

ENGINEERING EVALUATION
San Francisco Public Utilities Commission Building
Application: 23183
Plant: 20690

525 Golden Gate Ave, San Francisco, CA 94102

BACKGROUND

San Francisco Public Utilities Commission Building has applied to obtain an Authority to Construct (AC) for the following equipment:

- S-1 Emergency Standby Diesel Generator Set,
 Cummins Engine Model: QST30-G5-NR2
 1490 BHP, 9.89 MMBtu/hr**
- A-1 Diesel Particulate Filter
 Johnson Matthey, CRT, EO# DE-08-009-01**

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.

S-1 is also equipped with a Diesel Particulate Filter (A-1) to reduce the PM₁₀ emissions. A-1 has been certified by CARB to have greater than 85% PM reduction.

The engine meets the Environmental Protection Agency Tier 3 Off-road standard. 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

S-1 has been certified by EPA (Certification #C#X-STATCI-11-05) to be a cleaner burning engine. Except for SO₂, the emission factors for this engine is calculated from the manufacturer's emission specification. The SO₂ emissions were calculated based on the maximum allowable sulfur content (0.0015 wt% S) of the diesel fuel with assumption that all of the sulfur present will be converted to SO₂ during the combustion process. The POC emission factor is assumed to be 5% of the total CARB's certified NO_x and POC (NMHC+NO_x) factor based on District Policy.

Basis:

1490 hp output rating
50 hr/yr operation for testing and maintenance
72.2 gallons/hr max fuel use rate
NMHC + NO_x, CO and PM10 emission factors provided by the manufacturer's specification
POC is assumed to be 5% of NMHC + NO_x
NO_x is assumed to be 95% of NMHC + NO_x
SO₂ emissions are quantified based on the full conversion of 0.0015 wt% (~ 15 ppm) sulfur in the ULS diesel fuel. The SO₂ emission factor was derived from EPA AP-42, Table 3.4-1.
The particulate filter reduces 85% of PM emissions.

Annual Emissions:

Annual emissions are calculated based on the number of hours per year of operation for testing and maintenance.

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 will be assumed since no daily limits are imposed on intermittent and unexpected operations.

Table 1

Pollutant	Emission Factor (g/kw-hr)	Emission Factor (g/hp-hr)	Abated Emission Factor (g/hp-hr)	Annual Emissions (lb/yr)	Annual Emissions (TPY)	Max. Daily (lb/day)
NMHC+NOx	5.9	4.40	4.40			
NOx	5.61	4.18	4.18	686.14	0.3431	329.35
POC	0.30	0.22	0.22	36.11	0.0181	17.33
CO	0.67	0.50	0.50	82.02	0.0410	39.37
PM10	0.184	0.137	0.021	3.38	0.0017	1.62
SO2		0.001515		0.75	0.00037	0.36
		*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

Pollutant	Current Emissions (since April 5, 1991) (TPY)	Increase with this application (TPY)	Cumulative Emissions (Current + Increase) (TPY)
NOx	0.000	0.343	0.343
POC	0.000	0.018	0.018
CO	0.000	0.041	0.041
PM10	0.000	0.002	0.002
SO2	0.000	0.000	0.000

TOXIC RISK SCREENING ANALYSIS

This application required a Toxics Risk Screen because the diesel particulate emissions are greater than the toxic trigger level.

<u>Toxic Pollutant Emitted</u>	<u>Emission Rate (lb/yr)</u>	<u>Risk Screening Trigger (lb/yr)</u>
PM10 (Diesel Particulate)	3.38	0.34

S-1 meets Best Available Control Technology for toxics (TBACT) since the diesel particulate emissions are 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 May 4th, 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 (Resident) is 0.92 in a million with a hazard index of 0.00033. The increased cancer risk to the workers is 0.48 in a million with a hazard index of 0.00034. The engine is within 500 feet of the Tenderloin Elementary School, and therefore the engine is not allowed to operate between 7:30 am and 3:30 pm on days when the school is in session. Based on the Health Risk Screening result, the health risk for students in the Tenderloin Elementary School is negligible. 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, NO_x, CO, SO₂ or PM₁₀

BACT is triggered for NO_x, POC and CO since the maximum daily emissions 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:	<i>IC Engine – Compression Ignition: Stationary Emergency, non-Agricultural, non-direct drive fire pump</i>	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	
NO_x	1. n/s ^c 2. CARB ATCM standard ^a for NO _x 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 + NO_x is listed (with no individual standards for NO_x or NMHC) as the standard, the portions may be considered 95% NO_x 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.

Table 1: BACT 2 Emission Limits based on CARB ATCM

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)

For engine with horsepower greater than 750, BACT(2) requires NOx to be 4.56 g/hp-hr or lower, CO to be 2.6 g/hp-hr or lower, and POC to be 0.24 g/hp-hr. BACT(1) has not been determined. S-1 meets the BACT requirements based on the emission factor provided in the manufacturer's specification

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

Table 3

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	0.000	0.3431	0.3431	> 10; < 35
POC	0.000	0.0181	0.0181	> 10; < 35
CO	0.000	0.0410	0.0410	NA
PM10	0.000	0.0017	0.0017	> 1*
SO2	0.000	0.00037	0.00037	> 1*

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

It can be seen from Table 3 above that S-1 does not trigger any offsets. Therefore, offsets are not warranted for any emission.

