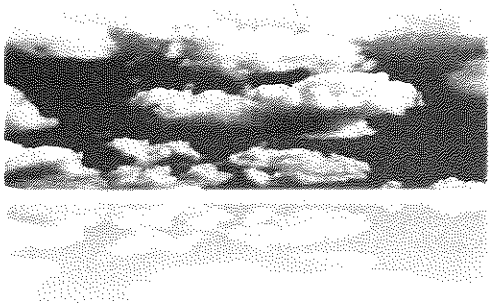
CleanAir

CleanAir Engineering
500 W. Wood Street
Palatine, IL 60067-4975
800-627-0033
www.cleanair.com



REPORT ON RATA & COMPLIANCE TESTING

Detroit Refinery

Zurn Boiler Stack (SV22-BR7)

Marathon Petroleum Company LP

1300 South Fort Street

Detroit, MI 48217

Client Reference No. 4101379616

CleanAir Project No. 13714-1

A2LA ISO 17025 Certificate No. 4342.01

A2LA / STAC Certificate No. 4342.02

Revision 1, Final Report

January 25, 2019

COMMITMENT TO QUALITY

To the best of our knowledge, the data presented in this report are accurate, complete, error free and representative of the actual emissions during the test program. Clean Air Engineering operates in conformance with the requirements of ASTM D7036-04 Standard Practice for Competence of Air Emission Testing Bodies.

Report Writer:

January 25, 2019

Peter Kaufmann, QSTI
pkaufmann@cleanair.com
(847) 778-8172

Date

I hereby certify that the information contained within the final test report has been reviewed and, to the best of my ability, verified as accurate.

Independent Report and Appendix Reviewer:

January 25, 2019

Ken Sullivan
Project Manager
ksullivan@cleanair.com
(800) 627-0033 ext. 4527

Date

REPORT REVISION HISTORY

Version	Revision	Date	Pages	Comments
Draft	D0a	01/18/19	All	Draft version of original document.
Final	0	01/24/19	All	Final version of original document.
Final	1	01/25/19	1	Revised Table 1-1.

PROJECT PERSONNEL

Name	Affiliation	Project Responsibility
Treva Formby	Marathon Petroleum Company LP	Client Contact
Paul Bortolussi	Marathon Petroleum Company LP	Client Contact
Ken Sullivan	CleanAir	Project Manager / Independent Reviewer of Report
Ricky Smith	CleanAir	Project Field Leader
Peter Kaufmann	CleanAir	Report Writer
Nadia Lazzar	CleanAir	Report Coordinator
Justin Lowe	CleanAir	Field Scientist
Josh Myers	CleanAir	Field Engineer
Chad Eilering	CleanAir	Field Scientist

