Dublin City Council
Dublin Waste to Energy Project

Report on Pre-Commissioning Tests

May 2018

CDM Smith

Table of Contents

APPENDICES

LIST OF TABLES

LIST OF FIGURES

Glossary

CEMS	Continuous Emissions Monitors
CR	Client's Representative
DWTE	Dublin Waste-to-Energy
DWTEL	Dublin Waste to Energy Limited
ELV	Emission Limit Values
GJ	Gigajoules
HZI	Hitachi Zosen Inova
IE	Industrial Emissions
MC	Mechanical Completion
MEC	Mechanical/Electrical Completion
MW	Megawatts
NIC	Nominal Input Capacity
PA	Project Agreement
PAT	Performance Acceptance Test
PDT	Performance Demonstration Test
PM	PM Group
PPP	Public Private Partnership

Section 1 Introduction

The Dublin Waste to Energy (DWTE) project is a Public Private Partnership (PPP) between Dublin City Council **'the Authority'** (acting on behalf of the four Dublin Local Authorities) and Dublin Waste to Energy Limited (DWTEL) **'the PPP Co.'**

The Project Agreement (PA) between the Authority and PPP Co. provides for the design, construction, operation, maintenance and financing of a waste to energy facility by the PPP Co., which is capable of thermally treating 600,000 tonnes per annum of non-hazardous municipal and industrial waste.

The construction schedule provided by PPP Co. for the delivery of the works envisaged a 33-month construction and commissioning programme, beginning in October 2014 (month 1) and ending June 2017 (month 33). Ultimately, the construction and initial commissioning activities took slightly longer, being completed in October 2017 (month 37), closely aligning with the schedule provided in the PA.

During the commissioning phase of the Project, the PPP Co. is required to conduct a number of tests to demonstrate to the Authority that the DWTE Facility is capable of operating at its design capacity and in accordance with the contractual and statutory requirements, namely the Waste Licence, now referenced as the Industrial Emissions (IE) licence.

The Authority appointed CDM Smith as Client's Representative (CR) for the construction and commissioning stages of the DWTE Project on 1 December 2014. A key scope of the appointment was the monitoring and reporting on the commissioning of the DWTE Facility and to evaluate if the DWTE Facility was operated under normal and representative conditions during the testing and that the DWTE Facility's performance was at or above the contractual and statutory requirements.

1.1 Purpose of this Document

As part of their contractual requirements, the PPP Co. is tasked with conducting a series of tests to demonstrate the operational capacity of the DWTE Facility pursuant to Schedule 08 of the PA. These tests include:

- Pre-Commissioning Tests (this report);
- Performance Demonstration Tests (PDT); and
- Performance Acceptance Tests (PAT).

The Pre-Commissioning Tests to determine readiness for the PDT were conducted in early September 2017 and the PDT was conducted between 08 September – 08 October 2017. The PAT will be conducted in 2018 following 4,000 hours of operation per the requirements of Schedule 08 of the PA and following the completion of all construction works.

This report focuses on the Pre-Commissioning Tests and does not discuss the PDT or PAT; the results of these tests are addressed in separate reports. The CR is responsible for monitoring and review of the DWTE Facility performance during the Pre-Commissioning Tests and advising the Authority on the readiness for the PDT. This report documents the actions taken and

observations made by the CR during the Pre-Commissioning Tests, our review of the test results and recommendations relative to the PPP Co.'s readiness to begin the PDT.

Section 2 Pre-Commissioning Tests

2.1 Introduction

The Project Agreement, Schedule 08, Section 2, details the requirements that must be met prior to starting the Performance Demonstration Test.

