1996 Inventory of Toxic Air Emissions:

A Product of the Great Lakes Regional

ТА	BLE OF CONTENTS	ii
LI	ST OF TABLES	iv
LI	ST OF FIGURES	v
AC	CRONYMS AND ABBREVIATIONS	viii
PR	EFACE	X
AC	CKNOWLEDGMENTS	xii
EX	ECUTIVE SUMMARY	xiii
1.	INTRODUCTION	1
2.	METHODOLOGY	4
	Air Toxics Emissions Inventory Protocol for the Great Lakes States	4
	Developing and Testing Client/Server Emission Estimation and Inventory	6
	Sollware: KAPIDS	0
	Coordination Methods	0
3.	RESULTS	
	Overall	
	Specific Pollutants	
4.	CONCLUSIONS	
	Further Refinements and Cooperative Efforts	97
5.	APPENDICES	100
	Appendix A: Illinois Toxic Emissions Inventory	
	Appendix B: Indiana Toxic Emissions Inventory	
	Appendix C: Michigan Toxic Emissions Inventory	
	Appendix D: Minnesota Toxic Emissions Inventory	190
	Appendix E: New York Toxic Emissions Inventory	
	Appendix F: Ohio Toxic Emissions Inventory	
	Appendix G: Ontario Toxic Emissions Inventory	
	Appendix H: Pennsylvania Toxic Emissions Inventory	
	Appendix I: Wisconsin Toxic Emissions Inventory	
	Appendix J: Methodology for Architectural Surface Coating	
	Appendix K: Methodology for Autobody Refinishing	
	Appendix L: Methodology for Consumer and Commercial Solvent Use	
	Appendix N: Methodology for Dry Cleaning	
	Appendix IV. Methodology for Dry Cleaning	
	Annendix P. Methodology for Granhic Arts	
	Appendix O: Methodology for Industrial Surface Coating	
	Appendix R: Methodology for Marine Vessel Loading, Ballasting and Transit	
	Appendix S: Methodology for Municipal Landfills	
	rr	

58
59
61
63
65
71
73
89
) Tj 47.25 0 TD -0.12

Table 1-1:

Figure 3-1:	Acenaphthene; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	20
Figure 3-2:	Acenaphthylene; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	21
Figure 3-3:	Acetaldehyde; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	22
Figure 3-4:	Acrolein; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	23
Figure 3-5:	Acrylamide; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	24
Figure 3-6:	Acrylonitrile; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	25
Figure 3-7:	Anthracene; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	
Figure 3-8:	Antimony; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	27
Figure 3-9:	Arsenic; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	
Figure 3-10:	Atrazine; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	29
Figure 3-11:	Benz(a)anthracene; 1996 Estimated Emissions by Source Category	

Figure 3-26:	Chrysene; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	45
Figure 3-27:	Cobalt; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	46
Figure 3-28:	Coke oven emissions; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	47
Figure 3-29:	Copper, 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	
Figure 3-30:	Dibenz(a,h)anthracene; 1996 Estimated Emissions by Source Category	
fdi9B6iEstindateck	EdioPricessabyl Americs Clategory	49
Figure 3-31:	Ethylene dibromide; 1996 Estimated Emissions by Source Category	
-	for Point and Area Sources	
Figure 3-32:	Di-n-butyl phthalate; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	51
Figure 3-33:	Ethylene dichloride; 1996 Estimated Emissions by Source Category	
	for Point and Area Sources	52
Figure 3-3420.13	648y5 41.3 Tw (f888 Tw r2ke oven emissions)g4exthalate	

Figure 3-54:	Polychlorinated biphenyls (PCBs); 1996 Estimated Emissions	
-	by Source Category for Point and Area Sources	73
Figure 3-55:	Polychlorinated dibenzodioxins (PCDD); 1996 Estimated Emissions	
-	by Source Category for Point and Area Sources	74
Figure 3-56:	Polychlorinated dibenzofurans (PCDF); 1996 Estimated Emissions	
C	by Source Category for Point and Area Sources	75
Figure 3-57:	Pentachlorophenol (PCP); 1996 Estimated Emissions by Source	
e	Category for Point and Area Sources	76
Figure 3-58:	Tetrachloroethylene: 1996 Estimated Emissions by Source Category	
U	for Point and Area Sources	77
Figure 3-59:	Phenanthrene: 1996 Estimated Emissions by Source Category for	
U	Point and Area Sources	78
Figure 3-60:	Phenol; 1996 Estimated Emissions by Source Category for	
C	Point and Area Sources	79
Figure 3-61:	Phosgene: 1996 Estimated Emissions by Source Category	
0	for Point and Area Sources	
Figure 3-62:	Pyrene: 1996 Estimated Emissions by Source Category	
8	for Point and Area Sources	
Figure 3-63:	Styrene: 1996 Estimated Emissions by Source Category	
U	for Point and Area Sources	
Figure 3-64:	2.3.7.8-Tetrachlorodibenzo-p-dioxin (TCDD.2378): 1996 Estimated	
0	Emissions by Source Category for Point and Area Sources	
Figure 3-65:	2.3.7.8-Tetrachlorodibenzofuran (TCDE.2378): 1996 Estimated	
8	Emissions by Source Category for Point and Area Sources	
Figure 3-66:	Methylene chloroform (111-TCE): 1996 Estimated Emissions by Source Category	
0	for Point and Area Sources	
Figure 3-67:	Toluene: 1996 Estimated Emissions by Source Category	
U	for Point and Area Sources	
Figure 3-68:	2.4-Toluene diisocyanate; 1996 Estimated Emissions by Source Category	
U	for Point and Area Sources	
Figure 3-69:	Trichloroethylene; 1996 Estimated Emissions by Source Category	
0	for Point and Area Sources	
Figure 3-70:	2,4,5-Trichlorophenol; 1996 Estimated Emissions by Source Category	
0	for Point and Area Sources	
Figure 3-71:	2,4,6-Trichlorophenol; 1996 Estimated Emissions by Source Category	
e	for Point and Area Sources	90
Figure 3-72:	Trifluralin; 1996 Estimated Emissions by Source Category	
-	for Point and Area Sources	91
Figure 3-73:	Vinyl chloride; 1996 Estimated Emissions by Source Category	
0	for Point and Area Sources	92
Figure 3-74:	Xylenes (M); 1996 Estimated Emissions by Source Category	
C	for Point and Area Sources	93
Figure 3-75:	Xylenes (O); 1996 Estimated Emissions by Source Category	
-	for Point and Area Sources	94
Figure 3-76:	Xylenes (P); 1996 Estimated Emissions by Source Category	
c	for Point and Area Sources	95
Figure 3-77:		
-		

Acronyms and Abbreviations

AIRS	Aerometric Information Retrieval System
AMS	Area and Mobile Source
BTU	British Thermal Unit
CAA	Clean Air Act
CAR	California Air Resources Board
CAS	Chemical Abstract Service
CEP	Cumulative Exposure Program
DVMT	Daily Vehicle Miles Traveled
EET	Emission Estimating Techniques
EIIP	Emission Inventory Improvement Program
EIS	Emission Inventory System
ESP	Electrostatic Precipitator
FIRE	Factor Information Retrieval System
FPRT	Fuel Process Rate
GIS	Geographic Information Systems
GLC	Great Lakes Commission
GLEI	Great Lakes Emissions Inventory
GLIN	Great Lakes Information Network
GLNPO	Great Lakes National Program Office, U.S. Environmental Protection Agency
GLPF	Great Lakes Protection Fund
HAP	Hazardous Air Pollution
IDEM	Indiana Department of Environmental Management
IEPA	Illinois Environmental Protection Agency
IJC	International Joint Commission
IMS	Information Management System
INDOT	Indiana Department of Transportation
MACT	Maximum Achievable Control Technology
MCEI	Minnesota Criteria Pollutant Emission Inventory
MDEQ	Michigan Department of Environmental Quality
MPCA	Minnesota Pollution Control Agency
MSDS	Material Safety Data Sheet
n.e.c.	Not Elsewhere Classified
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NO _x	Nitrogen Oxides
NTI	National Toxic Inventory
NYDEC	New York Department of Environmental Conservation
OEPA	Ohio Environmental Protection Agency
PAH	Polycyclic Aromatic Hydrocarbons
PDEP	Pennsylvania Department of Environmental Protection
PM	Particulate Matter
POTW	Publicly Owned Treatment Works
QA/QC	Quality Assurance/Quality Control
RAPIDS	Regional Air Pollutant Inventory Development System
SAMS	SIP Air Pollutant Inventory Management System
SCC	Source Classification Code
SIC	Standard Industrial Classification
SIP	

TOG	Total Organic Gases
TRI	Toxic Release Inventory
U.S. EPA	United States Environmental Protection Agency
USDA	United States Department of Agriculture
VOC	Volatile Organic Compound
WDNR	Wisconsin Department of Natural Resources

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The Great Lakes Regional Air Toxic Emissions Inventory was compiled by the following Steering Committee members and associates

Introduction and Inventory Objective

This report, a product of the Great Lakes Regional Air Toxic Emissions Inventory Project, presents a multijurisdictional inventory of point and area sources (mobile to be published early next year) of toxic air emissions that have the potential to impact environmental quality in the Great Lakes basin. This initiative was undertaken through an intergovernmental partnership involving the eight Great Lakes states, the province of Ontario, and the U.S. Environmental Protection Agency (U.S. EPA). The objective of this ongoing initiative is to present researchers and policy makers with detailed, basin wide data on the source and emission levels of 82 toxic contaminants.

The development and release of the inventory is an important step in meeting the goals of the 1986 Great Lakes Toxic Substances Control Agreement (signed by the Great Lakes governors and Premier of Ontario), and sections 112(c)(6), 112(k) and 112(m) of the 1990 U.S. Clean Air Act Amendments (see http://www.cglg.org/pub/toxics/index.html and http://earth1.epa.gov/oar/caa.html for further details).

The inventory project presents a compilation of the best available data for calendar year 1996 emissions from point and area sources. The data will be updated annually and the level of detail will increase year to year. This project also released version 2.0 of the *Regional Air Pollutant Inventory Development System (RAPIDS)* to calculate emissions for 82 pollutants (which include mobile sources). The Great Lakes jurisdictions believe this work will provide a strong foundation upon which to build national and binational strategies to reduce toxic air emissions affecting the Great Lakes.

The inventory effort focused on the identification of point and area source categories that contribute to the total emissions of toxic contaminants listed in Table 1-1. This list of 82 contaminants was compiled using the International Joint Commission's list of Great Lakes critical pollutants, U.S. EPA's list of targeted toxic chemicals and compounds defined in the U.S. Clean Air Act Amendments of 1990, section 112 (c)(6), and those pollutants suggested by the Great Lakes states. This project also identified significant number of small point and area sources not currently regulated under the Clean Air Act (CAA) and collectively release large amounts of one or more toxic air pollutants of concern. These sources include many traditionally unregulated sites with relatively small gas-fired, coal-fired, or oil-fired boilers, traffic markings, woodburning stoves and fireplaces and generally any facility with an incinerator. These are sources within one county or urban area that collectively release large amounts of one or more toxic air pollutants of concern.

The inventory project is strengthening decision making capabilities in the basin by promoting interjurisdictional consistency in data collection and analysis, establishing standard procedures and protocols, developing and testing an automated emission estimation and inventory system, and demonstrating the value of client/server technology via the Internet to transmit and exchange

environmental data among the Great Lakes jurisdictions and inform the larger Great Lakes community.

Inventory Scope and Findings

The 1996 emissions inventory effort began in September 1998 with primary funding provided by the U.S. EPA. In August 1998, the 1993 point and area source inventory was released. Over the four previous years, the Great Lakes states, with support from the U.S. EPA and the Great Lakes Protection Fund developed and tested (through a Southwest Lake Michigan Inventory), the regional infrastructure and tools for emissions inventory compilation including the *Regional Air Pollutant Inventory Development System* (RAPIDS) versions 1.0 and 2.0 and the *Air Toxic Emissions Inventory Protocol for the Great Lakes States*.

In compiling the inventory, challenges were encountered in the area of data breadth, quality, availability and consistency from one jurisdiction to the next. Given variances in staffing resources and data management from one jurisdiction to the next, project staff received data in varied forms that needed to be standardized before being incorporated into the inventory.

The 1996 inventory should not be used for jurisdictional comparisons, but rather to demonstrate the potential of such a complete and comprehensive inventory as a decision support tool. Key findings associated with the inventory effort, as expressed by the federal, state, and provincial members of the project Steering Committee, are as follows:

- A comprehensive, multijurisdictional inventory of toxic air pollutants, sources and emission levels within the Great Lakes basin provides an important decision-making tool for environmental protection efforts.
- Air emissions data varies significantly from one Great Lakes jurisdiction to the next in terms of breadth, quality and availability. Greater consistency in data acquisition, compilation and analysis is needed to ensure meaningful basin wide assessment and interjurisdictional comparison.
- Great Lakes jurisdictions are well advised to develop and maintain the program and staffing infrastructure needed to participate in basin wide emissions inventory efforts over the long term. Continuity in inventory development and updating will provide a much-needed benchmark for trend identification and analysis.

Inventory Methodology

The Regional Toxic Air Emissions Inventory effort focuses on significant sources of air emissions of 82 toxic air pollutants in the jurisdictions bordering the Great Lakes. Working cooperatively through the Great Lakes Commission, inventory work is undertaken by the air quality departments of the state and provincial governments in the region. Staff at each agency followed the *Regional Toxic Air Emissions Inventory Protocol* they developed jointly and finalized in June 1994. The protocol provides instructions to accomplish the regional inventory development effort so the inventory is complete, accurate, and consistent from one jurisdiction to the next. The protocol:

Emissions estimates for the 82 target compounds are presented in the first half of this report. Definitions of source categories, and the level of detail in emissions estimates, are state/province specific and are outlined in the state/provincial reports in Appendices A through I.

Next steps

This project is releasing its inaugural toxic mobile source emissions inventory using 1996 data early next year. This inventory will serve as a template for future mobile source inventories for both this project and on an individual state and provincial basis, both within and beyond the Great Lakes region.

Through the continued efforts of the Steering Committee, the inventory will become more comprehensive over time and become an increasingly valuable tool for decision making within the Great Lakes basin. The Steering Committee will continue to meet on a regular basis to discuss inventory enhancements, both through defining data collection and refining and testing the RAPIDS software to accommodate continued expansion of this project.

The Steering Committee has developed RAPIDS to include a mobile source estimation module which is used by each Great Lakes jurisdiction to estimate emissions from cars, trucks, trains, recreation vehicles, airplanes, marine vessels, farm equipment, construction equipment and other non-road engines. This expansion of RAPIDS provides a complete profile for air toxic emissions and expands the list of toxic compounds of concern to 82. The complete 1996 point, area and mobile source emissions inventory is available on the Great Lakes Information Network (GLIN) at http://great-lakes.net/envt/air/airtox.html.

Collection of 1997 and 1998 data for point and area sources is already underway. For the 1999 inventory, the Steering Committee is also planning to expand its list from 82 pollutants to match the 188 hazardous air pollutants designated by the U.S. EPA.

This bridges the gap between the science of inventorying toxic air emissions and the public policy debate concerning how these emissions affect human health and the environment and how they should be addressed. Follow-up by state, provincial and federal environmental protection agencies is necessary to make further progress toward these goals. The Steering Committee recommends that regulatory decisions not be based on this data alone.

1. Introduction

The Great Lakes Regional Air Toxic Emissions Inventory represents a unique milestone in the continuing effort to quantify and manage the toxic air emissions that impact the waters of the Great Lakes Basin. The air management programs in all eight Great Lakes states, Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin, and the province of Ontario, cooperated in compiling an emissions inventory of toxic air contaminants from point and area sources.

The emission inventory effort was developed in support of the Great Lakes Toxic Substances Control Agreement signed in 1986 by the governors of eight Great Lakes states, and in 1989 by the premier of Ontario. This agreement contains a provision ensuring cooperation toward "quantifying the loadings of toxic substances originating from all sources, with the purpose of developing the most environmentally and economically sound control programs". Sharing emissions information of comparable and compatible quality across jurisdictions will ensure sound regulatory and policy decisions in the region.

Since 1989, the Great Lakes states and Ontario have been working together, through the Great Lakes Commission (GLC), to develop a regional database of toxic air emissions. In 1994, the Southwest Lake Michigan Air Toxics Pilot Inventory project was developed. This pilot inventory, led by the states of Michigan, Illinois, Indiana and Wisconsin, served to test the infrastructure for regional emissions inventory compilation and to develop the Regional Air Pollutant Inventory Development System, RAPIDS. The pilot inventory focused on emissions of 49 compounds from small point and area sources. In late 1995, the eight Great Lakes states and Province of Ontario began compiling the first full inventory of toxic air emissions from point and area sources for the year 1993. That pilot inventory. Compilation of the 1997 and 1998 inventories are currently underway. The GLC will continue working with state and provincial agencies, organizations and industrial sectors in developing and implementing the latest emission estimation procedures.

In 1996, work began on the mobile source module for RAPIDS. RAPIDS 2.0 was designed with the ability to estimate emissions from on-road vehicles and non-road engines. This major addition, along with other enhancements, has made RAPIDS one of the most comprehensive multimedia inventory systems available. With the addition of mobile sources to the inventory, the database has been expanded to include 82 toxic air pollutants. The states and province began estimating mobile source emissions using RAPIDS 2.0 in late 1998.

Table 1-1: Great Lakes Commission's list of 82 targeted toxic air pollutants.

Non-Metal Compounds (Excluding PAHs)			
Acetaldehyde	Methyl chloroform (1,1,1-Trichloroethane)		
Acrolein	Methylene chloride (Dichlorot.9 f 526.5 695.25 0.	29 5h2.25 0.75e f 2	299

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The 1996 reports are available as a printed document or online via the Great Lakes Information Network (GLIN, http://www.great-lakes.net). Additional information, including background documents, GIS maps depicting air emissions across the basin, the emissions protocol document and list of products for the project are located on the emission inventory project's web site (http://www.glc.org/air/air3.html).

The air emissions inventory project is funded primarily by the U.S. EPA under the auspices of the urban area sources program, Section 112(k), and the Great Waters program, Section 112(m).

The eight states and Ontario will continue to work collaboratively to improve and refine the toxics inventory and strengthen its ability to support sound regulatory decisions at all levels of government.

2. Methodology

The Great Lakes Air Toxic Emissions Inventory Project focuses on locating, evaluating, and estimating emissions from sources regulated under each of the state and provincial air management programs. The inventory process also includes a number of small point and area sources not currently regulated under the Clean Air Act (CAA) and that collectively release large amounts of one or more toxic air pollutants of concern. These sources include small coal-fired boilers, consumer solvents, residential fuel combustion, wood burning stoves, and fireplaces. Summaries of the methodologies for area source emission estimations are shown in Appendices J through Y. These area source methodologies were based on the U.S. EPA's Emissions Inventory Improvement Program (EIIP) and the Great Lakes States methods for estimation emissions from 2.

automated tools available for developing the regional inventory (RAPIDS, FIRE, SPECIATE and others).

Since the participating states envision that the full regional database of air toxic emissions data and estimates will be updated periodically, the protocol also provides the procedures to update the regional inventory and an estimated schedule for such updates. Procedures to resolve differences of opinion among the participating states regarding various aspects of the regional inventory development effort is a significant component of the protocol.

The protocol outlines the major steps and checkpoints that the Great Lakes jurisdictions followed

The protocol refers to certain software tools (e.g. the Regional Air Pollutant Inventory Development System, discussed below) that can be used to prepare a state or province's portion of the regional inventory. However, the protocol procedures, if followed, will result in emissions data and estimates that are compatible and consistent, whether or not these software tools are used.

Developing and Testing Client/Server Emission Estimation and Inventory Software: RAPIDS

Development of the Regional Air Pollutant Inventory Development System (RAPIDS) has been the key to the effort to develop a comprehensive, accurate and consistent air toxic emissions inventory across eight states and one province of Ontario.

During the course of this inventory, the regional Steering Committee worked closely with the project software development contractor, Windsor Technologies Inc., to enhance and test RAPIDS. The RAPIDS enhancements during this phase of the project included: the incorporation of a mobile source module to estimate emissions from on-road and non-road mobile sources, growth factors algorithm to project emissions, controlled emission factor functionality, development of mobile sources emission factors, and improvement of emissions estimation and reporting capabilities. This effort represents the first attempt to prepare software for estimating toxic pollutant emissions on a multi-state basis. RAPIDS is a client/server system developed in PowerBuilder® with an ORACLE® back-end database. The software takes full advantage of new Internet/Great Lakes Information Network (GLIN) connections between the states, the Great Lakes Commission and the U.S. EPA GLNPO office in Chicago. For a more detailed discussion on RAPIDS, please see http://great-lakes.net/envt/air/airtox.html.

Collecting and Compiling Data from Eight States and One Province

Each state and province based emission estimates on the best available inventory data. The states and province promoted consistency among their respective inventories by following the *Air Toxics Emissions Inventory Protocol for the Great Lakes States* and by using emission factors from FIRE Version 6.0 or later.

Rather than comparing emissions from one jurisdiction to the next, the emphasis of this project was to prepare a reliable and technically accurate inventory for the region as a whole and to outline areas where improvements are needed in overall methodology and implementation.

Coordination Methods

As a regional effort, a high level of coordination and communication was necessary to ensure consistency among the eight states and province in terms of data management, methodology, calculation methods and other issues. The Great Lakes Commission provided project management and secretariat services.

During the course of the inventory, Steering Committee members and associates communicated via daily e-mail exchanges, conference calls on a weekly or biweekly basis, and monthly or bimonthly in-person meetings to oversee contractor development of the inventory software, and

to resolve outstanding issues and inconsistencies among the eight states and one province contributing to the regional inventory.

The Steering Committee developed an Internet group mailing service, airtoxics@great-lakes.net, which facilitates transmittal of thousands of messages between members, contractors, and with a larger group of peer reviewers, university and industry researchers, other Great Waters/Urban Area Source states (including Texas and Louisiana), and federal agency representatives. The Great Lakes Commission holds a complete archive of all airtoxics@great-lakes.net messages, including minutes for all conference calls and in-person meetings at http://great-lakes.net/lists/airtoxics/.

Finally, the Steering Committee established Quality Assurance/Quality Control (QA/QC) criteria for use by the states and province to ensure the report provides an accurate and useful summary of toxic air emissions at the regional level. The committee then made a QA/QC review of the regional inventory to identify and correct any remaining differences. Details of the Steering Committee QA/QC efforts and all related e-mail transactions have been archived by the Great Lakes Commission.

3. Results

The following results represent emissions from point and area sources in the Great Lakes region. These results are based on 1996 data. Mobile sources for 1996 will be released early next year.

Definitions of point and area sources are dependent on data collection methods, as reporting requirements for air toxics emissions are different from state to state, one emission source defined as an area source in one state may be covered as a point source in other states.

The regional emission inventory, using 1996 data, includes emissions from 16 area source categories:

- Agricultural Pesticide Application
- Architectural Surface Coatings
- Auto Body Refinishing
- Chromium Electroplating
- Consumer and Commercial Solvent Use
- Dry Cleaning
- Gasoline Marketing
- Graphic Arts
- Industrial Surface Coating
- Landfills
- Marine Vessel Loading, Ballasting, and Transit
- Public Owned Treatment Works
- Residential Fuel Combustion
- Residential Wood Combustion
- Solvent Cleaning
- Traffic Markings

Although these categories are covered by all states, some states and the province of Ontario may not estimate emissions for some area source categories due to the coverage of point sources and resource restrictions. For example, the Marine Vessel Loading, Ballasting, and Transit category is covered in point sources for IL, IN, and WI. No emissions were estimated for this area source category from these states.

Overall

The 1996 emissions were estimated for 82 target compounds, however, data were only available to obtain emissions for 77 air toxins, including 16 polycyclic aromatic hydrocarbons (PAHs), 49 non-metal compounds and 12 metal compounds. Table 2 shows pollutant names and estimated emissions from point and/or area sources. Among the 77 pollutants, 76 pollutants are emitted from point sources, and 62 pollutants are emitted from area sources. Area sources contribute more than two thirds of total emissions for 15 PAHs, 16 non-metal compounds, and 1 metal compound. Point sources are responsible for more than two thirds of total emissions for 1 PAH,

29 non-metal compounds and 10 metal compounds. The contributions of point and area sources to the remaining four non-metal compounds and one metal compound are relatively even.

Among the 77 pollutants, toluene was estimated to have the highest emissions at 265,156,995 pounds, while 2,4,5-Trichlorophenol emissions are the lowest recorded at about 0.02 pounds. Point and area source emissions are from 641 distinct standard industrial classification (SIC) codes and 1143 distinct source classification codes (SCC).

It should be noted that this project has demonstrated that area sources are significant contributors to the total emissions of certain toxic air pollutants; further improvement on emissions estimation techniques and development of emission factors are needed for some source categories.

Specific Pollutants

A closer look was taken at the top five non-metal compounds and the top five metal compounds according to the emission totals. The selected pollutants are toluene, xylenes (includes o, m, and p), tetrachloroethylene, benzene, methyl chloroform, manganese, chromium, copper, lead, and nickel.

