EAC AIR QUALITY SUBCOMMITTEE

FINAL REPORT – $PM_{2.5}$ SIP RECOMMENDATIONS

September 2007

5755e

NOACA

Planning For Greater Cleveland

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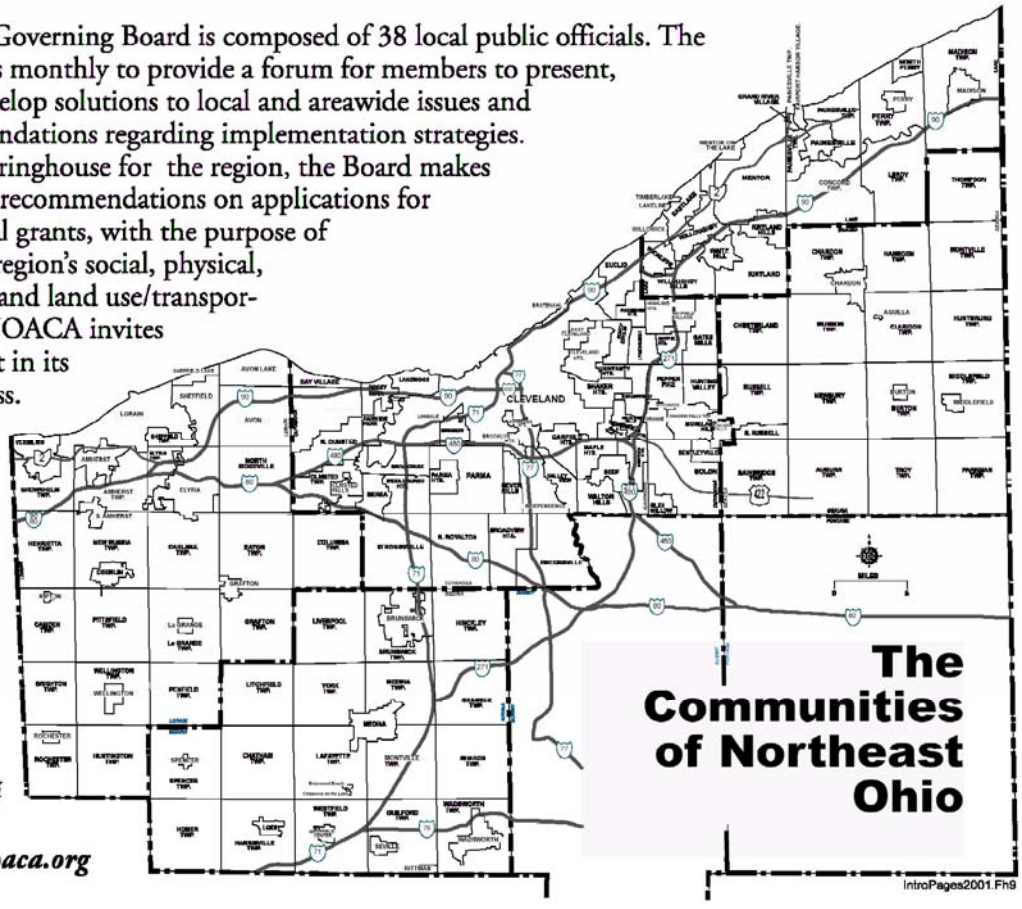

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3) Author(s) Amy Wainright, Esq., and Pamela Davis **Contributors:** Lake Michigan Air Directors' Consortium (LADCO)	**4) Report Date** **September 2007**
5) Performing Organization Name & Address **Northeast Ohio Areawide Coordinating Agency** **1299 Superior Avenue, Cleveland, OH 44114-3204** **Phone: (216) 241-2414 FAX: (216) 621-3024 Web site: www.noaca.org**	**6) Project Task No.** **101901 (FY 2007)**
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11) Supplementary Notes

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12) Abstracts

Recommendations from the NOACA Air Quality Public Advisory Task Force, as reviewed and modified by the EAC Air Quality Subcommittee, for referral to the NOACA Governing Board for endorsement and submittal to Ohio EPA for inclusion in the Northeast Ohio Fine Particle State Implementation Plan.

13) Key Words & Document Analysis

A. Descriptors: Air Pollution, SIP, State Implementation Plan, Fine Particles, Particulate Matter

B. Identifiers/Open Ended Terms

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September 2007

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Executive Summary

Six counties and one township in Northeast Ohio are in nonattainment of the National Ambient Air Quality Standards (NAAQS) for fine particles ($PM_{2.5}$ or particulate matter of less than 2.5 micrometers in diameter). The nonattainment area must demonstrate clean air by 2010. To help to achieve that goal, NOACA, under a Memorandum of Understanding with the Ohio Environmental Protection Agency (Ohio EPA) has studied possible emission reduction control strategies and will recommend a slate of them to the Ohio EPA.

Following 10 months of study by the NOACA Air Quality Public Advisory Task Force, the Air Quality Subcommittee recommends implementing the following:

Mobile Source Emission Reduction Strategies

1. **Diesel On-Road Strategies**
    a. Mandatory Best Available Retrofit Technology (BART) on Government-Owned Vehicles, with Funding *(Requiring "clean diesel" replacements and retrofits, but only when a dedicated funding source has been identified)*
    b. Voluntary Diesel Emissions Reduction Programs for Private Vehicles *(Grant or loan programs, with educational component)*

2. **Diesel Non-Road Strategies – Retrofit Financing**
    a. Combining Private Financing with Government Grants *(Innovative funding for public and private non-road diesel retrofits)*
    b. Low Interest Financing *(Funding for state and local governments)*
    c. Technical Assistance to Construction Equipment Owners *(Education Outreach)*
    d. Information on Grant Programs *(State clearinghouse of information)*

3. **Diesel Non-Road Strategies – Public Works Projects**
    a. Emissions Performance Specifications in Contracts for Public Works Projects *(Ohio EPA and ODOT to create diesel emissions limits and/or equipment requirements and/or contract bonus points for construction equipment on all large public works projects)*
    b. Accelerated Use of Ultra-Low Sulfur Diesel Fuel or Biodiesel *(Required use of low-emitting fuels on all public works projects)*

4. **Reduce Idling from Public Fleets**
    a. Mandatory Statewide School Bus Idling Regulation *(Idling time limits)*
    b. Idling Reduction Regulations for Transit and Other Public Fleets *(Voluntary idling time limits, eventually followed by mandatory)*
    c. Loan Program to Reduce Idling *(Funding for cab heaters, auxiliary power units, etc.)*

5. **Reduce Idling from Private Fleets**
    a. Voluntary Anti-Idling Program with Educational Outreach *(Voluntary idling time limits, eventually followed by mandatory requirements)*
    b. Contract Requirements for Public Projects Using Private Fleets *(Limit idling time for construction equipment)*
    c. Revolving Loan or Lease-to-Own Program for Anti-Idling Equipment *(Funding for cab heaters, auxiliary power units, etc.)*
    d. Reduce Idling from Switchyard and Line-Haul Locomotives *(State or federal law to limit railroad idling time)*

6. **Truck Stop Electrification (TSE)**
    a. Identify Key Sites for TSE *(Providing electric hook-up power at truck stops, rest areas, Turnpike locations, etc.)*
    b. Financing Program for TSE *(Public and private funding)*
    c. Require New Truck Stops to Include TSE Infrastructure *(ODOT to ensure hook-ups at all new rest areas, etc.)*

7. **Alternative Fuels and Electric Vehicles**
    a. Increased Use of Ethanol (E85) *(Public and private fleets)*
    b. Increased Use of Biodiesel *(Public and private fleets)*
    c. Increased Use of Natural Gas *(Public and private fleets)*
    d. Increased Use of Propane *(Public and private fleets)*
    e. Increased Use of Electric Vehicles *(Public and private fleets)*

8. **Roadside Diesel Opacity Testing**
    a. Statewide Roadside Diesel Opacity Testing – Public and Private Fleets *(Exhaust "smoke" testing for trucks, buses, etc., with (1) warning and (2) fine, to improve emissions from local fleets and those passing through)*

9. **Transportation Projects**
    a. Conformity Analysis of Innerbelt Project for Nonroad Emissions *(Comprehensive study of diesel construction equipment emissions)*

10. **Fuel Testing - Emission Reduction Strategies**
    a. Statewide Testing of Gasoline and Diesel Fuel Specifications *(Check for excess sulfur, water, etc., at distribution points)*

11. **Statewide Car Standards**
    a. Adopt a Safety/Anti-Tampering Inspection Program *(Prevent "dumping" of poorly functioning cars and trucks in Ohio)*

12. **Ports**
    a. Truck Traffic Anti-Idling Policy at the Port of Cleveland/Cuyahoga County *(Limit idling time while waiting for (un)loading)*

13. Airports

a. Ground Support Equipment (GSE) Replacement with Electric, CNG, or Other Clean Technology *(Low-emission baggage carts, fuel trucks, etc., with potential funding available through the federal Voluntary Airport Low Emissions (VALE) Program)*

Stationary Source Emission Reduction Strategies

1. Steel Mills
    a. NOx Reasonably Available Control Technology (RACT) for Industrial Boilers *(Reduced NOx limits according to size)*

2. NOx Credits
    a. NOx Credit Trading Bank with Partial Credit Retirement *(Ability to buy and sell NOx reductions; 5% annual removal of credits from the Ohio EPA bank)*

3. Diesel Generators
    a. Retrofit or Replace Large (Stationary) Diesel Gen-Sets
    b. Retrofit or Replace Medium (Portable) Diesel Gen-Sets
    c. Public Education Regarding Purchases of Small (Home) Diesel Generators

4. Residential Combustion
    a. Adoption of the NESCAUM Model Rule for Outdoor Hydronic Heaters *(Emission limits on new wood-fired boilers; gradual regulation of existing boilers)*
    b. Mandatory "No Burn" Days When Ozone or $PM_{2.5}$ is Elevated *(Affecting fireplaces, outdoor burning, etc.)*
    c. Voluntary Wood Stove Change-Out Program *(Subsidized USEPA-approved clean-burning inserts)*

5. Hot Mix Asphalt Plants
    a. Reasonably Available Control Technology (RACT) for Hot Mix Asphalt Plants *(Combination of flexible controls)*

6. Restaurants
    a. Food-Service Catalytic Oxidizer for Chain-Driven Charbroilers *(Air pollution controls on grilling and frying equipment)*

7. Road Salt
    a. Use of Liquefied Brine to Reduce Total Applied Road Salt
    b. Strict Adherence to Local Salt Minimization Policies

8. Enforcement Practices
    a. Adjust to an Appropriate Level of Staffing to Enhance Compliance with Existing Law *(Additional staff for OEPA and local air agencies)*

9. Long-Term Solutions: Energy Strategies
    a. Renewable Portfolio Standards and Wind Power
    b. Energy Audits for Businesses and Municipalities
    c. Encouraging Manufacturing of Energy Efficient Components

This report contains a brief summary of each of the strategies, with air quality impacts and costs. Much more extensive material is available in the Task Force reports, found at: www.noaca.org/pmsipplan.html Recommendations are due to the Ohio EPA in the fall of 2007.

