

Best Available Control Technology (BACT) Requirements for Natural Gas Or Propane Fuel Boilers Or Steam Generators

DRAFT

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Prepared by:

Jagmeet Kahlon, Senior Air Quality Engineer

Reviewed by:

James Harader, Supervising Air Quality Engineer

Nick Peirce, Permit Services Manager

Brian Clements, Director of Permit Services

SJVAPCD Best Available Control Technology (BACT) Guideline 1.1.1*
Last Update: TBD

Natural gas or propane fired boilers/steam generators** with heat input rate greater than 5 MMBtu/hr and less than or equal to 20 MMBtu/hr

Pollutant	Achieved in Practice or contained in SIP	Technologically Feasible	Alternate Basic Equipment
NO _x	5 ppmvd @ 3% O ₂ (0.0061 lb/MMBtu)		
SO _x	PUC quality natural gas or propane with LPG backup		
PM ₁₀	PUC quality natural gas or propane with LPG backup		
CO	50 ppmvd @ 3% O ₂ (0.037 lb/MMBtu)		
VOC	PUC quality natural gas or propane with LPG backup		

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

* This is a Summary Page for this Class of Source

**This guideline is not applicable to Oilfield Steam Generators & Electric Utility Steam Generating Units

SJVAPCD Best Available Control Technology (BACT) Guideline 1.1.2*
Last Update: TBD

Natural gas or propane fired boilers/steam generators** with heat input rate greater than 20 MMBtu/hr

Pollutant	Achieved in Practice or contained in SIP	Technologically Feasible	Alternate Basic Equipment
NO _x	2.5 ppmvd @ 3% O ₂ (0.003 lb/MMBtu)		
SO _x	PUC quality natural gas or propane with LPG backup		
PM ₁₀	PUC quality natural gas or propane with LPG backup		
CO	50 ppmvd @ 3% O ₂ (0.037 lb/MMBtu)		
VOC	PUC quality natural gas or propane with LPG backup		

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

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**This guideline is not applicable to Oilfield Steam Generators & Electric Utility Steam Generating Units

I. Introduction

The purpose of this document is to update the following Best Available Control Technology (BACT) guidelines:

- 1.1.1 – Natural gas or propane fired boilers with heat input rating of less than or equal to 20 MMBtu/hr
- 1.1.2 – Natural gas or propane fired boilers greater than 20 MMBtu/hr.

Both guidelines were rescinded after adoption of District Rule 4320 (Advanced Emission Reduction Options for Boilers, Steam generators, and Process Heaters Greater than 5.0 MMBtu/hr (Adopted October 16, 2008) since the NO_x limit in Rule 4320 was more stringent than the Achieved-in-Practice (AIP) NO_x limit in each of the BACT guidelines. Since that time permit staff has been conducting BACT analyses on a case-by-case basis for each project. This proactive update is necessary to bring consistency in implementing the BACT standard throughout the regional offices of the District for new and modified boilers triggering BACT for emissions of oxides of nitrogen (NO_x), particulate matter with an aerodynamic diameter of 10 microns or less (PM₁₀), carbon monoxide (CO), and volatile organic compounds (VOC).

II. Background

Because of the climate and geography of the San Joaquin Valley, the District faces some of the most difficult air quality challenges in the entire nation. The District is a public health agency whose mission is to improve the health and quality of life for all Valley residents through efficient, effective, and entrepreneurial air quality management strategies. The District is responsible for developing plans to continue to improve the air quality in the San Joaquin Valley in order to reach attainment with health-based ambient air quality standards, and these plans become part of state and federal law. As a critical part of these plans to attain the established ambient air quality standards to mitigate adverse health impacts, District Rule 2201 – New and Modified Stationary Source Review Rule requires the use of BACT to minimize potential emissions from new and modified equipment and processes.

District Rule 2201 defines BACT as the most stringent emission limitation or control technique of the following:

- Achieved in practice for such category and class of source;
- Contained in any State Implementation Plan approved by the Environmental Protection Agency for such category and class of source. A specific limitation or control technique shall not apply if the owner of the proposed emissions unit demonstrates to the satisfaction of the APCO that such a limitation or control technique is not presently achievable; or

- Contained in an applicable federal New Source Performance Standard; or
- Any other emission limitation or control technique, including process and equipment changes of basic or control equipment, found by the Air Pollution Control Officer (APCO) to be cost effective and technologically feasible for such class or category of sources or for a specific source.

In order to determine the most stringent emission limitation or control technique for boilers or steam generators, the District has reviewed emission limits in Federal New Source Performance Standards (NSPS), state and local air District rules and regulations, BACT determinations conducted at Federal, State and local level, and source test data for boilers operating in the San Joaquin Valley Air Pollution Control District (SJVAPCD). This analysis forms the basis for determining AIP BACT standards for boilers and steam generators.

III. Applicable Regulations and Achieved in Practice BACT Requirements for natural gas and propane fueled boilers/steam generators

In order to evaluate the achieved in practice emission levels for natural gas or propane fueled boilers and steam generators of various heat input rating units, the requirements of the Federal and California regulations listed below were considered. In addition, BACT and Lowest Achievable Emission Rate (LAER) determinations from the US EPA RACT/BACT/LAER Clearinghouse (RBLC), the California Air Resources Board (ARB) statewide BACT Clearinghouse, and the BACT guidelines from the South Coast Air Quality Management District (SCAQMD), the Bay Area Air Quality Management District (BAAQMD), the Sacramento Metropolitan Air Quality Management District (SMAQMD), the Santa Barbara County Air Pollution Control District (SBCAPCD), and the Monterey Bay Unified Air Pollution Control District (MBAPCD) were also reviewed to evaluate the emission requirements and control technologies that are currently being utilized for natural gas or propane fueled boilers or steam generators.