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS & ABBREVIATIONS

AAS (atomic absorption spectrometry)
acfm (actual cubic feet per minute)
ACI (activated carbon injection)
ADL (above detection limit)
AIG (ammonia injection grid)
APC (air pollution control)
AQCS (air quality control system(s))
ASME (American Society of Mechanical Engineers)
ASTM (American Society for Testing and Materials)
BDL (below detection limit)
Btu (British thermal units)
CAM (compliance assurance monitoring)
CARB (California Air Resources Board)
CCM (Controlled Condensation Method)
CE (capture efficiency)
°C (degrees Celsius)
CEMS (continuous emissions monitoring system(s))
CFB (circulating fluidized bed)
CFR (Code of Federal Regulations)
cm (centimeter(s))
COMS (continuous opacity monitoring system(s))
CT (combustion turbine)
CTI (Cooling Technology Institute)
CTM (Conditional Test Method)
CVAAS (cold vapor atomic absorption spectroscopy)
CVAFS (cold vapor atomic fluorescence spectrometry)
DI H_2O (de-ionized water)
%dv (percent, dry volume)
DLL (detection level limited)
DE (destruction efficiency)
DCI (dry carbon injection)
DGM (dry gas meter)
dscf (dry standard cubic feet)
dscfm (dry standard cubic feet per minute)
dscm (dry standard cubic meter)
ESP (electrostatic precipitator)
FAMS (flue gas adsorbent mercury speciation)
°F (degrees Fahrenheit)
FB (field blank)
FCC (fluidized catalytic cracking)
FCCU (fluidized catalytic cracking unit)
FEGT (furnace exit gas temperatures)
FF (fabric filter)
FGD (flue gas desulfurization)
FIA (flame ionization analyzer)
FID (flame ionization detector)
FPD (flame photometric detection)
FRB (field reagent blank)
FSTM (flue gas sorbent total mercury)
ft (feet or foot)
ft^2 (square feet)
ft^3 (cubic feet)
ft/sec (feet per second)
FTIR (Fourier Transform Infrared Spectroscopy)
FTRB (field train reagent blank)
g (gram(s))
GC (gas chromatography)
GFAAS (graphite furnace atomic absorption spectroscopy)
GFC (gas filter correlation)
gr/dscf (grains per dry standard cubic feet)
> (greater than)/ ≥ (greater than or equal to)
g/s (grams per second)
H_2O (water)
HAP(s) (hazardous air pollutant(s))
HI (heat input)
hr (hour(s))
HR GC/MS (high-resolution gas chromatography and mass spectrometry)
HRVOC (highly reactive volatile organic compounds)
HSRG(s) (heat recovery steam generator(s))
HVT (high velocity thermocouple)
IC (ion chromatography)
IC/PCR (ion chromatography with post column reactor)
ICP/MS (inductively coupled argon plasma mass spectroscopy)
ID (induced draft)
in. (inch(es))
in. H_2O (inches water)
in. Hg (inches mercury)
IPA (isopropyl alcohol)
ISE (ion-specific electrode)
kg (kilogram(s))
kg/hr (kilogram(s) per hour)
< (less than)/ ≤ (less than or equal to)
L (liter(s))
lb (pound(s))
lb/hr (pound per hour)
lb/MMBtu (pound per million British thermal units)
lb/TBtu (pound per trillion British thermal units)
lb/lb-mole (pound per pound mole)
LR GC/MS (low-resolution gas chromatography and mass spectrometry)
m (meter)
m^3 (cubic meter)
MACT (maximum achievable control technology)
MASS® (Multi-Point Automated Sampling System)
MATS (Mercury and Air Toxics Standards)
MDL (method detection limit)
µg (microgram(s))
min. (minute(s))
mg (milligram(s))
ml (milliliter(s))
MMBtu (million British thermal units)
MW (megawatt(s))
NCASI (National Council for Air and Stream Improvement)
ND (non-detect)
NDIR (non-dispersive infrared)
NDO (natural draft opening)
NESHAP (National Emission Standards for Hazardous Air Pollutants)
ng (nanogram(s))
Nm^3 (Normal cubic meter)
% (percent)
PEMS (predictive emissions monitoring systems)
PFGC (pneumatic focusing gas chromatography)
pg (picogram(s))
PJFF (pulse jet fabric filter)
ppb (parts per billion)
PPE (personal protective equipment)
ppm (parts per million)
ppmdv (parts per million, dry volume)
ppmwv (parts per million, wet volume)
PSD (particle size distribution)
psi (pound(s) per square inch)
PTE (permanent total enclosure)
PTFE (polytetrafluoroethylene)
QA/QC (quality assurance/quality control)
QI (qualified individual)
QSTI (qualified source testing individual)
QSTO (qualified source testing observer)
RA (relative accuracy)
RATA (relative accuracy test audit)
RB (reagent blank)
RE (removal or reduction efficiency)
RM (reference method)
scf (standard cubic feet)
scfm (standard cubic feet per minute)
SCR (selective catalytic reduction)
SDA (spray dryer absorber)
SNCR (selective non-catalytic reduction)
STD (standard)
STMS (sorbent trap monitoring system)
TBtu (trillion British thermal units)
TEOM (Tapered Element Oscillating Microbalance)
TEQ (toxic equivalency quotient)
ton/hr (ton per hour)
ton/yr (ton per year)
TSS (third stage separator)
USEPA or EPA (United States Environmental Protection Agency)
UVA (ultraviolet absorption)
WFGD (wet flue gas desulfurization)
%wv (percent, wet volume)