The source contribution of emissions for the selected 10 pollutants was analyzed by category for area sources and the first two digits of the SIC codes for point sources. The most significant source categories and their contributions are shown in Tables 3 and 4. More than 90% of emissions of tetrachloroethylene, benzene, and methyl chloroform are attributed to area sources. Dry Cleaning and Solvent Cleaning account for about 75% and 17% of tetrachloroethylene emissions, respectively. Residential Wood Combustion and Gasoline Marketing contribute approximately 71% and 9% of benzene emissions, respectively. Solvent Cleaning is responsible for about 62% of methyl chloroform emissions while Consumer and Commercial Solvent Use accounts for 35% of the total contribution. Although more than 73% of emissions are from area sources for toluene and xylenes, the source distribution is more scatted. The contributions from Solvent Cleaning, Consumer and Commercial Solvent Use, Gasoline Marketing, Architectural Surface Coatings, and Industrial Surface Coating ranged from 6.3% to 20.4% of toluene emissions. Consumer and Commercial Solvent Use, Gasoline Marketing, SIC 37xx (Manufacturing of Transportation Equipment), Industrial Surface Coating, and Auto Body Refinishing contribute from 8.5% to 22.6% of xylenes emissions.

In contrast with the top five non-metal compounds, point sources dominate the emissions of the top five metal compounds, accounting for more than 91% contributions. The most significant source category for all five metal compounds is Primary Metal Industries (SIC code 33xx) which contribute 33% to nickel emissions and up to 82% to copper emissions. Other significant sources include SIC 32xx (Stone, Clay, and Glass Products) with a 27.5% contribution to manganese; SIC 49xx (Electric, Gas, and Sanitary Services) with a 36.3% contribution to chromium, 19.4% contribution to lead and a 27.6% contribution to nickel; and SIC 10xx (Metal Mining) with a 17.3% contribution to lead.

Detailed analyses of source contributions for each pollutant are shown in pie charts and tables following Table 3-3.

Please note that the above analysis is based on point and area source emissions only. Mobile sources have been identified as significant sources for benzene, 1,3-butadiene, formaldehyde, and acrolein. Therefore, the source contributions are expected to change for these pollutants when mobile source emissions become available for analysis.

Table 3-1: Summary of 1996 air toxics emissions from point and area sources

Pollutant Name	Cas No.	Point (lb)	Area (lb)	Total (lb)	Point (%)	Area (%)

Table 3-4: Summary of 1996 air toxics emissions by SCC. (Those represented contribute more than 5% to the regional total)

SCC	Material Code	IL	IN	MI	MN	NY	он	PA	WI	ON	Emissions

Immary of 1996 air toxics	emis	ssion	s by	SCC	C. (c	ontir	ued))			
Material Code	IL	IN	MI	MN	NY	он	PA	WI	ON	Emissions	Regional Percentage
BENZO(K)FLUORANTHENE				х		х		х	х	51109.0534524588	87.47170
BENZO(K)FLUORANTHENE		х	х					х	х	4811.0767676429	8.23402
BENZO(K)FLUORANTHENE	х	х		х	х			х	х	2509.1154092104	4.29428
BERYLLIUM	х	х	х	x	х		х	х	х	6074.7461916712	37.54800
BERYLLIUM		х	х		х		х			3573.2830301510	22.08646
BERYLLIUM		х		х	х	х				1659.4097269998	10.25681
BERYLLIUM	x	х	x	x	x		х	х	x	4871.1752741303	30.10873

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SCC	Material Code	IL	IN	MI	MN	NY	ОН	PA	WI	ON	Emissions	Regional Percentage
2461800000	TRIFLURALIN	х		х	х						656024.0821191450	99.04551
Other	TRIFLURALIN	х	х				х				6322.0273805638	0.95449
30101864	VINYL CHLORIDE			х							567293.4121090000	64.15590
64630001	VINYL CHLORIDE	х									138000.000000000	15.60659
2630020000	VINYL CHLORIDE	х			х					х	131078.8564672990	14.82387
Other	VINYL CHLORIDE	х	х	х	х	х	х		х	х	47869.6755859449	5.41364
2501060101	XYLENE, M				х					х	281368.223644146	34.69789
2415000000	XYLENE, M			х	х						151594.080099535	18.69435
2501060100	XYLENE,M								х		70041.000000000	8.63735
0	XYLENE, M		х			х	х				46527.04000000	5.73764
Other	XYLENE,M		х	х	х	х		х	х	х	549530.343743681	67.76723
2104008051	XYLENE, O				х		х		х	х	5162048.98052351	25.83346
2401990000	XYLENE, O			х	х			х			4378803.21208584	21.91371
2401001000	XYLENE, O							х		х	4035705.32256469	20.19667

Table 3-4: Summary of 1996 air toxics emissions by SCC. (continued)

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	ОН	ON	PA	WI
3312	Blast furnaces and steel mills	40,954.26	Х	Х					Х		
	Residential wood combustion	204,768.23	Х	Х	Х	Х		Х	Х		Х
	Other Sources**	130.80	Х	Х	Х	Х	Х		Х		_

Figure 3-1:

Total Estimated Emissions: 245,853.29 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

** Other Sources: Individually less than five percent of the total.


SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3312	Blast furnaces and steel mills	202,537.59	Х	Х					Х		
	Residential wood combustion	2,431,824.46	Х	Х	Х	Х		Х	Х		Х
	Other Sources**	461.18	Х	Х	Х	Х	Х		Х		

Total Estimated Emissions: 2,634,823.24 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

** Other Sources: Individually less than five percent of the total.

Estimated

Emissions*

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2611	Pulp mills	216,620.35			Х		Х	Х	Х		Х
2621	Paper mills	315,350.10	Х		Х	Х	Х			Х	Х
2631	Paperboard mills	358,254.24	Х	Х				Х		Х	Х
2821	Plastics materials and resins	323,387.26	Х	Х			Х	Х			
	Public owned treatment works	340,310.28	Х								Х
	Other Sources**	366,251.99	Х	Х	Х	Х	Х	Х	Х	Х	Х

Figure 3-3:

Total Estimated Emissions: 1,920,174.23 lbs.

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SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2493	Reconstituted wood products	97,692.07	Х		Х	Х					
	Public owned treatment works	318,987.36	Х								Х
	Other Sources**	50,486.39	Х	Х	Х	Х	Х	Х		Х	Х

Total Estimated Emissions: 467,165.83 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

^{**} Other Sources: Individually less than five percent of the total.

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	ОН	ON	PA	WI
2672	Paper coated and laminated, nec	255.00									Х

Figure 3-5:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	ОН	ON	PA	WI
3312	Blast furnaces and steel mills	32,227.88	Х	Х					Х		

Figure	3-8:
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SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2816	Inorganic pigments	16,718.00						Х			Х
2911	Petroleum refining	3,301.73	Х	Х		Х		Х			
3229	Pressed and blown glass, nec	4,132.00						Х			
4911	Electric services	5,375.04	Х	Х	Х	Х	Х		Х	Х	
4952	Sewerage systems	7,403.12	Х	•	Х	Х	Х	-	Х	-	

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SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
1011	Iron ores	68,367.33			Х	Х			Х		
4911	Electric services	70,889.06	Х	Х	Х	Х	Х		Х	Х	Х

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
	Agricultural pesticide application	9,540,401.15	Х	Х	Х	Х	Х	Х			Х

Total Estimated Emissions: 9,540,401.15 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

Figure 3-11:

SIC DESCRIPTION EMISSIONS (LB) IL IN MI MN NY OH ON PA WI

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2911	Petroleum refining	39,272.37	Х	Х	Х	Х	Х		Х		
3312	Blast furnaces and steel mills	28,054.35	Х	Х	Х				Х		
	Public owned treatment works	14,734.96									Х

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI

BENZO(B)FLUORANTHENE 1996 Estimated Emissions* by Source Category for Point and Area Sources



SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3312	Blast furnaces and steel mills	59,321.22							Х		
	Residential wood combustion	127,953.70	Х	Х	Х	Х		Х	Х		Х
	Other Sources**	478.65	Х	Х	Х	Х	Х		Х		Х

Total Estimated Emissions: 187,753.57 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

** Other Sources: Individually less than five percent of the total.

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3312	Blast furnaces and steel mills	20,495.07	Х	Х					Х		
	Residential wood combustion	111,024.52	Х	Х	Х	Х		Х	Х		Х
	Other Sources**	299.61	Х	Х	Х	Х	Х		Х		

Total Estimated Emissions: 131,819.19 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
		()									
3241	Cement, hydraulic	3,914.47	Х	Х	Х		Х			Х	
3351	Copper rolling and drawing	1,653.02	Х					Х			
4911	Electric services	8,037.34	Х	Х	Х	Х	Х		Х	Х	Х
	Other Sources**	2,573.78	Х	Х	Х	Х	Х		Х	Х	Х

Figure 3-17:

Total Estimated Emissions: 16,178.61 lbs.

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
4952	Sewerage systems	923.15									Х

Total Estimated Emissions: 923.15 lbs.

* Each jurisdiction estimated emissions for those sources fs969(a)14.5(c)-11.8(h)-ihhr* O re 219her10I4.5(S)-8 202.56 33b3G1 1.27e109(f6(:)546 Ire 28(ndTc6 2(v/

Figure 3-18:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
	Gasoline marketing	6,065,974.65			Х	Х					Х

Figure 3-20:

SIC DESCRIPTION EMISSIONS (LB) IL IN MI MN NY OH ON PA WI

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Figure 3-23:



SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2611	Pulp mills	118,092.30							Х	Х	Х
2621	Paper mills	466,235.98				Х	Х			Х	Х
2821	Plastics materials and resins	724,189.82		Х			Х			Х	
	Public owned treatment works	78,842.26	Х			Х			Х		
	Other Sources**	174,484.41	Х	Х	Х	Х	Х	Х	Х	Х	Х

Total Estimated Emissions: 1,561,844.76 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

^{**} Other Sources: Individually less than five percent of the total.

Figure 3-24:

EMISSIONS (LB) IL IN MI MN NY OH ON PA WICa8-9633 DESCRIPTION

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Figure 3-25:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3432	Plumbing fixture fittings and trim	3,003.05	Х								
3471	Plating and polishing	5,889n7037	ur								

Figure 3-26:

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DESCRIPTION

EMISSIONS (LB) IL IN MI MN NY OH ON PA WI

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
4911	Electric services	10,638.89	Х	Х	Х	Х	Х		Х		Х

Figure 3-27:

Figure 3-28:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3312	Blast furnaces and steel mills	1,861,934.47	Х	Х	Х						
	Other Sources**	64,896.00		Х							

Total Estimated Emissions: 1,926,830.47 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

Figure 3-29:

SIC

DESCRIPTION

EMISSIONS (LB) IL IN MI MN NY OH ON PA WI

Figure 3-30:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON PA	WI
3312	Blast furnaces and steel mills	8,169.44	Х							
	Residential wood combustion	65,348.56	Х	Х	Х	Х		Х	Х	Х

Figure 3-31:

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SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	ОН	ON	PA	WI

DI-N-BUTYL PHTHALATE 1996 Estimated Emissions* by Source Category for Point and Area Sources



SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
	Graphic arts	5,310,077.84		Х	Х		Х	Х	Х	Х	Х
	Other Sources**	52,643.27	Х	Х	Х	Х	Х	Х	Х	Х	Х

Total Estimated Emissions: 5,362,721.10 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

** Other Sources: Individually less than five percent of the total.

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2899	Chemical preparations, nec	151,822.05		Х					Х		
	Gasoline marketing	11,882.77			Х	Х			Х		Х
	Other Sources**	22,622.08	Х	Х	Х	Х	Х		Х		Х

Total Estimated Emissions: 186,326.90 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

** Other Sources: Individually less than five percent of the total.

Figure 3-34:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	ОН	ON	PA	WI
0	Unknown	3,954.21	Х			Х	Х				
2431	Millwork	2,660.80		Х		Х					
2499	Wood products, nec	4,080.00		Х			Х				
2899	Chemical preparations, nec	4,409.20							Х		
3021	Rubber and plastics footwear	3,863.00					Х				
3086	Plastics foam products	3,873.48							Х		
3089	Plastics products, nec	2,308.51		Х		Х			Х		Х
3716	Motor homes	6,878.00		Х							
	Other Sources**	12,612.31	Х	Х	Х	Х	Х		Х		

DI-N-OCTYL PHTHALATE 1996 Estimated Emissions* by Source Category for Point and Area Sources



SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2431	Millwork	4,060.00		Х							
2511	Wood household furniture	1,582.00					Х				
3499	Fabricated metal products, nec	480.00		Х							
3931	Musical instruments	1,740.00		Х							
	Other Sources**	185.87		Х	Х		Х				

Total Estimated Emissions: 8,047.87 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

** Other Sources: Individually less than five percent of the total.

Figure 3-36:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3711	Motor vehicles and car bodies	1,372,366.31	Х	Х	Х	Х	Х	Х	Х		Х
	Architectural surface coatings	6,938,684.35	Х	Х	Х	Х	Х	Х	Х	Х	Х
	Gasoline marketing	4,810,030.13	Х	Х	Х	Х			Х	Х	Х
	Industrial surface coating	1,312,203.46	Х	Х	Х	Х				Х	Х
	Marine vessel loading, ballasting, & transit	1,047,585.60					Х			Х	
	Other Sources**	4,111,806.19	Х	Х	Х	Х	Х	Х	Х	Х	Х

Total Estimated Emissions: 19,592,676.04 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

Figure 3-37:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
	Consumer and Commercial Solvent Use	836,736.51	Х	Х	Х	Х	Х		-		Х

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SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3312	Blast furnaces and steel mills	68,044.95	Х	Х					Х	Х	
3334	Primary aluminum	42,155.03		Х			Х				
	Residential wood combustion	379,983.92	Х	Х	Х	Х		Х	Х		Х
	Other Sources**	18,686.29	Х	Х	Х	Х	Х		Х	Х	Х

Figure 3-39:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3312	Blast furnaces and steel mills	134,929.05	Х	Х					Х		

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ſ	SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
_	2911	Petroleum refining	6,342,952.17	Х	Х	-	Х	Х			Х	Х

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Figure 3-40:

DESCRIPTION	E	
Paper mills		
Cement, hydraulic		
Agricultural pesticide application		
Other Sources**		

Total Estimat

* Each jurisdiction estimated emissions for those sources for which
** Other Sources: Individually less than five percent of the total.
(X) Denotes jurisdictions that have contributed emissions data for the sources.

SIC 2621

3241

IN	MI	MN	NY	OH	ON	PA	WI
		Х					
					Х		
		Х					Х
					Х		

: 9.94 lbs.

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hydest aulic77%P icide application12%Ot her Sourc

Figure 3-44:

SICDESCRIP3011Tires and inner tube

* Each jurisdiction er ** Other Sources:

(X) Denotes jur

HEXACHLOROETHANE 1996 Estimated Emissions* by Source Category for Point and Area Sources



SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2899	Chemical preparations, nec	50.00						Х			
3365	Aluminum foundries	826.00		Х							

Total Estimated Emissions: 876.00 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

** Other Sources: Individually less than five percent of the total.

Figure 3-45:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3089	Plastics products, nec	398.00					Х				
3861	Photographic equipment and supplies	43.00					Х				
	Other Sources**	38.84					Х	Х	Х		Х

Figure 3-46:

SIC DESCRIPTION EMISSIONS (LB) IL IN MI MN N	′OHONPAW





SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
1011	Iron ores	140,249.73			Х	Х			Х		
3312	Blast furnaces and steel mills	80,929.68	Х	Х	Х	Х	Х	Х			Х
3321	Gray and ductile iron foundries	152,167.76	Х	Х	Х	Х		Х			Х
3341	Secondary nonferrous metals	42,970.50	Х	Х	Х	Х	Х	Х	Х	Х	Х
4911	Electric services	117,813.18	Х	Х	Х	Х	Х		Х		Х
	Other Sources**	278,177.35	Х	Х	Х	Х	Х	Х	Х		Х

Total Estimated Emissions: 812,308.21 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

** Other Sources: Individually less than five percent of the total.

Figure 3-48:



SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3241	Cement, hydraulic	752,891.65	Х	Х	Х		Х			Х	
3312	Blast furnaces and steel mills	976,500.90	Х	Х	Х	Х	Х	Х	Х	Х	Х
3313	Electrometallurgical products	668,204.00						Х			
3321	Gray and ductile iron foundries	214,689.86	Х	Х	Х	Х		Х		Х	Х
	Other Sources**	639,390.39	Х	Х	Х	Х	Х	Х	Х	Х	Х

Total Estimated Emissions: 3,251,676.81 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

^{**} Other Sources: Individually less than five percent of the total.

Figure 3-49:

SIC DESCRIPTION EMISSIONS (LB) IL IN MI MN NY OH ON PA WI

Figure 3-50:

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SIC	DESCRIPTION	EMISSIONS (L
2511	Wood household furniture	2,408
2752	Commercial printing, lithographic	3,575
3089	Plastics products, nec	4,158
3321	Gray and ductile iron foundries	11,033
3599	Industrial machinery, nec	5,193
3716	Motor homes	7,440.
	Other Sources**	10,537.

Total Estimated Emissio

* Each jurisdiction estimated emissions for those sources for which they had data available.

** Other Sources: Individually less than five percent of the total.

Figure 3-51:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2834	Pharmaceutical preparations	1,912,930.56	Х	Х	Х		Х		Х		Х
3086	Plastics foam products	6,509,023.07	Х	Х	Х	Х			Х		Х
3861	Photographic equipment and supplies	1,994,064.70					Х				
	Architectural surface coatings	5,187,767.64	Х	Х	Х	Х	Х	Х	Х		Х
	Consumer and Commercial Solvent Use	2,016,996.73	Х	Х	Х	Х	Х				Х
	Solvent cleaning	7,278,216.56	Х	Х	Х	Х				Х	Х
	Other Sources**	7,568,280.80	Х	Х	Х	Х	Х		Х		Х

Total Estimated Emissions: 32,467,280.08 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

** Other Sources: Individually less than five percent of the total.

(X) Denotes

 Figure 3-52:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
	Autobody refinishing	2,253,594.15	Х	Х	Х	Х	Х	Х		Х	Х
	Consumer and Commercial Solvent Use	2,554,555.31	Х	Х	Х	Х	Х	×		Х	

Figure 3-53:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3312	Blast furnaces and steel mills	159,155.32	Х	Х	Х	Х	Х	Х		Х	Х
4911	Electric services	116,721.05	Х	Х	Х	Х	Х		Х	Х	Х

Figure 3-55:

Figure 3-56:

DESCRIPTION EMISSIONS (LB) IL IN MI MN NY OH ON PA WI

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Figure 3-58:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
	Solvent cleaning	12,335,579.10	Х	Х	Х	Х				Х	Х

Figure 3-60:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2865	Cyclic crudes and intermediates	348,095.00						Х			
2869	Industrial organic chemicals, nec	472,777.41	Х	Х	Х		Х	Х	Х		Х
2899	Chemical preparations, nec	389,838.54	Х		Х				Х		
3296	Mineral wool	730,988.06		Х	Х		Х	Х			
3312	Blast furnaces and steel mills	602,499.30		Х			Х	Х	Х		

Figure 3-61:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2821	Plastics materials and resins	33.00		Х				Х			
2833	Medicinals and botanicals	160.00		Х							
	Other Sources**	1.76	Х				Х				

Figure 3-62:

Figure 3-63:

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ſ	SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI		
	2821	Plastics materials and resins	2,316,316.31	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	

Figure 3-64:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
4911	Electric services	0.31	Х	Х	Х	Х	Х				Х
	Other Sources**	0.02	Х	Х	Х	Х	Х		Х		Х

Total Estimated Emissions: 0.33 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

** Other Sources: Individually less than five percent of the total.

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		111													
Sic	DESCRIPTION		EN	1S	\$10	ONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2621	Paper mills	\prod	Γļ		\llbracket	23.72			Х						
	Other Sources**	$\downarrow\downarrow$				3.21	X	Х	X	Х	Х		Х		Х
0000	Chemical preparations, nec					2.87	Х		Х					ļ	
2899	Dependentity to days and produceto	1 1			11	<u> </u>									

Total Estimated Emissions: 32.64 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

** Other Sources: Individually less than five percent of the total.

Figure 3-66:



SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
	Consumer and Commercial Solvent Use	21,453,891.50	Х	Х	Х	Х	Х				Х
	Solvent cleaning	37,926,911.12	Х	Х	Х	Х				Х	Х
	Other Sources**	2,090,768.57									Х

Figure 3-67:

Figure 3-68:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
0	Unknown	2,638.00					Х				
2891	Adhesives and sealants	750.00						Х			
3086	Plastics foam products	2,641.52	Х	Х							Х
	Graphic arts	4,468.28					Х				
	Other Sources**	422.00		Х		Х	Х	Х			Х

Figure 3-69:

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3494	Valves and pipe fittings, nec	3,574,025.00	Х						-	Х	Х

ſ	SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI



SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI

Total Estimated Emissions: 662,346.08 lbs.

* Each jurisdiction estimated emissions for those sources for which they had data available.

^{**} Other Sources: Individually less than five percent of the total.

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2821	Plastics materials and resins	145,875.06	Х						Х		
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
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	Degreasing	279,266.48		Х	Х	Х					Х
	Gasoline marketing	351,409.22				Х			Х		Х
	Industrial surface coating	102,280.13		Х		Х					Х
	Other Sources**	77,952.87		Х	Х	Х	Х	Х	Х	Х	

DESCRIPTION EMISSIONS (LB) NY SIC IL IN MI MN ОН ON PA WI Architectural surface coating 4,035,705.32 Х Х -----4,090,117.72 Gasoline marketing Х Х Х Х -----5,427,070.30 Х Х Industrial surface coating Х Х Х -----Residential wood combustion 5,610,026.07 Х Х Х Х Х Х -----Other Sources** 819,110.60 Х Х Х Х Х Х Х -----

SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
	Degreasing	279,266.48		Х	Х	Х					Х
	Gasoline marketing	136,045.13				Х			Х		Х
	Industrial surface coating	68,207.74		Х		Х					Х
	Other Sources**	3,086.21									

Figure 3	-77:	
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SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI	
3711	Motor vehicles and car bodies	12,506,168.82	Х	Х	Х	Х	Х	Х	Х		Х	
	Architectural surface coating	7,248,807.21	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х

4. Conclusion

Air regulatory agencies in the eight Great Lakes states and province of Ontario agree that a collaborative effort is vital to successfully implementing a compatible database of airborne toxic pollutant emissions for the Great Lakes region. They have been working cooperatively toward this goal since 1987. As quality controlled and quality assured emissions inventories are developed and refined, the states, province of Ontario and the U.S. Environmental Protection Agency can work separately and in concert to define and regulate sources; evaluate control technology; establish guidelines for siting new facilities; and reduce airborne deposition of persistent toxic chemicals to the Great Lakes.

Realizing that mobile sources are a critically important category of air toxic emission sources relevant to human activities in industrialized societies, a mobile source emissions estimation module is now integrated into RAPIDS. This expansion of RAPIDS provides a more complete profile for toxic air emissions and will expand the list of toxic compounds of concern from 49 to 82.

Annual Great Lakes Toxic Air Emissions Inventories are available online through the Great Lakes Information Network. Also available through GLIN is AirMapper, where users can view a geographic representation of the inventory of pollutant concentrations and eventually point sources. Using GLIN's dissemination functions as a tool, decision makers and the general public will be able to make better informed decisions that help reduce toxic pollution, protect and restore habitats and support intergovernmental partnerships. Timely access to a comprehensive inventory will provide the foundation for sound public policy decisions.

This emissions inventory will assist in the successful implementation of key provisions of the Great Lakes Toxic Substances Control Agreement, signed by the Great Lakes governors and Premier of Ontario in 1986. In addition, this work is consistent with the state activities for the implementation of the Urban Area Source Program required under sections 112(c) and 112(k) of the Clean Air Act Amendments of 1990, and the assessment of atmospheric deposition to the Great Lakes under the efforts of U.S. EPA's Great Waters Program.

Further Refinements and Cooperative Efforts

The air regulatory agencies in the eight Great Lakes states and the province of Ontario have developed a system that can create a reliable and technically accurate inventory of estimated air toxic emissions. These inventories are to be used by the air agencies in coordination with ambient air quality data collected by the Great Lakes Monitoring Network to assess the contribution to airborne toxic impacts on the Great Waters and support the development of remedial action and other management plans.

While the states and Ontario are committed to compiling periodic inventories to assess and analyze the contribution of toxic air emissions on the Great Waters, these inventories can also serve a number of other very important purposes as well.

- 1. The NTI and the CEP;
- 2. Regional inventories for ozone, particulate matter and haze;
- 3. The urban air toxic program;
- 4. Mercury deposition studies; and,
- 5. Acid deposition studies.

The Great Lakes Regional Air Toxic Emissions Inventory is an example of regional cooperation of eight states and the province of Ontario. It can be used as a model for states compiling inventories for input into the National Toxics Inventory (NTI) or National Emissions Trends Inventory. It also serves as a model for the regional inventory efforts underway as part of a regional assessment of various toxic pollutants.

Autobody Refinishing

Employment data was obtained from the Census Bureau report "1996 County Business Patterns", November 19, 1998 (www.census.gov/prod/www/abs/cbptotal.html). RAPIDS had an emission factor of 0.84 lb VOC/person. The EIIP section had factors of 3519 lb VOC/employee and 2.3 lb VOC/person. These numbers were then used to obtain a per employee factor, to be consistent with other RAPIDS users, that was based upon RAPIDS data. This value was 1285.2 lb VOC/employee. Emissions were then speciated using profile 1194.

Chrome Plating

Inventoried as a point source.

Consumer Solvent Use

County population was multiplied by the overall emission factor, from EIIP, to obtain emissions. Emission factors for individual categories (e.g., personal care products, household products, etc.) was not used.

