

Best Available Retrofit Technology (BART) for Selected Non-EGU Source Categories



Regional Air Quality Workshop
June 28, 2005
Presented By:
Edward Sabo
MACTEC Federal Programs, Inc.
ejsabo@mactec.com

Process for Establishing BART Emission Limitations

- Step 1
 - States identify those sources which meet the definition of “BART-eligible source” set forth in 40 CFR 51.031
- Step 2
 - States determine whether such sources “emit any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility (in a Class I area)”.
 - A source which fits this description is “subject to BART”.
- Step 3
 - For each source subject to BART, States then identify the appropriate type and the level of control for reducing emissions

Preliminary BART Analyses

Step 1	States	Preliminary list of “BART-eligible Sources”
Step 2	LADCO	Air quality analysis to identify “Sources subject to BART”
Step 3	MACTEC	Engineering analysis of control technology

Step 1: Identify BART-Eligible Sources

A source is “BART-Eligible” if:

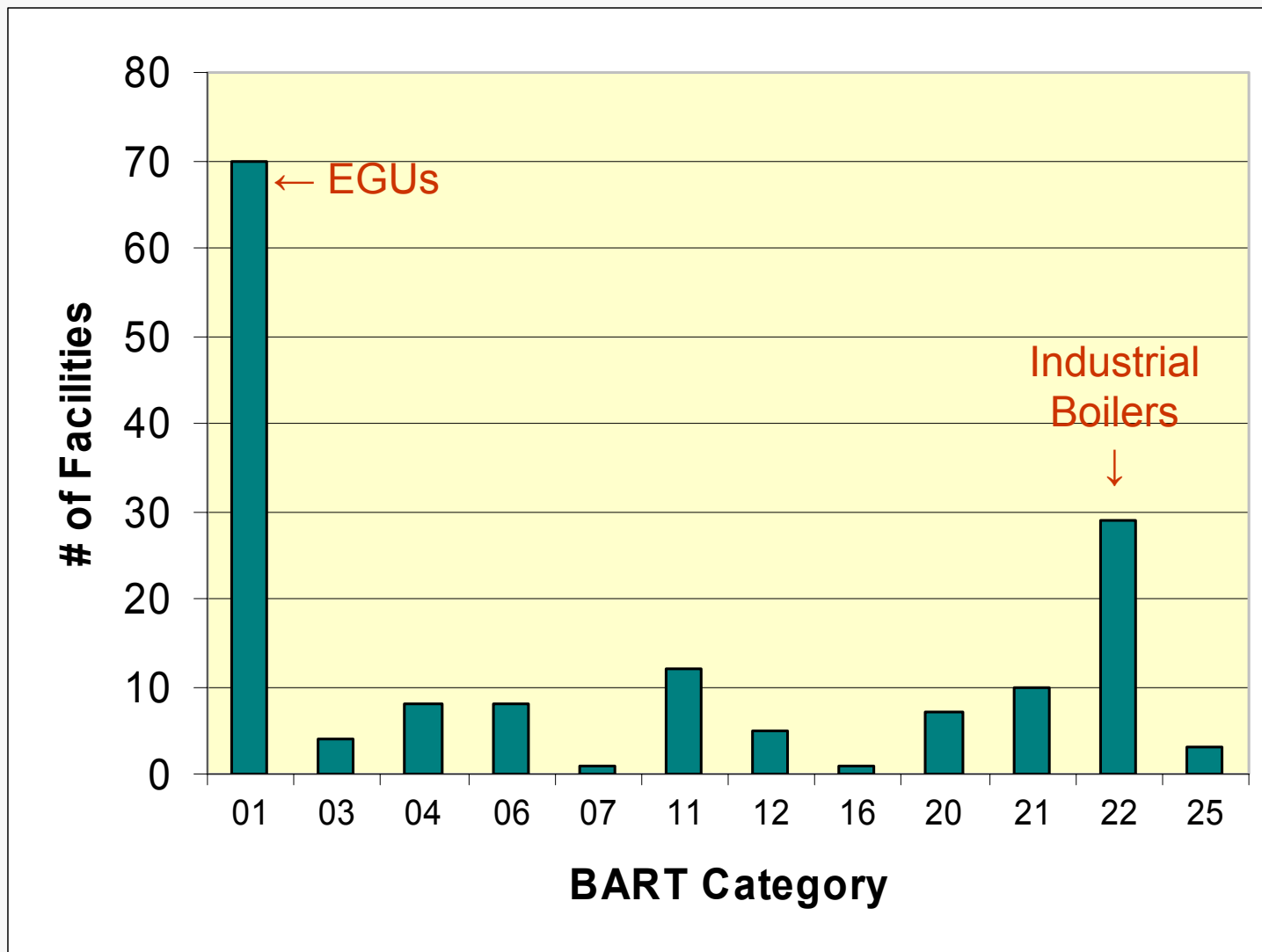
1. is one of 26 specified source categories,
2. was “in existence” on August 8, 1977, and “in operation” on or after August 8, 1962, and
3. has potential emissions greater than 250 TPY of any visibility impairing pollutant (i.e., SO_x, NO_x, PM, or VOC).

Information on operation dates and potential emissions were not readily available for all sources. As such, the States agreed that the current effort to identify BART-eligible sources would rely on whatever date information was available and actual emissions (with a threshold of 100 TPY). The States will continue to collect operating date information and potential emissions data. A final list of BART-eligible sources will be prepared after USEPA finalizes its BART rule in June 2005.

