Air Quality Subcommittee Report on the 8-Hour Ozone SIP Options

The report of the NOACA Environmental Advisory Committee, Air Quality Subcommittee, on the Options for Recommendation by the NOACA Governing Board to the Ohio Environmental Protection Agency related to the 8-Hour Ozone State Implementation Plan for Northeast Ohio

August 7, 2006
NOACA
Planning For Greater Cleveland

The Northeast Ohio Areawide Coordinating Agency (NOACA) is a public organization serving the counties of and municipalities & townships within Cuyahoga, Geauga, Lake, Lorain and Medina (covering an area with 2.1 million people). NOACA is the agency designated or recognized to perform the following functions:

- Serve as the Metropolitan Planning Organization (MPO), with responsibility for comprehensive cooperative and continuous planning for highways, public transit, and bikeways, as defined in the Transportation Equity Act for the 21st Century.
- Perform continuous water quality, transportation-related air quality and other environmental planning functions.
- Administer the area clearinghouse function, which includes providing local government with the opportunity to review a wide variety of local or state applications for federal funds.
- Conduct transportation and environmental planning and related demographic, economic and land use research.
- Serve as an information center for transportation and environmental and related planning.
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### Air Quality Subcommittee Report on the 8-Hour Ozone SIP Options

**2) NOACA Report No.**

**EV-06-03**

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**4) Report Date**

August 7, 2006

**5) Performing Organization Name & Address**

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Phone: (216) 241-2414  FAX: (216) 621-3024  Web site: www.noaca.org

**6) Project/Task No.**  
1019.01  (FY 2006)

**7) NOACA Contract/Grant No.**  
ODOT/FHWA

**8) Sponsoring Agency Name & Address**

Ohio Department of Transportation  
1980 W. Broad St., Box 899  
Columbus, OH 43216-0899

**9) Type of Report & Period Covered**  
(July 1, 2005 – June 30, 2006)

**10) Sponsoring Agency Code**

**11) Supplementary Notes**

Federal funding for this project was provided by the Federal Highway Administration and administered by the Ohio Department of Transportation.

**12) Abstracts**

The report of the NOACA Environmental Advisory Committee, Air Quality Subcommittee, on the Options for Recommendation by the NOACA Governing Board to the Ohio Environmental Protection Agency related to the 8-Hour Ozone State Implementation Plan for Northeast Ohio

**13) Key Words & Document Analysis**

A. Descriptors  Ozone SIP

B. Identifiers/Open Ended Terms

**14) Availability Statement**

NOACA  
www.noaca.org/sipplan.html

**15) No. Pages**

**16) Price**
Air Quality Subcommittee Report on the 8-Hour Ozone SIP Options

August 7, 2006

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The preparation of this publication was financed through grants received from the Federal Highway Administration and the Ohio Department of Transportation and appropriations from the counties of and municipalities within Cuyahoga, Geauga, Lake, Lorain and Medina. The contents do not necessarily reflect official views or policies of the U.S. Department of Transportation or the Ohio Department of Transportation. This report does not constitute a standard or regulation.
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A. EXECUTIVE SUMMARY

The NOACA EAC Air Quality Subcommittee endorses and recommends the following options for achieving attainment of the 8-Hour Ozone NAAQS in Northeast Ohio, in its role as the technical steering committee for the NOACA Air Quality Public Advisory Task Force:

Six general recommendations are described below:

I. Clean Fuel recommendation to be implemented by the Ohio Environmental Protection Agency (Ohio EPA);
II. Mobile Source Program recommendations to be implemented by NOACA and other local authorities;
III. Mobile Source Project recommendations to be encouraged by NOACA;
IV. Modification to NOACA’s Regional Transportation Investment Policy to support air quality priorities;
V. Ohio EPA rulemaking to more strictly control area and point sources; and
VI. Long-term strategies for sustainable air quality.

In addition to the recommendations listed below, the Board is also encouraged to support Ohio EPA’s effort to secure an extension for Northeast Ohio from 2010 to 2013, without having the region redesignated from “moderate” to “serious.” An extension allows time for substantial improvements in air quality to be realized as a result of new state and federal air pollution regulations.

I. CLEAN FUEL RECOMMENDATION TO BE IMPLEMENTED BY THE OHIO ENVIRONMENTAL PROTECTION AGENCY

NOACA recommends that Ohio EPA institute a clean fuel requirement for the eight nonattainment counties in Northeast Ohio as follows:

Low-Reid Vapor Pressure (RVP) gasoline of 7.8 psi (emitting fewer Volatile Organic Compounds - VOCs) for the summer of 2009, followed by a Low-RVP gasoline of 7.0 psi (emitting fewer VOCs than 7.8 psi) for the summer of 2010 and for every summer thereafter until the standard is attained.

II. MOBILE SOURCE PROGRAM RECOMMENDATIONS TO BE IMPLEMENTED BY NOACA AND OTHER LOCAL AUTHORITIES

The programs listed below will improve air quality by reducing emissions. These program recommendations include activities that can be undertaken locally, promoted regionally and pursued via a legislative agenda through the Ohio General Assembly and through Congress.

1. Anti-idling policies should be adopted for cars, trucks, buses, and off-road equipment at the state policy level and the local level through the adoption of policies and
regulations. Anti-idling policies improve air quality by eliminating unnecessary emissions of VOCs, oxides of nitrogen (NOx) and particulate matter (PM) from both gasoline and diesel engines. The policies generally require that fleet engines be turned off when not needed for work or emergency purposes.

2. **Voluntary trip reduction programs** by all employers throughout Northeast Ohio should be encouraged through education and outreach to promote increased use of mass transit, carpooling and RideShare, compressed work weeks, telecommuting, alternative practices such as conference calls and other "virtual meetings," trip combining, and promotion of commuting alternatives such as bicycling and walking. These programs improve air quality by reducing automobile emissions through the reduction of single occupancy vehicle trips undertaken by commuters.

3. **Stricter enforcement of existing speed limits** by local authorities should be pursued through the hiring of additional personnel and the collection of ticket revenue. This improves air quality by reducing air emissions, particularly NOx, associated with higher speeds.

4. **State legislative authority should be pursued for all counties, through their county auditors, to verify gasoline content** at gas pumps in order to determine that the gasoline sold meets the specifications stated for it. This will allow Northeast Ohio to verify specifications on any clean fuel sold during the summer months, as well as to check for excess sulfur throughout the year.

5. **Federal and state retrofit technology legislation** should be pursued to providing funding for both public and private fleets to install NOx retrofit technology on diesel engines or to replace them. This measure would have a direct NOx reduction effect for diesel trucks and off-road construction equipment, thereby reducing both ozone formation and particulate emissions.

III. **MOBILE SOURCE PROJECT RECOMMENDATIONS TO BE ENCOURAGED BY NOACA**

It is believed that identifying Congestion Mitigation & Air Quality (CMAQ) funding priority for the following types of projects will encourage project sponsors to submit projects to NOACA for funding consideration. Projects submitted would be evaluated for their air quality impact potential for attaining the federal ozone standard by Northeast Ohio’s Ozone SIP attainment demonstration deadline.

1. **Truck stop / rest area electrification** should be pursued at the 3 large private truck stops in Northeast Ohio (2 in Medina County near Seville and 1 in Cuyahoga County at Broadway in Cleveland), to provide heat, A/C, power, etc., to truck drivers when the engines are turned off thereby reducing diesel air emissions. In addition, the Ohio Department of Transportation and the Ohio Turnpike Commission are strongly
encouraged to implement truck stop electrification technologies at public rest areas along Interstate Corridors throughout Northeast Ohio and the remainder of the state.

2. **ODOT’s Intelligent Transportation System (ITS)** in the Cleveland area and the Akron area is currently programmed in the NOACA and AMATS TIPs. This is a valuable project that will improve the region’s air quality by increasing the efficiency of motor vehicle traffic.

3. **Bus replacement programs**, currently programmed in the TIP, should be accelerated and augmented, if feasible, to maximize the air quality benefit resulting from fleet turnovers to cleaner engines.

4. **Transit incentives** to encourage bus and train ridership on high air pollution days, thereby reducing single occupancy vehicle commuting traffic and its associated air emissions, should be pursued.

5. **Transit centers, Park- & -Ride lots and expansions, and enhanced waiting environments** that help to make transit more attractive to riders should be pursued as a means of encouraging greater use of transit; eliminating single-occupancy-vehicle trips by commuters who would otherwise drive.

6. **Traffic signal synchronizations** should be pursued and prioritized for funding along regional corridors where the air quality benefit will be the greatest. This measure improves air quality by relieving traffic congestion and allowing vehicles to move at their most efficient speeds, which are generally 30 m.p.h. and above.

7. **NOx retrofits and replacements for diesel vehicles** should be encouraged as a means to decrease emissions of oxides of nitrogen. In addition, legislation, both state and federal, should be supported to provide funding for such initiatives. The new technology also warrants **education and outreach programs** for fleet owners to build awareness of the benefits and costs associated with the technology.

8. **Replacement of ground-support vehicles** at Cleveland-Hopkins International Airport with electric, CNG, or hydrogen vehicles is recommended.

**IV. MODIFICATION TO NOACA’S REGIONAL TRANSPORTATION INVESTMENT POLICY**

The following amendment to NOACA’s Regional Transportation Investment Policy would act as a mechanism for advancing the mobile source program and project recommendations listed above:

"Congestion Mitigation and Air Quality (CMAQ) funding priority shall be given to mobile source programs and projects identified in NOACA’s recommendations to the Ohio Environmental Protection Agency for the State Implementation Plan
for attainment of the 8-Hour Ozone National Ambient Air Quality Standards (NAAQS)."

V. STATEWIDE CONTROLS ON POINT AND AREA SOURCES OF AIR POLLUTION TO BE IMPLEMENTED BY OHIO EPA

Ohio EPA is encouraged to incorporate the following controls on point and area sources throughout the entire state of Ohio as part of its rulemaking for the 8-Hour Ozone SIP, in order to combat ozone transport from regions outside of Northeast Ohio and to prevent Northeast Ohio from being at a competitive disadvantage:

1. Further controls statewide on cold cleaning/degreasing operations.
4. Switch to California-design portable fuel containers (gas cans) statewide.
5. Further controls statewide on mid-size industrial boilers.
6. Further controls greater than federal on electric utilities (coal-fired power plants), implemented on a multi-state basis through the efforts of the Director of Ohio EPA in working with the other states in the Midwest.
7. Enhancement of underground gasoline storage tank pressure-valve vents at gas stations in Northeast Ohio and statewide implementation of Stage I vents at all gas stations.
8. Enhancement of vapor recovery nozzles at gas pumps in the nonattainment area and statewide implementation of Stage II nozzles at all gas stations larger than the current threshold limit.
9. High Volume Low Pressure (HVLP) spray guns statewide for auto body paint sprayers.
10. More stringent limits statewide for formulation of paints and varnishes (architectural and industrial maintenance coatings).
11. NOx Credit Trading Bank to be implemented at the Ohio EPA, for the trading of NOx allowances and offsets within any nonattainment area.

VI. REGIONAL LONG-TERM STRATEGIES FOR SUSTAINABLE AIR QUALITY

A regional energy conservation strategy should be pursued with member communities and other stakeholders that addresses reduction in demand for electricity, more efficient public structures and more efficient transportation systems as a means of reducing air emissions long term. NOACA should work with the Ohio Office of Energy Efficiency, the U.S. Department of Energy, the foundation community and the business community on program development and funding mechanisms for this purpose.
B. INTRODUCTION

Nonattainment Status of Northeast Ohio

**Ozone:** On April 15, 2004, the eight counties of Northeast Ohio were declared by the United States Environmental Protection Agency (USEPA) to be a moderate nonattainment area under the new federal 8-hour ozone National Ambient Air Quality Standard (NAAQS). This designation includes the following counties:

- Ashtabula
- Cuyahoga
- Geauga
- Lake
- Lorain
- Medina
- Portage
- Summit

Ground-level ozone reduces lung function, exacerbating respiratory conditions and making it difficult for the young, the elderly, and those with heart-lung diseases to breathe. Ozone is formed in sunlight from volatile organic compounds (VOCs) and oxides of nitrogen (NOx) in a complex summertime atmospheric reaction.

The Ohio EPA, on behalf of Northeast Ohio, must submit to USEPA an 8-Hour Ozone State Implementation Plan (SIP) by June 2007 with sufficient control measures, plus airshed modeling, to show attainment of the federal standard by June 2010. Control measures, however, must be in place by June 2009.

**Fine Particles (PM$_{2.5}$):** On December 17, 2004, the USEPA designated the following counties as in nonattainment of the new fine particle NAAQS (PM$_{2.5}$ – particulate matter of 2.5 microns or less):

- Ashtabula (partial – Ashtabula Township only)
- Cuyahoga
- Lake
- Lorain
- Medina
- Portage
- Summit

Fine particles aggravate heart and lung diseases, and have been associated with premature death, according to USEPA.
The Ohio EPA, on behalf of Northeast Ohio, must submit to USEPA a PM$_{2.5}$ SIP by April 2008, sufficient to show attainment of the fine particle standard by April 2010. Control measures must be in place by April 2009.

**SIP Submission:** Ohio EPA is responsible for submitting all SIPs for Ohio. NOACA, through a public stakeholder and committee process, will contribute recommendations for the two SIPs for Northeast Ohio. In Akron, the AMATS Governing Board will also send comments as they relate to Summit and Portage Counties.

Failure of the Ohio EPA to submit a valid, timely SIP that demonstrates that attainment will be achieved may subject Northeast Ohio to loss of federal highway funds for capacity-adding projects, as well as 2-for-1 offsets for businesses locating or expanding in Northeast Ohio.

Failure to attain the 8-hour ozone NAAQS by 2010 subjects Northeast Ohio, automatically, to redesignation as a "serious" nonattainment area, with additional restrictions on businesses and on mobile sources.

**NOACA Air Quality Public Advisory Task Force**

Ohio EPA, on November 1, 2005, signed a Memorandum of Understanding with NOACA and northeast Ohio’s Local Air Agencies, acknowledging NOACA’s lead role as a Section 174 agency under the Clean Air Act in coordinating the public involvement process for all 8 counties related to the nonattainment status of Northeast Ohio for both ozone and fine particles (PM$_{2.5}$).

NOACA established a public stakeholder process with the following charge:

a. Develop an understanding of Northeast Ohio’s air quality issues.

b. Serve as a forum for public discussion of Northeast Ohio’s air quality challenge.

c. Review and evaluate alternative controls addressing Northeast Ohio’s sources of ozone precursors and particulate matter pollution.

d. Make recommendations for attaining federal clean air standards for ozone and particulate matter to the NOACA Governing Board.

The NOACA Air Quality Public Advisory Task Force, made up of 29 members who represent a broad spectrum of interests in Northeast Ohio, has been meeting almost monthly since May 2005. It has established Work Groups for Mobile Sources, Point Sources, Area Sources, Long-Term Planning Strategies, and a Public Health Forum on air pollution. The Work Groups met approximately every 3 weeks from August 2005 to April 2006. They will continue to meet through the fall of 2006 to address PM$_{2.5}$. 
The Task Force employed the following evaluation criteria to assess potential options for Northeast Ohio:

- Quantifiable
- Enforceable
- VOC Reductions in Tons Per Day
- NOx Reductions in Tons Per Day
- Technically Possible
- Successful Implementation Elsewhere
- Require State Legislation/State Rules/Local Ordinances
- Costs Per Ton of Pollutant Removed
- Costs in Other Units
- Economic Investment Required
- Economic Benefit or Detriment
- Health Benefit
- Other Benefits or Detriments
- Behavioral Change Required
- 2009 Timing Requirement
- Long-Term Effect
- Additional Comments or Concerns

The 80 options studied by the Task Force, using these criteria, appear in the final report of the NOACA Air Quality Public Advisory Task Force.

**Work of the NOACA EAC Air Quality Subcommittee**

The Task Force, through its Work Groups for Mobile Sources, Point Sources, Area Sources, Long-Term Planning Strategies, and a Public Health Forum on air pollution, reviewed options for recommendations to the Ohio Environmental Protection Agency (Ohio EPA) for inclusion in the State Implementation Plan (SIP) for the 8-Hour Ozone NAAQS.

The Task Force studied not only creditable SIP measures for Ohio EPA to include, but also “weight of evidence” measures, as described by USEPA’s Phase II Ozone Implementation Rule, to show the good faith of the citizens of Northeast Ohio in moving forward toward clean air and better quality of life and to demonstrate that the region will likely make attainment by the June 2010 deadline.

As the Task Force met, the NOACA EAC Air Quality Subcommittee, chaired by Lake County Commissioner Robert Aufuldish, functioned as a steering committee for the Task Force. The Air Quality Subcommittee met:

- May 18, 2005
- July 20, 2005
September 21, 2005
October 19, 2005
November 9, 2005
January 18, 2006
February 15, 2006
March 15, 2006
April 19, 2006
May 17, 2006
June 14, 2006
July 19, 2006

each time at NOACA's offices. The Air Quality Subcommittee reviewed all of the
technical documentation being presented to the Task Force. The Subcommittee also
suggested fruitful areas of research that the Task Force could undertake.

Finally, the Subcommittee carefully reviewed the Task Force recommendations,
modifying those recommendations for presentation to the NOACA Governing Board for
possible submittal to the Ohio EPA.

This Report represents the Subcommittee's final review, modifications, and
recommendations to the NOACA Governing Board.

Emissions Inventory

According to Ohio EPA, the sources of Northeast Ohio's ozone pollution comes from a
combination of sources, as demonstrated by the Ohio EPA bar charts that follow, each of
which show a rough estimate of what the emissions were in 2002, the "baseline" year:

**Ohio EPA 2002 NOx Emissions**

- 11% Point
- 30% Non-road
- 32% On-Road
- 27% Area

**Ohio EPA 2002 VOC Emissions**

- 4% Point
- 26% Non-road
- 29% On-Road
- 41% Area

**Point** = Large stationary sources, such as utilities and manufacturing.

**Non-road** = Off-road vehicles (construction, etc.), ships, trains, aircraft, boats,
lawnmowers, etc.
On-Road = Cars, trucks, buses, and motorcycles.

Area = Small businesses (gas stations, bakeries, dry cleaners, etc.) and miscellaneous, such as residential combustion and open burning.

Target Goal for Northeast Ohio

As stated above, volatile organic compounds (VOCs) combine with oxides of nitrogen (NOx) in hot sunlight during the summer months to form ground-level ozone. Ohio EPA is estimating that Northeast Ohio’s moderate nonattainment area for 8-hour ozone would have to reduce its VOCs by 25% of the 2009 projections in order to come into attainment, coupled with a statewide reduction in NOx of 15%.

This goal, as stated by Ohio EPA, is approximately:

- 65 tons/day VOCs (local reduction in Northeast Ohio) and
- 240 tons/day NOx (statewide reduction)

Ohio EPA states that VOCs reductions locally produce a corresponding ozone reduction. However, NOx controls must be statewide or even multi-state-wide to be effective.

Ozone Trends in Northeast Ohio

According to NOACA's annual reports, and according to a recent report by the Lake Michigan Air Directors' Consortium (LADCO) (See Appendix B), ozone has been trending downward in Northeast Ohio over the past decade.

After factoring out the effects of weather, the trend still remains downward, presumably reflecting the various steps already taken to enhance air quality and reflecting the loss of population and manufacturing sources throughout Northeast Ohio.

However, even with the current trend toward cleaner air, the federal 8-hour standard for ozone of 85 parts per billion (ppb) still will not be reached by 2010 without further action, as demonstrated by the following graph:
Air-Shed Modeling

To predict whether Northeast Ohio will attain the federal 8-hour ozone standard by June 2010, several parallel air-shed (photochemical grid) modeling efforts are ongoing. These include work done by the Lake Michigan Air Directors' Consortium (LADCO), working on behalf of the states of Ohio, Indiana, Illinois, Wisconsin, and Michigan.

The 8-hour ozone standard to be attained is 85 parts per billion (ppb). The high reading from the summer of 2002 (modified and lowered pursuant to USEPA rule) is 99 ppb.
The LADCO modeling results do not yet show Northeast Ohio attaining the federal 8-hour ozone standard, as demonstrated by the chart above. Other LADCO modeling "sensitivity runs" also fail to show attainment for Northeast Ohio, even if strong controls are placed on industry and a clean gasoline (7.0 psi) is chosen. The most recent LADCO modeling results show Northeast Ohio at 88.8 ppb in the summer of 2009.

A second modeling effort is being undertaken directly for NOACA by Ohio University. (See Appendix C.) As with the LADCO results, no collection of controls yet shows Northeast Ohio in attainment by June 2010. However, Ohio University is pursuing changes to the emissions inventory and alternative future year projections that show the region closer to the 85 ppb standard than the LADCO results. Ohio University is studying the impact of local economic and demographics factors to "grow" emissions to 2010 in a more realistic way than that previously used by LADCO. Ohio University and NOACA staff are currently working with LADCO to potentially include the assumptions from the Ohio University/NOACA effort into the official LADCO Round 5 model run.

**Weight of Evidence**

USEPA's Phase II Ozone Implementation Rule for the development of SIPs allows "weight of evidence" arguments to be made with the submission of a SIP where the accompanying modeling falls within the range of 83 - 87 ppb. It appears that the results from Northeast Ohio's modeling will fall within this range.

When the "weight of evidence" submission is made, many voluntary programs and "good faith efforts" in the nonattainment area can be considered by USEPA in determining whether the SIP is likely to bring the area into nonattainment by the required 2010 deadline.

Consequently, many measures, even voluntary ones, may have value to the overall SIP effort, even if they do not equal the currently estimated total of tons of air pollution needed to be reduced.

**Health Effects**

Neither the NOACA Air Quality Public Advisory Task Force nor the NOACA EAC Air Quality Subcommittee undertook its own local study of the health effects of ozone since it is USEPA’s responsibility to determine health safety levels under the federal Clean Air Act.

When USEPA set the new 8-hour standard, it did so based on credible, peer-reviewed scientific evidence that showed the standard was necessary to protect public health. The use of peer-reviewed data is part of the process that USEPA is mandated to follow under the Clean Air Act in setting health standards.
The 8-hour standard was challenged in the federal courts over the course of seven years, after which USEPA was directed to designate areas that did not attain the new standard. Northeast Ohio was identified as not meeting the new standard.

The Task Force and the Subcommittee recognized that there is a lack of information among Northeast Ohio’s residents regarding the region’s current air quality status. The Task Force felt strongly that a more visible public education and outreach effort should be undertaken regarding the effect of ozone on public health. It established the Public Health Forum Work Group to focus on illustrating the severity of Northeast Ohio’s air quality problem. The Work Group's efforts will continue through 2006 as the Task Force studies particulate matter.
C. ANALYSIS OF RECOMMENDATIONS

Introduction

The NOACA EAC Air Quality Subcommittee, as the technical steering committee for the NOACA Air Quality Public Advisory Task Force, spent much of the first half of 2006 reviewing the recommendations made by the Task Force, as the Task Force prioritized the 80 options it had under study.

The Subcommittee analyzed the recommendations for practicality, air pollution reduction effectiveness, cost, impact on various communities, and overall chance of successful implementation.

Throughout the process, the NOACA Air Quality Public Advisory Task Force and the NOACA EAC Air Quality Subcommittee relied on research performed by the Lake Michigan Air Directors' Consortium (LADCO), which serves the states of Ohio, Indiana, Illinois, Michigan, and Wisconsin.

The Lake Michigan Air Directors' Consortium (LADCO)

LADCO was established in 1990 by the states of Illinois, Indiana, Michigan, and Wisconsin. In 1991, the 4 states and USEPA entered into a Memorandum of Agreement that established LADCO as the organization to oversee the technical analysis of ozone formation in the Lake Michigan area and to develop a shared strategy for the reduction of ozone and ozone precursors.

In March 2004, the states signed a new Memorandum of Agreement which added the state of Ohio as a member. The main purpose of LADCO is to provide technical assessments for and assistance to its member states on problems of air quality; and to provide a forum for its member states to discuss air quality issues. LADCO's primary geographic focus is the area encompassed by its member states and any areas that affect air quality in its member states.

LADCO performed analyses in-house, using its staff and the staff of the 5 states that it serves. The analyses covered mobile, point, and area sources. In addition, LADCO contracted research work to MACTEC (a consultant) on point and area sources, and to ENVIRON (a consultant) on mobile sources.

