Expires - 9/3/2021

ACTIVE SMAQMD BACT CLEARINGHOUSE

CATEGORY: **COFFEE ROASTER**

BACT Size: Minor Source BACT **COFFEE ROASTER**

BACT Determination Number: 141	**BACT Determination Date:** 9/4/2019

Equipment Information

Permit Number: 25127
Equipment Description: COFFEE ROASTER
Unit Size/Rating/Capacity: < 110,000 Btu/hr
Equipment Location: VINTAGE PRODUCTION CALIFORNIA LLC
2827 S ST
SACRAMENTO, CA

Expires - 9/3/2021

BACT Determination Information

ROCs	**Standard:**	≥ 90% control efficiency
	Technology Description:	Afterburner (0.3 second retention time at 1200 °F) or equivalent technology
	Basis:	Achieved in Practice
NOx	**Standard:**	
	Technology Description:	Natural gas fuel
	Basis:	Achieved in Practice
SOx	**Standard:**	
	Technology Description:	Natural gas fuel
	Basis:	Achieved in Practice
PM10	**Standard:**	
	Technology Description:	Natural gas fuel with cyclone and afterburner (0.3 second retention time at 1200 °F) or equivalent technology
	Basis:	Achieved in Practice
PM2.5	**Standard:**	
	Technology Description:	Cyclone and natural gas fuel
	Basis:	Achieved in Practice
CO	**Standard:**	
	Technology Description:	Natural gas fuel and good combustion practices
	Basis:	Achieved in Practice
LEAD	**Standard:**	
	Technology Description:	
	Basis:	

Comments:

District Contact: Jeff Quok Phone No.: (916) 874-4863 email: jquok@airquality.org

Printed: 9/4/2019

Expires - 9/3/2021

ACTIVE SMAQMD BACT CLEARINGHOUSE

CATEGORY: **COFFEE ROASTER**

BACT Size: Minor Source BACT **COFFEE ROASTER**

BACT Determination Number:	184	**BACT Determination Date:**	**9/4/2019**

Equipment Information

Permit Number: N/A -- Generic BACT Determination
Equipment Description: COFFEE ROASTER
Unit Size/Rating/Capacity: 110,000 Btu/hr to 3.5 MMBtu/hr
Equipment Location:

Expires - 9/3/2021

BACT Determination Information

ROCs	**Standard:**	≥ 90% control efficiency
	Technology Description:	afterburner (0.3 second retention time at ≥1400 °F) or equivalent technology
	Basis:	Achieved in Practice
NOx	**Standard:**	40 or 60 ppm NOx at 3% O2, see comments
	Technology Description:	For units ≥ 325,000 BTU/hr: Low NOx burner, see comments for details
	Basis:	Achieved in Practice
SOx	**Standard:**	
	Technology Description:	Natural gas fuel
	Basis:	Achieved in Practice
PM10	**Standard:**	
	Technology Description:	Natural gas with cyclone and afterburner (0.3 second retention time at 1400 °F) or equivalent technology
	Basis:	Achieved in Practice
PM2.5	**Standard:**	
	Technology Description:	Cyclone and natural gas fuel
	Basis:	Achieved in Practice
CO	**Standard:**	
	Technology Description:	Natural gas fuel and good combustion practices
	Basis:	Achieved in Practice
LEAD	**Standard:**	
	Technology Description:	
	Basis:	

Comments: BACT for NOx:
1.40 ppm NOx at 3% O2 or 0.049 lb/MMBtu for roaster burners < 500 °F, 60 ppm NOx at 3% O2 or 0.073 lb/MMBtu for roaster burners ≥ 500 °F
2.60 ppm NOx at 3% O2 or 0.073 lb/MMBtu for afterburners, thermal oxidizers, catalytic oxidizers, and vapor incinerators

District Contact: Jeff Quok Phone No.: (916) 874-4863 email: jquok@airquality.org

Printed: 9/4/2019

777 12th Street, Third Floor

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Sacramento, CA 95814

Expires - 9/3/2021

BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

DETERMINATION NO.: 141 & 184

DATE: September 4, 2019

ENGINEER: Jeffrey Quok

Category/General Equip Description: Coffee Roaster

Equipment Specific Description: Coffee Roaster < 110,000 Btu/hr (BACT #141)
Coffee Roaster 110,000 Btu/hr to 3.5 MMbtu/hr (BACT # 184)

Equipment Size/Rating: Minor Source BACT

Previous BACT Det. No.: 100

This BACT/T-BACT determination will update Determination #100 for Coffee Roasters.

This BACT/T-BACT was determined under the project for A/C 25127 (Temple Coffee).

BACT ANALYSIS

A: ACHIEVED IN PRACTICE (Rule 202, §205.1a):

The following control technologies are currently employed as BACT for coffee roasters by the following air pollution control districts and agencies:

<table>
<tr><th>District/Agency</th><th>Best Available Control Technology (BACT)/Requirements</th></tr>
<tr><td>US EPA</td><td>BACT
Source: EPA RACT/BACT/LAER Clearinghouse

<table>
<tr><td colspan="2">Coffee Roaster</td></tr>
<tr><td>VOC</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>NOx</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>SOx</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>PM10</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>PM2.5</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>CO</td><td>N/A – No BACT determinations found</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>District/Agency</th><th>Best Available Control Technology (BACT)/Requirements</th></tr>
<tr><td>US EPA</td><td><u>T-BACT</u>
There are no T-BACT standards published in the clearinghouse for this category.

