Reliable Emission Measurements, Inc.
Phone: (559) 855-8402 Fax: (559) 841-3665

Prepared For:

California Boiler
7341 W. Goshen Ave.
Visalia, CA 93291

Attn: Ms. Ashley Martinez

PROTOTYPE DEMONSTRATION
California Boiler, Visalia Facility
One Fire-Tube Boiler with One 20 MMBtu/hr ClearSign Core Model #FTB500 Natural Gas-Fired Burner
Permit to Operate: N/A
Tested On: December 14, 2021

Prepared By:

Reliable Emission Measurements, Inc.
34055 Natoma Rd.
Auberry, CA 93602
(559) 855-8402

Client Number:
304

Laboratory Report Number:
211-129

Test Team Leader:
Jeremy Ross
Vice President

Reviewed by:
Cam Donnahoo
President

Prepared on:
December 17, 2021

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Emission Summary

California Boiler/ClearSign

Cleaver Brooks
Visalia, CA
20 MMBtu/hr
Permit Number: N/A
December 14, 2021

EMISSION CONSTITUENT	Averages	Limit
Oxides of Nitrogen		
NOx, ppm	**1.5**	
NOx, ppm @ 3% O2	**1.9**	2.5
NOx, lbs/MMBtu	**0.002**	N/A
Carbon Monoxide		
CO, ppm	**10.6**	
CO, ppm @ 3% O2	**13.8**	50
CO, lbs/MMBtu	**0.010**	N/A
Oxygen, %	**7.1**	
Load, % (Displayed)	**60.0**	
Load, % (Calculated)	**65.9**	
Steam, Psi	**105.3**	
Fuel Btu/scf (See page 29)	**1031**	

Introduction

December 17, 2021

Client Number: 304
Lab Number: 211-129

California Boiler
7341 W. Goshen Ave.
Visalia, CA 93291

Attn: Ms. Ashley Martinez

REGARDING: Prototype demonstration of one 20 MMBtu/hr natural gas-fired boiler at California Boiler

On December 14, 2021, Reliable Emission Measurements, Inc. (REM) personnel performed a prototype demonstration test on one natural gas-fired boiler at **California Boiler**, located in Visalia, California. The demonstration was performed while the unit was operating at three different load conditions (100%, 55%, 25%). Three 30-minute demonstration runs were performed.

During initial calibration the NOx analyzer failed to achieve proper values for the 0-6 ppm scale (this scale satisfies the APCD's condition of the limit being no less than 30% of strip chart range). The tester switched to the 0-10 ppm scale. All values were within calibration parameters, and the tester received verbal confirmation from APCD representatives to continue with the 0-10 ppm NOx scale (emission standard was 25% of strip chart range). Anticipating low O2 values, the tester selected the lower O2 (4.986%) concentration for CIBs. After the first run the tester elected to perform a probe-tip linearity for both O2 calibration gases (4.986%, 9.020%). Runs 1 and 2 used the lower concentration value for post-calibrations; Run 3 required the higher concentration and its bias was referenced from the initial Run 1 post-calibration linearity.

The following is a summary of the procedures used during the testing:

Exhaust Gas Analysis: A continuous sample of the exhaust gas was taken from the exhaust stack of the boiler. The extracted gas sample was conditioned with an ice-cooled sample gas conditioner and transported through a Teflon sample line to a flow panel for distribution to the individual analyzers. The nitrogen oxides were checked using a Teledyne API T200M chemiluminescent NOx analyzer. The carbon monoxide was checked with a TECO Model 48C NDIR w/GFC analyzer and the oxygen was checked with a Servomex 1440 paramagnetic analyzer. The method used was CARB Method-100 with data collected simultaneously for three 30-minute runs. The data were recorded on an 8" strip chart recorder and logged to a data logging system. The results were reported in units of %, ppmvd, ppmvd @ 3% O2, and lb/MMBtu.

All results and calculations have been presented in accordance with SJVAPCD standard conditions of 68 °F and 29.92 in. Hg.

If you have any questions regarding the testing procedures or the calculations, please contact the undersigned at (559) 855-8402.

Respectfully submitted,

Jeremy Ross
Vice President

Reviewed by:

Cam Donnahoo
President

Calculations

CARB METHOD 100 COMPLIANCE EMISSION CALCULATIONS

Client : California Boiler/ClearSign
Site : Visalia, CA
Unit : Cleaver Brooks
Permit #: N/A

Date : 12/14/2021
T(std) : 68
Client #: 304
Lab #: 211-129

FIELD DATA CALCULATIONS

Drift Corrected Emission Data

Run	Run #1		Run #2		Run #3		*Average*
NOx	1.4	ppmv	1.6	ppmv	1.5	ppmv	*1.5*
O2	7.1	%	6.8	%	7.5	%	*7.1*
CO	21.2	ppmv	-1.8	ppmv	12.4	ppmv	*10.6*

Load Data

Load, % (Displayed)	25.0	55.0	100.0	*60.0*
Load, % (Calculated)	26.3	57.6	113.6	*65.9*
Steam, Psi	107.0	107.4	101.6	*105.3*
Fuel F-Factor	8710	8710	8710	*8710*

CALCULATED EMISSIONS

OUTLET AVERAGE

NOx	*1.5*	*ppmv*
NOx	*1.9*	*ppmv @ 3% O2*
NOx	0.002	*lb/MMBtu*
O2	*7.1*	*%*
CO	*10.6*	*ppmv*
CO	*13.8*	*ppmv @ 3% O2*
CO	0.0102	*lb/MMBtu*

Equations used:
NOx or CO @ 3% O2 = [ppmv] * (17.9 / (20.9 - %O2))
lb/MMBtu = ppmv * 0.000001 * (MW / (379.5*((460+Tstd)/520))) * F-Factor * (20.9 / (20.9 - %O2))
MW= NOx 45.9988; CO 28.0104.

Field Data and Strip Charts

EMISSIONS TEST - CARB 100 SITE & UNIT PARAMETERS

Site, Unit and Personnel

Date:	12/14/21	Lab Unit:	REM 1
Client:	California Boiler/ClearSign	REM:	Jeremy
County:	S-SJVAPCD	Client:	ClearSign
Site:	Visalia, CA	APCD:	Multiple
Unit:	Cleaver Brooks	T(std), °F:	68
Lab #:	211-129	Client #:	304
On Site:	7:00	Leave Site:	-
Pbar:	30.11	Fuel F-Factor:	8710
Permit #:	N/A	MMBtu/hr:	20
NOx Limits		CO Limits	
3% O2:	2.5	3% O2:	50
Lb/MMBtu:	N/A	Lb/MMBtu:	N/A

Analyzer List

Analyzer	REM #	Make,Model
NOx:	4	API T200M
O2:	1	Servomex 1440
CO:	1	TECO 48C
CO2:	-	
Chart Recorder:	1	Chino AH Series/ 6 pens

Calibration Gas Information

	Units	Zero	Span	Range	Gas Cyl.#	Ex Date
NOx:	ppmv	0	5.078	10	CC725092	12/16/22
NOx:	ppmv	0	9.147	10	CC504983	3/8/24
NO2:	ppmv	0	9.448	10	CC503949	3/4/24
O2:	%	0	4.986	10	CC408501	11/27/27
O2:	%	0	9.020	10	CC345736	6/1/28
CO:	ppmv	0	39.99	100	CC725092	12/16/22
CO:	ppmv	0	89.78	100	CC504983	3/8/24

Recorder Information

		Chanl.	Color
Outlet NOx:	ppmv	5	Brown
O2:	%	4	Green
CO:	ppmv	6	Blue
CO2:	-	-	-

Calculations used in the following pages:

Zero and Calibration Drift = ((Cib - Cfb) / Scale) * 100 Used for zero or upscale.

Drift Correction Calculation, Avg = ppm-(Ciz+Cfz/2)*((Cal Gas/(Cib+Cfb/2)-(Ciz+Cfz/2))

O2 Corrections = (Cgas) *((20.9-O2 Corr)/(20.9-O2))

lb/MMBtu = ppm* 10^-6*(MW/SV)*F-Factor*(20.9/(20.9-O2))

MWs: NOx (as NO2) = 45.9988; CO = 28.0104 SV= 379.5*((460 + Tstd)/520)

NO2 Check Results:

	N2 Zero Gas	Internal Response 9.147	Internal Response 9.448
NO	0.00	-	0.13
NOx	-0.002	9.14	9.24
Results:			***97.8%***

Internal Calibrations

	N2	Mid Response	High Response
Analyzer NOx	0.00	5.078	9.147
	-0.002	4.98	9.12
Results:	0.00%	0.98%	0.27%
Analyzer O2	0.00	4.986	9.020
	0.00	4.85	8.85
Results:	0.00%	1.36%	1.70%
Analyzer CO	0.00	39.99	89.78
	0.055	39.6	90.6
Results:	0.00%	0.39%	-0.82%

EMISSIONS TEST - CARB 100 - RUN 1
25% Load

Date: 12/14/21
Client: California Boiler/ClearSign
Start Run @: 9:10
Site: Visalia, CA
Unit: Fire Tube Boiler
End Run @: 9:40

Component:	NOx	O2	CO
Units:	ppmv	%	ppmv
Pre-Test Calibrations			
Cal Value:	**5.1**	**5.0**	**40.0**
Ca Zero:	**0.0**	**0.0**	**0.0**
Ca Span:	**5.0**	**4.9**	**39.6**
Cib Zero:	**0.2**	**-0.1**	**-0.3**
Cib Span:	**5.0**	**5.0**	**38.9**
Analyzer Range:	10.0	10.0	100.0
Raw Emissions			
9:10 AM	1.4	7.2	26.2
9:11 AM	1.4	7.2	24.5
9:12 AM	1.4	7.2	24.3
9:13 AM	1.4	7.1	24.7
9:14 AM	1.4	7.1	23.3
9:15 AM	1.4	7.1	23.6
9:16 AM	1.4	7.1	24.2
9:17 AM	1.4	7.1	23.8
9:18 AM	1.5	7.1	19.8
9:19 AM	1.4	7.1	22.7
9:20 AM	1.4	7.1	20.2
9:21 AM	1.4	7.1	20.5
9:22 AM	1.4	7.6	20.1
9:23 AM	1.4	7.1	21.5
9:24 AM	1.4	7.1	18.0
9:25 AM	1.4	7.1	19.5
9:26 AM	1.4	7.1	18.1
9:27 AM	1.5	7.1	18.5
9:28 AM	1.5	7.1	17.8
9:29 AM	1.5	7.1	19.5
9:30 AM	1.5	7.1	18.8
9:31 AM	1.5	7.1	18.1
9:32 AM	1.4	7.1	16.5
9:33 AM	1.4	7.1	17.9
9:34 AM	1.4	7.1	16.6
9:35 AM	1.4	7.1	18.1
9:36 AM	1.4	7.2	18.0
9:37 AM	1.4	7.2	18.3
9:38 AM	1.4	7.2	19.4
9:39 AM	1.4	7.2	18.9
9:40 AM	1.4	7.3	16.4
Post Run Average			
Raw Avg (Cavg):	**1.4**	**7.2**	**20.3**
Max Avg:	**1.5**	**7.6**	**26.2**
Min Avg:	**1.4**	**7.1**	**16.4**
Post Run Drift			
Zero:	0.0	-0.1	-0.7
Span:	4.9	5.0	38.3
Cfb zero Drift %	-(1.8)	(0.0)	-(0.4)
Cfb span Drift %	-(0.7)	(0.5)	-(0.6)

NOx		CO	
3% O2	lb/MMBtu	3% O2	lb/MMBtu
1.8	0.002	34.2	0.025
1.8	0.002	31.9	0.024
1.8	0.002	31.7	0.023
1.9	0.002	32.1	0.024
1.9	0.002	30.4	0.022
1.9	0.002	30.7	0.023
1.9	0.002	31.5	0.023
1.9	0.002	31.0	0.023
1.9	0.002	25.8	0.019
1.9	0.002	29.5	0.022
1.9	0.002	26.3	0.019
1.9	0.002	26.6	0.020
1.9	0.002	27.0	0.020
1.8	0.002	27.9	0.021
1.9	0.002	23.4	0.017
1.9	0.002	25.3	0.019
1.9	0.002	23.5	0.017
1.9	0.002	23.9	0.018
1.9	0.002	23.0	0.017
1.9	0.002	25.3	0.019
1.9	0.002	24.5	0.018
1.9	0.002	23.5	0.017
1.9	0.002	21.4	0.016
1.8	0.002	23.3	0.017
1.8	0.002	21.6	0.016
1.9	0.002	23.6	0.017
1.9	0.002	23.5	0.017
1.9	0.002	23.9	0.018
1.8	0.002	25.4	0.019
1.8	0.002	24.8	0.018
1.8	0.002	21.5	0.016

1.9	0.002	26.4	0.020
2.0	0.002	35.2	0.026
1.8	0.002	21.2	0.016

Drift Corrected Results

	NOx	O2	CO	NOx		CO	
	ppm	%	ppm	3% O2	lb/MMBtu	3% O2	lb/MMBtu
Average:	**1.36**	**7.12**	**21.23**	**1.8**	**0.002**	**27.6**	**0.020**

