



Source Test Report

Tesoro Refining and Marketing Company
Salt Lake City Refinery
474 West 900 North
Salt Lake City, UT 84103

Source Tested: West Cogeneration Unit (CG2)
Test Date: November 9, 2023

Project No. AST-2023-4464-002

Prepared By
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Source Information

Source Name

West Cogeneration Unit (CG2)

Target Parameters

HCl, HF

Contact Information

Test Location

Tesoro Refining and Marketing
Company
Salt Lake City Refinery
474 West 900 North
Salt Lake City, UT 84103

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

To the best of my knowledge and abilities, all information, facts and test data are correct. Data presented in this report has been checked for completeness and is accurate, error-free and legible. Onsite testing was conducted in accordance with approved internal Standard Operating Procedures. Any deviations or problems are detailed in the relevant sections in the test report.

This report is only considered valid once an authorized representative of Alliance has signed in the space provided below; any other version is considered draft. This document was prepared in portable document format (.pdf) and contains pages as identified in the bottom footer of this document.



Charles Horton, QSTI
Alliance Technical Group, LLC

8/21/2024

Date

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Introduction

1.0 Introduction

Alliance Technical Group, LLC (Alliance) was retained by Marathon Petroleum Corporation (MPC) to conduct engineering testing at the Tesoro Refining and Marketing Company (Tesoro) Salt Lake City, Utah refinery. Testing was conducted to determine the emission rates of hydrogen chloride (HCl) and hydrogen fluoride (HF) at the exhaust of the West Cogeneration Unit (CG2).

1.1 Project Team

Personnel involved in this project are identified in the following table.

Table 1-1: Project Team

MPC Personnel	Chris Kaiser Hannah Placzek
Alliance Personnel	Charles Horton Curtis Berridge Dillon Brown Austin Mayfield Ryan Simon Matthew Swaykus

Summary of Results

2.0 Summary of Results

Alliance conducted engineering testing at the MPC facility in Salt Lake City, Utah on November 9, 2023. Testing consisted of determining the emission rates of HCl and HF at the exhaust of the West Cogeneration Unit (CG2).

Table 2-1 provides a summary of the emission testing results. Any difference between the summary results listed in the following table and the detailed results contained in appendices is due to rounding for presentation.

Underlined values in the following tables indicate that the laboratory result for one or more fraction for that analyte was below the laboratory's minimum detection limit (MDL). The MDL was used for calculation purposes.

Table 2-1: Summary of Results – West Cogeneration Unit (CG2)

Run Number	Run 1	Run 2	Run 3	Average
Date	11/9/23	11/9/23	11/9/23	--
Hydrogen Chloride Data				
Concentration, ppmvd	0.11	0.14	0.042	0.10
Emission Rate, lb/hr	0.032	0.041	0.013	0.029
Hydrogen Fluoride Data				
Concentration, ppmvd	0.010	0.011	<u>0.0024</u>	0.0078
Emission Rate, lb/hr	0.0029	0.0032	<u>0.00078</u>	0.0023

Testing Methodology

3.0 Testing Methodology

The emission testing program was conducted in accordance with the test methods listed in Table 3-1. Method descriptions are provided below while quality assurance/quality control data is provided in Appendix D.

Table 3-1: Source Testing Methodology

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Volumetric Flow Rate	1 & 2	Full Velocity Traverses
Moisture Content	4	Gravimetric Analysis
Hydrogen Chloride / Hydrogen Fluoride	26A	Isokinetic Sampling

3.1 U.S. EPA Reference Test Methods 1 and 2 – Sampling/Traverse Points and Volumetric Flow Rate

The sampling location and number of traverse (sampling) points were selected in accordance with U.S. EPA Reference Test Method 1. To determine the minimum number of traverse points, the upstream and downstream distances were equated into equivalent diameters and compared to Figure 1-1 in U.S. EPA Reference Test Method 1.

Full velocity traverses were conducted in accordance with U.S. EPA Reference Test Method 2 to determine the average stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system consisted of a pitot tube and inclined manometer. The stack gas temperature was measured with a K-type thermocouple and pyrometer.

Stack gas velocity pressure and temperature readings were recorded during each test run. The data collected was utilized to calculate the volumetric flow rate in accordance with U.S. EPA Reference Test Method 2.

3.2 U.S. EPA Reference Test Method 4 – Moisture Content

The stack gas moisture content (BWS) was determined in accordance with U.S. EPA Reference Test Method 4. The gas conditioning train consisted of a series of chilled impingers. Prior to testing, each impinger was filled with a known quantity of reagent, water or silica gel. Each impinger was analyzed gravimetrically before and after each test run on the same balance to determine the amount of moisture condensed.

3.3 U.S. EPA Reference Test Method 26A – Hydrogen Chloride and Hydrogen Fluoride

The hydrogen chloride and hydrogen fluoride testing was conducted in accordance with U.S. EPA Reference Test Method 26A. The complete Method 26A sampling system consisted of a glass nozzle, heated glass-lined probe, heated Teflon filter, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of four (4) chilled impingers. The first and second impingers contained 100 mL of 0.1 N H₂SO₄, the third was initially empty and the fourth contained 200-300 grams of silica gel. The probe liner and filter heating systems were maintained at 248-273°F, and the impinger temperature was maintained at 20°C (68°F) or less throughout the testing.

Following the completion of each test run, the sampling train was leak checked at a vacuum pressure greater than or equal to the highest vacuum pressure observed during the run and the contents of the impingers were measured for moisture gain. The absorbing solution (0.1 N H₂SO₄) from the first and second impingers was placed into sample container 3. The back-half of the filter holder, first, second and third impingers and all glassware leading to the

outlet of the third impinger were rinsed with de-ionized (DI) water. These rinses were also placed in container 3. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for analysis.

Appendix A

Location: MPC-Tesoro - Salt Lake City Refinery
Source: West Cogeneration Unit (CG2)
Project No.: AST-2023-4464
Run No.: 1
Parameter: HCl/HF

Meter Pressure (Pm), in. Hg

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

where,

P_b	<u>25.98</u>	= barometric pressure, in. Hg
ΔH	<u>1.154</u>	= pressure differential of orifice, in H ₂ O
P_m	<u>26.06</u>	= in. Hg

Absolute Stack Gas Pressure (Ps), in. Hg

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

where,

P_b	<u>25.98</u>	= barometric pressure, in. Hg
P_g	<u>-1.00</u>	= static pressure, in. H ₂ O
P_s	<u>25.91</u>	= in. Hg

Standard Meter Volume (Vmstd), dscf

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

where,

Y	<u>0.985</u>	= meter correction factor
V_m	<u>78.977</u>	= meter volume, cf
P_m	<u>26.06</u>	= absolute meter pressure, in. Hg
T_m	<u>517.8</u>	= absolute meter temperature, °R
$Vmstd$	<u>69.061</u>	= dscf

Standard Wet Volume (Vwstd), scf

$$Vwstd = 0.04716 \times Vlc$$

where,

Vlc	<u>176</u>	= weight of H ₂ O collected, g
$Vwstd$	<u>8.300</u>	= scf

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

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

where,

T_s	<u>309.9</u>	= stack temperature, °F
P_s	<u>25.91</u>	= absolute stack gas pressure, in. Hg
BWS_{sat}	<u>5.816</u>	= dimensionless

Moisture Fraction (BWS), dimensionless (measured)

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

where,

$Vwstd$	<u>8.300</u>	= standard wet volume, scf
$Vmstd$	<u>69.061</u>	= standard meter volume, dscf
BWS	<u>0.107</u>	= dimensionless

Location: MPC-Tesoro - Salt Lake City Refinery
Source: West Cogeneration Unit (CG2)
Project No.: AST-2023-4464
Run No.: 1
Parameter: HCl/HF

Moisture Fraction (BWS), dimensionless

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

where,

$$\begin{aligned} BWS_{sat} &= \frac{5.816}{0.107} = \text{moisture fraction (theoretical at saturated conditions)} \\ BWS_{msd} &= \frac{0.107}{0.107} = \text{moisture fraction (measured)} \\ BWS &= \frac{0.107}{0.107} \end{aligned}$$

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

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

where,

$$\begin{aligned} CO_2 &= \frac{5.8}{10.6} = \text{carbon dioxide concentration, \%} \\ O_2 &= \frac{10.6}{29.35} = \text{oxygen concentration, \%} \\ Md &= \frac{29.35}{29.35} = \text{lb/lb mol} \end{aligned}$$

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

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

where,

$$\begin{aligned} Md &= \frac{29.35}{0.107} = \text{molecular weight (DRY), lb/lb mol} \\ BWS &= \frac{0.107}{28.14} = \text{moisture fraction, dimensionless} \\ Ms &= \frac{28.14}{28.14} = \text{lb/lb mol} \end{aligned}$$

Average Velocity (Vs), ft/sec

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

where,

$$\begin{aligned} Cp &= \frac{0.840}{1.143} = \text{pitot tube coefficient} \\ \Delta P^{1/2} &= \frac{1.143}{769.6} = \text{velocity head of stack gas, (in. } H_2O)^{1/2} \\ Ts &= \frac{769.6}{25.91} = \text{absolute stack temperature, } ^\circ R \\ Ps &= \frac{25.91}{28.14} = \text{absolute stack gas pressure, in. Hg} \\ Ms &= \frac{28.14}{84.4} = \text{molecular weight of stack gas, lb/lb mol} \\ Vs &= \frac{84.4}{84.4} = \text{ft/sec} \end{aligned}$$

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

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

where,

$$\begin{aligned} Vs &= \frac{84.4}{27.88} = \text{stack gas velocity, ft/sec} \\ As &= \frac{27.88}{141,151} = \text{cross-sectional area of stack, ft}^2 \\ Qa &= \frac{141,151}{141,151} = \text{acfm} \end{aligned}$$

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

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

where,

$$\begin{aligned} Qa &= \frac{141,151}{0.107} = \text{average stack gas flow at stack conditions, acfm} \\ BWS &= \frac{0.107}{25.91} = \text{moisture fraction, dimensionless} \\ Ps &= \frac{25.91}{769.6} = \text{absolute stack gas pressure, in. Hg} \\ Ts &= \frac{769.6}{74,807} = \text{absolute stack temperature, } ^\circ R \\ Qs &= \frac{74,807}{74,807} = \text{dscfm} \end{aligned}$$

Location: MPC-Tesoro - Salt Lake City Refinery
Source: West Cogeneration Unit (CG2)
Project No.: AST-2023-4464
Run No.: 1
Parameter: HCl/HF

Dry Gas Meter Calibration Check (Yqa), dimensionless

$$Yqa = \frac{Y - \left(\frac{\Theta}{V_m} \sqrt{\frac{0.0319 \times T_m \times 29}{\Delta H@ \times \left(P_b + \frac{\Delta H_{avg}}{13.6} \right) \times M_d}} \sqrt{\Delta H_{avg}} \right)}{Y} \times 100$$

where,

Y	0.985	= meter correction factor, dimensionless
Θ	120	= run time, min.
V _m	78.977	= total meter volume, dcf
T _m	517.8	= absolute meter temperature, °R
ΔH@	1.843	= orifice meter calibration coefficient, in. H ₂ O
P _b	25.98	= barometric pressure, in. Hg
ΔH avg	1.154	= average pressure differential of orifice, in H ₂ O
M _d	29.35	= molecular weight (DRY), lb/lb mol
(Δ H) ^{1/2}	1.069	= average squareroot pressure differential of orifice, (in. H ₂ O) ^{1/2}
Yqa	3.8	= percent

Volume of Nozzle (Vn), ft³

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

where,

T _s	769.6	= absolute stack temperature, °R
P _s	25.91	= absolute stack gas pressure, in. Hg
V _{lc}	176.0	= volume of H ₂ O collected, ml
V _m	78.977	= meter volume, cf
P _m	26.06	= absolute meter pressure, in. Hg
Y	0.985	= meter correction factor, unitless
T _m	517.8	= absolute meter temperature, °R
V _n	130.282	= volume of nozzle, ft ³

