# PROPOSED RULE 1147.1
# WORKING GROUP MEETING #3

JANUARY 20, 2021
SOUTH COAST AQMD
DIAMOND BAR, CA

| | |
|---|---|
| **Zoom Meeting:** | https://scaqmd.zoom.us/j/96873414765 |
| **Meeting ID:** | **968 7341 4765** |
| **Passcode:** | **362107** |
| **Conference Call:** | **(669) 900-6833** |

## Agenda

- Highlights from Working Group #2
- BARCT Analysis
  - Existing Rule 1147 Emission Limits
  - Related rules from other agencies
  - Assessment of Emission Control Technology
- Cost-Effectiveness Analysis
- Next Steps

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# Previous Working Group Meeting Recap

- Discussed the criteria for inclusion in PR 1147.1
  - Type of facilities
  - Rule applicability
- Summarized six virtual site visits in lieu of a physical visit due to COVID-19
- Recommended incorporating PR 1147.1 equipment category into Proposed Amended Rule 1147 for miscellaneous combustion
- Discussed that under PAR 1147, the Asphalt Manufacturing Operations will be subject to individualized BARCT analysis

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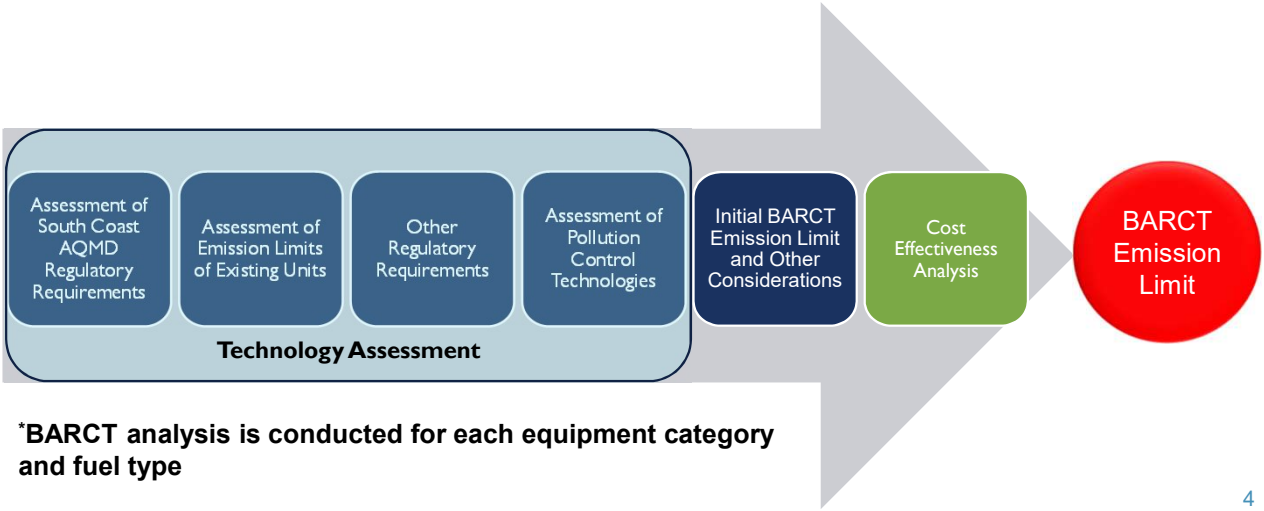
# BARCT ANALYSIS* OVERVIEW




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

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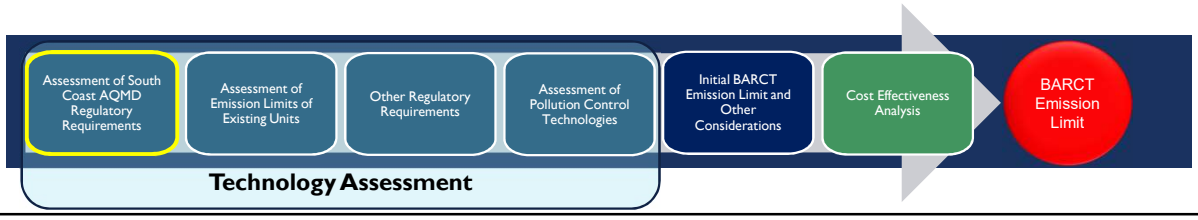
# EMISSION LIMITS OF EXISTING EQUIPMENT

