

Engineering Evaluation

Contra Costa County
 Application#: 23676
 Plant#: 20910
 13601 San Pablo Ave, San Pablo, 94806

BACKGROUND

Contra Costa County has applied to obtain an Authority to Construct (AC) and/or Permit to Operate (PO) for the following equipment:

**S-1 Emergency Standby Diesel Generator Set,
 MTU Detroit Diesel Inc, Model 6R1600G70S, Model Year 2011
 418 bhp, 2.44 MMBTU/hr**

The Emergency Diesel Engine Generator Set (S-1) is equipped with the best available control technology (BACT) for minimizing the release of air borne criteria pollutants and harmful air toxins due to fuel combustion. The criteria pollutants are nitrogen oxides (NO_x), carbon monoxide (CO), precursor organic compounds (POC) from unburned diesel fuel, sulfur dioxide (SO₂) and particulate matter (PM₁₀). POC is also denoted as NMHC (non-methane hydrocarbon). All of these pollutants are briefly discussed on the District's web site at www.baaqmd.gov.

The ISO 8178 D2 weighted average emission rates of this engine meets the California Air Resources Board/Environmental Protection Agency (CARB/EPA) Tier 3 Off-road standards. The engine will burn commercially available California low sulfur diesel fuel. The sulfur content of the diesel fuel will not exceed 0.0015% by weight.

EMISSIONS

Except for SO₂, the emission factors for this engine were calculated based on the ISO 8178 D2 weighted average emission rates using the test data from the manufacturer's specifications (Table 1). The SO₂ emissions were calculated based on the maximum allowable sulfur content (0.0015 wt% S) of the diesel fuel assuming that all of the sulfur present will be converted to SO₂ during the combustion process. The estimated annual emissions of criteria pollutants from the operation of S-1 are summarized in Table 2.

Basic Specification Information:	Assumptions:
418 bhp	POC is assumed to be 5% of NMHC + NO _x
Annual Activity: 50hrs/yr (assumed)	NO _x is assumed to be 95% of NMHC + NO _x
Fuel Consumption: 17.8 gal/hr	SO ₂ emissions are quantified based on the full conversion of 0.0015 wt% (~ 15 ppm) sulfur in the ULS diesel fuel (from EPA AP-42, Table 3.4-1).

Table 1 ISO 8178 D2 Emission Rates

Criteria Pollutant	Load %					D2
	100	75	50	25	10	
	g/kWh (from manufacturer's test data)					
NOx	4.56	3.54	2.52	2.61	3.52	2.37
CO	0.61	0.5	0.92	1.52	4.06	0.66
HC	0.15	0.2	0.4	0.77	2.17	0.29
PM	0.06	0.07	0.1	0.36	0.64	0.10

Annual Emissions

Annual emissions are calculated based on the number of hours per year of operation for electrical generation. The maximum allowable annual hour of operation of **50 hours** for stationary emergency diesel generators was used in emission calculation to simulate potential emergency situation.

Daily Emissions

Daily emissions are calculated to establish whether a source triggers the requirement for BACT (10 lb/highest day total source emissions for any class of pollutants). 24-hr/day of operation is assumed since no daily limits are imposed on intermittent and unexpected operations.

Table 2 Estimated Emissions for Criteria Pollutants

From Manufacturer's Test Data	Emission Factor	Emission Factor	Annual Emissions	Annual Emissions	Max. Daily
Pollutant	(g/kw-hr)	(g/hp-hr)	(lb/yr)	(TPY)	(lb/day)
NMHC+NOx	N/A	N/A			
NOx	3.18	2.37	109.10	0.0546	52.37
POC	0.39	0.29	13.35	0.0067	6.41
CO	0.88	0.66	30.38	0.0152	14.58
PM10	0.13	0.10	4.60	0.0023	2.21
SO2*		0.001515	0.18	0.00009	0.09

Note: * From Table 3.4-1 of AP-42 lb SO2/MMBTU

PLANT CUMULATIVE INCREASE

Table 2 summarizes the cumulative increase in criteria pollutant emissions that will result from the operation of S-1.