A. Evaluation of Federal, State and Local Regulations

40 CFR Part 60 Subpart D – Standards of Performance for Fossil-Fuel-Fired Steam Generators (Last amended Feb 16, 2012)

This subpart is applicable to fossil fuel fired and or fossil –fuel and wood – residue fired steam generating units that commenced construction or modification after August 17, 1971 and are capable of firing fossil fuel at a heat input rate more than 250 MMBtu/hr. The subpart contains standards for NO_x, SO_x and PM emissions. The following table summarizes standards of particulate matter, sulfur dioxide and NO_x for units fired on gaseous fuels:

Steam generators	NOx	SOx	PM
> 250 MMBtu/hr fossil-fuel (gaseous) fired units	86 ng/J (0.2 lb/MMBtu)	None	<p><u>Natural gas fired units:</u> Natural gas units are exempt from above PM standards</p> <p><u>For other gaseous fuel fired units:</u> 43 ng/J (0.1 lb/MMBtu) & no more than 20% opacity except for one 6-minute period per hour of not more than 27% opacity</p>

40 CFR Part 60 Subpart Db – Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units (Last amended February 16, 2012)

This subpart is applicable to each steam generating unit that commenced construction, modification or reconstruction after June 19, 1984 and has a heat input capacity from fuels combusted in the steam generating unit of greater than 100 MMBtu/hr. The subpart contains standards for NOx, SOx and PM emissions. The following table summarizes standards of particulate matter, sulfur dioxide and NOx for units fired on natural gas:

Steam generators	NOx	SOx	PM
> 100 MMBtu/hr natural gas fired units	<p>43 ng/J (0.1 lb/MMBtu) for low heat release rate (70,000 Btu/hr-ft³ or less^{***})</p> <p>86 ng/J (0.2 lb/MMBtu) for high heat release rate (>70,000 Btu/hr-ft^{3***})</p>	<p>87 ng/J (0.2 lb/MMBtu heat input) or 8% of the potential SO₂ emission rate (92% reduction) and 520 ng/J (1.2 lb/MMBtu) heat input*</p> <p>Gaseous fuel fired units with SO₂ emission rate of 140 ng/J (0.32 lb/MMBtu) or less are exempt from the above SO₂ standard**</p>	None

* §60.42b(k)(1); **§60.42b(k)(2); ***design heat input capacity divided by furnace volume; furnace volume is that volume bounded by the front furnace wall where the burner is located, the furnace side water wall, and extending to the level just below or in front of the first row of convection pass tubes.

40 CFR Part 60 Subpart Dc - Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units (February 16, 2012)

This subpart is applicable to each steam generating unit that commenced construction, modification or reconstruction after June 9, 1989 and has a maximum design heat input capacity of 100 MMBtu/hr or less, but greater than or equal to 10 MMBtu/hr. The subpart contains standards for SOx and PM emissions. The following table summarizes standards of particulate matter and sulfur dioxide for gaseous fuels:

Steam generators	SOx	PM
≥ 10 MMBtu/hr to ≤100 MMBtu/hr gaseous fuel fired units	None	None

South Coast AQMD Rule 1146 (Last amended December 4, 2020)

The following table summarizes the South Coast Rule 1146 emission limits for natural gas or propane fueled units:

Steam generators	*NOx	**CO
Group I Units (natural gas fuel fired units, ≥75 MMBtu/hr, excluding thermal fluid heaters and units at schools & universities)	5 ppmv @ 3% O2 (0.0061 lb/MMBtu)	400 ppmvd @ 3% O2
Group II Units (Gaseous fuel excluding digester and landfill gases fired units, ≥20 MMBtu/hr but <75 MMBtu/hr)	7 ppmv @ 3% O2 (Fire-tube boilers with a previous NOx limit less than or equal to 9 ppm and greater than 5 ppm prior to December 7, 2018) 9 ppmv @ 3% O2 (All others with a previous NOx limit less than or equal to 12 ppm and greater than 5 ppm prior to December 7, 2018) 5 ppmvd @ 3% O2 (All others)	
Group III Units (gaseous fuel fired units, excluding digester gas and landfill gases, ≥5 MMBtu/hr and all units operated at universities rated at ≥5 MMBtu/hr, excluding atmospheric units and thermal fluid heaters)	7 ppmv @ 3% O2 (Fire-tube boilers, excluding units with a previous NOx limit less than or equal to 12 ppm and greater than 9 ppm prior to December 7, 2018) OR 9 ppmvd @ 3% O2 (All others)	

*Table 1146-1

**Rule 1146(c)(3)

Bay Area AQMD Regulation 9, Rule 7 – Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional and Commercial Boilers, Steam Generators and Process Heaters (Last amended May 4, 2011)

The following table summarizes NOx and CO requirements for units fired on gaseous fuels, excluding units fired on landfill and digester gas.

Heat input rate	*NOx	*CO
>2 to 5 MMBtu/hr	30 ppmvd @ 3% O2	400 ppmvd @ 3% O2
>5 to <10 MMBtu/hr	15 ppmvd @ 3% O2	
10 to <20 MMBtu/hr		
20 or more MMBtu/hr, load-following unit	9 ppmvd @ 3% O2	
20 to <75 MMBtu/hr	5 ppmvd @ 3% O2	
75 MMBtu/hr or more		

*Section 9-7-307

Sacramento Metro AQMD Rule 411 – NOx from Boilers, Process Heaters and Steam Generators (Last amended August 23, 2007)

The following table summarizes NOx and CO requirements for boilers fired on gaseous fuels, excluding units fired on landfill gas or a combination of landfill gas and natural gas.

Heat input rate	*NOx	*CO
≥1 and <5 MMBtu/hr	30 ppmvd @ 3% O2	400 ppmvd @ 3% O2
≥5 and ≤20 MMBtu/hr	15 ppmvd @ 3% O2	
> 20 MMBtu/hr	9 ppmvd @ 3% O2	
≥5MMBtu/hr, load following unit	15 ppmvd @ 3% O2	

SBCAPCD Rule 342 – Boilers, Steam Generators, and Process Heaters (5 MMBtu/hr and greater) (Last amended June 20, 2019)

This rule shall apply to any boiler, steam generator, or process heater with a rated heat input capacity greater than or equal to 5 MMBtu/hr. The following table summarizes NOx and CO requirements effective on an after January 1, 2020 for units fired on gaseous fuels, except for units fired on landfill gas or combination of landfill gas and natural gas.

Heat input rate	*NOx	*CO
5-20 MMBtu/hr	9 ppmvd @ 3% O2	400 ppmvd @ 3% O2
> 20 MMBtu/hr	7 ppmvd @ 3% O2	

*Table 1 of Rule 342

MBAPCD Rule 441 – Boilers, Steam Generators, and Process Heaters (Adopted February 19, 2020)

The following table summarizes NOx and CO requirements for boilers and process heaters fired on gaseous fuels.

