

Appendix C

**Final Report of the
Area Source Work Group
of the NOACA Air Quality Public Advisory Task Force
(Ozone)**

NOACA Air Quality Public Advisory Task Force

Area Source Work Group

Final Report – 8-Hour Ozone Options

**“Driving Toward Economic and Environmental
Sustainability for Northeast Ohio”**

March 29, 2006

Contributions to this Report

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NOACA Air Quality Public Advisory Task Force

Area Source Work Group Final Report – 8-Hour Ozone Options “Driving Toward Economic and Environmental Sustainability for Northeast Ohio” March 29, 2006

I. Executive Summary

The Area Source Work Group of the NOACA Air Quality Public Advisory Task Force reports the following significant potential options for achieving attainment of the 8-Hour Ozone NAAQS in Northeast Ohio:

- AR-1 Anti-Idling Policy at the Port of Cleveland
- AR-2 Ground Support Equipment (GSE) Replacement with Electric, CNG, or Hydrogen
- AR-3 Anti-Idling Policy at Cleveland-Hopkins International Airport
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In addition, multiple issues were identified for further study.

II. Introduction

The NOACA Air Quality Public Advisory Task Force established Work Groups for Mobile Sources, Point Sources, Area Sources, Long-Term Planning Options, and a Public Health Forum on air pollution. Together, these Work Groups have assisted the Task Force in creating options for recommendations to the Ohio Environmental Protection Agency (Ohio EPA) for inclusion in the State Implementation Plan (SIP) for the new 8-Hour Ozone National Ambient Air Quality Standards (NAAQS). They will continue by assisting with the SIP for the new NAAQS for fine particulates (PM_{2.5}), thus helping Northeast Ohio to come into attainment for these criteria air pollutants.

The Task Force and the Work Groups together will help NOACA to assist the region to protect public health and to comply with federal law.

In addition, they will assist NOACA and Northeast Ohio to plan for future growth, economic viability, and environmental sustainability. The Work Groups have carefully weighed the many advantages and disadvantages of each proposed strategy.

Consequently, this forward-looking document is intended to provide 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.

A. Scope of Work

The Area Source Work Group explored potential emission reduction options for sources of air pollution associated with:

- airplanes, airports, their ground support vehicles and their passenger traffic
- railroads, their traffic, their switchyards and their loading equipment
- commercial marine vessels, their truck traffic and their loading equipment
- recreational boats, jet skis, snowmobiles, and other recreational vehicles
- construction equipment
- industrial equipment such as forklifts and tow motors
- all other nonroad engines, such as lawnmowers and landscaping equipment

Sources of air pollution that belong to small industrial sources, although commonly referred to as “area sources,” were covered by the Point Source Work Group, as was air pollution resulting from residences and consumer activity.

This Draft Final Report represents all options discussed to meet the 8-hour ozone standard. No recommendations are made, and all potential solutions are covered, along with their estimated impacts. It is anticipated that the Task Force will choose from among these options.

Note: Because the Draft Final Report does not discuss PM_{2.5} solutions, some options such as the use of alternative fuels will be re-visited during the Work Group's efforts on PM_{2.5}.

B. Area Source Work Group Membership

The Area Source Work Group is made up of the following, supplemented by public participants with knowledge and expertise in the areas under study:

Ted Esborn, McDonald Hopkins, Chair
Bob Farley, Team NEO
Ed Fasko, Ohio EPA – Northeast District Office
Rick Harkins, Lake Carriers' Association
David Hearne, City of Cleveland, Division of Air Quality
Stephen Pfeiffer, Cleveland-Cuyahoga County Port Authority
Dana Ryan, Cleveland Hopkins Airport
Linda Sekura, NASA-Glenn
JoAnn Uhlik, Greater Cleveland Partnership

C. Meetings

The Area Source Work Group met on:

September 19, 2005
October 11, 2005
November 28, 2005
January 23, 2006

each time at NOACA's offices. The Work Group also met on February 1, 2006, at the Cuyahoga River for a tour of the marine vessel "FRED R. WHITE," an ore carrier, which was docked there for diesel engine maintenance work.

D. Evaluation Criteria

The Work Group assessed the options using the Evaluation Criteria established by the full Task Force on July 25, 2005. Those Criteria are as follows:

- 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

E. Emissions Inventory

The Work Group reviewed the 2002 Ohio EPA Emissions Inventory for each of the sectors under study.

Marine Vessels

In 2002, according to Ohio EPA, based on USEPA, commercial marine vessels were identified as contributing:

45.3 tpd oxides of nitrogen (NO_x)

The data, which represent estimates made by the United States Environmental Protection Agency (USEPA), was questioned as being too high. The estimates were made using Category 3 engines, whereas Lake Erie only has Category 2 engines on lake carriers. Also, fuels that were not as clean-burning as Diesel #2 were used in the calculations, whereas lake carriers burn only Diesel #2.

The Lake Carriers' Association performed a microinventory of the Great Lakes ships for the Port of Cleveland, only. The Association concluded that ships coming to the Port of Cleveland contributed:

0.277 tpd NO_x

The number would increase somewhat if the other ports were added to it. However, the Port of Cleveland is the largest in the nonattainment area.

Railroads

According to Ohio EPA, based on USEPA, railroads were identified as contributing:

0.77 tpd VOCs

17.5 tpd NO_x

However, work performed by Environ, a subcontractor of the Lake Michigan Air Directors' Consortium (LADCO), determined that railroads in Northeast Ohio contributed:

1.10 tpd VOCs

23.49 tpd NO_x

A chart demonstrating the totals for trains appears in the section of the Report on Railroads.

Airplanes and Airports

According to Ohio EPA, based on USEPA, aircraft (at large airports only, including no small county airports) contributed:

0.55 tpd VOCs

1.86 tpd NOx

The ground support equipment and vehicles for airports, ports, and railroads were included in the category of Off-Highway Vehicle, Diesel, contributing together, according to Ohio EPA:

4.11 tpd VOCs

34.58 tpd NOx

Some of the ground support equipment and vehicles were also included in the category of Off-Highway Vehicle, Gasoline 4-stroke, which together contributed:

19.37 tpd VOCs

6.33 tpd NOx

A chart showing all of the nonroad equipment, such as ground support equipment, construction equipment, lawnmowers, and others, appears in Appendix A.

III. Emission Reduction Options Under Consideration

A. Marine Vessels, Shipping, and Ports

The Northeast Ohio nonattainment area has several ports:

Port of Cleveland, operated by the Cleveland-Cuyahoga County Port Authority
Port of Lorain
Port of Fairport Harbor
Port of Ashtabula
Port of Conneaut

Port of Cleveland

The vast majority of international shipping activity occurs at the Port of Cleveland. The Lakeside Port facilities include 8 international docks covering 100 acres on the east side of the Cuyahoga River and a 45-acre facility, the Cleveland Bulk Terminal, located on Whiskey Island. Private dock facilities on the Cuyahoga River receive the majority of the interlake bulk cargoes.

The Port of Cleveland averages 12.5 million tons of cargo per year, which includes 700,000 tons of international cargo. The remaining tonnage is interlake bulk cargo.

Shipments at the Port of Cleveland include iron ore, limestone, steel, heavy machinery, cement, sand, and slat in support of local manufacturing and construction. The Port currently handles no container traffic; that cargo moves through the East and West Coast ports of the United States because of vessel size restrictions on the St. Lawrence Seaway.

The interlake vessels that call Cleveland are self-unloading bulk carriers and therefore do not require shore-side equipment for discharge.

International vessels carrying steel and machinery require shore cranes for unloading and lift machines for handling. The Port of Cleveland has 26 diesel fork lift machines and 4 shore cranes for handling cargo. Both the cranes and the lift machines were retrofitted in December 2005 with particulate matter filters.

Truck traffic on the Port facilities on the lakefront appears to generate significant air emissions. The number of truckloads annually is 60,000. At the bulk-handling facilities on the Cuyahoga River, large front-end loaders move the cargo to truck. That volume is approximately 300,000 truckloads based on the totals of stone, cement, and sand moved. Iron ore goes directly into steel production, not to truck. Salt moves from the mine directly onto the vessel.

In 2005, 959 ship-visits (port calls) were made to the Port of Cleveland.

Most of the lake carriers on Lake Erie use diesel locomotive engines (Category 2 - EMD 645) and burn # 2 diesel oil. Bunker "C" oil is not used. The lake carriers can have a lifetime up to 60 years, with consistent diesel engine maintenance.

However, the average age of international ships ("salties") in 2002 was 15 years, but the average age in 2005 was only 8 years. Improvements in the form of new engine designs have been made for international ships. Of the 959 port calls, approximately 100 each year are from international ships.

Port of Lorain

A small amount of domestic tonnage is handled at the Port of Lorain. The Port handles only a few international vessels annually. Interlake bulk tonnage include iron ore, limestone, cement, and gypsum.

Port of Fairport Harbor

Some shipping is done through the Port of Fairport Harbor, particularly involving sand and gravel, as well as salt. No international cargo goes through the Port.

Port of Ashtabula / Port of Conneaut

The Port of Ashtabula handles international bulk cargo movements and some international general cargo. Interlake tonnages of coal, stone, iron ore, etc., make up the majority of the tonnage. The Port has significant shipping traffic but little opportunity for improvements to loading equipment. The loading equipment does not include forklifts, but instead uses equipment that deposits cargo directly into rail cars.

Marine Vessel Air Pollution Reduction Options

Docking Practices

Docking practices such as port electrification, known as "cold-ironing," were discussed as valuable in large ports that serve container ships and cruise vessels. However, the Work Group did not study cold-ironing further for Northeast Ohio because of the extremely large costs associated with installing cold-ironing equipment at the ports, and the limited benefit received. Lake carriers, unlike ocean-going vessels or cruise ships, dock for only 4-6 hours at a time.

Engine Design

As stated above, the Port of Cleveland handles approximately 900 commercial ship arrivals (port calls) per year with approximately 100 of those ships being international in origin. Ocean-going ships have a shorter life than the domestic Great Lakes vessels, thus their engines are generally newer and have more current air emission technology features. Also, USEPA has issued more stringent air emission requirements for all marine diesel engines, but **it is unlikely that Great Lakes vessels will be replaced or re-engined with the newer diesel engines in the near future.** In addition, the supporting tugboats are unlikely to be replaced.

Engine retrofit technologies were explored by the Work Group for emission reduction benefits. A tour of an ore carrier was made to view the diesel engines and the hold in which they are housed. Very little room exists in the hold of the ship for additional pollution controls. **Retrofitting would be very expensive in such lake carriers.**

The following chart, taken from "The Need to Reduce Marine Shipping Emissions: A Santa Barbara County Case Study" by the Santa Barbara County, CA, Air Pollution Control District, shows various retrofit control technologies that could be installed on large vessel engines:

Table 2: Performance Attributes Summary of NOx Control Technologies for Existing Engines.

Control Technology	Nominal NOx Reduction (%)	Nominal Reduction in PM and other Pollutants (%)	Nominal Increased Fuel Use (%)	Net Present Value (\$)	Global Cost Effectiveness (\$/ton NOx)
Aftercooler upgrade	10	-1	2	\$184,000	\$620
Engine derating	14	-10	4	\$386,000	\$933
Fuel pressure increase	14	-21	2	\$220,000	\$523
Injector upgrade	16	-21	2	\$192,000	\$410
Injection Timing Retard	19	-11	4	\$363,000	\$618
Water in combustion air	28	1	3	\$365,000	\$468
Exhaust gas recirculation	34	-51	0	\$16,900,000	\$16,377
Water/fuel emulsion	42	15	2	\$325,000	\$284
Selective catalytic reduction	81	0	0	\$475,000	\$227

The issue of possible particulate matter filters will be re-visited during the PM_{2.5} SIP development work.

Fuels

Commercial ships generally use diesel fuel. The use of low-sulfur diesel will result in particulate matter emission reductions. Beginning in 2007, all diesel fuel sold for marine use must meet USEPA low-sulfur requirements. The Work Group will review the subject during the PM_{2.5} SIP development work.

The Work Group explored the possibility of using either an emulsified diesel fuel (PuriNOx by Lubrizol) or using biodiesel.

a. PuriNOx

Each lake carrier, when re-filling with fuel, takes on approximately 85,000 gallons. There is no ability to build a PuriNOx blender that would hold the amount of fuel necessary to fill ships.

In fact, no ships re-fuel in Northeast Ohio because all fueling stations must be located at petroleum refineries, due to the large quantity needed. Some re-fuel in Canada and some re-fuel further down the Great Lakes.

b. Biodiesel

The Work Group noted that Minnesota currently requires 2% biodiesel for all diesel users except railroads. Marine vessel shipping associations are lobbying for a repeal of the requirement. Anecdotes relate that biodiesel may clog the engines. More importantly to marine vessel owners, the diesel engine manufacturers have informed them that changes to any alternative fuel will void the engine warranty. A diesel engine overhaul for routine maintenance can cost \$600,000 each time it is performed.

