

**DRAFT Engineering Evaluation
Royal Ground Coffee Cafe
1208 4th Street
San Rafael, CA 94901
Plant No. 25284
Application No. 31988**

BACKGROUND

Royal Ground Coffee Cafe has applied for an Authority to Construct (AC) and Permit to Operate (PO) the following equipment at 1208 4th Street, San Rafael, CA 94901:

S-1 Batch Coffee Roaster: San Franciscan-25, 100 lbs/hr capacity;

100,000 BTU/hr, natural gas

Abated by: A-1 Thermal Afterburner, 250,000 BTU/hr, natural gas

A district permit is required for any coffee roaster which processes 15 or more pounds of coffee beans per hour per Regulation 2-1-117.8. The proposed S-1 will process approximately 100 pounds of coffee beans per hour and therefore requires an Authority to Construct and Permit to Operate. The integral abatement unit A-1 afterburner is operated for the control of POC, CO, and PM emissions, as well as to control smoke and odors. The roaster and afterburner are fueled by natural gas.

The applicant proposed to move the equipment from 1146 4th Street, San Rafael, CA 94901 (Plant 22498, permitted in Application 26366) to 1208 4th Street, San Rafael, CA 94901 (Plant 25284). Due to movement of the source to a new location, the source has been evaluated as a new source.

EMISSION CALCULATIONS

This section summarizes the basis for, and results of, the emission calculations associated with this application. All calculation assumptions listed below are consistent with the BAAQMD Engineering Handbook¹ and BAAQMD Toxic Air Contaminant (TAC) Emission Factor Guidelines, Appendix A² for natural gas combustion.

Air pollutant emissions resulting from coffee roasting operations generally include particulate matter, volatile organic compounds, organic acids, and natural gas combustion byproducts (BAAQMD Engineering Handbook Chapter 11.3). Table 1 provides a summary of emission factors used for calculations.

¹ <http://www.baaqmd.gov/permits/permitting-manuals>

² https://www.baaqmd.gov/-/media/files/ab617-community-health/facility-risk-reduction/documents/tac_emission_factor_guidance_appendixa_august_2020-pdf.pdf?la=en

- Emission factors published in US EPA AP-42 Chapter 9.13.2 (Coffee Roasting)³ were used for the following coffee roasting emission byproducts: particulate matter (PM) and volatile organic compounds (VOCs, assumed as 100% precursor organic compounds [POCs]).
- The coffee roasting is also a source of gaseous toxic air contaminants, including formaldehyde and acetaldehyde (aldehydes). There are no California Air Toxics Emission Factors (CATEF) factors for the aldehydes from coffee roasting. In accordance with the BAAQMD Permit Handbook, source test results from Peets Coffee and Tea, Inc. were used to calculate toxic air contaminant emissions for this project.
- Natural gas combustion byproducts from the coffee roaster includes nitrogen oxides (NO_x), carbon monoxide (CO), PM, trace amounts of sulfur dioxide (SO₂), methane (CH₄), and VOCs. Emission factors for the coffee roaster's natural gas combustion byproducts were taken from AP-42 Chapter 1.4 (Natural Gas Combustion).⁴ AP-42 Table 1.4-1 small boiler (< 100 MMBTU/hr) category was used for NO_x and CO emission factors; Table 1.4-2 was used to obtain emission factors for PM, SO₂, CH₄, and VOC. TAC emission factors from natural gas combustion were based upon BAAQMD Toxic Air Contaminant (TAC) Emission Factor Guidelines, Appendix A².

Since a thermal afterburner is assumed to operate the same as a thermal oxidizer, the controlled emission factor with the thermal oxidizer for a batch roaster is used in the emission calculations. Emissions generated from the operation of abatement device operation are called secondary pollutants; secondary pollutant emissions have been calculated from operation of A-1 for natural gas usage.

