

SMAQMD BACT CLEARINGHOUSE

CATEGORY Type:

BOILER/HEATER > 5 MMBTU

BACT Category: 5 MMBtu/hr to 20 MMBtu/hr

BACT Determination Number: 283	BACT Determination Date: 9/7/2021
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Equipment Information

Permit Number: N/A -- Generic BACT Determination
Equipment Description: BOILER
Unit Size/Rating/Capacity: Small Emitter BACT (PTE < 10 lb/day)
Equipment Location:

EXPIRED

BACT Determination Information

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

ROCs	Standard:	
	Technology Description:	Good combustion practice and natural gas or LPG fuel
	Basis:	Achieved in Practice
NOx	Standard:	
	Technology Description:	For firetube boilers: 7 ppm at 3% O2 or 0.0085 lbs/106 Btu, Non-atmospheric units: 9 ppmvd at 3% O2 or 0.0085 lbs/106 Btu, Atmospheric units and thermal fluid heaters: 12 ppmvd at 3% O2 or 0.015 lbs/106 Btu
	Basis:	Achieved in Practice
SOx	Standard:	
	Technology Description:	Good combustion practice and natural gas or LPG fuel
	Basis:	Achieved in Practice
PM10	Standard:	
	Technology Description:	Good combustion practice and natural gas or LPG fuel
	Basis:	Achieved in Practice
PM2.5	Standard:	
	Technology Description:	Good combustion practice and natural gas or LPG fuel
	Basis:	Achieved in Practice
CO	Standard:	
	Technology Description:	Firetube Boilers: 50 ppmvd at 3% O2, Watertube Boilers: 100 ppmvd at 3% O2
	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.



BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

EXPIRED

DETERMINATION NO.:	283
DATE:	9/7/21
ENGINEER:	Jeffrey Quok

Category/General Equip Description:	Boiler/Heater – Natural Gas or LPG Fired
Equipment Specific Description:	#283 – Boiler/heater greater or equal to 5 MMBtu/hr and less than or equal to 20 MMBtu/hr
Equipment Size/Rating:	Small Emitter Source
Previous BACT Det. No.:	157, 177, 185, & 186

This BACT determination will update Determinations #157, 177, 185, & 186 for boilers/heaters greater or equal to 5 MMBtu/hr and less than or equal to 20 MMBtu/hr. Boilers include any external combustion equipment fired used to produce hot water or steam, excluding waste heat recovery boilers. Process heaters include any unit which transfers heat from combustion gases to water or process streams, including reformers. Process heaters do not include any dryer in which the material being dried is in direct contact with the products of combustion, cement or lime kilns, glass melting furnaces, or smelters.

The District's Small Emitter and "Otherwise-Exempt Equipment" BACT Determinations policy states that units which are classified as small emitters (less than 10 lbs/day of VOC, NO_x, SO_x, PM₁₀, or PM_{2.5} and less than 550 lbs/day of CO) and are located at non-major stationary sources are only required to meet BACT standards that have been achieved in practice. Therefore, this BACT determination will only be based on what is achieved in practice and will be only applied to small emitters at non-major sources. BACT will be evaluated on a case-by-case basis for units that do not fit this criteria.

BACT ANALYSIS

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

The following control technologies are currently employed as achieved in practice or meeting BACT for boilers/heaters greater or equal to 5 and less than or equal to 20 MMBTU/hr by the following air pollution control districts and agencies:

US EPA

BACT:

Source: [EPA RACT/BACT/LAER Clearinghouse](#)
 RBLC ID: [FL-0356 \(3/9/16\)](#), [FL-0364 \(3/21/18\)](#), [MI-0420 \(6/3/16\)](#) & [OH-0379 \(2/6/19\)](#)

For units with a rating of 5 to ≤ 20 MMBtu/hr	
VOC	0.005 lb/MMBtu ^(A) [FL-0364]
NOx	0.0418 lb/MMBtu (34.5 ppm NOx @ 3% O ₂) [OH-0379]
SOx	2.0 gr.s/100 scf gas ^(B) [FL-0356]
PM10	0.113 lb/hr (0.0075 lb/MMBtu) ^(C) [OH-0379]
PM2.5	0.113 lb/hr (0.0075 lb/MMBtu) ^(C) [OH-0379]
CO	0.08 lb/MMBtu (108 ppmvd @ 3% O ₂) [MI-0420]

- (A) Based on AP-42 emission factor.
- (B) Control technology listed as use of low-sulfur fuel.
- (C) AP-42 emission factor is equal at 0.0075 lb/MMBtu. Control technology listed as good combustion practices and natural gas fuel.

RULE REQUIREMENTS:

[40 CFR 60 Subpart Dc – Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units](#)

This regulation applies to steam generating units rated at between 10-100 MMBtu/hr. However, no standards within the subpart are applicable to units fired by natural gas or LPG only. Therefore, this NSPS is not applicable.

