

**State of the Art (SOTA)
Manual
for
Boilers and Process Heaters**

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State of New Jersey
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State of the Art (SOTA)
Manual for Boilers and Process Heaters
Section 3.12

Table of Contents

<u>Section</u>	<u>Page Number</u>
3.12.i: Tables.....	3.12 - 3
3.12.ii: Abbreviations	3.12 - 4
3.12: SOTA Manual for Boilers and Process Heaters	3.12 - 5
3.12.1: Scope	3.12 - 5
3.12.2: SOTA Performance Levels	3.12 - 5
3.12.2.1: SOTA Emission Levels for Natural Gas-Fired Boilers and Process Heaters	3.12 - 5
3.12.2.2: SOTA Emission Levels for Fuel Oil-Fired Boilers and Process Heaters ...	3.12 - 6
3.12.3: Technical Basis	3.12 - 7
3.12.3.1: Basis for Recommended Guidance.....	3.12 - 7
3.12.3.2: Control Technologies for Natural Gas-Fired Boilers and Process Heaters	3.12 - 7
3.12.3.3: Control Technologies for Fuel Oil-Fired Boilers and Process Heaters	3.12 - 8
3.12.3.4: Control Technologies for Coal and Other Solid Fuel Fired Boilers	3.12 - 9
3.12.4: Energy Efficiency Considerations	3.12 - 9

3.12.i TABLES

<u>Table</u>	<u>Page Number</u>
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SOTA Emission Level Tables:

Table 1a. Natural Gas-Fired Boilers and Process Heaters ≥ 10 to < 50 MMBTU/hr	3.12 - 5
Table 1b. Natural Gas-Fired Boilers and Process Heaters ≥ 50 to < 75 MMBTU/hr	3.12 - 5
Table 1c. Natural Gas-Fired Boilers and Process Heaters ≥ 75 MMBTU/hr	3.12 - 6
Table 2a. Distillate Fuel Oil-Fired Boilers and Process Heaters ≥ 10 to < 75 MMBTU/hr	3.12 - 6
Table 2b. Distillate Fuel Oil-Fired Boilers and Process Heaters ≥ 75 MMBTU/hr	3.12 - 6

SOTA Control Technology Tables:

Table 3a. Natural Gas-Fired Boilers and Process Heaters ≥ 10 to < 50 MMBTU/hr	3.12 - 7
Table 3b. Natural Gas-Fired Boilers and Process Heaters ≥ 50 to < 75 MMBTU/hr	3.12 - 8
Table 3c. Natural Gas-Fired Boilers and Process Heaters ≥ 75 MMBTU/hr	3.12 - 8
Table 4. Fuel Oil-Fired Boilers and Process Heaters, ≥ 10 to < 75 MMBTU/hr	3.12 - 9
Table 5. Fuel Oil-Fired Boilers and Process Heaters, ≥ 75 MMBTU/hr	3.12 - 9

3.12.ii ABBREVIATIONS

<i>BACT</i>	Best Achievable Control Technology
<i>CFR</i>	Code of Federal Regulations
<i>CO</i>	Carbon Monoxide
<i>EPA</i>	United States Environmental Protection Agency
<i>ESP</i>	Electrostatic Precipitator
<i>FGD</i>	Flue Gas Desulfurization
<i>FGR</i>	Flue Gas Recirculation
<i>LAER</i>	Lowest Achievable Emission Rate
<i>LNB</i>	Low NO _x Burner
<i>MMBTU</i>	Million British Thermal Units
<i>N.J.A.C.</i>	New Jersey Administrative Code
<i>NO_x</i>	Nitrogen Oxides
<i>NSPS</i>	New Source Performance Standards
<i>PM₁₀</i>	Particulate Matter Equal to or Smaller Than 10 Microns in Diameter
<i>PSD</i>	Prevention of Significant Deterioration
<i>SCR</i>	Selective Catalytic Reduction
<i>SNCR</i>	Selective Non-Catalytic Reduction
<i>SOTA</i>	State of the Art
<i>SO₂</i>	Sulfur Dioxide
<i>TSP</i>	Total Suspended Particulate Matter
<i>VOC</i>	Volatile Organic Compounds

3.12 STATE OF THE ART MANUAL FOR BOILERS AND PROCESS HEATERS

3.12.1 Scope

The state of the art (SOTA) performance levels outlined below apply to newly constructed, reconstructed, and modified industrial and utility boilers and process heaters subject to the SOTA provisions of N.J.A.C. 7:27-8 and N.J.A.C. 7:27-22.