Heat input rate	*NOx	*CO
≥2 to <5 MMBtu/hr	30 ppmvd @ 3% O2	400 ppmvd @ 3% O2
≥5 to <20 MMBtu/hr	15 ppmvd @ 3% O2	
≥20 MMBtu/hr	9 ppmvd @ 3% O2	

*Table 1 of Rule 441

SJVAPCD Rule 4306 – Boilers, Steam Generators, and Process Heaters – Phase 3 (Amended December 17, 2020)

The following table summarizes Tier 2 NOx and CO limits for boilers fired on gaseous fuels, excluding units fired on digester gas.

Heat input rate	*NOx	*CO
>5.0 to ≤20.0 MMBtu/hr	<u>Fire-tube boilers</u> 7 ppmvd @ 3% O2	400 ppmvd @ 3% O2
	<u>Units at schools</u> 9 ppmvd @ 3% O2	
	<u>All other units</u> 9 ppmvd @ 3% O2	
>20.0 to ≤75 MMBtu/hr	7 ppmvd @ 3% O2	
>75 MMBtu/hr	5 ppmvd @ 3% O2	

*Table 2 of Rule 4306

SJVAPCD Rule 4320 – Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr (Amended December 17, 2020)

The following table summarizes Tier 2 NOx and CO limits for boilers fired on gaseous fuels, excluding units fired on digester gas.

Heat input rate	*NOx	*CO	**PM
>5.0 to ≤20.0 MMBtu/hr	<u>Fire-tube boilers</u> 5 ppmvd @ 3% O2	400 ppmvd @ 3% O2	Use PUC quality gas, commercial propane, butane or LPG or a combination of such gases; Limit fuel sulfur content to no more than 5 gr-S/100 scf gas; Or Reduce SO ₂ emissions by at least 95% by wt. or limit exhaust SO ₂ to ≤ 9 ppmvd @ 3% O2
	<u>Units at schools</u> 9 ppmvd @ 3% O2		
	<u>All other units</u> 5 ppmvd @ 3% O2		
>20.0 to ≤75 MMBtu/hr	2.5 ppmvd @ 3% O2		
>75 MMBtu/hr	2.5 ppmvd @ 3% O2		

*Table 2 of Rule 4320; **Section 5.4 of Rule 4320

Summary:

Based on the above review of Federal, State and Local rules and regulations, the following standards are found to be the most stringent standards applicable to gaseous fired boilers. All ppmv limits are referenced at 3% O₂.

Category	NOx	SOx	PM10	CO	VOC
Gaseous fuel fired boiler >5 and ≤20 MMBtu/hr	5 ppmvd (SJVAPCD Rule 4320)	None	Use PUC quality gas, commercial propane, butane or LPG or a combination of such gases; Limit fuel sulfur content to no more than 5 gr-S/100 scf gas; OR Reduce SO ₂ emissions by at least 95% by wt. or limit exhaust SO ₂ to ≤ 9 ppmvd @ 3% O ₂	400 ppmvd @ 3% O ₂	None
Gaseous fuel fired >20 MMBtu/hr	2.5 ppmvd (SJVAPCD Rule 4320)	None	--same as above--	--same as above--	--same as above--

B. Evaluation of Federal, State and Local BACT/LAER Guidelines

EPA RACT/BACT/LAER clearinghouse

The EPA RACT/BACT/LAER clearinghouse, available at <https://cfpub.epa.gov/rblc/index.cfm?action=Search.BasicSearch&lang=en> was searched to determine limits established for boilers on natural gas fired boilers. The database was searched for records between 1/1/2012 and 8/22/2022 using process type 13.310 that covers commercial and institutional boilers. The following table shows the lowest values found for each pollutant.

EPA's RBLC Database Search					
Heat input rate	NOx	SOx	PM	CO	VOC
<=20 MMBtu/hr	9 ppmvd (RBLC ID: WY0070)	0.0004 lb/MMBtu (RBLC ID: AR-0173) Values varied from 0.0004 to 0.0022 lb/MMBtu**	0.0004 lb/MMBtu (RBLC ID: MI-0425 and MI-0448) Values varied from 0.0004 lb/MMBtu to 0.008 lb/MMBtu***	50 ppmvd (RBLC ID: PA-0309)	0.0038 lb/MMBtu (RBLC ID: NY-0104), 0.0055 lb/MMBtu (multiple units)
>20 MMBtu/hr	7 ppmvd (RBLC ID: AK-0083)	0.0006 lb/MMBtu (RBLC ID AR-0168 and others) Values varied from 0.0006 to 0.0022 lb/MMBtu*	0.0004 lb/MMBtu (RB:MI-0421 and MI-0448) Values varied from 0.0004 lb/MMBtu to 0.0175 lb/MMBtu	25 ppmvd (RBLC ID WI-0283, WI-0284) 50 ppmvd (RBLC ID AK-0083 & others)	0.0015 lb/MMBtu (RBLC ID: NY-0103, PA-0291)

*10 out of 13 records were 0.0006 lb/MMBtu, which is a generally accepted AP-42 emission factor
 **22 out of 29 records were 0.0006 lb/MMBtu, which is a generally accepted AP-42 emission factor
 ***13 out of 27 records were between 0.007 lb/MMBtu and 0.008 lb/MMBtu, which is close to the generally accepted AP-42 EF

SJVAPCD BACT guideline 1.1.1 - Natural gas Or propane fired boilers with heat input rate of less than or equal to 20 MMBtu/hr

The BACT requirements in this guideline became obsolete; therefore, the guideline was rescinded.

SJVAPCD BACT guideline 1.1.2 - Natural gas Or propane fired boilers with heat input rate of less than or equal to 20 MMBtu/hr

The BACT requirements in this guideline became obsolete; therefore, the guideline was rescinded.

