
PROPOSED AMENDED RULES 1146, 1146.1, 1146.2 & PROPOSED RULE 1100 WORKING GROUP #7

OCTOBER 16, 2018
SCAQMD
DIAMOND BAR, CA

1

Agenda

- Public Comments
- Cost Effectiveness Analysis
- BARCT Analysis for Landfill/Digester Gas Fired Units
- Updates on Rule Language
- Schedule
- Contacts

2

PUBLIC COMMENTS

3

Public Comments

- Comment letters received by due date of October 4, 2018
 - Ramboll
 - Southern California Alliance of Publicly Owned Treatment Works (SCAP)
 - Boiler Dynamics, Inc.
 - Southern California Gas Company
 - Western States Petroleum Association
- Key Comments
 - Programmatic CEQA
 - NSR issues
 - 7 ppm burner availability
 - Unexpected burner replacement due to breakdowns
 - Cost-effectiveness
 - Dual fuel units
 - Emissions for atmospheric units

4

Public Comments – Programmatic CEQA

❑ **Comment:** Some industry representatives stated that a program level CEQA analysis should be conducted and individual rulemaking is piecemealing of the project

❑ **Response:**

- CMB-05 was revised in the Revised Draft 2016 AQMP to include language on consideration of sunseting the RECLAIM program
- Socioeconomic and environmental impacts of the entire RECLAIM transition project (CMB-05) were analyzed in the 2016 AQMP and associated March 2017 Final Program Environmental Impact Report (PEIR)
- No additional program-level analysis is required and further analysis will be tiered off of the 2016 AQMP PEIR

5

Public Comments – New Source Review

❑ **Comment:** Some industry representatives and stakeholders stated RECLAIM transition rules such as PAR 1146 series and PR 1100 should not proceed without resolution of new source review (NSR) issues

❑ **Response:**

- State law (AB 617) requires implementation of Best Available Retrofit Control Requirements for facilities in the state greenhouse gas cap and trade program by December 31, 2023
- RECLAIM facilities can begin implementing BARCT requirements while in RECLAIM
- Rule 2002 provides an option for facilities to remain in RECLAIM for a limited time until future provisions in Regulation XIII pertaining to NSR are adopted
- Staff is continuing to working on NSR issues with EPA and the RECLAIM Working Group

6

Public Comments – Availability of 7 ppm Burners

□ Comment: Stakeholders expressed concern about the market availability of 7 ppm burner retrofits

□ Response:

- Staff has been in contact with five equipment vendors throughout the rulemaking process
 - Three vendors have expressed that 7 ppm retrofits are feasible
- 980 units (between 5 to 300 MMBtu/hr) located in SJVAPCD are able to comply with 7 ppm limit without use of the mitigation fee option
- >1,000 source test results from both SCAQMD and SJVAPCD support the feasibility of 7 ppm BARCT

7

Public Comments – Unexpected Burner Replacement Due To Breakdowns

□ Comment:

- Multiple representatives stated that burners in compliance with current limits may fail ahead of the 15 year compliance deadline and trigger permitting requirements for a new 7 ppm burner
- Proposed amended rule should allow burners with identical replacements to retain current emission limits until the 15 year compliance deadline

□ Response:

- Objective of the rule provision is to allow burner (currently in compliance) to operate through it's useful life and for facility to bear the cost of a new burner only upon burner replacement
- Burners that fail ahead of the 15 years will need to be replaced to meet new emission limits
- Spontaneous burner failure is rare and routine maintenance should be able to diagnose potential issues ahead of time for planning purposes

8

Public Comments – Dual Fuel Units

□ Comment: Some stakeholders commented dual fuel boilers using digester gas and natural gas will have difficulty meeting 7 ppm NOx limit when using natural gas only

□ Response:

- Dual fuel units located in SJVAPCD have been required to meet 7 ppm NOx when fired with only natural gas
- Units in SJVAPCD are permitted at 7 ppm or below when firing only on natural gas for both new and retrofits
- Units in SJVAPCD are complying with rule limits through emission control technology in lieu of mitigation fee option

9

Public Comments – Atmospheric Units

□ Comment:

