

**DRAFT
ENGINEERING EVALUATION
City & County of San Francisco.
P#16953-A#13107
375 Woodside Avenue
San Francisco, CA 94127**

BACKGROUND

Amoroso Construction on behalf of City & County of San Francisco has applied for an Authority to Construct and/or Permit to Operate the following equipment:

S-1 Emergency Standby Generator Set: Diesel Engine Make: Cummins; Model: KTA50-G9; Rated Horsepower: 2220 HP.

The standby generator set will be used at 375 Woodside Avenue, San Francisco, CA 94127. It will provide emergency power (in the event of a blackout) for all essential electrically powered equipment at the above site. The emergency engine must be periodically tested to ensure that it will generate electricity when needed.

DIESEL EXHAUST PURIFIER:

The Amoroso Construction is going to install the abatement device on this engine to reduce the emissions to meet the trigger level. In the effect of this air purifier the emissions from the above engine will be reduced as indicated below in Table (1)

Table (1)

Component	Emissions Before Abatement Device Installation g/bhp-hr	Emissions After Abatement Device Installation g/bhp-hr
NO _x	5.369	5.369
CO	0.969	0.921
POC	0.298	0.268
PM ₁₀	0.186	0.130

EMISSIONS SUMMARY

Annual Emissions:

The 2220 HP diesel engine at S-1 is CARB Certified and the emission factors are listed below in Table (2). For this report, it is assumed that the emission value of Total Unburned Hydrocarbons (HC) is equivalent to the emission value of POC.

Table (2)

Emission Factors		
Component	Emission (g/kw·hr)	Emission (g/bhp·hr)
NO _x	7.200	5.369
CO	1.235	0.921
POC	0.359	0.268
PM ₁₀	0.174	0.130
SO ₂ *	0.250	0.184

*The emission factor for SO₂ is from Chapter 3, Table 3.4-1 of the EPA Document AP-42, Compilation of Air Pollutant Emission Factors.
 SO₂ = $8.09E-3$ (% S in fuel oil) lb/hp-hr = $8.09E-3$ (0.05% S) (454 g/lb) = 0.184 g/hp-hr

Maximum Emissions in Tons per year:

Table (3)

Maximum Emissions in Tons per year	
NO _x	= (5.369 g/bhp-hr)(2220 hp)(26 hrs/yr)(1lb/453.6g) = 683.214 lb/yr = 0.342 TPY
CO	= (0.921 g/bhp-hr)(2220 hp)(26 hrs/yr)(1lb/453.6g) = 117.190 lb/yr = 0.059 TPY
POC	= (0.268 g/bhp-hr)(2220 hp)(26 hrs/yr)(1lb/453.6g) = 34.066 lb/yr = 0.017 TPY
PM ₁₀	= (0.130 g/bhp-hr)(2220 hp)(26 hrs/yr)(1lb/453.6g) = 16.511 lb/yr = 0.008 TPY
SO ₂	= (0.184 g/bhp-hr)(2220 hp)(26 hrs/yr)(1lb/453.6g) = 23.410 lb/yr = 0.012 TPY

Maximum Daily Emissions:

A full 24-hour day will be assumed since no daily limits are imposed on intermittent and unexpected operations. Check Table (4) for emissions per day.

Table (4)

Maximum Daily Emissions	
NO _x	= (5.369 g/bhp-hr)(2220 hp)(24 hrs/day)(1lb/453.6g) = 630.66 lb/day
CO	= (0.921 g/bhp-hr)(2220 hp)(24 hrs/day)(1lb/453.6g) = 108.18 lb/day
POC	= (0.268 g/bhp-hr)(2220 hp)(24 hrs/day)(1lb/453.6g) = 31.45 lb/day
PM ₁₀	= (0.130 g/bhp-hr)(2220 hp)(24 hrs/day)(1lb/453.6g) = 15.24 lb/day
SO ₂	= (0.184 g/bhp-hr)(2220 hp)(24 hrs/day)(1lb/453.6g) = 21.61 lb/day

Plant Cumulative Increase: (tons/year): Cumulative increase from the plant is as shown in Table (5).

