PUBLIC

DRAFT - ENGINEERING EVALUATION
Amazon.com Services LLC DFO2
Plant No. 202138
Application No. 724256
4000 Wilbur Avenue, Oakley, CA 94561

BACKGROUND

Mainspring Energy, Inc. on behalf of Amazon.com Services LLC DFO2 (Amazon) has applied for an Authority to Construct and Permit to Operate for three linear generators, fueled by natural gas:

Prime Natural Gas Linear Generator (Two Cores)
S-2 Core 1
Make: Mainspring Energy; Model: MSE-230-NG; Max Rated Output: [redacted];
Max Fuel Input: [redacted] MMBtu/hour;
Integrated Oxidation Catalysts, Make: [redacted], Model: [redacted] or Make: [redacted], Model: [redacted]

S-3 Core 2
Make: Mainspring Energy; Model: MSE-230-NG; Max Rated Output: [redacted];
Max Fuel Input: [redacted] MMBtu/hour;
Integrated Oxidation Catalysts, Make: [redacted], Model: [redacted] or Make: [redacted], Model: [redacted]

Prime Natural Gas Linear Generator (Two Cores)
S-4 Core 1
Make: Mainspring Energy; Model: MSE-230-NG; Max Rated Output: [redacted];
Max Fuel Input: [redacted] MMBtu/hour;
Integrated Oxidation Catalysts, Make: [redacted], Model: [redacted] or Make: [redacted], Model: [redacted]

S-5 Core 2
Make: Mainspring Energy; Model: MSE-230-NG; Max Rated Output: [redacted];
Max Fuel Input: [redacted] MMBtu/hour;
Integrated Oxidation Catalysts, Make: [redacted], Model: [redacted] or Make: [redacted], Model: [redacted]

Prime Natural Gas Linear Generator (Two Cores)
S-6 Core 1
Make: Mainspring Energy; Model: MSE-230-NG; Max Rated Output: [redacted];
Max Fuel Input: [redacted] MMBtu/hour;
Integrated Oxidation Catalysts, Make: [redacted], Model: [redacted] or Make: [redacted], Model: [redacted]

S-7 Core 2
Make: Mainspring Energy; Model: MSE-230-NG; Max Rated Output: [redacted];
Max Fuel Input: [redacted] MMBtu/hour;
Integrated Oxidation Catalysts, Make: [redacted], Model: [redacted] or Make: [redacted], Model: [redacted]

BACKGROUND

Amazon is proposing to operate the sources at the Amazon Last Mile Logistics facility located at 4000 Wilbur Avenue, Oakley, CA 94561. The area is designated as light industrial. The process includes assembly and testing three linear generators each one with two cores, meaning they will be considered as six sources.

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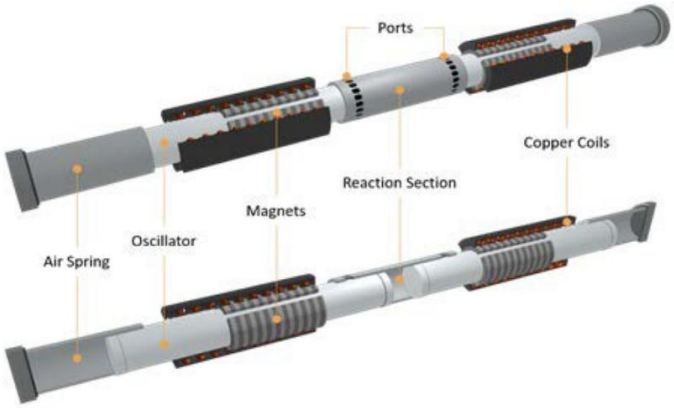
Mainspring Energy's linear generator uses a low-temperature reaction of air and fuel to drive magnets through copper coils to efficiently produce electricity with near-zero NOx emissions.

Figure 1 illustrates the components of linear generator technology. The linear generator has a center combustion chamber with two opposed oscillators and two outer air springs. The reaction section has intake and exhaust ports for gas exchange. Each oscillator has magnets attached to them for electricity production via the surrounding copper coils.

