

ENGINEERING EVALUATION

Facility ID No. 23872
Graffeo Coffee Roasting Co.
1314 4th Street, San Rafael, CA 94901
Application No. 29823

Background

Graffeo Coffee Roasting Company is applying for an Authority to Construct and Permit to Operate for the following equipment:

- S-1 Coffee Roaster**
Mfg: Sivetz, Model: Sivetz,
Max Firing Rate: 0.25 MMBtu/hr
abated by:
- A-1 Integral Incinerator**
Mfg: Sivetz, Model: Sivetz Thermal Oxidizer

Equipment will be located at 1314 4th, St, San Rafael, CA 94901. Graffeo Coffee Roasting Company has requested operating the roaster at 50 lb/batch, 3 batches/hour, 9 hours/day, 5 days/week plus 8 hours/day, 1 day per week, 52 weeks/year with an annual roasting throughput limit of 413,400 lbs (206.7 tons) of green coffee.

Emissions Summary

Basis:

- Operation Hours: (9 hrs/day) *(5 days/week)*(52 weeks/yr) *plus*
 (8 hrs/day)*(1 days/week)*(52 weeks/yr) = 2756 hrs/yr
- Maximum Daily Throughput: (50 lb/batch)*(3 batch/hr)*(9 hrs/day) = 1350 lb/day
- Maximum Yearly Throughput: (150 lb/hr) *(2736 hrs/yr) = 413,400 lb/yr = 206.7 tons/yr
- Roaster with Integrated Afterburner Firing Rate: 0.25 MMBtu/hr
- Total Fuel Throughput: (0.25 MMBtu/hr) * (2756 hrs/yr) = 689 MMBtu/yr
- Heat Capacity Natural Gas: 1,020 MMBtu/10⁶ ft³
- A-15 VOC Destruction Efficiency 90% by weight

Table 1. Emissions from Batch Roaster

Pollutant	Green Bean Throughput (TPY)	Emissions factor (lb/ton)	Emissions (lb/day)	Emissions (lb/yr)	Emissions (TPY)
NO _x	206.7	0.250	0.17	51.68	0.026
POC	206.7	0.047	0.03	9.71	0.005
CO	206.7	0.220	0.15	45.47	0.023
PM ₁₀	206.7	0.279	0.18	57.67	0.029
SO ₂	NA	NA			
NPOC	NA	NA			

Basis:

Emissions factors from source test, June 25, 2014 at Mountanos Brothers Coffee Company, (S-5), FID 21613, combines Batch Roasting and Natural Gas Combustion (*performed by Blue Sky Environmental*)

- NOx: 0.25 lb/ton
- CO: 0.22 lb/ton

Emissions factors from EPA AP-42 (*Coffee Roasting Operations, Tables 9.13.2-1 / 9.13.2-2, Batch Roaster with Thermal Oxidizer*).

- POC: 0.047 lb/ton
- PM₁₀: 0.22 lb/ton (*Batch Roaster with Thermal Oxidizer 0.12 lb/ton filterable PM + Continuous Roaster with Thermal Oxidizer 0.1 lb/ton condensible PM*)
- PM₁₀: 0.059 lb/ton (*Green Coffee Bean Screening, Handling, and Storage System with Fabric Filter*)`

Table 2. Emissions from Natural Gas Combustion

Pollutant	Fuel Use Rate (MMBtu/yr)	Emissions factor (lb/MMBtu)	Emissions (lb/day)	Emissions (lb/yr)	Emissions (TPY)
NOx		N/A			
POC		N/A			
CO		N/A			
PM ₁₀		N/A			
SO ₂	689	0.00059	0.00	0.41	0.000
NPOC	689	0.00225	0.00	1.55	0.001

Basis:

Emissions factors from EPA AP-42, Table 1.4-2 (small boilers <100 MMBtu/hr).

