

*Status Report to the WRAP Emissions Forum*

# **SSJF Emissions Inventory & Control Technology Technical Support Project**

*September 27, 2005*

*Presented by:*

**Eastern Research Group, Inc.**



# Contract Scope

---

- **Emissions Inventory Improvement & Development (Point and Area Sources)**
  - 2002 QA and Revisions
  - Tribal Point Sources
  - Oil & Gas Sources (ENVIRON)
  - 2018 Basecase Projections
- **Control Technology Analysis: NO<sub>x</sub> from EGUs**
- **Other Tasks**
  - NO<sub>x</sub> Controls (Non-EGUs), SO<sub>2</sub> Controls
  - EGU Temporal Profiles for Modeling
  - California 2002 and 2018 inventories

# 2002 Emissions Inventory QA & Revision - Objectives

---

- **Assess and Improve Completeness**
  - Geographic, facility, source category, pollutant coverage
  - Control types and efficiencies
- **Improve Basis for Other Analyses**
  - 2018 projections
  - Control technology analyses and strategies
- **Develop NIF and IDA files for EDMS and modeling**

# 2002 EI QA & Revision - Method

---

- **Compiled Point+Area Master Database and Assigned Common Facility Identifiers**
- **Contacted State/Local Agencies to Resolve Questions, Obtain Missing Data, Determine Point Source Thresholds**
- **Gap-filled and Applied Surrogate Data**
  - Facilities, pollutants, source cats.
  - Data from previous years, EIP c-e data
- **Adjusted for Double-Counting**
  - Tribal points
  - Oil & gas
  - Wildfires, area NH<sub>3</sub>, road dust, windblown dust

# Point Source Reporting Thresholds

---

- AK, AZ, ND, UT: 100 tpy PTE
- AZ: 100 tpy PTE and synthetic minors
- CO: 2 tpy
- ID:
  - CO = 1,000 tpy
  - Other criteria = 100 tpy
- SD: 100 tpy
- NM, WY: 25 tpy PTE
- NV: 5 tpy PTE
- OR: 40 tpy PTE
- WA:
  - CO = 5 tpy
  - NO<sub>x</sub>, SO<sub>2</sub>, VOC = 2 tpy
  - PM = 1.25 tpy
  - PM<sub>10</sub> = 0.75 tpy
- Tribes: Various

# 2002 EI QA Method – cont.

---

- QA'ed Point Source Stack Parameters
- Incorporated Agency Revisions Provided Via NEI Review Process (June 2005)
- EGUs
  - Incorporated CAMD NO<sub>x</sub> and SO<sub>2</sub> from CEMS
  - Resolved any conflicts in controls
  - Assigned BART flags in Site (SI) and Emission Unit (EU) tables

# Tribal Point & Area Sources

---

- **Scope:**

- Title V/Part 71 sources
- Non-Title V “Minor sources” > 50 tpy (actual) NO<sub>x</sub> or SO<sub>x</sub>
- Oil & gas sources (ENVIRON)

- **7 Entities/Reservations**

- Wind River Reservation (Title V - ITEP, O&G)
- Ute Mountain Tribe (O&G)
- Navajo Nation (Title V - ITEP, O&G, minor sources)
- Tohono O’odham Tribe (Title V - ITEP)
- Colville Tribe (Title V)
- Yakama Nation (Title V, minor sources)
- Warm Springs Reservation (Title V)

# 2002 WRAP Oil & Gas Sources (ENVIRON)

---

- **Area Sources Covered**

- Oil/Gas well drilling (NO<sub>x</sub>) – drill rig prime movers
- Natural gas compressor engines (NO<sub>x</sub>)
- Wellhead activities – (NO<sub>x</sub>, VOC) dehydration, heaters, tanks, etc...
- Coal bed methane generators

- **Stationary Sources**

- Compressor stations
- Gas plants
- Other smaller sources depending upon State inventory thresholds



# Oil & Gas Methods

Source	Method
Drilling	<p><b>Activity Data:</b> Drilling permits - number of wells drilled, duration and depth of wells</p> <p><b>Emission Factor:</b> Derived from WYDEQ survey of drilling operations in the Jonah-Pinedale area</p>
Compression	<p><b>Activity Data:</b> Gas production</p> <p><b>Emission Factor:</b> Derived from an emission inventory conducted by the New Mexico Oil and Gas Association</p>
CBM Pump Engines	<p><b>Activity Data:</b> Water production at CBM wells and well characteristics used to estimate engine activity</p> <p><b>Emission Factor:</b> NONROAD factor for gas fired engines</p>
Minor NOx and VOC Wellhead Processes	<p><b>Activity Data:</b> Well production data</p> <p><b>Emission Factors:</b> Default was to use factors provided by WYDEQ, but States and stakeholders were encouraged to provide local factors</p>

# Changes to 2002 NO<sub>x</sub> Oil & Gas

State/Tribe	WRAP Oil and Gas Inventory			Change in Oil and Gas Emissions	
	Area	Point	Total	Total	Percent
Arapahoe and Shoshone	1,169	54	1,223	1,223	
Navajo Nation	1,167	6,382	7,549	7,549	
Ute Mountain Ute	540	-	540	540	
Alaska	886	44,255	45,142	886	2%
Arizona	-	3,669	3,669	-	0%
California*	8,070	10,695	18,765	-	0%
Colorado	23,147	27,225	50,371	23,147	85%
Idaho	-	2,590	2,590	-	0%
Montana	7,792	3,989	11,781	7,792	195%
Nevada	62	120	182	62	52%
New Mexico	60,446	56,439	116,885	60,446	107%
North Dakota	4,631	3,538	8,169	4,631	131%
Oregon	85	1,182	1,267	85	7%
South Dakota	367	323	690	367	114%
Utah	5,190	2,923	8,113	5,190	178%
Washington	-	440	440	-	0%
Wyoming	19,699	13,501	33,200	13,290	67%
Total	133,251	177,325	310,576	125,209	68%

\*Area source emissions in WRAP Oil and Gas Inventory adopted from data provided by the California ARB.

