

# **NO<sub>x</sub> RECLAIM**

## **Working Group Meeting**

April 29, 2015

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## **Agenda**

- **BARCT Analysis**
  - Analysis Summary
  - Useful Life
  - Emissions Reductions/Remaining Emissions
  - Cumulative BARCT Cost Projections
- **Shave Methodology & Estimation**
- **Shave Approaches Under Consideration**
- **Other Considerations**
  - Energy & Efficiency – AB32 Integration
  - NSR RTC Holding Requirement
- **Schedule/Next Meeting**

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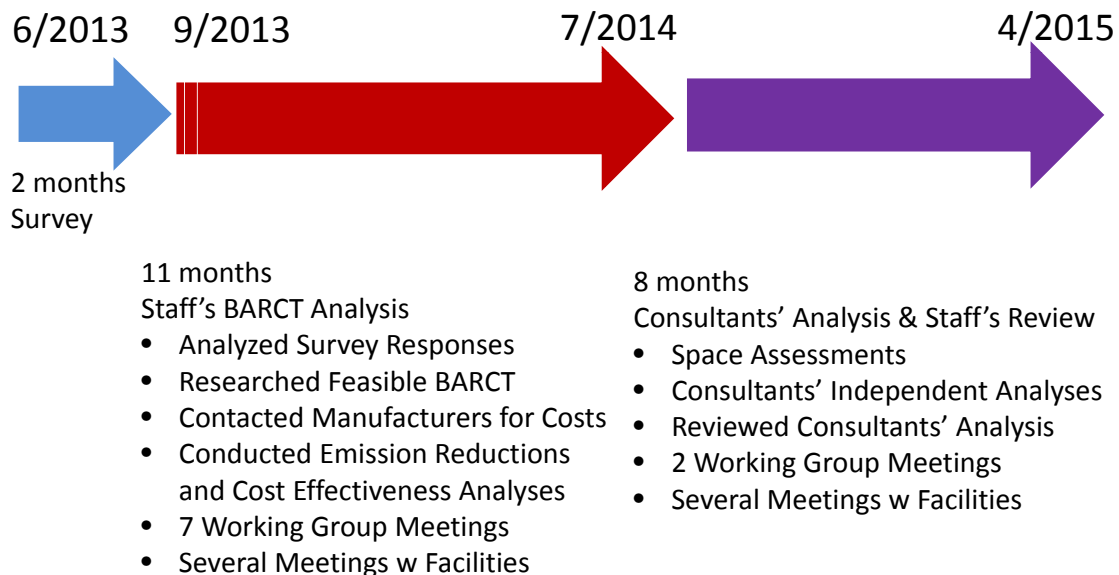
# Overall BARCT Methodology

- Technical Feasibility
- Cost Effectiveness
  - Incremental Cost Effectiveness Beyond 2000/2005 BARCT
  - Based on 2011 Activity
  - Set Cost Effectiveness threshold for individual pieces of equipment at \$50,000

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## BARCT Analysis Time Line



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## Useful Life of Control Equipment

- SCAQMD Assessment of SCRs: 25 Years
- Existing Basin Refinery Profile
  - 27% Refinery Combustion Equipment Have SCRs >25 Years
  - 36% Refinery Combustion Equipment Have SCRs 20-25 Years
- Other Air Districts
  - Bay Area: **20 Years** for SCR in Rule Development  
BACT Guidelines: 10 Yrs. Unless Shown to Be Different  
e.g. Refinery's SCR for Heaters Dated Back in 1984
  - Santa Barbara: **25 Years Supportable**. SCRs Installed in 1980-90's
  - Florida: **20 – 25 Years** BACT Analyses for SCR Permits
- EPA OAQPS: 20 Years
- SCR Manufacturers: 20-25 Years

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## Useful Life of SCAQMD NOx Control Equipment

| Rule    | Control Technology   | 15 ≤ Yrs. | 20 Yrs. | 25 Yrs. |
|---------|----------------------|-----------|---------|---------|
| 1121    | Ultra Low NOx Burner | X         |         |         |
| 1146.2  | Ultra Low NOx Burner | X         |         |         |
| 1147    | Ultra Low NOx Burner | X         |         |         |
| 1110.2  | Biogas SCR           |           | X       |         |
| 1111    | Ultra Low NOx Burner |           | X       |         |
| 1146    | SCR                  |           |         | X       |
| RECLAIM | SCR, Scrubber        |           |         | X       |
| 1105.1  | ESP                  |           |         | X       |
| 1156    | Baghouse             |           |         | X       |

