



# **Proposed Rule 1150.3**

## **Emissions of Oxides of Nitrogen from Combustion Equipment at Landfills**

**Working Group Meeting #2**  
August 13, 2019

### **Teleconference Information**

Dial-In Number: 1-913-227-1201

Participant Passcode: 145219

# Agenda

- Summary of Working Group Meeting #1
- Summary of Individual Stakeholder Meetings
- Proposed Rule Structure and Applicability
- BARCT Assessment
  - Assessment of Emission Limits for Existing Units
  - Other Regulatory Requirements

# Summary of Working Group Meeting #1

- Potential Equipment
- Applicability and Potential Universe
- BARCT Assessment Guiding Principles and Approach
  - Identify Emissions Levels of Existing Units

# Summary of Individual Stakeholder Meetings

- 9 individual stakeholder meetings
  - Unique circumstances and challenges
    - Utilizing landfill gas
    - Procurement process
  - Current facility operations and future plans
  - Equipment applicability
    - Boilers, turbines, and possibly engines
  - Start-up and shutdown limits
  - Rule structure
    - Possibility of combining Proposed Rules 1150.3 (landfills) and 1179.1 (wastewater treatment plants)
    - Possibility of incorporating relevant provisions from Rule 1110.2 (engines)
  - Staff would like to meet with the remaining stakeholders

# Proposed Rule Structure and Applicability

# Approach for Proposed Rules 1150.3 and 1179.1

- South Coast AQMD is proposing separate rules for equipment at landfills and publicly owned treatment works (POTWs)
  - Individual rules will allow for an in-depth Best Available Retrofit Control (BARCT) analysis and requirements tailored to unique issues at these facilities

## Proposed Rule 1150.3 (PR 1150.3)

- Emissions of Oxides of Nitrogen from Combustion Equipment at Landfills

## Proposed Rule 1179.1 (PR 1179.1)

- NO<sub>x</sub> Emission Reductions from Combustion Equipment at Publicly Owned Treatment Works Facilities

# Stakeholder Comments Regarding Applicability

## *PRs 1150.3 and 1179.1*

- **Comment:** One biogas rule for all equipment to simplify compliance
- **Response:** Staff believes PRs 1150.3 and 1179.1 should remain separate
  - Combining the rules would divert focus of technology assessment for each industry
  - Each industry has distinct gas characteristics
  - Rule development will be in tandem
    - Working group meetings will be held on the same day
    - Approximately same timeframe for rule development (BARCT analysis, rule language, etc.)

### Natural gas

- Ranges from 950 - 1150 Btu/ft<sup>3</sup>\*

### Digester gas

- Approximately 690 Btu/ft<sup>3</sup>\*
  - Produces less energy than natural gas
- Contains contaminants (i.e. siloxanes)
- Digester gas volume and quality is more consistent over time

### Landfill gas

- Approximately 476 Btu/ft<sup>3</sup>\*
  - Produces the least amount energy
- Contains higher amount of contaminants
- Landfill gas volume and quality declines over time

\* [https://www.engineeringtoolbox.com/heating-values-fuel-gases-d\\_823.html](https://www.engineeringtoolbox.com/heating-values-fuel-gases-d_823.html)

# Stakeholder Comments Regarding Applicability

## *Landfill Gas Engines*

- **Comment:** Include landfill gas engine provisions from Rule 1110.2 into PR 1150.3 for the purpose of having all landfill gas provisions in one rule
- **Response:** Staff is still discussing if engines should be incorporated into PR 1150.3
  - Recent amendments to Rule 1110.2 specifically addressed landfill gas engines
    - Rule 1110.2 lowered the NO<sub>x</sub> limit for landfill gas engines in 2012 with a compliance date in 2017
    - A new BARCT analysis is not needed for engines utilizing landfill gas
    - All 15 landfill gas engines are complying with Rule 1110.2 provisions and limits