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## Rule 1147 NOx Emission Limits

- **Applicability:** Existing Asphalt Manufacturing Operations category applies to units with process temperature <1,200° F
- **NOx limit:** 40 ppm @ 3% $O_2$
- **CO Limit:** None specified in rule
- **Monitoring and Testing:** Initial source testing requirement only

Staff is considering changing name of rule category from **"Asphalt Manufacturing Operations"** to **"Aggregate Dryers"**

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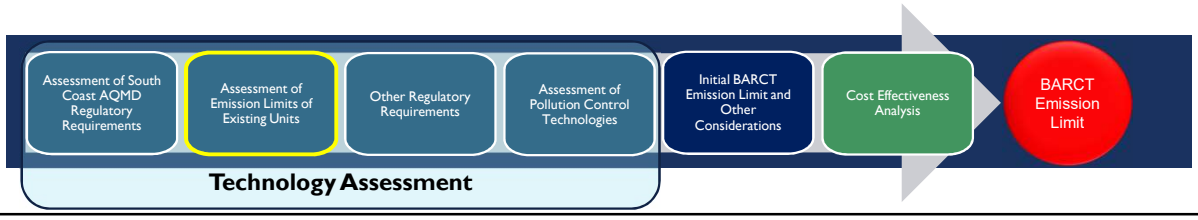
# EMISSION LIMITS OF EXISTING EQUIPMENT

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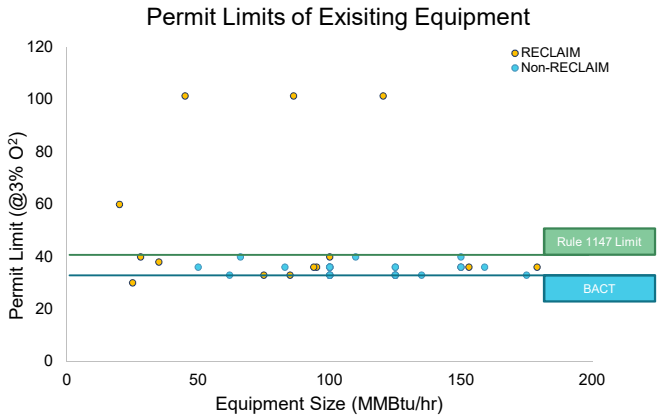
## Assessment of Emission Limits of Existing Equipment




- Identified 41 pieces of equipment applicable to the Aggregate Dryer category
- Permit limits corrected to 3% $O^2$ range between:
  - 33 to 40 ppm in Non-RECLAIM
  - 30 to 102 ppm* in RECLAIM
- Current Rule limit is 40 ppm[1]
- BACT for this category is 33 ppm[1]

** RECLAIM default emission factor of 130 lb/mmscf is equivalent to 102 ppm corrected to 3% $O_2$*

[1] http://www.aqmd.gov/docs/default-source/bact/bact-guidelines/part-d---bact-guidelines-for-non-major-polluting-facilities.pdf

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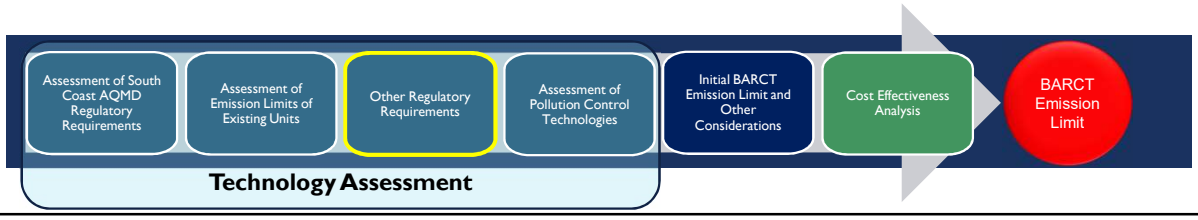
# RULES FROM OTHER AGENCIES