- SO₂: (0.6 lb/MMscf) / (1020 MMBtu/10⁶ ft³) = 0.000588 lb/MMBtu
- NPOC: (2.3 lb/MMscf) / (1020 MMBtu/10⁶ ft³) = 0.00225 lb/MMBtu

Table 3. Cumulative Emission Increase

Pollutant	Application Emissions Total (lb/day)	Existing Emissions Post 4/5/91 (TPY)	Application Emissions (TPY)	Cumulative Emissions (TPY)
NOx	0.17	0.000	0.026	0.026
POC	0.03	0.000	0.005	0.005
CO	0.15	0.000	0.023	0.023
PM ₁₀	0.18	0.000	0.029	0.029
SO ₂	0.00	0.000	0.000	0.000

Toxic Emissions from Roasting Operations and Natural Gas Combustion

Table 4. Toxic Air Contaminant Emissions

ROASTING OPERATIONS				NATURAL GAS COMBUSTION			Total
TAC	Green Bean Throughput (TPY)	Emission Factor (lb/ton)	Emission Rate (lb/yr)	Annual Fuel Use (MMBtu/yr)	Emission Factor (lb/MMBtu)	Emission Factor (lb/yr)	Emission Rate (lb/yr)
Acetaldehyde	206.7	0.00015	0.0310	NA			0.0310
Benzene	206.7	NA		689	2.06E-06	0.0014	0.0014
Formaldehyde	206.7	0.0003	0.0620	689	7.35E-05	0.0507	0.1127
Toluene	206.7	NA		689	3.33E-06	0.0023	0.0023

Basis:

According to AP-42, Chapter 9.13.2, Coffee Roasting, the roaster is the main source of gaseous pollutants, including aldehydes and acrolein. However, the California Air Resources Board (CARB) has invalidated the source test method for acrolein. Until CARB approves a new test method and acrolein emissions are estimated from factors developed using the new test method, the District is not evaluating risk for acrolein. There are no California Air Toxics Emission Factors (CATEF) factors for the aldehydes from coffee roasting. The following two emissions factors are from a source test conducted June 25, 2014 at Mountanos Brothers Coffee Company, (S-5), FID 21613, Natural Gas Combustion (*performed by Blue Sky Environmental*). These two emissions factors include a 50% buffer for variability.

- Formaldehyde: 0.0003 lb/ton
- Acetaldehyde: 0.00015 lb/ton

Emissions factors from EPA AP-42, Table 1.4-3 (*Emissions Factors For Speciated Organic Compounds From Natural Gas Combustion*).

- Benzene: $(2.1E-03 \text{ lb/ MMscf}) / (1020 \text{ MMBtu}/10^6 \text{ ft}^3) = 2.06E-06 \text{ lb/MMBtu}$
- Formaldehyde: $(7.5E-02 \text{ lb/ MMscf}) / (1020 \text{ MMBtu}/10^6 \text{ ft}^3) = 7.35E-05 \text{ lb/MMBtu}$
- Toluene: $(3.4E-03 \text{ lb/MMscf}) / (1020 \text{ MMBtu}/10^6 \text{ ft}^3) = 3.33E-06 \text{ lb/MMBtu}$

Statement of Compliance

Regulation 1: General Provisions and Definitions

The facility is subject to Regulation 1, Section 301, which prohibits discharge of air contaminants resulting in public nuisance.

The facility is expected to comply with this requirement.

Regulation 2, Rule 1: Permits – General Requirements

California Environmental Quality Act (CEQA): District Regulation 2, Rule 1, Section 310 specifies that all proposed new and modified sources subject to District permit requirements must be reviewed in accordance with CEQA requirements, except for ministerial projects or projects exempt from CEQA under Section 2-1-312. The engineering review for this project requires only the application of standard permit conditions and standard emission factors in accordance with Permit Handbook Chapter 11.3: Coffee Roasting Operations.

Therefore, this application is considered to be ministerial and is exempt from CEQA review.

Public Notification: The public notification requirements of Regulation 2-1-412 apply to applications which result in any increase in toxic air contaminant or hazardous air contaminant emissions at facilities within 1,000 feet of the boundary of a K-12 school. This project is within 1000 feet of Saint Raphael

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Elementary School located at 1100 5th Avenue, San Rafael, CA 94901 and within 1000 feet of Marin Academy located at 1600 Mission Avenue, San Rafael, CA 94901. An examination of Google Earth and relevant databases indicates that Saint Raphael K-12 school is 0.17 miles (920 feet) from the facility and Marin Academy is 0.18 miles (960 feet) from the facility.