Table 2 Results of Cumulative Increase

Pollutant	Current Emissions (since August 2011) (TPY)	Increase with this application (TPY)	Cumulative Emissions (Current + Increase) (TPY)
NO _x	0	0.0546	0.0546
POC	0	0.0067	0.0067
CO	0	0.0152	0.0152
PM ₁₀	0	0.0023	0.0023
SO ₂	0	0.0001	0.0001

TOXIC RISK SCREENING ANALYSIS

A Toxics Risk Screen Analysis is required for this application because the diesel particulate matter (DPM) emissions exceed the toxic trigger level (Table 3).

Table 3 Results of Toxic Risk Screening Analysis

Toxic Pollutant Emitted	Emission Rate (lb/yr)	Risk Screening Trigger (lb/yr)
PM ₁₀ (Diesel Particulate)	4.60	0.34

Based on the ISO 8178 D2 weighted average emission rate for PM₁₀, S-1 meets Best Available Control Technology for Toxics (TBACT) since DPM is less than 0.15 g/bhp-hr. For an engine that meets the TBACT requirement, it must also pass the toxic risk screening level of less than ten in a million. Estimates of residential risk assume exposure to annual average toxic air contaminant concentrations occur 24 hours per day, 350 days per year, for a 70-year lifetime. Risk estimates for offsite workers assume exposure occurs 8 hours per day, 245 days per year, for 40 years. Risk estimates for students assume a higher breathing rate, and exposure is assumed to occur 10 hours per day, 36 weeks per year, for 9 years.

Based on 50 hours per year of operation, the emergency generator passed the Health Risk Screening Analysis (HRSA) conducted on September 6th, 2011 by the District's Toxic Evaluation Section. The source poses no significant toxic risk, since the increased cancer risk to the maximally exposed receptor

(residents) is 8.9 in a million with a hazard index of 0.003. The increased cancer risk to workers is 4.3 in a million with a hazard index of 0.003. The increased cancer risk to students is 1.1 in a million with a hazard index of 0.0009. In accordance with the District's Regulation 2, Rule 5, this risk level is considered acceptable, as it has been determined that S-1 meets the current TBACT standards.

BACT

In accordance with Regulation 2, Rule 2, Section 301, BACT is triggered for any new or modified source with the potential to emit 10 pounds or more per highest day of POC, NPOC, NOx, CO, SO₂ or PM₁₀. BACT is triggered for NOx and CO because the maximum daily emissions of each of these pollutants exceed 10 lb/day. Please refer to the discussion on "Daily Emissions" in page 1 of this evaluation. BACT for this source is presented in the current BAAQMD BACT/TBACT Workbook for IC Engine – Compression Ignition: Stationary Emergency, non-Agricultural, non-direct drive fire pump, Document # 96.1.3, Revision 7 dated 12/22/2010.

Source:	IC Engine – Compression Ignition: Stationary Emergency, non- Agricultural, non-direct drive fire pump	Revision:	7
		Document #:	96.1.3
Class:	> 50 BHP Output	Date:	12/22/2010

POLLUTANT	BACT 1. Technologically Feasible/ Cost Effective 2. Achieved in Practice 3. TBACT	TYPICAL TECHNOLOGY
POC	1. n/s ^c 2. CARB ATCM standard ^a for POC at applicable horsepower rating (see attached Table 1).	1. n/s ^c 2. Any engine certified or verified to achieve the applicable standard. ^a
NOx	1. n/s ^c 2. CARB ATCM standard ^a for NOx at applicable horsepower rating (see attached Table 1).	1. n/s ^c 2. Any engine certified or verified to achieve the applicable standard. ^a
SO₂	1. n/s ^c 2. Fuel sulfur content not to exceed 0.0015% (wt) or 15 ppm (wt).	1. n/s ^c 2. CARB Diesel Fuel (Ultra Low Sulfur Diesel)
CO	1. n/s ^c 2. CARB ATCM standard ^a for CO at applicable horsepower rating (see attached Table 1).	1. n/s ^c 2. Any engine certified or verified to achieve the applicable standard. ^a
PM₁₀	1. n/s ^c 2. 0.15 g/bhp-hr 3. 0.15 g/bhp-hr	1. n/s ^c 2. Any engine or technology demonstrated, certified or verified to achieve the applicable standard. 3. Any engine or technology demonstrated, certified or verified to achieve the applicable standard.
NPOC	1. n/s ^c 2. n/s	1. n/s ^c 2. n/s