- Existing NOx emission limit for Atmospheric units is 12 ppm
- One stakeholder stated the emission limit for Atmospheric units:
 - Should have been subject to meet 9 ppm already since current technology can achieve 9 ppm
 - Should also be subject to proposed 7 ppm from current 12 ppm

□ Response:

- Combustion chambers of atmospheric units are exposed to the atmosphere which raises the concerns for fugitive CO in ultra low NOx applications
- Atmospheric units located in SJVAPCD are currently limited to 12 ppm
- Source test results reviewed were not able to provide sufficient data to support establishment of 9 ppm NOx emission limit
- Staff has reached out to commenter for source test results indicating 7 ppm is achievable

10

Public Comments – Source Test Reports

☐ **Comment:**

- Some stakeholders have stated source test reports of ultra-low NOx burner installations outside the District need validation by AQMD Source Testing Division
- Copies of the reports need to be made available to the public for transparency

☐ **Response:**

- Source test reports obtained from outside of SCAQMD were conducted using EPA approved test methods
- CARB Method 100, used by SJVAPCD, is considered equivalent to SCAQMD Method 100.1
- Information can be requested with public records request

11

Public Comments – Cost-Effectiveness

☐ **Comments:**

- Multiple stakeholders expressed concerns about the cost-effectiveness analysis and requested additional details regarding the cost assumptions used in the analysis
- One commenter requested to incorporate the annual permit to operate fee for SCR retrofits as an additional operating cost

☐ **Response:**

- Staff has presented assumptions and methodologies that were incorporated in the cost effectiveness analysis during Working Group #5 on August 2nd, 2018
- The latest cost estimates have been updated with recurring permitting costs for SCR retrofits based on stakeholders input
- Additional cost information is included later in this presentation

12

COST-EFFECTIVENESS

NATURAL GAS FIRED UNITS

13

Cost Information

- ☐ Control technology cost consists of two main components:

- Capital Cost
- Annual Operating Cost

- ☐ Source of information:

- Vendor discussions
 - 5 equipment/installation vendors
 - 2 ammonia suppliers
- U.S. EPA SCR Cost Manual*

Capital Cost

Equipment

Installation

Permitting fees

Annual Operating Cost

Additional electricity

Additional O&M

Additional monitoring

Ammonia

Catalyst

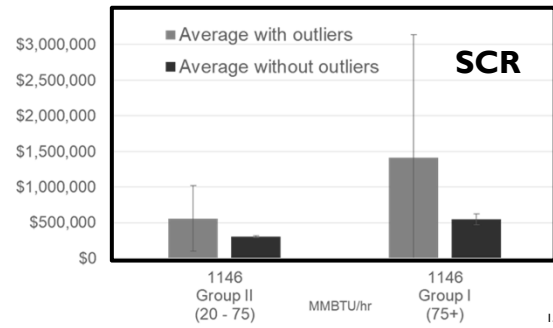
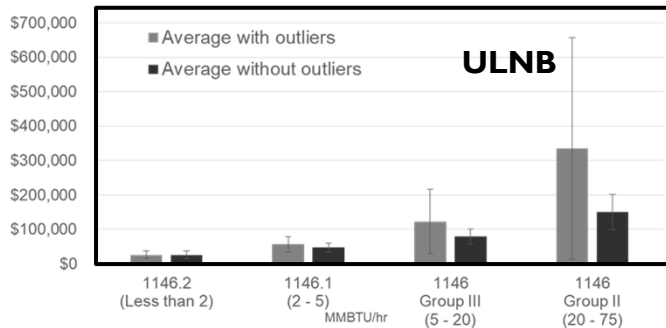
Additional permit fee

14

*Available at: https://www3.epa.gov/ttn/ecas/docs/SCRCostManualchapter7thEdition_2016.pdf

Cost Assumptions

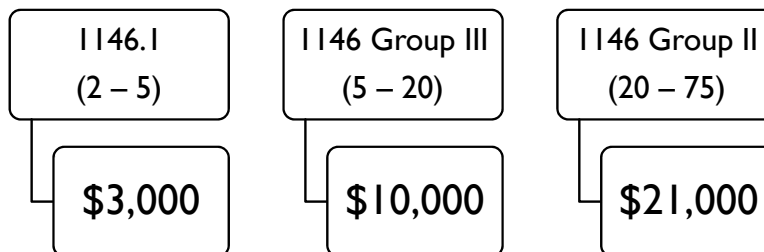
- ❑ Costs obtained from vendors based on equipment size and control technology (9 ppm for ultra-low NOx burner retrofits and 5 ppm for SCR retrofits)
- ❑ No major changes to existing units (such as structural or foundation changes)
- ❑ Equipment & installation costs vary among vendors
 - Cost-effectiveness analysis based on average cost with outliers



