

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Draft Staff Report

Proposed Amended Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines

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CHAPTER 1: BACKGROUND

INTRODUCTION

BACKGROUND

REGULATORY BACKGROUND

PUBLIC PROCESS

INTRODUCTION

In March 2017, the South Coast AQMD adopted the Final 2016 Air Quality Management Plan (2016 AQMP) which includes a series of control measures to achieve the National Ambient Air Quality Standards for ozone. The adoption resolution of the 2016 AQMP directed staff to achieve additional NO_x emission reductions and to transition the Regional Clean Air Incentives Market (RECLAIM) program to a command-and-control regulatory structure requiring Best Available Retrofit Control Technology (BARCT) as soon as practicable. In addition, California State Assembly Bill 617 (AB 617), which was signed by the Governor on July 26, 2017 and affects RECLAIM facilities that are also in the California Greenhouse Gas Cap and Trade program, requires implementation of Best Available Retrofit Control Technology (BARCT) no later than December 31, 2023, with priority given to older, higher polluting units.

Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines (Rule 1134) was adopted in 1989 and mostly recently amended in April 2019 to facilitate the transition of the NO_x RECLAIM program to a command-and-control regulatory structure and to implement Control Measure CMB-05 – Further NO_x Reductions from RECLAIM Assessment (Control Measure CMB-05) of the 2016 AQMP. Rule 1134 applies to stationary gas turbines that are located at RECLAIM, former RECLAIM, and non-RECLAIM facilities. Rule 1134 does not apply to gas turbines that are located at petroleum refineries or those subject to Rule 1135 – Emissions of Oxides of Nitrogen from Electricity Generating Facilities (Rule 1135), Rule 1150.3 – Emissions of Oxides of Nitrogen from Combustion Equipment at Landfills (Rule 1150.3), Rule 1179.1 – Emission Reductions from Combustion Equipment at Publicly Owned Treatment Works Facilities (Rule 1179.1).

Proposed Amended Rule (PAR) 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines will remove the ammonia emission limits for gas turbines and the provisions for startup, shutdown, and tuning to be consistent with policy changes that have been implemented after 2019. Additionally, PAR 1134 clarifies that recuperative gas turbines are included in a category referred to as “other” and adds new provisions for liquid fuel usage for health facilities to ensure Rule 1134 is consistent with state law provisions for use of liquid fuel in certain situations at health facilities.

The U.S. EPA has commented that interim emission limits are needed for former RECLAIM facilities that have compliance dates after the facility transitions out of RECLAIM. Only compressor gas turbines have NO_x BARCT limits that are likely to be implemented after the sunset of RECLAIM. PAR 1134 will establish an interim NO_x limit of 68 ppm for compressor gas turbines under paragraph (d)(4) which is consistent with current permit limits for this equipment.

BACKGROUND

The South Coast AQMD Governing Board adopted the RECLAIM program in October 1993. The purpose of RECLAIM is to reduce NO_x and SO_x emissions through a market-based approach. The program replaced a series of existing and future command-and-control rules and was designed to provide facilities with the flexibility to seek the most cost-effective solution to reduce their emissions. It also was designed to provide equivalent emission reductions, in the aggregate, for the facilities in the program compared to what would occur under a command-and-control regulatory approach. Regulation XX – Regional Clean Air Incentives Market (RECLAIM)

(Regulation XX) includes a series of rules that specify the applicability and procedures for determining NO_x and SO_x facility emissions allocations, program requirements, as well as monitoring, reporting, and recordkeeping requirements for RECLAIM facilities.

In response to concerns regarding actual emission reductions and implementation of BARCT under RECLAIM, Control Measure CMB-05 of the 2016 AQMP committed to an assessment of the RECLAIM program in order to achieve further NO_x emission reductions of five tons per day, including actions to sunset the program and ensure future equivalency to command-and-control regulations. During the adoption of the 2016 AQMP, the Resolution directed staff to modify Control Measure CMB-05 to achieve the five tons per day NO_x emission reduction as soon as feasible but no later than 2025, and to transition the RECLAIM program to a command-and-control regulatory structure requiring BARCT-level controls as soon as practicable. Staff provided a report on transitioning the NO_x RECLAIM program to a command-and-control regulatory structure at the May 5, 2017 Governing Board meeting and provides quarterly updates to the Stationary Source Committee, with the first quarterly report provided on October 20, 2017.

