

DRAFT
ENGINEERING EVALUATION
VOYAGER COFFEE ROASTERS; PLANT # 24290
APPLICATION NO: 29625
809 SAN ANTONIO ROAD, SUITE 6, PALO ALTO CA 94303

BACKGROUND

Voyager Coffee Roasters (Voyager) has applied for an Authority to Construct (AC) and Permit to Operate (PO) the following equipment at 809 San Antonio Road in Palo Alto, California:

S-1 Batch Coffee Roaster: Giesen W15A Coffee Roaster; 98,000 BTU/hr
Abated by: A-1 VortX EcoFilter Wet Cyclone
Emissions at: P-1 Stack

A district permit is required for any coffee roaster which processes 15 or more pounds (lbs) of coffee per hour per Regulation 2-1-117.8. The proposed S-1 will process approximately 86.1 lbs per hour and therefore requires an AC and PO. The abatement unit A-1 is being proposed primarily for particulate matter (smoke and odor) control purposes. The A-1 wet cyclone is assumed to be operational 100% of the time S-1 is operating for odor control purposes. A-1 has no secondary criteria pollutant or TAC emissions (i.e. emission byproducts generated by abatement unit itself).

This application proposes a new source of toxic air contaminant (TACs) and is located within 1,000 feet of the outer boundary of the nearest K-12 school (Meira Academy). 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.

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

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

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

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 wet cyclone is assumed to be operational 100% of the time S-1 is operating. According to the applicant, A-1 wet cyclone achieves near 100% collection efficiency for particles larger than PM₁₀. No abatement efficiency was applied for particles smaller than PM₁₀ (i.e. PM₁₀ and PM_{2.5} emissions). Emissions generated from the operation of abatement device operation are called secondary pollutants; there are no secondary pollutant emissions from operating wet cyclones.

Table 1: Emission Factors

Pollutant	Emission Factor (Value & Units of Measure)		Reference
<i>Batch Roasting Process (S-1 Coffee Roaster)</i>			
PM ₁₀ (filterable)	0.66	lb/ton	AP-42 Chapter 9.13.2 Coffee Roasting – Table 9.13.2-1. (Note that the emission factor for a Continuous roaster is used because one does not exist for a Batch roaster without a thermal oxidizer source category. Also, condensable PM is listed as non-detect for this source type.)
VOC (assume POC)	0.86	lb/ton	AP-42 Chapter 9.13.2 Coffee Roasting – Table 9.13.2-2 for Batch roaster
NPOC (Methane)	ND	lb/ton	AP-42 Chapter 9.13.2 Coffee Roasting – Table 9.13.2-2 for Batch roaster
CO	ND	lb/ton	AP-42 Chapter 9.13.2 Coffee Roasting – Table 9.13.2-2 for Batch roaster
Formaldehyde	0.016	lb/ton	BAAQMD Engineering Handbook, Chapter 11.3 (Source testing at Peets Coffee and Tea, Inc.); Unabated emission factor is back-calculated from the abated EF of 0.0008 lb/ton assuming afterburner 95% DRE: $0.0008 / (1 - 0.95) = 0.016$
Acetaldehyde	0.010	lb/ton	BAAQMD Engineering Handbook, Chapter 11.3 (Source testing at Peets Coffee and Tea, Inc.); Unabated emission factor is back-calculated from the abated EF of 0.0005 lb/ton assuming afterburner 95% DRE: $0.0005 / (1 - 0.95) = 0.010$
<i>Natural Gas Combustion Process (S-1 Coffee Roaster)</i>			
NO _x	100	lb/10 ⁶ scf	AP-42 Chapter 1.4 (Natural Gas Combustion) Table 1.4-1 (Small boilers < 100 MM BTU/hr, Uncontrolled)
CO	84	lb/10 ⁶ scf	AP-42 Chapter 1.4 (Natural Gas Combustion) Table 1.4-1 (Small boilers < 100 MM BTU/hr, Uncontrolled)
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:

Table 2. S-1 Coffee Roaster Operation Assumptions

Parameter	Assumption	Units
S-1 Operational Uptime	16	hours/day
	365	days/year
	5,840	hours/year
S-1 Green Coffee Bean Roaster Maximum Throughput	33.1	lbs/batch
	2.6	batch/hour
	86.1	lbs/hour
	0.043	tons/hour
	42	batch/day
	1,390	lbs/day
	0.7	tons/day
	507,423	lbs/year
	254	tons/year
S-1 Natural Gas consumption	98,000	Roaster S-1, BTU/hour
	0.098	TOTAL, MMBTU/hour
	0.0001	TOTAL, MMSCF/hour
	572	TOTAL, MMBTU/year
	0.56	MMSCF/year
Standard conversion factors	2,000	lbs/ton
	1,020	MMBTU/MMSCF
	7000	grain/lb
	60	min/hour