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# Emission Reductions & Remaining Emissions

|                                 | Total Units | 2011 Emissions (tpd) | 2000/2005 BARCT | 2011 Emissions at 2000/2005 BARCT (tpd) | 2015 BARCT              | 2011 Emissions at 2015 BARCT (tpd) | 2023 Emission Reductions Beyond 2000/2005 BARCT (tpd) | 2023 Emission at 2015 BARCT with GF = 1 (tpd) |
|---------------------------------|-------------|----------------------|-----------------|---|-------------------------|------------------------------------|---|---|
| FCCUs/CO Boilers                | 8           | 1.08                 | 85% control     | 0.60                                    | 2 ppmv                  | 0.17                               | 0.43  | 0.17  |
| Turbines/Duct Burners           | 21          | 1.33                 | 62.27 lbs/mmcf  | 4.86                                    | 2 ppmv                  | 0.72                               | 4.14  | 0.72  |
| Coke Calciner                   | 2           | 0.55                 | 30 ppmv         | 0.25                                    | 5 ppmv                  | 0.05                               | 0.20  | 0.05  |
| SRU/TG Incinerators             | 17          | 0.43                 | RV              | 0.43                                    | 2 ppmv (or 95% control) | 0.11                               | 0.32  | 0.11  |
| Boilers/Heaters, > 110 mmbtu/hr | 73          | 4.88                 | 5 ppmv          | 0.82                                    | 2 ppmv                  | 0.38                               | 0.44  | 0.38  |
| B/Heaters >40-110 mmbtu/hr      | 69          | 2.00                 | 25 ppmv         | 0.97                                    | 2 ppmv                  | 0.45                               | 0.52  | 0.45  |
| B/Heaters, 20-40 mmbtu/hr       | 52          | 0.45                 | 9 ppmv          | 0.10                                    | n/a                     | 0.10                               | 0.00  | 0.10  |
| B/Heaters <20 mmbtu/hr          | 18          | 0.06                 | 12 ppmv         | 0.02                                    | n/a                     | 0.02                               | 0.00  | 0.02  |
| Other Major/Large Sources       | 5           | 0.11                 | RV              | 0.10                                    | n/a                     | 0.10                               | 0.00  | 0.10  |
| Other Process Units             | n/a         | 0.60                 | RV              | 0.60                                    | n/a                     | 0.60                               | 0.00  | 0.60  |
| <b>Total</b>                    | <b>265</b>  | <b>11.50</b>         |                 | <b>8.76</b>                             |                         | <b>2.71</b>                        | <b>6.06</b>   | <b>2.71</b>                                   |

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# Emission Reductions and Remaining Emissions