Section 2.1 of Schedule 08 states that:

> *all mechanical and electrical systems, including the SCADA system, must be tested to the manufactures' recommendations prior to Commissioning.*

Section 2.2 of Schedule 08 states that:

> *The Facility is deemed ready for Performance Demonstration Tests once:*
>
> *(a) The PPP Co has demonstrated that each element/system works as intended, and that the overall Facility is constructed according to the Project Agreement and the Approved Design, and*
>
> *(b) The PPP Co has demonstrated based on SCADA printouts that the boilers and steam turbine and their associated equipment have been in continuous operation for a minimum period of 48 (forty-eight) hours while respecting the guaranteed emission limits as set out in Table 1 of Annex 1 of Part 1 of this Schedule 08. During this period the boiler unit shall have been above 80% (eighty per cent) of Nominal Input Capacity (as defined in paragraph 3.2(c) below) for a minimum of 24 (twenty-four) hours.*

2.2 Pre-Commissioning System Inspections and Startup

The requirements of Section 2.1 and Section 2.2(a) were met by the PPP Co. by the end of August 2017. Prior to commissioning individual systems, the PPP Co.'s primary subcontractors, PM Group (PM) and Hitachi Zosen Inova (HZI), conducted mechanical and electrical walkdowns of their respective work scopes in conjunction with the equipment supplier. PM, who was responsible for the civil and structural design, conducted approximately 245 Mechanical Completion (MC2) walkdowns of individual systems that were part of their scope of work. HZI, who was responsible for the process, mechanical and electrical design, conducted approximately 260 Mechanical/Electrical Completion (MEC) of individual systems covered by their work scope. The PPP Co. and CR witnessed most of these walkdowns.

Once a system walkdown was completed and any snags identified as Category A (safety) or Category B (equipment integrity) were satisfactorily addressed, the system was released for start-up and tuning. Both combustion lines and the turbine-generator were in full operation by the end of August 2017. Confirmation that the overall DWTE Facility was constructed according to the PA and the Approved Design was based on the Design Check Certificate process pursuant to Schedule 8 and the CR's observations during construction.

2.3 Continuous Operation Test Run

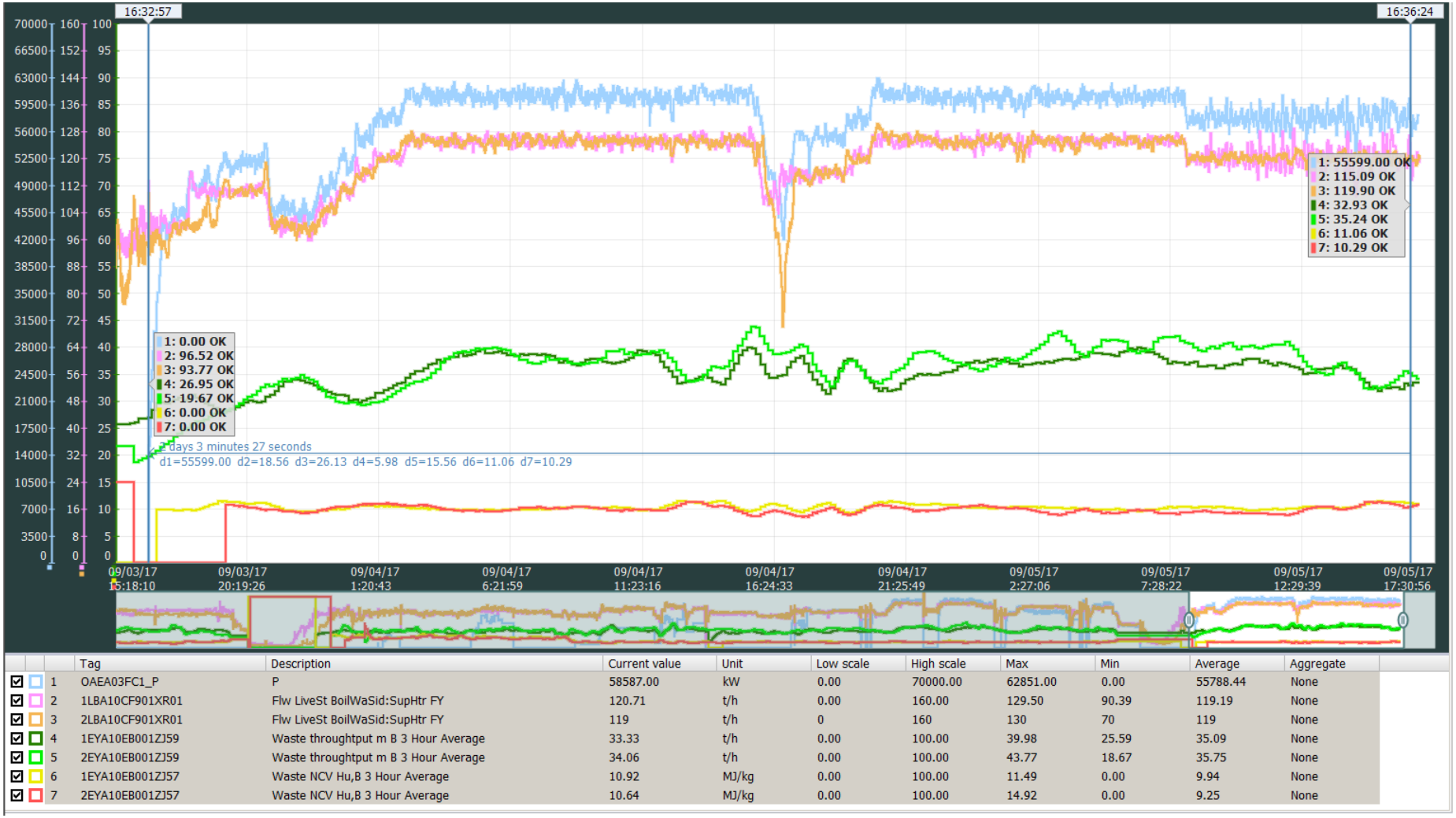
Section 2.2(b) requires that the PPP Co.:

- Operate both combustion lines and the turbine-generator for a minimum of 48 continuous hours;
- Operate each combustion line above 80% Nominal Input Capacity (NIC) for a minimum of 24 continuous hours within the 48-hour period; and
- Comply with the Emission Limit Values (ELV) for pollutants measured by the Continuous Emissions Monitoring System (CEMS) throughout the 48-hour period (Table 1 of Annex 1 of Part 1 of Schedule 08).

NIC is defined in the PA as "the thermal input capacity in megawatts (MW) equivalent to the thermal input capacity of 32 tonne/hour (t/h) at 11.5 gigajoules (GJ)/tonne". This equates to a heat input of 102.2 MW/combustion line, which is roughly equivalent to 125 tonnes steam/hour/line. Eighty percent of the NIC is 81.8 MW/combustion line or 100 tonnes steam/hour/line.

The 48 hour test commenced on 03 September at 16:33 and was successfully completed on 05 September at 16:36. The 24-hour run at NICs greater than 80% successfully occurred during the period from 16:36 on 04 September to 16:36 on 05 September.

Pursuant to Section 2.2(b), the PPP Co. submitted a copy of the control system printout demonstrating that both combustion lines and the turbine-generator operated for 48 consecutive hours and both combustion lines operated above 80% NIC for 24 consecutive hours. The printout covers the 48-hour period from 16:33 on 03 September to 16:36 on 05 September and is shown in Figure 1. The top line (blue) is the gross power output of the turbine-generator and the second (purple) and third (orange) lines are the steam flows for combustion line 1 and 2, respectively. Steam flows were used as the surrogate for NIC. The CR was on site and witnessed the 48-hour test run and reviewed the control system data.



	Tag	Description	Current value	Unit	Low scale	High scale	Max	Min	Average	Aggregate
1	OAEA03FC1_P	P	58587.00	kW	0.00	70000.00	62851.00	0.00	55788.44	None
2	1LBA10CF901XR01	Flw LiveSt BoilWaSid:SupHtr FY	120.71	t/h	0.00	160.00	129.50	90.39	119.19	None
3	2LBA10CF901XR01	Flw LiveSt BoilWaSid:SupHtr FY	119	t/h	0	160	130	70	119	None
4	1EYA10EB001ZJ59	Waste throughtput m B 3 Hour Average	33.33	t/h	0.00	100.00	39.98	25.59	35.09	None
5	2EYA10EB001ZJ59	Waste throughtput m B 3 Hour Average	34.06	t/h	0.00	100.00	43.77	18.67	35.75	None
6	1EYA10EB001ZJ57	Waste NCV Hu,B 3 Hour Average	10.92	MJ/kg	0.00	100.00	11.49	0.00	9.94	None
7	2EYA10EB001ZJ57	Waste NCV Hu,B 3 Hour Average	10.64	MJ/kg	0.00	100.00	14.92	0.00	9.25	None