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# Other Agencies that Regulate Similar Equipment

EPA general air quality permit for new or modified minor source hot mix asphalt plants in Tribal Territory (Dated: 3/23/2015)

San Joaquin Valley APCD Rule 4309 – dryers, dehydrators, and ovens (Adopted December 15, 2005)

Ventura County APCD Rule 74.34 – NOx reductions from miscellaneous sources (Adopted 12/13/2016)

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## EPA General Air Quality Permit for New or Modified Minor Source Hot Mix Asphalt Plants in Tribal Territory

- **Applicability**: Applies to new or modified minor source hot mix asphalt plants in tribal territory
- **NOx Limit**: For non-attainment areas, 40 ppm at 3% $O_2$ for liquid fuel and 36 ppm at 3% $O_2$ for gaseous fuel
- **CO Limit**: Based on the limits in this rule, 600 ppm at 3% $O_2$ for dryers burning liquid fuels and 400 ppm @ 3% $O_2$ for gaseous fuel
- **Emission Monitoring**: Each permit contains a separate section that specifically identifies the emission limitations and standards, monitoring and testing

| Type of Fuel | $NO_X$ Emission limitation for Dryers |
|---|---|
| Gaseous Fuel | 36 $ppm_{vd}$ at 3% $O_2$ |
| Liquid Fuel | 40 $ppm_{vd}$ at 3% $O_2$ |

Source: http://www.epa.gov/air/tribal/tribalnsr.html

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## San Joaquin Valley APCD Rule 4309 – Dryers, Dehydrators, and Ovens

- **Applicability**: Applies to Asphalt/Concrete Plant that is fired on gaseous fuel, liquid fuel, or is fired on gaseous and liquid fuel sequentially, and the total rated heat input for the unit is 5.0 MMBtu/hour or greater
- **NOx Limit**: Equivalent to 40 ppm @ 3% $O_2$
- **CO Limit**: Equivalent to 400 ppm @ 3% $O_2$
- **Emission Monitoring**: Initial source test upon permitting and once every 24 months thereafter.

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# Ventura County APCD Rule 74.34 – NOx Reductions From Miscellaneous Sources

- **Applicability**: This rule applies to any unit where the total rated heat input for the unit is 5 million BTU per hour or greater
- **NOx Limit**: 40 ppm @ 3% $O_2$
- **CO Limit**: 400 ppm @ 3% $O_2$
- **Emission Monitoring**: Requires NOx and CO source test every 48 months with an annual screening analysis of NOx and CO emissions no later than 30 days after the anniversary date of the previous source test

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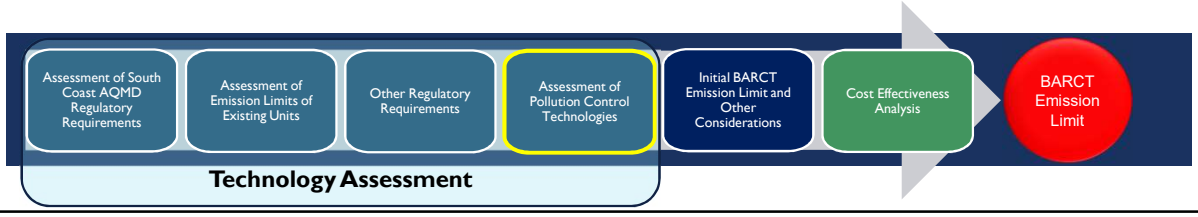
# ASSESSMENT OF EMISSION CONTROL TECHNOLOGY