California Air Resources Board (CARB)

BACT:

Source: [ARB BACT Clearinghouse](#)
[Application #413617 \(7-11-03\) SCAQMD](#)

For firetube boiler with a rating of 10 MMBtu/hr	
VOC	No Standard
NOx	12 ppmvd corrected to 3% O ₂
SOx	No Standard
PM10	No Standard
PM2.5	No Standard
CO	50 ppmvd corrected to 3% O ₂

RULE REQUIREMENTS:

None.

Sacramento Metropolitan AQMD

BACT:

Source: [SMAQMD BACTs #157, 177, 185, & 186](#)

BACT #157 for Boilers ≥ 5 and ≤ 10 Mmbtu/Hr at $\leq 50\%$ Annual Capacity (50% Capacity = 4,380 hours/year)	
VOC	Good combustion practice and natural gas or LPG fuel
NOx	9 ppmvd at 3% O ₂ , low NOx burner
SOx	Good combustion practice and natural gas or LPG fuel
PM10	Good combustion practice and natural gas or LPG fuel
PM2.5	Good combustion practice and natural gas or LPG fuel
CO	Firetube Boilers: 50 ppmvd corrected to 3% O ₂ Watertube Boilers: 100 ppmvd corrected to 3% O ₂

BACT #177 for Boilers ≥ 5 and ≤ 10 Mmbtu/Hr at $> 50\%$ Annual Capacity (50% Capacity = 4,380 hours/year)	
VOC	Good combustion practice and natural gas
NOx	7 ppmvd at 3% O ₂ , Ultra Low NOx burner
SOx	Good combustion practice and natural gas
PM10	Good combustion practice and natural gas
PM2.5	Good combustion practice and natural gas
CO	Firetube Boilers: 50 ppmvd corrected to 3% O ₂ Watertube Boilers: 100 ppmvd corrected to 3% O ₂

BACT #185 for Boilers > 10 and ≤ 20 Mmbtu/Hr at $\leq 30\%$ Annual Capacity (30% Capacity = 2,592 hours/year)	
VOC	Good combustion practice and natural gas or LPG fuel
NOx	9 ppmvd at 3% O ₂ , low NOx boiler
SOx	Good combustion practice and natural gas or LPG fuel
PM10	Good combustion practice and natural gas or LPG fuel
PM2.5	Good combustion practice and natural gas or LPG fuel
CO	Firetube Boilers: 50 ppmvd corrected to 3% O ₂ Watertube Boilers: 100 ppmvd corrected to 3% O ₂

BACT #186 for Boilers > 10 and ≤ 20 Mmbtu/Hr at > 30% Annual Capacity (30% Capacity = 2,592 hours/year)	
VOC	Good combustion practice and natural gas
NOx	7 ppmvd at 3% O ₂ , Ultra Low NOx burner
SOx	Good combustion practice and natural gas
PM10	Good combustion practice and natural gas
PM2.5	Good combustion practice and natural gas
CO	Firetube Boilers: 50 ppmvd corrected to 3% O ₂ Watertube Boilers: 100 ppmvd corrected to 3% O ₂

RULE REQUIREMENTS:

Rule 411 – NOx from Boilers, Process Heaters, and Steam Generators (8-23-2007)

For units with a rating of ≥ 5 and ≤ 20 MMBTU/hr, emissions shall not exceed the following levels:

1. 15 ppmvd of NOx corrected to 3% O₂
2. 400 ppmvd of CO corrected to 3% O₂

South Coast AQMD

BACT:

Source: [SCAQMD BACT Guidelines for Non-Major Polluting Facilities, page 14](#) (2/1/19)

For Natural Gas Fired Units with a Rating > 2 and < 20 MMBtu/hr	
VOC	No Standard
NOx	Compliance with SCAQMD Rules 1146 or 1146.1 (see below)
SOx	Use of natural gas
PM10	Use of natural gas
PM2.5	No standard
CO	Firetube Boiler: 50 ppmvd corrected to 3% O ₂ Watertube Boiler: 100 ppmvd corrected to 3% O ₂

For Propane Fired Units with a Rating > 2 and < 20 MMBtu/hr	
VOC	No Standard
NOx	12 ppmvd corrected to 3% O ₂
SOx	No Standard
PM10	No Standard
PM2.5	No standard
CO	Firetube Boiler: 50 ppmvd corrected to 3% O ₂ Watertube Boiler: 100 ppmvd corrected to 3% O ₂

For Atmospheric^(A) Units with a Rating ≥ 2 and ≤ 10 MMBtu/hr	
VOC	No Standard
NOx	Compliance with SCAQMD Rules 1146 and 1146.1 (12 ppm corrected to 3% O ₂ or 0.015 lbs/10 ⁶ BTU)
SOx	No Standard
PM10	No Standard
PM2.5	No standard
CO	Compliance with SCAQMD Rules 1146 and 1146.1 (400 ppm corrected to 3% O ₂ or 0.3 lbs/10 ⁶ BTU)

(A) Atmospheric unit is defined as natural gas fired unit with a heat input less than or equal to 10 million Btu per hour with a non-sealed combustion chamber in which natural draft is used to exhaust combustion gases.

