SMAQMD BACT CLEARINGHOUSE

ACTIVE

CATEGORY Type: **BOILER**

BACT Category: Small Emitter BACT (PTE <10lb/day)

BACT Determination Number:	361	**BACT Determination Date:**	09/05/2024

Equipment Information

Permit Number: 27865

Equipment Description: BOILERS - = 75,000 Btu/hr and < 2.0 MMBtu/hr NG Fired

Unit Size/Rating/Capacity: = 75,000 Btu/hr and < 2.0 MMBtu/hr NG Fired

Equipment Location: SACRAMENTO CITY UNIFIED SCHOOL DISTRICT
6879 14TH AVE, SACRAMENTO, CA 95820

BACT Determination Information

District Contact: Jeff Quok **Phone No.:** (279) 207-1145 **Email:** jquok@airquality.org

ROCs	**Standard:**	Good combustion practices
	Technology Description:	
	Basis:	Achieved in Practice
NOx	**Standard:**	Units rated < 0.7 MMBtu/hr: 20 ppmvd at 3% O2 Units rated = 0.7 to < 2.0 MMBtu/hr: 9 ppmvd at 3% O2
	Technology Description:	Low NOx Burner
	Basis:	Achieved in Practice
SOx	**Standard:**	PUC quality natural gas or produced gas treated using a continuously operating sulfur removal system (= 80 ppmv total sulfur & = 4 ppmv H2S)
	Technology Description:	
	Basis:	Achieved in Practice
PM10	**Standard:**	PUC quality natural gas or produced gas treated using a continuously operating sulfur removal system (= 80 ppmv total sulfur & = 4 ppmv H2S)
	Technology Description:	
	Basis:	Achieved in Practice
PM2.5	**Standard:**	PUC quality natural gas or produced gas treated using a continuously operating sulfur removal system (= 80 ppmv total sulfur & = 4 ppmv H2S)
	Technology Description:	
	Basis:	Achieved in Practice
CO	**Standard:**	Units rated < 0.4 MMBtu/hr: 50 ppmvd at 3% O2

			Units rated = 0.4 to < 2.0 MMBtu/hr: 100 ppmvd at 3% O2 Units rated = 0.4 MMBtu/hr: 100 ppmvd at 3% O2
		Technology Description:	
		Basis:	Achieved in Practice
	LEAD	**Standard:**	No Standard
		Technology Description:	
		Basis:	

Comments:	

Printed: 09/05/2024

SMAQMD BACT CLEARINGHOUSE

ACTIVE

CATEGORY Type: **BOILER**

BACT Category: Small Emitter BACT (PTE <10lb/day)

BACT Determination Number:	362	**BACT Determination Date:**	09/06/2024

Equipment Information

Permit Number: N/A - Generic BACT Determination

Equipment Description: BOILERS - = 75,000 Btu/hr and < 2.0 MMBtu/hr LPG Fired

Unit Size/Rating/Capacity: = 75,000 Btu/hr and < 2.0 MMBtu/hr LPG Fired

Equipment Location: N/A - Generic BACT Determination

BACT Determination Information

District Contact: Jeff Quok **Phone No.:** (279) 207-1145 **Email:** jquok@airquality.org

ROCs	**Standard:**	Good combustion practices
	Technology Description:	
	Basis:	Achieved in Practice
NOx	**Standard:**	Units rated < 0.7 MMBtu/hr: 20 ppmvd @ 3% O2 Units rated = 0.7 MMBtu/hr to < 2.0 MMBtu/hr: 12 ppmvd @ 3% O2 Units rated = 0.7 MMBtu/hr: 20 ppmvd @ 3% O2
	Technology Description:	
	Basis:	Achieved in Practice
SOx	**Standard:**	Good combustion practices
	Technology Description:	
	Basis:	Achieved in Practice
PM10	**Standard:**	Good combustion practices
	Technology Description:	
	Basis:	Achieved in Practice
PM2.5	**Standard:**	Good combustion practices
	Technology Description:	
	Basis:	Achieved in Practice
CO	**Standard:**	Units rated < 0.4 MMBTU/hr: Good combustion practices Units rated = 0.4 MMBTU/hr to < 2.0 MMBtu/hr: 400 ppmvd @ 3% O2

		Technology Description:	
		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.	

Printed: 09/13/2024

777 12th Street, Ste. 300

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Sacramento, CA 95814

BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

DETERMINATION NOS.: 361 & 362

DATE: 9/6/2024

ENGINEER: Jeffrey Quok

Category/General Equip Description: Boiler/Heater – Natural gas or LPG

Equipment Specific Description: #361 – Boiler/heater greater or equal to 75,000 BTU/hr to less than 2.0 MMBTU/hr, fired on natural gas

#362 – Boiler/heater greater or equal to 75,000 BTU/hr to less than 2.0 MMBTU/hr, fired on LPG

Equipment Size/Rating: Small Emitter BACT

Previous BACT Det. No.: N/A

This Best Available Control Technology (BACT) determination is for boilers/heaters greater than or equal to 75,000 BTU/hr and less than 2.0 MMBTU/hr, fired on natural gas or LPG. For purposes of this determination a boiler is any external combustion equipment fired with natural gas or LPG used to produce hot water or steam. Most boilers in this size range are used for providing general hot water to a large commercial or industrial facility or used for space heating.

Process heaters and make-up air heaters as defined below are not applicable to these BACT Determinations.

Make-up Air Heater: Any unit used to heat incoming air in order to maintain the temperature of a spray booth, container, room or other enclosed space to provide breathable air for a person who may be present during operation.