Isokinetic Sampling Rate (I), %

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

where,

V _n	130.282	= nozzle volume, ft ³
θ	120.0	= run time, minutes
A _n	0.00020	= area of nozzle, ft ²
V _s	84.4	= average velocity, ft/sec
I	107.8	= %

Hydrogen Chloride Concentration (C_{HCl}), mg/dscm

$$C_{HCl} = \frac{M_{HCl} \times 35.313}{V_{mstd} \times 1.0E + 03}$$

where,

M _{HCl}	223.0	= hydrogen chloride mass, ug
V _{mstd}	69.061	= standard meter volume, dscf
C _{HCl}	0.11	= mg/dscm

Location: MPC-Tesoro - Salt Lake City Refinery
Source: West Cogeneration Unit (CG2)
Project No.: AST-2023-4464
Run No.: 1
Parameter: HCl/HF

Hydrogen Chloride Emission Rate (ER_{HCl}), lb/hr

$$ER_{HCl} = \frac{M_{HCl} \times Qs \times 60 \frac{min}{hr}}{Vmstd \times 4.54 E + 08}$$

where,

M_{HCl}	<u>223.0</u>	= hydrogen chloride mass, ug
Qs	<u>74,807</u>	= average stack gas flow at standard conditions, dscfm
$Vmstd$	<u>69.061</u>	= standard meter volume, dscf
ER_{HCl}	<u>0.032</u>	= lb/hr

Hydrogen Fluoride Concentration (C_{HF}), mg/dscm

$$C_{HF} = \frac{M_{HF} \times 35.313}{Vmstd \times 1.0E + 03}$$

where,

M_{HF}	<u>19.9</u>	= hydrogen fluoride mass, ug
$Vmstd$	<u>69.061</u>	= standard meter volume, dscf
C_{HF}	<u>0.010</u>	= mg/dscm

Hydrogen Fluoride Emission Rate (ER_{HF}), lb/hr

$$ER_{HF} = \frac{M_{HF} \times Qs \times 60 \frac{min}{hr}}{Vmstd \times 4.54 E + 08}$$

where,

M_{HF}	<u>19.9</u>	= hydrogen fluoride mass, ug
Qs	<u>74,807</u>	= average stack gas flow at standard conditions, dscfm
$Vmstd$	<u>69.061</u>	= standard meter volume, dscf
ER_{HF}	<u>0.0029</u>	= lb/hr

Appendix B

Location MPC-Tesoro - Salt Lake City Refinery
Source West Cogeneration Unit (CG2)
Project No. AST-2023-4464
Parameter HCl/HF

Run Number		Run 1	Run 2	Run 3	Average
Date		11/9/23	11/9/23	11/9/23	--
Start Time		12:52	16:21	19:33	--
Stop Time		15:34	18:54	22:07	--
Run Time, min	(θ)	120.0	120.0	120.0	120.0
INPUT DATA					
Barometric Pressure, in. Hg	(Pb)	25.98	25.85	25.68	25.84
Meter Correction Factor	(Y)	0.985	0.985	0.985	0.985
Orifice Calibration Value	($\Delta H @$)	1.843	1.843	1.843	1.843
Meter Volume, ft ³	(Vm)	78.977	82.740	84.323	82.013
Meter Temperature, °F	(Tm)	58.1	52.3	51.0	53.8
Meter Temperature, °R	(Tm)	517.8	512.0	510.7	513.5
Meter Orifice Pressure, in. WC	(ΔH)	1.154	1.283	1.379	1.272
Volume H ₂ O Collected, mL	(Vlc)	176.0	190.9	169.1	178.7
Nozzle Diameter, in	(Dn)	0.191	0.191	0.191	0.191
Area of Nozzle, ft ²	(An)	0.0002	0.0002	0.0002	0.0002
Hydrogen Chloride Mass, ug	(M _{HCl})	223.0	288.0	87.8	199.6
Hydrogen Fluoride Mass, ug	(M _{HF})	19.9	22.0	5.11	15.7
ISOKINETIC DATA					
Standard Meter Volume, ft ³	(Vmstd)	69.061	72.838	73.946	71.948
Standard Water Volume, ft ³	(Vwstd)	8.300	9.003	7.975	8.426
Moisture Fraction Measured	(BWSmsd)	0.107	0.110	0.097	0.105
Moisture Fraction @ Saturation	(BWSsat)	5.816	6.365	6.185	6.122
Moisture Fraction	(BWS)	0.107	0.110	0.097	0.105
Meter Pressure, in Hg	(Pm)	26.06	25.94	25.78	25.93
Volume at Nozzle, ft ³	(Vn)	130.282	139.600	140.214	136.70
Isokinetic Sampling Rate, (%)	(I)	107.8	107.7	101.0	105.5
DGM Calibration Check Value, (+/- 5%)	(Y _{qa})	3.8	3.4	1.8	3.0
EMISSION CALCULATIONS					
Hydrogen Chloride Concentration, mg/dscm	(C _{HCl})	0.11	0.14	0.042	0.10
Hydrogen Chloride Emission Rate, lb/hr	(ER _{HCl})	0.032	0.041	0.013	0.029
Hydrogen Fluoride Concentration, mg/dscm	(C _{HF})	0.010	0.011	0.0024	0.0078
Hydrogen Fluoride Emission Rate, lb/hr	(ER _{HF})	0.0029	0.0032	0.00078	0.0023

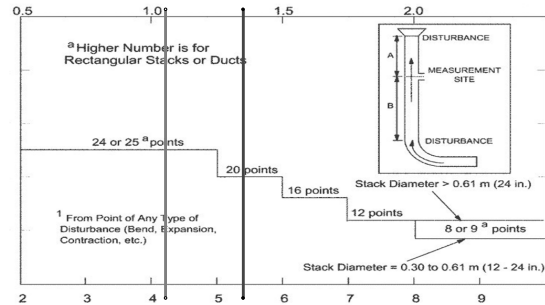
Location MPC-Tesoro - Salt Lake City Refinery
 Source West Cogeneration Unit (CG2)
 Project No. AST-2023-4464
 Parameter HCl/HF

Run Number		Run 1	Run 2	Run 3	Average
Date		11/9/23	11/9/23	11/9/23	--
Start Time		12:52	16:21	19:33	--
Stop Time		15:34	18:54	22:07	--
Run Time, min		120.0	120.0	120.0	120.0
VELOCITY HEAD, in. WC					
Point 1		1.70	1.30	1.50	1.50
Point 2		1.50	1.50	0.80	1.27
Point 3		1.50	1.30	0.80	1.20
Point 4		1.30	1.60	1.00	1.30
Point 5		1.20	1.40	1.30	1.30
Point 6		1.80	1.60	2.00	1.80
Point 7		1.20	1.70	2.00	1.63
Point 8		1.30	1.30	1.90	1.50
Point 9		1.30	1.70	1.90	1.63
Point 10		1.10	1.70	2.00	1.60
Point 11		1.40	1.80	1.90	1.70
Point 12		1.20	1.80	1.90	1.63
Point 13		0.95	1.20	1.70	1.28
Point 14		0.91	1.30	1.90	1.37
Point 15		1.10	1.20	1.90	1.40
Point 16		1.10	1.30	1.90	1.43
Point 17		1.10	1.80	1.90	1.60
Point 18		1.20	1.30	2.00	1.50
Point 19		1.00	1.30	1.80	1.37
Point 20		1.50	1.30	1.80	1.53
Point 21		1.70	1.70	1.90	1.77
Point 22		1.70	1.60	1.90	1.73
Point 23		1.60	1.80	1.90	1.77
Point 24		1.30	1.30	1.90	1.50
CALCULATED DATA					
Square Root of ΔP , (in. WC) ^{1/2}	(ΔP)	1.143	1.218	1.306	1.222
Pitot Tube Coefficient	(Cp)	0.840	0.840	0.840	0.840
Barometric Pressure, in. Hg	(Pb)	25.98	25.85	25.68	25.84
Static Pressure, in. WC	(Pg)	-1.00	-1.00	-1.00	-1.00
Stack Pressure, in. Hg	(Ps)	25.91	25.78	25.61	25.76
Stack Cross-sectional Area, ft ²	(As)	27.88	27.88	27.88	27.88
Temperature, °F	(Ts)	309.9	315.9	313.4	313.1
Temperature, °R	(Ts)	769.6	775.6	773.1	772.8
Moisture Fraction Measured	(BWSmsd)	0.107	0.110	0.097	0.105
Moisture Fraction @ Saturation	(BWSsat)	5.816	6.365	6.185	6.122
Moisture Fraction	(BWS)	0.107	0.110	0.097	0.105
O ₂ Concentration, %	(O ₂)	10.6	11.1	11.2	10.97
CO ₂ Concentration, %	(CO ₂)	5.8	5.8	5.7	5.77
Molecular Weight, lb/lb-mole (dry)	(Md)	29.35	29.37	29.36	29.36
Molecular Weight, lb/lb-mole (wet)	(Ms)	28.14	28.12	28.26	28.17
Velocity, ft/sec	(Vs)	84.4	90.5	96.9	90.6
VOLUMETRIC FLOW RATE					
At Stack Conditions, acfm	(Qa)	141,151	151,385	162,159	151,565
At Standard Conditions, scfm	(Qsw)	83,798	88,731	94,725	89,085
At Standard Conditions, dscfm	(Qs)	74,807	78,970	85,503	79,760

Location MPC-Tesoro - Salt Lake City Refinery
Source West Cogeneration Unit (CG2)
Project No. AST-2023-4464
Date: 11/08/23

Stack Parameters

Duct Orientation: Vertical
Duct Design: Circular
Distance from Far Wall to Outside of Port: 78.00 in
Nipple Length: 6.50 in
Depth of Duct: 71.50 in
Cross Sectional Area of Duct: 27.88 ft²
No. of Test Ports: 2
Distance A: 8.0 ft
Distance A Duct Diameters: 1.3 (must be ≥ 0.5)
Distance B: 25.0 ft
Distance B Duct Diameters: 4.2 (must be ≥ 2)
Minimum Number of Traverse Points: 24
Actual Number of Traverse Points: 24
Number of Readings per Point: 1
Measurer (Initial and Date): RJS 11/7
Reviewer (Initial and Date): CRH 11/7



CIRCULAR DUCT

LOCATION OF TRAVERSE POINTS

Number of traverse points on a diameter

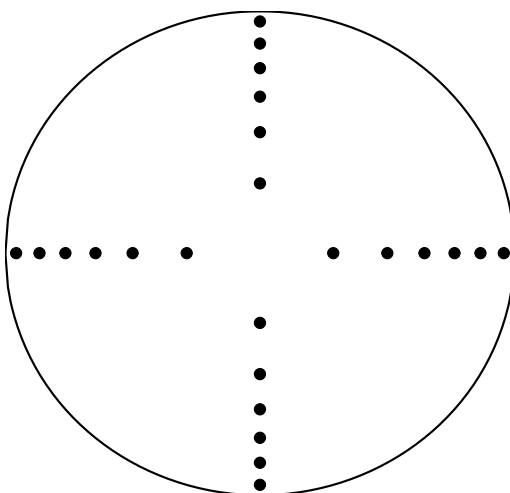
	2	3	4	5	6	7	8	9	10	11	12
1	14.6	--	6.7	--	4.4	--	3.2	--	2.6	--	2.1
2	85.4	--	25.0	--	14.6	--	10.5	--	8.2	--	6.7
3	--	--	75.0	--	29.6	--	19.4	--	14.6	--	11.8
4	--	--	93.3	--	70.4	--	32.3	--	22.6	--	17.7
5	--	--	--	--	85.4	--	67.7	--	34.2	--	25.0
6	--	--	--	--	95.6	--	80.6	--	65.8	--	35.6
7	--	--	--	--	--	--	89.5	--	77.4	--	64.4
8	--	--	--	--	--	--	96.8	--	85.4	--	75.0
9	--	--	--	--	--	--	--	--	91.8	--	82.3
10	--	--	--	--	--	--	--	--	97.4	--	88.2
11	--	--	--	--	--	--	--	--	--	--	93.3
12	--	--	--	--	--	--	--	--	--	--	97.9

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

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	2.1	1.50	8
2	6.7	4.79	11 5/16
3	11.8	8.44	14 15/16
4	17.7	12.66	19 1/8
5	25.0	17.88	24 3/8
6	35.6	25.45	31 15/16
7	44.4	32.60	38 1/2
8	53.3	39.33	45 1/4
9	62.3	45.84	52 1/4
10	71.4	52.00	59 1/2
11	80.7	58.84	66 1/4
12	90.0	65.00	73 1/2

Stack Diagram
A = 8 ft.
B = 25 ft.
Depth of Duct = 71.5 in.