Finally, as with PuriNOx, there is no re-fueling in Northeast Ohio. Thus, there is no opportunity to require marine vessels to use biodiesel when visiting Northeast Ohio.

Changes in Shipping Procedures

Changes in local shipping procedures showed marginal reductions in emissions. In 2003, a pellet terminal was relocated from the Lorain Port to the Cleveland Port, which resulted in a change in shipping traffic – now one large ship brings the ore pellets to the Cleveland port and smaller ships move the pellets upstream. Prior to the relocation, smaller ships were required to travel from Cleveland to Lorain and back to pick up the pellets. Representatives from the Cleveland Port Authority and the Lake Carriers Association believe that 8-12 ship running hours were saved for each cargo delivered, using the Cuyahoga River, to the steel mill.

Speed Reduction

No emission reduction benefits were available from a speed limit in the Lake Erie shipping lane because the "Reduced Speed Zone (RSZ)" already extends several miles out into Lake Erie. The ships slow voluntarily as they are approaching port in order to control the vessel.

Loading Equipment

The Cleveland Port utilizes 26 forklifts and 4 cranes to perform loading and unloading operations, each of which uses diesel fuel. The forklifts were retrofitted with particulate matter filters in 2006. However, no alternative fuels such as biodiesel or PuriNOx are in use by the loading equipment.

Any emissions reductions from an alternative fuel would be extremely small due to the very small number of equipment pieces affected.

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.

Finally, the Port Cleveland-Cuyahoga County Authority utilized Congestion Mitigation Air Quality (CMAQ) monies in 2002 to eliminate a truck traffic jam at East 9th Street, from which marginal air pollution reductions also resulted.

B. Aircraft and Airports

The Northeast Ohio nonattainment area has 26 airfields of various sizes. Of those, only 2 were accounted for in the 2002 emissions inventory provided by Ohio EPA (Cleveland-Hopkins International Airport and the Akron-Canton Regional Airport). The remaining 24 small airfields and their aircraft were not included. The Cleveland-Hopkins International Airport represents approximately 75% of the air emissions in the area associated with airports.

The Work Group noted that the Ohio EPA emissions associated with jet aircraft were probably correct in that jet fuel burns more efficiently than other fuels. However, there were no figures for the gasoline-powered small aircraft. Potential options regarding these airfields are discussed below.

The ground support equipment at Cleveland-Hopkins International Airport consists of hundreds of pieces of diesel and gasoline-powered baggage carts, service vehicles, etc. In addition, customer, taxi, and bus idling practices at the Airport were studied for possible reductions.

Controls at Small Local Airfields

There are significant numbers of take-offs and landings at the 24 small local airfields. However, many of the smaller aircraft burn AvGas, which is 100-octane gasoline approved by the Federal Aviation Administration. It was unlikely that such aircraft could burn an alternative summertime fuel, such as low-RVP 7.8 psi gasoline, that might be recommended for cars in the nonattainment area.

The Work Group determined that there might be some benefit to adopting the Florida approach of establishing a fine for dumping gasoline on the ground at an airfield. Because a 2-ounce sample must be taken from the tank before each flight, some pilots may be spilling it onto the ground after examining it for water. Gasoline collection containers would have to be provided.

Air Impact: Approximately 0.00 tpd VOCs reduced

Cost: \$2,400 (\$100 per dump tank multiplied by 24 airfields)

Cost per ton of VOC reduced: Unknown.

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

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 were identified.

Option AR-2

Air Impact:

Assume 100 ground support vehicles replaced with electric
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.

The federal Voluntary Airport Low Emissions Program (VALE) also contains funding 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 Airport may apply to become a VALE participant in the next round of federal funding.

The Work Group heard a presentation by Green Energy Technologies Inc., which intended to place a demonstration "Smart Energy Tower" at Cleveland-Hopkins International Airport. However, the company did not obtain grant funding for construction.

The following USEPA charts show potential VOC reductions associated with airport grounds support equipment:

TABLE 1. POTENTIAL HC REDUCTION STRATEGIES FOR AIRPORT GSE

		Potential HC Emission Reduction (Percent Reduction) if:												
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 ² with EV Equipment	Retrofit with Oxy Catalyst	Retrofit with PM Trap	Replace ¹ with Fixed "At Gate" Equipment	Replace 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-str Gas	0	0.0%	0.0%	0.0%									
	4-str Gas	489	1.1%	17.7%	2.2%	50	65	50	65	99+	90	n/a	n/a	n/a
	CNG	0	0.0%	0.0%	0.0%									
	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%	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
All	2759	6.1%			5.8%									
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-str Gas	0	0.0%	0.0%	0.0%									
	4-str Gas	4863	10.8%	46.3%	26.6%	50	65	50	65	99+	90	n/a	99+	n/a
	CNG	0	0.0%	0.0%	0.0%									
	LPG	973	2.2%	9.3%	2.7%	n/a	35	n/a	35	99	70	n/a	99	n/a
	Electric	270	0.6%	2.6%	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	n/a
All	10505	23.3%			33.8%									
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-str Gas	0	0.0%	0.0%	0.0%									
	4-str Gas	2317	5.1%	45.0%	6.4%	50	65	50	65	99+	90	n/a	99+	n/a
	CNG	0	0.0%	0.0%	0.0%									
	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	0	n/a
All	5154	11.4%			8.5%									
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-str Gas	612	1.4%	28.3%	2.0%	97	98	97	98	99.9+	80	n/a	n/a	94
	4-str 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%									
	LPG	0	0.0%	0.0%	0.0%									
	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%			2.1%									
Tool & Lavatory	Diesel	146	0.3%	4.4%	0.0%	n/a	n/a	up 105	up 35	98	50	20	n/a	n/a
	2-str Gas	0	0.0%	0.0%	0.0%									
	4-str Gas	873	1.9%	26.1%	1.5%	65	75	65	75	99+	90	n/a	n/a	n/a
	CNG	0	0.0%	0.0%	0.0%									
	LPG	1583	3.5%	47.4%	1.0%	n/a	35	n/a	35	99	70	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	0	n/a
All	3339	7.4%			2.5%									

TABLE 1. POTENTIAL HC REDUCTION STRATEGIES FOR AIRPORT GSE
(Continued)

GSE Type	Engine Type	Estimated U.S. Population	Fraction of All GSE	Fraction of Type Specific GSE	Estimated Fraction of All GSE HC	Potential HC Emission Reduction (Percent Reduction) ¹ if:								
						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
Ground Power Unit	Diesel	2504	5.6%	82.0%	3.7%	n/a	n/a	up 135	up 55	96	50	20	96	n/a
	2-str Gas	0	0.0%	0.0%	0.0%									
	4-str Gas	94	0.2%	3.1%	0.7%	50	65	50	65	99+	90	n/a	99+	n/a
	CNG	0	0.0%	0.0%	0.0%									
	LPG	0	0.0%	0.0%	0.0%									
Electric		455	1.0%	14.9%	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	n/a
	All	3053	6.8%		4.3%									
Service Trucks	Diesel	409	0.9%	11.5%	0.2%	n/a	n/a	up 155	up 70	96	50	20	96	n/a
	2-str Gas	0	0.0%	0.0%	0.0%									
	4-str Gas	2905	6.4%	81.5%	8.4%	50	65	50	65	99+	90	n/a	99+	n/a
	CNG	0	0.0%	0.0%	0.0%									
	LPG	251	0.6%	7.0%	0.4%	n/a	35	n/a	35	98	70	n/a	99	n/a
Electric		0	0.0%	0.0%	0.0%									
	All	3565	7.9%		9.0%									
Average		30538	67.8%		66.1%									

¹ Unsigned 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 air 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.

TABLE 3. POTENTIAL NO_x REDUCTION STRATEGIES FOR AIRPORT GSE

		Potential NO _x Emission Reduction (Percent Reduction) if:												
GSE Type	Engine Type	Estimated U.S. Population	Fraction of All GSE	Fraction of Type Specific GSE	Estimated Fraction of All GSE NO _x	Convert to LPG Fueling	Convert to CNG Fueling	Replace with LPG Equipment	Replace with CNG Equipment	Replacc ² with EV Equipment	Retrofit with Oxy Catalyst	Retrofit with PM Trap	Replacc ³ with Fixed "AI Gate" Equipment	Replace with 4-Str Gasoline Equipment
Aircraft Pushback Tractor	Diesel	2113	4.7%	76.6%	19.4%	n/a	n/a	75	75	97	0	0	n/a	n/a
	2-str Gas	0	0.0%	0.0%	0.0%									
	4-str Gas	489	1.1%	17.7%	1.0%	25	25	25	25	90	0	n/a	n/a	n/a
	CNG	0	0.0%	0.0%	0.0%									
	LPG	63	0.1%	2.3%	0.1%	n/a	0	n/a	0	90	0	n/a	n/a	n/a
	Electric	94	0.2%	3.4%	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
All	2759	6.1%			20.5%									
Baggage Tug	Diesel	4399	9.8%	41.9%	18.8%	n/a	n/a	80	80	97	0	0	97	n/a
	2-str Gas	0	0.0%	0.0%	0.0%									
	4-str Gas	4863	10.8%	46.3%	7.9%	25	25	25	25	90	0	n/a	90	n/a
	CNG	0	0.0%	0.0%	0.0%									
	LPG	973	2.2%	9.3%	1.2%	n/a	0	n/a	0	90	0	n/a	90	n/a
	Electric	270	0.6%	2.6%	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	n/a
All	10505	23.3%			28.0%									
Belt Loader	Diesel	2429	5.4%	47.1%	2.6%	n/a	n/a	55	55	95	0	0	95	n/a
	2-str Gas	0	0.0%	0.0%	0.0%									
	4-str Gas	2317	5.1%	45.0%	1.9%	25	25	25	25	90	0	n/a	90	n/a
	CNG	0	0.0%	0.0%	0.0%									
	LPG	314	0.7%	6.1%	1.2%	n/a	0	n/a	0	90	0	n/a	90	n/a
	Electric	94	0.2%	1.8%	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	n/a
All	5154	11.4%			4.7%									
Carts	Diesel	31	0.1%	1.4%	0.0%	n/a	n/a	80	80	96	0	0	n/a	n/a
	2-str Gas	612	1.4%	28.3%	0.0%	up 135	up 135	up 135	up 135	55	0	n/a	n/a	up 360
	4-str Gas	610	1.4%	28.2%	0.0%	50	50	50	50	90	0	n/a	n/a	n/a
	CNG	0	0.0%	0.0%	0.0%									
	LPG	0	0.0%	0.0%	0.0%									
	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%			0.0%									
Tool & Lavatory	Diesel	146	0.3%	4.4%	0.2%	n/a	n/a	80	80	97	0	0	n/a	n/a
	2-str Gas	0	0.0%	0.0%	0.0%									
	4-str Gas	873	1.9%	26.1%	0.3%	20	20	20	20	90	0	n/a	n/a	n/a
	CNG	0	0.0%	0.0%	0.0%									
	LPG	1583	3.5%	47.4%	0.4%	n/a	0	n/a	0	90	0	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	3339	7.4%			1.0%									

TABLE 3. POTENTIAL NO_x REDUCTION STRATEGIES FOR AIRPORT GSE
(Continued)

GSE Type	Engine Type	Estimated U.S. Population	Fraction of All GSE	Fraction of Type Specific GSE	Estimated Fraction of All GSE NO _x	Potential NO _x Emission Reduction (Percent Reduction) if:								
						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
Ground Power Unit	Diesel	2504	5.6%	82.0%	20.9%	n/a	n/a	75	75	97	0	0	97	n/a
	2-str Gas	0	0.0%	0.0%	0.0%									
	4-str Gas	94	0.2%	3.1%	0.3%	25	25	25	25	90	n/a	n/a	90	n/a
	CNG	0	0.0%	0.0%	0.0%									
	LPG	0	0.0%	0.0%	0.0%									
	Electric	455	1.0%	14.9%	0.1%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	n/a
All	3053	6.8%			21.3%									
Service Trucks	Diesel	409	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%									
	4-str Gas	2905	6.4%	81.5%	3.7%	25	25	25	25	90	n/a	n/a	90	n/a
	CNG	0	0.0%	0.0%	0.0%									
	LPG	251	0.6%	7.0%	0.3%	n/a	0	n/a	0	90	n/a	n/a	90	n/a
	Electric	0	0.0%	0.0%	0.0%									
All	3565	7.9%			5.3%									
Aggregate		30538	67.8%		80.8%									

¹ Unsigned 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_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 emissions; 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 70-90 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.