Table (5)

Plant Cumulative Increase			
Pollutant	Existing tons/yr.	New tons/yr.	Total tons/yr.
NOx	0	0.342	0.342
CO	0	0.059	0.059
POC	0	0.017	0.017
PM10	0	0.008	0.008
SO ₂	0	0.012	0.012
NPOC	0	0.000	0.000

Toxic Risk Screening:

The toxic emission of diesel particulate exceeds the District Risk Screening Trigger level, as shown below in Table (6). A Risk Screening Analysis has been performed.

Table (6)

Toxic Emission Of Diesel Particulate						
Source	PM ₁₀ Emission Factor (g/HP-hr)	HP	Annual Usage (Hours/year)	Diesel Exhaust Particulate Emissions (lb/year)	Trigger Level (lb/yr)	Risk Screen Required? (Yes/No)
1	0.130	2220	26	16.5	0.64	Yes

Calculation:

$$\begin{aligned}
 \text{PM}_{10} \text{ from CARB Certified levels } &= 0.174 \text{ (g/kW-hr)} / 1.341 \text{ (hp/kW)} = 0.130 \text{ (g/hp-hr)} \\
 \text{Diesel Exhaust Particulate Emission (lb/yr.)} &= \text{PM}_{10} \text{ (g/hp-hr)} * \text{HP} * \text{Annual Usage (hr/yr)} \\
 &= 0.130 * 2220 * 26 \\
 &= 7503.6 \text{ g/yr} / 453.6 \text{ g/lb} \\
 &= 16.5 \text{ lb/yr}
 \end{aligned}$$

Since the engine meets Best Available Control Technology for Toxics (TBACT) requirements (emission level of 0.15 g/hp-hr or less), the maximum acceptable cancer risk is estimated at 10 in a million. Results from the health risk screening analysis show that for 26 hours of operation per year, excluding periods when operation is required due to emergency conditions, the risk to the maximally exposed nearest receptor is 8 in a million. The analysis was performed at a PM₁₀ emission of 16.5 lb/year (see the September 19, 2005 memo from the Toxics Evaluation Section). In accordance with the District's Risk Management Policy, this risk level is considered acceptable.

Public Notification:

Since this plant is located within 1000 ft of the following schools public notification is required.

1. Woodside Learning Center
2. Montessori Maria School
3. School of the Arts & Athletics Office

STATEMENT OF COMPLIANCE

S-1 is subject to the 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 9-1 is expected since diesel fuel with a 0.05% by weight sulfur is mandated for use in California. Like all sources, S-1 is subject to Regulation 6 ("Particulate and Visible Emissions"). These engines are not expected to produce visible emissions or fallout in violation of this regulation and they will be assumed to comply with Regulation 6 pending a regular inspection.

This application is considered ministerial under the District's proposed CEQA guidelines (Regulation 2-1-312) and therefore is not subject to CEQA review.

Best Available Control Technology (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.

Based on the emission calculations above, the owner/operator of S-1 is subject to BACT for the following pollutants: POC, NO_x and CO. BACT 1 levels do not apply for 'engines used exclusively for emergency use during involuntary loss of power' as per Reference b, Document 96.1.2 of the BAAQMD BACT Guidelines for IC Engines. Hence, the owner/operator has to meet BACT 2 limits presented below in Table (7).

Table (7)

BACT 2 Limits

BACT 2 Limits		
POLLUTANT	BACT 1. Technologically Feasible/ Cost Effective 2. Achieved in Practice 3. TBACT	TYPICAL TECHNOLOGY
POC	1. 0.30 g/bhp-hr [62 ppmvd @ 15% O ₂] ^{a,b} 2. 1.5 g/bhp-hr [309 ppmvd @ 15% O ₂] ^b	1. <i>Catalytic Oxidation and CARB or EPA (or equivalent) low-total hydrocarbon emitting certified engine^{a,b}</i> 2. <i>CARB or EPA (or equivalent) low-total hydrocarbon emitting certified engine b,c</i>