Figure 1: Control System Trend for 48-Hour Test Run

The CR reviewed the data collected by the CEMS during the 48-hour test run and determined that all the results for all of the CEMS measured pollutants complied with the respective half hour and daily ELVs. The 24-hour average results for the first and second days of the test run are summarized in Table 1. The maximum half-hourly values for the first and second days of the test run are summarized in Table 2. The full dataset is included in **Appendix A**.

Table 1: Summary of 24-hour average CEMS Data During 48-Hour Test Run with

CEMS Parameter	Line 1		Line 2		PA 24-Hour ELV	IE Licence 24-Hour ELV	Pass / fail
	First 24 hours	Second 24 hours	First 24 hours	Second 24 hours			
Hydrogen Chloride (HCl)	0	0	0	0	9 mg/m3	10 mg/m3	Pass
Sulphur Dioxide (SO2)	3.0	3.9	4.2	4.2	45 mg/m3	50 mg/m3	Pass
Carbon Monoxide (CO)	1.0	1.9	1.0	0.3	50 mg/m3	50 mg/m3	Pass
Nitrogen Oxides (NOx)	162	170	158	171	180 mg/m3	200 mg/m3	Pass
Total Organic Carbon (TOC)	0	0	0	0	9 mg/m3	10 mg/m3	Pass
Dust	1	1	1	1	9 mg/m3	10 mg/m3	Pass

Table 2: Summary of Maximum Value CEMS data During 48-Hour Test Run with PA ELV

CEMS Parameter	Line 1		Line 2		PA Half-Hourly ELV	IE Licence Half-Hourly ELV	Pass / fail
	First 24 hours	Second 24 hours	First 24 hours	Second 24 hours			
Hydrogen Chloride (HCl)	0	0	0	0	54 mg/m3	60 mg/m3	Pass
Sulphur Dioxide (SO2)	4.0	4.0	5.0	5.0	180 mg/m3	200 mg/m3	Pass
Carbon Monoxide (CO)	2.0	15	32	2.0	100 mg/m3	100 mg/m3	Pass
Nitrogen Oxides (NOx)	187	188	188	189	360 mg/m3	400 mg/m3	Pass
Total Organic Carbon (TOC)	0	1	1	0	18 mg/m3	20 mg/m3	Pass
Dust	1	1	2	2	27 mg/m3	30 mg/m3	Pass

Section 3 Conclusion

The CR confirms that:

- The requirements of Section 2.1 and Paragraph (a) of Section 2.2 of Schedule 08 of the PA were deemed complete by 30 August 2017.
- A successful 48-hour test run was completed between the 03 September through 05 September 2017 in compliance with Paragraph (b) of Section 2.2 of Schedule 08 of the PA.
- Accordingly, after 06 September 2017 the DWTE Facility was deemed ready for the start of the Performance Demonstration Test pursuant to Section 2.2 of Schedule 08 of the PA.