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## ASSESSMENT OF EMISSION CONTROL TECHNOLOGY
BACKGROUND

- Technology assessments are conducted to assess current NOx control technologies available for equipment categories subject to Proposed Amended Rule 1147
  - Assessment will also consider opportunities for potential reductions
- NOx pollution control technologies are separated into two control categories:

| Combustion | Post-Combustion |
|---|---|
| ○ Low NOx/Ultra-Low NOx Burners<br>○ Flue Gas Recirculation | ○ Selective Catalytic Reduction |

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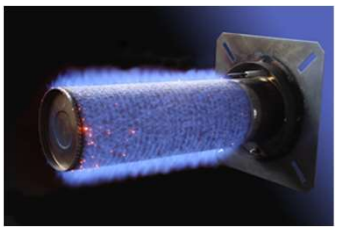
## OVERVIEW OF POLLUTION CONTROL TECHNOLOGIES

**Combustion Controls (Low-NOx/Ultra-Low NOx Burners)**

- Various burner configurations and designs:
  - Lean premix
  - Flue gas recirculation
  - Fuel/air staging
  - Metal mesh burner head
  - Recuperative/regenerative
- Reduces thermal NOx formation
- Costs are generally lower than post combustion controls
- Most common form of control in the PAR 1147/PR 1147.1 Universe



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## OVERVIEW OF POLLUTION CONTROL TECHNOLOGIES

### Combustion Controls (Low-NOx/Ultra-Low NOx Burners) – Cont'd

- Additional Considerations:
  - One burner manufacturer provided emission guarantee to meet <30 ppm^ for both new installations and retrofits to existing equipment
    - Emissions guarantees are for multiple output for a wide range of applications
  - In some limited applications, source test data gathered from equipment impacted by PR 1147.1 show low NOx burners are capable of achieving emissions of <20 ppm^
  - Ultra-Low NOx burners available in boiler applications capable of achieving <5 ppm^ without the need of post combustion controls

^ *NOx concentrations are corrected to 3% $O_2$ dry*

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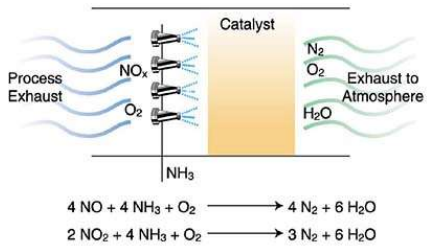
## OVERVIEW OF POLLUTION CONTROL TECHNOLOGIES

### Post-Combustion Controls (Selective Catalytic Reduction)




- NOx treatment at the exhaust with the use of reactant (ammonia/urea) and catalyst
  - Capable of >95% NOx reduction
  - Technology is scalable and used mostly in applications >10 MMBtu/hr
- Generally more costly than combustion controls via Low NOx/Ultra-Low NOx burners
  - Additional recurring costs includes electricity, catalyst, and reagent
- Some applications require exhaust pre-treatment prior to intake of SCR

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## OVERVIEW OF POLLUTION CONTROL TECHNOLOGIES

### Post-Combustion Controls (Selective Catalytic Reduction) – Cont'd

- Additional Considerations:
  - Upfront costs of SCR systems are generally more expensive than that of combustion control technologies
  - Additional monitoring will be required to keep SCR in optimal operation
    - Exhaust temperature and ammonia input
  - Introduction of ammonia/urea will cause unreacted ammonia to slip at the exhaust
    - Current South Coast AQMD BACT for ammonia slip is 5 ppm
  - Processes with low exhaust temperatures would need introduction of duct burners for proper control