SCAQMD BACT guidelines for natural gas or propane fueled boilers or steam generators

The following table summarizes BACT requirements for natural gas or propane fired boilers at non-major polluting facilities in SCAQMD. The requirements were last updated on February 1, 2019. BACT guideline is available at the

following link: <https://ww2.arb.ca.gov/sites/default/files/classic/technology-clearinghouse/bact/Guideline938.pdf?linktarget=self&embed=yes>

SCAQMD Database Search – Non-Major Source Polluting Facilities					
Heat input rate	NOx	SOx	PM	CO	VOC
Natural gas fired, >2 and <20 MMBtu/hr	Compliance with SCAQMD Rules 1146 or 1146.1	Natural gas	Natural gas	≤50 ppmvd for firetube ≤ 100 ppmvd for watertube, corrected to 3% O ₂	None
Propane fired, >2 and <20 MMBtu/hr	≤12 ppmvd @ 3% O ₂	None	None	Same as above	None
Natural gas or propane fired, ≥20 and <75 MMBtu/hr	Compliance with SCAQMD Rule 1146	Natural gas	Natural gas	Same as above	None
Natural gas or propane fired, ≥75 MMBtu/hr	Compliance with SCAQMD Rule 1146	Same as above	Same as above	Same as above	None

The following table summarizes BACT requirements for natural gas or propane fired boilers at major polluting facilities in SCAQMD.

SCAQMD Database Search – Major Source Polluting Facilities					
Heat input rate	NOx	SOx	PM	*CO	VOC
39.9 MMBtu/hr, water tube boiler fired on natural gas fuel (App #: 562449, 3/22/16)	5 ppmvd @ 3% O ₂	--	--	100 ppmvd @ 3% O ₂	--

BAAQMD BACT guidelines for natural gas or propane fueled boilers or steam generators

The following table summarizes BACT requirements for natural gas or propane fired boilers. BACT guidelines are available at the following link: <https://www.baaqmd.gov/permits/permitting-manuals/bact-tbact-workbook>. All ppmv limits are corrected to 3% O₂.

BAAQMD BACT Database					
Heat input rate	NOx	SOx	PM	CO	VOC
5 to <33.5 MMBtu/hr (Document # 17.1.1, 8/4/10)	No data	Natural gas	Natural gas	50 ppmvd for firetube 100 ppmvd for watertube	No data
≥33.5 to <50 MMBtu/hr (Document #17.2.1, 8/4/10)	No data	Natural gas	Natural gas	100 ppmvd	No data
≥50 MMBtu/hr (Document #17.3.1, 8/4/10)	No data	Natural gas	Natural gas	50 ppmvd (AIP), 10 ppmvd (Tech. feasible)	No data

SMAQMD BACT guidelines for natural gas or propane fueled boilers or steam generators

The following table summarizes BACT requirements for natural gas or propane fired boilers. BACT determination is available at the following link:

<https://ww2.arb.ca.gov/sites/default/files/classic/technology-clearinghouse/bact/BACTID294.pdf?linktarget=self&embed=yes>; all ppmvd limits are corrected to 3% O2.

SMAQMD Database					
Heat input rate	NOx	SOx	PM	CO	VOC
≥5 to ≤10 MMBtu/hr operating at <50% capacity* (6/19/18)	9 ppmvd (AIP)	Natural gas or LPG	Natural gas or LPG	50 ppmvd for firetube 100 ppmvd for watertube (AIP)	Natural gas or LPG
≥5 to ≤10 MMBtu/hr operating at >50% capacity (6/19/18)	7 ppmvd (cost effective)	Natural gas or LPG	Natural gas or LPG	50 ppmvd for firetube 100 ppmvd for watertube (AIP)	Natural gas or LPG
>10 to ≤20 MMBtu/hr at ≤30% capacity (6/19/18)	9 ppmvd (AIP)	Natural gas or LPG	Natural gas or LPG	50 ppmvd for firetube 100 ppmvd for watertube (AIP)	Natural gas or LPG
>10 to ≤20 MMBtu/hr at >30% capacity (6/19/18)	7 ppmvd (cost effective)	Natural gas or LPG	Natural gas or LPG	50 ppmvd for firetube 100 ppmvd for watertube (AIP)	Natural gas or LPG

*50% annual capacity is equivalent to full fire at 4,380 hr/yr.

MBAPCD BACT guidelines for natural gas or propane fueled boilers or steam generators

The following table summarizes BACT requirements for boilers on natural gas or propane fuel. <https://mbard.specialdistrict.org/boilers-and-heaters>, and then click “Clarification of Permit Requirements of Gaseous Fire Boilers”

MBAPCD BACT GUIDELINES FOR BOILERS			
Category/Fuel	Rating (MMBtu/hr)	NOx (as NO₂ @ 3% O₂)	CO (@ 3% O₂)
Natural Gas or Propane	= 2	≤ 20 ppmvd	400 ppmvd
Natural Gas	> 2 and < 75	≤ 9 ppmvd	≤ 50 ppmvd for firetube type ≤ 100 ppmvd for watertube type
Propane	> 2 and < 20	≤ 12 ppmvd	≤ 50 ppmvd for firetube type ≤ 100 ppmvd for watertube type
Propane	≥ 20 and < 75	≤ 9 ppmvd	≤ 50 ppmvd for firetube type ≤ 100 ppmvd for watertube type
Natural Gas or Propane	≥ 75	≤ 5 ppmvd	≤ 50 ppmvd for firetube type ≤ 100 ppmvd for watertube type

Summary:

Based on the above review of Federal, State and Local BACT/LAER guidelines, the following standards are found to be the most stringent standards to this date. All ppmv limits are referenced at 3% O₂.

Category	NOx	SOx	PM10	CO	VOC
Natural gas fired boiler >5 and ≤20 MMBtu/hr	7 ppmvd (SCAQMD Rule 1146, SMAQMD BACT Guideline)	Use of natural gas (multiple air districts)	Use of natural gas (multiple air districts)	50 ppmvd for fire-tube 100 ppmvd for water tube (multiple air districts)	Use of natural gas (multiple air districts)
Natural gas fired >20 MMBtu/hr	5 ppmvd (SCAQMD Rule 1146, SCAQMD BACT guideline)	--same as above--	--same as above--	--same as above--	--same as above--
Propane fired boiler >5 and ≤20 MMBtu/hr	7 ppmvd (SMAQMD BACT guideline*)	--same as above--	--same as above--	--same as above--	--same as above--
Propane fired >20 MMBtu/hr	5 ppmvd (SCAQMD Rule 1146, SCAQMD BACT guideline)	--same as above--	--same as above--	--same as above--	--same as above--

*It is presumed boiler operates at or above capacity limits set in SMAQMD guideline

C. Evaluation of Source Test Data for Permitted Units

San Joaquin Valley APCD maintains source test records of boilers in its permit database.