# Final 2002 Emissions Inventory

---

- **Table 1: Final 2002 WRAP Point Sources**
- **Table 2: Final 2002 WRAP Area Sources**
- **Interpreting results:**
  - Only primary PM<sub>10</sub> and PM<sub>2.5</sub> is shown, although filterable is reported. (CA reported only filterable.)
  - ND and MT area source inventory entirely gap filled
  - CO low point source reporting thresholds
  - NH<sub>3</sub> does not include fugitive sources

# 2018 Base Case Inventory

---

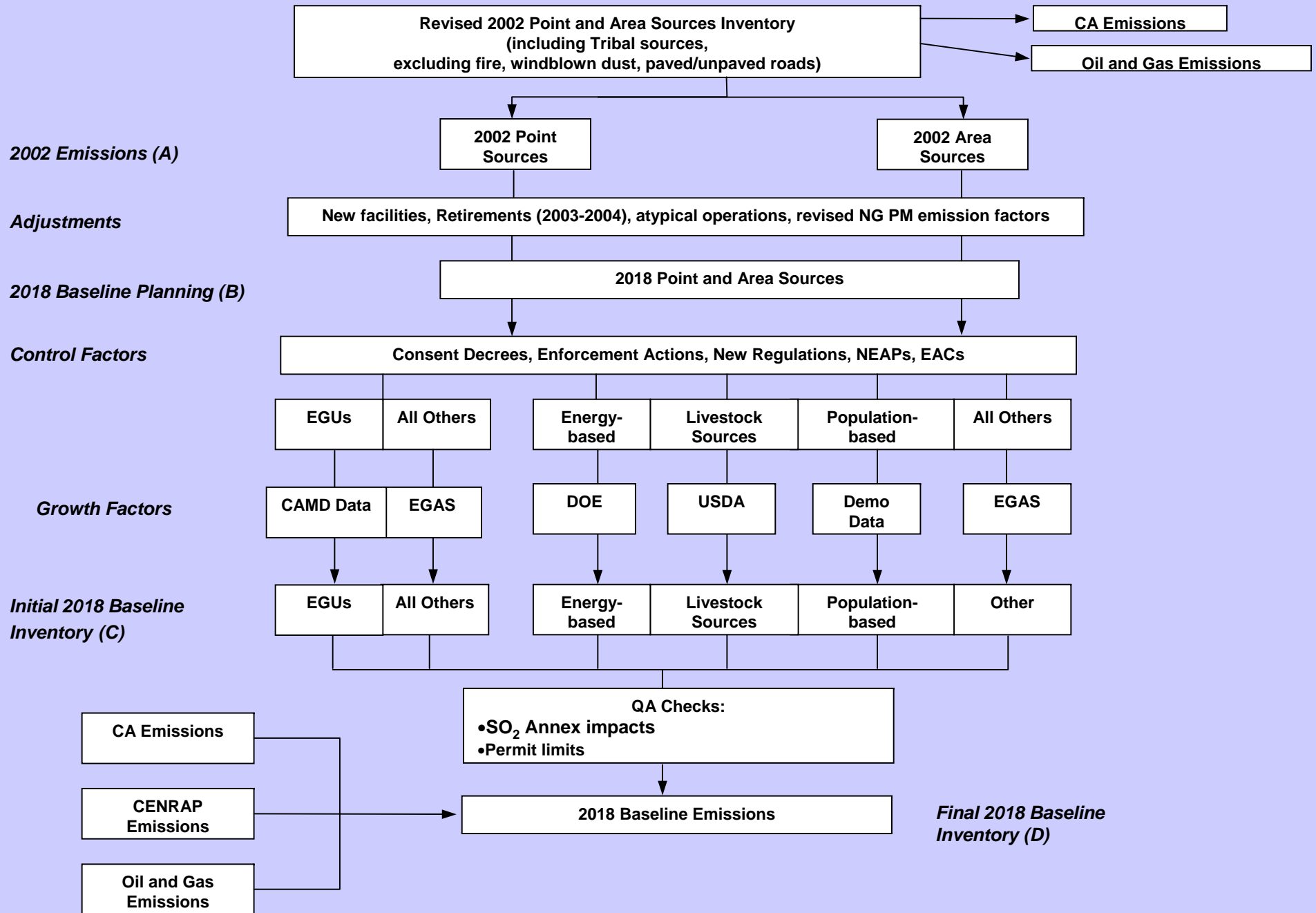
- **Scope**

- Point and area sources
- Not included: CA

- **Objectives**

- 2002 basecase modeling, control strategy development
- Transparent methodology that is easily updated and modified
- Facilitates NIF conversion
- Comprehensive set of growth and control factors
- Spreadsheet used for agency and stakeholder review

# Road Map for 2018 Baseline Emissions Development



# 2018 Key Assumptions

---

- **Adjustments:**

- Retirements 2003-2004 (no replacement)
- Retirements/replacement post-2004
  - CAMD EGUs: based on expected lifetimes
  - Other EGUs, industrial boilers, and selected other sources: based on annual retirement rates
  - All other industrial sources: no retirement/replacement
  - Replacement with % control equal to difference between 19xx and current BACT level
- Changes by EPA to the natural gas combustion emission factors
- Atypical operations in 2002 changed for 2004 based on information from agencies (*not* applied across the board)

# 2018 Key Assumptions – cont.

---

- **Controls:**

- Reflect current “OTB” controls, limits, etc.

- Refinery Compliance Initiative

- Consent Decrees (EGUs and Non-EGUs)

- EGU Voluntary Reductions TBD

- Denver Metro Area Plan – point sources

- Waiting on modeling inventory for area impacts on 500 hp ICES, condensate tanks, dehydrators

- Wood Productions Compliance Initiative (OR)

- Fugitive Dust in AZ/Maricopa from Ag BACM

- Post-2002 emission limits <2002 actuals

- **Growth (Non-EGUs and Area Sources): EGAS, EIA, and USDA**

# Projecting Emissions from EGUs

---

- Adjusted 2002 inventory for new/retired sources (Arapahoe #1/#2)
- Obtained EIA 2002 statistics and 2018 projections for Electricity Market Module Regions
- Developed capacity factor (CF) for each EGU in CAMD
  - Unit capacity
  - 2002 gross generated electricity