# Stakeholder Comments Regarding Applicability

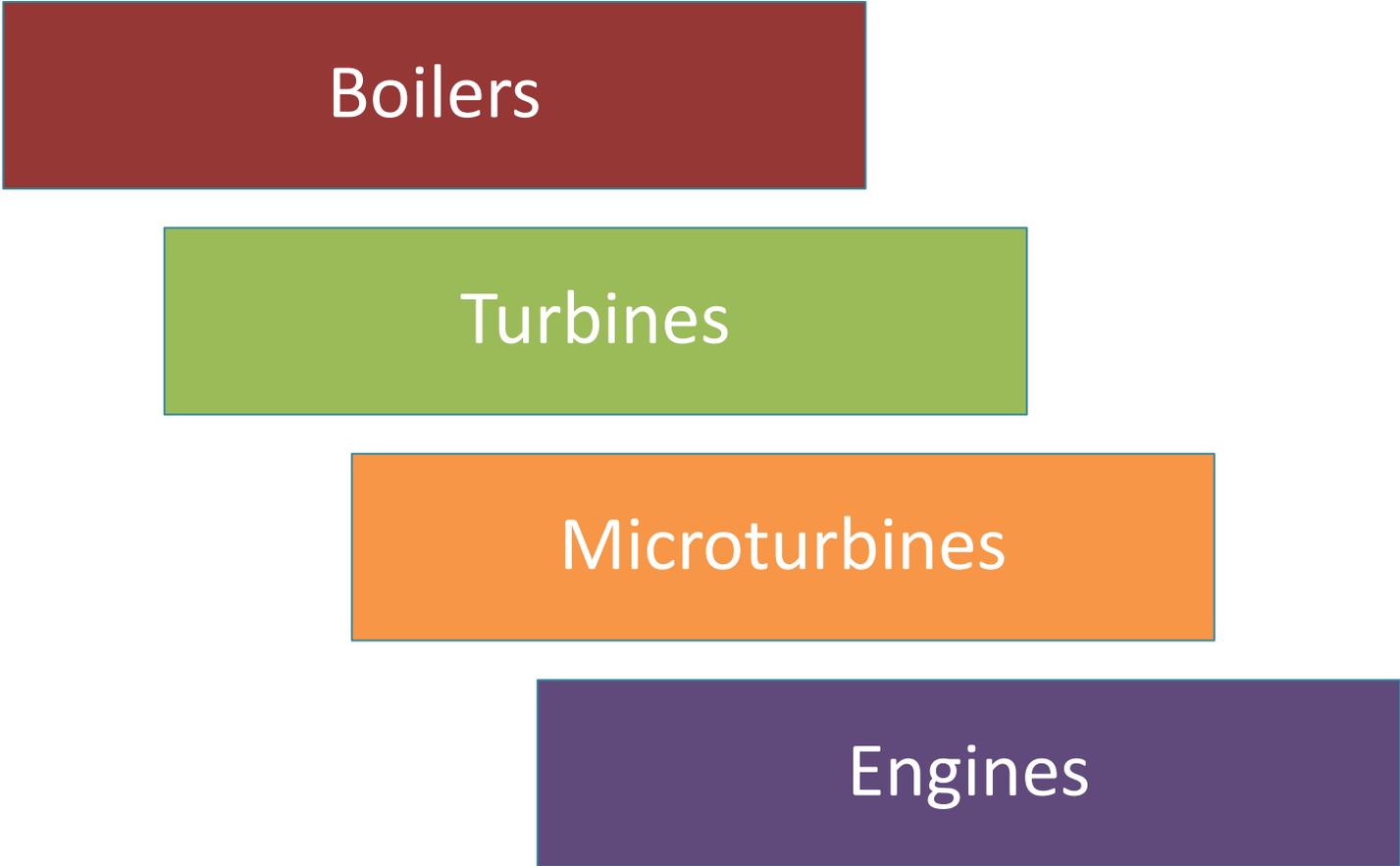
## *Landfill Gas Engines (continued)*

- **Response** *(continued)*:

- If landfill gas engines are included in PR 1150.3:
  - Applications for new permits and Inspection and Monitoring Plans will be required
    - Fees
    - Increased permitting timeline
  - Provisions for biogas engines in Rule 1110.2 will be copied directly into PR 1150.3
    - No emission limits will change