On July 26, 2017, AB 617 was approved by the Governor, which addresses non-vehicular air pollution (criteria pollutants and toxic air contaminants). Among the requirements of this bill is an expedited schedule for implementing BARCT for cap-and-trade facilities. The highest priority are given to older, higher polluting units that need to install retrofit controls.

REGULATORY BACKGROUND

Rule 1134 was adopted in 1989. The rule applies to stationary gas turbines rated at 0.3 MW and larger that were issued a Permit to Operate by the South Coast AQMD prior to August 4, 1989. The origin of the rule can be traced to a 1979 United States Environmental Protection Agency (U.S. EPA) New Source Performance Standard for Stationary Gas Turbines. In 1981, the California Air Resources Board (CARB) adopted a Suggested Control Measure for this same equipment. Rule 1134 was subsequently amended four times as summarized below.

- In December 1995, Rule 1134 was amended to exempt gas turbines located on San Clemente Island and the South East Desert Air Basin.
- In April 1997, Rule 1134 was amended to increase the NO_x concentration limit for turbines utilizing sewage digester gas.
- In August 1997, Rule 1134 was amended to clarify the need for continuous emission monitoring systems (CEMS) on turbines with a power output of 2.9 MW or larger.
- In April 2019, Rule 1134 was amended to expand applicability to include gas turbines installed after 1989 and RECLAIM facilities, lower NO_x concentration limits for gas turbines based on BARCT assessment, establish new ammonia slip limits and exemptions for low-use and near-NO_x-limit gas turbines, clarify monitoring, recordkeeping, and reporting compliance for former RECLAIM and Non-RECLAIM facilities, and exclude gas turbines located at electricity generating facilities, petroleum refineries, publicly-owned treatment works, landfills, and turbines utilizing landfill gas.

U.S. EPA approved Rule 1134 amendments through 1997 and were included into the SIP on August 1, 2000. The 2019 amendments were not submitted into the SIP because amendments were needed for the startup and shutdown provisions. The April 2019 amendment along with the current amendment will be submitted into the SIP.

STATIONARY GAS TURBINES AND RECLAIM

Beginning in 1994, a large number of utilities and third-party owned cogeneration facilities were included in the RECLAIM program and as such were not required to meet the NOx concentration limits imposed by Rule 1134 which had effective dates post 1994. However, gas turbines permitted prior to August 4, 1989 that were used at publicly owned treatment works, landfills, hospitals, and other public facilities, were not included in RECLAIM and were required to meet the concentration limits in Rule 1134. The 2019 amendment to Rule 1134 revised the applicability to all stationary gas turbines located at non-RECLAIM, former RECLAIM, and RECLAIM facilities (excluding those located at petroleum refineries or those subject to Rule 1135, Rule 1150.3, Rule 1179.1), regardless of the date they were permitted.

PUBLIC PROCESS

Development of Proposed Amended Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines was conducted through a public process. South Coast AQMD held two working group meetings on April 21, 2021 and May 12, 2021. The Working Group is composed of representatives from businesses, environmental groups, public agencies, and consultants. The purpose of the Working Group meetings is to discuss proposed concepts and work through the details of staff's proposals. Additionally, a Public Workshop was held on September 23, 2021.

CHAPTER 2: SUMMARY OF PROPOSAL

INTRODUCTION

APPLICABILITY (Subdivision (b))

DEFINITIONS (Subdivision (c))

EMISSIONS LIMITS (Subdivision (d))

MONITORING, RECORDKEEPING, AND REPORTING (Subdivision (e))

EXEMPTIONS (Subdivision (h))

INTRODUCTION

Proposed Amended Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines (PAR 1134) removes the ammonia emission limits for gas turbines and the provisions for startup, shutdown, and tuning. Additionally, PAR 1134 addresses recuperative gas turbines by inclusion into the “Other” category of stationary gas turbines and adds new provisions for liquid fuel usage for health facilities.

