

DRAFT ENGINEERING EVALUATION
Plant # 20450: Bellarmine College Preparatory
960 West Hedding Street
San Jose, CA 95126
Application # 28542: “New” Cogeneration System

I. BACKGROUND

Bellarmino College Preparatory in San Jose is applying for an Authority to Construct and/or Permit to Operate for the following equipment:

S-3: 75 kW Modularized Cogeneration System

Natural Gas Engine Generator

Make: General Motors/Tecogen; Model: TecoDrive 7400; Model Year 2017

8 Cylinders, 4-Stroke Rich-burn, Naturally Aspirated

Power Rating: 108 BHP (75 kW); 0.946 MMBtu/hr

Abated by

A-3: Three-Way Catalyst (Clariant, EnviCat 7319)

Bellarmino College Preparatory intends to install a 75 kW cogeneration system to provide electricity for the school campus in parallel to the utility grid, while also using the engine’s waste heat to heat the campus’s outdoor swimming pool.

The new cogeneration module will satisfy up to 75 kW of base load electrical demand that is needed by the campus, allowing it to purchase less electricity from the local utility. At the same time, 511,000 Btu/hr of recovered heat from the module will be transferred into the school’s outdoor swimming pool, displacing an equivalent amount of operation from the gas-fired pool heater.

S-3 will be abated by a three-way (oxidation-reduction) catalyst. The catalyst reduces exhaust emissions of nitrogen oxides (NOx), carbon monoxide (CO), and precursor organic compounds (POC).

II. EMISSIONS CALCULATIONS

The owner/operator of S-3 abated by A-3 will be conditionally permitted at NOx and CO limits of 25 ppmvd @ 15% O2 and 100 ppmvd @ 15% O2, respectively. The actual NOx and CO emissions provided by the manufacturer are 10.84 ppmvd @ 15% O2 and 71.21 ppmvd @ 15% O2, respectively. The 25ppmvd @ 15% O2 NOx limit is based on Regulation 9-8-303.1. Regulation 9-8-303.3 limits CO emissions to 2000 ppmvd @ 15% O2. A conservative CO limit of 100 ppmvd @ 15% O2 will be used to keep daily emissions less than 10 lb/day and Best Available Control Technology will not be triggered. The manufacturer abated emission rate of 31.13 ppmvd @ 15% O2 (0.15 g/bhp) will be used to estimate POC emissions. NMHC emissions are assumed to be equal to POC emissions. AP-42 emission factors provided in Table 3.2-3 “Uncontrolled Emission Factors for 4-Stroke Rich-burn Engines” were used to estimate SO2 and PM10 emissions. The engine will operate for a maximum of 24 hours per day and 8,760 hours per year. The maximum natural gas usage rate at S-3 is 927 scfh and 76,203 therms/yr. Criteria pollutant emissions from S-3/A-3 are listed in Table 1.

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**Table 1:
Annual and Daily Criteria Pollutants Emissions from Engine**

Pollutant	Emission Factor¹	E.F. Unit	Max. Hourly Emission (lb/hr)	Max. Daily Emission (lb/day)	Annual Emission (lb/yr)	Annual Emission (TPY)
NO _x	0.346	g/BHP-hr	0.083	1.975	721.020	0.361
POC	0.15	g/BHP-hr	0.036	0.856	312.581	0.156
CO	0.8426	g/BHP-hr	0.201	4.811	1,755.874	0.878
PM ₁₀	1.941E-02*	lb/MMBtu	0.018	0.441	160.850	0.080
SO ₂	5.88E-04	lb/MMBtu	0.0006	0.013	4.873	0.002

*PM₁₀ emission factor includes emission factor for PM₁₀ filterable (9.50 E-03 lb/MMBtu) + emission factor for PM Condensable (9.91E-03 lb/MMBtu)

III. TOXIC RISK SCREENING ANALYSIS

Toxic Air Contaminant (TAC) emissions from S-3 were estimated using emission factors provided in EPA AP-42 Table 3.2-3 for natural gas fired 4-stroke rich burn engines and CARB California Air Toxics Emissions Factors (CATEFs) for natural gas fired 4-stroke rich burn engines with less than 650 hp. S-3 has a maximum firing rate of 0.946 MMBtu/hr and a maximum rating of 108 hp.

