ENVIRONMENTAL SUPPLY COMPANY

Quality - Service - Reliability

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: 1/11/2011

METER PART #:

METER SERIAL #: M2

CRITICAL ORIFICE SET SERIAL #:

BAROMETRIC PRESSURE (in Hg):	INITIAL	FINAL	AVG (P_{bar})
	30.5	30.5	30.5

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS FINAL	DGM READINGS NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	$\Delta H_@$
19	1	0.5032	20	52.946	58.067	5.121	48	48	49	48	49	48.5	8	1.3	5.4386	5.4492	1.0019		1.5761
	2	0.5032	20	58.067	65.780	7.713	48	49	53	49	50	50.25	12	1.3	8.1632	8.1738	1.0013		1.5761
	3	0.5032	20	65.780	78.035	12.255	48	52	56	53	52	53.25	19	1.3	12.8945	12.9418	1.0037		1.5761
																AVG =	1.0023	0.29	
23	1	0.6384	20	78.035	87.881	9.846	49	58	52	54	52	54	12	2.1	10.3645	10.3597	0.9995		1.5849
	2	0.6384	20	87.881	95.293	7.412	49	51	54	58	55	54.5	9	2.1	7.7948	7.7698	0.9968		1.5849
	3	0.6384	20	95.293	102.746	7.453	49	55	60	55	55	56.25	9	2.1	7.8113	7.7698	0.9947		1.5849
																AVG =	0.9970	-0.24	
16	1	0.4208	21	102.746	109.868	7.122	49	56	62	63	57	59.5	13	0.89	7.3961	7.3976	1.0002		1.5460
	2	0.4208	21	109.868	114.792	4.924	49	62	58	57	62	59.75	9	0.89	5.1111	5.1214	1.0020		1.5460
	3	0.4208	21	114.792	118.646	3.854	50	58	59	62	60	59.75	7	0.89	4.0004	3.9794	0.9948		1.5491
																AVG =	0.9990	-0.04	

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 = 0.9994

AVERAGE $\Delta H_@$ = 1.5694

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

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

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

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

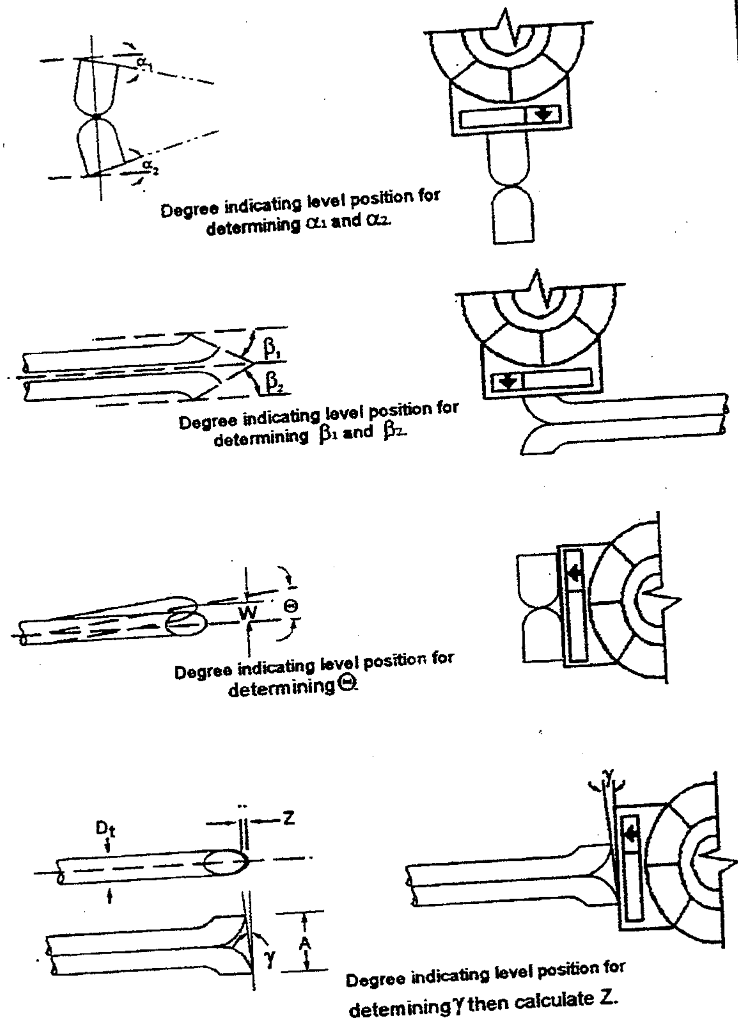
T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

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

Book1

CALIBRATION DATA SHEET 2
Type S Pitot Tube Inspection



Level and Perpendicular?	Yes
Obstruction?	No
Damaged?	NO
α_1 $(-10° \le \alpha_1 \le +10°)$	4°
α_2 $(-10° \le \alpha_2 \le +10°)$	3°
β_1 $(-5° \le \beta_1 \le +5°)$	2°
β_2 $(-5° \le \beta_2 \le +5°)$	-1°
γ	21°
Θ	0
$z = A \tan \gamma$ $(\le 0.125")$	/
$w = A \tan \Theta$ $(\le 0.03125")$	/
D_t $(3/16" \le D_t \le 3/8")$	3/8
A	.945
$A/2D_t$ $(1.05 \le P_A/D_t \le 1.5)$	1.26

T.C	Thermo
52.2	52.2
157.6	158.2
354.	355

QA/QC Check
Completeness ✓ Legibility ✓ Accuracy ✓ Specifications ✓ Reasonableness ✓

Certification
I certify that the Type S pitot tube/probe ID# 6-Z meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a pitot tube calibration factor C_p of 0.84.

Certified by: [signature] 11/12/10
Personnel (Signature/Date)

Team Leader (Signature/Date)

UAF CALIBRATION Analyzer log

Date	O_2 / CO_2 CAL gas	O_2 / CO_2 Analyzer Resp
11/3/10	14 / 4	14.1 % / 3.9 %
	8 / 8	8.0 % / 7.9 %
	0/0	0.1% / 0
11/4/10	14 / 4	13.95 / 4.0
	8/8	8.0 / 8.0
	0/0	0.1 / 0.1
11/5/10	14/ 4	14.1 / 4.0
	8/8	8.0 / 7.8
	0/0	0.0/0.1

RATA CLASS

Dual-Analyzed Calibration Standard

AIR LIQUIDE Air Liquide America Specialty Gases LLC SCOTT™

500 WEAVER PARK RD, LONGMONT, CO 80501

Phone: 888-253-1635 Fax: 303-772-7673

CERTIFICATE OF ACCURACY: Interference Free™ Multi-Component EPA Protocol Gas

Assay Laboratory

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
500 WEAVER PARK RD
LONGMONT, CO 80501

P.O. No.: 27091
Project No.: 08-83771-001

Customer

AIR LIQUIDE AMERICA,LP

C/O SPAN-ALASKA TRANS
3815 W VALLEY HWY N
AUBURN WA 98001

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM005326 **Certification Date:** 30Dec2009 **Exp. Date:** 29Dec2012

Cylinder Pressure*:** 2015 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)	ANALYTICAL ACCURACY**	TRACEABILITY
CARBON DIOXIDE	4.02 %	+/- 1%	Direct NIST and VSL
OXYGEN	14.1 %	+/- 1%	
NITROGEN	BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 2000	15Dec2011	K020703	4.954 %	CARBON DIOXIDE
NTRM 2658	02Oct2010	ALM065029	9.930 %	OXYGEN

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
FTIR//1602651	17Dec2009	FTIR
OXYMAT/6E/W5-951	15Dec2009	PARAMAGNETIC

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis — Second Triad Analysis — Calibration Curve

CARBON DIOXIDE

Date: 29Dec2009 Response Unit:%

Z1=0.00031	R1=4.93011	T1=4.01684
R2=4.95261	Z2=0.00045	T2=4.01868
Z3=0.00080	T3=4.01983	R3=4.95730

Avg. Concentration: 4.024 %

Concentration=A+Bx+Cx2+Dx3+Ex4
r=9.99989E-1
Constants: A=0.00000E+0
B=9.27539E-1 C=4.51530E-2
D=9.99000E-4 E=0.00000E+0

OXYGEN

Date: 30Dec2009 Response Unit:VOLTS

Z1=0.00000	R1=10.25000	T1=14.54000
R2=10.27000	Z2=0.00000	T2=14.55000
Z3=0.00000	T3=14.55000	R3=10.27000

Avg. Concentration: 14.08 %

Concentration=A+Bx+Cx2+Dx3+Ex4
r=0.999998
Constants: A=-0.01366451
B=0.968253695 C=
D= E=

APPROVED BY: SAM BENNETT

AIR LIQUIDE Air Liquide America Specialty Gases LLC SCOTT™

RATA CLASS

Dual-Analyzed Calibration Standard

500 WEAVER PARK RD, LONGMONT, CO 80501

Phone: 888-253-1635 Fax: 303-772-7673

CERTIFICATE OF ACCURACY: Interference Free™ Multi-Component EPA Protocol Gas

Assay Laboratory

AIR LIQUIDE AMERICA SPECIALTY GASES LLC
500 WEAVER PARK RD
LONGMONT, CO 80501

P.O. No.: 27094
Project No.: 08-83774-001

Customer

AIR LIQUIDE AMERICA,LP

C/O SPAN-ALASKA TRANS
3815 W VALLEY HWY N
AUBURN WA 98001

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM039412 **Certification Date:** 30Dec2009 **Exp. Date:** 29Dec2012

Cylinder Pressure*:** 2015 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)	ANALYTICAL ACCURACY**	TRACEABILITY
CARBON DIOXIDE	8.04 %	+/- 1%	Direct NIST and VSL
OXYGEN	8.06 %	+/- 1%	
NITROGEN	BALANCE		

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 2000	15Dec2011	K020703	4.954 %	CARBON DIOXIDE
NTRM 2658	02Oct2010	ALM065029	9.930 %	OXYGEN

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
FTIR//1602651	17Dec2009	FTIR
OXYMAT/6E/W5-951	15Dec2009	PARAMAGNETIC

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis | Second Triad Analysis | Calibration Curve

CARBON DIOXIDE

Date: 29Dec2009 Response Unit:%

Z1=-0.00010	R1=4.95691	T1=8.04193
R2=4.95889	Z2=0.00140	T2=8.04420
Z3=0.00159	T3=8.04643	R3=4.96232

Avg. Concentration: 8.036 %

Concentration=A+Bx+Cx2+Dx3+Ex4
r=9.99994E-1
Constants: A=0.00000E+0
B=7.77830E-1 C=7.90300E-3
D=0.00000E+0 E=0.00000E+0

OXYGEN

Date: 30Dec2009 Response Unit:VOLTS

Z1=0.00000	R1=10.25000	T1=8.33100
R2=10.27000	Z2=0.00000	T2=8.33400
Z3=0.00000	T3=8.33400	R3=10.27000

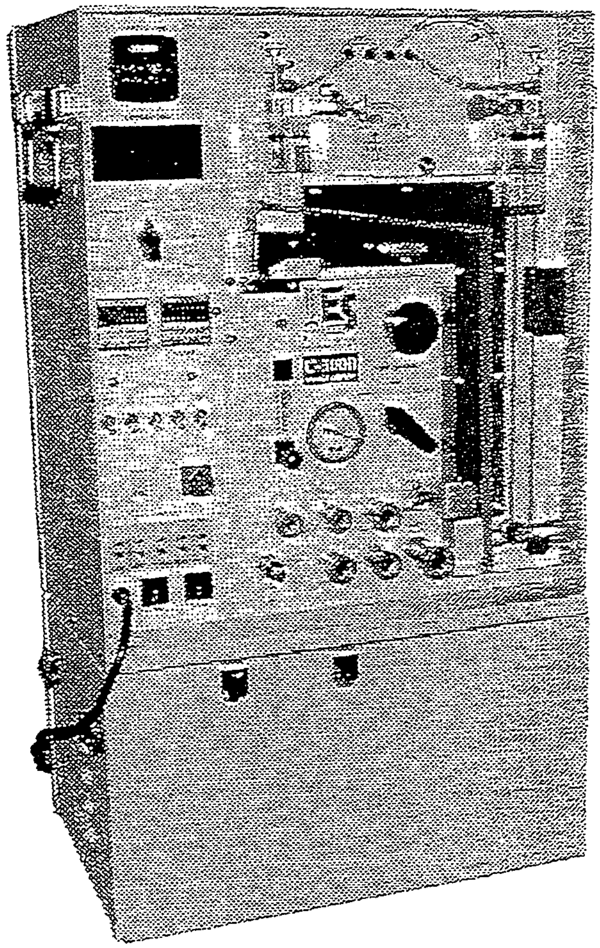
Avg. Concentration: 8.060 %

Concentration=A+Bx+Cx2+Dx3+Ex4
r=0.999998
Constants: A=-0.01366451
B=0.968253695 C=
D= E=

APPROVED BY: SAM BENNETT

2 MAINTENANCE

2.1 CONTROL CONSOLE



Periodic inspection of the C-5000 Source Sampler console components is essential to maintain proper operation of the system. Regular maintenance will insure a long system lifetime.

2.1.1 *Maintenance Access*

The C-5000 console components are designed to be easily accessible by removal of only the rear panel for periodic inspections and maintenance. Having the plumbing and electical panels mounted independently will be much appreciated. The front and rear covers can be removed by releasing the eight cover latches (four on each). It is seldom necessary to remove the casing wrap, however, if this becomes necessary, first unscrew the eight electrical and plumbing panel securing screws located on the sides and top of the casing wrap. Second, the ventilating fan wires must be disconnected at the terminal plug located on the side of the fan housing. Finally, unscrew the 6 base securing screw and remove the casing wrap by lifting straight up with care not to disturb the remaining assembly. To maintain stability of the console plumbing and electrical panel assemblies the screws securing these panels to the base should remain in place. Alternatively, the plumbing and electrical panel assemblies may be individually removed for specific maintenance procedures by unscrewing the top, side and base panel securing screws. For ease of removal, unscrew the 3 casing wrap-to-base securing screws on the side corresponding to the electrical or plumbing panel that is being removed. Pull the lower edge of the casing wrap slightly away from the base to release the panel from behind the curled edge of the casing wrap and maneuver the panel carefully towards the front of the unit.

Check the general condition of all components and make necessary repairs. The oil level in the small oiler bottle must be maintained to prevent damage to the vacuum pump.

2.1.2 *Pump*

A Gast fiber vane vacuum pump draws the stack gases through the sample train. This rotary pump is a precision instrument with .002 clearance at the top and .0025"–.0035" total at the ends of the rotor. The vanes self-adjust with wear and should last 5,000–15,000 hours depending upon operating conditions. It is designed for pumping dry air and should be protected against dirt and excessive moisture. With proper treatment and regular lubrication this pump requires little additional maintenance to insure a long working life.

Regular Pump Maintenance

There is a small hole in the top of the rear panel for regular inspection of the knockout jar. This jar should be emptied when accumulated oil interferes with the normal flow of air to the dry gas meter.

Frequent removal and cleaning of the oiler jar is required when the oil level is low or the oil is dirty. An inspection port and removable panel are located on the right rear side of the unit. Unscrew the oiler jar and fill with clean oil as

The configuration of this analyser is	
Model and Issue:	04 900 C1

Feature and option code number

F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Serial number 653352

Instrument Configuration

Transducer I1 Type: 04000990 Serial No: 70540 Sample Inlet Position 1	Transducer I2 Type: 04000950D Serial No: 3810 Sample Inlet Position 2
Transducer I3 Type: Serial No: Sample Inlet Position	Transducer I4 Type: Serial No: Sample Inlet Position
Servomex Order Reference No:	631031987
Software Revision No:	4000\653\2
Completed By:	Date : 4/8/10

WARNING

This analyser (4902C and 4904C) is not suitable for use with flammable or corrosive samples.

If toxic samples are present, the maximum pressure to the analyser must be limited to 5psig by means of a suitable release system.

Sample requirements

For best performance the flow supplied to the analyser should be kept at a constant value for both normal sampling and for calibration gas input.

Temperature:	5 to 60°C / 41 to 140°F
Dew point:	5°C / 9°F below minimum ambient
Condition:	Oil free, non - condensing, filtered to 1µm
Vent:	Each gas outlet should be connected to a separate atmospheric vent, free from any back-pressure. (Consideration should be given to the toxicity and asphyxiant nature of the sample gas when selecting a vent location).
Inlet Flow:	500 (min) - 1500 (max) ml/min (for each stream)
Inlet Pressure:	Up to 1psig (7kPa) to provide specified flow rate.

CAUTION

Do not exceed the rated sample flow as sensor damage may result.

Do not exceed the sample temperature and dew point criteria as analyser sensor damage will result.

Table 7.16: 4900C performance specification, oxygen and IR

Gases measured	Pm1111E O_2 Basic	Pm1158 O_2 Control	1520 CO_2	1522 CO
Range	0-25%	0-25%	see Table 7.5	
Min.rec.o/p range	0-5%	0-5%	80% of selected range	
Intrinsic error	<0.15%	<0.05%	1% of selected range	
Linearity error	<0.1%	<0.05%	1% of selected range	
	inherently linear, dependant on calibration gases			
Repeatability	<0.1%	<0.05% of reading or 0.01%*	1% of selected range	
Response (T90) at 1500ml/min	<15 sec	<15 sec	<30 sec	
Zero drift / week	0.1% O_2	0.05% O_2	2% of selected range	
Span drift	0.1% O_2 / week	0.05% O_2 / week	1% of selected range/ day	
Output fluctuation (peak to peak)	<0.1% O_2	<0.01% O_2	0.5% of selected range or 1% of reading*	
Ambient pressure coefficient	directly proportional to analyser vent pressure		0.2% of reading per mbar	
Ambient temp. coeff./ 10°C change	2% of reading or 0.5% O_2	1% of reading or 0.1% O_2*	1% of selected range +/- <2.0% of reading	
Sample flow effect over full flow range	<2% of reading or 0.2% O_2*	<2% of reading or 0.1% O_2*	1.5% of selected range or <3% of reading*	

* whichever is the larger

Table 7.17: 152X measurement ranges in 4900C

Gases measured	Full scale measurement range %								
	0.25	0.5	1.0	2.5	5	10	25	50	100
1520 CO_2	✓	✓	✓	✓	✓	✓	✓	✓	✓
1522 CO			✓	✓		✓			

Appendix F

Project Participants

Project Participant	Role
Bill Hudson	AST Project Manager
Buck Hudson	AST Field Technician
Charles Ward	UAF Project Coordinator
Adam Saaid	ADEC Observer
Shelley Hokenson	Technical Writer, AST

Appendix G

Project Correspondence

Enclosure 1

Best Available Control Technology Analysis

Independent Assessment of Technical Feasibility and Capital Cost
Addendum #1

Chena Power Plant

Aurora Energy, LLC
Fairbanks, Alaska

Draft (2024 Update)

January 25, 2024

Stanley Consultants INC.
A Stanley Group Company
Engineering, Environmental and Construction Services - Worldwide

January 25, 2024

Mr. David Fish
100 Cushman Street
Suite 210
Fairbanks, AK 99701

Dear Dave:

Stanley Consultants is pleased to provide you with the final version of the Independent Assessment of Technical Feasibility and Capital Cost in support of your Best Available Control Technology Analysis. We greatly appreciate the opportunity to assist Aurora Energy in this effort and we look forward to working with you again soon.

Respectfully submitted,
Stanley Consultants, Inc.

Prepared by ______________________
John P. Solan

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Alaska.

John P. Solan
AK License Number: AELM14412
My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: Entire Report

Table of Contents

APPENDICES

Section 1

Introduction

This report documents the results of an independent engineering assessment of the technical feasibility and probable capital costs for emissions control retrofits at the Chena Power Plant in Fairbanks, Alaska. The report is intended to update the information previously provided by Aurora Energy in the original Independent Assessment of Technical Feasibility and Probable Cost, dated April 2, 2019, and in the initial version of this document dated August 29, 2023.

Background

The US Environmental Protection Agency (EPA) has recently reclassified portions of the Fairbanks North Star Borough as a Serious PM 2.5 Non-Attainment Area. This reclassification triggers a requirement that all major sources within the non-attainment area perform a BACT analysis for particulate emissions and the emissions of any precursor pollutants. In response to this requirement, Aurora Energy submitted the required Best Available Control Technology (BACT) Analysis to Alaska Department of Environmental Conservation (ADEC) in March of 2017. An addendum to the report was submitted in December of that year.

After reviewing the data and conclusions presented in the original BACT Analysis, ADEC conducted their own analysis and presented the results as a Preliminary BACT Determination in March 2018. The ADEC report documented several conclusions that differed from those presented in the BACT report submitted by Aurora Energy, particularly with regards to the economic feasibility of a Dry Sorbent Injection (DSI) System. The EPA also requested that Aurora Energy conduct an evaluation of a Circulating Dry Scrubber (CDS) system, as this type of emissions control device was not included as a part of the BACT Analysis.

Aurora Energy retained Stanley Consultants to review the technical feasibility of control technologies for two specific precursor pollutants: Nitrogen Oxides (NO_x) and Sulfur Oxides (SO_x). Aurora Energy also requested that Stanley Consultants develop a site-specific, third-party estimate of the costs to install and operate technically feasible SO_2 emissions control equipment on the four operating boilers at the Chena Power Plant. This effort included the development of a capital cost estimate for the identified systems, sorbent consumption rate estimates, and an estimated cost for the purchase and delivery of sorbent to site. Aurora Energy and their environmental consultants, Environmental Resources Management (ERM), incorporated the estimated costs into a calculation to determine the cost effectiveness of the emissions control equipment on a basis of Dollars/Ton of SO_2 removed. This effort was documented in the Independent Assessment of Technical Feasibility and Probable Cost in April of 2019.

In the period since the Independent Assessment was issued, the EPA has reviewed the findings and has also had the opportunity to independently perform their own cost effectiveness calculations and collect information from suppliers of DSI equipment and sorbent. These discussions have resulted in the conclusion that the current performance standard for a DSI system is a 95% sulfur capture efficiency. Based on the information that they have collected; the EPA has requested that Aurora Energy revise their Independent Assessment to account for a DSI system with a 95% capture efficiency as opposed to the 80% efficient system previously provided. The EPA has also requested that Aurora Energy evaluate the technical feasibility of the other sulfur control technologies specifically with respect to the size of the equipment and the available space on plant property.

Project Scope

Aurora has again retained Stanley Consultants to update their previous assessment in accordance with the EPA requests. The scope includes:

- Collection of estimated footprints for Wet Flue Gas Desulfurization (WFGD), CDS, Spray Dry Absorber (SDA), and DSI technologies.

- Evaluation of the technical feasibility of these systems specifically in relationship to their ability to be located on plant property without impacting current plant operations or traffic flow.

- Solicit BACT, the vendor who previously provided equipment cost information, to update their estimate for 2023 pricing and with an emissions control efficiency of 95% or greater.

- Update the Balance of Plant (BOP) quantities and costs to reflect any new scope that may be required as a result of the updated BACT quote, and to reflect current materials and installation pricing.

- Document the findings of the assessment in this report.

Section 2

Technical Feasibility of SO_2 Control Technologies

The original Independent Assessment concluded that the four technologies commonly used to control sulfur emissions (WFGD, CDS, SDA, and DSI) were all technically feasible from a process standpoint. The assessment, however, did not adequately address the space that each technology requires or the ability for the plant to arrange the equipment footprint on the plant property without negatively impacting plant operations or vehicular traffic.

The first step in completing this task is collecting information regarding the existing open space on, and adjacent to, the plant site. Once the open space has been identified, equipment footprints that are approximately sized for this application can be overlaid on top of the open spaces to determine if there is sufficient space to accommodate the equipment without hampering existing plant operations.

Existing Conditions

The Figure 1 below is a portion of a plat drawing showing the area around the Chena Power Plant (reference Appendix A, image A6 for the complete plat drawing). The plant property is bounded on the south by 1st Avenue, on the north and east by the Chena River, and on the west by the water treatment plant (building on the far left). All immediately adjacent properties are occupied by other businesses or residences except for Block 20, lots 9 and 10. These properties are not suitable for the installation of emissions control system, however, considering the significant distance from the boilers and the adjacent residential and light commercial properties. It should be noted that the property immediately to the south of the plant is owned by Usibelli Investments, LLC and is occupied by Aurora Energy Solutions (AES). This is an independent company that is run separately from Aurora Energy. This site is utilized by AES as corporate offices and a sales point for their product, kiln dried firewood. Aurora Energy does not have control of this property in any way.

The plat drawing also shows two existing easements. These easements are for overhead lines which limit the height of any structures built within the easement. This would preclude locating any of the emissions control technologies within the easements as they all require tall structures. Reagent preparation and other similar buildings, however, are expected to be shorter, and therefore can be located in the easements.

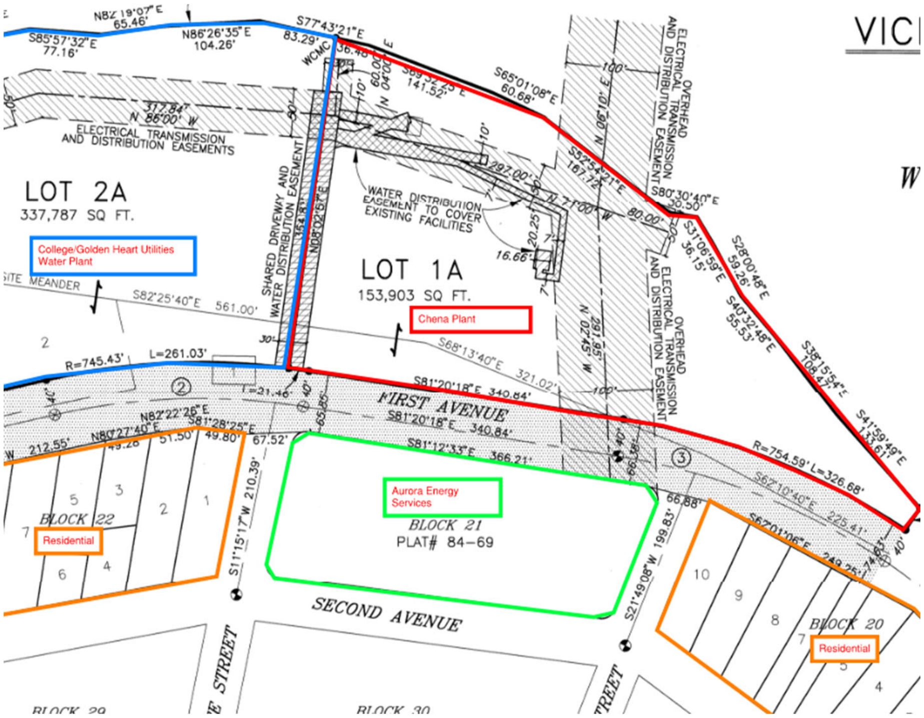


Figure 1 – Portion of Plat Drawing

Figure 2 – Chena Plant Existing Conditions

Figure 2 documents the current layout of structures on plant property as well as current roadways and access areas. An enlarged copy of this figure can also be found in Appendix A, image A1. Areas of the plant not currently occupied by structures have been highlighted to indicate their current purpose. The resulting image indicates that almost all of the open space on plant property is currently utilized for either vehicular traffic, loading/unloading operations, maintenance access, emergency services access, or parking. The remaining open space (namely the area adjacent to the cooling water outfall building) is not suitable for construction of tall structures; it is in the electrical right-of-way and the foundation system would interfere with existing buried utilities. It should also be noted that areas immediately adjacent to the river are heavily sloped and are not suitable for construction except for the pump house and outfall building, which are required to be on the river's edge. Given the image above, Stanley Consultants has concluded that there is no open area of any significant size on site that is available for the installation of WFGD, CDS, SDA, or DSI equipment or buildings.

DSI Equipment

As noted in the 2019 Opinion of Probable Cost Report, the original cost estimate assumed that a DSI system could be integrated into the Aurora Plant without major impacts to existing systems. One such potential impact that was ignored in the 2019 report was the effects the addition of dry sorbent would have on the existing baghouse. Given the additional focus that this report has on the availability of physical space within the property boundary, the project team determined that the potential need for a larger baghouse should be investigated further.

To determine if the existing baghouse had sufficient capacity to accommodate the larger dust loadings that will exist after a DSI system is installed, Stanley Consultants contacted the Original Equipment Manufacturer (Andritz, formerly Flakt). Technical information relating to the existing baghouse was also provided to aid in the analysis. The initial correspondence with Andritz can be found in Appendix B and the baghouse information is included in Appendix C.

Andritz indicated that, while a thorough analysis would take longer than the initial project schedule could allow, the existing baghouse is about 10-15% undersized by modern standards. This information, along with a recent operational history of operational limitations directly related to the baghouse, resulted in an initial determination by Stanley Consultants that any additional dust loading could potentially jeopardize reliable operation of the Chena Power Plant. This conclusion was included in the initial version of this report which Aurora Energy submitted to ADEC in October 2023. ADEC reviewed the document and provided comments back to Aurora Energy in December of the same year. One of the comments requested additional justification for the need to replace the baghouse.

In response to the ADEC request, Aurora Energy contracted directly with Andritz to send a Flakt Baghouse specialist to the plant for an on-site evaluation. Additionally, Andritz provided supplemental calculations based on site observations, EPA Method 1-5 testing upstream of the baghouse, and information supplied by Aurora Energy. The resulting report, included as Appendix E, has three major conclusions:

1. "At 'maximum load' conditions use of SBC will achieve the required 90 to 95% SO_2 removal rates. In a firm price bidding process Andritz <u>would be able</u> to guarantee this level of removal."

2. "However, the fabric filter is very likely undersized for the addition of SBC given the high air to cloth ratio and approximate 5x increase in dust loading. In a firm price RFQ

bidding process Andritz would not guarantee that the fabric filter pressure drop could be maintained at an acceptable level at "maximum load" conditions."

3. "At 'minimum load' conditions Andritz is concerned both with the temperature and the low velocity. In the case of the temperature Solvay is less concerned about the emissions performance at lower temperatures but notes an increase in SBC injection rate is required. Regarding velocity, turndown of the gas flow rate to only 12% of the total will result in drop out of SBC in the fabric filter inlet. It may be possible to overcome both of these issues by addition of a clean flue gas recirculation system, which routes flue gas from the ID fan outlet area back to the common boiler 1-3 and boiler 5 ducts, with control dampers and steam coils added to provide enough flow and temperature for operation at low load. This is an additional capital and operating cost, however. Without recirculation Andritz would not guarantee emissions performance at 'minimum load' conditions."

In addition to the final conclusions of the report, Andritz indicated that the existing baghouse is configured for off-line cleaning, which is not a preferred configuration for exhaust systems that include DSI. This is because the off-line cleaning system cleans an entire compartment at a time. This cleaning eliminates the ash cake on the bags, including any unreacted sodium bicarbonate. When the compartment is returned to service, it lacks the capacity for secondary sulfur capture and therefore allows sulfur to "bypass" the other modules with developed filter cakes. Stanley Consultants therefore recommends that a new baghouse be constructed in lieu of any attempt to modify or expand the current technology.

Given the conclusions reached by Andritz as a part of their investigation, Stanley Consultants reaffirms their position that the existing baghouse is not suitable for use with a DSI system. Further, Andritz has found that there is not sufficient temperature or flow (velocity) for a DSI system to function correctly. Should a DSI system be installed, it would require both a clean flue gas recirculation system to supplement the flow and steam coil heaters to boost the temperatures while the plant is operating at lower loads. The costs for this equipment are not currently reflected in the cost analysis as there was not sufficient time to obtain vendor quotes ahead of the ADEC submission deadline.

Equipment Footprint Overlays

Stanley Consultants contacted Andritz and Babcock and Wilcox (B&W) and requested equipment size and footprint estimates for WFGD, SDA, and CDS systems. The information provided by the vendors was overlaid on top of a satellite image of the Chena site. The images, located in Appendix A, show the size of the emissions control equipment relative to the other structures on the site. As previously indicated, none of the open space on the Chena site is available for construction, therefore it is currently assumed that the existing warehouse building will need to be demolished and reconstructed adjacent to any new plant equipment. It is also assumed that the existing baghouse cannot be demolished or modified in any way to ensure continuous reliable operation of the Chena Plant. Once the new exhaust system is fully constructed and commissioned, the existing exhaust ductwork can be redirected to the new equipment. Therefore, a location for the new baghouse was identified for the CDS, SDA, and DSI systems. The communications with the vendors and vendor supplied data can be found in Appendix B. The equipment sizes provided by the vendors are summarized in Table 1.

Equipment	Footprint (ft^2)	Height (ft)	Notes
WFGD	6,900	75 (reactor) 40 (equipment 2-5 bldg.)	Square footage includes reactor footprint and equipment building.
CDS	3,429	100	Footprint of sorbent preparation building at Eielson AFB assumed for this estimate (40'x27').
SDA	2,236	54	Footprint of sorbent preparation building at Eielson AFB assumed for this estimate (40'x27').
DSI	3,005	55	New baghouse is assumed to be the same height as the existing equipment. Footprint of sorbent preparation building at Eielson AFB used for this estimate (40'x27').

Table 1 – Equipment Footprint Summary

In addition to the other space constraints on site, the CDS and SDA systems share an additional limitation. They both require that the reactor vessel be located immediately adjacent to the entrance of the baghouse. This is due to the very high solids loading of the flue gas. Long duct runs (longer than 30 feet) or changes in direction will lead to large amounts of solids dropout in the duct. This can lead to collection of the material at these points. This material can, over time, build up to unacceptable levels, forcing extended shutdowns for cleaning or, if undiscovered, possibly result in damage to the ductwork due to the unexpected weight of the solids.

Given the estimated footprints for each type of emissions control equipment, the images in Appendix A showing the relative size of the equipment, and the determination of available space based on existing conditions, Stanley Consultants initially came to the conclusion that there is not sufficient space on site to support any of the available emissions control technologies (WFGD, CDS, SDA, or DSI); they are all technically infeasible.

The second ADEC comment requested that Aurora Energy evaluate making material changes to existing facilities to accommodate new emissions controls technologies. The images referenced above have been updated to reflect designs that utilize space that is currently occupied by the warehouse (including office space on the 2nd floor). It is assumed that the new warehouse space will be multi-level to ensure that the current available building square footage remains available to the Aurora Plant. It is currently estimated that there is approximately 24,000 square feet of available floor space spread between the main floor and a second floor in the tallest portion of the building. Reference Section 3 – Cost Estimate for discussion of additional costs to demolish and reconstruct warehouse space.

In addition to the information provided on the images in Appendix A, the following describes technology specific considerations for installation at the Aurora Energy Site.

WFGD: For this revision of the report, the arrangement of the WFGD equipment building on image A2 was relocated to space occupied by the existing warehouse. The reactor and stack, however, were left where they were previously shown as no suitable location outside of the easements for overhead electrical wires were available. Any open space that was evaluated for the reactor and stack was either too far away from the ID Fan Building for proper operation or was currently occupied by utilities that could not be moved. A reactor that is remotely located from the existing ID fan building will likely drive the need for larger, more power ID fans, and possibly require a larger ID Fan Building. Should we relocate the ID fan building adjacent to the reactor, stack, and access road displaces the WFGD equipment building too far to the east to allow construction of the new warehouse building. As no realistic way of implementing a WFGD system within the current plant site can be found, Stanley Consultants considers a WFGD system technical infeasible.

CDS: As can be seen in the updated image A3, with the demolition of the existing warehouse it is possible to locate the reactor and elevated baghouse in the space currently occupied by a plant road. Unfortunately, due to the electrical easement and the location of the connection into the existing ductwork, the new equipment must be located such that the exhaust of the baghouse is pointing away from the existing induced draft fans and stack. This arrangement will require the addition of a new induced draft fan building, and stack. Further, the stack must be located a significant distance away from the induced draft fan building on the eastern side of the easement. The ductwork between the fans and the stack would need to be run over the roof of the new warehouse building, thus limiting the height of that portion of the building. While it appears that it possible, in theory, to implement this solution, it will come at significant cost. The following is a list of scope items required by this approach that will have costs associated with them. These costs are above and beyond any previous estimate of capital costs. This list includes scope items that are apparent upon immediate consideration, and it is not intended to be a complete list.

- Warehouse building (2 stories, sized to match existing available square footage)
- ID Fan Building (required because the existing fan building is too far away)
- New ID Fans or relocation of existing fans.
- New electrical equipment to support new ID Fans.
- Additional ductwork and supports.
- New stack.

DSI: The configuration of the DSI system, shown on image A4, has also been updated to reflect the availability of the area currently associated with the existing warehouse. The resulting configuration is similar to the design presented for the CDS as the new baghouse will need to avoid the overhead electric easement as well.

The additional costs associated with this approach are as follows:

- Warehouse building (2 stories, sized to match existing available square footage)
- ID fan building (required because the existing fan building is too far away)
- New ID Fans or relocation of existing fans (cost omitted from estimate)
- Additional ductwork and supports.
- New stack.

The costs for the demolition of the existing warehouse and the construction of the items listed above were conservatively estimated and the costs added to the cost estimate, except as noted.

SDA: Given the information provided in the Andritz baghouse report, the addition of an SDA system is also not possible without the replacement of the existing baghouse due to the additional dust loading from the SDA reactor. The image A5 has been updated to reflect the SDA reactor and a new baghouse. The resulting configuration looks similar to that of the CDS as the reactor and new baghouse have the same constraints as the CDS system. The additional costs associated with this approach are as follows:

- Warehouse building (2 stories, sized to match existing available square footage)
- New baghouse (required to handle additional dust loading)
- ID fan building (required because the existing fan building is too far away)
- New ID Fans or relocation of existing fans.
- New electrical equipment to support new ID Fans.
- Additional ductwork and supports
- New stack

Section 3

DSI Cost Estimate

The information provided in this section is similar to Section 4 of the original Opinion of Probable Cost (dated April 2, 2019); however, it has been updated to reflect a DSI system capable of reducing sulfur emissions by 95%. As previously discussed in Section 2, the addition of a new baghouse is also included in the estimated costs. Construction and material prices have been updated to reflect current costs. In addition, costs have been included for the demolition of the existing warehouse and the construction of a new ID Fan building and stack. Given the limited time available ahead of an ADEC submission deadline, the new costs included in this version of the estimate were developed from readily available sources or estimated based on local rules-of-thumb. As a result, the cost estimate does not provide the level of detail typically expected by the EPA but is the best possible that could be prepared in the time available. The complete cost estimate can be found in Appendix D.

Disclaimer

The information presented in this section was developed using a methodology intended to produce a result that presented a cost on the low end of the range of potential costs. The cost information provided herein is not a detailed estimate of actual project costs and should not be utilized for project budgeting purposes or other financial predictions.

Design Basis

The following data and assumptions were utilized to identify the system performance requirements and scope of supply for both the DSI equipment vendor and the construction contractor. Equipment and piping (internal to silo skirts and sorbent preparation building) costs for the DSI systems were developed by BACT Process Systems, Inc. BACT supplied the DSI system that was recently installed at Eielson Air Force Base (AFB), and therefore was already familiar with this type of application. Additional information relating to the BACT scope of supply can be found in Appendix B. Information relating to the baghouse was developed by Andritz. Balance of Plant (BOP) piping, electrical, and foundations were estimated by Stanley Consultants, as described below.

Boiler Performance and Flue Gas

The coal used at both the Eielson AFB and Chena plants is supplied from the Usibelli Coal Mine in Healy, Alaska. Boiler heat input, flue gas flows, and uncontrolled SO_2 emissions rates for the Chena Plant were obtained from previous flue gas studies (reference Appendix C). The available coal data and the information provided in the studies was utilized to determine storage needs, equipment sizes, and required sorbent feed rates.

Dry Sorbent Unloading, Storage, Preparation, and Injection System

The BACT proposal includes the following equipment:

- Sorbent unloading equipment suitable for transporting sodium bicarbonate from a railcar or truck to a bulk storage silo. This equipment includes unloading blowers, coolers, piping, and piping components.
- Two bulk storage silos with a total storage capacity that is sufficient for three months of continuous full load operation.
- Sorbent transfer equipment for moving the sorbent from the bulk storage silos to the day bins located in a sorbent preparation building including transport blowers, coolers, and associated piping.
- Sorbent mills for optimizing the particle size of the sorbent prior to injection into each boiler flue.
- Sorbent injection equipment including filter receivers, airlock feeders, blowers, coolers, and piping up to the wall of the sorbent preparation building.
- All piping between the railcar unloading skid and the sorbent prep building.
- All piping inside the sorbent prep building.
- Dry reactors to be installed in each boiler flue including venturi, injection lances, and reactor section.
- Dedicated PLCs for the control of all equipment included in the proposal.
- Engineering to facilitate the integration of the sorbent control system into the plant control system.
- Computational Fluid Dynamics (CFD) of each flue to confirm predicted sorbent effectiveness.

Additional BOP equipment, ancillary support systems, foundations that are required for the DSI system, but were not included in the BACT vendor proposal have been accounted for by Stanley Consultants in the cost estimate. This scope includes:

- Piping between the sorbent preparation building and the injection lance on each boiler's dry reactor.
- Ductwork modifications as required to accommodate the BACT supplied dry reactors.
- Electrical feeds and equipment required to support the BACT vendor equipment.
- Foundations.
- Sorbent preparation building and interior structures.
- Structural steel as required to support dry reactors and modified ductwork.
- Miscellaneous steel and supports.
- Warehouse building (2 stories, sized to match existing available square footage)
- ID fan building
- New ID Fan
- New stack

The warehouse and ID fan building estimates were developed on a dollars-per-square-foot estimating method due to the limited time available prior to the EPA submittal deadline. We have also provided an estimate to demolish the existing baghouse and ID Fan Building. Once the new equipment is in place these building must be removed to minimize plant maintenance and eliminate potential safety hazards.

Baghouse

The baghouse scope provided by Andritz includes:

- Eight baghouse modules.
- Pulse jet filter cleaning system.
- Structural steel as required to support the baghouse modules.
- Stair towers and platforms for operator access.
- Local compressed air piping.
- Instrumentation and controls necessary for baghouse operation.

Additional scope that is required for proper installation and operation of the baghouse has been included in the estimate by Stanley Consultants as follows:

- Baghouse building
    - Foundations
    - Structural Steel
    - Building envelope (siding, roofing)
- Flue gas ductwork
- Ash piping

Equipment Layout

The cost estimate is based on the following approximate equipment locations:

- Unloading Equipment
    - North of Chena River
    - A rail spur adjacent and immediately northwest of the existing coal unloading building on the north side of Phillips Field Road.
- Bulk Storage and Transfer Equipment
    - North of Chena River
    - Adjacent to the existing coal pile on the south side of Phillips Field Road.
- Sorbent Preparation Building
    - South of Chena River
    - Adjacent to the new baghouse.
- Baghouse
    - South of Chena River
    - Adjacent to the existing baghouse.
- ID Fan Building/Stack/New Warehouse
    - Site of existing warehouse

See Appendix A for additional information on the proposed equipment locations and interconnecting piping.

General Assumptions

The estimated accuracy of this Opinion of Probable Costs is +30% and -15%. The approach used during the cost estimating effort was to make every reasonable assumption to simplify the project and reduce the estimated capital cost. Preliminary design activities, such as general arrangements and system integration evaluations, were conducted to determine the essential project scope that would be required. With the exception of the electrical system and baghouse, existing systems were assumed to have sufficient capacity to support the additional DSI equipment without modification. Foundations from similar projects in the Fairbanks area were utilized to estimate the cost of foundations for the new equipment, without consideration for recent code changes or review of recent geotechnical study results.

Many potential design considerations that would typically add significant cost to any project were assumed not to be necessary as the development of reasonable cost estimates for each was beyond the scope of this project. Design considerations that were intentionally omitted from the estimate include, but are not limited to:

1. Hazmat abatement (asbestos, lead, PCBs, soil remediation).
2. Subsurface Investigations (Geotechnical Report).
3. Existing soil conditions and impact on foundation requirements.
4. Structural capacity of boiler building roof to accommodate new reactors.
5. Seasonal work phasing/productivity.
6. Expansion of plant utilities (air, cooling water, HVAC).
7. Rail spur engineering or construction. Existing spur was assumed available and appropriately configured for tank car staging, without primary rail operating disruptions.
8. Startup and commissioning costs.
9. Project costs related to taxes, duties, and tariffs.

Stanley Consultants has provided cost estimates for several recent projects at various locations in the State of Alaska. Our experience on these previous projects has indicated that the use of typical cost estimating resources (in this case, RS Means) will result in a cost estimate that is significantly below the costs that are actually incurred by the Owner. In an effort to provide unit costs that better reflect the reality of construction in Alaska, Stanley Consultants presented the previous estimate to a contactor with current experience with major construction projects in interior Alaska. This contractor, Haskell Corporation, was able to provide feedback on the values that were used based on their actual construction data from that period. These values were either provided in 2019 or 2023 dollars, depending on the internal source of the data. Where Haskell provided a 2019 value, Stanley Consultants escalated the valve to 2023 dollars as described in the escalation section below. Haskell also provided input on the contractor's soft costs. All soft costs, except for project contingency, were updated based on Haskell's recommendation. Project contingency is fixed at 10% based on the requirements of the EPA's Cost Control Manual. Data provided by Haskell for use in this cost estimate can be found in Appendix D.

Technical Methodology and Assumptions

The methodology utilized to develop project quantities along with the subsequent procurement and installation costs is detailed below. Several assumptions were made about the equipment requirements and BOP aspects concerning the installation of a dry sorbent injection system at the Chena Power Plant. The most significant assumptions, by discipline, are as follows.

General

Building costs were generated by Haskell Corporation based on similar facilities that they have recently constructed in the Fairbanks area. In some cases, these buildings were scaled up in size to account for additional equipment required for the Chena DSI system. Haskell Corporation provided cost information for the following items for each building:

- Substructures
- Superstructures
- Building Envelopes
- Roofing

Quantities of commodity products (piping and electrical cable) and exhaust duct lengths were based on distances scaled from Google Earth satellite imagery. For this addendum, it is assumed that the locations of equipment and injection points did not change from the original estimates even though the original estimates did not include a baghouse.

Determined distances were multiplied by an aggregate cost for material and labor. This cost includes estimated commodity quantities along with any other components that are necessary for proper installation. The summation of the aggregated costs, for each unit was divided by the measured distances to determine the unit costs presented. Factored RS Means data was also utilized to estimate equipment installation costs.

General craneage and forklift costs were also estimated based on RS Means costing data and multiplied by a factor to obtain representative pricing for the Fairbanks, AK location. Durations were estimated based on the anticipated project schedule. Cranage costs for pile driving operations were considered separately.

Civil/Structural

Stanley Consultants has assumed that all heavy structures or structures with a low tolerance for possible settlement will be founded on deep, pile foundations. This is based not only on the soil bearing capacities indicated by the rail unloading building foundation design drawings, but on the proximity of these structures to the riverbank.

All light structures that can tolerate a minor amount of settlement were assumed to be founded on shallow, spread footings bearing on soils over-excavated and replaced with structural fill.

Miscellaneous structural steel was estimated by lineal feet for a pipe bridge, by square feet for platforms, and by piece for the pipe supports and reinforcing steel.

Electrical

Plant personnel have indicated that the existing 480V system in the plant is near its maximum capacity, therefore power must be routed from the 13.8kV switchgear in the substation. The electrical cost estimate includes the addition of new medium voltage gear and cabling, two 13.8kV/480V transformers along with two 480V motor control centers to feed the DSI equipment.

It was assumed that conduit would be routed above grade using existing building columns or support steel. Cable tray may be used as space allows. Above grade routing of circuits is the most economical. New conduit support steel was not included in the cost estimate.

The only below grade electrical installation is for the bare copper ground grid and ground rods surrounding the new equipment and MCC locations and would connect to the existing ground grid in a few locations.

Quotes used to support the electrical portion of the cost estimate can be found in Appendix B.

Mechanical

The facility's existing features have sufficient margin and correct configuration to be used to support the sorbent conveyance piping, which the vendor has indicated as 6" schedule 80 carbon steel pipe. Excessive ancillary steel for piping supports or to augment existing steel features has not been included in the cost estimate. It was also assumed that the ash pipe between the new baghouse and the ash building would be 6" schedule 80 carbon steel pipe as well. This is a conservative assumption as ash piping is usually composed of abrasion resistant alloys that are significantly more expensive than carbon steel.

Piping and supports in the sorbent storage silos and sorbent preparation building were provided by the vendor in the pricing and was not estimated as part of the BOP cost estimate.

Instrumentation & Controls

The quote from the equipment vendor includes the majority of the instrumentation and controls scope. The cost estimate includes costs for miscellaneous materials and engineering services provided by the existing control system vendor to facilitate the integration of the DSI system controllers.

Equipment Performance, Sizing, and Pricing

The flue gas streams from the Chena boilers operate at 300 to 350 °F at or near full load. The vendor has indicated that the predicted performance is valid for the indicated range of flue gas temperatures. The quote obtained for the DSI system and equipment can be found in Appendix B.

Cost Methodology and Assumptions

The costs included in the original Opinion of Probable Costs were developed in 2019 dollars. As previously discussed, where we believed the 2019 unit cost to be valid, the resulting capital cost (unit cost times number of units) was escalated to reflect 2023 dollars. The escalation factor used for this process was derived using the Chemical Engineering Plant Cost Index (CEPCI), which is published as a part of the Chemical Engineering Magazine. The CEPCI is preliminarily published each quarter, with a final number for the previous year becoming available sometime after the beginning of the current year. It is the EPA's preference to only utilize the final annual number for cost estimates, therefore this project utilized the annual cost indexes for 2018 and 2022 accordingly. The escalation factor was determined by dividing the 2022 index (816) by the 2018 index (603.1) to obtain the factor of 135.3%. All 2019 costs have therefore been multiplied by 1.353 to obtain costs reflective of 2023 dollars. Costs in this version of the report were not escalated to reflect current (2024 dollars). Given the continued supply chain issues associated with utility grade industrial equipment, the costs indicated in the cost estimate should be considered conservatively low, particularly with respect to electrical equipment.

Contractor Cost Assumptions

Project indirect costs include costs to manage, supervise, provide safety oversight/reporting, construction procurement, QA/QC, security, housekeeping staff, and insurance requirements to support the project. These costs are listed at the bottom of the cost estimate summary sheet and are calculated as a percentage of the bare costs. As previously stated, all percentages utilized in the estimate are based on the recommendations provided to us by Haskell Corporation.

Contractor profit was estimated at 10% for this cost estimate. In addition to the projects risk, profit also has a strong dependency on the owner's requirements concerning construction activities, competitiveness and other market conditions, and the availability of trades necessary to execute the work.