15

Additional cost – 7 ppm Ultra-low NOx burners

- ❑ Capital cost for 7 ppm ultra-low NOx burner (ULNB) retrofits estimated by adding an additional cost to the 9 ppm ULNB burner retrofits
 - Accounts for additional controls needed (such as variable frequency drive and O₂ trim)
 - Additional cost for 7 ppm ULNB retrofit varies by equipment size (MMBTu/hr):

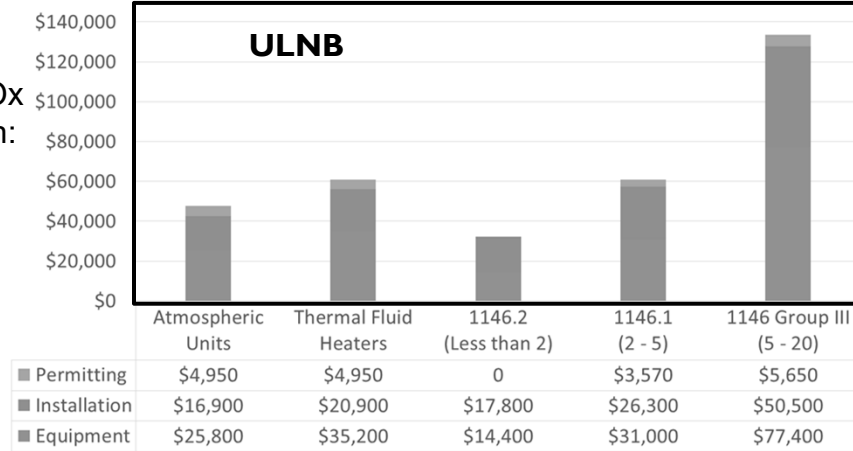


16

Capital Cost (Equipment + Installation + Permitting)

Capital cost included in the cost-effectiveness analysis for ultra-low NOx burner retrofits based on:

- 7 ppm (55% units are fire-tube boilers)
- 9 ppm (45% units are non fire-tube boilers)
- 12 ppm (atmospheric units and thermal fluid heaters)

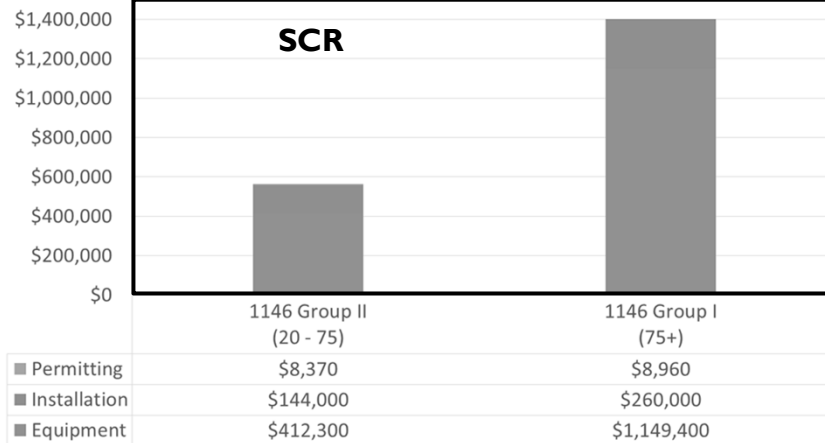


17

Capital Cost (Equipment + Installation + Permitting)

Capital cost included in the cost-effectiveness analysis for selective catalytic reduction (SCR) retrofits based on:

- 5 ppm



18

Additional Electricity Cost

- Recurring annual cost for the additional energy consumption above that already required for the existing operation
- No additional electricity cost for ultra-low NOx burner retrofits
- U.S. EPA SCR Cost Manual* used to estimate the additional energy cost
- Annual electricity cost based on:
 - SCR power consumption (kW)
 - Annual electricity cost (\$0.13 per kW-hr)
 - 50% operating capacity