Process Heater: Any unit which transfers heat from combustion gases to process streams, excluding water or steam.

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, 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.

BACT/T-BACT ANALYSIS

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

The following control technologies are currently employed as BACT for boilers/heaters ≥ 75,000 BTU/hr and < 2.0 MMBTU/hr by the following agencies and air pollution control districts:

US EPA

BACT
Source: EPA RACT/BACT/LAER Clearinghouse (See Attachment A)

Two determinations were found for units fueled on natural gas in this size range.

RBLC ID # MI-0426: Through contact with the permitting agency it was found that the 1.0 MMBTU/hr boilers in this determination were part of a larger project for a PSD modification of a natural gas compressing station. The boilers proposed by the applicant and the standards included in this determination are based on manufacturer data and not through testing. Because the emission standards were not tested and verified in the field, the District does not consider these emission standards achieved in practice.

RBLC ID # SC-0179: The emission standards in this determination for VOC and PM are in units of pounds per hour, which indicate that the standards are based on the specific input rating of the boiler model evaluated and not general standards for this equipment type and size. The EPA clearinghouse also shows that the emission rates are not based on any specific control technology but on the use of natural gas as a fuel and good combustion practices. Other agencies list natural gas usage and good combustion practices as BACT for VOC and PM and, therefore, this determination will be assumed to be equivalent.

No determinations were found for units fueled on LPG for this size range.

RULE REQUIREMENTS: None

California Air Resource Board (CARB)

BACT
Source: CARB BACT Clearinghouse
CARB BACT Guidelines Search

The only determinations staff found in the CARB BACT Clearinghouse that were not developed by one of the air districts examined later in this determination was SBCAPCD BACT Guidelines 2.1 (6/14/2017) and 2.2 (9/28/2021).

Natural Gas or LPG Fired Units ≥ 0.075 and < 2.0 MMBTU/hr			
Pollutant	**Size (MMBtu/hr)**	**Standard/Control Technology**	**Source**
VOC	All	Good combustion practices	SBCAPCD BACT 2.1 & 2.2
NOx	≤ 0.400	20 ppmvd at 3% O_2	SBCAPCD BACT 2.1
	> 0.400 & < 1.000	20 ppmvd at 3% O_2	SBCAPCD BACT 2.2
	≥ 1.000	12 ppmvd at 3% O_2	SBCAPCD BACT 2.2
SOx	All	1. Use PUC quality natural gas (A), or produced gas treated using a continuously operating sulfur removal system (≤ 80 ppmv total sulfur & ≤ 4 ppmv H_2S), and 2. Prepare a Fuel Gas Sulfur Plan (B)	SBCAPCD BACT 2.1 & 2.2
PM10	All	1. Use PUC quality natural gas (A), or produced gas treated using a continuously operating sulfur removal system (≤ 80 ppmv total sulfur & ≤ 4 ppmv H_2S), and 2. Prepare a Fuel Gas Sulfur Plan (B)	SBCAPCD BACT 2.1 & 2.2
PM2.5	All	1. Use PUC quality natural gas (A), or produced gas treated using a continuously operating sulfur removal system (≤ 80 ppmv total sulfur & ≤ 4 ppmv H_2S), and 2. Prepare a Fuel Gas Sulfur Plan (B)	SBCAPCD BACT 2.1 & 2.2
CO	≤ 0.400	50 ppmvd at 3% O_2	SBCAPCD BACT 2.1
	> 0.400	100 ppmvd at 3% O_2	SBCAPCD BACT 2.2

(A) PUC natural gas stands for California Public Utility Commission Quality Natural Gas. California requires that PUC Gas contain no more than 0.25 grains of hydrogen sulfide and no more than 5 grains of total sulfur per 100 scf of gas.

(B) A Fuel Gas Sulfur Plan is a plan that the owners of the equipment prepare outlining how sulfur will be removed to achieve the required standard. This is not required if the unit is fired on PUC natural gas.

RULE REQUIREMENTS: None

Sacramento Metropolitan AQMD

BACT

Source: SMAQMD BACT #299 – Boilers ≥ 0.075 and < 2 MMBtu/hr fired on Natural Gas (2/23/22)

Natural Gas-Fired Units ≥ 0.075 and < 2.0 MMBTU/hr – Small Emitter Category		
Pollutant	**Unit Size and Type**	**Standard**
VOC	All	Good combustion practices
NOx	Units rated < 1.0 MMBtu/hr	20 ppmvd at 3% O_2
	Units rated ≥ 1.0 MMBtu/hr	12 ppmvd at 3% O_2
SOx	All	PUC quality natural gas or produced gas treated using a continuously operating sulfur removal system (≤ 80 ppmv total sulfur & ≤ 4 ppmv H_2S)
PM10	All	PUC quality natural gas or produced gas treated using a continuously operating sulfur removal system (≤ 80 ppmv total sulfur & ≤ 4 ppmv H_2S) outlined in a Fuel Gas Sulfur Plan.
PM2.5	All	PUC quality natural gas or produced gas treated using a continuously operating sulfur removal system (≤ 80 ppmv total sulfur & ≤ 4 ppmv H_2S) outlined in a Fuel Gas Sulfur Plan.
CO	Units rated < 0.4 MMBtu/hr	50 ppmvd at 3% O_2
	Units rated ≥ 0.4 MMBtu/hr	100 ppmvd at 3% O_2

Source: SMAQMD BACT #300 – Boilers ≥ 0.075 and < 2 MMBtu/hr fired on LPG (2/3/22)