APPLICABILITY (Subdivision (b))

PAR 1134 applies to all stationary gas turbines located at non-RECLAIM and RECLAIM facilities, regardless of the date they were permitted, excluding those subject to other facility specific Regulation XI rules. PAR 1134 will move the following rules to the exemption section: Rule 1135 – Emission of Oxides of Nitrogen from Electricity Generating Facilities, Rule 1150.3 – Emissions of Oxides of Nitrogen from Combustion Equipment at Landfills, Rule 1179.1 – Emission Reductions from Combustion Equipment at Publicly Owned Treatment Works Facilities, and Proposed Rule 1109.1 – Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Operations.

DEFINITIONS (Subdivision (c))

PAR 1134 adds and modifies definition to clarify and explain key concepts and removes obsolete definitions. Please refer to PAR 1134 for each definition.

Proposed Deleted Definitions: Cogeneration Gas Turbine
Landfill
Petroleum Refinery
Publicly Owned Treatment Works

Proposed Added Definitions: Force Majeure Natural Gas Curtailment
Health Facility
Recuperative Gas Turbine

Proposed Modified Definitions: Combined Cycle/Cogeneration Gas Turbine
Existing Gas Turbine
Former RECLAIM NOx Facility
Shutdown
Startup
Thermal Stabilization Period

EMISSIONS LIMITS (Subdivision (d))

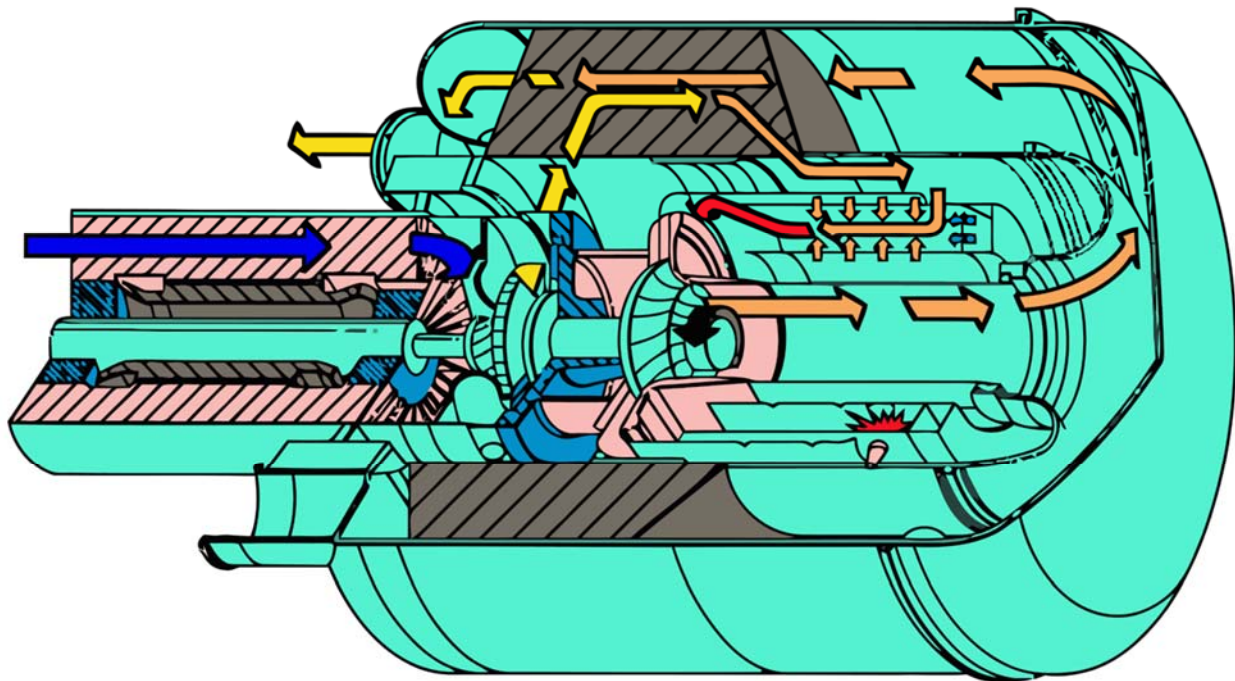
Paragraph (d)(3)