The TAC emissions were estimated based on controlled emissions because emissions from S-3 are abated by a three-way oxidation-reduction catalyst. It can be seen from Table 2 that a health risk screening analysis was not required with this application since none of the TAC trigger levels were exceeded.

**Table 2:
TAC Emissions from S-3**

Toxic Air Contaminant	Regulation 2.5 Potency Equivalency Factors (PEF's)	AP-42	Abated Emissions*	Chronic Trigger Level	HRSA Triggered?	Abated Emissions*	Acute Trigger Level	HRSA Triggered?
		EF (lb/MMBTU)	(lb/year)	(lb/year)	(Yes/No)	(lb/hr)	(lb/hr)	(Yes/No)
1,1,2,2-Tetrachloroethane		2.53E-05	1.36E-02	1.40E+00	No			
1,1,2-Trichloroethane		1.53E-05	8.24E-03	5.00E+00	No			
1,1-Dichloroethane		1.13E-05	6.09E-03	5.00E+01	No			
1,3-Butadiene		6.63E-04	3.57E-01	4.80E-01	No	3.14E-04	1.50E+00	No
Acetaldehyde		2.79E-03	1.50E+00	2.90E+01	No	1.72E-04	1.00E+00	No
Acrolein		2.63E-03	1.42E+00	1.40E+01	No	1.62E-04	5.50E-03	No
Benzene		1.58E-03	8.51E-01	2.90E+00	No	9.72E-05	6.00E-02	No
Carbon Tetrachloride		1.77E-05	9.53E-03	1.90E+00	No	1.09E-06	4.20E+00	No
Chlorobenzene		1.29E-05	6.95E-03	3.90E+04	No			
Chloroform		1.37E-05	7.38E-03	1.50E+01	No	8.42E-07	3.30E-01	No
Ethylbenzene		2.48E-05	1.34E-02	3.30E+01	No			

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		EF (lb/MMBTU)	(lb/year)	(lb/year)	(Yes/No)	(lb/hr)	(lb/hr)	(Yes/No)
Ethylene Dibromide		2.13E-05	1.15E-02	1.10E+00	No			
Formaldehyde		2.05E-02	1.10E+01	1.40E+01	No	1.26E-03	1.20E-01	No
Methanol		3.06E-03	1.65E+00	1.50E+05	No	1.88E-04	6.20E+01	No
Methylene Chloride		4.12E-05	2.22E-02	8.20E+01	No	2.53E-06	3.10E+01	No
Naphthalene		9.71E-05	5.23E-02	2.40E+00	No			
PAH or derivative **								
Benzo(a)anthracene	0.1	2.88E-07						
Benzo(a)pyrene	1	1.13E-07						
Benzo(b)fluoranthene	0.1	2.32E-07						
Benzo(k)fluoranthene	0.1	1.01E-07						
Chrysene	0.01	3.04E-07						
Dibenz(a,h)anthracene	1.05	1.23E-08						
Indeno(1,2,3-cd)pyrene	0.1	1.66E-07						
PAH or derivative TOTAL		2.07E-07	1.12E-04	6.90E-03	No			
Styrene		1.19E-05	6.41E-03	3.50E+04	No	7.32E-07	4.60E+01	No
Toluene		5.58E-04	3.01E-01	1.20E+04	No	3.43E-05	8.20E+01	No
Vinyl Chloride		7.18E-06	3.87E-03	1.40E+00	No	4.41E-07	4.00E+02	No
Xylene		1.95E-04	1.05E-01	2.70E+04	No	1.20E-05	4.90E+01	No

* Calculations assume Three-Way Catalyst (A-3) is 93.5% efficient in the reduction of Air Toxic Organic Emissions based on vendor guarantee.

** CATEF Factors were used instead of AP-42.

IV. PLANT CUMULATIVE INCREASE

Bellarmine College Preparatory is a permitted facility. Table 3 summarizes the cumulative increase in criteria pollutant emissions that will result from the operation of S-3.