1. PROJECT OVERVIEW

Test Program Summary

Marathon Petroleum Company LP (MPC) contracted CleanAir Engineering (CleanAir) to complete testing on the BR10 Boiler Stack (EU27-ZURNBOILER-S1) at the Detroit Refinery, located in Detroit, Michigan. The test program included the following objectives:

- Perform filterable particulate matter (FPM), sulfuric acid mist (H_2SO_4) and volatile organic compounds (VOCs) testing to demonstrate compliance with the Michigan Department of Environmental Quality (DEQ) Permit No. MI-ROP-A9831-2012c;
- Perform a relative accuracy test audit (RATA) on the facility continuous emissions monitoring system (CEMS) for oxygen (O_2) and nitrogen oxides (NO_X).

A summary of the test program results is presented below. Section 2 Results provides a more detailed account of the test conditions and data analysis. Test program information, including the test parameters, on-site schedule and a project discussion, begins on page 2.

Table 1-1:
Summary of Results – Compliance Testing

Source Constituent	Sampling Method	Average Emission	Permit Limit[1]
Zurn Boiler Stack			
PM (lb/MMBtu)	USEPA M5	0.00055	0.0019
H_2SO_4 (lb/MMBtu)	Draft ASTM CCM	0.000072	N/A
VOC (lb/MMBtu)	USEPA M25A	<0.00066	0.0055

[1] Permit limits obtained from MDEQ Renewable Operating Permit No. MI-ROP-A9831-2012c.

Table 1-2:
Summary of Results – CEMS RATA

Source Constituent	Reference Method	Relative Accuracy (%)[1]	Applicable Specification	Specification Limit[2]
Zurn Boiler Stack				
O_2 (% dv)	USEPA M3A	0.28	PS3	±1.0 % dv
NO_X (lb/MMBtu)	USEPA M3A / 7E / 19	4.7	PS2	20% of RM

[1] Relative Accuracy is expressed in terms of comparison to the reference method (% RM) or applicable emission standard (% Std.) The specific expression used depends on the specification limit cited.

[2] Specification limits obtained from 40 CFR 60, Appendix B, Performance Specifications.

Test Program Details

Parameters

The test program included the following measurements:

- particulate matter (PM), assumed equivalent to filterable particulate matter (FPM) only
- oxygen (O_2)
- carbon dioxide (CO_2)
- nitrogen oxide (NO_X)
- volatile organic compounds (VOCs), assumed equivalent to total hydrocarbons (THCs)
- sulfuric acid mist (H_2SO_4)
- flue gas composition (e.g., O_2, CO_2, H_2O)
- flue gas temperature
- flue gas flow rate

Schedule

The on-site schedule followed during the test program is outlined in Table 1-3.