Figure 1: Cross Section Illustration of a Linear Generator



An operating cycle of the linear generator begins with compression of a fuel/air mixture that is driven by energy stored in the air springs from a previous cycle. A fuel / air mixture is injected at low temperatures into a combustion chamber (termed "Reaction Section" in Figure 1) and compressed until autoignition occurs. The expanding gas pushes two opposing pistons (termed "Oscillator" in Figure 1) outward, during which a portion of the kinetic energy is directly converted into electricity through the copper coils and the remaining kinetic energy is stored in the air springs for use during the next cycle. Following expansion, gas exchange replaces the exhaust products with a fresh fuel/air mixture.

The electricity produced is rectified to direct current (DC) through power electronics and the DC power is then converted to 3-phase alternating current (AC) power via a UL 1741 SA-listed grid-tie inverter (these two are not shown in Figure 1).

Unlike gas turbines and conventional internal combustion engines, which both utilize a flame (resulting in high temperatures and NOx emissions), linear generator technology uses low-temperature, flameless (per the applicant) combustion that may result in lower NOx emissions than conventional internal combustion engines but may result in more emissions of toxic air contaminants that form at lower temperatures.

Per Mainspring Energy's United State patents for the technology underpinning Sources 2 through 7, the linear generators utilize a free-piston combustion engine (a form of internal combustion).

A free-piston combustion engine differs from what has traditionally been considered and regulated as an internal combustion engine, either a traditional compression ignition (CI) or spark ignition (SI) engine, where use of a crank shaft is employed to create rotation about a shaft connected to an electrical generator with a similar principle as above, utilizing magnets and copper windings. Free-piston engines are crankless.

However, per the patents, a generator assembly "may be configured to perform a cycle approximating, for example, an Otto cycle, a Diesel cycle, an Atkinson cycle, a Miller cycle, a Carnot cycle, an Ericsson cycle, a Stirling cycle, any other suitable idealized or actual cycle, or any suitable combination thereof."

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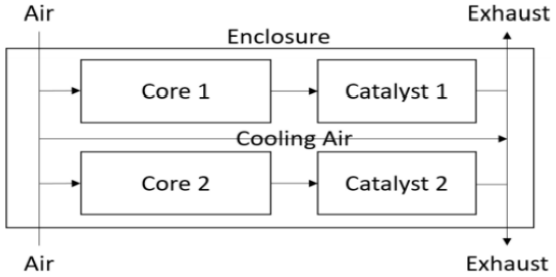
Gas turbines and internal combustion engines generate rotary motion of their shafts, which are coupled to generators to convert mechanical energy to electricity. Linear generators, however, create linear motion which is directly converted to electricity (engine and generator are combined).

The primary pollutants from linear generators are the products of combustion, including nitrogen oxides (NO_X), carbon monoxide (CO), hydrocarbon and other organic compounds (precursor organic compounds, POCs), sulfur dioxide (SO_2), and particulate matter (PM_{10} and $PM_{2.5}$). Various toxic air contaminants (TACs) are also emitted during the combustion of natural gas. Each source, S-2, S-3, S-4, S-5, S-6 and S-7 will be abated by two parallel oxidation catalysts that will reduce CO, POC, organic TACs, and formaldehyde.

The generator is comprised of two linear generator cores packaged inside a single enclosure. The two linear generator cores are mechanically and electrically independent, with each having their own intake and exhaust systems. A simple emissions flow diagram is presented in Figure 2.

Figure 2: Emission Flow Diagram



EMISSION CALCULATIONS

Basis:

- Maximum output rating 125 kW, 168 bhp.
- Maximum Annual Operation: 8,760 hours
- Maximum Daily Operation: 24 hours
- Maximum NG Consumption Rate 1,055 scf/hour (1.076 MMBtu/hour, based on a HHV of 1,020 Btu/scf)
- The generators will be equipped with commercially available oxidation catalysts subject to availability. The catalysts can be the Johnson Matthey, Model No. MC6T-6F-1 or EcoCat, Model 822616 according to correspondence dated July 6, 2026. These will reduce emissions of CO, POCs, organic TACs, and formaldehyde.

A linear generator is a natural gas fired (not an EPA certified) engine with a compression ignition architecture, which is different from the traditional CI diesel engines.