<u>RULE REQUIREMENTS</u>:
None</td></tr>
<tr><td>ARB</td><td><u>BACT</u>
Source: ARB BACT Clearinghouse

<table>
<tr><td colspan="2">Coffee Roaster</td></tr>
<tr><td>VOC</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>NOx</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>SOx</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>PM10</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>PM2.5</td><td>N/A – No BACT determinations found</td></tr>
<tr><td>CO</td><td>N/A – No BACT determinations found</td></tr>
</table>
<u>T-BACT</u>
There are no T-BACT standards published in the clearinghouse for this category.

<u>RULE REQUIREMENTS</u>:
None</td></tr>
<tr><td>SMAQMD</td><td><u>BACT</u>
Source: SMAQMD BACT Clearinghouse (1/30/15)
<table>
<tr><td colspan="2">Coffee Roaster</td></tr>
<tr><td>VOC</td><td>≥ 90% control efficiency</td></tr>
<tr><td>NOx</td><td>Natural Gas Fuel</td></tr>
<tr><td>SOx</td><td>Natural Gas Fuel</td></tr>
<tr><td>PM10</td><td>Cyclone and Natural Gas Fuel</td></tr>
<tr><td>PM2.5</td><td>Cyclone and Natural Gas Fuel</td></tr>
<tr><td>CO</td><td>Natural gas fuel and good combustion practices</td></tr>
</table>
<u>T-BACT</u>
There are no T-BACT standards published in the clearinghouse for this category.

<u>RULE REQUIREMENTS</u>:
Rule 419 – NOx from Miscellaneous Combustion Units (10/25/18)
This Rule applies to any miscellaneous combustion unit or cooking unit with a total rated heat input capacity of 2 MMBtu/hr or greater that is located at a major stationary source of NOx and to any miscellaneous combustion unit or cooking unit with a total rated heat input capacity of 5 MMBtu/hr or greater that is not located at a major stationary source of NOx.</td></tr>
</table>

<table>
<tr><th>District/Agency</th><th>Best Available Control Technology (BACT)/Requirements</th></tr>
<tr><td>SMAQMD</td><td>
The requirements of this rule do not apply to combustion equipment where its primary function is to operate as an air pollution control device including, but not limited to, afterburners, catalytic oxidizers, flares, thermal oxidizers, or vapor incinerators.
<table>
<tr><td colspan="4">TABLE 2: Cooking Units
Emission Limits Expressed As PPMV, corrected to 3% O_2</td></tr>
<tr><td rowspan="2">Equipment Category</td><td colspan="2">NOx Limit
ppmv, corrected to 3% O_2
(lb/MMBtu)</td><td>CO Limit
ppmv, corrected to 3% O_2
(lb/MMBtu)</td></tr>
<tr><td colspan="3">Effective (see Section 401)</td></tr>
<tr><td rowspan="2">Gaseous Fuel-Fired Equipment</td><td colspan="2">Process Temperature</td><td rowspan="2">All Temperatures</td></tr>
<tr><td>< 500°F</td><td>≥ 500 °F</td></tr>
<tr><td>Cooking Unit</td><td>40
(0.049)</td><td>60
(0.073)</td><td>800
(0.60)</td></tr>
</table>
</td></tr>
<tr><td>South Coast AQMD</td><td>
<u>BACT</u>
Source: SCAQMD BACT Guidelines for Non-Major Polluting Facilities, page 33 (2/1/2019)
<table>
<tr><td colspan="2">Coffee Roaster, < 110,000 BTU/hr</td></tr>
<tr><td>VOC</td><td>No standard</td></tr>
<tr><td>NOx</td><td>Compliance with Rule 1147</td></tr>
<tr><td>SOx</td><td>Natural Gas</td></tr>
<tr><td>PM10</td><td>Natural Gas</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
</table>
<table>
<tr><td colspan="2">Coffee Roaster, ≥ 110,000 BTU/hr</td></tr>
<tr><td>VOC</td><td>Afterburner (0.3 second retention time at 1200 °F)</td></tr>
<tr><td>NOx</td><td>Compliance with Rule 1147</td></tr>
<tr><td>SOx</td><td>Natural Gas</td></tr>
<tr><td>PM10</td><td>Natural Gas with cyclone and afterburner (0.3 second retention time at 1200 °F)</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
</table>
<u>T-BACT</u>
There are no T-BACT standards published in the clearinghouse for this category.
</td></tr>
</table>

<table>
<tr><th>District/Agency</th><th>Best Available Control Technology (BACT)/Requirements</th></tr>
<tr><td>South Coast AQMD</td><td>
<u>RULE REQUIREMENTS</u>:

<u>Reg XI, Rule 1147</u> – NOx Reductions from Miscellaneous Sources (7/7/2017)
The purpose of this rule is to reduce nitrogen oxide emissions from gaseous and liquid fuel fired combustion equipment as defined in the rule.

The rule requires than on or after January 1, 2010 any person owning or operating a unit subject to the rule shall not operate the unit in a manner that exceeds the applicable nitrogen oxide emission limits specified in Table 1 at the time a District permit is required for operation of a new, relocated or modified unit. The NOx emission limits of Table 1 only apply to units greater than or equal to 325,000 BTU/hr.

