



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

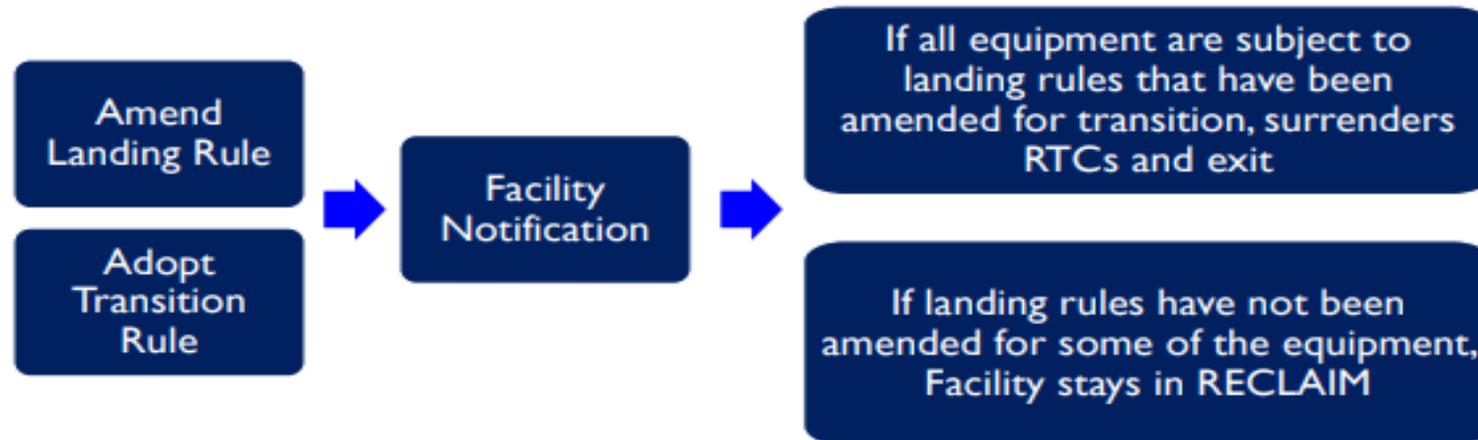
Working Group #1
February 22, 2018

Background

- ▶ **2016 Air Quality Management Plan**
 - ▶ Control Measure CMB-05 called for further NO_x reductions from an assessment of the RECLAIM program, including:
 - ▶ A five ton per day NO_x reduction to be achieved no later than 2025; and
 - ▶ Sunsetting the RECLAIM program and transitioning to a command-and-control regulatory structure that requires Best Available Retrofit Control Technology (BARCT) level controls
- ▶ **2017 - AB 617**
 - ▶ Expedited BARCT schedule for largest emitters
 - ▶ Implementation schedule to be developed by 1/1/2019
 - ▶ Full BARCT implementation by 12/31/2023

RECLAIM Transition

RECLAIM Transition



- ▶ Developing transition strategy for facilities exiting RECLAIM
 - ▶ Transition plan to be released shortly

Regulatory Background for Stationary Gas Turbines

- ▶ 1989 - Adoption of Rule 1134
 - ▶ Applicable to existing (as of August 1989) gas turbines rated ≥ 0.3 MW
- ▶ 1993 - Adoption of RECLAIM
 - ▶ Most utilities and third-party power generating gas turbines entered into RECLAIM
 - ▶ Gas turbines located at Publicly Owned Treatment Works, landfills, hospitals, and other public facilities not eligible under RECLAIM still subject to Rule 1134
 - ▶ As new equipment replaced older gas turbines, few facilities remain subject to Rule 1134; most are in RECLAIM or not subject to a source specific rule
- ▶ 1995 - Amendment of Rule 1134
 - ▶ Gas turbines located in Southeast Desert Air Basin (now Mojave Desert Air Basin) and San Clemente Island conditionally exempted
- ▶ 1997 - Amendment of Rule 1134
 - ▶ Increased NO_x limit for gas turbines using sewage digester gas from 9 ppm to 25 ppm and clarified that Continuous Emission Monitoring System (CEMS) requirements