Table 1-3:
Test Schedule

Run Number	Location	Method	Analyte	Date	Start Time	End Time
1	Zurn Boiler Stack	USEPA Method 3A/7E/10	$O_2/CO_2/NO_X$/THC	12/10/18	08:59	09:20
2	Zurn Boiler Stack	USEPA Method 3A/7E/10	$O_2/CO_2/NO_X$/THC	12/10/18	09:34	09:55
3	Zurn Boiler Stack	USEPA Method 3A/7E/10	$O_2/CO_2/NO_X$/THC	12/10/18	10:12	10:33
4	Zurn Boiler Stack	USEPA Method 3A/7E/10	$O_2/CO_2/NO_X$/THC	12/10/18	10:57	11:18
5	Zurn Boiler Stack	USEPA Method 3A/7E/10	$O_2/CO_2/NO_X$/THC	12/10/18	12:11	12:32
6	Zurn Boiler Stack	USEPA Method 3A/7E/10	$O_2/CO_2/NO_X$/THC	12/10/18	12:45	13:06
7	Zurn Boiler Stack	USEPA Method 3A/7E/10	$O_2/CO_2/NO_X$/THC	12/10/18	13:44	14:05
8	Zurn Boiler Stack	USEPA Method 3A/7E/10	$O_2/CO_2/NO_X$/THC	12/10/18	15:09	15:30
9	Zurn Boiler Stack	USEPA Method 3A/7E/10	$O_2/CO_2/NO_X$/THC	12/10/18	15:43	16:04
10	Zurn Boiler Stack	USEPA Method 3A/7E/10	$O_2/CO_2/NO_X$/THC	12/10/18	16:12	16:33
11	Zurn Boiler Stack	USEPA Method 3A/7E/10	$O_2/CO_2/NO_X$/THC	12/10/18	16:44	17:05
12	Zurn Boiler Stack	USEPA Method 3A/7E/10	$O_2/CO_2/NO_X$/THC	12/10/18	17:14	17:35
1	Zurn Boiler Stack	USEPA Method 4	Moisture	12/10/18	09:00	10:00
2	Zurn Boiler Stack	USEPA Method 4	Moisture	12/10/18	10:15	11:15
3	Zurn Boiler Stack	USEPA Method 4	Moisture	12/10/18	12:15	13:15
4	Zurn Boiler Stack	USEPA Method 4	Moisture	12/10/18	13:20	14:20
5	Zurn Boiler Stack	USEPA Method 4	Moisture	12/10/18	14:40	15:40
6	Zurn Boiler Stack	USEPA Method 4	Moisture	12/10/18	15:43	16:43
1	Zurn Boiler Stack	USEPA Method 5	FPM	12/10/18	18:32	20:37
2	Zurn Boiler Stack	USEPA Method 5	FPM	12/11/18	08:12	10:22
3	Zurn Boiler Stack	USEPA Method 5	FPM	12/11/18	11:03	13:13
4	Zurn Boiler Stack	USEPA Method 5	FPM	12/11/18	13:45	15:51
1	Zurn Boiler Stack	CTM-013 (mod) / Draft ASTM CCM	H_2SO_4	12/10/18	18:32	20:37
2	Zurn Boiler Stack	CTM-013 (mod) / Draft ASTM CCM	H_2SO_4	12/11/18	08:12	10:22
3	Zurn Boiler Stack	CTM-013 (mod) / Draft ASTM CCM	H_2SO_4	12/11/18	11:03	13:13
4	Zurn Boiler Stack	CTM-013 (mod) / Draft ASTM CCM	H_2SO_4	12/11/18	13:45	15:51

Discussion

Project Synopsis

As outlined above, the test program was conducted over a two-day period. During the first day, twelve (12) 21-minute RATA runs were conducted. During the RATA, six (6) 60-minute moisture runs were conducted.

After completing the RATA, the first of four (4) 120-minute particulate and sulfuric acid mist test runs were conducted. Three (3) additional test runs were conducted the following day.

Filterable Particulate Matter Testing

A total of four (4) 120-minute EPA Method 5 test runs were performed. FPM emission results were calculated in units of pounds per million Btu (lb/MMBtu). The final result was expressed as the average of the four (4) valid test runs.

Oxygen and Nitrogen Oxide RATA Testing

One-minute-average data points for O_2 and NO_X (dry basis) were collected over a period of 21 minutes for each test run utilizing EPA Methods 3A and 7E. Relative accuracy was determined based on nine (9) of 12 total test runs conducted per procedures outlined in Performance Specification (PS) 2, Section 8.4.4.

Run 2 was excluded due to low steam production during the test run. Runs 3 and 4 were excluded because maintenance was being performed on the MPC CEMS during the test runs.

Sampling occurred at the three (3) points as specified in Section 8.1.3.2 of PS 2 during each test run. The average result for each test run was converted to identical units of measurement as the facility CEMs and compared for relative accuracy.

Volatile Organic Compounds Testing

VOC emissions were determined using EPA Method 25A to quantify THC emissions. The results were comprised of three (3) 63-minute test runs. The Method 25A test runs were performed concurrently with the RATA test runs.

The THC results measured during RATA Runs 1 through 3 were averaged for Run 1. THC Run 2 was data from RATA Runs 6 through 8 and Run 3 from RATA Runs 9 through 11. O_2 concentrations from concurrent Method 3A test runs were utilized to convert VOC results to lb/MMBtu. THC data was converted from an actual (wet) basis to a dry basis using moisture data collected from concurrent Method 4 test runs. All emissions are reported on a propane basis.

