Oil Re-Refining Company (ORRCO)

dba. Industrial Oils, Inc.

Hazardous Air Emissions (HAPs)

Air Emission Source Test Report

Emission Source: Auxiliary Boiler

Determination of: Trace Metals,
PCDD/PCDFs, PAHs and PCBs

Project No. 2020.2232

Prepared for:

Oil Re-Refining Company (ORRCO)
Dba. Industrial Oils, Inc
1291 Laverne Ave.
Klamath Falls, Or. 97601

Test Date:

August 25 & 26, 2020

Performed by:

Environmental Technical Services, Inc.
2105 Corey Road
Central Point, Oregon 97502

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1.0 SOURCE EMISSION TEST CERTIFICATION SHEET

Emission Source:

Oil Re-Refining Company (ORRCO)
Dba. Industrial Oils, Inc
4150 N. Suttle Road
Portland, OR 97217

Facility Location:
Industrial Oils, Inc.
1291 Laverne Ave.
Klamath Falls, Or. 97601

Contact: Oil Re-Refining Company (ORRCO)
Dba, Industrial Oils, Inc.
Scott Briggs, CEO
4150 N Suttle Road
Portland, Oregon 97217
(503) 546-3542

Simple Air Contaminant Discharge Permit No. 18-0020-SI-01

Emission Units Tested:

Auxiliary Boiler
Burner: Manufacture: Industrial Combustion
Model: M Series #MM-28S Size 2
Fuel: 100% Waste Oil Distillates
Rating: 155,210 Btu/hr.
Boiler: Manufacture: Gabriel
Model: Scotch Marine Fire Tube, 61hp.

Date(s) Tested: August 25 & 26, 2020

Testing Firm: Environmental Technical Services, Inc.
2105 Corey Road
Central Point, Oregon 97502-9405
Phone: (541) 779-2646
Facsimile: (541) 734-5537
E-Mail: etsllc@msn.com

The data and results presented in this report are, to the best of my knowledge, accurate and complete:

By: _____
Andy Winkler, *Sr. Project Manager*

By: _____
Jacob Buss, *Report Development / QAQC*

2.0 INTRODUCTION

2.1 Emission Test Objective:

The objective of the emission testing effort is to determine the Auxiliary Boiler source-specific Hazardous Air Pollutants (HAPs) which have been identified by ODEQ with respect to the Cleaner Air Oregon (CAO) regulations. The results of the source test will be used in analysis for comparison to CAO, Table 4 – Risk Based Concentrations.

Test Location:

The emission tests were conducted at the ORRCO facility located near Klamath Falls, Oregon. Samples were collected from the Auxiliary Boiler exhaust stack which met EPA Method 1 sample port location requirements.

Test Date and Run Times:

The Trace Metal and Organic HAP emissions were sampled concurrent with each other.

Auxiliary Boiler Testing Time Log:

Test Run	Date	Start	Finish	Total Sample Time, min.
Run #1	Aug. 25, 2020	10:32	13:43	180
Run #2	Aug. 25, 2020	16:00	19:32	200
Run #3	Aug. 26, 2020	10:13	13:45	200

There were no test interruptions or delays during the emission testing.

Test Run #1 was sampled for 180 minutes, the sample volume collected was below the minimum target value. Test Runs #2 and 3 were extended to 200 minutes in duration which increased the total volume collected.

2.0 INTRODUCTION (Continued)

2.2 Parameters Tested:

The pollutants and parameters measured from the Auxiliary Boiler exhaust stack are listed as follows:

1) Oxygen, (O_2)
2) Carbon Monoxide, (CO)
3) Volume Flow Rates, (acfm, scfm, dscfm)

4) Trace Metals Determined:

Aluminum (Al)	Lead (Pb)
Antimony (Sb)	Manganese (Mn)
Arsenic (As)	Mercury (Hg)
Beryllium (Be)	Nickel (Ni)
Cadmium (Cd)	Phosphorus (P)
Total Chromium (Cr)	Selenium (Se)
Cobalt (Co)	Vanadium (Va)
Copper (Cu)	Zinc (Zn)

5) Polychlorinated dibenzo p-dioxin (PCDD) and Polychlorinated dibenzofurans

Polychlorinated dibenzo-p-dioxin (PCDD)

2,3,7,8-Tetrachlorodibenzop-dioxin (TCDD)
1,2,3,7,8-Pentachlorodibenzo p-dioxin (PeCDD)
1,2,3,4,7,8-Hexaclilorodibenzop-dioxin (HxCDD)
1,2,3,6,7,8-Hexaclilorodibenzop-dioxin (HxCDD)
1,2,3,7,8,9-Hexachlorodibenzop-dioxins (HxCDD)
1,2,3,4,6,7,8-Heptachlorodibenzop-dioxin (HpCDD)
Octachlorodibenzo-p-dioxin (OCDD)

Polychlorinated dibenzofuran (PCDF)

2,3,7,8-Tetrachlorodibenzofuran (TCDF)
1,2,3,7,8-Pentachlorodibenzofuran-an (PeCDF)
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
1,2,3,6,7,8- Hexachlorodibenzofuran (HxCDF)
1,2,3,7,8,9- Hexachlorodibenzofuran (HxCDF)
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
1,2,3,4,7,8,9- Heptachlorodibenzofuran (HpCDF)
Octachlorodibenzofuran (OCDF)

2.2 Parameters Tested (continued)

Polychlorinated biphenyls (PCBs) - all congeners with associated RBCs as provided in OAR 340-245-8040 Table 2.

Polychlorinated biphenyls (PCBs)

PCB-5/8 [2,4'-dichlorobiphenyl]	PCB-128 [2,2',3,3',4,4'-hexachlorobiphenyl]
PCB 18 [2,2',5-trichlorobiphenyl]	PCB-138 [2,2',3,4,4',5'-hexachlorobiphenyl]
PCB-28 [2,4,4'-trichlorobiphenyl]	PCB-153 [2,2',4,4',5,5'-hexachlorobiphenyl]
PCB-44 [2,2',3,5'-tetrachlorobiphenyl]	PCB 156 [2,3,3',4,4',5-hexachlorobiphenyl]
PCB-52 [2,2',5,5'-tetrachlorobiphenyl]	PCB 157 [2,3,3',4,4',5'-hexachlorobiphenyl]
PCB-66 [2,3',4,4'-tetrachlorobiphenyl]	PCB 167 [2,3',4,4',5,5'-hexachlorobiphenyl]
PCB 77 [3,3',4,4'-tetrachlorobiphenyl]	PCB 169 [3,3',4,4',5,5'-hexachlorobiphenyl]
PCB 81 [3,4,4',5-tetrachlorobiphenyl]	PCB-170 [2,2',3,3',4,4',5-heptachlorobiphenyl]
37680-73-2 PCB-101 [2,2',4,5,5'-pentachlorobiphenyl]	PCB-180 [2,2',3,4,4',5,5'-heptachlorobiphenyl]
PCB 105 [2,3,3',4,4'-pentachlorobiphenyl]	PCB-187 [2,2',3,4',5,5',6-heptachlorobiphenyl]
PCB 114 [2,3,4,4',5-pentachlorobiphenyl]	PCB 189 [2,3,3',4,4',5,5'-heptachlorobiphenyl]
PCB 118 [2,3',4,4',5-pentachlorobiphenyl]	PCB-195 [2,2',3,3',4,4',5,6-octachlorobiphenyl]
PCB 123 [2,3',4,4',5'-pentachlorobiphenyl]	PCB-206 [2,2',3,3',4,4',5,5',6-nonachlorobiphenyl]
PCB 126 [3,3',4,4',5-pentachlorobiphenyl]	PCB-209 [2,2'3,3',4,4',5,5',6,6 '-decachlorobiphenyl]

Total PCBs were also summarized and emission rates calculated.

Polycyclic aromatic hydrocarbons (PAHs) and polycyclic aromatic hydrocarbon derivatives (PAH-derivatives)

Polynuclear Aromatic Hydrocarbons (PAH)

Acenaphthene	Dibenz[a,h]anthracene
Acenaphthylene	Fluoranthene
Anthracene	Fluorene
Benzo(a)anthracene	Indeno[1,2,3-cd]pyrene
Benzo(a)pyrene	2-Methyl naphthalene
Benzo(b)fluoranthene	Perylene
Benzo(e)pyrene	Phenanthrene
Benzo(g,h,i)perylene	Pyrene
Benzo(k)fluoranthene	Naphthalene
Chrysene	

The HAPs listed above do not include all contaminates specified in the OAR 340-245-8020 Table 2 Toxic Air Contaminant Reporting List. Those contaminants not listed were not provided by the analytical laboratory due to standards that were not available or not in the laboratory inventory. ETS checked with several other labs which also stated the same situation and could only provide analysis for the same contaminants listed in this report.

Table 2.1 Summary of Test Methods and Replicates

Parameter	Test Method	Sample Replicates & Time	Reporting Units
Volume Flow Rates	EPA Methods 1, 2, 3A & 4	Triplicate Runs in conjunction with EPA 23 & 29	acfm, scfm, dscfm
HAPs: PCDF & PCDD, PAHs and PCBs	EPA Method 23	Three Runs, 180 minutes each	ng/m3, ng/sec, lbs/1000 gal combusted
Trace Metals *including* Mercury	EPA Method 29	Three Runs, 180 minutes each	ug/dscm, lbs/hr, lbs/1000 gal combusted

Reference Method Procedures are presented in Section 5 of this report.

2.3 Project Participants and Contact Information

2.3.1 Industry Observer(s):	Oil Re-Refining Company (ORRCO) Dba, Industrial Oils, Inc. Scott Briggs, CEO 4150 N Suttle Road Portland, Oregon 97217 (503) 546-3542
2.3.2 Agency Observer:	Thomas Rhodes CAO Source Test Coordinator Oregon Dept. of Environmental Quality (ODEQ) 700 NE Multnomah St. Suite 600 Portland, Oregon Phone: (503) 229-5534
2.3.3 Primary Consultant:	Cascade Environmental Management Marie Piper, Principal Engineer 316 SE Pioneer Way, #294 Oak Harbor, WA 98277 (360) 672-0088
2.3.4 Source Test Contractor:	Environmental Technical Services Andy Winkler, Sr. Project Manager 2105 Corey Road Central Point, OR 97502 (541) 779-2646
2.3.5 Trace Metals Laboratory:	Chester LabNet Paul Duda, Laboratory Manager 12242 SW Garden Place Tigard, OR 97223 (503) 624-2183
2.3.6 SVOC Laboratory:	Vista Analytical Laboratory Jennifer Christman 1104 Windfield Way El Dorado Hills, CA 95762 (916) 673-1520

3.0 Summary of Test Results

3.1 Presentation

Tables 3.1 through 3.4 present the summary of average test results for each HAP determined. **Tables 3.5 through 3.7** present the individual Metal HAPs run data. **Table 3.8 through 3.10** present the individual PCDD/PCDF test run data, **Tables 3.11 through 3.13** present the PAH HAP run data. **Tables 3.14 through 3.16** present the individual PCB HAP run data.

3.2 Reporting of Non-detect (ND) values

PCDD/PCDF, PAH and PCB analytes which were reported as ND, below analytical detection limits, are flagged as a less than value "<". Results are calculated following ODEQ guidance which considers the analyte present at the associated estimated detection limit (EDL) or estimated maximum possible concentration (EMPC) values were used for concentration and emission rate calculations.

The average results are reported as less than (<) if the numerical average of a test series includes at least one test replicate below the EDL or EMPC.

Metal analytical results were adjusted to account for any reagent blanks above detectable limits. In cases where the blank correction resulted in a negative value the blank correction is not used. The blank adjusted results were used in the concentration and emission rate calculations.

Nondetect metal compounds are treated in the same manner as described above, the EDL values are used to calculate the in-stack detection limits and flagged as a "<" value. The ISDL is used to calculate concentrations and emission factors.

Table 3.1
Summary of Trace Metal Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 25 & 26, 2020

Trace Metals Three Run Average	ug/dscm	lbs/hr	lbs/1000 gal
Aluminum (Al)	12.19	3.112E-05	2.070E-03
Antimony (Sb)	<0.556	<1.41E-06	<9.40E-05
Arsenic (As)	<0.717	<1.82E-06	<1.21E-04
Beryllium (Be)	<0.021	<5.23E-08	<3.48E-06
Cadmium (Cd)	<0.240	<6.07E-07	<4.04E-05
Chromium (Cr)	2.200	5.795E-06	3.826E-04
Cobalt (Co)	0.051	1.299E-07	8.653E-06
Copper (Cu)	3.403	8.636E-06	5.754E-04
Lead (Pb)	<15.05	<3.82E-05	<2.55E-03
Manganese (Mn)	1.767	4.508E-06	2.999E-04
Mercury (Hg)	<0.133	<3.37E-07	<2.25E-05
Nickel (Ni)	0.325	8.256E-07	5.503E-05
Phosphorus (P)	160.99	4.088E-04	2.723E-02
Selenium (Se)	<1.582	<4.01E-06	<2.67E-04
Vanadium (Va)	<0.102	<2.60E-07	<1.73E-05
Zinc (Zn)	17.00	4.316E-05	2.875E-03
Total Trace Metals:	<216.32	$<5.50^{E-04}$	$<3.66^{E-02}$

Data presented in this table represents the averages of the three test runs performed.

Note: Analytes which were below analytical detection limits are flagged as a less tan value "<". Selected Metal results were calculated according to ODEQ guidance, which requires that individual metals (or sample fractions) that are below method detection limits be considered present at detection limit for reporting purposes.

Table 3.2
Summary of PCDD/PCDF Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 25 & 26, 2020

PCDD	PCDD ng/m³	PCDD ng/sec	PCDD lbs/1000 gal.	PCDD TEQ ng/m³	PCDD TEQ ng/sec	PCDD TEQ lbs/1000 gal.
2,3,7,8-TCDD	<8.38E-04	<2.67E-04	<1.41E-10	<8.38E-04	<2.67E-04	<1.41E-10
1,2,3,7,8-PeCDD	0.007	0.002	1.16E-09	6.91E-03	2.19E-03	1.16E-09
1,2,3,4,7,8-HxCDD	<7.94E-03	<2.52E-03	<1.33E-09	<7.94E-04	<2.52E-04	<1.33E-10
1,2,3,6,7,8-HxCDD	0.025	0.008	4.19E-09	2.50E-03	7.92E-04	4.19E-10
1,2,3,7,8,9-HxCDD	0.013	0.004	2.18E-09	1.30E-03	4.13E-04	2.18E-10
1,2,3,4,6,7,8-HpCDD	0.158	0.050	2.64E-08	1.58E-03	5.00E-04	2.64E-10
OCDD	0.177	0.056	2.97E-08	5.32E-05	1.68E-05	8.91E-12
		Total PCDD			*Total PCDD TEQ*	
	<3.88E-01	<1.23E-01	<6.51E-08	<1.40E-02	<4.43E-03	<2.34E-09

PCDF	PCFD ng/m³	PCFD ng/sec	PCDF lbs/1000 gal.	PCDF TEQ ng/m³	PCDF TEQ ng/sec	PCDF TEQ lbs/1000 gal.
2,3,7,8-TCDF	9.83E-03	3.12E-03	1.65E-09	9.83E-04	3.12E-04	1.65E-10
1,2,3,7,8-PeCDF	<8.11E-03	<2.57E-03	<1.36E-09	<2.43E-04	<7.71E-05	<4.01E-11
2,3,4,7,8-PeCDF	1.56E-02	4.95E-03	2.62E-09	4.68E-03	1.48E-03	7.85E-10
1,2,3,4,7,8-HxCDF	1.04E-02	3.29E-03	1.74E-09	1.04E-03	3.29E-04	1.74E-10
1,2,3,6,7,8- HxCDF	1.04E-02	3.30E-03	1.75E-09	1.04E-03	3.30E-04	1.75E-10
1,2,3,7,8,9- HxCDF	1.12E-02	3.55E-03	1.88E-09	1.12E-03	3.55E-04	1.88E-10
2,3,4,6,7,8-HxCDF	<1.73E-03	<5.50E-04	<2.90E-10	<1.73E-04	<5.50E-05	<2.90E-11
1,2,3,4,6,7,8-HpCDF	2.43E-02	7.70E-03	4.07E-09	2.43E-04	7.70E-05	4.07E-11
1,2,3,4,7,8,9- HpCDF	<3.50E-03	<1.11E-03	<5.86E-10	<3.50E`-05	<1.11E-05	<5.86E-12
OCDF	8.20E-03	2.60E-03	1.37E-09	2.46E-06	7.80E-07	4.12E-13
		Total PCDF			Total PCDD TEQ	
	<1.03E-01	<3.27E-02	<1.73E-08	<9.56E-03	<3.03E-03	<1.60E-09

Total PCDD/PCDF			Total TEQ PCDD/PCDF		
ng/m³	ng/sec	lbs/1000 gal.	ng/m³	ng/sec	lbs/1000 gal.
<4.92E-01	<1.56E-01	<8.24E-08	<2.35E-02	<7.47E-03	<3.95E-09

Data presented in this table represents the averages of the three test runs performed.

Table 3.3
Summary of PAH Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 25 & 26, 2020

Polynuclear Aromatic Hydrocarbons, PAH	PAH ng/m³	PAH ng/sec	PAH lbs/1000 gal.	PAH TEQ ng/m³	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
Acenaphthene	1.387	0.439	2.33E-07	1.387	0.439	2.33E-07
Acenaphthylene	1.046	0.332	1.76E-07	1.046	0.332	1.76E-07
Anthracene	<1.451	<0.460	<1.56E-07	<1.451	<0.460	<2.43E-07
Benzo(a)anthracene	0.558	0.177	6.00E-08	0.112	0.035	1.87E-08
Benzo(a)pyrene	1.427	0.457	2.40E-07	1.427	0.457	2.40E-07
Benzo(b)fluoranthene	3.916	1.234	6.55E-07	3.133	0.987	5.24E-07
Benzo(e)pyrene	7.521	2.399	1.26E-06	7.521	2.399	1.26E-06
Benzo(g,h,i)perylene	34.154	10.958	5.75E-06	0.307	0.099	5.17E-08
Benzo(k)fluoranthene	1.502	0.473	2.51E-07	0.045	0.014	7.53E-09
Chrysene	2.627	0.830	4.40E-07	0.263	0.083	4.40E-08
Dibenz[a,h]anthracene	<0.508	<0.161	<5.46E-08	<5.079	<1.612	<8.52E-07
Fluoranthene	16.631	5.270	2.16E-06	1.330	0.422	2.23E-07
Fluorene	2.273	0.721	3.81E-07	2.273	0.721	3.81E-07
Indeno[1,2,3-cd]pyrene	4.977	1.593	8.37E-07	0.348	0.111	5.86E-08
2-Methyl naphthalene	20.620	6.546	2.11E-06	20.620	6.546	3.46E-06
Perylene	<0.391	<0.124	<4.20E-08	<0.391	<0.124	<6.55E-08
Phenanthrene	23.939	7.597	2.71E-06	23.939	7.597	4.02E-06
Pyrene	13.042	4.142	1.47E-06	13.465	4.274	2.19E-06
		Total PAH			*Total PAH TEQ*	
	<137.969	<43.913	<1.90E-05	<80.253	<25.481	<1.40E-05

Polynuclear Aromatic Hydrocarbons, PAH	PAH ng/m³	PAH ng/sec	PAH lbs/1000 gal.	PAH TEQ ng/m³	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
Naphthalene	47.387	15.041	4.72E-06	47.387	15.041	7.95E-06

Data presented in this table represents the averages of the three test runs performed.

Table 3.4
Summary of PCB Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 25 & 26, 2020

iiii	PCBs	PCB ng/m³	PCB ng/sec	PCB lbs/1000 gal.	PCB TEQ ng/m³	PCB TEQ ng/sec	PCB TEQ lbs/1000 gal.
1	PCB-5/8	<0.283	<0.090	<4.76E-08			
2	PCB 18	<0.097	<0.031	<1.63E-08			
3	PCB-28	0.216	0.069	3.63E-08			
4	PCB-44	<0.104	<0.033	<1.75E-08			
5	PCB-52	0.109	0.035	1.82E-08			
6	PCB-66	0.136	0.043	2.28E-08			
7	PCB 77	<0.051	<0.016	<8.51E-09	<1.44E-06	<4.58E-07	<8.51E-13
8	PCB 81	<0.018	<0.006	<3.23E-09	<1.62E-06	<5.34E-07	<9.70E-13
9	37680-73-2 PCB-101	<0.062	<0.020	<1.03E-08			
10	PCB 105	<0.026	<0.008	<4.42E-09	<2.24E-07	<7.09E-08	<1.33E-13
11	PCB 114	<0.006	<0.002	<9.63E-10	<4.93E-08	<1.56E-08	<2.89E-14
12	PCB 106/118	<0.036	<0.011	<5.99E-09	<3.02E-07	<9.59E-08	<1.80E-13
13	PCB 123	<0.008	<0.002	<1.28E-09	<6.60E-08	<2.09E-08	<3.85E-14
14	PCB 126	<0.023	<0.007	<3.91E-09	<6.75E-04	<2.14E-04	<3.91E-10
15	PCB-128/162	<0.011	<0.003	<1.81E-09			
16	PCB-138/163/164	<0.025	<0.008	<4.12E-09			
17	PCB-153	0.023	0.007	3.79E-09			
18	PCB 156	<0.009	<0.003	<1.49E-09	<7.59E-08	<2.40E-08	<4.48E-14
19	PCB 157	<0.006	<0.002	<1.08E-09	<5.53E-08	<1.75E-08	<3.24E-14
20	PCB 167	<0.005	<0.001	<7.77E-10	<3.88E-08	<1.23E-08	<2.33E-14
21	PCB 169	<0.005	<0.002	<9.13E-10	<4.66E-05	<1.48E-05	<2.74E-11
22	PCB-170	<0.006	<0.002	<1.07E-09			
23	PCB-180	<0.007	<0.002	<1.24E-09			
24	PCB-182/187	<0.006	<0.002	<1.06E-09			
25	PCB 189	<0.006	<0.002	<9.84E-10	<5.00E-08	<1.58E-08	<1.15E-06
26	PCB-195	<0.003	<0.001	<4.55E-10			
27	PCB-206	<0.011	<0.004	<1.85E-09			
28	PCB-209	<0.010	<0.003	<1.63E-09			
	Total of Specified *PCB:	**<1.308**	**<0.416**	**<2.20E-07**	**<7.25E-04**	**<2.30E-04**	**<1.15E-06**

Total PCB - Summation of all PCBs detected.	PCB, ng/m³	PCB ng/sec	PCB lbs/1000 gal.
	9.46	3.004	1.59E-06

Data presented in this table represents the averages of the three test runs performed.

Table 3.5

Summary of Trace Metal Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 25, 2020

EPA Method 29 Test Run #1

Analyte	ug/sample	ug/dscm	lbs/hr	lbs/1000 gal.
Aluminum (Al)	38.0	11.727	2.95E-05	1.97E-03
Antimony (Sb)	<2.241	<0.692	<1.74E-06	<1.16E-04
Arsenic (As)	<2.541	<0.784	<1.97E-06	<1.32E-04
Beryllium (Be)	<0.073	<0.023	<5.67E-08	<3.79E-06
Cadmium (Cd)	<0.845	<0.261	<6.56E-07	<4.39E-05
Chromium (Cr)	2.279	0.703	1.77E-06	1.18E-04
Cobalt (Co)	<0.181	<0.056	<1.40E-07	<9.40E-06
Copper (Cu)	13.180	4.067	1.02E-05	6.84E-04
Lead (Pb)	<49.57	<15.296	<3.85E-05	<2.57E-03
Manganese (Mn)	5.509	1.700	4.28E-06	2.86E-04
Mercury (Hg)	<0.450	<0.139	<3.49E-07	<2.33E-05
Nickel (Ni)	1.62	0.498	1.25E-06	8.38E-05
Phosphorus (P)	539.60	166.519	4.19E-04	2.80E-02
Selenium (Se)	<5.45	<1.682	<4.23E-06	<2.83E-04
Vanadium(V)	<0.363	<0.112	<2.82E-07	<1.88E-05
Zinc (Zn)	60.70	18.733	4.71E-05	3.15E-03
Run #1 Average TSM:		<222.990	<5.61E-04	<3.75E-02

Run #1 Sampling and Emission Parameters

Sample Time		Sample Volume Collected		Exhaust Flow Rate		Fuel Combusted
Start	Finish	Vm(std)	m^3(std)	dscfm	m^3/min(std)	1000 gal./hr.
10:32	13:43	114.421	3.240	671	19.011	0.0150

Table 3.6

Summary of Trace Metal Emissions
ORRCO Auxillary Boiler
Klamath Falls, Oregon
August 25, 2020

EPA Method 29 Test Run #2

Analyte	ug/sample	ug/dscm	lbs/hr	lbs/1000 gal.
Aluminum (Al)	52.8	13.772	3.68E-05	2.42E-03
Antimony (Sb)	<1.790	<0.467	<1.25E-06	<8.21E-05
Arsenic (As)	<2.506	<0.654	<1.75E-06	<1.15E-04
Beryllium (Be)	0.07	0.019	5.02E-08	3.30E-06
Cadmium (Cd)	<0.75	<0.196	<5.24E-07	<3.45E-05
Chromium (Cr)	20.3	5.283	1.41E-05	9.29E-04
Cobalt (Co)	<0.18	<0.047	<1.25E-07	<8.21E-06
Copper (Cu)	11.36	2.963	7.92E-06	5.21E-04
Lead (Pb)	<55.74	<14.539	<3.89E-05	<2.56E-03
Manganese (Mn)	7.61	1.984	5.30E-06	3.49E-04
Mercury (Hg)	<0.493	<0.128	3.43E-07	<2.26E-05
Nickel (Ni)	0.940	0.245	6.55E-07	4.31E-05
Phosphorus (P)	582.8	152.010	4.06E-04	2.67E-02
Selenium (Se)	<5.37	<1.401	<3.74E-06	<2.46E-04
Vanadium(V)	<0.358	<0.093	<2.50E-07	<1.64E-05
Zinc (Zn)	59.90	15.624	4.18E-05	2.75E-03
	Run #2 TSM:	209.43	<5.60E-04	<3.68E-02

Run #2 Sampling and Emission Parameters

Sample Time		Sample Volume Collected		Exhaust Flow Rate		Fuel Combusted
Start	Finish	Vm(std)	m^3(std)	dscfm	m^3/min(std)	1000 gal./hr.
16:00	19:32	135.377	3.834	713	20.206	0.0152

Table 3.7

Summary of Trace Metal Emissions
ORRCO Auxillary Boiler
Klamath Falls, Oregon
August 26, 2020

EPA Method 29 Test Run #3

Analyte	ug/sample	ug/dscm	lbs/hr	lbs/1000 gal.
Aluminum (Al)	38.90	11.083	2.71E-05	1.82E-03
Antimony (Sb)	<1.79	<0.510	<1.24E-06	<8.36E-05
Arsenic (As)	<2.51	<0.714	<1.74E-06	<1.17E-04
Beryllium (Be)	<0.072	<0.021	<5.01E-08	<3.36E-06
Cadmium (Cd)	<0.921	<0.262	<6.41E-07	<4.30E-05
Chromium (Cr)	2.152	0.613	1.50E-06	1.00E-04
Cobalt (Co)	<0.179	<0.051	1.24E-07	8.36E-06
Copper (Cu)	11.16	3.180	7.76E-06	5.21E-04
Lead (Pb)	<53.740	<15.312	<3.74E-05	<2.51E-03
Manganese (Mn)	5.675	1.617	3.95E-06	2.65E-04
Mercury (Hg)	<0.460	<0.131	<3.20E-07	<2.15E-05
Nickel (Ni)	0.817	0.233	5.68E-07	3.81E-05
Phosphorus (P)	577.1	164.426	4.01E-04	2.69E-02
Selenium (Se)	<5.84	<1.664	<4.06E-06	<2.73E-04
Vanadium(V)	<0.36	<0.102	<2.49E-07	<1.67E-05
Zinc (Zn)	58.40	16.640	4.06E-05	2.73E-03
	Run #3 TSM:	<216.56	<5.29E-04	<3.55E-02

Run #3 Sampling and Emission Parameters

Sample Time		Sample Volume Collected		Exhaust Flow Rate		Fuel Combusted
Start	Finish	Vm(std)	m^3(std)	dscfm	m^3/min(std)	1000 gal./hr.
10:13	13:45	123.930	3.510	652	18.454	0.0149

Table 3.8

Summary of PCDF/PCDD Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 25, 2020

EPA Method 23 Test Run #1 Summary

PCDD	PCDD ng/m³	PCDD ng/sec	PCDD lbs/1000 gal.	PCDD TEQ ng/m³	PCDD TEQ ng/sec	PCDD TEQ lbs/1000 gal.
2,3,7,8-TCDD	<7.92E-04	<2.51E-04	<1.33E-10	<7.92E-04	<2.51E-04	<1.33E-10
1,2,3,7,8-PeCDD	7.98E-03	2.53E-03	1.34E-09	7.98E-03	2.53E-03	1.34E-09
1,2,3,4,7,8-HxCDD	<6.39E-03	<2.03E-03	<1.08E-09	<6.39E-04	<2.03E-04	<1.08E-10
1,2,3,6,7,8-HxCDD	1.92E-02	6.09E-03	3.24E-09	1.92E-03	6.09E-04	3.24E-10
1,2,3,7,8,9-HxCDD	1.02E-02	3.23E-03	1.72E-09	1.02E-03	3.23E-04	1.72E-10
1,2,3,4,6,7,8-HpCDD	1.19E-01	3.76E-02	1.99E-08	1.19E-03	3.76E-04	1.99E-10
OCDD	1.21E-01	3.83E-02	2.03E-08	3.63E-05	1.15E-05	6.10E-12
PCDD Total:	*<2.84E-01*	*<9.00E-02*	*4.78E-08*	*<1.36E-02*	*<4.30E-03*	*<2.28E-09*

PCDD	PCDF ng/m³	PCDF ng/sec	PCDF lbs/1000 gal.	PCDF TEQ ng/m³	PCDF TEQ ng/sec	PCDF TEQ lbs/1000 gal.
2,3,7,8-TCDF	1.726E-02	5.47E-03	2.90E-09	1.73E-03	5.47E-04	2.90E-10
1,2,3,7,8-PeCDF	1.188E-02	3.77E-03	2.00E-09	3.57E-04	1.13E-04	6.00E-11
2,3,4,7,8-PeCDF	2.092E-02	6.63E-03	3.52E-09	6.28E-03	1.99E-03	1.06E-09
1,2,3,4,7,8-HxCDF	9.423E-03	2.99E-03	1.58E-09	9.42E-04	2.99E-04	1.58E-10
1,2,3,6,7,8- HxCDF	1.029E-02	3.26E-03	1.73E-09	1.03E-03	3.26E-04	1.73E-10
2,3,4,6,7,8-HxCDF	1.080E-02	3.42E-03	1.82E-09	1.08E-03	3.42E-04	1.82E-10
1,2,3,7,8,9- HxCDF	8.463E-04	2.68E-04	1.42E-10	8.46E-05	2.68E-05	1.42E-11
1,2,3,4,6,7,8-HpCDF	2.026E-02	6.42E-03	3.41E-09	2.03E-04	6.42E-05	3.41E-11
1,2,3,4,7,8,9- HpCDF	<2.368E-03	<7.50E-04	<3.98E-10	2.37E-05	<7.50E-06	<3.98E-12
OCDF	6.122E-03	1.94E-03	1.03E-09	1.84E-06	5.82E-07	3.09E-13
PCDF Total:	*<1.10E-01*	*<3.49E-02*	*<1.85E-08*	*<1.17E-02*	*<3.71E-03*	*<1.97E-09*
Total PCDD, PCDF:	*<0.394*	*<1.25E-01*	*<6.63E-08*	*<2.53E-02*	*<8.02E-03*	*<4.26E-09*

Run #1 Sampling and Emission Parameters

Sample Time		Sample Volume Collected		Exhaust Flow Rate		Fuel Combusted
Start	Finish	Vm(std)	m³(std)	dscfm	m³/min(std)	1000 gal./hr.
10:32	13:43	117.659	3.332	671	19.010	0.0150

Table 3.9
Summary of PCDF/PCDD Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 25, 2020

EPA Method 23 Test Run #2 Summary

PCDD	PCDD ng/m³	PCDD ng/sec	PCDD lbs/1000 gal.	PCDD TEQ ng/m³	PCDD TEQ ng/sec	PCDD TEQ lbs/1000 gal.
2,3,7,8-TCDD	<1.23E-03	<3.96E-04	<2.07E-10	<1.23E-03	<3.96E-04	<2.07E-10
1,2,3,7,8-PeCDD	6.16E-03	1.99E-03	1.04E-09	6.16E-03	1.99E-03	1.04E-09
1,2,3,4,7,8-HxCDD	7.24E-03	2.34E-03	1.22E-09	7.24E-04	2.34E-04	1.22E-10
1,2,3,6,7,8-HxCDD	2.47E-02	7.96E-03	4.16E-09	2.47E-03	7.96E-04	4.16E-10
1,2,3,7,8,9-HxCDD	1.26E-02	4.08E-03	2.13E-09	1.26E-03	4.08E-04	2.13E-10
1,2,3,4,6,7,8-HpCDD	1.63E-01	5.25E-02	2.74E-08	1.63E-03	5.25E-04	2.74E-10
OCDD	1.75E-01	5.65E-02	2.95E-08	5.25E-05	1.69E-05	8.85E-12
PCDD Total:	*<3.89E-01*	*<1.26E-01*	*<6.57E-08*	*<1.35E-02*	*<4.36E-03*	*<2.28E-09*

PCDD	PCDF ng/m³	PCDF ng/sec	PCDF lbs/1000 gal.	PCDF TEQ ng/m³	PCDF TEQ ng/sec	PCDF TEQ lbs/1000 gal.
2,3,7,8-TCDF	5.66E-03	1.83E-03	9.54E-10	5.66E-04	1.83E-04	9.54E-11
1,2,3,7,8-PeCDF	<5.286E-03	<1.71E-03	<8.91E-10	<1.59E-04	<5.12E-05	<2.46E-11
2,3,4,7,8-PeCDF	1.18E-02	3.81E-03	1.99E-09	3.54E-03	1.14E-03	5.96E-10
1,2,3,4,7,8-HxCDF	9.57E-03	3.09E-03	1.61E-09	9.57E-04	3.09E-04	1.61E-10
1,2,3,6,7,8- HxCDF	9.30E-03	3.00E-03	1.57E-09	9.30E-04	3.00E-04	1.57E-10
2,3,4,6,7,8-HxCDF	1.01E-02	3.25E-03	1.70E-09	1.01E-03	3.25E-04	1.70E-10
1,2,3,7,8,9- HxCDF	2.78E-03	8.96E-04	4.68E-10	2.78E-04	8.96E-05	4.68E-11
1,2,3,4,6,7,8-HpCDF	2.37E-02	7.64E-03	3.99E-09	2.37E-04	7.64E-05	3.99E-11
1,2,3,4,7,8,9- HpCDF	3.73E-03	1.20E-03	6.28E-10	3.73E-05	1.20E-05	6.28E-12
OCDF	8.43E-03	2.72E-03	1.42E-09	2.53E-06	8.17E-07	4.26E-13
PCDF Total:	*<9.03E-02*	*<2.91E-02*	*<1.52E-08*	*<7.71E-03*	*<2.49E-03*	*<1.30E-09*
Total PCDD, PCDF:	*<4.80E-01*	*<1.55E-01*	*<8.09E-08*	*<2.12E-02*	*<6.85E-03*	*<3.58E-09*

Run #2 Sampling and Emission Parameters

Sample Time		Sample Volume Collected		Exhaust Flow Rate		Fuel Combusted
Start	Finish	Vm(std)	m³(std)	dscfm	m³/min(std)	1000 gal./hr.
16:00	19:32	133.605	3.784	684	19.373	0.0152

Table 3.10
Summary of PCDF/PCDD Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 26, 2020

EPA Method 23 Test Run #3 Summary

PCDD	PCDD ng/m³	PCDD ng/sec	PCDD lbs/1000 gal.	PCDD TEQ ng/m³	PCDD TEQ ng/sec	PCDD TEQ lbs/1000 gal.
2,3,7,8-TCDD	<4.96E-04	<1.55E-04	<8.26E-11	<4.96E-04	<1.55E-04	<8.26E-11
1,2,3,7,8-PeCDD	6.60E-03	2.06E-03	1.10E-09	6.60E-03	2.06E-03	1.10E-09
1,2,3,4,7,8-HxCDD	1.02E-02	3.19E-03	1.70E-09	1.02E-03	3.19E-04	1.70E-10
1,2,3,6,7,8-HxCDD	3.11E-02	9.72E-03	5.18E-09	3.11E-03	9.72E-04	5.18E-10
1,2,3,7,8,9-HxCDD	1.62E-02	5.06E-03	2.70E-09	1.62E-03	5.06E-04	2.70E-10
1,2,3,4,6,7,8-HpCDD	1.92E-01	5.99E-02	3.19E-08	1.92E-03	5.99E-04	3.19E-10
OCDD	2.36E-01	7.37E-02	3.92E-08	7.07E-05	2.21E-05	1.18E-11
PCDD Total:	*<4.92E-01*	*<1.54E-01*	*<8.19E-08*	*<1.48E-02*	*<4.64E-03*	*<2.47E-09*

PCDD	PCDF ng/m³	PCDF ng/sec	PCDF lbs/1000 gal.	PCDF TEQ ng/m³	PCDF TEQ ng/sec	PCDF TEQ lbs/1000 gal.
2,3,7,8-TCDF	6.57E-03	2.05E-03	1.09E-09	6.57E-04	2.05E-04	1.09E-10
1,2,3,7,8-PeCDF	7.17E-03	2.24E-03	1.19E-09	2.15E-04	6.73E-05	3.58E-11
2,3,4,7,8-PeCDF	1.41E-02	4.41E-03	2.35E-09	4.23E-03	1.32E-03	7.04E-10
1,2,3,4,7,8-HxCDF	1.21E-02	3.79E-03	2.02E-09	1.21E-03	3.79E-04	2.02E-10
1,2,3,6,7,8- HxCDF	1.16E-02	3.64E-03	1.94E-09	1.16E-03	3.64E-04	1.94E-10
2,3,4,6,7,8-HxCDF	1.27E-02	3.98E-03	2.12E-09	1.27E-03	3.98E-04	2.12E-10
1,2,3,7,8,9- HxCDF	<1.55E-03	<4.86E-04	<2.59E-10	<1.55E-04	<4.86E-05	<2.59E-11
1,2,3,4,6,7,8-HpCDF	2.89E-02	9.04E-03	4.81E-09	2.89E-04	9.04E-05	4.81E-11
1,2,3,4,7,8,9- HpCDF	<4.39E-03	<1.37E-03	<7.31E-10	<4.39E-05	<1.37E-05	<7.31E-12
OCDF	1.00E-02	3.14E-03	1.67E-09	3.01E-06	9.41E-07	5.01E-13
PCDF Total:	*<1.09E-01*	*<3.41E-02*	*<1.82E-08*	*<9.25E-03*	*<2.89E-03*	*<1.54E-09*
Total PCDD, PCDF:	*<6.01E-01*	*<1.88E-01*	*<1.00E-07*	*<2.41E-02*	*<7.53E-03*	*<4.01E-09*

Run #3 Sampling and Emission Parameters

Sample Time		Sample Volume Collected		Exhaust Flow Rate		Fuel Combusted
Start	Finish	Vm(std)	m³(std)	dscfm	m³/min(std)	1000 gal./hr.
10:13	13:45	129.469	3.667	662	18.754	0.0149

Table 3.11
Summary of PAH Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 25, 2020

EPA Method 23 Test Run #1 Summary

Polynuclear Aromatic Hydrocarbons, PAH	PAH ng/m³	PAH ng/sec	PAH lbs/1000 gal.	PAH TEQ ng/m³	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
Acenaphthene	1.627	0.515	2.74E-07	1.627	0.515	2.74E-07
Acenaphthylene	1.020	0.323	1.72E-07	1.020	0.323	1.72E-07
Anthracene	<1.561	<0.494	<2.62E-10	<1.561	<0.494	<2.62E-07
Benzo(a)anthracene	<0.600	<0.190	<1.01E-10	<0.120	<0.038	<2.02E-08
Benzo(a)pyrene	0.795	0.252	1.34E-07	0.795	0.252	1.34E-07
Benzo(b)fluoranthene	1.807	0.572	3.04E-07	1.445	0.458	2.43E-07
Benzo(e)pyrene	3.871	1.227	6.51E-07	3.871	1.227	6.51E-07
Benzo(g,h,i)perylene	14.675	4.649	2.47E-06	0.132	0.042	2.22E-08
Benzo(k)fluoranthene	0.708	0.224	1.19E-07	0.021	0.007	3.57E-09
Chrysene	2.053	0.650	3.45E-07	0.205	0.065	3.45E-08
Dibenz[a,h]anthracene	<0.546	<0.173	<9.19E-11	<5.462	<1.730	<9.19E-07
Fluoranthene	11.164	3.537	1.88E-09	0.893	0.283	1.50E-07
Fluorene	2.773	0.879	4.66E-07	2.773	0.879	4.66E-07
Indeno[1,2,3-cd]pyrene	1.915	0.607	3.22E-07	0.134	0.042	2.25E-08
2-Methyl naphthalene	24.158	7.654	4.06E-09	24.158	7.654	4.06E-06
Perylene	<0.420	<0.133	<7.07E-11	<0.420	<0.133	<7.07E-08
Phenanthrene	23.288	7.378	3.92E-09	23.288	7.378	3.92E-06
Pyrene	12.754	4.041	2.15E-09	12.754	4.041	2.15E-06
		Total PAH			*Total PAH TEQ*	
	<105.736	<33.500	<5.27E-06	<80.681	<25.562	<1.36E-05

Polynuclear Aromatic Hydrocarbons, PAH	PAH ng/m³	PAH ng/sec	PAH lbs/1000 gal.	PAH TEQ ng/m3	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
Naphthalene	57.620	18.256	9.69E-09	57.620	18.256	9.69E-06

Run #1 Sampling and Emission Parameters

Sample Time		Sample Volume Collected		Exhaust Flow Rate		Fuel Combusted
Start	Finish	Vm(std)	m³(std)	dscfm	m³/min(std)	1000 gal./hr.
10:32	13:43	117.659	3.332	661	19.010	0.0150

Table 3.12

Summary of PAH Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 25, 2020

EPA Method 23 Test Run #2 Summary

Polynuclear Aromatic Hydrocarbons, PAH	PAH ng/m³	PAH ng/sec	PAH lbs/1000 gal.	PAH TEQ ng/m³	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
Acenaphthene	0.975	0.315	1.64E-07	0.975	0.315	1.64E-07
Acenaphthylene	1.166	0.376	1.96E-07	1.166	0.376	1.96E-07
Anthracene	<1.374	<0.444	<2.32E-07	<1.374	<0.444	<2.32E-07
Benzo(a)anthracene	<0.529	<0.171	<8.91E-08	<0.106	<0.034	<1.78E-08
Benzo(a)pyrene	2.801	0.905	4.72E-07	2.801	0.905	4.72E-07
Benzo(b)fluoranthene	2.170	0.701	3.66E-07	1.736	0.560	2.93E-07
Benzo(e)pyrene	12.527	4.045	2.11E-06	12.527	4.045	2.11E-06
Benzo(g,h,i)perylene	76.115	24.576	1.28E-05	0.685	0.221	1.15E-07
Benzo(k)fluoranthene	0.716	0.231	1.21E-07	0.021	0.007	3.62E-09
Chrysene	1.602	0.517	2.70E-07	0.160	0.052	2.70E-08
Dibenz[a,h]anthracene	<0.481	<0.155	<8.11E-08	<4.810	<1.553	<8.11E-07
Fluoranthene	16.201	5.231	2.73E-06	1.296	0.418	2.19E-07
Fluorene	1.935	0.625	3.26E-07	1.935	0.625	3.26E-07
Indeno[1,2,3-cd]pyrene	10.043	3.243	1.69E-06	0.703	0.227	1.19E-07
2-Methyl naphthalene	19.319	6.238	3.26E-06	19.319	6.238	3.26E-06
Perylene	<0.370	<0.119	<6.24E-08	<0.370	<0.119	<6.24E-08
Phenanthrene	23.601	7.620	3.98E-06	23.601	7.620	3.98E-06
Pyrene	13.717	4.429	2.31E-06	13.717	4.429	2.31E-06
		Total PAH			*Total PAH TEQ*	
Total PAH:	<185.64	<59.94	<3.13E-05	<87.30	<28.19	<1.47E-05

PAH *(Polynuclear Aromatic Hydrocarbons)*	PAH ng/m³	PAH ng/sec	PAH lbs/1000 gal.	PAH TEQ ng/m³	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
Naphthalene	42.815	13.824	7.22E-06	42.815	13.824	7.22E-06

Run #2 Sampling and Emission Parameters

Sample Time		Sample Volume Collected		Exhaust Flow Rate		Fuel Combusted
Start	Finish	Vm(std)	m³(std)	dscfm	m³/min(std)	1000 gal./hr.
16:00	19:32	133.605	3.784	684	19.373	0.0152

Table 3.13
Summary of PAH Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 26, 2020

EPA Method 23 Test Run #3 Summary

Polynuclear Aromatic Hydrocarbons, PAH	PAH ng/m³	PAH ng/sec	PAH lbs/1000 gal.	PAH TEQ ng/m³	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
Acenaphthene	1.560	0.488	2.60E-07	1.560	0.488	2.60E-07
Acenaphthylene	0.952	0.298	1.58E-07	0.952	0.298	1.58E-07
Anthracene	<1.418	<0.443	<2.36E-07	<1.418	<0.443	<2.36E-07
Benzo(a)anthracene	<0.545	<0.170	<9.08E-08	<0.109	<0.034	<1.82E-08
Benzo(a)pyrene	0.685	0.214	1.14E-07	0.685	0.214	1.14E-07
Benzo(b)fluoranthene	7.773	2.429	1.29E-06	6.218	1.944	1.04E-06
Benzo(e)pyrene	6.164	1.927	1.03E-06	6.164	1.927	1.03E-06
Benzo(g,h,i)perylene	11.673	3.648	1.94E-06	0.105	0.033	1.75E-08
Benzo(k)fluoranthene	3.082	0.963	5.13E-07	0.092	0.029	1.54E-08
Chrysene	4.227	1.321	7.04E-07	0.423	0.132	7.04E-08
Dibenz[a,h]anthracene	<0.496	<0.155	<8.26E-08	<4.964	<1.551	<8.26E-07
Fluoranthene	22.527	7.041	3.75E-06	1.802	0.563	3.00E-07
Fluorene	2.111	0.660	3.51E-07	2.111	0.660	3.51E-07
Indeno[1,2,3-cd]pyrene	2.973	0.929	4.95E-07	0.208	0.065	3.46E-08
2-Methyl naphthalene	18.382	5.745	3.06E-06	18.382	5.745	3.06E-06
Perylene	<0.382	<0.119	<6.36E-08	<0.382	<0.119	<6.36E-08
Phenanthrene	24.927	7.791	4.15E-06	24.927	7.791	4.15E-06
Pyrene	12.655	3.955	2.11E-06	13.925	4.352	2.11E-06
		Total PAH			*Total PAH TEQ*	
	<122.53	<38.298	<2.04E-05	<84.43	<26.388	<1.38E-05

PAH *(Polynuclear Aromatic Hydrocarbons)*	PAH ng/m³	PAH ng/sec	PAH lbs/1000 gal.	PAH TEQ ng/m³	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
Naphthalene	41.728	13.042	6.95E-06	41.728	13.042	6.95E-06

Run #3 Sampling and Emission Parameters

Sample Time		Sample Volume Collected		Exhaust Flow Rate		Fuel Combusted
Start	Finish	Vm(std)	m³(std)	dscfm	m³/min(std)	1000 gal./hr.
10:13	13:45	129.469	3.667	662	18.754	0.0149

Table 3.14
Summary of PCB Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 25, 2020

EPA Method 23 Test Run #1 Summary

Polynuclear Aromatic Hydrocarbons, PAH	PCB ng/m³	PCB ng/sec	PCB lbs/1000 gal.	PCB TEQ ng/m³	PCB TEQ ng/sec	PCB TEQ lbs/1000 gal.
PCB-5/8	0.585	0.185	9.84E-08			
PCB 18	<0.128	<0.041	<2.16E-08			
PCB-28	0.245	0.078	4.12E-08			
PCB-44	<0.067	<0.021	<1.13E-08			
PCB-52/69	0.103	0.033	1.73E-08			
PCB-66/76	0.109	0.035	1.84E-08			
PCB 77	0.080	0.025	1.34E-08	2.40E-06	7.59E-07	1.34E-12
PCB 81	0.043	0.014	7.17E-09	3.84E-06	1.22E-06	2.15E-12
PCB-90/101	0.069	0.022	1.16E-08			
PCB 105	0.035	0.011	5.91E-09	3.16E-07	1.00E-07	1.77E-13
PCB 114	<0.010	<0.003	<1.63E-09	<8.73E-08	<2.76E-08	<4.89E-14
PCB 106/118	0.046	0.015	7.77E-09	4.16E-07	1.32E-07	2.33E-13
PCB 123	0.013	0.004	2.24E-09	1.20E-07	3.80E-08	6.72E-14
PCB 126	0.047	0.015	7.82E-09	1.40E-03	4.42E-04	7.82E-10
PCB-128/162	0.016	0.005	2.62E-09			
PCB-138/163/164	<0.027	<0.009	<4.53E-09			
PCB-153	0.020	0.006	3.30E-09			
PCB 156	<0.013	<0.004	<2.22E-09	<1.19E-07	<3.76E-08	<6.65E-14
PCB 157	0.011	0.003	1.81E-09	9.70E-08	3.07E-08	5.44E-14
PCB 167	<0.004	<0.001	<7.02E-10	<3.76E-08	<1.19E-08	<2.10E-14
PCB 169	<0.009	<0.003	<1.49E-09	<7.97E-05	<2.53E-05	<4.47E-11
PCB-170	0.012	0.004	2.02E-09			
PCB-180	<0.007	<0.002	<1.22E-09			
PCB-182/187	<0.007	<0.002	<1.21E-09			
PCB 189	0.008	0.003	1.33E-09	7.11E-08	2.25E-08	3.98E-14
PCB-195	<0.002	<0.001	<2.75E-10		7.59E-07	1.34E-12
PCB-206	<0.007	<0.002	<1.12E-09			
PCB-209	<0.005	<0.002	<8.43E-10			
Total of Specified *PCB:	<1.727	<0.547	2.90E-07			
		**Total of Specified PCB TEQ:		<1.48E-03	<4.70E-04	<8.31E-10

	Total PCB ng/m³	Total PCB ng/sec	Total PCB lbs/1000 gal.
Total PCB - Summation of all PCBs Detected	18.757	5.943	<3.15E-06

Run #1 Sampling and Emission Parameters

Sample Time		Sample Volume Collected		Exhaust Flow Rate		Fuel Combusted
Start	Finish	Vm(std)	m³(std)	dscfm	m³/min(std)	1000 gal./hr.
10:32	13:43	117.659	3.332	671	19.010	0.0150

Table 3.15
Summary of PCB Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 25, 2020

EPA Method 23 Test Run #2 Summary

Polynuclear Aromatic Hydrocarbons, PAH	PCB ng/m³	PCB ng/sec	PCB lbs/1000 gal.	PCB TEQ ng/m³	PCB TEQ ng/sec	PCB TEQ lbs/1000 gal.
PCB-5/8	<0.149	<0.048	<2.51E-08			
PCB 18	0.097	0.031	1.64E-08			
PCB-28	0.270	0.087	4.54E-08			
PCB-44	0.175	0.057	2.95E-08			
PCB-52/69	0.138	0.045	2.33E-08			
PCB-66/76	0.204	0.066	3.44E-08			
PCB 77	<0.036	<0.012	<6.15E-09	<9.64E-07	<3.11E-07	<6.15E-13
PCB 81	<0.003	0.002	<8.87E-10	<2.09E-07	1.35E-07	<2.66E-13
PCB-90/101	0.063	0.020	1.07E-08			
PCB 105	<0.019	<0.006	<3.20E-09	<1.51E-07	<4.86E-08	<9.61E-14
PCB 114	<0.004	<0.001	<6.46E-10	<3.04E-08	<9.81E-09	<1.94E-14
PCB 106/118	0.030	0.010	5.03E-09	2.37E-07	7.65E-08	1.51E-13
PCB 123	<0.003	<0.001	<5.75E-10	<2.70E-08	<8.73E-09	<1.72E-14
PCB 126	<0.009	<0.003	<1.55E-09	<2.43E-04	<7.85E-05	<1.55E-10
PCB-128/162	<0.008	<0.003	<1.31E-09			
PCB-138/163/164	<0.017	<0.006	<2.92E-09			
PCB-153	0.023	0.007	3.81E-09			
PCB 156	<0.007	<0.002	<1.11E-09	<5.20E-08	<1.6E-08	<3.32E-14
PCB 157	<0.003	<0.001	<5.70E-10	<2.68E-08	<8.7E-09	<1.71E-14
PCB 167	<0.004	<0.001	<6.73E-10	<3.16E-08	<1.0E-08	<2.02E-14
PCB 169	<0.004	<0.001	<5.93E-10	<2.79E-05	<9.0E-06	<1.78E-11
PCB-170	<0.004	<0.001	<6.91E-10			
PCB-180	<0.003	<0.001	<5.53E-10			
PCB-182/187	<0.003	<0.001	<4.63E-10			
PCB 189	<0.003	<0.001	<4.72E-10	<2.22E-08	<7.17E-09	<1.42E-14
PCB-195	<0.002	<0.001	<3.10E-10			
PCB-206	0.012	0.004	2.00E-09			
PCB-209	0.012	0.004	2.09E-09			
Total of Specified *PCB:	<1.308	<0.422	<2.21E-07			
			**Total of Specified PCB TEQ:	<2.73E-04	<8.81E-05	<1.74E-10

	Total PCB ng/m³	Total PCB ng/sec	Total PCB lbs/1000 gal.
Total PCB - Summation of all PCBs Detected	6.079	1.963	1.02E-06

Run #2 Sampling and Emission Parameters

Sample Time		Sample Volume Collected		Exhaust Flow Rate		Fuel Combusted
Start	Finish	Vm(std)	m³(std)	dscfm	m³/min(std)	1000 gal./hr.
16:00	19:32	133.605	3.784	684	19.373	0.0152

Table 3.16
Summary of PCB Emissions
ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 25, 2020

EPA Method 23 Test Run #3 Summary

Polynuclear Aromatic Hydrocarbons, PAH	PCB ng/m³	PCB ng/sec	PCB lbs/1000 gal.	PCB TEQ ng/m³	PCB TEQ ng/sec	PCB TEQ lbs/1000 gal.
PCB-5/8	<0.115	<0.036	<1.92E-08			
PCB 18	0.066	0.021	1.10E-08			
PCB-28	0.134	0.042	2.23E-08			
PCB-44	0.070	0.022	1.16E-08			
PCB-52/69	0.085	0.026	1.41E-08			
PCB-66/76	0.093	0.029	1.55E-08			
PCB 77	0.036	0.011	5.95E-09	9.74E-07	3.05E-07	5.95E-13
PCB 81	0.010	0.003	1.65E-09	8.10E-07	2.53E-07	4.94E-13
PCB-90/101	<0.052	<0.016	<8.67E-09			
PCB 105	0.025	0.008	4.16E-09	2.04E-07	6.39E-08	1.25E-13
PCB 114	<0.004	<0.001	<6.13E-10	<3.01E-08	<9.42E-09	<1.84E-14
PCB 106/118	<0.031	<0.010	<5.18E-09	<2.54E-07	<7.95E-08	<1.55E-13
PCB 123	0.006	0.002	1.04E-09	5.09E-08	1.59E-08	3.11E-14
PCB 126	<0.014	<0.004	<2.35E-09	<3.85E-04	<1.20E-04	<2.35E-10
PCB-128/162	<0.009	<0.003	<1.49E-09			
PCB-138/163/164	<0.029	<0.009	<4.90E-09			
PCB-153	0.026	0.008	4.25E-09			
PCB 156	<0.007	<0.002	<1.16E-09	<5.71E-08	<1.79E-08	<3.49E-14
PCB 157	<0.005	<0.002	<8.58E-10	<4.22E-08	<1.32E-08	<2.57E-14
PCB 167	0.006	0.002	9.58E-10	4.71E-08	1.47E-08	2.87E-14
PCB 169	0.004	0.001	6.58E-10	3.24E-05	<1.01E-05	1.98E-11
PCB-170	<0.003	<0.001	<5.09E-10			
PCB-180	<0.012	<0.004	<1.95E-09			
PCB-182/187	<0.009	<0.003	<1.50E-09			
PCB 189	0.007	0.002	1.15E-09	5.668E-08	1.77E-08	3.46E-06
PCB-195	<0.005	<0.001	<7.81E-10		3.05E-07	5.95E-13
PCB-206	0.015	0.005	2.44E-09			
PCB-209	<0.012	<0.004	<2.02E-09			
Total of Specified *PCB:	<0.888	<0.278	<1.48E-07			
		Total of Specified PCB TEQ:		<4.20E-04	<1.31E-04	<3.46E-06

	Total PCB ng/m³	Total PCB ng/sec	Total PCB lbs/1000 gal.
Total PCB - Summation of all PCBs Detected	3.545	1.108	5.90E-07

Run #3 Sampling and Emission Parameters

Sample Time		Sample Volume Collected		Exhaust Flow Rate		Fuel Combusted
Start	Finish	Vm(std)	m³(std)	dscfm	m³/min(std)	1000 gal./hr.
10:13	13:45	129.469	3.667	662	18.754	0.0149

3.3 Data Representation:

Calculations presented in this report utilize a standard temperature of 528°R (68 °F) and standard pressure (29.92 in Hg). Calculation of final results listed in Section 3 are manually rounded according to the procedures outlined in ODEQ *"Source Sampling Manual, Volume I"*, November, 2018.

4.0 SOURCE DESCRIPTION AND OPERATION

4.1 Source Description

ORRCO operates a used oil reprocessing and blending operation. The process includes the transfer, storage, dehydrating and filtering of used oils recycled from various sources. Energy for the recycling process is produced by the burning of distillate fuel in an auxiliary boiler (rated at 61 horsepower, 155,210 Btu/hr). Propane is the backup fuel.

The recycle process takes place during batch cycles, approximately 24hrs, where the recycle oil is heated in one of three dehydrator tanks to 250° to 270° which removes entrained water and light end distillate oils. The tank capacity for dehydrator used during the emission test was 11,000 gallons. The auxiliary boiler provides steam to heat exchange coils located within the dehydrator tank. The Auxiliary Boiler was operated at the highest firing rate expected to be achieved during normal future operation.

Specific Auxiliary Boiler Information:

Burner: Manufacturer: Industrial Combustion
Model: Model M Series #: MM-28S Size 2,
Dual fuel – Distillate or Propane
Rating: 155,210 Btu/hr
Fuel: 100% Waste Oil Distillate

Boiler: Manufacturer: Gabriel
Model: Scotch Marine fire tube, 61hp.

4.2 Source Operating Conditions

The Auxiliary Boiler was operated under typical worst-case conditions that would generate the highest possible emissions expected during future operations. ORRCO defines the worst-case conditions for the boiler as the fuel firing rate, gallons of distillate combusted per hour. The Burner was manually set to the High Fire setting and remained at that setting for the duration of each test run.

Table 4.1

Auxiliary Boiler Operating Parameters

ORRCO Auxiliary Boiler
Klamath Falls, Oregon
August 25, 2020

Test Run	1	2	3	
Date:	8/25/2020	8/25/2020	8/26/2020	
Start Time:	10:32	16:00	10:13	
End Time:	13:43	19:32	13:45	
Auxiliary Boiler Operating Parameters				*Average*
Used Oil Processed, gal.:		11,000		
Tank Temperature Start, °F:	93	180	157	***143***
Tank Temperature End, °F:	167	185	190	***181***
Boiler Oxygen, %:	11.62	11.61	10.43	***11.22***
Distillate Fuel Oil Flow Rate, gph:	14.95	15.20	14.90	***15.02***

4.0 SOURCE DESCRIPTION AND OPERATION (continued)

4.3 Auxiliary Boiler Operation:

During the emission test only regular operating staff controlled the Boiler combustion system or production processes. At no time was ETS consulted regarding Boiler test results or operating parameters.

5.0 PROCEDURES

5.1 Summary of Procedures:

The reference methods followed during the emission testing were the same as outlined in the previously submitted Source Test Plan, presented in Appendix F, Section 11.1 of this report.

5.1.1 EPA Method 1

Sample port locations met method requirements for straight run diameters before and after flow disturbance. Ten sample traverse points were measured at each sample port for a total of twenty sample travers points.

Auxiliary Boiler Exhaust Stack:
Duct Diameter, inches: 16.0"
Dimensions Before (downstream, distance B): 81"
Equivalent Diameters (downstream distance B): 5.1
Dimensions After (upstream, distance A): 161"
Equivalent Diameters (upstream distance A): 10.1

5.1.2 EPA Method 2, Velocity and Volume Flow Rate

Velocity measurements of the gas stream were determined using a calibrated "S" type Pitot tube, incline oil manometer, and a calibrated type K thermocouple, using a digital temperature display. No deviations were made from the published method. Volumetric flow measurements are taken during each EPA Method 23 and 29 test runs. Dry volumetric flow rates were calculated using gas velocity, stack pressure, stack gas moisture, stack gas molecular weight, and area of exhaust stack measured.

All method quality control and assurance procedures are followed and are documented in this report. Leak checks are performed during each sample run and can be found on the respective field data sheets. Equipment calibration and inspection sheets are listed in Appendix E, Section 10.1 and 10.2.

The exhaust stack was checked for cyclonic flow conditions prior to testing. The exhaust stack did not exhibit cyclonic flow at any location sampled. Documentation of cyclonic flow check is presented in Appendix B, Section 7.1.7.

5.0 PROCEDURES (continued)

5.1.3 EPA Method 3A

The gaseous parameters, O_2 and CO_2 were determined using continuous instrumentation methodology and used for the determination of exhaust gas molecular weight. Sample gas is extracted from the center 10% of the exhaust stack through a heated (250° ± 5° F) Stainless Steel probe/filter assembly that is approximately 1 meter in length. A calibration-gas purge tee is fitted upstream of the filter assembly and is used during system bias calibrations.
The following instrumentation was used to analyze the gaseous parameters:

EPA Method 3A Measurement Specifications

Oxygen, %O_2
Analyzer Manufacturer: Servomex
Model: 1440D
Detector: Paramagnetic
Serial Number: 01440DIV02/4085
Analyzer Range: 0.0 – 20.10%
Operating Sensitivity: 0.4%

EPA Method 3A Measurement Specifications continued.

Carbon Dioxide, %CO_2:
Analyzer Manufacturer: Thermo Scientific
Model: 410i
Detector: Nondispersive Infrared
Serial Number: 1180730009
Analyzer Range: 0.0 - 20.30%
Operating Sensitivity: 0.4%

The data recorder consisted of a Parametric Systems digital data acquisition system. The Parametric Systems package is a fully automated reference method data recording and report generating software/hardware package.

Calibration gases used were EPA Protocol 1 cylinder gases. The certification sheets are located in Appendix E, Section 10.3.1.

The sample system will be leak checked prior to testing and after testing has been completed. Analyzer calibration error checks will be conducted Sample system bias checks are performed at the beginning and end of each test series. The test run is started after twice the response time has elapsed.

5.1.4 EPA Method 4, Exhaust Gas Moisture

Exhaust gas moisture determinations were accomplished using EPA Method 4 as a part of the EPA Method 23 and 29 sampling trains. EPA Methods 1-4 equipment calibration data are presented in Appendix E, Section 10.1 and 10.2.

Prior to sampling, the impingers were weighed to the nearest 0.1 gram and recorded. After sampling, final impinger weights were documented. Moisture content of the gas stream was calculated using weight gain of the impinger train and the dry gas volume sampled. No deviations were made from the published method.

5.1.5 EPA Method 23, Determination of Dioxins and Semi volatile Organic Compounds

EPA Method 23 was used for the determination of polychlorinated Dibenzo-p-Dioxins (PCDDs), Polychlorinated Dibenzofurans (PCDFs), Polycyclic Aromatic Hydrocarbons (PAHs) and Polychlorinated Biphenyls (PCBs) compounds.

Sample Collection

Gaseous and particulate bound target pollutants were withdrawn isokinetically from the exhaust stack and collected in the sampling probe, on to a glass fiber filter, on a packed column of adsorbent material and in the absorption train. During laboratory analysis, the target compounds were extracted from the combined sample collection media. PCDD, PCDF, PCB and PAH compounds were measured by the use of high-resolution gas chromatography/ high resolution mass spectrometry (HRGC/HRMS).

Sample System

The sample system consisted of a glass nozzle (fitted with a PTFE ferrule), heated probe (glass sample line), heated glass filter (supported by a borosilicate glass/PTFE gasket frit), an absorption module containing XAD-2 resin, a glass condenser coil and an absorption train. The sample probe and filter housing were maintained at a temperature of 248 ± 25 °F where the gas exiting the condenser and entering the absorption module is maintained at ≤ 68 °F.

The absorption train will consist of 5 impingers connected in series with leak free fittings. The first impinger will be a short stem (water dropout) design. The second, fourth and fifth impingers will be of the Greenburg-Smith design with the glass stem extending to approximately 1" – 2" from the bottom. The second and third impingers will contain known quantities of water ~100ml of HPLC grade, the first and fourth impinger remain empty while the fifth impinger will contain a known weight of silica gel. All glassware used will be pre cleaned following section 8.1.1.1 of method 23.

EPA Method 23 Sample Train

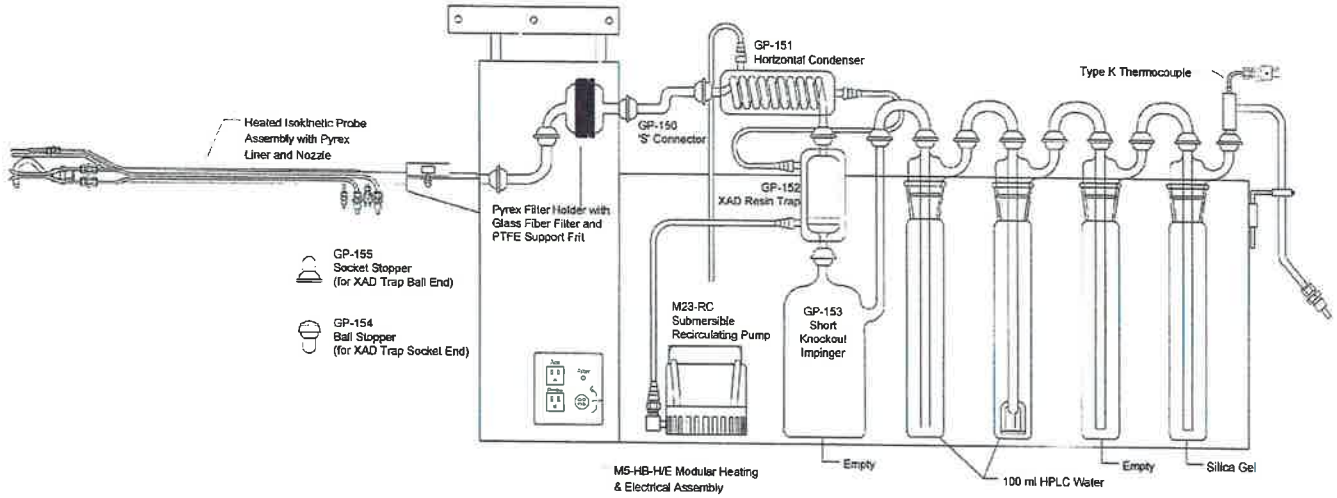


Figure 23-1

5.1.5 EPA Method 23, Determination of Dioxins and Semi Volatile Organic Compounds (continued).

Reagents and sample preparation

Reagents used during sample collection and recovery closely follow section 13 of EPA Method 23. Filters supplied by the lab were pre cleaned and follow the quality control checks as required in EPA Method 23. Filters supplied were quartz glass without organic binders. Pre cleaned XAD-2 traps and pre spiked media were supplied by the lab. Acetone and Toluene used during the clean-up process were pesticide grade reagents.

During field preparation, XAD-2 traps were kept wrapped in aluminum foil and kept well below 122 °F to prevent thermal decomposition. Excluding the XAD-2 traps, all sample glassware components before use were pre-rinsed immediately before assemble with acetone and toluene, the glass probe and nozzle were rinsed and brushed three times with acetone and toluene. Each impinger and absorbent module including fitting caps were weighed to the nearest 0.5 grams using a calibrated field balance.

The sample train will be assembled as shown in Figure 23-1 of EPA Method 23. Prior to testing the recirculation pump to the condenser and absorbent module was activate and the proper temperature monitored and maintained prior to starting the test. Temperatures of the probe, filter and absorbent trap were recorded and maintained throughout the entire test run. Once the temperatures of all sample system components were at desired operating ranges a pretest leak check was performed following the procedures outlined in EPA Method 5, Section 8.4.2.

Sampling strategy

Before sampling, a series of initial measurements were conducted using EPA Methods 1, 2, 3A, 4. The preliminary results were entered into the field computer, and an appropriate nozzle size for isokinetic sampling determined. The probe was positioned at the initial traverse point; velocity and temperature measurements were recorded and used to calculate the appropriate isokinetic sampling rate. Once the test was started the delta H was adjusted to obtain the isokinetic sample rate.

Following the completion of a test run the probe was removed from the stack and the nozzle caped off with PTFE tape. Once the probe could be safely handled the nozzle was wiped clean of any debris, a post test leak check of the sampling system was performed and documented.

5.1.5 EPA Method 23, Determination of Dioxins and Semi Volatile Organic Compounds (continued).

Sample Recovery

Sample recovery and shipping followed Sections 8.2.4 through 8.2.12 of EPA Method 23. After the proper samples and components have been placed in a clean environment (ETS mobile lab trailer) the following sample recovery steps were taken.

1. The filter was carefully removed from the filter holder with clean tweezers along with any loose debris and carefully placed in the proper container labeled Container #1 with the associated sample I.D.

2. The absorbent module once removed from the train was properly capped with PTFE tape and end caps. The recirculation water was drained and the absorption module weighed to the nearest 0.5 grams for moisture determinations. The final weight was noted and the proper sample I.D label placed on the absorbent module.

3. Material deposited in the front half components (nozzle, probe liner and front half of the filter holder) were brushed and rinsed three times with acetone followed by three rinses of toluene. All the rinses were collected in the proper sample jar and labeled Container #2.

4. All back half components (back half of the filter holder, sample transfer line and condenser were rinsed three times with acetone followed by three rinses of toluene. All rinses were collected in container #2. Liquid level was marked on jar.

5. All impingers were removed from the sample apparatus, outside surfaces wiped clean of debris and condensate and final weights taken to within 0.5 grams. Final weights were documented.

6. Water from inside the impingers were saved in a sample jar labeled Container #3 for PCBs and PAH analysis. All the impingers and connecting glassware were rinsed three times with acetone followed by three rinses of toluene. These rinses were collected in container #3 and liquid level noted on the sample jar.

7. Silica gel color was noted on the field data sheet to determine if it has been completely spent.

8. Field samples were placed in a clean sample box kept in cool dark conditions until arrival to the lab.

9. Sample chain of custody followed procedures outlined in ASTM D4880-99(2018).

5.1.5 EPA Method 23, Determination of Dioxins and Semi Volatile Organic Compounds (continued).

Sample Analysis

EPA Method 23 samples were analyzed by Vista laboratory, contact information follows:

Vista Analytical Laboratory
1104 Windfield Way
El Dorado Hills, CA 95762
Main: (916) 673-1520
Fax: (916) 673-0106
Contact: Martha Mailer,
Laboratory Director

Quality Control

Quality control followed Section 9.0 of EPA Method 23.

At least one field train proof blank was prepared, assembled and recovered as if it were to be used in the test series. A field blank will consist of all components necessary to conduct a test run.

Pre sampling absorbent spikes and pre extraction filter spikes samples were performed following requirements of Section 13 EPA Method 23. All the pre sampling absorbent spike standard recoveries were above 70 percent with the following exceptions:

Lab Number	Sample ID	Analyte	Flag	% Recovery
2001762-01	2020.2232.M23-Run 1	13C-1,2,3,4,7,8-HxCDD	H	133
2001762-02	2020.2232.M23-Run 2	13C-1,2,3,4,7,8-HxCDD	H	133
2001762-04	2020.2232.M23-Field Train Proof	13C6-Naphthalene	H	18.8

Laboratory quality control results are found in the Vista Analytical Laboratory analysis report located in Appendix B, Section 7.1.4.

5.0 PROCEDURES (continued)

5.1.6 EPA Method 29, Selected Trace Metals EPA Method 29

Select trace metals were determined using EPA Method 29. The samples measured included aluminum, antimony, arsenic, beryllium, cadmium, total chromium, cobalt, copper lead, manganese, mercury, nickel, phosphorus, selenium, vanadium, and zinc. Triplicate test runs were performed collecting a minimum of 3.568 cubic meters over 180 minutes in duration for each sample. Samples were collected isokinetically with a multi-point traverse of the exhaust stack.

Sample Train Operation:

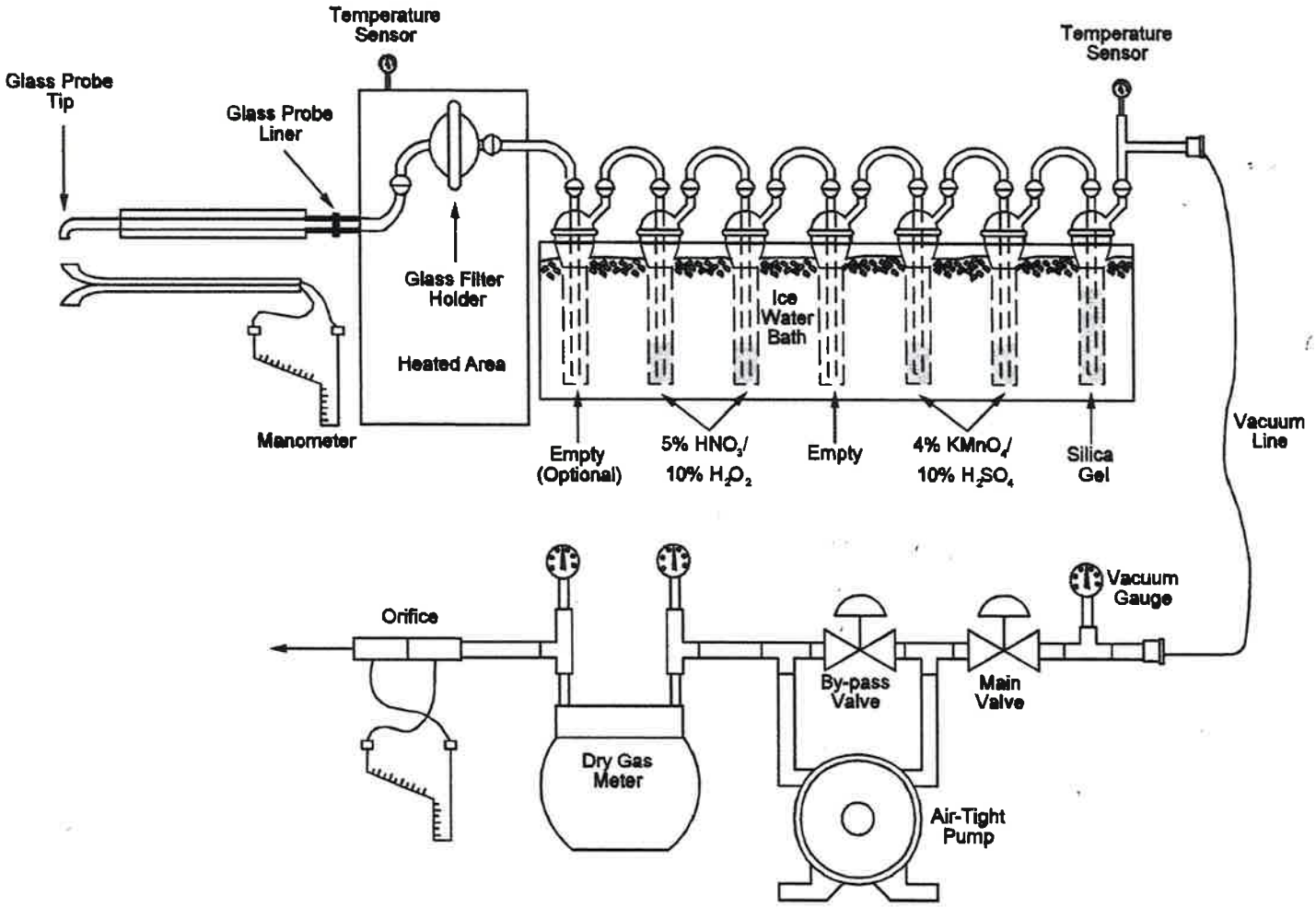
Pretest preparations, preliminary determinations, and leak check procedures followed those outlined in EPA Method 5 and EPA Method 29. Borosilicate glass probe liners and nozzles were used to avoid possible contamination.

The EPA Method 29 sampling train include a heated glass probe equipped with an S-type pitot tube and thermocouple. The probe is attached to an oven containing a heated filter holder, Teflon frit and quartz glass-fiber filter. Both the probe exit temperature and oven are maintained at 248°F ± 25°F during sampling. The filter holder is connected by a length of new 3/8" diameter Teflon tubing to the impinger train containing six chilled impingers in series. The impinger train is connected to the dry gas meter control box. The optional first impinger is empty, and serves as a moisture knock-out; the second and third impingers each contained 100 ml of 5% HNO3/10% H_2O_2, the fourth was empty, the fifth and sixth impingers each contained 100 ml of 4% KMnO4/10% H2SO4. The seventh impinger contains indicating silica gel. All of the impinger tare weights were recorded prior to sampling.

The entire sample train was leak checked prior to sampling and again following the test run. The pre-test leak check is performed at -10" vacuum to ensure that sample system leak rate does not exceed 0.02 cfm. The post-test leak check is performed at a vacuum greater than the highest vacuum recorded during the test run. The leak rate cannot exceed the lesser of a) 4 percent of the average sampling rate, or b) 0.02 cfm.

5.0 PROCEDURES (continued)

EPA Method 29 Sample Train



Note: The ETS Method 29 Sample Train utilizes a TFE sample line from the front-half filter exit to the 1st impinger inlet.

5.1.6 EPA Method 29, Selected Trace Metals EPA Method 29 (continued)

Sample Recovery

Following the post test run leak check the filter housing was removed from the oven and sealed with TFE tape and transported to the lab trailer. Separate filter to impinger lines were used for each test run. The TFE lines consisted of new Teflon and were rinsed with 0.1N HNO_3 then sealed prior to use. Post test, the lines were drained of any condensate into the first impinger then sealed and recovered in the lab trailer.

Sample containers used for the Method 29 tests are pre-cleaned amber glass, wide mouth jars with Teflon leak-proof caps. Each jar was rinsed with 5% nitric acid prior to use. The contents of the impingers were weighed and recorded prior to recovery. All sample system components were rinsed a minimum of three times using the appropriate recovery reagent. The liquid level was marked on each sample container.

The filter was collected and placed into Container 1. The nozzle, probe and front-half of the filter holder were rinsed into Container 2 using a total of 100 ml of 0.1N HNO_3. The contents of the first three impingers were placed into Container 3. The impingers and filter holder back half were rinsed into Container 3 using a total of 100 ml of 0.1N HNO3. The contents of the fourth impinger were collected into Container 4 and the impinger rinsed with 100 ml of 0.1 HNO3 and poured into the same container. The contents of the fifth and sixth impingers were collected into Container 5 followed by rinses of a total of 100 ml of both 4% KMnO4/10% H_2SO_4 and DI water in that order. Finally, these impingers are rinsed into Container 6 using exactly 25 ml of 8N HCl.

Samples were hand delivered to the laboratory and analysis performed within the method's hold-time. All QA/QC and chain of custody procedures were followed in accordance with the test method.

Sample Analysis:

The sample analysis will be performed by Chester Labnet contact information:

Chester LabNet
Paul Duda, Laboratory Manager
12242 SW Garden Place
Tigard, OR 97223
(503) 624-2183

Sample analysis procedures were performed in accordance with the method including the use of microwave digestion and proportional compositing of the front half, filter, and back half sample fractions (impingers 1-3) for analysis of trace metals. The potassium permanganate impinger catch and the hydrochloric acid rinse fractions were analyzed separately for mercury. Analysis techniques included the use of inductively coupled plasma (ICP) and cold vapor atomic absorption

5.1.6 EPA Method 29, Selected Trace Metals EPA Method 29 (continued)

Sample Analysis:

spectroscopy (CVAAS). Spiked quality control samples, matrix spikes, serial dilution, and duplicate analyses were used to establish the quality of the data. Duplicate analyses will be performed on 10% of all samples. Laboratory quality control results are presented in the Chester LabNet analytical report located in Appendix A, Section 6.1.2.

6.0 Appendix A: Auxiliary Boiler Trace Metals Emission Results

6.1 Trace Metals and Mercury Emissions – EPA Method 29

- 6.1.1 Trace Metal Emission Results
- 6.1.2 EPA Method 29, Chester LabNet Report
- 6.1.3 Emission Parameters and Volumetric Flow Rates
- 6.1.4 Field Data Sheets
- 6.1.5 Sample Traverse Point Determinations

Total Selected Metals - EPA Method 29 Results

Client: ORRCO
Location: Klamath Falls, OR
Source: Auxiliary Boiler
Date: Aug. 25 & 26, 2020
Project No.: 2020.2232

Three Run Average

Analyte	ug/dscm	lbs/hr	lbs/1000 gal.
Aluminum (Al)	12.19	3.112E-05	2.070E-03
Antimony (Sb)	<0.556	<1.41E-06	<9.40E-05
Arsenic (As)	<0.717	<1.82E-06	<1.21E-04
Beryllium (Be)	<0.021	<5.23E-08	<3.48E-06
Cadmium (Cd)	<0.240	<6.07E-07	<4.04E-05
Chromium (Cr)	2.200	5.795E-06	3.826E-04
Cobalt (Co)	0.051	1.299E-07	8.653E-06
Copper (Cu)	3.403	8.636E-06	5.754E-04
Lead (Pb)	<15.05	<3.82E-05	<2.55E-03
Manganese (Mn)	1.767	4.508E-06	2.999E-04
Mercury (Hg)	<0.133	<3.37E-07	<2.25E-05
Nickel (Ni)	0.325	8.256E-07	5.503E-05
Phosphorus (P)	160.99	4.088E-04	2.723E-02
Selenium (Se)	<1.582	<4.01E-06	<2.67E-04
Vanadium(V)	<0.102	<2.60E-07	<1.73E-05
Zinc (Zn)	17.00	4.316E-05	2.875E-03
Total Selected Metals:	***<216.32***	***<5.50E-04***	***<3.66E-02***

Note: Analytes which were below analytical detection limits are flaged as a less tan value "<".
Selected Metal results were calculated according to ODEQ guidence, which requires that individual metals (or sample fractions) that are below method detection limits be considered present at detection limit for reporting purposes.

Total Selected Metals - EPA Method 29 Results

Client: ORRCO
Location: Klamath Falls, OR
Source: Auxiliary Boiler
Date: Aug. 25, 2020
Project No.: 2020.2232

Test Run: #1
Sample Time:
Start: 10:32
End: 13:43

Volume Sampled: 114.421 Vmstd
3.240 m3
Exhaust Rate: 671 dscfm
Fuel Firing Rate: 0.0150 1000 gal/hr

Analyte	*ug/sample*	*ug/dscm*	*lbs/hr*	*lbs/1000 gal.*
Aluminum (Al)	*38.0*	*11.727*	*2.95E-05*	1.97E-03
Antimony (Sb)	*<2.241*	*<0.692*	*<1.74E-06*	<1.16E-04
Arsenic (As)	*<2.541*	*<0.784*	*<1.97E-06*	<1.32E-04
Beryllium (Be)	*<0.073*	*<0.023*	*<5.67E-08*	<3.79E-06
Cadmium (Cd)	*<0.845*	*<0.261*	*<6.56E-07*	<4.39E-05
Chromium (Cr)	*2.279*	*0.703*	*1.77E-06*	1.18E-04
Cobalt (Co)	*<0.181*	*<0.056*	*<1.40E-07*	<9.40E-06
Copper (Cu)	*13.180*	*4.067*	*1.02E-05*	6.84E-04
Lead (Pb)	*<49.57*	*<15.296*	*<3.85E-05*	<2.57E-03
Manganese (Mn)	*5.509*	*1.700*	*4.28E-06*	2.86E-04
Mercury (Hg)	*<0.450*	*<0.139*	*<3.49E-07*	<2.33E-05
Nickel (Ni)	*1.62*	*0.498*	*1.25E-06*	8.38E-05
Phosphorus (P)	*539.60*	*166.519*	*4.19E-04*	2.80E-02
Selenium (Se)	*<5.45*	*<1.682*	*<4.23E-06*	<2.83E-04
Vanadium(V)	*<0.363*	*<0.112*	*<2.82E-07*	<1.88E-05
Zinc (Zn)	*60.70*	*18.733*	*4.71E-05*	3.15E-03
Run #1 Total Selected Metals:	*<222.990*	*<5.61E-04*	*<3.75E-02*	

Note: Analytes which were below analytical detection limits are flaged as a less tan value "<".
Selected Metal results were calculated according to ODEQ guidence, which requires that individual metals (or sample fractions) that are below method detection limits be considered present at detection limit for reporting purposes.