# Proposed Applicable Equipment

- Four equipment categories were assessed for applicability



Boilers

Turbines

Microturbines

Engines

# Applicability – Boilers

- All boilers at landfills will be subject to PR 1150.3
  - Boilers fueled by landfill gas
    - A BARCT analysis will be conducted
  - Boilers fueled by natural gas
    - A BARCT analysis will not be conducted
    - Recent rulemaking for Rule 1146 series addressed natural gas boilers
- Staff proposes to copy provisions and limits for natural gas boilers from Rule 1146 into PR 1150.3

# Applicability – Turbines

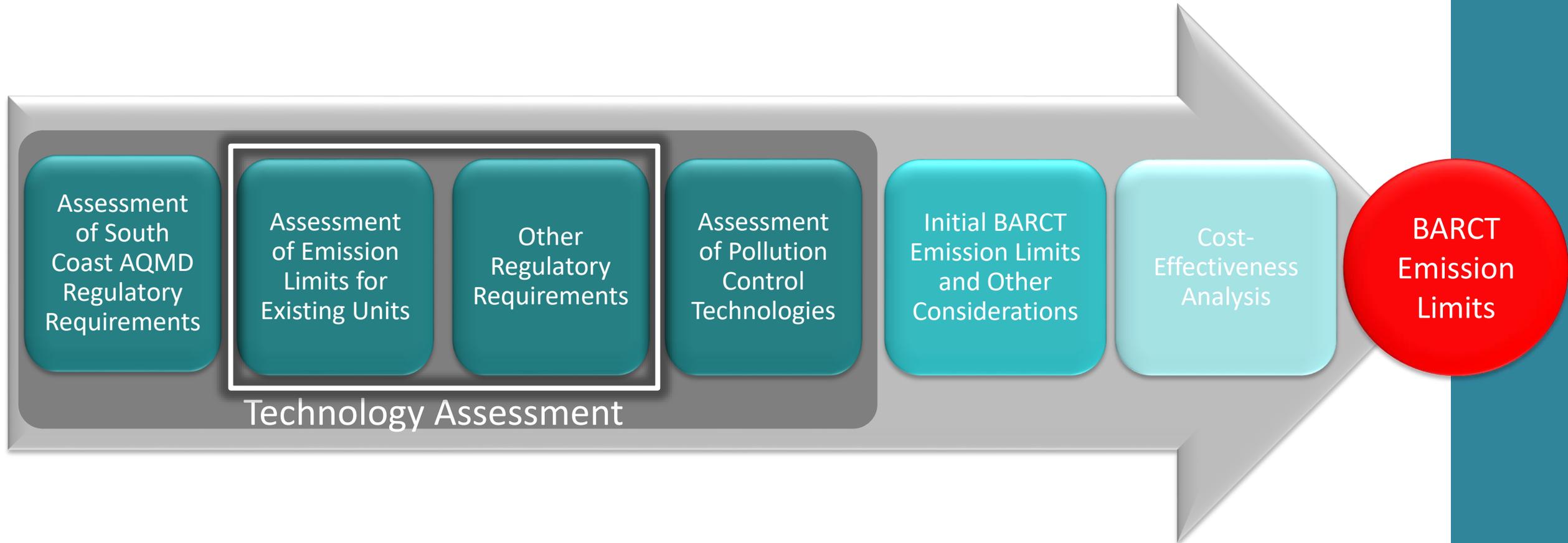
- All turbines at landfills and turbines fueled by landfill gas will be subject to PR 1150.3
  - Turbines fueled by landfill gas
    - A BARCT analysis will be conducted
  - Turbines fueled by natural gas
    - A BARCT analysis will not be conducted
    - Recent rulemaking for Rule 1134 addressed natural gas turbines
- Staff proposes to copy provisions and limits for natural gas turbines from Rule 1134 into PR 1150.3

# Applicability – Microturbines

- There is no current rule for microturbines
- A BARCT assessment for microturbines is needed
- Staff proposes to include microturbines fueled by landfill gas into PR 1150.3

# BARCT Assessment

# BARCT Assessment



\*BARCT analysis is conducted for each equipment category and fuel type

# **BARCT Analysis**

Assessment of Emission Limits for Existing Units

# Overview

Grouped equipment by:

- Equipment type – boiler, simple cycle turbine, combined cycle turbine, and microturbine
- Fuel type – landfill gas and natural gas

