

To Town of Vienna Planning & Zoning  
Town Hall  
127 Center Street S  
Vienna, VA 22180

Project Navy Federal Credit Union  
Generator Replacement  
1408121

Project Number 1408121  
Memorandum Date December 13, 2024

Subject Generator Performance Standards

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This narrative provides supplemental information on the new emergency generators that will replace the existing emergency generators at Navy Federal Credit Union's facility. Town of Vienna Code Chapter 18, Section 18-548, lists performance standards related to vibration, noise, smoke, combustion and particulate matter.

**Smoke**

Article 3 of Section 18-548 requires discharged emissions to be of opacity no greater than the equivalent of No. 2 on the Ringelmann chart. The Ringelmann chart contains levels 1 through 5 with level 1 being 20% opacity and level 5 being 100% opacity. An opacity level of No. 2 on the Ringelmann chart would therefore be approximately 40% opacity.

See Table 1 for performance data provided by Caterpillar for the generator set engines. Figures of merit relative to the ordinance are highlighted. "Dry smoke opacity" is demonstrated to be less than 3%, which is well under the 40% opacity limit of the ordinance.

The engine generator set control system, as well as standard test procedures, will disallow continuous operation below about 50% loading for the generators, so performance at 50% and greater loading is highlighted. However, performance at levels under 50% loading is still within Town ordinance criteria.

**Combustion Contaminants and Particulate Matter**

Article 4 for combustion contaminants requires that any single emission source must not exceed 0.3 grains per cubic foot of gas at standard conditions. Since 1 grain/ft<sup>3</sup> is approximately 2288 mg/m<sup>3</sup>, 0.3 grain/ft<sup>3</sup> is approximately 686 mg/m<sup>3</sup>. Article 5 for particulate matter emissions refers back to Article 4 for rate of combustion into the atmosphere.

See Table 1 which highlights particulate matter emissions. At standard conditions, the particulate matter emissions are observed to be 14.1 mg/m<sup>3</sup> or less, which is well within the 686 mg/m<sup>3</sup> limit of the ordinance.

Table 1. Caterpillar Generator Engine Performance Data

GENSET POWER WITH FAN	EKW	1,500.0	1,125.0	750.0	375.0	150.0
ENGINE POWER	BHP	2,206	1,662	1,144	632	312
PERCENT LOAD	%	100	75	50	25	10
TOTAL NOX (AS NO2)	G/HR	11,615	5,877	3,912	2,972	2,290
TOTAL CO	G/HR	1,019	634	898	1,060	1,024
TOTAL HC	G/HR	257	278	262	207	241
TOTAL CO2	KG/HR	1,063	828	584	342	198
PART MATTER	G/HR	67.7	68.8	104.8	127.8	77.9
TOTAL NOX (AS NO2)	(CORR 5% O2) MG/NM3	2,303.5	1,458.7	1,352.5	1,792.1	2,400.6
TOTAL CO	(CORR 5% O2) MG/NM3	230.3	181.4	384.5	802.1	1,284.5
TOTAL HC	(CORR 5% O2) MG/NM3	50.3	69.9	90.2	128.2	263.2
PART MATTER	(CORR 5% O2) MG/NM3	12.6	16.3	37.9	76.2	80.1
TOTAL NOX (AS NO2)	(CORR 15% O2) MG/NM3	854.8	541.3	501.9	665.0	890.8
TOTAL CO	(CORR 15% O2) MG/NM3	85.5	67.3	142.7	297.6	476.6
TOTAL HC	(CORR 15% O2) MG/NM3	18.7	25.9	33.5	47.6	97.7
PART MATTER	(CORR 15% O2) MG/NM3	4.7	6.0	14.1	28.3	29.7
TOTAL NOX (AS NO2)	(CORR 5% O2) PPM	1,122	711	659	873	1,169
TOTAL CO	(CORR 5% O2) PPM	184	145	308	642	1,028
TOTAL HC	(CORR 5% O2) PPM	94	130	168	239	491
TOTAL NOX (AS NO2)	(CORR 15% O2) PPM	416	264	244	324	434
TOTAL CO	(CORR 15% O2) PPM	68	54	114	238	381
TOTAL HC	(CORR 15% O2) PPM	35	48	62	89	182
TOTAL NOX (AS NO2)	G/HP-HR	5.32	3.57	3.45	4.73	7.39
TOTAL CO	G/HP-HR	0.47	0.39	0.79	1.69	3.30
TOTAL HC	G/HP-HR	0.12	0.17	0.23	0.33	0.78
PART MATTER	G/HP-HR	0.03	0.04	0.09	0.20	0.25
TOTAL NOX (AS NO2)	G/KW-HR	7.23	4.85	4.69	6.43	10.05
TOTAL CO	G/KW-HR	0.63	0.52	1.08	2.29	4.49
TOTAL HC	G/KW-HR	0.16	0.23	0.31	0.45	1.06
PART MATTER	G/KW-HR	0.04	0.06	0.13	0.28	0.34
TOTAL NOX (AS NO2)	LB/HR	25.61	12.96	8.62	6.55	5.05
TOTAL CO	LB/HR	2.25	1.40	1.98	2.34	2.26
TOTAL HC	LB/HR	0.57	0.61	0.58	0.46	0.53
TOTAL CO2	LB/HR	2,344	1,825	1,289	753	436
PART MATTER	LB/HR	0.15	0.15	0.23	0.28	0.17
OXYGEN IN EXH	%	10.9	12.0	12.7	13.7	15.7
DRY SMOKE OPACITY	%	1.0	1.3	2.9	5.0	3.0
BOSCH SMOKE NUMBER		0.77	0.79	1.02	1.30	1.04

**Environmental Noise and Vibration Control**

**Noise Emissions**

Section 18-548 outlines that maximum acceptable noise levels in octave bands at different times of the day.

Article 5A. Development Standards – Commercial, Industrial, and Mixed Uses

Frequency Band Cycles Per Second	Sound Pressure Level Decibels re 0.0002 dyne/cm <sup>2</sup>
20-75	69
75-150	60
150-300	56
300-600	51
600-1,200	42
1,200-2,400	40
2,400-4,800	38
4,800-10,000	35

  

Frequency Band Cycles Per Second	Sound Pressure Level Decibels re 0.0002 dyne/cm <sup>2</sup>
20-75	65
75-150	50
150-300	43
300-600	38
600-1,200	33
1,200-2,400	30
2,400-4,800	28
4,800-10,000	26