Dry Cleaning

Employment data was obtained from the Census Bureau report "1996 County Business Patterns", November 19, 1998 (www.census.gov/prod/www/abs/cbptotal.html). The EIIP emission factors were then used to calculate perchloroethylene emissions.

Gasoline Marketing

The amount of gasoline and gasohol sold in Illinois was obtained from *Monthly Gasoline Reported by States 1996* (Federal Highway Administration Highway Statistics, Table MF-33GA, October 1997). Use was apportioned to county by VMT (vehicle miles traveled). Emissions were calculated as follows:

Tank Filling (Stage I) – Used EIIP calculation methodology assuming balanced operation in combination with speciation profile 1190.

Vehicle Refueling (Stage II) – Multiplied monthly gasoline use times the monthly emission factor obtained from MOBILE 5b in combination with speciation profile 1190.

Industrial Surface Coating

Employment data was obtained from the Census Bureau report "1996 County Business Patterns", November 19, 1998 (www.census.gov/prod/www/abs/cbptotal.html) for the SIC categories of 25, 34, 35 and 37. The per employee EIIP emission factors were then used to calculate TOG emissions. Emissions were speciated by using profile 1003.

The calculated emissions were then converted to controlled emissions by assuming 90% control efficiency, 90% rule effectiveness and 90% rule penetration. The point source inventory values for solvent cleaning were then subtracted from the calculated emissions to obtain area source emissions.

Landfills

Inventoried as a point source.

Pesticides

Obtained pesticide use and application by county from *Agricultural Chemical Usage 1996 Field Crops Summary* (National Agricultural Statistics Service, September 1997 (www.ann.usda.gov/il/ctyest/estimates.htm and www.agr.state.il.us/agstats.htm). Emission factors from EIIP were then used to calculate emissions.

Publicly Owned Treatment Works (POTWs)

Data from USEPA's 1996 NTI inventory was used.

Residential Fuel Combustion

The amount of fuel burned in Illinois was obtained from the *State Energy Data Report 1996* (Department of Energy, Energy Information Administration, DOE/EIA-2014(96), February 1999). Use by county was apportioned by the number of houses in a county (1990 census) divided by the total number of houses in the state in the following manner:

Natural gas – apportioned to county level by residences in county Fuel oil – apportioned to county level by residences burning wood in county Kerosene – apportioned to county level by residences burning wood in county Coal – apportioned to county level by residences burning wood in county

The county-wide fuel use was then multiplied by the emission factors for commercial/institutional natural gas fired boilers < 10 million BTU/hr to obtain emissions for the county.

Residential Wood Combustion

The amount of wood burned in Illinois was obtained from the *State Energy Data Report 1996* (Department of Energy, Energy Information Administration, DOE/EIA-2014(96), February 1999). Use by county was apportioned by the number of houses in a county (1990 census) that burned wood.

EIIP emission factors for non-catalytic stoves were then used to calculate emissions.

Solvent Cleaning

Fayette	Ford	Franklin	Fulton	Gallatin

	Greene	Grundy	Hamilton	Hancock	Hardin
ACENAPHTHEN	186.21	29.17	168.89	207.59	167.18
ACENAPHTHYL	595.88	87.73	540.46	664.28	503.39
ACETALDEHYDE	15.29	141.30	10.40	28.49	6.55
ACROLEIN	18.24	166.63	10.80	33.92	7.80
ACRYLAMIDE					
ACRYLONITRIL		1218.04			
ANTHRACENE	167.59	24.77	152.00	186.83	144.19
ANTIMONY		437.23	0.04		
ARSENIC	0.22	109.99	0.21	0.31	0.19
ATRAZINE	15702.74	17072.00	8755.46	22691.06	311.66
BENZ (A) ANTHR	24.03	3.72	20.86	26.34	19.36
BENZ(GHI)PE	372.42	55.00	337.78	415.17	311.98
BENZENE	38648.41	15440.80	34755.44	45060.96	34347.52
BENZO(A)PYRE	112.11	16.45	101.33	124.81	93.65
BENZO(B)FLUO	74.48	10.96	67.56	83.03	64.51
BENZO(K)FLUO	18.62	2.74	16.89	20.76	15.60
BERYLLIUM	0.13	2.34	0.12	0.15	0.12
BUTADIENE,13	0.20	0.51	0.19	0.28	0.06
CADMIUM	1.15	33.48	0.88	1.40	0.82
CARBON TETRA	44.17	48.42	23.86	46.84	14.59
CHLOROFORM	55.00	140.78	28.84	82.38	21.96
CHROMIUM	3.20	71.01	2.90	3.79	2.62
CHROMIUM VI	0.01	20.65		0.01	negl
CHRYSENE	189.15	27.61	168.89	209.57	156.09
COBALT	negl	501.34	0.02	negl	
COKE OVEN GS					

	Jefferson	Jersey	Jo Daviess	Johnson	Kane	
ACENAPHTHEN	444.27	273.69	250.71	222.10	86.69	
ACENAPHTHYL	1421.41	875.81	802.26	710.70	277.33	
ACETALDEHYDE	52.86	18.80	43.48	10.83	375.05	
ACROLEIN	62.93	22.44	49.96	12.93	449.56	
ACRYLAMIDE						
ACRYLONITRIL		65.41			753.51	
ANTHRACENE	399.78	246.32	225.64	199.88	78.00	
ANTIMONY	20.20				6.12	
ARSENIC	12.53	0.33	0.39	174.68	7.02	
ATRAZINE	7659.88	9192.44	14123.20	2333.58	14909.82	
BENZ (A) ANTHR	69.91	33.80	31.24	27.43	119.18	
BENZ(GHI)PE	888.39	547.38	501.41	444.19	173.33	
BENZENE	98220.28	56522.16	53457.32	46950.00	75176.87	
BENZO(A)PYRE	270.01	164.22	151.14	133.26	183.63	
BENZO(B)FLUO	177.68	109.48	100.28	88.84	34.67	
BENZO(K)FLUO	44.42	27.37	25.07	22.21	8.67	
BERYLLIUM	0.44	0.20	0.19	0.16	2.98	
BUTADIENE,13	0.51	0.27	0.28	0.17	4.83	
CADMIUM	6.32	1.41	2.55	15.02	2088.03	
CARBON TETRA	48.15	38.17	44.18	31.25	247.54	
CHLOROFORM	158.42	81.06	82.86	51.98	1575.72	
CHROMIUM	105.47	4.55	5.83	3.69	766.27	
CHROMIUM VI	1.02	negl	negl	negl	572.75	
CHRYSENE	472.15	273.69	250.71	222.10	182.44	
COBALT	23.17	negl	negl		7.00	
COKE OVEN GS		_				
COPPER	11.77	4.30	10.39	3.49	214.09	
DIBENZAHAN	177.68	109.48	100.28	88.84	34.67	
DIBROMOET,12	negl				0.01	
DIBUTYL PHTH	2.70				533.68	
DICHLORETH12	0.66	8.00	0.11	0.06	94.34	
DIEYLHEX PHT						
ETHYLBENZENE	18488.09	6271.41	7942.93	6463.41	142219.09	
ETHYLENE OXI	606.90	310.21	348.30	182.56	14872.96	
FLUORANTHENE	455.07	219.02	200.83	177.71	422.88	
FLUORENE	621.88	383.17	350.99	310.93	121.35	
FORMALDEHYDE	1789.78	548.73	1992.78	454.62	26070.26	
GLYCOL ETHRS	1565.34	829.98	931.87	488.44	14170.10	
HEXCLBENZENE	negl	negl	0.01	negl	0.01	
INDN(123CDPY	888.39	547.38	501.41	444.19	173.33	
LEAD	26.45	0.70	5386.10	116.76	693.50	
MANGANESE	19.62	4.93	3633.43	4.02	72.23	
MERCURY	38.28	11.76	30.39	7.45	267.98	
METHENE(B)4-					509.00	
METHYLENE CL	6764.24	3126.18	6186.28	141701 3110	039 0.48 -0.48 ref	201 312 0

	Kankakee	Kendall	Knox	Lake	LaSalle
ACENAPHTHEN	97.17	37.09	150.36	93.64	175.01
ACENAPHTHYL	310.89	118.68	481.11	299.20	570.26
ACETALDEHYDE	196.80	50.02	100.90	1033.96	215.25
ACROLEIN	207.84	59.64	119.84	827.34	218.84
ACRYLAMIDE					
ACRYLONITRIL	112.43		106.25	1352.97	151.36
ANTHRACENE	87.43	33.38	135.31	84.42	157.53
ANTIMONY	1.80		3.73	12.72	0.90
ARSENIC	1.02	6.06	1.31	136.59	35.57
ATRAZINE	27953.46	13192.00	24375.58	939.30	44232.00
BENZ (A) ANTHR	21.05	4.74	18.70	72.20	27.32
BENZ(GHI)PE	194.28	74.17	300.69	185.64	349.91
BENZENE	37133.27	15921.36	40362.68	132599.77	62877.75
BENZO(A)PYRE	70.71	22.48	90.21	61.39	107.73
BENZO(B)FLUO	38.86	14.83	60.134	37.17	70.03
BENZO(K)FLUO	9.72	3.71	15.03	9.34	17.51
BERYLLIUM	0.14	0.50	0.92	9.22	3.13
BUTADIENE,13	1.32	0.62	0.72	26.70	44402.99
CADMIUM	15.07	22.93	3.16	55.92	13.17
CARBON TETRA	89.96	41.20	318.22	401.44	138.59



	Mercer	Monroe	Montgomery	Morgan	Moultrie
ACENAPHTHEN	116.09	185.05	199.55	154.27	43.18
ACENAPHTHYL	371.51	592.16	638.47	465.48	138.18
ACETALDEHYDE	18.15	42.09	71.11	77.28	44.33
ACROLEIN	19.67	27.82	57.79	89.24	21.07
ACRYLAMIDE					
ACRYLONITRIL			340.88		17.46
ANTHRACENE	104.50	166.56	179.58	133.24	38.88
ANTIMONY		0.60	24.94	17.30	0.74
ARSENIC	0.19	0.51	568.60	194.23	0.24
ATRAZINE	19404.14	7077.60	23654.12	20041.68	13354.94
BENZ (A) ANTHR	15.94	22.85	25.22	49.97	5.79
BENZ(GHI)PE	232.18	370.03	399.04	288.60	86.26
BENZENE	25691.81	40638.94	50921.58	38581.79	11510.46
BENZO(A)PYRE	70.24	111.02	119.90	93.05	26.04
BENZO(B)FLUO	46.44	74.01	79.81	59.59	17.25
BENZO(K)FLUO	11.61	18.50	19.95	14.43	4.32
BERYLLIUM	0.08	0.15	29.32	3.00	0.06
BUTADIENE,13	0.23	1.39	0.40	0.47	1.70
CADMIUM	1.12	1.62	645.98	23.42	0.50
CARBON TETRA	44.59	40.09	52.52	45.37	23.95

	Rock Island	St. Clair	Saline	Sangamon	Schuyler
ACENAPHTHEN	154.80	400.33	199.52	159.61	139.46
ACENAPHTHYL	495.48	1280.94	638.46	510.61	446.28
ACETALDEHYDE	220.35	309.86	28.05	757.33	9.33
ACROLEIN	242.26	344.24	33.43	309.69	11.11
ACRYLAMIDE					
ACRYLONITRIL	1041.43	963.22	127.33	45.05	
ANTHRACENE	139.43	360.27	179.56	143.97	125.52
ANTIMONY	0.09	6.68		17.74	
ARSENIC	58.39	63.57	0.40	58.94	0.19
ATRAZINE	10868.50	13628.40	7164.04	31824.82	9650.12
BENZ (A) ANTHR	53.46	58.83	25.23	111.90	17.22
BENZ(GHI)PE	309.58	800.52	399.04	317.18	278.93
BENZENE	58003.01	234563.02	43444.60	70368.00	29140.68
BENZO(A)PYRE	104.59	243.65	119.93	128.44	83.68
BENZO(B)FLUO	61.92	160.11	79.81	63.47	55.78
BENZO(K)FLUO	15.48	40.03	19.95	15.95	13.95
BERYLLIUM	0.46	3.73	0.18	1.78	0.10
BUTADIENE,13	2.12	4.14	0.34	30.44	0.10
CADMIUM	19.49	43.48	1.74	31.44	0.88
CARBON TETRA	1215.42	224.28	51.50	150.02	21.58

	Scott	Shelby	Stark	Stephenson	Tazewell
ACENAPHTHEN	56.90	243.86	32.64	119.31	245.55
ACENAPHTHYL	182.02	780.35	104.46	381.79	785.56
ACETALDEHYDE	27.81	21.74	6.36	75.24	228.56
ACROLEIN	9.23	25.94	7.59	89.51	247.22
ACRYLAMIDE					
ACRYLONITRIL				68.42	578.38
ANTHRACENE	51.21	219.47	29.38	107.38	220.98
ANTIMONY	0.64			0.08	15399
ARSENIC	0.21	0.46	0.07	0.41	467.93
ATRAZINE	8083.18	25828.00	14278.40	22355.82	23447.08
BENZ (A) ANTHR	7.02	31.30	4.03	26.00	128.04

	Wayne	White	Whiteside	Will	Williamson
ACENAPHTHEN	328.52	164.54	144.33	151.54	376.96
ACENAPHTHYL	1051.26	516.06	461.81	484.98	1206.01
ACETALDEHYDE	28.87	22.80	49.04	1337.50	169.53
ACROLEIN	27.88	21.97	49.13	990.93	130.12
ACRYLAMIDE					
ACRYLONITRIL	160.50		31.87	1235.02	87.08
ANTHRACENE	295.67	146.01	129.87	136.64	339.22
ANTIMONY	0.17	0.13		51.34	66.52
ARSENIC	1.12	0.32	20.60	808.45	1523.46
ATRAZINE	14669.08	12358.72	33838.82	15539.62	3266.04
BENZ (A) ANTHR	41.74	19.96	26.12	70.89	52.52
BENZ (GHI)PE	657.02	321.64	288.59	301.76	753.73
BENZENE	68624.06	36613.80	41637.44	226387.33	88495.33
BENZO(A)PYRE	197.52	96.61	90.40	3689.44	228.32

	Winnebago	Woodford	State Total
ACENAPHTHEN	189.94	122.12	17,738.77
ACENAPHTHYL	607.83	390.80	56,661.97
ACETALDEHYDE	414.33	32.60	17,373.01
ACROLEIN	419.30	38.89	16,981.94
ACRYLAMIDE			390.04
ACRYLONITRIL	169.97		24,799.43
ANTHRACENE	170.99	109.91	15,943.57
ANTIMONY	2.85		1,320.94
ARSENIC	2.07	0.20	10,402.53
ATRAZINE	14444.58	21114.22	1,710,115.46
BENZ (A) ANTHR	47.47	15.51	7,219.44
BENZ(GHI)PE	379.71	244.25	35,390.08
BENZENE	101158.47	31667.71	2,742,206.46
BENZO(A)PYRE	126.07	73.43	35,565.85
BENZO(B)FLUO	75.94	48.85	7,084.77
BENZO(K)FLUO	18.99	12.21	1,769.91
BERYLLIUM	0.84	0.09	521.04
BUTADIENE,13	5.96	0.45	52,308.73
CADMIUM	77.52	1.88	5,238.50
CARBON TETRA	200.50	53.59	5,725.73
CHLOROFORM	1131.15	132.35	13,636.38
CHROMIUM	334.53	2.31	77,967.67
CHROMIUM VI	277.30	negl	15,342.60
CHRYSENE	251.52	123.34	24,035.78
COBALT	2.29	negl	1,733.93
COKE OVEN GS			1,151,548.62
COPPER	2643.97	2.25	542,844.92
DIBENZAHAN	75.96	48.85	7,079.11
DIBROMOET,12	negl	negl	35.30
DIBUTYL PHTH	52.18		6,539.36
DICHLORETH12	22.79	0.17	6,097.20
DIEYLHEX PHT			2,420.02
ETHYLBENZENE	88297.90	14571.51	4,959,804.98
ETHYLENE OXI	4404.93	492.94	343,709.99
FLUORANTHENE	380.35	102.28	29,324.14
FLUORENE	267.66	170.97	24,870.06
FORMALDEHYDE	12859.10	923.24	12,288,429.91

GLYCOL ETH 42(4.16 Tm-7422.94)-56711318.86.94

Code	Pollutant Name
ACENAPHTHEN	Acenapthene
ACENAPHTHYL	Acenaphthylene
ACETALDEHYDE	Acetaldehyde
ACROLEIN	Acrolein
ACRYLAMIDE	Acrylamide
ACRYLONITRIL	Acrylonitrile
ANTHRACENE	Anthracene
ANTIMONY	Antimony
ARSENIC	Arsenic
ATRAZINE	Atrazine
BENZ (A) ANTHR	Benz(a)anthracene
BENZ(GHI)PE	Benz(g,h,i)perylene
BENZENE	Benzene
BENZO(A)PYRE	Benzo(a)pyrene
BENZO(B)FLUO	Benzo(b)fluoranthene
BENZO(K)FLUO	Benzo(k)fluoranthene
BERYLLIUM	Beryllium
BUTADIENE, 13	1,2-Butadiene
CADMIUM	Cadmium
CARBON TETRA	Carbon Tetrachloride
CHLOROFORM	Chloroform
CHROMIUM	Chromium
CHROMIUM VI	Hexavalent Chromium

CHRYSENE

BACKGROUND

The Indiana Department of Environmental Management, Office of Air Management, has developed a statewide inventory of the target air toxic compounds for the Great Lakes Air Toxic Emissions Inventory Project for calendar year 1996. With a 1996 population of 5,840,528, Indiana represents approximately 6.4% of the total population of the overall Great Lakes region. The table below provides a brief demographic overview of Indiana.

Demographic Characteristics for the Indiana Area of the Great Lakes Region Air Toxics Emissions Inventory

Indiana
sources. The voluntarily reported emissions and TRI data are primarily source totals, however some sources did report process level HAPs in STEPS.

AREA SOURCES

The area source inventory covers sources typically too small and too numerous to be inventoried as individual point sources. These source categories are grouped in such a way that emissions can be estimated collectively using one methodology. The main reason not to treat them as point sources is that the effort required to gather data and estimate emissions for each individual facility is very great and the emissions per facility are generally small. However given the large numbers of some source categories, especially in densely populated, urbanized areas, the overall contribution to air pollutant loading can be significant.

Categories inventoried by IDEM for the 1996 Great Lakes Inventory include architectural surface coating, automobile refinishing, consumer and commercial solvent use, traffic markings, agricultural pesticide use, perchloroethylene dry cleaners, industrial surface coating and metal cleaning operations, gasoline dispensing facilities, graphic arts activities, landfills, public owned treatment works and residential fossil fuel consumption, including wood, coal, natural gas and distillate oil.

The emission estimation methodology followed for each area source category typically follows guidance compiled by the Great Lakes Air Toxics Emission Inventory Steering Committee⁵, or

SAMPLE CALCULATION

Adams County

(15 employees in SIC 7532 * 3519 lbs VOC/employee SIC 7532/yr) * (0.2067 lbs Xylene isomers/lb VOC) = 10911 lbs Xylene isomers

Consumer and Commercial Solvent Use

SOURCE IDENTIFICATION There are no SIC codes for this category.

AMS-SCC CODES

The following AMS-SCC code was used: 2465000000.

METHODOLOGY

The method used for this category is population based. 1996 population data was obtained from the Indiana University School of Business Research Center⁷. The toxic emission factors were obtained from Emission Inventory Improvement Program, Volume 3, Chapter 5, Consumer and Commercial Solvent Use⁸.

Pollutant	EF (Ib/person)	Pollutant	EF (Ib/person)
Benzene	4.72e-06	Glycol ethers	4.04e-02
Carbon tetrachloride	4.10e-10	Methylene chloride	3.64e-02
Chloroform	9.91e-04	Naphthalene	4.61e-02
1,2-Dichloroethane	4.65e-06	Perchloroethylene	2.82e-02
Ethylbenzene	2.07e-03	Toluene	4.29e-01
Ethylene oxide	1.51 e -02	1,1,1-Trichloroethane	3.87e-01
Formaldehyde	1.26e-03	Trichloroethylene 4.86e-04	
		Xylene isomers	2.03e-01A dams Co

national and state roadway spending expenditures data, and average VOC content of traffic markings. The Ib VOC/mile was then multiplied by the county roadway miles to estimate VOC emissions, which were then speciated into toxics. The average VOC content of traffic markings (3.36 lb/gallon) was obtained from EIIPChapter 14, Traffic Markings⁸. National sales of traffic markings were obtained from the U.S. Census Bureau⁹. The amount of money spent on roadways was obtained from the Federal Highway Administration¹⁰. County roadway miles were obtained from the Indiana Department of Transportation¹¹.

Pollutant	Volume%	EF Units
Carbon tetrachloride	0.009	lb/lb VOC
Ethylbenzene	0.009	lb/lb VOC
Glycol ethers	0.040	lb/lb VOC
Naphthalene	0.002	lb/lb VOC
Styrene	0.277	lb/lb VOC
Toluene	6.914	lb/lb VOC
Xylene isomers	0.499	lb/lb VOC
VOC	24.54	lb/mile

POLLUTANTS AND EMISSION FACTORS

SAMPLE CALCULATION Emission Factor Determination

36,944,000 gals traffic markings used nationally in 1996 \$68,247,791,000 spent nationally on road maintenance in 1996 \$1,252,256,000 spent in Indiana on road maintenance in 1996 Average VOC content of traffic marking is 3.36 lbs/gallon 92779 total highway miles in Indiana

(36,944,000 gals traffic markings used nationally * 3.36 lbs VOC/gal * \$1,252,256,000 spent in Indiana/\$68,247,791,000 spent nationally)/ (92779 state total highway miles) = 24.55 lbs VOC/mile

Adams County

883.24 miles * 24.54 lb VOC/mile * 0.06914 lbs toluene/lb VOC = 1,498 lbs toluene

Agricultural Pesticide Use

SOURCE IDENTIFICATION There are no SIC codes for this category.

AMS-SCC CODES The following AMS-SCC code was used: 2461800000.

POLLUTANTS AND EMISSION FACTORS

The following pollutant was inventoried: Atrazine.

METHODOLOGY

The method used to estimate atrazine emissions uses published state total pesticide use, acres of corn planted in each county, and an emission factor. The amount of atrazine used in the state of Indiana was obtained from the United States Department of Agriculture (USDA) economics and statistics system web site¹². The emission factor for atrazine was obtained from EIIP Chapter 9: Pesticides⁸. Land acreage planted per county with corn was obtained from Purdue University's agricultural statistics web site¹³.

EMISSION FACTOR

An emission factor of 700 lbs atrazine per ton applied was used⁴.

SAMPLE CALCULATION <u>Adams County</u> 6,672,000 lbs atrazine applied in state in 1996 40,900 acres planted Adams County in 1996 5,600,000 total acres planted state in 1996 700 lbs of atrazine released/ton applied

(40,900 acres corn A dams County /5,600,000 acres corn in state)* (6,672,000 lbs atrazine/2000 lb/ton) * 700 lbs/ton = 17,055 lbs atrazine

Commercial/Industrial Dry Cleaning Operations

SOURCE IDENTIFICATION The primary SIC code for this category is 7212.

AMS-SCC CODES The following AMS-SCC code was used: 2420010055.

METHODOLOGY

The emissions for 1996 were estimated using 1993 total perchloroethylene consumption data¹⁴ from the initial notification report filed by dry cleaners under the NESHAP¹⁵.

SAMPLE CALCULATION <u>Marion County</u> 1993 emissions = 655,074 lbs of perchloroethylene 7.3% rule effectiveness reduction

655,074 lbs * (1-0.073) = 607,254 lbs perchloroethylene

Industrial Surface Coatings

SOURCE IDENTIFICATION There are many different SIC codes associated with this area source category.

AMS-SCC CODES The following AMS-SCC codes were used: 2401015000 - Factory Finished Wood 2401020000 - Wood Furniture

2401065000 - Electronic and Other Electrical 2401075000 - Other Transportation

Employment Based VOC Emission Factors Used for Industrial Surface Coatings						
SCC	Description	SICs	Statewide Employment	Point Source Employment	Point Source Emissions (tons VOC)	Emission Factor (ton VOC/Emp)
2401015000	Factory Finished Wood	2426-2429, 243-245, 2492, 2499	22,596	14,339	3,593	0.251
2401020000	Wood Furniture	25	25,259	19,558	5,694	0.291
2401030000	Paper Coating	26	15,524	6,389	2,506	0.392
2401040000	Metal Cans (National Default)*	341	829	511	NA	3.015 3

The following counties have controlled submerge-fill (stage I controls) requirements: Boone,

Municipal Solid Waste Landfills

SOURCE IDENTIFICATION The SIC code for this category is 4953.

AMS-SCC CODES The following AMS-SCC code were used: 262003000.

METHODOLOGY

U.S. EPA's landfill air emissions estimation model software was used to calculate landfill emissions¹⁷. Specifications for each landfill were obtained from the IDEM landfill compliance database¹⁴. Not all counties in Indiana have landfills therefore; some counties do not have estimates. Some of the landfills did not have either their total waste in place or amount accepted per year. In those cases, the information given was interpolated to obtain the missing data. Still others had no data available. These landfills are not represented in the inventory. All landfills, closed or open, that had data available, were included in the inventory.

