Assessment of Candidate NOx Control Options for Stationary Point Sources in LADCO Region

NOx Control Group Final Presentation

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Presented to LADCO
by
Tejas Shah, John Grant, Lit Chan

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Agenda

- Study Overview
- Result Summary
- Draft White Paper Review
- Current Status and Next Steps

Task Overview

Task 1: Master List of NOx Controls for Stationary Sources

Task 2: Identify Control Measure for Each Source Category with Three Levels of Stringency

Task 3: Evaluation of Cost Effectiveness, Total Cost and Potential Emissions Reductions

Task 4: Control Measures White Paper and SMOKE Control Packets

Task 1: Master List of NOx Controls

- Created a master list of potential control measures for NOx emitting units in the LADCO region based on several key technical resources.

Data Sources	
CoST CMDB	Control Strategy Tool (CoST) Control Measure Database (CMDB)
EPA CATC	EPA Clean Air Technology Center
EPA MCM	EPA Menu of Control Measures
SCAQMD	South Coast AQMD 2016 air quality management plan
EPA ACT	Alternative Control Technologies Document -- NOx Emissions from ICI Boilers.
LADCO 4FA	Four Factor Analysis of Sources for Regional Haze in the LADCO Class I Areas (2015)
Wiscosin NOx RACT	Wiscosin NAA SIP Attachment 1: NOx RACT Rules
Ramboll	Ramboll assigned controls to 2016v1 inventory SCCs that were >500 tpy NOx without applicable control in the draft list by tiering to known controls for similar

- Two primary categories of NOx reduction technologies:
  - Combustion modifications (e.g., LNB, Overfire Air, FGR etc.)
  - Post-combustion processes (e.g., SCR and SNCR).
- Removed "Experimental" control measures per input from the Workgroup.

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Task 2: Identification of Control Measure(s) for Each Source Category with Three Levels of Stringency

- Added control efficiency and cost effectiveness estimates to the master list from Task 1
  - All the control costs were adjusted to 2020 dollars
- Identified control measures for each source category (i.e., SCC) in the LADCO region from the Task 1 master list based on control efficiency ranking to represent three levels of stringency
  - A high stringency NOx control scenario
  - A medium stringency NOx control scenario
  - A low stringency NOx control scenario
- For each source category,
  a. control measures with the highest efficiency were selected for the High stringency;
  b. control measures with the lowest efficiency were selected for the Low stringency; and
  c. control measures with efficiency closest to the mean of low and high stringency scenario control efficiencies were selected for the Medium stringency. Incorporated Workgroup revision requests.

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Task 3: Evaluation of Cost Effectiveness, Total Cost and Potential Emissions Reductions of Control Measure Scenarios

- **Objective:** Estimate total cost and potential NOx emission reductions
- Applied Task 2 control measures for each scenario to EPA's 2016v1 non-EGU inventory
- Cross referenced existing control information from 2016v1 against the master list to estimate existing control efficiency
  - Modeling Platform File contains source level "control id" information but lacks existing control efficiency estimates.
  - State agencies reviewed and helped gap fill existing control efficiency information, to the extent feasible
  - Uncertainty in existing efficiency due to not capturing site-specific conditions.
- If the existing control efficiency was higher than the selected control measure for a unit, no emission reduction or cost was calculated
- Assumed Potential-to-emit (APTE) criteria
  - Assumed facilities meet APTE criteria if actual emissions ≥ 50% of PTE threshold

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Task 3: Scenarios to Evaluate

- Geographical scope
  1) all LADCO state ozone nonattainment areas (NAA)
  2) statewide outside of the NAAs

Each scenario is a combination of a a) stringency level and b) PTE criteria

Scenarios
High Stringency with a PTE greater than 100 tpy of NOx
High Stringency with a PTE greater than 50 tpy of NOx
High Stringency with a PTE greater than 25 tpy of NOx
High Stringency with a PTE greater than 10 tpy of NOx
Low Stringency with a PTE greater than 100 tpy of NOx
Low Stringency with a PTE greater than 50 tpy of NOx
Low Stringency with a PTE greater than 25 tpy of NOx
Low Stringency with a PTE greater than 10 tpy of NOx
Medium Stringency with a PTE greater than 100 tpy of NOx
Medium Stringency with a PTE greater than 50 tpy of NOx
Medium Stringency with a PTE greater than 25 tpy of NOx
Medium Stringency with a PTE greater than 10 tpy of NOx

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Task 3: Source Groupings

- Workgroup divided the entire non-EGU sector into 10 broad source categories and created a mapping of SCCs-to-aggregate point source categories.

