ENGINEERING EVALUATION
Plant 25072: Invitae Corporation
444 De Haro Street, Suite 110, San Francisco, CA 94107

Application 31401: De Haro Standby Emergency Natural Gas Generator Engine

BACKGROUND

Invitae Corporation ("Invitae") conducts research and development related to genetic diagnostic testing for hereditary diseases in a laboratory environment and has requested an Authority to Construct for the following equipment:

S-1 Emergency Standby Natural Gas Generator (unabated)
Kohler KG6208THD; Engine: MKHXB06.2HNG, Model Year: TBD
EPA Certificate #: MKHXB06.2HNG-012
204 bhp, 152 kW, Engine displacement: 6.2 Liter (378 in^3), 1.71 MMBtu/hour; 4-Stroke Rich Burn engine
Subject to Permit Condition: 23112

S-1 will provide backup power to Invitae in the event of a power outage. Under normal conditions, S-1 will be operated for preventative maintenance purposes only and is not being installed in response to PGE's PSPS program.

EMISSIONS

The unabated emission factors used to calculate Precursor Organic Compound (POC ~ NMHC), Nitrogen Oxide (NOx), and Carbon Monoxide (CO) emissions are based on emission rates shown by the shaded cells in Table 1.

Table 1:

Pollutant	NSPS JJJJ		Kohler		US EPA NRSI	
	g/hp-hour	g/bhp-hour	g/kW-hour	g/bhp-hour	g/hp-hour	g/bhp-hour
NOx	2.00	2.028	0.01	0.007	0.0	0.0
POC	1.00	1.014	0.17	0.127	0.1	0.101
CO	4.00	4.056	0.35	0.261	0.3	0.304

Emission factors for NOx and POC provided by Kohler in Table 1 are higher than US EPA emission factors provided in the Annual Certification Data for Large Nonroad Spark-Ignition (NRSI) Engines (Model Years: 2011 – Present) for engine family MKHXB06.2HNG. Hence, NOx and POC emissions summarized in Table 2 were conservatively estimated using the Kohler emission factors, and CO emissions were estimated using the NRSI emission factor. Filterable particulate matter (PM) with an aerodynamic diameter equal to 10 microns or less (PM_{10}), Filterable 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.

Per a footnote in the above AP-42 table, no data was available for condensable PM_{10} and $PM_{2.5}$ emissions. Hence, emissions for the above PM species are limited to filterable PM (and not PM_{10}). However, for the purposes of cumulative increase discussed later in this report, filterable PM_{10} and $PM_{2.5}$ emissions evaluated in the discussion that follows will be logged in as PM_{10} and $PM_{2.5}$ in the District's database.

S-1 will operate during emergencies and for a maximum of 50 hours per year each for reliability-related testing.

Basis:

- Maximum Fuel Consumption Rate: 1,678.00 standard cubic feet per hour
- Heating Value for Natural Gas: 1,020 Btu per standard cubic foot
- Heat Input: 1.71 MMBtu per hour
- Power Output: 204 bhp
- Annual Operating Hours: 50 hours per year for reliability-related activities
- Daily Operating Hours: 24 hours per day since emergency operation is unrestricted

Table 2 summarizes emissions from S-1:

Table 2:
Criteria pollutant emissions from S-1

Pollutant	Emission Factor	Units	Emissions		
			pounds per hour	pounds per day	pounds per year
NOx	0.007	g/bhp-hour	3.35E-03	0.08	0.17
POC	0.127	g/bhp-hour	5.70E-02	1.37	2.85
CO	0.304	g/bhp-hour	1.37E-01	3.28	6.84
PM_{10} (filterable)	9.50E-03	lb/MMBTU	1.63E-02	0.39	0.81
$PM_{2.5}$ (filterable)	9.50E-03	lb/MMBTU	1.63E-02	0.39	0.81

Table 2: Criteria pollutant emissions from S-1					
Pollutant	**Emission Factor**	**Units**	**Emissions**		
			pounds per hour	**pounds per day**	**pounds per year**
SO_2[1]	2.94E-03	lb/MMBTU	5.03E-03	0.12	0.25

HEALTH RISK ASSESMENT (HRA)

In accordance with the Air District's policy "Calculating Potential to Emit for Emergency Backup Power Generators", annual Hazardous Air Pollutants (HAP)/Toxic Air Contaminants (TAC) emissions from S-1 summarized in Table 3 are based on 50 hours per year for reliability-related testing.

The emission factors used to estimate TAC emissions from S-1 is 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

[1] The AP-42 Table 3.2-3 emission factor for SO_2 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 could 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.

The emission factors used to estimate TAC emissions from S-1 was selected in the order of priority listed below:

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.

