ENGINEERING EVALUATION

Facility ID No. 3893
Sonoma Valley Hospital District
347 Andrieux Street, Sonoma, CA 95476
Application No. 30890

BACKGROUND

Sonoma Valley Hospital District has applied for an Authority to Construct for the following equipment:

S-8 Natural Gas Generator Set
Make: 2G, Model: aura 412, Model Year: 2020
586 bhp, 3.97 MMBtu/hour, 4-Stroke Rich-burn Engine
Permit Condition No. ####

Abated by:

A-8 Non-Selective Catalytic Reduction

S-8 will be used in prime service as part of a cogeneration project at the hospital. The cogeneration project supplies space heating to the old hospital wing, and S-8 will provide a portion of the hospital's typical electrical load as well as operate as a source of backup power in the event normal electrical utility service is disrupted.

EMISSIONS

The emission factors used to estimate Precursor Organic Compound (POC), Nitrogen Oxide (NOx), and Carbon Monoxide (CO) emissions are from manufacturer-provided emissions data sheets. These emission factors and their destruction and removal efficiency (DRE), where applicable, will be verified via Air District-approved source testing after S-8 is installed and started up.

Particulate matter with an aerodynamic diameter equal to 10 microns or less (PM_{10}), PM with an aerodynamic diameter equal to 2.5 microns or less ($PM_{2.5}$), and Sulfur Dioxide (SO_2) emissions were calculated based on the Environmental Protection Agency's (EPA) document "AP-42: Compilation of Air Emissions Factors" Table 3.2-3: Uncontrolled Emission Factors for 4-Stroke Rich-burn Engines.

S-8's emissions were estimated assuming it will operate for 8,760 hours per year.

Basis:

- Maximum Fuel Consumption Rate: 64.9 standard cubic feet per hour
- Heating Value for Natural Gas: 1,020 Btu per standard cubic foot
- Heat Input: 3.97 MMBtu per hour
- Power Output: 586 bhp
- Daily Operating Hours: 24 hours

Tables 1, 2, and 3 summarize the emission factor basis, abatement efficiency, and abated emissions of criteria pollutants from S-8.

Table 1: Unabated Criteria Pollutant Emission Factor Basis and Unabated Emission Rate for S-8

Pollutant	Emission Factor			Unabated Emission Rate
	(grams per bhp-hour)	(pounds per MMBtu)	Basis	(pounds per hour)[1][2]
NOx	14.91	N/A	Manufacturer Datasheet[3]	1.93E+01
POC	0.49	N/A	Manufacturer Datasheet/Guarantee[3]	6.33E-01
CO	14.91	N/A	Manufacturer Datasheet[3]	1.93E+01
PM10	N/A	9.50E-03	AP-42: Table 3.2-3	3.77E-02
PM2.5	N/A	9.50E-03		3.77E-02
SO_2	N/A	2.94E-03[4]		1.17E-02

(1) NOx, POC, and CO emission factors were converted from units of "grams per bhp-hour" to "pounds per hour" using the following conversions:
   a. 453.592 grams per pound

For example using NOx: (14.91 grams/bhp-hour) x (586 bhp per engine) x (1 pound/453.592 grams) = 1.93E+01 pounds per hour

(2) PM10, PM2.5, and SO_2 emission factors were converted from units of "pounds per MMBtu" to "pounds per hour" using the following conversions:
   a. 3.97 MMBtu per hour for S-8

For example using PM10: (9.50E-03 pounds/MMBtu) x (3.97 MMBtu/hour) = 3.77E-02 pounds per hour

(3) NOx and CO factors are based on manufacturer-provided emissions. The POC factor is based on the Air District's definition of POC of 0.49 grams per bhp-hour (vs. 0.7 grams per bhp-hour of VOC provided by the manufacturer data). The proposed permit conditions will require Sonoma Valley Hospital District to verify the POC emission rate of 0.49 grams per bhp-hour via Air District-approved source testing after S-8 is installed and started up.

(4) The AP-42 Table 3.2-3 emission factor for SO_2 of 5.88E-04 pounds per MMBTU is based on a natural gas sulfur content of 2,000 grains per million standard cubic foot. The sulfur content of natural gas available from public utility companies in California may contain up to 1 grain per hundred standard cubic foot, equal to 10,000 grains per million standard cubic foot. Therefore, the AP-42 Table 3.2-3 emission factor was multiplied by a factor of 5 and SO_2 emissions from S-8 are based on an emission factor of 2.94E-03 pounds per MMBTU.