Whitepaper Group	2016 Emissions (tons/year)
EXCOMB Gas	32,318
ProcessHeater	18,285
Coal NONEGU	12,413
Cement Kiln	11,408
Glass	10,312
Lime Kiln	9,943
Coke	5,522
ICE Diesel	4,750
Iron&Steel	4,148
Ice Gas	3,505

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Task 3 Results

Emission Reductions and Cost-effectiveness Summary

LADCO-wide by Scenario

Scenario	2016v1 Emissions (tpy)	Emission Reductions (tpy)	Percent Emissions Reduction	Cost Effectiveness ($/ton)
Low				
10	192,235	75,903	39%	7,022
25	177,421	71,669	40%	6,641
50	161,050	67,089	42%	6,347
100	144,523	62,296	43%	6,061
Medium				
10	192,235	100,694	52%	6,888
25	177,421	94,099	53%	6,362
50	161,050	87,263	54%	5,868
100	144,523	80,109	55%	5,366
High				
10	192,235	128,550	67%	9,844
25	177,421	119,313	67%	8,998
50	161,050	109,589	68%	8,159
100	144,523	99,837	69%	7,385

LADCO-wide by Grouping for Medium, 50 tpy PTE

Source Category Grouping	Emission Reductions (tpy)	Percent Emissions Reduction	Cost Effectiveness ($/ton)
ICE GAS	1,269	62%	776
Glass	6,541	56%	842
Lime Kiln	2,813	29%	1,109
ICE Diesel	633	25%	1,367
Cement Kiln	7,719	49%	1,591
Iron&Steel	2,819	70%	2,879
Coke	3,302	60%	3,248
Coal NONEGU	9,405	64%	3,348
Other	33,882	52%	7,491
ProcessHeat	6,666	60%	7,987
EXCOMB Gas	12,215	67%	10,799
Total	**87,263**	**54%**	**3,179**

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Estimated cost and surplus NOx reduction by nonattainment area and stringency scenario: PTE 50 TPY

Row Labels	High Surplus Reduction (tons/year)	Cost (2020$)	Medium Surplus Reduction (tons/year)	Cost (2020$)	Low Surplus Reduction (tons/year)	Cost (2020$)
Allegan, MI	76	$ 187,838	65	$ 30,142	55	$ 154,154
Berrien, MI	0	$ -	0	$ -	0	$ -
Chicago, IL	2,475	$ 31,442,836	1,690	$ 15,541,754	1,090	$ 7,841,602
Chicago, IN	12,687	$ 93,718,758	9,859	$ 52,003,490	7,629	$ 32,875,561
Chicago, WI	38	$ 107,586	25	$ 78,199	25	$ 78,199
Cincinatti, OH	2,111	$ 21,335,086	1,649	$ 11,818,554	1,048	$ 8,180,419
Cleveland, OH	1,456	$ 11,535,380	992	$ 4,719,272	890	$ 4,409,061
Columbus, OH	478	$ 3,708,285	410	$ 1,218,490	250	$ 1,186,185
Detroit, MI	3,510	$ 28,759,744	2,257	$ 11,018,548	1,493	$ 6,419,496
Louisville, IN	571	$ 3,895,927	333	$ 493,059	183	$ 155,555
Manitowoc County, WI	104	$ 412,915	81	$ 113,204	81	$ 113,204
Northern Milwaukee/Ozaukee, WI	535	$ 4,458,224	409	$ 2,013,177	272	$ 1,570,067
Sheboygan, WI	28	$ 304,818	23	$ 88,809	15	$ 150,797
St. Louis, IL	1,728	$ 15,078,093	1,328	$ 12,459,317	866	$ 2,629,681

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Estimated cost and surplus NOx reduction for areas outside of NAAs and stringency scenario: PTE 50 TPY