TABLE 4. POTENTIAL PM REDUCTION STRATEGIES FOR AIRPORT GSE

GSE Type	Engine Type	Estimated U.S. Population	Fraction of All GSE	Fraction of Type Specific GSE	Estimated Fraction of All GSE PM	Potential PM Emission Reduction (Percent Reduction) if:									
						Convert to LPG Fueling	Convert to CNG Fueling	Replace with LPG Equipment	Replace with CNG Equipment	Replace ² with EV Equipment	Retrofit with Oxy Catalyst	Retrofit with PM Trap	Replace ¹ 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	20	20	10	n/a	n/a	n/a	
	4-str Gas	489	1.1%	17.7%	0.1%	n/a	0	n/a	5	5	10	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%	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
	Electric	94	0.2%	3.4%	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
All	2759	6.1%			21.7%										
Baggage Tug	Diesel	4399	9.8%	41.9%	26.8%	n/a	n/a	96	96	98	30	90	98	n/a	
	2-str Gas	0	0.0%	0.0%	0.0%	15	15	15	45	45	10	n/a	45	n/a	
	4-str Gas	4863	10.8%	46.3%	1.6%	n/a	0	n/a	0	35	10	n/a	35	n/a	
	CNG	0	0.0%	0.0%	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	n/a	
	LPG	973	2.2%	9.3%	0.3%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
	Electric	270	0.6%	2.6%	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
All	10505	23.3%			28.8%										
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	45	45	10	n/a	45	n/a	
	4-str Gas	2317	5.1%	45.0%	0.4%	n/a	0	n/a	0	35	10	n/a	35	n/a	
	CNG	0	0.0%	0.0%	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	n/a	
	LPG	314	0.7%	6.1%	0.0%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	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	5154	11.4%			6.6%										
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	99+	99+	10	n/a	n/a	96	
	4-str Gas	610	1.4%	28.2%	0.0%	35	35	35	90	90	10	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	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	2163	4.8%			0.6%										
Tool & Lavatory	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	55	55	10	n/a	n/a	n/a	
	4-str Gas	873	1.9%	26.1%	0.1%	n/a	0	n/a	0	30	10	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	1583	3.5%	47.4%	0.1%	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	3339	7.4%			0.5%										

TABLE 4. POTENTIAL PM REDUCTION STRATEGIES FOR AIRPORT GSE
(Continued)

		Potential PM Emission Reduction (Percent Reduction) ¹ if:												
GSE Type	Engine Type	Estimated U.S. Population	Fraction 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
Ground Power Unit	Diesel	2504	5.6%	82.0%	23.0%	n/a	n/a	96	96	97	30	90	97	n/a
	2-str Gas	0	0.0%	0.0%	0.0%									
	4-str Gas	94	0.2%	3.1%	0.0%	15	15	15	15	20	10	n/a	20	n/a
	CNG	0	0.0%	0.0%	0.0%									
	LPG	0	0.0%	0.0%	0.0%									
Electric		455	1.0%	14.9%	0.1%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	n/a
	All	3053	6.8%		23.2%									
Service Trucks	Diesel	409	0.9%	11.5%	1.5%	n/a	n/a	96	96	97	30	90	97	n/a
	2-str Gas	0	0.0%	0.0%	0.0%									
	4-str Gas	2905	6.4%	81.5%	0.5%	15	15	15	15	20	10	n/a	20	n/a
	CNG	0	0.0%	0.0%	0.0%									
	LPG	251	0.6%	7.0%	0.0%	n/a	0	n/a	0	5	10	n/a	5	n/a
Electric		0	0.0%	0.0%	0.0%									
	All	3565	7.9%		2.0%									
Aggregate		30538	67.8%		83.4%									

¹ Unsigned 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 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.

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 70-90 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.

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 is developing 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. 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.

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.

AR-4 Free Pick-Up/Drop-Off Parking Lot at Cleveland-Hopkins International Airport

At the Akron-Canton Regional Airport, cars performing pick-up and drop-off of passengers are allowed an area of free parking where the cars are not allowed to idle.

A similar lot might be possible at Cleveland-Hopkins International Airport because such cars currently simply circle the airport or park on side roads, idling their engines. For example:

Option AR-4

Air Impact:

Assume 3,000 private car drop-offs or pick-ups

Assume idling of 30 minutes per vehicle

For 90,000 minutes of idling:

0.028 tpd VOCs reduced

0.007 tpd NOx reduced

Cost: Enforcement and education. Assume hiring 6 additional police officers for \$75,000 total salary and benefits per year = \$ 450,000.

**AR-5 Parking Garage - Improved Signage at Cleveland-Hopkins
International Airport**

Cleveland Hopkins International Airport currently provides 30 minutes of free parking for passenger pick-up/drop-off as an effort to discourage idling practices. Better marketing and signage regarding the free 30 minutes, along with anti-idling enforcement, may result in emission reductions.

Option AR-5

Air Impact: Unknown.

Cost: Cost of signage.

Docking Practices

Gate electrification may be combined with electric GSE at Cleveland-Hopkins International Airport, to the extent it is not already employed. The agreement of the individual airlines would be needed. Continental Airlines owns the largest number of gates at the Cleveland-Hopkins International Airport. The City of Cleveland could own the infrastructure, possibly by purchase with CMAQ dollars.

Providing such infrastructure would enable and encourage the individual airlines to adopt electrification practices.

Engine Design

Airplane companies are gradually transitioning to Stage III jet engines, which have lower emissions, as part of general business practices. As of the date of this Report, substantially all of the aircraft at Cleveland-Hopkins International Airport has changed over to Stage III.

C. Railroads

The Northeast Ohio nonattainment area is served by Norfolk Southern (NS) and CSX for line-haul activities. The area is served by several short-line and industrial railroads that move freight only a few miles. Finally, it is served by Amtrak for passenger travel.

Emission reduction options vary depending on whether the train under discussion is line-haul, short-line, passenger, or a switching locomotive at a switching yard.

Railroad Grade Separation Projects

As reported in the Mobile Source Work Group Draft Final Report, the following emission reductions were seen from the grade separation projects that eliminated the crossing of railroad tracks and roads:

0.000 tpd VOCs reduced

0.003 tpd NO_x reduced

Cost: \$ 32,390,000

The figures are those reported in the NOACA Transportation Improvement Program.

AR-6 Idling at Railroad Switchyards - Auxiliary Power Units on Switch Yard Locomotives

Anti-idling practices at switching yards may provide significant emission reduction benefits. Several short-line railroads have invested in "hot start" technology to enable switching locomotives to shut off when they are not in use.

There are three significant switching yards in the nonattainment area: Collinwood, Maple Heights, and near Cleveland Hopkins International Airport.

Option AR-6

Air Impact:

USEPA recommends:

- Using mobile auxiliary power units (APUs)
(these would provide heat and electricity to the switch yard locomotives (SYLs) during times of rest, rather than continuing to run the engine)

- Install electric-powered heating systems on SYLs
(these would connect to the electrical grid and provide energy to operate on-board equipment during times of rest)

Cost: Unknown.

USEPA has promulgated exhaust emission standards for locomotives

- mandates in-use emissions testing
- Only 0.15 percent of a fleet is tested annually

AR-7 Hybrid Electric Locomotives

Hybrid electric locomotives, some of which are diesel-electric and some of which may be ethanol-diesel (E-Diesel)-electric in the future, are available. Hybrids tend to work best in short-haul situations.

Ordinarily, switch yard locomotives (SYLs) are the oldest locomotives, costing between \$20,000 - \$50,000 each. They tend to pollute more than newer locomotives.

Option AR-7

Air Impact: Not yet calculated in tons per day.

Cost: Approximately \$1,000,000 per hybrid locomotive.

This option will be re-visited during the PM_{2.5} SIP work.

Fuels

Biodiesel fuels may be an alternative fuel option for railroad engines, as may ethanol-diesel (E-Diesel). A local short-line experience with emulsified diesel fuel (PuriNOx) showed that much larger quantities of fuel were needed in comparison to standard diesel.

However, because both biodiesel and E-Diesel do not yet show any benefit for ozone formation, the issue will be re-visited during the PM_{2.5} SIP development work, with a focus on particulate matter emissions.

D. Nonroad Engines

Nonroad sources of VOCs and NOx include many categories, such as:

- Boats
- Jet skis
- Snowmobiles
- Lawnmowers
- Landscaping equipment
- Construction equipment
- Nonroad diesel trucks
- Agricultural tractors
- Logging equipment
- Mining equipment

For a complete list, along with their VOC and NOx emissions, as reported by Ohio EPA for the year 2002, see Appendix A.

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.)

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:

Option AR-8

Air Impact:

Assume one tractor, loader, or backhoe in Tier 0, 175-300 hp

Assume a useful life of 10 years

NOx reduction in tons/year: 0.28 tpy

NOx reduction in tons/day = 0.0007 tpd

Assume that a fleet of 100 construction equipment vehicles in Tier 0, 175-300 hp in

Northeast Ohio were retrofitted:

100 vehicles x 0.0007 tpd = 0.07 tons per day NOx reduced

Cost for 100 vehicles: \$2,000,000 (capital cost) plus additional fuel for 10 years

Cost for one vehicle: \$20,000 (capital cost) plus additional fuel for 10 years

Cost per ton of NOx removed: \$10,542

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 vehicles x 0.0006 tpd = 0.06 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

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 vehicles x 0.0014 tpd = 0.14 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

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.

Option AR-11

Air Impact:

First example - For purposes of this Report:

Assume replacing 100 loaders or backhoes (100-175 hp) Tier 0 with Tier 2 engines

Useful life of 10 years

NO_x reduction of 0.21 tons per year x 100 engines = 21 tons per year

NO_x reduction of 0.06 tons per day

Cost: \$1,375,000 (\$13,750 per new engine)

Cost per ton of NO_x removed: \$7,675

Elimination of Two-Stroke Engines

The Work Group noted that 2-stroke engines tend to pollute more than 4-stroke engines. Eliminating 2-stroke engines from the marketplace would eventually tend to reduce ozone formation, as well as particulate matter.

The Work Group did not pursue the strategy because data from "*Evaluation of Candidate Mobile Source Control Measures*" by *Environ for the Lake Michigan Air Directors' Consortium (LADCO) Feb. 28, 2006*) shows no NOx benefit, and the VOC benefit is unknown. The strategy will continue to be studied during the PM_{2.5} SIP development work because the data shows definite PM benefits.

Low-RVP Gasoline

Northeast Ohio, as of 2004, had the following registered watercraft:

- 18,971 boats
- 3,188 personal watercraft (jet skis)

The Work Group noted that a low-RVP gasoline such as 7.0 psi or 7.8 psi, or federal reformulated gasoline (RFG), would produce VOC benefits from gasoline-powered boats and jet skis across the nonattainment area in the summer months when the gasoline was sold.

Air Impact: The emissions benefits are included in the overall sales of gasoline figures discussed in the "Fuels" Section of the Final Mobile Source Report.

Costs: The costs are as they appear in the Final Mobile Source Report. An increase in the cost of a gallon of gasoline may occur between 1 cent and 6 cents, although even higher prices are possible, depending on supply and demand in any given summer.

Accelerated Turnover of Gasoline-Powered Lawn and Garden Equipment

Accelerating the purchase of new gasoline-powered lawn, garden, and landscaping equipment would provide VOC benefits, and even some NOx benefits. Newer equipment provides more complete combustion.

The Work Group noted that USEPA is going to promulgate new standards for small engines for this entire sector. However, the new equipment will not be available for purchase in time to affect the 2010 attainment date for Northeast Ohio.

AR-12 Clean Marina / Clean Boater Programs

Northeast Ohio, as of 2004, had the following registered watercraft:

- 18,971 boats
- 3,188 personal watercraft (jet skis)

The Ohio Department of Natural Resources' (ODNR) Clean Marinas Program is a proactive partnership designed to encourage marinas and boaters to use simple, innovative solution to keep Ohio's coastal and inland waterway resources clean.

The basic goal of the Program is environmental stewardship by making marinas and boaters more aware of environmental laws, rules and jurisdictions, and to get as many marinas as possible to follow best management practices and to be designated as "Clean Marinas."

Marinas take a pledge to commit to improving water quality protection through basically the adoption of boating best management practices. Each marina is required to assess their facility using Ohio's Clean Marinas Program Checklist and the Program Guidebook to determine if the marina meets the Clean Marina standards. Once designated, marinas are encouraged to annually assess and confirm in writing to ODNR their continued Clean Marina status.

The Ohio Clean Boater Program is part of the Ohio Clean Marina Program that encourages boat owners to follow Best Boater Practices (BBPs) to keep oil, sewage, toxic boat cleaning and maintenance products, plastics, cigarette butts and other trash, fishing gear and invasive species out the local environment. Many of the BBPs are water-related, but some have air emission reduction benefits, as well, including:

a. Fuel & Engine Maintenance

Maintaining inboard engines can cause special problems because of materials such as oil, gasoline, and antifreeze. The discharge of all of these materials is prohibited under federal and state law and detrimental to the environment. The hydrocarbons and heavy metals that are present in petroleum products are toxic even in very small amounts. Some petroleum products are even suspected of causing cancer.

