

**Engineering Evaluation Report
Royal Ground
Plant # 22498
Application Number 26366**

I. BACKGROUND

Royal Ground is applying for an Authority to Construct and/or Permit to Operate the following equipment:

S-1 Coffee Roaster, San Franciscan Roaster SF-25, 0.1 MMBtu/hr; abated by A-1 Afterburner with Cyclone, San Franciscan SF-25 Afterburner, 0.25 MMBtu/hr

Royal Ground estimates roasting approximately 900 lb/month. To allow for high months, the permit will be calculated based on an annual throughput limit of 24,000 pounds (12 tons) of green coffee.

II. EMISSIONS SUMMARY

Basis:

S-1

- 100 lbs/hr (25 lb capacity, 15 min/cycle, continuous operation)
- Coffee Throughput = 24,000 lb/yr
- Operation hours = 24,000 lbs/yr/100 lb/hr = 240 hours/yr
- Roaster Firing Rate = 0.1 MM BTU/hr
- Afterburner Firing Rate = 0.25 MMBTU/hr
- Total fuel throughput = 0.35 MMBTU/hr(240 hrs/yr) = 84.0 MMBTU/yr
- Heat capacity = 1,050 MMBtu/10⁶ ft³ natural gas
- A-1 VOC Destruction Efficiency 90% by weight

Emission factors taken from AP-42, Table 1.4-2 (revised 7/1/98) for small boiler <100 MMBtu/hr, uncontrolled, are taken for NOx, CO, SO2, and VOC for the combustion of natural gas:

$$\text{NOx} = (100 \text{ lb/ MMscf}) / (1050 \text{ MMBtu}/10^6 \text{ ft}^3) = 0.095 \text{ lb/MMBtu}$$

$$\text{CO} = (84 \text{ lb/ MMscf}) / (1050 \text{ MMBtu}/10^6 \text{ ft}^3) = 0.08 \text{ lb/MMBtu}$$

$$\text{SO2} = (0.6 \text{ lb/MMscf}) / (1050 \text{ MMBtu}/10^6 \text{ ft}^3) = 5.7 \times 10^{-4} \text{ lb/MMBtu}$$

$$\text{VOC} = (5.5 \text{ lb/MMscf}) / (1050 \text{ MMBTU}/10^6 \text{ ft}^3) = 0.00524 \text{ lb/MMBtu}$$

Combustion Emission Calculations:

S-1 fuel throughput (MMBtu/year)	84	
Pollutant	Emission Factor	Annual Emissions
	(lb/MMBtu)	(lb/year)
NOx	0.095	8.0
CO	0.08	6.7
SO2	0.00057	0.05
VOC	0.00524	0.4

PLANT NAME: Royal Ground	ENGINEERING EVALUATION	APPLICATION NO.: 26366
STREET ADDRESS: 1146 4 th St.		PLANT NO.: 22498
CITY, STATE: San Rafael, CA		DATE: 20 October 2014
ZIP CODE: 94901		PAGE NO.: Page 2 of 5

Table 9.13.2-1 and 9.13.2-2 from AP-42 Chapter 9.13.2 (Coffee Roasting) provides the following emission factors for particulate (as PM10), volatile organics (VOC), and carbon monoxide from the coffee roasting process:

Emission Factors for Coffee Roasting Operations

Green coffee bean screening, handling, and storage	PM10 = 0.059 lb/ton
Continuous roaster with thermal oxidizer	PM10 = 0.192 lb/ton VOC = 0.16 lb/ton CO = 0.098 lb/ton

Emission from coffee roaster:

Emission factors (batch roaster abated by thermal oxidizer) for emissions of particulate and organics are taken from AP-42 Table 9.13.2-1.

Pollutant	Emission Factors (lb/ton)	Annual Emissions (lb/yr)
PM10	0.192 +0.059	3.0
VOC (abated)	0.16	1.9
CO	0.098	1.2

Emissions Summary:

Pollutant	Emissions (lb/yr)	Total Emissions (TPY)
NOx	8.0	0.004
CO	7.9	0.004
SO2	0.05	Negligible
PM10	3.0	0.002
POC	1.9	0.001

For Compliance with Regulation 6 -1-310 Particulate Weight Limitations:

Limitation of 0.15 grain/dscf

Basis: 1 hour of roaster operation
100 lbs/hr roaster capacity
Roaster emission point: 850 acfm @ 1200°F
850 acfm(460+70°R)/(460+1200 °R) =
271 scfm @ 70°F

Grain loading calculation from coffee roasting process:

[3.0 lb PM₁₀/yr X 7000 grain/lb] / [60 min/hr X 240 hr/yr X 271 dscfm]
= 0.005 grain/dscf

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STREET ADDRESS: 1146 4 th St.		PLANT NO.: 22498
CITY, STATE: San Rafael, CA		DATE: 20 October 2014
ZIP CODE: 94901		PAGE NO.: Page 3 of 5