The cost estimate assumed that the prime contractor will self-perform all aspects of the work. Typically, prime contractors need to subcontract architectural, civil, and electrical work. Each of these subcontractors to the prime contractor have their own overhead and profit that is then marked up again by the prime contractor. No subcontract to the prime contractor mark-ups have been assumed in the cost estimate.

Owners Cost Assumptions

Project costs that are unrelated to the construction contract were also excluded from the cost estimate. These costs include administrative expenses, O&M mobilization and training, security surveillance, owner insurance during construction, and testing and commissioning. Proposed non-construction costs for the example projects were reviewed and converted to a value expressed as a percent of total construction cost. These values were then used as a guide for approximating non-construction costs for this project.

Opinion of Probable Cost

Based on the information above, the current minimum estimate of probable cost for a DSI system is as follows:

- Total Installed Cost: $82.321 MM
- Sorbent Cost: $563/Ton, Delivered by Rail and $623/Ton, Delivered by Truck

Sorbent pricing information provided by BACT in their proposal was supplied by their preferred sorbent vendor, Solvay. Solvay specifically developed the indicated pricing for use in this study.

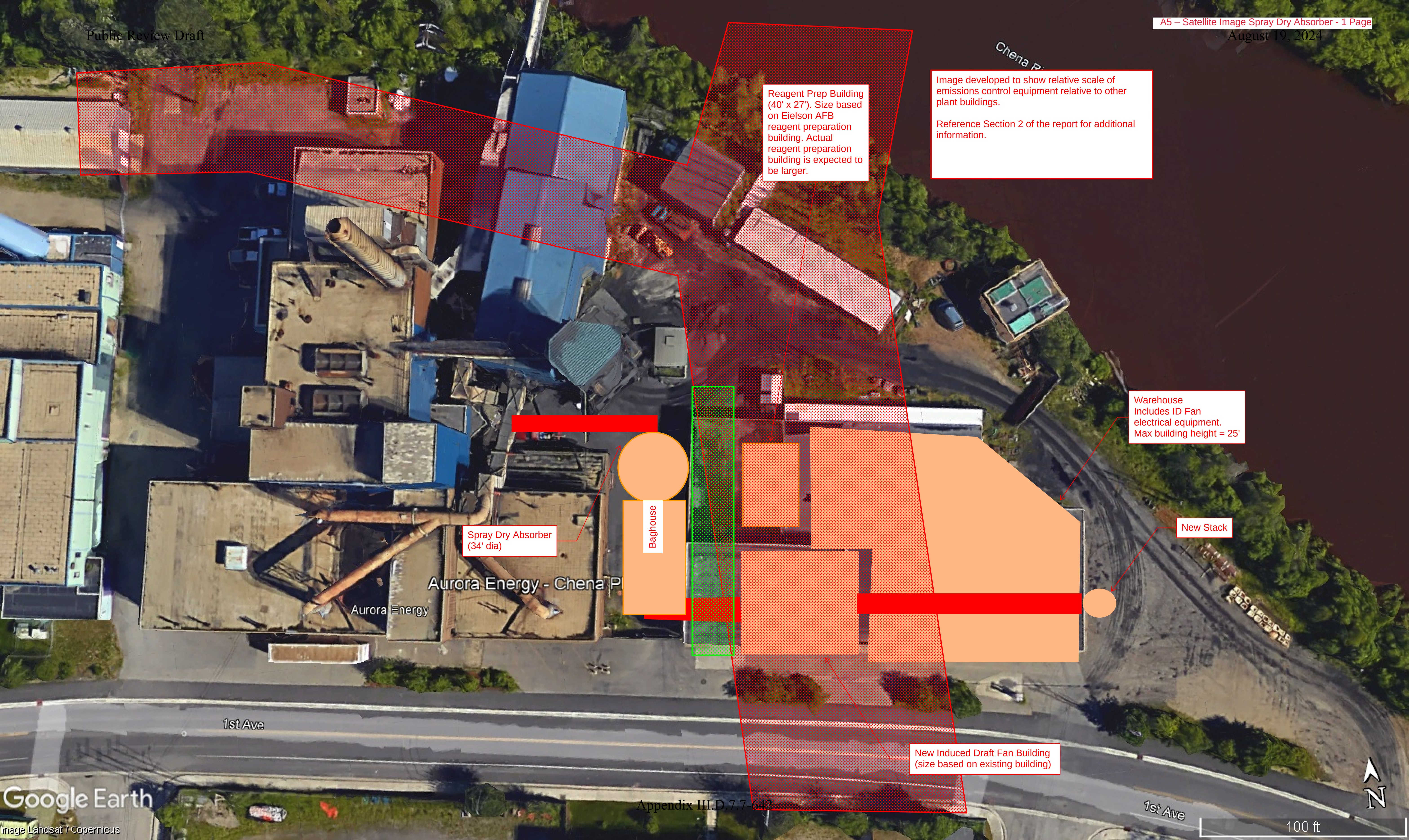
Appendix A
Drawings & Illustrations


A1 – Satellite Image Chena Plant Space Usage - 1 Page
Cooling Water Outfall
Overhead electrical easement. Buried utilities.
Access to Induced Draft Fan via roll up door.
Alternate coal delivery point (in the event of conveyor belt failure)
Truck access for ash loading.
Approximate area impacted by Overhead Electrical Easement. Also serves as a plant access road.
Chena River
Induced Draft Fan
Emergency services / buried utilities
Baghouse Elec
Baghouse
Storage
Pump House
Water Plant
Ash Silo
Well
Ash Haul Road
Note: Ash trucks must use this path to ensure sufficient distance for tire cleaning before entering public roadways.
Chena Plant
Warehouse
Aurora Energy - Chena Plant
Aurora Energy
Access road easement and parking
Access road / Emergency Services
Google Earth
Image Landsat / Copernicus
1st Ave
100 ft
N


Overhead Electric Easement
Chena River
Image developed to show relative scale of emissions control equipment relative to other plant buildings.
Area in which reactor is shown is not available for use and therefore this image should not be interpreted as a proposed location for the equipment. Reference Section 2 of the report for additional information.
Warehouse
WFGD Reactor and Stack (19' Dia)
Aurora Energy - Chena Plant
Aurora Energy
WFGD Equipment Building (100' x 65')
Max building height = 25'
1st Ave
1st Ave
Google Earth
Image Landsat / Copernicus
N
100 ft


Overhead Electric Easement
Chena River
Image developed to show relative scale of emissions control equipment relative to other plant buildings.
Reference Section 2 of the report for additional information.
Circulating Dry Scrubber (22' square)
Warehouse Includes ID Fan electrical equipment. Max building height = 25'
New Stack
Aurora Energy - Chena Plant
Aurora Energy
Elevated Baghouse (50'x33')
New plant road
1st Ave
New Induced Draft Fan Building (size based on existing building)
Google Earth
Image Landsat / Copernicus
1st Ave
100 ft
N


Existing baghouse and ID fan building to be abandoned.
Chena River
Warehouse
Includes ID Fan electrical equipment.
Max building height = 25'
68'-10 1/4"
33'-6 1/4"
25' vertical
Baghouse
DSI Prep
New Stack
75'-4 3/4"
33'-4 3/4"
73'-8 1/4"
111'-3 3/4"
Aurora Energy - Chena Plant
Aurora Energy
Area of duct replacement due to addition of DSI reactors
43'-6 3/4"
1st Ave
New Induced Draft Fan Building (size based on existing building)
Google Earth
Image Landsat / Copernicus
1st Ave
N
100 ft


Chena Ri
Image developed to show relative scale of emissions control equipment relative to other plant buildings.
Reference Section 2 of the report for additional information.
Reagent Prep Building (40' x 27'). Size based on Eielson AFB reagent preparation building. Actual reagent preparation building is expected to be larger.
Warehouse
Includes ID Fan electrical equipment.
Max building height = 25'
New Stack
Baghouse
Spray Dry Absorber (34' dia)
Aurora Energy - Chena P
Aurora Energy
New Induced Draft Fan Building (size based on existing building)
1st Ave
1st Ave
Google Earth
Image Landsat / Copernicus
100 ft
N

A6 – Plat Drawing - 1 Page

CERTIFICATE OF CORPORATE OWNERSHIP & DEDICATION

I HEREBY CERTIFY THAT THE CITY OF FAIRBANKS, A MUNICIPAL CORPORATION, IS THE OWNER OF THE HEREIN SPECIFIED PROPERTY SHOWN AND DESCRIBED HEREON AND THAT I HEREBY ADOPT THIS PLAN OF SUBDIVISION WITH MY FREE CONSENT AND DEDICATE ALL STREETS, ALLEYS, WALKS, PARKS, AND OTHER DESIGNATED PUBLIC SPACES TO PUBLIC USE.

[signature] 10-3-97
MAYOR, CITY OF FAIRBANKS DATE

UNITED STATES OF AMERICA)
) S. S.
STATE OF ALASKA)

THIS IS TO CERTIFY THAT ON THIS 3rd DAY OF October, 19__ BEFORE ME, A NOTARY PUBLIC FOR THE STATE OF ALASKA, DULY COMMISSIONED AND SWORN, PERSONALLY APPEARED

James C. Hayes

TO ME KNOWN TO BE THE IDENTICAL INDIVIDUAL MENTIONED AND WHO EXECUTED THE WITHIN PLAT, AND HE ACKNOWLEDGED TO ME THAT HE SIGNED THE SAME FREELY AND VOLUNTARILY FOR THE USES AND PURPOSES THEREIN SPECIFIED IN HIS CAPACITY AS Mayor OF THE CITY OF FAIRBANKS AND THAT AT THE SAME TIME HE PRESENTED THIS PLAT HE WAS CLOAKED WITH THE POWER AND AUTHORITY TO SIGN THIS PLAT ON BEHALF OF SAID MUNICIPAL CORPORATION.

WITNESS MY HAND AND NOTARIAL SEAL THE DAY AND YEAR IN THIS CERTIFICATE FIRST HEREIN WRITTEN.

[signature]
NOTARY PUBLIC IN AND FOR THE STATE OF ALASKA
MY COMMISSION EXPIRES: 3-16-98

CERTIFICATE OF PAYMENT OF TAXES

I, THE UNDERSIGNED, BEING DULY APPOINTED AND QUALIFIED TAX COLLECTOR FOR THE FAIRBANKS NORTH STAR BOROUGH, DO HEREBY CERTIFY THAT, ACCORDING TO THE RECORDS OF THE FAIRBANKS NORTH STAR BOROUGH THE FOLLOWING DESCRIBED PROPERTY IS CARRIED ON THE TAX RECORDS IN THE NAME OF:

City of Fairbanks

DESCRIPTION:

Townsite Tract "D"

AND THAT, ACCORDING TO THE RECORDS IN MY POSSESSION, ALL TAXES LEVIED AGAINST SAID LAND AND IN FAVOR OF THE FAIRBANKS NORTH STAR BOROUGH, ARE NOT DELINQUENT.
DATED AT FAIRBANKS, ALASKA, THIS 3rd DAY OF October, 1997.

Carol Heltunen
TAX COLLECTOR
FAIRBANKS NORTH STAR BOROUGH

CERTIFICATE OF APPROVAL BY THE PLATTING AUTHORITY

I HEREBY CERTIFY THAT THIS SUBDIVISION PLAT HAS BEEN FOUND TO COMPLY WITH THE REGULATIONS OF CHAPTER 17.80, FINAL PLATS, OF THE FAIRBANKS NORTH STAR BOROUGH CODE OF ORDINANCES, AND THAT SAID PLAT HAS BEEN APPROVED.

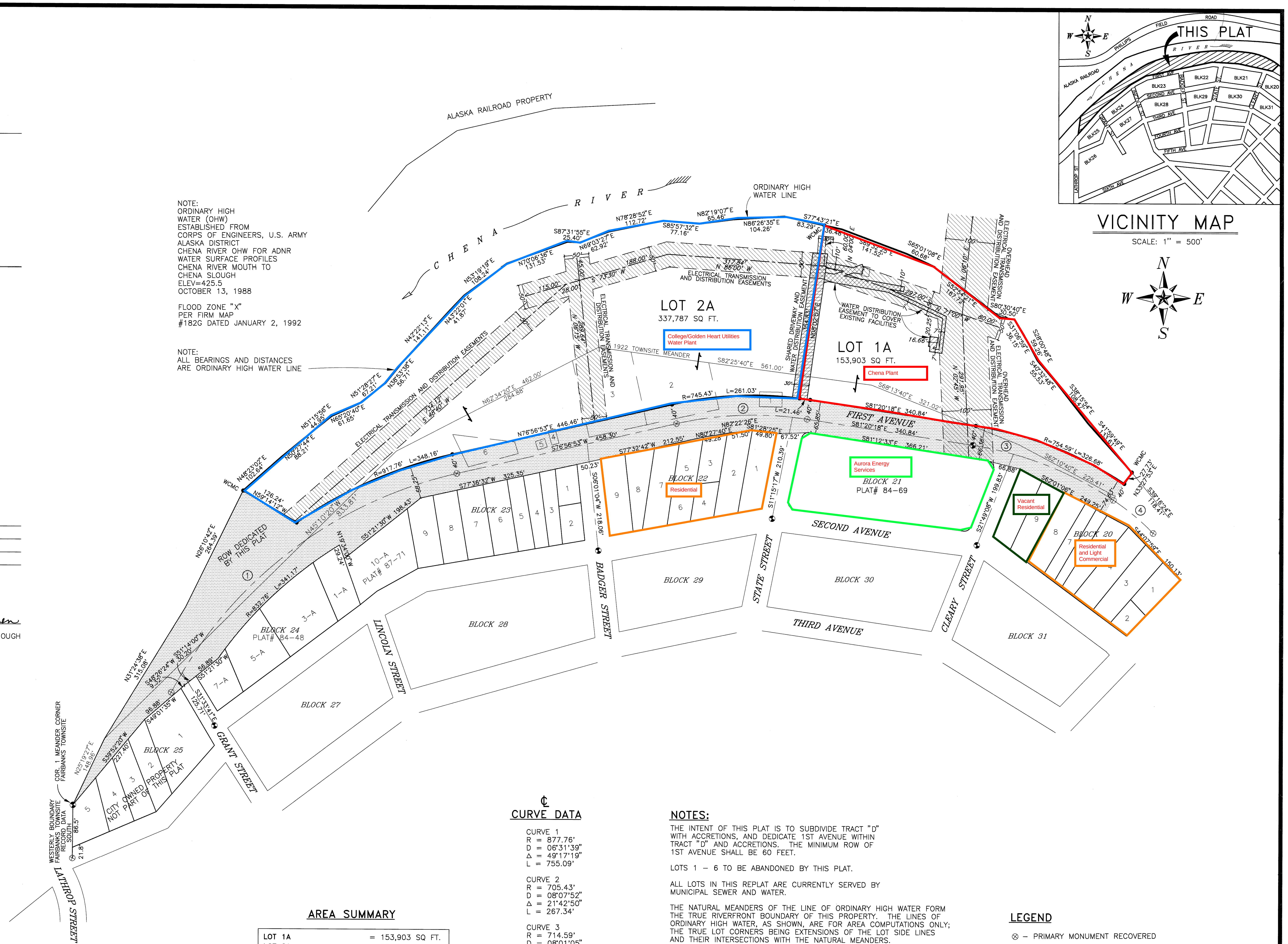
FAIRBANKS NORTH STAR BOROUGH — APPROVED — DATE 10-3-97 — PLATTING OFFICER

CERTIFICATE OF REGISTERED LAND SURVEYOR

I, DAVID M. MCNARY, A PROFESSIONAL LAND SURVEYOR REGISTERED IN THE STATE OF ALASKA, DO HEREBY CERTIFY THIS PLAT TO BE A TRUE AND CORRECT REPRESENTATION OF LANDS ACTUALLY SURVEYED BY ME OR UNDER MY DIRECT SUPERVISION, ACCORDING TO THE STANDARDS OF TITLE 17, SUBDIVISIONS, FAIRBANKS NORTH STAR BOROUGH CODE, AND THAT THE DISTANCES AND BEARINGS ARE SHOWN CORRECTLY AND THAT ALL MONUMENTS REQUIRED HAVE BEEN SET.

[signature] 10-3-97
REGISTRATION No. 4911-S

STATE OF ALASKA — 49TH — David M. McNary No. 4911-S — REGISTERED PROFESSIONAL LAND SURVEYOR



NOTE:
ORDINARY HIGH WATER (OHW) ESTABLISHED FROM CORPS OF ENGINEERS, U.S. ARMY ALASKA DISTRICT CHENA RIVER OHW FOR ADNR WATER SURFACE PROFILES CHENA RIVER MOUTH TO CHENA SLOUGH ELEV=425.5 OCTOBER 13, 1988

FLOOD ZONE "X" PER FIRM MAP #182G DATED JANUARY 2, 1992

NOTE:
ALL BEARINGS AND DISTANCES ARE ORDINARY HIGH WATER LINE

℄ CURVE DATA

CURVE 1
R = 877.76'
D = 06°31'39"
Δ = 49°17'19"
L = 755.09'

CURVE 2
R = 705.43'
D = 08°07'52"
Δ = 21°42'50"
L = 267.34'

CURVE 3
R = 714.59'
D = 08°01'05"
Δ = 24°48'16"
L = 309.36'

CURVE 4
R = 481.30'
D = 11°54'16"
Δ = 12°30'28"
L = 105.07'

AREA SUMMARY

LOT 1A	=	153,903 SQ FT.
LOT 2A	=	337,787 SQ FT.
NET LOT AREA	=	491,690 SQ FT.
ROAD DEDICATION	=	196,041 SQ FT.

NOTES:

THE INTENT OF THIS PLAT IS TO SUBDIVIDE TRACT "D" WITH ACCRETIONS, AND DEDICATE 1ST AVENUE WITHIN TRACT "D" AND ACCRETIONS. THE MINIMUM ROW OF 1ST AVENUE SHALL BE 60 FEET.

LOTS 1 – 6 TO BE ABANDONED BY THIS PLAT.

ALL LOTS IN THIS REPLAT ARE CURRENTLY SERVED BY MUNICIPAL SEWER AND WATER.

THE NATURAL MEANDERS OF THE LINE OF ORDINARY HIGH WATER FORM THE TRUE RIVERFRONT BOUNDARY OF THIS PROPERTY. THE LINES OF ORDINARY HIGH WATER, AS SHOWN, ARE COMPUTATIONS ONLY; THE TRUE LOT CORNERS BEING EXTENSIONS OF THE LOT SIDE LINES AND THEIR INTERSECTIONS WITH THE NATURAL MEANDERS.

BASIS OF SURVEY AND BEARINGS

FAIRBANKS TOWNSITE MONUMENTATION WITH RW BECK DEPENDENT TOWNSITE MONUMENTATION SURVEY, COORDINATES ON FILE IN THE CITY SURVEYOR'S OFFICE.

LEGEND

⊗ – PRIMARY MONUMENT RECOVERED
◆ – PRIMARY MONUMENT NOT RECOVERED
● – 5/8" REBAR W/ AL. CAP SET
▨ – AREA OF DEDICATION

97-96
RECORDED – FILED Fairbanks REC. DIST.
DATE 10-3 1997
TIME 4:07 P M
Requested by FNSB

FAIRBANKS RECORDING DISTRICT

DATE	REVISION	BY

PLAT SCALE: 1"=100' (0 50 100 200 300)

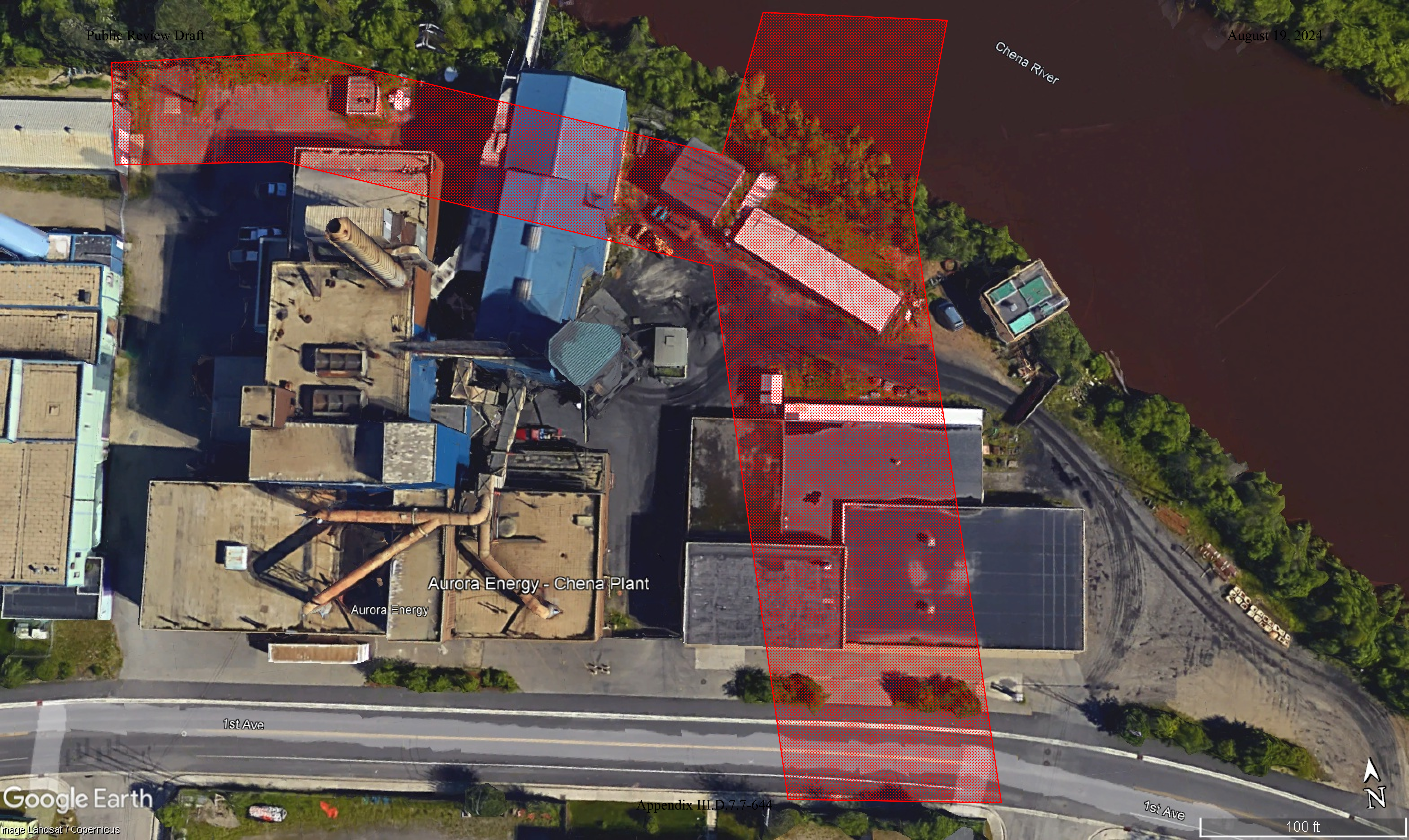
DESIGNED:	DMM	SURVEYOR:	CHB
DRAWN:	CHB, DEW	FNSB NUMBER:	RP 014-98
CHECKED:	DMM, RBB		
DATE:	OCT, 1997	FILE NUMBER:	30.03

CITY OF FAIRBANKS, ALASKA
ENGINEERING DEPARTMENT

REPLAT OF LOTS 1 THRU 6 AND REMAINING PORTIONS OF TRACT "D", AND DEDICATION OF FIRST AVENUE WITHIN TRACT "D" AND ACCRETIONS, FAIRBANKS TOWNSITE, SECTION 10, T1S, R1W, FAIRBANKS MERIDIAN

1/1

Fairbanks 97-96


Chena River
Aurora Energy - Chena Plant
Aurora Energy
1st Ave
1st Ave
Google Earth
Image Landsat / Copernicus
N
100 ft

Google Maps Fairbanks

Imagery ©2018 Google, Map data ©2018 Google 50 ft

49.88 ft

Google Maps Fairbanks

Imagery ©2018 Google, Map data ©2018 Google 20 ft

20.10 ft

Appendix B
Vendor Communications, Data, and Quotes

Appendix B1 – Andritz Baghouse Shipping Costs
Appendix B2 – Andritz Baghouse Suitability
Appendix B3 – Andritz CDS General Arrangement
Appendix B4 – Andritz CDS Sizing Information
Appendix B5 – BACT Proposal No. 1899-R2
Appendix B6 – B&W Equipment Sizing Question
Appendix B7 – MV Electrical Equipment Quote
Appendix B8 – QES MCC Panel Duct Quote
Appendix B9 – OLSUN Electrics Small Transformers Quote
Appendix B10 – Office Warehouse Square Foot Price Est.

Solan, John

From: Petty Paul <Paul.Petty@andritz.com>
Sent: Thursday, September 28, 2023 3:17 PM
To: Solan, John
Cc: Courtney Kimball (ckimball@boreal-services.com); dfish@usibelli.com; Payne, Mark; Chilkoot Ward; Alvarez Gustavo; Prieler Harald; Verreault Ron
Subject: Re: Aurora Energy: Baghouse Air Flow

***** EXTERNAL EMAIL - Use caution and verify authenticity before trusting any contents. *****

John

Freight to Alaska is tricky to guess at. typically for budgetary work within in us taking freight as 6% of the price would be safe. For Alaska I am not sure but I would think at least double that value.

Paul Petty
Andritz Inc.
+1 667 351 8872

From: Solan, John <SolanJohn@stanleygroup.com>
Sent: Wednesday, September 27, 2023 10:13:01 AM
To: Petty Paul <Paul.Petty@andritz.com>
Cc: Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>; dfish@usibelli.com <dfish@usibelli.com>; Payne, Mark <PayneMark@stanleygroup.com>; Chilkoot Ward <cward@auroraenergyak.com>; Alvarez Gustavo <Gustavo.Alvarez@andritz.com>; Prieler Harald <Harald.Prieler@andritz.com>; Verreault Ron <Ron.Verreault@andritz.com>
Subject: RE: Aurora Energy: Baghouse Air Flow

CAUTION: External email. Do not click on links or open attachments unless you know the sender and that the content is safe.

Paul,
I was wondering if I could get one more piece of information. Do you have an recent example of shipping cost that might be reasonably accurate for just the baghouse? It's ok if you don't have one handy. We can take a low ball guess, but I hate doing that without checking with your first.

Thanks!
-John

From: Petty Paul <Paul.Petty@andritz.com>
Sent: Tuesday, September 19, 2023 6:56 AM
To: Solan, John <SolanJohn@stanleygroup.com>
Cc: Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>; dfish@usibelli.com; Payne, Mark <PayneMark@stanleygroup.com>; Chilkoot Ward <cward@auroraenergyak.com>; Alvarez Gustavo <Gustavo.Alvarez@andritz.com>; Prieler Harald <Harald.Prieler@andritz.com>; Verreault Ron <Ron.Verreault@andritz.com>
Subject: RE: Aurora Energy: Baghouse Air Flow

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John,

Yes the footprint of the baghouse itself would be very close to correct, all you would need to do is drop off the scrubber vessel. I would be lower to the ground since it does not need to be elevated for the ash recycle but in plan view it is very close. Thanks.

Best regards,

Paul Petty
Director, Proposals and Technology
Andritz, Inc.
+1 667 351 8872

From: Solan, John <SolanJohn@stanleygroup.com>
Sent: Monday, September 18, 2023 5:46 PM
To: Petty Paul <Paul.Petty@andritz.com>
Cc: Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>; dfish@usibelli.com; Payne, Mark <PayneMark@stanleygroup.com>; Chilkoot Ward <cward@auroraenergyak.com>; Alvarez Gustavo <Gustavo.Alvarez@andritz.com>; Prieler Harald <Harald.Prieler@andritz.com>; Verreault Ron <Ron.Verreault@andritz.com>
Subject: RE: Aurora Energy: Baghouse Air Flow

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Paul,
Thanks for the detailed response! Greatly appreciated.
Quick follow up… Can I use the footprint from the 8 compartment TurboCDS example drawing that you previously provided for the baghouse that you suggest below? Obviously, it will be shorter, but is the length and width about right?
Thanks
-John

From: Petty Paul <Paul.Petty@andritz.com>
Sent: Monday, September 18, 2023 8:33 AM
To: Solan, John <SolanJohn@stanleygroup.com>
Cc: Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>; dfish@usibelli.com; Payne, Mark <PayneMark@stanleygroup.com>; Chilkoot Ward <cward@auroraenergyak.com>; Alvarez Gustavo <Gustavo.Alvarez@andritz.com>; Prieler Harald <Harald.Prieler@andritz.com>; Verreault Ron <Ron.Verreault@andritz.com>
Subject: RE: Aurora Energy: Baghouse Air Flow

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John,

Regarding the below, to really assess if the existing FF would take more drawings and an assessment from our process folks in Sweden. It does not sound like you have time for this. Regarding the existing design I can see that if the gas flow rate is still 250,000 acfm then the baghouse is undersized by modern standards, with about a 4.1 gross A/C ratio and 4.5

net. We would size this today as 4 : 1 net max so the baghouse is about 10-15% undersized assuming the design for a net (N-1) condition. The dust load does not look abnormally high assuming I can take the dust tpy value from the .xls sheet and assume that is at 100% capacity factor and full load where dividing it by 365 x 24 hours is appropriate to come up with a dust concentration. Using 250,000 acfm this is 2.26 gr/acf which should be OK for a normally sized baghouse. At the gross condition 4.1 I would have thought this would still function It makes me question if the 250,000 acfm value is accurate or if the real flow is somewhat higher. There could be other issues at play like the pulse air pressure being too wet or too low. It really is not possible to be definitive but if I was sizing this today I would be 10-15% larger to hold 4.0 : 1 net.

here is not typically space in a baghouse casing to add 10- 15% more fabric so any increase in height would mean demolishing the roof and adding a "Belly band" casing height extension in some way, as with ESPs when taller collecting plates are required. The manifolds would need to be modified as well. This is unusual for a baghouse and outage intensive.

A new baghouse could be configured in several ways. One sizing, assuming the design for modular baghouse compartments to minimize field labor – would be 8 compartments with 270 x 5" dia x 9m tall bags per compartment. The price for this including the baghouse casing itself, cleaning system, support steel, local access, stairtower, local instruments, piping from pulse valves to receiver at grade, and an allowance for field service support, but reusing the plant air system for cleaning is about $2,900,000. Freight is ex-works, lower 48 US.

Hopefully this helps. Thanks

Best regards,

Paul Petty
Director, Proposals and Technology
Andritz, Inc.
+1 667 351 8872

From: Solan, John <SolanJohn@stanleygroup.com>
Sent: Friday, September 15, 2023 2:10 PM
To: Petty Paul <Paul.Petty@andritz.com>
Cc: Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>; dfish@usibelli.com; Payne, Mark <PayneMark@stanleygroup.com>; Chilkoot Ward <cward@auroraenergyak.com>
Subject: RE: Aurora Energy: Baghouse Air Flow

Paul,
I left you a voicemail, but here is the question that I wanted to ask…

We are evaluating the impacts to the plant if we add a DSI system. Attached is a spreadsheet that calculates the current ash generation at full load and the predicted ash generation after we add the DSI system. It results in a net increase of 2,930.25 tons of ash/spent sorbent per year. This is approximately a 16% increase in baghouse dust loading. Plant personnel have indicated that they have had issues with the existing baghouse in the past..

1. They were previously baghouse limited on boiler capacity. They recently installed new bags that allowed them to reach full load, but they do not believe that there is much margin.

2. They have run across events where a minor increase in dust loading due to mechanical issues in the plant resulted in a significant increase in cleaning cycles. Occasionally, the baghouse would enter a continuous cleaning mode in order to keep the dP down.

Long story short, it does not appear that there is much dP margin in the existing baghouse. The plant is concerned that the additional dust loading associated with the DSI system will exceed the maximum recommended loading and cause operational problems (particularly in the winter when the loads are highest and the steam is most critical).

Is there any way that you can have a look at the old baghouse and let us know if it is suitable for use with the new dust loading rates? If it is not, would a new baghouse be required? Note that there is no room available to add modules, therefore the only way to increase bag surface area is to go up with longer bags.

If you think a new baghouse is required, can you provide an estimate on the cost? To save on time and effort, I don't need a full proposal.

Thanks!
-John

PS: we are under the gun to get this report out. A quick response is greatly appreciated.

From: Solan, John
Sent: Thursday, August 31, 2023 11:14 AM
To: Petty Paul <Paul.Petty@andritz.com>
Subject: FW: Aurora Energy: Baghouse Air Flow

From: David Fish <dfish@usibelli.com>
Sent: Monday, August 28, 2023 6:56 PM
To: Solan, John <SolanJohn@stanleygroup.com>
Subject: Aurora Energy: Baghouse Air Flow

***** EXTERNAL EMAIL - Use caution and verify authenticity before trusting any contents. *****

David Fish
Environmental Manager

Aurora Energy, LLC
100 Cushman St., Suite 210 | Fairbanks, AK 99701-4674
Office 907-457-0230 | Fax 907-451-6543 | Cell 907-799-9464
dfish@usibelli.com

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Thank you

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Thank you

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Thanks!
-John

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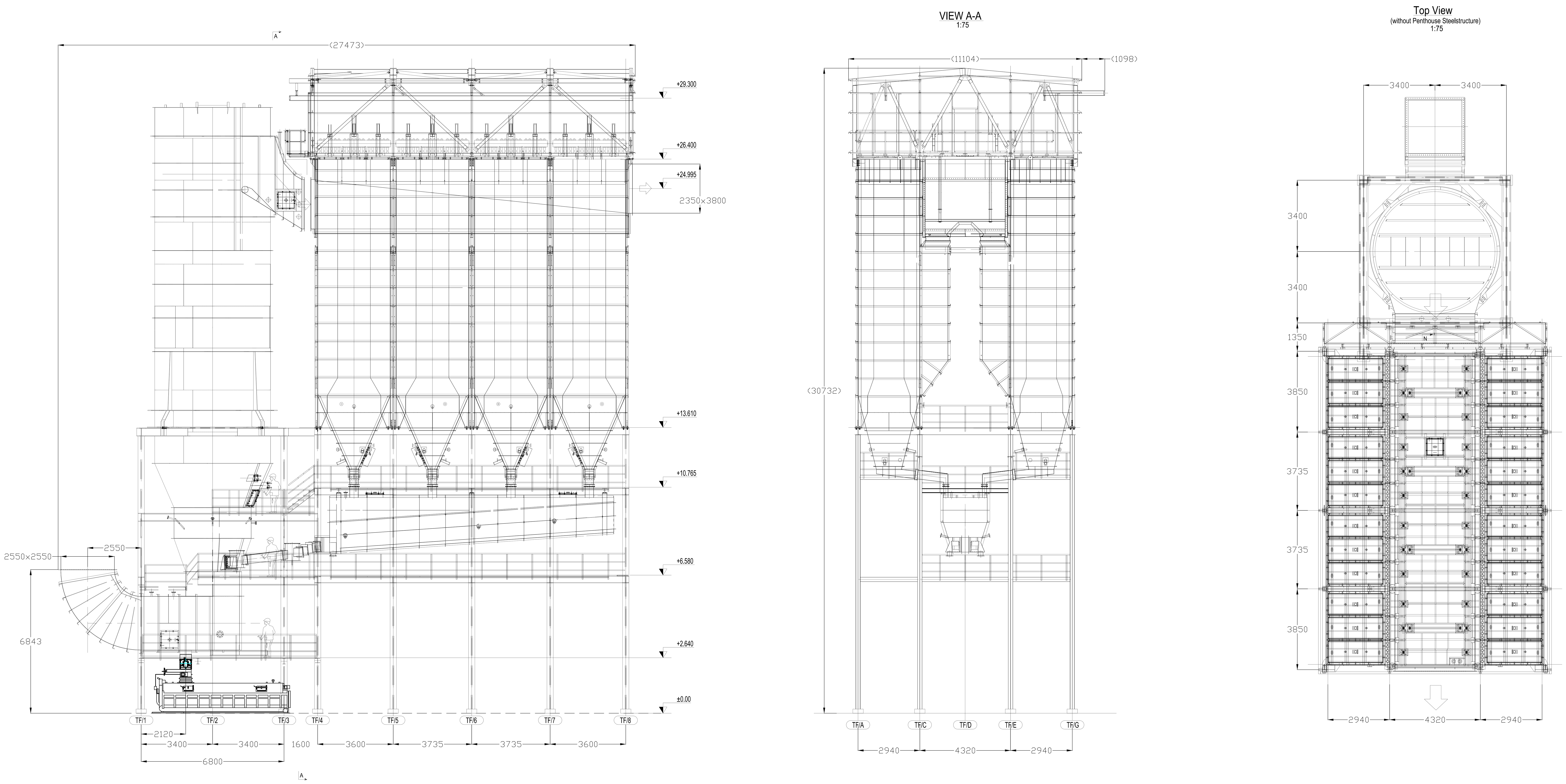
To: Solan, John <SolanJohn@stanleygroup.com>
Subject: Aurora Energy: Baghouse Air Flow

***** EXTERNAL EMAIL - Use caution and verify authenticity before trusting any contents. *****

David Fish
Environmental Manager

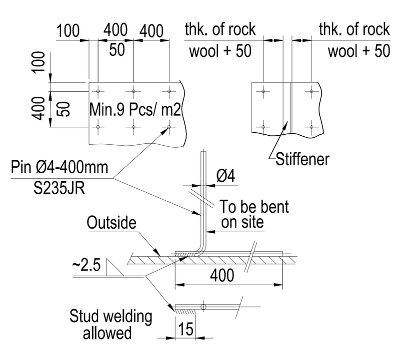
Aurora Energy, LLC
100 Cushman St., Suite 210 | Fairbanks, AK 99701-4674
Office 907-457-0230 | Fax 907-451-6543 | Cell 907-799-9464
dfish@usibelli.com

B3 – Andritz CDS General Arrangement - 1 Page



Material	: S235JR if not otherwise specified

INSULATION PINS ARRANGEMENT



Insulation	YES
Insulation : See component Basic	
Reference drawings: -	
Partly pre-assembly in workshop	YES
See component Basic All welds need to be tight.	

Corrosion protection :

Areas under insulation : Transport coating 60 µm
Areas in contact with flue gas : no treatment

15x18 8 Chamber

Surfaces Exposed To Atmosphere And Not Under Insulation.

INDOOR	Sa 2,5 2 comp epoxy zincrich 110 µm 2 comp. polyurethane 50 µm RAL 7001
OUTDOOR	Sa 2,5 2 comp epoxy zincrich 70 µm 2 comp epoxy micaceous iron oxide 120 µm 2 comp. polyurethane 50 µm RAL 7001

Revision	Modification	Date	Erstel. / Prep. Untersch. / Sign.	Date	Geprüft/Checked Untersch. /Sign.	Date	Freiga. / Releas. Untersch. /Sign.
00	First Issue	15.02.2017	Taucher	15.02.2017	And Graz	-	-

Schutzvermerk gemäß EN ISO 16016
Protection Note acc. EN ISO 16016
© 2016

Maßstab Scale: 1:75
Format Size: A0

Trennmaßtoleranzen nach EN ISO 13920/B
Schweißsymbole nach EN 22553
Allgemeintoleranzen nach EN 22768 mk
General tolerances according EN ISO 13920/B
Welding Symbols according EN 22553
General tolerances according EN 22768 mk
Bauteilspez. Toleranzen entsprechend Bauteil. Spezifikation
Unit tolerances according component specification

Besteller Purchaser: BESTELLER_1 BESTELLER_2
Bauwerk Structure: ANLAGE_1 ANLAGE_2

ANDRITZ

Benennung Title: COMPACT FILTER 15X18, 8 CHAMBER
CONCEPTUAL LAYOUT
FABRIC FILTER, REACTOR, PROD. RECIRC.

Anlagenkennzeichnung/Plant Identification	Auftrag/Order – BG/Comp. – Lfd Nr./Ser.No. – Art/Type – Revision
KKS-NR	R-01-002220-141-5010-010-0595__00

Solan, John

From: Petty Paul <Paul.Petty@andritz.com>
Sent: Thursday, August 31, 2023 12:23 PM
To: Solan, John
Cc: Prieler Harald; Alvarez Gustavo; Verreault Ron
Subject: RE: Aurora Energy: Baghouse Air Flow
Attachments: Andritz TurboCDS 8 compartment GA drawing.pdf; ANDRITZ-Air_Pollution_Control-Leaflet-210x105-April23-WEB.pdf

***** EXTERNAL EMAIL - Use caution and verify authenticity before trusting any contents. *****

John,

As requested, please see attached a drawing for one of our standard "TurboCDS" trains using our modular "Compact Filter" baghouse design. This is the right size for 250,000 acfm. Not shown is the lime silo which can be located anywhere within pneumatic conveying distance of the vessel, say within 200', but which is typically near the vessel. The lime silo is more or less a DSI type system with a nominal 13' diameter vessel, skirt supported and with a pneumatic line to the scrubber. You can locate this 13' circle in plan view as needed.

Regarding an SDA, the existing baghouse may be able to be reused but as discussed we would strongly suggest close coupling the SDA vessel to the inlet end of the fabric filter to minimize risk of dust buildup in the SDA to FF duct.

For future use on this or other projects I'm also attaching our "QR code" based AQCS line list, which now includes all of the ex-GE, Alstom, Flakt, etc. lines.

Thanks again

Best regards,

Paul Petty
Andritz, Inc.
+1 667 351 8872

From: Solan, John <SolanJohn@stanleygroup.com>
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Subject: FW: Aurora Energy: Baghouse Air Flow

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David Fish
Environmental Manager

Aurora Energy, LLC
100 Cushman St., Suite 210 | Fairbanks, AK 99701-4674
Office 907-457-0230 | Fax 907-451-6543 | Cell 907-799-9464
dfish@usibelli.com

BACT PROCESS SYSTEMS, INC.

3345 N. ARLINGTON HEIGHTS RD. SUITE B
ARLINGTON HEIGHTS, IL 60004-1900
(847) 577-0950
FAX: (847) 577-6355
E-MAIL: bact_process@sbcglobal.net

July 28, 2023

Mr. John Solan, P.E.
Senior Mechanical Engineer
Stanley Consultants
8000 S. Chester Street, Suite 500
Centennial, CO 80112

RE: DSI for Aurora Energy / BACT Proposal No. 1899-R2

Dear John,

We are revising our proposal in the light of your recent email. The Emissions and sorbent usage from the boiler is based on recent information from you: on 0.30 lbs. of SO2/MBTU these calculations are based on using a weight ratio of 2.6 lbs. of sodium bicarbonate to 1 lb. of sulfur and a NSR of 1.5; Sulphur at .28%; Heating Volume of 7,600; 95% removal of SO2.

BOILER	MBTU/HR	S02 PPH	SODIUM BICARBONATE PPH
1	76	22.8	111
2	76	22.8	111
3	76	22.8	111
5	269	80.7	392
		TOTAL 228 PPH	725 PPH
			.3625 Tons/Hr.
	Per Month:	8.7 Tons/Day	261 Tons

Bicarbonate Storage

For four months; we need 1,044 Tons of sorbent
(2) Silos: 518 Tons capacity each
TOTAL CAPACITY = 1,036 Tons
Silo Size: Same as Eielsen

Cost of Sodium Bicarbonate = per month; this is based on estimate by Solvay for year 2024 delivery including freight: $563/Ton by railcar - $623/Ton by truck; from terminal in Fairbanks.

Scope of Supply

1. (2) Bolted Storage Silos – 22' DIA x 100' tall with bin-vent level control and bin vibrators; capacity = 1,036 tons; storage silo complete.
2. (1) Rail car unloading and diverters to fill silos located 500' away; rate = 33,000 PPH, blower = 200 HP; installed spare; backup blower.
3. (3) Day bins with pneumatic conveying from storage silos. Conveying distance 1,000', 6,000 PPH capacity, blower = 200 HP; blowers are spared.
4. (3) Classifier mills; 1,000 PPH capacity, 75 HP total, connected HP (for 2). The 75 HP is the sum of the grinding motor, classifier motor, brakes, and VFD.

5.&6. (3) Filter receivers with conveying blowers. Milled material conveying material from mill to filter receivers. (2) Blowers 75 HP total; total connected.

7. (4) Injector sets to be installed on duct work.
8. (1) Dedicated compressor.
9. (1) NEMA 6 control panel with microprocessor.
10. Integration to the boiler control panel.
11. CFD modeling and programing.
12. All pneumatic piping up to the reagent building. All piping within the sorbent prep building by BACT. Pipe from the building wall for the 4 pipes leading to each stack by customer. Air coolers are provided to minimize puffing of the reagent.
13. Sorbent building and foundation by customer.
14. Dry reactor for each boiler.

Budget Sell Price: $5,990,000
Freight: $ 250,000
F.O.B. Shipping Point
Taxes Extra

NOTES:

1. In order to meet 95%, we need to incorporate a small dry reactor in each boiler exhaust. Residence time is less than 2 seconds. We will develop dimensions of reactor in the event this proposal gets more interest from customer.

2. Since our last visit to this project, Solvay has established a terminal in Fairbanks. We could reduce the size of silo. We could also remove railcar unloading. The savings will be approximately $300,000.

3. Solvay assures me the temperature of 300-350°f will be acceptable to them to assure performance.

If you have any questions, please let me know.

Best regards,

BACT PROCESS SYSTEMS, INC.

N.S. ("Bala") Balakrishnan
President

cc: Mario Jahn

Solan, John

From: Pon, Ronald T <rtpon@babcock.com>
Sent: Thursday, September 14, 2023 11:19 PM
To: Solan, John
Cc: Payne, Mark; Jahn, Mario; Courtney Kimball (ckimball@boreal-services.com)
Subject: RE: Quick Question for AQCS folks

***** EXTERNAL EMAIL - Use caution and verify authenticity before trusting any contents. *****

John,

Apologies for the delay. Here is what was provided by Ohio -

For a wet FGD:

The absorber diameter will be 19ft with the tower about 75ft tall and a stack could be put directly on top of the absorber to whatever height would be required. On a project of this size we would close couple all of the equipment as best as we could and have done this on about a 65ft by 100 ft area which would have included the absorber, ox air blowers, recirc pumps, and dewatering belt filters. We can design the wet FGD system for zero liquid discharge so a waste water treatment building may not be necessary.

For an SDA:

The SDA vessel will be about 34ft in diameter by 54 ft tall with a 4 or 6 compartment baghouse following the SDA. It would take up a similar footprint of about 75ft by 90 ft.

Please let me know if you have any questions or comments.

Best regards,
Ron

Ronald Pon
Account Manager
Email: rtpon@babcock.com
Desk: 707.265.1055
Mobile: 925.451.4272
FAX: 707.265.1000
710 Airpark Road
Napa, CA 94558
www.babcock.com • NYSE BW
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TARGET ZERO - *To finish each and every day injury- and incident-free*

From: Solan, John <SolanJohn@stanleygroup.com>
Sent: Thursday, September 14, 2023 10:19 AM
To: Pon, Ronald T <rtpon@babcock.com>
Cc: Payne, Mark <PayneMark@stanleygroup.com>; Jahn, Mario <JahnMario@stanleygroup.com>; Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>
Subject: EXTERNAL: RE: Quick Question for AQCS folks

Ron,
Just checking in on this. Have you been able to get any feedback from Ohio?

Thanks
-John

From: Pon, Ronald T <rtpon@babcock.com>
Sent: Tuesday, August 29, 2023 10:09 AM
To: Solan, John <SolanJohn@stanleygroup.com>
Cc: Payne, Mark <PayneMark@stanleygroup.com>; Jahn, Mario <JahnMario@stanleygroup.com>; Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>
Subject: RE: Quick Question for AQCS folks

***** EXTERNAL EMAIL - Use caution and verify authenticity before trusting any contents. *****

John,

Thank you for the feedback, I've forwarded for review and will let you know if there are any other questions.

Best regards,
Ron

Ronald Pon
Account Manager
Email: rtpon@babcock.com
Desk: 707.265.1055
Mobile: 925.451.4272
FAX: 707.265.1000
710 Airpark Road
Napa, CA 94558
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From: Solan, John <SolanJohn@stanleygroup.com>
Sent: Tuesday, August 29, 2023 5:36 AM
To: Pon, Ronald T <rtpon@babcock.com>
Cc: Payne, Mark <PayneMark@stanleygroup.com>; Jahn, Mario <JahnMario@stanleygroup.com>; Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>
Subject: EXTERNAL: RE: Quick Question for AQCS folks

Ron,
Oops! I thought the flows were in that word doc, but now that I look, they are steam flows.
See attached for baghouse data. FYI, this baghouse is common to all 4 operating boilers. (1-3 and 5)
There is also an SO2 emissions testing report attached as well.
Thanks
-John

From: Pon, Ronald T <rtpon@babcock.com>
Sent: Monday, August 28, 2023 6:33 PM
To: Solan, John <SolanJohn@stanleygroup.com>
Cc: Payne, Mark <PayneMark@stanleygroup.com>; Jahn, Mario <JahnMario@stanleygroup.com>; Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>
Subject: RE: Quick Question for AQCS folks

***** EXTERNAL EMAIL - Use caution and verify authenticity before trusting any contents. *****

John,

Ohio has provided the following information request -

> In an ideal world we would have the gas flow and gas constituents so we know how much SO2 removal we would need. Would they consider combining the flows from the boilers into a single AQCS train?
>
> As a minimum we need gas flows.

It seems that having a response for you by the end of the week may be a little bit optimistic due to other commitments, but they are willing to try once we get your feedback to the above.

Best regards,
Ron

Ronald Pon
Account Manager
Email: rtpon@babcock.com
Desk: 707.265.1055
Mobile: 925.451.4272
FAX: 707.265.1000
710 Airpark Road
Napa, CA 94558

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From: Solan, John <SolanJohn@stanleygroup.com>
Sent: Monday, August 28, 2023 10:50 AM
To: Pon, Ronald T <rtpon@babcock.com>
Cc: Payne, Mark <PayneMark@stanleygroup.com>; Jahn, Mario <JahnMario@stanleygroup.com>; Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>
Subject: EXTERNAL: RE: Quick Question for AQCS folks

Fair enough. As aways, the help is appreciated.

From: Pon, Ronald T <rtpon@babcock.com>
Sent: Monday, August 28, 2023 1:37 PM
To: Solan, John <SolanJohn@stanleygroup.com>
Cc: Payne, Mark <PayneMark@stanleygroup.com>; Jahn, Mario <JahnMario@stanleygroup.com>; Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>
Subject: RE: Quick Question for AQCS folks

***** EXTERNAL EMAIL - Use caution and verify authenticity before trusting any contents. *****

John,

I'll do my best. There's been some personal shifts, so trying to track down who the right person is more the challenge sometimes.