Per section (g)(2), the provisions of this rule shall not apply to charbroilers or food ovens. Food oven means an oven, cooker, dryer, roaster, or other fuel-fired unit, excluding fryer, used to heat, cook, dry, roast, or prepare food, food products, or products used for making beverages for human consumption. Since a coffee roaster is used to roast products used for making beverages for human consumption, coffee roasters are exempt from this rule. However, afterburners are still applicable.

<table>
<tr><th rowspan="2">Equipment Categories</th><th colspan="3">Table 1 - NOx Emission Limit for Unit Heating Ratings ≥ 325,000 BTU/hr
PPM @ 3% O2, dry or lb/mmBtu heat input</th></tr>
<tr><th colspan="3">Process Temperature</th></tr>
<tr><td>Gaseous Fuel-Fired Equipment</td><td>≤ 800° F</td><td>> 800 ° F and < 1200° F</td><td>≥ 1200 ° F</td></tr>
<tr><td>Afterburner, Degassing Unit, Remediation Unit, Thermal Oxidizer, Catalytic Oxidizer or Vapor Incinerator (A)</td><td>60 ppm or 0.073 lb/mmBtu</td><td>60 ppm or 0.073 lb/mmBtu</td><td>60 ppm or 0.073 lb/mmBtu</td></tr>
</table>
(A) Emission limit applies to burners in units fueled by 100% natural gas that are used to incinerate air toxics, VOCs, or other vapors; or to heat a unit. The emission limit applies solely when burning 100% fuel and not when the burner is incinerating air toxics, VOCs, or other vapors. The unit shall be tested or certified to meet the emission limit while fueled with natural gas.
</td></tr>
</table>

<table>
<tr><th>District/Agency</th><th>Best Available Control Technology (BACT)/Requirements</th></tr>
<tr><td>San Diego County APCD</td><td>
<u>BACT</u>
Source: NSR Requirements for BACT, page 3-8. (6/2011)

<table>
<tr><td colspan="2">Coffee Roaster (A)</td></tr>
<tr><td>VOC</td><td>Afterburner (0.3 second retention time at 1200 °F)</td></tr>
<tr><td>NOx</td><td>Natural Gas, with heat recovery on afterburner exhaust to reduce fuel consumption</td></tr>
<tr><td>SOx</td><td>Natural Gas</td></tr>
<tr><td>PM10</td><td>Natural Gas with cyclone and afterburner (0.3 second retention time at 1200 °F)</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
</table>
(A) The applicant may choose to limit the Potential to Emit (PTE) from the equipment to less than 10 pounds per day for each pollutant in lieu of meeting the stated BACT requirement.

<u>T-BACT</u>
There are no T-BACT standards published in the clearinghouse for this category.

<u>RULE REQUIREMENTS</u>:
None
</td></tr>
<tr><td>Bay Area AQMD</td><td>
<u>BACT</u>
Source: BAAQMD BACT Guidelines: 47.1.1 (3/3/1992), 47.3.1 (4/2/2008)

<table>
<tr><td colspan="2">Coffee Roaster, < 110,00 BTU/hr</td></tr>
<tr><td>VOC</td><td>Afterburner (0.3 second retention time at ≥1200 °F); or catalytic afterburner (≥ 550 °F) – (Technologically Feasible)</td></tr>
<tr><td>NOx</td><td>1. Natural gas firing with combustion modifications – (Technologically feasible)
2. Natural gas firing – (Achieved in Practice)</td></tr>
<tr><td>SOx</td><td>Natural Gas</td></tr>
<tr><td>PM10</td><td>1. Natural gas firing with baghouse and afterburner (0.3 second retention time at ≥1400 °F) – (Technologically Feasible)
2. Natural Gas firing with cyclone – (Achieved in Practice)</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>District/Agency</th><th>Best Available Control Technology (BACT)/Requirements</th></tr>
<tr><td>Bay Area AQMD</td><td>
<table>
<tr><td colspan="2">Coffee Roaster, 110,00 BTU/hr to 3.5 MMBtu/hr</td></tr>
<tr><td>VOC</td><td>0.047 lb/ton of beans roasted, afterburner (0.3 second retention time at ≥1400 °F) – (Achieved in Practice)</td></tr>
<tr><td>NOx</td><td>0.2 lb/MMBtu, natural gas firing – (Achieved in Practice)</td></tr>
<tr><td>SOx</td><td>Natural gas firing – (Achieved in Practice)</td></tr>
<tr><td>PM10</td><td>0.01 gr/dscf, Natural Gas with cyclone and afterburner (0.3 second retention time at 1400 °F) – (Achieved in Practice)</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>1. 0.1 lb/MMBtu, natural gas firing and use of heat exchangers – (Technologically feasible)
2. 0.4 lb/MMBtu, good combustion practice – (Achieved in Practice)</td></tr>
</table>
<u>T-BACT</u>
<table>
<tr><td colspan="2">Coffee Roaster, < 110,00 BTU/hr</td></tr>
<tr><td>VOC</td><td>Afterburner (0.3 second retention time at ≥1200 °F); or catalytic afterburner (≥ 550 °F) – (Technologically Feasible)</td></tr>
<tr><td>PM10</td><td>Natural gas firing with baghouse and afterburner (0.3 second retention time at ≥1400 °F) – (Technologically Feasible)</td></tr>
</table>
<u>RULE REQUIREMENTS</u>:
None
</td></tr>
<tr><td>San Joaquin Valley APCD</td><td><u>BACT</u>
<u>Source: SJVUAPCD BACT Guideline</u>
There are no BACT standards published in the clearinghouse for this category.

