Draft
Engineering Evaluation
Clifford Elementary School
Application No. 31167 / Plant No. 24989
225 Clifford Avenue
Redwood City, CA 94062

BACKGROUND

Clifford Elementary School has applied for an Authority to Construct (AC) for the following equipment:

S-1 Emergency Standby NG Engine
Kohler, Model: KG2204T, Model Year: 2021
64 BHP, 1.34 MMBtu/hr

A-1 Nett TG-Series Three-way Catalyst

EMISSIONS CALCULATIONS

The emission factors used to estimate criteria pollutant emissions from the LPG engine generator set described above are based on generic engine manufacturer abated emissions data. Total Hydrocarbon emission rates were assumed to be equal to Precursor Organic Compound (POC) emission rates.

The Abated Efficiency, PM_{10} and SO_2 emission factors are based on AP 42, Fifth Edition, Volume I, Chapter 3: Stationary Internal Combustion Sources; Section 2.4.1 Control Techniques for 4-Cycle Rich-burn Engines. The engine will operate during emergency use and for a maximum of 50 hours per year for maintenance and testing. Manufacturer emission factors after abatement was used for NOx and CO emissions. Manufacturer abatement efficiency (A-1) for NOx and CO were used. A 50% efficiency for POC was assumed as a worst-case scenario. Actual efficiency is expected to be much higher. AP-42 Table 3.2-3 uncontrolled emission factors for Rich Burn Natural Gas fired engines (assumed equal to LPG engines) was used for PM_{10} and SO_2 emissions with 0.0% abatement efficiency.

Table 1-Estimated abated Emissions From S-1

Pollutant	Abated Emission Factor	Units	Emission (lb/hr)	Emission (lb/yr)	Emission (TPY)	Maximum Daily Emissions (lb/day)
NOx	0.070	g/BHP-hr	0.010	0.49	0.000	0.24
POC	0.037	g/BHP-hr	0.005	0.26	0.000	0.13
CO	1.916	g/BHP-hr	0.270	13.51	0.007	6.5
PM10	0.034	lb/MMBtu	0.005	0.24	0.000	0.11
SO2	0.002	lb/MMBtu	0.000	0.01	0.000	0.007

Basis:
64 hp Max Rated Output
492 scf/hr; Max fuel use Rate = 1.34 MMBTU/hr
Abatement efficiency of 98% and 95% was used for NOx and CO respectively. 50% for POC.
The PM and SO_2 emission factors are from EPA AP-42, Table 3.2-3 for 4 stroke Rich-burn Engines
Annual Emissions are based on the Annual Limit (50 hr/yr) of operation for testing and maintenance
Max daily emissions are based on 24 hr/day since no daily limits are imposed on emergency operations.

TOXIC RISK SCREENING ANALYSIS

The emission factors used to estimate Hazardous Air Pollutants (HAPs) emissions from the engine described above are from: AP-42 for natural gas fired 4-cycle rich burn engine Table 3.2-3 (assumed equal to LPG fired engine), or the California Air Toxics Emission Factor Database (maintained by the California Air Resources Board) for natural gas fired 4-cycle rich burn engines with less than 650 hp (assumed equal to LPG fired engine).

The CATEF Emission Factors maintained by the ARB were used to estimate emissions for all compounds that have AP-42 emission factors and CATEF emission factors.

The HAP emission estimates are based on uncontrolled emission factors for natural gas engines and an assumed abatement efficiency of 50% removal of organic HAP compounds, except for the pollutants which have abated emission factors in CATEF. The abatement efficiency is based on the fact that the engine is being permitted with a three-way catalyst and an air fuel ratio controller. The actual abatement efficiency of the engine is expected to be much higher but using a more conservative estimate of 50% which is the default factors used for other natural gas engines was selected as a worst-case scenario.

As shown in Table 2 and Table 3 below, no toxic air contaminants exceed the District Risk Screening Triggers and a Risk Screening Analysis is not required.

Table 2
HAP EMISSIONS ESTIMATES BASED ON AP-42 TABLE 3.2-3 (FOR COMPOUNDS WITH NO CATEF E.F.)