RULE REQUIREMENTS:

[Reg XI, Rule 1146 – Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters \(12-4-2020\)](#)

Requirements Table 1146-1

Category	NOx Limitv for Units ≥ 5 MMBTU/hr
Atmospheric Units	12 ppmvd @ 3% O ₂ or 0.015 lbs/10 ⁶ BTU
Group III Units ^(A) (Fire-tube boilers, excluding units with a previous NOx limit less than or equal to 12 ppm and greater than 9 ppm prior to 12/7/18)	7 ppm @ 3% O ₂ or 0.0085 lbs/10 ⁶ Btu
Group III Units ^(A) (All Others)	9 ppm @ 3% O ₂ or 0.011 lbs/10 ⁶ Btu
Thermal Fluid Heaters	12 ppm @ 3% O ₂ or 0.015 lbs/10 ⁶ Btu

(A) GROUP III UNIT means any unit burning gaseous fuels, excluding digester and landfill gases, with a rated heat input less than 20 million Btu per hour down to and including 5 million Btu per hour, and all units operated at schools and universities greater than or equal to 5 million Btu per hour, excluding atmospheric units and thermal fluid heaters.

(B) Atmospheric unit is defined as any natural gas fired unit with a heat input less than or equal to 10 million Btu per hour with a non-sealed combustion chamber in which natural draft is used to exhaust combustion gases.

All units rated > 5 MMBtu/hr must have CO emissions ≤ 400 ppmvd @ 3% O₂

San Diego County APCD

BACT

Source: [NSR Requirements for BACT, page 3-5](#) (6/2011)

For boilers with a rating of less than 50 MMBtu/hr	
VOC	NG or LPG fuel (If using NG or LPG fuel)
NOx	1. 9 ppmvd corrected to 3% O ₂ 2. Low NOx burner, FGR, and oxygen controller (If using NG or LPG fuel) 3. Low NOx burner, FGR, and oxygen controller (If using No. 2 oil as a backup fuel)
SOx	1. NG or LPG fuel (If using NG or LPG fuel) 2. No. 2 fuel oil with <0.05% sulfur content (If using No. 2 oil as a backup fuel)
PM10	1. 0.10 gr/dscf (verified by use of NG or LPG fuel) 2. NG or LPG fuel (If using NG or LPG fuel) 3. Low ash fuel (If using No. 2 oil as a backup fuel)
PM2.5	No standard
CO	No standard

RULE REQUIREMENTS:

[Regulation 4, Rule 69.2 – Industrial and Commercial Boilers, Process Heaters and Steam Generators \(9-27-1994\)](#)

For any unit with a heat input rating less than or equal to 50 million Btu/hr and an annual heat input of 220,000 therms or more, or for any unit with a heat input rating greater than 50 million Btu/hr and an annual capacity factor 10% or greater, emissions shall not exceed the following levels:

1. 30 ppmvd of NOx when operated on a gaseous fuel, corrected to 3% O₂
2. 40 ppmvd of NOx when operated on a liquid fuel, corrected to 3% O₂
3. 400 ppmvd of CO corrected to 3% O₂

Bay Area AQMD

BACT

Source: [BAAQMD BACT Guideline 17.1.1](#) (8/4/10)

For Boilers with a Rating of 5 MMBtu/hr to Less than 33.5 MMBtu/hr	
VOC	Good combustion practice
NOx	Low NOx burners + flue gas recirculation
SOx	Natural gas or treated refinery gas fuel with ≤100 ppmv total reduced sulfur
PM10	Natural gas or treated refinery gas fuel
PM2.5	No standard

For Boilers with a Rating of 5 MMBtu/hr to Less than 33.5 MMBtu/hr	
CO	Firetube Boilers: 50 ppmvd corrected to 3% O ₂ Watertube Boilers: 100 ppmvd corrected to 3% O ₂

RULE REQUIREMENTS:

[Regulation 9, Rule 7 – Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters \(5-4-2011\)](#)

For units with a rating of greater than 5 MMBtu/hr and less than 20 MMBtu/hr:

1. NO_x limit of 15 ppmvd corrected to 3% O₂
2. CO limit of 400 ppmvd corrected to 3% O₂

For units with a rating of 20 MMBtu/hr and less than 75 MMBtu/hr:

1. NO_x limit of 9 ppmvd corrected to 3% O₂
2. CO limit of 400 ppmvd corrected to 3% O₂

San Joaquin Valley APCD

BACT

Source: [SJVUAPCD BACT Guideline \(Rescinded\)](#)

The boiler BACT determinations listed in the SJVAPCD Clearinghouse have been rescinded.