1. Boilers/steam generators with heat input rate between 5 and 20 MMBtu/hr

The SJVAPCD permits database was queried to identify units that tested at emission levels equal to or below of 5 ppm NO_x @ 3% O₂. This NO_x limit was recently established in District Rule 4320 for units between 5 and 20 MMBtu/hr. CO emission data was also reviewed for units tested at or below 5 ppmv NO_x @ 3% O₂.

It is evident from the source test data in **Appendix I**, multiple boilers across all heat input ratings and multiple industry types have reliably achieved a NO_x emission rate of 5 ppmv @ 3% O₂, or less, on multiple tests. The overwhelming majority of the CO test results were below 50 ppmvd @ 3% O₂, regardless of the industry or type of boiler. The majority of the boilers surveyed in Appendix I are fired on PUC quality natural gas. The boiler under permit S-8027-1-1 was operated and tested on propane fuel during 2012, 2013 and 2017 source tests.

Typically, for natural gas or propane fuel fired units, the District uses generally accepted emission factors for SO_x, PM₁₀, and VOC emissions to establish permit limits. Since these generally accepted emission factors are developed from source testing data, source testing for SO_x, PM₁₀ or VOC is generally not required. Therefore, source test data are not available for these pollutants.

2. Boilers/steam generators with heat input rate greater than 20 MMBtu/hr

Similar to item 1 above, the SJVAPCD permits database was also queried to identify units rated greater than 20 MMBtu/hr that tested at or below the NO_x limit of 2.5 ppm NO_x @ 3% O₂. This NO_x limit was recently established in District Rule 4320 for units greater than 20 MMBtu/hr. CO emission data was also reviewed for units tested at or below 2.5 ppmv NO_x @ 3% O₂.

It is evident from the data in **Appendix B**, boilers across all heat input ratings and multiple industry types in this category have reliably achieved a NO_x emission rate of 2.5 ppmv @ 3% O₂, or less, on multiple tests. The overwhelming majority of the CO test results were below 50 ppmvd @ 3% O₂, regardless of the industry or type of boiler.

Typically, for natural gas or propane fuel fired units, the District uses generally accepted emission factors for SO_x, PM₁₀, and VOC emissions to establish permit limits. Since these generally accepted emission factors are developed from source testing data, source testing for SO_x, PM₁₀ or VOC is generally not

required. Therefore, source test data is not available for these pollutants.

D. Summary of Findings

Based on the review of summaries in Section III. A, B, C above, the most stringent emission levels required and/or achieved are summarized in the following table:

Category	NOx	SOx	PM10	CO	VOC
Gaseous fuel fired boiler >5 and ≤20 MMBtu/hr	5 ppmvd (SJVAPCD Rule 4320, SJVAPCD source test data)	Use of natural gas (multiple air districts)	Use PUC quality gas, commercial propane, butane or LPG or a combination of such gases; Limit fuel sulfur content to no more than 5 gr-S/100 scf gas; Or Reduce SO ₂ emissions by at least 95% by wt. or limit exhaust SO ₂ to ≤ 9 ppmvd @ 3% O ₂	50 ppmvd (industry survey)	Use of natural gas (multiple air districts)
Gaseous fuel fired >20 MMBtu/hr	2.5 ppmvd (SJVAPCD Rule 4320, SJVAPCD source test data)	--same as above--	--same as above--	--same as above--	--same as above--

IV. Determination that Emission Limits are Achieved in Practice BACT

- A. Boilers/steam generator with heat input rate greater than 5 MMBtu/hr but less than or equal to 20 MMBtu/hr

Several gaseous fuel fired boilers in the valley rated greater than 5 MMBtu/hr up to 20 MMBtu/hr have demonstrated NOx emissions at or below 5 ppmvd @ 3% O₂. Additionally, CO emissions are well below 50 ppmvd for the overwhelming majority of fire-tube and water tube boilers.

Predominantly, PUC quality natural gas fuel is used to reduce to reduce SOx, PM, and VOC emissions.

B. Boilers/steam generator with heat input rate greater than 20 MMBtu/hr

Several gaseous fuel fired boilers in the valley rated greater than 20 MMBtu/hr have demonstrated NO_x emissions at or below 2.5 ppmvd @ 3% O₂. Furthermore, CO emissions are well below 50 ppmvd for the overwhelming majority of fire-tube and water tube boilers.

Predominantly, PUC quality natural gas fuel is used to reduce to reduce SO_x, PM, and VOC emissions.

Technologically Feasible Emission Control Options

As shown in Appendices I and II of this document, ultra low NO_x (ULN) burner systems and selective catalytic reduction (SCR) systems are the predominant emission control technologies currently employed by permitted sources to achieve NO_x emission levels below the emission standards recommended as achieved in practice in this BACT analysis.

The District is not aware of any other commercially available emission control technologies that can achieve NO_x emissions lower than what ULN burner systems and SCR systems have been demonstrated to achieve for this class and category of source at this time. Therefore, no other emission control technologies will be listed as feasible at this time.

V. Recommendation

For natural gas or propane fired boilers/steam generators with heat input rate greater than 5 MMBtu/hr and less than or equal to 20 MMBtu/hr, the following emissions standards are recommended.

Pollutant	Achieved in Practice or contained in SIP	Technologically Feasible	Alternate Basic Equipment
NO _x	5 ppmvd @ 3% O ₂ (0.0061 lb/MMBtu)		
SO _x	PUC quality natural gas or propane with LPG backup		
PM ₁₀	PUC quality natural gas or propane with LPG backup		
CO	50 ppmvd @ 3% O ₂ (0.037 lb/MMBtu)		
VOC	PUC quality natural gas or propane with LPG backup		

For natural gas or propane fired boilers/steam generators with heat input rate greater than 20 MMBtu/hr, the following emissions standards are recommended.