Best regards,
Ron

Ronald Pon
Account Manager
Email: rtpon@babcock.com
Desk: 707.265.1055
Mobile: 925.451.4272
FAX: 707.265.1000
710 Airpark Road
Napa, CA 94558

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TARGET ZERO - *To finish each and every day injury- and incident-free*

From: Solan, John <SolanJohn@stanleygroup.com>
Sent: Monday, August 28, 2023 10:30 AM
To: Pon, Ronald T <rtpon@babcock.com>
Cc: Payne, Mark <PayneMark@stanleygroup.com>; Jahn, Mario <JahnMario@stanleygroup.com>; Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>
Subject: EXTERNAL: RE: Quick Question for AQCS folks

Ron,
I was hoping that it was a quick question that someone could answer relatively quickly (like by the end of the week). If that is not the case and it will take some time, let me know. I will see if I can work with it.

Thanks!
-John

From: Pon, Ronald T <rtpon@babcock.com>
Sent: Monday, August 28, 2023 1:21 PM
To: Solan, John <SolanJohn@stanleygroup.com>
Cc: Payne, Mark <PayneMark@stanleygroup.com>; Jahn, Mario <JahnMario@stanleygroup.com>; Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>
Subject: RE: Quick Question for AQCS folks

***** EXTERNAL EMAIL - Use caution and verify authenticity before trusting any contents. *****

John,

Sorry for the delayed acknowledgement on receipt of your e-mail. I am sharing with the folks back in Ohio to get a response for you and will update you as soon as I get some feedback.

Do you have a target of when you need a response by?

Best regards,
Ron

Ronald Pon
Account Manager
Email: rtpon@babcock.com
Desk: 707.265.1055
Mobile: 925.451.4272
FAX: 707.265.1000
710 Airpark Road
Napa, CA 94558

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TARGET ZERO - *To finish each and every day injury- and incident-free*

From: Solan, John <SolanJohn@stanleygroup.com>
Sent: Thursday, August 24, 2023 10:32 AM
To: Pon, Ronald T <rtpon@babcock.com>
Cc: Payne, Mark <PayneMark@stanleygroup.com>; Jahn, Mario <JahnMario@stanleygroup.com>; Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>
Subject: EXTERNAL: RE: Quick Question for AQCS folks

Resent with attachment.

From: Solan, John
Sent: Thursday, August 24, 2023 12:58 PM
To: Pon, Ronald T (rtpon@babcock.com) <rtpon@babcock.com>
Cc: Payne, Mark <PayneMark@stanleygroup.com>; Jahn, Mario <JahnMario@stanleygroup.com>; Courtney Kimball (ckimball@boreal-services.com) <ckimball@boreal-services.com>
Subject: Quick Question for AQCS folks

Ron,
We are still working with the EPA to resolve all their questions and concerns regarding the BACT analyses for plants in the Fairbanks area. This time we are talking about the Aurora Energy plant instead of the UAF unit. I know that we previously discussed the effort to provide cost estimates for emissions technologies at UAF. The good news is that I don't think we need to go down that rabbit hole again. The EPA has indicated that they might be able to consider that an emissions control technology is technically infeasible if we can provide evidence that the equipment cannot physically fit on the plant property. If a technology is infeasible, then I do not have to provide cost information. Unfortunately, we were not able to collect any sizing information for WFGD or SDA as a part of our efforts.

My question for your AQCS folks is this. Can they provide any indication of physical size for a WFGD or SDA system that would work for the equipment identified in the attachment. The permitted SO_2 emissions limit is 0.301 lb/mmbtu and you should assume that this is the rate that the boilers operate at.

- If they have example drawings, that would be best. That being said, I understand that the odds of that are pretty slim
- Even an email stating an estimated size of the reactor and the sorbent preparation building (and wastewater treatment facilities for WFGD) will be better than what I have.
- There is no need to discuss sorbent storage space. We are locating storage remotely.

Any help that you can provide is greatly appreciated.

-John

John Solan, P.E.*, Principal Mechanical Engineer
STANLEYCONSULTANTS, P.O. Box 192, East Glastonbury, CT 06025-0192
T: 303.649.7830 | stanleyconsultants.com
Schedule a meeting
* Registered in the States of North Carolina, Colorado, Connecticut, Rhode Island, and Alaska

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Solan, John

From: Thornam, Joseph
Sent: Friday, September 22, 2023 6:39 PM
To: Solan, John
Cc: Chilkoot Ward
Subject: RE: photo of electrical equipment

John,

I reached out to a vendor and he gave the following rough budgetaries:

- Metal Enclosed Switchgear:
  - Budgetary price: $190,000 for whole lineup.
  - Lead time: ~45 weeks.
- Transformer:
  - Budgetary price: $110,000 each.
  - Lead time: 50 weeks.
  - Note that this is a dry-type because liquid filled lead times are insane (3 years).
- MCC:
  - Budgetary price: $30,000 / section
  - Lead time 40-50 weeks.

Joe Thornam, Electrical Engineer
STANLEYCONSULTANTS
T: 303.649.7808 | M: 303.507.3114 | stanleyconsultants.com

From: Chilkoot Ward <cward@auroraenergyak.com>
Sent: Friday, September 15, 2023 10:54 AM
To: Thornam, Joseph <ThornamJoseph@stanleygroup.com>; Solan, John <SolanJohn@stanleygroup.com>
Subject: RE: photo of electrical equipment

***** EXTERNAL EMAIL - Use caution and verify authenticity before trusting any contents. *****

I like option 1 as it gives some operational flexibility. But I am guessing as I do not know what is going to be on each MCC.

Chilkoot

From: Thornam, Joseph <ThornamJoseph@stanleygroup.com>
Sent: Friday, September 15, 2023 7:13 AM
To: Solan, John <SolanJohn@stanleygroup.com>
Cc: Chilkoot Ward <cward@auroraenergyak.com>
Subject: RE: photo of electrical equipment

QUALITY ELECTRICAL SYSTEMS

PHONE 1(801) 566-7200
FAX 1 (801) 255-0835

REV 1
PREPARED FOR: Joseph Thorman
Stanley Consultants
C/o: Applied Power
303-238-8860

PREPARED BY: Kade Worton

BILL OF MATERIAL
For
Stanley Consultants

FACTORY TEST BY AUTHORIZED WARRANTY SERVICE PERSONNEL INCLUDED IN PRICE

ITEM	QTY	DESCRIPTION			
1		**MV MCC INCLUDING:**		**$**	**175,000.00**
	1	NEMA 1 FREE STANDING ENCLOSURE	3 Sections		
	1	Arc Resistant Type 2B			
	1	4160V Main Lug Only, 800A Buss			
	3	400A Starter			
	1	SEL-710 protection			
	AR	Lights and Switches			
1		**LV BOP MCC:**		**$**	**101,360.00**
	1	GE 9000 Series, 3 Phase, Nema 3R, 480V, 1200A Main Circuit Breaker			
		Tin plated copper bus, 65kA bracing			
		General purpose type NEMA 3R enclosure. 20" deep construction, 8 Sections			
	20	NEMA size 2 FVNR starter Including:			
	1	Solid State OL Relay			
	1	3 pole 480 VAC motor circuit protector (65KAIC) with lockable disconnect handle			
	2	NO/NC run contacts			
	2	NO/NC OL trip contact			
	2	Run pilot light (green), trip pilot light (yellow) installed on MCC cabinet door			
	1	Include hand-off-auto selector switch			
	A/R	WIRE, DUCT, MARKERS, MISC.			
		LABOR TO ASSEMBLE, TEST, AND UL LIST			
		AS-BUILT CAD DRAWING			
	20	NEMA size 1 FVNR starters Including:			
	1	Solid State OL Relay			
	1	3 pole 480 VAC motor circuit protector (65KAIC) with lockable disconnect handle			
	2	NO/NC run contacts			
	2	NO/NC OL trip contact			
	2	Run pilot light (green), Stop pilot light (Red) installed on MCC cabinet door			
	1	Include hand-off-auto selector switch			
	A/R	WIRE, DUCT, MARKERS, MISC.			
		LABOR TO ASSEMBLE, TEST, AND UL LIST			
		AS-BUILT CAD DRAWING			

PHONE 1(801) 566-7200
FAX 1 (801) 255-0835

REV 1
PREPARED FOR: Ben Hughes
PREPARED BY: Kade Worton

BILL OF MATERIAL
For
Stanley Consultants

FACTORY TEST BY AUTHORIZED WARRANTY SERVICE PERSONNEL INCLUDED IN PRICE

ITEM	QTY	DESCRIPTION		
1		**LV Inlet Heat MCC:**	**$**	**44,408.00**
	1	GE 9000 Series, 3 Phase, Nema 3R, 480V, 2000A Main Lugs Only		
		Tin plated copper bus, 65kA bracing		
		General purpose type NEMA 3R enclosure. 20” deep construction, 4 Sections		
	12	NEMA size 3 FVNR starter Including:		
	1	Solid State OL Relay		
	1	3 pole 480 VAC motor circuit protector (65KAIC) with lockable disconnect handle		
	2	NO/NC run contacts		
	2	NO/NC OL trip contact		
	2	Run pilot light (green), trip pilot light (yellow) installed on MCC cabinet door		
	1	Include hand-off-auto selector switch		
	A/R	WIRE, DUCT, MARKERS, MISC.		
		LABOR TO ASSEMBLE, TEST, AND UL LIST		
		AS-BUILT CAD DRAWING		
1		**175 amp main breaker surface mount panel board, Including:**	**$**	**2,695.00**
		NEMA 1 indoor rated 480/277V, 14 KAIC main circuit breaker fault current rating		
		225 amp copper bus for 3 phase		
		Neutral and grounding bus – copper		
	20	20 amp 1 pole circuit breakers		
	11	30 amp 1 pole circuit breakers		
	11	40 amp 1 pole circuit breakers		
	1	panel-board cover for surface mount trim.		
1		**250 amp main breaker surface mount panel board, Including:**	**$**	**1,540.00**
		NEMA 1 indoor rated 208/120V, 14 KAIC main circuit breaker fault current rating		
		400 amp copper bus for 3 phase		
		Neutral and grounding bus – copper		
	20	20 amp 1 pole circuit breakers		
	11	30 amp 1 pole circuit breakers		
	11	40 amp 1 pole circuit breakers		
	1	panel-board cover for surface mount trim.		
1		**150 amp main breaker surface mount panel board, Including:**	**$**	**1,260.00**
		NEMA 1 indoor rated 208/120V, 14 KAIC main circuit breaker fault current rating		
		225 amp copper bus for 3 phase		
		Neutral and grounding bus – copper		
	20	20 amp 1 pole circuit breakers		
	11	30 amp 1 pole circuit breakers		
	11	40 amp 1 pole circuit breakers		
	1	panel-board cover for surface mount trim.		

PHONE 1(801) 566-7200
FAX 1 (801) 255-0835

REV 1
PREPARED FOR: Ben Hughes
PREPARED BY: Kade Worton

BILL OF MATERIAL
For
Stanley Consultants

FACTORY TEST BY AUTHORIZED WARRANTY SERVICE PERSONNEL INCLUDED IN PRICE

ITEM	QTY	DESCRIPTION		
1		**GSU relay Panel:**	**$**	**40,600.00**
	2	SEL-487E Relays		
	20	10 pole test switch blocks		
	2	lockout relays		
	1	duplex panel design		
1		**UAT relay Panel:**	**$**	**19,600.00**
	1	SEL-387 Relay		
	10	pole test switch blocks,		
	1	lockout relay		
	1	duplex panel design		
1		**Heat Trace Panel:**	**$**	**13,300.00**
	1	Nema 3R, 480/277V Input, 277V Branches output		
	1	225A Main Circuit Breaker		
	30	20A Branch Circuits		
		Non-seg Bus Duct: 15kV rating, 6000A, need a budgetary Price Per foot	**$**	**2,000.00**
	1	Start and a Finish combinde Cost	**$**	**20,000.00**

COST PER BUILDING $ 399,763.00

FACTORY AUTHORIZED START UP SERVICE $ 1,250.00 DAY + PLUS TRAVEL EXPENSE

CLARIFICATIONS:

Quoted price DOES NOT include freight. F.O.B. SHIP POINT
Quoted price DOES NOT include sales tax.
This quotation good for 45 days after project bid date.
Submittal lead time (if required) is 6 weeks after receipt of order.
Material lead time is 12-16 weeks after receipt of returned approved submittals - based on current inventory, subject to prior sale.
QES REQUIRES A MINIMUM OF 4 WEEKS AFTER ARRIVAL OF LAST OWNER FURNISHED EQUIPMENT TO COMPLETE A BUILDIN
QES REQUIRES A MINIMUM OF 1 WEEKS AFTER COMPLETION OF BUILDING FOR FAT TEST.
Quotation includes only items specifically listed in this bill of material and its referenced attachments.
Terms; Net 30 days OAC - PROGRESS PAYMENTS WILL BE REQUIRED.

OLSUN Electrics
Engineered Transformer Solutions
Richmond, Illinois • www.olsun.com
We can do that!

certified WBENC WOMEN'S BUSINESS ENTERPRISE

Designed and Manufactured in the U.S.A.

Quote Date: 02/22/2021

Quote Number: 48720 Rev: 0
Printed: 2/22/2021

To:

Stanley Consultants Inc.
Attn: Joe Thornam
c/o: Applied Power
303-649-7808

From: Letty Reeves

Olsun Electrics Corporation
10901 Commercial Street
Richmond,IL.60071-9642
Phone: 815-678-2421
Fax: 815-678-4909
Web: www.olsun.com

Project: Drake Plant budgetary

Summary Sheet - Item details on the following pages

In response to your request for quotation we are pleased to offer the following:

Quote valid until: **04/23/2021**

Total Items	Total Qty.	Quote Total
3	**3**	**$16,590.00**

Shipping Info: Payment-FREIGHT ALLOWED, Method-BEST WAY Terms- Net 30 days, FOB-FOB FACTORY

Item #	Alt.	Part #	Qty	Description	Unit Price (USD)	Ext. Price (USD)
1		112.5KVA	1	General Purpose Transformer 112.5 KVA	$7,150.00	$7,150.00
2		75KVA	1	General Purpose Transformer 75 KVA	$5,250.00	$5,250.00
3		45KVA	1	General Purpose Transformer 45 KVA	$4,190.00	$4,190.00

ITEM 1 **Price (Net Each USD)** **$7,150.00**

Qty	Part #	Description
1	112.5KVA	General Purpose Transformer 112.5 KVA
	Cust Part #	

TRANSFORMER SPECIFICATIONS:
General Purpose Transformer 112.5 KVA
3 Phase 60 Hertz K Factor: 1 Design Impedance: STD%
Temp. Rise: 150C Max. Ambient Temp: 40 Deg. C Insulation
AA Air Cooled

VOLTAGES:
Pri. Volt: 480D
Pri. BIL: 10
Pri. Taps: +/-2 (2.5%)
Conductor: Aluminum Wound

Sec. Volt: 480Y/277
Sec. BIL: 10
None
Conductor: Aluminum Wound

ENCLOSURE:
Enclosure: Ventilated
NEMA: 1
Material/Finish: Mild Steel
Est. Dimensions: 42H x 36W x 24D

Paint: ANSI 61 gray powder coat finish
Mount: Floor
Weight: lbs

ATC LOCATION:

CERTIFICATIONS:
UL/cUL Listed
Meets DOE 2016 Energy Efficiency Requirements

VECTOR CONFIGURATIONS:
DELTA- Wye (STEP DOWN) (Dyn1)

TERMINATIONS:
Stub up For top entry

PHASING:
HV: H1-H2-H3 L-R

LV: Olsun Std.

OPTIONS:

Bar Code Needed: No

Tag Info

Tags Needed: No

Shipping

Lead Time: Approval Drawings 1-2 weeks. Order shipment after receipt of signed approval drawings with NO changes 5-6 weeks. To avoid and drawing/shipment delays, please provide terminal location, HV and LV phasing at time of order entry.

Test

Notes

Budgetary Price
Includes IEEE/ANSI Standard production tests
Standard Sound Level per ST-20
Quoted Standard Warranty Includes:
° 18 Months from the date of shipment or 12 Months from initial energization
° For each additional year of warranty (12 months) add 2%
° Up to 8% for 5years

Pricing is valid for only the features and ratings explicitly stated in this quotation.
Domestic package and Standard freight allowed to all shipments in excess of $2500.00 within the contiguous 48 states.

ITEM 2 **Price (Net Each USD)** **$5,250.00**

Qty	Part #	Description
1	75KVA	General Purpose Transformer 75 KVA
	Cust Part #	

TRANSFORMER SPECIFICATIONS:
General Purpose Transformer 75 KVA
3 Phase 60 Hertz K Factor: 1 Design Impedance: STD%
Temp. Rise: 150C Max. Ambient Temp: 40 Deg. C Insulation
AA Air Cooled

VOLTAGES:
Pri. Volt: 480D Sec. Volt: 208Y/120
Pri. BIL: 10 Sec. BIL: 10
Pri. Taps: +/-2 (2.5%) None
Conductor: Aluminum Wound Conductor: Aluminum Wound

ENCLOSURE:
Enclosure: Ventilated
NEMA: 1 Paint: ANSI 61 gray powder coat finish
Material/Finish: Mild Steel Mount: Floor
Est. Dimensions: 37H x 30W x 20D Weight: lbs

ATC LOCATION:

CERTIFICATIONS:
UL/cUL Listed
Meets DOE 2016 Energy Efficiency Requirements

VECTOR CONFIGURATIONS:
DELTA- Wye (STEP DOWN) (Dyn1)

TERMINATIONS:
Stub up For top entry

PHASING:
HV: H1-H2-H3 L-R LV: Olsun Std.

OPTIONS:

Bar Code Needed: No

Tag Info

Tags Needed: No

Shipping

Lead Time: Approval Drawings 1-2 weeks. Order shipment after receipt of signed approval drawings with NO changes 5-6 weeks. To avoid and drawing/shipment delays, please provide terminal location, HV and LV phasing at time of order entry.

Test

Notes

Budgetary Price
Includes IEEE/ANSI Standard production tests
Standard Sound Level per ST-20
Quoted Standard Warranty Includes:
° 18 Months from the date of shipment or 12 Months from initial energization
° For each additional year of warranty (12 months) add 2%
° Up to 8% for 5years

Pricing is valid for only the features and ratings explicitly stated in this quotation.
Domestic package and Standard freight allowed to all shipments in excess of $2500.00 within the contiguous 48 states.

ITEM 3

Price (Net Each USD)
$4,190.00

Qty	Part #	Description
1	45KVA	General Purpose Transformer 45 KVA
	Cust Part #	

TRANSFORMER SPECIFICATIONS:
General Purpose Transformer 45 KVA
3 Phase 60 Hertz K Factor: 1 Design Impedance: STD%
Temp. Rise: 150C Max. Ambient Temp: 40 Deg. C Insulation
AA Air Cooled

VOLTAGES:
Pri. Volt: 480D Sec. Volt: 208Y/120
Pri. BIL: 10 Sec. BIL: 10
Pri. Taps: +/-2 (2.5%) None
Conductor: Aluminum Wound Conductor: Aluminum Wound

ENCLOSURE:
Enclosure: Ventilated
NEMA: 1 Paint: ANSI 61 gray powder coat finish
Material/Finish: Mild Steel Mount: Floor
Est. Dimensions: 31H x 24W x 16D Weight: lbs

ATC LOCATION:

CERTIFICATIONS:
UL/cUL Listed
Meets DOE 2016 Energy Efficiency Requirements

VECTOR CONFIGURATIONS:
DELTA- Wye (STEP DOWN) (Dyn1)

TERMINATIONS:
Stub up For top entry

PHASING:
HV: H1-H2-H3 L-R LV: Olsun Std.

OPTIONS:

Bar Code Needed: No

Tag Info

Tags Needed: No

Shipping

Lead Time: Approval Drawings 1-2 weeks. Order shipment after receipt of signed approval drawings with NO changes 5-6 weeks. To avoid and drawing/shipment delays, please provide terminal location, HV and LV phasing at time of order entry.

Test

Notes

Budgetary Price
Includes IEEE/ANSI Standard production tests
Standard Sound Level per ST-20
Quoted Standard Warranty Includes:
° 18 Months from the date of shipment or 12 Months from initial energization
° For each additional year of warranty (12 months) add 2%
° Up to 8% for 5years

Pricing is valid for only the features and ratings explicitly stated in this quotation.
Domestic package and Standard freight allowed to all shipments in excess of $2500.00 within the contiguous 48 states.

In order to protect the buyer's interests as well as those of all Olsun Electrics Corporation's ("Olsun") customers, in the event of buyer's acceptance of the order set forth on the reverse side, it is necessary to make certain conditions a part of the order. The order set forth on the reverse side is subject t the Terms and Conditions set forth below. There are no other agreements, understandings, or stipulations relative to this order that are not fully expressed below or on the reverse side.

Cancellations, Modifications and Deferred Deliveries: With the exception of clerical errors, the order cannot be cancelled or modified, nor can delivery be changed without the written consent of both Olsun and the buyer upon terms that will indemnify Olsun against any loss. "Hold for approval" orders can be modified at the time drawings are returned and the order is released. Additional costs, if any, will be determined at that time and submitted to buyer at that time.

Purchase Prices: The prices set forth in this order constitute Olsun's offer to sell the products of this order according to Olsun's terms and conditions as stated in this document.
The prices set forth in the order and delivery date(s) are subject to change by Olsun for justifiable reasons. After acceptance, when the delivery date(s) specified extend(s) beyond 90 days from the date of the order or when delays beyond Olsun's control prevent production of buyer's order within this period, Olsun reserves the right to adjust prices at the expiration of such a 90 day period and at any time thereafter on the basis of prevailing labor and raw material costs. Prices on "hold" orders not released within 90 days are subject to renegotiation at the time of release. These Terms and Conditions will be part of any re-order that may be accepted by Olsun. Prices are based on copper or aluminum base and differential costs, and steel prices at the date of this order. If these costs decrease or increase, Olsun reserves the right to modify Olsun's prices at the time of delivery.

Taxes: Any taxes (except income taxes), fees or charges of any type which may now or hereafter be imposed by any taxing authority in respect to this order or product which is the subject of this order are to be added to and become a part of the price payable by the buyer.

Delivery: Delivery of an order to a carrier shall constitute delivery to buyer, and title and all risk of loss or damage in transit shall pass to purchaser at that time. Buyer shall pay for all shipping, freight and insurance costs protecting the products during shipment.
Claims for shortages, damages or defects must be made immediately upon receipt of the order, and such order is to be held by buyer subject to Olsun's written disposition. No consequential expenses, damages or losses shall be allowed, and Olsun's liability shall be limited to cost of repairs, or cost of product(s) or any part thereof, whichever is the lesser.
Olsun shall not be liable for any damage as a result of any delay due to any cause beyond Olsun's reasonable control, including, without limitation, an act of God, act of buyer or Olsun's suppliers, embargo or other governmental act, regulation or request, fire, accident, strike, slowdown, war, riot, delay in transportation, and inability to obtain necessary labor, materials, or manufacturing facilities. In the event of any such delay, the date of delivery shall be extended for a period of time equal to the time lost by reason of the delay.

Warranty: Olsun warrants the transformer(s), switch(es) and reactor(s) [manufactured] to be free of defects in materials and workmanship for a period of 18 months from the date of shipment or 12 months from initial energization, whichever occurs first. If within the applicable period of warranty buyer discovers that the transformer(s), switch(es) or reactor(s) was (were) not as was (were) warranted, Olsun agrees to correct such defect at Olsun's facilities, or to send
at Olsun's discretion, either competent personnel to repair or remedy a defect, or to furnish a replacement transformer(s), switch(es) or reactor(s) without charge. Buyer shall pay freight costs to return a transformer(s), switch(es) or reactor(s) to Olsun's facilities and Olsun shall pay freight costs to return a transformer(s), switch(es) or reactor(s) to the buyer within the continental United States. The correction of any default shall constitute a fulfillment of all Olsun's liabilities with respect to said transformer(s), switch(es) or reactor(s). This warranty shall not apply to any transformer(s), switch(es) or reactor(s) subjected to accident, abuse, negligence or any conditions beyond Olsun's control, or to improper operations, abnormal use, use under other than ordinary conditions, or any use other than the task for which it is designed. This warranty does not include expenses for transportation except as previously stated, removal, installation, losses or damages due to a transformer(s), switch(es) or reactor(s) failure, or any other expenses that may be incurred in relation with repair or replacement. In no instance shall Olsun be liable for any consequential damages, secondary charges, expenses of installation or disconnecting, or losses of damages resulting from an alleged defect of Olsun's product(s). Olsun's liability shall be limited to cost of repairs, or cost of the product, whichever is the lesser.
Olsun shall not be subject to any other liabilities of any kind, except as specifically noted in writing by Olsun in relation to transformer(s), switch(es) or reactor(s) which Olsun has manufactured.
UNDER NO CIRCUMSTANCES SHALL OLSUN BE LIABLE FOR ANY CONSEQUENTIAL DAMAGE OR ANY SPECIAL INDIRIECT OR INCIDENTAL DAMAGES, WHETHER ARISING OUT OF ANY BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, BREACH OF CONTRACT, NEGLIGENCE, OR ANY DEFECT IN, OR MALFUNCTION OF, ANY TRANSFORMER(S), SWITCH(ES) OR REACTOR(S).
This warranty is exclusive and in lieu of all other written, oral, express, implied or statutory warranties except warranties of title, including but not limited to warranties of merchantability and fitness for a particular purpose.
OLSUN DISCLAIMS ALL OTHER EXPRESS WARRANTIES AND ALL IMPLIED WARRANTIES AS TO THE QUALITY OF ANY PRODUCTS, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSES.
The equipment has been sold based on the purchaser's independent determination that is appropriate for purchaser's intended application. The giving or failure to give any advice or recommendation by seller shall not constitute any warranty or impose any liability upon seller.

Returned Transformer(s), Switch(es) or Reactor(s): Returns accepted only with prior written approval from Olsun.
All transformer(s), switch(es), and reactor(s) accepted for credit shall be subject to a service charge of 25% of the invoice price.
Only transformer(s), switch(es) and reactor(s) in a salable condition that are regularly carried in Olsun's stock shall be accepted for credit. The buyer will be charged any costs required to return the transformer(s), switch(es) and/or reactor(s) to a salable condition. It is also the responsibility of the buyer to pay any freight costs brought about by the returning of a transformer(s), switch(es) or reactor(s).

Patents: If any claim is made or noticed given that the manufacture of the material covered by the order, or any part thereof, is an infringement of patent rights, the buyer agrees to forthwith intervene and indemnify Olsun against any loss or damage or expenses of any such claim or notice.

Terms: All terms are net 30 days. A 1-½% per month or fraction of month charge will be assessed delinquent accounts. All Credit Card orders will Incur a 4% processing fee.

Governing Law: The order and the aforementioned Terms and Conditions shall be governed by and construed in accordance with the laws of the State of Illinois.

From: David Fish
To: Solan, John
Subject: FW: Fairbanks Office Warehouse building
Date: Wednesday, January 24, 2024 3:23:16 PM

*** EXTERNAL EMAIL - Use caution and verify authenticity before trusting any contents. ***

See below from Piotr.

David Fish
Environmental Manager

Aurora Energy, LLC
100 Cushman St., Suite 210 | Fairbanks, AK 99701-4674
Office 907-457-0230 | Fax 907-451-6543 | Cell 907-799-9464
dfish@usibelli.com

From: Piotr Kawka <pkawka@auroraenergyak.com>
Sent: Wednesday, January 24, 2024 9:52 AM
To: David Fish <dfish@usibelli.com>
Subject: RE: Fairbanks Office Warehouse building

I talked to RT from Johnson River last night.
I would say lest use $750/sf.
A little bit higher but safer (more realistic when shit hits the fan)

Appendix C
Existing Equipment Information

Appendix C1 – Summary of Test Results Report
Appendix C2 – Flakt Baghouse Installation O&M Manual
Appendix C3 – Airflow Sciences PJFF Inlet Ductwork Flow Modeling – Initial Design Results

Summary of Test Results
Chena River Power Plant
Chena Coal-fired Boilers
SO_2 Emissions Testing
October 12, 2021

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

December 10, 2021

Report Certification

As project manager, I certify that the testing was performed in accordance with approved methods and the data, calculations and results described in this report are true and accurate to the best of my knowledge.

W.M. Hudson
President

W.M. Hudson

Signature

12/10/11

Date

Table of Contents

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1 INTRODUCTION

Aurora Energy LLC (Aurora) operates a power generation facility located on the Chena River in Fairbanks, Alaska. The facility operates under Air Quality Permit No. AQ0315TVP03 and includes four coal-fired boilers. The common stack was tested.

Alaska Source Testing LLC (AST), commissioned by Aurora, performed a source test program for sulfur dioxide (SO_2), carbon dioxide (CO_2) emissions and oxygen (O_2) content on the common stack of the four boilers.

William Hudson was the AST onsite project manager and was assisted by AST technician Chase Aikey. David Fish was the Aurora project manager. The testing took place on October 12, 2021.

The testing program was performed in accordance with the *Code of Federal Regulations Title 40 Part 60* (40 CFR 60), Reference Methods 1, 2, 3A, 4, 6C, 7E, and 19.

Detailed test information and documentation is provided in the appendices of this report.

2 SUMMARY OF RESULTS

The results of sample runs are presented in Table 2-1. Calculation spreadsheets are found in Appendix A.

Table 2-1 Summary of SO_2 Emissions
Chena 5 Coal-fired Boiler 10/12/2021

Run	Run Date	Start Time	SO2 dppmv	M1-4 SO2 lb/ mmBTU	M19 SO2 lb/ mmBTU	M1-4 SO2 lb/hr	M19 SO2 lb/hr
1	10/12/2021	1120	60.21	0.167	0.164	88.083	86.777
2	10/12/2021	1230	61.60	0.181	0.169	94.852	88.753
3	10/12/2021	1350	62.16	0.186	0.172	97.082	89.790
AVE			**61.33**	**0.178**	**0.169**	**93.339**	**88.440**

3 DESCRIPTION OF THE SOURCE

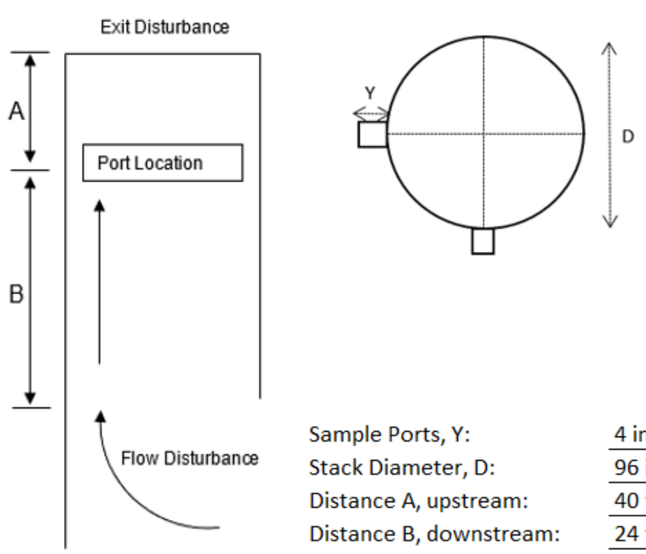
ID	Source Name	Current Rating/size	Permit Rating/size
4	Chena 1 Coal-fired Boiler	50 Mlb/hr steam	76 MMBtu/hr
5	Chena 2 Coal-fired Boiler	50 Mlb/hr steam	76 MMBtu/hr
6	Chena 3 Coal-fired Boiler	50 Mlb/hr steam	76 MMBtu/hr
7	Chena 5 Coal-fired Boiler	220 Mlb/hr steam	269 MMBtu/hr

4 DESCRIPTION OF THE SAMPLE LOCATION

The boilers exhaust into a 96-inch internal diameter circular stack that is equipped with two four-inch sample ports oriented 90 degrees apart. The ports are located approximately 24 feet downstream and approximately 40 feet upstream of the nearest flow disturbance. The ports meet USEPA Method 1 requirements. The ports were accessed via the roof. See Figure 1-1 for a diagram.

Figure 4-1 Chena common stack

Chena Common Stack



5.00	Duct Diameters that measurement site is upstream from flow disturbance (A)
3.00	Duct Diameters that measurement site is upstream from flow disturbance (B)

Referencing Figure 1-2: 6 traverse points per port
AST used 12 traverse points per port exceeding minimum requirement
Traverse points: Table 1-2 (percent of stack diameter from inside wall to traverse point)

Sample Ports, Y:	4 inches
Stack Diameter, D:	96 inches
Distance A, upstream:	40 feet
Distance B, downstream:	24 feet

Traverse point	% of Stack Dia	Location in stack, inches from port (includes port length)
1	2.1	6.02
2	6.7	10.43
3	11.8	15.33
4	17.7	20.99
5	25	28.00
6	35.6	38.18
7	64.4	65.82
8	75	76.00
9	82.3	83.01
10	88.2	88.67
11	93.3	93.57
12	97.9	97.98

5 DESCRIPTION OF SOURCE OPERATIONS AND TEST CONDITIONS

To evaluate source operations and conditions during each of the test series, process data was collected concurrently with each sample run.

The Steam flow (lb/hr) was recorded throughout the test. The boilers operated normally and there were no upsets.

Table 5-1 Summary of Operation Parameters

Run	Steam Production (lbs/hr)	Fuel Consumption (mmBTU/hr)	O_2 Content (%)	Opacity (%)
1	271,577	528	7.3	6.9
2	269,345	524	7.3	6.8
3	267,978	521	7.4	7.0
Ave	**269,633**	**524**	**7.3**	**6.9**

This data is included in Appendix C, Operational Data.

6 DESCRIPTION OF TEST PROCEDURES

6.1 Test Methods

The individual test procedures used during this testing program were conducted 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
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 Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)
Method 19	Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxides Emission Rates

6.2 Description of Test Procedures

Prior to the beginning the testing program, an initial full-scale calibration was performed on each gas analyzer to determine linearity. The zero and calibration gases used were certified in accordance with EPA protocol procedures and traceable to standards of the National Institute of Standards and Technology (NIST). Calibration gas for the initial calibration and any subsequent adjusted calibrations was introduced directly to the back of each analyzer. System bias checks and calibration checks for zero and span drift were conducted by introducing the calibration gases at the probe connection which allowed the calibration gases to flow through the entire sample system. This served two purposes, (1) to check for any system bias and (2) to check sample system integrity for air leaks. A system response time check was performed. The SO_2, O_2, and CO_2 analyzer system response times were 150 seconds, 70 seconds, and 70 seconds respectively Zero and span checks were performed for each gas analyzer prior to and following each sample run. This was to assess calibration drift during the sample period and determine if calibration adjustments were necessary. The zero and span checks are noted in the data files in Appendix B. These values are also used to adjust the raw analyzer data in accordance with USEPA Method 7E. Zero drift and span values all met method requirements.

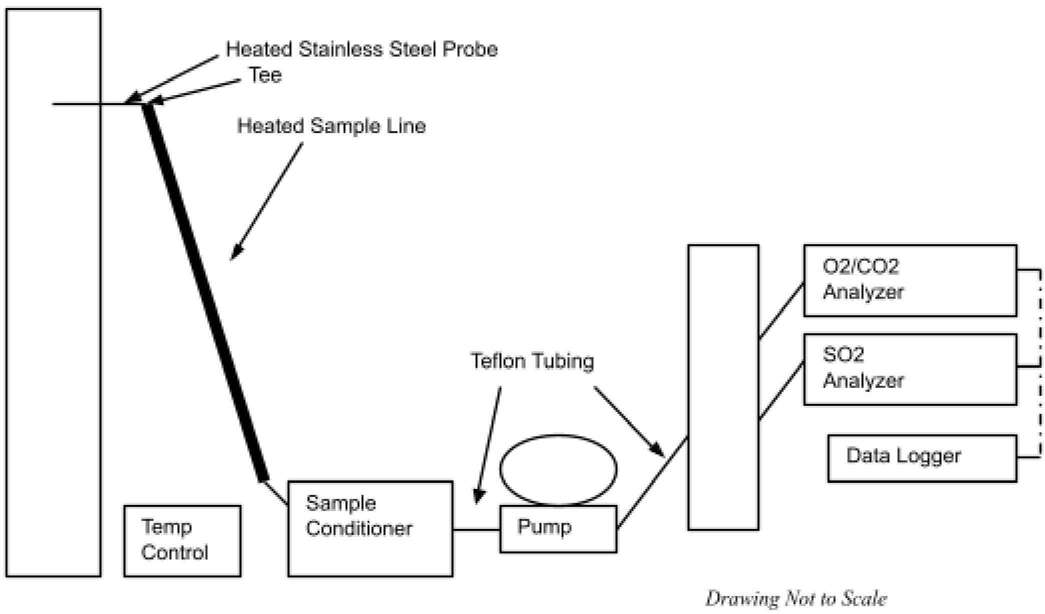
The sample run duration was 60 minutes for each run. The initial stratification check demonstrated that the stack was not stratified. Previous stratification checks were inconclusive due to variations in the process.

The exhaust gas concentrations for SO_2, CO_2, and O_2 were measured using instrumental methods. Sample gas was extracted though a heated stainless-steel probe equipped with a filter and inserted through the sample port. The sample gas was drawn from the probe through a 100-foot heated Teflon sample line and into a sample conditioner. The sample line temperature was maintained at 250 ºF. 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 entered a Teflon-lined head sample pump and then the sample flow was distributed to the individual gas analyzers. Each of the instruments sent an output signal to a data recorder. The data recorder polled each analog instrument signal once every 30 seconds, converted the signal to engineering units, and recorded each data point into memory.

A velocity traverse was performed during each run; a S-type Pitot tube and a calibrated Magna-helix pressure gauge was used for all units. The stack was under slight positive pressure. Care was taken to keep the ports sealed when

traverses were taken. Temperatures were measured using a “K” type thermocouple and a hand-held Omega read-out. The ports were sealed with high-temperature cloth.
A schematic of the sample train is found in Figure 6 – 1.

Figure 6-1 Method 3A, 6C Stack Sampling System



The range for the SO2 analyzer was 0 – 241 for the generator testing. Calibration gases used during the analyzer linearity were 0, 102, and 241 ppm. At no point during testing did the analyzers need to be recalibrated.

One moisture run was performed simultaneously per run. The moisture sample was extracted through a separate stainless steel probe through a heated 10-foot, 3/8-inch thick-walled hose from the stack to the impinger train and then through a 100-foot, 3/8-inch thick-walled hose to the meter box. The line was drained into the first impinger after each run.

6.3 List of Field Testing Equipment

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" H_2O) 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.

Prior to each sample run, the impinger train was prepared and a pre-sample impinger weight determined with a top loading electronic balance. The data was recorded on a field data sheet. A pre-run leak test was then performed with a vacuum up to 15" of mercury (Hg). Once the leak test was successfully completed, the initial DGM reading was recorded. Data were recorded for ΔH, impinger train exit temperature, DGM inlet/outlet temperature and system vacuum. At the conclusion of the moisture sample run the sample pump valve was closed and the probe was removed from the stack. The final sample volume was recorded from the DGM. A post-run leak check was performed at a vacuum equal to or greater than the highest vacuum recorded during the run.

The impinger train was disassembled and final weights determined for each impinger (to the nearest 0.5 grams). The total grams of water captured was calculated and recorded on the field data sheet.

Method 3A equipment is described below. O_2/CO_2 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 $\pm$ 1 % full scale	Linearity: Better than $\pm$ 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 Method 6C SO_2 analysis for the combustion gas sample was 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.

7 CALCULATIONS

All calculations were checked by an in-house second party. Hand calculations have been performed to verify the spreadsheet calculations. Please refer to Appendix A for a printout of the spreadsheet and for the hand calculations.

8 QUALITY ASSURANCE

To ensure the collection of high quality and accurate data AST strictly adhered to all the U.S. EPA Reference Methods and the *Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III* used during this testing program. In all other aspects of the testing, AST followed its own corporate Quality Program Manual QPM-1,Rev 1, 08/08/10.

Documentation for all quality control/quality assurance activities for the sample collection is presented in Appendix D.

Table 8-1 Initial Analyzer Calibration and Bias Error Percentage

<table>
<tr><th colspan="2">Calibration Gas</th><th>Analyzer Response</th><th>Bias Error %</th><th>Span</th></tr>
<tr><td>Zero SO_2</td><td>0.00 ppm</td><td>0.49 ppm</td><td>0.20%</td><td rowspan="3">241.30 ppm</td></tr>
<tr><td>Mid-Range SO_2</td><td>101.20 ppm</td><td>102.58 ppm</td><td>0.57%</td></tr>
<tr><td>High Range SO_2</td><td>241.30 ppm</td><td>241.66 ppm</td><td>0.15%</td></tr>
<tr><td>Zero CO_2</td><td>0.00%</td><td>-0.06%</td><td>-0.46%</td><td rowspan="2">13.90%</td></tr>
<tr><td>Mid-Range CO_2</td><td>7.055%</td><td>7.10%</td><td>0.32%</td></tr>
</table>

High Range CO_2	13.90%	13.90%	0.00%	
Zero O_2	0.00%	-0.09%	-0.44%	
Mid-Range O_2	10.06%	10.05%	-0.04%	20.900%
High Range O_2	20.90%	20.80%	-0.47%	

*Method 7E, Eq. 7E-1 ACE = ((C_{Dir} – C_V)/CS)*100 where ACE is Analyzer Calibration Error, C_{Dir} is measured concentration, C_V is concentration of calibration gas, and CS is calibration span.

ACE must be within ± 2.0 percent of calibration span of the analyzer for each level of calibration gas.

Table 8 – 2 Analyzer Response Times in seconds

Analyzer	AVE.
CO_2	70
O_2	70
SO_2	150

Appendix A

Calculation Spreadsheets and Example Calculation

Unit			Boiler 5		
Run Number			1	2	3
Date			10/12/2021	10/12/2021	10/12/2021
Run Start Time			1120	1230	1350
DGM Volume	V_m	cubic feet	25.139	26.93	28.497
DGM Y Factor	Y	-	0.991	0.991	0.991
DGM Average Temperature	T_m	Degrees R	519.63	528.50	530.06
Barometric Pressure	P_{bar}	Inches Hg	29.85	29.85	29.85
Delta H	ΔH	Inches Water	1.5	1.5	1.5
Sample Volume at Standard Conditions	V_{mstd}	Standard	25.33	26.68	28.15
Total Volume of Water collected	V_{lc}	Milliliters	61	63	56
Standard Volume of Water	V_{wstd}	Standard Cubic	2.871	2.965	2.635
Stack Gas Moisture Content	B_{ws}	-	0.1018	0.1000	0.0856
Pitot Tube Coefficient	C_p	-	0.84	0.84	0.84
Average Pitot differential pressure	ΔP	Inches Water	1.31	1.44	1.45
Square Root of Differential Pressure		-	1.144	1.202	1.202
Average Stack Gas Temperature	$T_{s(ave)}$	Degrees R	741.04	740.58	740.13
Measured Stack Pressure	P_g	Inches Water	0.5	0.5	0.5
Absolute Stack Pressure	P_s	Inches Hg	29.9	29.9	29.9
Stack %O_2		%	8.622	8.723	8.817
Stack %CO_2		%	11.370	11.282	11.190
Stack %N_2 + %CO		%	80.008	80.0	80.0
Stack Gas Dry Molecular Weight	M_d		30.164	30.2	30.1
Stack Gas Wet Molecular Weight	M_s	lb/lb mole	28.93	28.94	29.10
Actual Average Velocity	V_s	ft/sec	76.04	79.84	79.64
Stack Diameter		ft	8.00	8.00	8.00
Stack Area	A	sq ft	50.27	50.27	50.27
Standard Stack Gas Volumetric Flow	Q_{sd}	Standard Dry Cubic Feet/min	147160.3	154908.9	157103.3
SO2 dry volumetric concentration	$C_{d(NOx)}$	dppmv	60.214	61.597	62.165
Fuel Consumption		MMbtu/hr	528.18	523.72	520.97
SO2 concentration	$E_{(NOx)}$	lb/hr	88.1	94.9	97.1
SO2 emissions		lb/mmBTU	0.167	0.181	0.186
SO2 emissions (M19)		lb/hr	86.78	88.75	89.79
SO2 emissions (M19)		lb/mmBTU	0.164	0.169	0.172

Example Average Gas Concentration

From 40 CFR 60, App. A, Method 7E

Aurora Energy LLC

Common Stack, Run 1, O_2 Bias Correction

Where:

Variable	Definition	Comn Stk, Run 1 Data
C_{gas}	Effluent gas concentration, %	
C_{avg}	Average gas concentration indicated by gas analyzer, %	C_{avg}= 8.60
C_{Dir}	Measured concentration of a calibration gas (low, mid, or high) when introduced in direct calibration mode, %	$C_{Dir(zero)}$= -0.092 $C_{Dir(upscale)}$= 10.0517
C_O	Average of initial and final system calibration bias check responses for the zero gas, %.	$C_O = \frac{((-0.0229)+(-0.0183))}{2} = -0.0206$
C_M	Average of initial and final system calibration bias check responses for the upscale calibration gas, %	$C_M = \frac{(10.0491+10.0258)}{2} = 10.0375$
C_{MA}	Actual concentration of the upscale calibration gas, %	C_{MA}= 10.06
C_s	Measured concentration of a calibration gas (low, mid, or high) when introduced in system calibration mode, %	$C_{s(zero)}$= -0.0229 $C_{s(upscale)}$= 10.0491
CS	Calibration span, % “upper limit of valid instrument response during sampling” (range)	CS = 20.9
D	Drift assessment, percent of calibration	
SB	System bias, percent of calibration span	
SB_i	Pre-run system bias, percent of calibration span	$SB_{i(zero)}$= 0.331 $SB_{i(upscale)}$= -0.012
SB_{final}	Post-run system bias, percent of calibration span	$SB_{final(zero)}$= 0.353 $SB_{final(upscale)}$= -0.124
SCE	System calibration error, percent of calibration span	

Sample System Bias (USEPA Method 7E, Eq. 7E- 2)

$$SB = 100\left(\frac{C_s - C_{Dir}}{CS}\right)$$

$$SB_{Zero} = 100\left(\frac{(-0.0229)-(-0.092)}{20.9}\right) = 0.331\%$$

$$SB_{upscale} = 100\left(\frac{10.0491-10.0517}{20.9}\right) = -0.0124\%$$

Sample Drift Assessment (USEPA Method 7E, Eq. 7E – 4)

$$D = \left|SB_{final} - SB_i\right|$$

$$D_{zero} = |0.353 - 0.331| = 0.022\%$$

$$D_{upscale} = |-0.012 - (-0.124)| = 0.112\%$$

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

Sample Gas Concentration (USEPA Method 7E, Eq. 7E – 5b)

$$C_{gas} = \left(C_{avg} - C_O\right)\left(\frac{C_{MA}}{C_M - C_O}\right)$$

$$C_{gas} = (8.60 - (-0.0206))\left(\frac{10.06}{10.0375 - (-0.0206)}\right) = 8.622$$

Example Moisture Content

From 40 CFR 60, App. A-3, Method 4

Aurora Energy, LLC

Common Stack, Run 1

Sample Volume at Standard Conditions $V_{m(std)}$ (USEPA Method 5, Eq. 5-1)

Dry Gas Meter (DGM) Volume (V_m):	25.139 ft^3
DGM Y Factor (Y):	0.9907
DGM Average Temperature (T_m):	519.63 °R
Barometric Pressure (P_{bar}):	*29.85 "Hg*
Average Delta H (ΔH):	1.5 "H_2O

$$V_{m(std)} = K_1 V_m Y \left(\frac{P_{bar} + \left(\frac{\Delta H}{13.6}\right)}{T_m}\right)$$

Where:

$V_{m(std)}$ = Volume of gas sample in standard cubic feet
Y = Dry gas meter calibration factor
T_m = Average DGM temperature
P_{bar} = Barometric pressure at site
ΔH = Average pressure differential across the orifice meter
K_1 = 17.64 $\frac{°R}{"Hg}$

$$V_{m(std)} = \left(17.64 \frac{°R}{"Hg}\right)(25.139 ft^3)(0.9907)\left(\frac{29.85\ "Hg + \left(\frac{1.5"\ H_2O}{13.6}\right)}{519.63\ °R}\right)$$

$$V_{m(std)} = 25.33\ ft^3_{standard}$$

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

Volume of water vapor condensed (USEPA Method 5, Eq. 5-2)

Total Water Collected in Sample Train (V_{1c}): 61 *ml*

$$V_{w(std)} = K_2 V_{1c}$$

Where:

$V_{w(std)}$ = Volume of water vapor in the gas sample in standard cubic feet

K_2 = 0.04707 $\frac{ft^3}{ml}$

V_{1c} = total volume of liquid collect in ml at standard conditions

$$V_{w(std)} = \left(0.04707 \frac{ft^3}{ml}\right)(61\ ml)$$

$$V_{w(std)} = 2.871\ ft^3_{standard}$$

Moisture Content (USEPA Method 5, Eq. 5-3)

$$B_{ws} = \frac{V_{w(std)}}{(V_{m(std)} + V_{w(std)})}$$

Where:

B_{ws} = Moisture content of the sample gas expressed as a fraction

$$B_{ws} = \frac{2.871\ ft^3_{std}}{(25.33 ft^3_{std} + 2.871 ft^3_{std})}$$

$$B_{ws} = 0.1018$$

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

Example Stack Gas Velocity and Volumetric Flow Rate

From 40 CFR 60, App. A-1, Method 2

Aurora Energy, LLC

Common Stack, Run 1

Dry Molecular weight of stack gas (USEPA Method 3, Eq. 3-1)

$\boldsymbol{Nitrogen, Carbon\ Monoxide\ Concentration} = (\boldsymbol{O_2}\% + \boldsymbol{CO_2}\%) - \mathbf{100}\%$ (Method 3, 12.2)

$(\%\boldsymbol{N_2} + \%\boldsymbol{CO}) = (\%\boldsymbol{O_2} + \%\boldsymbol{CO_2}) - \mathbf{100}\%$

$(\%\boldsymbol{N_2} + \%\boldsymbol{CO}) = (\mathbf{8.622} + \mathbf{11.370}) - \mathbf{100} = \mathbf{80.008}\%$

$$\boldsymbol{M_d} = \mathbf{0.440}(\%\boldsymbol{CO_2}) + \mathbf{0.320}(\%\boldsymbol{O_2}) + \mathbf{0.280}(\%\boldsymbol{N_2} + \%\boldsymbol{CO})$$

