DRAFT

ENGINEERING EVALUATION REPORT

Plant Name:	**JOHN MUIR MEDICAL CENTER**
Application Number:	**18522**
Plant Number:	**1753**

BACKGROUND

John Muir Medical Center is applying for an Authority to Construct for four new natural gas-fired cogeneration engines. The applicant is requesting an AC for the following equipment:

S-13 Natural Gas-Fired IC Engine; Caterpillar Model G3406 NA, 1.97 MM Btu/hr, abated by
A-4 MINE-X Non Selective Catalytic Reduction Converter, Model 3-DC50

S-14 Natural Gas-Fired IC Engine; Caterpillar Model G3412 NA, 3.14 MM Btu/hr, abated by
A-5 MINE-X Non Selective Catalytic Reduction Converter, Model 3-DC50

S-15 Natural Gas-Fired IC Engine; Caterpillar Model G3412 NA, 3.14 MM Btu/hr, abated by
A-6 MINE-X Non Selective Catalytic Reduction Converter, Model 3-DC50

S-16 Natural Gas-Fired IC Engine; Caterpillar Model G3412 NA, 3.14 MM Btu/hr, abated by
A-7 MINE-X Non Selective Catalytic Reduction Converter, Model 3-DC50

These engines are 4 stroke rich burn reciprocating IC engines fueled solely by natural gas. They are assumed to operate 8,760 hours per year, providing electrical power and thermal energy for hot water and space heat for the hospital.

CUMULATIVE EMISSIONS

The engines meet Best Available Control Technology (BACT) for Natural Gas-Fired Spark Ignition Rich Burn Engines (see Attachment 1). Criteria pollutants are particulate matter (PM), nitrogen oxides (NOx), carbon monoxide (CO), precursor organic compounds (POC), and sulfur dioxide (SO2). TOC, NOx and CO emission factors are provided by the manufacturer. PM and SO2 emission factors for natural gas-fired 4 stroke rich burn spark ignition engines are taken from AP-42 Chapter 3.2, Table 3.2-3 "Natural Gas-Fired Reciprocating Engines". The following calculated factors include reductions due to the SCR abatement devices:

	G3406 NA	G3412 NA	UNITS
PM	10.1	10.1	lb/MMSCF
NOx	27.13	49.77	lb/MMSCF
CO	104.6	49.85	lb/MMSCF
TOC	39.3	36.6	lb/MMSCF

SO2	0.6	0.6	lb/MMSCF

Based on these calculated factors, cumulative emissions for this project are as follows:

TABLE 1 - CRITERIA POLLUTANT EMISSIONS

SOURCE	SCF/HR	PM (total) LB/MM SCF	ORG LB/MM SCF	NOX LB/MM SCF	SO2 LB/MM SCF	CO LB/MM SCF
S-13	**1934**	**10.10**	**39.30**	**27.13**	**0.60**	**104.60**
S-14	**3076**	**10.10**	**36.60**	**49.77**	**0.60**	**49.85**
S-15	**3076**	**10.10**	**23.18**	**31.52**	**0.60**	**31.57**
S-16	**3076**	**10.10**	**23.18**	**31.52**	**0.60**	**31.57**
TOTAL LB/HOUR		**0.113**	**0.414**	**0.512**	**0.007**	**0.662**
TOTAL LB/DAY		**2.71**	**9.93**	**12.28**	**0.16**	**15.90**
LB/DAY FOR S-13		**0.47**	**1.82**	**1.26**	**0.03**	**4.86**
LB/DAY/ENGINE FOR S-14, S-15 AND S-16		**0.75**	**2.70**	**3.67**	**0.04**	**3.68**
TOTAL LB/YEAR*		**988**	**3,624**	**4,483**	**59**	**5,802**
TOTAL TPY		**0.49**	**1.81**	**2.24**	**0.03**	**2.90**

PM and SO2 emission factors from AP 42, Table 3.2-3 "Natural Gas-Fired Reciprocating Engines"

NOx, CO and VOC Emission Factors from Manufacturer's Specifications

All emissions after abatement

Based on 8,760 hours/year/engine operation

TOXIC EMISSIONS

The burning of natural gas produces toxic pollutant emissions affecting the health of surrounding residential and industrial populations. Under Regulation 2, Rule 5, the effect of such toxic pollutant exposure must be considered in determining whether an Authority to Construct is in the public interest.