<u>RULE REQUIREMENTS</u>:
None</td></tr>
</table>

The following control technologies have been identified and are ranked based on stringency:

SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES	
Pollutant	**Control Technology**
VOC	<u>For Coffee Roasters < 110,000 Btu/hr</u> 1. ≥ 90% control efficiency [SMAQMD] 2. Afterburner (≥ 0.3 second retention time at **1200 °F**) [SDAPCD] <u>For Coffee Roasters 110,000 Btu/hr to 3.5 MMBtu/hr</u> 1. ≥ 90% control efficiency [SMAQMD] 2. 0.047 lb/ton of beans roasted, afterburner (≥ 0.3 second retention time at ≥**1400 °F**) [BAAQMD] 3. Afterburner (≥ 0.3 second retention time at **1200 °F**) [SCAQMD, SDAPCD]
NOx	<u>For Coffee Roasters < 110,000 Btu/hr</u> 1. Natural gas, with heat recovery on afterburner exhaust to reduce fuel consumption [SDPACD](A) 2. Natural gas fuel [SMAQMD, SCAQMD, BAAQMD] <u>For Coffee Roasters 110,000 Btu/hr to 3.5 MMBtu/hr</u> 1. For units ≥ 325,000 BTU/hr: 40 ppm NOx at 3% O_2 or 0.049 lb/MMBtu for **roaster burners** < 500 °F [SMAQMD], 60 ppm NOx at 3% O_2 or 0.073 lb/MMBtu for **roaster burners** ≥ 500 °F [SMAQMD] 2. For units ≥ 325,000 BTU/hr: 60 ppm NOx at 3% O_2 or 0.073 lb/MMBtu for **afterburners, thermal oxidizers, catalytic oxidizers, and vapor incinerators** [SCAQMD] 3. Natural gas, with heat recovery on afterburner exhaust to reduce fuel consumption [SDAPCD](A) 4. 0.2 lb/MMBtu, natural gas firing [BAAQMD] 5. Natural gas fuel [SMAQMD]
SOx	<u>For Coffee Roasters < 110,000 Btu/hr</u> 1. Natural gas fuel [SMAQMD, SCAQMD, SDAPCD, BAAQMD] <u>For Coffee Roasters 110,000 Btu/hr to 3.5 MMBtu/hr</u> 1. Natural gas fuel [SMAQMD, SCAQMD, SDAPCD, BAAQMD]
PM10	<u>For Coffee Roasters < 110,000 Btu/hr</u> 1. Natural gas with cyclone and afterburner (≥ 0.3 second retention time at **1200 °F**) [SDAPCD] 2. Cyclone and natural gas fuel [SMAQMD] 3. Natural gas fuel [SCAQMD] <u>For Coffee Roasters 110,000 Btu/hr to 3.5 MMBtu/hr</u> 1. 0.01 gr/dscf, natural gas with cyclone and afterburner (≥0.3 second retention time at **1400 °F**) [BAAQMD] 2. Natural gas with cyclone and afterburner (≥0.3 second retention time at **1200 °F**) [SCAQMD, SDAPCD] 3. Cyclone and natural gas fuel [SMAQMD]

SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES	
Pollutant	**Control Technology**
PM2.5	For Coffee Roasters < 110,000 Btu/hr 1. Cyclone and natural gas fuel [SMAQMD] For Coffee Roasters 110,000 Btu/hr to 3.5 MMBtu/hr 1. Cyclone and natural gas fuel [SMAQMD]
CO	For Coffee Roasters < 110,000 Btu/hr 1. 0.6 lb/MMBtu [SMAQMD, Rule 419] 2. Natural gas fuel and good combustion practices [SMAQMD] For Coffee Roasters 110,000 Btu/hr to 3.5 Btu/hr 1. 0.4 lb/MMBtu, good combustion practice [BAAQMD] 2. 0.6 lb/MMBtu [SMAQMD, Rule 419] 3. Natural gas fuel and good combustion practices [SMAQMD]
HAP/VHAP (T-BACT)	For Coffee Roasters < 110,000 Btu/hr 1. Afterburner (0.3 second retention time at ≥1200 °F); or catalytic afterburner (≥ 550 °F) [BAAQMD] 2. Natural gas firing with baghouse and afterburner (≥0.3 second retention time at ≥1400 °F) [BAAQMD]

(A) SDAPCD has a BACT trigger level of 10 lbs/day. In order to emit 10 lbs/day of NOx a burner would need to be 4.3 MMBtu/hr, assuming the uncontrolled small boiler NOx emission factor from AP-42, Table 1.4-1 and 24 hrs/day of operation.

BACT for Coffee Roasters 110,000 Btu/hr to 3.5 MMBtu/hr Discussion:

BAAQMD lists emission standards for VOC, NOx, PM10, and CO. However, due to BAAQMD's BACT trigger level of 10 lbs/day only industrial sized facilities trigger these standards. BAAQMD BACT requirements were based on roaster permits for Peet's Coffee and Tea Inc., which have throughputs of 2,200 lbs beans/hr and 3.5 MMBtu/hr burners. Non-industrial roasters have typical throughputs of around 100-600 lbs/hr and burner ratings of 50,000-600,000 btu/hr, based on 12-60 kg capacity roasters. Most permitted coffee roasters in BAAQMD's size category of 110,000 BTU/hr to 3.5 MMBtu/hr have not been source tested to confirm these standards and therefore the emission standards are not considered achieved in practice. However, for the associated control technology are used by almost all roasters and can be considered BACT as these technologies have been achieved in practice.