Category (MMBtu/hr)	Additional Electricity Cost	FGR Savings
1146 Group II (20 - 75)	\$11,900	-\$3,000
1146 Group I (75+)	\$51,800	-\$14,700

*Available at: https://www3.epa.gov/ttn/ecas/docs/SCRCostManualchapter7thEdition_2016.pdf

19

Electrical Savings – FGR Reduction w/ SCR

- SCR retrofits could lower the need for Flue Gas Recirculation (FGR)
- Savings assumed to be the difference in electrical cost from the reduction of electricity utilized for FGR assuming:
 - Decrease from 30% FGR down to 15% FGR utilization
 - Annual electricity cost (\$0.13 per kW-hr)
 - 50% Operating capacity

Category (MMBtu/hr)	Non-Compliant Units	Number of Units w/ FGR	Assumed Reduction in Electrical Use* (KW)	Total Savings (\$)	Group savings per unit (\$)
1146 Group I (75+)	52	47	15	\$158,000	\$3,000
1146 Group II (20 – 75)	3	3	67	\$44,000	\$14,700

*Electrical use for FGR utilization estimated using data chart available at: <https://www.preferred-mfg.com/assets/documents/Combustion%20Control%20Strategies.pdf>

20

Ammonia and Catalyst Cost – SCR

□ Recurring annual cost for ammonia and catalyst estimated using:

- U.S. EPA SCR Cost Manual* & vendor prices
- Annual consumption estimated according to heat input capacity, NOx emissions reduction from 30 ppm to 5 ppm, and 50% operating capacity

Ammonia
<ul style="list-style-type: none"> • Consumption rate (lb/hr) • Aqueous NH3 price (\$2.50/lb NH3)

Catalyst
<ul style="list-style-type: none"> • Catalyst volume (ft³) • Catalyst cost (\$259/ft³) • Replacement frequency (9 yrs)

Category (MMBtu/hr)	Ammonia Cost	Catalyst Cost
1146 Group II (20 - 75)	\$5,400	\$3,200
1146 Group I (75+)	\$23,100	\$13,900

* Available at: https://www3.epa.gov/ttn/ecas/docs/SCRCostManualchapter7thEdition_2016.pdf

21

Annual Operating Permit Renewal Fee – SCR

- Cost effectiveness analysis includes the annual operating permit renewal fee for Selective Catalytic Reduction (SCR) retrofits
- SCR equipment fee listed in Rule 301 (Permitting and Associated Fees) under Schedule C in Table 1A
 - Assumed cost for Title V facilities = \$1,825.70 per year

22

Additional Operation & Maintenance Cost

- Recurring annual cost for operation & maintenance (O&M) labor and materials not already part of existing operations
 - Additional O&M cost for SCR retrofits only
 - No additional O&M cost for ultra-low NOx burner retrofits since contracts already in place to maintain existing burner and potentially less maintenance and fewer repairs for a retrofit burner
- U.S. EPA SCR Cost Manual* used to estimate the O&M cost for SCR retrofits
 - Cost assumed to be 0.5% of capital cost (equipment + installation cost only)
 - Emissions monitoring considered separately

Category (MMBtu/hr)	Additional O&M Cost
1146 Group II (20 - 75)	\$2,760
1146 Group I (75+)	\$7,033

*Available at: https://www3.epa.gov/ttn/ecas/docs/SCRCostManualchapter7thEdition_2016.pdf

23

Additional Monitoring Cost

- Recurring annual cost for additional monitoring, reporting, and recordkeeping (MRR) not already required
- Existing RECLAIM MRR requirements comparable with landing rule requirements (except for reporting)
- Additional monitoring cost for SCR ammonia slip test only
- Annual ammonia source test based on average cost obtained from vendors

Category (MMBtu/hr)	Additional Monitoring cost
1146 Group II (20 - 75)	\$3,333
1146 Group I (75+)	\$3,333

24

Potential Monitoring/Reporting Savings

☐ Reporting requirements

Rule 1146

Every 6-months (Rule 218)
for units >40 MMBtu/hr

RECLAIM

Daily, monthly, and quarterly
electronic reporting

Paper submittal of quarterly
certifications and annual
permit emissions reports

☐ Savings based on estimated annual staffing cost needed to fulfill RECLAIM reporting requirements