Table 2: Abatement Efficiency and Abated Criteria Pollutant Emission Rates for S-8

Pollutant	Abatement Efficiency (%)	Abated Emission Rate (pounds per hour)
NOx	99.6[1]	7.70E-02
POC	88.5[2]	7.28E-02
CO	99.1[1]	1.73E-01
PM10	0[2]	3.77E-02
PM2.5	0[2]	3.77E-02
SO_2	0[2]	1.17E-02

(1) S-8 is equipped with a non-selective catalytic reduction unit (A-8). The manufacturer has guaranteed an abatement efficiency of 99.6% for NOx and 99.1% for CO.

(2) The manufacturer has guaranteed a 98% abatement efficiency for POC. However, a lower abatement efficiency of 88.5% was used to conservatively estimate emissions of POC and POC Toxic Air Contaminants from S-8. It is expected that TAC emissions will be abated at slightly different and at unknown rates and therefore it is more conservative to lower the abatement efficiency for POC emissions. The value of 88.5% was selected as it is expected that the true abatement efficiency will likely exceed 90%, but also because 88.5% is the lowest efficiency at which the project health risk requirements will be met.

(3) PM_{10}, $PM_{2.5}$, and SO_2 are not abated by A-8 and therefore there is no assigned abatement efficiency for these pollutants.

Table 3: Abated Criteria Pollutant Emissions from S-8

Pollutant	(pounds per hour)	(pounds per day)	(pounds per year)	(tons per year)
NOx	0.08	1.85	675.0	0.337
POC	0.07	1.75	637.7	0.319
CO	0.17	4.16	1,518.6	0.759
PM10	0.04	0.91	330.5	0.165
PM2.5	0.04	0.91	330.5	0.165
SO_2	0.01	0.28	102.3	0.051

HEALTH RISK ASSESMENT

The emission factors used to estimate TAC emissions from S-8 are from either:

- The California Air Toxics Emission Factor (CATEF) database maintained by the California Air Resources Board (Internal Combustion Engine; Natural Gas; 4S/Rich/<650Hp); or

- AP-42 Table 3.2-3

The emission factors used to estimate TAC emissions from S-8 were selected in this order of priority:

1) Unabated CATEF factors, for pollutants identified in Footnote 8 of Table 2-5-1 of Air District Regulation 2, Rule 5 to calculate Polycyclic Aromatic Hydrocarbon (PAH) emissions. The unabated CATEF factor for each chemical species was multiplied by their corresponding Potency Equivalency Factor (PEF) listed in Footnote 8 and then each product was summed. The CATEF database provides maximum, mean, and median emission factors. Consistent with the methodology suggested in the Air District's Petroleum Refinery Emissions Inventory Guidelines, the mean PAH emission factors from the CATEF database were used to estimate TAC emissions in this evaluation report.

2) Unabated CATEF factors, where available. The CATEF database provides maximum, mean, and median emission factors. Consistent with the methodology suggested in the Air District's Petroleum Refinery Emissions Inventory Guidelines, the mean emission factors for non-PAHs from the CATEF database were used to estimate TAC emissions in this evaluation report.

3) AP-42 Table 3.2-3 factors, for any remaining TACs not already listed in items 1 or 2 above.

There are several xylene emission factors available from these data sources: AP-42 Table 3.2.3 for “Xylene”, unabated CATEF for “Xylene (m,p)”, unabated CATEF for “Xylene (o)”, and unabated CATEF for “Xylene (Total)”. The highest emission factor of these options was the sum of unabated CATEF Xylene (m,p) and Xylene (o). This factor was used to estimate total Xylene emissions.

Though A-8’s manufacturer guaranteed a 98% by wt. abatement efficiency for POC and POC TACs, emission rates used in the Health Risk Assessment (HRA) were conservatively based on a lower abatement efficiency of 88.5% by wt. to ensure the pertinent project health risk requirements will be met.

Table 4 summarizes the total hourly and annual project TAC emissions from S-8. Since there are no related applications for this facility, the scope of the HRA evaluated S-8’s TAC emissions.