MACTEC produced a series of "white papers" on point and area sources after surveying air pollution measures adopted in various states across the country. ENVIRON produced a report on mobile source options, including on-road, off-road, marine, aircraft, and rail options, based upon information from its nationwide literature survey.
All research reports and "white papers" were critiqued through a public review process involving the 5 states, the USEPA, and participating stakeholders, which included affected private sector businesses. Each paper was revised following the comment periods and then re-published.

LADCO, with the help of the 5 states and the stakeholders, has produced 11 revisions to the emissions inventory for the 5-state region (Base A - Base K) and is working on the 12th iteration (Base L), striving for ever-greater accuracy. LADCO has produced 4 rounds of photochemical grid modeling to accompany the emissions inventory revisions, in order to provide the states with an assessment of how close each will be to attainment in 2010. "Sensitivity runs" including batches of potential air pollution control options have also been performed by LADCO for the states. Such runs provide information on the amount of reduction that might be gained by the various combinations of options as applied.

Sources of Mobile Data

The NOACA Air Quality Public Advisory Task Force and the NOACA EAC Air Quality Subcommittee relied on Mobile 6 modeling runs performed by NOACA, the Akron Metropolitan Area Transportation Study (AMATS), and the Ohio Department of Transportation (ODOT) in assessing air pollution impacts related to the mobile source options.

The Task Force and the Subcommittee also relied on air emission calculations made by NOACA staff using emission factors generated by Mobile 6 for Northeast Ohio, which were then used to make assumptions about impacts from various scenarios, for example, the amount of NOx reduced by implementing truck anti-idling restrictions at the Port of Cleveland.

In assessing the financial costs and air pollution emissions reductions associated with the various mobile source options, the NOACA Air Quality Public Advisory Task Force and the Subcommittee relied on data from LADCO's subcontractor, ENVIRON.

Finally, the Task Force and the Subcommittee relied on data provided by the participating stakeholders in Northeast Ohio during the public process.

Sources of Point and Area Data

The NOACA Air Quality Public Advisory Task Force and the NOACA EAC Air Quality Subcommittee relied on research performed by LADCO and by MACTEC in assessing the point and area source options, including both air pollution reduction estimates and estimates of financial cost associated with each option.
Again, the Task Force and the Subcommittee also relied on information provided by the participating stakeholders in Northeast Ohio during the public process.

**Cross-References Between Reports; Acronyms**

The recommendations that follow make use of the acronyms and numbering system used by the NOACA Air Quality Public Advisory Task Force in its Final Reports. For example, "Option MO-1" was the first option considered in the "Mobile Source" category, but the number does not reflect any qualitative ranking.

MO - Mobile Source Option  
PT - Point Source Option  
AR - Area Source Option

All the reports and background information of the NOACA Air Quality Public Advisory Task Force can be found at www.noaca.org/sipplan.html.

The acronyms used in this section can be found in Appendix E. They are also repeated here:

AIM - Architectural and industrial maintenance  
ALAPCO – Association of Local Air Pollution Control Officials  
AMATS - Akron Metropolitan Area Transportation Study  
APU – Auxiliary power unit  
AR - Area source option  
BAAQMD - Bay Area Air Quality Management District (California)  
BACT - Best available control technology  
CAIR - Clean Air Interstate Rule  
CARB - California Air Resources Board  
CFR – Code of Federal Regulations  
CHP – Combined heat and power  
CMAQ - Congestion Mitigation & Air Quality funds  
CNG - Compressed natural gas  
CO - Carbon monoxide  
DERA – Diesel Emission Reduction Act  
DPF - Diesel particulate filter  
EAC - Environmental Advisory Committee (NOACA)  
EGU - Electric generating unit  
EGR - Exhaust gas recirculation  
EVR - Enhanced vapor recovery  
GDF - Gasoline distribution facility  
GSE - Ground support equipment (airport)  
HDDV - Heavy duty diesel vehicle  
HDGV - Heavy duty gasoline vehicle  
HPLV - High pressure low volume
ICI – Industrial, commercial, and institutional
LADCO - Lake Michigan Air Directors' Consortium
LDGV - Light duty gasoline vehicle
LEED - Leadership in Energy and Environmental Design
MO - Mobile source option
MY - Model year
NAAQS - National Ambient Air Quality Standards
NOx - Oxides of nitrogen
ODOT - Ohio Department of Transportation
OEM - Original equipment manufacturer
O.R.C. - Ohio Revised Code
OTC - Ozone Transport Commission
PFC - Portable fuel container (gas can)
PM - Particulate matter
PSI - Pounds per square inch
PT - Point source option
RACT - Reasonably available control technology
RFG – Reformulated gasoline
RVP - Reid vapor pressure, a measure of gasoline volatility
SCAQMD - South Coast Air Quality Management District (California)
SCR - Selective catalytic reduction
SFY – State fiscal year
SIP - State implementation Plan
SOV – Single occupancy vehicle
STAPPA – State and Territorial Air Pollution Program Administrators
TIP - Transportation Improvement Program
TPD - Tons per day
TPY – Tons per year
UST - Underground storage tank
VALE - Voluntary Airport Low Emission program
VMT – Vehicle miles traveled
VOC - Volatile organic compound
I. Clean Fuel Recommendation

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that low-RVP gasoline of 7.8 psi be required for Northeast Ohio for the summer of 2009 and that low-RVP gasoline of 7.0 psi be required for the summer of 2010 and each summer after that year, until attainment of the NAAQS and redesignation to "maintenance" is achieved.

The recommendation accommodates the lead time required by the area's refineries to provide such fuels (1-3 years following SIP approval by USEPA), as stated by the American Petroleum Institute.

Background: Gasoline of various formulations could be sold in the summer ozone season in Northeast Ohio that would result in emission reductions. Summertime fuel strategies have been effectively employed in other nonattainment areas.

The Northeast Ohio nonattainment area is currently purchasing 9.0 psi gasoline in the summer, although when ethanol is blended in, it may be 10.0 psi under the 1 psi ethanol waiver for the State of Ohio. The following fuels were considered:

- **MO-1** Low-Reid Vapor Pressure (RVP) gasoline of 7.8 pounds per square inch (psi)
- **MO-2** Low-RVP gasoline of 7.0 psi
- **MO-3** Federal Reformulated Gasoline (RFG)

Rationale: "Lowering gasoline volatility reduces evaporative VOC emissions from anything that either uses gasoline or is used to transport or store gasoline, including on-road vehicles, off-road equipment such as lawnmowers, portable fuel containers, gasoline dispensing facilities, and above ground gasoline storage tanks... Lowering fuel volatility primarily affects VOC exhaust, and to a lesser degree CO and NOx. Lowering volatility has no effect on PM directly emitted by on-road vehicles, but if exhaust VOC and evaporative VOC are lowered, secondary PM that forms in the atmosphere from VOCs may also be lower." (Source: Environ: "Development of Technical Information for a Regional Fuels Strategy, Feb. 28, 2006."")

In Northeast Ohio's previous 1-hour Ozone SIP, 7.8 psi gasoline was promulgated as an Ohio EPA rule for use in the summer months if Northeast Ohio were to exceed the 1-hour ozone standard. This contingency measure was never implemented, although it remained available if needed.

Air Impacts: Mobile 6.2 modeling runs for low-RVP gasolines of 7.0 psi, 7.8 psi, plus Federal RFG show the reductions that might be achieved in the 8-county nonattainment area, including potential refining costs. These are as follows:
Reductions: NOACA Mobile 6.2, Nov. 2005
Costs: Environ, under contract to LADCO, Feb. 2006

<table>
<thead>
<tr>
<th></th>
<th>5.25 tons per day VOCs eliminated</th>
<th>0.32 tons per day NOx eliminated</th>
<th>1 cent at refinery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>7.8 psi</strong></td>
<td>8.20 tons per day VOCs eliminated</td>
<td>0.48 tons per day NOx eliminated</td>
<td>0.6 - 3 cents at refinery</td>
</tr>
<tr>
<td><strong>7.0 psi</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Federal RFG</strong></td>
<td>11.22 tons per day VOCs eliminated</td>
<td>0.13 tons per day NOx eliminated</td>
<td>1.7 – 6.2 cents at refinery</td>
</tr>
</tbody>
</table>

**Costs:** Costs at the refinery do not translate directly to "pump prices" for the consumer. However, some studies such as Environ's "Development of Technical Information for a Regional Fuels Strategy, Feb. 28, 2006" use the upper limits of these costs as the "pump price."

**Cost Per Ton of VOC Removed:** To calculate a cost per ton of pollutant reduced, the following calculation was performed:

Gasoline sold in all of Ohio for May - Sept. 2005 = 2,231,400,000 gallons
Population of Northeast Ohio (2000 census) = 2,945,831 people
Population of all of Ohio (2000 census) = 11,353,140 people
Portion that Northeast Ohio represents = 26% of the state
26% of all gasoline sold in summer 2005 = 580,164,000 gallons

**Option MO-1**
If 7.8 psi cost an additional 1 cent = $5,801,640
Cost per ton of VOC removed (5.25 tpd; summer lasting 150 days) = $ 7,367

(Note: Ohio EPA calculates a similar cost per ton at $ 7,651 VOC.)

**Option MO-2**
If 7.0 psi cost an additional 3 cents = $17,404,920
Cost per ton of VOC removed (8.20 tpd; summer lasting 150 days) = $ 14,150
Option MO-3

If RFG cost an additional 6 cents

Cost per ton of VOC removed
(11.22 tpd; summer lasting 150 days)

= $34,809,840

= $20,683

The Northeast Ohio nonattainment area is served by four refineries, none of which are currently equipped to deliver federal RFG. The American Petroleum Institute states that the lead time to provide federal RFG to Northeast Ohio would mean that the 2009 implementation deadline could not be met.

However, the required lead time of 2-3 years following SIP approval by USEPA could be met for both 7.0 psi gasoline and 7.8 psi gasoline. The NOACA Air Quality Public Advisory Task Force and the NOACA EAC Air Quality Subcommittee are relying on those representations in order to have a clean fuel for Northeast Ohio before the attainment deadline. It was stated by the Task Force and the Subcommittee that proceeding from the less stringent 7.8 psi gasoline to the more stringent 7.0 psi gasoline would obviate any difficulties in production that might otherwise challenge the refineries.

Note: USEPA, in the spring of 2006, proposed a rule to remove benzene from gasoline. The federal Energy Policy Act of 2005 removed the requirement that oxygenates be added to federal RFG. Thus, within a few years, federal RFG may have the same formulation as 7.0 psi low-RVP fuel.
II. Mobile Source Program Recommendations

1. Anti-Idling Regulations / Policies

**Recommendation:** The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that anti-idling regulations and policies be implemented across Northeast Ohio and across the state, to reduce both VOC and NOx emissions from idling motor vehicles and off-road equipment.

**Background:** Reducing car and truck idling would reduce both VOCs and NOx, as well as fine particulates (PM$_{2.5}$). Anti-idling regulations are often focused on truck traffic, short-term (deliveries or projects) or long-term (overnight), thus reducing NOx and PM$_{2.5}$.

USEPA conducted extensive workshops throughout 2005 in order to draft a Model Anti-Idling Law for states to work from. (See Appendix D.)

Anti-idling regulations for school buses were also studied. School buses, although running for short periods of time, have direct health impacts on children through emissions. The Ohio Department of Health is implementing a pilot project for schools in 2006 that may result in statewide recommendations to school districts regarding anti-idling policies.

**Option MO-25 - Anti-Idling Policy Throughout Northeast Ohio Air Impacts:** For purposes of this Report, for all residents of the Northeast Ohio nonattainment area (driving various types of vehicles):

Assume 500,000 vehicles in the entire area operating daily
Assume 10 minutes of idling per vehicle per day
5,000,000 minutes of idling
0.266 grams/minute VOCs $\times$ 5,000,000 minutes $= 13,300,000$ grams $= 1.466$ tpd VOC
0.073 grams/minute NOx $\times$ 5,000,000 minutes $= 365,000$ grams $= 0.402$ tpd NOx

**1.466 tpd VOCs reduced**
**0.402 tpd NOx reduced**

For purposes of this Report, for a hypothetical fleet of trucks loading or unloading:
Assume 5,000 trucks (HDDV8A) operating daily
Assume 30 minutes of idling per vehicle per day
150,000 minutes of idling
0.06 grams/minute VOCs $\times$ 150,000 minutes $= 9,000$ grams $= 0.01$ tpd VOC
0.59 grams/minute NOx $\times$ 150,000 minutes $= 88,500$ grams $= 0.10$ tpd NOx

**0.01 tpd VOCs reduced**
**0.10 tpd NOx reduced**
(Source of emissions factors for idling: NOACA generated emissions factors in grams/mile for various vehicles at various speeds, based on Mobile 6.2 for the summer of 2009. The emissions factors were then converted from grams/mile to grams/minute, using the slowest speed - 2.7 mph - generated by Mobile 6.2, which has no "idling" speed. For a comparison with 1998 idling emission figures, see USEPA's "Idling Vehicle Emissions" EPA420-F-98-014, April 1998. The USEPA emission factors show even greater reductions because 1998 vehicles were considered, rather than 2009 vehicles.)

Cost: Short-term idling restrictions save fuel for the vehicle driver. According to USEPA, a gas-powered car should idle for no more than 30 seconds before turning the engine off to save fuel. A diesel truck or school bus should idle no more than 3-5 minutes before turning off the engine to save fuel, as well as engine wear. Education and enforcement are costs that will vary.

Cost per ton of pollutant removed: Cost savings.

Funding: There is potential for Congestion Mitigation and Air Quality (CMAQ) funding to support a regional public education and outreach effort to public and private fleet owners, and for coordination among NOACA members to encourage adoption of anti-idling policies and regulations by local governments.

Note: Long-term (overnight) truck idling is addressed in the section on "Truck Stop Electrification."

**Option AR-1  Anti-Idling Policy at the Port of Cleveland**
The Port of Cleveland handles approximately 360,000 truckloads per year, with some trucks idling more than 45 minutes because of long lines for loading. The trucks carry an estimated 10 million tons of cargo per year. Private companies utilizing the port also support large numbers of truckloads per year.

An "anti-idling policy" would reduce NOx emissions associated with the trucks serving the ports. Such a policy would have to be mandatory for all vehicles within the affected area, such as the City of Cleveland, Cuyahoga County, Ashtabula Township, etc. An "anti-idling policy" could even be a statewide law.

**Option AR-1**

**Air Impacts:** For purposes of this Report:
Assume 360,000 truckloads annually, or 986 per day.
Assume idling of 30 minutes per truck.
986 trucks x 30 minutes = 29,589 idling minutes per day
0.06 grams/minute VOCs x 29,589 minutes = 1,775 grams = 0.003 tpd VOC
0.59 grams/minute NOx x 41,100 minutes = 16,867 grams = 0.027 tpd NOx

**0.002 tpd VOCs reduced**
**0.019 tpd NOx reduced**
(Source of emissions factors for idling: NOACA generated emissions factors in grams/mile for various vehicles at various speeds, based on Mobile 6.2 for the summer of 2009. The emissions factors were then converted from grams/mile to grams/minute, using the slowest speed - 2.7 mph - generated by Mobile 6.2, which has no "idling" speed. For a comparison with 1998 idling emission figures, see USEPA's "Idling Vehicle Emissions" EPA420-F-98-014, April 1998. The USEPA emission factors show even greater reductions because 1998 vehicles were considered, rather than 2009 vehicles.)

**Cost:** Enforcement and education costs. The measure saves fuel for the truckers.

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**Option AR-3 Anti-Idling Policy at Cleveland-Hopkins International Airport**

The topic of idling reductions at the large airports was also studied. Anti-idling practices appeared to have some benefit for ground support vehicles. Further study was needed on whether jets were actually using the “single-engine taxi” that was the recommended practice.

The City of Cleveland has developed an "anti-idling policy" for all city vehicles, which would also apply to city-owned airport vehicles at Cleveland-Hopkins International Airport.

The Airport has already addressed idling from emergency vehicles by providing them with electric "hot start" facilities that allow them to start immediately at any time. In 2006, 23 snow plows will be retired, being replaced with 10 high-speed plows that also have "hot start" technology, which allow immediate start-ups without previous idling. Snow plows that currently idle during any snowstorm will no longer be idling.

Taxi and bus idling at Cleveland-Hopkins International Airport also produces air pollution, as well as traffic congestion. A City of Cleveland policy affecting City vehicles would have no impact on such private vehicles. Controlling private vehicle idling would have to be done through a city ordinance affecting all vehicles and through cooperation with the adjacent community of Brookpark.

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**Option AR-3 Air Impact:**

To estimate emissions for reducing taxi and bus idling:
Assume 1,500 bus and taxi stops per day at Cleveland-Hopkins International Airport
Assume idling of 10 minutes per vehicle
For 15,000 minutes of idling:

- 0.005 tpd VOCs reduced
- 0.001 tpd NOx reduced

**Cost:** Enforcement and education. Assume hiring 6 additional police officers for $75,000 total salary and benefits per year = $ 450,000.
II. Mobile Source Program Recommendations

2. Voluntary Trip Reduction Programs

**Recommendation:** The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that voluntary trip reduction programs be implemented across Northeast Ohio by local governments, employers, individuals, and all motorists.

**Background:** Trip reduction programs can involve multiple choices for employees to decrease travel by single-occupancy vehicles (SOVs). Such choices can include:

- Commuter financial incentives, including cash instead of parking spaces and including receiving transit allowances
- Rideshare (computerized carpool database) matching
- Organized vanpools
- Compressed work weeks, as in four 10-hour shifts in one week or nine 9-hour shifts in two weeks
- Telecommuting, allowing employees to work at home
- "Virtual meetings," using telecommunications to substitute for physical travel
- Guaranteed ride home for transit users, for emergencies or late nights
- Walking and bicycling showers and changing facilities
- Bike racks
- Transit subsidies, including free bus passes or bus passes provided pre-tax. The incentive offered by the Greater Cleveland RTA is "Commuter Advantage," a transit pass subsidy.
- Worksite amenities such as on-site childcare, restaurants, and shops, to reduce the need to drive for errands
- Company travel reimbursement policies that reimburse bicycle or transit mileage for business trips when these modes are comparable in speed to driving, rather than only reimbursing automobile mileage
- Company vehicles, to eliminate the need for employees to drive to work in order to have their cars for business travel
- Proximate commuting, which allows employees to shift to worksites that are closest to their home (for employers who have multiple work locations, such as banks and other large organizations)

Decreasing employee travel by one day per week or one day every 2 weeks would result in a decrease of the VOCs and NOx associated with the SOVs that would ordinarily be driven on that day.
Option MO-14    Trip Reduction Programs for All Residents of Northeast Ohio
Voluntary trip reduction programs could be put in place that all residents of Northeast Ohio could participate in, making strong use of NOACA's and AMATS' RideShare programs, as well as all other trip reduction possibilities.

Option MO-14
Air Impact:
If all residents of Northeast Ohio were to participate in Trip Reduction Programs, and 10% took transit, while another 10% worked at home, the following reductions would result, as demonstrated by NOACA Mobile 6.2 modeling runs for Cuyahoga, Geauga, Lake, Lorain, and Medina Counties:
2.12 tpd VOCs reduced
4.63 tpd NOx reduced

These reductions are for NOACA's 5 counties, to which reductions in Ashtabula, Portage, and Summit would be added.

Cost: Employer Trip Reduction Programs tend to save money, rather than cost money. Walking and biking cost nothing unless the employer provides showers, lockers, and bike racks. Telecommuting sometimes involves home computer equipment. Compressed work weeks cost nothing. Carpooling cuts commuting costs in half if two share the ride. Taking transit generally costs less than driving an SOV.

Cost per ton of pollutant removed: Cost savings.

Funding: There is potential for CMAQ funding for a new regional education and outreach program initiative focused on a comprehensive approach to trip reduction programs by public and private employers.
II. Mobile Source Program Recommendations

3. Stricter Enforcement of Existing Speed Limits

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that existing speed limits be more strictly enforced in order to gain air pollution benefits from lower speeds.

Background: According to LADCO's subcontractor, Environ, and according to NOACA staff, the emissions from on-road vehicles, especially heavy-duty diesel trucks, vary significantly as a function of vehicle speed. While cars may run efficiently at higher speeds, diesel vehicles put out greater quantities of NOx as the load on the engine increases, generally after approximately 40 m.p.h.

Air Impact:
Environ's combined VOC and NOx estimates, based on Mobile 6 runs, show:

<table>
<thead>
<tr>
<th>Speed (mph)</th>
<th>LDGV (grams/mile)</th>
<th>HDGV (g/mi)</th>
<th>HDDV (g/mi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>0.773</td>
<td>4.017</td>
<td>16.046</td>
</tr>
<tr>
<td>55</td>
<td>0.75</td>
<td>3.764</td>
<td>11.555</td>
</tr>
<tr>
<td>3% reduction</td>
<td>6.3% reduction</td>
<td>28% reduction</td>
<td></td>
</tr>
</tbody>
</table>

(LDGV = Light Duty Gas Vehicle. HDGV = Heavy Duty Gas Vehicle. HDDV = Heavy Duty Diesel Vehicle.)

Mobile 6.2 modeling runs from NOACA staff reflect air pollution reductions in the 5-county NOACA area that might result from vehicles traveling at 55 mph rather than 65 mph. It was found that while VOCs and NOx are reduced, the model showed disbenefits when hypothetical LDGV commuters left the freeway and began to drive on side roads rather than obey a 55 mph speed limit. The data for the 5-county NOACA area for reducing 65 mph freeway speeds to 55 mph showed:

1.0 tpd increase in VOCs
2.0 tpd decrease in NOx

Note: Environ's conclusions and NOACA's conclusions conflict as to whether VOCs increase or decrease.

Cost: The primary costs of more strictly enforcing existing speed limits are increased highway patrol staffs and increased court costs. Court costs were not estimated. Assuming $75,000 per year for a highway patrol officer (average salary of $41,000 plus fringe, according to www.salary.com), adding 10 new officers would cost $ 750,000.

The costs could be recouped through collection of speeding fines. Assuming:
$100 per ticket
8 tickets issued each shift that an officer worked
236 shifts per year
**Total: $188,800 would be recouped by each officer each year.**

Additional non-air-quality benefits would come from lower accident rates. Additional savings would accrue to drivers through reduced fuel consumption.

**Cost per ton of VOC removed: Cost savings.**

The NOACA charts that follow show LDGV and their emissions at various speeds, compared to HDDV and their NOx emissions at various speeds:
NOX from Heavy Duty Diesel Vehicles

The graph illustrates the emission of NOX (Nitrogen Oxides) from heavy-duty diesel vehicles as a function of speed. The graph includes lines for different models, labeled HDDV2B, HDDV3, HDDV4, HDDV5, HDDV6, HDDV7, HDDV8A, and HDDV8B. The x-axis represents speed, while the y-axis shows grams per mile. The data shows a general trend where NOX emissions decrease as speed increases, with each model having a unique curve.
The Mobile 6.2 computer model assumes that no one can drive above the speed limit. However, many drivers drive at speeds higher than the posted limit.

Consequently, it was not possible to model reductions from 75 mph to 65 mph, nor from 70 mph to 60 mph.

However, the charts on the previous pages show that NOx reductions from HDDV would be achieved by enforcing existing speed limits.

**Funding:** This option does not qualify for NOACA funding.
II. Mobile Source Program Recommendations

4. State Legislative Authority for All Counties, Through Their County Auditors, to Verify Gasoline Content at the Point of Sale

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Planning Advisory Committee that all counties be granted the authority that Summit County now has to test gasoline specifications at the pump.

Background: Summit County is the only county in Ohio, by virtue of its state constitutional authority, that performs testing of gasoline at the pumps to see whether the gasoline sold meets the specifications that it purports to meet.

The purpose behind such testing is to check for high-sulfur gasoline that could foul engines, disable air pollution controls, and result in increased particulate matter emissions.

Testing gasoline specifications would also be useful for verifying that any low-RVP gasoline sold during the summer months actually met the psi rating that was required.

Funding: The potential for CMAQ funding to support a pilot program will be investigated.
II. Mobile Source Program Recommendations

5. Federal And State Retrofit Technology Funding Legislation

**Recommendation:** The NOACA EAC Air Quality Subcommittee, in endorsing the diesel retrofit technologies discussed later in this report, also endorsed the seeking of funding for those technologies.