EMISSIONS TEST - CARB 100 - RUN 2
55% Load

Date: 12/14/21
Client: California Boiler/ClearSign
Start Run @: 12:03

Site: Visalia, CA
Unit: Fire Tube Boiler
End Run @: 12:33

Component:	NOx	O2	CO
Units:	ppmv	%	ppmv
Pre-Test Calibrations			
Cal Value:	**5.1**	**5.0**	**40.0**
Ca Zero:	**0.0**	**0.0**	**0.0**
Ca Span:	**5.0**	**4.9**	**39.6**
Cib Zero:	**0.2**	**-0.1**	**-0.3**
Cib Span:	**5.0**	**5.0**	**38.9**
Analyzer Range:	10.0	10.0	100.0
Raw Emissions			
12:03 PM	**1.5**	**7.0**	**-1.8**
12:04 PM	**1.5**	**7.0**	**-1.7**
12:05 PM	**1.6**	**7.0**	**-1.6**
12:06 PM	**1.5**	**7.0**	**-1.7**
12:07 PM	**1.5**	**7.0**	**-1.8**
12:08 PM	**1.6**	**6.9**	**-1.8**
12:09 PM	**1.6**	**6.9**	**-1.8**
12:10 PM	**1.6**	**6.8**	**-2.0**
12:11 PM	**1.6**	**6.8**	**-1.9**
12:12 PM	**1.6**	**6.8**	**-1.9**
12:13 PM	**1.7**	**6.8**	**-1.9**
12:14 PM	**1.7**	**6.8**	**-2.0**
12:15 PM	**1.6**	**7.8**	**-2.0**
12:16 PM	**1.7**	**6.8**	**-2.1**
12:17 PM	**1.6**	**6.8**	**-1.9**
12:18 PM	**1.6**	**6.8**	**-2.0**
12:19 PM	**1.6**	**6.8**	**-1.9**
12:20 PM	**1.7**	**6.8**	**-2.0**
12:21 PM	**1.7**	**6.8**	**-2.1**
12:22 PM	**1.7**	**6.8**	**-2.1**
12:23 PM	**1.7**	**6.8**	**-2.1**
12:24 PM	**1.7**	**6.8**	**-2.0**
12:25 PM	**1.7**	**6.8**	**-2.1**
12:26 PM	**1.7**	**6.8**	**-2.1**
12:27 PM	**1.7**	**6.8**	**-2.1**
12:28 PM	**1.7**	**6.8**	**-2.1**
12:29 PM	**1.7**	**6.8**	**-2.1**
12:30 PM	**1.7**	**6.8**	**-2.0**
12:31 PM	**1.7**	**6.8**	**-2.1**
12:32 PM	**1.7**	**6.8**	**-2.0**
12:33 PM	**1.7**	**6.8**	**-2.1**
Post Run Average			
Raw Avg (Cavg):	**1.6**	**6.9**	**-2.0**
Max Avg:	**1.7**	**7.8**	**-1.6**
Min Avg:	**1.5**	**6.8**	**-2.1**
Post Run Drift			
Zero:	**0.0**	**-0.1**	**-0.2**
Span:	**4.9**	**5.0**	**37.8**
Cfb zero Drift %	-(2.0)	(0.0)	(0.1)
Cfb span Drift %	-(0.9)	(0.5)	-(1.1)
Drift Corrected Results			

	NOx		CO		NOx		CO	
	ppm	%	ppm		3% O2	lb/MMBtu	3% O2	lb/MMBtu
Average:	**1.59**	**6.85**	**-1.81**		**2.0**	**0.002**	**-2.3**	**-0.002**

NOx		CO	
3% O2	lb/MMBtu	3% O2	lb/MMBtu
2.0	**0.002**	**-2.3**	**-0.002**
2.0	**0.002**	**-2.2**	**-0.002**
2.0	**0.002**	**-2.1**	**-0.002**
2.0	**0.002**	**-2.2**	**-0.002**
2.0	**0.002**	**-2.3**	**-0.002**
2.0	**0.002**	**-2.4**	**-0.002**
2.0	**0.002**	**-2.3**	**-0.002**
2.1	**0.003**	**-2.5**	**-0.002**
2.1	**0.003**	**-2.4**	**-0.002**
2.1	**0.003**	**-2.5**	**-0.002**
2.1	**0.003**	**-2.5**	**-0.002**
2.1	**0.003**	**-2.5**	**-0.002**
2.2	**0.003**	**-2.7**	**-0.002**
2.1	**0.003**	**-2.7**	**-0.002**
2.1	**0.003**	**-2.5**	**-0.002**
2.1	**0.002**	**-2.6**	**-0.002**
2.1	**0.003**	**-2.5**	**-0.002**
2.1	**0.003**	**-2.6**	**-0.002**
2.1	**0.003**	**-2.6**	**-0.002**
2.1	**0.003**	**-2.7**	**-0.002**
2.2	**0.003**	**-2.6**	**-0.002**
2.2	**0.003**	**-2.6**	**-0.002**
2.1	**0.003**	**-2.7**	**-0.002**
2.1	**0.003**	**-2.6**	**-0.002**
2.1	**0.003**	**-2.7**	**-0.002**
2.1	**0.003**	**-2.7**	**-0.002**
2.1	**0.003**	**-2.7**	**-0.002**
2.1	**0.003**	**-2.5**	**-0.002**
2.1	**0.003**	**-2.6**	**-0.002**
2.1	**0.003**	**-2.5**	**-0.002**
2.1	**0.003**	**-2.6**	**-0.002**

2.1	**0.003**	**-2.5**	**-0.002**
2.3	**0.003**	**-2.2**	**-0.002**
1.9	**0.002**	**-2.7**	**-0.002**

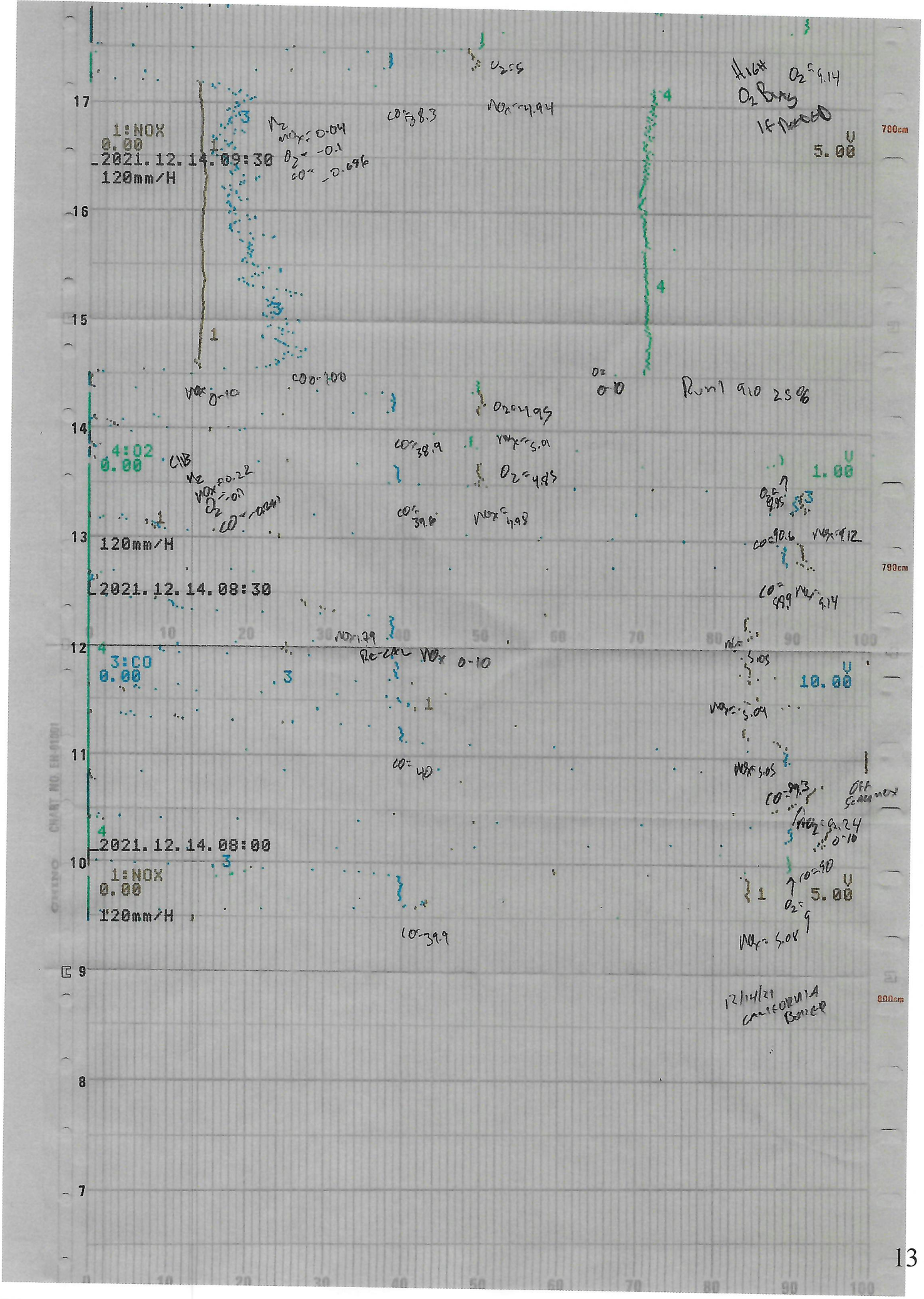
EMISSIONS TEST - CARB 100 - RUN 3
100% Load

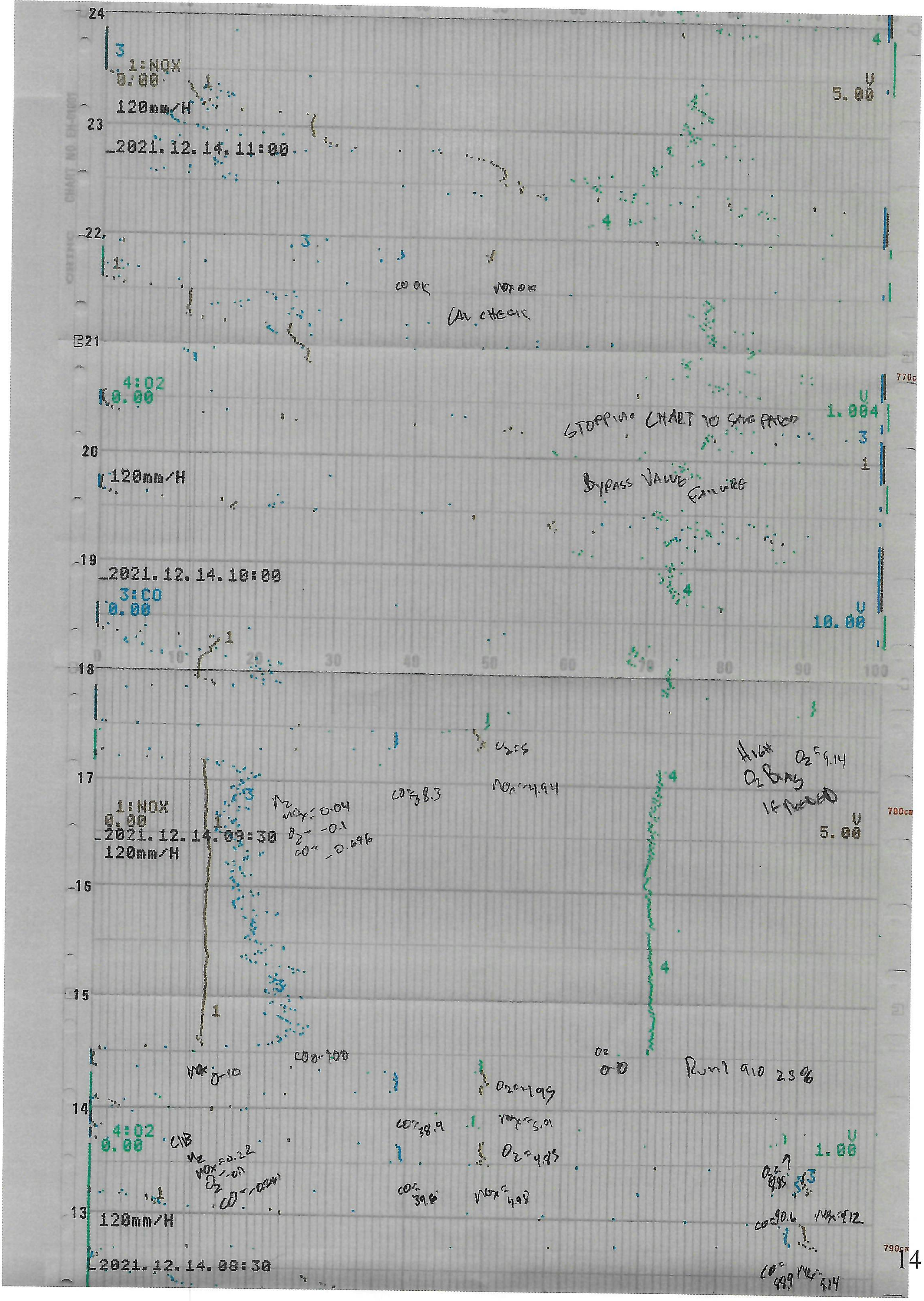
Date: 12/14/21
Client: California Boiler/ClearSign
Start Run @: 14:39
Site: Visalia, CA
Unit: Fire Tube Boiler
End Run @: 15:09