Selected Metals - EPA Method 29 Results

Client: ORRCO
Location: Klamath Falls, OR
Source: Auxiliary Boiler
Date: Aug. 25, 2020
Project No.: 2020.2232

Test Run: #2
Sample Time:
Start: 16:00
End: 19:32

Volume Sampled: 135.377 Vmstd
3.834 m3
Exhaust Rate: 713 dscfm
Fuel Firing Rate: 0.0152 1000 gal/hr

Analyte	*Total ug*	*ug/dscm*	*lbs/hr*	*lbs/1000 gal.*
Aluminum (Al)	*52.8*	*13.772*	*3.68E-05*	2.42E-03
Antimony (Sb)	*<1.790*	*<0.467*	*<1.25E-06*	<8.21E-05
Arsenic (As)	*<2.506*	*<0.654*	*<1.75E-06*	<1.15E-04
Beryllium (Be)	*0.07*	*0.019*	*5.02E-08*	3.30E-06
Cadmium (Cd)	*<0.75*	*<0.196*	*<5.24E-07*	<3.45E-05
Chromium (Cr)	*20.3*	*5.283*	*1.41E-05*	9.29E-04
Cobalt (Co)	*<0.179*	*<0.047*	*<1.25E-07*	<8.21E-06
Copper (Cu)	*11.36*	*2.963*	*7.92E-06*	5.21E-04
Lead (Pb)	*<55.74*	*<14.539*	*<3.89E-05*	<2.56E-03
Manganese (Mn)	*7.61*	*1.984*	*5.30E-06*	3.49E-04
Mercury (Hg)	*<0.493*	*<0.128*	*3.43E-07*	<2.26E-05
Nickel (Ni)	*0.940*	*0.245*	*6.55E-07*	4.31E-05
Phosphorus (P)	*582.8*	*152.010*	*4.06E-04*	2.67E-02
Selenium (Se)	*<5.37*	*<1.401*	*<3.74E-06*	<2.46E-04
Vanadium(V)	*<0.358*	*<0.093*	*<2.50E-07*	<1.64E-05
Zinc (Zn)	*59.90*	*15.624*	*4.18E-05*	2.75E-03
Run #2 Total Selected Metals:		*209.43*	*<5.60E-04*	*<3.68E-02*

Note: Analytes which were below analytical detection limits are flaged as a less tan value "<".
Selected Metal results were calculated according to ODEQ guidence, which requires that individual metals (or sample fractions) that are below method detection limits be considered present at detection limit for reporting purposes.

Total Selected Metals - EPA Method 29 Results

Client: ORRCO
Location: Klamath Falls, OR
Source: Auxiliary Boiler
Date: Aug. 26, 2020
Project No.: 2020.2232

Test Run: #3
Sample Time:
Start: 10:13
End: 13:45

Volume Sampled: 123.930 Vmstd
3.510 m3
Exhaust Rate: 652 dscfm
Fuel Firing Rate: 0.0149 1000 gal/hr

Analyte	Total uG	ug/dscm	lbs/hr	lbs/1000 gal.
Aluminum (Al)	38.90	11.083	2.71E-05	1.82E-03
Antimony (Sb)	<1.79	<0.510	<1.24E-06	<8.36E-05
Arsenic (As)	<2.51	<0.714	<1.74E-06	<1.17E-04
Beryllium (Be)	<0.072	<0.021	<5.01E-08	<3.36E-06
Cadmium (Cd)	<0.921	<0.262	<6.41E-07	<4.30E-05
Chromium (Cr)	2.152	0.613	1.50E-06	1.00E-04
Cobalt (Co)	0.179	0.051	1.24E-07	8.36E-06
Copper (Cu)	11.16	3.180	7.76E-06	5.21E-04
Lead (Pb)	<53.740	<15.312	<3.74E-05	<2.51E-03
Manganese (Mn)	5.675	1.617	3.95E-06	2.65E-04
Mercury (Hg)	<0.460	<0.131	<3.20E-07	<2.15E-05
Nickel (Ni)	0.817	0.233	5.68E-07	3.81E-05
Phosphorus (P)	577.1	164.426	4.01E-04	2.69E-02
Selenium (Se)	<5.84	<1.664	<4.06E-06	<2.73E-04
Vanadium(V)	<0.36	<0.102	<2.49E-07	<1.67E-05
Zinc (Zn)	58.40	16.640	4.06E-05	2.73E-03
Run #3 Total Selected Metals:		<216.559	<5.29E-04	<3.55E-02

Note: Analytes which were below analytical detection limits are flaged as a less tan value "<".
Selected Metal results were calculated according to ODEQ guidence, which requires that individual metals (or sample fractions) that are below method detection limits be considered present at detection limit for reporting purposes.

Auxiliary Boiler EPA Method 29 Laboratory Results

Client: ORRCO
Location: Klamath Falls, OR
Source: Auxiliary Boiler
Date: Aug. 25 & 26, 2020
Project No.: 2020.2232

Run #1 Sample	Aluminum	Antimony	Arsenic	Beryllium	*Cadmium*	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Phosphorus	Selenium	Vanadium	Zinc
Sample Description	*Results, ug*	*Results, ug*	*Results, ug*	*Results, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*
Front-half, P/N & Filter	*108.00*	*<1.25*	*<1.750*	*<0.050*	*0.800*	*1.41*	*<0.125*	*9.54*	*49.0*	*7.15*	*0.0688*	*4.81*	*522.00*	*<3.75*	*<0.250*	*60.20*
(Container #1 & #3)																
Sample ID: 2020.2232.M29.01&.02																
Back-half, Imp #1, #2, #3	*37.9*	*0.991*	*<0.791*	*<0.023*	*<0.045*	*0.869*	*<0.056*	*3.640*	*<0.565*	*0.472*	*0.202*	*0.509*	*50.8*	*<1.70*	*<0.113*	*3.910*
(Container #4)																
Sample ID: 2020.2232.M29.03																
Back-half, Imp #4 KO											0.0131					
(Container #5a)																
Sample ID: 2020.2232.M29.04																
Back-half, Imp #5&#6, KMnO4											*0.1480*					
(Container #5b)																
Sample ID: 2020.2232.M29.05																
Back-half, HCl Rinse											*<0.0178*					
(Container #5c)																
Sample ID: 2020.2232.M29.06																
Run #1 Total, ug:	***38.00***	***<2.241***	***<2.541***	***<0.073***	***<0.845***	***2.28***	***<0.181***	***13.18***	***<49.565***	***5.509***	***<0.450***	***1.62***	***539.60***	***<5.45***	***<0.363***	***60.70***

Run #2 Sample	Aluminum	Antimony	Arsenic	Beryllium	*Cadmium*	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Phosphorus	Selenium	Vanadium	Zinc
Sample Description	*Results, ug*	*Results, ug*	*Results, ug*	*Results, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*
Front-half, P/N & Filter	*107.0*	*<1.25*	*<1.75*	*<0.050*	*0.709*	*13.60*	*<0.125*	*9.72*	*55.2*	*8.22*	*<0.0219*	*3.77*	*524*	*<3.75*	*<0.250*	*60.50*
(Container #1 & #3)																
Sample ID: 2019.2189.B2.M29.07&08																
Back-half, Imp #1, #2, #3	*53.7*	*<0.540*	*<0.756*	*<0.022*	*<0.043*	*11.0*	*<0.054*	*1.64*	*<0.540*	*1.50*	*0.214*	*0.874*	*92.000*	*<1.62*	*<0.108*	*2.810*
(Container #4)																
Sample ID: 2020.2232.M29.09																
Back-half, Imp #4 KO											*0.0204*					
(Container #5a)																
Sample ID: 2020.2232.B2.M29.10																
Back-half, Imp #5&#6, KMnO4											*0.215*					
(Container #5b)																
Sample ID: 2020.2232.M29.11																
Back-half, HCl Rinse											*<0.0212*					
(Container #5c)																
Sample ID: 2020.2232.M29.12																
Run #2 Total, ug:	***52.8***	***<1.790***	***<2.506***	***<0.072***	***<0.752***	***20.26***	***<0.179***	***11.36***	***<55.74***	***7.61***	***<0.493***	***0.940***	***582.80***	***<5.37***	***<0.358***	***59.90***

Run #3 Sample	Aluminum	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Phosphorus	Selenium	Vanadium	Zinc
Sample Description	*Results, ug*	*Results, ug*	*Results, ug*	*Results, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*
Front-half, P/N & Filter	*111.00*	*<1.25*	*<1.75*	*<0.050*	*0.878*	*1.32*	*<0.125*	*9.44*	*53.2*	*7.26*	*<0.0219*	*3.80*	*536.00*	*<3.75*	*<0.250*	*56.10*
(Container #1 & #3)																
Sample ID: 2020.2232.M29.13&14																
Back-half, Imp #1, #2, #3	35.8	*<0.540*	*<0.756*	*<0.022*	*<0.043*	*0.832*	*<0.054*	*1.720*	*<0.540*	*0.528*	*0.219*	*0.721*	*74.300*	*2.09*	*<0.108*	*5.71*
(Container #4)																
Sample ID: 2019.2189.M29.15																
Back-half, Imp #4 KO																
(Container #5a)											*<0.00910*					
Sample ID: 2020.2232.M29.16																
Back-half, Imp #5&#6, KMnO4											*0.190*					
(Container #5b)																
Sample ID: 2020.2232.M29.17																
Back-half, HCl Rinse											*<0.0198*					
(Container #5c)																
Sample ID: 2020.2232.M29.18																
Run #3 Total, ug:	***38.90***	***<1.79***	***<2.51***	***<0.072***	***<0.921***	***2.152***	***<0.179***	***11.16***	***<53.74***	***5.675***	***<0.460***	***0.817***	***577.10***	***<5.84***	***<0.36***	***58.40***

Blank Correction	Aluminum	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Nickel	Phosphorus	Selenium	Vanadium	Zinc
Sample Description	*Results, ug*	*Results, ug*	*Results, ug*	*Results, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*	*Reported, ug*
Front-half																
(Container #12: Filter Blank)	94.7				0.712	1.74				1.69		3.10	10.70			3.04
Sample ID: 2020.2232.M29.24																
0.1 N HNO_3, Blank Vol 300ml																
(Container #8A: 0.1N HNO_3 Blank)						1.94				0.181						
Sample ID: 2020.2232.M29.19																
Back-half																
HNO_3 /H_2O_2, Blank Vol 200ml	13.2					0.664				0.242		0.604	22.50			0.367
(Container #9)																
Sample ID: 2020.2232.M29.21																
Blank Total, ug:	***107.9***				***0.71***	***4.344***				***2.113***		***3.704***	***33.200***			***3.407***

NOTE: Blank corrections were made using the Filter Blanks, HNO_3 and HNO_3/H_2O_2 Reagent Blank.

ENVIRONMENTAL TECHNICAL SERVICES

PROJECT: 20202232
OIL RE-REFINING COMPANY

CLIENT # E043
REPORT # 20-378

SUBMITTED BY:
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CHESTER LabNet

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Case Narrative

Date: October 13, 2020

General Information

Client:	Environmental Technical Services
Client Number:	E043
Report Number:	20-378
Sample Description:	Impinger trains
Sample Numbers:	20-S1688 – 20-S1708

Analysis

Analytes:	Al, Sb, As, Be, Cd, Cr, Co, Cu, Pb, Mn, Hg, Ni, P, Se, V, Zn
Analytical Protocols:	EPA Method 29 (8/2/17 version)
Analytical Notes:	No problems were encountered during the analyses. Results have not been blank corrected.
QA/QC Review:	All of the data have been reviewed by the analysts performing the analyses and the project manager. All of 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 that of the samples as received into the laboratory. All data are reported to the detection limit. Results <5x 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.

Paul Duda 10/13/20

Project Manager Date
Paul Duda

Client: E043 - ETS
Report Number: 20-378

Run #1

Lab ID: 20-S1688
Client ID: 2020.2232.M29.01 &.02
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 1 C1&3
Sample Date: 9/ 1/20

Analyte	Result	DL	Units
Aluminum, ICP	108.	3.75	µg/sample
Antimony, ICP	< DL	1.25	µg/sample
Arsenic, ICP	< DL	1.75	µg/sample
Beryllium, ICP	< DL	0.050	µg/sample
Cadmium, ICP	0.800	0.100	µg/sample
Chromium, ICP	1.41	0.200	µg/sample
Cobalt, ICP	< DL	0.125	µg/sample
Copper, ICP	9.54	1.25	µg/sample
Lead, ICP	49.0	1.25	µg/sample
Manganese, ICP	7.15	0.075	µg/sample
Mercury, CVAA	0.0688	0.0219	µg/sample
Nickel, ICP	4.81	0.750	µg/sample
Phosphorus, ICP	522.	5.00	µg/sample
Selenium, ICP	< DL	3.75	µg/sample
Vanadium, ICP	< DL	0.250	µg/sample
Zinc, ICP	60.2	0.750	µg/sample

Lab ID: 20-S1689
Client ID: 2020.2232.M29.03
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 1 C4
Sample Date: 9/ 1/20

Analyte	Result	DL	Units
Aluminum, ICP	37.9	1.70	µg/sample
Antimony, ICP	0.991	0.565	µg/sample
Arsenic, ICP	< DL	0.791	µg/sample
Beryllium, ICP	< DL	0.023	µg/sample
Cadmium, ICP	< DL	0.045	µg/sample
Chromium, ICP	0.869	0.090	µg/sample
Cobalt, ICP	< DL	0.056	µg/sample
Copper, ICP	3.64	0.565	µg/sample
Lead, ICP	< DL	0.565	µg/sample
Manganese, ICP	0.472	0.034	µg/sample
Mercury, CVAA	0.202	0.0455	µg/sample
Nickel, ICP	0.509	0.339	µg/sample
Phosphorus, ICP	50.8	2.26	µg/sample
Selenium, ICP	< DL	1.70	µg/sample
Vanadium, ICP	< DL	0.113	µg/sample
Zinc, ICP	3.91	0.339	µg/sample

Lab ID: 20-S1690
Client ID: 2020.2232.M29.04
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 1 C5a
Sample Date: 9/ 1/20

Analyte	Result	DL	Units
Mercury, CVAA	0.0131	0.00831	µg/sample

Client: E043 - ETS
Report Number: 20-378

Lab ID: 20-S1691
Client ID: 2020.2232.M29.05
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 1 C5b
Sample Date: 9/ 1/20

Analyte	Result	DL	Units
Mercury, CVAA	0.148	0.0346	µg/sample

Lab ID: 20-S1692
Client ID: 2020.2232.M29.06
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 1 C5c
Sample Date: 9/ 1/20

Analyte	Result	DL	Units
Mercury, CVAA	< DL	0.0178	µg/sample

Run #2

Lab ID: 20-S1693
Client ID: 2020.2232.M29.07 & .08
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 2 C1&3
Sample Date: 9/ 1/20

Analyte	Result	DL	Units
Aluminum, ICP	107.	3.75	µg/sample
Antimony, ICP	< DL	1.25	µg/sample
Arsenic, ICP	< DL	1.75	µg/sample
Beryllium, ICP	< DL	0.050	µg/sample
Cadmium, ICP	0.709	0.100	µg/sample
Chromium, ICP	13.6	0.200	µg/sample
Cobalt, ICP	< DL	0.125	µg/sample
Copper, ICP	9.72	1.25	µg/sample
Lead, ICP	55.2	1.25	µg/sample
Manganese, ICP	8.22	0.075	µg/sample
Mercury, CVAA	< DL	0.0219	µg/sample
Nickel, ICP	3.77	0.750	µg/sample
Phosphorus, ICP	524.	5.00	µg/sample
Selenium, ICP	< DL	3.75	µg/sample
Vanadium, ICP	< DL	0.250	µg/sample
Zinc, ICP	60.5	0.750	µg/sample

Client: E043 - ETS
Report Number: 20-378

Lab ID: 20-S1694
Client ID: 2020.2232.M29.09
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 2 C4
Sample Date: 9/ 1/20

Analyte	Result	DL	Units
Aluminum, ICP	53.7	1.62	µg/sample
Antimony, ICP	< DL	0.540	µg/sample
Arsenic, ICP	< DL	0.756	µg/sample
Beryllium, ICP	< DL	0.022	µg/sample
Cadmium, ICP	< DL	0.043	µg/sample
Chromium, ICP	11.0	0.086	µg/sample
Cobalt, ICP	< DL	0.054	µg/sample
Copper, ICP	1.67	0.540	µg/sample
Lead, ICP	< DL	0.540	µg/sample
Manganese, ICP	1.50	0.032	µg/sample
Mercury, CVAA	0.214	0.0455	µg/sample
Nickel, ICP	0.874	0.324	µg/sample
Phosphorus, ICP	92.0	2.16	µg/sample
Selenium, ICP	< DL	1.62	µg/sample
Vanadium, ICP	< DL	0.108	µg/sample
Zinc, ICP	2.81	0.324	µg/sample

Lab ID: 20-S1695
Client ID: 2020.2232.M29.10
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 2 C5a
Sample Date: 9/ 1/20

Analyte	Result	DL	Units
Mercury, CVAA	0.0204	0.00892	µg/sample

Lab ID: 20-S1696
Client ID: 2020.2232.M29.11
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 2 C5b
Sample Date: 9/ 1/20

Analyte	Result	DL	Units
Mercury, CVAA	0.215	0.0350	µg/sample

Lab ID: 20-S1697
Client ID: 2020.2232.M29.12
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 2 C5c
Sample Date: 9/ 1/20

Analyte	Result	DL	Units
Mercury, CVAA	< DL	0.0212	µg/sample

Client: E043 - ETS
Report Number: 20-378

Run #3

Lab ID: 20-S1698
Client ID: 2020.2232.M29.13 & .14
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 3 C1&3
Sample Date: 9/ 1/20

Analyte	Result	DL	Units
Aluminum, ICP	111.	3.75	µg/sample
Antimony, ICP	< DL	1.25	µg/sample
Arsenic, ICP	< DL	1.75	µg/sample
Beryllium, ICP	< DL	0.050	µg/sample
Cadmium, ICP	0.878	0.100	µg/sample
Chromium, ICP	1.32	0.200	µg/sample
Cobalt, ICP	< DL	0.125	µg/sample
Copper, ICP	9.44	1.25	µg/sample
Lead, ICP	53.2	1.25	µg/sample
Manganese, ICP	7.26	0.075	µg/sample
Mercury, CVAA	< DL	0.0219	µg/sample
Nickel, ICP	3.80	0.750	µg/sample
Phosphorus, ICP	536.	5.00	µg/sample
Selenium, ICP	< DL	3.75	µg/sample
Vanadium, ICP	< DL	0.250	µg/sample
Zinc, ICP	56.1	0.750	µg/sample

Lab ID: 20-S1699
Client ID: 2020.2232.M29.15
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 3 C4
Sample Date: 9/ 2/20

Analyte	Result	DL	Units
Aluminum, ICP	35.8	1.62	µg/sample
Antimony, ICP	< DL	0.540	µg/sample
Arsenic, ICP	< DL	0.756	µg/sample
Beryllium, ICP	< DL	0.022	µg/sample
Cadmium, ICP	< DL	0.043	µg/sample
Chromium, ICP	0.832	0.086	µg/sample
Cobalt, ICP	< DL	0.054	µg/sample
Copper, ICP	1.72	0.540	µg/sample
Lead, ICP	< DL	0.540	µg/sample
Manganese, ICP	0.528	0.032	µg/sample
Mercury, CVAA	0.219	0.0464	µg/sample
Nickel, ICP	0.721	0.324	µg/sample
Phosphorus, ICP	74.3	2.16	µg/sample
Selenium, ICP	2.09	1.62	µg/sample
Vanadium, ICP	< DL	0.108	µg/sample
Zinc, ICP	5.71	0.324	µg/sample

Lab ID: 20-S1700
Client ID: 2020.2232.M29.16
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 3 C5a
Sample Date: 9/ 2/20

Analyte	Result	DL	Units
Mercury, CVAA	< DL	0.00910	µg/sample

Client: E043 - ETS
Report Number: 20-378

Lab ID: 20-S1701
Client ID: 2020.2232.M29.17
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 3 C5b
Sample Date: 9/ 2/20

Analyte	Result	DL	Units
Mercury, CVAA	0.190	0.0341	µg/sample

Lab ID: 20-S1702
Client ID: 2020.2232.M29.18
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: 3 C5c
Sample Date: 9/ 2/20

Analyte	Result	DL	Units
Mercury, CVAA	< DL	0.0198	µg/sample

Lab ID: 20-S1703
Client ID: 2020.2232.M29.19
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: C8a HNO3 Blk
Sample Date: 9/ 2/20

Analyte	Result	DL	Units
Aluminum, ICP	< DL	3.75	µg/sample
Antimony, ICP	< DL	1.25	µg/sample
Arsenic, ICP	< DL	1.75	µg/sample
Beryllium, ICP	< DL	0.050	µg/sample
Cadmium, ICP	< DL	0.100	µg/sample
Chromium, ICP	1.94	0.200	µg/sample
Cobalt, ICP	< DL	0.125	µg/sample
Copper, ICP	< DL	1.25	µg/sample
Lead, ICP	< DL	1.25	µg/sample
Manganese, ICP	0.181	0.075	µg/sample
Mercury, CVAA	< DL	0.0219	µg/sample
Nickel, ICP	< DL	0.750	µg/sample
Phosphorus, ICP	< DL	5.00	µg/sample
Selenium, ICP	< DL	3.75	µg/sample
Vanadium, ICP	< DL	0.250	µg/sample
Zinc, ICP	< DL	0.750	µg/sample

Client: E043 - ETS
Report Number: 20-378

Lab ID: 20-S1704
Client ID: 2020.2232.M29.24
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: C12 Filter Blk
Sample Date: 9/ 2/20

Analyte	Result	DL	Units
Aluminum, ICP	94.7	3.75	µg/sample
Antimony, ICP	< DL	1.25	µg/sample
Arsenic, ICP	< DL	1.75	µg/sample
Beryllium, ICP	< DL	0.050	µg/sample
Cadmium, ICP	0.712	0.100	µg/sample
Chromium, ICP	1.74	0.200	µg/sample
Cobalt, ICP	< DL	0.125	µg/sample
Copper, ICP	< DL	1.25	µg/sample
Lead, ICP	< DL	1.25	µg/sample
Manganese, ICP	1.69	0.075	µg/sample
Mercury, CVAA	< DL	0.0219	µg/sample
Nickel, ICP	3.10	0.750	µg/sample
Phosphorus, ICP	10.7	5.00	µg/sample
Selenium, ICP	< DL	3.75	µg/sample
Vanadium, ICP	< DL	0.250	µg/sample
Zinc, ICP	3.04	0.750	µg/sample

Lab ID: 20-S1705
Client ID: 2020.2232.M29.21
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: C9 HNO3/H2O2 Blk
Sample Date: 9/ 2/20

Analyte	Result	DL	Units
Aluminum, ICP	13.2	1.72	µg/sample
Antimony, ICP	< DL	0.575	µg/sample
Arsenic, ICP	< DL	0.805	µg/sample
Beryllium, ICP	< DL	0.023	µg/sample
Cadmium, ICP	< DL	0.046	µg/sample
Chromium, ICP	0.664	0.092	µg/sample
Cobalt, ICP	< DL	0.058	µg/sample
Copper, ICP	< DL	0.575	µg/sample
Lead, ICP	< DL	0.575	µg/sample
Manganese, ICP	0.242	0.034	µg/sample
Mercury, CVAA	< DL	0.0271	µg/sample
Nickel, ICP	0.604	0.345	µg/sample
Phosphorus, ICP	22.5	2.30	µg/sample
Selenium, ICP	< DL	1.72	µg/sample
Vanadium, ICP	< DL	0.115	µg/sample
Zinc, ICP	0.367	0.345	µg/sample

Lab ID: 20-S1706
Client ID: 2020.2232.M29.20
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: C8b H2O Blk
Sample Date: 9/ 2/20

Analyte	Result	DL	Units
Mercury, CVAA	< DL	0.00884	µg/sample

Client: E043 - ETS
Report Number: 20-371

Lab ID: 20-S1707
Client ID: 2020.2232.M29.22
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: C10 KMnO4 Blk
Sample Date: 9/ 2/20

Analyte	Result	DL	Units
Mercury, CVAA	< DL	0.00901	µg/sample

Lab ID: 20-S1708
Client ID: 2020.2232.M29.23
Site: Oil Re-Refining Company
Source: Aux. Boiler
Run Number: C11 HCl Blk
Sample Date: 9/ 2/20

Analyte	Result	DL	Units
Mercury, CVAA	< DL	0.0192	µg/sample

QA/QC Report

Client Name: ETS
Project Number: E043
Analytical Technique: ICP - Optima 8300
Sample Description: EPA Method 29 Cont. 1&3
Report Number: 20-378

Blank Data

Analyte	Sample ID	Measured Conc. µg/L	DL Conc. µg/L
Al	ICB	< DL	15.0
Al	MB_FH	38.8	15.0
Al	CCB	< DL	15.0
Al	MB_BH	75.4	15.0
Al	CCB	< DL	15.0
Al	CCB	< DL	15.0
As	ICB	< DL	7.00
As	Meth_Blk	< DL	7.00
As	CCB	< DL	7.00
As	CCB	< DL	7.00
Be	ICB	< DL	0.200
Be	Meth_Blk	< DL	0.200
Be	CCB	< DL	0.200
Be	CCB	< DL	0.200
Cd	ICB	< DL	0.400
Cd	Meth_Blk	< DL	0.400
Cd	CCB	< DL	0.400
Cd	CCB	< DL	0.400
Co	ICB	< DL	0.500
Co	Meth_Blk	< DL	0.500
Co	CCB	< DL	0.500
Co	CCB	< DL	0.500
Cr	ICB	< DL	0.800
Cr	Meth_Blk	< DL	0.800
Cr	CCB	< DL	0.800
Cr	CCB	< DL	0.800
Cu	ICB	< DL	5.00
Cu	Meth_Blk	< DL	5.00
Cu	CCB	< DL	5.00
Cu	CCB	< DL	5.00
Mn	ICB	< DL	0.300
Mn	Meth_Blk	< DL	0.300
Mn	CCB	< DL	0.300
Mn	CCB	< DL	0.300
Ni	ICB	< DL	3.00
Ni	Meth_Blk	< DL	3.00
Ni	CCB	< DL	3.00
Ni	CCB	< DL	3.00
P	ICB	< DL	20.0
P	Meth_Blk	< DL	20.0
P	CCB	< DL	20.0
P	CCB	< DL	20.0
Pb	ICB	< DL	5.00
Pb	Meth_Blk	< DL	5.00
Pb	CCB	< DL	5.00
Pb	CCB	< DL	5.00
Sb	ICB	< DL	5.00
Sb	Meth_Blk	< DL	5.00
Sb	CCB	< DL	5.00
Sb	CCB	< DL	5.00
Se	ICB	< DL	15.0
Se	Meth_Blk	< DL	15.0
Se	CCB	< DL	15.0
Se	CCB	< DL	15.0
V	ICB	< DL	1.00
V	Meth_Blk	< DL	1.00
V	CCB	< DL	1.00
V	CCB	< DL	1.00

*: Sample Media Blank (SM_Blk) concentration in µg/filter
ICB: Initial Calibration Blank CCB: Continuing Calibration Blank
Method Blank is in control if Method Blank results are <10% of sample results

QA/QC Report

Client Name: ETS
Project Number: E043
Analytical Technique: ICP - Optima 8300
Sample Description: EPA Method 29 Cont. 1&3
Report Number: 20-378

Blank Data

Analyte	Sample ID	Measured Conc. µg/L	DL Conc. µg/L
Zn	ICB	< DL	3.00
Zn	Meth_Blk	< DL	3.00
Zn	CCB	< DL	3.00
Zn	CCB	< DL	3.00

*: Sample Media Blank (SM_Blk) concentration in µg/filter
ICB: Initial Calibration Blank CCB: Continuing Calibration Blank
Method Blank is in control if Method Blank results are <10% of sample results

Calibration QC

Analyte	Sample ID	Standard Conc. µg/L	Measured Conc. µg/L	Percent Recovery
Al	ICV	2500	2400	95.9
Al	LL-CCV	150.	136.	90.8
Al	LL-LCS	75.0	78.7	105.0
Al	CCV	2500	2490	99.4
Al	LL-LCS	75.0	115.	153.2
Al	CCV	2500	2490	99.4
Al	CCV	2500	2370	94.8
As	ICV	2500	2470	98.9
As	LL-CCV	35.0	39.3	112.2
As	LL-LCS	20.0	18.4	92.0
As	CCV	2500	2480	99.3
As	CCV	2500	2510	100.4
Be	ICV	2500	2440	97.8
Be	LL-CCV	1.00	0.909	90.9
Be	LL-LCS	0.500	0.443	88.6
Be	CCV	2500	2470	98.7
Be	CCV	2500	2480	99.2
Cd	ICV	2500	2510	100.4
Cd	LL-CCV	2.00	2.14	106.9
Cd	LL-LCS	1.50	1.66	110.8
Cd	CCV	2500	2500	99.8
Cd	CCV	2500	2480	99.4
Co	ICV	2500	2480	99.0
Co	LL-CCV	2.50	3.31	132.4
Co	LL-LCS	1.50	1.73	115.3
Co	CCV	2500	2480	99.3
Co	CCV	2500	2500	99.9
Cr	ICV	2500	2510	100.4
Cr	LL-CCV	4.00	3.78	94.6
Cr	LL-LCS	2.00	4.67	233.7
Cr	CCV	2500	2500	100.0
Cr	CCV	2500	2500	99.8
Cu	ICV	2500	2430	97.1
Cu	LL-CCV	25.0	28.8	115.3
Cu	LL-LCS	15.0	16.3	108.5
Cu	CCV	2500	2430	97.0
Cu	CCV	2500	2460	98.3
Mn	ICV	2500	2580	103.2
Mn	LL-CCV	1.50	1.82	121.7
Mn	LL-LCS	1.00	1.16	116.4
Mn	CCV	2500	2570	102.9

ICV: Initial Calibration Verification CCV: Continuing Calibration Verification
Calibration Verification Limits: 90% - 110% Recovery
LL-CCV (Low Level CCV) Limits: 60% - 140% Recovery
LL-LCS Limits: 50% - 150% Recovery
LL-LCS results are not significant if sample results are >10x LL-LCS concentration

QA/QC Report

Client Name: ETS
Project Number: E043
Analytical Technique: ICP - Optima 8300
Sample Description: EPA Method 29 Cont. 1&3
Report Number: 20-378

Calibration QC

Analyte	Sample ID	Standard Conc. µg/L	Measured Conc. µg/L	Percent Recovery
Mn	CCV	2500	2580	103.0
Ni	ICV	2500	2460	98.5
Ni	LL-CCV	15.0	16.2	107.7
Ni	LL-LCS	6.00	5.06	84.4
Ni	CCV	2500	2460	98.4
Ni	CCV	2500	2470	98.9
P	ICV	2500	2510	100.5
P	LL-CCV	100.	85.5	85.5
P	LL-LCS	75.0	51.6	68.8
P	CCV	2500	2520	100.7
P	CCV	2500	2590	103.6
Pb	ICV	2500	2510	100.4
Pb	LL-CCV	25.0	28.0	112.2
Pb	LL-LCS	15.0	13.6	90.7
Pb	CCV	2500	2490	99.6
Pb	CCV	2500	2540	101.8
Sb	ICV	2500	2530	101.3
Sb	LL-CCV	25.0	25.6	102.2
Sb	LL-LCS	15.0	14.7	97.8
Sb	CCV	2500	2540	101.4
Sb	CCV	2500	2550	102.0
Se	ICV	2500	2430	97.4
Se	LL-CCV	75.0	56.7	75.6
Se	LL-LCS	30.0	21.2	70.7
Se	CCV	2500	2460	98.4
Se	CCV	2500	2500	100.1
V	ICV	2500	2500	100.1
V	LL-CCV	5.00	5.68	113.5
V	LL-LCS	3.00	3.17	105.6
V	CCV	2500	2490	99.8
V	CCV	2500	2480	99.3
Zn	ICV	2500	2520	100.9
Zn	LL-CCV	15.0	17.5	116.7
Zn	LL-LCS	6.00	5.92	98.7
Zn	CCV	2500	2500	100.1
Zn	CCV	2500	2510	100.4

ICV: Initial Calibration Verification CCV: Continuing Calibration Verification
Calibration Verification Limits: 90% - 110% Recovery
LL-CCV (Low Level CCV) Limits: 60% - 140% Recovery
LL-LCS Limits: 50% - 150% Recovery
LL-LCS results are not significant if sample results are >10x LL-LCS concentration

Replicate Data

Analyte	Sample ID	Sample Conc. µg/L	Replicate Conc. µg/L	RPD
Al	20-S1688	433.0	440.5	1.72
Al	20-S1689	335.3	328.7	1.99
As	20-S1688	< 7	< 7	N/C #
Be	20-S1688	< 0.2	< 0.2	N/C #
Cd	20-S1688	3.202	3.140	1.96
Co	20-S1688	< 0.5	< 0.5	N/C #
Cr	20-S1688	5.635	5.691	0.99

RPD = {(sample-replicate)/[(sample+replicate)/2]}x100
N/C: RPD is not calculated when sample or replicate is below detection limit
Replicate Limit: 20% RPD
#: per EPA CLP protocol, control limits do not apply if sample and/or replicate concentration is less than 5x the detection limit

QA/QC Report

Client Name: ETS
Project Number: E043
Analytical Technique: ICP - Optima 8300
Sample Description: EPA Method 29 Cont. 1&3
Report Number: 20-378

Replicate Data

Analyte	Sample ID	Sample Conc. µg/L	Replicate Conc. µg/L	RPD
Cu	20-S1688	38.18	34.67	9.64
Mn	20-S1688	28.60	26.46	7.77
Ni	20-S1688	19.23	17.93	7.00
P	20-S1688	2088.	1924.	8.18
Pb	20-S1688	195.9	182.7	6.97
Sb	20-S1688	< 5	< 5	N/C #
Se	20-S1688	< 15	< 15	N/C #
V	20-S1688	< 1	< 1	N/C #
Zn	20-S1688	240.9	237.0	1.63

N/C: RPD is not calculated when sample or replicate is below detection limit
Replicate Limit: 20% RPD
#: per EPA CLP protocol, control limits do not apply if sample and/or replicate concentration is less than 5x the detection limit

Laboratory Control Sample/Post Digestion Spike Analysis

Analyte	Sample ID	Sample Conc. µg/L	Spike Conc. µg/L	Spike Amount µg/L	Percent Recovery
Al	LCS	38.81	2436.	2500.	95.9
Al	LCS	38.81	2658.	2500.	105.
Al	20-S1693	426.3	3157.	2500.	109.
Al	LCS	75.35	2393.	2500.	92.7
Al	LCS	75.35	2355.	2500.	91.2
Al	20-S1694	497.4	2635.	2500.	85.5
As	LCS	< 7	2412.	2500.	96.5
As	LCS	< 7	2430.	2500.	97.2
As	20-S1693	< 7	2477.	2500.	99.1
Be	LCS	< 0.2	2251.	2500.	90.0
Be	LCS	< 0.2	2178.	2500.	87.1
Be	20-S1693	< 0.2	2222.	2500.	88.9
Cd	LCS	< 0.4	2468.	2500.	98.7
Cd	LCS	< 0.4	2479.	2500.	99.2
Cd	20-S1693	2.835	2458.	2500.	98.2
Co	LCS	< 0.5	2393.	2500.	95.7
Co	LCS	< 0.5	2404.	2500.	96.2
Co	20-S1693	< 0.5	2409.	2500.	96.4
Cr	LCS	< 0.8	2405.	2500.	96.2
Cr	LCS	< 0.8	2420.	2500.	96.8
Cr	20-S1693	54.57	2503.	2500.	97.9
Cu	LCS	< 5	2305.	2500.	92.2
Cu	LCS	< 5	2338.	2500.	93.5
Cu	20-S1693	38.86	2532.	2500.	99.7
Mn	LCS	< 0.3	2413.	2500.	96.5
Mn	LCS	< 0.3	2430.	2500.	97.2
Mn	20-S1693	32.89	2524.	2500.	99.6
Ni	LCS	< 3	2433.	2500.	97.3
Ni	LCS	< 3	2444.	2500.	97.8
Ni	20-S1693	15.07	2452.	2500.	97.5
P	LCS	< 20	2436.	2500.	97.4
P	LCS	< 20	2471.	2500.	98.8
P	20-S1693	2097.	4551.	2500.	98.2
Pb	LCS	< 5	2484.	2500.	99.4
Pb	LCS	< 5	2516.	2500.	101.
Pb	20-S1693	220.8	2646.	2500.	97.0
Sb	LCS	< 5	2370.	2500.	94.8

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

QA/QC Report

Client Name: ETS
Project Number: E043
Analytical Technique: ICP - Optima 8300
Sample Description: EPA Method 29 Cont. 1&3
Report Number: 20-378

Laboratory Control Sample/Post Digestion Spike Analysis

Analyte	Sample ID	Sample Conc. µg/L	Spike Conc. µg/L	Spike Amount µg/L	Percent Recovery
Sb	LCS	< 5	2388.	2500.	95.5
Sb	20-S1693	< 5	2428.	2500.	97.1
Se	LCS	< 15	2379.	2500.	95.2
Se	LCS	< 15	2368.	2500.	94.7
Se	20-S1693	< 15	2336.	2500.	93.4
V	LCS	< 1	2378.	2500.	95.1
V	LCS	< 1	2397.	2500.	95.9
V	20-S1693	< 1	2475.	2500.	99.0
Zn	LCS	< 3	2567.	2500.	103.
Zn	LCS	< 3	2578.	2500.	103.
Zn	20-S1693	242.0	2798.	2500.	102.

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

Laboratory Control Sample Duplicate Data

Analyte	Sample ID	Spike Conc. µg/L	Duplicate Conc. µg/L	RPD
Al	LCS-DUP	2440	2660	8.72
Al	LCS-DUP	2390	2360	1.60
As	LCS-DUP	2410	2430	0.74
Be	LCS-DUP	2250	2180	3.30
Cd	LCS-DUP	2470	2480	0.44
Co	LCS-DUP	2390	2400	0.46
Cr	LCS-DUP	2400	2420	0.62
Cu	LCS-DUP	2300	2340	1.42
Mn	LCS-DUP	2410	2430	0.70
Ni	LCS-DUP	2430	2440	0.45
P	LCS-DUP	2440	2470	1.43
Pb	LCS-DUP	2480	2520	1.28
Sb	LCS-DUP	2370	2390	0.76
Se	LCS-DUP	2380	2370	0.46
V	LCS-DUP	2380	2400	0.80
Zn	LCS-DUP	2570	2580	0.43

Duplicate Limit: 20% RPD

Client Name: ETS
Project Number: E043
Analytical Technique: ICP - Optima 8300
Sample Description: EPA Method 29 Cont. 4
Report Number: 20-378

Blank Data

Analyte	Sample ID	Measured Conc. µg/L	DL Conc. µg/L
Al	ICB	< DL	15.0
Al	MB_FH	38.8	15.0
Al	CCB	< DL	15.0
Al	MB_BH	75.4	15.0
Al	CCB	< DL	15.0
Al	CCB	< DL	15.0
As	ICB	< DL	7.00
As	Meth_Blk	< DL	7.00
As	CCB	< DL	7.00
As	CCB	< DL	7.00
Be	ICB	< DL	0.200
Be	Meth_Blk	< DL	0.200
Be	CCB	< DL	0.200
Be	CCB	< DL	0.200
Cd	ICB	< DL	0.400
Cd	Meth_Blk	< DL	0.400
Cd	CCB	< DL	0.400
Cd	CCB	< DL	0.400
Co	ICB	< DL	0.500
Co	Meth_Blk	< DL	0.500
Co	CCB	< DL	0.500
Co	CCB	< DL	0.500
Cr	ICB	< DL	0.800
Cr	Meth_Blk	9.40	0.800
Cr	CCB	< DL	0.800
Cr	CCB	< DL	0.800
Cu	ICB	< DL	5.00
Cu	Meth_Blk	< DL	5.00
Cu	CCB	< DL	5.00
Cu	CCB	< DL	5.00
Mn	ICB	< DL	0.300
Mn	Meth_Blk	1.43	0.300
Mn	CCB	< DL	0.300
Mn	CCB	< DL	0.300
Ni	ICB	< DL	3.00
Ni	Meth_Blk	< DL	3.00
Ni	CCB	< DL	3.00
Ni	CCB	< DL	3.00
P	ICB	< DL	20.0
P	Meth_Blk	< DL	20.0
P	CCB	< DL	20.0
P	CCB	< DL	20.0
Pb	ICB	< DL	5.00
Pb	Meth_Blk	< DL	5.00
Pb	CCB	< DL	5.00
Pb	CCB	< DL	5.00
Sb	ICB	< DL	5.00
Sb	Meth_Blk	6.45	5.00
Sb	CCB	< DL	5.00
Sb	CCB	< DL	5.00
Se	ICB	< DL	15.0
Se	Meth_Blk	< DL	15.0
Se	CCB	< DL	15.0
Se	CCB	< DL	15.0
V	ICB	< DL	1.00
V	Meth_Blk	< DL	1.00
V	CCB	< DL	1.00
V	CCB	< DL	1.00

*: Sample Media Blank (SM_Blk) concentration in µg/filter
ICB: Initial Calibration Blank CCB: Continuing Calibration Blank
Method Blank is in control if Method Blank results are <10% of sample results

QA/QC Report

Client Name: ETS
Project Number: E043
Analytical Technique: ICP - Optima 8300
Sample Description: EPA Method 29 Cont. 4
Report Number: 20-378

Blank Data

Analyte	Sample ID	Measured Conc. µg/L	DL Conc. µg/L
Zn	ICB	< DL	3.00
Zn	Meth_Blk	< DL	3.00
Zn	CCB	< DL	3.00
Zn	CCB	< DL	3.00

*: Sample Media Blank (SM_Blk) concentration in µg/filter
ICB: Initial Calibration Blank CCB: Continuing Calibration Blank
Method Blank is in control if Method Blank results are <10% of sample results

Calibration QC

Analyte	Sample ID	Standard Conc. µg/L	Measured Conc. µg/L	Percent Recovery
Al	ICV	2500	2400	95.9
Al	LL-CCV	150.	136.	90.8
Al	LL-LCS	75.0	78.7	105.0
Al	CCV	2500	2490	99.4
Al	LL-LCS	75.0	115.	153.2
Al	CCV	2500	2490	99.4
Al	CCV	2500	2370	94.8
As	ICV	2500	2490	99.8
As	LL-CCV	35.0	33.0	94.2
As	LL-LCS	20.0	19.7	98.6
As	CCV	2500	2520	100.7
As	CCV	2500	2490	99.8
Be	ICV	2500	2420	97.0
Be	LL-CCV	1.00	0.957	95.7
Be	LL-LCS	0.500	0.451	90.2
Be	CCV	2500	2390	95.7
Be	CCV	2500	2410	96.5
Cd	ICV	2500	2480	99.2
Cd	LL-CCV	2.00	1.86	93.1
Cd	LL-LCS	1.50	1.41	93.9
Cd	CCV	2500	2430	97.2
Cd	CCV	2500	2440	97.5
Co	ICV	2500	2460	98.4
Co	LL-CCV	2.50	2.68	107.2
Co	LL-LCS	1.50	1.23	82.1
Co	CCV	2500	2430	97.0
Co	CCV	2500	2440	97.4
Cr	ICV	2500	2500	100.0
Cr	LL-CCV	4.00	4.05	101.3
Cr	LL-LCS	2.00	3.75	187.6
Cr	CCV	2500	2470	98.6
Cr	CCV	2500	2470	98.8
Cu	ICV	2500	2400	96.0
Cu	LL-CCV	25.0	26.5	106.1
Cu	LL-LCS	15.0	15.4	102.5
Cu	CCV	2500	2400	95.8
Cu	CCV	2500	2400	96.1
Mn	ICV	2500	2560	102.3
Mn	LL-CCV	1.50	1.56	104.1
Mn	LL-LCS	1.00	1.38	138.3
Mn	CCV	2500	2530	101.1

ICV: Initial Calibration Verification CCV: Continuing Calibration Verification
Calibration Verification Limits: 90% - 110% Recovery
LL-CCV (Low Level CCV) Limits: 60% - 140% Recovery
LL-LCS Limits: 50% - 150% Recovery
LL-LCS results are not significant if sample results are >10x LL-LCS concentration

QA/QC Report

Client Name: ETS
Project Number: E043
Analytical Technique: ICP - Optima 8300
Sample Description: EPA Method 29 Cont. 4
Report Number: 20-378

Calibration QC

Analyte	Sample ID	Standard Conc. µg/L	Measured Conc. µg/L	Percent Recovery
Mn	CCV	2500	2530	101.2
Ni	ICV	2500	2460	98.4
Ni	LL-CCV	15.0	15.3	101.9
Ni	LL-LCS	6.00	6.22	103.7
Ni	CCV	2500	2420	96.8
Ni	CCV	2500	2430	97.0
P	ICV	2500	2470	98.9
P	LL-CCV	100.	92.5	92.5
P	LL-LCS	75.0	68.6	91.5
P	CCV	2500	2490	99.5
P	CCV	2500	2470	98.6
Pb	ICV	2500	2440	97.4
Pb	LL-CCV	25.0	23.3	93.2
Pb	LL-LCS	15.0	15.2	101.5
Pb	CCV	2500	2460	98.3
Pb	CCV	2500	2440	97.6
Sb	ICV	2500	2480	99.1
Sb	LL-CCV	25.0	21.3	85.3
Sb	LL-LCS	15.0	14.6	97.0
Sb	CCV	2500	2490	99.6
Sb	CCV	2500	2470	98.6
Se	ICV	2500	2440	97.5
Se	LL-CCV	75.0	69.4	92.5
Se	LL-LCS	30.0	35.1	117.1
Se	CCV	2500	2460	98.2
Se	CCV	2500	2430	97.2
V	ICV	2500	2490	99.4
V	LL-CCV	5.00	5.32	106.5
V	LL-LCS	3.00	3.03	101.0
V	CCV	2500	2450	98.1
V	CCV	2500	2460	98.2
Zn	ICV	2500	2490	99.5
Zn	LL-CCV	15.0	15.8	105.6
Zn	LL-LCS	6.00	7.18	119.7
Zn	CCV	2500	2450	98.2
Zn	CCV	2500	2460	98.4

ICV: Initial Calibration Verification CCV: Continuing Calibration Verification
Calibration Verification Limits: 90% - 110% Recovery
LL-CCV (Low Level CCV) Limits: 60% - 140% Recovery
LL-LCS Limits: 50% - 150% Recovery
LL-LCS results are not significant if sample results are >10x LL-LCS concentration

Replicate Data

Analyte	Sample ID	Sample Conc. µg/L	Replicate Conc. µg/L	RPD
Al	20-S1688	433.0	440.5	1.72
Al	20-S1689	335.3	328.7	1.99
As	20-S1689	< 7	< 7	N/C #
Be	20-S1689	< 0.2	< 0.2	N/C #
Cd	20-S1689	< 0.4	< 0.4	N/C #
Co	20-S1689	< 0.5	< 0.5	N/C #
Cr	20-S1689	7.689	7.492	2.60

RPD = {(sample-replicate)/[(sample+replicate)/2]}x100
N/C: RPD is not calculated when sample or replicate is below detection limit
Replicate Limit: 20% RPD
#: per EPA CLP protocol, control limits do not apply if sample and/or replicate concentration is less than 5x the detection limit

QA/QC Report

Client Name: ETS
Project Number: E043
Analytical Technique: ICP - Optima 8300
Sample Description: EPA Method 29 Cont. 4
Report Number: 20-378

Replicate Data

Analyte	Sample ID	Sample Conc. µg/L	Replicate Conc. µg/L	RPD
Cu	20-S1689	32.20	31.52	2.13
Mn	20-S1689	4.181	4.122	1.42
Ni	20-S1689	4.502	5.260	15.5 #
P	20-S1689	450.0	457.1	1.57
Pb	20-S1689	< 5	< 5	N/C #
Sb	20-S1689	8.768	7.118	20.8 #
Se	20-S1689	< 15	< 15	N/C #
V	20-S1689	< 1	< 1	N/C #
Zn	20-S1689	34.62	34.16	1.34

N/C: RPD is not calculated when sample or replicate is below detection limit
Replicate Limit: 20% RPD
#: per EPA CLP protocol, control limits do not apply if sample and/or replicate concentration is less than 5x the detection limit

Laboratory Control Sample/Post Digestion Spike Analysis

Analyte	Sample ID	Sample Conc. µg/L	Spike Conc. µg/L	Spike Amount µg/L	Percent Recovery
Al	LCS	38.81	2436.	2500.	95.9
Al	LCS	38.81	2658.	2500.	105.
Al	20-S1693	426.3	3157.	2500.	109.
Al	LCS	75.35	2393.	2500.	92.7
Al	LCS	75.35	2355.	2500.	91.2
Al	20-S1694	497.4	2635.	2500.	85.5
As	LCS	< 7	2399.	2500.	96.0
As	LCS	< 7	2365.	2500.	94.6
As	20-S1694	< 7	2335.	2500.	93.4
Be	LCS	< 0.2	2323.	2500.	92.9
Be	LCS	< 0.2	2291.	2500.	91.6
Be	20-S1694	< 0.2	2279.	2500.	91.2
Cd	LCS	< 0.4	2313.	2500.	92.5
Cd	LCS	< 0.4	2304.	2500.	92.2
Cd	20-S1694	< 0.4	2334.	2500.	93.4
Co	LCS	< 0.5	2292.	2500.	91.7
Co	LCS	< 0.5	2288.	2500.	91.5
Co	20-S1694	< 0.5	2274.	2500.	91.0
Cr	LCS	9.395	2383.	2500.	94.9
Cr	LCS	9.395	2391.	2500.	95.3
Cr	20-S1694	101.4	2384.	2500.	91.3
Cu	LCS	< 5	2322.	2500.	92.9
Cu	LCS	< 5	2331.	2500.	93.2
Cu	20-S1694	15.49	2454.	2500.	97.5
Mn	LCS	1.433	2384.	2500.	95.3
Mn	LCS	1.433	2393.	2500.	95.7
Mn	20-S1694	13.93	2382.	2500.	94.7
Ni	LCS	< 3	2326.	2500.	93.0
Ni	LCS	< 3	2317.	2500.	92.7
Ni	20-S1694	8.093	2305.	2500.	91.9
P	LCS	< 20	2326.	2500.	93.0
P	LCS	< 20	2307.	2500.	92.3
P	20-S1694	851.4	3148.	2500.	91.9
Pb	LCS	< 5	2318.	2500.	92.7
Pb	LCS	< 5	2294.	2500.	91.8
Pb	20-S1694	< 5	2291.	2500.	91.6
Sb	LCS	6.451	2308.	2500.	92.1

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

QA/QC Report

Client Name: ETS
Project Number: E043
Analytical Technique: ICP - Optima 8300
Sample Description: EPA Method 29 Cont. 4
Report Number: 20-378

Laboratory Control Sample/Post Digestion Spike Analysis

Analyte	Sample ID	Sample Conc. µg/L	Spike Conc. µg/L	Spike Amount µg/L	Percent Recovery
Sb	LCS	6.451	2296.	2500.	91.6
Sb	20-S1694	< 5	2262.	2500.	90.5
Se	LCS	< 15	2331.	2500.	93.2
Se	LCS	< 15	2301.	2500.	92.0
Se	20-S1694	< 15	2320.	2500.	92.8
V	LCS	< 1	2369.	2500.	94.8
V	LCS	< 1	2374.	2500.	95.0
V	20-S1694	< 1	2370.	2500.	94.8
Zn	LCS	< 3	2344.	2500.	93.8
Zn	LCS	< 3	2324.	2500.	93.0
Zn	20-S1694	26.02	2396.	2500.	94.8

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

Laboratory Control Sample Duplicate Data

Analyte	Sample ID	Spike Conc. µg/L	Duplicate Conc. µg/L	RPD
Al	LCS-DUP	2440	2660	8.72
Al	LCS-DUP	2390	2360	1.60
As	LCS-DUP	2400	2360	1.43
Be	LCS-DUP	2320	2290	1.39
Cd	LCS-DUP	2310	2300	0.39
Co	LCS-DUP	2290	2290	0.17
Cr	LCS-DUP	2380	2390	0.34
Cu	LCS-DUP	2320	2330	0.39
Mn	LCS-DUP	2380	2390	0.38
Ni	LCS-DUP	2330	2320	0.39
P	LCS-DUP	2330	2310	0.82
Pb	LCS-DUP	2320	2290	1.04
Sb	LCS-DUP	2310	2300	0.52
Se	LCS-DUP	2330	2300	1.30
V	LCS-DUP	2370	2370	0.21
Zn	LCS-DUP	2340	2320	0.86

Duplicate Limit: 20% RPD

QA/QC Report

Client Name: ETS
Project Number: E043
Analytical Technique: CVAA
Sample Description: EPA Method 29 Cont. 1&3
Report Number: 20-378

Blank Data

Analyte	Sample ID	Measured Conc. µg	DL Conc. µg
Hg	ICB	< DL	0.007
Hg	Meth_Blk	< DL	0.007
Hg	CCB	< DL	0.007
Hg	CCB	< DL	0.007
Hg	CCB	< DL	0.007

ICB: Initial Calibration Blank CCB: Continuing Calibration Blank
Method Blank is in control if Method Blank results are <10% of sample results

Calibration QC

Analyte	Sample ID	Standard Conc. µg	Measured Conc. µg	Percent Recovery
Hg	ICV	5.00	5.09	101.7
Hg	LL-LCS	0.020	0.008	40.0
Hg	CCV	5.00	5.10	102.1
Hg	CCV	5.00	5.09	101.7
Hg	CCV	5.00	5.07	101.5

ICV: Initial Calibration Verification CCV: Continuing Calibration Verification
Calibration Verification Limits: 90% - 100% Recovery
LL-LCS Limits: 50% - 150% Recovery
LL-LCS results are not significant if sample results are >10x LL-LCS concentration

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. µg/L	Spike Conc. µg/L	Spike Amount µg/L	Percent Recovery
Hg	LCS	< 0.007	3.96	5.00	79.1
Hg	LCS	< 0.007	4.37	5.00	87.4
Hg	20-S1688	0.022	5.07	5.00	101.

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

Laboratory Control Sample Duplicate Data

Analyte	Sample ID	Spike Conc. µg/L	Duplicate Conc. µg/L	RPD
Hg	LCS-DUP	3.96	4.37	9.94

Duplicate Limit: 20% RPD

QA/QC Report

Client Name: ETS
Project Number: E043
Analytical Technique: CVAA
Sample Description: EPA Method 29 Cont. 4, 5a, 5b
Report Number: 20-378

Blank Data

Analyte	Sample ID	Measured Conc. µg	DL Conc. µg
Hg	ICB	< DL	0.007
Hg	CCB	< DL	0.007
Hg	CCB	< DL	0.007
Hg	CCB	< DL	0.007
Hg	CCB	< DL	0.007
Hg	CCB	< DL	0.007

ICB: Initial Calibration Blank CCB: Continuing Calibration Blank
Method Blank is in control if Method Blank results are <10% of sample results

Calibration QC

Analyte	Sample ID	Standard Conc. µg	Measured Conc. µg	Percent Recovery
Hg	ICV	5.00	5.05	101.0
Hg	LL-LCS	0.020	0.020	100.0
Hg	CCV	5.00	5.04	100.9
Hg	CCV	5.00	5.02	100.4
Hg	CCV	5.00	5.04	100.7
Hg	CCV	5.00	5.03	100.6
Hg	CCV	5.00	5.05	100.9

ICV: Initial Calibration Verification CCV: Continuing Calibration Verification
Calibration Verification Limits: 90% - 100% Recovery
LL-LCS Limits: 50% - 150% Recovery
LL-LCS results are not significant if sample results are >10x LL-LCS concentration

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. µg/L	Spike Conc. µg/L	Spike Amount µg/L	Percent Recovery
Hg	20-S1689	0.031	5.13	5.00	102.
Hg	20-S1690	0.011	5.10	5.00	102.
Hg	20-S1691	0.030	5.15	5.00	102.

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

QA/QC Report

Client Name: ETS
Project Number: E043
Analytical Technique: CVAA
Sample Description: EPA Method 29 Cont. 5c
Report Number: 20-378

Blank Data

Analyte	Sample ID	Measured Conc. µg	DL Conc. µg
Hg	ICB	< DL	0.007
Hg	CCB	< DL	0.007

ICB: Initial Calibration Blank CCB: Continuing Calibration Blank
Method Blank is in control if Method Blank results are <10% of sample results

Calibration QC

Analyte	Sample ID	Standard Conc. µg	Measured Conc. µg	Percent Recovery
Hg	ICV	5.00	5.00	100.0
Hg	LL-LCS	0.020	0.015	75.0
Hg	CCV	5.00	5.01	100.2

ICV: Initial Calibration Verification CCV: Continuing Calibration Verification
Calibration Verification Limits: 90% - 100% Recovery
LL-LCS Limits: 50% - 150% Recovery
LL-LCS results are not significant if sample results are >10x LL-LCS concentration

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. µg/L	Spike Conc. µg/L	Spike Amount µg/L	Percent Recovery
Hg	20-S1692	< 0.007	5.05	5.00	101.

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	ETS	Date	9/8/20
# Runs	3 + Blank	Report #	20-378

Custody Seals Inspected, If Present	Hand Delivered	
Chain-of-Custody Form Inspected	✓	
CoC present with samples?	✓	*
CoC indicate analytical methodology to be used? (eg M29 etc)	M29	!!
CoC indicate if compliance testing? (esp. M26)	Not Stated	!!
M26 samples have Thiosulfate added in field?	NA	!!
M29 indicate FH/BH separate or combined?	Hg - Separate	!!
Has Form Been Signed?	✓	
Have Date and Time Custody Released Been Noted on Form?	✓	
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?	✓	*
If required by method, did client vent samples prior to shipment?	✓	
Are the Sample Containers Intact?	✓	!!
Are signs of leakage present?	NO	*
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)	9/8 LvB	
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 Lisa Ball

Notes Client emailed updated CoC with additional analytes on 9/23/20.

Report # 20-378

ETS
2105 Corey Road
Central Point, OR 97502
Office: 541-779-2646
FAX: 541-734-5537

CHAIN of CUSTODY

Client: Oil Re-Refining Company
Location: Klamath Falls, Or.

Project No.: 2020.2232
Test Date: Aug.25-26 , 2020
Project Manager: A. Winkler
Emission Source:
Auxiliary Boiler

Laboratory: Chester LabNet
Contact: Mr. Paul Duda
Telephone: 503.624.2183
Fax: 503.624.2653

Results Needed By: *Normal*

Al
Cu
V
Zn

SAMPLE IDENTIFICATION	SAMPLE SOURCE	SAMPLE DISCRIPTION		EPA Method 29	
				Arsenic, Beryllium, Cadmium, Chromium, Lead, Manganese, Nickel, Selenium	Mercury
2020.2232.M29.01 2051688	Aux. Boiler	Run #1, Container #1	Filter	X	X
2020.2232.M29.02 ↓	Aux. Boiler	Run #1, Container #3	P/N, 0.1nHNO3 rinse	X	X
2020.2232.M29.03 51689	Aux. Boiler	Run #1, Container #4	Imp 1,2&3	X	X
2020.2232.M29.04 51690	Aux. Boiler	Run #1, Container #5a	Imp #4, K.O.	X	X
2020.2232.M29.05 51691	Aux. Boiler	Run #1, Container #5b	Imp #5 & #6 (KMnO4).		X
2020.2232.M29.06 51692	Aux. Boiler	Run #1, Container #5c	#5 & #6 8N HCl rinse		X
2020.2232.M29.07 51693	Aux. Boiler	Run #2, Container #1	Filter	X	X
2020.2232.M29.08 ↓	Aux. Boiler	Run #2, Container #3	P/N, 0.1nHNO3 rinse	X	X
2020.2232.M29.09 51694	Aux. Boiler	Run #2, Container #4	Imp 1,2&3	X	X
2020.2232.M29.10 51695	Aux. Boiler	Run #2, Container #5a	Imp #4, K.O.	X	X
2020.2232.M29.11 51696	Aux. Boiler	Run #2, Container #5b	Imp #5 & #6 (KMnO4).		X
2020.2232.M29.12 51697	Aux. Boiler	Run #2, Container #5c	#5 & #6 8N HCl rinse		X
2020.2232.M29.13 51698	Aux. Boiler	Run #3, Container #1	Filter	X	X
2020.2232.M29.14 ↓	Aux. Boiler	Run #3, Container #3	P/N, 0.1nHNO3 rinse	X	X
2020.2232.M29.15 51699	Aux. Boiler	Run #3, Container #4	Imp 1,2&3	X	X
2020.2232.M29.16 51700	Aux. Boiler	Run #3, Container #5a	Imp #4, K.O.	X	X
2020.2232.M29.17 51701	Aux. Boiler	Run #3, Container #5b	Imp #5 & #6 (KMnO4).		X
2020.2232.M29.18 51702	Aux. Boiler	Run #3, Container #5c	#5 & #6 8N HCl rinse		X

CHAIN of CUSTODY *continued*

2020.2232.M29.19	20-1707	EPA 29 - QA/QC	Container #8a	0.1N HNO3, 300ml	X	X
2020.2232.M29.20	51706	EPA 29 - QA/QC	Container #8b	DI water blank, 100ml.	X	X
2020.2232.M29.21	51705	EPA 29 - QA/QC	Container #9	HNO3/H2O2, 300ml.	X	X
2020.2232.M29.22	51702	EPA 29 - QA/QC	Container #10	KMnO4, 100ml		X
2020.2232.M29.23	51708	EPA 29 - QA/QC	Container #11	8N HCl, 25ml 8N HCl into 200ml DI water		X
2020.2232.M29.24	51704	EPA 29 - QA/QC	Container #12	Filter blank, unused filter.	X	X

Comments:

Sent by: Anna Winkler	Received by: Lisa Ball
Date/Time: 9-8-2020 1500	Date/Time: 9/8/20 15:05

Sent by:	Received by:
Date/Time:	Date/Time:

RAW DATA

Available upon request

Auxiliary Boiler EPA Method 29

Client: ORRCO
Location: Klamath Falls, OR
Source: Auxiliary Boiler
Date: Aug. 25 & 26, 2020
Project No.: 2020.2232

		Run #1	Run #2	Run #3	
		Aug. 25	Aug. 25	Aug. 26	
	Start	10:32	16:00	10:13	
	End	13:43	19:32	13:45	**Averages**
Q:	Total sample time[1]:	180	200	200	**193**
Vm:	(Volume,dry gas meter,cf)	142.298	169.704	153.702	**155.235**
Y:	(Dry gas meter calibration factor)	0.991	0.991	0.991	**0.991**
Pbar:	(Barometric pressure,in.Hg)	25.82	25.82	25.78	**25.81**
ΔH:	(Avg. differential pressure,in.H2O)	1.56	1.77	1.47	**1.60**
Tm:	(Avg. meter temperature,°F)	103.8	108.7	101.3	**104.6**
Vm(std.):	(Std.* sample gas volume, DSCF)	114.421	135.377	123.930	**124.576**
	(Std.* sample gas volume, DSCM)	3.240	3.834	3.510	**3.530**
Vlc:	(Liquid volume collected,ml)	186.1	223.1	208.2	**205.8**
WV:	(Final silica weight)	24.4	28.5	24.2	**25.7**
Vw(std):	(Std.* water vapor volume,scf)	9.910	11.845	10.941	**10.899**
SVP:	(Saturated H_2O vapor pressure, in. Hg)	415.08	414.93	461.34	**430.45**
Bwsat:	(Saturated Moisture @ Ts)	16.081	16.075	17.900	**16.685**
Bwsvol	(Volumemetric Moisture content)	0.080	0.080	0.081	**0.080**
Bws:	(SCF H_2O / SCF Total)[2]	0.080	0.080	0.081	**0.080**
%CO_2:	(Carbon Dioxide,% by volume,dry)	6.70	6.46	7.52	**6.89**
%O_2:	(Oxygen,% by volume,dry)	11.62	11.61	10.43	**11.22**
%N_2:	(Nitrogen,% by volume,dry)	81.68	81.93	82.05	**81.89**
Md:	(Molecular Weight,lb/lb-mole,dry)	29.54	29.50	29.62	**29.55**
Mw:	(Molecular Weight,lb/lb-mole,wet)	28.62	28.57	28.68	**28.62**
D:	(Duct diameter, in.)	16.00	16.00	16.00	**16.00**
A:	(Duct area, sq. ft.)	1.40	1.40	1.40	**1.40**
Dn:	(Nozzle diameter, in.)	0.495	0.495	0.495	***0.495***
An:	(Nozzle area, ft2)	1.34E-03	1.34E-03	1.34E-03	***1.34E-03***
Ts:	(Stack temperature, °F)	460.7	460.6	475.4	**465.6**
Pg:	(Static pressure of flue gas, in. H_2O)	-0.10	-0.10	-0.10	**-0.10**
Ps:	(Absolute stack gas pressure, in. Hg)	25.81	25.81	25.77	**25.80**
Cp:	(Pitot tube coefficient)	0.80	0.80	0.80	**0.80**
ΔP:	(Average velocity head, in. H_2O)	0.054	0.061	0.052	**0.055**
√ΔP:	(Average velocity head, SqRt in. H_2O)	0.230	0.245	0.226	**0.234**
Vs:	(Gas velocity, ft./second)	17.6	18.7	17.4	**17.9**
ACFM:	(Actual cubic feet/min., wet)	1,474	1,568	1,458	**1,500**
SCFM	(Std. cubic ft/min., wet)	730	776	709	**738**
SDCFM:	(Std.* cubic feet/min., dry)	671	713	652	**679**
SDCMM:	(Std.* cubic meter/min., dry)	19.011	20.206	18.454	**19.224**
% Iso:	Isokinetic variation)	99.0	99.2	99.4	***99.2***

[1] - Total sample time does not include port change.

[2] - If the Volumetric moisture exceeds the calculated saturated moisture, the calculated saturated moisture is used.

M-29

Client: ORACO
Location: KLAMATH FALLS
Source: AUX. BOILER
Date: 8-25
Project No.: 2020.2232

		Run #1	Run #2	Run #3
Time:	start:	1032	1000	1013
	finish:	1343	1932	1345
Q: Total sample time(min.):		180	200	200
Vm: (Volume,dry gas meter,cf)		142.298	169.704	153.702
Y: (Dry gas meter calibration factor)		0991	0991	0.991
Pbar: (Barometric pressure,in.Hg)		25.82	25.82	25.78
DH: (Avg. differential pressure,in.H2O)		1.520	1.77	1.47
Tm: (Avg. meter temperature,°F)		103.8	108.7	101.3

	RUN #: Filter #:			RUN #: Filter #:			RUN #: Filter #:		
	Filter tare weight, gms.:			Filter tare weight, gms.:			Filter tare weight, gms.:		
CONTENTS	**FINAL**	**TARE**	**NET**	**FINAL**	**TARE**	**NET**	**FINAL**	**TARE**	**NET**
K.O.		—			—			-	
HNO_3/H_2O_2	946.4	748.2	198.2	990.9	763.3	227.6	875.1	657.5	217.6
HNO_3/H_2O_2	783.5	755.7	27.8	793.5	761.1	32.4	788.0	758.4	29.6
K.O.	591.8	588.5	3.3	602.1	597.3	4.8	607.2	603.8	3.4
KMnO4	769.0	763.9	5.1	801.0	793.8	7.2	769.5	763.0	6.5
KMnO4	764.7	763.0	1.7	764.8	763.7	1.1	757.1	756.0	1.1
SiGEL	993.6	969.2	24.4	1018.5	990.0	28.5	963.5	939.3	24.2
L.W.		968.2	-50			-50			-50
Vlc: (Liquid volume collected, ml)			180.1			223.1			208.2
Si: (Silica Gel)			24.4			28.5			24.2

%CO2: (Carbon Dioxide,% by volume,dry)	6.70	6.64	7.52
%O2: (Oxygen,% by volume,dry)	11.62	11.61	10.43
%N: (Nitrogen,% by volume,dry)	81.68	81.75	82.05
D: (Duct diameter, in.)	16.0	16.0	16.0
A: (Duct area, sq. ft.)	1.40	1.40	1.40
Dn: (Nozzle diameter, inches)	0.495	0.495	0.495
Ts: (Stack temperature, °F)	460.7	460.6	475.4
Pg: (Static pressure of flue gas, in. H_2O)	-0.10	-0.10	-0.10
Ps: (Absolute stack gas pressure, in. Hg)	25.81	25.81	25.77
Cp: (Pitot tube coefficient)	0.80	0.80	0.80
#: (Pitot tube number)	M5.4.1	M5.4.1	M5.4.1
√DP: (Average velocity head, in. H_2O)	0.230	0.245	0.220
% ISO: (Mini iso)	99.8	100.5	100.8

*Standard conditions corrected to 68°F, 29.92 in. Hg.

R-1 STRONG PURPLE 80Z

R-2 STRONG PURPLE 80Z

R-3 STRONG PURPLE 80Z

HANDY 5.602 REMAINING

Document Control # 2020.451

High Flow/Isokinetics Data Sheet

Method: 29

Company/Plant: ORRCO

Sampling location: Klamath Falls, OR

Date: 8-25-20 Project #: 2020.2232

Operator: JDB

Meter Box #: HF-4 Meter Box H@: 1.609

Meter Box Calibration(Y): 0.991

Probe #: MS.4.1 c_p: 0.80

Filter Box #: F-2

Pitot Tube Leak Check			
Side A:	0.0	@ -7	(in)H_2O
Side B:	0.0	@ -7	(in)H_2O

Sample Train Leak Check			
Initial:	0.003	Cuft@ -10	(in)Hg
Final:	0.001	Cuft@ -5	(in)Hg
Ambient Temp (°F):	96°		

Run #: 1

Barometric Pressure(P_b): 25.82 (in)Hg

Duct Diameter(in): 16" (D_b) (D_a)

Assumed Moisture(%) (T_w): (T_a):

Nozzle Dia_{avg}: 0.495 Nozzle ID: G49

Static Pressure("H_2O): -0.10

Probe & Nozzle Material: Glass

Impinger Exit #: 3

	mln./pt Traverse Pt. Number	Time: Sampling Time	Time: Clock (24 hr.)	Sample Vacuum (in)Hg.	Stack Temp (°F)	Velocity Head $\Delta Ps(in)H_2O$	Pressure Differential DH (in) H2O	Gas sample Volume (Vm) (Cuft)	Dry Gas Meter Temp (°F): Inlet	Dry Gas Meter Temp (°F): Outlet	Sample Probe Temps(°F): Probe	Sample Probe Temps(°F): Filter	Exit Gas Temp(°F)	
1	10	0	1032	-2.5	431	0.05	1.46	642.000	88	87	251	254	67	
2	9	9	1041	-2.0	432	0.04	1.17	648.84	92	88	249	245	51	
3	8	18	1050	-2.5	445	0.05	1.45	654.96	95	90	251	256	51	
4	7	27	1059	-2.5	454	0.05	1.45	661.80	99	92	250	245	50	
5	6	36	1108	-2.5	464	0.06	1.73	668.64	102	94	247	255	50	
6	5	45	1117	-2.5	469	0.06	1.72	676.11	104	96	250	246	50	
7	4	54	1126	-2.5	470	0.07	2.01	683.58	105	98	250	253	50	
8	3	63	1135	-2.5	467	0.07	2.02	691.68	107	99	250	247	51	
9	2	72	1144	-2.5	461	0.06	1.75	699.78	108	100	250	252	53	
1202/1213 10	1	81	1153	-2.5	461	0.06	1.75	707.34	109	102	251	247	54	
1	10	90	1202/1213	-2.0	443	0.04	1.19	714.90	104	103	248	248	67	
2	9	99	1222	-2.0	448	0.04	1.19	721.11	107	103	250	249	56	
3	8	108	1231	-2.0	457	0.04	1.18	727.32	109	104	250	255	57	
4	7	117	1240	-2.5	463	0.05	1.47	733.53	111	105	250	248	58	
5	6	126	1249	-2.5	472	0.05	1.46	740.46	113	106	250	253	60	
6	5	135	1258	-2.5	477	0.05	1.45	747.39	115	108	250	245	64	
7	4	144	1307	-2.5	477	0.06	1.75	754.32	116	109	250	254	53	← ADDED ICE
8	3	153	1316	-2.5	475	0.05	1.46	761.97	117	110	249	248	50	
9	2	162	1325	-2.5	473	0.06	1.76	768.99	117	111	249	252	50	
10	1	171	1334	-2.5	474	0.06	1.76	776.64	118	112	250	249	50	
		180	1343					784.298						
Average														

Post Test T/C	
Reference °F	Probe °F

High Flow/Isokinetics Data Sheet

Method: 29

Company/Plant: ORRCO

Sampling location: Klamath Falls, OR

Date: 8-25-20 Project #: 2020.2232

Operator: SDR

Meter Box #: HF-4 Meter Box H@: 1.69

Meter Box Calibration(Y): 0.991

Probe #: MS.4.1 C_p: 0.80

Filter Box #: 2

Pitot Tube Leak Check

Side A: 0.0 @ -5 (in)H_2O

Side B: 0.0 @ -5 (in)H_2O

Sample Train Leak Check

Initial: 0.002 Cuft@ -10 (in)Hg

Final: 0.001 Cuft@ -5 (in)Hg

Ambient Temp (°F): 88

Run #: 2

Barometric Pressure(P_b): 25.82 (in)Hg

Duct Diameter(in): 16" (D_b) (D_a)

Assumed Moisture(%) (T_w): (T_d):

Nozzle Dia_{avg}: 0.495 Nozzle ID: 949

Static Pressure("H_2O): -0.10

Probe & Nozzle Material: Glass

Impinger Exit #: 3

min./pt	Time		Sample	Stack	Velocity	Pressure	Gas sample	Dry Gas Meter Temp (°F)		Sample Probe Temps(°F)		Exit
Traverse Pt. Number	Sampling Time	Clock (24 hr.)	Vacuum (in)Hg.	Temp (°F)	Head $\Delta Ps(in)H_2O$	Differential DH (in) H2O	Volume (Vm) (Cuft)	Inlet	Outlet	Probe	Filter	Gas Temp(°F)
1	0	1600	-2.0	382	0.04	1.28	784.800	105	105	250	249	67
2	10	1610	-2.0	403	0.04	1.24	792.00	104	104	250	249	57
3	20	1620	-2.5	428	0.05	1.52	799.10	107	104	249	250	55
4	30	1630	-2.5	455	0.05	1.47	807.00	109	104	250	250	54
5	40	1640	-3.0	473	0.06	1.74	814.70	111	105	250	250	55
6	50	1650	-3.0	478	0.06	1.73	823.10	112	106	250	250	55
7	60	1700	-3.5	479	0.07	2.02	831.50	113	106	750	250	56
8	70	1710	-3.5	478	0.07	2.03	840.60	114	107	250	250	57
9	80	1720	-3.5	476	0.07	2.03	849.70	114	108	250	249	58
10	90	1730	-3.5	476	0.07	2.04	858.80	115	108	250	250	60
1	100	~~1740~~ 1752	-2.5	429	0.05	1.52	867.90	109	108	251	251	67
2	110	1802	-2.5	448	0.05	1.49	875.80	110	107	750	249	57
3	120	1812	-2.5	459	0.05	1.48	883.60	112	107	250	250	55
4	130	1822	-3.0	472	0.06	1.75	891.40	112	107	249	250	55
5	140	1832	-3.5	480	0.07	2.02	899.90	112	107	251	250	54
6	150	1842	-3.5	485	0.07	2.01	909.00	112	107	751	250	54
7	160	1852	-3.5	482	0.07	2.02	918.10	112	107	250	250	55
8	170	1902	-3.5	479	0.07	2.02	927.20	112	107	249	250	57
9	180	1912	-3.5	475	0.07	2.03	936.30	112	107	250	250	58
10	190	1922	-4.0	475	0.07	2.03	945.40	112	107	750	250	57
	200	1932					954.504					
Average												

1740
1752

↳ ADDED ICE

Post Test T/C	
Reference °F	Probe °F

High Flow/Isokinetics Data Sheet

Method: 29

Company/Plant: ORRCO

Sampling location: Klamath Falls, OR

Date: 8-26-20 Project #: 2020.2232

Operator: JDB

Meter Box #: HF-4 Meter Box H@: 1.69

Meter Box Calibration(Y): 0.991

Probe #: M5.4.1 C_p: 0.80

Filter Box #: 2

Pitot Tube Leak Check			
Side A:	0.0	@ −8	(in)H_2O
Side B:	0.0	@ −8	(in)H_2O

Sample Train Leak Check			
Initial:	0.003	Cuft@ −10	(in)Hg
Final:	0.003	Cuft@ −6	(in)Hg
Ambient Temp (°F):	99		

Run #: 3

Barometric Pressure(P_b): 25.78 (in)Hg

Duct Diameter(in): 16" (D_b) (D_a)

Assumed Moisture(%) (T_w): (T_d):

Nozzle Dia_{avg}: 0.495 Nozzle ID: G49

Static Pressure("H_2O): −0.10

Probe & Nozzle Material: Glass

Impinger Exit #: 3

min./pt Traverse Pt. Number	Time: Sampling Time	Time: Clock (24 hr.)	Sample Vacuum (in)Hg.	Stack Temp (°F) 447	Velocity Head ΔPs(in)H_2O	Pressure Differential DH (in) H2O	Gas sample Volume (Vm) (Cuft)	Dry Gas Meter Temp (°F): Inlet	Dry Gas Meter Temp (°F): Outlet	Sample Probe Temps(°F): Probe	Sample Probe Temps(°F): Filter	Exit Gas Temp(°F)
1	0	1013	-2.0	~~395~~	0.04	~~1.69~~	956.600	~~81~~	~~80~~	251	251	66
2	10	1023	-2.0	451	0.04	1.14	963.30	86	81	250	249	47
3	20	1033	-2.5	461	0.05	1.42	970.00	91	84	250	250	50
4	30	1043	-2.5	473	0.05	1.40	977.50	95	86	250	250	52
5	40	1053	-2.5	479	0.06	1.68	984.90	98	89	250	250	52
6	50	1103	-2.5	484	0.06	1.68	993.10	101	92	249	250	53
7	60	1113	-2.5	482	0.06	1.69	1001.30	103	94	250	250	54
8	70	1123	-2.5	480	0.06	1.70	1009.50	105	96	250	250	54
9	80	1133	-2.5	476	0.06	1.72	1017.80	106	98	250	250	55
10	90	1143	-2.5	476	0.06	1.72	1026.10	107	100	250	250	55
1153												
1205												
1	100	~~1153~~ 1205	-2.0	452	0.04	1.18	1034.40	104	~~102~~	253	249	68
2	110	1215	-2.0	462	0.04	1.17	1041.30	107	103	250	250	56
3	120	1225	-2.0	473	0.04	1.16	1048.20	109	104	249	250	57
4	130	1235	-2.5	482	0.05	1.44	1055.10	111	105	250	250	55
5	140	1245	-2.5	488	0.05	1.43	1062.80	112	106	250	250	54
6	150	1255	-2.5	490	0.05	1.43	1070.40	113	107	250	250	54
7	160	1305	-3.0	490	0.06	1.72	1078.10	114	108	250	250	56
8	170	1315	-2.5	489	0.05	1.43	1086.50	115	108	251	250	57
9	180	1325	-3.0	487	0.06	1.73	1094.20	115	109	250	250	59
10	190	1335	-2.5	486	0.05	1.44	1102.60	116	110	250	250	59
	200	1345					1110.302					
Average												

Post Test T/C	
Reference °F	Probe °F
98	99
98	99
98	99

Sample & Traverse Point Determination

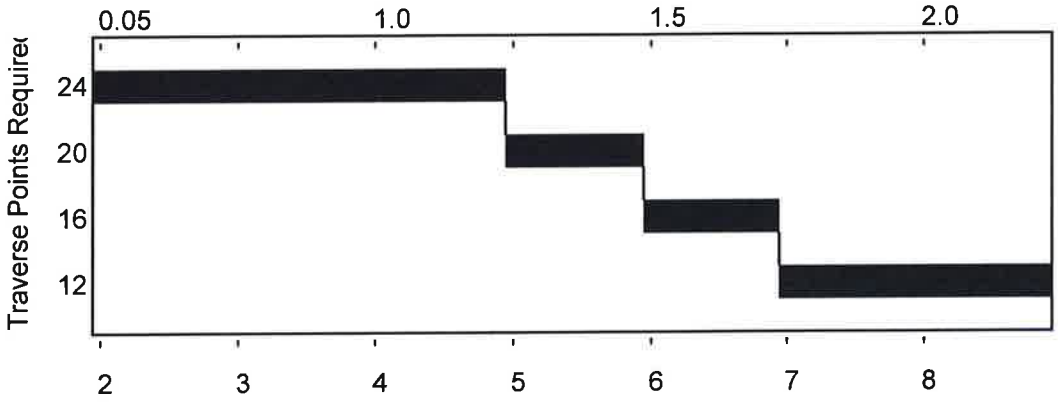
Minimum Number of Traverse Points for Particulate Traverses

EPA Method 1 Circular Ducts

Client: Oil Re-Refinon Co.
Location: Klamath Falls, Or.
Source: Auxillary Boiler
Date: 8/25/2020
Project No.: 2020.2232

Stack Diameter(in.): 16
Points Required: 20
Distance A(in.): 161.0
Distance A(dia.): 10.1
Distance B: 81.0
Distance B(dia.): 5.1

Sample Port Location
Duct Diameters upstream from flow disturbance (distance A)



Sample Port Location
Duct Diameters downstream from flow disturbance (distance B)

Traverse Point No.	Number of Traverse Points on a Diameter					***Sample Points***	**Port Legth 6.0**
	4	6	8	10	12		
1	6.7	4.4	3.2	2.6	2.1	*0.5*	***6.5***
2	25.0	14.6	10.5	8.2	6.7	*1.3*	***7.3***
3	75.0	29.6	19.4	14.6	11.8	*2.3*	***8.3***
4	93.3	70.4	32.2	22.6	17.7	*3.6*	***9.6***
5		85.5	67.7	34.2	25	*5.5*	***11.5***
6		95.6	80.6	65.8	35.6	*10.5*	***16.5***
7			89.5	77.4	64.4	*12.4*	***18.4***
8			96.8	85.4	75	*13.7*	***19.7***
9				91.8	82.3	*14.7*	***20.7***
10				97.4	88.2	*15.5*	***21.5***
11					93.3		
12					97.9		

7.0 Appendix B: Auxiliary Boiler PCDD/PCDF, PAH and PCB Emission Results

7.1 Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans (PCDF/PCDD) and Polynuclear Aromatic Hydrocarbons (PAHs) and Polychlorinated Biphyenyls (PCBs) – EPA Method 23

- 7.1.1 PCDF/PCDD Emission Results
- 7.1.2 PAH Emission Results
- 7.1.3 PCB Emission Results
- 7.1.4 EPA Method 23, Vista Analytical Laboratories Report
- 7.1.5 Emission Parameters and Volumetric Flow Rates
- 7.1.6 Field Data Sheets
- 7.1.7 Cyclonic Flow Check Documentation

Test Summary for EPA Method 23 Determination of Dioxin/Furans

Company: ORRCO
Location: Klamath Falls, OR.
Source: Auxiliary Boiler
Date: Aug. 25, 2020

i.	PCDD	PCDD ng/m3	PCDD ng/sec	PCDD lbs/1000 gal.	PCDD TEQ ng/m3	PCDD TEQ ng/sec	PCDD TEQ lbs/1000 gal.
1	2,3,7,8-TCDD	<8.38E-04	<2.67E-04	<1.41E-10	<8.38E-04	<2.67E-04	<1.41E-10
2	1,2,3,7,8-PeCDD	0.007	0.002	1.16E-09	6.91E-03	2.19E-03	1.16E-09
3	1,2,3,4,7,8-HxCDD	<7.94E-03	<2.52E-03	<1.33E-09	<7.94E-04	<2.52E-04	<1.33E-10
4	1,2,3,6,7,8-HxCDD	0.025	0.008	4.19E-09	2.50E-03	7.92E-04	4.19E-10
5	1,2,3,7,8,9-HxCDD	0.013	0.004	2.18E-09	1.30E-03	4.13E-04	2.18E-10
6	1,2,3,4,6,7,8-HpCDD	0.158	0.050	2.64E-08	1.58E-03	5.00E-04	2.64E-10
7	OCDD	0.177	0.056	2.97E-08	5.32E-05	1.68E-05	8.91E-12
			Total PCDD			*Total PCDD TEQ*	
		<3.88E-01	<1.23E-01	<6.51E-08	<1.40E-02	<4.43E-03	<2.34E-09

ii.	PCDF	PCFD ng/m3	PCFD ng/sec	PCDF lbs/1000 gal.	PCDF TEQ ng/m3	PCDF TEQ ng/sec	PCDF TEQ lbs/1000 gal.
1	2,3,7,8-TCDF	9.83E-03	3.12E-03	1.65E-09	9.83E-04	3.12E-04	1.65E-10
2	1,2,3,7,8-PeCDF	<8.11E-03	<2.57E-03	<1.36E-09	<2.43E-04	<7.71E-05	<4.01E-11
3	2,3,4,7,8-PeCDF	1.56E-02	4.95E-03	2.62E-09	4.68E-03	1.48E-03	7.85E-10
4	1,2,3,4,7,8-HxCDF	1.04E-02	3.29E-03	1.74E-09	1.04E-03	3.29E-04	1.74E-10
5	1,2,3,6,7,8- HxCDF	1.04E-02	3.30E-03	1.75E-09	1.04E-03	3.30E-04	1.75E-10
6	1,2,3,7,8,9- HxCDF	1.12E-02	3.55E-03	1.88E-09	1.12E-03	3.55E-04	1.88E-10
7	2,3,4,6,7,8-HxCDF	<1.73E-03	<5.50E-04	<2.90E-10	<1.73E-04	<5.50E-05	<2.90E-11
8	1,2,3,4,6,7,8-HpCDF	2.43E-02	7.70E-03	4.07E-09	2.43E-04	7.70E-05	4.07E-11
9	1,2,3,4,7,8,9- HpCDF	<3.50E-03	<1.11E-03	<5.86E-10	<3.50E-05	<1.11E-05	<5.86E-12
10	OCDF	8.20E-03	2.60E-03	1.37E-09	2.46E-06	7.80E-07	4.12E-13
			Total PCDF			*Total PCDF TEQ*	
		<1.03E-01	<3.27E-02	<1.73E-08	<9.56E-03	<3.03E-03	<1.60E-09

Total PCDD,PCDF:

ng/m3	ng/sec	lbs/1000 gal.	TEQ ng/m3	TEQ ng/sec	TEQ lbs/1000 gal.
<4.92E-01	<1.56E-01	<8.24E-08	<2.35E-02	<7.47E-03	<3.95E-09

DATA REPORTING: Analytes which were below analytical detection limits are flagged as a less than value, "<". Results are calculated according to ODEQ guidance, which requires that individual PAH analytes that are below method detection limits be considered present at the analyte detection limit for reporting purposes.