Cross Sectional Area



Downstream Disturbance

A

B

Upstream Disturbance

Cyclonic Flow Check

Location MPC-Tesoro - Salt Lake City Refinery
 Source West Cogeneration Unit (CG2)
 Project No. AST-2023-4464
 Date 11/07/23

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

Location MPC-Tesoro - Salt Lake City Refinery

Source West Cogeneration Unit (CG2)

Project No. AST-2023-4464

Parameter HCl/HF

Analysis Gravimetric

Run 1	Date: 11/9/23				
Impinger No.	1	2	3	4	Total
Contents	H2SO4	H2SO4	Empty	Silica	--
Initial Mass, g	762.8	741.1	631.6	902.4	3037.9
Final Mass, g	846.1	801.5	643.3	923.0	3213.9
Gain	83.3	60.4	11.7	20.6	176.0
Run 2	Date: 11/9/23				
Impinger No.	1	2	3	4	Total
Contents	H2SO4	H2SO4	Empty	Silica	--
Initial Mass, g	761.9	741.5	637.0	923.0	3063.4
Final Mass, g	836.1	801.0	678.2	939.0	3254.3
Gain	74.2	59.5	41.2	16.0	190.9
Run 3	Date: 11/9/23				
Impinger No.	1	2	3	4	Total
Contents	H2SO4	H2SO4	Empty	Silica	--
Initial Mass, g	752.5	742.6	636.8	939.0	3070.9
Final Mass, g	844.1	793.8	649.6	952.5	3240.0
Gain	91.6	51.2	12.8	13.5	169.1

Location: MPC-Tesoro - Salt Lake City Refinery				Start Time: 12:52		Source: West Cogeneration Unit (CG2)					
Date: 11/9/23		Run 1		VALID		End Time: 15:34		Project No.: AST-2023-4464		Parameter: HCl/HF	

STACK DATA (EST)			EQUIPMENT		STACK DATA (EST)			FILTER NO.		STACK DATA (FINAL)			MOIST. DATA			
Moisture:	7.0	% est.	Meter Box ID:	M5-09	Est. Tm:	50	°F		Pb:	25.98	in. Hg	Vlc (ml)				
Barometric:	25.85	in. Hg	Y:	0.985	Est. Ts:	316	°F		Pg:	-1.00	in. WC	176.0				
Static Press:	0.00	in. WC	ΔH @ (in.WC):	1.843	Est. ΔP:	1.64	in. WC		O ₂ :	10.6	%	K-FACTOR				
Stack Press:	25.85	in. Hg	Probe ID:	708-6	Est. Dn:	--	in.		CO ₂ :	5.8	%	--				
CO ₂ :	6.0	%	Liner Material:	glass	Target Rate:	--	scfm						Check Pt.	Initial	Final	Corr.
O ₂ :	13.0	%	Pitot ID:	PT708-6	LEAK CHECK!	Pre	Mid 1	Mid 2	Mid 3	Post	Mid 1 (cf)	--				
N ₂ /CO:	81.0	%	Pitot Cp/Type:	0.840	S-type	Leak Rate (cfm):	0.001	--	--	--	0.001	Mid 2 (cf)	--			
Md:	29.48	lb/lb-mole	Nozzle ID:	G191-26	glass	Vacuum (in Hg):	15	--	--	--	15	Mid 3 (cf)	--			
Ms:	28.68	lb/lb-mole	Nozzle Dn (in.):	0.191		Pitot Tube:	Pass	--	--	--	Pass	Mid-Point Leak Check Vol (cf):	--			

Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft ³)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)
					DGM Average	Stack	Ideal			Actual	Probe	Filter	Imp Exit		
	Amb.	Amb.					Amb.	Amb.		Amb.	Amb.				
	56	56			56	56	56	56		56	56				
a1	0.00	5.00	136.373	1.70	59	314	1.48	1.50	14	266	269	56	-	101.0	95.65
2	5.00	10.00	140.008	1.50	58	313	1.30	1.30	14	265	265	56	-	109.4	89.79
3	10.00	15.00	143.704	1.50	59	313	1.31	1.30	14	265	265	61	-	91.6	89.79
4	15.00	20.00	146.803	1.30	59	315	1.13	1.10	14	268	266	64	-	114.3	83.70
5	20.00	25.00	150.402	1.20	58	315	1.04	1.10	12	268	269	64	-	139.5	80.42
6	25.00	30.00	154.615	1.80	58	314	1.56	1.60	15	265	269	63	-	105.1	98.43
7	30.00	35.00	158.500	1.20	59	314	1.04	1.10	14	268	255	56	-	105.7	80.37
8	35.00	40.00	161.700	1.30	59	314	1.13	1.10	13	267	267	52	-	101.6	83.65
9	40.00	45.00	164.900	1.30	59	314	1.13	1.10	13	266	259	53	-	104.7	83.65
10	45.00	50.00	168.200	1.10	59	313	0.96	1.00	13	267	265	52	-	103.4	76.89
11	50.00	55.00	171.200	1.40	59	313	1.22	1.20	12	266	255	53	-	103.9	86.75
12	55.00	60.00	174.600	1.20	59	312	1.05	1.10	13	265	259	53	-	105.6	80.26
b1	60.00	65.00	177.800	0.95	57	306	0.83	0.80	11	265	254	48	-	111.1	71.14
2	65.00	70.00	180.800	0.91	58	306	0.80	0.80	11	266	266	47	-	102.0	69.62
3	70.00	75.00	183.500	1.10	58	306	0.97	1.00	11	265	253	46	-	91.1	76.55
4	75.00	80.00	186.150	1.10	58	306	0.97	1.00	11	267	262	46	-	89.0	76.55
5	80.00	85.00	188.740	1.10	58	306	0.97	1.00	10	269	264	47	-	118.3	76.55
6	85.00	90.00	192.180	1.20	58	306	1.05	1.10	11	268	263	49	-	84.6	79.95
7	90.00	95.00	194.750	1.00	57	305	0.88	0.90	12	268	260	51	-	106.5	72.94
8	95.00	100.00	197.700	1.50	58	306	1.32	1.30	12	266	272	53	-	101.4	89.39
9	100.00	105.00	201.140	1.70	58	306	1.49	1.50	13	268	260	54	-	101.4	95.16
10	105.00	110.00	204.800	1.70	57	307	1.49	1.50	14	268	259	55	-	104.1	95.22
11	110.00	115.00	208.550	1.60	57	307	1.40	1.40	14	267	268	56	-	107.3	92.38
12	115.00	120.00	212.300	1.30	56	307	1.14	0.90	14	266	262	59	-	96.9	83.27
Final DGM:			215.350												

RESULTS	Run Time		Vm	AP	Tm	Ts	Max Vac	ΔH	%ISO	BWS	Y _{qa}
	min		ft ³	in. WC	°F	°F		in. WC			
	120.0		78.977	1.32	58.1	309.9	15	1.154	107.8	0.107	3.8

Location: MPC-Tesoro - Salt Lake City Refinery				Start Time: 16:21		Source: West Cogeneration Unit (CG2)					
Date: 11/9/23		Run 2		VALID		End Time: 18:54		Project No.: AST-2023-4464		Parameter: HCl/HF	

STACK DATA (EST)	EQUIPMENT	STACK DATA (EST)	FILTER NO.	STACK DATA (FINAL)	MOIST. DATA
Moisture: 7.0 % est.	Meter Box ID: M5-09	Est. Tm: 58 °F		Pb: 25.85 in. Hg	Vlc (ml)
Barometric: 25.85 in. Hg	Y: 0.985	Est. Ts: 310 °F		Pg: -1.00 in. WC	190.9
Static Press: 0.00 in. WC	ΔH @ (in.WC): 1.843	Est. ΔP: 1.32 in. WC		O ₂ : 11.1 %	K-FACTOR
Stack Press: 25.85 in. Hg	Probe ID: 708-6	Est. Dn: ##### in.		CO ₂ : 5.8 %	--
CO ₂ : 6.0 %	Liner Material: glass	Target Rate: -- scfm		Check Pt.	Initial Final Corr.
O ₂ : 13.0 %	Pitot ID: PT708-6	LEAK CHECK!	Pre Mid 1 Mid 2 Mid 3 Post	Mid 1 (cf)	--
N ₂ /CO: 81.0 %	Pitot Cp/Type: 0.840 S-type	Leak Rate (cfm): 0.001 -- -- -- 0.001		Mid 2 (cf)	--
Md: 29.48 lb/lb-mole	Nozzle ID: G191-26 glass	Vacuum (in Hg): 15 -- -- --		Mid 3 (cf)	--
Ms: 28.68 lb/lb-mole	Nozzle Dn (in.): 0.191	Pitot Tube: Pass -- -- -- Pass		Mid-Point Leak Check Vol (cf):	--

Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft ³)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)
					DGM Average	Stack				Probe	Filter	Imp Exit	Aux		
	Begin	End			Amb.	Amb.	Amb.	Amb.		Amb.	Amb.				
	--	--			Ideal	Actual									
a1	0.00	5.00	216.110	1.30	52	315	1.12	1.10	10	266	255	57	-	108.5	83.70
2	5.00	10.00	219.480	1.50	53	312	1.29	1.30	10	266	264	53	-	103.7	89.74
3	10.00	15.00	222.950	1.30	56	313	1.13	1.10	11	267	260	52	-	100.5	83.59
4	15.00	20.00	226.100	1.60	55	313	1.38	1.40	11	267	270	50	-	103.8	92.74
5	20.00	25.00	229.700	1.40	59	313	1.22	1.20	12	265	265	54	-	100.9	86.75
6	25.00	30.00	233.000	1.60	53	313	1.38	1.40	11	265	267	55	-	105.7	92.74
7	30.00	35.00	236.650	1.70	52	313	1.46	1.50	12	266	268	57	-	102.7	95.59
8	35.00	40.00	240.300	1.30	52	313	1.12	1.10	13	264	266	58	-	114.1	83.59
9	40.00	45.00	243.850	1.70	52	313	1.46	1.50	12	265	266	59	-	102.7	95.59
10	45.00	50.00	247.500	1.70	52	313	1.46	1.50	14	267	261	59	-	105.6	95.59
11	50.00	55.00	251.250	1.80	52	316	1.54	1.60	12	266	263	59	-	105.6	98.55
12	55.00	60.00	255.100	1.80	53	316	1.54	1.60	13	267	267	60	-	106.3	98.55
b1	60.00	65.00	258.985	1.20	53	316	1.03	1.00	11	266	270	51	-	100.9	80.47
2	65.00	70.00	262.000	1.30	51	316	1.11	1.10	10	265	262	50	-	100.1	83.76
3	70.00	75.00	265.100	1.20	50	323	1.02	1.00	10	268	253	49	-	103.1	80.83
4	75.00	80.00	268.150	1.30	54	318	1.12	1.10	10	268	258	50	-	101.9	83.86
5	80.00	85.00	271.320	1.80	50	317	1.53	1.50	11	263	269	51	-	98.6	98.62
6	85.00	90.00	274.900	1.30	50	320	1.10	1.10	12	266	265	51	-	106.7	83.97
7	90.00	95.00	278.190	1.30	51	318	1.11	1.10	11	266	263	54	-	103.7	83.86
8	95.00	100.00	281.400	1.30	51	319	1.11	1.10	11	268	269	56	-	103.8	83.92
9	100.00	105.00	284.610	1.70	51	318	1.45	1.50	12	266	270	54	-	100.2	95.90
10	105.00	110.00	288.150	1.60	52	317	1.37	1.40	14	266	265	56	-	107.6	92.98
11	110.00	115.00	291.850	1.80	51	320	1.53	1.50	13	265	260	55	-	101.9	98.81
12	115.00	120.00	295.550	1.30	50	317	1.11	1.10	13	264	261	53	-	106.8	83.81
Final DGM:			298.850												

