Air Resources Board

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Alan C. Lloyd, Ph.D.
Agency Secretary

Arnold Schwarzenegger
Governor

March 30, 2005

John Whitney
Vice President/Engineering
Clarke Fire Protection Products
3133 East Kemper Road
Cincinnati, Ohio 45241

Dear Mr. Whitney:

This letter is in response to your request, dated November 30, 2004, for approval of the direct-drive fire pump engines listed in Enclosure 1 as meeting the requirements of the Airborne Toxic Control Measure for Stationary Compression Ignition Engines (ATCM). The implementation of the ATCM is primarily within the jurisdiction of local air pollution control districts and air quality management districts (ACPDs/AQMDs), however, the ARB is authorized to provide technical advice to the local districts regarding your engines. Based on this authority, we evaluated the information you provided along with your request; the discussion of our evaluation is provided below.

From the information you provided to ARB staff, it is my understanding that the engines listed in Enclosure 1 should be able to meet the particulate matter (PM), oxides of nitrogen plus non-methane hydrocarbon (NOx+NMHC), and carbon monoxide (CO) emission standards specified in the ATCM for this type of engine. See title 17, California Code of Regulations (CCR), section 93115. However, the ATCM requires approval of your emissions estimation methodology by the control officer (APCO) of the local ACPDs and AQMDs where you wish to sell your engines. See 17 CCR 93115(h)(1). Therefore, our advice as discussed in this letter is not binding on the local air districts. You will need to obtain approval of your emissions estimation methodology by the local APCO in whose jurisdiction you wish to place the engines listed in Enclosure 1.

Enclosure 1 identifies the engines your request encompasses by Clarke Model Number and provides their recommended operating speeds, nameplate brake horsepowers, emission rates, and the ATCM-specified limits they are required to meet. Enclosure 2 provides a brief narrative description of the methodology Clarke used to calculate the estimated emission outputs found in Enclosure 1. Enclosure 3 provides the data generated for each engine listed in Enclosure 1 using the Clarke methodology.

Before we discuss our evaluation, it is important to note the reasons why we undertook this evaluation rather than requiring you to submit your information and request to the local districts first. We recognize the limited number of options that direct-drive fire pump manufacturers have in replacing or modifying engines. Direct-drive fire pump engines are designed differently than other stationary or off-road diesel-fueled engines. Direct drive fire pump engines must meet the stringent NFPA Standards that establish minimum requirements that address, among other things, reserve horsepower capacity, engine cranking systems, engine cooling systems, fuel types used, instrumentation and control, and exhaust systems. The direct-drive fire pump engine, and anything connected to the engine that may effect its performance abilities must be tested and or inspected, and then certified by an independent agency (e.g. Underwriter's Laboratory) to be conforming to the requirements of NFPA 20. Certification typically takes 12 to 18 months. In our discussions, you have informed us that you do not have emissions test data for the specific engines used in your direct drive fire pump assemblies. Also, adding exhaust system controls to these engines would void the existing certifications. Given these facts, we believe it is appropriate for you to use existing emissions test data from similar engines to demonstrate compliance with the ATCM's emission standards. Given the statewide applicability of your emission estimation results, we also believe it is appropriate for the ARB to evaluate your request and advise the local air districts as to our findings. Future requests for ARB evaluations would need to be addressed on a case-by-case basis and may not necessarily result in an ARB evaluation or in similar findings.

ARB staff has thoroughly reviewed the emissions estimation methodology used by Clarke and believes it to be a valid method for estimating the emissions from these engines and showing presumptive compliance with the ATCM's emission standards. However, it should be emphasized that your methodology only provides an estimate of emissions that would be a basis for the presumption of compliance with the ATCM. Actual test data or other information established by the local districts or the ARB that show higher emissions from these engines would supercede the estimated emissions from your methodology. In addition, the presumption of compliance will not necessarily apply if the engines found in actual use are different than the engines used in your emission estimation methodology.

To briefly summarize, Clarke used ATCM-permitted test methods to measure the emission rates (identified as "Emission Outputs" in Enclosure 1) at two specific revolutions per minute (rpms) for each of the direct-drive fire pump engines identified in Enclosure 1. Clarke then used these measured values at the specified rpms to interpolate and extrapolate the estimated emissions for the same engines at different rpms, both within the rpm range and slightly outside of the range.

All of the engines listed in Enclosure 1 are off-road certified and are similar to each other. In this case, "similar" means the engines are made by the same engine manufacturer; are part of the same engine series/base model/family; have the same bore and stroke, compression ratio, and aspiration; have fuel injection components made by the same manufacturer; and the fuel injection pumps belong to the same series/base model/family. The engines in Enclosure 1 essentially differ slightly only in horsepower ratings and engine speeds.