For each piece of equipment, identified:

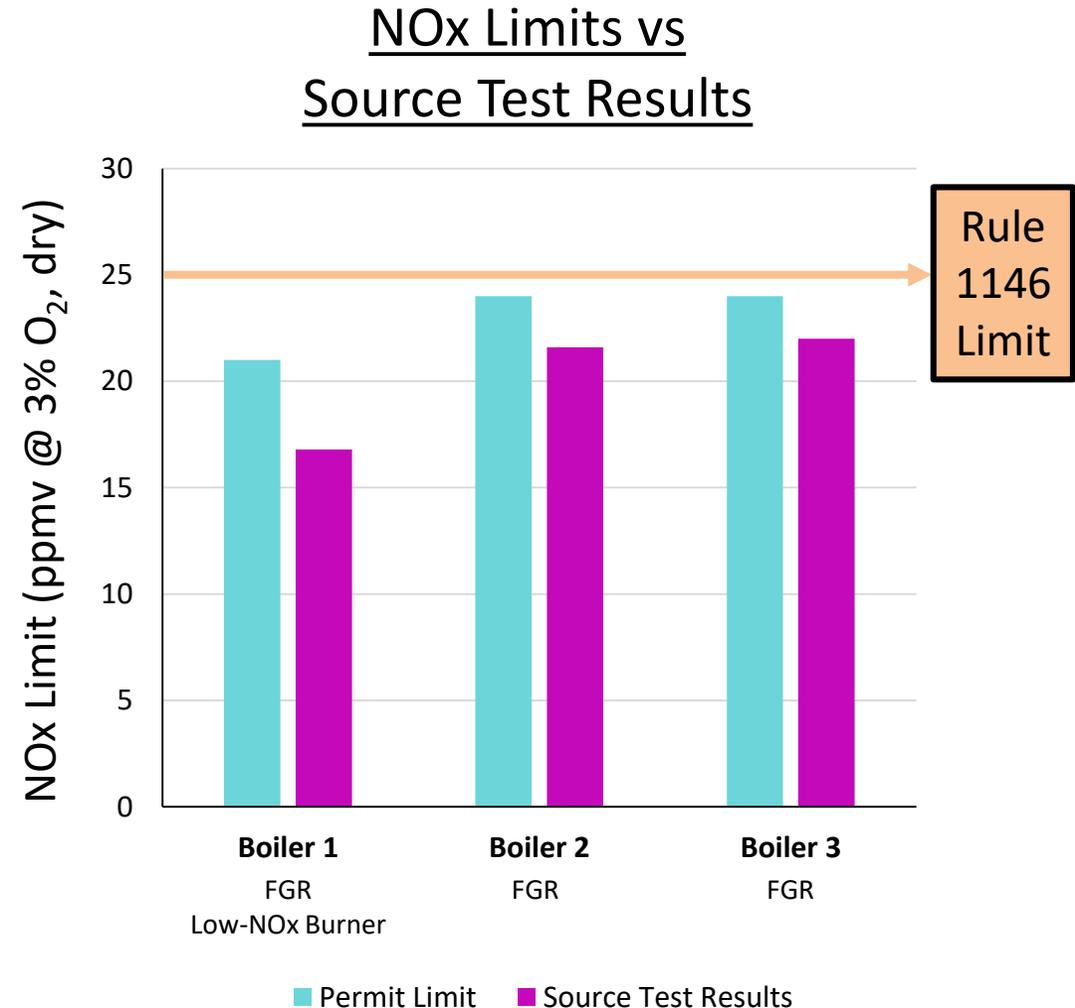
- NO<sub>x</sub> and NH<sub>3</sub> permit limits
- NO<sub>x</sub> and NH<sub>3</sub> source test result
- Pre-treatment systems and control technology
- Installation date and/or retrofit date

# Assessment of NOx Levels

- Staff evaluated all permitted NOx concentration limits for boilers, turbines, and microturbines fueled by landfill gas
  - All NOx limits for boilers were corrected to 3% O<sub>2</sub>
  - All NOx limits for turbines and microturbines were corrected to 15% O<sub>2</sub>
- Staff reviewed source tests to identify tested emissions
  - Source tests represent a snapshot of emission
- Staff compared NOx permit limit data with NOx source test results to assess “compliance margin”