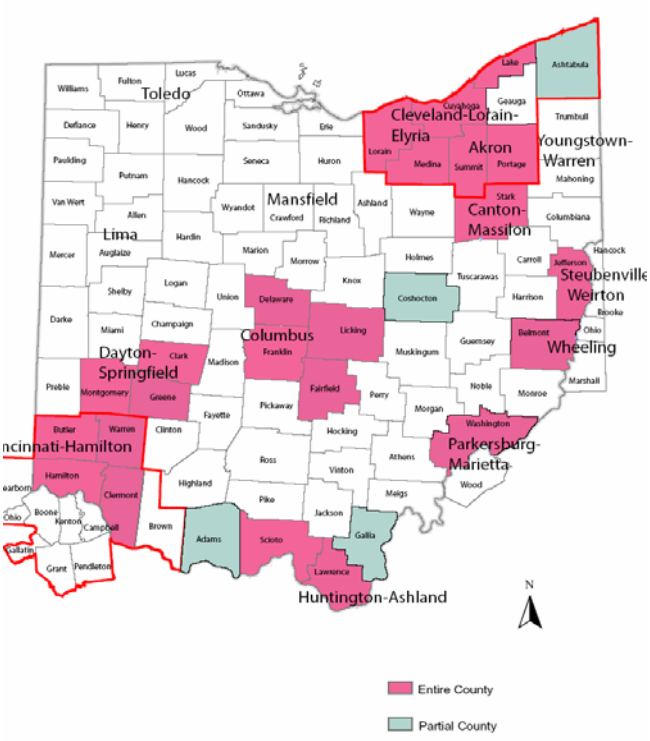
Because of the uncertain nature of $PM_{2.5}$ formation and the current lack of substantial studies on the controls that might reduce formation, the strategies contained in this report are expected to assist Northeast Ohio to achieve attainment in a timely fashion, but they have not yet been modeled to see whether attainment would result. NOACA continues to rely on the services of the Lake Michigan Air Directors' Consortium (LADCO) in its airshed modeling efforts for the states of Ohio, Indiana, Illinois, Michigan, and Wisconsin, and encourages modeling of the combination of strategies described in this report. NOACA staff will have continued involvement with LADCO and the Ohio EPA in order to continue providing information on modeling to NOACA and this Subcommittee.

Northeast Ohio and $PM_{2.5}$ Nonattainment

A. Counties in Nonattainment

On December 17, 2004, the United States Environmental Protection Agency (USEPA) designated Ashtabula (partial), Cuyahoga, Lake, Lorain, Medina, Portage, and Summit Counties as in nonattainment for the annual fine particulate ($PM_{2.5}$) standard. "$PM_{2.5}$" stands for "particulate matter smaller than 2.5 micrometers in diameter," which is so small as to be essentially invisible until it accumulates to the point where a brown haze can be seen by the observer.

This map shows the State of Ohio and its $PM_{2.5}$ nonattainment areas:



"Nonattainment" means a region is unable to achieve the federal National Ambient Air Quality Standards (NAAQS), which are health-based limits set by USEPA for the six criteria pollutants named in the federal Clean Air Act.

The NAAQS for $PM_{2.5}$ include an annual standard set at 15 micrograms per cubic meter (15 $\mu g/m^3$), based on the 3-year average of annual mean $PM_{2.5}$ concentrations. There is also a 24-hour standard, recently revised from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ based on the 3-year average of the 98th percentile of 24-hour concentrations. Currently, Northeast Ohio is in nonattainment for the **annual** standard. Designations under the new 24-hour standard will not be made until late 2008 or early 2009.

B. Federal Requirement: A State Implementation Plan (SIP)

States must draft a State Implementation Plan (SIP) to improve the air quality in their nonattainment areas. States having $PM_{2.5}$ nonattainment areas are required to submit to USEPA a SIP by April 2008. Control measures have to be in place by 2009. The area must demonstrate attainment by April 2010, with possible extensions available until 2015, if control measures are not feasible.

Ohio EPA is responsible for submitting all SIPs for Ohio. NOACA will contribute recommendations through the efforts of the NOACA Air Quality Public Advisory Task Force and the adoption of a slate of recommendations by the NOACA Governing Board, as it did for the 8-Hour Ozone SIP.

C. Complications in Creating a $PM_{2.5}$ SIP

As noted by the National Association of Clean Air Agencies, in their report: *"Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options"* (STAPPA/ALAPCO, now NACAA, March 2006).

Health Benefits

"USEPA estimates that meeting the current $PM_{2.5}$ standards would avoid tens of thousands of premature deaths annually and save hundreds of thousands of people from significant respiratory and cardiovascular disease."

Formation

"**The chemistry and physics of $PM_{2.5}$ formation in the atmosphere are incompletely understood.**"

Data

"There are further challenges for SIP writers. **In a perfect world, control-efficiency and cost-effectiveness data would be at hand; however, it is not consistently available.**"

Constituents

"The common chemical constituents of PM include sulfates, nitrates, ammonium, elemental carbon, a variety of organic compounds, water and crustal material (including metals, dust, sea salt, and other trace elements)."

Seasons

"$PM_{2.5}$ concentrations exhibit seasonal variability."

Sources

"The sources of $PM_{2.5}$ and $PM_{2.5}$-precursor emissions are highly diverse, including both natural (biogenic) and human-made (anthropogenic) sources. Sources include motor vehicles, power plants, industrial facilities, wood stoves and fireplaces, forest fires, sea salt, paved and unpaved roads and many others."

The Nonlinear Relationship

"The relationship between changes in precursor emissions and ambient $PM_{2.5}$ concentrations, moreover, can be nonlinear. Generally, SO_2 emissions reductions lead to reductions in concentrations of sulfate aerosols and nitrogen oxide (NOx) emissions reductions lead to reductions in nitrate aerosols. However, the direction and extent of changes in ambient $PM_{2.5}$ concentration as a result of a given level of emissions reduction **vary by location and season and depend on fluctuations in ammonia emissions and changes in prevailing meteorology and photochemistry.** This **complicates the task** for state and local officials attempting to prioritize their $PM_{2.5}$ control strategies."

D. $PM_{2.5}$ in Northeast Ohio – Transported Air Pollution

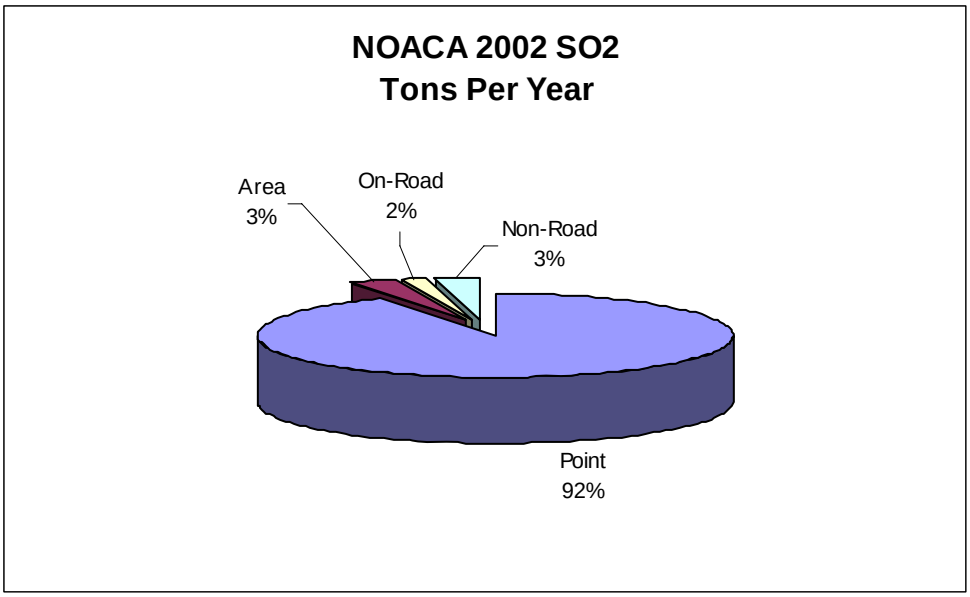
"$PM_{2.5}$ mass in Cleveland is comprised of mostly ammonium sulfate, organic carbon, and ammonium nitrate. **The regional and local urban contributions vary by chemical species, with regional contributions comprising approximately all of the sulfates, one-half to two-thirds of the nitrates, and one-third to one-half of the organics.**" (*"$PM_{2.5}$ in Urban Areas in the Upper Midwest"* (Lake Michigan Air Directors' Consortium (LADCO) February 12, 2004.)

