

**DRAFT**  
**ENGINEERING EVALUATION**  
**VMware, Plant: 18015**  
**Application: 15148**

**BACKGROUND**

VMware has applied to obtain an Authority to Construct (AC) and/or a Permit to Operate (PO) for the following CARB-certified diesel engine that will be used to power a standby generator located at 2197 East Bayshore Road, Palo Alto, CA 94303:

**S-1**      Emergency Standby Generator Set  
Caterpillar Engine; Model C15; 779 BHP  
EPA/CARB Family: 6CPXL15.2ESL  
CARB Executive Order: U-R-001-0296

**EMISSIONS**

**Annual Average Emissions:**

Basis:        -    779 bhp output rating  
              -    50 hr/yr operation for testing and maintenance (ATCM limit)  
              -    NO<sub>x</sub>, VOC, CO and PM<sub>10</sub> emission factors from CARB certification data:

NO<sub>x</sub>:            4.53 g/hp-hr  
VOC:            0.24 g/hp-hr (assume all POC compounds)  
CO:             2.61 g/hp-hr  
PM<sub>10</sub>:          0.149 g/hp-hr

SO<sub>2</sub> emissions are quantified based on the full conversion of 0.05 wt% (~ 500 ppm) sulfur in the diesel fuel with a density of 7.206 lbs/gal that is consumed at a rate of 37.4 gal/hr.

$$\text{NO}_x = 50 \text{ hr/yr} * 779 \text{ hp} * 4.53 \text{ g/bhp-hr} * \text{lb}/454\text{g} = \mathbf{388.98 \text{ lb/yr}} = \mathbf{0.194 \text{ TPY}}$$

$$\text{POC} = 50 \text{ hr/yr} * 779 \text{ hp} * 0.24 \text{ g/bhp-hr} * \text{lb}/454\text{g} = \mathbf{20.47 \text{ lb/yr}} = \mathbf{0.010 \text{ TPY}}$$

$$\text{CO} = 50 \text{ hr/yr} * 779 \text{ hp} * 2.61 \text{ g/bhp-hr} * \text{lb}/454\text{g} = \mathbf{223.92 \text{ lb/yr}} = \mathbf{0.112 \text{ TPY}}$$

$$\text{PM}_{10} = 50 \text{ hr/yr} * 779 \text{ hp} * 0.15 \text{ g/bhp-hr} * \text{lb}/454\text{g} = \mathbf{12.80 \text{ lb/yr}} = \mathbf{0.006 \text{ TPY}}$$

$$\text{SO}_2 = 0.0005 \text{ lb S/lb fuel} * 7.206 \text{ lb fuel/gal fuel} * 37.4 \text{ gal fuel/hr} * 64 \text{ lb SO}_2/32 \text{ lb S} * 50 \text{ hr/yr} \\ = \mathbf{13.48 \text{ lb/yr}} = \mathbf{0.007 \text{ TPY}}$$

**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.

$$\text{NO}_x = 24 \text{ hr/day} * 779 \text{ hp} * 4.53 \text{ g/bhp-hr} * \text{lb}/454\text{g} = \mathbf{186.71 \text{ lb/day}}$$

$$\text{POC} = 24 \text{ hr/day} * 779 \text{ hp} * 0.24 \text{ g/bhp-hr} * \text{lb}/454\text{g} = \mathbf{9.83 \text{ lb/day}}$$

$$\text{CO} = 24 \text{ hr/day} * 779 \text{ hp} * 2.61 \text{ g/bhp-hr} * \text{lb}/454\text{g} = \mathbf{107.48 \text{ lb/day}}$$

$$\text{PM}_{10} = 24 \text{ hr/day} * 779 \text{ hp} * 0.15 \text{ g/bhp-hr} * \text{lb}/454\text{g} = \mathbf{6.14 \text{ lb/day}}$$

$$\text{SO}_2 = 0.0005 \text{ lb S/lb fuel} * 7.206 \text{ lb fuel/gal fuel} * 31.9 \text{ gal fuel/hr} * 64 \text{ lb SO}_2/32 \text{ lb S} * 24 \text{ hr/day} \\ = \mathbf{5.52 \text{ lb/day}}$$

**PLANT CUMULATIVE INCREASE**

VMware is a new facility. Therefore, the District’s database does not contain information on existing emissions at the plant. Table 1 summarizes the cumulative increase in criteria pollutant emissions that will result from S-1.