³ <https://www3.epa.gov/ttnchie1/ap42/ch09/final/c9s13-2.pdf>

⁴ <https://www3.epa.gov/ttnchie1/ap42/ch01/final/c01s04.pdf>

Table 1: Emission Factors

Pollutant	Emission Factor		Reference
Batch Roasting Process (S-1 Coffee Roaster)			
VOC (assume POC)	0.047	lbs./ton	AP-42 Chapter 9.13.2 Coffee Roasting – Table 9.13.2-1. for Batch roaster with thermal oxidizer
CO	0.55	lbs./ton	AP-42 Chapter 9.13.2 Coffee Roasting – Table 9.13.2-2 for Batch roaster with thermal oxidizer
PM ₁₀ (filterable)	0.12	lbs./ton	AP-42 Chapter 9.13.2 Coffee Roasting – Table 9.13.2-1. for Batch roaster with thermal oxidizer
Formaldehyde	0.0008	lbs./ton	BAAQMD Engineering Handbook, Chapter 11.3 (Source testing at Peets Coffee and Tea, Inc.)
Acetaldehyde	0.0005	lbs./ton	
Natural Gas Combustion Process (S-1 Coffee Roaster)			
NOx	100	lbs./10 ⁶ scf	AP-42 Chapter 1.4 (Natural Gas Combustion) Table 1.4-1 (Small boilers < 100 MM BTU/hr, Uncontrolled)
CO	84	lbs./10 ⁶ scf	
PM (Assume PM ₁₀)	7.6	lbs./10 ⁶ scf	AP-42 Chapter 1.4 (Natural Gas Combustion) Table 1.4-2
SO ₂	0.6	lbs./10 ⁶ scf	
VOC (Assume POC)	5.5	lbs./10 ⁶ scf	
Acetaldehyde	4.22E-06	lbs./MMBtu	BAAQMD Toxic Air Contaminant (TAC) Emission Factor Guidelines, Appendix A.
Acrolein	2.65E-06	lbs./MMBtu	
Arsenic	1.96E-07	lbs./MMBtu	
Benzene	7.84E-06	lbs./MMBtu	
Beryllium	5.88E-09	lbs./MMBtu	
Cadmium	1.08E-06	lbs./MMBtu	
Copper	8.33E-07	lbs./MMBtu	
Ethyl Benzene	9.31E-06	lbs./MMBtu	
Formaldehyde	2.17E-04	lbs./MMBtu	
n-Hexane	6.18E-06	lbs./MMBtu	
Lead	4.90E-07	lbs./MMBtu	
Manganese	3.73E-07	lbs./MMBtu	
Mercury	2.55E-07	lbs./MMBtu	
Naphthalene	5.98E-07	lbs./MMBtu	
Nickel	2.06E-06	lbs./MMBtu	
PAH (as benzo(a)pyrene-equiv.)	6.60E-09	lbs./MMBtu	
Propylene	7.17E-04	lbs./MMBtu	
Selenium	1.18E-08	lbs./MMBtu	
Toluene	3.59E-05	lbs./MMBtu	
Vanadium	2.25E-06	lbs./MMBtu	

Xylene	2.67E-05	lbs./MMBtu
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Table 2 summarizes additional emission calculation assumptions pertaining to the proposed coffee roasting operation.

Table 2. S-1 Coffee Roaster Operation Assumptions

Parameter	Assumption	Units
S-1 Operational Uptime	8	hours/day
	365	days/year
	2,920	hours/year
S-1 Coffee Bean Roaster Maximum Throughput	25.0	lbs./batch
	4	batch/hour
	100.0	lbs./hour
	0.050	tons/hour
	8	batch/day
	200	lbs./day
	0.100	tons/day
	72,800	lbs./year
	36.4	tons/year
S-1 Natural Gas consumption	100,000	Roaster S-1, BTU/hour
	0.250	Afterburner Firing Rate: 0.250 MMBtu/hr
	0.3500	TOTAL, MMBTU/hour
	3.43E-04	TOTAL, MMSCF/hour
	1019	TOTAL, MMBTU/year
	0.999	MMSCF/year
	101.920	therm/year
Standard Conversion Factors	2,000	lbs./ton
	1,020	MMBTU/MMSCF
	7000	grain/lb
	60	min/hour
	2.204	lbs./kg
	3,142	BTU/kW

BTU = British Thermal Units
 MMBTU = 10⁶ BTU
 MMSCF = 10⁶ standard cubic feet
 therm = 10⁵ BTU

Combined emissions from the S-1 and A-1 coffee roasting unit are summarized in Table 3.