Where:

M_d	=	Dry molecular weight, $\frac{lb}{lb-mole}$
$\%CO_2$	=	Percent CO_2 by volume, dry basis
$\%O_2$	=	Percent O_2 by volume, dry basis
$\%CO$	=	Percent CO by volume, dry basis
$\%N_2$	=	Percent N_2 by volume, dry basis
0.280	=	MW of N_2 or CO, divided by 100
0.320	=	MW of O_2, divided by 100
0.440	=	MW of CO_2, divided by 100

$$\boldsymbol{M_d} = \mathbf{0.440}(\mathbf{11.37}\%) + \mathbf{0.320}(\mathbf{8.622}\%) + \mathbf{0.280}(\mathbf{80.008}\%)$$

$$\boldsymbol{M_d} = \mathbf{30.164}\frac{\boldsymbol{lb}}{\boldsymbol{lb - mole}}$$

Saturated Molecular Weight of stack gas (USEPA Method 2, Eq. 2-6)

$$\boldsymbol{M_S} = \boldsymbol{M_d}(\mathbf{1} - \boldsymbol{B_{WS}}) + \mathbf{18.0}(\boldsymbol{B_{WS}})$$

Where:

M_S	=	Saturated molecular weight, $\frac{lb}{lb-mole}$
18.0	=	Molecular weight of water, $\frac{lb}{lb-mole}$

$$\boldsymbol{M_S} = \mathbf{30.164}(\mathbf{1} - \mathbf{0.1018}) + \mathbf{18.0}(\mathbf{0.0825})$$

$$\boldsymbol{M_S} = \mathbf{28.5783}\frac{\boldsymbol{lb}}{\boldsymbol{lb - mole}}$$

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

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

Average Pitot differential pressure (∆p): 1.31 in.H_2O
Average stack temperature (T_s): 741 °R
Measured Stack Static Pressure (P_g): 0.5 in.H_2O
Barometric Pressure (P_{bar}): 29.85 in.Hg

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

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

Where:

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

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

C_p = Pitot tube coefficient = 0.84 (dimensionless)
∆p = Measured velocity head in.H_2O
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.H_2O

1 in.H_2O = 0.0736 in.Hg

$$P_S = 29.85 in.Hg + \left(0.5 in.H_2O\left(0.0736\frac{in.Hg}{inH_2O}\right)\right) = 29.887\ in.Hg$$

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

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

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

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

Stack Diameter: 8.00 ft
Stack Area: 50.27 ft^2
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 (ft^2)
- T_{STD} = Standard absolute temperature, 530°R
- P_{STD} = Standard absolute pressure, 29.92 in Hg
- $T_{S(abs)}$ = Absolute stack temperature, °R

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

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

Emission Calculations

SO_2 dry volumetric Concentration ($C_{D(NOx)}$): 60.214 dppmv
Fuel Consumption (FC_{gal} or FC_{MMBtu}): 528.18 MMbtu/hr

$$E_{SO2} = \frac{Q_{sd}}{386.3}\left(C_{D(SO2)} * 1 \times 10^{-6}\right) MW_{SO2} * 60\frac{hr}{min}$$

$$E_{SO2} = \frac{148197.58\frac{dscf}{min}}{386.3}\left(60.214\ dppm_v * 1 \times 10^{-6}Btu\right) 64\frac{g}{mol} * 60\frac{hr}{min} = 88.7\frac{lb}{hr}$$

Conversions:

$$\frac{E_{SO2}}{FC_{MMBtu}} = \frac{88.7\frac{lb}{hr}}{528.18\frac{MMBTU}{hr}} = 0.167\ \frac{lb}{MMBTU}$$

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

Mass Emissions Estimates

From 40 CFR 60, App. A-7, Method 19

Aurora Energy, LLC

Common Stack, Run 1

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

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

$$C_d = C_{D(SO2)} * 1.194 \times 10^{-7}$$

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

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

$$E_{SO2} = C_d F_d \frac{20.9}{(20.9 - \%O_{2d})} * FC_{MMbtu}$$

$$E_{SO2} = 9.996 \times 10^{-6} \frac{lb}{scf} \left(9656 \frac{dscf}{1 \times 10^6 Btu}\right) \frac{20.9}{20.9 - 8.622\%} * \left(528.18 \frac{MMbtu}{hr}\right)$$

$$E_{SO2} = 86.777 \frac{lb}{hr}$$

Conversions:

$$\frac{E_{SO2}}{FC_{MMBtu}} = \frac{86.777 \frac{lb}{hr}}{528.18 \frac{MMbtu}{hr}} = 0.164 \frac{lb}{MMbtu}$$

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

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		

Aurora Energy - Common Stack
Analyzer Data 10.12.21

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	**O2 Zero**	
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	**CO2 Zero**	**SO2 Span**
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	**O2 Span**	
10/12/2021 12:28	9.99004	10.027	1.99786		
10/12/2021 12:29	10.0004	10.0249	1.49651	**CO2 Span**	**SO2 Zero**
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	

Alaska Source Testing, LLC

Aurora Energy
EU 5 SO2 Bias Correction

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%				
	Finish	Zero	0.49	1.50	0.42%					
		Upscale	102.58	101.08	-0.62%					
2	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%				
	Finish	Zero	0.49	1.49	0.42%					
		Upscale	102.58	101.08	-0.62%					
3	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%					

Alaska Source Testing, LLC

Aurora Energy
EU 5 O2 Bias Correction

2021

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

Client: AurorA

Test Date: 10/12/21

Performed By: Hudson / Aikey

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 SO_2 Test 10/12/21

SO_2	High 241.3	Mid 101.2	Resp 2.5 min ✓✓
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

Alaska Source Testing, LLC

Plant: Aurora

Date: 10/12/21

Location: FBK

Stack I.D.: 5

Barometric Pressure, in. Hg: ~~+0.5~~ 29.85

Stack Gauge Pressure, in. H20: +0.5"

Operators: Hudson Aikey

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	0.6	✓
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~~ 1.0
~~0.7~~ 1.1
1.1

R2

Traverse Point Number	Velocity Head (Δps), in. H2O	Stack Temperature (Ts), °F
1	.50	279
2	.60	282
3	.65	✓
4	.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	278
1	1.0	277
2	.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. H20: + 0.5"
Operators: HA

Alaska Source Testing, LLC

R3

Traverse Point Number	Velocity Head (Δps), in. H2O	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. H2O	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	12:29	13:40
Vacuum, in. Hg	5"	5"	5"
Pre-leak test, cfm	Ø	Ø	Ø
Post-leak test, cfm	Ø	Ø	Ø
Baro Press, in. Hg	29.85	29.85	29.85

Traverse Point	Time (min)	Delta H, in.H2O	DGM Reading, scf	DGM Temp Inlet, °F	DGM Temp Outlet, °F	Gas Temp leaving condenser or last impinger
	0	1.5	650.640	53	53	42
1	5	1.5	654.7	62	55	✓
2	10	1.5	658.3	63	55	✓
3	15	1.5	661.4	64	55	✓
4	20	1.5	664.9	65	56	✓
5	25	1.5	668.5	66	57	✓
6	30	1.5	672.2	68	58	✓
7	35	1.5	675.7	65	59	42
8						
9						
10						
11						
Ave				+ 460= °R		

Traverse Point	Delta H, in.H2O	DGM Reading, scf	DGM Temp ~~Inlet, °F~~ Outlet, °F	DGM Temp Inlet, °F	Gas Temp leaving condenser or last impinger
	0				
1	1.5	680.9	64	65	43
2	1.5	683.5	71	64	✓
3	1.5	687.2	72	65	✓
4	1.5	690.8	73	65	✓
5	1.5	693.2	73	66	✓
6	1.5	697.3	74	66	✓
7	1.5	700.6	73	66	43
8	1.5	703.4	73	66	✓
9					
10					
11					
Ave			+ 460= °R		

Traverse Point	~~DGM Temp~~ Delta H	DGM Reading, scf (Inlet, °F)	DGM Temp Outlet, °F	DGM Temp Inlet, °F	Gas Temp leaving condenser or last impinger
	0				
1	1.5	706.6	67	67	44
2	1.5	710.2	73	67	✓
3	1.5	713.8	74	67	✓
4	1.5	717.5	75	67	✓
5	1.5	721.1	75	68	✓
6	1.5	724.6	75	68	✓
7	1.5	728.3	76	68	✓
8	1.5	731.9			
9					
10					
11					
Ave		+ 460= °R	+ 460= °R		

		Initial	Final	Net gain/loss	
DGM Volume	cubic ft	650.640	675.729		
Impinger 1	grams	747	[illegible] 748	[illegible]	[illegible]
Impinger 2	grams	[illegible] 729	731		
Impinger 3	grams	634	636		
Impinger 4	grams	840	846		
Total Water, grams					

	Initial	Final	Net gain/loss
DGM Volume	676.290	703.220	
Impinger 1	798	852	
Impinger 2	731	733	
Impinger 3	636	638	
Impinger 4	846	851	
Total Water			

	Initial	Final	Net gain/loss
DGM Volume	703.404	731.901	
Impinger 1	852	908	
Impinger 2	733	731	
Impinger 3	638	637	
Impinger 4	851	854	
Total Water			

Appendix D

Operational Data

Coal Barn Fill Report 10/12 07:30 - 14:45 (lbs)	183,550.00
Oldside lbs coal/lbs steam	0.26

Time	M_112-LIC-26/AI1/PV.CV Boiler 1 lb/hour	Boiler 1 lbs coal/hour	M_212-LIC-26/AI1/PV.CV Boiler 2 lb/hour	Boiler 2 lbs coal/hour	M_312-LIC-26/AI1/PV.CV 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	9,291.99	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	10,339.30	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	9,246.95	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	9,377.27	40,197.13	10,373.27	23,652.75	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	39,178.61
10/12/21 9:00	37,843.89	9,765.99	41,742.11	10,771.97	27,548.63	7,109.20	153,605.39	39,639.39
10/12/21 9:01	38,636.41	9,970.51	42,191.29	10,887.88	27,275.12	7,038.62	155,407.10	40,104.34
10/12/21 9:02	38,340.29	9,894.09	41,972.42	10,831.40	25,751.06	6,645.32	157,174.83	40,560.52
10/12/21 9:03	38,107.12	9,833.92	41,976.71	10,832.51	25,291.11	6,526.62	158,931.08	41,013.74
10/12/21 9:04	38,955.42	10,052.83	42,134.07	10,873.11	25,301.27	6,529.24	160,704.26	41,471.33
10/12/21 9:05	38,679.33	9,981.58	42,928.01	11,078.00	25,550.46	6,593.55	162,490.23	41,932.21
10/12/21 9:06	38,479.05	9,929.90	42,556.07	10,982.02	24,645.38	6,359.99	164,251.57	42,386.75
10/12/21 9:07	38,045.60	9,818.04	42,607.57	10,995.31	25,256.39	6,517.66	166,016.73	42,842.26
10/12/21 9:08	38,496.22	9,934.33	42,764.93	11,035.91	25,456.32	6,569.26	167,795.35	43,301.25
10/12/21 9:09	38,921.09	10,043.97	42,925.15	11,077.26	25,540.39	6,590.95	169,585.13	43,763.12
10/12/21 9:10	38,366.04	9,900.74	42,613.29	10,996.78	25,241.80	6,513.90	171,355.48	44,219.98
10/12/21 9:11	37,863.92	9,771.16	42,425.89	10,948.42	25,043.43	6,462.71	173,111.03	44,673.02
10/12/21 9:12	37,893.96	9,778.91	42,897.97	11,070.25	25,262.68	6,519.29	174,878.61	45,129.16

Coal Barn Fill Report 10/12 10:50-16:15 (lbs)	231,225.00
Boiler 5 lbs coal/lbs steam	0.24

Time	M_521-FT-06/AI1/PV.CV Boiler 5 lb/hour	Boiler 5 lbs coal/hour	chena 5 Cumulative lbs-steam	chena 5 Cumulative lbs-coal
10/12/21 10:50	177,580.09	42,792.94	2,959.67	713.22
10/12/21 10:51	177,330.59	42,732.82	5,915.18	1,425.43
10/12/21 10:52	175,247.59	42,230.86	8,835.97	2,129.28
10/12/21 10:53	176,692.70	42,579.10	11,780.85	2,838.93
10/12/21 10:54	175,307.09	42,245.20	14,702.63	3,543.02
10/12/21 10:55	176,511.41	42,535.41	17,644.49	4,251.94
10/12/21 10:56	177,417.91	42,753.86	20,601.46	4,964.50
10/12/21 10:57	176,072.91	42,429.74	23,536.00	5,671.67
10/12/21 10:58	176,384.70	42,504.88	26,475.75	6,380.08
10/12/21 10:59	177,339.91	42,735.06	29,431.42	7,092.33
10/12/21 11:00	175,410.41	42,270.09	32,354.92	7,796.83
10/12/21 11:01	175,027.70	42,177.87	35,272.05	8,499.80
10/12/21 11:02	174,770.50	42,115.89	38,184.89	9,201.73
10/12/21 11:03	175,822.30	42,369.35	41,115.26	9,907.88
10/12/21 11:04	178,112.59	42,921.26	44,083.81	10,623.24
10/12/21 11:05	177,841.80	42,856.01	47,047.84	11,337.51
10/12/21 11:06	177,342.70	42,735.74	50,003.55	12,049.77
10/12/21 11:07	175,661.20	42,330.53	52,931.24	12,755.28
10/12/21 11:08	176,684.59	42,577.15	55,875.98	13,464.90
10/12/21 11:09	176,032.59	42,420.03	58,809.85	14,171.90
10/12/21 11:10	175,575.91	42,309.98	61,736.12	14,877.06
10/12/21 11:11	176,094.09	42,434.85	64,671.02	15,584.31
10/12/21 11:12	176,410.09	42,511.00	67,611.19	16,292.83
10/12/21 11:13	175,260.20	42,233.90	70,532.19	16,996.73
10/12/21 11:14	174,989.41	42,168.64	73,448.68	17,699.54
10/12/21 11:15	176,087.80	42,433.33	76,383.48	18,406.76
10/12/21 11:16	177,374.00	42,743.28	79,339.71	19,119.15
10/12/21 11:17	178,117.00	42,922.32	82,308.33	19,834.52
10/12/21 11:18	177,842.20	42,856.10	85,272.37	20,548.79
10/12/21 11:19	176,917.50	42,633.27	88,220.99	21,259.34
10/12/21 11:20	176,088.41	42,433.48	91,155.80	21,966.57
10/12/21 11:21	175,837.59	42,373.04	94,086.43	22,672.78
10/12/21 11:22	175,754.30	42,352.96	97,015.66	23,378.67
10/12/21 11:23	175,597.00	42,315.06	99,942.28	24,083.92
10/12/21 11:24	177,173.91	42,695.06	102,895.18	24,795.50
10/12/21 11:25	176,951.41	42,641.44	105,844.37	25,506.19
10/12/21 11:26	176,696.59	42,580.04	108,789.31	26,215.86
10/12/21 11:27	177,002.91	42,653.85	111,739.36	26,926.76
10/12/21 11:28	176,309.00	42,486.64	114,677.84	27,634.87
10/12/21 11:29	176,278.80	42,479.36	117,615.82	28,342.86
10/12/21 11:30	177,011.41	42,655.90	120,566.01	29,053.79
10/12/21 11:31	177,121.41	42,682.41	123,518.04	29,765.16
10/12/21 11:32	177,333.50	42,733.52	126,473.60	30,477.39
10/12/21 11:33	177,609.91	42,800.13	129,433.76	31,190.72
10/12/21 11:34	177,676.59	42,816.20	132,395.04	31,904.33
10/12/21 11:35	176,400.41	42,508.66	135,335.04	32,612.80
10/12/21 11:36	176,934.70	42,637.42	138,283.96	33,323.43
10/12/21 11:37	176,997.20	42,652.48	141,233.91	34,034.30
10/12/21 11:38	176,907.91	42,630.96	144,182.37	34,744.82
10/12/21 11:39	175,821.30	42,369.11	147,112.73	35,450.97
10/12/21 11:40	176,898.00	42,628.57	150,061.03	36,161.45
10/12/21 11:41	176,703.00	42,581.58	153,006.08	36,871.14
10/12/21 11:42	175,057.50	42,185.05	155,923.70	37,574.22
10/12/21 11:43	174,929.09	42,154.11	158,839.19	38,276.79
10/12/21 11:44	175,642.30	42,325.97	161,766.56	38,982.22
10/12/21 11:45	176,320.91	42,489.50	164,705.24	39,690.38
10/12/21 11:46	175,556.59	42,305.32	167,631.19	40,395.47
10/12/21 11:47	176,744.20	42,591.51	170,576.92	41,105.33
10/12/21 11:48	177,620.00	42,802.56	173,537.26	41,818.71
10/12/21 11:49	176,500.20	42,532.71	176,478.93	42,527.58
10/12/21 11:50	177,081.50	42,672.79	179,430.28	43,238.80
10/12/21 11:51	175,306.91	42,245.15	182,352.07	43,942.88
10/12/21 11:52	176,040.80	42,422.00	185,286.08	44,649.92
10/12/21 11:53	176,036.20	42,420.90	188,220.02	45,356.93
10/12/21 11:54	176,208.09	42,462.32	191,156.82	46,064.64
10/12/21 11:55	177,206.09	42,702.82	194,110.25	46,776.35
10/12/21 11:56	175,916.70	42,392.10	197,042.20	47,482.89
10/12/21 11:57	176,396.41	42,507.70	199,982.14	48,191.35
10/12/21 11:58	178,739.91	43,072.43	202,961.14	48,909.22
10/12/21 11:59	177,210.91	42,703.98	205,914.65	49,620.95
10/12/21 12:00	175,810.09	42,366.41	208,844.82	50,327.06
10/12/21 12:01	175,237.70	42,228.48	211,765.45	51,030.87
10/12/21 12:02	175,300.00	42,243.49	214,687.11	51,734.93
10/12/21 12:03	174,530.20	42,057.98	217,595.95	52,435.89
10/12/21 12:04	174,650.20	42,086.90	220,506.79	53,137.34
10/12/21 12:05	176,350.50	42,496.64	223,445.96	53,845.62
10/12/21 12:06	177,018.20	42,657.54	226,396.27	54,556.58
10/12/21 12:07	175,793.50	42,362.41	229,326.16	55,262.62
10/12/21 12:08	175,226.20	42,225.71	232,246.59	55,966.38
10/12/21 12:09	175,076.20	42,189.56	235,164.53	56,669.54
10/12/21 12:10	175,110.59	42,197.85	238,083.04	57,372.84
10/12/21 12:11	175,747.80	42,351.40	241,012.17	58,078.69
10/12/21 12:12	174,782.41	42,118.76	243,925.21	58,780.67
10/12/21 12:13	175,096.91	42,194.55	246,843.49	59,483.91
10/12/21 12:14	175,670.41	42,332.75	249,771.33	60,189.46
10/12/21 12:15	175,455.41	42,280.94	252,695.59	60,894.14
10/12/21 12:16	175,003.09	42,171.94	255,612.31	61,597.01
10/12/21 12:17	175,488.59	42,288.94	258,537.12	62,301.82
10/12/21 12:18	176,052.70	42,424.87	261,471.33	63,008.91
10/12/21 12:19	175,852.70	42,376.68	264,402.21	63,715.18
10/12/21 12:20	176,295.91	42,483.48	267,340.47	64,423.24
10/12/21 12:21	175,158.41	42,209.37	270,259.78	65,126.73
10/12/21 12:22	175,118.70	42,199.80	273,178.42	65,830.06
10/12/21 12:23	175,469.50	42,284.33	276,102.92	66,534.80
10/12/21 12:24	174,917.91	42,151.41	279,018.21	67,237.32
10/12/21 12:25	175,369.70	42,260.29	281,941.04	67,941.66
10/12/21 12:26	175,913.30	42,391.28	284,872.93	68,648.18
10/12/21 12:27	175,992.80	42,410.44	287,806.14	69,355.02
10/12/21 12:28	175,569.00	42,308.31	290,732.29	70,060.16
10/12/21 12:29	175,963.30	42,403.33	293,665.02	70,766.88
10/12/21 12:30	175,080.09	42,190.50	296,583.02	71,470.06
10/12/21 12:31	176,040.70	42,421.98	299,517.03	72,177.09
10/12/21 12:32	175,385.91	42,264.19	302,440.13	72,881.50

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
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 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 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 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 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 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 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 9:20	36,543.54	9,430.42	42,896.54	11,069.88	26,577.66	6,858.63	189,069.42	48,791.24
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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 9:37	36,576.45	9,438.92	42,488.84	10,964.67	23,548.95	6,077.04	218,782.05	56,458.88
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 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 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 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 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 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 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 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 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 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 9:48	39,736.50	10,254.40	42,365.81	10,932.92	24,256.31	6,259.58	237,852.38	61,380.17
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 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 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 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 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 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 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 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 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 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 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 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 10:01	35,988.50	9,287.19	43,563.17	11,241.91	23,132.85	5,969.66	260,407.61	67,200.74
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 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 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 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 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 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 10:08	37,077.13	9,568.12	40,846.59	10,540.87	25,526.09	6,587.26	272,522.64	70,327.17
10/12/21 10:09	36,417.66	9,397.94	39,908.16	10,298.70	26,329.90	6,794.69	274,233.57	70,768.69
10/12/21 10:10	38,028.44	9,813.62	41,750.69	10,774.18	28,680.61	7,401.32	276,041.23	71,235.18
10/12/21 10:11	38,255.89	9,872.31	41,165.59	10,623.19	28,222.65	7,283.13	277,835.30	71,698.15
10/12/21 10:12	35,535.02	9,170.16	38,727.96	9,994.13	24,843.51	6,411.11	279,487.07	72,124.41
10/12/21 10:13	36,825.36	9,503.15	39,220.07	10,121.13	26,560.18	6,854.12	281,197.17	72,565.72
10/12/21 10:14	37,728.02	9,736.09	39,710.75	10,247.75	27,416.60	7,075.13	282,944.76	73,016.70
10/12/21 10:15	37,506.29	9,678.87	40,310.14	10,402.43	27,291.64	7,042.88	284,696.56	73,468.77
10/12/21 10:16	33,998.63	8,773.68	37,629.32	9,710.62	24,522.02	6,328.15	286,299.06	73,882.31
10/12/21 10:17	35,573.64	9,180.13	37,124.34	9,580.30	26,699.57	6,890.09	287,955.68	74,309.78
10/12/21 10:18	35,876.91	9,258.39	37,009.90	9,550.77	25,685.89	6,628.50	289,598.56	74,733.78
10/12/21 10:19	35,001.43	9,032.47	36,576.45	9,438.92	24,335.13	6,279.92	291,197.11	75,146.30
10/12/21 10:20	34,871.25	8,998.87	37,789.54	9,751.97	25,650.02	6,619.24	292,835.62	75,569.14
10/12/21 10:21	34,540.80	8,913.60	37,914.00	9,784.08	25,364.21	6,545.49	294,465.94	75,989.86
10/12/21 10:22	35,477.79	9,155.40	38,892.48	10,036.59	26,226.02	6,767.88	296,142.55	76,422.52
10/12/21 10:23	33,775.46	8,716.09	37,901.12	9,780.76	23,457.30	6,053.39	297,728.11	76,831.69
10/12/21 10:24	35,951.30	9,277.59	37,623.60	9,709.14	25,036.70	6,460.97	299,371.64	77,255.82
10/12/21 10:25	36,642.25	9,455.90	36,090.06	9,313.40	25,185.07	6,499.26	301,003.59	77,676.96
10/12/21 10:26	36,600.77	9,445.19	35,104.43	9,059.05	25,592.32	6,604.35	302,625.22	78,095.44
10/12/21 10:27	36,750.97	9,483.95	34,530.78	8,911.01	26,652.20	6,877.86	304,257.45	78,516.65
10/12/21 10:28	36,818.21	9,501.30	33,921.38	8,753.75	27,034.83	6,976.61	305,887.03	78,937.18
10/12/21 10:29	37,007.04	9,550.03	33,965.72	8,765.19	27,229.59	7,026.87	307,523.73	79,359.55
10/12/21 10:30	36,135.84	9,325.21	33,356.31	8,607.93	26,404.92	6,814.05	309,122.02	79,772.00
10/12/21 10:31	35,778.21	9,232.92	33,402.09	8,619.74	26,882.21	6,937.22	310,723.06	80,185.17
10/12/21 10:32	36,649.40	9,457.74	34,271.86	8,844.19	27,577.65	7,116.69	312,364.71	80,608.81
10/12/21 10:33	35,889.79	9,261.72	33,366.33	8,610.51	26,464.80	6,829.50	313,960.05	81,020.51
10/12/21 10:34	35,537.88	9,170.90	33,626.68	8,677.70	27,131.57	7,001.57	315,564.99	81,434.68
10/12/21 10:35	36,085.77	9,312.29	33,895.63	8,747.10	27,969.62	7,217.84	317,197.51	81,855.96
10/12/21 10:36	35,821.13	9,244.00	34,067.29	8,791.40	27,169.08	7,011.25	318,815.13	82,273.41
10/12/21 10:37	34,490.73	8,900.68	34,131.66	8,808.01	26,414.95	6,816.64	320,399.09	82,682.16
10/12/21 10:38	35,008.58	9,034.31	35,040.05	9,042.43	27,125.26	6,999.94	322,018.65	83,100.11
10/12/21 10:39	34,517.91	8,907.69	35,007.15	9,033.94	26,088.20	6,732.32	323,612.21	83,511.34
10/12/21 10:40	34,792.57	8,978.57	34,612.32	8,932.05	26,105.12	6,736.68	325,204.04	83,922.13
10/12/21 10:41	36,195.92	9,340.72	34,905.58	9,007.73	26,929.26	6,949.36	326,837.89	84,343.76
10/12/21 10:42	36,101.51	9,316.35	34,623.77	8,935.01	26,323.19	6,792.96	328,455.36	84,761.16
10/12/21 10:43	35,669.49	9,204.87	33,945.70	8,760.02	26,217.94	6,765.80	330,052.58	85,173.34
10/12/21 10:44	36,934.08	9,531.21	34,264.70	8,842.35	26,616.61	6,868.68	331,682.84	85,594.05
10/12/21 10:45	36,546.41	9,431.16	34,090.18	8,797.31	25,522.75	6,586.40	333,285.49	86,007.63
10/12/21 10:46	36,733.80	9,479.52	34,756.80	8,969.34	26,062.79	6,725.76	334,911.38	86,427.20
10/12/21 10:47	37,380.40	9,646.38	36,414.80	9,397.20	26,158.50	6,750.46	336,577.28	86,857.10
10/12/21 10:48	36,353.28	9,381.32	35,789.65	9,235.87	24,013.47	6,196.91	338,179.88	87,270.67
10/12/21 10:49	36,271.74	9,360.28	36,630.80	9,452.94	24,092.80	6,217.39	339,796.47	87,687.85
10/12/21 10:50	36,268.88	9,359.54	38,563.45	9,951.68	23,597.63	6,089.60	341,436.97	88,111.20
10/12/21 10:51	35,281.81	9,104.82	38,543.43	9,946.51	21,959.13	5,666.77	343,033.38	88,523.17
10/12/21 10:52	33,759.73	8,712.03	38,367.47	9,901.11	21,855.86	5,640.12	344,599.76	88,927.39
10/12/21 10:53	34,811.16	8,983.37	39,760.81	10,260.67	22,599.86	5,832.12	346,219.29	89,345.32
10/12/21 10:54	34,167.43	8,817.24	38,416.11	9,913.66	21,349.65	5,509.49	347,784.85	89,749.33
10/12/21 10:55	35,140.19	9,068.27	38,646.42	9,973.09	23,344.71	6,024.33	349,403.70	90,167.09
10/12/21 10:56	35,061.51	9,047.97	38,361.75	9,899.63	23,053.13	5,949.09	351,011.64	90,582.04
10/12/21 10:57	34,321.93	8,857.11	37,401.86	9,651.92	22,695.93	5,856.91	352,585.30	90,988.13
10/12/21 10:58	36,340.41	9,378.00	38,188.66	9,854.96	23,476.86	6,058.44	354,218.74	91,409.66
10/12/21 10:59	35,884.07	9,260.24	37,341.78	9,636.42	22,764.42	5,874.58	355,818.57	91,822.51
10/12/21 11:00	34,616.62	8,933.16	36,060.02	9,305.65	23,073.62	5,954.38	357,381.08	92,225.73

Time	Boiler 5 lb/hour	Boiler 5 lbs coal/hour	Cumulative lbs-steam	Cumulative lbs-coal
10/12/21 12:33	175,877.70	42,382.70	305,371.42	73,587.87
10/12/21 12:34	175,755.41	42,353.23	308,300.68	74,293.76
10/12/21 12:35	174,986.59	42,167.96	311,217.12	74,996.56
10/12/21 12:36	175,637.80	42,324.89	314,144.42	75,701.98
10/12/21 12:37	175,915.80	42,391.88	317,076.35	76,408.51
10/12/21 12:38	176,043.91	42,422.75	320,010.41	77,115.55
10/12/21 12:39	176,136.20	42,445.00	322,946.02	77,822.97
10/12/21 12:40	175,198.59	42,219.05	325,865.99	78,526.62
10/12/21 12:41	175,650.41	42,327.93	328,793.50	79,232.09
10/12/21 12:42	177,163.41	42,692.53	331,746.23	79,943.63
10/12/21 12:43	176,311.09	42,487.14	334,684.74	80,651.75
10/12/21 12:44	174,908.00	42,149.03	337,599.88	81,354.23
10/12/21 12:45	175,896.91	42,387.33	340,531.49	82,060.69
10/12/21 12:46	175,794.70	42,362.70	343,461.40	82,766.73
10/12/21 12:47	175,193.00	42,217.70	346,381.29	83,470.36
10/12/21 12:48	174,998.50	42,170.83	349,297.93	84,173.21
10/12/21 12:49	175,089.80	42,192.83	352,216.09	84,876.42
10/12/21 12:50	174,639.59	42,084.35	355,126.75	85,577.83
10/12/21 12:51	174,827.00	42,129.51	358,040.53	86,279.98
10/12/21 12:52	175,041.50	42,181.20	360,957.89	86,983.00
10/12/21 12:53	174,451.91	42,039.12	363,865.43	87,683.66
10/12/21 12:54	174,735.70	42,107.51	366,777.69	88,385.45
10/12/21 12:55	176,395.70	42,507.53	369,717.62	89,093.91
10/12/21 12:56	177,189.91	42,698.91	372,670.78	89,805.56
10/12/21 12:57	176,120.20	42,441.14	375,606.12	90,512.91
10/12/21 12:58	174,954.09	42,160.13	378,522.02	91,215.58
10/12/21 12:59	175,024.50	42,177.10	381,439.09	91,918.53
10/12/21 13:00	174,997.00	42,170.47	384,355.71	92,621.37
10/12/21 13:01	175,867.80	42,380.32	387,286.84	93,327.71
10/12/21 13:02	174,399.09	42,026.39	390,193.49	94,028.15
10/12/21 13:03	175,562.70	42,306.79	393,119.54	94,733.26
10/12/21 13:04	176,569.00	42,549.29	396,062.35	95,442.42
10/12/21 13:05	175,865.41	42,379.74	398,993.44	96,148.74
10/12/21 13:06	176,062.70	42,427.28	401,927.82	96,855.87
10/12/21 13:07	176,895.30	42,627.92	404,876.08	97,566.33
10/12/21 13:08	176,476.00	42,526.88	407,817.34	98,275.11
10/12/21 13:09	176,156.09	42,449.79	410,753.28	98,982.61
10/12/21 13:10	176,093.80	42,434.78	413,688.18	99,689.86
10/12/21 13:11	176,887.09	42,625.94	416,636.29	100,400.29
10/12/21 13:12	175,715.70	42,343.66	419,564.89	101,106.02
10/12/21 13:13	175,915.91	42,391.91	422,496.82	101,812.55
10/12/21 13:14	174,504.50	42,051.79	425,405.23	102,513.41
10/12/21 13:15	175,586.70	42,312.58	428,331.67	103,218.62
10/12/21 13:16	175,446.09	42,278.69	431,255.78	103,923.27
10/12/21 13:17	175,118.91	42,199.85	434,174.42	104,626.60
10/12/21 13:18	175,632.91	42,323.71	437,101.64	105,331.99
10/12/21 13:19	174,643.80	42,085.36	440,012.37	106,033.41
10/12/21 13:20	175,327.00	42,250.00	442,934.49	106,737.58
10/12/21 13:21	175,872.50	42,381.45	445,865.69	107,443.94
10/12/21 13:22	174,340.70	42,012.32	448,771.37	108,144.14
10/12/21 13:23	175,106.30	42,196.81	451,689.81	108,847.42
10/12/21 13:24	175,390.80	42,265.37	454,612.99	109,551.85
10/12/21 13:25	175,472.91	42,285.16	457,537.54	110,256.60
10/12/21 13:26	175,606.00	42,317.23	460,464.31	110,961.89
10/12/21 13:27	174,341.00	42,012.39	463,369.99	111,662.09
10/12/21 13:28	175,185.50	42,215.90	466,289.75	112,365.69
10/12/21 13:29	176,893.80	42,627.56	469,237.98	113,076.15
10/12/21 13:30	174,752.70	42,111.60	472,150.52	113,778.01
10/12/21 13:31	175,749.50	42,351.81	475,079.68	114,483.87
10/12/21 13:32	176,708.30	42,582.86	478,024.82	115,193.59
10/12/21 13:33	175,199.91	42,219.37	480,944.82	115,897.24
10/12/21 13:34	175,393.80	42,266.09	483,868.05	116,601.68
10/12/21 13:35	174,961.70	42,161.97	486,784.08	117,304.38
10/12/21 13:36	174,609.50	42,077.09	489,694.23	118,005.66
10/12/21 13:37	174,692.00	42,096.97	492,605.77	118,707.28
10/12/21 13:38	177,772.80	42,839.38	495,568.65	119,421.27
10/12/21 13:39	175,544.80	42,302.48	498,494.39	120,126.31
10/12/21 13:40	175,414.09	42,270.98	501,417.96	120,830.83
10/12/21 13:41	175,419.00	42,272.17	504,341.61	121,535.36
10/12/21 13:42	175,348.59	42,255.20	507,264.09	122,239.62
10/12/21 13:43	175,622.09	42,321.11	510,191.12	122,944.97
10/12/21 13:44	175,487.41	42,288.65	513,115.91	123,649.78
10/12/21 13:45	173,997.91	41,929.71	516,015.88	124,348.61
10/12/21 13:46	175,321.09	42,248.57	518,937.90	125,052.75
10/12/21 13:47	174,104.41	41,955.38	521,839.64	125,752.01
10/12/21 13:48	174,538.59	42,060.01	524,748.61	126,453.01
10/12/21 13:49	176,453.91	42,521.55	527,689.51	127,161.70
10/12/21 13:50	176,204.00	42,461.33	530,626.25	127,869.39
10/12/21 13:51	176,239.50	42,469.89	533,563.57	128,577.22
10/12/21 13:52	176,236.20	42,469.09	536,500.84	129,285.04
10/12/21 13:53	174,933.30	42,155.12	539,416.40	129,987.62
10/12/21 13:54	173,711.91	41,860.79	542,311.59	130,685.30
10/12/21 13:55	173,933.70	41,914.24	545,210.49	131,383.87
10/12/21 13:56	174,247.91	41,989.96	548,114.62	132,083.71
10/12/21 13:57	174,343.30	42,012.94	551,020.34	132,783.92
10/12/21 13:58	175,971.41	42,405.28	553,953.20	133,490.68
10/12/21 13:59	175,485.50	42,288.19	556,877.96	134,195.48
10/12/21 14:00	175,082.30	42,191.03	559,796.00	134,898.66
10/12/21 14:01	174,931.30	42,154.64	562,711.52	135,601.24
10/12/21 14:02	175,539.91	42,301.30	565,637.18	136,306.26
10/12/21 14:03	174,483.20	42,046.66	568,545.24	137,007.04
10/12/21 14:04	173,912.20	41,909.06	571,443.77	137,705.52
10/12/21 14:05	174,348.70	42,014.25	574,349.58	138,405.76
10/12/21 14:06	175,037.91	42,180.33	577,266.88	139,108.77
10/12/21 14:07	176,602.20	42,557.29	580,210.25	139,818.06
10/12/21 14:08	176,079.91	42,431.43	583,144.92	140,525.25
10/12/21 14:09	175,756.41	42,353.47	586,074.19	141,231.14
10/12/21 14:10	175,841.20	42,373.91	589,004.88	141,937.37
10/12/21 14:11	175,436.00	42,276.26	591,928.81	142,641.97
10/12/21 14:12	174,753.80	42,111.87	594,841.37	143,343.84
10/12/21 14:13	174,522.41	42,056.11	597,750.08	144,044.77
10/12/21 14:14	175,148.41	42,206.96	600,669.22	144,748.22
10/12/21 14:15	175,606.00	42,317.23	603,595.99	145,453.51
10/12/21 14:16	175,476.41	42,286.00	606,520.59	146,158.28
10/12/21 14:17	175,578.30	42,310.55	609,446.90	146,863.45
10/12/21 14:18	174,799.80	42,122.95	612,360.23	147,565.50
10/12/21 14:19	174,615.09	42,078.44	615,270.48	148,266.81
10/12/21 14:20	174,576.80	42,069.21	618,180.09	148,967.96

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
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 11:02	35,037.19	9,041.69	35,007.15	9,033.94	23,192.61	5,985.08	360,576.59	93,050.37
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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 11:35	36,632.23	9,453.31	34,052.98	8,787.71	26,648.75	6,876.97	413,522.42	106,713.56
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 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 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 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 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 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 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 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 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 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 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 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 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 11:49	35,180.25	9,078.61	35,384.81	9,131.40	25,114.31	6,481.00	435,810.63	112,465.26
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 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 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 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 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 11:55	34,585.14	8,925.04	35,281.81	9,104.82	23,236.50	5,996.41	445,495.08	114,964.42
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 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
10/12/21 11:58	34,888.41	9,003.30	35,371.94	9,128.08	22,399.20	5,780.34	450,277.36	116,198.54
10/12/21 11:59	35,366.21	9,126.60	36,248.85	9,354.38	24,533.11	6,331.01	451,879.83	116,612.07
10/12/21 12:00	35,617.99	9,191.58	36,377.60	9,387.60	24,401.58	6,297.07	453,486.45	117,026.68
10/12/21 12:01	33,147.46	8,554.03	34,373.43	8,870.40	23,697.93	6,115.49	455,006.76	117,419.01
10/12/21 12:02	34,666.68	8,946.08	34,961.37	9,022.13	25,722.43	6,637.93	456,595.94	117,829.11
10/12/21 12:03	34,769.68	8,972.66	35,153.07	9,071.60	24,719.39	6,379.08	458,173.31	118,236.17
10/12/21 12:04	35,236.04	9,093.01	35,324.73	9,115.90	25,494.45	6,579.10	459,774.23	118,649.30
10/12/21 12:05	36,208.80	9,344.04	35,223.16	9,089.69	25,310.19	6,531.55	461,386.59	119,065.39
10/12/21 12:06	34,935.63	9,015.49	33,539.42	8,655.18	23,929.36	6,175.21	462,926.67	119,462.82
10/12/21 12:07	36,456.28	9,407.91	34,343.38	8,862.65	25,804.85	6,659.20	464,536.74	119,878.31
10/12/21 12:08	36,263.16	9,358.07	34,128.80	8,807.28	24,597.41	6,347.61	466,119.90	120,286.86
10/12/21 12:09	34,463.55	8,893.66	33,290.51	8,590.95	22,968.52	5,927.25	467,631.94	120,677.06
10/12/21 12:10	36,281.76	9,362.87	35,141.62	9,068.64	24,565.27	6,339.31	469,231.75	121,089.91
10/12/21 12:11	37,167.26	9,591.38	36,436.25	9,402.74	24,265.56	6,261.97	470,862.90	121,510.84
10/12/21 12:12	36,009.96	9,292.73	35,895.51	9,263.19	23,372.97	6,031.63	472,450.88	121,920.64
10/12/21 12:13	35,549.32	9,173.85	36,902.61	9,523.08	24,782.50	6,395.37	474,071.45	122,338.84
10/12/21 12:14	34,489.30	8,900.31	37,358.95	9,640.85	24,389.12	6,293.85	475,675.41	122,752.76
10/12/21 12:15	31,659.71	8,170.10	36,376.17	9,387.23	23,013.49	5,938.86	477,192.90	123,144.36
10/12/21 12:16	32,755.49	8,452.88	37,786.68	9,751.23	24,159.56	6,234.61	478,771.26	123,551.67
10/12/21 12:17	31,014.53	8,003.61	36,868.27	9,514.22	22,760.85	5,873.66	480,281.99	123,941.53
10/12/21 12:18	30,416.57	7,849.30	36,825.36	9,503.15	23,230.68	5,994.91	481,789.86	124,330.65
10/12/21 12:19	33,100.25	8,541.85	38,105.69	9,833.55	24,650.22	6,361.23	483,387.47	124,742.93
10/12/21 12:20	31,930.07	8,239.87	37,338.92	9,635.68	23,362.39	6,028.90	484,931.32	125,141.34
10/12/21 12:21	31,722.64	8,186.34	37,240.21	9,610.21	24,134.98	6,228.27	486,482.95	125,541.75
10/12/21 12:22	33,443.58	8,630.45	36,919.77	9,527.51	25,015.45	6,455.48	488,072.60	125,951.98
10/12/21 12:23	33,492.21	8,643.00	35,479.23	9,155.77	23,442.46	6,049.56	489,612.83	126,349.45
10/12/21 12:24	34,545.09	8,914.70	35,928.41	9,271.68	25,184.82	6,499.19	491,207.14	126,760.87
10/12/21 12:25	35,330.45	9,117.37	36,486.32	9,415.66	24,954.62	6,439.79	492,819.99	127,177.09
10/12/21 12:26	34,171.72	8,818.35	35,962.75	9,280.54	23,289.69	6,010.14	494,377.06	127,578.91
10/12/21 12:27	33,357.75	8,608.30	35,758.18	9,227.75	22,609.26	5,834.54	495,905.82	127,973.42
10/12/21 12:28	34,712.46	8,957.89	36,672.29	9,463.65	23,775.68	6,135.55	497,491.82	128,382.70
10/12/21 12:29	36,420.52	9,398.68	37,088.57	9,571.07	23,125.17	5,967.68	499,102.40	128,798.32
10/12/21 12:30	37,261.67	9,615.74	36,855.40	9,510.90	22,859.47	5,899.11	500,718.67	129,215.42
10/12/21 12:31	38,982.60	10,059.85	36,779.58	9,491.33	23,435.46	6,047.75	502,371.96	129,642.07
10/12/21 12:32	37,975.51	9,799.96	35,065.80	9,049.08	21,317.75	5,501.26	503,944.62	130,047.91
10/12/21 12:33	36,848.25	9,509.06	33,236.15	8,576.92	21,142.83	5,456.12	505,465.07	130,440.28
10/12/21 12:34	38,929.67	10,046.19	33,409.25	8,621.59	23,976.77	6,187.44	507,070.33	130,854.53
10/12/21 12:35	40,493.25	10,449.68	32,445.07	8,372.77	22,301.46	5,755.11	508,657.66	131,264.16
10/12/21 12:36	38,998.33	10,063.91	31,267.73	8,068.95	21,626.26	5,580.87	510,189.20	131,659.38
10/12/21 12:37	39,514.76	10,197.18	32,044.51	8,269.40	22,992.42	5,933.42	511,765.06	132,066.05
10/12/21 12:38	39,403.18	10,168.38	31,887.16	8,228.80	22,338.16	5,764.58	513,325.54	132,468.75
10/12/21 12:39	36,949.81	9,535.26	31,216.23	8,055.66	21,861.68	5,641.62	514,826.00	132,855.96
10/12/21 12:40	35,891.22	9,262.09	31,396.48	8,102.17	22,348.53	5,767.26	516,319.94	133,241.48
10/12/21 12:41	37,303.16	9,626.45	33,613.81	8,674.38	24,018.18	6,198.13	517,902.19	133,649.80
10/12/21 12:42	36,775.29	9,490.23	34,314.77	8,855.27	23,278.51	6,007.25	519,475.00	134,055.68
10/12/21 12:43	35,616.56	9,191.21	34,691.00	8,952.36	22,764.81	5,874.69	521,026.20	134,455.98
10/12/21 12:44	35,849.73	9,251.38	36,507.78	9,421.20	23,407.60	6,040.56	522,622.29	134,867.87
10/12/21 12:45	34,822.61	8,986.32	37,154.38	9,588.06	22,311.85	5,757.79	524,193.77	135,273.40
10/12/21 12:46	32,184.71	8,305.58	36,619.36	9,449.99	21,943.07	5,662.63	525,706.22	135,663.71
10/12/21 12:47	32,314.89	8,339.18	39,170.00	10,108.21	24,131.38	6,227.34	527,299.83	136,074.95
10/12/21 12:48	33,499.37	8,644.85	40,328.73	10,407.23	24,133.70	6,227.94	528,932.52	136,496.28

Time	Boiler 5 lb/hour	Boiler 5 lbs coal/hour	Cumulative lbs-steam	Cumulative lbs-coal
10/12/21 14:21	175,169.70	42,212.09	621,099.59	149,671.50
10/12/21 14:22	175,396.09	42,266.65	624,022.86	150,375.94
10/12/21 14:23	175,682.00	42,335.54	626,950.89	151,081.53
10/12/21 14:24	176,123.80	42,442.01	629,886.29	151,788.90
10/12/21 14:25	175,169.59	42,212.06	632,805.78	152,492.43
10/12/21 14:26	174,208.80	41,980.53	635,709.26	153,192.11
10/12/21 14:27	175,276.80	42,237.90	638,630.54	153,896.08
10/12/21 14:28	174,988.30	42,168.37	641,547.01	154,598.88
10/12/21 14:29	174,420.20	42,031.48	644,454.02	155,299.41
10/12/21 14:30	174,529.80	42,057.89	647,362.85	156,000.37
10/12/21 14:31	173,848.30	41,893.66	650,260.32	156,698.60
10/12/21 14:32	173,654.30	41,846.91	653,154.56	157,396.05
10/12/21 14:33	174,570.59	42,067.72	656,064.07	158,097.18
10/12/21 14:34	174,736.00	42,107.58	658,976.33	158,798.97
10/12/21 14:35	175,922.00	42,393.38	661,908.37	159,505.52
10/12/21 14:36	176,546.91	42,543.97	664,850.81	160,214.59
10/12/21 14:37	176,508.50	42,534.71	667,792.62	160,923.50
10/12/21 14:38	175,769.09	42,356.53	670,722.11	161,629.44
10/12/21 14:39	175,431.70	42,275.23	673,645.97	162,334.03
10/12/21 14:40	176,536.50	42,541.46	676,588.24	163,043.06
10/12/21 14:41	176,665.70	42,572.59	679,532.67	163,752.60
10/12/21 14:42	177,094.59	42,675.95	682,484.25	164,463.87
10/12/21 14:43	176,418.50	42,513.02	685,424.56	165,172.42
10/12/21 14:44	176,603.59	42,557.63	688,367.95	165,881.71
10/12/21 14:45	176,107.80	42,438.15	691,303.08	166,589.01
10/12/21 14:46	175,916.00	42,391.93	694,235.01	167,295.54
10/12/21 14:47	176,008.59	42,414.24	697,168.49	168,002.45
10/12/21 14:48	175,380.20	42,262.82	700,091.49	168,706.83
10/12/21 14:49	175,521.09	42,296.77	703,016.85	169,411.77
10/12/21 14:50	176,762.20	42,595.85	705,962.88	170,121.71
10/12/21 14:51	177,487.80	42,770.70	708,921.01	170,834.55
10/12/21 14:52	177,434.50	42,757.86	711,878.25	171,547.18
10/12/21 14:53	177,575.20	42,791.76	714,837.84	172,260.38
10/12/21 14:54	177,091.70	42,675.25	717,789.37	172,971.63
10/12/21 14:55	176,310.50	42,487.00	720,727.88	173,679.75
10/12/21 14:56	176,179.20	42,455.36	723,664.20	174,387.34
10/12/21 14:57	176,297.59	42,483.89	726,602.49	175,095.40
10/12/21 14:58	178,285.09	42,962.83	729,573.91	175,811.45
10/12/21 14:59	178,278.20	42,961.17	732,545.21	176,527.47
10/12/21 15:00	177,261.70	42,716.22	735,499.57	177,239.41
10/12/21 15:01	179,547.41	43,267.02	738,492.03	177,960.52
10/12/21 15:02	178,537.30	43,023.61	741,467.65	178,677.58
10/12/21 15:03	178,084.59	42,914.52	744,435.73	179,392.83
10/12/21 15:04	177,913.91	42,873.38	747,400.96	180,107.38
10/12/21 15:05	178,661.59	43,053.56	750,378.65	180,824.94
10/12/21 15:06	177,837.80	42,855.04	753,342.62	181,539.19
10/12/21 15:07	177,705.41	42,823.14	756,304.37	182,252.91
10/12/21 15:08	177,379.30	42,744.55	759,260.70	182,965.32
10/12/21 15:09	178,640.09	43,048.38	762,238.03	183,682.79
10/12/21 15:10	177,213.20	42,704.53	765,191.58	184,394.53
10/12/21 15:11	179,770.09	43,320.68	768,187.75	185,116.55
10/12/21 15:12	178,738.80	43,072.16	771,166.73	185,834.42
10/12/21 15:13	177,243.00	42,711.71	774,120.78	186,546.28
10/12/21 15:14	178,444.50	43,001.24	777,094.86	187,262.96
10/12/21 15:15	178,417.09	42,994.64	780,068.47	187,979.54
10/12/21 15:16	179,276.80	43,201.81	783,056.42	188,699.57
10/12/21 15:17	179,098.00	43,158.72	786,041.39	189,418.88
10/12/21 15:18	180,036.30	43,384.83	789,041.99	190,141.97
10/12/21 15:19	178,793.00	43,085.23	792,021.88	190,860.05
10/12/21 15:20	178,486.41	43,011.34	794,996.65	191,576.91
10/12/21 15:21	179,519.80	43,260.37	797,988.65	192,297.91
10/12/21 15:22	179,383.20	43,227.45	800,978.37	193,018.37
10/12/21 15:23	179,309.80	43,209.76	803,966.86	193,738.53
10/12/21 15:24	178,270.41	42,959.29	806,938.04	194,454.52
10/12/21 15:25	178,635.59	43,047.29	809,915.30	195,171.98
10/12/21 15:26	176,760.91	42,595.54	812,861.31	195,881.90
10/12/21 15:27	178,646.00	43,049.80	815,838.74	196,599.40
10/12/21 15:28	179,227.59	43,189.95	818,825.87	197,319.23
10/12/21 15:29	177,451.70	42,762.00	821,783.40	198,031.93
10/12/21 15:30	176,795.91	42,603.97	824,730.00	198,742.00
10/12/21 15:31	177,158.09	42,691.25	827,682.63	199,453.52
10/12/21 15:32	177,361.50	42,740.27	830,638.66	200,165.86
10/12/21 15:33	178,586.80	43,035.54	833,615.10	200,883.12
10/12/21 15:34	178,367.09	42,982.59	836,587.89	201,599.49
10/12/21 15:35	177,355.91	42,738.92	839,543.82	202,311.81
10/12/21 15:36	178,467.91	43,006.89	842,518.29	203,028.59
10/12/21 15:37	178,295.80	42,965.41	845,489.88	203,744.68
10/12/21 15:38	179,106.20	43,160.70	848,474.99	204,464.02
10/12/21 15:39	176,964.09	42,644.50	851,424.39	205,174.77
10/12/21 15:40	178,257.20	42,956.11	854,395.34	205,890.70
10/12/21 15:41	178,983.80	43,131.20	857,378.40	206,609.55
10/12/21 15:42	178,389.91	42,988.09	860,351.57	207,326.02
10/12/21 15:43	178,553.59	43,027.53	863,327.46	208,043.15
10/12/21 15:44	177,785.59	42,842.46	866,290.56	208,757.19
10/12/21 15:45	178,283.41	42,962.42	869,261.95	209,473.23
10/12/21 15:46	177,871.80	42,863.24	872,226.48	210,187.62
10/12/21 15:47	177,732.80	42,829.74	875,188.69	210,901.45
10/12/21 15:48	178,997.50	43,134.51	878,171.98	211,620.35
10/12/21 15:49	179,258.00	43,197.28	881,159.61	212,340.31
10/12/21 15:50	178,524.20	43,020.45	884,135.02	213,057.32
10/12/21 15:51	178,072.50	42,911.60	887,102.89	213,772.51
10/12/21 15:52	179,540.80	43,265.43	890,095.24	214,493.60
10/12/21 15:53	178,246.20	42,953.46	893,066.01	215,209.49
10/12/21 15:54	178,378.91	42,985.44	896,038.99	215,925.92
10/12/21 15:55	177,485.30	42,770.10	898,997.08	216,638.75
10/12/21 15:56	178,684.41	43,059.06	901,975.15	217,356.40
10/12/21 15:57	179,850.41	43,340.04	904,972.66	218,078.74
10/12/21 15:58	178,297.59	42,965.84	907,944.29	218,794.83
10/12/21 15:59	177,481.30	42,769.13	910,902.31	219,507.65
10/12/21 16:00	177,964.09	42,885.48	913,868.38	220,222.41
10/12/21 16:01	180,145.80	43,411.22	916,870.81	220,945.93
10/12/21 16:02	179,089.20	43,156.60	919,855.63	221,665.21
10/12/21 16:03	178,318.50	42,970.88	922,827.60	222,381.39
10/12/21 16:04	179,349.80	43,219.40	925,816.76	223,101.71
10/12/21 16:05	182,895.20	44,073.77	928,865.02	223,836.27
10/12/21 16:06	184,073.50	44,357.71	931,932.91	224,575.57
10/12/21 16:07	184,779.50	44,527.84	935,012.57	225,317.70
10/12/21 16:08	184,267.00	44,404.34	938,083.68	226,057.77