EPA Method 23 Determination of Dioxin/Furans

Company: ORRCO
Location: Klamath Falls, OR.
Source: Auxiliary Boiler
Date: Aug. 25, 2020

Test Run: #1
Start: 10:32
Finish: 13:43
Sample Volume Collected: 3.332 dscm
Exhaust Flow Rate: 19.010 dscmm
Fuel Firing Rate: 0.0150 1000 gal/hr

i.	PCDD	Sample Concentration (pg/sample)	EDL / EMPC (pg/sample)	PCDD ng/m3	PCDD ng/sec	PCDD lbs/1000 gal.	Toxic Eq. Factors (TEFs)	PCDD TEQ ng/m3	PCDD TEQ ng/sec	PCDD TEQ lbs/1000 gal.
1	2,3,7,8-TCDD	ND	2.64 EDL	<7.92E-04	<2.51E-04	<1.33E-10	1	<7.92E-04	<2.51E-04	<1.33E-10
2	1,2,3,7,8-PeCDD	26.6		7.98E-03	2.53E-03	1.34E-09	1	7.98E-03	2.53E-03	1.34E-09
3	1,2,3,4,7,8-HxCDD	ND	21.3 EMPC	<6.39E-03	<2.03E-03	<1.08E-09	0.1	<6.39E-04	<2.03E-04	<1.08E-10
4	1,2,3,6,7,8-HxCDD	64.1		1.92E-02	6.09E-03	3.24E-09	0.1	1.92E-03	6.09E-04	3.24E-10
5	1,2,3,7,8,9-HxCDD	34		1.02E-02	3.23E-03	1.72E-09	0.1	1.02E-03	3.23E-04	1.72E-10
6	1,2,3,4,6,7,8-HpCDD	395		1.19E-01	3.76E-02	1.99E-08	0.01	1.19E-03	3.76E-04	1.99E-10
7	OCDD	403		1.21E-01	3.83E-02	2.03E-08	0.0003	3.63E-05	1.15E-05	6.10E-12
			PCDD Total:	*<2.84E-01*	*<9.00E-02*	*4.78E-08*	*PCDD TEQ Total::*	*<1.36E-02*	*<4.30E-03*	*<2.28E-09*

ii.	PCDF	Sample Concentration (pg/sample)	EDL / EMPC (pg/sample)	PCFD ng/m3	PCFD ng/sec	PCDF lbs/1000 gal.	Toxic Eq. Factors (TEFs)	PCDF TEQ ng/m3	PCDF TEQ ng/sec	PCDF TEQ lbs/1000 gal.
1	2,3,7,8-TCDF	57.5		1.73E-02	5.47E-03	2.90E-09	0.1	1.73E-03	5.47E-04	2.90E-10
2	1,2,3,7,8-PeCDF	39.6		1.19E-02	3.77E-03	2.00E-09	0.03	3.57E-04	1.13E-04	6.00E-11
3	2,3,4,7,8-PeCDF	69.7		2.09E-02	6.63E-03	3.52E-09	0.3	6.28E-03	1.99E-03	1.06E-09
4	1,2,3,4,7,8-HxCDF	31.4		9.42E-03	2.99E-03	1.58E-09	0.1	9.42E-04	2.99E-04	1.58E-10
5	1,2,3,6,7,8- HxCDF	34.3		1.03E-02	3.26E-03	1.73E-09	0.1	1.03E-03	3.26E-04	1.73E-10
6	2,3,4,6,7,8-HxCDF	36		1.08E-02	3.42E-03	1.82E-09	0.1	1.08E-03	3.42E-04	1.82E-10
7	1,2,3,7,8,9- HxCDF	2.82		8.46E-04	2.68E-04	1.42E-10	0.1	8.46E-05	2.68E-05	1.42E-11
8	1,2,3,4,6,7,8-HpCDF	67.5		2.03E-02	6.42E-03	3.41E-09	0.01	2.03E-04	6.42E-05	3.41E-11
9	1,2,3,4,7,8,9- HpCDF	ND	7.89 EMPC	<2.37E-03	<7.50E-04	<3.98E-10	0.01	2.37E-05	<7.50E-06	<3.98E-12
10	OCDF	20.4		6.12E-03	1.94E-03	1.03E-09	0.0003	1.84E-06	5.82E-07	3.09E-13
			PCDF Total:	*<1.10E-01*	*<3.49E-02*	*<1.85E-08*	*PCDF TEQ Total:*	*<1.17E-02*	*<3.71E-03*	*<1.97E-09*
			Total PCDD,PCDF:	*<3.94E-01*	*<1.25E-01*	*<6.63E-08*	*al TEQ PCDD,PCDF:*	*<2.53E-02*	*<8.02E-03*	*<4.26E-09*

DATA REPORTING: Analytes which were below analytical detection limits are flagged as a less than value, "<". Results are calculated according to ODEQ guidance, which require that individual analytes below the estimated detection limit (EDL) or below the estimated maximum possible concentration (EMPC) be considered present at the respective detection limit for reporting purposes.

EPA Method 23 Determination of Dioxin/Furans

Company: ORRCO
Location: Klamath Falls, OR.
Source: Auxiliary Boiler
Date: Aug. 25, 2020

Test Run: #2
Start: 16:00
Finish: 19:32
Sample Volume Collected: 3.784 dscm
Exhaust Flow Rate: 19.373 dscmm
Fuel Firing Rate: 0.0152 1000 gal/hr

i.	PCDD	Sample Concentration (pg/sample)	EDL / EMPC (pg/sample)	PCDD ng/m3	PCDD ng/sec	PCDD lbs/1000 gal.	Toxic Eq. Factors (TEFs)	PCDD TEQ ng/m3	PCDD TEQ ng/sec	PCDD TEQ lbs/1000 gal.
1	2,3,7,8-TCDD	ND	4.64 EDL	1.23E-03	<3.96E-04	<2.07E-10	1	<1.23E-03	<3.96E-04	<2.07E-10
2	1,2,3,7,8-PeCDD	23.3		6.16E-03	1.99E-03	1.04E-09	1	6.16E-03	1.99E-03	1.04E-09
3	1,2,3,4,7,8-HxCDD	27.4		7.24E-03	2.34E-03	1.22E-09	0.1	7.24E-04	2.34E-04	1.22E-10
4	1,2,3,6,7,8-HxCDD	93.3		2.47E-02	7.96E-03	4.16E-09	0.1	2.47E-03	7.96E-04	4.16E-10
5	1,2,3,7,8,9-HxCDD	47.8		1.26E-02	4.08E-03	2.13E-09	0.1	1.26E-03	4.08E-04	2.13E-10
6	1,2,3,4,6,7,8-HpCDD	615		1.63E-01	5.25E-02	2.74E-08	0.01	1.63E-03	5.25E-04	2.74E-10
7	OCDD	662		1.75E-01	5.65E-02	2.95E-08	0.0003	5.25E-05	1.69E-05	8.85E-12
			PCDD Total:	*<3.89E-01*	*<1.26E-01*	*<6.57E-08*	*PCDD TEQ Total::*	*<1.35E-02*	*<4.36E-03*	*<2.28E-09*

ii.	PCDF	Sample Concentration (pg/sample)	EDL / EMPC (pg/sample)	PCDF ng/m3	PCDF ng/sec	PCDF lbs/1000 gal.	Toxic Eq. Factors (TEFs)	PCDF TEQ ng/m3	PCDF TEQ ng/sec	PCDF TEQ lbs/1000 gal.
1	2,3,7,8-TCDF	21.4		5.66E-03	1.83E-03	9.54E-10	0.1	5.66E-04	1.83E-04	9.54E-11
2	1,2,3,7,8-PeCDF	ND	20.00 EDL	<5.286E-03	<1.71E-03	<8.91E-10	0.03	<1.59E-04	<5.12E-05	<2.46E-11
3	2,3,4,7,8-PeCDF	44.6		1.18E-02	3.81E-03	1.99E-09	0.3	3.54E-03	1.14E-03	5.96E-10
4	1,2,3,4,7,8-HxCDF	36.2		9.57E-03	3.09E-03	1.61E-09	0.1	9.57E-04	3.09E-04	1.61E-10
5	1,2,3,6,7,8- HxCDF	35.2		9.30E-03	3.00E-03	1.57E-09	0.1	9.30E-04	3.00E-04	1.57E-10
6	2,3,4,6,7,8-HxCDF	38.1		1.01E-02	3.25E-03	1.70E-09	0.1	1.01E-03	3.25E-04	1.70E-10
7	1,2,3,7,8,9- HxCDF	10.5		2.78E-03	8.96E-04	4.68E-10	0.1	2.78E-04	8.96E-05	4.68E-11
8	1,2,3,4,6,7,8-HpCDF	89.5		2.37E-02	7.64E-03	3.99E-09	0.01	2.37E-04	7.64E-05	3.99E-11
9	1,2,3,4,7,8,9- HpCDF	14.1		3.73E-03	1.20E-03	6.28E-10	0.01	3.73E-05	1.20E-05	6.28E-12
10	OCDF	31.9		8.43E-03	2.72E-03	1.42E-09	0.0003	2.53E-06	8.17E-07	4.26E-13
			PCDF Total:	*<9.03E-02*	*<2.91E-02*	*<1.52E-08*	*PCDF TEQ Total:*	*<7.71E-03*	*<2.49E-03*	*<1.30E-09*
			Total PCDD,PCDF:	*<4.80E-01*	*<1.55E-01*	*<8.09E-08*	*al TEQ PCDD,PCDF:*	*<2.12E-02*	*<6.85E-03*	*<3.58E-09*

DATA REPORTING: Analytes which were below analytical detection limits are flagged as a less than value, "<".
Results are calculated according to ODEQ guidance, which require that individual
analytes below the estimated detection limit (EDL) or below the estimated maximum possible concentration (EMPC)
be considered present at the respective detection limit for reporting purposes.

EPA Method 23 Determination of Dioxin/Furans

Company: ORRCO
Location: Klamath Falls, OR.
Source: Auxiliary Boiler
Date: Aug. 26, 2020

Test Run: #3
Start: 10:13
Finish: 13:45
Sample Volume Collected: 3.667 dscm
Exhaust Flow Rate: 18.754 dscmm
Fuel Firing Rate: 0.0149 1000 gal/hr

i.	PCDD	Sample Concentration (pg/sample)	EDL / EMPC (pg/sample)	PCDD ng/m3	PCDD ng/sec	PCDD lbs/1000 gal.	Toxic Eq. Factors (TEFs)	PCDD TEQ ng/m3	PCDD TEQ ng/sec	PCDD TEQ lbs/1000 gal.
1	2,3,7,8-TCDD	*ND*	1.82 EDL	<4.96E-04	<1.55E-04	<8.26E-11	1	<4.96E-04	<1.55E-04	<8.26E-11
2	1,2,3,7,8-PeCDD	24.2		6.60E-03	2.06E-03	1.10E-09	1	6.60E-03	2.06E-03	1.10E-09
3	1,2,3,4,7,8-HxCDD	37.4		1.02E-02	3.19E-03	1.70E-09	0.1	1.02E-03	3.19E-04	1.70E-10
4	1,2,3,6,7,8-HxCDD	114		3.11E-02	9.72E-03	5.18E-09	0.1	3.11E-03	9.72E-04	5.18E-10
5	1,2,3,7,8,9-HxCDD	59.4		1.62E-02	5.06E-03	2.70E-09	0.1	1.62E-03	5.06E-04	2.70E-10
6	1,2,3,4,6,7,8-HpCDD	703		1.92E-01	5.99E-02	3.19E-08	0.01	1.92E-03	5.99E-04	3.19E-10
7	OCDD	864		2.36E-01	7.37E-02	3.92E-08	0.0003	7.07E-05	2.21E-05	1.18E-11
			PCDD Total:	*<4.92E-01*	*<1.54E-01*	*<8.19E-08*	*PCDD TEQ Total::*	*<1.48E-02*	*<4.64E-03*	*<2.47E-09*

ii.	PCDF	Sample Concentration (pg/sample)	EDL / EMPC (pg/sample)	PCDF ng/m3	PCDF ng/sec	PCDF lbs/1000 gal.	Toxic Eq. Factors (TEFs)	PCDF TEQ ng/m3	PCDF TEQ ng/sec	PCDF TEQ lbs/1000 gal.
1	2,3,7,8-TCDF	24.1		6.57E-03	2.05E-03	1.09E-09	0.1	6.57E-04	2.05E-04	1.09E-10
2	1,2,3,7,8-PeCDF	26.3		7.17E-03	2.24E-03	1.19E-09	0.03	2.15E-04	6.73E-05	3.58E-11
3	2,3,4,7,8-PeCDF	51.7		1.41E-02	4.41E-03	2.35E-09	0.3	4.23E-03	1.32E-03	7.04E-10
4	1,2,3,4,7,8-HxCDF	44.5		1.21E-02	3.79E-03	2.02E-09	0.1	1.21E-03	3.79E-04	2.02E-10
5	1,2,3,6,7,8- HxCDF	42.7		1.16E-02	3.64E-03	1.94E-09	0.1	1.16E-03	3.64E-04	1.94E-10
6	2,3,4,6,7,8-HxCDF	46.7		1.27E-02	3.98E-03	2.12E-09	0.1	1.27E-03	3.98E-04	2.12E-10
7	1,2,3,7,8,9- HxCDF	*ND*	5.70 EMPC	<1.55E-03	<4.86E-04	<2.59E-10	0.1	<1.55E-04	<4.86E-05	<2.59E-11
8	1,2,3,4,6,7,8-HpCDF	106		2.89E-02	9.04E-03	4.81E-09	0.01	2.89E-04	9.04E-05	4.81E-11
9	1,2,3,4,7,8,9- HpCDF	*ND*	16.10 EMPC	<4.39E-03	<1.37E-03	<7.31E-10	0.01	<4.39E-05	<1.37E-05	<7.31E-12
10	OCDF	36.8		1.00E-02	3.14E-03	1.67E-09	0.0003	3.01E-06	9.41E-07	5.01E-13
			PCDF Total:	*<1.09E-01*	*<3.41E-02*	*<1.82E-08*	*PCDF TEQ Total:*	*<9.25E-03*	*<2.89E-03*	*<1.54E-09*
			Total PCDD,PCDF:	*<6.01E-01*	*<1.88E-01*	*<1.00E-07*	*al TEQ PCDD,PCDF:*	*<2.41E-02*	*<7.53E-03*	*<4.01E-09*

DATA REPORTING: Analytes which were below analytical detection limits are flagged as a less than value, "<". Results are calculated according to ODEQ guidance, which require that individual analytes below the estimated detection limit (EDL) or below the estimated maximum possible concentration (EMPC) be considered present at the respective detection limit for reporting purposes.

Test Summary for EPA Method 23 Determination of PAHs

Company: ORRCO
Location: Klamath Falls, OR.
Source: Auxiliary Boiler
Date: Aug. 25&26, 2020

iii.	PAH (Polynuclear Aromatic Hydrocarbons)	PAH ng/m3	PAH ng/sec	PAH lbs/1000 gal.	PAH TEQ ng/m3	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
1	Acenaphthene	1.387	0.439	2.33E-07	1.387	0.439	2.33E-07
2	Acenaphthylene	1.046	0.332	1.76E-07	1.046	0.332	1.76E-07
3	Anthracene	<1.451	<0.460	<1.56E-07	<1.451	<0.460	<2.43E-07
5	Benzo(a)anthracene	0.558	0.177	6.00E-08	0.112	0.035	1.87E-08
6	Benzo(a)pyrene	1.427	0.457	2.40E-07	1.427	0.457	2.40E-07
7	Benzo(b)fluoranthene	3.916	1.234	6.55E-07	3.133	0.987	5.24E-07
9	Benzo(e)pyrene	7.521	2.399	1.26E-06	7.521	2.399	1.26E-06
10	Benzo(g,h,i)perylene	34.154	10.958	5.75E-06	0.307	0.099	5.17E-08
11	Benzo(k)fluoranthene	1.502	0.473	2.51E-07	0.045	0.014	7.53E-09
12	Chrysene	2.627	0.830	4.40E-07	0.263	0.083	4.40E-08
13	Dibenz[a,h]anthracene	<0.508	<0.161	<5.46E-08	<5.079	<1.612	<8.52E-07
14	Fluoranthene	16.631	5.270	2.16E-06	1.330	0.422	2.23E-07
15	Fluorene	2.273	0.721	3.81E-07	2.273	0.721	3.81E-07
16	Indeno[1,2,3-cd]pyrene	4.977	1.593	8.37E-07	0.348	0.111	5.86E-08
17	2-Methyl naphthalene	20.620	6.546	2.11E-06	20.620	6.546	3.46E-06
18	Perylene	<0.391	<0.124	<4.20E-08	<0.391	<0.124	<6.55E-08
19	Phenanthrene	23.939	7.597	2.71E-06	23.939	7.597	4.02E-06
20	Pyrene	13.042	4.142	1.47E-06	13.465	4.274	2.19E-06
			*Total PAH			*Total PAH TEQ	
		<137.969	<43.913	<1.90E-05	<80.253	<25.481	<1.40E-05

PAH	PAH ng/m3	PAH ng/sec	PAH lbs/1000 gal.	PAH TEQ ng/m3	PAH TEQ ng/sec	PAH lbs/1000 gal.
Naphthalene	47.387	15.041	4.72E-06	47.387	15.041	7.95E-06

DATA REPORTING: Analytes which were below analytical detection limits are flagged as a less than value, "<". Results are calculated according to ODEQ guidance, which requires that individual PAH analytes that are below method detection limits be considered present at the analyte detection limit for reporting purposes.

* Total PAH values are the sum of the three test run averages.

EPA Method 23 Determination of PAHs

Company: ORRCO
Location: Klamath Falls, OR.
Source: Auxiliary Boiler
Date: Aug. 25, 2020

Test Run: #1
Start: 10:32
Finish: 13:43
Sample Volume Collected: 3.332 dscm
Exhaust Flow Rate: 19.010 dscmm
Fuel Firing Rate: 0.0150 1000 gal/hr

iii.	PAH *(Polynuclear Aromatic Hydrocarbons)*	Sample Concentration (ng/sample)	MDL (ng/sample)	PAH ng/m3	PAH ng/sec	PAH lbs/1000 gal.	Toxic Eq. Factors (TEFs)	PAH TEQ ng/m3	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
1	Acenaphthene	5.42		1.627	0.515	2.74E-07	1	1.627	0.515	2.74E-07
2	Acenaphthylene	3.4		1.020	0.323	1.72E-07	1	1.020	0.323	1.72E-07
3	Anthracene	ND	5.2	<1.561	<0.494	<2.62E-10	1	<1.561	<0.494	<2.62E-07
5	Benzo(a)anthracene	ND	2.0	<0.600	<0.190	<1.01E-10	0.2	<0.120	<0.038	<2.02E-08
6	Benzo(a)pyrene	2.65		0.795	0.252	1.34E-07	1	0.795	0.252	1.34E-07
7	Benzo(b)fluoranthene	6.02		1.807	0.572	3.04E-07	0.8	1.445	0.458	2.43E-07
9	Benzo(e)pyrene	12.9		3.871	1.227	6.51E-07	1	3.871	1.227	6.51E-07
10	Benzo(g,h,i)perylene	48.9		14.675	4.649	2.47E-06	0.009	0.132	0.042	2.22E-08
11	Benzo(k)fluoranthene	2.36		0.708	0.224	1.19E-07	0.03	0.021	0.007	3.57E-09
12	Chrysene	6.84		2.053	0.650	3.45E-07	0.1	0.205	0.065	3.45E-08
13	Dibenz[a,h]anthracene	ND	1.82	<0.546	<0.173	<9.19E-11	10	<5.462	<1.730	<9.19E-07
14	Fluoranthene	37.2		11.164	3.537	1.88E-09	0.08	0.893	0.283	1.50E-07
15	Fluorene	9.24		2.773	0.879	4.66E-07	1	2.773	0.879	4.66E-07
16	Indeno[1,2,3-cd]pyrene	6.38		1.915	0.607	3.22E-07	0.07	0.134	0.042	2.25E-08
17	2-Methyl naphthalene	80.5		24.158	7.654	4.06E-09	1	24.158	7.654	4.06E-06
18	Perylene	ND	1.4	<0.420	<0.133	<7.07E-11	1	<0.420	<0.133	<7.07E-08
19	Phenanthrene	77.6		23.288	7.378	3.92E-09	1	23.288	7.378	3.92E-06
20	Pyrene	42.5		12.754	4.041	2.15E-09	1	12.754	4.041	2.15E-06
			Total PAH:	<105.736	<33.500	<5.27E-06	Total PAH TEQ:	<80.681	<25.562	<1.36E-05

	PAH *(Polynuclear Aromatic Hydrocarbons)*	Sample Concentration (ng/sample)	PAH ng/m3	PAH ng/sec	PAH lbs/1000 gal.	Toxic Eq. Factors (TEFs)	PAH TEQ ng/m3	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
21	Naphthalene	192	57.620	18.256	9.69E-09	1	57.620	18.256	9.69E-06

DATA REPORTING: Analytes which were below analytical detection limits are flagged as a less than value, "<". Results are calculated according to ODEQ guidance, which requires that individual PAH analytes that are below method detection limits be considered present at the analyte detection limit for reporting purposes.

EPA Method 23 Determination of PAHs

Company: ORRCO
Location: Klamath Falls, OR.
Source: Auxiliary Boiler
Date: Aug. 25, 2020

Test Run: #2
Start: 16:00
Finish: 19:32
Sample Volume Collected: 3.784 dscm
Exhaust Flow Rate: 19.373 dscmm
Fuel Firing Rate: 0.0152 1000 gal/hr

iii.	PAH *(Polynuclear Aromatic Hydrocarbons)*	Sample Concentration (ng/sample)	MDL (ng/sample)	PAH ng/m3	PAH ng/sec	PAH lbs/1000 gal.	Toxic Eq. Factors (TEFs)	PAH TEQ ng/m3	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
1	Acenaphthene	3.69		0.975	0.315	1.64E-07	1	0.975	0.315	1.64E-07
2	Acenaphthylene	4.41		1.166	0.376	1.96E-07	1	1.166	0.376	1.96E-07
3	Anthracene	ND	5.2	<1.374	<0.444	<2.32E-07	1	<1.374	<0.444	<2.32E-07
5	Benzo(a)anthracene	ND	2.0	<0.529	<0.171	<8.91E-08	0.2	<0.106	<0.034	<1.78E-08
6	Benzo(a)pyrene	10.6		2.801	0.905	4.72E-07	1	2.801	0.905	4.72E-07
7	Benzo(b)fluoranthene	8.21		2.170	0.701	3.66E-07	0.8	1.736	0.560	2.93E-07
9	Benzo(e)pyrene	47.4		12.527	4.045	2.11E-06	1	12.527	4.045	2.11E-06
10	Benzo(g,h,i)perylene	288		76.115	24.576	1.28E-05	0.009	0.685	0.221	1.15E-07
11	Benzo(k)fluoranthene	2.71		0.716	0.231	1.21E-07	0.03	0.021	0.007	3.62E-09
12	Chrysene	6.06		1.602	0.517	2.70E-07	0.1	0.160	0.052	2.70E-08
13	Dibenz[a,h]anthracene	ND	1.82	<0.481	<0.155	<8.11E-08	10	<4.810	<1.553	<8.11E-07
14	Fluoranthene	61.3		16.201	5.231	2.73E-06	0.08	1.296	0.418	2.19E-07
15	Fluorene	7.32		1.935	0.625	3.26E-07	1	1.935	0.625	3.26E-07
16	Indeno[1,2,3-cd]pyrene	38.0		10.043	3.243	1.69E-06	0.07	0.703	0.227	1.19E-07
17	2-Methyl naphthalene	73.1		19.319	6.238	3.26E-06	1	19.319	6.238	3.26E-06
18	Perylene	ND	1.4	<0.370	<0.119	<6.24E-08	1	<0.370	<0.119	<6.24E-08
19	Phenanthrene	89.3		23.601	7.620	3.98E-06	1	23.601	7.620	3.98E-06
20	Pyrene	51.9		13.717	4.429	2.31E-06	1	13.717	4.429	2.31E-06
			Total PAH:	<185.64	<59.94	<3.13E-05	Total PAH TEQ:	<87.30	<28.19	<1.47E-05

	PAH *(Polynuclear Aromatic Hydrocarbons)*	Sample Concentration (ng/sample)	PAH ng/m3	PAH ng/sec	PAH lbs/1000 gal.	Toxic Eq. Factors (TEFs)	PAH TEQ ng/m3	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
21	Naphthalene	162	42.815	13.824	7.22E-06	1	42.815	13.824	7.22E-06

DATA REPORTING: Analytes which were below analytical detection limits are flagged as a less than value, "<". Results are calculated according to ODEQ guidance, which requires that individual PAH analytes that are below method detection limits be considered present at the analyte detection limit for reporting purposes.

EPA Method 23 Determination of PAHs

Company: ORRCO
Location: Klamath Falls, OR.
Source: Auxiliary Boiler
Date: Aug. 26, 2020

Test Run: #3
Start: 10:13
Finish: 13:45
Company: ORRCO
Sample Volume Collected: 3.667 dscm
Exhaust Flow Rate: 18.754 dscmm
Fuel Firing Rate: 0.0149 1000 gal/hr

iii.	PAH *(Polynuclear Aromatic Hydrocarbons)*	Sample Concentration (ng/sample)	RL (ng/sample)	PAH ng/m3	PAH ng/sec	PAH lbs/1000 gal.	Toxic Eq. Factors (TEFs)	PAH TEQ ng/m3	PAH TEQ ng/sec	PAH TEQ lbs/1000 gal.
1	Acenaphthene	5.72		1.560	0.488	2.60E-07	1	1.560	0.488	2.60E-07
2	Acenaphthylene	3.49		0.952	0.298	1.58E-07	1	0.952	0.298	1.58E-07
3	Anthracene	ND	5.2	<1.418	<0.443	<2.36E-07	1	<1.418	<0.443	<2.36E-07
5	Benzo(a)anthracene	ND	2.0	<0.545	<0.170	<9.08E-08	0.2	<0.109	<0.034	<1.82E-08
6	Benzo(a)pyrene	2.51		0.685	0.214	1.14E-07	1	0.685	0.214	1.14E-07
7	Benzo(b)fluoranthene	28.5		7.773	2.429	1.29E-06	0.8	6.218	1.944	1.04E-06
9	Benzo(e)pyrene	22.6		6.164	1.927	1.03E-06	1	6.164	1.927	1.03E-06
10	Benzo(g,h,i)perylene	42.8		11.673	3.648	1.94E-06	0.009	0.105	0.033	1.75E-08
11	Benzo(k)fluoranthene	11.3		3.082	0.963	5.13E-07	0.03	0.092	0.029	1.54E-08
12	Chrysene	15.5		4.227	1.321	7.04E-07	0.1	0.423	0.132	7.04E-08
13	Dibenz[a,h]anthracene	ND	1.82	<0.496	<0.155	<8.26E-08	10	<4.964	<1.551	<8.26E-07
14	Fluoranthene	82.6		22.527	7.041	3.75E-06	0.08	1.802	0.563	3.00E-07
15	Fluorene	7.74		2.111	0.660	3.51E-07	1	2.111	0.660	3.51E-07
16	Indeno[1,2,3-cd]pyrene	10.9		2.973	0.929	4.95E-07	0.07	0.208	0.065	3.46E-08
17	2-Methyl naphthalene	67.4		18.382	5.745	3.06E-06	1	18.382	5.745	3.06E-06
18	Perylene	ND	1.4	<0.382	<0.119	<6.36E-08	1	<0.382	<0.119	<6.36E-08
19	Phenanthrene	91.4		24.927	7.791	4.15E-06	1	24.927	7.791	4.15E-06
20	Pyrene	46.4		12.655	3.955	2.11E-06	1	13.925	4.352	2.11E-06
			Total PAH:	<122.53	<38.298	<2.04E-05	Total PAH TEQ:	<84.43	<26.388	<1.38E-05

	PAH *(Polynuclear Aromatic Hydrocarbons)*	Sample Concentration (ng/sample)	PAH ng/m3	PAH ng/sec	PAH lbs/1000 gal.	Toxic Eq. Factors (TEFs)	PAH TEQ ng/m3	PAH ng/sec	PAH TEQ lbs/1000 gal.
21	Naphthalene	153	41.728	13.042	6.95E-06	1	41.728	13.042	6.95E-06

DATA REPORTING: Analytes which were below analytical detection limits are flagged as a less than value, "<". Results are calculated according to ODEQ guidance, which requires that individual PAH analytes that are below method detection limits be considered present at the analyte detection limit for reporting purposes.

Test Summary of EPA Method 23 Determination of PCBs

Company: ORRCO
Location: Klamath Falls, OR.
Source: Auxiliary Boiler
Date: Aug. 25&26, 2020

iiii	PCBs	PCB ng/m3	PCB ng/sec	PCB lbs/1000 gal.	PCB TEQ ng/m3	PCB TEQ ng/sec	PCB TEQ lbs/1000 gal.
1	PCB-5/8	<0.283	<0.090	<4.76E-08			
2	PCB 18	<0.097	<0.031	<1.63E-08			
3	PCB-28	0.216	0.069	3.63E-08			
4	PCB-44	<0.104	<0.033	<1.75E-08			
5	PCB-52/69	0.109	0.035	1.82E-08			
6	PCB-66/76	0.136	0.043	2.28E-08			
7	PCB 77	<0.051	<0.016	<8.51E-09	<1.44E-06	<4.58E-07	<8.51E-13
8	PCB 81	<0.019	<0.006	<3.23E-09	<1.69E-06	<5.34E-07	<9.70E-13
9	PCB-90/101	<0.062	<0.020	<1.03E-08			
10	PCB 105	<0.026	<0.008	<4.42E-09	<2.24E-07	<7.09E-08	<1.33E-13
11	PCB 114	<0.006	<0.002	<9.63E-10	<4.93E-08	<1.56E-08	<2.89E-14
12	PCB 106/118	<0.036	<0.011	<5.99E-09	<3.02E-07	<9.59E-08	<1.80E-13
13	PCB 123	<0.008	<0.002	<1.28E-09	<6.60E-08	<2.09E-08	<3.85E-14
14	PCB 126	<0.023	<0.007	<3.91E-09	<6.75E-04	<2.14E-04	<3.91E-10
15	PCB-128/162	<0.011	<0.003	<1.81E-09			
16	PCB-138/163/164	<0.025	<0.008	<4.12E-09			
17	PCB-153	0.023	0.007	3.79E-09			
18	PCB 156	<0.009	<0.003	<1.49E-09	<7.59E-08	<2.40E-08	<4.48E-14
19	PCB 157	<0.006	<0.002	<1.08E-09	<5.53E-08	<1.75E-08	<3.24E-14
20	PCB 167	<0.005	<0.001	<7.77E-10	<3.88E-08	<1.23E-08	<2.33E-14
21	PCB 169	<0.005	<0.002	<9.13E-10	<4.66E-05	<1.48E-05	<2.74E-11
22	PCB-170	<0.006	<0.002	<1.07E-09			
23	PCB-180	<0.007	<0.002	<1.24E-09			
24	PCB-182/187	<0.006	<0.002	<1.06E-09			
25	PCB 189	<0.006	<0.002	<9.84E-10	<5.00E-08	<1.58E-08	<1.15E-06
26	PCB-195	<0.003	<0.001	<4.55E-10			
27	PCB-206	<0.011	<0.004	<1.85E-09			
28	PCB-209	<0.010	<0.003	<1.65E-09			
	Total of Specified *PCB:	**<1.308**	**<0.416**	**<2.20E-07**	**<7.25E-04**	**<2.30E-04**	**<1.15E-06**

	Total PCB ng/m3	Total PCB ng/sec	Total PCB lbs/1000 gal.
Total PCB - Average Summation of all PCBs detected.	**9.46**	**3.004**	**1.59E-06**

NOTE: *Polychlorinated biphenyls (PCBs) - all congeners with associated RBCs as provided in OAR 340-245-8040 Table 2.
**ODEQ Guidance specifies determining the TEQ for the 12 dioxin-like PCBs listed.

DATA REPORTING: Analytes which were below analytical detection limits are flagged as a less than value, "<".
Results are calculated according to ODEQ guidance, which require that individual analytes below the estimated detection limit (EDL) or below the estimated maximum possible concentration (EMPC) be considered present at the respective detection limit for reporting purposes.

EPA Method 23 Determination of PCBs

Company: ORRCO
Location: Klamath Falls, OR.
Source: Auxiliary Boiler
Date: Aug. 25, 2020

Test Run: #1
Start: 10:32
Finish: 13:43
Sample Volume Collected: 3.332 dscm
Exhaust Flow Rate: 19.010 dscmm
Fuel Firing Rate: 0.0150 1000 gal/hr

iiii	PCBs	Sample Concentration (pg/sample)	EDL / EMPC (pg/sample)	PCB ng/m3	PCB ng/sec	PCB lbs/1000 gal.	Toxic Equivalency Factors (TEFs)	PCB TEQ ng/m3	PCB TEQ ng/sec	PCB TEQ lbs/1000 gal.
1	PCB-5/8	1950		0.585	0.185	9.84E-08				
2	PCB 18	*ND*	428 EMPC	<0.128	<0.041	<2.16E-08				
3	PCB-28	816		0.245	0.078	4.12E-08				
4	PCB-44	*ND*	224 EMPC	<0.067	<0.021	<1.13E-08				
5	PCB-52/69	343		0.103	0.033	1.73E-08				
6	PCB-66/76	364		0.109	0.035	1.84E-08				
7	PCB 77	266		0.080	0.025	1.34E-08	0.0001	2.40E-06	7.59E-07	1.34E-12
8	PCB 81	142		0.043	0.014	7.17E-09	0.0003	3.84E-06	1.22E-06	2.15E-12
9	PCB-90/101	230		0.069	0.022	1.16E-08				
10	PCB 105	117		0.035	0.011	5.91E-09	0.00003	3.16E-07	1.00E-07	1.77E-13
11	PCB 114	*ND*	32.3 EMPC	<0.010	<0.003	<1.63E-09	0.00003	<8.73E-08	<2.76E-08	<4.89E-14
12	PCB 106/118	154		0.046	0.015	7.77E-09	0.00003	4.16E-07	1.32E-07	2.33E-13
13	PCB 123	44.4		0.013	0.004	2.24E-09	0.00003	1.20E-07	3.80E-08	6.72E-14
14	PCB 126	155		0.047	0.015	7.82E-09	0.1	1.40E-03	4.42E-04	7.82E-10
15	PCB-128/162	52		0.016	0.005	2.62E-09				
16	PCB-138/163/164	*ND*	89.7 EMPC	<0.027	<0.009	<4.53E-09				
17	PCB-153	65.4		0.020	0.006	3.30E-09				
18	PCB 156	*ND*	43.9 EMPC	<0.013	<0.004	<2.22E-09	0.00003	<1.19E-07	<3.76E-08	<6.65E-14
19	PCB 157	35.9		0.011	0.003	1.81E-09	0.00003	9.70E-08	3.07E-08	5.44E-14
20	PCB 167	*ND*	13.9 EMPC	<0.004	<0.001	<7.02E-10	0.00003	<3.76E-08	<1.19E-08	<2.10E-14
21	PCB 169	*ND*	29.5 EMPC	<0.009	<0.003	<1.49E-09	0.03	<7.97E-05	<2.53E-05	<4.47E-11
22	PCB-170	40.1		0.012	0.004	2.02E-09				
23	PCB-180	*ND*	24.1 EMPC	<0.007	<0.002	<1.22E-09				
24	PCB-182/187	*ND*	24.0 EMPC	<0.007	<0.002	<1.21E-09				
25	PCB 189	26.3		0.008	0.003	1.33E-09	0.00003	7.11E-08	2.25E-08	3.98E-14
26	PCB-195	*ND*	5.45 EDL	<0.002	<0.001	<2.75E-10				
27	PCB-206	*ND*	22.1 EMPC	<0.007	<0.002	<1.12E-09				
28	PCB-209	*ND*	16.7 EMPC	<0.005	<0.002	<8.43E-10				
			Total of Specified *PCB:	**<1.727**	**<0.547**	**2.90E-07**	****Total of Specified PCB TEQ:**	**<1.48E-03**	**<4.70E-04**	**<8.31E-10**

	Sample Concentration (pg/sample)	Total PCB ng/m3	Total PCB ng/sec	Total PCB lbs/1000 gal.
Total PCB - Summation of all PCBs detected.	**62,500**	**18.757**	**5.943**	**<3.15E-06**

NOTE: *Polychlorinated biphenyls (PCBs) - all congeners with associated RBCs as provided in OAR 340-245-8040 Table 2.
**ODEQ Guidance specifies determining the TEQ for the 12 dioxin-like PCBs listed.

DATA REPORTING: Analytes which were below analytical detection limits are flagged as a less than value, "<". Results are calculated according to ODEQ guidance, which require that individual analytes below the estimated detection limit (EDL) or below the estimated maximum possible concentration (EMPC) be considered present at the respective detection limit for reporting purposes.

EPA Method 23 Determination of PCBs

Company: ORRCO
Location: Klamath Falls, OR.
Source: Auxiliary Boiler
Date: Aug. 25, 2020

Test Run: #2
Start: 16:00
Finish: 19:32
Sample Volume Collected: 3.784 dscm
Exhaust Flow Rate: 19.373 dscmm
Fuel Firing Rate: 0.0152 1000 gal/hr

iiii	PCBs	Sample Concentration (pg/sample)	EDL / EMPC (pg/sample)	PCB ng/m3	PCB ng/sec	PCB lbs/1000 gal.	Toxic Equivalency Factors (TEFs)	PCB TEQ ng/m3	PCB TEQ ng/sec	PCB TEQ lbs/1000 gal.
1	PCB-5/8	*ND*	563 EMPC	<0.149	<0.048	<2.51E-08				
2	PCB 18	368		0.097	0.031	1.64E-08				
3	PCB-28	1020		0.270	0.087	4.54E-08				
4	PCB-44	663		0.175	0.057	2.95E-08				
5	PCB-52/69	524		0.138	0.045	2.33E-08				
6	PCB-66/76	772		0.204	0.066	3.44E-08				
7	PCB 77	*ND*	138 EMPC	<0.036	<0.012	<6.15E-09	0.0001	<9.64E-07	<3.11E-07	<6.15E-13
8	PCB 81	*ND*	19.9 EMPC	<0.005	0.002	<8.87E-10	0.0003	<4.17E-07	1.35E-07	<2.66E-13
9	PCB-90/101	240		0.063	0.020	1.07E-08				
10	PCB 105	*ND*	71.9 EMPC	<0.019	<0.006	<3.20E-09	0.00003	<1.51E-07	<4.86E-08	<9.61E-14
11	PCB 114	*ND*	14.5 EDL	<0.004	<0.001	<6.46E-10	0.00003	<3.04E-08	<9.81E-09	<1.94E-14
12	PCB 106/118	113		0.030	0.010	5.03E-09	0.00003	2.37E-07	7.65E-08	1.51E-13
13	PCB 123	*ND*	12.9 EDL	<0.003	<0.001	<5.75E-10	0.00003	<2.70E-08	<8.73E-09	<1.72E-14
14	PCB 126	*ND*	34.8 EMPC	<0.009	<0.003	<1.55E-09	0.1	<2.43E-04	<7.85E-05	<1.55E-10
15	PCB-128/162	*ND*	29.3 EMPC	<0.008	<0.003	<1.31E-09				
16	PCB-138/163/164	*ND*	65.5 EMPC	<0.017	<0.006	<2.92E-09				
17	PCB-153	85.6		0.023	0.007	3.81E-09				
18	PCB 156	*ND*	24.8 EMPC	<0.007	<0.002	<1.11E-09	0.00003	<5.20E-08	<1.6E-08	<3.32E-14
19	PCB 157	*ND*	12.8 EMPC	<0.003	<0.001	<5.70E-10	0.00003	<2.68E-08	<8.7E-09	<1.71E-14
20	PCB 167	*ND*	15.1 EMPC	<0.004	<0.001	<6.73E-10	0.00003	<3.16E-08	<1.0E-08	<2.02E-14
21	PCB 169	*ND*	13.3 EMPC	<0.004	<0.001	<5.93E-10	0.03	<2.79E-05	<9.0E-06	<1.78E-11
22	PCB-170	*ND*	15.5 EDL	<0.004	<0.001	<6.91E-10				
23	PCB-180	*ND*	12.4 EDL	<0.003	<0.001	<5.53E-10				
24	PCB-182/187	*ND*	10.4 EDL	<0.003	<0.001	<4.63E-10				
25	PCB 189	*ND*	10.6 EDL	<0.003	<0.001	<4.72E-10	0.00003	<2.22E-08	<7.17E-09	<1.42E-14
26	PCB-195	*ND*	6.96 EDL	<0.002	<0.001	<3.10E-10				
27	PCB-206	44.8		0.012	0.004	2.00E-09				
28	PCB-209	46.9		0.012	0.004	2.09E-09				
			Total of Specified *PCB:	**<1.308**	**<0.422**	**<2.21E-07**	****Total of Specified PCB TEQ:**	**<2.73E-04**	**<8.81E-05**	**<1.74E-10**

	Sample Concentration (pg/sample)	Total PCB ng/m3	Total PCB ng/sec	Total PCB lbs/1000 gal.
Total PCB - Summation of all PCBs detected.	**23,000**	**6.079**	**1.963**	**1.02E-06**

NOTE: *Polychlorinated biphenyls (PCBs) - all congeners with associated RBCs as provided in OAR 340-245-8040 Table 2.
**ODEQ Guidance specifies determining the TEQ for the 12 dioxin-like PCB listed.

DATA REPORTING: Analytes which were below analytical detection limits are flagged as a less than value, "<". Results are calculated according to ODEQ guidance, which require that individual analytes below the estimated detection limit (EDL) or below the estimated maximum possible concentration (EMPC) be considered present at the respective detection limit for reporting purposes.

EPA Method 23 Determination of PCBs

Company: ORRCO
Location: Klamath Falls, OR.
Source: Auxiliary Boiler
Date: Aug. 26, 2020

Test Run: #3
Start: 10:13
Finish: 13:45
Sample Volume Collected: 3.667 dscm
Exhaust Flow Rate: 18.754 dscmm
Exhaust Flow Rate: 0.0149 1000 gal/hr

iiii	PCBs	Sample Concentration (pg/sample)	EDL / EMPC (pg/sample)	PCB ng/m3	PCB ng/sec	PCB lbs/1000 gal.	Toxic Equivalency Factors (TEFs)	PCB TEQ ng/m3	PCB TEQ ng/sec	PCB TEQ lbs/1000 gal.
1	PCB-5/8	*ND*	422 EMPC	<0.115	<0.036	<1.92E-08				
2	PCB 18	242		0.066	0.021	1.10E-08				
3	PCB-28	492		0.134	0.042	2.23E-08				
4	PCB-44	255		0.070	0.022	1.16E-08				
5	PCB-52/69	310		0.085	0.026	1.41E-08				
6	PCB-66/76	342		0.093	0.029	1.55E-08				
7	PCB 77	131		0.036	0.011	5.95E-09	0.0001	9.74E-07	3.05E-07	5.95E-13
8	PCB 81	36.3		0.010	0.003	1.65E-09	0.0003	8.10E-07	2.53E-07	4.94E-13
9	PCB-90/101	*ND*	191 EMPC	<0.052	<0.016	<8.67E-09				
10	PCB 105	91.6		0.025	0.008	4.16E-09	0.00003	2.04E-07	6.39E-08	1.25E-13
11	PCB 114	*ND*	13.50 EDL	<0.004	<0.001	<6.13E-10	0.00003	<3.01E-08	<9.42E-09	<1.84E-14
12	PCB 106/118	*ND*	114 EMPC	<0.031	<0.010	<5.18E-09	0.00003	<2.54E-07	<7.95E-08	<1.55E-13
13	PCB 123	22.8		0.006	0.002	1.04E-09	0.00003	5.09E-08	1.59E-08	3.11E-14
14	PCB 126	*ND*	51.8 EMPC	<0.014	<0.004	<2.35E-09	0.1	<3.85E-04	<1.20E-04	<2.35E-10
15	PCB-128/162	*ND*	32.9 EMPC	<0.009	<0.003	<1.49E-09				
16	PCB-138/163/164	*ND*	108.0 EMPC	<0.029	<0.009	<4.90E-09				
17	PCB-153	93.5		0.026	0.008	4.25E-09				
18	PCB 156	*ND*	25.6 EMPC	<0.007	<0.002	<1.16E-09	0.00003	<5.71E-08	<1.79E-08	<3.49E-14
19	PCB 157	*ND*	18.9 EMPC	<0.005	<0.002	<8.58E-10	0.00003	<4.22E-08	<1.32E-08	<2.57E-14
20	PCB 167	21.1		0.006	0.002	9.58E-10	0.00003	4.71E-08	1.47E-08	2.87E-14
21	PCB 169	14.5		0.004	0.001	6.58E-10	0.03	3.24E-05	<1.01E-05	1.98E-11
22	PCB-170	*ND*	11.2 EDL	<0.003	<0.001	<5.09E-10				
23	PCB-180	*ND*	43.0 EMPC	<0.012	<0.004	<1.95E-09				
24	PCB-182/187	*ND*	33.0 EDL	<0.009	<0.003	<1.50E-09				
25	PCB 189	25.4		0.007	0.002	1.15E-09	0.00003	5.668E-08	1.77E-08	3.46E-06
26	PCB-195	*ND*	17.2 EMPC	<0.005	<0.001	<7.81E-10				
27	PCB-206	53.8		0.015	0.005	2.44E-09				
28	PCB-209	*ND*	44.5 EMPC	<0.012	<0.004	<2.02E-09				
			Total of Specified *PCB:	**<0.888**	**<0.278**	**<1.48E-07**	****Total of Specified PCB TEQ:**	**<4.20E-04**	**<1.31E-04**	**<3.46E-06**

	Sample Concentration (pg/sample)	Total PCB ng/m3	Total PCB ng/sec	Total PCB lbs/1000 gal.
Total PCB - Summation of all PCBs detected.	**13,000**	**3.545**	**1.108**	**5.90E-07**

NOTE: *Polychlorinated biphenyls (PCBs) - all congeners with associated RBCs as provided in OAR 340-245-8040 Table 2.
**ODEQ Guidance specifies determining the TEQ for the 12 dioxin-like PCBs listed.

DATA REPORTING: Analytes which were below analytical detection limits are flagged as a less than value, "<".
Results are calculated according to ODEQ guidance, which require that individual analytes below the estimated detection limit (EDL) or below the estimated maximum possible concentration (EMPC) be considered present at the respective detection limit for reporting purposes.

November 16, 2020

Vista Work Order No. 2001762

Mr. Andy Winkler
Environmental Technical Services, LLC
4848 Airway Drive
Central Point, OR 97502

Dear Mr. Winkler,

Enclosed are the amended results for the sample set received at Vista Analytical Laboratory on September 01, 2020 under your Project Name '2020.2232'.

Vista Analytical Laboratory is committed to serving you effectively. If you require additional information, please contact me at 916-673-1520 or by email at mmaier@vista-analytical.com.

Thank you for choosing Vista as part of your analytical support team.

Sincerely,

Martha Maier

Martha Maier
Laboratory Director

Vista Analytical Laboratory certifies that the report herein meets all the requirements set forth by NELAP for those applicable test methods. Results relate only to the samples as received by the laboratory. This report should not be reproduced except in full without the written approval of Vista.

Vista Work Order No. 2001762
Case Narrative

Sample Condition on Receipt:

Four air train samples were received in good condition and within the method temperature requirements. The samples were received and stored securely in accordance with Vista standard operating procedures and EPA methodology. Date ranges were given for the collection dates, and no collection times were noted on the Chain-of-Custody. The collection times have been reported as 00:00, and the collection dates have been reported as 08/18/20. As requested, the report was amended to report the PAH results to the Method Detection Limits (MDL).

Analytical Notes:

Draft EPA Method 23, January 2020 (Dioxins and Furans)

These samples were extracted and analyzed for tetra-through-octa chlorinated dioxins and furans by the draft revision of EPA Method 23, January 2020 using a ZB-DIOXIN GC column.

Holding Times

The method holding time criteria were met for the samples.

Quality Control

The Initial Calibration and Continuing Calibration Verifications met the method acceptance criteria.

A Method Blank and Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) were extracted and analyzed with the preparation batch. No analytes were detected above the sample quantitation limit in the Method Blank. The LCS/LCSD recoveries and relative percent differences (RPD) were within the method acceptance criteria.

The labeled standard recoveries outside the method acceptance criteria are listed in the table below:

Draft EPA Method 23, January 2020 (PAHs)

These samples were extracted and analyzed for PAHs by the draft revision of EPA Method 23, January 2020 using a ZB-50 GC column.

Holding Times

The method holding time criteria were met for the samples.

Quality Control

The Initial Calibration and Continuing Calibration Verifications met the method acceptance criteria.

A Method Blank and Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) were extracted and analyzed with the preparation batch. No analytes were detected above the sample quantitation limit in the Method Blank. The LCS/LCSD recoveries and relative percent differences (RPD) were within the method acceptance criteria.

The labeled standard recoveries outside the method acceptance criteria are listed in the table below:

Draft EPA Method 23, January 2020 (PCB Congeners)

These samples were extracted and analyzed for 209 PCB congeners by the draft revision of EPA Method 23, January 2020 using a ZB-1 GC column.

Holding Times

The samples were extracted and analyzed within the method hold times.

Quality Control

The Initial Calibration and Continuing Calibration Verifications met the method acceptance criteria.

A Method Blank and Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) were extracted and analyzed with the preparation batch. No analytes were detected above the sample quantitation limit in the Method Blank. The LCS/LCSD recoveries and relative percent differences (RPD) were within the method acceptance criteria.

Labeled standard recoveries for all QC and field samples were within method acceptance criteria.

QC Anomalies

LabNumber	SampleName	Analysis	Analyte	Flag	%Rec
2001762-01	2020.2232.M23-Run 1	EPA Method 23	13C-1,2,3,4,7,8-HxCDD	H	133
2001762-02	2020.2232.M23-Run 2	EPA Method 23	13C-1,2,3,4,7,8-HxCDD	H	133
2001762-04	2020.2232.M23-Field Train Proof	EPA Method 23	13C6-Naphthalene	H	18.8

H = Recovery was outside laboratory acceptance criteria.

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Sample Inventory Report

Vista Sample ID	Client Sample ID	Sampled	Received	Components/Containers
2001762-01	2020.2232.M23-Run 1	25-Aug-20 13:43	01-Sep-20 11:34	Filter
				XAD
				P/N, Filter Housing, Condenser
				Imp #1-4 Catch
2001762-02	2020.2232.M23-Run 2	25-Aug-20 19:32	01-Sep-20 11:34	Filter
				XAD
				P/N, Filter Housing, Condenser
				Imp #1-4 Catch
2001762-03	2020.2232.M23-Run 3	26-Aug-20 13:45	01-Sep-20 11:34	Filter
				XAD
				P/N, Filter Housing, Condenser
				Imp #1-4 Catch
2001762-04	2020.2232.M23-Field Train Proof	26-Aug-20 13:50	01-Sep-20 11:34	Filter
				XAD
				P/N, Filter Housing, Condenser
				Imp #1-4 Catch

ANALYTICAL RESULTS

Sample ID: Method Blank — **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air

Laboratory Data
Lab Sample: B0J0009-BLK1
QC Batch: B0J0009
Date Extracted: 01-Oct-20
Column: ZB-DIOXIN

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
2,3,7,8-TCDD	ND	1.38			07-Oct-20 19:41	1
1,2,3,7,8-PeCDD	ND	1.95			07-Oct-20 19:41	1
1,2,3,4,7,8-HxCDD	ND	2.03			07-Oct-20 19:41	1
1,2,3,6,7,8-HxCDD	ND	2.05			07-Oct-20 19:41	1
1,2,3,7,8,9-HxCDD	ND	2.00			07-Oct-20 19:41	1
1,2,3,4,6,7,8-HpCDD	70.6			J	07-Oct-20 19:41	1
OCDD	14.2			J	07-Oct-20 19:41	1
2,3,7,8-TCDF	ND	0.877			07-Oct-20 19:41	1
1,2,3,7,8-PeCDF	ND	1.41			07-Oct-20 19:41	1
2,3,4,7,8-PeCDF	ND	1.29			07-Oct-20 19:41	1
1,2,3,4,7,8-HxCDF	ND	0.900			07-Oct-20 19:41	1
1,2,3,6,7,8-HxCDF	ND	0.886			07-Oct-20 19:41	1
2,3,4,6,7,8-HxCDF	ND	0.959			07-Oct-20 19:41	1
1,2,3,7,8,9-HxCDF	ND	1.09			07-Oct-20 19:41	1
1,2,3,4,6,7,8-HpCDF	ND	1.96			07-Oct-20 19:41	1
1,2,3,4,7,8,9-HpCDF	ND	2.38			07-Oct-20 19:41	1
OCDF	ND	3.43			07-Oct-20 19:41	1
Toxic Equivalent						
TEQMinWHO2005Dioxin	0.710					
Totals						
Total TCDD	ND	1.38				
Total PeCDD	ND	1.95				
Total HxCDD	ND	2.05				
Total HpCDD	70.6					
Total TCDF	3.11					
Total PeCDF	ND	1.41				
Total HxCDF	ND	1.09				
Total HpCDF	ND	2.38				

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-2,3,7,8-TCDD	IS	94.4	20 - 130		07-Oct-20 19:41	1
13C-1,2,3,7,8-PeCDD	IS	108	20 - 130		07-Oct-20 19:41	1
13C-1,2,3,6,7,8-HxCDD	IS	94.6	20 - 130		07-Oct-20 19:41	1
13C-1,2,3,4,6,7,8-HpCDD	IS	101	20 - 130		07-Oct-20 19:41	1
13C-OCDD	IS	91.6	20 - 130		07-Oct-20 19:41	1
13C-2,3,7,8-TCDF	IS	97.7	20 - 130		07-Oct-20 19:41	1
13C-1,2,3,7,8-PeCDF	IS	112	20 - 130		07-Oct-20 19:41	1
13C-1,2,3,6,7,8-HxCDF	IS	89.6	20 - 130		07-Oct-20 19:41	1
13C-1,2,3,4,6,7,8-HpCDF	IS	92.8	20 - 130		07-Oct-20 19:41	1
13C-OCDF	IS	89.5	20 - 130		07-Oct-20 19:41	1
37Cl-2,3,7,8-TCDD	PS	93.1	70 - 130		07-Oct-20 19:41	1
13C-2,3,4,7,8-PeCDF	PS	102	70 - 130		07-Oct-20 19:41	1
13C-1,2,3,4,7,8-HxCDD	PS	130	70 - 130		07-Oct-20 19:41	1
13C-1,2,3,4,7,8-HxCDF	PS	107	70 - 130		07-Oct-20 19:41	1
13C-1,2,3,4,7,8,9-HpCDF	PS	124	70 - 130		07-Oct-20 19:41	1
13C-1,2,3,7,8,9-HxCDF	AS	92.9	70 - 130		07-Oct-20 19:41	1

EDL - Sample specifc estimated detection limit
EMPC - Estimated maximum possible concentration

Sample ID: LCSD **EPA Method 23**

Name:	Environmental Technical Services, LLC		
Project:	2020.2232	Lab Sample:	B0J0009-BSD1
Matrix:	Air	QC Batch:	B0J0009
Date Analyzed:	07-Oct-20 18:14	Samp Size:	N/A
	07-Oct-20 17:30		
		Date Extracted:	01-Oct-20
		Column:	ZB-DIOXIN

Analyte	LCS (pg/Sample)	LCS Spike Amt	LCS % Rec	LCS Quals	LCSD (pg/Sample)	LCSD Spike Amt	LCSD % Rec	RPD	LCSD Quals	%Rec Limits	RPD Limits
2,3,7,8-TCDD	281	300	93.8		269	300	89.8	4.36		70-130	200
1,2,3,7,8-PeCDD	1430	1500	95.5		1470	1500	98.0	2.56		70-130	200
1,2,3,4,7,8-HxCDD	1470	1500	97.8		1450	1500	97.0	0.830		70-130	200
1,2,3,6,7,8-HxCDD	1530	1500	102		1500	1500	99.9	1.97		70-130	200
1,2,3,7,8,9-HxCDD	1520	1500	101		1480	1500	98.6	2.82		70-130	200
1,2,3,4,6,7,8-HpCDD	1570	1500	104	B	1510	1500	101	3.79	B	70-130	200
OCDD	2970	3000	99.0	B	2920	3000	97.3	1.73	B	70-130	200
2,3,7,8-TCDF	278	300	92.6		287	300	95.8	3.34		70-130	200
1,2,3,7,8-PeCDF	1510	1500	101		1480	1500	98.7	1.99		70-130	200
2,3,4,7,8-PeCDF	1450	1500	96.9		1400	1500	93.3	3.77		70-130	200
1,2,3,4,7,8-HxCDF	1520	1500	101		1500	1500	100	1.19		70-130	200
1,2,3,6,7,8-HxCDF	1540	1500	103		1530	1500	102	0.827		70-130	200
2,3,4,6,7,8-HxCDF	1550	1500	103		1540	1500	102	0.683		70-130	200
1,2,3,7,8,9-HxCDF	1530	1500	102		1530	1500	102	0.0583		70-130	200
1,2,3,4,6,7,8-HpCDF	1480	1500	98.5		1470	1500	97.9	0.631		70-130	200
1,2,3,4,7,8,9-HpCDF	1540	1500	103		1520	1500	102	1.02		70-130	200
OCDF	2950	3000	98.4		2920	3000	97.5	0.917		70-130	200

Labeled Standards	Type	LCS % Rec	LCS Quals	LCSD % Rec	LCSD Quals	Limits
13C-2,3,7,8-TCDD	IS	85.3		83.5		20 - 130
13C-1,2,3,7,8-PeCDD	IS	102		97.1		20 - 130
13C-1,2,3,6,7,8-HxCDD	IS	83.5		80.7		20 - 130
13C-1,2,3,4,6,7,8-HpCDD	IS	95.0		92.0		20 - 130
13C-OCDD	IS	86.0		85.6		20 - 130
13C-2,3,7,8-TCDF	IS	90.7		89.5		20 - 130
13C-1,2,3,7,8-PeCDF	IS	99.5		103		20 - 130
13C-1,2,3,6,7,8-HxCDF	IS	81.4		77.1		20 - 130
13C-1,2,3,4,6,7,8-HpCDF	IS	88.5		85.2		20 - 130
13C-OCDF	IS	86.3		85.5		20 - 130

Sample ID: 2020.2232.M23-Run 1 **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 25-Aug-20 13:43

Laboratory Data
Lab Sample: 2001762-01
QC Batch: B0J0009
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-DIOXIN

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
2,3,7,8-TCDD	ND	2.64			07-Oct-20 22:36	1
1,2,3,7,8-PeCDD	26.6			J	07-Oct-20 22:36	1
1,2,3,4,7,8-HxCDD	ND		21.3		07-Oct-20 22:36	1
1,2,3,6,7,8-HxCDD	64.1			J	07-Oct-20 22:36	1
1,2,3,7,8,9-HxCDD	34.0			J	07-Oct-20 22:36	1
1,2,3,4,6,7,8-HpCDD	395			B	07-Oct-20 22:36	1
OCDD	403			B	07-Oct-20 22:36	1
2,3,7,8-TCDF	57.5				07-Oct-20 22:36	1
1,2,3,7,8-PeCDF	39.6			J	07-Oct-20 22:36	1
2,3,4,7,8-PeCDF	69.7			J	07-Oct-20 22:36	1
1,2,3,4,7,8-HxCDF	31.4			J	07-Oct-20 22:36	1
1,2,3,6,7,8-HxCDF	34.3			J	07-Oct-20 22:36	1
2,3,4,6,7,8-HxCDF	36.0			J	07-Oct-20 22:36	1
1,2,3,7,8,9-HxCDF	2.82			J	07-Oct-20 22:36	1
1,2,3,4,6,7,8-HpCDF	67.5			J	07-Oct-20 22:36	1
1,2,3,4,7,8,9-HpCDF	ND		7.89		07-Oct-20 22:36	1
OCDF	20.4			J	07-Oct-20 22:36	1
Toxic Equivalent						
TEQMinWHO2005Dioxin	79.5					
Totals						
Total TCDD	618		648			
Total PeCDD	491		677			
Total HxCDD	652		673			
Total HpCDD	623			B		
Total TCDF	2430		2500	B		
Total PeCDF	794		934			
Total HxCDF	270		279			
Total HpCDF	86.3		94.2			

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-2,3,7,8-TCDD	IS	91.5	20 - 130		07-Oct-20 22:36	1
13C-1,2,3,7,8-PeCDD	IS	102	20 - 130		07-Oct-20 22:36	1
13C-1,2,3,6,7,8-HxCDD	IS	91.8	20 - 130		07-Oct-20 22:36	1
13C-1,2,3,4,6,7,8-HpCDD	IS	97.2	20 - 130		07-Oct-20 22:36	1
13C-OCDD	IS	88.1	20 - 130		07-Oct-20 22:36	1
13C-2,3,7,8-TCDF	IS	99.9	20 - 130		07-Oct-20 22:36	1
13C-1,2,3,7,8-PeCDF	IS	106	20 - 130		07-Oct-20 22:36	1
13C-1,2,3,6,7,8-HxCDF	IS	84.1	20 - 130		07-Oct-20 22:36	1
13C-1,2,3,4,6,7,8-HpCDF	IS	90.1	20 - 130		07-Oct-20 22:36	1
13C-OCDF	IS	88.0	20 - 130		07-Oct-20 22:36	1
37Cl-2,3,7,8-TCDD	PS	98.5	70 - 130		07-Oct-20 22:36	1
13C-2,3,4,7,8-PeCDF	PS	106	70 - 130		07-Oct-20 22:36	1
13C-1,2,3,4,7,8-HxCDD	PS	133	70 - 130	H	07-Oct-20 22:36	1
13C-1,2,3,4,7,8-HxCDF	PS	109	70 - 130		07-Oct-20 22:36	1
13C-1,2,3,4,7,8,9-HpCDF	PS	125	70 - 130		07-Oct-20 22:36	1
13C-1,2,3,7,8,9-HxCDF	AS	89.5	70 - 130		07-Oct-20 22:36	1

EDL - Sample specifc estimated detection limit
EMPC - Estimated maximum possible concentration

Sample ID: 2020.2232.M23-Run 2 **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 25-Aug-20 19:32

Laboratory Data
Lab Sample: 2001762-02
QC Batch: B0J0009
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-DIOXIN

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
2,3,7,8-TCDD	ND		4.64		07-Oct-20 21:52	1
1,2,3,7,8-PeCDD	23.3			J	07-Oct-20 21:52	1
1,2,3,4,7,8-HxCDD	27.4			J	07-Oct-20 21:52	1
1,2,3,6,7,8-HxCDD	93.3			J	07-Oct-20 21:52	1
1,2,3,7,8,9-HxCDD	47.8			J	07-Oct-20 21:52	1
1,2,3,4,6,7,8-HpCDD	615			B	07-Oct-20 21:52	1
OCDD	662			B	07-Oct-20 21:52	1
2,3,7,8-TCDF	21.4				07-Oct-20 21:52	1
1,2,3,7,8-PeCDF	ND		20.0		07-Oct-20 21:52	1
2,3,4,7,8-PeCDF	44.6			J	07-Oct-20 21:52	1
1,2,3,4,7,8-HxCDF	36.2			J	07-Oct-20 21:52	1
1,2,3,6,7,8-HxCDF	35.2			J	07-Oct-20 21:52	1
2,3,4,6,7,8-HxCDF	38.1			J	07-Oct-20 21:52	1
1,2,3,7,8,9-HxCDF	10.5			J	07-Oct-20 21:52	1
1,2,3,4,6,7,8-HpCDF	89.5			J	07-Oct-20 21:52	1
1,2,3,4,7,8,9-HpCDF	14.1			J	07-Oct-20 21:52	1
OCDF	31.9			J	07-Oct-20 21:52	1
Toxic Equivalent						
TEQMinWHO2005Dioxin	75.1					
Totals						
Total TCDD	319		324			
Total PeCDD	506		670			
Total HxCDD	939					
Total HpCDD	974			B		
Total TCDF	621		681	B		
Total PeCDF	429		460			
Total HxCDF	273		280			
Total HpCDF	128					

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-2,3,7,8-TCDD	IS	101	20 - 130		07-Oct-20 21:52	1
13C-1,2,3,7,8-PeCDD	IS	110	20 - 130		07-Oct-20 21:52	1
13C-1,2,3,6,7,8-HxCDD	IS	103	20 - 130		07-Oct-20 21:52	1
13C-1,2,3,4,6,7,8-HpCDD	IS	109	20 - 130		07-Oct-20 21:52	1
13C-OCDD	IS	100	20 - 130		07-Oct-20 21:52	1
13C-2,3,7,8-TCDF	IS	108	20 - 130		07-Oct-20 21:52	1
13C-1,2,3,7,8-PeCDF	IS	115	20 - 130		07-Oct-20 21:52	1
13C-1,2,3,6,7,8-HxCDF	IS	96.1	20 - 130		07-Oct-20 21:52	1
13C-1,2,3,4,6,7,8-HpCDF	IS	101	20 - 130		07-Oct-20 21:52	1
13C-OCDF	IS	97.1	20 - 130		07-Oct-20 21:52	1
37Cl-2,3,7,8-TCDD	PS	96.5	70 - 130		07-Oct-20 21:52	1
13C-2,3,4,7,8-PeCDF	PS	103	70 - 130		07-Oct-20 21:52	1
13C-1,2,3,4,7,8-HxCDD	PS	133	70 - 130	H	07-Oct-20 21:52	1
13C-1,2,3,4,7,8-HxCDF	PS	108	70 - 130		07-Oct-20 21:52	1
13C-1,2,3,4,7,8,9-HpCDF	PS	128	70 - 130		07-Oct-20 21:52	1
13C-1,2,3,7,8,9-HxCDF	AS	101	70 - 130		07-Oct-20 21:52	1

EDL - Sample specifc estimated detection limit
EMPC - Estimated maximum possible concentration

Sample ID: 2020.2232.M23-Run 3 **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 26-Aug-20 13:45

Laboratory Data
Lab Sample: 2001762-03
QC Batch: B0J0009
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-DIOXIN

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
2,3,7,8-TCDD	ND	1.82			07-Oct-20 21:09	1
1,2,3,7,8-PeCDD	24.2			J	07-Oct-20 21:09	1
1,2,3,4,7,8-HxCDD	37.4			J	07-Oct-20 21:09	1
1,2,3,6,7,8-HxCDD	114				07-Oct-20 21:09	1
1,2,3,7,8,9-HxCDD	59.4			J	07-Oct-20 21:09	1
1,2,3,4,6,7,8-HpCDD	703			B	07-Oct-20 21:09	1
OCDD	864			B	07-Oct-20 21:09	1
2,3,7,8-TCDF	24.1				07-Oct-20 21:09	1
1,2,3,7,8-PeCDF	26.3			J	07-Oct-20 21:09	1
2,3,4,7,8-PeCDF	51.7			J	07-Oct-20 21:09	1
1,2,3,4,7,8-HxCDF	44.5			J	07-Oct-20 21:09	1
1,2,3,6,7,8-HxCDF	42.7			J	07-Oct-20 21:09	1
2,3,4,6,7,8-HxCDF	46.7			J	07-Oct-20 21:09	1
1,2,3,7,8,9-HxCDF	ND		5.70		07-Oct-20 21:09	1
1,2,3,4,6,7,8-HpCDF	106				07-Oct-20 21:09	1
1,2,3,4,7,8,9-HpCDF	ND		16.1		07-Oct-20 21:09	1
OCDF	36.8			J	07-Oct-20 21:09	1
Toxic Equivalent						
TEQMinWHO2005Dioxin	85.7					
Totals						
Total TCDD	308		356			
Total PeCDD	602		746			
Total HxCDD	1100		1140			
Total HpCDD	1130			B		
Total TCDF	591		698	B		
Total PeCDF	450		504			
Total HxCDF	320		337			
Total HpCDF	123		152			

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-2,3,7,8-TCDD	IS	78.5	20 - 130		07-Oct-20 21:09	1
13C-1,2,3,7,8-PeCDD	IS	89.2	20 - 130		07-Oct-20 21:09	1
13C-1,2,3,6,7,8-HxCDD	IS	83.4	20 - 130		07-Oct-20 21:09	1
13C-1,2,3,4,6,7,8-HpCDD	IS	86.1	20 - 130		07-Oct-20 21:09	1
13C-OCDD	IS	79.4	20 - 130		07-Oct-20 21:09	1
13C-2,3,7,8-TCDF	IS	83.8	20 - 130		07-Oct-20 21:09	1
13C-1,2,3,7,8-PeCDF	IS	91.7	20 - 130		07-Oct-20 21:09	1
13C-1,2,3,6,7,8-HxCDF	IS	76.4	20 - 130		07-Oct-20 21:09	1
13C-1,2,3,4,6,7,8-HpCDF	IS	82.7	20 - 130		07-Oct-20 21:09	1
13C-OCDF	IS	77.8	20 - 130		07-Oct-20 21:09	1
37Cl-2,3,7,8-TCDD	PS	97.0	70 - 130		07-Oct-20 21:09	1
13C-2,3,4,7,8-PeCDF	PS	101	70 - 130		07-Oct-20 21:09	1
13C-1,2,3,4,7,8-HxCDD	PS	130	70 - 130		07-Oct-20 21:09	1
13C-1,2,3,4,7,8-HxCDF	PS	109	70 - 130		07-Oct-20 21:09	1
13C-1,2,3,4,7,8,9-HpCDF	PS	122	70 - 130		07-Oct-20 21:09	1
13C-1,2,3,7,8,9-HxCDF	AS	79.8	70 - 130		07-Oct-20 21:09	1

EDL - Sample specifc estimated detection limit
EMPC - Estimated maximum possible concentration

Sample ID: 2020.2232.M23-Field Train Proof

EPA Method 23

Client Data

Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 26-Aug-20 13:50

Laboratory Data

Lab Sample: 2001762-04
QC Batch: B0J0009
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-DIOXIN

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
2,3,7,8-TCDD	ND	1.26			07-Oct-20 20:25	1
1,2,3,7,8-PeCDD	ND	1.98			07-Oct-20 20:25	1
1,2,3,4,7,8-HxCDD	ND	1.87			07-Oct-20 20:25	1
1,2,3,6,7,8-HxCDD	ND	1.89			07-Oct-20 20:25	1
1,2,3,7,8,9-HxCDD	ND	1.85			07-Oct-20 20:25	1
1,2,3,4,6,7,8-HpCDD	74.3			J, B	07-Oct-20 20:25	1
OCDD	ND	4.42			07-Oct-20 20:25	1
2,3,7,8-TCDF	ND	0.766			07-Oct-20 20:25	1
1,2,3,7,8-PeCDF	ND	1.61			07-Oct-20 20:25	1
2,3,4,7,8-PeCDF	ND	1.48			07-Oct-20 20:25	1
1,2,3,4,7,8-HxCDF	ND	0.972			07-Oct-20 20:25	1
1,2,3,6,7,8-HxCDF	ND	0.958			07-Oct-20 20:25	1
2,3,4,6,7,8-HxCDF	ND	1.04			07-Oct-20 20:25	1
1,2,3,7,8,9-HxCDF	ND	1.18			07-Oct-20 20:25	1
1,2,3,4,6,7,8-HpCDF	ND	1.37			07-Oct-20 20:25	1
1,2,3,4,7,8,9-HpCDF	ND	1.67			07-Oct-20 20:25	1
OCDF	ND	3.47			07-Oct-20 20:25	1
Toxic Equivalent						
TEQMinWHO2005Dioxin	0.743					
Totals						
Total TCDD	ND	1.26				
Total PeCDD	ND	1.98				
Total HxCDD	ND	1.89				
Total HpCDD	74.3			B		
Total TCDF	4.08			B		
Total PeCDF	ND	1.61				
Total HxCDF	ND	1.18				
Total HpCDF	ND	1.67				

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-2,3,7,8-TCDD	IS	91.9	20 - 130		07-Oct-20 20:25	1
13C-1,2,3,7,8-PeCDD	IS	100	20 - 130		07-Oct-20 20:25	1
13C-1,2,3,6,7,8-HxCDD	IS	94.0	20 - 130		07-Oct-20 20:25	1
13C-1,2,3,4,6,7,8-HpCDD	IS	102	20 - 130		07-Oct-20 20:25	1
13C-OCDD	IS	89.3	20 - 130		07-Oct-20 20:25	1
13C-2,3,7,8-TCDF	IS	96.5	20 - 130		07-Oct-20 20:25	1
13C-1,2,3,7,8-PeCDF	IS	95.7	20 - 130		07-Oct-20 20:25	1
13C-1,2,3,6,7,8-HxCDF	IS	88.4	20 - 130		07-Oct-20 20:25	1
13C-1,2,3,4,6,7,8-HpCDF	IS	93.1	20 - 130		07-Oct-20 20:25	1
13C-OCDF	IS	88.9	20 - 130		07-Oct-20 20:25	1
37Cl-2,3,7,8-TCDD	PS	95.9	70 - 130		07-Oct-20 20:25	1
13C-2,3,4,7,8-PeCDF	PS	103	70 - 130		07-Oct-20 20:25	1
13C-1,2,3,4,7,8-HxCDD	PS	130	70 - 130		07-Oct-20 20:25	1
13C-1,2,3,4,7,8-HxCDF	PS	107	70 - 130		07-Oct-20 20:25	1
13C-1,2,3,4,7,8,9-HpCDF	PS	125	70 - 130		07-Oct-20 20:25	1
13C-1,2,3,7,8,9-HxCDF	AS	90.4	70 - 130		07-Oct-20 20:25	1

EDL - Sample specifc estimated detection limit
EMPC - Estimated maximum possible concentration

Sample ID: Method Blank — **EPA Method 23**

Client Data		Laboratory Data			
Name:	Environmental Technical Services, LLC	Lab Sample:	B0J0010-BLK1		
Project:	2020.2232	QC Batch:	B0J0010	Date Extracted:	01-Oct-20
Matrix:	Air			Column:	ZB-50

Analyte	Conc. (ng/Sample)	MDL	RL	Qualifiers	Analyzed	Dilution
Naphthalene	ND	17.1	50.0		09-Oct-20 22:28	1
2-Methylnaphthalene	ND	4.32	20.0		09-Oct-20 22:28	1
Acenaphthylene	ND	3.30	20.0		09-Oct-20 22:28	1
Acenaphthene	2.38	2.17	20.0	J	09-Oct-20 22:28	1
Fluorene	ND	3.54	20.0		09-Oct-20 22:28	1
Phenanthrene	ND	30.5	50.0		09-Oct-20 22:28	1
Anthracene	ND	5.20	20.0		09-Oct-20 22:28	1
Fluoranthene	ND	3.31	20.0		09-Oct-20 22:28	1
Pyrene	ND	2.92	20.0		09-Oct-20 22:28	1
Benz(a)anthracene	ND	2.00	20.0		09-Oct-20 22:28	1
Chrysene	1.36	1.18	20.0	J	09-Oct-20 22:28	1
Benzo(b)fluoranthene	3.59	0.820	20.0	J	09-Oct-20 22:28	1
Benzo(k)fluoranthene	ND	0.992	20.0		09-Oct-20 22:28	1
Benzo(e)pyrene	ND	1.20	20.0		09-Oct-20 22:28	1
Benzo(a)pyrene	ND	1.17	20.0		09-Oct-20 22:28	1
Perylene	ND	1.40	20.0		09-Oct-20 22:28	1
Indeno(1,2,3-c,d)pyrene	ND	1.28	20.0		09-Oct-20 22:28	1
Dibenz(a,h)anthracene	ND	1.82	20.0		09-Oct-20 22:28	1
Benzo(g,h,i)perylene	ND	1.60	20.0		09-Oct-20 22:28	1

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C6-Naphthalene	IS	24.5	20 - 130		09-Oct-20 22:28	1
13C6-2-Methylnaphthalene	IS	30.7	20 - 130		09-Oct-20 22:28	1
13C6-Acenaphthylene	IS	34.2	20 - 130		09-Oct-20 22:28	1
13C6-Acenaphthene	IS	39.5	20 - 130		09-Oct-20 22:28	1
13C6-Fluorene	IS	44.5	20 - 130		09-Oct-20 22:28	1
13C6-Phenanthrene	IS	53.9	20 - 130		09-Oct-20 22:28	1
13C6-Anthracene	IS	50.8	20 - 130		09-Oct-20 22:28	1
13C6-Fluoranthene	IS	47.4	20 - 130		09-Oct-20 22:28	1
13C3-Pyrene	IS	47.1	20 - 130		09-Oct-20 22:28	1
13C6-Benz[a]anthracene	IS	55.4	20 - 130		09-Oct-20 22:28	1
13C6-Chrysene	IS	52.5	20 - 130		09-Oct-20 22:28	1
13C6-Benzo[b]fluoranthene	IS	50.4	20 - 130		09-Oct-20 22:28	1
13C6-Benzo[k]fluoranthene	IS	46.3	20 - 130		09-Oct-20 22:28	1
13C4-Benzo[E]Pyrene	IS	49.4	20 - 130		09-Oct-20 22:28	1
13C4-Benzo[a]pyrene	IS	45.1	20 - 130		09-Oct-20 22:28	1
d12-Perylene	IS	40.0	20 - 130		09-Oct-20 22:28	1
13C6-Indeno[1,2,3-cd]pyrene	IS	48.2	20 - 130		09-Oct-20 22:28	1
13C6-Dibenz[a,h]anthracene	IS	52.9	20 - 130		09-Oct-20 22:28	1
13C12-Benzo[ghi]perylene	IS	49.3	20 - 130		09-Oct-20 22:28	1
13C6-Benzo[C]Fluorene	PS	112	70 - 130		09-Oct-20 22:28	1
13C12-Benzo(j)Fluoranthene	PS	114	70 - 130		09-Oct-20 22:28	1

MDL - Method Detection Limit
RL - Reporting limit

Results reported to MDL.

Sample ID: LCSD — **EPA Method 23**

Name:	Environmental Technical Services, LLC	Lab Sample:	B0J0010-BSD1
Project:	2020.2232	QC Batch:	B0J0010
Matrix:	Air	Samp Size:	N/A
Date Analyzed:	09-Oct-20 20:50 09-Oct-20 20:01	Date Extracted:	01-Oct-20
		Column:	ZB-50

Analyte	LCS (ng/Sample)	LCS Spike Amt	LCS % Rec	LCS Quals	LCSD (ng/Sample)	LCSD Spike Amt	LCSD % Rec	RPD	LCSD Quals	%Rec Limits	RPD Limits
Naphthalene	1390	1500	92.9		1410	1500	94.2	1.31		70- 130	200
2-Methylnaphthalene	557	600	92.8		553	600	92.1	0.687		70- 130	200
Acenaphthylene	554	600	92.4		528	600	88.0	4.87		70- 130	200
Acenaphthene	535	600	89.2	B	542	600	90.4	1.26	B	70- 130	200
Fluorene	533	600	88.9		527	600	87.9	1.09		70- 130	200
Phenanthrene	1240	1500	82.6		1320	1500	87.7	6.01		70- 130	200
Anthracene	515	600	85.9		514	600	85.7	0.205		70- 130	200
Fluoranthene	540	600	90.0		542	600	90.4	0.414		70- 130	200
Pyrene	536	600	89.3		531	600	88.5	0.854		70- 130	200
Benz(a)anthracene	557	600	92.9		549	600	91.6	1.43		70- 130	200
Chrysene	518	600	86.4	B	524	600	87.3	1.08	B	70- 130	200
Benzo(b)fluoranthene	539	600	89.8	B	542	600	90.4	0.660	B	70- 130	200
Benzo(k)fluoranthene	571	600	95.2		571	600	95.2	0.0520		70- 130	200
Benzo(e)pyrene	568	600	94.6		573	600	95.5	0.870		70- 130	200
Benzo(a)pyrene	619	600	103		582	600	97.0	6.18		70- 130	200
Perylene	626	600	104		620	600	103	1.05		70- 130	200
Indeno(1,2,3-c,d)pyrene	605	600	101		581	600	96.8	4.09		70- 130	200
Dibenz(a,h)anthracene	611	600	102		576	600	96.0	5.89		70- 130	200
Benzo(g,h,i)perylene	610	600	102		597	600	99.5	2.10		70- 130	200

Labeled Standards	Type	LCS % Rec	LCS Quals	LCSD % Rec	LCSD Quals	Limits
13C6-Naphthalene	IS	32.6		33.7		20 - 130
13C6-2-Methylnaphthalene	IS	39.9		44.1		20 - 130
13C6-Acenaphthylene	IS	43.0		35.6		20 - 130
13C6-Acenaphthene	IS	47.1		49.3		20 - 130
13C6-Fluorene	IS	57.0		56.6		20 - 130
13C6-Phenanthrene	IS	72.2		70.3		20 - 130
13C6-Anthracene	IS	66.8		63.1		20 - 130
13C6-Fluoranthene	IS	62.1		59.8		20 - 130
13C3-Pyrene	IS	60.0		59.0		20 - 130
13C6-Benz[a]anthracene	IS	76.2		73.9		20 - 130
13C6-Chrysene	IS	75.5		73.5		20 - 130
13C6-Benzo[b]fluoranthene	IS	65.0		63.9		20 - 130
13C6-Benzo[k]fluoranthene	IS	56.9		54.0		20 - 130
13C4-Benzo[E]Pyrene	IS	61.1		58.3		20 - 130
13C4-Benzo[a]pyrene	IS	57.2		45.8		20 - 130
d12-Perylene	IS	53.5		37.6		20 - 130
13C6-Indeno[1,2,3-cd]pyrene	IS	65.9		63.0		20 - 130
13C6-Dibenz[a,h]anthracene	IS	67.7		71.0		20 - 130
13C12-Benzo[ghi]perylene	IS	66.9		62.3		20 - 130

Sample ID: 2020.2232.M23-Run 1 **EPA Method 23**

Client Data		Laboratory Data			
Name:	Environmental Technical Services, LLC	Lab Sample:	2001762-01	Date Received:	01-Sep-20 11:34
Project:	2020.2232	QC Batch:	B0J0010	Date Extracted:	01-Oct-20
Matrix:	Air Train			Column:	ZB-50
Date Collected:	25-Aug-20 13:43				

Analyte	Conc. (ng/Sample)	MDL	RL	Qualifiers	Analyzed	Dilution
Naphthalene	192	17.1	50.0		10-Oct-20 00:06	1
2-Methylnaphthalene	80.5	4.32	20.0		10-Oct-20 00:06	1
Acenaphthylene	3.40	3.30	20.0	J	10-Oct-20 00:06	1
Acenaphthene	5.42	2.17	20.0	J, B	10-Oct-20 00:06	1
Fluorene	9.24	3.54	20.0	J	10-Oct-20 00:06	1
Phenanthrene	77.6	30.5	50.0		10-Oct-20 00:06	1
Anthracene	ND	5.20	20.0		10-Oct-20 00:06	1
Fluoranthene	37.2	3.31	20.0		10-Oct-20 00:06	1
Pyrene	42.5	2.92	20.0		10-Oct-20 00:06	1
Benz(a)anthracene	ND	2.00	20.0		10-Oct-20 00:06	1
Chrysene	6.84	1.18	20.0	J, B	10-Oct-20 00:06	1
Benzo(b)fluoranthene	6.02	0.820	20.0	J, B	10-Oct-20 00:06	1
Benzo(k)fluoranthene	2.36	0.992	20.0	J	10-Oct-20 00:06	1
Benzo(e)pyrene	12.9	1.20	20.0	J	10-Oct-20 00:06	1
Benzo(a)pyrene	2.65	1.17	20.0	J	10-Oct-20 00:06	1
Perylene	ND	1.40	20.0		10-Oct-20 00:06	1
Indeno(1,2,3-c,d)pyrene	6.38	1.28	20.0	J	10-Oct-20 00:06	1
Dibenz(a,h)anthracene	ND	1.82	20.0		10-Oct-20 00:06	1
Benzo(g,h,i)perylene	48.9	1.60	20.0		10-Oct-20 00:06	1

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C6-Naphthalene	IS	26.0	20 - 130		10-Oct-20 00:06	1
13C6-2-Methylnaphthalene	IS	33.7	20 - 130		10-Oct-20 00:06	1
13C6-Acenaphthylene	IS	40.6	20 - 130		10-Oct-20 00:06	1
13C6-Acenaphthene	IS	44.4	20 - 130		10-Oct-20 00:06	1
13C6-Fluorene	IS	58.0	20 - 130		10-Oct-20 00:06	1
13C6-Phenanthrene	IS	74.6	20 - 130		10-Oct-20 00:06	1
13C6-Anthracene	IS	73.3	20 - 130		10-Oct-20 00:06	1
13C6-Fluoranthene	IS	55.8	20 - 130		10-Oct-20 00:06	1
13C3-Pyrene	IS	54.9	20 - 130		10-Oct-20 00:06	1
13C6-Benz[a]anthracene	IS	69.1	20 - 130		10-Oct-20 00:06	1
13C6-Chrysene	IS	63.8	20 - 130		10-Oct-20 00:06	1
13C6-Benzo[b]fluoranthene	IS	60.6	20 - 130		10-Oct-20 00:06	1
13C6-Benzo[k]fluoranthene	IS	50.7	20 - 130		10-Oct-20 00:06	1
13C4-Benzo[E]Pyrene	IS	53.1	20 - 130		10-Oct-20 00:06	1
13C4-Benzo[a]pyrene	IS	55.0	20 - 130		10-Oct-20 00:06	1
d12-Perylene	IS	51.5	20 - 130		10-Oct-20 00:06	1
13C6-Indeno[1,2,3-cd]pyrene	IS	55.1	20 - 130		10-Oct-20 00:06	1
13C6-Dibenz[a,h]anthracene	IS	63.3	20 - 130		10-Oct-20 00:06	1
13C12-Benzo[ghi]perylene	IS	53.6	20 - 130		10-Oct-20 00:06	1
13C6-Benzo[C]Fluorene	PS	110	70 - 130		10-Oct-20 00:06	1
13C12-Benzo(j)Fluoranthene	PS	117	70 - 130		10-Oct-20 00:06	1

MDL - Method Detection Limit
RL - Reporting limit

Results reported to MDL.

