steamflow (lbs/hr)			Steamflow (lbs/hr)		
12/20/23 15:18	34,364.13	10.21		36,124.39	9.05		35,177.51	10.26	
12/20/23 15:18	33,827.91	10.19		36,144.90	9.02		35,088.89	10.23	
12/20/23 15:19	33,963.58	10.18		35,806.82	9.05		34,618.77	10.23	
12/20/23 15:19	34,457.11	10.19		35,857.60	9.09		35,097.68	10.28	
12/20/23 15:20	34,979.97	10.24		36,193.06	9.13		35,324.44	10.33	
12/20/23 15:20	35,374.80	10.28		36,159.45	9.09		35,249.45	10.32	
12/20/23 15:21	35,045.06	10.31		36,459.86	9.05		35,131.80	10.29	
12/20/23 15:21	34,948.50	10.32		36,059.66	9.02		35,214.95	10.22	
12/20/23 15:22	35,127.31	10.29		36,175.89	9.00		35,088.64	10.16	
12/20/23 15:22	34,870.53	10.27		36,137.27	8.95		35,041.50	10.10	
12/20/23 15:23	34,746.08	10.28		35,962.75	8.96		34,999.70	10.06	
12/20/23 15:23	35,547.89	10.28		35,822.55	8.95		34,947.31	10.01	
12/20/23 15:24	35,395.54	10.27		35,733.14	8.95		35,237.45	9.97	
12/20/23 15:24	35,931.27	10.26		35,647.32	8.93		35,154.13	9.92	
12/20/23 15:25	35,556.12	10.25		35,549.32	8.89		35,390.00	9.83	
12/20/23 15:25	35,543.60	10.23		35,102.99	8.86		34,880.52	9.74	
12/20/23 15:26	34,777.55	10.19		35,061.52	8.86		34,880.67	9.67	
12/20/23 15:26	34,999.99	10.18		35,276.09	8.83		35,135.45	9.65	
12/20/23 15:27	34,984.26	10.22		35,633.01	8.77		35,613.45	9.58	
12/20/23 15:27	35,291.82	10.25		35,961.32	8.66		35,949.56	9.50	
12/20/23 15:28	35,274.66	10.30		35,997.08	8.54		35,883.55	9.30	
12/20/23 15:28	35,106.21	10.33		35,898.02	8.45		35,556.13	9.17	
12/20/23 15:29	34,921.31	10.32		35,692.38	8.39		35,071.65	9.08	
12/20/23 15:29	34,992.84	10.32		35,761.04	8.36		35,112.82	9.06	
12/20/23 15:30	35,411.27	10.35		35,717.41	8.31		35,090.95	8.99	
12/20/23 15:30	35,649.46	10.37		35,860.46	8.27		35,729.89	9.00	
12/20/23 15:31	35,650.89	10.38		36,131.55	8.19		35,720.82	8.88	
12/20/23 15:31	35,699.52	10.39		35,775.34	8.12		35,921.63	8.81	
12/20/23 15:32	35,736.36	10.38		35,341.54	8.06		35,698.59	8.67	
12/20/23 15:32	35,478.28	10.36		34,732.01	8.05		35,514.64	8.56	
12/20/23 15:33	35,756.04	10.34		34,412.05	8.07		35,784.13	8.51	
12/20/23 15:33	35,745.30	10.32		34,505.04	8.08		36,225.13	8.44	
12/20/23 15:34	36,220.95	10.30		34,270.43	8.12		36,753.46	8.43	
12/20/23 15:34	36,572.87	10.31		34,447.81	8.13		36,332.32	8.37	
12/20/23 15:35	36,771.71	10.35		34,198.19	8.10		36,528.71	8.37	
12/20/23 15:35	36,743.10	10.36		34,331.22	8.07		36,297.67	8.28	
12/20/23 15:36	36,610.06	10.31		33,993.62	8.06		36,328.05	8.18	
12/20/23 15:36	36,121.54	10.28		33,963.58	8.08		35,727.53	8.06	
12/20/23 15:37	36,003.52	10.27		33,786.19	8.11		35,932.33	8.08	

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	Steamflow (lbs/hr)	O ₂ (%)
12/20/23 15:37	36,132.27	10.26		33,955.70	8.16		36,260.06		8.05
12/20/23 15:38	36,445.55	10.26		33,972.16	8.16		36,503.84		7.99
12/20/23 15:38	36,611.49	10.26		34,006.13	8.19		36,657.72		7.92
12/20/23 15:39	36,592.18	10.25		33,853.43	8.20		36,584.70		7.84
12/20/23 15:39	36,856.82	10.24		33,610.23	8.26		36,492.42		7.87
12/20/23 15:40	36,884.73	10.21		33,799.06	8.30		36,435.93		7.89
12/20/23 15:40	36,772.43	10.18		33,821.24	8.33		36,751.87		7.98
12/20/23 15:41	36,341.84	10.16		34,137.38	8.35		36,477.73		8.06
12/20/23 15:41	36,645.12	10.15		34,123.80	8.35		36,352.84		8.19
12/20/23 15:42	36,056.45	10.16		34,750.02	8.36		36,067.13		8.31
12/20/23 15:42	35,940.57	10.18		35,170.95	8.32		35,962.48		8.46
12/20/23 15:43	35,663.05	10.22		35,639.45	8.29		35,417.13		8.58
12/20/23 15:43	35,416.28	10.26		35,889.79	8.20		34,848.22		8.74
12/20/23 15:44	34,790.42	10.31		36,218.09	8.14		34,018.02		8.87
12/20/23 15:44	34,810.45	10.37		36,372.59	8.05		33,667.59		9.07
12/20/23 15:45	34,818.32	10.42		36,650.84	8.03		33,347.94		9.29
12/20/23 15:45	35,089.77	10.46		36,564.64	8.00		33,317.32		9.43
12/20/23 15:46	35,737.44	10.49		36,697.33	8.02		33,366.95		9.54
12/20/23 15:46	36,098.65	10.49		36,634.38	8.02		33,404.19		9.60
12/20/23 15:47	36,021.39	10.47		36,464.86	8.06		33,416.39		9.67
12/20/23 15:47	35,494.96	10.43		36,276.75	8.09		33,588.45		9.69
12/20/23 15:48	35,175.24	10.38		36,026.41	8.15		33,844.42		9.69
12/20/23 15:48	35,513.56	10.34		35,503.55	8.27		34,049.63		9.66
12/20/23 15:49	35,635.51	10.34		35,314.71	8.42		34,885.43		9.68
12/20/23 15:49	35,802.53	10.34		34,808.30	8.58		35,500.87		9.61
12/20/23 15:50	35,500.69	10.33		34,491.45	8.69		35,956.40		9.57
12/20/23 15:50	35,901.95	10.32		33,897.06	8.81		35,955.79		9.49
12/20/23 15:51	35,608.69	10.31		34,256.84	8.91		36,115.58		9.49
12/20/23 15:51	35,374.80	10.31		34,364.13	8.97		35,953.12		9.49
12/20/23 15:52	35,174.16	10.33		34,777.91	8.93		35,613.71		9.53
12/20/23 15:52	34,706.27	10.37		35,339.03	8.87		35,352.35		9.60
12/20/23 15:53	34,673.84	10.43		36,492.05	8.69		34,459.84		9.67
12/20/23 15:53	33,655.30	10.47		37,828.16	8.49		34,092.83		9.76
12/20/23 15:53	33,713.95	10.51		38,369.62	8.19		33,283.05		9.83
12/20/23 15:54	33,176.78	10.53		39,329.51	7.94		33,040.71		9.91
12/20/23 15:55	33,096.67	10.54		39,787.28	7.68		32,685.25		9.93
12/20/23 15:55	33,102.03	10.54		40,083.03	7.51		32,646.26		9.94
12/20/23 15:56	33,487.21	10.52		39,817.32	7.40		32,415.87		9.96
12/20/23 15:56	34,064.43	10.50		39,999.71	7.41		32,189.75		10.02

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	M_313-O2/AI1/PV.CV	O ₂ (%)
	Steamflow (lbs/hr)			Steamflow (lbs/hr)			Steamflow (lbs/hr)		
12/20/23 15:57	34,133.81	10.48		39,727.91	7.44		32,326.04		10.10
12/20/23 15:57	34,450.68	10.46		39,861.66	7.49		31,910.81		10.19
12/20/23 15:58	34,248.25	10.46		39,391.02	7.53		32,249.95		10.27
12/20/23 15:58	34,889.13	10.46		38,964.71	7.58		31,865.29		10.30
12/20/23 15:59	34,745.00	10.45		38,540.57	7.66		32,514.29		10.30
12/20/23 15:59	34,472.84	10.44		38,444.72	7.70		32,308.52		10.26
12/20/23 16:00	34,500.74	10.42		38,413.96	7.70		32,613.88		10.20
12/20/23 16:00	34,089.46	10.41		38,755.14	7.67		32,290.62		10.15
12/20/23 16:01	34,211.05	10.41		38,506.23	7.65		32,470.64		10.11
12/20/23 16:01	34,123.80	10.40		38,628.55	7.64		32,065.84		10.06
12/20/23 16:02	34,462.83	10.37		38,175.06	7.59		32,248.80		10.03
12/20/23 16:02	33,949.03	10.35		38,773.27	7.59		32,207.56		9.99
12/20/23 16:03	34,641.65	10.35		38,708.66	7.57		32,716.92		9.94
12/20/23 16:03	34,469.98	10.36		39,287.30	7.52		32,730.04		9.86
12/20/23 16:04	34,603.74	10.40		39,256.55	7.41		32,906.02		9.78
12/20/23 16:04	34,464.98	10.41		39,385.30	7.39		32,935.30		9.64
12/20/23 16:05	34,726.05	10.39		38,489.07	7.39		33,187.47		9.52
12/20/23 16:05	34,067.29	10.38		38,404.67	7.43		32,802.08		9.36
12/20/23 16:06	34,583.00	10.38		37,505.57	7.46		33,329.61		9.27
12/20/23 16:06	35,058.65	10.39		37,486.98	7.55		33,706.14		9.16
12/20/23 16:07	35,499.97	10.41		37,061.39	7.60		34,453.41		9.09
12/20/23 16:07	35,661.62	10.41		36,929.07	7.66		34,452.52		8.94
12/20/23 16:08	35,380.52	10.39		36,534.25	7.64		34,991.89		8.82
12/20/23 16:08	34,685.28	10.37		36,323.24	7.67		34,789.62		8.59
12/20/23 16:09	34,332.65	10.35		35,730.64	7.73		35,195.92		8.44
12/20/23 16:09	34,392.02	10.35		35,406.27	7.83		35,773.09		8.28
12/20/23 16:10	34,834.05	10.40		35,187.39	7.94		36,595.07		8.21
12/20/23 16:10	35,074.38	10.44		34,831.91	7.98		37,177.86		8.04
12/20/23 16:11	35,067.95	10.50		34,663.82	8.03		37,694.30		7.89
12/20/23 16:11	35,288.96	10.51		34,256.12	8.06		37,666.23		7.71
12/20/23 16:12	35,140.19	10.48		33,967.16	8.11		37,388.92		7.64
12/20/23 16:12	34,890.20	10.45		33,619.53	8.18		37,104.85		7.63
12/20/23 16:13	35,327.23	10.42		33,131.72	8.31		37,223.30		7.64
12/20/23 16:13	36,027.84	10.40		33,058.05	8.42		37,695.19		7.70
12/20/23 16:14	36,557.85	10.39		33,161.05	8.51		37,600.34		7.69
12/20/23 16:14	35,386.24	10.36		33,403.52	8.53		38,270.59		7.73
12/20/23 16:15	35,749.60	10.31		33,376.34	8.51		37,945.42		7.70
12/20/23 16:15	35,929.84	10.29		33,153.89	8.51		37,815.20		7.72
12/20/23 16:16	35,962.75	10.33		33,103.11	8.55		37,178.43		7.73

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	M_313-O2/AI1/PV.CV	O ₂ (%)
	Steamflow (lbs/hr)			Steamflow (lbs/hr)			Steamflow (lbs/hr)		
12/20/23 16:16	35,681.65	10.30		33,226.13	8.60		37,038.07	7.90	
12/20/23 16:17	35,075.81	10.19		33,831.97	8.59		37,573.56	8.03	
12/20/23 16:17	35,759.61	10.18		33,697.49	8.59		37,622.00	8.13	
12/20/23 16:18	36,530.67	10.30		33,501.52	8.56		36,628.70	8.16	
12/20/23 16:18	36,664.42	10.32		33,406.38	8.62		36,731.62	8.32	
12/20/23 16:19	36,974.84	10.19		33,581.63	8.64		35,989.57	8.44	
12/20/23 16:19	36,707.58	10.10		33,483.63	8.68		36,259.84	8.62	
12/20/23 16:20	36,549.27	10.07		33,270.48	8.69		35,190.51	8.71	
12/20/23 16:20	36,301.07	10.03		33,333.43	8.74		35,314.41	8.86	
12/20/23 16:21	36,478.45	9.98		33,500.09	8.80		35,061.38	8.96	
12/20/23 16:21	36,665.85	9.96		33,864.87	8.84		35,684.12	9.13	
12/20/23 16:22	37,167.97	9.97		34,192.46	8.81		35,353.36	9.18	
12/20/23 16:22	36,792.81	9.97		34,450.68	8.79		35,296.27	9.27	
12/20/23 16:23	36,762.41	9.98		34,598.73	8.69		34,665.25	9.33	
12/20/23 16:23	36,097.21	9.97		34,140.96	8.66		34,280.55	9.42	
12/20/23 16:24	36,357.58	9.96		33,365.62	8.70		34,489.05	9.54	
12/20/23 16:24	36,106.52	9.96		34,206.05	8.92		34,611.00	9.67	
12/20/23 16:25	36,386.19	9.98		34,565.12	8.83		34,831.74	9.72	
12/20/23 16:25	36,896.16	9.98		34,419.20	8.80		34,705.56	9.75	
12/20/23 16:26	37,091.07	9.95		34,148.48	8.76		35,037.43	9.79	
12/20/23 16:26	37,188.71	9.91		34,321.92	8.77		34,608.54	9.82	
12/20/23 16:27	36,898.32	9.88		33,937.11	8.80		34,821.23	9.89	
12/20/23 16:27	36,630.09	9.86		33,411.39	8.98		34,138.16	9.95	
12/20/23 16:28	36,596.48	9.87		33,216.12	9.28		34,238.67	10.03	
12/20/23 16:28	36,479.16	9.86		33,750.43	9.32		34,136.91	10.09	
12/20/23 16:29	37,229.48	9.84		33,537.27	9.34		34,465.67	10.17	
12/20/23 16:29	37,085.35	9.82		33,914.94	9.44		34,428.52	10.23	
12/20/23 16:30	37,304.59	9.80		33,460.02	9.46		34,386.11	10.31	
12/20/23 16:30	36,939.80	9.79		33,794.06	9.45		34,344.73	10.33	
12/20/23 16:31	36,983.43	9.79		33,050.90	9.39		33,944.45	10.33	
12/20/23 16:31	36,813.91	9.78		32,438.63	9.38		33,613.02	10.35	
12/20/23 16:32	37,125.77	9.77		32,551.64	9.36		33,757.19	10.34	
12/20/23 16:32	37,291.71	9.74		32,714.72	9.36		33,994.32	10.32	
12/20/23 16:33	37,355.01	9.70		33,145.67	9.38		34,311.77	10.27	
12/20/23 16:33	37,699.41	9.67		32,854.20	9.41		34,369.77	10.22	
12/20/23 16:34	37,284.56	9.64		32,791.97	9.47		34,486.02	10.17	
12/20/23 16:34	37,393.27	9.62		32,650.34	9.49		34,927.90	10.03	
12/20/23 16:35	36,914.77	9.59		32,725.46	9.53		34,774.43	9.93	
12/20/23 16:35	36,698.76	9.56		32,278.41	9.53		34,482.69	9.93	

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	M_313-O2/AI1/PV.CV	O ₂ (%)
	Steamflow (lbs/hr)			Steamflow (lbs/hr)			Steamflow (lbs/hr)		
12/20/23 16:36	36,625.09	9.54		32,449.36	9.52		34,444.20		9.93
12/20/23 16:36	36,765.28	9.53		32,461.28	9.49		34,506.73		9.86
12/20/23 16:37	36,901.89	9.52		32,533.76	9.50		35,369.94		9.78
12/20/23 16:37	36,881.15	9.53		32,744.77	9.51		35,523.88		9.69
12/20/23 16:38	36,896.88	9.54		32,698.27	9.52		35,699.66		9.61
12/20/23 16:38	36,924.06	9.55		32,594.55	9.52		35,560.69		9.53
12/20/23 16:39	36,690.17	9.56		32,422.18	9.54		35,636.34		9.52
12/20/23 16:39	36,119.04	9.56		32,133.56	9.56		35,610.97		9.51
12/20/23 16:40	36,150.14	9.56		32,137.50	9.57		35,840.79		9.49
12/20/23 16:40	35,904.81	9.57		31,724.79	9.56		36,150.07		9.45
12/20/23 16:41	36,132.27	9.58		32,001.61	9.55		35,878.81		9.41
12/20/23 16:41	35,793.94	9.58		31,996.59	9.54		36,537.79		9.49
12/20/23 16:42	36,027.84	9.57		32,261.25	9.50		36,394.03		9.47
12/20/23 16:42	35,505.69	9.57		32,292.00	9.45		36,357.29		9.45
12/20/23 16:43	35,445.96	9.57		32,496.56	9.42		36,274.88		9.42
12/20/23 16:43	35,445.61	9.59		32,785.53	9.42		36,841.51		9.39
12/20/23 16:44	35,415.56	9.66		32,834.89	9.42		36,991.23		9.34
12/20/23 16:44	35,278.95	9.73		33,434.99	9.39		37,389.08		9.29
12/20/23 16:45	35,650.89	9.80		33,424.98	9.32		37,115.48		9.19
12/20/23 16:45	35,733.86	9.85		33,339.14	9.26		37,068.53		9.11
12/20/23 16:46	35,459.91	9.87		33,442.15	9.17		36,502.67		9.00
12/20/23 16:46	35,211.72	9.89		32,986.17	9.10		35,583.30		8.94
12/20/23 16:47	35,346.91	9.90		33,139.59	9.04		35,787.16		8.90
12/20/23 16:47	35,639.45	9.92		33,558.73	9.00		35,978.13		8.83
12/20/23 16:48	36,542.12	9.94		33,786.91	8.90		35,340.25		8.76
12/20/23 16:48	36,587.89	9.94		34,293.31	8.78		35,270.13		8.75
12/20/23 16:49	36,620.08	9.92		34,321.93	8.66		35,053.84		8.71
12/20/23 16:49	36,198.79	9.90		34,272.57	8.55		35,544.84		8.57
12/20/23 16:50	36,231.69	9.89		34,385.58	8.46		35,075.87		8.29
12/20/23 16:50	35,766.05	9.89		34,093.75	8.38		34,297.51		8.19
12/20/23 16:51	35,680.93	9.92		34,165.28	8.34		34,341.95		8.18
12/20/23 16:51	35,887.64	9.97		34,721.05	8.30		34,796.47		8.16
12/20/23 16:52	35,998.51	10.05		34,661.68	8.25		35,339.58		8.07
12/20/23 16:52	35,801.81	10.11		35,201.70	8.14		35,836.11		7.83
12/20/23 16:53	35,621.56	10.16		35,281.81	8.05		35,521.41		7.63
12/20/23 16:53	35,188.11	10.19		35,097.99	7.96		36,007.02		7.62
12/20/23 16:54	35,399.12	10.21		34,556.53	7.91		36,098.26		7.47
12/20/23 16:54	34,824.76	10.23		34,565.11	7.92		35,832.71		7.46
12/20/23 16:55	34,706.73	10.24		34,321.92	7.91		35,858.83		7.59