For permitting the previous application AN29327, submitted by EtaGen, emission rates for NO_x, CO, and POC emissions from the engine were taken from the BACT Guideline for a Spark Ignition, Natural Gas fired, lean burn engine >= 50 HP, Revision 1, Document 96.3.3 from May 7, 2003.

However, emissions measured from the EtaGen linear generator tests averaged at 5.07 ppmv (1.91E-02 lb/MMBtu) and 8.33 ppmv (1.10E-02 lb/MMBtu) at 15% O_2 concentration, for NO_X and CO concentration, respectively; therefore, NO_X and CO concentration of 6 ppmv (0.0225 lbs/MMBtu) and 12 ppmv (0.0273 lbs/MMBtu) will be used in this project, respectively, to provide compliance margin for the linear generators.

POC emission factor was taken from source test data for linear generators at Colton Facility (South Coast Air Quality Management District).

No emission factors for PM or SO_2 are available from source testing. The Air District used the most stringent PM emission factor, based on requirements for CI engines, in reviewing the permit application #29327. Sources S-2, S-3, S-4, S-5, S-6 and S-7 of the current application are expected to meet the same standards since these sources will be fueled exclusively using natural gas instead of diesel fuel. A summary of the emission factors used in this application are given in Table 1.

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Table 1. Emission Factors for sources S-2, S-3, S-4, S-5, S-6 and S-7			
Pollutant	**Emission Factor**	**Units**	**Sources of Information**
NO_X	2.25E-02	lb/MMBtu	Based on NO_X concentration 6 ppmv at O_2% of 15%
CO	2.73E-02	lb/MMBtu	Based on CO concentration limit of 12 ppmv at O_2% of 15%
POC	1.10E-02	lb/MMBtu	Based on test data from linear generators at Colton Facility (SCAQMD).
PM_{10}	1.50E-02	g/hp-hour	Based on Tier 4 Final Emission Standards set forth in 40 CFR Section 1039.101 for CI Engines (Subpart IIII)
$PM_{2.5}$	1.50E-02	g/hp-hour	
SO_2	2.60E-03	lb/MMBtu	PG&E natural gas sulfur standard content of 1 grain (ppmv) of sulfur per 100 SCF.

The annual and daily maximum emissions from each of the sources, S-2, S-3, S-4, S-5, S-6 and S-7, are summarized below in Table 2.

Table 2 – Abated emissions per each identical Linear Generator's Core.						
Pollutant	**Abated Emission Factor**	**Unit**	**Hourly (lbs/hour)**	**Daily (lbs/day)**	**Annual (lbs/year)**	**Annual (tons/year)**
NO_x	2.25E-02	lb/MMBtu	0.01	0.29	106	0.053
CO	2.73E-02	lb/MMBtu	0.01	0.35	129	0.064
POC	1.10E-02	lb/MMBtu	0.01	0.14	52	0.026
PM_{10}	1.50E-02	g/hp-hr	0.00	0.07	24	0.012
$PM_{2.5}$	1.50E-02	g/hp-hr	0.00	0.07	24	0.012
SO_2	2.60E-03	lb/MMBtu	0.00	0.03	12	0.006

Notes:

-Maximum Hourly Heat Rate [redacted] (from fuel).

-Operating schedule: [redacted].

-All emissions emitted from the linear generators are assumed to be less than 2.5 micrometer in diameter for most conservative estimate of $PM_{2.5}$ emissions.

PLANT CUMULATIVE INCREASE

Table 3 summarizes the cumulative increase in criteria pollutant emissions resulting from the operation of all six sources, S-2, S-3, S-4, S-5, S-6 and S-7 and S-1, an existing emergency diesel engine set for a fire pump and limited to operate 34 hours per year for maintenance and reliability.

Table 3 - Plant Cumulative Emissions			
Pollutant	**Existing Emissions (tons/year)**	**New Emissions (tons/year)**	**Total Emissions (tons/year)**
NOx	0.020	0.318	0.338
CO	0.006	0.386	0.392
POC	0.001	0.156	0.157
PM_{10}	0.001	0.073	0.073
$PM_{2.5}$	0.001	0.073	0.073
SO_2	0.000	0.037	0.037

TOXIC HEALTH RISK ASSESSMENT

Toxic Air Contaminants (TAC) are expected from the operation of S-2, S-3, S-4, S-5, S-6 and S-7. Emission factors for TAC were selected based on data taken from source tests and engineering tests and reviewed by the Air District.