Component:	NOx	O2	CO	NOx		CO	
Units:	ppmv	%	ppmv	3% O2	lb/MMBtu	3% O2	lb/MMBtu
Pre-Test Calibrations							
Cal Value:	**5.1**	**9.0**	**40.0**				
Ca Zero:	**0.0**	**0.0**	**0.0**				
Ca Span:	**5.0**	**8.9**	**39.6**				
Cib Zero:	**0.2**	**-0.1**	**-0.3**				
Cib Span:	**5.0**	**9.1**	**38.9**				
Analyzer Range:	10.0	10.0	100.0				
Raw Emissions							
2:39 PM	**1.6**	**7.4**	**5.3**	**2.1**	**0.003**	**7.0**	**0.005**
2:40 PM	**1.6**	**7.4**	**5.0**	**2.1**	**0.003**	**6.6**	**0.005**
2:41 PM	**1.6**	**7.4**	**4.4**	**2.2**	**0.003**	**5.8**	**0.004**
2:42 PM	**1.7**	**7.3**	**3.1**	**2.2**	**0.003**	**4.1**	**0.003**
2:43 PM	**1.7**	**7.3**	**1.8**	**2.3**	**0.003**	**2.4**	**0.002**
2:44 PM	**1.8**	**7.3**	**1.5**	**2.3**	**0.003**	**2.0**	**0.001**
2:45 PM	**1.7**	**7.4**	**3.5**	**2.3**	**0.003**	**4.7**	**0.003**
2:46 PM	**1.7**	**7.3**	**2.9**	**2.2**	**0.003**	**3.8**	**0.003**
2:47 PM	**1.7**	**7.3**	**2.6**	**2.2**	**0.003**	**3.4**	**0.003**
2:48 PM	**1.7**	**7.3**	**2.8**	**2.2**	**0.003**	**3.6**	**0.003**
2:49 PM	**1.7**	**7.3**	**2.7**	**2.2**	**0.003**	**3.6**	**0.003**
2:50 PM	**1.7**	**7.3**	**2.7**	**2.2**	**0.003**	**3.5**	**0.003**
2:51 PM	**1.5**	**8.0**	**2.8**	**2.1**	**0.003**	**3.9**	**0.003**
2:52 PM	**1.7**	**7.3**	**3.6**	**2.2**	**0.003**	**4.7**	**0.003**
2:53 PM	**1.7**	**7.4**	**3.9**	**2.2**	**0.003**	**5.2**	**0.004**
2:54 PM	**1.6**	**7.4**	**6.4**	**2.2**	**0.003**	**8.5**	**0.006**
2:55 PM	**1.6**	**7.5**	**9.4**	**2.1**	**0.003**	**12.5**	**0.009**
2:56 PM	**1.5**	**7.5**	**9.7**	**2.0**	**0.002**	**13.0**	**0.010**
2:57 PM	**1.5**	**7.6**	**8.8**	**2.0**	**0.002**	**11.9**	**0.009**
2:58 PM	**1.5**	**7.6**	**15.2**	**2.0**	**0.002**	**20.5**	**0.015**
2:59 PM	**1.4**	**7.7**	**17.8**	**1.9**	**0.002**	**24.0**	**0.018**
3:00 PM	**1.4**	**7.7**	**20.9**	**1.9**	**0.002**	**28.3**	**0.021**
3:01 PM	**1.4**	**7.7**	**22.4**	**1.9**	**0.002**	**30.4**	**0.023**
3:02 PM	**1.3**	**7.7**	**25.8**	**1.8**	**0.002**	**35.0**	**0.026**
3:03 PM	**1.3**	**7.7**	**26.5**	**1.8**	**0.002**	**35.9**	**0.027**
3:04 PM	**1.3**	**7.7**	**26.2**	**1.8**	**0.002**	**35.6**	**0.026**
3:05 PM	**1.3**	**7.7**	**26.6**	**1.8**	**0.002**	**36.1**	**0.027**
3:06 PM	**1.3**	**7.7**	**24.2**	**1.8**	**0.002**	**32.8**	**0.024**
3:07 PM	**1.4**	**7.7**	**22.2**	**1.8**	**0.002**	**30.0**	**0.022**
3:08 PM	**1.4**	**7.7**	**18.6**	**1.9**	**0.002**	**25.2**	**0.019**
3:09 PM	**1.4**	**7.6**	**20.8**	**1.9**	**0.002**	**28.1**	**0.021**
Post Run Average							
Raw Avg (Cavg):	**1.5**	**7.5**	**11.3**	**2.1**	**0.002**	**15.1**	**0.011**
Max Avg:	**1.8**	**8.0**	**26.6**	**2.4**	**0.003**	**36.8**	**0.027**
Min Avg:	**1.3**	**7.3**	**1.5**	**1.8**	**0.002**	**2.0**	**0.001**
Post Run Drift							
Zero:	**0.0**	**-0.1**	**-1.0**				
Span:	**5.0**	**9.1**	**36.9**				
Cfb zero Drift %	-(2.0)	(0.0)	-(0.7)				
Cfb span Drift %	(0.0)	-(0.4)	-(2.0)				

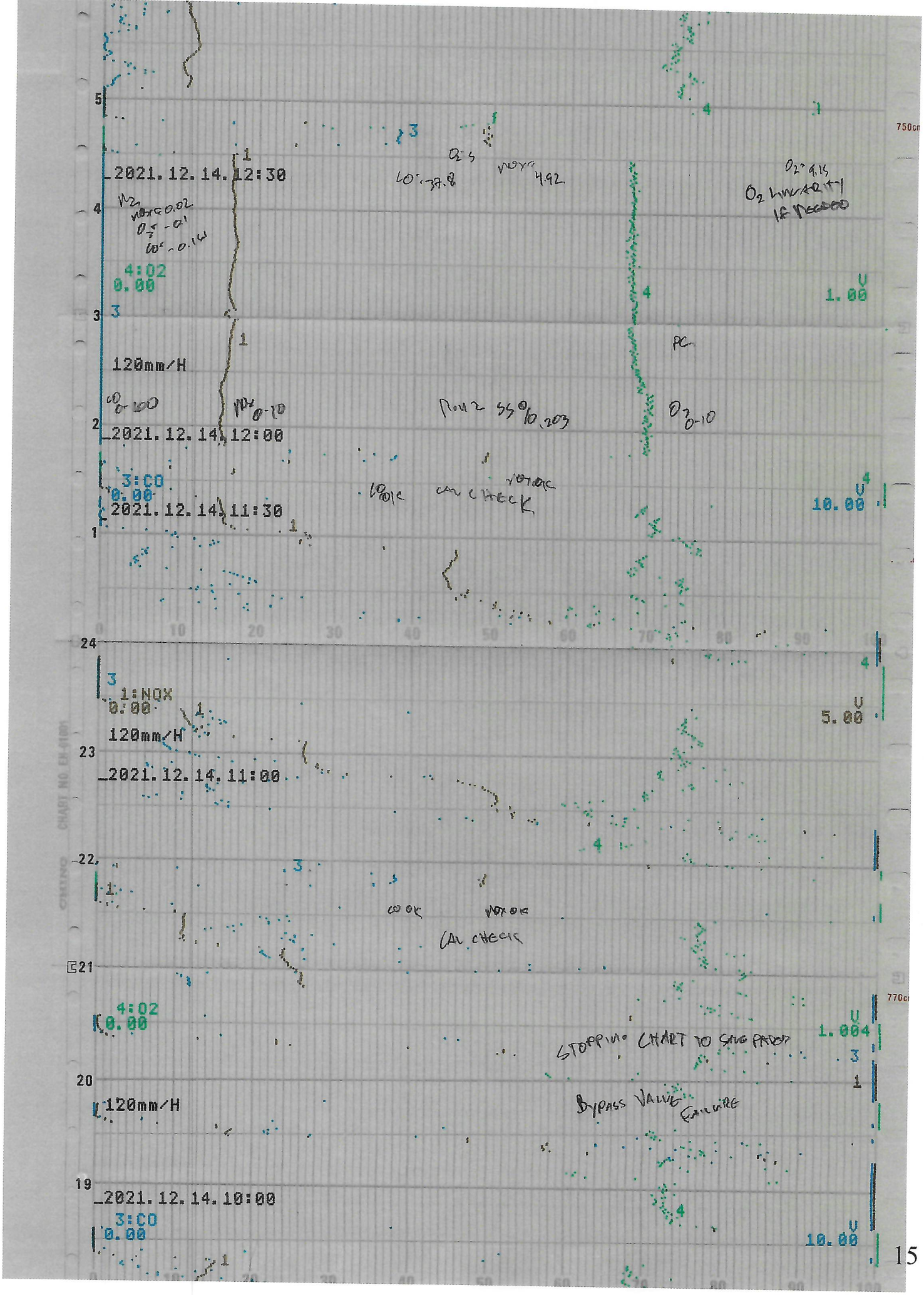
Drift Corrected Results

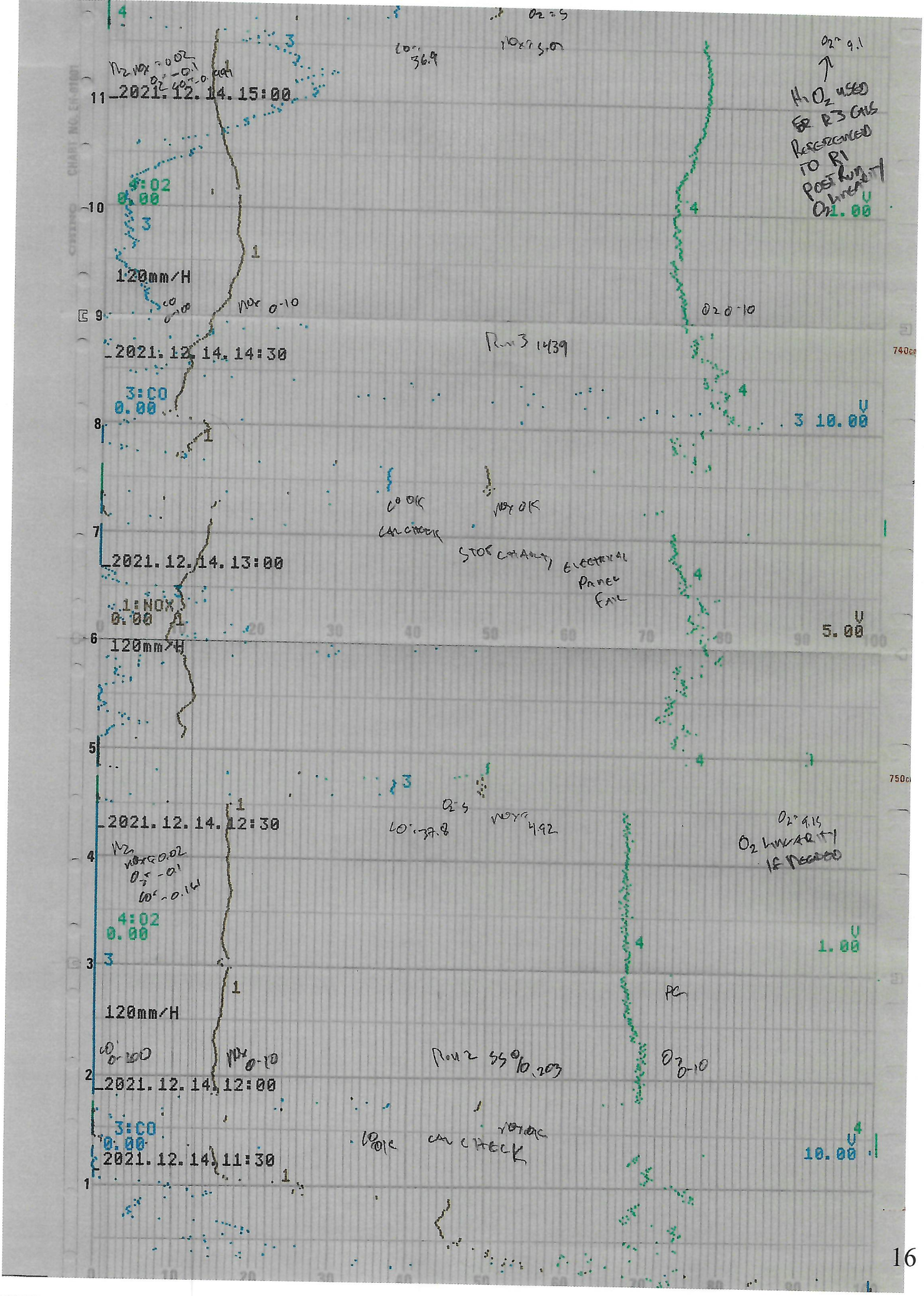
	NOx	O2	CO	NOx		CO	
	ppm	%	ppm	3% O2	lb/MMBtu	3% O2	lb/MMBtu
Average:	**1.47**	**7.45**	**12.37**	**2.0**	**0.002**	**16.5**	**0.012**