During all Method 25A test runs, the measured concentrations of THC were below the minimum detection limit (MDL) of the analyzer. The MDL is defined as 'less than 1%' of the calibration span of the THC instrument. During this test program, the calibration span was 45.3 ppm. Therefore, 0.453 ppm was substituted for the average drift-corrected concentration for all test runs.

The final results are reported assuming the worst-case scenario; the resultant VOC emissions are less than the defined THC MDL corrected to dry conditions.

An integrated gas sample was collected during each test run for follow-up analysis for methane and ethane. Because all test runs were below the MDL for THC, the follow-up analyses were not conducted.

At the end of RATA Run 7, the THC analyzer drifted beyond the acceptable 3% of span criteria. This invalidates 21 minutes of the 63 minutes of collected data for VOC Run 2. The instrument was recalibrated prior to continuing the test program. Because all test runs were under the detectable level, the data was included in VOC Run 2. The final result was expressed as the average of the three (3) test runs.

Sulfuric Acid Mist Testing

Sulfuric acid mist (H_2SO_4) emissions were determined referencing the Draft ASTM Controlled Condensation Method (CCM). Four (4) 120-minute Draft ASTM CCM test runs were performed. H_2SO_4 emission results were calculated in units of lb/MMBtu. The final results were expressed as the average of four (4) valid test runs.

Prior to the first official test run, a 60-minute sample conditioning run (Run 0) was performed to minimize the absorption capacity of the front-half components of the sample train (upstream of the H_2SO_4-collecting portion of the sample train). The conditioning run was recovered in the same manner as the official test runs, but the condenser rinse and SAM filter were not analyzed.

Fuel Fd Factor

Emission results in units of dry volume-based concentration (lb/dscf, ppmdv) were converted into units of pound per million Btu (lb/MMBtu) per EPA Method 19 specifications. The F_d factor used for all calculations was the published value for natural gas, 8,710 dscf/MMBtu.

Test Conditions

The unit was operated at the maximum normal operating capacity during each of the emissions compliance test runs and no less than 50% of the maximum normal operating capacity during RATA test runs. MPC was responsible for logging any relevant process-related data and providing it to CleanAir for inclusion in the test report.

End of Section

2. RESULTS

This section summarizes the test program results. Additional results are available in the report appendices, specifically Appendix C Parameters.

Table 2-1:
Zurn Boiler Stack – FPM Emissions

Run No.		1	2	3	4	Average
Date (2018)		Dec 10	Dec 11	Dec 11	Dec 11	
Start Time (approx.)		18:32	08:12	11:03	13:45	
Stop Time (approx.)		20:37	10:22	13:13	15:51	
Process Conditions						
P_1	Steam production (mlb/hr)	117	96.9	93.2	95.1	**100**
P_2	Firing rate (MMBtu/hr)	141	116	111	113	**121**
F_d	Oxygen-based F-factor (dscf/MMBtu)	8,710	8,710	8,710	8,710	
Gas Conditions						
O_2	Oxygen (dry volume %)	3.8	4.8	5.0	4.0	**4.4**
CO_2	Carbon dioxide (dry volume %)	10.1	9.2	8.9	9.4	**9.4**
T_s	Sample temperature (°F)	293	280	281	280	**284**
B_w	Actual water vapor in gas (% by volume)	15.9	16.0	15.8	15.8	**15.9**
Gas Flow Rate						
Q_a	Volumetric flow rate, actual (acfm)	54,600	48,500	46,300	42,000	**47,900**
Q_s	Volumetric flow rate, standard (scfm)	38,600	34,600	33,000	30,000	**34,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	32,400	29,100	27,800	25,300	**28,600**
Sampling Data						
V_{mstd}	Volume metered, standard (dscf)	59.82	61.66	74.63	64.31	**65.10**
%I	Isokinetic sampling (%)	103.9	101.1	104.1	98.7	**101.9**
Laboratory Data						
m_{filter}	Matter collected on filter(s) (g)	0.00029	0.00029	0.00029	0.00029	
m_s	Matter collected in solvent rinse(s) (g)	0.00131	0.00084	0.00166	0.00091	
m_n	Total FPM (g)	0.00160	0.00113	0.00195	0.00120	
n_{MDL}	Number of non-detectable fractions	1 out of 2	1 out of 2	1 out of 2	1 out of 2	
DLC	Detection level classification	DLL	DLL	DLL	DLL	
FPM Results						
C_{sd}	Particulate Concentration (lb/dscf)	5.90E-08	4.04E-08	5.76E-08	4.11E-08	**4.95E-08**
C_{sd}	Particulate Concentration (mg/dscm)	0.944	0.647	0.923	0.659	**0.793**
$E_{lb/hr}$	Particulate Rate (lb/hr)	0.11	0.070	0.096	0.062	**0.086**
E_{Fd}	Particulate Rate - F_d-based (lb/MMBtu)	0.00063	0.00046	0.00066	0.00044	**0.00055**