- Potential savings approximately \$40,000 and \$2,000 per piece of major and non-major sources, respectively
- Savings not included in cost-effectiveness analysis
 - At this time no change is being proposed for reporting requirements for Title V facilities
 - Minimal savings for non-Title V facilities

25

Determination of Cost-Effectiveness

☐ Cost effectiveness is measured in terms of the control equipment cost in dollars per ton of air pollutant reduced

$$\text{Cost Effectiveness} = \frac{\text{Present worth value}}{\text{Emissions reductions over equipment life}}$$

☐ Present worth value of the control equipment is the capital cost plus the annual operating cost over the life of the equipment

$$\text{Present worth value} = \text{Capital cost} + (\text{Annual operating cost} \times \text{Present worth factor})$$

☐ Cost effectiveness calculated using the Discount Cash Flow (DCF) method and 4% interest rate

26

Cost-Effectiveness

Category (MMBtu/hr)	Recommended Emission Limit	Present Worth Value per unit	Number of Units	Reductions* (tpy)	Control Technology useful life	Cost-effectiveness (\$/ton)
1146 Group I (75+)	5 ppm (existing limit)	\$2,765,000	3	16	SCR – 25 yrs	\$21,000
1146 Group II (20 – 75)	5 ppm	For units > 12 ppm*				
		\$960,000	52	56	SCR – 25 yrs	\$36,000
	7 ppm for fire-tube boilers	\$21,000	13	1.72	ULNB – 15 yrs	\$11,000
1146 Group III (5 – 20)	7 ppm for fire-tube boilers (9 ppm for others)	For units > 12 ppm*				
		\$134,000	69	22.6	ULNB – 15 yrs	\$28,000
		\$10,000	15	1.88	ULNB – 15 yrs	<\$10,000
1146.1 (2 – 5)	Same as above	For units > 12 ppm*				
		\$61,000	19	2.18	ULNB – 15 yrs	\$36,000
		\$3,000	1	0.19	ULNB – 15 yrs	<\$10,000
1146.2 (<2)	30 ppm (existing limit)	\$33,000	3	0.95	ULNB – 15 yrs	<\$10,000

* Estimated using emissions from RECLAIM units

Total cost for pollution control equipment

Emissions reduction over equipment lifetime

Cost ÷ Reduction ²⁷

Cost-Effectiveness (con't)

- Cost-effectiveness for atmospheric units and thermal fluid heaters estimated on a per unit basis assuming:
- Baseline emissions of 30 ppm
 - 20% operating capacity
 - Heat input capacities between 2 – 10 MMBtu/hr

Category	Size (MMBtu/hr)	Recommended Emission Limit	Present Worth Value per unit	Reduction per unit (tpy)	Control Technology useful life	Cost-Effectiveness (\$/ton)
Atmospheric Units	≤10	12 ppm (existing limit)	\$143,000	0.34	ULNB – 15 yrs	\$29,000
Thermal Fluid Heaters	NA	12 ppm	\$183,000	0.34	ULNB – 15 yrs	\$36,000

BARCT Analysis (Landfill and Digester Gas Fired Units)

29

Overview of Technology Assessment

Assessment of
SCAQMD
Regulatory
Requirements

Purpose:
Identify existing
SCAQMD
regulatory
requirements
for that
particular
source category

Assessment of
Emission Limits
for Existing Units

Purpose:
Evaluate
existing units to
identify
emission levels
achieved based
on permitted
and actual
levels

Other Regulatory
Requirements

Purpose:
Identify any
other regulatory
requirements
with lower
emission limits

Assessment of
Pollution Control
Technologies

Purpose:
Identify
pollution control
technologies
and potential
emission
reductions

30

SCAQMD Regulatory Requirements

Assessment of
SCAQMD Regulatory
Requirements

Type	Rules 1146 & 1146.1	Compliance Date	Implementation Period (Sept 2008 Amendment)
Digester Gas	15 ppm	January 1, 2015	7 years
Landfill Gas	25 ppm	January 1, 2015	7 years