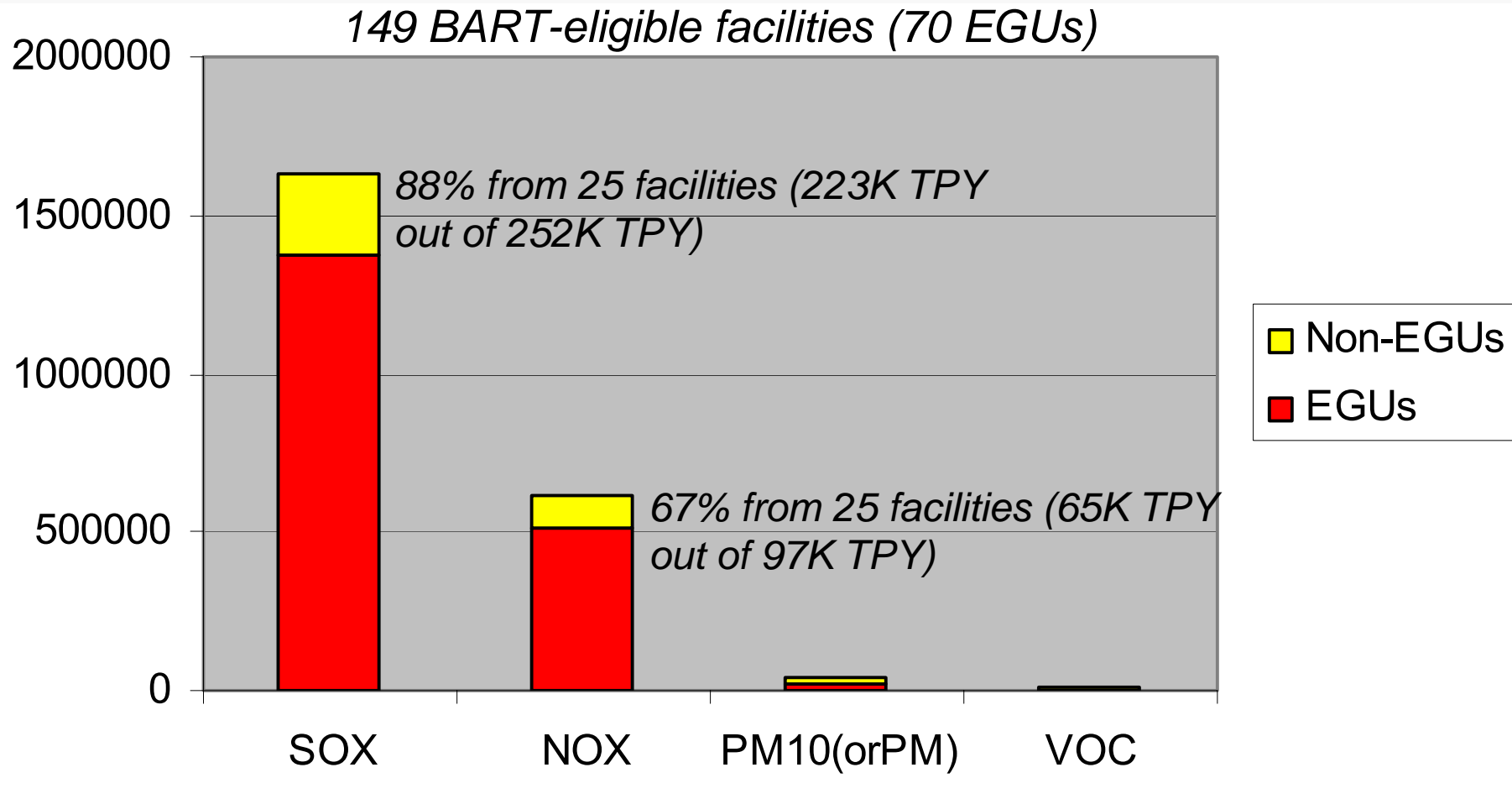
26 Listed BART Categories

- (1) Fossil-fuel fired steam electric plants of more than 250 million British thermal units (BTU) per hour heat input
- (2) Coal cleaning plants (thermal dryers)
- (3) Kraft pulp mills
- (4) Portland cement plants
- (5) Primary zinc smelters
- (6) Iron and steel mill plants
- (7) Primary aluminum ore reduction plants,
- (8) Primary copper smelters
- (9) Municipal incinerators capable of charging more than 250 tons of refuse per day
- (10) Hydrofluoric, sulfuric, and nitric acid plants
- (11) Petroleum refineries
- (12) Lime plants
- (13) Phosphate rock processing plants
- (14) Coke oven batteries
- (15) Sulfur recovery plants
- (16) Carbon black plants (furnace process)
- (17) Primary lead smelters
- (18) Fuel conversion plants
- (19) Sintering plants
- (20) Secondary metal production facilities
- (21) Chemical process plants
- (22) Fossil-fuel boilers of more than 250 million BTUs per hour heat input
- (23) Petroleum storage and transfer facilities with a capacity exceeding 300,000 barrels
- (24) Taconite ore processing facilities
- (25) Glass fiber processing plants
- (26) Charcoal production facilities