Average includes 4 runs.

DLL = Detection Level Limited - all filters are below detection limit.

Table 2-2:
Zurn Boiler Stack – H_2SO_4 Emissions

Run No.		1	2	3	4	Average
Date (2018)		Dec 10	Dec 11	Dec 11	Dec 11	
Start Time (approx.)		18:32	08:12	11:03	13:45	
Stop Time (approx.)		20:37	10:22	13:13	15:51	
Process Conditions						
P_1	Steam production (mlb/hr)	117	96.9	93.2	95.1	**100**
P_2	Firing rate (MMBtu/hr)	141	116	111	113	**121**
F_d	Oxygen-based F-factor (dscf/MMBtu)	8,710	8,710	8,710	8,710	
Gas Conditions						
O_2	Oxygen (dry volume %)	3.9	4.7	5.3	3.9	**4.5**
CO_2	Carbon dioxide (dry volume %)	10.0	9.0	8.7	9.5	**9.3**
T_s	Sample temperature (°F)	297	285	282	283	**287**
B_w	Actual water vapor in gas (% by volume)	16.0	15.0	16.2	16.6	**16.0**
Gas Flow Rate[1]						
Q_a	Volumetric flow rate, actual (acfm)	54,600	48,500	46,300	42,000	**47,900**
Q_s	Volumetric flow rate, standard (scfm)	38,600	34,600	33,000	30,000	**34,000**
Q_{std}	Volumetric flow rate, dry standard (dscfm)	32,400	29,100	27,800	25,300	**28,600**
Sampling Data						
V_{mstd}	Volume metered, standard (dscf)	56.80	53.84	56.15	55.14	**55.49**
Laboratory Data (Ion Chromatography)						
m_n	Total H2SO4 collected (mg)	0.129	0.116	0.218	0.192	
Sulfuric Acid Vapor (H_2SO_4) Results						
C_{sd}	H_2SO_4 Concentration (lb/dscf)	5.00E-09	4.73E-09	8.54E-09	7.69E-09	**6.49E-09**
C_{sd}	H_2SO_4 Concentration (ppmdv)	0.020	0.019	0.034	0.030	**0.026**
E_{Fd}	H_2SO_4 Rate - Fd-based (lb/MMBtu)	0.000054	0.000053	0.00010	0.000082	**0.000072**

[1] Gas flow rate from concurrent Method 5 test runs.