# EGU Method – cont.

---

- **Assumed capacity thresholds (CT)**
  - Coal (0.85); Oil (0.50); Natural Gas Turbine (0.25);  
Natural Gas Combined Cycle (0.60)
- **Assumed that all CAMD EGUs would be grown up to CT**
- **Unit-level growth factor (GF) =  $CT/CF$**
- **2018 unit-level emissions = 2002 unit-level emissions x GF**
- **If EGU was already operating above CT, then GF = 1.0 and 2018 = 2002**

# EGU Method – cont.

---

- Needed generation capacity determined from EIA projections
- Existing generation capacity calculated from differential between CF and CT
- $\text{New capacity} = \text{needed capacity} - \text{existing capacity}$

# EGU Retirement/Replacement

---

- CAMD EGU

- Commencement year from CAMD
- Lifetime – 60 yrs (45 yrs for coal <100 MW)
- If retired between 2002 and 2018, then replaced with new facility grown to CT and adjusted by new emission rates

- Non-CAMD EGU

- Retirement rates applied to emissions
- Retired fraction replaced by new emission rates

# 2018 Oil & Gas Projection Method (ENVIRON)

---

- **Grow county and tribal level emissions based on estimated growth in oil and gas production**
- **Sources of data**
  - Local
    - Resource management plans (BLM)
    - Alaska Department of Natural Resources projections
  - Regional – Energy Information Administration
- **Adjust for post-2002 on-the-books controls**

# Post-2002 Oil and Gas Controls

---

- **On-the-books (Included)**

- Nonroad compression and spark-ignition engine emissions standards (under review)
- Colorado – included in point source inventory

- **Proposed (Not Included)**

- Montana – proposed rule to limit PTE to 25 TPY
- Utah – new rules under development

# Draft 2018 O&G Area Source NO<sub>x</sub> Emissions

State/Tribe	CBM Pump Engines	Compressor Engines	Drill Rigs	Wellhead	Total
Tribes	1	341	201	1,902	2,446
Alaska	-	-	431	-	431
Colorado	169	-	3,084	21,652	24,904
Montana	240	1,563	2,766	7,149	11,719
Nevada	-	4	13	7	23
New Mexico	21	7,786	5,978	24,402	38,187
North Dakota	1	536	985	630	2,151
Oregon	-	4	-	7	11
South Dakota	-	31	19	63	113
Utah	1	4,565	1,684	6,193	12,444
Wyoming	901	32,345	5,662	17,942	56,850
<b>Total</b>	<b>1,334</b>	<b>47,174</b>	<b>20,824</b>	<b>79,947</b>	<b>149,280</b>