3.12.2 SOTA Performance Levels

The following tables present state of the art one hour average emission levels for criteria pollutants and control technologies for each category of boilers and process heaters. Where no emission levels for SO₂ and TSP are specified, the emissions of these pollutants would be dependent on fuel composition. Coal and other solid fuel fired boilers will address SOTA levels on a case-by-case basis.

3.12.2.1 State of the Art Emission Levels for Natural Gas-Fired Boilers and Process Heaters

Table 1a
Natural Gas-Fired Boilers and Process Heaters

Criteria Pollutant	Emission Level (LB/MMBTU)
	³ 10 to < 50 MMBTU/hr
NO _x	0.0350
CO	0.0500
VOC	0.00500

Table 1b
Natural Gas-Fired Boilers and Process Heaters

Criteria Pollutant	Emission Level (LB/MMBTU)
	³ 50 to < 75 MMBTU/hr
NO _x	0.0200
CO	0.0500
VOC	0.00500

Table 1c
Natural Gas-Fired Boilers and Process Heaters

Criteria Pollutant	Emission Level (LB/MMBTU)
	³ 75 MMBTU/hr
NO _x	0.010
CO	0.0390
VOC	0.00500

3.12.2.2 State of the Art Emission Levels for Distillate Fuel Oil-Fired Boilers and Process Heaters

Table 2a
Distillate Fuel Oil-Fired Boilers and Process Heaters

Criteria Pollutant	Emission Level (LB/MMBTU)
	³ 10 and < 75 MBTU/hr
NO _x	0.0600
CO	0.0390
VOC	0.0100

Table 2b
Distillate Fuel Oil-Fired Boilers and Process Heaters

Criteria Pollutant	Emission Level (LB/MMBTU)
	³ 75 MMBTU/hr
NO _x	0.0300
CO	0.0390
VOC	0.0100

NOTE: SOTA performance levels for boilers and process heaters combusting fuel oils other than distillate oil will be addressed on a case-by-case basis.
 SOTA performance levels for natural draft process heaters and air pre-heaters will be addressed on a case-by-case basis.

3.12.3 Technical Basis

3.12.3.1 Basis for Recommended Guidance

The recommended standards are based on the following:

- Permits issued by the New Jersey Department of Environmental Protection and other states in United States;
- State and federal regulations;
- BACT data from the Bay Area Air Quality Management District;
- BACT data from the California Air Resource Board; and
- Data from the United States Environmental Protection Agency's RACT/BACT/LAER Information Systems.

3.12.3.2 Control Technologies for Natural Gas Fired Boilers and Process Heaters

The state of the art NO_x emission levels listed for natural gas-fired boilers and process heaters for the size ranges 10 to 50 MMBTU/hr heat input rate have been achieved with the use of Low NO_x Burners (LNBs) with Flue Gas Recirculation (FGR) or ultra LNBs (ULNB).

The state of the art NO_x emission levels listed for natural gas-fired boilers and process heaters for the size ranges 50 to 75 MMBTU/hr heat input rate have been achieved with LNBs with FGR or ULNB.

The state of the art NO_x emission levels listed for natural gas-fired boilers and process heaters for the size ranges equal to and greater than 75 MMBTU/hr heat input rate have been achieved with or without Selective Catalytic Reduction System (SCR).

The state of the art CO and VOC emission levels listed for natural gas-fired boilers and process heaters for the size ranges greater than 10 MMBTU/hr heat input rate have been achieved with combustion controls. Oxidation catalysts also reduce emissions of CO and VOC.

Natural gas is considered a "clean fuel" due to its low sulfur and particulate content.