Pollutant	Achieved in Practice or contained in SIP	Technologically Feasible	Alternate Basic Equipment
NO _x	2.5 ppmvd @ 3% O ₂ (0.003 lb/MMBtu)		
SO _x	PUC quality natural gas or propane with LPG backup		
PM ₁₀	PUC quality natural gas or propane with LPG backup		
CO	50 ppmvd @ 3% O ₂ (0.037 lb/MMBtu)		
VOC	PUC quality natural gas or propane with LPG backup		

Appendix I

**Source Test Data for Boilers Greater than 5 and less than
or equal to 20 MMBtu/hr**

Permit	Heat input rate MMBtu/hr	Test Date	Results NOx (Permit Limit) ppmvd @3% O ₂	Results CO (Permit Limit) ppmvd @3% O ₂	Boiler Type	NOx control tech.	Facility Description
N-8750-4-0	5.5	27-Aug-13	3.3 (9)	2.8 (50)	Water-tube	ULN	CORRECTIONAL INSTITUTION
		28-Nov-17	4.6 (9)	0.3 (50)			
		14-Jun-21	4.7 (0)	0.7 (50)			
S-4299-3-1	8.4	27-Aug-12	4 (9)	0 (100)	Fire-Tube	ULN	LAUNDRY CLEANERS
		10-Sep-13	4.9 (9)	0 (100)			
		22-Aug-16	4.6 (9)	0.1 (100)			
S-5688-3-1 (Propane)	10.0	17-Mar-17	4.0 (9)	3.2 (50)	Fire-Tube	LN	GENERAL FARM
C-2108-9-1	10.5	2-Feb-16	4 (6)	0.4 (75)	Fire-Tube	ULN	INDUSTRIAL LAUNDERER
		19-Feb-19	4 (6)	4.6 (75)			
		25-Feb-22	4.78 (6)	0.4 (75)			
C-3463-1-4	10.5	5-Jun-14	4.1 (9)	2.8 (100)	Fire-Tube	ULN	FOOD PREPARATION
		31-May-17	4.5 (9)	1.5 (100)			
S-8027-1-0 (Propane)	11.5	24-Feb-12	3.34 (9)	9.8 (111)	Water-tube	LN	FRUIT OR VEGETABLE JUICE PRODUCTION
		20-Mar-13	0.32 (9)	9.7 (111)			
		7-Mar-16	2.79 (9)	9.72 (111)			
S-3655-6-0	12.5	4-Apr-17	4.9 (5)	11.3 (110)	Fire-Tube	ULN	CORRUGATED CONTAINER MANUFACTURING
		24-Apr-18	4.3 (5)	12.1 (110)			
		15-Mar-21	4.6 (5)	53.1 (110)			
N-1946-1-2	12.5	13-Jan-22	4.7 (5)	1.1 (50)	Fire-Tube	FGR+SCR	MEDICAL WASTE TREATMENT
C-1336-2-3	12.6	29-Jun-12	4.3 (9)	0.1 (100)	Fire-Tube	ULN	HOSPITAL
		14-Aug-14	3.3 (9)	4 (100)			
N-1660-15-0	12.6	1-Apr-20	4.72 (5.2)	3.36 (125)	Fire-Tube	LN	CHEESE PRODUCTION
		25-Mar-19	4.7 (5.2)	3.9 (125)			
N-3655-3-0	12.6	18-Mar-14	3.1 (5)	1.3 (50)	Fire-Tube	SCR	FOOD PREPARATION
		24-Feb-15	3.3 (5)	0 (50)			
		26-Jan-18	4.8 (5)	2 (50)			
		03-Mar-21	4.2 (5)	14.6 (50)			
N-3902-4-2	12.6	16-Jan-13	4.31 (9)	0.71 (50)	Fire-Tube	ULN	FOOD PRODUCTS
		19-Feb-16	4.79 (9)	0.72 (50)			
S-1257-26-0	13.78	6-Aug-20	4.19 (5)	0.2 (100)	Water-Tube	LN	AGRICULTURAL CHEMICALS

*ULN = Ultra low-NOx burner; FGR = Flue gas recirculation; SCR = Selective Catalytic Reduction; LN = Low NOx burner

NOTE: Cells highlighted in green show units with a permitted NOx limit of 5 ppmv or lower.

Permit	Heat input rate MMBtu/hr	Test Date	Results NOx (Permit Limit) ppmvd @3% O ₂	Results CO (Permit Limit) ppmvd @3% O ₂	Boiler Type	NOx control tech*	Facility Description
S-1257-19-0	14.6	26-Apr-12	3.23 (6)	3.94 (100)	Water-tube	ULN	AGRICULTURAL CHEMICALS
		01-May-15	5.13 (6)	2.34 (100)			
		17-Apr-18	3.98 (6)	2.06 (100)			
		23-Apr-21	3.01 (6)	0 (100)			
N-8234-10-0	14.65	8-Aug-13	1.3 (9)	0.1 (50)	Fire-Tube	SCR	PET FOOD MANUFACTURING
		17-Aug-16	1.8 (9)	0.23 (50)			
		23-Jul-19	1.5 (9)	1.1 (50)			
N-8234-11-0	14.65	19-Jul-12	0.05 (9)	0.1 (50)	Fire-Tube	SCR	PET FOOD MANUFACTURING
		8-Aug-13	2.9 (9)	0.1 (50)			
		17-Aug-16	2.7 (9)	0.28 (50)			
		23-Jul-19	5.1 (9)	2.2 (50)			
C-906-10-1	14.7	6-Sep-12	3.3 (9)	0 (50)	Fire-Tube	ULN	FOOD PREPARATION
		19-Sep-18	3.9 (9)	3 (50)			
C-3463-7-4	16.8	22-Nov-11	3.1 (8.29)	0.14 (76.9)	Fire-Tube	ULN	FOOD PREPARATION
		22-Nov-11	4.9 (9)	0.23 (100)			
		17-Nov-14	4.1 (8.29)	0.7 (76.9)			
		17-Nov-14	3.6 (9)	0.3 (100)			
		09-Nov-17	5.1 (8.29)	1.3 (76.9)			
		09-Nov-17	5.6 (9)	1.4 (100)			
		01-Dec-20	4.1 (8.29)	2.8 (76.9)			
01-Dec-20	4.5 (9)	2.9 (100)					
C-3463-18-0	17.5	24-Jun-13	4 (9)	0.1 (48)	Fire-Tube	ULN	FOOD PREPARATION
		28-Apr-16	4.6 (9)	0.4 (48)			
		18-Apr-19	4.39 (9)	3.09 (48)			
S-3591-17-0	18.6	18-Nov-13	4.5 (9)	0 (200)	Water-tube	ULN	POULTRY PROCESSING
		18-Oct-19	4.6 (9)	0.4 (200)			
N-8622-1-0	19.5	19-Sep-13	2.6 (5)	5.2 (50)	Water-tube	FGR+SCR	COOKING OIL PROCESSING
		9-Oct-14	3.7 (5)	0.3 (50)			
		12-Sep-17	4.6 (5)	1.1 (50)			
		19-Oct-18	1.6 (5)	0.2 (50)			
		15-Mar-18	1.5 (5)	2.3 (50)			
		15-Mar-21	3.2 (5)	0.4 (50)			

*ULN = Ultra low-NOx burner; FGR = Flue gas recirculation; SCR = Selective Catalytic Reduction; LN = Low NOx burner
NOTE: Cells highlighted in green show units with a permitted NOx limit of 5 ppmv or lower.