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Table 4 – TAC Emission Factors Review		
Compound	**Chosen Emission Factor**	**Unit**
1,3-Butadiene	7.80E-06	lb/MMBtu
Acetaldehyde	1.30E-04	lb/MMBtu
Benzene	3.80E-04	lb/MMBtu
Formaldehyde	4.00E-03	lb/MMBtu
Naphthalene	1.60E-06	lb/MMBtu

Based on the calculations in Tables 5 and 6 below, some compounds exceed the Air District's Risk Screening Trigger Levels set forth in Table 1 of Reg. 2-5 (New Source Review for Toxic Air Contaminants). Therefore, a Health Risk Assessment (HRA) was required and performed for this permit application. An emergency diesel engine (S-1; Application # 631232) was permitted within the five-year lookback period, so its emissions have been included as part of this project.

Table 5 - TAC Emission Review: Acute Trigger Level				
Compound	**Single Source Emissions (lb/hour)**	**Total Acute Emissions (lbs/hour)**	**Acute Trigger Level (lbs/hour)**	**Emissions exceed Acute Trigger?**
1,3-Butadiene	8.4E-06	5.0E-05	2.9E-01	No
Acetaldehyde	1.4E-04	8.4E-04	2.1E-01	No
Benzene	4.1E-04	2.5E-03	1.2E-02	No
Formaldehyde	4.3E-03	2.6E-02	2.4E-02	Yes
Naphthalene	1.7E-06	1.0E-05	None	No

Table 6 - TAC Emission Review: Chronic Trigger Level				
Compound	**Single Source Emissions (lb/yr)**	**Total Chronic Emissions (lbs/yr)**	**Chronic Level (lbs/yr)**	**Emissions exceed Chronic Trigger?**
1,3-Butadiene	7.4E-02	4.4E-01	4.8E-01	No
Acetaldehyde	1.2E+00	7.4E+00	2.9E+01	No
Benzene	3.6E+00	2.1E+01	2.9E+00	Yes
Formaldehyde	3.8E+01	2.3E+02	1.4E+01	Yes
Naphthalene	1.5E-02	9.0E-02	2.4E+00	No

Results from this HRA indicate that the project cancer risk is estimated at 0.13 in a million, the project chronic hazard index (HI) is estimated at 0.0013, and the project acute HI is estimated at 0.026. In accordance with the District's Regulation 2-5-301, none of the proposed new sources requires TBACT because each of the estimated source risk does not exceed a cancer risk of 1.0 in a million, and/or chronic hazard index of 0.20. Since the estimated project cancer risk does not exceed 6.0 in a million and hazard indices do not exceed 1.0, this proposed project complies with the District's Regulation 2-5-302 project risk requirements, for projects located in an Overburdened Community, as defined in Regulation 2-1-243.

BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

Sources S-2, S-3, S-4, S-5, S-6 and S-7 do not trigger Best Available Control Technology (BACT), since the maximum daily emissions for POC, NO_X, CO, SO_2, PM_{10}, or $PM_{2.5}$ do not exceed 10 pounds per highest day per Regulation 2, Rule 2, Section 301 ("Best Available Control Technology Requirement").

OFFSETS

Offsets must be provided for any new or modified source at a facility that emits more than 10 tons per year of POC or NOx or emits more than 100 tons per year of PM_{10}. Since the permitted emissions from the facility are less than 10 tons per year of POC or NOx and less than 100 tons per year of PM_{10}, offsets are not required.

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Table 7 - Plant Potential to Emit			
Pollutant	**Existing Emissions (tons/year)**	**New Emissions (tons/year)**	**Total Emissions (tons/year)**
NOx	0.079	0.318	0.397
CO	0.024	0.386	0.410
POC	0.004	0.156	0.159
PM_{10}	0.002	0.073	0.075
$PM_{2.5}$	0.002	0.073	0.075
SO_2	0.000	0.037	0.037

STATEMENT OF COMPLIANCE

District Regulations

Regulation 2-1: General Requirements

-*Section 2-1-311*: This permit application is categorically exempt from CEQA because the project has no potential for causing a significant adverse environmental impact, or the application is categorically exempt from CEQA under CEQA Guidelines Section 15301: No or negligible expansion of use. In making the determination that this application is categorically exempt: 1) the Air District reviewed the CEQA-related Information from the applicant per Regulation 2-1-426-1 indicating that there is no potential for a significant adverse environmental impact from the project; 2) a formal health risk assessment was either not required or was approved by the Air District; and 3) the Air District determined there are no unusual circumstances, or that the cumulative impacts from successive projects of the same type in the same place do not result in significant adverse environmental impacts.