Stage II Vapor Recovery: Unfortunately, the Work Group learned that Stage II vapor recovery nozzles cannot be employed on marina gas pumps because the design of boat gas tanks allows vapors to escape.

Regular inspection of fuel lines will help reduce air pollution. Replacing deteriorated lines with a U.S. Coast Guard Type A alcohol-resistant fuel line hose also helps. The alcohol content of unleaded fuels can deteriorate fuel lines in several months resulting in leak or evaporation of fuels.

In addition, USEPA encourages boaters to:

- limit engine operation at full throttle
- eliminate unnecessary idling
- avoid spilling gasoline
- use a gasoline container that can be held securely
- pour gasoline slowly
- use a funnel or spout with an automatic stop device to prevent overfilling the gas tank
- close the vent on portable gas tanks when the engine is not in use or when the tank is stored
- transport and store gasoline out of the direct sunlight
- use caution when pumping gasoline in to a container at the gas station
- carefully measure the proper amounts of gasoline and oil when refueling
- follow the manufacturer's recommended maintenance schedule
- prepare engines properly for winter storage
- buy new, cleaner marine engines

b. Boat Cleaning & Painting

To reduce air pollution, boaters are encouraged by ODNR to:

- use environmentally friendly products
- use legal bottom paints
- avoid toxic paints
- use water-based paints
- avoid the use of wood preserver, paint thinners, etc.

Option AR-12

Air Impact: Unknown because it depends on the number of marinas joining the program and the number of boaters using good practices.

Cost: Unknown.

AR-13, AR-14 Portable Fuel Containers

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 MRPO region in 2002.

The LADCO Potential Control Measures, as presented by LADCO's subcontractor MACTEC, are as follows:

AR-13 Candidate Measure ID SOLV3A:

- Adopt Ozone Transport Commission (OTC) Model Rule PFCs (18% reduction in 2009 and 54% reduction in 2015, assuming a 10% turnover in PFCs per year starting in 2007.)

SOLV3A Capital Control Cost Estimate

LADCO: \$250 - 480/ ton VOC reduced

SOLV3A

	5 State LADCO Region		NE Ohio	
2002 Base VOC Emissions	51,000 tpy	140 tpd	10,800tpy	29 tpd
2009 VOC Reduction	- 9,200 tpy	- 25 tpd	- 1,500 tpy	- 4 tpd
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-			-	
2009 Base VOC Emissions	41,800 tpy	115 tpd	9,300 tpy	25 tpd
2015 VOC Reduction	- 18,300 tpy	- 50 tpd	- 3,500 tpy	- 10 tpd
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-				
2015 VOC Emissions	23,500 tpy	65 tpd	5,800 tpy	15 tpd
Estimated Capital Costs	\$7 - 13 M		\$2 - 3 M	

AR-14 Candidate Measure ID SOLV3B:

- Adopt incentive programs in nonattainment areas to accelerate phase in of compliance PFCs. (Give out a new PFC when an old one is traded in at no additional cost.)

SOLV3B Capital Control Cost Estimate

LADCO: \$4,600/ ton VOC reduced

SOLV3B

	5 State LADCO Region		NE Ohio	
2002 Base VOC Emissions	51,000 tpy	140 tpd	10,800tpy	29 tpd
2009 VOC Reduction	- 12,300 tpy	- 34 tpd	- 1,500 tpy	- 4 tpd
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-				
2009 Base VOC Emissions	38,700 tpy	114 tpd	9,300 tpy	25 tpd
2015 VOC Reduction	- 15,200 tpy	- 42 tpd	- 3,500 tpy	- 10 tpd
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-				
2015 Emissions	23,500 tpy	72 tpd	5,800 tpy	15 tpd
Estimated Capital Costs	\$38 M		\$10 M	

Ohio EPA has indicated that it will promulgate a rule for Portable Fuel Containers that would be statewide.

F. Agriculture

Megafarms

The Work Group reviewed "megafarms" and Certified Animal Feeding Operations (CAFOs) to see whether there were any manure lagoons in the Northeast Ohio nonattainment area that might emit VOCs affecting ozone formation. Such manure lagoons might be susceptible to containment with methane digesters.

However, none appeared within the 8 counties, although several large chicken farms and swine farms are just outside the nonattainment area.

The area's 2 horse-racing tracks constituted the largest concentrated animal operation, but their combined manure output was not a substantial contributor to air pollution in the nonattainment area.

AR-15 Diesel Agricultural Tractors - Lean-NOx Retrofits

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

Retrofitting diesel farm tractors with a lean-NOx catalyst showed various NOx reductions for Tier 0, Tier 1, Tier 2, and Tier 3, according to LADCO's subcontractor Environ. A Lonestar catalyst was used for Environ's study. One example follows, using the oldest and dirtiest engines, which would be Tier 0:

Option AR-15

Air Impact:

Assume one farm tractor, Tier 0, 100-175 hp

Assume a useful life of 10 years

NOx reduction in tons/year: 0.16 tpy

NOx reduction in tons/day = 0.0004 tpd

Cost for one tractor: \$13,579 (capital cost) plus additional fuel for 10 years

Cost per ton of NOx removed: \$10,498

For purposes of this Report, assume that a fleet of 10 tractors in Northeast Ohio were retrofitted:

10 tractors x 0.0004 tpd = 0.004 tons per day NOx reduced

Cost for 10 tractors: \$104,980 (capital cost) plus additional fuel for 10 years

AR-16 Diesel Agricultural Tractors - 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 of varying sizes.

According to LADCO's subcontractor, Environ, the following ranges might result, depending on the tractor size and assuming a useful life of 10 years.

Agricultural tractors	Replace Tier 0 With Tier 2	Tier 1 with 3	Tier 2 with 3
NOx reduced - tons per year	0.02 - 1.07	0.04 - 0.84	0.02 - 0.36
NOx reduced - tons per day	0 - 0.003	0 - 0.002	0 - 0.001
Cost per ton of NOx removed:	\$7,000-26,000	\$11k-36k	\$22k-84k

Option AR-16

Air Impact:

Assume one farm tractor, Tier 0, 100-175 hp, replaced with a Tier 2 engine

Assume a useful life of 10 years

NOx reduction in tons/year: 0.21 tpy

NOx reduction in tons/day = 0.0006 tpd

Cost for one engine: \$13,750

Cost per ton of NOx removed: \$7,833

For purposes of this Report, assume that a fleet of 10 tractors in Northeast Ohio received engine replacements:

10 tractors x 0.0006 tpd = 0.006 tons per day NOx reduced

Cost for 10 tractors: \$134,500

IV. Qualitative Options

Trees and Shrubs

Some trees and shrubs are biogenic background sources of VOCs, which contribute to ozone formation. However, some trees and shrubs do not emit VOCs. And most trees and shrubs help to remove pollutants, such as particulate matter and carbon dioxide, from the air.

According to USEPA, heat islands are of growing concern millions of Americans living in and around cities. This phenomenon describes urban and suburban temperatures that are 2 to 10°F (1 to 6°C) hotter than nearby rural areas. Elevated temperatures can impact communities by increasing peak energy demand, air conditioning costs, air pollution levels, and heat-related illness and mortality.

Urban vegetation can directly and indirectly affect local and regional air quality by altering the urban atmospheric environment. The four main ways that urban trees affect air quality area:

- Temperature reduction and other microclimatic effects
- Removal of air pollutants
- Emission of volatile organic compounds and tree maintenance emissions
- Energy effects on buildings

According to USEPA, trees remove gaseous air pollution primarily by uptake via leaf stomata, though some gases are removed by the plant surface. The amount of gaseous pollutants and particulates removed by trees depends on tree size and architecture, and local meteorology and pollutant concentrations. Uptake rates are high when pollutant concentrations and leaf surface areas are high. Trees remove pollution by intercepting airborne particles. Some particles can be absorbed into the tree, although most particles that are intercepted are retained on the plant surface. The intercepted particle often is resuspended to the atmosphere, washed off by rain, or dropped to the ground with leaf and twig fall. Consequently, vegetation is only a temporary retention site for many atmospheric particles.

By shading cars and lowering parking lot temperatures, trees can reduce evaporative emissions of hydrocarbons (VOCs) that leak from fuel tanks and hoses. Parked cars contribute 15 to 20 percent of total motor vehicle VOC emissions. Parking lot tree planting is one practical strategy communities can use to meet and sustain mandated air quality standards.

The Work Group studied a list of low-ozone-emitting trees and shrubs and then shortened the list to native species that would do well in Northeast Ohio. The list follows:

TREES:

Black cherry

Black walnut

Box elder

Red mulberry

Choke cherry

Green ash (caution: emerald ash borer problems)

Redbud

Sassafras

Silver maple

SHRUBS:

Smooth sumac

APPENDIX A - VOCs

CLEVELAND MSA, 2002 NON ROAD EIS

10/14/05 VOC

Emissions (Tons Per Day)	Sc	Scname
	2260	
3.45	2260001010	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Recreational Equipment, Motorcycles: Off-road, Hour, Vehicle, Operated
0.83	2260001020	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Recreational Equipment, Snowmobiles, Horsepower-Hours, Work, Output
2.67	2260001030	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Recreational Equipment, All Terrain Vehicles, Hour, Vehicle, Operated
0.05	2260001060	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Recreational Equipment, Specialty Vehicles/Carts, Hour, Vehicle, Operated
0.26	2260002006	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Construction and Mining Equipment, Tampers/Rammers, Horsepower-Hours, Work, Output
0.01	2260002009	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Construction and Mining Equipment, Plate Compactors, Horsepower-Hours, Work, Output
0.02	2260002021	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Construction and Mining Equipment, Paving Equipment, Horsepower-Hours, Work, Output
0.00	2260002027	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Construction and Mining Equipment, Signal Boards/Light Plants, Horsepower-Hours, Work, Output
0.72	2260002039	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Construction and Mining Equipment, Concrete/Industrial Saws, Horsepower-Hours, Work, Output
0.00	2260002054	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Construction and Mining Equipment, Crushing/Processing Equipment, Horsepower-Hours, Work, Output
0.01	2260003030	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Industrial Equipment, Sweepers/Scrubbers, Horsepower-Hours, Work, Output
0.00	2260003040	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Industrial Equipment, Other General Industrial Equipment, Horsepower-Hours, Work, Output
0.07	2260004015	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Rotary Tillers < 6 HP (Residential), Horsepower-Hours, Work, Output
0.36	2260004016	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Rotary Tillers < 6 HP (Commercial), , ,
0.99	2260004020	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Chain Saws < 6 HP (Residential), Horsepower-Hours, Work, Output

Emissions (Tons Per Day)	Scs	Scsname
4.76	2260004021	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Chain Saws < 6 HP (Commercial), , ,
1.30	2260004025	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Trimmers/Edgers/Brush Cutters (Residential), Horsepower-Hours, Work
3.46	2260004026	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Trimmers/Edgers/Brush Cutters (Commercial), , ,
0.81	2260004030	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Leafblowers/Vacuums (Residential), Horsepower-Hours, Work, Output
3.17	2260004031	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Leafblowers/Vacuums (Commercial), , ,
0.63	2260004035	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Snowblowers (Residential), Horsepower-Hours, Work, Output
1.60	2260004036	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Snowblowers (Commercial), , ,
0.00	2260004071	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Turf Equipment (Commercial), , ,
0.00	2260005035	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Agricultural Equipment, Sprayers, Horsepower-Hours, Work, Output
0.00	2260005050	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Agricultural Equipment, Hydro-power Units, Horsepower-Hours, Work, Output
0.11	2260006005	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Commercial Equipment, Generator Sets, Horsepower-Hours, Work, Output
0.80	2260006010	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Commercial Equipment, Pumps, Horsepower-Hours, Work, Output
0.00	2260006015	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Commercial Equipment, Air Compressors, Horsepower-Hours, Work, Output
0.00	2260007005	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Logging Equipment, Chain Saws > 6 HP, Horsepower-Hours, Work, Output
26.08		
	2265	
0.07	2265001010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Recreational Equipment, Motorcycles: Off-road, , ,
0.56	2265001030	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Recreational Equipment, All Terrain Vehicles, , ,