LPG-Fired Units ≥ 0.075 and < 2.0 MMBtu/hr – Small Emitter Category		
Pollutant	**Unit Type**	**Standard**
VOC	All	Good combustion practices
NOx	Units rated < 0.4 MMBtu/hr	77 ppmvd @ 3% O_2
	Units rated ≥ 0.4 MMBtu/hr	30 ppmvd @ 3% O_2
SOx	All	Good combustion practices
PM10	All	Good combustion practices
PM2.5	All	Good combustion practices

LPG-Fired Units ≥ 0.075 and < 2.0 MMBtu/hr – Small Emitter Category		
Pollutant	**Unit Type**	**Standard**
CO	Units rated < 0.4 MMBTU/hr	Good combustion practices
	Units rated ≥ 0.4 MMBTU/hr	400 ppmvd @ 3% O_2

RULE REQIREMENTS:

Rule 414 – Water Heaters, Boilers and Process Heaters Rated Less Than 1,000,000 BTU Per Hour (Amended 10/25/2018)

This rule applies to any person who manufactures, distributes, offers for sale, sells, or installs any type of water heater, boiler or process heater with a rated heat input capacity less than 1.0 MMBTU/hr, fired with gaseous or nongaseous fuels. Units must be certified to meet the emission limits by the SMAQMD or SCAQMD. **LPG-fired units are exempt from this rule.**

No person shall distribute, offer for sale, sell, or install any unit that does not meet the following standards:

Heat Input Range and Type	NOx Limit Nanograms per Joule of Heat Output (ppmv @ 3% O_2)*	CO Limit (ppmv @ 3% O_2)
75,000 to < 400,000 Btu/hr Pool/Spa All others	 40 (55) 14 (20)	 No Limit No Limit
400,000 to 1 million Btu/hr All Types	 14 (20)	 400

* Where limits are shown in units of both nanograms per joule of heat output and ppmv at 3% oxygen, compliance can be demonstrated using either limit.

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

This rule applies to units fired on gaseous or nongaseous fuels with a rated heat input capacity of 1 million Btu per hour or greater.

No unit shall exceed the following limits:

Unit Size/Description mmBtu/hr Input	NOx Limit ppmvd @ 3% O_2	CO Limit ppmvd @ 3% O_2
Greater than or equal to 1 and less than 5	30	400

South Coast AQMD

BACT

SCAQMD BACT Guidelines do not contain a determination for boilers/heaters rated 2 MMBTU/hr or less, because these units are not required to obtain a written permit, pursuant to SCAQMD Rule 219.

SCAQMD Rule 219 – Equipment Not Requiring a Written Permit Pursuant to Regulation II (Amended 4/7/2023)

Section (d)(2)(C): Boilers, process heaters, or any combustion equipment that has a rated maximum heat input capacity of 2,000,000 Btu per hour (gross) or less and are equipped to be heated exclusively with natural gas, methanol, liquefied petroleum gas, or any combination thereof. Rule 222 may be applicable for boilers, steam generators, or process heaters with rated heat input capacities from 1,000,000 up to and including 2,000,000 Btu per hour. This exemption does not apply to:

(i) Internal combustion engines;
(ii) Turbines; or
(iii) Boilers process heaters, or any combustion equipment whenever there are emissions other than products of fuel combustion, except for food ovens with a rated maximum heat input capacity of 2,000,000 Btu/hour or less, that are fired exclusively on natural gas and where the process VOC emissions are less than one pound per day. Rule 222 may be applicable.

Rule 222 – Filing Requirements for Specific Emission Sources not Requiring a Written Permit Pursuant to Regulation II (Amended 4/7/23)

The purpose of this rule is to provide an alternative to written permits. This rule requires owners or operators of specified emission sources to submit information regarding the source, including, but not limited to:

(1) A description of the source;
(2) Data necessary to estimate emissions from the source; and
(3) Information to determine whether the emission source is operating in compliance with applicable South Coast AQMD, state and federal rules and regulations.

RULE REQUIREMENTS:

Reg XI, Rule 1146.2 – Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters (Amended 6/7/2024)

This rule is applicable to all natural gas-fired units that have a rated heat input capacity less than or equal to 2,000,000 Btu per hour. Units must be certified to meet the emission limits by the SCAQMD.

New units must meet the following standards:

Category	NOx Limit	CO Limit
Units ≤ 0.4 MMBTU/hr (except pool heaters)	14 nanograms per joule of heat output (20 ppmvd @ 3% O_2)	No standard
Pool heaters ≤ 0.4 MMBTU/hr	40 nanograms per joule of heat output (55 ppmvd @ 3% O_2)	No standard

Category	NOx Limit	CO Limit
Units > 0.4 and ≤ 2.0 MMBTU/hr	14 nanograms per joule of heat output (20 ppmvd @ 3% O_2)	400 ppmvd @ 3% O_2

San Joaquin Valley Unified APCD

BACT

SJVUAPCD BACT Guidelines do not contain a determination for boilers rated 5 MMBTU/hr or less, because these units are not required to obtain a written permit, pursuant to SJUVAPCD Rule 2020.

SJVUAPCD Rule 2020 – Exemptions (Amended December 18, 2014)

Section 6.1.1: No Authority to Construct or Permit to Operate shall be required for steam generators, steam superheaters, water boilers, steam cleaners, and closed indirect heat transfer systems that have a maximum input heat rating of 5,000,000 Btu per hour (gross) or less and is equipped to be fired exclusively with natural gas, liquefied petroleum gas, or any combination of the two.