The Air District received a completed, signed, and dated preliminary environmental study from the applicant as required by Regulation 2-1-426.1, with information equivalent to that contained in Appendix H of the State CEQA Guidelines. Therefore, the application was deemed complete for CEQA purposes per Regulation 2-1-426.1.

-*Section 2-1-428*: the review of proposed new source is based on the criteria set forth in the section "Criteria for Approval of Ministerial Permit Applications" and based on procedures, fixed standards, and objective measurements outlined in District's Permit Handbook and BACT workbook.

The engineering review for this project requires only the application of standard permit conditions and standard emission factors in the Permit Handbook Chapters (Chapter 2.3.2 Stationary Natural Gas Engines).

-*Section 2-1-412:* Public/School Notification

The project is within an Overburdened Community (OBC) and triggered a refined HRA, therefore is subject to the public notification requirements of Regulation 2-1-412. OBC is defined in Regulation 2-1-243.

Regulation 6-1: Particulate Matter and Visible Emissions

Sources S-2, S-3, S-4, S-5, S-6 and S-7 are subject to and expected to comply with standards set forth in the sections below since S-2, S-3, S-4, S-5, S-6 and S-7
will exclusively consume natural gas.

-*Section 6-1-301* Ringelmann No. 1 Limitation
-*Section 6-1-305* Visible Particles
-*Section 6-1-310* Total Suspended Particulate Concentrations Limits

Regulation 9-1: Inorganic Gaseous Pollutants, Sulfur Dioxide

-*Section 9-1-301* Limitations on Ground Level Concentrations

Regulation 9-8 – NO_X and CO Emissions from Stationary Internal Combustion Engines

-*Section 9-8-101* states that the rule applies to "stationary internal combustion engines with an output rated by the manufacturer at more than 50 brake horsepower".

-*Section 9-8-203* defines "rated brake horsepower" as the maximum brake horsepower rating at maximum revolutions per minute (RPM) specified for the engine by the manufacturer or indicated on the engine nameplate.

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Sources S-2, S-3, S-4, S-5, S-6 and S-7 do not have rotating shafts, linear generators, create linear motion, which is directly converted to electricity then, brake horsepower as defined in this section, does not apply. Thus, S-2, S-3, S-4, S-5, S-6 and S-7 are not subject to the requirements of Regulation 9-8.
-*Section 9-8-304* if sources S-2, S-3, S-4, S-5, S-6 and S-7 were subject to the requirements of the rule, the maximum permitted and expected emissions rates are well below the emission limits of this section.

Air Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines
The purpose of this ATCM is to reduce diesel particulate matter and criteria pollutant emissions from stationary diesel-fueled CI engines. Since the generators will be fueled exclusively using natural gas, sources 2 through 7 are not subject to this ATCM.

New Source Performance Standards (NSPS)
40 CFR 60, Subpart IIII, Standards of Performance for Stationary CI Internal Combustion Engines (ICEs)
40 CFR 60, Subpart JJJJ, Standards of Performance for Stationary SI Internal Combustion Engines (ICEs)

40 CFR 60, Subpart IIII and Subpart JJJJ, in their Section 60.4219 and 60.4248 respectively, define "Stationary Internal Combustion Engine", as follows:

Stationary internal combustion engine means any internal combustion engine, except combustion turbines, that converts heat energy into mechanical work and is not mobile. Stationary ICE differs from mobile ICE in that a stationary internal combustion engine is not a nonroad engine as defined at 40 CFR 1068.30 (excluding paragraph (2)(ii) of that definition), and is not used to propel a motor vehicle, aircraft, or a vehicle used solely for competition. Stationary ICE includes reciprocating ICE, rotary ICE, and other ICE, except combustion turbines.