SDAPCD lists heat recovery on afterburner exhaust to reduce fuel consumption as BACT for NOx. However, due to SDAPCD's BACT trigger level of 10 lbs/day only industrial sized facilities trigger these standards. In order to emit 10 lbs/day of NOx a burner would need to be 4.3 MMBtu/hr and operate 24 hrs/day, assuming the uncontrolled small boiler NOx emission factor from AP-42. Therefore, heat recovery on afterburner exhaust won't be considered achieved in practice for this BACT category of roasters ≤ 3.5 MMBtu/hr.

The following control technologies have been identified as the most stringent, achieved in practice control technologies:

BEST CONTROL TECHNOLOGIES ACHIEVED		
Pollutant	**Standard**	**Source**
VOC	<u>For Coffee Roasters < 110,000 Btu/hr</u> 1. ≥ 90% control efficiency, Afterburner (≥0.3 second retention time at **1200 °F**)	SMAQMD, SDAPCD
	<u>For Coffee Roasters 110,000 Btu/hr to 3.5 MMBtu/hr</u> 1. ≥ 90% control efficiency, lb/ton of beans roasted, afterburner (≥0.3 second retention time at ≥**1400 °F**)	SMAQMD, BAAQMD
NOx	<u>For Coffee Roasters < 110,000 Btu/hr</u> 1. Natural gas fuel	SMAQMD
	<u>For Coffee Roasters 110,000 Btu/hr to 3.5 MMBtu/hr</u> 1. For units ≥ 325,000 BTU/hr: 40 ppm NOx at 3% O_2 or 0.049 lb/MMBtu for **roaster burners** < 500°F, 60 ppm NOx at 3% O_2 or 0.073 lb/MMBtu for **roaster burners** ≥ 500 °F 2. For units ≥ 325,000 BTU/hr: 60 ppm NOx at 3% O_2 or 0.073 lb/MMBtu for **afterburners, thermal oxidizers, catalytic oxidizers, and vapor incinerators**	SMAQMD, SCAQMD
SOx	<u>For Coffee Roasters < 110,000 Btu/hr</u> 1. Natural gas fuel	SMAQMD, SCAQMD, SDAPCD, BAAQMD
	<u>For Coffee Roasters 110,000 Btu/hr to 3.5 MMBtu/hr</u> 2. Natural gas fuel	SMAQMD, SCAQMD, SDAPCD, BAAQMD
PM10	<u>For Coffee Roasters < 110,000 Btu/hr</u> 1. Natural gas with cyclone and afterburner (≥0.3 second retention time at **1200 °F**)	SDAPCD
	<u>For Coffee Roasters 110,000 Btu/hr to 3.5 MMBtu/hr</u> 1. Natural Gas with cyclone and afterburner (≥0.3 second retention time at **1400 °F**)	BAAQMD
PM2.5	<u>For Coffee Roasters < 110,000 Btu/hr</u> 1. Cyclone and natural gas fuel	SMAQMD
	<u>For Coffee Roasters 110,000 Btu/hr to 3.5 MMBtu/hr</u> 1. Cyclone and natural gas fuel	SMAQMD
CO	<u>For Coffee Roasters < 110,000 Btu/hr</u> 1. Natural gas fuel and good combustion practices	SMAQMD
	<u>For Coffee Roasters 110,000 Btu/hr to 3.5 MMBtu/hr</u> 1. Natural gas fuel, and good combustion practices.	SMAQMD, BAAQMD

BEST CONTROL TECHNOLOGIES ACHIEVED		
Pollutant	**Standard**	**Source**
HAP/VHAP (T-BACT)	For Coffee Roasters < 110,000 Btu/hr 1. Afterburner (≥0.3 second retention time at ≥1200 °F); or catalytic afterburner (≥ 550 °F) 2. Natural gas firing with baghouse and afterburner (≥0.3 second retention time at ≥1400 °F)	BAAQMD

B. TECHNOLOGICALLY FEASIBLE AND COST EFFECTIVE (Rule 202, §205.1.b.):

Technologically Feasible Alternatives:

Any alternative basic equipment, fuel, process, emission control device or technique, singly or in combination, determined to be technologically feasible by the Air Pollution Control Officer.

The table below shows the technologically feasible alternatives identified as capable of reducing emissions beyond the levels determined to be "Achieved in Practice" as per Rule 202, §205.1.a.

Pollutant	Technologically Feasible Alternatives
VOC	No other technologically feasible option identified (A)
NOx	No other technologically feasible option identified
SOx	No other technologically feasible option identified
PM10	For Coffee Roasters < 110,000 Btu/hr (A) Baghouse and afterburner (≥0.3 sec retention time at ≥1400°F)
PM2.5	No other technologically feasible option identified
CO	For Coffee Roasters 110,000 Btu/hr to 3.5 MMBtu/hr 1. 0.1 lb/MMBtu, natural gas firing with use of heat exchangers [BAAQMD]

(A) BAAQMD lists an afterburner with a 0.3 retention time as technologically feasible for both VOC and PM10 for coffee roasters less than 110,000 Btu/hr. However, an afterburner with a 0.3 retention time for roasters less than 110,000 Btu/hr is considered achieved in practice by SMAQMD and SDAPCD BACT determinations.

Cost Effective Determination:

After identifying the technologically feasible control options, a cost analysis is performed to take into consideration economic impacts for all technologically feasible controls identified.