The ammonia emissions limits in paragraph (d)(3) of Table I will be removed for all turbines currently subject to Rule 1134 which would have been effective on January 1, 2024. Additionally, paragraph (d)(3) clarifies that startup and shutdown periods are not applicable to the Table I limits and instead are pursuant to Rule 429 – Start-up and Shutdown Exemption Provisions for Oxides of Nitrogen.

Staff conducted a BARCT assessment for stationary gas turbines as part of the 2019 amendment to Rule 1134. The BARCT assessment did not include recuperative gas turbines as staff was only aware of their use at landfills which are subject to Rule 1150.3. Subsequently, staff has learned that one recuperative gas turbine is subject to Rule 1134.

The 4.6 MW recuperative gas turbine is fired on natural gas with a NO_x permit limit of 5 ppm NO_x at 15 percent oxygen, dry. Recuperative gas turbines differ in design from a simple or combined cycle/cogeneration turbine. The recuperative gas turbine recovers combustion heat from the exhaust which is used to pre-heat the air from the compressor before returning it to the combustor. Figure 1 depicts a recuperated microturbine showing the recovery and reuse of combustion heat from the exhaust.

Figure 1 – Cutaway of Recuperated Microturbine



Harold F. Weaver - <http://www.grc.nasa.gov/WWW/RT2002/5000/5960weaver.html>

Recuperative gas turbines will be subject to the “Other” NO_x limit in paragraph (d)(3) of Table I. The facility operating the gas turbine will not need to make any changes to the equipment to meet

the “Other” NO_x limit. As a result, the cost-effectiveness is zero, since there is no feasible alternative more stringent than the NO_x limit to conduct the incremental cost-effectiveness.

Table 2-1
PAR 1134 Table I: Emissions Limits for Stationary Gas Turbines

Fuel Type	NO_x¹ (ppmv)	Oxygen (%, dry)
Liquid – Outer Continental Shelf	30	15
Natural Gas – Combined Cycle/Cogeneration	2	15
Natural Gas – Simple Cycle	2.5	15
Produced Gas	9	15
Produced Gas – Outer Continental Shelf	15	15
Other ¹	12.5	15

¹ – Includes recuperative gas turbines

PAR 1134 requires that a recuperative gas turbine have an integrated heat exchanger already built in as part of the original design of the equipment. The heat exchanger must be a built-in integral part of the gas turbine, instead of an operator-installed modification.

The U.S. EPA has commented that interim emission limits are needed for former RECLAIM facilities that have compliance dates after the facility transitions out of RECLAIM. Only compressor gas turbines have NO_x BARCT limits that are likely to be implemented after the sunset of RECLAIM. PAR 1134 will establish an interim NO_x limit of 68 ppm for compressor gas turbines under paragraph (d)(4) which is consistent with current permit limits for this equipment.

Former Paragraph (d)(5)

PAR 1134 will remove startup and shutdown provisions under subparagraph (d)(5). Currently, Rule 429 establishes provisions for simple cycle and combined cycle gas turbines regulated under Rule 1134. Proposed Amended Rule 429 will address startup and shutdown provisions for compressor gas turbines and recuperative turbines. Additional requirements for startup, shutdown, and tuning of existing stationary gas turbines are currently included in most operating permits for that equipment. The permit conditions are tailored to each unit and evaluated during the permitting process.