As explained in the Background Section, linear generators convert heat energy, from autoigniting compressed fuel, into linear motion, which is then converted into electric energy. After combusting the compressed fuel, work is done by expanding gas on the *pistons*. In a traditional internal combustion engine, pistons are connected to a crankshaft that is rotated by the movement of the pistons. In this case, mechanical work is clearly being done by the pistons on the crankshaft.

For sources 2 through 7, it is not clear whether the work done by the expanding gas on the pistons may be considered "mechanical work". A force (the expanding gas) is applied to a body (the pistons) in the direction of the body's motion. The facility has submitted an argument and request to the U.S. EPA stating that the technology does not meet the definition of mechanical work. The company has not reached any conclusion with EPA.

Still, regardless of the sources being subject to the NSPS or not, sources 2 through 7 used for non-emergency purposes, are expected to comply with the emissions requirement set forth in CFR 60, Subpart IIII and Subpart JJJJ.

National Emission Standards for Hazardous Air Pollutants (NESHAP)
40 CFR 63, Subpart ZZZZ, National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (ICE)

This subpart applies to stationary reciprocating internal combustion engines (RICE) at both major and area sources. The facility is not a major source and is therefore considered an area source.

Per Section 63.6585(a), a stationary reciprocating internal combustion engine is "any internal combustion engine which uses reciprocating motion to convert heat energy into mechanical work and which is not mobile."

As described in the Background Section and within the discussion of the applicability of New Source Performance Standards, sources 2 through 7 convert heat energy into linear motion that is repeated or reciprocated through use of the air springs.

Per Section 63.6590(c)(1), a new stationary RICE at an area source is subject to the requirements of 40 CFR 60 Subpart IIII (if a compression ignition engine) or 40 CFR 60 Subpart JJJJ (if a spark ignition engine). As discussed above, sources 2 through 7 are expected to meet the emission limits of both subparts. However, the facility has submitted a request to the U.S. EPA regarding the applicability of the subparts. As such, it is not known whether the sources will be required to comply with the non-emission requirements.

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PERMIT CONDITIONS

Permit Condition # 100909 for S-2, S-3, S-4, S-5, S-6 and S-7

Condition for Natural Gas Linear Generators
Number of Linear Generators: 3
Number of Cores per Generator: 2
Number of Sources: 6 (each core is considered an independent source)

1. The owner/operator of S-2, S-3, S-4, S-5, S-6 and S-7 shall operate these sources on natural gas fuel exclusively.
   [Basis: Cumulative Increase, Toxics]

2. The owner/operator of S-2, S-3, S-4, S-5, S-6 and S-7 shall not exceed natural gas fuel usage of [redacted] in any hour at either source.
   [Basis: Cumulative Increase]

3. The owner/operator shall not operate S-2, S-3, S-4, S-5, S-6 and S-7 unless each source is abated with two oxidation catalysts in parallel. The catalysts shall be maintained and operated in accordance with manufacturer's recommendations. The owner/operator of S-2, S-3, S-4, S-5, S-6 and S-7 shall operate each oxidation catalyst at a minimum operating temperature of 200 degrees Celsius whenever S-2, S-3, S-4, S-5, S-6 and S-7 are in operation.
   [Basis: Cumulative Increase]

4. The owner/operator of S-2, S-3, S-4, S-5, S-6 and S-7 shall meet the following emission limits per source (core), unless – for Parts 4d-h only – the owner/operator demonstrates compliance with all requirements in Part 10:
   a. NOx: 6 ppmv, dry basis and corrected to 15% oxygen before dilution, averaged over a 15-minute period,
   b. CO: 12 ppmv, dry basis and corrected to 15% oxygen before dilution, averaged over a 15-minute period,
   c. POC: 25 ppmv, dry basis and corrected to 15% oxygen before dilution, averaged over a 15-minute period,
   d. Formaldehyde: 0.004 pounds per hour,
   e. Benzene: 0.0004 pounds per hour,
   f. Naphthalene: 0.0000002 pounds per hour,
   g. Acetaldehyde: 0.00014 pounds per hour,
   h. 1,3-Butadiene: 0.000008 pounds per hour.
   [Basis: Cumulative Increase, Regulation 2-5]