- Limits apply for facilities with >90% average monthly biogas usage
 - Executive Officer may approve the burning of more than 10% natural gas under certain circumstances
- Units burning more than approved percent natural gas shall comply with weighted average NOx Limit

31

Permitted Limits

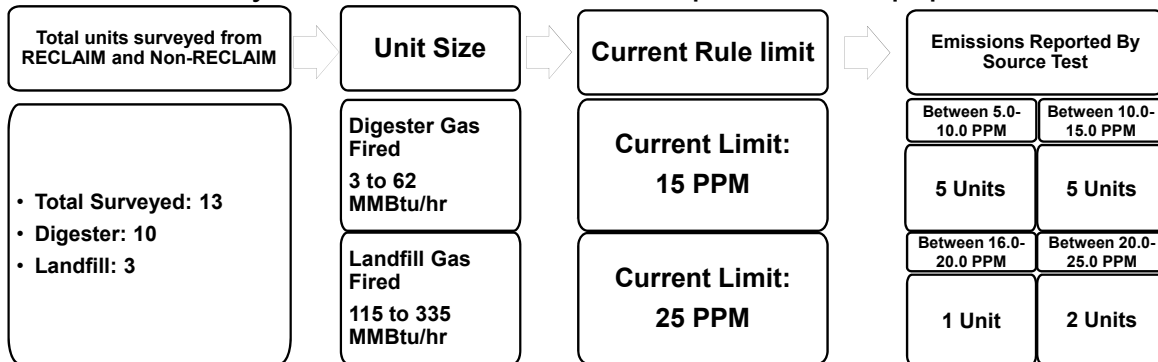
- Reviewed lowest permitted limits from SCAQMD, SJVAPCD, and SMAQMD permits

Type of Fuel	Size (MMBtu/hr)	Permitted Limit	Control Technology	New or Retrofit	Location
Digester Gas	99	5	SCR	New	SJVAPCD
	62	15	ULNB	New	SCAQMD
	22	15	ULNB	Retrofit	SCAQMD
	16	9	ULNB	Retrofit	SJVAPCD
Type of Fuel	Size (MMBtu/hr)	Permitted Limit	Control Technology	New or Retrofit	Location
Landfill Gas	335	24	LNB	New (Year 1984)	SCAQMD
	115	21	LNB	New (Year 1990)	SCAQMD
	38	9	ULNB	Retrofit	SJVAPCD
	32	15	LNB	Retrofit	SMAQMD

32

Source Test Records Analysis

☐ Source test reports from equipment located in SCAQMD were used to analyze actual emissions from permitted equipment



33

Summary of Assessment

Landfill Gas Fired

- Units located in SMAQMD and SJVAPCD have been retrofitted units to meet ≤15 ppm
- All SCAQMD units are permitted below current limits (25 ppm) in Rule 1146/1146.1
- Continuous Emissions Monitoring Systems (CEMS)
 - All three landfill gas fired units located in SCAQMD are equipped with CEMS
 - Evaluated one out of three landfill gas fired units
 - Monthly average (year 2017) between 16 to 18 ppm

Digester Gas Fired

- Units in SJVAPCD have been retrofitted to meet 15 ppm or less

34

Other Considerations

□ Landfill Gas Fired Units:

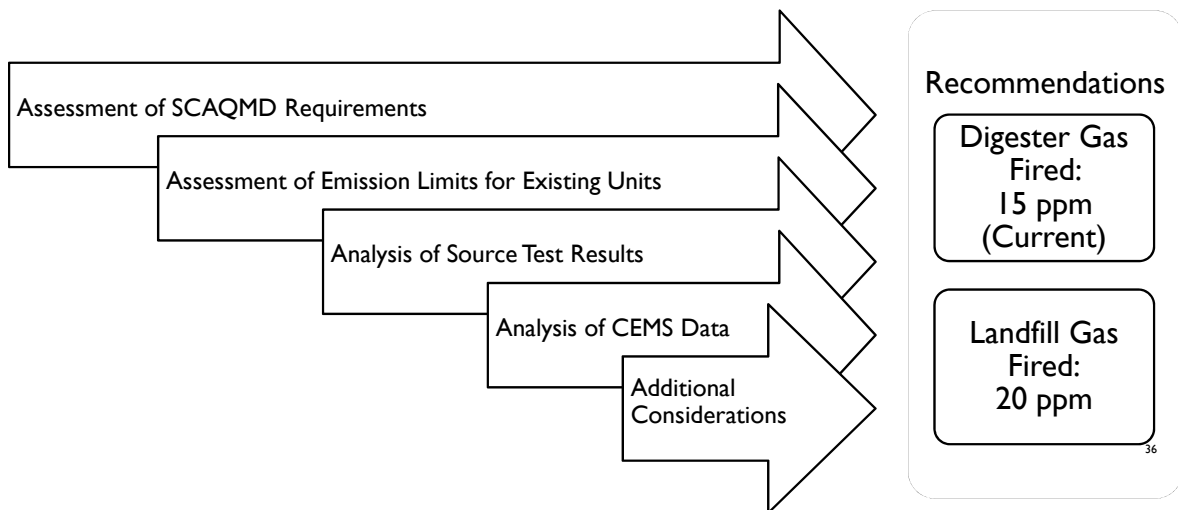
- Emissions from three landfill fired units (~0.47 tpd) are comparable to emissions from all 259 RECLAIM units (~0.42 tpd)
- All landfill fired units are located on inactive landfills
 - Two landfills became inactive in 1996 and 2013
 - Gas quality has degraded over time; therefore life of the units may be in question
- All landfill units located are still operating with original burners permitted between 1984 to 1990
- One facility is under a power purchase agreement expiring by 2024

□ Digester Gas Fired Units

- Emission limit in SCAQMD, after adjusting for the 50% gas mix allowance in SJVAPCD, is about 12 ppm
- Not cost effective (>\$50,000/ton) to require immediate retrofit given the previous compliance date of January 1, 2015

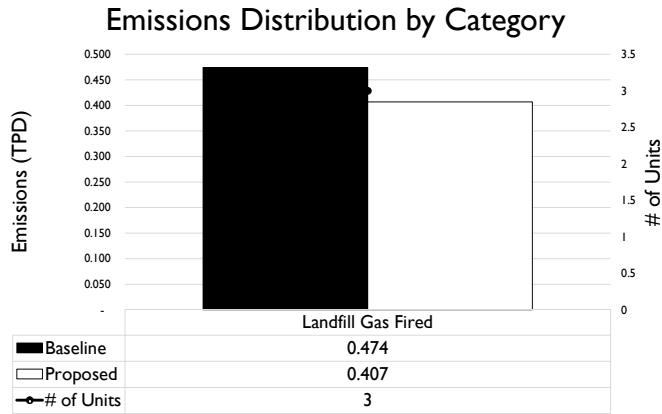
35

Summary of Technical Assessment



36

Emission Reductions



- ❑ Emission reduction estimates are calculated with three active landfill units
- ❑ Based on staff recommendations of 20 ppm, total emission reduction is 0.07 tpd by January 1, 2022

37

Cost-effectiveness – Landfill gas fired units

- ❑ Conservative assumption using the cost of a 9 ppm ULNB since the recommended NOx emission limit for landfill gas fired units is 20 ppm
- ❑ Capital cost has been updated to include cost for a performance study and contingency expenses

Category	Size MMBTU/hr	Recommended Emission Limit	Number of Units	Equipment#	Installation#	Permitting	Performance Study	Contingency Expenses	Present Worth Value per unit	Reduction per unit (tpy)	Cost-Effectiveness* (\$/ton)
Landfill Gas Fired Units	115	20 ppm	1	\$667,000	\$229,000	\$17,833	\$200,000	\$896,000	\$2,009,000	1.7	\$35,000
	335		2	\$1,925,000	\$625,000	\$17,833	\$200,000	\$2,549,000	\$5,316,000	22.7	

* Assumed 15 years useful life for ultra-low NOx burner

Equipment (burner retrofit) and installation cost was linearly extrapolated using the vendor cost for 9 ppm ultra-low NOx burners

38

RULE LANGUAGE UPDATES

39

Background

- Preliminary draft rule language provided with the 75-day package (released on September 18, 2018)
- Presentation will discuss rule language updates under consideration
- Draft rule language will be released with the 30-day package on or before November 7, 2018

