

DRAFT
ENGINEERING EVALUATION
RED BAY COFFEE COMPANY; PLANT # 24238
APPLICATION NO: 29504
3098 E 10TH ST OAKLAND CA 94601

BACKGROUND

Red Bay Coffee Company (Red Bay) currently operates a coffee roasting facility at 3098 E 10th Street in Oakland, California. The facility has applied for a Permit to Operate (PO) the following equipment:

S-1 Batch Coffee Roaster: Probat UG-22; 0.15 MM BTU/hr (Natural Gas)
Abated by: A1 and A2 (in series)
A1 Cyclone; Probat Chaff Collector
A2 Afterburner; Conversion Products, Inc. TR18/30V-500MC-72NB,
1.5MM BTU/hr (Natural Gas)
Emissions at: P-1 Stack

S-1 was installed without obtaining an authority to construct and has been in operation since May 2016. A district permit is required for any coffee roaster which processes 15 or more pounds (lbs) of coffee beans per hour per Regulation 2-1-117.8. S-1 processes approximately 145.2 lbs of green coffee beans per hour and therefore it requires a PO. To date, all applicable late and back fees have been paid for installing and operating the source without an AC or PO. The A1 cyclone and A2 afterburner abatement devices control solid and gaseous emissions from the S-1 coffee roaster.

This application proposes a new source of toxic air contaminant (TAC) emissions and is located within 1,000 feet of the outer boundary of the nearest K-12 school. Therefore, public notification pursuant to BAAQMD Regulation 2-1-412 is required.

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 Chapter 11.3 for coffee roasting operations and Chapter 2.1 for natural gas combustion.

Calculation Basis

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. Emission factors published in US EPA AP-42 Chapter 9.13.2 (Coffee Roasting)² were used for the following coffee roasting emission byproducts: particulate matter (PM) and volatile organics (VOCs, assumed as 100% precursor organic compounds [POCs]). The roaster is also the main source of gaseous toxic air pollutants, including aldehydes (formaldehyde and acetaldehyde) and acrolein. However, the California Air Resources Board 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. In accordance with the BAAQMD Engineering Handbook, source testing results from Peets Coffee and Tea, Inc. were referenced for the toxic emission factors of formaldehyde and acetaldehyde.

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

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

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).³ 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. A District Policy⁴ dated September 7, 2005 ("Emission Factors for Toxic Air Contaminants from Miscellaneous Natural Gas Combustion Sources") was referenced for the roaster's natural gas TAC emission factors (benzene, formaldehyde, and toluene).

The A-1 cyclone and A-2 afterburner is assumed to be operational 100% of the time S-1 is operating for particulate (chaff, i.e. coffee bean shell) and gaseous odor (VOC) control purposes, respectively. Emissions generated from the operation of abatement device operation are called secondary pollutants. Secondary pollutant emissions are subject to Reasonably Available Control Technology (RACT) requirements when the abatement device is being used to meet Best Available Control Technology (BACT) or Best Available Retrofit Technology (BARCT). BAAQMD District Policy on RACT control levels for afterburners was therefore used for the final NO_x and CO emission factors (these supersede any listed above in AP-42).