RULE REQUIREMENTS:

SJVUAPCD Rule 4308 – Boilers, Steam Generators, and Process Heaters – 0.075 MMBtu/hr to less than 2.0 MMBtu/hr (Amended 11/14/2013)

This rule applies to any person who supplies, sells, offers for sale, installs, or solicits the installation of any boiler, steam generator, process heater or water heater with a rated heat input capacity of greater than or equal to 75,000 British thermal units per hour and less than 2,000,000 British thermal units per hour.

A person shall not supply, sell, offer for sale, install, or solicit the installation of any boiler, process heater or water heater unless it has been certified pursuant to the standards in the table below.

Type and Size of Unit, in MMBtu/hr	NOx Limit lb/MMBtu of heat input (ppmvd @ 3% O_2)	
	PUC Natural Gas*	Non-PUC Natural Gas or Liquid
Units ≥ 0.075 and ≤ 0.4, except as below	0.024 (20)	0.093 (77)
Units > 0.4 and < 2.0, except as below	0.024 (20)	0.036 (30)
Instantaneous water heaters ≥ 0.075 and ≤ 0.4	0.024 (20)	0.093 (77)
Instantaneous water heaters > 0.4 and < 2.0	0.024 (20)	0.093 (77)
Pool heaters ≥ 0.075 and ≤ 0.4	0.068 (55)	0.093 (77)
Pool heaters > 0.4 and < 2.0	0.024 (20)	0.036 (30)

* PUC Natural Gas stands for California Public Utility Commission Quality Natural Gas

Units with a rating of ≥ 0.4 MMBtu/hr and < 2.0 MMBtu/hr must meet a standard of 400 ppmvd @ 3% O_2 for CO.

San Diego County APCD

BACT

SDCAPCD BACT Guidelines do not contain a determination for boilers/heaters rated 2 MMBtu/hr or less fired exclusively with natural gas and/or liquefied petroleum gas, because these units are not required to obtain a written permit, pursuant to SDCAPCD Rule 11.

SDCAPCD Rule 11 – Exemptions from Rule 10 Permit Requirements (Amended 10/13/2022)

Section (d)(2)(iv): Any boiler, process heater, steam generator, or water heater with a manufacturer's maximum gross heat input rating of:

(A) less than 1 million BTU per hour fired with any fuel, or

(B) 2 million BTU per hour or less fired exclusively with natural gas and/or liquefied petroleum gas.

RULE REQUIREMENTS:

Regulation 4, Rule 69.2.1 – Small Boilers, Process Heaters, and Steam Generators (Adopted 7/8/2020)

This rule applies to any person who manufactures, sells, offers for sale or distributes for use within San Diego County, or installs within San Diego County a new unit (boiler, process heater, or steam generator) with a heat input rating from 75,000 Btu per hour to 2 million Btu per hour.

Effective 7/1/2021 no person shall manufacture, distribute, sell, offer for sale, or install within San Diego County any new unit that exceeds the following emission levels:

Fuel	Unit Type & Heat Input Rating BTU/hr	NOx Limit ppmvd @ 3% O_2	CO Limit ppmvd @ 3% O_2
Natural Gas	75,000 to 400,000 Pool Heaters	55	N/A
Natural Gas	75,000 to 400,000 All Other Units	20	N/A
Natural Gas	> 400,000 to 2,000,000 All Units	20	400
Non PUC Gas or Liquid Fuel	75,000 to 400,000 All Units	77	N/A
Non PUC Gas or Liquid Fuel	> 400,000 to 2,000,000 All Units	30	400

Bay Area AQMD

BACT

BAAQMD BACT Guidelines do not contain a determination for boilers/heaters rated 10 MMBTU/hr or less fired exclusively on natural gas or LPG, because units rated less than 10 MMBTU/hr fired exclusively on natural gas or LPG are not required to obtain a permit, pursuant to BAAQMD Rule 2-1.

BAAQMD Regulation 2, Rule 1 – General Requirements (Amended 12/6/2017)

Section 2-1-114: Boilers, heaters, steam generators, duct burners, and similar combustion equipment with less than 10 million BTU per hour rated heat input if fired exclusively with natural gas (including compressed natural gas), liquefied petroleum gas (e.g. propane, butane, isobutene, propylene, butylene, and their mixtures), or any combination thereof are exempt from being required to obtain an Authority to Construct or Permit to Operate.

RULE REQUIREMENTS:

BAAQMD Regulation 9, Rule 6 – Nitrogen Oxides Emissions from Natural Gas-Fired Water Heaters (Amended 3/15/2023)

This rule applies to any person who sells, installs, or offers for sale a natural gas-fired water heater for use within the District and any manufacturer who intends to sell or distribute for sale or installation of a natural gas-fired water heater within the District.

Rated Heat Input Capacity Btu/hr	Type of Unit	NOx Limit nanograms per joule of heat output (ppm @ 3% O_2)
≤ 75,000	Storage tank water heater **(Manufactured after 7/1/1992)**	40
	Storage tank water heater **(Manufactured after 1/1/2011)** Does not apply to water heaters used for mobile homes.	10
	Storage tank water heater less than or equal to 50 gallons capacity. Does not apply to direct-vent, power-vent, power direct-vent water storage tank heaters and water heaters used for mobile homes.	10
	Pool/spa heaters	Exempt
75,001 to 400,000	Storage tank water heaters **(Manufactured after 1/1/2008)**	40
	Large natural gas-fired boiler, storage tank water heater, or instantaneous water heater **(Manufactured after 1/1/2013)**	14
	Pool/spa heaters	Exempt

Rated Heat Input Capacity Btu/hr	Type of Unit	NOx Limit nanograms per joule of heat output (ppm @ 3% O_2)
400,001 to 2,000,000	Large natural gas-fired boiler, storage tank water heater, or instantaneous water heater **(Manufactured after 1/1/2008)**	20 (30)
	Large natural gas-fired boiler, storage tank water heater, or instantaneous water heater **(Manufactured after 1/1/2013)**	14 (20)
75,001 to 2,000,000	Large natural gas-fired boiler, storage tank water heater, or instantaneous water heater **(Manufactured after 1/1/2031)**	0.0(A)

(A) BAAQMD's zero NOx standard is based on BAAQMD's current understanding of available technology accessibility, and current barriers to an immediate effective date. The standards would apply when appliances are replaced upon burnout. Only appliances that meet the new standard could be sold and installed in the Bay Area upon implementation.