RESULTS	Run Time		Vm	AP	Tm	Ts	Max Vac	ΔH	%ISO	BWS	Y _{qa}
	min		ft ³	in. WC	°F	°F		in. WC			
	120.0		82.740	1.49	52.3	315.9	14	1.283	107.7	0.110	3.4

Location: MPC-Tesoro - Salt Lake City Refinery				Start Time: 19:33		Source: West Cogeneration Unit (CG2)					
Date: 11/9/23		Run 3		VALID		End Time: 22:07		Project No.: AST-2023-4464		Parameter: HCl/HF	

STACK DATA (EST)			EQUIPMENT		STACK DATA (EST)			FILTER NO.		STACK DATA (FINAL)			MOIST. DATA			
Moisture:	10.0	% est.	Meter Box ID:	M5-09	Est. Tm:	52	°F		Pb:	25.68	in. Hg	Vlc (ml)				
Barometric:	25.85	in. Hg	Y:	0.985	Est. Ts:	316	°F		Pg:	-1.00	in. WC	169.1				
Static Press:	0.00	in. WC	ΔH @ (in.WC):	1.843	Est. ΔP:	1.49	in. WC		O ₂ :	11.2	%	K-FACTOR				
Stack Press:	25.85	in. Hg	Probe ID:	708-6	Est. Dn:	#####	in.		CO ₂ :	5.7	%	--				
CO ₂ :	6.0	%	Liner Material:	glass	Target Rate:	--	scfm						Check Pt.	Initial	Final	Corr.
O ₂ :	13.0	%	Pitot ID:	PT708-6	LEAK CHECK!	Pre	Mid 1	Mid 2	Mid 3	Post	Mid 1 (cf)	--				
N ₂ /CO:	81.0	%	Pitot Cp/Type:	0.840	S-type	Leak Rate (cfm):	0.001	--	--	--	0.001	Mid 2 (cf)	--			
Md:	29.48	lb/lb-mole	Nozzle ID:	G191-26	glass	Vacuum (in Hg):	15	--	--	--	15	Mid 3 (cf)	--			
Ms:	28.33	lb/lb-mole	Nozzle Dn (in.):	0.191	Pitot Tube:	Pass	--	--	--	Pass	Mid-Point Leak Check Vol (cf):	--				

Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft ³)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)
					DGM Average	Stack	Ideal			Actual	Probe	Filter	Imp Exit		
	Amb.	Amb.					Amb.	Amb.		Amb.	Amb.				
	--	--					--	--		--	--				
a1	0.00	5.00	299.487	1.50	52	312	1.22	1.30	12	266	273	49	-	114.1	90.28
2	5.00	10.00	303.200	0.80	51	312	0.65	0.70	12	266	270	47	-	113.7	65.93
3	10.00	15.00	305.900	0.80	50	312	0.65	0.70	10	266	264	44	-	113.9	65.93
4	15.00	20.00	308.600	1.00	49	312	0.81	0.90	10	265	266	43	-	113.5	73.71
5	20.00	25.00	311.600	1.30	48	312	1.05	1.00	10	265	265	43	-	94.8	84.05
6	25.00	30.00	314.450	2.00	48	312	1.62	1.60	10	264	266	43	-	92.6	104.25
7	30.00	35.00	317.900	2.00	48	312	1.62	1.60	12	264	266	43	-	96.7	104.25
8	35.00	40.00	321.500	1.90	48	312	1.54	1.50	12	264	266	43	-	96.4	101.61
9	40.00	45.00	325.000	1.90	53	312	1.55	1.50	12	264	264	45	-	98.2	101.61
10	45.00	50.00	328.600	2.00	49	310	1.63	1.60	12	265	267	46	-	91.0	104.11
11	50.00	55.00	332.000	1.90	50	312	1.54	1.50	12	265	265	48	-	101.5	101.61
12	55.00	60.00	335.700	1.90	50	312	1.54	1.50	12	265	270	49	-	106.4	101.61
b1	60.00	65.00	339.578	1.70	50	312	1.38	1.30	12	265	265	48	-	116.6	96.11
2	65.00	70.00	343.600	1.90	50	313	1.54	1.50	12	265	266	43	-	107.1	101.67
3	70.00	75.00	347.500	1.90	51	313	1.54	1.50	12	264	266	43	-	93.2	101.67
4	75.00	80.00	350.900	1.90	51	314	1.54	1.50	12	266	265	43	-	93.2	101.74
5	80.00	85.00	354.300	1.90	51	315	1.54	1.50	12	266	266	45	-	104.3	101.80
6	85.00	90.00	358.100	2.00	52	315	1.62	1.60	12	266	264	48	-	93.4	104.45
7	90.00	95.00	361.600	1.80	53	316	1.46	1.40	12	266	264	49	-	98.3	99.15
8	95.00	100.00	365.100	1.80	53	316	1.46	1.40	12	266	264	51	-	101.1	99.15
9	100.00	105.00	368.700	1.90	54	316	1.55	1.50	12	264	265	52	-	109.2	101.87
10	105.00	110.00	372.700	1.90	54	316	1.55	1.50	12	265	265	54	-	99.6	101.87
11	110.00	115.00	376.350	1.90	56	317	1.55	1.50	12	265	265	53	-	102.0	101.93
12	115.00	120.00	380.100	1.90	54	317	1.55	1.50	12	267	265	53	-	101.3	101.93
Final DGM:			383.810												

RESULTS	Run Time		Vm	AP	Tm	Ts	Max Vac	ΔH	%ISO	BWS	Y _{qa}
	min		ft ³	in. WC	°F	°F		in. WC			
	120.0		84.323	1.73	51.0	313.4	12	1.379	101.0	0.097	1.8

Appendix C

ALLIANCE SOURCE TESTING

PROJECT # AST-23-4464
MARATHON

CLIENT # A085
REPORT # 23-607 REVISION 1

SUBMITTED BY:

CHESTER LabNet

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Case Narrative

Date: August 20, 2024

General Information

Client: Alliance Technical Group
Client Number: A085
Report Number: 23-607 Revision 1
Sample Description: Impinger Trains
Sample Numbers: 23-S3160 – 23-S3162, 23-S3169, 23-S3170

Analysis

Analytes: HF, HCl
Analytical Protocols: EPA Method 26A (10/7/20 version)
Analytical Notes: No problems were encountered during the analyses. The results are not blank corrected.
QA/QC Review: All the data have been reviewed by the analysts performing the analyses and the project manager. All the quality control and sample-specific information in this package is complete and meets or exceeds the minimum requirements for acceptability.
Comments: If you have any questions or concerns regarding this analysis, please feel free to contact the project manager.
Disclaimer: This report shall not be reproduced, except in full, without the written approval of the laboratory. The results only represent those of the samples as received into the laboratory. All data are reported to the detection limit. Results $<5 \times$ DL must be considered to have a higher degree of uncertainty associated with them. Due to the statistical process of detection limit determination, data in this report should not be used for statistical analysis as the data has been censored in such a manner as to bias statistical analyses high.


Project Manager
Paul Duda

8/20/24
Date

Client: A085 - Alliance Source Testing
Report Number: 23-607

Lab ID: 23-S3160
Client ID: M26A-COGEN UNIT-R1
Site: Marathon
Source: West Cogen
Sample Date: 11/ 9/23
Sample Volume: 540. mL

Analyte	mg/L		µg/sample	
	Conc.	DL	Conc.	DL
HF	0.0369	0.011	19.9	5.69
HCl	0.413	0.010	223.	5.55

Lab ID: 23-S3161
Client ID: M26A-COGEN UNIT-R2
Site: Marathon
Source: West Cogen
Sample Date: 11/ 9/23
Sample Volume: 510. mL

Analyte	mg/L		µg/sample	
	Conc.	DL	Conc.	DL
HF	0.0432	0.011	22.0	5.37
HCl	0.564	0.010	288.	5.24

Lab ID: 23-S3162
Client ID: M26A-COGEN UNIT-R3
Site: Marathon
Source: West Cogen
Sample Date: 11/ 9/23
Sample Volume: 485. mL

Analyte	mg/L		µg/sample	
	Conc.	DL	Conc.	DL
HF	< DL	0.011	< DL	5.11
HCl	0.181	0.010	87.8	4.99

Client: A085 - Alliance Source Testing
Report Number: 23-607

Lab ID: 23-S3169
Client ID: M26A .1N H2SO4 Blank
Site: Marathon
Sample Date: 11/ 9/23
Sample Volume: 198. mL

Analyte	mg/L		µg/sample	
	Conc.	DL	Conc.	DL
HF	< DL	0.011	< DL	2.08
HCl	2.26	0.010	447.	2.04

Lab ID: 23-S3170
Client ID: M26A DI Water Blank
Site: Marathon
Sample Date: 11/ 9/23
Sample Volume: 110. mL

Analyte	mg/L		µg/sample	
	Conc.	DL	Conc.	DL
HF	< DL	0.011	< DL	1.16
HCl	4.07	0.010	448.	1.13

QA/QC Report

Client Name: Alliance Source Testing
 Project Number: A085
 Analytical Technique: Ion Chromatography
 Instrument: Thermo ICS-5000
 Sample Description: EPA Method 26A
 Report Number: 23-607

Blank Data

Analyte	Sample ID	Measured Conc. mg/L	DL Conc. mg/L
F	ICB	< DL	0.010
F	CCB	< DL	0.010
F	CCB	< DL	0.010
F	CCB	< DL	0.010
F	CCB	< DL	0.010
F	CCB	< DL	0.010
Cl	ICB	< DL	0.010
Cl	CCB	< DL	0.010
Cl	CCB	< DL	0.010
Cl	CCB	< DL	0.010
Cl	CCB	< DL	0.010
Cl	CCB	< DL	0.010

ICB: Initial Calibration Blank CCB: Continuing Calibration Blank

*: Sample Media Blank (SM_Blk) concentration in µg/filter

Method Blank is in control if Method Blank results are <10% of sample results

Calibration QC

Analyte	Sample ID	Standard Conc. mg/L	Measured Conc. mg/L	Percent Recovery
F	ICV	0.500	0.495	99.0
F	LL-LCS	0.030	0.031	103.3
F	CCV	0.500	0.512	102.4
F	CCV	0.500	0.537	107.4
F	CCV	0.500	0.510	102.0
F	CCV	0.500	0.533	106.6
F	CCV	0.500	0.524	104.8
Cl	ICV	0.500	0.494	98.8
Cl	LL-LCS	0.030	0.030	100.0
Cl	CCV	0.500	0.500	100.0
Cl	CCV	0.500	0.506	101.2
Cl	CCV	0.500	0.497	99.4
Cl	CCV	0.500	0.524	104.8
Cl	CCV	0.500	0.515	103.0

ICV: Initial Calibration Verification CCV: Continuing Calibration Verification

Calibration Verification Limits: 90% - 110% Recovery

Low Level-LCS Limits: 50% - 150% Recovery

LL-LCS results are insignificant if sample results are >10x LL-LCS concentration

QA/QC Report

Client Name: Alliance Source Testing
Project Number: A085
Analytical Technique: Ion Chromatography
Instrument: Thermo ICS-5000
Sample Description: EPA Method 26A
Report Number: 23-607

Duplicate Data

All samples analyzed in duplicate. The reported concentrations are the average of the two measurements.