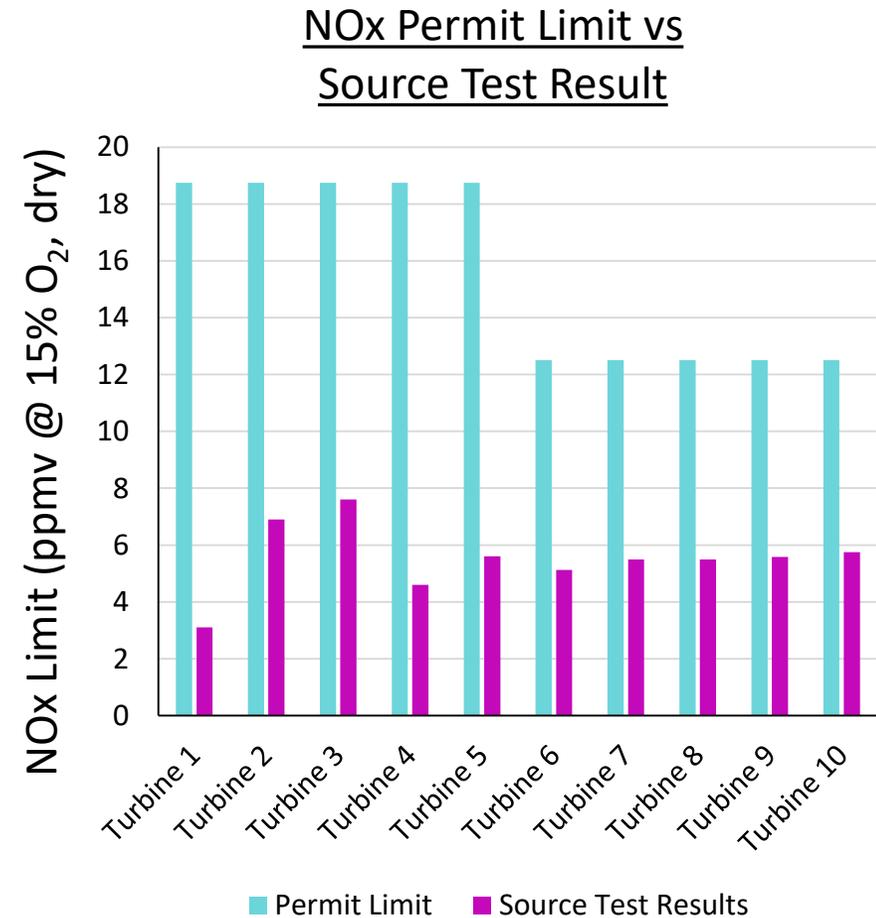
# Landfill Gas Boilers

- 3 landfill gas boilers
- Source test results range from 17 – 22 ppmv NOx @ 3% O<sub>2</sub>
- Size range from 115 to 335 MMBtu/hr
- All boilers are > 30 years old
  - Boiler 1 is a replacement
  - Boilers 2 and 3 are retrofits
- Unit with low-NOx burner and flue gas recirculation (FGR) has lowest source test result