A public notice was prepared and sent to all addresses within 1000 feet of the coffee roaster and parents and guardians of students of (please list the school names here). The public comment period lasted from (start date) to (end date). At the end of the comment period, there were (number of comments received via email) written comments and (number of voice mails received) voicemails received. All comments were in opposition/support to the project. **The District responded to each comment and informed them that the District was proposing to approve the project because, for a project that satisfies the District's Toxic Risk Rule (Regulation 2, Rule 5) and meets all other applicable District regulations, the District was obligated to grant an Authority to Construct and does not have the authority to deny a project solely based on public opposition.**

Regulation 2, Rule 2: Permits – New Source Review

Best Available Control Technology (BACT): Per Regulation 2, Rule 2, Section 301 BACT is required for new or modified sources with potential emissions of 10.0 pounds per day or more of POC, NPOC, NO_x, PM₁₀, or SO₂.

Referencing Table 3, the coffee roaster will not emit 10 lb/day or more of any criteria pollutant, therefore, is not subject to BACT requirements.

Emission Offsets: Under Section 2-2-302, POC and NO_x emission offsets are required for new or modified sources at a facility which emits or will be permitted to emit 10 tons per year or more on a pollutant specific basis.

The facility does not have the potential to emit more than 10 tons per year of NO_x or POC emissions, therefore, the facility is not subject to NO_x or POC offsets.

The facility will not have the potential to emit more than 100 tons per year of any criteria pollutant, therefore, the facility is not a "Major Facility" as defined in Regulation 2-2-217 and is not subject to PM₁₀ or SO₂ offsets under Regulation 2-2-303.

PSD:

Under this application this facility will not have the potential to emit more than 100 tons per year of any criteria pollutant, therefore this facility is not a "Major Facility" as defined in Regulation 2-1-203 and is not subject to PSD permitting requirements under Regulation 2-2-304.

Regulation 2, Rule 5: Permits – New Source Review of Toxic Air Contaminants

Health Risk Assessment: The District's regulation concerning toxic air contaminant emissions is codified in Regulation 2, Rule 5, New Source Review of Toxic Air Contaminants (TAC). The TAC emissions from new and modified sources are subject to risk assessment review, if the emissions of any individual TAC exceed either the acute or chronic emission thresholds defined in Table 2-5-1.

Based on the trigger levels listed in Regulation 2, Rule 5, Table 2-5-1, the proposed emissions from the operation of S-1 listed in Table 5 do not exceed any chronic or acute trigger levels. No health risk assessment is required for this application.

Table 5. Toxic Air Contaminants HRSA Determination

TAC	CAS Number	Total Chronic Emissions (lb/yr)	Chronic Trigger Level (lb/yr)	Exceeds Chronic Trigger	Total Acute Emissions (lb/hr)	Acute Trigger Level (lb/hr)	Exceeds Acute Trigger
Acetaldehyde	75-07-0	3.10E-02	2.90E+01	No	1.13E-05	1.00E+00	No
Benzene	71-43-2	1.42E-03	2.90E+00	No	5.15E-07	6.00E-02	No
Formaldehyde	50-00-0	1.13E-01	1.40E+01	No	4.09E-05	1.20E-01	No
Toluene	108-88-3	2.30E-03	1.20E+04	No	8.33E-07	8.20E+01	No

For each TAC, the projected toxic emission rate is less than 2% of the chronic trigger level. Since toxic emissions are far below the trigger level, source testing to verify compliance with these limits is not necessary.

Regulation 6, Rule 1: Particulate Matter – General Requirements

Section 301 prohibits for more than 3 minutes per hour, visible emissions as dark or darker than Ringelmann 1 or equivalent opacity. This facility is expected to comply with this standard. Section 305 prohibits emissions of visible particles from causing a nuisance on property other than the operators.

This operation is expected to comply with this standard.

Section 6-1-310 limits particulate emissions to 0.15 grains/dscf of exhaust gas volume.

Due to lack of comprehensive data for Sivetz Coffee Roasters and the fact that the company no longer exists we extrapolated a dscfm factor from a Loring S-15 Coffee Roaster which uses a fluid bed roasting process.

From the Permit Handbook we use the following equation:

$$Q_{dry} = Q_{act}[(68 + 460)/(T_{act} + 460)](1 - \%H_2O).$$

At 17.0% weight fraction of water vapor the exhaust gas flow from the coffee roaster thermal oxidizer is 33.0 scfm at 68°F (132.5 acfm at 1300°F). At this flow rate, the estimated grain loading for the coffee roasting process is calculated as follows:

$$[(0.279 \text{ lb PM}_{10}/\text{ton}) * (150 \text{ lb/hr}) / (2000 \text{ lb/ton})] * [(7000 \text{ grains/lb}) / (60 \text{ min/hour}) / (33.0 \text{ dscf/min})] = 0.074 \text{ grains/dscf}.$$

This particulate weight emission complies with the Regulation 6-310 requirement that no operations may exceed a particulate weight emission of 0.15 grains/dscf.