Note: Compressor engine emissions are still under review

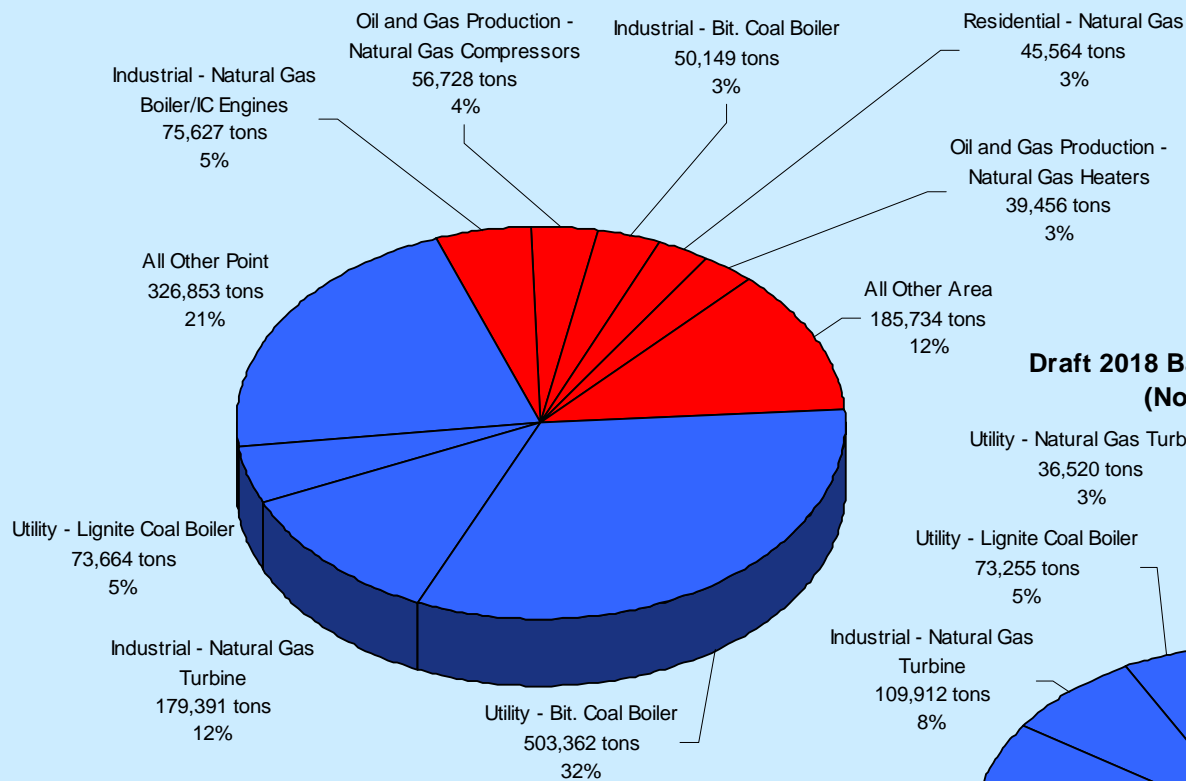
# Draft 2018 Emissions Inventory

---

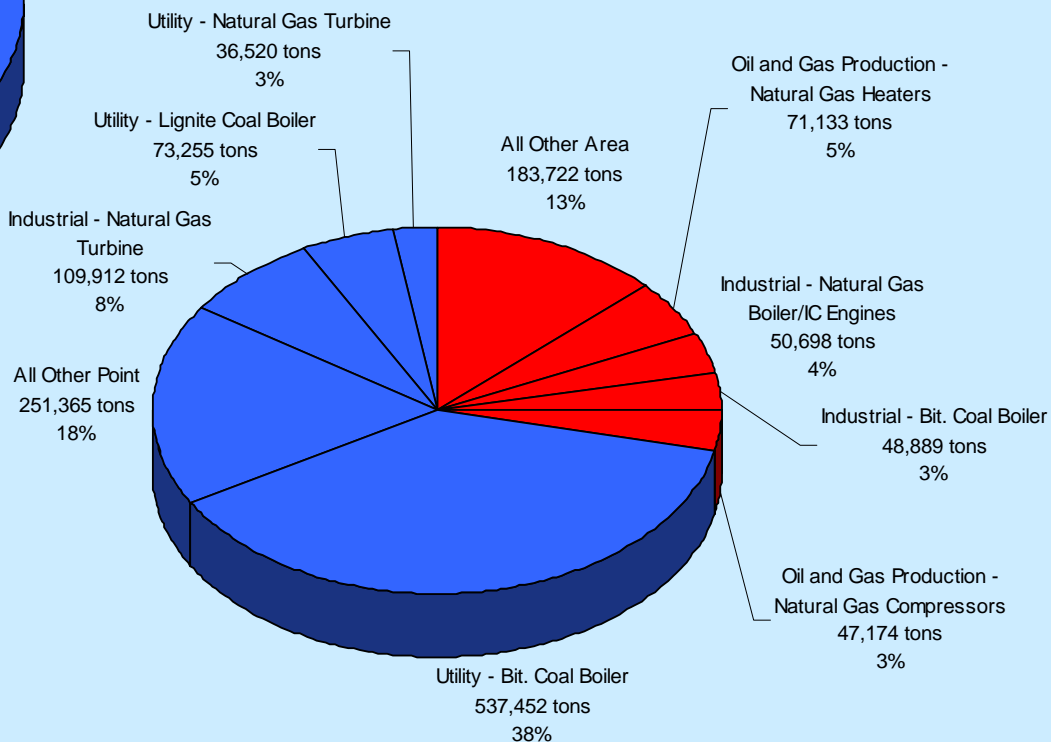
- **Table 3: Draft 2018 Base Case Point Source Inventory**
- **Table 4: Draft 2018 Base Case Area Source Inventory**
- **Final 2002-to-Draft 2018 Comparison**
  - Table 5: Point Sources
  - Table 6: Area Sources
  - Pie Charts

# NO<sub>x</sub> Emissions: Point & Area Sources

**Final 2002: 1,536,527 tons**



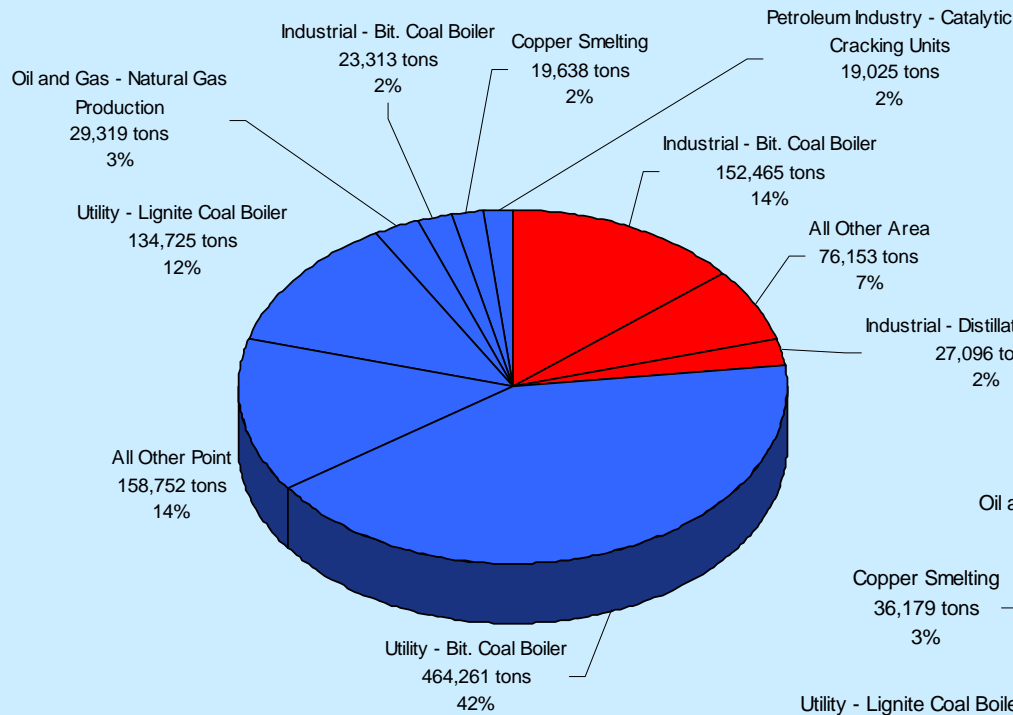
**Draft 2018 Basecase: 1,410,121 tons (Not Including CA)**