# Landfill Gas Simple Cycle Turbines

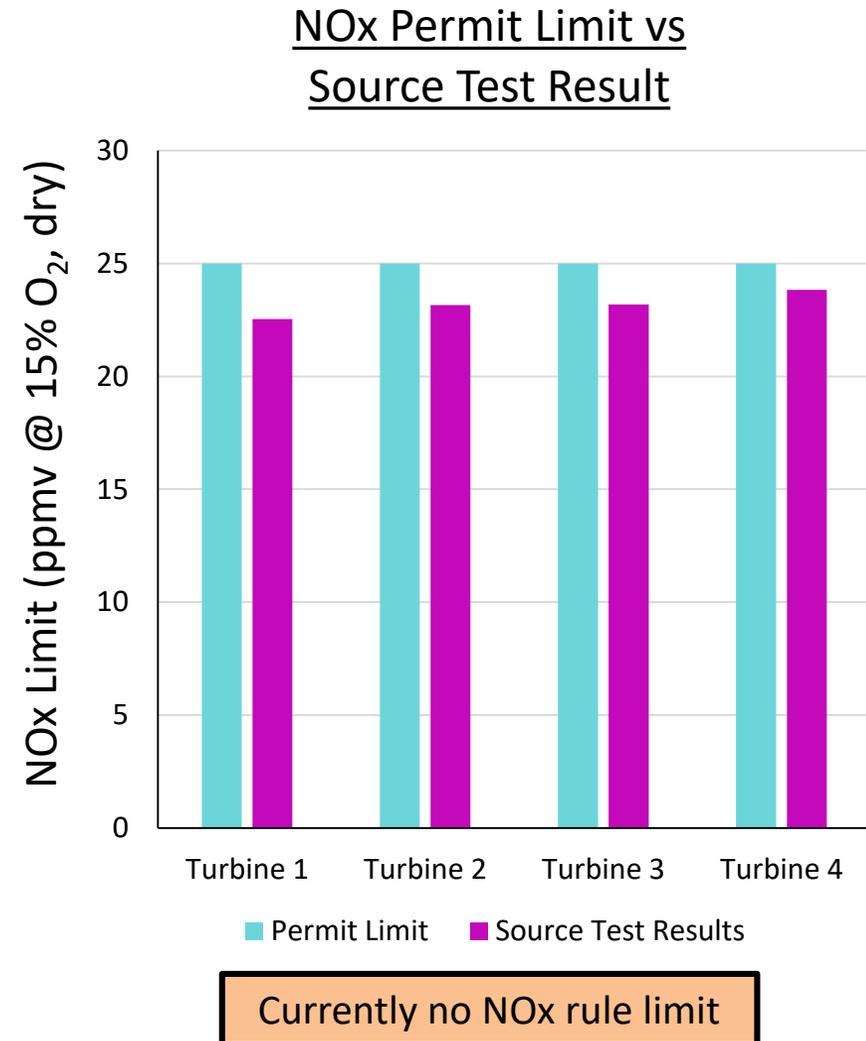
- 10 landfill gas simple cycle turbines
- Source test results range from 3 – 8 ppmv NO<sub>x</sub> @ 15% O<sub>2</sub>
- Size range from 51 – 61 MMBtu/hr
- Units are 3-9 years old (all replacements)
- All units have lean mix control technology and gas pre-treatment system