Table 3: Hourly and Annual Project TAC Emissions (S-1)										
Emission Factor Basis	TAC	Emission Factor		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?
		pounds per million cubic feet	pounds per MMBtu							
AP-42 T3.2-3	1,1,2,2-Tetrachloroethane		2.53E-05	0.0%		1.4	4.33E-05	2.17E-03	NO	NO
AP-42 T3.2-3	1,1,2-Trichloroethane		1.53E-05	0.0%		5	2.62E-05	1.31E-03	NO	NO
AP-42 T3.2-3	1,1-Dichloroethane		1.13E-05	0.0%		50	1.93E-05	9.67E-04	NO	NO
AP-42 T3.2-3	1,2-Dichloroethane		1.13E-05	0.0%		4	1.93E-05	9.67E-04	NO	NO
CATEF	1,3-Butadiene	1.04E-01	1.02E-04	0.0%	1.5	0.48	1.75E-04	8.73E-03	NO	NO
CATEF	Acetaldehyde	8.83E-01	8.66E-04	0.0%	1	29	1.48E-03	7.41E-02	NO	NO
CATEF	Acrolein	5.47E-01	5.36E-04	0.0%	0.0055	14	9.18E-04	4.59E-02	NO	NO
CATEF	Benzene	1.91E+00	1.87E-03	0.0%	0.06	2.9	3.20E-03	1.60E-01	NO	NO
AP-42 T3.2-3	Carbon Tetrachloride		1.77E-05	0.0%	4.2	1.9	3.03E-05	1.51E-03	NO	NO
AP-42 T3.2-3	Chlorobenzene		1.29E-05	0.0%		39000	2.21E-05	1.10E-03	NO	NO
AP-42 T3.2-3	Chloroform		1.37E-05	0.0%	0.33	15	2.34E-05	1.17E-03	NO	NO
CATEF	Ethylbenzene	1.16E-02	1.14E-05	0.0%		33	1.95E-05	9.73E-04	NO	NO
AP-42 T3.2-3	Ethylene Dibromide		2.13E-05	0.0%		1.1	3.65E-05	1.82E-03	NO	NO
CATEF	Formaldehyde	2.35E+00	2.30E-03	0.0%	0.12	14	3.94E-03	1.97E-01	NO	NO
AP-42 T3.2-3	Methanol		3.06E-03	0.0%	62	150000	5.24E-03	2.62E-01	NO	NO
AP-42 T3.2-3	Methylene Chloride		4.12E-05	0.0%	31	82	7.05E-05	3.53E-03	NO	NO
CATEF	Naphthalene	7.65E-02	7.50E-05	0.0%		2.4	1.28E-04	6.42E-03	NO	NO
CATEF	PAH	2.12E-04	2.07E-07	0.0%		0.0033	3.55E-07	1.77E-05	NO	NO
CATEF	Propylene	1.60E+01	1.57E-02	0.0%		120000	2.68E-02	1.34E+00	NO	NO
AP-42 T3.2-3	Styrene		1.19E-05	0.0%	46	35000	2.04E-05	1.02E-03	NO	NO
CATEF	Toluene	1.07E+00	1.05E-03	0.0%	82	12000	1.80E-03	8.98E-02	NO	NO
AP-42 T3.2-3	Vinyl Chloride		7.18E-06	0.0%	400	1.1	1.23E-05	6.14E-04	NO	NO
AP-42 T3.2-3	Xylene			0.0%	49	27000	0.00E+00	0.00E+00	NO	NO
CATEF	Xylene (m,p)	4.54E-01		0.0%	49	27000	0.00E+00	0.00E+00	NO	NO
CATEF	Xylene (o)	2.22E-01		0.0%	49	27000	0.00E+00	0.00E+00	NO	NO
CATEF	Xylene (total)	2.22E-01	6.45E-04	0.0%	49	27000	1.10E-03	5.52E-02	NO	NO

It can be seen from Table 3 that an HRA is not required for this application.

CUMULATIVE INCREASE

In accordance with the Air District's policy "Calculating Potential to Emit for Emergency Backup Power Generators", Table 4 summarizes the cumulative increase in criteria pollutant emissions that will result from this application assuming S-1 will operate for 50 hours/year for reliability related testing.

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

Pollutant	NO_X	POC	CO	PM_{10}	$PM_{2.5}$	SO_2
Existing Emissions Post 4/5/91	0.000	0. 000	0.000	0.000	0.000	0.000
Total Application Emissions	8.38E-05	1.42E-03	3.42E-03	4.06E-04	4.06E-04	1.26E-04
Post-Application Emissions	8.38E-05	1.42E-03	3.42E-03	4.06E-04	4.06E-04	1.26E-04

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 2 above, BACT is not triggered for any pollutant.

OFFSETS

In accordance with the Air District's policy "Calculating Potential to Emit for Emergency Backup Power Generators", the Potential to Emit (PTE) for S-1 was estimated assuming 150 hours of operation per year (50 hours for reliability-related activities + 100 hours for emergency operation). The facility-wide PTE resulting from this application is summarized in Table 5.