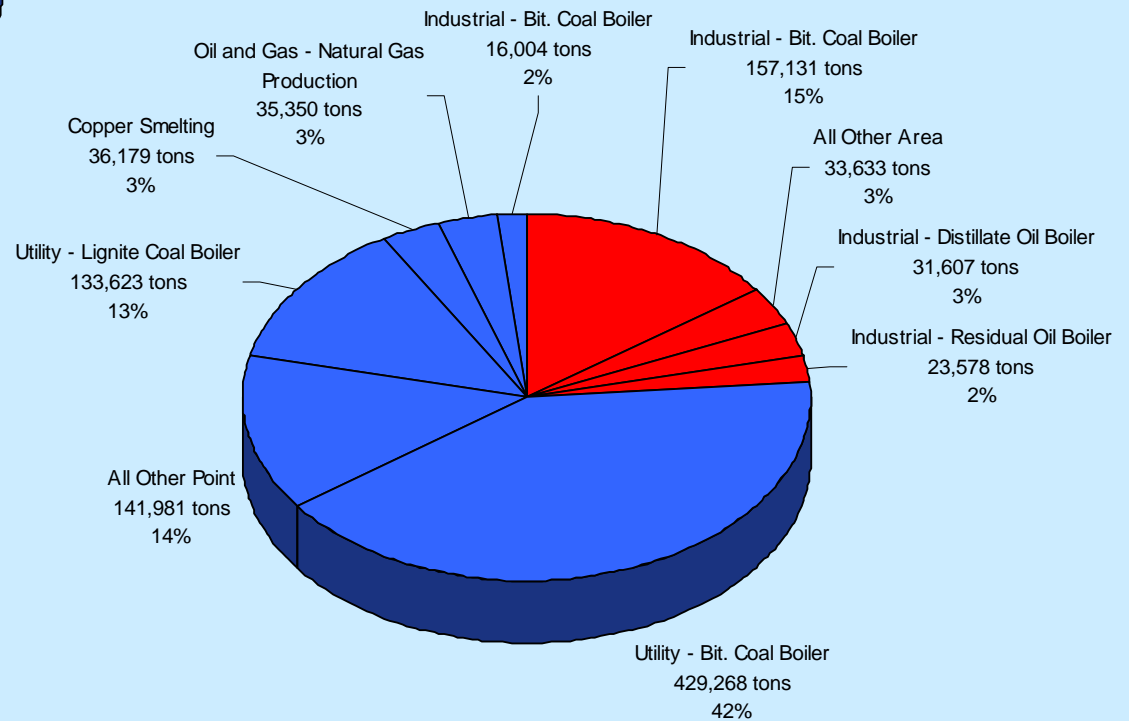


# SO<sub>2</sub> Emissions: Point & Area Sources

Final 2002: 1,104,747 tons

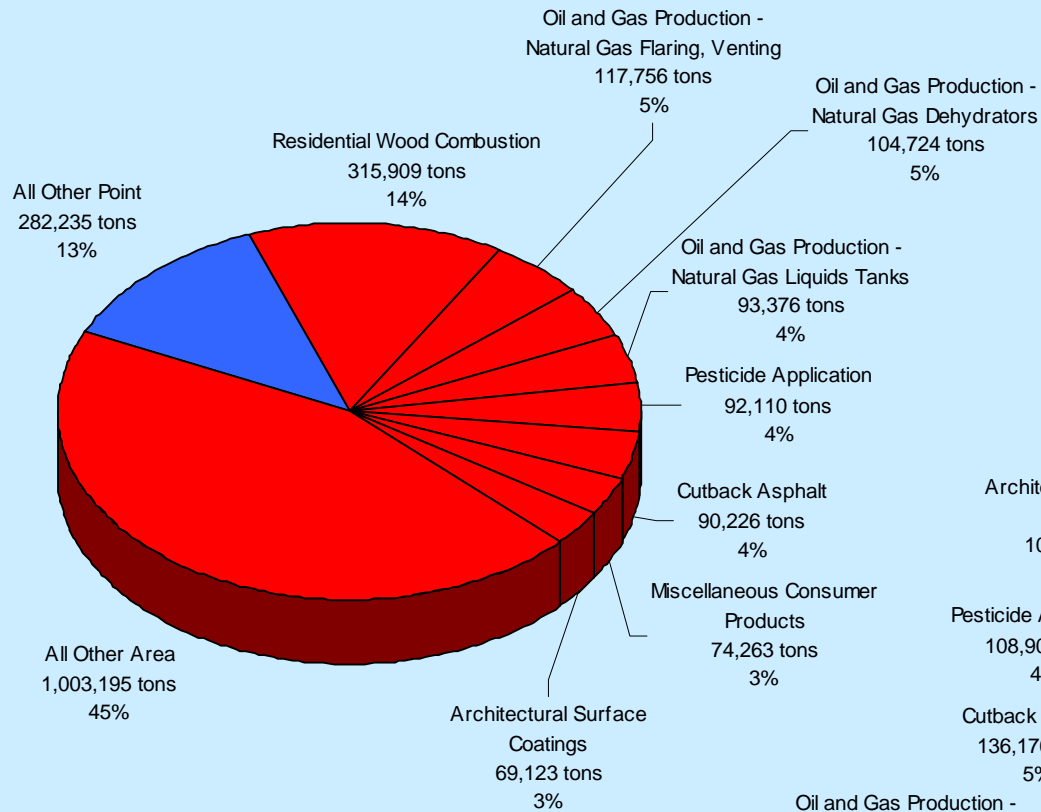


Draft 2018 Basecase: 1,038,353 tons  
(Not Including CA)