Reference:

a. ATCM standard (listed below): Where NMHC + NOx is listed (with no individual standards for NOx or NMHC) as the standard, the portions may be considered 95% NOx and 5% NMHC. For the purposes of determining BACT NMHC = POC. Any engine which has been certified or demonstrated to meet the current year tier standard may be considered compliant with the certified emission standard for that pollutant.

b. Deleted (no longer applies).

c. Cost effectiveness analysis must be based on lesser of 50 hr/yr or non-emergency operation as limited by District health risk screen analysis.

Emissions Standards for Stationary Emergency Standby Diesel-Fueled CI Engines >50 BHP g/Kw-hr (g/bhp-hr)			
Maximum Engine Power	PM	NMHC+NOx	CO
37 < KW < 56 (50 < HP < 75)	0.20 (0.15)	4.7 (3.5)	5.0 (3.7)
56 < KW < 75 (75 < HP < 100)	0.20 (0.15)	4.7 (3.5)	5.0 (3.7)
75 < KW < 130 (100 < HP < 175)	0.20 (0.15)	4.0 (3.0)	5.0 (3.7)
130 < KW < 225 (175 < HP < 300)	0.20 (0.15)	4.0 (3.0)	3.5 (2.6)
225 < KW < 450 (300 < HP < 600)	0.20 (0.15)	4.0 (3.0)	3.5 (2.6)
450 < KW < 560 (600 < HP < 750)	0.20 (0.15)	4.0 (3.0)	3.5 (2.6)
KW > 560 (HP > 750)	0.20 (0.15)	6.4 (4.8)	3.5 (2.6)

BACT(2) requires emission factor for PM to be 0.15 g/hp-hr or lower, NO_x to be 2.85 g/hp-hr or lower, HC to be 0.15 g/hp-hr or lower, and CO to be 2.6 g/bhp-hr and lower. BACT(1) has not been determined. Based on the ISO 8178 D2 weighted average emission rate of the criteria pollutants, S-1 meets BACT.

OFFSETS

Offsets must be provided for any new or modified source at a facility that emits more than 10 tons/yr of POC or NOx per Regulation 2-2-302. Table 4 summarizes the increase in criteria pollutant emissions that will result from the operation of S-1.

Table 4 Offsets Analysis

Pollutant	Current plant emissions (TPY)	Increase in plant emissions associated with this application (TPY)	Cumulative emissions (Current + Increase) (TPY)	Regulation 2-2-302 and 2-2-303 Offset Triggers (TPY)
NOx	0	0.0546	0.0546	> 10; < 35
POC	0	0.0067	0.0067	> 10; < 35
CO	0	0.0152	0.0152	NA
PM10	0	0.0023	0.0023	> 1*
SO2	0	0.0001	0.0001	> 1*

*Applies to major facilities with a cumulative increase, minus contemporaneous emission reduction credits, in excess of 1 ton/year since April 5, 1991.

Results from Table 4 suggest S-1 do not trigger any offsets. Therefore, offsets are not warranted for any emission.

NSPS

This engine is subject to 40 CFR 60, Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines because it was manufactured after April 1, 2006, as required by Section 60.4200(a)(2)(i). The engine has a total displacement of 641 in³. The engine is a 2011 model year engine, and is not a fire pump. Section 60.4205(b) requires these engines to comply with the emission standards in Section 60.4202, which refers to 40CFR89.112 and 40CFR89.113 for all pollutants. For engines have horsepower greater than 300 but less than 600, these standards are:

<i>NMHC+NOx: 3.0 g/hp-hr</i>
CO: 2.6 g/hp-hr
PM: 0.15 g/hp-hr
20% opacity during acceleration mode
15% opacity during lugging mode
<u>50% opacity during peaks in acceleration or lugging mode</u>

According to the ISO 8178 D2 weighted average emission rate of the criteria pollutants, the engine will comply with the standards.