Laboratory Control Sample/Matrix Spike Analysis

Analyte	Sample ID	Sample Conc. mg/L	Spike Conc. mg/L	Spike Amount mg/L	Percent Recovery
F	23-S3160	0.035	0.573	0.500	108.
Cl	23-S3160	0.402	0.894	0.500	98.4

LCS Limit: 80% - 120% Recovery

Spike Limit: 75% - 125% Recovery

*: per EPA CLP protocol, control limits do not apply if spike concentration is less than 25% of the sample concentration

CHESTER LABNET
SOURCE SAMPLE RECEIPT CHECKLIST

Client	Alliance Source Testing	Date	11/14/2023
# Runs	M26A: 9 + blanks	Report #	23-607
	M5/29: 3 + blanks		

Package intact?	✓
Chain-of-Custody form inspected	✓
CoC present with samples?	✓
CoC indicates analytical methodology to be used? (eg M29, etc.)	M26A, M5/29 !!
Has CoC been signed by client?	✓
Custody release date and time noted on CoC?	✓
All sample containers inspected	✓
Does number of samples match number on CoC form?	✓ !!
Do all sample ID numbers match those on the CoC form?	✓ !!
Did client mark sample volumes prior to shipment?	✓
Sample temperature recorded?	Ambient
Are the sample containers intact?	✓ !!
If present, Audit Sample intact?	n/a !!
Are signs of leakage present?	None *
Chain-of-Custody form signed and dated by CLN	✓
Corrective actions	✓
Client contacted due to mismatching sample ID numbers	✓
Client contacted due to broken sample container(s)	—
Client contacted due to leaking sample container(s)	—
Client contacted for verification of methodology?	
Corrective actions documented?	
Corrective actions accomplished?	

Items marked **!!** shall be addressed **prior to any analytical work being started**.
Items marked ***** shall be **noted in case narrative** upon reporting of results to client.

Signed 

Notes The IDs didn't match the labels for run 3 of the
M5/29 for cont. 4 and 5A. The IDs are correct per Charles Horton.
E-mailed to get list of metals - use list from C4B436

Alliance Analytical Services

12242 SW Garden Place ♦ Tigard, OR 97223 ♦ (503) 624-2183 ♦ www.alliancetg.com ♦ ChesterLabNet@AllianceTG.com

CHAIN-OF-CUSTODY RECORD

For use by Lab:
Report #: 23-607

CLIENT INFORMATION	
Company Name: MARATHON (2023-4464)	
Contact: Charles Horton	Email: charles.horton@alliancetg.com
Phone #: 352-663-7568	Office: Salt Lake City
Report To: <u>SLCreports@alliancetg.com</u>	Billing Address: <u>AST-2023-4464</u>

Project Name: MPC Cogen Eng
PO#: AST-2023-4464

Analysis Requested				Turn Around Time Requested		Page 2 of 2 COCs
LabNet ID	Field Sample ID	Site	Sample Date	Volume (ft ³)	Particle Size	
23-S3160	M26A-COGEN UNIT- RUN1	West Cogen	11/9/2023	69.061	na	<div> <div>Standard</div> <div>Rush (Specify)</div> </div> <div> <div>10d TAT, "Rush" 1d</div> <div>na, 1d</div> </div>
23-S3161	M26A-COGEN UNIT- RUN2	West Cogen	11/9/2023	72.838	na	
23-S3162	M26A-COGEN UNIT- RUN3	Swest Cogen	11/9/2023	73.946	na	
23-S3163	M26A-NG Fuel- RUN1	NG Fuel Line	11/9/2023	54.445	na	<div> <div>Blank</div> <div>HCl/HF - H2SO4 Solution</div> </div>
23-S3164	M26A-NG Fuel- RUN2	NG Fuel Line	11/9/2023	61.583	na	
23-S3165	M26A-NG Fuel- RUN3	NG Fuel Line	11/9/2023	52.910	na	
23-S3166	M26A-RG Fuel- RUN1	RG Fuel Line	11/9/2023	48.081	na	<div> <div>Blank</div> <div>HCl/HF - H2SO4 Solution</div> </div>
23-S3167	M26A-RG Fuel- RUN2	RG Fuel Line	11/9/2023	43.114	na	
23-S3168	M26A-RG Fuel- RUN3	RG Fuel Line	11/9/2023	47.483	na	
23-S3169	0.1N H2SO4 Blank		11/9/2023			<div> <div>Blank</div> <div>HCl/HF - H2SO4 Solution</div> </div>
23-S3170	DI WATER BLANK		11/9/2023			

Do the samples pose any potential hazards?
If yes please explain:

Are samples for compliance? ☒ Yes ☐ No

Special Instructions/QC Requirements & Comments: HCL and HF desired

Relinquished by: <u>[Signature]</u>	Date/Time: <u>11/13/23 0900</u>	Received By: <u>Fal DL</u>	Date/Time/Temp: <u>11/14/23 950 amb</u>
Relinquished by:	Date/Time:	Received By:	Date/Time/Temp:

Laboratory Receipt Comments:

RAW DATA

Available upon request

Appendix D


Location MPC-Tesoro - Salt Lake City Refinery

Source West Cogeneration Unit (CG2)

Project No. AST-2023-4464

Parameter HCl/HF

		Nozzle Diameter (in.)						
Date	Nozzle ID	#1	#2	#3	Dn (Average)	Difference	Criteria	Material
11/8/23	G191-26	0.191	0.191	0.191	0.191	0.000	≤ 0.004 in.	glass
Date	Pitot ID	Evidence of damage?	Evidence of mis-alignment?	Calibration or Repair required?				
11/8/23	PT708-6	no	no	no				
Date	Probe or Thermocouple ID	Reference Temp. (°F)	Indicated Temp. (°F)	Difference				
11/8/23	708-6	80.0	85.0	0.9%	± 1.5 % (absolute)	--		
Field Balance Check								
Date	11/08/23	11/09/23						
Balance ID:	B304743079	B304743079						
Certified Weight ID:	SLC- 1KG-4	SLC- 1KG-4						
Certified Weight (g):	1000.0	1000.0						
Measured Weight (g):	999.8	999.6						
Weight Difference (g):	0.2	0.4	--	--	--	--		
Date	Barometric Pressure	Evidence of damage?	Reading Verified	Calibration or Repair required?	Weather Station Location			
11/7/23	Weather Station	No	Yes	No	Salt Lake City, UT			
Date	Meter Box ID	Positive Pressure Leak Check						
11/7/23	M5-09	Pass						
Reagent	Lot#	Field Prep performed	Field Lot	Date				By
0.1N H2SO4	DEN4/26/23	No	NA	11/7/2023	NA			
DI	231106	No	NA	11/7/2023	NA			

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

Equipment Detail - Dry Gas Meter

Console ID: M5-9
 Meter S/N: 20035541
 Critical Orifice S/N: 1330

Calibration Detail

Initial Barometric Pressure, in. Hg	(P _b)	25.84					
Final Barometric Pressure, in. Hg	(P _{bF})	25.81					
Average Barometric Pressure, in. Hg	(P _b)	25.83					
Critical Orifice ID	(Y)	1330-31	1330-31	1330-25	1330-25	1330-19	1330-19
K' Factor, ft ³ ·R ^{1/2} / in. WC·min	(K')	0.8429	0.8429	0.6728	0.673	0.5186	0.519
Vacuum Pressure, in. Hg	(V _p)	13.0	13.0	15.0	15.0	16.0	16.0
Initial DGM Volume, ft ³	(V _m)	60.233	72.479	90.179	111.485	121.102	128.055
Final DGM Volume, ft ³	(V _{mF})	71.254	83.508	98.955	120.285	128.055	134.893
Total DGM Volume, ft ³	(V _m)	11.021	11.029	8.776	8.800	6.953	6.838
Ambient Temperature, °F	(T _a)	71	71	72	72	73	71
Initial DGM Temperature, °F	(T _m)	68	68	70	71	71	72
Final DGM Temperature, °F	(T _{mF})	68	69	71	71	72	73
Average DGM Temperature, °F	(T _m)	68	69	71	71	72	73
Elapsed Time	(Θ)	10.00	10.00	10.00	10.00	10.00	10.00
Meter Orifice Pressure, in. WC	(ΔH)	3.40	3.40	2.10	2.10	1.30	1.30
Standard Meter volume, ft ³	(V _{mstd})	9.6065	9.6044	7.5857	7.5992	5.9850	5.8750
Standard Critical Orifice Volume, ft ³	(V _{cr})	9.4492	9.4492	7.5352	7.5352	5.8028	5.8137
Meter Correction Factor	(Y)	0.984	0.984	0.993	0.992	0.970	0.990
Tolerance	--	0.002	0.001	0.008	0.006	0.016	0.004
Orifice Calibration Value	(ΔH @)	1.867	1.865	1.798	1.797	1.869	1.859
Tolerance	--	0.025	0.023	0.044	0.046	0.027	0.016
Orifice Cal Check	--	0.88		1.32		1.30	
Meter Correction Factor	(Y)	0.985					
Orifice Calibration Value	(ΔH @)	1.843					
Positive Pressure Leak Check		Yes					

Equipment Detail - Thermocouple Sensor

Reference Calibrator Make: OMEGA
 Reference Calibrator Model: CL23A
 Reference Calibrator S/N: T-197207

Calibration Detail

Reference Temp.		Display Temp.		Accuracy	Difference
°F	°R	°F	°R	%	°F
0	460	2	462	-0.4	2
68	528	68	528	0.0	0
100	560	100	560	0.0	0
223	683	225	685	-0.3	2
248	708	250	710	-0.3	2
273	733	275	735	-0.3	2
300	760	302	762	-0.3	2
400	860	401	861	-0.1	1
500	960	500	960	0.0	0
600	1,060	601	1,061	-0.1	1
700	1,160	703	1,163	-0.3	3
800	1,260	803	1,263	-0.2	3
900	1,360	903	1,363	-0.2	3
1,000	1,460	1,004	1,464	-0.3	4
1,100	1,560	1,103	1,563	-0.2	3
1,200	1,660	1,203	1,663	-0.2	3

Personnel

Calibration By: RYAN LYONS
 Calibration Date: 10/30/2023
 Reviewed By: Stacey Cunningham