**Background:** Funding the purchase and installation of diesel retrofit technologies would provide an incentive to local governments, private fleet owners, and other interested parties to implement the retrofits of diesel engines in order to reduce their emissions of both NOx and fine particulate matter.

**Funding:** Congestion Mitigation and Air Quality (CMAQ) funds are available for such diesel retrofits, as specifically outlined in SAFETEA-LU, the federal Transportation Bill of 2005.

In addition, funding may become available under the federal Diesel Emission Retrofit Act (DERA) through continued action by Congress.

Finally, state funding is also a possibility.
III. Mobile Source Project Recommendations

1. Truck Stop / Rest Area Electrification

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that truck stops in Northeast Ohio be provided with electrical hook-ups for drivers as an incentive to turn off diesel engines, thereby reducing NOx emissions from overnight idling.

The Subcommittee expanded on the recommendation by endorsing rest area electrification on the Ohio Turnpike and other highways under the jurisdiction of the Ohio Department of Transportation.

Background: Supplying equipment at truck stops so that truckers could turn off their diesel engines while still having power, light, heat, air conditioning, and other services would result in large NOx reductions.

The 3 truck stops in the Northeast Ohio nonattainment area are:

- United Truck Stop, 3950 Broadway Ave., Cleveland, Ohio (I-77 Exit 161A).
- Pilot Travel Center #013, 8924 Lake Rd., Seville, Ohio (I-71 Exit 209)
- TA-Lodi, 8834 Lake Rd., Seville, Ohio (I-71 Exit 209)

The two truck stops on I-71 are significantly larger than the truck stop in Cleveland. Electrification services are provided in other states by the IdleAire Technologies Corporation. IdleAire has proposed an installation of 70 Advanced Truckstop Electrification (ATE) spaces at the Travel Centers of America #15 – Lodi, and 70 ATE spaces at the Pilot #13 – Seville. If the Cleveland truck stop were also included, it would receive 50 spaces.

Option MO-20
Air Impact: The data for electrifying all three truck stops in the Northeast Ohio nonattainment area, according to IdleAire, are:

0.02 tpd VOCs reduced
0.38 tpd NOx reduced
0.01 tpd PM reduced
0.16 tpd CO reduced
26.33 tpd CO2 reduced

Cost: The cost to electrify all three truck stops, using “IdleAire” commercial technology, would be $3,273,200.

At today’s diesel prices, the current hourly charge for IdleAire services of $1.60 would generate $1.35 of savings per hour of use for the trucker renting the electric services.
Cost per ton of VOC removed, assuming a useful life of 10 years:
$3,273,200 divided by 10 years divided by 365 days per year divided by 0.02 = $44,838

Cost per ton of NOx removed, assuming a useful life of 10 years:
$3,273,200 divided by 10 years divided by 365 days per year divided by 0.38 = $2,359

Funding: In addition to private funding by owners of the truck stops, there is potential for state and local CMAQ funding. In addition, the State of Ohio awarded a total of $400,000 in 2006 for truckstop electrification, through a federal grant from USEPA.
III. Mobile Source Project Recommendations

2. ODOT’s Intelligent Transportation Systems

**Recommendation:** The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that the Intelligent Transportation Systems contained in the NOACA and AMATS TIPs for the Cleveland area and the Akron area be included in the SIP for Northeast Ohio.

**Background:** The Ohio Department of Transportation has already begun to implement two Intelligent Transportation Systems (ITS) that will watch for traffic congestion via vehicle counters and convey that information to motorists via electronic signage and radio.

One system (ODOT Cleveland Freeway Management System) will cover freeways in Cuyahoga County with extensions into surrounding counties. The other system (ODOT Akron-Canton Freeway Management System) will cover portions of Portage, Stark, and Summit Counties.

An “intelligent transportation system” uses freeway cameras or vehicle counters to view traffic continuously, allowing monitoring of congestion, accidents, and other situations affecting the free flow of traffic. The information is transmitted to a central base from which alternative routes can be calculated. The alternative suggestions are then published via electronic freeway signs, radio, computer websites, and other methods designed to reach motorists in real-time.

**Option MO-16 Cleveland Freeway Management System**
As conceived, the Cleveland Freeway Management System will perform the following functions:

- Remotely monitor freeway traffic flow
- Receive notification of freeway crashes
- Distribute information in real time to multiple, local, public safety agencies
- Manage traffic, via the operation of permanent highway dynamic message signs, and possibly via coordination with local traffic signal systems
- Provide future, web-based, traveler information services

To perform these functions, the freeway management system will use the following subsystems and components:

- Gigabit-ethernet communications topology, carried over a hybrid media that includes dedicated fiber optic, wireless, and leased telecommunications services
- Closed circuit television cameras
- Speed and volume detection (non-intrusive)
- Incident detection via interface with local public safety dispatch center(s)
- Dynamic message sign subsystem
- Highway advisory radio
- Control center, with distributed capabilities for operating the system from one or more remote locations
The preliminary engineering plans produced the following estimate of devices and geographical coverage:

- 27 dynamic message signs
- 98 closed circuit television cameras
- 60 vehicle detection stations (traffic flow)
- 2 highway advisory radios
- approximately 273 centerline miles of coverage on I-71, I-76, I-77, I-80, I-90, I-271, I-480, SR 8, and SR 176

The Cleveland Freeway Management System is currently committed for funding in the NOACA Transportation Improvement Program (TIP) for SFYs 2006-2009.

### Option MO-16
**Air Impacts:** According to ODOT's estimations, the impacts are as follows, assuming that traffic congested at 15 mph is relieved and allowed to regain speeds of 55 mph:

<table>
<thead>
<tr>
<th>Year</th>
<th>HC</th>
<th>NOX</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>-0.867</td>
<td>0.344</td>
<td>-0.0014</td>
</tr>
<tr>
<td>2006</td>
<td>-0.788</td>
<td>0.276</td>
<td>-0.0011</td>
</tr>
<tr>
<td>2007</td>
<td>-0.708</td>
<td>0.208</td>
<td>-0.0009</td>
</tr>
<tr>
<td>2008</td>
<td>-0.629</td>
<td>0.139</td>
<td>-0.0006</td>
</tr>
<tr>
<td>2009</td>
<td>-0.549</td>
<td>0.071</td>
<td>-0.0003</td>
</tr>
<tr>
<td>2010</td>
<td>-0.470</td>
<td>0.003</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

The above figures represent the net change in daily emissions due to operational improvements in the freeway system.

In the year 2009, as the chart shows, changes are:

**0.549 tpd VOCs reduced**
**0.071 tpd NOx increased**

The VOC reduction results from gasoline-powered cars moving faster, which is more efficient for their engines. (See charts in "Speed Limit" sections of the Report.)

The NOx increases as a result of diesel-powered trucks moving faster, which moves them past their optimum fuel-burning speed. More diesel is required to move the load as speed increases.

**Cost:** $28,050,000

**Cost per ton of VOC removed:** $23,330, when spread over the 6 years
Option MO-17  
**Akron-Canton Freeway Management System**
The Akron-Canton Freeway Management System is currently committed for funding in the AMATS TIP for 2006-2009. The system will focus on I-76, I-77, and SR 8.

Option MO-17  
**Air Impact:**
ODOT has estimated the air pollution impacts as follows:

<table>
<thead>
<tr>
<th>Summit</th>
<th>Tons/Day Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>HC</td>
</tr>
<tr>
<td>2005</td>
<td>-0.312</td>
</tr>
<tr>
<td>2006</td>
<td>-0.284</td>
</tr>
<tr>
<td>2007</td>
<td>-0.255</td>
</tr>
<tr>
<td>2008</td>
<td>-0.227</td>
</tr>
<tr>
<td>2009</td>
<td>-0.198</td>
</tr>
<tr>
<td>2010</td>
<td>-0.169</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Portage</th>
<th>Tons/Day Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>HC</td>
</tr>
<tr>
<td>2005</td>
<td>-0.021</td>
</tr>
<tr>
<td>2006</td>
<td>-0.019</td>
</tr>
<tr>
<td>2007</td>
<td>-0.017</td>
</tr>
<tr>
<td>2008</td>
<td>-0.015</td>
</tr>
<tr>
<td>2009</td>
<td>-0.013</td>
</tr>
<tr>
<td>2010</td>
<td>-0.012</td>
</tr>
</tbody>
</table>

The above figures represent the net change in daily emissions due to operational improvements in the freeway system.

In the year 2009, as the chart shows, changes are:

- **0.211 tpd VOC's reduced**
- **0.093 tpd NOx increased**

The VOC reduction results from gasoline-powered cars moving faster, which is more efficient for their engines. (See charts in "Speed Limit" sections of the Report.)

The NOx increases as a result of diesel-powered trucks moving faster, which moves them past their optimum fuel-burning speed. More diesel is required to move the load as speed increases.

**Cost:** $14,400,000

**Cost per ton of VOC removed:** $31,162 when spread over the 6 years

**Funding:** The two ITS systems are already programmed and funded.
III. Mobile Source Project Recommendations

3. Bus Replacement Programs

**Recommendation:** The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that bus improvements, replacements, and retirements, as contained in the NOACA and AMATS TIPs, be submitted for inclusion in the SIP. The Subcommittee also endorsed the recommendation that such replacements and retirements be accelerated if and where feasible.

**Background:** Bus replacements allow older, higher-polluting buses to be retired, with newer, cleaner buses coming into use, some of which might use alternative fuels.

The Subcommittee is aware of the following bus replacements:

The City of Cleveland Municipal School District retired 270 of its oldest buses after the 2002 baseline year. The buses were scrapped or sold out of the area.

Using the replacement figures found below, it is estimated that the retirement of these 270 school buses resulted in:

0 tpd VOCs reduced, 0.468 tpd NOx reduced

**Option MO-15  Bus Replacements**

**Air Impact and cost:**

Many bus replacements are already underway, and more could be undertaken. Below are some of the planned replacements programmed in the NOACA and AMATS TIPs:

<table>
<thead>
<tr>
<th>Replacement</th>
<th>Cost</th>
<th>VOCs Reduced</th>
<th>NOx Reduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laketran - 8 replacement buses</td>
<td>$3,600,000</td>
<td>0 tpd VOCs reduced</td>
<td>0.013 tpd NOx reduced</td>
</tr>
<tr>
<td>Laketran - 18 para-transit vans</td>
<td>$1,440,000</td>
<td>0 tpd VOCs reduced</td>
<td>0.007 tpd NOx reduced</td>
</tr>
<tr>
<td>Laketran - 18 para-transit vans</td>
<td>$1,483,200</td>
<td>0 tpd VOCs reduced</td>
<td>0.009 tpd NOx reduced</td>
</tr>
<tr>
<td>Laketran - Replace 12 bus engines</td>
<td>$120,000</td>
<td>0 tpd VOCs reduced</td>
<td>0.012 tpd NOx reduced</td>
</tr>
<tr>
<td>Laketran - Replace 14 bus engines</td>
<td>$210,000</td>
<td>0 tpd VOCs reduced</td>
<td>0.005 tpd NOx reduced</td>
</tr>
<tr>
<td>GCRTA - 15 replacement buses</td>
<td>$3,600,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 tpd VOCs reduced</td>
<td>0.026 tpd NOx reduced</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The AMATS TIP reveals the following:
Metro RTA Bus Replacements FY 2005 - Clean Diesel - 8 buses
0.001 tpd VOCs reduced 0.009 tpd NOx reduced

Total from known bus replacements and retirements show:

| 0.001 tpd VOCs reduced | 0.52 tpd NOx reduced |

Total costs, without knowing the AMATS portion, are: $10,453,000

For cost per ton of NOx removed per day:
Assume a useful life of 10 years for each new bus
$10,453,000 divided by 10 years divided by 365 days per year = $2,863 divided by 0.52 tons per day of NOx removed = **$5,507 per ton of NOx removed**

**Funding:** There is potential for CMAQ funding. Also, the federal Transportation Act of 2005, SAFETEA-LU, establishes an alternative fuel bus replacement program that will award grants prior to 2009. Therefore, other replacements, as yet unknown, may take place before the attainment deadline of 2010.
III. Mobile Source Project Recommendations

4. Transit Incentives

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that transit incentives (free rides) be offered to the public on declared high air pollution days, in order to increase ridership.

Background: Some areas of the United States have had success in increasing mass transit ridership on high air pollution days by offering free travel on buses and trains on those days.

If free transit were offered by all transit authorities in the 8-county nonattainment area on high air pollution days, ridership might increase. However, a previous effort by the Greater Cleveland Regional Transit Authority did not experience any increase.

Laketran previously offered "Dime-A-Ride" all summer long to all transit riders along 6 fixed routes and, in 2006, raised this summer bargain fare to 50 cents, in response to rising fuel costs.

Increases in ridership throughout Northeast Ohio occurred in 2005. Ridership increases are as shown below, in accordance with an informal NOACA survey:

<table>
<thead>
<tr>
<th>Transit Authority</th>
<th>2004</th>
<th>2005</th>
<th>Increase</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater Cleveland Regional Transit Authority (GCRTA)</td>
<td>55,465,000</td>
<td>57,097,000</td>
<td>1,632,000</td>
<td>2.9%</td>
</tr>
<tr>
<td>Laketran</td>
<td>1,018,776</td>
<td>1,070,754</td>
<td>51,978</td>
<td>5.1%</td>
</tr>
<tr>
<td>Lorain County Transit (LCT)</td>
<td>812,571</td>
<td>855,087</td>
<td>42,516</td>
<td>5.2%</td>
</tr>
<tr>
<td>Geauga</td>
<td>69,101</td>
<td>71,428</td>
<td>2,327</td>
<td>3.4%</td>
</tr>
<tr>
<td>Medina County Para-Transit (MCPT)</td>
<td>116,054</td>
<td>117,898</td>
<td>1,844</td>
<td>1.6%</td>
</tr>
<tr>
<td>Brunswick Transit Alternative (BTA)</td>
<td>20,267</td>
<td>25,213</td>
<td>4,946</td>
<td>24.4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------</td>
<td>--------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metro Regional Transit Authority</td>
<td>5,778,658</td>
<td>(-244,383)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-4.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portage Area Regional Transit Authority (PARTA)</td>
<td>959,595</td>
<td>1,253,418</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(PARTA absorbed the Kent State system)</td>
<td></td>
<td>293,823</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30.6%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Option MO-33**

**Air Impact:**
To estimate the potential air pollution benefit from such an incentive on a high air pollution day, as declared by NOACA through its Ozone Action Day Program (OAD) or Fine Particle Pollution Program (FP3):

Assume 500 new riders choose to ride transit
Assume they would otherwise drive single-occupancy cars (LDGV) 10 miles round-trip
Elimination of 5,000 vehicle miles traveled (VMTs) for one day shows:

- **0.003 tpd VOC reduction**
- **0.002 tpd NOx reduction**

**Cost:** Costs to all transit agencies have not yet been calculated, although GCRTA estimates that it would sustain a $40,000 loss on each day on which fares were not collected.

**Funding:** There is potential for CMAQ funding, although certain aspects would have to be explored so that the funding is targeted to gaining new riders.
III. Mobile Source Project Recommendations

5. Transit Centers, Park-&-Ride Lot Expansions, and Enhanced Waiting Environments

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that transit centers be created and expanded to encourage transit usage, that Park-&-Ride lots be expanded and created to allow greater commuter use, and that transit waiting environments be enhanced and made more physically attractive and useful.

Background: Transit centers, Park-&-Ride lot enhancements, and improvements to transit waiting environments may provide air pollution reductions by encouraging greater use of mass transit.

Option MO-22 Transit Centers

Air Impact:
The NOACA Transportation Improvement Program (TIP) shows the following:
W. 3rd St. Transit Center
0.45 tpd VOCs reduced
0.33 tpd NOx reduced

Cost: $5,020,000

Cost per ton of VOC removed:
Assume a useful life of 10 years
$5,020,000 divided by 10 years divided by 365 days per year divided by 0.45 = $3,056

Cost per ton of NOx removed:
Assume a useful life of 10 years
$5,020,000 divided by 10 years divided by 365 days per year divided by 0.45 = $4,167

There is also an Eastside Transit Center under consideration by Greater Cleveland RTA.

Option MO-23 Park & Ride Lot Enhancements

"Park & Ride" lots are parking lots where commuters leave their cars for the day in order to take mass transit to their place of employment. Enhancements generally include expansion of parking space and may also include shelters and other items for commuter use.
**Air Impact:**  
The NOACA TIP shows the following:

<table>
<thead>
<tr>
<th>Project Description</th>
<th>VOCs Reduced</th>
<th>NOx Reduced</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laketran Eastlake Stadium Commuter Service</td>
<td>0.009 tpd</td>
<td>0.003 tpd</td>
<td>$250,000</td>
</tr>
<tr>
<td>Laketran MDT/AVI System</td>
<td>0.004 tpd</td>
<td>0.014 tpd</td>
<td>$3,500,000</td>
</tr>
<tr>
<td>Laketran Market Street Park-n-Ride Lot expansion</td>
<td>0.006 tpd</td>
<td>0.007 tpd</td>
<td>$100,000</td>
</tr>
<tr>
<td>GCRTA North Olmsted Park-n-Ride Lot</td>
<td>0.005 tpd</td>
<td>0.003 tpd</td>
<td>$1,325,000</td>
</tr>
<tr>
<td>GCRTA Strongsville Park-n-Ride Lot</td>
<td>0.008 tpd</td>
<td>0.005 tpd</td>
<td>$620,000</td>
</tr>
<tr>
<td>GCRTA Westlake Park-n-Ride Lot</td>
<td>0.008 tpd</td>
<td>0.005 tpd</td>
<td>$2,130,000</td>
</tr>
</tbody>
</table>

**Totals for these projects are:**  
0.04 tpd VOCs reduced  
0.037 tpd NOx reduced  
$7,925,000

**Cost per ton of VOC removed:**  
Assume a useful life of 10 years  
$7,925,000 divided by 10 years divided by 365 days per year divided by 0.04 = $54,280

**Cost per ton of NOx removed:**  
Assume a useful life of 10 years  
$7,925,000 divided by 10 years divided by 365 days per year divided by 0.037 = $58,681

**Option MO-24 Transit Waiting Environments**  
Improvements to transit waiting environments can include any or all of the following:

- Larger bus/train shelters
- Shelters with heat and light
- Maps of bus routes
- Electronic signs indicating number of minutes until next bus arrival
• Security cameras
• Emergency telephones
• Landscaping, including flowers, trees, benches, trash cans, and street lights
• Public art
• Shower facilities
• Bicycle facilities

Air Impact: The Subcommittee found that, although enhanced transit waiting environments would almost certainly increase bus/train ridership, the reduction in air pollution directly associated with such improvements would be difficult to quantify for SIP purposes.

However, as an example, increasing mass transit ridership by 500 commuters who would otherwise drive would produce the following air pollution reductions:

Assume 500 new riders across the nonattainment area
Assume no new buses/trains needed
Assume the new riders would otherwise drive single-occupancy cars (LDGV) 10 miles round-trip
Elimination of 5,000 vehicle miles traveled (VMTs) for one day shows:

0.003 tpd VOC reduction
0.002 tpd NOx reduction

Cost: The cost of improving existing transit waiting environments, or building new ones, varies with the scope of the project. In the Northeast Ohio nonattainment area, thousands of bus stops exist, any of which might become candidates for bus shelters or improved bus shelters.

Funding: These measures have potential for CMAQ funding.
III. Mobile Source Project Recommendations

6. Traffic Signal Synchronizations

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that traffic signal synchronizations, as contained in the NOACA and AMATS TIPs, be submitted for inclusion in the SIP. The Subcommittee also endorsed the recommendation that further traffic signal synchronizations be funded and encouraged, where such projects would result in air pollution reductions, as indicated after study by NOACA and AMATS.

Background: Traffic signal synchronization projects reduce air pollution by reducing the amount of time that vehicles have to wait for a light to change. Similarly, railroad grade separation projects, which prevent railroad tracks from crossing roads, reduce wait time while a train passes. However, the rail separations studied did not show measurable reductions.

The data for traffic signal synchronization projects in the NOACA 5 counties (Cuyahoga, Geauga, Lake, Lorain, and Medina), the AMATS 2 counties (Portage and Summit), and the ODOT 1 county (Ashtabula) are as follows, as shown by the respective Transportation Improvement Programs (TIPs) for those areas for SFY 2006-2009.

Option MO-21 Traffic signal synchronizations

Air Impact:
Decimal places have not been carried out beyond 3 places, leaving some minimal reductions listed as "0".

Costs include entire projects, which often involve road construction, not just signal synchronizations and interconnects:

<table>
<thead>
<tr>
<th>AMATS</th>
<th>VOC reduction</th>
<th>NOx reduction</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steels Corners</td>
<td>0.010 tpd</td>
<td>0.004 tpd</td>
<td>$2,430,000</td>
</tr>
<tr>
<td>Tallmadge, Howard</td>
<td>0.005 tpd</td>
<td>0.003 tpd</td>
<td>$530,000</td>
</tr>
<tr>
<td>Highland Rd turn lanes</td>
<td>0.003 tpd</td>
<td>0.001 tpd</td>
<td>$1,440,000</td>
</tr>
<tr>
<td>W. Market and Pershing</td>
<td>0.007 tpd</td>
<td>0.004 tpd</td>
<td>$2,784,000</td>
</tr>
<tr>
<td>W. Market and Hawkins</td>
<td>0.017 tpd</td>
<td>0.007 tpd</td>
<td>$2,927,000</td>
</tr>
<tr>
<td>E. Market and Summit</td>
<td>0.004 tpd</td>
<td>0.003 tpd</td>
<td>$656,000</td>
</tr>
<tr>
<td>E. Market and Martha</td>
<td>0.002 tpd</td>
<td>0.001 tpd</td>
<td>$4,500,000</td>
</tr>
<tr>
<td>Canton and Tripplet</td>
<td>0.006 tpd</td>
<td>0.003 tpd</td>
<td>$720,000</td>
</tr>
<tr>
<td>SR 241 at Greensburg</td>
<td>0</td>
<td>0</td>
<td>$878,000</td>
</tr>
<tr>
<td>SR 241 at Steese</td>
<td>0.002 tpd</td>
<td>0.004 tpd</td>
<td>$640,000</td>
</tr>
<tr>
<td>Tallmadge, Home</td>
<td>0.008 tpd</td>
<td>0.001 tpd</td>
<td>$378,000</td>
</tr>
<tr>
<td>Arlington, Waterloo</td>
<td>0.011 tpd</td>
<td>0.001 tpd</td>
<td></td>
</tr>
<tr>
<td>Darrow, N. River Rd</td>
<td>0.010 tpd</td>
<td>0.003 tpd</td>
<td></td>
</tr>
</tbody>
</table>
NOACA Traffic Signal Synchronization Projects
Olmsted Falls $ 955,000
Parma $ 6,175,000
Parma $ 4,046,000
Beachwood, Highland Hills, Orange, Woodmere $ 1,122,000

Because the NOACA-funded projects' air pollution reductions were not quantified in the TIP, all NOACA traffic signal synchronizations are presumed to have air pollution reductions of 0.010 tpd reductions for VOCs and 0.001 tpd reductions for NOx for purposes of this summary. This presumption is based on the averages achieved by AMATS-funded projects.

0.040 tpd  
0.004 tpd

Total NOACA and AMATS: 0.125 tpd VOC 0.038 NOx $ 30,181,000

Costs per ton of pollutant removed, assuming (by default) that all the funds listed are necessary to the portion of the project that deals with air emissions, are as follows:

Assume a useful life of 10 years
$30,181,000 divided by 10 divided by 365 days per year divided by 0.125 = $66,150 per ton of VOC removed

$30,181,000 divided by 10 divided by 365 days per year divided by 0.038 = $217,599 per ton of NOx removed

The projects are also valuable for other reasons, such as traffic flow and safety. Their primary purposes are not to reduce air pollution.

Funding: These projects have potential for CMAQ funding.
III. Mobile Source Project Recommendations

7. NOx Retrofits and Replacements for Diesel Vehicles, plus Education and Outreach Programs

**Recommendation:** The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that retrofits and replacements be encouraged for existing onroad and nonroad diesel engines, all of which emit NOx.

**Funding:** The Subcommittee noted that the federal transportation bill, SAFETEA-LU, enacted in 2005, sets diesel retrofits as priorities for funding under CMAQ.