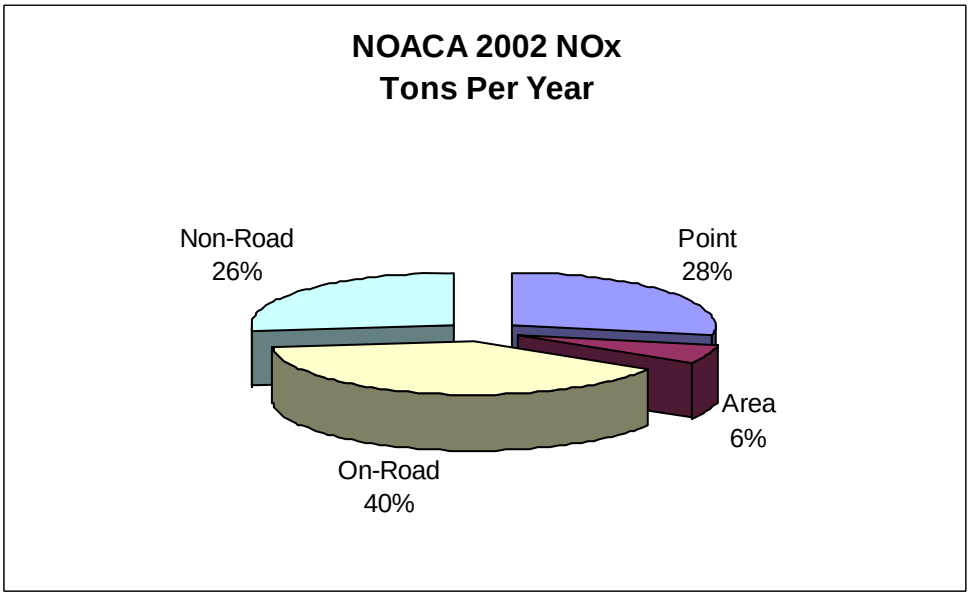
Please note that "regional contributions" mean transported air pollution over which the local area has no control. The regional contributions may come from elsewhere in the state of Ohio or elsewhere in the nation.

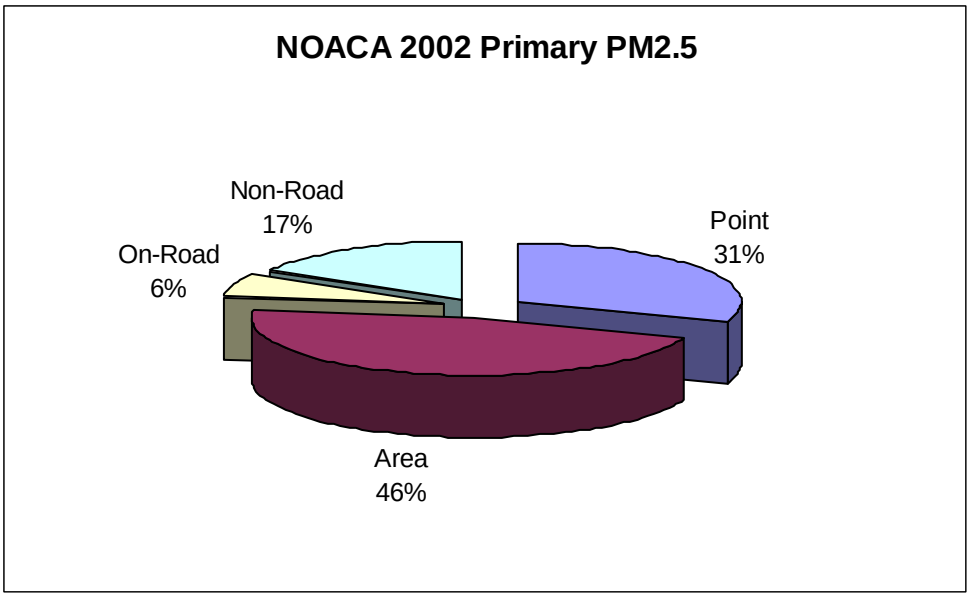
E. 2002 Emissions Inventory – Ohio EPA

The following three pie charts represent the sources that contribute several of the largest precursors to $PM_{2.5}$: Primary (directly emitted) PM2.5 itself; oxides of nitrogen (NOx), and sulfur dioxide (SO2):

"Point":	Large stationary sources, which may be industrial or institutional.
"On-Road"	Motor vehicles including cars, trucks, buses, and motorcycles.
"Non-Road"	Motor vehicles including construction equipment and agricultural equipment.
"Area	Fugitive dust, dirt, open burning, stone quarrying, fuel combustion (residential and small commercial), and incineration.


NOACA 2002 SO2
Tons Per Year
Area
3%
On-Road
2%
Non-Road
3%
Point
92%


NOACA 2002 NOx
Tons Per Year
Non-Road
26%
Point
28%
Area
6%
On-Road
40%



Please note that "Primary $PM_{2.5}$" is an estimate generated by USEPA-approved methodology from coarse particulate emissions (PM_{10}). Consequently, it may be under-represented in the total inventory at this time.

It can be readily seen that Northeast Ohio's $PM_{2.5}$ nonattainment problem stems from a combination of sources, indicating that emission reduction strategies on all the various sources would assist in achieving clean air for the region.

F. Data Sources

Much of the mobile source data in this report was taken from *"Final Report: Evaluation of Candidate Mobile Source Control Measures for LADCO States in 2009 and 2012"* Environ, March 21, 2007. Other data, both mobile and stationary, was taken from USEPA, Ohio EPA, the National Association of Clean Air Agencies (NACAA), as well as industry-specific sources. Please see the full reports of the NOACA Air Quality Public Advisory Task Force at www.noaca.org/pmsipplan.html for more information on each of the topics included here and their associated data.

Glossary

BART – Best Available Retrofit Technology.

CMAQ – Congestion Mitigation and Air Quality funds.

DOC – Diesel oxidation catalyst.

DPF – Diesel particulate filter.

Environ – Subcontractor to LADCO.

LADCO – Lake Michigan Air Directors' Consortium.

NOx – Oxides of nitrogen.

ODOD – Ohio Department of Development.

ODOT – Ohio Department of Transportation.

PM – Particulate matter.

$PM_{2.5}$ – Particulate matter of less than 2.5 micrometers in diameter.

RACT – Reasonably Available Control Technology.

SO_2 – Sulfur dioxide.

THC – Total hydrocarbons (volatile organic compounds).

TSE – Truck stop electrification.

ULSD – Ultra-low-sulfur diesel fuel (15 parts per million sulfur)

VOC – Volatile organic carbon.

Mobile Sources

1. Diesel On-Road Strategies

1.a. Mandatory Best Available Retrofit Technology (BART) for Government-Owned Vehicles, with Funding

Ohio EPA should develop new rules requiring government-owned diesel fleets to install Best Available Retrofit Technology (BART) on their vehicles phased in over a period of years. BART in this context means the technology that is appropriate for the specific vehicles or equipment being modified and which provides maximum reduction of targeted emissions considering both tons of emissions avoided and diesel emissions exposure within affected populations. Ohio EPA should consider including the opportunity for compliance extensions for carefully defined hardship circumstances. Any BART required should be "technology neutral" (i.e., any verified technology that can achieve the required reductions is acceptable).

The Subcommittee recommends that this strategy be pursued only if there is a secure, dedicated funding source, sector by sector, for Northeast Ohio. The new diesel emission reduction fund, created by the State of Ohio and administered by the Ohio Department of Development, might be one such fund. School buses should be a top priority because of the population affected. Northeast Ohio's nonattainment area should receive priority funding.

Air Quality Impacts

- For a group of 4,281 on-road Heavy-Duty Diesel Vehicles (HDDV), which might be the reasonable number of government-owned vehicles in Northeast Ohio out of the 5,919 total possible, and retrofitting with a Diesel Oxidation Catalyst (DOC), according to Environ:
    - 0.00 tons per day (tpd) NOx (oxides of nitrogen) reduced
    - 0.09 tons per day (tpd) PM (particulate matter) reduced
    - 0.77 tons per day THC (total hydrocarbons) reduced

Cost

- DOC scenario (low-cost but achieving 25-50% PM reductions):
    - $2,000 per unit
    - $900 – 1,300 per ton of pollution reduced
    - Total cost for the entire group: $8,561,949
    - Costs of the survey and enforcement by Ohio EPA, assuming one full-time employee with salary and overhead, might be $100,000.

NOACA's Role NOACA's CMAQ Task Force should prioritize these recommendations in the Regional Transportation Investment Policy. NOACA should undertake a public education campaign.

1.b. Voluntary Emissions Reduction Programs for Private Vehicles

The state of Ohio should establish a grant fund or loan program to assist both public and private fleets with the purchase and installation of emission control equipment. The state of Ohio should establish and implement an educational campaign to provide public and private fleet managers with the technical resources and information needed to install, operate and maintain effective emission control equipment.

Air Quality Impacts

- The following air quality impacts and costs might accrue to Northeast Ohio, according to Environ:
    - 5.70 tons per day NOx reduced
    - 0.28 tons per day PM reduced
    - 1.55 tons per day THC reduced

Cost

- The following cost might accrue to Northeast Ohio:
    - $177,065,574

In addition, the costs of the study by Ohio EPA would accrue, as would the costs of administering the grant program and of creating the educational campaign. Approximate costs might total $500,000.

NOACA's Role A public education campaign be undertaken by NOACA.

2. Diesel Non-Road Strategies – Retrofit Financing

2.a. Combining Private Financing with Government Grants

Develop and encourage innovative ways to leverage the combination of private financing with available government grant funds (including tax incentives, rebates and performance bonuses) to maximize the benefits to equipment owners and minimize the burdens on equipment owners and contracting agencies.

2.b. Low Interest Bridge Financing

Develop a program of low interest, state bond-supported, bridge financing to assist state and local governments in increasing the replacement of older, higher emitting equipment.

2.c. Technical Assistance to Construction Equipment Owners

Provide construction equipment owners with technical assistance on available retrofit, repowering and other emission reduction technologies and practices, including information on expected costs and benefits.

2.d. Provide Information on Grant Programs

Make information available on, and support the use of, grant programs from other federal and state agencies to help broaden the overall funding pool and leverage available grant funds for retrofit-related projects.

Air Quality Impacts

- The following air quality impacts might accrue to Northeast Ohio if the potential 2,138 pieces of non-road diesel construction equipment were replaced or retrofitted, according to Environ:
    - 1.94 tons per day NOx reduced
    - 0.08 tons per day PM reduced
    - 0.29 tons per day THC reduced

Cost

- $39,071,902
- Costs for the educational component and technical assistance component would also accrue.