Appendix E

	GEN TOTAL		Estimated	West Cogen %
	REAL POWER	Gas Fuel Flow	West Turbine	Nameplate
	KW	mscfh	Fired Duty	Power
			MMBTUH	Generated
				%
09-Nov-23 12:52:00	11842.10	57.47	51.48	80% Run 1 Start
09-Nov-23 12:53:00	11826.24	57.42	51.45	80%
09-Nov-23 12:54:00	11826.49	57.43	51.45	80%
09-Nov-23 12:55:00	11787.36	57.42	51.45	79%
09-Nov-23 12:56:00	11770.14	57.44	51.46	79%
09-Nov-23 12:57:00	11745.91	57.45	51.47	79%
09-Nov-23 12:58:00	11789.25	57.48	51.49	79%
09-Nov-23 12:59:00	11815.57	57.47	51.48	80%
09-Nov-23 13:00:00	11828.25	57.45	51.47	80%
09-Nov-23 13:01:00	11848.25	57.43	51.45	80%
09-Nov-23 13:02:00	11846.73	57.45	51.47	80%
09-Nov-23 13:03:00	11820.14	57.48	51.49	80%
09-Nov-23 13:04:00	11829.26	57.43	51.45	80%
09-Nov-23 13:05:00	11858.29	57.38	51.41	80%
09-Nov-23 13:06:00	11857.28	57.42	51.45	80%
09-Nov-23 13:07:00	11839.25	57.42	51.44	80%
09-Nov-23 13:08:00	11845.64	57.42	51.44	80%
09-Nov-23 13:09:00	11864.45	57.39	51.42	80%
09-Nov-23 13:10:00	11882.80	57.42	51.45	80%
09-Nov-23 13:11:00	11850.56	57.39	51.42	80%
09-Nov-23 13:12:00	11801.33	57.46	51.48	79%
09-Nov-23 13:13:00	11766.15	57.47	51.48	79%
09-Nov-23 13:14:00	11756.14	57.47	51.49	79%
09-Nov-23 13:15:00	11758.98	57.46	51.47	79%
09-Nov-23 13:16:00	11788.79	57.46	51.48	79%
09-Nov-23 13:17:00	11810.50	57.44	51.46	80%
09-Nov-23 13:18:00	11787.47	57.47	51.49	79%
09-Nov-23 13:19:00	11760.62	57.46	51.48	79%
09-Nov-23 13:20:00	11786.78	57.46	51.48	79%
09-Nov-23 13:21:00	11761.18	57.48	51.50	79%
09-Nov-23 13:22:00	11783.22	57.50	51.51	79%
09-Nov-23 13:23:00	11801.36	57.47	51.49	79%
09-Nov-23 13:24:00	11778.78	57.46	51.48	79%
09-Nov-23 13:25:00	11789.37	57.46	51.48	79%
09-Nov-23 13:26:00	11827.81	57.47	51.49	80%
09-Nov-23 13:27:00	11802.73	57.46	51.47	79%
09-Nov-23 13:28:00	11795.61	57.46	51.48	79%
09-Nov-23 13:29:00	11791.43	57.45	51.47	79%
09-Nov-23 13:30:00	11777.68	57.47	51.48	79%
09-Nov-23 13:31:00	11780.52	57.46	51.48	79%
09-Nov-23 13:32:00	11803.14	57.46	51.48	79%
09-Nov-23 13:33:00	11818.10	57.48	51.50	80%
09-Nov-23 13:34:00	11797.80	57.50	51.52	79%
09-Nov-23 13:35:00	11794.41	57.49	51.51	79%
09-Nov-23 13:36:00	11796.68	57.50	51.52	79%
09-Nov-23 13:37:00	11807.16	57.49	51.51	79%
09-Nov-23 13:38:00	11810.73	57.50	51.52	80%
09-Nov-23 13:39:00	11794.34	57.47	51.49	79%
09-Nov-23 13:40:00	11791.65	57.43	51.45	79%
09-Nov-23 13:41:00	11799.79	57.44	51.47	79%
09-Nov-23 13:42:00	11860.34	57.47	51.49	80%
09-Nov-23 13:43:00	11833.75	57.50	51.52	80%
09-Nov-23 13:44:00	11774.02	57.51	51.53	79%
09-Nov-23 13:45:00	11812.22	57.50	51.52	80%
09-Nov-23 13:46:00	11838.21	57.47	51.49	80%
09-Nov-23 13:47:00	11816.98	57.45	51.47	80%

	GEN TOTAL		Estimated	West Cogen %
	REAL POWER	Gas Fuel Flow	West Turbine	Nameplate
	KW	mscfh	Fired Duty	Power
			MMBTUH	Generated
				%
09-Nov-23 13:48:00	11804.71	57.45	51.47	79%
09-Nov-23 13:49:00	11816.97	57.53	51.54	80%
09-Nov-23 13:50:00	11795.21	57.53	51.54	79%
09-Nov-23 13:51:00	11779.31	57.50	51.52	79%
09-Nov-23 13:52:00	11770.01	57.47	51.49	79%
09-Nov-23 13:53:00	11777.63	57.46	51.48	79%
09-Nov-23 13:54:00	11838.12	57.48	51.50	80%
09-Nov-23 13:55:00	11847.18	57.47	51.49	80%
09-Nov-23 13:56:00	11784.74	57.49	51.50	79%
09-Nov-23 13:57:00	11800.52	57.49	51.51	79%
09-Nov-23 13:58:00	11837.66	57.47	51.49	80%
09-Nov-23 13:59:00	11810.30	57.48	51.50	80%
09-Nov-23 14:00:00	11822.46	57.52	51.53	80%
09-Nov-23 14:01:00	11837.04	57.51	51.52	80%
09-Nov-23 14:02:00	11835.66	57.48	51.49	80%
09-Nov-23 14:03:00	11799.56	57.49	51.51	79%
09-Nov-23 14:04:00	11773.92	57.52	51.53	79%
09-Nov-23 14:05:00	11785.86	57.49	51.50	79%
09-Nov-23 14:06:00	11763.33	57.48	51.50	79%
09-Nov-23 14:07:00	11775.08	57.51	51.53	79%
09-Nov-23 14:08:00	11810.69	57.48	51.50	80%
09-Nov-23 14:09:00	11807.46	57.49	51.50	79%
09-Nov-23 14:10:00	11779.64	57.52	51.53	79%
09-Nov-23 14:11:00	11783.23	57.49	51.51	79%
09-Nov-23 14:12:00	11816.20	57.55	51.56	80%
09-Nov-23 14:13:00	11809.57	57.58	51.59	79%
09-Nov-23 14:14:00	11744.78	57.49	51.51	79%
09-Nov-23 14:15:00	11715.56	57.52	51.53	79%
09-Nov-23 14:16:00	11730.01	57.51	51.53	79%
09-Nov-23 14:17:00	11773.54	57.53	51.54	79%
09-Nov-23 14:18:00	11775.03	57.52	51.54	79%
09-Nov-23 14:19:00	11776.22	57.52	51.54	79%
09-Nov-23 14:20:00	11787.08	57.50	51.52	79%
09-Nov-23 14:21:00	11747.04	57.51	51.52	79%
09-Nov-23 14:22:00	11738.90	57.55	51.56	79%
09-Nov-23 14:23:00	11795.05	57.50	51.52	79%
09-Nov-23 14:24:00	11776.89	57.55	51.56	79%
09-Nov-23 14:25:00	11743.99	57.52	51.53	79%
09-Nov-23 14:26:00	11759.06	57.52	51.53	79%
09-Nov-23 14:27:00	11756.92	57.52	51.53	79%
09-Nov-23 14:28:00	11783.74	57.49	51.51	79%
09-Nov-23 14:29:00	11786.30	57.53	51.54	79%
09-Nov-23 14:30:00	11774.84	57.56	51.57	79%
09-Nov-23 14:31:00	11751.85	57.55	51.56	79%
09-Nov-23 14:32:00	11749.17	57.51	51.53	79%
09-Nov-23 14:33:00	11768.04	57.50	51.52	79%
09-Nov-23 14:34:00	11768.84	57.53	51.54	79%
09-Nov-23 14:35:00	11746.35	57.52	51.53	79%
09-Nov-23 14:36:00	11790.20	57.53	51.55	79%
09-Nov-23 14:37:00	11799.78	57.53	51.55	79%
09-Nov-23 14:38:00	11775.91	57.57	51.58	79%
09-Nov-23 14:39:00	11784.42	57.55	51.56	79%
09-Nov-23 14:40:00	11786.16	57.53	51.54	79%
09-Nov-23 14:41:00	11760.86	57.53	51.55	79%
09-Nov-23 14:42:00	11740.53	57.52	51.53	79%
09-Nov-23 14:43:00	11752.88	57.50	51.51	79%
09-Nov-23 14:44:00	11759.45	57.51	51.53	79%

	GEN TOTAL		Estimated	West Cogen %
	REAL POWER	Gas Fuel Flow	West Turbine	Nameplate
	KW	mscfh	Fired Duty	Power
			MMBTUH	Generated
				%
09-Nov-23 14:45:00	11774.01	57.55	51.56	79%
09-Nov-23 14:46:00	11794.62	57.55	51.56	79%
09-Nov-23 14:47:00	11787.05	57.53	51.54	79%
09-Nov-23 14:48:00	11760.69	57.55	51.56	79%
09-Nov-23 14:49:00	11781.24	57.56	51.57	79%
09-Nov-23 14:50:00	11792.95	57.57	51.57	79%
09-Nov-23 14:51:00	11777.61	57.54	51.55	79%
09-Nov-23 14:52:00	11792.38	57.54	51.55	79%
09-Nov-23 14:53:00	11805.44	57.55	51.56	79%
09-Nov-23 14:54:00	11809.58	57.56	51.57	79%
09-Nov-23 14:55:00	11805.47	57.55	51.56	79%
09-Nov-23 14:56:00	11799.42	57.58	51.59	79%
09-Nov-23 14:57:00	11780.93	57.57	51.58	79%
09-Nov-23 14:58:00	11748.90	57.55	51.56	79%
09-Nov-23 14:59:00	11736.88	57.54	51.55	79%
09-Nov-23 15:00:00	11690.87	57.53	51.54	79%
09-Nov-23 15:01:00	11684.28	57.54	51.55	79%
09-Nov-23 15:02:00	11760.21	57.51	51.52	79%
09-Nov-23 15:03:00	11813.40	57.53	51.54	80%
09-Nov-23 15:04:00	11779.36	57.56	51.57	79%
09-Nov-23 15:05:00	11760.67	57.56	51.57	79%
09-Nov-23 15:06:00	11776.58	57.55	51.56	79%
09-Nov-23 15:07:00	11753.70	57.50	51.52	79%
09-Nov-23 15:08:00	11774.72	57.56	51.57	79%
09-Nov-23 15:09:00	11811.95	57.57	51.58	80%
09-Nov-23 15:10:00	11785.93	57.56	51.57	79%
09-Nov-23 15:11:00	11788.12	57.56	51.57	79%
09-Nov-23 15:12:00	11781.86	57.55	51.56	79%
09-Nov-23 15:13:00	11790.06	57.55	51.56	79%
09-Nov-23 15:14:00	11805.36	57.55	51.56	79%
09-Nov-23 15:15:00	11815.75	57.56	51.56	80%
09-Nov-23 15:16:00	11824.51	57.53	51.54	80%
09-Nov-23 15:17:00	11771.41	57.51	51.53	79%
09-Nov-23 15:18:00	11779.98	57.53	51.54	79%
09-Nov-23 15:19:00	11791.86	57.52	51.53	79%
09-Nov-23 15:20:00	11776.64	57.56	51.57	79%
09-Nov-23 15:21:00	11775.43	57.58	51.59	79%
09-Nov-23 15:22:00	11779.78	57.51	51.53	79%
09-Nov-23 15:23:00	11786.32	57.54	51.55	79%
09-Nov-23 15:24:00	11792.40	57.57	51.58	79%
09-Nov-23 15:25:00	11810.22	57.57	51.57	80%
09-Nov-23 15:26:00	11829.60	57.53	51.54	80%
09-Nov-23 15:27:00	11824.70	57.49	51.51	80%
09-Nov-23 15:28:00	11796.59	57.53	51.54	79%
09-Nov-23 15:29:00	11789.15	57.51	51.53	79%
09-Nov-23 15:30:00	11797.63	57.54	51.56	79%
09-Nov-23 15:31:00	11790.98	57.56	51.57	79%
09-Nov-23 15:32:00	11769.44	57.57	51.57	79%
09-Nov-23 15:33:00	11749.58	57.59	51.59	79%
09-Nov-23 15:34:00	11736.31	57.54	51.55	79% Run 1 End
09-Nov-23 16:21:00	11806.33	57.48	51.50	79% Run 2 Start
09-Nov-23 16:22:00	11786.77	57.54	51.55	79%
09-Nov-23 16:23:00	11789.86	57.51	51.52	79%
09-Nov-23 16:24:00	11814.04	57.48	51.50	80%
09-Nov-23 16:25:00	11866.35	57.45	51.47	80%
09-Nov-23 16:26:00	11882.77	57.48	51.50	80%
09-Nov-23 16:27:00	11871.41	57.47	51.49	80%