Summary of Achieved in Practice Control Technologies

The following control technologies have been identified as achieved in practice and are ranked based on stringency:

UNIT CONVERSION FOR NOx & CO

Depending on the agency, NOx and CO emission standards were listed in either ppmvd @ 3% O_2 or in nanograms per joule of heat output. For purposes of comparison all nanograms per joule of heat output standards have been converted to ppmvd @ 3% O_2.

NOx AND CO ACHIEVED IN PRACTICE STANDARDS

For boilers in the size range covered by this determination, burner design is the predominant method to control NOx emissions. Low-NOx burners typically lower the flame temperature and require greater excess air levels which can cause increases in CO emissions. Therefore, because these pollutants can be dependent on one another, standards will be ranked together. Due to the non-attainment status in Sacramento County, an emphasis will be placed on NOx emissions when ranking emission standards. Previously, the industry standard for units in this range was to obtain SCAQMD certification for compliance with their Rule 1146.2 – Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters. As shown below, the NOx and CO standards in the SBCAPCD BACT Guidelines are more stringent than SCAQMD certification.

SBCAPCD BACT Guidelines 2.1 and 2.2 apply to units fueled by liquid and/or gaseous and/or solid fossil fuels. SBCAPCD Rule 802 requires BACT to be applied to new sources that emit 25 lbs/day or more of any nonattainment pollutant or its precursors (except CO). The rule also has an exemption for sources from offset requirements as long as applicants

meet the specified conditions, one of which is to apply BACT to the equipment or process. This rule also sets an offset threshold of 25 tons/year for nonattainment pollutants and precursors (except CO and PM2.5). As of yet, for the size range covered by this determination, the SBCAPCD guidelines have only been applied to units at a single source in order for the source to be exempt from offset requirements. Specifically, the 12 ppmvd NOx standard BACT was applied to three 1.5 MMBtu/hr natural gas-fired boilers in a stacked configuration (manifolded together).

In contrast, the SMAQMD requires BACT to be applied to all new sources that emit over 0 lbs/day (or 0.49 lbs/day due to rounding) of NOx. The SMAQMD permits all units with a maximum heat input of 1.0 MMBtu/hr or greater or multiple units used in the same process whose combined maximum heat input rating is 1.0 MMBtu/hr or greater. Whereas the SBCAPCD exempts external combustion equipment with a maximum heat input rating less than or equal to 2.0 MMBTU/hr. Because of the low permitting and BACT thresholds, if adopted, the 12 ppmvd NOx limit would be applied to many more boilers including small sources where the only permitted unit may be a space heating boiler between 1.0 and 2.0 MMBtu/hr. Because of this discrepancy staff reviewed current new products being offered by major boiler manufactures for natural gas-fired units in this range. Staff found that several manufacturers have natural gas-fired units that span the size range between 1.0 and 2.0 MMBtu/hr that are guaranteed to meet a NOx standard of 12 ppmvd at 3% O_2. Based on this review, the SMAQMD considers SBCAPCD's 12 ppmvd NOx limit to be achieved in practice in the size range of 1.0 to 2.0 MMBtu/hr.

Even though many of the units that guarantee the 12 ppmvd standard for NOx can be fueled by either natural gas or LPG, the guaranteed NOx standard only applies to the unit when it is fueled by natural gas. The BACT Guidelines from SBCAPCD apply to LPG fired unit as well. When asked if the standard had been applied to any LPG-fired units, SBCAPCD responded saying that it had not. They also stated that if an applicant was proposing an LPG-fired unit that was required to meet BACT, they would require the applicant to propose a natural gas-fired unit instead. The SMAQMD currently has active permits with businesses that operate propane/LPG-fired boilers in areas of Sacramento County that are not served by pipeline natural gas. Therefore, the SMAQMD does not consider the SBCAPCD BACT Guidelines 2.1 and 2.2 to be achieved in practice for Propane/LPG-fired units and because natural gas is not available to areas of Sacramento County it is not feasible to require all units to use natural gas as a fuel.

Ultra Low NOx Burner (ULNB):

California Boiler was contacted and they provided the lowest NOx ppm standard for natural gas and LPG boilers between 0.075-2 MMBtu/hr that they provide (See Attachment B). California Boiler explained that for 0.7-2 MMBtu/hr natural gas boilers 9 ppm NOx is the lowest achievable NOx at these levels by using a "NP2" metal mesh element type burner. For 0.7-2 MMBtu/hr LPG boilers, 12 ppm NOx is the lowest achievable NOx at these levels by using a "NP2" metal mesh element type burner. For both natural gas and LPG boilers below 0.7 MMBtu/hr, 20 ppm NOx is the lowest achievable NOx.

