

Application to the South Coast AQMD for a Permit to Construct For the Grayson Repowering Project

prepared for:

**City of Glendale,
Department of Water & Power**

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prepared by:

Foulweather Consulting
Sacramento, CA
Foulweather Bluff, Hansville, WA



Appendix C

Commissioning Schedule and Emissions

Engine commissioning consists of no-load, partial-load and full-load testing performed immediately after construction for the purpose of optimizing engine operations, followed by installation of the emission control systems and optimizing and testing of the SCR systems. Several parameters – such as engine load, engine tuning, and degree of SCR control – may be varied simultaneously during testing at the discretion of the applicant and in accordance with the commissioning program laid out by the engine and control equipment manufacturers. Table C-1 shows the expected sequence and approximate timing of each commissioning event, as well as estimated monthly and maximum hourly emissions for a single engine. Wärtsilä estimates that approximately 218 hours of operating time will be required to complete the commissioning process for each engine, and that all five engines will be commissioned within a four-month period. The duration shown for each event is for a typical engine; the actual duration required to complete each event may vary from engine to engine.

Emissions during the commissioning year may be higher than those during a non-commissioning year for some pollutants due to the fact that the engines may not be optimally tuned and the SCR systems may be only partially operational or not operational at all. However, monthly emissions during the commissioning period will not exceed the proposed monthly limits in effect during normal project operation.

The CEMS will be installed and calibrated on each engine prior to the first start of each engine, and NO_x and CO emissions will be continuously monitored during the commissioning phase. Estimated NO_x and CO emissions prior to catalyst installation are shown in Table C-2, in the columns labeled “Failed Start (full RPM not achieved),” “Start with No Sync/Load (2 minutes),” and “Normal Start with Load (first 10 minutes)” and reflect the higher emissions that occur during the first few minutes of uncontrolled startups and during engine idle. Prior to installation and tuning of the emission control systems, VOC emissions calculations will be based on AP-42 emission factors¹ and fuel consumption to represent the best estimate of uncontrolled emissions from the engines. After the oxidation catalysts are installed, VOC emission factors reflecting normal operations, including startups, will be used to track emissions of these pollutants (see Table C-3). PM₁₀/PM_{2.5} and SO₂ emissions are assumed not to be controlled by the SCR systems or oxidation catalysts, so the emission factors used for those pollutants will be the same during uncontrolled engine operation as they are during normal operation.

¹ From AP-42, Section 3 (Table 3.2-2, “Uncontrolled Emission Factors for 4-Stroke Lean-Burn Engines”: VOC, 0.118 lb/MMBtu.

**Table C-1. Estimated Emissions for Each Engine During the Commissioning Process
(Averaged over all engines; individual engines may vary)**

Event	Running Profile Description	Engine Running		Engine Startups		Total Estimated Monthly Hours	Estimated Monthly Emissions for a Single Engine (lb)				
		Estimated Duration (hours)	Avg Load (%)	Estimated Number of Starts	Estimated Minutes per Startup Event		NOx	CO	VOC	SOx	PM10/2.5
First start of engine	Bearing run 5 minutes	0	n/a	1	5	0.1	13.0	0.7	0.2	0.0	0.0
Failed start	1 minute ramp up	0	n/a	5	1	0.1	8.0	0.7	0.2	0.0	0.0
Safety stops check	20-25 safety stops check, to nominal rpm 2 minutes	0	n/a	25	2	0.8	167.5	7.1	1.5	0.0	0.1
Synchronization & relay setting	No load 5 minutes	0	n/a	6	5	0.5	78.0	4.3	0.9	0.0	0.1
Engine loading and run-in	20%, 40%, 60%, 80%, 100% steps	7	75	2	2	7.1	286.4	385.0	81.6	0.4	6.9
Initial SCR system tuning prior to catalyst loading	1 hour for initial tuning, up to 100% load (average 75% load)	1	75	1	10	1.2	50.2	92.6	19.6	0.1	1.7
Subtotal Prior to Catalyst Loading		8		40		9.7	603.1	490.4	103.9	0.5	8.8
Catalyst Loaded											
SCR tuning	Average 75% load	8	75	2	30	9.0	30.2	46.8	20.7	0.6	10.7
Engine loading and run-in (cont'd)	Various loads, 40%-100%, majority at full load	20	100	10	30	25.0	137.7	196.2	84.7	1.7	28.7
Engine tuning	Various loads, 40%-100%, majority at full load	25	100	6	30	28.0	99.9	166.6	75.3	1.9	32.5
Plant optimization testing	Various loads, 40%-100%, majority at full load	16	100	4	30	18.0	65.7	108.6	49.0	1.2	20.9
CEMS RATA	100% load	6	100	2	30	7.0	30.2	46.8	20.7	0.6	10.5
Output/heat rate/emissions tests	Depending on performance test procedure	20	100	4	30	22.0	71.0	123.6	56.5	1.6	27.7
Other misc tests	Average 75% load	5	75	5	30	7.5	60.5	74.6	30.6	0.5	8.6
Subtotal Following Catalyst Loading		100	97	33		116.5	495.3	763.2	337.5	8.2	139.4
Total Prior to Substantial Completion		108		73		126	1,098.4	1,253.6	441.4	8.7	148.2
Substantial Completion											
Reliability test	100% load	72		1		72.5	106.9	282.9	140.4	10.3	111.0
Project Demonstration test	100% load	10		4		12.0	57.7	86.0	37.7	1.7	17.9
Grid code test	100% load	5		5		7.5	62.2	79.3	32.9	1.1	10.9
Subtotal		87		10		92.0	226.8	448.3	211.0	13.1	139.8
Final Acceptance											
Total		195		83		218	1,325.2	1,701.9	652.4	21.8	288.0

Table C-1. Estimated Emissions for Each Engine During the Commissioning Process (continued)

Event	Running Profile Description	Estimated Max Hourly Em (lb/hr)		
		NOx	CO	VOC
First start of engine	Bearing run 5 minutes	13.0	0.7	0.2
Failed start	1 minute ramp up	8.0	0.7	0.2
Safety stops check	20-25 safety stops check, to nominal rpm 2 minutes	67.0	2.8	0.6
Synchronization & relay setting	No load 5 minutes	39.0	2.1	0.5
Engine loading and run-in	20%, 40%, 60%, 80%, 100% steps	40.5	54.5	11.5
Initial SCR system tuning prior to catalyst loading	1 hour for initial tuning, up to 100% load (average 75% load)	43.0	79.4	16.8
Subtotal Prior to Catalyst Loading				
Catalyst Loaded				
SCR tuning	Average 75% load	11.8	14.0	5.6
Engine loading and run-in (cont'd)	Various loads, 40%-100%, majority at full load	11.8	14.0	5.6
Engine tuning	Various loads, 40%-100%, majority at full load	11.8	14.0	5.6
Plant optimization testing	Various loads, 40%-100%, majority at full load	11.8	14.0	5.6
CEMS RATA	100% load	11.8	14.0	5.6
Output/heat rate/emissions tests	Depending on performance test procedure	11.8	14.0	5.6
Other misc tests	Average 75% load	11.8	14.0	5.6
Subtotal Following Catalyst Loading				
Total Prior to Substantial Completion				
Substantial Completion				
Reliability test	100% load	11.8	14.0	5.6
Project Demonstration test	100% load	11.8	14.0	5.6
Grid code test	100% load	11.8	14.0	5.6
Subtotal				
		Max Hourly Em (lb/hr)		
Total		67.0	79.4	16.8