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	M_313-O2/AI1/PV.CV	O ₂ (%)
	Steamflow (lbs/hr)			Steamflow (lbs/hr)			Steamflow (lbs/hr)		
12/20/23 16:55	35,175.95	10.27		34,359.84	7.94		36,081.05	7.73	
12/20/23 16:56	35,636.58	10.31		34,497.88	7.95		36,580.89	7.88	
12/20/23 16:56	35,899.09	10.33		34,400.96	7.94		36,558.60	7.92	
12/20/23 16:57	35,939.86	10.32		34,476.42	7.91		36,523.30	7.98	
12/20/23 16:57	36,116.53	10.29		34,371.99	7.91		36,232.02	8.05	
12/20/23 16:58	35,665.91	10.24		34,093.04	7.93		35,891.26	8.15	
12/20/23 16:58	35,200.98	10.20		33,602.37	7.97		34,980.48	8.22	
12/20/23 16:59	34,910.59	10.19		33,662.45	8.04		34,718.88	8.38	
12/20/23 16:59	35,974.91	10.20		33,907.79	8.09		34,974.21	8.50	
12/20/23 17:00	35,890.14	10.24		34,159.20	8.16		35,131.96	8.64	
12/20/23 17:00	36,401.93	10.25		34,512.19	8.14		34,961.18	8.70	
12/20/23 17:01	36,245.27	10.21		34,708.88	8.12		34,838.94	8.80	
12/20/23 17:01	36,477.74	10.16		34,752.52	8.05		34,580.72	8.86	
12/20/23 17:02	35,893.37	10.12		34,617.33	8.04		34,487.98	8.96	
12/20/23 17:02	35,631.58	10.09		34,338.38	8.06		33,744.32	9.01	
12/20/23 17:03	35,865.47	10.07		34,492.87	8.11		34,270.75	9.10	
12/20/23 17:03	36,192.70	10.07		34,510.75	8.17		34,206.26	9.19	
12/20/23 17:04	36,395.48	10.09		34,287.59	8.20		34,768.46	9.29	
12/20/23 17:04	36,703.76	10.09		34,632.35	8.22		34,610.37	9.32	
12/20/23 17:05	36,425.52	10.07		34,346.25	8.26		34,927.84	9.35	
12/20/23 17:05	35,970.62	10.04		34,489.30	8.31		34,439.50	9.36	
12/20/23 17:06	35,973.48	10.01		33,614.52	8.37		34,437.63	9.40	
12/20/23 17:06	35,516.42	9.99		33,648.86	8.47		34,262.38	9.44	
12/20/23 17:07	35,691.66	10.00		33,777.97	8.57		34,746.41	9.53	
12/20/23 17:07	35,780.35	10.01		33,872.74	8.63		34,937.19	9.56	
12/20/23 17:08	35,848.30	10.03		33,785.48	8.65		35,076.57	9.59	
12/20/23 17:08	35,760.33	10.03		34,084.45	8.67		34,735.74	9.61	
12/20/23 17:09	36,042.14	10.01		33,815.52	8.69		34,504.23	9.64	
12/20/23 17:09	35,803.24	9.98		33,622.39	8.70		34,321.00	9.67	
12/20/23 17:10	35,326.16	9.95		33,449.30	8.74		33,594.69	9.69	
12/20/23 17:10	35,161.65	9.94		33,115.27	8.78		33,565.13	9.75	
12/20/23 17:11	35,238.18	9.94		33,440.71	8.82		33,907.77	9.78	
12/20/23 17:11	35,773.20	9.94		34,044.40	8.81		34,481.89	9.82	
12/20/23 17:12	36,130.83	9.94		34,228.23	8.78		34,116.36	9.81	
12/20/23 17:12	36,148.71	9.93		34,303.32	8.72		34,059.71	9.81	
12/20/23 17:13	36,095.08	9.90		34,605.17	8.68		33,955.95	9.78	
12/20/23 17:13	35,410.56	9.87		34,684.56	8.60		33,823.33	9.79	
12/20/23 17:14	34,957.55	9.86		34,900.34	8.57		33,594.17	9.77	
12/20/23 17:14	34,911.30	9.86		34,651.66	8.53		33,531.83	9.78	

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	M_313-O2/AI1/PV.CV	O ₂ (%)
	Steamflow (lbs/hr)			Steamflow (lbs/hr)			Steamflow (lbs/hr)		
12/20/23 17:15	35,304.70	9.90		35,158.07	8.54		33,727.61	9.78	
12/20/23 17:15	35,301.13	9.94		35,293.97	8.49		33,958.77	9.76	
12/20/23 17:16	35,733.14	9.96		35,499.97	8.46		34,186.65	9.71	
12/20/23 17:16	35,540.02	9.98		35,376.94	8.38		34,352.65	9.67	
12/20/23 17:17	35,059.01	9.98		35,297.55	8.35		34,582.05	9.58	
12/20/23 17:17	34,324.07	9.99		34,625.91	8.33		34,094.50	9.48	
12/20/23 17:18	34,240.38	10.03		33,985.75	8.33		34,088.59	9.34	
12/20/23 17:18	34,444.23	10.07		34,422.78	8.38		35,015.52	9.27	
12/20/23 17:19	34,990.70	10.12		34,397.03	8.37		35,608.21	9.16	
12/20/23 17:19	34,830.48	10.17		34,654.52	8.34		35,882.53	9.06	
12/20/23 17:20	35,473.87	10.21		34,392.38	8.26		35,609.84	8.88	
12/20/23 17:20	34,985.70	10.23		34,437.80	8.24		35,599.05	8.77	
12/20/23 17:21	35,273.95	10.22		34,207.48	8.19		35,396.41	8.67	
12/20/23 17:21	34,826.18	10.21		33,628.83	8.19		34,917.17	8.66	
12/20/23 17:22	34,468.55	10.22		33,279.78	8.17		34,404.55	8.64	
12/20/23 17:22	34,652.38	10.24		33,474.34	8.19		34,597.95	8.70	
12/20/23 17:23	35,029.32	10.30		34,175.30	8.18		35,013.35	8.72	
12/20/23 17:23	35,535.38	10.34		34,199.97	8.12		35,327.75	8.67	
12/20/23 17:24	35,465.40	10.36		34,796.86	8.05		35,210.22	8.61	
12/20/23 17:24	35,699.52	10.35		34,927.75	7.90		34,664.40	8.56	
12/20/23 17:25	35,154.49	10.31		35,026.46	7.82		34,493.92	8.59	
12/20/23 17:25	35,020.74	10.29		34,680.99	7.75		33,568.02	8.61	
12/20/23 17:26	34,299.04	10.28		34,179.59	7.74		33,035.46	8.71	
12/20/23 17:26	35,152.35	10.28		34,520.77	7.78		32,984.09	8.79	
12/20/23 17:27	35,751.02	10.29		35,080.83	7.75		33,532.25	8.95	
12/20/23 17:27	35,900.52	10.31		35,588.66	7.69		33,382.63	9.03	
12/20/23 17:28	35,958.45	10.31		35,610.12	7.58		33,352.70	9.04	
12/20/23 17:28	35,964.89	10.29		36,070.75	7.46		32,892.95	9.02	
12/20/23 17:29	35,360.49	10.23		36,334.68	7.36		32,302.07	9.04	
12/20/23 17:29	34,976.39	10.19		35,894.08	7.30		31,781.29	9.16	
12/20/23 17:30	34,256.84	10.18		35,417.00	7.29		31,330.27	9.29	
12/20/23 17:30	34,957.43	10.20		35,652.68	7.39		32,158.18	9.37	
12/20/23 17:31	35,384.80	10.25		36,385.47	7.44		32,784.64	9.48	
12/20/23 17:31	35,718.84	10.29		36,071.47	7.44		32,899.46	9.51	
12/20/23 17:32	35,350.48	10.33		36,105.80	7.43		33,143.13	9.48	
12/20/23 17:32	35,315.43	10.33		36,156.58	7.45		33,338.57	9.46	
12/20/23 17:33	34,819.03	10.30		36,389.76	7.49		33,079.83	9.43	
12/20/23 17:33	34,687.43	10.28		35,733.86	7.50		32,987.58	9.46	
12/20/23 17:34	34,370.56	10.28		35,542.53	7.59		33,359.31	9.49	

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	M_313-O2/AI1/PV.CV	O ₂ (%)
	Steamflow (lbs/hr)			Steamflow (lbs/hr)			Steamflow (lbs/hr)		
12/20/23 17:34	34,399.89	10.28		35,851.88	7.69		33,863.47	9.52	
12/20/23 17:35	34,514.33	10.30		36,060.74	7.77		33,845.41	9.54	
12/20/23 17:35	34,884.12	10.31		35,833.28	7.80		34,074.37	9.55	
12/20/23 17:36	34,588.72	10.31		36,003.52	7.87		34,100.09	9.54	
12/20/23 17:36	34,510.76	10.30		35,384.09	7.92		34,033.27	9.54	
12/20/23 17:37	33,564.45	10.27		34,859.09	8.01		33,559.87	9.53	
12/20/23 17:37	34,202.71	10.25		34,452.58	8.08		33,831.46	9.56	
12/20/23 17:38	34,123.08	10.26		34,844.79	8.14		34,294.37	9.61	
12/20/23 17:38	34,524.34	10.27		35,454.91	8.11		34,469.23	9.58	
12/20/23 17:39	34,283.30	10.28		35,818.98	8.08		34,415.03	9.57	
12/20/23 17:39	34,000.77	10.28		36,009.95	8.02		34,521.62	9.50	
12/20/23 17:40	33,848.42	10.25		35,848.30	8.02		34,582.19	9.49	
12/20/23 17:40	33,575.18	10.23		35,074.03	8.02		33,959.45	9.47	
12/20/23 17:41	33,515.11	10.22		34,844.79	8.08		33,785.51	9.48	
12/20/23 17:41	33,715.38	10.22		34,626.63	8.15		34,121.59	9.48	
12/20/23 17:42	33,780.47	10.21		34,551.52	8.20		34,371.92	9.50	
12/20/23 17:42	33,904.92	10.21		35,115.88	8.20		34,775.94	9.45	
12/20/23 17:43	33,910.64	10.19		35,301.12	8.18		35,231.39	9.40	
12/20/23 17:43	33,776.89	10.18		35,610.84	8.14		35,453.52	9.30	
12/20/23 17:44	33,382.78	10.18		35,345.11	8.11		35,800.58	9.21	
12/20/23 17:44	32,756.92	10.19		35,033.62	8.10		35,491.70	9.09	
12/20/23 17:45	32,347.79	10.23		34,952.07	8.15		35,751.66	9.03	
12/20/23 17:45	32,568.09	10.27		34,881.98	8.16		35,842.80	8.94	
12/20/23 17:46	32,728.60	10.33		34,468.98	8.20		36,622.33	8.88	
12/20/23 17:46	33,212.55	10.38		34,432.07	8.24		36,410.06	8.82	
12/20/23 17:47	33,083.08	10.41		34,372.70	8.24		37,074.59	8.74	
12/20/23 17:47	32,862.06	10.41		33,964.65	8.23		36,453.43	8.61	
12/20/23 17:48	32,730.46	10.39		33,240.45	8.24		36,673.72	8.50	
12/20/23 17:48	32,926.44	10.38		33,404.24	8.32		36,581.57	8.41	
12/20/23 17:49	33,197.52	10.39		33,154.61	8.39		37,108.08	8.37	
12/20/23 17:49	33,885.61	10.41		33,403.52	8.42		37,424.70	8.25	
12/20/23 17:50	34,085.88	10.43		33,439.29	8.35		37,886.49	8.14	
12/20/23 17:50	34,649.52	10.43		33,514.39	8.32		37,498.54	7.97	
12/20/23 17:51	34,334.44	10.38		33,273.34	8.28		37,188.52	7.91	
12/20/23 17:51	33,929.25	10.34		33,215.41	8.26		36,530.00	7.85	
12/20/23 17:52	33,815.52	10.29		32,877.09	8.28		36,452.61	7.88	
12/20/23 17:52	34,540.80	10.27		33,153.18	8.31		36,632.63	7.93	
12/20/23 17:53	34,974.96	10.28		33,515.11	8.34		36,753.48	8.01	
12/20/23 17:53	35,594.38	10.27		33,232.57	8.31		36,586.18	8.07	

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	M_313-O2/AI1/PV.CV	O ₂ (%)
	Steamflow (lbs/hr)			Steamflow (lbs/hr)			Steamflow (lbs/hr)		
12/20/23 17:54	35,527.87	10.23		33,207.54	8.27		36,752.02		8.06
12/20/23 17:54	35,827.20	10.18		32,977.94	8.25		36,613.72		8.08
12/20/23 17:55	34,803.65	10.12		32,642.47	8.30		35,830.30		8.18
12/20/23 17:55	35,282.17	10.08		32,389.99	8.35		35,361.71		8.27
12/20/23 17:56	35,292.54	10.06		32,535.54	8.46		35,803.58		8.42
12/20/23 17:56	35,758.89	10.05		32,745.48	8.51		35,744.06		8.50
12/20/23 17:57	35,746.02	10.03		33,141.73	8.52		36,068.56		8.59
12/20/23 17:57	36,008.16	10.00		33,286.93	8.49		35,551.04		8.64
12/20/23 17:58	35,458.12	9.95		33,682.83	8.43		35,378.10		8.74
12/20/23 17:58	35,212.79	9.91		33,779.75	8.31		34,167.01		8.83
12/20/23 17:59	34,063.00	9.86		34,039.39	8.27		33,824.19		9.01
12/20/23 17:59	34,674.55	9.85		34,370.56	8.22		33,345.75		9.16
12/20/23 18:00	34,155.27	9.88		35,198.13	8.17		33,278.02		9.36
12/20/23 18:00	34,504.32	9.92		35,887.64	8.04		32,384.99		9.51
12/20/23 18:01	34,652.02	9.97		36,269.59	7.92		32,422.51		9.68
12/20/23 18:01	32,787.32	9.99		37,853.91	7.81		32,673.71		9.79
12/20/23 18:02	30,315.36	9.99		39,610.61	7.63		33,539.99		9.90
12/20/23 18:02	28,743.56	9.93		40,531.87	7.37		32,679.05		9.96
12/20/23 18:03	30,324.30	9.78		40,234.31	7.18		30,954.63		10.03
12/20/23 18:03	31,158.30	9.53		40,344.48	7.04		30,684.13		10.14
12/20/23 18:04	32,187.57	9.11		41,023.26	6.97		30,377.20		10.23
12/20/23 18:04	32,542.70	8.91		40,795.45	6.94		30,684.88		10.36
12/20/23 18:05	34,392.74	9.01		40,380.23	6.99		29,983.48		10.42
12/20/23 18:05	34,674.79	9.16		39,205.29	7.09		30,610.58		10.47
12/20/23 18:06	35,917.45	9.38		36,099.12	7.23		31,714.94		10.43
12/20/23 18:06	35,762.47	9.56		34,801.15	7.01		32,065.00		10.39
12/20/23 18:07	35,726.71	9.68		33,613.09	6.81		31,765.75		10.22
12/20/23 18:07	36,421.95	9.74		33,219.70	6.73		32,430.29		10.15
12/20/23 18:08	36,307.86	9.73		34,016.87	6.73		32,559.16		10.07
12/20/23 18:08	36,307.50	9.71		34,159.91	6.74		33,275.59		10.05
12/20/23 18:09	36,358.53	9.68		34,236.57	6.81		33,409.01		9.96
12/20/23 18:09	35,999.94	9.65		33,658.16	6.91		33,683.73		9.89
12/20/23 18:10	35,283.24	9.62		33,286.93	7.06		33,471.60		9.78
12/20/23 18:10	33,311.97	9.60		35,549.32	7.33		32,362.57		9.73
12/20/23 18:11	33,939.25	9.62		35,085.48	7.88		32,908.04		9.75
12/20/23 18:11	34,807.95	9.69		34,581.56	8.32		33,295.19		9.78
12/20/23 18:12	35,716.34	9.83		34,367.70	8.62		33,355.59		9.75
12/20/23 18:12	36,491.09	9.91		34,419.68	8.75		33,010.55		9.65
12/20/23 18:13	36,087.91	9.87		34,281.87	8.84		34,122.84		9.29

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	M_313-O2/AI1/PV.CV	O ₂ (%)
	Steamflow (lbs/hr)			Steamflow (lbs/hr)			Steamflow (lbs/hr)		
12/20/23 18:13	36,534.96	9.83		34,665.96	8.91		31,821.09	9.17	
12/20/23 18:14	35,404.84	9.77		34,106.63	8.87		33,875.48	8.80	
12/20/23 18:14	35,105.14	9.71		34,523.27	8.86		32,609.74	8.67	
12/20/23 18:15	34,701.38	9.65		33,746.85	8.88		34,775.34	8.70	
12/20/23 18:15	34,598.02	9.62		33,883.46	8.90		34,779.39	8.84	
12/20/23 18:16	34,584.07	9.65		33,732.90	8.93		34,988.30	9.04	
12/20/23 18:16	34,517.91	9.69		33,730.40	8.94		34,625.10	9.15	
12/20/23 18:17	34,141.68	9.74		33,573.04	8.94		34,959.66	9.20	
12/20/23 18:17	34,176.73	9.80		33,411.39	8.94		34,861.20	9.17	
12/20/23 18:18	34,206.41	9.85		33,291.94	8.95		35,168.83	9.16	
12/20/23 18:18	34,938.12	9.89		33,603.08	8.92		35,087.59	9.14	
12/20/23 18:19	35,134.95	9.91		33,660.07	8.89		35,939.48	9.10	
12/20/23 18:19	35,490.10	9.92		33,983.75	8.85		35,636.35	9.00	
12/20/23 18:20	34,761.58	9.91		33,881.32	8.81		36,009.42	8.98	
12/20/23 18:20	34,560.11	9.90		34,092.32	8.73		35,332.48	8.87	
12/20/23 18:21	34,016.50	9.90		33,181.07	8.67		34,900.68	8.85	
12/20/23 18:21	34,542.59	9.91		33,073.42	8.69		34,505.94	8.80	
12/20/23 18:22	34,991.06	9.95		33,341.66	8.72		34,928.08	8.88	
12/20/23 18:22	35,483.04	9.97		33,706.32	8.68		35,067.71	8.88	
12/20/23 18:23	35,933.18	9.99		33,683.43	8.57		35,429.73	8.83	
12/20/23 18:23	35,669.48	9.98		34,070.15	8.50		35,362.58	8.71	
12/20/23 18:24	35,361.92	9.93		33,817.66	8.45		35,255.54	8.66	
12/20/23 18:24	35,067.23	9.90		33,475.05	8.41		34,947.20	8.61	
12/20/23 18:25	34,570.84	9.91		33,150.32	8.38		34,469.38	8.55	
12/20/23 18:25	35,128.03	9.92		32,864.57	8.40		35,147.69	8.56	
12/20/23 18:26	35,810.04	9.94		33,395.29	8.41		35,164.82	8.54	
12/20/23 18:26	36,004.95	9.96		33,795.48	8.37		35,354.16	8.58	
12/20/23 18:27	35,762.48	9.96		34,251.82	8.28		35,164.87	8.56	
12/20/23 18:27	35,640.16	9.96		34,306.91	8.17		35,342.14	8.53	
12/20/23 18:28	35,808.96	9.94		34,142.75	8.11		34,564.22	8.52	
12/20/23 18:28	35,218.87	9.93		33,731.48	8.09		33,628.38	8.60	
12/20/23 18:29	35,615.12	9.93		34,085.41	8.11		33,298.71	8.70	
12/20/23 18:29	35,878.82	9.94		34,332.89	8.11		33,717.10	8.93	
12/20/23 18:30	36,684.68	9.95		34,493.11	8.07		33,514.38	9.06	
12/20/23 18:30	36,543.55	9.93		34,961.37	8.03		33,383.74	9.17	
12/20/23 18:31	36,735.95	9.85		35,165.94	7.97		32,965.40	9.22	
12/20/23 18:31	36,356.14	9.79		35,121.59	7.95		33,023.17	9.29	
12/20/23 18:32	36,354.00	9.75		34,424.57	7.96		32,346.93	9.34	
12/20/23 18:32	35,983.73	9.72		34,095.42	8.03		32,052.40	9.45	

Address Parameter units	Boiler 1			Boiler 2			Boiler 3		
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	O ₂ (%)	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	O ₂ (%)	M_312-LIC-26/AI1/PV.CV	M_313-O2/AI1/PV.CV	O ₂ (%)
	Steamflow (lbs/hr)			Steamflow (lbs/hr)			Steamflow (lbs/hr)		
12/20/23 18:33	36,556.42	9.71		34,137.39	8.10		32,595.86		9.54
12/20/23 18:33	36,813.20	9.72		34,301.19	8.16		33,050.38		9.61
12/20/23 18:34	37,162.01	9.73		34,543.65	8.15		33,200.98		9.61
12/20/23 18:34	36,640.81	9.73		34,548.66	8.16		33,668.16		9.58
12/20/23 18:35	36,570.73	9.68		34,487.51	8.16		33,645.73		9.51
12/20/23 18:35	35,743.16	9.65		33,871.66	8.18		32,976.16		9.50
12/20/23 18:36	35,295.04	9.64		33,150.67	8.24		32,537.25		9.49
12/20/23 18:36	35,633.72	9.66		33,162.48	8.41		33,163.45		9.60
12/20/23 18:37	35,870.48	9.74		33,711.09	8.49		33,534.67		9.63
12/20/23 18:37	36,007.81	9.80		34,276.15	8.49		33,902.74		9.67
12/20/23 18:38	35,909.11	9.84		34,951.36	8.40		33,521.83		9.64
12/20/23 18:38	36,239.20	9.87		34,883.41	8.34		33,307.66		9.68
12/20/23 18:39	35,279.43	9.87		34,832.15	8.30		32,960.28		9.71
12/20/23 18:39	34,661.43	9.88		34,667.64	8.25		32,490.42		9.76
12/20/23 18:40	34,090.89	9.88		34,251.83	8.20		31,930.49		9.74
12/20/23 18:40	34,824.75	9.88		34,707.45	8.21		32,466.71		9.81
12/20/23 18:41	35,051.49	9.89		35,551.47	8.17		32,865.87		9.84
12/20/23 18:41	35,070.45	9.90		35,786.79	8.08		33,257.05		9.89
12/20/23 18:42	34,779.70	9.93		36,609.71	7.93		32,990.97		9.84
12/20/23 18:42	34,770.04	9.96		36,598.26	7.88		32,880.47		9.83
12/20/23 18:43	34,352.68	9.97		36,611.49	7.84		32,111.49		9.82
12/20/23 18:43	33,970.01	9.99		36,082.91	7.82		31,591.37		9.88
12/20/23 18:44	34,008.64	10.02		35,968.47	7.83		31,400.87		9.95
12/20/23 18:44	34,680.99	10.07		36,510.64	7.84		32,282.24		10.00
12/20/23 18:45	35,144.84	10.12		36,961.61	7.77		32,357.79		9.97
12/20/23 18:45	34,805.08	10.13		37,518.81	7.64		32,517.98		9.90
12/20/23 18:46	35,047.21	10.09		37,715.86	7.50		32,192.47		9.79
12/20/23 18:46	34,638.07	10.07		37,708.00	7.42		32,413.55		9.75
12/20/23 18:47	34,310.48	10.06		37,410.45	7.39		31,811.27		9.71
12/20/23 18:47	34,010.07	10.08		36,286.05	7.44		31,609.42		9.70
12/20/23 18:48	34,371.28	10.14		36,207.37	7.59		31,865.69		9.71
12/20/23 18:48	34,787.56	10.19		35,779.28	7.73		32,400.03		9.81
12/20/23 18:49	35,506.05	10.26		35,601.18	7.87		32,797.49		9.82
12/20/23 18:49	35,562.67	10.30		35,762.47	7.91		33,182.89		9.77
12/20/23 18:50	35,681.29	10.30		35,657.33	7.93		33,335.73		9.63
12/20/23 18:50	35,280.38	10.28		35,298.98	7.93		33,586.29		9.52
12/20/23 18:51	35,009.30	10.22		34,695.29	7.99		33,201.06		9.38
12/20/23 18:51	34,870.54	10.18		34,420.63	8.09		33,687.09		9.36
12/20/23 18:52	35,432.38	10.17		34,331.58	8.19		33,859.27		9.36