Permit	Heat input rate MMBtu/hr	Test Date	Results NOx (Permit Limit) ppmvd @3% O ₂	Results CO (Permit Limit) ppmvd @3% O ₂	Boiler Type	NOx control tech*	Facility Description
C-2282-10-0	19.95	17-Jan-17	4.3 (7)	1.5 (50)	Fire-Tube	ULN	MEAT PACKING PLANT
		22-Jan-18	3 (7)	3 (50)			
S-335-32-0	19.95	3-Sep-13	4.5 (7)	0 (50)	Fire-Tube	ULN	ANIMAL FEED PROCESSING
		29-Sep-16	4.8 (7)	0 (50)			
		23-Sep-19	4.4 (7)	0.05 (50)			
		09-Aug-22	4.98 (7)	0 (50)			
N-421-29-0	19.99	9-Jul-15	4.3 (6)	6.9 (100)	Water-tube	LN+FGR	CORRUGATED CONTAINER MANUFACTURING
		31-Jul-18	3.7 (6)	2.4 (100)			
		26-Jul-21	4.5 (6)	5.6 (100)			
N-421-30-0	19.99	31-Jul-18	3.6 (6)	35.4 (100)	Water-tube	LN+FGR	CORRUGATED CONTAINER MANUFACTURING
		9-Jul-15	4.6 (6)	2.41 (100)			
		26-Jul-21	4.6 (6)	8.3 (100)			
S-335-31-0	19.95	4-Sep-12	4.9 (7)	0 (50)	Fire-Tube	ULN	ANIMAL FEED PROCESSING
		3-Sep-13	3.9 (7)	0 (50)			
		29-Sep-16	4.8 (7)	0 (50)			
		23-Sep-19	5.5 (7)	0 (50)			
		09-Aug-22	3.94 (7)	0 (50)			
N-1399-38-0	19.95	26-Jul-21	0.5 (3.5)	1.3 (50)	Fire-Tube	ULN+SCR	TOMATO PROCESSING
S-1205-16-0	20	31-Dec-13	4.2 (5)	7.8 (100)	Fire-Tube	ULN+FGR	HOSPITAL
		23-Dec-14	3.67 (5)	10 (100)			
		13-Dec-17	4.67 (5)	1 (100)			
		20-Dec-20	5 (5)	0.5 (100)			

*ULN = Ultra low-NOx burner; FGR = Flue gas recirculation; SCR = Selective Catalytic Reduction; LN = Low NOx burner

NOTE: Cells highlighted in green show units with a permitted NOx limit of 5 ppmv or lower.

Appendix II

Source Test Data for Boilers Greater than 20 MMBtu/hr

Permit	Heat input rate MMBtu/hr	Test Date	Results NOx (Permit Limit) ppmvd @ 3% O ₂	Results CO (Permit Limit) ppmvd @ 3% O ₂	Boiler Type	NOx control tech*	Facility Description
C-1863-2-8	26	26-Dec-13	1.7 (5)	2.2 (200)	Water-tube	ULN+SCR	WINERY
		30-Oct-14	2.3 (5)	2.7 (200)			
		9-Nov-17	2.7 (5)	5.4 (200)			
		29-Oct-20	2.07 (5)	5.35 (200)			
C-9573-1-0	28.574	28-Jul-20	0.6 (2.5)	2.9 (50)	Fire-Tube	LN + SCR	CORRUGATED BOX MFG
		20-Aug-21	0.53 (2.5)	2.5 (50)			
S-8423-1-0	29.3	27-Oct-14	0.9 (5)	10.2 (100)	Fire-Tube	LN+SCR	CONCENTRATE, FROZEN FRUIT JUICE
		2-Oct-15	1 (5)	5.62 (100)			
		3-Mar-20	2.8 (5)	40 (100)			
N-9406-1-0	29.4	5-Jun-18	2 (2.5)	2.4 (10)	Fire-Tube	LN+SCR	CORRUGATED BOX MFG
		11-Jul-19	0.9 (2.5)	0.5 (10)			
		15-May-19	0.9 (2.5)	2.6 (10)			
		29-May-20	0.4 (2.5)	0.8 (10)			
N-8044-4-0	29.47	27-Jun-19	1.3 (2.5)	2.4 (50)	Fire-Tube	LN+SCR	CORRUGATED BOX MFG
		6-Jul-20	1.4 (2.5)	0.1 (50)			
C-72-11-0	30.3	10-Feb-20	0.8 (2.5)	0.6 (10)	Fire-Tube	SCR	RENDERING
		25-Feb-21	0.2 (2.5)	0.6 (10)			
S-6971-15-1	32.7	15-Aug-14	2.19 (5)	0 (50)	Fire-Tube	SCR	BIODIESEL PRODUCTION
		22-Jul-15	1.7 (5)	0.1 (50)			
		3-Aug-18	2.1 (5)	0.3 (50)			
		7-Jul-21	1.8 (5)	0.2 (50)			

*ULN = Ultra low-NOx burner; FGR = Flue gas recirculation; SCR = Selective Catalytic Reduction; LN = Low NOx burner

NOTE: Cells highlighted in green show units with a permitted NOx limit of 2.5 ppmv.