Table 3a
Natural Gas-Fired Boilers and Process Heaters, ³ 10 and < 50 MBTU/hr

Criteria Pollutant	Control Technology
NO _x	LNB with FGR or ULNB
CO	Combustion Control
VOC	Combustion Control

SO ₂	Natural Gas
TSP/PM10	Natural Gas

Table 3b
Natural Gas-Fired Boilers and Process Heaters, ³ 50 to 75 MMBTU/hr

Criteria Pollutant	Control Technology
NO _x	LNB with FGR or ULNB
CO	Combustion Control
VOC	Combustion Control
SO ₂	Natural Gas
TSP/PM10	Natural Gas

Table 3c
Natural Gas-Fired Boilers and Process Heaters, ³ 75 MMBTU/hr

Criteria Pollutant	Control Technology
NO _x	LNB with FGR and/or SCR
CO	Combustion Control
VOC	Combustion Control
SO ₂	Natural Gas
TSP/PM10	Natural Gas

3.12.3.3 Control Technologies for Fuel Oil-Fired Boilers and Process Heaters

The state of the art NO_x emission levels listed for distillate fuel oil-fired boilers and process heaters for the size ranges 10 to 75 MMBTU/hr heat input rate have been achieved with the use of LNBS with FGR.

The state of the art NO_x emission levels listed for distillate fuel oil-fired boilers and process heaters for the size ranges greater than 75 MMBTU/hr heat input rate have been achieved with the use of LNBS with FGR and SCR.

The state of the art CO and VOC emission levels listed for distillate fuel oil-fired boilers and process heaters for the sizes greater than 10 MMBTU/hr heat input rate can be achieved by combustion controls.

SO₂ emissions are controlled on fuel oil-fired boilers and process heaters by using low sulfur fuel. Distillate oil (No. 1 or No. 2) contains less sulfur than residual oil (No. 5 or No. 6), and thus use of distillate oil is considered a control strategy. Ultra low sulfur fuel oil shall be evaluated as a back up

fuel instead of conventional low sulfur fuel because Ultra low S has less than 50 ppm sulfur and will result in very low SO₂ emissions. This fuel will have very low TSP and PM-10 emissions.

Methods for controlling particulate emissions from fuel oil-fired boilers and process heaters include fuel specification (clean burning distillate fuels) and mechanical methods (multi cyclones).

Table 4
Fuel Oil-Fired Boilers and process heaters, ³ 10 and <75 MMBTU/hr

Criteria Pollutant	Control Technology
NO _x	LNB with FGR
CO	Combustion Control
VOC	Combustion Control
SO ₂	Fuel Specification (Low Sulfur Fuel)

Table 5
Fuel Oil-Fired Boilers and process heaters, ³ 75 MMBTU/hr

Criteria Pollutant	Control Technology
NO _x	LNB with FGR and SCR
CO	Combustion Control
VOC	Combustion Control
SO ₂	Fuel Specification (Low Sulfur Fuel)
TSP/PM10	Multi cyclones

3.12.3.4 Control Technologies for Coal and Other Solid Fuel Fired Boilers and Process Heaters

Coal fired boilers would be large enough to be subject to 40 CFR 52.21 Best Available Control Technology (BACT) requirements, and N.J.A.C. 7:27-18.1 et. seq. Lowest Achievable Emission rate (LAER) requirements. Both BACT and LAER requirements are determined on a case by case. Other solid fuel-fired boilers and process heaters may also be subject to the same requirements.

The control technology currently available for coal fired boilers is SCR and/or SNCR for NO_x, scrubbers for SO₂, carbon injection for mercury and baghouses for particulate matter emissions. These air pollution control technologies are also applicable to other solid fuel fired boilers.

EMISSIONS REDUCTION WITH INCREASED ENERGY EFFICIENCY- POLLUTION PREVENTION

The New Jersey Air Pollution Control Code, N.J.A.C. 7:27-8.4(k)1 and N.J.A.C. 7:27-22, require inclusion of greenhouse gases resulting from fuel combustion in boilers and process heaters in air pollution control permits. Greenhouse gases include carbon dioxide, methane and nitrous oxide. Emissions of carbon dioxide can be reduced by favoring higher efficiency processes such as boilers and process heaters which are inherently more efficient. The energy efficiency of the boilers and process heaters expressed in terms of fuel to steam efficiency must be reported in the application. The SOTA level will be determined at the time of the application on a case by case basis. DEP is not setting a specific energy level requirement at this time as a SOTA level. Improving the energy efficiency of the system used is the best pollution prevention method. Higher efficiency systems require less fuel to produce the needed power. Improving energy efficiency also results in boilers and process heaters which emit lesser amounts of the criteria and hazardous air pollutants on an output basis.