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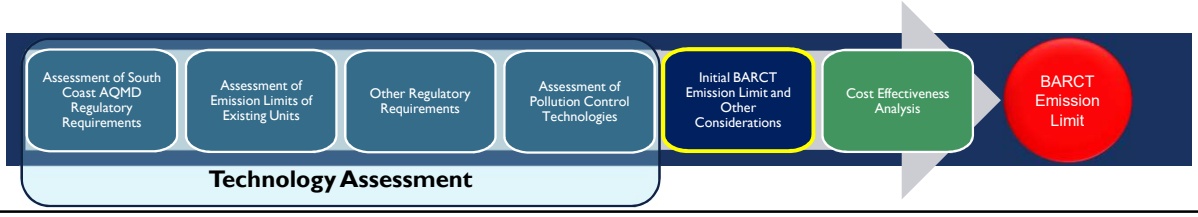
## INITIAL $NO_X$ BARCT EMISSION LIMIT FOR RECLAIM AND NON-RECLAIM UNITS

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# INITIAL BARCT LIMIT AND COST-EFFECTIVENESS ANALYSIS

## Aggregate Dryers

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## SUMMARY OF INITIAL BARCT LIMIT
AGGREGATE DRYER

| Equipment Size | Rule 1147 Limit^ | Other Regulatory# | Technology Assessment*^ | Initial BARCT NOx Limit*^ |
|---|---|---|---|---|
| ≥40 MMBtu/hr | 40 ppm | 36 to 40 ppm^ | 5 ppm (via SCR*) | 5 ppm (via SCR*) |
| <40 MMBtu/hr | 40 ppm | 36 to 40 ppm^ | 25 ppm (via LNB[1]) | 25 ppm (via LNB[1]) |

18 RECLAIM units representing 0.07 tons/day of NOx emissions[2]

Cost-Effectiveness Analysis is needed

+ *Emissions data collected from source test results*
* *Staff assumption of 95% efficiency for SCR reductions from default emission factor of 130 lb/mmscf (~102 ppm)*
^ *NOx concentrations are corrected to 3% $O_2$ dry*
# *Oxygen corrections for NOx concentrations vary depending on regulatory agency*
[1] *Low NOx Burner (LNB) technology assessment is based off of vendor guarantees. Source test results analyzed demonstrate burners can achieve lower concentrations*
[2] *Emissions calculated from reporting emissions under the RECLAIM program for compliance year 2019*

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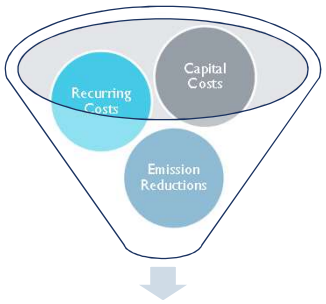
# COST BASIS FOR 5 PPM BARCT LIMIT
## AGGREGATE DRYERS

- Capital cost for selective catalytic reduction (SCR) systems obtained from two system manufacturers
  - Used higher cost figure for cost-effectiveness analysis
  - Assume SCR useful life of 25 years
- Annual recurring costs provided by vendor quotes to a facility in another Rule 1147 category
- Each system assumes installation of duct burner and total emission reductions of about 65%
  - Exhaust concentration of 5 ppm* with increased gas usage due to duct burner




*NOx concentrations are corrected to 3% $O_2$ dry

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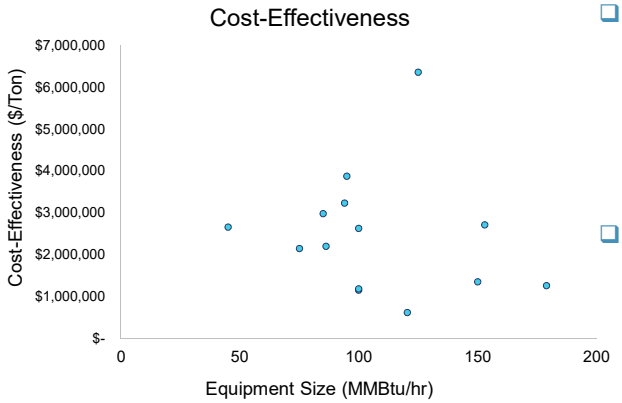
# COST-EFFECTIVENESS ASSESSMENT OF 5 PPM BARCT LIMIT
## AGGREGATE DRYERS




| | |
|---|---|
| **Cost-Effectiveness (MAX)** | **$6,364,000/Ton** |
| **Cost-Effectiveness (MIN)** | **$616,000/Ton** |