RULE REQUIREMENTS:

[Rule 4306 – Boilers, Steam Generators, and Process Heaters – Phase 3 \(12-17-2020\)](#)

For units > 5.0 MMBtu/hr to ≤ 20 MMBtu/hr until December 30, 2023

1. 9 ppm of NO_x corrected to 3% O₂
2. 400 ppm of CO corrected to 3% O₂

For units > 5.0 MMBtu/hr to ≤ 20 MMBtu/hr on and after December 30, 2023

1. 7 ppm of NO_x corrected to 3% O₂ for fire tube boilers
2. 9 ppm of NO_x corrected to 3% O₂
2. 400 ppm of CO corrected to 3% O₂

Units rated at 5 MMBtu/hr (gross) or less are exempt from permit requirement per SJVAPCD [Rule 2020](#).

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

SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES	
VOC	1. Good combustion practice and natural gas or LPG fuel – [SMAQMD] 2. Good combustion practice – [BAAQMD] 3. 0.005 lb/MMBtu (Based on AP-42) [FL-0364] 4. NG or LPG fuel (If using NG or LPG fuel) – [SDCAPCD] 5. No standard – [SCAQMD, SJVAPCD]
NOx	1. For Firetube boilers: 7 ppm at 3% O ₂ or 0.0085 lbs/10 ⁶ Btu [SCAQMD, SJVAPCD] For Atmospheric Units or Thermal Fluid Heaters: 12 ppm at 3% O ₂ or 0.015 lbs/10 ⁶ Btu For all others: 9 ppm at 3% O ₂ or 0.0085 lbs/10 ⁶ Btu 2. 9 ppmvd at 3% O ₂ – [SMAQMD, SJVAPCD, SDCAPCD] 3. 15 ppmvd corrected to 3% O ₂ – [BAAQMD] 4. 0.0418 lb/MMBtu (34.5 ppmvd @ 3% O ₂) [US EPA, RBLIC ID:OH-0379] 5. Low NOx burner, FGR, and oxygen controller (If using NG or LPG fuel) – [SDCAPCD] 6. Low NOx burner, FGR, and oxygen controller (If using No. 2 oil as a backup fuel) – [SDCAPCD]
SOx	1. Good combustion practice and natural gas or LPG fuel [SMAQMD] 2. Use of natural gas or LPG fuel ^(A) (If using NG or LPG fuel) – [SCAQMD, SDCAPCD] 3. 2.0 grains/100 scf gas (use of low-sulfur fuel) [US EPA, RBLIC ID:FL-0356] 4. Natural gas or treated refinery gas fuel with ≤100 ppmv total reduced sulfur – [BAAQMD] 5. No. 2 fuel oil with <0.05% sulfur content (If using No. 2 oil as a backup fuel) – [SDCAPCD] 6. No standard – [SJVAPCD]
PM10	1. Good combustion practice and use of natural gas or LPG fuel – [SMAQMD] ^(A) 2. 0.10 gr/dscf (verified by use of NG or LPG fuel) – [SCAQMD, SDCAPCD] ^(B) 3. 0.113 lb/hr (0.0075 lb/MMBtu) lb/MMBtu [US EPA, RBLIC ID: OH-0379] ^(C) 4. Use of PUC-quality natural gas, commercial propane, butane, LPG, or a combination of such gases. [SJVAPCD] 5. Natural gas or treated refinery gas fuel – [BAAQMD] 6. Low ash fuel (If using No. 2 oil as a backup fuel) – [SDCAPCD]
PM2.5	1. Good combustion practice and use of natural gas or LPG fuel – [SMAQMD] ^(A) 2. 0.113 lb/hr (0.0075 lb/MMBtu) lb/MMBtu [US EPA, RBLIC ID: OH-0379] ^(C) 3. No standard – [SCAQMD, SDCAPCD, BAAQMD, & SJVAPCD]
CO	1. Firetube Boilers: 50 ppmvd corrected to 3% O ₂ – [SMAQMD, SCAQMD, & BAAQMD] Watertube Boilers: 100 ppmvd corrected to 3% O ₂ – [SMAQMD, SCAQMD, BAAQMD] 2. 0.08 lb/MMBtu (108 ppmvd @ 3% O ₂) [US EPA, RBLIC ID: MI-0420] ^(D) 3. 400 ppm of CO corrected to 3% O ₂ – [SDCAPCD, BAAQMD, & SJVAPCD]

(A) Pursuant to the SCAQMD's BACT Clean Fuel Guidelines, the use of LPG is equivalent to natural gas.
 (B) The 0.10 gr/dscf limit has not been demonstrated to be achieved in practice by source testing, it has only been assumed to be achievable by the use of natural gas or LPG. Therefore, the use of natural gas or LPG when natural gas is not available will be considered Achieved in Practice BACT.
 (C) Standard is equal to AP-42 natural gas boiler emission factor.
 (D) This BACT determination did not specify if the boiler was a firetube or watertube boiler.