Sections 60.4206 and 60.4211(a) require that the owner/operator operate and maintain the engine according to the manufacturer's written instructions or procedures developed by the owner or operator that are approved by the engine manufacturer, over the entire life of the engine. The owner/operator is expected to comply with this requirement.

Section 60.4207(a) requires that by October 1, 2007, the owner/operator must use fuel that complies with 40 CFR 80.510(a). This means that the fuel must have a sulfur content of 500 parts per million (ppm) maximum, a cetane index of 40 or a maximum aromatic content of 35 volume percent. The owner/operator is expected to comply with this requirement because CARB diesel is required to be used in California.

Section 60.4207(b) requires that by October 1, 2010, the owner/operator must use fuel that complies with 40 CFR 80.510(b). This means that the fuel must have a sulfur content of 15 parts per million (ppm) maximum, and the same cetane index or aromatic content as above. The owner/operator is expected to comply with this requirement because CARB diesel is required to be used in California.

Section 60.4209(a) requires a non-resettable hour meter. This requirement is already in the standard permit conditions.

The engine will comply with the requirements of Section 60.4211(c) because it has been certified in accordance with 40 CFR Part 89.

The engine will comply with the requirement in Section 60.4211(e) to run for less than 100 hours per year for maintenance checks and readiness testing, and the prohibition of running for any reason other than emergency operation, maintenance, and testing because they are limited by permit condition to 50 hours per year for reliability testing and otherwise may only operate for emergencies.

The owner/operator is not required to perform tests in accordance with Section 60.4212 or 60.4213.

Section 60.4214 states that owner/operators do not have to submit an initial notification to EPA for emergency engines.

Because the engine does not have a diesel particulate filter, the owner/operator is not subject to Section 60.4214(c).

The owner/operator is required to comply with certain sections of 40 CFR 60, Subpart A, General Provisions. The owner/operator is expected to comply with this requirement.

NESHAP

This engine is not subject to the emission or operating limitations in 40 CFR 63, Subpart ZZZZ, National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines, because it is an emergency stationary reciprocating internal combustion engine (40 CFR 63.6600(c)).

CARB STATIONARY DIESEL ENGINE ATCM

The State Office of Administrative Law approved the Airborne Toxic Control Measure (ATCM) on November 8, 2004. State law requires the local Air Districts to implement and enforce the requirements of the ATCM. Effective May 19th, 2011, there is a prohibition on the operation of new diesel emergency standby engines greater than 50 bhp unless the following operating requirements and emission standards are met:

“Stationary Diesel Engine ATCM” section 93115.6 (3)(A), title 17, CA Code of Regulations.

1. New stationary emergency standby diesel-fueled engines (>50 bhp) shall:
 - a. meet the applicable emission standards for all pollutants for the same model year and maximum horsepower rating as specified in the following Table Emission Standards for New Stationary Emergency Standby Diesel-Fueled CI Engines, in effect on the date of acquisition or submittal, and
 - b. after December 31, 2008, be certified to the new nonroad compression-ignition (CI) engine emission standards for all pollutants for 2007 and later model year engines as specified in 40 CFR, PART 60, Subpart III-Standards of Performance for Stationary Compression Ignition Internal Combustion Engines(2006); and
 - c. not operate more than 50 hours per year for maintenance and testing purposes.

2. The District may allow a new stationary emergency standby diesel-fueled CI engine (> 50 hp) to operate up to 100 hours per year for maintenance and testing purposes on a site-specific basis, provided the diesel PM emission rate is less than or equal to 0.01 g/bhp-hr.