**Option MO-8 On-Road Diesel Engine or Vehicle Replacement**
(Source of data: "Evaluation of Candidate Mobile Source Control Measures" by Environ for the Lake Michigan Air Directors' Consortium (LADCO) Feb. 28, 2006.)

Replacing diesel engines or vehicles, that still have many years of useful life remaining, with newer, cleaner engines or vehicles brings about substantial air pollution reductions. The replacement engines can be either new or remanufactured to meet newer USEPA specifications.

Environ notes that Heavy Duty Diesel Vehicles (HDDV) Class 8, which are the largest and heaviest, are the largest NOx contributors to the on-road NOx inventory for the midwestern states. Replacing HDDV8's create varying levels of air pollution reduction, depending on the model year of the truck replaced.

<table>
<thead>
<tr>
<th>Option MO-8</th>
<th>Air Impact:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assume one Heavy Duty Diesel Vehicle (HDDV)</td>
<td></td>
</tr>
<tr>
<td>Assume MY 1989 or earlier replaced with a MY 2002-2004 engine</td>
<td></td>
</tr>
<tr>
<td>Assume a useful life of 8 years</td>
<td></td>
</tr>
<tr>
<td>NOx reduction in tons/year: 1.45 tpy</td>
<td></td>
</tr>
<tr>
<td><strong>NOx reduction in tons/day</strong> = 0.004 tpd</td>
<td></td>
</tr>
<tr>
<td><strong>Cost for one truck engine:</strong> $45,000</td>
<td></td>
</tr>
<tr>
<td><strong>Cost per ton of NOx removed:</strong> $4,423</td>
<td></td>
</tr>
</tbody>
</table>

For purposes of this Report, assume that a fleet of 100 trucks in Northeast Ohio were replaced with newer engines:

100 trucks x 0.004 tpd = 0.4 tons per day NOx reduced

**Cost for 100 truck engines:** $4,500,000
Option MO-9 On-Road Heavy Duty Diesel Vehicle (HDDV) Accelerated Low-NOx Rebuild/Chip Reflashing
(Source of data: "Evaluation of Candidate Mobile Source Control Measures" by Environ for the Lake Michigan Air Directors' Consortium (LADCO) Feb. 28, 2006.)

Some HDDVs have ignition cycles that allow additional NOx emissions during "off-cycle" steady-state driving. Software programs to modify the truck's computer chips are available to change the ignition timing sufficiently to reduce the NOx emissions by an average of 23%. Fuel consumption is increased by approximately 2%, according to Environ.

<table>
<thead>
<tr>
<th>Option MO-9</th>
<th>Air Impact:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assume one Heavy Duty Diesel Vehicle (HDDV)</td>
<td></td>
</tr>
<tr>
<td>Assume MY 1993-1998</td>
<td></td>
</tr>
<tr>
<td>Assume a useful life of 8 years</td>
<td></td>
</tr>
<tr>
<td>NOx reduction in tons/year: 0.22 tpy</td>
<td></td>
</tr>
</tbody>
</table>

\[
\text{NOx reduction in tons/day} = 0.0006 \text{ tpd}
\]

Cost for one truck: Free software pursuant to California consent decree
Additional fuel = $398

Cost per ton of NOx removed: $1,842 including fuel cost

For purposes of this Report, assume that a fleet of 100 trucks in Northeast Ohio were retrofitted:

\[
100 \text{ trucks} \times 0.0006 \text{ tpd} = 0.06 \text{ tons per day NOx reduced}
\]

Cost for 100 trucks: $39,800 in fuel

Option MO-10 NOx Retrofits for Diesel Vehicles: Lean-NOx Catalysts
(Source of data: "Evaluation of Candidate Mobile Source Control Measures" by Environ for the Lake Michigan Air Directors' Consortium (LADCO) Feb. 28, 2006.)

Environ studied 3 types of NOx retrofits for diesel vehicles:

1.) Lean-NOx Catalysts - 40% control efficiency
2.) Exhaust Gas Recirculation (EGR) + Diesel Particulate Filters (DPF)
3.) Selective Catalytic Reduction (SCR)

Retrofitting diesel vehicles with a lean-NOx catalyst for Model Years 1989 and earlier shows the greatest NOx reductions, according to LADCO's subcontractor Environ. A Lonestar catalyst was used for Environ's study:
Option MO-10

Air Impact:
Assume one Heavy Duty Diesel Vehicle (HDDV)
Assume MY 1989 or earlier
NOx grams/mile without a lean-NOx catalyst: 33.24 g/mi.
NOx grams/mile with a lean-NOx catalyst: 14.96
Assume a useful life of 8 years
NOx reduction in tons/year: 0.55 tpy

\[ \text{NOx reduction in tons/day} = 0.0015 \text{ tpd} \]

Cost for one truck: $20,000 (capital cost) plus additional fuel for 8 years

Cost per ton of NOx removed: $5,905

For purposes of this Report, assume that a fleet of 100 trucks in Northeast Ohio were retrofitted:

\[ 100 \text{ trucks} \times 0.0015 \text{ tpd} = 0.15 \text{ tons per day NOx reduced} \]

Cost for 100 trucks: $2,000,000 (capital cost) plus additional fuel for 8 years

According to Environ, 23,247 such trucks are available throughout Ohio. Northeast Ohio represents 26% of all Ohio, by population, so it is possible that 26% of these trucks, or 6,044, may be available for retrofit.

Option MO-11  NOx Retrofits for Diesel Vehicles: Exhaust Gas Recirculation (EGR) + Diesel Particulate Filters (DPF)

(Source of data: "Evaluation of Candidate Mobile Source Control Measures" by Environ for the Lake Michigan Air Directors' Consortium (LADCO) Feb. 28, 2006.)

Environ studied 3 types of NOx retrofits for diesel vehicles:
1.) Lean-NOx Catalysts - 40% control efficiency
2.) Exhaust Gas Recirculation (EGR) + Diesel Particulate Filters (DPF)
3.) Selective Catalytic Reduction (SCR)

Retrofitting diesel vehicles with equipment for exhaust gas recirculation plus a diesel particulate filter results in emissions reductions, depending on the age of the vehicle and its weight. As much as 50% control efficiency can be achieved.
Option MO-11

Air Impact:
Assume one Heavy Duty Diesel Vehicle (HDDV)
Assume MY 1989 or earlier
Assume a useful life of 8 years
NOx reduction in tons/year: 0.55 tpy

\[
\text{NOx reduction in tons/day} = \frac{0.55}{365} \approx 0.0015 \text{ tpd}
\]

Cost for one truck: $23,000

Cost per ton of NOx removed: $5,970

For purposes of this Report, assume that a fleet of 100 trucks in Northeast Ohio were retrofitted:

\[
100 \text{ trucks} \times 0.0015 \text{ tpd} = 0.15 \text{ tons per day NOx reduced}
\]

Cost for 100 trucks: $2,300,000

According to Environ, 23,247 such trucks are available throughout Ohio. Northeast Ohio represents 26% of all Ohio, by population, so it is possible that 26% of these trucks, or 6,044, may be available for retrofit.

Option MO-12

NOx Retrofits for Diesel Vehicles: Selective Catalytic Reduction (SCR)
(Source of data: "Evaluation of Candidate Mobile Source Control Measures" by Environ for the Lake Michigan Air Directors' Consortium (LADCO) Feb. 28, 2006.)

Environ studied 3 types of NOx retrofits for diesel vehicles:
1.) Lean-NOx Catalysts - 40% control efficiency
2.) Exhaust Gas Recirculation (EGR) + Diesel Particulate Filters (DPF)
3.) Selective Catalytic Reduction (SCR)

Retrofitting diesel vehicles with selective catalytic reduction (SCR) technology produces emissions reductions depending on the age of the truck and the weight. The control efficiency can range from 70-99%.
Option MO-12

Air Impact:
Assume one Heavy Duty Diesel Vehicle (HDDV)
Assume MY 1989 or earlier
Assume a useful life of 8 years
NOx reduction in tons/year: 1.37 tpy
NOx reduction in tons/day = 0.004 tpd

Cost for one truck: $27,500 (capital cost)

Cost per ton of NOx removed: $3,139

For purposes of this Report, assume that a fleet of 100 trucks in Northeast Ohio were retrofitted:

100 trucks x 0.004 tpd = 0.4 tons per day NOx reduced

Cost for 100 trucks: $2,750,000

According to Environ, 23,247 such trucks are available throughout Ohio. Northeast Ohio represents 26% of all Ohio, by population, so it is possible that 26% of these trucks, or 6,044, may be available for retrofit.
Options AR-9, AR-9, AR-10, AR-11  Diesel Retrofits for Diesel Construction

Equipment (Tractors/Loaders/Backhoes)
(Source: "Evaluation of Candidate Mobile Source Control Measures" by Environ for the Lake Michigan Air Directors' Consortium (LADCO) Feb. 28, 2006.)

Option AR-8  
**Construction Equipment - Lean-NOx Retrofits**
Retrofitting diesel construction equipment such as tractors, loaders, and backhoes, with a lean-NOx catalyst for Tier 0, Tier 1, Tier 2, and Tier 3 show varying levels of NOx reductions, according to LADCO's subcontractor Environ. A Lonestar catalyst was used for Environ's study. An example follows, using the oldest and dirtiest engines, which would be Tier 0:

<table>
<thead>
<tr>
<th>Option AR-8</th>
<th>Air Impact:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assume one tractor, loader, or backhoe in Tier 0, 175-300 hp</td>
</tr>
<tr>
<td></td>
<td>Assume a useful life of 10 years</td>
</tr>
<tr>
<td></td>
<td>NOx reduction in tons/year: 0.28 tpy</td>
</tr>
<tr>
<td></td>
<td>NOx reduction in tons/day = 0.0007 tpd</td>
</tr>
<tr>
<td></td>
<td>Assume that a fleet of 100 construction equipment vehicles in Tier 0, 175-300 hp in Northeast Ohio were retrofitted:</td>
</tr>
<tr>
<td></td>
<td><strong>100 vehicles x 0.0007 tpd = 0.07 tons per day NOx reduced</strong></td>
</tr>
<tr>
<td>Cost for 100 vehicles:</td>
<td>$2,000,000 (capital cost) plus additional fuel for 10 years</td>
</tr>
<tr>
<td>Cost for one vehicle:</td>
<td>$20,000 (capital cost) plus additional fuel for 10 years</td>
</tr>
<tr>
<td>Cost per ton of NOx removed:</td>
<td>$10,542</td>
</tr>
</tbody>
</table>

Option AR-9  
**Construction Equipment - Exhaust Gas Recirculation (EGR) plus Diesel Particulate Filters (DPF)**
(Source of data: "Evaluation of Candidate Mobile Source Control Measures" by Environ for the Lake Michigan Air Directors' Consortium (LADCO) Feb. 28, 2006.)

Retrofitting with equipment for exhaust gas recirculation with a diesel particulate filter results in emission reductions. The reductions vary with the model of the equipment and the horsepower that it generates.
**Option AR-9**  
**Air Impact:**  
Assume one tractor, loader, or backhoe in Tier 0, 175-300 hp, retrofitted with EGR + DPF  
Assume a useful life of 10 years  
NOx reduction in tons/year: 0.21 tpy  
NOx reduction in tons/day = 0.0006 tpd  
Assume that a fleet of 100 construction equipment vehicles in Tier 0, 175-300 hp in Northeast Ohio were retrofitted:  
\[ 100 \text{ vehicles} \times 0.0006 \text{ tpd} = 0.06 \text{ tons per day NOx reduced} \]  
Cost: $2,300,000  
($23,000 (capital cost) plus additional fuel for 10 years)  
Cost per ton of NOx removed: $23,788

**Option AR-10**  
**Construction Equipment - Selective Catalytic Reduction (SCR)**  
(Source of data: "Evaluation of Candidate Mobile Source Control Measures" by Environ for the Lake Michigan Air Directors' Consortium (LADCO) Feb. 28, 2006.)

Retrofitting with equipment for selective catalytic reduction (SCR) results in emission reductions. The reductions vary with the model of the equipment and the horsepower that it generates.

**Option AR-10**  
**Air Impact:**  
Assume one tractor, loader, or backhoe in Tier 0, 175-300 hp, retrofitted with SCR  
Assume a useful life of 10 years  
NOx reduction in tons/year: 0.52 tpy  
NOx reduction in tons/day = 0.0014 tpd  
Assume that a fleet of 100 construction equipment vehicles in Tier 0, 175-300 hp in Northeast Ohio were retrofitted:  
\[ 100 \text{ vehicles} \times 0.0014 \text{ tpd} = 0.14 \text{ tons per day NOx reduced} \]  
Cost: $2,750,000  
($27,500 (capital cost) plus additional fuel for 10 years)  
Cost per ton of NOx removed: $7,788
Option AR-11  Construction Equipment - Replacing Older Engines with Newer Engines
(Source of data: "Evaluation of Candidate Mobile Source Control Measures" by Environ for the Lake Michigan Air Directors' Consortium (LADCO) Feb. 28, 2006.)

Replacing older engines, such as Tier 0 engines with uncontrolled emissions, with newer engines such as Tier 2 or Tier 3, results in emission reductions.

<table>
<thead>
<tr>
<th>Option AR-11</th>
<th>Air Impact:</th>
</tr>
</thead>
<tbody>
<tr>
<td>First example - For purposes of this Report:</td>
<td></td>
</tr>
<tr>
<td>Assume replacing 100 loaders or backhoes (100-175 hp) Tier 0 with Tier 2 engines</td>
<td></td>
</tr>
<tr>
<td>Useful life of 10 years</td>
<td></td>
</tr>
<tr>
<td>NOx reduction of 0.21 tons per year x 100 engines = 21 tons per year</td>
<td></td>
</tr>
<tr>
<td><strong>NOx reduction of 0.06 tons per day</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Cost:</strong> $1,375,000  ($13,750 per new engine)</td>
<td></td>
</tr>
<tr>
<td><strong>Cost per ton of NOx removed:</strong> $7,675</td>
<td></td>
</tr>
</tbody>
</table>

**Funding:** These projects have potential for CMAQ funding.

**Education and Outreach Programs:** Across the United States, the United States Environmental Protection Agency has been hosting diesel technology conferences in order to educate diesel fleet owners about new technologies that may be available to reduce air pollution.

The NOACA EAC Air Quality Subcommittee realized that local education and outreach programs would be necessary in order to help the new technologies penetrate the local market in Northeast Ohio.

Such programs could be conducted through NOACA or through its member cities, towns, and counties. Partnering with the USEPA would also be beneficial.

The Subcommittee stated that such programs should address both ozone formation and PM$_{2.5}$ formation, because NOx is a precursor to both pollutants.

NOACA has air quality programs, such as the Ozone Action Day Program and the Fine Particle Pollution Program, that could also be platforms for such outreach.
III. Mobile Source Project Recommendations

8. Replacement of Ground Support Vehicles at Cleveland-Hopkins International Airport

**Recommendation:** The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that ground support equipment (GSE) at Cleveland-Hopkins International Airport be replaced with electric vehicles, hydrogen vehicles, or vehicles run on compressed natural gas (CNG).

The Subcommittee also endorsed a recommendation that the City of Cleveland be encouraged to apply for funding under the federal Voluntary Airport Low Emission (VALE) program.

**Background:** There are an average of 8 GSEs that attend to each aircraft that takes off or lands at the Airport. Of the 300 GSEs at Cleveland-Hopkins, approximately 100 of them are municipally owned by the City of Cleveland. The remainder belong to individual airlines, who might also be encouraged to replace their GSEs with cleaner-running alternatives, such as electric, if an electric infrastructure were provided to all users.

**Option AR-2 Ground Support Equipment (GSE) Replacement with Electric, CNG, or Hydrogen**

According to USEPA, aircraft ground support equipment (GSE) represents one of three groups of mobile emission sources at airports. Together with aircraft and ground access vehicles, GSE contribute a small but significant share of VOCs, NOx, and particulate matter (PM) emitted in metropolitan statistical nonattainment areas. Total emissions from these three source categories comprise on the order of 2-3% of total manmade emissions in a typical metropolitan area, but this share is expected to increase as air travel continues to grow while emissions from other, non-airport sources are subject to increasingly stringent controls.

According to USEPA, ground access vehicles such as passenger cars and buses just entering and leaving airports often exceed airplanes as the dominant sources of air pollution at airports. Nationally, ground access vehicles emit 56% of VOCs, while aircraft taking off and landing give off only 32.6% (including emissions from Auxiliary power units (APUs). Ground access vehicles emit 39.3% of NOx, trailing closely behind emissions by aircraft and APUs of 46.3%. Ground service equipment is responsible for 10.9% of airport-generated VOCs and 14.3% of NOx nationally, according to the EPA.

Emission reduction options include:

- The replacement or conversion of gasoline or diesel powered GSE to LPG or CNG fueling
- The replacement or conversion of gasoline, diesel, LPG, or CNG powered GSE to electric power
- The replacement of mobile GSE with electrically powered fixed gate-based equipment
- The retrofit of existing GSE with catalytic converters or particulate traps
- The preferential replacement of existing two-stroke gasoline engines

Again, at Cleveland-Hopkins International Airport, approximately 300 ground support vehicles were reported to be in use. Some operate on gasoline and some on diesel. Approximately 100 are municipally owned and might be candidates for substitution with electric vehicles, CNG vehicles, or hydrogen vehicles, if a funding source such as CMAQ dollars or funds from the federal Voluntary Airport Low Emissions (VALE) program were identified. The City of Cleveland is not yet a VALE member but could apply to become one.

The VALE program also contains funding for the incremental cost of a "clean air" technology, over the cost of an ordinary diesel or gasoline-powered vehicle. It can fund gate electrification and other air quality improvements, including the electric infrastructure needed for charging electric GSEs.

Option AR-2

Air Impact:
Assume 100 ground support vehicles replaced with electric vehicles.
According to Ohio EPA emissions inventory (Appendix A), the VOC and NOx emissions are essentially zero when rounded off to 2 decimal places.
VOCs reduced - Negligible.
NOx reduced - Negligible.

Cost: Not yet estimated because the figure depends on the types of GSE to be replaced.

Funding: The municipally owned portions have potential for CMAQ funding. In addition, funding may be available to the City of Cleveland under the federal Voluntary Airport Low Emission (VALE) program.

The following USEPA charts show potential VOC (hydrocarbon) reductions, NOx reductions, and PM reductions associated with airport ground support equipment:
## TABLE 1. POTENTIAL HC REDUCTION STRATEGIES FOR AIRPORT GSE

<p>| GSE Type | Engine Type | Estimated U.S. Population | Fraction of All GSE | Fraction of Type Specific GSE | Estimated Fraction of All GSE HC | Convert to LPG Fueling | Convert to CNG Fueling | Replace with LPG Equipment | Replace with CNG Equipment | Replace with EV Equipment | Retrofit with Oxy Catalyst | Retrofit with PM Trap | Retrofit with 4-Str Gasoline Equipment |
|----------|-------------|---------------------------|---------------------|------------------------------|----------------------------------|-------------------------|-----------------------|--------------------------------|----------------------------|----------------------------|------------------------|-----------------------|---------------------------|-----------------------------------|
| Aircraft Pushback Tractor | Diesel | 2113 | 4.7% | 76.6% | 3.4% | n/a | n/a | up 135 | up 55 | 96 | 50 | 20 | n/a | n/a |
| | 2-st Gas | 0 | 0.0% | 0.0% | 0.0% | 50 | 65 | 50 | 65 | 99+ | 50 | 90 | n/a | n/a |
| | 4-st Gas | 489 | 1.1% | 17.2% | 2.2% | n/a | 35 | n/a | 35 | 98 | 70 | n/a | n/a | n/a |
| | CNG | 0 | 0.0% | 0.0% | 0.0% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | LPG | 63 | 0.1% | 2.3% | 0.1% | n/a | 35 | n/a | 35 | 98 | 70 | n/a | n/a | n/a |
| | Electric | 94 | 0.2% | 3.4% | 0.3% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | All | 2758 | 0.1% | 5.8% | 0.2% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Baggage Tug | Diesel | 4399 | 9.8% | 41.9% | 4.6% | n/a | n/a | up 105 | up 35 | 97 | 50 | 20 | 97 | n/a |
| | 2-st Gas | 0 | 0.0% | 0.0% | 0.0% | 50 | 65 | 50 | 65 | 99+ | 90 | n/a | n/a | n/a |
| | 4-st Gas | 4863 | 10.8% | 46.3% | 26.6% | n/a | 35 | n/a | 35 | 99 | 70 | 99 | n/a | n/a |
| | CNG | 0 | 0.0% | 0.0% | 0.0% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | LPG | 973 | 2.1% | 9.3% | 2.7% | n/a | 35 | n/a | 35 | 99 | 70 | n/a | 99 | n/a |
| | Electric | 220 | 0.5% | 2.6% | 0.5% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | All | 10505 | 23.3% | 33.8% | 11.3% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Belt Loader | Diesel | 2429 | 5.4% | 47.1% | 1.7% | n/a | n/a | up 45 | up 5 | 98 | 50 | 20 | 98 | n/a |
| | 2-st Gas | 0 | 0.0% | 0.0% | 0.0% | 50 | 65 | 50 | 65 | 99+ | 90 | n/a | 99+ | n/a |
| | 4-st Gas | 2317 | 5.1% | 48.0% | 6.4% | n/a | 35 | n/a | 35 | 99 | 70 | n/a | 99 | n/a |
| | CNG | 0 | 0.0% | 0.0% | 0.0% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | LPG | 314 | 0.7% | 6.1% | 0.4% | n/a | 35 | n/a | 35 | 99 | 70 | n/a | 99 | n/a |
| | Electric | 94 | 0.2% | 1.8% | 0.0% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | All | 3154 | 11.4% | 8.5% | 0.0% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Carts | Diesel | 31 | 0.1% | 1.4% | 0.0% | n/a | n/a | up 375 | up 215 | 98 | 50 | 20 | n/a | n/a |
| | 2-st Gas | 612 | 1.4% | 28.3% | 2.0% | 97 | 98 | 97 | 98 | 99+ | 80 | n/a | 94 | n/a |
| | 4-st Gas | 610 | 1.4% | 28.2% | 0.1% | 45 | 65 | 45 | 65 | 99+ | 90 | n/a | n/a | n/a |
| | CNG | 0 | 0.0% | 0.0% | 0.0% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | LP Gas | 0 | 0.0% | 0.0% | 0.0% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | Electric | 910 | 2.0% | 42.1% | 0.0% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | All | 2516 | 4.8% | 2.1% | 0.0% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Forklift | Diesel | 146 | 0.3% | 4.4% | 0.0% | n/a | n/a | up 105 | up 35 | 98 | 50 | 20 | n/a | n/a |
| | 2-st Gas | 0 | 0.0% | 0.0% | 0.0% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | 4-st Gas | 873 | 1.9% | 26.1% | 1.3% | 65 | 75 | 65 | 75 | 99+ | 90 | n/a | n/a | n/a |
| | CNG | 0 | 0.0% | 0.0% | 0.0% | n/a | 35 | n/a | 35 | 99 | 70 | n/a | n/a | n/a |
| | LPG | 1583 | 3.5% | 47.4% | 1.0% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | Electric | 737 | 1.6% | 22.1% | 0.0% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | All | 3319 | 7.4% | 7.8% | 0.2% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |</p>
<table>
<thead>
<tr>
<th>GSE Type</th>
<th>Engine Type</th>
<th>Estimated U.S. Population</th>
<th>Fraction of All GSE</th>
<th>Fraction of Type Specific GSE</th>
<th>Estimated Fraction of All GSE HC</th>
<th>Convert to LPG Fueling</th>
<th>Convert to CNG Fueling</th>
<th>Replace with LPG Equipment</th>
<th>Replace with CNG Equipment</th>
<th>Replace with EV Equipment</th>
<th>Retrofit with Oxy Catalyst</th>
<th>Retrofit with PM Trap</th>
<th>Replace^2 with Fixed &quot;At Gate&quot; Equipment</th>
<th>Replace^2 with 4-Str Gasoline Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Power Unit</td>
<td>Diesel</td>
<td>2394</td>
<td>5.6%</td>
<td>32.0%</td>
<td>3.3%</td>
<td>n/a</td>
<td>n/a</td>
<td>up 155</td>
<td>up 55</td>
<td>95</td>
<td>50</td>
<td>20</td>
<td>96</td>
<td>n/a</td>
</tr>
<tr>
<td>Ground Power Unit</td>
<td>2-str Gas</td>
<td>0</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Ground Power Unit</td>
<td>4-str Gas</td>
<td>94</td>
<td>0.2%</td>
<td>3.1%</td>
<td>0.7%</td>
<td></td>
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<tr>
<td>Ground Power Unit</td>
<td>CNG</td>
<td>0</td>
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1 Unscheduled and unqualified values signify emission reductions (in percent). Values preceded by the qualifier "up" signify emission increases (in percent).