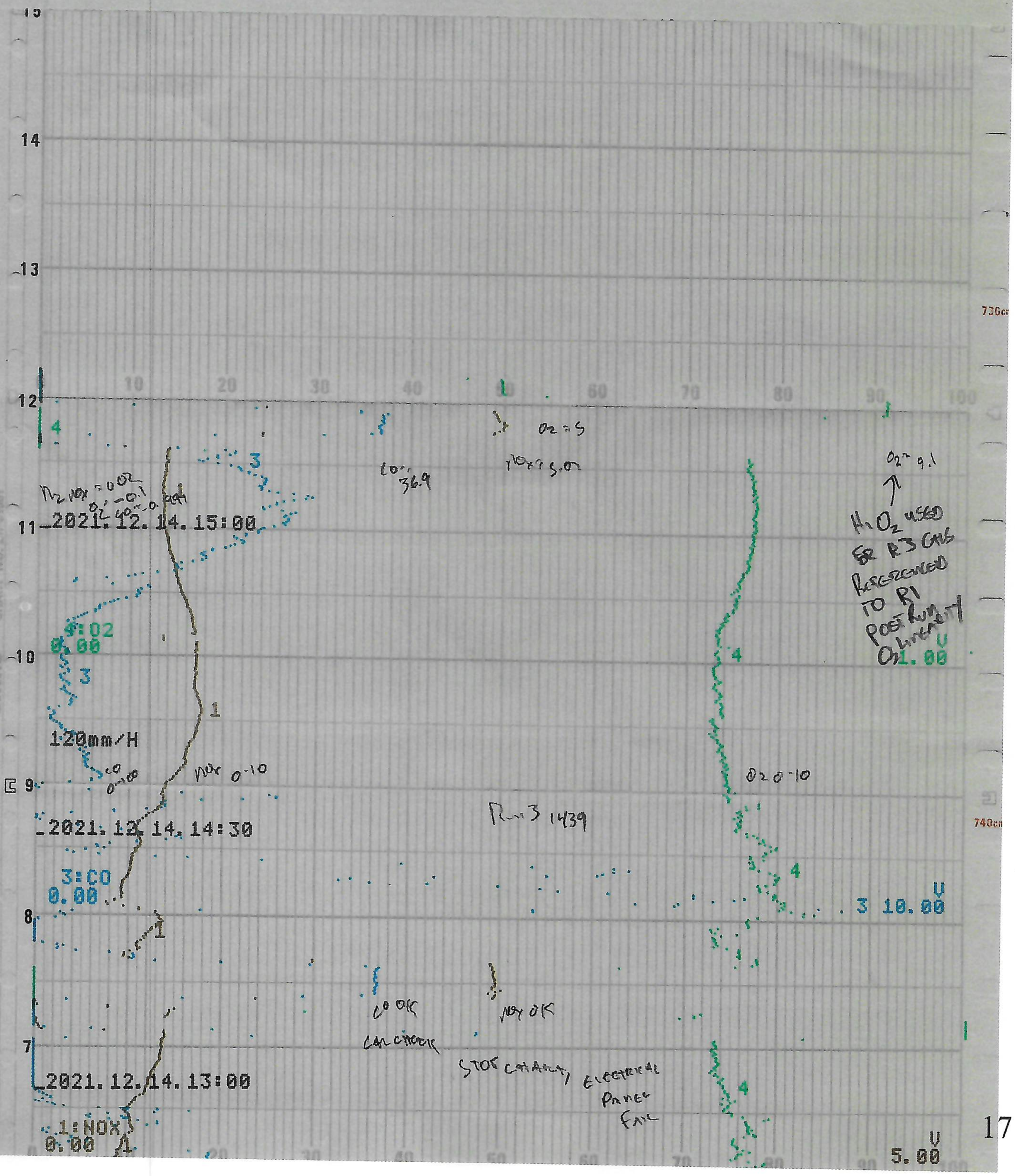

1:NOX
0.00
2021.12.14.09:30
120mm/H
4:O2
0.00
120mm/H
2021.12.14.08:30
3:CO
0.00
2021.12.14.08:00
1:NOX
0.00
120mm/H
5.00
1.00
10.00
5.00
700cm
790cm
800cm
Run 910 25%
12/14/21
CALIFORNIA
Burner



1:NOX
0.00
120mm/H
2021.12.14.11:00
5.00
CO OK
NOX OK
CAL CHECK
4:02
0.00
STOPPING CHART TO SAVE PAPER
1.004
120mm/H
BYPASS VALVE FAILURE
2021.12.14.10:00
3:CO
0.00
10.00
0 10 20 30 40 50 60 70 80 90 100
HIGH O2 BIAS IF NEEDED
1:NOX
0.00
2021.12.14.09:30
120mm/H
5.00
4:02
0.00
1.00
120mm/H
2021.12.14.08:30
Run 1 910 25%
770cm
780cm
790cm


2021.12.14.12:30
4:O2
0.00
120mm/H
2021.12.14.12:00
3:CO
0.00
2021.12.14.11:30
1:NOX
0.00
120mm/H
2021.12.14.11:00
4:O2
0.00
120mm/H
2021.12.14.10:00
3:CO
0.00
1.00
10.00
5.00
1.00
10.00
CAL CHECK
CAL CHECK
STOPPING CHART TO SAVE PRINT
BYPASS VALVE FAILURE


2021.12.14.15:00
2021.12.14.14:30
2021.12.14.13:00
2021.12.14.12:30
2021.12.14.12:00
2021.12.14.11:30
120mm/H
3:CO
0.00
1:NOX
4:O2
10.00
5.00
1.00
Run 3 1439
Run 2 55% 10.203
STOP CHANGE ELECTRICAL Panel Fail
H2O2 USED FOR R3 GAS REFERENCED TO R1 POST RUN O2 linearity


2021.12.14.15:00
4:O2
0.00
120mm/H
2021.12.14.14:30
3:CO
0.00
3 10.00
2021.12.14.13:00
1:NOX
0.00
5.00
1.00

Boiler Operation Data Sheet

Client: California Boiler/ClearSign
Site(s): Visalia, CA
Unit(s): Cleaver Brooks
REM: Jeremy

APCD: Multiple
Rated MMBtu/hr: 20
T(std), °F: 68
Pbar: **30.11**

Permit #: N/A
Burner Serial Number: 1002
Burner Model: FTB 500
Fuel F-Factor: 8710

NOx Limits
3% O2: 2.5
Lb/MMBtu: N/A
Lab #: 211-129

CO Limits
3% O2: 50
Lb/MMBtu: N/A
Client #: 304

COMPLIANCE TEST RUNS

Test Data		Load	Steam				Fuel Data			Load Results		
Time	*Run #*	%	Psi						SCFH	SCFM	MMBtu/hr		Load %
9:13	1	25.0	107.0						5110.0	85.2	5.3		26.3
12:15	2	55.0	107.4						11178.4	186.3	11.5		57.6
14:55	3	100.0	101.6						22039.8	367.3	22.7		113.6
Average:		**60.0**	**105.3**						**12776.1**	**212.9**	**13.2**		**65.9**

MOBILE LAB ENVIRONMENT

Time	*Run #*	*In Temp*	*Volts*
9:13	1	59	112
12:15	2	63	110
14:55	3	74	110

REM - AMS 30 - 2003

Quality Assurance

Airgas
an Air Liquide company

Airgas USA, LLC
525 North Industrial Loop Road
Tooele, UT 84074
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI99E15A1451	Reference Number:	153-401662919-1
Cylinder Number:	CC725092	Cylinder Volume:	144.3 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
PGVP Number:	B72019	Valve Outlet:	660
Gas Code:	CO,NO,NOX,BALN	Certification Date:	Dec 16, 2019

Expiration Date: Dec 16, 2022

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
NOX	5.000 PPM	5.078 PPM	G1	+/- 1.1% NIST Traceable	12/09/2019, 12/16/2019
NITRIC OXIDE	5.000 PPM	5.040 PPM	G1	+/- 1.2% NIST Traceable	12/09/2019, 12/16/2019
CARBON MONOXIDE	40.00 PPM	39.99 PPM	G1	+/- 0.4% NIST Traceable	12/09/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08012121A	KAL004278	5.08 PPM NITRIC OXIDE/NITROGEN	1.0%	Jun 05, 2021
NTRM	08012121A	KAL004278-NOX	5.08 PPM NOx/NITROGEN	1.0%	Jun 05, 2021
NTRM	12011222	KAL004134	49.24 PPM CARBON MONOXIDE/NITROGEN	0.3%	Aug 31, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Thermo 48i-TLE 1163640031 CO	CO NDIR (Mason)	Dec 03, 2019
Thermo 42i-LS 1123749327 NO	Chemiluminescence (Mason)	Dec 16, 2019
Thermo 42i-LS 1123749327 NOx	Chemiluminescence (Mason)	Dec 16, 2019

Triad Data Available Upon Request

Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
525 North Industrial Loop Road
Tooele, UT 84074
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI99E15A00K5	Reference Number:	153-402040736-1
Cylinder Number:	CC504983	Cylinder Volume:	144.3 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
PGVP Number:	B72021	Valve Outlet:	660
Gas Code:	CO,NO,NOX,BALN	Certification Date:	Mar 08, 2021

Expiration Date: Mar 08, 2024

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
NOX	9.000 PPM	9.147 PPM	G1	+/- 1.0% NIST Traceable	02/26/2021, 03/08/2021
NITRIC OXIDE	9.000 PPM	9.078 PPM	G1	+/- 1.1% NIST Traceable	02/26/2021, 03/08/2021
CARBON MONOXIDE	90.00 PPM	89.78 PPM	G1	+/- 0.5% NIST Traceable	02/26/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	120102	AAL073426	10.04 PPM NITRIC OXIDE/NITROGEN	1.0%	Oct 16, 2022
NTRM	120102	AAL073426-NOX	10.04 PPM NOx/NITROGEN	1.0%	Oct 16, 2022
NTRM	12011222	KAL004134	49.24 PPM CARBON MONOXIDE/NITROGEN	0.3%	Aug 31, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Thermo 48i-TLE 1163640031 CO	CO NDIR (Mason)	Feb 01, 2021
Thermo 42i-LS 1123749327 NO	Chemiluminescence (Mason)	Feb 19, 2021
Thermo 42i-LS 1123749327 NOx	Chemiluminescence (Mason)	Feb 19, 2021

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:	E02NI99E15W0004	Reference Number:	48-402041349-1
Cylinder Number:	CC503949	Cylinder Volume:	144.0 Cubic Feet
Laboratory:	124 - Los Angeles (SAP) - CA	Cylinder Pressure:	2016 PSIG
PGVP Number:	B32021	Valve Outlet:	660
Gas Code:	NO2,BALN	Certification Date:	Mar 04, 2021

Expiration Date: Mar 04, 2024

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
NITROGEN DIOXIDE	9.500 PPM	9.448 PPM	G1	+/- 2.3% NIST Traceable	02/25/2021, 03/04/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	4014238391058	CC508987	9.023 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1%	Feb 10, 2023
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR NO2 018335821	FTIR	Feb 13, 2021

Triad Data Available Upon Request

PERMANENT NOTES: Oxygen added to maintain stability

Approved for Release

Airgas
an Air Liquide company

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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI77E15A0031	Reference Number:	48-401660375-1
Cylinder Number:	CC408501	Cylinder Volume:	155.9 CF
Laboratory:	124 - Los Angeles (SAP) - CA	Cylinder Pressure:	2015 PSIG
PGVP Number:	B32019	Valve Outlet:	580
Gas Code:	O2,BALN	Certification Date:	Nov 27, 2019

Expiration Date: Nov 27, 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 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
OXYGEN	5.000 %	4.986 %	G1	+/- 0.5% NIST Traceable	11/27/2019
CARBON DIOXIDE	18.00 %	17.86 %	G1	+/- 0.6% NIST Traceable	11/27/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	11060718	CC338458	4.861 % OXYGEN/NITROGEN	+/- 0.4%	Dec 13, 2022
NTRM	12061520	CC354777	19.87 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 11, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS 6E CO2	NDIR	Nov 27, 2019
SIEMENS OXYMAT 6	PARAMAGNETIC	Nov 05, 2019

Triad Data Available Upon Request

Signature on file

Approved for Release

Airgas
an Air Liquide company

Airgas USA, LLC
525 North Industrial Loop Road
Tooele, UT 84074
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI82E15A0220	Reference Number:	153-401824413-1
Cylinder Number:	CC345736	Cylinder Volume:	150.2 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
PGVP Number:	B72020	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Jun 01, 2020

Expiration Date: Jun 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	9.000 %	9.005 %	G1	+/- 1.9% NIST Traceable	06/01/2020
OXYGEN	9.000 %	9.020 %	G1	+/- 0.7% NIST Traceable	06/01/2020
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060628	CC413727	13.359 % CARBON DIOXIDE/NITROGEN	0.6%	May 14, 2025
NTRM	98051017	SG9142416BAL	12.05 % OXYGEN/NITROGEN	0.7%	Dec 14, 2023

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA-510 SV4MEUTJ CO2	CO2 NDIR (Dixon)	May 14, 2020
Horiba MPA-510 W603MM58 O2	O2 Paramagnetic (Mason)	May 21, 2020

Triad Data Available Upon Request

Approved for Release

Appendix A

SOURCE EMISSION DEMONSTRATION PROTOCOL

FOR

California Boiler

One Cleaver Brooks Fire Tube Boiler with One 20.0 MMBtu/hr Natural Gas-Fired ClearSign Model FTB500 Burner

Authority to Construct: N/A

Burner Serial Number: 1002

Presented to:

San Joaquin Valley APCD
1990 East Gettysburg Ave.
Fresno, CA 93726

Attn: Mr. John Copp

Prepared for:

CALIFORNIA BOILER
7341 West Goshen Avenue
Visalia, CA 93291
(559) 625-5151

Attn: Mrs. Mary Cervantes

Prepared by:

Reliable Emission Measurements, Inc.
34055 Natoma
Auberry, CA 93602
(559) 855-8402

Jeremy Ross
Vice President

December 23, 2021

Reliable Emission Measurements, Inc.
Phone: (559) 855-8402 Fax: (559) 841-3665

December 23, 2021

San Joaquin Valley APCD
1990 East Gettysburg Ave.
Fresno, CA 93726

Attn: Mr. John Copp

RE: Source emission demonstration protocol for one fire tube boiler with one 20.0 MMBtu/hr natural gas-fired Model FTB500 burner at California Boiler in Visalia, CA – (No ATC at this time)

Dear Mr. Copp,

Enclosed is REM's source emission demonstration protocol for testing for one boiler with a natural gas-fired burner (model: FTB500). The boiler's exhaust shall be monitored for Oxides of Nitrogen (NOx), Carbon Monoxide (CO), and Oxygen (O2) using CARB Method-100. The boiler will be tested for compliance on natural gas. The unit does not have a load demand, therefore steam will be vented during the testing. Due to the steam venting, the boiler shall be operated at 30%, 60%, and 90% load conditions (or closest achievable). Each load will be monitored for one 30-minute test run. The boiler is located at **7341 W. Goshen Ave, Visalia, CA.**

The unit will be tested without adjustments. The boiler will run a minimum of two hours after the last adjustment before testing is started.