- Cost-effectiveness analysis assumes total emission reductions of about 65% due to required duct burner
  - Typical SCR applications without duct burners provide total emission reductions of ~95%
- Emission reductions calculated with RECLAIM reported emissions from 2019

**SCR is not cost effective for all RECLAIM facilities in this category**

**Equipment ≥40 MMBtu/hr to be included in evaluation for low NOx burners**

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# SUMMARY OF INITIAL BARCT LIMIT
## AGGREGATE DRYERS

| Equipment Size | Existing Units Meeting 25 ppm | South Coast AQMD Limit^ | Other Regulatory# | Technology Assessment^ | Initial BARCT NOx Limit*^ |
|---|---|---|---|---|---|
| All | 1 of 4 RECLAIM Units Source Tested <25 ppm<br>1 of 5 Non-RECLAIM Units Source Tested <25 ppm | 40 ppm | 36 ppm^ | 25 ppm (via LNB[1]) | 25 ppm (via LNB[1]) |

Cost-Effectiveness Analysis is needed

18 RECLAIM units representing 0.07 tons/day of NOx emissions[2]

* *Emissions data collected from source test results*
^ *NOx concentrations are corrected to 3% $O_2$ dry*
\# *Oxygen corrections for NOx concentrations vary depending on regulatory agency*
[1] *Low NOx Burner (LNB) technology assessment is based on vendor guarantees. Source test results analyzed demonstrate burners can achieve lower concentrations*
[2] *Emissions calculated from reporting emissions under the RECLAIM program for compliance year 2019*

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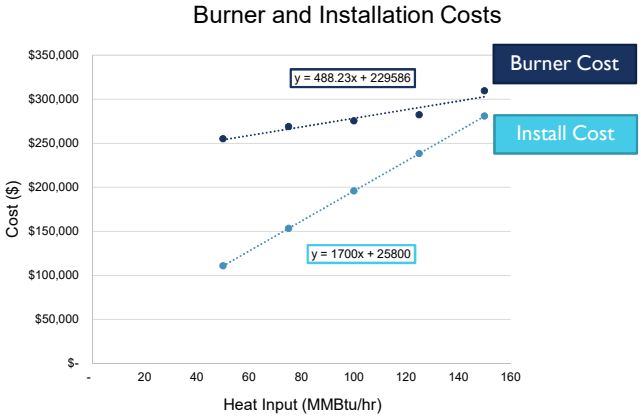
# COST BASIS FOR 25 PPM BARCT LIMIT
## AGGREGATE DRYERS

- Cost-effectiveness analysis to achieve 25 ppm is based on burner replacement
- Costs were obtained from one equipment manufacturer
  - Manufacturer provided burner costs for units between 50 to 150 MMBtu/hr
  - Unit sizes outside of provided burner range were estimated using equation created from provided costs
- Used installation cost from Rule 1146 equipment
  - Seeking feedback from stakeholders

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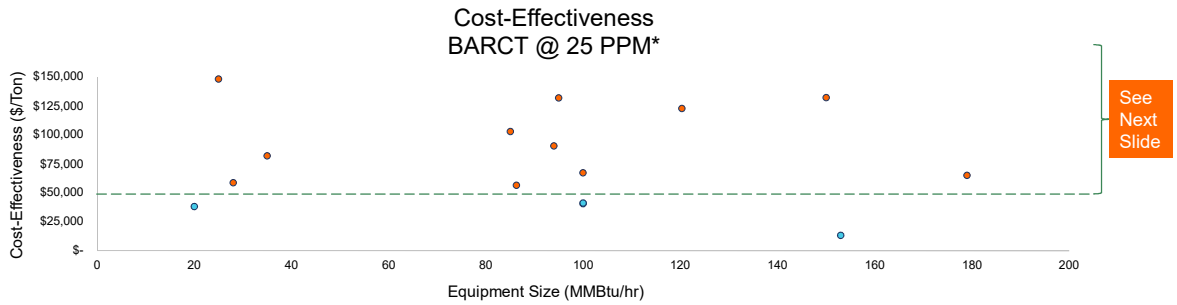
# COST-EFFECTIVENESS ANALYSIS
## AGGREGATE DRYERS