|                           | # of Facilities | 2012 Emissions (tpd) | 2000/2005 BARCT          | 2012 Emissions at BARCT/BACT (tpd)      | 2015 BARCT          | 2012 Emissions at 2015 BARCT (tpd) | Emission Reductions Beyond 2005 BARCT (tpd) | Growth Factor | 2023 Emissions at 2015 BARCT (tpd) |
|---------------------------|-----------------|----------------------|--------------------------|---|---------------------|------------------------------------|---|---------------|------------------------------------|
| <b>POWER PLANTS*</b>      |                 |                      |                          |   |                     |                                    |   |               |                                    |
| <b>TOTAL</b>              | <b>30</b>       | <b>2.50</b>          | <b>P/O or BACT level</b> | <b>2.35</b>                             | <b>No new BARCT</b> | <b>2.35</b>                        | <b>0</b>                                    | <b>0.8683</b> | <b>2.04</b>                        |
|                           | # of Units      | 2011 Emissions (tpd) | 2000/2005 BARCT          | 2011 Emissions at 2000/2005 BARCT (tpd) | 2015 BARCT          | 2011 Emissions at 2015 BARCT (tpd) | Emission Reductions Beyond 2005 BARCT (tpd) | Growth Factor | 2023 Emissions at 2015 BARCT (tpd) |
| <b>NON-POWER PLANTS</b>   |                 |                      |                          |   |                     |                                    |   |               |                                    |
| Boilers                   | 16              | 0.08                 | 9-12 ppm                 | 0.07                                    | No new BARCT        | 0.07                               | 0   | 0.96          | 0.07                               |
| Heaters                   | 3               | 0.01                 | 60 ppm                   | 0.01                                    | No new BARCT        | 0.01                               | 0   | 0.93          | 0.01                               |
| Furnaces >150 MMBTU/hr    | 2               | 0.49                 | 45 ppm                   | 0.70                                    | 9 ppm               | 0.14                               | 0.56  | 0.93          | 0.13                               |
| Furnaces                  | 10              | 0.31                 | 45 ppm                   | 0.31                                    | No new BARCT        | 0.31                               | 0   | 0.93          | 0.29                               |
| Glass Melting Furnaces    | 2               | 0.30                 | 1.2 lb/ton               | 0.30                                    | 80% Reduction       | 0.06                               | 0.24  | 1.18          | 0.07                               |
| Sodium Silicate Furnace   | 1               | 0.11                 | 6.4 lb/ton               | 0.11                                    | 80% Reduction       | 0.02                               | 0.09  | 1.21          | 0.02                               |
| Gas Turbines (non-OCS)    | 14              | 1.43                 | 61.45 lb/mmcf            | 1.24                                    | 2 ppm               | 0.21                               | 1.04  | 1.10          | 0.23                               |
| Gas Turbines (OCS)        | 6               | 0.49                 | 61.45 lb/mmcf            | 0.12                                    | No new BARCT        | 0.12                               | 0   | 1.46          | 0.18                               |
| ICES (non-OCS)            | 25              | 0.35                 | 217.36 lb/mmcf           | 1.05                                    | 11 ppm              | 0.21                               | 0.84  | 1.03          | 0.22                               |
| ICES (OCS)                | 6               | 0.03                 | 217.36 lb/mmcf           | 0.11                                    | No new BARCT        | 0.11                               | 0   | 1.46          | 0.16                               |
| <b>Cement Kilns**</b>     | <b>2</b>        | <b>1.61</b>          | <b>2.73 lb/ton</b>       | <b>1.61</b>                             | <b>0.5 lb/ton</b>   | <b>0.32</b>                        | <b>1.29</b>                                 | <b>0.9</b>    | <b>0.29</b>                        |
| <b>TOTAL</b>              | <b>87</b>       | <b>3.60</b>          |                          | <b>4.02</b>                             |                     | <b>1.26</b>                        | <b>2.77</b>                                 |               | <b>1.37</b>                        |
| <b>Other Sources***</b>   |                 | <b>3.12</b>          |                          | <b>3.12</b>                             |                     | <b>3.12</b>                        |   |               | <b>4.06</b>                        |
| <b>TOTAL NON-REFINERY</b> |                 | <b>9.22</b>          |                          | <b>9.49</b>                             |                     | <b>6.73</b>                        | <b>2.77</b>                                 |               | <b>7.47</b>                        |

\*This includes all power plants in RECLAIM. Calendar year 2012 AER reported fuel usage was used to calculate emissions at BARCT/BACT level.

\*\* CPCC's emissions and emission reductions have NOT been included in the totals, this facility did not have any emissions in CY2011. CY2008 emissions were used to calculate the emission reductions.