We plan to test this unit on **December 14, 2021**, testing is scheduled to begin at **08:00 hours**.

If you have any questions, please contact Reliable Emission Measurements, Inc. at (559) 855-8402.

Respectfully submitted,

Jeremy Ross
Vice President

METHODOLOGY

This test plan defines the testing methodology proposed for the source emission demonstration of one boiler with one 20.0 MMBtu/hr natural gas-fired burner, model FTB500. The boiler will be operated at 30%, 60%, and 90% simulated load conditions (or closest achievable) for the emission demonstration. The boiler's load rates and operating parameters will be monitored during all test runs. This will be a "hands-off" demonstration. The boiler will be running for a minimum of two hours after the final adjustments before the demonstration begins.

The demonstration shall include the following:

Parameter	**Location Tested**	**Samples/Runs**	**Method**
Oxides of Nitrogen	Exhaust stack	3-30 min runs 1 per load condition	CARB Method 100 Chemiluminescent Analyzer
Carbon Monoxide	Exhaust stack	3-30 min runs 1 per load condition	CARB Method 100 NDIR/GFC Analyzer
Oxygen	Exhaust stack	3-30 min runs 1 per load condition	CARB Method 100 Paramagnetic Analyzer
Flow Rate	Fuel Meter	3; 1 per run condition	EPA Method 19 Fuel Expansion Factor

The results will be reported in units of ppmvd, %, lb/MMBtu, and ppmvd @ 3% O2.

All results will be calculated according to SJVAPCD Standard Conditions (68 °F and 29.92 inches of Hg).

All test procedures, analyses, and calculations for the methods listed above will follow the published methods.

Emission Limits:
NOx – 2.5 ppmvd @ 3% O2
CO – 50 ppmvd @ 3% O2

Company: California Boiler
Address:

Ref.:

Name: R&D 500hp Burner
Title:
Direct Line:
Email:

Required Burner Sizing Data

1 Boiler Horse Power		500	H.P.
2 Evaporation Rate (Boiler Steam Capacity)		17,250	Lbs/Hr
3 Feed Water Temperature		200°	deg. F
4 Steam Drum / Boiler Pressure		150	PSIG
5 Number of Boilers		1	#
6 Boiler Efficiency		85	%
7 Fuel Flow at Maximum Continuous Rating			Lbs/Hr
8 Maximum Fuel Pressure Available		10	PSIG
9 Fuel Type	Natural Gas		Btu/lb
10 Fuel Type	Natural Gas	1031	Btu/SCF
11 Fuel Temperature		140	deg. F
12 Combustion Air Temperature		90	deg. F
13 Excess Air Required / Design			%
14 Fan Power Curves Available			Yes/No
15 Burner Draft Loss	Existing		"WC
16 Boiler Draft Loss	Existing		"WC
17 Other Draft Losses	Existing		"WC
18 Plant or Site Elevation		500 Ft abSL	FASL

Notes:
What is clearance in front of the boiler?

* It is important that this information is as complete and accurate as possible. It will be used for calculating burner sizing, fan sizing, gas nozzle and atomizer capacities.

Prepared By: _____ Date: _____

EMISSIONS DATA

Note: See District BACT and District Rule 4320 requirements for applicability to proposed unit at http://www.valleyair.org/busind/pto/bact/chapter1.pdf, and http://www.valleyair.org/rules/currntrules/r4320.pdf

Primary Fuel

Fuel Type: ☒ Natural Gas ☐ LPG/Propane ☐ Diesel ☐ Other: —

Higher Heating Value: 1040 Btu/gal or 0 Btu/scf | Sulfur Content: 0 % by weight or 0 gr/scf

Primary Fuel Emissions Data

Operational Mode	Steady State (ppmv)	Steady State (lb/MMBtu)	Start-up (ppmv)	Start-up (lb/hr)	Shutdown (ppmv)	Shutdown (lb/hr)
Nitrogen Oxides	2.5	—	NA	NA	NA	NA
Carbon Monoxide	50	—	NA	NA	NA	NA
Volatile Organic Compounds	10	—	NA	NA	NA	NA
Duration (please provide justification)			NA hr/day	NA hr/yr	NA hr/day	NA hr/yr

$\% O_2$, dry basis, if corrected to other than 3%: 2-3 %

Secondary Fuel

Fuel Type: ☐ Natural Gas ☐ LPG/Propane ☐ Diesel ☐ Other: NA

Higher Heating Value: — Btu/gal or — Btu/scf | Sulfur Content: — % by weight or — gr/scf

How will the secondary fuel be used?
☐ Secondary full-time fuel ☐ Backup for primary fuel ☐ Other: NA

Secondary Fuel Emissions Data

Operational Mode	Steady State (ppmv)	Steady State (lb/MMBtu)	Start-up (ppmv)	Start-up (lb/hr)	Shutdown (ppmv)	Shutdown (lb/hr)
Nitrogen Oxides	NA	NA	NA	NA	NA	NA
Carbon Monoxide	NA	NA	NA	NA	NA	NA
Volatile Organic Compounds	NA	NA	NA	NA	NA	NA
Duration (please provide justification)			NA hr/day	NA hr/yr	NA hr/day	NA hr/yr

$\% O_2$, dry basis, if corrected to other than 3%: NA %

Source of Data

☒ Manufacturer's Specifications ☒ Emission Source Test ☐ Other _____ (please provide copies)

Additional Emissions Control Equipment

☐ Selective Catalytic Reduction - Manufacturer: NA Model: NA
☐ Ammonia (NH_3) ☐ Urea ☐ Other: NA
☐ Non-Selective Catalytic Reduction - Manufacturer: NA Model: NA
Control Efficiencies: NO_x NA %, SO_x NA %, PM_{10} NA %, CO NA %, VOC NA %
☐ Other (please specify): NA

HEALTH RISK ASSESSMENT DATA

Note: See Manufacturer's Specifications for Stack Parameters and Exhaust Data. All information is required.

Operating Hours

Maximum Operating Schedule: — hours per day, and — hours per year - RENTAL -

Receptor Data

Distance to nearest Residence	NA feet	Distance is measured from the proposed stack location to the nearest boundary of the nearest apartment, house, dormitory, etc.
Direction to nearest Residence	NA	Direction from the stack to the receptor, i.e. Northeast or South.
Distance to nearest Business	NA feet	Distance is measured from the proposed stack location to the nearest boundary of the nearest office building, factory, store, etc.
Direction to nearest Business	NA	Direction from the stack to the receptor, i.e. North or Southwest.

Stack Parameters

Release Height	15' feet above grade
Stack Diameter	24" inches at point of release
Rain Cap	☐ Flapper-type ☐ Fixed-type ☒ None ☐ Other:
Direction of Flow	☒ Vertically Upward ☐ Horizontal ☐ Other: ° from vert. or ° from horiz.

Exhaust Data

Flowrate: 5225 acfm | Temperature: 390 °F

Facility Location

☐ Urban (area of dense population) ☐ Rural (area of sparse population) - RENTAL -

Include a facility plot plan showing the location of the stack. Please indicate North on the plot plan. For public notice projects, indicate on plot plan the facility boundaries or fence line and distance(s) from stack to boundaries.

Prepared For:

California Boiler
7341 W. Goshen Ave.
Visalia, CA 93291

Attn: Ms. Ashley Martinez

PROTOTYPE DEMONSTRATION
California Boiler, Visalia Facility
One 3.98 MMBtu/hr Hurst Natural Gas-Fired Boiler
Permit to Operate: N/A
Tested On: August 20, 2021

Prepared By:

Reliable Emission Measurements, Inc.
34055 Natoma Rd.
Auberry, CA 93602
(559) 855-8402

Client Number:
304

Laboratory Report Number:
211-096

Test Team Leader:
Jeremy Ross
Vice President

Reviewed by:
Cam Donnahoo
President

Prepared on:
September 15, 2021

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Reliable Emission Measurements, Inc.
Phone: (559) 855-8402 Fax: (559) 841-3665

Emission Summary

California Boiler/ClearSign

R&D
Visalia, CA
3.98 MMBtu/hr
Permit Number: N/A
August 20, 2021

EMISSION CONSTITUENT	Averages	Limit
Oxides of Nitrogen		
NOx, ppm	**3.0**	
NOx, ppm @ 3% O2	**3.7**	5
NOx, lbs/MMBtu	**0.005**	N/A
Carbon Monoxide		
CO, ppm	**14.2**	
CO, ppm @ 3% O2	**17.9**	50
CO, lbs/MMBtu	**0.013**	N/A
Oxygen, %	**6.8**	
Load, % (Displayed)	**60.0**	
Load, % (Calculated)	**85.3**	
Steam, Psi	**107**	

Introduction

Reliable Emission Measurements, Inc.
Phone: (559) 855-8402 Fax: (559) 841-3665

September 15, 2021

Client Number: 304
Lab Number: 211-096

California Boiler
7341 W. Goshen Ave.
Visalia, CA 93291

Attn: Ms. Ashley Martinez

REGARDING: Prototype demonstration of one 3.98 MMBtu/hr Hurst natural gas-fired boiler at California Boiler

On August 20, 2021, Reliable Emission Measurements, Inc. (REM) personnel performed a prototype demonstration test on one natural gas-fired boiler at **California Boiler**, located in Visalia, California. The demonstration was performed while the unit was operating at three different load conditions (90%, 60%, 30%). Three 30-minute demonstration runs were performed. During the demonstration, the emission control systems were under manual adjustment to demonstrate the burner's emissions capability.

The following is a summary of the procedures used during the testing:

Exhaust Gas Analysis: A continuous sample of the exhaust gas was taken from the exhaust stack of the boiler. The extracted gas sample was conditioned with an ice-cooled sample gas conditioner and transported through a Teflon sample line to a flow panel for distribution to the individual analyzers. The nitrogen oxides were checked using a Teledyne API T200M chemiluminescent NOx analyzer. The carbon monoxide was checked with a TECO Model 48C NDIR w/GFC analyzer and the oxygen was checked with a Servomex 1440 paramagnetic analyzer. The method used was CARB Method-100 with data collected simultaneously for three 30-minute runs. The data were recorded on an 8" strip chart recorder and logged to a data logging system. The results were reported in units of %, ppmvd, ppmvd @ 3% O2, and lb/MMBtu.

All results and calculations have been presented in accordance with SJVAPCD standard conditions of 68 °F and 29.92 in. Hg.

If you have any questions regarding the testing procedures or the calculations, please contact the undersigned at (559) 855-8402.

Respectfully submitted,

Jeremy Ross
Vice President

Reviewed by:

Cam Donnahoo
President

Calculations

CARB METHOD 100 PROTOTYPE DEMONSTRATION CALCULATIONS

Client : California Boiler/ClearSign	**Date :** 8/20/2021
Site : Visalia, CA	**T(std) :** 68
Unit : R&D	**Client #:** 304
Permit #: N/A	**Lab #:** 211-096

FIELD DATA CALCULATIONS

Drift Corrected Emission Data

Run	Run #1	Run #2	Run #3	*Average*
NOx	**1.7** ppmv	**2.9** ppmv	**4.3** ppmv	***3.0***
O2	**7.9** %	**6.8** %	**5.6** %	***6.8***
CO	**2.0** ppmv	**17.1** ppmv	**23.4** ppmv	***14.2***

Load Data

Load, % (Displayed)	**90.0**	**60.0**	**30.0**	***60.0***
Load, % (Calculated)	**127.9**	**82.5**	**45.6**	***85.3***
Steam, Psi	**100**	**110**	**110**	***107***
Fuel F-Factor	**8710**	**8710**	**8710**	***8710***

CALCULATED EMISSIONS

OUTLET AVERAGE

NOx	***3.0***	***ppmv***
NOx	***3.7***	***ppmv @ 3% O2***
NOx	**0.005**	***lb/MMBtu***
O2	***6.8***	***%***
CO	***14.2***	***ppmv***
CO	***17.9***	***ppmv @ 3% O2***
CO	**0.0132**	***lb/MMBtu***

Equations used:

NOx or CO @ 3% O2 = [ppmv] * (17.9 / (20.9 - %O2))

lb/MMBtu = ppmv * 0.000001 * (MW / (379.5*((460+Tstd)/520))) * F-Factor * (20.9 / (20.9 - %O2))

MW= NOx 45.9988; CO 28.0104.