5. The owner/operator of S-2, S-3, S-4, S-5, S-6 and S-7 shall not exceed the following emission limits per source during any consecutive 12-month period per source (core):
   a. NO_X: 213 pounds
   b. CO: 258 pounds
   c. POC: 121 pounds
   d. PM_{10}: 49 pounds
   e. SO2: 25 pounds
   f. Formaldehyde: 37.8 pounds
   g. Benzene: 3.6 pounds
   h. Naphthalene: 0.02 pounds
   i. 1,3-butadiene: 0.08 pounds
   j. Acetaldehyde: 1.2 pounds
   [Basis: Cumulative Increase, Regulation 2-5]

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6. The owner/operator shall use a portable analyzer to take NOx and CO emission readings to verify compliance with Part 4 at least once every calendar quarter in which a source test is not performed unless the owner/operator has not operated the linear generator in the entire quarter. All emissions readings shall be taken with the source operating at conditions representative of normal operations.
   [Basis: Cumulative Increase, Regulation 2-1-403]

7. When determining compliance with the formaldehyde emission limit of Part 4, a higher heating value for natural gas of 1,020 Btu per standard cubic feet shall be used.
   [Basis: Cumulative Increase, Regulation 2-5]

8. In order to demonstrate compliance with Part 4 and 5, the owner/operator shall ensure that an initial Air District-approved source test is conducted on S-2, S-3, S-4, S-5, S-6 and S-7 within 60 days of startup and annually thereafter at the maximum load expected during operation using Air District approved source test methods. Each source test shall test for each pollutant identified in Part 4 and 5. Each source test shall be conducted at the main line after control and before mixing with the cooling air while the source is operating under normal operating conditions while fired on natural gas and shall not include startup or shutdown periods. Each linear generator core shall be source tested individually. Each source test shall determine all items identified below. The Source Test Section of the District shall be contacted to obtain approval of source test procedures at least 14 days in advance of each source test. The Source Test Section shall be notified of the scheduled test date at least 7 days in advance of each source test. Source test reports for compliance testing shall be submitted to the Source Test Section within 60 days of the test date.
   a. Actual gross electrical output (kW-hours) from the core during the test period;
   b. Total flow rate (standard cubic feet per minute, dry basis, or scfm) of all gaseous flow to the linear generator;
   c. Exhaust flow rate (sdcfm) from the linear generator based on EPA Methods 1-4;
   d. Concentrations (ppmv or percent by volume, dry basis) of NOx, CO, CH_4, NMOC, SO_2, and O2 in the exhaust gas from the linear generator;
   e. Emission rates (pounds per hour) of formaldehyde, benzene, naphthalene, acetaldehyde, and 1,3 Butadiene from the linear generator;
   f. Corrected concentrations (ppmv, corrected to 15% O2, dry basis) of CO, NOx, SO_2, and CH4 in the exhaust gas from the linear generator;
   g. Corrected concentration (ppmv, dry basis) of NMOC in the fuel to the generator,
   h. During the source test, the owner/operator shall also measure concentrations of NOx, CO, and O_2 (ppmv) in the exhaust from the linear generator using the portable analyzer procedures described in Part 6. The portable analyzer measurements shall be compared to the values measured pursuant to Part 8d.

   [Basis: Cumulative Increase, Regulation 2-5]

9. The owner/operator of S-2, S-3, S-4, S-5, S-6 and S-7 shall obtain prior approval for all source test procedures from the Air District's Source Test Section prior to conducting any test. 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 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: Cumulative Increase]

10. If any of the limits in Part 4d-h are exceeded, the Air District shall use the results of the most recent source test to determine if the limits in Part 4d-h may be amended or if an amended health risk assessment is required. The measured emission rate and maximum permitted natural gas throughput rate shall be used to determine proposed annual emission rates and the resulting adjusted prioritization score for this project. If the adjusted prioritization score is less than 1, the emission rates in Parts 4d-h may be amended. If the adjusted prioritization score is 1.0 or higher, an amended health risk shall be required. If the Air District determines that S-2, S-3, S-4, S-5, S-6 and S-7 have a risk over the limits in Regulation 2-5-301, the owner/operator shall shut down S-2, S-3, S-4, S-5, S-6 and S-7 until changes have been made to lower the risk below the limits or TBACT is determined. If the Air District determines that the project as defined in Regulation 2-5-216 has a risk over the limits in Regulation 2-5-302, the owner/operator shall shut down S-2, S-3, S-4, S-5, S-6 and S-7 until changes have been made to lower the risk below the limits. If TBACT