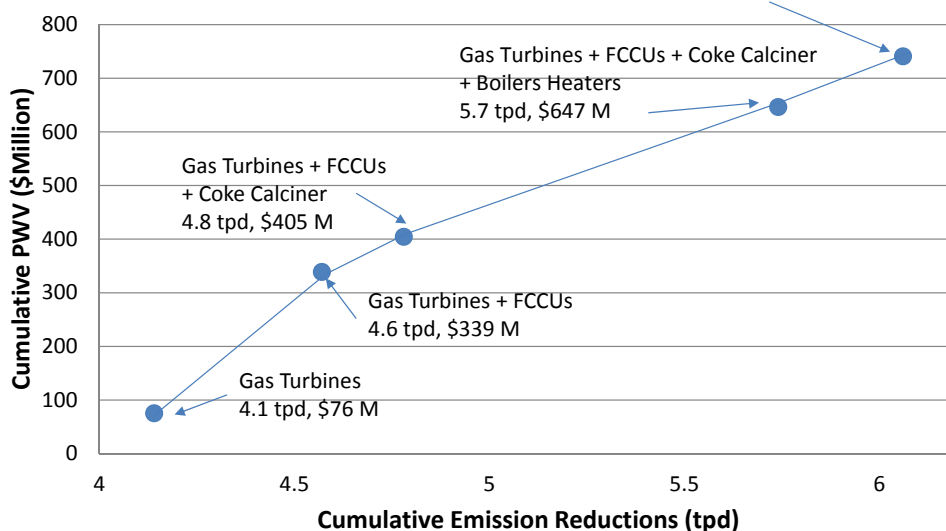
\*\*\* Includes Non-Refinery, Non-Power Plant Process Units in the Top 37 and all other sources outside the Top 37.

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# BARCT Costs for Refinery Sector

**BARCT in All 5 Categories**  
**6.06 tpd NOx Reductions \$741 Million \$13 K per ton NOx Reduced**  
**2017–2022 Implementation Synchronizing with Turnaround Schedule**



Average numbers are used in this graph to include all feasible control technologies and reconcile estimates from various sources of information

## Cost Effectiveness Summary

| Source Category                           | Average DCF Cost Effectiveness (\$/ton) | Average LCF Cost Effectiveness (\$/ton) |
|---|---|---|
| Refinery Gas Turbines                     | 1.9                                     | 3.3                                     |
| Metal Heat Treating Furnaces >150MMBTU/hr | 3.4                                     | 5.5                                     |
| Sodium Silicate Furnace                   | 4.8                                     | 7.6                                     |
| Glass Melting Furnaces                    | 4.9                                     | 7.7                                     |
| Non-Refinery ICES                         | 6                                       | 9.6                                     |
| Cement                                    | 8.2                                     | 13.1                                    |
| FCCUs                                     | 10.5                                    | 18                                      |
| Non-Refinery Gas Turbines                 | 20.3                                    | 32.5                                    |
| Coke Calciner                             | 23                                      | 38                                      |
| Refinery Boilers/Heaters                  | 28                                      | 45                                      |
| SRU/TG                                    | 34                                      | 56                                      |
| <b>Average</b>                            | <b>13.2</b>                             | <b>21.5</b>                             |

# Shave Methodology and Estimation

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## Shave Calculation

- Remaining Emissions in 2023  
= (Refinery Remaining Emissions) + (Non-Refinery Remaining Emissions x Growth)
- RTC Reductions
- Sample Calculation
- Proposed Shave Alternatives

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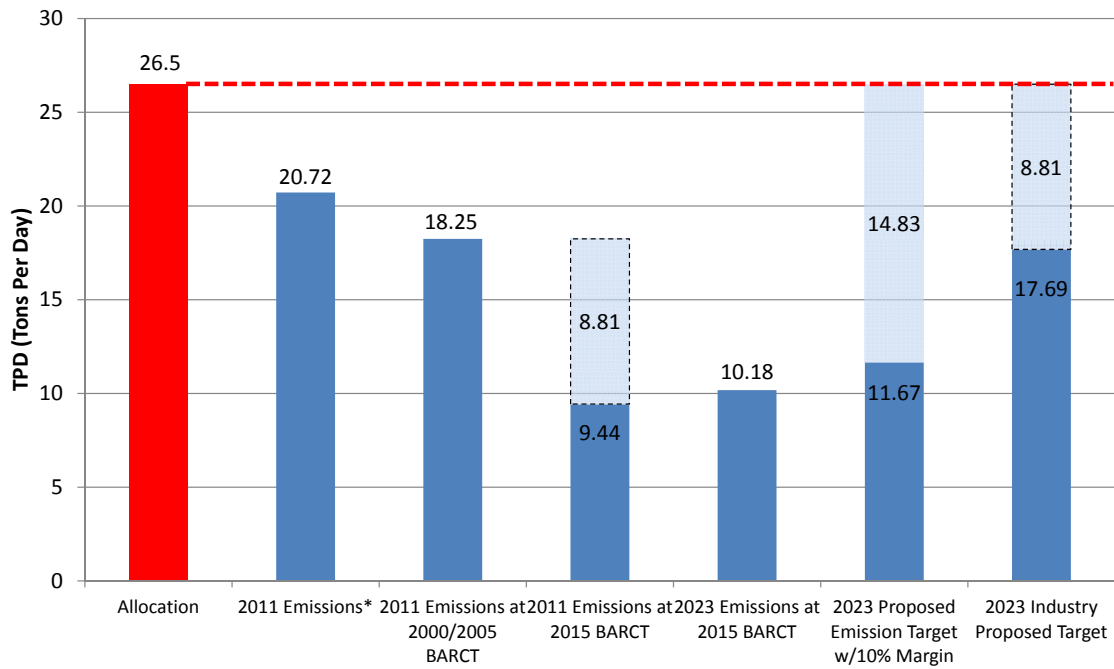
## 2023 Remaining Emissions