2 Emission reductions due to replacement with EV equipment can vary with the emissions performance of local power generating stations. The tabulated values represent "typical" or "average" power generating station emission rates. For HC, the range of emissions variability across U.S. power generating stations is not dramatic and the tabulated emission reduction percentages will be affected by only a few percentage points regardless of local conditions.

3 In addition to the potential for direct replacement of some GSE services, fixed, gate-based systems such as electrical power and conditioned aircraft also potentially reduce aircraft auxiliary power unit (APU) emissions by 70-90 percent and emissions from (non-tabulated) GSE-based air conditioning service equipment by nearly 100 percent. Of the tabulated GSE, ground power unit (GPU) replacement is most feasible, with baggage tug and belt loader replacement quite difficult in retrofit applications.
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<th>GSE Type</th>
<th>Engine Type</th>
<th>Estimated U.S. Population</th>
<th>Fraction of All GSE</th>
<th>Fraction of Type Specific GSE</th>
<th>Estimated Fraction of All GSE NO</th>
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<th>Convert to CNG Fuelling</th>
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<th>Replace with CNG Equipment</th>
<th>Replace with EV Equipment</th>
<th>Retrofit with Oxy Catalyst</th>
<th>Retrofit with PM Trap</th>
<th>Replace with Fixed &quot;At Gate&quot; Equipment</th>
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TABLE 3. POTENTIAL NO\textsubscript{X} REDUCTION STRATEGIES FOR AIRPORT GSE
(Continued)

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<th>Retrofit with Oxy Catalyst</th>
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<td>75</td>
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<td>0.0%</td>
<td>0.0%</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>90</td>
<td>0</td>
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<td>90</td>
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</tr>
<tr>
<td></td>
<td>4-Str Gas</td>
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<td>3.1%</td>
<td>0.3%</td>
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<td>n/a</td>
<td>n/a</td>
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<tr>
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<td>21.3%</td>
<td>21.3%</td>
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<td>n/a</td>
<td>n/a</td>
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<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
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</table>

| Service Trucks    | Diesel      | 499                       | 0.9%                | 11.5%                         | 1.4%                             | n/a                    | n/a                   | 70                       | 70                         | 97                        | 0                            | 0                            | 97                            | n/a                            |
|                   | 2-Str Gas   | 0                         | 0.0%                | 0.0%                          | 0.0%                             | 25                     | 25                    | 25                       | 25                         | 90                        | 0                            | n/a                          | 90                            | n/a                            |
|                   | 4-Str Gas   | 2905                      | 6.4%                | 81.5%                         | 3.7%                             | n/a                    | n/a                   | n/a                      | n/a                        | n/a                       | n/a                          | n/a                          | n/a                            | n/a                            |
|                   | CNG         | 0                         | 0.0%                | 0.0%                          | 0.0%                             | n/a                    | n/a                   | n/a                      | n/a                        | n/a                       | n/a                          | n/a                          | n/a                            | n/a                            |
|                   | LPG         | 251                       | 0.6%                | 7.0%                          | 0.3%                             | n/a                    | n/a                   | n/a                      | n/a                        | n/a                       | n/a                          | n/a                          | n/a                            | n/a                            |
|                   | Electric    | 0                         | 0.0%                | 0.0%                          | 0.0%                             | n/a                    | n/a                   | n/a                      | n/a                        | n/a                       | n/a                          | n/a                          | n/a                            | n/a                            |
|                   | All         | 3565                      | 7.9%                | 5.3%                          | 5.3%                             | n/a                    | n/a                   | n/a                      | n/a                        | n/a                       | n/a                          | n/a                          | n/a                            | n/a                            |

1 Unsolicited and unqualified values signify emission reductions (in percent). Values preceded by the qualifier "up" signify emission increases (in percent).
2 Emission reductions due to replacement with EV equipment can vary with the emissions performance of local power generating stations. The tabulated values represent "typical" or "average" power generating station emission rates. For NO\textsubscript{X}, the range of emissions variability across U.S. power generating stations is dramatic and emission reduction percentages can range, depending on local conditions, from a 182 percent increase through a 91 percent reduction relative to 2-stroke gasoline engines; a 40-90 percent reduction relative to 4-stroke gasoline emissions; a 20-97 percent reduction relative to LPG emissions; or a 60-99+ percent reduction relative to diesel emissions.
3 In addition to the potential for direct replacement of some GSE services, fixed, gate-based systems such as electrical power and conditioned air also potentially reduce aircraft auxiliary power unit (APU) emissions by 70-99 percent and emissions from (non-tabulated) GSE-based air conditioning service equipment by nearly 100 percent. Of the tabulated GSE, ground power unit (GPU) replacement is most feasible, with baggage tug and belt loader replacement quite difficult in retrofit applications.
### TABLE 4. POTENTIAL PM REDUCTION STRATEGIES FOR AIRPORT GSE

| GSE Type | Engine Type | Estimated U.S. Population of All GSE | Fraction of Type Specific GSE | Estimated Fraction of All GSE PM | Convert to LPG Fueling | Convert to CNG Fueling | Replace with LPG Equipment | Replace with CNG Equipment | Replace with EV Equipment | Retrofit with Oxy Catalyst | Retrofit with PM Trap | Replace with Fixed "At Gate" Equipment | Replace with 4-Str Gasoline Equipment |
|----------|-------------|-------------------------------------|-------------------------------|----------------------------------|------------------------|-----------------------|-----------------------------|-----------------------------|---------------------------|--------------------------|------------------------|---------------------------|--------------------------------|--------------------------------|
| Aircraft Pushback Tractor | Diesel | 2113 | 4.7% | 76.6% | 21.6% | n/a | n/a | 97 | 97 | 97 | 30 | 90 | n/a | n/a |
| | 2-str Gas | 0 | 0.0% | 0.0% | 0.0% | 15 | 15 | 15 | 15 | 20 | 10 | n/a | n/a | n/a |
| | 4-str Gas | 489 | 1.1% | 17.7% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | CNG | 0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | LPG | 63 | 0.1% | 2.3% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | Electric | 94 | 0.2% | 3.4% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| All | 7759 | 6.1% | 21.7% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Baggage Tug | Diesel | 4399 | 9.8% | 41.9% | 26.8% | n/a | n/a | 96 | 96 | 98 | 10 | 90 | 45 | n/a |
| | 2-str Gas | 0 | 0.0% | 0.0% | 0.0% | 15 | 15 | 15 | 15 | 45 | 10 | n/a | 45 | n/a |
| | 4-str Gas | 4863 | 10.3% | 46.3% | 16.6% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | CNG | 0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | LPG | 973 | 2.2% | 9.3% | 0.3% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | Electric | 270 | 0.6% | 2.6% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| All | 10505 | 23.3% | 28.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Belt Loader | Diesel | 2429 | 5.4% | 47.1% | 6.2% | n/a | n/a | 96 | 96 | 97 | 30 | 90 | 97 | n/a |
| | 2-str Gas | 0 | 0.0% | 0.0% | 0.0% | 15 | 15 | 15 | 15 | 45 | 10 | n/a | 45 | n/a |
| | 4-str Gas | 2317 | 5.1% | 45.0% | 0.4% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | CNG | 0 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | LPG | 314 | 0.7% | 6.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | Electric | 94 | 0.2% | 1.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| All | 5154 | 11.4% | 16.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Carts | Diesel | 31 | 0.1% | 1.4% | 0.0% | n/a | n/a | 85 | 85 | 98 | 30 | 90 | n/a | n/a |
| | 2-str Gas | 612 | 1.4% | 28.3% | 0.6% | 98 | 98 | 98 | 98 | 99 | 10 | n/a | 96 | n/a |
| | 4-str Gas | 610 | 1.4% | 28.2% | 0.0% | 35 | 35 | 35 | 35 | 90 | 10 | n/a | n/a | n/a |
| | CNG | 0 | 0.0% | 0.0% | 0.0% | 35 | 35 | 35 | 35 | 90 | 10 | n/a | n/a | n/a |
| | LPG | 0 | 0.0% | 0.0% | 0.0% | 35 | 35 | 35 | 35 | 90 | 10 | n/a | n/a | n/a |
| | Electric | 910 | 2.0% | 42.1% | 0.0% | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| All | 2163 | 4.8% | 56.6% | 0.0% | n/a | n/a | 96 | 96 | 98 | 30 | 90 | n/a | n/a |
| Forklift | Diesel | 146 | 0.3% | 4.4% | 0.3% | n/a | n/a | 96 | 96 | 98 | 30 | 90 | n/a | n/a |
| | 2-str Gas | 0 | 0.0% | 0.0% | 0.0% | 35 | 35 | 35 | 35 | 55 | 10 | n/a | n/a | n/a |
| | 4-str Gas | 873 | 1.9% | 26.1% | 0.1% | n/a | n/a | 96 | 96 | 98 | 30 | 90 | n/a | n/a |
| | CNG | 0 | 0.0% | 0.0% | 0.0% | 35 | 35 | 35 | 35 | 55 | 10 | n/a | n/a | n/a |
| | LPG | 1583 | 3.5% | 47.4% | 0.1% | n/a | n/a | 96 | 96 | 98 | 30 | 90 | n/a | n/a |
| | Electric | 757 | 1.6% | 22.1% | 0.0% | n/a | n/a | 96 | 96 | 98 | 30 | 90 | n/a | n/a |
| All | 3339 | 7.4% | 50.5% | 0.0% | n/a | n/a | 96 | 96 | 98 | 30 | 90 | n/a | n/a |

Potential PM Emission Reduction (Percent Reduction) if:

- All GSE types are replaced
- All GSE engines are modernized
- All GSEs are operated under controlled conditions

Note: Data represents estimated potential for reduction in PM emissions.
**TABLE 4. POTENTIAL PM REDUCTION STRATEGIES FOR AIRPORT GSE**  
(Continued)

<table>
<thead>
<tr>
<th>GSE Type</th>
<th>Engine Type</th>
<th>Estimated U.S. Population</th>
<th>Fraction of All GSE</th>
<th>Fraction of Type Specific GSE</th>
<th>Estimated Fraction of All GSE PM</th>
<th>Convert to LPG Fueling</th>
<th>Convert to CNG Fueling</th>
<th>Replace with LPG Equipment</th>
<th>Replace with CNG Equipment</th>
<th>Replace with EV Equipment</th>
<th>Retrofit with Oxy Catalyst</th>
<th>Retrofit with PM Trap</th>
<th>Replace with Fixed &quot;At Gate&quot; Equipment</th>
<th>Replace with 4-Str Gasoline Equipment</th>
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<tr>
<td>Ground Power Unit</td>
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<td>96</td>
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<td>90</td>
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<td>10</td>
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<td>n/a</td>
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<td>96</td>
<td>96</td>
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<td>n/a</td>
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</tbody>
</table>

1 Emission reductions due to replacement with EV equipment can vary with the emissions performance of local power generating stations. The tabulated values represent "typical" or "average" power generating station emission rates. For PM, the range of emissions variability across U.S. power generating stations is dramatic and emission reduction percentages can range, depending on local conditions, from an 80-99+ percent reduction relative to 2-stroke gasoline emissions; a 5000 percent increase through a 98 percent reduction relative to 4-stroke gasoline emissions; a 6000 percent increase through a 98 percent reduction relative to LPG emissions; or a 100 percent increase through a 99+ percent reduction relative to diesel emissions.

2 In addition to the potential for direct replacement of some GSE services, fixed, gate-based systems such as electrical power and conditioned air also potentially reduce aircraft auxiliary power unit (APU) emissions by 70-96 percent and emissions from (non-tabulated) GSE-based air conditioning service equipment by nearly 100 percent. Of the tabulated GSE, ground power unit (GPU) replacement is most feasible, with baggage tug and belt loader replacement quite difficult in retrofit applications.
IV. Amendment to NOACA's Regional Transportation Investment Policy

**Recommendation:** The NOACA EAC Air Quality Subcommittee, as well as the NOACA Transportation Advisory Committee and the NOACA Planning Advisory Committee, endorsed the following amendment to NOACA’s Regional Transportation Investment Policy.

The Subcommittee approves this amendment as a mechanism for advancing the mobile source program and project recommendations listed in this report. The language reads as follows:

"Congestion Mitigation and Air Quality (CMAQ) funding priority shall be given to mobile source programs and projects identified in NOACA's recommendations to the Ohio Environmental Protection Agency for the State Implementation Plan for attainment of the 8-Hour Ozone National Ambient Air Quality Standards (NAAQS)."

**Background:** The amendment does not require that the programs and projects be actually submitted by Ohio EPA for inclusion in the SIP. Instead, priority can be given to any of the programs and projects listed in this report, even if they are voluntary and not used for SIP credit by the State of Ohio. The Subcommittee recognized that the programs and projects would be highly valuable for air pollution reductions, for cost savings, for improved quality of life, and other purposes.
V. Statewide Controls on Point and Area Sources of Air Pollution

Point sources, generally, are defined to be large permitted stationary sources of air pollution. Examples are power plants and steel mills.

Area sources, generally, are defined to be smaller stationary sources, with or without permits, plus miscellaneous sources that may not be stationary. Examples are gasoline stations, lawnmowers, mobile asphalt batch plants, and consumer goods such as hairsprays.

The NOACA Air Quality Public Advisory Task Force and the NOACA EAC Air Quality Subcommittee recommended that controls on point and area sources be implemented statewide for several reasons:

1. LADCO and the Ohio EPA have stated that Northeast Ohio will need statewide NOx reductions in order to reach attainment.
2. Controls that affect businesses that are not statewide would leave Northeast Ohio at a competitive disadvantage economically.
3. Ozone transport is a significant issue for Northeast Ohio, due to its geographic placement. Consequently, ozone formation in other parts of Ohio may result in elevated ozone readings in Northeast Ohio.

Thus, the point and area source recommendations are each for statewide implementation.

Where statewide control figures were not available for the State of Ohio, the figures are provided for Northeast Ohio only and for the 5 LADCO states of Ohio, Indiana, Illinois, Michigan, and Wisconsin.

For further discussion of the sources of data used in this report, please see the introductory material in the beginning of this section entitled "Analysis of Recommendations."
V. Statewide Controls on Point and Area Sources of Air Pollution

1. Cold Cleaning and Degreasing

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that further controls be required statewide on cold cleaning/degreasing operations.

Background: According to LADCO, the most promising reductions beyond current requirements can be obtained by increasing the stringency of existing Reasonably Available Control Technology (RACT) rules and extending the geographic coverage of those rules. Since area source cold cleaning emissions are the largest component of this category, the most promising candidate for strengthening RACT is to adopt limits on the volatility of cleaning solvents used for cold cleaning operations (i.e. max. of 1 mmHg vapor pressure).

This measure has already been promulgated by the Ohio EPA for the Cincinnati and Dayton areas.

Option PT-9 Cold cleaning and degreasing
The measure involves the adoption of the Chicago/Metro East cold cleaning regulation (similar to the Ozone Transport Commission Model Rule) in Northeast Ohio.

Capital Control Cost Estimate
LADCO: $1,400/ ton VOC reduced

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<th>5 State LADCO Region</th>
<th>NE Ohio</th>
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<tr>
<td>2009 Base VOC Emissions</td>
<td>56,300 tpy</td>
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<tr>
<td>VOC Reduction</td>
<td>-39,900 tpy</td>
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<td>2009 VOC Emissions</td>
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<tr>
<td>Estimated Capital Costs</td>
<td>$56 M</td>
<td>$4.3 M</td>
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</table>
Cost effectiveness and time frame to implement

According to LADCO, the existing RACT rules in the Chicago/Metro East areas are very similar to the Ozone Transport Commission (OTC) Model Rule. The OTC estimated a cost of $1,400 per ton of VOC reduced based on the South Coast Air Quality Management District’s cost analysis for their solvent cleaning rule (Rule 1122). This value should approximate costs that would be incurred to meet the same limits in the OTC rules.

States generally provided a 2-year period for compliance with RACT rules. LADCO assumed that SIP rules would be adopted in early 2007. If the states chose to extend the existing RACT rules for the Chicago/Metro East areas to additional counties, sources would be required to use solvents with lower volatility. Since the lower-VOC content limits already exist in California and several northeastern states, solvent manufacturers would not need to reformulate products. It seems reasonable to assume that a 2-year period after SIP submittal is adequate for the installation of controls.
V. Statewide Controls on Point and Area Sources of Air Pollution

2. Industrial Surface Coatings – Area and Point Sources

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that more stringent limits at 90% VOC capture efficiency be placed statewide on the formulation of industrial surface coatings for both area and point sources in order to achieve a 90% reduction in VOC emissions.

Background: According to LADCO, the use of surface coatings by manufacturing industries and other sectors of the economy is pervasive. Applications include coatings that are applied during the manufacture of a wide variety of products by Original Equipment Manufacturers (OEMs) including furniture, cans, automobiles, other transportation equipment, machinery, appliances, metal coils, flat wood, wire, paper, plastic parts, and other miscellaneous products.

Reductions beyond current requirements appear to be reasonable and can be obtained by increasing the stringency of existing RACT rules, eliminating exemptions and lowering applicability thresholds, and extending the geographic coverage of the rules. VOC emissions from area sources exceed those from point sources and it appears that most area source emissions were calculated assuming no control programs are in place. While there is some uncertainty about these emission estimates, it seems feasible to obtain significant emission reductions by requiring non-major sources to reduce emissions using one or more of the techniques described above for major sources.

Many point source industrial surface coating operations are already controlled. LADCO assumed that more stringent requirements are feasible and could generally achieve a 90 percent reduction from uncontrolled levels.

Option PT-7 Industrial Surface Coatings – Area Sources
The measure involves adopting more stringent RACT regulations, lowering applicability thresholds and extending geographic areas.

Capital Control Cost Estimate
LADCO: $100 - $5,000/ ton VOC reduced
### Option PT-8  Industrial Surface Coatings – Point Sources

This measure involves adopting more stringent RACT regulations, lower applicability thresholds and extend geographic areas.

**Capital Control Cost Estimate**

LADCO: $100 - $5,000/ ton VOC reduced

<table>
<thead>
<tr>
<th></th>
<th>5 State LADCO Region</th>
<th>NE Ohio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2002 Base VOC Emissions</strong></td>
<td>108,100 tpy</td>
<td>296 tpd</td>
</tr>
<tr>
<td><strong>VOC Reduction</strong></td>
<td>- 77,800 tpy</td>
<td>- 213 tpd</td>
</tr>
<tr>
<td><strong>2009 VOC Emissions</strong></td>
<td>30,300 tpy</td>
<td>83 tpd</td>
</tr>
<tr>
<td><strong>Estimated Capital Costs</strong></td>
<td>$8 - 389 M</td>
<td>$0.5 - 24 M</td>
</tr>
</tbody>
</table>

### Cost effectiveness and time frame to implement

Cost effectiveness of applying specific requirements to coating operations would vary depending on the particular source and process type. Factors might include the size of the operation, the age and type of coating equipment used, and availability of add-on controls including high efficiency spray guns or reformulated coatings. Improved transfer efficiency requirements will result in the modification or replacement of conventional spray equipment. Costs for new/modified equipment will be offset by a savings in paint consumption. According to USEPA, the use of add-on control devices such as catalytic or thermal incinerators $100-5,000 per ton of VOC removed. The cost of reformulation of low-VOC coatings is difficult to predict. BAAQMD assumes a cost-effectiveness of $2,000 per ton removed based on cost estimates used in the past for coating reformulations.

States generally provided a 2-year period for compliance with RACT rules. LADCO assumed that SIP rules would be adopted in early 2007. Manufacturers may need to reformulate coatings...
and sources may be required to install high transfer-efficiency painting equipment or add-on controls. It seems reasonable to assume that a 2-year period after SIP submittal is adequate for the installation of new process or control equipment. Thus, emission reductions would occur in 2009 for the generic control measure described above.
V. Statewide Controls on Point and Area Sources of Air Pollution

3. Consumer and Commercial Products

**Recommendation:** The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that more stringent limits be imposed statewide for the formulation of consumer and commercial products, such as hairspray and deodorant.

**Background:** According to LADCO, VOC emission reductions can be obtained through product reformulation, modifying the current formulation of the coating to obtain a lower VOC content. The product reformulation options vary with each product category, and can involve one or more of the following approaches:

- Replacing VOC solvents with a water-based formulation
- Replacing VOC solvents with acetone or another exempt solvent
- Increasing the solids content of the product
- Formulating a non-VOC propellant
- Changing the valve, container, or delivery system to reduce VOC content

**Option PT-12 Consumer and Commercial Products**

The measure involves adopting the Ozone Transport Commission (OTC) Model Rule with additional product coverage and more stringent VOC limits (14.2% reduction beyond Federal Consumer and Commercial Products Rules (40 CFR Part 59)). The measure does not involve adopting more stringent California standards.

**Capital Control Cost Estimate**

LADCO: $800/ton VOC reduced

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<tr>
<th></th>
<th>5 State LADCO Region</th>
<th>NE Ohio</th>
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<tbody>
<tr>
<td><strong>2002 Base VOC Emissions</strong></td>
<td>165,800 tpy</td>
<td>454 tpd</td>
</tr>
<tr>
<td><strong>VOC Reduction</strong></td>
<td>- 23,500 tpy</td>
<td>- 64 tpd</td>
</tr>
<tr>
<td><strong>2009 VOC Emissions</strong></td>
<td>142,300 tpy</td>
<td>390 tpd</td>
</tr>
<tr>
<td><strong>Estimated Capital Costs</strong></td>
<td><strong>$19 M</strong></td>
<td></td>
</tr>
</tbody>
</table>
V. Statewide Controls on Point and Area Sources of Air Pollution

4. Portable Fuel Containers (Gas Cans)

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that new design specifications be required statewide for portable fuel containers (gas cans) so that they evaporate less gasoline to the ambient air.

The Ohio EPA has proposed such a statewide rule.

The Subcommittee did not endorse financial incentives, estimated at $10 million, to create faster turnover in the purchase of new gas cans by consumers.

Background: According to the Lake Michigan Air Directors' Consortium (LADCO), portable fuel containers (PFCs) are designed for transporting and storing fuel from a retail distribution point to a point of use and eventually dispensing fuel into equipment. Commonly referred to as “gas cans,” these products come in a variety of shapes and sizes with nominal capacities ranging in size from less than one gallon to over six gallons. Available in metal or plastic, these products are widely used to refuel residential and commercial equipment and vehicles when the situation or circumstances prohibits direct refueling at a service station. PFCs are used to refuel a broad range of small off-road engines and other equipment (e.g., lawnmowers, chainsaws, personal watercraft, motorcycles, etc.).

VOC emissions from PFCs are classified by different processes:

- PFC refueling vapor displacement and spillage emissions result when fuel vapor is displaced from the gas can and from gasoline spillage/over-filling during refueling at a service station. These emissions may already be accounted for under the Stage II refueling source category.

- Transport-spillage emissions from PFCs occur when fuel escapes from gas cans that are in transit.

- Diurnal emissions result when stored fuel vapors escape to the air through any possible openings while the container is subjected to the daily cycle of increasing and decreasing ambient temperatures. Diurnal emissions depend on the closed- or open- storage condition of the PFC.

- Permeation emissions are produced after fuel has been stored long enough in a container for fuel molecules to infiltrate and saturate the container material, allowing vapors to escape through the walls of containers made from plastic. Transport-spillage emissions from PFCs occur when fuel escapes from gas cans that are in transit.
Diurnal emissions are the largest category, accounting for roughly two-thirds of the total emissions from these five processes. Transport-spillage, diurnal, and permeation emissions associated with PFCs were estimated to account for about 1.2% of the total anthropogenic VOC emissions in the LADCO region in 2002.

Option AR-13 Portable Fuel Containers
The measure involves adopting the Ozone Transport Commission (OTC) Model Rule for PFCs, which should result in an 18% reduction in 2009 and 54% reduction in 2015, assuming a 10% turnover in PFCs per year starting in 2007.