Units with Permit Limit >25 ppm and Estimated Usage ≥1 Pound Per Day




| | | |
|---|---|---|
| Average Cost-Effectiveness | RECLAIM | $2,413,200 /Ton |
| # of Identified Equipment | | 17 Units |

* *Two outliers with cost-effectiveness of $35 Million/Ton and $3.2 Million/Ton were excluded from this graph*

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# ADDITIONAL ANALYSIS FOR UNITS >$50,000/TON
## AGGREGATE DRYERS

| Unit Size (MMBtu/hr) | Permit Limit (PPM) | Source Test Results (PPM) | Cost-Effectiveness ($/Ton) |
|---|---|---|---|
| 28 | 40 | 26 | $ 3,200,000 |
| 35 | 38 | 34 | $ 59,000 |
| 20 | 60 | N/A | $ 34,995,000 |
| 25 | 30 | N/A | $ 82,000 |
| 95 | 36 | N/A | $ 148,000 |
| 179 | 36 | N/A | $ 68,000 |
| 85 | 33 | N/A | $ 132,000 |
| 150 | 36 | N/A | $ 66,000 |
| 100 | 36 | N/A | $ 103,000 |
| 153 | 36 | N/A | $ 132,000 |
| 100 | 33 | N/A | $ 57,000 |
| 94 | 36 | N/A | $ 123,000 |
| 75 | 33 | N/A | $ 91,000 |

^ *NOx concentrations corrected to 3% $O_2$ dry*

- 12 out of 13 units with cost-effectiveness greater than $50,000/ton are permitted at or below existing Rule 1147 limit of 40 ppm
- Remaining unit with permit limit of 60 ppm was identified as low-use back up emitting ~2 lb/year according to 2019 RECLAIM reporting

**Staff to develop separate implementation approach for units that are low-use or near final BARCT limit**

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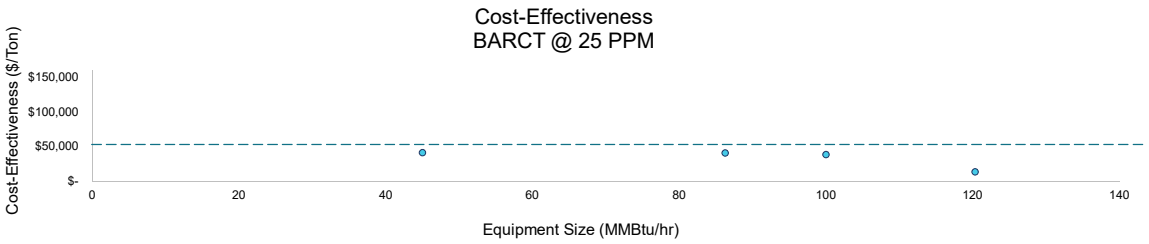
## COST-EFFECTIVENESS ANALYSIS
AGGREGATE DRYERS

Units with Permit Limit >25 ppm and Estimated Usage >1 LB/Day
**Remaining Units**




| | | |
|---|---|---|
| Average Cost-Effectiveness | RECLAIM | $36,100 /Ton |
| # of Identified Equipment | | 4 Units |

Analysis shows 25 ppm is cost-effective for Aggregate Dryers

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## Next Steps

- Transition rulemaking into Proposed Amended Rule 1147
- Further evaluate aggregate dryers within Proposed Amended Rule 1147

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# CONTACTS

| General RECLAIM Questions | Proposed Amended Rules 1147 and 1100 (Including Aggregate Dryers) | Proposed Amended Rule 1147, 1100 and Proposed Rule 1147.2 |
|---|---|---|
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