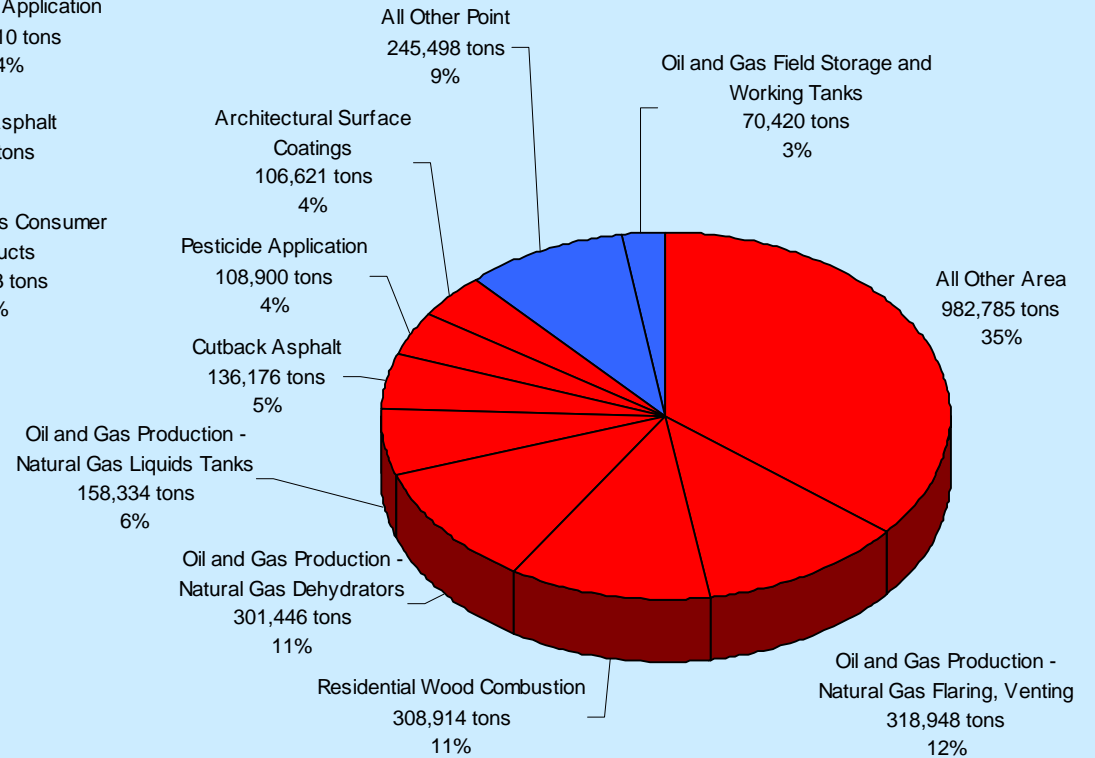


# VOC Emissions: Point & Area Sources

Final 2002: 2,242,916 tons

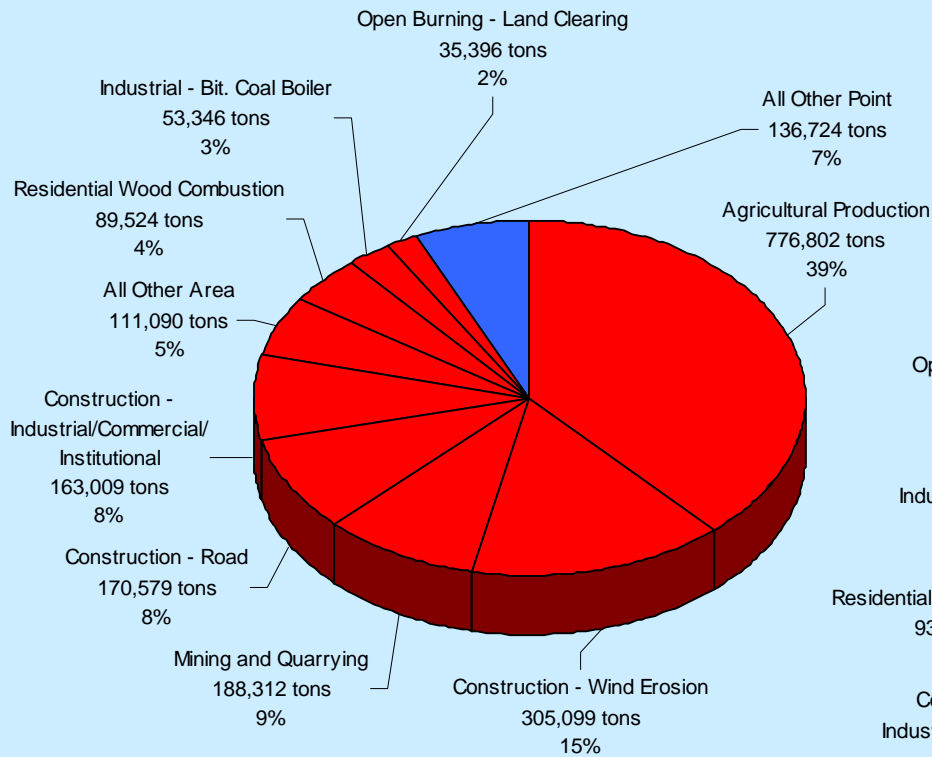


Draft 2018 Basecase: 2,738,041 tons  
(Not Including CA)