For Compliance with Regulation 6-1-311 General Operations:

Emission limit for S-1
Emission limit = $4.10 \cdot P^{0.67} = 0.55 \text{ lb/hr}$
where P = process rate (tons/hr)
= $100 \text{ lb/hr} / (2000 \text{ lb/ton})$
= 0.05 ton PM/hr

Hourly emissions from S-1
= $0.05 \text{ ton beans/hr} (0.192 + 0.059 \text{ lb PM/ton})$
= 0.01 lb PM/hr

III. PLANT CUMULATIVE INCREASE

Pollutant	Current (TPY)	New (TPY)	Total TPY
NOx	0	0.004	0.004
CO	0	0.004	0.004
SO2	0	Negligible	Negligible
PM10	0	0.002	0.002
POC	0	0.001	0.001

IV. TOXIC RISK SCREENING

According to Chapter 9.13.2, Coffee Roasting of AP-42, the roaster (S-1) is the main source of gaseous pollutants, including aldehydes 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. However, Puget Sound Clean Air Agency did some source testing of a coffee roaster and determined the following toxic emission factors:

Formaldehyde = 0.062 lb/ton
Acetaldehyde = 0.036 lb/ton
Acrolein = 0.018 lb/ton *

Summary of Toxic Pollutants

Pollutant	Emission Factors (lb/ton)	Throughput (ton/yr)	Annual Emissions (lb/yr)	Hourly Emissions (lb/hr)	Trigger Level (lb/hr)	Trigger Level (lb/yr)
Formaldehyde	0.062	12	0.74	0.003	0.12	18
Acetaldehyde	0.036	12	0.43	0.0018	1.0	38

Note: * 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, per the Risk Screening Memo.

A toxic risk screen is not triggered.

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STREET ADDRESS: 1146 4 th St.		PLANT NO.: 22498
CITY, STATE: San Rafael, CA		DATE: 20 October 2014
ZIP CODE: 94901		PAGE NO.: Page 4 of 5

V. BEST AVAILABLE CONTROL TECHNOLOGY

BACT is not triggered since emissions are less than 10 lbs per day for all pollutants.

VI. OFFSETS

Offsets are not required since the facility's POC and NOx emissions do not exceed 10 ton/yr per Regulation 2-2-302.

VII. CEQA

This application is considered to be ministerial under the District's CEQA guidelines (Regulation 2-1-311) and therefore is 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 11.3.

VIII. STATEMENT OF COMPLIANCE

S-1 will comply with the following requirements:

- Regulation 6 -1-301 - Ringelmann No. 1 Limitation
- Regulation 6 -1-302 - Opacity Limitation
- Regulation 6 -1-310 - Grain loading < 0.15 gr/dscf

NSPS, PSD, and NESHAPS are not triggered

Royal Ground is located within 1000 feet of St. Raphael School. As a result, per Regulation 2-1-412, school notification is triggered.

IX. PERMIT CONDITIONS

S-1 shall be subject to the following permit conditions:

Condition 25874

1. The owner/operator shall not roast more than 24,000 pounds of green coffee beans at S-1 Coffee Roaster with Afterburner with Cyclone (A-1) in any consecutive 12-month period. [Basis: Cumulative Increase]
2. The owner/operator of S-1 shall set the minimum furnace temperature of the Afterburner (A-1) at 1200 degrees Fahrenheit (° F) or higher. [Basis: Regulation 2-1-403]
3. The owner/operator shall ensure that Afterburner (A-1) is equipped with a temperature-measuring device capable of continuously measuring and recording the temperature in the afterburner. 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 determine compliance with the temperature requirements in Part 2.

PLANT NAME: Royal Ground	ENGINEERING EVALUATION	APPLICATION NO.: 26366
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CITY, STATE: San Rafael, CA		DATE: 20 October 2014
ZIP CODE: 94901		PAGE NO.: Page 5 of 5

[Basis: Regulation 1-521]

4. 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.
 - b. Monthly usage records shall be totaled for each consecutive 12-month period.
 - c. Records of continuous temperature measurements of the integrated afterburner whenever S-1 Coffee Roaster is in operation.
 - d. Monthly natural gas usage for A-1 and S-1 (estimate from facility total monthly natural gas usage is acceptable).

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 recordkeeping requirements shall not replace the recordkeeping requirements contained in any applicable District Regulations.

[Basis: Cumulative Increase]

X. RECOMMENDATION

This 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 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 Coffee Roaster, San Franciscan Roaster SF-25, 0.1 MMBtu/hr; abated by A-1 Afterburner with Cyclone, San Franciscan SF-25 Afterburner, 0.25 MMBtu/hr**

By: _____ Date: _____
 Kathleen Truesdell
 Air Quality Engineer II