Sample ID: 2020.2232.M23-Run 2 **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 25-Aug-20 19:32

Laboratory Data
Lab Sample: 2001762-02
QC Batch: B0J0010
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-50

Analyte	Conc. (ng/Sample)	MDL	RL	Qualifiers	Analyzed	Dilution
Naphthalene	162	17.1	50.0		10-Oct-20 00:55	1
2-Methylnaphthalene	73.1	4.32	20.0		10-Oct-20 00:55	1
Acenaphthylene	4.41	3.30	20.0	J	10-Oct-20 00:55	1
Acenaphthene	3.69	2.17	20.0	J, B	10-Oct-20 00:55	1
Fluorene	7.32	3.54	20.0	J	10-Oct-20 00:55	1
Phenanthrene	89.3	30.5	50.0		10-Oct-20 00:55	1
Anthracene	ND	5.20	20.0		10-Oct-20 00:55	1
Fluoranthene	61.3	3.31	20.0		10-Oct-20 00:55	1
Pyrene	51.9	2.92	20.0		10-Oct-20 00:55	1
Benz(a)anthracene	ND	2.00	20.0		10-Oct-20 00:55	1
Chrysene	6.06	1.18	20.0	J, B	10-Oct-20 00:55	1
Benzo(b)fluoranthene	8.21	0.820	20.0	J, B	10-Oct-20 00:55	1
Benzo(k)fluoranthene	2.71	0.992	20.0	J	10-Oct-20 00:55	1
Benzo(e)pyrene	47.4	1.20	20.0		10-Oct-20 00:55	1
Benzo(a)pyrene	10.6	1.17	20.0	J	10-Oct-20 00:55	1
Perylene	ND	1.40	20.0		10-Oct-20 00:55	1
Indeno(1,2,3-c,d)pyrene	38.0	1.28	20.0		10-Oct-20 00:55	1
Dibenz(a,h)anthracene	ND	1.82	20.0		10-Oct-20 00:55	1
Benzo(g,h,i)perylene	288	1.60	20.0		10-Oct-20 00:55	1

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C6-Naphthalene	IS	26.0	20 - 130		10-Oct-20 00:55	1
13C6-2-Methylnaphthalene	IS	30.7	20 - 130		10-Oct-20 00:55	1
13C6-Acenaphthylene	IS	33.3	20 - 130		10-Oct-20 00:55	1
13C6-Acenaphthene	IS	37.7	20 - 130		10-Oct-20 00:55	1
13C6-Fluorene	IS	45.1	20 - 130		10-Oct-20 00:55	1
13C6-Phenanthrene	IS	57.3	20 - 130		10-Oct-20 00:55	1
13C6-Anthracene	IS	54.5	20 - 130		10-Oct-20 00:55	1
13C6-Fluoranthene	IS	44.8	20 - 130		10-Oct-20 00:55	1
13C3-Pyrene	IS	44.5	20 - 130		10-Oct-20 00:55	1
13C6-Benz[a]anthracene	IS	53.5	20 - 130		10-Oct-20 00:55	1
13C6-Chrysene	IS	52.9	20 - 130		10-Oct-20 00:55	1
13C6-Benzo[b]fluoranthene	IS	49.3	20 - 130		10-Oct-20 00:55	1
13C6-Benzo[k]fluoranthene	IS	38.6	20 - 130		10-Oct-20 00:55	1
13C4-Benzo[E]Pyrene	IS	45.4	20 - 130		10-Oct-20 00:55	1
13C4-Benzo[a]pyrene	IS	41.8	20 - 130		10-Oct-20 00:55	1
d12-Perylene	IS	43.3	20 - 130		10-Oct-20 00:55	1
13C6-Indeno[1,2,3-cd]pyrene	IS	47.8	20 - 130		10-Oct-20 00:55	1
13C6-Dibenz[a,h]anthracene	IS	57.3	20 - 130		10-Oct-20 00:55	1
13C12-Benzo[ghi]perylene	IS	47.2	20 - 130		10-Oct-20 00:55	1
13C6-Benzo[C]Fluorene	PS	111	70 - 130		10-Oct-20 00:55	1
13C12-Benzo(j)Fluoranthene	PS	125	70 - 130		10-Oct-20 00:55	1

MDL - Method Detection Limit
RL - Reporting limit

Results reported to MDL.

Sample ID: 2020.2232.M23-Run 3 **EPA Method 23**

Client Data		Laboratory Data			
Name:	Environmental Technical Services, LLC	Lab Sample:	2001762-03	Date Received:	01-Sep-20 11:34
Project:	2020.2232	QC Batch:	B0J0010	Date Extracted:	01-Oct-20
Matrix:	Air Train			Column:	ZB-50
Date Collected:	26-Aug-20 13:45				

Analyte	Conc. (ng/Sample)	MDL	RL	Qualifiers	Analyzed	Dilution
Naphthalene	153	17.1	50.0		10-Oct-20 01:44	1
2-Methylnaphthalene	67.4	4.32	20.0		10-Oct-20 01:44	1
Acenaphthylene	3.49	3.30	20.0	J	10-Oct-20 01:44	1
Acenaphthene	5.72	2.17	20.0	J, B	10-Oct-20 01:44	1
Fluorene	7.74	3.54	20.0	J	10-Oct-20 01:44	1
Phenanthrene	91.4	30.5	50.0		10-Oct-20 01:44	1
Anthracene	ND	5.20	20.0		10-Oct-20 01:44	1
Fluoranthene	82.6	3.31	20.0		10-Oct-20 01:44	1
Pyrene	46.4	2.92	20.0		10-Oct-20 01:44	1
Benz(a)anthracene	ND	2.00	20.0		10-Oct-20 01:44	1
Chrysene	15.5	1.18	20.0	J, B	10-Oct-20 01:44	1
Benzo(b)fluoranthene	28.5	0.820	20.0	B	10-Oct-20 01:44	1
Benzo(k)fluoranthene	11.3	0.992	20.0	J	10-Oct-20 01:44	1
Benzo(e)pyrene	22.6	1.20	20.0		10-Oct-20 01:44	1
Benzo(a)pyrene	2.51	1.17	20.0	J	10-Oct-20 01:44	1
Perylene	ND	1.40	20.0		10-Oct-20 01:44	1
Indeno(1,2,3-c,d)pyrene	10.9	1.28	20.0	J	10-Oct-20 01:44	1
Dibenz(a,h)anthracene	ND	1.82	20.0		10-Oct-20 01:44	1
Benzo(g,h,i)perylene	42.8	1.60	20.0		10-Oct-20 01:44	1

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C6-Naphthalene	IS	48.2	20 - 130		10-Oct-20 01:44	1
13C6-2-Methylnaphthalene	IS	57.0	20 - 130		10-Oct-20 01:44	1
13C6-Acenaphthylene	IS	60.7	20 - 130		10-Oct-20 01:44	1
13C6-Acenaphthene	IS	66.7	20 - 130		10-Oct-20 01:44	1
13C6-Fluorene	IS	81.1	20 - 130		10-Oct-20 01:44	1
13C6-Phenanthrene	IS	105	20 - 130		10-Oct-20 01:44	1
13C6-Anthracene	IS	105	20 - 130		10-Oct-20 01:44	1
13C6-Fluoranthene	IS	78.6	20 - 130		10-Oct-20 01:44	1
13C3-Pyrene	IS	78.2	20 - 130		10-Oct-20 01:44	1
13C6-Benz[a]anthracene	IS	106	20 - 130		10-Oct-20 01:44	1
13C6-Chrysene	IS	96.2	20 - 130		10-Oct-20 01:44	1
13C6-Benzo[b]fluoranthene	IS	90.0	20 - 130		10-Oct-20 01:44	1
13C6-Benzo[k]fluoranthene	IS	70.4	20 - 130		10-Oct-20 01:44	1
13C4-Benzo[E]Pyrene	IS	75.0	20 - 130		10-Oct-20 01:44	1
13C4-Benzo[a]pyrene	IS	73.6	20 - 130		10-Oct-20 01:44	1
d12-Perylene	IS	71.8	20 - 130		10-Oct-20 01:44	1
13C6-Indeno[1,2,3-cd]pyrene	IS	78.4	20 - 130		10-Oct-20 01:44	1
13C6-Dibenz[a,h]anthracene	IS	90.2	20 - 130		10-Oct-20 01:44	1
13C12-Benzo[ghi]perylene	IS	76.1	20 - 130		10-Oct-20 01:44	1
13C6-Benzo[C]Fluorene	PS	106	70 - 130		10-Oct-20 01:44	1
13C12-Benzo(j)Fluoranthene	PS	115	70 - 130		10-Oct-20 01:44	1

MDL - Method Detection Limit
RL - Reporting limit

Results reported to MDL.

Sample ID: 2020.2232.M23-Field Train Proof — **EPA Method 23**

Client Data

Name:	Environmental Technical Services, LLC
Project:	2020.2232
Matrix:	Air Train
Date Collected:	26-Aug-20 13:50

Laboratory Data

Lab Sample:	2001762-04	Date Received:	01-Sep-20 11:34
QC Batch:	B0J0010	Date Extracted:	01-Oct-20
		Column:	ZB-50

Analyte	Conc. (ng/Sample)	MDL	RL	Qualifiers	Analyzed	Dilution
Naphthalene	43.3	17.1	50.0	J	09-Oct-20 23:17	1
2-Methylnaphthalene	9.50	4.32	20.0	J	09-Oct-20 23:17	1
Acenaphthylene	ND	3.30	20.0		09-Oct-20 23:17	1
Acenaphthene	ND	2.17	20.0		09-Oct-20 23:17	1
Fluorene	ND	3.54	20.0		09-Oct-20 23:17	1
Phenanthrene	ND	30.5	50.0		09-Oct-20 23:17	1
Anthracene	ND	5.20	20.0		09-Oct-20 23:17	1
Fluoranthene	5.22	3.31	20.0	J	09-Oct-20 23:17	1
Pyrene	12.0	2.92	20.0	J	09-Oct-20 23:17	1
Benz(a)anthracene	ND	2.00	20.0		09-Oct-20 23:17	1
Chrysene	1.33	1.18	20.0	J, B	09-Oct-20 23:17	1
Benzo(b)fluoranthene	2.33	0.820	20.0	J, B	09-Oct-20 23:17	1
Benzo(k)fluoranthene	ND	0.992	20.0		09-Oct-20 23:17	1
Benzo(e)pyrene	1.93	1.20	20.0	J	09-Oct-20 23:17	1
Benzo(a)pyrene	ND	1.17	20.0		09-Oct-20 23:17	1
Perylene	ND	1.40	20.0		09-Oct-20 23:17	1
Indeno(1,2,3-c,d)pyrene	ND	1.28	20.0		09-Oct-20 23:17	1
Dibenz(a,h)anthracene	ND	1.82	20.0		09-Oct-20 23:17	1
Benzo(g,h,i)perylene	5.01	1.60	20.0	J	09-Oct-20 23:17	1

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C6-Naphthalene	IS	18.8	20 - 130	H	09-Oct-20 23:17	1
13C6-2-Methylnaphthalene	IS	24.5	20 - 130		09-Oct-20 23:17	1
13C6-Acenaphthylene	IS	25.9	20 - 130		09-Oct-20 23:17	1
13C6-Acenaphthene	IS	29.8	20 - 130		09-Oct-20 23:17	1
13C6-Fluorene	IS	35.8	20 - 130		09-Oct-20 23:17	1
13C6-Phenanthrene	IS	49.8	20 - 130		09-Oct-20 23:17	1
13C6-Anthracene	IS	49.8	20 - 130		09-Oct-20 23:17	1
13C6-Fluoranthene	IS	41.4	20 - 130		09-Oct-20 23:17	1
13C3-Pyrene	IS	42.2	20 - 130		09-Oct-20 23:17	1
13C6-Benz[a]anthracene	IS	48.3	20 - 130		09-Oct-20 23:17	1
13C6-Chrysene	IS	46.9	20 - 130		09-Oct-20 23:17	1
13C6-Benzo[b]fluoranthene	IS	44.5	20 - 130		09-Oct-20 23:17	1
13C6-Benzo[k]fluoranthene	IS	38.0	20 - 130		09-Oct-20 23:17	1
13C4-Benzo[E]Pyrene	IS	41.2	20 - 130		09-Oct-20 23:17	1
13C4-Benzo[a]pyrene	IS	41.1	20 - 130		09-Oct-20 23:17	1
d12-Perylene	IS	37.9	20 - 130		09-Oct-20 23:17	1
13C6-Indeno[1,2,3-cd]pyrene	IS	40.9	20 - 130		09-Oct-20 23:17	1
13C6-Dibenz[a,h]anthracene	IS	44.3	20 - 130		09-Oct-20 23:17	1
13C12-Benzo[ghi]perylene	IS	41.7	20 - 130		09-Oct-20 23:17	1
13C6-Benzo[C]Fluorene	PS	104	70 - 130		09-Oct-20 23:17	1
13C12-Benzo(j)Fluoranthene	PS	107	70 - 130		09-Oct-20 23:17	1

MDL - Method Detection Limit
RL - Reporting limit

Results reported to MDL.

Sample ID: Method Blank — **EPA Method 23**

Client Data		Laboratory Data			
Name:	Environmental Technical Services, LLC	Lab Sample:	B0J0011-BLK1		
Project:	2020.2232	QC Batch:	B0J0011	Date Extracted:	01-Oct-20
Matrix:	Air			Column:	ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-1	ND	5.27			07-Oct-20 17:35	1
PCB-2	ND	5.56			07-Oct-20 17:35	1
PCB-3	ND	5.72			07-Oct-20 17:35	1
PCB-4/10	ND	47.7			07-Oct-20 17:35	1
PCB-5/8	ND	36.4			07-Oct-20 17:35	1
PCB-6	ND	35.3			07-Oct-20 17:35	1
PCB-7/9	ND	37.6			07-Oct-20 17:35	1
PCB-11	ND	33.6			07-Oct-20 17:35	1
PCB-12/13	ND	36.9			07-Oct-20 17:35	1
PCB-14	ND	37.2			07-Oct-20 17:35	1
PCB-15	ND	36.6			07-Oct-20 17:35	1
PCB-16/32	ND	10.7			07-Oct-20 17:35	1
PCB-17	ND	13.1			07-Oct-20 17:35	1
PCB-18	ND	12.1			07-Oct-20 17:35	1
PCB-19	ND	13.5			07-Oct-20 17:35	1
PCB-20/21/33	ND	10.8			07-Oct-20 17:35	1
PCB-22	ND	10.5			07-Oct-20 17:35	1
PCB-23	ND	11.5			07-Oct-20 17:35	1
PCB-24/27	ND	9.18			07-Oct-20 17:35	1
PCB-25	ND	10.7			07-Oct-20 17:35	1
PCB-26	ND	10.8			07-Oct-20 17:35	1
PCB-28	22.7			J	07-Oct-20 17:35	1
PCB-29	ND	11.4			07-Oct-20 17:35	1
PCB-30	ND	8.30			07-Oct-20 17:35	1
PCB-31	ND	9.81			07-Oct-20 17:35	1
PCB-34	ND	10.8			07-Oct-20 17:35	1
PCB-35	ND	11.2			07-Oct-20 17:35	1
PCB-36	ND	10.9			07-Oct-20 17:35	1
PCB-37	ND	11.6			07-Oct-20 17:35	1
PCB-38	ND	11.1			07-Oct-20 17:35	1
PCB-39	ND	11.8			07-Oct-20 17:35	1
PCB-40	ND	12.3			07-Oct-20 17:35	1
PCB-41/64/71/72	ND	6.23			07-Oct-20 17:35	1
PCB-42/59	ND	7.05			07-Oct-20 17:35	1
PCB-43/49	ND	7.68			07-Oct-20 17:35	1
PCB-44	ND	8.97			07-Oct-20 17:35	1
PCB-45	ND	9.10			07-Oct-20 17:35	1
PCB-46	ND	9.40			07-Oct-20 17:35	1
PCB-47	ND	8.02			07-Oct-20 17:35	1
PCB-48/75	ND	6.60			07-Oct-20 17:35	1
PCB-50	ND	7.19			07-Oct-20 17:35	1
PCB-51	ND	7.33			07-Oct-20 17:35	1
PCB-52/69	ND	6.69			07-Oct-20 17:35	1
PCB-53	ND	7.83			07-Oct-20 17:35	1
PCB-54	ND	5.86			07-Oct-20 17:35	1
PCB-55	ND	5.56			07-Oct-20 17:35	1
PCB-56/60	ND	6.39			07-Oct-20 17:35	1
PCB-57	ND	5.74			07-Oct-20 17:35	1
PCB-58	ND	5.55			07-Oct-20 17:35	1
PCB-61/70	ND	6.33			07-Oct-20 17:35	1
PCB-62	ND	6.56			07-Oct-20 17:35	1
PCB-63	ND	6.23			07-Oct-20 17:35	1
PCB-65	ND	5.77			07-Oct-20 17:35	1

Sample ID: Method Blank — **EPA Method 23**

Client Data		Laboratory Data			
Name:	Environmental Technical Services, LLC	Lab Sample:	B0J0011-BLK1		
Project:	2020.2232	QC Batch:	B0J0011	Date Extracted:	01-Oct-20
Matrix:	Air			Column:	ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-66/76	ND	5.73			07-Oct-20 17:35	1
PCB-67	ND	6.16			07-Oct-20 17:35	1
PCB-68	ND	5.79			07-Oct-20 17:35	1
PCB-73	ND	5.41			07-Oct-20 17:35	1
PCB-74	ND	5.63			07-Oct-20 17:35	1
PCB-77	ND	6.97			07-Oct-20 17:35	1
PCB-78	ND	6.52			07-Oct-20 17:35	1
PCB-79	ND	5.71			07-Oct-20 17:35	1
PCB-80	ND	5.48			07-Oct-20 17:35	1
PCB-81	ND	7.08			07-Oct-20 17:35	1
PCB-82	ND	14.2			07-Oct-20 17:35	1
PCB-83	ND	7.56			07-Oct-20 17:35	1
PCB-84/92	ND	11.9			07-Oct-20 17:35	1
PCB-85/116	ND	9.82			07-Oct-20 17:35	1
PCB-86	ND	12.4			07-Oct-20 17:35	1
PCB-87/117/125	ND	8.88			07-Oct-20 17:35	1
PCB-88/91	ND	11.2			07-Oct-20 17:35	1
PCB-89	ND	11.0			07-Oct-20 17:35	1
PCB-90/101	ND	10.8			07-Oct-20 17:35	1
PCB-93	ND	12.8			07-Oct-20 17:35	1
PCB-94	ND	12.6			07-Oct-20 17:35	1
PCB-95/98/102	ND	9.95			07-Oct-20 17:35	1
PCB-96	ND	7.46			07-Oct-20 17:35	1
PCB-97	ND	10.8			07-Oct-20 17:35	1
PCB-99	ND	9.17			07-Oct-20 17:35	1
PCB-100	ND	9.03			07-Oct-20 17:35	1
PCB-103	ND	9.19			07-Oct-20 17:35	1
PCB-104	ND	7.67			07-Oct-20 17:35	1
PCB-105	ND	9.18			07-Oct-20 17:35	1
PCB-106/118	ND	8.88			07-Oct-20 17:35	1
PCB-107/109	ND	8.27			07-Oct-20 17:35	1
PCB-108/112	ND	9.58			07-Oct-20 17:35	1
PCB-110	ND	7.95			07-Oct-20 17:35	1
PCB-111/115	ND	7.25			07-Oct-20 17:35	1
PCB-113	ND	8.00			07-Oct-20 17:35	1
PCB-114	ND	8.61			07-Oct-20 17:35	1
PCB-119	ND	7.67			07-Oct-20 17:35	1
PCB-120	ND	6.91			07-Oct-20 17:35	1
PCB-121	ND	7.01			07-Oct-20 17:35	1
PCB-122	ND	10.4			07-Oct-20 17:35	1
PCB-123	ND	9.27			07-Oct-20 17:35	1
PCB-124	ND	7.95			07-Oct-20 17:35	1
PCB-126	ND	9.94			07-Oct-20 17:35	1
PCB-127	ND	8.59			07-Oct-20 17:35	1
PCB-128/162	ND	6.38			07-Oct-20 17:35	1
PCB-129	ND	7.94			07-Oct-20 17:35	1
PCB-130	ND	7.47			07-Oct-20 17:35	1
PCB-131/133	ND	6.43			07-Oct-20 17:35	1
PCB-132/161	ND	5.15			07-Oct-20 17:35	1
PCB-134/143	ND	6.96			07-Oct-20 17:35	1
PCB-135	ND	5.22			07-Oct-20 17:35	1
PCB-136	ND	4.72			07-Oct-20 17:35	1
PCB-137	ND	5.95			07-Oct-20 17:35	1

Sample ID: Method Blank — **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air

Laboratory Data
Lab Sample: B0J0011-BLK1
QC Batch: B0J0011
Date Extracted: 01-Oct-20
Column: ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-138/163/164	ND	5.36			07-Oct-20 17:35	1
PCB-139/149	ND	5.08			07-Oct-20 17:35	1
PCB-140	ND	6.07			07-Oct-20 17:35	1
PCB-141	ND	6.44			07-Oct-20 17:35	1
PCB-142	ND	7.00			07-Oct-20 17:35	1
PCB-144	ND	6.11			07-Oct-20 17:35	1
PCB-145	ND	4.05			07-Oct-20 17:35	1
PCB-146/165	ND	5.19			07-Oct-20 17:35	1
PCB-147	ND	5.77			07-Oct-20 17:35	1
PCB-148	ND	5.72			07-Oct-20 17:35	1
PCB-150	ND	4.45			07-Oct-20 17:35	1
PCB-151	ND	6.13			07-Oct-20 17:35	1
PCB-152	ND	4.06			07-Oct-20 17:35	1
PCB-153	ND	4.93			07-Oct-20 17:35	1
PCB-154	ND	5.24			07-Oct-20 17:35	1
PCB-155	ND	4.62			07-Oct-20 17:35	1
PCB-156	ND	5.46			07-Oct-20 17:35	1
PCB-157	ND	6.14			07-Oct-20 17:35	1
PCB-158/160	ND	5.55			07-Oct-20 17:35	1
PCB-159	ND	4.76			07-Oct-20 17:35	1
PCB-166	ND	5.06			07-Oct-20 17:35	1
PCB-167	ND	5.25			07-Oct-20 17:35	1
PCB-168	ND	4.90			07-Oct-20 17:35	1
PCB-169	ND	6.38			07-Oct-20 17:35	1
PCB-170	ND	7.23			07-Oct-20 17:35	1
PCB-171	ND	6.65			07-Oct-20 17:35	1
PCB-172	ND	6.36			07-Oct-20 17:35	1
PCB-173	ND	7.36			07-Oct-20 17:35	1
PCB-174	ND	6.47			07-Oct-20 17:35	1
PCB-175	ND	5.07			07-Oct-20 17:35	1
PCB-176	ND	3.71			07-Oct-20 17:35	1
PCB-177	ND	6.85			07-Oct-20 17:35	1
PCB-178	ND	5.14			07-Oct-20 17:35	1
PCB-179	ND	3.74			07-Oct-20 17:35	1
PCB-180	ND	6.20			07-Oct-20 17:35	1
PCB-181	ND	5.94			07-Oct-20 17:35	1
PCB-182/187	ND	4.55			07-Oct-20 17:35	1
PCB-183	ND	4.74			07-Oct-20 17:35	1
PCB-184	ND	3.94			07-Oct-20 17:35	1
PCB-185	ND	6.23			07-Oct-20 17:35	1
PCB-186	ND	3.65			07-Oct-20 17:35	1
PCB-188	ND	3.76			07-Oct-20 17:35	1
PCB-189	ND	5.42			07-Oct-20 17:35	1
PCB-190	ND	5.47			07-Oct-20 17:35	1
PCB-191	ND	5.12			07-Oct-20 17:35	1
PCB-192	ND	4.79			07-Oct-20 17:35	1
PCB-193	ND	5.22			07-Oct-20 17:35	1
PCB-194	ND		18.5		07-Oct-20 17:35	1
PCB-195	ND	4.60			07-Oct-20 17:35	1
PCB-196/203	ND	5.13			07-Oct-20 17:35	1
PCB-197	ND	3.79			07-Oct-20 17:35	1
PCB-198	ND	5.41			07-Oct-20 17:35	1
PCB-199	ND	5.31			07-Oct-20 17:35	1

Sample ID: Method Blank — **EPA Method 23**

Client Data		Laboratory Data			
Name:	Environmental Technical Services, LLC	Lab Sample:	B0J0011-BLK1		
Project:	2020.2232	QC Batch:	B0J0011	Date Extracted:	01-Oct-20
Matrix:	Air			Column:	ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-200	ND	4.01			07-Oct-20 17:35	1
PCB-201	ND	4.08			07-Oct-20 17:35	1
PCB-202	ND	3.68			07-Oct-20 17:35	1
PCB-204	ND	3.77			07-Oct-20 17:35	1
PCB-205	ND	3.73			07-Oct-20 17:35	1
PCB-206	ND	3.75			07-Oct-20 17:35	1
PCB-207	ND	2.34			07-Oct-20 17:35	1
PCB-208	ND	2.30			07-Oct-20 17:35	1
PCB-209	ND	2.68			07-Oct-20 17:35	1
Totals						
Total monoCB	ND	5.72				
Total diCB	ND	47.7				
Total triCB	22.7					
Total tetraCB	ND	12.3				
Total pentaCB	ND	14.2				
Total hexaCB	ND	7.94				
Total heptaCB	ND	7.36				
Total octaCB	ND		18.5			
Total nonaCB	ND	3.75				
DecaCB	ND	2.68				
Total PCB	22.7					

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-PCB-1	IS	69.8	20 - 145		07-Oct-20 17:35	1
13C-PCB-3	IS	67.3	20 - 145		07-Oct-20 17:35	1
13C-PCB-4	IS	76.3	20 - 145		07-Oct-20 17:35	1
13C-PCB-11	IS	79.2	20 - 145		07-Oct-20 17:35	1
13C-PCB-9	IS	78.8	20 - 145		07-Oct-20 17:35	1
13C-PCB-19	IS	71.0	20 - 145		07-Oct-20 17:35	1
13C-PCB-28	IS	77.2	20 - 145		07-Oct-20 17:35	1
13C-PCB-32	IS	71.9	20 - 145		07-Oct-20 17:35	1
13C-PCB-37	IS	78.1	20 - 145		07-Oct-20 17:35	1
13C-PCB-47	IS	89.8	20 - 145		07-Oct-20 17:35	1
13C-PCB-52	IS	90.0	20 - 145		07-Oct-20 17:35	1
13C-PCB-54	IS	90.5	20 - 145		07-Oct-20 17:35	1
13C-PCB-70	IS	86.8	20 - 145		07-Oct-20 17:35	1
13C-PCB-77	IS	80.5	20 - 145		07-Oct-20 17:35	1
13C-PCB-80	IS	86.2	20 - 145		07-Oct-20 17:35	1
13C-PCB-81	IS	82.8	20 - 145		07-Oct-20 17:35	1
13C-PCB-95	IS	87.0	20 - 145		07-Oct-20 17:35	1
13C-PCB-97	IS	86.4	20 - 145		07-Oct-20 17:35	1
13C-PCB-101	IS	85.2	20 - 145		07-Oct-20 17:35	1
13C-PCB-104	IS	94.7	20 - 145		07-Oct-20 17:35	1
13C-PCB-105	IS	97.3	20 - 145		07-Oct-20 17:35	1
13C-PCB-114	IS	97.8	20 - 145		07-Oct-20 17:35	1
13C-PCB-118	IS	79.9	20 - 145		07-Oct-20 17:35	1
13C-PCB-123	IS	81.7	20 - 145		07-Oct-20 17:35	1
13C-PCB-126	IS	87.0	20 - 145		07-Oct-20 17:35	1
13C-PCB-127	IS	97.7	20 - 145		07-Oct-20 17:35	1
13C-PCB-138	IS	85.4	20 - 145		07-Oct-20 17:35	1
13C-PCB-141	IS	89.4	20 - 145		07-Oct-20 17:35	1

Sample ID: Method Blank — **EPA Method 23**

Client Data		Laboratory Data			
Name:	Environmental Technical Services, LLC	Lab Sample:	B0J0011-BLK1		
Project:	2020.2232	QC Batch:	B0J0011	Date Extracted:	01-Oct-20
Matrix:	Air			Column:	ZB-1

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-PCB-153	IS	93.4	20 - 145		07-Oct-20 17:35	1
13C-PCB-155	IS	115	20 - 145		07-Oct-20 17:35	1
13C-PCB-156	IS	78.6	20 - 145		07-Oct-20 17:35	1
13C-PCB-157	IS	81.1	20 - 145		07-Oct-20 17:35	1
13C-PCB-159	IS	84.0	20 - 145		07-Oct-20 17:35	1
13C-PCB-167	IS	81.9	20 - 145		07-Oct-20 17:35	1
13C-PCB-169	IS	75.1	20 - 145		07-Oct-20 17:35	1
13C-PCB-170	IS	77.8	20 - 145		07-Oct-20 17:35	1
13C-PCB-180	IS	79.0	20 - 145		07-Oct-20 17:35	1
13C-PCB-188	IS	92.9	20 - 145		07-Oct-20 17:35	1
13C-PCB-189	IS	70.5	20 - 145		07-Oct-20 17:35	1
13C-PCB-194	IS	85.1	20 - 145		07-Oct-20 17:35	1
13C-PCB-202	IS	104	20 - 145		07-Oct-20 17:35	1
13C-PCB-206	IS	83.1	20 - 145		07-Oct-20 17:35	1
13C-PCB-208	IS	84.2	20 - 145		07-Oct-20 17:35	1
13C-PCB-209	IS	107	20 - 145		07-Oct-20 17:35	1
13C-PCB-79	PS	88.9	70 - 130		07-Oct-20 17:35	1
13C-PCB-178	PS	97.4	70 - 130		07-Oct-20 17:35	1

EDL - Sample specifc estimated detection limit
EMPC - Estimated maximum possible concentration

Sample ID: LCSD **EPA Method 23**

Name:	Environmental Technical Services, LLC		
Project:	2020.2232	Lab Sample:	B0J0011-BSD1
Matrix:	Air	QC Batch:	B0J0011
Date Analyzed:	07-Oct-20 13:33	Samp Size:	N/A
	07-Oct-20 12:35		

		Date Extracted:	01-Oct-20
		Column:	ZB-1

Analyte	LCS (pg/Sample)	LCS Spike Amt	LCS % Rec	LCS Quals	LCSD (pg/Sample)	LCSD Spike Amt	LCSD % Rec	RPD	LCSD Quals	%Rec Limits	RPD Limits
PCB-5/8	90700	75000	121		87800	75000	117	3.29		70- 130	200
PCB-18	38700	37500	103		38600	37500	103	0.366		70- 130	200
PCB-28	46800	37500	125	B	47500	37500	127	1.57	B	70- 130	200
PCB-44	40200	37500	107		40000	37500	107	0.386		70- 130	200
PCB-52/69	82600	75000	110		84000	75000	112	1.72		70- 130	200
PCB-66/76	83800	75000	112		81800	75000	109	2.42		70- 130	200
PCB-77	41400	37500	110		41200	37500	110	0.549		70- 130	200
PCB-81	42300	37500	113		42100	37500	112	0.504		70- 130	200
PCB-90/101	76200	75000	102		74600	75000	99.5	2.10		70- 130	200
PCB-105	45100	37500	120		45000	37500	120	0.198		70- 130	200
PCB-106/118	78500	75000	105		77900	75000	104	0.776		70- 130	200
PCB-114	43300	37500	115		43200	37500	115	0.0995		70- 130	200
PCB-123	38200	37500	102		38900	37500	104	1.94		70- 130	200
PCB-126	44500	37500	119		44300	37500	118	0.429		70- 130	200
PCB-128/162	81000	75000	108		81800	75000	109	0.952		70- 130	200
PCB-138/163/164	127000	113000	113		124000	113000	110	2.73		70- 130	200
PCB-153	40600	37500	108		40400	37500	108	0.574		70- 130	200
PCB-156	41400	37500	111		41700	37500	111	0.720		70- 130	200
PCB-157	39100	37500	104		41000	37500	109	4.68		70- 130	200
PCB-167	40700	37500	109		39900	37500	106	2.11		70- 130	200
PCB-169	41000	37500	109		39800	37500	106	2.86		70- 130	200
PCB-170	39800	37500	106		38900	37500	104	2.25		70- 130	200
PCB-180	39600	37500	106		39400	37500	105	0.548		70- 130	200
PCB-182/187	75700	75000	101		74700	75000	99.6	1.23		70- 130	200
PCB-189	38900	37500	104		39500	37500	105	1.47		70- 130	200
PCB-195	39300	37500	105		39400	37500	105	0.294		70- 130	200
PCB-206	40800	37500	109		40700	37500	108	0.369		70- 130	200
PCB-209	40000	37500	107		39700	37500	106	0.745		70- 130	200

Labeled Standards	Type	LCS % Rec	LCS Quals	LCSD % Rec	LCSD Quals	Limits
13C-PCB-1	IS	56.9		69.7		20 - 145
13C-PCB-3	IS	56.3		67.0		20 - 145
13C-PCB-4	IS	62.7		73.1		20 - 145
13C-PCB-11	IS	69.8		77.7		20 - 145
13C-PCB-9	IS	67.0		77.4		20 - 145
13C-PCB-19	IS	61.2		65.7		20 - 145
13C-PCB-28	IS	67.6		73.6		20 - 145
13C-PCB-32	IS	63.0		69.3		20 - 145
13C-PCB-37	IS	69.8		76.3		20 - 145
13C-PCB-47	IS	78.3		83.1		20 - 145
13C-PCB-52	IS	79.3		82.1		20 - 145
13C-PCB-54	IS	78.5		83.3		20 - 145
13C-PCB-70	IS	78.6		84.9		20 - 145
13C-PCB-77	IS	75.5		82.9		20 - 145
13C-PCB-80	IS	80.2		85.0		20 - 145
13C-PCB-81	IS	76.9		82.8		20 - 145
13C-PCB-95	IS	78.0		83.7		20 - 145
13C-PCB-97	IS	75.7		82.8		20 - 145
13C-PCB-101	IS	75.0		81.7		20 - 145
13C-PCB-104	IS	77.7		79.9		20 - 145

Sample ID: LCSD **EPA Method 23**

Name:	Environmental Technical Services, LLC				
Project:	2020.2232	Lab Sample:	B0J0011-BSD1		
Matrix:	Air	QC Batch:	B0J0011	Date Extracted:	01-Oct-20
Date Analyzed:	07-Oct-20 13:33 07-Oct-20 12:35	Samp Size:	N/A	Column:	ZB-1

Labeled Standards	Type	LCS % Rec	LCS Quals	LCSD % Rec	LCSD Quals	Limits
13C-PCB-105	IS	88.3		95.7		20 - 145
13C-PCB-114	IS	89.1		95.0		20 - 145
13C-PCB-118	IS	72.0		83.2		20 - 145
13C-PCB-123	IS	72.4		81.3		20 - 145
13C-PCB-126	IS	84.3		89.9		20 - 145
13C-PCB-127	IS	87.1		96.3		20 - 145
13C-PCB-138	IS	78.3		84.9		20 - 145
13C-PCB-141	IS	75.9		84.7		20 - 145
13C-PCB-153	IS	78.6		86.5		20 - 145
13C-PCB-155	IS	91.1		102		20 - 145
13C-PCB-156	IS	79.3		83.2		20 - 145
13C-PCB-157	IS	83.5		85.5		20 - 145
13C-PCB-159	IS	79.0		84.9		20 - 145
13C-PCB-167	IS	78.3		84.5		20 - 145
13C-PCB-169	IS	80.5		79.4		20 - 145
13C-PCB-170	IS	77.9		78.0		20 - 145
13C-PCB-180	IS	79.7		79.9		20 - 145
13C-PCB-188	IS	79.0		86.6		20 - 145
13C-PCB-189	IS	84.6		76.3		20 - 145
13C-PCB-194	IS	72.5		80.7		20 - 145
13C-PCB-202	IS	91.8		101		20 - 145
13C-PCB-206	IS	78.9		84.0		20 - 145
13C-PCB-208	IS	67.3		76.0		20 - 145
13C-PCB-209	IS	106		113		20 - 145
13C-PCB-79	PS	81.1		85.8		70 - 130
13C-PCB-178	PS	80.6		85.1		70 - 130

Sample ID: 2020.2232.M23-Run 1 | **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 25-Aug-20 13:43

Laboratory Data
Lab Sample: 2001762-01
QC Batch: B0J0011
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-1	6280				07-Oct-20 19:36	1
PCB-2	12800				07-Oct-20 19:36	1
PCB-3	10400				07-Oct-20 19:36	1
PCB-4/10	999				07-Oct-20 19:36	1
PCB-5/8	1950				07-Oct-20 19:36	1
PCB-6	665				07-Oct-20 19:36	1
PCB-7/9	3420				07-Oct-20 19:36	1
PCB-11	2410				07-Oct-20 19:36	1
PCB-12/13	5340				07-Oct-20 19:36	1
PCB-14	1380				07-Oct-20 19:36	1
PCB-15	966				07-Oct-20 19:36	1
PCB-16/32	543				07-Oct-20 19:36	1
PCB-17	1210				07-Oct-20 19:36	1
PCB-18	ND		428		07-Oct-20 19:36	1
PCB-19	317				07-Oct-20 19:36	1
PCB-20/21/33	1150				07-Oct-20 19:36	1
PCB-22	405				07-Oct-20 19:36	1
PCB-23	ND		104		07-Oct-20 19:36	1
PCB-24/27	104				07-Oct-20 19:36	1
PCB-25	427				07-Oct-20 19:36	1
PCB-26	ND		173		07-Oct-20 19:36	1
PCB-28	816			B	07-Oct-20 19:36	1
PCB-29	202				07-Oct-20 19:36	1
PCB-30	ND		39.3		07-Oct-20 19:36	1
PCB-31	578				07-Oct-20 19:36	1
PCB-34	110				07-Oct-20 19:36	1
PCB-35	798				07-Oct-20 19:36	1
PCB-36	220				07-Oct-20 19:36	1
PCB-37	798				07-Oct-20 19:36	1
PCB-38	966				07-Oct-20 19:36	1
PCB-39	254				07-Oct-20 19:36	1
PCB-40	ND		115		07-Oct-20 19:36	1
PCB-41/64/71/72	304				07-Oct-20 19:36	1
PCB-42/59	172				07-Oct-20 19:36	1
PCB-43/49	316				07-Oct-20 19:36	1
PCB-44	ND		224		07-Oct-20 19:36	1
PCB-45	80.3				07-Oct-20 19:36	1
PCB-46	26.0				07-Oct-20 19:36	1
PCB-47	498				07-Oct-20 19:36	1
PCB-48/75	123				07-Oct-20 19:36	1
PCB-50	ND		28.7		07-Oct-20 19:36	1
PCB-51	756				07-Oct-20 19:36	1
PCB-52/69	343				07-Oct-20 19:36	1
PCB-53	57.6				07-Oct-20 19:36	1
PCB-54	ND	5.39			07-Oct-20 19:36	1
PCB-55	ND		85.7		07-Oct-20 19:36	1
PCB-56/60	370				07-Oct-20 19:36	1
PCB-57	49.3				07-Oct-20 19:36	1
PCB-58	ND		32.0		07-Oct-20 19:36	1
PCB-61/70	417				07-Oct-20 19:36	1
PCB-62	ND		32.6		07-Oct-20 19:36	1
PCB-63	ND		36.3		07-Oct-20 19:36	1
PCB-65	ND		9.58		07-Oct-20 19:36	1

Sample ID: 2020.2232.M23-Run 1 **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 25-Aug-20 13:43

Laboratory Data
Lab Sample: 2001762-01
QC Batch: B0J0011
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-66/76	364				07-Oct-20 19:36	1
PCB-67	68.0				07-Oct-20 19:36	1
PCB-68	142				07-Oct-20 19:36	1
PCB-73	ND	4.72			07-Oct-20 19:36	1
PCB-74	150				07-Oct-20 19:36	1
PCB-77	266				07-Oct-20 19:36	1
PCB-78	196				07-Oct-20 19:36	1
PCB-79	143				07-Oct-20 19:36	1
PCB-80	27.2				07-Oct-20 19:36	1
PCB-81	142				07-Oct-20 19:36	1
PCB-82	64.2				07-Oct-20 19:36	1
PCB-83	17.1			J	07-Oct-20 19:36	1
PCB-84/92	87.6				07-Oct-20 19:36	1
PCB-85/116	ND		66.9		07-Oct-20 19:36	1
PCB-86	ND		23.8		07-Oct-20 19:36	1
PCB-87/117/125	ND		66.6		07-Oct-20 19:36	1
PCB-88/91	93.2				07-Oct-20 19:36	1
PCB-89	ND	9.46			07-Oct-20 19:36	1
PCB-90/101	230				07-Oct-20 19:36	1
PCB-93	ND	11.4			07-Oct-20 19:36	1
PCB-94	ND	11.3			07-Oct-20 19:36	1
PCB-95/98/102	165				07-Oct-20 19:36	1
PCB-96	ND	7.23			07-Oct-20 19:36	1
PCB-97	74.7				07-Oct-20 19:36	1
PCB-99	105				07-Oct-20 19:36	1
PCB-100	63.3				07-Oct-20 19:36	1
PCB-103	ND	8.91			07-Oct-20 19:36	1
PCB-104	ND	7.43			07-Oct-20 19:36	1
PCB-105	117				07-Oct-20 19:36	1
PCB-106/118	154				07-Oct-20 19:36	1
PCB-107/109	64.9				07-Oct-20 19:36	1
PCB-108/112	ND		37.6		07-Oct-20 19:36	1
PCB-110	ND		122		07-Oct-20 19:36	1
PCB-111/115	ND	6.61			07-Oct-20 19:36	1
PCB-113	ND	6.90			07-Oct-20 19:36	1
PCB-114	ND		32.3		07-Oct-20 19:36	1
PCB-119	ND	6.99			07-Oct-20 19:36	1
PCB-120	ND	6.30			07-Oct-20 19:36	1
PCB-121	ND	6.25			07-Oct-20 19:36	1
PCB-122	ND		55.9		07-Oct-20 19:36	1
PCB-123	44.4				07-Oct-20 19:36	1
PCB-124	ND	6.66			07-Oct-20 19:36	1
PCB-126	155				07-Oct-20 19:36	1
PCB-127	ND		41.6		07-Oct-20 19:36	1
PCB-128/162	52.0				07-Oct-20 19:36	1
PCB-129	ND		30.2		07-Oct-20 19:36	1
PCB-130	28.7				07-Oct-20 19:36	1
PCB-131/133	ND		17.9		07-Oct-20 19:36	1
PCB-132/161	ND		30.9		07-Oct-20 19:36	1
PCB-134/143	ND		15.3		07-Oct-20 19:36	1
PCB-135	21.1			J	07-Oct-20 19:36	1
PCB-136	ND		12.0		07-Oct-20 19:36	1
PCB-137	ND		9.94		07-Oct-20 19:36	1

Sample ID: 2020.2232.M23-Run 1 **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 25-Aug-20 13:43

Laboratory Data
Lab Sample: 2001762-01
QC Batch: B0J0011
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-138/163/164	ND		89.7		07-Oct-20 19:36	1
PCB-139/149	71.3				07-Oct-20 19:36	1
PCB-140	ND	8.81			07-Oct-20 19:36	1
PCB-141	19.8			J	07-Oct-20 19:36	1
PCB-142	ND	8.32			07-Oct-20 19:36	1
PCB-144	ND	8.86			07-Oct-20 19:36	1
PCB-145	ND	5.88			07-Oct-20 19:36	1
PCB-146/165	29.5			J	07-Oct-20 19:36	1
PCB-147	ND	8.38			07-Oct-20 19:36	1
PCB-148	ND	8.31			07-Oct-20 19:36	1
PCB-150	ND	6.45			07-Oct-20 19:36	1
PCB-151	19.8			J	07-Oct-20 19:36	1
PCB-152	ND	5.89			07-Oct-20 19:36	1
PCB-153	65.4				07-Oct-20 19:36	1
PCB-154	ND	7.61			07-Oct-20 19:36	1
PCB-155	ND	6.70			07-Oct-20 19:36	1
PCB-156	ND		43.9		07-Oct-20 19:36	1
PCB-157	35.9				07-Oct-20 19:36	1
PCB-158/160	ND		26.6		07-Oct-20 19:36	1
PCB-159	ND		12.2		07-Oct-20 19:36	1
PCB-166	ND	5.39			07-Oct-20 19:36	1
PCB-167	ND		13.9		07-Oct-20 19:36	1
PCB-168	ND	5.83			07-Oct-20 19:36	1
PCB-169	ND		29.5		07-Oct-20 19:36	1
PCB-170	40.1				07-Oct-20 19:36	1
PCB-171	ND	8.07			07-Oct-20 19:36	1
PCB-172	ND	7.73			07-Oct-20 19:36	1
PCB-173	ND	8.93			07-Oct-20 19:36	1
PCB-174	ND		22.6		07-Oct-20 19:36	1
PCB-175	ND	6.99			07-Oct-20 19:36	1
PCB-176	ND	5.11			07-Oct-20 19:36	1
PCB-177	ND	8.32			07-Oct-20 19:36	1
PCB-178	ND	7.09			07-Oct-20 19:36	1
PCB-179	14.2			J	07-Oct-20 19:36	1
PCB-180	ND		24.1		07-Oct-20 19:36	1
PCB-181	ND	7.21			07-Oct-20 19:36	1
PCB-182/187	ND		24.0		07-Oct-20 19:36	1
PCB-183	ND		14.5		07-Oct-20 19:36	1
PCB-184	ND	5.43			07-Oct-20 19:36	1
PCB-185	ND	7.56			07-Oct-20 19:36	1
PCB-186	ND	5.03			07-Oct-20 19:36	1
PCB-188	ND	5.18			07-Oct-20 19:36	1
PCB-189	26.3				07-Oct-20 19:36	1
PCB-190	ND		13.5		07-Oct-20 19:36	1
PCB-191	ND	6.21			07-Oct-20 19:36	1
PCB-192	ND	5.82			07-Oct-20 19:36	1
PCB-193	ND	6.34			07-Oct-20 19:36	1
PCB-194	47.2				07-Oct-20 19:36	1
PCB-195	ND	5.45			07-Oct-20 19:36	1
PCB-196/203	16.9			J	07-Oct-20 19:36	1
PCB-197	ND	4.63			07-Oct-20 19:36	1
PCB-198	20.6			J	07-Oct-20 19:36	1
PCB-199	ND	6.48			07-Oct-20 19:36	1

Sample ID: 2020.2232.M23-Run 1 **EPA Method 23**

Client Data		Laboratory Data			
Name:	Environmental Technical Services, LLC	Lab Sample:	2001762-01	Date Received:	01-Sep-20 11:34
Project:	2020.2232	QC Batch:	B0J0011	Date Extracted:	01-Oct-20
Matrix:	Air Train			Column:	ZB-1
Date Collected:	25-Aug-20 13:43				

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-200	ND	4.90			07-Oct-20 19:36	1
PCB-201	ND	4.98			07-Oct-20 19:36	1
PCB-202	ND	4.49			07-Oct-20 19:36	1
PCB-204	ND	4.60			07-Oct-20 19:36	1
PCB-205	ND		8.94		07-Oct-20 19:36	1
PCB-206	ND		22.1		07-Oct-20 19:36	1
PCB-207	ND		12.5		07-Oct-20 19:36	1
PCB-208	13.0			J	07-Oct-20 19:36	1
PCB-209	ND		16.7		07-Oct-20 19:36	1
Totals						
Total monoCB	29500					
Total diCB	17100					
Total triCB	8900		9640			
Total tetraCB	5010		5570			
Total pentaCB	1430		1880			
Total hexaCB	343		675			
Total heptaCB	80.5		179			
Total octaCB	84.8		93.7			
Total nonaCB	13.0		47.5			
DecaCB	ND		16.7			
Total PCB	62500					

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-PCB-1	IS	58.2	20 - 145		07-Oct-20 19:36	1
13C-PCB-3	IS	60.4	20 - 145		07-Oct-20 19:36	1
13C-PCB-4	IS	67.7	20 - 145		07-Oct-20 19:36	1
13C-PCB-11	IS	71.7	20 - 145		07-Oct-20 19:36	1
13C-PCB-9	IS	70.0	20 - 145		07-Oct-20 19:36	1
13C-PCB-19	IS	61.6	20 - 145		07-Oct-20 19:36	1
13C-PCB-28	IS	68.7	20 - 145		07-Oct-20 19:36	1
13C-PCB-32	IS	64.6	20 - 145		07-Oct-20 19:36	1
13C-PCB-37	IS	72.4	20 - 145		07-Oct-20 19:36	1
13C-PCB-47	IS	74.1	20 - 145		07-Oct-20 19:36	1
13C-PCB-52	IS	73.1	20 - 145		07-Oct-20 19:36	1
13C-PCB-54	IS	68.8	20 - 145		07-Oct-20 19:36	1
13C-PCB-70	IS	76.2	20 - 145		07-Oct-20 19:36	1
13C-PCB-77	IS	75.1	20 - 145		07-Oct-20 19:36	1
13C-PCB-80	IS	77.6	20 - 145		07-Oct-20 19:36	1
13C-PCB-81	IS	75.3	20 - 145		07-Oct-20 19:36	1
13C-PCB-95	IS	74.8	20 - 145		07-Oct-20 19:36	1
13C-PCB-97	IS	75.6	20 - 145		07-Oct-20 19:36	1
13C-PCB-101	IS	76.9	20 - 145		07-Oct-20 19:36	1
13C-PCB-104	IS	73.6	20 - 145		07-Oct-20 19:36	1
13C-PCB-105	IS	88.2	20 - 145		07-Oct-20 19:36	1
13C-PCB-114	IS	89.3	20 - 145		07-Oct-20 19:36	1
13C-PCB-118	IS	75.2	20 - 145		07-Oct-20 19:36	1
13C-PCB-123	IS	75.6	20 - 145		07-Oct-20 19:36	1
13C-PCB-126	IS	82.8	20 - 145		07-Oct-20 19:36	1
13C-PCB-127	IS	91.0	20 - 145		07-Oct-20 19:36	1
13C-PCB-138	IS	78.5	20 - 145		07-Oct-20 19:36	1
13C-PCB-141	IS	77.9	20 - 145		07-Oct-20 19:36	1

Sample ID: 2020.2232.M23-Run 1 **EPA Method 23**

Client Data

Name:	Environmental Technical Services, LLC
Project:	2020.2232
Matrix:	Air Train
Date Collected:	25-Aug-20 13:43

Laboratory Data

Lab Sample:	2001762-01	Date Received:	01-Sep-20 11:34
QC Batch:	B0J0011	Date Extracted:	01-Oct-20
		Column:	ZB-1

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-PCB-153	IS	80.3	20 - 145		07-Oct-20 19:36	1
13C-PCB-155	IS	97.4	20 - 145		07-Oct-20 19:36	1
13C-PCB-156	IS	75.9	20 - 145		07-Oct-20 19:36	1
13C-PCB-157	IS	77.4	20 - 145		07-Oct-20 19:36	1
13C-PCB-159	IS	78.1	20 - 145		07-Oct-20 19:36	1
13C-PCB-167	IS	77.4	20 - 145		07-Oct-20 19:36	1
13C-PCB-169	IS	75.4	20 - 145		07-Oct-20 19:36	1
13C-PCB-170	IS	76.8	20 - 145		07-Oct-20 19:36	1
13C-PCB-180	IS	78.7	20 - 145		07-Oct-20 19:36	1
13C-PCB-188	IS	80.8	20 - 145		07-Oct-20 19:36	1
13C-PCB-189	IS	73.4	20 - 145		07-Oct-20 19:36	1
13C-PCB-194	IS	74.6	20 - 145		07-Oct-20 19:36	1
13C-PCB-202	IS	95.4	20 - 145		07-Oct-20 19:36	1
13C-PCB-206	IS	70.3	20 - 145		07-Oct-20 19:36	1
13C-PCB-208	IS	69.3	20 - 145		07-Oct-20 19:36	1
13C-PCB-209	IS	81.6	20 - 145		07-Oct-20 19:36	1
13C-PCB-79	PS	79.8	70 - 130		07-Oct-20 19:36	1
13C-PCB-178	PS	81.5	70 - 130		07-Oct-20 19:36	1

EDL - Sample specifc estimated detection limit
EMPC - Estimated maximum possible concentration

Sample ID: 2020.2232.M23-Run 2 | **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 25-Aug-20 19:32

Laboratory Data
Lab Sample: 2001762-02
QC Batch: B0J0011
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-1	1150				07-Oct-20 20:36	1
PCB-2	2440				07-Oct-20 20:36	1
PCB-3	2260				07-Oct-20 20:36	1
PCB-4/10	ND		220		07-Oct-20 20:36	1
PCB-5/8	ND		563		07-Oct-20 20:36	1
PCB-6	167				07-Oct-20 20:36	1
PCB-7/9	632				07-Oct-20 20:36	1
PCB-11	988				07-Oct-20 20:36	1
PCB-12/13	875				07-Oct-20 20:36	1
PCB-14	ND		210		07-Oct-20 20:36	1
PCB-15	352				07-Oct-20 20:36	1
PCB-16/32	345				07-Oct-20 20:36	1
PCB-17	285				07-Oct-20 20:36	1
PCB-18	368				07-Oct-20 20:36	1
PCB-19	ND		52.5		07-Oct-20 20:36	1
PCB-20/21/33	961				07-Oct-20 20:36	1
PCB-22	559				07-Oct-20 20:36	1
PCB-23	ND	12.6			07-Oct-20 20:36	1
PCB-24/27	45.6			J	07-Oct-20 20:36	1
PCB-25	158				07-Oct-20 20:36	1
PCB-26	169				07-Oct-20 20:36	1
PCB-28	1020			B	07-Oct-20 20:36	1
PCB-29	50.4				07-Oct-20 20:36	1
PCB-30	ND	10.1			07-Oct-20 20:36	1
PCB-31	898				07-Oct-20 20:36	1
PCB-34	ND	11.7			07-Oct-20 20:36	1
PCB-35	227				07-Oct-20 20:36	1
PCB-36	ND		41.7		07-Oct-20 20:36	1
PCB-37	954				07-Oct-20 20:36	1
PCB-38	ND		134		07-Oct-20 20:36	1
PCB-39	ND		34.1		07-Oct-20 20:36	1
PCB-40	239				07-Oct-20 20:36	1
PCB-41/64/71/72	677				07-Oct-20 20:36	1
PCB-42/59	258				07-Oct-20 20:36	1
PCB-43/49	393				07-Oct-20 20:36	1
PCB-44	663				07-Oct-20 20:36	1
PCB-45	ND		88.0		07-Oct-20 20:36	1
PCB-46	47.3				07-Oct-20 20:36	1
PCB-47	301				07-Oct-20 20:36	1
PCB-48/75	171				07-Oct-20 20:36	1
PCB-50	ND	14.4			07-Oct-20 20:36	1
PCB-51	117				07-Oct-20 20:36	1
PCB-52/69	524				07-Oct-20 20:36	1
PCB-53	69.1				07-Oct-20 20:36	1
PCB-54	ND	11.7			07-Oct-20 20:36	1
PCB-55	ND		37.5		07-Oct-20 20:36	1
PCB-56/60	871				07-Oct-20 20:36	1
PCB-57	ND		10.2		07-Oct-20 20:36	1
PCB-58	15.0			J	07-Oct-20 20:36	1
PCB-61/70	1020				07-Oct-20 20:36	1
PCB-62	ND	13.1			07-Oct-20 20:36	1
PCB-63	ND		32.0		07-Oct-20 20:36	1
PCB-65	ND	11.5			07-Oct-20 20:36	1

Sample ID: 2020.2232.M23-Run 2 — **EPA Method 23**

Client Data		Laboratory Data			
Name:	Environmental Technical Services, LLC	Lab Sample:	2001762-02	Date Received:	01-Sep-20 11:34
Project:	2020.2232	QC Batch:	B0J0011	Date Extracted:	01-Oct-20
Matrix:	Air Train			Column:	ZB-1
Date Collected:	25-Aug-20 19:32				

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-66/76	772				07-Oct-20 20:36	1
PCB-67	ND		44.0		07-Oct-20 20:36	1
PCB-68	41.2				07-Oct-20 20:36	1
PCB-73	ND	10.8			07-Oct-20 20:36	1
PCB-74	380				07-Oct-20 20:36	1
PCB-77	ND		138		07-Oct-20 20:36	1
PCB-78	44.5				07-Oct-20 20:36	1
PCB-79	30.8				07-Oct-20 20:36	1
PCB-80	ND	9.98			07-Oct-20 20:36	1
PCB-81	ND		19.9		07-Oct-20 20:36	1
PCB-82	ND	19.7			07-Oct-20 20:36	1
PCB-83	ND	11.0			07-Oct-20 20:36	1
PCB-84/92	ND		91.0		07-Oct-20 20:36	1
PCB-85/116	ND		75.7		07-Oct-20 20:36	1
PCB-86	ND	18.1			07-Oct-20 20:36	1
PCB-87/117/125	107				07-Oct-20 20:36	1
PCB-88/91	ND		38.3		07-Oct-20 20:36	1
PCB-89	ND	16.0			07-Oct-20 20:36	1
PCB-90/101	240				07-Oct-20 20:36	1
PCB-93	ND	18.8			07-Oct-20 20:36	1
PCB-94	ND	18.5			07-Oct-20 20:36	1
PCB-95/98/102	199				07-Oct-20 20:36	1
PCB-96	ND	12.2			07-Oct-20 20:36	1
PCB-97	85.5				07-Oct-20 20:36	1
PCB-99	115				07-Oct-20 20:36	1
PCB-100	ND	14.7			07-Oct-20 20:36	1
PCB-103	ND	15.0			07-Oct-20 20:36	1
PCB-104	ND	12.5			07-Oct-20 20:36	1
PCB-105	ND		71.9		07-Oct-20 20:36	1
PCB-106/118	113				07-Oct-20 20:36	1
PCB-107/109	ND		25.0		07-Oct-20 20:36	1
PCB-108/112	ND	14.0			07-Oct-20 20:36	1
PCB-110	193				07-Oct-20 20:36	1
PCB-111/115	ND	10.6			07-Oct-20 20:36	1
PCB-113	ND	11.7			07-Oct-20 20:36	1
PCB-114	ND	14.5			07-Oct-20 20:36	1
PCB-119	ND	11.2			07-Oct-20 20:36	1
PCB-120	ND	10.1			07-Oct-20 20:36	1
PCB-121	ND	10.3			07-Oct-20 20:36	1
PCB-122	ND	17.5			07-Oct-20 20:36	1
PCB-123	ND	12.9			07-Oct-20 20:36	1
PCB-124	ND	11.0			07-Oct-20 20:36	1
PCB-126	ND		34.8		07-Oct-20 20:36	1
PCB-127	ND	14.2			07-Oct-20 20:36	1
PCB-128/162	ND		29.3		07-Oct-20 20:36	1
PCB-129	ND	13.0			07-Oct-20 20:36	1
PCB-130	ND		25.9		07-Oct-20 20:36	1
PCB-131/133	ND		17.6		07-Oct-20 20:36	1
PCB-132/161	ND		26.2		07-Oct-20 20:36	1
PCB-134/143	ND	12.9			07-Oct-20 20:36	1
PCB-135	ND	8.34			07-Oct-20 20:36	1
PCB-136	22.2			J	07-Oct-20 20:36	1
PCB-137	ND	10.7			07-Oct-20 20:36	1

Sample ID: 2020.2232.M23-Run 2 **EPA Method 23**

Client Data		Laboratory Data			
Name:	Environmental Technical Services, LLC	Lab Sample:	2001762-02	Date Received:	01-Sep-20 11:34
Project:	2020.2232	QC Batch:	B0J0011	Date Extracted:	01-Oct-20
Matrix:	Air Train			Column:	ZB-1
Date Collected:	25-Aug-20 19:32				

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-138/163/164	ND		65.5		07-Oct-20 20:36	1
PCB-139/149	77.7				07-Oct-20 20:36	1
PCB-140	ND	9.69			07-Oct-20 20:36	1
PCB-141	29.2				07-Oct-20 20:36	1
PCB-142	ND	13.0			07-Oct-20 20:36	1
PCB-144	ND		10.2		07-Oct-20 20:36	1
PCB-145	ND	6.47			07-Oct-20 20:36	1
PCB-146/165	39.6			J	07-Oct-20 20:36	1
PCB-147	ND	9.22			07-Oct-20 20:36	1
PCB-148	ND	9.14			07-Oct-20 20:36	1
PCB-150	ND	7.10			07-Oct-20 20:36	1
PCB-151	ND		17.5		07-Oct-20 20:36	1
PCB-152	ND	6.48			07-Oct-20 20:36	1
PCB-153	85.6				07-Oct-20 20:36	1
PCB-154	ND	8.37			07-Oct-20 20:36	1
PCB-155	ND	7.37			07-Oct-20 20:36	1
PCB-156	ND		24.8		07-Oct-20 20:36	1
PCB-157	ND		12.8		07-Oct-20 20:36	1
PCB-158/160	ND		15.1		07-Oct-20 20:36	1
PCB-159	ND	7.88			07-Oct-20 20:36	1
PCB-166	ND	8.39			07-Oct-20 20:36	1
PCB-167	ND		15.1		07-Oct-20 20:36	1
PCB-168	ND	9.12			07-Oct-20 20:36	1
PCB-169	ND		13.3		07-Oct-20 20:36	1
PCB-170	ND	15.5			07-Oct-20 20:36	1
PCB-171	ND	13.3			07-Oct-20 20:36	1
PCB-172	ND	12.7			07-Oct-20 20:36	1
PCB-173	ND	14.7			07-Oct-20 20:36	1
PCB-174	ND	12.9			07-Oct-20 20:36	1
PCB-175	ND	11.5			07-Oct-20 20:36	1
PCB-176	ND	8.44			07-Oct-20 20:36	1
PCB-177	ND	13.7			07-Oct-20 20:36	1
PCB-178	ND	11.7			07-Oct-20 20:36	1
PCB-179	ND	8.51			07-Oct-20 20:36	1
PCB-180	ND	12.4			07-Oct-20 20:36	1
PCB-181	ND	11.9			07-Oct-20 20:36	1
PCB-182/187	ND	10.4			07-Oct-20 20:36	1
PCB-183	ND	10.8			07-Oct-20 20:36	1
PCB-184	ND	8.97			07-Oct-20 20:36	1
PCB-185	ND	12.4			07-Oct-20 20:36	1
PCB-186	ND	8.31			07-Oct-20 20:36	1
PCB-188	ND	8.56			07-Oct-20 20:36	1
PCB-189	ND	10.6			07-Oct-20 20:36	1
PCB-190	ND	11.7			07-Oct-20 20:36	1
PCB-191	ND	10.2			07-Oct-20 20:36	1
PCB-192	ND	9.58			07-Oct-20 20:36	1
PCB-193	ND	10.4			07-Oct-20 20:36	1
PCB-194	44.4				07-Oct-20 20:36	1
PCB-195	ND	6.96			07-Oct-20 20:36	1
PCB-196/203	ND		19.2		07-Oct-20 20:36	1
PCB-197	ND	5.61			07-Oct-20 20:36	1
PCB-198	ND		8.10		07-Oct-20 20:36	1
PCB-199	11.7			J	07-Oct-20 20:36	1

Sample ID: 2020.2232.M23-Run 2 **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 25-Aug-20 19:32

Laboratory Data
Lab Sample: 2001762-02
QC Batch: B0J0011
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-200	ND	5.93			07-Oct-20 20:36	1
PCB-201	ND	6.03			07-Oct-20 20:36	1
PCB-202	ND		8.56		07-Oct-20 20:36	1
PCB-204	ND	5.57			07-Oct-20 20:36	1
PCB-205	ND		10.3		07-Oct-20 20:36	1
PCB-206	44.8				07-Oct-20 20:36	1
PCB-207	ND	6.75			07-Oct-20 20:36	1
PCB-208	ND		15.2		07-Oct-20 20:36	1
PCB-209	46.9				07-Oct-20 20:36	1
Totals						
Total monoCB	5850					
Total diCB	3010		4010			
Total triCB	6040		6300			
Total tetraCB	6640		7010			
Total pentaCB	1050		1390			
Total hexaCB	254		528			
Total heptaCB	ND	15.5				
Total octaCB	56.1		102			
Total nonaCB	44.8		60.0			
DecaCB	46.9					
Total PCB	23000					

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-PCB-1	IS	55.8	20 - 145		07-Oct-20 20:36	1
13C-PCB-3	IS	58.0	20 - 145		07-Oct-20 20:36	1
13C-PCB-4	IS	64.5	20 - 145		07-Oct-20 20:36	1
13C-PCB-11	IS	71.1	20 - 145		07-Oct-20 20:36	1
13C-PCB-9	IS	68.4	20 - 145		07-Oct-20 20:36	1
13C-PCB-19	IS	62.4	20 - 145		07-Oct-20 20:36	1
13C-PCB-28	IS	66.6	20 - 145		07-Oct-20 20:36	1
13C-PCB-32	IS	63.1	20 - 145		07-Oct-20 20:36	1
13C-PCB-37	IS	69.1	20 - 145		07-Oct-20 20:36	1
13C-PCB-47	IS	76.7	20 - 145		07-Oct-20 20:36	1
13C-PCB-52	IS	77.5	20 - 145		07-Oct-20 20:36	1
13C-PCB-54	IS	76.2	20 - 145		07-Oct-20 20:36	1
13C-PCB-70	IS	79.9	20 - 145		07-Oct-20 20:36	1
13C-PCB-77	IS	77.7	20 - 145		07-Oct-20 20:36	1
13C-PCB-80	IS	79.0	20 - 145		07-Oct-20 20:36	1
13C-PCB-81	IS	75.8	20 - 145		07-Oct-20 20:36	1
13C-PCB-95	IS	72.8	20 - 145		07-Oct-20 20:36	1
13C-PCB-97	IS	73.0	20 - 145		07-Oct-20 20:36	1
13C-PCB-101	IS	72.0	20 - 145		07-Oct-20 20:36	1
13C-PCB-104	IS	73.0	20 - 145		07-Oct-20 20:36	1
13C-PCB-105	IS	83.6	20 - 145		07-Oct-20 20:36	1
13C-PCB-114	IS	83.5	20 - 145		07-Oct-20 20:36	1
13C-PCB-118	IS	73.1	20 - 145		07-Oct-20 20:36	1
13C-PCB-123	IS	74.9	20 - 145		07-Oct-20 20:36	1
13C-PCB-126	IS	80.9	20 - 145		07-Oct-20 20:36	1
13C-PCB-127	IS	86.1	20 - 145		07-Oct-20 20:36	1
13C-PCB-138	IS	76.8	20 - 145		07-Oct-20 20:36	1
13C-PCB-141	IS	76.3	20 - 145		07-Oct-20 20:36	1

Sample ID: 2020.2232.M23-Run 2 **EPA Method 23**

Client Data		Laboratory Data			
Name:	Environmental Technical Services, LLC	Lab Sample:	2001762-02	Date Received:	01-Sep-20 11:34
Project:	2020.2232	QC Batch:	B0J0011	Date Extracted:	01-Oct-20
Matrix:	Air Train			Column:	ZB-1
Date Collected:	25-Aug-20 19:32				

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-PCB-153	IS	76.3	20 - 145		07-Oct-20 20:36	1
13C-PCB-155	IS	94.8	20 - 145		07-Oct-20 20:36	1
13C-PCB-156	IS	74.2	20 - 145		07-Oct-20 20:36	1
13C-PCB-157	IS	74.4	20 - 145		07-Oct-20 20:36	1
13C-PCB-159	IS	76.0	20 - 145		07-Oct-20 20:36	1
13C-PCB-167	IS	76.0	20 - 145		07-Oct-20 20:36	1
13C-PCB-169	IS	71.9	20 - 145		07-Oct-20 20:36	1
13C-PCB-170	IS	71.8	20 - 145		07-Oct-20 20:36	1
13C-PCB-180	IS	76.2	20 - 145		07-Oct-20 20:36	1
13C-PCB-188	IS	77.2	20 - 145		07-Oct-20 20:36	1
13C-PCB-189	IS	70.0	20 - 145		07-Oct-20 20:36	1
13C-PCB-194	IS	74.6	20 - 145		07-Oct-20 20:36	1
13C-PCB-202	IS	91.8	20 - 145		07-Oct-20 20:36	1
13C-PCB-206	IS	71.9	20 - 145		07-Oct-20 20:36	1
13C-PCB-208	IS	70.3	20 - 145		07-Oct-20 20:36	1
13C-PCB-209	IS	82.1	20 - 145		07-Oct-20 20:36	1
13C-PCB-79	PS	80.4	70 - 130		07-Oct-20 20:36	1
13C-PCB-178	PS	82.9	70 - 130		07-Oct-20 20:36	1

EDL - Sample specifc estimated detection limit
EMPC - Estimated maximum possible concentration

Sample ID: 2020.2232.M23-Run 3 **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 26-Aug-20 13:45

Laboratory Data
Lab Sample: 2001762-03
QC Batch: B0J0011
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-1	862				07-Oct-20 21:37	1
PCB-2	1800				07-Oct-20 21:37	1
PCB-3	1520				07-Oct-20 21:37	1
PCB-4/10	ND	47.4			07-Oct-20 21:37	1
PCB-5/8	ND		422		07-Oct-20 21:37	1
PCB-6	ND	35.2			07-Oct-20 21:37	1
PCB-7/9	465				07-Oct-20 21:37	1
PCB-11	796				07-Oct-20 21:37	1
PCB-12/13	ND	35.6			07-Oct-20 21:37	1
PCB-14	ND		152		07-Oct-20 21:37	1
PCB-15	248				07-Oct-20 21:37	1
PCB-16/32	220				07-Oct-20 21:37	1
PCB-17	184				07-Oct-20 21:37	1
PCB-18	242				07-Oct-20 21:37	1
PCB-19	ND		42.3		07-Oct-20 21:37	1
PCB-20/21/33	453				07-Oct-20 21:37	1
PCB-22	209				07-Oct-20 21:37	1
PCB-23	ND	10.7			07-Oct-20 21:37	1
PCB-24/27	ND		27.3		07-Oct-20 21:37	1
PCB-25	95.3				07-Oct-20 21:37	1
PCB-26	ND		82.8		07-Oct-20 21:37	1
PCB-28	492			B	07-Oct-20 21:37	1
PCB-29	ND		17.6		07-Oct-20 21:37	1
PCB-30	ND	8.60			07-Oct-20 21:37	1
PCB-31	414				07-Oct-20 21:37	1
PCB-34	ND	9.95			07-Oct-20 21:37	1
PCB-35	164				07-Oct-20 21:37	1
PCB-36	39.3				07-Oct-20 21:37	1
PCB-37	341				07-Oct-20 21:37	1
PCB-38	110				07-Oct-20 21:37	1
PCB-39	ND		30.5		07-Oct-20 21:37	1
PCB-40	88.4				07-Oct-20 21:37	1
PCB-41/64/71/72	269				07-Oct-20 21:37	1
PCB-42/59	129				07-Oct-20 21:37	1
PCB-43/49	184				07-Oct-20 21:37	1
PCB-44	255				07-Oct-20 21:37	1
PCB-45	ND		37.2		07-Oct-20 21:37	1
PCB-46	ND		13.4		07-Oct-20 21:37	1
PCB-47	219				07-Oct-20 21:37	1
PCB-48/75	70.8				07-Oct-20 21:37	1
PCB-50	ND	7.94			07-Oct-20 21:37	1
PCB-51	78.3				07-Oct-20 21:37	1
PCB-52/69	310				07-Oct-20 21:37	1
PCB-53	ND		32.0		07-Oct-20 21:37	1
PCB-54	ND	6.47			07-Oct-20 21:37	1
PCB-55	ND		28.7		07-Oct-20 21:37	1
PCB-56/60	310				07-Oct-20 21:37	1
PCB-57	ND	5.80			07-Oct-20 21:37	1
PCB-58	ND	5.60			07-Oct-20 21:37	1
PCB-61/70	412				07-Oct-20 21:37	1
PCB-62	ND	7.11			07-Oct-20 21:37	1
PCB-63	ND		13.7		07-Oct-20 21:37	1
PCB-65	ND	6.26			07-Oct-20 21:37	1

Sample ID: 2020.2232.M23-Run 3 **EPA Method 23**

Client Data

Name:	Environmental Technical Services, LLC
Project:	2020.2232
Matrix:	Air Train
Date Collected:	26-Aug-20 13:45

Laboratory Data

Lab Sample:	2001762-03	Date Received:	01-Sep-20 11:34
QC Batch:	B0J0011	Date Extracted:	01-Oct-20
		Column:	ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-66/76	342				07-Oct-20 21:37	1
PCB-67	28.8				07-Oct-20 21:37	1
PCB-68	ND		33.5		07-Oct-20 21:37	1
PCB-73	ND	5.76			07-Oct-20 21:37	1
PCB-74	170				07-Oct-20 21:37	1
PCB-77	131				07-Oct-20 21:37	1
PCB-78	32.0				07-Oct-20 21:37	1
PCB-79	ND		29.3		07-Oct-20 21:37	1
PCB-80	ND	5.47			07-Oct-20 21:37	1
PCB-81	36.3				07-Oct-20 21:37	1
PCB-82	36.5				07-Oct-20 21:37	1
PCB-83	ND	6.29			07-Oct-20 21:37	1
PCB-84/92	ND		88.5		07-Oct-20 21:37	1
PCB-85/116	ND	8.17			07-Oct-20 21:37	1
PCB-86	ND	10.3			07-Oct-20 21:37	1
PCB-87/117/125	85.2				07-Oct-20 21:37	1
PCB-88/91	ND		43.5		07-Oct-20 21:37	1
PCB-89	ND	8.92			07-Oct-20 21:37	1
PCB-90/101	ND		191		07-Oct-20 21:37	1
PCB-93	ND	10.4			07-Oct-20 21:37	1
PCB-94	ND	10.3			07-Oct-20 21:37	1
PCB-95/98/102	170				07-Oct-20 21:37	1
PCB-96	ND	6.60			07-Oct-20 21:37	1
PCB-97	52.0				07-Oct-20 21:37	1
PCB-99	71.3				07-Oct-20 21:37	1
PCB-100	ND	7.99			07-Oct-20 21:37	1
PCB-103	ND	8.14			07-Oct-20 21:37	1
PCB-104	ND	6.79			07-Oct-20 21:37	1
PCB-105	91.6				07-Oct-20 21:37	1
PCB-106/118	ND		114		07-Oct-20 21:37	1
PCB-107/109	21.4			J	07-Oct-20 21:37	1
PCB-108/112	ND	7.98			07-Oct-20 21:37	1
PCB-110	184				07-Oct-20 21:37	1
PCB-111/115	ND	6.04			07-Oct-20 21:37	1
PCB-113	ND	6.51			07-Oct-20 21:37	1
PCB-114	ND	13.5			07-Oct-20 21:37	1
PCB-119	ND	6.39			07-Oct-20 21:37	1
PCB-120	ND	5.75			07-Oct-20 21:37	1
PCB-121	ND	5.70			07-Oct-20 21:37	1
PCB-122	ND	16.3			07-Oct-20 21:37	1
PCB-123	22.8			J	07-Oct-20 21:37	1
PCB-124	ND	6.40			07-Oct-20 21:37	1
PCB-126	ND		51.8		07-Oct-20 21:37	1
PCB-127	ND	13.0			07-Oct-20 21:37	1
PCB-128/162	ND		32.9		07-Oct-20 21:37	1
PCB-129	ND	9.78			07-Oct-20 21:37	1
PCB-130	ND		18.8		07-Oct-20 21:37	1
PCB-131/133	ND	8.91			07-Oct-20 21:37	1
PCB-132/161	44.5			J	07-Oct-20 21:37	1
PCB-134/143	ND	9.64			07-Oct-20 21:37	1
PCB-135	ND	5.41			07-Oct-20 21:37	1
PCB-136	28.2				07-Oct-20 21:37	1
PCB-137	ND	8.00			07-Oct-20 21:37	1

Sample ID: 2020.2232.M23-Run 3 **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 26-Aug-20 13:45

Laboratory Data
Lab Sample: 2001762-03
QC Batch: B0J0011
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-138/163/164	ND		108		07-Oct-20 21:37	1
PCB-139/149	ND		87.9		07-Oct-20 21:37	1
PCB-140	ND	6.29			07-Oct-20 21:37	1
PCB-141	30.9				07-Oct-20 21:37	1
PCB-142	ND	9.70			07-Oct-20 21:37	1
PCB-144	ND	6.33			07-Oct-20 21:37	1
PCB-145	ND	4.20			07-Oct-20 21:37	1
PCB-146/165	ND		30.5		07-Oct-20 21:37	1
PCB-147	ND	5.98			07-Oct-20 21:37	1
PCB-148	ND	5.93			07-Oct-20 21:37	1
PCB-150	ND	4.61			07-Oct-20 21:37	1
PCB-151	31.9				07-Oct-20 21:37	1
PCB-152	ND	4.21			07-Oct-20 21:37	1
PCB-153	93.5				07-Oct-20 21:37	1
PCB-154	ND	5.43			07-Oct-20 21:37	1
PCB-155	ND	4.78			07-Oct-20 21:37	1
PCB-156	ND		25.6		07-Oct-20 21:37	1
PCB-157	ND		18.9		07-Oct-20 21:37	1
PCB-158/160	28.1			J	07-Oct-20 21:37	1
PCB-159	ND	6.10			07-Oct-20 21:37	1
PCB-166	ND	6.49			07-Oct-20 21:37	1
PCB-167	21.1			J	07-Oct-20 21:37	1
PCB-168	ND	6.79			07-Oct-20 21:37	1
PCB-169	14.5			J	07-Oct-20 21:37	1
PCB-170	ND	11.2			07-Oct-20 21:37	1
PCB-171	ND		14.2		07-Oct-20 21:37	1
PCB-172	ND	9.24			07-Oct-20 21:37	1
PCB-173	ND	10.7			07-Oct-20 21:37	1
PCB-174	ND	9.39			07-Oct-20 21:37	1
PCB-175	ND	8.63			07-Oct-20 21:37	1
PCB-176	ND	6.30			07-Oct-20 21:37	1
PCB-177	ND	9.94			07-Oct-20 21:37	1
PCB-178	ND	8.75			07-Oct-20 21:37	1
PCB-179	ND	6.36			07-Oct-20 21:37	1
PCB-180	ND		43.0		07-Oct-20 21:37	1
PCB-181	ND	8.62			07-Oct-20 21:37	1
PCB-182/187	ND		33.0		07-Oct-20 21:37	1
PCB-183	ND	8.07			07-Oct-20 21:37	1
PCB-184	ND	6.70			07-Oct-20 21:37	1
PCB-185	ND	9.04			07-Oct-20 21:37	1
PCB-186	ND	6.21			07-Oct-20 21:37	1
PCB-188	ND	6.40			07-Oct-20 21:37	1
PCB-189	25.4				07-Oct-20 21:37	1
PCB-190	ND	8.44			07-Oct-20 21:37	1
PCB-191	15.3			J	07-Oct-20 21:37	1
PCB-192	ND	6.96			07-Oct-20 21:37	1
PCB-193	ND	7.58			07-Oct-20 21:37	1
PCB-194	53.7				07-Oct-20 21:37	1
PCB-195	ND		17.2		07-Oct-20 21:37	1
PCB-196/203	43.7			J	07-Oct-20 21:37	1
PCB-197	ND	4.87			07-Oct-20 21:37	1
PCB-198	ND	6.94			07-Oct-20 21:37	1
PCB-199	ND		12.3		07-Oct-20 21:37	1

Sample ID: 2020.2232.M23-Run 3 **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 26-Aug-20 13:45

Laboratory Data
Lab Sample: 2001762-03
QC Batch: B0J0011
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-200	ND	5.15			07-Oct-20 21:37	1
PCB-201	ND	5.23			07-Oct-20 21:37	1
PCB-202	ND	4.72			07-Oct-20 21:37	1
PCB-204	ND	4.83			07-Oct-20 21:37	1
PCB-205	ND		22.8		07-Oct-20 21:37	1
PCB-206	53.8				07-Oct-20 21:37	1
PCB-207	20.6			J	07-Oct-20 21:37	1
PCB-208	ND		13.8		07-Oct-20 21:37	1
PCB-209	ND		44.5		07-Oct-20 21:37	1
Totals						
Total monoCB	4180					
Total diCB	1510		2080			
Total triCB	2960		3170			
Total tetraCB	3060		3250			
Total pentaCB	735		1220			
Total hexaCB	293		615			
Total heptaCB	40.6		131			
Total octaCB	97.4		150			
Total nonaCB	74.4		88.2			
DecaCB	ND		44.5			
Total PCB	13000					

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-PCB-1	IS	66.1	20 - 145		07-Oct-20 21:37	1
13C-PCB-3	IS	68.2	20 - 145		07-Oct-20 21:37	1
13C-PCB-4	IS	77.4	20 - 145		07-Oct-20 21:37	1
13C-PCB-11	IS	85.5	20 - 145		07-Oct-20 21:37	1
13C-PCB-9	IS	81.0	20 - 145		07-Oct-20 21:37	1
13C-PCB-19	IS	73.3	20 - 145		07-Oct-20 21:37	1
13C-PCB-28	IS	102	20 - 145		07-Oct-20 21:37	1
13C-PCB-32	IS	77.5	20 - 145		07-Oct-20 21:37	1
13C-PCB-37	IS	97.5	20 - 145		07-Oct-20 21:37	1
13C-PCB-47	IS	91.1	20 - 145		07-Oct-20 21:37	1
13C-PCB-52	IS	92.9	20 - 145		07-Oct-20 21:37	1
13C-PCB-54	IS	89.1	20 - 145		07-Oct-20 21:37	1
13C-PCB-70	IS	91.7	20 - 145		07-Oct-20 21:37	1
13C-PCB-77	IS	92.1	20 - 145		07-Oct-20 21:37	1
13C-PCB-80	IS	93.1	20 - 145		07-Oct-20 21:37	1
13C-PCB-81	IS	89.9	20 - 145		07-Oct-20 21:37	1
13C-PCB-95	IS	90.7	20 - 145		07-Oct-20 21:37	1
13C-PCB-97	IS	89.2	20 - 145		07-Oct-20 21:37	1
13C-PCB-101	IS	91.6	20 - 145		07-Oct-20 21:37	1
13C-PCB-104	IS	93.1	20 - 145		07-Oct-20 21:37	1
13C-PCB-105	IS	99.2	20 - 145		07-Oct-20 21:37	1
13C-PCB-114	IS	98.6	20 - 145		07-Oct-20 21:37	1
13C-PCB-118	IS	90.2	20 - 145		07-Oct-20 21:37	1
13C-PCB-123	IS	91.3	20 - 145		07-Oct-20 21:37	1
13C-PCB-126	IS	97.5	20 - 145		07-Oct-20 21:37	1
13C-PCB-127	IS	102	20 - 145		07-Oct-20 21:37	1
13C-PCB-138	IS	93.6	20 - 145		07-Oct-20 21:37	1
13C-PCB-141	IS	91.9	20 - 145		07-Oct-20 21:37	1

