# Status Report to the Stationary Sources Joint Forum : Task 2b: $NO_x$ From EGUs

September 7th, 2005

Presented by:
Eastern Research Group, Inc.

# $NO_x$ From Coal-fired EGUs – Overall Methodology

- Assembled database of all EGUs in WRAP
- Generated a profile state of the art $NO_x$ combustion controls
- Identified control options
- Calculated costs and impacts of options

# Bins for Coal-fired EGUs in WRAP

- EGUs were grouped into bins based on similarities in combustor type, coal fired, and nitrogen content of coal.
- Bins were further specified by the generation of existing combustion control.
  - E.g., 1st generation LNB, 2nd generation LNB, State of the Art LNB
- Insufficient information was available on more specific combustor parameters (e.g., residence time, combustor volume, and heat release rate).

# Control Option Investigated

- Identified 5-7 control options for bins (except for fluidized bed, cell, and cyclone burners).
- Options 1-3 are existing combustion controls that are widely used.
  - Most are variations of LNB and/or OFA
- Options 4-7 are next generation burners or state of art combustion controls.
  - E.g., ULNB, ULNB+OFA, ROFA

# Costs and Impacts of Scenarios

- Costs for LNB and OFA from CAMD analysis were updated to 2004 $.
- Vendor information on LNB and OFA in 2004 $ were compared to updated CAMD costs. If significantly different, vendor data used to reflect decrease in costs.
- O & M costs were based on CAMD data
- Vendor information used for new state of the art combustion controls.
  - Costs and emission reductions based on few data points

# Costs and Impacts Methodology

- Incorporated the generation of the control category to determine the baseline level of control
- Baseline $NO_x$ emissions were based on CEM information from CAMD and vendor data when CAMD data did not account for recent installations
- Emission reductions were calculated using the percent reduction the control option can achieve, but bounded by the emission limit that can be achieved

# Control Options Explanation

| Option | Number of Units with Option Control Applied | Baseline Emissions Average 2001 to 2003 (tons) |
|---|---|---|
| **BIN 1a - Tangential-fired burners (bituminous and sub-bituminous-A,B rank)** | | |
| Option 1: LNC1 or better | 10 | 237,751 |
| Option 2: LNC2 or better | 20 | |
| Option 3: LNC3 | 25 | |
| Option 4: ROFA | 30 | |
| Option 5: ULNC4 | 25 | |
| **BIN 1b - Tangential-fired burners (PRB and lignite)** | | |
| Option 1: LNC1 or better | 6 | 43,960 |
| Option 2: LNC2 or better | 8 | |
| Option 3: LNC3 | 9 | |
| Option 4: ROFA | 11 | |
| Option 5: ULNC4 | 9 | |

# Control Options Explanation (cont'd)

| Option | Number of Units with Option Control Applied | Baseline Emissions Average 2001 to 2003 (tons) |
|---|---|---|
| **BIN 2 - Dry Bottom Wall-fired burners (including turbo-fired) (bituminous and sub-bituminous-A,B rank)** | | |
| **Option 1: LNB or better (any generation)** | 4 | 157,947 |
| **Option 2: LNBO or better (any generation)** | 20 | |
| **Option 3: State of the Art ULNB or better** | 11 | |
| **Option 4: State of the Art ULNBO or better** | 22 | |
| **Option 5: State of the Art ULNBO and OEC on Applicable Units** | 27 | |
| **Option 6: ROFA** | 30 | |
| **BIN 3 - Dry Bottom Wall-fired burners (including turbo-fired) (PRB and lignite)** | | |
| **Option 1: LNB or better (any generation)** | 4 | 55,631 |
| **Option 2: LNBO or better (any generation)** | 9 | |
| **Option 3: State of the Art ULNB or better** | 10 | |
| **Option 4: State of the Art ULNBO or better** | 12 | |
| **Option 5: ROFA** | 13 | |

# Control Options Explanation (cont'd)

| Option | Number of Units with Option Control Applied | Baseline Emissions Average 2001 to 2003 (tons) |
|---|---|---|
| **BIN 4- Cyclone Burners** | | |
| **Option 1: Micronized Reburn** | 5 | 62,780 |
| **BIN 5 - Cell Burners** | | |
| **Option 1: ULNCB (any generation)** | 1 | 45,425 |
| **BIN 7 - Dry Bottom Vertically-fired burners** | | |
| **Option 1: LNB or better (any generation)** | 2 | 7,251 |