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
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 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 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 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 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 12:54	33,955.71	8,762.61	39,499.02	10,193.11	23,479.52	6,059.22	538,331.15	138,921.69
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 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	34,992.84	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	8,163.09	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	29,978.83	7,736.33	35,533.59	9,169.80	23,959.66	6,183.03	647,563.02	167,110.06
10/12/21 14:05	33,173.20	8,560.67	37,021.34	9,553.72	25,420.85	6,560.10	649,156.61	167,521.30
10/12/21 14:06	34,113.07	8,803.22	35,061.51	9,047.97	23,610.55	6,092.94	650,703.02	167,920.37
10/12/21 14:07	33,929.96	8,755.96	33,510.81	8,647.80	22,619.93	5,837.30	652,204.04	168,307.72
10/12/21 14:08	36,210.23	9,344.41	33,595.21	8,669.58	24,161.91	6,235.22	653,770.16	168,711.87
10/12/21 14:09	39,617.76	10,223.76	33,517.96	8,649.64	24,412.14	6,299.80	655,395.96	169,131.43
10/12/21 14:10	40,313.00	10,403.17	32,098.88	8,283.43	22,016.79	5,681.65	656,969.77	169,537.57
10/12/21 14:11	40,158.50	10,363.30	31,144.71	8,037.20	21,105.80	5,446.56	658,509.92	169,935.02
10/12/21 14:12	42,720.59	11,024.47	32,114.61	8,287.49	22,161.04	5,718.88	660,126.52	170,352.20
10/12/21 14:13	43,168.34	11,140.02	31,143.28	8,036.83	21,669.01	5,591.90	661,726.20	170,765.01
10/12/21 14:14	40,028.32	10,329.71	29,892.99	7,714.18	21,014.73	5,423.06	663,241.80	171,156.13
10/12/21 14:15	39,888.13	10,293.53	31,181.90	8,046.80	22,706.54	5,859.65	664,804.74	171,559.46
10/12/21 14:16	39,657.81	10,234.09	32,409.30	8,363.54	22,663.43	5,848.52	666,383.58	171,966.89
10/12/21 14:17	37,218.75	9,604.67	31,971.56	8,250.58	20,544.89	5,301.81	667,879.17	172,352.85
10/12/21 14:18	35,921.26	9,269.84	33,299.09	8,593.16	21,926.77	5,658.42	669,398.29	172,744.87
10/12/21 14:19	36,665.14	9,461.80	34,163.14	8,816.14	22,214.54	5,732.68	670,949.00	173,145.05
10/12/21 14:20	34,649.52	8,941.65	33,653.86	8,684.71	21,730.00	5,607.64	672,449.56	173,532.28
10/12/21 14:21	34,164.57	8,816.51	33,695.35	8,695.42	23,110.58	5,963.91	673,965.73	173,923.54
10/12/21 14:22	36,404.79	9,394.62	35,092.98	9,056.09	25,759.24	6,647.43	675,586.68	174,341.85
10/12/21 14:23	34,951.36	9,019.54	33,183.22	8,563.26	23,536.97	6,073.95	677,114.54	174,736.12
10/12/21 14:24	34,379.15	8,871.88	31,653.98	8,168.62	23,190.80	5,984.62	678,601.61	175,119.88
10/12/21 14:25	36,657.98	9,459.96	32,646.77	8,424.82	25,397.11	6,553.98	680,179.97	175,527.19
10/12/21 14:26	37,410.45	9,654.14	32,210.46	8,312.23	24,685.54	6,370.35	681,751.75	175,932.80
10/12/21 14:27	36,423.38	9,399.41	30,725.57	7,929.04	23,816.81	6,146.16	683,267.84	176,324.04
10/12/21 14:28	38,125.71	9,838.72	31,871.42	8,224.74	26,632.51	6,872.78	684,878.34	176,739.65
10/12/21 14:29	39,274.43	10,135.16	32,334.91	8,344.34	26,485.11	6,834.75	686,513.25	177,161.55
10/12/21 14:30	37,217.32	9,604.30	31,623.94	8,160.87	24,669.02	6,366.09	688,071.75	177,563.74
10/12/21 14:31	36,904.04	9,523.45	31,666.86	8,171.95	25,799.90	6,657.92	689,644.60	177,969.63
10/12/21 14:32	38,205.82	9,859.39	32,447.93	8,373.51	26,152.75	6,748.98	691,258.04	178,385.99
10/12/21 14:33	37,280.27	9,620.54	32,227.63	8,316.66	24,284.02	6,266.73	692,821.24	178,789.39
10/12/21 14:34	36,626.51	9,451.83	31,230.54	8,059.35	23,413.37	6,042.05	694,342.41	179,181.95
10/12/21 14:35	38,665.02	9,977.89	32,263.39	8,325.89	25,001.06	6,451.77	695,941.24	179,594.54
10/12/21 14:36	39,087.03	10,086.80	30,993.08	7,998.07	23,711.42	6,118.97	697,504.43	179,997.94

Time	Boiler 5 lb/hour	Boiler 5 lbs coal/hour	Cumulative lbs-steam	Cumulative lbs-coal
10/12/21 16:09	183,208.50	44,149.27	941,137.16	226,793.59
10/12/21 16:10	184,644.91	44,495.41	944,214.57	227,535.18
10/12/21 16:11	183,765.30	44,283.44	947,277.33	228,273.24
10/12/21 16:12	183,335.20	44,179.80	950,332.92	229,009.57
10/12/21 16:13	183,841.91	44,301.90	953,396.95	229,747.94
10/12/21 16:14	183,296.50	44,170.47	956,451.89	230,484.11
10/12/21 16:15	184,470.50	44,453.38	959,526.40	231,225.00

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
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

Time	Boiler 5 lb/hour	Boiler 5 lbs coal/hour	Cumulative lbs-steam	Cumulative lbs-coal

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/AI1/PV.CV		M_113-O2/AI1/PV.CV	M_212-LIC-26/AI1/PV.CV		M_213-O2/AI1/PV.CV	M_112-LIC-26/AI1/PV.CV		M_313-O2/AI1/PV.CV	M_521-FT-06/AI1/PV.CV		M_513-AT_02/AI1/PV.CV	M_513-AT_03/AI1/PV.CV				M_513-AT_05/AI1/PV.CV	M_513-OT-53/AI1/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	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)	(%)	(%)
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	35,347.61	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	7.00	35,401.98	9,135.83	5.76	35,278.95	9,104.08	9.62	177,224.09	42,707.15	3.81	4.67	276,287.71	68,271.50	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	10.20	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	176,898.00	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	35,658.04	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	272,939.75	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	36,283.19	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	6.70
10/12/21 11:48	25,364.77	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	42,632.84	3.44	4.60	272,135.08	67,205.14	529.21	7.09	6.86
10/12/21 11:50	27,248.16	7,031.66	6.39	36,007.09	9,291.99	5.48	36,493.48	9,417.50	9.85	177,081.50	42,672.79	3.49	4.70	276,830.23	68,413.94	538.73	7.08	6.79
10/12/21 11:50	27,419.21	7,075.80	6.20	37,198.73	9,599.50	5.46	37,474.82	9,670.75	9.82	176,070.50	42,429.16	3.55	4.80	278,163.26	68,775.21	541.57	7.16	6.73
10/12/21 11:51	27,080.72	6,988.45	5.78	36,577.88	9,439.28	5.24	37,463.38	9,667.80	9.67	175,306.91	42,245.15	3.51	4.75	276,428.88	68,340.68	538.15	7.15	6.71
10/12/21 11:51	24,042.78	6,204.48	5.49	34,380.58	8,872.25	5.21	35,150.20	9,070.86	9.65	175,709.59	42,342.19	3.54	4.78	269,283.15	66,489.78	523.57	7.05	6.95
10/12/21 11:52	24,795.79	6,398.80	5.82	34,400.61	8,877.42	5.36	34,629.49	8,936.48	9.90	176,040.80	42,422.00	3.64	4.86	269,866.68	66,634.71	524.71	7.03	6.76
10/12/21 11:52	26,585.96	6,860.77	6.26	35,891.22	9,262.09	5.64	36,014.25	9,293.83	9.99	176,034.91	42,420.59	3.61	4.85	274,526.34	67,837.28	534.18	7.09	6.72
10/12/21 11:53	25,436.16	6,564.05	6.34	35,563.63	9,177.55	5.59	35,935.57	9,273.53	10.00	176,036.20	42,420.90	3.50	4.75	272,971.56	67,436.03	531.03	7.20	6.67
10/12/21 11:53	25,774.01	6,651.24	6.12	36,144.42	9,327.43	5.46	36,720.93	9,476.20	10.00	176,071.30	42,429.35	3.27	4.49	274,710.66	67,884.22	534.55	7.15	6.62
10/12/21 11:54	24,449.32	6,309.39	6.02	35,813.97	9,242.15	5.34	36,068.61	9,307.86	10.06	176,208.09	42,462.32	3.32	4.55	272,539.99	67,321.72	530.12	6.97	7.36
10/12/21 11:54	23,834.27	6,150.67	6.00	35,509.27	9,163.52	5.30	35,035.76	9,041.33	10.17	176,823.91	42,610.72	3.65	4.82	271,203.21	66,966.23	527.33	7.16	6.79
10/12/21 11:55	23,236.50	5,996.41	6.26	35,281.81	9,104.82	5.34	34,585.14	8,925.04	10.25	177,206.09	42,702.82	4.01	5.22	270,309.54	66,729.08	525.46	7.28	6.76
10/12/21 11:55	23,000.19	5,935.43	6.48	35,030.04	9,039.85	5.41	34,459.26	8,892.55	10.41	176,486.91	42,529.51	4.18	5.43	268,976.40	66,397.34	522.85	7.50	6.74
10/12/21 11:56	24,962.77	6,441.89	6.58	36,839.66	9,506.84	5.51	35,896.94	9,263.56	10.42	175,916.70	42,392.10	4.05	5.24	273,616.07	67,604.39	532.35	7.62	6.71
10/12/21 11:56	23,516.85	6,068.76	6.48	36,047.15	9,302.32	5.45	36,005.66	9,291.62	10.37	176,049.41	42,424.08	3.96	5.06	271,619.06	67,086.78	528.27	7.57	7.53
10/12/21 11:57	24,198.75	6,244.73	6.18	36,217.38	9,346.25	5.34	36,161.59	9,331.86	10.34	176,396.41	42,507.70	3.82	4.87	272,974.13	67,430.54	530.98	7.51	6.78
10/12/21 11:57	22,560.76	5,822.03	6.18	35,590.81	9,184.56	5.27	35,556.48	9,175.70	10.29	177,754.09	42,834.87	3.70	4.68	271,462.14	67,017.16	527.73	7.31	6.73
10/12/21 11:58	22,399.20	5,780.34	6.14	35,371.94	9,128.08	5.26	34,888.41	9,003.30	10.37	178,739.91	43,072.43	3.62	4.54	271,399.46	66,984.15	527.47	7.19	6.68
10/12/21 11:58	23,386.91	6,035.22	6.39	35,324.73	9,115.90	5.34	34,339.09	8,861.54	10.36	177,972.70	42,887.55	3.51	4.37	271,023.43	66,900.22	526.81	7.13	6.63
10/12/21 11:59	24,533.11	6,331.01	6.60	36,248.85	9,354.38	5.49	35,366.21	9,126.60	10.34	177,210.91	42,703.98	3.42	4.25	273,359.08	67,515.96	531.65	7.09	8.21
10/12/21 11:59	26,104.05	6,736.41	6.69	36,891.16	9,520.13	5.46	35,861.18	9,254.33	10.24	176,474.09	42,526.42	3.43	4.34	275,330.48	68,037.29	535.76	7.20	6.89
10/12/21 12:00	24,401.58	6,297.07	6.56	36,377.60	9,387.60	5.36	35,617.99	9,191.58	10.02	175,810.09	42,366.41	3.60	4.58	272,207.26	67,242.66	529.50	7.24	6.70
10/12/21 12:00	24,045.43	6,205.16	6.37	35,387.67	9,132.14	5.26	34,503.60	8,904.00	10.05	175,489.30	42,289.11	3.73	4.65	269,426.00	66,530.40	523.89	7.26	6.70
10/12/21 12:01	23,697.93	6,115.49	6.50	34,373.43	8,870.40	5.33	33,147.46	8,554.03	9.97	175,237.70	42,228.48	3.74	4.67	266,456.52	65,768.40	517.89	7.27	6.70
10/12/21 12:01	25,222.97	6,509.04	6.66	35,595.10	9,185.67	5.50	34,250.40	8,838.66	10.08	175,312.09	42,246.40	3.73	4.65	270,380.56	66,779.76	525.86	7.25	6.70
10/12/21 12:02	25,722.43	6,637.93	6.86	34,961.37	9,022.13	5.61	34,666.68	8,946.08	10.03	175,300.00	42,243.49	3.58	4.55	270,650.48	66,849.63	526.41	7.28	6.71
10/12/21 12:02	25,538.35	6,590.42	6.50	35,977.05	9,284.23	5.54	35,652.32	9,200.43	9.93	174,880.09	42,142.30	3.46	4.50	272,047.81	67,217.39	529.30	7.29	6.78
10/12/21 12:03	24,719.39	6,379.08	6.28	35,153.07	9,071.60	5.43	34,769.68	8,972.66	9.99	174,530.20	42,057.98	3.64	4.67	269,172.34	66,481.33	523.51	7.22	7.33
10/12/21 12:03	24,220.36	6,250.30	6.18	34,739.64	8,964.91	5.46	34,167.43	8,817.24	9.97	174,510.50	42,053.24	3.98	4.94	267,637.93	66,085.69	520.39	7.26	6.98
10/12/21 12:04	25,494.45	6,579.10	6.32	35,324.73	9,115.90	5.59	35,236.04	9,093.01	10.12	174,650.20	42,086.90	4.18	5.15	270,705.42	66,874.90	526.61	7.38	6.93
10/12/21 12:04	25,204.79	6,504.35	6.33	35,011.44	9,035.05	5.62	35,194.55	9,082.30	10.02	175,540.91	42,301.54	4.16	5.12	270,951.69	66,923.24	526.99	7.51	6.88
10/12/21 12:05	25,310.19	6,531.55	6.32	35,223.16	9,089.69	5.60	36,208.80	9,344.04	10.03	176,350.50	42,496.64	3.97	4.94	273,092.65	67,461.91	531.23	7.52	6.83
10/12/21 12:05	23,932.28	6,175.96	6.21	33,748.28	8,709.08	5.60	35,201.70	9,084.15	10.03	176,777.91	42,599.63	3.67	4.69	269,660.17	66,568.82	524.20	7.38	7.50
10/12/21 12:06	23,929.36	6,175.21	6.36	33,539.42	8,655.18	5.66	34,935.63	9,015.49	10.09	177,018.20	42,657.54	3.45	4.54	269,422.61	66,503.41	523.68	7.25	6.97
10/12/21 12:06	23,901.71	6,168.07	6.48	32,756.92	8,453.25	5.86	35,087.26	9,054.62	10.25	176,376.20	42,502.83	3.52	4.55	268,122.10	66,178.77	521.12	7.16	6.90
10/12/21 12:07	25,804.85	6,659.20	6.41	34,343.38	8,862.65	5.94	36,456.28	9,407.91	10.21	175,793.50	42,362.41	3.82	4.81	272,398.01	67,292.16	529.89	7.29	6.82
10/12/21 12:07	25,140.83	6,487.84	6.30	34,702.45	8,955.31	5.89	36,617.93	9,449.62	10.18	175,490.41	42,289.37	4.11	5.06	271,951.62	67,182.14	529.03	7.47	6.74
10/12/21 12:08	24,597.41	6,347.61	5.91	34,128.80	8,807.28	5.63	36,263.16	9,358.07	10.13	175,226.20	42,225.71	4.25	5.22	270,215.57	66,738.65	525.53	7.58	7.23
10/12/21 12:08	23,504.54	6,065.58	5.86	33,990.04	8,771.47	5.59	35,537.88	9,170.90	10.16	175,145.91	42,206.36	4.16	5.12	268,178.36	66,214.30	521.40	7.55	6.81
10/12/21 12:09	22,968.52	5,927.25	5.91	33,290.51	8,590.95	5.63	34,463.55	8,893.66	10.29	175,076.20	42,189.56	3.84	4.72	265,798.79	65,601.42	516.58	7.40	6.81
10/12/21 12:09	25,424.61	6,561.07	6.19	34,952.79	9,019.91	5.79	35,894.08	9,262.82	10.35	175,056.59	42,184.83	3.47	4.29	271,328.07	67,028.64	527.82	7.25	6.81
10/12/21 12:10	24,565.27	6,339.31	6.18	35,141.62	9,068.64	5.75	36,281.76	9,362.87	10.33	175,110.59	42,197.85	3.42	4.12	271,099.25	66,968.67	527.34	7.11	6.81
10/12/21 12:10	25,505.50	6,581.95	5.86	35,944.15	9,275.74	5.46	36,430.53	9,401.26	10.24	175,511.80	42,294.53	3.66	4.38	273,391.98	67,553.48	531.95	7.16	6.90
10/12/21 12:11	24,265.56	6,261.97	5.67	36,436.25	9,402.74	5.27	37,167.26	9,591.38	10.17	175,747.80	42,351.40	3.85	4.69	273,616.87	67,607.48	532.38	7.13	6.74
10/12/21 12:11	24,297.97	6,270.33	5.39	36,261.73	9,357.70	5.07	36,686.59	9,467.34	10.21	175,205.30	42,220.67	3.98	4.86	272,451.59	67,316.04	530.08	7.16	6.73
10/12/21 12:12	23,372.97	6,031.63	5.42	35,895.51	9,263.19	5.02	36,009.96	9,292.73	10.17	174,782.41	42,118.76	4.08	4.96	270,060.85	66,706.31	525.28	7.18	6.72

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	4.81	269,530.88	66,567.13	524.18	7.19	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	4.63	272,331.34	67,286.86	529.85	7.13	6.70
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	4.56	272,288.10	67,270.18	529.72	7.30	6.65
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	4.61	271,907.78	67,167.76	528.91	7.26	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	8,446.61	10.15	175,578.50	42,310.60	3.98	4.77	267,062.90	65,919.06	519.08	7.21	6.57
10/12/21 12:15	23,013.49	5,938.86	6.25	36,376.17	9,387.23	4.86	31,659.71	8,170.10	10.32	175,455.41	42,280.94	4.09	4.84	266,504.78	65,777.13	517.96	7.27	6.53
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	4.86	270,545.69	66,824.55	526.21	7.35	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	4.87	269,704.82	66,610.66	524.53	7.46	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	4.80	267,951.19	66,154.10	520.93	7.43	6.61
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	4.65	266,132.24	65,680.43	517.20	7.36	6.61
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	10.27	175,811.00	42,366.63	3.68	4.41	266,443.27	65,755.18	517.79	7.22	6.61
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	10.22	176,052.70	42,424.87	3.52	4.25	266,525.31	65,772.23	517.92	7.13	7.57
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	4.38	272,381.32	67,285.80	529.84	7.16	6.79
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	4.49	271,708.87	67,113.31	528.48	7.17	6.74
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	4.49	271,400.61	67,028.60	527.82	7.15	6.70
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	4.41	268,927.29	66,387.93	522.77	6.96	6.65
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	4.50	266,564.60	65,788.79	518.05	6.90	6.66
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**	**4.68**	**271,576.51**	**67,074.29**	**528.18**	**7.26**	**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	4.39	272,056.63	67,216.25	529.29	7.14	6.75
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	4.51	273,605.79	67,606.41	532.37	7.12	6.79
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	4.61	275,238.34	68,020.92	535.63	7.13	6.84
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	4.66	274,654.43	67,876.81	534.50	7.16	6.88
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	4.52	269,744.97	66,614.48	524.56	7.15	7.66
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	4.48	268,057.79	66,174.45	521.09	7.09	7.02
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	4.39	267,104.93	65,924.79	519.12	7.14	6.96
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	4.40	267,217.39	65,954.21	519.36	7.23	6.91
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	4.53	272,071.10	67,208.45	529.23	7.36	6.86
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	4.65	271,079.42	66,960.29	527.28	7.50	7.73
10/12/21 12:35	22,301.46	5,755.11	5.06	32,445.07	8,372.77	6.35	40,493.25	10,449.68	10.74	174,986.59	42,167.96	4.25	4.79	270,226.38	66,745.53	525.59	7.52	7.01
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	4.83	267,630.54	66,069.80	520.27	7.48	6.96
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	4.73	267,530.12	66,038.61	520.02	7.42	6.91
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	4.56	268,509.03	66,288.73	521.99	7.42	6.86
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	4.22	270,467.49	66,791.88	525.95	7.37	7.00
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	4.03	271,769.07	67,126.74	528.59	7.28	6.92
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	4.09	269,672.41	66,584.52	524.32	7.19	6.86
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	4.40	267,549.04	66,034.83	519.99	7.15	6.81
10/12/21 12:39	21,861.68	5,641.62	5.61	31,216.23	8,055.66	6.48	36,949.81	9,535.26	10.74	176,136.20	42,445.00	4.16	4.87	266,163.92	65,677.54	517.18	7.32	6.76
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	10.80	175,606.70	42,317.40	4.39	5.09	264,639.98	65,293.32	514.15	7.58	6.70
10/12/21 12:40	22,348.53	5,767.26	6.19	31,396.48	8,102.17	6.68	35,891.22	9,262.09	10.77	175,198.59	42,219.05	4.25	5.07	264,834.82	65,350.57	514.60	7.74	6.60
10/12/21 12:40	24,325.97	6,277.56	6.45	33,467.90	8,636.72	6.71	37,838.18	9,764.52	10.73	175,363.09	42,258.69	3.83	4.61	270,995.14	66,937.49	527.10	7.63	6.61
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	4.27	270,585.55	66,826.89	526.23	7.45	6.61
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	4.09	269,222.70	66,460.39	523.34	7.30	6.62
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	4.13	271,531.97	67,045.27	527.95	7.13	6.63
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	4.51	266,930.02	65,864.33	518.65	7.17	6.63
10/12/21 12:43	22,764.81	5,874.69	6.38	34,691.00	8,952.36	5.81	35,616.56	9,191.21	10.69	176,311.09	42,487.14	4.09	4.85	269,383.46	66,505.39	523.70	7.49	6.62
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	5.20	269,403.79	66,524.66	523.85	7.63	6.62
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	5.31	270,673.11	66,862.16	526.51	7.80	6.61
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	5.08	270,476.48	66,802.12	526.03	7.76	6.61
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	10.49	175,896.91	42,387.33	3.88	4.69	270,185.74	66,719.50	525.38	7.53	6.93
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	175,871.50	42,381.21	3.56	4.36	266,174.29	65,684.74	517.23	7.25	6.69
10/12/21 12:46	21,943.07	5,662.63	7.03	36,619.36	9,449.99	4.82	32,184.71	8,305.58	10.63	175,794.70	42,362.70	3.41	4.18	266,541.84	65,780.90	517.99	7.09	6.63
10/12/21 12:46	22,152.02	5,716.55	7.36	37,454.79	9,665.58	4.82	31,429.38	8,110.66	10.64	175,475.91	42,285.88	3.44	4.21	266,512.10	65,778.67	517.97	7.13	6.57
10/12/21 12:47	24,131.38	6,227.34	7.67	39,170.00	10,108.21	4.78	32,314.89	8,339.18	10.62	175,193.00	42,217.70	3.52	4.30	270,809.27	66,892.43	526.74	7.23	6.52
10/12/21 12:47	23,696.54	6,115.13	7.58	39,533.36	10,201.98	4.50	32,994.39	8,514.53	10.46	175,079.30	42,190.30	3.78	4.55	271,303.59	67,021.94	527.76	7.32	7.10
10/12/21 12:48	24,133.70	6,227.94	7.45	40,328.73	10,407.23	4.18	33,499.37	8,644.85	10.38	174,998.50	42,170.83	3.90	4.71	272,960.30	67,450.85	531.14	7.39	6.97
10/12/21 12:48	23,541.02	6,074.99	7.14	40,374.51	10,419.04	3.76	33,276.21	8,587.26	10.28	175,073.00	42,188.79	4.08	4.83	272,264.74	67,270.08	529.72	7.30	7.02
10/12/21 12:49	22,769.16	5,875.81	7.08	40,436.03	10,434.92	3.57	32,613.87	8,416.33	10.27	175,089.80	42,192.83	4.09	4.91	270,908.86	66,919.89	526.96	7.26	7.02
10/12/21 12:49	22,189.76	5,726.29	7.15	40,014.02	10,326.01	3.55	31,904.33	8,233.23	10.34	174,834.59	42,131.34	4.02	4.83	268,942.70	66,416.87	523.00	7.17	7.10
10/12/21 12:50	22,676.72	5,851.95	7.29	40,252.92	10,387.67	3.62	31,157.58	8,040.52	10.35	174,639.59	42,084.35	3.94	4.72	268,726.82	66,364.49	522.59	7.17	7.15
10/12/21 12:50	23,331.21	6,020.85	7.57	40,539.02	10,461.50	3.85	31,762.71	8,196.68	10.41	174,728.00	42,105.65	3.78	4.54	270,360.94	66,784.68	525.90	7.21	6.76
10/12/21 12:51	23,077.64	5,955.41	7.54	40,197.13	10,373.27	3.88	31,230.54	8,059.35	10.36	174,827.00	42,129.51	3.67	4.48	269,332.31	66,517.54	523.79	7.17	6.61
10/12/21 12:51	22,942.25	5,920.48	7.59	40,175.67	10,367.73	3.97	31,892.88	8,230.27	10.35	174,976.20	42,165.46	3.74	4.54	269,987.01	66,683.94	525.10	7.12	6.65
10/12/21 12:52	21,766.35	5,617.02	7.55	39,228.65	10,123.34	4.03	30,452.33	7,858.53	10.41	175,041.50	42,181.20	3.95	4.68	266,488.83	65,780.09	517.99	7.16	6.68
10/12/21 12:52	22,191.18	5,726.65	7.70	38,629.26	9,968.66	4.23	30,525.29	7,877.35	10.44	174,711.50	42,101.67	4.29	5.05	266,057.23	65,674.34	517.15	7.30	7.43
10/12/21 12:53	21,975.90	5,671.10	7.82	38,449.01	9,922.15	4.41	30,699.81	7,922.39	10.52	174,451.91	42,039.12	4.47	5.23	265,576.63	65,554.76	516.21	7.67	6.77
10/12/21 12:53	22,722.07	5,863.66	7.81	38,360.32	9,899.26	4.51	31,007.38	8,001.76	10.55	174,524.70	42,056.66	4.37	5.13	266,614.47	65,821.34	518.31	7.78	6.72
10/12/21 12:54	23,479.52	6,059.12	7.66	39,499.02	10,193.11	4.62	33,955.71	8,762.61	10.49	174,735.70	42,107.51	4.05	4.81	271,669.95	67,122.35	528.55	7.69	6.68
10/12/21 12:54	22,753.75	5,871.83	7.00	38,410.39	9,912.18	4.52	34,052.98	8,787.71	10.39	175,598.70	42,315.47	3.68	4.45	270,815.82	66,887.19	526.70	7.50	6.63
10/12/21 12:55	22,470.45	5,798.72	6.58	37,271.68	9,618.33	4.61	34,482.14	8,898.46	10.29	176,395.70	42,507.53	3.48	4.22	270,619.97	66,823.04	526.20	7.22	7.42
10/12/21 12:55	21,408.19	5,524.60	6.29	36,154.44	9,330.01	4.79	34,097.33	8,799.15	10.39	176,881.20	42,624.52	3.22	4.03	268,541.16	66,278.29	521.91	7.06	6.69
10/12/21 12:56	22,020.10	5,682.51	6.41	35,577.93	9,181.24	5.18	34,085.89	8,796.20	10.51	177,189.91	42,698.91	3.13	3.97	268,873.83	66,358.86	522.54	6.91	6.68
10/12/21 12:56	22,714.15	5,861.61	6.50	35,562.20	9,177.18	5.49	35,769.62	9,230.71	10.57	176,665.50	42,572.54	3.22	4.00	270,711.47	66,842.04	526.35	6.93	6.66
10/12/21 12:57	23,514.56	6,068.17	6.28	35,361.92	9,125.49	5.70	37,217.32	9,604.30	10.57	176,120.20	42,441.14	3.50	4.21	272,214.01	67,239.10	529.47	7.08	6.64
10/12/21 12:57	22,520.83	5,811.72	5.84	34,052.98	8,787.71	5.72	37,703.71	9,729.82	10.42	175,476.91	42,286.12	3.81	4.46	269,754.43	66,615.37	524.56	7.25	7.90
10/12/21 12:58	22,009.20	5,679.69	5.59	33,207.54	8,569.53	5.86	37,190.14	9,597.28	10.49	174,954.09	42,160.13	4.17	4.98	267,360.97	66,006.64	519.77	7.42	6.72
10/12/21 12:58	21,758.08	5,614.89	5.73	32,483.69	8,382.74	6.10	37,210.17	9,602.45	10.61	174,999.30	42,171.03	4.33	5.19	266,451.24	65,771.11	517.91	7.54	6.75
10/12/21 12:59	21,838.16	5,635.55	5.83	32,427.90	8,368.34	6.31	36,437.68	9,403.10	10.70	175,024.50	42,177.10	4.09	4.94	265,728.24	65,584.10	516.44	7.68	6.80
10/12/21 12:59	23,675.10	6,109.59	5.98	33,649.57	8,683.61	6.41	38,370.34	9,901.85	10.73	174,955.80	42,160.54	3.69	4.50	270,650.81	66,855.59	526.45	7.61	6.85
10/12/21 13:00	22,780.60	5,878.76	5.55	33,045.89	8,527.82	6.29	39,384.58	10,163.58	10.60	174,997.00	42,170.47	3.51	4.29	270,208.07	66,740.63	525.55	7.44	6.90
10/12/21 13:00	22,393.07	5,778.75	5.15	32,901.40	8,490.53	6.15	39,981.11	10,317.52	10.62	175,556.70	42,305.35	3.52	4.29	270,832.28	66,892.16	526.74	7.27	6.94
10/12/21 13:01	20,995.91	5,418.20	4.87	32,244.79	8,321.09	6.11	39,214.35	10,119.65	10.62	175,867.80	42,380.32	3.55	4.39	268,322.85	66,239.26	521.60	7.17	6.99
10/12/21 13:01	20,445.59	5,276.19	5.06	32,224.77	8,315.92	6.18	38,636.41	9,970.51	10.80	175,007.30	42,172.95	3.79	4.60	266,314.07	65,735.57	517.63	7.16	7.29
10/12/21 13:02	20,625.02	5,322.49	5.36	32,367.81	8,352.83	6.24	37,373.25	9,644.54	10.91	174,399.09	42,026.39	4.03	4.87	264,765.17	65,346.25	514.57	7.33	6.98
10/12/21 13:02	20,851.15	5,380.85	5.76	32,971.50	8,508.62	6.32	36,905.46	9,523.82	10.98	174,980.20	42,166.42	4.18	5.01	265,708.31	65,579.71	516.41	7.53	6.93
10/12/21 13:03	22,287.53	5,751.52	5.99	34,266.13	8,842.71	6.29	38,564.88	9,952.05	11.02	175,562.70	42,306.79	4.20	4.99	270,681.24	66,853.08	526.43	7.68	6.88

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 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	20,760.44	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 13:06	22,334.35	5,763.60	5.95	35,296.12	9,108.51	6.07	39,032.67	10,072.77	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	523.79	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	525.94	7.53	7.82
10/12/21 13:14	21,725.36	5,606.44	6.65	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	10.01	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	10.03	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	5.77	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	5.68	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	9,025.08	5.27	30,804.24	7,949.34	9.71	174,745.50	42,109.87	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	9.74	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	7.44	6.60
10/12/21 13:28	25,625.62	6,612.95	6.90	37,719.44	9,733.88	4.48	33,352.02	8,606.82	9.50	176,238.50	42,469.65	3.62	4.58	272,935.58	67,423.29	530.92	7.33	6.60
10/12/21 13:29	25,897.66	6,683.15	6.64	37,669.38	9,720.96	4.43	34,143.11	8,810.97	9.52	176,893.80	42,627.56	3.56	4.56	274,603.95	67,842.63	534.23	7.14	6.60
10/12/21 13:29	24,445.74	6,308.47	6.47	36,529.24	9,426.73	4.49	33,743.99	8,707.97	9.62	175,673.80	42,333.57	3.60	4.62	270,392.76	66,776.73	525.83	7.05	6.60
10/12/21 13:30	25,932.44	6,692.12	6.45	37,459.09	9,666.69	4.62	34,911.30	9,009.21	9.75	174,752.70	42,111.60	3.67	4.62	273,055.53	67,479.62	531.37	7.06	6.60
10/12/21 13:30	25,263.25	6,519.43	6.31	37,207.31	9,601.72	4.69	36,087.20	9,312.66	9.77	175,240.80	42,229.22	3.89	4.71	273,798.55	67,663.03	532.81	7.12	7.14
End Run 2	**22,915.11**	**5,913.47**	**6.40**	**35,381.32**	**9,130.50**	**5.45**	**35,486.34**	**9,157.60**	**10.47**	**175,562.23**	**42,306.68**	**3.81**	**4.62**	**269,345.00**	**66,508.25**	**523.72**	**7.34**	**6.82**

Run 3

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
10/12/21 13:50	24,558.96	6,337.68	6.14	32,518.02	8,391.60	6.13	35,815.40	9,242.52	10.07	176,204.00	42,461.33	3.89	4.80	269,096.38	66,433.13	523.13	7.40	6.63
10/12/21 13:50	26,522.84	6,844.48	6.19	33,447.87	8,631.55	6.15	38,607.80	9,963.13	10.03	176,217.59	42,464.61	3.68	4.59	274,796.11	67,903.77	534.71	7.33	6.61
10/12/21 13:51	25,111.54	6,480.28	5.82	33,743.99	8,707.97	6.01	38,380.35	9,904.43	9.94	176,239.50	42,469.89	3.23	4.25	273,475.38	67,562.57	532.02	7.25	7.42
10/12/21 13:51	25,256.87	6,517.79	5.66	33,828.39	8,729.75	5.79	38,603.51	9,962.02	9.98	176,299.91	42,484.44	2.68	3.89	273,988.68	67,694.00	533.06	7.13	6.95
10/12/21 13:52	24,079.06	6,213.84	5.63	33,875.60	8,741.94	5.71	37,367.53	9,643.06	10.00	176,236.20	42,469.09	2.62	3.85	271,558.40	67,067.93	528.13	6.76	6.88
10/12/21 13:52	23,401.21	6,038.91	5.82	33,097.39	8,541.11	5.59	36,097.21	9,315.24	10.11	175,587.41	42,312.75	3.36	4.42	268,183.22	66,208.02	521.36	6.74	6.80
10/12/21 13:53	23,477.68	6,058.65	6.13	33,745.42	8,708.34	5.65	35,220.30	9,088.95	10.17	174,933.30	42,155.12	4.05	5.27	267,376.70	66,011.06	519.80	7.17	6.73
10/12/21 13:53	23,610.29	6,092.87	6.55	33,958.57	8,763.35	5.64	34,439.23	8,887.39	10.24	174,254.00	41,991.43	4.36	5.53	266,262.09	65,735.03	517.63	7.60	7.54
10/12/21 13:54	25,503.91	6,581.54	6.79	35,493.53	9,159.46	5.58	35,429.16	9,142.85	10.23	173,711.91	41,860.79	4.05	5.10	270,138.51	66,744.63	525.58	7.74	6.79
10/12/21 13:54	24,843.79	6,411.19	6.73	36,214.52	9,345.52	5.28	35,058.65	9,047.23	10.07	173,816.59	41,886.02	3.63	4.57	269,933.55	66,689.95	525.15	7.51	6.77
10/12/21 13:55	23,556.80	6,079.07	6.57	35,816.83	9,242.89	4.97	34,107.34	8,801.74	10.03	173,933.70	41,914.24	3.60	4.46	267,414.67	66,037.93	520.02	7.25	6.74
10/12/21 13:55	23,130.50	5,969.05	6.67	35,789.65	9,235.87	4.88	32,100.30	8,283.80	10.03	174,109.30	41,956.56	3.79	4.61	265,129.75	65,445.28	515.35	7.12	6.72
10/12/21 13:56	23,038.92	5,945.42	7.07	35,748.16	9,225.17	4.86	31,632.53	8,163.09	10.08	174,247.91	41,989.96	4.28	5.00	264,667.52	65,323.63	514.39	7.22	8.21
10/12/21 13:56	23,974.66	6,186.90	7.47	36,477.74	9,413.44	4.95	30,370.79	7,837.48	10.10	174,212.41	41,981.40	4.49	5.38	265,035.59	65,419.23	515.14	7.61	7.00
10/12/21 13:57	24,506.66	6,324.19	7.83	37,047.09	9,560.37	4.91	30,575.36	7,890.27	10.07	174,343.30	42,012.94	4.40	5.34	266,472.41	65,787.77	518.05	7.80	6.98
10/12/21 13:57	26,126.26	6,742.14	7.90	38,045.60	9,818.04	4.85	32,296.29	8,334.38	9.97	175,259.00	42,233.61	4.01	5.01	271,727.15	67,128.17	528.60	7.78	6.95
10/12/21 13:58	25,715.38	6,636.11	7.53	38,331.71	9,891.88	4.43	32,390.71	8,358.74	9.66	175,971.41	42,405.28	3.63	4.59	272,409.21	67,292.01	529.89	7.63	7.13
10/12/21 13:58	24,610.95	6,351.10	7.23	37,831.02	9,762.67	4.09	31,323.53	8,083.35	9.54	175,725.30	42,345.98	3.40	4.38	269,490.79	66,543.09	523.99	7.25	7.29
10/12/21 13:59	23,862.84	6,158.04	7.16	37,502.00	9,677.76	3.96	29,669.83	7,656.59	9.57	175,485.50	42,288.19	3.47	4.45	266,520.17	65,780.59	517.99	6.97	7.18
10/12/21 13:59	23,694.60	6,114.63	7.44	37,253.09	9,613.53	4.02	29,286.45	7,557.66	9.61	175,276.00	42,237.71	3.81	4.74	265,510.14	65,523.52	515.96	7.00	7.08
10/12/21 14:00	23,947.01	6,179.76	7.77	37,356.09	9,640.11	4.23	28,845.84	7,443.96	9.76	175,082.30	42,191.03	3.95	4.81	265,231.24	65,454.85	515.42	7.22	7.42
10/12/21 14:00	24,403.69	6,297.61	8.10	37,437.63	9,661.15	4.31	28,533.99	7,363.48	9.75	174,962.50	42,162.16	3.89	4.70	265,337.81	65,484.40	515.66	7.36	7.05
10/12/21 14:01	26,661.04	6,880.15	8.23	38,883.89	10,034.37	4.35	30,938.72	7,984.04	9.72	174,931.30	42,154.64	3.74	4.54	271,414.95	67,053.20	528.01	7.36	7.09
10/12/21 14:01	25,966.86	6,701.01	7.80	38,436.14	9,918.83	4.08	31,399.34	8,102.91	9.53	175,317.20	42,247.63	3.64	4.44	271,119.54	66,970.38	527.36	7.29	7.13
10/12/21 14:02	24,935.44	6,434.84	7.26	38,190.09	9,855.33	3.83	32,323.47	8,341.39	9.36	175,539.91	42,301.30	3.67	4.48	270,988.91	66,932.86	527.06	7.17	7.20
10/12/21 14:02	23,605.33	6,091.59	6.87	37,481.97	9,672.59	3.78	31,074.62	8,019.11	9.41	174,992.80	42,169.46	3.91	4.64	267,154.71	65,952.76	519.34	7.01	7.61
10/12/21 14:03	23,107.98	5,963.24	6.91	36,185.91	9,338.13	3.91	30,232.03	7,801.68	9.53	174,483.20	42,046.66	4.10	4.85	264,009.12	65,149.71	513.02	7.07	7.15
10/12/21 14:03	23,421.76	6,044.22	7.26	36,110.09	9,318.57	4.32	30,104.71	7,768.82	9.67	174,150.09	41,966.39	4.17	4.96	263,786.65	65,097.99	512.61	7.18	6.96
10/12/21 14:04	23,959.66	6,183.03	7.56	35,533.59	9,169.80	4.61	29,978.83	7,736.33	9.78	173,912.20	41,909.06	4.10	4.88	263,384.28	64,998.22	511.83	7.35	6.79

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	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	4.69	269,964.09	66,688.75	525.14	7.43	7.14
10/12/21 14:05	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	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	4.77	267,823.04	66,124.45	520.70	7.32	6.81
10/12/21 14:06	23,235.29	5,996.10	6.19	34,499.31	8,902.89	4.95	34,052.98	8,787.71	9.83	175,920.80	42,393.09	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	8,755.96	9.96	176,602.20	42,557.29	3.77	4.53	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	176,333.59	42,492.56	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	3.93	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	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	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	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	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	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	31,144.71	8,037.20	6.44	40,158.50	10,363.30	10.64	175,436.00	42,276.26	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	3.87	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	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	4.76	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	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	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	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	29,440.95	7,597.53	6.91	39,586.29	10,215.63	10.72	175,406.80	42,269.22	3.69	4.60	265,034.60	65,398.57	514.98	7.53	6.94
10/12/21 14:15	22,706.54	5,859.65	5.44	31,181.90	8,046.80	7.10	39,888.13	10,293.53	10.86	175,606.00	42,317.23	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	10.76	175,525.80	42,297.90	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	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	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	6.40	37,218.75	9,604.67	10.63	175,578.30	42,310.55	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	6.39	36,454.85	9,407.54	10.64	175,161.00	42,209.99	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	4.52	265,946.92	65,644.37	516.92	7.45	6.88
10/12/21 14:18	23,209.57	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	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	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	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	5.90	34,649.52	8,941.65	10.17	174,576.80	42,069.21	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	5.98	34,128.80	8,807.28	10.27	174,891.00	42,144.93	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	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	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	4.76	272,653.10	67,364.78	530.46	7.57	6.85
10/12/21 14:22	23,840.92	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	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	4.72	267,353.55	65,992.29	519.66	7.49	7.00
10/12/21 14:23	23,401.66	6,039.03	6.89	32,881.38	8,485.37	6.02	34,978.54	9,026.56	9.67	175,968.80	42,404.65	3.85	4.66	267,230.38	65,955.61	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	9.79	176,123.80	42,442.01	3.89	4.75	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	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	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	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	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	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	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	6.69	35,517.85	9,165.73	9.53	175,149.41	42,207.20	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	6.78	38,125.71	9,838.72	9.51	174,988.30	42,168.37	3.89	4.83	271,617.94	67,104.61	528.42	7.32	6.91
10/12/21 14:28	26,179.31	6,755.83	6.28	32,324.90	8,341.76	6.64	38,091.38	9,829.86	9.39	174,668.00	42,091.19	4.06	4.98	271,263.59	67,018.64	527.74	7.53	6.91
10/12/21 14:29	26,485.11	6,834.75	5.99	32,334.91	8,344.34	6.35	39,274.43	10,135.16	9.20	174,420.20	42,031.48	4.00	4.86	272,514.65	67,345.72	530.31	7.51	7.40
10/12/21 14:29	25,444.40	6,566.18	5.71	32,237.64	8,319.24	6.24	38,376.06	9,903.32	9.19	174,514.70	42,054.25	3.82	4.65	270,572.80	66,842.99	526.36	7.34	7.19
10/12/21 14:30	24,669.02	6,366.09	5.75	31,623.94	8,160.87	6.20	37,217.32	9,604.30	9.27	174,529.80	42,057.89	3.60	4.51	268,040.08	66,189.14	521.21	7.11	7.15
10/12/21 14:30	24,156.16	6,233.74	5.94	30,852.88	7,961.89	6.32	35,974.19	9,283.50	9.38	174,171.20	41,971.47	3.74	4.56	265,154.44	65,450.60	515.39	7.08	7.10
10/12/21 14:31	25,799.90	6,657.92	6.36	31,666.86	8,171.95	6.55	36,904.04	9,523.45	9.58	173,848.30	41,893.66	4.02	4.80	268,219.10	66,246.98	521.66	7.18	7.06
10/12/21 14:31	26,466.43	6,829.92	6.40	32,077.42	8,277.90	6.66	37,388.98	9,648.60	9.44	173,694.20	41,856.53	4.22	5.03	269,627.03	66,612.94	524.54	7.47	7.77
10/12/21 14:32	26,152.75	6,748.98	6.20	32,447.93	8,373.51	6.56	38,205.82	9,859.39	9.42	173,654.30	41,846.91	4.21	5.11	270,460.80	66,828.79	526.24	7.63	7.19
10/12/21 14:32	25,857.12	6,672.69	6.02	32,302.02	8,335.86	6.39	37,577.82	9,697.33	9.32	174,153.41	41,967.18	3.98	5.00	269,890.37	66,673.06	525.02	7.55	7.15
10/12/21 14:33	24,284.02	6,266.73	6.04	32,227.63	8,316.66	6.32	37,280.27	9,620.54	9.47	174,570.59	42,067.72	3.91	4.91	268,362.51	66,271.65	521.86	7.40	7.10
10/12/21 14:33	24,118.66	6,224.06	6.14	31,665.42	8,171.58	6.31	36,925.49	9,528.99	9.67	174,602.00	42,075.29	3.82	4.78	267,311.57	65,999.91	519.72	7.35	7.06
10/12/21 14:34	23,413.37	6,042.05	6.25	31,230.54	8,059.35	6.43	36,626.51	9,451.83	9.82	174,736.00	42,107.58	3.65	4.56	266,006.42	65,660.81	517.05	7.35	7.14
10/12/21 14:34	25,449.43	6,567.48	6.37	32,259.10	8,324.78	6.58	38,205.82	9,859.39	9.97	175,353.20	42,256.31	3.34	4.24	271,267.55	67,007.96	527.65	7.30	7.04
10/12/21 14:35	25,001.06	6,451.77	6.21	32,263.39	8,325.89	6.59	38,665.02	9,977.89	9.83	175,922.00	42,393.38	3.16	4.06	271,851.47	67,148.93	528.76	7.21	7.02
10/12/21 14:35	24,727.34	6,381.14	5.90	32,100.30	8,283.80	6.52	40,091.27	10,345.95	9.82	176,262.91	42,475.53	3.27	4.15	273,181.82	67,486.41	531.42	7.12	7.02
10/12/21 14:36	23,711.42	6,118.97	5.64	30,993.08	7,998.07	6.52	39,087.03	10,086.80	9.76	176,546.91	42,543.97	3.54	4.38	270,338.44	66,747.80	525.61	7.11	7.02
10/12/21 14:36	23,245.30	5,998.68	5.59	30,203.42	7,794.29	6.71	39,524.77	10,199.76	9.88	176,562.50	42,547.72	3.71	4.56	269,535.99	66,540.46	523.97	7.16	7.02
10/12/21 14:37	22,717.04	5,862.36	5.69	28,937.40	7,467.58	7.13	38,511.96	9,938.39	10.00	176,508.50	42,534.71	3.79	4.63	266,674.90	65,803.04	518.17	7.26	6.96
10/12/21 14:37	23,120.12	5,966.38	5.94	27,707.14	7,150.10	7.63	38,790.91	10,010.38	10.11	176,126.59	42,442.68	3.77	4.62	265,744.76	65,569.54	516.33	7.30	6.98
10/12/21 14:38	25,783.45	6,653.67	6.08	28,305.10	7,304.41	8.07	40,344.47	10,411.29	10.13	175,769.09	42,356.53	3.63	4.55	270,202.11	66,725.91	525.43	7.43	6.99
10/12/21 14:38	25,123.88	6,483.47	5.89	27,298.01	7,044.52	8.33	41,395.91	10,682.63	9.91	175,526.59	42,298.09	3.57	4.43	269,344.39	66,508.71	523.72	7.48	7.00
10/12/21 14:39	26,487.58	6,835.38	4.18	26,877.43	6,935.99	8.57	41,292.91	10,656.05	9.86	175,431.70	42,275.23	3.54	4.37	270,089.62	66,702.64	525.25	7.43	7.02
10/12/21 14:39	25,083.14	6,472.95	5.61	25,196.55	6,502.22	8.85	40,670.63	10,495.46	9.70	176,032.80	42,420.08	3.58	4.39	266,983.12	65,890.71	518.86	7.38	7.00
10/12/21 14:40	25,569.51	6,598.47	5.59	24,436.94	6,306.19	9.15	40,284.39	10,395.79	9.73	176,536.50	42,541.46	3.69	4.49	266,827.34	65,841.91	518.47	7.52	6.96
10/12/21 14:40	25,908.36	6,685.91	5.67	23,414.11	6,042.24	9.47	40,869.47	10,546.77	9.56	176,581.20	42,552.23	3.86	4.68	266,773.14	65,827.15	518.36	7.57	6.93
10/12/21 14:41	26,987.11	6,964.29	5.65	23,886.19	6,164.07	9.79	41,038.27	10,590.33	9.55	176,665.70	42,572.59	3.94	4.79	268,577.27	66,291.29	522.01	7.68	6.89
10/12/21 14:41	29,002.06	7,484.27	5.76	22,994.96	5,934.08	10.12	42,194.15	10,888.62	9.34	176,937.41	42,638.07	3.84	4.74	271,128.58	66,945.03	527.16	7.71	6.85
10/12/21 14:42	29,545.26	7,624.45	5.70	22,664.51	5,848.80	10.45	41,970.99	10,831.03	9.16	177,094.59	42,675.95	3.77	4.67	271,275.35	66,980.23	527.44	7.71	7.17
10/12/21 14:42	29,860.08	7,705.69	5.67	21,050.87	5,432.39	10.74	41,318.66	10,662.69	8.94	176,712.00	42,583.75	3.87	4.79	268,941.61	66,384.52	522.74	7.65	7.04
10/12/21 14:43	27,913.15	7,203.27	5.62	20,136.76	5,196.49	10.91	40,437.45	10,435.28	8.89	176,418.50	42,513.02	3.85	4.76	264,905.86	65,348.06	514.58	7.75	6.92
10/12/21 14:43	28,081.99	7,246.84	5.70	19,802.01	5,110.11	11.09	40,866.61	10,546.03	9.07	176,544.91	42,543.48	3.56	4.48	265,295.52	65,446.46	515.36	7.69	6.91
10/12/21 14:44	27,889.43	7,197.14	5.71	20,221.16	5,218.27	11.30	40,755.03	10,517.24	9.21	176,603.59	42,557.63	3.20	4.11	265,469.21	65,490.28	515.70	7.57	6.91
10/12/21 14:44	29,080.76	7,504.58	5.77	20,342.76	5,249.65	11.59	42,199.87	10,890.10	9.40	176,342.80	42,494.78	2.96	4.02	267,966.19	66,139.10	520.81	7.45	7.27
10/12/21 14:45	29,661.02	7,654.32	5.74	20,724.71	5,348.22	11.89	42,490.27	10,965.04	9.40	176,107.80	42,438.15	2.99	4.08	268,983.80	66,405.72	522.91	7.48	7.16
10/12/21 14:45	29,392.14	7,584.93	5.78	20,162.51	5,203.14	12.15	42,739.18	11,029.27	9.54	175,994.59	42,410.87	3.22	4.36	268,288.42	66,228.21	521.51	7.53	7.11
10/12/21 14:46	29,023.77	7,489.87	5.77	19,643.22	5,069.13	12.37	41,820.78	10,792.27	9.45	175,916.00	42,391.93	3.60	4.74	266,403.77	65,743.20	517.69	7.75	7.06
10/12/21 14:46	27,886.39	7,196.36	5.98	19,205.48	4,956.16	12.51	40,816.55	10,533.12	9.53	175,999.91	42,412.15	3.89	4.95	263,908.33	65,097.79	512.61	7.93	7.01
10/12/21 14:47	28,055.86	7,240.09	6.01	19,590.29	5,055.47	12.48	40,765.05	10,519.83	9.50	176,008.59	42,414.24	3.92	4.94	264,419.79	65,229.63	513.65	8.09	7.16
10/12/21 14:47	27,094.07	6,991.89	6.14	18,544.57	4,785.61	12.53	39,853.80	10,284.67	9.51	175,662.70	42,330.89	3.88	4.79	261,155.14	64,393.06	507.06	8.11	6.92

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 14:48	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 August 19, 2024

Logsheet: Barn Fill Tuesday, 10-12-2021

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

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	
3	100%	16203	94965	10/7/21	4.9%	189,800	7:50AM	8:55AM	
4	100%	16334	94965	10/7/21	4.9%	188,500	8:55AM	10:00AM	
5	75%	16472	94965	10/7/21	4.9%	136,425	10:00AM	10:50AM	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

Oldside

Spot	Run	Car	Weighbill	Date1	Ash	Weight	Start Time	Stop Time	Topped
1	100%	16339	94966	10/7/21	4.9%	182,800	5:45AM	6:50AM	
2	75%	16319	94966	10/7/21	4.9%	133,950	6:50AM	7:30AM	x
5	25%	16472	94965	10/7/21	4.9%	45,475	1:40PM	2:00PM	
6	75%	16337	94965	10/7/21	4.9%	138,075	2:00PM	2:45PM	x

Stockpile

Spot	Run	Car	Weighbill	Date1	Ash	Weight	Start Time	Stop Time	Topped

No barn fill stockpiles found

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

Spot	Left	Car
1	mt	16326
2	mt	62032
3	mt	16411
4	mt	16416
5	mt	62017
6	mt	62055
7	mt	61998
8	75%	62038
9		
10		

Today Barn Spot

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

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

Operators

Operator
Ken

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

Created on Oct. 11 at 12:53 AM (AKDT). Owned by Dunkle, Bruce.