Sample ID: 2020.2232.M23-Run 3 **EPA Method 23**

Client Data		Laboratory Data			
Name:	Environmental Technical Services, LLC	Lab Sample:	2001762-03	Date Received:	01-Sep-20 11:34
Project:	2020.2232	QC Batch:	B0J0011	Date Extracted:	01-Oct-20
Matrix:	Air Train			Column:	ZB-1
Date Collected:	26-Aug-20 13:45				

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-PCB-153	IS	92.5	20 - 145		07-Oct-20 21:37	1
13C-PCB-155	IS	117	20 - 145		07-Oct-20 21:37	1
13C-PCB-156	IS	91.0	20 - 145		07-Oct-20 21:37	1
13C-PCB-157	IS	90.9	20 - 145		07-Oct-20 21:37	1
13C-PCB-159	IS	90.5	20 - 145		07-Oct-20 21:37	1
13C-PCB-167	IS	90.4	20 - 145		07-Oct-20 21:37	1
13C-PCB-169	IS	90.7	20 - 145		07-Oct-20 21:37	1
13C-PCB-170	IS	91.7	20 - 145		07-Oct-20 21:37	1
13C-PCB-180	IS	92.8	20 - 145		07-Oct-20 21:37	1
13C-PCB-188	IS	93.0	20 - 145		07-Oct-20 21:37	1
13C-PCB-189	IS	89.9	20 - 145		07-Oct-20 21:37	1
13C-PCB-194	IS	92.3	20 - 145		07-Oct-20 21:37	1
13C-PCB-202	IS	113	20 - 145		07-Oct-20 21:37	1
13C-PCB-206	IS	84.7	20 - 145		07-Oct-20 21:37	1
13C-PCB-208	IS	86.1	20 - 145		07-Oct-20 21:37	1
13C-PCB-209	IS	97.5	20 - 145		07-Oct-20 21:37	1
13C-PCB-79	PS	94.6	70 - 130		07-Oct-20 21:37	1
13C-PCB-178	PS	98.2	70 - 130		07-Oct-20 21:37	1

EDL - Sample specifc estimated detection limit
EMPC - Estimated maximum possible concentration

Sample ID: 2020.2232.M23-Field Train Proof

EPA Method 23

Client Data

Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 26-Aug-20 13:50

Laboratory Data

Lab Sample: 2001762-04
QC Batch: B0J0011
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-1	ND	7.61			07-Oct-20 18:36	1
PCB-2	ND	7.35			07-Oct-20 18:36	1
PCB-3	ND	7.57			07-Oct-20 18:36	1
PCB-4/10	ND	53.7			07-Oct-20 18:36	1
PCB-5/8	ND	40.0			07-Oct-20 18:36	1
PCB-6	ND	38.8			07-Oct-20 18:36	1
PCB-7/9	ND	41.3			07-Oct-20 18:36	1
PCB-11	139				07-Oct-20 18:36	1
PCB-12/13	ND	40.3			07-Oct-20 18:36	1
PCB-14	ND	40.7			07-Oct-20 18:36	1
PCB-15	ND	40.0			07-Oct-20 18:36	1
PCB-16/32	ND		41.2		07-Oct-20 18:36	1
PCB-17	ND	15.3			07-Oct-20 18:36	1
PCB-18	ND	14.2			07-Oct-20 18:36	1
PCB-19	ND	15.4			07-Oct-20 18:36	1
PCB-20/21/33	ND		48.6		07-Oct-20 18:36	1
PCB-22	41.2				07-Oct-20 18:36	1
PCB-23	ND	14.2			07-Oct-20 18:36	1
PCB-24/27	ND	10.8			07-Oct-20 18:36	1
PCB-25	ND	13.2			07-Oct-20 18:36	1
PCB-26	ND	13.3			07-Oct-20 18:36	1
PCB-28	74.8			B	07-Oct-20 18:36	1
PCB-29	ND	14.0			07-Oct-20 18:36	1
PCB-30	ND	9.51			07-Oct-20 18:36	1
PCB-31	73.3				07-Oct-20 18:36	1
PCB-34	ND	13.3			07-Oct-20 18:36	1
PCB-35	ND	13.8			07-Oct-20 18:36	1
PCB-36	ND	13.4			07-Oct-20 18:36	1
PCB-37	31.2				07-Oct-20 18:36	1
PCB-38	ND	13.7			07-Oct-20 18:36	1
PCB-39	ND	14.6			07-Oct-20 18:36	1
PCB-40	ND	21.3			07-Oct-20 18:36	1
PCB-41/64/71/72	58.3			J	07-Oct-20 18:36	1
PCB-42/59	ND	12.2			07-Oct-20 18:36	1
PCB-43/49	41.3			J	07-Oct-20 18:36	1
PCB-44	ND		58.4		07-Oct-20 18:36	1
PCB-45	ND		13.1		07-Oct-20 18:36	1
PCB-46	ND	16.3			07-Oct-20 18:36	1
PCB-47	ND		39.9		07-Oct-20 18:36	1
PCB-48/75	ND	11.5			07-Oct-20 18:36	1
PCB-50	ND	11.7			07-Oct-20 18:36	1
PCB-51	ND		14.7		07-Oct-20 18:36	1
PCB-52/69	ND		65.2		07-Oct-20 18:36	1
PCB-53	ND	13.5			07-Oct-20 18:36	1
PCB-54	ND	9.53			07-Oct-20 18:36	1
PCB-55	ND	9.66			07-Oct-20 18:36	1
PCB-56/60	ND		33.6		07-Oct-20 18:36	1
PCB-57	ND	10.1			07-Oct-20 18:36	1
PCB-58	ND	9.74			07-Oct-20 18:36	1
PCB-61/70	72.8				07-Oct-20 18:36	1
PCB-62	ND	11.4			07-Oct-20 18:36	1
PCB-63	ND	10.9			07-Oct-20 18:36	1
PCB-65	ND	10.0			07-Oct-20 18:36	1

Sample ID: 2020.2232.M23-Field Train Proof | **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 26-Aug-20 13:50

Laboratory Data
Lab Sample: 2001762-04
QC Batch: B0J0011
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-66/76	ND		50.9		07-Oct-20 18:36	1
PCB-67	ND	10.8			07-Oct-20 18:36	1
PCB-68	ND	10.0			07-Oct-20 18:36	1
PCB-73	ND	9.36			07-Oct-20 18:36	1
PCB-74	28.6				07-Oct-20 18:36	1
PCB-77	ND	12.1			07-Oct-20 18:36	1
PCB-78	ND	11.6			07-Oct-20 18:36	1
PCB-79	ND	9.92			07-Oct-20 18:36	1
PCB-80	ND	9.52			07-Oct-20 18:36	1
PCB-81	ND	12.6			07-Oct-20 18:36	1
PCB-82	ND	17.2			07-Oct-20 18:36	1
PCB-83	ND	9.39			07-Oct-20 18:36	1
PCB-84/92	ND	15.4			07-Oct-20 18:36	1
PCB-85/116	ND	12.2			07-Oct-20 18:36	1
PCB-86	ND	15.4			07-Oct-20 18:36	1
PCB-87/117/125	ND		24.9		07-Oct-20 18:36	1
PCB-88/91	ND	13.6			07-Oct-20 18:36	1
PCB-89	ND	14.2			07-Oct-20 18:36	1
PCB-90/101	ND	14.0			07-Oct-20 18:36	1
PCB-93	ND	15.5			07-Oct-20 18:36	1
PCB-94	ND	15.3			07-Oct-20 18:36	1
PCB-95/98/102	66.9			J	07-Oct-20 18:36	1
PCB-96	ND	9.30			07-Oct-20 18:36	1
PCB-97	ND		27.4		07-Oct-20 18:36	1
PCB-99	ND		21.1		07-Oct-20 18:36	1
PCB-100	ND	11.2			07-Oct-20 18:36	1
PCB-103	ND	11.5			07-Oct-20 18:36	1
PCB-104	ND	9.56			07-Oct-20 18:36	1
PCB-105	ND		18.8		07-Oct-20 18:36	1
PCB-106/118	33.5			J	07-Oct-20 18:36	1
PCB-107/109	ND	10.0			07-Oct-20 18:36	1
PCB-108/112	ND	11.9			07-Oct-20 18:36	1
PCB-110	ND		36.2		07-Oct-20 18:36	1
PCB-111/115	ND	9.01			07-Oct-20 18:36	1
PCB-113	ND	10.4			07-Oct-20 18:36	1
PCB-114	ND	12.6			07-Oct-20 18:36	1
PCB-119	ND	9.53			07-Oct-20 18:36	1
PCB-120	ND	8.58			07-Oct-20 18:36	1
PCB-121	ND	8.50			07-Oct-20 18:36	1
PCB-122	ND	15.2			07-Oct-20 18:36	1
PCB-123	ND	11.2			07-Oct-20 18:36	1
PCB-124	ND	9.63			07-Oct-20 18:36	1
PCB-126	ND	13.7			07-Oct-20 18:36	1
PCB-127	ND	13.1			07-Oct-20 18:36	1
PCB-128/162	ND	11.0			07-Oct-20 18:36	1
PCB-129	ND	13.1			07-Oct-20 18:36	1
PCB-130	ND	13.7			07-Oct-20 18:36	1
PCB-131/133	ND	11.5			07-Oct-20 18:36	1
PCB-132/161	ND		13.1		07-Oct-20 18:36	1
PCB-134/143	ND	12.4			07-Oct-20 18:36	1
PCB-135	ND	9.00			07-Oct-20 18:36	1
PCB-136	ND	8.13			07-Oct-20 18:36	1
PCB-137	ND	10.9			07-Oct-20 18:36	1

Sample ID: 2020.2232.M23-Field Train Proof **EPA Method 23**

Client Data
Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 26-Aug-20 13:50

Laboratory Data
Lab Sample: 2001762-04
QC Batch: B0J0011
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-138/163/164	ND		18.9		07-Oct-20 18:36	1
PCB-139/149	ND		25.9		07-Oct-20 18:36	1
PCB-140	ND	10.5			07-Oct-20 18:36	1
PCB-141	ND	11.8			07-Oct-20 18:36	1
PCB-142	ND	12.5			07-Oct-20 18:36	1
PCB-144	ND	10.5			07-Oct-20 18:36	1
PCB-145	ND	6.98			07-Oct-20 18:36	1
PCB-146/165	ND	9.27			07-Oct-20 18:36	1
PCB-147	ND	9.94			07-Oct-20 18:36	1
PCB-148	ND	9.86			07-Oct-20 18:36	1
PCB-150	ND	7.66			07-Oct-20 18:36	1
PCB-151	ND	10.6			07-Oct-20 18:36	1
PCB-152	ND	6.99			07-Oct-20 18:36	1
PCB-153	ND		16.1		07-Oct-20 18:36	1
PCB-154	ND	9.03			07-Oct-20 18:36	1
PCB-155	ND	7.95			07-Oct-20 18:36	1
PCB-156	ND	9.90			07-Oct-20 18:36	1
PCB-157	ND	10.3			07-Oct-20 18:36	1
PCB-158/160	ND	9.15			07-Oct-20 18:36	1
PCB-159	ND	8.21			07-Oct-20 18:36	1
PCB-166	ND	8.74			07-Oct-20 18:36	1
PCB-167	ND	9.03			07-Oct-20 18:36	1
PCB-168	ND	8.75			07-Oct-20 18:36	1
PCB-169	ND	11.2			07-Oct-20 18:36	1
PCB-170	ND	8.60			07-Oct-20 18:36	1
PCB-171	ND	7.25			07-Oct-20 18:36	1
PCB-172	ND	6.94			07-Oct-20 18:36	1
PCB-173	ND	8.02			07-Oct-20 18:36	1
PCB-174	ND	7.05			07-Oct-20 18:36	1
PCB-175	ND	5.77			07-Oct-20 18:36	1
PCB-176	ND	4.22			07-Oct-20 18:36	1
PCB-177	ND	7.47			07-Oct-20 18:36	1
PCB-178	ND	5.85			07-Oct-20 18:36	1
PCB-179	ND	4.25			07-Oct-20 18:36	1
PCB-180	ND	6.76			07-Oct-20 18:36	1
PCB-181	ND	6.47			07-Oct-20 18:36	1
PCB-182/187	ND	5.18			07-Oct-20 18:36	1
PCB-183	ND	5.39			07-Oct-20 18:36	1
PCB-184	ND	4.48			07-Oct-20 18:36	1
PCB-185	ND	6.79			07-Oct-20 18:36	1
PCB-186	ND	4.15			07-Oct-20 18:36	1
PCB-188	ND	4.28			07-Oct-20 18:36	1
PCB-189	ND	5.72			07-Oct-20 18:36	1
PCB-190	ND	6.50			07-Oct-20 18:36	1
PCB-191	ND	5.58			07-Oct-20 18:36	1
PCB-192	ND	5.22			07-Oct-20 18:36	1
PCB-193	ND	5.69			07-Oct-20 18:36	1
PCB-194	ND		29.0		07-Oct-20 18:36	1
PCB-195	ND	6.63			07-Oct-20 18:36	1
PCB-196/203	ND	6.31			07-Oct-20 18:36	1
PCB-197	ND	4.67			07-Oct-20 18:36	1
PCB-198	ND	6.67			07-Oct-20 18:36	1
PCB-199	ND	6.54			07-Oct-20 18:36	1

Sample ID: 2020.2232.M23-Field Train Proof — **EPA Method 23**

Client Data

Name:	Environmental Technical Services, LLC
Project:	2020.2232
Matrix:	Air Train
Date Collected:	26-Aug-20 13:50

Laboratory Data

Lab Sample:	2001762-04	Date Received:	01-Sep-20 11:34
QC Batch:	B0J0011	Date Extracted:	01-Oct-20
		Column:	ZB-1

Analyte	Conc. (pg/Sample)	EDL	EMPC	Qualifiers	Analyzed	Dilution
PCB-200	ND	4.94			07-Oct-20 18:36	1
PCB-201	ND	5.03			07-Oct-20 18:36	1
PCB-202	ND	4.53			07-Oct-20 18:36	1
PCB-204	ND	4.64			07-Oct-20 18:36	1
PCB-205	ND	5.37			07-Oct-20 18:36	1
PCB-206	ND	6.02			07-Oct-20 18:36	1
PCB-207	ND	3.59			07-Oct-20 18:36	1
PCB-208	ND	3.53			07-Oct-20 18:36	1
PCB-209	ND	4.90			07-Oct-20 18:36	1
Totals						
Total monoCB	ND	7.61				
Total diCB	139					
Total triCB	221		310			
Total tetraCB	201		477			
Total pentaCB	100		229			
Total hexaCB	ND		74.1			
Total heptaCB	ND	8.02				
Total octaCB	ND		29.0			
Total nonaCB	ND	6.02				
DecaCB	ND	4.90				
Total PCB	661					

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-PCB-1	IS	54.4	20 - 145		07-Oct-20 18:36	1
13C-PCB-3	IS	57.9	20 - 145		07-Oct-20 18:36	1
13C-PCB-4	IS	64.5	20 - 145		07-Oct-20 18:36	1
13C-PCB-11	IS	69.0	20 - 145		07-Oct-20 18:36	1
13C-PCB-9	IS	68.5	20 - 145		07-Oct-20 18:36	1
13C-PCB-19	IS	61.7	20 - 145		07-Oct-20 18:36	1
13C-PCB-28	IS	76.1	20 - 145		07-Oct-20 18:36	1
13C-PCB-32	IS	62.5	20 - 145		07-Oct-20 18:36	1
13C-PCB-37	IS	69.7	20 - 145		07-Oct-20 18:36	1
13C-PCB-47	IS	77.5	20 - 145		07-Oct-20 18:36	1
13C-PCB-52	IS	78.5	20 - 145		07-Oct-20 18:36	1
13C-PCB-54	IS	81.7	20 - 145		07-Oct-20 18:36	1
13C-PCB-70	IS	75.9	20 - 145		07-Oct-20 18:36	1
13C-PCB-77	IS	68.4	20 - 145		07-Oct-20 18:36	1
13C-PCB-80	IS	75.9	20 - 145		07-Oct-20 18:36	1
13C-PCB-81	IS	69.1	20 - 145		07-Oct-20 18:36	1
13C-PCB-95	IS	77.1	20 - 145		07-Oct-20 18:36	1
13C-PCB-97	IS	75.2	20 - 145		07-Oct-20 18:36	1
13C-PCB-101	IS	73.4	20 - 145		07-Oct-20 18:36	1
13C-PCB-104	IS	82.2	20 - 145		07-Oct-20 18:36	1
13C-PCB-105	IS	79.5	20 - 145		07-Oct-20 18:36	1
13C-PCB-114	IS	81.9	20 - 145		07-Oct-20 18:36	1
13C-PCB-118	IS	74.6	20 - 145		07-Oct-20 18:36	1
13C-PCB-123	IS	74.1	20 - 145		07-Oct-20 18:36	1
13C-PCB-126	IS	74.4	20 - 145		07-Oct-20 18:36	1
13C-PCB-127	IS	82.0	20 - 145		07-Oct-20 18:36	1
13C-PCB-138	IS	73.5	20 - 145		07-Oct-20 18:36	1
13C-PCB-141	IS	74.5	20 - 145		07-Oct-20 18:36	1

Sample ID: 2020.2232.M23-Field Train Proof

EPA Method 23

Client Data

Name: Environmental Technical Services, LLC
Project: 2020.2232
Matrix: Air Train
Date Collected: 26-Aug-20 13:50

Laboratory Data

Lab Sample: 2001762-04
QC Batch: B0J0011
Date Received: 01-Sep-20 11:34
Date Extracted: 01-Oct-20
Column: ZB-1

Labeled Standards	Type	% Recovery	Limits	Qualifiers	Analyzed	Dilution
13C-PCB-153	IS	76.1	20 - 145		07-Oct-20 18:36	1
13C-PCB-155	IS	96.9	20 - 145		07-Oct-20 18:36	1
13C-PCB-156	IS	68.5	20 - 145		07-Oct-20 18:36	1
13C-PCB-157	IS	70.4	20 - 145		07-Oct-20 18:36	1
13C-PCB-159	IS	72.6	20 - 145		07-Oct-20 18:36	1
13C-PCB-167	IS	71.8	20 - 145		07-Oct-20 18:36	1
13C-PCB-169	IS	63.5	20 - 145		07-Oct-20 18:36	1
13C-PCB-170	IS	64.2	20 - 145		07-Oct-20 18:36	1
13C-PCB-180	IS	68.7	20 - 145		07-Oct-20 18:36	1
13C-PCB-188	IS	75.3	20 - 145		07-Oct-20 18:36	1
13C-PCB-189	IS	60.7	20 - 145		07-Oct-20 18:36	1
13C-PCB-194	IS	72.4	20 - 145		07-Oct-20 18:36	1
13C-PCB-202	IS	89.6	20 - 145		07-Oct-20 18:36	1
13C-PCB-206	IS	70.3	20 - 145		07-Oct-20 18:36	1
13C-PCB-208	IS	73.2	20 - 145		07-Oct-20 18:36	1
13C-PCB-209	IS	86.3	20 - 145		07-Oct-20 18:36	1
13C-PCB-79	PS	76.6	70 - 130		07-Oct-20 18:36	1
13C-PCB-178	PS	85.0	70 - 130		07-Oct-20 18:36	1

EDL - Sample specifc estimated detection limit
EMPC - Estimated maximum possible concentration

DATA QUALIFIERS & ABBREVIATIONS

B	This compound was also detected in the method blank
Conc.	Concentration
CRS	Cleanup Recovery Standard
D	Dilution
DL	Detection Limit
E	The associated compound concentration exceeded the calibration range of the instrument
H	Recovery and/or RPD was outside laboratory acceptance limits
I	Chemical Interference
IS	Internal Standard
J	The amount detected is below the Reporting Limit/LOQ
K	EMPC (specific projects only)
LOD	Limit of Detection
LOQ	Limit of Quantitation
M	Estimated Maximum Possible Concentration (CA Region 2 projects only)
MDL	Method Detection Limit
NA	Not applicable
ND	Not Detected
OPR	Ongoing Precision and Recovery sample
P	The reported concentration may include contribution from chlorinated diphenyl ether(s).
Q	The ion transition ratio is outside of the acceptance criteria.
RL	Reporting Limit
TEQ	Toxic Equivalency
U	Not Detected (specific projects only)

Unless otherwise noted, solid sample results are reported in dry weight. Tissue samples are reported in wet weight.

Vista Analytical Laboratory Certifications

Accrediting Authority	Certificate Number
Alaska Department of Environmental Conservation	17-013
Arkansas Department of Environmental Quality	19-013-0
California Department of Health – ELAP	2892
DoD ELAP - A2LA Accredited - ISO/IEC 17025:2005	3091.01
Florida Department of Health	E87777-23
Hawaii Department of Health	N/A
Louisiana Department of Environmental Quality	01977
Maine Department of Health	2018017
Massachusetts Department of Environmental Protection	N/A
Michigan Department of Environmental Quality	9932
Minnesota Department of Health	1521520
New Hampshire Environmental Accreditation Program	207718-B
New Jersey Department of Environmental Protection	190001
New York Department of Health	11411
Oregon Laboratory Accreditation Program	4042-010
Pennsylvania Department of Environmental Protection	016
Texas Commission on Environmental Quality	T104704189-19-10
Vermont Department of Health	VT-4042
Virginia Department of General Services	10272
Washington Department of Ecology	C584-19
Wisconsin Department of Natural Resources	998036160

Current certificates and lists of licensed parameters are located in the Quality Assurance office and are available upon request.

NELAP Accredited Test Methods

MATRIX: Air	
Description of Test	**Method**
Determination of Polychlorinated p-Dioxins & Polychlorinated Dibenzofurans	EPA 23
Determination of Polychlorinated p-Dioxins & Polychlorinated Dibenzofurans	EPA TO-9A

MATRIX: Biological Tissue	
Description of Test	**Method**
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613B
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS	EPA 1699
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

MATRIX: Drinking Water	
Description of Test	**Method**
2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD) GC/HRMS	EPA 1613/1613B
1,4-Dioxane (1,4-Diethyleneoxide) analysis by GC/HRMS	EPA 522
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	ISO 25101 2009

MATRIX: Non-Potable Water	
Description of Test	**Method**
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613B
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS	EPA 1699
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Dioxin by GC/HRMS	EPA 613
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

MATRIX: Solids	
Description of Test	**Method**
Tetra-Octa Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613B
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS	EPA 1699
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

2001762 5.2°C

2105 Corey Road
Central Point, OR 97502
Office: 541-779-2646
FAX: 541-734-5537

CHAIN of CUSTODY

Client: Oil Re-Refining Co. Location: Klamath Falls, OR. Project No.: 2020.2232 Test Date: Aug. 18,19, 2020 Project Manager: A. Winkler Emission Source: Auxiliary Boiler	Laboratory: Vista Analytical Laboratory Contact: Ms. Jade White Telephone: 916.673-1520 Results Needed By: *Normal*			*EPA Method 23* See attached Analyte List
SAMPLE IDENTIFICATION	SAMPLE SOURCE	SAMPLE DISCRIPTION	SAMPLE DISCRIPTION	
2020.2232.M23.01	Auxiliary Boiler	Run #1, Container #1	Filter	X
2020.2232.M23.02	Auxiliary Boiler	Run #1, XAD	Adsorbent Module	X
2020.2232.M23.03	Auxiliary Boiler	Run #1, Container #2	P/N, Filter Housing, Condenser	X
2020.2232.M23.04	Auxiliary Boiler	Run #1, Container #3	Imp #1-4 Catch	X
2020.2232.M23.05	Auxiliary Boiler	Run #2, Container #1	Filter	X
2020.2232.M23.06	Auxiliary Boiler	Run #2, XAD	Adsorbent Module	X
2020.2232.M23.07	Auxiliary Boiler	Run #2, Container #2	P/N, Filter Housing, Condenser	X
2020.2232.M23.08	Auxiliary Boiler	Run #2, Container #3	Imp #1-4 Catch	X
2020.2232.M23.09	Auxiliary Boiler	Run #3, Container #1	Filter	X
2020.2232.M23.10	Auxiliary Boiler	Run #3, XAD	Adsorbent Module	X
2020.2232.M23.11	Auxiliary Boiler	Run #3, Container #2	P/N, Filter Housing, Condenser	X
2020.2232.M23.12	Auxiliary Boiler	Run #3, Container #3	Imp #1-4 Catch	X
2020.2232.M23.13	Auxiliary Boiler	Field Train Proof Blank Container #1	Filter	X
2020.2232.M23.14	Auxiliary Boiler	Field Train Proof Blank XAD	Adsorbent Module	X
2020.2232.M23.15	Auxiliary Boiler	Field Train Proof Blank Container #2	P/N, Filter Housing, Condenser	X
2020.2232.M23.16	Auxiliary Boiler	Field Train Proof Blank Container #3	Imp #1-4 Catch	X

Comments: ODEQ has requested that a total for all 209 PCB congeners be reported.

Sent by: Andy Winkler	Received by:
Date/Time: 9-1-20 0615	Date/Time: 9/01/20 11:34

Sent by:	Received by:
Date/Time:	Date/Time:

2001762

Pollutant Parameters to be Determined:

A. Polychlorinated dibenzo p-dioxin (PCDD) - the following selected congeners

i.	Polychlorinated dibenzo-p-dioxin (PCDD)	CAS#	Analysis included
1	2,3,7,8-Tetrachlorodibenzop-dioxin (TCDD)	1746-01-6	Yes
2	1,2,3,7,8-Pentachlorodibenzo p-dioxin (PeCDD)	40321-76-4	Yes
3	1,2,3,4,7,8-Hexaclilorodibenzop-dioxin (HxCDD)	39227-28-6	Yes
4	1,2,3,6,7,8-Hexaclilorodibenzop-dioxin (HxCDD)	57653-85-7	Yes
5	1,2,3,7,8,9-Hexachlorodibenzop-dioxins (HxCDD)	19408-74-3	Yes
6	1,2,3,4,6,7,8-Heptachlorodibenzop-dioxin (HpCDD)	35822-46-9	Yes
7	Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	Yes

B. Polychlorinated dibenzofuran (PCDF) - the following selected congeners

ii.	Polychlorinated dibenzofuran (PCDF)	CAS#	Analysis included
1	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	Yes
2	1,2,3,7,8-Pentachlorodibenzofuran-an (PeCDF)	57117-41-6	Yes
3	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	Yes
4	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	Yes
5	1,2,3,6,7,8- Hexachlorodibenzofuran (HxCDF)	57117-44-9	Yes
6	1,2,3,7,8,9- Hexachlorodibenzofuran (HxCDF)	72918-21-9	Yes
7	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	Yes
8	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	Yes
9	1,2,3,4,7,8,9- Heptachlorodibenzofuran (HpCDF)	55673-89-7	Yes
10	Octachlorodibenzofuran (OCDF)	39001-02-0	Yes

2001762

Pollutant Parameters to be Determined: (continued)

C. Polychlorinated biphenyls (PCBs) - all congeners

iiii	Polychlorinated biphenyls (PCBs)	CAS#	Analysis included
1	PCB-5/8 [2,4'-dichlorobiphenyl]	34883-43-7	Yes
2	PCB 18 [2,2',5-trichlorobiphenyl]	37680-65-2	Yes
3	PCB-28 [2,4,4'-trichlorobiphenyl]	7012-37-5	Yes
4	PCB-44 [2,2',3,5'-tetrachlorobiphenyl]	41464-39-5	Yes
5	PCB-52 [2,2',5,5'-tetrachlorobiphenyl]	35693-99-3	Yes
6	PCB-66 [2,3',4,4'-tetrachlorobiphenyl]	32598-10-0	Yes
7	PCB 77 [3,3',4,4'-tetrachlorobiphenyl]	32598-13-3	Yes
8	PCB 81 [3,4,4',5-tetrachlorobiphenyl]	70362-50-4	Yes
9	37680-73-2 PCB-101 [2,2',4,5,5'-pentachlorobiphenyl]	37680-73-2	Yes
10	PCB 105 [2,3,3',4,4'-pentachlorobiphenyl]	32598-14-4	Yes
11	PCB 114 [2,3,4,4',5-pentachlorobiphenyl]	74472-37-0	Yes
12	PCB 118 [2,3',4,4',5-pentachlorobiphenyl]	31508-00-6	Yes
13	PCB 123 [2,3',4,4',5'-pentachlorobiphenyl]	65510-44-3	Yes
14	PCB 126 [3,3',4,4',5-pentachlorobiphenyl]	57465-28-8	Yes
15	PCB-128 [2,2',3,3',4,4'-hexachlorobiphenyl]	38380-07-3	Yes
16	PCB-138 [2,2',3,4,4',5'-hexachlorobiphenyl]	35065-28-2	Yes
17	PCB-153 [2,2',4,4',5,5'-hexachlorobiphenyl]	35065-27-1	Yes
18	PCB 156 [2,3,3',4,4',5-hexachlorobiphenyl]	38380-08-4	Yes
19	PCB 157 [2,3,3',4,4',5'-hexachlorobiphenyl]	69782-90-7	Yes
20	PCB 167 [2,3',4,4',5,5'-hexachlorobiphenyl]	52663-72-6	Yes
21	PCB 169 [3,3',4,4',5,5'-hexachlorobiphenyl]	32774-16-6	Yes
22	PCB-170 [2,2',3,3',4,4',5-heptachlorobiphenyl]	35065-30-6	Yes
23	PCB-180 [2,2',3,4,4',5,5'-heptachlorobiphenyl]	35065-29-3	Yes
24	PCB-187 [2,2',3,4',5,5',6-heptachlorobiphenyl]	52663-68-0	Yes
25	PCB 189 [2,3,3',4,4',5,5'-heptachlorobiphenyl]	39635-31-9	Yes
26	PCB-195 [2,2',3,3',4,4',5,6-octachlorobiphenyl]	52663-78-2	Yes
27	PCB-206 [2,2',3,3',4,4',5,5',6-nonachlorobiphenyl]	40186-72-9	Yes
28	PCB-209 [2,2'3,3',4,4',5,5',6,6 '-decachlorobiphenyl]	2051-24-3	Yes

NOTE: Include Total for all 209 PCB congeners as requested by ODEQ.

Pollutant Parameters to be Determined: (continued)

D. Polycyclic aromatic hydrocarbons (PAHs) and polycyclic aromatic hydrocarbon derivatives (PAH-derivatives)

iii.	Polynuclear Aromatic Hydrocarbons (PAH)	CAS#	Analysis included
5	Benzo(a)anthracene	56-55-3	Yes
6	Benzo(a)pyrene	50-32-8	Yes
7	Benzo(b)fluoranthene	205-99-2	Yes
10	Benzo(g,h,i)perylene	191-24-2	Yes
12	Benzo(k)fluoranthene	207-08-9	Yes
14	Chrysene	218-01-9	Yes
19	Dibenz[a,h]anthracene	53-70-3	Yes
25	Fluoranthene	206-44-0	Yes
27	Indeno[1,2,3-cd]pyrene	193-39-5	Yes
28	2-Methyl naphthalene	91-57-6	Yes
29	Perylene	198-55-0	Yes
30	Phenanthrene	85-01-8	Yes
31	Pyrene	129-00-0	Yes
32	*Coronene (optional)	191-07-1	Yes
33	Naphthalene	91-20-3	Yes

Vista Analytical Laboratory

Sample Log-In Checklist

Page # 1 of 1

Vista Work Order #: 2001762 TAT std

Samples Arrival:	**Date/Time** 9/1/20 11:34		**Initials:** LRW		**Location:** UR-2 **Shelf/Rack:** NA		
Delivered By:	FedEx	UPS	On Trac	GLS	DHL	Hand Delivered	Other
Preservation:	Ice		Blue Ice		Techni Ice	Dry Ice	None
Temp °C: 5.2 (uncorrected) **Temp °C:** 5.2 (corrected)			**Probe used:** (Y) N		**Thermometer ID:** DT-3		

	YES	NO	NA
Shipping Container(s) Intact?	✓		
Shipping Custody Seals Intact?			X
Airbill — Trk # —			X
Shipping Documentation Present?			X
Shipping Container: (Vista) Client Retain Return Dispose			
Chain of Custody / Sample Documentation Present?	✓		
Chain of Custody / Sample Documentation Complete?	✓		
Holding Time Acceptable?	✓		

Logged In:	**Date/Time** 09/01/20 1607	**Initials:** LWS	**Location:** R-9 **Shelf/Rack:** U/8
COC Anomaly/Sample Acceptance Form completed?	✓		

Comments:

Document Control # 2020.451

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CoC/Label Reconciliation Report WO# 2001762

LabNumber	CoC Sample ID		SampleAlias	Sample Date/Time		Container	BaseMatrix	Sample Comments
2001762-01	B 2020.2232.M23-Run 1	☐ (a)		18-Aug-20 00:00	☐ (b)	Filter	Air	
2001762-01	C 2020.2232.M23-Run 1	☐		18-Aug-20 00:00	☐	XAD	Air	
2001762-01	D 2020.2232.M23-Run 1	☐		18-Aug-20 00:00	☐	P/N, Filter Housing, Condenser	Air	
2001762-01	E 2020.2232.M23-Run 1	☐		18-Aug-20 00:00	☐	Imp #1-4 Catch	Air	
2001762-02	B 2020.2232.M23-Run 2	☐		18-Aug-20 00:00	☐	Filter	Air	
2001762-02	C 2020.2232.M23-Run 2	☐		18-Aug-20 00:00	☐	XAD	Air	
2001762-02	D 2020.2232.M23-Run 2	☐		18-Aug-20 00:00	☐	P/N, Filter Housing, Condenser	Air	
2001762-02	E 2020.2232.M23-Run 2	☐		18-Aug-20 00:00	☐	Imp #1-4 Catch	Air	
2001762-03	B 2020.2232.M23-Run 3	☐		18-Aug-20 00:00	☐	Filter	Air	
2001762-03	C 2020.2232.M23-Run 3	☐		18-Aug-20 00:00	☐	XAD	Air	
2001762-03	D 2020.2232.M23-Run 3	☐		18-Aug-20 00:00	☐	P/N, Filter Housing, Condenser	Air	
2001762-03	E 2020.2232.M23-Run 3	☐		18-Aug-20 00:00	☐	Imp #1-4 Catch	Air	
2001762-04	B 2020.2232.M23-Field Train Proof	☐		18-Aug-20 00:00	☐	Filter	Air	
2001762-04	C 2020.2232.M23-Field Train Proof	☐		18-Aug-20 00:00	☐	XAD	Air	
2001762-04	D 2020.2232.M23-Field Train Proof	☐		18-Aug-20 00:00	☐	P/N, Filter Housing, Condenser	Air	
2001762-04	E 2020.2232.M23-Field Train Proof	☐		18-Aug-20 00:00	☐	Imp #1-4 Catch	Air	

Checkmarks indicate that information on the COC reconciled with the sample label.
Any discrepancies are noted in the following columns.

	Yes	No	NA
Sample Container Intact?	✓		
Sample Custody Seals Intact?			✓
Adequate Sample Volume?	✓		
Container Type Appropriate for Analysis(es)	✓		
Preservation Documented: Na2S2O3 Trizma None Other		✓	✓
If Chlorinated or Drinking Water Samples, Acceptable Preservation?			✓

Comments: (a) Samples reconciled by run number and component
(b) No date/time listed on sample labels
XAD traps labeled by client on inside of foil

Verifed by/Date: WJS 09/02/20

Vista Analytical Laboratory

ANOMALY FORM

Vista Work Order 2001762

Initial/Date		The following checked issues were noted during sample receipt and login:
_____	☐	**1. The samples were received out of temperature at (WI-PHT):** _____ Was Ice present: Yes No Melted Blue Ice
_____	☐	2. The Chain-of-Custody (CoC) was not relinquished properly.
WWS 09/02/20	☑	3. The CoC did not include collection time(s). 00:00 will be used unless notified otherwise.
_____	☐	4. The sample(s) did not include a sample collection time. All or Sample Name: _____
_____	☐	5. A sample ID discrepancy was found. See the Reconciliation report. The CoC Sample ID will be used unless notified otherwise.
_____	☐	6. A sample date and/or time discrepancy was found. See the Reconciliation report. The CoC Sample date/time will be used unless notified otherwise.
_____	☐	**7. The CoC did not include a sample matrix. The following sample matrix will be used:** _____
_____	☐	**8. Insufficent volume received for analysis. All or Sample Name:** _____
_____	☐	9. The backup bottle was received broken. Sample Name: _____
_____	☐	**10. CoC not received, illegible or destroyed.**
_____	☐	**11. The sample(s) were received out of holding time. All or Sample Name:** _____
_____	☐	**12. The CoC did not include an analysis. All or Sample Name:** _____
WWS 09/02/20	☑	**13. Sample(s) received without collection date. (All) or Sample Name:** all
_____	☐	**14. Sample(s) not received. All or Sample Name:** _____
_____	☐	**15. Sample(s) received broken. All or Sample Name:** _____
_____	☐	**16. An incorrect container-type was used. All or Sample Name:** _____
_____	☐	17. Other:

Bolded items require sign-off

Client Contacted: Yes, in Acklet body of email

Date of Contact: 09/04/2020

Vista Client Manager: KJR

Resolution: Andy Winkler provided sampling dates/times

Auxiliary Boiler EPA Method 23

Client: ORRC
Location: Klamath Falls, OR.
Source: Auxiliary Boiler
Date: Aug. 25 & 26, 2020
Project No.: 2020.2232

		Run #1	Run #2	Run #3	
		Aug. 25	Aug. 25	Aug. 26	
	Start	10:32	16:00	10:13	
	End	13:43	19:32	13:45	**Averages**
Q:	Total sample time[1]:	180	200	200	**193**
Vm:	(Volume,dry gas meter,cf)	143.820	164.601	158.002	**155.474**
Y:	(Dry gas meter calibration factor)	1.006	1.006	1.006	**1.006**
Pbar:	(Barometric pressure,in.Hg)	25.82	25.82	25.78	**25.81**
ΔH:	(Avg. differential pressure,in.H2O)	1.60	1.68	1.56	**1.61**
Tm:	(Avg. meter temperature,°F)	102.6	107.2	100.8	**103.5**
Vm(std.):	(Std.* sample gas volume, DSCF)	117.659	133.605	129.469	**126.911**
	(Std.* sample gas volume, DSCM)	3.332	3.784	3.667	**3.590**
Vlc:	(Liquid volume collected,ml)	185.9	214.5	213.0	**204.5**
WV:	(Final silica weight)	31.9	38.8	36.0	**35.6**
Vw(std):	(Std.* water vapor volume,scf)	10.254	11.926	11.723	**11.301**
SVP:	(Saturated H_2O vapor pressure, in. Hg)	365.76	387.87	386.86	**380.16**
Bwsat:	(Saturated Moisture @ Ts)	14.170	15.026	15.010	**14.735**
Bwsvol	(Volumemetric Moisture content)	0.080	0.082	0.083	**0.082**
Bws:	(SCF H_2O / SCF Total)[2]	0.080	0.082	0.083	**0.082**
%CO_2:	(Carbon Dioxide,% by volume,dry)	6.70	6.64	7.52	**6.95**
%O_2:	(Oxygen,% by volume,dry)	11.62	11.61	10.43	**11.22**
%N_2:	(Nitrogen,% by volume,dry)	81.68	81.75	82.05	**81.83**
Md:	(Molecular Weight,lb/lb-mole,dry)	29.54	29.53	29.62	**29.56**
Mw:	(Molecular Weight,lb/lb-mole,wet)	28.61	28.58	28.66	**28.62**
D:	(Duct diameter, in.)	16.00	16.00	16.00	**16.00**
A:	(Duct area, sq. ft.)	1.40	1.40	1.40	**1.40**
Dn:	(Nozzle diameter, in.)	0.498	0.498	0.498	***0.498***
An:	(Nozzle area, ft2)	1.35E-03	1.35E-03	1.35E-03	***1.35E-03***
Ts:	(Stack temperature, °F)	443.7	451.5	451.1	**448.7**
Pg:	(Static pressure of flue gas, in. H_2O)	-0.10	-0.10	-0.10	**-0.10**
Ps:	(Absolute stack gas pressure, in. Hg)	25.81	25.81	25.77	**25.80**
Cp:	(Pitot tube coefficient)	0.82	0.82	0.82	**0.82**
ΔP:	(Average velocity head, in. H_2O)	0.050	0.053	0.050	**0.051**
√ΔP:	(Average velocity head, SqRt in. H_2O)	0.223	0.228	0.222	**0.224**
Vs:	(Gas velocity, ft./second)	17.3	17.8	17.3	**17.4**
ACFM:	(Actual cubic feet/min., wet)	1,448	1,491	1,447	**1,462**
SCFM	(Std. cubic ft/min., wet)	730	745	722	**733**
SDCFM:	(Std.* cubic feet/min., dry)	671	684	662	**672**
SDCMM:	(Std.* cubic meter/min., dry)	19.010	19.373	18.754	**19.045**
% Iso:	Isokinetic variation)	100.6	100.9	101.0	***100.8***

[1] - Total sample time does not include port change.

[2] - If the Volumetric moisture exceeds the calculated saturated moisture, the calculated saturated moisture is used.

M-23

Client: ORRCO
Location: KLAMATH FALLS
Source: AUX. BOILER
Date: 8-25 & 26 2020
Project No.: 2020.2232

		Run #1	Run #2	Run #3
		8.25	8.25	8.26
Time:	start:	1032	1600	1013
	finish:	1343	1932	1345
Q:	Total sample time(min.):	180	200	200
Vm:	(Volume,dry gas meter,cf)	143.820	164.601	158.002
Y:	(Dry gas meter calibration factor)	1.006	1.006	1.006
Pbar:	(Barometric pressure,in.Hg)	25.82	25.82	25.78
DH:	(Avg. differential pressure,in.H2O)	1.60	1.68	1.50
Tm:	(Avg. meter temperature,°F)	102.0	107.2	100.8

TARE 252.9

	RUN #: Filter #:			RUN #: Filter #:			RUN #: Filter #:		
	Filter tare weight, gms.:			Filter tare weight, gms.:			Filter tare weight, gms.:		
CONTENTS	**FINAL**	**TARE**	**NET**	**FINAL**	**TARE**	**NET**	**FINAL**	**TARE**	**NET**
XAD Module	258.5	~~209.8~~	5.6	215.7	211.2	4.5	271.5	260.0	11.5
K.O.	655.3	470.4	184.9	697.0	481.7	215.3	691.5	483.4	208.1
100 ml	734.8	739.5	-4.7	729.3	734.0	-4.7	735.4	739.2	-3.8
100 ml	732.7	735.2	-2.5	735.1	738.0	-2.9	732.3	736.4	-4.1
K.O.	639.6	637.0	2.6	638.5	636.2	2.3	639.2	637.9	1.3
Silica	995.5	963.6	31.9	1023.9	985.1	38.8	991.4	955.4	36.0
Vlc: (Liquid volume collected, ml)			185.9			Vlc: 214.5			Vlc: 213.0
Si: (Silica Gel)			31.9			Si: 38.8			Si: 36.0

%CO2:	(Carbon Dioxide,% by volume,dry)	6.70	6.64	7.52
%O2:	(Oxygen,% by volume,dry)	11.62	11.61	10.43
%N:	(Nitrogen,% by volume,dry)	81.68	81.75	82.05
D:	(Duct diameter, in.)	16.0	16.0	16.0
A:	(Duct area, sq. ft.)	0.498	0.498	0.498
Dn:	(Nozzle diameter, inches)	0.498	0.498	0.498
Ts:	(Stack temperature, °F)	443.7	451.5	451.1
Pg:	(Static pressure of flue gas, in. H_2O)	-0.10	-0.10	-0.10
Ps:	(Absolute stack gas pressure, in. Hg)	25.81	25.81	25.77
Cp:	(Pitot tube coefficient)	0.82	0.82	0.82
#:	(Pitot tube number)	0.223	0.228	0.222
√DP:	(Average velocity head, SqRt in. H_2O)	0.223	0.228	0.222
% ISO:	(Mini iso)	101.5	101.9	102.0

*Standard conditions corrected to 68°F, 29.92 in. Hg.

R-1 R-2 R-3

Document Control # 2020.451 80% 147 80% 80%
% REMAINING

High Flow/Isokinetics Data Sheet - EPA Method 23

ETS

Method: 23
Company/Plant: ORRCO
Sampling location: Klamath Falls, OR
Date: 8-25-2020 Project #: 2020.2232
Operator: GMW
Meter Box #: HF-5 Meter Box H@: 1.70
Meter Box Calibration(Y): 1.008
Probe #: MS.4.3 C_p: 0.82
Filter Box #: F-6

Pitot Tube Leak Check			
Side A:	6.00	@ 5"	(in)H_2O
Side B:	6.00	@ 5"	(in)H_2O

Sample Train Leak Check			
Initial:	0.003 Cuft@	-10"	(in)Hg
Final:	0.007 Cuft@	-5"	(in)Hg
Ambient Temp (°F):	96°		

Run #: 1
Barometric Pressure(P_b): 25.82 (in)Hg
Duct Diameter(in): 16" (Db) (Da)
Assumed Moisture(%): ~8% (T_w): (T_d):
Nozzle Dia_{avg}: ~~0.500~~ .498 Nozzle ID: #16
Static Pressure("H_2O): -0.10
Probe & Nozzle Material: Glass
Impinger Exit #: 1

min./pt Traverse Pt. Number	Time: Sampling Time	Time: Clock (24 hr.)	Sample Vacuum (in)Hg.	Stack Temp (°F)	Velocity Head ΔPs(in)H_2O	Pressure Differential DH (in) H2O	Gas sample Volume (Vm) (Cuft)	Dry Gas Meter Temp (°F): Inlet	Dry Gas Meter Temp (°F): Outlet	Sample Probe Temps(°F): Probe	Sample Probe Temps(°F): Filter	XAD Trap Inlet Temp(°F)	Imp. Exit Gas Temp(°F)
10	0	10:32	-3.0	452	0.06	1.86	286.200	88	87	251	247	55	65
9	9		-3.1	460	0.06	1.85	293.85	91	88	250	246	48	64
8	18		-3.1	460	0.06	1.86	301.50	94	90	250	249	48	64
7	27		-3.4	460	0.06	1.86	309.24	98	91	250	250	48	63
6	36		-3.5	464	0.06	1.86	316.98	101	93	250	250	50	62
5	45		-3.4	462	0.05	1.56	324.72	103	95	250	250	54	64
4	54		-3.4	450	0.05	1.59	331.83	105	97	250	251	54	65
3	63		-3.1	425	0.04	1.31	339.03	106	98	250	250	49	62
2	72		-3.0	400	0.04	1.35	345.51	107	99	250	251	49	62
1	81	12:02	-3.1	395	0.04	1.36	352.17	108	100	250	250	53	63
10	90	12:13	-3.3	450	0.05	1.59	358.83	103	102	250	251	54	65
9	99		-3.5	460	0.06	1.90	366.03	106	102	250	246	53	66
8	108		-3.5	461	0.06	1.90	373.86	108	102	250	249	55	67
7	117		-3.4	465	0.05	1.58	381.78	110	103	250	250	~~64~~ 50	64
6	126		-3.4	469	0.05	1.58	388.98	112	104	252	250	50	61
5	135		-3.4	471	0.05	1.57	396.18	113	105	250	250	50	62
4	144		-3.1	436	0.04	1.31	403.38	115	107	250	250	52	62
3	153		-3.1	420	0.04	1.34	409.95	115	108	250	250	54	64
2	162		-3.1	423	0.04	1.34	416.61	116	109	250	251	57	67
1	171		-3.1	390	0.04	1.39	423.27	116	110	250	250	50	64
	180	13:43					430.020						
Average													

Post Test T/C	
Reference °F	Probe °F
500	

High Flow/Isokinetics Data Sheet - EPA Method 23

Method: 23

Company/Plant: ORRCO

Sampling location: Klamath Falls, OR

Date: 8-25-20 Project #: 7020.2232

Operator: GMcW

Meter Box #: HP5 Meter Box H@: 1.70

Meter Box Calibration(Y): 1.006

Probe #: MS.4.3 C_p: 0.82

Filter Box #: F-6

Pitot Tube Leak Check		
Side A: 0.00	@ 6"	(in)H_2O
Side B: 0.00	@ 5"	(in)H_2O

Sample Train Leak Check		
Initial: 0.000	Cuft@ -10"	(in)Hg
Final: 0.000	Cuft@ -10"	(in)Hg
Ambient Temp (°F): 88		

Run #: 2

Barometric Pressure(P_b): 25.82 (in)Hg

Duct Diameter(in): 16" (Db) (Da)

Assumed Moisture(%): (T_w): (T_d):

Nozzle Dia_{avg}: 0.498 Nozzle ID: #16

Static Pressure("H_2O): -0.10

Probe & Nozzle Material: Glass

Impinger Exit #: 1

min./pt	Time		Sample	Stack	Velocity	Pressure	Gas sample	Dry Gas Meter Temp (°F)		Sample Probe Temps(°F)		XAD Trap	Imp. Exit
Traverse Pt. Number	Sampling Time	Clock (24 hr.)	Vacuum (in)Hg.	Temp (°F)	Head $\Delta Ps(in)H_2O$	Differential DH (in) H2O	Volume (Vm) (Cuft)	Inlet	Outlet	Probe	Filter	Inlet Temp(°F)	Gas Temp(°F)
10	0	16:00	-3.5	440	0.06	1.97	430.400	108	102	250	246	46	67
9	10		-3.9	455	0.06	1.90	439.40	103	102	250	251	47	67
8	20		-4.0	463	0.06	1.89	448.10	105	102	250	249	48	67
7	30		-4.1	470	0.06	1.88	456.80	108	102	260	250	46	61
6	40		-4.1	473	0.06	1.88	465.50	110	103	250	250	45	59
5	50		-3.9	475	0.05	1.57	474.20	111	105	250	250	45	60
4	60		-4.0	441	0.05	1.62	482.20	112	104	250	250	45	60
3	70		-3.6	420	0.04	1.33	490.30	112	105	250	250	42	61
2	80		-3.6	395	0.04	1.37	497.60	113	105	250	250	42	62
1	90		-3.6	398	0.04	1.37	505.10	113	106	250	250	43	63
10	100	17:40	-4.3	461	0.06	1.90	512.60	107	106	250	250	43	62
9	110	17:52	-4.3	475	0.06	1.88	521.40	109	105	250	250	46	62
8	120		-4.4	474	0.06	1.88	530.10	111	105	250	251	47	65
7	130		-4.4	478	0.06	1.87	538.80	112	105	250	251	44	63
6	140		-4.5	479	0.06	1.87	547.50	112	105	250	249	44	61
5	150		-4.0	478	0.05	1.56	556.20	112	105	250	251	45	61
4	160		-4.0	466	0.05	1.58	564.20	112	105	250	250	46	62
3	170		-3.8	439	0.04	1.30	572.20	112	105	250	251	49	63
2	180		-3.8	405	0.04	1.35	579.50	112	105	250	251	52	66
1	190		-4.1	444	0.05	1.62	586.90	111	105	250	250	44	62
	200	19:32					595.001						
Average													

Post Test T/C	
Reference °F	Probe °F
500	

High Flow/Isokinetics Data Sheet - EPA Method 23

Method: 23
Company/Plant: ORRCO
Sampling location: Klamath Falls, OR
Date: 8-26-2020 Project #: 2020.2232
Operator: LMW
Meter Box #: HF-5 Meter Box H@: 1.70
Meter Box Calibration(Y): 1.006
Probe #: MS4.3 C_p: 0.82
Filter Box #: F-6

Pitot Tube Leak Check
Side A: 6.0 @ -8 (in)H_2O
Side B: 6.0 @ -8 (in)H_2O

Sample Train Leak Check
Initial: 0.001 Cuft@ -10 (in)Hg
Final: 0.001 Cuft@ -6 (in)Hg
Ambient Temp (°F): 99°

Run #: 3
Barometric Pressure(P_b): 25.78 (in)Hg
Duct Diameter(in): 16" (Db) (Da)
Assumed Moisture(%): (T_w): (T_d):
Nozzle Dia_{avg}: 0.498 Nozzle ID: #16
Static Pressure("H_2O): -0.10
Probe & Nozzle Material: Glass
Impinger Exit #: 1

min./pt Traverse Pt. Number	Time: Sampling Time	Time: Clock (24 hr.)	Sample Vacuum (in)Hg.	Stack Temp (°F)	Velocity Head ΔPs(in)H_2O	Pressure Differential DH (in) H2O	Gas sample Volume (Vm) (Cuft)	Dry Gas Meter Temp (°F): Inlet	Dry Gas Meter Temp (°F): Outlet	Sample Probe Temps(°F): Probe	Sample Probe Temps(°F): Filter	XAD Trap Inlet Temp(°F)	Imp. Exit Gas Temp(°F)
10	0	10:13	-3.8	397	0.06	1.79	595.200	73°	72°	249°	247°	41°	65°
9	9		-4.8	478°	0.06	1.79	603.50	85°	82°	250°	251°	43°	58°
8	18		-4.4	476	0.06	1.81	611.80	90°	84°	250°	250	46°	62°
7	27		-4.5	478°	0.06	1.81	620.20	94°	87°	250°	251°	51°	63°
6	36		-4.5	478°	0.05	1.82	628.60	98°	89°	250°	250°	43°	59°
5	45		-4.2	479°	0.05	1.53	637.10	101°	91°	250°	250°	43°	56°
4	54		-4.3	459°	0.05	1.57	644.90	103°	94°	250°	250°	44°	54°
3	63		-4.0	445°	0.04	1.28	652.80	105°	96°	250°	250°	45°	56°
2	72		-4.0	390°	0.04	1.36	660.00	107°	98°	250°	250°	47°	58°
1	81		-4.0	343°	0.04	1.45	667.40	108°	99°	250°	251°	48°	59°
10	90	11:53	-4.3	456°	0.05	1.58	675.00	103°	102°	250°	250°	49°	66°
9	99	12:05	-4.4	476°	0.05	1.56	683.00	108°	103°	250°	249°	54°	63°
8	108		-5.0	477°	0.06	1.87	690.90	110°	104°	250°	250°	55°	67°
7	117		-4.5	479°	0.05	1.56	699.60	112°	104°	250°	250°	46°	61°
6	126		-4.5	483°	0.05	1.56	707.60	113°	106°	250°	250°	44°	58°
5	135		-4.5	484°	0.05	1.55	715.60	113°	106°	250°	250°	45°	59°
4	144		-4.0	469°	0.04	1.27	723.50	114°	107°	250°	250°	47°	59°
3	153		-4.0	444°	0.04	1.30	730.70	115°	108°	250°	250°	49°	61°
2	162		-4.0	408°	0.04	1.36	738.00	115°	108°	250°	250°	50°	61°
1	171		-4.2	360°	0.04	1.44	745.50	116°	109°	250°	250°	52°	63°
200	180	13:45					753.202						
Average													

Post Test T/C	
Reference °F	Probe °F

EPA Method 1 Cyclonic Flow Determination

Company/Plant: ORRCO
Sampling location: Klamath Falls, OR
Project Number: 2020.2232
Date: 8-25-2020
Measuring Device: S-Type
Operator: GMW

Unit / Run/Time	Cyclonic Flow Determination	
Traverse Point Number	ΔP at 0° Reference	Angle (∂) which yields a null ΔP
1 10	0	<5
2 9	0	<5
3 8	0	<5
4 7	0	<5
5 6	0	<5
6 5	0	<5
7 4	0	<5
8 3	0	<5
9 2	0	<5
10 1	0	<5
11 10	0	<5
12 9	0	<5
13 8	0	<5
14 7	0	<5
15 6	0	<5
16 5	0	<5
17 4	0	<5
18 3	0	<5
19 2	0	<5
20 1	0	<5
21		
22		
23		
24		
25		
Average:		
Diameter:	16"	
Diam. Before:	See M-1	
Diam. After:		
Pbar(inHg):	25.82	
Static:	-0.10	

Probe id. M5.4.3
C_p: 0.82

Pitot Tube Leak Check			
Side A:	0.00	@ -5	(in)H_2O
Side B:	0.00	@ -5	(in)H_2O

Note: Average of angle ∂ must be <20 degrees to be acceptable

8.0 Appendix C: Auxiliary Boiler Gaseous Emissions – %O2 & %CO2

8.1 Oxygen and Carbon Dioxide -EPA Method 3A

8.1.1 Calculation of Average Emissions

8.1.2 Sample System Bias and Drift

8.1.3 Calibration Error

8.1.4 Raw Data Readings

Calculation of Average Emissions

Test Performed For:
Industrial Oils, Inc
Klamath Falls Facility
Oil Refining Company
O2, CO2
Date:8/25/20

Test Performed By:
Environmental Technical Services
Emission Testing
T-4 Trailer
Project Number: 2020.2232
Run 1

Calibration Gas Value	Initial Calibration	Final Calibration	Average
0.00 percent O_2	-0.03 %	-0.11 %	-0.07 %
9.93 percent O_2	9.88 %	9.85 %	9.86 %
0.00 percent CO_2	0.11 %	0.11 %	0.11 %
11.80 percent CO_2	11.84 %	11.86 %	11.85 %

Mean Reference Values:	**Corrected Results:**	**Basis:**
11.56 percent O_2	**11.62** percent O_2	DRY
6.78 percent CO_2	**6.70** percent CO_2	DRY

Calculation of Average Emissions

Test Performed For:
Industrial Oils, Inc
Klamath Falls Facility
Oil Refining Company
O2, CO2
Date:8/25/20

Test Performed By:
Environmental Technical Services
Emission Testing
T-4 Trailer
Project Number: 2020.2232
Run 2

Calibration Gas Value	Initial Calibration	Final Calibration	Average
0.00 percent O_2	-0.11 %	-0.10 %	-0.11 %
9.93 percent O_2	9.85 %	9.85 %	9.85 %
0.00 percent CO_2	0.11 %	0.14 %	0.12 %
11.80 percent CO_2	11.86 %	11.89 %	11.88 %

Mean Reference Values:
11.53 percent O_2
6.74 percent CO_2

Corrected Results:
11.61 percent O_2
6.64 percent CO_2

Basis:
DRY
DRY

Calculation of Average Emissions

Test Performed For:
Industrial Oils, Inc
Klamath Falls Facility
Oil Refining Company
O2, CO2
Date:8/26/20

Test Performed By:
Environmental Technical Services
Emission Testing
T-4 Trailer
Project Number: 2020.2232
Run 3

Calibration Gas Value	Initial Calibration	Final Calibration	Average
0.00 percent O_2	0.00 %	-0.03 %	-0.02 %
9.93 percent O_2	9.90 %	9.86 %	9.88 %
0.00 percent CO_2	0.08 %	0.10 %	0.09 %
11.80 percent CO_2	11.83 %	11.88 %	11.85 %

Mean Reference Values:	**Corrected Results:**	**Basis:**
10.38 percent O_2	**10.43** percent O_2	DRY
7.59 percent CO_2	**7.52** percent CO_2	DRY

Sampling System Bias and Drift

Test Performed For:
Industrial Oils, Inc
Klamath Falls Facility
Oil Refining Company
O2, CO2
Date:8/25/20

Test Performed By:
Environmental Technical Services
Emission Testing
T-4 Trailer
Project Number: 2020.2232
Run 1

Oxygen Analyzer

Calibration Span: 20.10 % Serial Number: 01440D1V02/4085

Gas Level	Direct Gas Value	Initial Response	Initial Bias	Final Response	Final Bias	Total Run Drift
Low O_2	0.02 %	-0.03 %	-0.25 %	-0.11 %	-0.65 %	-0.40 %
Upscale O_2	9.94 %	9.88 %	-0.30 %	9.85 %	-0.45 %	-0.15 %

Carbon Dioxide Analyzer

Calibration Span: 20.30 % Serial Number: 1180730009

Gas Level	Direct Gas Value	Initial Response	Initial Bias	Final Response	Final Bias	Total Run Drift
Low CO_2	0.10 %	0.11 %	0.05 %	0.11 %	0.05 %	0.00 %
Upscale CO_2	11.84 %	11.84 %	0.00 %	11.86 %	0.10 %	0.10 %

Sampling System Bias and Drift

Test Performed For:
Industrial Oils, Inc
Klamath Falls Facility
Oil Refining Company
O2, CO2
Date:8/25/20

Test Performed By:
Environmental Technical Services
Emission Testing
T-4 Trailer
Project Number: 2020.2232
Run 2

Oxygen Analyzer

Calibration Span: 20.10 %

Serial Number: 01440D1V02/4085

Gas Level	Direct Gas Value	Initial Response	Initial Bias	Final Response	Final Bias	Total Run Drift
Low O2	0.02 %	-0.11 %	-0.65 %	-0.10 %	-0.60 %	0.05 %
Upscale O2	9.94 %	9.85 %	-0.45 %	9.85 %	-0.45 %	0.00 %

Carbon Dioxide Analyzer

Calibration Span: 20.30 %

Serial Number: 1180730009

Gas Level	Direct Gas Value	Initial Response	Initial Bias	Final Response	Final Bias	Total Run Drift
Low CO2	0.10 %	0.11 %	0.05 %	0.14 %	0.20 %	0.15 %
Upscale CO2	11.84 %	11.86 %	0.10 %	11.89 %	0.25 %	0.15 %

Sampling System Bias and Drift

Test Performed For:
Industrial Oils, Inc
Klamath Falls Facility
Oil Refining Company
O2, CO2
Date:8/25/20

Test Performed By:
Environmental Technical Services
Emission Testing
T-4 Trailer
Project Number: 2020.2232
Run 3

Oxygen Analyzer

Calibration Span: 20.10 % Serial Number: 01440D1V02/4085

Gas Level	Direct Gas Value	Initial Response	Initial Bias	Final Response	Final Bias	Total Run Drift
Low O2	-0.03 %	0.00 %	0.15 %	-0.03 %	0.00 %	-0.15 %
Upscale O2	9.97 %	9.90 %	-0.35 %	9.86 %	-0.55 %	-0.20 %

Carbon Dioxide Analyzer

Calibration Span: 20.30 % Serial Number: 1180730009

Gas Level	Direct Gas Value	Initial Response	Initial Bias	Final Response	Final Bias	Total Run Drift
Low CO2	0.07 %	0.08 %	0.05 %	0.10 %	0.15 %	0.10 %
Upscale CO2	11.80 %	11.83 %	0.15 %	11.88 %	0.39 %	0.25 %

Analyzer Calibration Error

Test Performed For:
Industrial Oils, Inc
Klamath Falls Facility
Oil Refining Company
O2, CO2
Date:8/25/20

Test Performed By:
Environmental Technical Services
Emission Testing
T-4 Trailer
Project Number: 2020.2232
Run 1

Oxygen Monitor

Method 3A

Calibration Span: 20.10 %

Serial Number: 01440D1V02/4085

Cylinder Number	Reference Gas Concentration	Analyzer Response	Difference	Calibration Error	Error Type
N2/cg1	0.00 %	0.02 %	-0.02 %	-0.10	%
CC480487/cg3	9.93 %	9.94 %	-0.01 %	-0.05	%
CC453172/cg2	20.10 %	20.10 %	0.00 %	0.00	%

Carbon Dioxide Monitor

Method 3A

Calibration Span: 20.30 %

Serial Number: 1180730009

Cylinder Number	Reference Gas Concentration	Analyzer Response	Difference	Calibration Error	Error Type
N2/cg1	0.00 %	0.10 %	-0.10 %	-0.49	%
CC480487/cg3	11.80 %	11.84 %	-0.04 %	-0.20	%
CC453172/cg2	20.30 %	20.36 %	-0.06 %	-0.30	%

Analyzer Calibration Error

Test Performed For:
Industrial Oils, Inc
Klamath Falls Facility
Oil Refining Company
O2, CO2
Date:8/25/20

Test Performed By:
Environmental Technical Services
Emission Testing
T-4 Trailer
Project Number: 2020.2232
Run 2

Oxygen Monitor

Method 3A

Calibration Span: 20.10 %

Serial Number: 01440D1V02/4085

Cylinder Number	Reference Gas Concentration	Analyzer Response	Difference	Calibration Error	Error Type
N2/cg1	0.00 %	0.02 %	-0.02 %	-0.10	%
CC480487/cg3	9.93 %	9.94 %	-0.01 %	-0.05	%
CC453172/cg2	20.10 %	20.10 %	0.00 %	0.00	%

Carbon Dioxide Monitor

Method 3A

Calibration Span: 20.30 %

Serial Number: 1180730009

Cylinder Number	Reference Gas Concentration	Analyzer Response	Difference	Calibration Error	Error Type
N2/cg1	0.00 %	0.10 %	-0.10 %	-0.49	%
CC480487/cg3	11.80 %	11.84 %	-0.04 %	-0.20	%
CC453172/cg2	20.30 %	20.36 %	-0.06 %	-0.30	%

Analyzer Calibration Error

Test Performed For:
Industrial Oils, Inc
Klamath Falls Facility
Oil Refining Company
O2, CO2
Date:8/26/20

Test Performed By:
Environmental Technical Services
Emission Testing
T-4 Trailer
Project Number: 2020.2232
Run 3

Oxygen Monitor

Method 3A

Calibration Span: 20.10 %

Serial Number: 01440D1V02/4085

Cylinder Number	Reference Gas Concentration	Analyzer Response	Difference	Calibration Error	Error Type
N2/cg1	0.00 %	-0.03 %	0.03 %	0.15	%
CC480487/cg3	9.93 %	9.97 %	-0.04 %	-0.20	%
CC453172/cg2	20.10 %	20.10 %	0.00 %	0.00	%

Carbon Dioxide Monitor

Method 3A

Calibration Span: 20.30 %

Serial Number: 1180730009

Cylinder Number	Reference Gas Concentration	Analyzer Response	Difference	Calibration Error	Error Type
N2/cg1	0.00 %	0.07 %	-0.07 %	-0.34	%
CC480487/cg3	11.80 %	11.80 %	0.00 %	0.00	%
CC453172/cg2	20.30 %	20.28 %	0.02 %	0.10	%

filename		8/25/2020	7:04:52	C:\Program Files\Perma Pure LLC\RATAmation\DATA\Oil.csv									
testby1	Environmental Technical Services												
testby2	Emission Testing												
testby3	T-4 Trailer												
testby4	Project Number: 2020.2232												
testfor1	Industrial Oils, Inc												
testfor2	Klamath Falls Facility												
testfor3	Oil Refining Company												
testfor4	O2, CO2												
name				1) O2	6) CO2								
sn				01440D1V02/4085	1180730009								
offset				0	0								
fullscale				25	20								
train				1	1								
gastype				o2 3a	co2 3a								
o2ezero1		8/25/2020	7:09:30	0.02	0.10	N2/cg1	N2	0		0	0		
co2ezero1		8/25/2020	7:09:30	0.02	0.10	N2/cg1	N2	0		0	0		
o2high1		8/25/2020	7:12:00	20.10	20.36	CC453172/cg2	O2	20.1	CO2	20.3	0		
co2high1		8/25/2020	7:12:00	20.10	20.36	CC453172/cg2	O2	20.1	CO2	20.3	0		
o2mid1		8/25/2020	7:14:15	9.94	11.84	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2
co2mid1		8/25/2020	7:14:15	9.94	11.84	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2
o2zero1		8/25/2020	7:29:15	-0.03	0.11	N2/cg1	N2	0		0	0		
co2zero1		8/25/2020	7:29:15	-0.03	0.11	N2/cg1	N2	0		0	0		
o2span1		8/25/2020	7:32:45	9.88	11.84	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2
co2span1		8/25/2020	7:32:45	9.88	11.84	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2
run1		8/25/2020	10:32:45	11.40	6.90								
run1		8/25/2020	10:33:00	11.40	6.91								
run1		8/25/2020	10:33:15	11.37	6.88								
run1		8/25/2020	10:33:30	11.38	6.91								
run1		8/25/2020	10:33:45	11.40	6.91								
run1		8/25/2020	10:34:00	11.41	6.91								
run1		8/25/2020	10:34:15	11.44	6.91								
run1		8/25/2020	10:34:30	11.44	6.89								
run1		8/25/2020	10:34:45	11.40	6.88								
run1		8/25/2020	10:35:00	11.42	6.89								
run1		8/25/2020	10:35:15	11.48	6.90								
run1		8/25/2020	10:35:30	11.48	6.88								
run1		8/25/2020	10:35:45	11.48	6.85								
run1		8/25/2020	10:36:00	11.50	6.84								
run1		8/25/2020	10:36:15	11.51	6.84								
run1		8/25/2020	10:36:30	11.48	6.84								
run1		8/25/2020	10:36:45	11.48	6.83								
run1		8/25/2020	10:37:00	11.50	6.84								
run1		8/25/2020	10:37:15	11.48	6.85								
run1		8/25/2020	10:37:30	11.50	6.85								
run1		8/25/2020	10:37:45	11.50	6.84								
run1		8/25/2020	10:38:00	11.49	6.83								
run1		8/25/2020	10:38:15	11.46	6.85								
run1		8/25/2020	10:38:30	11.47	6.86								
run1		8/25/2020	10:38:45	11.48	6.86								
run1		8/25/2020	10:39:00	11.47	6.85								
run1		8/25/2020	10:39:15	11.50	6.85								
run1		8/25/2020	10:39:30	11.51	6.85								
run1		8/25/2020	10:39:45	11.52	6.83								
run1		8/25/2020	10:40:00	11.54	6.82								
run1		8/25/2020	10:40:15	11.54	6.82								
run1		8/25/2020	10:40:30	11.49	6.82								
run1		8/25/2020	10:40:45	11.48	6.83								
run1		8/25/2020	10:41:00	11.48	6.83								
run1		8/25/2020	10:41:15	11.46	6.85								
run1		8/25/2020	10:41:30	11.44	6.86								
run1		8/25/2020	10:41:45	11.44	6.87								
run1		8/25/2020	10:42:15	11.46	6.87								
run1		8/25/2020	10:42:30	11.50	6.86								
run1		8/25/2020	10:42:45	11.50	6.86								
run1		8/25/2020	10:43:00	11.50	6.84								
run1		8/25/2020	10:43:15	11.49	6.83								
run1		8/25/2020	10:43:30	11.47	6.83								
run1		8/25/2020	10:43:45	11.46	6.86								
run1		8/25/2020	10:44:00	11.46	6.86								
run1		8/25/2020	10:44:15	11.50	6.85								
run1		8/25/2020	10:44:30	11.52	6.84								
run1		8/25/2020	10:44:45	11.52	6.84								

run1	8/25/2020	10:45:00	11.52	6.83
run1	8/25/2020	10:45:15	11.49	6.82
run1	8/25/2020	10:45:30	11.48	6.83
run1	8/25/2020	10:45:45	11.49	6.85
run1	8/25/2020	10:46:00	11.51	6.85
run1	8/25/2020	10:46:15	11.51	6.84
run1	8/25/2020	10:46:30	11.49	6.82
run1	8/25/2020	10:46:45	11.48	6.84
run1	8/25/2020	10:47:00	11.47	6.85
run1	8/25/2020	10:47:15	11.47	6.85
run1	8/25/2020	10:47:30	11.47	6.84
run1	8/25/2020	10:47:45	11.47	6.85
run1	8/25/2020	10:48:00	11.49	6.86
run1	8/25/2020	10:48:15	11.50	6.85
run1	8/25/2020	10:48:30	11.52	6.83
run1	8/25/2020	10:48:45	11.52	6.83
run1	8/25/2020	10:49:00	11.52	6.83
run1	8/25/2020	10:49:15	11.54	6.82
run1	8/25/2020	10:49:30	11.55	6.81
run1	8/25/2020	10:49:45	11.56	6.80
run1	8/25/2020	10:50:00	11.54	6.81
run1	8/25/2020	10:50:15	11.52	6.81
run1	8/25/2020	10:50:30	11.50	6.81
run1	8/25/2020	10:50:45	11.48	6.82
run1	8/25/2020	10:51:00	11.52	6.84
run1	8/25/2020	10:51:15	11.51	6.84
run1	8/25/2020	10:51:30	11.50	6.82
run1	8/25/2020	10:51:45	11.55	6.82
run1	8/25/2020	10:52:00	11.56	6.82
run1	8/25/2020	10:52:15	11.53	6.81
run1	8/25/2020	10:52:30	11.52	6.81
run1	8/25/2020	10:52:45	11.53	6.81
run1	8/25/2020	10:53:00	11.52	6.81
run1	8/25/2020	10:53:15	11.53	6.82
run1	8/25/2020	10:53:30	11.55	6.82
run1	8/25/2020	10:53:45	11.53	6.80
run1	8/25/2020	10:54:00	11.52	6.80
run1	8/25/2020	10:54:15	11.54	6.82
run1	8/25/2020	10:54:30	11.53	6.82
run1	8/25/2020	10:54:45	11.50	6.81
run1	8/25/2020	10:55:00	11.49	6.82
run1	8/25/2020	10:55:15	11.49	6.84
run1	8/25/2020	10:55:30	11.47	6.85
run1	8/25/2020	10:55:45	11.47	6.84
run1	8/25/2020	10:56:00	11.48	6.85
run1	8/25/2020	10:56:15	11.48	6.86
run1	8/25/2020	10:56:30	11.51	6.86
run1	8/25/2020	10:56:45	11.52	6.84
run1	8/25/2020	10:57:00	11.53	6.82
run1	8/25/2020	10:57:15	11.53	6.82
run1	8/25/2020	10:57:30	11.51	6.82
run1	8/25/2020	10:57:45	11.51	6.83
run1	8/25/2020	10:58:00	11.54	6.82
run1	8/25/2020	10:58:15	11.57	6.81
run1	8/25/2020	10:58:30	11.56	6.81
run1	8/25/2020	10:58:45	11.51	6.80
run1	8/25/2020	10:59:00	11.47	6.81
run1	8/25/2020	10:59:15	11.44	6.84
run1	8/25/2020	10:59:30	11.38	6.88
run1	8/25/2020	10:59:45	11.37	6.91
run1	8/25/2020	11:00:15	11.41	6.91
run1	8/25/2020	11:00:30	11.43	6.91
run1	8/25/2020	11:00:45	11.40	6.90
run1	8/25/2020	11:01:00	11.39	6.90
run1	8/25/2020	11:01:15	11.40	6.90
run1	8/25/2020	11:01:30	11.45	6.90
run1	8/25/2020	11:01:45	11.46	6.89
run1	8/25/2020	11:02:00	11.47	6.88
run1	8/25/2020	11:02:15	11.47	6.86
run1	8/25/2020	11:02:30	11.50	6.84
run1	8/25/2020	11:02:45	11.47	6.85
run1	8/25/2020	11:03:00	11.45	6.86
run1	8/25/2020	11:03:15	11.50	6.86

run1	8/25/2020	11:03:30	11.50	6.84
run1	8/25/2020	11:03:45	11.46	6.84
run1	8/25/2020	11:04:00	11.43	6.87
run1	8/25/2020	11:04:15	11.43	6.88
run1	8/25/2020	11:04:30	11.49	6.87
run1	8/25/2020	11:04:45	11.45	6.86
run1	8/25/2020	11:05:00	11.46	6.87
run1	8/25/2020	11:05:15	11.46	6.87
run1	8/25/2020	11:05:30	11.44	6.86
run1	8/25/2020	11:05:45	11.41	6.87
run1	8/25/2020	11:06:00	11.43	6.89
run1	8/25/2020	11:06:15	11.44	6.90
run1	8/25/2020	11:06:30	11.47	6.87
run1	8/25/2020	11:06:45	11.42	6.86
run1	8/25/2020	11:07:00	11.45	6.89
run1	8/25/2020	11:07:15	11.47	6.89
run1	8/25/2020	11:07:30	11.42	6.86
run1	8/25/2020	11:07:45	11.43	6.87
run1	8/25/2020	11:08:00	11.44	6.89
run1	8/25/2020	11:08:15	11.48	6.89
run1	8/25/2020	11:08:30	11.63	6.85
run1	8/25/2020	11:08:45	11.75	6.79
run1	8/25/2020	11:09:00	11.74	6.71
run1	8/25/2020	11:09:15	11.80	6.68
run1	8/25/2020	11:09:30	11.79	6.64
run1	8/25/2020	11:09:45	11.80	6.62
run1	8/25/2020	11:10:00	11.78	6.63
run1	8/25/2020	11:10:15	11.80	6.64
run1	8/25/2020	11:10:30	11.80	6.63
run1	8/25/2020	11:10:45	11.78	6.62
run1	8/25/2020	11:11:00	11.76	6.63
run1	8/25/2020	11:11:15	11.77	6.65
run1	8/25/2020	11:11:30	11.81	6.65
run1	8/25/2020	11:11:45	11.85	6.62
run1	8/25/2020	11:12:00	11.88	6.60
run1	8/25/2020	11:12:15	11.84	6.59
run1	8/25/2020	11:12:30	11.83	6.59
run1	8/25/2020	11:12:45	11.82	6.59
run1	8/25/2020	11:13:00	11.81	6.60
run1	8/25/2020	11:13:15	11.80	6.62
run1	8/25/2020	11:13:30	11.83	6.63
run1	8/25/2020	11:13:45	11.84	6.61
run1	8/25/2020	11:14:00	11.83	6.60
run1	8/25/2020	11:14:15	11.84	6.60
run1	8/25/2020	11:14:30	11.81	6.61
run1	8/25/2020	11:14:45	11.81	6.60
run1	8/25/2020	11:15:00	11.79	6.61
run1	8/25/2020	11:15:15	11.81	6.62
run1	8/25/2020	11:15:30	11.82	6.63
run1	8/25/2020	11:15:45	11.76	6.62
run1	8/25/2020	11:16:00	11.72	6.63
run1	8/25/2020	11:16:15	11.76	6.66
run1	8/25/2020	11:16:30	11.80	6.66
run1	8/25/2020	11:16:45	11.82	6.63
run1	8/25/2020	11:17:00	12.01	6.61
run1	8/25/2020	11:17:15	12.49	6.51
run1	8/25/2020	11:17:30	12.73	6.31
run1	8/25/2020	11:17:45	12.84	6.06
run1	8/25/2020	11:18:15	12.86	5.93
run1	8/25/2020	11:18:30	12.86	5.87
run1	8/25/2020	11:18:45	12.89	5.87
run1	8/25/2020	11:19:00	12.90	5.86
run1	8/25/2020	11:19:15	12.95	5.84
run1	8/25/2020	11:19:30	12.96	5.81
run1	8/25/2020	11:19:45	12.98	5.80
run1	8/25/2020	11:20:00	12.98	5.80
run1	8/25/2020	11:20:15	12.96	5.78
run1	8/25/2020	11:20:30	12.97	5.78
run1	8/25/2020	11:20:45	12.97	5.78
run1	8/25/2020	11:21:00	12.99	5.79
run1	8/25/2020	11:21:15	12.97	5.78
run1	8/25/2020	11:21:30	12.96	5.78
run1	8/25/2020	11:21:45	12.91	5.79

run1	8/25/2020	11:22:00	12.94	5.81
run1	8/25/2020	11:22:15	12.98	5.82
run1	8/25/2020	11:22:30	12.94	5.79
run1	8/25/2020	11:22:45	12.91	5.78
run1	8/25/2020	11:23:00	12.95	5.82
run1	8/25/2020	11:23:15	12.96	5.82
run1	8/25/2020	11:23:30	12.97	5.79
run1	8/25/2020	11:23:45	12.89	5.79
run1	8/25/2020	11:24:00	12.88	5.82
run1	8/25/2020	11:24:15	13.00	5.84
run1	8/25/2020	11:24:30	13.07	5.79
run1	8/25/2020	11:24:45	13.04	5.74
run1	8/25/2020	11:25:00	13.01	5.73
run1	8/25/2020	11:25:15	12.95	5.75
run1	8/25/2020	11:25:30	12.98	5.77
run1	8/25/2020	11:25:45	13.08	5.76
run1	8/25/2020	11:26:00	13.05	5.74
run1	8/25/2020	11:26:15	13.03	5.72
run1	8/25/2020	11:26:30	13.10	5.73
run1	8/25/2020	11:26:45	13.39	5.69
run1	8/25/2020	11:27:00	13.55	5.56
run1	8/25/2020	11:27:15	13.50	5.45
run1	8/25/2020	11:27:30	13.49	5.39
run1	8/25/2020	11:27:45	13.43	5.40
run1	8/25/2020	11:28:00	13.44	5.42
run1	8/25/2020	11:28:15	13.51	5.44
run1	8/25/2020	11:28:30	13.52	5.42
run1	8/25/2020	11:28:45	13.54	5.39
run1	8/25/2020	11:29:00	13.51	5.37
run1	8/25/2020	11:29:15	13.49	5.39
run1	8/25/2020	11:29:30	13.49	5.41
run1	8/25/2020	11:29:45	13.48	5.41
run1	8/25/2020	11:30:00	13.52	5.40
run1	8/25/2020	11:30:15	13.51	5.40
run1	8/25/2020	11:30:30	13.51	5.40
run1	8/25/2020	11:30:45	13.52	5.39
run1	8/25/2020	11:31:00	13.50	5.38
run1	8/25/2020	11:31:15	13.47	5.39
run1	8/25/2020	11:31:30	13.46	5.42
run1	8/25/2020	11:31:45	13.46	5.42
run1	8/25/2020	11:32:00	13.42	5.42
run1	8/25/2020	11:32:15	13.39	5.44
run1	8/25/2020	11:32:30	13.44	5.47
run1	8/25/2020	11:32:45	13.50	5.46
run1	8/25/2020	11:33:00	13.50	5.42
run1	8/25/2020	11:33:15	13.46	5.40
run1	8/25/2020	11:33:30	13.39	5.43
run1	8/25/2020	11:33:45	13.38	5.46
run1	8/25/2020	11:34:00	13.42	5.47
run1	8/25/2020	11:34:15	13.40	5.47
run1	8/25/2020	11:34:30	13.33	5.48
run1	8/25/2020	11:34:45	13.36	5.50
run1	8/25/2020	11:35:00	13.40	5.50
run1	8/25/2020	11:35:15	13.44	5.47
run1	8/25/2020	11:35:30	13.34	5.47
run1	8/25/2020	11:35:45	13.24	5.49
run1	8/25/2020	11:36:00	13.15	5.55
run1	8/25/2020	11:36:30	13.12	5.61
run1	8/25/2020	11:36:45	13.10	5.66
run1	8/25/2020	11:37:00	13.13	5.68
run1	8/25/2020	11:37:15	13.20	5.67
run1	8/25/2020	11:37:30	13.14	5.64
run1	8/25/2020	11:37:45	13.10	5.65
run1	8/25/2020	11:38:00	13.11	5.68
run1	8/25/2020	11:38:15	13.11	5.69
run1	8/25/2020	11:38:30	13.13	5.67
run1	8/25/2020	11:38:45	13.12	5.67
run1	8/25/2020	11:39:00	13.12	5.68
run1	8/25/2020	11:39:15	13.12	5.68
run1	8/25/2020	11:39:30	13.05	5.67
run1	8/25/2020	11:39:45	13.00	5.69
run1	8/25/2020	11:40:00	13.01	5.74
run1	8/25/2020	11:40:15	13.04	5.76