NOx	<ol style="list-style-type: none"> 1. 1.5 g/bhp-hr [107 ppmvd @ 15% O₂] ^{a,b} 2. 6.9 g/bhp-hr [490 ppmvd @ 15% O₂] ^{a,b,c} 3. 6.9 g/bhp-hr [490 ppmvd @ 15% O₂] 	<ol style="list-style-type: none"> 1. <i>Selective Catalytic Reduction (SCR) + Timing Retard + Turbocharger w/ Intercooler</i> ^{a,b} 2. <i>Timing Retard $\leq 4^\circ$ + Turbocharger w/ Intercooler</i> ^{a,b,c} 3. <i>Timing Retard $\leq 4^\circ$ + Turbocharger w/ Intercooler</i>
CO	<ol style="list-style-type: none"> 1. n/s 2. 2.75 g/bhp-hr [319 ppmvd @ 15% O₂] ^{b,c} 	<ol style="list-style-type: none"> 1. <i>Catalytic Oxidation</i> ^b 2. <i>CARB or EPA (or equivalent) low-CO emitting certified engine</i> ^{b,c}

For POC, NOx, and CO, the emission limits set by BACT 2 are met, as shown in Table (8) below.

Table (8)

Analysis of BACT2 Limits			
Pollutant	Engine Emission Factors with Catalyst (g/hp-hr)	Emission Factor Limits as set by BACT 2 (g/hp-hr)	Have the limits been met?
POC	0.268	1.5	YES
NOx	5.369	6.9	YES
CO	0.921	2.75	YES

Therefore, S-1 is determined to comply with the BACT 2 limits for POC, NOx and CO. Since CARB certification data was used to establish the POC, NOx and CO emission factors, the BACT 2 emission limits have not been incorporated into the permit conditions and are assumed to be complied with through the design standards demonstrated by the CARB certification testing.

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. Based on the emission calculations above, offsets are not required for this application.

PSD, NSPS, and NESHAPS do not apply.

Airborne Toxic Control Measure (ATCM): This facility will comply with new ATCM. Compliance with the following permit conditions will meet the ATCM requirements.

PERMIT CONDITIONS

Condition Number 22434

Engine Family: 3CEXL050ABA

Engine Model Number: KTA50-G9

Standby Power Rating: 2220 BHP

Rated Speed: 1800 RPM

Condition for S-1 Emergency Standby Generator Set, at Plant #16953

1. The owner or operator shall operate S-1, stationary emergency standby engine, only to mitigate emergency conditions or for reliability-related activities (maintenance and testing). Operating while mitigating emergency conditions and while emission testing to show compliance with this part is unlimited. Operating for reliability-related activities are limited to 26 hours per year.

(Basis: "Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(2)(A)(3))

2. The Owner/Operator shall equip the emergency standby engine(s) with
 - a. a non-resettable totalizing meter with a minimum display capability of 9,999 hours that measures the hours of operation for the engine.

(Basis: "Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(4)(G)(1))

3. The owner/operator shall not operate the emergency standby engine(s) for testing or maintenance between 7:30 AM and 3:30 PM on days when schools are in session.

[Basis: ATCM]

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. 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 (maintenance and testing).
 - b. Hours of operation for emission testing.
 - c. Hours of operation (emergency).
 - d. For each emergency, the nature of the emergency condition.
 - e. Fuel usage for engine.
 - f. CARB Certification Executive Order for the engine.

(Basis: "Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, Subsection (e)(4)(I), Regulation 1-441, Toxics)

RECOMMENDATION

Issue an Authority to Construct to City and County Of San Francisco. Located at 375 Woodside Avenue, San Francisco, CA 94127:

EXEMPTIONS

None.

By: Madhav Patil Date: 09/21/05

Air Quality Engineering

Acronyms:			
S-1	Source one	NPOC	Non- Precursor Organic Compound
HP	Horse Power	TBACT	Best Available Control Technology for Toxics
CARB	California Air Resource Board	BACT	Best Available Control Technology
NOx	Oxides of Nitrogen as NO ₂	BAAQMD	Bay Area Air Quality Management District
CO	Carbon Monoxide	IC Engines	Internal Combustion Engines
POC	Precursor Organic Compound	EPA	Environmental Protection Agency
HC	Hydrocarbons	SCR	Selective Catalytic Reduction
PM ₁₀	Particulate Matter	PSD	Prevention of Significant Deterioration
SO ₂	Sulfur Dioxide	NSPS	New Source Performance Standard
O ₂	Oxygen	NESHAPS	National Emission Standard for Hazardous Air Pollutants
ppmv	parts per million by volume	CEQA	California Environmental Quality Act
ATCM	Airborne Toxic Control Measure		