POLLUTANTS

The following pollutants were inventoried: 1,1,1 - trichloroethane, 1,2 - dichloroethane, acrylonitrile, benzene, carbon tetrachloride, chloroform, methylene chloride, ethylbenzene, mercury, perchloroethylene, toluene, trichloroethylene, vinyl chloride and xylene isomers.

SAMPLE CALCULATION

No sample calculations are available for this category because the landfill emissions model was used.

Public Owned Treatment Works (Potws)

SOURCE IDENTIFICATION The SIC code for this category is 4952.

AMS-SCC CODES

The following AMS-SCC code was used: 2630020000.

METHODOLOGY

The methodology followed for POTWs was obtained from reference 18. To calculate VOC emissions the annual flow for the treatment plant was multiplied by a default industrial flow rate of 16% to obtain an estimate of industrial wastewater flow. The estimated amount of industrial flow is then multiplied by the emission factor 110 lb of VOC per million gallons of industrial wastewater treated. Speciation profiles from RAPIDS were then applied to estimate air toxic emissions.

POLLUTANTS AND EMISSION FACTORS

Pollutant

(116 homes A dams County/3,912 homes in state) * 98,000 tons coal state = 2,905.9 tons coal used in A dams County
(13,000 btu/lb * 2000lb/ton)* 2,905.9 tons = 7.55e⁻² trillion btu
7.55e⁻² trillion btu * 73 lbs beryllium/trillion btu = 6 lbs beryllium

Residential Distillate Oil Combustion

SOURCE IDENTIFICATION There are no SIC codes for this category.

AMS-SCC CODES

The following AMS-SCC code was used: 2104004000.

METHODOLOGY

County number of households using distillate oil as their primary heating source was obtained from Census of Housing, Detailed Housing Characteristic¹⁹. The amount of distillate oil used by residential units was obtained from Energy Information Administration²⁰, using 1995 numbers. In order to allow a representation of kerosene as a fraction of distillate oil, kerosene totals and distillate oil totals were added together. All emission factors were taken from FIRE version 6.01¹.

Emission factors obtained from FIRE for point source SCC 10300501						
Pollutant	Pollutant Emission Factor (Ibs/MMbtu) Pollutant Emission Factor (Lbs/MMbtu)					
Arsenic	nic 4.2e-6 Manganese 1.4e-5					

Residential Wood Combustion

SOURCE IDENTIFICATION There are no SIC codes associated with residential wood combustion.

AMS-SCC CODES

For the 1996 inventory fireplaces were dropped due to lack of emission factors. All emission factors associated with fireplaces were deleted from FIRE 6.0.

SAMPLE CALCULATION <u>Adams County</u> 499,000 cords wood burned in the state 850 households in Adams County burning wood as primary heat source 86,977 households in the state burning wood as primary heat source 1.25 tons/cord of wood

(850 households using wood as primary heat source in Adams County/ 86,977 total houses in state using wood as primary heat source) * (499,000 cords used in state) * 1.25 tons/cord * 1.464 lbs benzene/ ton of wood burned = 8924 lbs benzene

Residential Natural Gas Combustion

SOURCE IDENTIFICATION There are no SIC codes for this category.

AMS-SCC CODES

The following AMS-SCC code was used: 2104006000.

METHODOLOGY

County number of households using natural gas was obtained from Census of Housing, Detailed Housing Characteristic¹⁹. The amount of natural gas used by residential units was obtained from Energy Information Administration²⁰, using 1995 numbers. All emission factors are from AP- 42, Section 1.4 "Natural Gas Combustion"⁴. No "U" rated emission factors were used.

-	Dollutont	Emission Factor	Pollutant	Emission Factor
		(lbs/10E6 scf)	1 ondtant	

Fluorene	2.8E-6	Mercury	2.6E-4
Formaldehyde	7.5E-2	Nickel	2.1E-3
Indeno(1,2,3-cd)pyrene	1.8E-6		

12. <u>USDA Economics and Statistics System Document</u>; Agricultural Chemical Usage - 1996 Field Crops Summary. http://www.usda.mannlib.cornell.edu/data-sets/inputs/9x171/97171/agch0997.txt

13. <u>Indiana Agricultural Statistics</u>, Purdue University School of Agriculture http://www.aes.purdue.edu/agstat/annbul/9798/pg9495.html

14. <u>Indiana Department of Environmental Management</u>, Office of Air Management, Dry Cleaning and Landfill Data Bases, 1996.

15. <u>Code of Federal Regulations, Title 40, Part 63, Subpart M</u>, Perchloroethylene Dry Cleaning NESHAP, (58 FR 49376), September 22, 1993. http://www.epa.gov/ttn/oarpg/t3pfpr.html

16. <u>U.S. Bureau of the Census</u>, Census of Retail Trade, Indiana http://govinfo.library.orst.edu/cgi-bin/econ-state?Indiana

17. Landfill Air Emission Estimation Model. Version 1.1. Prepared by Radian International (as of this writing version 2.01 is available), http://www.epa.gov/ttn/catc/products.html#software

18. <u>Procedures for the Preparation of Emissions Inventories for Carbon Monoxide and</u> <u>Precursors of Ozone, Volume 1</u>, EPA-450/4-91-016, U.S.EPA, Office of Air Quality Planning and Standards, May 1991.

19. <u>U.S. Bureau of the Census</u>, 1990 Census of Housing, Detailed Housing Characteristics - Table 67 - Fuel, Occupancy and Social Characteristics.

20. <u>U.S. Department of Energy</u>, Energy Information Administration, Table 102 - Residential Energy Consumption Estimates, 1960, 1970 - 1995, Indiana (as of this writing 1996 is available). http://www.eia.doe.gov/emeu/sep/in/frame.html

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	Decatur	Dekalb	Delaware	Dubois	Elkhart
1,1,1-TRICHLOROETHANE	52486	74842	189638	96980	566129.7
1,2-DIBROMOETHANE					
1,2-DICHLOROETHANE	0.1	0.2	0.6	0.2	53.8
1,3-BUTADIENE			28.01		0.03
TCDD,2378				0.00000108	0.0000021
TCDF, 2378					
ACENAPHTHENE	46.01	36	45.01	55.1	79.12
ACENAPHTHYLENE	516	407	505.01	627.21	901.25
ACETALDEHYDE			0.2	117.5	17.53
ACROLEIN			0.03	29.11	0.09
ACRYLONITRILE				28	437

	Gibson	Grant	Greene	Hamilton	Hancock
1,1,1-TRICHLOROETHANE	47230	136506	29809	143441.01	60523.01
1,2-DIBROMOETHANE	10			0.0009	0.0009
1,2-DICHLOROETHANE	306.1	0.3	0.2	0.73	2.33
1,3-BUTADIENE					0.09
TCDD,2378	0.00011			0.0000009	
TCDF, 2378	0.00039			0.00003	
ACENAPHTHENE	26.9	39	67	29.01	19.01
ACENAPHTHYLENE	264.9	439	758	334.01	216.01
ACETALDEHYDE	4366			0.3	2.2
ACROLEIN	2221			0.19	0.22
ACRYLONITRILE					13
ANTHRACENE	32.7	52	89	39.01	25.01
ANTIMONY	139	0.03		0.01	
ARSENIC	3144.11	26.15	0.6	1.78	0.72
ATRAZINE	46621	26188	21684	25103	26563
BENZ (A) ANTHRACENE	93.51	155	267	118.01	83.01
BENZENE	28311.2	24380.32	20513.2	24000.6	10884.4
BENZO (A) PYRENE	15.29	26	45	20	14.2
BENZO (B) FLUORANTHENE	15	26	45	20	13
BENZO(G,H,I)PERYLENE	8.21	13	22	10	6
BENZO(K)FLUORANTHENE	8	13	22	10.01	6
BERYLLIUM	167.22	1.13	6.21	0.95	0.92
CADMIUM	395.28	264.03	2.3	12.23	4.84
CARBON TETRACHLORIDE	3	3	3	3	2.03
CHLOROFORM	484	73	33	146.03	52.11
CHROMIUM	2023.19	10.78	31.07	307.32	95.58
CHROMIUM (VI)	605			0.06	0.02
CHRYSENE	39.8	65	111	49.01	42
COBALT	766.04	0.15	0.2	0.11	0.2
COKE OVEN EMISSIONS					
COPPER	250.42	32.71	2	11.5	12
DIBENZO(A,H)ANTHRACENE	8	13	22	10	6
DIBUTYL PHTHALATE	6	29	5	44	8.6
DIETHYLHEXYL PHTHALATE					
DIOCTYL PHTHALATE	560			0.06	
ETHYLBENZENE	6387	11980	4799	17861.06	10680.36
ETHYLENE GLYCOL		163		710	2709
ETHYLENE OXIDE	484	1109	497	2231	785
FLU()-1391 416.76 66.72 -0.48	8 ref295.6	•	•	•	•

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	Jackson	Jasper	Jay	Jefferson	Jennings
1,1,1-TRICHLOROETHANE	86275	48028	29841	42232	31738
1,2-DIBROMOETHANE		5			
1,2-DICHLOROETHANE	54.2	170.1	0.1	0.1	8.1
1,3-BUTADIENE	4				
TCDD,2378					
TCDF, 2378					
ACENAPHTHENE	83	21.2	30	54	67
ACENAPHTHYLENE	944	219	335	616	760
ACETALDEHYDE	65	2523			
ACROLEIN	3	1235			
ACRYLONITRILE	447				67
ANTHRACENE	111	26.9	39	73	89
ANTIMONY		77			
ARSENIC	0.7	1816.3	0.3	2831.5	76.59
ATRAZINE	30983	65678	19682	6255	14887
BENZ (A) ANTHRACENE	333	77.31	118	218	268
BENZENE	32243.2	19363.1	10154.1	18205.1	20153.7
BENZO(A) PYRENE	56	13.16	20	988	45
BENZO (B) FLUORANTHENE	56	13	20	36	45
BENZO(G,H,I)PERYLENE	28	6.09	10	18	22
BENZO (K) FLUORANTHENE	28	6	10	18	22
BERYLLIUM	0.71	90.51	2.11	426.71	0.81
CADMIUM	2.5	225.1	1.3	1592.88	8.3

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	Laporte	Lawrence	Madison	Marion	Marshall
1,1,1-TRICHLOROETHANE	185165	67577	175257	1195475.5	82701
1 2-DIBROMOETHANE	2			1 75	
		0.0	10 6	120,00	0 0
I, Z-DICHLOROEIHANE	58.5	0.2	19.6	420.08	0.2
1,3-BUTADIENE	2.3			2.35	
TCDD,2378	0.00002			3.32E-05	
TCDF 2378	0 00007			3 10E-05	
	14 00	115	44 01	10.00	4 5
ACENAPHTHENE	44.89	115	44.01	40.02	45
ACENAPHTHYLENE	500.76	1299	494.01	446.24	514
ACETALDEHYDE	876	126.09		3296.89	360
	428 8			501 59	
ACROLEIN	420.0		150	501.59	
ACRYLONITRILE			153	3009	
ANTHRACENE	59.42	153	58.01	52.85	60
ANTIMONY	31	0.4		447.51	0.1
ADGENIC	711 56	10.09	177 9	807 52	02 31
ARGENIC	/11.50	10.05	177.5	007.52	20200
ATRAZINE	2/105	9091	3/488	3962	38322
BENZ (A) ANTHRACENE	177.2	459.01	175.01	168.8	181
BENZENE	30585.5	34601.8	35990.63	178602	21122.2
$DENIZO(\lambda) DVDENIE$	29.09	76	29	620 11	20
BENZO(A) PIRENE	29.08	70	29	020.11	30
BENZO (B) FLUORANTHENE	29.01	76	29.01	26.07	30
BENZO(G,H,I)PERYLENE	15.07	38	15	13.12	15
BENZO (K) FLUORANTHENE	15.02	38	15.01	13.06	15
PEDVILITIM	32 01	1 1 5	1 01	44 25	2 5
	JZ.74	10.0	18 5	11.43	4.0
CADMIUM	⊥43.5	12.8	17.5	242.06	73.5
CARBON TETRACHLORIDE	4	2	3.3	10.01	3
CHLOROFORM	195	45	133	2411.01	45
	2776 14	E2 6	9490 04	6210.06	112 75
CHROMIUM	2770.14	52.0	0409.04	0310.90	113.75
CHROMIUM (VI)	115	0.06	161	130.19	
CHRYSENE	74.23	191.01	73.01	77.13	76
COBALT	332	0.3	767.08	892.24	434.2
COVE OVEN EMICCIONC	551	013		64906	10111
CORE OVEN EMISSIONS	11.60	1.50.0	1451.0	04090	
COPPER	1168	162.3	1471.8	15495.57	37.6
DIBENZO(A,H)ANTHRACENE	15.04	38	15	13.07	15
DIBUTYI, PHTHALATE	29	39 7	51	218 04	11
	E1E /	32.7	31	210.01	
DIEIHILHEAIL PHIHALAIE	515.4				
DIOCTYL PHTHALATE	107	69		179	40
ETHYLBENZENE	20967	7527	18960	115825.2	15737
ETHYLENE GLYCOL	349	108	5350	10328 8	158
ETHILIBHE OFFOE	1655	605	2005	10245	600
EIHYLENE OXIDE	1022	680	2005	12345	682
FLUORANTHENE	89.47	229.03	87	138.02	91.08
FLUORENE	105.34	267.01	102	95.65	106.08
FORMALDEHYDE	5225	1086	1177 4	120008 14	5633 04
	200476	2040	120104	20000.11	F2001
GLYCOL EIHERS (MISC.)	309476	3942	132184	203335	52091
HEXACHLORO-1, 3-BUTADIENE					
HEXACHLOROETHANE					
INDENO(1 2 3-C D) DVRENE	29 14	76 01	29	26 13	30 05
TEND	1007 00	044 0	41 F	17700 54	004 01
	423/.38	044.2	415	1//U9.50	924.91
MANGANESE	19425.3	27995.6	6866.33	15081.11	7537.2
MERCURY	158.58	168.87	0.92	914.87	7.7
METHYLENE CHLORIDE	145976	14790	38481	401232 06	38731
METUVIENE (D) A DIENVI TOOGVANATE	E200		30101	2576	1100
METRILENE(B)4-PHENILISUCIANATE	J28U	B A F	1000	0/ 30	1120
M-XYLENE	1851	795	1727	14624.87	2138
NAPHTHALENE	17503.8	7214	15083.6	75559.94	5428
NICKEL	4456 42	55 14	1565 02	2771 29	198 1
O VVI ENE	14050	0010	7675	44010 50	20010
U-AILENE	14058	8UIU	/0/5	44012.53	8048
PHENANTHRENE	3603.59	9342.07	3556.02	3209.79	3696.5
PHENOL	33129	80		5784.49	1200
PHOSGENE			1		
DCBC			1		
			-		
PCDD	0.004	0.0015	ļ	0.08	0.002
PCDF	0.01	0.01		0.21	0.01
P-XYLENE	1620	679	1576	10480 27	877
DVDENE	74 04	101 00			76 1
FIRENE	/4.04	191.02	/ 3	00.00	/0.1
STYRENE	729	64.2	107	16304.9	761123
TETRACHLOROETHYLENE	95292	34578	189789	1085788.01	36158
TOLUENE	265396	116135	366836	1638658 94	376341
	16		222020	1000000001	5,5511
IULUENE-Z, 4-DIISUCIANATE	40	48455	101111	0.5.6.1.6.1	
TRICHLOROETHYLENE	118088	47351	121809	956181	79230
TRIFLURALIN					
VINYL CHLORIDE			221	1153 2	
VVIENEO (MIVED TOOMEDO)	226205 0	02440	2221	1000007 01	200207
AILENES (MIAED ISOMERS)	430495.9	03449	344493	ΤΠΩΩΆζΙ'ΠΤ	20029/

	Martin	Miami	Monroe	Montgomery	Morgan	
1,1,1-TRICHLOROETHANE	14665	43970.02	150447	59861	76653	
1,2-DIBROMOETHANE		0.0012			0.44	
1,2-DICHLOROETHANE	0.05	0.25	23.5	0.2	14.3	
1,3-BUTADIENE	20		-			
	Union	Vanderburgh	Vermillion	Vigo	Wabash	
-----------------------	-------	-------------	------------	-------------	--------	
1,1,1-TRICHLOROETHANE	2843	240557.06	16596.06	132774.3	56567	
1,2-DIBROMOETHANE		0.01	3.08	1.42		
1,2-DICHLOROETHANE	0.03	2.04	98.48	94.21	51.2	
1,3-BUTADIENE		26		0.04		
TCDD,2378		0.000004	0.000009	0.00008201		
TCDF, 2378			0.00003	0.000031903		
ACENAPHTHENE	10	21.06	17.34	53.63	27	
ACENAPHTHYLENE	110	241.51	182.63	596.36	309	
ACETALDEHYDE		32	1390	26685.63		
ACROLEIN		0.04	708	349.48	13	
ACRYLONITRILE				376	423	

Table B-1: Indiana Emissions by County in pounds/year

			· · · · · · · · ·	· · · · · ·	
	Warren	Warrick	Washington	Wayne	Wells
1,1,1-TRICHLOROETHANE	3519	56105.3	38114	107191	31786
1,2-DIBROMOETHANE		4.21		0.3	
1,2-DICHLOROETHANE	0.04	141.8	12.1	12.3	0.1
1,3-BUTADIENE		1.91			
TCDD,2378		0.0000452	0.0000019	0.00000409	
TCDF, 2378		0.0001747	0.000001	0.000015	
ACENAPHTHENE	16	22.85	96.02	46.16	18
ACENAPHTHYLENE	180	241.91	1090.22	518.18	207
ACETALDEHYDE		2040.2	13.5	168	
ACROLEIN		1039.02	0.12	82.01	
ACRYLONITRILE		16	96		
ANTHRACENE	21	28.77	128.2	61.15	24
ANTIMONY		88.3		5	
ARSENIC	0.3	1481.25	2.52	150.1	0.7
ATRAZINE	41116	16972	15846	23144	22226

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Table B-1: Indiana Emissions by County in pounds/year

Table B-1: Indiana Emissions by County in pounds/year

Appendix C: Michigan Toxic Emissions Inventory

BACKGROUND

The State of Michigan conducted its portion of the Great Lakes Region air toxic emissions inventory over all of its eighty-three counties for the calendar year 1996. With a 1990 population of 9,295,297, Michigan represents approximately 10.7 percent of the total population of the Great Lakes Region. The table below provides a brief demographic overview of the Michigan portion of the regional inventory.

Demographic Characteristics for the Michigan Area of the Great Lakes Region Air Toxics Emissions Inventory

Michigan

Architectural Surface Coating

This category was estimated consistent with the Regional Protocol. Protocol provided speciation profiles were applied to an estimated VOC to estimate emissions.

Dry Cleaning

The Regional Protocol recommended either the EIIP guidance or AP-42 methodology to estimate emissions for dry cleaning. Michigan followed the EIIP guidance, alternative method two, utilizing per employee emission factors for SIC 7215 and 7216.

As employment data for dry cleaning was only available for 13 counties, an average per capita emission factor was developed by calculating and averaging the per capita emissions from those 13 counties. This Michigan specific per capita emission factor was then applied to the remaining 70 counties.

Consumer and Commercial Solvent Use

This category was estimated consistent with the Regional Protocol. Michigan used the preferred method from the EIIP guidance.

Solvent Cleaning/Cleanup

This category was estimated consistent with the Regional Protocol. Michigan selected the EIIP Alternative Method and developed the *Recommended Method for Solvent Cleaning Equipment* detailed in the protocol document.

Graphic Arts

The Regional Protocol recommending the use of the EIIP guidance was followed. Alternative method two, the per capita emission factor, was the method selected.

Industrial Surface Coating

These emissions were estimated in accordance with the Regional Protocol. The state that prepared this protocol recommended the use of a 1991 EPA procedural document. Michigan used alternative method one of the EIIP guidance, the method recommended by the 1991 EPA document.

Pesticides – Agricultural and Non-agricultural

The Regional Protocol was followed. Michigan's Department of Agriculture was contacted, they referred staff to contacts at Michigan State University. State specific emission factors for ATRAZINE and TRIFLURALIN were obtained from MSU.

Gasoline Marketing (Stage I and II)

The Regional Protocol recommendation to utilize the EIIP guidance was followed. An exception is that Michigan has not estimated emissions from vehicle refueling in the current report. Refueling emissions will be added to the inventory when available.

Auto Body Refinishing

The Regional Protocol recommendation to use the EIIP methodology was followed. Alternate method one, the apportionment of national data, was the specific method utilized.

Landfills

This area source category was covered as point source emissions in Michigan's inventory.

Traffic Markings

Michigan has elected to use the method recommended in the Regional Protocol. This utilizes the EIIP recommendations. Michigan will use alternate method one. Michigan is waiting for

Chapter 3, Architectural Surface Coating. November 1995

Chapter 4, Dry Cleaning. May 1996

Chapter 5, Consumer and Commercial Solvent Use. August 1996

Chapter 6, Solvent Cleaning. September 1997

Chapter 7, Graphic Arts. November 1996

Chapter 8, Industrial Surface Coating. September 1997

Chapter 9, Pesticides – Agricultural and Nonagricultural. December 1997

Chapter 11, Gasoline Marketing (Stage I and Stage II). September 1997

Chapter 13, Auto Body Refinishing. January 1997

Kells, Jim. Michigan State University, Department of Crop and Soil Sciences. Personal Communication. 3/29/99

Michigan Department of Environmental Quality, Air Quality Division. 1996 Emission Inventory System.

Michigan Department of Environmental Quality, Air Quality Division. Paul Shutt, Chief, Air Quality Evaluation Section, and Jerry Trautman, Strategy Development Unit. Personal communication. 8/26/99

Michigan Department of Environmental Quality, Air Quality Division. Renewable Operating

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Alcona	Alger	Allegan	Alpena	Antrim

	Berrien	Branch	Calhoun	Cass	Charlevoix
ACENAPHTHEN	115.3427853	72.9020812	107.8061697	107.1635430	90.7886742
ACENAPHTHYL	1307.1892004	826.2073858	1221.8032568	1213.8410066	1027.7322633
ACETALDEHYDE	1.7892315				
ACROLEIN					
ACRYLONITRIL			181.1910019		
ANTHRACENE	153.7877471	97.2013055	143.7415596	142.8231251	120.9421770
ANTIMONY	0.0787500		4.0161634		
ARSENIC	4.6403422	0.0000561	8.7713347	0.0776585	202.3683857
ATRAZINE	34360.3846000	76270.0788000	65652.4624000	57219.3564000	1167.1970000

		0			
	Gladwin	Gogebic	Grand Traverse	Gratiot	Hillsdale
ACENAPHTHEN	80.1635621	59.8381153	111.2327168	61.3557487	87.9143325
ACENAPHTHYL	908.5203705	678.1653070	1260.5073875	695.3651517	996.3624347
ACETALDEHYDE					
ACROLEIN					
ACRYLONITRIL					
ANTHRACENE	106.8847495	79.7841538	148.2984917	81.8076649	117.2191100
ANTIMONY			0.0589500		
ARSENIC			2.5957557		695.6771232
ATRAZINE	4577.4796000	0.000000	3574.8100000	66703.3704000	63027.7766000
BENZ (A) ANTHR	320.6542484	239.3524613	444.8834866	245.4229947	351.6573980
BENZ(GHI)PE	26.7211874	19.9460384	37.0736149	20.4519162	29.3047775
BENZENE	23664.8916651	19539.7999520	56923.4269353	24344.6906322	30081.8074953
BENZO(A)PYRE	53.4423747	39.8920769	74.1472903	3182.2400141	58.6096362
BENZO(B)FLUO	53.4423747	39.8920769	74.1494699	40.9038325	58.6095550
BENZO(K)FLUORA NTHENE	26.7211874	19.9460384	37.0736149	20.4519162	29.3047775
BERYLLIUM			0.1528805		82.3998674
BUTADIENE,13	4889.2333637	7334.1354648	25377.0610625	13063.6433774	10986.9322300
CADMIUM	0.6145873	0.4587589	1.3187163	0.4703941	45.9233486
CARBON TETRA	0.0000101	0.000072	0.0000295	0.0000164	0.0000188
CHLOROFORM	24.3686900	17.4604290	71.3985770	39.5418910	45.4393320
CHROMIUM	0.0133606	0.0099730	7.7540908	0.0102260	11.2972032
CHROMIUM VI			0.0028733		
CHRYSENE	133.6059368	99.7301922	185.3681822	102.2595811	146.5240574
COBALT			0.0681200		
COKE OVEN GS					
COPPER			0.2514176		0.0568009
DIBENZAHAN	26.7211874	19.9460384	37.0736149	20.4519162	29.3047775
DIBENZOFURAN	0.1984413	0.1421853	0.5814193	0.3220011	0.3700256
DIBROMOET,12	0.6961444	1.0442573	6.1863201	1.8600426	1.5643540
DIBUTYL PHTH	777.8293193	557.3230898	2278.9865767	1262.1458996	1450.3875539
DICHLORETH12	7.2634606	10.8059212	63.8302114	19.2872789	16.2784352
DIEYLHEX PHT					
DIOCTYL PHTH					
ETHYLBENZENE	2451.7375625	1728.2256371	7928.1186227	3986.8740318	5639.3438912
ETHYLENE OXI	371.3090000	266.0469000	1087.9097000	602.5051000	692.3652000
FLUORANTHENE	160.3271242	119.6762306	222.4498585	122.7114974	175.8297676
FLUORENE	187.0483116	139.6222691	259.5160213	143.1634136	205.1334424
FORMALDEHYDE	31.1761856	22.3380730	697.0872622	50.5880838	61.5161417