Address Parameter units	Boiler 1		Boiler 2		Boiler 3	
	M_112-LIC-26/AI1/PV.CV	M_113_AT_O2/AI2/PV.CV	M_212-LIC-26/AI1/PV.CV	M_213-O2/AI1/PV.CV	M_312-LIC-26/AI1/PV.CV	M_313-O2/AI1/PV.CV
	Steamflow (lbs/hr)	O ₂ (%)	Steamflow (lbs/hr)	O ₂ (%)	Steamflow (lbs/hr)	O ₂ (%)
12/20/23 18:52	35,683.08	10.16	34,705.67	8.22	34,342.30	9.36
12/20/23 18:53	36,003.76	10.17	34,462.59	8.23	34,606.39	9.28
12/20/23 18:53	35,579.72	10.15	34,414.91	8.27	35,077.46	9.21
12/20/23 18:54	35,565.54	10.10	33,925.19	8.33	34,868.96	9.09
12/20/23 18:54	34,771.82	10.07	33,399.95	8.41	34,516.94	9.02
12/20/23 18:55	35,227.45	10.06	32,726.16	8.55	34,382.52	8.98
12/20/23 18:55	35,218.16	10.07	32,802.70	8.72	34,996.44	9.02
12/20/23 18:56	36,171.24	10.09	32,511.23	8.79	35,417.50	8.99
12/20/23 18:56	36,040.35	10.10	32,597.77	8.83	36,156.78	8.95
12/20/23 18:57	36,356.86	10.11	32,551.64	8.82	35,905.95	8.79
12/20/23 18:57	35,942.01	10.10	32,628.18	8.83	36,252.46	8.69
12/20/23 18:58	35,703.11	10.10	32,136.79	8.81	35,815.02	8.56
12/20/23 18:58	34,765.03	10.10	31,533.81	8.87	35,544.84	8.52
12/20/23 18:59	35,703.35	10.10	31,430.82	8.94	35,818.26	8.50
12/20/23 18:59	35,340.82	10.12	31,452.27	9.02	36,766.19	8.55
12/20/23 19:00	35,744.23	10.16	32,023.42	9.03	36,980.92	8.46

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Enclosure 2

Supplemental Sulfur Dioxide Best Available Control Technology Analysis – Revision 1**Aurora Energy, LLC Chena Power Plant****1. Introduction**

A portion of the Fairbanks North Star Borough (FNSB) that includes the Aurora Energy, LLC (Aurora) Chena Power Plant (CPP) location has been classified as a Serious Nonattainment Area for fine particulate matter (PM_{2.5}). The Alaska Department of Environmental Conservation (ADEC) prepared a Serious PM_{2.5} Nonattainment State Implementation Plan (SIP). ADEC adopted the Serious PM_{2.5} SIP on November 19, 2019. Amendments to the SIP were adopted on November 18, 2020. The Serious PM_{2.5} SIP addresses direct PM_{2.5} emissions and precursor emissions of oxides of nitrogen (NO_x) and sulfur dioxide (SO₂). ADEC submitted the Serious PM_{2.5} SIP and the amendments to the U.S. Environmental Protection Agency (EPA) for review and approval.

Aurora owns and operates four coal-fired boilers, Emissions Units (EUs) 4 through 7, at the CPP. EUs 4 through 6 are each rated at 76.8 million British thermal units per hour (MMBtu/hr). EU 7 is rated at 254.7 MMBtu/hr. The four boilers share a common stack. The Serious PM_{2.5} SIP includes Best Available Control Technology (BACT) determinations for EUs 4 through 7. The current Title V Operating Permit for the CPP, AQ0315TVP04, Revision 2, incorporates the BACT limits that are included in the SIP. The SO₂ SIP BACT limits as included in the Title V permit are provided below.

- Condition 14 limits the block quarterly average of the sulfur content of coal delivered to the CCP to no greater than 0.25 percent by weight as received.
- Condition 15 limits sulfur compound emissions, expressed as SO₂, from the common stack at the CPP to no more than 0.301 pounds per million British thermal units (lb/MMBtu), on a three-hour average basis.

On January 10, 2023, EPA published a proposed rulemaking action¹ to partially approve and partially disapprove the Serious PM_{2.5} SIP. Table 12 in the proposed rulemaking action states that EPA proposes to disapprove the SO₂ BACT limits of 0.301 lb/MMBtu SO₂ emissions and 0.25 weight percent sulfur content of coal on the basis that “Alaska’s BACT determinations are not sufficient to meet BACT requirements. Additionally, the economic infeasibility demonstration is inadequate.” Section 8 of the EPA technical support memorandum² (herein referred to as the Technical Support Memo) states that “basic cost information necessary to process a cost effectiveness analysis of at least study-level, or +/- 30% accuracy, has not been obtained to date.” On December 5, 2023, EPA published a final rule³ approving in part and disapproving in part the Serious PM_{2.5} SIP. ADEC withdrew the SO₂ BACT determinations for the stationary sources, including the Chena Power Plant, in a letter to EPA Region 10 dated September 25, 2023.⁴ In the preamble to the final rule, EPA references the withdrawal of the SO₂ BACT determinations

¹ Federal Register (FR) Vol. 88, No. 6, January 10, 2023.

² Hedgpeth, Z. Review of Best Available Control Technology analyses submitted for the Aurora Energy, LLC Chena Power Plant as part of the Fairbanks PM_{2.5} Nonattainment SIP. August 24, 2022. Docket Document ID EPA-R10-OAR-2022-0115-0212.

³ FR Vol. 88, No. 232, December 5, 2023.

⁴ Letter from Emma Pokon, ADEC, to Casey Sixkiller, EPA Region 10, dated September 25, 2023. Docket Document ID EPA-R10-OAR-2022-0115-0428.

from the Serious PM_{2.5} SIP and states that because the Serious SIP does not identify, adopt, or implement BACT for SO₂, EPA has finalized partial disapproval of the SIP.

Aurora believes that the existing Alaska Serious SIP SO₂ BACT determinations for EUs 4 through 7 reach the correct conclusions. Aurora is submitting this supplemental SO₂ BACT analysis for EUs 4 through 7 to provide ADEC with updated information to support the existing SO₂ BACT determinations.

2. BACT Methodology

This supplemental BACT analysis was prepared consistent with five-step “top-down” methodology provided in the EPA New Source Review (NSR) Rule Revisions (proposed)⁵, which references the 1990 Draft NSR Workshop Manual. The five steps of the BACT Analysis process are:

1. Identify all available control options;
2. Eliminate technically infeasible options;
3. Rank the remaining options by control effectiveness;
4. Evaluate the most effective controls; and
5. Select BACT.

3. Step 1 – Available SO₂ Control Technologies

Consistent with the comments in the EPA Technical Support Memo, this BACT analysis identifies the control technologies presented in Table 1 as available SO₂ emission control technologies.

Table 1. Available SO₂ Emission Control Technologies for EUs 4 through 7

Available SO ₂ Emission Control Technologies
Wet Flue Gas Desulfurization (WFGD)
Circulating Dry Scrubber (CDS)
Spray Dry Absorber (SDA)
Dry Sorbent Injection (DSI)
Base Case: SO ₂ Emission Limit, Low Sulfur Coal, and Good Combustion Practices

The Alaska Serious SIP analysis did not include CDS but did address the other available technologies. This supplemental BACT analysis includes CDS as an available SO₂ emission control technology.

⁵ Federal Register Vol. 61, No.142, July 23, 1996.

4. Step 2 – Technical Feasibility of Available SO₂ Control Technologies

Aurora has determined that WFGD is technically infeasible due to physical space constraints at the Chena Power Plant. Stanley Consultants Inc. (SCI) prepared a report “Best Available Control Technology Analysis – Independent Assessment of Technical Feasibility and Capital Cost, Addendum #1,” dated January 25, 2024, herein referred to as the SCI Report and provided in Appendix D. Section 2 of the SCI Report evaluates the technical feasibility of the SO₂ emission control technologies and provides a detailed analysis of the engineering requirements that would be necessary to install either CDS, SDA, or DSI due to limited space being available to install emissions control equipment.

For purposes of this BACT analysis, CDS, SDA, and DSI will each be carried forward for evaluation as technically feasible technologies. WFGD is also carried forward in case ADEC disagrees with the technical infeasibility determination. The evaluation of DSI in this analysis also allows Aurora to further address the EPA comments in the Technical Support Memo regarding the previous economic infeasibility determination and affordability analysis that Aurora submitted to ADEC in 2019.

This supplemental analysis identifies the technically feasible control technologies in Table 2.

Table 2. Technically Feasible SO₂ Emission Control Technologies for EUs 4 through 7

Technically Feasible SO₂ Emission Control Technologies
Wet Flue Gas Desulfurization (WFGD)
Circulating Dry Scrubber (CDS)
Spray Dry Absorber (SDA)
Dry Sorbent Injection (DSI)
Base Case: SO ₂ Emission Limit, Low Sulfur Coal, and Good Combustion Practices

EUs 4 through 7 are currently subject to federally enforceable coal sulfur content limits. The Serious SIP sulfur content limit of 0.25 weight percent was established in conjunction with the Usibelli Coal Mine, the sole provider of coal in Interior Alaska, as the lowest practically feasible coal sulfur content limit. As a result, the use of low sulfur coal will not be addressed further in this supplemental analysis. In Permit AQ0315TVP04 Revision 2, Conditions 24 and 25 limit sulfur compound emissions, expressed as SO₂, to no more than 500 parts per million (ppm) averaged over three hours. If any shipment of coal contains more than 0.4 percent sulfur by weight, the three-hour exhaust concentration of SO₂ must be calculated. If the calculation shows that the exhaust SO₂ concentration would exceed 500 ppm, source testing for sulfur compound emissions is required while combusting that shipment of fuel. Condition 14 of Permit AQ0315TVP04 Revision 2 incorporates the Serious SIP limit by requiring that the block quarterly average

of the sulfur content of coal received at the stationary source not exceed 0.25 percent by weight as received. Condition 16 provides the monitoring, recordkeeping, and reporting requirements.

The combined base case SO₂ potential to emit for EUs 4 through 7 is 639.5 tons per year (tpy). Detailed emissions calculations are provided in Appendix A. The EPA Technical Support Memo, written in 2022, states that the baseline emission rate should not be based on the limit of 0.301 lb/MMBtu because that limit was not federally enforceable. On April 5, 2023, the SO₂ emission limit of 0.301 lb/MMBtu was incorporated into Condition 15 of the federally enforceable Title V Permit AQ0315TVP04, Revision 2, effective May 5, 2023. As a result, Aurora believes that the SO₂ emission rate limit of 0.301 lb/MMBtu is federally enforceable and is the correct baseline emission rate for use in this analysis. This issue is further addressed in Section 7 of this report.

Good combustion practices will not be addressed further in this supplemental analysis because this technology is already in practice and will not reduce SO₂ emissions below the existing levels that are based on the operating permit requirements. As a result, the remaining steps of this supplemental BACT analysis will address WFGD, CDS, SDA, and DSI.

5. Step 3 – Rank Technically Feasible SO₂ Control Technologies

For purposes of this analysis, the technically feasible control technologies are WFGD, CDS, SDA, DSI, and the base case consisting of the SO₂ emission limit, combusting low sulfur coal, and using good combustion practices. The combined base case SO₂ potential to emit for EUs 4 through 7 is 639.5 tpy. Table 3 presents the removal efficiency, potential SO₂ emissions, and the amount of SO₂ emission reduction for each control option.

Table 3. Ranking of Technically Feasible SO₂ Emission Control Technologies

Control Technology	Control Efficiency Compared to Base Case (pct.)	SO ₂ Emission Rate (lb/MMBtu)	SO ₂ Emission Rate (lb/hr)	Potential SO ₂ Emissions (tpy)	Potential SO ₂ Emissions Reduction (tpy)
Dry Sorbent Injection (DSI) ¹	95	0.015	7.3	32.0	607.6
Wet Flue Gas Desulfurization (WFGD) ²	93.4	0.02	9.7	42.5	597.1
Circulating Dry Scrubber (CDS)	86.7	0.04	19.4	85.0	554.6
Spray Dry Absorber (SDA)	76.7	0.07	34.0	148.7	490.8
Base Case: SO ₂ Emission Limit, Low Sulfur Coal, and Good Combustion Practices	0	0.301	146.0	639.5	0.0

Notes:

¹ The SO₂ control efficiency, in terms of percentage, for DSI is the vendor-provided emission reduction capability.

² The SO₂ emission rates, in terms of lb/MMBtu, for WFGD, CDS, and SDA are the average values for the top 20 percent performing coal-fired power plants per Table 1.3 of Section 5, Chapter 1 of the EPA Air Pollution Control Cost Manual (2021).

6. Step 4 – Evaluate Most Effective Control Options

This section presents an evaluation of the economic impacts of DSI. WFGD, CDS, and SDA are addressed qualitatively because DSI is the top-ranked control technology and is less costly than the lower-ranked control technology options. This section also includes the base case.

6.1 Highest SO₂ Removal Efficiency – DSI

This section evaluates the economic impacts that would result from installing DSI at the Chena Power Plant. Energy and environmental impacts, aside from those addressed as part of the cost estimating process, were not enumerated for the DSI system as an element of this analysis.

The DSI emission control system is 95 percent efficient in reducing SO₂ emissions. Section 3 of the SCI Report presents a detailed capital cost estimate for DSI at the Chena Power Plant. Table B of Appendix B presents the economic analysis by incorporating the SCI capital cost estimate and calculating direct and indirect annual costs. The economic analysis in Appendix B also incorporates the capital cost of a Continuous Emission Monitoring System (CEMS), which Aurora anticipates would be operationally necessary if the facility is required to install control technology with a 95 percent SO₂ emissions reduction capability. Costs for an initial SO₂ performance test and CEMS Relative Accuracy Test Audit (RATA) are included.

The direct annual costs presented in Table B of Appendix B include operating labor, supervisory labor, and maintenance materials needed to operate and maintain the DSI system. These costs are estimated consistent with the methodology presented in the EPA Control Cost Manual (CCM). The direct annual costs also include costs for the DSI sorbent, station service electrical demand, and ash disposal. Indirect annual costs include overhead, administrative charges, property tax, and insurance. These costs are calculated consistent with the methodology in the EPA CCM. Capital recovery is calculated using the bank prime loan rate⁶ of 8.50 percent, effective July 27, 2023, through the time of writing this report. The bank prime rate used to annualize costs and a DSI equipment life of 30 years are used to calculate the Capital Recovery Factor for DSI.

As shown in Table B of Appendix B, the Total Capital Investment for retrofitting the Chena Power Plant with DSI is estimated at \$82,545,945. The Total Annual Cost is estimated at \$13,276,117.

The SCI Report identifies several cost items which are not included in the cost estimate, and which would likely increase capital costs if addressed. In addition to those items, the possibility exists that the use of DSI would alter the fly ash constituents to a degree that the current monofil method used by Aurora would no longer be feasible. This issue is addressed in the article “The Growth of Dry Sorbent Injection (DSI) and the impact on Coal Combustion Residue,” provided in Appendix C. Determining whether DSI would affect the ash constituents and result in different landfilling procedures was beyond the scope of this analysis. Any costs of alternate landfill requirements are not included in the economic analysis for DSI.

⁶ <https://www.federalreserve.gov/releases/h15/>

6.2 Second through Fourth Highest SO₂ Removal Efficiency – WFGD, CDS, and SDA

The economic impacts that would result from installing any of WFGD, CDS, or SDA at the CCP are not evaluated in this report. Compared to these other control technologies, DSI has a lower cost and a higher sulfur capture efficiency. This conclusion is consistent with the recent SO₂ BACT analysis⁷ that the University of Alaska Fairbanks (UAF) submitted to EPA, which is publicly available.

DSI systems are generally the lowest in cost because the systems are less complex than the other SO₂ control technologies, including WFGD, CDS, and SDA. A DSI system typically requires only a relatively simple material handling system consisting of only storage and transport equipment. The injection of the sorbent typically occurs in a section of duct work or in a very simple reaction chamber. As a result, preparing detailed economic impact analyses for control technologies with equal or lower SO₂ emissions reductions and equal or higher costs compared to DSI are not necessary.

6.3 Fifth-Highest SO₂ Removal Efficiency – Base Case

This option, consisting of the existing SO₂ emission limit, existing coal sulfur content limit, and good combustion practices, is the base case and is in use at the Chena Power Plant.

6.4 Cost-Effectiveness Evaluation

In this analysis, evaluating the impacts of the SO₂ emission control options hinges on the economic feasibility of DSI. For any emission control technology, the cost-effectiveness value is expressed in terms of the cost in dollars per ton of pollutant reduction. This value is calculated as the annualized cost of the control technology divided by the annual reduction in emissions compared to the baseline emission rate. The annualized cost of DSI was calculated using the Equivalent Uniform Annual Cost (EUAC) approach consistent with EPA methodology. Table 4 presents the cost-effectiveness for DSI as evaluated in Step 4 of this BACT analysis.

Table 4. SO₂ Cost-Effectiveness Summary

Control Technology	Total Capital Investment (\$)¹	Total Annual Cost (\$/year)²	Emissions Reduction (tpy)³	Cost-Effectiveness (\$/ton SO₂ Emissions Avoided)
Dry Sorbent Injection (DSI)	\$82,545,945	\$13,276,117	607.6	\$21,851
Base Case: SO ₂ Emission Limit, Low Sulfur Coal, and Good Combustion Practices	~	~	0.00	~

Notes:

¹Total Capital Investment is calculated in Table B of Appendix B.

²Total Annual Cost is calculated in Table B of Appendix B.

³Emissions reductions are calculated in Table 3 of this report.

⁷ Sulfur Dioxide Best Available Control Technology Analysis for Emission Unit 113, January 2023. Docket Comment ID EPA-R10-OAR-2022-0115-0357.

The cost-effectiveness of DSI, with an SO₂ removal efficiency of 95 percent, is \$21,851 per ton of SO₂ emission reductions.

7. Step 5 - Select BACT

The final step in a top-down BACT analysis is to select the most effective emission control option that is not eliminated in Step 4. Even though the SCI Report demonstrates that DSI is not technically feasible, Aurora conservatively carried DSI forward to the economic analysis step to evaluate the economic feasibility of installing DSI. As shown in Table 4, the cost-effectiveness of DSI is greater than \$21,000 per ton of SO₂ removed. This cost-effectiveness value is not economically feasible. Control options which are not economically feasible are by definition eliminated from consideration as BACT.

Aurora acknowledges that, because ADEC has withdrawn the SO₂ BACT determinations in the Serious PM_{2.5} SIP, ADEC or EPA may consider that the basis for the existing SO₂ emission limit of 0.301 lb/MMBtu is no longer valid. Under this scenario, the baseline SO₂ emission rate for the BACT cost-effectiveness analysis could revert to the SO₂ potential to emit of 1,983.1 tpy in effect prior to the issuance of Permit AQ0315MSS02. In this situation, DSI might be cost-effective. If so, Aurora believes that DSI would not be affordable and will provide, under separate cover, a confidential affordability analysis as outlined in the preamble to the Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements; Final Rule.⁸

The existing, base case SO₂ emission control technology which includes the SO₂ emission limit, low sulfur coal, and good combustion practices, is the best available control technology for the Chena Power Plant boilers. As a result, the BACT emission limit is 0.301 lb/MMBtu. Aurora is currently in compliance with this emission limit as required by Condition 15 of Permit AQ0315TVP04, Revision 2.

Appendices:

Appendix A – SO₂ Emission Calculations

Appendix B – DSI Economic Analysis

Appendix C – Article: “The Growth of Dry Sorbent Injection (DSI) and the impact on Coal Combustion Residue”

Appendix D – Best Available Control Technology Analysis – Independent Assessment of Technical Feasibility and Capital Cost, Addendum #1

⁸ FR Vol. 81, No. 164, August 24, 2016, p. 58085.