Preliminary BART-Eligible Sources in LADCO Region



BART-Eligible Sources: Emissions (tpy)



Preliminary BART-Eligible Sources

- Approximately 150 facilities
 - 70 EGUs
 - 29 Facilities with Industrial Boilers
 - 51 other non-EGU Facilities
- IL-36 IN-34 MI-27 OH-32 WI-20
- SO₂ - 1.6 million tons per year
- NO_x - 0.6 million tons per year
- 700 Emission Units

Step 2: Identify Sources Subject to BART

Three approaches to determine whether a source may “cause or contribute to any impairment of visibility in a Class I area” (i.e., is “subject to BART)

1. Consider all BART-Eligible sources to be subject to BART
2. Perform modeling to show that all BART-eligible sources (in a State) cumulatively do not cause or contribute to visibility impairment
3. Consider individualized contributions of each BART-eligible source

Modeling Approaches to Identify Sources Subject to BART

- Proposed BART Guideline allowed several alternative approaches
- LADCO considered three methods:
 1. A screening analysis based on the emissions divided by distance (Q/d) method
 2. Limited CALPUFF modeling
 3. A CAMx Source Apportionment Analysis

Mandatory Class I Areas



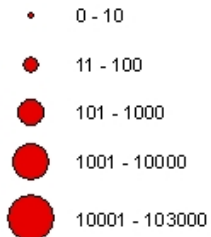
Class I Areas Closest to LADCO States

- Boundary Waters Canoe Area Wilderness, Minnesota
- Dolly Sods Wilderness, West Virginia
- Isle Royal Wilderness, Michigan
- Mammoth Cave National Park, Kentucky
- Mingo Wilderness, Missouri
- Seney Wilderness Area, Michigan

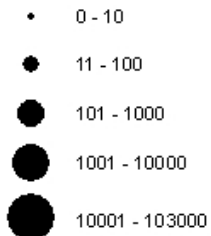
SO₂ Emissions in Tons for BART-Eligible EGUs and Non-EGUs

Legend

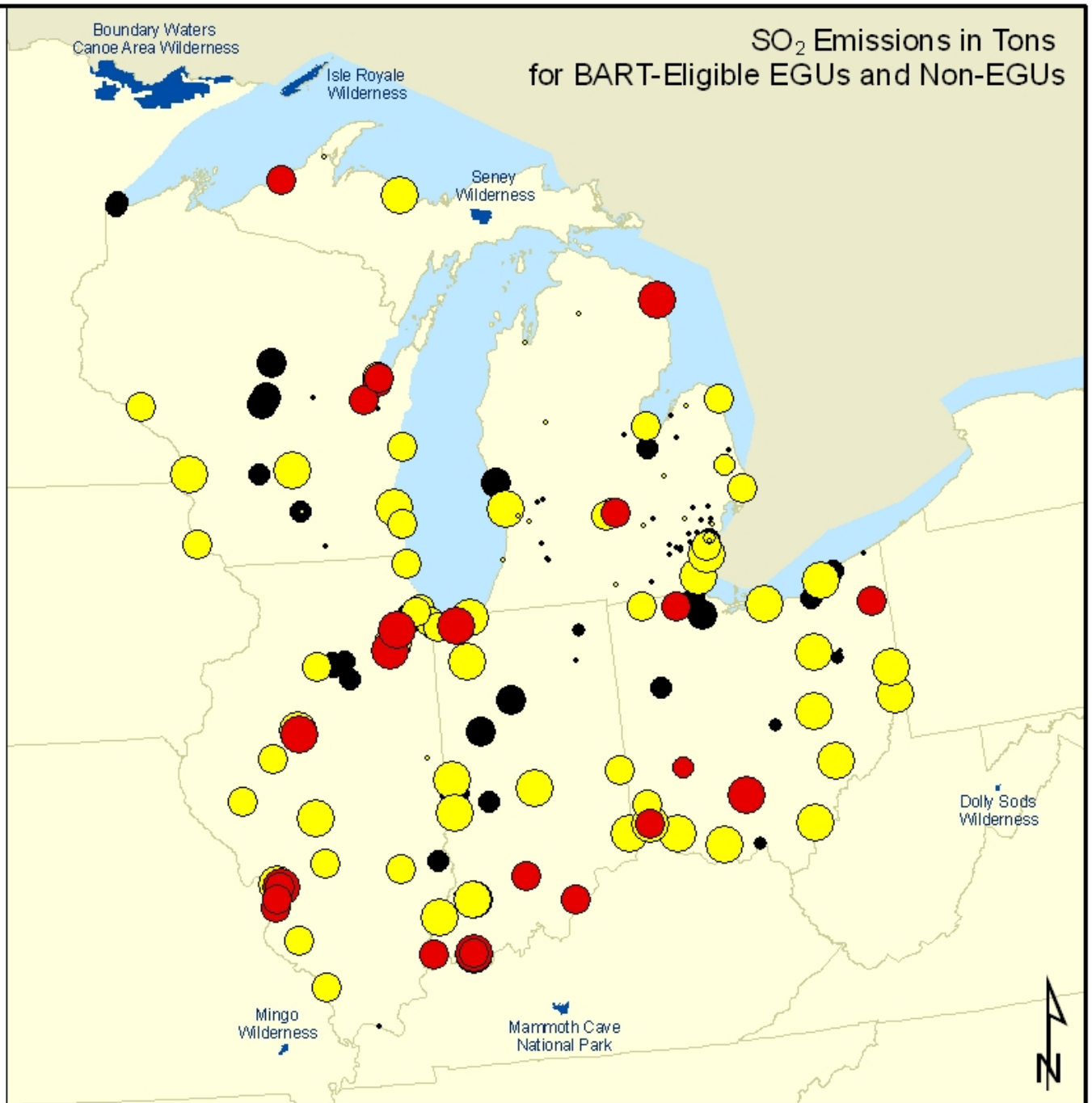
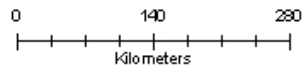
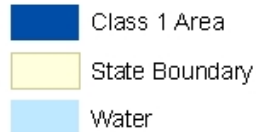
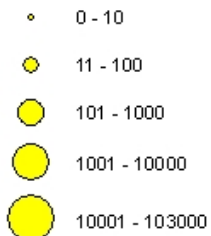
BART-Eligible Non-EGUs Subject to BART