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

BEST CONTROL TECHNOLOGIES ACHIEVED		
Pollutant	Standard	Source
VOC	Good combustion practice and natural gas or LPG fuel	SMAQMD (BACT)
NOx	For firetube boilers: 7 ppm at 3% O ₂ or 0.0085 lbs/10 ⁶ Btu Non-atmospheric units: 9 ppmvd at 3% O ₂ or 0.0085 lbs/10 ⁶ Btu Atmospheric units and thermal fluid heaters: 12 ppmvd at 3% O ₂ or 0.015 lbs/10 ⁶ Btu	SMAQMD (BACT), SCAQMD (Rule 1146), SJVAPCD (Rule 4306)
SOx	Good combustion practice and natural gas or LPG fuel	SMAQMD (BACT)
PM10	Good combustion practice and natural gas or LPG fuel	SMAQMD (BACT)
PM2.5	Good combustion practice and natural gas or LPG fuel	SMAQMD (BACT)
CO	Firetube Boilers: 50 ppmvd at 3% O ₂ Watertube Boilers: 100 ppmvd at 3% O ₂	SMAQMD (BACT), SCAQMD (BACT), BAAQMD (BACT)

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

The District’s Small Emitter and “Otherwise-Exempt Equipment” BACT Determinations policy (dated 5/16/2019) states that units which are classified as small emitters (less than 10 lbs/day of VOC, NOx, SOx, PM10, or PM2.5 and less than 550 lbs/day of CO) and are located at non-major stationary sources are only required to meet BACT standards that have been achieved in practice. Therefore, this BACT determination will only be based on what is achieved in practice and will only be applied to small emitters at non-major sources. BACT will be evaluated on a case-by-case basis for units that do not fit these criteria.

C: SELECTION OF BACT

Based on the above analysis, BACT for VOC, NO_x, SO_x, PM₁₀, PM_{2.5} and CO will be the most stringent standards of what is currently achieved in practice.

BACT #283 FOR BOILERS ≥ 5 AND ≤ 20 MMBTU/HR		
Pollutant	Standard	Source
VOC	Good combustion practice and natural gas or LPG fuel	SMAQMD (BACT)
NO _x	For firetube boilers: 7 ppm at 3% O ₂ or 0.0085 lbs/10 ⁶ Btu Non-atmospheric units: 9 ppmvd at 3% O ₂ or 0.0085 lbs/10 ⁶ Btu Atmospheric units and thermal fluid heaters: 12 ppmvd at 3% O ₂ or 0.015 lbs/10 ⁶ Btu	SMAQMD (current BACT), SCAQMD (Rule 1146)
SO _x	Good combustion practice and natural gas or LPG fuel	SMAQMD (BACT)
PM ₁₀	Good combustion practice and natural gas or LPG fuel	SMAQMD (BACT)
PM _{2.5}	Good combustion practice and natural gas or LPG fuel	SMAQMD (BACT)
CO	Firetube Boilers: 50 ppmvd at 3% O ₂ Watertube Boilers: 100 ppmvd at 3% O ₂	SMAQMD (BACT), SCAQMD (BACT), BAAQMD (BACT)

D: SELECTION OF T-BACT:

Toxics are in the form of VOCs and particulate matter. Since toxic emissions from natural gas fired boilers in the 5 MMBtu/hr to 20 MMBtu/hr size range are so small and the cancer risk is expected to be well below 1 in a million, T-BACT was not evaluated for this determination.

APPROVED BY: *Brian F Krebs*

DATE: 09-07-2021

Attachment A

Review of BACT Determinations published by EPA

List of BACT determinations published in EPA's RACT/BACT/LAER Clearinghouse (RBLC) for Automotive Refinishing:

RBLC	Permit Date	Process Code (A)	Process/Equipment	Pollutant	Standard	Control Technology	Case-By-Case Basis
TX-0693	04/22/2014	13.310	Heater 5.5 MMBtu/hr	NOx	0.036 lb/MMBtu	N/A	BACT-PSD
				CO	0.08 lb/MMBtu	N/A	BACT-PSD
MI-0420	6/3/16	13.310	Boiler 6.0 MMBtu/hr	NOx	14 ppmvd at 15% O ₂ (0.0516 lb/MMBtu)	Ultra Low Nox Burner	BACT-PSD
				CO	0.08 lb/MMBtu	Good combustion Practices and pipeline quality natural gas	BACT-PSD
				PM10	0.0075 lb/MMBtu	Good combustion Practices and pipeline quality natural gas	BACT-PSD
FL-0356	3/9/16	13.310	Heater 10.0 MMBtu/hr	NOx	0.1 lb/MMBtu	N/A	BACT-PSD
				SO2	2.0 gr.s/100 scf gas	Use of low-sulfur fuel	BACT-PSD
FL-0364	3/21/18		Heater 9.90 MMBtu/hr	VOC	0.005 lb/MMBtu	N/A	BACT-PSD
OH-0379	2/6/19		Boiler 15.17 MMBtu/hr	NOx	0.0418 lb/MMBtu	Low NOx Burners, good combustion practices, natural gas fuel	BACT-PSD
				PM	0.113 lb/hr (0.0075 lb/MMBtu)	Good combustion practices and natural gas fuel	BACT-PSD

(A) Process Code 13.310 includes commercial and industrial natural gas (includes propane and LPG) boilers < 100 million BTU/hr.