Table 5:
Facility-Wide PTE Resulting from this Application

Pollutant	Pre-Application Facility-Wide PTE (tons/year)	S-1 Emissions (tons/year)	Post-Application Facility-Wide PTE (tons/year)	Offset Triggers (tons/year)	Exceeds Offset Trigger?
NOx	0.000	2.51E-04	2.51E-04	> 10	No
POC	0. 000	4.27E-03	4.27E-03	> 10	No
CO	0.000	1.03E-02	1.03E-02	N/A	N/A
PM_{10}	0.000	1.22E-03	1.22E-03	> 100	No
$PM_{2.5}$	0.000	1.22E-03	1.22E-03	> 100	No
SO_2	0.000	3.77E-04	3.77E-04	> 100	No

It can be seen from Table 5 that the facility's PTE after S-1 is permitted is below the Regulation 2-2 offset trigger levels. Therefore, offsets are not required.

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)

Opacity and visible emissions from S-1 is subject to Ringelmann 2 per Regulations 6-1-303.1 (displacement < 25 liters) and 6-1-303.2 (engine used solely as a standby source of motive power).

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-1 is natural gas fired engines, they are not expected to produce visible emissions or fallout in violation of this regulation and will be assumed to comply with Regulation 6-1-305.

S-1'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-1 is subject to and is expected to comply with the applicable SO_2 limitations in Regulation 9, Rule 1 ("Inorganic Gaseous Pollutants – Sulfur Dioxide"). Because SO_2 emissions from S-1 are negligible, it is unlikely the APCO will require Invitae to conduct ground level monitoring.

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

S-1 will be operated as emergency standby engine and is therefore not subject to the emission rate limits in Regulation 9, Rule 8 ("Inorganic Gaseous Pollutants – NOx and CO from Stationary Internal Combustion Engines") per Regulation 9-8-110.5, which exempts it from the requirements of Sections 9-8-301 through 305, 501, and 503.

S-1 is subject to and is expected to comply with 9-8-330.3 (Emergency Standby Engines, Hours of Operation) since its reliability-related hours of operation will be limited by the proposed permit conditions to 50 hours per year/engine. S-1 is also subject to and is expected to comply with monitoring and record keeping requirements of Regulations 9-8-502.1 and 9-8-530, 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-1 is subject to 40 CFR 60, Subpart JJJJ as they are each spark ignition engines with a maximum engine power greater than 25 HP and were manufactured after January 1, 2009 (60.4230(a)(4)(iv)). Applicable emissions standards for S-1 are found in Table 1 of Subpart JJJJ and are required per 60.4233(e). NSPS JJJJ emission standards are summarized in Table 6.

Table 6:
NSPS Subpart JJJJ Emission Standards

Pollutant	S-1 Emission Factor provided by Kohler (grams/bhp-hour)	NSPS JJJJ (grams/bhp-hour)
NOx	0.007	2.028
POC	0.127	1.014
CO	0.261	4.056

It can be seen from Table 6 that S-1 complies with NSPS JJJJ emission requirements.

National Emissions Standards for Hazardous Air Pollutants (NESHAP)
S-1 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-1 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 Invitae 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-1 are less than the significance thresholds in Section 2-2-227.2. Hence, Section 2-2-308 does not apply.

School Notification (Regulation 2-1-412)

Per information provided by Invitae in Form P-101B, S-1 is located within 1,000 feet of the outer boundary of the three (3) K-12 school sites provided below.

1. Downtown High School (693 Vermont St, San Francisco, CA 94107)
2. San Francisco International High School (655 De Haro St, San Francisco, CA 94107)
3. Live Oak School (1555 Mariposa St, San Francisco, CA 94107)

Therefore, this application is subject to the public notification requirements of Regulation 2-1-412.

PERMIT CONDITIONS

Permit Condition #23112 for S-1

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 to show 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 meter that measures hours of operation or fuel usage.
   (Basis: Emergency Standby Engines, Monitoring and Record keeping 9-8-530)

3. 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, (60 months if the facility has been issued a Title V Major Facility Review Permit or a Synthetic Minor Operating Permit). 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 the emergency condition.
   e. Fuel usage for engine.
   (Basis: Emergency Standby Engines, Monitoring and Recordkeeping 9-8-530)

End of Conditions

RECOMMENDATION

The 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 District, state, and federal air quality-related regulations. The preliminary recommendation is to issue an Authority to Construct for the equipment listed below. However, the proposed source will be located within 1000 feet of a school, which triggers the public notification requirements of District Regulation 2-1-412. After the comments are received and reviewed, the District will make a final determination on the permit.

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

S-1 Emergency Standby Natural Gas Generator (unabated)
Kohler KG6208THD; Engine: MKHXB06.2HNG, Model Year: TBD
EPA Certificate #: MKHXB06.2HNG-012
204 bhp, 152 kW, Engine displacement: 6.2 Liter (378 in^3), 1.71 MMBtu/hour; 4-Stroke Rich Burn engine
Subject to Permit Condition: 23112

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G. D. Eric