Emissions (Tons Per Day)	Scs	Scsname
0.47	2265001050	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Recreational Equipment, Golf Carts, , ,
0.05	2265001060	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Recreational Equipment, Specialty Vehicles/Carts, , ,
0.01	2265002003	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Pavers, , ,
0.00	2265002006	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Tampers/Rammers, , ,
0.05	2265002009	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Plate Compactors, , ,
0.02	2265002015	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Rollers, , ,
0.06	2265002021	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Paving Equipment, , ,
0.02	2265002024	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Surfacing Equipment, , ,
0.00	2265002027	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Signal Boards/Light Plants, , ,
0.05	2265002030	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Trenchers, , ,
0.03	2265002033	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Bore/Drill Rigs, , ,
0.08	2265002039	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Concrete/Industrial Saws, , ,
0.07	2265002042	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Cement and Mortar Mixers, , ,
0.00	2265002045	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Cranes, , ,
0.01	2265002054	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Crushing/Processing Equipment, , ,
0.01	2265002057	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Rough Terrain Forklifts, , ,
0.02	2265002060	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Rubber Tire Loaders, , ,
0.02	2265002066	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Tractors/Loaders/Backhoes, , ,

Emissions (Tons Per Day)	Scs	Scsname
0.02	2265002072	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Skid Steer Loaders, , ,
0.01	2265002078	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Dumpers/Tenders, , ,
0.01	2265002081	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Other Construction Equipment, , ,
0.11	2265003010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Aerial Lifts, , ,
0.38	2265003020	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Forklifts, , ,
0.09	2265003030	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Sweepers/Scrubbers, , ,
0.25	2265003040	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Other General Industrial Equipment, , ,
0.01	2265003050	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Other Material Handling Equipment, , ,
0.00	2265003060	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, AC\Refrigeration, , ,
0.04	2265003070	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Terminal Tractors, , ,
1.94	2265004010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Lawn Mowers (Residential), , ,
1.69	2265004011	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Lawn Mowers (Commercial), , ,
0.17	2265004015	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Rotary Tillers < 6 HP (Residential), , ,
0.86	2265004016	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Rotary Tillers < 6 HP (Commercial), , ,
0.01	2265004025	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Trimmers/Edgers/Brush Cutters (Residential), , ,
0.04	2265004026	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Trimmers/Edgers/Brush Cutters (Commercial), , ,
0.02	2265004030	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Leafblowers/Vacuums (Residential), , ,
0.68	2265004031	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Leafblowers/Vacuums (Commercial), , ,

Emissions (Tons Per Day)	Sc	Scname
0.08	2265004035	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Snowblowers (Residential), , ,
0.14	2265004036	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Snowblowers (Commercial), , ,
0.16	2265004040	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Rear Engine Riding Mowers (Residential), , ,
0.06	2265004041	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Rear Engine Riding Mowers (Commercial), , ,
0.09	2265004046	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Front Mowers (Commercial), , ,
0.10	2265004051	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Shredders < 6 HP (Commercial), , ,
1.97	2265004055	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Lawn and Garden Tractors (Residential), , ,
0.79	2265004056	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Lawn and Garden Tractors (Commercial), , ,
0.16	2265004066	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Chippers/Stump Grinders (Commercial), , ,
3.07	2265004071	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Turf Equipment (Commercial), , ,
0.13	2265004075	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Other Lawn and Garden Equipment (Residential), , ,
0.19	2265004076	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Other Lawn and Garden Equipment (Commercial), , ,
0.00	2265005010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, 2-Wheel Tractors, , ,
0.00	2265005015	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Agricultural Tractors, , ,
0.00	2265005020	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Combines, , ,
0.00	2265005025	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Balers, , ,
0.00	2265005030	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Agricultural Mowers, , ,
0.01	2265005035	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Sprayers, , ,

Emissions (Tons Per Day)	Sc	Scname
0.01	2265005040	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Tillers > 6 HP, , ,
0.00	2265005045	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Swathers, , ,
0.00	2265005050	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Hydro-power Units, , ,
0.00	2265005055	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Other Agricultural Equipment, , ,
0.00	2265005060	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Irrigation Sets, , ,
1.94	2265006005	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Commercial Equipment, Generator Sets, , ,
0.66	2265006010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Commercial Equipment, Pumps, , ,
0.28	2265006015	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Commercial Equipment, Air Compressors, , ,
0.43	2265006025	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Commercial Equipment, Welders, , ,
1.12	2265006030	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Commercial Equipment, Pressure Washers, , ,
0.00	2265007010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Logging Equipment, Shredders > 6 HP, , ,
0.00	2265007015	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Logging Equipment, Forest Eq - Feller/Bunch/Skidder, , ,
0.01	2265008005	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Airport Ground Support Equipment, Airport Ground Support Equipment, , ,
0.02	2265010010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Other Oil Field Equipment, , ,
19.35		
	2267	
0.00	2267001060	Mobile Sources, LPG, Recreational Equipment, Specialty Vehicles/Carts, , ,
0.00	2267002003	Mobile Sources, LPG, Construction and Mining Equipment, Pavers, , ,
0.00	2267002015	Mobile Sources, LPG, Construction and Mining Equipment, Rollers, , ,
0.00	2267002021	Mobile Sources, LPG, Construction and Mining Equipment, Paving Equipment, , ,

Emissions (Tons Per Day)	Sc	Scname
0.00	2267002024	Mobile Sources, LPG, Construction and Mining Equipment, Surfacing Equipment, , ,
0.00	2267002030	Mobile Sources, LPG, Construction and Mining Equipment, Trenchers, , ,
0.00	2267002033	Mobile Sources, LPG, Construction and Mining Equipment, Bore/Drill Rigs, , ,
0.00	2267002039	Mobile Sources, LPG, Construction and Mining Equipment, Concrete/Industrial Saws, , ,
0.00	2267002045	Mobile Sources, LPG, Construction and Mining Equipment, Cranes, , ,
0.00	2267002054	Mobile Sources, LPG, Construction and Mining Equipment, Crushing/Processing Equipment, , ,
0.00	2267002057	Mobile Sources, LPG, Construction and Mining Equipment, Rough Terrain Forklifts, , ,
0.00	2267002060	Mobile Sources, LPG, Construction and Mining Equipment, Rubber Tire Loaders, , ,
0.00	2267002066	Mobile Sources, LPG, Construction and Mining Equipment, Tractors/Loaders/Backhoes, , ,
0.00	2267002072	Mobile Sources, LPG, Construction and Mining Equipment, Skid Steer Loaders, , ,
0.00	2267002081	Mobile Sources, LPG, Construction and Mining Equipment, Other Construction Equipment, , ,
0.03	2267003010	Mobile Sources, LPG, Industrial Equipment, Aerial Lifts, , ,
2.82	2267003020	Mobile Sources, LPG, Industrial Equipment, Forklifts, , ,
0.02	2267003030	Mobile Sources, LPG, Industrial Equipment, Sweepers/Scrubbers, , ,
0.01	2267003040	Mobile Sources, LPG, Industrial Equipment, Other General Industrial Equipment, , ,
0.00	2267003050	Mobile Sources, LPG, Industrial Equipment, Other Material Handling Equipment, , ,
0.01	2267003070	Mobile Sources, LPG, Industrial Equipment, Terminal Tractors, , ,
0.02	2267004066	Mobile Sources, LPG, Lawn and Garden Equipment, Chippers/Stump Grinders (Commercial), , ,
0.00	2267005050	Mobile Sources, LPG, Agricultural Equipment, Hydro-power Units, , ,
0.00	2267005055	Mobile Sources, LPG, Agricultural Equipment, Other Agricultural Equipment, , ,
0.00	2267005060	Mobile Sources, LPG, Agricultural Equipment, Irrigation Sets, , ,
0.05	2267006005	Mobile Sources, LPG, Commercial Equipment, Generator Sets, , ,

Emissions (Tons Per Day)	Scs	Scsname
0.01	2267006010	Mobile Sources, LPG, Commercial Equipment, Pumps, , ,
0.02	2267006015	Mobile Sources, LPG, Commercial Equipment, Air Compressors, , ,
0.03	2267006025	Mobile Sources, LPG, Commercial Equipment, Welders, , ,
0.00	2267006030	Mobile Sources, LPG, Commercial Equipment, Pressure Washers, , ,
0.00	2267008005	Mobile Sources, LPG, Airport Ground Support Equipment, Airport Ground Support Equipment, , ,
3.02		
2268		
0.00	2268002081	Mobile Sources, CNG, Construction and Mining Equipment, Other Construction Equipment, , ,
0.01	2268003020	Mobile Sources, CNG, Industrial Equipment, Forklifts, , ,
0.00	2268003030	Mobile Sources, CNG, Industrial Equipment, Sweepers/Scrubbers, , ,
0.00	2268003040	Mobile Sources, CNG, Industrial Equipment, Other General Industrial Equipment, , ,
0.00	2268003060	Mobile Sources, CNG, Industrial Equipment, AC\Refrigeration, , ,
0.00	2268003070	Mobile Sources, CNG, Industrial Equipment, Terminal Tractors, , ,
0.00	2268005050	Mobile Sources, CNG, Agricultural Equipment, Hydro-power Units, , ,
0.00	2268005055	Mobile Sources, CNG, Agricultural Equipment, Other Agricultural Equipment, , ,
0.00	2268005060	Mobile Sources, CNG, Agricultural Equipment, Irrigation Sets, , ,
0.00	2268006005	Mobile Sources, CNG, Commercial Equipment, Generator Sets, , ,
0.00	2268006010	Mobile Sources, CNG, Commercial Equipment, Pumps, , ,
0.00	2268006015	Mobile Sources, CNG, Commercial Equipment, Air Compressors, , ,
0.00	2268006020	Mobile Sources, CNG, Commercial Equipment, Gas Compressors, , ,
0.00	2268010010	Mobile Sources, CNG, Industrial Equipment, Other Oil Field Equipment, , ,
0.01		
2270		
0.02	2270001060	Mobile Sources, Off-highway Vehicle Diesel, Recreational Equipment, Specialty Vehicles/Carts, Hour, Vehicle, Operated
0.02	2270002003	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Pavers, Horsepower-Hours, Work, Output

Emissions (Tons Per Day)	Scs	Scsname
0.00	2270002006	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Tampers/Rammers, Horsepower-Hours, Work, Output
0.00	2270002009	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Plate Compactors, Horsepower-Hours, Work, Output
0.07	2270002015	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Rollers, Horsepower-Hours, Work, Output
0.07	2270002018	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Scrapers, Horsepower-Hours, Work, Output
0.01	2270002021	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Paving Equipment, Horsepower-Hours, Work, Output
0.00	2270002024	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Surfacing Equipment, Horsepower-Hours, Work, Output
0.01	2270002027	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Signal Boards/Light Plants, Horsepower-Hours, Work, Output
0.04	2270002030	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Trenchers, Horsepower-Hours, Work, Output
0.04	2270002033	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Bore/Drill Rigs, Horsepower-Hours, Work, Output
0.21	2270002036	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Excavators, Horsepower-Hours, Work, Output
0.00	2270002039	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Concrete/Industrial Saws, Horsepower-Hours, Work, Output
0.00	2270002042	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Cement and Mortar Mixers, Horsepower-Hours, Work, Output
0.05	2270002045	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Cranes, Horsepower-Hours, Work, Output
0.07	2270002048	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Graders, Horsepower-Hours, Work, Output
0.20	2270002051	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Off-highway Trucks, Horsepower-Hours, Work, Output
0.01	2270002054	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Crushing/Processing Equipment, Horsepower-Hours, Work, Output
0.11	2270002057	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Rough Terrain Forklifts, Horsepower-Hours, Work, Output
0.33	2270002060	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Rubber Tire Loaders, Horsepower-Hours, Work, Output

Emissions (Tons Per Day)	Sc	Scname
0.54	2270002066	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Tractors/Loaders/Backhoes, Horsepower-Hours, Work, Output
0.34	2270002069	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Crawler Tractor/Dozers, Horsepower-Hours, Work, Output
0.42	2270002072	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Skid Steer Loaders, Horsepower-Hours, Work, Output
0.02	2270002075	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Off-highway Tractors, Horsepower-Hours, Work, Output
0.00	2270002078	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Dumpers/Tenders, Horsepower-Hours, Work, Output
0.03	2270002081	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Other Construction Equipment, Horsepower-Hours, Work, Output
0.04	2270003010	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Aerial Lifts, Horsepower-Hours, Work, Output
0.11	2270003020	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Forklifts, Horsepower-Hours, Work, Output
0.06	2270003030	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Sweepers/Scrubbers, Horsepower-Hours, Work, Output
0.07	2270003040	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Other General Industrial Equipment, Horsepower-Hours, Work, Output
0.01	2270003050	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Other Material Handling Equipment, Horsepower-Hours, Work, Output
0.15	2270003060	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, AC\Refrigeration, , ,
0.06	2270003070	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Terminal Tractors, , ,
0.00	2270004031	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Leafblowers/Vacuums (Commercial), , ,
0.00	2270004036	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Snowblowers (Commercial), , ,
0.19	2270004046	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Front Mowers (Commercial), , ,
0.03	2270004056	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Lawn and Garden Tractors (Commercial), , ,
0.04	2270004066	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Chippers/Stump Grinders (Commercial), , ,