run1	8/25/2020	11:40:30	13.05	5.74
run1	8/25/2020	11:40:45	12.99	5.72
run1	8/25/2020	11:41:00	13.01	5.74
run1	8/25/2020	11:41:15	13.07	5.76
run1	8/25/2020	11:41:30	13.08	5.73
run1	8/25/2020	11:41:45	13.08	5.70
run1	8/25/2020	11:42:00	13.09	5.70
run1	8/25/2020	11:42:15	13.11	5.70
run1	8/25/2020	11:42:30	13.13	5.69
run1	8/25/2020	11:42:45	13.10	5.67
run1	8/25/2020	11:43:00	13.10	5.68
run1	8/25/2020	11:43:15	13.08	5.70
run1	8/25/2020	11:43:30	13.09	5.70
run1	8/25/2020	11:43:45	13.08	5.69
run1	8/25/2020	11:44:00	13.02	5.70
run1	8/25/2020	11:44:15	13.02	5.73
run1	8/25/2020	11:44:30	13.12	5.74
run1	8/25/2020	11:44:45	13.11	5.70
run1	8/25/2020	11:45:00	12.96	5.68
run1	8/25/2020	11:45:15	12.87	5.74
run1	8/25/2020	11:45:30	12.80	5.83
run1	8/25/2020	11:45:45	12.79	5.87
run1	8/25/2020	11:46:00	12.82	5.89
run1	8/25/2020	11:46:15	12.83	5.90
run1	8/25/2020	11:46:30	12.79	5.89
run1	8/25/2020	11:46:45	12.72	5.89
run1	8/25/2020	11:47:00	12.70	5.93
run1	8/25/2020	11:47:15	12.70	5.96
run1	8/25/2020	11:47:30	12.77	5.98
run1	8/25/2020	11:47:45	12.87	5.94
run1	8/25/2020	11:48:00	12.89	5.89
run1	8/25/2020	11:48:15	12.83	5.86
run1	8/25/2020	11:48:30	12.88	5.87
run1	8/25/2020	11:48:45	12.85	5.87
run1	8/25/2020	11:49:00	12.85	5.86
run1	8/25/2020	11:49:15	12.91	5.86
run1	8/25/2020	11:49:30	12.91	5.86
run1	8/25/2020	11:49:45	12.91	5.84
run1	8/25/2020	11:50:00	12.90	5.82
run1	8/25/2020	11:50:15	12.87	5.83
run1	8/25/2020	11:50:30	12.85	5.85
run1	8/25/2020	11:50:45	12.89	5.86
run1	8/25/2020	11:51:00	12.94	5.85
run1	8/25/2020	11:51:15	12.90	5.80
run1	8/25/2020	11:51:30	12.81	5.83
run1	8/25/2020	11:51:45	12.74	5.88
run1	8/25/2020	11:52:00	12.82	5.90
run1	8/25/2020	11:52:15	12.85	5.90
run1	8/25/2020	11:52:30	12.78	5.88
run1	8/25/2020	11:52:45	12.72	5.90
run1	8/25/2020	11:53:00	12.74	5.93
run1	8/25/2020	11:53:15	12.92	5.92
run1	8/25/2020	11:53:30	13.12	5.86
run1	8/25/2020	11:53:45	13.18	5.75
run1	8/25/2020	11:54:00	13.18	5.66
run1	8/25/2020	11:54:30	13.15	5.62
run1	8/25/2020	11:54:45	13.13	5.63
run1	8/25/2020	11:55:00	13.14	5.65
run1	8/25/2020	11:55:15	13.13	5.62
run1	8/25/2020	11:55:30	13.17	5.60
run1	8/25/2020	11:55:45	13.17	5.64
run1	8/25/2020	11:56:00	13.19	5.63
run1	8/25/2020	11:56:15	13.19	5.62
run1	8/25/2020	11:56:30	13.19	5.61
run1	8/25/2020	11:56:45	13.14	5.61
run1	8/25/2020	11:57:00	13.10	5.63
run1	8/25/2020	11:57:15	13.14	5.66
run1	8/25/2020	11:57:30	13.11	5.66
run1	8/25/2020	11:57:45	13.08	5.65
run1	8/25/2020	11:58:00	13.10	5.67
run1	8/25/2020	11:58:15	13.13	5.68
run1	8/25/2020	11:58:30	13.11	5.67
run1	8/25/2020	11:58:45	13.07	5.65

run1	8/25/2020	11:59:00	13.06	5.68
run1	8/25/2020	11:59:15	13.11	5.70
run1	8/25/2020	11:59:30	13.14	5.69
run1	8/25/2020	11:59:45	13.12	5.66
run1	8/25/2020	12:00:00	13.16	5.65
run1	8/25/2020	12:00:15	13.18	5.65
run1	8/25/2020	12:00:30	13.13	5.64
run1	8/25/2020	12:00:45	13.08	5.65
run1	8/25/2020	12:01:00	13.16	5.66
run1	8/25/2020	12:01:15	13.16	5.66
run1	8/25/2020	12:01:30	13.10	5.65
run1	8/25/2020	12:01:45	13.04	5.66
run1	8/25/2020	12:02:00	13.07	5.69
run1	8/25/2020	12:02:15	13.13	5.70
run1	8/25/2020	12:02:30	13.18	5.69
run1	8/25/2020	12:02:45	13.23	5.65
run1	8/25/2020	12:03:00	13.19	5.60
run1	8/25/2020	12:03:15	13.11	5.60
run1	8/25/2020	12:03:30	13.14	5.65
run1	8/25/2020	12:03:45	13.12	5.66
run1	8/25/2020	12:13:00	10.59	7.51
run1	8/25/2020	12:13:15	10.60	7.49
run1	8/25/2020	12:13:30	10.58	7.46
run1	8/25/2020	12:13:45	10.59	7.45
run1	8/25/2020	12:14:00	10.62	7.44
run1	8/25/2020	12:14:15	10.62	7.44
run1	8/25/2020	12:14:30	10.63	7.44
run1	8/25/2020	12:14:45	10.62	7.42
run1	8/25/2020	12:15:00	10.60	7.43
run1	8/25/2020	12:15:15	10.58	7.46
run1	8/25/2020	12:15:30	10.54	7.47
run1	8/25/2020	12:15:45	10.55	7.47
run1	8/25/2020	12:16:00	10.55	7.48
run1	8/25/2020	12:16:15	10.55	7.49
run1	8/25/2020	12:16:30	10.53	7.49
run1	8/25/2020	12:16:45	10.54	7.48
run1	8/25/2020	12:17:00	10.56	7.48
run1	8/25/2020	12:17:15	10.57	7.48
run1	8/25/2020	12:17:30	10.57	7.48
run1	8/25/2020	12:17:45	10.58	7.46
run1	8/25/2020	12:18:00	10.58	7.45
run1	8/25/2020	12:18:15	10.60	7.45
run1	8/25/2020	12:18:30	10.59	7.46
run1	8/25/2020	12:18:45	10.56	7.46
run1	8/25/2020	12:19:00	10.55	7.46
run1	8/25/2020	12:19:15	10.57	7.47
run1	8/25/2020	12:19:30	10.61	7.48
run1	8/25/2020	12:19:45	10.63	7.46
run1	8/25/2020	12:20:00	10.63	7.43
run1	8/25/2020	12:20:15	10.61	7.42
run1	8/25/2020	12:20:30	10.59	7.44
run1	8/25/2020	12:20:45	10.60	7.46
run1	8/25/2020	12:21:00	10.62	7.46
run1	8/25/2020	12:21:15	10.60	7.43
run1	8/25/2020	12:21:30	10.56	7.45
run1	8/25/2020	12:21:45	10.55	7.47
run1	8/25/2020	12:22:00	10.56	7.49
run1	8/25/2020	12:22:15	10.57	7.48
run1	8/25/2020	12:22:30	10.55	7.48
run1	8/25/2020	12:22:45	10.54	7.49
run1	8/25/2020	12:23:00	10.55	7.50
run1	8/25/2020	12:23:15	10.59	7.48
run1	8/25/2020	12:23:30	10.58	7.47
run1	8/25/2020	12:23:45	10.57	7.47
run1	8/25/2020	12:24:00	10.54	7.49
run1	8/25/2020	12:24:15	10.54	7.49
run1	8/25/2020	12:24:30	10.54	7.49
run1	8/25/2020	12:24:45	10.56	7.50
run1	8/25/2020	12:25:00	10.59	7.50
run1	8/25/2020	12:25:15	10.59	7.48
run1	8/25/2020	12:25:30	10.58	7.46
run1	8/25/2020	12:25:45	10.57	7.47
run1	8/25/2020	12:26:00	10.56	7.48

run1	8/25/2020	12:26:15	10.55	7.49
run1	8/25/2020	12:26:30	10.56	7.48
run1	8/25/2020	12:26:45	10.57	7.49
run1	8/25/2020	12:27:00	10.54	7.50
run1	8/25/2020	12:27:15	10.56	7.50
run1	8/25/2020	12:27:30	10.56	7.49
run1	8/25/2020	12:27:45	10.54	7.48
run1	8/25/2020	12:28:00	10.53	7.50
run1	8/25/2020	12:28:15	10.55	7.51
run1	8/25/2020	12:28:30	10.56	7.50
run1	8/25/2020	12:28:45	10.60	7.48
run1	8/25/2020	12:29:00	10.62	7.48
run1	8/25/2020	12:29:15	10.61	7.46
run1	8/25/2020	12:29:30	10.59	7.45
run1	8/25/2020	12:29:45	10.57	7.45
run1	8/25/2020	12:30:00	10.56	7.48
run1	8/25/2020	12:30:15	10.57	7.50
run1	8/25/2020	12:30:45	10.57	7.48
run1	8/25/2020	12:31:00	10.57	7.47
run1	8/25/2020	12:31:15	10.56	7.48
run1	8/25/2020	12:31:30	10.56	7.49
run1	8/25/2020	12:31:45	10.66	7.48
run1	8/25/2020	12:32:00	10.76	7.44
run1	8/25/2020	12:32:15	10.80	7.38
run1	8/25/2020	12:32:30	10.79	7.35
run1	8/25/2020	12:32:45	10.79	7.34
run1	8/25/2020	12:33:00	10.80	7.32
run1	8/25/2020	12:33:15	10.80	7.32
run1	8/25/2020	12:33:30	10.81	7.32
run1	8/25/2020	12:33:45	10.81	7.32
run1	8/25/2020	12:34:00	10.83	7.31
run1	8/25/2020	12:34:15	10.82	7.29
run1	8/25/2020	12:34:30	10.82	7.30
run1	8/25/2020	12:34:45	10.83	7.31
run1	8/25/2020	12:35:00	10.84	7.30
run1	8/25/2020	12:35:15	10.82	7.29
run1	8/25/2020	12:35:30	10.80	7.30
run1	8/25/2020	12:35:45	10.80	7.32
run1	8/25/2020	12:36:00	10.78	7.32
run1	8/25/2020	12:36:15	10.77	7.32
run1	8/25/2020	12:36:30	10.73	7.33
run1	8/25/2020	12:36:45	10.72	7.36
run1	8/25/2020	12:37:00	10.73	7.37
run1	8/25/2020	12:37:15	10.74	7.36
run1	8/25/2020	12:37:30	10.77	7.37
run1	8/25/2020	12:37:45	10.79	7.36
run1	8/25/2020	12:38:00	10.78	7.34
run1	8/25/2020	12:38:15	10.80	7.33
run1	8/25/2020	12:38:30	10.82	7.32
run1	8/25/2020	12:38:45	10.81	7.32
run1	8/25/2020	12:39:00	10.81	7.31
run1	8/25/2020	12:39:15	10.83	7.30
run1	8/25/2020	12:39:30	10.81	7.30
run1	8/25/2020	12:39:45	10.80	7.31
run1	8/25/2020	12:40:00	10.79	7.33
run1	8/25/2020	12:40:15	10.76	7.32
run1	8/25/2020	12:40:30	10.73	7.33
run1	8/25/2020	12:40:45	10.73	7.36
run1	8/25/2020	12:41:00	10.74	7.37
run1	8/25/2020	12:41:15	10.79	7.36
run1	8/25/2020	12:41:30	10.79	7.33
run1	8/25/2020	12:41:45	10.80	7.32
run1	8/25/2020	12:42:00	10.82	7.32
run1	8/25/2020	12:42:15	10.79	7.31
run1	8/25/2020	12:42:30	10.81	7.30
run1	8/25/2020	12:42:45	10.81	7.30
run1	8/25/2020	12:43:00	10.82	7.31
run1	8/25/2020	12:43:15	10.84	7.30
run1	8/25/2020	12:43:30	10.82	7.28
run1	8/25/2020	12:43:45	10.82	7.28
run1	8/25/2020	12:44:00	10.82	7.29
run1	8/25/2020	12:44:15	10.84	7.29
run1	8/25/2020	12:44:30	10.83	7.27

run1	8/25/2020	12:44:45	10.86	7.27
run1	8/25/2020	12:45:00	10.90	7.27
run1	8/25/2020	12:45:15	10.91	7.26
run1	8/25/2020	12:45:30	10.85	7.23
run1	8/25/2020	12:45:45	10.82	7.25
run1	8/25/2020	12:46:00	10.81	7.28
run1	8/25/2020	12:46:15	10.80	7.30
run1	8/25/2020	12:46:30	10.79	7.31
run1	8/25/2020	12:46:45	10.79	7.30
run1	8/25/2020	12:47:00	10.79	7.31
run1	8/25/2020	12:47:15	10.81	7.33
run1	8/25/2020	12:47:30	10.81	7.31
run1	8/25/2020	12:47:45	10.79	7.30
run1	8/25/2020	12:48:00	10.77	7.30
run1	8/25/2020	12:48:15	10.78	7.33
run1	8/25/2020	12:48:45	10.82	7.34
run1	8/25/2020	12:49:00	10.85	7.31
run1	8/25/2020	12:49:15	10.82	7.28
run1	8/25/2020	12:49:30	10.78	7.29
run1	8/25/2020	12:49:45	10.82	7.32
run1	8/25/2020	12:50:00	10.90	7.31
run1	8/25/2020	12:50:15	10.95	7.26
run1	8/25/2020	12:50:30	11.00	7.22
run1	8/25/2020	12:50:45	11.03	7.20
run1	8/25/2020	12:51:00	11.05	7.17
run1	8/25/2020	12:51:15	11.06	7.14
run1	8/25/2020	12:51:30	11.06	7.13
run1	8/25/2020	12:51:45	11.05	7.14
run1	8/25/2020	12:52:00	11.04	7.15
run1	8/25/2020	12:52:15	11.01	7.14
run1	8/25/2020	12:52:30	10.99	7.15
run1	8/25/2020	12:52:45	11.01	7.17
run1	8/25/2020	12:53:00	11.02	7.18
run1	8/25/2020	12:53:15	11.01	7.17
run1	8/25/2020	12:53:30	11.03	7.16
run1	8/25/2020	12:53:45	11.07	7.16
run1	8/25/2020	12:54:00	11.05	7.15
run1	8/25/2020	12:54:15	11.04	7.14
run1	8/25/2020	12:54:30	11.02	7.13
run1	8/25/2020	12:54:45	11.04	7.15
run1	8/25/2020	12:55:00	11.05	7.16
run1	8/25/2020	12:55:15	11.03	7.15
run1	8/25/2020	12:55:30	11.03	7.15
run1	8/25/2020	12:55:45	11.04	7.15
run1	8/25/2020	12:56:00	11.03	7.16
run1	8/25/2020	12:56:15	11.01	7.16
run1	8/25/2020	12:56:30	11.00	7.16
run1	8/25/2020	12:56:45	10.99	7.16
run1	8/25/2020	12:57:00	11.00	7.18
run1	8/25/2020	12:57:15	11.03	7.19
run1	8/25/2020	12:57:30	11.02	7.16
run1	8/25/2020	12:57:45	11.01	7.15
run1	8/25/2020	12:58:00	11.05	7.17
run1	8/25/2020	12:58:15	11.06	7.16
run1	8/25/2020	12:58:30	10.99	7.14
run1	8/25/2020	12:58:45	10.92	7.15
run1	8/25/2020	12:59:00	10.86	7.21
run1	8/25/2020	12:59:15	10.84	7.26
run1	8/25/2020	12:59:30	10.83	7.28
run1	8/25/2020	12:59:45	10.82	7.28
run1	8/25/2020	13:00:00	10.81	7.30
run1	8/25/2020	13:00:15	10.82	7.31
run1	8/25/2020	13:00:30	10.82	7.30
run1	8/25/2020	13:00:45	10.80	7.30
run1	8/25/2020	13:01:00	10.81	7.31
run1	8/25/2020	13:01:15	10.81	7.32
run1	8/25/2020	13:01:30	10.81	7.31
run1	8/25/2020	13:01:45	10.81	7.30
run1	8/25/2020	13:02:00	10.79	7.30
run1	8/25/2020	13:02:15	10.80	7.32
run1	8/25/2020	13:02:30	10.81	7.33
run1	8/25/2020	13:02:45	10.82	7.31
run1	8/25/2020	13:03:00	10.81	7.29

run1	8/25/2020	13:03:15	10.82	7.31
run1	8/25/2020	13:03:30	10.83	7.31
run1	8/25/2020	13:03:45	10.81	7.30
run1	8/25/2020	13:04:00	10.81	7.29
run1	8/25/2020	13:04:15	10.83	7.31
run1	8/25/2020	13:04:30	10.84	7.31
run1	8/25/2020	13:04:45	10.84	7.29
run1	8/25/2020	13:05:00	10.83	7.28
run1	8/25/2020	13:05:15	10.82	7.29
run1	8/25/2020	13:05:30	10.80	7.30
run1	8/25/2020	13:05:45	10.79	7.31
run1	8/25/2020	13:06:00	10.80	7.31
run1	8/25/2020	13:06:15	10.83	7.31
run1	8/25/2020	13:06:30	10.83	7.31
run1	8/25/2020	13:07:00	10.83	7.30
run1	8/25/2020	13:07:15	10.83	7.29
run1	8/25/2020	13:07:30	10.84	7.29
run1	8/25/2020	13:07:45	10.85	7.29
run1	8/25/2020	13:08:00	10.84	7.29
run1	8/25/2020	13:08:15	10.85	7.28
run1	8/25/2020	13:08:30	10.85	7.27
run1	8/25/2020	13:08:45	10.84	7.28
run1	8/25/2020	13:09:00	10.85	7.29
run1	8/25/2020	13:09:15	10.85	7.28
run1	8/25/2020	13:09:30	10.89	7.27
run1	8/25/2020	13:09:45	10.87	7.26
run1	8/25/2020	13:10:00	10.83	7.27
run1	8/25/2020	13:10:15	10.81	7.29
run1	8/25/2020	13:10:30	10.81	7.29
run1	8/25/2020	13:10:45	10.82	7.30
run1	8/25/2020	13:11:00	10.83	7.31
run1	8/25/2020	13:11:15	10.83	7.30
run1	8/25/2020	13:11:30	10.82	7.29
run1	8/25/2020	13:11:45	10.83	7.29
run1	8/25/2020	13:12:00	10.84	7.30
run1	8/25/2020	13:12:15	10.83	7.30
run1	8/25/2020	13:12:30	10.85	7.28
run1	8/25/2020	13:12:45	10.85	7.16
run1	8/25/2020	13:13:00	10.82	7.28
run1	8/25/2020	13:13:15	10.81	7.24
run1	8/25/2020	13:13:30	10.83	7.26
run1	8/25/2020	13:13:45	10.84	7.27
run1	8/25/2020	13:14:00	10.85	7.29
run1	8/25/2020	13:14:15	10.84	7.29
run1	8/25/2020	13:14:30	10.81	7.29
run1	8/25/2020	13:14:45	10.80	7.29
run1	8/25/2020	13:15:00	10.80	7.31
run1	8/25/2020	13:15:15	10.81	7.32
run1	8/25/2020	13:15:30	10.85	7.31
run1	8/25/2020	13:15:45	10.87	7.28
run1	8/25/2020	13:16:00	10.88	7.27
run1	8/25/2020	13:16:15	10.89	7.27
run1	8/25/2020	13:16:30	10.90	7.26
run1	8/25/2020	13:16:45	10.88	7.24
run1	8/25/2020	13:17:00	10.86	7.25
run1	8/25/2020	13:17:15	10.84	7.27
run1	8/25/2020	13:17:30	10.83	7.29
run1	8/25/2020	13:17:45	10.82	7.28
run1	8/25/2020	13:18:00	10.83	7.28
run1	8/25/2020	13:18:15	10.81	7.30
run1	8/25/2020	13:18:30	10.82	7.31
run1	8/25/2020	13:18:45	10.81	7.30
run1	8/25/2020	13:19:00	10.78	7.29
run1	8/25/2020	13:19:15	10.75	7.32
run1	8/25/2020	13:19:30	10.77	7.35
run1	8/25/2020	13:19:45	10.80	7.34
run1	8/25/2020	13:20:00	10.82	7.31
run1	8/25/2020	13:20:15	10.82	7.31
run1	8/25/2020	13:20:30	10.83	7.31
run1	8/25/2020	13:20:45	10.82	7.30
run1	8/25/2020	13:21:00	10.80	7.29
run1	8/25/2020	13:21:15	10.80	7.31
run1	8/25/2020	13:21:30	10.83	7.32

run1	8/25/2020	13:21:45	10.83	7.31
run1	8/25/2020	13:22:00	10.82	7.28
run1	8/25/2020	13:22:15	10.83	7.29
run1	8/25/2020	13:22:30	10.87	7.30
run1	8/25/2020	13:22:45	10.89	7.27
run1	8/25/2020	13:23:00	10.88	7.26
run1	8/25/2020	13:23:15	10.87	7.25
run1	8/25/2020	13:23:30	10.83	7.27
run1	8/25/2020	13:23:45	10.82	7.29
run1	8/25/2020	13:24:00	10.82	7.29
run1	8/25/2020	13:24:15	10.83	7.29
run1	8/25/2020	13:24:30	10.82	7.30
run1	8/25/2020	13:25:00	10.81	7.31
run1	8/25/2020	13:25:15	10.82	7.30
run1	8/25/2020	13:25:30	10.83	7.29
run1	8/25/2020	13:25:45	10.81	7.29
run1	8/25/2020	13:26:00	10.77	7.31
run1	8/25/2020	13:26:15	10.76	7.32
run1	8/25/2020	13:26:30	10.77	7.33
run1	8/25/2020	13:26:45	10.77	7.34
run1	8/25/2020	13:27:00	10.79	7.34
run1	8/25/2020	13:27:15	10.80	7.33
run1	8/25/2020	13:27:30	10.78	7.31
run1	8/25/2020	13:27:45	10.80	7.32
run1	8/25/2020	13:28:00	10.85	7.32
run1	8/25/2020	13:28:15	10.84	7.30
run1	8/25/2020	13:28:30	10.81	7.28
run1	8/25/2020	13:28:45	10.78	7.29
run1	8/25/2020	13:29:00	10.75	7.32
run1	8/25/2020	13:29:15	10.76	7.34
run1	8/25/2020	13:29:30	10.77	7.34
run1	8/25/2020	13:29:45	10.77	7.33
run1	8/25/2020	13:30:00	10.79	7.34
run1	8/25/2020	13:30:15	10.80	7.33
run1	8/25/2020	13:30:30	10.81	7.31
run1	8/25/2020	13:30:45	10.80	7.30
run1	8/25/2020	13:31:00	10.79	7.31
run1	8/25/2020	13:31:15	10.76	7.32
run1	8/25/2020	13:31:30	10.75	7.33
run1	8/25/2020	13:31:45	10.75	7.33
run1	8/25/2020	13:32:00	10.73	7.34
run1	8/25/2020	13:32:15	10.76	7.36
run1	8/25/2020	13:32:30	10.75	7.35
run1	8/25/2020	13:32:45	10.74	7.34
run1	8/25/2020	13:33:00	10.76	7.35
run1	8/25/2020	13:33:15	10.79	7.36
run1	8/25/2020	13:33:30	10.78	7.34
run1	8/25/2020	13:33:45	10.77	7.32
run1	8/25/2020	13:34:00	10.77	7.33
run1	8/25/2020	13:34:15	10.78	7.34
run1	8/25/2020	13:34:30	10.80	7.34
run1	8/25/2020	13:34:45	10.80	7.31
run1	8/25/2020	13:35:00	10.78	7.31
run1	8/25/2020	13:35:15	10.76	7.32
run1	8/25/2020	13:35:30	10.75	7.34
run1	8/25/2020	13:35:45	10.77	7.34
run1	8/25/2020	13:36:00	10.81	7.32
run1	8/25/2020	13:36:15	10.79	7.32
run1	8/25/2020	13:36:30	10.78	7.32
run1	8/25/2020	13:36:45	10.77	7.32
run1	8/25/2020	13:37:00	10.75	7.32
run1	8/25/2020	13:37:15	10.73	7.34
run1	8/25/2020	13:37:30	10.74	7.36
run1	8/25/2020	13:37:45	10.74	7.36
run1	8/25/2020	13:38:00	10.76	7.34
run1	8/25/2020	13:38:15	10.76	7.34
run1	8/25/2020	13:38:30	10.75	7.35
run1	8/25/2020	13:38:45	10.74	7.35
run1	8/25/2020	13:39:00	10.75	7.34
run1	8/25/2020	13:39:15	10.78	7.33
run1	8/25/2020	13:39:30	10.76	7.33
run1	8/25/2020	13:39:45	10.74	7.34
run1	8/25/2020	13:40:00	10.76	7.34

run1	8/25/2020	13:40:15	10.80	7.33									
run1	8/25/2020	13:40:30	10.81	7.32									
run1	8/25/2020	13:40:45	10.78	7.31									
run1	8/25/2020	13:41:00	10.79	7.31									
run1	8/25/2020	13:41:15	10.81	7.30									
run1	8/25/2020	13:41:30	10.77	7.30									
run1	8/25/2020	13:41:45	10.75	7.32									
run1	8/25/2020	13:42:00	10.73	7.34									
run1	8/25/2020	13:42:15	10.73	7.34									
run1	8/25/2020	13:42:30	10.72	7.35									
run1	8/25/2020	13:42:45	10.70	7.37									
run1	8/25/2020	13:43:15	10.71	7.38									
run1	8/25/2020	13:43:30	10.74	7.37									
averun1	8/25/2020	10:32:45	11.56	6.78	180								
o2zero1	8/25/2020	13:51:30	-0.11	0.11	N2/cg1	N2	0		0	0			
co2zero1	8/25/2020	13:51:30	-0.11	0.11	N2/cg1	N2	0		0	0			
o2span1	8/25/2020	13:57:00	9.85	11.88	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2	
co2span1	8/25/2020	13:56:45	9.85	11.86	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2	
run2	8/25/2020	16:00:45	11.06	7.05									
run2	8/25/2020	16:01:00	11.01	7.05									
run2	8/25/2020	16:01:15	10.99	7.06									
run2	8/25/2020	16:01:30	11.00	7.09									
run2	8/25/2020	16:01:45	10.99	7.11									
run2	8/25/2020	16:02:00	10.98	7.12									
run2	8/25/2020	16:02:15	10.98	7.11									
run2	8/25/2020	16:02:30	10.98	7.11									
run2	8/25/2020	16:02:45	11.05	7.12									
run2	8/25/2020	16:03:15	11.06	7.10									
run2	8/25/2020	16:03:30	11.10	7.07									
run2	8/25/2020	16:03:45	11.12	7.04									
run2	8/25/2020	16:04:00	11.10	7.02									
run2	8/25/2020	16:04:15	11.07	7.03									
run2	8/25/2020	16:04:30	11.09	7.05									
run2	8/25/2020	16:04:45	11.09	7.04									
run2	8/25/2020	16:05:00	11.06	7.03									
run2	8/25/2020	16:05:15	11.06	7.06									
run2	8/25/2020	16:05:30	11.10	7.07									
run2	8/25/2020	16:05:45	11.10	7.05									
run2	8/25/2020	16:06:00	11.07	7.04									
run2	8/25/2020	16:06:15	11.07	7.05									
run2	8/25/2020	16:06:30	11.07	7.07									
run2	8/25/2020	16:06:45	11.06	7.07									
run2	8/25/2020	16:07:00	11.06	7.06									
run2	8/25/2020	16:07:15	11.06	7.06									
run2	8/25/2020	16:07:30	11.08	7.08									
run2	8/25/2020	16:07:45	11.07	7.08									
run2	8/25/2020	16:08:00	11.03	7.06									
run2	8/25/2020	16:08:15	10.97	7.07									
run2	8/25/2020	16:08:30	10.96	7.12									
run2	8/25/2020	16:08:45	10.99	7.15									
run2	8/25/2020	16:09:00	10.98	7.13									
run2	8/25/2020	16:09:15	10.98	7.12									
run2	8/25/2020	16:09:30	11.00	7.13									
run2	8/25/2020	16:09:45	11.01	7.13									
run2	8/25/2020	16:10:00	11.05	7.12									
run2	8/25/2020	16:10:15	11.03	7.09									
run2	8/25/2020	16:10:30	11.00	7.09									
run2	8/25/2020	16:10:45	10.95	7.12									
run2	8/25/2020	16:11:00	11.01	7.14									
run2	8/25/2020	16:11:15	11.06	7.13									
run2	8/25/2020	16:11:30	11.06	7.08									
run2	8/25/2020	16:11:45	11.05	7.07									
run2	8/25/2020	16:12:00	11.06	7.09									
run2	8/25/2020	16:12:15	11.07	7.07									
run2	8/25/2020	16:12:30	11.03	7.06									
run2	8/25/2020	16:12:45	11.01	7.07									
run2	8/25/2020	16:13:00	10.99	7.11									
run2	8/25/2020	16:13:15	10.97	7.13									
run2	8/25/2020	16:13:30	10.95	7.13									
run2	8/25/2020	16:13:45	10.97	7.14									
run2	8/25/2020	16:14:00	10.97	7.15									
run2	8/25/2020	16:14:15	10.98	7.15									
run2	8/25/2020	16:14:30	10.99	7.14									

run2	8/25/2020	16:14:45	11.05	7.12
run2	8/25/2020	16:15:00	11.07	7.10
run2	8/25/2020	16:15:15	11.07	7.09
run2	8/25/2020	16:15:30	11.07	7.08
run2	8/25/2020	16:15:45	11.05	7.06
run2	8/25/2020	16:16:00	11.03	7.07
run2	8/25/2020	16:16:15	11.01	7.10
run2	8/25/2020	16:16:30	11.00	7.12
run2	8/25/2020	16:16:45	11.00	7.11
run2	8/25/2020	16:17:00	11.06	7.11
run2	8/25/2020	16:17:15	11.09	7.10
run2	8/25/2020	16:17:30	11.07	7.08
run2	8/25/2020	16:17:45	11.00	7.06
run2	8/25/2020	16:18:00	10.96	7.08
run2	8/25/2020	16:18:15	11.02	7.12
run2	8/25/2020	16:18:30	11.00	7.13
run2	8/25/2020	16:18:45	11.00	7.12
run2	8/25/2020	16:19:00	10.97	7.12
run2	8/25/2020	16:19:15	10.99	7.12
run2	8/25/2020	16:19:30	11.04	7.13
run2	8/25/2020	16:19:45	11.05	7.11
run2	8/25/2020	16:20:00	10.98	7.09
run2	8/25/2020	16:20:15	10.95	7.10
run2	8/25/2020	16:20:30	11.01	7.14
run2	8/25/2020	16:20:45	11.03	7.14
run2	8/25/2020	16:21:00	11.04	7.11
run2	8/25/2020	16:21:30	11.03	7.08
run2	8/25/2020	16:21:45	10.97	7.10
run2	8/25/2020	16:22:00	10.97	7.13
run2	8/25/2020	16:22:15	11.00	7.13
run2	8/25/2020	16:22:30	11.05	7.10
run2	8/25/2020	16:22:45	11.07	7.09
run2	8/25/2020	16:23:00	11.07	7.08
run2	8/25/2020	16:23:15	11.14	7.07
run2	8/25/2020	16:23:30	11.19	7.04
run2	8/25/2020	16:23:45	11.19	6.99
run2	8/25/2020	16:24:00	11.12	6.99
run2	8/25/2020	16:24:15	11.11	7.02
run2	8/25/2020	16:24:30	11.13	7.03
run2	8/25/2020	16:24:45	11.12	7.02
run2	8/25/2020	16:25:00	11.14	7.02
run2	8/25/2020	16:25:15	11.22	7.03
run2	8/25/2020	16:25:30	11.29	7.00
run2	8/25/2020	16:25:45	11.32	6.93
run2	8/25/2020	16:26:00	11.28	6.90
run2	8/25/2020	16:26:15	11.28	6.91
run2	8/25/2020	16:26:30	11.27	6.93
run2	8/25/2020	16:26:45	11.22	6.92
run2	8/25/2020	16:27:00	11.20	6.94
run2	8/25/2020	16:27:15	11.22	6.97
run2	8/25/2020	16:27:30	11.21	6.97
run2	8/25/2020	16:27:45	11.16	6.97
run2	8/25/2020	16:28:00	11.11	6.98
run2	8/25/2020	16:28:15	11.12	7.01
run2	8/25/2020	16:28:30	11.16	7.04
run2	8/25/2020	16:28:45	11.11	7.02
run2	8/25/2020	16:29:00	11.10	7.02
run2	8/25/2020	16:29:15	11.12	7.03
run2	8/25/2020	16:29:30	11.16	7.04
run2	8/25/2020	16:29:45	11.22	7.02
run2	8/25/2020	16:30:00	11.21	6.98
run2	8/25/2020	16:30:15	11.15	6.96
run2	8/25/2020	16:30:30	11.23	6.98
run2	8/25/2020	16:30:45	11.28	6.98
run2	8/25/2020	16:31:00	11.32	6.94
run2	8/25/2020	16:31:15	11.31	6.90
run2	8/25/2020	16:31:30	11.29	6.90
run2	8/25/2020	16:31:45	11.29	6.92
run2	8/25/2020	16:32:00	11.30	6.92
run2	8/25/2020	16:32:15	11.30	6.91
run2	8/25/2020	16:32:30	11.27	6.91
run2	8/25/2020	16:32:45	11.27	6.92
run2	8/25/2020	16:33:00	11.25	6.93

run2	8/25/2020	16:33:15	11.26	6.93
run2	8/25/2020	16:33:30	11.30	6.92
run2	8/25/2020	16:33:45	11.35	6.92
run2	8/25/2020	16:34:00	11.37	6.90
run2	8/25/2020	16:34:15	11.37	6.87
run2	8/25/2020	16:34:30	11.34	6.86
run2	8/25/2020	16:34:45	11.35	6.87
run2	8/25/2020	16:35:00	11.32	6.89
run2	8/25/2020	16:35:15	11.28	6.90
run2	8/25/2020	16:35:30	11.29	6.90
run2	8/25/2020	16:35:45	11.31	6.90
run2	8/25/2020	16:36:00	11.27	6.91
run2	8/25/2020	16:36:15	11.27	6.92
run2	8/25/2020	16:36:30	11.30	6.92
run2	8/25/2020	16:36:45	11.28	6.91
run2	8/25/2020	16:37:00	11.30	6.91
run2	8/25/2020	16:37:15	11.34	6.92
run2	8/25/2020	16:37:30	11.34	6.90
run2	8/25/2020	16:37:45	11.35	6.88
run2	8/25/2020	16:38:00	11.40	6.87
run2	8/25/2020	16:38:15	11.39	6.86
run2	8/25/2020	16:38:30	11.29	6.86
run2	8/25/2020	16:38:45	11.26	6.88
run2	8/25/2020	16:39:00	11.28	6.91
run2	8/25/2020	16:39:30	11.32	6.93
run2	8/25/2020	16:39:45	11.32	6.91
run2	8/25/2020	16:40:00	11.26	6.90
run2	8/25/2020	16:40:15	11.19	6.91
run2	8/25/2020	16:40:30	11.17	6.95
run2	8/25/2020	16:40:45	11.20	6.99
run2	8/25/2020	16:41:00	11.27	6.98
run2	8/25/2020	16:41:15	11.30	6.94
run2	8/25/2020	16:41:30	11.26	6.92
run2	8/25/2020	16:41:45	11.21	6.93
run2	8/25/2020	16:42:00	11.15	6.96
run2	8/25/2020	16:42:15	11.18	6.98
run2	8/25/2020	16:42:30	11.22	6.99
run2	8/25/2020	16:42:45	11.21	6.99
run2	8/25/2020	16:43:00	11.23	6.97
run2	8/25/2020	16:43:15	11.28	6.96
run2	8/25/2020	16:43:30	11.30	6.93
run2	8/25/2020	16:43:45	11.30	6.92
run2	8/25/2020	16:44:00	11.29	6.92
run2	8/25/2020	16:44:15	11.26	6.91
run2	8/25/2020	16:44:30	11.30	6.91
run2	8/25/2020	16:44:45	11.33	6.91
run2	8/25/2020	16:45:00	11.31	6.91
run2	8/25/2020	16:45:15	11.33	6.90
run2	8/25/2020	16:45:30	11.36	6.88
run2	8/25/2020	16:45:45	11.35	6.87
run2	8/25/2020	16:46:00	11.29	6.88
run2	8/25/2020	16:46:15	11.23	6.90
run2	8/25/2020	16:46:30	11.18	6.93
run2	8/25/2020	16:46:45	11.16	6.96
run2	8/25/2020	16:47:00	11.13	7.00
run2	8/25/2020	16:47:15	11.11	7.02
run2	8/25/2020	16:47:30	11.15	7.03
run2	8/25/2020	16:47:45	11.13	7.02
run2	8/25/2020	16:48:00	11.10	7.02
run2	8/25/2020	16:48:15	11.13	7.04
run2	8/25/2020	16:48:30	11.12	7.03
run2	8/25/2020	16:48:45	11.12	7.02
run2	8/25/2020	16:49:00	11.12	7.03
run2	8/25/2020	16:49:15	11.10	7.04
run2	8/25/2020	16:49:30	11.10	7.05
run2	8/25/2020	16:49:45	11.10	7.04
run2	8/25/2020	16:50:00	11.08	7.04
run2	8/25/2020	16:50:15	11.06	7.06
run2	8/25/2020	16:50:30	11.06	7.07
run2	8/25/2020	16:50:45	11.08	7.07
run2	8/25/2020	16:51:00	10.93	7.06
run2	8/25/2020	16:51:15	10.80	7.13
run2	8/25/2020	16:51:30	10.73	7.22

run2	8/25/2020	16:51:45	10.73	7.27
run2	8/25/2020	16:52:00	10.68	7.29
run2	8/25/2020	16:52:15	10.66	7.32
run2	8/25/2020	16:52:30	10.67	7.35
run2	8/25/2020	16:52:45	10.70	7.35
run2	8/25/2020	16:53:00	10.71	7.33
run2	8/25/2020	16:53:15	10.70	7.32
run2	8/25/2020	16:53:30	10.68	7.33
run2	8/25/2020	16:53:45	10.70	7.34
run2	8/25/2020	16:54:00	10.71	7.33
run2	8/25/2020	16:54:15	10.72	7.32
run2	8/25/2020	16:54:30	10.73	7.32
run2	8/25/2020	16:54:45	10.71	7.32
run2	8/25/2020	16:55:00	10.68	7.31
run2	8/25/2020	16:55:15	10.67	7.32
run2	8/25/2020	16:55:30	10.67	7.34
run2	8/25/2020	16:55:45	10.69	7.36
run2	8/25/2020	16:56:00	10.73	7.34
run2	8/25/2020	16:56:15	10.77	7.31
run2	8/25/2020	16:56:30	10.75	7.29
run2	8/25/2020	16:56:45	10.73	7.29
run2	8/25/2020	16:57:00	10.71	7.31
run2	8/25/2020	16:57:30	10.70	7.31
run2	8/25/2020	16:57:45	10.66	7.32
run2	8/25/2020	16:58:00	10.65	7.34
run2	8/25/2020	16:58:15	10.65	7.37
run2	8/25/2020	16:58:30	10.62	7.36
run2	8/25/2020	16:58:45	10.62	7.36
run2	8/25/2020	16:59:00	10.68	7.38
run2	8/25/2020	16:59:15	10.72	7.37
run2	8/25/2020	16:59:30	10.70	7.34
run2	8/25/2020	16:59:45	10.70	7.32
run2	8/25/2020	17:00:00	10.73	7.32
run2	8/25/2020	17:00:15	10.73	7.33
run2	8/25/2020	17:00:30	10.76	7.31
run2	8/25/2020	17:00:45	10.79	7.28
run2	8/25/2020	17:01:00	10.80	7.27
run2	8/25/2020	17:01:15	10.77	7.27
run2	8/25/2020	17:01:30	10.76	7.28
run2	8/25/2020	17:01:45	10.79	7.29
run2	8/25/2020	17:02:00	10.81	7.27
run2	8/25/2020	17:02:15	10.78	7.26
run2	8/25/2020	17:02:30	10.75	7.27
run2	8/25/2020	17:02:45	10.74	7.29
run2	8/25/2020	17:03:00	10.73	7.29
run2	8/25/2020	17:03:15	10.69	7.29
run2	8/25/2020	17:03:30	10.71	7.32
run2	8/25/2020	17:03:45	10.74	7.34
run2	8/25/2020	17:04:00	10.73	7.31
run2	8/25/2020	17:04:15	10.72	7.30
run2	8/25/2020	17:04:30	10.74	7.31
run2	8/25/2020	17:04:45	10.68	7.32
run2	8/25/2020	17:05:00	10.64	7.33
run2	8/25/2020	17:05:15	10.67	7.34
run2	8/25/2020	17:05:30	10.68	7.35
run2	8/25/2020	17:05:45	10.71	7.35
run2	8/25/2020	17:06:00	10.71	7.34
run2	8/25/2020	17:06:15	10.70	7.32
run2	8/25/2020	17:06:30	10.70	7.32
run2	8/25/2020	17:06:45	10.72	7.33
run2	8/25/2020	17:07:00	10.74	7.33
run2	8/25/2020	17:07:15	10.73	7.31
run2	8/25/2020	17:07:30	10.71	7.30
run2	8/25/2020	17:07:45	10.73	7.31
run2	8/25/2020	17:08:00	10.73	7.32
run2	8/25/2020	17:08:15	10.71	7.31
run2	8/25/2020	17:08:30	10.67	7.31
run2	8/25/2020	17:08:45	10.69	7.33
run2	8/25/2020	17:09:00	10.71	7.35
run2	8/25/2020	17:09:15	10.68	7.34
run2	8/25/2020	17:09:30	10.67	7.33
run2	8/25/2020	17:09:45	10.67	7.34
run2	8/25/2020	17:10:00	10.67	7.36

run2	8/25/2020	17:10:15	10.71	7.36
run2	8/25/2020	17:10:30	10.73	7.33
run2	8/25/2020	17:10:45	10.72	7.31
run2	8/25/2020	17:11:00	10.70	7.32
run2	8/25/2020	17:11:15	10.72	7.33
run2	8/25/2020	17:11:30	10.70	7.33
run2	8/25/2020	17:11:45	10.65	7.32
run2	8/25/2020	17:12:00	10.65	7.33
run2	8/25/2020	17:12:15	10.68	7.35
run2	8/25/2020	17:12:30	10.70	7.29
run2	8/25/2020	17:12:45	10.72	7.30
run2	8/25/2020	17:13:00	10.68	7.32
run2	8/25/2020	17:13:15	10.62	7.34
run2	8/25/2020	17:13:30	10.63	7.37
run2	8/25/2020	17:13:45	10.68	7.38
run2	8/25/2020	17:14:00	10.70	7.35
run2	8/25/2020	17:14:15	10.70	7.34
run2	8/25/2020	17:14:30	10.69	7.34
run2	8/25/2020	17:14:45	10.67	7.34
run2	8/25/2020	17:15:00	10.68	7.33
run2	8/25/2020	17:15:15	10.70	7.33
run2	8/25/2020	17:15:45	10.68	7.33
run2	8/25/2020	17:16:00	10.66	7.34
run2	8/25/2020	17:16:15	10.65	7.34
run2	8/25/2020	17:16:30	10.62	7.35
run2	8/25/2020	17:16:45	10.59	7.37
run2	8/25/2020	17:17:00	10.60	7.39
run2	8/25/2020	17:17:15	10.63	7.40
run2	8/25/2020	17:17:30	10.64	7.38
run2	8/25/2020	17:17:45	10.65	7.36
run2	8/25/2020	17:18:00	10.69	7.37
run2	8/25/2020	17:18:15	10.71	7.35
run2	8/25/2020	17:18:30	10.71	7.32
run2	8/25/2020	17:18:45	10.69	7.31
run2	8/25/2020	17:19:00	10.68	7.33
run2	8/25/2020	17:19:15	10.62	7.35
run2	8/25/2020	17:19:30	10.57	7.37
run2	8/25/2020	17:19:45	10.60	7.39
run2	8/25/2020	17:20:00	10.68	7.40
run2	8/25/2020	17:20:15	10.74	7.38
run2	8/25/2020	17:20:30	10.72	7.33
run2	8/25/2020	17:20:45	10.69	7.31
run2	8/25/2020	17:21:00	10.66	7.33
run2	8/25/2020	17:21:15	10.69	7.35
run2	8/25/2020	17:21:30	10.70	7.35
run2	8/25/2020	17:21:45	10.69	7.33
run2	8/25/2020	17:22:00	10.70	7.33
run2	8/25/2020	17:22:15	10.71	7.34
run2	8/25/2020	17:22:30	10.70	7.34
run2	8/25/2020	17:22:45	10.64	7.33
run2	8/25/2020	17:23:00	10.62	7.35
run2	8/25/2020	17:23:15	10.62	7.38
run2	8/25/2020	17:23:30	10.66	7.39
run2	8/25/2020	17:23:45	10.68	7.37
run2	8/25/2020	17:24:00	10.66	7.35
run2	8/25/2020	17:24:15	10.64	7.36
run2	8/25/2020	17:24:30	10.66	7.37
run2	8/25/2020	17:24:45	10.68	7.37
run2	8/25/2020	17:25:00	10.68	7.35
run2	8/25/2020	17:25:15	10.67	7.35
run2	8/25/2020	17:25:30	10.66	7.36
run2	8/25/2020	17:25:45	10.64	7.36
run2	8/25/2020	17:26:00	10.62	7.36
run2	8/25/2020	17:26:15	10.62	7.37
run2	8/25/2020	17:26:30	10.61	7.39
run2	8/25/2020	17:26:45	10.58	7.40
run2	8/25/2020	17:27:00	10.60	7.40
run2	8/25/2020	17:27:15	10.64	7.40
run2	8/25/2020	17:27:30	10.63	7.39
run2	8/25/2020	17:27:45	10.62	7.39
run2	8/25/2020	17:28:00	10.63	7.38
run2	8/25/2020	17:28:15	10.66	7.37
run2	8/25/2020	17:28:30	10.63	7.37

run2	8/25/2020	17:28:45	10.64	7.38
run2	8/25/2020	17:29:00	10.64	7.38
run2	8/25/2020	17:29:15	10.64	7.37
run2	8/25/2020	17:29:30	10.64	7.37
run2	8/25/2020	17:29:45	10.66	7.38
run2	8/25/2020	17:30:00	10.62	7.38
run2	8/25/2020	17:30:15	10.63	7.37
run2	8/25/2020	17:30:30	10.64	7.37
run2	8/25/2020	17:30:45	10.62	7.38
run2	8/25/2020	17:31:00	10.65	7.39
run2	8/25/2020	17:31:15	10.70	7.37
run2	8/25/2020	17:31:30	10.72	7.34
run2	8/25/2020	17:31:45	10.71	7.32
run2	8/25/2020	17:32:00	10.66	7.34
run2	8/25/2020	17:32:15	10.64	7.35
run2	8/25/2020	17:32:30	10.69	7.35
run2	8/25/2020	17:32:45	10.70	7.35
run2	8/25/2020	17:33:00	10.68	7.35
run2	8/25/2020	17:33:15	10.68	7.35
run2	8/25/2020	17:33:45	10.69	7.34
run2	8/25/2020	17:34:00	10.72	7.34
run2	8/25/2020	17:34:15	10.77	7.33
run2	8/25/2020	17:34:30	10.75	7.31
run2	8/25/2020	17:34:45	10.70	7.29
run2	8/25/2020	17:35:00	10.67	7.31
run2	8/25/2020	17:36:00	10.66	7.34
run2	8/25/2020	17:36:30	10.69	7.35
run2	8/25/2020	17:36:45	10.69	7.35
run2	8/25/2020	17:37:00	10.69	7.33
run2	8/25/2020	17:37:15	10.67	7.33
run2	8/25/2020	17:37:30	10.64	7.36
run2	8/25/2020	17:37:45	10.63	7.37
run2	8/25/2020	17:38:00	10.63	7.37
run2	8/25/2020	17:38:15	10.63	7.37
run2	8/25/2020	17:38:30	10.63	7.38
run2	8/25/2020	17:38:45	10.61	7.39
run2	8/25/2020	17:39:00	10.62	7.39
run2	8/25/2020	17:39:15	10.65	7.38
run2	8/25/2020	17:39:30	10.71	7.37
run2	8/25/2020	17:39:45	10.73	7.35
run2	8/25/2020	17:40:00	10.68	7.33
run2	8/25/2020	17:52:00	11.63	6.66
run2	8/25/2020	17:52:15	11.59	6.66
run2	8/25/2020	17:52:30	11.53	6.68
run2	8/25/2020	17:52:45	11.56	6.73
run2	8/25/2020	17:53:00	11.62	6.73
run2	8/25/2020	17:53:15	11.60	6.71
run2	8/25/2020	17:53:30	11.64	6.69
run2	8/25/2020	17:53:45	11.73	6.68
run2	8/25/2020	17:54:00	11.75	6.65
run2	8/25/2020	17:54:15	11.74	6.61
run2	8/25/2020	17:54:30	11.73	6.59
run2	8/25/2020	17:54:45	11.75	6.61
run2	8/25/2020	17:55:00	11.72	6.61
run2	8/25/2020	17:55:15	11.68	6.62
run2	8/25/2020	17:55:30	11.64	6.63
run2	8/25/2020	17:55:45	11.57	6.65
run2	8/25/2020	17:56:00	11.57	6.71
run2	8/25/2020	17:56:15	11.57	6.72
run2	8/25/2020	17:56:30	11.57	6.72
run2	8/25/2020	17:56:45	11.63	6.71
run2	8/25/2020	17:57:00	11.71	6.70
run2	8/25/2020	17:57:15	11.76	6.66
run2	8/25/2020	17:57:30	11.72	6.61
run2	8/25/2020	17:57:45	11.68	6.60
run2	8/25/2020	17:58:00	11.65	6.63
run2	8/25/2020	17:58:15	11.63	6.66
run2	8/25/2020	17:58:30	11.57	6.68
run2	8/25/2020	17:58:45	11.55	6.70
run2	8/25/2020	17:59:00	11.59	6.72
run2	8/25/2020	17:59:15	11.56	6.73
run2	8/25/2020	17:59:30	11.65	6.73
run2	8/25/2020	17:59:45	11.77	6.69

run2	8/25/2020	18:00:00	11.77	6.62
run2	8/25/2020	18:00:15	11.77	6.59
run2	8/25/2020	18:00:30	11.83	6.60
run2	8/25/2020	18:00:45	11.80	6.56
run2	8/25/2020	18:01:00	11.79	6.55
run2	8/25/2020	18:01:15	11.72	6.56
run2	8/25/2020	18:01:30	11.69	6.60
run2	8/25/2020	18:01:45	11.79	6.62
run2	8/25/2020	18:02:00	11.82	6.60
run2	8/25/2020	18:02:15	11.73	6.56
run2	8/25/2020	18:02:30	11.71	6.59
run2	8/25/2020	18:02:45	11.73	6.62
run2	8/25/2020	18:03:00	11.71	6.61
run2	8/25/2020	18:03:15	11.64	6.62
run2	8/25/2020	18:03:30	11.60	6.65
run2	8/25/2020	18:03:45	11.54	6.69
run2	8/25/2020	18:04:00	11.52	6.71
run2	8/25/2020	18:04:15	11.57	6.73
run2	8/25/2020	18:04:45	11.61	6.74
run2	8/25/2020	18:05:00	11.57	6.72
run2	8/25/2020	18:05:15	11.56	6.72
run2	8/25/2020	18:05:30	11.56	6.72
run2	8/25/2020	18:05:45	11.62	6.73
run2	8/25/2020	18:06:00	11.66	6.72
run2	8/25/2020	18:06:15	11.57	6.68
run2	8/25/2020	18:06:30	11.50	6.69
run2	8/25/2020	18:06:45	11.56	6.74
run2	8/25/2020	18:07:00	11.65	6.74
run2	8/25/2020	18:07:15	11.63	6.70
run2	8/25/2020	18:07:30	11.58	6.68
run2	8/25/2020	18:07:45	11.63	6.69
run2	8/25/2020	18:08:00	11.67	6.70
run2	8/25/2020	18:08:15	11.68	6.67
run2	8/25/2020	18:08:30	11.67	6.65
run2	8/25/2020	18:08:45	11.64	6.64
run2	8/25/2020	18:09:00	11.69	6.66
run2	8/25/2020	18:09:15	11.67	6.66
run2	8/25/2020	18:09:30	11.75	6.64
run2	8/25/2020	18:09:45	11.78	6.61
run2	8/25/2020	18:10:00	11.78	6.59
run2	8/25/2020	18:10:15	11.68	6.59
run2	8/25/2020	18:10:30	11.71	6.61
run2	8/25/2020	18:10:45	11.81	6.62
run2	8/25/2020	18:11:00	11.85	6.58
run2	8/25/2020	18:11:15	11.77	6.55
run2	8/25/2020	18:11:30	11.73	6.57
run2	8/25/2020	18:11:45	11.77	6.59
run2	8/25/2020	18:12:00	11.82	6.58
run2	8/25/2020	18:12:15	11.77	6.56
run2	8/25/2020	18:12:30	11.67	6.58
run2	8/25/2020	18:12:45	11.72	6.61
run2	8/25/2020	18:13:00	11.88	6.61
run2	8/25/2020	18:13:15	11.90	6.56
run2	8/25/2020	18:13:30	11.91	6.51
run2	8/25/2020	18:13:45	11.94	6.49
run2	8/25/2020	18:14:00	11.96	6.46
run2	8/25/2020	18:14:15	11.94	6.45
run2	8/25/2020	18:14:30	11.95	6.46
run2	8/25/2020	18:14:45	11.99	6.46
run2	8/25/2020	18:15:00	12.03	6.43
run2	8/25/2020	18:15:15	12.09	6.41
run2	8/25/2020	18:15:30	12.12	6.38
run2	8/25/2020	18:15:45	12.11	6.36
run2	8/25/2020	18:16:00	12.08	6.34
run2	8/25/2020	18:16:15	12.08	6.35
run2	8/25/2020	18:16:30	11.99	6.37
run2	8/25/2020	18:16:45	11.86	6.41
run2	8/25/2020	18:17:00	11.85	6.47
run2	8/25/2020	18:17:15	11.88	6.50
run2	8/25/2020	18:17:30	11.90	6.51
run2	8/25/2020	18:17:45	11.99	6.50
run2	8/25/2020	18:18:00	12.04	6.46
run2	8/25/2020	18:18:15	12.08	6.40

run2	8/25/2020	18:18:30	12.03	6.37
run2	8/25/2020	18:18:45	11.98	6.39
run2	8/25/2020	18:19:00	12.00	6.42
run2	8/25/2020	18:19:15	12.01	6.42
run2	8/25/2020	18:19:30	12.04	6.41
run2	8/25/2020	18:19:45	11.99	6.41
run2	8/25/2020	18:20:00	11.98	6.42
run2	8/25/2020	18:20:15	12.00	6.43
run2	8/25/2020	18:20:30	12.08	6.42
run2	8/25/2020	18:20:45	12.09	6.39
run2	8/25/2020	18:21:00	12.05	6.38
run2	8/25/2020	18:21:15	12.05	6.38
run2	8/25/2020	18:21:30	12.07	6.38
run2	8/25/2020	18:21:45	12.07	6.37
run2	8/25/2020	18:22:00	12.10	6.38
run2	8/25/2020	18:22:15	12.14	6.37
run2	8/25/2020	18:22:45	12.17	6.34
run2	8/25/2020	18:23:00	12.18	6.31
run2	8/25/2020	18:23:15	12.21	6.30
run2	8/25/2020	18:23:30	12.16	6.29
run2	8/25/2020	18:23:45	12.16	6.30
run2	8/25/2020	18:24:00	12.16	6.30
run2	8/25/2020	18:24:15	12.08	6.31
run2	8/25/2020	18:24:30	12.09	6.34
run2	8/25/2020	18:24:45	12.17	6.36
run2	8/25/2020	18:25:00	12.17	6.33
run2	8/25/2020	18:25:15	12.13	6.30
run2	8/25/2020	18:25:30	12.17	6.32
run2	8/25/2020	18:25:45	12.24	6.32
run2	8/25/2020	18:26:00	12.29	6.28
run2	8/25/2020	18:26:15	12.34	6.22
run2	8/25/2020	18:26:30	12.38	6.20
run2	8/25/2020	18:26:45	12.41	6.17
run2	8/25/2020	18:27:00	12.34	6.15
run2	8/25/2020	18:27:15	12.22	6.15
run2	8/25/2020	18:27:30	12.19	6.22
run2	8/25/2020	18:27:45	12.18	6.28
run2	8/25/2020	18:28:00	12.13	6.30
run2	8/25/2020	18:28:15	12.18	6.31
run2	8/25/2020	18:28:30	12.24	6.30
run2	8/25/2020	18:28:45	12.25	6.27
run2	8/25/2020	18:29:00	12.23	6.26
run2	8/25/2020	18:29:15	12.22	6.25
run2	8/25/2020	18:29:30	12.29	6.25
run2	8/25/2020	18:29:45	12.33	6.23
run2	8/25/2020	18:30:00	12.29	6.21
run2	8/25/2020	18:30:15	12.16	6.22
run2	8/25/2020	18:30:30	12.13	6.27
run2	8/25/2020	18:30:45	12.18	6.30
run2	8/25/2020	18:31:00	12.25	6.31
run2	8/25/2020	18:31:15	12.25	6.28
run2	8/25/2020	18:31:30	12.20	6.25
run2	8/25/2020	18:31:45	12.16	6.25
run2	8/25/2020	18:32:00	12.13	6.29
run2	8/25/2020	18:32:15	12.11	6.32
run2	8/25/2020	18:32:30	12.13	6.34
run2	8/25/2020	18:32:45	12.16	6.33
run2	8/25/2020	18:33:00	12.20	6.31
run2	8/25/2020	18:33:15	12.25	6.30
run2	8/25/2020	18:33:30	12.34	6.26
run2	8/25/2020	18:33:45	12.33	6.21
run2	8/25/2020	18:34:00	12.27	6.18
run2	8/25/2020	18:34:15	12.29	6.21
run2	8/25/2020	18:34:30	12.31	6.23
run2	8/25/2020	18:34:45	12.32	6.21
run2	8/25/2020	18:35:00	12.31	6.19
run2	8/25/2020	18:35:15	12.29	6.20
run2	8/25/2020	18:35:30	12.34	6.22
run2	8/25/2020	18:35:45	12.42	6.19
run2	8/25/2020	18:36:00	12.37	6.15
run2	8/25/2020	18:36:15	12.28	6.14
run2	8/25/2020	18:36:30	12.32	6.19
run2	8/25/2020	18:36:45	12.43	6.20

run2	8/25/2020	18:37:00	12.47	6.15
run2	8/25/2020	18:37:15	12.43	6.09
run2	8/25/2020	18:37:30	12.43	6.10
run2	8/25/2020	18:37:45	12.37	6.12
run2	8/25/2020	18:38:00	12.37	6.14
run2	8/25/2020	18:38:15	12.33	6.14
run2	8/25/2020	18:38:30	12.28	6.17
run2	8/25/2020	18:38:45	12.26	6.22
run2	8/25/2020	18:39:00	12.27	6.24
run2	8/25/2020	18:39:15	12.24	6.23
run2	8/25/2020	18:39:30	12.26	6.24
run2	8/25/2020	18:39:45	12.29	6.24
run2	8/25/2020	18:40:00	12.33	6.23
run2	8/25/2020	18:40:15	12.36	6.20
run2	8/25/2020	18:40:45	12.37	6.17
run2	8/25/2020	18:41:00	12.45	6.16
run2	8/25/2020	18:46:30	12.51	6.11
run2	8/25/2020	18:47:00	12.70	5.94
run2	8/25/2020	18:47:15	12.69	5.92
run2	8/25/2020	18:47:30	12.66	5.93
run2	8/25/2020	18:47:45	12.65	5.94
run2	8/25/2020	18:48:00	12.64	5.95
run2	8/25/2020	18:48:15	12.63	5.95
run2	8/25/2020	18:48:30	12.64	5.96
run2	8/25/2020	18:48:45	12.66	5.97
run2	8/25/2020	18:49:00	12.64	5.96
run2	8/25/2020	18:49:15	12.68	5.95
run2	8/25/2020	18:49:30	12.65	5.94
run2	8/25/2020	18:49:45	12.63	5.95
run2	8/25/2020	18:50:00	12.61	5.97
run2	8/25/2020	18:50:15	12.65	5.98
run2	8/25/2020	18:50:30	12.58	5.97
run2	8/25/2020	18:50:45	12.60	5.98
run2	8/25/2020	18:51:00	12.59	6.00
run2	8/25/2020	18:51:15	12.58	6.00
run2	8/25/2020	18:51:30	12.59	5.99
run2	8/25/2020	18:51:45	12.60	6.00
run2	8/25/2020	18:52:00	12.67	6.00
run2	8/25/2020	18:52:15	12.83	5.97
run2	8/25/2020	18:52:30	13.12	5.88
run2	8/25/2020	18:52:45	13.24	5.71
run2	8/25/2020	18:53:00	13.27	5.60
run2	8/25/2020	18:53:15	13.26	5.53
run2	8/25/2020	18:53:30	13.27	5.52
run2	8/25/2020	18:53:45	13.36	5.50
run2	8/25/2020	18:54:00	13.38	5.47
run2	8/25/2020	18:54:15	13.35	5.45
run2	8/25/2020	18:54:30	13.33	5.45
run2	8/25/2020	18:54:45	13.24	5.46
run2	8/25/2020	18:55:00	13.17	5.49
run2	8/25/2020	18:55:15	13.20	5.56
run2	8/25/2020	18:55:30	13.18	5.58
run2	8/25/2020	18:55:45	13.15	5.57
run2	8/25/2020	18:56:00	13.12	5.59
run2	8/25/2020	18:56:15	13.14	5.61
run2	8/25/2020	18:56:30	13.13	5.61
run2	8/25/2020	18:57:00	13.14	5.61
run2	8/25/2020	18:57:15	13.17	5.60
run2	8/25/2020	18:57:30	13.21	5.59
run2	8/25/2020	18:57:45	13.19	5.58
run2	8/25/2020	18:58:00	13.23	5.57
run2	8/25/2020	18:58:15	13.28	5.54
run2	8/25/2020	18:58:30	13.35	5.52
run2	8/25/2020	18:58:45	13.37	5.48
run2	8/25/2020	18:59:00	13.29	5.46
run2	8/25/2020	18:59:15	13.21	5.47
run2	8/25/2020	18:59:30	13.13	5.52
run2	8/25/2020	18:59:45	13.13	5.59
run2	8/25/2020	19:00:00	13.23	5.61
run2	8/25/2020	19:00:15	13.28	5.57
run2	8/25/2020	19:00:30	13.21	5.52
run2	8/25/2020	19:00:45	13.23	5.53
run2	8/25/2020	19:01:00	13.33	5.54

run2	8/25/2020	19:01:15	13.31	5.50
run2	8/25/2020	19:01:30	13.23	5.48
run2	8/25/2020	19:01:45	13.17	5.52
run2	8/25/2020	19:02:00	13.21	5.57
run2	8/25/2020	19:02:15	13.33	5.57
run2	8/25/2020	19:02:30	13.39	5.51
run2	8/25/2020	19:02:45	13.42	5.45
run2	8/25/2020	19:03:00	13.55	5.42
run2	8/25/2020	19:03:15	13.66	5.36
run2	8/25/2020	19:03:30	13.69	5.28
run2	8/25/2020	19:03:45	13.74	5.22
run2	8/25/2020	19:04:00	13.70	5.20
run2	8/25/2020	19:04:15	13.63	5.20
run2	8/25/2020	19:04:30	13.67	5.23
run2	8/25/2020	19:04:45	13.70	5.23
run2	8/25/2020	19:05:00	13.68	5.21
run2	8/25/2020	19:05:15	13.74	5.21
run2	8/25/2020	19:05:30	13.69	5.20
run2	8/25/2020	19:05:45	13.71	5.19
run2	8/25/2020	19:06:00	13.64	5.20
run2	8/25/2020	19:06:15	13.59	5.23
run2	8/25/2020	19:06:30	13.62	5.27
run2	8/25/2020	19:06:45	13.65	5.27
run2	8/25/2020	19:07:00	13.73	5.24
run2	8/25/2020	19:07:15	13.71	5.22
run2	8/25/2020	19:07:30	13.62	5.20
run2	8/25/2020	19:07:45	13.66	5.23
run2	8/25/2020	19:08:00	13.68	5.24
run2	8/25/2020	19:08:15	13.70	5.23
run2	8/25/2020	19:08:30	13.75	5.22
run2	8/25/2020	19:08:45	13.69	5.19
run2	8/25/2020	19:09:00	13.68	5.19
run2	8/25/2020	19:09:15	13.71	5.21
run2	8/25/2020	19:09:30	13.66	5.21
run2	8/25/2020	19:09:45	13.65	5.22
run2	8/25/2020	19:10:00	13.66	5.23
run2	8/25/2020	19:10:15	13.66	5.23
run2	8/25/2020	19:10:30	13.67	5.24
run2	8/25/2020	19:10:45	13.63	5.24
run2	8/25/2020	19:11:00	13.53	5.24
run2	8/25/2020	19:11:15	13.55	5.28
run2	8/25/2020	19:11:30	13.60	5.31
run2	8/25/2020	19:11:45	13.65	5.30
run2	8/25/2020	19:12:00	13.68	5.26
run2	8/25/2020	19:12:15	13.67	5.23
run2	8/25/2020	19:12:30	13.74	5.22
run2	8/25/2020	19:12:45	13.79	5.20
run2	8/25/2020	19:13:00	13.78	5.17
run2	8/25/2020	19:13:15	13.73	5.13
run2	8/25/2020	19:13:30	13.65	5.16
run2	8/25/2020	19:13:45	13.68	5.21
run2	8/25/2020	19:14:00	13.69	5.23
run2	8/25/2020	19:14:15	13.69	5.21
run2	8/25/2020	19:14:30	13.74	5.20
run2	8/25/2020	19:14:45	13.49	5.20
run2	8/25/2020	19:15:15	12.50	5.32
run2	8/25/2020	19:15:30	11.54	5.73
run2	8/25/2020	19:15:45	11.13	6.35
run2	8/25/2020	19:16:00	10.99	6.82
run2	8/25/2020	19:16:15	10.98	7.06
run2	8/25/2020	19:16:30	10.98	7.12
run2	8/25/2020	19:16:45	11.02	7.12
run2	8/25/2020	19:17:00	10.99	7.12
run2	8/25/2020	19:17:15	10.99	7.13
run2	8/25/2020	19:17:30	11.00	7.14
run2	8/25/2020	19:17:45	10.95	7.12
run2	8/25/2020	19:18:00	10.95	7.13
run2	8/25/2020	19:18:15	10.93	7.15
run2	8/25/2020	19:18:30	10.91	7.17
run2	8/25/2020	19:18:45	10.93	7.17
run2	8/25/2020	19:19:00	10.93	7.17
run2	8/25/2020	19:19:15	10.90	7.17
run2	8/25/2020	19:19:30	10.87	7.19

run2	8/25/2020	19:19:45	10.89	7.21								
run2	8/25/2020	19:20:00	10.89	7.20								
run2	8/25/2020	19:20:15	10.89	7.20								
run2	8/25/2020	19:20:30	10.90	7.20								
run2	8/25/2020	19:20:45	10.97	7.20								
run2	8/25/2020	19:21:00	10.99	7.17								
run2	8/25/2020	19:21:15	10.97	7.14								
run2	8/25/2020	19:21:30	10.97	7.15								
run2	8/25/2020	19:21:45	10.92	7.16								
run2	8/25/2020	19:22:00	10.88	7.17								
run2	8/25/2020	19:22:15	10.90	7.19								
run2	8/25/2020	19:22:30	10.94	7.20								
run2	8/25/2020	19:22:45	10.92	7.19								
run2	8/25/2020	19:23:00	10.86	7.19								
run2	8/25/2020	19:23:15	10.86	7.20								
run2	8/25/2020	19:23:30	10.90	7.22								
run2	8/25/2020	19:23:45	10.98	7.21								
run2	8/25/2020	19:24:00	10.97	7.17								
run2	8/25/2020	19:24:15	10.90	7.15								
run2	8/25/2020	19:24:30	10.85	7.17								
run2	8/25/2020	19:24:45	10.86	7.22								
run2	8/25/2020	19:25:00	10.88	7.24								
run2	8/25/2020	19:25:15	10.87	7.23								
run2	8/25/2020	19:25:30	10.88	7.21								
run2	8/25/2020	19:25:45	10.92	7.22								
run2	8/25/2020	19:26:00	10.94	7.21								
run2	8/25/2020	19:26:15	10.93	7.19								
run2	8/25/2020	19:26:30	10.92	7.17								
run2	8/25/2020	19:26:45	10.94	7.18								
run2	8/25/2020	19:27:00	10.96	7.19								
run2	8/25/2020	19:27:15	10.99	7.18								
run2	8/25/2020	19:27:30	10.96	7.16								
run2	8/25/2020	19:27:45	10.96	7.15								
run2	8/25/2020	19:28:00	10.97	7.16								
run2	8/25/2020	19:28:15	10.94	7.17								
run2	8/25/2020	19:28:30	10.93	7.18								
run2	8/25/2020	19:28:45	10.96	7.18								
run2	8/25/2020	19:29:00	10.96	7.17								
run2	8/25/2020	19:29:15	10.97	7.18								
run2	8/25/2020	19:29:30	10.94	7.18								
run2	8/25/2020	19:29:45	10.94	7.17								
run2	8/25/2020	19:30:00	10.96	7.17								
run2	8/25/2020	19:30:15	10.93	7.18								
run2	8/25/2020	19:30:30	10.91	7.19								
run2	8/25/2020	19:30:45	10.91	7.20								
run2	8/25/2020	19:31:00	10.93	7.20								
run2	8/25/2020	19:31:15	10.93	7.20								
run2	8/25/2020	19:31:30	10.91	7.20								
run2	8/25/2020	19:31:45	10.87	7.21								
run2	8/25/2020	19:32:00	10.85	7.22								
run2	8/25/2020	19:32:15	10.89	7.24								
run2	8/25/2020	19:32:30	10.91	7.23								
run2	8/25/2020	19:32:45	10.92	7.23								
averun2	8/25/2020	16:00:45	11.53	6.74								
o2zero1	8/25/2020	19:39:45	-0.10	0.14	N2/cg1	N2	0		0	0		
co2zero1	8/25/2020	19:39:45	-0.10	0.14	N2/cg1	N2	0		0	0		
o2span1	8/25/2020	19:46:00	9.85	11.89	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2
co2span1	8/25/2020	19:46:00	9.85	11.89	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2
o2ezero1	8/26/2020	8:13:45	-0.03	0.07	N2/cg1	N2	0		0	0		
co2ezero1	8/26/2020	8:14:00	-0.04	0.07	N2/cg1	N2	0		0	0		
o2high1	8/26/2020	8:16:30	20.10	20.28	CC453172/cg2	O2	20.1	CO2	20.3		0	
co2high1	8/26/2020	8:16:30	20.10	20.28	CC453172/cg2	O2	20.1	CO2	20.3		0	
o2mid1	8/26/2020	8:18:45	9.97	11.80	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2
co2mid1	8/26/2020	8:19:00	9.97	11.80	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2
o2zero1	8/26/2020	8:34:45	0.00	0.08	N2/cg1	N2	0		0	0		
co2zero1	8/26/2020	8:35:00	0.00	0.08	N2/cg1	N2	0		0	0		
o2span1	8/26/2020	8:39:15	9.90	11.83	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2
co2span1	8/26/2020	8:39:15	9.90	11.83	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2
run3	8/26/2020	10:13:30	10.36	7.61								
run3	8/26/2020	10:13:45	10.36	7.60								

run3	8/26/2020	10:14:00	10.36	7.60
run3	8/26/2020	10:14:15	10.35	7.61
run3	8/26/2020	10:14:30	10.35	7.62
run3	8/26/2020	10:14:45	10.36	7.60
run3	8/26/2020	10:15:00	10.36	7.60
run3	8/26/2020	10:15:15	10.35	7.61
run3	8/26/2020	10:15:45	10.35	7.61
run3	8/26/2020	10:16:00	10.36	7.61
run3	8/26/2020	10:16:15	10.36	7.60
run3	8/26/2020	10:16:30	10.36	7.61
run3	8/26/2020	10:16:45	10.35	7.62
run3	8/26/2020	10:17:00	10.35	7.61
run3	8/26/2020	10:17:15	10.35	7.61
run3	8/26/2020	10:17:30	10.35	7.61
run3	8/26/2020	10:17:45	10.36	7.62
run3	8/26/2020	10:18:00	10.37	7.61
run3	8/26/2020	10:18:15	10.37	7.60
run3	8/26/2020	10:18:30	10.37	7.60
run3	8/26/2020	10:18:45	10.36	7.61
run3	8/26/2020	10:19:00	10.35	7.61
run3	8/26/2020	10:19:15	10.35	7.60
run3	8/26/2020	10:19:30	10.34	7.60
run3	8/26/2020	10:19:45	10.35	7.62
run3	8/26/2020	10:20:00	10.35	7.62
run3	8/26/2020	10:20:15	10.35	7.61
run3	8/26/2020	10:20:30	10.35	7.60
run3	8/26/2020	10:20:45	10.35	7.62
run3	8/26/2020	10:21:00	10.35	7.62
run3	8/26/2020	10:21:15	10.35	7.61
run3	8/26/2020	10:21:30	10.35	7.60
run3	8/26/2020	10:21:45	10.36	7.60
run3	8/26/2020	10:22:00	10.35	7.61
run3	8/26/2020	10:22:15	10.35	7.61
run3	8/26/2020	10:22:30	10.34	7.60
run3	8/26/2020	10:22:45	10.34	7.61
run3	8/26/2020	10:23:00	10.34	7.62
run3	8/26/2020	10:23:15	10.35	7.62
run3	8/26/2020	10:23:30	10.35	7.60
run3	8/26/2020	10:23:45	10.35	7.60
run3	8/26/2020	10:24:00	10.35	7.61
run3	8/26/2020	10:24:15	10.35	7.61
run3	8/26/2020	10:24:30	10.35	7.60
run3	8/26/2020	10:24:45	10.33	7.59
run3	8/26/2020	10:25:00	10.33	7.61
run3	8/26/2020	10:25:15	10.35	7.62
run3	8/26/2020	10:25:30	10.36	7.61
run3	8/26/2020	10:25:45	10.35	7.60
run3	8/26/2020	10:26:00	10.34	7.60
run3	8/26/2020	10:26:15	10.33	7.62
run3	8/26/2020	10:26:30	10.33	7.62
run3	8/26/2020	10:26:45	10.34	7.61
run3	8/26/2020	10:27:00	10.34	7.60
run3	8/26/2020	10:27:15	10.34	7.62
run3	8/26/2020	10:27:30	10.33	7.62
run3	8/26/2020	10:27:45	10.34	7.61
run3	8/26/2020	10:28:00	10.34	7.61
run3	8/26/2020	10:28:15	10.33	7.62
run3	8/26/2020	10:28:30	10.33	7.62
run3	8/26/2020	10:28:45	10.33	7.62
run3	8/26/2020	10:29:00	10.33	7.61
run3	8/26/2020	10:29:15	10.34	7.62
run3	8/26/2020	10:29:30	10.34	7.62
run3	8/26/2020	10:29:45	10.34	7.62
run3	8/26/2020	10:30:00	10.34	7.61
run3	8/26/2020	10:30:15	10.34	7.61
run3	8/26/2020	10:30:30	10.34	7.62
run3	8/26/2020	10:30:45	10.34	7.62
run3	8/26/2020	10:31:00	10.34	7.61
run3	8/26/2020	10:31:15	10.34	7.61
run3	8/26/2020	10:31:30	10.34	7.62
run3	8/26/2020	10:31:45	10.33	7.62
run3	8/26/2020	10:32:00	10.33	7.61
run3	8/26/2020	10:32:15	10.34	7.60

run3	8/26/2020	10:32:30	10.33	7.62
run3	8/26/2020	10:32:45	10.33	7.62
run3	8/26/2020	10:33:00	10.33	7.62
run3	8/26/2020	10:33:15	10.35	7.60
run3	8/26/2020	10:33:45	10.36	7.60
run3	8/26/2020	10:34:00	10.38	7.60
run3	8/26/2020	10:34:15	10.38	7.59
run3	8/26/2020	10:34:30	10.37	7.57
run3	8/26/2020	10:34:45	10.37	7.57
run3	8/26/2020	10:35:00	10.38	7.59
run3	8/26/2020	10:35:15	10.39	7.59
run3	8/26/2020	10:35:30	10.38	7.58
run3	8/26/2020	10:35:45	10.37	7.57
run3	8/26/2020	10:36:00	10.38	7.58
run3	8/26/2020	10:36:15	10.39	7.59
run3	8/26/2020	10:36:30	10.40	7.58
run3	8/26/2020	10:36:45	10.39	7.56
run3	8/26/2020	10:37:00	10.40	7.57
run3	8/26/2020	10:37:15	10.39	7.58
run3	8/26/2020	10:37:30	10.39	7.58
run3	8/26/2020	10:37:45	10.39	7.57
run3	8/26/2020	10:38:00	10.40	7.57
run3	8/26/2020	10:38:15	10.39	7.58
run3	8/26/2020	10:38:30	10.39	7.59
run3	8/26/2020	10:38:45	10.40	7.57
run3	8/26/2020	10:39:00	10.40	7.57
run3	8/26/2020	10:39:15	10.40	7.58
run3	8/26/2020	10:39:30	10.40	7.59
run3	8/26/2020	10:39:45	10.39	7.58
run3	8/26/2020	10:40:00	10.38	7.57
run3	8/26/2020	10:40:15	10.38	7.58
run3	8/26/2020	10:40:30	10.38	7.60
run3	8/26/2020	10:40:45	10.38	7.59
run3	8/26/2020	10:41:00	10.38	7.58
run3	8/26/2020	10:41:15	10.38	7.58
run3	8/26/2020	10:41:30	10.38	7.59
run3	8/26/2020	10:41:45	10.39	7.60
run3	8/26/2020	10:42:00	10.39	7.58
run3	8/26/2020	10:42:15	10.39	7.57
run3	8/26/2020	10:42:30	10.38	7.58
run3	8/26/2020	10:42:45	10.39	7.59
run3	8/26/2020	10:43:00	10.39	7.58
run3	8/26/2020	10:43:15	10.37	7.57
run3	8/26/2020	10:43:30	10.35	7.59
run3	8/26/2020	10:43:45	10.35	7.61
run3	8/26/2020	10:44:00	10.36	7.60
run3	8/26/2020	10:44:15	10.36	7.60
run3	8/26/2020	10:44:30	10.35	7.60
run3	8/26/2020	10:44:45	10.36	7.61
run3	8/26/2020	10:45:00	10.35	7.60
run3	8/26/2020	10:45:15	10.35	7.59
run3	8/26/2020	10:45:30	10.35	7.60
run3	8/26/2020	10:45:45	10.35	7.62
run3	8/26/2020	10:46:00	10.34	7.61
run3	8/26/2020	10:46:15	10.35	7.60
run3	8/26/2020	10:46:30	10.35	7.60
run3	8/26/2020	10:46:45	10.34	7.62
run3	8/26/2020	10:47:00	10.34	7.62
run3	8/26/2020	10:47:15	10.35	7.61
run3	8/26/2020	10:47:30	10.35	7.60
run3	8/26/2020	10:47:45	10.34	7.61
run3	8/26/2020	10:48:00	10.34	7.62
run3	8/26/2020	10:48:15	10.33	7.62
run3	8/26/2020	10:48:30	10.34	7.61
run3	8/26/2020	10:48:45	10.33	7.62
run3	8/26/2020	10:49:00	10.34	7.63
run3	8/26/2020	10:49:15	10.34	7.62
run3	8/26/2020	10:49:30	10.35	7.61
run3	8/26/2020	10:49:45	10.35	7.61
run3	8/26/2020	10:50:00	10.35	7.62
run3	8/26/2020	10:50:15	10.34	7.61
run3	8/26/2020	10:50:30	10.35	7.61
run3	8/26/2020	10:50:45	10.35	7.61

run3	8/26/2020	10:51:00	10.34	7.62
run3	8/26/2020	10:51:15	10.34	7.62
run3	8/26/2020	10:51:30	10.34	7.61
run3	8/26/2020	10:52:00	10.35	7.61
run3	8/26/2020	10:52:15	10.34	7.62
run3	8/26/2020	10:52:30	10.34	7.62
run3	8/26/2020	10:52:45	10.34	7.61
run3	8/26/2020	10:53:00	10.34	7.61
run3	8/26/2020	10:53:15	10.35	7.61
run3	8/26/2020	10:53:30	10.35	7.61
run3	8/26/2020	10:53:45	10.35	7.60
run3	8/26/2020	10:54:00	10.35	7.59
run3	8/26/2020	10:54:15	10.35	7.61
run3	8/26/2020	10:54:30	10.36	7.61
run3	8/26/2020	10:54:45	10.36	7.60
run3	8/26/2020	10:55:00	10.36	7.59
run3	8/26/2020	10:55:15	10.38	7.59
run3	8/26/2020	10:55:30	10.38	7.59
run3	8/26/2020	10:55:45	10.38	7.59
run3	8/26/2020	10:56:00	10.37	7.58
run3	8/26/2020	10:56:15	10.36	7.58
run3	8/26/2020	10:56:30	10.37	7.59
run3	8/26/2020	10:56:45	10.37	7.60
run3	8/26/2020	10:57:00	10.37	7.58
run3	8/26/2020	10:57:15	10.37	7.58
run3	8/26/2020	10:57:30	10.37	7.59
run3	8/26/2020	10:57:45	10.37	7.60
run3	8/26/2020	10:58:00	10.38	7.59
run3	8/26/2020	10:58:15	10.37	7.58
run3	8/26/2020	10:58:30	10.37	7.59
run3	8/26/2020	10:58:45	10.38	7.61
run3	8/26/2020	10:59:00	10.39	7.59
run3	8/26/2020	10:59:15	10.39	7.58
run3	8/26/2020	10:59:30	10.39	7.58
run3	8/26/2020	10:59:45	10.38	7.59
run3	8/26/2020	11:00:00	10.38	7.59
run3	8/26/2020	11:00:15	10.39	7.58
run3	8/26/2020	11:00:30	10.39	7.58
run3	8/26/2020	11:00:45	10.38	7.59
run3	8/26/2020	11:01:00	10.37	7.59
run3	8/26/2020	11:01:15	10.38	7.58
run3	8/26/2020	11:01:30	10.37	7.58
run3	8/26/2020	11:01:45	10.36	7.59
run3	8/26/2020	11:02:00	10.36	7.60
run3	8/26/2020	11:02:15	10.36	7.59
run3	8/26/2020	11:02:30	10.36	7.58
run3	8/26/2020	11:02:45	10.37	7.60
run3	8/26/2020	11:03:00	10.38	7.60
run3	8/26/2020	11:03:15	10.55	7.58
run3	8/26/2020	11:03:30	10.56	7.51
run3	8/26/2020	11:03:45	10.48	7.47
run3	8/26/2020	11:04:00	10.46	7.50
run3	8/26/2020	11:04:15	10.46	7.52
run3	8/26/2020	11:04:30	10.46	7.51
run3	8/26/2020	11:04:45	10.47	7.52
run3	8/26/2020	11:05:00	10.47	7.53
run3	8/26/2020	11:05:15	10.47	7.53
run3	8/26/2020	11:05:30	10.47	7.51
run3	8/26/2020	11:05:45	10.47	7.51
run3	8/26/2020	11:06:00	10.47	7.53
run3	8/26/2020	11:06:15	10.47	7.52
run3	8/26/2020	11:06:30	10.47	7.51
run3	8/26/2020	11:06:45	10.47	7.51
run3	8/26/2020	11:07:00	10.47	7.52
run3	8/26/2020	11:07:15	10.45	7.53
run3	8/26/2020	11:07:30	10.45	7.52
run3	8/26/2020	11:07:45	10.45	7.51
run3	8/26/2020	11:08:00	10.45	7.53
run3	8/26/2020	11:08:15	10.44	7.54
run3	8/26/2020	11:08:30	10.45	7.54
run3	8/26/2020	11:08:45	10.46	7.53
run3	8/26/2020	11:09:00	10.46	7.54
run3	8/26/2020	11:09:15	10.46	7.54

run3	8/26/2020	11:09:30	10.47	7.53
run3	8/26/2020	11:10:00	10.47	7.52
run3	8/26/2020	11:10:15	10.47	7.52
run3	8/26/2020	11:10:30	10.46	7.53
run3	8/26/2020	11:10:45	10.47	7.54
run3	8/26/2020	11:11:00	10.46	7.52
run3	8/26/2020	11:11:15	10.46	7.52
run3	8/26/2020	11:11:30	10.46	7.54
run3	8/26/2020	11:11:45	10.46	7.54
run3	8/26/2020	11:12:00	10.47	7.52
run3	8/26/2020	11:12:15	10.47	7.52
run3	8/26/2020	11:12:30	10.47	7.53
run3	8/26/2020	11:12:45	10.47	7.53
run3	8/26/2020	11:13:00	10.48	7.53
run3	8/26/2020	11:13:15	10.46	7.51
run3	8/26/2020	11:13:30	10.45	7.52
run3	8/26/2020	11:13:45	10.45	7.54
run3	8/26/2020	11:14:00	10.45	7.53
run3	8/26/2020	11:14:15	10.44	7.52
run3	8/26/2020	11:14:30	10.45	7.53
run3	8/26/2020	11:14:45	10.44	7.54
run3	8/26/2020	11:15:00	10.44	7.54
run3	8/26/2020	11:15:15	10.44	7.52
run3	8/26/2020	11:15:30	10.43	7.53
run3	8/26/2020	11:15:45	10.43	7.55
run3	8/26/2020	11:16:00	10.43	7.55
run3	8/26/2020	11:16:15	10.43	7.53
run3	8/26/2020	11:16:30	10.43	7.53
run3	8/26/2020	11:16:45	10.44	7.54
run3	8/26/2020	11:17:00	10.44	7.55
run3	8/26/2020	11:17:15	10.44	7.54
run3	8/26/2020	11:17:30	10.43	7.53
run3	8/26/2020	11:17:45	10.43	7.54
run3	8/26/2020	11:18:00	10.44	7.55
run3	8/26/2020	11:18:15	10.43	7.55
run3	8/26/2020	11:18:30	10.43	7.54
run3	8/26/2020	11:18:45	10.44	7.54
run3	8/26/2020	11:19:00	10.44	7.55
run3	8/26/2020	11:19:15	10.44	7.54
run3	8/26/2020	11:19:30	10.45	7.53
run3	8/26/2020	11:19:45	10.43	7.53
run3	8/26/2020	11:20:00	10.43	7.55
run3	8/26/2020	11:20:15	10.43	7.55
run3	8/26/2020	11:20:30	10.44	7.54
run3	8/26/2020	11:20:45	10.44	7.54
run3	8/26/2020	11:21:00	10.44	7.55
run3	8/26/2020	11:21:15	10.43	7.56
run3	8/26/2020	11:21:30	10.42	7.56
run3	8/26/2020	11:21:45	10.41	7.56
run3	8/26/2020	11:22:00	10.43	7.58
run3	8/26/2020	11:22:15	10.44	7.57
run3	8/26/2020	11:22:30	10.45	7.55
run3	8/26/2020	11:22:45	10.46	7.55
run3	8/26/2020	11:23:00	10.43	7.55
run3	8/26/2020	11:23:15	10.41	7.56
run3	8/26/2020	11:23:30	10.41	7.57
run3	8/26/2020	11:23:45	10.42	7.57
run3	8/26/2020	11:24:00	10.42	7.58
run3	8/26/2020	11:24:15	10.42	7.58
run3	8/26/2020	11:24:30	10.42	7.57
run3	8/26/2020	11:24:45	10.42	7.56
run3	8/26/2020	11:25:00	10.42	7.57
run3	8/26/2020	11:25:15	10.42	7.58
run3	8/26/2020	11:25:30	10.42	7.57
run3	8/26/2020	11:25:45	10.41	7.56
run3	8/26/2020	11:26:00	10.41	7.57
run3	8/26/2020	11:26:15	10.41	7.58
run3	8/26/2020	11:26:30	10.41	7.58
run3	8/26/2020	11:26:45	10.41	7.57
run3	8/26/2020	11:27:00	10.41	7.57
run3	8/26/2020	11:27:15	10.41	7.58
run3	8/26/2020	11:27:30	10.41	7.58
run3	8/26/2020	11:27:45	10.42	7.57