= Selected as the most stringent BACT determination achieved in practice.

Attachment B

Review of BACT Determinations published by CARB

List of BACT determinations published in CARB's BACT Clearinghouse for boilers ≥ 2 MMBtu/hr to < 5 MMBtu/hr:

Capacity MMBtu/hr	Source	Date	Type	NOx ppmv @ 3% O ₂	CO ppmv @ 3% O ₂	VOC lbs/MMBtu	Filterable PM10 lbs/MMBtu	SO ₂ lbs/MMBtu
10.0	SOUTH COAST AQMD	9/12/2003	Firetube	12	50	NA	NA	NA

 = Selected as the most stringent BACT determination achieved in practice.

Attachment C

**Review of BACT Determinations published by
California Air Districts**

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
Best Available Control Technology (BACT) Guidelines for Non-Major Polluting Facilities*

10-20-2000 Rev. 0; 10-03-2008 Rev. 1; 12-02-2016 Rev. 2

2-1-2019 Rev. 3

Equipment or Process: Boiler

Subcategory/Rating/ Size	Criteria Pollutants					Inorganic
	VOC	NOx ¹	SOx	CO	PM ₁₀	
Natural Gas Fired, > 2 and < 20 MMBtu/HR		Compliance with SCAQMD Rules 1146 or 1146.1 ² (12-02-2016)	Natural Gas (10-20-2000)	≤50 ppmvd for firetube type, ≤ 100 ppmvd for watertube type, corrected to 3% O ₂ (04-10-98)	Natural Gas (04-10-98)	
Propane Fired, > 2 and < 20 MMBtu/HR		≤ 12 ppmvd corrected to 3% O ₂ ² (10-20-2000)		≤50 ppmvd for firetube type, ≤ 100 ppmvd for watertube type, corrected to 3% O ₂ (04-10-98)		
Natural Gas or Propane Fired, ≥ 20 and < 75 MM Btu/HR		Compliance with SCAQMD Rule 1146 (2-1-2019)	Natural Gas (10-20-2000)	Same as above. (04-10-98)	Natural Gas (04-10-98)	<u>With Add-On Controls:</u> ≤ 5 ppmvd NH ₃ , corrected to 3% O ₂ ≤ 1 ppmvd ozone, corrected to 3% O ₂ (10-20-2000)
Natural Gas or Propane Fired, ≥ 75 MM Btu/HR		Compliance with SCAQMD Rule 1146 (12-02-2016)	Natural Gas (10-20-2000)	Same as above. (04-10-98)	Natural Gas (04-10-98)	<u>With Add-On Controls:</u> ≤ 5 ppmvd NH ₃ , corrected to 3% O ₂ ≤ 1 ppmvd ozone, corrected to 3% O ₂ (10-20-2000)

* Means those facilities that are minor facilities as defined by Rule 1302 - Definitions

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
Best Available Control Technology (BACT) Guidelines for Non-Major Polluting Facilities*

Subcategory/Rating/ Size	Criteria Pollutants					Inorganic
	VOC	NO _x ¹	SO _x	CO	PM ₁₀	
Oil Fired ³		Compliance with SCAQMD Rule 1146 or 1146.1 (10-20-2000)	Fuel Sulfur Content ≤ 0.0015% by weight (10-03-2008)	≤ 50 ppmvd for firetube type ≤ 100 ppmvd for watertube type, corrected to 3% O ₂ (04-10-98)		
Atmospheric Unit, ≥ 2 and ≤ 10 MMBtu/HR		Compliance with SCAQMD Rules 1146 and 1146.1 (12-02-2016)		Compliance with SCAQMD Rules 1146 and 1146.1 (12-02-2016)		
Landfill Gas Fired, < 75 MMBTU/Hr		Compliance with SCAQMD Rules 1146 and 1146.1 (12-02-2016)		≤ 100 ppmvd at 3% O ₂ dry. (04-10-98)	≤ 0.1 gr/scf at 12% CO ₂ (Rule 409) (04-10-98)	
Digester Gas Fired, < 75 MMBTU/Hr		Compliance with SCAQMD Rules 1146 and 1146.1 (12-02-2016)		≤ 100 ppmvd at 3% O ₂ dry. (04-10-98)	≤ 0.1 gr/scf at 12% CO ₂ (Rule 409) (04-10-98)	

- 1) Electric utility boilers, refinery boilers rated >40 MMBtu/hr and sulfur plant reaction boilers rated ≥5 MMBtu/hr are excluded; and there are exceptions for low-use boilers and boilers that met a 12-ppm limit prior to 9/5/08. Applicants are advised to review these rules for further details.
- 2) A higher NO_x limit may be allowed for facilities required to have a standby fuel, where use of a clean standby fuel is not possible and an ultra low-NO_x burner is not available.
- 3) See Clean Fuels Policy in Part C of the BACT Guidelines. Oil firing is only allowed as a standby fuel, and where use of a clean standby fuel is not possible.