Emissions (Tons Per Day)	Scs	Scsname
0.05	2270004071	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Turf Equipment (Commercial), , ,
0.00	2270004076	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Other Lawn and Garden Equipment (Commercial), , ,
0.00	2270005010	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, 2-Wheel Tractors, Horsepower-Hours, Work, Output
0.18	2270005015	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Agricultural Tractors, Horsepower-Hours, Work, Output
0.01	2270005020	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Combines, Horsepower-Hours, Work, Output
0.00	2270005025	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Balers, Horsepower-Hours, Work, Output
0.00	2270005030	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Agricultural Mowers, Horsepower-Hours, Work, Output
0.00	2270005035	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Sprayers, Horsepower-Hours, Work, Output
0.00	2270005040	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Tillers > 6 HP, Horsepower-Hours, Work, Output
0.00	2270005045	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Swathers, Horsepower-Hours, Work, Output
0.00	2270005050	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Hydro-power Units, Horsepower-Hours, Work, Output
0.00	2270005055	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Other Agricultural Equipment, Horsepower-Hours, Work, Output
0.00	2270005060	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Irrigation Sets, , ,
0.19	2270006005	Mobile Sources, Off-highway Vehicle Diesel, Commercial Equipment, Generator Sets, Horsepower-Hours, Work, Output
0.04	2270006010	Mobile Sources, Off-highway Vehicle Diesel, Commercial Equipment, Pumps, Horsepower-Hours, Work, Output
0.09	2270006015	Mobile Sources, Off-highway Vehicle Diesel, Commercial Equipment, Air Compressors, Horsepower-Hours, Work, Output
0.00	2270006020	Mobile Sources, Off-highway Vehicle Diesel, Commercial Equipment, Gas Compressors, Horsepower-Hours, Work, Output
0.15	2270006025	Mobile Sources, Off-highway Vehicle Diesel, Commercial Equipment, Welders, Horsepower-Hours, Work, Output

Emissions (Tons Per Day)	Scs	Scsname
0.01	2270006030	Mobile Sources, Off-highway Vehicle Diesel, Commercial Equipment, Pressure Washers, Horsepower-Hours, Work, Output
0.00	2270007010	Mobile Sources, Off-highway Vehicle Diesel, Logging Equipment, Shredders > 6 HP, Horsepower-Hours, Work, Output
0.00	2270007015	Mobile Sources, Off-highway Vehicle Diesel, Logging Equipment, Forest Eq - Feller/Bunch/Skidder, Horsepower-Hours, Work, Output
0.01	2270008005	Mobile Sources, Off-highway Vehicle Diesel, Airport Ground Support Equipment, Airport Ground Support Equipment, Horsepower-Hours, Work, Output
0.00	2270009010	Mobile Sources, Off-highway Vehicle Diesel, Underground Mining Equipment, Other Underground Mining Equipment, , ,
0.01	2270010010	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Other Oil Field Equipment, , ,
4.11		
2275		
0.01	2275001000	Mobile Sources, Aircraft, Military Aircraft, Total, Each, Landing-Takeoff Cycle, Occurred
0.33	2275020000	Mobile Sources, Aircraft, Commercial Aircraft, Total: All Types, Each, Landing-Takeoff Cycle, Occurred
0.03	2275050000	Mobile Sources, Aircraft, General Aviation, Total, Each, Landing-Takeoff Cycle, Occurred
0.18	2275060000	Mobile Sources, Aircraft, Air Taxi, Total, Each, Landing-Takeoff Cycle, Occurred
0.55		
2280		
1.05	2280002100	, , , , , ,
0.06	2280002200	, , , , , ,
0.28	2280003100	, , , , , ,
0.02	2280003200	, , , , , ,
1.41		
2282		
31.22	2282005010	Mobile Sources, Pleasure Craft, Gasoline 2-Stroke, Outboard, Gallons, Gasoline, Burned
14.35	2282005015	Mobile Sources, Pleasure Craft, Gasoline 2-Stroke, Personal Water Craft, Gallons, Gasoline, Burned

Emissions (Tons Per Day)	Scs	Scsname
2.95	2282010005	Mobile Sources, Pleasure Craft, Gasoline 4-Stroke, Inboard/Sterndrive, Gallons, Gasoline, Burned
0.05	2282020005	Mobile Sources, Pleasure Craft, Diesel, Inboard/Sterndrive, Gallons, Diesel, Burned
0.00	2282020010	Mobile Sources, Pleasure Craft, Diesel, Outboard, Gallons, Diesel, Burned
48.57		
	2285	
0.45	2285002006	, , , , ,
0.02	2285002008	, , , , ,
0.28	2285002010	Mobile Sources, Railroad Equipment, Diesel, Yard Locomotives, Gallons, Diesel, Burned
0.02	2285002015	Mobile Sources, Railroad Equipment, Diesel, Railway Maintenance, , ,
0.00	2285004015	Mobile Sources, Railroad Equipment, Gasoline, 4-Stroke, Railway Maintenance, , ,
0.00	2285006015	Mobile Sources, Railroad Equipment, LPG, Railway Maintenance, , ,
0.77		
Total	103.87	

CLEVELAND MSA, 2002 NON ROAD EIS

10/14/05 NOX

Emissions (Tons Per Day)	Scc	Sccname
2260		
0.01	2260001010	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Recreational Equipment, Motorcycles: Off-road, Hour, Vehicle, Operated
0.01	2260001020	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Recreational Equipment, Snowmobiles, Horsepower-Hours, Work, Output
0.01	2260001030	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Recreational Equipment, All Terrain Vehicles, Hour, Vehicle, Operated
0.01	2260001060	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Recreational Equipment, Specialty Vehicles/Carts, Hour, Vehicle, Operated
0.00	2260002006	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Construction and Mining Equipment, Tampers/Rammers, Horsepower-Hours, Work, Output
0.00	2260002009	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Construction and Mining Equipment, Plate Compactors, Horsepower-Hours, Work, Output
0.00	2260002021	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Construction and Mining Equipment, Paving Equipment, Horsepower-Hours, Work, Output
0.00	2260002027	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Construction and Mining Equipment, Signal Boards/Light Plants, Horsepower-Hours, Work, Output
0.01	2260002039	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Construction and Mining Equipment, Concrete/Industrial Saws, Horsepower-Hours, Work, Output
0.00	2260002054	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Construction and Mining Equipment, Crushing/Processing Equipment, Horsepower-Hours, Work, Output
0.00	2260003030	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Industrial Equipment, Sweepers/Scrubbers, Horsepower-Hours, Work, Output
0.00	2260003040	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Industrial Equipment, Other General Industrial Equipment, Horsepower-Hours, Work, Output
0.00	2260004015	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Rotary Tillers < 6 HP (Residential), Horsepower-Hours, Work, Output
0.00	2260004016	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Rotary Tillers < 6 HP (Commercial), , ,
0.00	2260004020	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Chain Saws < 6 HP (Residential), Horsepower-Hours, Work, Output

Emissions (Tons Per Day)	Sc	Scname
0.06	2260004021	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Chain Saws < 6 HP (Commercial), , ,
0.00	2260004025	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Trimmers/Edgers/Brush Cutters (Residential), Horsepower-Hours, Work
0.02	2260004026	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Trimmers/Edgers/Brush Cutters (Commercial), , ,
0.00	2260004030	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Leafblowers/Vacuums (Residential), Horsepower-Hours, Work, Output
0.03	2260004031	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Leafblowers/Vacuums (Commercial), , ,
0.00	2260004035	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Snowblowers (Residential), Horsepower-Hours, Work, Output
0.00	2260004036	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Snowblowers (Commercial), , ,
0.00	2260004071	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Lawn and Garden Equipment, Turf Equipment (Commercial), , ,
0.00	2260005035	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Agricultural Equipment, Sprayers, Horsepower-Hours, Work, Output
0.00	2260005050	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Agricultural Equipment, Hydro-power Units, Horsepower-Hours, Work, Output
0.00	2260006005	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Commercial Equipment, Generator Sets, Horsepower-Hours, Work, Output
0.00	2260006010	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Commercial Equipment, Pumps, Horsepower-Hours, Work, Output
0.00	2260006015	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Commercial Equipment, Air Compressors, Horsepower-Hours, Work, Output
0.00	2260007005	Mobile Sources, Off-highway Vehicle Gasoline, 2-Stroke, Logging Equipment, Chain Saws > 6 HP, Horsepower-Hours, Work, Output
0.16		
	2265	
0.01	2265001010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Recreational Equipment, Motorcycles: Off-road, , ,
0.09	2265001030	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Recreational Equipment, All Terrain Vehicles, , ,

Emissions (Tons Per Day)	Scs	Scsname
0.20	2265001050	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Recreational Equipment, Golf Carts, , ,
0.01	2265001060	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Recreational Equipment, Specialty Vehicles/Carts, , ,
0.01	2265002003	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Pavers, , ,
0.00	2265002006	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Tampers/Rammers, , ,
0.01	2265002009	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Plate Compactors, , ,
0.01	2265002015	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Rollers, , ,
0.02	2265002021	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Paving Equipment, , ,
0.01	2265002024	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Surfacing Equipment, , ,
0.00	2265002027	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Signal Boards/Light Plants, , ,
0.02	2265002030	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Trenchers, , ,
0.01	2265002033	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Bore/Drill Rigs, , ,
0.04	2265002039	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Concrete/Industrial Saws, , ,
0.02	2265002042	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Cement and Mortar Mixers, , ,
0.00	2265002045	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Cranes, , ,
0.00	2265002054	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Crushing/Processing Equipment, , ,
0.01	2265002057	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Rough Terrain Forklifts, , ,
0.01	2265002060	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Rubber Tire Loaders, , ,
0.01	2265002066	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Tractors/Loaders/Backhoes, , ,

Emissions (Tons Per Day)	Scs	Scsname
0.02	2265002072	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Skid Steer Loaders, , ,
0.00	2265002078	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Dumpers/Tenders, , ,
0.01	2265002081	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Construction and Mining Equipment, Other Construction Equipment, , ,
0.08	2265003010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Aerial Lifts, , ,
0.34	2265003020	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Forklifts, , ,
0.06	2265003030	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Sweepers/Scrubbers, , ,
0.06	2265003040	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Other General Industrial Equipment, , ,
0.01	2265003050	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Other Material Handling Equipment, , ,
0.00	2265003060	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, AC\Refrigeration, , ,
0.04	2265003070	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Terminal Tractors, , ,
0.21	2265004010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Lawn Mowers (Residential), , ,
0.20	2265004011	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Lawn Mowers (Commercial), , ,
0.02	2265004015	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Rotary Tillers < 6 HP (Residential), , ,
0.10	2265004016	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Rotary Tillers < 6 HP (Commercial), , ,
0.00	2265004025	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Trimmers/Edgers/Brush Cutters (Residential), , ,
0.00	2265004026	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Trimmers/Edgers/Brush Cutters (Commercial), , ,
0.00	2265004030	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Leafblowers/Vacuums (Residential), , ,
0.30	2265004031	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Leafblowers/Vacuums (Commercial), , ,

Emissions (Tons Per Day)	Sc	Scname
0.06	2265004035	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Snowblowers (Residential), , ,
0.15	2265004036	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Snowblowers (Commercial), , ,
0.05	2265004040	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Rear Engine Riding Mowers (Residential), , ,
0.03	2265004041	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Rear Engine Riding Mowers (Commercial), , ,
0.03	2265004046	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Front Mowers (Commercial), , ,
0.01	2265004051	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Shredders < 6 HP (Commercial), , ,
0.75	2265004055	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Lawn and Garden Tractors (Residential), , ,
0.36	2265004056	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Lawn and Garden Tractors (Commercial), , ,
0.11	2265004066	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Chippers/Stump Grinders (Commercial), , ,
1.25	2265004071	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Turf Equipment (Commercial), , ,
0.02	2265004075	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Other Lawn and Garden Equipment (Residential), , ,
0.03	2265004076	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Lawn and Garden Equipment, Other Lawn and Garden Equipment (Commercial), , ,
0.00	2265005010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, 2-Wheel Tractors, , ,
0.00	2265005015	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Agricultural Tractors, , ,
0.00	2265005020	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Combines, , ,
0.00	2265005025	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Balers, , ,
0.00	2265005030	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Agricultural Mowers, , ,
0.00	2265005035	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Sprayers, , ,