Notes & Abbreviations:

BTU = British Thermal Units

MMBTU = 10⁶ British Thermal Units

MMSCF = 10⁶ standard cubic feet

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	0.010	0.160	56.0	0.028
	CO*	0.008	0.134	47.0	0.024
	POC*	0.038	0.609	221.1	0.111
	NPOC*	0.00023	0.0037	1.3	0.001
	PM ₁₀ *	0.029	0.472	172.3	0.086
	SO ₂	0.0001	0.001	0.34	0.000
Toxic Air Contaminants (TACs)	Formaldehyde*	3.4E-05	5.6E-04	2.0E-01	1.0E-04
	Acetaldehyde	2.2E-05	3.5E-04	1.3E-01	6.4E-05
	Benzene	2.1E-10	3.4E-09	1.2E-06	5.9E-10
	Toluene	3.4E-10	5.4E-09	1.9E-06	9.5E-10

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

Health Risk Screening Analysis

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

Table 4. Proposed TAC Emissions vs. HRSA Trigger Levels

TAC	Total Net Emissions		Trigger Levels		HRSA Triggered?	
	lb/hour	lb/year	Acute	Chronic	Acute	Chronic
			(lb/hour)	(lb/yr)		
Formaldehyde	6.9E-04	4.1E+00	1.2E-01	1.4E+01	No	No
Acetaldehyde	4.3E-04	2.5E+00	1.0E+00	2.9E+01	No	No
Benzene	2.1E-10	1.2E-06	6.0E-02	2.9E+00	No	No
Toluene	3.4E-10	1.9E-06	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	0.028	0.028
CO	0	0.024	0.024
POC	0	0.111	0.111
NPOC	0	0.001	0.001
PM ₁₀	0	0.086	0.086
PM _{2.5}	0	0.086	0.086
SO ₂	0	0.000	0.000

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, below).

$$[0.029 \text{ lb PM}_{10}/\text{hr} \times 7000 \text{ grain/lb}] / [60 \text{ min/hr} \times 480 \text{ DSCFM}] = 0.007 \text{ grain/dscf}$$

Assumptions:

- 0.029 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 600 acfm at 90°F and 17% water volume; this is equivalent to 480 DSCFM:

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

Where: ACFM = 600cfm, temp = 90°F, Actual P = 17.7 psi, B_w = 0.17 (vol. fraction of water)

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 0.007 gr/dscf does not exceed the 0.15 gr/dscf flue gas exhaust set in Regulation 6, Rule 1-310.1. The TSP 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-1 wet cyclone.

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 (with more than 12 children enrolled). Therefore, public notification pursuant to Reg. 2-1-412 is required. Meira Academy is located within 1,000 feet of the proposed source and the District confirmed in October 2019 (via phone call with the Meira Academy main office) that it is an active high school with more than 12 students enrolled. There are no other schools within a ¼-mi. radius of the proposed project. The school public notice will therefore be distributed on [DATE] to the parents and guardians of the students of the following school as well as to addresses located within 1,000 feet of the school:

Meira Academy, 3921 Fabian Way, Palo Alto CA 94303

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 # 24290, Voyager Coffee Roasters
Application # 29265*

**S-1 Batch Coffee Roaster: Giesen W15A Coffee Roaster; 98,000 BTU/hr
Abated by: A-1 VortX EcoFilter Wet Cyclone
Emissions at: P-1 Stack**

Permit Condition No. 27124

1. The owner/operator shall operate S-1 Coffee Roaster so that it does not exceed the following limits:
 - a. 254 tons of green beans roasted, totaled over any consecutive twelve-month period
 - b. 0.56 MM SCF natural gas used, totaled over any consecutive twelve-month period.
[basis: Cumulative Increase]
2. 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 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]
3. 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.
[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 record-keeping 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: Giesen W15A Coffee Roaster; 98,000 BTU/hr
Abated by: A-1 VortX EcoFilter Wet Cyclone
Emissions at: P-1 Stack

Caryn Quist, P.E.
Air Quality Engineer

Date