

**DRAFT
ENGINEERING EVALUATION
P#19589-A#20345
County of Contra Costa- (Juvenile Hall) New Wing
202 Glacier Drive
Martinez, CA 94553**

BACKGROUND

The County of Contra Costa- (Juvenile Hall) New Wing has applied for an Authority to Construct and Permit to Operate two internal combustion engines cogeneration systems powered by Natural Gas engines S-1 and S-2. The engines will be located at 202 Glacier Drive in Martinez, California.

- S-1 Internal Combustion Engine Cogeneration System: Natural Gas fired Engine, Make: General Motors; Model: 8.1 LV8; Model year: 2008; Rated Horsepower: 122HP.
- A-1 Abated by: Air to fuel ratio controller and Non Selective Catalytic Reduction (3-way catalyst), Make: DCL International Inc, Model: MINE-X SOOTFILTER.
- S-2 Internal Combustion Engine Cogeneration System: Natural Gas fired Engine, Make: General Motors; Model: 8.1 LV8; Model year: 2008; Rated Horsepower: 122HP.
- A-2 Abated by: Air to fuel ratio controller and Non Selective Catalytic Reduction (3-way catalyst), Make: DCL International Inc, Model: MINE-X SOOTFILTER.

EMISSIONS SUMMARY

The cogeneration systems will be running 24 hr/day, 7 day/week, 52 weeks/year. For this report, it is assumed that the emission value of Total Unburned Hydrocarbons (HC) is equivalent to the emission value of POC.

Abatement Device: Each engine is abated with an air to fuel ratio controller and a Johnson Matthey, BanditoCXX8” non-selective catalytic reduction system. This non- selective catalytic reduction will perform to meet the following emissions. The emission reduction achieved through A-1 and A-2 are indicated in the following table (1)

Table-1
Emission Factors for S-1 and S-2 before and after Abatement

Component	Emission Without Abatement Device (g/bhp·hr)	Emission With Abatement Device (g/kw·hr)	Reduction In %
NO _x	10	1.0	90
CO	12	1.2	90
POC	0.2	0.04	80
PM ₁₀	Negligible	Negligible	N/A

**The emission factor for SO₂ is from Chapter-3, Table 3.2-2 of the EPA Document AP-42, Emission Factors for 2-Stroke Rich-Burn Engines. SO₂:5.88E-4 lb/MMBtu*

Maximum Emissions in Tons per year:

Table-2

Emissions in Tons per year (each engine)									
Pollutant		g/hp-hr	hp	hr/yr	1 lb/453.6 g		lb/yr		TPY
NO _x	=	1.0	122	8736	0.0022	=	2344.74	=	1.17
CO	=	1.2	122	8736	0.0022	=	2813.69	=	1.41
POC	=	0.04	122	8736	0.0022	=	93.79	=	0.047
PM ₁₀	=	0.00	122	8736	0.0022	=	0000.0	=	0.000

$$SO_2 = (5.88E-4 \text{ lb/MMBtu}) * (1.0640 \text{ MMBtu/hr}) * (8736 \text{ hrs/yr}) = 5.466 \text{ lb/yr} = 0.0027 \text{ TPY}$$

Maximum Daily Emissions:

A full 24-hour day will be assumed since no daily limits are imposed on intermittent and unexpected operations.

Table-3

Maximum Daily Emissions							
Pollutant		g/hp-hr	hp	hr/day	1 lb/453.6 g		lb/day
NO _x	=	1.0	122	24	0.0022	=	6.44
CO	=	1.2	122	24	0.0022	=	7.73
POC	=	0.04	122	24	0.0022	=	0.26
PM ₁₀	=	0.00	122	24	0.0022	=	0000.0

$$SO_2 = (5.88E-4 \text{ lb/MMBtu}) * (1.0640 \text{ MMBtu/hr}) * (24 \text{ hrs/yr}) = 0.0150 \text{ lb/day}$$

Plant Cumulative Increase: (tons/year):

Table-4

Plant Cumulative Increase				
Pollutant	Existing tons/yr	New tons/yr S-1	New tons/yr S-2	Total tons/yr
NO _x	0.000	1.17	1.17	2.34
CO	0.000	1.41	1.41	2.82
POC	0.000	0.047	0.047	0.094
PM10	0.000	0.000	0.000	0.000
SO ₂	0.000	0.0027	0.0027	0.0054
NPOC	0.000	0.000	0.000	0.000

Regulation 9-8-301: Effective January 1, 1997, a person shall not operate a stationary internal combustion engine fired exclusively on fossil derived fuels, unless the following emission limits are met:

NOx:

Rich burn engines: NOx emissions shall not exceed 56 ppm as corrected to 15% O₂, dry basis.