Paragraph (d)(5), (d)(8), and (d)(9)

Currently Rule 1134 prohibits the use of liquid fuel for stationary turbines except for outer continental shelf gas turbines which do not have access to natural gas. Paragraphs (d)(5) and (d)(8) includes provisions to allow turbines the use of liquid fuel during a force majeure natural gas curtailment at health facilities such as hospitals. This is consistent with the Office of Statewide Health Planning and Development (OSHPD) 2019 California Electrical Code, Title 24, Part 3, Articles 517.29 and 517.30 which requires a facility to have two independent power sources. Without this set of provisions, a turbine supplying power, or emergency power, for a health facility would be unable to operate during a natural gas curtailment. This would likely result in the health

facility utilizing a diesel engine which would generate far more emissions than the turbine which is vented to air pollution control equipment that would remain operating at all times the turbine is operating. When conducting fuel readiness testing, paragraphs (d)(5) and (d)(9) exempt stationary gas turbines burning a liquid fuel from the NO_x emission limits specified in paragraph (d)(3) but specify how the readiness testing shall be conducted and require NO_x emission limits and duration limits be included in the Permit to Construct or Permit to Operate.

MONITORING, RECORDKEEPING, AND REPORTING (Subdivision (e))

Paragraph (e)(1)

In March 2021 Rule 218 – Continuous Emission Monitoring was amended and Rule 218.2 – Continuous Emission Monitoring System: General Provisions and 218.3 – Continuous Emission Monitoring System: Performance Specification were adopted to address the continuous emission monitoring system (CEMS) requirements for non-RECLAIM and former RECLAIM facilities. Under paragraph (e)(2), Rules 218.2 and 218.3 require the installment of a continuous in-stack NO_x and oxygen monitoring system to demonstrate that the turbine is in compliance with the emission limits in subdivision (d). Paragraph (e)(3) applies to non-RECLAIM NO_x facilities.

Paragraph (e)(2)

The source testing frequency is clarified for stationary gas turbines emitting less than 25 tons of NO_x per calendar year to specify that the facility will need to perform a source test every three years. Additionally, source testing is required to be performed simultaneously for NO_x and ammonia. Because of their interdependency, simultaneous testing will ensure that compliance with one pollutant emission limit does not come at the expense of the other.

Paragraph (e)(3)

Continuous emission monitoring parameters pursuant to Rule 2012 – Requirements for Monitoring, Reporting, and Recordkeeping for Oxides of Nitrogen (NO_x) Emissions were previously included for former RECLAIM NO_x facilities. With the recent adoption of Rules 218.2 – Continuous Emission Monitoring System: General Provisions and 218.3 – Continuous Emission Monitoring System, the monitoring parameters will reference the newly adopted rules. Stationary gas turbines at RECLAIM facilities will still be subject to the provisions under Rule 2012.

EXEMPTIONS (Subdivision (h))

Paragraph (h)(1)

The facility specific stationary gas turbines previously excluded in the applicability subdivision are now listed in the exemptions.

CHAPTER 3: IMPACT ASSESSMENT

POTENTIALLY IMPACTED FACILITIES

EMISSIONS INVENTORY AND EMISSION REDUCTIONS

COST-EFFECTIVENESS

INCREMENTAL COST-EFFECTIVENESS

RULE ADOPTION RELATIVE TO COST-EFFECTIVENESS

SOCIOECONOMIC IMPACT ASSESSMENT

CALIFORNIA ENVIRONMENTAL QUALITY ACT

**DRAFT FINDINGS UNDER CALIFORNIA HEALTH AND SAFETY CODE
SECTION 40727**

COMPARATIVE ANALYSIS

POTENTIALLY IMPACTED FACILITIES

There are 37 facilities subject to Rule 1134. The amendments to monitoring, recordkeeping, and reporting, and removal of ammonia limits and startup and shutdown requirements will apply to all facilities subject to the rule, but these changes are not expected to have any impacts. One facility is subject to each of the following: the recuperative gas turbine (“Other”) NO_x limit, interim gas compressor NO_x limit, and force majeure natural gas curtailment allowance for health facilities. In each case, the revisions are not expected to result in equipment modifications or additional costs. The turbines currently in operation can comply with the revisions without making any changes.