Row Labels	High Surplus Reduction (tons/year)	Cost (2020$)	Medium Surplus Reduction (tons/year)	Cost (2020$)	Low Surplus Reduction (tons/year)	Cost (2020$)
outside	**74,135**	**$ 605,178,002**	**61,500**	**$ 371,009,599**	**48,845**	**$ 335,807,906**
IL	8,678	$ 76,835,220	6,055	$ 19,908,700	3,528	$ 19,439,557
MI	25,201	$ 202,599,496	21,289	$ 143,909,933	18,657	$ 134,438,168
MN	20,454	$ 174,068,894	18,839	$ 140,763,787	16,971	$ 131,987,274
OH	10,662	$ 64,472,947	8,310	$ 33,856,371	5,981	$ 22,336,559
WI	9,140	$ 87,201,445	7,007	$ 32,570,808	3,709	$ 27,606,348

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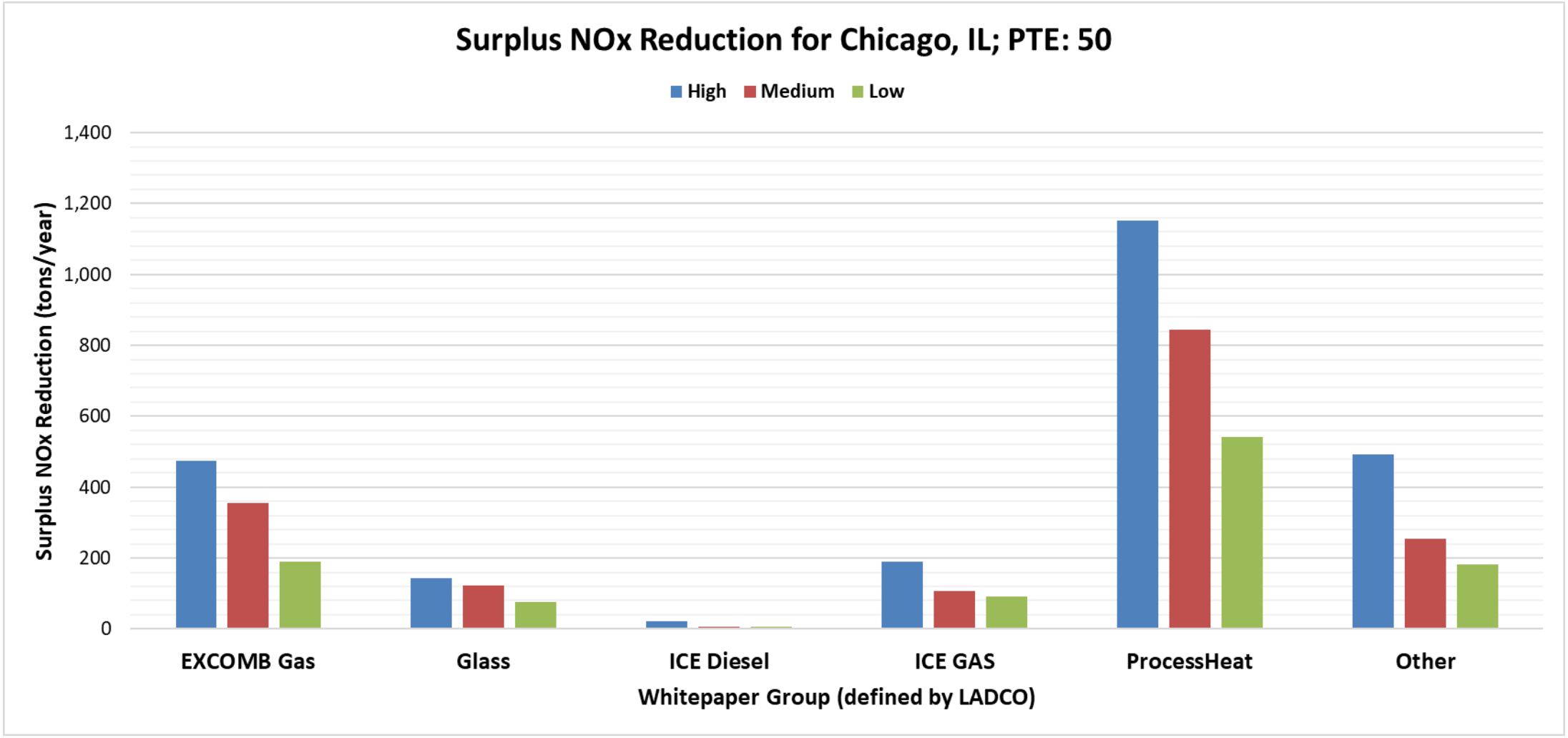
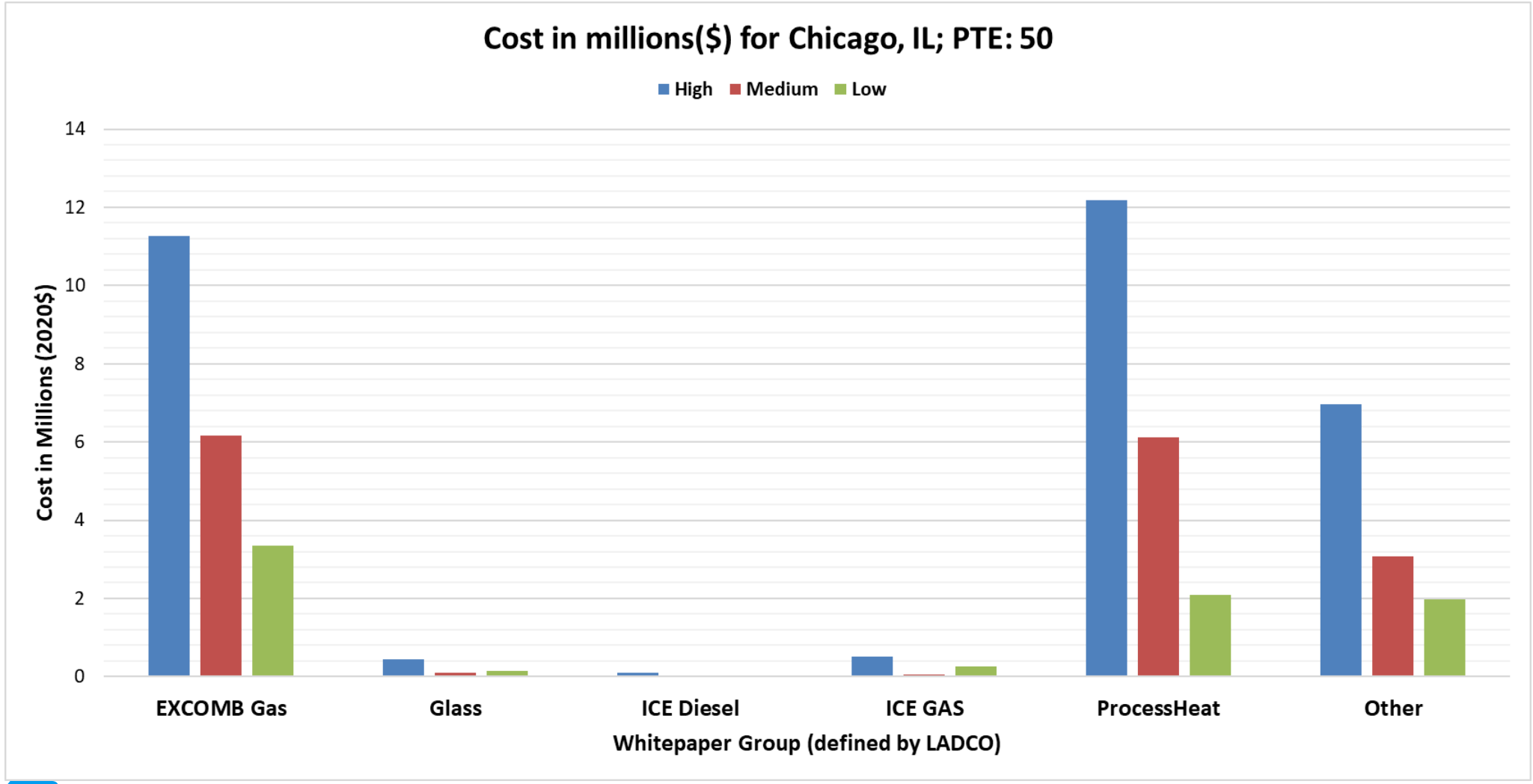
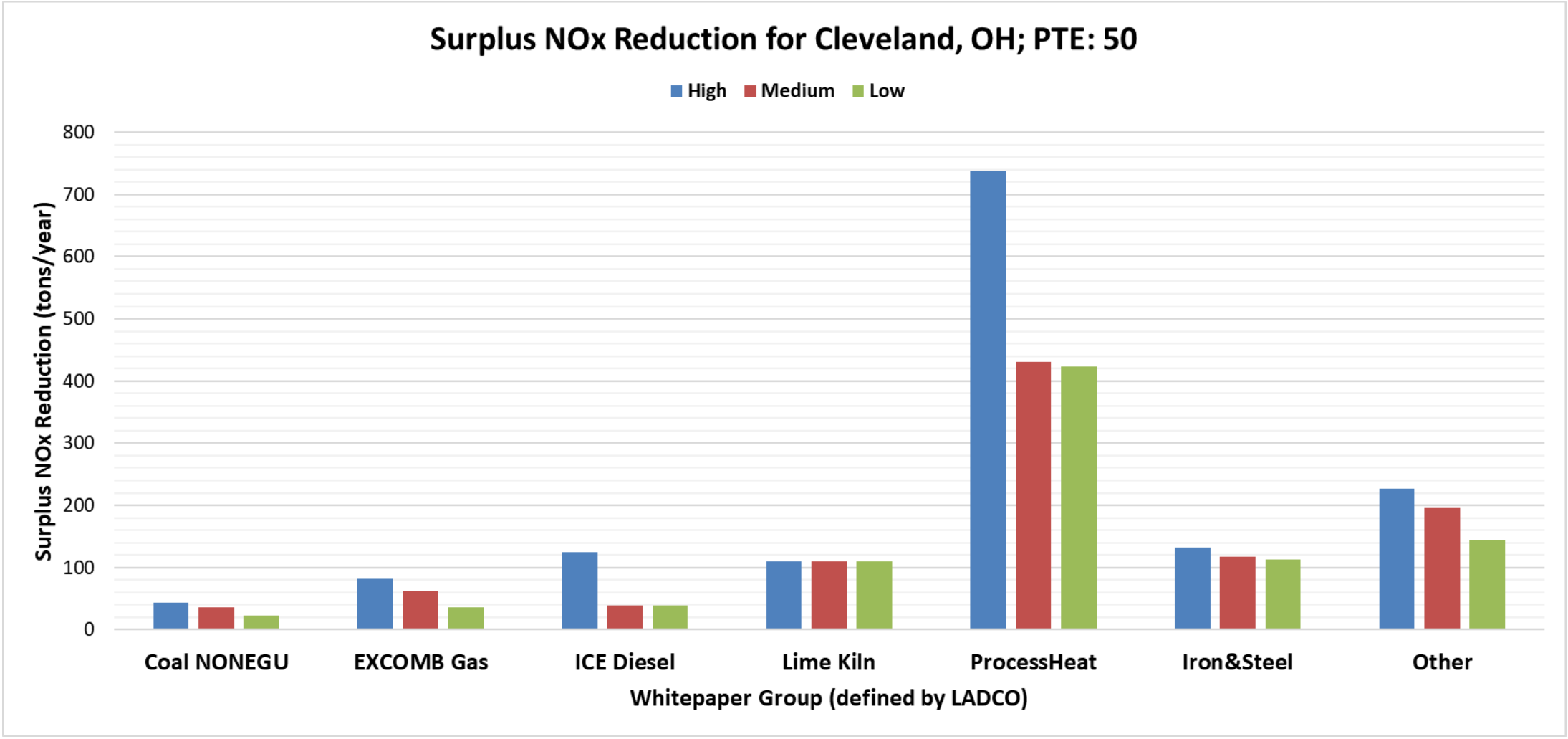
Example summary of potential NOx reductions by source category for Chicago, IL Nonattainment Area