Current Rule 1134 Requirements

- ▶ Applies to gas turbines greater than 0.3 MW existing prior to 1989
 - ▶ Does not apply to turbines installed after August 4, 1989
- ▶ NOx limits based on:
 - ▶ Size of unit
 - ▶ Type of unit (combined or simple cycle)
 - ▶ Type of gas burned
 - ▶ Presence of Selective Catalytic Reduction
- ▶ CEMS required for gas turbines ≥ 2.9 MW
- ▶ Source testing required annually for units emitting ≥ 25 ppm of NOx
 - ▶ Others test after 8,400 hours of operation
- ▶ Daily records and monthly reporting

Current NOx Limits in Rule 1134

Unit Size (MW)	NOx Reference Limit (ppm)
No SCR	
0.3 to < 2.9	25
2.9 to < 10	15
2.9 to < 10 (Sewage Digester Gas)	25
10 and Over	12
60 and Over (Combined Cycle)	15
With SCR	
2.9 to < 10	9
10 and Over	9
60 and Over (Combined Cycle)	9

NOx Compliance Limit = Reference Limit x (EFF/25%)

EFF = (3413 x 100%) / Actual Heat Rate at Higher Heating Value of Fuel

Overview of Amendments to Rule 1134

- ▶ Revise the applicability to include RECLAIM facilities and post-1989 gas turbines
- ▶ BARCT review of NOx limits
- ▶ Review of Monitoring, Reporting, and Recordkeeping requirements
- ▶ Exclude Rule 1134 gas turbines at refineries and electricity generating facilities
 - ▶ Gas turbines at refineries and electricity generating facilities will be included in industry specific rules
 - ▶ Rule 1109.1 - Refineries
 - ▶ Rule 1135 - Electricity Generating Facilities

Possible Rule 1134 Facilities

Facility Type	Non-RECLAIM Facilities	RECLAIM Facilities
Publicly Owned Treatment Works	5	0
Landfill	3	0
Hospital	2	0
Other Public Facility	5	1
Third Party Generator	3	4
Petroleum Production	0	5
On-Site Generator	1	7
Emergency	6	0
TOTAL	25	17

Equipment Potentially Subject to PAR 1134

- ▶ 98 turbines/duct burners at 42 facilities
 - ▶ 47 simple cycle
 - ▶ 38 combined cycle and duct burners
 - ▶ Emergency - 17 turbines at 6 facilities are operated less than 200 hours per year

Turbines at Non-RECLAIM Facilities

Facility Type	Total Number of Facilities	Simple Cycle Units	Combined Cycle Units and Duct Burners
Publicly Owned Treatment Works	5	7	12
Landfill	3	7	4
Hospital	2	0	4
Other Public Facility	5	4	6
Third Party Generator	3	1	3
On-Site Generator	1	1	0
Emergency	6	17	0
TOTAL	25	37	29

Turbines at RECLAIM Facilities

Facility Type	Total Number of Facilities	Simple Cycle Units	Combined Cycle Units
Other Public Facility	1	1	0
Third Party Generator	4	3	1
On-Site Generator	7	11	7
Petroleum	5	9	0
TOTAL	17	24	8