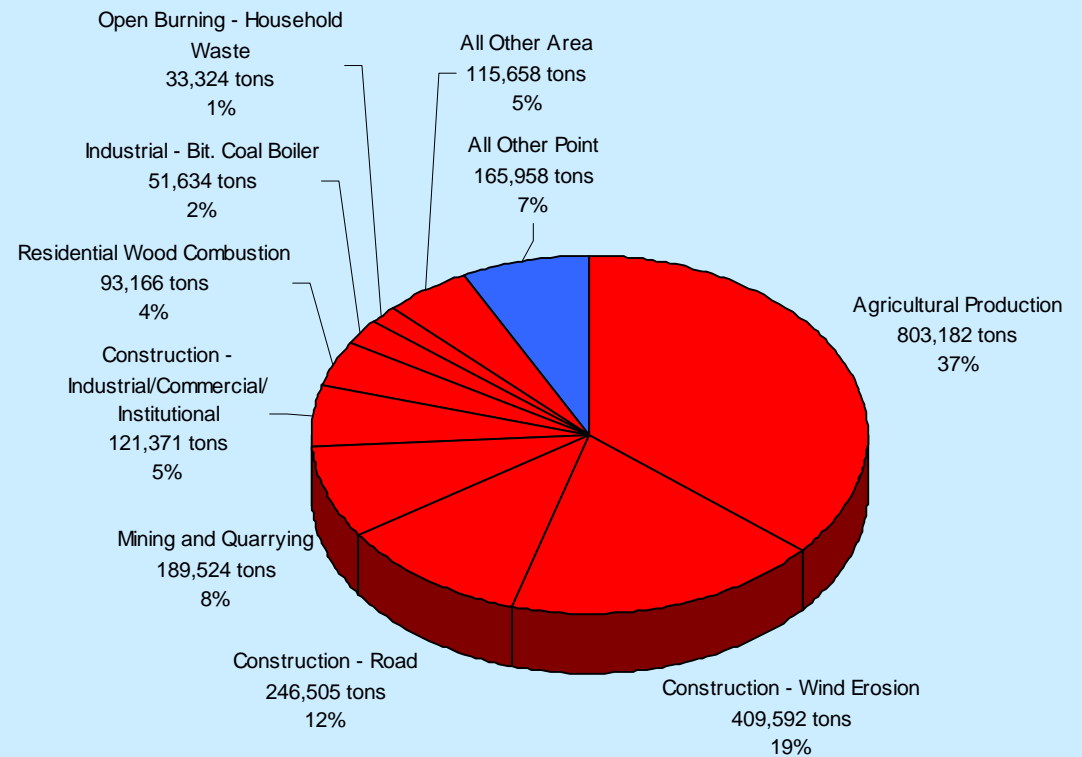


# PM<sub>10</sub>-PRI Emissions: Point & Area

Final 2002: 2,029,880 tons

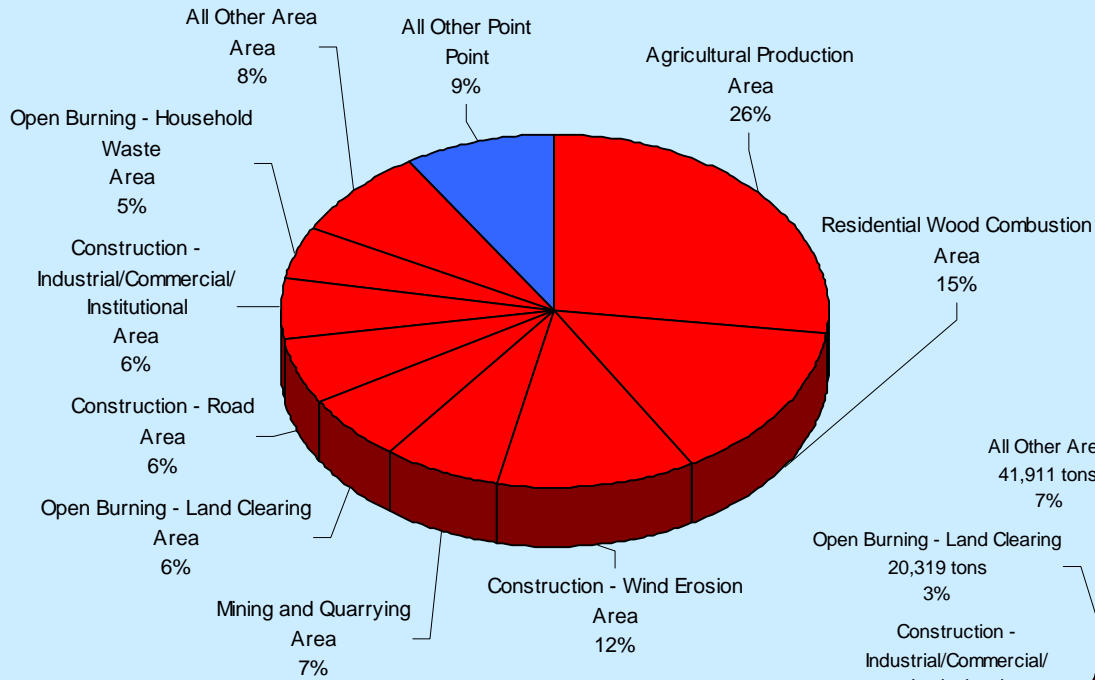


Draft 2018 Basecase: 2,229,913 tons

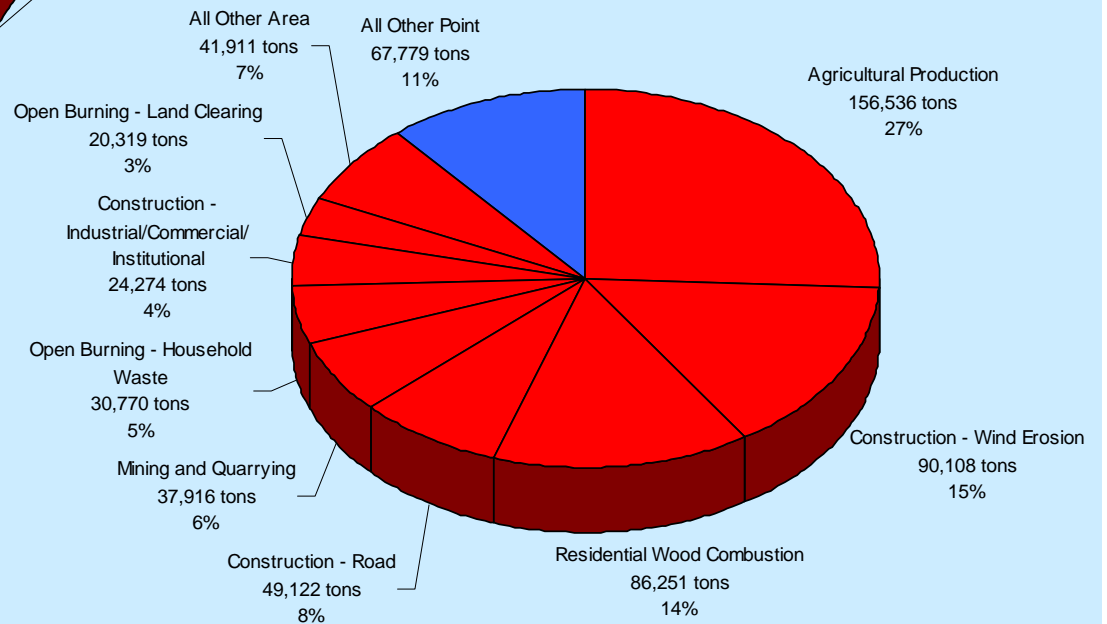


# PM<sub>2.5</sub>-PRI Emissions: Point & Area

Final 2002: 562,008 tons

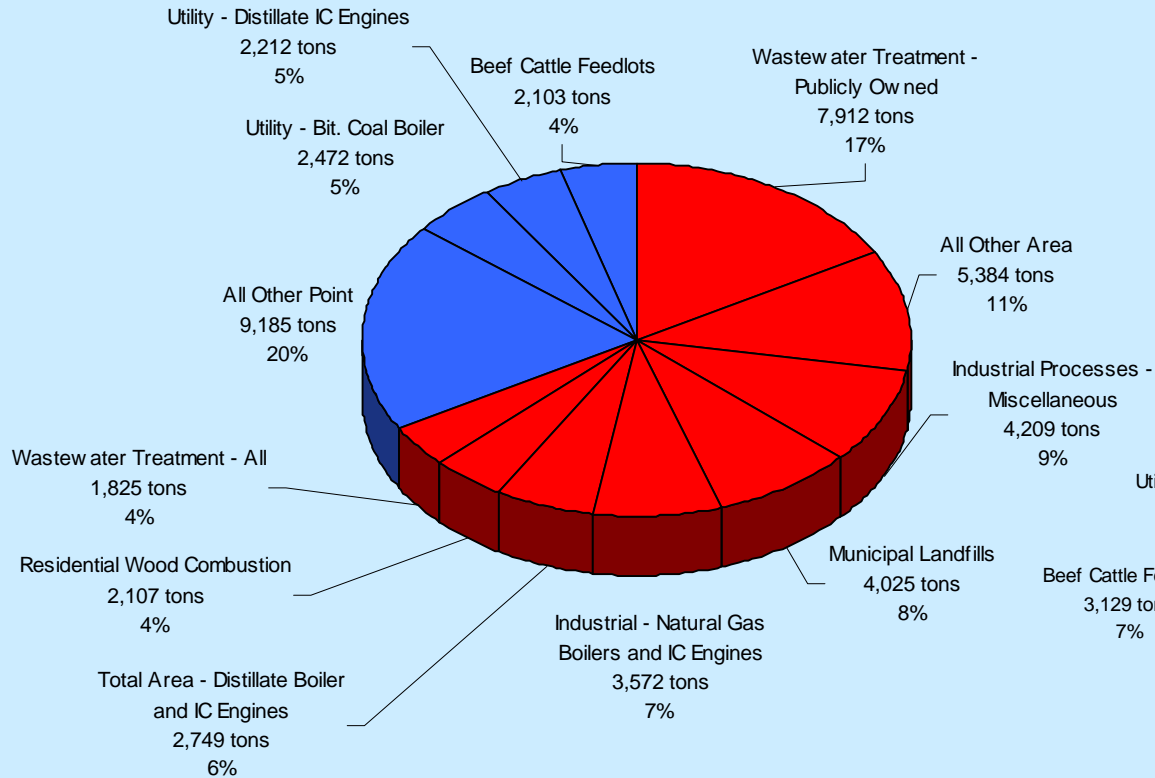


Draft 2018 Basecase: 604,985 tons

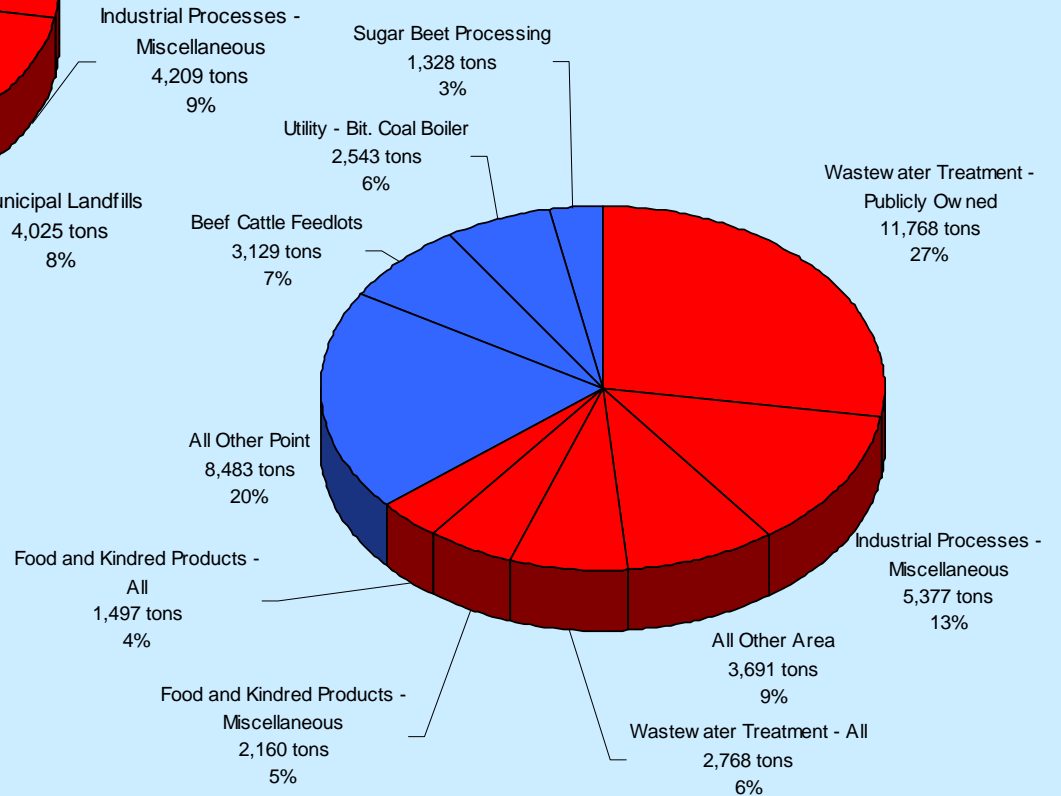


# NH<sub>3</sub> Emissions: Point & Area Sources

Final 2002: 47,756 tons



Draft 2018 Basecase: 42,743 tons





# Next Steps – 2018 Base Case

---

- (Held State/Stakeholder call on 9/23)
- Hold Tribal call on date TBD
- Receive comments from States, Tribes, Stakeholders by 9/30/05
- Finalize and submit IDA files to RMC by 10/28/05
- Upload to EDMS by 10/28/05
- Draft and final reports in November

# NO<sub>x</sub> Controls for Coal-fired EGUs – Overall Methodology

---

- Assembled database of all EGUs in WRAP
- Generated a profile of state-of-the-art NO<sub>x</sub> 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., 1<sup>st</sup> generation LNB, 2<sup>nd</sup> 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).

# NO<sub>x</sub> Control Options (Bin 1)

Option	Number of Units with Option Control Applied	Baseline Emissions Average 2001 to 2003 (tons)
<b>BIN 1a - Tangential-fired burners (bituminous and sub-bituminous-A,B rank)</b>		
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	
<b>BIN 1b - Tangential-fired burners (PRB and lignite)</b>		
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	

# Cost and Emission Reductions for NO<sub>x</sub> Control Options Applied to Bins

	Emission Reductions (tons)			\$/ton		% Emission Reduction		
	Min	Max	Best Pt.	Min TAC/Best Pt. Reduction	Max TAC/Best Pt. Reduction	Min	Max	Best Pt.
<b>BIN 1a - Tangential-fired burners (bituminous and sub-bituminous-A,B rank)</b>								
1	12,833	40,541	20,875	\$72	\$4,883	5%	17%	9%
2	NA	58,455	34,646	\$72	\$4,883	NA	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%
<b>BIN 1b - Tangential-fired burners (PRB and lignite)</b>								
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%

---

THANK YOU!

*Any questions?*