NSPS

The 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 30 liters and has 12 cylinders, so each cylinder has a volume of less than 10 liters. 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 greater 750 bhp, these standards are:

NMHC+NO_x: 4.8 g/hp-hr

CO: 2.6 g/hp-hr

PM: 0.15 g/hp-hr

20% opacity during acceleration mode

15% opacity during lugging mode

50% opacity during peaks in acceleration or lugging mode

According to the manufacturer's specification, 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.

The owner/operator is subject to Section 60.4214(c) which requires the engine to operate only equipped with the particulate filter.

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 January 1, 2005, 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, title 17, CA Code of Regulations.

Diesel PM – General Requirements

1. Meet 0.15 g/bhp-hr PM standard
2. Operate 50 hours per year, or less, for maintenance and testing (except emergency use and emissions testing)

or

1. Meet 0.01 g/bhp-hr PM standard
2. Operate up to 100 hours per year for maintenance and testing (except emergency use and emissions testing), upon approval by the District.

HC,NOx, NMHC+NOx, CO

1. Meet standards for off-road engines of the same model year and horsepower rating as specified in the OFF-Road Compression Ignition Engine Standards;

or if no standards have been established

2. Meet the Tier 2 standards for an off-road engine for the same maximum rated power.

This emergency standby diesel engine (S-1) is in compliance with the above ATCM requirements. The diesel engine will operate for no more than 50 hours per year for maintenance and reliability testing. This engine is subject to the Tier 3 off-road CI engine standards for HC, NOx, NMHC+NOx and CO. As shown in the Table 4, the engine meets these requirements.

Table 4. ATCM Tier 3 Compliance

	Manufacturer's emission g/bhp-hr	ATCM Tier 3 g/bhp-hr
NMHC+NOx	4.4	4.8
NOx	N/A	N/A
NMHC (POC)	N/A	N/A
CO	0.5	2.6
PM	0.137	0.15

STATEMENT OF COMPLIANCE

S-1 will be operated as an emergency standby engine and therefore is not subject to the emission rate limits in Regulation 9, Rule 8 ("NOx and CO from Stationary Internal Combustion Engines"). S-1 is exempt from the requirements of Sections 9-8-301 through 305, 501 and 503 per Reg. 9-8-110.5 (Emergency Standby Engines). S-1 is subject to and expected to comply with 9-8-330 (Emergency Standby Engines, Hours of Operation) since non-emergency hours of operation will be limited in the permit conditions to 50 hours per year. S-1 is also subject to and expected to comply with monitoring and record keeping requirements of Regulation 9-8-530 and the SO2 limitations of 9-1-301 (ground-level concentration) and 9-1-304 (0.5% by weight in fuel). Regulation 9-8-530 requirements are incorporated into the proposed permit conditions. Compliance with Regulation 9, Rule 1 is very likely since diesel fuel with a 0.0015% by weight sulfur is mandated for use in California. Like all combustion sources, S-1 is subject to Regulation 6, Rule 1 ("Particulate Matter"). Regulation 6-1-303.1 limits opacity from internal combustion

engines to Ringelmann 2. This engine is not expected to produce visible emissions or fallout in violation of this regulation and will be assumed to be in compliance with Regulation 6-1.

This application is considered to be ministerial under the District's Regulation 2-1-311 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.

Whenever the District receives a permit application for a new or modified source of toxic air contaminants located within 1,000 feet of a school site, State law requires that we notify the public. To comply with this requirement, we distribute or mail a Public Notice to the parents or guardians of students enrolled at schools located within ¼ mile, and all residents and businesses located within 1,000 feet, of the proposed source. The following schools are within ¼ of S-1:

Within 500 ft:

Tenderloin Elementary School
637 Turk Street
San Francisco, CA 94102

Within ¼ mile:

Sacred Heart Cathedral Preparatory School
1055 Ellis Street
San Francisco, CA 94108

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.
- Hours of operation for reliability-related activities (maintenance and testing).
 - Hours of operation for emission testing to show compliance with emission limits.
 - Hours of operation (emergency).
 - For each emergency, the nature of the emergency condition.
 - Fuel usage for each engine(s).

[Basis: "Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection e)(4)(I), (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:

- Whenever there is a school sponsored activity (if the engine is located on school grounds)
- 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 **San Francisco Public Utilities Commission Building** for:

- S-1 Emergency Standby Diesel Generator Set,
 Cummins Engine Model: QST30-G5-NR2
 1490 BHP, 9.89 MMBtu/hr**
- A-1 Diesel Particulate Filter
 Johnson Matthey, CRT, EO# DE-08-009-01**

Yu Zhang Liu
Air Quality Engineering Intern
Engineering Division
Date: 5/17/11