Compound		E.F.	Unit	Assumed Abatement Efficiency %	Abated Emissions (lb/hr)	Acute Trigger Level (lb/hr)	HRSA Triggered? (Y/N)	Abated Emissions (lb/yr)	Chronic Trigger Level (lb/yr)	HRSA Triggered? (Y/N)
1,1,2,2-Tetrachloroethane		2.53E-05	lb/MMBtu	50%	6.35E-06	None	NO	3.17E-04	1.40E+00	NO
1,1,2-Trichloroethane	<	1.53E-05	lb/MMBtu	50%	3.84E-06	None	NO	1.92E-04	5.00E+00	NO
1,1-Dichloroethane	<	1.13E-05	lb/MMBtu	50%	2.84E-06	None	NO	1.42E-04	5.00E+01	NO
1,2-Dichloroethane	<	1.13E-05	lb/MMBtu	50%	2.84E-06	None	NO	1.42E-04	None	NO
1,2-Dichloropropane	<	1.30E-05	lb/MMBtu	50%	3.26E-06	None	NO	1.63E-04	None	NO
1,3-Butadiene		6.63E-04	lb/MMBtu	50%	CATEF	None	NO	CATEF	4.80E-01	NO
1,3-Dichloropropene	<	1.27E-05	lb/MMBtu	50%	3.19E-06	None	NO	1.59E-04	None	NO
Acetaldehyde		2.79E-03	lb/MMBtu	50%	CATEF	1.00E+00	NO	CATEF	2.90E+01	NO
Acrolein		2.63E-03	lb/MMBtu	50%	CATEF	5.50E-03	NO	CATEF	1.40E+01	NO
Benzene		1.58E-03	lb/MMBtu	50%	CATEF	6.00E-02	NO	CATEF	2.90E+00	NO
Butyr/isobutyraldehyde		4.86E-05	lb/MMBtu	50%	1.22E-05	None	NO	6.10E-04	None	NO
Carbon Tetrachloride	<	1.77E-05	lb/MMBtu	50%	4.44E-06	4.20E+00	NO	2.22E-04	1.90E+00	NO
Chlorobenzene	<	1.29E-05	lb/MMBtu	50%	3.24E-06	None	NO	1.62E-04	3.90E+04	NO
Chloroform	<	1.37E-05	lb/MMBtu	50%	3.44E-06	3.30E-01	NO	1.72E-04	1.50E+01	NO
Ethylbenzene	<	2.48E-05	lb/MMBtu	50%	CATEF	None	NO	CATEF	3.30E+01	NO
Ethylene Dibromide	<	2.13E-05	lb/MMBtu	50%	5.34E-06	None	NO	2.67E-04	1.10E+00	NO
Formaldehyde		2.05E-02	lb/MMBtu	50%	CATEF	1.20E-01	NO	CATEF	1.40E+01	NO
Methanol		3.06E-03	lb/MMBtu	50%	7.68E-04	6.20E+01	NO	3.84E-02	1.50E+05	NO
Methylene Chloride		4.12E-05	lb/MMBtu	50%	2.07E-05	3.10E+01	NO	1.03E-03	8.20E+01	NO
Naphthalene	<	9.71E-05	lb/MMBtu	50%	CATEF	None	NO	CATEF	2.40E+00	NO
PAH		1.41E-04	lb/MMBtu	50%	CATEF	None	NO	CATEF	None	NO
Styrene	<	1.19E-05	lb/MMBtu	50%	2.99E-06	4.60E+01	NO	1.49E-04	3.50E+04	NO
Toluene		5.58E-04	lb/MMBtu	50%	1.40E-04	8.20E+01	NO	7.00E-03	1.20E+04	NO
Vinyl Chloride	<	7.18E-06	lb/MMBtu	50%	1.80E-06	4.00E+02	NO	9.01E-05	1.10E+00	NO
Xylene		1.95E-04	lb/MMBtu	50%	4.89E-05	4.90E+01	NO	2.45E-03	2.70E+04	NO