Appendix A

SO₂ Emission Calculations

Table A. Potential to Emit Calculations for EUs 4 through 7 Supplemental BACT Analysis - SO₂ Emissions
Aurora Energy, LLC - Chena Power Plant

Emissions Unit		Fuel Type	SO ₂ Emission Factor		Maximum Rating/Capacity	Allowable Annual Operation	Short Term SO ₂ Emissions	Potential SO ₂ Emissions
ID	Description		Reference	Factor				
4	Chena 1 Coal-Fired Boiler	Coal	Condition 15, Permit No. AQ0315TVP04, Revision 2	0.301 lb/MMBtu	76.8 MMBtu/hr	8,760 hr/yr	23.12 lb/hr	101.3 tpy
5	Chena 2 Coal-Fired Boiler				76.8 MMBtu/hr	8,760 hr/yr	23.12 lb/hr	101.3 tpy
6	Chena 3 Coal-Fired Boiler				76.8 MMBtu/hr	8,760 hr/yr	23.12 lb/hr	101.3 tpy
7	Chena 5 Coal-Fired Boiler				254.7 MMBtu/hr	8,760 hr/yr	76.66 lb/hr	335.8 tpy
Total SO ₂ Potential Emissions								639.5 tpy

Notes:

¹ Conversion factors:

Mass Conversion 2,000 lb/ton

² The combined SO₂ emissions from the common stack for EU IDs 4 through 7 are limited to 0.301 lb/MMBtu per Condition 15 of Permit No. AQ0315TVP04, Revision 2.

Appendix B

DSI Economic Analysis

Table B. Dry Sorbent Injection (DSI) - Economic Analysis
Aurora Energy Chena Power Plant SO₂ BACT Analysis

CAPITAL COSTS

DIRECT COSTS		Quantity	Unit	Unit Cost	Total	Notes
1. Purchased Equipment and Material Costs (PEMC)						
	a. Basic equipment - DSI System	1	ea	\$5,990,000	\$5,990,000	BACT Process Systems, Inc. 7/28/2023 proposal
	b. Freight - DSI System	1	ea	\$250,000	\$250,000	BACT Process Systems, Inc. 7/28/2023 proposal
	c. Equipment - Baghouse system	1	ea	\$2,900,000	\$2,900,000	Stanley Consultants Jan 2024 cost estimate
	d. Freight - Baghouse system	1	ea	\$348,000	\$348,000	Stanley Consultants Jan 2024 cost estimate
	e. Continuous Emission Monitoring System	1	ea	\$125,257	\$125,257	Emerson 10/22/2019 cost estimate (equipment and shipping)
Purchased Equipment and Material Cost (PEMC)				PEMC=	\$9,613,257	
2. Direct Installation Costs (DIC)						
	a. Field installation - DSI	1	ea	\$488,847	\$488,847	Stanley Consultants Jan 2024 cost estimate
	b. Field installation - Baghouse	1	LOT	\$322,667	\$322,667	Stanley Consultants Jan 2024 cost estimate
	c. Structural	1	LOT	\$31,601,763	\$31,601,763	Stanley Consultants Jan 2024 cost estimate
	d. Mechanical	1	LOT	\$610,884	\$610,884	Stanley Consultants Jan 2024 cost estimate
	e. Electrical	1	LOT	\$1,355,710	\$1,355,710	Stanley Consultants Jan 2024 cost estimate
	f. Instrumentation and Controls	1	ea	\$103,408	\$103,408	Stanley Consultants Jan 2024 cost estimate
	g. Heavy Equipment	1	LOT	\$834,300	\$834,300	Stanley Consultants Jan 2024 cost estimate
	h. Demolition	1	LOT	\$1,000,000	\$1,000,000	Stanley Consultants Jan 2024 cost estimate
Direct Installation Costs (DIC)				DIC =	\$36,317,579	

Total Direct Costs (TDC)	TDC=PEMC+DIC=	\$45,930,836
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INDIRECT COSTS

3. Engineering, Construction Support						
	a. Engineering Services	1	ea	\$7,483,700	\$7,483,700	Stanley Consultants Jan 2024 cost estimate
	b. Mobilization/Demobilization	5	pct. TDC		\$2,296,542	Calculation consistent with Stanley Consultants Jan 2024 cost estimate. TDC calculated in this table also includes CEMS equipment cost in PEMC.
	c. Prime Contractor Indirect Labor	10	pct.		\$4,544,214	Stanley Consultants Jan 2024 cost estimate plus 10 pct. of CEMS PEMC.
	d. Contractor Overhead and Labor Burdens	15	pct. TDC		\$6,889,625	Stanley Consultants Jan 2024 cost estimate. TDC calculated in this table also includes CEMS equipment cost in PEMC.
	e. Equipment and Small Tools	5	pct.		\$2,254,827	Calculation consistent with Stanley Consultants Jan 2024 cost estimate. TDC calculated in this table also includes CEMS equipment cost in PEMC.
4. Contingency		10	pct.		\$6,191,604	Default value of 10 percent of direct and indirect costs [CCM Section 5, Chapter 1, page 1-79]
5. Profit		10	pct.		\$6,191,604	Calculation consistent with Stanley Consultants Jan 2024 cost estimate. TDC calculated in this table also includes CEMS equipment cost in PEMC.
6. Bond		1	pct.		\$742,993	Calculation consistent with Stanley Consultants Jan 2024 cost estimate. TDC calculated in this table also includes CEMS equipment cost in PEMC.
7. Performance testing		1	ea	\$20,000	\$20,000	Initial emissions performance test and CEMS RATA. Estimate based on recent source test costs at Aurora Energy.
Total Indirect Costs (TIC)				TIC=	\$36,615,109	

TOTAL CAPITAL INVESTMENT (TCI)	TCI = TDC+TIC=	\$82,545,945
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ANNUAL COSTS

DIRECT COSTS		Quantity	Unit	Unit Cost	Total	Notes
1. Operating Labor						
		365	hours	\$66.40	\$24,236	Assumes 0.5 hours per shift, 12 hour shifts [CCM Section 5, Chapter 1]. Burdened operator labor rate is \$66.40/hr per Table C, Aurora Energy, 2023.
2. Supervisory Labor						
		15	pct.		\$3,635	Assumes 15% of operator labor [CCM Section 5, Chapter 1]
3. Maintenance Labor						
		365	hours	\$66.40	\$24,236	Assumes 0.5 hours per shift, 12 hour shifts [CCM Section 5, Chapter 1]. Burdened operator labor rate is \$66.40/hr per Table C, Aurora Energy, 2023.
4. Maintenance Materials						
		100	pct.		\$24,236	Assumes 100% of maintenance labor [CCM Section 5, Chapter 1]
5. Reagent						
		3,175.5	ton	\$563	\$1,787,807	Sodium bicarbonate. Feed rate of 0.3625 tons per hour; unit cost includes rail delivery per BACT Process Systems, Inc. 7/28/2023 proposal.
6. Utilities	a. Electricity	2,735,960	kWh	\$0.093	\$254,444	Steady state operating station service requirement for DSI equipment per demand in Table F at 8,760 hr/yr. Aurora Energy calculation of station service cost at \$0.093/kWh for 2023.
	b. Waste Disposal (ash)	2,930	ton	\$44	\$128,931	Incremental increase in ash disposal cost due to DSI. Ash tonnage calculated in Table D. Unit cost is market rate in ash hauling contract.
Total Direct Annual Costs (TDAC)				TDAC=	\$2,247,525	

INDIRECT COSTS

7. Overhead						
		60	pct.		\$45,806	60 percent of total labor and material costs [CCM Section 1, Chapter 2, page 35]
8 Administrative Charges						
		2	pct. TCI		\$1,650,919	2 percent of TCI [CCM Section 1, Chapter 2, page 35]
9. Property Tax						
		1	pct. TCI		\$825,459	1 percent of TCI [CCM Section 1, Chapter 2, page 35]
10. Insurance						
		1	pct. TCI		\$825,459	1 percent of TCI [CCM Section 1, Chapter 2, page 35]
11. Capital Recovery						
	Capital Recovery Factor (CRF)	0.0931			\$7,680,948	CRF = $\frac{i(1+i)^n}{(1+i)^n - 1}$ [CCM Section 1, Chapter 2, page 22]
	i = interest rate	8.50	pct.			Bank prime interest rate 7/27/2023 through 1/22/2024, https://www.federalreserve.gov/releases/h15/
	n = life of control equipment	30	years			

Total Indirect Annual Costs (TIAC)	TIAC=	\$11,028,591
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TOTAL ANNUALIZED COST (TAC)	TAC = TDAC+TIAC=	\$13,276,117
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Table C. Full-time Burden Operator Labor Rate
Aurora Energy, LLC

	Per Hour*	CBA Section*
Operator Wage Rate Y1	\$ 43.07	17.1
Shift Diff.	\$ 1.29	17.2
401K (0.50/hr)	\$ 0.50	15.3
H&W (Annual cost/hrs)	\$ 9.82	15.1
Pension	\$ 10.00	15.2
Reg Rate	\$ 63.39	
OT Rate	\$ 84.93	
Grave Rate	\$ 64.69	
Grave OT Rate	\$ 86.87	
Reg Hours	838.50	5.2
OT Hours	113.75	5.2
Grave Reg Hours	1,118.00	5.2
Grave OT Hours	113.75	5.2
Reg Rate x Reg Hours	\$ 53,156.02	
OT Rate x OT Hours	\$ 9,660.69	
Grave Rate x Grave Reg Hours	\$ 72,319.26	
Grave OT Rate x Grave OT Hours	\$ 9,881.16	
Total Labor Cost for FT Burden Operator working day/graves	\$ 145,017.12	
x 2 for Adding two Operators	2.00	
Total Labor Cost for two FT Burden Operators	<u>\$ 290,034.25</u>	
Annual Working Hours	2,184.00	
Average Hourly Rate	\$ 66.40	

*Aurora Energy, LLC CBA 2023 - 2025

**Table D. Projected Annual Ash Disposal Requirement for DSI
Aurora Energy Chena Power Plant SO₂ BACT Analysis**

	Value	Unit
Ash Generation Based on Potential to Emit, No SO₂ Control		
Max Annual Heat Input	4,222,320,000,000	Btu/lb
Coal Heat Content	7,536.5	Btu/lb ¹
Coal Use per Year	560,251,775.7	lb/yr
Coal Use per Year	280,125.9	tpy
Coal Ash Content	0.07	Fraction ²
Total	18,301	tpy

	Value	Unit
Ash Generation due to Dry Sorbent Injection		
Maximum SO ₂ Emission Rate	0.301	lb/MMBtu
SO ₂ Potential Emissions	1,270,918.32	lb/yr
SO ₂ Potential Emissions	635.5	tpy
SO ₂ Emission Reduction	603.7	tpy
NaHCO ₃ Use	3,175.50	tpy
2(NaHCO ₃)/NaSO ₄	1.18	wt. ratio
Na ₂ SO ₄ /SO ₂	2.22	wt. ratio
Na ₂ SO ₄	1,339.43	tpy (in ash)
NaHCO ₃	1,590.82	tpy (unreacted)
Total	2,930	tpy

Total Ash Disposal Requirement	21,232	tpy
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Notes:

¹ Coal heat content based on 2022 deliveries, shown in Table E.

² Coal ash content based on 2022 deliveries, shown in Table E.

Table E. 2022 Rail Sample Analyses of Delivered Coal
Aurora Energy Chena Power Plant SO₂ BACT Analysis

	Sample Date	Cars	AR BTU	AR Moisture	AR Ash	AR Volatiles	AR Carbon	AR Sulfur	Location	Bench	Seam	Tons
AURORA ENERGY LLC	1/1/2022	13	7628	32.82	4.76	35.30	27.12	0.12	JD		4	1132.1
AURORA ENERGY LLC	1/3/2022	10	7598	32.33	5.60	34.64	27.43	0.13	JD		4	903.3
AURORA ENERGY LLC	1/4/2022	9	7545	32.52	5.62	34.79	27.08	0.14	JD		4	777.1
AURORA ENERGY LLC	1/5/2022	6	7814	30.17	5.42	35.48	28.93	0.12	JD		4	497.7
AURORA ENERGY LLC	1/6/2022	10	7542	32.71	5.29	34.59	27.41	0.13	JD		4	842.6
AURORA ENERGY LLC	1/7/2022	7	7672	31.53	5.43	35.60	27.44	0.15	JD		4	604.35
AURORA ENERGY LLC	1/10/2022	3	7590	32.30	5.34	34.74	27.63	0.13	JD		4	253.7
AURORA ENERGY LLC	1/11/2022	6	7590	32.18	5.37	34.72	27.73	0.14	JD		4	560.2
AURORA ENERGY LLC	1/13/2022	3	7611	32.06	5.36	35.02	27.57	0.12	JD		4	270.05
AURORA ENERGY LLC	1/14/2022	4	7612	32.59	4.66	34.50	28.26	0.10	JD		4	346.1
AURORA ENERGY LLC	1/17/2022	11	7610	32.86	4.47	34.51	28.16	0.09	JD		4	966.05
AURORA ENERGY LLC	1/18/2022	8	7617	32.96	4.14	34.85	28.06	0.08	JD		4	710.45
AURORA ENERGY LLC	1/19/2022	8	7817	31.76	3.63	35.63	28.99	0.08	JD		4	670.4
AURORA ENERGY LLC	1/20/2022	9	7815	31.82	4.10	35.91	28.18	0.09	JD		4	788.45
AURORA ENERGY LLC	1/21/2022	5	7617	32.73	4.43	34.54	28.31	0.09	JD		4	455.4
AURORA ENERGY LLC	1/24/2022	9	7697	31.34	5.51	35.23	27.93	0.13	JD		4	776.8
AURORA ENERGY LLC	1/25/2022	10	7749	31.18	5.08	35.54	28.21	0.12	JD		4	879.75
AURORA ENERGY LLC	1/26/2022	10	7693	31.76	5.02	34.62	28.61	0.13	JD		4	882.65
AURORA ENERGY LLC	1/27/2022	9	7594	32.10	5.77	34.69	27.45	0.14	JD		4	812.25
AURORA ENERGY LLC	1/28/2022	5	7555	32.33	5.95	34.64	27.09	0.14	JD		4	464.15
AURORA ENERGY LLC	1/31/2022	12	7641	32.68	4.46	35.13	27.73	0.11	JD		4	1047
AURORA ENERGY LLC	2/1/2022	8	7648	32.99	4.07	34.58	28.36	0.09	JD		4	674.7
AURORA ENERGY LLC	2/2/2022	7	7694	33.31	3.41	35.01	28.28	0.08	JD		4	605.35
AURORA ENERGY LLC	2/3/2022	10	7644	32.59	4.14	35.35	27.92	0.09	JD		4	882.15
AURORA ENERGY LLC	2/7/2022	12	7764	31.38	4.37	34.92	29.33	0.10	BDL/JD	Q3	3/4	1040.5
AURORA ENERGY LLC	2/8/2022	9	7785	30.61	4.82	35.49	29.09	0.09	BDL/JD	Q3	3/4	783.6
AURORA ENERGY LLC	2/9/2022	9	7647	32.23	4.40	34.64	28.73	0.09	BDL/JD	Q3	3/4	776.5
AURORA ENERGY LLC	2/10/2022	8	7645	31.13	5.42	34.39	29.06	0.11	BDL/JD	Q3	3/4	740.6
AURORA ENERGY LLC	2/11/2022	9	7624	31.36	5.56	34.73	28.36	0.10	JD/BDL	Q3	3/4	837.55
AURORA ENERGY LLC	2/14/2022	8	7671	30.99	5.47	34.91	28.64	0.09	BDL/JD	Q3	3/4	709.1
AURORA ENERGY LLC	2/15/2022	9	7723	30.12	5.93	34.93	29.02	0.09	BDL/JD	Q3	3/4	824.6
AURORA ENERGY LLC	2/16/2022	8	7702	30.64	5.53	34.59	29.24	0.10	BDL/JD	Q3	3/4	699.25
AURORA ENERGY LLC	2/17/2022	8	7751	30.73	5.22	35.39	28.66	0.10	BDL/JD	Q3	3/4	707.6
AURORA ENERGY LLC	2/18/2022	6	7588	33.19	4.14	34.74	27.94	0.09	JD		4	517.75
AURORA ENERGY LLC	2/22/2022	10	7613	31.52	5.42	34.58	28.48	0.11	JD		4	882.3
AURORA ENERGY LLC	2/23/2022	10	7519	33.57	4.30	34.33	27.80	0.09	JD		4	851.3
AURORA ENERGY LLC	2/24/2022	9	7559	31.66	5.84	34.10	28.40	0.11	BDL/JD	Q3	3/4	798.65
AURORA ENERGY LLC	2/25/2022	9	7551	32.32	5.12	34.25	28.32	0.10	BDL/JD	Q3	3/4	787.1
AURORA ENERGY LLC	2/28/2022	9	7697	31.27	5.38	34.68	28.67	0.09	BDL/JD	Q3	3/4	769.55
AURORA ENERGY LLC	3/1/2022	12	7472	31.97	6.54	33.63	27.87	0.10	BDL/JD	Q3	3/4	1065.2
AURORA ENERGY LLC	3/2/2022	7	7505	31.68	6.95	33.68	27.70	0.11	BDL/JD	Q3	3/4	649.25
AURORA ENERGY LLC	3/3/2022	7	7479	31.34	7.31	33.64	27.72	0.12	BDL/JD	Q3	3/4	653.3
AURORA ENERGY LLC	3/4/2022	7	7525	31.10	6.70	34.24	27.97	0.12	BDL/JD	Q3	3/4	625.6
AURORA ENERGY LLC	3/7/2022	11	7569	31.12	6.77	34.07	28.03	0.12	BDL/JD	Q3	3/4	993.2
AURORA ENERGY LLC	3/8/2022	10	7586	30.46	6.88	34.67	28.00	0.11	BDL/JD	Q3	3/4	920.1
AURORA ENERGY LLC	3/9/2022	16	7406	31.55	7.47	33.68	27.30	0.11	JD/BDL	Q3	3/3	1493.55
AURORA ENERGY LLC	3/11/2022	8	7505	31.68	6.59	33.87	27.87	0.10	JD/BDL	Q3	3/3	748.8
AURORA ENERGY LLC	3/21/2022	8	7446	32.11	6.73	34.05	27.11	0.11	JD/BDL	Q3	3/3	689.6
AURORA ENERGY LLC	3/22/2022	9	7397	31.72	7.80	33.59	26.90	0.12	JD/BDL	Q3	3/3	774.75
AURORA ENERGY LLC	3/23/2022	20	7196	32.16	8.54	32.64	26.67	0.12	JD/BDL	Q3	3/3	1794.5
AURORA ENERGY LLC	3/28/2022	6	7411	31.13	7.96	33.84	27.08	0.13	JD/BDL	Q3	3/3	565
AURORA ENERGY LLC	3/29/2022	6	7551	30.51	7.23	34.42	27.84	0.12	JD/BDL	Q3	3/3	547.95
AURORA ENERGY LLC	3/30/2022	7	7403	31.59	7.36	34.02	27.04	0.12	JD/BDL	Q3	3/3	644.4
AURORA ENERGY LLC	3/31/2022	6	7525	31.40	6.66	34.44	27.49	0.10	JD/BDL	Q3	3/3	561.65
AURORA ENERGY LLC	4/5/2022	7	7558	30.50	7.10	34.51	27.89	0.10	JD/BDL	Q3	3/3	654.65
AURORA ENERGY LLC	4/6/2022	4	7566	30.39	6.83	34.79	27.99	0.09	JD/BDL	Q3	3/3	331.2
AURORA ENERGY LLC	4/7/2022	5	7583	31.00	6.41	35.26	27.34	0.09	JD/BDL	Q3	3/3	390.6
AURORA ENERGY LLC	4/8/2022	5	7635	30.87	6.09	35.04	28.01	0.09	JD/BDL	Q3	3/3	446.25
AURORA ENERGY LLC	4/12/2022	15	7647	31.00	5.98	34.68	28.35	0.10	JD/BDL	Q3	3/3	1371.05
AURORA ENERGY LLC	4/13/2022	15	7621	30.15	7.20	34.57	28.09	0.11	JD/BDL	Q3	3/3	1402.05
AURORA ENERGY LLC	4/14/2022	15	7657	30.54	6.68	34.63	28.16	0.11	JD/BDL	Q3	3/3	1410.35
AURORA ENERGY LLC	4/15/2022	15	7548	30.56	7.12	34.73	27.60	0.13	JD/BDL	Q3	3/3	1435.95
AURORA ENERGY LLC	4/19/2022	13	7572	30.38	7.20	34.52	27.90	0.10	JD/BDL	Q3	3/3	1208.8
AURORA ENERGY LLC	4/20/2022	12	7713	30.15	6.06	35.39	28.40	0.09	JD/BDL	Q3	3/3	1092.9

Table E. 2022 Rail Sample Analyses of Delivered Coal
Aurora Energy Chena Power Plant SO₂ BACT Analysis