REM - 2005

Field Data and Strip Charts

PROTOTYPE DEMONSTRATION - CARB 100 SITE & UNIT PARAMETERS

Site, Unit and Personnel

Date:	08/20/21	Lab Unit:	REM 1
Client:	California Boiler/ClearSign	REM:	Jeremy
County:	Tulare	Client:	Ken
Site:	Visalia, CA	APCD:	John Copp
Unit:	R&D	T(std), °F:	68
Lab #:	211-096	Client #:	304
On Site:	7:00	Leave Site:	-
Pbar:	29.91	Fuel F-Factor:	8710
Permit #:	N/A	MMBtu/hr:	3.98
NOx Limits		CO Limits	
3% O2:	5	3% O2:	50
Lb/MMBtu:	N/A	Lb/MMBtu:	N/A

Analyzer List

Analyzer	REM #	Make,Model
NOx:	2	Teledyne API T200M
O2:	1	Servomex 1440
CO:	1	TECO 48C
CO2:	-	
Chart Recorder:	1	Chino AH Series/ 6 pens

Calibration Gas Information

	Units	Zero	Span	Range	Gas Cyl.#	Ex Date
NOx:	ppmv	0	5.043	10	CC708696	12/16/22
NOx:	ppmv	0	9.128	10	CC431315	6/18/23
NO2:	ppmv	0	9.753	10	CC507421	9/14/21
O2:	%	0	4.988	10	XC010021B	11/27/27
O2:	%	0	8.992	10	CC122461	11/25/27
CO:	ppmv	0	40.10	100	CC708696	12/16/22
CO:	ppmv	0	89.32	100	CC431315	6/18/23

Recorder Information

		Chanl.	Color
Outlet NOx:	ppmv	5	Brown
O2:	%	4	Green
CO:	ppmv	6	Blue
CO2:	-	-	-

Calculations used in the following pages:

Zero and Calibration Drift = ((Cib - Cfb) / Scale) * 100 Used for zero or upscale.

Drift Correction Calculation, Avg = ppm-(Ciz+Cfz/2)*((Cal Gas/(Cib+Cfb/2)-(Ciz+Cfz/2))

O2 Corrections = (Cgas) *((20.9-O2 Corr)/(20.9-O2))

lb/MMBtu = ppm* 10^-6*(MW/SV)*F-Factor*(20.9/(20.9-O2))

MWs: NOx (as NO2) = 45.9988; CO = 28.0104 SV= 379.5*((460 + Tstd)/520)

NO2 Check Results:

	N2 Zero Gas	Internal Response 9.128	Internal Response 9.753
NO	0.00	9.12	0.06
NOx	0.01	-	9.63
Results:			***98.7%***

Internal Calibrations

	N2	Mid Response	High Response
Analyzer	**0.00**	**5.043**	**9.128**
NOx	0.010	5.03	9.13
Results:	**0.00%**	**0.13%**	**0.02%**
Analyzer	**0.00**	**4.988**	**8.992**
O2	0.00	4.8	8.9
Results:	**0.00%**	**1.88%**	**0.92%**
Analyzer	**0.00**	**40.10**	**89.32**
CO	0.055	39.6	88.5
Results:	**0.00%**	**0.50%**	**0.82%**

PROTOTYPE DEMONSTRATION - CARB 100 - RUN 1

Date: 08/20/21 | Site: Visalia, CA
Client: California Boiler/ClearSign | Unit: R&D
Start Run @: 9:31 | End Run @: 10:01

Component:	NOx	O2	CO	NOx		CO	
Units:	ppmv	%	ppmv	3% O2	lb/MMBtu	3% O2	lb/MMBtu
Pre-Test Calibrations							
Cal Value:	**5.0**	**9.0**	**40.1**				
Ca Zero:	**0.0**	**0.0**	**0.0**				
Ca Span:	**5.0**	**8.9**	**39.6**				
Cib Zero:	0.2	0.0	-0.4				
Cib Span:	4.8	8.9	39.8				
Analyzer Range:	10.0	10.0	100.0				
Raw Emissions							
9:31 AM	**1.7**	**7.7**	**0.3**	**2.3**	**0.003**	**0.4**	**0.000**
9:32 AM	**1.7**	**7.9**	**1.4**	**2.3**	**0.003**	**1.9**	**0.001**
9:33 AM	**1.6**	**7.9**	**3.7**	**2.3**	**0.003**	**5.1**	**0.004**
9:34 AM	**1.6**	**7.9**	**3.6**	**2.2**	**0.003**	**4.9**	**0.004**
9:35 AM	**1.6**	**7.9**	**3.6**	**2.2**	**0.003**	**5.0**	**0.004**
9:36 AM	**1.6**	**7.9**	**3.7**	**2.2**	**0.003**	**5.2**	**0.004**
9:37 AM	**1.6**	**8.0**	**4.2**	**2.2**	**0.003**	**5.8**	**0.004**
9:38 AM	**1.6**	**7.9**	**4.1**	**2.2**	**0.003**	**5.7**	**0.004**
9:39 AM	**1.6**	**7.7**	**2.2**	**2.2**	**0.003**	**3.0**	**0.002**
9:40 AM	**1.6**	**7.7**	**0.9**	**2.2**	**0.003**	**1.2**	**0.001**
9:41 AM	**1.7**	**7.7**	**0.8**	**2.3**	**0.003**	**1.1**	**0.001**
9:42 AM	**1.7**	**7.7**	**0.8**	**2.3**	**0.003**	**1.1**	**0.001**
9:43 AM	**1.7**	**8.2**	**0.7**	**2.4**	**0.003**	**1.0**	**0.001**
9:44 AM	**1.7**	**7.7**	**0.8**	**2.3**	**0.003**	**1.0**	**0.001**
9:45 AM	**1.7**	**7.7**	**0.8**	**2.3**	**0.003**	**1.1**	**0.001**
9:46 AM	**1.7**	**7.8**	**1.3**	**2.3**	**0.003**	**1.8**	**0.001**
9:47 AM	**1.7**	**7.8**	**1.5**	**2.3**	**0.003**	**2.1**	**0.002**
9:48 AM	**1.7**	**7.7**	**1.2**	**2.3**	**0.003**	**1.6**	**0.001**
9:49 AM	**1.7**	**7.8**	**1.3**	**2.3**	**0.003**	**1.8**	**0.001**
9:50 AM	**1.7**	**7.8**	**1.4**	**2.3**	**0.003**	**1.9**	**0.001**
9:51 AM	**1.7**	**7.7**	**1.1**	**2.3**	**0.003**	**1.6**	**0.001**
9:52 AM	**1.7**	**7.7**	**1.1**	**2.3**	**0.003**	**1.6**	**0.001**
9:53 AM	**1.7**	**7.7**	**0.9**	**2.3**	**0.003**	**1.3**	**0.001**
9:54 AM	**1.7**	**7.7**	**0.7**	**2.3**	**0.003**	**0.9**	**0.001**
9:55 AM	**1.7**	**7.7**	**0.8**	**2.3**	**0.003**	**1.1**	**0.001**
9:56 AM	**1.7**	**7.7**	**0.6**	**2.3**	**0.003**	**0.8**	**0.001**
9:57 AM	**1.7**	**7.7**	**0.4**	**2.3**	**0.003**	**0.5**	**0.000**
9:58 AM	**1.7**	**7.7**	**0.4**	**2.4**	**0.003**	**0.6**	**0.000**
9:59 AM	**1.7**	**7.7**	**0.4**	**2.4**	**0.003**	**0.6**	**0.000**
10:00 AM	**1.7**	**7.7**	**0.4**	**2.3**	**0.003**	**0.5**	**0.000**
10:01 AM	**1.7**	**7.7**	**0.6**	**2.4**	**0.003**	**0.7**	**0.001**
Post Run Average							
Raw Avg (Cavg):	**1.7**	**7.8**	**1.5**	**2.3**	**0.003**	**2.0**	**0.001**
Max Avg:	**1.7**	**8.2**	**4.2**	**2.5**	**0.003**	**5.9**	**0.004**
Min Avg:	**1.6**	**7.7**	**0.3**	**2.1**	**0.003**	**0.4**	**0.000**
Post Run Drift							
Zero:	0.1	0.0	-0.6				
Span:	4.7	8.9	39.0				
Cfb zero Drift %	-(1.1)	(0.0)	-(0.1)				
Cfb span Drift %	-(1.0)	(0.0)	-(0.8)				

Drift Corrected Results

	NOx	O2	CO	NOx		CO	
	ppm	%	ppm	3% O2	lb/MMBtu	3% O2	lb/MMBtu
Average:	**1.67**	**7.86**	**1.99**	**2.3**	**0.003**	**2.7**	**0.002**

PROTOTYPE DEMONSTRATION - CARB 100 - RUN 2

Date: 08/20/21
Client: California Boiler/ClearSign
Start Run @: 10:58

Site: Visalia, CA
Unit: R&D
End Run @: 11:28

Component:	NOx	O2	CO	NOx		CO	
Units:	ppmv	%	ppmv	3% O2	lb/MMBtu	3% O2	lb/MMBtu
Pre-Test Calibrations							
Cal Value:	**5.0**	**9.0**	**40.1**				
Ca Zero:	**0.0**	**0.0**	**0.0**				
Ca Span:	**5.0**	**8.9**	**39.6**				
Cib Zero:	0.2	0.0	-0.4				
Cib Span:	4.8	8.9	39.8				
Analyzer Range:	10.0	10.0	100.0				
Raw Emissions							
10:58 AM	2.3	7.0	12.3	2.9	0.004	15.9	0.012
10:59 AM	2.2	7.1	14.1	2.9	0.004	18.2	0.013
11:00 AM	2.2	7.1	61.5	2.9	0.003	80.0	0.059
11:01 AM	2.2	7.1	28.8	2.8	0.003	37.4	0.028
11:02 AM	2.2	7.1	15.9	2.8	0.003	20.7	0.015
11:03 AM	2.7	7.1	65.3	3.6	0.004	84.8	0.063
11:04 AM	2.4	7.1	31.4	3.1	0.004	40.7	0.030
11:05 AM	2.2	7.0	12.7	2.9	0.003	16.4	0.012
11:06 AM	2.2	7.1	13.7	2.9	0.004	17.9	0.013
11:07 AM	2.2	7.1	16.2	2.9	0.003	21.0	0.016
11:08 AM	2.2	7.1	13.0	2.8	0.003	16.8	0.012
11:09 AM	2.2	7.3	12.8	2.9	0.004	16.8	0.012
11:10 AM	2.2	7.9	10.5	3.0	0.004	14.4	0.011
11:11 AM	2.2	7.1	12.0	2.8	0.003	15.5	0.011
11:12 AM	2.2	7.0	10.9	2.8	0.003	14.1	0.010
11:13 AM	2.2	7.0	11.2	2.9	0.003	14.4	0.011
11:14 AM	2.2	7.0	10.4	2.9	0.003	13.4	0.010
11:15 AM	2.2	7.0	8.9	2.9	0.003	11.4	0.008
11:16 AM	2.2	7.0	9.1	2.9	0.004	11.8	0.009
11:17 AM	2.2	7.0	11.1	2.9	0.003	14.3	0.011
11:18 AM	2.2	7.0	10.0	2.9	0.003	12.9	0.010
11:19 AM	2.2	7.0	11.4	2.9	0.004	14.7	0.011
11:20 AM	2.2	7.0	12.0	2.9	0.003	15.5	0.011
11:21 AM	2.2	7.0	13.1	2.8	0.003	17.0	0.013
11:22 AM	2.2	7.0	10.9	2.8	0.003	14.1	0.010
11:23 AM	2.4	7.1	46.5	3.1	0.004	60.4	0.045
11:24 AM	5.0	5.2	30.7	5.7	0.007	35.0	0.026
11:25 AM	7.6	4.7	-1.3	8.4	0.010	-1.4	-0.001
11:26 AM	6.3	5.1	-0.2	7.1	0.009	-0.2	0.000
11:27 AM	5.3	4.7	-1.3	5.8	0.007	-1.4	-0.001
11:28 AM	5.1	4.2	-1.3	5.4	0.007	-1.4	-0.001
Post Run Average							
Raw Avg (Cavg):	**2.8**	**6.7**	**16.5**	**3.6**	**0.004**	**20.9**	**0.015**
Max Avg:	**7.6**	**7.9**	**65.3**	**10.5**	**0.013**	**89.6**	**0.066**
Min Avg:	**2.2**	**4.2**	**-1.3**	**2.3**	**0.003**	**-1.4**	**-0.001**
Post Run Drift							
Zero:	0.2	0.0	-0.6				
Span:	4.8	8.9	39.2				
Cfb zero Drift %	-(0.6)	(0.0)	-(0.2)				
Cfb span Drift %	-(0.2)	(0.0)	-(0.6)				

Drift Corrected Results

	NOx	O2	CO	NOx		CO	
	ppm	%	ppm	3% O2	lb/MMBtu	3% O2	lb/MMBtu
Average:	**2.89**	**6.79**	**17.09**	**3.7**	**0.004**	**21.7**	**0.016**