Capital Control Cost Estimate
LADCO: $250 - 480/ ton VOC reduced

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<tr>
<th></th>
<th>5 State LADCO Region</th>
<th>NE Ohio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2002 Base VOC Emissions</strong></td>
<td>51,000 tpy 140 tpd</td>
<td>10,800 tpy 29 tpd</td>
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<tr>
<td><strong>2009 VOC Reduction</strong></td>
<td>- 9,200 tpy - 25 tpd</td>
<td>- 1,500 tpy - 4 tpd</td>
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<tr>
<td><strong>2009 Base VOC Emissions</strong></td>
<td>41,800 tpy 115 tpd</td>
<td>9,300 tpy 25 tpd</td>
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<td><strong>2015 VOC Reduction</strong></td>
<td>- 18,300 tpy - 50 tpd</td>
<td>- 3,500 tpy - 10 tpd</td>
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<td><strong>2015 VOC Emissions</strong></td>
<td>23,500 tpy 65 tpd</td>
<td>5,800 tpy 15 tpd</td>
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<td><strong>Estimated Capital Costs</strong></td>
<td>$7 - 13 M</td>
<td>$2 - 3 M</td>
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</table>
V. Statewide Controls on Point and Area Sources of Air Pollution

5. Industrial, Commercial and Institutional (ICI) Boilers

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that more stringent NOx controls be required statewide for industrial, commercial, and institutional (ICI) boilers, particularly in the midsize range.

Background: Industrial boilers are generally smaller than boilers in the electric power industry. Industrial boilers typically have a heat input in the 10-250 mmBtu/hr range; however, industrial boilers can be as large as 1,000 mmBtu/hr or as small as 0.5 mmBtu/hour. Most commercial and institutional boilers are quite small, with 80 percent of the population smaller than 15 mmBtu/hour, for which there are not many practicable controls.

Option PT-3 Industrial, Commercial, and Institutional Boilers
The measure involves applying a 60% NOx Reduction that would be similar to the federal NOx SIP Call for large boilers to midsize boilers (100 – 250 mmBtu/hr). This is equivalent to a 24% reduction from the 2002 levels. The measure does not involve a more stringent reduction of 80% that was also considered.

Capital Control Cost Estimate
LADCO: $280 - $1,300/ton NOx reduced

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<tr>
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<th>5 State LADCO Region</th>
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<tbody>
<tr>
<td>2009 Base NOx Emissions</td>
<td>219,300 tpy</td>
<td>600 tpd</td>
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<tr>
<td>NOx Reduction</td>
<td>- 55,000 tpy</td>
<td>-150 tpd</td>
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<tr>
<td>2009 NOx Emissions</td>
<td>164,000 tpy</td>
<td>450 tpd</td>
</tr>
<tr>
<td>Estimated Capital Costs</td>
<td>$15 M - $71 M</td>
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</tr>
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</table>
V. Statewide Controls on Point and Area Sources of Air Pollution

6. Electric Generating Units (EGUs)

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that controls on electric generating units (EGUs) greater than those required by existing federal programs be pursued and implemented on a multistate basis, through the ongoing efforts of the Director of the Ohio EPA in working with other states in the Midwest.

Background: Two emission reduction options, one of greater stringency (PT-2) than the other (PT-1), were considered. The existing federal programs include the Acid Rain program under Title IV of the Clean Air Act, the NOx SIP Call, and the Clean Air Interstate Rule (CAIR), which will combine to show reductions in NOx from EGUs through the coming decades.

Options PT-1 and PT-2 would decrease the allowable NOx limits, requiring more controls on more EGU individual units in a shorter timeframe. The NOACA Air Quality Public Advisory Task Force asked that both be considered by the Ohio EPA, as the modeling for Northeast Ohio for the attainment year of 2010 might require.

Boilers at EGUs produce steam used to drive turbine generators for electricity production. The fuel used to produce steam is primarily a function of the availability and price of fuels. Although there are many natural gas-fired or gas/oil fired units in the Midwest, it is important to note that coal-fired units constitute the greatest power output and a very high percentage of NOx emissions.

The EGUs in Northeast Ohio are as follows, in alphabetical order by county, as provided by their respective air permitting agencies:

**CEI Ashtabula - 0204010000 - 2133 Lake Road, Ashtabula (Ashtabula County)**

NOx emissions

2002 - 2,800 Tons
2004 - 1,492 Tons

**CEI Lakeshore - 1318000245 - 6800 S. Marginal Rd., Cleveland (Cuyahoga County)**

NOx Emissions

2003 - 1,315 Tons
2004 - 1,387 Tons

**CEI Eastlake - 0243160009 - 10 Erie Road, Eastlake (Lake County)**

NOx Emissions

2002 - 20,667 Tons
2004 - 8,968 Tons
Painesville Municipal Electric Light Plant - 0243110008 - 325 Richmond Street, Painesville (Lake County)
NOx Emissions
2002 - 869 Tons
2004 - 831 Tons

Avon Plant (Reliant Energy) - 0247030013 - 33750 Lake Road, Avon Lake (Lorain County)
NOx Emissions
2002 - 17,871 Tons
2004 - 5,804 Tons

West Lorain Plant - 0247080487 - 7101 West Erie Street, Lorain (Lorain County)
NOx Emissions (calculated - actual emissions may be less)
2002 - 112 Tons
2004 - 107 Tons

The measures are as follow:

**Option PT-1 Electric Generating Units**
The measure involves the same NOx limits as the “Retrofit NOx BACT (Best Available Control Technology)” standards, which would result in a 33% reduction from the CAIR levels. NOx emissions would be limited to 0.1 lbs/mmBtu input.

**Capital Control Cost Estimate**
LADCO: $700 - $1,600/ton NOx reduced
Note: The EGU industry quotes $2,200 – 2,700/ton NOx reduced

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<tr>
<th></th>
<th>5-State LADCO Region</th>
<th>NE Ohio</th>
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<tbody>
<tr>
<td><strong>2010 Base NOx Emissions</strong></td>
<td>372,300 tpy</td>
<td>1,020 tpd</td>
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<tr>
<td><strong>NOx Reduction</strong></td>
<td>- 122,900 tpy</td>
<td>- 337 tpd</td>
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<tr>
<td><strong>2013 NOx Emissions</strong></td>
<td>249,400 tpy</td>
<td>683 tpd</td>
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<td><strong>Estimated Capital Costs</strong></td>
<td>$86 M - $331 M</td>
<td></td>
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</tbody>
</table>
Option PT-2 Electric Generating Units

The measure involves the same NOx limits as the “NOx BACT for New Plants” standards, which would result in a 53% reduction from the CAIR levels. NOx emissions would be limited to 0.07 lbs/mmBtu input.

Capital Control Cost Estimate
LADCO: $700 - $2,100/ ton NOx reduced
Note: The EGU industry quotes $2,200 – 2,700/ ton NOx reduced

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<tr>
<th></th>
<th>5-State LADCO Region</th>
<th>NE Ohio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 Base NOx Emissions</td>
<td>372,300 tpy</td>
<td>1,020 tpd</td>
</tr>
<tr>
<td>NOx Reduction</td>
<td>- 241,200 tpy</td>
<td>- 660 tpd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15,600 tpy</td>
</tr>
<tr>
<td>2013 NOx Emissions</td>
<td>131,100 tpy</td>
<td>350 tpd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5,500 tpy</td>
</tr>
<tr>
<td>Estimated Capital Costs</td>
<td>$168 M - $650 M</td>
<td>$7 M - 27 M</td>
</tr>
</tbody>
</table>

One way to meet the limits of Option PT-2 would be to switch from coal to natural gas. This would increase the demand for natural gas.

Note: The EGU industry states that there is a physical inability to obtain and install more controls on more EGU units by the required control-installation deadline of 2009, under these options, because the manufacturers of the controls, nationwide, are already in full production mode to meet the CAIR requirements, and no more capacity for manufacturing is available.
V. Statewide Controls on Point and Area Sources of Air Pollution

7. Enhanced Stage I Pressure-Valve Vents at Gasoline Stations

**Recommendation:** The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that Stage I pressure-valve vents on underground storage tanks at gasoline distribution facilities (GDFs) (gas stations) be enhanced to meet California standards (98% VOC capture effectiveness) and that all other GDFs statewide, which meet the applicable Ohio threshold, be required to install Stage I vents (90% VOC capture effectiveness).

The Subcommittee also endorsed more stringent owner testing and record-keeping in order to increase ease of enforcement.

**Background:** The following information is from the *Environ Final Report to LADCO, "Development of Technical Information for a Regional Fuels Strategy, Feb. 28, 2006."

"Emissions associated with gasoline dispensing facilities are Stage I emissions, Stage II emissions, and tank breathing losses.

Stage I Emissions - emissions from the underground storage tanks (USTs) when they are refilled with gasoline. The incoming gasoline displaces the gasoline vapor in the tank. USEPA requires these emissions to be controlled by recycling the vapor back into the tank truck, but the control effectiveness is not 100%.

Stage II Emissions - emissions at the pump when vehicles are refilled. The emissions come from the vehicle’s fuel tank. All modern vehicles are equipped with onboard vapor recovery systems (phase-in of these requirements started in 1998), but older vehicles do not have these systems.

Breathing Losses - when vehicles are refueled, makeup air enters the UST from pipes above the ground, and this air mixes with the gasoline vapor in the UST, causing a small amount of UST breathing losses each time a vehicle is refueled." (Source: *Environ Final Report to LADCO, "Development of Technical Information for a Regional Fuels Strategy, Feb. 28, 2006."

According to LADCO, the most promising reductions beyond current requirements can be obtained by increasing the required control efficiency of Stage I vapor recovery systems from 90 to 98 percent in areas with existing Stage I programs and requiring Stage I vapor recovery systems in areas that currently do not have Stage I vapor recovery requirements. Additional reductions could be obtained by requiring Stage I vapor recovery in counties bordering 8-hour ozone nonattainment areas. The Stage I requirements could be based on the California Air Resources Board (CARB) Enhanced Vapor Recovery (EVR) Module 1 requirements, which
changes the control efficiency requirement to 98 percent, requires pressure-vent (PV) valves on all systems, and contains additional specifications to prevent leaks.

Cost effectiveness and time frame to implement

CARB estimated the cost effectiveness of upgrading existing systems to meet Phase I of the EVR program to range from $0 to 2,120 per ton of VOC reduced. For larger stations (monthly throughput greater than 300,000 gallons), CARB estimated that the EVR Phase I enhancements would pay for itself with the value of the recovered gasoline. For smaller stations (monthly throughput less than 15,000 gallons), CARB estimated the cost effectiveness to be $2,120 per ton for the Phase I EVR program. For stations without Stage I vapor recovery systems, the cost effectiveness of new systems is estimated to be between $100 to $4,742 depending on the size of the station.

Note: All GDFs in Northeast Ohio have Stage I vapor recovery systems. However, they are not required to meet the enhanced California standards.

In the Northeast Ohio nonattainment area, for the counties other than Cuyahoga, in 2004, of the GDFs under Ohio EPA-Northeast District Office jurisdiction, 216 inspections were done, 45 had to schedule a re-test, 15 had to schedule a second re-test, and 5 had to schedule a third re-test. In 2005, 195 inspections were done, 80 needed a retest, 14 needed a second re-test, and 2 had to schedule a third re-test.

Therefore, general compliance with existing requirements appears to be an issue.

States generally provided a 2-year period for compliance with RACT rules. LADCO assumed that SIP rules would be adopted in early 2007. It seems reasonable to assume that a 2-year period after SIP submittal is adequate for the installation of controls.

Option PT-16  Enhanced Stage I Pressure-Valve Vents at Gasoline Stations

The measure involves adopting the California Air Resources Board EVR (Enhanced Vapor Recovery) Stage I Requirements for underground storage tanks at all gasoline stations in Northeast Ohio.

Capital Control Cost Estimate
LADCO: $0 – 2,100/ton VOC reduced
<table>
<thead>
<tr>
<th></th>
<th>5 State LADCO Region</th>
<th>NE Ohio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002 Base VOC Emissions</td>
<td>42,300 tpy</td>
<td>1,200 tpy</td>
</tr>
<tr>
<td>VOC Reduction</td>
<td>-33,000 tpy</td>
<td>-90 tpd</td>
</tr>
<tr>
<td>2009 VOC Emissions</td>
<td>9,000 tpy</td>
<td>26 tpd</td>
</tr>
<tr>
<td>Estimated Capital Costs</td>
<td>$0 - 69 M</td>
<td>$0 - 2 M</td>
</tr>
</tbody>
</table>

There are 858 gasoline distribution facilities (GDFs) in the Northeast Ohio nonattainment area. As stated above, all are currently required to have Stage I vents on the fill pipes to capture vapors.
V. Statewide Controls on Point and Area Sources of Air Pollution

8. Enhanced Stage II Vapor Recovery Nozzles at Gasoline Stations

**Recommendation:** The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that the existing Stage II vapor recovery nozzles on gas pumps at gasoline distribution facilities (GDFs) be enhanced to meet California standards, and that GDFs statewide be required to install Stage II nozzles.

The Subcommittee also endorsed more stringent owner testing and record-keeping in order to increase ease of enforcement.

**Background:** Stage II vapor recovery nozzle emissions occur at the pump when vehicles are refilled. The emissions come from the vehicle's fuel tank. All modern vehicles are equipped with onboard vapor recovery systems (since 1998), but older vehicles do not have these systems.

The California Air Resources Board (CARB) has created and instituted Enhanced Vapor Recovery (EVR) standards for Stage II nozzles, which consequently capture more VOCs.

**PT-17 Enhanced Stage II Vapor Recovery Nozzles at Gasoline Stations**
The measure involves adopting the California Air Resources Board (CARB) EVR (Enhanced Vapor Recovery) Stage II Requirements.

**Capital Control Cost Estimate**
LADCO: $840 – 13,400/ ton VOC reduced to upgrade to Stage II
LADCO: $13,300 (2009) – 28,500 (2015)/ ton VOC reduced to upgrade to Stage II

<table>
<thead>
<tr>
<th></th>
<th>5 State LADCO Region</th>
<th>NE Ohio</th>
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</thead>
<tbody>
<tr>
<td>2009 Base VOC Emissions</td>
<td>22,000 tpy</td>
<td>60 tpd</td>
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<tr>
<td>VOC Reduction</td>
<td>- 18,000 tpy</td>
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<tr>
<td>2009 VOC Emissions</td>
<td>4,000 tpy</td>
<td>11 tpd</td>
</tr>
<tr>
<td>Estimated Capital Costs</td>
<td>S 15 – 32 M</td>
<td>S 0.5 - 10 M</td>
</tr>
</tbody>
</table>
V. Statewide Controls on Point and Area Sources of Air Pollution

9. High Volume Low Pressure (HVLP) Spray Guns for Auto Body Refinishers

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that high volume low pressure (HVLP) spray guns be required statewide for use by auto body paint spraying and refinishing operations, to reduce VOC emissions from over-spray.

Background: Although many larger facilities in Northeast Ohio already use HVLP spray guns and gun-cleaning systems, not all establishments statewide do so. The use of the HVLP spray guns reduces wasted paint as well as VOC emissions.

The measure endorsed was originally created by the Ozone Transport Commission (OTC) as a model rule. Another measure, created by the South Coast Air Quality Management District in California, was considered but not endorsed by the Subcommittee.

This measure has already been promulgated by the Ohio EPA for the Cincinnati and Dayton areas.

According to LADCO, auto body refinishing includes the application of coatings subsequent to original equipment manufacture (OEM). (Coating of new cars is not included in this category). Vehicles included in this category are passenger cars, trucks, vans, motorcycles, and other mobile equipment capable of being driven or drawn on the highway. The majority of these operations occur at small body shops that repair and refinish automobiles. The coating applications include washes, primers, primer surfacers, and primer sealers, and topcoats. Emissions of VOCs result from the evaporation of solvents during application, curing, and cleanup. Emissions are typically controlled through use of compliant coatings, increased transfer efficiency, and control of clean-up solvents.

Option PT-14 High Volume Low Pressure (HVLP) Spray Guns for Auto Body Refinishers
The measure involves adopting the Ozone Transport Commission (OTC) Model Rule for spray guns and gun cleaning systems.

Capital Control Cost Estimate
LADCO: $1,354/ton VOC reduced
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<tr>
<th></th>
<th>5 State LADCO Region</th>
<th>NE Ohio</th>
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</thead>
<tbody>
<tr>
<td><strong>2002 Base VOC Emissions</strong></td>
<td>25,300 tpy</td>
<td>69 tpd</td>
</tr>
<tr>
<td><strong>VOC Reduction</strong></td>
<td>- 6,200 tpy</td>
<td>- 17 tpd</td>
</tr>
<tr>
<td><strong>2009 VOC Emissions</strong></td>
<td>19,100 tpy</td>
<td>52 tpd</td>
</tr>
<tr>
<td><strong>Estimated Capital Costs</strong></td>
<td>$8.3 M</td>
<td>$0.75 M</td>
</tr>
</tbody>
</table>

**Cost effectiveness and time frame to implement**

According to LADCO, the existing RACT rules in Illinois, Indiana, and Wisconsin are similar to the Ozone Transport Commission (OTC) Model Rule. The OTC estimated a cost of $1,354 per ton of VOC reduced based on the use of High Volume Low Pressure (HVLP) spray guns and a gun cleaning system. This value should approximate costs that would be incurred to meet the same limits in the OTC rules.

States generally provided a 2-year period for compliance with RACT rules. LADCO assumed that SIP rules would be adopted in early 2007. Sources would be required to install high transfer-efficiency painting equipment and institute methods and controls on emissions from equipment cleaning and housekeeping activities, and conduct operator training. Since the VOC content limits in the existing RACT rules are very similar to the Part 59 VOC limits, manufacturers would not need to reformulate products. It seems reasonable to assume that a 2-year period after SIP submittal is adequate for the installation of controls.
V. Statewide Controls on Point and Area Sources of Air Pollution

10. Architectural and Industrial Maintenance (AIM) Coatings

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that more stringent limits be required statewide on the formulation of paints and varnishes, also known as architectural and industrial maintenance (AIM) coatings. The Ozone Transport Commission (OTC) Model Rule was endorsed, rather than the more stringent standard set by the South Coast Air Quality Management District in California.

Background: According to LADCO, several states in the Ozone Transport Region, made up of the 12 eastern seaboard states from Virginia to Maine and the District of Columbia, are in the process of adopting AIM coating rules. The OTC developed a Model Rule for AIM Coatings that requires manufacturers to reformulate coatings to meet specified VOC content limits, which are based on rules adopted by the California Air Resources Board (CARB) and the STAPPA/ALAPCO model rule for AIM Coatings. All products manufactured for sale or use within an OTC State after January 1, 2005, would need to comply with the VOC content limits in the AIM OTC Model Rule.

According to LADCO, in general, VOC emission reductions can be obtained through product reformulation - modifying the current formulation of the coating to obtain a lower VOC content. Product reformulation can involve one or several of the following approaches:

- Replacing VOC solvents with non-VOC solvents
- Increasing the solids content of the coating
- Altering the chemistry of the resin so that less solvent is needed for the required viscosity
- Switching to a waterborne latex or water-soluble resin system

The regulatory approach for reducing emissions is to establish VOC content limits for specific coatings that manufacturers are required to meet either through reformulating products or substituting products with compliant coatings.

Option PT-10 Architectural and Industrial Maintenance (AIM) Coatings

The measure involves adopting the Ozone Transport Commission (OTC) Model Rule for the formulation of AIM coatings, which would result in a 21% reduction beyond federal AIM Rules (40 CFR Part 59).

Capital Control Cost Estimate
LADCO: $6,500/ton VOC reduced
<table>
<thead>
<tr>
<th></th>
<th>5 State LADCO Region</th>
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<th>NE Ohio</th>
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<tr>
<td><strong>2002 Base VOC Emissions</strong></td>
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<td>299 tpd</td>
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<td><strong>VOC Reduction</strong></td>
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<td><strong>2009 VOC Emissions</strong></td>
<td>86,200 tpy</td>
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<td><strong>Estimated Capital Costs</strong></td>
<td>$145 M</td>
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<td>$37 M</td>
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</table>
V. Statewide Controls on Point and Area Sources of Air Pollution

11. NOx Credit Trading Bank

Recommendation: The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that a NOx Credit Trading Bank be established by the Ohio EPA, for the trading of NOx allowances and offsets within any nonattainment area in Ohio.

Background: NOx allowances must be discovered and purchased by existing facilities within a nonattainment area that wish to expand because NOx offsets are required. Similarly, NOx allowances must be purchased by new facilities that wish to locate in a nonattainment area.

The Subcommittee determined that NOx credits are created by facilities within Northeast Ohio, but that the Ohio EPA does not maintain any easily accessible database for verifying the credits or for allowing their discovery and purchase by new facilities.

Many other states have successfully implemented NOx credit trading banks. Ohio's "Nitrogen Oxides - Budget Trading Program" could be amended to allow banking and trading in a system that would be "user friendly" and easily accessible by businesses in Northeast Ohio and by those wishing to locate in Northeast Ohio. The “bank” would be a central location in which information about air emissions, reductions, credits, and offsets could be kept so that businesses that need offsets would know where they might be found and purchased.

A “bank” would create a market value for NOx reductions, thus providing an incentive for existing sources to reduce their emissions. Forced retirement of credits would also be possible by the Ohio EPA Director.

O.R.C. § 3704.03(V) currently provides the Ohio EPA with authority to implement an emissions banking and trading program, however, the scope of the statute appears to be quite limited, and the Director's authority is only discretionary. The statute states:

"The director of environmental protection may do any of the following: (V) Provide for emissions trading, marketable permits, auctions of emission rights, and economic incentives that would reduce the cost or increase the efficiency of achieving a specified level of environmental protection." O.R.C. § 3704.03(V).

Language has been suggested by the law firm of Squire, Sanders, & Dempsey, representing the Ohio Steel Group, to expand the statute as follows:

"The director of environmental protection shall create and maintain an emission reduction credit banking and trading program to help make emission offsets available for new and modified sources in nonattainment areas, while encouraging voluntary emission reductions of those pollutants most critical to achieving national air quality standards."
Voluntary emission reductions that are real, quantifiable, and permanent shall be eligible for banking as emission reduction credits (ERCs). ERCs may be certified by a licensed Ohio professional engineer for the purpose of verifying and documenting that these emission reductions are voluntary, real, quantifiable, and permanent.

Owners of ERCs or certified ERCs (CERCs) may post relevant information about ERCs and CERCs on a website operated and maintained by the director or his designee.

Banked ERCs and CERCs may be transferred among parties without limitation and without the director’s approval. Banked ERCs and CERCs shall be included in relevant emissions inventories to make them available for use as offsets under the nonattainment new source review program.

The director shall review ERCs and CERCs when a complete application is submitted for their use as an offset or for their permanent retirement and removal from the bank when an applicant specifies that such a review is warranted.

The director may develop rules consistent with this statute to implement the emission reduction credit banking and trading program. Such rules shall include provisions that (1) Establish a simple and efficient process for posting relevant information about ERCs and CERCs on a website or otherwise make the information available to the public as quickly as practicable; (2) Assure that unusual or abnormal operational patterns can be accounted for in the determination of any source’s baseline from which reductions would be made; and (3) Establish guidelines for measuring and quantifying emissions to help increase the certainty that banked ERCs and CERCs will be approvable as offsets when reviewed by the agency.

The director shall also consider the role of a third party professional in the banking, verification, validation of use, enforcement, and program audits associated with ERCs, and, to the maximum extent possible, create and preserve opportunities for private sector participation in any emissions trading program established by the director."

Nearby states such as Pennsylvania already post such information on a website that is easily accessible to businesses and which may have drawn new businesses away from Ohio because offsets were easier to find and obtain.

**Cost:** The cost of such a measure would involve both computer equipment and staff on the part of the Ohio EPA.
VI. Long-Term Strategies for Sustainable Air Quality

**Recommendation:** The NOACA EAC Air Quality Subcommittee has endorsed the recommendation made by the NOACA Air Quality Public Advisory Task Force that a regional energy conservation strategy should be pursued with member communities and other stakeholders that addresses reduction in demand for electricity, more efficient public structures and more efficient transportation systems as a means of reducing air emissions long term.

The Subcommittee stated that NOACA should work with the Ohio Office of Energy Efficiency, the U.S. Department of Energy, the foundation community, and the business community on program development and funding mechanisms for this purpose.