Based on the reasons discussed previously, ARB staff does not believe the Clarke methodology discussed in this letter can be used for estimating the emissions for any engine or application outside the Clarke direct-drive fire pump product line engines identified in Enclosure 1.

Sincerely,

/s/

Daniel E. Donohoue, Chief
Emissions Assessment Branch

Enclosures

cc: Rick McVaigh, Chairman,
Toxics and Risk Managers Committee
1990 E. Gettysburg Avenue
Fresno, CA 93726-0244

bcc: Floyd Vergara, OLA
Peggy Taricco, SSD
Ron Hand, SSD
Alex Santos, SSD
John Lee, SSD
Bonnie Soriano, SSD

ENCLOSURE 1

CLARKE FIRE PROTECTION PRODUCTIONS, INC.

CARB ATCM Compliant Fire Pump Driver Models and Ratings Based on Emission Correction for California Fuel and Mode Data

25-Mar-05

			EMISSION OUTPUTS			EMISSION LIMITS					
CLARKE MODEL NUMBER	RPM	NAMEPLATE BHP	Nox + NMHC w/ California Low Sulfur Fuel *	CO from Data Sheet	PM w/ California Low Sulfur Fuel	Tier Year	NOx + NMHC	CO	EPA PM	ATCM PM	Reference Built from John Deere Base Model
JU4H-UF10	1760	41	5.01	2.13	0.09	2004	5.6	3.7	0.30	0.15	4045D (1)
JU4H-UF10	2100	51	4.56	2.58	0.11	2004	5.6	3.7	0.22	0.15	
JU4H-UF10	2350	55	4.55	3.39	0.10	2004	5.6	3.7	0.22	0.15	
JU4H-UF20	1760	60	4.72	1.20	0.11	2004	5.6	3.7	0.22	0.15	
JU4H-UF20	2100	67	4.53	1.81	0.14	2004	5.6	3.7	0.22	0.15	
JU4H-UF20	2350	72	4.37	2.18	0.10	2004	5.6	3.7	0.22	0.15	
JU4H-UF22	2350	72	4.37	2.18	0.10	2004	5.6	3.7	0.22	0.15	
JU4H-UF22	2600	75	4.22	2.69	0.07	2004	5.6	3.7	0.22	0.15	
JU4H-UF30	1760	64	5.60	1.49	0.12	2004	5.6	3.7	0.22	0.15	4045T (2)
JU4H-UF30	2100	79	5.60	0.96	0.14	2004	5.6	3.7	0.22	0.15	
JU4H-UF30	2350	85	4.75	0.56	0.15	2004	5.6	3.7	0.22	0.15	
JU4H-UF32	2350	85	4.75	0.56	0.15	2004	5.6	3.7	0.22	0.15	
JU4H-UF32	2600	85	5.60	0.27	0.11	2004	5.6	3.7	0.22	0.15	
JU4H-UF40	1760	94	5.60	1.31	0.12	2004	5.6	3.7	0.22	0.15	
JU4H-UF40	2100	105	4.90	0.81	0.14	2003	4.9	3.7	0.22	0.15	
JU4H-UF40	2350	106	4.90	0.47	0.13	2003	4.9	3.7	0.22	0.15	
JU4H-UF42	2350	106	4.90	0.47	0.13	2003	4.9	3.7	0.22	0.15	
JU4H-UF42	2600	106	3.63	0.27	0.14	2003	4.9	3.7	0.22	0.15	
JU4H-UF50	1760	110	4.90	1.11	0.13	2003	4.9	3.7	0.22	0.15	
JU4H-UF50	2100	130	4.90	0.86	0.14	2003	4.9	3.7	0.22	0.15	
JU4H-UF50	2350	127	4.90	0.42	0.11	2003	4.9	3.7	0.22	0.15	
JU4H-UF52	2350	127	4.90	0.42	0.11	2003	4.9	3.7	0.22	0.15	
JU4H-UF52	2600	127	4.17	0.27	0.12	2003	4.9	3.7	0.22	0.15	
JU6H-UF30	1760	140	4.90	0.45	0.11	2003	4.9	3.7	0.22	0.15	6068T (3)
JU6H-UF30	2100	160	4.90	0.54	0.13	2003	4.9	3.7	0.22	0.15	
JU6H-UF30	2350	160	4.71	0.60	0.15	2003	4.9	3.7	0.22	0.15	
JU6H-UF32	2350	160	4.71	0.60	0.15	2003	4.9	3.7	0.22	0.15	
JU6H-UF32	2600	160	4.90	0.66	0.15	2003	4.9	3.7	0.22	0.15	
JU6H-UF50	1760	183	4.90	0.49	0.13	2003	4.9	2.6	0.15	0.15	
JU6H-UF50	2100	210	4.90	0.59	0.14	2003	4.9	2.6	0.15	0.15	
JU6H-UF50	2350	210	4.90	0.56	0.13	2003	4.9	2.6	0.15	0.15	
JU6H-UF52	2350	210	4.90	0.56	0.13	2003	4.9	2.6	0.15	0.15	
JU6H-UF52	2600	210	4.86	0.59	0.13	2003	4.9	2.6	0.15	0.15	
JU6H-UF60	1760	200	4.90	0.47	0.15	2003	4.9	2.6	0.15	0.15	6068H (4)
JU6H-UF60	2100	240	4.90	0.59	0.14	2003	4.9	2.6	0.15	0.15	
JU6H-UF60	2350	240	4.90	0.55	0.13	2003	4.9	2.6	0.15	0.15	
JU6H-UF62	2350	240	4.90	0.55	0.13	2003	4.9	2.6	0.15	0.15	
JU6H-UF62	2600	240	4.90	0.61	0.09	2003	4.9	2.6	0.15	0.15	