$$\begin{aligned} & (56 \text{ ppmv}) \left(\frac{20.9-0}{20.9-15} \right) = 198.37 \text{ ppmvd @ } 0\% \text{ O}_2 \\ & (198.37/1,000,000) (1\text{lbmol}/385.3 \text{ dscf}) (46 \text{ lb NO}_x \text{ (as NO}_2\text{)}/\text{lbmol}) \times \\ & (8600 \text{ dscf/MMBTU} = 0.204 \text{ lb NO}_2\text{/MMBTU} \\ & 1.064 \text{ MMBTU/hr} \times 0.204 \text{ lb NO}_2\text{/MMBTU} = 0.216 \text{ lb NO}_2\text{/hr} \\ & 24 \text{ hr/day} \times 0.216 \text{ lbNO}_2\text{/hr} = 5.20 \text{ lb NO}_2\text{/day} \end{aligned}$$

Rich burn engines: Effective January 1, 2012 NOx emissions shall not exceed 25 ppmvd as corrected to 15% O₂, dry basis.

$$\begin{aligned} & (25 \text{ ppmv}) \left(\frac{20.9-0}{20.9-15} \right) = 88.559 \text{ ppmvd @ } 0\% \text{ O}_2 \\ & (88.559/1,000,000) (1\text{lbmol}/385.3 \text{ dscf}) (46 \text{ lb NO}_x \text{ (as NO}_2\text{)}/\text{lbmol}) \times \\ & (8600 \text{ dscf/MMBTU} = 0.091 \text{ lb NO}_2\text{/MMBTU} \\ & 1.064 \text{ MMBTU/hr} \times 0.091 \text{ lb NO}_2\text{/MMBTU} = 0.097 \text{ lb NO}_2\text{/hr} \\ & 24 \text{ hr/day} \times 0.0979 \text{ lbNO}_2\text{/hr} = 2.33 \text{ lb NO}_2\text{/day} \end{aligned}$$

CO:

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

$$\begin{aligned} & (2000 \text{ ppmvd}) \left(\frac{20.9-0}{20.9-15} \right) = 7084.74 \text{ ppmvd @ } 0\% \text{ O}_2 \\ & (7084.74/1,000,000) (1\text{lbmol}/385.3 \text{ dscf}) (28 \text{ lb CO}/\text{lbmol}) \times \\ & (8600 \text{ dscf/MMBtu}) = 4.43 \text{ lb CO/MMBtu} \\ & 1.064 \text{ MMBTU/hr} \times 4.43 \text{ lb CO/MMBtu} = 4.71 \text{ lb CO/hr} \\ & 24 \text{ hr/day} \times 4.71 \text{ lbNO}_2\text{/hr} = 113.04 \text{ lb CO/day} \end{aligned}$$

After comparing the above emissions with the actual emissions in table-3 it proves that both the engines are in compliance.

Toxic Risk Screening:

The emission factors used to estimate HAPs emissions from the engine described above are from: AP-42 for natural gas fired 4 Stroke Spark Ignition Engine Table 3.2-3, or the California Air Toxics Emission Factor Database (maintained by the California Air Resources Board) for natural gas fired 4- Stroke Spark Ignition Engines with less than 650 hp. The engine being permitted has a maximum firing rate of 1.0640 MM Btu/hr and a maximum rating of 122 hp.

The HAP emission estimates are based on uncontrolled emission factors for natural gas engines and an assumed abatement efficiency of 80% removal of organic HAP compounds. The abatement efficiency is based on the fact that the engine is being permitted with a Non-Selective Catalytic Reduction (NSCR) and an air fuel ratio controller.

HAP Emissions Estimates BASED On AP-42 Table 3.2-3

Table-5

Compound Name	Emission Factor lb/MMBtu (Fuel Input)	Calculated Emission lb/yr	Abatement Efficiency %	Abated Emission lb/yr	Total Emission lb/yr	TAC Trigger Levels in lb/yr
1,3-Butadiene	6.63E-04	6.16261E+00	80	1.23252E+00	1.23252	1.10
Acetaldehyde	2.79E-03	2.59331E+01	80	5.18663E+00	5.18663	64.0
Acrolein	2.63E-03	2.44459E+01	80	4.88919E+00	4.88919	2.30
Benzene	1.58E-03	1.46862E+01	80	2.93723E+00	2.93723	6.40
Ethylbenzene	2.48E-05	2.30517E-01	80	4.61034E-02	0.0461	77000
Formaldehyde	2.05E-02	1.90548E+02	80	3.81096E+01	38.109	30.0
Methanol	3.06E-03	2.84428E+01	80	5.68856E+00	5.6885	150000
Naphthalene	9.71E-05	9.02548E-01	80	1.80510E-01	0.1805	0.0110
PAH	1.41E-04	1.31060E+00	80	2.62120E-01	0.2621	0.011
Benzo(a)anthracene	3.32E-07	3.08923E-03	80	6.17846E-04	0.00062	0.0110
Benzo(b)fluoranthene	9.11E-07	8.46577E-03	80	1.69315E-03	0.00169	0.0110
Benzo(k)fluoranthene	1.05E-06	9.75067E-03	80	1.95013E-03	0.00195	0.0110
Benzo(a)pyrene	5.07E-08	4.71131E-04	80	9.42261E-05	0.00009	0.0110
chrysene	1.10E-07	1.02063E-03	80	2.04126E-04	0.00020	0.0110
dibenz(a,h)anthracene	9.41E-08	8.74827E-04	80	1.74965E-04	0.00017	0.0110
dibenzo(a,h)pyrene	1.44E-08	1.33958E-04	80	2.67916E-05	0.00003	0.0110
indeno(1,2,3-cd)pyrene	2.89E-07	2.68827E-03	80	5.37654E-04	0.00054	0.0110
Styrene	1.19E-05	1.10611E-01	80	2.21222E-02	0.02212	35000
Toluene	5.58E-04	5.18663E+00	80	1.03733E+00	1.03733	12000
Xylene	1.95E-04	1.81253E+00	80	3.62506E-01	0.36250	27000