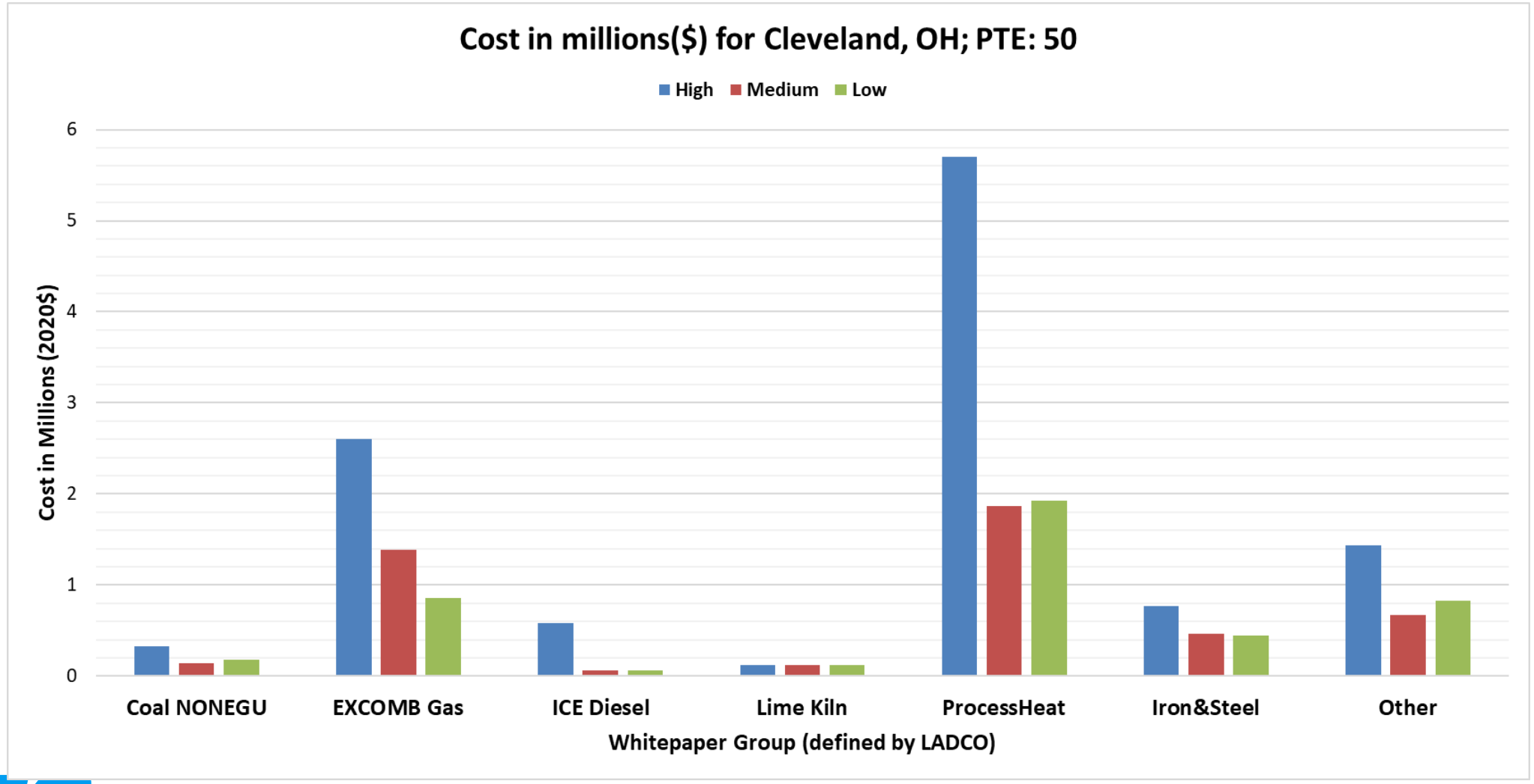
Example summary of total cost by source category for Chicago, IL Nonattainment Area