* Means those facilities that are minor facilities as defined by Rule 1302 - Definitions

CATEGORY:

BOILER/HEATER > 5 MMBTU

BACT Size: MINOR SOURCE BACT

BOILER

BACT Determination Number: 157		BACT Determination Date: 6/19/2018	
Equipment Information			
Permit Number: N/A -- Generic BACT Determination			
Equipment Description: BOILER			
Unit Size/Rating/Capacity: ≥5 MMBtu/hr and ≤ 10 MMBtu/hr at ≤ 50% capacity			
Equipment Location:			
BACT Determination Information			
ROCs	Standard:		
	Technology Description:	Good combustion practice and use of natural gas or LPG	
	Basis:	Achieved in Practice	
NOx	Standard:	9 ppm at 3% O ₂	
	Technology Description:	9 ppm at 3% O ₂ , Low NO _x burner	
	Basis:	Achieved in Practice	
SOx	Standard:		
	Technology Description:	Good combustion practice and use of natural gas or LPG	
	Basis:	Achieved in Practice	
PM10	Standard:		
	Technology Description:	Good combustion practice and use of natural gas or LPG	
	Basis:	Achieved in Practice	
PM2.5	Standard:		
	Technology Description:	Good combustion practice and use of natural gas or LPG	
	Basis:	Achieved in Practice	
CO	Standard:	50/100 ppm @ 3% O ₂ for firetube/watertube	
	Technology Description:	Firetube Boilers: 50 ppmvd corrected to 3% O ₂ Watertube Boilers: 100 ppmvd corrected to 3% O ₂	
	Basis:	Achieved in Practice	
LEAD	Standard:		
	Technology Description:		
	Basis:		

Comments: 50% annual capacity is equivalent to full fire at 4,380 hours/year.**District Contact:**

CATEGORY:

BOILER/HEATER > 5 MMBTU

BACT Size: Minor Source BACT

BOILER

BACT Determination Number: 177	BACT Determination Date: 6/19/2018
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Equipment Information

Permit Number: N/A -- Generic BACT Determination
Equipment Description: BOILER
Unit Size/Rating/Capacity: ≥5 MMBtu/hr and ≤ 10 MMBtu/hr > at 50% Capacity
Equipment Location:

BACT Determination Information

ROCs	Standard:	
	Technology Description:	Good combustion practice and use of natural gas
	Basis:	Achieved in Practice
NOx	Standard:	7 ppm at 3% O2
	Technology Description:	Ultra Low NOx burner
	Basis:	Cost Effective
SOx	Standard:	
	Technology Description:	Good combustion practice and use of natural gas
	Basis:	Achieved in Practice
PM10	Standard:	
	Technology Description:	Good combustion practice and use of natural gas
	Basis:	Achieved in Practice
PM2.5	Standard:	
	Technology Description:	Good combustion practice and use of natural gas
	Basis:	Achieved in Practice
CO	Standard:	
	Technology Description:	Firetube Boilers: 50 ppmvd corrected to 3% O2 Watertube Boilers: 100 ppmvd corrected to 3% O2
	Basis:	Achieved in Practice
LEAD	Standard:	
	Technology Description:	
	Basis:	

Comments: 50% annual capacity is equivalent to full fire at 4,380 hours/year.

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

CATEGORY:

BOILER/HEATER > 5 MMBTU

BACT Size: Minor Source BACT

BOILER

BACT Determination Number: 185		BACT Determination Date: 6/19/2018	
Equipment Information			
Permit Number: N/A -- Generic BACT Determination			
Equipment Description: BOILER			
Unit Size/Rating/Capacity: >10 MMBtu/hr to ≤ 20 MMBtu/hr at ≤ 30% capacity			
Equipment Location:			
BACT Determination Information			
ROCs	Standard:		
	Technology Description:	Good combustion practice and use of natural gas or LPG	
	Basis:	Achieved in Practice	
NOx	Standard:	9 ppm at 3% O ₂	
	Technology Description:	Low NOx burner	
	Basis:	Achieved in Practice	
SOx	Standard:		
	Technology Description:	Good combustion practice and use of natural gas or LPG	
	Basis:	Achieved in Practice	
PM10	Standard:		
	Technology Description:	Good combustion practice and use of natural gas or LPG	
	Basis:	Achieved in Practice	
PM2.5	Standard:		
	Technology Description:	Good combustion practice and use of natural gas or LPG	
	Basis:	Achieved in Practice	
CO	Standard:		
	Technology Description:	Firetube Boilers: 50 ppmvd corrected to 3% O ₂ Watertube Boilers: 100 ppmvd corrected to 3% O ₂	
	Basis:	Achieved in Practice	
LEAD	Standard:		
	Technology Description:		
	Basis:		