Maximum Cost per Ton of Air Pollutants Controlled

1. A control technology is considered to be cost-effective if the cost of controlling one ton of that air pollutant is less than the limits specified below (except coating

operations):

Pollutant	Maximum Cost ($/ton)
ROG	17,500
NO_X	24,500
PM10	11,400
SO_X	18,300
CO	TBD if BACT triggered

Cost Effectiveness Analysis Summary

The cost analysis was processed in accordance with the EPA OAQPS Air Pollution Control Cost Manual (Sixth Edition). The sales tax rate was based on the District's standard rate of 8.5% as approved on 10/17/16. The electricity (13.8 cents/kWh) rates were based on a commercial application as approved by the District on 10/17/16. The life of the equipment was based on the EPA cost manual recommendation. The interest rate was based on the previous 6-month average interest rate on United States Treasury Securities (based on the life of the equipment) and addition of two percentage points and rounding up to the next higher integer rate. The labor (Occupation Code 51-3091: Food and Tobacco Roasting, Baking, and Drying Machine Operators and Tenders) and maintenance (Occupation Code 49-9099: Installation, maintenance, and repair workers, all other) rates were based on data from the Bureau of Labor Statistics.

Baghouse:

Equipment Life = 20 years

Total Capital Investment = $11,680.84

Direct Annual Cost = $8,106.54 per year

Indirect Annual Cost = $5,873.19 per year

Total Annual Cost = $13,979.74 per year

PM10 Removed = 0.31 tons per year

Cost of PM10 Removal = $45,060.32 per ton reduced

A detailed calculation of the cost effectiveness for PM10 removal with a baghouse is shown in Attachment B. As shown above, the cost of venting the emissions to a baghouse is not cost effective.

CO BACT

BACT for CO is not triggered for this type of source and would only be triggered for extremely large process rates. Therefore, a cost effective analysis for BAAQMD's CO BACT for roasters between ≥ 110,000 Btu/hr to 3.5 MMBtu/hr won't be evaluated for this BACT determination. BAAQMD identified 0.1 lb/MMBtu and natural gas firing with use of heat exchangers as technologically feasible.

The CO BACT trigger for SMAQMD is emissions greater than 550 lb/day. At 3.5 MMBtu/hr and a CO emission factor of 295.5 lb/MMcf (400 ppm CO), the worst case natural gas combustion emissions for 24 hours of operation would be 24.8 lbs CO per day. The CO emissions of a continuous roaster per AP-42 is 1.5 lb/ton coffee roasted. If a roaster operated for 24 hours, in order to trigger BACT for CO a roaster would need to process at least 350

tons of coffee beans per day. Therefore, it is highly unlikely that any coffee roasting source of this size would trigger BACT for CO. If BACT for CO is ever triggered for a coffee roaster, a new BACT will be made at that time.

C. SELECTION OF BACT:

Based on the cost effectiveness determinations, BACT for NOx will remain at what is currently achieved in practice and BACT for PM2.5 will be set to be the same as for PM10 (use of natural gas).

BACT # 141 FOR COFFEE ROASTERS < 110,000 BTU/HR		
Pollutant	**Standard**	**Source**
VOC	≥ 90% control efficiency, Afterburner (≥0.3 second retention time at **1200 °F**) or equivalent technology	SMAQMD SDAPCD
NOx	Natural gas fuel	SCAQMD
SOx	Natural gas fuel	SMAQMD, SCAQMD, SDAPCD, BAAQMD
PM10	Natural gas fuel with cyclone and afterburner (0.3 second retention time at **1200 °F**) or equivalent technology	SDAPCD
PM2.5	Cyclone and natural gas fuel	SMAQMD
CO	Natural gas fuel and good combustion practices	SMAQMD

BACT # 184 FOR COFFEE ROASTERS 110,000 BTU/HR to 3.5 MMBTU/HR		
Pollutant	**Standard**	**Source**
VOC	≥ 90% control efficiency, afterburner (≥0.3 second retention time at **≥1400 °F**) or equivalent technology	SMAQMD, BAAQMD
NOx	1. For units ≥ 325,000 BTU/hr: 40 ppm NOx at 3% O_2 or 0.049 lb/MMBtu **for roaster burners < 500 °F**, 60 ppm NOx at 3% O_2 or 0.073 lb/MMBtu **for roaster burners ≥ 500 °F** 2. For units ≥ 325,000 BTU/hr: 60 ppm NOx at 3% O_2 or 0.073 lb/MMBtu **for afterburners, thermal oxidizers, catalytic oxidizers, and vapor incinerators**	SMAQMD, SCAQMD
SOx	Natural gas fuel	SMAQMD, SCAQMD, SDAPCD, BAAQMD
PM10	Natural gas with cyclone and afterburner (≥0.3 second retention time at **1400 °F**) or equivalent technology	BAAQMD
PM2.5	Cyclone and natural gas fuel	SMAQMD
CO	Natural gas fuel and good combustion practices	SMAQMD, BAAQMD

D. SELECTION OF T-BACT:

The toxics at issue with this technology are VOCs. The control of VOCs through meeting the BACT standard will also control toxics found in the VOCs. Therefore, the BACT VOC controls are also the T-BACT controls.