	GEN TOTAL		Estimated	West Cogen %
	REAL POWER	Gas Fuel Flow	West Turbine	Nameplate
	KW	mscfh	Fired Duty	Power
			MMBTUH	Generated
				%
09-Nov-23 16:28:00	11904.49	57.46	51.48	80%
09-Nov-23 16:29:00	11897.79	57.50	51.52	80%
09-Nov-23 16:30:00	11845.10	57.49	51.50	80%
09-Nov-23 16:31:00	11831.03	57.47	51.49	80%
09-Nov-23 16:32:00	11828.25	57.44	51.46	80%
09-Nov-23 16:33:00	11840.28	57.42	51.44	80%
09-Nov-23 16:34:00	11865.70	57.45	51.47	80%
09-Nov-23 16:35:00	11877.56	57.48	51.49	80%
09-Nov-23 16:36:00	11895.67	57.49	51.50	80%
09-Nov-23 16:37:00	11894.68	57.48	51.50	80%
09-Nov-23 16:38:00	11894.70	57.47	51.49	80%
09-Nov-23 16:39:00	11934.64	57.50	51.52	80%
09-Nov-23 16:40:00	11950.43	57.48	51.50	80%
09-Nov-23 16:41:00	11950.72	57.48	51.50	80%
09-Nov-23 16:42:00	11943.57	57.47	51.49	80%
09-Nov-23 16:43:00	11932.10	57.48	51.50	80%
09-Nov-23 16:44:00	11944.05	57.46	51.48	80%
09-Nov-23 16:45:00	11961.28	57.46	51.48	81%
09-Nov-23 16:46:00	11973.30	57.46	51.48	81%
09-Nov-23 16:47:00	11984.50	57.47	51.49	81%
09-Nov-23 16:48:00	11982.79	57.47	51.49	81%
09-Nov-23 16:49:00	11964.59	57.47	51.49	81%
09-Nov-23 16:50:00	11969.68	57.45	51.47	81%
09-Nov-23 16:51:00	11987.02	57.45	51.47	81%
09-Nov-23 16:52:00	11986.19	57.44	51.47	81%
09-Nov-23 16:53:00	11982.34	57.47	51.49	81%
09-Nov-23 16:54:00	12006.97	57.47	51.49	81%
09-Nov-23 16:55:00	12015.48	57.44	51.46	81%
09-Nov-23 16:56:00	12024.81	57.44	51.46	81%
09-Nov-23 16:57:00	12022.54	57.46	51.48	81%
09-Nov-23 16:58:00	12006.02	57.48	51.49	81%
09-Nov-23 16:59:00	12026.66	57.41	51.44	81%
09-Nov-23 17:00:00	12009.36	57.43	51.45	81%
09-Nov-23 17:01:00	12004.87	57.43	51.45	81%
09-Nov-23 17:02:00	12001.51	57.44	51.46	81%
09-Nov-23 17:03:00	11973.19	57.47	51.49	81%
09-Nov-23 17:04:00	11984.80	57.44	51.46	81%
09-Nov-23 17:05:00	12016.78	57.40	51.42	81%
09-Nov-23 17:06:00	12022.78	57.44	51.46	81%
09-Nov-23 17:07:00	12026.62	57.43	51.45	81%
09-Nov-23 17:08:00	12065.62	57.48	51.50	81%
09-Nov-23 17:09:00	12056.71	57.45	51.47	81%
09-Nov-23 17:10:00	12028.44	57.45	51.47	81%
09-Nov-23 17:11:00	12031.80	57.43	51.45	81%
09-Nov-23 17:12:00	12034.48	57.44	51.46	81%
09-Nov-23 17:13:00	12013.87	57.42	51.44	81%
09-Nov-23 17:14:00	11995.13	57.42	51.45	81%
09-Nov-23 17:15:00	11993.41	57.44	51.46	81%
09-Nov-23 17:16:00	12003.18	57.44	51.46	81%
09-Nov-23 17:17:00	12009.02	57.44	51.46	81%
09-Nov-23 17:18:00	12036.06	57.43	51.46	81%
09-Nov-23 17:19:00	12057.40	57.41	51.44	81%
09-Nov-23 17:20:00	12044.48	57.42	51.45	81%
09-Nov-23 17:21:00	12050.46	57.42	51.45	81%
09-Nov-23 17:22:00	12043.90	57.39	51.42	81%
09-Nov-23 17:23:00	12024.34	57.42	51.44	81%
09-Nov-23 17:24:00	12038.49	57.42	51.44	81%

	GEN TOTAL		Estimated West Turbine	West Cogen % Nameplate Power
	REAL POWER	Gas Fuel Flow	Fired Duty	Generated
	KW	mscfh	MMBTUH	%
09-Nov-23 17:25:00	12044.97	57.42	51.44	81%
09-Nov-23 17:26:00	12059.28	57.39	51.42	81%
09-Nov-23 17:27:00	12070.97	57.42	51.44	81%
09-Nov-23 17:28:00	12042.09	57.37	51.40	81%
09-Nov-23 17:29:00	12042.00	57.43	51.45	81%
09-Nov-23 17:30:00	12054.71	57.37	51.40	81%
09-Nov-23 17:31:00	12033.07	57.31	51.34	81%
09-Nov-23 17:32:00	12043.95	57.35	51.38	81%
09-Nov-23 17:33:00	12094.26	57.38	51.41	81%
09-Nov-23 17:34:00	12079.47	57.41	51.44	81%
09-Nov-23 17:35:00	12062.93	57.41	51.43	81%
09-Nov-23 17:36:00	12054.89	57.40	51.42	81%
09-Nov-23 17:37:00	12032.25	57.43	51.45	81%
09-Nov-23 17:38:00	12015.35	57.42	51.44	81%
09-Nov-23 17:39:00	12025.25	57.39	51.42	81%
09-Nov-23 17:40:00	12056.94	57.39	51.42	81%
09-Nov-23 17:41:00	12073.63	57.39	51.42	81%
09-Nov-23 17:42:00	12053.06	57.31	51.34	81%
09-Nov-23 17:43:00	12043.35	57.38	51.41	81%
09-Nov-23 17:44:00	12035.00	57.39	51.42	81%
09-Nov-23 17:45:00	12006.80	57.37	51.40	81%
09-Nov-23 17:46:00	12027.73	57.41	51.43	81%
09-Nov-23 17:47:00	12077.20	57.40	51.43	81%
09-Nov-23 17:48:00	12088.90	57.39	51.41	81%
09-Nov-23 17:49:00	12075.40	57.38	51.41	81%
09-Nov-23 17:50:00	12095.99	57.40	51.43	81%
09-Nov-23 17:51:00	12111.70	57.38	51.41	82%
09-Nov-23 17:52:00	12083.18	57.39	51.42	81%
09-Nov-23 17:53:00	12069.35	57.39	51.41	81%
09-Nov-23 17:54:00	12109.33	57.38	51.41	82%
09-Nov-23 17:55:00	12116.11	57.38	51.40	82%
09-Nov-23 17:56:00	12122.54	57.35	51.38	82%
09-Nov-23 17:57:00	12159.26	57.39	51.42	82%
09-Nov-23 17:58:00	12152.39	57.40	51.43	82%
09-Nov-23 17:59:00	12134.53	57.38	51.41	82%
09-Nov-23 18:00:00	12128.02	57.38	51.41	82%
09-Nov-23 18:01:00	12154.16	57.39	51.42	82%
09-Nov-23 18:02:00	12178.88	57.39	51.41	82%
09-Nov-23 18:03:00	12162.94	57.37	51.40	82%
09-Nov-23 18:04:00	12159.96	57.37	51.40	82%
09-Nov-23 18:05:00	12143.55	57.35	51.38	82%
09-Nov-23 18:06:00	12147.09	57.40	51.42	82%
09-Nov-23 18:07:00	12177.18	57.42	51.44	82%
09-Nov-23 18:08:00	12209.34	57.38	51.41	82%
09-Nov-23 18:09:00	12260.36	57.34	51.37	83%
09-Nov-23 18:10:00	12267.87	57.38	51.41	83%
09-Nov-23 18:11:00	12244.17	57.38	51.41	82%
09-Nov-23 18:12:00	12237.49	57.39	51.41	82%
09-Nov-23 18:13:00	12274.56	57.38	51.41	83%
09-Nov-23 18:14:00	12302.64	57.34	51.37	83%
09-Nov-23 18:15:00	12303.08	57.34	51.37	83%
09-Nov-23 18:16:00	12321.67	57.36	51.39	83%
09-Nov-23 18:17:00	12315.23	57.38	51.40	83%
09-Nov-23 18:18:00	12274.17	57.37	51.40	83%
09-Nov-23 18:19:00	12287.46	57.38	51.40	83%
09-Nov-23 18:20:00	12295.53	57.38	51.41	83%
09-Nov-23 18:21:00	12296.19	57.41	51.43	83%

	GEN TOTAL		Estimated	West Cogen %
	REAL POWER	Gas Fuel Flow	West Turbine	Nameplate
	KW	mscfh	Fired Duty	Power
			MMBTUH	Generated
				%
09-Nov-23 18:22:00	12320.86	57.37	51.40	83%
09-Nov-23 18:23:00	12316.00	57.35	51.38	83%
09-Nov-23 18:24:00	12334.15	57.37	51.40	83%
09-Nov-23 18:25:00	12359.32	57.37	51.39	83%
09-Nov-23 18:26:00	12351.85	57.37	51.40	83%
09-Nov-23 18:27:00	12312.35	57.40	51.42	83%
09-Nov-23 18:28:00	12272.29	57.37	51.40	83%
09-Nov-23 18:29:00	12295.30	57.36	51.39	83%
09-Nov-23 18:30:00	12327.45	57.34	51.37	83%
09-Nov-23 18:31:00	12298.83	57.38	51.40	83%
09-Nov-23 18:32:00	12289.43	57.40	51.43	83%
09-Nov-23 18:33:00	12305.10	57.36	51.39	83%
09-Nov-23 18:34:00	12305.79	57.36	51.39	83%
09-Nov-23 18:35:00	12315.39	57.38	51.41	83%
09-Nov-23 18:36:00	12294.25	57.38	51.40	83%
09-Nov-23 18:37:00	12271.42	57.35	51.38	83%
09-Nov-23 18:38:00	12301.45	57.35	51.38	83%
09-Nov-23 18:39:00	12331.67	57.34	51.37	83%
09-Nov-23 18:40:00	12327.87	57.31	51.35	83%
09-Nov-23 18:41:00	12334.85	57.35	51.38	83%
09-Nov-23 18:42:00	12340.44	57.33	51.36	83%
09-Nov-23 18:43:00	12348.96	57.36	51.39	83%
09-Nov-23 18:44:00	12350.50	57.37	51.40	83%
09-Nov-23 18:45:00	12333.46	57.35	51.38	83%
09-Nov-23 18:46:00	12325.13	57.30	51.34	83%
09-Nov-23 18:47:00	12341.04	57.33	51.36	83%
09-Nov-23 18:48:00	12376.40	57.36	51.39	83%
09-Nov-23 18:49:00	12366.53	57.35	51.38	83%
09-Nov-23 18:50:00	12322.32	57.34	51.37	83%
09-Nov-23 18:51:00	12315.20	57.34	51.37	83%
09-Nov-23 18:52:00	12349.87	57.33	51.36	83%
09-Nov-23 18:53:00	12343.85	57.34	51.38	83%
09-Nov-23 18:54:00	12321.23	57.33	51.37	83% Run 2 End
09-Nov-23 19:33:00	12352.23	57.31	51.35	83% Run 3 Start
09-Nov-23 19:34:00	12340.05	57.32	51.36	83%
09-Nov-23 19:35:00	12379.34	57.31	51.34	83%
09-Nov-23 19:36:00	12411.22	57.33	51.36	84%
09-Nov-23 19:37:00	12396.67	57.30	51.33	83%
09-Nov-23 19:38:00	12382.38	57.26	51.30	83%
09-Nov-23 19:39:00	12385.04	57.29	51.33	83%
09-Nov-23 19:40:00	12413.41	57.33	51.36	84%
09-Nov-23 19:41:00	12390.14	57.30	51.34	83%
09-Nov-23 19:42:00	12377.18	57.30	51.33	83%
09-Nov-23 19:43:00	12372.10	57.28	51.32	83%
09-Nov-23 19:44:00	12371.71	57.28	51.32	83%
09-Nov-23 19:45:00	12371.15	57.28	51.32	83%
09-Nov-23 19:46:00	12337.17	57.32	51.36	83%
09-Nov-23 19:47:00	12352.54	57.32	51.36	83%
09-Nov-23 19:48:00	12366.45	57.31	51.35	83%
09-Nov-23 19:49:00	12355.11	57.31	51.35	83%
09-Nov-23 19:50:00	12383.12	57.29	51.33	83%
09-Nov-23 19:51:00	12408.04	57.29	51.32	84%
09-Nov-23 19:52:00	12400.42	57.31	51.34	83%
09-Nov-23 19:53:00	12383.38	57.31	51.34	83%
09-Nov-23 19:54:00	12378.78	57.30	51.34	83%
09-Nov-23 19:55:00	12395.57	57.31	51.34	83%
09-Nov-23 19:56:00	12383.99	57.30	51.34	83%