Currently no NO<sub>x</sub> rule limit

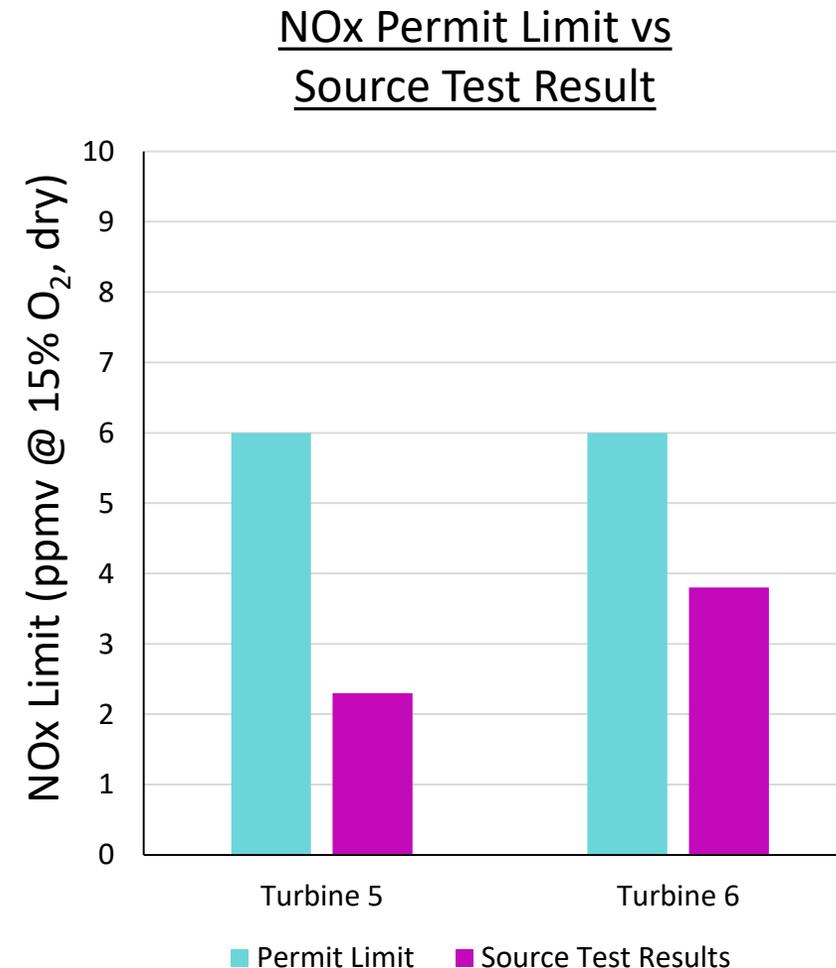
# Landfill Gas Combined Cycle Turbines

- 6 combined cycle turbines
  - 4 fueled by landfill gas
  - 2 fueled by natural gas, but landfill gas-capable
- 4 landfill gas fueled units
  - Source test results range from 23 – 24 ppmv NOx @ 15% O<sub>2</sub>
  - Units are 72 MMBtu/hr
  - Units are 9 years old (all replacements)
  - Units have selective catalytic reduction (SCR) and gas pre-treatment system
- Facility has challenges meeting current NOx limit even with SCR and gas pre-treatment system



# Landfill Gas-Capable Combined Cycle Turbines

- 2 landfill gas-capable combined cycle turbines
  - Currently using 100% natural gas
  - Permitted to use landfill gas
  - Source test results range from 2.3 – 3.8 ppmv NO<sub>x</sub> @ 15% O<sub>2</sub>
    - Source tested while using ≈ 98% natural gas and ≈ 2% landfill gas
  - Units are 140 MMBtu/hr
  - Units are 26 years old
  - Units have water injection and selective catalytic reduction
- If units continue to use 100% natural gas, they will have to meet Rule 1134 limit of 2 ppmv NO<sub>x</sub> and 5 ppmv NH<sub>3</sub> at 15% O<sub>2</sub>



# Landfill Gas Microturbines

- 4 landfill gas microturbines currently under construction
  - Units are 2.28 MMBtu/hr
  - All have lean mix control technology and gas pre-treatment system
  - Manufacturer guarantees NO<sub>x</sub> concentration levels  $\leq 9$  ppmv @ 15% O<sub>2</sub>
    - Minor Source Best Available Control Technology Requirement for Stationary Turbines is 25 ppmv NO<sub>x</sub> @ 15% O<sub>2</sub>

# Summary

Equipment Type	NOx Source Test Retrofit	NOx Source Test Replacement
Landfill Gas Boilers	≤ 22 ppmv @ 3% O2	< 17 ppmv @ 3% O2
Landfill Gas Simple Cycle Turbines	None	< 4 @ 15% O2
Landfill Gas Combined Cycle Turbines	None	< 23 @ 15% O2
Microturbines	None	To be source tested*

\* Units still under construction

# **BARCT Assessment**

## Other Regulatory Requirements

# Landfill Gas Boiler Limits from Other Districts

Agency/Regulation (Year)	Fuel Type	Heat Input Rating (MMBtu/hr)	NOx Limit (ppmv @ 3% O <sub>2</sub> , dry)
San Joaquin Valley Air Pollution Control District/Rule 4320 (2008) <a href="https://www.valleyair.org/rules/currnrules/r4320.pdf">https://www.valleyair.org/rules/currnrules/r4320.pdf</a>	Gaseous Fuel	> 5.0 – ≤ 20.0	6 – 9
		> 20.0	5 – 7
Sacramento Metropolitan Air Quality Management District/Rule 411 (2007) <a href="http://www.airquality.org/ProgramCoordination/Documents/rule411.pdf">http://www.airquality.org/ProgramCoordination/Documents/rule411.pdf</a>	Landfill Gas or Combination Landfill Gas/Natural Gas	≥ 5	15
Bay Area Air Quality Management District/Regulation 9 – Rule 7 (2011) <a href="http://www.baaqmd.gov/~media/dotgov/files/rules/reg-9-rule-7-nitrogen-oxides-and-carbon-monoxide-from-industrial-institutional-and-commercial-boiler/documents/rg0907.pdf?la=en">http://www.baaqmd.gov/~media/dotgov/files/rules/reg-9-rule-7-nitrogen-oxides-and-carbon-monoxide-from-industrial-institutional-and-commercial-boiler/documents/rg0907.pdf?la=en</a>	Landfill Gas	≥ 1	30