Permit	Heat input rate MMBtu/hr	Test Date	Results NOx (Permit Limit) ppmvd@3% O ₂	Results CO (Permit Limit) ppmvd @ 3% O ₂	Boiler Type	NOx control tech*	Facility Description
C-3275-3-1	33.66	15-Aug-12	0.1 (5)	5 (200)	Fire-Tube	LN+FGR+SCR	AGRICULTURAL PRODUCTS PROCESSING
		31-Aug-12	1.4 (5)	1 (200)			
		12-Sep-13	1.1 (5)	1 (200)			
		11-Aug-16	2.4 (5)	3 (200)			
N-1275-30-1	50.2	27-Aug-14	0.7 (5)	0.4 (50)	Water-tube	SCR	CHEESE PRODUCTION
		22-Jun-17	2 (5)	4 (50)			
C-1344-7-1	60	6-May-13	1.1 (5)	2.2 (100)	Water-tube	LN+FGR+SCR	WINERY
		18-Apr-16	1.7 (5)	0.2 (100)			
		17-May-19	2.85 (5)	6.71 (100)			
		26-May-22	1.9 (5)	0.4 (100)			
C-447-1-12	62	12-Mar-13	1.8 (7)	6 (100)	Water-tube	LN+FGR+SCR	WINERY
		12-Apr-13	2.4 (7)	16 (100)			
		30-Apr-14	1.9 (7)	1.1 (100)			
		30-Aug-17	2.8 (7)	6.5 (100)			
		25-Aug-21	1.4 (7)	1.1 (100)			
S-416-37-0	62	29-Mar-16	0.7 (5)	0 (45)	Water-tube	SCR	FOOD PREPARATION
		16-Mar-17	1.3 (5)	2.6 (45)			
		12-Mar-20	2.6 (5)	0 (200)			
C-705-1-8	71.4	4-Dec-13	2.3 (5)	0.05 (200)	Water-tube	LN+FGR+SCR	FERTILIZER PRODUCTION
		2-Dec-14	1.5 (5)	0.16 (200)			
		7-Dec-21	1.26 (5)	0.28 (200)			
C-1344-2-8	72	7-Nov-13	1.9 (5)	13.3 (140)	Water-tube	ULN+SCR	WINERY
		29-Oct-14	2.3 (5)	20 (140)			
		8-Nov-17	1 (5)	18.7 (140)			

*ULN = Ultra low-NOx burner; FGR = Flue gas recirculation; SCR = Selective Catalytic Reduction; LN = Low NOx burner
NOTE: Cells highlighted in green show units with a permitted NOx limit of 2.5 ppmv.

Permit	Heat input rate MMBtu/hr	Test Date	Results NOx (Permit Limit) ppmvd @ 3% O2	Results CO (Permit Limit) ppmvd @ 3% O2	Boiler Type	NOx control tech*	Facility Description
N-1174-9-0	81.8	20-Aug-12	2.4 (5)	0.3 (100)	Water-tube	LN+SCR	AGRICULTURAL PRODUCTS PROCESSING
		20-Aug-13	0.7 (5)	0.02 (100)			
		19-Sep-16	0.8 (5)	0.34 (100)			
C-1243-5-1	89	16-Aug-16	0.7 (5)	9.7 (100)	Water-tube	LN+FGR+SCR	CANNED SPECIALTIES
		10-Aug-17	1.2 (5)	1.8 (100)			
		29-Jul-20	1.8 (5)	3.2 (100)			
S-1203-22-1	90	9-May-12	0.5 (5)	8.8 (50)	Water-tube	LN+FGR+SCR	CHEESE PRODUCTION
		19-Mar-13	0.5 (5)	1.7 (50)			
		20-Mar-14	0.3 (5)	3.7 (50)			
		21-Mar-17	0.2 (5)	16.6 (50)			
		5-Mar-20	0.4 (5)	0.8 (50)			
N-1276-1-14	93	3-Oct-11	1.6 (5)	0 (100)	Water-tube	LN+FGR+SCR	PRODUCE PROCESSING PLANT
		5-Sep-17	2.4 (5)	0.3 (100)			
		8-Sep-14	1.2 (5)	0 (100)			
		30-Aug-21	0.8 (5)	1.7 (100)			
N-1276-15-6	98	8-Sep-14	0.4 (5)	1.3 (50)	Water-tube	LN+FGR+SCR	PRODUCE PROCESSING PLANT
		5-Sep-17	0.3 (5)	0.7 (50)			
		31-Aug-20	2.2 (5)	0.8 (50)			
C-447-295-2	99	13-Aug-13	0.9 (5)	1.9 (200)	Water-tube	LN+FGR+SCR	WINERY
		11-Sep-17	2 (5)	2.8 (200)			
		26-Aug-20	0.1 (5)	2.3 (200)			

*ULN = Ultra low-NOx burner; FGR = Flue gas recirculation; SCR = Selective Catalytic Reduction; LN = Low NOx burner

NOTE: Cells highlighted in green show units with a permitted NOx limit of 2.5 ppmv.

Permit	Heat input rate MMBtu/hr	Test Date	Results NOx (Permit Limit) ppmvd @ 3% O2	Results CO (Permit Limit) ppmvd @ 3% O2	Boiler Type	NOx control tech*	Facility Description
N-1680-2-9	140	4-Aug-15	0.5 (7)	5.1 (200)	Water-tube	LN+SCR	AGRICULTURAL PRODUCTS PROCESSING
		14-Aug-13	1.3 (7)	26 (200)			
N-1237-4-13	150	20-Apr-10	0.56 (7)	4.38 (200)	Water-tube	LN+FGR+SCR	WINERY
		16-Apr-13	2.22 (7)	1.26 (200)			
		14-Jul-16	1.8 (7)	3.3 (200)			
		16-May-19	1.91 (7)	65.34 (200)			
N-1276-18-3	180	16-Aug-10	0.6 (5)	12.9 (100)	Water-tube	FGR+SCR	PRODUCE PROCESSING PLANT
		8-Sep-14	1.6 (5)	17.5 (100)			
		5-Sep-17	0.67 (5)	32.8 (100)			
		11-Aug-11	0.6 (5)	12 (100)			
		31-Aug-20	0.7 (5)	0.8 (100)			
S-3550-1-8	180	5-Aug-11	2.5 (6)	0.18 (50)	Water-tube	SCR	TOMATO PROCESSING
		21-Jun-12	2.2 (6)	21.5 (50)			
		13-Jun-18	1.8 (6)	7.7 (50)			
		25-May-21	1.8 (6)	11.1(50)			

*ULN = Ultra low-NOx burner; FGR = Flue gas recirculation; SCR = Selective Catalytic Reduction; LN = Low NOx burner
NOTE: Cells highlighted in green show units with a permitted NOx limit of 2.5 ppmv.