Table 3. PTE for S-1 Roaster Abated by A-1 Afterburner

Pollutant	Calculated Emissions		
	lbs./day	lbs./year	ton/year
POC	0.025	7.221	0.004
NO _x	0.270	100.196	0.050
SO ₂	0.002	0.601	3.01E-04
CO	0.285	104.185	0.052
PM10	0.032	11.985	0.006
PM2.5	0.032	11.985	0.006

AP-42 does not include emission factors for PM10 or PM2.5. It only contains an emission factor for filterable PM. For a worst-case evaluation of emissions, PM10 emissions and PM2.5 emissions are each assumed to equal that of filterable PM.

CUMULATIVE INCREASE

This is a new facility. Therefore, there are no existing emissions. The emissions from this project will be added to the facility's cumulative emissions as shown below.

Table 4. Plant Cumulative Increase Since 4/5/91

	POC	NO _x	SO ₂	CO	PM10	PM2.5
Existing	0.000	0.000	0.000	0.000	0.000	0.000
Un-Offset Total	0.000	0.000	0.000	0.000	0.000	0.000
S-1 Emission Increase	0.004	0.050	3.01E-04	0.052	0.006	0.006
Offset Ratio	N/A	N/A	N/A	N/A	N/A	N/A
Offsets Provided	N/A	N/A	N/A	N/A	N/A	N/A
Bank Certificate	N/A	N/A	N/A	N/A	N/A	N/A
Onsite Credit	N/A	N/A	N/A	N/A	N/A	N/A

Post-Project Cumulative	0.004	0.050	3.01E-04	0.052	0.006	0.006
Post-Project Un-Offset Total	0.004	0.050	3.01E-04	0.052	0.006	0.006

HEALTH RISK ASSESSMENT (HRA)

Table 5 summarizes the TAC emissions associated with this application in comparison with the respective HRA trigger levels set forth in BAAQMD Regulation 2-5, Table 1.

Table 5. TAC Emissions

TAC Pollutant	Hourly Emissions (lb/hr)	Acute Trigger Limit (lb/hr)	Acute Trigger?	Annual Emissions (lb/yr)	Chronic Trigger Limit (lb/yr)	Chronic Trigger?
Acetaldehyde	2.65E-05	2.10E-01	no	2.43E-02	2.90E+01	no
Acrolein	9.28E-07	1.10E-03	no	2.70E-03	1.40E+01	no
Arsenic	6.86E-08	8.80E-05	no	2.00E-04	1.60E-03	no
Benzene	2.74E-06	1.20E-02	no	7.99E-03	2.90E+00	no
Beryllium	2.06E-09	--	no	5.99E-06	3.40E-02	no
Cadmium	3.78E-07	--	no	1.10E-03	1.90E-02	no
Copper	2.92E-07	4.40E-02	no	8.49E-04	--	no
Ethyl Benzene	3.26E-06	--	no	9.49E-03	3.30E+01	no
Formaldehyde	1.16E-04	2.40E-02	no	2.51E-01	1.40E+01	no
n-Hexane	2.16E-06	--	no	6.30E-03	2.70E+05	no
Lead	1.72E-07	--	no	4.99E-04	2.90E-01	no
Manganese	1.31E-07	--	no	3.80E-04	3.50E+00	no
Mercury	8.93E-08	2.70E-04	no	2.60E-04	2.10E-01	no
Naphthalene	2.09E-07	--	no	6.09E-04	2.40E+00	no
Nickel	7.21E-07	8.80E-05	no	2.10E-03	3.10E-01	no
PAH (as benzo(a)pyrene -equiv.)	2.31E-09	--	no	6.73E-06	3.30E-03	no
Propylene	2.51E-04	--	no	7.31E-01	1.20E+05	no
Selenium	4.13E-09	--	no	1.20E-05	8.00E+00	no
Toluene	1.26E-05	2.20E+00	no	3.66E-02	1.60E+04	no
Vanadium	7.88E-07	1.30E-02	no	2.29E-03	--	no
Xylene	9.35E-06	9.70E+00	no	2.72E-02	2.70E+04	no

All TAC emissions are below their respective trigger levels. Therefore, an HRA is not required.