	Iron	Isabella	Jackson	Kalamazoo	Kalkaska
ACENAPHTHEN	63.4535817	80.9223788	121.9526807	98.7133069	71.1661643
ACENAPHTHYL	719.1429281	917.1202928	1382.1303810	1118.6090704	806.5498624
ACETALDEHYDE	29.5470004				18.5162640
ACROLEIN	0.0393960				
ACRYLONITRIL				487.9500122	
ANTHRACENE	84.9297172	107.8965050	162.6035742	131.6048866	94.8882191
ANTIMONY				44.4829856	
ARSENIC	0.3104031	0.1031150	0.3701283	220.3653293	
ATRAZINE	0.000000	34370.7214000	55527.5668000	43095.8420.0448	8121 164.2(107.89

	Manistee	Marquette	Mason	Mecosta	Menominee	
ACENAPHTHEN	79.2869232	137.9247366	80.0551597	91.6702770	86.4181989	
ACENAPHTHYL	898.6571316	1563.1581428	907.2918101	1038.7714484	979.4408222	
ACETALDEHYDE	40.5813965	29.1779995		1.2375000	18.9703809	
ACROLEIN						

	Muskegon	Newaygo	Oakland	Oceana	Ogemaw
ACENAPHTHEN	155.3619662	153.4435729	112.7389758	84.4454562	86.9493110
ACENAPHTHYL	1761.1518688	1739.0271594	1277.5045165	957.0485039	985.3093916
ACETALDEHYDE	210.1380005	1.2656511	111.2109468		
ACROLEIN	0.2801840		0.1482368		
ACRYLONITRIL					
ANTHRACENE					

185

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	Presque Isle	Roscommon	Saginaw	Saint Clair	Saint Joseph
ACENAPHTHEN	72.3123393	66.5153400	103.4723428	123.0641304	101.5188315
ACENAPHTHYL	819.4527459	753.7257218	1172.6616993	1393.8026830	1150.5467572
ACETALDEHYDE					
ACROLEIN					
ACRYLONITRIL					
ANTHRACENE	96.4085525	88.6767078	137.9608696	163.9813908	135.3584420
ANTIMONY			0.5302500	20.3100452	1.8014849
ARSENIC	0.0000218	0.0000331	54.4459863	220.0466864	4.7594008
ATRAZINE	2093.2020000	0.000000	69001.5856000	88058.3378000	0.0000000
BENZ(A)ANTHR	289.2176294	266.0195424	413.8803182	491.9479783	406.0754674
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	Washtenaw	Wayne	Wexford	Pollutant Totals
ACENAPHTHEN	58.5372867	65.4710003	89.8017633	7162.7500623
ACENAPHTHYL	663.4225829	738.9958000	1019.8410772	81176.1092753
ACETALDEHYDE	10.9576950		1390.3559570	11271.5058108
ACROLEIN			1.8538080	14.8961942
ACRYLONITRIL	474.4554977	411.7530060		2279.8753300
ANTHRACENE	78.0497156	86.9646019	135.2054454	9672.7037584
ANTIMONY	6.5211799	12.9089620		308.2088495
ARSENIC	66.5516627	82.2991990	0.8020470	7689.5120229
ATRAZINE	45349.2644000	3689.3762000	1589.2830000	1858748.7322000
BENZ(A)ANTHR	236.2297218	500.4771056	353.5759358	29525.1510634
BENZ(GHI)PE	19.5124289	21.7371398	29.4019534	2385.5813637
BENZENE	73608.4618579	241316.7587199	37389.8637927	3901477.2138795
BENZO(A)PYRE	39.0248578	4834.8398676	58.8784888	12989.1040981
BENZO(B)FLUO	39.0248578	43.4763555	58.7979026	4765.5827192
BENZO(K)FLUORA	10 5124280	21 7346778	20 2051128	2382 7024416
NTHENE	19.5124209	21.7540778	29.3931120	2382.7024410
BERYLLIUM	2.1323001	4.2779807	39.9999991	1541.0665652
BUTADIENE,13	43085.8071133	223907.5484151	24866.4229856	1852608.0705286
CADMIUM	42.7483887	49.3076968	0.7729957	15899.0925701
CARBON TETRA	0.1899034	0.5237535	0.0000118	152.1442510
CHLOROFORM	293.6248936	2118.9004656	28.4575560	9646.8424372
CHROMIUM	211.7641753	917.0463156	0.7557593	16605.6716509
CHROMIUM VI	0.000017	0.2807239	0.2622219	118.2941816
CHRYSENE	97.5621445	433.2094153	166.9043688	12808.8293881
COBALT	6.4127077	26.3878422	0.7410617	758.9752197
COKE OVEN GS		343173.8540039		343173.8540039
COPPER	101.8902092	1134.1771873	20.6497159	7495.8127162
DIBENZAHAN	19.5124289	21.7528710	29.3951128	2382.7846311

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INTRODUCTION

Minnesota developed a statewide inventory of the target air toxic compounds for the Great Lakes Air Toxic Emissions Inventory Project for calendar year 1993. Minnesota has a 1990 population of 4,375,099 million people, which represents approximately 5.0 percent of the total population of the Great Lakes region. The table below provides a brief demographic overview of Minnesota's portion of the regional inventory.

	Minnesota
Total Population, 1990	4,375,099
Urban Population, 1990	3,055,728
Rural Population, 1990	1,319,371

Demographic Characteristics for the Minnesota Area of the Great Lakes Region Air Toxics Emissions Inventory

Source: U.S. Bureau of the Census

Generally, the development of the Minnesota portion of the regional air toxics emission inventory follows the instructions illustrated in the protocol document and uses RAPIDS to estimate the emissions. However, because Minnesota does not have air toxic emission inventory reporting requirements for industrial point sources, we have established an alternative approach for development of the Minnesota inventory that meet the protocol requirements. Using this approach, 824 point sources were estimated to have emissions for one or more pollutants listed in the 1996 Great Lakes regional air toxics emission inventory. Also, various area sources were examined and emissions were estimated for 16 area source categories. Presented in the following sections is a detailed discussion on data acquisition, emission estimation, quality assurance and quality control plans, and uncertainties inherent in the inventory.

METHODOLOGY

Data Acquisition

The 1996 Minnesota portion of the air toxic emission inventory includes three principal source categories: point, area, and mobile sources. This report contains two parts: Part 1 for point and area sources, Part 2 for mobile sources. The following sections give separate discussions on emission data acquisition for point and area source categories.

Point Sources

Minnesota does not have air toxic emission inventory reporting requirements for industrial point sources. However, emission data for point sources are collected for the Minnesota criteria pollutant emission inventory (MCEI). Therefore, for the purpose of the Minnesota air toxics emission inventory, point sources are identified as facilities that are required to submit their

annual inventories of criteria pollutants (carbon monoxide, nitrogen oxides, particulate matter, particulate matter smaller than 10 microns, lead, sulfur dioxide, and volatile organic compounds) to the Minnesota Pollution Control Agency (MPCA). According to this definition, there were a total of 2586 point sources in Minnesota in calendar year 1996.

To estimate emissions of air toxic pollutants from Minnesota point sources, computer software was developed to convert the MCEI data into the RAPIDS computing environment. The conversion process was started by converting MCEI data into Aerometric Information Retrieval System (AIRS) transaction record formatted data. Then, the AIRS transaction records are converted to RAPIDS format and imported to RAPIDS.

Area Sources

Area sources are stationary sources that are not required to submit criteria pollutant data to the MPCA. The categories of area sources have been determined by the Great Lakes States after reviewing the Emission Inventory Improvement Program (EIIP) documents and other available information. The emission data for area sources were obtained from surveys, literature, and the submittals for the National Emission Standards for Hazardous Air Pollutants. There are 16 source categories included in Minnesota portion of the regional emission inventory: Agricultural Pesticide Applications, Architectural Surface Coatings, Auto Body Refinishing, Chromium Electroplating, Consumer and Commercial Products, Commercial Dry Cleaning, Gasoline Marketing, Graphic Arts, Industrial Surface Coating, Marine Vessel Loading, Municipal Solid

Activity Data Pre-Treatment

There are different levels of source activity data available for different categories of area sources. Source activities are any parameters associated with the source that are surrogates for emissions, for example, fuel throughput, solvent usage, or population. Some source categories, such as Dry Cleaning, Chromium Electroplating, Halogenated Solvent Cleaners, need to comply with NESHAPs and the source-level or process-level activity data are available from the initial notification forms. In this case, spreadsheets were used to aggregate emission data for all similar or identical device/processes within each county. For example, county total PCE consumption values were calculated for all dry-to-dry machines with control, all dry-to-dry machines without control, all transfer machines with control, and all transfer machines without control, using PCE consumption data from each individual dry cleaner within the county.

However, for some area sources direct activity data are not available at the county level. In these cases, statewide activity data were apportioned to each county based on appropriate activity indicators. For example, fuel consumption data for Residential Fuel Combustion were calculated from the state fuel consumption by using population data. If state-level activity data were not available, appropriate surrogate activity data were used. For example, county-based population data were used as the most appropriate or applicable activity data for commercial and consumer solvent products and architectural surface coating.

Source-Specific Emission Factors and Speciation Profiles

Since FIRE version 6.01 and SPECIATE version 1.5 only contain scarce emission factors and speciation profiles for area sources, source-specific emission factors and speciation profiles were developed for the area sources included in the Minnesota portion of the regional emission inventory.^{2, 5}

Quality Control

The QC procedures in the inventory development include technical reviews, accuracy checks, and use of approved standardized procedures for emission calculations. The QC activities have been performed and will be performed in the following three aspects.

Activity Data

For point source, the Minnesota emission inventory data for criteria pollutants were used. Using the MCEI data minimized errors in the activity data because these data are the bases for emission fees. For this reason, facilities pay close attention to the quality of these data.

For area sources, the activity data were compared with other states data. Special attention was paid to point and area source reconciliation to eliminate double counting of emissions. This is because a given category of emissions can be comprised of both point and area sources. For example, some of the halogenated solvent cleaners are point sources and are subject to emissions fees, therefore their emissions are included with the point source emissions. To eliminate double counting of emissions, all facilities in area source categories were verified in the MCEI.

Emission Factors

There are many multiple generic emission factors found in FIRE 6.0. To select the appropriate emission factors, each state reviewed a section of FIRE 6.0. The generic criteria for emission factor selection were established after the review process. These selections were then reviewed and subsequently approved by the other states.

The source-specific emission factors for point sources that were developed in Minnesota were based on stack testing data, mass balance, chemical analysis results, available literature, and engineering calculations. These emission factors were reviewed by both the MPCA and the individual facilities. Most of these emission factors were derived from facility air quality permit applications.

Emission Results

To assess the reasonableness of estimated emission results for point sources, the process-based emissions for each pollutant were examined. The extraordinary emission values were recalculated. The activity data and emission factors which led to the extraordinary emissions were verified. For area sources, the emissions were calculated using the RAPIDS software and spreadsheets. The results from these two approaches were compared and evaluated until a perfect match was reached.

Quality Assurance

The QA plan included the following activities:

- Release of the toxic emission estimates within the MPCA, obtain comments, particularly, from permit engineers and staff working on emission-related projects such as the Mercury Task Force.
- Release of the process-level emission inventories to selected facilities. Requested their voluntary validation of the emission data and estimates. The selection of these facilities was

based on the source-specific emission factor development efforts. The information and comments in the facility responses were also incorporated in the emission inventory.

• Requested technical review at Great Lakes regional level. Minnesota emission estimates were compared with estimates from other Great Lakes States. Extraordinary values, missing pollutants, and extra pollutants were examined.

RESULTS AND DISCUSSIONS

Emissions were estimated for the 82 target compounds in the Great Lakes regional air toxics emission inventory project. However, data were only available to obtain emissions for 65 out of the 82 air toxics. Among the 65 pollutants, 63 pollutants are emitted from point sources, 59 pollutants are emitted from area sources. The summary table (Table D-2) shows the name and the emissions of these 65 pollutants in each county.

It was estimated that 824 out of 2586 point sources emitted one or more pollutants listed in the summary table. Emissions from area sources were calculated for the 16 categories mentioned in the previous section. Point and area source emissions are from 192 distinct standard industrial classification (SIC) codes and 237 distinct source classification codes (SCC).

If more information is needed, please contact Ms. Chun Yi Wu at Minnesota Pollution Control Agency, 520 Lafayette Road, St. Paul, MN 55155, (612)282-5855 (Phone), (612)297-7709 (Fax), chun.yi.wu@pca.state.mn.us

UNCERTAINTIES

Although QA/QC plans were established to ensure the best results, there are uncertainties in the Minnesota portion of the Great Lakes regional air toxics emission inventory. Some uncertainties are common for all air toxics emission inventories. For example, not all pollutants are included in the inventory and some emission factors are missing or are of poor quality, resulting in unrepresentative emission estimates. These uncertainties are not discussed here. The following discussions focus on three uncertainties specifically for Minnesota.

Source Classification Code Assignment

Since Minnesota does not have air toxic emission inventory reporting requirements, the emission data in MCEI were used for point sources. These emission data, including facility identification, device identification, process identification, and process activities, were submitted by the individual facilities. However, the quality of a key component, source classification codes (SCC), is in question because these codes have never been reviewed by facilities in the MCEI reporting system. SCC codes are very important for estimating air toxics emissions because all emission factors are directly tied to SCC codes. It is interesting to note that the relationship of emissions and SCC codes for criteria pollutants is not as sensitive as for air toxics. An increct SCC assignment may still give correct emission values for criteria pollutants but lead to significant over-estimation or under-estimation of air toxics emissions.

Small Point Sources

Starting with the calendar year 1995 MCEI, facilities who used only VOC-containing materials and used or purchased less than 2000 gallons of VOC-containing materials in a 12 month period were not required to report information on their emission units but rather, reported only facility total VOC emissions or the amounts of VOC-containing materials. Without the information on the emission units and SCC codes, RAPIDS cannot estimate air toxics emissions for these facilities. Relying on the MCEI to convert point source emissions data to the RAPIDS computing environment caused the air toxics emission inventory to be incomplete. The small sources which do not report the process-level information to the MCEI include auto body shops, small painting shops, wood furniture shops, asphalt plants, grain elevators, seed elevators, feed mills, and others. There were 731 facilities in this source category in 1996. One possible way to overcome this deficiency is to treat the small point sources as area sources. The best solution is to collect material usage and composition data from these facilities.

Control Efficiencies

Most of control efficiencies used in the MCEI are default values and may not reflect the operating conditions in facilities. Therefore, uncertainties are introduced for criteria pollutant emission estimates. Due to scarce information on control efficiencies for air toxics, control efficiencies for particulate matter (PM) and volatile organic compounds (VOC) were used for all air toxics in PM format and VOC format, respectively. It is recognized that the control efficiencies for individual air toxics can deviate greatly from the control efficiencies for PM or VOC. However, PM and VOC control efficiencies have to be used until better information is obtained for each individual air toxic. Therefore, it is unlikely there will be a reduction in this uncertainty for some time.

REFERENCES

1. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources

7. Protocols for Estimating Air Toxic Emissions from Minnesota Area Sources, Minnesota Pollution Control Agency, Environmental Indicators Unit: St. Paul, MN, 1999; Unpublished Manuscript.

Source Categories	Sub-Source Category	Emission Estimation Method	Activity Data Information Source
Agricultural Pesticide Application		Use vapor pressure of the active ingredients to determine	

Table D-1: A rea source categories and information sources for their activity data.

Source Categories	Sub-Source Category	Emission Estimation Method	Activity Data Information Source
Industrial Surface Coating		Use employee-based emission factors for VOC and apply sepciation profiles to VOC emissions	Census data
Landfills		Create a model based on AP-42, Section 2.4. Most concentrations of air toxics are obtained from MPCA landfill gas study. Use facility-specific activity information.	MPCA Ground Water and Solid Waste Division
Marine Vessel Loading, Ballasting, and Transit		VOC emissions based on estimates of amount and type of products transported to or from the inventory area by waterways and the traffic classification. Air toxics emissions are assumed to be proportional to their vapor phase weight concentrations	US Army Corps of Engineers
Public Owned Treatment Works		Survey to gather annual influent flowrate and chlorine	

Table D-2: Minnesota Emissions by County in pounds/year
					u
	Cass	Chippewa	Chisago	Clay	Clearwater
ACENAPHTHEN	269.2146046	35.80699951	149.2590866	128.2486733	91.88240234
ACENAPHTHYL	5707.331789	759.1083896	3164.142885	2718.754214	1947.90693
ACETALDEHYDE	0.545982814	0	4.586255638	3.603486572	58.44657
ACROLEIN	0.065845385	0	0.553101234	0.434579541	0
ACRYLONITRIL	47.9551	72.12806	158.4151	134.515	0
ANTHRACENE	376.9003624	50.12979932	208.9620156	179.5475883	128.6353633
ANTIMONY	0	0.140472033	0.6405	16.5375	0
ARSENIC	0.963706344	0.670855596	2.584865663	55.08529776	0.311053462
ATRAZINE	923.6272192	12115.8327	3069.706377	3622.071489	389.3714923
BENZ (A) ANTHR	538.5303147	71.66962591	298.6688209	256.715552	194.898119
3ENZ(GHI)PE	107.6857856	14.3227998	59.70316224	51.29909818	36.75296094
BENZENE	56566.502	10062.8837	36149.13814	34027.89423	19284.53207
BENZO(A)PYRE	107.6855713	14.32279995	59.70136242	51.29768403	36.75296094
BENZO(B)FLUO	161.5282268	21.48419971	89.55094999	76.94566676	55.12944141
BENZO(K)FLUO	53.84282909	7.161399902	29.85104596	25.64912861	18.37648047
BERYLLIUM	0.290893185	0.188309841	0.453982025	2.682398156	0.085668823
BUTADIENE,13	18706.13205	11402.16088	33975.29243	32157.05546	6392.334011
CADMIUM	1.89822926	0.771859465	4.09582913	58.50567006	26.18636048
CARBON TETRA	8.001500879	16.67834697	28.06709636	34.75237445	0.29033917
CHLOROFORM	33.3596242	53.6172916	77.51252147	148.898165	10.05377295
CHROMIUM	55.510831	31.12107271	85.48577035	225.3893869	68.34611465
CHROMIUM VI	0	8.595E-07	0	0	0
CHRYSENE	323.0565638	42.96839956	179.1053876	153.9582108	110.2588828
OBALT	170.8687863	93.46030562	265.9718465	421.6936619	60.11984104
OPPER	13.47645715	4.724665184	11.90938384	17.75207799	260.6262892
DIBENZAHAN	107.6858525	14.3227998	59.70372431	51.29953981	36.75296094
DIBROMOET,12	17.2971419	25.55198321	41.2201128	41.70484642	6.072102446
DIBUTYL PHTH	4.580330078	2.49945	7.081110156	10.05005	1.61157998
)ICHLORETH12	40.98734825	35.30143382	83.08283383	92.2610673	12.93807995
DIEYLHEX PHT	0	0	0	0	0
THYLBENZENE	3167.618423	2085.891038	5386.171394	6935.246852	1065.87797
ETHYLENE OXI	2130.094468	2938.7976	4858.388536	5160.9812	749.469533
FLUORANTHENE	538.4352402	71.61520545	298.5535956	256.6158495	188.2045624
LUORENE	646.1334108	85.93679883	358.3760303	307.9179909	220.5177656
FORMALDEHYDE	554.2971529	302.6346604	858.2932367	1817.610697	1394.681782
GLYCOL ETHRS	1029.368898	615.0645	1638.392297	2273.2465	362.1814004
HEXCLBENZENE	0.000246301	0.003230889	0.000818588	0.000965886	0.000103832
INDN(123CDPY	538.4274544	71.61399902	298.5034337	256.4857657	183.7648047
LEAD	7.045589522	24.42234813	10.89235801	9335.459263	2.478976603

	Cook	Cottonwood	Crow Wing	Dakota	Dodge
ACENAPHTHEN	33.4184814	34.83580275	561.0914103	474.9319596	40.98339844
ACENAPHTHYL	708.1799435	738.5154528	11895.09511	10066.81927	868.8480469
ACETALDEHYDE	30.63839313	0.109196563	1.310358754	53.24871105	0
ACROLEIN	0.066898154	0.013169077	0.158028924	6.420403875	0
ACRYLONITRIL	6.862776	19.33535	57.72343	1067.089453	33.92702
ANTHRACENE	46.78573896	48.77010705	785.5277729	705.8219537	57.37675781
ANTIMONY	0.0149552	0	0	284.0140453	0
ARSENIC	105.8574157	0.47150725	10.75257199	170.092791	0.620713387
ATRAZINE	15.12314947	16127.27895	1014.180337	9028.016279	10241.41228
BENZ (A) ANTHR	67.41867411	69.72553282	1122.390396	951.1579447	82.03836485
BENZ(GHI)PE	13.35510067	13.93430985	224.4364292	189.9673062	16.39335938
BENZENE	7523.662318	9385.867019	118997.6583	180569.9412	11822.06608
BENZO(A)PYRE	13.46140379	13.934267	224.4359215	189.9467185	16.39335938
BENZO(B)FLUO	20.03018886	20.90137446	336.6535599	295.6132198	24.59003906
BENZO(K)FLUO	6.676764349	6.967142184	112.2180617	94.97743485	8.196679688
BERYLLIUM	12.62200842	0.130615001	0.504071562	8.734334623	0.170953847
BUTADIENE,13	4300.473038	11492.72393	39880.46207	231871.4826	13500.07044
CADMIUM	7.309756038	0.665157464	4.214840896	62.66670547	0.860636118
CARBON TETRA	2.5827205	7.071348949	16.06920029	274.3111598	9.457648404
CHLOROFORM					

	Koochiching	Lac Qui Parle	Lake	Lake of the Woods	Le Sueur
ACENAPHTHEN	111.4162482	23.60101475	78.06759312	49.80439941	104.8472395
ACENAPHTHYL	2356.473441	500.3165544	1654.69419	1055.853268	2222.693734

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Lincoln Lyon Mc Leod Mahnomen Marshall

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	Rice	Rock	Roseau	St Louis	Scott
ACENAPHTHEN	205.781172	26.19540826	171.5889147	1449.23817	98.35246442
ACENAPHTHYL	4362.286306	555.3283933	3637.186125	30716.3462	2084.341603
ACETALDEHYDE	9.602615336	0.436786251	52.48258969	1351.881101	22.89890225
ACROLEIN	1.014018929	0.052676308	0.109047231	23719.27888	2.674298631
ACRYLONITRIL	114.335	26.58589	75.06743	630.9795	347.6731
ANTHRACENE	288.0923473	36.67350437	240.1661357	2028.096376	137.6900375
ANTIMONY	4.01625	0	19.2	604.9945295	7.416672519
ARSENIC	9.684166468	0.434251518	0.657729466	8797.393243	14.15619371
ATRAZINE	7850.842822	12939.8567	588.5869592	15.12314947	3857.508765

BENZ (A) ANTHR

	Sherburne	Sibley	Stearns	Steele	Stevens
ACENAPHTHEN	203.5353261	37.58	505.0908071	82.29698957	26.44600098
ACENAPHTHYL	4314.73855	796.696	10707.58639	1744.382417	560.6552207
ACETALDEHYDE	6.442597205	0	14.35980947	13.47476753	0
ACROLEIN	0.776975543	0	1.251062315	1.158878776	0
ACRYLONITRIL	148.1393	14.42289	182.329	115.5221	26.33576
ANTHRACENE	284.9484653	52.612	707.1255339	115.2143071	37.02440137
ANTIMONY	113.0001991	0	5.74875	0	0
ARSENIC	269.1722632	1.97193669	37.5994451	1.207799982	0.390082026
ATRAZINE	3078.762627	12305.9918	21804.88078	10504.01215	11029.21189
BENZ(A)ANTHR	407.3641845	75.38736341	1010.709353	165.4487775	52.93697824

BENZ(GHI)PE

	Wright	Yellow Medicine	Portable Sources	State Total
ACENAPHTHEN	313.0529433	31.68340088	0.044826114	14403.13077
ACENAPHTHYL	6636.410882	671.6880986	0.142769879	305294.3692
ACETALDEHYDE	9.641100964	0	18.51162205	62048.35083
ACROLEIN	1.145897699	0	2.243523821	98267.57042
ACRYLONITRIL	254.4235	34.49603	0	8369.087552
ANTHRACENE	438.2742214	44.35676123	0.047794496	20234.05133
ANTIMONY	0.159737345	0	0	1414.932798

ARSENIC

Appendix E: New York Toxic Emissions Inventory

New York's emission estimates are part of the regional report, but the state report was unavailable at time of publication.

For further information please contact: Mr. Rob Sliwinski New York Department of Environmental Conservation P.O. Box 3250 Albany, NY 12233 (T) 518.457.2823 (F) 518.457.0794 (E) rgsliwin@gw.dec.state.ny.us

Appendix F: Ohio Toxic Emissions Inventory

BACKGROUND

With a 1996 population of approximately 11,160,000, Ohio represents approxiamately 12.5

reported toxic emissions are a close representation of what would have been reported if there was a complete point source inventory.