SGS

Analysis Report

November 19, 2021

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

Client Sample ID:	AE101221B1 - 12PM	**Sample ID By :**	Usibelli Coal Co.
Date Received:	11/12/2021	**Sample Taken At :**	Usibelli Coal Mine
Matrix:	Coal	**Sample Taken By :**	Usibelli Coal Co.
		Sample Type :	-4 mesh

SGS Minerals Sample ID: 072-123129-001

		As Received	**Dry**	**MAF**
% 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	

Tests	**Result**	**Unit**	**Method**
Pounds of Ash/mm Btu	6.96	lb	
Pounds of Sulfur/mm Btu	0.18	lb	
Pounds of SO2/mm Btu	0.36	lb	

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Analysis Report

November 15, 2021

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

		As Received	Dry	MAF
% 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	

Tests	Result	Unit	Method
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 SO2/mm Btu	0.33	lb	

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November 15, 2021

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

Client Sample ID:	AE101221B1- 2PM	**Sample ID By :**	Usibelli Coal Co.
Date Received:	11/08/2021	**Sample Taken At :**	Usibelli Coal Mine
Matrix:	Coal	**Sample Taken By :**	Usibelli Coal Co.
		Sample Type :	-4 mesh

SGS Minerals Sample ID: 072-123049-001

		As Received	Dry	MAF
% 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	

Tests	Result	Unit	Method
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 SO2/mm Btu	0.33	lb	

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Analysis Report

November 23, 2021

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

Client Sample ID:	AE101221B2-12PM	**Sample ID By :**	Usibelli Coal Co.
Date Received:	11/18/2021	**Sample Taken At :**	Usibelli Coal Mine
Matrix:	Coal	**Sample Taken By :**	Usibelli Coal Co.
		Sample Type :	-4 mesh

SGS Minerals Sample ID: 072-123222-001

		As Received	Dry	MAF
% 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	

Tests	Result	Unit	Method
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 SO2/mm Btu	0.33	lb	

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Analysis Report

November 30, 2021

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

Client Sample ID:	AE101221B2-1PM	**Sample ID By :**	Usibelli Coal Co.
Date Received:	11/19/2021	**Sample Taken At :**	Usibelli Coal Mine
Matrix:	Coal	**Sample Taken By :**	Usibelli Coal Co.
		Sample Type :	-4 mesh

SGS Minerals Sample ID: 072-123240-001

		As Received	Dry	MAF
% 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	

Tests	Result	Unit	Method
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

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

Client Sample ID:	AE101221B2-2PM	**Sample ID By :**	Usibelli Coal Co.
Date Received:	11/19/2021	**Sample Taken At :**	Usibelli Coal Mine
Matrix:	Coal	**Sample Taken By :**	Usibelli Coal Co.
		Sample Type :	-4 mesh

SGS Minerals Sample ID: 072-123240-002

		As Received	Dry	MAF
% 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	

Tests	Result	Unit	Method
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 SO2/mm Btu	0.32	lb	

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Analysis Report

November 19, 2021

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

Client Sample ID:	AE101221B3 - 12PM	**Sample ID By :**	Usibelli Coal Co.
Date Received:	11/12/2021	**Sample Taken At :**	Usibelli Coal Mine
Matrix:	Coal	**Sample Taken By :**	Usibelli Coal Co.
		Sample Type :	-4 mesh

SGS Minerals Sample ID: 072-123129-002

		As Received	Dry	MAF
% 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	

Tests	Result	Unit	Method
Pounds of Ash/mm Btu	5.55	lb	
Pounds of Sulfur/mm Btu	0.16	lb	
Pounds of SO2/mm Btu	0.32	lb	

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Analysis Report

November 23, 2021

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

Client Sample ID:	AE101221B3-1PM	**Sample ID By :**	Usibelli Coal Co.
Date Received:	11/18/2021	**Sample Taken At :**	Usibelli Coal Mine
Matrix:	Coal	**Sample Taken By :**	Usibelli Coal Co.
		Sample Type :	-4 mesh

SGS Minerals Sample ID: 072-123222-002

		As Received	Dry	MAF
% 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	Result	Unit	Method
Density, Bulk	44.2	lbs/ft^3	SGS Method
Pounds of Ash/mm Btu	5.40	lb	
Pounds of Sulfur/mm Btu	0.27	lb	
Pounds of SO2/mm Btu	0.55	lb	

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Analysis Report

November 15, 2021

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

Client Sample ID:	AE101221B3 - 2PM	**Sample ID By :**	Usibelli Coal Co.
Date Received:	11/08/2021	**Sample Taken At :**	Usibelli Coal Mine
Matrix:	Coal	**Sample Taken By :**	Usibelli Coal Co.
		Sample Type :	-4 mesh

SGS Minerals Sample ID: 072-123049-003

		As Received	Dry	MAF
% 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	Result	Unit	Method
Density, Bulk	42.2	lbs/ft^3	SGS Method
Pounds of Ash/mm Btu	5.20	lb	
Pounds of Sulfur/mm Btu	0.16	lb	
Pounds of SO2/mm Btu	0.32	lb	

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Analysis Report

November 23, 2021

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

Client Sample ID:	AE101221B5-12PM	**Sample ID By :**	Usibelli Coal Co.
Date Received:	11/18/2021	**Sample Taken At :**	Usibelli Coal Mine
Matrix:	Coal	**Sample Taken By :**	Usibelli Coal Co.
		Sample Type :	-4 mesh

SGS Minerals Sample ID: 072-123222-003

		As Received	Dry	MAF
% 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	

Tests	Result	Unit	Method
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 SO2/mm Btu	0.34	lb	

Byron C. Caton

Byron C. Caton, Branch Manager

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Analysis Report

November 15, 2021

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

Client Sample ID:	AE101221B51PM	**Sample ID By :**	Usibelli Coal Co.
Date Received:	11/08/2021	**Sample Taken At :**	Usibelli Coal Mine
Matrix:	Coal	**Sample Taken By :**	Usibelli Coal Co.
		Sample Type :	-4 mesh

SGS Minerals Sample ID: 072-123048-001

		As Received	Dry	MAF
% 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	

Tests	Result	Unit	Method
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 SO2/mm Btu	0.34	lb	

Byron C. Caton
Byron C. Caton, Branch Manager

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Analysis Report

November 15, 2021

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

Client Sample ID:	AE101221B52PM	**Sample ID By :**	Usibelli Coal Co.
Date Received:	11/08/2021	**Sample Taken At :**	Usibelli Coal Mine
Matrix:	Coal	**Sample Taken By :**	Usibelli Coal Co.
		Sample Type :	-4 mesh

SGS Minerals Sample ID: 072-123048-002

		As Received	Dry	MAF
% 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	

Tests	Result	Unit	Method
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 SO2/mm Btu	0.33	lb	

Byron C. Caton, Branch Manager

SGS North America Inc. | Minerals Services Division
4665 Paris St Suite B-200 Denver CO 80239 t (303) 373-4772 f (303) 373-4791 www.sgs.com/minerals

Member of SGS Group

Appendix E

Quality Assurance Data

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
11711 S. Alameda Street
Los Angeles, CA 90059
Airgas.com

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	+/- 0.8% NIST Traceable	10/16/2020, 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

Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
11711 S. Alameda Street
Los Angeles, CA 90059
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0262	Reference Number:	48-401394066-1
Cylinder Number:	CC84450	Cylinder Volume:	144.4 CF
Laboratory:	124 - Los Angeles (SAP) - CA	Cylinder Pressure:	2015 PSIG
PGVP Number:	B32019	Valve Outlet:	660
Gas Code:	SO2,BALN	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

Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
[illegible] Alameda Street
Los Angeles, CA 90059
Airgas.com

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

AIR LIQUIDE

AIR LIQUIDE

Certificate of Accuracy

AIR LIQUIDE AMERICA LP

PO NO. 45964

CAS REG. COMPONENT NO.	COMPONENT	CERTIFIED ANALYSIS
124-38-9	CARBON DIOXIDE	13.9 %
7782-44-7	OXYGEN	4.11 %
7727-37-9	NITROGEN	BALANCE

LOT NUMBER 8222 — Sales Order # 52016
ANALYSIS DATE 21SEP2015 — ANALYST David Connolly
Cylinder # ALM003704
Expires 22SEP2023 — ITEM NO.14% CO2/4% O2
EPA Protocol Gas

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
11711 S. Alameda Street
Los Angeles, CA 90059
Airgas.com

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

a. Vargas

Approved for Release

QA

CO_2 linearity 10/17/21

Analyzer Resp.	CAL gas	AST #
13.90 %	13.9%	AZM003704 (18)
7.1 %	7.05%	CC189851 (25)
0	0	CC66258 (6)

[signature] 10/17/21

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

Quality - Service - Reliability

ENVIRONMENTAL SUPPLY COMPANY

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 29.88	FINAL 29.88	AVG (P_{bar}) 29.88
METER PART #:		CRITICAL ORIFICE SET SERIAL #:			

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS FINAL	DGM READINGS NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	$\Delta H_@$
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

AVERAGE $\Delta H_@$ = 2.1666

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

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

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

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

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

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

critical orifice august 25 2021 M1.xls

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

Quality - Service - Reliability

ENVIRONMENTAL SUPPLY COMPANY

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
METER PART #:		CRITICAL ORIFICE SET SERIAL #:		AVG (P_{bar})	29.82	

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	FINAL	NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	$\Delta H_@$
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

AVERAGE $\Delta H_@$ = 2.1958

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

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

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

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

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

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

critical orifice october 17 2021 M1.xls

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	SO_2
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 (SO_2) 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.

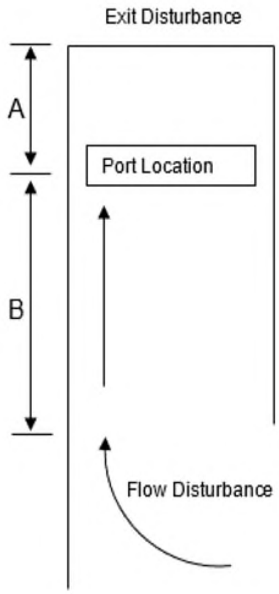
The SO_2 testing program will be performed in accordance with the *Code of Federal Regulations Title 40 Part 60* (40 CFR 60), Methods 1, 2, 3A, 4, 6C, and 19. The boilers will be operated at the maximum achievable site load.

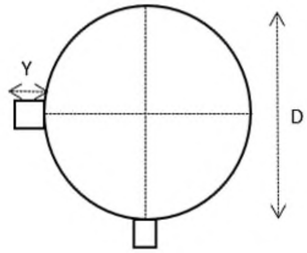
2. SOURCE DESCRIPTIONS

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





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

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

3. SOURCE TEST DESCRIPTION

3.1. Test Objectives

For boilers 1,2, 3, and 5 measure, SO_2, O_2, and CO_2 in the combined stack with the units operating at maximum achievable site load. SO_2 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

SO_2, O_2, and CO_2 concentrations will be measured according to Methods 6C, and 3A on a dry basis. Sample gas will be extracted though 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.

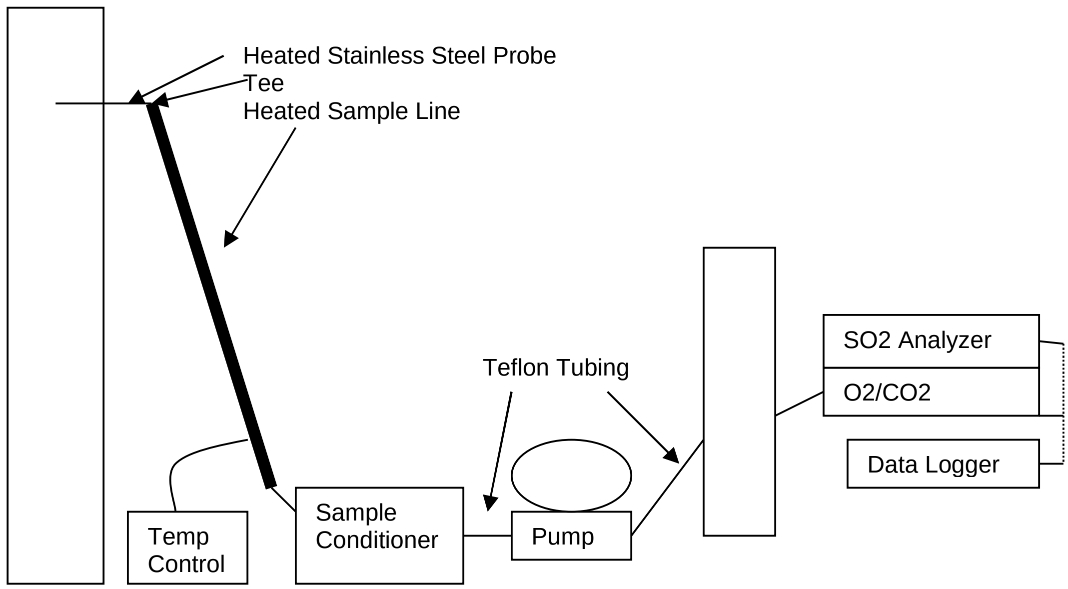
Stack moisture will be measured using a second dedicated probe. Stack gas will be drawn through the probe then into through an impinger train in accordance with Method 4. For each boiler and the combined stack, three moisture runs will be performed.

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 SO_2 will be set at approximately 500 ppmv; a mid-range gas of 250 ppmv will be used.

For diluent O_2 calibration gases, the high-range gas will be purified air at 20.9 percent O_2. A gas concentration between 8 and 12 percent O_2 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



Drawing Not to Scale

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" H_2O) 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. O_2/CO_2 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 SO_2 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 SO_2 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.

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

FLAKT BAGHOUSE INSTALLATION
11 SECTION HP-266-14 COLLECTOR

Projects GS

CUSTOMER ORDER NO.:
86-24047

FLAKT, INC. JOB NO.:
615

OPERATION AND MAINTENANCE MANUAL

March 31, 1987

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.

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 disphragm 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.

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.

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.

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.

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

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

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October 28, 2015

Mr. Michael Schmetzer
AURORA ENERGY
1206 First Avenue
Fairbanks, AK 99701-4659

Re: Chena PJFF Inlet Ductwork Flow Modeling – Initial Design Results (ASC Document L-15-AUR-02)

Dear Mr. Schmetzer:

Airflow Sciences Corporation (ASC) has completed an initial design analysis of the Chena PJFF inlet ductwork flow model in an effort to improve the pressure balance and flow distribution between the four separate duct trains. Baseline model results (previously submitted as L-15-AUR-01 on 14 October 2015) indicated that the existing turning vanes upstream of the PJFF are not optimized for flow uniformity, leading to flow separation and significant pressure fluctuations. This is particularly apparent at the junction between the Boiler1/2 and Boiler 3 trains and at the elbow just downstream of the Boiler 5 fan outlet. For this current analysis, ASC has focused on improving the flow issues by modifying the turning vane design and also considering minor changes to the duct geometry.

Model Details

Details of the model geometry and operating conditions are summarized below for reference:

- The model represents the full-scale three-dimensional geometry starting at the outlets of each of Boilers 1, 2, 3, and 5 and ending at the PJFF inlet plenum. The ductwork geometry was defined via 2D CAD drawings provided by Aurora and augmented by field measurements by Craig Rood of ASC. Internal details of the PJFF inlet were not available, so a typical inlet plenum geometry was assumed. A pressure loss of 5 IWC was applied at the model outlet to represent the dP of the PJFF bags.
- A single operating condition was simulated.
- Operating conditions were obtained by ASC during the field inspection prior to the start of the modeling:
    - Boiler 1: 93,700 lb/hr
    - Boiler 2: 91,200 lb/hr
    - Boiler 3: 96,350 lb/hr
    - Boiler 5: 350,150 lb/hr
- A model density of 0.048 lb/ft^3 was assumed based on the average of the test data

CFD Model Results

Results for the design simulation are presented in the attached figures. A set of schematics is included detailing the design features as modeled. Following the schematics, Figures 1 – 12 detail the velocity patterns in the ductwork. These figures can be compared to the plots in the baseline model report. The most striking differences are observed in Figures 7 and 8.

Figure 7 shows the junction of the combined Boilers 1 & 2 flow (upper duct) with the Boiler 3 flow (lower left duct). In the baseline model, the Boiler 1/2 flow essentially crowded out the Boiler 3 flow and traveled through the inside half of the first elbow following the junction, bypassing the outer half of the corner. To establish better control over the competing flow streams in this region, a divider plate was added underneath the Boiler 1/2 duct opening, positioned to maintain the correct 2:1 ratio between the two flow streams. Additionally, new turning vanes were added to improve the distribution as the flows merge into the downward vertical duct and continue to the PJFF inlet. With these changes, the flow through the vertical duct and into the horizontal PJFF inlet duct is much more uniform compared to the baseline. Dimensioned drawings of the divider plate and vanes in this duct are shown in D-AUR-1-001 and -002 in this report.

For the Boiler 5 flow, the primary area of improvement is the first elbow after the boiler exhaust, where flow turns from vertical to horizontal. In the existing configuration, the duct inside wall meets at a sharp corner, then immediately expands downward as the duct height increases to 6'-0” in the horizontal duct. As Figure 8 of the baseline model results shows, this geometry combined with the lack of a trailing edge on the innermost turning vane creates a very large flow separation off of the inside corner. This significant velocity gradient persists all the way to the PJFF inlet, and is a probable cause of the pressure fluctuations observed in the field. Design changes to address this include a re-design of the turning vanes in the elbows from the Boiler 5 exhaust to the PJFF inlet. Additionally, ASC recommends a modification to the external duct geometry at the inside corner of the first elbow, shown in D-AUR-1-003. By removing the existing corner which requires the flow to turn more than 90 degrees, and adding a radius and flat floor as shown, the flow separation in the baseline model is almost completely eliminated.

The pressure losses in the ductwork are summarized in Table 1 below:

Location	Parameter	Baseline	Design 1
Blr 1 Exhaust to PJFF Inlet	Total Pressure Loss	0.56 IWC	0.43 IWC
Blr 1 Exhaust Plane	Static Pressure (Relative to -1 IWC static at PJFF Inlet)	0.05 IWC	-0.12 IWC
Blr 2 Exhaust to PJFF Inlet	Total Pressure Loss	0.55 IWC	0.42 IWC
Blr 2 Exhaust Plane	Static Pressure (Relative to -1 IWC static at PJFF Inlet)	0.06 IWC	-0.11 IWC
Blr 3 Exhaust to PJFF Inlet	Total Pressure Loss	0.11 IWC	0.26 IWC
Blr 3 Exhaust Plane	Static Pressure (Relative to -1 IWC static at PJFF Inlet)	-0.40 IWC	-0.29 IWC
Blr 5 Exhaust to PJFF Inlet	Total Pressure Loss	1.21 IWC	0.89 IWC
Blr 5 Exhaust Plane	Static Pressure (Relative to -1 IWC static at PJFF Inlet)	0.04 IWC	-0.33 IWC

Table 1. CFD Model Results Summary

As the table shows, in the baseline model the pressure loss through the Boiler 5 exhaust ductwork is significantly higher compared to the other three boilers. Also, while the static pressures at the Boiler 1 and 2 outlets are roughly equivalent, the Boiler 3 outlet static pressure is about 0.4 IWC lower. In the design results, the pressure loss through the Boiler 3 duct is increased slightly due to the added divider plate; however, the overall balance between Boilers 1 – 3 is much closer, with a difference of less than 0.2 IWC. The pressure loss in the Boiler 5 duct is still high compared to the others but has decreased by 0.3 IWC compared to the baseline.

Conclusions

CFD model results for an initial set of design recommendations were presented. The design results are encouraging, showing a significant improvement in the velocity distributions in the various boiler duct trains and in the pressure loss through each duct. The results show that there is still an imbalance between the measured pressures at each of the boiler exhaust planes which may contribute to instability in the ductwork. ASC would like to discuss options for control strategies of the various system fans to achieve further improvement in the pressure balance for these ducts.

Please review these results at your earliest convenience and let us know if you have any questions or concerns.

Best regards,

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734-525-0300 x208

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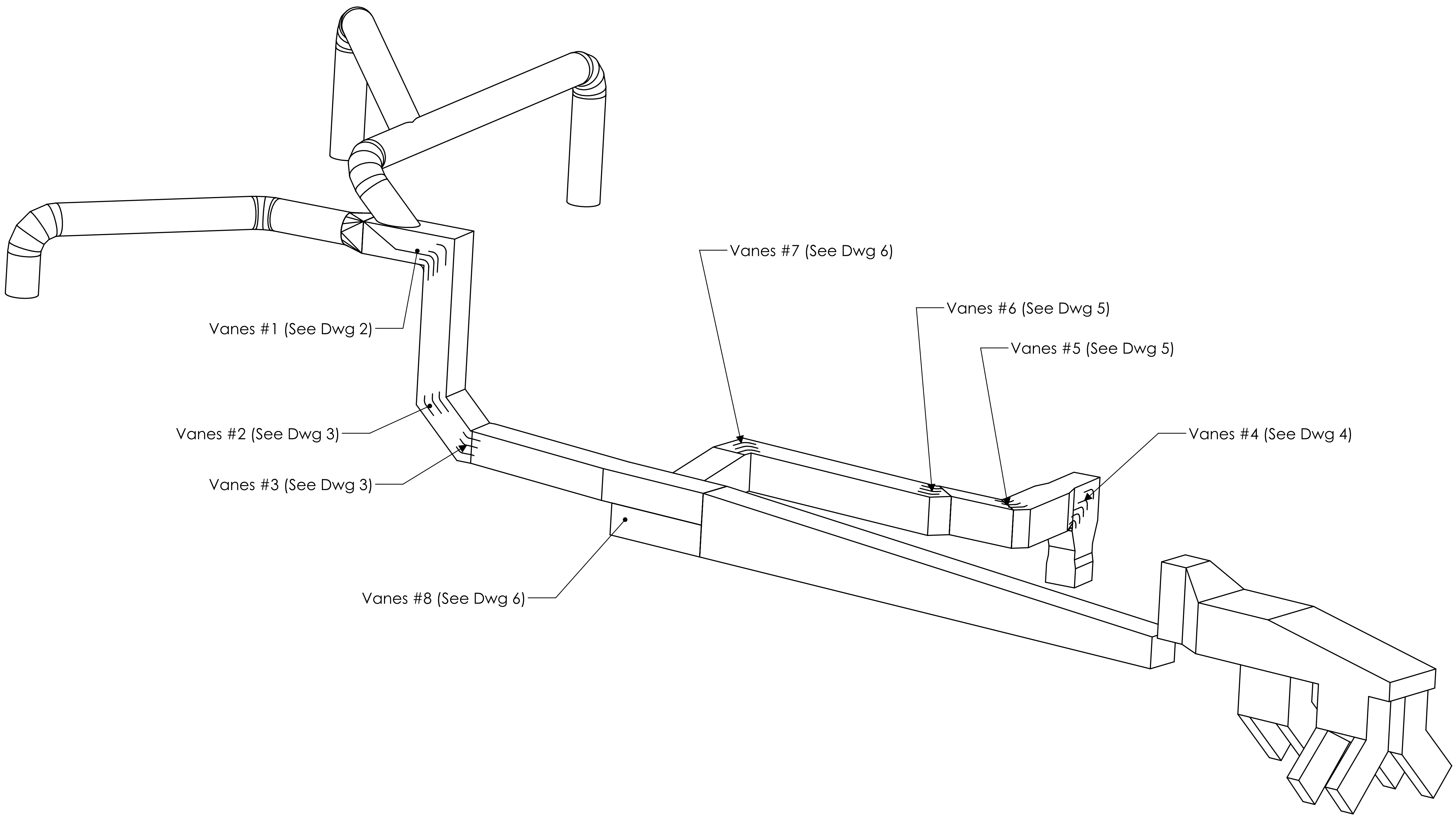


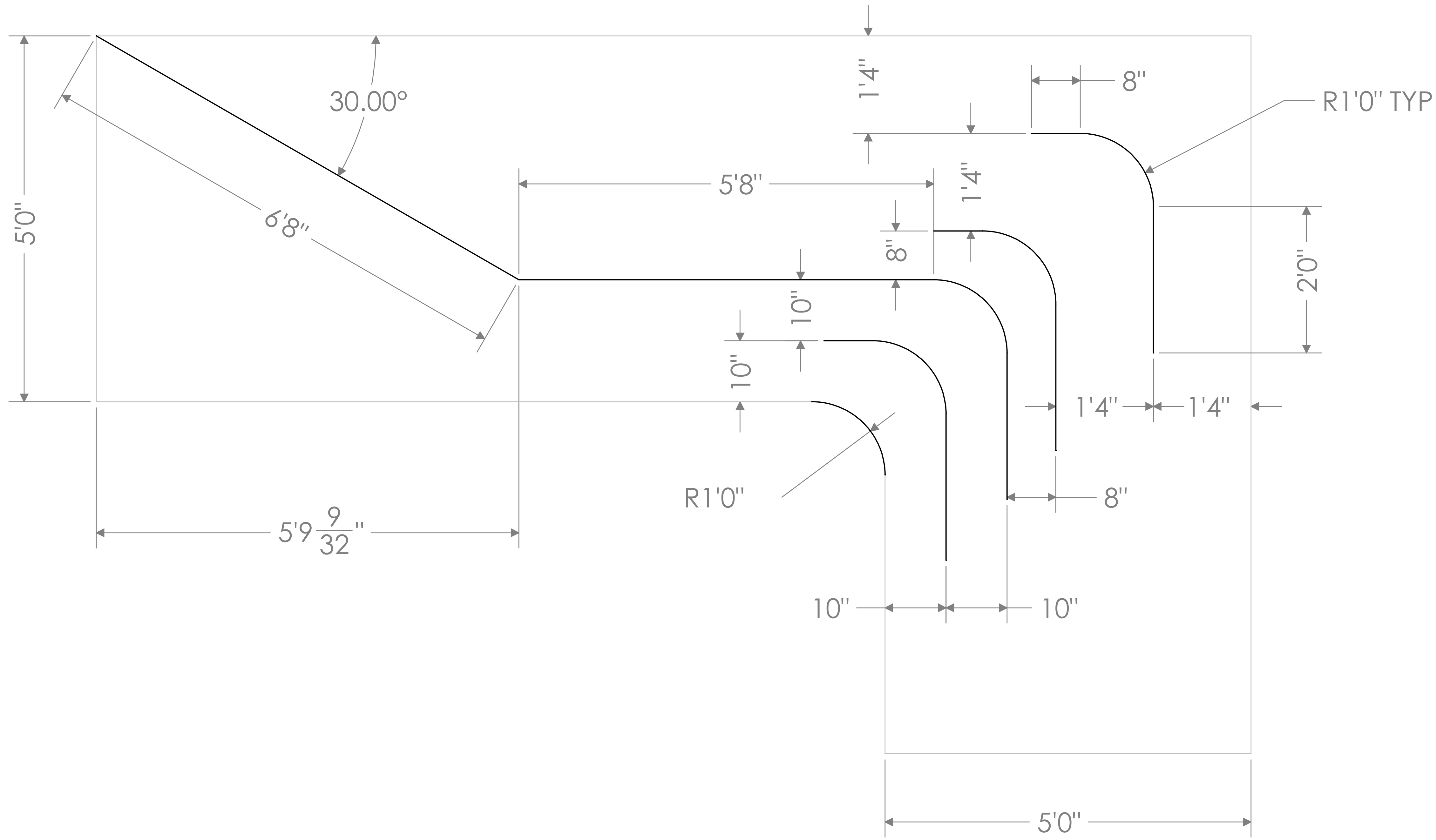
Rev No.	Date	Description	Name
0	27Oct2015	Initial Issue	JDE

Airflow Sciences Corporation

TITLE:
AURORA ENERGY - CHENA PLANT
PJFF INLET DUCTWORK MODELING
ASC DESIGN 1 FLOW CONTROL DEVICES
GENERAL ARRANGEMENT - OVERVIEW

DWG. NO. D-AUR-1-GA — REV 0

DATE: 27 October 2015



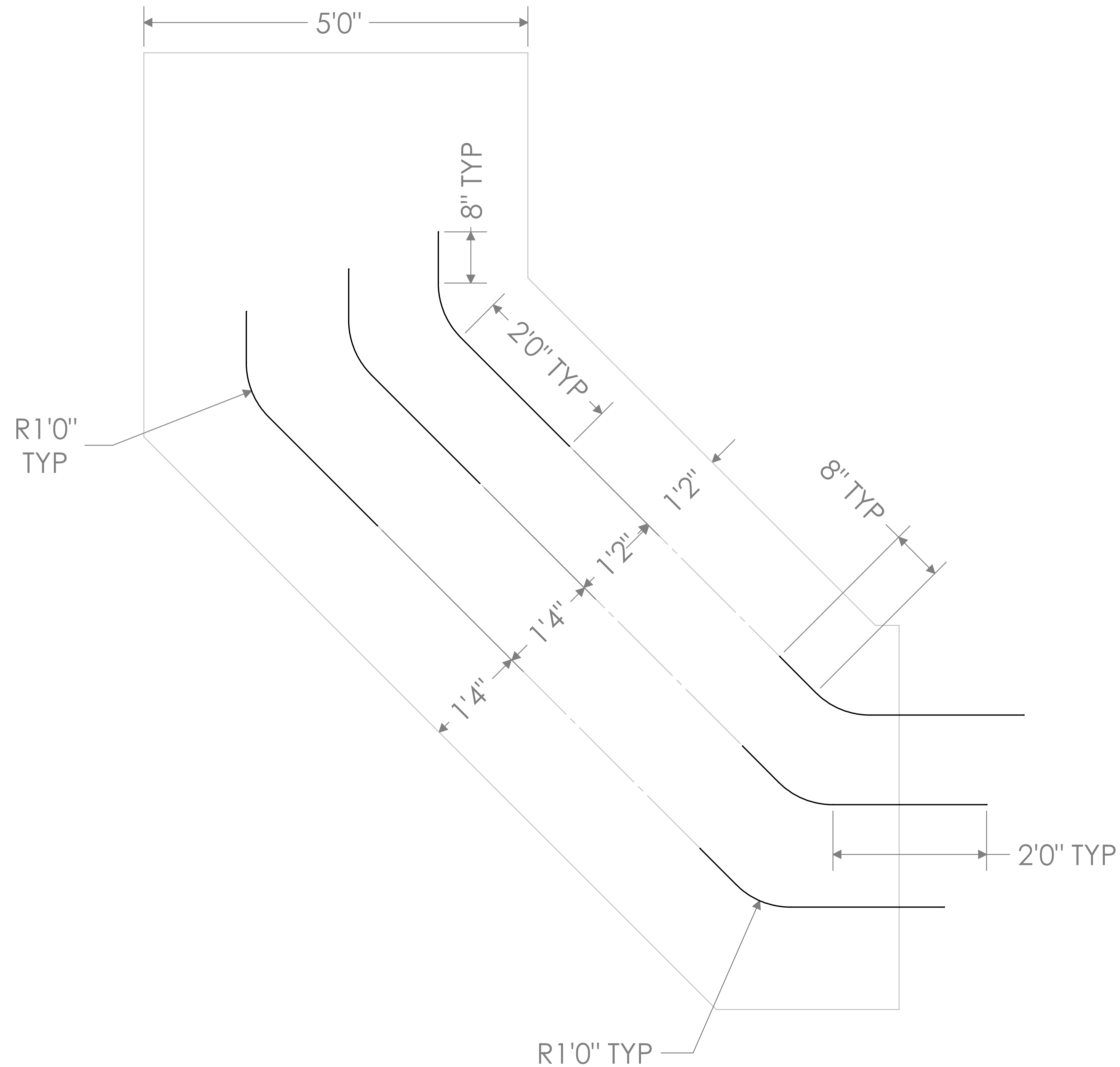
0	27Oct2015	Initial Issue	JDE
Rev No.	Date	Description	Name

Airflow Sciences Corporation

TITLE:
AURORA ENERGY - CHENA PLANT
PJFF INLET DUCTWORK MODELING
ASC DESIGN 1 FLOW CONTROL DEVICES
TURNING VANES #1 / DUCT DIVIDER

DWG. NO. D-AUR-1-001 REV 0

DATE: 27 October 2015



Rev No.	Date	Description	Name
0	27Oct2015	Initial Issue	JDE

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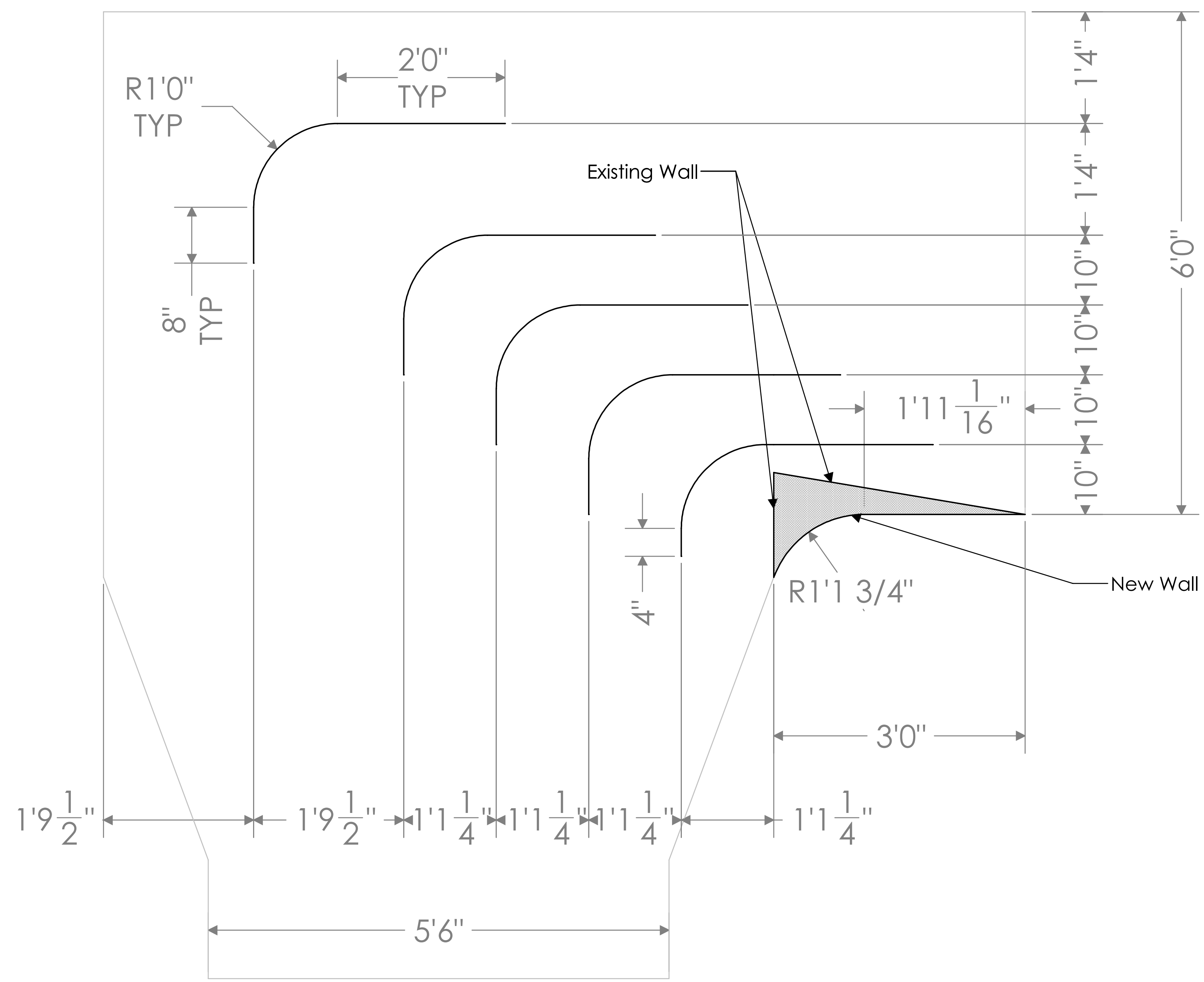
TITLE:
AURORA ENERGY - CHENA PLANT
PJFF INLET DUCTWORK MODELING
ASC DESIGN 1 FLOW CONTROL DEVICES
TURNING VANES #2 / TURNING VANES #3

DWG. NO. D-AUR-1-002 REV 0

DATE: 27 October 2015



Rev No.	Date	Description	Name
0	27Oct2015	Initial Issue	JDE

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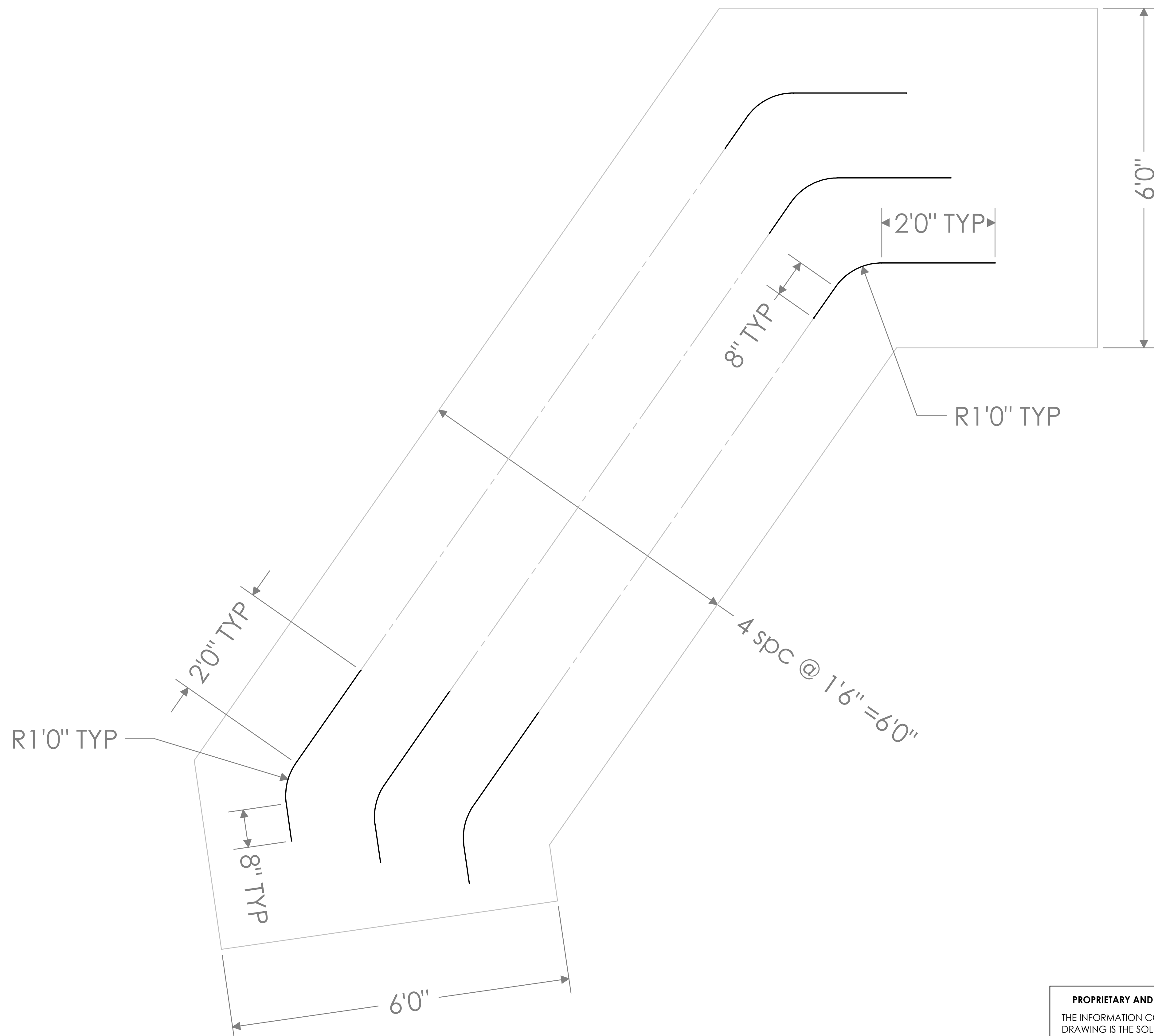
TITLE:
AURORA ENERGY - CHENA PLANT
PJFF INLET DUCTWORK MODELING
ASC DESIGN 1 FLOW CONTROL DEVICES
TURNING VANES #4 / MODIFIED INSIDE CORNER

DWG. NO. D-AUR-1-003 REV 0

DATE: 27 October 2015



Rev No.	Date	Description	Name
0	27Oct2015	Initial Issue	JDE

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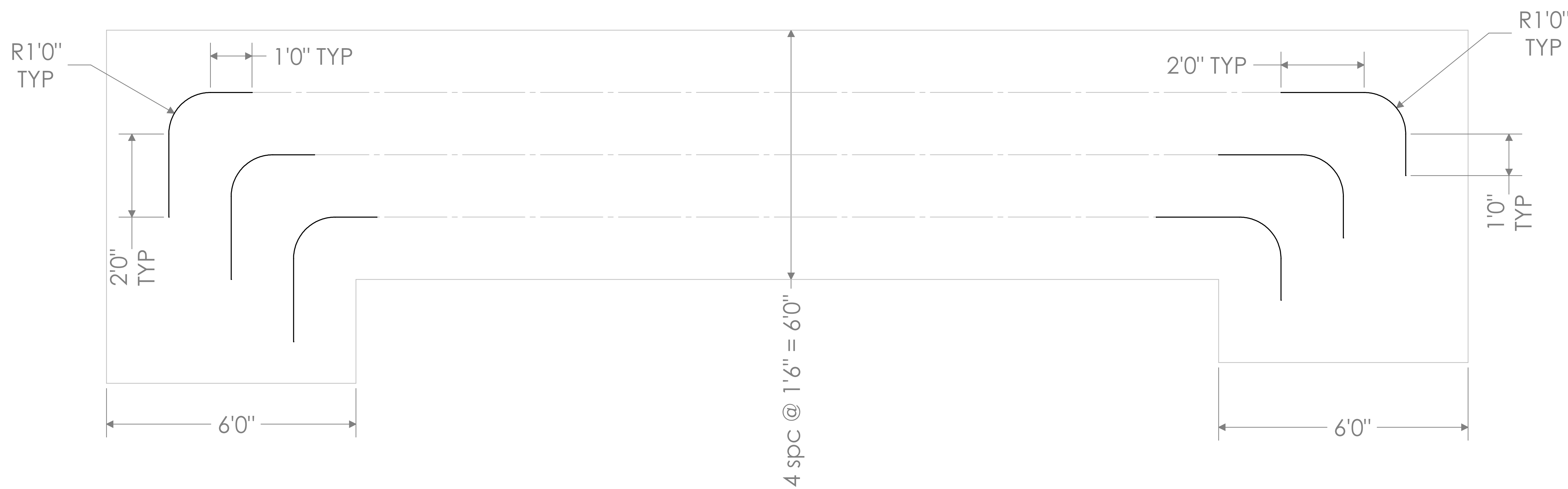
TITLE:
AURORA ENERGY - CHENA PLANT
PJFF INLET DUCTWORK MODELING
ASC DESIGN 1 FLOW CONTROL DEVICES
TURNING VANES #5 / TURNING VANES #6

DWG. NO. D-AUR-1-004 REV 0
DATE: 27 October 2015



Rev No.	Date	Description	Name
0	27Oct2015	Initial Issue	JDE

Airflow Sciences Corporation

TITLE: AURORA ENERGY - CHENA PLANT
PJFF INLET DUCTWORK MODELING
ASC DESIGN 1 FLOW CONTROL DEVICES
TURNING VANES #7 / TURNING VANES #8