STATEMENT OF COMPLIANCE

Regulation 1

The proposed coffee roaster is subject to and expected to comply with the requirements of Regulation 1-301 (Public Nuisance).

Regulation 2, Rule 1

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. This application is ministerial under the District's CEQA Regulation 2-1-311 and is exempt from CEQA review.

California Environmental Quality Act (CEQA) and Regulation 2-1

This permit application was reviewed following the specific procedures, fixed standards and objective measurements set forth in BAAQMD Engineering Permit Handbook Chapters 2.1 (Boilers, Steam Generators & Process Heaters) and 11.3 (Coffee Roasting Operations) and is therefore classified as ministerial. As such, it is exempt from CEQA review per Regulation 2-1-311.

Public Notification

California Health & Safety Code §42301.6 and Regulation 2-1-412

Pursuant to California Health & Safety Code §42301.6(a), prior to approving an application for a permit to construct or modification of a source, which is located within 1,000 feet from the outer boundary of a school site, the District shall prepare a public notice as detailed in §42301.6. §42301.9(a) defines a "school" as any public or private school used for the purposes of the education of more than 12 children in kindergarten or any grades 1 to 12, inclusive, but does not include any private school in which education is primarily conducted in private homes.

The public notification requirements of Regulation 2-1-412 apply to modifications which result in an increase in toxic air contaminant or hazardous air contaminant emission at facilities within 1,000 feet of the boundary of a K-12 school.

Public School and Overburdened Community Notification

This project is not located within an Overburdened Community (OBC). However, this project is within 1,000 feet of Saint Raphael School (1100 Fifth Avenue, San Rafael, CA

94901). Therefore, this project is subject to the public notification requirements of Regulation 2-1-412. Notification of the proposed new source will be mailed out to the parents or guardians of all children enrolled in the school and to all addresses within 1,000 feet of the proposed source. The District will publish a public notice, accepting comments on the project for a period of 30 days.

Regulation 2, Rule 2

Best Available Control Technology (BACT)

Pursuant to Regulation 2-2-301, BACT is required for a new source with PTE emission increases that equal 10.0 lbs. or greater of POC, NPOC, NO_x, SO₂, PM₁₀, PM_{2.5}, or CO. The proposed S-1 will not emit criteria pollutants (POC, NPOC, NO_x, SO₂, PM₁₀, PM_{2.5}, or CO) at rates of 10.0 lbs. or more per highest day and therefore, is not required to implement BACT per Regulation 2-2-301. Furthermore, this roaster is not capable of triggering BACT at 24 hours of daily operation. Therefore, daily throughput limit will not be included in the permit condition for this roaster.

Offsets

Pursuant to Regulation 2-2-302, offsets must be provided for any new or modified source at a facility that emits, or is permitted to emit, more than 10 tons per year of POC or NO_x. Furthermore, pursuant to Regulation 2-2-303, offsets must be provided for any new or modified source with a cumulative increase that exceeds 100 tons per year of PM₁₀ or SO₂. Potential emissions for this facility are equal to the permitted emissions from S-1 and do not exceed the offset threshold for any pollutant. Therefore, offsets are not triggered for this project.

Lastly, the facility will not emit greater than 100 tons per year or more of any air pollutant subject to regulation under the Clean Air Act or 10 tons of a single hazardous air pollutant (HAP) or 25 tons of a combination of HAPs per year. The facility is not a major facility and is not required to meet the requirements of Regulation 2-2-405 (Publication and Public Comment).

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). This facility is not one of the 28 listed PSD source categories, and the maximum potential facility-wide emissions will be less than 250 tons/year for each regulated air pollutant. Therefore, 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 the proposed new coffee roaster are less than the significance thresholds in Section 2-2-227.2. Therefore, Section 2-2-308 does not apply.