			<i>, , , ,</i>	,	
	Adams	Allen	Ashland	Ashtabula	Athens
ACENAPHTHENE	337	1309	613	1242	731
ACENAPHTHYLENE	3814	14839	6949	14078	8285
ACETALDEHYDE		44005			
ACROLEIN		3800			
ACRYLAMIDE		0			
ACRYLONITRILILE		126100			
ANTHRACENE	449	1746	818	1656	975
ANTIMONY					
ARSENIC					

Table F-1: Ohio Emissions by County in pounds/year Champaign Clark Clermont Clinton Columbiana

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Table F-1: Ohio Emissions by County in pounds/year Coshocton Crawford Cuyahoga Darke

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		<i>,</i>	7 1		
	Delaware	Erie	Fairfield	Fayette	Franklin
ACENAPHTHENE	963	943	1424	344	12233
ACENAPHTHYLENE	10912	10686	16142	3894	138636
ACETALDEHYDE					
ACROLEIN					
ACRYLAMIDE	0				15
ACRYLONITRILILE	3194				
ANTHRACENE	1284	1257	1899	458	16310
ANTIMONY					
ARSENIC					
ATRAZINE	5743	7574	4837	10957	14058
BENZ (A) ANTHRACENE	3851	3772	5697	1374	48930
BENZO(G,H,I)PERYLENE	163	321	314	475	115



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Table F-1: Ohio Emissions by County in pounds/year Highland Hocking Holmes Huron

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Jackson

	Jefferson	Knox	Lake	Lawrence	Licking		
ACENAPHTHENE	962	612	2644	768	1661		
ACENAPHTHYLENE	10901	6938	29969	8699	18828		
ACETALDEHYDE							
ACROLEIN							
ACRYLAMIDE							
ACRYLONITRILILE			30842				
ANTHRACENE	1283	816	3526	13295	2215		
ANTIMONY							
ARSENIC							
ATRAZINE	961	494	8320	145	197		
BENZ (A) ANTHRACENE	3848	2449	10577	3070	6645		
BENZO(G,H,I)PERYLENE	129	321	204	881	256		
BENZENE	237789	151347	655247	242336	410698		
BENZO(A) PYRENE	641	408	1763	512	1108		
BENZO(B)FLUORATHNE	641	408	1763	512	1108		

	Logan	Lorain	Lucas	Madison	Mahoning
ACENAPHTHENE	544	3423	5536	484	3241
ACENAPHTHYLENE	6168	38790	62739	5482	36728
ACETALDEHYDE			1400		
ACROLEIN					
ACRYLAMIDE		0			
ACRYLONITRILILE		6860			
ANTHRACENE	726	4564	7381	645	4321
ANTIMONY					
ARSENIC					
ATRAZINE	8683	10079	4171	3680	14415
BENZ (A) ANTHRACENE	2177	13691	22143	1935	12963
BENZO(G,H,I)PERYLENE	554	181	1141	1845	161
BENZENE	135047	846202	1397930	119574	801146
BENZO(A)PYRENE	363	2282	3691	322	2160
BENZO(B)FLUORATHNE	363	2282	3691	322	2160
BENZO(K)FLUORATHENE	181	1141	1845	161	1080
BERYLLIUM					
BUTADIENE,13			27		
CADMIUM	4	26	42	4	25
CARBON TETRACHLORIDE	52	326	527	46	308
CHLOROFORM					
CHROMIUM	5	261	1	0	950
CHRYSENE	907	5704	9226	806	5401
COBALT					250
COPPER	177	0	242	0	29
DIBENZO(A,H)ANTHRACENE	181	1141	1845	161	1080
1,2 DIBROMOETHANE					
DIBUTYL PHTHALATE	6933	43599	70522	6161	41282

				,	
	Monroe	Montgomery	Morgan	Morrow	Muskingum
ACENAPHTHENE	184	7034	171	365	1003
ACENAPHTHYLENE	2087	79716	1942	4141	11362
ACETALDEHYDE					
ACROLEIN					
ACRYLAMIDE		56			
ACRYLONITRILILE					
ANTHRACENE	246	9378	229	487	1337
ANTIMONY		86			
ARSENIC					
ATRAZINE	11257	397	5679	919	7049
BENZ (A) ANTHRACENE	737	28135	686	1462	4010
BENZO(G,H,I)PERYLENE	390	61	2345	57	122
BENZENE	45532	1739340	42369	90332	247834
BENZO(A)PYRENE	123	4689	114	244	668
BENZO(B)FLUORATHNE	123	4689	114	244	668

	Noble	Ottawa	Paulding	Perry	Pickaway
ACENAPHTHENE	145	486	250	407	628
ACENAPHTHYLENE	1640	5503	2837	4607	7117
ACETALDEHYDE					341631
ACROLEIN					
ACRYLAMIDE					
ACRYLONITRILILE					
ANTHRACENE	193	647	334	542	837
ANTIMONY	89				
ARSENIC					
ATRAZINE	3163	240	2606	8220	3374
BENZ (A) ANTHRACENE	579	1942	1001	1626	2512
BENZO(G,H,I)PERYLENE	334	48	162	83	136
BENZENE	35777	120040	61886	100498	262636
BENZO(A)PYRENE	96	324	167	271	419
Area Sources

The area source inventory for this GLC inventory includes 9 sectors (out of a total of 14) which represent smaller emitting sources; wide spread sources and certain industrial sectors that cannot be completely considered in the point source inventory because of a lack of facility and process specific information. The area source inventory was developed using a top down approach with available statistical information, including energy demand statistics, census data, housing data, production statistics, employment information etc. The 1996 Ontario area source inventory contained 9 sectors with estimated emissions for 49 substances out of the 82 targeted toxics on the GLC substance list. The combined point and area source inventory emissions capture a total of 66 substances.

Architectural Surface Coating

VOC emissions from architectural surface coating were estimated by applying emission factors to the quantity of paint used per capita. The VOC emissions were then speciated into specific targeted air toxics.

Dry Cleaning

A perchloroethylene (PERC) emission factor of 0.375 lb/person/year was developed using provincial emissions from a provincial solvent usage survey. The provincial total was then distributed to the county level using population statistics.

Fuel Marketing

Emissions for fuel marketing were estimated using VOC speciation and toxic specific emission factors that were applied to county level fuel sales statistics. Emissions were estimated for Trucks in Transit Losses, Stage I (Gasoline Retail Operations - Balanced Submerged Filling), and Stage II (Filling Vehicle Gas Tanks - Vapour Loss and Liquid Spill Loss w/o Control) Losses.

Graphic Arts

Emissions for graphic arts were estimated using employee based emission factors. The SIC specific employment numbers used are from Statistics Canadas 1996 Manufacturing Industries of Canada: National and Provincial Areas document. The Canadian SIC used for this category is 281X (Commercial Printing Industries). The total provincial emissions were then apportioned to the county level using population statistics.

Industrial Surface Coating

The Canadian SICs used for this category are 2521-2561, 26XX, 3042, 305X, 31XX, 32XX, 3311, 3321. Emissions were calculated by speciating each toxic from the total VOC emissions. VOC numbers for all, except three SCC groups from this source category (Other

SCC groups were calculated using a per capita emission factor. Both categories of VOC emissions were then speciated into the targeted air toxics.

Publicly Owned Treatment Works

POTW emission were estimated using effluent flow information from all POTWs in Ontario. The individual POTW facilities were separated into facilities with the dewatering process and those without. Specific sets of flow based emission factors from FIRE were used to estimate emissions from facilities with the dewatering process and those without the dewatering process.

Residential Wood Combustion

Emission estimations were based upon merchantable fuelwood statistics. Softwood and hardwood statistics for merchantable fuelwood were provided by the National Forestry Database. Emission factors were used for the three wood burning stove types used in Ontario: conventional, catalytic, and non-catalytic. Total provincial wood stove emissions were apportioned to the county level according to regional wood use statistics and rural dwelling statistics from an Ontario wood use study and Statistics Canada respectively.

Residential Fuel Combustion

Residential Fuel Combustion emissions were estimated using residential fuel consumption data from Statistics Canada and emission factors. The two fuel types for which targeted toxic emissions were estimated are fuel oil and natural gas. Fuel was apportioned to the county level according to population statistics.

Traffic Markings

Emissions for traffic markings were based on total traffic paint used in each county, the air

Uncertainties also exist on the use of emission factor tables which vary in terms of data quality. In preparing this emission inventory, Ontario has further updated some of the RAPIDS emission factor tables with the most recent information from FIRE, AP-42, and EIIP.

RESULTS

Ontario-s 1996 Great Lakes Toxic Inventory included toxic estimates of 67 substances out of 82 Great Lakes air toxics. There are 5075 estimates for 468 different point sources and nine area source categories. There are 131 SCC codes and 101 SIC codes included in this Ontario inventory. Combined point and area source emissions for each county in Ontario are provided in the County Emissions table at the end of Ontario-s portion of the report document.

If more information is needed, please contact: Peter Wong Ontario Ministry of the Environment 125 Resources Road, East Wing Etobicoke, Ontario Canada M9P 3V6 Tel (416) 235-6130 Fax (416) 235-5818 e-mail: wongpe@ene.gov.on.ca

	Durham	Elgin	Essex	Frontenac	Grey
1,1,1-TRICHLOROETHANE	1,752	155	781	342	122
1,2-DIBROMOETHANE	5.49E-01	5.44E-02	3.07E-01	1.64E-01	4.37E-02
1,2-DICHLOROETHANE	37	4	19	10	3
1,3-BUTADIENE					
TCDD,2378	6.01E-06	2.57E-05	9.29E-06	1.79E-06	1.32E-05
TCDF,2378	5.69E-06	1.09E-04	2.50E-05	1.69E-06	5.41E-05
2,4,5-TRICHLOROPHENOL					
2,4,6-TRICHLOROPHENOL					
ACENAPHTHENE	98	40	70	93	62
ACENAPHTHYLENE	2,040	839	1,455	1,945	1,296
ACETALDEHYDE	54			86,062	
ACROLEIN					
ACRYLAMIDE					
ACRYLONITRILE					
ANTHRACENE	136	56	97	130	87
ANTIMONY		6	7.05E-01		3
ARSENIC	8	1	6	2	2
BENZ (A) ANTHRACENE	191	79	136	182	121
BENZENE	48,710	10,223	29,438	24,893	14,355

rable of the official contractions by obdining in poundary car							
	Huron	Kenora	Kent	Lambton	Lanark		
1,1,1-TRICHLOROETHANE	105	114	1,158	288	122		
1,2-DIBROMOETHANE		5.27E-02	7.71E-02	1.11E-01	3.72E-02		
1,2-DICHLOROETHANE	6.99E-01	3	11	29	3		
1,3-BUTADIENE				229,137			

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	Parry Sound	Peel	Perth	Peterborough	Prescott and
1 1 1_ΤΡΤΟΠΙΟΡΟΓΤΊλΝΕ	30	1 607	110	103	RUSSEII 83
	3 498-02	1 308+00	4 468-02	1 528-01	2 46 - 04
1 2-DICHLOROFTHANE	2.175-02	73	3	1.JZE-01 8	5 53F-01
1,2-DICHLOROEIHANE	2	13	3	0	0.03E-01
T, 3-BUIADIENE	E 22E 07	4 01 E 0E		1 650 06	0.700.07
TCDD, 2370	5.22E-07	4.ZIE-05	1.50E-05	1.65E-06	9.70E-07
	4.901-07	2 17E 02	0.59E-05	1.00E-00	9.19E-07
		2.1/E-02			
2,4,6-IRICHLOROPHENOL	COL	2.11E-01 100	2.2	100	0.0
ACENAPHIHENE	095	2 1 2 0	33	123	92
ACENAPHIHILENE	14,558	2,129	701	2,583	1,922
ACETALDEHYDE		246			
ACROLEIN		255			
ACRYLAMIDE		355			
ACRYLONITRILE	0.00	1.4.0	48	1 🗖 0	100
ANTHRACENE	972	142	47	172	128
ANTIMONY	6 6 6 7 7 9 1	22	3	6.89E-03	
ARSENIC	6.67E-01	76	1	2	1
BENZ (A) ANTHRACENE	1,364	199	66	242	180
BENZENE	130,731	85,076	8,809	28,865	18,586
BENZO(A)PYRENE	290	42	14	51	38
BENZO(B)FLUORANTHENE	418	104	20	74	55
BENZO(G,H,I)PERYLENE	277	66	13	49	37
BENZO(K)FLUORANTHENE	141	21	7	25	19
BERYLLIUM	3.97E-01	9	7.19E-01	1	7.36E-01
CADMIUM	705	15,049	1,273	2,176	1,305
CARBON TETRACHLORIDE	35	394	29	54	22
CHLORDANE					
CHLOROFORM	33	1,639	112	197	84
CHROMIUM	88	2,338	159	272	163
CHROMIUM (VI)		3.77E-03			
CHRYSENE	836	122	40	148	110
COBALT	281	6,074	507	868	521
COPPER	8	1,583	16	22	13
DIBENZO(A,H)ANTHRACENE	19	3	9.32E-01	3	3
DIBUTYL PHTHALATE	1	24	2	3	2
DIETHYLHEXYL PHTHALATE		4,409			
ETHYLBENZENE	4,541	123,470	269,807	69,068	8,191
ETHYLENE OXIDE		5,997			
FLUORANTHENE	1,351	203	65	240	178
FLUORENE	1,667	245	80	296	220
FORMALDEHYDE	732	14,929	1,160	1,988	1,174
GLYCOL ETHERS (MISC.)	2,702	56,244	4,763	8,160	4,887
HEXACHLOROBENZENE		8			
HYDRAZINE					
INDENO(1,2,3-C,D)PYRENE	78	50	4	14	10
LEAD	7	215	32	22	13
M-XYLENE	480	17,840	613	2,082	3
MANGANESE	21	301	17	31	19
MERCURY	4.76E-01	458	40	2	8.83E-01
METHYLENE CHLORIDE	3,376	782,863	6,162	10,556	6,289
METHYLENE(B)4-		2,205	223	1,166	
NAPHTHALENE	20,263	26,420	1,871	6,239	2,820
NICKEL	98	2,735	176	301	180
O-XYLENE	16,602	69,663	6,031	12,013	7,069
P-XYLENE	186	6.908	237	806	. 1

		,	, , ,	, ,	
	Prince Edward	Rainy River	Renfrew	Simcoe	Stormont, Dundas
1,1,1-TRICHLOROETHANE	20	54	133	451	260
1,2-DIBROMOETHANE		1.47E-02	7.52E-02	3.88E-01	7.00E-02
1,2-DICHLOROETHANE	1.31E-01	1	4	21	5
1,3-BUTADIENE					
TCDD,2378	3.28E-07	3.26E-07	1.26E-06	4.33E-06	1.92E-06

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	Victoria	Waterloo	Wellington	York	Prov. Total
1,1,1-TRICHLOROETHANE	81	633	273	59	310,906
1,2-DIBROMOETHANE	1.73E-02	4.96E-01	1.38E-01	9.30E-01	12
1,2-DICHLOROETHANE	1	27	8	43	744
1,3-BUTADIENE					229,137
TCDD,2378	9.26E-07	8.40E-06	3.65E-06	7.89E-06	3.88E-04
TCDF,2378	9.99E-07	1.86E-05	8.30E-06	7.88E-06	1.80E-03
2,4,5-TRICHLOROPHENOL					2.17E-02
2,4,6-TRICHLOROPHENOL					2.11E-01
ACENAPHTHENE	106	32	53	85	48,530
ACENAPHTHYLENE	2,218	669	1,112	1,776	360,980
ACETALDEHYDE		2,420	36	218	228,333
ACROLEIN					
ACRYLAMIDE					564
ACRYLONITRILE					18,849
ANTHRACENE	148	45	74	119	42,566
ANTIMONY	8.32E-03	7.21E-01	3.29E-01	2.84E-02	7,506
ARSENIC	1	7	3	10	60,763
BENZ (A) ANTHRACENE	208	63	104	166	46,530
BENZENE	21,475	25,447	16,751	40,851	5,073,924
BENZO(A)PYRENE	44	13	22	35	31,362

BACKGROUND

The Commonwealth of Pennsylvania conducted its portion of the Great Lakes Region air toxic emissions inventory for the calendar year 1996. This includes both Point and Area source data drawn from a variety of sources. With a 1990 population of 11,881,643, Pennsylvania represents approximately 13.7 percent of the total population of the Great Lakes Region. The table below

Fuel Oil Comb (Residential)	Gasoline Marketing (Stage II)
Gasoline Marketing (Truck Transit)	Gasoline Marketing (UST Breathing)
Graphic Arts	High Performance Coatings
Landfills	Machinery & Equipment
Marine Surface Coating	Metal Cans Surface Coating
Metal Furniture & Fixtures	Misc. Finished Metals
Misc. Manufacturing	Motor Vehicle Surface Coating
Other Special Purpose Coating	Pesticides
POTWs	Railroad
Traffic Line Painting	Wood Furniture

The 1996 emissions of criteria pollutants were first calculate for these sources using methodologies approved by the U.S. EPA. The data were then compared with the Point Source

unknown number of employees, the sample calculation used the above ratio to calculate the number of employees.

SAMPLE CALCULATIONS:

Counties with a known number of employees:

 $Emissions = (Emission Factor)(Employees)(ton conversion)(Activity Days)\left(\frac{SAF}{POS}\right)$

where: Emission Factor = 3,519 lbsVOC /employee/year

PopulationUnknown = 3,456,818 people (1995 data)² Activity Days = 5 days (1 year/52 weeks)(1 week/5 days)³ Seasonal Activity Factor = 0.25^{3} Peak Ozone Season = 0.25 years (3 months)³



Commercial and Consumer Solvent Use

Population = 547,592 (Delaware County)² Activity Days = 7 days 1 year/365 days³ Seasonal Activity Factor = 0.25^{3} Peak Ozone Season = 0.25 years (3 months)³

_____ () -

EmployeesUnknown	Employees Unknown
Population _{County} =	Population Unknown

where: Employees_{Unknown} = unknown number of employees in county Population_{County} = population of county with unknown number of employees Employees_{Unknown} Activity Days = 6 days $(1 \text{ year}/52 \text{ weeks})(1 \text{ week}/6 \text{ days})^3$ Seasonal Activity Factor = 0.25³ Peak Ozone Season = 0.25 years (3 months)³ Point Sources = 0.0645 lbsVOC/day (Allegheny County)⁹

Emissions	lbsVOC/ Employee year	Employees	Employees) -	ton lbs	year	

Total Employees = 3,436 Employees⁷ Employees_{Known} = 1,826 Employees⁷ Population_{County} = 83,998 People (1995 est. census)² Population_{Unknown} = 6,124,581 People (1995 est. census) 2E

Electrical Insulation

The volatile organic compound emissions from this source category result from the evaporation of the solvent used to insulate wire and cable. There were no point sources. The

therefore:



 $1995 \ County \ Population = 1,309,821 \ people \ (Allegheny \ County)^2$ $1990 \ County \ Dwelling \ Units = 541,261 \ Dwelling \ Units^{15}$ $1990 \ County \ Population = 1,336,449 \ people^2$ $\% \ DU_{FO} = \% \ Dwelling \ Units \ which \ use \ fuel \ oil = 1.9\%^{15}$ $County \ DU_{FO} = 1,290,615 \ Dwelling \ Units^{15}$ $Residential \ Fuel \ Oil \ Useage = Distillate \ Oil \ Useage + Kerosene \ Useage$ $= 826,651,000 \ gallons + 86,682,000 \ gallons$ $= 913,333,000 \ gallons^{20}$ $Activity \ Days = 7 \ days \quad 1 \ year/365 \ days^3$ $Seasonal \ Activity \ Factor = 0.08 \ (VOC), \ 0.08 \ (NOx), \ 0.43 \ (CO)^3$ $Peak \ Ozone \ Season = 0.25 \ years \ (3 \ months)^3$

VOC Emissions:





Seasonal Activity Factor = 0.15 (VOC), 0.15 (NOx), 0.35 (CO) Peak Ozone Season = 0.25 years (3 months)³

VOC Emissions:



Emissionsvoc tonsVOC day

Below are the total emissions for VOC, NOx, and CO for fuel oil combustion in Allegheny County. The VOC point sources, where present, were subtracted from the inventory of the corresponding county.

Emissions_{VOC} = Residential + Commercial - Point Sources = 0.0022 tonsVOC/day + 0.0133 tonsVOC/day - 0.0569 tonsVOC/day⁹ = -0.0414 tonsVOC/day 0.0000 tonsVOC/day

 $Emissions_{NOx} = Residential + Commercial$ = 0.0563 tonsNOx/day + 0.7821 tonsNOx/day= 0.8384 tonsNOx/day

 $Emissions_{CO} = Residential + Commercial$ = 0.0840 tonsCO/day + 0.4562 tonsCO/day= 0.5402 tonsCO/day

Gasoline Marketing

Gasoline marketing involves the operations typically associated with transporting gasoline from refineries to final consumption in gasoline powered vehicles. Evaporative emissions of VOCs occur at all points in the distributive process. The operations that were generally inventoried as area sources are gasoline dispensing outlets and gasoline tank trucks in transit. Bulk terminals and outlets are usually inventoried as point sources. VOC emissions result from the following sources: 1) truck transit, 2) tank truck unloading into underground storage tanks (Stage I), 3) vehicle fueling (Stage II), and 4) underground storage tank breathing.

Each category's AP-42 emission factor is based on the average daily throughput that was calculated from monthly data obtained from the Pennsylvania Department of Revenue. The vehicle miles traveled (VMT), which were obtained from the Pennsylvania Department of Transportation, was used to apportion the throughput to each county. Control efficiency and control effectiveness were applied to Stage I for each county. Rule effectiveness was applied to Stage II to each regulated county. There were no point sources for this source category. Each county's emissions were estimated per the following sample calculation.

SAMPLE CALCULATION:

<u>Stage I</u>:

 $Emissions = (EmissionFactor)(State Throughput)|\frac{CountyVMT}{StateVMT}|(Control Efficiency)(Rule Effectiveness)|$

(ton conversion)

where: Emission Factor = 0.3 lbs VOC/1000 gallons ¹⁹

State Throughput = 13,969,015 gallons/day ²⁷ County VMT = 19,013,693 VMT (Montgomery County) ⁵ State VMT = 289,714,968 VMT ⁵ Control Efficiency = 0.96 (1-0.96) Rule Effectiveness = 0.8 (1-0.8) ⁹

$$Emissions = \left| \frac{0.3 lbs VOC}{1000 gallons} \right| \left(\frac{13,969,015 gallons}{day} \right) \left(\frac{19,013,693 VMT}{289,714,968 VMT} \right) (1 - 0.96)(1 - 0.8) \left(\frac{1 ton}{2000 lbs} \right) \\ Emissions = 0.0011 tons VOC / day$$

<u>Stage II</u>:

 $Emissions = (EmissionFactor)(State Throughput)| \frac{CountyVMT}{StateVMT} | (Rule Effectiveness)(ton conversion)$

where: Emission Factor = 1.8 lbs VOC/1000 gallons (for counties with Stage II) 19 = 11.7 lbsVOC/1000 gallons (for counties without Stage II) State Throughput = 13,969,015 gallons/day 27 County VMT = 19,013,693 VMT (Montgomery County) 5 State VMT = 289,714,968 VMT 5 Rule Effectiveness = 0.9 (1-0.9) 9 (not applicable for counties without Stage II)

$$Emissions = \left| \frac{1.8 \, lbs VOC}{1000 \, gallons} \right| \left(\frac{13,969,015 \, gallons}{day} \right) \left(\frac{19,013,693 VMT}{289,714,968 VMT} \right) (1-0.9) \left(\frac{1 \, ton}{2000 \, lbs} \right)$$

Emissions = 0.0825*tonsVOC* / *day*

Underground Storage Tank Breathing:

 $Emissions = (EmissionFactor)(State Throughput) \frac{CountyVMT}{StateVMT} (ton conversion)$

where: Emission Factor = 1.0 lbs VOC/1000 gallon ¹⁹ State Throughput = 13,969,015 gallons/day ²⁷ County VMT = 19,013,693 VMT (Montgomery County) ⁵ State VMT = 289,714,968 VMT ⁵

 $Emissions = \left| \frac{1.0 \, lbs VOC}{1000 \, gallons} \right| \left(\frac{13,969,015 \, gallons}{day} \right) \left(\frac{19,013,693 VMT}{289,714,968 VMT} \right) \left(\frac{1 \, ton}{2000 \, lbs} \right)$ Emissions = 0.4584 tons VOC / day

Emissions = 0.4304 ions voc

<u>Truck Transit</u>:

 $Emissions = (EmissionFactor)(State Throughput) \frac{CountyVMT}{StateVMT} (ton conversion)$

$$Emissions = \left| \frac{\frac{13lbsVOC}{person}}{year} \right| (547\,592\,persons) \left(\frac{1ton}{2000\,lbs} \right) \left[\left(\frac{1\,year}{52\,weeks} \right) \left(\frac{1week}{5\,days} \right) \right] \left(\frac{025}{025} \right) - 03767\,tonsVOC\,day$$

Emissions = tonsVOC/day

SAMPLE CALCULATION:

Emissions = (*Emission Factor*)(*Precipitation Adjustment Factor*)(*Amount of Waste*)(*Activity Days*)

where: Emission Factor = 13.6 tonsVOC/10⁶ tons of waste ¹ Precipitation Adjustment Factor = 2.6 ¹ Amount of Waste = 20,959,149 tons of refuse (Bucks County) ¹⁹ Activity Days = 7 days 1 year/365 days

$$Emissions = \left| \frac{\frac{136 \text{ tons VOC}}{1,000,000 \text{ tons refuse}}}{\text{year}} \right| (2.6)(20,959,149 \text{ tons of refuse}) \left(\frac{1 \text{ year}}{365 \text{ days}}\right) \right|$$

Emissions = 2.0305 *tonsVOC* / *day*

Machinery and Equipment

The VOC emissions of from this source category result from the evaporation of the solvent

employee data from SIC code 373x obtained from the *Pennsylvania Industrial Directory*. Each county's emissions were estimated per the following sample calculation.