- Remaining Emissions in 2023  
= (Refinery Remaining Emissions) + (Non-Refinery Remaining Emissions x Growth)  
= 2.71 + 7.47 = 10.18 tpd
- Remaining Emissions from Shutdown Glass Facilities = 0.10 tpd after BARCT adjustment
- Remaining Emissions from CPCC after BARCT adjustment with growth = 0.29 tpd

## 2023 Remaining Emissions, con't

- Remaining Emissions from New Facilities since 2005 Amendments = 0.07 tpd
- 10% Adjustment Factor Applied to Refinery, Non-Refinery and New Facility Emissions Only
- Total Remaining Emissions in 2023 after 10% Adjustment Factor  
– 11.67 tpd

## Comparison of NOx RECLAIM Emission Levels Relative to Total Allocation



\*Includes 2012 Power Plant Calculated Emissions

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## RTC Reductions and Sample Calculation

- RTC Reductions  
= Current RTC Holdings (26.5 tpd)  
– (Remaining Emissions in 2023)
- Sample Calculation  
RTC Reductions = 26.5 – 11.67 = 14.83 tpd
- Across the Board Shave = 56% RTC Reduction

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# Shave Approaches Under Consideration

|    |  | Refinery | Non-Refinery |
|----|--|----------|--------------|
| #1 | <b>Across the Board</b><br><i>Affects all facilities and investors</i>   | 56%      | 56%          |
| #2 | <b>Weighted by BARCT Reduction Contribution</b><br><i>Affects all facilities and investors</i>   | 75%      | 36%          |
| #3 | <b>Hybrid of #1 and #2: BARCT reductions applied to adjusted initial allocation; C&amp;C equivalent adjustment across the board</b><br><i>Affects all facilities and investors</i> | 67%      | 44%          |
| #4 | <b>Shave applied to top 90% of emitter's RTC holdings</b><br><i>33 facilities, plus investors as 1 company</i><br><i>25 non-major refinery facilities</i>                          | 72%      | 72%          |
| #5 | <b>Shave applied to top 90% of RTC holders</b><br><i>63 facilities, plus investors as 1 company</i><br><i>55 non-major refinery facilities</i>                                     | 62%      | 62%          |

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# Other Considerations

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## Energy Efficiency Projects

- Information Submitted from Refineries to CARB on Energy Efficiency Projects with Co-Benefits NOx Reductions
- 0.7 tpd NOx Reductions For Projects Completed From 2007 Not Yet Included in Inventory Baseline
- Integration of Co-Benefits?

## NSR RTC Holding Requirement

- NSR Required RTC Holdings
  - Holding purpose only, not usable to cover emissions
  - Leasing Option
  - Non-tradable RTC bank

## **Power Plants- Demand for Additional RTCs**

- Frequent Start-Up Emissions due to renewable power considerations
- Future electrification in the transportation sector

## **Next Steps**

- Notice of Public Workshop – April 30 2015
- Public Workshop – May 2015
- Continued Working Group Meetings
- Stationary Source Committee Meeting – May and June 2015
- Rule Adoption – July - August 2015

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