**Table 3:
Cumulative Increase Post 4/5/91 in tons/year**

Pollutant	Existing	Application Increase	New
NO _x	0.019	0.361	0.380
POC	0.001	0.156	0.157
CO	0.007	0.878	0.885
PM ₁₀	0.001	0.080	0.081
SO ₂	0.0	0.002	0.002

V. BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

In accordance with Regulation 2-2-301, 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.

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Per emissions summarized in Table 1, BACT is not triggered for any pollutants since the maximum daily emission of each pollutant does not exceed 10 lb/day.

VI. OFFSETS

The pre-Application 28542 cumulative increase in emissions is listed in Table 3.

Per Reg. 2-2-302, the facility POC emissions (0.157 TPY) and NO_x emissions (0.380 TPY) are each less than 10 TPY. Therefore, the increase in POC and NO_x emissions associated with this application do not have to be offset. Per Reg. 2-2-303, the facility PM₁₀ emissions (0.081 TPY) and SO₂ emissions (0.002 TPY) do not have to be offset since this facility is not a Major Facility.

VII. NSPS (NEW SOURCE PERFORMANCE STANDARDS)

S-3 is a 2017 model year, 108 BHP (75 kW) engine. 40 CFR 60, Subpart JJJJ, Standards of Performance for Stationary Spark Ignition (SI) Internal Combustion Engines (ICEs) applies to owners and operators of stationary SI ICE that commence construction after June 12, 2006, where the stationary SI ICE are manufactured on or after July 1, 2008, for engines with a maximum engine power less than 500 HP. This Subpart also applies to owners and operators of stationary SI ICE that are modified or reconstructed after June 12, 2006, and any person that modifies or reconstructs any stationary SI ICE after June 12, 2006.

Therefore, S-3 is subject to Subpart JJJJ.

Section 60.4233(e) states that owners and operators of stationary SI ICE with a maximum engine power greater than or equal to 75 KW (100 HP) (except gasoline and rich burn engines that use LPG) must comply with the emission standards in Table 1 to this subpart for their stationary SI ICE.

For non-emergency engines that are $100 \leq \text{hp} < 500$, the emission standards in Table 1 to this subpart are:

NO _x :	2.0 g/hp-hr (2.03 g/bhp-hr)
CO:	4.0 g/hp-hr (4.06 g/bhp-hr)
VOC:	1.0 g/hp-hr (1.01 g/bhp-hr)

Per S-3 manufacturer’s emissions data listed in Table 1 of this report, S-3 complies with Subpart JJJJ emissions standards.

VIII. NESHAP (NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS)

S-3 is subject to 40 CFR 63, Subpart ZZZZ (MACT ZZZZ), National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines because the engine was constructed (~installed) on/after June 12, 2006. Per §63.6590(c)(1), “new” sources such as S-3 are required to meet the requirements in MACT ZZZZ by meeting the requirements in NSPS JJJJ. As previously discussed, S-3 complies with NSPS JJJJ. Therefore, S-3 complies with MACT ZZZZ as well.

IX. STATEMENT OF COMPLIANCE

The owner/operator of S-3 shall comply with Regulation 6-1 (*Particulate Matter – General Requirements*) and Regulation 9-1-301 (*Inorganic Gaseous Pollutants: Sulfur Dioxide for Limitations on Ground Level Concentrations*). Pursuant to Regulation 9-1-301, the ground level concentrations of

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SO₂ shall 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.

Regulation 9, Rule 8: Inorganic Gaseous Pollutants – Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines:

Regulation 9, Rule 8 applies to stationary internal combustion engines with a rated output greater than 50 bhp. The engine has a rated capacity of 108 bhp and is subject to this rule. The emission limits that S-3 is subject to are:

9-8-301.1: ...nitrogen oxide (NO_x) emissions shall not exceed 25 ppmv as corrected to 15% oxygen, dry basis.

9-8-301.3: Carbon monoxide (CO) emissions shall not exceed 2000 ppmv as corrected to 15% oxygen, dry basis.

Abated emission factors provided by the abatement device manufacturer were used to estimate NO_x and CO concentrations in the exhaust from S-3. The NO_x and CO concentrations in the exhaust from S-3 were found to be 10.84 ppmv and 71.21 ppmv, respectively, both corrected to 15% oxygen, dry basis and meet the emissions limits in Regulation 9, Rule 8.