Table 1: Emission Factors

Pollutant	Emission Factor (Value & Units of Measure)		Reference
<i>Batch Roasting Process (S-1 Coffee Roaster)</i>			
PM ₁₀ (filterable)	0.148	lb/ton	AP-42 Chapter 9.13.2 Coffee Roasting – Table 9.13.2-1 for Batch roaster with thermal oxidizer (0.12 lb/ton) + Continuous cooler with cyclone (0.028 lb/ton). Note: condensable PM is listed as non-detect for this source type.
VOC (assume POC)	0.047	lb/ton	AP-42 Chapter 9.13.2 Coffee Roasting – Table 9.13.2-2 for Batch roaster with thermal oxidizer
NPOC (Methane)	ND	lb/ton	AP-42 Chapter 9.13.2 Coffee Roasting – Table 9.13.2-2 for Batch roaster with thermal oxidizer
CO	0.55	lb/ton	AP-42 Chapter 9.13.2 Coffee Roasting – Table 9.13.2-2 for Batch roaster with thermal oxidizer
Formaldehyde	0.0008	lb/ton	BAAQMD Engineering Handbook, Chapter 11.3 (Source testing at Peets Coffee and Tea, Inc.)
Acetaldehyde	0.0005	lb/ton	BAAQMD Engineering Handbook, Chapter 11.3 (Source testing at Peets Coffee and Tea, Inc.)
<i>Natural Gas Combustion Process (S-1 Coffee Roaster & A-2 Afterburner)</i>			
NO _x	0.2	lb/MMBTU	BAAQMD District Policy: RACT control level for afterburners – 50 ppmvd NO _x @ 15% O ₂
CO	0.8	lb/MMBTU	BAAQMD District Policy: RACT control level for afterburners – 350 ppmvd CO @ 15% O ₂
PM (Assume PM ₁₀)	7.6	lb/10 ⁶ scf	AP-42 Chapter 1.4 (Natural Gas Combustion) Table 1.4-2
SO ₂	0.6	lb/10 ⁶ scf	AP-42 Chapter 1.4 (Natural Gas Combustion) Table 1.4-2
NPOC (Methane)	2.3	lb/10 ⁶ scf	AP-42 Chapter 1.4 (Natural Gas Combustion) Table 1.4-2
VOC (Assume POC)	5.5	lb/10 ⁶ scf	AP-42 Chapter 1.4 (Natural Gas Combustion) Table 1.4-2
Benzene	2.1E-06	lb/10 ⁶ scf	BAAQMD Policy: Emission Factors for Toxic Air Contaminants from Miscellaneous Natural Gas Combustion Sources (9/7/2005)
Formaldehyde	7.5E-05	lb/10 ⁶ scf	BAAQMD Policy: Emission Factors for Toxic Air Contaminants from Miscellaneous Natural Gas Combustion Sources (9/7/2005)
Toluene	3.4E-06	lb/10 ⁶ scf	BAAQMD Policy: Emission Factors for Toxic Air Contaminants from Miscellaneous Natural Gas Combustion Sources (9/7/2005)

³ <https://www3.epa.gov/ttnchie1/ap42/ch01/final/c01s04.pdf>

⁴ http://www.baaqmd.gov/~media/Files/Engineering/policy_and_procedures/TACEmFacfromNatGasCombustion.ashx

Table 2 summarizes additional emission calculation assumptions pertaining to the current coffee roasting operations. Note that the Red Bay S-1 roaster is a refurbished Probat UG22 model originally built in the 1960's; based on the nameplate, S-1 was refurbished in 2016 by PPA Konnik company. The S-1 refurbished unit does not currently have a nameplate showing the S-1 maximum firing rate. However, BAAQMD permitted a similar Probat UG22 roaster in application number 29147; in that application, the maximum firing rate listed is 150,000 BTU/hour. For this application, it is assumed that the same firing rate applies to S-1.

The maximum input rating for A-2 Afterburner is 1.5MMBTU/hour. However, the hourly operating rate of 800,000 BTU/hour is used for emission calculation purposes.

Table 2. S-1 Coffee Roaster Operation Assumptions

Parameter	Assumption	Units
S-1 Operational Uptime	12	hours/day
	6	days/week
	52	weeks/year
	3,744	hours/year
S-1 Green Coffee Bean Roaster Maximum Throughput	22	kg/batch
	48.4	lbs/batch
	3	batch/hour
	145.2	lbs/hour
	0.0726	tons/hour
	36	batch/day
	1,742.40	lbs/day
	0.8712	tons/day
	543,629	lbs/year
	272	tons/year
S-1 & A-2 Natural Gas consumption	150,000	Roaster S-1, BTU/hour
	800,000	Afterburner A-2, BTU/hour
	0.95	TOTAL, MMBTU/hour
	3,557	TOTAL, MMBTU/year
	0.00093	TOTAL, MMSCF/hour
	3.5	MMSCF/year
Standard conversion factors	2,000	lbs/ton
	1,020	MMBTU/MMSCF
	7000	grain/lb
	60	min/hour

Red Bay staff noted that the A-1 chaff collector is emptied after approximately five roasting cycles (after which, the chaff collected is sent off-site for composting); in addition, staff perform on a weekly basis a full wipe-down cleaning of the chaff collector inside (including the exhaust ducting line between abatement devices A-1 and A-2).

Calculated Emission Increases

Table 3 summarizes the calculated criteria pollutant and TAC emissions from proposed source S-1.