Emissions from PAR 1134 Equipment

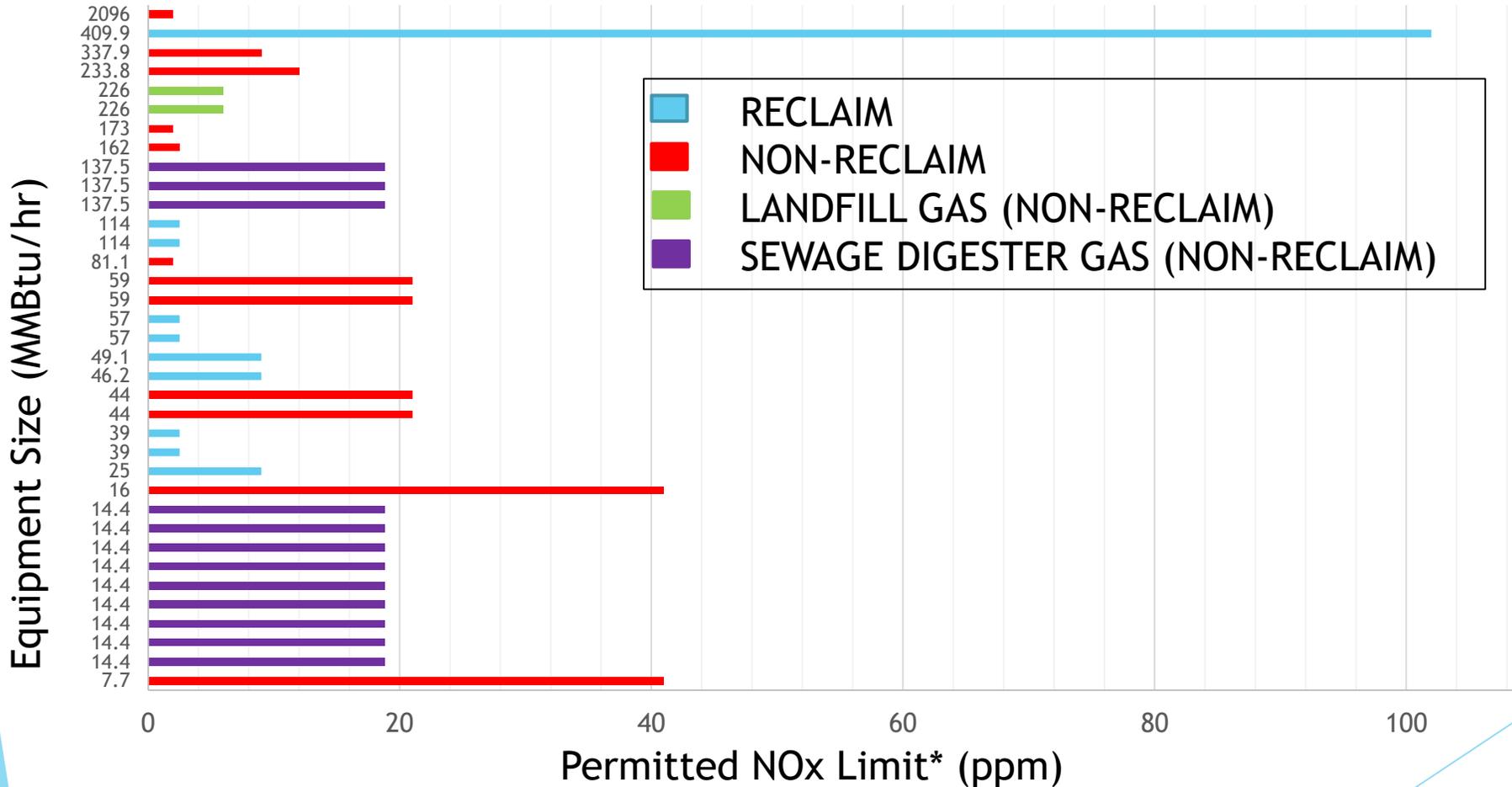
- ▶ Mass emissions reported from facilities
- ▶ Some missing data, will complete in future analysis
 - ▶ Many emergency only equipment not reporting
 - ▶ Facilities beginning operations after 2015 not included

Type of Facility	Tons Per Year NOx (2015)
RECLAIM	673.8
Simple Cycle	652.9
Combined Cycle	20.9
Non-RECLAIM	281.7
Simple Cycle	204.8
Combined Cycle	76.9
Total	955.5

Combined Cycle Gas Turbines/Duct Burners

- ▶ Sizes: 8 - 2,096 MMBtu/hr
- ▶ NOx Permit Emission Limits: 2 - 102 ppm
- ▶ 4 outliers
 - ▶ 2 units - 2,096 MMBtu/hr with 2 ppm emission limit (BACT)
 - ▶ 1 unit - 410 MMBtu/hr with 102 ppm emission limit
 - ▶ Unit had 2 ppm emission limit removed from permit conditions
 - ▶ 2 units - 16 MMBtu/hr turbine combined with 7 MMBtu/hr duct burner both with 41 ppm emission limit
 - ▶ Unit installed in 1993