Emission Standards for New Stationary Emergency Standby Diesel-Fueled CI Engine g/bhp-hr (g/kW-hr)				
Maximum Engine Power	Model Year	PM	NHMC+NOx	CO
50 ≤ HP < 75 (37 ≤ kW < 56)	2007	0.15 (0.20)	5.6 (7.5) 3.5 (4.7)	3.7 (5.0)
	2008+			
75 ≤ HP < 100 (56 ≤ kW < 75)	2007	0.15 (0.20)	5.6 (7.5) 3.5 (4.7)	3.7 (5.0)
	2008+			
100 ≤ HP <175 (75 ≤ kW < 130)	2007	0.15 (0.20)	3.0 (4.0)	3.7 (5.0)
	2008+			
175 ≤ HP < 300 (130 ≤ kW < 225)	2007	0.15 (0.20)	3.0 (4.0)	2.6 (3.5)
	2008+			
300 ≤ HP < 600 (225 ≤ kW < 450)	2007	0.15 (0.20)	3.0 (4.0)	2.6 (3.5)
	2008+			
600 ≤ HP < 750 (450 ≤ kW < 560)	2007	0.15 (0.20)	3.0 (4.0)	2.6 (3.5)
	2008+			
HP > 750 (kW > 560)	2007	0.15 (0.20)	4.8 (6.4)	2.6 (3.5)
	2008+			

S-1 is in compliance with the above ATCM requirements. The diesel engine will operate for no more than 50 hours per year for electrical generation. This engine is subject to the Current off-road CI engine

standards for HC, NOx, NMHC+NOx and CO. As shown in the Table 5, the engine meets the PM requirement.

Table 5 ATCM Compliance

Criteria Pollutant	Test Data g/kw-hr	ATCM Requirement g/kw-hr
NMHC+NOx	3.57	4.0
NOx	3.18	N/A
NMHC (POC)	0.39	N/A
CO	0.88	3.5
PM	0.13	0.2

STATEMENT OF COMPLIANCE

S-1 is subject to and expected to be in compliance with the requirements of District Regulation 1-301 (*Public Nuisance*), Regulation 6-1-303 (*Ringelmann No. 2 Limitation*), Regulation 9-1 (*Sulfur Dioxide*) and Regulation 9-8 (*NOx and CO from Stationary Internal Combustion Engines*). In order to ensure compliance with the requirements of these regulations, the facility will be conditionally permitted to meet the requirements.

From Regulation 1-301, no person shall discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance or annoyance to any considerable number of persons or the public; or which endangers the comfort, repose, health or safety of any such persons or the public, or which causes, or has a natural tendency to cause, injury or damage to business or property. For purposes of this section, three or more violation notices validly issued in a 30 day period to a facility for public nuisance shall give rise to a rebuttable presumption that the violations resulted from negligent conduct.

S-1 is subject to the limitations of Regulation 6-1-303 (*Ringelmann No. 2 Limitation*). Regulation 6, Rule 1, Section 303 states that a person shall not emit for a period or periods aggregating more than three minutes in any hour, a visible emission that is as dark or darker than No. 2 on the Ringelmann Chart, or of such opacity as to obscure an observer’s view to an equivalent or greater degree, nor shall said emission, as perceived by an opacity sensing device in good working order, where such device is required by District Regulations, be equal to or greater than 40% opacity. This low PM10 emitting engine is not expected to produce visible emissions or fallout in violation of this regulation, and it will be assumed to be in compliance with Regulation 6 pending a regular inspection

S-1 is also subject to the SO₂ limitations of Regulation 9-1-301 (*Limitation on Ground Level Concentrations of Sulfur Dioxide*), Regulation 9-1-302 (*General Emission Limitation*) and 9-1-304 (*Fuel Burning*). From Regulation 9-1-301, the ground level concentrations of SO₂ will not exceed 0.5 ppm continuously for 3 consecutive minutes or 0.25 ppm averaged over 60 consecutive minutes, or 0.05 ppm averaged over 24 hours. Per Regulation 9, Rule 1, Section 302, a person shall not emit from any source a gas stream containing sulfur dioxide in excess of 300 ppm (dry). And Regulation 9, Rule 1, Section 304, states that a person shall not burn any liquid fuel having sulfur content in excess of 0.5% by weight. Compliance with both Regulations 9-1-302 and 9-1-304 is likely since California law mandates using diesel fuel with a 0.015% by weight sulfur.