Table 3. Calculated Criteria Pollutant and TAC Emissions

Pollutant		Calculated Emissions			
		lb/hr	lb/day	lb/yr	tons/yr
Criteria Pollutants	NO _x	0.190	2.28	711	0.356
	CO*	0.800	9.60	2995	1.498
	POC*	0.008	0.101	32.2	0.016
	NPOC*	0.002	0.026	8.0	0.004
	PM10*	0.018	0.215	66.5	0.033
	SO ₂	0.00056	0.007	2.1	0.001
Toxic Air Contaminants (TACs)	Formaldehyde*	5.8E-05	7.0E-04	2.2E-01	1.1E-04
	Acetaldehyde	3.6E-05	4.4E-04	1.4E-01	6.8E-05
	Benzene	2.0E-09	2.3E-08	7.3E-06	3.7E-09
	Toluene	3.2E-09	3.8E-08	1.2E-05	5.9E-09

*Combined emissions from roasting of coffee beans and combustion of natural gas.

Grain Loading Rate

The grain loading rate calculation is required for determining the compliance of this application with BAAQMD Regulation 6, Rule 1 (refer to “Statement of Compliance” section).

$$[0.018 \text{ lb PM}_{10}/\text{hr} \times 7000 \text{ grain/lb}] / [60 \text{ min/hr} \times 294 \text{ DSCFM}] = 0.007 \text{ grain/dscf}$$

Assumptions:

- 0.018 lb PM₁₀/hr (Table 3 Emissions from S-1 roaster, see table above)
- 7000 grain/lb standard conversion factor (AP-42 Appendix A, Page A-19)
- Per applicant, S-1 Roaster has maximum flow of 500 acfm at 350°F and 10% water volume; this is equivalent to 294 DSCFM:

$$DSCFM = ACFM \times [(460^\circ R + 70^\circ F)/(460^\circ R + temp)] \times (Actual P/14.7 \text{ psi}) \times (1 - B_w)$$

Where: ACFM = 500 cfm, temp = 350°F, Actual P = 14.7 psi, B_w = 0.1 (vol. fraction of water)

Health Risk Analysis (HRA)

Table 4 summarizes the TAC emissions associated with the current application in comparison with the respective HRS trigger levels set forth in BAAQMD Regulation 2-5, Table 1. All TAC emissions are below the respective trigger levels. Therefore, an HRA is not required.

Table 4. Proposed TAC Emissions vs. HRA Trigger Levels

TAC	Total Net Emissions		Trigger Levels		HRA Triggered?	
	lb/hour	lb/year	Acute	Chronic	Acute	Chronic
			(lb/hour)	(lb/yr)		
Formaldehyde	5.8E-05	2.2E-01	1.2E-01	1.4E+01	No	No
Acetaldehyde	3.6E-05	1.4E-01	1.0E+00	2.9E+01	No	No
Benzene	2.0E-09	7.3E-06	6.0E-02	2.9E+00	No	No
Toluene	3.2E-09	1.2E-05	8.2E+01	1.2E+04	No	No

Plant Cumulative Increase

Table 5 below shows the plant cumulative increase in emissions (tons per year, TPY) as a result of this application. PM_{2.5} is conservatively assumed to equal PM₁₀ emissions.

Table 5. Plant Cumulative Increase

Pollutant	Currently-Permitted Emissions	New Increase with this application	Total Emissions
NO _x	0	0.356	0.356
CO	0	1.498	1.498
POC	0	0.016	0.016
NPOC	0	0.004	0.004
PM ₁₀	0	0.033	0.033
PM _{2.5}	0	0.033	0.033
SO ₂	0	0.001	0.001

STATEMENT OF COMPLIANCE

District Rules and Regulations

Source S-1 is expected to comply with Regulation 6-1-301 for visible emissions that do not exceed Ringelmann 1 for period or periods aggregating more than three minutes in any hour.

Regulation 6-1-310 contains total suspended particulate (TSP) concentration limits. The calculated grain loading rate of 0.007 grain/dscf is well-below the limit of 0.15 gr/dscf flue gas exhaust set in Regulation 6-1-310.1. The limits in 6-1-310.2 will not apply (once effective July 1, 2020) because the potential to emit TSP is below 1,000 kg per year.

Compliance with Regulation 7, Odorous Substances, is expected due to the operation of A-2 afterburner.

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.