Combined Cycle Gas Turbines and Associated Duct Burners

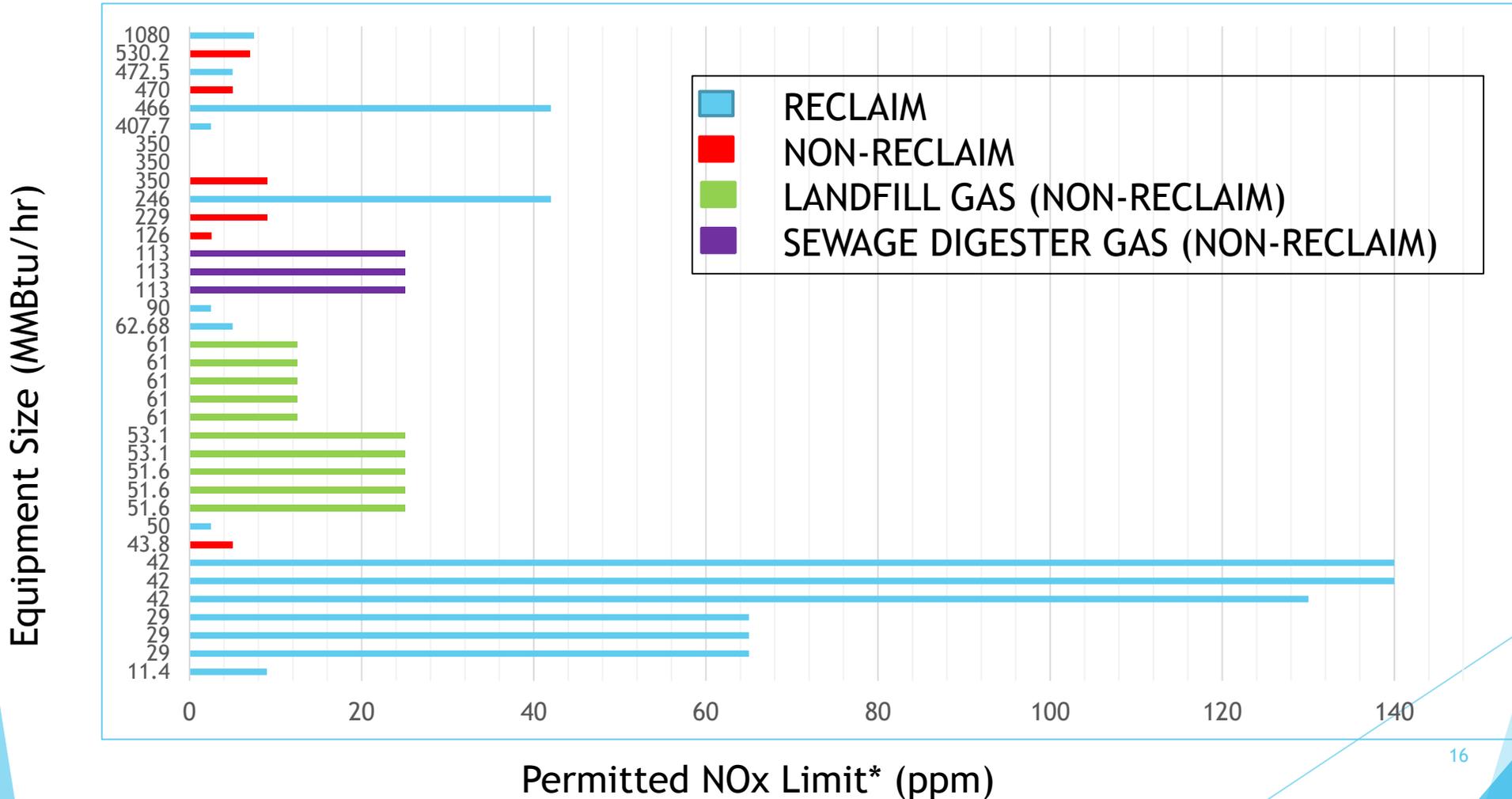


*Some units installed to meet BACT and BARCT

Simple Cycle Gas Turbines

- ▶ Sizes: 11 - 1,080 MMBtu/hr
- ▶ NOx Permit Emission Limits: 2.5 - 140 ppm
 - ▶ Permitted emission limits vary widely
- ▶ Outliers
 - ▶ 6 smaller units (29-42 MMBtu/hr) with highest permitted emission limits (65-140 ppm NOx @ 15% O₂)
 - ▶ All associated with offshore platforms
 - ▶ 246 MMBtu/hr unit with 42 ppm NOx @ 15% O₂
 - ▶ NOx limit not included in RECLAIM permit; reinstated 1986 BACT limit
 - ▶ 466 MMBtu/hr unit with 42 ppm NOx @ 15% O₂
 - ▶ Unit installed in 1991

Simple Cycle Gas Turbines (continued)



*Some units installed to meet BACT and BARCT

Landfill Gas Turbines and Duct Burners

- ▶ Sixteen turbines utilizing landfill gas
- ▶ Sizes: 52 - 226 MMBtu/hr
- ▶ NOx Limits:
 - ▶ Three 52 MMBtu/hr simple cycle units with 25 ppm NOx @ 15% O₂
 - ▶ Two 53 MMBtu/hr simple cycle units with permitted emission limits of 25 ppm NOx @ 15% O₂
 - ▶ Five 61 MMBtu/hr simple cycle units with 12.5 ppm NOx @ 15% O₂ (BACT)
 - ▶ Four 72 MMBtu/hr combined cycle units with 25 ppm NOx @ 15% O₂
 - ▶ Two 226 MMBtu/hr combined cycle units with 6 ppm NOx @ 15% O₂ (BACT)

Sewage Digester Gas Turbines and Duct Burners

- ▶ Fifteen turbines and duct burners utilizing sewage digester gas
- ▶ Sizes: 14 - 113 MMBtu/hr
- ▶ NOx Limits:
 - ▶ Nine 14 MMBtu/hr duct burners and three 138 MMBtu/hr combined cycle units with permitted emission limits of 18.8 ppm NOx @ 15% O₂
 - ▶ Three 113 MMBtu/hr simple cycle units with 25 ppm NOx @ 15% O₂

BARCT Determination Process