PROTOTYPE DEMONSTRATION - CARB 100 - RUN 3

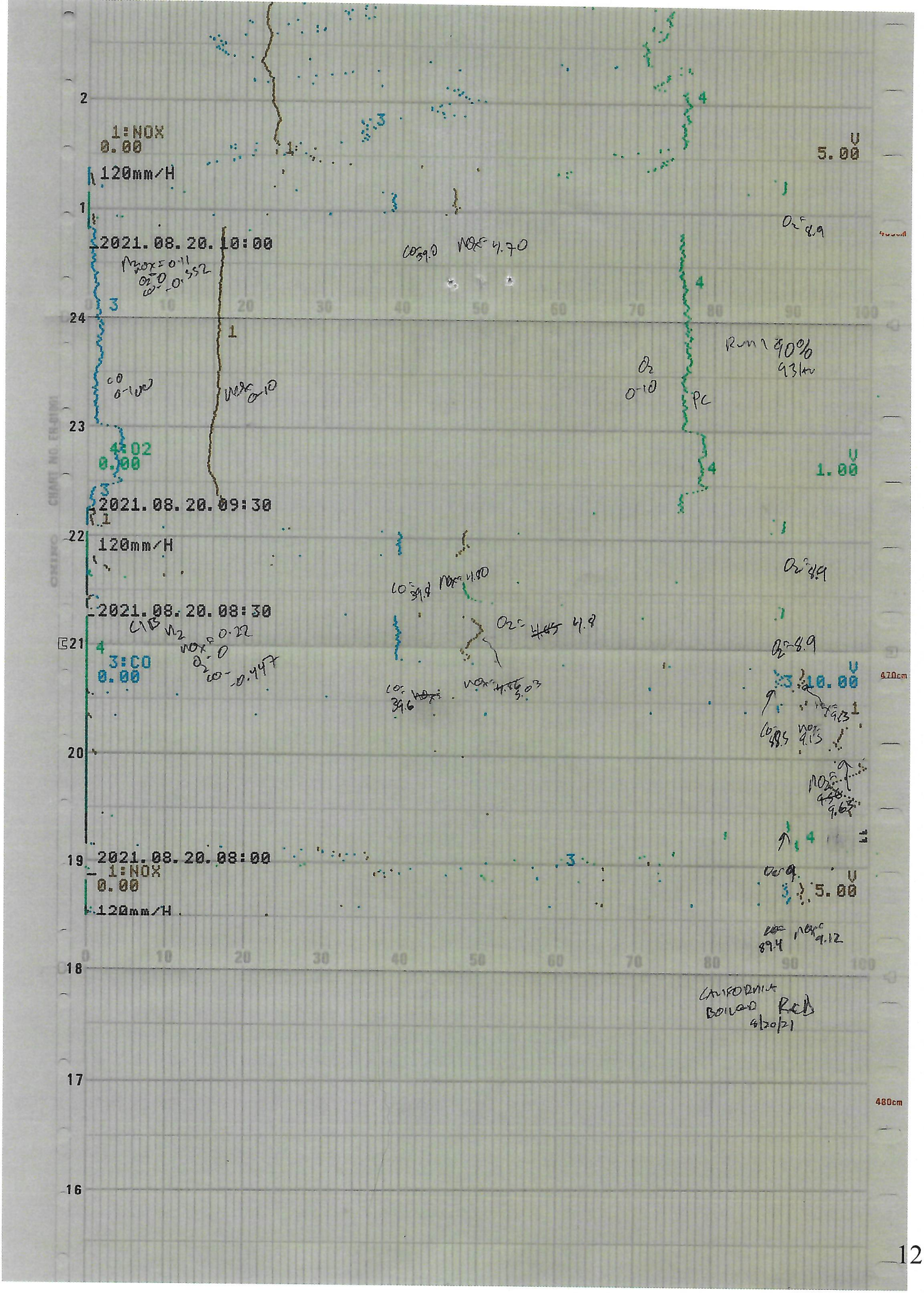
Date: 08/20/21
Client: California Boiler/ClearSign
Start Run @: 13:36

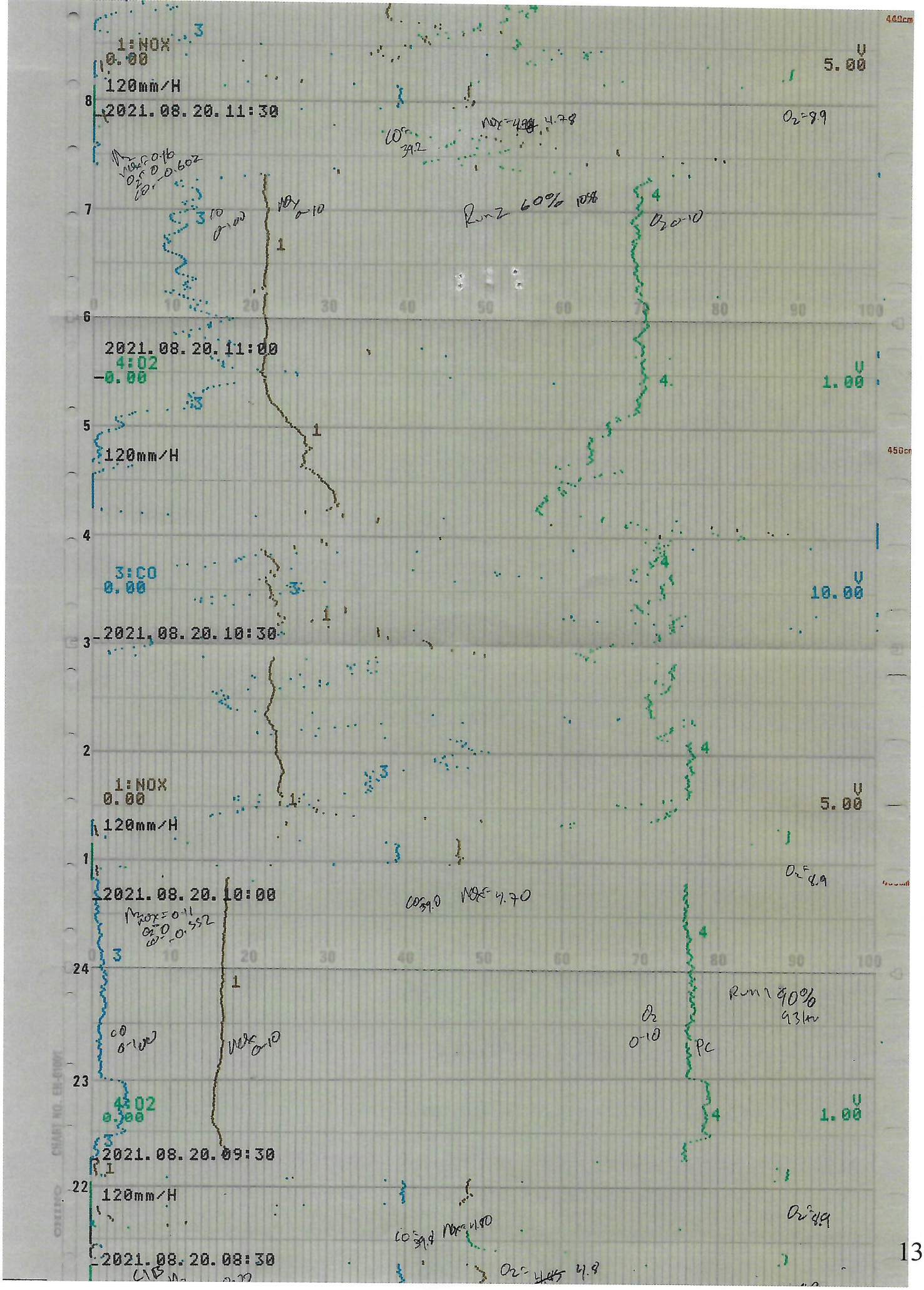
Site: Visalia, CA
Unit: R&D
End Run @: 14:06

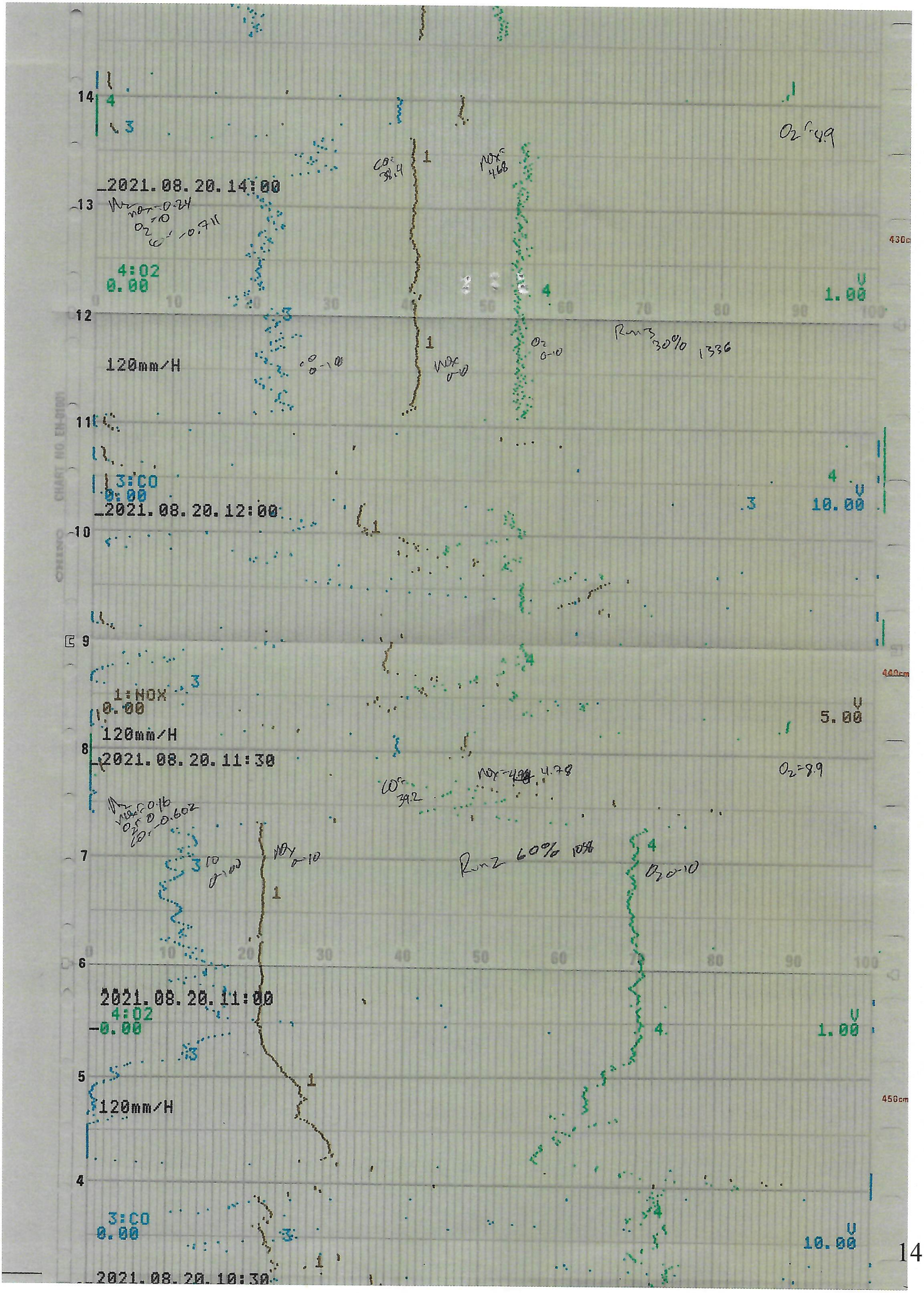
Component:	NOx	O2	CO
Units:	ppmv	%	ppmv
Pre-Test Calibrations			
Cal Value:	**5.0**	**9.0**	**40.1**
Ca Zero:	**0.0**	**0.0**	**0.0**
Ca Span:	**5.0**	**8.9**	**39.6**
Cib Zero:	**0.2**	**0.0**	**-0.4**
Cib Span:	**4.8**	**8.9**	**39.8**
Analyzer Range:	10.0	10.0	100.0
Raw Emissions			

				NOx		CO	
				3% O2	lb/MMBtu	3% O2	lb/MMBtu
1:36 PM	4.1	5.6	24.1	4.7	0.006	28.2	0.021
1:37 PM	4.1	5.5	23.2	4.8	0.006	27.0	0.020
1:38 PM	4.1	5.5	22.2	4.8	0.006	25.8	0.019
1:39 PM	4.1	5.5	21.6	4.8	0.006	25.2	0.019
1:40 PM	4.1	5.5	23.4	4.8	0.006	27.2	0.020
1:41 PM	4.1	5.5	21.6	4.8	0.006	25.2	0.019
1:42 PM	4.1	5.5	21.6	4.8	0.006	25.2	0.019
1:43 PM	4.1	5.5	23.0	4.8	0.006	26.7	0.020
1:44 PM	4.1	5.5	24.1	4.8	0.006	28.0	0.021
1:45 PM	4.1	5.5	22.6	4.8	0.006	26.3	0.019
1:46 PM	4.1	5.5	22.3	4.8	0.006	25.9	0.019
1:47 PM	4.1	5.5	20.2	4.7	0.006	23.5	0.017
1:48 PM	4.1	6.2	18.4	4.8	0.006	22.4	0.017
1:49 PM	4.1	5.5	20.2	4.7	0.006	23.5	0.017
1:50 PM	4.1	5.5	20.4	4.7	0.006	23.7	0.018
1:51 PM	4.1	5.5	20.5	4.8	0.006	23.8	0.018
1:52 PM	4.1	5.5	20.6	4.8	0.006	23.9	0.018
1:53 PM	4.1	5.5	20.3	4.8	0.006	23.6	0.017
1:54 PM	4.1	5.5	21.0	4.7	0.006	24.5	0.018
1:55 PM	4.0	5.5	21.2	4.7	0.006	24.6	0.018
1:56 PM	4.1	5.5	23.2	4.7	0.006	26.9	0.020
1:57 PM	4.1	5.5	22.3	4.7	0.006	26.0	0.019
1:58 PM	4.1	5.5	21.8	4.7	0.006	25.3	0.019
1:59 PM	4.1	5.5	20.8	4.8	0.006	24.3	0.018
2:00 PM	4.1	5.5	21.4	4.8	0.006	24.9	0.018
2:01 PM	4.1	5.5	20.0	4.7	0.006	23.2	0.017
2:02 PM	4.1	5.6	26.3	4.8	0.006	30.8	0.023
2:03 PM	4.1	5.6	28.3	4.7	0.006	33.1	0.024
2:04 PM	4.1	5.6	26.8	4.7	0.006	31.3	0.023
2:05 PM	4.1	5.5	28.6	4.7	0.006	33.4	0.025
2:06 PM	4.1	5.6	28.0	4.7	0.006	32.7	0.024
Post Run Average							
Raw Avg (Cavg):	**4.1**	**5.5**	**22.6**	**4.8**	**0.006**	**26.3**	**0.019**
Max Avg:	**4.1**	**6.2**	**28.6**	**5.1**	**0.006**	**34.9**	**0.026**
Min Avg:	**4.0**	**5.5**	**18.4**	**4.7**	**0.006**	**21.3**	**0.016**
Post Run Drift							
Zero:	0.2	0.0	-0.7				
Span:	4.7	8.9	38.4				
Cfb zero Drift %	(0.2)	(0.0)	-(0.3)				
Cfb span Drift %	-(1.2)	(0.0)	-(1.4)				
Drift Corrected Results							