EMISSION INVENTORY AND EMISSION REDUCTIONS

The NO_x emission inventory for turbines subject to Rule 1134 is 3.2 tons per day in 2015. With full implementation of the April 2019 amendments, 2.8 tons per day of NO_x will be reduced by 2024. The proposed revisions in PAR 1134 will not impact the emission inventory or emission reductions.

COST-EFFECTIVENESS

The provisions in PAR 1134 are not expected to impose any additional costs.

INCREMENTAL COST-EFFECTIVENESS

H&SC Section 40920.6 requires an incremental cost-effectiveness analysis for BARCT rules or emission reduction strategies when there is more than one control option which would achieve the emission reduction objective of the proposed amendments, relative to ozone, CO, SO_x, NO_x, and their precursors. PAR 1134 does not reduce emissions or provide more than one control option.

RULE ADOPTION RELATIVE TO COST-EFFECTIVENESS

On October 14, 1994, the Governing Board adopted a resolution that requires staff to address whether rules being proposed for amendment are considered in the order of cost-effectiveness. The 2016 Air Quality Management Plan (AQMP) ranked, in the order of cost-effectiveness, all of the control measures for which costs were quantified. It is generally recommended that the most cost-effective actions be taken first. Proposed Amended Rule 1134 helps implement Control Measure CMB-05. The 2016 AQMP ranked Control Measure CMB-05 sixth in cost-effectiveness.

SOCIOECONOMIC IMPACT ASSESSMENT

The Proposed Amended Rule 1134 does not impose any additional costs to the affected facilities and does not result in any adverse socioeconomic impacts.

CALIFORNIA ENVIRONMENTAL QUALITY ACT

Pursuant to the California Environmental Quality Act (CEQA) Guidelines Sections 15002(k) and 15061, the proposed project is exempt from CEQA pursuant to CEQA Guidelines Section 15061(b)(3). A Notice of Exemption has been prepared pursuant to CEQA Guidelines Section

15062 and if the proposed project is approved, the Notice of Exemption will be filed for posting with the county clerks of Los Angeles, Orange, Riverside, and San Bernardino Counties. The Notice of Exemption will also be electronically filed with the State Clearinghouse of the Governor's Office of Planning and Research to be posted on their CEQAnet Web Portal, which may be accessed via the following weblink: <https://ceqanet.opr.ca.gov/search/recent>. In addition, the Notice of Exemption will be electronically posted on South Coast AQMD's webpage which can be accessed via the following weblink: <http://www.aqmd.gov/nav/about/public-notices/ceqanotices/notices-of-exemption/noe---year-2021>.

DRAFT FINDINGS UNDER CALIFORNIA HEALTH AND SAFETY CODE SECTION 40727

Requirements to Make Findings

California Health and Safety Code Section 40727 requires that prior to adopting, amending or repealing a rule or regulation, the South Coast AQMD Governing Board shall make findings of necessity, authority, clarity, consistency, non-duplication, and reference based on relevant information presented at the public hearing, and in the staff report.

Necessity

Proposed Amended Rule 1134 is needed to address establish BARCT requirements for stationary gas turbines, including stationary gas turbines at facilities that will be transitioning from RECLAIM to a command-and-control regulatory structure.

Authority

The South Coast AQMD Governing Board has authority to adopt amendments to Proposed Amended Rule 1134 pursuant to the California Health and Safety Code Sections 39002, 40000, 40001, 40440, 40702, 40725 through 40728, and 41508.

Clarity

Proposed Amended Rule 1134 is written or displayed so that its meaning can be easily understood by the persons directly affected by it.

Consistency

Proposed Amended Rule 1134 is in harmony with and not in conflict with or contradictory to, existing statutes, court decisions, or state or federal regulations.

Non-Duplication

Proposed Amended Rule 1134 will not impose the same requirements as any existing state or federal regulations. The proposed amended rule is necessary and proper to execute the powers and duties granted to, and imposed upon, the South Coast AQMD.