At the maximum potential to emit, the three cogeneration engines would have the following toxic emissions:

TABLE 2 - TOXIC POLLUTANT EMISSIONS

Source 13	1934	SCF/HR/ENGINE
Sources 14 - 16	3076	SCF/HR/ENGINE
	8760	hrs/year/engine
	97.78	MMSCF/year total

POLL NAME	CAS	Chronic Trigger (lb/yr)	Emission Factor lb/MMCF	Total EMS 4 Engines (lb/yr)	Over Chronic Trigger?	Emission Factor Source
Acetaldehyde	75-07-0	64	8.83E-01	8.63E+01	YES	CATEF
Benzene	71-43-2	6.4	1.91E+00	1.87E+02	YES	CATEF
1,3-Butadiene	106-990-0	1.1	1.04E-01	1.02E+01	YES	CATEF
Ethyl benzene	100-41-4	77000	1.23E-02	1.20E+00	NO	CATEF
Formaldehyde	50-00-0	30	2.35E+00	2.30E+02	YES	CATEF
Naphthalene	91-20-3	5.3	7.65E-02	7.48E+00	YES	CATEF
Propylene	115-07-1	120000	1.60E+01	1.56E+03	NO	CATEF
Toluene	108-88-3	12000	1.07E+00	1.05E+02	NO	CATEF
Xylene	1330-20-7	27000	6.02E-02	5.89E+00	NO	CATEF
PAHs (total)		0.011		2.07E-02	YES	CATEF

The polycyclic aromatic hydrocarbon emissions are calculated as benzo[a]pyrene equivalent as follows:

Source 13	1934	SCF/HR/ENGINE
Sources 14 - 16	3076	SCF/HR/ENGINE
	8760	hrs/year/engine
	97.78	MMSCF/year total

Polycyclic Aromatic Hydrocarbons

	CATEF Mean EMS Factor (lb/MMCF) [1]	PAH Emissions (lb/yr)	Benzo(a)pyrene Equivalency Factor (PEF)[2]	Equivalent PAH Emissions (lb/yr)
Benzo(a)anthracene	2.94E-04	2.87E-02	0.1	2.87E-03
Benzo(b)fluoranthene	2.37E-04	2.32E-02	0.1	2.32E-03
Benzo(k)fluoranthene	1.03E-04	1.01E-02	0.1	1.01E-03
Benzo(a)pyrene	1.15E-04	1.12E-02	1	1.12E-02
Chrysene	3.10E-04	3.03E-02	0.01	3.03E-04
Dibenz(a,h)anthracene	1.25E-05	1.22E-03	1.05	1.28E-03
Indeno(1,2,3-cd)pyrene	1.69E-04	1.65E-02	0.1	1.65E-03
			Total =	2.07E-02

[1] CATEF Emission Factor for Natural Gas-Fired Spark Ignition Engines, 4 Stroke/Rich Burn, < 650 bhp

[2] Benzo[a]pyrene Equivalency Factor from BAAQMD, Regulation 2, Rule 5, Table 2-5-1, Footnote 9

Because several of the toxic emissions exceed Regulation 2, Rule 5 chronic trigger levels, a health risk screening assessment must be performed for the project.

HEALTH RISK SCREENING ASSESSMENT

A Health Risk Screening Assessment was made for this project, using a nominal combined toxic emission of 1 g/sec, divided among the four engines in amounts proportional to their annual toxic emissions. Because no representative meteorological data was available for this site, an ISCST3 model for PM10 exposure using SCREEN3 meteorological data was used to estimate maximum 1-hour average ambient PM10 concentrations. Annual average concentrations were estimated to be equal to ten percent of the predicted maximum 1-hour maximum concentration at each receptor. Distance and directionality were used as the primary considerations to determine sites of maximum exposure. The sources release emissions vertically, and they do not have raincaps.

The site is in a light residential/commercial zone, with the closest residential receptor located approximately 345 feet from the proposed sources. There is a school, Mt. Diablo High School, within 500 feet of the proposed engines.