Comments: 30% annual capacity is equivalent to full fire at 2,592 hours/year.**District Contact:** Jeff Quok Phone No.: (916) 874-4863 email: jquok@airquality.org

CATEGORY:

BOILER/HEATER > 5 MMBTU

BACT Size: Minor Source BACT

BOILER

BACT Determination Number: 186	BACT Determination Date: 6/19/2018
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Equipment Information

Permit Number: N/A -- Generic BACT Determination
Equipment Description: BOILER
Unit Size/Rating/Capacity: >10 MMBtu/hr to ≤ 20 MMBtu/hr at > 30% capacity
Equipment Location:

BACT Determination Information

ROCs	Standard:	
	Technology Description:	Good combustion practice and use of natural gas
	Basis:	Achieved in Practice
NOx	Standard:	7 ppm at 3% O2
	Technology Description:	Ultra Low NOx burner
	Basis:	Cost Effective
SOx	Standard:	
	Technology Description:	Good combustion practice and use of natural gas
	Basis:	Achieved in Practice
PM10	Standard:	
	Technology Description:	Good combustion practice and use of natural gas
	Basis:	Achieved in Practice
PM2.5	Standard:	
	Technology Description:	Good combustion practice and use of natural gas
	Basis:	Achieved in Practice
CO	Standard:	
	Technology Description:	Firetube Boilers: 50 ppmvd corrected to 3% O2 Watertube Boilers: 100 ppmvd corrected to 3% O2
	Basis:	Achieved in Practice
LEAD	Standard:	
	Technology Description:	
	Basis:	

Comments: 30% annual capacity is equivalent to full fire at 2,592 hours/year.

District Contact:

SDAPCD BACT Determination

BOILER (<50 MM BTU/HR)

Fee Schedule 13A

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	NO_x	SO_x	PM
BACT Emission Rate Limit	Not Determined	9 PPM corrected to 3% O ₂ NG or LPG	Not Determined	0.10 grain/dscf [†]
BACT Control Option (Using NG or LPG fuel only.)	NG or LPG fuel (A/P)	Low NO _x burner, FGR, and oxygen controller. NG or LPG (A/P)	NG or LPG fuel (A/P)	NG or LPG fuel (A/P)
BACT Control Option (Using No. 2 oil as backup fuel.)	(N/A)	Low NO _x burner, FGR, and oxygen controller. (A/P)	No. 2 fuel oil with <0.05% sulfur content (A/P)	Low ash fuel (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.

NOTES:

FGR - Flue Gas Recirculation

LPG - Liquefied Petroleum Gas

NG - Natural Gas

† The District has determined that the use of Natural Gas ensures compliance with the PM BACT Emission Rate Limit of 0.1 gr/dscf. No further analysis is required for this pollutant.

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

Source Category

Source:	Boiler	Revision:	4
		Document #:	17.1.1
Class:	5 MMBtu/hr to < 33.5 MMBtu/hr Heat Input	Date:	08/04/10

Determination

Pollutant	BACT 1. Technologically Feasible/ Cost Effective 2. Achieved in Practice	TYPICAL TECHNOLOGY
POC	1. n/d 2. n/s	1. n/d 2. Good Combustion Practice ^a
NO_x	1. n/d 2. n/d	1. Low NO _x Burners + Flue Gas Recirculation + Selective Catalytic Reduction ^a 2. Low NO _x Burners + Flue Gas Recirculation ^a
SO₂	1. Natural Gas or Treated Refinery Gas Fuel w/ ≤.50 ppmv Hydrogen Sulfide and ≤100 ppmv Total Reduced Sulfur ^a 2. Natural Gas or Treated Refinery Gas Fuel w/ ≤100 ppmv Total Reduced Sulfur ^a	1. Fuel Selection ^{Error! Reference source not found.} 2. Fuel Selection ^{Error! Reference source not found.}
CO	1. 50 ppmv @ 3% O ₂ Dry ^{a,e} 2. 50 ppmv @ 3% O ₂ Dry, for Firetube Boilers ^f 100 ppmv @ 3% O ₂ Dry, for Watertube Boilers ^{a,e}	1. Good Combustion Practice ^a 2. Good Combustion Practice ^a
PM₁₀	1. n/d 2. Natural Gas or Treated Refinery Gas Fuel ^a	1. n/d 2. Fuel Selection ^a
NPOC	1. n/a 2. n/a	1. n/a 2. n/a

References

- a. BAAQMD
- d. NO_x determination by BAAQMD source Test method ST-13A or B (average of three 30-minute sampling runs), or BAAQMD approved equivalent.
- e. CO determination by BAAQMD Source Test Method ST-6 (average of three 30 minute sampling runs), or BAAQMD approved equivalent.
- f. CO 100 ppmv allowance for firetube boilers meeting the 20 ppmv NO_x standard.