To pass the Risk Screen, a project is acceptable if the cancer risk is less than one in a million but, if a project has applied Best Available Control Technology for Toxics (TBACT), the project maximum acceptable cancer risk allowed is 10 in a million if TBACT is used. For these engines TBACT is satisfied through the use of NSCR.

Results from the health risk screening analysis indicated that for the 12-foot hinged rain flap stack case, the project maximum incremental cancer risk is estimated at 4.28 in a million. In accordance with the District's Regulation 2, Rule 5, these risk levels are considered acceptable for 12-foot hinged rain flap stack case.

STATEMENT OF COMPLIANCE

The owner/operator of S-1 and S-2 two Natural Gas Fired 122 hp General Motors Cogeneration System, abated by A-1 and A-2 two Non-selective catalytic reduction systems, respectively shall comply with Reg. 6 (Particulate Matter General Requirements) and Reg. 9-1-301 (Inorganic Gaseous Pollutants: Sulfur Dioxide for Limitations on Ground Level Concentrations). The owner/operator is expected to comply with Regulation 6 since the engines are fueled with natural gas. Thus for any period aggregating more than three minutes in any hour, there should be no visible emission as dark or darker than No. 1 on the Ringlemann Chart (Regulation 6-1-301) and no visible emission to exceed 20% opacity (Regulation 6-1-302).

Regulation 9-8

These engines are spark-ignited engines powered by natural gas therefore they are required to meet 9-8-301.1.

The project is considered to be ministerial under the District's CEQA 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 emissions factors and therefore is not discretionary as defined by CEQA. (Permit Handbook Chapter 2.3)

The project is within 1000 feet from the nearest school and therefore facility is subject to the public notification requirements of Reg. 2-1-412.

Best Available Control Technology:

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 daily (24 hours) emission calculations above, the owner/operator of S-1 and S-2 is not subject to BACT for any pollutants.

Offsets:

Offsets must be provided for any new or modified source at a facility that emits more than 10 tons/yr of POC or NO_x. Based on the emission calculations above, offsets are not required for this application.

PSD, NSPS, and NESHAPS do not apply.

PERMIT CONDITIONS

Condition #24506 for S-1 and S-2 Natural Gas Fired Cogeneration System, Plant #19589:

1. The owner/operator shall operate each cogeneration 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 installed, operated and properly maintained. [Basis: Regulation 9-8-530]
2. The owner/operator shall operate each cogeneration engine on natural gas and must be abated by a Non-selective catalyst reduction with an air fuel ratio controller. The owner/operator shall ensure that the Non-selective catalyst reduction and air fuel ratio controller are operated in accordance with manufacturer instructions and are properly maintained.
3. Records: The Owner/Operator shall maintain the following each calendar quarter records in a District-approved log for at least 24 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 on a monthly basis.
 - b. Each Calendar Quarter Monitoring for NO_x and CO emissions testing to show compliance with emission limits. An approved handheld monitor may be used provide that the instrument will be calibrated, maintained and operated in accordance with the manufacturer specifications and recommendations.
 - c. Fuel usage for engine.(Basis: Monitoring and Recordkeeping 9-8-500)

RECOMMENDATION

Issue an Authority to Construct to NorthBay Fairfield located at 1200 B Gale Wilson Blvd., Fairfield, CA 94533 for:

S-1 Internal Combustion Engine Cogeneration System: Natural Gas fired Engine, Make: General Motors; Model: 8.1 LV8; Model year: 2008; Rated Horsepower: 122HP.

A-1 Abated by: Air to fuel ratio controller and Non Selective Catalytic Reduction (3-way catalyst), Make: Johnson Matthey, Model: BanditoCXX8.

S-2 Internal Combustion Engine Cogeneration System: Natural Gas fired Engine, Make: General Motors; Model: 8.1 LV8; Model year: 2008; Rated Horsepower: 122HP.

A-2 Abated by: Air to fuel ratio controller and Non Selective Catalytic Reduction (3-way catalyst), Make: Johnson Matthew, Model: BanditoCXX8.

EXEMPTIONS

None.

By: Madhav Patil Date: 11/23/2009

Air Quality Engineer