# Cost and Emission Reductions for Control Options Applied to Bins

| Option | Emission Reductions (tons) | | | $/tonB | | % Emission Reduction | | |
|---|---|---|---|---|---|---|---|---|
| | Min | Max | Best Pt. | Min TAC/Best Pt. Reduction | Max TAC/Best Pt. Reduction | Min | Max | Best Pt. |
| **BIN 1a - Tangential-fired burners (bituminous and sub-bituminous-A,B rank)** | | | | | | | | |
| 1 | 12,833 | 40,541 | 20,875 | $72 | $4,883 | 5% | 17% | 9% |
| 2 | NAa | 58,455 | 34,646 | $72 | $4,883 | NAa | 25% | 15% |
| 3 | 1,576 | 89,955 | 58,981 | $74 | $3,936 | 1% | 38% | 25% |
| 4 | 19,542 | 109,970 | 67,066 | $116 | $2,547 | 8% | 46% | 28% |
| 5 | 1,576 | 89,955 | 58,981 | $128 | $7,186 | 1% | 38% | 25% |
| **BIN 1b - Tangential-fired burners (PRB and lignite)** | | | | | | | | |
| 1 | 5,218 | 16,718 | 11,163 | $226 | $1,081 | 12% | 38% | 25% |
| 2 | 6,811 | 18,527 | 12,971 | $226 | $1,081 | 15% | 42% | 30% |
| 3 | 10,768 | 20,258 | 18,382 | $186 | $763 | 24% | 46% | 42% |
| 4 | 16,830 | 21,685 | 16,830 | $398 | $1,163 | 38% | 49% | 38% |
| 5 | 11,722 | 19,953 | 17,555 | $339 | $1,410 | 27% | 45% | 40% |

# Cost and Emission Reductions for Control Options Applied to Bins (cont'd)

| Option | Emission Reductions (tons) | | | $/tonB | | % Emission Reduction | | |
|---|---|---|---|---|---|---|---|---|
| | Min | Max | Best Pt. | Min TAC/Best Pt. Reduction | Max TAC/Best Pt. Reduction | Min | Max | Best Pt. |
| **BIN 2 - Dry Bottom Wall-fired burners (including turbo-fired) (bituminous and sub-bituminous A,B rank)** | | | | | | | | |
| 1 | 286 | 8,346 | 2,239 | $589 | $2,528 | 0% | 5% | 1% |
| 2 | 13,034 | 22,892 | 15,882 | $301 | $3,951 | 8% | 14% | 10% |
| 3 | 1,815 | 18,617 | 8,306 | $138 | $2,919 | 1% | 12% | 5% |
| 4 | 12,880 | 36,090 | 19,646 | $208 | $5,137 | 8% | 23% | 12% |
| 5 | 14,221 | 35,541 | 20,255 | $208 | $7,496 | 9% | 23% | 13% |
| 6 | 41,473 | 76,948 | 55,844 | $179 | $958 | 26% | 49% | 35% |
| **BIN 3 - Dry Bottom Wall-fired burners (including turbo-fired) (PRB and lignite)** | | | | | | | | |
| 1 | 4,684 | 5,000 | 6,750 | $188 | $399 | 8% | 9% | 12% |
| 2 | 10,676 | 11,897 | 11,090 | $311 | $835 | 19% | 21% | 20% |
| 3 | 14,707 | 15,988 | 14,876 | $188 | $801 | 26% | 29% | 27% |
| 4 | 19,939 | 24,593 | 21,497 | $267 | $2,119 | 36% | 44% | 39% |
| 5 | 30,415 | 32,014 | 30,415 | $202 | $1,543 | 55% | 58% | 55% |

# Cost and Emission Reductions for Control Options Applied to Bins (cont'd)

| Option | Emission Reductions (tons) | | | $/tonB | | % Emission Reduction | | |
|---|---|---|---|---|---|---|---|---|
| | Min | Max | Best Pt. | Min TAC/Best Pt. Reduction | Max TAC/Best Pt. Reduction | Min | Max | Best Pt. |
| **BIN 4- Cyclone Burners** | | | | | | | | |
| 1 | 14,386 | 31,708 | 26,690 | $652 | $1,394 | 23% | 51% | 43% |
| **BIN 5 - Cell Burners** | | | | | | | | |
| 1 | 74 | 1,515 | 363 | $1,588 | $1,588 | 0% | 3% | 1% |
| **BIN 7 - Dry Bottom Vertically-fired burners** | | | | | | | | |
| 1 | NAa | 3,297 | 2,596 | $118 | $256 | NAa | 45% | 36% |