SAMPLE CALCULATION:

 $Emissions = (Emission Factor)(Employees)(ton conversion)[Activity Days]|\frac{SAF}{POS}|$

where:


Emissions = 1.7234 tons VOC / day

Metal Furniture and Fixtures

This source category includes the manufacturing metal household and office furniture such as beds, cabinets, desks, bookcases, and chairs. The emissions from point sources, where present, were subtracted from the emissions of the corresponding county. The emissions for each county were calculated per the sample calculation below using an employee emission factor and employee data from SIC codes 2514 and 2522 obtained from the *Pennsylvania*

$$Emissions = (Emission Factor)(Employees)(ton conversion)[Activity Days]\left(\frac{SAF}{POS}\right) - Point Sources$$
where: Emission Factor = 2,877 lbsVOC /employee/year¹
Employees = 99 employees (Westmoreland County)⁶
Activity Days = 6 days (1 year/52 weeks)(1 week/6 days)³
Seasonal Activity Factor = 0.25³
Peak Ozone Season = 0.25 years (3 months)³
Point Sources = 0.1765 tonsVOC/day (Westmoreland County)⁹

$$Emissions = \left| \frac{\frac{2,877 \, lbs VOC}{Employee}}{year} \right| (99 \, Employees) \left(\frac{1 ton}{2000 \, lbs} \right) \left[\left(\frac{1 year}{52 weeks} \right) \left(\frac{1 week}{6 \, days} \right) \left(\frac{0.25}{0.25} \right) - \frac{0.1765 \, tons VOC}{day} \right]$$

$$Emissions = 0.2799 \, tons VOC / day$$

Miscellaneous Manufacturing

This source category includes establishments primarily engaged in manufacturing products not classified in any other group such as jewelry, silverware, musical instruments, dolls, toys, games, pens, pencils, buttons, brooms, and caskets. There are no point source emissions. The emissions for each county were calculated per the sample calculation below using a capita emission factor and U.S. Census Bureau population data.

SAMPLE CALCULATION:

 $Emissions = (Emission Factor)(Population)(ton conversion)(Activity Days)\left(\frac{SAF}{POS}\right)$

where: Emission Factor = 0.6 lbs VOC/capita/year ¹ Population = 321,309 (Luzerne County)² Activity Days = 6 days (1 year/52 weeks)(1 week/6 days)³ Seasonal Activity Factor = 0.25^{3} Peak Ozone Season = 0.25 years (3 months)³

$$Emissions = \left| \frac{\frac{06lbsVOC}{person}}{year} \right| (321\,309\,persons) \left(\frac{ton}{lbs} \right) \left[\left(\frac{year}{weeks} \right) \left(\frac{week}{days} \right) \right] \left(\frac{week}{days} \right]$$

Emissions = tonsVOC/day

This source category includes the finishing of new vehicles such as cars, trucks, emergency



-0.3653 tons VOC / day

Emissions = 0.3766 tons VOC / day

 $Emissions = (Emission \ Factor)(Flow)(Industrial \ Discharge \ Adjustment)(tonconversion)(Activity Days)$

$$\left|\frac{SAF}{POS}\right|$$
 – Point Sources

where: Emission Factor = 0.00011lbsVOC /gallon flow/year¹ Flow = 91,623.71 million gallons (Allegheny County)²⁴ Industrial Discharge Adjustment = 16%¹ Activity Days = 7 days 1 year/365 days³ Seasonal Activity Factor = 0.35³ Peak Ozone Season = 0.25 years (3 months)³ Point Sources = 0.1240 tonsVOC/day⁹



Railroad Solvents

This source category includes the finishing of rail cars or locomotives for freight or passenger service. This does not include mining cars, and railroad car or locomotive repair establishments. There were no point source emissions. The emissions for each county were calculated per the sample calculation below using an employee emission factor and employee data from SIC code 374x obtained from the *Pennsylvania Industrial Directory*.

SAMPLE CALCULATION:

Emissions = (*Emission Factor*)(*Employees*)(*ton conversion*)(*Activity Days*)

Traffic Line Painting

Traffic paints are used to mark pavement in applications such as dividing lines for traffic lanes, parking space markings, crosswalks, and arrows. The markings are usually applied by state or local highway maintenance crews. Volatile organic compound emissions result from the evaporation of organic solvents during and shortly after application of the marking paint.

Point Sources = 0.0792 tonsVOC/day (Lancaster County)⁹





I GOIL					
	Adams	Allegheny	Armstrong	Beaver	Bedford
1,3-BUTADIENE	10.4000003	0	10.4000003	0.3402	31.19999915
ACETALDEHYDE					
ACROLEIN	0				
ACRYLONITRILE	0				
ANTIMONY					
ARSENIC	0.17424		3997.498752	4654.72311	0.0112409
BENZENE	73460.25202	426227.6033	46313.09333	82600.52891	63704.41845
BERYLLIUM			571.0628	664.89374	
CADMIUM	0.0191664		0.006506678	85.97295826	0.001236499

			,	7 1	<i>J</i>
	Berks	Blair	Bradford	Bucks	Butler
1,3-BUTADIENE	42121.08	176.7999977	0	0	0
ACETALDEHYDE	2556.110935			0.0144392	
ACROLEIN	958.536				
ACRYLONITRILE	0	46478			
ANTIMONY					
ARSENIC	3.99064356	0.07424438	0.33257368	0.59652856	0.9323804
BENZENE	218184.7515	112301.5929	80728.64368	232701.0437	89434.61868
BERYLLIUM	4.22247				577.106
CADMIUM	0.632972792	0.008166882	0.036583105	0.065618142	0.102561844

	Fayette	Forest	Franklin	Fulton	Greene
1,3-BUTADIENE	62.39999831	10.4000003	10.4000003	0	0
ACETALDEHYDE					
ACROLEIN					
ACRYLONITRILE					
ANTIMONY					
ARSENIC	0.0523538		0.0206726		2410.198573
BENZENE	58853.95154	2736.800063	122727.7743	28108.20043	23413.73794
BERYLLIUM					344.3122

	Lycoming	McKean	Mercer	Mifflin	Monroe
1,3-BUTADIENE	0	0	10.4000003	0	353.5999954
ACETALDEHYDE			0.9678824		0.00101664
ACROLEIN					
ACRYLONITRILE					
ANTIMONY					

					-
	Philadelphia	Pike	Potter	Schuylkill	Snyder
1,3-BUTADIENE	0	31.19999915	0	52.00000107	0
ACETALDEHYDE				0.0169536	
ACROLEIN					
ACRYLONITRILE					

SomersetSullivanSusquehannaTiogaUnion1,3-BUTADIENE0041.60000011135.19999380

	,		,			
	Venango	Warren	Washington	Wayne	Westmoreland	
1,3-BUTADIENE	20.8000006	0	0	0	93.59999746	
ACETALDEHYDE						
ACROLEIN						
ACRYLONITRILE					53206.6	
ANTIMONY						
ARSENIC	9.7605382	118.7292405	1057.572953	1.74346	0.91786352	
BENZENE	31826.60683	30186.22002	104971.3783	30900.60011	158580.0733BE	NZ072 -

			7 1
	Wyoming	York	Grand Total
1,3-BUTADIENE	0	0	58389.22537
ACETALDEHYDE		0.0014972	2573.891048
ACROLEIN		0.0014972	958.5600708
ACRYLONITRILE		0	2057452.2
ANTIMONY			752.0300698
ARSENIC	0.66102	1907.095567	34918.04619
BENZENE	20105.51904	223269.3414	5930380.25
BERYLLIUM		450.1654	8055.09366
CADMIUM	0.0727122	90393.41705	173824.7209

BACKGROUND

The State of Wisconsin conducted its statewide air toxic emissions inventory for the Great Lakes Air Toxic Emissions Inventory Project for calendar year 1996. With a 1996 population of 5,161,920, Wisconsin represents approximately 5.6 percent of the total population of the overall Great Lakes region. The table below provides a brief demographic overview of Wisconsin.

> Demographic Characteristics for the Wisconsin Area of the Great Lakes Regional Air Toxics Emissions Inventory

> > Wisconsin

ACRYLONITRIL	Acrylonitrile	Acrylonitrile	12
ANTHRACENE	Anthracene		
ANTIMONY	Antimony	Antimony & compounds, as Sb	179
ARSENIC	Arsenic	Arsenic and inorganic compounds, as As	12
ATRAZINE	Atrazine	Atrazine	1829
BENZ(A)ANTHR	Benz(a)anthracene	Benz(a)anthracene	12
BENZ(GHI)PE	Benzo(ghi))perylene		
BENZENE	Benzene (including benzene from gasoline)	Benzene	150
BENZO(A)PYRE	Benzo(a)pyrene	Benzo(a)pyrene	12
BENZO(B)FLUO	Benzo(b)fluoranthene	Benzo(b)fluoranthene	12
BENZO(K)FLUO	Benzo(k)fluoranthene		
BERYLLIUM	Beryllium	Beryllium and beryllium compounds, as Be	12
BIS(2-CLETH)	Dichloroethyl ether (bis(2-chloroethyl) ether)	Dichloroethyl ether	6000
BUTADIENE,13	1,3-Butadiene	1,3-Butadiene	6000
CADMIUM	Cadmium	Cadmium and cadmium compounds, as Cd	12
CARBON TETRA	Carbon tetrachloride	Carbon tetrachloride	12
CHLORDANE	Chlordane	Chlordane	179
CHLOROFORM	Chloroform	Chloroform	125

PARATHION	Parathion	Parathion	37
PCBS	Total polychlorinated biphenyls (PCBs)	Polychlorinated biphenyls (PCB)	0.05
PCDD	Total polychlorinated dibenzodioxins (PCDDs)		
PCDF	Total polychlorinated dibenzofurans (PCDFs)		

Landfills

The SIC for this category is 4953 (Refuse Systems). Emissions were calculated by applying the equations from the US EPA Landfill Air Emissions Estimation Model. The input variables needed to generate emissions for a single facility using these equations were tons of waste received per year, total years since the facility opened, and total years the facility has been closed. Landfill data were obtained from the WDNR, Bureau of Solid and Hazardous Waste. Emissions for each facility in a county were added to obtain emissions per county. Adjustments were made to emissions for facilities with flaring by applying a 75% capture efficiency and a 98% control efficiency in accordance to state regulations.

Publicly Owned Treatment Works

once per year. The miles of paved road in each county were obtained from the Wisconsin Blue Book 1997-1998. Park and forest roads were not included.

				Chippewa	Clark
CADIENE				19213.06	13667.47
CDF				2.03E-05	1.19E-05
CDD				7.73E-07	4.54E-07
RICHLOPHEN					
34DII					
ITHEN				522.46	493.45
ITHY				7619.17	7196.17
EHYDE				1993.93	1229.56
N				1865.92	1150.62
יייד					
	4.64	3.87	4.77	17.67	8.95

sions by County in pounds/year

j		,
Dane	Dodge	Door
14740.68	2491.03	698.80
1.52E-04	2.86E-05	1.07E-05
5.79E-06	1.09E-06	4.08E-07
85.00		
442.24	214.91	175.79
8403.49	4083.82	3340.66
29070.15	4912.58	1381.64
27203.84	4597.19	1290.74
131.87	69.73	64.64
602.48	292.78	239.50
	3.87	
107.83	29.42	3.10
18602.87	12415.57	1573.45
933.64	453.71	371.23
181182.01	58227.61	39032.70
1460.81	308.83	137.69
263.33	127.96	104.67
216.22	105.07	85.94
92.42	44.91	36.73
314.68	37.44	23.49
833.67	80.57	27.02
924.73	198.20	63.71
1.77	0.87	
548.65	2.7261	218.30

	Forest	Grant	Green	Green Lake	Iowa
1,3-BUTADIENE	7411.36	18357.15	13746.34	10260.86	10515.91
2378, TCDF	3.50E-06	1.83E-05	1.23E-05	7.65E-06	7.88E-06
2378, TCDD	1.33E-07	6.96E-07	4.68E-07	2.91E-07	3.00E-07
246, TRICHLOPHEN					
TOLUENE34DII			4.00		
ACENAPHTHEN	190.04	370.90	139.13	109.41	181.93
ACENAPHTHY	2363.33	3593.91	2643.95	2079.42	1762.99

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Table 1 1. Wisconstrict Enhanced by County in poundary ca					
Iron	Jackson	Jefferson	Juneau	Kenosha	
6793.04	9550.17	2609.81	10986.85	6827.84	
2.77E-06	6.65E-06	2.56E-05	8.79E-06	5.00E-05	
1.05E-07	2.53E-07	9.73E-07	3.35E-07	1.91E-06	
	Iron 6793.04 2.77E-06 1.05E-07	Iron Jackson 6793.04 9550.17 2.77E-06 6.65E-06 1.05E-07 2.53E-07	Iron Jackson Jefferson 6793.04 9550.17 2609.81 2.77E-06 6.65E-06 2.56E-05 1.05E-07 2.53E-07 9.73E-07	Iron Jackson Jefferson Juneau 6793.04 9550.17 2609.81 10986.85 2.77E-06 6.65E-06 2.56E-05 8.79E-06 1.05E-07 2.53E-07 9.73E-07 3.35E-07	

	Kewaunee	La Crosse	Lafayette	Langlade	Lincoln
1,3-BUTADIENE	559.95	33050.46	9477.42	11003.50	12565.21
2378, TCDF	7.19E-06	3.90E-05	6.25E-06	8.05E-06	1.08E-05
2378, TCDD	2.74E-07	1.49E-06	2.38E-07	3.07E-07	4.12E-07
246, TRICHLOPHEN					
TOLUENE34DII					
ACENAPHTHEN	88.93	272.57	91.79	302.64	335.48
ACENAPHTHY	1689.97	2641.25	889.57	3763.58	4171.90
ACETALDEHYDE	1104.29	6915.19	614.16	1939.56	2601.47
ACROLEIN	1033.39	6471.21	574.73	1815.04	1255.33
ACRYLAMIDE					
ACRYLONITRIL	32.70	51.31	28.95	15.23	10.61
ANTHRACENE	121.15	312.37	105.20	362.53	401.87
ANTIMONY					
ARSENIC	2.08	61.31	1.81	2.34	3.14
ATRAZINE	2810.91	2954.33	10653.63	909.65	516.29

	Manitowoc	Marathon	Marinette	Marquette	Menominee	
1,3-BUTADIENE	3733.98	36406.80	18363.04	8389.07		
2378, TCDF	3.20E-05	4.42E-05	1.65E-05	5.14E-06	1.15E-06	
2378, TCDD	1.22E-06	8.17E-05	6.30E-07	1.96E-07	4.37E-08	
246, TRICHLOPHEN						
TOLUENE34DII						
ACENAPHTHEN	220.17	972.13	481.46	171.97	49.77	
965CBS						
309

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Table I-1: Wisconsin Emissions by County in pounds/year

	Price	Racine	Richland	Rock	Rusk
1,3-BUTADIENE	9431.39	8899.81	9538.31	7161.30	9128.06
2378, TCDF	6.44E-06	6.78E-05	7.01E-06	5.56E-05	6.06E-06
2378, TCDD	2.45E-07	2.58E-06	2.67E-07	2.12E-06	2.31E-07
246, TRICHLOPHEN					
TOLUENE34DII					
ACENAPHTHEN	371.82	105.28	222.15	224.68	337.37
ACENAPHTHY	3741.21	2000.81	2152.77	4269.62	3394.60
ACETALDEHYDE	756.08	17551.35	24.29	14122.83	414.27
ACROLEIN	1504.54	16424.55	22.73	13220.14	387.67
ACRYLAMIDE					
ACRYLONITRIL	5.04	322.03	9.25	875.23	46.77
ANTHRACENE	418.14	143.44	254.58	306.10	379.41
ANTIMONY					
ARSENIC	18.88	19.76	2.04	377.35	1.75
ATRAZINE	426.14	3794.33	3183.79	13267.86	1458.72

Table 1-1. Wisconsin Enrissions by County in pounds year						
	Taylor	Trempealeau	Vernon	Vilas	Walworth	
1,3-BUTADIENE	10251.58	11977.34	11898.01	9725.82	2094.68	
2378, TCDF	7.12E-06	1.01E-05	1.03E-05	7.76E-06	2.94E-05	
2378, TCDD	2.71E-07	3.85E-07	3.94E-07	2.96E-07	1.12E-06	
246, TRICHLOPHEN						
TOLUENE34DII						

Table I-1: Wisconsin Emissions by County in pounds/year

Table I-1: Wisconsin Emissions by County in pounds/year

	Winnebago	Wood	State Total
1,3-BUTADIENE	8121.66	26025.92	833153.75
2378, TCDF	5.66E-05	2.92E-05	1.94E-03
2378, TCDD	2.16E-06	1.11E-06	3.10E-03
246, TRICHLOPHEN			12783.93
TOLUENE34DII			164.91
ACENAPHTHEN	173.36	468.38	19439.35
ACENAPHTHY	3294.21	6830.51	260667.91
ACETALDEHYDE	16016.76	62456.04	651286.24
ACROLEIN	15207.28	7896.26	328514.65
ACRYLAMIDE	255.00	1.47E-03	255.00
ACRYLONITRIL	89.80	66.00	3919.18
ANTHRACENE	236.17	581.36	23705.26

PREFERRED EMISSION CALCULATION METHODS

1. Survey

EIIP (Volume III - Area Sources) describes the ideal survey in detail.

2. Apply speciation profiles to the VOC emission estimate

Although the survey approach is the preferred method of emission estimation, it is costly and time consuming. Applying speciation profiles to a VOC emission estimate is the more feasible alternative. Architectural surface coating speciation profiles are obtained from the California Air Resource Board Speciation Manual (CARB, 1991, VOC Profile 196 and 717). The pollutants pertinent to RAPIDS for the solvent-based paint profile are Ethylbenzene, Isomers of Xylene and Toluene and for the water-based paint profile are Benzene and Methylene Chloride. All compounds are classified as VOC. The speciation profiles listed for the compounds are given in Table J-1.

Air	Toxin	Speciation		
(TOX)		(TOX/VOC), % by wt		
Solvent based paints	Ethylbenzene	4.3		
	Isomers of Xylene	2.6		
	Toluene	5.2		
Water based paints	Benzene	0.3		
	Methylene chloride	5.5		

Table J-1: Speciation Profile for Architectural Surface Coating (CARB, 1991)

EMISSION FACTOR

The emission factors used in calculating the VOC emissions were acquired from the STAPPA-

Table J-2: VOC Emission Factors and Paint Usage Factors

Paint Type	VOC Emission Factor	Usage Factors
	(Ib/gal)	

Alternate Method 1 -

2) Per Employee

Emissions=area employment in SIC 7532* employee EF of Ibs VOC/yr ÷ 2000 lbs/ton

Employee EF for VOC from EIIP document = 3,519 lbs/employee/yr

- 3) Per Capita Emissions = population * Ibs VOC/person/yr ÷ 2000 lbs/ton
 - *** Per capita EF for VOC in Rapids is 0.84 lbs/person/yr Per capita EF for VOC from EIIP document is 2.3 lbs/yr/person***

The per capita emission factor of 2.3 lbs per person is referenced from, <u>Procedures for the</u> <u>Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone,</u> <u>Volume I: General Guidance for Stationary Sources</u>.

SPECIATION

ASC: 2401005000 Profile Name Auto Body Repair Profile Code: 1194

 000071-43-2
 Benzene

 000084-74-2
 Dibutyl Phthalate

 000091-20-3
 Naphthalene

 000108-88-3
 Toluene

0.0151 lbs/lbs VOC 0.0001 lbs/lbs VOC 0.0146 lbs/lbs VOC 0.0865 lbs/lbs VOC An example calculation to determine CE is included below and based on the following background information:

New York had a regulation in place affecting the NY Metropolitan Area (NYMA) nonattainment area before the inventory year being developed. This regulation established controlled VOC limits of:

Touch up/repair products = 6.2 lbs VOC/gal (lacquers)

Full paint job products = 5.0 lbs/gal (enamels)

The average 1990 uncontrolled VOC content = 6.75 lbs VOC/gal per "Meeting the 15-Percent Rate-of-Progress Requirement Under the Clean Air Act," dated September 1993 as provided by STAPPA/ALAPCO. Additional information provided by EPA document, <u>Reduction of Volatile Organic Compound Emissions from Automobile Refinishing</u>, indicates that:

53% of total usage is for full paint jobs

47% is for touch up/repair jobs

Because New York State's existing regulation (6NYCRR Part 228) limits VOC below this uncontrolled average VOC content value, the calculation below needs to be made to estimate control efficiency.

CE=(0.47[(6.75-6.2)/6.75]+(0.53[(6.75-5.0)/6.75])*100 CE=17.6%

RP=50% based on good engineering judgement RE=80% EPA default based on good engineering judgement

Any federal regulations affecting the area source need to also, be considered. In the case of auto body refinishing, a federal regulation was promulgated in September, 1998. While it is arguable that VOC limits in auto body refinishing coatings have decreased in anticipation of this regulation, it is most likely that adjustments to actual emissions would be made beginning with the 1999 inventory year.

Spatial and temporal resolution

Emissions would most appropriately be represented by county except where attainment designations require a further breakdown. While EPA reports no evidence of seasonal variation, there may be a correlation between number of accidents and seasons. Accident statistics may be an indicator for increases or decreases in refinishing. Daily resolution of refinishing activity has been reported as being typically five days of the week.

RECOMMENDATIONS

Although the preferred method is to survey auto refinishing facilities including original coating facilities which may also refinish autos, each state and province needs to assess whether or not

techniques which enables states to estimate emissions for this source category when the preferred method is not feasible. When using other alternative methods, states should use the most recent emission factors available.

When estimating emissions using emission factors, each state and province will need to use the latest published emission factors available. It is important that point source estimates are subtracted out from the area source estimates. Additional work may need to be performed, as demonstrated within, in order to account for regulations and controls on the industry.

L. Consumer and Commercial Solvent Use

OVERVIEW

All quotes and information contained within are from the source, Emission Inventory

Emissions = Population x Per Capita Emission Factor

Given a population of 1 million persons for a particular area, the VOC emissions from personal care products would be:

1,000,000 persons x 2.32 lbs VOC' s/person/year

= 2,320,000 lb VOC/year = 1,160 tons VOC/year

HAP's

-Use of national average per capita emission factors adjusted for state or local emission limits. -Identify speciation profiles and apply them to the VOC emissions estimate developed using the alternative method.

The population based method is again the preferred method with adjustments made for state and local regulations on this industry.

An alternative procedure for estimating VOC and HAP emissions would include:

- Perform a survey of distributors and retailers or consumers of consumer and commercial products in the inventory region;
- Obtain data on the amounts of products sold or used in the inventory region;
- Estimate the total amount of VOC's (or HAP's) emitted in the inventory region from consumer and commercial products.

DATA NEEDED

Data needs for estimating the emissions of VOC's and HAP's from this source category are as follows:

Population-based method:

- Population in the inventory area.
- National average per capita emission factors.
- Information on state and local regulations.

Survey method:

-Product type.

-Product amount distributed or used by type (weight or volume).

-Product density.

Table L-3: Per Capita Consumer and Commercial Solvent HAP Emission Factors by Category (Ib/yr/person).

Pollutant	Personal	Household	Automotive	Adhesives	FIFRA-	Coatings	Misc.	Overall
	Care	Products	Aftermarket	&	Regulated	&		Emission
	Products		Products	Sealants	Products ^b	Related		Factor
						Products		(lb/yr/person)
Acetamide	1.38E-07							1.38E-07
Acetophenone						8.53E-06		8.53E-06
Acrylic acid				3.94E-09				3.94E-09
Benzene			4.72E-06					4.72E-06
Carbon						4 10E-10		4 10E-10
tetrachloride						4.102-10		4.100-10
Chlorobenzene					7.16E-02	1.51E-05		7.16E-02
Chloroform			3.60E-05			9.55E-04		9.91E-04
Dibenzofurans				8.07E-06				8.07E-06
1,4-		4 70E-02			3 52E-02			8 31E-02
Dichlorobenzene		4.792-02			J.JZL-02			0.312-02
1,2-	4 62E-06	3 52E-08						4.65E-06
Dichloroethane	4.022 00	0.02E 00						4.000 00
1,3-					1 60E-01			1 60E-01
Dichloropropene					1.002 01			1.002 01
Dimethyl formamide	2.71E-05		2.78E-08	2.29E-07			7.43E-06	3.49E-05
1,4-Dioxane				1.09E-05				1.09E-05
Ethyl benzene		2.56E-06	7.51E-05	1.36E-05	1.30E-03	6.86E-04		2.07E-03
Ethylene oxide					1.51E-02			1.51E-02
Formaldehyde		6.74E-06		2.51E-05	3.81E-04	8.55E-04		1.26E-03
Glycol ethers	1.52E-05	5.31E-03	2.69E-02	1.28E-04	5.65E-03	2.24E-03	2.42E-04	4.04E-02
Hexane		2.09E-03	3.53E-03	7.83E-02		2.39E-03		8.63E-02
Hydrochloric acid		1.75E-06						1.75E-06

When estimating emissions using emission factors, each state and province will need to use the latest published emission factors available. It is important that point source estimates are subtracted out from the area source estimates. Additional work may need to be performed, as demonstrated below, in order to account for regulations and controls on the industry.