Other BART-Eligible Non-EGUs



BART-Eligible EGU



NO_x Emissions in Tons for BART-Eligible EGUs and Non-EGUs

Legend

BART-Eligible EGU

- 0 - 10
- 11 - 100
- 101 - 1000
- 1001 - 10000
- 10001 - 103000

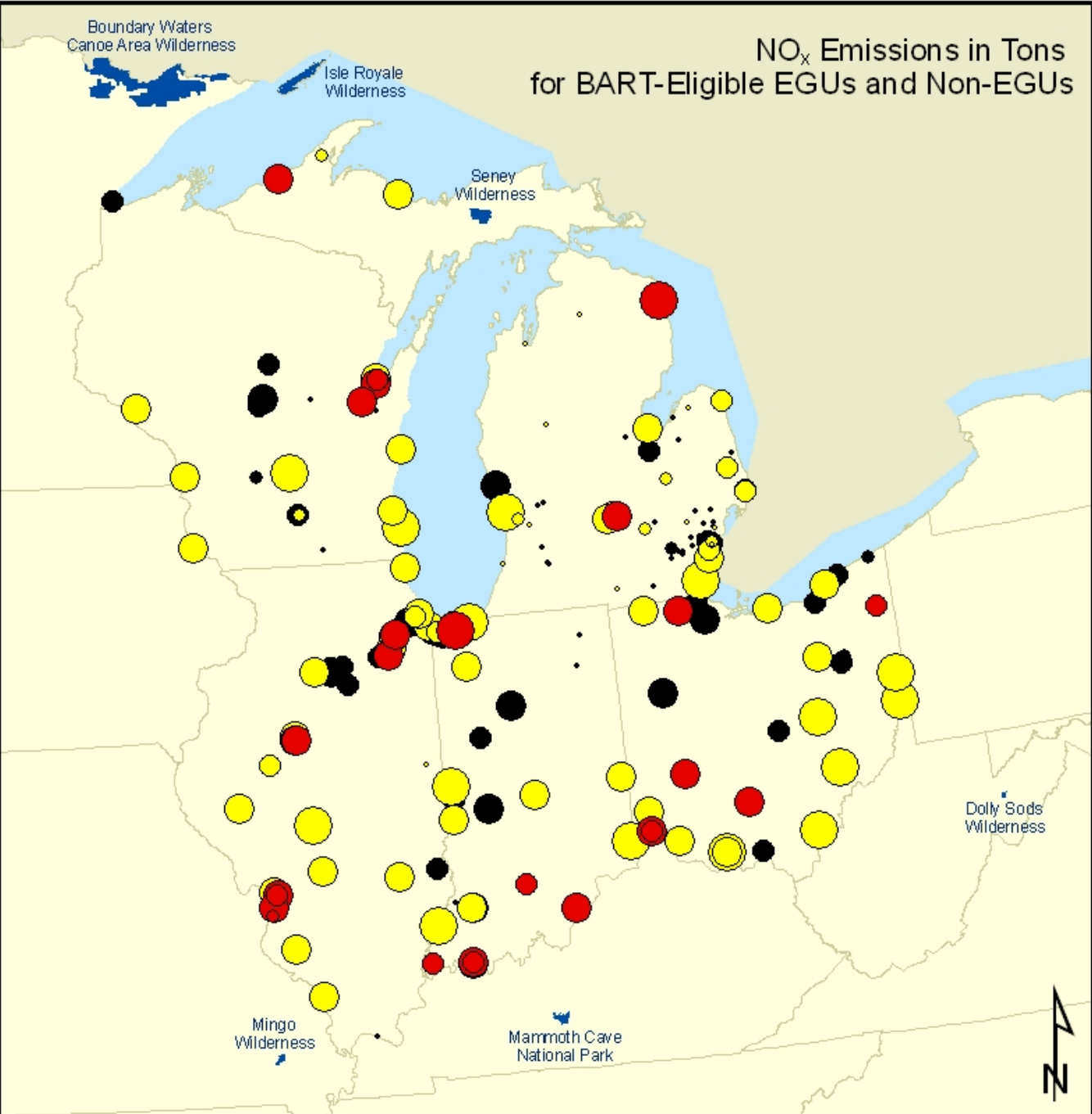
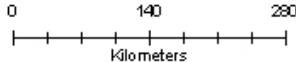
BART-Eligible Non-EGUs Subject to BART