APPROVED BY: Brian F Kuhl **DATE:** 9-4-19

Attachment A

BACT Determinations form SMAQMD, SCAQMD, SDAPCD, & BAAQMD

REPLACED

SMAQMD BACT CLEARINGHOUSE

CATEGORY: **COFFEE ROASTER**

BACT Size: Minor Source BACT

COFFEE ROASTER W/ AFTERBURNER

BACT Determination Number:	100	**BACT Determination Date:**	**1/30/2015**

Equipment Information

Permit Number: N/A -- Generic BACT Determination

Equipment Description: COFFEE ROASTER W/ AFTERBURNER

Unit Size/Rating/Capacity: Minor Source BACT

Equipment Location:

BACT Determination Information

ROCs	**Standard:**	≥90% control efficiency
	Technology Description:	Use of afterburner or catalytic after burner and ≥0.3 second retention time at 1200°F, to be reached in the final 5 minutes of the roast.
	Basis:	Achieved in Practice
NOx	**Standard:**	
	Technology Description:	Natural Gas Fuel
	Basis:	Achieved in Practice
SOx	**Standard:**	
	Technology Description:	Natural Gas Fuel
	Basis:	Achieved in Practice
PM10	**Standard:**	
	Technology Description:	Cyclone and Natural Gas Fuel
	Basis:	Achieved in Practice
PM2.5	**Standard:**	
	Technology Description:	Cyclone and Natural Gas Fuel
	Basis:	Achieved in Practice
CO	**Standard:**	
	Technology Description:	Natural gas fuel and good combustion practices
	Basis:	Achieved in Practice
LEAD	**Standard:**	
	Technology Description:	
	Basis:	

Comments: This is a generic BACT determination based on BACT determinations made, and published, by other air agencies in California and/or other States.

SCAQMD

10-20-2000 Rev. 0
2-1-2019 Rev. 1

Equipment or Process: Coffee Roasting

	Criteria Pollutants					
Subcategory/ Rating/Size	**VOC**	**NOx**	**SOx**	**CO**	**PM_{10}**	**Inorganic**
Roaster, < 110,000 BTU/Hr		Compliance with Rule 1147 (2-1-2019)	Natural Gas (1988)		Natural Gas (1988)	
Roaster, ≥ 110,000 BTU/Hr	Afterburner (0.3 Sec Retention Time at 1200 °F) (1990)	Compliance with Rule 1147 (2-1-2019)	Natural Gas (1990)		Natural Gas with Cyclone and Afterburner (≥ 0.3 Second Retention Time at ≥ 1200 °F) (1990)	
Handling Equipment, < 1,590 Lbs/Hr All[1]						
Handling Equipment, ≥ 1,590 Lbs/Hr All					Cyclone (1990)	

1) At the date of the last revision for this category, there was no Achieved In Practice BACT Determination for this subcategory. Technologically Feasible options listed in historic SCAQMD BACT Guidelines for this subcategory require cost effective analyses before they can be listed in these current Guidelines.

SDAPCD

COFFEE ROASTERS
Fee Schedule 50A

Review the BACT Control Option listed below. The applicant must propose the Control Option listed or perform a Top-down BACT Analysis as described in Section 4 to justify the selection of another Control Option. The applicant will be required to provide documentation that the Control Option selected meets the requirements listed in the table.

	VOC	NOx	SOx	PM
BACT Emission Rate Limit	Not Determined	Not Determined	Not Determined	Not Determined
BACT Control Option	Afterburner (0.3 sec retention time at 1200 degrees F	Natural gas with heat recovery on afterburner exhaust to reduce fuel consumption (A/P)	Natural gas (A/P)	Natural gas with cyclone and afterburner (0.3 sec retention time at 1200 degrees F (A/P)

The applicant may choose to limit the Potential to Emit (PTE) from the equipment to less than 10 pounds per day for each pollutant in lieu of meeting the stated BACT requirement.

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
Best Available Control Technology (BACT) Guideline

Source Category

Source:	*Coffee Roasting*	Revision:	*2*
		Document #:	*47.1.1*
Class:	*< 110,000 Btu/hr*	Date:	*03/03/92*

Determination

POLLUTANT	BACT 1. Technologically Feasible/ Cost Effective 2. Achieved in Practice	TYPICAL TECHNOLOGY
POC	1. *Afterburner (≥0.3 sec. retention time at ≥1200°F); or catalytic afterburner (≥550°F)*[a,b,T] 2. *n/d*	1. *BAAQMD Approved Design and Operation*[b] 2. *n/d*
NOx	1. *Natural gas firing with combustion modifications*[a,b] 2. *Natural gas firing*[a,b]	1. *BAAQMD Approved Design and Operation*[b] 2. *Fuel Selection*[b]
SO_2	1. *Natural gas firing*[b] 2. *Natural gas firing*[b]	1. *Fuel Selection*[b] 2. *Fuel Selection*[b]
CO	1. *n/d* 2. *n/s*	1. *n/d* 2. *Good Combustion Practice*[b]
PM_{10}	1. *Natural gas firing with baghouse and afterburner (≥ 0.3 sec retention time at ≥1400°F)*[a,b,T] 2. Natural gas firing with cyclone[b]	1. *BAAQMD Approved Design and Operation*[b] 2. *BAAQMD Approved Design and Operation*[b]
NPOC	1. *n/a* 2. *n/a*	1. *n/a* 2. *n/a*

References

a. SCAQMD Guideline
b. BAAQMD
T. TBACT

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
Best Available Control Technology (BACT) Guideline

Source Category

Source:	*Coffee Roasting*	Revision:	*1*
		Document #:	*47.3.1*
Class:	*110,000 BTU/hr to 3.5 MM BTU/hr*	Date:	*4/2/08*