Table 3
HAP EMISSION ESTIMATES BASED ON CATEF EMISSION FACTORS

SUBSTANCE	E.F. MEAN	UNIT	Assumed Abatement Efficiency %*	Abated Emissions (lb/hr)	Acute Trigger Level (lb/hr)	HRSA Triggered? (Y/N)	Abated Emissions (lb/yr)	Chronic Trigger Level (lb/yr)	HRSA Triggered? (Y/N)
1,3-Butadiene	1.04E-01	lbs/MMcf	50%	2.56E-05	1.50E+00	NO	1.28E-03	4.80E-01	NO
Acenaphthene	1.94E-03	lbs/MMcf	50%	4.77E-07	None	NO	2.39E-05	None	NO
Acenaphthylene	1.45E-02	lbs/MMcf	50%	3.57E-06	None	NO	1.78E-04	None	NO
Acetaldehyde	8.83E-01	lbs/MMcf	50%	2.17E-04	1.00E+00	NO	1.09E-02	2.90E+01	NO
Acrolein	5.47E-01	lbs/MMcf	50%	1.35E-04	5.50E-03	NO	6.73E-03	1.40E+01	NO
Anthracene	1.84E-03	lbs/MMcf	50%	4.53E-07	None	NO	2.26E-05	None	NO
Benzene	7.39E-02	lbs/MMcf	50%	1.82E-05	6.00E-02	NO	9.09E-04	2.90E+00	NO
Benzo(a)anthracene	3.39E-04	lbs/MMcf	50%	8.34E-08	None	NO	4.17E-06	None	NO
Benzo(a)pyrene	1.15E-04	lbs/MMcf	50%	2.83E-08	None	NO	1.41E-06	None	NO
Benzo(b)fluoranthene	2.37E-04	lbs/MMcf	50%	5.83E-08	None	NO	2.92E-06	None	NO
Benzo(g,h,i)perylene	1.95E-04	lbs/MMcf	50%	4.80E-08	None	NO	2.40E-06	None	NO
Benzo(k)fluoranthene	1.03E-04	lbs/MMcf	50%	2.53E-08	None	NO	1.27E-06	None	NO
Chrysene	3.10E-04	lbs/MMcf	50%	7.63E-08	None	NO	3.81E-06	None	NO
Dibenz(a,h)anthracene	1.25E-05	lbs/MMcf	50%	3.08E-09	None	NO	1.54E-07	None	NO
Ethylbenzene	1.16E-02	lbs/MMcf	50%	2.85E-06	None	NO	1.43E-04	4.30E+01	NO
Fluoranthene	9.95E-04	lbs/MMcf	50%	2.45E-07	None	NO	1.22E-05	None	NO
Fluorene	6.91E-03	lbs/MMcf	50%	1.70E-06	None	NO	8.50E-05	None	NO
Formaldehyde	4.99E-02	lbs/MMcf	50%	1.23E-05	2.10E-01	NO	6.14E-04	1.80E+01	NO
Indeno(1,2,3-cd)pyrene	1.69E-04	lbs/MMcf	50%	4.16E-08	None	NO	2.08E-06	None	NO
Naphthalene	7.65E-02	lbs/MMcf	50%	1.88E-05	None	NO	9.41E-04	2.40E+00	NO
Phenanthrene	7.07E-03	lbs/MMcf	50%	1.74E-06	None	NO	8.70E-05	None	NO
Propylene	1.60E+01	lbs/MMcf	50%	3.94E-03	None	NO	1.97E-01	1.20E+05	NO
Pyrene	1.79E-03	lbs/MMcf	50%	4.40E-07	None	NO	2.20E-05	None	NO
Toluene	1.07E+00	lbs/MMcf	50%	2.63E-04	8.20E+01	NO	1.32E-02	1.20E+04	NO
Xylene (m,p)	4.41E-01	lbs/MMcf	50%	1.08E-04	4.90E+01	NO	5.42E-03	2.70E+04	NO
Xylene (o)	2.17E-01	lbs/MMcf	50%	5.34E-05	4.90E+01	NO	2.67E-03	2.70E+04	NO
Xylene (Total)	6.02E-02	lbs/MMcf	50%	1.48E-05	4.90E+01	NO	7.40E-04	2.70E+04	NO
PAH Equivalents as Benzo(a)pyrene	2.66E-06	lbs/MMcf	50%	6.54E-10	5.00E+01	NO	3.27E-08	3.30E-03	NO

PLANT CUMULATIVE EMISSIONS

Table 4 summarizes the cumulative increase in criteria pollutant emissions that will result from the operation of S-1.

Table 4

Plant Cumulative Increase: (tons/year)			
Pollutant	**Existing**	**New**	**Total**
NOx	0.000	0.001	0.001
POC	0.00	0.001	0.001
CO	0.00	0.006	0.006
PM_{10}	0.00	0.000	0.000
SO2	0.00	0.000	0.000

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, NOx, CO, SO_2 or PM_{10}. Based on the emission calculations above, BACT is not triggered for any pollutant since the maximum daily emission for any pollutant does not exceed 10 lb/day.

OFFSETS

Per Regulation 2-2-302, offsets must be provided for any new or modified source at a facility that emits more than 10 tons/yr of POC or NOx. Based on the emission calculations above, offsets are not required for this application.