Table 2-3:
Zurn Boiler Stack – VOC Emissions

Run No.		1	2	3	Average
Date (2018)		Dec 10	Dec 10	Dec 10	
Start Time (approx.)		08:59	12:45	13:44	
Stop Time (approx.)		10:33	15:30	16:04	
Process Conditions					
P_1	Steam production (mlb/hr)	75.3	81.8	122	**93.0**
P_2	Firing Rate (MMBtu/hr)	89.8	95.8	144	**82.5**
F_d	Oxygen-based F-factor (dscf/MMBtu)	8,710	8,710	8,710	
Gas Conditions					
O_2	Oxygen (dry volume %)	4.11	4.01	3.36	**3.83**
CO_2	Carbon dioxide (dry volume %)	9.54	9.56	9.99	**9.70**
T_s	Sample temperature (°F)	272	283	300	**284**
B_w	Actual water vapor in gas (% by volume)	15.7	15.9	16.0	**15.9**
THC Results (as Propane)					
C_{sd}	Concentration (ppmdv)	<0.54	<0.54	<0.54	**<0.54**
C_{sd}	Concentration (lb/dscf)	<6.1E-08	<6.2E-08	<6.2E-08	**<6.2E-08**
E_{Fd}	Emission Rate - F_d-based (lb/MMBtu)	<0.00067	<0.00066	<0.00064	**<0.00066**

Table 2-4:
Zurn Boiler Stack – O_2 (%dv) Relative Accuracy

Run No.	Start Time	Date (2018)	RM Data (%dv)	CEMS Data (%dv)	Difference (%dv)	Difference Percent
1	08:59	Dec 10	3.51	3.86	-0.35	-9.9%
2 *	09:34	Dec 10	4.07	4.49	-0.42	-10.4%
3 *	10:12	Dec 10	4.76	5.41	-0.64	-13.5%
4 *	10:57	Dec 10	3.98	4.31	-0.33	-8.3%
5	12:11	Dec 10	3.99	4.30	-0.31	-7.9%
6	12:45	Dec 10	4.03	4.36	-0.32	-8.0%
7	13:44	Dec 10	4.01	4.37	-0.36	-8.9%
8	15:09	Dec 10	3.97	4.12	-0.14	-3.6%
9	15:43	Dec 10	3.35	3.59	-0.23	-6.9%
10	16:12	Dec 10	3.36	3.60	-0.24	-7.2%
11	16:44	Dec 10	3.36	3.56	-0.20	-6.1%
12	17:14	Dec 10	3.32	3.71	-0.40	-12.0%
Average			**3.66**	**3.94**	**-0.28**	**-7.8%**

Relative Accuracy Test Audit Results

Standard Deviation of Differences	0.08353	
Confidence Coefficient (CC)	0.06421	
t-Value for 9 Data Sets	2.306	
		Limit
Avg. Abs. Diff. (%dv)	**0.28**	**1.0**

RM = Reference Method (CleanAir Data) 011719 210055
CEMS = Continuous Emissions Monitoring System (Marathon Petroleum Company LP Data
RATA calculations are based on 9 of 12 runs. * indicates the excluded runs.