**Background:** The options that were originally considered by the NOACA Air Quality Public Advisory Task Force included the following:

- **PT-21** Tapping into grant funding for energy efficiency projects.
- **PT-22** Creating state appliance standards for electric appliances not covered by federal law.
- **PT-23** Having the Public Utilities Commission of Ohio disallow electric rate increases where there is no renewable energy initiative on the part of the EGU.
- **PT-24** Setting a statewide or nonattainment-area wide electricity reduction goal of 5%.
- **PT-25** Creating incentives for government entities and businesses to replace electric devices with energy efficient models.
- **PT-26** Creating incentives for combined heat and power (CHP) projects.
- **PT-27** Encouraging generation of wind power on or near Lake Erie.

The Subcommittee stated that a broader, more over-arching recommendation would provide a better goal for air quality in Northeast Ohio.
D. “No Penalty” Time Extension

The NOACA EAC Air Quality Subcommittee, the NOACA Transportation Advisory Committee, and the NOACA Planning Advisory Committee each discussed and endorsed support for a “no penalty” extension of time for Northeast Ohio to reach attainment, if such a solution were possible through federal legislative action.

The term under discussion was from 2010 to 2013, without having the region redesignated from “moderate” to “serious” because a “bump up to serious” would entail additional mandatory transportation control measures and offsets for businesses, which would adversely affect the economy of Northeast Ohio.

An extension would allow time for substantial improvements in air quality to be realized as a result of new state and federal air pollution regulations, thus making attainment of the 8-hour ozone standard easier to reach without additional local controls.

Because the deadlines for attainment are set by Section 181 of the Clean Air Act, obtaining an extension of time without changing the classification to “serious” would entail Congressional amendment of the Clean Air Act for ozone nonattainment areas such as Northeast Ohio.

The Subcommittee was aware that there had been efforts in the United States Senate to obtain such an extension, and it wished to express support for those efforts through a resolution of the NOACA Governing Board.
E. Conclusion and Next Steps

The NOACA Air Quality Public Advisory Task Force and the NOACA EAC Air Quality Subcommittee each determined that multiple measures would have to be implemented in Northeast Ohio in order for the region to reach attainment of the 8-hour ozone NAAQS by the federally imposed deadline of June 2010.

Consequently, the recommendations contained in this report are intended to be presented to the NOACA Governing Board for review and adoption by resolution.

Following any such action by the NOACA Governing Board, approved measures are to be submitted to the Director of the Ohio EPA, in keeping with the Memorandum of Understanding signed by NOACA, the Ohio EPA, and the local air agencies on November 1, 2005.

The Director of the Ohio EPA is responsible for making the final choices about which measures are to become federally enforceable through inclusion in the SIP for the State of Ohio.

Voluntary measures, such as some of the mobile source recommendations described in this report, can be implemented directly by NOACA and its member cities, counties, and towns through independent action.

It is the conclusion of the Subcommittee that each of the measures recommended in this report will assist in attaining the 8-hour ozone NAAQS by the required deadline.

This report is to be posted at: www.noaca.org/sipplan.html
Appendix A

Ohio Environmental Protection Agency

Emissions Inventory for Northeast Ohio - 2002

The counties covered by this Emissions Inventory are:

Ashtabula
Cuyahoga
Geauga
Lake
Lorain
Medina
Portage
Summit
The following information is presented in tons per day. The mobile source data is expressed in tons per summer day based on U.S. EPA Mobile 6 modeling runs, all other values are based on a 365 day period. All the following data is subject to change as more accurate information becomes available (e.g., updated meteorological data for Mobile 6, emission factors for area source categories, etc.).
Cleveland MSA 2002 EIS Data

### Area NOx

<table>
<thead>
<tr>
<th>NOx Source</th>
<th>Cumulative</th>
<th>On Road</th>
<th>Non-Road</th>
<th>Total in Tons Per Day</th>
</tr>
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<tbody>
<tr>
<td>Stationary Source Fuel Combustion, Commercial/Industrial</td>
<td>4.52%</td>
<td>2.73%</td>
<td>1.79%</td>
<td>1.04%</td>
</tr>
<tr>
<td>Stationary Source Fuel Combustion, Residential</td>
<td>7.87%</td>
<td>4.15%</td>
<td>3.72%</td>
<td>2.50%</td>
</tr>
<tr>
<td>Waste Disposal, Treatment, and Recovery, On-site Incineration</td>
<td>23.55%</td>
<td>13.26%</td>
<td>10.29%</td>
<td>8.40%</td>
</tr>
<tr>
<td>Wood/Residue And Other Combustion</td>
<td>19.56%</td>
<td>11.72%</td>
<td>7.84%</td>
<td>6.75%</td>
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<td></td>
<td>Total</td>
<td>50.85%</td>
<td>31.73%</td>
<td>19.12%</td>
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### On Road NOx

<table>
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<th>Non-Road</th>
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<td>6.75%</td>
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<td></td>
<td>Total</td>
<td>50.85%</td>
<td>31.73%</td>
<td>19.12%</td>
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</table>

### Non-Road NOx

<table>
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<tr>
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<td>Waste Disposal, Treatment, and Recovery, On-site Incineration</td>
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<tr>
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<td>6.75%</td>
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<td>Total</td>
<td>50.85%</td>
<td>31.73%</td>
<td>19.12%</td>
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### Total in Tons Per Day

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<th>Category</th>
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<tr>
<td>Non-Road</td>
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<td>Area</td>
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Cleveland - 2002 NOx

Total in Tons Per Day:

- **Point (30.17%)**
- **Non-Road (26.93%)**
- **On Road (31.73%)**
- **Area (11.18%)**
Cleveland - 2002 NOx
Point Source in Tons Per Day
Cleveland - 2002 NOx
Non-Road Mobile in Tons Per Day

Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke (0.16%)
Mobile Sources, CNG (0.94%)
Mobile Sources, Aircraft (1.52%)
Mobile Sources, Pleasure Craft (3.46%)
Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke (5.17%)
Mobile Sources, LPG (9.29%)
Mobile Sources, Railroad Equipment (14.28%)
Mobile Sources, Off-highway Vehicle Diesel (28.22%)
Mobile Sources, Marine Vessels, Commercial (36.97%)
Cleveland - 2002 NOx Area Source in Tons Per Day

- Miscellaneous Area Sources, Other Combustion (0.08%)
- Waste Disposal, Treatment, and Recovery, On-site Incineration (2.58%)
- Waste Disposal, Treatment, and Recovery, Open Burning (4.25%)
- Stationary Source Fuel Combustion, Industrial (13.43%)
- Stationary Source Fuel Combustion, Residential (30.64%)
- Stationary Source Fuel Combustion, Commercial/Institutional (49.03%)
### Cleveland MSA 2002 EIS Data

#### VOC Emissions

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#### Area VOC

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<td>Persistent and Halogenated Air Dispersions</td>
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<td>Industrial Processes, Solvent and Miscellaneous Products</td>
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#### Non-Road VOC

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#### On-Road VOC

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### Cleveland - 2002 VOC

**Total in Tons Per Day**

- **Point (4.37%)**
- **Non-Road (26.49%)**
- **On Road (29.07%)**
- **Area (40.07%)**
Cleveland - 2002 VOC
Point Source in Tons Per Day
Cleveland - 2002 VOC
Non-Road Mobile in Tons Per Day

Mobile Sources, Pleasure Craft (46.72%)

Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke (25.10%)

Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke (18.63%)
  Mobile Sources, Off-highway Vehicle Diesel (3.95%)
  Mobile Sources, LPG (2.93%)
  Mobile Sources, Marine Vessels, Commercial (1.37%)
  Mobile Sources, Railroad Equipment (0.74%)
  Mobile Sources, Aircraft (0.53%)
  Mobile Sources, CNG (0.02%)
Cleveland - 2002 VOC
Area Source in Tons Per Day

- Solvent Utilization, Surface Coating (32.57%)
- Solvent Utilization, Misc. Non-industrial: Consumer and Commercial (18.54%)
- Solvent Utilization, Degreasing (17.05%)
- Stationary Source Fuel Combustion, Residential (10.14%)
- Solvent Utilization, Miscellaneous Industrial (4.47%)
- Storage and Transport, Petroleum and Petroleum Product Storage (3.81%)
- Waste Disposal, Treatment, and Recovery, Open Burning (3.79%)
- Waste Disposal, Treatment, and Recovery, TSDFs (2.20%)
- Solvent Utilization, Graphic Arts (2.14%)
- Solvent Utilization, Dry Cleaning (1.36%)
- Waste Disposal, Treatment, and Recovery, Wastewater Treatment (1.16%)
- Solvent Utilization, Rubber/Plastics (0.84%)
- Solvent Utilization, Miscellaneous Non-industrial: Commercial (0.60%)
- Waste Disposal, Treatment, and Recovery, On-site Incineration (0.57%)
- Industrial Processes, Food and Kindred Products: SIC 20 (0.22%)
- Stationary Source Fuel Combustion, Commercial/Institutional (0.17%)
- Stationary Source Fuel Combustion, Industrial (0.12%)
- Waste Disposal, Treatment, and Recovery, Landfills (0.11%)
- Miscellaneous Area Sources, Other Combustion (0.10%)
- Industrial Processes, Oil and Gas Production: SIC 13 (0.03%)
Appendix B

Ozone Trends in Northeastern Ohio

Lake Michigan Air Directors' Consortium (LADCO)

March 20, 2006

The counties covered by this analysis are:

Ashtabula
Cuyahoga
Geauga
Lake
Lorain
Medina
Portage
Summit
Ozone Trends in Northeastern Ohio

The purpose of this document is to review the trends in ozone concentrations and ozone precursor emissions for counties in northeastern Ohio. These historical trends provide information on the effectiveness of past control programs and can be used (along with projected emissions data) to estimate future year ozone concentrations. The data show that ozone levels have declined in northeastern Ohio since the early 1990s and are expected to continue to decline due to existing control programs. Projected future year design values in 2009 and 2012 are expected to be close to (albeit slightly above) the 8-hour ozone standard. Additional emission reductions appear to be necessary to bring all monitoring sites in the Cleveland area into attainment.

Ozone Monitoring Data
A total of 12 sites have measured ozone concentrations in northeastern Ohio since at least 1995 (see Figure 1 and Table 1). Data from these sites were used to examine the changes in ozone concentrations over time.

Map 1
Ozone Monitors

Figure 1. Ozone Monitoring Sites in Northeastern Ohio (Courtesy of Northeast Ohio Areawide Coordinating Agency)

11 monitoring sites are currently operating during the summer in northeastern Ohio.
### Table 1. Ozone Monitoring Sites in Northeastern Ohio

<table>
<thead>
<tr>
<th>Site Name</th>
<th>County</th>
<th>City</th>
<th>Site Address</th>
<th>Monitor Type</th>
<th>Location Type</th>
<th>Monitor ID</th>
<th>Latitude (Degrees)</th>
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<tr>
<td>CONNEAUT</td>
<td>Ashtabula Co</td>
<td>Conneaut</td>
<td>Conneaut Water Treat. Plant</td>
<td>SLAMS</td>
<td>Suburban</td>
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<td>DISTRICT</td>
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<td>891 E. 152 St.</td>
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<td>Suburban</td>
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<td>BERE A</td>
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<td>Suburban</td>
<td>391530020</td>
<td>41.1061</td>
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</table>
Basic Ozone Parameter Trends
A few simple parameters are presented here to characterize the change in ozone levels over time in northeastern Ohio: number of site exceedance days and design values.

*Number of Site Exceedance Days:* The figure below shows the number of site exceedance days (which provides a measure of the frequency and spatial extent of "high" 8-hour ozone days), along with the number of cooling degree days and "hot" days which provide an indication of ozone conduciveness.

![Graph of cooling degree days and site exceedance days](image)

*Figure 2. 8-Hour Ozone and Weather Statistics (Northeastern Ohio)*

The figure shows that ozone is strongly influenced by meteorology. The number of site exceedance days is higher during the hotter summers. Interestingly, the summers of 1995, 2002, and 2005 had a similar number of cooling degree days and hot days, but a very different number of site exceedance days.

*Design Values:* The figure below shows the trend in ozone design values since the early 1990's. In general, the trend is significantly downward except for the summer of 2002. The high ozone concentrations during that summer affected the design values for three 3-year periods (2000-2002, 2001-2003, and 2002-2004). (Note, the "background" trends are based on data from three nearby rural CASTNet sites in OH and PA.)
Figure 3. Trend in 8-Hour Ozone Design Values (Northeastern Ohio)

Meteorologically Adjusted Ozone Trends
Given the strong effect of meteorology on ambient ozone levels (as noted above), the year-to-year variations in meteorology can make it difficult to assess trends in ozone air quality. Two approaches were considered to adjust ozone trends for meteorological influences: an air quality-meteorology statistical model developed by USEPA (i.e., Cox method), and statistical grouping of meteorological variables performed by LADCO (i.e., Classification and Regression Trees, or CART).

Cox Method: This method uses a statistical model to “remove” the annual effect of meteorology on ozone. A generalized linear model was prepared using 1990 – 2004 data to relate daily peak ozone levels to four meteorological variables (i.e., daily peak 1-hour temperature, midday average relative humidity, morning and afternoon wind speed and wind direction, and morning mixing heights). The model is then used to compute 4th high ozone values which account for differences among years due to both meteorology and trend-related factors (e.g., emissions). Meteorologically-adjusted 4th high values for 1990, for example, are derived by averaging the 4th highest values for the 1990 year effect with each of the meteorological years from 1990 thru 2004 (i.e., the meteorological effect is averaged out).

Figure 4 shows the observed and model-predicted 4th high ozone concentration (left) and the meteorologically-adjusted 4th high ozone concentrations for three high ozone sites in the Cleveland CMSA: Ashtabula, Eastlake, and Akron. The meteorologically-adjusted data for these sites show a downward trend in the 4th high values since about 2001-2002.
Figure 4. Observed and Model-Predicted 4th High 8-Hour Ozone Concentrations (left) and Meteorologically-Adjusted 4th High 8-Hour Ozone Concentrations (right) for Ashtabula (top), Eastlake (middle), and Akron (bottom) based on the Cox Method
CART: Classification and Regression Tree (CART) analysis is another statistical technique which partitions data sets into similar groups. While the relationships between ozone and meteorological variables are well understood in a general sense, CART offers the ability to quantify the unique relationship among those variables at a specific geographic location. The meteorological variables tested in the model included surface and aloft wind direction (converted to north/south and east/west components), wind speed, relative humidity, temperature, dewpoint, pressure, mixing height, solar radiation, and cloud cover. Ozone data were examined for the period 1990-2005.

The regression tree for Cleveland shows 11 groups of meteorologically similar days (referred to as nodes), with maximum daily temperature being the most important variable for categorizing ozone. The highest ozone concentration node (node 11: average ozone concentration = 81 ppb) is associated with maximum daily temperatures greater than 85°F. The higher ozone concentration nodes (8, 10, and 11) occurred most often during the “hotter” summers (1995, 2002, and 2005). Simply based on the frequency of the meteorology associated with these high concentration days (i.e., similar total number of days), it is not clear what resulted in the very high 8-hour ozone concentrations during the summer of 2002. Further analysis of the meteorology during this summer should be conducted to understand the relationship between meteorology, emissions, and ozone concentrations.

Examining concentration changes over time by group minimizes the influence of meteorology and reveals trends in ozone concentrations due presumably to emission control programs. The results for the higher ozone concentration nodes are presented in Figure 5 and show a fairly flat trend overall, although there appears to be a general downward trend since about 2001-2002, consistent with the results of the Cox method.

![Figure 5](image_url)

*Figure 5. Average 8-Hour Ozone Concentrations by Year for Higher Concentration Nodes*
Emission Trends

A summary of VOC and NOx emissions was prepared based on USEPA's National Emissions Inventory (1990, 1996, and 1999), USEPA's Preliminary Nationwide Utility Emissions (2002-2005), and LADCO's latest regional modeling inventory (2002, 2009, and 2012). VOC and NOx emissions were identified for the 8-county Cleveland CMSA, and NOx emissions for the State of Ohio.

The emissions are presented in the table and figure below. Local VOC emissions decreased significantly during the 1990s, and are expected to continue to decrease (although at a slower rate) over the next decade. Local and statewide NOx emissions, on the other hand, remained fairly steady during the 1990s, but are decreasing now due to federal controls for cars and trucks, and the NOx SIP Call for power plants.

Table 1. VOC and NOx Emissions for Cleveland Area, and NOx Emissions for State of Ohio

<table>
<thead>
<tr>
<th>Year</th>
<th>VOC - Cleveland</th>
<th>NOx - Cleveland</th>
<th>NOx-Statewide</th>
</tr>
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<td>1990</td>
<td>683</td>
<td>639</td>
<td>3439</td>
</tr>
<tr>
<td>1993</td>
<td></td>
<td></td>
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<tr>
<td>1996</td>
<td>560</td>
<td>625</td>
<td>3520</td>
</tr>
<tr>
<td>1999</td>
<td>460</td>
<td>534</td>
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</tr>
<tr>
<td>2002</td>
<td>330</td>
<td>498</td>
<td>2831</td>
</tr>
<tr>
<td>2005</td>
<td>290 (est.)</td>
<td></td>
<td>1950 (est.)</td>
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<tr>
<td>2009</td>
<td>253</td>
<td>287</td>
<td>1449</td>
</tr>
<tr>
<td>2012</td>
<td>203</td>
<td>198</td>
<td>1305</td>
</tr>
</tbody>
</table>

Figure 6. Trends in VOC and NOx Emissions for Cleveland CMSA and NOx Emissions for the State of Ohio (Note: emissions units are tons per summer day)

---

2 See [http://www.epa.gov/air/data/repsco.html](http://www.epa.gov/air/data/repsco.html)

3 See [http://www.epa.gov/airmarkets/emissions/primarp/index.html](http://www.epa.gov/airmarkets/emissions/primarp/index.html)
**Expected Future Air Quality**

*Modeling:* Projections of future year air quality (based on existing control programs, including the Clean Air Interstate Rule) were performed by USEPA\(^4\) and LADCO\(^5\). The results from these two analyses are qualitatively similar (i.e., expect significant reductions in concentration, although the projected levels are still above the standard in the 2009/2010 timeframe), and most of the quantitative differences can be explained (e.g., different starting point – year and design value, and different projection period – seven years v. nine years).

*Table 2. Ozone Design Values from USEPA and LADCO (Round 4) Modeling*

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th>Geauga</th>
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<td>LADCO</td>
<td>USEPA</td>
</tr>
<tr>
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<td>2002</td>
<td>95.7</td>
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<td>99.0</td>
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<td></td>
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</tr>
<tr>
<td>2015</td>
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<td></td>
<td>82.5</td>
</tr>
</tbody>
</table>

*Figure 7. Model-Projected Future Year Ozone Design Values for Geauga (left) and Ashtabula (right) Sites Based on USEPA and LADCO Modeling*

---


\(^5\) Preliminary Round 4 modeling results (LADCO, 2006)
**Proportional Extrapolation:** USEPA’s “Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-Hour Ozone NAAQS” (October 2005) discusses a number of additional analyses to support the attainment demonstration. One such analysis is to extrapolate future trends in 8-hour ozone based on measured historical trends in air quality and emissions. (Further discussion of this analysis is provided in “Recommended Approach for Performing Mid-Course Review of SIPs to Meet the 1-Hour NAAQS for Ozone” (January 2002).)

The historical trends are based on the change in emissions and the change in meteorologically-adjusted ozone design values. The emissions trends of interest include: (1) local VOC emissions (based on application of observation-based models, which show VOC-limited conditions in Cleveland)\(^6\), and (2) regional NOx emissions (based on application of observation-based models\(^5\) and dispersion modeling analyses, which show NOx-limited conditions across large portions of the upper Midwest). Consequently, the change in local VOC emissions for the nonattainment area (which affect the local ozone contribution) and the change in statewide NOx emissions (which affect the regional/transported ozone concentrations) should be considered. The effect of these emissions changes (and the associated changes in regional and local ozone concentrations) is addressed separately below.

The change in regional ozone concentrations is estimated based on data from three rural CASTNet sites in OH and PA. Between 1996 (i.e., 1995-1997 design value) and 2004 (i.e., 2003-2005 design value), the design values declined by about 7 ppb. Statewide NOx emissions over this period declined by about 1600 TPD. Based on these historical changes and projected future statewide NOx emissions decreases of 500 TPD in 2009 and 600 TPD in 2012, the regional ozone concentrations are expected to decline by an additional 2 ppb in 2009 and 3 ppb in 2012.

The change in the local ozone contribution is estimated based on data from high ozone sites in the Cleveland area (e.g., Ashtabula, Eastlake, and Akron). Between 1996 (i.e., met-adjusted 1995-1997 design value) and 2004 (i.e., met-adjusted 2003-2005 design value), the design values declined by about 9 ppb (7 ppb due to regional contribution and 2 ppb due to local contribution). Local VOC emissions over this period declined by about 270 TPD. Based on these historical changes and the projected future local VOC emissions decreases of 35 TPD in 2009 and 85 TPD in 2012, the local ozone contribution is expected to decline by an additional 0.2 ppb in 2009 and 0.6 ppb in 2012.

Projected further year design values for Cleveland are estimated to be about 88 ppb (2009) and 86 ppb (2012), based on the current design values (about 90 ppb) and the expected change in regional and local ozone levels (due to emissions changes). This result is consistent with the modeling.

---

Summary
Ozone levels have declined in northeastern Ohio since the early 1990s and are expected to continue to decline due to existing control programs. Projected future year design values in 2009 and 2012 are expected to be close to (albeit slightly above) the 8-hour ozone standard. Additional emission reductions appear to be necessary to bring all monitoring sites in the Cleveland area into attainment.
Appendix C

Evaluation of 2009 Alternative Emission Reductions for Northeast Ohio

Ohio University

August 2, 2006

The counties covered by this analysis are:

Ashtabula
Cuyahoga
Geauga
Lake
Lorain
Medina
Portage
Summit
EVALUATION OF 2009 ALTERNATIVE EMISSION REDUCTIONS FOR NORTHEAST OHIO

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Submitted to NOACA August 2, 2006
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1.0 Overview

Results of this project showed that selected monitors in the Northeast Ohio 8-county region will remain in moderate non-attainment of the 8-hour ozone standards for the future year 2010, the year set by the USEPA for attainment demonstration for moderate non-attainment regions. An earlier modeling analysis by the Lake Michigan Air Directors Consortium (LADCO) of the future year 2009 emissions, developed from its 2002 emissions inventory, showed that this region will be in non-attainment despite the imposition of control strategies and a decline of economic activity in the project region. The Northeast Ohio Areawide Coordinating Agency (NOACA) believes that the growth factors projected by LADCO in some source categories for this earlier run may have been overestimated for the Northeast Ohio region. On the basis of consultations with NOACA and the Ohio EPA, the Air Quality Center of Ohio University was commissioned to complete two tasks: 1) evaluate projected emissions for 2009 for the project area and 2) conduct photochemical modeling to evaluate the impact of the modified projected emissions on air quality.

2.0 Evaluation of Projected Emissions

Researchers identified emissions source growth factors that may have resulted in an overestimation of the projected change from 2002 to 2009 in Northeast Ohio. More locally precise growth factors were identified and substituted for these.

The member states of LADCO, the Midwest Regional Planning Organizations (RPO), revised the point, area, mobile source inventories, and the growth and control factors for future year modeling. LADCO updated emission growth factors. These amended and less optimistic emissions growth factors, called Base K emissions, were lower than the previous growth rates for the Northeast Ohio region (Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Portage, and Summit Counties).

Ohio University obtained the 2002 and 2009 Base K emissions from LADCO. Estimates of the non-electrical generating unit (non-EGU) point, area, and agricultural future projections are usually made using USEPA's model, the Economic Growth Analysis System (EGAS). In this case, Ohio University researchers based some of the projected source categories for 2009 on the 2002 Base K data using the “new approximations” stated below. The modified 2009 emissions inventory was compared to LADCO’s original 2009 emissions inventory to determine any significant differences between the two. The comparison of the 2009 emission projections, if appreciably lower, would indicate that LADCO may have overestimated growth factors in the Base K emissions for Northeast Ohio.