California Boiler can currently provide boilers in the 0.7-2 MMBtu/hr size range that meet 9 ppm NOx for natural gas and 12 ppm NOx for LPG. Therefore, 9 ppm NOx limit for natural gas and 12 ppm NOx for LPG will be considered achieved in practice for the 0.7-2 MMBtu/hr size range. For natural gas and LPG boilers below 0.7 MMBtu/hr, fuel 20 ppm NOx will be considered achieved in practiced.

NOx AND CO FOR NATURAL GAS-FIRED UNITS RATED ≥ 75,000 and < 400,000 BTU/HR

Achieved in Practice Standards for NOx & CO for Natural Gas-Fired Units Rated ≥ 75,000 and < 400,000 BTU/hr(A)				
Rank	**Unit Type**	**Standard/Control**		**Source**
		NOx (ppmvd @ 3% O_2)	**CO (ppmvd @ 3% O_2)**	
1	All units	20	50	SBCAPCD BACT 2.1 (2017)
2	Units rated < 700,000 Btu/hr	20	No Standard	California Boiler
3	Units rated < 1.0 MMBtu/hr (NOx) Units rated < 0.4 MMBtu/hr (CO)	20	50	SMAQMD BACT 299 (2022)
4	Pool heaters	55	No standard	SCAQMD Rule 1146.2 (2018)
	All other units	20	No standard	
5	Units fueled on non-PUC gas	77	No standard	SJVAPCD Rule 4308 (2013) & SDCAPCD Rule 69.2.1 (2020)
	Pool Heaters Fueled on PUC Gas	55	No standard	
	All other units	20	No standard	
6	Storage tank water heaters **(Manufactured after 1/1/2008)**	55	No standard	BAAQMD Reg. 9 Rule 6 (2023)
	Large natural gas-fired boiler, storage tank water heater, or instantaneous water heater **(Manufactured after 1/1/2013)**	20	No standard	
	Pool/spa heaters	Exempt	Exempt	

(A) For California Boiler standards the size range goes up to 700,000 Btu/hr.

NOx AND CO FOR NATURAL GAS-FIRED UNITS RATED ≥ 0.4 and < 2.0 MMBTU/HR

Achieved in Practice Standards for NOx & CO for Natural Gas-Fired Units Rated ≥ 400,000 and < 2,000,000 BTU/hr				
Rank	**Unit Type**	**Standard/Control**		**Source**
		NOx (ppmvd @ 3% O_2)	**CO (ppmvd @ 3% O_2)**	
1	Units rated ≥ 700,000 to < 2,000,000 BTU/hr	9	No Standard	California Boiler
2	< 1.000 MMBtu/hr (A)	20	100	SMAQMD BACT 299 (2022) & SBCAPCD BACT 2.2 (2017)
	≥ 1.000 MMBtu/hr	12	100	
3	All units	20	400	SCAQMD Rule 1146.2 (2018)
4	All units fueled on non-PUC gas	30	400	SDCAPCD Rule 69.2.1 (2020)
	All units fueled on PUC gas	20	400	
5	Instantaneous water heaters fueled on non-PUC gas	77	400	SJVAPCD Rule 4308 (2013)
	All other units fueled on non-PUC gas	30	400	
	All units fueled on PUC gas	20	400	
6	Large natural gas-fired boiler, storage tank water heater, or instantaneous water heater **(Manufactured after 1/1/2008)**	55	No standard	BAAQMD Reg. 9 Rule 6 (2023)
	Large natural gas-fired boiler, storage tank water heater, or instantaneous water heater **(Manufactured after 1/1/2013)**	20	No standard	

(A) Units with a maximum heat input rating of exactly 400,000 Btu/hr has a lower CO standard of 50 ppmvd at 3% O_2 for both SMAQMD and SBAPCD BACTs.

NOx AND CO LPG-FIRED UNITS RATED ≥ 75,000 and < 400,000 BTU/HR

Achieved in Practice Standards for NOx & CO for LPG-Fired Units Rated ≥ 75,000 and < 400,000 BTU/hr				
Rank	**Unit Type**	**Standard/Control**		**Source**
		NOx (ppmvd @ 3% O_2)	**CO (ppmvd @ 3% O_2)**	
1	Units rated < 700,000 Btu/hr	20	No Standard	California Boiler
2	All units	77	Good combustion practices	SMAQMD BACT 300 (2022)
3	All units	77	No standard	SJVAPCD Rule 4308 (2013) & SDCAPCD Rule 69.2.1 (2020)
4	All units	No standard	No standard	SCAQMD & BAAQMD

NOx and CO FOR LPG-FIRED UNITS RATED ≥ 0.4 and < 2.0 MMBTU/HR

Achieved in Practice Standards for NOx & CO for LPG-Fired Units Rated ≥ 400,000 and < 2,000,000 BTU/hr				
Rank	**Unit Type**	**Standard/Control**		**Source**
		NOx (ppmvd @ 3% O_2)	**CO (ppmvd @ 3% O_2)**	
1	Units rated ≥ 700,000 to < 2,000,000 BTU/hr	12	No Standard	California Boiler
1	All units	30	400	SMAQMD BACT 300 (2022) & SDCAPCD Rule 69.2.1 (2020)
2	Instantaneous water heaters	77	400	SJVAPCD Rule 4308 (2013) & SDCAPCD Rule 69.2.1 (2020)
	All other units	30	400	
3	All units	No standard	No standard	SCAQMD & BAAQMD

VOC FOR NATURAL GAS AND LPG-FIRED UNITS

The only standard set for VOC for this category of equipment is the use of good combustion practices by last SMAQMD BACT Determination, CARB BACT Clearinghouse (SBCAPCD), and EPA BACT Clearinghouse.