DWG. NO. D-AUR-1-005 REV 0

DATE: 27 October 2015

Design 1 Results - Velocity

Isometric View - Various Cutting Planes

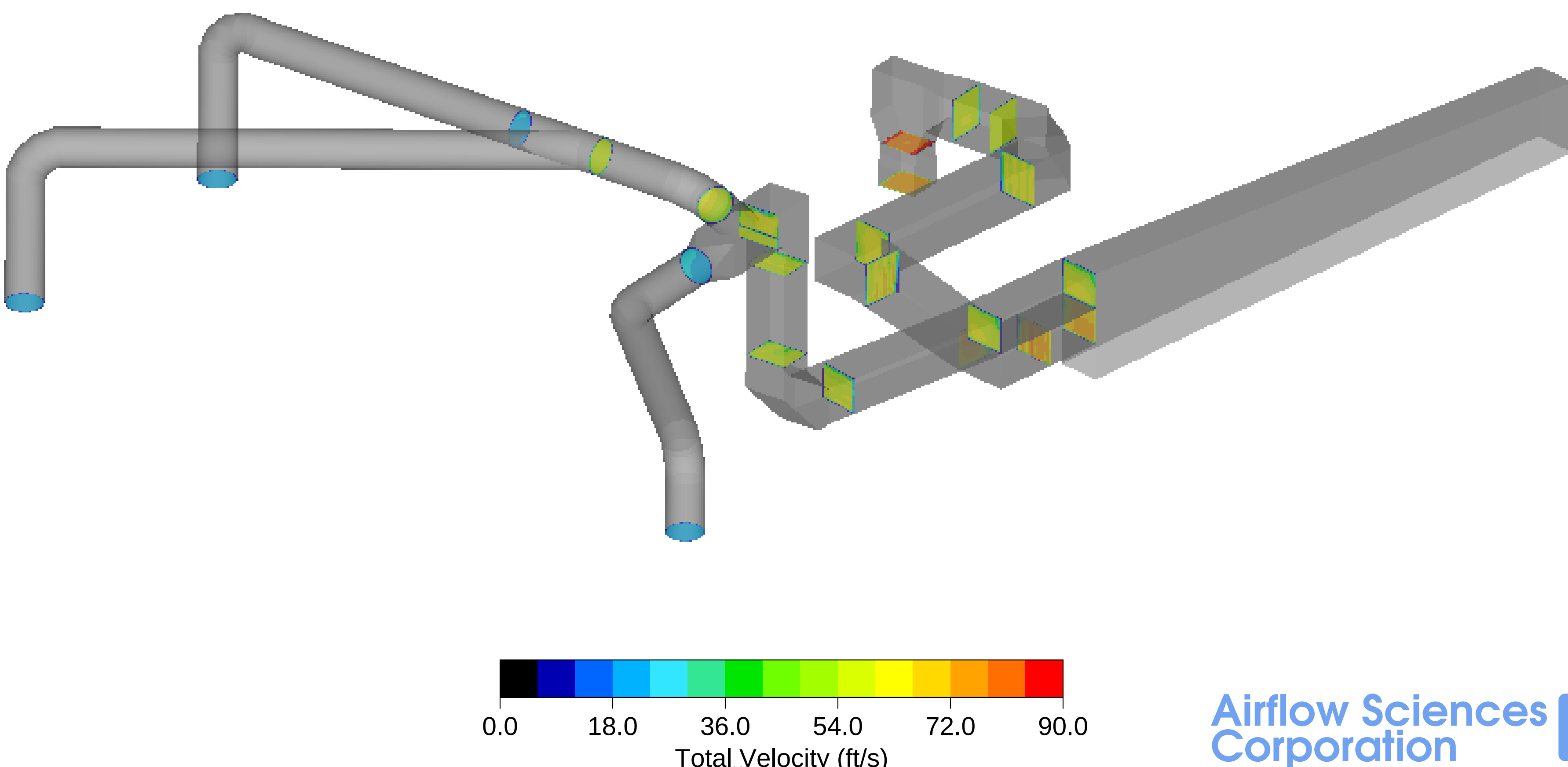
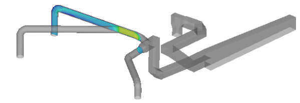


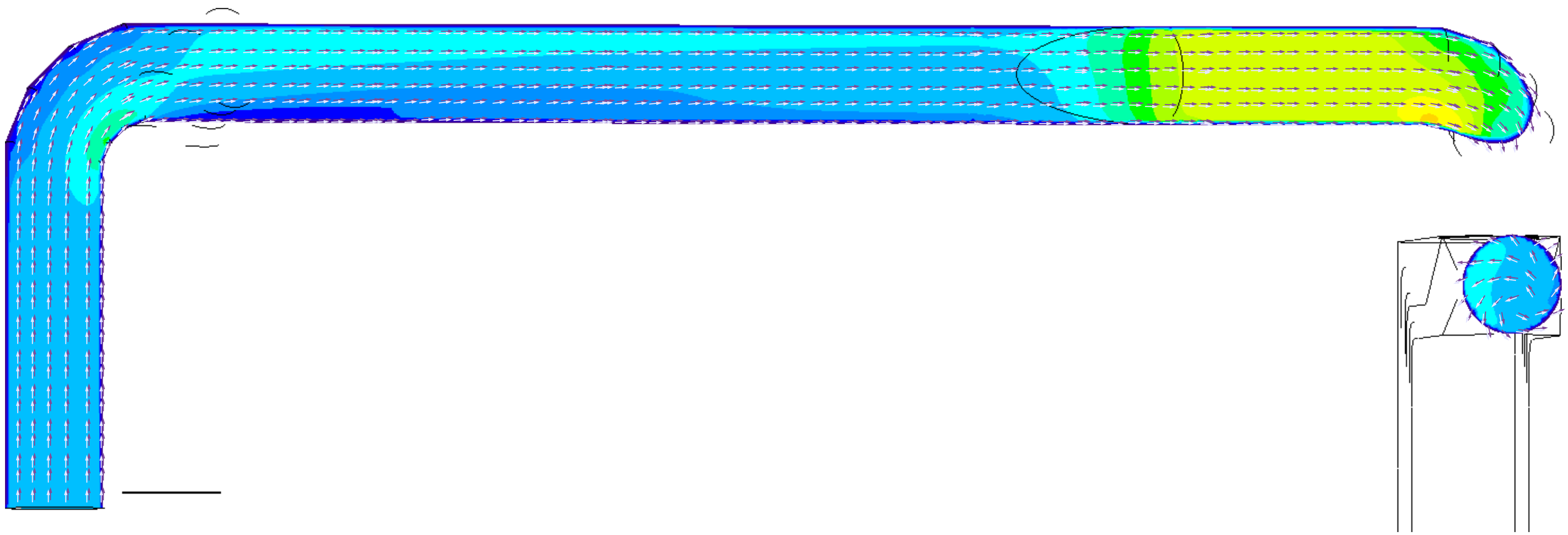
Figure 1

Airflow Sciences Corporation

Design 1 Results - Velocity

Aligned Elevation View - U1 Round Old Stack Exit Duct





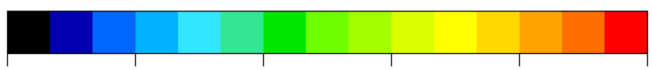
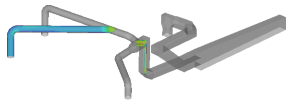


Figure 2

Airflow Sciences Corporation

Design 1 Results - Velocity

Aligned Elevation View - U2 Round Old Stack Exit Duct



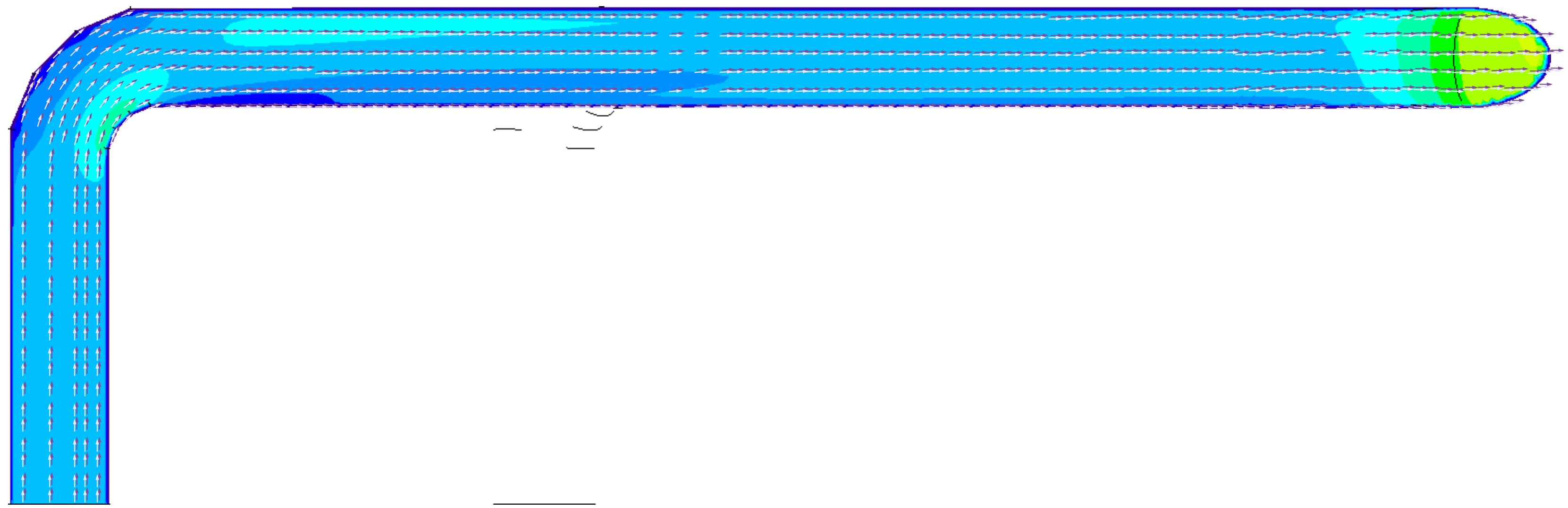
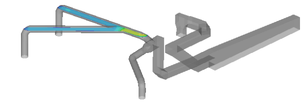


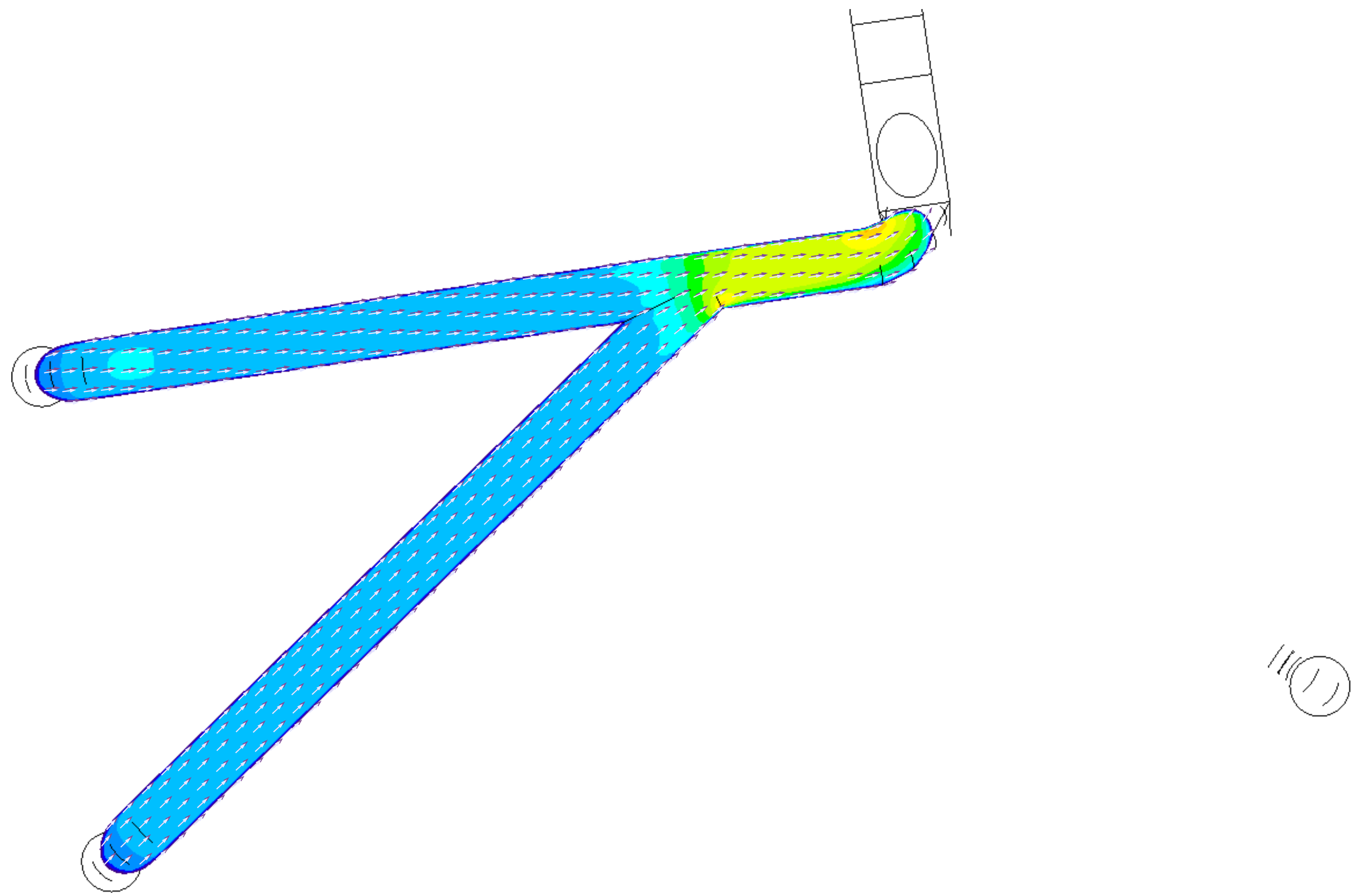
Figure 3

Airflow Sciences Corporation

Design 1 Results - Velocity

Plan View - U1 and U2 Round Old Stack Exit Ducts





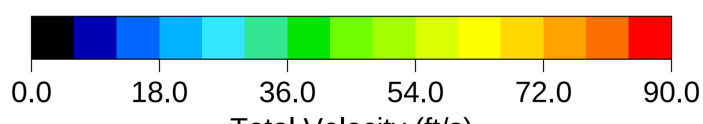
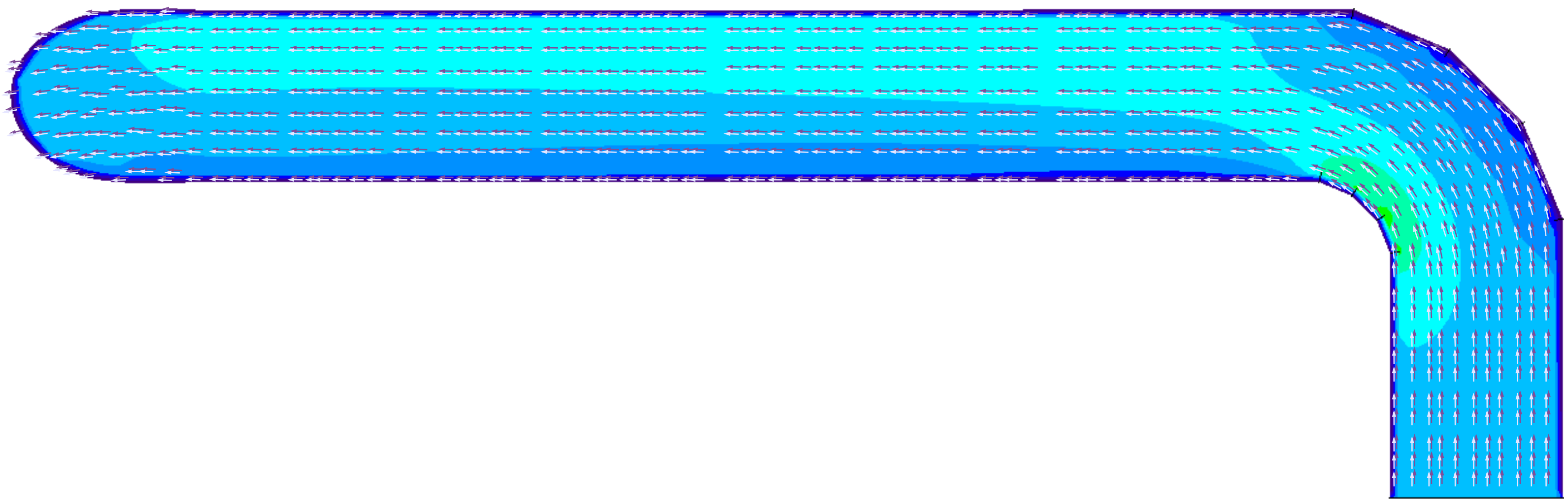


Figure 4

Airflow Sciences Corporation

Design 1 Results - Velocity

Aligned Elevation View - U3 Round Old Stack Exit Duct



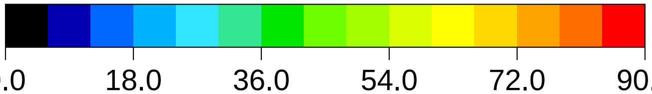
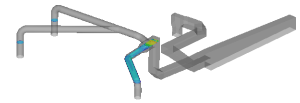


Figure 5

Airflow Sciences Corporation

Design 1 Results - Velocity

Plan View - U3 Round Old Stack Exit Duct



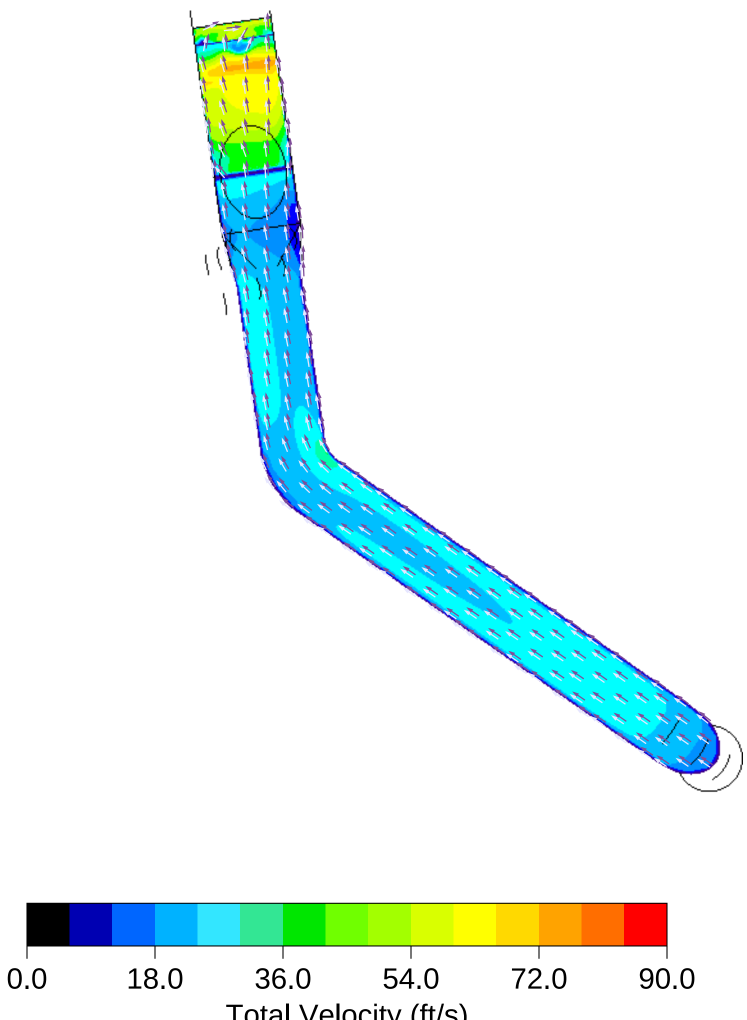
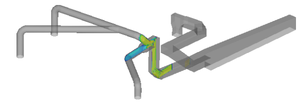


Figure 6

Airflow Sciences Corporation

Design 1 Results - Velocity

Aligned Elevation View - U1-3 Wye



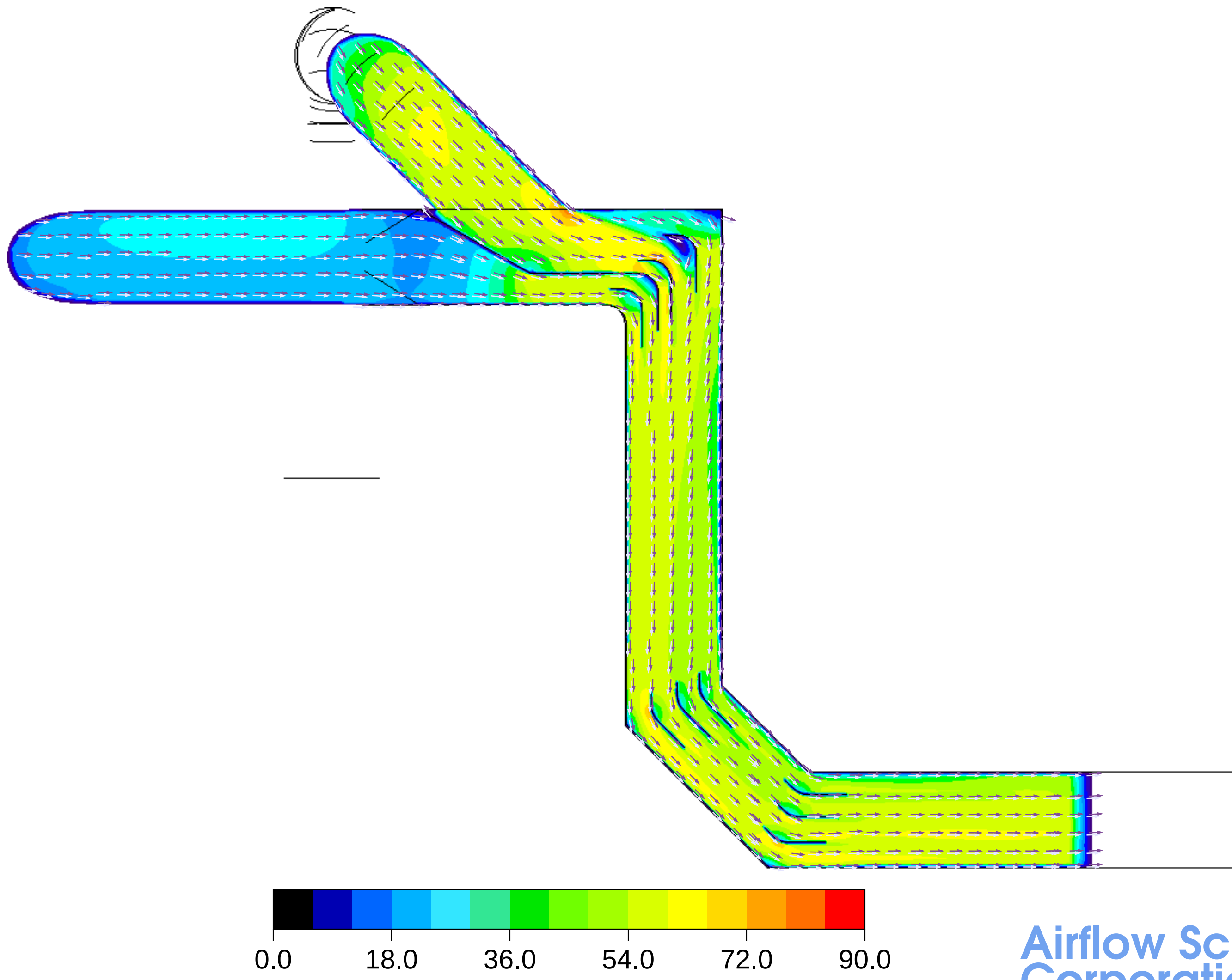


Figure 7

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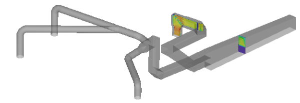
Design 1 Results - Velocity

Aligned Elevation View - U5 Old Stack Exit Duct



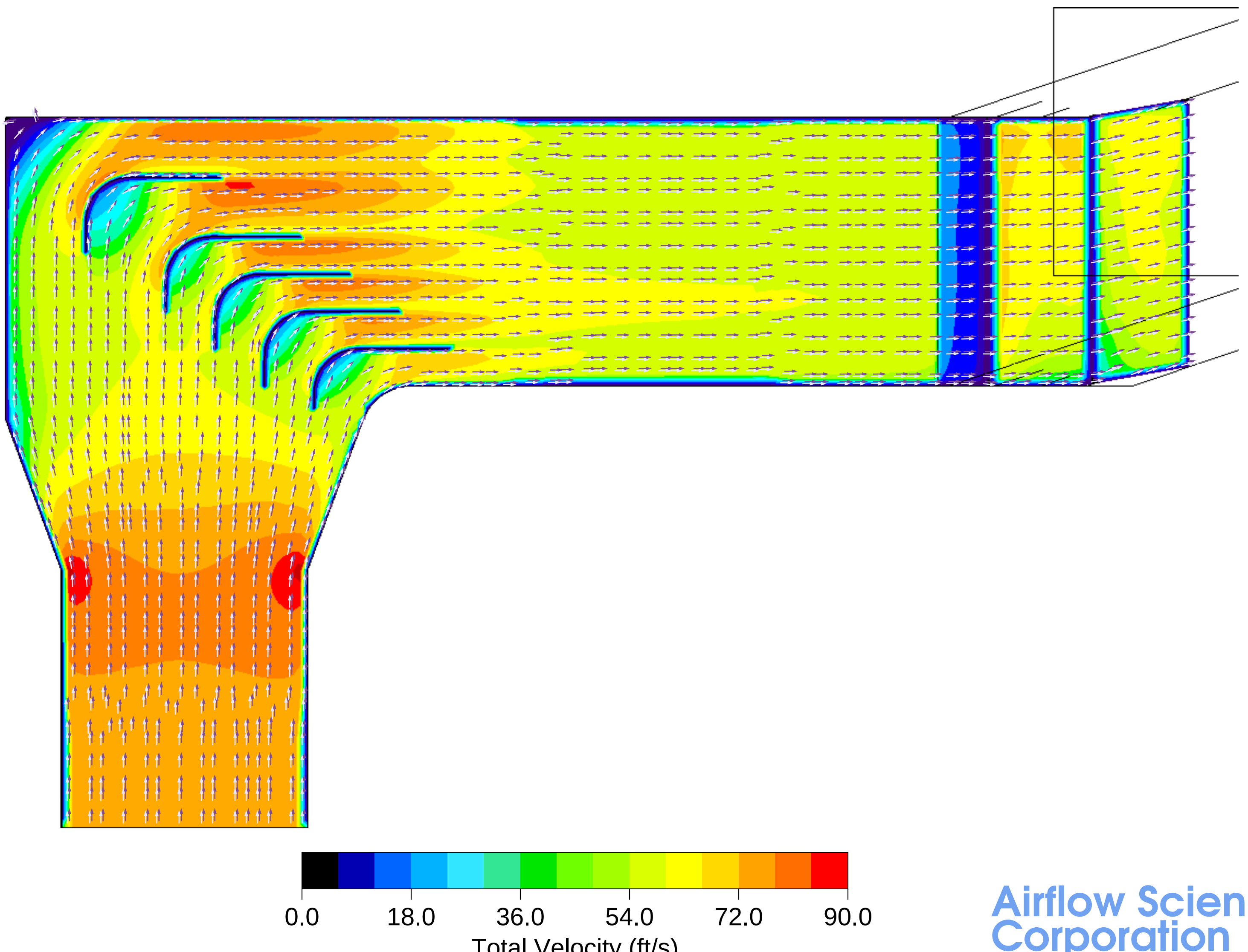
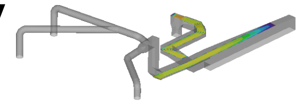


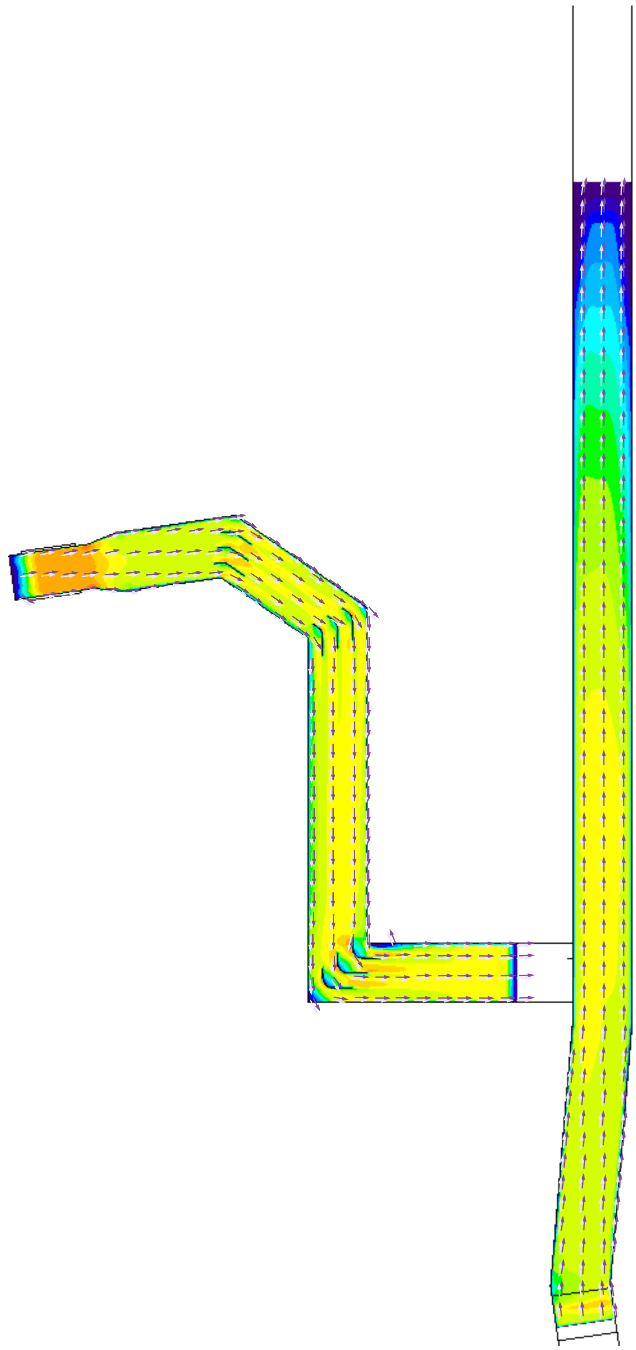
Figure 8

Airflow Sciences Corporation

Design 1 Results - Velocity

Plan View - U5 Old Stack Exit Duct



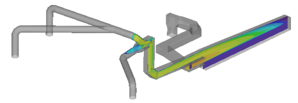


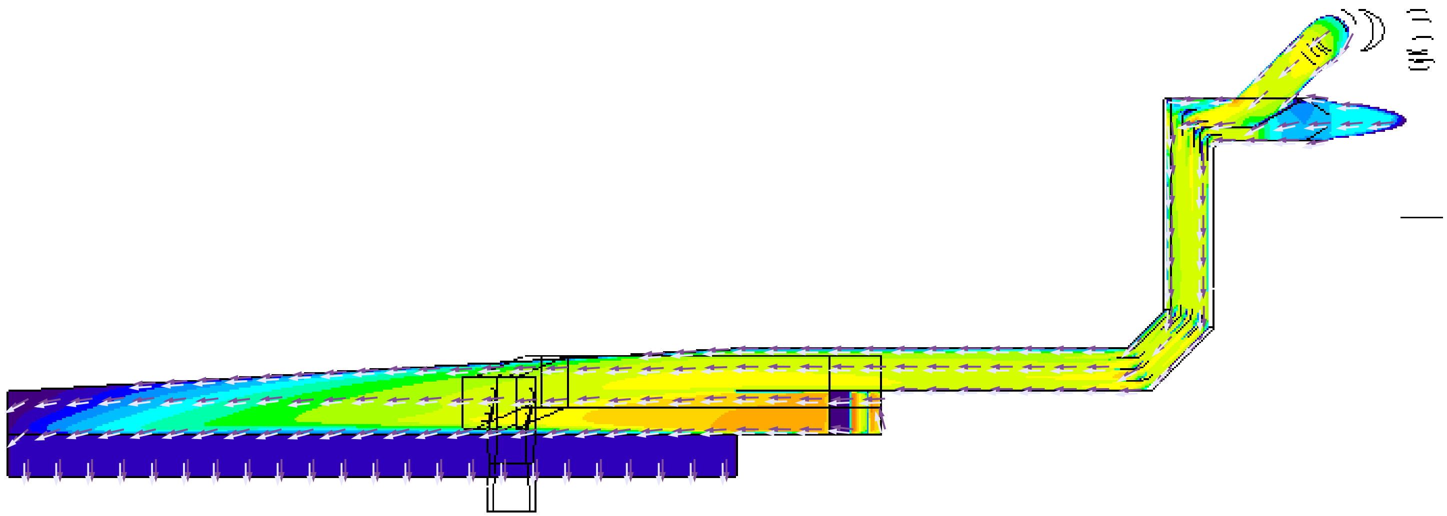
Airflow Sciences Corporation

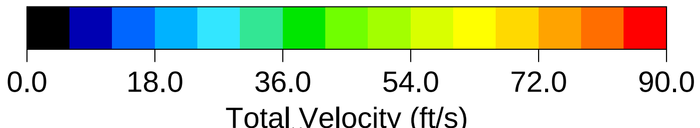
Figure 9

Design 1 Results - Velocity

Elevation View - PJFF Inlet Duct





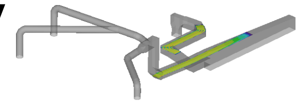


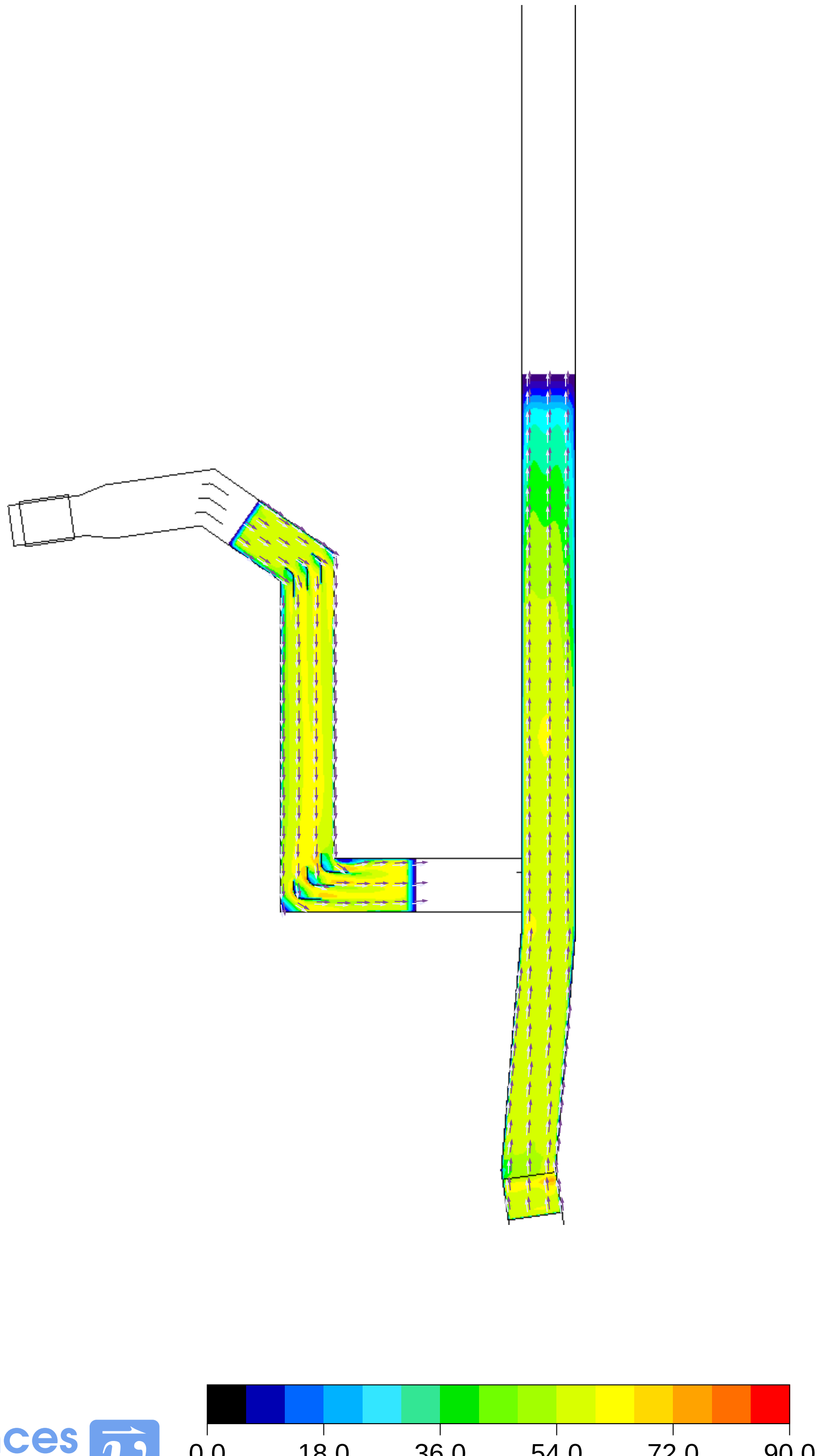
Airflow Sciences Corporation

Figure 10

Design 1 Results - Velocity

Plan View - U1-3 PJFF Inlet



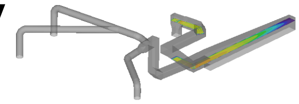


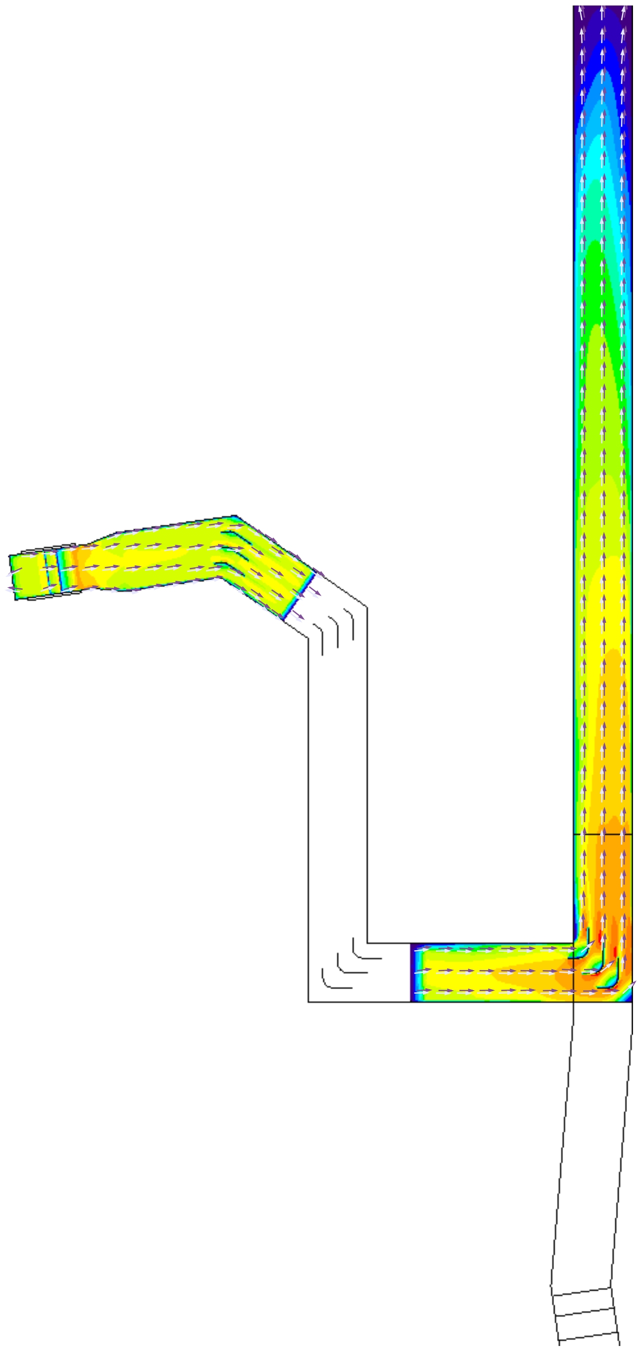
Airflow Sciences Corporation

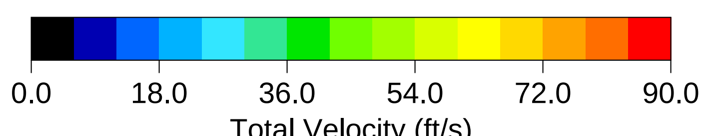
Figure 11

Design 1 Results - Velocity

Plan View - U5 PJFF Inlet







Airflow Sciences Corporation

Figure 12

Appendix D
DSI Opinion of Probable Cost and Supporting Information

Stanley Consultants INC.

	Rev. 1	Job No.	31430.01.00	Page No.	1		
		Subject	Aurora Energy Chena - Dry Sorbent Injection				
Computed by	J. Smith / S. Worcester/ D. Bacon	Date	2/8/2019	Updatded Opinion of Probable Cost			
Updated by	J. Solan	Date	1/22/2023				
		Sheet No.	1	of	1		

Chem. Eng PCI - 2018	603.1
Chem. Eng PCI - 2022	816
Cost Escalation Factor	135.30%

Item	Item Description	Quantity No. of Unit	Quantity UOM	Unit Cost (2019)	Unit Cost (2023)	Total Cost	Data Source/Notes
Engineering Services							
Engineering services provided throughout the project to assist with BOP design, technical specifications, procurement, bid evaluation, and construction observation.		1	EA		$7,483,700.00	$7,483,700	10% of PROBABLE EQUIPMENT AND CONSTRUCTION COST
Dry Sorbent Injection System Supply							
DSI	Includes Railcar offloading, long term storage silos, day storage silos, milling, metering and feed.	1	EA		$5,990,000.00	$5,990,000	Per Revised BACT Estimate
DSI Installation	Field Installation	1	EA		$488,847.07	$488,847	Escalated from 2019 to 2023
DSI Equipment Freight	DDP jobsite	1	EA		$250,000.00	$250,000	Per Revised BACT Estimate
Baghouse	Includes the baghouse casing itself, cleaning system, support steel, local access, stairtower, local instruments, piping from pulse valves to receiver at grade, and an allowance for field service support, but reusing the plant air system for cleaning	1	EA		$2,900,000.00	$2,900,000	Per Andritz Email
Baghouse Installation	Field Installation	1	EA		$322,667.41	$322,667	Per Haskell Estimate
Baghouse Freight	DDP jobsite	1	EA		$348,000.00	$348,000	Per Andritz Shipping Email 12% of equipment cost
Demolition							
Existing Warehouse		1	EA		$500,000.00	$500,000	
Existing Baghouse and ID Fan Buidling		1	EA		$500,000.00	$500,000	
Structural							
Silo Foundation		2	EA		$186,396.00	$372,792	Per Haskell Estimate
Sorbent Building Substructure		1	EA		$183,008.80	$183,009	Per Haskell Estimate
Sorbent Building Superstructure		1	EA		$2,754,613.11	$2,754,613	Per Haskell Estimate
Sorbent Building Exterior Closure		1	EA		$642,600.00	$642,600	Per Haskell Estimate
Sorbent Building Roofing		1	EA		$140,940.00	$140,940	Per Haskell Estimate
Baghouse Substructure		1	EA		$567,933.10	$567,933	Per Haskell Estimate
Baghouse Superstructure		1	EA		$4,087,081.61	$4,087,082	Per Haskell Estimate
Baghouse Exterior Closure		1	EA		$987,425.03	$987,425	Per Haskell Estimate
Baghouse Roofing		1	EA		$437,542.63	$437,543	Per Haskell Estimate
Railcar Unloading Skid Foundation		5	CY	$1,500.00	$2,029.51	$10,148	Per Haskell Estimate
Transfer Skid Enclosure Foundation		5	CY	$1,500.00	$2,029.51	$10,148	Per Haskell Estimate
MCC Foundation		4	CY	$1,500.00	$2,029.51	$8,118	Per Haskell Estimate
Pipe Bridge by Silos - Steel	coal yard front end loader drive under.	4	TONS	$10,800.00	$14,612.50	$58,450	Per Haskell Estimate
Pipe Bridge by Silos - Foundations		6	CY	$1,250.00	$1,691.26	$10,148	Per Haskell Estimate
Outside Pipe Supports - Steel		10.0	TONS	$10,800.00	$14,612.50	$146,125	Per Haskell Estimate
Outside Pipe Supports - Foundations		40	CY	$1,000.00	$1,353.01	$54,120	Per Haskell Estimate
Inside Pipe Supports - Steel		3.00	TONS	$10,800.00	$14,612.50	$43,838	Per Haskell Estimate
Ductwork	600' Feet of Ductwork to accommodate new baghouse and new DSI reactors	50.00	TONS		$27,571.66	$1,378,583	Per Haskell Estimate. 12.5 tons/100 ft.
Stack	Concrete cylinder with stainless steel flue	1.00	EA	$958,150.00	$958,150.00	$958,150	Per UAF. Not adjusted for inflation
ID Fan Building	3000 sqft * $500/sqft	1.00	EA	$1,500,000.00	$1,500,000.00	$1,500,000	Per Johnson River $/sqft estimate. Costs reduced due to simplicity of building compared to warehouse.
Warehouse Building	23,000 sqft * $750/sqft	1.00	EA	$17,250,000.00	$17,250,000.00	$17,250,000	Per Johnson River $/sqft estimate.
Mechanical							
Unit 1 Aggregate Piping Cost: 6" Sch 80 Pipe/Fittings/Flanges/Supports - Sorbent Prep to Injection Location		300	LF	$350.00	$473.55	$142,066	Per Haskell Estimate
Unit 2 Aggregate Piping Cost: 6" Sch 80 Pipe/Fittings/Flanges/Supports - Sorbent Prep to Injection Location		310	LF	$350.00	$473.55	$146,802	Per Haskell Estimate
Unit 3 Aggregate Piping Cost: 6" Sch 80 Pipe/Fittings/Flanges/Supports - Sorbent Prep to Injection Location		280	LF	$350.00	$473.55	$132,595	Per Haskell Estimate
Unit 5 Aggregate Piping Cost: 6" Sch 80 Pipe/Flanges/Supports - Sorbent Prep to Injection Location		200	LF	$350.00	$473.55	$94,711	Per Haskell Estimate
Baghouse Ash Piping: 6" Sch 80		200	LF	$350.00	$473.55	$94,711	Per Haskell Estimate
Electrical							
Medium Voltage Switchgear	Mtl & Labor	1	EA		$192,750.00	$192,750	2023 Vendor Quote + RSMeans Labor
13.8kV to 480V Transformers	Mtl	2	EA		$110,000.00	$220,000	2023 Vendor Quote
480V MCC	Mtl & Labor	2	EA		$103,750.00	$207,500	2021 Vendor Quote + RSMeans Labor
480V Panelboard and Xfmr	Mtl & Labor	2	EA		$11,805.00	$23,610	2021 Vendor Quote + RSMeans Labor
Cable - 15kV, 3 Cond, #2 AWG	Mtl & Labor	2,500	LF		$35.00	$87,500	Vendor Quote
Cable - 480V - MCC, Loads	Mtl & Labor	9000	LF		$20.00	$180,000	5600 ft of 3#12, 500 ft of 3#2/0, 800ft of
Conduit - RGS	Mtl & Labor	9300	LF		$30.00	$279,000	2" Average conduit size. Price from
Cable Terminations (Mat'l)	480V Material & Labor	496	EA		$100.00	$49,600	Per Haskell Estimate
Light Fixtures Interior/Exterior	Surface mounted LED light fixtures (Mtl & Labor)	50	EA		$2,000.00	$100,000	Per Haskell Estimate
Ground Grid extension	Mtl & Labor	1050	LF		$15.00	$15,750	Per Haskell Estimate
Instrumentation & Controls							
BOP DCS Aspects		1	EA	$76,428.00	$103,407.81	$103,408	
Heavy Equipment							
All Terrain Forklift	45' lift, 35' reach, 9000 lb. capacity	24	WK		$7,200.00	$172,800	Per Haskell Estimate
Hydraulic Crane	80-ton	135	DY		$4,900.00	$661,500	Per Haskell Estimate
				Furnish and Erection Subtotal		$45,805,579	
	MOBILIZATION / DEMOBILIZATION & MISC COSTS			5%		$2,290,279	Per Haskell Estimate
	PRIME CONTRACTOR INDIRECT LABOR			10%		$4,531,688	Per Haskell Estimate
	CONTRACTOR OH & LABOR BURDENS ON PRIME CONTRACTORS LABOR			15%		$6,870,837	Per Haskell Estimate
	EQUIPMENT & SMALL TOOLS			5%		$2,248,564	Per Haskell Estimate
	CONTINGENCY			10%		$6,174,695	Cost Manual
	PROFIT			10%		$6,174,695	Per Haskell Estimate
	BOND			1%		$740,963	Per Haskell Estimate
				Total Construction Cost		$74,837,299	
				PROBABLE EQUIPMENT & CONSTRUCTION COST		$74,837,000	
				PROBABLE ENGINEERING, EQUIPMENT & CONSTRUCTION COST		**$82,321,000**	

Note: All costs presented in this document are Stanley Consultants' opinions of probable project, construction, and/or operation and maintenance costs. This estimate of probable construction cost is based on our experience and represent our best judgment. We have no control over cost of labor, materials, equipment, contractor's methods, or over competitive bidding or market conditions. Therefore, we do not guarantee that proposals, bids, or actual construction costs will not vary from estimates of project costs, construction, and/or operation and maintenance costs presented. The costs identified are based on Means Building Construction Cost Data, Engineering News Record Construction Cost Index, and/or vendor quotes.

Stanley Consultants INC.