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is required, the facility shall shut down the source until the source complies with TBACT. If the project cannot be modified so that the project risk is below the 2-5-302 limits, the Air District shall deny the final permit. Any changes that are made to S-2, S-3, S-4, S-5, S-6 and S-7 for the purposes of this part shall require a permit application and approval by the Air District before the changes can be made.
[Basis: Regulation 2-5-301]

11. The owner/operator of S-2, S-3, S-4, S-5, S-6 and S-7 shall retain the following records on-site at least for 24 months, from the date of entry, and make them available for inspection by District staff upon request.
    a. Fuel usage on a monthly basis for S-2, S-3, S-4, S-5, S-6 and S-7.
    b. Any maintenance records for S-2, S-3, S-4, S-5, S-6 and S-7, including the oxidation catalysts.
    c. Records of all monitoring or source testing conducted to demonstrate compliance with this permit condition and District rules.
    d. Records of startups, shutdowns, and malfunctions for the linear generator. For any malfunction, the records shall include the cause of the malfunction, the actions taken to correct the malfunction, the date and time that the malfunction was corrected, and the actions taken to prevent such malfunctions in the future.

    [Basis: Cumulative Increase]

End of Conditions

RECOMMENDATION

The Air District has reviewed the material contained in the permit application for the proposed project and has made a preliminary determination that the project is expected to comply with all applicable requirements of Air District, State, and Federal air quality-related regulations. The preliminary recommendation is to issue an Authority to Construct for the equipment listed below. However, because the proposed source is located within an Overburdened Community and requires a Health Risk Assessment, it triggers the public notification requirements of Regulation 2-1-412. Once public comments are received and reviewed, the Air District will make a final determination on the permit.

I recommend that the Air District initiate a public notice and consider any comments received prior to taking final action on the issuance of an Authority to Construct and/or a Permit to Operate for the following equipment:

Prime Natural Gas Linear Generator (Two Cores)

S-2 Core 1
Make: Mainspring Energy; Model: MSE-230-NG; Max Rated Output: [redacted];
Max Fuel Input: [redacted] MMBtu/hour;
Integrated Oxidation Catalysts, Make: [redacted], Model: [redacted] or Make: [redacted], Model: [redacted]

S-3 Core 2
Make: Mainspring Energy; Model: MSE-230-NG; Max Rated Output: [redacted];
Max Fuel Input: [redacted] MMBtu/hour;
Integrated Oxidation Catalysts, Make: [redacted], Model: [redacted] or Make: [redacted], Model: [redacted]

Prime Natural Gas Linear Generator (Two Cores)

S-4 Core 1
Make: Mainspring Energy; Model: MSE-230-NG; Max Rated Output: [redacted];
Max Fuel Input: [redacted] MMBtu/hour;
Integrated Oxidation Catalysts, Make: [redacted], Model: [redacted] or Make: [redacted], Model: [redacted]

S-5 Core 2
Make: Mainspring Energy; Model: MSE-230-NG; Max Rated Output: [redacted];
Max Fuel Input: [redacted] MMBtu/hour;

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Integrated Oxidation Catalysts, Make: [redacted], Model: [redacted] or Make: [redacted], Model: [redacted]

Prime Natural Gas Linear Generator (Two Cores)

S-6 Core 1
Make: Mainspring Energy; Model: MSE-230-NG; Max Rated Output: [redacted];
Max Fuel Input: [redacted] MMBtu/hour;
Integrated Oxidation Catalysts, Make: [redacted], Model: [redacted] or Make: [redacted], Model: [redacted]

S-7 Core 2
Make: Mainspring Energy; Model: MSE-230-NG; Max Rated Output: [redacted];
Max Fuel Input: [redacted] MMBtu/hour;
Integrated Oxidation Catalysts, Make: [redacted], Model: [redacted] or Make: [redacted], Model: [redacted]

Prepared by Isis Virrueta,
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July 13, 2026

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