SOx AND PM FOR NATURAL GAS-FIRED UNITS

The SBCAPCD BACT Guidelines list the same standard for SOx, PM10 and PM2.5, which relates to burning only low sulfur fuel. Sulfur content in fuels does contribute to particulate emissions through the formation of sulfates. A small portion of sulfates is directly emitted from combustion, but most are formed in the atmosphere as a biproduct of sulfur dioxide emissions. Therefore, a reduction in the sulfur content of the fuel would lead to a reduction in particulate matter and will be considered achieved in practice as a standard for particulate matter. Because the achieved in practice per agency for SOx, PM10, and PM2.5 for natural gas-fired units are equivalent they have been combined into one section for brevity.

Achieved in Practice Standards for SOx for Natural Gas-Fired Units Rated ≥ 75,000 and < 2,000,000 BTU/hr		
Rank	**Standard/Control**	**Source**
1	PUC quality natural gas or produced gas treated using a continuously operating sulfur removal system (≤ 80 ppmv total sulfur & ≤ 4 ppmv H_2S) outlined in a Fuel Gas Sulfur Plan.	SMAQMD BACT 299 (2022) & SBCAPCD BACT 2.1 & 2.2 (2017)
2	No standards	SCAQMD, SJVAPCD, SDCAPCD, BAAQMD

(A) PUC Natural Gas stands for California Public Utility Commission Quality Natural Gas. California requires that PUC Gas contain no more than 0.25 grains of hydrogen sulfide and no more than 5 grains of total sulfur per 100 scf of gas.

SOx AND PM FOR LPG-FIRED UNITS

As stated previously the SBCAPCD BACT Guidelines 2.1 and 2.2 are not considered achieved in practice for LPG-fired units and will not be considered in this comparison. Because the achieved in practice per agency for SOx, PM10, and PM2.5 for natural gas-fired units are equivalent they have been combined into one section for brevity.

Achieved in Practice Standards for SOx, PM10, and PM2.5 for LPG-Fired Units Rated ≥ 75,000 and < 2,000,000 BTU/hr		
Rank	**Standard/Control**	**Source**
1	Good combustion practices	SMAQMD BACT 299 (2022)
2	No standards	SMAQMD, SJVAPCD, SDCAPCD, BAAQMD

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, NOx, SOx, PM10, PM2.5 and CO will be the most stringent standards of what is currently achieved in practice.

BACT DETERMINATION #361 – BOILERS/HEATERS RATED GREATER THAN OR EQUAL TO 75,000 BTU/HR TO LESS THAN 2.0 MMBTU/HR, FIRED ON NATURAL GAS – SMALL EMITTER CATEGORY		
Pollutant	**Standard**	**Source**
VOC	Good combustion practices	SMAQMD, SBCAPCD
NOx	Units rated < 0.7 MMBtu/hr: 20 ppmvd at 3% O_2 Units rated ≥ 0.7 to < 2.0 MMBtu/hr: 9 ppmvd at 3% O_2	Achieved in Practice per California Boiler
SOx	PUC quality natural gas or produced gas treated using a continuously operating sulfur removal system (≤ 80 ppmv total sulfur & ≤ 4 ppmv H_2S)	SMAQMD, SBCAPCD
PM10	PUC quality natural gas or produced gas treated using a continuously operating sulfur removal system (≤ 80 ppmv total sulfur & ≤ 4 ppmv H_2S) outlined in a Fuel Gas Sulfur Plan.	SMAQMD, SBCAPCD
PM2.5	PUC quality natural gas or produced gas treated using a continuously operating sulfur removal system (≤ 80 ppmv total sulfur & ≤ 4 ppmv H_2S) outlined in a Fuel Gas Sulfur Plan.	SMAQMD, SBCAPCD
CO	Units rated < 0.4 MMBtu/hr: 50 ppmvd at 3% O_2 Units rated ≥ 0.4 to < 2.0 MMBtu/hr: 100 ppmvd at 3% O_2	SMAQMD

BACT DETERMINATION #362 – BOILERS/HEATERS RATED GREATER THAN OR EQUAL TO 75,000 BTU/HR TO LESS THAN 2.0 MMBTU/HR, FIRED ON LPG – SMALL EMITTER CATEGORY		
Pollutant	**Standard**	**Source**
VOC	Good combustion practices	SMAQMD
NOx	Units rated < 0.7 MMBtu/hr: 20 ppmvd @ 3% O_2 Units rated ≥ 0.7 MMBtu/hr to < 2.0 MMBtu/hr: 12 ppmvd @ 3% O_2	SMAQMD/California Boiler
SOx	Good combustion practices	SMAQMD
PM10	Good combustion practices	SMAQMD
PM2.5	Good combustion practices	SMAQMD
CO	Units rated < 0.4 MMBTU/hr: Good combustion practices Units rated ≥ 0.4 MMBTU/hr to < 2.0 MMBtu/hr: 400 ppmvd @ 3% O_2	SMAQMD

D. SELECTION OF T-BACT:

Toxics are in the form of VOCs and particulate matter. Since toxic emissions from natural gas and LPG-fired boilers in the 75,000 Btu/hr to less than 2.0 MMBtu/hr range are so small and the cancer risk is expected to be well below 1 in a million cases, T-BACT was not evaluated for this determination.