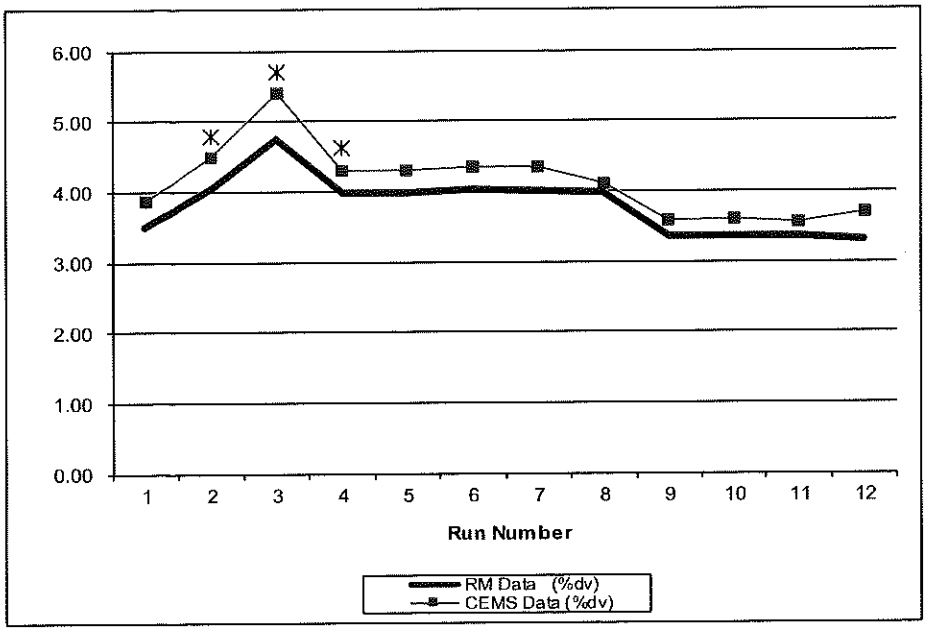


Table 2-5:
Zurn Boiler Stack – NO_X (lb/MMBtu) Relative Accuracy

Run No.	Start Time	Date (2018)	RM Data (lb/MMBtu)	CEMS Data (lb/MMBtu)	Difference (lb/MMBtu)	Difference Percent
1	08:59	Dec 10	0.0416	0.0402	0.0014	3.4%
2 *	09:34	Dec 10	0.0474	0.0467	0.0007	1.4%
3 *	10:12	Dec 10	0.0491	0.0483	0.0008	1.6%
4 *	10:57	Dec 10	0.0470	0.0457	0.0013	2.7%
5	12:11	Dec 10	0.0460	0.0448	0.0012	2.6%
6	12:45	Dec 10	0.0466	0.0447	0.0019	4.0%
7	13:44	Dec 10	0.0467	0.0449	0.0018	3.9%
8	15:09	Dec 10	0.0427	0.0403	0.0024	5.6%
9	15:43	Dec 10	0.0401	0.0383	0.0018	4.5%
10	16:12	Dec 10	0.0403	0.0386	0.0017	4.1%
11	16:44	Dec 10	0.0402	0.0385	0.0018	4.4%
12	17:14	Dec 10	0.0403	0.0386	0.0017	4.1%
Average			**0.0427**	**0.0410**	**0.0017**	**4.1%**

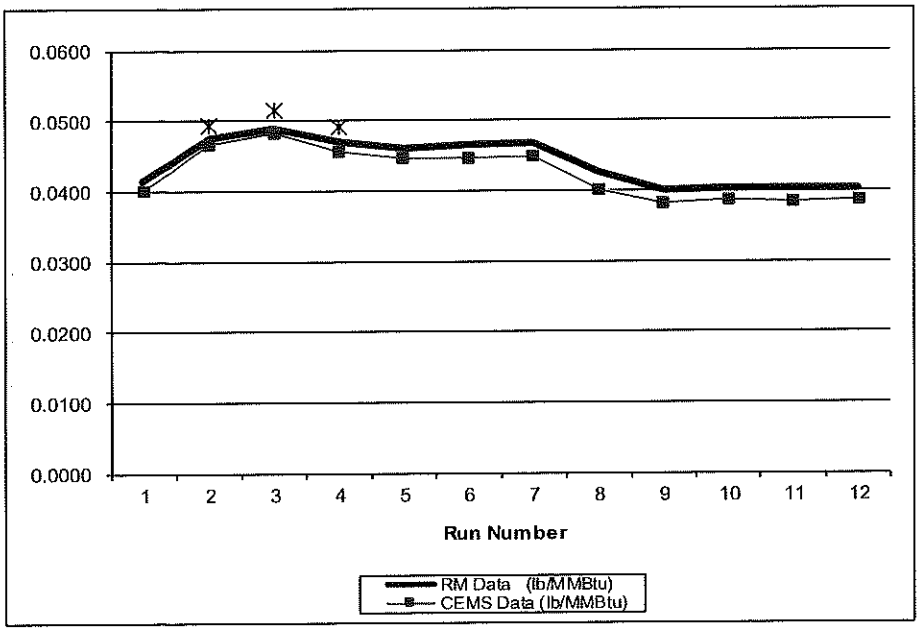
Relative Accuracy Test Audit Results

Standard Deviation of Differences	0.000332	
Confidence Coefficient (CC)	0.000255	
t-Value for 9 Data Sets	2.306	
		Limit
Relative Accuracy (as % of RM)	**4.7%**	**20.0%**

RM = Reference Method (CleanAir Data) 011719 210055

CEMS = Continuous Emissions Monitoring System (Marathon Petroleum Company LP Data

RATA calculations are based on 9 of 12 runs. * indicates the excluded runs.



End of Section