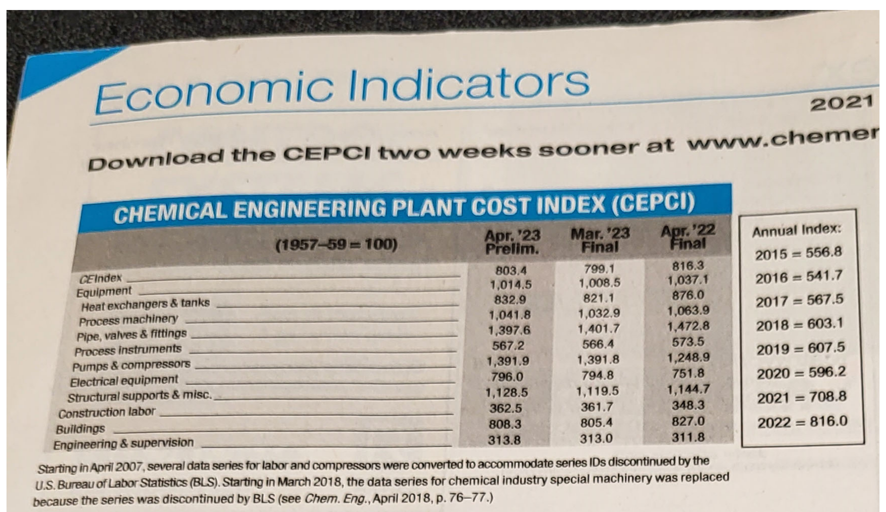
	Rev. 1	Job No.	31430.01.00 Page No. 1
		Subject	Aurora Energy Chena - Dry Sorbent Injection
Computed by	J. Smith / S. Worcester/ D. Bacon Date 2/8/2019		Updatded Opinion of Probable Cost
Updated by	J. Solan Date 9/7/2023		
Approved by	Date	Sheet No.	1 of 1

Chem. Eng PCI - 2018	603.1
Chem. Eng PCI - 2022	816
Cost Escallation Factor	135.30%

Item Description		Quantity No. of Unit	Quantity UOM	Unit Cost (2019)	Unit Cost (2023)	Total Cost	Data Source	QTY	UOM	HOURS	LABOR DOLLARS (Based in 2023 dollars)	MATERIAL	SUBCONTRACT	TOTAL	NOTES
Engineering Services															
Engineering services provided throughout the project to assist with BOP design, technical specifications, procurement, bid evaluation, and construction observation.		1	EA		$0.00	$0	10% of PROBABLE EQUIPMENT AND CONSTRUCTION COST							$0.00	
														$0.00	
Dry Sorbent Injection System Supply														$0.00	
DSI	Includes Railcar offloading, long term storage silos, day storage silos, milling, metering and feed.	1	EA		$5,990,000.00	$5,990,000	Per Revised BACT Estimate							$0.00	
DSI Installation	Field Installation	1	EA	$1,550,000.00	$2,097,164.65	$2,097,165	Escalated from 2019 to 2023	1.00	LS	5346.5	$488,847.07			$488,847.07	Includes silo, pump, day bin and and filter receiver installation based on Eielson. Used a current boilermaker journeymen rate ($88.77/hr) x 3% because the wage change happens at the end of September 2023.
DSI Equipment Freight	FOB jobsite	1	EA		$250,000.00	$250,000	Per Revised BACT Estimate							$0.00	
Baghouse	Includes the baghouse casing itself, cleaning system, support steel, local access, stairtower, local instruments, piping from pulse valves to receiver at grade, and an allowance for field service support, but reusing the plant air system for cleaning	1	EA		$2,900,000.00	$2,900,000	Per Andritz Email							$0.00	
Baghouse Installation	Field Installation	1	EA		$0.00	$0		6.00	CELL	3529	$322,667.41			$322,667.41	UAF was a six hopper pulse jet fabric filter. Used a current boilermaker journeymen rate ($88.77/hr) x 3% because the wage change happens at the end of September 2023.
Baghouse Freight	DDP jobsite	1	EA		$0.00	$0								$0.00	See if the person that gave you the quote can give you the approximate number of loads that need to be shipped.
														$0.00	
Structural														$0.00	
Silo Foundation		2	EA	$244,304.00	$330,545.62	$661,091	Escalated from 2019 to 2023	177.22	CY	1,772.22	$124,268.22	$62,127.78		$186,396.00	Used the SF dimenions of the Eielson sorbent silo foundation. Assumed a thickness of 3'. Includes formwork, rebar and concrete labor and material. Used a laborer rate of $70.12 per hour x 1.03 because the rate expired in June 2023.
Sorbent Building Substructure		1	EA	$247,047.00	$334,256.93	$334,257	Escalated from 2019 to 2023	174.00	CY	1,740.00	$122,008.80	$61,000.00		$183,008.80	Used the floor SF from the Eielson sorbent building and used a thickness of 3'. Includes formwork, rebar and concrete labor and material. Used a laborer rate of $70.12 per hour x 1.03 because the rate expired in June 2023.
Sorbent Building Superstructure		1	EA	$183,067.00	$247,691.38	$247,691	Escalated from 2019 to 2023	186.12	TN	2,792	$241,379.33	$2,513,233.78		$2,754,613.11	Ratioed the tons of steel based on the tons of steel per SF for the UAF baghouse building. Used a current ironworker journeymen rate ($83.94/hr) x 3% because the wage change happened in July 2023. Material pricing is based on current price charged for the Healy structure.
Sorbent Building Exterior Closure		1	EA	$160,334.00	$216,933.42	$216,933	Escalated from 2019 to 2023	7,140.00	SF				$642,600.00	$642,600.00	Used the height, length and width from the Eielson sorbent building. The subcontract includes material and labor for siding and is based on siding and roofing pricing for our SCR building at Healy.
Sorbent Building Roofing		1	EA	$12,149.00	$16,437.71	$16,438	Escalated from 2019 to 2023	1,566.00	SF				$140,940.00	$140,940.00	Used length and width from the Eielson sorbent building. The subcontract includes material and labor for siding and is based on siding and roofing pricing for our SCR building at Healy.
Baghouse Substructure		1	EA	$247,047.00	$334,256.93	$334,257	Escalated from 2019 to 2023	540.18	CY	5,401.76	$378,771.47	$189,161.63		$567,933.10	Used the floor SF of the baghouse drawing supplied by Solan and assumed a foundation 3' thick. Includes formwork, rebar and concrete labor and material.
Baghouse Superstructure		1	EA	$183,067.00	$247,691.38	$247,691	Escalated from 2019 to 2023	286.00	TN	2605	$225,223.61	$3,861,858.00		$4,087,081.61	Used UAF baghouse quantity. Used a current ironworker journeymen rate ($83.94/hr) x 3% because the wage change happened in July 2023. Material pricing is based on current price charged for the Healy structure.
Baghouse Exterior Closure		1	EA	$160,334.00	$216,933.42	$216,933	Escalated from 2019 to 2023	10,971.39	SF				$987,425.03	$987,425.03	Quantities are based on baghouse sketch supplied by Solan. 20% was added for additional hieght above and below the baghouse. The subcontract includes material and labor for siding and is based on siding and roofing pricing for our SCR building at Healy.
Baghouse Roofing		1	EA	$12,149.00	$16,437.71	$16,438	Escalated from 2019 to 2023	4,861.58	SF				$437,542.63	$437,542.63	Quantities are based on baghouse sketch supplied by Solan. 100% was added for room around the baghouse. The subcontract includes material and labor for siding and is based on siding and roofing pricing for our SCR building at Healy.
Railcar Unloading Skid Foundation		5	CY	$1,500.00	$2,029.51	$10,148	Haskell 2019 Estimate. Escalated from 2019 to 2023							$0.00	Orignal estimate in column J still "ok"
Transfer Skid Enclosure Foundation		5	CY	$1,500.00	$2,029.51	$10,148	Haskell 2019 Estimate. Escalated from 2019 to 2023							$0.00	Orignal estimate in column J still "ok"
MCC Foundation		4	CY	$1,500.00	$2,029.51	$8,118	Haskell 2019 Estimate. Escalated from 2019 to 2023							$0.00	Orignal estimate in column J still "ok"
Pipe Bridge by Silos - Steel	coal yard front end loader drive under.	4	TONS	$10,800.00	$14,612.50	$58,450	Haskell 2019 Estimate. Escalated from 2019 to 2023							$0.00	Orignal estimate in column J still "ok"
Pipe Bridge by Silos - Foundations		6	CY	$1,250.00	$1,691.26	$10,148	Haskell 2019 Estimate. Escalated from 2019 to 2023							$0.00	Orignal estimate in column J still "ok"
Outside Pipe Supports - Steel		10.0	TONS	$10,800.00	$14,612.50	$146,125	Haskell 2019 Estimate. Escalated from 2019 to 2023							$0.00	Orignal estimate in column J still "ok"
Outside Pipe Supports - Foundations		40	CY	$1,000.00	$1,353.01	$54,120	Haskell 2019 Estimate. Escalated from 2019 to 2023							$0.00	Orignal estimate in column J still "ok"
Inside Pipe Supports - Steel		3.00	TONS	$10,800.00	$14,612.50	$43,838	Haskell 2019 Estimate. Escalated from 2019 to 2023							$0.00	Orignal estimate in column J still "ok"
Ductwork	1000' Feet of Ductwork to accommodate new baghouse	50.00	TONS	$15,000.00	$20,295.14	$1,014,757	Haskell 2019 Estimate. Escalated from 2019 to 2023. Confirm ductwork tonage	50.00	TN	2,500.00	$228,582.75	$1,150,000.00		$1,378,582.75	Used boilermaker wage rate x 50 hours per ton, which comes from a recently (2023) awarded project. Used $23000 per ton based on a recent quote. This does not include refractory.
														$0.00	
Mechanical														$0.00	
Unit 1 Aggregate Piping Cost: 6" Sch 80 Pipe/Fittings/Flanges/Supports - Sorbent Prep to Injection Location		300	LF	$350.00	$473.55	$142,066	Haskell 2019 Estimate. Escalated from 2019 to 2023							$0.00	Orignal estimate in column J still "ok"

Unit 2 Aggregate Piping Cost: 6" Sch 80 Pipe/Fittings/Flanges/Supports - Sorbent Prep to Injection Location		310	LF	$350.00	$473.55	$146,802	Haskell 2019 Estimate. Escalated from 2019 to 2023	$0.00	Orignal estimate in column J still "ok"		
Unit 3 Aggregate Piping Cost: 6" Sch 80 Pipe/Fittings/Flanges/Supports - Sorbent Prep to Injection Location		280	LF	$350.00	$473.55	$132,595	Haskell 2019 Estimate. Escalated from 2019 to 2023	$0.00	Orignal estimate in column J still "ok"		
Unit 5 Aggregate Piping Cost: 6" Sch 80 Pipe/Flanges/Supports - Sorbent Prep to Injection Location		200	LF	$350.00	$473.55	$94,711	Haskell 2019 Estimate. Escalated from 2019 to 2023	$0.00	Orignal estimate in column J still "ok"		
Baghouse Ash Piping: 6" Sch 80		200	LF	$350.00	$473.55	$94,711	Haskell 2019 Estimate. Escalated from 2019 to 2023	$0.00	Orignal estimate in column J still "ok"		
								$0.00			
								$0.00			
Instrumentation & Controls								$0.00			
BOP DCS Aspects		1	EA	$76,428.00	$103,407.81	$103,408	Escalated from 2019 to 2023	$0.00			
								$0.00			
Heavy Equipment								$0.00			
All Terrain Forklift	45' lift, 35' reach, 9000 lb. capacity	24	WK		$7,200.00	$172,800	Haskell Estimate	$0.00	Orignal estimate in column J still "ok"		
Hydraulic Crane	80-ton	135	DY		$4,900.00	$661,500	Haskell Estimate	$0.00	Orignal estimate in column J still "ok"		
								$0.00			
				Furnish and Erection Subtotal				$0.00			
								$0.00			
MOBILIZATION / DEMOBILIZATION & MISC COSTS		5%					Haskell Estimate	$0.00	Orignal estimate in column J still "ok"	8%	$0.00
PRIME CONTRACTOR INDIRECT LABOR		10%					Haskell Estimate	$0.00	Orignal estimate in column J still "ok"	40%	-$2,829,720.00
CONTRACTOR OH & LABOR BURDENS ON PRIME CONTRACTORS LABOR		15%					Haskell Estimate	$0.00	Orignal estimate in column J still "ok"	15%	$0.00
EQUIPMENT & SMALL TOOLS		5%					Haskell Estimate	$0.00	Orignal estimate in column J still "ok"	10%	-$66,150.00
CONTINGENCY		10%					Cost Manual	$0.00	Orignal estimate in column J still "ok"	15%	-$434,380.50
PROFIT		10%					Haskell Estimate	$0.00	Orignal estimate in column J still "ok"	10%	-$289,587.00
BOND		1%					Haskell Estimate	$0.00	Orignal estimate in column J still "ok"	2%	-$72,396.75
								$0.00			
				Total Construction Cost				$0.00			**-$3,692,234.25**
								$0.00			
				PROBABLE EQUIPMENT & CONSTRUCTION COST				$0.00			
				PROBABLE ENGINEERING, EQUIPMENT & CONSTRUCTION COST				$0.00			

Note: All costs presented in this document are Stanley Consultants' opinions of probable project, construction, and/or operation and maintenance costs. This estimate of probable construction cost is based on our experience and represent our best judgment. We have no control over cost of labor, materials, equipment, contractor's methods, or over competitive bidding or market conditions. Therefore, we do not guarantee that proposals, bids, or actual construction costs will not vary from estimates of project costs, construction, and/or operation and maintenance costs presented. The costs identified are based on Means Building Construction Cost Data, Engineering News Record Construction Cost Index, and/or vendor quotes.



Economic Indicators

2021

Download the CEPCI two weeks sooner at www.chemer

CHEMICAL ENGINEERING PLANT COST INDEX (CEPCI)

(1957–59 = 100)	Apr. '23 Prelim.	Mar. '23 Final	Apr. '22 Final
CE Index	803.4	799.1	816.3
Equipment	1,014.5	1,008.5	1,037.1
Heat exchangers & tanks	832.9	821.1	876.0
Process machinery	1,041.8	1,032.9	1,063.9
Pipe, valves & fittings	1,397.6	1,401.7	1,472.8
Process instruments	567.2	566.4	573.5
Pumps & compressors	1,391.9	1,391.8	1,248.9
Electrical equipment	796.0	794.8	751.8
Structural supports & misc.	1,128.5	1,119.5	1,144.7
Construction labor	362.5	361.7	348.3
Buildings	808.3	805.4	827.0
Engineering & supervision	313.8	313.0	311.8

Annual Index:
2015 = 556.8
2016 = 541.7
2017 = 567.5
2018 = 603.1
2019 = 607.5
2020 = 596.2
2021 = 708.8
2022 = 816.0

Starting in April 2007, several data series for labor and compressors were converted to accommodate series IDs discontinued by the U.S. Bureau of Labor Statistics (BLS). Starting in March 2018, the data series for chemical industry special machinery was replaced because the series was discontinued by BLS (see *Chem. Eng.*, April 2018, p. 76–77.)

Appendix E
Andritz Process Assessment

Appendix E1 – Andritz DSI Process Assessment
Appendix E2 – Engineering PM Test Results Baghouse Inlet

ANDRITZ DSI Process Assessment
Aurora Energy, LLC

Chena Power Plant Boilers, 1, 2, 3 and 5

Project No.: S-03-L69558-183
Revision.: Preliminary / January 5, 2024

Client PO #: 5472

ENGINEERED SUCCESS

Customer: Aurora Energy LLC
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ANDRITZ

Table of contents

1 INTRODUCTION

Andritz is a leading international supplier of air pollution control technology for power stations, paper mills, and other heavy industrial plants. The Andritz product portfolio includes dry and wet ESPs, large scale wet and dry scrubbers, dry sorbent (DSI) flue gas cleaning based on hydrated lime or dry sodium sorbents, SCR (selective catalytic reduction for NO_X removal) and carbon capture systems. Andritz offers tailor-made concepts and is a "one-stop-shop" for flue gas cleaning solutions.

Aurora Energy has requested a technical assessment from Andritz Inc. of the existing fabric filter (FF) system installed at the Chena Power Plant, as further described below.

Aurora's existing fabric filter treats the flue gas from four coal fired boilers, after pre-removal of fly ash via mechanical collectors. Aurora is considering the addition of a Sodium Bicarbonate (SBC) based Dry Sorbent Injection (DSI) system. Andritz was requested to assess if the existing system is suitable for addition of SBC injection to achieve 90 to 95% SO_2 removal. This assessment included the following:

1) Assessment of the flue gas flow rate, temperature, and dust loading for the current system at the fabric filter inlet for a range of flows from a "maximum" load (all four boilers at full load) to a "minimum" load (only one of the smaller boilers on "near" full load).
2) Assessment of the suitability of SBC for the specified operational ranges for 90 to 95% SO_2 removal rates and an estimate of the quantity of SBC required, assuming SBC was found to be suitable.
3) Mechanical assessment of the existing fabric filter system to assess general condition and current cleaning system functionality to estimate if addition of sorbent will cause operational or emissions issues.
4) Assessment of the existing fabric filter sizing as compared to Andritz's in house design standards for a new fabric filter sized for use with SBC type DSI.

Based on the above assessments, Andritz presents this document as a summary of the conclusions reached. Detailed information follows regarding the information that was used for this assessment.

2 ASSESSMENT OVERVIEW

2.1 PROVIDED INFORMATION AND ASSESSMENT

Andritz has been sent the following information regarding the project:

<u>2.1.1 Existing Fabric Filter Flue Gas Process Inputs</u> – Andritz was provided the following sources of information regarding existing fabric filter inlet conditions:

1. Alaska Source Testing SO_2 Test Report Dated October 12, 2021 (refer to Attachment 1), including SGS coal analyses of the coal burned during the testing.
2. Alliance Technical Group preliminary EPA 1-5 flow rate and ash load data dated 12/20/23 (refer to Attachment 2)

3. Several older stack test reports dated 2000 through 2011.
4. Historical Fabric Filter Inlet Flue Gas Temperature Data (Attachment 5)

Via combustion calculation, Andritz calculated a “maximum load” design case gas flow rate using the data from Attachment 1 as this is the most recent of the stack test reports provided and also provided good information regarding the coal analysis. The first task was to perform a combustion calculation for the stack flow rates to compare to the values measured via EPA 1-4 as part of the broader SO_2 testing. For this, the boiler heat input, stack temperature, stack O_2 percent, site barometric pressure and stack draft were taken as the average of the three EPA runs. Unburned carbon was assumed as 15% per discussions with Aurora. Coal analysis was taken as the average of the coal analyses for the Unit 5 boiler. The results of this analysis compared well with the measured values. The calculated stack flow rate was 247,684 acfm, as compared to the measured value of 236,792 acfm (from the stack test report, this is the stack area times the average stack velocity). Aurora stated that this testing was performed “near” full load conditions and so this result is used as the “maximum load” condition.

The above assessment indicated that agreement between the combustion calculation and the stack test results was quite good and therefore the combustion calculation was modified to reflect “fabric filter inlet” conditions by increasing the temperature to 300 deg. F (based on Aurora input), by deceasing the O_2 by an assumed 0.5% and by increasing the draft to an assumed -8” WG. The resulting value is 249,330 acfm. The output of this calculation is included as Attachment 3.

The above calculations were also used to calculate the SO_2 and HCl loading for the “maximum load” conditions. Fly ash was calculated using 90% assumed ash carryover, but this value was not used as the actual performance of the existing mechanical collectors is not known. The preliminary EPA 1-5 test results (Attachment 2), taken downstream of the mechanical collectors, were used to assess the existing ash load into the fabric filter. Specifically, the blended average dust load was found to be 0.119 gr/dscf. The measured fabric filter inlet gas flow rate from this test was stated as 201,087 acfm at an average total steam rate for all boilers of 290.7 klb/hr. This indicates that the testing was not at “maximum load” conditions as, per Aurora the total steam rate is 350 klb/hr, meaning the boilers were running at 82.8% of the rated aggregate capacity. Therefore the dust concentration was applied to the “maximum load” flow rate from the combustion calculation to create an expected ash loading value at “maximum load” conditions. The 0.119 gr/dscf value, applied to a calculated flow rate of 149,049 dscf results in a fabric filter inlet load of 153 #/hr.

Assessment of “minimum load” case operation was somewhat less rigorous. Aurora reported that operation with only one of the smaller boilers (1, 2 or 3) was possible, at a partially reduced load. The resulting volumetric flow rate at this condition was reported by Aurora as 12% of the full load condition.

As SBC effectiveness is dependant on flue gas temperature, historical data for a recent one year timeframe was provided for assessment. This was provided for all boilers other than boiler 1, which has an instrument malfunction in that area. This data was assessed by Andritz for maximum, minimum and average temperature for any condition where 30% or greater boiler load was achieved. Andritz assumed for this purpose that DSI injection would not be required for boiler loads below 30%. This data was then filtered to show any condition below Andritz's standard minimum requirement for SBC injection (145 deg. C / 293 deg. F). The resulting file is included as Attachment 5. It will be seen that, especially for boiler #5, there are periods of time that are below this minimum temperature value. See 2.1.3 below for more on this topic.

2.1.2 Existing Fabric Filter Equipment – The following information was received regarding the fabric filter:

1. O&M manual for the original 1987 vintage Flakt fabric filter (Attachment 4)
2. Information from Aurora that the fabric filter bags are relatively new (approximately 1 year old) fiberglass bags with a PTFE membrane (Attachment 7).

From this information Andritz assessed the air to cloth ratio, bag material, and other basic fabric filter design information. The fabric filter is a Flakt design (Andritz now owns the technology rights for this design based on Andritz's acquisition of GE's fabric filter and other AQCS technologies in 2021) of an early pulse jet type, with 11 compartments each with 266 x 14' bags x 6" diameter. Andritz could not locate drawings for this specific project in our files but found tubesheet arrangements and pulse system drawings from another project with a 266 bag per compartment design.

To assess the actual condition of the fabric filter Andritz held a phone call and exchanged several emails with Aurora and then sent a field engineer who is familiar with the Flakt design, Mr. Mark Fiedler, to the site for an external inspection. Information was also gathered from Aurora personnel regarding maintenance history, pulse system pressure, cleaning frequency, cleaning mode, and historical pressure drop data. The trip report from this inspection is attached as Attachment 8. During these discussions, pulse pressure was stated as 60 psig, which is on the high side for a unit with new bags. Cleaning type was stated to be off-line, which is consistent with 1987 vintage fabric filters but which is no longer the preferred cleaning method (See 2.1.3 for more on this topic). Cycle time to complete 1 cleaning cycle was stated as 44 minutes, with cleaning occurring for a total of just under 2 hours per day. The need to operate the fabric filter with one compartment out of service for maintenance was stated. This is a typical requirement for utility clients. This means the fabric filter sizing must be assessed for "N-2" compartments out of service, not "N-1" as is the case for units with on-line cleaning.

During the site visit, Aurora reported that with the current bags full load pressure drop across the fabric filter at full load is typically 6.5" WG, which is slightly on the higher side of typical. Historical data was given for several days near full load, see Attachment 9. The previous bags were reported as problematic regarding pressure drop at end of life.

For the above information, the "maximum load" case effective (without seams and cuffs) air to cloth ratio was calculated as 4.15 : 1 (gross), 4.57 : 1 (N-1), and 5.07 : 1 (N-2). The N-1 and N-2 values in particular is well above Andritz's standard air to cloth ratio either with or without SBC injection and may only provide adequate performance now due to the low dust loading due to fly ash pre-collection in the upstream mechanical collectors.

2.1.3 Future DSI Performance – Using the above information, the following information was generated by Andritz to assess DSI performance:

1. Solvay assessment of SBC injection rates (Attachment 6)
2. Andritz in house calculation of SBC injection rates.

Next, Andritz assessed the "maximum load" case conditions listed in Attachment 3 with our DSI product specialists and with Solvay, a well known supplier of SBC and Trona in North America and globally. At the

300 deg. F flue gas temperature specified at “maximum load” conditions Andritz estimates that 625 #/hr of 100% pure SBC is required for 95% SO_2 removal and 601 #/hr for 90% removal. Solvay did not assess the consumption at 300 deg. F but rather at 280 deg. F, in case margin was needed to the 300 deg. F value. Solvay, unlike Andritz, believes that SBC is reliably effective at 280 deg. F. Their assessment was an injection rate of 782 #/hr was required for 95% removal and 628 #/hr at 90% removal. Their higher injection rates as compared to Andritz’s are due to use of the lower flue gas temperature. Note that in both cases this assumes use of a well milled SBC product (per Attachment 6).

Next, SBC injection at “minimum load” conditions was discussed. From a gas flow rate perspective, the turndown is severe for a DSI system, resulting in duct velocities well below the minimum value at the point where the boiler 1-3 and boiler 5 ducts join at the fabric filter inlet. Regardless of the injection locations, there will be severe dropout of SBC in the inlet manifold of the fabric filter. From a temperature perspective, Andritz’s position for projects with guarantees is that a minimum 145 C / 293 F temperature be seen at minimum load and per Attachment 5 this temperature is not seen continuously. Solvay states that they have some data that SBC is effective as low as approx. 265 deg. F but Andritz cannot corroborate this statement.

Regarding the ability of the fabric filter to accept the increased dust load imposed by the DSI system, Andritz notes that our in house standard for the air to cloth ratio for a system with SBC injection is 3.3 : 1 in the condition where guarantees are required (typically N-1 for utility clients). Note that this is a larger baghouse than Andritz would use for a typical industrial or utility fabric filter without SBC injection. The value for that is 4 : 1. As noted above the air to cloth ratios are all above 4 : 1 and in the case of the N-2 condition above 5 : 1.

As described above, Andritz estimates that at full load the fabric filter is currently subjected to 153 #/hr of fly ash. Using Solvay’s SBC injection rate values, and adjusting them to reflect the loss of mass as the SBC decomposes in the flue gas, the amount of byproduct created by the DSI system is estimated to be 581 to 682 #/hr (90% and 95% removal, respectively). The total dust load to the fabric filter in the future “maximum load” case conditions is therefore 735 to 835 #/hr, or 4.8 to 5.5 times the current loading.

Use of off-line cleaning is not ideal for DSI systems as the cleaning method is to fully clean an entire compartment of bags and then place that compartment back into service. This means that that compartment has been cleaned of any SBC which was providing secondary acid gas removal as part of the filter bag cake, resulting in possible “bypass” with only partly controlled flue gas. Andritz’s standard design is to use on-line cleaning, with or without DSI.

2.2 SUMMARY

In summary:

1. At “maximum load” conditions use of SBC will achieve the required 90 to 95% SO_2 removal rates. In a firm price bidding process Andritz would be able to guarantee this level of removal.
2. However, the fabric filter is very likely undersized for the addition of SBC given the high air to cloth ratio and approximate 5x increase in dust loading. In a firm price RFQ bidding process Andritz would not guarantee that the fabric filter pressure drop could be maintained at an acceptable level at “maximum load” conditions.
3. At “minimum load” conditions Andritz is concerned both with the temperature and the low velocity. In the case of the temperature Solvay is less concerned about the emissions performance at lower temperatures but notes an increase in SBC injection rate is required. Regarding velocity,

turndown of the gas flow rate to only 12% of the total will result in drop out of SBC in the fabric filter inlet. It may be possible to overcome both of these issues by addition of a clean flue gas recirculation system, which routes flue gas from the ID fan outlet area back to the common boiler 1-3 and boiler 5 ducts, with control dampers and steam coils added to provide enough flow and temperature for operation at low load. This is an additional capital and operating cost, however. Without recirculation Andritz would not guarantee emissions performance at “minimum load” conditions.

3 ATTACHMENTS

Attachment 1 – 2021 SO2 Stack Test Report

Attachment 2 – 2023 Preliminary FF Inlet Test Data

Attachment 3 – Andritz Combustion Calculation Output

Attachment 4 – Flakt Fabric Filter O&M Manual

Attachment 5 – Historical Fabric Filter Inlet Temperatures

Attachment 6 – Solvay Estimated SBC Injection Rates

Attachment 7 – Aurora Bag Material

Attachment 8 – Andritz Site Visit Report

Attachment 9 – Historical Fabric Filter Pressure Drop Data

Summary of Test Results
Chena River Power Plant
Chena Coal-fired Boilers
SO_2 Emissions Testing
October 12, 2021

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

December 10, 2021

Report Certification

As project manager, I certify that the testing was performed in accordance with approved methods and the data, calculations and results described in this report are true and accurate to the best of my knowledge.

W.M. Hudson
President

W.M. Hudson
Signature

12/10/11
Date

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1 INTRODUCTION

Aurora Energy LLC (Aurora) operates a power generation facility located on the Chena River in Fairbanks, Alaska. The facility operates under Air Quality Permit No. AQ0315TVP03 and includes four coal-fired boilers. The common stack was tested.

Alaska Source Testing LLC (AST), commissioned by Aurora, performed a source test program for sulfur dioxide (SO_2), carbon dioxide (CO_2) emissions and oxygen (O_2) content on the common stack of the four boilers.

William Hudson was the AST onsite project manager and was assisted by AST technician Chase Aikey. David Fish was the Aurora project manager. The testing took place on October 12, 2021.

The testing program was performed in accordance with the *Code of Federal Regulations Title 40 Part 60* (40 CFR 60), Reference Methods 1, 2, 3A, 4, 6C, 7E, and 19.

Detailed test information and documentation is provided in the appendices of this report.

2 SUMMARY OF RESULTS

The results of sample runs are presented in Table 2-1. Calculation spreadsheets are found in Appendix A.

Table 2-1 Summary of SO_2 Emissions
Chena 5 Coal-fired Boiler 10/12/2021

Run	Run Date	Start Time	SO2 dppmv	M1-4 SO2 lb/ mmBTU	M19 SO2 lb/ mmBTU	M1-4 SO2 lb/hr	M19 SO2 lb/hr
1	10/12/2021	1120	60.21	0.167	0.164	88.083	86.777
2	10/12/2021	1230	61.60	0.181	0.169	94.852	88.753
3	10/12/2021	1350	62.16	0.186	0.172	97.082	89.790
AVE			**61.33**	**0.178**	**0.169**	**93.339**	**88.440**

3 DESCRIPTION OF THE SOURCE

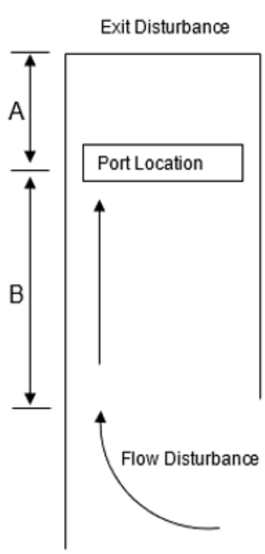
ID	Source Name	Current Rating/size	Permit Rating/size
4	Chena 1 Coal-fired Boiler	50 Mlb/hr steam	76 MMBtu/hr
5	Chena 2 Coal-fired Boiler	50 Mlb/hr steam	76 MMBtu/hr
6	Chena 3 Coal-fired Boiler	50 Mlb/hr steam	76 MMBtu/hr
7	Chena 5 Coal-fired Boiler	220 Mlb/hr steam	269 MMBtu/hr

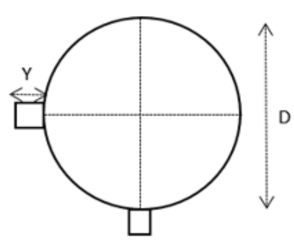
4 DESCRIPTION OF THE SAMPLE LOCATION

The boilers exhaust into a 96-inch internal diameter circular stack that is equipped with two four-inch sample ports oriented 90 degrees apart. The ports are located approximately 24 feet downstream and approximately 40 feet upstream of the nearest flow disturbance. The ports meet USEPA Method 1 requirements. The ports were accessed via the roof. See Figure 1-1 for a diagram.

Figure 4-1 Chena common stack

Chena Common Stack





5.00	Duct Diameters that measurement site is upstream from flow disturbance (A)
3.00	Duct Diameters that measurement site is upstream from flow disturbance (B)

Referencing Figure 1-2: 6 traverse points per port
AST used 12 traverse points per port exceeding minimum requirement
Traverse points: Table 1-2 (percent of stack diameter from inside wall to traverse point)

Sample Ports, Y:	4 inches
Stack Diameter, D:	96 inches
Distance A, upstream:	40 feet
Distance B, downstream:	24 feet

Traverse point	% of Stack Dia	Location in stack, inches from port (includes port length)
1	2.1	6.02
2	6.7	10.43
3	11.8	15.33
4	17.7	20.99
5	25	28.00
6	35.6	38.18
7	64.4	65.82
8	75	76.00
9	82.3	83.01
10	88.2	88.67
11	93.3	93.57
12	97.9	97.98

5 DESCRIPTION OF SOURCE OPERATIONS AND TEST CONDITIONS

To evaluate source operations and conditions during each of the test series, process data was collected concurrently with each sample run.

The Steam flow (lb/hr) was recorded throughout the test. The boilers operated normally and there were no upsets.

Table 5-1 Summary of Operation Parameters

Run	Steam Production (lbs/hr)	Fuel Consumption (mmBTU/hr)	O_2 Content (%)	Opacity (%)
1	271,577	528	7.3	6.9
2	269,345	524	7.3	6.8
3	267,978	521	7.4	7.0
Ave	**269,633**	**524**	**7.3**	**6.9**

This data is included in Appendix C, Operational Data.

6 DESCRIPTION OF TEST PROCEDURES

6.1 Test Methods

The individual test procedures used during this testing program were conducted 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
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 Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)
Method 19 Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxides Emission Rates

6.2 Description of Test Procedures

Prior to the beginning the testing program, an initial full-scale calibration was performed on each gas analyzer to determine linearity. The zero and calibration gases used were certified in accordance with EPA protocol procedures and traceable to standards of the National Institute of Standards and Technology (NIST). Calibration gas for the initial calibration and any subsequent adjusted calibrations was introduced directly to the back of each analyzer. System bias checks and calibration checks for zero and span drift were conducted by introducing the calibration gases at the probe connection which allowed the calibration gases to flow through the entire sample system. This served two purposes, (1) to check for any system bias and (2) to check sample system integrity for air leaks. A system response time check was performed. The SO_2, O_2, and CO_2 analyzer system response times were 150 seconds, 70 seconds, and 70 seconds respectively Zero and span checks were performed for each gas analyzer prior to and following each sample run. This was to assess calibration drift during the sample period and determine if calibration adjustments were necessary. The zero and span checks are noted in the data files in Appendix B. These values are also used to adjust the raw analyzer data in accordance with USEPA Method 7E. Zero drift and span values all met method requirements.

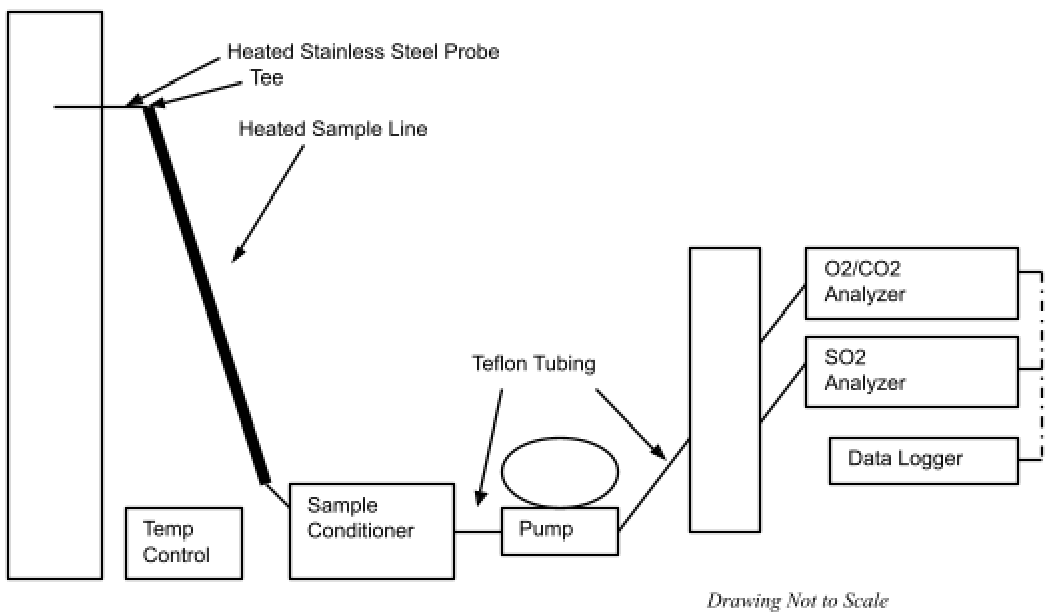
The sample run duration was 60 minutes for each run. The initial stratification check demonstrated that the stack was not stratified. Previous stratification checks were inconclusive due to variations in the process.

The exhaust gas concentrations for SO_2, CO_2, and O_2 were measured using instrumental methods. Sample gas was extracted though a heated stainless-steel probe equipped with a filter and inserted through the sample port. The sample gas was drawn from the probe through a 100-foot heated Teflon sample line and into a sample conditioner. The sample line temperature was maintained at 250 ºF. 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 entered a Teflon-lined head sample pump and then the sample flow was distributed to the individual gas analyzers. Each of the instruments sent an output signal to a data recorder. The data recorder polled each analog instrument signal once every 30 seconds, converted the signal to engineering units, and recorded each data point into memory.

A velocity traverse was performed during each run; a S-type Pitot tube and a calibrated Magna-helix pressure gauge was used for all units. The stack was under slight positive pressure. Care was taken to keep the ports sealed when

traverses were taken. Temperatures were measured using a “K” type thermocouple and a hand-held Omega read-out. The ports were sealed with high-temperature cloth.
A schematic of the sample train is found in Figure 6 – 1.

Figure 6-1 Method 3A, 6C Stack Sampling System



The range for the SO2 analyzer was 0 – 241 for the generator testing. Calibration gases used during the analyzer linearity were 0, 102, and 241 ppm. At no point during testing did the analyzers need to be recalibrated.

One moisture run was performed simultaneously per run. The moisture sample was extracted through a separate stainless steel probe through a heated 10-foot, 3/8-inch thick-walled hose from the stack to the impinger train and then through a 100-foot, 3/8-inch thick-walled hose to the meter box. The line was drained into the first impinger after each run.

6.3 List of Field Testing Equipment

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” H_2O) 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.

Prior to each sample run, the impinger train was prepared and a pre-sample impinger weight determined with a top loading electronic balance. The data was recorded on a field data sheet. A pre-run leak test was then performed with a vacuum up to 15” of mercury (Hg). Once the leak test was successfully completed, the initial DGM reading was recorded. Data were recorded for ΔH, impinger train exit temperature, DGM inlet/outlet temperature and system vacuum. At the conclusion of the moisture sample run the sample pump valve was closed and the probe was removed from the stack. The final sample volume was recorded from the DGM. A post-run leak check was performed at a vacuum equal to or greater than the highest vacuum recorded during the run.

The impinger train was disassembled and final weights determined for each impinger (to the nearest 0.5 grams). The total grams of water captured was calculated and recorded on the field data sheet.

Method 3A equipment is described below. O_2/CO_2 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 Method 6C SO_2 analysis for the combustion gas sample was 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.

7 CALCULATIONS

All calculations were checked by an in-house second party. Hand calculations have been performed to verify the spreadsheet calculations. Please refer to Appendix A for a printout of the spreadsheet and for the hand calculations.

8 QUALITY ASSURANCE

To ensure the collection of high quality and accurate data AST strictly adhered to all the U.S. EPA Reference Methods and the *Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III* used during this testing program. In all other aspects of the testing, AST followed its own corporate Quality Program Manual QPM-1,Rev 1, 08/08/10.

Documentation for all quality control/quality assurance activities for the sample collection is presented in Appendix D.

Table 8-1 Initial Analyzer Calibration and Bias Error Percentage

Calibration Gas		**Analyzer Response**	**Bias Error %**	**Span**
Zero SO_2	0.00 ppm	0.49 ppm	0.20%	241.30 ppm
Mid-Range SO_2	101.20 ppm	102.58 ppm	0.57%	
High Range SO_2	241.30 ppm	241.66 ppm	0.15%	
Zero CO_2	0.00%	-0.06%	-0.46%	13.90%
Mid-Range CO_2	7.055%	7.10%	0.32%	

High Range CO_2	13.90%	13.90%	0.00%	
Zero O_2	0.00%	-0.09%	-0.44%	20.900%
Mid-Range O_2	10.06%	10.05%	-0.04%	
High Range O_2	20.90%	20.80%	-0.47%	

*Method 7E, Eq. 7E-1 ACE = ((C_{Dir} – C_V)/CS)*100 where ACE is Analyzer Calibration Error, C_{Dir} is measured concentration, C_V is concentration of calibration gas, and CS is calibration span.

ACE must be within ± 2.0 percent of calibration span of the analyzer for each level of calibration gas.

Table 8 – 2 Analyzer Response Times in seconds

Analyzer	AVE.
CO_2	70
O_2	70
SO_2	150

Appendix A

Calculation Spreadsheets and Example Calculation

Unit			Boiler 5		
Run Number			1	2	3
Date			10/12/2021	10/12/2021	10/12/2021
Run Start Time			1120	1230	1350
DGM Volume	V_m	cubic feet	25.139	26.93	28.497
DGM Y Factor	Y	-	0.991	0.991	0.991
DGM Average Temperature	T_m	Degrees R	519.63	528.50	530.06
Barometric Pressure	P_{bar}	Inches Hg	29.85	29.85	29.85
Delta H	ΔH	Inches Water	1.5	1.5	1.5
Sample Volume at Standard Conditions	V_{mstd}	Standard	25.33	26.68	28.15
Total Volume of Water collected	V_{lc}	Milliliters	61	63	56
Standard Volume of Water	V_{wstd}	Standard Cubic	2.871	2.965	2.635
Stack Gas Moisture Content	B_{ws}	-	0.1018	0.1000	0.0856
Pitot Tube Coefficient	C_p	-	0.84	0.84	0.84
Average Pitot differential pressure	ΔP	Inches Water	1.31	1.44	1.45
Square Root of Differential Pressure		-	1.144	1.202	1.202
Average Stack Gas Temperature	$T_{s(ave)}$	Degrees R	741.04	740.58	740.13
Measured Stack Pressure	P_g	Inches Water	0.5	0.5	0.5
Absolute Stack Pressure	P_s	Inches Hg	29.9	29.9	29.9
Stack %O_2		%	8.622	8.723	8.817
Stack %CO_2		%	11.370	11.282	11.190
Stack %N_2 + %CO		%	80.008	80.0	80.0
Stack Gas Dry Molecular Weight	M_d		30.164	30.2	30.1
Stack Gas Wet Molecular Weight	M_s	lb/lb mole	28.93	28.94	29.10
Actual Average Velocity	V_s	ft/sec	76.04	79.84	79.64
Stack Diameter		ft	8.00	8.00	8.00
Stack Area	A	sq ft	50.27	50.27	50.27
Standard Stack Gas Volumetric Flow	Q_{sd}	Standard Dry Cubic Feet/min	147160.3	154908.9	157103.3
SO2 dry volumetric concentration	$C_{d(NOx)}$	dppmv	60.214	61.597	62.165
Fuel Consumption		MMbtu/hr	528.18	523.72	520.97
SO2 concentration	$E_{(NOx)}$	lb/hr	88.1	94.9	97.1
SO2 emissions		lb/mmBTU	0.167	0.181	0.186
SO2 emissions (M19)		lb/hr	86.78	88.75	89.79
SO2 emissions (M19)		lb/mmBTU	0.164	0.169	0.172

Example Average Gas Concentration

From 40 CFR 60, App. A, Method 7E

Aurora Energy LLC

Common Stack, Run 1, O_2 Bias Correction

Where:

Variable	Definition	Comn Stk, Run 1 Data
C_{gas}	Effluent gas concentration, %	
C_{avg}	Average gas concentration indicated by gas analyzer, %	C_{avg}= 8.60
C_{Dir}	Measured concentration of a calibration gas (low, mid, or high) when introduced in direct calibration mode, %	$C_{Dir(zero)}$= -0.092 $C_{Dir(upscale)}$= 10.0517
C_O	Average of initial and final system calibration bias check responses for the zero gas, %.	$C_O = \frac{((-0.0229)+(-0.0183))}{2} = -0.0206$
C_M	Average of initial and final system calibration bias check responses for the upscale calibration gas, %	$C_M = \frac{(10.0491+10.0258)}{2} = 10.0375$
C_{MA}	Actual concentration of the upscale calibration gas, %	C_{MA}= 10.06
C_s	Measured concentration of a calibration gas (low, mid, or high) when introduced in system calibration mode, %	$C_{s(zero)}$= -0.0229 $C_{s(upscale)}$= 10.0491
CS	Calibration span, % “upper limit of valid instrument response during sampling” (range)	CS = 20.9
D	Drift assessment, percent of calibration	
SB	System bias, percent of calibration span	
SB_i	Pre-run system bias, percent of calibration span	$SB_{i(zero)}$= 0.331 $SB_{i(upscale)}$= -0.012
SB_{final}	Post-run system bias, percent of calibration span	$SB_{final(zero)}$= 0.353 $SB_{final(upscale)}$= -0.124
SCE	System calibration error, percent of calibration span	

Sample System Bias (USEPA Method 7E, Eq. 7E- 2)

$$SB = 100\left(\frac{C_s - C_{Dir}}{CS}\right)$$

$$SB_{Zero} = 100\left(\frac{(-0.0229)-(-0.092)}{20.9}\right) = 0.331\%$$

$$SB_{upscale} = 100\left(\frac{10.0491-10.0517}{20.9}\right) = -0.0124\%$$

Sample Drift Assessment (USEPA Method 7E, Eq. 7E – 4)

$$D = \left|SB_{final} - SB_i\right|$$

$$D_{zero} = |0.353 - 0.331| = 0.022\%$$

$$D_{upscale} = |-0.012 - (-0.124)| = 0.112\%$$

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

Sample Gas Concentration (USEPA Method 7E, Eq. 7E – 5b)

$$C_{gas} = (C_{avg} - C_O)\left(\frac{C_{MA}}{C_M - C_O}\right)$$

$$C_{gas} = (8.60 - (-0.0206))\left(\frac{10.06}{10.0375 - (-0.0206)}\right) = 8.622$$

Example Moisture Content

From 40 CFR 60, App. A-3, Method 4

Aurora Energy, LLC

Common Stack, Run 1

Sample Volume at Standard Conditions $V_{m(std)}$ (USEPA Method 5, Eq. 5-1)

Dry Gas Meter (DGM) Volume (V_m):	25.139 *ft³*
DGM Y Factor (Y):	0.9907
DGM Average Temperature (T_m):	519.63 *°R*
Barometric Pressure (P_{bar}):	*29.85 ”Hg*
Average Delta H (ΔH):	1.5 *”H_2O*

$$V_{m(std)} = K_1 V_m Y \left(\frac{P_{bar} + \left(\frac{\Delta H}{13.6}\right)}{T_m}\right)$$

Where:

- $V_{m(std)}$ = Volume of gas sample in standard cubic feet
- Y = Dry gas meter calibration factor
- T_m = Average DGM temperature
- P_{bar} = Barometric pressure at site
- ΔH = Average pressure differential across the orifice meter
- K_1 = $17.64 \frac{°R}{"Hg}$

$$V_{m(std)} = \left(17.64 \frac{°R}{"Hg}\right)(25.139 ft^3)(0.9907)\left(\frac{29.85\ "Hg + \left(\frac{1.5"\ H_2O}{13.6}\right)}{519.63\ °R}\right)$$

$$V_{m(std)} = 25.33\ ft^3_{standard}$$

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

Volume of water vapor condensed (USEPA Method 5, Eq. 5-2)

Total Water Collected in Sample Train ($\boldsymbol{V_{1c}}$): 61 *ml*

$$\boldsymbol{V_{w(std)} = K_2 V_{1c}}$$

Where:

$V_{w(std)}$ = Volume of water vapor in the gas sample in standard cubic feet

K_2 = 0.04707 $\frac{ft^3}{ml}$

V_{1c} = total volume of liquid collect in ml at standard conditions

$$\boldsymbol{V_{w(std)} = \left(0.04707\ \frac{ft^3}{ml}\right)(61\ ml)}$$

$$\boldsymbol{V_{w(std)} = 2.871\ ft^3_{standard}}$$

Moisture Content (USEPA Method 5, Eq. 5-3)

$$\boldsymbol{B_{ws} = \frac{V_{w(std)}}{(V_{m(std)} + V_{w(std)})}}$$

Where:

B_{ws} = Moisture content of the sample gas expressed as a fraction

$$\boldsymbol{B_{ws} = \frac{2.871\ ft^3_{std}}{(25.33 ft^3_{std} + 2.871 ft^3_{std})}}$$

$$\boldsymbol{B_{ws} = 0.1018}$$

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

Example Stack Gas Velocity and Volumetric Flow Rate

From 40 CFR 60, App. A-1, Method 2

Aurora Energy, LLC

Common Stack, Run 1

Dry Molecular weight of stack gas (USEPA Method 3, Eq. 3-1)

$\boldsymbol{Nitrogen, Carbon\ Monoxide\ Concentration} = (\boldsymbol{O_2}\% + \boldsymbol{CO_2}\%) - \mathbf{100}\%$ (Method 3, 12.2)

$(\%\boldsymbol{N_2} + \%\boldsymbol{CO}) = (\%\boldsymbol{O_2} + \%\boldsymbol{CO_2}) - \mathbf{100}\%$

$(\%\boldsymbol{N_2} + \%\boldsymbol{CO}) = (\mathbf{8.622} + \mathbf{11.370}) - \mathbf{100} = \mathbf{80.008}\%$

$$\boldsymbol{M_d} = \mathbf{0.440}(\%\boldsymbol{CO_2}) + \mathbf{0.320}(\%\boldsymbol{O_2}) + \mathbf{0.280}(\%\boldsymbol{N_2} + \%\boldsymbol{CO})$$

Where:

M_d	=	Dry molecular weight, $\frac{lb}{lb-mole}$
$\%CO_2$	=	Percent CO_2 by volume, dry basis
$\%O_2$	=	Percent O_2 by volume, dry basis
$\%CO$	=	Percent CO by volume, dry basis
$\%N_2$	=	Percent N_2 by volume, dry basis
0.280	=	MW of N_2 or CO, divided by 100
0.320	=	MW of O_2, divided by 100
0.440	=	MW of CO_2, divided by 100

$$\boldsymbol{M_d} = \mathbf{0.440}(\mathbf{11.37}\%) + \mathbf{0.320}(\mathbf{8.622}\%) + \mathbf{0.280}(\mathbf{80.008}\%)$$

$$\boldsymbol{M_d} = \mathbf{30.164}\frac{\boldsymbol{lb}}{\boldsymbol{lb - mole}}$$

Saturated Molecular Weight of stack gas (USEPA Method 2, Eq. 2-6)

$$\boldsymbol{M_S} = \boldsymbol{M_d}(\mathbf{1} - \boldsymbol{B_{WS}}) + \mathbf{18.0}(\boldsymbol{B_{WS}})$$

Where:

M_S	=	Saturated molecular weight, $\frac{lb}{lb-mole}$
18.0	=	Molecular weight of water, $\frac{lb}{lb-mole}$

$$\boldsymbol{M_S} = \mathbf{30.164}(\mathbf{1} - \mathbf{0.1018}) + \mathbf{18.0}(\mathbf{0.0825})$$

$$\boldsymbol{M_S} = \mathbf{28.5783}\frac{\boldsymbol{lb}}{\boldsymbol{lb - mole}}$$

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