- 0 - 10
- 11 - 100
- 101 - 1000
- 1001 - 10000
- 10001 - 103000

Other BART-Eligible Non-EGUs

- 0 - 10
- 11 - 100
- 101 - 1000
- 1001 - 10000
- 10001 - 103000

- Class 1 Area
- State Boundary
- Water

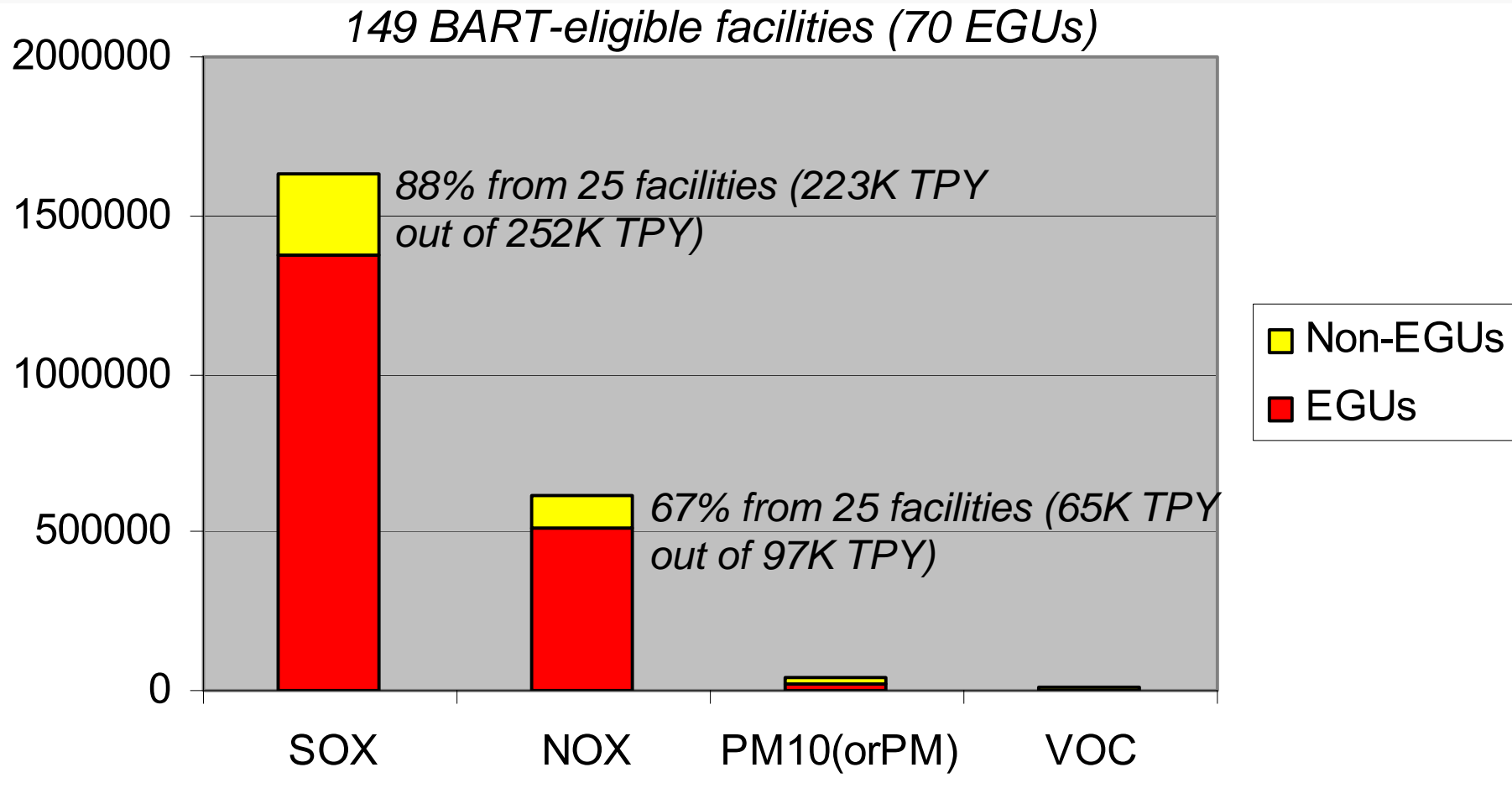


Source: National Atlas of the United States, 2004, 2005; MACTEC, 2005; USGS, 2002.

25 Facilities Determined to be Subject to BART

BART Category	IL	IN	MI	OH	WI	Total	
22 Industrial Boilers		1	2	4	3	10	
11 Petroleum Refineries	4			1		5	
04 Portland Cement Plants		2	1	1		4	
06 Iron and Steel Mills	1	1				2	
21 Chemical Process Plants	1	1				2	
17 Primary Lead Smelters	1					1	
07 Primary Aluminum Plants		1				1	
	Total	7	6	3	6	3	25

BART-Eligible Sources: Emissions (tpy)