**Table 1**

Pollutant	Existing Emissions (TPY)	Increase in Emissions (TPY)	Total Emissions (TPY)
SO2	0	0.007	0.007
NOx	0	0.194	0.194
VOC	0	0.010	0.010
CO	0	0.112	0.112
PM10	0	0.006	0.006

**TOXIC RISK SCREENING ANALYSIS**

S-1 meets Best Available Control Technology requirement 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. The cancer risk is conservative. It assumes a constant exposure of the ultra sensitive population (young people, the elderly, and the infirm, etc.) at 24 hours per day for a 70-year lifetime.

This emergency generator passed the Health Risk Screening Analysis (HRA) conducted on October 24, 2006 by the District's Toxic Evaluation Section. The results from the HRA indicate that the maximum cancer risk is estimated at 9.3 in a million if the engine were to run for 50 hours/year. The maximum cancer risk for students is estimated at 0.2 in a million. In accordance with the District’s Risk Management Policy, the above risk level is considered acceptable for an engine such as S-1 that meets TBACT.

**BACT**

BACT is triggered for NOx and CO since the maximum daily emissions of the above pollutants exceeds 10 lb/day. Please refer to the discussion on Daily Emissions in page 1 of this evaluation. BACT for this source for NOx and CO is presented in the current BAAQMD BACT/TBACT Workbook for this source category as shown below:

**Table 2**

Source:	<i>IC Engine - Compression Ignition</i>		Revision:	<i>5</i>
			Document #:	<i>96.1.2</i>
Class:	<i>&gt; or = 175 horsepower output rating</i>		Date:	<i>01/11/02</i>
POLLUTANT	BACT 1. Technologically Feasible/ Cost Effective 2. Achieved in Practice 3. TBACT		TYPICAL TECHNOLOGY	
NOx	1. <i>1.5 g/ bhp-br [107 ppmvd @ 15% O<sub>2</sub>] <sup>a,b</sup></i> 2. <i>6.9 g/ bhp-br [490 ppmvd @ 15% O<sub>2</sub>] <sup>a,b,c</sup></i> 3. <i>6.9 g/ bhp-br [490 ppmvd @ 15% O<sub>2</sub>]</i>		1. <i>Selective Catalytic Reduction (SCR) + Timing Retard + Turbocharger w/ Intercooler <sup>a,b</sup></i> 2. <i>Timing Retard ≤ 4° + Turbocharger w/ Intercooler. <sup>a,b,c</sup></i> 3. <i>Timing Retard ≤ 4° + Turbocharger w/ Intercooler</i>	
CO	1. <i>n/s</i> 2. <i>2.75 g/ bhp-br [319 ppmvd @ 15% O<sub>2</sub>] <sup>b,c</sup></i>		1. <i>Catalytic Oxidation <sup>b</sup></i> 2. <i>CARB or EPA (or equivalent) low-CO emitting</i>	

		<i>certified engine<sup>b,c</sup></i>
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**References**

- a. CARB/CAPCOA Clearinghouse
- b. BAAQMD NOTE: IC Engine BACT and TBACT is a low emitting, spark-ignited, gas-fueled engine with lean burn combustion or rich burn with non-selective catalytic reduction, or electric motor. A diesel engine will be permitted only if a gas-fueled engine, or electric motor, is not practical (e.g., a remote location without natural gas availability or electric power, or only a diesel engine will meet the portability and/or power/torque/rpm requirements of the application under review, or the engine is used exclusively for emergency use during involuntary loss of power).
- c. Timing retard, etc. controls alone may be acceptable only in very limited situations for temporary sources.