Appendix A: 48 Hour CEMS Data

		% dry vol	Nm³/hr	mg/Nm³	mg/Nm³	mg/Nm³	mg/Nm³	mg/Nm³	mg/Nm³	% dry vol	Nm³/hr	mg/Nm³	mg/Nm³	mg/Nm³	mg/Nm³	mg/Nm³	mg/Nm³
		Line 1	Line 1	Line 1	Line 1	Line 1	Line 1	Line 1	Line 1	Line 2	Line 2	Line 2	Line 2	Line 2	Line 2	Line 2	Line 2
		O2	Flow	HCl	SO2	CO	NOx	TOC	Dust	O2	Flow	HCl	SO2	CO	NOx	TOC	Dust
Date	Time	O2 Line 1	Flow Line 1	HCl Line 1	SO2 Line 1	CO Line 1	NOx Line 1	TOC Line 1	Dust Line 1	O2 Line 2	Flow Line 2	HCl Line 2	SO2 Line 2	CO Line 2	NOx Line 2	TOC Line 2	Dust Line 2
09/03/2017	16:30:00s	6.77	147,628.52	0	3	1	172	0	1	6.04	195,805.94	0	4	32	134	1	1
09/03/2017	17:00:00s	6.91	150,285.83	0	3	1	165	0	1	6.04	195,387.95	0	4	0	156	0	1
09/03/2017	17:30:00s	6.92	149,471.72	0	3	1	174	0	1	6.36	196,011.64	0	4	1	149	0	1
09/03/2017	18:00:00s	7.02	149,819.63	0	3	1	165	0	1	6.19	204,995.59	0	4	1	157	0	1
09/03/2017	18:30:00s	6.37	161,056.31	0	3	1	169	0	1	6.09	204,280.00	0	4	1	155	0	1
09/03/2017	19:00:00s	6.64	162,575.69	0	3	1	163	0	1	6.21	212,678.33	0	3	1	166	0	1
09/03/2017	19:30:00s	6.66	162,125.03	0	3	1	172	0	1	5.86	217,424.73	0	4	0	152	0	1
09/03/2017	20:00:00s	6.79	162,044.72	0	3	1	163	0	1	6.03	224,343.64	0	4	1	164	0	1
09/03/2017	20:30:00s	6.74	161,820.13	0	3	1	163	0	1	5.93	223,474.73	0	4	0	149	0	1
09/03/2017	21:00:00s	6.57	162,170.78	0	3	1	156	0	1	5.93	224,170.56	0	4	0	160	0	1
09/03/2017	21:30:00s	7.07	152,367.48	0	2	1	152	0	1	6.36	211,295.27	0	4	3	153	0	1
09/03/2017	22:00:00s	7.12	151,021.03	0	1	1	154	0	1	6.87	215,619.31	0	4	1	166	0	1
09/03/2017	22:30:00s	7.19	151,863.09	0	2	1	151	0	1	6.45	205,770.28	0	4	0	144	0	1
09/03/2017	23:00:00s	7.03	151,757.09	0	2	1	138	0	1	6.41	204,329.64	0	4	0	151	0	1
09/03/2017	23:30:00s	6.85	156,902.47	0	2	1	153	0	1	6.14	214,205.73	0	4	1	155	0	1
09/04/2017	00:00:00s	6.59	159,804.23	0	2	1	160	0	1	5.96	219,569.28	0	4	0	159	0	1
09/04/2017	00:30:00s	6.55	163,919.86	0	2	1	170	0	1	5.98	225,990.64	0	4	0	164	0	1
09/04/2017	01:00:00s	6.55	168,827.78	0	2	1	187	0	1	5.86	234,126.33	0	4	0	165	0	1
09/04/2017	01:30:00s	6.39	173,833.83	0	2	1	179	0	1	5.94	240,066.75	0	4	0	147	0	1
09/04/2017	02:00:00s	6.51	174,847.50	0	2	1	164	0	1	5.8	244,358.53	0	4	0	168	0	1
09/04/2017	02:30:00s	6.52	177,885.33	0	2	1	155	0	1	5.62	252,254.11	0	4	0	160	0	1
09/04/2017	03:00:00s	6.4	181,326.09	0	2	1	170	0	1	5.76	254,573.14	0	4	1	162	0	2
09/04/2017	03:30:00s	6.32	180,226.97	0	2	1	166	0	1	5.75	255,050.42	0	4	1	151	0	1
09/04/2017	04:00:00s	6.4	180,415.86	0	2	1	160	0	1	5.78	255,419.05	0	4	1	161	0	2