At 8,760 hours per year per engine operation, the highest residential and non-residential cancer risks were obtained by modeling emissions from engines using rural terrain model adjustments, and highest student cancer risks were obtained by modeling emissions from engines using urban terrain model adjustments. This model produced a maximum annual residential GLC of 83.42 $\mu g/m^3$ per g/sec, resulting in a cancer risk of approximately 11.32 in a million. This risk level is not considered acceptable under the provisions of Regulation 2, Rule 5, which requires that total project cancer risk be limited to no more than 10 in a million. If the applicant agrees to limit the operating hours of the engines to no more than a

combined usage of no more than 85.88 MM SCF/year (87,600 MM BTU/year), the maximum cancer risk will be acceptable under Regulation 2, Rule 5.

Both chronic and acute hazard indices are less than one for all cases.

Health Risk Screening Assessment results are summarized in Attachment 2.

BACT REVIEW

Under Regulation 2, Rule 2, any new source which results in an increase of criteria pollutants must be evaluated for adherence to BACT control technologies. A BACT review is required if a source emits more than 10 lbs/day of any criteria pollutant.

Bsed on Table 1 above, no single source emits more than 10 lbs/day of any criteria pollutant; therefore, a BACT review is not rquired for this application.

COMPLIANCE DETERMINATION

These sources are covered under ministerial exemption, Chapter 2.3.2 of the BAAQMD Permit Handbook. CEQA is not triggered for small natural gas-fired engines under this provision.

The engines are governed by and comply with the provisions of **Regulation 2, Rule 5, "New Source Review for Toxic Air Contaminants."**

The engines are governed by the provisions of **Regulation 9, Rule 8, "Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines."**

Until January 1, 2012, Source S-13, will be exempt from emission limitations of District **Regulation 9, Rule 8-301 through 8-305**, "Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines," under the provisions of **Regulation 9, Rule 8-110.1**, (temporary exemption for engines rated by the manufacturer at less than 250 BHP output rating). Sources S-14, S-15 and S-16 must meet the emissions limitations of **Regulation 9, Rule 8-301 through 8-305** immediately**.**

These are new sources, and no sources are proposed to be closed in connection with this application. The facility will not emit more than 10 TPY of any criteria pollutant, and is not a Major Facility; therefore, the facility is not subject to emission offset requirements under Regulation 2-2-302 or 2-2-303.

There is a school within 1,000 feet of the site and therefore a public notice was distributed to residences, businesses and parents/guardians in accordance with District **Regulation 2, Rule 1-412**.

CONDITIONS

Condition #24157, setting out the operating conditions and recordkeeping requirements for operations at Sources S-13, S-14, S-15, and S-16 shall be made part of the sources' authority to construct/permits to operate.

RECOMMENDATION

I recommend that an Authority to Construct be issued for the following sources:

S-13	**Natural Gas-Fired IC Engine; Caterpillar Model G3406 NA, 1.97 MM Btu/hr, abated by A-4 MINE-X Non Selective Catalytic Reduction Converter, Model 3-DC50**
S-14	**Natural Gas-Fired IC Engine; Caterpillar Model G3412 NA, 3.14 MM Btu/hr, abated by A-5 MINE-X Non Selective Catalytic Reduction Converter, Model 3-DC50**
S-15	**Natural Gas-Fired IC Engine; Caterpillar Model G3412 NA, 3.14 MM Btu/hr, abated by A-6 MINE-X Non Selective Catalytic Reduction Converter, Model 3-DC50**
S-16	**Natural Gas-Fired IC Engine; Caterpillar Model G3412 NA, 3.14 MM Btu/hr, abated by A-7 MINE-X Non Selective Catalytic Reduction Converter, Model 3-DC50**

subject to Condition #24157.

By _____ **Date** **10/7/08**

Catherine S. Fortney

COND# 24157 ----------

1. Sources S-13, S-14, S-15, and S-16, Caterpillar Natural Gas-Fired Cogeneration Units, shall be fired exclusively on natural gas, at a firing rate not to exceed 1.97 MM BTU/hr (HHV) for Source S-13, and 3.14 MM BTU/hr (HHV) for Sources S-14, S-15 and S-16. [Basis: Cumulative Increase]

2. Sources S-13, S-14, S-15, and S-16, Caterpillar Natural Gas-Fired Cogeneration Units, shall operate with a combine heat input of no more than 87,600 MM BTU per year (85.88 MM SCF per year). [Basis: Cumulative Increase; Regulation 2, Rule 5]