**Table 3**

Pollutant	Engine Emission Factors (g/hp-hr)	Emission Factor Limits as set by BACT 2 (g/hp-hr)	Have the limits been met?
NOx	4.53	6.9	YES
CO	2.61	2.75	YES

It can be seen from Table 3 that S-1 satisfies the current BACT 2 standards for NOx and CO. The more restrictive BACT 1 standard is not applicable to this engine because it will be limited to operation as an emergency standby engine.

Since CARB certification data was used to establish the emission factors for NOx and CO, the BACT 2 emission limits will not be incorporated into the permit conditions. Compliance with BACT 2 will be assumed through the design standards demonstrated by the CARB certification testing.

**OFFSETS**

VMware is a new facility. Therefore, the District’s database does not contain information on existing emissions at the plant. Table 4 summarizes the increase in criteria pollutant emissions that will result at Plant 18015 from the operation of S-1.

**Table 4**

Pollutant	Current Emissions (TPY)	Increase in Emissions (TPY)	Total Emissions (TPY)	Reg 2-2-302 and 2-2-303 Offset Triggers (TPY)
SO2	0	0.007	0.007	> 1
NOx	0	0.194	0.194	> 10; < 35
POC	0	0.010	0.010	> 10; < 35
CO	0	0.112	0.112	NA
PM10	0	0.006	0.006	> 1

It can be seen from Table 4 above that offsets are not warranted for NOx and POC, since the individual emissions of the above pollutants is less than 10 TPY. In addition, per Regulation 2-2-303, an increase in emissions of SO2 and PM10 from a new or modified source at a Major Facility needs to be offset only if the cumulative increase in emissions for the above pollutants minus any contemporaneous emission reduction credits provided by a facility for those pollutants since April 5, 1991 exceeds 1 TPY. VMware is not a Major Facility as defined in Regulation 2-6-212. Therefore, offsets are not warranted for SO2 and PM10.

**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)

**HC, NO<sub>x</sub>, NMHC+NO<sub>x</sub>, 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 in Title 13, CCR, Section 2423 for off-road engines of the same horsepower rating, irrespective of the new engine’s model year

This emergency standby diesel engine (S-1) complies 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 exhaust certification standards for HC, NO<sub>x</sub>, NMHC+NO<sub>x</sub> and CO. As shown in the table below, the engine meets these requirements.

**Table 5**

<b>Pollutant</b>	<b>CARB g/bhp-hr</b>	<b>Standards Tier 2 g/bhp-hr</b>
HC (POC)	0.20	N/A
NO <sub>x</sub>	3.75	N/A
NMHC+NO <sub>x</sub>	3.95	4.8
CO	1.34	2.6
PM	0.09	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 (“NO<sub>x</sub> and CO from Stationary Internal Combustion Engines”). S-1 is subject to the monitoring and record keeping requirements of Regulation 9-8-530 and the SO<sub>2</sub> 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 0.05% by weight sulfur is mandated for use in California. Like all combustion sources, S-1 is subject to Regulation 6 (“Particulate and Visible Emissions”). 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 pending a regular inspection.

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 2.3.1.

PSD, NSPS and NESHAPS are not triggered.

In compliance with the District's Regulation 2-1-412 a public notice will be posted on the internet and mailed to all Parents or Guardians with children enrolled at International School of the Peninsula. It will also be mailed to all residential neighbors located within 1000 feet of the proposed new source of pollution.

### **PERMIT CONDITIONS**

COND# 22850 -----

- 1) Operating for reliability-related activities is limited to 50 hours per year per engine.  
[Basis: "Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(2)(B)(3) or Regulation 2-5]
- 2) The owner or 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)(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 or 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)] End of Conditions

### **RECOMMENDATION**

Issue VMware an Authority to Construct for the following equipment:

- S-1**      Emergency Standby Generator Set  
                 Caterpillar Engine; Model C15; 779 BHP  
                 EPA/CARB Family: 6CPXL15.2ESL  
                 CARB Executive Order: U-R-001-0296

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