Public School Notification

This application proposes a new source of TACs and is located within 1,000 feet of the outer boundary of the nearest K-12 school. Therefore, public notification pursuant to Reg. 2-1-412 is required. There are also additional schools (listed below) located within a ¼-mi. radius of the proposed project. The school public notice will therefore be distributed on February 14, 2020 to the parents and guardians of the students of the following schools as well as to addresses located within 1,000 feet of the site:

- Lazear Charter Academy, 824 29th Avenue, Oakland CA 94601
- Arise High School, 3301 East 12th Street, Suite 205, Oakland CA 94601
- International Community School, 2825 International Blvd, Oakland CA 94601
- Think College Now School, 2825 International Blvd, Oakland CA 94601

Note that Decolores Head Start (1155 35th Ave Oakland) is also located within a ¼-mi radius of the site but it is a pre-kindergarten school and therefore it is not subject to the above school notification requirements.

Offsets

Offsets are not required per Regulation 2-2-302 because the Plant's potential to emit POC and NO_x emissions are each less than 10 ton/yr.

Best Available Control Technology (BACT)

The proposed project source S-1 will not emit criteria pollutants (POCs, NPOC, NO_x, SO₂, PM₁₀, or CO) at rates of 10 lbs or more per highest day and is therefore not required to implement BACT per Regulation 2-2-301.

California Environmental Quality Act (CEQA)

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.

Other

PSD, NSPS, and NESHAPS do not apply. While all proposed TACs to be emitted are included on the US EPA list of Hazardous Air Pollutants [Clean Air Act Section 112(b)(1)], site operations are not included in any industry groups listed in the air toxics source categories. Therefore, maximum achievable control technology (MACT) standards, generally available control technology, and/or residual risk standards do not apply to this project.

PERMIT CONDITIONS

*Plant # 24238, Red Bay Coffee Company
Application # 29504*

S-1 Batch Coffee Roaster: Probat UG-22; 0.15 MM BTU/hr (Natural Gas)
Abated by: A1 and A2 (in series)
A1 Cyclone; Probat Chaff Collector
A2 Afterburner; Conversion Products, Inc. TR18/30V-500MC-72NB,
1.5MM BTU/hr (Natural Gas)
Emissions at: P-1 Stack

Permit Condition #27113:

1. The owner/operator shall operate the S-1 Coffee Roaster, A-1 Cyclone, and A-2 Afterburner so that they do not exceed the following limits:
 - a. S-1: 272 tons (544,000 lbs) of green beans totaled over any consecutive twelve-month period
 - b. Natural Gas Usage (total combined for S-1 Roaster and A-2 Afterburner): 35,570 therms totaled over any consecutive twelve-month period.
[basis: Cumulative Increase, BACT Avoidance]
2. The owner/operator shall ensure that S-1 Coffee Roaster is abated by A-1 Cyclone and A-2 Afterburner whenever S-1 is in operation. [basis: Cumulative Increase]
3. The owner/operator shall maintain a minimum furnace temperature at A-2 of 1200° F and maintain a residence time of at least 0.3 seconds. [basis: Regulation 2-1-403]
4. The owner/operator shall ensure that A-2 Afterburner is equipped with a temperature-measuring device capable of continuously measuring and recording the temperature in the thermal oxidizer. This device shall

be accurate to within 10 degrees Fahrenheit (° F) and shall be maintained in accordance with manufacturer’s recommendations. These temperature monitor(s) shall be used to determine compliance with the temperature requirements in Part 3. [basis: Regulation 1-521]

5. 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 6-1-310.1]
6. To demonstrate compliance with the above conditions, the owner/operator shall maintain the following records and provide all 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 of A-2 Afterburner whenever S-1 Coffee Roaster is in operation.

[basis: Cumulative Increase]

All records shall be retained on-site for two years from the date of entry and made available for inspection by District staff upon request. These recordkeeping requirements shall not replace the recordkeeping 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 1,000 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/Permit to Operate for the following source:

- S-1 Batch Coffee Roaster: Probat UG-22; 0.15 MM BTU/hr (Natural Gas)**
- Abated by: A1 and A2 (in series)**
- A1 Cyclone; Probat Chaff Collector**
- A2 Afterburner; Conversion Products, Inc. TR18/30V-500MC-72NB,**
- 1.5MM BTU/hr (Natural Gas)**
- Emissions at: P-1 Stack**

Caryn Quist, P.E.
Air Quality Engineer

Date