New Source Performance Standards (NSPS)

The New Source Performance Standard (NSPS) in 40 CFR 60, Subpart JJJJ does apply because the engine is to be installed after January 1, 2011. Section 60.4233(c) states owners and operators of stationary SI ICEs with a maximum engine power greater than 25 hp that are rich burn engines and use LPG must comply with emission standards set forth in Section 60.4231(c). Section 60.4231(c) states that emergency spark ignition internal combustion engines with a maximum engine power greater than 25 hp that are rich burn engines, use LPG and are manufactured on or after January 1, 2009, must comply with 40 CFR 1048. 40 CFR 1048.101(a) states that engine starting model year 2007 must comply with the following emission standards:

Pollutant	S-1 Emission Factor	NSPS Standard
NOx + HC	0.255 g/bhp-hr	2.01 g/bhp-hr
CO	1.14 g/bhp-hr	3.28 g/bhp-hr

As the information above shows, S-1 is in compliance with these NSPS emission requirements.

National Emission Standards for Hazardous Air Pollutants (NESHAP)

This engine will be classified as a HAP area source therefore will be subject to the Reciprocating Internal Combustion Engine (RICE) NESHAP (40 CFR Part 63, Subpart ZZZZ) because it is a new source and installed after 2007. A new RICE at an area source that is subject to Part 60 Subpart JJJJ NSPS requirements has no further requirements under Subpart ZZZZ pursuant to 40 CFR Part 63.6590(c). Therefore, S-1 complies with NESHAP by meeting the requirements under 40CFR60 (NSPS).

STATEMENT OF COMPLIANCE

The owner/operator of S-1 shall comply with Regulation 6, Rule 1 (*Particulate Matter and Visible Emissions Standards*) and Regulation 9-1-301 (*Inorganic Gaseous Pollutants: Sulfur Dioxide for Limitations on Ground Level Concentrations*). From Regulation 9-1-301, the ground level concentrations of SO_2 will 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.

S-1 is an emergency standby generator; from Regulation 9, Rule 8 (*NOx and CO from Stationary Internal Combustion Engines*), Section 110.5 (*Emergency Standby Engines*), S-1 is exempt from the requirements of Regulations 9-8-301 (*Emission Limits on Fossil Derived Fuel Gas*), 9-8-302 (*Emission Limits on Waste Derived Fuel Gas*), 9-8-303 (*Emissions Limits – Delayed Compliance, Existing Spark-Ignited Engines, 51 to 250 bhp or Model Year 1996 or Later*), 9-8-304 (*Emission Limits – Compression-Ignited Engines*), 9-8-305 (*Emission Limits – Delayed Compliance, Existing Compression-Ignited Engines, Model Year 1996 or Later*), 9-8-501 (*Initial Demonstration of Compliance*) and 9-8-503 (*Quarterly Demonstration of Compliance*).
Allowable operating hours and the corresponding record keeping in Regulations 9-8-330 (*Emergency Standby Engines, Hours of Operation*) and 9-8-530 (*Emergency Standby Engines, Monitoring and Recordkeeping*) will be included in the Permit Conditions below.

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)

Public Notice is required because the equipment is not located within 1000 feet of a K-12 school.

PERMIT CONDITIONS

COND# 23113 ----------

1. The owner or operator shall operate the stationary emergency standby engine only to mitigate emergency conditions or for reliability-related activities (maintenance and testing). Operating while mitigating emergency conditions and while emission testing toshow compliance with this part is unlimited.

   Operating for reliability-related activities are limited to 50 hours per year.
   (Basis: Emergency Standby Engines, Hours of Operation Regulation 9-8-330)

2. The Owner/Operator shall equip the emergency standby engine(s) with: a non-resettable totalizing meterthat measures hours of operation or fuel usage
   (Basis: Emergency Standby Engines, Monitoring and Record keeping 9-8-530)

3. The Owner/Operator shall not operate unless theliquid petroleum gas fired engine is abated with a Catalytic Converter. (Basis: Cumulative Increase)

4. Records: The Owner/Operator shall maintain thefollowing monthly records in a District-approved log for atleast
   24 months from the date of entry or 60 months from the date of entry for a Title V Facility. 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 (maintenance and testing).
   b. Hours of operation for emission testing.
   c. Hours of operation (emergency).
   d. For each emergency, the nature of theemergency condition.
   e. Fuel usage for engine.
   (Basis: Emergency Standby Engines, Monitoring and Recordkeeping 9-8-530)

RECOMMENDATION

Recommend that a conditional Authority to Construct be issued for the following equipment:

S-1 Emergency Standby NG Engine
Kohler, Model: KG6208, Model Year: 2020
97.9 BHP, 2.84 MMBtu/hr

A-1 Nett TG-Series Three-way Catalyst

by _____ June 4, 2021

Anne Werth, Air Quality Engineer