	NOx	O2	CO	NOx		CO	
	ppm	%	ppm	3% O2	lb/MMBtu	3% O2	lb/MMBtu
Average:	**4.32**	**5.60**	**23.41**	**5.0**	**0.006**	**27.4**	**0.020**


1:NOX
0.00
120mm/H
5.00
2021.08.20.10:00
4:O2
0.00
1.00
2021.08.20.09:30
120mm/H
2021.08.20.08:30
3:CO
0.00
10.00
2021.08.20.08:00
1:NOX
0.00
120mm/H
5.00
CHIFORNIA
BOILER
RCB
4/20/21


1:NOX
0.00
120mm/H
2021.08.20.11:30
5.00
2021.08.20.11:00
4:O2
0.00
1.00
120mm/H
3:CO
0.00
10.00
2021.08.20.10:30
2021.08.20.10:00
1:NOX
0.00
5.00
120mm/H
2021.08.20.09:30
4:O2
0.00
1.00
120mm/H
2021.08.20.08:30


14
13
12
11
10
9
8
7
6
5
4
2021.08.20.14:00
4:02
0.00
1.00
120mm/H
3:CO
0.00
2021.08.20.12:00
10.00
1:NOX
0.00
5.00
120mm/H
2021.08.20.11:30
2021.08.20.11:00
4:02
0.00
1.00
120mm/H
3:CO
0.00
10.00
2021.08.20.10:30

Boiler Operation Data Sheet

Client:	California Boiler/ClearSign	APCD:	John Copp	Permit #:	N/A	NOx Limits	CO Limits
Site(s):	Visalia, CA	Rated MMBtu/hr:	3.98	Serial Number:	S415-200-1	3% O2: 5	3% O2: 50
Unit(s):	R&D	T(std), °F:	68	Model:	Hurst	Lb/MMBtu: N/A	Lb/MMBtu: N/A
REM:	Jeremy	Pbar:	**29.91**	Fuel F-Factor:	8710	Lab #: 211-096	Client #: 304

DEMONSTRATION TEST RUNS

Test Data		Load	Steam				Fuel Data				Load Results		
Time	*Run #*	%	Psi				SCFH 1	SCFH 2	SCFH 3	SCFM	MMBtu/hr		Load %
9:56	1	90.0	100				2598.0	2189.0	108.1	81.6	5.1		127.9
11:21	2	60.0	110				2752.0	306.2	98.2	52.6	3.3		82.5
13:49	3	30.0	110				1617.0	0.0	128.0	29.1	1.8		45.6
Average:		**60.0**	**107**				**2322.3**	**831.7**	**111.4**	**54.4**	**3.4**		**85.3**

MOBILE LAB ENVIRONMENT

Time	*Run #*	*In Temp*	*Volts*
9:56	1	62	112
11:21	2	63	110
13:49	3	67	110

REM - AMS 30 - 2003

Quality Assurance

Airgas
an Air Liquide company

Airgas USA, LLC
525 North Industrial Loop Road
Tooele, UT 84074
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI99E15A1451	Reference Number:	153-401662919-1
Cylinder Number:	CC708696	Cylinder Volume:	144.3 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
PGVP Number:	B72019	Valve Outlet:	660
Gas Code:	CO,NO,NOX,BALN	Certification Date:	Dec 16, 2019

Expiration Date: Dec 16, 2022

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
NOX	5.000 PPM	5.043 PPM	G1	+/- 1.1% NIST Traceable	12/09/2019, 12/16/2019
NITRIC OXIDE	5.000 PPM	4.986 PPM	G1	+/- 1.2% NIST Traceable	12/09/2019, 12/16/2019
CARBON MONOXIDE	40.00 PPM	40.10 PPM	G1	+/- 0.5% NIST Traceable	12/09/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08012121A	KAL004278	5.08 PPM NITRIC OXIDE/NITROGEN	1.0%	Jun 05, 2021
NTRM	08012121A	KAL004278-NOX	5.08 PPM NOx/NITROGEN	1.0%	Jun 05, 2021
NTRM	12011222	KAL004134	49.24 PPM CARBON MONOXIDE/NITROGEN	0.3%	Aug 31, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Thermo 48i-TLE 1163640031 CO	CO NDIR (Mason)	Dec 03, 2019
Thermo 42i-LS 1123749327 NO	Chemiluminescence (Mason)	Dec 16, 2019
Thermo 42i-LS 1123749327 NOx	Chemiluminescence (Mason)	Dec 16, 2019

Triad Data Available Upon Request

Approved for Release

Airgas
an Air Liquide company

Airgas USA, LLC
525 North Industrial Loop Road
Tooele, UT 84074
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI99E15A00K5	Reference Number:	153-401824417-1
Cylinder Number:	CC431315	Cylinder Volume:	144.3 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
PGVP Number:	B72020	Valve Outlet:	660
Gas Code:	CO,NO,NOX,BALN	Certification Date:	Jun 18, 2020

Expiration Date: Jun 18, 2023

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
NOX	9.000 PPM	9.128 PPM	G1	+/- 1.1% NIST Traceable	06/10/2020, 06/18/2020
NITRIC OXIDE	9.000 PPM	9.071 PPM	G1	+/- 1.0% NIST Traceable	06/10/2020, 06/18/2020
CARBON MONOXIDE	90.00 PPM	89.32 PPM	G1	+/- 0.4% NIST Traceable	06/10/2020
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	16060708	CC437400	10.08 PPM NITRIC OXIDE/NITROGEN	1.0%	Oct 16, 2022
NTRM	16060708	CC437400-NOX	10.08 PPM NOx/NITROGEN	1.0%	Oct 16, 2022
NTRM	12011222	KAL004134	49.24 PPM CARBON MONOXIDE/NITROGEN	0.3%	Aug 31, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Thermo 48i-TLE 1163640031 CO	CO NDIR (Mason)	May 20, 2020
Thermo 42i-LS 1123749327 NO	Chemiluminescence (Mason)	Jun 15, 2020
Thermo 42i-LS 1123749327 NOx	Chemiluminescence (Mason)	Jun 15, 2020

Triad Data Available Upon Request

Approved for Release

18

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:	E02NI99E15W0004	Reference Number:	48-401293782-1
Cylinder Number:	CC507421	Cylinder Volume:	144.3 Cubic Feet
Laboratory:	124 - Los Angeles (SAP) - CA	Cylinder Pressure:	2015.3 PSIG
PGVP Number:	B32018	Valve Outlet:	660
Gas Code:	NO2,BALN	Certification Date:	Sep 14, 2018

Expiration Date: Sep 14, 2021

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
NITROGEN DIOXIDE	9.500 PPM	9.753 PPM	G1	+/- 1.7% NIST Traceable	09/07/2018, 09/14/2018
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	0228201702	CC503933	15.05 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Feb 28, 2020
PRM	12365	5604119	30.03 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Jun 02, 2017

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801551 NO2	FTIR	Sep 11, 2018

Triad Data Available Upon Request

PERMANENT NOTES: Oxygen added to maintain stability

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:	E03NI77E15A0031	Reference Number:	48-401660375-1
Cylinder Number:	XC010021B	Cylinder Volume:	155.9 CF
Laboratory:	124 - Los Angeles (SAP) - CA	Cylinder Pressure:	2015 PSIG
PGVP Number:	B32019	Valve Outlet:	580
Gas Code:	O2,BALN	Certification Date:	Nov 27, 2019

Expiration Date: Nov 27, 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 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
OXYGEN	5.000 %	4.988 %	G1	+/- 0.5% NIST Traceable	11/27/2019
CARBON DIOXIDE	18.00 %	17.86 %	G1	+/- 0.6% NIST Traceable	11/27/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	11060718	CC338458	4.861 % OXYGEN/NITROGEN	+/- 0.4%	Dec 13, 2022
NTRM	12061520	CC354777	19.87 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 11, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS 6E CO2	NDIR	Nov 27, 2019
SIEMENS OXYMAT 6	PARAMAGNETIC	Nov 05, 2019

Triad Data Available Upon Request

a.Vargas
Approved for Release

Airgas USA, LLC
525 North Industrial Loop Road
Tooele, UT 84074
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI82E15A0220	Reference Number:	153-401662902-1
Cylinder Number:	CC 122461	Cylinder Volume:	150.2 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
PGVP Number:	B72019	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Nov 25, 2019

Expiration Date: Nov 25, 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 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	9.000 %	8.954 %	G1	+/- 1.0% NIST Traceable	11/25/2019
OXYGEN	9.000 %	8.992 %	G1	+/- 1.0% NIST Traceable	11/25/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060410	CC413504	7.489 % CARBON DIOXIDE/NITROGEN	0.6%	May 14, 2025
NTRM	09060214	CC262390	9.961 % OXYGEN/NITROGEN	0.3%	Nov 05, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA-510 SV4MEUTJ CO2	CO2 NDIR (Dixon)	Nov 12, 2019
Horiba MPA-510 W603MM58 O2	O2 Paramagnetic (Mason)	Nov 06, 2019

Triad Data Available Upon Request

Approved for Release

Appendix A

SOURCE EMISSION TEST PROTOCOL
FOR
California Boiler
One 3.98 MMBtu/hr Natural Gas-Fired Boiler
"R&D 119 Hp Prototype Boiler"

Presented to:

San Joaquin Valley APCD
1990 East Gettysburg Ave.
Fresno, CA 93726

Attn: Mr. John Copp

Prepared for:

CALIFORNIA BOILER
7341 West Goshen Avenue
Visalia, CA 93291
(559) 625-5151

Attn: Mrs. Mary Cervantes

Prepared by:

Reliable Emission Measurements, Inc.
34055 Natoma
Auberry, CA 93602
(559) 855-8402

Jeremy Ross
Vice President

July 16, 2021

Reliable Emission Measurements, Inc.
Phone: (559) 855-8402 Fax: (559) 841-3665

July 16, 2021

San Joaquin Valley APCD
1990 East Gettysburg Ave.
Fresno, CA 93726

Attn: Mr. John Copp

RE: Test Protocol for one 3.98 MMBtu/hr R&D Prototype natural gas-fired boiler at California Boiler in Visalia, CA – (No ATC at this time)

Dear Mr. Copp,

Enclosed is REM's source test protocol for testing one R&D Prototype boiler. The boiler's exhaust shall be monitored for Oxides of Nitrogen (NOx), Carbon Monoxide (CO), and Oxygen (O2) using CARB Method-100. The boiler will be tested for compliance on natural gas. The unit does not have a load demand, therefore steam will be vented during the testing. Due to the steam venting, the boiler shall be operated at 30%, 60%, and 90% load conditions (or closest achievable). Each load will be monitored for one 30-minute test run. The boiler is located at **7341 W. Goshen Ave, Visalia, CA**

We plan to test this unit on **July 23, 2021**, testing is scheduled to begin at **08:00 hours.**

If you have any questions, please contact Reliable Emission Measurements, Inc. at (559) 855-8402.

Respectfully submitted,

Jeremy Ross
Vice President

METHODOLOGY

This test plan defines the testing methodology proposed for the source emission testing of one 3.98 MMBtu/hr R&D Prototype natural gas-fired boiler. The boiler will be operated at 30%, 60%, and 90% simulated lad conditions (or closest achievable) for the compliance testing. The boiler's load rates and operating parameters will be monitored during all test runs.

The testing shall include the following:

Parameter	**Location Tested**	**Samples/Runs**	**Method**
Oxides of Nitrogen	Exhaust stack	3-30 min runs 1 per load condition	CARB Method 100 Chemiluminescent Analyzer
Carbon Monoxide	Exhaust stack	3-30 min runs 1 per load condition	CARB Method 100 NDIR/GFC Analyzer
Oxygen	Exhaust stack	3-30 min runs 1 per load condition	CARB Method 100 Paramagnetic Analyzer
Flow Rate	Fuel Meter	3; 1 per run condition	EPA Method 19 Fuel Expansion Factor

The results will be reported in units of ppmvd, %, ppmvd corrected at 3% O2, and lb/MMBtu.

All results will be calculated according to SJVAPCD Standard Conditions (68 °F and 29.92 inches of Hg).

All test procedures, analyses, and calculations for the methods listed above will follow the published methods.

Emission Limits:
NOx – 5 ppmvd @ 3% O2; 0.0062 lb-NOx/MMBtu
CO – 50 ppmvd @3% O2: 0.037 lb-CO/MMBtu