	Sample Date	Cars	AR BTU	AR Moisture	AR Ash	AR Volatiles	AR Carbon	AR Sulfur	Location	Bench	Seam	Tons
AURORA ENERGY LLC	4/21/2022	13	7656	31.04	6.01	34.87	28.09	0.09	JD/BDL	Q3	3/3	1228.6
AURORA ENERGY LLC	4/22/2022	12	7605	31.45	5.77	35.18	27.61	0.09	JD/BDL	Q3	3/3	1131.95
AURORA ENERGY LLC	4/26/2022	12	7541	30.86	7.35	34.13	27.67	0.10	JD/BDL	Q3	3/3	1140.5
AURORA ENERGY LLC	4/27/2022	12	7493	30.66	7.77	33.93	27.65	0.12	JD/BDL	Q3	3/3	1132.4
AURORA ENERGY LLC	4/28/2022	10	7468	31.44	7.12	33.96	27.49	0.10	JD/BDL	Q3	3/3	943.8
AURORA ENERGY LLC	4/29/2022	4	7495	32.17	6.17	33.95	27.72	0.11	BDL/JD	Q3	3/4	357.5
AURORA ENERGY LLC	4/29/2022	5	7233	33.64	6.33	33.33	26.70	0.10	BDL/JD	Q3	3/4	454.7
AURORA ENERGY LLC	4/29/2022	4	7439	31.92	6.54	33.94	27.60	0.12	BDL/JD	Q3	3/4	364.55
AURORA ENERGY LLC	4/29/2022	6	7636	30.24	6.94	34.64	28.19	0.10	JD/BDL	Q3	3/3	562.95
AURORA ENERGY LLC	5/3/2022	9	7627	29.95	6.90	34.99	28.16	0.10	JD/BDL	Q3	3/3	846.05
AURORA ENERGY LLC	5/4/2022	9	7592	30.48	6.82	34.43	28.27	0.10	JD/BDL	Q3	3/3	860.15
AURORA ENERGY LLC	5/5/2022	9	7486	31.83	6.54	34.19	27.44	0.10	JD/BDL	Q3	3/3	858.9
AURORA ENERGY LLC	5/6/2022	9	7548	30.79	7.12	34.64	27.45	0.10	JD/BDL	Q3	3/3	878.4
AURORA ENERGY LLC	5/10/2022	25	7211	31.34	9.59	32.92	26.16	0.13	JD/BDL	Q3	3/3	2321.85
AURORA ENERGY LLC	5/12/2022	8	7146	31.33	9.61	33.12	25.94	0.11	JD/BDL	Q3	3/3	740.4
AURORA ENERGY LLC	5/16/2022	4	6819	33.93	9.51	31.36	25.21	0.13	JD/BDL	Q3	3/3	401.75
AURORA ENERGY LLC	5/19/2022	6	7324	32.12	7.41	33.55	26.93	0.09	JD/JD		3/4	550.9
AURORA ENERGY LLC	5/23/2022	18	7537	31.30	6.16	34.85	27.69	0.09	JD/JD		3/4	1607
AURORA ENERGY LLC	5/25/2022	17	7543	31.08	6.69	34.54	27.70	0.08	JD/JD		3/4	1537.05
AURORA ENERGY LLC	5/26/2022	13	7483	31.17	7.05	35.04	26.75	0.09	JD/JD		3/4	1208.8
AURORA ENERGY LLC	5/31/2022	17	7454	31.52	6.66	34.73	27.09	0.09	JD/JD		4/3	1602.4
AURORA ENERGY LLC	6/1/2022	17	7594	32.01	5.24	34.99	27.75	0.08	JD/JD		3/4	1579.7
AURORA ENERGY LLC	6/2/2022	14	7613	31.51	5.43	35.22	27.85	0.07	JD/JD		3/4	1245.35
AURORA ENERGY LLC	6/3/2022	9	7695	31.14	5.25	35.57	28.05	0.07	JD/JD		3/4	821.8
AURORA ENERGY LLC	6/6/2022	11	7652	31.47	5.45	35.24	27.84	0.08	JD/JD		3/4	1019.8
AURORA ENERGY LLC	6/7/2022	12	7552	31.34	6.18	34.88	27.61	0.08	JD/JD		3/4	1129.25
AURORA ENERGY LLC	6/9/2022	11	7000	32.01	10.81	32.42	24.76	0.13	JD/JD		3/4	1045.6
AURORA ENERGY LLC	6/10/2022	12	7416	31.67	6.93	34.36	27.05	0.10	JD/JD		3/4	1120.9
AURORA ENERGY LLC	6/20/2022	4	7628	31.21	6.07	35.68	27.03	0.10	JD/JD		3/4	374.6
AURORA ENERGY LLC	6/21/2022	5	7488	31.72	6.23	34.64	27.41	0.12	JD/JD		3/4	444.7
AURORA ENERGY LLC	6/23/2022	4	7652	31.98	5.15	35.25	27.63	0.09	JD/JD		3/4	377.85
AURORA ENERGY LLC	6/24/2022	7	7623	30.92	5.86	35.29	27.92	0.10	JD/JD		3/4	659.15
AURORA ENERGY LLC	6/27/2022	14	7680	30.93	5.60	35.63	27.84	0.10	JD/JD		3/4	1327
AURORA ENERGY LLC	6/28/2022	14	7584	30.87	6.30	34.88	27.96	0.11	JD/JD		3/4	1333.5
AURORA ENERGY LLC	6/30/2022	14	7480	32.09	6.34	34.45	27.13	0.10	JD/JD		3/4	1316
AURORA ENERGY LLC	7/1/2022	13	7199	32.37	8.34	33.50	25.79	0.14	JD/JD		3/4	1260
AURORA ENERGY LLC	7/5/2022	11	7518	31.44	6.77	35.06	26.73	0.13	JD/JD		3/4	1023.35
AURORA ENERGY LLC	7/6/2022	8	7581	31.46	6.08	35.00	27.46	0.12	JD/JD		3/4	711.65
AURORA ENERGY LLC	7/7/2022	14	7581	31.51	6.05	35.03	27.41	0.12	JD/JD		3/4	1281.7
AURORA ENERGY LLC	7/8/2022	11	7727	30.79	5.65	35.98	27.59	0.12	JD/JD		3/4	1006.05
AURORA ENERGY LLC	7/11/2022	12	7644	30.96	6.17	35.43	27.46	0.12	JD/JD		3/4	1097.95
AURORA ENERGY LLC	7/12/2022	11	7449	31.29	7.26	34.22	27.24	0.14	JD/JD		3/4	1027.95
AURORA ENERGY LLC	7/14/2022	12	7658	29.29	6.75	35.89	28.07	0.13	JD/BDL	Q3	3/3	1096.2
AURORA ENERGY LLC	7/15/2022	11	7213	33.05	7.32	33.43	26.20	0.11	JD/JD		3/4	1032.2
AURORA ENERGY LLC	7/18/2022	10	7568	31.61	5.58	34.99	27.82	0.12	JD/JD		3/4	927
AURORA ENERGY LLC	7/19/2022	10	7534	31.67	6.17	34.72	27.45	0.12	JD/JD		3/4	935.75
AURORA ENERGY LLC	7/21/2022	10	7534	31.54	6.21	35.13	27.12	0.12	JD/JD		3/4	976.5
AURORA ENERGY LLC	7/22/2022	10	7498	32.28	6.20	34.37	27.16	0.12	JD/JD		3/4	928.1
AURORA ENERGY LLC	7/25/2022	14	7507	31.16	6.93	34.70	27.22	0.13	JD/JD		3/4	1324.5
AURORA ENERGY LLC	7/26/2022	12	7138	32.23	9.28	33.02	25.47	0.15	JD/JD		4/3	1096.35
AURORA ENERGY LLC	7/28/2022	13	7588	31.86	5.76	34.68	27.71	0.13	JD/JD		3/4	1215.85
AURORA ENERGY LLC	7/29/2022	11	7569	31.81	5.80	34.89	27.49	0.12	JD/JD		3/4	1045.65
AURORA ENERGY LLC	8/1/2022	12	7499	31.77	6.28	34.96	26.99	0.12	JD/JD		3/4	1149.8
AURORA ENERGY LLC	8/2/2022	11	7470	31.82	6.63	34.23	27.33	0.13	JD/JD		3/4	1037
AURORA ENERGY LLC	8/4/2022	12	7517	31.82	6.50	35.04	26.65	0.14	JD/JD		3/4	1188.55
AURORA ENERGY LLC	8/5/2022	11	7428	31.96	6.83	33.92	27.30	0.13	JD/JD		3/4	1022.65
AURORA ENERGY LLC	8/8/2022	8	7353	31.99	7.32	34.07	26.63	0.13	JD/JD		3/4	734.35
AURORA ENERGY LLC	8/9/2022	8	7487	32.62	6.16	34.63	26.59	0.13	JD/JD		3/4	766.8
AURORA ENERGY LLC	8/11/2022	8	7173	32.48	8.30	33.53	25.68	0.15	JD/JD		3/4	755.35
AURORA ENERGY LLC	8/12/2022	7	7169	31.93	8.81	33.61	25.66	0.18	JD/JD		3/4	651.75
AURORA ENERGY LLC	8/15/2022	9	7194	31.92	8.75	33.55	25.79	0.14	JD/JD		3/4	842.55
AURORA ENERGY LLC	8/16/2022	10	6944	32.83	9.54	32.64	24.99	0.15	JD/JD		3/4	924.1
AURORA ENERGY LLC	8/18/2022	9	7416	30.21	8.27	34.46	27.06	0.18	BDL/JD	R4	4/4	838.5
AURORA ENERGY LLC	8/19/2022	10	7603	28.64	8.20	35.29	27.87	0.19	BDL/JD	R4	4/3	895.05
AURORA ENERGY LLC	8/22/2022	9	7472	30.68	7.71	34.11	27.51	0.18	BDL/JD	R4	4/3	857.05

Table E. 2022 Rail Sample Analyses of Delivered Coal
Aurora Energy Chena Power Plant SO₂ BACT Analysis

	Sample Date	Cars	AR BTU	AR Moisture	AR Ash	AR Volatiles	AR Carbon	AR Sulfur	Location	Bench	Seam	Tons
AURORA ENERGY LLC	8/23/2022	10	7499	30.12	7.98	34.39	27.52	0.16	BDL/JD	R4	4/3	966
AURORA ENERGY LLC	8/25/2022	9	7539	30.60	7.30	34.60	27.51	0.15	JD/BDL	R4	3/4	870.1
AURORA ENERGY LLC	8/26/2022	10	7477	30.96	7.31	34.35	27.38	0.14	BDL/JD	R4	4/3	943
AURORA ENERGY LLC	8/29/2022	21	7171	31.58	9.25	33.22	25.94	0.17	BDL/JD	R4	4/3	1979.6
AURORA ENERGY LLC	8/30/2022	4	7235	32.28	8.14	33.51	26.07	0.17	BDL/JD	R4	4/3	375.4
AURORA ENERGY LLC	9/1/2022	14	7267	30.75	9.00	34.33	25.92	0.18	BDL/JD	R4	4/3	1329.3
AURORA ENERGY LLC	9/2/2022	10	7374	30.66	8.03	34.31	27.01	0.19	JD/STK		3	931.75
AURORA ENERGY LLC	9/6/2022	33	7120	30.19	10.12	33.45	26.25	0.19	JD/STK		3	3088.6
AURORA ENERGY LLC	9/9/2022	8	7671	30.24	6.82	34.89	28.05	0.14	JD/BDL	R4	3/4	775.55
AURORA ENERGY LLC	9/13/2022	17	7167	30.01	10.56	33.43	26.01	0.18	JD/BDL	R4	3/4	1640.35
AURORA ENERGY LLC	9/14/2022	11	7154	30.47	10.29	33.68	25.56	0.19	JD/BDL	R4	3/4	1035.55
AURORA ENERGY LLC	9/14/2022	13	7184	30.90	9.67	33.87	25.57	0.20	JD/BDL	R4	3/4	1281.7
AURORA ENERGY LLC	9/16/2022	6	7429	28.55	8.66	34.96	27.84	0.21	BDL/STK	R4	4	566.25
AURORA ENERGY LLC	9/19/2022	13	7405	30.20	8.38	34.35	27.08	0.22	BDL/STK	R4	4	1276.65
AURORA ENERGY LLC	9/20/2022	12	7486	29.78	8.59	34.41	27.21	0.21	JD/BDL	R4	3/4	1112.05
AURORA ENERGY LLC	9/21/2022	10	7704	29.41	7.12	35.43	28.04	0.20	JD/BDL	R4	3/4	954.5
AURORA ENERGY LLC	9/24/2022	14	7225	30.97	9.23	33.64	26.16	0.21	JD/BDL	R4	3/4	1290.25
AURORA ENERGY LLC	9/26/2022	14	7551	30.63	7.36	34.64	27.37	0.17	JD/BDL	R4	3/4	1306.3
AURORA ENERGY LLC	9/27/2022	8	7537	30.77	7.34	34.40	27.51	0.16	JD/BDL	R4	3/4	752.5
AURORA ENERGY LLC	9/28/2022	8	7572	31.28	6.45	34.78	27.49	0.14	JD/BDL	R4	3/4	770.75
AURORA ENERGY LLC	9/30/2022	14	7582	30.91	6.47	34.86	27.76	0.14	JD/BDL	R4	3/4	1312.9
AURORA ENERGY LLC	10/4/2022	16	7589	30.72	6.73	35.14	27.41	0.13	JD/BDL	R4	3/4	1467.9
AURORA ENERGY LLC	10/5/2022	15	7599	30.54	6.81	34.83	27.82	0.13	JD/BDL	R4	3/4	1468.8
AURORA ENERGY LLC	10/6/2022	6	7448	31.04	7.50	34.34	27.14	0.14	JD/BDL	R4	3/4	557.25
AURORA ENERGY LLC	10/7/2022	19	7610	29.93	7.11	35.08	27.88	0.14	JD/BDL	R4	3/4	1837.1
AURORA ENERGY LLC	10/11/2022	17	7586	30.46	7.13	35.37	27.05	0.13	JD/BDL	R4	3/4	1552.7
AURORA ENERGY LLC	10/12/2022	12	7451	30.71	7.88	35.16	26.26	0.16	JD/BDL	R4	3/4	1153.45
AURORA ENERGY LLC	10/13/2022	12	7531	31.30	6.81	34.42	27.47	0.15	JD/BDL	R4	3/4	1137.95
AURORA ENERGY LLC	10/14/2022	13	7584	30.06	7.44	34.66	27.85	0.16	JD/BDL	R4	3/4	1251.4
AURORA ENERGY LLC	10/18/2022	11	7636	29.78	7.41	34.86	27.95	0.19	JD/BDL	R4	3/4	1066.5
AURORA ENERGY LLC	10/19/2022	11	7629	29.91	7.34	34.84	27.92	0.19	JD/BDL	R4	3/4	1064.9
AURORA ENERGY LLC	10/20/2022	11	7606	30.47	7.02	34.78	27.74	0.16	JD/BDL	R4	3/4	1059.2
AURORA ENERGY LLC	10/21/2022	11	7503	31.61	6.74	34.41	27.25	0.16	JD/BDL	R4	3/4	1041.9
AURORA ENERGY LLC	10/25/2022	14	7586	30.33	7.64	34.71	27.32	0.16	JD/BDL	R4	3/4	1353.65
AURORA ENERGY LLC	10/26/2022	15	7600	30.20	7.66	34.77	27.38	0.16	JD/BDL	R4	3/4	1447.15
AURORA ENERGY LLC	10/28/2022	15	7627	29.42	7.92	35.27	27.39	0.17	JD/BDL	R4	3/4	1462.15
AURORA ENERGY LLC	11/2/2022	15	7651	30.26	6.93	35.71	27.11	0.13	JD/BDL	R4	3/4	1439.85
AURORA ENERGY LLC	11/3/2022	11	7630	30.15	7.03	34.94	27.88	0.14	JD/BDL	R4	3/4	1035.1
AURORA ENERGY LLC	11/4/2022	16	7593	29.85	7.23	34.98	27.95	0.13	JD/BDL	R4	3/4	1404.15
AURORA ENERGY LLC	11/8/2022	9	7516	31.10	7.07	34.48	27.35	0.13	JD/BDL	R4	3/4	840.55
AURORA ENERGY LLC	11/9/2022	10	7660	30.50	6.21	35.17	28.13	0.11	JD/BDL	R4	3/4	945.5
AURORA ENERGY LLC	11/10/2022	9	7696	29.90	6.48	35.18	28.45	0.13	JD/BDL	R4	3/4	858.65
AURORA ENERGY LLC	11/11/2022	10	7629	30.16	6.29	34.91	28.66	0.13	JD/BDL	R4	3/4	942.5
AURORA ENERGY LLC	11/15/2022	12	7487	31.02	6.87	34.24	27.87	0.13	JD/BDL	R4	3/4	1149.05
AURORA ENERGY LLC	11/16/2022	11	7600	31.54	5.68	34.78	28.00	0.11	JD/JD		4/3	993.7
AURORA ENERGY LLC	11/17/2022	11	7740	31.60	4.77	35.80	27.84	0.10	JD/JD		3/4	1007.85
AURORA ENERGY LLC	11/18/2022	11	7736	31.95	4.42	35.63	28.00	0.09	JD/JD		3/4	1030.85
AURORA ENERGY LLC	11/21/2022	13	7741	31.55	4.58	35.71	28.17	0.09	JD/JD		4/3	1172.2
AURORA ENERGY LLC	11/22/2022	12	7717	31.45	4.78	35.19	28.58	0.10	JD/JD		3/4	1095.6
AURORA ENERGY LLC	11/23/2022	5	7675	31.74	5.06	35.20	28.00	0.13	JD/JD		4/3	461
AURORA ENERGY LLC	11/25/2022	14	7698	31.36	5.10	35.32	28.23	0.12	JD/JD		4/3	1299.6
AURORA ENERGY LLC	11/29/2022	11	7314	31.86	7.79	33.41	26.95	0.14	JD/BDL	R4	4/4	893.5
AURORA ENERGY LLC	11/30/2022	8	7463	32.33	6.21	34.02	27.45	0.13	JD/BDL	R4	4/4	645.8
AURORA ENERGY LLC	12/1/2022	11	7697	31.08	5.60	35.41	27.92	0.14	JD/BDL	R4	4/4	920.5
AURORA ENERGY LLC	12/2/2022	8	7745	30.45	5.72	35.60	28.24	0.13	JD/BDL	R4	4/4	667.3
AURORA ENERGY LLC	12/6/2022	12	7714	31.23	4.92	36.00	27.86	0.13	JD/BDL	R4	4/4	1097.55
AURORA ENERGY LLC	12/7/2022	14	7680	31.32	5.33	35.78	27.57	0.14	JD/BDL	R4	4/4	1262.6
AURORA ENERGY LLC	12/8/2022	15	7737	31.70	4.44	35.66	28.21	0.10	JD/BDL	R4	4/4	1353.6
AURORA ENERGY LLC	12/9/2022	13	7703	31.17	5.00	36.02	27.82	0.12	JD/BDL	R4	4/4	1125.15
AURORA ENERGY LLC	12/13/2022	12	7731	31.32	5.01	35.74	27.93	0.13	JD/BDL	R4	4/4	1061.9
AURORA ENERGY LLC	12/14/2022	14	7701	31.62	4.79	36.02	27.58	0.11	JD/BDL	R4	4/4	1190.25
AURORA ENERGY LLC	12/15/2022	6	7589	32.69	4.73	34.93	27.66	0.14	JD/BDL	R4	4/4	520.55
AURORA ENERGY LLC	12/20/2022	4	7493	31.56	6.50	34.51	27.43	0.10	JD/STK		4	362
Annual Average			7536	31.31	6.53	34.63	27.53	0.12				

AR = as received

Table F. Estimated Station Service Electrical Load for DSI Equipment
Aurora Energy Chena Power Plant SO₂ BACT Analysis

Do not use for electrical equipment sizing. Use only
for approximating actual kW consumption under
normal operating conditions.