NOACA's Role NOACA's CMAQ Task Force should prioritize these recommendations in the Regional Transportation Investment Policy. NOACA should undertake a public education campaign.

3. Diesel Non-Road Strategies – Public Works Projects

3.a. Emissions Performance Specifications in Contracts for Public Works Projects

Ohio EPA and ODOT should work with representatives of the construction industry, government contracting agencies, and environmental and other interested citizens' groups to establish a program of improved emissions performance specifications in contracts of substantial public works projects (e.g., projects over $2 million in total cost), including all major highway, bridge and public building construction.

Options for achieving such performance specifications might include:

- Anti-idling practices
- Use of ultra-low-sulfur diesel fuel (ULSD)
- Use of alternatively fueled vehicles
- Diesel retrofits (pollution control devices) or repowers (new engines)
- Diesel replacements (new equipment)

The Subcommittee recommends that the contract specifications take the form of incentives through awarded bid points, rather than mandatory emission limits at job sites, so that the field of available contractors will not be unnecessarily reduced.

Air Quality Impacts

- The following air quality impacts might accrue to Northeast Ohio if 10% of the possible 2,138 pieces of non-road diesel construction equipment (meaning 214 pieces) were being used on public works projects and were replaced, repowered or retrofitted, according to Environ:
    - 0.19 tons per day NOx reduced
    - 0.01 tons per day PM reduced
    - 0.03 tons per day THC reduced

Cost

- $3,907,190

3.b. Accelerated Use of Ultra-Low Sulfur Diesel Fuel and/or Biodiesel

Accelerate the introduction of ultra-low sulfur diesel (ULSD) fuel or other fuel with equal or greater emissions performance, such as blended biodiesel at B20 (20%) or higher level, by mandating its use in public construction projects where equipment is fueled on-site through either visiting fuel jobbers or on-site tankage.

"Ultra-Low Sulfur Diesel Fuel" (ULSD) refers to 15 ppm sulfur. Accelerating the use of ULSD means requiring its use prior to the federally mandated deadline of 2010. Biodiesel can also be blended from ULSD to increase lubricity and reduce engine wear.

Air Quality Impacts

- If ULSD is used:
  - 10% PM reduced
- If biodiesel B20 (20% blend) is used:
  - 18% PM reduced

Cost

- Cost of ULSD is nearly equivalent to off-road diesel, which is currently selling for approximately $2.15 per gallon.
- Cost of biodiesel is currently 5-10 cents higher per gallon than ultra-low sulfur diesel (ULSD) fuel.

The Subcommittee also recommends that use of such fuel be mandated by the State of Ohio for all non-road uses before the federally mandated deadline of 2010.

NOACA's Role NOACA should assist Ohio EPA and ODOT with creating the program of improved emissions performance specifications.

4. Reduce Idling From Public Fleets

4.a. Mandatory Statewide School Bus Idling Regulation

Ohio should establish a mandatory statewide school bus idling regulation.

4.b. Idling Reduction Regulations for Transit and Other Public Fleets

Ohio should establish an idling reduction regulation for transit and/or other public fleets. This could begin with voluntary adoption of policies by fleets to exhibit public leadership in emissions reduction followed by mandatory adoption of a statewide idling regulation. (The Subcommittee notes that idling reductions for public fleets is already one of the 8-Hour Ozone SIP Recommendations.)

4.c. Loan Program to Reduce Idling

Ohio should create an incentive to reduce idling by establishing a revolving loan or lease-to-own program to assist publicly owned fleets with the initial purchase of idling reduction equipment. This could be developed through a partnership with the Ohio Air Quality Development Authority (OAQDA) and other appropriate Ohio agencies, such as Ohio EPA and the Ohio Department of Development's Office of Energy Efficiency (OEE). This program would promote voluntary efforts by fleets to install idling reduction equipment such as auxiliary power units (APUs) and engine preheaters.

Air Quality Impacts

- The following air quality impacts might accrue to Northeast Ohio, according to Environ:
    - 0.21 tons per day NOx reduced
    - 0.005 tons per day PM reduced

Cost

- Cost-savings for the fuel saved.
- Education and enforcement costs, only, if no technology is purchased.
- For heavy-duty diesel vehicles (HDDV), the cost of an automatic shut-off system ranges from $1,325 – 2,500.
- Cost of an auxiliary power unit (APU) ranges from $6,000 – 9,000. Pay-back time can be 12-24 months, depending on the price of fuel.
- Cost of engine heat recirculation equipment is approximately $500.
- Cost of bunk heaters is approximately $3,000.
- Cost of engine pre-heaters is $1,400 - 3,200.
- Additional costs might accrue to Northeast Ohio if it could place anti-idling restrictions on 3,092 vehicles and have each of them purchase an APU for $7,500 (as an example):
    - $29,270,062
    - Cost-effectiveness is $1,700 per ton of pollutant removed, according to Environ.

NOACA's Role NOACA should coordinate sharing members' anti-idling ordinances.

5. Reduce Idling from Private Fleets

5.a. Voluntary Anti-Idling Program with Educational Outreach

Ohio should promote a voluntary anti-idling program for private fleets with educational outreach for a limited time; the next phase would be to establish a mandatory statewide policy in law. Public and private fleets must be treated identically. Municipalities should not enact conflicting requirements through Home Rule. If a law were to be passed, it should be statewide to ensure such consistency. The exceptions and exemptions as provided in the USEPA Model Anti-Idling Ordinance should be followed.

5.b. Contract Requirements for Public Projects Using Private Fleets

Set contract requirements for public projects using private fleets to require the use of idling reduction operational policies and/or hardware to reduce emissions in the communities served. Please see the discussion earlier in this Report on contract specifications for public works projects.

5.c. Revolving Loan or Lease-to-Own Program for Anti-Idling Equipment

Create a revolving loan or lease-to-own or grant program for purchasing anti-idling equipment for private fleets and private owners, coupled with an outreach program to inform private fleet operators of this opportunity.

Air Quality Impacts

- The following air quality impacts might accrue to Northeast Ohio:
  - 0.21 tons per day NOx reduced
  - 0.005 tons per day PM reduced

Cost

- Cost-savings for the fuel saved.
- Education and enforcement costs, assuming no technology is purchased.
- Costs for administering the loan program might involve two full-time employees, with salary and overhead totaling $75,000 each, for a total of $150,000.
- For heavy-duty diesel vehicles (HDDV), the cost of an automatic shut-off system ranges from $1,325 – 2,500.
- Cost of an auxiliary power unit (APU) ranges from $6,000 – 9,000. Pay-back time can be 12-24 months, depending on the price of fuel.
- Cost of engine heat recirculation equipment is approximately $500.
- Cost of bunk heaters is approximately $3,000.
- Cost of engine pre-heaters is $1,400 - 3,200.
- The following cost might accrue to Northeast Ohio if it could place anti-idling restrictions on 3,092 vehicles and have each of them purchase an APU for $7,500 (as an example):
  - $29,270,062
  - Cost-effectiveness is $1,700 per ton of pollutant removed.

NOACA's Role NOACA should assist with educational outreach.

5.d. Reduce Idling From Switchyard and Line-Haul Locomotives

The State of Ohio or the federal government should develop a program to reduce idling from switchyard locomotives.

Air Quality Impacts

- According to Environ's *"Final Report: Evaluation of Candidate Mobile Source Control Measures for LADCO States in 2009 and 2012"* (March 21, 2007), the following air quality reductions would accrue to the five LADCO states (Indiana, Illinois, Michigan, Ohio, and Wisconsin) if anti-idling restrictions were applied to both switching and line-haul locomotives:

March 2007

ENVIRON

Table ES-8. An example emission reduction scenario for anti-idling restrictions on locomotives in LADCO states in 2009 and 2012.

Technology	Project Cost-Effectiveness ($/ton)	Estimated Reductions per locomotive (tons/yr)			Cost per Unit ($)	# of Units Available	Units Estimated	Total Cost	Total Emissions Reductions (tons/day)		
		NOx	PM	ROG					NOx	PM	ROG
Measure 33/34/35/37: Anti-Idling Restriction on Locomotives											
2009											
Switching	$1,400	1.28	0.04	0.10	$30,000	NA	757	$22,713,439	2.65	0.08	0.22
Line-Haul	$1,400	0.84	0.06	0.11	$30,000	NA	898	$26,953,254	2.07	0.15	0.27
Total		2.12	0.10	0.22			1,656	$49,666,693	4.72	0.23	0.49
2012											
Switching	$1,400	1.28	0.04	0.10	$30,000	NA	1,514	$45,426,878	5.31	0.16	0.44
Line-Haul	$1,400	0.84	0.06	0.11	$30,000	NA	1,797	$53,906,508	4.14	0.29	0.55
Total		2.12	0.10	0.22		NA	3,311	$99,333,386	9.44	0.45	0.98

A very small portion of these emissions would accrue to Northeast Ohio, depending on the number of locomotives in the region to which the emission reduction strategy could be applied. The reductions of NOx, PM, and reactive organic gases (ROG), stated in "tons per day" rather than "tons per year" per locomotive would be:

- 0.006 tons per day NOx reduced per locomotive
- 0.0003 tons per day PM reduced per locomotive
- 0.0006 tons per day ROG reduced per locomotive

Cost

- Costs would include $30,000 per APU purchased, multiplied by the number of locomotives purchasing and installing the APUs.
- Cost-effectiveness is $1,400 per ton of pollution removed.

NOACA's Role NOACA should undertake an update of the railroad inventory.

6. Truck Stop Electrification

Supplying equipment at truck stops so that truckers can turn off their diesel engines while still having power, light, heat, air conditioning, and other services would result in large NOx reductions, as well as some PM and CO reductions. Truck stop electrification (TSE) was also recommended in the 8-Hour Ozone SIP Recommendations.

6.a. Identify Key Sites for Truck Stop Electrification (TSE)

Ohio should work with the trucking industry and neighboring states to identify key sites for truck stop electrification (TSE) along heavily traveled corridors on major trucking routes. These sites should include not only truck stops, but state highway rest areas as well. The Ohio Turnpike Commission should be part of this coordination effort.