09/04/2017	04:30:00s	6.05	180,902.83	0	3	1	160	0	1	5.87	254,022.86	0	4	1	157	0	2
09/04/2017	05:00:00s	6.63	179,960.38	0	4	1	161	0	1	5.68	254,247.41	0	4	1	158	0	2
09/04/2017	05:30:00s	6.37	180,329.47	0	4	1	151	0	1	6.57	267,863.81	0	3	1	165	0	2
09/04/2017	06:00:00s	6.45	182,217.41	0	4	1	164	0	1	5.71	254,653.33	0	4	0	159	0	2
09/04/2017	06:30:00s	6.51	182,168.06	0	4	1	159	0	1	5.61	253,744.98	0	5	0	161	0	2
09/04/2017	07:00:00s	6.48	< 179,793.98	< 0	< 4	< 1	< 158	< 0	< 1	< 5.6	< 250,806.61	< 0	< 5	< 0	< 188	< 0	< 2
09/04/2017	07:30:00s	6.53	179,120.41	0	4	1	156	0	1	5.66	254,513.17	0	5	0	154	0	2
09/04/2017	08:00:00s	6.57	179,249.27	0	4	1	163	0	1	5.9	255,208.22	0	4	0	163	0	1
09/04/2017	08:30:00s	6.39	179,109.25	0	4	1	160	0	1	5.78	254,881.48	0	4	0	151	0	2
09/04/2017	09:00:00s	6.35	178,700.33	0	4	1	156	0	1	5.78	255,279.58	0	4	0	154	0	2
09/04/2017	09:30:00s	6.4	179,231.78	0	4	1	161	0	1	5.94	255,141.25	0	4	0	163	0	2
09/04/2017	10:00:00s	6.56	190,241.41	0	2	1	167	0	1	5.74	255,085.86	0	5	0	147	0	1
09/04/2017	10:30:00s	5.57	184,871.55	0	1	1	171	0	1	5.74	255,343.64	0	5	0	162	0	2
09/04/2017	11:00:00s	6.36	180,344.13	0	3	1	165	0	1	5.92	257,192.33	0	5	0	148	0	2
09/04/2017	11:30:00s	6.36	181,082.75	0	4	1	158	0	1	5.78	254,840.22	0	5	0	171	0	2
09/04/2017	12:00:00s	6.52	180,955.41	0	4	1	158	0	1	5.8	255,264.78	0	4	0	168	0	2
09/04/2017	12:30:00s	6.49	181,672.52	0	4	1	163	0	1	5.88	253,694.42	0	4	0	161	0	1
09/04/2017	13:00:00s	6.32	182,137.72	0	3	1	160	0	1	5.76	255,861.17	0	5	0	158	0	2
09/04/2017	13:30:00s	6.57	184,924.47	0	4	1	159	0	1	5.81	255,459.11	0	5	0	159	0	2
09/04/2017	14:00:00s	6.46	181,181.75	0	4	1	164	0	1	5.73	255,779.95	0	5	0	159	0	2
09/04/2017	14:30:00s	6.6	179,014.78	0	4	1	164	0	1	5.7	254,708.53	0	5	1	155	0	2
09/04/2017	15:00:00s	6.51	181,966.61	0	4	1	156	0	1	5.64	255,412.05	0	5	0	164	0	2
09/04/2017	15:30:00s	6.4	182,920.81	0	4	2	157	0	1	5.84	255,094.17	0	5	0	168	0	1
09/04/2017	16:00:00s	7.13	175,286.42	0	4	1	163	0	1	6.21	252,682.22	0	4	2	141	0	1
09/04/2017	16:30:00s	6.97	160,475.77	0	4	1	138	0	1	7	226,321.52	0	4	1	155	0	1
09/04/2017	17:00:00s	6.62	168,821.06	0	4	2	178	0	1	7.8	201,973.17	0	5	2	167	0	1
09/04/2017	17:30:00s	6.58	167,669.39	0	3	1	176	0	1	5.7	231,049.53	0	5	1	151	0	1
09/04/2017	18:00:00s	6.8	168,471.52	0	3	1	167	0	1	5.88	236,796.20	0	5	0	166	0	1
09/04/2017	18:30:00s	6.62	168,374.13	0	3	0	167	0	1	5.98	236,861.00	0	5	0	185	0	1
09/04/2017	19:00:00s	6.56	168,532.59	0	4	1	178	0	1	5.96	236,288.17	0	4	0	188	0	1