3. For Sources S-13: After January 1, 2012, NOx emissions from the engine shall not exceed 25 ppmv, dry, at 15% O2. [Basis: Regulation 9-8-110.1, 9-8-301.1]

4. For Sources S-13: After January 1, 2012, CO emissions from the engine shall not exceed 2000 ppmv, dry, at 15% O2. [Basis: Regulation 9-8-110.1, 9-8-301.3]

5. For Sources S-14, S-15 and S-16: NOx emissions from the engines shall not exceed 25 ppmv, dry, at 15% O2. [Basis: Regulation 9-8-110.1, 9-8-301.1]

6. For Sources S-14, S-15 and S-16: CO emissions from the engines shall not exceed 2000 ppmv, dry, at 15% O2. [Basis: Regulation 9-8-110.1, 9-8-301.3]

7. Within 60 days of start-up, the applicant shall conduct a District-approved source test to demonstrate compliance with the above emissions limitations. All source testing shall be done in accordance with the District's Manual of Procedures. The applicant shall obtain approval from the Manager of the District's Source Test Section for the installation of test ports and source test procedures. The source test results shall be submitted to the District's Director of Compliance and Enforcement no later than 30 days from the date of the source test. [Basis: Cumulative Increase; BACT]

8. The permit holder shall maintain records of total monthly natural gas usage, and dates and times of such usage for each engine. Such records shall be maintained in a District-approved logbook. All records, including source test reports, shall be retained on site for at least two years from date of entry and shall be made available to District staff upon request. [Basis: Cumulative Increase; BACT]

ATTACHMENT 1

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
Best Available Control Technology (BACT) Guideline

Source Category

Source:	***IC Engine – Spark Ignition, Natural Gas Fired Rich Burn Engine***	Revision:	***1***
		Document #:	***96.3.2***
Class:	***>= 50 HP***	Date:	***5/7/03***

Determination

POLLUTANT	BACT 1. Technologically Feasible/ Cost Effective 2. Achieved in Practice	TYPICAL TECHNOLOGY
POC	BACT 1. Technologically Feasible/ Cost Effective 2. Achieved in Practice	TYPICAL TECHNOLOGY
NOx	1. *0.069 g/bhp-hr*[a] *(12 ppmvd @ 15% oxygen)* 2. *0.15 g/bhp-hr*[b] *(25 ppmvd @ 15% oxygen)*	1. *3-way catalyst + air/fuel ratio controller*[a] 2. N*SCR, 3-way catalyst*[b]
SO_2	1. *0.071 g/bhp-hr*[a] *(4 ppmvd @ 15% oxygen)* 2. *0.15 g/bhp-hr*[b] *(9 ppmvd @ 15% oxygen)*	1. *3-way catalyst + air/fuel ratio controller*[a] 2. N*SCR, 3-way catalyst*[b]
CO	1.*n/d* 2.*n/s*	1. *n/d* 2. *natural gas*[b]
PM_{10}	1. *n/d* 2. *0.60 g/bhp-hr*[b] *(56 ppmvd @ 15% oxygen)*	1. *n/d* 2. *3-way catalyst*[b]
NPOC	1. *n/d* 2. *n/s*	1. *n/d* 2. *natural gas*[b]

References

a. San Joaquin Valley Air Pollution Control District (SJVUAPCD): Aera Energy Oilfield
b. CARB "Guidance for the Permitting of Electrical Generation Technologies", September 2001

ATTACHMENT 2

RISK SUMMARY

TOTAL OPERATION LIMITED TO 85.88 MM SCF/YEAR NATURAL GAS USAGE

	Resident (ug/m^3 per g/sec)	Worker (ug/m^3 per g/sec)	Student (ug/m^3 per g/sec)
Rural - Annual Average	83.42	91.71	45.505
Urban - Annual Average	50.05	43.92	45.877
MAX	83.42	91.71	45.88
Max Cancer Risk/million	9.94	2.1	0.29

	Resident (ug/m^3 per g/sec)	Worker (ug/m^3 per g/sec)	Student (ug/m^3 per g/sec)
Rural - 1-hour Average	834.18	917.05	455.05
Urban - 1-hour Average	500.47	439.22	458.77
MAX	834.18	917.05	458.77
Max Chronic HI	9.2 E-2	2.4 E-2	1.1 E-2
Max Acute HI	2.7 E-2	3.0 E-2	1.5 E-2