Table 4: Hourly and Annual Project TAC Emissions (S-8)

Emission Factor Basis	TAC	Emission Factor (pounds per million cubic feet)	Emission Factor (pounds per MMBtu)	Abatement Efficiency	Table 2-5-1 Acute Trigger (pounds per hour)	Table 2-5-1 Chronic Trigger (pounds per year)	Hourly Emissions (pounds per hour)	Annual Emissions (pounds per year)	Exceeds Acute?	Exceeds Chronic?
AP-42 T3.2-3	1,1,2,2-Tetrachloroethane		2.53E-05	88.5%		1.4	1.16E-05	1.01E-01		
AP-42 T3.2-3	1,1,2-Trichloroethane		1.53E-05	88.5%		5	6.99E-06	6.12E-02		
AP-42 T3.2-3	1,1-Dichloroethane		1.13E-05	88.5%		50	5.16E-06	4.52E-02		
AP-42 T3.2-3	1,2-Dichloroethane		1.13E-05	88.5%		4	5.16E-06	4.52E-02		
CATEF	1,3-Butadiene	1.04E-01		88.5%	1.5	0.48	4.66E-05	4.08E-01		
CATEF	Acetaldehyde	8.83E-01		88.5%	1	29	3.95E-04	3.46E+00		
CATEF	Acrolein	5.47E-01		88.5%	0.0055	14	2.45E-04	2.15E+00		
CATEF	Benzene	1.91E+00		88.5%	0.06	2.9	8.55E-04	7.49E+00		YES
AP-42 T3.2-3	Carbon Tetrachloride		1.77E-05	88.5%	4.2	1.9	8.08E-06	7.08E-02		
AP-42 T3.2-3	Chlorobenzene		1.29E-05	88.5%		39000	5.89E-06	5.16E-02		
AP-42 T3.2-3	Chloroform		1.37E-05	88.5%	0.33	15	6.26E-06	5.48E-02		
CATEF	Ethylbenzene	1.16E-02		88.5%		33	5.19E-06	4.55E-02		
AP-42 T3.2-3	Ethylene Dibromide		2.13E-05	88.5%		1.1	9.73E-06	8.52E-02		
CATEF	Formaldehyde	2.35E+00		88.5%	0.12	14	1.05E-03	9.22E+00		
AP-42 T3.2-3	Methanol		3.06E-03	88.5%	62	150000	1.40E-03	1.22E+01		
AP-42 T3.2-3	Methylene Chloride		4.12E-05	88.5%	31	82	1.88E-05	1.65E-01		
CATEF	Naphthalene	7.65E-02		88.5%		2.4	3.43E-05	3.00E-01		
CATEF	PAH	2.12E-04		88.5%		0.0033	9.47E-08	8.30E-04		
CATEF	Propylene	1.60E+01		88.5%		120000	7.16E-03	6.28E+01		
AP-42 T3.2-3	Styrene		1.19E-05	88.5%	46	35000	5.44E-06	4.76E-02		
CATEF	Toluene	1.07E+00		88.5%	82	12000	4.79E-04	4.20E+00		
AP-42 T3.2-3	Vinyl Chloride		7.18E-06	88.5%	400	1.1	3.28E-06	2.87E-02		
CATEF	Xylene (m,p) + (o)	6.58E-01		88.5%	49	27000	2.95E-04	2.58E+00		

As shown in Table 4, annual benzene emissions of 7.49 pounds per year from S-8 exceeded the chronic trigger level of 2.9 pounds per year for the above TAC in Table 2-5-1 of Regulation 2, Rule 5. Therefore, a HRA was required.

The HRA estimated the project cancer risk at 0.99 in a million, the project chronic hazard index is estimated at 0.0078, and the project acute hazard index is estimated at 0.013. In accordance with the Air District's Regulation 2, Rule 5, the HRA concluded that this project complies with the TBACT and project risk requirements in the above rule.

CUMULATIVE INCREASE

Assuming S-8 will operate for 8,760 hours per year, Table 5 summarizes the cumulative increase in criteria pollutant emissions that will result from this application.

Table 5: Cumulative Emissions Increase, Post 4/5/91 (tons per year)

Pollutant	**NOX**	**POC**	**CO**	**PM10**	**PM2.5**	**SO_2**
Existing Emissions Post 4/5/91	9.676	0.592	2.592	0.265	0.000	0.141
S-8	0.337	0.319	0.759	0.165	0.165	0.051
Post-Application Emissions	10.013	0.911	3.351	0.430	0.165	0.192

BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

Per Regulation 2-2-301, an Authority to Construct and/or Permit to Operate for a new source shall require BACT to control emissions of a District BACT pollutant as defined in Regulation 2-2-210 if the source will have the potential to emit that pollutant in an amount of 10.0 or more pounds on any day, as defined in Regulation 2-2-301.1. Per emissions information summarized in Table 3 above, S-8 does not trigger BACT.

OFFSETS

The facility-wide PTE resulting from this application is summarized in Table 6.