Determination

POLLUTANT	BACT 1. Technologically Feasible/ Cost Effective 2. Achieved in Practice	TYPICAL TECHNOLOGY
POC	1. *n/d* 2. *0.047 lb/ton of beans roasted*	1. *n/d* 2. *Afterburner (≥0.3 sec. retention time at ≥1400°F)*[a]
NOx	1. *n/d* 2. *0.2 lb/MMBTU*[a]	1. *n/d* 2. *Natural Gas Firing*[a]
SO_2	1. *Natural gas firing*[a] 2. *Natural gas firing*[a]	1. *Fuel Selection*[a] 2. *Fuel Selection*[a]
CO	1. *0.1 lb/MMBTU* 2. *0.4 lb/MMBTU*	1. *Natural Gas Firing & Use of Heat Exchangers*[a] 2. *Good combustion practice*[a]
PM_{10}	1. *n/d* 2. *0.01 gr/dscf*[a]	1. *n/d* 2. *Natural gas firing with cyclone and afterburner (≥ 0.3 sec retention time at ≥1400°F)*[a]
NPOC	1. *n/a* 2. *n/a*	1. *n/a* 2. *n/a*

References

a. *BAAQMD Application # 13807 & 15187*

Attachment B

Cost Effectiveness Determination for Baghouse

COST EFFECTIVENESS ANALYSIS FOR BAGHOUSE		
This cost effectiveness analysis was performed using EPA's OAQPS Control Cost Manual		
EPA publication No. 452/B-02-001, Chapter 1, Baghouses and Filters (12/98)		
FACILITY NAME:	Temple	
LOCATION:	2827 S St., Sacramento	
PERMIT NO.:	25127	
EQUIPMENT DESCRIPTION:	Coffee Roaster	
PM10 Baghouse Cost Effective Requirements		
Coffee beans processed	546.5	lb/hr
PM10 Emission Factor	1.114	lb/ton
PM Emission Rate	0.304	lb/hr
Hours per day	8	
Days per week	5	
Weeks per year	52	
PM emission from coffee roasting operation	0.31657652	tons/year
Baghouse Control Efficiency	98%	
Controlled PM Emissions	0.31	tons/year
CRF (5% interest and 20 year life)	0.080242587	
Particulate Matter Control (Bag House) Cost Analysis		
Gas to cloth ratio for shaker or reverse air bag house	2.8	Table 1.1
A	15	Table 1.4
B	1	Table 1.4
L	0.1	
D	10	
V	11.11956286	equation 1.11
acfm of system	900	acfm
Bag Size	80.93843355	ft^2

Cost of Bag house common housing design	$ 2,886.76	
Cost of insulation	$ 1,221.49	
Cost of bag (Pulse jet, BBR - fiberglass, Table 1.8), bottom bag removal	$ 136.79	
Bag house cages	$ 6.03	
cage cost	$ 12.23	$/cage
Total cage costs	$ 73.76	
Equipment Costs (A)	$ 4,318.80	
Instrumentation	$ 431.88	0.10*A
California Sales taxes	$ 367.10	0.085*A
Freight	$ 215.94	0.05*A
Purchase Equipment Cost (**PEC**)	$ 5,333.72	
Direct Installation Costs		
Foundation & Supports	$ 213.35	0.04*PEC
Handling & erection	$ 2,666.86	0.50*PEC
Electrical	$ 426.70	0.08*PEC
Piping	$ 53.34	0.01*PEC
Insulation for ductwork	$ 373.36	0.07*PEC
Painting	$ 213.35	0.04*PEC
Total direct installation costs	$ 3,946.95	
Indirect Costs (installation)		
Engineering	$ 533.37	0.10*PEC
Construction and field expense	$ 1,066.74	0.20*PEC
Contractor fees	$ 533.37	0.10*PEC
Startup-up	$ 53.34	0.01*PEC
Performance test	$ 53.34	0.01*PEC
Contingencies	$ 160.01	0.03*PEC
Total indirect installation costs	$ 2,400.17	

Total Capital Investment (TCI) (PEC+DC+IC)	$11,680.84	
Direct Annual Costs		
Operating Labor	$2,011.10	(.5 hr/shift) (1 shift/8 hrs)(2080 hrs/yr)*$15.47
Supervisor	$301.67	15% of operating Labor
Maintenance Labor	$2,567.50	(.5 hr/shift) (1 shift/8 hrs)(2080 hrs/yr)*$19.75
Material	$2,567.50	100% of maintenance labor
Bag replacement labor	$0.19	$/ft2 of bag area
CRF for bags (5% interest and 2 year life)	0.54	
Replacement Parts, Bags	$123.45	equation 1.13
Electricity	$467.59	(0.000181)(900 acfm)(10 in H2O)(2080 hr/yr)($0.138 kW/h)
Compressed Air	$56.16	(2scfm/1000acfm)*900cfm*($0.25/1000scf)*(60min/hr)*(2080hr/year)
Waste Disposal	$10.86	$35/ton
Total Annual DC	$8,106.54	
Indirect Annual Costs		
Overhead	$4,468.66	60% of total labor and material
Admin charges	$233.62	2% of TCI
Property Tax	$116.81	1% of TCI
Insurance	$116.81	1% of TCI
Capital Recovery	$937.30	
Total Annual IC	$5,873.19	
Total Annual Costs (DAC + DIC)	$13,979.74	
TAC/tons controlled	**$45,060.32**	