Regulation 9-8 “NOx and CO from Stationary Internal Combustion Engines.” From Regulation 9-8-110.5, this source is not subject to the requirements of Regulations 9-8-301 (*Emission Limits on Fossil Derived Fuel Gas*), 9-8-302 (*Emission Limits on Waster Derived Fuel Gas*), 9-8-304 (*Emission Limits on Compression Ignited Engines*), 9-8-501 (*Initial Demonstration of Compliance*), 9-8-502 (*Record Keeping*), and 9-8-503 (*Quarterly Demonstration of Compliance*).

S-1 is exempt from Regulation 9-8-502 however; it is subject to the monitoring and record keeping procedures described in Regulation 9-8-530 (*Emergency Standby Engines, Monitoring and Recordkeeping*). The requirements of this Regulation are included in the permit conditions

This application is considered to be ministerial under the District's proposed CEQA guidelines, Regulation 2-1-311 (*Ministerial Projects*) and therefore is not subject to CEQA review. The engineering review for this project requires only the application of standard permit conditions and standard emission factors in accordance with Permit Handbook Chapter 2.3.

This facility is within 1,000 feet from the nearest school and therefore is subject to the public notification requirements of Regulation 2-1-412. PSD is not triggered.

PERMIT CONDITIONS

COND# 22850

1. The owner/operator shall not exceed 50 hours per year per engine for reliability-related testing.
[Basis: "Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(2)(A)(3) or (e)(2)(B)(3)]

2. The owner/operator shall operate each emergency standby engine only for the following purposes: to mitigate emergency conditions, for emission testing to demonstrate compliance with a District, State or Federal emission limit, or for reliability-related activities (maintenance and other testing, but excluding emission testing). Operating while mitigating emergency conditions or while emission testing to show compliance with District, State or Federal emission limits is not limited.
[Basis: "Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(2)(A)(3) or (e)(2)(B)(3)]

3. The owner/operator shall operate each emergency standby engine only when a non-resettable totalizing meter (with a minimum display capability of 9,999 hours) that measures the hours of operation for the engine is installed, operated and properly maintained.
[Basis: "Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection(e)(4)(G)(1)]

4. Records: The owner/operator shall maintain the following monthly records in a District-approved log for at least 36 months from the date of entry (60 months if the facility has been issued a Title V Major Facility Review Permit or a Synthetic Minor Operating Permit). Log entries shall be retained on-site, either at a central location or at the engine's location, and made immediately available to the District staff upon request.
a. Hours of operation for reliability-related activities (maintenance and testing).
b. Hours of operation for emission testing to show compliance with emission limits.
c. Hours of operation (emergency).
d. For each emergency, the nature of the emergency condition.
e. Fuel usage for each engine(s).
[Basis: "Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection e)(4)(l), (or, Regulation 2-6-501)]

5. At School and Near-School Operation:
If the emergency standby engine is located on school grounds or within 500 feet of any school grounds, the

following requirements shall apply: The owner/operator shall not operate each stationary emergency standby diesel-fueled engine for non-emergency use, including maintenance and testing, during the following periods:

- a. Whenever there is a school sponsored activity (if the engine is located on school grounds)
- b. Between 7:30 a.m. and 3:30 p.m. on days when school is in session. "School" or "School Grounds" means
any public or private school used for the purposes of the education of more than 12 children in kindergarten or any of grades 1 to 12, inclusive, but does not include any private school in which education is primarily conducted in a private home(s). "School" or "School Grounds" includes any building or structure, playground, athletic field, or other areas of school property but does not include unimproved school property.

[Basis: "Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(2)(A)(1)] or (e)(2)(B)(2)]

RECOMMENDATION

Issue an Authority to Construct to **Contra Costa County** for:

- S-1 Emergency Standby Diesel Generator Set,
 MTU Detroit Diesel Inc, Model 6R1600G70S, Model Year 2011
 418 bhp, 2.44 MMBTU/hr**

Jin Qiu
Air Quality Engineering Intern
Engineering Division