Regulation 9, Rule 1: Inorganic Gaseous Pollutants – Sulfur Dioxide

The coffee roaster is subject to and will comply with Regulation 9, Rule 1, "Inorganic Gaseous Pollutants, Sulfur Dioxide," by restricting fuel use to natural gas only. Based on the following calculation, combustion of natural gas is expected to produce a SO₂ concentration of less than 1 ppmv:

$$SO_2 \text{ ppmv} = [(0.00057 \text{ lb/MMBtu}) * (385.5 \text{ ft}^3 \text{ SO}_2/\text{lb mol SO}_2)] / [(1 \text{ ft}^3 \text{ SO}_2/10^6 \text{ scft}^3 \text{ flue}) * ((20.9)/(20.9 - 3)) * (64.0588 \text{ lb SO}_2/\text{lb mol SO}_2) * (8710 \text{ scft}^3 \text{ flue/MMBtu})] = 0.338 \text{ ppmv at } 3\% \text{ O}_2$$

The combustion of natural gas meets the requirement of a maximum outlet concentration of 300 ppmv of SO₂ prescribed in Regulation 9, Rule 1-302.

NSPS/NESHAPS

This source is not subject to any NSPS or NESHAP requirements.

Permit Conditions

Permit Condition # 27192

1. The owner/operator shall not roast more than 413,400 lbs (206.7 tons) of green coffee beans at Coffee Roaster S1 in any consecutive 12-month period.
[Basis: Cumulative Increase]
2. The owner/operator shall not use more than 6890 therms of natural gas at S1 and A1 combined during any consecutive twelve-month period.
[Basis: Cumulative Increase]
3. The owner/operator shall abate S1 Coffee Roaster at all times while operating by A1 Incinerator.
[Basis: Cumulative Increase]
4. The owner/operator shall maintain a minimum furnace temperature of 1200 °F at A1 Incinerator whenever coffee beans are being roasted at S1 Coffee Roaster.
[Basis: Regulation 2-1-403]
5. The owner/operator shall ensure that the A1 Incinerator is equipped with a temperature-measuring device capable of continuously measuring and recording the temperature in the incineration zone when roasting. This device shall be accurate to within 10 degrees Fahrenheit (°F) and shall be maintained in accordance with manufacturer's recommendations. These temperature monitors shall be used to determine compliance with the temperature requirements in Part 4.
[Basis: Regulation 1-521]
6. The owner/operator shall not emit from any source for a period or periods aggregating more than three minutes in any hour, a visible emission which is as dark or darker than No. 1.0 on the Ringelmann Chart or of such opacity as to obscure an observer's view to an equivalent or greater degree.
[Basis: Regulation 6-1-301]
7. The owner/operator shall not exceed the following limits while operating S1 Coffee Roaster and A1 Incinerator:
NOx. 0.096 lb/MMBtu
CO. 0.085 lb/MMBtu
POC. 0.047 lb/ton of beans roasted
Formaldehyde. 0.0003 lb/ton of beans roasted
Acetaldehyde. 0.00015 lb/ton of beans roasted
[Basis: Cumulative Increase, BACT]
8. To demonstrate compliance with the above conditions, the owner/operator shall maintain the following records and provide all of the data necessary to evaluate compliance with the above conditions, including the following information:

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- a. Monthly records of the quantity of green coffee beans roasted at S1 Coffee Roaster.
- b. Monthly records of natural gas usage.
- c. Monthly usage records shall be totaled for each consecutive 12-month period.
- d. Records of continuous temperature measurements of the exhaust stack whenever S1 Coffee Roaster is roasting coffee beans.

All records shall be retained onsite for two years from the date of entry and made available for inspection by District staff upon request. These record-keeping requirements shall not replace the record keeping requirements contained in any applicable District Regulations.
[Basis: Cumulative Increase]

Recommendation

The proposed 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 subject to **Permit Condition # 27192**:

- S-1 Coffee Roaster**
Mfg: Sivetz, Model: Sivetz,
Max Firing Rate: 0.25 MMBtu/hr
Abated by:
- A-1 Integral Incinerator**
Mfg: Sivetz, Model: Sivetz Thermal Oxidizer

Jeffrey Cleary
Air Quality Engineer

Date