# Summary of Landfill Gas Boiler Limits from Other Districts

Agency/Regulation (Year)	Fuel Type	Heat Input Rating (MMBtu/hr)	NOx Limit (ppmv @ 3% O <sub>2</sub> , dry)
San Joaquin Valley Air Pollution Control District (SJVAPCD)/Rule 4320 (2008)	Gaseous Fuel	> 20.0	5 – 7
Sacramento Metropolitan Air Quality Management District/Rule 411 (2007)	Landfill Gas or Combination Landfill Gas/Natural Gas	≥ 5	15

- Currently no permitted landfill gas boilers in SJVAPCD or in Sacramento Metropolitan Air Quality Management District
- SJVAPCD Rule 4320 defines “gaseous fuel” as *any fuel which is a gas at standard conditions*
  - Does not specify type of gas (i.e., landfill gas, digester, etc.)

# Landfill Gas Turbine Limits from Other Districts

Agency/Regulation (Year)	Fuel Type	Output Rating (MW)	NOx Limit (ppmv @ 15% O <sub>2</sub> , dry)
San Joaquin Valley Air Pollution Control District/Rule 4703 (2007) <a href="http://www.valleyair.org/rules/currnrules/r4703.pdf">http://www.valleyair.org/rules/currnrules/r4703.pdf</a>	Gas Fuel (includes landfill gas)	< 3	9
		3 – 10 (< 877 / ≥ 877 hours/year)	9 / 5
		> 10 (≤ 200 / > 200 hours/year)	25 / 5
Sacramento Metropolitan Air Quality Management District/Rule 413 (2005) <a href="https://www.arb.ca.gov/drdb/sac/curhtml/r413.pdf">https://www.arb.ca.gov/drdb/sac/curhtml/r413.pdf</a>	Gaseous Fuel	>0.3 – <2.9	42
		≥2.9 (< 877 hours/year)	42
		≥2.9 – <10 (≥ 877 hours/year)	25
		≥10 (≥ 877 hours/year, no SCR*)	15
		≥10 (≥ 877 hours/year, w/ SCR*)	9
Bay Area Air Quality Management District/Regulation 9 – Rule 9 (2006) <a href="http://www.baaqmd.gov/~media/dotgov/files/rules/reg-9-rule-9-nitrogen-oxides-and-carbon-monoxide-from-stationary-gas-turbines/documents/rg0909.pdf?la=en">http://www.baaqmd.gov/~media/dotgov/files/rules/reg-9-rule-9-nitrogen-oxides-and-carbon-monoxide-from-stationary-gas-turbines/documents/rg0909.pdf?la=en</a>	Waste Gas (includes landfill gas)	< 0.3**	Exempt
		0.3 – 10**	50
		> 10 – 19**	15

\* Selective catalytic reduction

\*\* Converted from MMBtu/hr

# Summary of Landfill Gas Turbine Limits from Other Districts

Agency/Regulation (Year)	Fuel Type	Output Rating (MW)	NOx Limit (ppmv @ 15% O <sub>2</sub> , dry)
San Joaquin Valley Air Pollution Control District (SJVAPCD)/Rule 4703 (2007)	Gas Fuel (includes landfill gas)	3 – 10 (< 877 / ≥ 877 hours/year)	9 / 5
		> 10 (≤ 200 / > 200 hours/year)	25 / 5

- There are currently no permitted landfill gas turbines in SJVAPCD

# Schedule

# Rule Schedule

Action	Target Dates
Site Visits	Ongoing
Next Working Group Meeting	September 2019
Public Workshop	October 2019
Set Hearing	November 6, 2019
Public Hearing	December 6, 2019

# Contacts

# Contacts

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