Emissions (Tons Per Day)	Scs	Scsname
0.00	2265005040	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Tillers > 6 HP, , ,
0.00	2265005045	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Swathers, , ,
0.00	2265005050	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Hydro-power Units, , ,
0.00	2265005055	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Other Agricultural Equipment, , ,
0.00	2265005060	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Agricultural Equipment, Irrigation Sets, , ,
0.67	2265006005	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Commercial Equipment, Generator Sets, , ,
0.19	2265006010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Commercial Equipment, Pumps, , ,
0.12	2265006015	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Commercial Equipment, Air Compressors, , ,
0.23	2265006025	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Commercial Equipment, Welders, , ,
0.29	2265006030	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Commercial Equipment, Pressure Washers, , ,
0.00	2265007010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Logging Equipment, Shredders > 6 HP, , ,
0.00	2265007015	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Logging Equipment, Forest Eq - Feller/Bunch/Skidder, , ,
0.00	2265008005	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Airport Ground Support Equipment, Airport Ground Support Equipment, , ,
0.01	2265010010	Mobile Sources, Off-highway Vehicle Gasoline, 4-Stroke, Industrial Equipment, Other Oil Field Equipment, , ,
6.30		
	2267	
0.00	2267001060	Mobile Sources, LPG, Recreational Equipment, Specialty Vehicles/Carts, , ,
0.00	2267002003	Mobile Sources, LPG, Construction and Mining Equipment, Pavers, , ,
0.01	2267002015	Mobile Sources, LPG, Construction and Mining Equipment, Rollers, , ,
0.00	2267002021	Mobile Sources, LPG, Construction and Mining Equipment, Paving Equipment, , ,

Emissions (Tons Per Day)	Sc	Scname
0.00	2267002024	Mobile Sources, LPG, Construction and Mining Equipment, Surfacing Equipment, , ,
0.01	2267002030	Mobile Sources, LPG, Construction and Mining Equipment, Trenchers, , ,
0.00	2267002033	Mobile Sources, LPG, Construction and Mining Equipment, Bore/Drill Rigs, , ,
0.01	2267002039	Mobile Sources, LPG, Construction and Mining Equipment, Concrete/Industrial Saws, , ,
0.00	2267002045	Mobile Sources, LPG, Construction and Mining Equipment, Cranes, , ,
0.00	2267002054	Mobile Sources, LPG, Construction and Mining Equipment, Crushing/Processing Equipment, , ,
0.01	2267002057	Mobile Sources, LPG, Construction and Mining Equipment, Rough Terrain Forklifts, , ,
0.02	2267002060	Mobile Sources, LPG, Construction and Mining Equipment, Rubber Tire Loaders, , ,
0.00	2267002066	Mobile Sources, LPG, Construction and Mining Equipment, Tractors/Loaders/Backhoes, , ,
0.01	2267002072	Mobile Sources, LPG, Construction and Mining Equipment, Skid Steer Loaders, , ,
0.01	2267002081	Mobile Sources, LPG, Construction and Mining Equipment, Other Construction Equipment, , ,
0.11	2267003010	Mobile Sources, LPG, Industrial Equipment, Aerial Lifts, , ,
10.43	2267003020	Mobile Sources, LPG, Industrial Equipment, Forklifts, , ,
0.08	2267003030	Mobile Sources, LPG, Industrial Equipment, Sweepers/Scrubbers, , ,
0.02	2267003040	Mobile Sources, LPG, Industrial Equipment, Other General Industrial Equipment, , ,
0.01	2267003050	Mobile Sources, LPG, Industrial Equipment, Other Material Handling Equipment, , ,
0.05	2267003070	Mobile Sources, LPG, Industrial Equipment, Terminal Tractors, , ,
0.09	2267004066	Mobile Sources, LPG, Lawn and Garden Equipment, Chippers/Stump Grinders (Commercial), , ,
0.00	2267005050	Mobile Sources, LPG, Agricultural Equipment, Hydro-power Units, , ,
0.00	2267005055	Mobile Sources, LPG, Agricultural Equipment, Other Agricultural Equipment, , ,
0.00	2267005060	Mobile Sources, LPG, Agricultural Equipment, Irrigation Sets, , ,
0.26	2267006005	Mobile Sources, LPG, Commercial Equipment, Generator Sets, , ,

Emissions (Tons Per Day)	Sc	Scname
0.06	2267006010	Mobile Sources, LPG, Commercial Equipment, Pumps, , ,
0.08	2267006015	Mobile Sources, LPG, Commercial Equipment, Air Compressors, , ,
0.10	2267006025	Mobile Sources, LPG, Commercial Equipment, Welders, , ,
0.00	2267006030	Mobile Sources, LPG, Commercial Equipment, Pressure Washers, , ,
0.00	2267008005	Mobile Sources, LPG, Airport Ground Support Equipment, Airport Ground Support Equipment, , ,
11.37		
2268		
0.00	2268002081	Mobile Sources, CNG, Construction and Mining Equipment, Other Construction Equipment, , ,
0.78	2268003020	Mobile Sources, CNG, Industrial Equipment, Forklifts, , ,
0.00	2268003030	Mobile Sources, CNG, Industrial Equipment, Sweepers/Scrubbers, , ,
0.00	2268003040	Mobile Sources, CNG, Industrial Equipment, Other General Industrial Equipment, , ,
0.00	2268003060	Mobile Sources, CNG, Industrial Equipment, AC\Refrigeration, , ,
0.00	2268003070	Mobile Sources, CNG, Industrial Equipment, Terminal Tractors, , ,
0.00	2268005050	Mobile Sources, CNG, Agricultural Equipment, Hydro-power Units, , ,
0.00	2268005055	Mobile Sources, CNG, Agricultural Equipment, Other Agricultural Equipment, , ,
0.00	2268005060	Mobile Sources, CNG, Agricultural Equipment, Irrigation Sets, , ,
0.09	2268006005	Mobile Sources, CNG, Commercial Equipment, Generator Sets, , ,
0.00	2268006010	Mobile Sources, CNG, Commercial Equipment, Pumps, , ,
0.01	2268006015	Mobile Sources, CNG, Commercial Equipment, Air Compressors, , ,
0.23	2268006020	Mobile Sources, CNG, Commercial Equipment, Gas Compressors, , ,
0.03	2268010010	Mobile Sources, CNG, Industrial Equipment, Other Oil Field Equipment, , ,
1.14		
2270		
0.05	2270001060	Mobile Sources, Off-highway Vehicle Diesel, Recreational Equipment, Specialty Vehicles/Carts, Hour, Vehicle, Operated
0.25	2270002003	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Pavers, Horsepower-Hours, Work, Output

Emissions (Tons Per Day)	Sc	Scname
0.00	2270002006	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Tampers/Rammers, Horsepower-Hours, Work, Output
0.01	2270002009	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Plate Compactors, Horsepower-Hours, Work, Output
0.68	2270002015	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Rollers, Horsepower-Hours, Work, Output
1.00	2270002018	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Scrapers, Horsepower-Hours, Work, Output
0.06	2270002021	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Paving Equipment, Horsepower-Hours, Work, Output
0.01	2270002024	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Surfacing Equipment, Horsepower-Hours, Work, Output
0.06	2270002027	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Signal Boards/Light Plants, Horsepower-Hours, Work, Output
0.28	2270002030	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Trenchers, Horsepower-Hours, Work, Output
0.45	2270002033	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Bore/Drill Rigs, Horsepower-Hours, Work, Output
2.70	2270002036	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Excavators, Horsepower-Hours, Work, Output
0.02	2270002039	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Concrete/Industrial Saws, Horsepower-Hours, Work, Output
0.02	2270002042	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Cement and Mortar Mixers, Horsepower-Hours, Work, Output
0.60	2270002045	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Cranes, Horsepower-Hours, Work, Output
0.93	2270002048	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Graders, Horsepower-Hours, Work, Output
2.95	2270002051	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Off-highway Trucks, Horsepower-Hours, Work, Output
0.13	2270002054	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Crushing/Processing Equipment, Horsepower-Hours, Work, Output
0.87	2270002057	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Rough Terrain Forklifts, Horsepower-Hours, Work, Output
4.06	2270002060	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Rubber Tire Loaders, Horsepower-Hours, Work, Output

Emissions (Tons Per Day)	Sc	Scname
2.30	2270002066	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Tractors/Loaders/Backhoes, Horsepower-Hours, Work, Output
4.32	2270002069	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Crawler Tractor/Dozers, Horsepower-Hours, Work, Output
1.17	2270002072	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Skid Steer Loaders, Horsepower-Hours, Work, Output
0.25	2270002075	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Off-highway Tractors, Horsepower-Hours, Work, Output
0.00	2270002078	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Dumpers/Tenders, Horsepower-Hours, Work, Output
0.40	2270002081	Mobile Sources, Off-highway Vehicle Diesel, Construction and Mining Equipment, Other Construction Equipment, Horsepower-Hours, Work, Output
0.16	2270003010	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Aerial Lifts, Horsepower-Hours, Work, Output
1.15	2270003020	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Forklifts, Horsepower-Hours, Work, Output
0.63	2270003030	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Sweepers/Scrubbers, Horsepower-Hours, Work, Output
0.72	2270003040	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Other General Industrial Equipment, Horsepower-Hours, Work, Output
0.04	2270003050	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Other Material Handling Equipment, Horsepower-Hours, Work, Output
1.19	2270003060	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, AC\Refrigeration, , ,
0.75	2270003070	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Terminal Tractors, , ,
0.00	2270004031	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Leafblowers/Vacuums (Commercial), , ,
0.02	2270004036	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Snowblowers (Commercial), , ,
0.96	2270004046	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Front Mowers (Commercial), , ,
0.13	2270004056	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Lawn and Garden Tractors (Commercial), , ,
0.30	2270004066	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Chippers/Stump Grinders (Commercial), , ,

Emissions (Tons Per Day)	Sc	Scname
0.44	2270004071	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Turf Equipment (Commercial), , ,
0.00	2270004076	Mobile Sources, Off-highway Vehicle Diesel, Lawn and Garden Equipment, Other Lawn and Garden Equipment (Commercial), , ,
0.00	2270005010	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, 2-Wheel Tractors, Horsepower-Hours, Work, Output
1.47	2270005015	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Agricultural Tractors, Horsepower-Hours, Work, Output
0.13	2270005020	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Combines, Horsepower-Hours, Work, Output
0.00	2270005025	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Balers, Horsepower-Hours, Work, Output
0.00	2270005030	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Agricultural Mowers, Horsepower-Hours, Work, Output
0.01	2270005035	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Sprayers, Horsepower-Hours, Work, Output
0.00	2270005040	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Tillers > 6 HP, Horsepower-Hours, Work, Output
0.01	2270005045	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Swathers, Horsepower-Hours, Work, Output
0.00	2270005050	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Hydro-power Units, Horsepower-Hours, Work, Output
0.03	2270005055	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Other Agricultural Equipment, Horsepower-Hours, Work, Output
0.02	2270005060	Mobile Sources, Off-highway Vehicle Diesel, Agricultural Equipment, Irrigation Sets, , ,
1.23	2270006005	Mobile Sources, Off-highway Vehicle Diesel, Commercial Equipment, Generator Sets, Horsepower-Hours, Work, Output
0.27	2270006010	Mobile Sources, Off-highway Vehicle Diesel, Commercial Equipment, Pumps, Horsepower-Hours, Work, Output
0.71	2270006015	Mobile Sources, Off-highway Vehicle Diesel, Commercial Equipment, Air Compressors, Horsepower-Hours, Work, Output
0.00	2270006020	Mobile Sources, Off-highway Vehicle Diesel, Commercial Equipment, Gas Compressors, Horsepower-Hours, Work, Output
0.36	2270006025	Mobile Sources, Off-highway Vehicle Diesel, Commercial Equipment, Welders, Horsepower-Hours, Work, Output

Emissions (Tons Per Day)	Sc	Scname
0.04	2270006030	Mobile Sources, Off-highway Vehicle Diesel, Commercial Equipment, Pressure Washers, Horsepower-Hours, Work, Output
0.00	2270007010	Mobile Sources, Off-highway Vehicle Diesel, Logging Equipment, Shredders > 6 HP, Horsepower-Hours, Work, Output
0.00	2270007015	Mobile Sources, Off-highway Vehicle Diesel, Logging Equipment, Forest Eq - Feller/Bunch/Skidder, Horsepower-Hours, Work, Output
0.16	2270008005	Mobile Sources, Off-highway Vehicle Diesel, Airport Ground Support Equipment, Airport Ground Support Equipment, Horsepower-Hours, Work, Output
0.00	2270009010	Mobile Sources, Off-highway Vehicle Diesel, Underground Mining Equipment, Other Underground Mining Equipment, , ,
0.08	2270010010	Mobile Sources, Off-highway Vehicle Diesel, Industrial Equipment, Other Oil Field Equipment, , ,
34.58		
	2275	
0.00	2275001000	Mobile Sources, Aircraft, Military Aircraft, Total, Each, Landing-Takeoff Cycle, Occurred
1.83	2275020000	Mobile Sources, Aircraft, Commercial Aircraft, Total: All Types, Each, Landing-Takeoff Cycle, Occurred
0.01	2275050000	Mobile Sources, Aircraft, General Aviation, Total, Each, Landing-Takeoff Cycle, Occurred
0.02	2275060000	Mobile Sources, Aircraft, Air Taxi, Total, Each, Landing-Takeoff Cycle, Occurred
1.86		
	2280	
33.69	2280002100	, , , , ,
2.06	2280002200	, , , , ,
8.99	2280003100	, , , , ,
0.57	2280003200	, , , , ,
45.31		
	2282	
0.95	2282005010	Mobile Sources, Pleasure Craft, Gasoline 2-Stroke, Outboard, Gallons, Gasoline, Burned
0.25	2282005015	Mobile Sources, Pleasure Craft, Gasoline 2-Stroke, Personal Water Craft, Gallons, Gasoline, Burned