- ▶ Identify one or more potential control options which achieves the emission reduction objectives for the regulation
- ▶ Review the information developed to assess the cost-effectiveness of the potential control option
 - ▶ Cost-effectiveness is the cost, in dollars, of the potential control option divided by emission reduction potential, in tons (For example: \$ per ton of NO_x reduced)
- ▶ Calculate the incremental cost-effectiveness for the potential control options identified in paragraph
 - ▶ The incremental cost-effectiveness is the difference in the dollar costs divided by the difference in the emission reduction potentials between each progressively more stringent potential control option as compared to the next less expensive control option
- ▶ In addition to the overall cost-effectiveness, additional considerations for:
 - ▶ Outliers
 - ▶ Stranded assets
 - ▶ Accounting for recent installations - implementation of previous requirements - BARCT or BACT

Considerations for NOx Limits

- ▶ Limits may vary by size (input in MMBtu/hr or power output in MW) and fuel gas (natural gas, landfill gas, sewage digester gas)
- ▶ Limits may vary by type of turbine (simple/combined cycle)
- ▶ Possible Start-up and Shutdown provisions including number of starts, NOx limits, and time limits
- ▶ CEQA implications for ammonia slip
- ▶ Averaging times (15 minutes, 1 hour, etc.) under consideration
- ▶ Implementation timeline may also vary by size and fuel gas

Schedule

Next Working Group Meeting

March 2018

Public Workshop

3rd Quarter 2018

Stationary Source Committee

July 20, 2018

Set Hearing

September 7, 2018

Public Hearing

October 5, 2018

Contacts

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