Ohio University researchers based new approximations of future emissions projections on the following:

- Linear trends in the reduction of Title V Non-EGU Point Sources
- Linear trends in the decline of aircraft emissions
- Economic indicators such as employment and population growth in Northeastern Ohio
The results of this preliminary analysis were used to develop a list of alternative realistic assumptions for the future 2009 base-case emissions inventory for Northeast Ohio based on the current emissions reduction trends in the case of Title V sources and the percent change in the economic indicators for some categories of area sources.

2.1 Title V Sources

Major stationary sources of air pollutants are subject to Title V of the federal Clean Air Act. Title V requires major stationary sources of air pollution and a limited group of non-major sources to obtain operating permits that assure compliance with all applicable federal air pollution control requirements. A major source is defined as a source that has the potential to emit the following amounts:

- 100 tons or more per year of any pollutant
- 25 tons or more per year of either reactive organic compounds or nitrogen oxides
- 10 tons or more per year of a single hazardous air pollutant (HAP)
- 25 tons or more per year of a combination of HAPs

A Title V operating permit provides a means of implementing federal maximum achievable control technologies (MACT) standards and acid rain requirements.

2.1a. Data Analysis of Title V Sources

The Ohio EPA provided Ohio University with a list of Title V sources for the years 2002, 2003, and 2004. The source categories consisted of major electrical power generating unit (EGU) and non-EGU point sources. EGU stationary sources are the largest nitrogen oxide (NOx) emitters in Northeast Ohio. The USEPA uses the Integrated Planning Model (IPM) to analyze the projected impact of environmental policies on the electric power sector (EGU sources) in the contiguous United States. Therefore, this analysis consisted of an assessment of emission trends only for non-EGU point sources in Northeastern Ohio. The results were used to calculate approximate projected emissions of non-EGU point sources for the future base case of 2009.

2.1b. Methodology

The non-EGU point sources were broadly classified in different source categories based on their source classification codes (SCCs). To accomplish this task, different reporting facilities with similar SCCs were combined for each year. Then the SCCs of the entire group were matched with the list of corresponding SCCs from USEPA’s website at http://www.epa.gov/tnn/Chief/codes/.

The emissions from these sources were the calculated daily NOx and volatile organic compound (VOC) rates, estimated as follows:
Daily emissions (pounds per day) = Emissions (tons per year) \times \text{seasonal adjustment factor} \times \text{the daily factor}

where the seasonal adjustment factor is June–August % / 25% and the daily factor = 1 / (number of days/week) / (number of weeks per year)

2.1c Results and Discussion

![Figure 1. Total NOx emissions](image)

Figure 1. Total NOx emissions

Figure 1 depicts the total NOx emissions from Northeast Ohio non-EGU sources for 2002, 2003, and 2004. This figure depicts a 32% decrease of emissions from 2002 to 2003 and a further 16% reduction in emissions from 2003 to 2004. The shut-down of one external combustion boiler source caused the large decline from 2002 to 2003. After consultations with the NOACA and the Ohio EPA, project researchers assumed that, since the linear trend in reductions of NOx emissions was approximately 25% from 2002 to 2004, this trend would flatten out in future years as a result of Northeast Ohio’s stagnant economy. A similar assumption was made for the decline of VOC emissions from non-EGU Title V sources. Therefore, the NOx and VOC emissions from these source categories were reduced by 25% (as a result of real data from 2002 to 2004) and a flat growth assumption was used to grow the emissions from 2004 to 2009.
Figure 2. NO\textsubscript{x} emissions of non-EGUs for 2002, 2003, and 2004

Figure 2 depicts a box-whiskers plot of NO\textsubscript{x} emissions (lbs per day) of non-EGUs for the years 2002, 2003, and 2004. The left-hand dots indicate data distribution and the right box-whiskers indicate maximum, 90th, 75th, 50th, 25th, 10th, mean, and minimum. A more detailed analysis of the Title V sources revealed that the largest contribution to the decline in emissions have come from the sources in the 90\textsuperscript{th} percentile range (those sources contributing \(n \text{ lbs/day}\) to 10,000 lbs/day), which are the high emitters, and in the 50–75\textsuperscript{th} percentile range (those source contributing 1,000 to \(n \text{ lbs/day}\)), which are the medium emitters. Hence, medium emitters also play an important role in determining potential control strategies because there is a downward decline in the medium percentile range.

2.2. Mobile Sources

Mobile source emissions were not modified for this analysis since they are computed by a separate transportation model that takes into account locally precise transportation demand factors.

2.3. Area Sources

The area source categories represent individual sources that are numerous yet small in magnitude and which are not classified as point, mobile, or biogenic sources. These area sources are grouped so they can be estimated collectively using one methodology. They consist of area
“other” source emissions, area “mar” sources (marine vessels, aircrafts, and railroads), and area non-road emissions.

2.3a. Alternative Growth Assumptions

The following changes were made to area source categories in the 2002 Base K emission inventory to grow to 2009 emissions:

Area sources “other” emissions. These were not changed since economic indicators could not be used as surrogates.

Area sources “mar” (marine vessels, aircraft, and railroad) emissions. Emissions from marine vessels and railroads have not been modified since current trends were not available. A 28% reduction was applied to 2002 Base-K aircraft emissions based on current trends of fleet changeover from older stage-two engines to newer stage-three engines (NOACA). The relative contribution of emissions generated by aircraft is approximately 3% in the project sector. Emissions from marine vessels were the chief contributors in this category (approximately 70%) followed by emissions from railroads (approximately 27%). The marine vessels’ contributions are still under study by NOACA and LADCO.

Area sources “non-road” such as agricultural, commercial, and residential emissions. Researchers did not modify emissions from the agricultural category.

Commercial sources. In the case of commercial categories such as construction equipment, employment trends were used as a surrogate. A 25% reduction was applied in this category. NOACA challenged this assumption – a reduction is not logical. A redistribution of the emissions to follow population trends was more realistic.

Residential non-road mobile emissions. Researchers applied county-based population growth estimates for residential non-road mobile emissions such as lawn mowers.

2.4. Emission Reduction Methodology

In the case of emissions projections from 2002 Base-K emissions to 2009, researchers used the following methods:

1) Selective reduction strategies for low point sources and area non-road sources such as aircraft

\[ E_{2009\text{new}} = E_{2009\text{original}} - (E_{2009\text{original}} \times \text{%contribution of source emissions} \times \text{%area occupied by each county in each grid cell}) + (1 + \text{% reduction}) \times E_{2002} \times \text{%contribution of source emissions} \times \text{%area occupied by each county in each grid cell} \]

2) Selective growth of emissions from 2002 to 2009 based on county-based population surrogates (varying from –3% in Cuyahoga County to 11% in Portage County to increments of 13% in all other counties)
\[ E_{2009\text{new}} = E_{2009\text{original}} - (E_{2009\text{original}} \times \%\text{contribution of source emissions} \times \%\text{area occupied by each county in each grid cell}) + (1 + \%\text{growth in population}) \times E_{2002} \times \%\text{contribution of source emissions} \times \%\text{area occupied by each county in each grid cell} \]

2.5. Results and Discussion (Emissions Analysis)

In this section, the results of the emissions reduction evaluation are distributed across the Northeast Ohio region in terms of twelve-kilometer square grids, which constitute the template for photochemical modeling of regional NO\textsubscript{x} and VOC emissions. Results of the VOC emissions reduction evaluation are shown in Figures 3 to 5.

In Figure 3, LADCO emissions reductions between 2002 and 2009 are shown for each grid. As an example, 22\% emissions reduction means that emissions are decreased by 22\% between 2002 and 2009.

In Figure 4, NOACA/OU percentage emissions reductions between 2002 and 2009 are shown for each grid.

Figure 5 depicts the difference between LADCO-projected reductions and NOACA/OU-projected reductions. A negative value indicates that the projected NOACA/OU emissions reduction will be more than the LADCO emissions decrease between 2002 and 2009. Hence, NOACA/OU growth projections, where shown as negative grid numbers, resulted in more substantial reductions of emissions than the growth projections applied by LADCO.

Comparable results of the NO\textsubscript{x} emissions reduction evaluation for Northeast Ohio are shown in Figures 6 to 8.

Table 1 is an example of how each grid cell percentage was calculated for regional reduction.

Table 2 shows the regional reductions for VOCs and NO\textsubscript{x}, summarizing statistical differences between the LADCO and NOACA/OU results. As depicted in Figure 5, some of the grid cells experienced an increase in NO\textsubscript{x} and VOC emissions as compared to the LADCO analysis. This was mainly due to the population and economic projections for the region. Again, negative grid percentages show that the NOACA/OU projections resulted in lower emissions projected for 2009. Table 2 shows the number of grid cells that experienced a positive and negative difference and the maximum and minimum differences (positive and negative). Overall, for the Northeast Ohio region, this project illustrates that the NOACA/OU projected VOC emissions for 2009 are 0.93\% less than the LADCO 2009 projected emissions, and the projected NO\textsubscript{x} emission are 0.02\% less than the LADCO 2009 projected emissions, indicating that the growth assumptions applied by NOACA/OU would produce fewer emissions than the LADCO growth assumptions.
Figure 3. LADCO emissions reduction (%) for total VOC (2002–2009).

(A 22% reduction means emissions are decreased by 22% between 2002 and 2009 emissions in 2002 – emissions in 2009 / emissions in 2002 x 100.)
Figure 4. NOACA/OU emissions reduction (%) for total VOC (2002–2009).

(A 22% reduction means the emissions are decreased by 22% between 2002 and 2009 emissions in 2002—emissions in 2009 / emissions in 2002 x 100.)
Figure 5. Percentage reduction difference (%) (LADCO reduction vs. NOACA/OU reduction) for total VOC (2002-2009).

Negative value means that the NOACA/OU emissions reduction is greater than LADCO emissions reduction. Table 1 is an example.

Table 1. Example of LADCO vs. NOACA/OU Emissions Reduction (2002–2009)

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<thead>
<tr>
<th></th>
<th>2002</th>
<th>2009</th>
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<td>110 t/day</td>
<td>10 t/day</td>
<td>(120-110)/120 = 9 %</td>
</tr>
<tr>
<td>NOACA/OU</td>
<td>120 t/day</td>
<td>100 t/day</td>
<td>20 t/day</td>
<td>(120-100)/120 = 16 %</td>
</tr>
</tbody>
</table>

% Difference: -7 %
Figure 6. LADCO emissions reduction (%) for total NOx (2002–2009).

(A 22% reduction means emissions are decreased by 22% between 2002 and 2009 emissions in 2002 – emissions in 2009) / emissions in 2002 x 100.)
Figure 7. NOACA/OU emissions reduction (%) for total NO\textsubscript{x} (2002–2009).

(A 22\% reduction means emissions are decreased by 22\% between 2002 and 2009 emissions in 2002 – emission in 2009) / emissions in 2002 x 100.)
Figure 8. Percentage reduction difference (%) (LADCO emissions reduction vs. NOACA/OU emissions reduction) for total NOx (2002–2009).

A negative value means that NOACA/OU emissions reduction is greater than LADCO emissions reduction. See example in Table 1 on page 9.

As shown in Figures 5 and 8, the plots of differences in both VOC and NOx across the Northeast non-attainment area appear to indicate that modeling of the NOACA/OU alternative 2009 base case would be significantly different from the LADCO 2009 projected base case. While it appears that the absolute difference in tons may not be as much as was expected, the redistribution of emissions alone warrants further investigation.
Table 2. Summary of Emissions Reduction Difference for Total VOC and Total NO$_x$ for Each Grid Cell in the Model Domain.

<table>
<thead>
<tr>
<th></th>
<th>Total VOC</th>
<th>Total NO$_x$</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of cells with +</td>
<td>11</td>
<td>38</td>
</tr>
<tr>
<td>No. of cells with -</td>
<td>34</td>
<td>52</td>
</tr>
<tr>
<td>Max</td>
<td>4.0 %</td>
<td>6.27 %</td>
</tr>
<tr>
<td>Min</td>
<td>-12.0 %</td>
<td>-3.3 %</td>
</tr>
<tr>
<td>Sum</td>
<td>-83 %</td>
<td>-1.87 %</td>
</tr>
<tr>
<td>Average</td>
<td>-0.93 %</td>
<td>-0.02 %</td>
</tr>
</tbody>
</table>

In Table 2, a negative difference means that the NOACA/OU emission projections were lower than those of LADCO. Again, negative grid percentages show that the NOACA/OU projections resulted in lower emissions projected for 2009. Therefore, this project illustrates that the NOACA/OU projected VOC emissions for 2009 are 0.93% less than the LADCO 2009 projected emissions, and the projected NOx emissions are 0.02% less than the LADCO 2009 projected emissions, indicating that the growth assumptions applied by NOACA/OU would produce fewer emissions than the LADCO growth assumptions.

3.0 Photochemical Grid Modeling Using CAMx

3.1 Model Description

The photochemical model used in this study was the Comprehensive Air Quality Model with Extensions (CAMx), Version 4.3, a three-dimensional photochemical grid-based model with extensions. The non-hydrostatic Penn State/NCAR Mesoscale model (MM5), Version 3 (Grell et al., 1994) provided the meteorological inputs to the photochemical model. The Emissions Modeling System (EMS) (LADCO, 1999) was used for processing the emissions. The model simulations were performed for the summer months of 2002 (June 5 to August 31) in a nested mode with a horizontal grid cell dimension of 36 km in a coarse domain and a 12 km fine grid covering Northeast Ohio (Figure 9). The vertical structure in the model consisted of 14 layers from the surface up through 4 km.
3.2 Methodology

Researchers used the USEPA modeling guidance (USEPA, Nov. 2005) for the attainment demonstration.

- CAMx was applied with the emission inventory (EI) process based on the assumptions in Section 2.3a. CAMx was run for 87 days (June 5 through August 31). Figure 11 summarizes the results of the model run with comparison to LADCO’s model runs for the same period. The CAMx outputs were post-processed for daily maximum 8-hour ozone calculations. In addition, researchers conducted the daily maximum 8-hour ozone calculations from the data received from the Geauga monitor.

- Several Excel macro files were utilized to take maximum values from the 3x3 grids (Figure 10) of “nearby grids of the monitor” and to calculate relative reduction factors (RRFs).

- The RRFs were calculated with the 2002 and 2009 LADCO model run and the 2009 OU-EI-modified runs for each day.
3.3 Results and Discussion (Photochemical Model Runs)

OU researchers calculated the relative reduction factors for the Geauga county monitoring site with a design value above 85 ppb. The RRFs for the future base case and the alternative emissions reduction are listed in Figure 11. The RRFs are defined as the ratio of the maximum daily 8-hour average ozone level for the future case to the average of the base case over the entire simulation.

For the base-case model simulations, days on which the maximum 8-hour average ozone level was less than 70 ppb were not included in the calculation (USEPA 1999). The researchers calculated the mean RRF values of the 87 RRF values and applied the mean RRF values of LADCO’s 2009 and OU’s 2009 projections to the design value of 99.0 ppb (2000 to 2004) for the Geauga monitor. The LADCO 2009 design value (Round 3 modeling results) was 89.6 ppb and the OU design value was 88.2 ppb, a 1.4 ppb difference. Figure 11 depicts the ozone design value difference between LADCO 2009 and the OU 2009 alternative emissions reduction.
Figure 11. Ozone design value difference between LADCO 2009 and OU 2009.

4.0 Future Work

As this analysis demonstrates, for the State Implementation Plan (SIP) demonstration of attainment purposes, there may be value in substituting locally accurate growth factors for emissions sources in Northeast Ohio to facilitate future emissions inventory work on the behalf of the Ohio EPA.
Table 3. Daily Maximum 8-hour Ozone, Relative Reduction Factors, and Design Values for 2009: Geauga County

<table>
<thead>
<tr>
<th>Julian</th>
<th>Date</th>
<th>2002</th>
<th>2009</th>
<th>2009ch</th>
<th>2009_LADCO_rrf</th>
<th>2009_OU_rrf</th>
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<tr>
<td>161</td>
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<td>101.3583</td>
<td>92.58766</td>
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<td>79.91012</td>
<td>79.91061</td>
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<td>0.881611831</td>
</tr>
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<td>0.91767434</td>
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<tr>
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<td>95.9463</td>
<td>0.876483133</td>
<td>0.876305947</td>
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<tr>
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<td>0.861703843</td>
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<td>176</td>
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<tr>
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<td>182</td>
<td>01-Jul-02</td>
<td>103.3307</td>
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<td>0.90444021</td>
<td>0.904129557</td>
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<td>185</td>
<td>04-Jul-02</td>
<td>85.25371</td>
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<td>78.18088</td>
<td>0.916653305</td>
<td>0.917037863</td>
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<td>195</td>
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<td>86.61142</td>
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<td>75.47301</td>
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<td>92.77339</td>
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<tr>
<td>207</td>
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<td>87.61736</td>
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<td>98.56635</td>
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<td>0.915698004</td>
<td>0.891369113</td>
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<tr>
<td>216</td>
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<td>11-Aug-02</td>
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<td>0.76597341</td>
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<tr>
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<td>12-Aug-02</td>
<td>86.0311</td>
<td>88.53455</td>
<td>80.65033</td>
<td>1.029099361</td>
<td>0.937455525</td>
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<td>225</td>
<td>13-Aug-02</td>
<td>86.10134</td>
<td>74.4422</td>
<td>71.04831</td>
<td>0.86458817</td>
<td>0.825170781</td>
</tr>
</tbody>
</table>

| 2002 DV: | 99 | 99 |
| 2009 rfrs: | 0.904742527 | 0.890631729 |
| 2009 DV: | 89.56951014 | 88.17254114 |
| LADCO-OU: | 1.396969007 |
Appendix D

State Idle Reduction Model Law

United States Environmental Protection Agency

2006
IV. STATE IDLE REDUCTION MODEL LAW

(a) PURPOSE: The purpose of this law is to protect public health and the environment by reducing emissions while conserving fuel and maintaining adequate rest and safety of all drivers of diesel vehicles.

(b) APPLICABILITY: This law applies to commercial diesel vehicles which are designed to operate on highways, and to locations where diesel vehicles load or unload (hereinafter referred to as "load/unload locations").

(c) GENERAL REQUIREMENT FOR LOAD/UNLOAD LOCATIONS: No entity shall cause vehicles covered by this rule to idle for a period greater than 30 minutes while waiting to load or unload at a location under their control.

(d) GENERAL REQUIREMENT FOR VEHICLES: No entity shall cause or permit vehicles covered by this rule to idle for more than 5 minutes in any 60 minute period except as noted in sections (e) and (f).

(e) EXEMPTIONS: Subsection (d) does not apply for the period or periods where:

1. a vehicle idles while forced to remain motionless because of on-highway traffic, an official traffic control device or signal, or at the direction of a law enforcement official.

2. A vehicle idles when operating defrosters, heaters, air conditioners, or other equipment solely to prevent a safety or health emergency.

3. a police, fire, ambulance, public safety, military, other emergency or law enforcement vehicle, or any vehicle being used in an emergency capacity, idles while in an emergency or training mode and not for the convenience of the vehicle operator.

4. the primary propulsion engine idles for maintenance, servicing, repairing, or diagnostic purposes if idling is necessary for such activity.

5. a vehicle idles as part of a state or federal inspection to verify that all equipment is in good working order, provided idling is required as part of the inspection.

6. idling of the primary propulsion engine is necessary to power work related mechanical or electrical operations other than propulsion (e.g., loading or unloading, mixing or processing cargo, or straight truck refrigeration). This exemption does not apply when idling for cabin comfort or to operate non-essential on-board equipment.

7. an armored vehicle idles when a person remains inside the vehicle to guard the contents, or while the vehicle is being loaded or unloaded.
(f) CONDITIONAL EXEMPTIONS: Subsection (d) does not apply for the period or periods where:

(1) a passenger bus idles a maximum of 15 minutes in any 60 minute period to maintain passenger comfort while non-driver passengers are onboard. The exemption lapses 5 years after implementing a state financial assistance program for idle reduction technologies.

(2) an occupied vehicle with a sleeper berth compartment idles for purposes of air conditioning or heating during rest or sleep period, until 5 years after implementing a state financial assistance program for idle reduction technologies, whereupon this exemption lapses.

(3) an occupied vehicle idles for purposes of air conditioning or heating while waiting to load or unload, until 5 years after implementing a state financial assistance program for idle reduction technologies, whereupon this exemption lapses.

(4) a vehicle idles due to mechanical difficulties over which the driver has no control;

Provided that the vehicle owner submits the repair paperwork or product receipt (by mail; within 30 days) to the appropriate authority verifying that the mechanical problem has been fixed.

(g) AUXILIARY POWER UNITS AND GENERATOR SETS

(1) Operating an auxiliary power unit or generator set as a means to heat, air condition, or provide electrical power as an alternative to idling the main engine is not considered to be an idling engine.

(2) Operating an auxiliary power unit or generator set on all model year 2006 or older commercial diesel vehicles is allowed.

(3) [Reserved for possible inclusion of criteria for APU use on 2007 and subsequent model year commercial vehicles]

(h) PENALTIES: The owner and/or operator of a vehicle, and/or the owner of a load/unload location, that is in violation of this law is responsible for penalties as follows.

(1) First offense: Warning ticket issued to truck driver and truck owner, and where applicable, the load/unload facility owner.

(2) Second and subsequent offenses: $150 fine is issued to the driver; and/or, $500 fine issued to the registered vehicle owner or load/unload location owner.

(i) ENFORCEMENT: The responsibility for enforcement of this idle restriction law rests, in general, with law enforcement, and specifically, with parking enforcement officers.
Appendix E

List of Acronyms

The following acronyms are used in this report:

AIM - Architectural and industrial maintenance
ALAPCO - Association of Local Air Pollution Control Officials
AMATS - Akron Metropolitan Area Transportation Study
APU - Auxiliary power unit
AR - Area source option
BAAQMD - Bay Area Air Quality Management District (California)
BACT - Best available control technology
CAIR - Clean Air Interstate Rule
CARB - California Air Resources Board
CFR - Code of Federal Regulations
CHP - Combined heat and power
CMAQ - Congestion Mitigation & Air Quality funds
CNG - Compressed natural gas
CO - Carbon monoxide
DERA - Diesel Emission Reduction Act
DPF - Diesel particulate filter
EAC - Environmental Advisory Committee (NOACA)
EGU - Electric generating unit
EGR - Exhaust gas recirculation
EVR - Enhanced vapor recovery
GDF - Gasoline distribution facility
GSE - Ground support equipment (airport)
HDDV - Heavy duty diesel vehicle
HDGV - Heavy duty gasoline vehicle
HPLV - High pressure low volume
ICI - Industrial, commercial, and institutional
LADCO - Lake Michigan Air Directors' Consortium
LDGV - Light duty gasoline vehicle
LEED - Leadership in Energy and Environmental Design
MO - Mobile source option
MY - Model year
NAAQS - National Ambient Air Quality Standards
NOx - Oxides of nitrogen
ODOT - Ohio Department of Transportation
OEM - Original equipment manufacturer
O.R.C. - Ohio Revised Code
OTC - Ozone Transport Commission
PFC - Portable fuel container (gas can)
PM - Particulate matter
PSI - Pounds per square inch
PT - Point source option
RACT - Reasonably available control technology
RFG – Reformulated gasoline
RVP - Reid vapor pressure, a measure of gasoline volatility
SCAQMD - South Coast Air Quality Management District (California)
SCR - Selective catalytic reduction
SFY – State fiscal year
SIP - State implementation Plan
SOV – Single occupancy vehicle
STAPPA – State and Territorial Air Pollution Program Administrators
TIP - Transportation Improvement Program
TPD - Tons per day
TPY – Tons per year
UST - Underground storage tank
VALE - Voluntary Airport Low Emission program
VMT – Vehicle miles traveled
VOC - Volatile organic compound
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDGV</td>
<td>Light-Duty Gasoline Vehicles (Passenger Cars)</td>
</tr>
<tr>
<td>LDGT1</td>
<td>Light-Duty Gasoline Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LWV)</td>
</tr>
<tr>
<td>LDGT2</td>
<td>Light-Duty Gasoline Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)</td>
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<td>LDGT3</td>
<td>Light-Duty Gasoline Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW)</td>
</tr>
<tr>
<td>LDGT4</td>
<td>Light-Duty Gasoline Trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater ALVW)</td>
</tr>
<tr>
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<tr>
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<td>HDGV8B</td>
<td>Class 8b Heavy-Duty Gasoline Vehicles (&gt;60,000 lbs. GVWR)</td>
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