In addition, the permittee submitted two source test results for systems similar to A-3/S-3 that demonstrated compliance with the NO_x and CO limits in Regulation 9, Rule 8.

The project is considered to be ministerial under the District's CEQA regulation 2-1-311 and is therefore not subject to CEQA review. The engineering review for this project requires only the application of standard permit conditions and standard emissions factors provided in Permit Handbook Chapter 2.3.2.

The project is located at Bellarmine College Preparatory High School and is therefore subject to the public notification requirements of Regulation 2-1-412. A public notice has been prepared and will be sent to the parents or guardians of students at Bellarmine College Preparatory and to each address within a radius of 1,000 feet of the source.

The operation of S-3 will not trigger a PSD review.

X. PERMIT CONDITIONS

S-3 will be subject to the following permit conditions:

DRAFT COND# 26490 -----

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S-3: Natural Gas Fired Cogeneration System Abated by A-3: Three-Way Catalyst

1. The owner/operator of S-3 Natural Gas Fired Cogeneration System abated by A-3 Three-Way Catalyst shall fire it exclusively with natural gas, not to exceed 76,203 therms in any consecutive twelve-month period. (Basis: Cumulative Increase)

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2. The owner/operator shall abate emissions from S-3 at all times of operation by A-3. A-3 shall be properly installed, maintained and operated. (Basis: Cumulative Increase)
3. The owner/operator of S-3 shall operate and maintain the engine and A-3 three-way catalyst in accordance with manufacturer recommendations. (Basis: Cumulative Increase, 40 CFR Part 60.4243(b)(2)(i))
4. The owner/operator of S-3 abated A-3 shall not exceed the following limits:
 - a. NO_x = 25 ppmvd @ 15% O₂
 - b. CO = 100 ppmvd @ 15% O₂(Basis: Cumulative Increase, BAAQMD Regulation 9-8-301.1, 40 CFR Part 60.4233(d))
5. Not later than 60 days from the startup of S-3, the owner/operator shall conduct District approved source tests to determine initial compliance with the limits in Part 4. The owner/operator shall submit the source test results to the District staff no later than 60 days after the source test. (Basis: 40 CFR Part 60.4243(b)(2)(i), Cumulative Increase)
6. The owner/operator shall obtain approval for all source test procedures from the District's Source Test Section prior to conducting any tests. The owner/operator shall comply with all applicable testing requirements as specified in 40 CFR Part 60.4244 (and Volume V of the District's Manual of Procedures, as applicable). The owner/operator shall notify the District's Source Test Section, in writing, of the source test protocols and projected test dates at least 7 days prior to testing. (Basis: Cumulative Increase)
7. To determine compliance with the above Parts, the owner/operator shall maintain the following records for S-3 and A-3 in a District approved log:
 - a. Monthly natural gas usage in therms
 - b. Maintenance records
 - c. Emissions testing documentation, including date and time of testing, operating conditions during test, and test results
 - d. Notifications sent to the District

The log for the monthly natural gas usage shall be kept for at least 2 years and shall be made available to the District upon request. The maintenance records, emissions testing documentation, and notifications shall be kept for the lifetime of the engine.

(Basis: Recordkeeping, 40 CFR Part 60.4245(a))

End of Conditions

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XI. RECOMMENDATION

The District has reviewed the material contained in the permit application for the proposed project and has made a preliminary determination that the project is expected to comply with all applicable requirements of District, state, and federal air quality-related regulations. The preliminary recommendation is to issue an Authority to Construct for the equipment listed below. However, the proposed source will be located within 1,000 feet of a school, which triggers the public notification requirements of District Regulation 2-1-412. After the comments are received and reviewed, the District will make a final determination on the permit.

I recommend that the District initiate a public notice and consider any comments received prior to taking any final action on issuance of an Authority to Construct for the following source:

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Natural Gas Engine Generator

Make: General Motors/Tecogen; Model: TecoDrive 7400; Model Year 2017

8 Cylinders, 4-Stroke Rich-burn, Naturally Aspirated

Power Rating: 108 BHP (75 kW); 0.946 MMBtu/hr

Abated by

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April 24, 2017