Step 3: Engineering Analysis of Controls

Task 1 - Recommend Source Categories

Task 2 - Develop Approach for Performing
the BART Engineering Analysis

Task 3 - Perform the BART Engineering
Analysis

Task 4 - Prepare Technical Report Detailing
the Results of the Analysis

Task 1 - Recommend Source Categories

- MACTEC worked with LADCO in identifying the 25 facilities subject to BART
- Five Categories Selected:
 - Cat. 22 Boilers > 250 mmBtu/hr
 - Cat. 3 Portland Cement Plants
 - Cat. 6 Iron and Steel Mill Plants
 - Cat. 11 Petroleum Refineries
 - Cat. 21 Chemical Process Plants
 - (combined with Cat. 22 Boilers since all emission units identified as being subject to BART were boilers)

Task 2 - Develop Approach for BART Engineering Analysis

- BART means an emission limitation, established on a **case-by-case** basis, taking into account:
 - the technology available
 - the costs of compliance
 - the energy and non-air quality environmental impacts of compliance
 - any pollution control equipment in use or in existence at the source
 - the remaining useful life of the source
 - the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

Approach for BART Engineering Analysis

- MACTEC decided to use a “model” facility/emission unit approach
 - While BART requires case-by-case analysis, there was insufficient data available to perform a source specific BART analysis
 - BART guidelines were not final, so any evaluations would have to be considered preliminary until final guidelines were established

Approach for BART Engineering Analysis

- Describe Available Control Technologies by Process and Pollutant
- Conduct Engineering Screening Analysis on Model Sources
 - Identify Retrofit Control Technologies
 - Eliminate Technically Infeasible Options
 - Rank Remaining Control Technologies
 - Evaluate Impacts and Document the Results
- Evaluate Source Specific Data and Make Preliminary BART Recommendation
 - Remaining Useful Life
 - Existing Controls

BART Engineering Analysis Results

Coal-fired Boilers > 250mmBtu/hour

NOx Control Technology	NOx Removal Efficiency	Cost per Ton NOx Removed
LNB + FGR	50%	\$1,381 to \$2,649
	72%	\$959 to \$1,839
LNB + SNCR	50%	\$2,500 to \$3,707
	89%	\$1,405 to \$2,082
ULNB	75%	\$607
	85%	\$536
SCR	70%	\$2,704 to \$4,493
	90%	\$2,103 to \$3,495
ULNB + SCR	85%	\$2,762 to \$4,236
	97%	\$2,421 to \$ \$3,712

BART Engineering Analysis Results

Coal-fired Boilers > 250mmBtu/hour

SO2 Control Technology	SO2 Removal Efficiency	Cost per Ton SO2 Removed
Advanced FGD	95%	\$1,299 to \$3,011
	99.5%	\$1,240 to \$2,875
Dry FGD	90%	\$1,712 to \$3,578
	95%	\$1,622 to \$3,390
Wet FGD	90%	\$2,089 to \$3,822
	99%	\$1,881 to \$3,440

BART Engineering Analysis Results

Oil-fired Boilers > 250mmBtu/hour

NOx Control Technology	NOx Removal Efficiency	Cost per Ton NOx Removed
LNB + FGR	50%	\$2,777 to \$5,326
	72%	\$1,928 to \$3,698
LNB + SNCR	50%	\$3,650 to \$6,075
	89%	\$2,051 to \$3,413
ULNB	75%	\$1,220
	85%	\$1,077
SCR	70%	\$5,273 to \$8,871
	90%	\$4,102 to \$6,900
ULNB + SCR	85%	\$3,771 to \$6,734
	97%	\$3,305 to \$5,901

BART Engineering Analysis Results

Oil-fired Boilers > 250mmBtu/hour

SO2 Control Technology	SO2 Removal Efficiency	Cost per Ton SO2 Removed
Advanced FGD	95%	\$1,342 to \$4,347
	99.5%	\$1,281 to \$4,150
Dry FGD	90%	\$1,944 to \$5,219
	95%	\$1,841 to \$4,945
Wet FGD	90%	\$2,173 to \$5,215
	99%	\$1,956 to \$4,694

TABLE 4.2 LADCO BART CATEGORY 22 (BOILER) EMISSION UNITS – RECOMMENDED BART CONTROLS

STATE	SOURCE NAME	EMIS UNIT ID	EMIS UNIT DESCRIPTION	BART CATEGORY	Existing Controls	NO _x Control Recommendation	SO ₂ Control Recommendation	PM Control Recommendation	VOC Control Recommendation
IN	AGC DIVISION-ALCOA POWER GEENRATING	003	BOILER NO.3	22	No info	ULNB	AFGD (if there is a local market for gypsum) or Wet FGD	Dry ESP	None
IN	AGC DIVISION-ALCOA POWER GEENRATING	012	BOILER NO.2-NO. 1 STACK	22	No info	ULNB	AFGD (if there is a local market for gypsum) or Wet FGD	Dry ESP	None
IN	AGC DIVISION-ALCOA POWER GEENRATING	022	BOILER NO.2-NO. 2 STACK	22	No info	ULNB	AFGD (if there is a local market for gypsum) or Wet FGD	Dry ESP	None
MI	MICHIGAN STATE UNIVERSITY	EU00 529	Boiler	22	LNB and Baghouse	SNCR (if flame area meets temperature requirements) or SCR (with reheat)*	Dry FGD	None – use or modify existing	None
MI	MICHIGAN STATE UNIVERSITY	EU00 530	Boiler	22	LNB and Baghouse	SNCR (if flame area meets temperature requirements) or SCR (with reheat)*	Dry FGD	None – use or modify existing	None
MI	MICHIGAN STATE UNIVERSITY	EU00 531	Boiler	22	LNB and ESP	SNCR (if flame area meets temperature requirements) or SCR (with reheat)*	Dry FGD	None – use or modify existing	None