		% dry vol	Nm^3/hr	mg/Nm^3	mg/Nm^3	mg/Nm^3	mg/Nm^3	mg/Nm^3	mg/Nm^3	% dry vol	Nm^3/hr	mg/Nm^3	mg/Nm^3	mg/Nm^3	mg/Nm^3	mg/Nm^3	mg/Nm^3
		Line 1	Line 1	Line 1	Line 1	Line 1	Line 1	Line 1	Line 1	Line 2	Line 2	Line 2	Line 2	Line 2	Line 2	Line 2	Line 2
		O2	Flow	HCl	SO2	CO	NOx	TOC	Dust	O2	Flow	HCl	SO2	CO	NOx	TOC	Dust
Date	Time	O2 Line 1	Flow Line 1	HCl Line 1	SO2 Line 1	CO Line 1	NOx Line 1	TOC Line 1	Dust Line 1	O2 Line 2	Flow Line 2	HCl Line 2	SO2 Line 2	CO Line 2	NOx Line 2	TOC Line 2	Dust Line 2
09/04/2017	19:30:00s	6.35	169,202.22	0	4	1	171	0	1	5.85	246,628.42	0	5	0	173	0	1
09/04/2017	20:00:00s	6.55	175,288.53	0	4	1	180	0	1	5.68	247,557.63	0	5	0	179	0	1
09/04/2017	20:30:00s	6.44	178,803.22	0	4	1	174	0	1	5.28	255,423.14	0	5	0	174	0	2
09/04/2017	21:00:00s	6.48	178,717.58	0	4	1	181	0	1	5.71	256,387.09	0	5	0	169	0	2
09/04/2017	21:30:00s	6.67	179,066.59	0	4	1	158	0	1	5.68	256,429.83	0	5	0	179	0	2
09/04/2017	22:00:00s	6.37	178,700.22	0	4	1	175	0	1	5.69	256,311.69	0	5	0	178	0	2
09/04/2017	22:30:00s	6.59	179,315.67	0	4	1	165	0	1	5.82	255,875.80	0	4	0	167	0	2
09/04/2017	23:00:00s	6.51	179,161.44	0	4	1	175	0	1	5.91	256,004.75	0	4	0	159	0	2
09/04/2017	23:30:00s	6.61	179,255.41	0	4	2	164	0	1	5.74	255,414.59	0	4	0	167	0	2
09/05/2017	00:00:00s	6.66	179,496.25	0	4	2	159	0	1	5.89	254,536.28	0	4	1	161	0	2
09/05/2017	00:30:00s	6.43	179,207.56	0	4	2	166	0	1	5.75	255,177.67	0	4	1	170	0	2
09/05/2017	01:00:00s	6.62	180,430.11	0	4	2	162	0	1	5.67	255,524.53	0	4	0	166	0	1
09/05/2017	01:30:00s	6.43	186,453.05	0	3	2	161	0	1	5.93	257,020.59	0	5	0	186	0	2
09/05/2017	02:00:00s	6.62	183,797.78	0	4	2	166	0	1	6.12	256,243.20	0	5	1	158	0	2
09/05/2017	02:30:00s	6.24	179,586.03	0	4	1	175	0	1	5.59	254,335.05	0	4	1	169	0	2
09/05/2017	03:00:00s	6.37	180,241.05	0	4	1	188	0	1	5.76	255,436.83	0	5	1	178	0	2
09/05/2017	03:30:00s	6.26	187,432.27	0	4	1	177	0	1	5.85	255,416.33	0	5	1	165	0	2
09/05/2017	04:00:00s	6.55	178,430.70	0	4	2	163	0	1	5.85	255,269.73	0	5	0	167	0	2
09/05/2017	04:30:00s	5.98	180,803.83	0	2	1	168	0	1	5.69	255,539.33	0	5	0	173	0	2
09/05/2017	05:00:00s	6.47	179,605.69	0	4	1	179	0	1	5.77	255,545.05	0	5	1	166	0	2