6.b. Financing Program for TSE

The Ohio Office of Energy Efficiency (OEE), Ohio EPA, and the Ohio Air Quality Development Authority should work together on the establishment of a financing program for TSE projects. Efforts are needed to move TSE projects from federally funded grant projects to matching grant/loan programs for private truck stops and eventually to projects funded entirely by private dollars to meet user demand. The new diesel emission reduction fund, created by the State of Ohio and administered by the Ohio Department of Development, might be one such fund.

6.c. Require New Truck Stops to Include TSE Infrastructure

ODOT should require that all newly constructed public rest stops/truck stops include the electrical infrastructure necessary to meet the increasing demand of long haul transportation on Ohio's roadways and air quality requirements.

Air Quality Impacts

- The data for electrifying all three truck stops in the Northeast Ohio nonattainment area would achieve:
    - 0.38 tons per day NOx reduced
    - 0.01 tons per day PM reduced

Cost

- The cost to electrify all three truck stops in Northeast Ohio, using "IdleAire" commercial technology, would be $3,273,200. However, one has been completed as of 2006 (63 spaces at TA #015 Lodi). This reduces the estimated cost to $2,000,000.
- At today's diesel prices ($2.85/gal.), the current hourly charge for IdleAire services of approximately $1.85 (fleet price) would generate $1.00 of savings per hour of use for the trucker renting the electric services.

NOACA's Role NOACA's CMAQ Task Force should prioritize these recommendations in the Regional Transportation Investment Policy. NOACA should coordinate with the Ohio Turnpike Commission and ODOT regarding sites for TSE.

7. Alternative Fuels and Electric Vehicles

The following strategies are *not additive* – only one can be used at a time. They are alternatives to one another, suited to various purposes. Public education campaigns related to these recommended strategies are encouraged.

However, the Subcommittee recommends that CNG, propane, and electric vehicles be encouraged where possible, rather than E85 and biodiesel, in the event that increased ozone formation is shown to be associated with E85 and biodiesel use.

7.a. Increased Use of Ethanol (E85)

Ethanol in a blend of 85% ethanol to 15% gasoline can be used in vehicles marked "Flex Fuel" and can result in air pollution reductions.

Air Quality Impact:

- According to USEPA, the following tailpipe emissions result when E85 is used:
  - 10% NOx reduced
  - 20% PM reduced

Cost

- According to USEPA, ethanol blends are more expensive than traditional fuel. However, in the midwest, E85 is sold at a price equivalent to or less than the mid-range unleaded gasoline.
- Cost is subject to availability, which is extremely limited at this time in Northeast Ohio. Only 22 stations in the state of Ohio sell E85 at this time.
- The cost of FFVs themselves is generally comparable to other gasoline-powered cars.
- There is a fuel penalty associated with E85 of 5-15%.

7.b. Increased Use of Biodiesel

Biodiesel can be used in blends with diesel or ultra-low-sulfur diesel at 1%, 20% (B20), and 100% (B100), with varying impacts.

Air Quality Impact:

- According to USEPA, the following air emissions result when B20 is used:
  - NOx impact unknown – National Renewable Energy Laboratory
  - 15% PM reduced

Cost

- According to USEPA, B100 costs between $1.95 to $3.00 per gallon, depending on the supplier. B20 costs only slightly more than conventional diesel, per gallon, by about 5-10 cents.

7.c. Increased Use of Natural Gas (NG)

The use of compressed natural gas and liquid natural gas has been successful in varying applications to reduce air pollution.

Air Quality Impact

- According to USEPA, the following air emissions result from CNG use, when compared to conventional gasoline engines:
    - 35% NOx reduced
    - 100% PM reduced
    - When compared to diesel engines, CNG reduces NOx by 80%.

Cost

- CNG generally costs 15-40% less than gasoline or diesel fuel, per gallon. In 2007, CNG sold in one area for $2.55 per gallon, while gasoline was $3.50 per gallon. The "gas gallon equivalent (GGE)" (taking into account the energy produced) for CNG can be as low as $1.85, according to Clean Fuels Ohio.
- Cost-effectiveness per ton of NOx removed is $9,188.

7.d. Increased Use of Propane

The use of propane cars and trucks has been successful in reducing air pollution, according to the Propane Education and Research Council.

Air Quality Impact

- There were no available emission reduction figures from USEPA for propane.
- The Propane Education and Research Council (PERC) states: *"Perhaps the most important advantage of propane is that it is an extremely clean fuel. It emits minimal sulfur oxides and has ultra-low emissions of particulates, carbon monoxide, and volatile organic compounds. It also burns much cleaner than gasoline, home heating oil, and diesel fuel."*

Cost

- Propane in 2007 costs approximately $1.50 per gallon.
- Capital cost for the purchase of a propane forklift, for example, is $16,000 – $22,000 each. (This is slightly less than the price of either a diesel or electric forklift and approximately the same as a gasoline or CNG forklift.)

7.e. Increased Use of Electric Vehicles

Electric vehicles, such as forklifts, or electric hybrid automobiles and trucks, have varying reductions on air pollution.

Air Quality Impacts

- Assuming a fleet of 100 electric hybrid cars, the following reductions might accrue:
    - 0.1 tpd NOx
- The data for a single electric forklift show reveal that it is essentially emission-free (without quantifying the very small cost of recharging). Air pollution reductions would vary depending on the number of forklifts in the nonattainment area that were replaced with electric forklifts.

Cost

- Cost of an electric hybrid car, compared to a standard gasoline-powered vehicle, is several thousand dollars higher. The savings in fuel, plus the substantially higher resale value, may result in a payback on the additional price of the car. If one hybrid is $3,000 more than a standard vehicle, then the cost for a fleet of 100 hybrids is an additional $300,000.
- Cost-effectiveness, varies from $40,000 - $82,000 per ton of pollution removed
- Cost of an electric forklift is $22,000 - $39,000
- Cost per ton of NOx removed through the use of an electric forklift, per the California Air Resources Board, is $13,000/ton.

NOACA's Role NOACA's CMAQ Task Force should prioritize these recommendations in the Regional Transportation Investment Policy. NOACA should undertake a public education campaign.

8. Roadside Diesel Opacity Testing

8.a. Statewide Roadside Diesel Opacity Testing – Public and Private Fleets

The Ohio EPA should implement a roadside diesel opacity testing program for large tractor-trailers. Roadside diesel "smoke" testing programs usually are implemented at truck weigh stations or rest areas, using a single state EPA employee, using a hand-held device for a "snap idle" test. (In Ohio, the program could also be implemented as part of the State Troopers Motor Carrier Inspection Program.)

The exhaust is tested for opacity. Trucks failing to meet the opacity limit are fined by ticketing. Across the United States, 22 states test exhaust from diesel trucks for its opacity, which is a good estimate of the particulate matter being put out.

Public fleets (including municipal vehicles, state vehicles, school buses, and transit buses), rather than being tested at the roadside, could be tested at their home garages.

The fines generated from such a program would assist in implementing other air quality reduction strategies. Assessing a fine of $250 for each violation of an opacity standard might generate as much as $4 million annually across the state of Ohio, if testing were implemented at all weigh stations statewide.

In order to increase air quality impacts, while reducing costs to public and private truck owners, a "Warning Ticket" should be the ticket given out on the first occasion that a truck failed the opacity test. Only on a second discovered violation should a fine be imposed.

Air Quality Impact

- Reduction of $PM_{2.5}$. Total impact dependent on the number of trucks failing.

Cost

- Cost of implementing a statewide program is approximately $700,000.
- Cost to truck owners would vary depending on whether engine tune-ups or PM filters were required. A tune-up might cost several hundred dollars, while the least expensive PM filter might cost $1,000.
- Fines collected might amount to $4 million, assuming a fine of $250 per violation. The funds could be directed to be used for Diesel Retrofit Programs, including grant and loan programs for public and private fleets.

NOACA's Role None.

9. Transportation Projects

Background
A large number of transportation projects, including road and bridge work, will take place in the Northeast Ohio nonattainment area between 2006-2009. For one project, the Cleveland Innerbelt Project, the timeline stretches to 2025.

A concern was raised that neither Transportation Conformity analyses nor General Conformity analyses would take into account the emissions from non-road diesel construction vehicles. Also, the potential increased emissions from congested traffic during construction and the dust raised during construction fail to be included for analysis.

Ordinarily, Transportation Conformity (a federal requirement for road projects) analyzes whether the completed road will result in more emissions compared to not building the road. A "build/no-build" scenario is studied. However, the emissions studied are only those from the vehicles that will use the road when it is built. General Conformity analyzes emissions from other types of federally funded projects (non-transportation).

However, Transportation Conformity analysis of non-road emissions (such as construction equipment) **does** apply to projects that are significantly large or that last significantly long (more than 5 years).

The Subcommittee recommends the strategy below, in addition to the "Diesel Non-Road Strategies – Public Works Projects" options outlined earlier in this Report, which will assist in lowering construction emissions significantly.

9.a. Conformity Analysis of Innerbelt Project for Nonroad Emissions

The Cleveland Innerbelt Project should be analyzed under Transportation Conformity to see whether the non-road diesel emissions, traffic congestion emissions, and construction dust will cause the emissions budget to be exceeded.

NOACA's Role NOACA should perform the requested Conformity analysis.

10. Statewide Testing of Gasoline and Diesel Fuel Specifications

Background
Summit County is the only county in Ohio 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. It also checks for water, other contaminants, and for proper octane level.

For diesel engines, testing could ensure that new USEPA ultra-low-sulfur diesel limits are being met in Ohio. At least part of Northeast Ohio's nonattainment problem is related to sulfur and ammonium sulfates in the air. Consequently, the control of excess sulfur is essential.

Rather than testing at retail pumps, the Subcommittee recommends that the testing be performed at the supply source or at the tanks, in order to increase efficiency and lessen the cost.

10.a. Statewide Testing of Gasoline and Diesel Specifications

Testing of gasoline and diesel specifications, at the supply source or at the tanks, could be performed by the Ohio Department of Agriculture, Ohio EPA, by the Ohio Department of Transportation, or by individual counties.

Costs would involve salaries and overhead for the employees performing the work, as well as for the laboratories performing the tests.