Reference

In amending Rule 1134, the following statutes which the South Coast AQMD hereby implements, interprets or makes specific are referenced: Health and Safety Code sections 39002, 40000, 40001, 40406 (BARCT), 40702, 40440(a), and 40725 through 40728.5, and Clean Air Act Section 172 (c)(1) (reasonably available control technology).

COMPARATIVE ANALYSIS

Health and Safety Code Section 40727.2 requires a comparative analysis of the proposed amended rule with any Federal or District rules and regulations applicable to the same source. A comparative analysis is presented below in Table 3-1.

**Table 3-1
PAR 1134 Comparative Analysis**

Rule Element	PAR 1134	RECLAIM	40 CFR Part 60 GG	40 CFR Part 60 KKKK
Applicability	Turbines with generating capacity greater than 0.3 MW except those located electric generating facilities, landfills, petroleum refineries, and publicly owned treatment works or fueled with landfill gas	Facilities regulated under the NOx RECLAIM program (South Coast AQMD Reg. XX)	Gas turbines with heat input of ≥ 10 MMBtu/hr constructed or modified before 2/18/2005	Gas turbines with heat input of ≥ 10 MMBtu/hr constructed or modified after 2/18/2005
Requirements	Emission limits: <ul style="list-style-type: none"> • Combined Cycle/Cogeneration Gas Turbine and Associated Duct Burner: NOx 2 ppmv @ 15% O₂ • Simple Cycle Gas Turbine: NOx 2.5 ppmv @ 15% O₂ • Produced Gas Turbine: NOx 9 ppmv @ 15% O₂ • Outer Continental Shelf Produced Gas Turbine: NOx 15 ppmv @ 15% O₂ • Outer Continental Shelf Produced Gas Turbine (Liquid Fuel): NOx 30 ppmv @ 15% O₂ • Compressor Gas Turbine: NOx 3.5 ppmv @ 15% O₂ • Other Gas Turbine: NOx 12.5 ppmv @ 15% O₂ 	None	NOx limit @ 15% O ₂ : $0.0075*(14.4/Y)+F$ where Y = manufacture's rated heat input and F = NOx emission allowance for fuel-bound nitrogen	NOx limit for electric generating units (@ 15% O ₂): <ul style="list-style-type: none"> • ≤ 50 MMBtu/hr – 42 ppm when firing natural gas • 50 MMBtu/hr and ≤ 850 MMBtu/hr – 15 ppm when firing natural gas • >850 MMBtu/hr – 15 ppm when firing natural gas • ≤ 50 MMBtu/hr – 96 ppm when firing other fuel • 50 MMBtu/hr and ≤ 850 MMBtu/hr – 74 ppm when firing other fuel • >850 MMBtu/hr – 42 ppm when firing natural gas
Reporting	Annual reporting of NOx emissions	<ul style="list-style-type: none"> • Daily electronic reporting for major sources • Quarterly Certification of Emissions Report and Annual Permit Emissions Program for all units 	Excess emissions and CEMS downtime within 30 days	Excess emissions and CEMS downtime within 30 days; annual performance testing within 60 days
Monitoring	A continuous in-stack NOx monitor for turbines with a capacity of 2.9 MW or greater. Periodic source testing for turbines with a capacity of < 2.9	A continuous in-stack NOx monitor for major sources	A continuous in-stack NOx monitor	A continuous in-stack NOx monitor
Recordkeeping	Performance testing; emission rates; monitoring data; CEMS audits and checks maintained for five years	<ul style="list-style-type: none"> • < 15-min. data = min. 48 hours; ≥ 15-min. data = 3 years (5 years if Title V) • Maintenance & emission records, source test reports, RATA reports, audit reports and fuel meter calibration records for Annual Permit Emissions Program = 3 years (5 years if Title V) 	Performance testing; emission rates; monitoring data; CEMS audits and checks	Performance testing; emission rates; monitoring data; CEMS audits and checks
Fuel Restrictions	Liquid petroleum fuel limited to Outer Continental Shelf turbines and those supplying power for health facilities	None	None	None