Table 6. Facility-Wide PTE Resulting from this Application

Pollutant	**Pre-Application Facility-Wide PTE (tons/year)**	**S-8 Emissions (tons/year)**	**Post-Application Facility-Wide PTE (tons/year)**	**Offset Triggers (tons/year)**	**Exceeds Offset Trigger?**
NOx	9.676	0.337	10.013	> 10	Yes
POC	0.592	0.319	0.911	> 10	No
CO	2.592	0.759	3.351	N/A	N/A
PM10	0.265	0.165	0.430	> 100	No
PM2.5	0.000	0.165	0.165	> 100	No
SO_2	0.141	0.051	0.192	> 100	No

It can be seen from Table 6 that the facility's PTE after S-8 is permitted is above the Regulation 2-2 offset trigger levels for NOx. Per Regulation 2-2-302.1, NOx offsets will be provided from the Air District's Small Facility Banking Account at a 1:1 ratio, equal to 10.013 tons. The applicant (or any entity controlling, controlled by, or under common control with the applicant) does not own or control offsets and is therefore eligible to receive the requisite offsets from the Air District's Small Facilities Banking Account, per Regulation 2-2-302.1.1.

STATEMENT OF COMPLIANCE

The owner/operator is expected to comply with all applicable requirements. Key requirements are listed below:

District Rules

Regulation 6-1 (Particulate Matter – General Requirements)

S-8 is subject to Regulation 6, Rule 1. Opacity and visible emissions from S-8 are limited by Regulation's 6-1-301 and 302, respectively.

Regulation 6-1-305 prohibits emission of particles from any operation in sufficient number to cause annoyance to any other person where the particles are large enough to be visible as individual particles at the emission point, or of such size and nature as to be visible individually as incandescent particles. Since S-8 will fire natural gas, it is not expected to produce visible emissions or fallout in violation of this regulation. Hence, it will be assumed to be in compliance with Regulation 6-1-305.

S-8's compliance with Regulation 6, Rule 1 will be confirmed by the District's Compliance & Enforcement staff during their routine inspections.

Regulation 9-1-301 (*Limitations on Ground Level Concentrations*)

S-8 is subject to and is expected to comply with the applicable SO_2 limitations in Regulation 9, Rule 1 ("Inorganic Gaseous Pollutants – Sulfur Dioxide"). Since S-8 will fire natural gas and because SO_2 emissions from S-8 are negligible, it is unlikely the APCO will require Sonoma Valley Hospital District to conduct ground level monitoring.

Regulation 9-8 (*Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines*)

S-8 is subject to Regulation 9, Rule 8 ("Inorganic Gaseous Pollutants – NOx and CO from Stationary Internal Combustion Engines") and is expected to comply with emission limits in Regulation 9-8-301.1 (NOx: 25 ppmv corrected to 15% oxygen, dry basis) and Regulation 9-8-301.3 (CO: 2,000 ppmv corrected to 15% oxygen, dry basis). Source testing required by the proposed permit conditions will require Sonoma Valley Hospital District to demonstrate compliance with the above NOx and CO emission limits.

The owner/operator of S-8 is also subject to and is expected to comply with monitoring and record keeping requirements of Regulations 9-8-502.3, which are incorporated into the proposed permit conditions.

California Environmental Quality Act (CEQA)
This project is ministerial under the District Regulation 2-1-311 (Permit Handbook Chapter 2.3.2) and is therefore 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 2.3.2

New Source Performance Standards (NSPS)
S-8 is subject to 40 CFR 60, Subpart JJJJ since it is a spark ignition engine with a maximum engine power greater than 500 HP and where construction will commence after June 12, 2006 (60.4230(a)(4)(i)). Applicable emissions standards for S-8 are found in Table 1 of Subpart JJJJ as required per 60.4233(e). These emission standards are summarized in Table 7 below.

Table 7: NSPS Subpart JJJJ Emission Standards

Pollutant	S-8 Abated Emission Factor (grams/HP-hour)	NSPS JJJJ (grams/HP-hour)
NOx	0.06	2.0
POC	0.06	1.0
CO	0.13	4.0

It can be seen from Table 7 that S-8 complies with NSPS JJJJ emission standards.

National Emissions Standards for Hazardous Air Pollutants (NESHAP)
S-8 is subject to the emission or operating limitations in 40 CFR 63, Subpart ZZZZ (MACT ZZZZ), "National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (RICE)". S-8 is a new engine at an area source and will comply with MACT ZZZZ by meeting the requirements in 40 CFR Part 60 Subpart JJJJ per §63.6590(c)(1).