Air Quality Impacts

- Reduction of SO_2 if high-sulfur gasoline or diesel is found.

Cost

- Assuming 10 new state employees, each with salary and overhead of $75,000 each, gives a cost of $750,000, for statewide implementation.
- Laboratory testing would be an additional cost.

NOACA's Role None.

11. Statewide Safety/Anti-Tampering Standards for All Vehicles

11.a. Statewide Safety/Anti-Tampering Standards for All Vehicles

Statewide standards for vehicle safety and to prevent tampering with air pollution controls would be valuable for all used vehicles sold in Ohio because many such vehicles pass through Northeast Ohio or emit pollution that transports to Northeast Ohio.

An annual or bi-annual inspection program could be implemented, or a "point of sale" program could be implemented that would include dealership sales, auto auctions, and private sales.

A safety/anti-tampering program would increase protection of the public health and safety, as well as offering consumer protection now enjoyed by neighboring states.

Pennsylvania has a vehicle safety inspection program that covers the following:

- "Safety inspections for passenger cars and light-duty trucks require that the following items be checked: suspension components, steering, braking systems, tires and wheels, lighting and electrical systems, glazing (glass), mirrors, windshield washer, defroster, wipers, fuel systems, the speedometer, the odometer, the exhaust systems, horns and warning devices, the body, and chassis. ***For most vehicles in the 42 county, Non-I/M region this safety inspection will also include a Visual Anti-Tampering Check. The Visual Anti-Tampering Check is an examination of the vehicle to see if the required emissions components have been tampered with or removed."***

- "Safety inspections for medium and heavy duty trucks and buses require that the following items be checked: suspension components, steering, braking systems, tires and wheels, lighting and electrical systems, glazing (glass), mirrors, windshield washer, defroster, wipers, fuel systems, the speedometer, the odometer, the exhaust systems, horns and warning devices, the body, and chassis."

- "Safety inspections for recreational, semi- and utility trailers require that the following items be checked: suspension components, braking systems, tires and wheels, lighting and electrical systems, glazing, the body, and chassis."

- "Safety inspections for motorcycles require that the following items be checked: suspension components, steering, braking systems, tires and wheels, lighting and electrical systems, glazing (glass), mirrors, fuel systems, the speedometer, the odometer, the exhaust systems, horns and warning devices, the body, and chassis."

- "Safety inspections for motor-driven cycles and motorized pedalcycles require that the following items be checked: steering, braking systems, tires and wheels, lighting and electrical systems, glazing (glass), mirrors, fuel systems, the speedometer, the odometer, the exhaust systems, horns and warning devices, the body, and chassis."

Air Quality Impacts

- Reductions in CO, VOCs, NOx, and PM as tampered or removed parts are replaced by owners.

Cost

- Cost for administering the program across the State of Ohio, through the services of individual mechanic's locations, would be borne by the vehicle owner through an inspection fee.

NOACA's Role None.

12. Ports

12.a. Truck Traffic Anti-Idling Policy at the Port of Cleveland/Cuyahoga County

The Port of Cleveland handles approximately 500,000 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. Imposing an anti-idling policy would reduce air pollution emissions.

The Subcommittee notes that this was also a recommendation in the 8-Hour Ozone SIP Recommendations.

As with all other anti-idling recommendations, the USEPA Model Anti-Idling Ordinance should be used as guidance.

Air Quality Impacts:

- 0.027 tpd NOx reduced
- 0.002 tpd $PM_{2.5}$ reduced

Cost

- None. Education only. The measure saves fuel.

NOACA's Role NOACA should coordinate the sharing of anti-idling ordinances of its members with the Port Authority.

13. Airports

13.a. Replace or convert gasoline or diesel powered airport ground-support equipment (GSE) to compressed natural gas (CNG), propane, electric or other clean technology.

Cleveland-Hopkins International Airport is encouraged to replace its municipally owned GSE with clean technology. Private airlines having their own GSE at the Airport are encouraged to do the same and to coordinate with Cleveland-Hopkins in such purchases, particularly those involving infrastructure, fueling, or bulk purchases.

Funding through the federal Voluntary Airport Low Emissions Program (VALE) might be available for the incremental cost of a "clean air" technology, over the cost of an ordinary diesel or gasoline-powered vehicle. It also can fund gate electrification and other air quality improvements.

The Subcommittee notes that this recommendation was also made in the 8-Hour Ozone SIP Recommendations.

Air Quality Impacts:

- NOx reduced
- $PM_{2.5}$ reduced

Cost

- Dependent on the technology chosen.

NOACA's Role NOACA should assist with a VALE application, if requested, by working with the Ohio EPA to quantify emission reduction credits for the Airport.

Stationary Sources

1. Steel Mills

1.a. NOx Reasonably Available Control Technology (RACT) for Industrial Boilers

The Ohio EPA should impose RACT limits on the boilers in use at the steel mills in the Northeast Ohio nonattainment area, and on all other steel mills statewide, sufficient to lower NOx levels in the Northeast Ohio area.

The Subcommittee notes that this recommendation was also made in the 8-Hour Ozone SIP Recommendations.

Air Quality Impacts

- The Ohio EPA has proposed NOx limitations range from 0.10 – 0.30 lbs. NOx per MMBtu depending on the fuel used.
- Progressively greater reductions in NOx would result if a lower limit is selected by Ohio EPA.

Cost

- The cost is dependent upon the final NOx limitation and relative fuel costs.
- Varying impacts to the steel mill if a lower emissions limit is selected and it restricts the fuel blends used by the steel mill or its potential use of coal as a back-up fuel.

NOACA's Role None.

2. NOx Credit Trading Bank with Partial Credit Retirement

2.a. NOx Credit Trading Bank with Partial Credit Retirement

As part of the 8-Hour Ozone SIP Recommendations made in 2006, the NOACA Air Quality Public Advisory Task Force urged the immediate formation of a centralized "bank" at the Ohio EPA for registering and trading NOx credits. These credits are known as "emission reduction credits." They are used as offsets in nonattainment areas when they are purchased to fulfill air pollution reduction requirements for new or modified businesses.

At the present time, although NOx trading is permitted, Ohio EPA has no central location for registering the credits so that they can be easily discovered by interested businesses. In addition, no NOx credits are currently allowed for mobile sources or for area sources. Allowing NOx credits in these additional situations would create a monetary incentive for voluntary reductions.

Finally, the Subcommittee recommends that an annual 5% (five percent) of all credits in the NOx Credit Trading Bank be permanently retired by the Ohio EPA, in order to reduce ozone and fine particle formation.

Air Quality Impacts

- NOx reductions dependent on number of credits banked and either retired or not re-sold.

Cost

- Cost for one full-time Ohio EPA employee, with salary and overhead, might be $100,000 annually. As of 2007, such an employee has been hired and is creating a regulatory program for the NOx Credit Trading Bank.

NOACA's Role NOACA should create a public education campaign after mobile source credits become a part of the bank.

3. Diesel Generators (Stationary Diesel Engines)
Large Land-Based Gen-Sets, Portable Units, Residential Units

3.a. Retrofit or Replace Large (Stationary) Diesel Gen-Sets
3.b. Retrofit or Replace Medium (Portable) Diesel Gen-sets

Diesel gen-sets, used for load management and for short-term power for public events, etc., should be treated in the same manner as mobile source diesel engines and examined for appropriate retrofitting or replacing. However, emergency generators, which operate at fewer than 500 hours/year, by regulation, should be exempt.

Air Quality Impacts

One scenario for large land-based (stationary) gen-sets, used for load management, using selective catalytic reduction (SCR) technology:

- Assume one Diesel Generator Set: 2000hp
- Annual hours of operation (est.): 800
- 90% of operating hours are in the summer (June/July/August)
- 8 hours per day on hottest day (average)
- Current NOx emissions: 5g/bhp-hr
- SCR-installed NOx emissions: 0.5g/bhp-hr
- NOx reductions: 15,859 lb/yr or 0.0792 tons per day per engine, based on 100 operating days per year
- Applying to all 200 units across Ohio = 15.84 tons per day NOx total reduction

Cost

- Cost for one SCR for one large diesel gen-set is $150,000 - 200,000 for a 2-megawatt unit. For all 200 units across Ohio, the total would be $30,000,000.
- Costs for diesel oxidation catalysts (DOCs) and PM filters vary, depending on size.
- Costs could be offset by offering NOx credits through the Ohio EPA NOx Credit Trading Bank, so long as the NOx reductions were not already used for SIP credit.

3.c. Public Education Regarding Purchases of Small Diesel Generators

Nonattainment areas in California have had success educating consumers about, and discouraging them from, purchasing diesel generators for home use.

Air Quality Impacts

- Reduction of direct $PM_{2.5}$, NOx, elemental carbon, and organic carbon.
- Reductions may be minimal because no part of the program is mandatory; it is educational only.

Cost

- Cost for the Ohio EPA and local air agencies to post information via websites.
- Cost of using an alternative to a diesel generator varies, depending on the alternative chosen:
    - Portable gasoline generator for job-sites, camping, etc. $500-1,500
    - Propane or natural gas home back-up generator. $3,000-10,000.

NOACA's Role NOACA should undertake a public education campaign through its Air Quality Programs, if a source of funding is available.

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4. Residential Combustion – Wood-Fired Boilers, Fireplaces, and Wood Stoves

Background

Residential combustion can be a significant source of $PM_{2.5}$ pollution. The term includes water heaters, “wood burners” (also known as "wood-fired boilers" or "outdoor hydronic heaters") that provide heat or hot water from outdoor wood-fired devices, fireplaces, patio recreational “fire circles” and chimneas, campfires, wood stoves, and furnaces.

The number of wood-fired boilers has been increasing in recent years in Northeast Ohio, although the exact inventory is unknown. Nationally, the Northeast States for Coordinated Air Use Management (NESCAUM) estimates that wood-fired boilers currently contribute as much as 250,000 tons per year of directly emitted particulate matter, and that figure could increase to 900,000 tons per year by 2010. Statewide, the combined impact of wood-fired boilers is the equivalent of a major industrial source of air pollution. Home fireplaces, patio firepits, and chimneas have also become increasingly popular in Ohio.