EQUIPMENT Equip Tag	Load Name	MCC Starter Size	MCC Starter Type	Voltage [V]	Load [VA]	Load [HP]	Load [KW]	FLA	Load Factor	Adjusted Load (kVA)	PF	Adjusted Load (kW)	Notes
05B3A	Unloading Blower	5	FVNR	480		125		150.36	0.10	12.5	0.85	10.6	Only used for unloading
05B3B	Air Cooler for Unloading Blower	1	FVNR	480		1		1.20	0.10	0.1	0.80	0.1	Only used for unloading
06B3A	Bin Vent Exhaust Fan	1	FVNR	480		7.5		9.02	0.87	6.5	0.80	5.2	
06B3B	Bin Discharger Silo #1	1	FVNR	480		3		3.61	0.87	2.6	0.80	2.1	
06B3B	Bin Discharger Silo #2	1	FVNR	480		3		3.61	0.87	2.6	0.80	2.1	
08B3A	Transfer Blower for Day Bins A	3	FVNR	480		50		60.14	0.25	12.5	0.85	10.6	Only used to transfer to plant
08B3A	Transfer Blower for Day Bins B	3	FVNR	480		50		60.14	0.00	0.0	0.85	0.0	Spare
08B3A	Air Cooler for Transfer Blower	3	FVNR	480		1		1.20	0.25	0.3	0.80	0.2	Only used to transfer to plant
09B3B	Airlock Silo #1	1	FVNR	480		1		1.20	0.25	0.3	0.80	0.2	Only used to transfer to plant
09B3B	Airlock Silo #2	1	FVNR	480		1		1.20	0.25	0.3	0.80	0.2	Only used to transfer to plant
	Unloading Skid heater			480	5000.0		5000.00	6.01	0.10	0.5	1.00	0.5	Only used for unloading
	Silo #1 Heater			480	5000.0		5000.00	6.01	1.00	5.0	1.00	5.0	
	Silo #2 Heater			480	5000.0		5000.00	6.01	1.00	5.0	1.00	5.0	
	Silo #1 Exhaust Fan	1	FVNR	480		2		2.41	0.87	1.7	0.80	1.4	
	Silo #2 Exhaust Fan	1	FVNR	480		2		2.41	0.87	1.7	0.80	1.4	
	Air Compressor	3	FVNR	480		30		36.09	0.87	26.1	0.85	22.2	For continuous supply of fluidizing air
	Area Lighting		100A BKR	480	1500.0		1500.00	1.80	1.00	1.5	0.90	1.4	
	Receptacles			480	1500.0		1500.00	1.80	1.00	1.5	0.90	1.4	
	Total	25				276.5		354.24				69.5	
05B3A	Bin Vent Exhaust Fan #1	1	FVNR	480		3		3.61	0.87	2.6	0.8	2.1	
05B3A	Bin Vent Exhaust Fan #2	1	FVNR	480		3		3.61	0.87	2.6	0.8	2.1	
	Bin Discharger #1	1	FVNR	480		1.5		1.80	0.87	1.3	0.8	1.0	
	Bin Discharger #2	1	FVNR	480		1.5		1.80	0.87	1.3	0.8	1.0	
	Feeder #1	1	FVNR	480		1		1.20	0.87	0.9	0.8	0.7	
	Feeder #2	1	FVNR	480		2		2.41	0.87	1.7	0.8	1.4	
	Feeder #3	1	FVNR	480		2		2.41	0.00	0.0	0.8	0.0	Spare
	Grinding Motor #1	3	FVNR	480		30		36.09	0.87	26.1	0.85	22.2	
	Grinding Motor #2	4	FVNR	480		60		72.17	0.87	52.2	0.85	44.4	
	Grinding Motor #3	3	FVNR	480		30		36.09	0.00	0.0	0.85	0.0	Spare
	Classifier Motor #1	1	FVNR	480		3		3.61	0.87	2.6	0.8	2.1	
	Classifier Motor #2	1	FVNR	480		6		7.22	0.87	5.2	0.8	4.2	
	Classifier Motor #3	1	FVNR	480		3		3.61	0.00	0.0	0.8	0.0	Spare
	Injection Blower Boiler #1	2	FVNR	480		25		30.07	0.87	21.8	0.85	18.5	
	Backup Injection Blower Boiler #1 (25HP)	2	FVNR	480				0.00	0.87	0.0	0.85	0.0	Spare
	Injection Blower Boiler #2	2	FVNR	480		25		30.07	0.87	21.8	0.85	18.5	
	Backup Injection Blower Boiler #2 (25HP)	2	FVNR	480				0.00	0.87	0.0	0.85	0.0	Spare
	Injection Blower Boiler #3	2	FVNR	480		25		30.07	0.87	21.8	0.85	18.5	
	Backup Injection Blower Boiler #3 (25HP)	2	FVNR	480				0.00	0.87	0.0	0.85	0.0	Spare
	Injection Blower Boiler #5	4	FVNR	480		75		90.21	0.87	65.3	0.85	55.5	
	Backup Injection Blower Boiler #5 (75HP)	4	FVNR	480				0.00	0.87	0.0	0.85	0.0	Spare
	Air Cooler #1	1	FVNR	480		2		2.41	0.87	1.7	0.8	1.4	
	Air Cooler #2	1	FVNR	480		2		2.41	0.87	1.7	0.8	1.4	
	Air Cooler #3	1	FVNR	480		2		2.41	0.87	1.7	0.8	1.4	
	Air Cooler #5	1	FVNR	480		2		2.41	0.87	1.7	0.8	1.4	
	Exhaust Fan Mill #1	2	FVNR	480		15		18.04	0.87	13.1	0.8	10.4	
	Exhaust Fan Mill #2	2	FVNR	480		15		18.04	0.87	13.1	0.8	10.4	
	Exhaust Fan Mill #3	2	FVNR	480		15		18.04	0.87	13.1	0.8	10.4	
	Exhaust Fan Mill #4	2	FVNR	480		15		18.04	0.87	13.1	0.8	10.4	
	Airlock Mill #1	1	FVNR	480		0.25		0.30	0.87	0.2	0.8	0.2	
	Airlock Mill #2	1	FVNR	480		0.25		0.30	0.87	0.2	0.8	0.2	
	Airlock Mill #3	1	FVNR	480		0.25		0.30	0.87	0.2	0.8	0.2	

EQUIPMENT Equip Tag	Load Name	MCC Starter Size	MCC Starter Type	Voltage [V]	Load [VA]	Load [HP]	Load [KW]	FLA	Load Factor	Adjusted Load (kVA)	PF	Adjusted Load (kW)	Notes
	Airlock Mill #4	1	FVNR	480		0.25		0.30	0.87	0.2	0.8	0.2	
	Area Lighting		100A BKR	480	1500.0		1500.00	1.80	1.00	1.5	0.9	1.4	
	Receptacles			480	1500.0		1500.00	1.80	1.00	1.5	0.9	1.4	
	Total	56				365		442.65				242.8	

Total	312.3
-------	-------



Emerson
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F (713)-466-8497
www.Emerson.com

22 October 2019

Aurora Energy, LLC
100 Cushman Street, Ste. 210
Fairbanks, AK 99701

Attention: David Fish

Telephone: (907) 457-0230
Email Address: dfish@usibelli.com

Subject: One (1) Gas Analyzer System for Combined Stack Multi-Gas Analyzer
Rosemount™ Proposal No. 196011, **Rev. 2**

Dear David Fish:

Emerson's Rosemount™ is pleased to submit a **revised** proposal for one (1) Gas Analyzer System for Combined Stack Multi-Gas Analyzer. Rosemount's proposal includes Cascade Technologies Quantum Laser Analyzer Model CT5400 for measuring SO₂, CO, O₂, CO₂, and NO_x along with a sample handling system. The analyzer along with sample handling system will be housed in a self-standing painted steel NEMA 4 enclosure with cabinet heater and HVAC.

The pricing in this proposal is predicated upon the terms and conditions of sale as outlined in Rosemount's Terms and Conditions of Sale, Form A (4/2011). All prices are in U.S. dollars (\$USD). The equipment will be shipped F.C.A. Origin, Houston, TX, USA (prepaid and added). The estimated lead time for the proposed system is 21 weeks after receipt and acceptance of written purchase order, subject to prior sale, and complete project information at the factory. Quoted lead time is estimated per the current workload, subject to adjustment at time of purchase order acceptance based on workload at that time.

The information in this proposal (including its attachments) is CONFIDENTIAL and may be legally privileged. This proposal is intended solely for the addressees. Any disclosure, copying, or distribution of the proposal, or any action or omission taken by an unauthorized recipient in reliance on it, is prohibited and may be unlawful.

Rosemount is dedicated to fully serving the needs of our customers. Years of experience have resulted in satisfied customers for whom we have supplied equipment, engineering, and field service all over the world. We thank you for the opportunity of presenting our proposal and trust you will find the offering acceptable, resulting in Rosemount being favored with your valued order. Should you have any questions, please feel free to contact our sales representative, Frank Spevak via telephone at (206) 979-1953 or via email at Frank.Spevak@Emerson.com.

Best regards,

Karthik Krishnan

Karthik Krishnan

CC: Frank Spevak - Emerson Tacoma, WA USA
Kimberly Muckelroy - Emerson Houston, TX USA



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Aurora Energy, LLC

One (1) Cascade Gas Analyzer System for Combined Stack Multi-Gas Analyzer

Emerson / Rosemount™
10241 West Little York, Suite 200
Houston, TX 77040
USA

Proposal Number 196011, **Rev. 2**

22 October 2019



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PROPOSAL REVISION HISTORY

Rev.	Date	Changes	Prepared By
0	18 June 2019	Original Issue	KK
1	26 June 2019	Major Changes - Painted steel NEMA 4 cabinet quoted in lieu of 304 SS NEMA 4X - Probe included in the base offer	KK
2	22 October 2019	Major Changes Revised commercial proposal for CT5400 Cascade option	KK



SECTION 1.0: COMMERCIAL OFFER

1.1 PRICING SUMMARY

Item	Description	Qty.	Unit Price	Total Price
1	Rosemount™ Cascade Gas Analyzer System Suitable for Safe Area consisting of the following equipment: - One (1) Cascade Technologies Quantum Laser Analyzer Model CT5400 for SO₂, CO, O₂, CO₂, and NO_x Measurement - One (1) GMP1000 Based Sample Handling System - One (1) Self Standing Painted Steel NEMA 4 Cabinet with Cabinet with HVAC - Universal Analyzers Probes with Blowback and Probe Tube Base price includes one (1) set of drawings and O&M manual submitted electronically to Buyer.	1	\$ 123,630.00	\$ 123,630.00
	Packing Fee for Domestic Shipping			\$ 1,627.00
	Total Price			\$ 125,257.00

1.2 PRICING OPTIONS

Item	Description	Unit Price
Option #1:	Hardcopy Operating and Maintenance Manuals in Three-Ring Binders (Add) Manuals include Operating/Maintenance Instructions for major system components and "As Built" system drawings. Manuals are written in English.	\$ 598.00 Each
Option #2:	Customer Witness of Factory Acceptance Test (FAT) at Seller's Facility (Add) Customer will be responsible for their travel and living expenses associated with the FAT. NOTE: Please add an additional week to the lead time if requesting FAT.	\$ 2,100.00 Per Day
Option #5:	Emerson SureService™ Startup & Checkout Assistance and Hands-On Training – U.S. Rate (Add) For startup, commissioning, or hands-on training services, please feel free to contact: FieldService.IVSNarc@Emerson.com for a separate proposal.	Upon Request
Option #4:	Electrically Heat Traced Sample Bundle Suitable for Safe Area - One (1) PFA Teflon sample gas tube (3/8" O.D.), heated - RTD located at midpoint of sample line bundle - Field termination kits - Power requirements: 220VAC, 60Hz (provided from cabinet/shelter) - Heated line controller is not included Maximum line length based on this configuration is 250 ft. ≈ 76 meters	\$ 42.00 Per Foot



SECTION 2.0: COMMERCIAL TERMS

2.1 TERMS AND SHIPMENT SCHEDULE

BID VALIDITY

This proposal is valid for 60 days from the date of this proposal document. Prices are firm for the deliveries noted below.

CONFIDENTIAL AND PRIVILEGED

The information in this proposal (including its attachments) is CONFIDENTIAL and may be legally privileged. This proposal is intended solely for the addressees. Any disclosure, copying or distribution of the proposal, or any action or omission taken by an unauthorized recipient in reliance on it, is prohibited and may be unlawful.

PAYMENT TERMS

Payment terms are net 30 days after invoice.

SHIPMENT DETAILS

Shipment is FCA Houston, TX, USA (prepaid and added). The estimated lead-time for the proposed system is 21 weeks for the equipment after receipt and acceptance of a written purchase order, subject to prior sales, and receipt of complete information at the factory. This shipment date assumes that complete engineering information required to design the system is available at time of purchase order issuance. Quoted lead time is estimated per the current workload, subject to adjustment at time of purchase order acceptance based on workload at that time.

ORDERING INFORMATION

Please be sure your written purchase order references this proposal by number. This assures a mutual understanding your requirements are met by Rosemount's response to your specification contained in this proposal. Please send purchase orders via email to:

AnalyticalSystemNA.csc@Emerson.com

When placing an order, the following information must be provided before Rosemount can process an order. Please ensure this is provided with your purchase order, as to not delay delivery of your order.

- | | |
|-------------------------|--|
| • P.O. Number | • Payment Terms |
| • Customer Need Date | • Tax Exemption Document (if applicable) |
| • Bill to Address | • Agreed Terms and Conditions |
| • Ship to Address | • End User Name |
| • Shipping Instructions | • End User Address |
| • Freight Terms | • End User Contact Name and Phone Number |



This order will be from:

Rosemount Inc.
 8200 Market Blvd.
 Chanhassen, MN 55317

Accounts Receivable Contact: epm-cfs.ep@emerson.com
 Accounts Receivable Phone/Fax: Phone: 952-828-3700 / Fax: 952-828-3737

Remit to Address:

Rosemount Inc.
 22737 Network Place
 Chicago, IL 60673-1227

Order Cancellation Charges Schedule

Schedule for Cancellation Charges	Percent of Purchase Order Price
Within 30 Days After Receipt of P.O.:	15%
Upon Completion of Engineering/Drawing Submittal:	30%
Upon Procurement of Materials:	70%
Upon Release to Production:	80%
Upon Completion of Production:	95%
Upon Shipment:	100%

2.2 TERMS AND CONDITIONS OF SALE

Form A (4/2011)

These terms and conditions the attendant quotation or acknowledgment, and all documents incorporated by reference therein, binds seller, (i.e., Rosemount Inc. or other Emerson Group Company), hereinafter Seller, and the buyer, as referenced on the face of the purchase order (Order), hereinafter Buyer, and constitutes the entire agreement (Agreement) between Buyer and Seller for the provision of services (Services) and/or the sale of goods (Goods) including (except as provided in Section 10) firmware incorporated therein.

- PRICES:** Unless otherwise specified by Seller, Seller's price for the Goods and/or Services shall remain in effect for thirty (30) days after the date of Seller's quotation or acceptance of the order for the Goods/Services, whichever is delivered first, provided an unconditional, complete authorization for the immediate manufacture and shipment of the Goods and/or provision of Services pursuant to Seller's standard order processing procedures is received and accepted by Seller within such time period. If such authorization is not received by Seller within such thirty (30) day period, Seller shall have the right to change the price for the Goods/Services to Seller's price in effect for the Goods/Services at the time the Order is released to final manufacture. Prices for Goods do not cover storing, installing, starting up or maintaining Goods unless expressly stated in Seller's quotation. Notwithstanding the foregoing, the price for Goods/Services sold by Seller, but manufactured by others, shall be Seller's price in effect at the time of shipment to Buyer.
- DELIVERY, ORDER ACCEPTANCE, AND DOCUMENTATION:** All shipping dates are approximate and are based upon Seller's prompt receipt of all necessary information from Buyer to properly process the Order. Notwithstanding any provisions to the contrary in this or other documents related to this trans-action, and regardless of how price was quoted, whether FOB, FAS, CIF, or otherwise, legal title to the Goods and risk of loss thereto shall transfer to Buyer as follows: for sales in which the



end destination of the Goods is within the United States, upon delivery to the freight carrier at the shipping point; for sales in which the end destination of the Goods is outside of the United States, immediately after the Goods have passed beyond the territorial limits of the United States. Seller shall provide Buyer with that data/documentation which is specifically identified in the quotation. If additional copies of data/documentation or non-standard data/documentation are to be provided by Seller, they shall be provided to Buyer at Seller's price then in effect. Data/documentation marked as confidential or proprietary may not be reproduced or used for any purpose other than the purpose for which it was provided and may not be disclosed to third parties without the prior written permission of Seller. Notwithstanding any provision to the contrary, if delivery is delayed due to any act or omission of Buyer, or if having been notified that the Goods are ready for inspection, customer checkout (CCO), or dispatch, Buyer fails within fourteen (14) days of such notice: (i) to take the Goods, or (ii) provide adequate shipping instructions, or (iii) attend inspection or (iv) specify a CCO date; Seller shall be entitled to place the Goods into a suitable storage at Buyer's expense. At that time, delivery shall be deemed to be complete, risk and title of the Goods shall transfer to Buyer, and Buyer shall pay Seller Net 30 days from date of Seller's invoice.

3. **EXCUSE OF PERFORMANCE:** Seller shall not be liable for delays in performance or for non-performance due to failure or interruption of computer or telecommunication systems, acts of God, war, riot, fire, terrorism, labor trouble, unavailability of materials or components, explosion, accident, compliance with governmental requests, laws, regulations, orders or actions, or other unforeseen circumstances or causes beyond Seller's reasonable control. In the event of such delay, the time for performance or delivery shall be extended by a period of time reasonably necessary to overcome the effect of the delay.
4. **TERMINATION AND SUSPENSION BY BUYER:** Buyer may terminate or suspend its Order for any or all of the Goods/Services covered by the Agreement only upon Seller's written consent or pursuant to Seller's applicable policy or practices covering such termination or suspension. Any changes affecting the Goods or Services made by Buyer shall only be binding upon Seller if agreed to by Seller in writing and any resulting adjustment to price, schedule, or both shall be mutually agreed in writing. Seller may cancel any Order or terminate any agreement without liability to Seller if Buyer fails to meet the conditions specified herein.
5. **LIMITED WARRANTY:** Subject to the limitations contained in Section 6 herein, Seller warrants that the licensed firmware embodied in the Goods will execute the programming instructions provided by Seller, and that the Goods manufactured by Seller will be free from defects in materials or workmanship under normal use and care and Services will be performed by trained personnel using proper equipment and instrumentation for the particular Service provided. The foregoing warranties will apply until the expiration of the applicable warranty period. Except as specified below, Goods are warranted for twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller, whichever period expires first. Consumables and Services (except as specified below) are warranted for a period of ninety (90) days from the date of shipment or completion of the Services. Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that Seller has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products. If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, correct any errors that are found by Seller in the firmware or Services or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Seller to be defective, or refund the purchase price of the defective portion of the Goods/Services. All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources or environmental conditions, accident, misuse, improper installation, modification, repair, use of unauthorized replacement parts, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense. Seller shall not be obligated to pay



any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by Seller. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel and representatives for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller. Goods repaired and parts replaced by Seller during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by Seller. THE WARRANTIES AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE. THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

6. **LIMITATION OF REMEDY AND LIABILITY:** SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE REMEDIES OF BUYER SET FORTH IN THIS AGREEMENT ARE EXCLUSIVE. IN NO EVENT, REGARDLESS OF THE FORM OF THE CLAIM OR CAUSE OF ACTION (WHETHER BASED IN CONTRACT, INFRINGEMENT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT OR OTHERWISE), SHALL SELLER'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS MANUFACTURED OR SERVICES PROVIDED BY SELLER GIVING RISE TO THE CLAIM OR CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXTEND TO INCLUDE INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES. THE TERM "CONSEQUENTIAL DAMAGES" SHALL INCLUDE BUT NOT BE LIMITED TO, LOSS OF ANTICIPATED PROFITS, REVENUE OR USE AND COSTS INCURRED INCLUDING WITHOUT LIMITATION FOR CAPITAL, FUEL AND POWER, AND CLAIMS OF BUYER'S CUSTOMERS.
7. **PATENTS:** Subject to the limitations contained in Section 6, Seller shall defend any suits brought against Buyer based on a claim that use of the Goods manufactured by Seller constitutes an infringement of a valid patent of the United States, and shall pay any damages awarded therein against Buyer, provided that Buyer: promptly notifies Seller in writing of the filing of such suit or the threat thereof; permits Seller to control completely the defense or compromise of such claim of infringement; and provides all reasonable assistance and cooperation requested by Seller for the defense of such suit. In the event that only the Goods manufactured by Seller are held to be infringing in such suit and their use is enjoined, Seller shall, at its sole option and expense, provide a commercially reasonable alternative, including, but not limited to, procuring for Buyer the right to continue using the Goods, replacing them with a non-infringing product or modifying them so they become non-infringing. Buyer agrees that Seller shall not be liable for infringement, and that Buyer shall fully indemnify Seller therefore, if infringement is based upon the use of Goods in connection with goods not manufactured by Seller or in a manner for which the Goods were not designed by the Seller or if the Goods were not designed by the Seller or if the Goods were designed by the Buyer or were modified by or for the Buyer in a manner to cause them to become infringing.
8. **TAXES:** Any tax or governmental charge payable by the Seller because of the manufacture, sale or delivery of the Goods, or provision of Services, may at Seller's option be added to the price herein specified. The foregoing shall not apply to taxes based upon Seller's net income. Prices do not include any sales, use, excise, value added, or similar taxes. Taxes shall be the responsibility of Buyer and Seller shall include them on all invoices, absent the receipt of a valid exemption from Buyer.
9. **TERMS OF PAYMENT:** Unless otherwise agreed by Seller, and subject to the approval of Seller's Credit Department, terms are F.O.B. shipping point, net 30 days from date of Seller's invoice in U.S. currency, except for applicable milestone payments or export shipments for which Seller may require other arrangements. Freight charges may include shipping and handling charges, and Buyer shall pay all such charges. If any payment owed to Seller hereunder is not paid when due, it shall bear interest, at a rate to be determined by Seller which shall not exceed the maximum rate permitted by



law, from the date on which it is due until it is received. Seller shall have the right, among other remedies, either to terminate the Agreement or to suspend further deliveries under this and/or other agreements with Buyer in the event Buyer fails to make any payment hereunder when due. Buyer shall be liable for all expenses attendant to collection of past due amounts, including attorneys' fees.