	GEN TOTAL		Estimated West Turbine	West Cogen % Nameplate Power Generated
	REAL POWER KW	Gas Fuel Flow mscfh	Fired Duty MMBTUH	%
09-Nov-23 19:57:00	12385.11	57.25	51.29	83%
09-Nov-23 19:58:00	12378.01	57.26	51.30	83%
09-Nov-23 19:59:00	12350.54	57.29	51.33	83%
09-Nov-23 20:00:00	12348.26	57.32	51.35	83%
09-Nov-23 20:01:00	12356.89	57.31	51.35	83%
09-Nov-23 20:02:00	12385.32	57.31	51.34	83%
09-Nov-23 20:03:00	12420.84	57.29	51.33	84%
09-Nov-23 20:04:00	12436.17	57.29	51.33	84%
09-Nov-23 20:05:00	12416.00	57.24	51.28	84%
09-Nov-23 20:06:00	12397.09	57.28	51.32	83%
09-Nov-23 20:07:00	12377.15	57.27	51.31	83%
09-Nov-23 20:08:00	12374.62	57.32	51.35	83%
09-Nov-23 20:09:00	12418.85	57.32	51.36	84%
09-Nov-23 20:10:00	12437.57	57.33	51.36	84%
09-Nov-23 20:11:00	12413.13	57.32	51.35	84%
09-Nov-23 20:12:00	12392.00	57.28	51.32	83%
09-Nov-23 20:13:00	12382.99	57.29	51.33	83%
09-Nov-23 20:14:00	12373.27	57.30	51.34	83%
09-Nov-23 20:15:00	12371.39	57.29	51.33	83%
09-Nov-23 20:16:00	12369.10	57.30	51.34	83%
09-Nov-23 20:17:00	12369.29	57.30	51.33	83%
09-Nov-23 20:18:00	12370.76	57.31	51.34	83%
09-Nov-23 20:19:00	12390.45	57.31	51.35	83%
09-Nov-23 20:20:00	12395.08	57.27	51.31	83%
09-Nov-23 20:21:00	12380.74	57.28	51.32	83%
09-Nov-23 20:22:00	12397.97	57.28	51.32	83%
09-Nov-23 20:23:00	12378.01	57.27	51.31	83%
09-Nov-23 20:24:00	12351.28	57.29	51.33	83%
09-Nov-23 20:25:00	12386.59	57.26	51.30	83%
09-Nov-23 20:26:00	12364.17	57.29	51.32	83%
09-Nov-23 20:27:00	12352.58	57.25	51.29	83%
09-Nov-23 20:28:00	12399.81	57.27	51.31	83%
09-Nov-23 20:29:00	12367.57	57.28	51.32	83%
09-Nov-23 20:30:00	12338.32	57.30	51.34	83%
09-Nov-23 20:31:00	12389.11	57.31	51.34	83%
09-Nov-23 20:32:00	12408.81	57.27	51.31	84%
09-Nov-23 20:33:00	12396.87	57.25	51.29	83%
09-Nov-23 20:34:00	12380.54	57.28	51.32	83%
09-Nov-23 20:35:00	12382.05	57.28	51.32	83%
09-Nov-23 20:36:00	12412.74	57.28	51.32	84%
09-Nov-23 20:37:00	12415.07	57.29	51.33	84%
09-Nov-23 20:38:00	12400.98	57.27	51.31	83%
09-Nov-23 20:39:00	12419.49	57.27	51.31	84%
09-Nov-23 20:40:00	12427.02	57.28	51.31	84%
09-Nov-23 20:41:00	12409.28	57.28	51.32	84%
09-Nov-23 20:42:00	12396.89	57.31	51.34	83%
09-Nov-23 20:43:00	12374.84	57.27	51.31	83%
09-Nov-23 20:44:00	12359.11	57.27	51.31	83%
09-Nov-23 20:45:00	12344.62	57.29	51.32	83%
09-Nov-23 20:46:00	12359.96	57.28	51.31	83%
09-Nov-23 20:47:00	12355.46	57.28	51.32	83%
09-Nov-23 20:48:00	12346.10	57.21	51.26	83%
09-Nov-23 20:49:00	12379.87	57.28	51.32	83%
09-Nov-23 20:50:00	12386.27	57.30	51.33	83%
09-Nov-23 20:51:00	12394.21	57.26	51.30	83%
09-Nov-23 20:52:00	12385.10	57.24	51.28	83%
09-Nov-23 20:53:00	12367.50	57.24	51.28	83%

	GEN TOTAL		Estimated West Turbine	West Cogen % Nameplate Power Generated
	REAL POWER KW	Gas Fuel Flow mscfh	Fired Duty MMBTUH	%
09-Nov-23 20:54:00	12374.62	57.27	51.31	83%
09-Nov-23 20:55:00	12395.25	57.29	51.32	83%
09-Nov-23 20:56:00	12403.25	57.28	51.32	83%
09-Nov-23 20:57:00	12392.77	57.27	51.31	83%
09-Nov-23 20:58:00	12388.95	57.30	51.34	83%
09-Nov-23 20:59:00	12384.80	57.27	51.31	83%
09-Nov-23 21:00:00	12402.29	57.28	51.32	83%
09-Nov-23 21:01:00	12427.75	57.30	51.33	84%
09-Nov-23 21:02:00	12418.07	57.30	51.34	84%
09-Nov-23 21:03:00	12412.06	57.28	51.31	84%
09-Nov-23 21:04:00	12427.27	57.26	51.30	84%
09-Nov-23 21:05:00	12435.38	57.27	51.31	84%
09-Nov-23 21:06:00	12436.82	57.30	51.34	84%
09-Nov-23 21:07:00	12414.85	57.27	51.31	84%
09-Nov-23 21:08:00	12380.60	57.26	51.30	83%
09-Nov-23 21:09:00	12385.19	57.27	51.31	83%
09-Nov-23 21:10:00	12391.64	57.27	51.31	83%
09-Nov-23 21:11:00	12397.11	57.29	51.33	83%
09-Nov-23 21:12:00	12400.82	57.27	51.31	83%
09-Nov-23 21:13:00	12425.34	57.27	51.31	84%
09-Nov-23 21:14:00	12444.80	57.26	51.30	84%
09-Nov-23 21:15:00	12420.35	57.19	51.24	84%
09-Nov-23 21:16:00	12399.44	57.24	51.28	83%
09-Nov-23 21:17:00	12384.49	57.30	51.33	83%
09-Nov-23 21:18:00	12392.89	57.29	51.33	83%
09-Nov-23 21:19:00	12412.68	57.28	51.32	84%
09-Nov-23 21:20:00	12429.97	57.26	51.30	84%
09-Nov-23 21:21:00	12421.44	57.26	51.30	84%
09-Nov-23 21:22:00	12381.56	57.29	51.33	83%
09-Nov-23 21:23:00	12335.13	57.27	51.31	83%
09-Nov-23 21:24:00	12360.03	57.29	51.32	83%
09-Nov-23 21:25:00	12410.81	57.27	51.31	84%
09-Nov-23 21:26:00	12428.01	57.29	51.33	84%
09-Nov-23 21:27:00	12400.95	57.27	51.31	83%
09-Nov-23 21:28:00	12352.44	57.28	51.32	83%
09-Nov-23 21:29:00	12391.25	57.26	51.30	83%
09-Nov-23 21:30:00	12426.98	57.28	51.32	84%
09-Nov-23 21:31:00	12412.60	57.27	51.31	84%
09-Nov-23 21:32:00	12447.61	57.28	51.31	84%
09-Nov-23 21:33:00	12446.59	57.21	51.26	84%
09-Nov-23 21:34:00	12410.49	57.27	51.31	84%
09-Nov-23 21:35:00	12400.61	57.26	51.30	83%
09-Nov-23 21:36:00	12414.20	57.26	51.30	84%
09-Nov-23 21:37:00	12439.57	57.25	51.29	84%
09-Nov-23 21:38:00	12458.02	57.27	51.31	84%
09-Nov-23 21:39:00	12453.46	57.30	51.33	84%
09-Nov-23 21:40:00	12433.77	57.30	51.34	84%
09-Nov-23 21:41:00	12417.85	57.28	51.31	84%
09-Nov-23 21:42:00	12393.85	57.26	51.30	83%
09-Nov-23 21:43:00	12420.55	57.25	51.30	84%
09-Nov-23 21:44:00	12460.28	57.26	51.30	84%
09-Nov-23 21:45:00	12448.72	57.25	51.29	84%
09-Nov-23 21:46:00	12445.44	57.26	51.30	84%
09-Nov-23 21:47:00	12429.89	57.26	51.30	84%
09-Nov-23 21:48:00	12394.64	57.25	51.29	83%
09-Nov-23 21:49:00	12417.83	57.27	51.31	84%
09-Nov-23 21:50:00	12459.88	57.26	51.30	84%

	GEN TOTAL		Estimated	West Cogen %
	REAL POWER	Gas Fuel Flow	West Turbine	Nameplate
	KW	mscfh	Fired Duty	Power
			MMBTUH	Generated
				%
09-Nov-23 21:51:00	12466.52	57.27	51.31	84%
09-Nov-23 21:52:00	12458.84	57.21	51.26	84%
09-Nov-23 21:53:00	12434.90	57.27	51.31	84%
09-Nov-23 21:54:00	12403.88	57.27	51.31	83%
09-Nov-23 21:55:00	12420.72	57.28	51.32	84%
09-Nov-23 21:56:00	12424.67	57.27	51.31	84%
09-Nov-23 21:57:00	12421.14	57.26	51.30	84%
09-Nov-23 21:58:00	12437.88	57.26	51.30	84%
09-Nov-23 21:59:00	12439.62	57.26	51.30	84%
09-Nov-23 22:00:00	12439.27	57.27	51.31	84%
09-Nov-23 22:01:00	12466.18	57.26	51.30	84%
09-Nov-23 22:02:00	12468.57	57.24	51.28	84%
09-Nov-23 22:03:00	12462.32	57.24	51.28	84%
09-Nov-23 22:04:00	12446.72	57.27	51.31	84%
09-Nov-23 22:05:00	12466.77	57.28	51.32	84%
09-Nov-23 22:06:00	12520.50	57.24	51.28	84%
09-Nov-23 22:07:00	12528.01	57.25	51.29	84% Run 3 End

Last Page of Report