APPROVED BY: *Brian F Krebs* **DATE:** 09-06-2024

Attachment A

Review of BACT Determinations published by EPA

List of BACT determinations published in EPA's RACT/BACT/LAER Clearinghouse (RBLC) for Commercial/Institutional-Sized Boilers/Furnaces < 100 Million BTU/H - Natural Gas (includes propane & liquefied petroleum gas) (Process Code 13.310):

Boilers/Heaters < 2.0 MMBTU/hr							
RBLC#	**Permit Date[(A)]**	**Rating**	**Fuel**	**Pollutant**	**Standard**	**Control Technology**	**Case-By-Case Basis**
MI-0426	3/24/2017	1 MMBTU/hr	Natural gas	NOx	9 ppmvd @ 3% O_2	Ultra-low NOx burner and good combustion practices	BACT-PSD
MI-0426	3/24/2017	1 MMBTU/hr	Natural gas	CO	84 lb/MMSCF	Good combustion practices and clean burn fuel (pipeline quality NG)	BACT-PSD
MI-0426	3/24/2017	1 MMBTU/hr	Natural gas	PM10/PM2.5	0.52 lb/MMSCF	Good combustion practices and clean burn fuel (pipeline quality NG)	BACT-PSD
SC-0179	3/18/2015	1.83 MMBTU/hr	Natural gas	PM10	0.01 lb/hr	Use of natural gas and good combustion practices	BACT-PSD
SC-0179	3/18/2015	1.83 MMBTU/hr	Natural gas	PM2.5	0.003 lb/hr	Use of natural gas and good combustion practices	BACT-PSD
SC-0179	3/18/2015	1.83 MMBTU/hr	Natural gas	VOC	0.01 lb/hr	Use of natural gas and good combustion practices	BACT-PSD

(A) Due to the large number of entries only determinations made (based on Permit Date) entered since 01/01/2009 are included in the above table.

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

Attachment B

California Boiler NOx Cost Estimate for 9 ppm Boilers

Jeffrey Quok

From: Roehl Fabay <rfabay@californiaboiler.com>
Sent: Tuesday, January 31, 2023 5:26 PM
To: Jeffrey Quok
Subject: RE: Boiler NOx emissions for Boilers less than 2 MMBtu/hr

Hi Jeffrey,

For industrial type boiler, the Powerflame NP2 burner can do 9ppm from 700MBH to 2000MBH. However this depends on which boiler it goes into. Since the NP2 burner are metal mesh element type burner, there are some boilers which have some tight combustion chamber dimension which this burner will not work. The Powerflame NPM premix burner can only do 20ppm and this can be use on some of those smaller boiler with tight combustion chamber that the NP2 can't work.

Most industrial type boiler package are built by two separate company, we have the boiler manufacturer and the burner manufacturer. The boiler manufacturer normally mounts the burner at their facility. Unlike the commercial packaged type boiler, the boiler manufacturer also designs the burner that goes into their equipment. The combustion chamber design limits them from lowering the NOx even further.

The price difference between NPM and NP2 is quite significant because of the use of more advance controls versus linkage type on the NPM, you're looking at around $10-14k difference.

Roehl Fabay
California Boiler

From: Roehl Fabay <rfabay@californiaboiler.com>
Sent: Wednesday, March 1, 2023 9:37 AM
To: Jeffrey Quok
Subject: RE: Boiler NOx emissions for Boilers less than 2 MMBtu/hr

Jeffrey – see my response below in Red. – thanks!

Roehl Fabay
California Boiler

From: Jeffrey Quok <JQuok@airquality.org>
Sent: Tuesday, February 28, 2023 5:02 PM
To: Roehl Fabay <rfabay@californiaboiler.com>
Subject: RE: Boiler NOx emissions for Boilers less than 2 MMBtu/hr

Hi Roehl,

Thank you for providing this information. I did have a few follow up questions.

1. Is the 9 ppm for the NP2 burner and 20 ppm for the Powerflame NPM burner achievable for both natural gas and LPG? If not, what ppm is achievable for LPG? Only on natural gas. LP on NP2 will be around 12 or 15. LP on NPM is still 20ppm on both LP and NG.
2. Regarding the $10-$14k price difference, what are some rough estimated total costs for boilers in the 700 MBH to 2000 MBH range. This will vary depending on the type of boiler. NPM and NP2 can be use in different brand.

Thanks again for your help,

Jeffrey Quok
Air Quality Engineer
Desk: (279) 207-1145
JQuok@airquality.org
www.AirQuality.org
@AQMD

Jeffrey Quok

From: Roehl Fabay <rfabay@californiaboiler.com>
Sent: Thursday, March 23, 2023 7:43 PM
To: Jeffrey Quok
Subject: RE: Boiler NOx emissions for Boilers less than 2 MMBtu/hr

Jeffrey,

See response below.

Thanks!

Roehl Fabay
California Boiler

From: Jeffrey Quok <JQuok@airquality.org>
Sent: Thursday, March 23, 2023 4:01 PM
To: Roehl Fabay <rfabay@californiaboiler.com>
Subject: RE: Boiler NOx emissions for Boilers less than 2 MMBtu/hr

Hi Roehl,

Thanks again for all your help. I've got a two more questions after receiving some comments on the proposed BACT.

1. Is the proposed 9 ppm NOx limit for the Powerflame NP2 burner guaranteed by the manufacturer? Yes, this is guaranteed by the manufacturer.
2. Have units been installed and were tested that meet the 9 ppm NOx limit in the 700MBH to 2000MBH range? Yes, this was commonly installed here in SCAQMD area.

Thank you,

Jeffrey Quok
Air Quality Engineer
Desk: (279) 207-1145
JQuok@airquality.org
www.AirQuality.org
@AQMD