run3	8/26/2020	11:28:15	10.43	7.56
run3	8/26/2020	11:28:30	10.43	7.57
run3	8/26/2020	11:28:45	10.43	7.57
run3	8/26/2020	11:29:00	10.42	7.56
run3	8/26/2020	11:29:15	10.43	7.56
run3	8/26/2020	11:29:30	10.43	7.57
run3	8/26/2020	11:29:45	10.44	7.57
run3	8/26/2020	11:30:00	10.45	7.56
run3	8/26/2020	11:30:15	10.44	7.55
run3	8/26/2020	11:30:30	10.43	7.56
run3	8/26/2020	11:30:45	10.44	7.57
run3	8/26/2020	11:31:00	10.45	7.56
run3	8/26/2020	11:31:15	10.44	7.55
run3	8/26/2020	11:31:30	10.43	7.55
run3	8/26/2020	11:31:45	10.42	7.57
run3	8/26/2020	11:32:00	10.41	7.57
run3	8/26/2020	11:32:15	10.42	7.56
run3	8/26/2020	11:32:30	10.42	7.56
run3	8/26/2020	11:32:45	10.42	7.57
run3	8/26/2020	11:33:00	10.42	7.57
run3	8/26/2020	11:33:15	10.45	7.56
run3	8/26/2020	11:33:30	10.44	7.55
run3	8/26/2020	11:33:45	10.41	7.56
run3	8/26/2020	11:34:00	10.40	7.57
run3	8/26/2020	11:34:15	10.40	7.57
run3	8/26/2020	11:34:30	10.40	7.57
run3	8/26/2020	11:34:45	10.41	7.58
run3	8/26/2020	11:35:00	10.41	7.58
run3	8/26/2020	11:35:15	10.41	7.57
run3	8/26/2020	11:35:30	10.41	7.56
run3	8/26/2020	11:35:45	10.40	7.57
run3	8/26/2020	11:36:00	10.40	7.58
run3	8/26/2020	11:36:15	10.41	7.57
run3	8/26/2020	11:36:30	10.40	7.57
run3	8/26/2020	11:36:45	10.40	7.57
run3	8/26/2020	11:37:00	10.41	7.58
run3	8/26/2020	11:37:15	10.41	7.58
run3	8/26/2020	11:37:30	10.41	7.56
run3	8/26/2020	11:37:45	10.40	7.57
run3	8/26/2020	11:38:00	10.40	7.58
run3	8/26/2020	11:38:15	10.42	7.58
run3	8/26/2020	11:38:30	10.41	7.57
run3	8/26/2020	11:38:45	10.40	7.57
run3	8/26/2020	11:39:00	10.41	7.58
run3	8/26/2020	11:39:15	10.42	7.58
run3	8/26/2020	11:39:30	10.41	7.56
run3	8/26/2020	11:39:45	10.41	7.56
run3	8/26/2020	11:40:00	10.42	7.57
run3	8/26/2020	11:40:15	10.42	7.58
run3	8/26/2020	11:40:30	10.42	7.56
run3	8/26/2020	11:40:45	10.40	7.56
run3	8/26/2020	11:41:00	10.39	7.57
run3	8/26/2020	11:41:15	10.39	7.58
run3	8/26/2020	11:41:30	10.39	7.58
run3	8/26/2020	11:41:45	10.38	7.58
run3	8/26/2020	11:42:00	10.38	7.58
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run3	8/26/2020	11:42:30	10.40	7.58
run3	8/26/2020	11:42:45	10.39	7.57
run3	8/26/2020	11:43:00	10.39	7.58
run3	8/26/2020	11:43:15	10.40	7.59
run3	8/26/2020	11:43:30	10.41	7.58
run3	8/26/2020	11:43:45	10.41	7.56
run3	8/26/2020	11:44:00	10.40	7.57
run3	8/26/2020	11:44:15	10.40	7.58
run3	8/26/2020	11:44:30	10.40	7.58
run3	8/26/2020	11:44:45	10.40	7.57
run3	8/26/2020	11:45:00	10.40	7.57
run3	8/26/2020	11:45:15	10.40	7.59
run3	8/26/2020	11:45:30	10.39	7.59
run3	8/26/2020	11:45:45	10.40	7.57
run3	8/26/2020	11:46:15	10.39	7.57
run3	8/26/2020	11:46:30	10.38	7.59

run3	8/26/2020	11:46:45	10.39	7.60
run3	8/26/2020	11:47:00	10.39	7.59
run3	8/26/2020	11:47:15	10.39	7.58
run3	8/26/2020	11:47:30	10.39	7.59
run3	8/26/2020	11:47:45	10.37	7.59
run3	8/26/2020	11:48:00	10.37	7.59
run3	8/26/2020	11:48:15	10.38	7.59
run3	8/26/2020	11:48:30	10.38	7.60
run3	8/26/2020	11:48:45	10.38	7.60
run3	8/26/2020	11:49:00	10.39	7.60
run3	8/26/2020	11:49:15	10.39	7.58
run3	8/26/2020	11:49:30	10.38	7.58
run3	8/26/2020	11:49:45	10.38	7.60
run3	8/26/2020	11:50:00	10.38	7.60
run3	8/26/2020	11:50:15	10.39	7.59
run3	8/26/2020	11:50:30	10.38	7.59
run3	8/26/2020	11:50:45	10.38	7.60
run3	8/26/2020	11:51:00	10.38	7.60
run3	8/26/2020	11:51:15	10.38	7.59
run3	8/26/2020	11:51:30	10.37	7.59
run3	8/26/2020	11:51:45	10.38	7.60
run3	8/26/2020	11:52:00	10.38	7.61
run3	8/26/2020	11:52:15	10.39	7.59
run3	8/26/2020	11:52:30	10.39	7.59
run3	8/26/2020	11:52:45	10.39	7.59
run3	8/26/2020	11:53:00	10.38	7.60
run3	8/26/2020	12:05:00	10.39	7.57
run3	8/26/2020	12:05:15	10.39	7.59
run3	8/26/2020	12:05:30	10.40	7.60
run3	8/26/2020	12:05:45	10.40	7.60
run3	8/26/2020	12:06:00	10.39	7.57
run3	8/26/2020	12:06:15	10.39	7.59
run3	8/26/2020	12:06:30	10.39	7.60
run3	8/26/2020	12:06:45	10.40	7.59
run3	8/26/2020	12:07:00	10.40	7.58
run3	8/26/2020	12:07:15	10.40	7.59
run3	8/26/2020	12:07:30	10.40	7.60
run3	8/26/2020	12:07:45	10.40	7.60
run3	8/26/2020	12:08:00	10.40	7.59
run3	8/26/2020	12:08:15	10.40	7.58
run3	8/26/2020	12:08:30	10.40	7.60
run3	8/26/2020	12:08:45	10.40	7.60
run3	8/26/2020	12:09:00	10.39	7.58
run3	8/26/2020	12:09:15	10.39	7.59
run3	8/26/2020	12:09:30	10.40	7.60
run3	8/26/2020	12:09:45	10.40	7.61
run3	8/26/2020	12:10:00	10.39	7.59
run3	8/26/2020	12:10:15	10.38	7.59
run3	8/26/2020	12:10:30	10.40	7.60
run3	8/26/2020	12:10:45	10.39	7.60
run3	8/26/2020	12:11:00	10.39	7.59
run3	8/26/2020	12:11:15	10.37	7.59
run3	8/26/2020	12:11:30	10.39	7.60
run3	8/26/2020	12:11:45	10.39	7.61
run3	8/26/2020	12:12:00	10.39	7.60
run3	8/26/2020	12:12:15	10.39	7.58
run3	8/26/2020	12:12:30	10.39	7.59
run3	8/26/2020	12:12:45	10.40	7.60
run3	8/26/2020	12:13:00	10.39	7.59
run3	8/26/2020	12:13:15	10.38	7.59
run3	8/26/2020	12:13:30	10.39	7.60
run3	8/26/2020	12:13:45	10.40	7.61
run3	8/26/2020	12:14:00	10.40	7.60
run3	8/26/2020	12:14:15	10.39	7.58
run3	8/26/2020	12:14:30	10.39	7.59
run3	8/26/2020	12:14:45	10.40	7.60
run3	8/26/2020	12:15:00	10.40	7.60
run3	8/26/2020	12:15:15	10.40	7.58
run3	8/26/2020	12:15:30	10.39	7.58
run3	8/26/2020	12:15:45	10.39	7.60
run3	8/26/2020	12:16:00	10.40	7.60
run3	8/26/2020	12:16:15	10.39	7.58
run3	8/26/2020	12:16:30	10.40	7.58

run3	8/26/2020	12:16:45	10.39	7.59
run3	8/26/2020	12:17:00	10.37	7.60
run3	8/26/2020	12:17:15	10.37	7.60
run3	8/26/2020	12:17:30	10.37	7.60
run3	8/26/2020	12:17:45	10.36	7.61
run3	8/26/2020	12:18:00	10.36	7.62
run3	8/26/2020	12:18:15	10.37	7.61
run3	8/26/2020	12:18:30	10.39	7.60
run3	8/26/2020	12:18:45	10.39	7.61
run3	8/26/2020	12:19:00	10.39	7.60
run3	8/26/2020	12:19:15	10.39	7.59
run3	8/26/2020	12:19:30	10.39	7.59
run3	8/26/2020	12:19:45	10.40	7.60
run3	8/26/2020	12:20:00	10.40	7.60
run3	8/26/2020	12:20:15	10.39	7.59
run3	8/26/2020	12:20:30	10.38	7.58
run3	8/26/2020	12:20:45	10.40	7.60
run3	8/26/2020	12:21:00	10.40	7.60
run3	8/26/2020	12:21:15	10.40	7.59
run3	8/26/2020	12:21:30	10.38	7.58
run3	8/26/2020	12:21:45	10.38	7.60
run3	8/26/2020	12:22:00	10.39	7.61
run3	8/26/2020	12:22:30	10.38	7.61
run3	8/26/2020	12:22:45	10.38	7.59
run3	8/26/2020	12:23:00	10.38	7.60
run3	8/26/2020	12:23:15	10.38	7.61
run3	8/26/2020	12:23:30	10.38	7.60
run3	8/26/2020	12:23:45	10.40	7.59
run3	8/26/2020	12:24:00	10.40	7.58
run3	8/26/2020	12:24:15	10.41	7.59
run3	8/26/2020	12:24:30	10.41	7.58
run3	8/26/2020	12:24:45	10.42	7.57
run3	8/26/2020	12:25:00	10.47	7.56
run3	8/26/2020	12:25:15	10.45	7.56
run3	8/26/2020	12:25:30	10.42	7.56
run3	8/26/2020	12:25:45	10.40	7.56
run3	8/26/2020	12:26:00	10.38	7.57
run3	8/26/2020	12:26:15	10.39	7.59
run3	8/26/2020	12:26:30	10.38	7.61
run3	8/26/2020	12:26:45	10.39	7.59
run3	8/26/2020	12:27:00	10.39	7.58
run3	8/26/2020	12:27:15	10.40	7.58
run3	8/26/2020	12:27:30	10.40	7.60
run3	8/26/2020	12:27:45	10.40	7.59
run3	8/26/2020	12:28:00	10.41	7.58
run3	8/26/2020	12:28:15	10.39	7.58
run3	8/26/2020	12:28:30	10.37	7.60
run3	8/26/2020	12:28:45	10.38	7.60
run3	8/26/2020	12:29:00	10.39	7.60
run3	8/26/2020	12:29:15	10.38	7.59
run3	8/26/2020	12:29:30	10.37	7.60
run3	8/26/2020	12:29:45	10.37	7.61
run3	8/26/2020	12:30:00	10.38	7.61
run3	8/26/2020	12:30:15	10.39	7.59
run3	8/26/2020	12:30:30	10.39	7.60
run3	8/26/2020	12:30:45	10.38	7.60
run3	8/26/2020	12:31:00	10.37	7.60
run3	8/26/2020	12:31:15	10.37	7.60
run3	8/26/2020	12:31:30	10.37	7.61
run3	8/26/2020	12:31:45	10.37	7.61
run3	8/26/2020	12:32:00	10.37	7.60
run3	8/26/2020	12:32:15	10.37	7.60
run3	8/26/2020	12:32:30	10.37	7.61
run3	8/26/2020	12:32:45	10.36	7.62
run3	8/26/2020	12:33:00	10.37	7.61
run3	8/26/2020	12:33:15	10.37	7.60
run3	8/26/2020	12:33:30	10.38	7.61
run3	8/26/2020	12:33:45	10.37	7.61
run3	8/26/2020	12:34:00	10.36	7.61
run3	8/26/2020	12:34:15	10.35	7.61
run3	8/26/2020	12:34:30	10.34	7.61
run3	8/26/2020	12:34:45	10.38	7.63
run3	8/26/2020	12:35:00	10.46	7.61

run3	8/26/2020	12:35:15	10.42	7.57
run3	8/26/2020	12:35:30	10.40	7.56
run3	8/26/2020	12:35:45	10.39	7.59
run3	8/26/2020	12:36:00	10.36	7.60
run3	8/26/2020	12:36:15	10.35	7.60
run3	8/26/2020	12:36:30	10.37	7.61
run3	8/26/2020	12:36:45	10.36	7.62
run3	8/26/2020	12:37:00	10.36	7.62
run3	8/26/2020	12:37:15	10.36	7.61
run3	8/26/2020	12:37:30	10.37	7.61
run3	8/26/2020	12:37:45	10.38	7.61
run3	8/26/2020	12:38:00	10.38	7.62
run3	8/26/2020	12:38:15	10.36	7.60
run3	8/26/2020	12:38:30	10.34	7.60
run3	8/26/2020	12:38:45	10.35	7.62
run3	8/26/2020	12:39:00	10.36	7.63
run3	8/26/2020	12:39:15	10.36	7.62
run3	8/26/2020	12:39:30	10.36	7.61
run3	8/26/2020	12:39:45	10.35	7.61
run3	8/26/2020	12:40:00	10.35	7.62
run3	8/26/2020	12:40:30	10.34	7.63
run3	8/26/2020	12:40:45	10.37	7.61
run3	8/26/2020	12:41:00	10.36	7.61
run3	8/26/2020	12:41:15	10.34	7.62
run3	8/26/2020	12:41:30	10.34	7.63
run3	8/26/2020	12:41:45	10.34	7.62
run3	8/26/2020	12:42:00	10.36	7.62
run3	8/26/2020	12:42:15	10.38	7.63
run3	8/26/2020	12:42:30	10.39	7.61
run3	8/26/2020	12:42:45	10.37	7.60
run3	8/26/2020	12:43:00	10.37	7.59
run3	8/26/2020	12:43:15	10.38	7.61
run3	8/26/2020	12:43:30	10.40	7.61
run3	8/26/2020	12:43:45	10.41	7.59
run3	8/26/2020	12:44:00	10.40	7.57
run3	8/26/2020	12:44:15	10.36	7.59
run3	8/26/2020	12:44:30	10.34	7.61
run3	8/26/2020	12:44:45	10.33	7.62
run3	8/26/2020	12:45:00	10.35	7.62
run3	8/26/2020	12:45:15	10.39	7.63
run3	8/26/2020	12:45:30	10.56	7.61
run3	8/26/2020	12:45:45	10.63	7.52
run3	8/26/2020	12:46:00	10.64	7.45
run3	8/26/2020	12:46:15	10.63	7.43
run3	8/26/2020	12:46:30	10.63	7.43
run3	8/26/2020	12:46:45	10.63	7.42
run3	8/26/2020	12:47:00	10.62	7.41
run3	8/26/2020	12:47:15	10.62	7.43
run3	8/26/2020	12:47:30	10.63	7.44
run3	8/26/2020	12:47:45	10.61	7.42
run3	8/26/2020	12:48:00	10.57	7.42
run3	8/26/2020	12:48:15	10.55	7.45
run3	8/26/2020	12:48:30	10.57	7.47
run3	8/26/2020	12:48:45	10.59	7.46
run3	8/26/2020	12:49:00	10.61	7.44
run3	8/26/2020	12:49:15	10.61	7.44
run3	8/26/2020	12:49:30	10.61	7.44
run3	8/26/2020	12:49:45	10.61	7.43
run3	8/26/2020	12:50:00	10.63	7.42
run3	8/26/2020	12:50:15	10.63	7.42
run3	8/26/2020	12:50:30	10.59	7.43
run3	8/26/2020	12:50:45	10.58	7.44
run3	8/26/2020	12:51:00	10.62	7.43
run3	8/26/2020	12:51:15	10.63	7.43
run3	8/26/2020	12:51:30	10.64	7.43
run3	8/26/2020	12:51:45	10.66	7.42
run3	8/26/2020	12:52:00	10.66	7.40
run3	8/26/2020	12:52:15	10.64	7.39
run3	8/26/2020	12:52:30	10.62	7.41
run3	8/26/2020	12:52:45	10.61	7.42
run3	8/26/2020	12:53:00	10.61	7.42
run3	8/26/2020	12:53:15	10.62	7.42
run3	8/26/2020	12:53:30	10.61	7.43

run3	8/26/2020	12:53:45	10.62	7.43
run3	8/26/2020	12:54:00	10.60	7.42
run3	8/26/2020	12:54:15	10.57	7.42
run3	8/26/2020	12:54:30	10.73	7.44
run3	8/26/2020	12:54:45	10.89	7.40
run3	8/26/2020	12:55:00	10.64	7.31
run3	8/26/2020	12:55:15	10.45	7.34
run3	8/26/2020	12:55:30	10.37	7.46
run3	8/26/2020	12:55:45	10.34	7.57
run3	8/26/2020	12:56:00	10.35	7.61
run3	8/26/2020	12:56:15	10.37	7.61
run3	8/26/2020	12:56:30	10.39	7.60
run3	8/26/2020	12:56:45	10.38	7.60
run3	8/26/2020	12:57:00	10.37	7.60
run3	8/26/2020	12:57:15	10.36	7.59
run3	8/26/2020	12:57:30	10.34	7.59
run3	8/26/2020	12:57:45	10.32	7.62
run3	8/26/2020	12:58:00	10.30	7.63
run3	8/26/2020	12:58:30	10.29	7.64
run3	8/26/2020	12:58:45	10.27	7.64
run3	8/26/2020	12:59:00	10.27	7.67
run3	8/26/2020	12:59:15	10.30	7.67
run3	8/26/2020	12:59:30	10.33	7.65
run3	8/26/2020	12:59:45	10.34	7.63
run3	8/26/2020	13:00:00	10.33	7.63
run3	8/26/2020	13:00:15	10.31	7.64
run3	8/26/2020	13:00:30	10.31	7.63
run3	8/26/2020	13:00:45	10.32	7.63
run3	8/26/2020	13:01:00	10.31	7.63
run3	8/26/2020	13:01:15	10.32	7.65
run3	8/26/2020	13:01:30	10.33	7.64
run3	8/26/2020	13:01:45	10.33	7.62
run3	8/26/2020	13:02:00	10.33	7.62
run3	8/26/2020	13:02:15	10.31	7.64
run3	8/26/2020	13:02:30	10.31	7.64
run3	8/26/2020	13:02:45	10.29	7.63
run3	8/26/2020	13:03:00	10.27	7.64
run3	8/26/2020	13:03:15	10.28	7.66
run3	8/26/2020	13:03:30	10.29	7.66
run3	8/26/2020	13:03:45	10.29	7.64
run3	8/26/2020	13:04:00	10.29	7.65
run3	8/26/2020	13:04:15	10.29	7.66
run3	8/26/2020	13:04:30	10.29	7.66
run3	8/26/2020	13:04:45	10.48	7.64
run3	8/26/2020	13:05:00	10.70	7.56
run3	8/26/2020	13:05:15	10.52	7.45
run3	8/26/2020	13:05:30	10.37	7.46
run3	8/26/2020	13:05:45	10.32	7.54
run3	8/26/2020	13:06:00	10.29	7.59
run3	8/26/2020	13:06:15	10.29	7.63
run3	8/26/2020	13:06:30	10.29	7.65
run3	8/26/2020	13:06:45	10.29	7.65
run3	8/26/2020	13:07:00	10.28	7.64
run3	8/26/2020	13:07:15	10.29	7.65
run3	8/26/2020	13:07:30	10.30	7.66
run3	8/26/2020	13:07:45	10.30	7.65
run3	8/26/2020	13:08:00	10.31	7.63
run3	8/26/2020	13:08:15	10.32	7.62
run3	8/26/2020	13:08:30	10.32	7.64
run3	8/26/2020	13:08:45	10.31	7.64
run3	8/26/2020	13:09:00	10.32	7.62
run3	8/26/2020	13:09:15	10.31	7.62
run3	8/26/2020	13:09:30	10.30	7.63
run3	8/26/2020	13:09:45	10.30	7.65
run3	8/26/2020	13:10:00	10.30	7.64
run3	8/26/2020	13:10:15	10.31	7.63
run3	8/26/2020	13:10:30	10.32	7.63
run3	8/26/2020	13:10:45	10.31	7.64
run3	8/26/2020	13:11:00	10.31	7.63
run3	8/26/2020	13:11:15	10.31	7.62
run3	8/26/2020	13:11:30	10.30	7.63
run3	8/26/2020	13:11:45	10.31	7.65
run3	8/26/2020	13:12:00	10.31	7.65

run3	8/26/2020	13:12:15	10.30	7.63
run3	8/26/2020	13:12:30	10.29	7.63
run3	8/26/2020	13:12:45	10.29	7.65
run3	8/26/2020	13:13:00	10.30	7.65
run3	8/26/2020	13:13:15	10.30	7.64
run3	8/26/2020	13:13:30	10.30	7.63
run3	8/26/2020	13:13:45	10.30	7.64
run3	8/26/2020	13:14:00	10.30	7.65
run3	8/26/2020	13:14:15	10.31	7.63
run3	8/26/2020	13:14:30	10.31	7.63
run3	8/26/2020	13:14:45	10.30	7.63
run3	8/26/2020	13:15:00	10.31	7.64
run3	8/26/2020	13:15:15	10.50	7.62
run3	8/26/2020	13:15:30	10.53	7.55
run3	8/26/2020	13:15:45	10.40	7.50
run3	8/26/2020	13:16:00	10.33	7.54
run3	8/26/2020	13:16:15	10.30	7.60
run3	8/26/2020	13:16:45	10.29	7.62
run3	8/26/2020	13:17:00	10.30	7.63
run3	8/26/2020	13:17:15	10.30	7.65
run3	8/26/2020	13:17:30	10.30	7.65
run3	8/26/2020	13:17:45	10.29	7.63
run3	8/26/2020	13:18:00	10.30	7.63
run3	8/26/2020	13:18:15	10.30	7.64
run3	8/26/2020	13:18:30	10.30	7.64
run3	8/26/2020	13:18:45	10.29	7.63
run3	8/26/2020	13:19:00	10.29	7.63
run3	8/26/2020	13:19:15	10.30	7.64
run3	8/26/2020	13:19:30	10.30	7.65
run3	8/26/2020	13:19:45	10.30	7.64
run3	8/26/2020	13:20:00	10.31	7.62
run3	8/26/2020	13:20:15	10.30	7.63
run3	8/26/2020	13:20:30	10.29	7.64
run3	8/26/2020	13:20:45	10.29	7.65
run3	8/26/2020	13:21:00	10.28	7.64
run3	8/26/2020	13:21:15	10.29	7.64
run3	8/26/2020	13:21:30	10.30	7.65
run3	8/26/2020	13:21:45	10.30	7.65
run3	8/26/2020	13:22:00	10.30	7.63
run3	8/26/2020	13:22:15	10.29	7.63
run3	8/26/2020	13:22:30	10.30	7.65
run3	8/26/2020	13:22:45	10.30	7.65
run3	8/26/2020	13:23:00	10.31	7.64
run3	8/26/2020	13:23:15	10.31	7.63
run3	8/26/2020	13:23:30	10.31	7.63
run3	8/26/2020	13:23:45	10.30	7.64
run3	8/26/2020	13:24:00	10.29	7.63
run3	8/26/2020	13:24:15	10.28	7.63
run3	8/26/2020	13:24:30	10.31	7.65
run3	8/26/2020	13:24:45	10.43	7.65
run3	8/26/2020	13:25:00	10.40	7.60
run3	8/26/2020	13:25:15	10.34	7.57
run3	8/26/2020	13:25:30	10.31	7.59
run3	8/26/2020	13:25:45	10.32	7.63
run3	8/26/2020	13:26:00	10.33	7.64
run3	8/26/2020	13:26:15	10.31	7.62
run3	8/26/2020	13:26:30	10.32	7.62
run3	8/26/2020	13:26:45	10.32	7.63
run3	8/26/2020	13:27:00	10.32	7.64
run3	8/26/2020	13:27:15	10.31	7.63
run3	8/26/2020	13:27:30	10.31	7.63
run3	8/26/2020	13:27:45	10.31	7.64
run3	8/26/2020	13:28:00	10.30	7.65
run3	8/26/2020	13:28:15	10.31	7.64
run3	8/26/2020	13:28:30	10.31	7.63
run3	8/26/2020	13:28:45	10.29	7.64
run3	8/26/2020	13:29:00	10.29	7.66
run3	8/26/2020	13:29:15	10.29	7.65
run3	8/26/2020	13:29:30	10.30	7.64
run3	8/26/2020	13:29:45	10.30	7.64
run3	8/26/2020	13:30:00	10.31	7.65
run3	8/26/2020	13:30:15	10.30	7.64
run3	8/26/2020	13:30:30	10.29	7.64

run3	8/26/2020	13:30:45	10.29	7.64								
run3	8/26/2020	13:31:00	10.29	7.66								
run3	8/26/2020	13:31:15	10.29	7.66								
run3	8/26/2020	13:31:30	10.29	7.65								
run3	8/26/2020	13:31:45	10.30	7.64								
run3	8/26/2020	13:32:00	10.31	7.65								
run3	8/26/2020	13:32:15	10.31	7.65								
run3	8/26/2020	13:32:30	10.31	7.64								
run3	8/26/2020	13:32:45	10.30	7.63								
run3	8/26/2020	13:33:00	10.31	7.64								
run3	8/26/2020	13:33:15	10.32	7.65								
run3	8/26/2020	13:33:30	10.32	7.64								
run3	8/26/2020	13:33:45	10.32	7.62								
run3	8/26/2020	13:34:00	10.32	7.63								
run3	8/26/2020	13:34:15	10.32	7.65								
run3	8/26/2020	13:34:45	10.32	7.64								
run3	8/26/2020	13:35:00	10.31	7.62								
run3	8/26/2020	13:35:15	10.31	7.63								
run3	8/26/2020	13:35:30	10.32	7.65								
run3	8/26/2020	13:35:45	10.31	7.64								
run3	8/26/2020	13:36:00	10.31	7.63								
run3	8/26/2020	13:36:15	10.31	7.64								
run3	8/26/2020	13:36:30	10.31	7.65								
run3	8/26/2020	13:36:45	10.30	7.65								
run3	8/26/2020	13:37:00	10.29	7.63								
run3	8/26/2020	13:37:15	10.28	7.65								
run3	8/26/2020	13:37:30	10.28	7.66								
run3	8/26/2020	13:37:45	10.29	7.67								
run3	8/26/2020	13:38:00	10.29	7.66								
run3	8/26/2020	13:38:15	10.30	7.65								
run3	8/26/2020	13:38:30	10.29	7.66								
run3	8/26/2020	13:38:45	10.29	7.66								
run3	8/26/2020	13:39:00	10.30	7.65								
run3	8/26/2020	13:39:15	10.30	7.65								
run3	8/26/2020	13:39:30	10.29	7.66								
run3	8/26/2020	13:39:45	10.30	7.67								
run3	8/26/2020	13:40:00	10.30	7.66								
run3	8/26/2020	13:40:15	10.30	7.64								
run3	8/26/2020	13:40:30	10.30	7.65								
run3	8/26/2020	13:40:45	10.31	7.66								
run3	8/26/2020	13:41:00	10.31	7.65								
run3	8/26/2020	13:41:15	10.31	7.64								
run3	8/26/2020	13:41:30	10.30	7.64								
run3	8/26/2020	13:41:45	10.29	7.66								
run3	8/26/2020	13:42:00	10.28	7.66								
run3	8/26/2020	13:42:15	10.28	7.65								
run3	8/26/2020	13:42:30	10.30	7.65								
run3	8/26/2020	13:42:45	10.30	7.66								
run3	8/26/2020	13:43:00	10.31	7.66								
run3	8/26/2020	13:43:15	10.30	7.64								
run3	8/26/2020	13:43:30	10.30	7.64								
run3	8/26/2020	13:43:45	10.29	7.65								
run3	8/26/2020	13:44:00	10.29	7.66								
run3	8/26/2020	13:44:15	10.28	7.65								
run3	8/26/2020	13:44:30	10.27	7.65								
run3	8/26/2020	13:44:45	10.27	7.67								
run3	8/26/2020	13:45:00	10.28	7.68								
run3	8/26/2020	13:45:15	10.28	7.66								
run3	8/26/2020	13:45:30	10.29	7.60								
run3	8/26/2020	13:45:45	10.29	7.62								
averun3	8/26/2020	10:13:30	10.38	7.59								
o2zero1	8/26/2020	13:52:15	-0.03	0.10	N2/cg1	N2	0		0	0		
co2zero1	8/26/2020	13:52:15	-0.03	0.10	N2/cg1	N2	0		0	0		
o2span1	8/26/2020	13:56:30	9.86	11.88	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2
co2span1	8/26/2020	13:56:30	9.86	11.88	CC480487/cg3	O2	9.93	CO2	11.8	O2	0	CO2
End												

9.0 Appendix D: Auxiliary Boiler Process Operational

9.1 Auxiliary Boiler Operational Summaries

RE: Emission Test Fuel Combusted

Scott Briggs <scottb@orrcorecycles.com>
Fri 10/30/2020 1:37 PM

To: ETS LLC <etsllc@msn.com>
Cc: Marie E. Piper <marieatcascade@gmail.com>

Andy,
Here is the firing rate for the 3 tests. Let me know if you need anything else.

Thanks,
Scott

Source Test Fuel Burned Tank F1							
8/25/2020	Start Time	End Time	Start Gallons	End Gallons	Gallons Burned	Minutes	Firing Rate GPH
High Fire Run #1	9:30 AM	2:15 PM	828	757	71	285	14.95
High Fire Run #2	3:50 AM	6:20	741	703	38	150	15.2
8/26/2020							
High Fire Run #3	9:10	2:00 PM	681.3	609.3	72	290	14.9

From: ETS LLC <etsllc@msn.com>
Sent: Friday, October 30, 2020 11:24 AM
To: Scott Briggs <scottb@orrcorecycles.com>
Cc: Marie E. Piper <marieatcascade@gmail.com>
Subject: Emission Test Fuel Combusted

Hi Scott,
ODEQ would like us to report the air emissions we measured on a *process rate/hr. basis* in other words pounds of pollutant per 1000 gallons of waste oil combusted (lbs./1000 gal. combusted). When you have a chance, we are ready for the fuel measurements recorded during the test (gal./hr.). If you have any questions give me a call.

Thanks again,

Andy Winkler
Sr. Project Manager
ETS
Environmental Technical Services
Office: (541) 779-2646
Cell: (541) 941-6748
Website: etsstacktesting.org

FW: Attached Image

Scott Briggs <scottb@orrcorecycles.com>
Mon 11/16/2020 4:35 PM
To: ETS LLC <etsllc@msn.com>

1 attachments (77 KB)
1671_001.pdf;

Hello Andy
Here is the signed page and the temperatures (it was all one batch of 11,084 gallons):

Day 1
10:32 = 93F 13:34 = 167F
16:00 = 180F 19:32 = 185F

Day 2
10:13 = 157F 13:45 = 190F

Thanks,
Scott

From: Copier <copier@orrcorecycles.com>
Sent: Monday, November 16, 2020 4:16 PM
To: Scott Briggs <scottb@orrcorecycles.com>
Subject: Attached Image

10.0 Appendix E: Project Quality Assurance Documentation

10.1 EPA Methods 1-4 and 29 Sample Equipment QA/QC
- 10.1.1 Dry Gas Meter Calibrations
- 10.1.2 Thermocouple Calibrations
- 10.1.3 Pitot Tube Calibration
- 10.1.4 Nozzle Calibration
- 10.1.5 Example Equations for EPA 29

10.2 EPA Methods 1-4 and 23 Sample Equipment QA/QC
- 10.2.1 Dry Gas Meter Calibrations
- 10.2.2 Thermocouple Calibrations
- 10.2.3 Pitot Tube Calibration
- 10.2.4 Nozzle Calibration
- 10.2.5 Field Barometer Calibration
- 10.2.6 Example Equations for EPA 23

10.3 EPA Method 3A CEMs QA/QC
- 10.3.1 Cylinder Gas Certification Sheets
- 10.3.2 Sampling System Response Time, CEM Leak Checks
- 10.3.3 Stratification Check
- 10.3.4 CEMS Sampling Traverse Points
- 10.3.5 Analyzer Interference Check

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

Quality - Service - Reliability

DATE: 4/1/2020
METER Box #: HF-4

METER SERIAL #: 1370
CRITICAL ORIFICE SET SERIAL #: 1754s

Metering System Leak Check: Passed @ 7 (in) H_2O

BAROMETRIC PRESSURE (in Hg): INITIAL 28.75 | FINAL 28.75 | AVG (P_{bar}) 28.75

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	$\Delta H_@$
29	1	0.8178	-15	634.992	640.286	5.294	56	58	59	57	57	58	5.00	3.4	5.2338	5.1768	0.989		1.76
	2	0.8178	-15	640.286	645.570	5.284	56	59	60	57	57	58	5.00	3.4	5.2189	5.1768	0.992		1.76
	3	0.8178	-15	645.570	650.824	5.254	56	60	61	57	57	59	5.00	3.4	5.1843	5.1768	0.999		1.76
																AVG =	0.993	0.23	
25	1	0.6946	-16.5	650.824	656.292	5.468	56	61	62	57	58	60	6.00	2.4	5.3740	5.2763	0.982		1.72
	2	0.6946	-16.5	656.292	661.714	5.422	56	62	62	58	58	60	6.00	2.4	5.3236	5.2763	0.991		1.71
	3	0.6946	-16.5	661.714	667.153	5.439	56	62	63	58	58	60	6.00	2.4	5.3378	5.2763	0.988		1.71
																AVG =	0.987	-0.38	
19	1	0.5351	-18	667.153	672.038	4.885	56	62	62	58	59	60	7.00	1.4	4.7819	4.7422	0.992		1.68
	2	0.5351	-18	672.038	676.924	4.886	56	62	62	59	59	61	7.00	1.4	4.7806	4.7422	0.992		1.68
	3	0.5351	-18	676.924	681.815	4.891	57	62	62	59	59	61	7.00	1.4	4.7855	4.7376	0.990		1.68
																AVG =	0.991	0.03	
16	1	0.4549	-19	681.815	687.162	5.347	57	61	61	59	59	60	9.00	1.0	5.2313	5.1782	0.990		1.66
	2	0.4549	-19	687.162	692.506	5.344	57	61	61	59	59	60	9.00	1.0	5.2284	5.1782	0.990		1.66
	3	0.4549	-19	692.506	697.832	5.326	57	61	61	59	59	60	9.00	1.0	5.2108	5.1782	0.994		1.66
																AVG =	0.991	0.05	
12	1	0.3351	-20.5	618.000	623.659	5.659	54	57	57	55	56	56	13.00	0.53	5.5701	5.5259	0.992		1.62
	2	0.3351	-20.5	623.659	629.317	5.658	55	57	58	56	56	57	13.00	0.53	5.5638	5.5206	0.992		1.63
	3	0.3351	-20.5	629.317	634.992	5.675	55	58	58	56	57	57	13.00	0.53	5.5751	5.5206	0.990		1.62
																AVG =	0.992	0.06	

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

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.991

AVERAGE $\Delta H_@$ = 1.69

(1) $$Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm}$$

= Net volume of gas sample passed through DGM, corrected to standard conditions
K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)
T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $$Vcr_{(std)} = K' * \frac{Pbar * \Theta}{\sqrt{Tamb}}$$

= Volume of gas sample passed through the critical orifice, corrected to standard conditions
T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)
K' = Average K' factor from Critical Orifice Calibration

(3) $$Y = \frac{Vcr_{(std)}}{Vm_{(std)}}$$

= DGM calibration factor

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

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METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

Quality - Service - Reliability

HF-29

DATE: 8/31/20 | METER SERIAL #: 1370 | BAROMETRIC PRESSURE (in Hg): INITIAL 28.68, FINAL 28.68, AVG (P_{bar}) 28.68

METER PART #: HF-4 | CRITICAL ORIFICE SET SERIAL #: 1754s

Initial Y value: 0.991

Metering System Leak Check: Passed @ 8 (in) H_2O | Initial DH@ value: 1.69

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	$\Delta H_@$
19	1	0.5351	-18.5	122.800	126.310	3.510	67	69	70	69	69	69	5.00	1.4	3.3693	3.3435	0.992	0.2%	1.69
	2	0.5351	-18.5	126.310	129.828	3.518	69	70	71	69	69	70	5.00	1.4	3.3737	3.3372	0.989	-0.1%	1.70
	3	0.5351	-18.5	129.828	133.347	3.519	69	71	71	69	69	70	5.00	1.4	3.3731	3.3372	0.989	-0.1%	1.69
																AVG =	0.990		

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

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

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.990

AVERAGE $\Delta H_@$ = 1.69

(1) $$Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm}$$

= Net volume of gas sample passed through DGM, corrected to standard conditions

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

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

(2) $$Vcr_{(std)} = K' * \frac{Pbar * \Theta}{\sqrt{Tamb}}$$

= Volume of gas sample passed through the critical orifice, corrected to standard conditions

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

K' = Average K' factor from Critical Orifice Calibration

(3) $$Y = \frac{Vcr_{(std)}}{Vm_{(std)}}$$

= DGM calibration factor

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

Post Calibration Difference

Difference from Initial Y value: -0.1%

Difference from Initial DH@ value: 0.2%

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METHOD 5 CRITICAL ORIFICE CALIBRATION

Environmental Supply Company, Inc.

CRITICAL ORIFICE SET S/N: 1754s

DATE: March 16, 2020

REFERENCE DRY GAS METER
SERIAL NUMBER: 16300942
CALIBRATION FACTOR, Yc: 0.997

LEAK CHECK: Passed

ORIFICE #	RUN #	CRITICAL VACUUM (in Hg)	TESTED VACUUM (in Hg)	Barometric Pressure per Orifice AVG (P_{bar})	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	K' FACTOR (english)	K' FACTOR (metric-liters)	K' FACTOR (metric-m^3)	K' FACTOR VARIATION (%)
29	1	15	18	30.11	832.531	838.927	6.396	68.5	72.2	72.2	71.8	71.9	72.03	6.00	3.78	0.8178	0.6796	6.7957E-04	0.01
	2	15	18		838.927	845.322	6.395	68.5	72.1	72.1	71.9	72.0	72.03	6.00	3.78	0.8177	0.6795	6.7946E-04	-0.01
															AVG K' FACTOR =	0.8178	0.6795	6.795E-04	
25	1	15	18	30.10	845.322	851.678	6.356	68.4	72.1	71.9	72.1	72.0	72.03	7.00	2.74	0.6948	0.5773	5.7733E-04	0.02
	2	15	18		851.678	858.030	6.352	68.7	72.0	72.0	72.1	72.3	72.10	7.00	2.74	0.6944	0.5771	5.7705E-04	-0.02
															AVG K' FACTOR =	0.6946	0.5772	5.772E-04	
19	1	15	18	30.10	858.030	863.638	5.608	68.7	71.9	71.8	72.2	72.2	72.03	8.00	1.67	0.5352	0.4447	4.4469E-04	0.02
	2	15	18		863.638	869.244	5.606	68.7	71.9	71.7	72.2	72.2	72.00	8.00	1.67	0.5350	0.4445	4.4455E-04	-0.02
															AVG K' FACTOR =	0.5351	0.4446	4.446E-04	
16	1	15	18	30.10	869.244	875.210	5.966	68.7	71.7	71.8	72.1	72.3	71.98	10.00	1.21	0.4550	0.3781	3.7807E-04	0.02
	2	15	18		875.210	881.173	5.963	69.0	71.9	71.8	72.3	72.3	72.08	10.00	1.21	0.4548	0.3779	3.7792E-04	-0.02
															AVG K' FACTOR =	0.4549	0.3780	3.780E-04	
12	1	15	18	30.10	881.173	886.460	5.287	69.1	72.1	71.9	72.3	72.5	72.20	12.00	0.65	0.3355	0.2788	2.7881E-04	0.11
	2	15	18		886.460	891.736	5.276	69.1	72.1	72.1	72.5	72.5	72.30	12.00	0.65	0.3348	0.2782	2.7818E-04	-0.11
															AVG K' FACTOR =	0.3351	0.2785	2.785E-04	

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
Calculate the standard volumes of air passed through the DGM and the critical orifices, and calculate the DGM calibration factor, Y, using the equations in US EPA Method 5, Section 16.2.3.3 (these equations are programmed on the spreadsheet included with each orifice set)

K' = Critical orifice coefficient,

$[(ft^3)(°R)^{1/2}]/[(in.Hg)(min.)]$ - English Units

$[(liters)(°K)^{1/2}]/[(mm\ Hg)(min.)]$ - Metric-Liters Units

$[(m^3)(°K)^{1/2}]/[(mm\ Hg)(min.)]$ - Metric Units

Critical Orifice Set number 1754s was calibrated in accordance with the Code of Federal Regulations, Title 40, Part 60, Appendix A, Method 5, Section 7.2

Signature

03/16/20
Date

2^9

THERMOMETER AND THERMOCOUPLE
IDENTIFICATION AND CALIBRATION

THERMOCOUPLE SYSTEM IDENTIFICATION

CONTROL UMBILICAL ID #: UMB 25.12

THERMOCOUPLE ID #: M5.4.1

CALIBRATION DATE: 3/17/2020

CALIBRATED BY: CAR

CALIBRATION PROCEDURE FOLLOWING APPROVED ALTERNATIVE METHOD (ALT-011)

Reference Meter
Manufacturer: Omega
Model: CL3512A
Type K Calibrator
SN # 19000490
Date of Cert: 9/23/2019

Reference Thermocouple
Manufacturer: Omega
Model: TJ36/48 Series Thermocouple Type K
ASTM Cert. # C020668R00
Exp. Date: 2/18/2021

READING	REFERENCE THERMOMETER °F	TEST THERMOMETER °F
I	33.8	33.7
II	33.8	33.7
III	33.8	33.7
AVERAGE °F:	34	34

PERCENT DIFFERENCE OF ABSOLUTE READINGS:

ALLOWABLE	1.5 %
ACTUAL	0.02%

READING	REFERENCE THERMOMETER °F	TEST THERMOMETER °F
I	211.0	212.0
II	211.0	212.0
III	211.0	212.0
AVERAGE °F:	211	212

PERCENT DIFFERENCE OF ABSOLUTE READINGS:

ALLOWABLE	1.5 %
ACTUAL	0.15%

THERMOMETER AND THERMOCOUPLE
IDENTIFICATION AND CALIBRATION

THERMOCOUPLE SYSTEM IDENTIFICATION

CONTROL UMBILICAL ID #: UMB 25.4

THERMOCOUPLE ID #: M5.4.1

JOB #: 2020.2232

TEST DATE: 8/25-26/2020

CALIBRATED DATE: 8/26/2020

CALIBRATED BY: GMW

CALIBRATION PROCEDURE FOLLOWING APPROVED ALTERNATIVE METHOD (ALT-011)

Because of the inherent accuracy and precision of the thermocouple within ±1.3°F in the range of -32°F to 2500°F, the two-point post-test calibration procedure may be replaced with a single-point check. A single-point calibration procedure that checks the operation of a thermocouple system within ±1.0 percent of the absolute measured temperature is all that is necessary to check the system for the presence of disconnected wire junctions, other loose connections, or a potential miscalibrated emf readout. A system that performs accurately at one temperature is expected to behave similarly at other temperatures.

Reference Meter
Manufacturer: Omega
Model: CL3512A
Type K Calibrator
SN # 19000490
Date of Cert: 9/23/2019

Reference Thermocouple
Manufacturer: Omega
Model: TJ36/48
Serial Number: OM-121123892-1
Exp. Date: 2/18/2021

READING	REFERENCE THERMOMETER °F	TEST THERMOMETER °F
I	98.0	99.0
II	98.0	99.0
III	98.0	99.0
AVERAGE °F:	98	99

PERCENT DIFFERENCE OF ABSOLUTE READINGS:

ALLOWABLE	1.5 %
ACTUAL	0.18%

THERMOMETER AND THERMOCOUPLE
IDENTIFICATION AND CALIBRATION

THERMOCOUPLE SYSTEM IDENTIFICATION

CONTROL UMBILICAL ID #: UMB 25.12

THERMOCOUPLE ID #: Filter Box ("Hotbox") #2

CALIBRATION DATE: 3/16/2020

CALIBRATED BY: CAR

CALIBRATION PROCEDURE FOLLOWING APPROVED ALTERNATIVE METHOD (ALT-011)

Because of the inherent accuracy and precision of the thermocouple within ±1.3°F in the range of -32°F to 2500°F, the two-point post-test calibration procedure may be replaced with a single-point check. A single-point calibration procedure that checks the operation of a thermocouple system within ±1.0 percent of the absolute measured temperature is all that is necessary to check the system for the presence of disconnected wire junctions, other loose connections, or a potential miscalibrated emf readout. A system that performs accurately at one temperature is expected to behave similarly at other temperatures.
Due to the difficulty of manipulating the "Hotbox" TC, ETS performs a single reference measurement at the normal controled temp ~250°F.

Reference Meter
Manufacturer: Omega
Model: CL3512A
Type K Calibrator
SN # 19000490
Date of Cert: 9/23/2019

Reference Thermocouple
Manufacturer: Omega
Model: TJ36/48 Series Thermocouple Type K
ASTM Cert. # C020668R00
Exp. Date: 2/18/2021

READING	REFERENCE THERMOMETER °F	TEST THERMOMETER °F
I	256.0	258.0
II	256.0	259.0
III	256.0	258.0
AVERAGE °F:	256	258

PERCENT DIFFERENCE OF ABSOLUTE READINGS:

ALLOWABLE 1.5 %

ACTUAL 0.32%

READING	REFERENCE THERMOMETER °F	TEST THERMOMETER °F
I	255.0	258.0
II	255.0	258.0
III	256.0	259.0
AVERAGE °F:	255	258

PERCENT DIFFERENCE OF ABSOLUTE READINGS:

ALLOWABLE 1.5 %

ACTUAL 0.42%

THERMOMETER AND THERMOCOUPLE
IDENTIFICATION AND CALIBRATION

THERMOCOUPLE SYSTEM IDENTIFICATION

CONTROL UMBILICAL ID #: UMB 25.12

THERMOCOUPLE ID #: Impinger Exit ("Gooseneck") #3

CALIBRATION DATE: 3/17/2020

CALIBRATED BY: CAR

CALIBRATION PROCEDURE FOLLOWING APPROVED ALTERNATIVE METHOD (ALT-011)

Reference Meter
Manufacturer: Omega
Model: CL3512A
Type K Calibrator
SN # 19000490
Date of Cert: 9/23/2019

Reference Thermocouple
Manufacturer: Omega
Model: TJ36/48 Series Thermocouple Type K
ASTM Cert. # C020668R00
Exp. Date: 2/18/2021

READING	REFERENCE THERMOMETER °F	TEST THERMOMETER °F
I	34.0	34.1
II	34.0	34.1
III	34.0	34.1
AVERAGE °F:	34	34

PERCENT DIFFERENCE OF ABSOLUTE READINGS:

ALLOWABLE	1.5 %
ACTUAL	0.02%

READING	REFERENCE THERMOMETER °F	TEST THERMOMETER °F
I	211.0	210.0
II	211.0	210.0
III	211.0	210.0
AVERAGE °F:	211	210

PERCENT DIFFERENCE OF ABSOLUTE READINGS:

ALLOWABLE	1.5 %
ACTUAL	0.15%

HF-4 Meterbox Thermocouple Potentiometer Calibrations

Date: 3/16/2020 Calibrated By: CAR Location: ETS Shop

Calibrator set point:	32			212			350		
Channel	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %
Stack	32	31	0.20%	212	212	0.00%	350	349	0.12%
Probe	32	31	0.20%	212	212	0.00%	350	349	0.12%
Filter	32	31	0.20%	212	212	0.00%	350	349	0.12%
Aux	32	*31*	0.20%	212	*212*	0.00%	350	*349*	0.12%
Calibrator set point:	450			750			900		
Channel	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %
Stack	450	448	0.22%	750	751	0.08%	900	901	0.07%
Probe	450	448	0.22%	750	751	0.08%	900	901	0.07%
Filter	450	448	0.22%	750	751	0.08%	900	901	0.07%
Aux	450	*448*	0.22%	750	*751*	0.08%	900	*901*	0.07%
Calibrator set point:	32			50			75		
Channel	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %
Impinger	32	31	0.20%	50	49	0.20%	75	73	0.38%
Meter In	32	31	0.20%	50	49	0.20%	75	73	0.38%
Meter Out	32	31	0.20%	50	49	0.20%	75	73	0.38%
Calibrator set point:	100			150			212		
Channel	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %
Impinger	100	98	0.36%	150	149	0.16%	212	212	0.00%
Meter In	100	98	0.36%	150	149	0.16%	212	212	0.00%
Meter Out	100	98	0.36%	150	149	0.16%	212	212	0.00%

Reference: T/C Voltage Source

Tollorence level within 1.5% of absolute temperature.

Potentiometer ID:
Manufacturer: Omega
Model: CL3512A
Type K Calibrator
SN # 19000490

Calibration:
Date of Cert: 9/23/2019

omega.com
OMEGA

CERTIFICATE OF CALIBRATION

Model number : CL3512A
Serial number : 19000490
Temperature : 75.2°F - 78.8°F
Relative Humidity : 50±10%
Calibration result of calibrator thermometer

Type	Target	Reading	Deviation
K	32.0 °F	32.0	0.0
	212 °F	212	0
J	32.0 °F	31.9	-0.1
	212 °F	212	0
T	32.0 °F	32.0	0.0
	212 °F	212	0
E	32.0 °F	32.0	0.0
	212 °F	212	0

According to temperature standard ITS-90
Calibrated standard : FLUKE 5520A calibrator (S/N:7465202)
The listed calibrator has been calibrated using standard whose accuracy is traceable to the U.S. National Institute of Standards and Technology, and meets or exceeds its published specifications. Calibration trace ability of the above listed instrument is in full compliance with ANSI/Z540-1-1994 standards and requirements.

Authorized signature: Y.I.Tsung Tested: L.M.Pereng Date: September 23, 2019

ACCREDITED
CERTIFICATE #4024.01

Certificate of Calibration

ThermoWorks

Model Name:	Type K Thermocouple Probe	**Procedure Number:**	ECI 107.1
Model Number:	TJ36/48 Series Thermocouple Type K	**Certificate Number:**	C020668R00
Manufacturer:	Omega	**Calibration Date:**	2/18/2020
Serial Number:	OM-121123892-1	**Calibration Due:**	2/18/2021
As-Found Condition:	In Tolerance	**Lab Temperature:**	23.0 °C ± 2.0 °C
As-Left Condition:	Same	**Lab RH:**	20.0 %RH to 55 %RH
Customer:	Environmental Technical Services Central Point / OR / 97502	**Customer ID:**	7808902
PO Number:		**RMA or SO:**	RMA-153765

The instrument described above was calibrated by comparison to laboratory reference standards. The reference standards utilized in the calibration are shown in the table below. The calibration data and measurement uncertainties are shown in the tables on the following page(s) of this certificate. This calibration is traceable to standards maintained at NIST and is in compliance with ISO 17025:2005 and ANSI/NCSL Z540.1. The calibration has been carried out in accordance with the written calibration instruction (procedure) shown above and completed in accordance with the ThermoWorks Quality Manual QPD-001. This certificate applies solely to the instrument identified above and shall not be reproduced, other than in full, without the specific written consent of ThermoWorks, Inc. Calibration certificates without signatures are not valid. This certificate shall not be used to claim product endorsement by the accreditation body.

A note pertaining to measurement uncertainties: The measurement uncertainties provided with the calibration data represent the uncertainties present at the time of calibration. The uncertainty evaluation considers all known, significant, and relevant sources of uncertainty involved in the calibration, including reference measurement, process, and device under test contributions. The uncertainties are calculated in accordance with the methods described in the ISO Guide to the Expression of Uncertainty in Measurement (GUM). This document is available through the BIPM as JCGM 100:2008 and through the NCSL as ANSI/NCSL Z540.2-1997 (R2012).The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a coverage probability of approximately 95%.

Reference Standards Used				**Traceable to NIST**
Model Number	**Serial Number**	**Manufacturer**	**Description**	**Due Date**
12005	926652	Burns	Platinum Resistance Thermometer	3/13/2020
12005	926653	Burns	Platinum Resistance Thermometer	3/16/2020
12005	926654	Burns	Platinum Resistance Thermometer	4/5/2020
1595A	B06025	Fluke	Super-Thermometer	12/16/2020
7526A	3542136	Fluke	Multifunction Calibrator	3/5/2020

Calibration performed by:

Ramon A Perez

Approved by:

Adam J Whetton

ThermoWorks Inc.
741 E Utah Valley Drive
American Fork, UT 840003

Web: www.thermoworks.com
Phone: 801.756.7705
Fax: 801.756.8948

ACCREDITED
CERTIFICATE #4024.01

ThermoWorks

Certificate Number: C020668R00 **Certificate Date: 2/18/2020**

Instrument Specifications	
Parameter	**Stated Accuracy**
Max temperature range on the probe sheath 0 to 1250 °C	0 to 1250°C / 1.1°C or 0.4% Whichever value is greater.

Calibration Data - As Found								
Parameter	**Nominal Value**	**Actual Value**	**DUT Data**	**DUT Error**	**DUT Tolerance**	**Acceptance Tolerance***	**Pass Fail**	**Uncertainty (K = 2)**
Temperature, °C	0.0 °C	0.022	0.64	0.62	1.10	1.10	P	0.090
Temperature, °C	50.0 °C	50.032	49.78	-0.25	1.10	1.10	P	0.090
Temperature, °C	100.0 °C	99.958	99.83	-0.13	1.10	1.10	P	0.090
Temperature, °C	250.0 °C	249.930	249.98	0.05	1.10	1.10	P	0.180
None								

Calibration Data - As Left								
Parameter	**Nominal Value**	**Actual Value**	**DUT Data**	**DUT Error**	**DUT Tolerance**	**Acceptance Tolerance***	**Pass Fail**	**Uncertainty (K = 2)**
Same	Same	Same	Same	Same	Same	Same	Same	Same
Same	Same	Same	Same	Same	Same	Same	Same	Same
Same	Same	Same	Same	Same	Same	Same	Same	Same
Same	Same	Same	Same	Same	Same	Same	Same	Same

* The DUT acceptance tolerance is based on the DUT specifications, the measurement uncertainty, the resulting test uncertainty ratio (TUR), and the maximum allowable probability of false accept risk (PFA, assumed to be 2%). In cases where the TUR ≥ 4:1, the acceptance tolerance = the DUT tolerance (referred to as simple acceptance). In cases where the TUR < 4:1, the acceptance limits are reduced by guard bands calculated using method 6 of NCSL Z540.3.

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American Fork, UT 840003

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Phone: 801.756.7705
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M.29

SINGLE-VELOCITY "S" TYPE PITOT TUBE CALIBRATION WORKSHEET

PITOT/PROBE ASSEMBLY #	M5.4.1	DATE	04/02/20
EFFECTIVE LENGTH- in.	52 1/4	CALIBRATOR	GMW
FACE-OPENING ALIGNMEN	Good	MANOMETER LEAK CHECK	0.0 @ 3"
			0.0 @ 3"

VELOCITY DETERMINATION DATA

FAN SETTING	I
EXHAUST GAS TEMPERATURE- F.	44.0
BAROMETRIC PRESSURE- "Hg	28.85
STATIC PRESSURE- "H2O	-0.37
ABSOLUTE EXHAUST GAS PRESSURE- "Hg	28.82
MOLECULAR WEIGHT OF EXHAUST GAS	28.73
CALIBRATION VELOCITY- fpm	2938

CALIBRATION DATA

FAN SETTING	SIDE "A" dP(std)	dP(s)	Cp
	0.550	0.840	0.801
I	0.550	0.840	0.801
	0.550	0.840	0.801
AVG.	0.550	0.840	0.801

SIDE "A"

Average Cp: 0.80

FAN SETTING	SIDE "B" dP(std)	dP(s)	Cp
	0.550	0.830	0.806
I	0.550	0.830	0.806
	0.550	0.830	0.806
AVG.	0.550	0.830	0.806

SIDE "B"

Average Cp: 0.81

MAXIMUM DIFFERENCE BETWEEN Cp AVERAGES OF SIDES "A" & "B" AT ANY GIVEN FAN SETTING:

ALLOWABLE=	0.01
DIFFERENCE=	0.00

MAXIMUM AVERAGE DEVIATION FROM THE MEAN FOR SIDES "A" & "B" AT ANY GIVEN FAN SETTING:

ALLOWABLE=	0.01
SIDE "A" DEVIATION=	0.00
SIDE "B" DEVIATION=	0.00

SIDE "A" IS THE SIDE UTALIZED DURING SOURCE TESTING

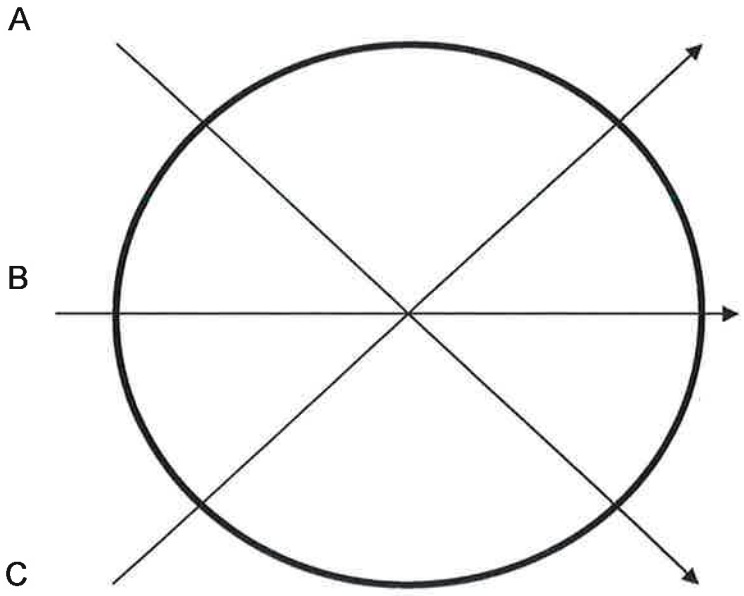
Post Test Pitot Inspection:
Date: 8/26/2020
Results: No Damage/No Change, GMW

ETS Sample Nozzle Calibration

Company: ORRCO
Location: KLAMATH FALLS
Emission Source: AUXILIARY BOILER
Project No.: 2020.2232
Test Site: BOILER EXHAUST

Calibrated by: CAW

Nozzle ID: GLASS M-29 (0.49)



Diameter Measurements (inches):

A. 0.495
B. 0.495
C. 0.495

Average: 0.495

Pre-Test Nozzle Condition: X Round _____Other
Chips or Dents: X No _____Yes

Nozzle Criteria:
The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.).

Example Equations
EPA Method 29

Absolute pressure in the Stack(P_s)

	Run 1	Run 2	Run 3
Where P_{bar} = barometric pressure, In Hg	*25.82*	*25.82*	*25.78*
P_g = static pressure of the stack, in H_2O	*-0.10*	*-0.10*	*-0.10*
P_s: $P_{bar} + (P_g/13.6)$			
P_s:	25.81	25.81	25.77

Volume of Metered Sample Gas @ Std. Conditions

	Run 1	Run 2	Run 3
Where V_m = Volume, Dry Gas Meter, cubic ft.	*142.298*	*169.704*	*153.702*
K_1 = 17.64 °R/in. Hg	*17.64*	*17.64*	*17.64*
Y = DGM calibration factor	*0.991*	*0.991*	*0.991*
P_{bar} = Barometric pressure	*25.82*	*25.82*	*25.78*
ΔH = DGM average differential pressure, in. H_2O	*1.56*	*1.77*	*1.47*
T_m = DGM average temperature, °F	*103.8*	*108.7*	*101.3*
$V_{m(std)}$: $K_1 * V_m * Y * (P_{bar} + (\Delta H/13.6))/(T_m + 460)$			
$V_{m(std)}$:	114.421	135.377	123.930

Volume of Water@ Standard Conditions

	Run 1	Run 2	Run 3
Where V_{lc} = Impinger liquid volume collected, ml	*186.1*	*223.1*	*208.2*
WV = (final silica weight)	*24.4*	*28.5*	*24.2*
$V_{w(std)}$: $(0.04707 * V_{lc}) + (0.04715 * WV)$			
$V_{w(std)}$:	9.910	11.845	10.941

Moisture(Bws) Volumetric

	Run 1	Run 2	Run 3
Where $V_{w(std)}$ = Std. Water vapor volume, scf	*9.910*	*11.845*	*10.941*
$V_{m(std)}$ = Std. Sample gas volume,DSCF	*114.421*	*135.377*	*123.930*
Bws: $V_{w(std)} / (V_{w(std)} + V_{m(std)})$			
Bws:	0.080	0.080	0.081

Molecular Weight lb/lb - mole, Dry (M_d)

	Run 1	Run 2	Run 3
Where: $\%CO_{2=}$	*6.70*	*6.46*	*7.52*
$\%O_{2=}$	*11.62*	*11.61*	*10.43*
$\%N_{2=}$	*81.68*	*81.93*	*82.05*
M_d: $((0.44*\%CO_2)+(0.32*\%O_2)+(0.28*\%N_2)$			
M_d:	29.54	29.50	29.62

Molecular Weight lb/lb - mole, Wet (M_w)

	Run 1	Run 2	Run 3
Where: Bws =	*0.080*	*0.080*	*0.081*
M_w: (M_d * (1-Bws) + (18 * Bws)			
M_w:	28.62	28.57	28.68

Gas Velocity(V_s)

	Run 1	Run 2	Run 3
Where C_p = pitot tube coefficient	*0.80*	*0.80*	*0.80*
T_s = temperature of the stack	*460.7*	*460.6*	*475.4*
M_w = molecular weight lb/lb - mole, wet	*28.62*	*28.57*	*28.68*
Ps = absolute pressure in the stack	*25.81*	*25.81*	*25.77*
ΔP:=Avg SQRT Velocity Head, in. H_2O	*0.230*	*0.245*	*0.226*
V_s: (85.49 * C_p * ΔP * SQRT((T_s + 460)/(P_s * M_w))			
V_s:	17.6	18.7	17.4

Actual Cubic Feet/Minute (acfm)

	Run 1	Run 2	Run 3
Where A = area of the duct in square feet	*1.40*	*1.40*	*1.40*
V_s = Stack gas velocity, ft/sec	*17.6*	*18.7*	*17.4*
acfm: A * V_s * 60			
acfm:	1,474	1,568	1,458

Dry Standard Actual Cubic Feet/Minute (dscfm)

	Run 1	Run 2	Run 3
Where T_s = temperature of the stack	*460.7*	*460.6*	*475.4*
acfm = actual cubic ft/min	*1,474*	*1,568*	*1,458*
Ps = absolute pressure in the stack	*25.81*	*25.81*	*25.77*
Bws= Gas *Moisture Content*	*0.080*	*0.080*	*0.081*
dscfm: (1-(Bws)) * acfm * (528/(T_s + 460)) * (P_s/(29.92))			
dscfm:	671	713	652

Percent Isokinetic Variation

	Run 1	Run 2	Run 3
Where T_s = temperature of the stack	*460.7*	*460.6*	*475.4*
P_s = absolute pressure in the stack	*25.81*	*25.81*	*25.77*
$V_{m(std)}$ = Std. Sample gas volume,DSCF	*114.421*	*135.377*	*123.930*
V_s = Stack gas velocity, ft/sec	*17.6*	*18.7*	*17.4*
A_n = Nozzle area, ft^2	*1.34E-03*	*1.34E-03*	*1.34E-03*
K_4 = 0.0945 constant from EPA method 5	*0.0945*	*0.0945*	*0.0945*
θ = sample time in minutes	*180*	*200*	*200*
Bws=Stack Gas Moisture	*0.080*	*0.080*	*0.081*
%Iso: K_4 * (T_s + 460) * $V_{m(std)}$ / (P_s * V_s * A_n * θ * (1- B_{ws}))			
%Iso:	99.0	99.2	99.4

Selected Metal, Manganese (Mn) - lbs/dscf

lbs/dscf= (ug * 2.2046E-9) / Vmstd

		Run 1	Run 2	Run 3
Where	ug, micrograms manganese	*5.51*	*7.61*	*5.68*
	$V_{m(std)}$ = Std.* sample gas volume, DSCF	114.421	135.377	123.930
lbs/dscf=		1.061E-10	1.239E-10	1.010E-10

Selected Metal, Manganese (Mn) - lbs/hr

lbs/hr = lbs/dscf * sdcfm * 60

		Run 1	Run 2	Run 3
Where	lbs/dscf, pounds per cubic feet	1.061E-10	1.239E-10	1.010E-10
	sdcfm, Std. cubic feet per min.	671	713	652
lbs/hr =		4.28E-06	5.30E-06	3.95E-06

Selected Metal, Manganese (Mn) - lbs/1000gal

lbs/1000gal = (lbs/hr) / (Kgal/hr)

		Run 1	Run 2	Run 3
Where	lbs/hr, pounds per hour	4.275E-06	5.303E-06	3.947E-06
	Kgal/hr, 1000 gallons per hour	0.0150	0.0152	0.0149
lbs/1000gal =		2.86E-04	3.49E-04	2.65E-04

Total Selected Metals, TSM - lbs/1000gal

TSM lbs/1000gal = ∑ TSM lbs/1000gal

Where ∑ TSM lbs/1000gal = Sum of TSM metals lbs/1000gal

	lbs/1000gal		
	Run 1	Run 2	Run 3
Aluminum (Al)	1.97E-03	2.42E-03	1.82E-03
Antimony (Sb)	<1.16E-04	<8.21E-05	<8.36E-05
Arsenic (As)	<1.32E-04	<1.15E-04	<1.17E-04
Beryllium (Be)	<3.79E-06	3.30E-06	<3.36E-06
Cadmium (Cd)	<4.39E-05	<3.45E-05	<4.30E-05
Chromium (Cr)	1.18E-04	9.29E-04	1.00E-04
Cobalt (Co)	9.40E-06	8.21E-06	8.36E-06
Copper (Cu)	6.84E-04	5.21E-04	5.21E-04
Lead (Pb)	<2.57E-03	<2.56E-03	<2.51E-03
Manganese (Mn)	2.86E-04	3.49E-04	2.65E-04
Mercury (Hg)	<2.33E-05	<2.26E-05	<2.15E-05
Nickel (Ni)	8.38E-05	4.31E-05	3.81E-05
Phosphorus (P)	2.80E-02	2.67E-02	2.69E-02
Selenium (Se)	<2.83E-04	<2.46E-04	<2.73E-04
Vanadium(V)	<1.88E-05	<1.64E-05	<1.67E-05
Zinc (Zn)	3.15E-03	2.75E-03	2.73E-03
Total Selected Metals, lbs/1000gal =	<3.75E-02	<3.68E-02	<3.55E-02

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

Quality - Service - Reliability

DATE: 4/1/2020 | METER SERIAL #: 2930

METER PART #: HF-5 | CRITICAL ORIFICE SET SERIAL #: 1754s

Metering System Leak Check: Passed @ 8 (in) H_2O

BAROMETRIC PRESSURE (in Hg): INITIAL 28.75 | FINAL 28.75 | AVG (P_{bar}) 28.75

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	$\Delta H_@$
29	1	0.8178	-16.0	904.00	909.194	5.194	56	57	58	57	57	57.25	5.00	3.5	5.1412	5.1768	1.007		1.82
	2	0.8178	-16.0	909.194	914.930	5.736	56	58	60	57	57	58.00	5.50	3.5	5.6695	5.6945	1.004		1.82
	3	0.8178	-16.0	914.930	920.144	5.214	57	60	61	57	57	58.75	5.00	3.5	5.1461	5.1718	1.005		1.82
																AVG =	1.005	-0.06	
25	1	0.6946	-17.0	920.144	925.468	5.324	57	60	61	57	58	59.00	6.00	2.5	5.2388	5.2712	1.006		1.79
	2	0.6946	-17.0	925.468	930.812	5.344	57	61	62	58	58	59.75	6.00	2.5	5.2509	5.2712	1.004		1.79
	3	0.6946	-17.0	930.812	936.151	5.339	57	62	62	58	58	60.00	6.00	2.5	5.2435	5.2712	1.005		1.79
																AVG =	1.005	-0.09	
19	1	0.5351	-19.0	937.000	941.800	4.80	57	62	61	59	59	60.25	7.00	1.4	4.6987	4.7376	1.008		1.68
	2	0.5351	-19.0	941.800	946.600	4.80	57	61	61	59	59	60.00	7.00	1.4	4.7009	4.7376	1.008		1.68
	3	0.5351	-19.0	946.600	951.425	4.825	58	61	62	59	59	60.25	7.00	1.4	4.7232	4.7330	1.002		1.69
																AVG =	1.006	0.01	
16	1	0.4549	-20.0	951.425	956.677	5.252	58	61	62	59	60	60.50	9.00	0.98	5.1332	5.1732	1.008		1.63
	2	0.4549	-20.0	956.677	961.935	5.258	58	62	62	60	60	61.00	9.00	0.98	5.1341	5.1732	1.008		1.63
	3	0.4549	-20.0	961.935	967.193	5.258	58	62	62	60	60	61.00	9.00	0.98	5.1341	5.1732	1.008		1.63
																AVG =	1.008	0.17	
12	1	0.3351	-21.0	967.193	972.806	5.613	58	62	62	60	60	61.00	13.00	0.52	5.4743	5.5045	1.006		1.59
	2	0.3351	-21.0	972.806	978.411	5.605	59	62	62	60	60	61.00	13.00	0.52	5.4665	5.4992	1.006		1.59
	3	0.3351	-21.0	978.411	984.021	5.610	59	62	62	60	61	61.25	13.00	0.52	5.4688	5.4992	1.006		1.59
																AVG =	1.006	-0.03	

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

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

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 1.006

AVERAGE $\Delta H_@$ = 1.70

(1) $$Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm}$$

= Net volume of gas sample passed through DGM, corrected to standard conditions

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

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

(2) $$Vcr_{(std)} = K' * \frac{Pbar * \Theta}{\sqrt{Tamb}}$$

= Volume of gas sample passed through the critical orifice, corrected to standard conditions

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

K' = Average K' factor from Critical Orifice Calibration

(3) $$Y = \frac{Vcr_{(std)}}{Vm_{(std)}}$$

= DGM calibration factor

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

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

Quality - Service - Reliability

DATE: 8/31/20
METER PART #: HF-5
METER SERIAL #: 2930
CRITICAL ORIFICE SET SERIAL #: 1754s

BAROMETRIC PRESSURE (in Hg):	INITIAL	FINAL	AVG (P_{bar})
	28.68	28.68	28.68

Metering System Leak Check: Passed @ 6 (in) H_2O

Initial Y value: 1.006
Initial DH@ value: 1.70

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	$\Delta H_@$
19	1	0.5351	-19.5	764.400	767.824	3.424	77	74	76	73	73	74	5.00	1.4	3.2575	3.3122	1.017	0.5%	1.71
	2	0.5351	-19.5	767.824	771.298	3.474	76	76	75	73	73	74	5.00	1.4	3.3035	3.3153	1.004	-0.8%	1.70
	3	0.5351	-19.5	771.298	774.737	3.439	76	75	76	73	74	75	5.00	1.4	3.2687	3.3153	1.014	0.3%	1.70
																AVG =	1.012		

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

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 1.012

AVERAGE $\Delta H_@$ = 1.70

(1) $$Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm}$$

= Net volume of gas sample passed through DGM, corrected to standard conditions
K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)
T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $$Vcr_{(std)} = K' * \frac{Pbar * \Theta}{\sqrt{Tamb}}$$

= Volume of gas sample passed through the critical orifice, corrected to standard conditions
T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)
K' = Average K' factor from Critical Orifice Calibration

(3) $$Y = \frac{Vcr_{(std)}}{Vm_{(std)}}$$

= DGM calibration factor

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

Post Calibration Difference
Difference from Initial Y value: 0.6%
Difference from Initial DH@ value: 0.3%

METHOD 5 CRITICAL ORIFICE CALIBRATION

CRITICAL ORIFICE SET S/N: 1754s

DATE: March 16, 2020

REFERENCE DRY GAS METER
SERIAL NUMBER: 16300942
CALIBRATION FACTOR, Yc: 0.997

LEAK CHECK: Passed

ORIFICE #	RUN #	CRITICAL VACUUM (in Hg)	TESTED VACUUM (in Hg)	Barometric Pressure per Orifice AVG (P_{bar})	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	K' FACTOR (english)	K' FACTOR (metric-liters)	K' FACTOR (metric-m^3)	K' FACTOR VARIATION (%)
29	1	15	18		832.531	838.927	6.396	68.5	72.2	72.2	71.8	71.9	72.03	6.00	3.78	0.8178	0.6796	6.7957E-04	0.01
	2	15	18	30.11	838.927	845.322	6.395	68.5	72.1	72.1	71.9	72.0	72.03	6.00	3.78	0.8177	0.6795	6.7946E-04	-0.01
															AVG K' FACTOR =	0.8178	0.6795	6.795E-04	
25	1	15	18		845.322	851.678	6.356	68.4	72.1	71.9	72.1	72.0	72.03	7.00	2.74	0.6948	0.5773	5.7733E-04	0.02
	2	15	18	30.10	851.678	858.030	6.352	68.7	72.0	72.0	72.1	72.3	72.10	7.00	2.74	0.6944	0.5771	5.7705E-04	-0.02
															AVG K' FACTOR =	0.6946	0.5772	5.772E-04	
19	1	15	18		858.030	863.638	5.608	68.7	71.9	71.8	72.2	72.2	72.03	8.00	1.67	0.5352	0.4447	4.4469E-04	0.02
	2	15	18	30.10	863.638	869.244	5.606	68.7	71.9	71.7	72.2	72.2	72.00	8.00	1.67	0.5350	0.4445	4.4455E-04	-0.02
															AVG K' FACTOR =	0.5351	0.4446	4.446E-04	
16	1	15	18		869.244	875.210	5.966	68.7	71.7	71.8	72.1	72.3	71.98	10.00	1.21	0.4550	0.3781	3.7807E-04	0.02
	2	15	18	30.10	875.210	881.173	5.963	69.0	71.9	71.8	72.3	72.3	72.08	10.00	1.21	0.4548	0.3779	3.7792E-04	-0.02
															AVG K' FACTOR =	0.4549	0.3780	3.780E-04	
12	1	15	18		881.173	886.460	5.287	69.1	72.1	71.9	72.3	72.5	72.20	12.00	0.65	0.3355	0.2788	2.7881E-04	0.11
	2	15	18	30.10	886.460	891.736	5.276	69.1	72.1	72.1	72.5	72.5	72.30	12.00	0.65	0.3348	0.2782	2.7818E-04	-0.11
															AVG K' FACTOR =	0.3351	0.2785	2.785E-04	

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
Calculate the standard volumes of air passed through the DGM and the critical orifices, and calculate the DGM calibration factor, Y, using the equations in US EPA Method 5, Section 16.2.3.3 (these equations are programmed on the spreadsheet included with each orifice set)

K' = Critical orifice coefficient,

$[(ft^3)(°R)^{1/2}]/[(in.Hg)(min.)]$ - English Units

$[(liters)(°K)^{1/2}]/[(mm\ Hg)(min.)]$ - Metric-Liters Units

$[(m^3)(°K)^{1/2}]/[(mm\ Hg)(min.)]$ - Metric Units

Critical Orifice Set number 1754s was calibrated in accordance with the Code of Federal Regulations, Title 40, Part 60, Appendix A, Method 5, Section 7.2

Signature

03/16/20
Date

2.4

THERMOMETER AND THERMOCOUPLE
IDENTIFICATION AND CALIBRATION

THERMOCOUPLE SYSTEM IDENTIFICATION

CONTROL UMBILICAL ID #: UMB 25.12

THERMOCOUPLE ID #: M5.4.3

CALIBRATION DATE: 3/17/2020

CALIBRATED BY: CAR

CALIBRATION PROCEDURE FOLLOWING APPROVED ALTERNATIVE METHOD (ALT-011)

Reference Meter
Manufacturer: Omega
Model: CL3512A
Type K Calibrator
SN # 19000490
Date of Cert: 9/23/2019

Reference Thermocouple
Manufacturer: Omega
Model: TJ36/48 Series Thermocouple Type K
ASTM Cert. # C020668R00
Exp. Date: 2/18/2021

READING	REFERENCE THERMOMETER °F	TEST THERMOMETER °F
I	33.8	34.2
II	33.8	34.2
III	33.8	34.2
AVERAGE °F:	34	34

PERCENT DIFFERENCE OF ABSOLUTE READINGS:

ALLOWABLE	1.5 %
ACTUAL	0.08%

READING	REFERENCE THERMOMETER °F	TEST THERMOMETER °F
I	211.0	211.0
II	211.0	211.0
III	211.0	211.0
AVERAGE °F:	211	211

PERCENT DIFFERENCE OF ABSOLUTE READINGS:

ALLOWABLE	1.5 %
ACTUAL	0.00%

THERMOMETER AND THERMOCOUPLE
IDENTIFICATION AND CALIBRATION

THERMOCOUPLE SYSTEM IDENTIFICATION

CONTROL UMBILICAL ID #: UMB 25.4

THERMOCOUPLE ID #: M5.4.3

JOB #: 2020.2232

TEST DATE: 8/25-26/2020

CALIBRATED DATE: 8/26/2020

CALIBRATED BY: GMW

CALIBRATION PROCEDURE FOLLOWING APPROVED ALTERNATIVE METHOD (ALT-011)

Because of the inherent accuracy and precision of the thermocouple within ±1.3°F in the range of -32°F to 2500°F, the two-point post-test calibration procedure may be replaced with a single-point check. A single-point calibration procedure that checks the operation of a thermocouple system within ±1.0 percent of the absolute measured temperature is all that is necessary to check the system for the presence of disconnected wire junctions, other loose connections, or a potential miscalibrated emf readout. A system that performs accurately at one temperature is expected to behave similarly at other temperatures.

Reference Meter
Manufacturer: Omega
Model: CL3512A
Type K Calibrator
SN # 19000490
Date of Cert: 9/23/2019

Reference Thermocouple
Manufacturer: Omega
Model: TJ36/48
Serial Number: OM-121123892-1
Exp. Date: 2/18/2021

READING	REFERENCE THERMOMETER °F	TEST THERMOMETER °F
I	97	97
II	97	98
III	97	98
AVERAGE °F:	97	98

PERCENT DIFFERENCE OF ABSOLUTE READINGS:

ALLOWABLE 1.5 %

ACTUAL 0.12%

THERMOMETER AND THERMOCOUPLE
IDENTIFICATION AND CALIBRATION

THERMOCOUPLE SYSTEM IDENTIFICATION

CONTROL UMBILICAL ID #: UMB 25.12

THERMOCOUPLE ID #: M-23 Rail Box

CALIBRATION DATE: 8/15/2020

CALIBRATED BY: CAR

CALIBRATION PROCEDURE FOLLOWING APPROVED ALTERNATIVE METHOD (ALT-011)

Because of the inherent accuracy and precision of the thermocouple within ±1.3°F in the range of -32°F to 2500°F, the two-point post-test calibration procedure may be replaced with a single-point check. A single-point calibration procedure that checks the operation of a thermocouple system within ±1.0 percent of the absolute measured temperature is all that is necessary to check the system for the presence of disconnected wire junctions, other loose connections, or a potential miscalibrated emf readout. A system that performs accurately at one temperature is expected to behave similarly at other temperatures.
Due to the difficulty of manipulating the "Hotbox" TC, ETS performs a single reference measurement at the normal controled temp ~250°F.

Reference Meter
Manufacturer: Omega
Model: CL3512A
Type K Calibrator
SN # 19000490
Date of Cert: 9/23/2019

Reference Thermocouple
Manufacturer: Omega
Model: TJ36/48 Series Thermocouple Type K
ASTM Cert. # C020668R00
Exp. Date: 2/18/2021

READING	REFERENCE THERMOMETER °F	TEST THERMOMETER °F
I	249.0	250.0
II	251.0	251.0
III	251.0	250.0
AVERAGE °F:	250	250

PERCENT DIFFERENCE OF ABSOLUTE READINGS:

ALLOWABLE	1.5 %
ACTUAL	0.00%

THERMOMETER AND THERMOCOUPLE
IDENTIFICATION AND CALIBRATION

THERMOCOUPLE SYSTEM IDENTIFICATION

CONTROL UMBILICAL ID #: UMB 25.12

THERMOCOUPLE ID #: Impinger Exit ("Gooseneck") #1

CALIBRATION DATE: 3/17/2020

CALIBRATED BY: CAR

CALIBRATION PROCEDURE FOLLOWING APPROVED ALTERNATIVE METHOD (ALT-011)

Reference Meter
Manufacturer: Omega
Model: CL3512A
Type K Calibrator
SN # 19000490
Date of Cert: 9/23/2019

Reference Thermocouple
Manufacturer: Omega
Model: TJ36/48 Series Thermocouple Type K
ASTM Cert. # C020668R00
Exp. Date: 2/18/2021

READING	REFERENCE THERMOMETER °F	TEST THERMOMETER °F
I	33.8	33.9
II	33.8	33.9
III	33.8	33.9
AVERAGE °F:	34	34

PERCENT DIFFERENCE OF ABSOLUTE READINGS:

ALLOWABLE	1.5 %
ACTUAL	0.02%

READING	REFERENCE THERMOMETER °F	TEST THERMOMETER °F
I	211.0	210.0
II	211.0	210.0
III	211.0	210.0
AVERAGE °F:	211	210

PERCENT DIFFERENCE OF ABSOLUTE READINGS:

ALLOWABLE	1.5 %
ACTUAL	0.15%

HF-5 Meterbox Thermocouple Potentiometer Calibrations

Date: 3/16/2020 Calibrated By: CAR Location: ETS Shop

Calibrator set point:	**32**			**212**			**350**		
Channel	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %
Stack	32	29	0.61%	212	211	0.15%	350	349	0.12%
Probe	32	29	0.61%	212	211	0.15%	350	349	0.12%
Filter	32	29	0.61%	212	211	0.15%	350	349	0.12%
Aux	32	*30*	0.41%	212	*211*	0.15%	350	*349*	0.12%
Calibrator set point:	**450**			**750**			**900**		
Channel	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %
Stack	450	448	0.22%	750	754	0.33%	900	905	0.37%
Probe	450	448	0.22%	750	754	0.33%	900	905	0.37%
Filter	450	448	0.22%	750	754	0.33%	900	905	0.37%
Aux	450	*448*	0.22%	750	*754*	0.33%	900	*905*	0.37%
Calibrator set point:	**32**			**50**			**75**		
Channel	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %
Impinger	32	29	0.61%	50	47	0.59%	75	72	0.56%
Meter In	32	29	0.61%	50	47	0.59%	75	72	0.56%
Meter Out	32	29	0.61%	50	47	0.59%	75	72	0.56%
Calibrator set point:	**100**			**150**			**212**		
Channel	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %	Reference, °F	Measured, °F	Difference, %
Impinger	100	97	0.54%	150	148	0.33%	212	211	0.15%
Meter In	100	97	0.54%	150	148	0.33%	212	211	0.15%
Meter Out	100	97	0.54%	150	148	0.33%	212	211	0.15%

Reference: T/C Voltage Source

Tollorence level within 1.5% of absolute temperature.