4.a. Adoption of the NESCAUM Model Rule for Outdoor Hydronic Heaters

The Ohio EPA should adopt the NESCAUM Model Rule that applies to outdoor wood-fired boilers, statewide, and it should grandfather in the existing units that meet the applicable municipal height and set-back limits. However, Ohio EPA should, over time, develop ways to regulate existing wood-fired boilers, on an age-adjusted basis, possibly requiring upgrades at point-of-sale of the associated property. Ohio EPA should also support local communities that choose to enact more stringent regulations of such boilers.

Air Quality Impacts

- Reduction of direct $PM_{2.5}$, NOx, organic carbon, and elemental carbon from any new units installed, and from older units that are brought into compliance over time by the Ohio EPA or by individual municipalities.

Cost

- Cost for the new clean-burning units is $8,000 or more, depending on size and other factors.

4.b. Mandatory "No Burn" Days When Ozone or $PM_{2.5}$ is Elevated

Several nonattainment areas announce mandatory "No Burn" days when their pollutants of concern reach elevated levels.

The Northeast Ohio region has both an Ozone Action Day program, which announces high levels of ozone during the summer months, and a Fine Particle Pollution Program, which announces high levels of $PM_{2.5}$ year-round.

"No Burn" days could apply to home fireplaces, chimneas, patio fire circles, campfires, bonfires, and other types of open burning. Local air agencies, fire departments, and park officials would all need enforcement authority. Exemptions would be proper for situations in which the fireplace, etc., was the sole source of heat or hot water for a home. (Some jurisdictions also exempt USEPA-certified clean wood stoves.)

A statewide law with local enforcement would work best and produce the most benefits to the Northeast Ohio nonattainment area.

Air Quality Impacts

- Reduction of direct $PM_{2.5}$, NOx, organic carbon, and elemental carbon.
- Total pollution reduced is dependent on the number of advisories issued annually.

Cost

- Cost of notice is minimal because the programs are already in place in Northeast Ohio through NOACA's Air Quality Programs.
- Cost to consumers is zero.
- Cost of enforcement may be small because such duties may overlap with existing official duties for fire personnel and others.

4.c. Voluntary Wood Stove Change-Out Program

Dayton, Ohio, and other locations have had success with offering USEPA-certified wood stoves and wood stove inserts at a reduced cost through a grant-funded program. The USEPA-certified products burn wood much more efficiently, with fewer emissions.

Air Quality Impacts

- Reduction of direct $PM_{2.5}$, NOx, organic carbon, and elemental carbon.
- USEPA estimates that EPA-certified wood stoves can emit 50-70% less pollution than old conventional wood stoves.
- Total pollution reduced is dependent on the number of persons opting to make a change-out.

Cost

- Cost for one wood stove insert is $1,000 – 2,000, and the reduced price is $ 300 less with a "Clean Air Coupon" in Dayton's program.
- Cost to implement the program would be one-quarter-time staff person, plus advertising costs and overhead, at an estimated total of $25,000, in addition to the cost of the "Clean Air Coupons" themselves, estimated at $50,000.

NOACA's Role None related to wood-fired boilers. NOACA should coordinate with local governments and fire departments in issuing Air Quality Advisories related to "No Burn Days." NOACA would require a one-quarter-time staff person to implement a Wood Stove Change-out Program.

5. Hot Mix Asphalt Plants

5.a. RACT (Reasonably Available Control Technology) for Hot Mix Asphalt Plants

The Ohio Department of Transportation (ODOT) has the number of approved plants listed as 167. These plants produce the bulk of the hot mix asphalt work in Ohio. The total number of plants, including much smaller plants, may be as high as 265. The Ohio EPA Fee report of 2005 shows the following actual **annual** emissions for the group:

SO_2	489 tons
NOx	697 tons
VOC	115 tons
PM	504 tons
PM_{10}	198 tons

A RACT limitation on NOx and SO_2 that is flexible would allow a hot mix asphalt plant permittee to make use of each of various options, as appropriate, including:

- Low-NOx Burners
- Limestone Injection
- Fuel Changes
- Good Operational Practices, including
    - Maintenance (annual tune-ups)
    - Reduction of Moisture Content
    - Anti-Idling Policies and Technologies for Support Vehicles

Air Quality Impacts

- Reduction of NOx and SO_2.

Cost

- Cost for low-NOx burner or other technologies and supplies, such as limestone.
- Cost for fuel changes depends upon price and availability.
- Cost for good operational practices should result in cost-savings related to reduced fuel consumption.

NOACA's Role None.

6. Restaurants

Background
Char-broiling and grilling of meats creates particulate matter; the higher the fat content, the greater the emissions as the fat strikes the heating element.

Chain-driven charbroiling of meats at restaurants accounts for only 10% of the $PM_{2.5}$ emissions from the restaurant sector. However, chain-driven charbroiling is one of the few grilling mechanisms for which a cost-effective control technology has been devised, that being a catalytic oxidizer to control $PM_{2.5}$ emissions. Control technologies are also available for other grilling situations, although the cost is higher.

The Subcommittee recommends that all restaurants in Northeast Ohio that can reasonably accommodate air pollution controls be required to do so. A tiered approach, based on restaurant size, should be employed.

6.a. Food-Service Catalytic Oxidizer for Chain-Driven Charbroilers

A flameless catalytic oxidizer contains a bed of inert ceramic material coated with a metal catalyst that oxidizes smoke and gases from the cooking process, converting them to carbon dioxide and water. The system in mounted into the charbroiler ventilation duct. Such devices should be required by rule by the Ohio EPA.

Air Quality Impacts

- Using the catalytic oxidizer, emissions average 1.29 lb. PM per 1,000 lb. of hamburger, for an 83% reduction from the high-end estimates of uncontrolled emissions.
- Total impact to Northeast Ohio would depend on the number of restaurants using chain-driven charbroilers, which could be as few as 50 or 100 restaurants. Assuming that 100 restaurants emit at the same rate as those in Southern California in 1997 (31,000 restaurants emitting 11.6 tons per day of $PM_{2.5}$), then the 100 restaurants would produce 0.037 tons per day $PM_{2.5}$, and an 83% reduction would achieve a reduction of:
    - 0.03 tons per day $PM_{2.5}$.

Cost

- $3,700 for each catalytic oxidizer.
- $1,000 for installation
- $500 for annual operation and maintenance, but this may be balanced out by the need for fewer cleanings.
- Cost per ton is a minimum of $1,680 - $2,800 per ton of PM and VOCs reduced (South Coast Air Quality Management District, California), although some industry sources quote as much as $7,000 per ton due to the need to replace the catalyst every 5 years.

NOACA's Role None.

7. Road Salt and Liquefied Brine

7.a. Use of Liquefied Brine to Reduce Total Applied Road Salt

The Ohio Department of Transportation (ODOT), as well as communities in Northeast Ohio such as Pepper Pike, Brecksville, Brunswick, and Euclid, along with several other states and Canada, use liquefied brine or other pre-wetting agents, rather than using only solid road salt for de-icing purposes. The brine creates wet conditions in which the salt can perform its de-icing function. Salt brine is salt water at a concentration of about 23 percent. Traditional salt does not actually melt snow and ice; it is instead the brine that the salt forms that does the melting. Salt brine does not freeze until it reaches approximately minus 21 degrees Celsius (minus 5 degrees Fahrenheit), making it a good agent to use when temperatures are above this level. The practice of using brine is being pursued because it can reduce total road salt application by as much as 30 percent.

Air Quality Impacts

- Reduction of direct $PM_{2.5}$ by 20-30%.
- Total $PM_{2.5}$ reduced would depend on the total road application during any given winter season, which is highly weather-dependent. One example given after actual application by one user was a reduction of 100 lb. of salt per mile.

Cost

- Cost for water to add to solid road salt is minimal.
- Approximately $30,000 per each brine mixer. Payback time can be as little as one year, depending on number of uses.
- Cost-savings regarding total salt purchased as well as cost-savings on diesel fuel for fewer applications of salt per mile.

7.b. Strict Adherence to Local Salt Minimization Policies

ODOT and most communities in Northeast Ohio have salt minimization policies to protect the environment, particularly as it relates to water quality and vegetation. Strict adherence to such policies would result in less salt of all types being applied to roadways in the nonattainment area.

Air Quality Impacts

- Reduction of direct $PM_{2.5}$ by the percentage called for in the local policy.
- Total $PM_{2.5}$ reduced would depend on the total road application during any given winter season, which is highly weather-dependent.

Cost

- Cost-savings regarding total salt purchased and applied.
- Cost for a public education campaign would be minimal.

NOACA's Role NOACA should assist in sharing information regarding use of liquefied brine and members' policies on salt application.

8. Enforcement Practices: Adjust to an Appropriate Level of Staffing

8.a. Adjust to an Appropriate Level of Staffing to Enhance Compliance with Existing Law

Funds should be provided to adjust the staffing of the Ohio EPA and the local air agencies (Ohio EPA delegates) to an appropriate level so that they can better enforce existing laws and regulations.

Ohio EPA, the local air agencies, their attorneys, and the USEPA as their backup, often express frustration with lacking the resources to initiate and complete as many investigations as might be warranted. In addition, the Ohio EPA Office of Compliance Assistance and Pollution Prevention (OCAPP) could reach more industries with its free information and services for small businesses.

As one example, USEPA achieved a settlement in 2007 with an out-of-compliance nitric acid plant in Cincinnati that will result in new controls that will eliminate 200 tons per year of NOx from Ohio's skies. In addition, the plant will pay a $750,000 penalty, which may result in some funding for air pollution initiatives. Finding and correcting any out-of-compliance facilities improves air quality and protects public health.

Air Quality Impacts

- Reduction of direct $PM_{2.5}$ and its precursors (NOx, SO_2, carbon) by varying amounts, depending on the individual violation being corrected or the individual situation being remedied with OCAPP's assistance.

Cost

- Salaries and overhead for 8 new full-time employees at an approximate cost of $100,000 per employee, for a total cost of $800,000 per year. The employees would be apportioned between:
  Ohio EPA – Northeast District Office (Enforcement and OCAPP)
  Cleveland Division of Air Quality
  Lake County General Health District
  Akron Regional Air Quality Management District
- Costs might be partially reimbursed by fines collected.