09/05/2017	05:30:00s	6.36	187,991.78	0	4	1	171	0	1	6.22	268,607.34	0	3	1	189	0	2
09/05/2017	06:00:00s	6.32	179,739.73	0	4	1	177	0	1	5.76	256,045.69	0	4	1	182	0	2
09/05/2017	06:30:00s	6.47	188,255.69	0	4	1	169	0	1	5.78	255,842.75	0	4	0	170	0	2
09/05/2017	07:00:00s	6.4	191,490.86	0	4	1	163	0	1	5.78	255,397.67	0	4	1	162	0	2
09/05/2017	07:30:00s	6.57	186,498.83	0	4	1	176	0	1	5.61	255,082.98	0	4	0	180	0	2
09/05/2017	08:00:00s	6.46	179,410.05	0	4	1	176	0	1	5.83	256,136.28	0	4	0	182	0	2
09/05/2017	08:30:00s	6.76	173,483.50	0	4	1	167	0	1	5.9	246,793.25	0	4	0	163	0	1
09/05/2017	09:00:00s	6.5	174,096.05	0	4	2	170	0	1	5.93	247,617.95	0	4	0	167	0	1
09/05/2017	09:30:00s	6.42	172,436.34	0	4	4	172	0	1	6	247,841.36	0	4	0	167	0	1
09/05/2017	10:00:00s	6.61	173,992.22	0	4	2	165	0	1	5.92	246,954.44	0	4	1	173	0	1
09/05/2017	10:30:00s	6.68	176,866.19	0	4	1	169	0	1	5.97	247,858.31	0	3	0	176	0	1
09/05/2017	11:00:00s	6.45	176,823.67	0	4	15	166	1	1	6.01	248,001.97	0	4	0	165	0	1
09/05/2017	11:30:00s	6.61	175,431.17	0	4	1	171	0	1	5.9	247,202.63	0	3	0	164	0	1
09/05/2017	12:00:00s	6.48	173,324.17	0	4	3	159	0	1	5.97	246,812.67	0	3	0	179	0	1
09/05/2017	12:30:00s	6.61	174,982.66	0	4	9	183	0	1	5.82	246,810.56	0	3	0	166	0	1
09/05/2017	13:00:00s	6.79	173,647.33	0	4	2	167	0	1	5.98	247,565.48	0	4	0	158	0	1
09/05/2017	13:30:00s	6.44	172,925.00	0	4	1	154	0	1	5.94	247,087.16	0	4	0	176	0	1
09/05/2017	14:00:00s	6.62	174,016.44	0	4	1	183	0	1	5.94	247,345.02	0	3	0	174	0	1
09/05/2017	14:30:00s	7.03	175,380.89	0	4	5	170	0	1	5.96	247,331.89	0	3	0	170	0	1
09/05/2017	15:00:00s	6.62	176,599.95	0	4	1	158	0	1	6.07	247,574.52	0	4	0	171	0	1
09/05/2017	15:30:00s	6.62	176,665.25	0	4	2	186	0	1	6.04	248,201.75	0	4	0	156	0	1
09/05/2017	16:00:00s	6.04	174,159.22	0	4	2	167	0	1	5.94	247,423.73	0	3	1	171	0	1
09/05/2017	16:30:00s	6.96	174,756.72	0	4	1	183	0	1	6.13	247,631.95	0	3	0	186	0	1
	Max	7.2	191,490.86	0.0	4.0	15.0	188.0	1.0	1.0	7.8	268,607.34	0.0	5.0	32.0	189.0	1.0	2.0
	Min	5.6	147,628.52	0.0	1.0	0.0	138.0	0.0	1.0	5.3	195,387.95	0.0	3.0	0.0	134.0	0.0	1.0
	Average	6.6	174,429.83	0.0	3.5	1.5	166.1	0.0	1.0	5.9	244,087.81	0.0	4.2	0.7	164.4	0.0	1.5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