Emissions (Tons Per Day)	Sc	Scname
1.64	2282010005	Mobile Sources, Pleasure Craft, Gasoline 4-Stroke, Inboard/Stern Drive, Gallons, Gasoline, Burned
1.40	2282020005	Mobile Sources, Pleasure Craft, Diesel, Inboard/Stern Drive, Gallons, Diesel, Burned
0.01	2282020010	Mobile Sources, Pleasure Craft, Diesel, Outboard, Gallons, Diesel, Burned
4.25		
	2285	
12.05	2285002006	, , , , , ,
0.62	2285002008	, , , , , ,
4.73	2285002010	Mobile Sources, Railroad Equipment, Diesel, Yard Locomotives, Gallons, Diesel, Burned
0.10	2285002015	Mobile Sources, Railroad Equipment, Diesel, Railway Maintenance, , ,
0.00	2285004015	Mobile Sources, Railroad Equipment, Gasoline, 4-Stroke, Railway Maintenance, , ,
0.00	2285006015	Mobile Sources, Railroad Equipment, LPG, Railway Maintenance, , ,
17.50		
Total	122.47	

NUMBER OF "TOTAL ANNUAL OPERATIONS"

2004

Ashtabula County (HZY)	16,886
Germack (7D9)	840
Champion Executive (9B9)	254
Cuyahoga County (CGF)	67,662
Burke Lakefront (BKL)	95,412
Geauga County (7G80)	5,350
Gates (7D8)	4,200
Concord Airpark (2G1)	4,510
Willoughby Lost Nation Muni (LNN)	61,370
Columbia (4G8)	5,150
Elyria (1G1)	14,300
Lorain County Regional (LPR)	62,000
Harlan Airfield (92D)	1,155
Reader - Botsford (67D)	18,700
Medina Municipal (1G5)	79,685
Weltzien Skypark (15G)	79,130
Wadsworth Muni (3G3)	41,025
Portage County (29G)	9,621
Mills (7E3)	1,050
Freedom Air Field (7D6)	1,623
Far View (86D)	3,334
Mayfield (1D4)	350
Akron Fulton Intl (AKR)	26,000
Kent State Univ. (1G3)	<u>72,500</u>
	672,107

(TAKE-OFFS
&
LANDINGS)

Cleveland - Hopkins Intl (CLE)	262,108
Akron - Canton Regional (CAK)	<u>123,460</u>
	385,568

APPENDIX B

Low Ozone-Forming Potential Trees

APPENDIX C



Serving Sutter and Yuba Counties

- Home
- Air Quality
- Burn Info
- Permit
- SB 700
- Air Toxics
- CEQA Planning
- Area Designations
- Grant Programs
- Calendar
- Rules 'n Regs
- 2003 NSVAB Plan
- Ask Eric Wality
- American Lung Association (State of the Air 2004 Report)
- Yuba-Sutter Transit
- Contact Us

Aleppo Pine [Pinus halepensis]	Italian Stone Pine [Pinus pinea]
American Elm [Ulmus americana]	Jacaranda [Jacaranda mimosifolia]
Apple [Malus sp.]	Japanese Maple [Acer palmatum]
Aristocrat Flowering Pear [Pyrus calleryana 'Aristocrat']	Leylandi Cypress [Cupressocyparis leylandii]
Arizona Ash [Fraxinus velutina]	Loquat [Eriobotrya japonica]
Atlas Cedar [Cedrus atlantica]	Meyer Lemon [Citrus limon 'Meyer']
Australian Willow [Geijera parvifolia]	Meyer Lemon [Citrus limonia burm.]
Avocado [Persea americana]	Modesto Ash [Fraxinus velutina 'Modesto']
Bigleaf Maple [Acer macrophyllum]	Montebello Ash [Fraxinus velutina coriacea]
Bing Cherry [Prunus avium]	Monterey Pine [Pinus radiata]
Black Cherry [Prunus serotina]	Mountain Serviceberry [Amelanchier alnifolia]
Black Locust [Robinia pseudoacacia]	Nonpareil Almond [Prunus dulcis]
Black Walnut [Juglans nigra]	Nootka Cypress [Chamaecyparis nootkatensis]
Blenheim Apricot [Prunus armeniaca]	Olive [Olea europaea]
Box Elder [Acer negundo]	Orange [Citrus orangoma]
Bradford Pear [Pyrus calleryana 'Bradford']	Oregon Ash [Fraxinus latifolia]
Bronze Loquat [Eriobotrya deflexa]	Pear [Pyrus communis]
California Black Walnut [Juglans hindsii]	Port Orford Cedar [Chamaecyparis lawsoniana]
California Pepper [Schinus molle]	Portugal Laurel [Prunus lusitanica]
California Walnut [Juglans californica]	Queensland Pittosporum [Pittosporum rhombifolium]
Camphor [Cinnamomum camphora]	Red Bay [Persea borbonia]
Camphor [Cinnamomum pedunculatum]	Red Hickory [Carya sp.]
Canary Island Pine [Pinus canariensis]	Red Maple [Acer rubrum]
Cape Chestnut [Calodendrum capense]	Red Mulberry [Morus rubra]
Carolina Laurel Cherry [Prunus caroliniana]	Red Pine [Prunus densiflora]
Catalina Cherry [Prunus lyonii]	

Catalina Ironwood [<i>Lyonothamnus floribundus asplenifolius</i>]	Redbud [<i>Cercis canadensis</i>]
Cherry Plum [<i>Prunus cerasifera</i>]	Rocky Mountain Maple [<i>Acer glabrum</i>]
Chinese Elm [<i>Ulmus parvifolia</i>]	Sago Palm [<i>Cycas revoluta</i>]
Chinese Hackberry [<i>Celtis sinensis</i>]	Santa Rosa Plum [<i>Prunus domestica</i>]
Choke Cherry [<i>Prunus virginiana</i>]	Sassafras [<i>Sassafras albidum</i>]
Crape Myrtle [<i>Lagerstroemia indica</i>]	Sawleaf Zelkova [<i>Zelkova serrata</i>]
English Walnut [<i>Juglans regia</i>]	Sierra Plum [<i>Prunus subcordata</i>]
Evergreen Ash [<i>Fraxinus uhdei</i>]	Silver Maple [<i>Acer floridanum</i>]
Evergreen Pear [<i>Pyrus kawakamii</i>]	Silver Maple [<i>Acer saccharinum</i>]
Foothill Ash [<i>Fraxinus dipetala</i>]	Sweetshade [<i>Hymenosporum flavum</i>]
Foothill Pine [<i>Pinus sabiniana</i>]	Valencia Orange [<i>Citrus sinensis 'Valencia'</i>]
Fruitless Mulberry [<i>Morus alba 'Fruitless'</i>]	Victorian Box [<i>Pittosporum tobira</i>]
Ginkgo [<i>Ginkgo biloba</i>]	Vine Maple [<i>Acer circinatum</i>]
Grapefruit [<i>Citrus paradisi</i>]	Water Hickory [<i>Carya aquatica</i>]
Grecian Laurel [<i>Laurus nobilis</i>]	Western Redbud [<i>Cercis occidentalis</i>]
Green Ash [<i>Fraxinus pennsylvanica</i>]	White Sapote [<i>Casimiroa edulis</i>]
Halford Peach [<i>Prunus persica</i>]	Yew Pine [<i>Podocarpus macrophyllus</i>]
Incense Cedar [<i>Calocedrus decurrens</i>]	
Italian Cypress [<i>Cupressus sempervirens</i>]	

Medium Ozone-Forming Potential Trees



Serving Sutter and Yuba Counties

[Home](#)[Air Quality](#)[Burn Info](#)[Permit](#)[SB 700](#)[Air Toxics](#)[CEQA Planning](#)[Area Designations](#)[Grant Programs](#)[Calendar](#)[Rules 'n Regs](#)[2003 NSVAB Plan](#)[Ask Eric Wality](#)[American Lung Association \(State of the Air 2004 Report\)](#)[Yuba-Sutter Transit](#)[Contact Us](#)

Bailey Acacia	Loblolly Pine
Beach Pine	Longleaf Pine
Bigcone Douglas Fir	Lowland Fir
Bishop Pine	Magnolia
Blue Oak	Mango
Blue Palo Verde	Mountain Hemlock
Brazilian Pepper	Myrtle Oak
Bristlecone Pine	Navel Orange
California Laurel	Noble Fir
California Sycamore	Northern Red Oak
Carob	Pinyon Pine
Chestnut Oak	Ponderosa Pine
Chinese Pistache	Purple Orchid Tree
Cluster Pine	Red Fir
Coast Redwood	Ribbon Gum
Coulter Pine Cypress	Rubber Tree
Deodar Cedar	Santa Lucia Fir
Desert Ironwood	Saucer Magnolia
Desert Willow.	Scots Pine
Diamond Leaf Oak	Silk Tree
Douglas Fir	Singleleaf Pinyon Pine
Foothills Palo Verde	Sitka Spruce
Four Needle Pinyon Pine	Slash Pine
Foxtail Pine	Sugar Pine
Giant Sequoia	Sweet Acacia
Golden Trumpet Tree	Tipu Tree
Japanese Black Pine	Torrey Pine

Japanese Pagoda Tree	Tulip Tree
Jeffery Pine	Valencia Orange
Jerusalem Thorn	Valley Oak
Kaffir Plum	Western Hemlock
Kaffirboom Coral Tree	Western White Pine
Kerman Pistachio	White Fir
Knobcone Pine	White Oak
Limber Pine	Whitebark Pine
Lisbon Lemon	

APPENDIX D

	Class I			Class II-III			Passenger			Commuter			Switch Yards		
	NOX	VOC	PM25-PRI	NOX	VOC	PM25-PRI	NOX	VOC	PM25-PRI	NOX	VOC	PM25-PRI	NOX	VOC	PM25-PRI
Ashtabula	993.730	43.867	25.146	14.820	0.580	0.332	20.228	0.841	0.482	0.000	0.000	0.000	169.821	10.538	3.946
Cuyahoga	1814.098	80.081	45.904	24.399	0.955	0.547	22.395	0.931	0.534	0.000	0.000	0.000	604.211	37.275	13.957
Geauga	0.000	0.000	0.000	0.562	0.022	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake	627.858	27.716	15.887	0.000	0.000	0.000	20.228	0.841	0.482	0.000	0.000	0.000	96.981	6.027	2.257
Lorain	1354.278	59.783	34.269	14.132	0.553	0.317	14.449	0.601	0.344	0.000	0.000	0.000	197.023	12.245	4.585
Medina	407.935	18.008	10.322	36.486	1.429	0.818	14.449	0.601	0.344	0.000	0.000	0.000	68.026	4.227	1.583
Portage	950.860	41.975	24.061	11.609	0.455	0.260	15.893	0.661	0.379	0.000	0.000	0.000	145.230	9.019	3.377
Summit	766.741	33.847	19.402	19.451	0.762	0.436	14.449	0.601	0.344	0.000	0.000	0.000	135.936	8.431	3.157
Totals (tons/yr)	6915.501	305.277	174.991	121.459	4.756	2.724	122.091	5.076	2.910	0.000	0.000	0.000	1417.227	87.762	32.862

	NOX	VOC	PM25-PRI
Ashtabula	1198.599	55.827	29.906
Cuyahoga	2465.104	119.243	60.943
Geauga	0.562	0.022	0.013
Lake	745.067	34.584	18.626
Lorain	1579.881	73.182	39.515
Medina	526.896	24.264	13.068
Portage	1123.593	52.109	28.077
Summit	936.576	43.640	23.339

	NOX	VOC	PM25-PRI
8 County Area	8576.277	402.871	213.487

*Data is shown in tons/yr unless otherwise labeled.

TONS PER DAY

	NOX	VOC	PM25-PRI
8 County Area	23.497	1.104	0.585

CLASS I - LINE HAUL
CLASS II - SHORT HAUL

ENVIRON DEC. 04

(SWITCH YARDS ARE ESTIMATES ONLY.)