BART Engineering Analysis Results

Cement Plants

Kiln Type	Kiln Size	NOx Control Technology	NOx Removal Efficiency	Cost per Ton NOx Removed
Long Dry Kiln	Small	LNB	40%	\$448 to \$1,299
	Medium	LNB	40%	\$260 to \$1,111
	Large	LNB	40%	\$166 to \$1,018
Long Dry Kiln	Small	SCR	70-90%	\$815 to \$1,902
	Medium	SCR	70-90%	\$774 to \$1861
	Large	SCR	70-90%	\$754 to \$1,841
Preheater Kiln	Small	LNB	40%	\$527 to \$1,201
	Medium	LNB	40%	\$292 to \$966
	Large	LNB	40%	\$175 to \$849
Preheater Kiln	Small	SCR	70-90%	\$724 to \$1,584
	Medium	SCR	70-90%	\$673 to \$1,533
	Large	SCR	70-90%	\$648 to \$1,508

BART - Cement Plants

Kiln Type	Kiln Size	SO2 Control Technology	SO2 Removal Efficiency	Cost per Ton SO2 Removed
Long Dry Kiln	Small	AFGD	95-99.5%	\$2,088 to \$4,218
	Medium	AFGD	95-99.5%	\$2,054 to \$4,183
	Large	AFGD	95-99.5%	\$2,038 to \$4,165
Long Dry Kiln	Small	Wet FGD	90-99.99%	\$2,030 to \$6,861
	Medium	Wet FGD	90-99.99%	\$2,004 to \$6,831
	Large	Wet FGD	90-99.99%	\$1,990 to \$6,816
Long Dry Kiln	Small	Dry FGD	90-95%	\$2,000 to \$6,917
	Medium	Dry FGD	90-95%	\$1,925 to \$7,379
	Large	Dry FGD	90-95%	\$1,881 to \$7,201
Preheater Kiln	Small	AFGD	95-99.5%	\$14,490 to \$38,568
	Medium	AFGD	95-99.5%	\$13,878 to \$37,927
	Large	AFGD	95-99.5%	\$13,572 to \$37,607
Preheater Kiln	Small	Wet FGD	90-99.99%	\$10,393 to \$64,573
	Medium	Wet FGD	90-99.99%	\$9,906 to \$64,032
	Large	Wet FGD	90-99.99%	\$9,663 to \$63,761
Preheater Kiln	Small	Dry FGD	90-95%	\$12,008 to \$72,834
	Medium	Dry FGD	90-95%	\$10,633 to \$71,383
	Large	Dry FGD	90-95%	\$9,945 to \$70,657

TABLE 4.2 LADCO BART CATEGORY 4 PORTLAND CEMENT EMISSION UNITS – RECOMMENDED BART CONTROLS

STATE	SOURCE NAME	EMIS UNIT ID	EMIS UNIT DESCRIPTION	Existing Controls	NO _x Control Recommendation	SO ₂ Control Recommendation	PM Control Recommendation	VOC Control Recommendation
INDIANA	ESSROC CEMENT CORP.	G01	KILN #1 (LONG DRY) FAC.		LNB	Wet FGD	FF	None
INDIANA	ESSROC CEMENT CORP.	H01	KILN #2 (PREHEATER) FAC.	Fabric Filter Medium Temperature	SCR	Wet FGD	Existing (or with mods)	None
INDIANA	ESSROC CEMENT CORP.	I01	KILN #1 CLINKER COOLER		None	None	FF	None
INDIANA	ESSROC CEMENT CORP.	J01	KILN #2 CLINKER COOLER		None	None	FF	None
INDIANA	ESSROC CEMENT CORP.	K01	KILN #1 CLINKER HANDLING	Fabric Filter Medium Temperature	None	None	Existing (or with mods)	None

TABLE 4.2 LADCO BART CATEGORY 4 IRON AND STEEL PLANT EMISSION UNITS – RECOMMENDED BART CONTROLS

STATE	SOURCE NAME	EMISSION UNIT ID	EMISSION UNIT DESCRIPTION	SO ₂	NO ₂	PM	VOC
ILLINOIS	National Steel Corp	0015	SLAB FURNACE #1	None	ULNB	None	None
ILLINOIS	National Steel Corp	0033	BOF - TWO VESSELS	None	ULNB	FF or DESP	None
ILLINOIS	National Steel Corp	0041	BOILER HOUSE 1: BOILERS 1 TO 7	Wet FGD	ULNB	FF or DESP	None
ILLINOIS	National Steel Corp	0042	BOILER HOUSE 1: BOILERS 8 TO 10	Wet FGD	ULNB	FF or DESP	None
ILLINOIS	National Steel Corp	0044	BOILER HOUSE 2: BOILER #11 - BLAST FURNACE DEPT	Wet FGD	ULNB	FF or DESP	None
ILLINOIS	National Steel Corp	0048	BOILER HOUSE 2: BOILER #12 - BLAST FURNACE DEPT	Wet FGD	ULNB	FF or DESP	None
ILLINOIS	National Steel Corp	0122	SLAB FURNACE #2	Vented to common wet FGD or none	ULNB or LNB	None	None
ILLINOIS	National Steel Corp	0123	SLAB FURNACE #3	Vented to common wet FGD or none	ULNB or LNB	None	None
INDIANA	ISG-BURNS HARBOR (Formerly Bethlehem Steel)	001	BEDDING PLANT MATL TRANS	None	None	None	None
INDIANA	ISG-BURNS HARBOR (Formerly Bethlehem Steel)	002	SINTER MIXING DRUM	None	None	Existing	None
INDIANA	ISG-BURNS HARBOR (Formerly Bethlehem Steel)	003	SINTER WINDBOX	AFGD or wet FGD	ULNB	Existing	None
INDIANA	ISG-BURNS HARBOR (Formerly Bethlehem Steel)	004	SINTER MISC MATL HANDLING	None	None	Existing	None
INDIANA	ISG-BURNS HARBOR (Formerly Bethlehem Steel)	005	SINTER TRANSFER STATIONS	None	None	Existing	None