Potentiometer ID:
Manufacturer: Omega
Model: CL3512A
Type K Calibrator
SN # 19000490

Calibration:
Date of Cert: 9/23/2019

omega.com
OMEGA

CERTIFICATE OF CALIBRATION

Model number : CL3512A
Temperature : 75.2°F - 78.8°F
Serial number : 19000490
Relative Humidity : 50±10%

Calibration result of calibrator thermometer

Type	Target	Reading	Deviation
K	32.0 °F	32.0	0.0
	212 °F	212	0
J	32.0 °F	31.9	-0.1
	212 °F	212	0
T	32.0 °F	32.0	0.0
	212 °F	212	0
E	32.0 °F	32.0	0.0
	212 °F	212	0

According to temperature standard ITS-90
Calibrated standard : FLUKE 5520A calibrator (S/N:7465202)
The listed calibrator has been calibrated using standard whose accuracy is traceable to the U.S. National Institute of Standards and Technology, and meets or exceeds its published specifications. Calibration trace ability of the above listed instrument is in full compliance with ANSI/Z540-1-1994 standards and requirements.

Authorized signature: Y.I.Tsung Tested: L.M.Pereng Date: September 23, 2019

ACCREDITED
CERTIFICATE #4024.01

Certificate of Calibration

ThermoWorks

Model Name:	Type K Thermocouple Probe	**Procedure Number:**	ECI 107.1
Model Number:	TJ36/48 Series Thermocouple Type K	**Certificate Number:**	C020668R00
Manufacturer:	Omega	**Calibration Date:**	2/18/2020
Serial Number:	OM-121123892-1	**Calibration Due:**	2/18/2021
As-Found Condition:	In Tolerance	**Lab Temperature:**	23.0 °C ± 2.0 °C
As-Left Condition:	Same	**Lab RH:**	20.0 %RH to 55 %RH
Customer:	Environmental Technical Services Central Point / OR / 97502	**Customer ID:**	7808902
PO Number:		**RMA or SO:**	RMA-153765

The instrument described above was calibrated by comparison to laboratory reference standards. The reference standards utilized in the calibration are shown in the table below. The calibration data and measurement uncertainties are shown in the tables on the following page(s) of this certificate. This calibration is traceable to standards maintained at NIST and is in compliance with ISO 17025:2005 and ANSI/NCSL Z540.1. The calibration has been carried out in accordance with the written calibration instruction (procedure) shown above and completed in accordance with the ThermoWorks Quality Manual QPD-001. This certificate applies solely to the instrument identified above and shall not be reproduced, other than in full, without the specific written consent of ThermoWorks, Inc. Calibration certificates without signatures are not valid. This certificate shall not be used to claim product endorsement by the accreditation body.

A note pertaining to measurement uncertainties: The measurement uncertainties provided with the calibration data represent the uncertainties present at the time of calibration. The uncertainty evaluation considers all known, significant, and relevant sources of uncertainty involved in the calibration, including reference measurement, process, and device under test contributions. The uncertainties are calculated in accordance with the methods described in the ISO Guide to the Expression of Uncertainty in Measurement (GUM). This document is available through the BIPM as JCGM 100:2008 and through the NCSL as ANSI/NCSL Z540.2-1997 (R2012).The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a coverage probability of approximately 95%.

Reference Standards Used				**Traceable to NIST**
Model Number	**Serial Number**	**Manufacturer**	**Description**	**Due Date**
12005	926652	Burns	Platinum Resistance Thermometer	3/13/2020
12005	926653	Burns	Platinum Resistance Thermometer	3/16/2020
12005	926654	Burns	Platinum Resistance Thermometer	4/5/2020
1595A	B06025	Fluke	Super-Thermometer	12/16/2020
7526A	3542136	Fluke	Multifunction Calibrator	3/5/2020

Calibration performed by:

Ramon A Perez

Approved by:

Adam J Whetton

ThermoWorks Inc.
741 E Utah Valley Drive
American Fork, UT 840003

Web: www.thermoworks.com
Phone: 801.756.7705
Fax: 801.756.8948

ACCREDITED
CERTIFICATE #4024.01

ThermoWorks

Certificate Number: C020668R00 **Certificate Date: 2/18/2020**

Instrument Specifications	
Parameter	**Stated Accuracy**
Max temperature range on the probe sheath 0 to 1250 °C	0 to 1250°C / 1.1°C or 0.4% Whichever value is greater.

Calibration Data - As Found								
Parameter	**Nominal Value**	**Actual Value**	**DUT Data**	**DUT Error**	**DUT Tolerance**	**Acceptance Tolerance***	**Pass Fail**	**Uncertainty (K = 2)**
Temperature, °C	0.0 °C	0.022	0.64	0.62	1.10	1.10	P	0.090
Temperature, °C	50.0 °C	50.032	49.78	-0.25	1.10	1.10	P	0.090
Temperature, °C	100.0 °C	99.958	99.83	-0.13	1.10	1.10	P	0.090
Temperature, °C	250.0 °C	249.930	249.98	0.05	1.10	1.10	P	0.180
None								

Calibration Data - As Left								
Parameter	**Nominal Value**	**Actual Value**	**DUT Data**	**DUT Error**	**DUT Tolerance**	**Acceptance Tolerance***	**Pass Fail**	**Uncertainty (K = 2)**
Same	Same	Same	Same	Same	Same	Same	Same	Same
Same	Same	Same	Same	Same	Same	Same	Same	Same
Same	Same	Same	Same	Same	Same	Same	Same	Same
Same	Same	Same	Same	Same	Same	Same	Same	Same

* The DUT acceptance tolerance is based on the DUT specifications, the measurement uncertainty, the resulting test uncertainty ratio (TUR), and the maximum allowable probability of false accept risk (PFA, assumed to be 2%). In cases where the TUR ≥ 4:1, the acceptance tolerance = the DUT tolerance (referred to as simple acceptance). In cases where the TUR < 4:1, the acceptance limits are reduced by guard bands calculated using method 6 of NCSL Z540.3.

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SINGLE-VELOCITY "S" TYPE PITOT TUBE CALIBRATION WORKSHEET

PITOT/PROBE ASSEMBLY #	M5.4.3	DATE	04/02/20
EFFECTIVE LENGTH- in.	50.0	CALIBRATOR	GMW
FACE-OPENING ALIGNMEN	Good	MANOMETER LEAK CHECK	0.0 @ 3"
			0.0 @ 3"

VELOCITY DETERMINATION DATA

FAN SETTING	I
EXHAUST GAS TEMPERATURE- F.	44.0
BAROMETRIC PRESSURE- "Hg	28.85
STATIC PRESSURE- "H2O	-0.37
ABSOLUTE EXHAUST GAS PRESSURE- "Hg	28.82
MOLECULAR WEIGHT OF EXHAUST GAS	28.73
CALIBRATION VELOCITY- fpm	2938

CALIBRATION DATA

FAN SETTING	SIDE "A" dP(std)	dP(s)	Cp
	0.550	0.800	0.821
I	0.550	0.810	0.816
	0.550	0.810	0.816
AVG.	0.550	0.807	0.817

SIDE "A" Average Cp: 0.82

FAN SETTING	SIDE "B" dP(std)	dP(s)	Cp
	0.550	0.810	0.816
I	0.550	0.810	0.816
	0.550	0.810	0.816
AVG.	0.550	0.810	0.816

SIDE "B" Average Cp: 0.82

MAXIMUM DIFFERENCE BETWEEN Cp AVERAGES OF SIDES "A" & "B" AT ANY GIVEN FAN SETTING:

ALLOWABLE=	0.01
DIFFERENCE=	0.00

MAXIMUM AVERAGE DEVIATION FROM THE MEAN FOR SIDES "A" & "B" AT ANY GIVEN FAN SETTING:

ALLOWABLE=	0.01
SIDE "A" DEVIATION=	0.00
SIDE "B" DEVIATION=	0.00

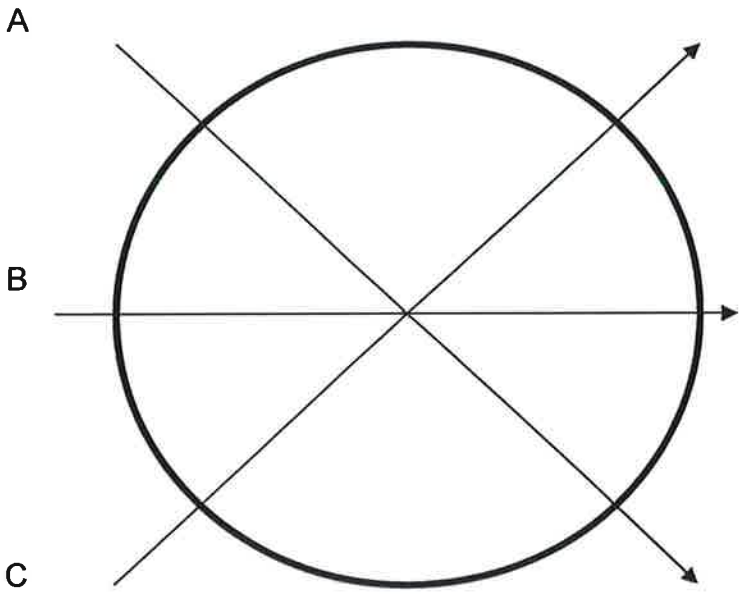
Post Test Pitot Inspection:
Date: 8/26/2020
Results: No Damage/No Change, GMW

ETS Sample Nozzle Calibration

Company: OARCO
Location: KLAMATH FALLS
Emission Source: AUXILIARY BOILER
Project No.: 2020.2232
Test Site: BOILER EXHAUST

Calibrated by: CAW

Nozzle ID: GLASS M-23 (#16)



Diameter Measurements (inches):

A. _____
B. _____
C. _____

Average: 0.498

Pre-Test Nozzle Condition: _____ Round _____Other

Chips or Dents: ____No _____Yes

Nozzle Criteria:
The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.).

FIELD BAROMETER
IDENTIFICATION AND CALIBRATION

IDENTIFICATION

BAROMETER ID #: ETS ALT-2

DATE: April 1, 2020

TIME: 13:00

CALIBRATED BY: GMW

CALIBRATION

Medford Station Barometric Pressure, "Hg	Field Barometer Barometric Pressure, "Hg	Pressure Difference %
28.68	28.69	0.03

Medford, Oregon NOAA station Mercury Barometer is used as reference.
Weather Station phone number (541) 776-4303 x 0.

Example Equations
Auxiliary Boiler

Absolute pressure in the Stack(P_s)

EPA Method 5	Run 1	Run 2	Run 3
Where P_{bar} = barometric pressure, In Hg	*25.82*	*25.82*	*25.78*
P_g = static pressure of the stack, in H_2O	*-0.10*	*-0.10*	*-0.10*
P_s: $P_{bar} + (P_g/13.6)$			
P_s:	*25.81*	*25.81*	*25.77*

Volume of Metered Sample Gas @ Std. Conditions

EPA Method 5	Run 1	Run 2	Run 3
Where V_m = Volume, Dry Gas Meter, cubic ft.	*143.820*	*164.601*	*158.002*
K_1 = 17.64 °R/in. Hg	*17.64*	*17.64*	*17.64*
Y = DGM calibration factor	*1.006*	*1.006*	*1.006*
P_{bar} = Barometric pressure	*25.82*	*25.82*	*25.78*
ΔH = DGM average differential pressure, in. H_2O	*1.60*	*1.68*	*1.56*
T_m = DGM average temperature, °F	*102.6*	*107.2*	*100.8*
$V_{m(std)}$: $K_1 * V_m * Y * (P_{bar} + (\Delta H/13.6))/(T_m + 460)$			
$V_{m(std)}$:	*117.659*	*133.605*	*129.469*

Saturated H2O vapor pressure

	Run 1	Run 2	Run 3
Where T_w = Stack Temperature, °F	*443.7*	*451.5*	*451.1*
SVP: $(0.00000608764 \times T_w\text{^}3)-(0.00100431 \times T_w\text{^}2)+(0.0756026 \times T_w)-1.69343$			
SVP:	*365.76*	*387.87*	*386.86*

Saturated Moisture (BWS) @ Ts

	Run 1	Run 2	Run 3
Where SVP = Saturated H2O vapor pressure, in. Hg	*365.76*	*387.87*	*386.86*
Td = Stack Temperature	*443.7*	*451.5*	*451.1*
P_s = absolute pressure in the stack	*25.81*	*25.81*	*25.77*
Bws: $(Svp-((0.000367) * P_s * (T_d - T_w) * (1 + ((T_w - 32)/1571))))/P_s$			
Bws:	*14.170*	*15.026*	*15.010*

Volume of Water@ Standard Conditions

EPA Method 5	Run 1	Run 2	Run 3
Where V_{lc} = Impinger liquid volume collected, ml	*185.9*	*214.5*	*213.0*
WV = (final silica weight)	*31.9*	*38.8*	*36.0*
$V_{w(std)}$: $(0.04707 * V_{lc})+(0.04715*WV)$			
$V_{w(std)}$:	*10.254*	*11.926*	*11.723*

Moisture(Bws) Volumetric

EPA Method 5	Run 1	Run 2	Run 3
Where $V_{w(std)}$ = Std. Water vapor volume, scf	*10.254*	*11.926*	*11.723*
$V_{m(std)}$ = Std. Sample gas volume,DSCF	*117.659*	*133.605*	*129.469*
Bws: $V_{w(std)} / (V_{w(std)} + V_{m(std)})$			
Bws:	*0.080*	*0.082*	*0.083*

Molecular Weight lb/lb - mole, Dry (M_d)

EPA Method 3

	Run 1	Run 2	Run 3
Where: $\%CO_{2=}$	6.70	6.64	7.52
$\%O_{2=}$	11.62	11.61	10.43
$\%N_{2=}$	81.68	81.75	82.05
M_d: $((0.44*\%CO_2)+(0.32*\%O_2)+(0.28*\%N_2)$			
M_d:	29.54	29.53	29.62

Molecular Weight lb/lb - mole, Wet (M_w)

EPA Method 2

	Run 1	Run 2	Run 3
Where: M_d =	29.54	29.53	29.62
Bws =	0.080	0.082	0.083
M_w: $(M_d * (1-Bws) + (18 * Bws))$			
M_w:	28.61	28.58	28.66

Gas Velocity(V_s)

EPA Method 2

	Run 1	Run 2	Run 3
Where C_p = pitot tube coefficient	0.82	0.82	0.82
K_p = Velocity equation constant (english)	85.49	85.49	85.49
n = Total number of traverse points	20	20	20
T_s = temperature of the stack	443.7	451.5	451.1
$T_{s(abavg)}$ = Average absolute stack temperature, °R 460+Ts for english units	903.7	911.5	911.1
M_w = molecular weight lb/lb - mole, wet	28.61	28.58	28.66
Ps = absolute pressure in the stack	25.81	25.81	25.77
$\sqrt{\Delta P_i}$ = Sum of the SQRT Velocity Head, in H_2O	4.456	4.568	4.435

V_s: $K_p * C_p * \left[\frac{\sum_{i=1}^{n}\sqrt{\Delta P_i}}{n}\right] * \sqrt{\frac{T_{s\,(abavg)}}{P_s * M_w}}$

V_s:	17.3	17.8	17.3

Actual Cubic Feet/Minute (acfm)

EPA Method 2

	Run 1	Run 2	Run 3
Where A = area of the duct in square feet	1.40	1.40	1.40
V_s = Stack gas velocity, ft/sec	17.3	17.8	17.3
acfm: $A * V_s * 60$			
acfm:	1,448	1,491	1,447

Dry Standard Cubic Feet/Minute (dscfm)

EPA Method 2

	Run 1	Run 2	Run 3
Where T_s = temperature of the stack	443.7	451.5	451.1
acfm = actual cubic ft/min	1,448	1,491	1,447
Ps = absolute pressure in the stack	25.81	25.81	25.77
Bws = Gas Moisture Content	0.080	0.082	0.083
dscfm: $(1-(Bws)) * acfm * (528/(T_s + 460)) * (P_s/(29.92))$			
dscfm:	671	684	662

Percent Isokinetic Variation

EPA Method 5/23

	Run 1	Run 2	Run 3
Where T_s = temperature of the stack	443.7	451.5	451.1
P_s = absolute pressure in the stack	25.81	25.81	25.77
$V_{m(std)}$ = Std. Sample gas volume,DSCF	117.659	133.605	129.469
V_s = Stack gas velocity, ft/sec	17.3	17.8	17.3
A_n = Nozzle area, ft^2	1.35E-03	1.35E-03	1.35E-03
K_4 = 0.0945 constant from EPA method 5	0.0945	0.0945	0.0945
θ = sample time in minutes	180	200	200
Bws=Stack Gas Moisture	0.080	0.082	0.083
%Iso: $K_4 * (T_s + 460) * V_{m(std)} / (P_s * V_s * A_n * \theta * (1- B_{ws}))$			
%Iso:	100.6	100.9	101.0

PCDD ng/m3

EPA Method 23: 2,3,7,8-PeCDD		Run 1	Run 2	Run 3
Where	pg/sample = picograms collected, 2,3,7,8-PeCDD	*26.60*	*23.3*	*24.2*
	dscm = Std. Dry Meters Collected	*3.332*	*3.784*	*3.667*
	TEQ factor for 2,3,7,8=PeCDD	*1*	*1*	*1*
ng/m3= (pg/1000)/M3	ng/m3=	*7.98E-03*	*6.16E-03*	*6.60E-03*
TEQ ng/m3 = ng/m3 * TEQ Factor	ng/m3=	*7.98E-03*	*6.16E-03*	*6.60E-03*

PCDD ng/second

EPA Method 23: 2,3,7,8-PeCDD		Run 1	Run 2	Run 3
Where	ng/m3 -= nanograms per cubic meter	*7.98E-03*	*6.16E-03*	*6.60E-03*
	dscmm = Std. Dry Meters per minte	*19.010*	*19.373*	*18.754*
	TEQ factor for 2,3,7,8=PeCDD	*1*	*1*	*1*
ng/sec= (ng/se*dscmm)/60	ng/sec=	*2.53E-03*	*1.99E-03*	*2.06E-03*
TEQ ng/sec = ng/sec * TEQ Factor	TEQ ng/sec =	*2.53E-03*	*1.99E-03*	*2.06E-03*

PCDD lbs/1000 gal

EPA Method 23: 2,3,7,8-PeCDD		Run 1	Run 2	Run 3
Where	pg/sample = picograms collected, 2,3,7,8-PeCDD	*26.60*	*23.3*	*24.2*
	lbs/sample = pg *2.2046E-15	*5.86E-14*	*5.14E-14*	*5.34E-14*
	Vmstd.= Cubic feet sampled at Std. Conditions	*117.659*	*133.605*	*129.469*
	dscfm = Dry Std. Cubic Feet per minute	*671*	*684*	*662*
	1000/gal Fuel = 1000 gal fuel combusted per hour.	*0.0150*	*0.0152*	*0.0149*
	TEQ factor for 2,3,7,8=PeCDD	*1*	*1*	*1*
lbs/1000 gal. = ((lbs/sample / Vmstd)* DSCFM * 60)/1000 gal/hr	lbs/1000 gal. =	*1.34E-09*	*1.04E-09*	*1.10E-09*
TEC lbs/1000 gal. = TEQ *lbs/1000 gal.	TEQ lbs/1000 gal. =	*1.34E-09*	*1.04E-09*	*1.10E-09*

AXIUM Gases Northwest

AXIUM Gases Northwest
1322 Antelope Road
White City, OR 97503
tel: 541-878-1000
fax: 541-878-1046

Cylinder Number:	CC453172	Certification Date:	20 February 2018
Mixture Grade:	EPA Protocol Standard Gas Mixture	Expiration Date:	21 February 2026
Certificate Number:	0448A-04T5-C01	Lot Number:	0448A-04T5
Cylinder Pressure:	2015 psig	Customer Part Number:	T5E 4800001-A1-1

Do not use below 100 psi (0.7 megapascals)

EPA Traceability Protocol for Gaseous Calibration Standards Procedure G1, EPA/600/R-12/531 May 2012

Certified Concentrations

Component	Concentration	Uncertainty	Assay Dates
Oxygen	20.1%	+/- 0.10% (absolute)	2/19/2018
Carbon Dioxide	20.3%	+/- 0.10% (absolute)	2/20/2018
Nitrogen	Balance		

Analytical Instrumentation

Component	Analytical Principle	Make	Model	Serial	MPC Date
Oxygen	GC-TCD	Shimadzu	GC-8A	C104950214975A	2/19/2018
Carbon Dioxide	GC-TCD	Shimadzu	GC-8A	C104950214975A	2/14/2018

Reference Standards

Serial Number	Lot	Expiration	Type	Component	Balance	Concentration	Uncertainty (%)	NIST Reference
CC480398	1027A-01T5	6/6/2025	GMIS	O2	N2	0.2097	0.095	2659a
CAL010808	35-D-37	8/2/2018	SRM	CO2	N2	0.02938	0.204	2624a

The calibration results published in this certificate were obtained using equipment and standards capable of producing results that are traceable to National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI). The expanded uncertainties, if included on this certificate, use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. If uncertainties are not included on this certificate, they are available upon request. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from the calibration facility. Calibration certificates without signatures are not valid. This calibration meets the requirements of ISO/IEC 17025-2005

Preparer: Tim Brown

Reviewer: Eric Frymier

Production Laboratory:
Tier 5 Labs, LLC
5353 W. Southern Ave.
Indianapolis, IN 46241
PGVP Vendor ID R12018

TIER 5 LABS
5353 W. SOUTHERN AVE.
INDIANAPOLIS, IN 46241
317-636-5690

Cylinder Number:	CC480487	Certification Date:	13 March 2019
Mixture Grade:	EPA Protocol Standard Gas Mixture	Expiration Date:	14 March 2027
Certificate Number:	0639C-02T5-C01	Lot Number:	0639C-02T5
Cylinder Fill Pressure:	2015 PSIG	Customer Part Number:	T5E 8400001-A1-5

Do not use below 100 psi (0.7 megapascals)

EPA Traceability Protocol for Gaseous Calibration Standards Procedure G1, EPA/600/R-12/531 May 2012

Certified Concentrations

Component	Concentration	Uncertainty	Assay Dates
Oxygen	9.93%	+/- 0.5 % (absolute)	3/13/2019
Carbon Dioxide	11.8%	+/- 0.10 % (absolute)	3/13/2019
Nitrogen	Balance		

Analytical Instrumentation

Component	Analytical Principle	Make	Model	Serial	MPC Date
Oxygen	GC-TCD	Shimadzu	GC-8A	C10495021497SA	2/22/2019
Carbon Dioxide	GC-TCD	Shimadzu	GC-8A	C10495021497SA	3/5/2019

Reference Standards

Serial Number	Lot	Expiration	Type	Component	Balance	Concentration	Uncertainty (%)	NIST Reference
D685109	VSL	9/14/2023	PRM	O2	N2	21.002%	0.100	VSL
FF13624	9-D-37	3/8/2021	SRM	CO2	N2	16.08 %	0.124	2745

The calibration results published in this certificate were obtained using equipment and standards capable of producing results that are traceable to National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI). The expanded uncertainties, if included on this certificate, use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. If uncertainties are not included on this certificate, they are available upon request. The nitrogen used as a component or balance gas as well as the oxygen used in air mixtures meets the requirements set forth in EPA 1065.750. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from the calibration facility. Calibration certificates without signatures are not valid. This calibration meets the requirements of ISO/IEC 17025-2005

Prepared by: Eric Frymier

Reviewer: Allison Hanover

Production Laboratory:
Tier 5 Labs, LLC
5353 W. Southern Ave.
Indianapolis, IN 46241
PGVP Vendor ID R12019

Sampling System Response Time Test

Company: ORRCO
Location: Klamath Falls, Oregon
Emission Source: Auxiliary Boiler.
Date: 8/25-26/2020

Project No.: 2020.2232
Test Site: Boiler Exhaust Duct.

Length/Type of Sample line used: 100' Heated TFE

CEMS Sample Rate, liters per minute: 4lpm

Upscale Response Time, seconds:

Gas Injection	*O_2/CO_2*	*CO*	*NOx*	*SO_2*	*THC*	*TRS*	*SF_6*
#1	60						
#2	60						
#3	60						
Average:	*60*						

Downscale response Time, seconds:

Gas Injection	*O_2/CO_2*	*CO*	*NOx*	*SO_2*	*THC*	*TRS*	*SF_6*
#1	60						
#2	60						
#3	60						
Average:	*60*						

Initial CEMS Sample System Leak Check: PASS ~~FAIL~~

Final CEMS Sample System Leak Check: PASS ~~FAIL~~

Analyzer Interference Check
EPA Method 20, section 5.4

Preformed by: Andy Winkler, Max Winkler

Gas Parameter: Oxygen, O_2
Manufacture: Servomex
Model: 1440
Serial Number: 01440DIV02-4085
Span: 20.00%

Date: 6/16/2019
Cylinder ID: EB005064/dg7

Cylinder Components	*Concentration, ppm*	*Analyzer Output Response*	*% of Span*
NOx:	196.5 ppm	0	0
CO:	200.0 ppm	0	0
SO2:	186.1 ppm	0	0

Date: 7/9/2019
Cylinder ID: CC516191/dg4

Cylinder Components	*Concentration %, ppm*	*Analyzer Output Response*	*% of Span*
H_2S	16.5 ppm	0	0

Date: 7/2/2019
Cylinder ID: CC516191/dg4

Cylinder Components	*Concentration, ppm*	*Analyzer Output Response*	*% of Span*
THC	42.1 ppm	0	0

$$\%\ of\ Span = \frac{\text{Analyzer Output Response}}{\text{Instrument Span}} \times 100$$

% of Span must be less than 2% of the analyzer span value

Analyzer Interference Check
EPA Method 20, section 5.4

Date: March 10, 2019
Preformed by: Andy Winkler, Max Winkler

Gas Parameter: Oxygen, O_2
Manufacture: Siemens
Model: Oxymat 5E
Serial Number: E2-301A
Span: 20.00%

Cylinder ID: CC462253cg/5

Cylinder Components	*Concentration, ppm*	*Analyzer Output Response*	*% of Span*
NOx:	485.0 ppm	0	0
CO:	501.0 ppm	0	0
SO2:	483.0 ppm	0	0

Cylinder ID: CC501958cg/7

Cylinder Components	*Concentration %, ppm*	*Analyzer Output Response*	*% of Span*
H_2S	16.5 ppm	0	0

Cylinder ID: CC449468cg/4

Cylinder Components	*Concentration, ppm*	*Analyzer Output Response*	*% of Span*
Propane	97.5 ppm	0	0

NOT USED

Gas Parameter: Carbon dioxide, CO_2
Manufacture: Thermo
Model: 410i
Serial Number: 1180730009
Span: 20.20%

Cylinder ID: CC462253cg/5

Cylinder Components	*Concentration, ppm*	*Analyzer Output Response*	*% of Span*
NOx:	485.0 ppm	0	0
CO:	501.0 ppm	0	0
SO2:	483.0 ppm	0	0

Cylinder ID: CC475284cg/6

Cylinder Components	*Concentration %, ppm*	*Analyzer Output Response*	*% of Span*
O_2:	9.28 %	0	0
SO_2	165.0 ppm	0	0

Cylinder ID: CC449468cg/4

Cylinder Components	*Concentration, ppm*	*Analyzer Output Response*	*% of Span*
Propane	97.5 ppm	0	0

Cylinder ID: CC501958cg/7

Cylinder Components	*Concentration %, ppm*	*Analyzer Output Response*	*% of Span*
H_2S	16.5 ppm	0	0

$$\% \text{ of Span} = \frac{\text{Analyzer Output Response}}{\text{Instrument Span}} \times 100$$

% of Span must be less than 2% of the analyzer span value

11.0 Appendix F: Supporting Data/Documentation

11.1 Source Test Protocol
11.2 ODEQ Agency Response
11.3 STAR Certification Form

2105 Corey Road
Central Point, Oregon 97502
Ph: 541.779.2646
FAX: 541.734.5537
E-Mail: ETSLLC@msn.com

July 23, 2020

Oregon Department of Environmental Quality
700NE Multnomah Street, Suite 600
Portland, Oregon 97232

Attention: Mr. Thomas Rhodes

Subject: Oil Re-Refining Company - Source Test Plan (STP) for the Auxiliary Boiler operating at the Klamath Falls facility.

Simple Air Contaminant Discharge Permit No. 18-0020-SI-01

Dear Mr. Rhodes:

On behalf of Oil Re-Refining Company (ORRCO), Environmental Technical Services, Inc. (ETS) is notifying the Oregon Department of Environmental Quality (ODEQ) of a pending air emission source test scheduled for the week of August 24, 2020 at the facility located in Klamath Falls, Oregon.

1.) **Source Test Objective**

The objective of the emission testing effort is to determine the source-specific Hazardous Air Pollutants (HAPs) which have been identified by ODEQ with respect to the Cleaner Air Oregon (CAO) regulations. The results of the source test will be used in analyses for comparison to CAO, Table 4 – Risk Based Concentrations.

2.) ***Name and Location of Source:***

Oil Re-Refining Company (ORRCO)
Dba. Industrial Oils, Inc
4150 N. Suttle Road
Portland, OR 97217

Facility Location:
Industrial Oils, Inc.
1291 Laverne Ave.
Klamath Falls, Or. 97601

3.) Project Personnel and Contact Information:

Source Owner:
Oil Re-Refining Company (ORRCO)
Dba, Industrial Oils, Inc.
Scott Briggs, CEO
4150 N Suttle Road
Portland, Oregon 97217
(541) 923-3128

Facility:
Oil Re-Refining Company
Dba, Industrial Oils, Inc.
Scott Briggs, CEO
(503) 546-3542
Dave Archulets, Site Operator
1291 Laverne Ave.
Klamath Falls, OR 97601

Primary Consultant:
Cascade Environmental Management
Marie Piper, Principal Engineer
316 SE Pioneer Way, #294
Oak Harbor, WA 98277
(360) 672-0088

Source Test Contractor:
Environmental Technical Services
Andy Winkler, Sr. Project Manager
2105 Corey Road
Central Point, OR 97502
(541) 779-2646

Metals Laboratory, EPA Method 29:
Chester LabNet
Paul Duda, Laboratory Manager
12242 SW Garden Place
Tigard, OR 97223
(503) 624-2183

SVOC Laboratory, EPA Method 23:
Vista Analytical Laboratory
Jennifer Christman
1104 Windfield Way
El Dorado Hills, CA 95762
(916) 673-1520

4.) ***Date and Time of Emission Test:***

August 24, 2020: Travel to ORRCO, Site Set-up.
August 25, 2020: Perform auxiliary boiler emission testing for Dioxin/Furan, PAH, PCB and Multiple Metals
August 26, 2020: Extra day for unforeseen circumstances.

5.) ***Description of the Process:***

ORRCO operates a used oil reprocessing and blending operation. The process includes the transfer, storage, dehydrating and filtering of used oils recycled from various sources. Energy for the recycling process is produced by the burning of distillate fuel in an auxiliary boiler (rated at 61 horsepower, 155,210 Btu/hr). Propane is the backup fuel.

The recycle process takes place during a twenty-hour batch cycle where the recycle oil is heated in one of three dehydrator tanks to 250° to 270° which removes entrained water and light end distillate oils. The auxiliary boiler provides steam to heat exchange coils located within the dehydration tanks. The auxiliary boiler will operate in two-hour cycles during the emission test at the highest steam rate expected during normal future operation.

Specific Auxiliary Boiler Information:

Burner: Manufacturer: Industrial Combustion
Model: Model M Series #: MM-28S Size 2,
Dual fuel – Distillate or Propane
Rating: 155,210 Btu/hr
Fuel: 100% Distillate

Boiler: Manufacturer: Gabriel
Model: Scotch Marine fire tube, 61hp.

6.) ***Pollutant Parameters to be Determined:***

The Auxiliary Boiler emission parameters to be measured include the following:

A. Polychlorinated dibenzo p-dioxin (PCDD) - the following selected congeners as provided in OAR 340-245-8040 Table 2.

i.	Polychlorinated dibenzo-p-dioxin (PCDD)	CAS#	RBC in Table 4	Analysis included
1	2,3,7,8-Tetrachlorodibenzop-dioxin (TCDD)	1746-01-6	Yes	Yes
2	1,2,3,7,8-Pentachlorodibenzo p-dioxin (PeCDD)	40321-76-4	Yes	Yes
3	1,2,3,4,7,8-Hexaclilorodibenzop-dioxin (HxCDD)	39227-28-6	Yes	Yes
4	1,2,3,6,7,8-Hexaclilorodibenzop-dioxin (HxCDD)	57653-85-7	Yes	Yes
5	1,2,3,7,8,9-Hexachlorodibenzop-dioxins (HxCDD)	19408-74-3	Yes	Yes
6	1,2,3,4,6,7,8-Heptachlorodibenzop-dioxin (HpCDD)	35822-46-9	Yes	Yes
7	Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	Yes	Yes

B. Polychlorinated dibenzofuran (PCDF) - the following selected congeners as provided in OAR 340-245-8040 Table 2.

ii.	Polychlorinated dibenzofuran (PCDF)	CAS#	RBC in Table 4	Analysis included
1	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	Yes	Yes
2	1,2,3,7,8-Pentachlorodibenzofuran-an (PeCDF)	57117-41-6	Yes	Yes
3	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	Yes	Yes
4	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	Yes	Yes
5	1,2,3,6,7,8- Hexachlorodibenzofuran (HxCDF)	57117-44-9	Yes	Yes
6	1,2,3,7,8,9- Hexachlorodibenzofuran (HxCDF)	72918-21-9	Yes	Yes
7	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	Yes	Yes
8	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	Yes	Yes
9	1,2,3,4,7,8,9- Heptachlorodibenzofuran (HpCDF)	55673-89-7	Yes	Yes
10	Octachlorodibenzofuran (OCDF)	39001-02-0	Yes	Yes

6.) Pollutant Parameters to be Determined: (continued)

C. Polychlorinated biphenyls (PCBs) - all congeners with associated RBCs as provided in OAR 340-245-8040 Table 2.

iiii	Polychlorinated biphenyls (PCBs)	CAS#	RBC in Table 4	*Analysis included
1	PCB-5/8 [2,4'-dichlorobiphenyl]	34883-43-7		Yes
2	PCB 18 [2,2',5-trichlorobiphenyl]	37680-65-2		Yes
3	PCB-28 [2,4,4'-trichlorobiphenyl]	7012-37-5		Yes
4	PCB-44 [2,2',3,5'-tetrachlorobiphenyl]	41464-39-5		Yes
5	PCB-52 [2,2',5,5'-tetrachlorobiphenyl]	35693-99-3		Yes
6	PCB-66 [2,3',4,4'-tetrachlorobiphenyl]	32598-10-0		Yes
7	PCB 77 [3,3',4,4'-tetrachlorobiphenyl]	32598-13-3	Yes	Yes
8	PCB 81 [3,4,4',5-tetrachlorobiphenyl]	70362-50-4	Yes	Yes
9	37680-73-2 PCB-101 [2,2',4,5,5'-pentachlorobiphenyl]	37680-73-2		Yes
10	PCB 105 [2,3,3',4,4'-pentachlorobiphenyl]	32598-14-4	Yes	Yes
11	PCB 114 [2,3,4,4',5-pentachlorobiphenyl]	74472-37-0	Yes	Yes
12	PCB 118 [2,3',4,4',5-pentachlorobiphenyl]	31508-00-6	Yes	Yes
13	PCB 123 [2,3',4,4',5'-pentachlorobiphenyl]	65510-44-3	Yes	Yes
14	PCB 126 [3,3',4,4',5-pentachlorobiphenyl]	57465-28-8	Yes	Yes
15	PCB-128 [2,2',3,3',4,4'-hexachlorobiphenyl]	38380-07-3		Yes
16	PCB-138 [2,2',3,4,4',5'-hexachlorobiphenyl]	35065-28-2		Yes
17	PCB-153 [2,2',4,4',5,5'-hexachlorobiphenyl]	35065-27-1		Yes
18	PCB 156 [2,3,3',4,4',5-hexachlorobiphenyl]	38380-08-4	Yes	Yes
19	PCB 157 [2,3,3',4,4',5'-hexachlorobiphenyl]	69782-90-7	Yes	Yes
20	PCB 167 [2,3',4,4',5,5'-hexachlorobiphenyl]	52663-72-6	Yes	Yes
21	PCB 169 [3,3',4,4',5,5'-hexachlorobiphenyl]	32774-16-6	Yes	Yes
22	PCB-170 [2,2',3,3',4,4',5-heptachlorobiphenyl]	35065-30-6		Yes
23	PCB-180 [2,2',3,4,4',5,5'-heptachlorobiphenyl]	35065-29-3		Yes
24	PCB-187 [2,2',3,4',5,5',6-heptachlorobiphenyl]	52663-68-0		Yes
25	PCB 189 [2,3,3',4,4',5,5'-heptachlorobiphenyl]	39635-31-9	Yes	Yes
26	PCB-195 [2,2',3,3',4,4',5,6-octachlorobiphenyl]	52663-78-2		Yes
27	PCB-206 [2,2',3,3',4,4',5,5',6-nonachlorobiphenyl]	40186-72-9		Yes
28	PCB-209 [2,2'3,3',4,4',5,5',6,6 '-decachlorobiphenyl]	2051-24-3		Yes

6.) Pollutant Parameters to be Determined: (continued)

D. Polycyclic aromatic hydrocarbons (PAHs) and polycyclic aromatic hydrocarbon derivatives (PAH-derivatives) with associated RBCs as provided in OAR 340-245-8040 Table 2.

iii.	Polynuclear Aromatic Hydrocarbons (PAH)	CAS#	RBC in Table 4	*Analysis included
1	Acenaphthene	83-32-9		Yes
2	Acenaphthylene	208-96-8		Yes
3	Anthracene	120-12-7		Yes
4	Anthanthrene	191-26-4	Yes	No
5	Benzo(a)anthracene	56-55-3	Yes	Yes
6	Benzo(a)pyrene	50-32-8	Yes	Yes
7	Benzo(b)fluoranthene	205-99-2	Yes	Yes
8	Benzo(c)fluorene	205-12-9	Yes	No
9	Benzo(e)pyrene	192-97-2		Yes
10	Benzo(g,h,i)perylene	191-24-2	Yes	Yes
11	Benzo(j)fluoranthene	205-82-3	Yes	No
12	Benzo(k)fluoranthene	207-08-9	Yes	Yes
13	Carbazole	86-74-8		No
14	Chrysene	218-01-9	Yes	Yes
15	Cyclopenta(c,d)pyrene	27208-37-3	Yes	No
16	Dibenz(a,h)acridine	226-36-8		No
17	Dibenz(a,j)acridine	224-42-0		No
18	7H-Dibenzo[c,g]carbazole	194-59-2		No
19	Dibenz[a,h]anthracene	53-70-3	Yes	Yes
20	Dibenzo[a,e]fluoranthene	5385-75-1		No
21	Dibenzo[a,e]pyrene	192-65-4	Yes	No
22	Dibenzo[a,h]pyrene	189-64-0	Yes	No
23	Dibenzo[a,i]pyrene	189-55-9	Yes	No
24	Dibenzo[a,l]pyrene	191-30-0	Yes	No
25	Fluoranthene	206-44-0	Yes	Yes
26	Fluorene	86-73-7		Yes
27	Indeno[1,2,3-cd]pyrene	193-39-5	Yes	Yes
28	2-Methyl naphthalene	91-57-6		Yes
29	Perylene	198-55-0		Yes
30	Phenanthrene	85-01-8		Yes
31	Pyrene	129-00-0		Yes
32	*Coronene (optional)	191-07-1		Yes
Naphthalene is considered a separate PAH having it's own risk base concentration.				
33	Naphthalene	91-20-3	Yes	Yes

*Note: Where analytes are identified as "*Analysis Included – No*" is due to the lack of available laboratory standards.

	PAH-Derivatives	CAS#	RBC in Table 4	*Analysis included
34	2-Acetylaminofluorene	53-96-3		No
35	2-Aminoanthraquinone	117-79-3		No
36	Carbaryl	63-25-2		No
37	7,12-Dimethylbenz[a]anthracene	57-97-6		No
38	1,6-Dinitropyrene	42397-64-8		No
39	1,8-Dinitropyrene	42397-65-9		No
40	3-Methylcholanthrene	56-49-5		No
41	5-Methylchrysene	3697-24-3	Yes	No
42	5-Nitroacenaphthene	602-87-9		No
43	6-Nitrochrysene	2/8/7496	Yes	No
44	2-Nitrofluorene	607-57-8		No
45	1-Nitropyrene	5522-43-0		No
46	4-Nitropyrene	57835-92-4		No

*Note: Where analytes are identified as "*Analysis Included – No*" is due to the lack of available laboratory standards.

E. Multiple Metals analytes as provided in OAR 340-245-8040 Table 2.

		CAS #	RBC in Table 4	Analysis included
1	Aluminum (Al)	7429-90-5	Yes	Yes
2	Antimony (Sb)	7440-36-0	Yes	Yes
3	Arsenic (As)	7440-38-2	Yes	Yes
4	Beryllium (Be)	7440-41-7	Yes	Yes
5	Cadmium (Cd)	7440-43-9	Yes	Yes
6	Total Chromium (Cr)	18540-29-9	Yes	Yes
7	Cobalt (Co)	7440-48-4	Yes	Yes
8	Copper (Cu)	7440-50-8	Yes	Yes
9	Lead (Pb)	7439-92-1	Yes	Yes
10	Manganese (Mn)	7439-96-5	Yes	Yes
11	Mercury (Hg)	7439-97-6	Yes	Yes
12	Nickel (Ni)	7440-02-0	Yes	Yes
13	Phosphorus (P)	12185-10-3	Yes	Yes
14	Selenium (Se)	7782-49-2	Yes	Yes
15	Vanadium (Va)	7440-62-2	Yes	Yes
16	Zinc (Zn)	7440-66-6	No	Yes

7) Summary of Source Test Program

Emission testing performed will follow EPA and ODEQ reference methods in accordance with the Oregon Source Sampling Manual. Reference test methods to be followed are listed in Table 1 below.

Table 1:
Reference Test Method Matrix

ORRCO Auxiliary Boiler		
Reference Method	Parameter	Specific Procedures
EPA Method 1	Sample Port & Sample Point location	Diameter confirmed through both sample ports
EPA Method 2	Volume Flow	Concurrent with each test, Initial cyclonic check.
EPA Method 3a	O_2, CO_2, Molecular Weight	Continuously measured during each test run.
EPA Method 4	Gas Moisture	Measured as a part of the EPA Method 23 and 29 sample train.
EPA Method 23	Dioxin, Furan, PAH, & PCB	Three, 120-minute test runs
EPA Method 29	Multiple Metals	Three, 120-minute test runs

The recycle process takes place over two-hour batch cycles. The ETS plan is to conduct the EPA Method 29 and 23 test runs concurrently to optimize the process time available.

8.) ***Applicable Process Information - Operating Load During Emission Testing:***

The Auxiliary Boiler will be operated under typical worst-case conditions that will generate the highest emissions that may be expected during future operations. ORRCO defines worst-case conditions for the boiler as the fuel firing rate, gallons of distillate combusted per hour. The burner designed maximum firing rate is 19.3 gallons per hour. The expected firing rate for the emission test will be approximately 16.4 gallons per hour which has been determined to be the highest sustainable firing rate for the system.

During each test run, the following operating parameters will be recorded:

- Used Oil processed per hour, gph;
- Used Oil temperature, °F;
- Boiler operating temperature;
- Boiler excess oxygen, $\%O_2$;
- Fuel flow rate, gpm;
- Fuel Description: Distillate;
- Steam pounds per hour, lbs/hr.

Auxiliary Boiler Operation:

Only regular operating staff may adjust the combustion system or production process and emission control parameters during the source performance tests and within two (2) hours prior to the tests. Any operating adjustments made during the source performance tests, which are a result of consultation during the tests with source testing personnel, equipment vendors or consultants, may render the source performance test invalid.

9.) ***General Approach:***

The following EPA and ODEQ reference methods will be used during the performance test. The respective summaries outline each method specific proceedures to be followed and any deviations proposed.

Method-specific quality assurance/quality control (QA/QC) procedures will be performed to ensure that the data is valid for determining the emission test objective. Documentation of test procedures and results will be presented in the source test report for review. Omission of this critical information may result in rejection of the data, requiring a retest.

9.1 Volume Flow, EPA Methods 1 and 2

EPA Methods 1 and 2 are used to measure gas velocity and volumetric flow rates. These measurements will be performed for both EPA Method 23 and 29.

EPA Method 1 is used to locate the representative sample points within the stack area. Exhaust stack is 16" diameter and will be confirmed prior to testing. Sample port locations will be checked to insure the minimum straight run requirements are meet. The cross-sectional area of the stack is divided into a number of equal areas following EPA Method 1 criteria. Sample traverse points are then located at the center of each equal area.

EPA Method 2 is used to measure average stack gas velocity using a calibrated type "S" Pitot tube connected to an incline oil manometer. Stack temperature is measured simultaneously using a calibrated type "K" thermocouple.

Cyclonic flow is not expected however will be check prior to sampling. Pitot tubes will be leak checked prior to and after each test run.

9.2 Molecular Weight, EPA Method 3a

The gaseous parameters, O_2 and CO_2 are determined using continuous instrumentation methodology and used for the determination of exhaust gas molecular weight. Sample gas is extracted from the center 10% of the exhaust stack through a heated (250° ± 5° F) Stainless Steel probe/filter assembly that is approximately 1 meter in length. A calibration-gas purge tee is fitted upstream of the filter assembly and is used during system bias calibrations.
The following instrumentation is used to analyze the gaseous parameters:

Parameter	Manufacturer	Model	Technology
O_2	Servomex	1440D	Paramagnetic
CO_2	Thermo	410i	NDIR

The data recorder consists of a Parametric Systems digital data acquisition system. The Parametric Systems package is a fully automated reference method data recording and report generating software/hardware package.

Calibration gases used will be EPA Protocol 1 cylinder gas or are blended following EPA Method 205, with an Environics Series 4000 precision gas divider.

The sample system will be leak checked prior to testing and after testing has been completed. Analyzer calibration error checks will be conducted Sample system bias checks are performed at the beginning and end of each test series. The test run is started after twice the response time has elapsed.

9.3 Stack Gas Moisture Content, EPA Method 4

Exhaust gas moisture content is determined as a part of each isokinetic sample train used for the EPA Method 23 and 29 procedures.

A sample of the gas stream is extracted, dried, and gas volume metered. The weight gain of condensed moisture is then measured by volume. The percentage of moisture is used to calculate the dry molecular weight of the stack gas and correct wet volume measurements to a dry volume basis.

9.4 EPA Method 23, Determination of Dioxins and Semi volatile Organic Compounds

Any EPA Method 23 references within this procedural write up refer to the proposed action regarding editorial and technical revisions to EPA Method 23 (Docket ID No. EPA-HQ-OAR-2016-0677).

EPA Method 23 is used for the determination of polychlorinated Dibenzo-p-Dioxins (PCDDs), Polychlorinated Dibenzofurans (PCDFs), Polycyclic Aromatic Hydrocarbons (PAHs) and Polychlorinated Biphenyls (PCBs) compounds.

Sample Collection

Gaseous and particulate bound target pollutants are withdrawn isokinetically from the source and collected in the sampling probe, on a glass fiber filter, on a packed column of adsorbent material and in the absorption train. During laboratory analysis, target compounds are extracted from the combined sample collection media. PCDD, PCDF, PCB and PAH compounds will be determined by the use of high-resolution gas chromatography/ high resolution mass spectrometry (HRGC/HRMS).

Sample System

The sample system will consist of a glass nozzle (fitted with a PTFE ferrule), heated probe (glass sample line), heated glass filter (supported by a borosilicate glass/PTFE gasket frit), an absorption module containing XAD-2 resin, a glass condenser coil and an absorption train. The sample probe and filter housing is maintained at a temperature of 248 ± 25 °F whereas the gas exiting the condenser and entering the absorption module is maintained at ≤ 68 °F. The sample transfer line, if used, will be heat traced and constructed of glass or PTFE, transfer lines will be maintained at 248 ± 25 °F.

Brominated flame retardant coated tape and stopcock grease will not be used in any aspect of the sampling train. Viton A O-rings and PTFE tape will be used within the sample train and hexane rinsed aluminum foil may be utilized during the clean-up/recovery process. During sample collection, recovery and clean up special precautions will be taken to shield samples from ultraviolet light.

The absorption train will consist of 5 impingers connected in series with leak free fittings. The first impinger will be a short stem (water dropout) design. The second, fourth and fifth impingers will be of the Greenburg-Smith design with the glass stem extending to approximately 1" – 2" from the bottom. The second and third impingers will contain known quantities of water ~100ml of HPLC grade, the first and fourth impinger remain empty while the fifth impinger will contain a known weight of silica gel. All glassware used will be pre cleaned following section 8.1.1.1 of method 23.

9.4 EPA Method 23, Determination of Dioxins and Semi Volatile Organic Compounds (continued).

Reagents and sample preparation

Reagents used during sample collection and recovery will closely follow section 13 of EPA Method 23. Filters supplied by the lab will pre cleaned and follow the quality control checks as required in EPA Method 23. Filters will be quartz glass without organic binders. Pre cleaned XAD-2 traps and pre spiked media will be supplied by the lab. Acetone and Toluene used during the clean-up process will be of pesticide grade reagents.

During field preparation, XAD-2 traps will be kept wrapped in aluminum foil and kept well below 122 °F to prevent thermal decomposition. Excluding the XAD-2 traps, all sample glassware components before use will be immediately rinsed with acetone and toluene, the glass probe and nozzle will be rinsed and brushed three times with acetone and toluene. Each impinger and absorbent module including fitting caps will be weighed to the nearest 0.5 grams using a calibrated field balance.

The sample train will be assembled as shown in Figure 23-1 of EPA Method 23. Inspection of the entire sample system prior to and during disassembly will take place and any abnormalities will be noted and recorded on the field data sheet. Prior to testing the recirculation pump to the condenser and absorbent module will activate and the proper temperature monitored and maintained prior to starting. Proper temperatures of the filter and absorbent trap will be recorded and maintained throughout the entire test run. Once temperatures of all sample system components are at desired operating ranges a pretest leak check following the procedures outlined in EPA Method 5, Section 8.4.2 will commence.

Sampling strategy

Before sampling, a series of initial measurements will be conducted; EPA Methods 1, 2, 3A, 4 and depending on source conditions ODEQ 4 will be performed to determine the location and number of traverse points, average gas velocity and pressure, moisture and gas molecular weight. The preliminary results will be entered into the field computer, and an appropriate nozzle size for isokinetic sampling determined. The probe will be positioned at the initial traverse point; velocity and temperature measurements will be maintained, recorded and used to calculate the appropriate isokinetic sampling rate. Once the test commences the vacuum pump will immediately be adjusted to obtain the isokinetic sample rate.

Following the completion of a test run the probe will be removed from the stack and the nozzle caped off with either pre toluene rinsed aluminum foil or PTFE tape. Once the probe can be safely handled and the nozzle wiped clean of any debris, a post test leak check of the sampling system following procedures outlined in EPA Method 5, Section 8.4.4 will commence.

9.4 EPA Method 23, Determination of Dioxins and Semi Volatile Organic Compounds (continued).

Sample Recovery

Sample recovery and shipping will follow Sections 8.2.4 through 8.2.12 of EPA Method 23. After the proper samples and components have been placed in a clean environment (ETS mobile lab trailer) the following sample recovery steps will take place.

- The filter will be carefully removed from the filter holder with clean tweezers along with any loose debris and carefully placed in the proper container labeled Container #1 with the associated sample I.D.

- The absorbent module once removed from the train will be properly capped with PTFE tape and end caps. The recirculation water will be drained and the absorption module will then be weighed to the nearest 0.5 grams for moisture determinations. The final weight will be noted and the proper sample I.D label placed on the absorbent module.

- Material deposited in the front half components (nozzle, probe liner and front half of the filter holder) will be brushed and rinsed three times with acetone followed by three rinses of toluene. All the rinses will be collected in the proper sample jar and labeled Container #2.

- All back half components (back half of the filter holder, sample transfer line and condenser will be rinsed three times with acetone followed by three rinses of toluene. All rinses will be collected in container #2. Liquid level will be marked on jar.

- All impingers will be removed from the sample apparatus, outside surfaces wiped clean of debris and condensate and final weights taken to within 0.5 grams. Final weights will be noted.

- All water from inside the impingers will be saved in a sample jar labeled Container #3 for PCBs and PAH analysis. All impingers and connecting glassware will be rinsed three times with acetone followed by three rinses of toluene. These rinses will be collected in container #3 and liquid level noted on the sample jar.

- Silica gel color will be noted on the field data sheet to determine if it has been completely spent.

- Field samples will be placed in a clean sample box kept in cool dark conditions until arrival to the lab.

- Sample chain of custody will strictly follow procedures outlined in ASTM D4880-99(2018).

9.4 EPA Method 23, Determination of Dioxins and Semi Volatile Organic Compounds (continued).

Sample Analysis

EPA Method 23 samples will be analyzed by Vista laboratory, contact information follows:

Vista Analytical Laboratory
1104 Windfield Way
El Dorado Hills, CA 95762
Main: (916) 673-1520
Fax: (916) 673-0106
Contact: Jennifer Christmann
Project Manager

Reporting Results that are below the In-Stack Detection Limits

When a target compound is measured at or below the Estimated Detection Limit (EDL), the EDL will be used for concentration calculations and when determining In Stack Detection Limit (ISDL). As stated in the Oregon Source Sampling Manual Section 2.11.c states "*Each test replicate that is below the ISDL should be reported as less than (<) the detection limit value (e.g., <0.14). If the test replicate is included in a multi-run test series, the ISDL value is used when calculating the numerical average. Label the average result as less than (<) if the numerical average of a test series includes at least one test replicate below the ISDL*".

Quality Control

Quality control will strictly follow Section 9.0 of EPA Method 23.

At least one field train proof blank will be prepared, assembled and recovered as if it were to be used in the test series. A field blank will consist of all components necessary to conduct a test run.

If a field train proof blank or batch blank results in a higher value than the EDL then resulting calculations will include the compound specific EDL plus the larger of the batch or field train proof blank.

Pre sampling absorbent spikes and pre extraction filter spikes samples must meet the requirements of Section 13 EPA Method 23. If the recovery of all the pre sampling absorbent spike standards are below 70 percent, the sampling runs are considered not valid. Alternatively, you do not have to repeat sampling if the average pre sampling absorbent spike recovery is 25 percent or more and you divide the final results by the average fraction of pre sampling absorbent spike recovery.

Due to limited operating cycles ETS proposes a sampling rate of at least 0.75 CFM to collect a minimum of 120 dscf over a three-hour test run.

Estimated In Stack Detection Limits for Dioxin/Furans, PCBs, and PAHs

Note: Analytes listed are those which can be measured by the analytical laboratory

i.	Polychlorinated dibenzo-p-dioxin (PCDD)	*Estimated EDL (ng/sample)	Toxic Equivalency Factors (TEFs)	Estimated In Stack Detection Limit, ISDL (ng/m3) TEQ
1	2,3,7,8-Tetrachlorodibenzop-dioxin (TCDD)	0.01	1	2.803E-03
2	1,2,3,7,8-Pentachlorodibenzo p-dioxin (PeCDD)	0.05	1	1.401E-02
3	1,2,3,4,7,8-Hexaclilorodibenzop-dioxin (HxCDD)	0.05	0.1	1.401E-03
4	1,2,3,6,7,8-Hexaclilorodibenzop-dioxin (HxCDD)	0.05	0.1	1.401E-03
5	1,2,3,7,8,9-Hexachlorodibenzop-dioxins (HxCDD)	0.05	0.1	1.401E-03
6	1,2,3,4,6,7,8-Heptachlorodibenzop-dioxin (HpCDD)	0.05	0.01	1.401E-04
7	Octachlorodibenzo-p-dioxin (OCDD)	0.1	0.0003	8.408E-06
			PCDD TEQ:	*0.0212*

ii.	Polychlorinated dibenzofuran (PCDF)	*Estimated EDL (ng/sample)	Toxic Equivalency Factors (TEFs)	Estimated In Stack Detection Limit, ISDL (ng/m3) TEQ
1	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.01	0.1	2.803E-04
2	1,2,3,7,8-Pentachlorodibenzofuran-an (PeCDF)	0.05	0.03	4.204E-04
3	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.05	0.3	4.204E-03
4	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.05	0.1	1.401E-03
5	1,2,3,6,7,8- Hexachlorodibenzofuran (HxCDF)	0.05	0.1	1.401E-03
6	1,2,3,7,8,9- Hexachlorodibenzofuran (HxCDF)	0.05	0.1	1.401E-03
7	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.05	0.1	1.401E-03
8	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.05	0.01	1.401E-04
9	1,2,3,4,7,8,9- Heptachlorodibenzofuran (HpCDF)	0.05	0.01	1.401E-04
10	Octachlorodibenzofuran (OCDF)	0.1	0.0003	8.408E-06
			PCDF TEQ:	*0.0108:*
			Total TEQ $_{PCDD,PCDF}$:	*0.0320*

Note: *Data will be reported down to the EDLs, which are sample specific and generally 1/2 - 1/5 the associated QLs.

***Estimated In Stack Detection Limit, ISDL, is based on the following:

A) Sample rate of 0.7 ft3/min (0.0198 m3/min)

B) Three-hour test run at a sample rate of 42 ft3/hr (1.189 m3/hr) would yield approximately 126 ft3 (3.568 m3)

iii. Polynuclear Aromatic Hydrocarbons (PAH)

		*QL (ng/sample)	Toxic Equivalency Factors (TEFs)	**Estimated In Stack Detection Limit, ISDL (ng/m3) TEQ
1	Acenaphthene	20	1	5.606
2	Acenaphthylene	20	1	5.606
3	Anthracene	20	1	5.606
5	Benzo(a)anthracene	20	0.2	1.121
6	Benzo(a)pyrene	20	1	5.606
7	Benzo(b)fluoranthene	20	0.8	4.484
9	Benzo(e)pyrene	20	1	5.606
10	Benzo(g,h,i)perylene	20	0.009	0.050
12	Benzo(k)fluoranthene	20	0.03	0.168
14	Chrysene	20	0.1	0.561
19	Dibenz[a,h]anthracene	20	10	56.056
25	Fluoranthene	20	0.08	0.448
26	Fluorene	20	1	5.606
27	Indeno[1,2,3-cd]pyrene	20	0.07	0.392
28	2-Methyl naphthalene	20	1	5.606
29	Perylene	20	1	5.606
30	Phenanthrene	50	1	14.014
31	Pyrene	20	1	5.606
32	*Coronene (optional)	50	1	14.014
			Total PAH TEQ:	141.7589
	Considered as a Separate PAH			
	Naphthalene	50	1	19.623
	Note: Naphthalene is reported separately having its own risk-based concentration.			

Note: *Data will be reported >QL ng.

**Estimated In Stack Detection Limit, ISDL, is based on the following:

A) Sample rate of 0.7 ft^3/min (0.0198 m^3/min)

B) Three-hour test run at a sample rate of 42 ft^3/hr (1.189 m^3/hr) would yield approximately 126 ft^3 (3.568 m^3)

iiii	Polychlorinated biphenyls (PCBs)	Estimated *EDL (ng/sample)	Toxic Equivalency Factors (TEFs)	Estimated In Stack Detection Limit, ISDL (ng/m3) TEQ	***Estimated In Stack Detection Limit, ISDL (ng/m^3) Total
1	PCB-5/8 [2,4'-dichlorobiphenyl]	0.1			2.803E-02
2	PCB 18 [2,2',5-trichlorobiphenyl]	0.05			1.401E-02
3	PCB-28 [2,4,4'-trichlorobiphenyl]	0.05			1.401E-02
4	PCB-44 [2,2',3,5'-tetrachlorobiphenyl]	0.05			1.401E-02
5	PCB-52 [2,2',5,5'-tetrachlorobiphenyl]	0.1			2.803E-02
6	PCB-66 [2,3',4,4'-tetrachlorobiphenyl]	0.1			2.803E-02
7	PCB 77 [3,3',4,4'-tetrachlorobiphenyl]	0.05	0.0001	1.401E-06	1.401E-02
8	PCB 81 [3,4,4',5-tetrachlorobiphenyl]	0.05	0.0003	4.204E-06	1.401E-02
9	37680-73-2 PCB-101 [2,2',4,5,5'-pentachlorobiphenyl]	0.1			2.803E-02
10	PCB 105 [2,3,3',4,4'-pentachlorobiphenyl]	0.05	0.00003	4.204E-07	1.401E-02
11	PCB 114 [2,3,4,4',5-pentachlorobiphenyl]	0.05	0.00003	4.204E-07	1.401E-02
12	PCB 118 [2,3',4,4',5-pentachlorobiphenyl]	0.1	0.00003	8.408E-07	2.803E-02
13	PCB 123 [2,3',4,4',5'-pentachlorobiphenyl]	0.05	0.00003	4.204E-07	1.401E-02
14	PCB 126 [3,3',4,4',5-pentachlorobiphenyl]	0.1	0.1	2.803E-03	2.803E-02
15	PCB-128 [2,2',3,3',4,4'-hexachlorobiphenyl]	0.05			1.401E-02
16	PCB-138 [2,2',3,4,4',5'-hexachlorobiphenyl]	0.15			4.204E-02
17	PCB-153 [2,2',4,4',5,5'-hexachlorobiphenyl]	0.05			1.401E-02
18	PCB 156 [2,3,3',4,4',5-hexachlorobiphenyl]	0.05	0.00003	4.204E-07	1.401E-02
19	PCB 157 [2,3,3',4,4',5'-hexachlorobiphenyl]	0.05	0.00003	4.204E-07	1.401E-02
20	PCB 167 [2,3',4,4',5,5'-hexachlorobiphenyl]	0.05	0.00003	4.204E-07	1.401E-02
21	PCB 169 [3,3',4,4',5,5'-hexachlorobiphenyl]	0.05	0.03	4.204E-04	1.401E-02
22	PCB-170 [2,2',3,3',4,4',5-heptachlorobiphenyl]	0.05			1.401E-02
23	PCB-180 [2,2',3,4,4',5,5'-heptachlorobiphenyl]	0.05			1.401E-02
24	PCB-187 [2,2',3,4',5,5',6-heptachlorobiphenyl]	0.1			2.803E-02
25	PCB 189 [2,3,3',4,4',5,5'-heptachlorobiphenyl]	0.05	0.00003	4.204E-07	1.401E-02
26	PCB-195 [2,2',3,3',4,4',5,6-octachlorobiphenyl]	0.05			1.401E-02
27	PCB-206 [2,2',3,3',4,4',5,5',6-nonachlorobiphenyl]	0.05			1.401E-02
28	PCB-209 [2,2'3,3',4,4',5,5',6,6 '-decachlorobiphenyl]	0.05			1.401E-02
			Total PCB TEQ:	*3.233E-03*	
				Total PCB:	*0.519*

Note: *Data will be reported down to the EDLs, which are sample specific and generally 1/2 - 1/5 the associated QLs.

***Estimated In Stack Detection Limit, ISDL, is based on the following:

A) Sample rate of 0.7 ft3/min (0.0198 m_3/min)

B) Three-hour test run at a sample rate of 42 ft3/hr (1.189 m_3/hr) would yield approximately 126 ft^3 3.568 m^3)

EPA Method 23 Laboratory QA

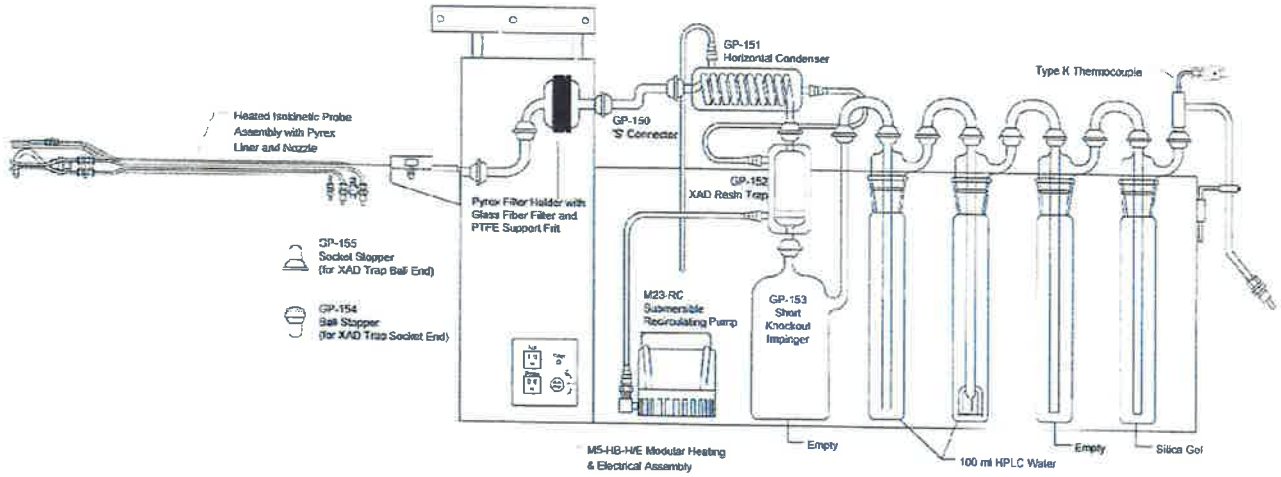
Vista Analytical Laboratory
1104 Windfield Way, El Dorado Hills, CA 95762
(916) 673-1520

Matrix: Air
Analytical Group: PCDDs/PCDFs, PAHs, PCBs
Analytical Method EPA Method 23

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action
Pre-sampling Adsorbent Spike and Pre-extraction Filter Spike	Pre-sampling adsorbent and pre-extraction filter spike recoveries must demonstrate on a per sample basis that recovery of the labeled standard achieved the requirements this method.	Recoveries of all pre-sampling isotopically labeled spike compounds standards added to the sample and all pre-extraction filter recovery spike compounds added to the filter must be between 70 and 130 percent.	If the recovery of all the presampling adsorbent spike standards is below 70 percent, the sampling runs are not valid, and repeat the invalid runs. As an alternative, repeating the invalid sampling runs is not required if the average pre-sampling adsorbent spike recovery is 25 percent or more and you divide the final results by the average fraction of pre-sampling adsorbent spike recovery. If the recovery of the preextraction filter spike is below 70 percent, the filter sampling extraction recovery is not valid, and flag the test run results.	Analyst and/or data validator
Pre-extraction Spike Recoveries	Pre-extraction spike recoveries must demonstrate on a per sample basis that recovery of the labeled standard achieved the requirements of this method.	Recoveries of all pre-extraction isotopically labeled spike compounds standards added to the sample must be between 20 to 130 percent for PCDD/PCDFs and PAHs (Tables 23–7 and 23–8 of this method) and between 20 to 145 percent for PCBs (Table 23–9 of this method).		Analyst and/or data validator
Pre-analysis Spike Recoveries	Add pre-analysis standards to every sample in a known concentration.	Response of all pre-analysis isotopically labeled spike compounds must show a S/N for every selected ion current profile of ≥10.	Recoveries below the limits may be accepted if the signal to noise is >10:1. If the signal to noise is not >10:1, samples must be re-extracted and re-analyzed or the data must be qualified.	Analyst and/or data validator
Batch Blank Samples	Analyze batch blank samples at least once during each analytical sequence or every 24 hours, whichever period is shorter.	Target levels must be ≤ three times the EDL of the method or 10 times lower than the quantitation limit required by the end use of the data, whichever is higher.	If blank assessment fails this criterion, flag sample data from this test with explanation that the blank samples failed the method criteria.	Analyst and/or data validator
Field Train Proof Blank	Conduct at least one field train proof blank for each test series at the sampling site.	Native target compound concentrations must be less than or equal to three times the EDL of the method or 10 times lower than the quantitation limit required by the end use of the data, whichever is higher.	If blank assessment fails this criterion, flag sample data from this test with explanation that the blank samples failed the method criteria.	Analyst and/or data validator

DISCLAIMER: Information may change as Vista establishes our In-house SOP for this method.

EPA Method 23 Sample Train



9.5 Selected Trace Metals EPA Method 29

Select trace metals will be determined using EPA Method 29. The samples to be determined are aluminum, antimony, arsenic, beryllium, cadmium, total chromium, cobalt, copper lead, manganese, mercury, nickel, phosphorus, selenium, vanadium, and zinc. Triplicate test runs will be performed collecting a minimum of 3.568 cubic meters over 180 minutes in duration for each sample. Samples are collected isokinetically with a multi-point traverse of the exhaust stack.

Pre-test Cleaning Procedure: All glassware and sample components which come in contact with the sample gas will be pre-cleaned using the following procedure according to the method:

a. Soak in a hot solution of Liquinox detergent and water;
b. Following soaking, rinse six times with hot tap water;
c. Next, soak in 10% nitric acid for at least four hours;
d. Next, rinse three times with DI water;
e. Next, rinse with acetone and allow to air dry;
f. Finally, seal all pieces with parafilm.

Sample Train Operation: Pretest preparations, preliminary determinations, and leak check procedures will follow those outlined in EPA Method 5 and EPA Method 29. Borosilicate glass probe liners and nozzles are used to avoid possible contamination.

The EPA Method 29 sampling train include a heated glass probe equipped with an S-type pitot tube and thermocouple. The probe is attached to an oven containing a heated filter holder, Teflon frit and quartz glass-fiber filter. Both the probe exit temperature and oven are maintained at 248°F ± 25°F during sampling. The filter holder is connected by a length of new 3/8" diameter Teflon tubing to the impinger train containing six chilled impingers in series. The impinger train is connected to the dry gas meter control box. The optional first impinger is empty, and serves as a moisture knock-out; the second and third impingers each contained 100 ml of 5% HNO3/10% H2O2, the fourth was empty, the fifth and sixth impingers each contained 100 ml of 4% KMnO4/10% H2SO4. The seventh impinger contains indicating silica gel. All of the impinger tare weights were recorded prior to sampling.

The entire sample train is leak checked prior to sampling and again following test run. The pre-test leak check is performed at -10" vacuum to ensure that sample system leak rate does not exceed 0.02 cfm. The post-test leak check is performed at a vacuum greater than the highest vacuum recorded during the test run. The leak rate cannot exceed the lesser of a) 4 percent of the average sampling rate, or b) 0.02 cfm.

9.5 Selected Trace Metals EPA Method 29 (continued)

Sample Recovery

Sample containers used for the Method 29 tests are pre-cleaned amber glass, wide mouth jars with Teflon leak-proof caps. Each jar is rinsed with 5% nitric acid prior to use. The contents of the impingers were weighed and recorded prior to recovery. All sample system components are rinsed a minimum of three times using the appropriate recovery reagent. The liquid level was marked on each sample container.

The filter is collected and placed into Container 1. The nozzle, probe and front-half of the filter holder are rinsed into Container 2 using a total of 100 ml of 0.1N HNO_3. The contents of the first three impingers are placed into Container 3. The impingers and back half of the filter holder were rinsed into Container 3 using a total of 100 ml of 0.1N HNO3. The contents of the fourth impinger are collected into Container 4 and the impinger rinsed with 100 ml of 0.1 HNO3 and poured into the same container. The contents of the fifth and sixth impingers are collected into Container 5 followed by rinses of a total of 100 ml of both 4% KMnO4/10% H_2SO_4 and DI water in that order. Finally, these impingers are rinsed into Container 6 using exactly 25 ml of 8N HCl.

Samples will be hand delivered to the laboratory and analysis performed within the method's hold-time. All QA/QC and chain of custody procedures will be followed in strict accordance with the test method.

Sample Analysis:

The sample analysis will be performed by Chester Labnet contact information:

Chester LabNet
Paul Duda, Laboratory Manager
12242 SW Garden Place
Tigard, OR 97223
(503) 624-2183

Sample analysis procedures will be performed in accordance with the method including the use of microwave digestion and proportional compositing of the front half, filter, and back half sample fractions (impingers 1-3) for analysis of trace metals. The potassium permanganate impinger catch and the hydrochloric acid rinse fractions will be analyzed separately for mercury. Analysis techniques include the use of inductively coupled plasma (ICP) and cold vapor atomic absorption spectroscopy (CVAAS). Spiked quality control samples, matrix spikes, serial dilution, and duplicate analyses will all be used to establish the quality of the data. Duplicate analyses will be performed on 10% of all samples.

Reporting Results that are below the In-Stack Detection Limits

As stated previously, when a target compound is measured at or below the Estimated Detection Limit (EDL), the EDL will be used for concentration calculations and when determining In Stack Detection Limit (ISDL). As stated in the Oregon Source Sampling Manual Section 2.11.c states "*Each test replicate that is below the ISDL should be reported as less than (<) the detection limit value (e.g., <0.14). If the test replicate is included in a multi-run test series, the*

9.5 Selected Trace Metals EPA Method 29 (continued)

Reporting Results that are below the In-Stack Detection Limits (continued)

ISDL value is used when calculating the numerical average. Label the average result as less than (<) if the numerical average of a test series includes at least one test replicate below the ISDL".
assessment determination). Results will be reported in units of concentration (µg/dscm) and mass emissions (lb/hr). Complete documentation of the calculations is provided in the appendices.

Selected Trace Metals In Stack Detection Limits

		*Laboratory Analytical Detection Limit			
		Front Half MDL (ug/250ml)	Back Half MDL (ug/100ml)	Total MDL (ug/sample)	***Estimated In Stack Detection Limit, ISDL (ug/m^3)
1	Aluminum (Al)	3.75	1.50	5.25	1.4715
2	Antimony (Sb)	1.25	0.50	1.75	0.4905
3	Arsenic (As)	1.75	0.70	2.45	0.6867
4	Beryllium (Be)	0.05	0.02	0.07	0.0196
5	Cadmium (Cd)	0.10	0.04	0.14	0.0392
6	Total Chromium (Cr)	0.20	0.08	0.28	0.0785
7	Cobalt (Co)	0.13	0.05	0.18	0.0505
8	Copper (Cu)	1.25	0.50	1.75	0.4905
9	Lead (Pb)	1.25	0.50	1.75	0.4905
10	Manganese (Mn)	0.08	0.03	0.11	0.0308
11	**Mercury (Hg)	0.022	0.025	0.05	0.0132
12	Nickel (Ni)	0.75	0.30	1.05	0.2943
13	Phosphorus (P)	5.00	2.00	7.00	1.9619
14	Selenium (Se)	3.75	1.50	5.25	1.4715
15	Vanadium (Va)	0.25	0.10	0.35	0.0981
16	Zinc (Zn)	0.75	0.30	1.05	0.2943

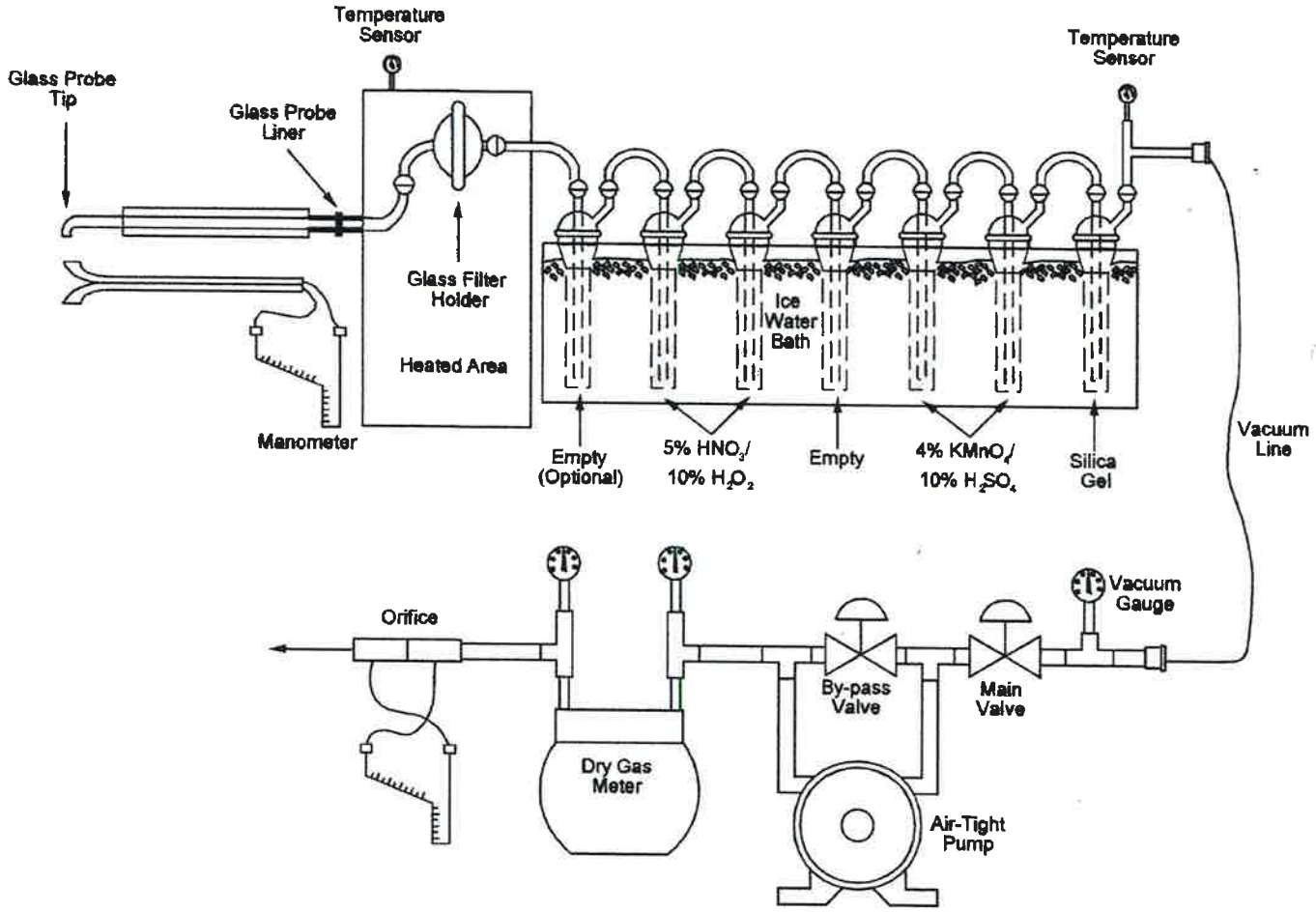
Note: *Laboratory Analytical Detection Limit based on ICP analysis.
**Mercury Analytical Detection Limit based on CVAA analysis.
***Estimated In Stack Detection Limit, ISDL, is based on the following:
A) Sample rate of 0.7 ft3/min (0.0198 m3/min)
B) Three-hour test run at a sample rate of 42 ft3/hr (1.189 m3/hr) would yield approximately 126 ft3 (3.568 m3)

EPA Method 29 QA

ETS & Chester LabNet Analytical Laboratory **Matrix:** Air

QC Sample	Frequency/Number	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action
Field QA	Acetone Blank, 100ml 0.1N HNO3 Blank, 300ml DI Water Blank, 100ml HNO3/H2O2 Blank, 300ml KMnO4 Blank, 100ml 8N HCl 25ml/200ml DI water Blank Filter Blanks, 3 unused filters	Once per Source		
Laboratory Analysis	Method Blank	Once per digestion batch, ≤20 samples	< Detection Limit	1.) Re-analyze digestate 2.) Re-digest + reanalyze batch 3.) Note in Case Narrative
	Low Level LCS, Spiked at ~3% of DL	Once per digestion batch, ≤20 samples	50% - 200% Recovery	1.) Re-analyze digestate 2.) Re-digest + reanalyze batch 3.) Note in Case Narrative
	LCS, Spiked at ~midpoint of calibration curve	Once per digestion batch, ≤20 samples	80% - 120% Recovery	1.) Re-analyze digestate 2.) Re-digest + reanalyze batch 3.) Note in Case Narrative
	LCS Duplicate, Spiked at ~midpoint of calibration curve	Once per digestion batch, ≤20 samples	80% - 120% Recovery	1.) Re-analyze digestate 2.) Re-digest + reanalyze batch 3.) Note in Case Narrative
	Duplicate Analysis	Once per sample	±3% RPD	1.) Re-analyze digestate 2.) Re-digest + reanalyze batch 3.) Note in Case Narrative
	Spike	One per fraction per source	80% - 120% Recovery	1.) Re-analyze digestate 2.) Re-digest + reanalyze batch 3.) Note in Case Narrative
	Method Blank	Once per digestion batch, ≤20 samples	< Detection Limit or < lowest sample result	1.) Re-analyze digestate 2.) Note in Case Narrative

EPA Method 29 Sample Train



Note: The ETS Method 29 Sample Train utilizes a TFE sample line from the front-half filter exit to the 1st impinger inlet.

10.) General

Method-specific quality assurance / quality control procedures will be followed to ensure that the data is valid for determining source compliance and emission factor development. Documentation of the procedures and results will be presented in the final source test report for review.

In no case will sampling replicates be accepted if separated by a time duration of more than twenty-four hours (24hrs), unless prior authorization is granted by ODEQ. The agency will be notified of any significant change in the source test plan prior to testing. In accordance with Department guidelines, a signed Source Test Audit Certification will be included with the final report.

Source test reports will be submitted to the Agency within sixty (60) days of the test completion due to the additional time needed by the laboratories to complete the required analysis. Industrial Oils Inc. will send one (1) copy of the completed source test report to the ODEQ, Cleaner Air Oregon (Portland) office. If you have any questions please give us a call at (541) 779-2646.

Respectfully Submitted,

Andy Winkler
Sr. Project Manager
Environmental Technical Services, Inc.

Oregon
Kate Brown, Governor

Department of Environmental Quality
Agency Headquarters
700 NE Multnomah Street, Suite 600
Portland, OR 97232
(503) 229-5696
FAX (503) 229-6124
TTY 711

July 29, 2020

Scott Briggs
Oil Re-Refining Company dba Industiral Oils, Inc
4150 N Suttle Road
Portland, OR 97217

Mr. Briggs,

The Oregon Department of Environmental Quality (DEQ) received a revised source test plan from Environmental Technical Services (ETS) on behalf of Oil Re-Refining Company (ORRCO) on July 23, 2020 as required by the Cleaner Air Oregon (CAO) process. Based on our review the source test plan is approved with the following comments.

General Comments

PCB totals reporting is for all congeners, not the sum of just the congeners in OAR 340-245-8020 Table 2.

Any modifications and/or alternatives to testing methods or procedures that are implemented to satisfy DEQ testing requirements must receive approval from DEQ prior to their use in the field. Changes not acknowledged by the DEQ could be the basis for invalidating an entire test run and potentially the entire testing program.

DEQ appreciates the continued assistance with this process. The results will provide valuable information that will help us better understand emissions from the facility, and allow for completing the CAO emissions inventory. If you have any questions or concerns please contact me directly. Thank you for your continued efforts with this process.

Sincerely,

Thomas Rhodes

Thomas Rhodes
DEQ CAO Source Test Coordinator

Cc: Andy Winkler, ETS
Marie Piper, Cascade Environmental Management
Keith Johnson, DEQ
Kenzie Billings, DEQ
Mark Bailey, DEQ
Frank Messina, DEQ
Mark Ludwiczak, DEQ
File

SOURCE TESTING AUDIT REPORT: CERTIFICATION FORM

Facility: ORRCO dba Industrial Oils, Inc **Permit #:** 18-0020-SI-01
Test Date: Aug. 25 & 26, 2020 **Emission Unit:** Auxiliary Boiler
Sampling Location: Boiler Exhaust Stack

SECTION 1: TESTING PROGRAM CERTIFICATION INFORMATION

ITEM OF INQUIRY	Yes	No	EXPLANATION
A. Is the purpose(s) for the testing clearly defined within the test report?	X		
B. Did testing include all pollutants specified within the Source Test Plan (STP)?	X		
C. Were all issues within the Department's response to the STP fully addressed?	X		
D. Was the source operating within ±10% of normal maximum capacity?	X		
E. Are all appropriate operating conditions documented?	X		
F. Were there any test interruptions?		X	
G. Were there any variances or modifications to the STP? (if Yes; reply to i & ii)		X	
i. Were the variances or modifications approved by the Department?			
ii. Does the report include an evaluation of the impact the variances or modifications had on the test data?			

SECTION 2: SOURCE SAMPLING REPORT AUDITOR CERTIFICATION:

I hereby certify that to the best of my knowledge, the information provided within this source sampling audit report is complete and factual.

Name: Andy Winkler Title: Sr. Project Manager

Signature: [signature] Date: 11.16.20

SECTION 3: PERMITTEE REPRESENTATIVE CERTIFICATION:

I hereby certify that to the best of my knowledge, the information provided within this source sampling audit report is complete and factual.

Name: Scott BRIGGS Title: PRESIDENT

Signature: [signature] Date: 11-16-2020

SECTION 4: DEPARTMENT REPRESENTATIVE:

The Oregon Department of Environmental Quality has evaluated the Source Sampling Audit Report and has determined that the information provided is sufficient for accepting the results originating from the testing program. Although no deficiencies were exposed by the Source Sampling Audit Report, additional errors and/or inconsistencies may be detected through additional Departmental review at a later date, which may lead to a retest or an enforcement action against the permittee.

Name: _____ Title: _____

Signature: _____ Date: _____