Example summary of potential NOx reductions by source category for Cleveland, OH Nonattainment Area



Example summary of total cost by source category for Cleveland, OH Nonattainment Area



Task 4: Control Measures White Paper and SMOKE Control Packets

- **White paper** documents the analysis by source category grouping
  - Listing of major stationary source categories and applicable SCC
  - Total cost and cost effectiveness ($/ton)
  - Control efficiency and potential emission reductions
  - Geographic applicability, responsible agency, implementation feasibility, implementation schedule, public acceptance
  - All controls emission reductions (Appendix)
- **SMOKE control packets** will be developed for each control scenario. The control packets will have percent reduction by county, SCC, facility or Unit ID (if appliable).

Task 4: Technical Support Document (TSD)

- TSD will document methods, data basis, and comprehensive results

Outline:

a. Emission Inventory Basis (EPA 2016v1 Modeling Platform)
   i. Listing of source category groupings
   ii. Appendix Table: Source category groupings to SCC xref
   iii. Table: State NOx emissions by source category
   iv. Table: NAA NOx emissions by source category

b. Control Measures Basis
   i. Summary of basis of control measures selected in the analysis
   ii. Table: Reference sources that are the basis of control measures applied

c. Control Measure Scenarios Development
   i. Describe scenarios (low, med, high)
   ii. Describe procedure for identification of controls for each scenario
   iii. Describe stringency Levels (10, 25, 50, 100 tpy)
   iv. Describe basis of existing controls
   v. Describe how controls were applied to the inventory (in the context of existing controls; note uncertainty)
   vi. Appendix Table: Control measures by SCC grouping

d. Control Packet Basis
   a. Table: Control packet format, fields, and basis/notes for compilation of each
   b. Electronic Appendix: Control Packets

e. Results
   a. Table: Emission reduction by state, scenario and stringency level
   b. Table: Emission reduction by NAA, scenario and stringency level
   c. Electronic Appendix Table: Comprehensive unit-level control efficiency, cost-effectiveness, and emission reductions

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Sample White Paper: Cement Kiln

Current Regulations and 2016 Emissions Estimates		
2016 Emissions [a]	NOx:	11,408 tons/year
Control Measure Summary, Including 2016 Emission Reduction Estimates		
		All APTE [b] Levels [c]
Selective Catalytic Reduction (High Stringency Scenario)	NOx Reduction:	10,087 tons/year
	Cost Effectiveness:	*$6,155 or $7,202/ton [d]*
	Applicable States:	*IL, MI, OH*
	Applicable NAAs:	*None [e]*
Selective Non-Catalytic Reduction (Medium Stringency Scenario)	NOx Reduction:	2,335 tons/year
	Cost Effectiveness:	*$1,525/ton*
	Applicable States:	*IL, MI, OH*
	Applicable NAAs:	*None [e]*
Selective Non-Catalytic Reduction - Ammonia (Medium Stringency Scenario)	NOx Reduction:	3,147 tons/year
	Cost Effectiveness:	*$1,683/ton*
	Applicable States:	*IL, MI*
	Applicable NAAs:	*None [e]*
Biosolid Injection Technology (Low Stringency Scenario)	NOx Reduction:	474 tons/year
	Cost Effectiveness:	*$523/ton*
	Applicable States:	*MI*
	Applicable NAAs:	*None [e]*
Low NOx Burner (Low Stringency Scenario)	NOx Reduction:	2,403 tons/year
	Cost Effectiveness:	*$710/ton*
	Applicable States:	*IL, MI, OH*
	Applicable NAAs:	*None [e]*

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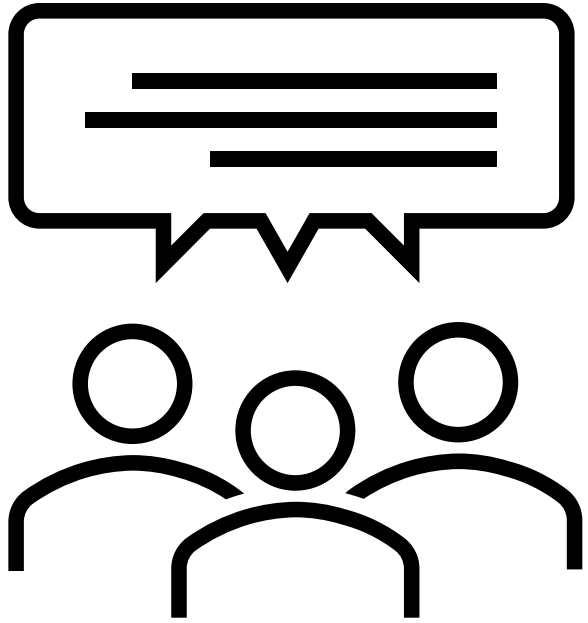
Review of Draft Whitepaper



Current Status and Next Steps

- **Database + Tool:** Developed NOx control measure database for stationary point sources and a tool to perform "what if" analysis to inform regulatory strategies development
- **White Paper:** Prepared Draft Whitepaper that documents key assumptions and results for control measures evaluated in this project
- **TSD:** Preparing a separate stand-alone technical support document
- **Control Packets:** Developing SMOKE control packets for each control scenario which will include percent reduction by county, SCC, facility or Unit ID
- **Recommendation:** We recommend LADCO to continue curation of the control measure database as new information becomes available.
- **Schedule:**

Deliverable	Date
Final Project Webinar	Feb 9, 2022
Comments from LADCO on Draft White Paper	Feb 17, 2022
Final White Paper, Technical Support Document, and SMOKE Control Packets	Feb 23, 2022

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Qs & As