- 10. SOFTWARE AND FIRMWARE:** Notwithstanding any other provision herein to the contrary, Seller or applicable third party owner shall retain all rights of ownership and title in its respective firmware and software, including all copyrights relating to such firmware and software and all copies of such firmware and software. Except as otherwise provided herein, Buyer is hereby granted a nonexclusive, royalty free license to use firmware and software, and copies of firmware and software, incorporated into the Goods only in conjunction with such Goods and only at the Buyer's plant site where the Goods are first used. Buyer's use of certain firmware (as specified by Seller) and all other software shall be governed exclusively by Seller's and/or third party owner's applicable license terms.
- 11. BUYER SUPPLIED DATA:** To the extent that Seller has relied upon any data or information supplied by Buyer to Seller ("Data") in the selection or design of the Goods and/or provision of the Services and the preparation of Seller's quotation, and the Data is inadequate or inaccurate, any warranties or other provisions contained herein which are affected by such conditions shall be null and void.
- 12. EXPORT/IMPORT:** Buyer agrees to comply with all applicable import and export control laws, regulations, orders and requirements, including without limitation those of the United States and the European Union, and the jurisdictions in which the Seller and Buyer are established or from which items may be supplied. Accurate and complete disclosure of destination and end user is required of all product scheduled for overseas shipment.
- 13. GENERAL PROVISIONS:** (a) Buyer shall not assign its rights or obligations under the Agreement without Seller's prior written consent. (b) There are no understandings, agreements or representations, express or implied, not specified in the Agreement. (c) No action, regardless of form, arising out of transactions under the Agreement, may be brought by either party more than two [2] years after the cause of action has accrued. (d) Any modification of these terms and conditions must be set forth in a written instrument signed by a duly authorized representative of Seller. (e) The Agreement is formed and shall be construed, performed and enforced under the laws of the State of Missouri. However, Buyer and Seller agree that the proper venue for all actions arising under the Agreement shall be only in the USA and in the State where the Goods involved in such actions were manufactured. (f) UNLESS OTHERWISE SPECIFICALLY PROVIDED IN SELLER'S QUOTATION, GOODS AND SERVICES HEREUNDER ARE NOT INTENDED FOR USE IN ANY NUCLEAR OR NUCLEAR RELATED APPLICATIONS. Buyer (i) accepts Goods and Services in accordance with the restriction set forth in the immediately preceding sentence, (ii) agrees to communicate such restriction in writing to any and all subsequent purchasers or users and (iii) agrees to defend, indemnify and hold harmless Seller from any and all claims, losses, liabilities, suits, judgments and damages, including incidental and consequential damages, arising from use of Goods and Services in any nuclear or nuclear related applications, whether the cause of action be based in tort, contract or otherwise, including allegations that the Seller's liability is based on negligence or strict liability. (g) The 1980 United Nations Convention on Contracts for the International Sale of Goods does not apply to this Agreement. (h) If any provision of the Agreement is invalid under any statute or rule of law, such provision, to that extent only, shall be deemed to be omitted without affecting the validity of the remainder of the Agreement (i) Seller specifically objects to the application of any Federal Acquisition Regulation ("FAR") or other governmental procurement provision or clause to this Agreement. (j) The rights, remedies and protections afforded to Seller under this Agreement, including but not limited to indemnification of Seller, limitation of remedy and liability and limited warranty shall extend to Seller and to its affiliates, subsidiaries or related companies performing or supplying work, services or products under this Agreement or any agreement into which it is incorporated by reference. (k) Seller does not agree to: (i) indemnify Buyer; or (ii) name Buyer as an additional insured.



SECTION 3.0: TECHNICAL SCOPE OF WORK

3.1 EQUIPMENT LIST AND SERVICES – BASE OFFERING

Item	Qty.	Description																		
1	1	Rosemount™ Cascade Technologies Quantum Laser Analyzer System Suitable for Safe Area, consisting of the following equipment: (1) Cascade Technologies Quantum Cascade Laser Analyzers Model CT5400 for SO₂, O₂, CO, CO₂, NO, and NO₂ Measurement <table border="1"> <thead> <tr> <th>Component</th><th>Concentration</th><th>Range</th></tr> </thead> <tbody> <tr> <td>Sulfur Dioxide (SO₂)</td><td>0 / 100 / 1000 ppm</td><td>0 – 1000 ppm / 10 ppm</td></tr> <tr> <td>Carbon Monoxide (CO)</td><td>0 / 400 / 2000 ppm</td><td>0 – 3000 ppm / 30 ppm</td></tr> <tr> <td>Oxygen (O₂)</td><td>0 / 10 / 20.9%</td><td>0 – 21 % / 0.4%</td></tr> <tr> <td>Carbon Dioxide (CO₂)</td><td>0 / 10 / 20%</td><td>0 – 10 % / 0.1%</td></tr> <tr> <td>Oxides of Nitrogen (NO_x)</td><td>0 / 170 / 1000 ppm</td><td>0 – 1000 ppm / 10 ppm</td></tr> </tbody> </table> Note: Refer to Section 5.0: Product Data Bulletins of this proposal for additional information on the analyzer.	Component	Concentration	Range	Sulfur Dioxide (SO ₂)	0 / 100 / 1000 ppm	0 – 1000 ppm / 10 ppm	Carbon Monoxide (CO)	0 / 400 / 2000 ppm	0 – 3000 ppm / 30 ppm	Oxygen (O ₂)	0 / 10 / 20.9%	0 – 21 % / 0.4%	Carbon Dioxide (CO ₂)	0 / 10 / 20%	0 – 10 % / 0.1%	Oxides of Nitrogen (NO _x)	0 / 170 / 1000 ppm	0 – 1000 ppm / 10 ppm
Component	Concentration	Range																		
Sulfur Dioxide (SO ₂)	0 / 100 / 1000 ppm	0 – 1000 ppm / 10 ppm																		
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Carbon Dioxide (CO ₂)	0 / 10 / 20%	0 – 10 % / 0.1%																		
Oxides of Nitrogen (NO _x)	0 / 170 / 1000 ppm	0 – 1000 ppm / 10 ppm																		
	(1)	Sample Conditioning System, includes: - Universal Analyzers sample gas cooler (two-stage thermoelectric cooler) with integral sample pump, condensate monitor and condensate removal system - Constant dew point of 5°C ± 1°C - ADI sample pump - Two (2) 3-way solenoid valves for local/remote injection of calibration gas to system - Indicator panel assembly: Provides local indication of sample flows and pressures - Sample gas distribution panel including: valves, solenoids, and flow meters to provide proper gas distribution to the analyzer - Temperature controllers/Solid State relays for heated sample line and sample probe heater																		
	(1)	Universal Analyzers Heated Sample Probe consisting of the following: - Heated Sample Probe for Installation in General Purpose area - Filter Element: 9" Removable filter - Heating: Chamber Temp Controlled to 400°F - Alarm: Low Temperature Alarm - Process Connection: 4" – 150# RF Flange - Power Requirements: 115V AC, 60Hz - Sample Line Connection: 3/8" Compression Fitting Connection - Blowback Air Requirement: 100 PSIG (min.) / 125 PSIG (max) - Insertion Tube: Probe Tube: 3 ft. Probe Tube (can be cut to length)																		
	(1)	NEMA 4 Single-Bay System Cabinet with HVAC suitable for Safe Area installation: - On-line gas analyzers and sample conditioning system (listed separately) - Load center (BB) for system only will be located in cabinet 24 VDC power supply for solenoid valves and other miscellaneous equipment; power supply will be sized based upon quantity and configuration of other miscellaneous equipment; power distribution terminal blocks will also be supplied - Temperature controllers / solid state relays for heated sample line and sample probe heater; also includes fuse block with fuses - The cabinet is front access allowing total access to rack interior and contains the equipment - NEMA 4 Cabinet constructed of painted steel - HVAC (4,000 BTU/hr. cooling and 400-watt heating) - add additional 12" to cabinet width for HVAC - Approximate Size: 78" high x 32" deep x 25" wide																		



Item	Qty.	Description
	(1)	System Operating and Instruction Manual on CD , includes: • Operating / Maintenance Instructions for analyzers and major system components • “As Built” Drawings • Recommend Spare Parts List • Manuals written in the English language

3.2 BASE OFFERING - OPTIONS

Item	Description
Option #1:	Hardcopy Operating and Maintenance Manuals in Three-Ring Binders (Add) Manuals include Operating/Maintenance Instructions for major system components and “As Built” system drawings. Manuals are written in English.
Option #2:	Customer Witness of Factory Acceptance Test (FAT) at Seller’s Facility (Add) Prior to shipment of the equipment, Rosemount system engineer will review system parameters, operation, and performance of the system as part of our standard factory acceptance testing (FAT). The customer will be advised of the FAT at Seller’s facility in Houston, TX and are invited to witness the testing. FAT procedures will be sent to customer 2 weeks prior to projected FAT date. Rosemount’s project manager will coordinate with the customer the FAT testing with the shipping date of the equipment. Customer will be responsible for their travel and living expenses associated with the FAT. NOTE: Please add an additional week to the lead time if requesting FAT.
Option #3:	Emerson SureService™ Startup & Checkout Assistance and Hands-On Training For startup, commissioning, or hands-on training services, please feel free to contact: FieldService.IVSNarc@Emerson.com for a proposal.
Option #4:	Electrically Heat Traced Sample Bundle suitable for Safe Area Heat-Traced Line includes: • One (1) PFA Teflon sample gas tube (3/8" O.D.) heated • RTD located at midpoint of sample line bundle • Field termination kits • Power requirements: 220VAC, 60Hz (provided from cabinet/shelter) Maximum line length based on this configuration is 250 ft. ≈ 76 meters

3.3 ANALYZER SYSTEM APPLICATION DATA TABLES

ROSEMOUNT ASSUMES THE FOLLOWING: Trace is defined as 1.0% or less of lowest stated component concentration. All stated values vary not more than $\pm 10\%$ unless otherwise stated. No component will polymerize, decompose, or otherwise react. No other components will be present during upset conditions.

Stream Composition: Per customer provided datasheet (or RFP documents) and per assumptions.



Process Extraction Point

Component	Concentration	Measurement Range(s) (of full scale) %
	Min / Norm / Max	Range/Limit of Detection (LOD)
Oxides of Nitrogen (NOx)	0 / 25 / 50 ppm	0 – 50 PPM / 0.5 ppm
Carbon Monoxide (CO)	0 / 50 / 1000 ppm	0 – 1000 PPM / 10 ppm
Oxygen (O2)	0 / 2.5% / 10%	0 – 10% / 0.1
Argon (Ar)	0.86%	Not Measured
Carbon Dioxide (CO2)	8.53%	Not Measured
Water (H2O)	16.64%	Not Measured
Nitrogen (N2)	71.47%	Not Measured
Sample Phase: Vapor		
Sample Temperature: +1300°F to +1500°F		
Sample Pressure: -1" H2O		
Sample Return Pressure: Sample vent to atmosphere at safe areas		
Area Classification: North America: Class 1, Division 2, Groups B, C, D for Analyzer System Safe Area for Sample Probe and Heat Traced Sample Line		
Specified Sample Condition / Cell Parameters CT5400		
Temperature: 50°C		
Pressure: 0.46 atm.		

3.4 UTILITY REQUIREMENTS

Electrical Power:

120V AC, 60 Hz (please specify if other)

Instrument Air Requirement:

80-100 psig instrument air for Purge Control / Vortex Cooling / Valve Actuation

3.5 VALIDATION GAS

Span values for the validation gas should be between 80 to 100% of the analyzer full-scale range with the balance being nitrogen. Zero gas cylinder should be nitrogen. Some gases can be mixed to create “cocktail” mix cylinders.

Validation gas/cylinders and associated pressure regulators are supplied by Others unless purchased as an option. Gas cylinder pressure to be set to approximately 15 to 25 psig.

3.6 MATERIALS OF CONSTRUCTION

Materials in contact with the sample include 316 stainless steel, Teflon, Viton, and glass.



SECTION 4.0: EXCEPTIONS, CLARIFICATIONS, AND COMMENTS

4.1 GENERAL COMMERCIAL EXCEPTIONS, CLARIFICATIONS, AND COMMENTS

1. Terms and conditions of this proposal are predicated upon the terms and conditions of sale as outlined in Rosemount Terms and Conditions of Sales, Form A (4/2011).
2. Rosemount's prime goal is to provide all customers the highest quality products at the lowest possible prices, with the soonest possible delivery date. To accomplish this goal, Rosemount prices, quotes, and sells all products subject to Rosemount's standard Terms and Conditions of Sale. Any changes or variations to Rosemount's Terms and Conditions of Sale may result in delay in delivery or an increase in price. Of course, Rosemount will always negotiate in good faith fair and reasonable, mutually acceptable Terms and Conditions of Sale.
3. The information in this proposal (including its attachments) is CONFIDENTIAL and may be legally privileged. This proposal is intended solely for the addressees. Any disclosure, copying or distribution of the proposal or any action or omission taken by an unauthorized recipient in reliance on it is prohibited and may be unlawful.
4. Notwithstanding any provisions to the contrary in this or other documents related to this transaction, and regardless of how price was quoted, whether FOB, FAS, CIF, or otherwise, legal title to the Goods and risk of loss thereto shall transfer to Buyer as follows: for sales in which the end destination of the Goods is in the United States, upon delivery to the agreed delivery point; sales in which the end destination of the Goods is outside of the United States, immediately after the Goods have passed beyond the territorial limits of the United States
5. A completed Transaction Screening Form (TSF) is required prior to commencement of manufacturing of the equipment. The TSF form is provided in an appendix in this proposal.
6. Packaging and crating of the equipment does not include a fumigation certificate and will follow standard procedures for domestic USA shipping. Any special requirements for packaging (special materials, fumigation, etc.) of the equipment or packaging will require a change order. Please contact us should this be required.

4.2 GENERAL TECHNICAL EXCEPTIONS, CLARIFICATIONS, AND COMMENTS

7. Instrument design will be based upon the assumed application information provided in Section 2: Commercial Terms of this proposal. Concentrations or conditions other than those listed in this proposal may cause analyzer failure. Charges for corrective service or parts will be directed to the user /purchaser.
8. Rosemount assumes there are no polymerizing constituents in the sample gas stream. If after review of the sample gas stream composition, Rosemount discovers constituents that may damage the system components, Rosemount reserves the right to requote pricing and scope of supply to meet the need of the system as dictated by the sample gas stream composition.
9. Where any equipment is specified as to brands or manufacturers, it indicates a general quality standard with final selection made by Rosemount with the approval of the purchaser. However, in the event the purchaser/end user has a specific vendor preference, the amount of the contract price and delivery date will be adjusted accordingly.
10. Rosemount reserves the right to make changes in materials or arrangement to assure proper operation of the systems at no cost to the purchaser. Any other revisions resulting in a change in delivery date, purchase price, or terms must be agreed upon by both Rosemount and the purchaser.



11. Rosemount assumes the purchaser shall install the system. Installation includes but is not limited to all craft labor, site preparations, foundations, material such as wire, conduit, air, and drain piping.
12. Rosemount systems may require seals, which will be shipped unpoured. Pouring the seals is not in Rosemount's scope of supply and will need to be poured on-site by customer.
13. Rosemount has NOT included sample probe, sample line, validation gases, validation gas lines, or associated equipment in our base bid. Rosemount believes it is most economical for the end user to purchase this material from a local supplier (if required).
14. Rosemount will require process and instrument datasheet with current process parameters to ascertain the suitability of the proposed system. In absence of the same, Rosemount cannot guarantee the performance of the quoted system.
15. The wetted materials within an analyser are stainless steel, PFA coated aluminum, SiO3 Protected Gold, BaF2 and CaF2. O-rings are either FKM or FFKM (application dependent). There are additional wetted materials in CT5400 analyzers: hardened steel, glass, ZnSe, anodized aluminum, PTFE, Silicone and Rocol Oxy Lube Molybdenum Disulphide. It is the responsibility of the end user to establish the suitability for their specific application. Cascade Technologies Limited can offer advice but cannot warrant, guarantee, or assume responsibility for the accuracy of the information or suitability for a specific application.
16. The CO2 measurement has been assessed based on 'Normal' process concentrations as per the supplied ADS. If the maximum CO2 concentration varies from normal, measurement performance may be affected.
17. Repeatability ± 1 % of measurement or limit of detection (LOD) whichever is greater
18. Purchaser needs to provide all power and signal termination with accessories directly to analyzer.

4.3 PROJECT SPECIFIC EXCEPTIONS, CLARIFICATIONS, AND COMMENTS

Item	Document Title / Number	Rev.		Clarification / Exception
1	System ADS point no. 7.1			Rosemount has proposed CT5400 in lieu of CT 5100
2	System ADS point no. 8.2			Rosemount has proposed NEMA 4 painted steel cabinet in lieu of NEMA 4X enclosure.



SECTION 5.0: PRODUCT DATA BULLETINS

Links for the Product Data Bulletins and other brochures/details are provided below. Kindly note: If there are issues with the links provided below, please copy the address and paste it into your browser.

Bulletin Description	
	Rosemount™ Analytical Systems & Integration Services https://sales.emersonprocess.com/DocumentCenter/RosemountAnalyticalDocuments/AS_BRO_Analytical_Systems.pdf
	Quantum Cascade Laser Analyzers http://www.emerson.com/documents/automation/brochure-rosemount-ct5000-series-qcl-analyzers-en-73002.pdf
	Cascade CT5400 Process Gas Analyzer http://www.emerson.com/documents/automation/product-data-ct5400-continuous-gas-analyzer-en-72658.pdf
	The Importance of Quality http://www.emerson.com/documents/automation/brochure-importance-of-quality-en-69494.pdf
Continuous Gas Analyzers	To visit our other product documents or look at instrument manuals, please search using the below link: http://www.emerson.com/en-us/automation/measurement-instrumentation/gas-analysis/continuous-gas-analyzers



SECTION 6.0: DOCUMENTATION

Drawings/document submittals for analytical systems vary based on the specific system components as well as the number of systems ordered. Typical drawings and documents along with estimated lead times that may be submitted for one (1) analytical system are shown in the table below. After contract award, Rosemount will provide a detailed project schedule at project kick-off meeting. The project schedule is based on customer providing comments on drawings and documentation within one (1) week of receipt of documents from Rosemount. If additional changes are necessary or if there is a delay in receiving comments from the customer, the system delivery may be delayed.

		ROSEMOUNT TYPICAL PROJECT DATA SUBMITALS (as applicable)		
		INTEGRATED ANALYZER SYSTEMS		
DOCUMENT SECTION		DOCUMENT TITLE	E-ELECTRONIC/ P - PRINTS	LEAD TIME (IN WEEKS)*
1		System Drawings		
	1.1	Drawing Index	1E	10 ARO
	1.2	Enclosure Arrangement Drawing	1E	10 ARO
	1.3	Flow Diagram	1E	10 ARO
	1.4	Equipment List	1E	10 ARO
	1.5	Field Connection Diagram-Electrical	1E	10 ARO
	1.6	Internal System Wiring Diagram (if applicable)	1E	2 ASP
2		Rosemount Analyzers		
	2.1	Analyzer Datasheets	1E	2 ASP
	2.2	Spare Parts List	1E	2 ASP
	2.3	Analyzer Test Data	1E	2 ASP
3		Test Data		
	3.1	Factory Acceptance Test Record	1E	2 ASP
	3.2	Storage and Preservation Procedure	1E	2 ASP
	3.3	Probe Calculation (if applicable)	1E	2 ASP
4		Major Equipment Specification Sheets	1E	2 ASP
5		Operation and Maintenance Manuals	1E	2 ASP
Notes *: ARO: After order acceptance ASP: After shipment				



SECTION 7.0: PROJECT MANAGEMENT AND ENGINEERING SERVICES

A key factor in the success of any system integration project is experienced Project Management. For this project, Rosemount have included time for an experienced project manager to plan, control, monitor, and report the status of the overall project.

During the kickoff meeting, the Project Schedule will be finalized, and the system integration design freeze dates will be established. Any application and/or system integration change, requested after these applicable freeze dates, may represent additional scope of supply, and result in a contractual change (delivery schedule and/or price).

Rosemount will provide the following project management and engineering services:

Item	Description
1	<u>Project Kickoff Meeting</u> The Rosemount Project Manager will conduct a project kick-off meeting with the customer within one (1) month after receiving purchase order. Subjects to be covered in the meeting include: • Project Plan • Commercial Issues • Project Schedule • System Integration Data • Drawings and Documentation
2	<u>System Hardware Manufacturing Schedule</u> The proposed system configuration and project schedule will be finalized during the kickoff meeting. Rosemount will perform the system manufacturing according to the hardware-manufacturing schedule.
3	<u>Project Schedule</u> With customer's input, the Rosemount Project Manager will develop a detailed project schedule and keep it updated as a tool for management and tracking. Progress reports will be provided monthly through the project. The reports will address the status of the project. All changes in project scope, schedule, and / or status will be documented at this time.
4	<u>Design Meeting</u> Rosemount's Project Manager will conduct one (1) design review meeting during the project – location TBD.
5	<u>Overall Project Follow Up</u> The Rosemount Project Manager will provide overall project follow up to ensure the project is executed according to the agreed upon scope and schedule, and the highest possible level of satisfaction for this project is achieved.
6	<u>Engineering Services</u> Rosemount provides professional engineering service through one (1) set of custom engineering drawing package for each integration project.