D1 weighted emission values based on Reference Data used in calulations.

	Base Model	RPM	Nox+NMHC	CO	PM
1)	4045D	1760	5.269	1.117	0.237
		2350	4.542	1.709	0.087
2)	4045T	1760	5.688	1.119	0.110
		2350	10.018	0.368	0.132
3)	6068T	1760	6.151	0.487	0.139
		2350	5.301	0.585	0.146
4)	6068H	1760	5.272	0.508	0.166
		2350	3.786	0.514	0.138

*11 ppm

Enclosure 2

March 28, 2005

Narrative Description of the Clarke Methodology Used to Estimate the Emission Rates of The Engines Identified In Enclosure 1.

1. Low Speed Reference Emission Data. The low speed reference emission data is from one of the following sources;
   a. When available actual test data from a fire pump engine at 1760 rpm was used,
   b. When 1.a. was not available, specific mode point data from actual 5 mode (D2 cycle) test of a similar engine used for generator sets at 1800 rpm (from power levels as close as possible to the fire pump power rating) was used.

   Using the reference data defined above a curve was established for each emission element at either 1760 or 1800 rpm - resulting in an emission element curve based on percent of power at the tested rpm.

2. High Speed Reference Emission Data. The high speed reference emission data is from one of the following sources;
   a. When available actual test data from a fire pump engine at the highest speed up 2600 rpm was used,
   b. When 1.a. was not available, specific mode point data from actual 8 mode (C1 cycle) test of a similar engine (from power levels as close as possible to the fire pump power rating) was used.

   Using the reference data defined above a curve was established for each emission element at the highest speed available of either 2350, 2400, 2500 or 2600 rpm - resulting in an emission element curve based on percent of power at the tested rpm.