40

Rule Language Update – PAR 1146

- ❑ NO_x limit for landfill fired gas unit will be changed to 20 ppm with compliance date of Jan 1, 2022
- ❑ Limit for digester gas fired units not changing

Rule Reference	Category	Limit (@ 3% O ₂)
(c)(1)(A)	All Units Fired on Gaseous Fuels	30 ppm or 0.036 lbs/10 ⁶ Btu for natural gas fired units
(c)(1)(B)	Any Units Fired on Non-gaseous Fuels	40 ppm
(c)(1)(C)	Any Units Fired on Landfill Gas	20 ppm
(c)(1)(D)	Any Units Fired on Digester Gas	15 ppm
(c)(1)(E)	Atmospheric Units	12 ppm or 0.015 lbs/10 ⁶ Btu
(c)(1)(F)	Group I Units	5 ppm or 0.0062 lbs/10 ⁶ Btu
(c)(1)(G)	Group II Units	5 ppm or 0.0062 lbs/10 ⁶ Btu
(c)(1)(H)	Group II Units (Fire-tube boilers with an existing NO _x limit ≤12 ppm or > 5 ppm)	7 ppm or 0.0085 lbs/10 ⁶ Btu
(c)(1)(I)	Group II Units (All others with an existing NO _x limit ≤12 ppm or > 5 ppm)	9 ppm or 0.011 lbs/10 ⁶ Btu
(c)(1)(J)	Group III Units (Fire-tube boilers Only)	7 ppm or 0.0085 lbs/10 ⁶ Btu
(c)(1)(K)	Group III Units (Excluding fire-tube boilers)	9 ppm or 0.011 lbs/10 ⁶ Btu
(c)(1)(L)	Thermal Fluid Heaters	12 ppm or 0.015 lbs/10 ⁶ Btu

41

Rule Language Update – PAR 1146

- ❑ Updates under consideration
 - Ammonia emission limit compliance demonstrations
 - Quarterly source testing for the first 12 months of operation, annually thereafter when four consecutive quarterly source tests demonstrate compliance; or
 - Ammonia CEMS under an approved SCAQMD protocol

42

Rule Language Update – PAR 1146.1

- NO_x limit for landfill fired gas unit will be changed to 20 ppm with compliance date of Jan 1, 2022
- Limit for digester gas fired units not changing

Rule Reference	Category	Limit (@ 3% O ₂)
(c)(1)(A)	All Other Units	30 ppm or 0.036 lbs/10 ⁶ Btu (natural gas fired units)
(c)(1)(B)	Any Units Fired on Landfill Gas	20 ppm
(c)(1)(C)	Any Units Fired on Digester Gas	15 ppm
(c)(1)(D)	Atmospheric Units	12 ppm or 0.015 lbs/10 ⁶ Btu
(c)(1)(E)	Any Units Fired on Natural Gas, Excluding Fire-tube boilers, Atmospheric Units, and Thermal Fluid Heaters	9 ppm or 0.011 lbs/10 ⁶ Btu
(c)(1)(F)	Any fire-tube Boilers Fired on Natural Gas	7 ppm or 0.0085 lbs/10 ⁶ Btu
(c)(1)(G)	Thermal Fluid Heaters	12 ppm or 0.015 lbs/10 ⁶ Btu

43

Updated Schedule

- Oct 19, 2018 Stationary Source Committee
- Nov 2, 2018 Set Hearing
- Dec 7, 2018 Public Hearing

44

Contacts

General RECLAIM Questions

- Gary Quinn, P.E.
Program Supervisor
909-396-3121
GQuinn@aqmd.gov
- Kevin Orellana
Program Supervisor
909-396-3492
KOrellana@aqmd.gov

Proposed Amended Rules 1146, 1146.1, 1146.2 and Proposed Rule 1100

- Gary Quinn, P.E.
Program Supervisor
909-396-3121
GQuinn@aqmd.gov
- Kalam Cheung, Ph.D.
Program Supervisor
909-396-3281
KCheung@aqmd.gov
- Lizabeth Gomez
Air Quality Specialist
909-396-3103
LGomez@aqmd.gov
- Shawn Wang
Air Quality Specialist
909-396-3319
SVWang@aqmd.gov

45