Regulation 2, Rule 5

Pursuant to Regulation 2-5-110, the provisions of this rule are not subject to sources with an increase in emissions less than the trigger levels listed in Table 2-5-1. Based on the proposed operation parameters, the proposed coffee roaster does not trigger a Health Risk Assessment.

Regulation 6, Rule 1

Source S-1 is expected to comply with Regulation 6-1-301, which requires that visible emissions do not exceed Ringelmann 1 for period or periods aggregating more than three minutes in any hour. S-1 is expected to comply with this visible emission limit with operation of the afterburner.

Grain Loading Rate

The grain loading rate calculation is required for determining the compliance of this application with BAAQMD Regulation 6, Rule 1.

$$\frac{[0.12 \text{ lb PM}/\text{ton} \times 36.4 \text{ ton}/\text{year} \times \text{year}/2,912 \text{ operation hours} \times 7000 \text{ grain}/\text{lb}]}{[60 \text{ min}/\text{hr} \times 850 \text{ cfm}]} = 0.001 \text{ grain}/\text{dscf}$$

Assumptions:

- 0.12 lb PM₁₀/ton from the coffee roaster (excluding the PM₁₀ emissions due to natural gas fuel combustion) is assumed to represent TSP, as there is no TSP data available.
- 7000 grain/lb standard conversion factor.
- 2,912 operation hours in a year.
- 850 cfm rating of the A-1 afterburner.

Section 6-1-310.1 limits the total suspended particulate (TSP) concentration to no more than 0.15 gr/dscf. Since 0.0002 gr/dscf is less than 0.15 gr/dscf, compliance with this rule is expected.

The TSP limits in 6-1-310.2 will not apply because the potential to emit TSP is below 1,000 kg per year.

Regulation 7

Compliance with Regulation 7, Odorous Substances, is expected with the operation of A-1 thermal afterburner.

Regulation 9, Rule 1

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.

Combustion of natural gas is expected to produce a SO₂ concentration of no more than 1 ppmv of SO₂, thereby meeting the requirement of a maximum outlet concentration of 300 ppmv of SO₂ prescribed in Regulation 9, Rule 1-302.

New Sources Performance Standards (NSPS)

National Emission Standards for Hazardous Air Pollutants (NESHAP)

Coffee roasting operations are not subject to NSPS or NESHAP.

Permit Condition # 27887

1. The owner/operator shall ensure the following limits are not exceeded at S-1 and A-1:

Coffee beans	36.4 tons (72,800 pounds) in any consecutive
12-month period	
Natural Gas	0.999 MM scf (standard cubic feet) in any
consecutive 12-month period	
[basis: Cumulative Increase]	

2. The owner/operator shall ensure A-1 Afterburner abates S-1 Coffee Roaster at all times of operation. [basis: Cumulative Increase]

3. The owner/operator shall ensure A-1 operates at 1200° F or more at all times. [basis: Regulation 2-1-403]

4. The owner/operator shall ensure that A-1 Afterburner is equipped with a temperature- measuring device capable of continuously measuring and recording the temperature. This device shall be accurate to within 10 degrees Fahrenheit (° F) and shall be maintained in accordance with manufacturer's recommendations. This temperature monitor shall be used to demonstrate compliance with the temperature requirements in Part 3. [basis: Regulation 1-521]

5. The owner/operator shall not emit from S-1 for a period or periods aggregating more than three minutes in any hour, a visible emission which is as dark or darker than No. 0.5 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]

6. 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:

a. Monthly records of the quantity of green coffee beans roasted at S-1 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 for A-1 Afterburner whenever S-1 is in operation.

Royal Ground Coffee Cafe
Application 31988
Plant 25284

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 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 Batch Coffee Roaster: San Franciscan-25, 100 lbs/hr capacity;

100,000 BTU/hr, natural gas

Abated by: A-1 Thermal Afterburner, 250,000 BTU/hr, natural gas



Youjin Kim
Air Quality Engineer

05/22/2023
Date