TABLE 4.2 LADCO BART CATEGORY 11 PETROLEUM REFINERY EMISSION UNITS – RECOMMENDED BART CONTROLS

STATE	SOURCE NAME	EMISSION UNIT ID	EMISSION UNIT DESCRIPTION	EXISTING CONTROLS	NO _x	SO ₂	PM	VOC
ILLINOIS	CITGO PETROLEUM CORP	0003	ATMOSPHERIC HEATER 111B-1A	NONE	ULNB	AFGD	NONE	NONE (3)
ILLINOIS	CITGO PETROLEUM CORP	0004	ATMOSPHERIC HEATER 111B-1B	NONE	ULNB	AFGD	NONE	NONE (3)
ILLINOIS	CITGO PETROLEUM CORP	0007	FCCU CATALYST REGENERATION 112D-1	CO BOILER 112B-2 + TWO ESPS	ULNB	AFGD	NONE (1)	NONE
ILLINOIS	CITGO PETROLEUM CORP	0019	CHARGE HEATER & STABILIZER REBOILER 116B-1	NONE	ULNB	AFGD	N/A	NONE (3)
ILLINOIS	CITGO PETROLEUM CORP	0022	SULFUR CONVERTER (CLAUS PROCESS, 2 TRAIN UNIT), UN	TWO COMBUSTORS	N/A	AFGD	N/A	NONE
ILLINOIS	CITGO PETROLEUM CORP	0215	CLAUS SULFUR RECOVERY UNITS 119A & B	TAIL GAS OXIDIZERS	N/A	AFGD	N/A	NONE
ILLINOIS	CONOCOPHILLIPS CO, WOOD RIVER REFINERY	0004	H-1 FEED PREHEATER FURNACE, CR-1	NONE	ULNB	AFGD	NONE	NONE (2)
ILLINOIS	CONOCOPHILLIPS CO, WOOD RIVER REFINERY	0005	H-2 FIRST INTERREACTOR HEATER, CR-1	NONE	ULNB	AFGD	NONE	NONE (2)
ILLINOIS	CONOCOPHILLIPS CO, WOOD RIVER REFINERY	0005	H-2 FIRST INTERREACTOR HEATER, CR-1	NONE	ULNB	AFGD	NONE	NONE (2)
ILLINOIS	CONOCOPHILLIPS CO, WOOD RIVER REFINERY	0006	H-3 SECOND INTERREACTOR HEATER, CR-1	NONE	ULNB	AFGD	NONE	NONE (2)
ILLINOIS	CONOCOPHILLIPS CO, WOOD RIVER REFINERY	0012	FIRST STAGE CHARGE HEATER, H-1, HYDROCRACKER UNIT	NONE	ULNB	AFGD	NONE	NONE (2)
ILLINOIS	CONOCOPHILLIPS CO, WOOD RIVER REFINERY	0013	SECOND STAGE CHARGE HEATER, H-2, HYDROCRACKER UNIT	NONE	ULNB	AFGD	NONE	NONE (2)
ILLINOIS	CONOCOPHILLIPS CO, WOOD RIVER REFINERY	0014	FRACTIONATOR REBOIL HEATER H-3, HYDROCRACKER UNIT	NONE	ULNB	AFGD	NONE	NONE (3)
ILLINOIS	CONOCOPHILLIPS CO, WOOD RIVER REFINERY	0017	H-1 MEDIUM HEATER - BENZENE EXTRACTION (PITCH AND	NONE	ULNB	AFGD	NONE	NONE (2)

Task 4 - Prepare Technical Reports

- Four BART Engineering Analysis Reports
 - Boilers
 - Cement Plants
 - Iron and Steel Mill Plants
 - Petroleum Refineries
- Each Report addresses
 - Available Control Technologies
 - Results of BART Engineering Screening Analysis
 - Source Specific Data
 - **Preliminary** BART Recommendations
- Available at:
http://www.ladco.org/Regional_Air_Quality.html

Next Steps/Future Directions

- Review/finalize list of BART-eligible sources
- Apply the appropriate air quality analyses to determine which BART-eligible sources are subject to BART
- Collect better source-specific operating data
 - Existing controls
 - Improve estimates of control costs
 - Better evaluate the technical feasibility of controls
- Involve facilities in the BART engineering process
- Use CALPUFF, or other appropriate dispersion model, to determine the visibility improvement expected at a Class I area from the potential BART control technology applied to the source
- Evaluate emission trading as an option for BART