Prevention of Significant Deterioration (PSD)
The requirements in District Regulation 2, Rule 2, Section 304 through 306 apply to PSD projects. A PSD project is defined in Section 2-2-224 and includes new or modified sources located at a facility that has potential emissions of 100 tons per year or more of any regulated NSR Pollutant (including fugitive emissions), if one of the 28 PSD source categories listed in section 169(l) of the federal Clean Air Act, or if not in a listed source category, 250 tons/year for each regulated air pollutant (excluding fugitive emissions for determining if a project is major). Since Sonoma Valley Hospital District is not one of the 28 listed source categories and will not emit 250 tons per year or more of a regulated air pollutant, this project is not a PSD project and is not subject to the PSD requirements in Sections 2-2-304 through 306.

Section 2-2-307 applies to projects located in Class I areas; this project is not located in a Class I area, so this section does not apply. Section 2-2-308 applies to projects with a significant net emission increase in a pollutant subject to a National Ambient Air Quality Standard, as defined in Sections 2-2-224.3 and 2-2-227.2. The emissions from S-8 are less than the significance thresholds in Section 2-2-227.2, so Section 2-2-308 does not apply.

School Notification (Regulation 2-1-412)

S-8 is located within 1,000 feet of the outer boundary of the Sassarini Elementary School. Therefore, S-8 is subject to the public notification requirements of Regulation 2-1-412. A public notice will be prepared and sent to the parents or guardians of children enrolled in any school within one-quarter mile of the source and to each address within a radius of 1,000 feet of the source.

Sassarini Elementary School
652 5th St. W.
Sonoma, CA 95476

UPDATE ONCE PUBLIC NOTICE PERIOD CONCLUDES.

PERMIT CONDITIONS

Permit Condition ###### for S-8

1. The Owner/Operator shall equip S-8 (4-Stroke Rich-burn Engine) with a non-resettable totalizing meter that measures hours of operation or fuel usage.
   (Basis: Regulation 2-1-403, Cumulative Increase)

2. The Owner/Operator shall not operate S-8 unless emissions from the natural gas fired engine are abated during all times of operation by a properly installed, maintained and operated non-selective catalytic reduction (NSCR) system, A-8.
   (Basis: BACT, Cumulative Increase, Health Risk Assessment, Regulation 2-1-320)

3. The Owner/Operator of S-8 shall ensure compliance with the following abated mass emission rates at all times of operation:
   a. NOx: 0.019 lb/MMBtu
   b. POC: 0.018 lb/MMBtu
   c. CO: 0.044 lb/MMBtu
   d. 1,3-Butadiene: 1.17E-05 lb/MMBtu
   e. Benzene: 2.15E-04 lb/MMBtu
   f. Formaldehyde: 2.65E-04 lb/MMBtu

   (Basis: BACT; Cumulative Increase; Health Risk Assessment; Regulation 2-1-320, Regulation 9, Rule 8)

4. No later than 60 days from the startup of S-8, the owner/operator shall conduct Air District approved source tests to determine initial compliance with the emission rates outlined in Part 3 of this permit condition when operating S-8 at/above 90% of its maximum electrical load. The owner/operator shall submit the source test results to the manager of the Air District's Source Test Section no later than 60 days after the source test date. Each source test shall be conducted in compliance with Part 6 of this permit condition.
   (Basis: Regulation 2-1-403, Health Risk Assessment)

5. The owner/operator shall conduct triennial Air District approved source tests on S-8. The source tests shall be conducted no earlier than 34 months and no later than 38 months from the date of the previous test for each device. The source tests shall demonstrate compliance with Part 3 and shall be performed in accordance with Part 6. Each source test shall be conducted with S-8 operating at/above 90% of its maximum electrical load.
   (Basis: Regulation 2-1-403, Health Risk Assessment)

6. The owner/operator shall obtain approval for all source test procedures from the Air District's Source Test Section prior to conducting any source tests. The owner/operator shall comply with all applicable testing requirements as specified in Volume IV of the Air District's Manual of Procedures. The owner/operator shall notify the manager of the Air District's Source Test Section, in writing, of the source test protocols and projected test dates at least 7 days prior to testing.
   (Basis: Regulation 2-1-403)

7. 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 District staff upon request.

   a. Hours of operation
   b. Fuel usage for engine
   c. All source test records, including source test conditions, test dates/times, testing results, and any reports generated by the source testing entity and/or that are submitted to or received by the Air District.

   (Basis: Regulation 2-1-403)

End of Conditions

RECOMMENDATION

I recommend that the District issue an Authority to Construct for the following:

S-8 Natural Gas Generator Set
Make: 2G, Model: aura 412, Model Year: 2020
586 bhp, 3.97 MMBtu/hour, 4-Stroke Rich-burn Engine
Permit Condition No. ####

Abated by:

A-8 Non-Selective Catalytic Reduction

Prepared by: _____
Mark H. Gage, Air Quality Engineer II