APPENDIX A: TRANSACTION SCREEN FORM (TSF)

**Transaction Screening Form (TSF)**

Date:	Purchase/Sales Order/RFQ Number:	Project Name/Number:
-------	----------------------------------	----------------------

A. Purchaser☐ Check if included on purchase order or complete below

Company Name	
Address line 1	
Address line 2	
City	
State/Province	
Postal Code	
Country	

B. Consignee/Ship To☐ Check if same as A. Purchaser☐ Check if included on purchase order or complete below

Company Name	
Address line 1	
Address line 2	
City	
State/Province	
Postal Code	
Country	

C. End User/Ultimate Destination☐ Check if same as A. Purchaser☐ Check if same as B. Consignee/Ship To☐ Check if included on purchase order or complete below

Company Name	
Address line 1	
Address line 2	
City	
State/Province	
Postal Code	
Country	

D. Additional Parties[Click here for appendix to add additional parties](#)☐ Check if included on purchase order or complete below☐ Bank☐ Freight Forwarder☐ Carrier☐ Other _____

Company Name	
Address line 1	
Address line 2	
City	
State/Province	
Postal Code	
Country	

E. End-Use Information

Explain in detail the end-use of the supplied product:

End-use: ☐ Chemical Weapons/Biological Weapons ☐ Military ☐ Rockets/Missiles ☐ Nuclear
☐ Space ☐ Stock ☐ Other _____

F. Form Completed By

Name		City	
Company Name		State/Province	
Phone		Country	
Email		Signature	

For Emerson Internal Use Only

Reviewed By: _____

Date: _____

Emerson Process/Gas Analysis

AMERICAS

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ROSEMOUNT™



From: [Solan, John](#)
To: [Chilkoot Ward](#); dfish@usibelli.com
Cc: [Courtney Kimball](#); [Thornam, Joseph](#)
Subject: FW: Aurora Loads
Date: Friday, September 29, 2023 07:18:33
Attachments: [image001.png](#)
[Aurora Electrical Equipment List.xlsx](#)

All,

Here is what our electrical came up with. See his justification below and the attached spreadsheet. As I said before, I don't have any hard data on actual electrical consumption. I do know that there aren't any VFDs in the DSI design, so we don't have to worry about part load consumptions. I checked the list and made sure that any redundant equipment was "turned off."

Please have a look and let me know if you think that this is sufficient support for the electrical consumption values that you need.

-John

From: Thornam, Joseph <ThornamJoseph@stanleygroup.com>
Sent: Friday, September 29, 2023 9:09 AM
To: Solan, John <SolanJohn@stanleygroup.com>
Subject: Aurora Loads

John,

The 80% factor I mentioned yesterday is a method of estimating continuous load on a circuit for which you have only breaker ratings, but nothing else. In the case of the attached spreadsheet, there are motor rating values, so that's a little different. If motor nameplate values are known and the objective is to apply a factor to more closely estimate what the motor will actually pull, my vote is for an 87% factor. I came up with this because our specs (as an example) require that the motor be sized 115% of the mechanical load. $1/1.15 = 0.87$.

To that end, I added some columns in the attached so that it's set up to estimate actual anticipated load (I assumed you wanted it in kW). The demand factor column can be used to adjust each line item to the appropriate value. I added the factor discussed above. Also, if you know that some loads are redundant and won't run simultaneously, you could zero those out too.

This what you're looking for?



Joe Thornam, Electrical Engineer

STANLEYCONSULTANTS

T: 303.649.7808 | M: 303.507.3114 | stanleyconsultants.com

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Appendix C

Article: “The Growth of Dry Sorbent Injection (DSI) and the impact on Coal Combustion Residue”

The Growth of Dry Sorbent Injection (DSI) and the impact on Coal Combustion Residue

Michael D. Schantz¹, Melissa Sewell²

¹Director Flue Gas Treatment Solutions, Lhoist North America, 3700 Hulen Street, Fort Worth, TX 76132, ²Manager Flue Gas Treatment Solutions, Lhoist North America, 3700 Hulen Street, Fort Worth, TX 76132

KEYWORDS: Dry Sorbent Injection, DSI, calcium hydroxide, hydrated lime, trona, SO₃, HCl

INTRODUCTION

Dry Sorbent Injection (DSI) refers to the practice of injecting a dry alkaline mineral into a flue gas stream in an effort to capture acid gases. The use of this technology at utilities and industries is expanding rapidly as a low capital cost solution for compliance with evolving environmental control requirements. This paper discusses the drivers for the use of DSI technology and the potential impacts of the DSI reagents on the Coal Combustion Residue (CCR), whether disposed or marketed.

THE DRIVERS FOR DRY SORBENT INJECTION (DSI)

DSI technology was evaluated as a potential acid gas control technology as early as the 1980's, however as a general rule, capture efficiencies were not high enough to address the removals required at utility coal-fired boilers under Phase One SO₂ control requirements of the 1990 Clean Air Act Amendments. However, advances in sorbent effectiveness, combined with new regulatory drivers, have DSI playing a major role in U.S. utility and industry compliance strategies.

Much of the recent rebirth of DSI technology was driven by the unintended consequence of installing SCR technology on coal-fired utility boilers combusting high sulfur fuel. Unfortunately retrofitted SCR systems designed to capture NO_x also convert some percentage of SO₂ to SO₃. This SO₃ has become a major issue for many utilities as the SO₃ reacts with moisture in the flue gas and atmosphere as the gas cools. This has resulted in localized H₂SO₄ emissions or so called "blue plume" issues. Over the last ten years, DSI with both calcium and sodium products have proven effective for control of SO₃ emissions and are in use at dozens of facilities today.

Three additional rule making efforts aimed at coal-fired utilities are expanding the interest in DSI technology. Perhaps most significant is the implementation of the utility MATS rule, which requires control of HCl emissions from coal-fired power plants for the first time. In fact, the U.S. EPA has estimated that 62 GW of coal-fired utilities will utilize DSI technology to comply with the recently finalized utility MATS rule. While the validity

In the case of the sodium chemistry the primary reaction products are sodium sulfate and sodium chloride. Just as with calcium, there is generally much more of the sulfate reaction product than the chloride reaction product due to the relative concentration of the pollutants in a coal-fired utility typical fuel gas.

FACTORS THAT IMPACT DSI SYSTEM EFFECTIVENESS

DSI is being employed for a wide variety of acid gas control applications. At unscrubbed utilities, DSI technology is being employed for primary SO_2 control as well as a viable approach for HCl compliance for the MATS rule. At scrubbed utility units, DSI technology is generally employed for SO_3 control. However, there is a growing population of facilities using DSI technology to remove chlorides from the scrubber chemistry and minimize the use of activated carbon for mercury control. Regardless of the specific application, the effectiveness of a DSI system is a function of the three broad categories of factors listed below:

- Flue Gas Properties –Temperature, flue gas moisture and other competing acid gases (SO_3 , HCl, HF and SO_2)
- Reagent Properties – inherent reagent reactivity, reagent surface area, reagent porosity, pore geometry
- Injection System Configuration - Particulate control device, in flight residence time, reagent mixing and injection location

In addition to impacting the effectiveness of a DSI system for a given control requirement, the impacts of a DSI system on the CCRs are influenced by these factors as well. While the use of DSI reagents at utilities using wet scrubbers for SO_2 compliance will clearly impact the scrubber sludge, this presentation will focus primarily on the impacts to the fly ash, whether marketed or disposed.

INJECTION SYSTEM CONFIGURATION IMPACTS

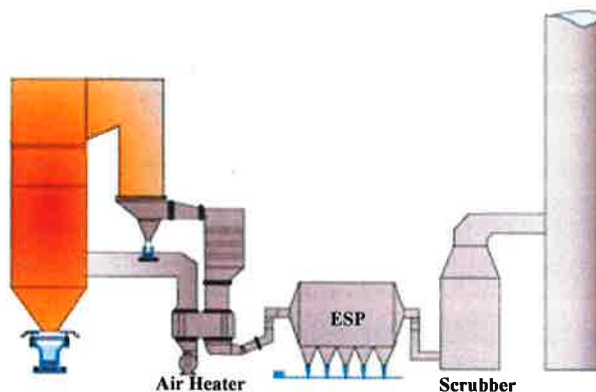


Figure One

gas applications. The choice of sodium reagent and pre-injection treatment will impact the amount of residual sodium bicarbonate or sodium sesquicarbonate in the CCR.

FLUE GAS PROPERTIES

The flue gas properties at the injection point will impact how reactive a DSI reagent is with specific acid gases. This in turn will impact how much the CCR will be impacted. As an example, while optimized calcium hydroxide is quite reactive with SO_2 at higher temperatures, at lower injection temperatures such as those typically encountered post air heater, hydrated lime not very reactive with SO_2 . This would suggest that if the goal of a DSI system is to capture HCl for MATS compliance and minimize the impact on the CCR residue, injection of hydrated lime at post air heater temperatures would be preferred.

Conversely, since sodium compounds are relatively reactive with SO_2 regardless of temperature, a significant amount of SO_2 would be captured even when targeting HCl. This would result in an increase in the sulfate reaction compound, sodium sulfate (Na_2SO_4) in the CCR material.

It is clear that the DSI injection system configuration, reagent properties and flue gas properties will determine the efficacy of the system and the resulting impacts on the CCRs. And while the impacts can be minimized to an extent, the questions of how the marketability of a fly ash stream and the potential liability associated with disposal of CCRs impacted by DSI reagents remains. The potential impacts of DSI reagents on the disposal of CCRs are addressed first.

THE IMPLICATIONS OF THE USE OF DSI REAGENTS ON DISPOSED CCRs

While maintaining the marketability of fly ash after the implementation of DSI technology is the desired outcome, it is likely that that a majority of fly ash impacted by DSI reagent use will be disposed. Given the focus of the EPA on developing rules for disposed CCRs, the impact of these DSI reagents must be considered.

While the most obvious impact will be an increase in the volume of CCR materials, the impacts that are likely more significant are the impacts on the metals leaching potential of the fly ash and the soluble constituents of the resulting fly ash. While it is recommended these impacts be evaluated for each specific fly ash, Lhoist North America (LNA) determined it would be useful to develop a method to evaluate the relative impacts of calcium hydroxide DSI reagents versus sodium based sorbents for these specific properties in a laboratory environment.

Bench Test Design

While we are aware of at least one unit switching from sodium DSI reagents to calcium DSI reagents, there was not any data available to compare the relative impacts on the associated CCR materials. Also, any changes in fuel or unit operations would present a significant challenge in analyzing any available data. Accordingly, LNA elected to enlist

In an effort to accurately predict the impacts of the use of DSI reagents on the CCRs, we then estimated the relative amount of DSI reagent necessary for two acid gas control requirements. When making these calculations we assumed the fuel was 1.2% sulfur, 0.1% chlorides, 10% ash and 10,000 Btu/lb. Typical stoichiometric rates for 90% SO₃ capture and 95% HCl capture were then assumed. These calculations resulted in two blends of DSI reagent by weight, one 15% DSI reagent and the second 30%, for both the sodium and calcium reagents. Note that even though the mass of DSI reagents are the same for both sodium and calcium, the difference in molecular weight between these two reagents (96 versus 56) means that a 70% higher stoichiometric rate is assumed for the given control level with the calcium reagent. This is likely a conservative assumption given that optimized hydrated limes have been demonstrated to compete very effectively with trona reagents on a weigh basis.

These blends were then subjected to a simulated flue gas consistent with the combustion of the typical bituminous fuel in a pulverized coal fired unit. Note that the temperature maintained in the batch kiln was 204° C or 399° F to represent post combustion conditions representative of those at typical DSI injection locations. The composition of the simulated flue gas is shown below.

Simulated Flue Gas Composition

Gas	Volume, %
N ₂	74.27
CO ₂	13.8
O ₂	3.53
SO ₂	0.12
SO ₃	0.002
HCl	0.004
H ₂ O	8.27

Table Two

Impact on metals leachability

The raw fly ash, as well as the resulting combination of fly ash, DSI reaction product and unreacted reagent was then subjected to the SPLP leaching procedure per EPA method 1312. The leachates from these products were analyzed for heavy metals per EPA methods SW-846 6010C and SW-846-7470A with the results shown below.

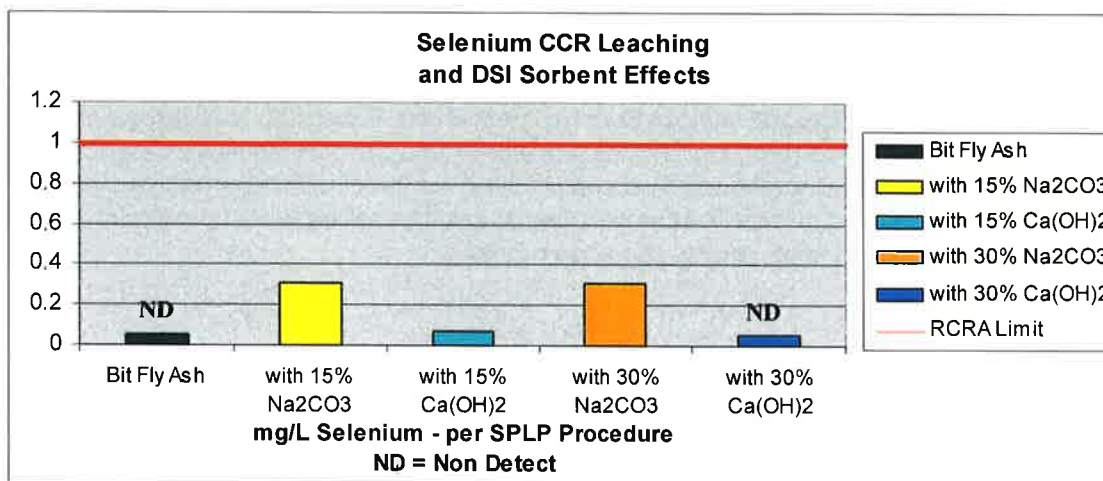


Figure 4

For selenium, the data indicates that again the fly ash subjected to treatment with a sodium based reagent results in a greater potential for leaching of this metal than that impacted by the use of a calcium hydroxide reagent. In fact, with 30% calcium addition, the resulting material leaches selenium at less than detection levels, just as the raw ash does.

While discerning the specific mechanisms at work here is beyond the scope of this bench testing, the results above are rational given the nature of the fly ash materials. Fly ashes are pozzolans, which by definition are finely divided siliceous compounds that react with water and calcium hydroxide to form compounds that exhibit cementitious properties. Accordingly, it is likely that when calcium hydroxide is used as a DSI reagent some of the reagent that does not react with acid gases in the flue gas stream reacts with the pozzolan in the flue gas stream resulting in some metals being encapsulated in the process. There is an additional mechanism that will impact the metals leachability from a given fly ash. Since metals leachability is function of pH, the addition of alkaline DSI reagents will clearly impact the metal mobility for a given material. It is likely that this pH impact without any offsetting impacts from metal encapsulation is the reason the fly ashes impacted by sodium reagents exhibit elevated levels of metal leachability. It should be noted that this affect of pH impact will be different for every fly ash and accordingly, it is recommended that a site specific evaluation be performed to determine the impact of DSI reagents on metals leachability for a given CCR material.

Impact on Total Dissolved Solids

In addition to measuring the impact of the DSI reagents on metal leaching potential, the impact on the amount of soluble constituents that could be leached from a given fly ash were analyzed.

Reaction Compound	Cold H ₂ O Solubility*
N ₂ SO ₄	100
CaSO ₄	0.21
NaCl	35.7
CaCl ₂	74.5

*Grams per 100 cc H₂O

Table 5^[3]

The impact on TDS is also quite significant. While both calcium impacted fly ashes indicate a 10-20% increase in total dissolved solids, the sodium impacted fly ashes reflect an order of magnitude difference in TDS leaching from both the 15% and 30% sodium fly ash blends. The dramatic difference in TDS between the calcium hydroxide (Sorbacal[®]) and sodium product (Solvaire[®] Select 200) is illustrated below.

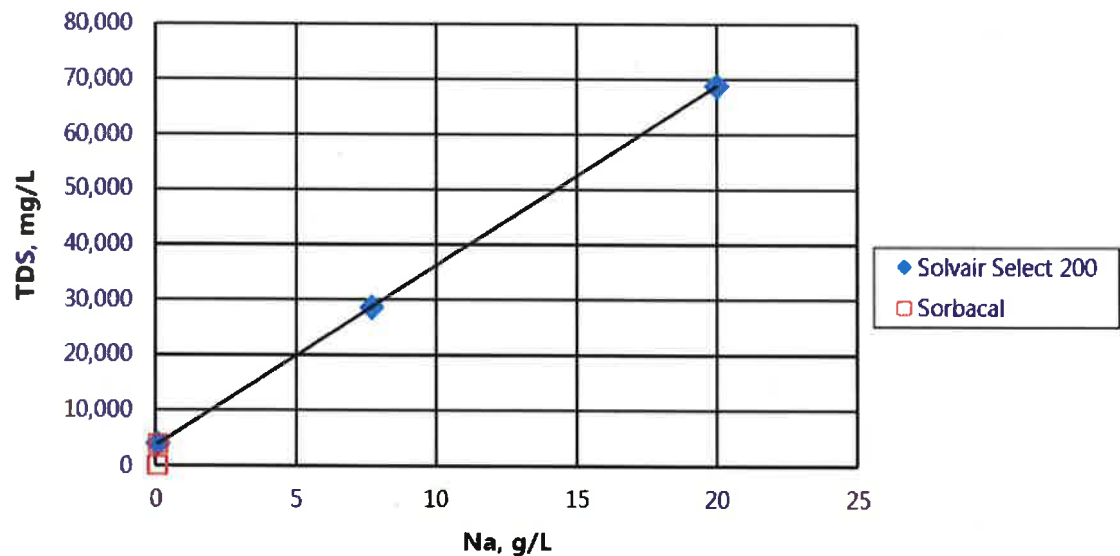


Figure 5

FLY ASH MARKETABILITY

The use of DSI reagents has both direct and indirect impacts on the marketability of fly ash CCRs. The direct impacts are a result of the acid gas capture reaction products and unreacted reagent being comingled with the fly ash. Whether these impacts will preclude marketing of the ash for concrete applications will be a function of the

Accordingly, using a DSI reagent to minimize the amount of carbon necessary to achieve a given mercury control requirement can enhance the potential to continue marketing a fly ash impacted by the use of ACI. Note that while both calcium hydroxide and sodium sorbents have proven successful in the control of SO_3 over the last 10 years, recently a complicating factor has been identified when using sodium chemistry for acid gas control. This factor is the potential for sodium reagents to catalyze NO_x compounds to NO_2 . Just as is the case with SO_3 , NO_2 tends to compete for the activated carbon and can offset the benefits of SO_3 reduction. The potential for NO_2 generation is illustrated below in Figure 7 for a field trial performed by ADA Environmental Solutions. This data was presented at the recent Reinhold Environmental conference ^[5].

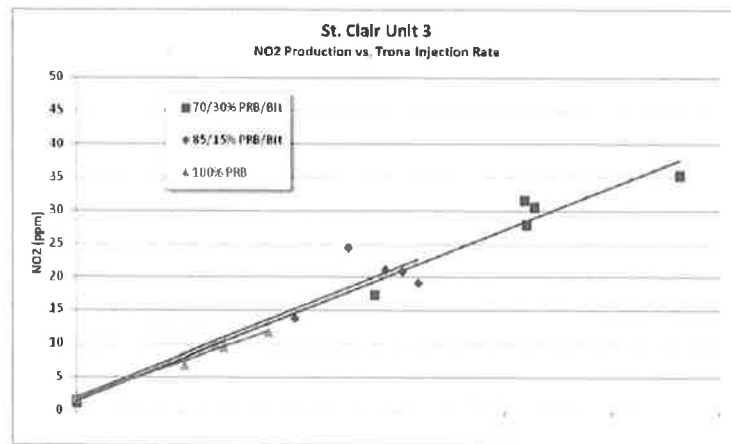


Figure 7

Figure 8 below illustrates the impact on the demand of activated carbon for a given mercury capture requirement as a function of the amount of trona utilized for acid gas capture.

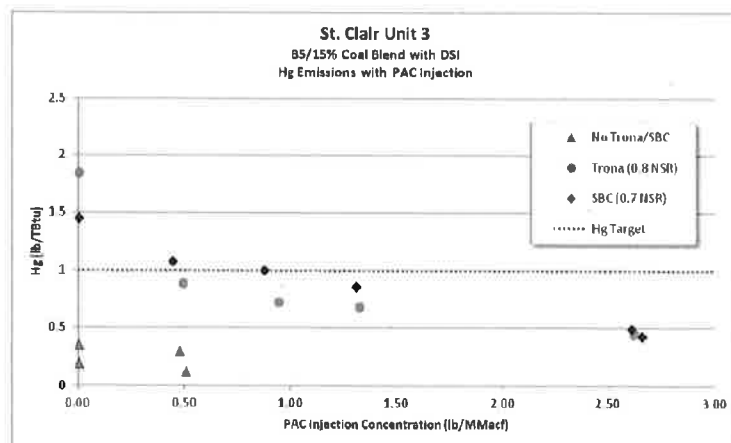


Figure 8

Appendix D

Best Available Control Technology Analysis – Independent Assessment of Technical Feasibility and Capital Cost, Addendum #1