NOACA's Role None.

9. Long-Term Solution: Energy Strategies

9.a. Wind Power and Renewable Portfolio Standards

A renewable portfolio standard (RPS) is a state policy that requires electricity providers to obtain a minimum percentage of their power from renewable energy resources by a certain date. Currently there are 20 states plus the District of Columbia that have RPS policies in place. In 2007, Ohio's Governor Strickland recommended an RPS that would eventually achieve 25% in renewable energy use.

Many renewable sources of energy are used in RPS programs, including wind farms. The Cuyahoga County Regional Energy Task Force recommends placing up to 10 wind turbines in Lake Erie three to five miles offshore as a pilot project.

The list of possible renewable sources might include the following, as demonstrated by Pennsylvania's current program:

- Solar water heat
- Solar space heat
- Solar thermal electric
- Solar thermal process heat
- Photovoltaics
- Landfill gas
- Wind
- Biomass
- Hydroelectric
- Geothermal electric
- Fuel cells
- Municipal solid waste
- Combined heat and power (CHP)
- Waste coal
- Coal mine methane
- Coal gasification
- Anaerobic digestion
- Other distributed generation technologies

<u>Air Quality Impacts</u>

- Assume for a wind farm that each of 10 wind turbines generates 3,500 MWh of electricity in one period.
- Based on 0.0015 lb. NOx / kWh (Ohio EPA default emissions factor), the project will displace fossil fuel electricity production that would have produced 26.25 tons NOx.

Cost

- Cost for a single wind turbine can exceed $1 million, including installation.

9.b. Energy Audits for Businesses and Municipalities

Energy audits for small businesses, large industries, governmental units, and other consumers of electricity that would be generated by coal-fired power plants might result in reduced emissions associated with that electricity generation.

Air Quality Impacts

- Reductions of direct $PM_{2.5}$, NOx, and SO2 otherwise emitted by coal-fired power plants.
- Reductions may not occur in the nonattainment area, as electricity may continue to be produced for sale to the electric grid, destined for other locations.

Cost

- Cost for an audit is dependent on the size of the customer's facility. If 100 entities each purchased an audit costing $5,000, the total cost would be $500,000.
- Cost of making process changes may be small.
- Cost of installing new, more efficient equipment may be large.
- Cost-savings may result from reduced energy use.

9.c. Encouraging Local Manufacturing of Energy Efficient Components

Northeast Ohio is suited to manufacturing and has been noted in one study as being the second most like place in the United States to increase its abilities to make components associated with renewable energy and energy efficiency.

Specifically, the manufacture of wind turbines and their associated components has been suggested, as has the continued manufacture of electric forklifts and other vehicles.

The Toledo, Ohio, area has already been successful in manufacturing photovoltaic cells for sale to Europe.

Air Quality Impacts

- New industries would have no negative or positive impact on air pollution in the nonattainment area, so long as the nonattainment offset requirements were met.
- No air quality benefits would result unless the energy efficient components were actually purchased and used in projects within the nonattainment area.

Cost

- Cost for starting new manufacturing initiatives is large.
- Governmental incentives would be valuable in reducing start-up costs.

NOACA's Role NOACA should study energy conservation as it relates to the transportation and environmental goals of NOACA. Specifically, the second Goal of the Transportation Division of NOACA is:

> **"Goal 2. Enhance the natural environment and ecology of the region by improving air, land and water quality, *conserving transportation energy* and by identifying and preserving existing critical natural resources and environmentally sensitive areas."**
> NOACA Governing Board Resolution 2002-042.

NOACA, through its Executive Director, should also continue to participate in the Cuyahoga County Regional Energy Task Force.

Summary Matrix

Note: Many of the figures were obtained from Environ, a subcontractor to the Lake Michigan Air Directors' Consortium (LADCO), in *"Final Report: Evaluation of Candidate Mobile Source Control Measures for LADCO States in 2009 and 2012"* (March 21, 2007),

Strategy No.	Emission Reduction Strategy	Pollutants Reduced	Cost
Mobile Sources			
1.a.	Diesel On-Road: Mandatory Best Available Retrofit Technology (BART) for Government-Owned Vehicles, with Funding	0.09 tons per day (tpd) PM	$8,561,949 for 4,281 public vehicles in NE Ohio
1.b.	Diesel On-Road: Voluntary Emissions Reduction Programs for Private Vehicles	5.7 tpd NOx 0.28 tpd PM	$177,065,574 for private vehicles in NE Ohio, plus possible $500,000 to administer the program
2.a., b., c., d.	Diesel Non-Road: Retrofit Financing	1.94 tpd NOx 0.08 tpd PM	$39,071,902 for NE Ohio
3.a., b.	Diesel Non-Road: Public Works Projects	0.19 tpd NOx 0.01 tpd PM	$3,907,190 for NE Ohio
4.a., b., c.	Reduce Idling from Public Fleets	0.21 tpd NOx 0.005 tpd PM	$29,270,062 for NE Ohio, if anti-idling technology purchased
5.a., b., c.	Reduce Idling from Private Fleets	0.21 tpd NOx 0.005 tpd PM	$29,270,062 for NE Ohio, if anti-idling technology purchased
5.d.	Reduce Idling from Switchyard and Line-Haul Locomotives	0.006 tpd NOx per locomotive 0.0003 tpd PM per locomotive	$30,000 per auxiliary power unit purchased
6.a., b., c.	Truck Stop Electrification	0.38 tpd NOx 0.01 tpd PM	$2,000,000 for remaining two truck stops in NE Ohio
7.a.	Increased Use of Ethanol (E85)	10% NOx reduced 20% PM reduced	Equivalent to gasoline; 5-15% fuel penalty
7.b.	Increased Use of Biodiesel (B20 and B100)	NOx impact unknown 15% PM reduced	Slightly more expensive per gallon than diesel
7.c.	Increased Use of Natural Gas (NG)	35% NOx reduced for cars 80% NOx reduced for diesel trucks 100% PM reduced for both	15-40% less in cost per gallon than gasoline or diesel
7.d.	Increased Use of Propane	SO2 and PM reduced	$1.50 per gallon
7.e.	Increased Use of Electric Vehicles	0.1 tpd NOx for 100 electric hybrid vehicles similar for electric forklifts	$3,000 extra per electric vehicle, or $300,000 extra for fleet of 100

8.a.	Statewide Roadside Diesel Opacity Testing	PM reduced	$700,000 to administer program; gain of $4,000,000 through fines; costs to violating trucks of up to $1,000 in repairs
9.a.	Conformity Analysis of Innerbelt Project for Non-Road Emissions	Unknown	Cost to NOACA to perform the analysis, plus costs to reduce emissions, if needed
10.a.	Statewide Testing of Gasoline and Diesel Specifications	SO2 reduced	$750,000 for statewide implementation
11.a.	Statewide Safety/Anti-Tampering Standards for All Vehicles	CO, VOCs, NOx and PM reduced	Costs borne by owners through a fee for inspection
12.a.	Port of Cleveland-Cuyahoga County - Truck Traffic Anti-Idling Policy	0.027 tpd NOx 0.002 tpd PM	Cost-saving through fuel savings.
13.a.	Cleveland-Hopkins International Airport - Replace Ground Support Equipment with Clean Technology	NOx reduced PM reduced	Cost depends on replacement vehicles chosen
Stationary Sources			
1.a.	Steel Mills - NOx RACT for Industrial Boilers	NOx reduced	Cost depends on fuel costs
2.a.	NOx Credit Trading Bank with Partial Credit Retirement	NOx reduced	$100,000 for one year of Ohio EPA administration
3.a., b.	Retrofit or Replace Large and Medium Diesel Generators	15.84 tpd NOx statewide	$30,000,000 statewide
3.c.	Public Education Regarding Purchases of Small Diesel Generators	NOx reduced	Minimal cost for public outreach through government websites
4.a.	Adoption of NESCAUM Model Rule for Outdoor Hydronic Heaters (wood-fired boilers)	NOx reduced PM reduced elemental carbon reduced organic carbon reduced	Cost for each new unit is approx. $8,000. No cost to existing units if they are "grandfathered."
4.b.	Mandatory "No Burn" Days When Ozone or PM Levels Are Elevated	NOx reduced PM reduced elemental carbon reduced organic carbon reduced	Minimal cost through NOACA's Ozone Action and Fine Particle Pollution Programs; enforcement costs
4.c.	Voluntary Wood Stove Change-Out Program	NOx reducedPM reducedelemental carbon reducedorganic carbon reduced	$75,000 for grant funds and to administer program
5.a.	RACT for Hot Mix Asphalt Plants	SO2 and NOx reduced	Cost depends upon option chosen by permittee; some are fuel-saving and cost-saving

6.a.	Restaurants - Catalytic Oxidizer for Chain-Driven Charbroilers	0.03 tpd PM	$4,700 for each unit, for 100 restaurants, would total $470,000
7.a.	Use of Liquefied Brine to Reduce Total Applied Road Salt	20-30% PM reduced	Cost savings are purported to recoup the cost of each $30,000 brine mixer
7.b.	Strict Adherence to Local Salt Minimization Policies	PM reduced	Minimal cost in outreach; cost savings for salt saved
8.a.	Enforcement Practices: Adjusting to an Appropriate Level of Environmental Staffing	SO2, NOx, and PM reduced, if violations found and corrected	$800,000 per year for 8 additional enforcement staff; some costs may be recouped through fines
9.a.	Long-Term Solutions: Wind Power and Renewable Portfolio Standards	26.25 tpd NOx for 10 wind turbines	$10,000,000 for installation of 10 wind turbines, plus operation and maintenance
9.b.	Long-Term Solutions: Energy Audits for Businesses and Municipalities	SO2, NOx, and PM reduced through reduced electricity draw	$500,000 for 100 organizations to have a $5,000 audit performed
9.c.	Long-Term Solutions: Encouraging Local Manufacture of Energy Efficient Components	Reductions spread nationally and globally	High start-up costs