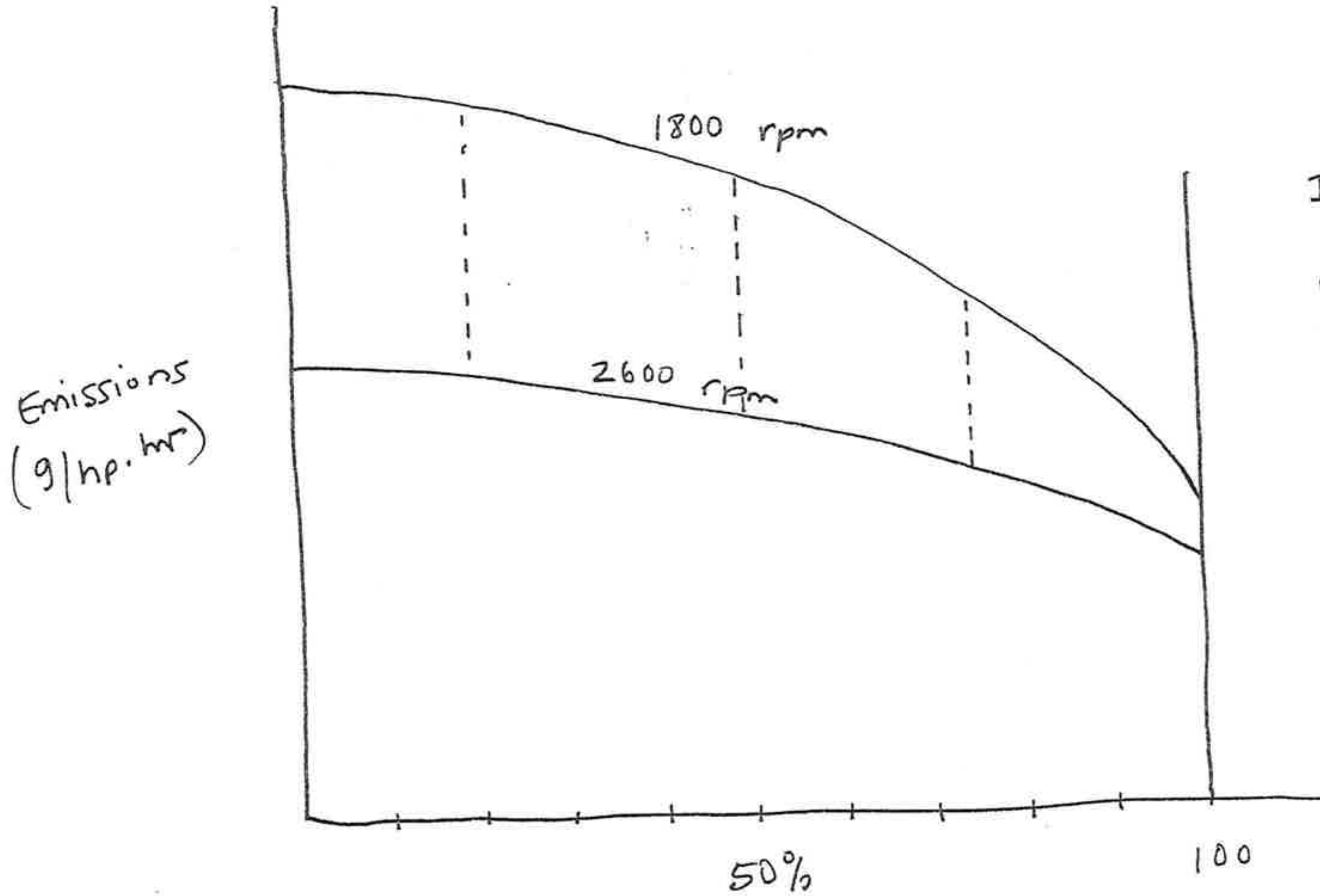
3. Using actual test emission values (from power levels as close as possible to the fire pump power rating) from high speed portion of 8 mode data a curve was established for each element at the high speed - resulting in an emission element curve based on percent of power at the high speed tested speed.

4. From the curves established in steps 1 & 2 a linear calculation is made (within the same power level) to fire pump specific speeds - resulting in an emission element curve based on percent of power for each of the actual speeds fire pump engines are operated.

5. From the curve established in step 3 a linear calculation is made from the next higher and next lower horsepower points to the specific fire pump engine horsepower rating - resulting in a specific value for specific element for each horsepower rating at a specific speed used for fire pumps.

6. From the curve established in step 4 the values were weighted according to B-Type ISO 8178 Test Cycles, Type D1.

7. From the weighted values established in step 5, using the EPA predictive model NOx, PM and HC is modified to represent those values when the engine is operated on California Low Sulfur fuel. 500 ppm → 11 ppm



ISO 8178
D1 Cycle
0.20 – 50%
0.50 – 75%
0.30 – 100%

CLARKE METHODOLOGY

- Includes EPA Allowance for Cal ULSD – ~11 ppm

SAMPLE ISO 8178 D2 CYCLE CALCULATION								
Genset 12V4000-T1237K36								
SAMPLE CALCULATION, ISO 8178, D-2 CYCLE								
Diesel Usage, est, gal/hr, 2200 hp Detroit Diesel	101.10							
Engine Load, %	10%	25%	50%	75%	100%			
Multiplier, D2 Cycle	0.1	0.3	0.3	0.25	0.05			
						CALCULATION METHOD A		
Engine Example, New, 2200 BHP Detroit Diesel 12V4000-T1237K36								
Max HP	2200	2200	2200	2200	2200			
Load	10%	25%	50%	75%	100%	TOTALS		FACTORS
instantaneous HP	220	550	1100	1650	2200	(1 hr basis)		(g/hp-hr)
Hp-Hr for portion of test	22	165	330	412.5	110	1039.5	hp-hr total	
NOx g/hr	1385	3190	7040	10395	13200			
NOx g/test Period (fraction of hour)	138.5	957	2112	2598.75	660	6466.3		6.2
CO g/hr	2200	1265	770	495	1100			
CO g/test Period (fraction of hour)	220	379.5	231	123.75	55	1009.3		1.0
HC g/hr	1115	842	792	726	550			
HC g/test Period (fraction of hour)	111.5	252.6	237.6	181.5	27.5	810.7		0.8
PM10 g/hr	143	132	165	149	220			
PM10 g/test Period (fraction of hour)	14.3	39.6	49.5	37.25	11	151.7	g total period	0.15