Adjusting for regulations and control of VOC and HAP's

EFA	=	emission factor for pollutant A
Q	=	activity factor for category
CE	=	control efficiency/100
RP	=	rule penetration/100
RE	=	rule effectiveness/100
UAE _A	=	uncontrolled area source emissions of pollutant A
CAE _A	=	controlled area source emissions of pollutant A

Adjustments to preferred method using emissions factors and activity data

Adjustments to survey method

Example:

New York has a regulation in place affecting various product subcategories of the categories listed in Table L-3. Hair spray, antiperspirants, deodorants, and all purpose cleaners had limits on the % VOC by weight of the products in these subcategories pursuant to 6NYCRR Part 235. The products regulated make up only parts of several categories listed in Table L-3. Therefore, when estimating emissions, CE and RP need to be calculated per affected category (see Table L-3) as follows:

RP = per capita emissions of regulated portion of category/per capita emissions of all products in category)* 100

- RE = 80% EPA default based on good engineering judgement (RE of 100 for federal regulation)
- CE = (Uncontrolled VOC content controlled VOC content)/uncontrolled VOC * 100

Calculate speciateor defauc5/uncontrollori and R s[(r)4.-eCw tent)792 T-*r 5/u.6(oEpol)5.,4.2(E)(oEpol)5

aected categuegculnt Tw[(Ex(be cal)(nt cul)-4.h3 Tw[etp-)1erriExe-4.5(cul)-4.h3 Tw3.aseabove.9.2())2.1

Spatial and temporal resolution

Emissions would most appropriately be represented by county except where attainment designations require a further breakdown. Consumer and commercial product use is not influenced by season. While some exceptions can be noted as with pesticide use and with products like windshield washer (which typically has a higher VOC content in colder climates and seasons), there is no significant difference in the use between seasons. Daily resolution of product use is 7 days per week.

Chromium electroplating and anodizing operations include hard chromium, decorative chromium, decorative trivalent chromium, and chromic acid anodizing. Chromium electroplating and anodizing operations produce chromic acid mists. As these mists escape into the air, chromium emissions are released. As a result, these operations produce significant emissions of hexavalent chromium (nt c)9(v)iec7.4(i)-3.8(um)]TfcvmpoundchroThis s.2(a)4(um)]T2.9(will fi)-0

Emission Factors

There were no emission factors found for any of the applicable AMS codes in the FIRE database. The following emission factors were found in FIRE for the corresponding SCC codes.

Pollutant	SCC Code	Description	Factor Quality	Emission Factor (Ib/1000 amp-hr)
Chromium VI	30901018	Hard Chrome - Electroplating	В	0.12
Chromium VI	30901028	Decorative Chrome - Electroplating	D	0.033
Chromium VI	30901038	Chromic Acid Anodizing (uncontrolled)	D	2.0 (1b/1000hr-ft ²)
Chromium VI	30901038	Chromic Acid Anodizing (packed bed scrubber)	D	0.0096 (Ib/1000hr-ft ²)

Table M-1: Emission Factors from FIRE 5.1B

All emission factors are from FIRE 5.1, Version B, but are referenced from EPA AP-42, Supplement B, October 1996.

Because emissions from chromium electroplating are considered area source emissions, the final emissions estimates will be included in the inventory with the appropriate AMS code, A2309100010 or A2309100050.

Facility Identification

Applicable chromium electroplating facilities were identified by using the Initial Notification forms submitted to the PCA by electroplating facilities as required by the NESHAP for chromium electroplating facilities (subpart N). The initial notification forms provided information such as type of process, rectifier capacity (amperes), and location of the facility. Only those facilities with hexavalent chromium operations were included for the inventory. Trivalent chromium operations are significantly less toxic. In addition, emission factors and calculation methods for trivalent chromium were difficult to find.

Although some electroplating facilities do have fume suppressant equipment or incorporate some other type of emissions control method, the emission factors from FIRE are for uncontrolled systems. Therefore, these factors will be applied for all electroplating operations. One chromic anodizing facility in Minnesota has a packed bed scrubber for emissions control, but this facility is included in the point source inventory and therefore, the emission factor for chromic anodizing with a packed bed scrubber is shown in Table M-1 for reference.

Bo-Decor Metal Finishing	Dakota	dec. hex	1040	Amp-hr	
D.S. Manufacturing	Goodhue	dec. hex	2,265,655	Amp-hrs	
Douglas Corp. Plating Division	Hennepin	dec. hex	50,000,000	Amp-hr	\checkmark

County	Dec. Hex Emissions	Hard Chrome Emissions	Anodizing	Hexavalent Chromium Emissions	Total Chromium Emissions
Benton	20.59			20.59	27.46
Crow Wing	34.65			34.65	46.2
Dakota	0.003			0.003	0.004
Goodhue	7.48			7.48	9.97
Hennepin	178.05	1238.8	101.55	1518.4	2024.5
McLeod	0.99	40.8		41.79	55.72
Ramsey	0.24			0.24	0.32
St. Louis	0.17			0.17	0.23
Steele	7.42			7.42	9.89
Watonwan	10.33			10.33	13.77

Table M-3: Chromium Emissions (Ibs) by County

Total chromium emissions are calculated assuming that hexavalent chromium is 75% of total chromium emissions.

Those facilities which are included in the point source inventory (EIS) are not included in this summary.

REFERENCES

Strong, Phyllis, 1995. Minnesota Small Business Assistance Program, Minnesota Pollution Control Agency. Conversation with Cathy Tran, October 2, 1995.

U.S. Environmental Protection Agency. AP-42, Supplement B, Compilation of Air Pollution Emission Factors, Section 12.20. Oct. 1996.

NESHAP Subpart N - 1997 Compliance Certification Reports

N. Drycleaners

General Hierarchy of Methods

Coin operated

- local per facility emission factor (through survey/permits)
- local per machine factor from commercial dry cleaners
- national per employee emission factor

Commercial/Industrial

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• Xylenes

These pollutants came from the following speciation profiles in RAPIDS: 0085, 1193, 1196 and 9017. Profile 0085 is 100% perc while profile 1193 looks to be for petroleum solvent dry cleaning. The other two profiles are composites (sometimes with degreasers) and probably shouldn't be used.

Point source emission factors exist for dry cleaners in RAPIDS. No area source emission factors exist in RAPIDS for dry cleaners.

AP-42 has emission factors on a per capita basis and machine basis.

Reference Documents

The following are good reference documents to read about calculating emissions from dry cleaners

- AP-42 Section 4.1 (<u>www.epa.gov/ttn/chief/ap42.html</u>)
- EIIP Document Volume III: Chapter 4 (<u>www.epa.gov/ttn/chief/eiip/techrep.htm</u>)

Method to use for RAPIDS calculations

For states that have the manpower, need, rules or capability, a survey is the way to go. This method should give accurate emissions that were based upon actual usage. Since emissions from the dry cleaners can be significant, some calculation methodology would need to be applied to the sources that do not submit the questionnaire to have a complete inventory.

Other states should be able to calculate emissions using per capita factors, at a minimum. Data available to the state will determine if the state uses employee based or population based emission factors. I would imagine that every state should have population by county. The Census Bureau (www.census.gov) does have data on number of employees per county per SIC code called County Business Patterns. This data can be obtained at www.census.gov/epcd/cbp/view/cbpview.html.

Another possible option is to use the data compiled for the 1993 inventory and convert that to a population based emission factor. For the Pilot Project Inventory compiled by Illinois, Indiana and Wisconsin, the calculated per capita emission factors for Illinois and Wisconsin were very close. Again, a state specific emission factor should probably override the national per capita factor.

Emission Factors

From EIIP

Subcategory	Reactive VOC	Total Organics
Subcategoly	(lb/year/employee)	(lb/year/employee)
All solvents (total)	1,800	2,300
Halogenated Solvents		
PERC, TCA and CFC 113		980
Coin Operated		52
Commercial/Industrial		1,200
Mineral Spirits and Other	1,800	1,800
Unspecified Solvents		

On a per-unit basis: 0.8 tons/facility-year (assumes that average coin-op facility has two dry

O. Gasoline Marketing

DESCRIPTION OF EMISSION SOURCES

Currently, there are essentially two types of fuel dispensed at gasoline service stations to consumers in the Great Lakes States and Ontario, unleaded gasoline and diesel. As a result of the low volatility of diesel fuel, the evaporative emissions from diesel fuel at service stations are very small and considered negligible. However, the evaporative emissions from gasoline fuel are significant and will be discussed in this section. The following emissions are covered:

a) delivery trucks in transit;

b)

Table O-1.1	SCC Codes for	Transportation of	Gasoline
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FIRE SCC Code	Description	
406001	Petroleum and Solvent Evaporation Transportation and Marketing of Petroleum Products Tank Cars and Trucks	
40600162	Gasoline: Loaded with Fuel (Transit Losses)	
40600163	Gasoline: Return with Vapor (Transit Losses)	
FIRE AMS Code	Description	Equivalent
		SCC
A 2505030	Storage and Transport Petroleum and Petroleum Product Transport Truck	SCC

Identification of Emission Factors

There are four sources of information that contain the emission factors regarding gasoline service station operation, i) AP42-Chapter 5 Section 2^{1} , ii) Emission Inventory Improvement Program, Volume III, Chapter 11^{2} , iii) FIRE 6.1 (Factor Information Retrieval System Version 6.1)³, and iv) other technical documents⁵. A search of the first three sources revealed some emission factors on VOCs. Reference 5 provided a HAP profile on gasoline (Table 0.1.2) and was used to generate a speciation profile for Benzene, Ethylbenzene, Naphthalene, Toluene, and Xylene. Only Ethylbenzene is included in the GLC 49 substance list.

Since the emissions from gasoline transportation are inventoried under area sources, new AMS codes are created for this GREAT LAKES COMMISSION (GLC) inventory and will be used to identify the sources. In FIRE 6, there are no associated emission factors for the AMS codes. The emission factors from the equivalent SCC codes will be applied as state-specific emission factors. A state-specific VOC speciation profile will be created for HAPs when there are no direct emission factors for the concerned HAPs in FIRE. Table 0.1.3 presented a summary of the available emission factors from FIRE and the HAP profile.

НАР	Weight Perc	entage
Benzene	0.9%	Ib/Ib VOC
Ethylbenzene	0.1%	Ib/Ib VOC
Naphthalene	0.5%	Ib/Ib VOC
Toluene	1.3%	Ib/Ib VOC
Xylenes	0.5%	Ib/Ib VOC

Table O-1.2 HA	P Profile in Gasoline Vapor
----------------	-----------------------------

Ethylbenzene	1.000E-3	Lb per Ib of VOC	UNCONTROLLED	HAP SPECIATE
Naphthalene	5.000E-3	Lb per lb of VOC	UNCONTROLLED	HAP SPECIATE
Toluene	1.300E-2	Lb per Ib of VOC	UNCONTROLLED	HAP SPECIATE
Xylene, mixed isomers	5.000E-3	Lb per lb of VOC	UNCONTROLLED	HAP SPECIATE

Notes:

1. EIIP document recommends the midpoint value of the typical range, i.e. 5.000E-3 lb/1000 gallon throughput 2. EIIP document recommends the midpoint value of the typical range, i.e. 5.500E-2 lb/1000 gallon throughput

3. This factor is the sum of transit losses (loaded with fuel and return with vapor).

- LEF = Loaded tank truck in-transit emission factor (lb/1,000 gallons throughput)
- UEF = Unloaded tank truck in-transit emission factor (lb/1,000 gallons throughput)

GASOLINE SERVICE STATIONS

Introduction

There are two stages of fueling losses from gasoline fuel. Stage I fueling losses occur at the gas retail operations and result from truck delivery drop losses and underground tank breathing losses. Stage II fueling losses occur via the filling of vehicle gas tanks and include refueling losses from motor vehicle tanks and spillage.

Source Identification

Gasoline service stations are categorized under SIC 5541 in the Standard Industrial Classification Code 1972, and under 44711 (gasoline service station with convenience store) and 44719 (other gasoline service station) in the North America Industry Classification System 1997 (NAICS).

Table O-2.2 Emission Factors for Gasoline Service Stations (Stage I and II)

Pollutant	Emission Factors	Remarks	Reference
SCC 40600301:	Petroleum and Solvent Evaporation		
	Transportation and Marketing of Pe	troleum Products	
AMSA2501060052	Gasoline Retail Operations - Stage		
	Splashing Filling		

SCC 40600306:	Petroleum and Solvent Evaporation
	Transportation and Marketing of Petroleum Products
AMS A2501060053	Gasoline Retail Operations - Stage I
	Balanced Submerged Filling
Xylene, mixed isomers 4.500E-1 mg per L Gas Stored The Stage I emissions of a specific pollutant from gasoline filling operations in a county is estimated by the following formula:

 $EM_{fill} = [(BQ * P_{splash} * EF_{splash}) +$ (BQ * P_{submerged} * EF_{submerged}) + (BQ * P_{balsub} * EF_{balsub})] / 100,000 (eq. 0.2.1) Where EM_{fill} = Annual emission of a pollutant in a county (lb/yr) BQ = Total annual consumption of gasoline in a county (gal) = Percentage of gasoline filling using splash method (%) **P**_{splash} EF_{splash} Emission factor of pollutant for splash filling (lb/1000 gal) $P_{submerged}$ = Percentage of gasoline filling using submerged method (%) EF_{submerged} = Emission factor of pollutant for submerged filling (lb/1000 gal) = Percentage of gasoline filling using balanced submerged method Pbalsub (%) EFbalsub = Emission factor of pollutant for balanced submerged filling (lb/1000 gal)

Stage I: Gas Retail Operations - Storage Tank Breathing and Emptying Storage tank breathing losses occur daily and are attributed to gasoline evaporation that results from temperature and barometric pressure changes. As gasoline is withdrawn from the tank fresh air enters and enhances evaporation. This has a major effect on these emissions.

The Stage I emissions of a specific pollutant from storage tank breathing/emptying in a county is estimated by the following formula:

	EM _{breath} :	= B(Q * EF _{breath} / 1,000	(eq. 0.2.2)
Where	EM _{breath} BQ EF _{breath}	= = =	Annual emission of a pollutant in a county (lb/yr) Total annual consumption/throughput of gasoline Emission factor of pollutant for splash filling (lb/	in a county (gal) 1000 gal)

Stage II: Motor Vehicle Refueling - refueling

Service station vehicle refueling also produces evaporate emissions. Vehicle refueling emissions result from vapors displaced from the automobile tank via dispensed gasoline and from spillage. The quantity of displaced vapors depends on gasoline temperature, auto tank

	$EM_{refuel} =$	BC	Q* Prefuel * EFrefuel + BQ * Prefuel_con * EFrefuel_con (eq. 0.2.3)
Where	EM _{refuel} BQ P _{refuel} EF _{refuel}	= = =	Annual emission of a pollutant in a county (lb/yr) Total annual consumption/throughput of gasoline in a county (gal) Percentage of gasoline dispensed without Stage II control (%) Emission factor of pollutant for vehicle refueling without Stage II control (lb/gal)
	P _{refuel_con} EF _{refuel_con}	=	Percentage of gasoline dispensed with Stage II control (%) Emission factor of pollutant for vehicle refueling with Stage II control (Ib/gal)

Stage II: Motor Vehicle Refueling - Spill

Other evaporate emissions from vehicle refueling include spillage loss which is a result of prefill and postfill nozzle drip and from spit-back and overflow from the vehicle's tank filler pipe during filling.

The Stage II emissions of a specific pollutant from spillage loss in a county is estimated by the following formula:

	EM _{spill} =	BQ	* EF _{spill} / 1,000		(eq. 0.2.4)
Where	EM _{spill}	=	Annual emission of a	a pollutant in a count	ty (Ib/yr)
	BQ	=	Total annual consum	ption/throughput of	gasoline in a county (gal)
	EF _{spill}	=	Emission factor of po	pllutant for spilling l	oss (Ib/1,000 gal)

REFERENCES

- 1. USEPA, "Compilation of Air Pollutant Emission Factors, 5th Edition, Volume I and Supplements, Section 5.2", AP-42, U.S. Environmental Protection Agency, January 1995
- 2. USEPA, "Emission Inventory Improvement Program documents, Volume III: Chapter 11>", U.S. Environmental Protection Agency, September 1997
- 3. USEPA, "User Guide to Mobile 5B", U.S. Environmental Protection Agency, September 1996
- 4. USEPA, "Factor Information Retrieval System Version 6.1", U.S. Environmental Protection Agency, November 1998
- 5. USEPA, "Technical Guidance Stage II Vapor Recovery Systems for Control of Vehicle Refueling Emissions at Gasoline Dispensing Facilities, Volume I, EPA-450/3-91-022a, November 1991.

P. Graphic Arts

POLLUTANTS OF CONCERN

The following HAPs are associated with the this source category

* Toluene * Xylene * Trychloroethylene Toluene Diisoyanate Dibuthyl Phthalate

* Obtained from those reported by establishments in SIC 27%% to the Wisconsin emissions inventory.

AMSCODESFOR THISCATEGORY

A2425000 All Processes A2425010 Lithography A2425020 Letterpress A2425030 Rotogravure A2425040 Flexography

EMISSION FACTORS

No toxic emission factors were found in FIRE, EIIP or AP-42. The following speciation factors were found:

SCC: 2425040000, 2425040999 Profile Code: 1086 Process: Printing/Flexographic Pollutant: Toluene EF: 0.0648lb/lb TOG

AMS: 242500000, 2425000999 Profile Code: 1191

Pollutant: Dibuthyl Phthalate EF: 0.099991b/Ib TOG

Pollutant: Toluene Diisoyanate EF: 0.0003lb/lb TOG

EIIP'S EMISSION ESTIMATION METHODOLOGY REVIEW

VOCs:

Release to the atmosphere are from evaporation of the VOC contained in the raw materials used in the process (inks, fountain solutions and cleaning agents).

The three main approaches to estimating VOC emissions:

Facility Survey Ink sales emission factor method Per capita emission factor method (NOT RECOMMENDED FOR HAPs)

The facility survey method provides the most accurate information. The Ink sales emission factor method is recommended over the per capita method for speciating HAPs.

DATA NEEDS

For facility survey

Type of printing Number of employees involved in the printing operation from the Census Bureau's report Statistics for industry Groups and Industries. State information is also available from the state's departments of industry.

- Correct for point sources in the state.
- Apportion statewide ink sales data for each type of printing.

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ASSOCIATED TOXIC POLLUTANTS

The EPA's *Speciate* database contains fifteen different profiles associated with various surface coating operations. According to those profiles, eight of the 79 target compounds may be produced. These are Benzene, Ethylbenzene, Ethylene Oxide, Glycol Ether, Methyl Chloride, O-Xylene, P-Xylene, and Toluene. Although the profiles do not appear to include Lead, it is also possible that small amounts of Lead based coatings are still in use.

By Solvent	Profile
Naptha	0282
Butyl Acetate	0288
Butyl Alcohol	0289
Cellosolve	0290
Methyl Alcohol	0291

Table O-1	Profiles	in the 9	Sneciate	Database
	11011162		operiare	Dalabase

OTHER AVAILABLE METHODS Speciation of VOC emissions

R. Marine Vessel Loading, Ballasting and Transit

AMS-SCC Code 2505020120

Method 1

The first method was found in AP 42 Chapter 5: *Petroleum Refining*. The method involves applying VOC emission factors to the amount of fuel transferred. There are several VOC emission factors based on previous barge load and vessel tank condition. In RAPIDS, the speciation profile for barge loading is 1190. The speciation profile is based on Total Organics (TOG). It is assumed that a 1:1 ratio exists for VOC: TOG.

Table R-1: Speciation Profiles for Toxins Associated with Marine Vessel Loadi

Toxic	Speciation (tox/tog), % by weight
Benzene	3.25
Ethylbenzene	4.07
Naphthalene	0.8

S. Municipal Landfills

PREFERRED METHOD (landfill based)

The preferred method requires the following information:

- landfill design capacity, amount of refuse in place or annual refuse acceptance rate
- methane generation rate
- potential methane generation capacity
- NMOC concentration in landfill gas
- Toxics concentration in landfill gas
- years the landfill has been in operation
- controls in place
- has the landfill been used for disposal of hazardous waste?

The calculation methodology is AP-42. The LAEEM program (Landfill Air Emissions Estimation Model) calculates emissions using AP-42 methodology

• provides defaults for methane generation rate, potential methane generation capacity and NMOC concentration. AP-42 also provides concentrations for HAPs.

The alternative methods are really variations on the preferred method. The difference is in the detail of data needed to calculate or the assumptions made. For all methods, the minimum information for using AP-42 or LAEEM is waste in place and the open and close dates for the landfills. Some examples of simplifying assumptions are:

- acreage of the landfills and landfill depth substituted for waste in place
- assumptions for open and close dates (opened 25 years before inventory year or if only the closed date is known, assume waste received for 10 years)
- estimate waste in place by using estimate of capacity and percent filled

ALTERNATIVE METHOD (population based)

Information needed:

- population figures for the inventory year and the 24 years previous
- use the waste generation factor of 0.69 tons/person/year of waste generated
- convert to Mg by multiplying by 0.9072
- use the annual waste estimates in LAEEM or calculate average annual waste estimates and use that value in the equation

POLLUTANTS EMITTED PERTINENT TO RAPIDS

- 1,1,1-trichloroethane
- 1,2-dichloroethane
- •

- Carbon tetrachloride
- Chloroform
- Ethylbenzene
- Mercury
- Methylene chloride
- Perchloroethylene
- Toluene
- Trichloroethylene
- Xylenes

There is a speciation profile (0202) in RAPIDS which shows pollutants of perchloroethylene, toluene and xylene. These factors are probably out of date since the landfill section of AP-42 was updated recently.

T. Pesticides

AGRICULTURAL PESTICIDES

Emission factors for pesticides in FIRE are in Kg per hectare. The conversion to acres is 1 hectare equals 2.47 acres. The number of acres harvested for each crop by county can be found in the 1992 Census of agriculture.

http://www.nass.usda.gov/census/census92/atlas92/datafile/**st.txt ** insert 2 letter state abbreviation

A list of active ingredients used on a given crop can be obtained from each state's Department of Agriculture. For example, in Ohio, atrizine is the ingredient used almost exclusively on corn. Most commonly used pesticides on crops can be found at:

http://130.118.109.185/pnsp/crop/corn.html.

Substitute wheat, soybean, etc. in the address for other crops.

Once you know the method of application (emission factors are broken down by application method) multiply the appropriate emission factor from FIRE by the number of hectares harvested per county for that crop to get each county's emissions.

Example

Adams County

15792 acres of corn harvested. Converting to hectares equals 39006 hectares. A trizine applied by spraying has an emission factor of 1.800E-1 kg per hectare of pesticide applied.

Multiply 1.800E-1 * 39006 to obtain atrizine emissions used in Adams County in 1992. Multiply by .0011023 to get tons used.

7.7 tons atrizine used in

NON AGRICULTURAL PESTICIDES

Since non agriculture use of pesticides account for less than 25% of all pesticide use, the use of per capita emission factor is justified when compared with a survey approach of government agencies, commercial exterminators, lawn care companies, and consumers pesticide buying habits.

A per capita FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) emission factor is 1.78 E+00 RVOC (Ibs/yr/person).

If active ingredient is known, the total tons of FIFRA used in 1992 in the US was 1411632.3.

U. Publicly Owned Treatment Works

OTHER AVAILABLE METHODS

V. Residential Fuel Combustion

RESIDENTIAL FUEL COMBUSTION

Energy consumption by households by Census Region and Division is available from The Energy Information Administration State Energy Data Report 1995 (by State). Internet address is www.eia.doe.gov/pub/pdf/multi.fuel/

Energy is broken down into electricity, natural gas, fuel oil and liquefied petro gas (LPG) and coal.

Emission factors from the MN methodology for Residential Fuel were reviewed and found more than worthy of use.

Pollutant	Factor (Ib/MMBTU)	SCC
	Distillate Fuel Oils	
Arsenic	4.2 x 10-6	10300501
Benzene	2.75 x 10-3 (Ib/10 ^{00gal})	10300501
Beryllium	2.5 x 10-6	10300501
Cadmium	1.1 x 10-5	10300501
Chromium	6.7 x 10-5	10300501
Fluoranthene	2.48 x 10-8	10300501
Formaldehyde	6.1 x 10-2 (Ib/10 ^{00gal})	10300501
Manganese	1.4 x 10-5	10300501
Mercury	3 x 10-6	10300501
Nickel	1.7 x 10-4	10300501
POM	3.3 x 10-3 (Ib/10 ^{00gal})	10300501
Pollutant	LPG Factor	Nat. Gas Factor
	(lb/1000gal)	(Ib/MMcf)
Benzene	2.04 x10-2	2.30 x 10-1
Cadmium	2.00 x 10-2	6.00 x 10-1
Cobalt	8.00 x 10-3	2.40 x 10-1
Copper	2.00 x 10-4	6.00 x 10-3
Chromium	2.20 x 10-3	6.6 x 10-2
Formaldehyde	4.09 x 10-2	4.61 x 10-1
Lead	2.00 x 10-4	6.00 x 10-3
Manganese	2.00 x 10-4	6.00 x 10-3
Nickel	2.00 X 10-3	6.00 x 10-2
Toluene	1.02 X 10-2	1.15 x 10-1

POLLUTANT	EMISSION FACTOR
Arsenic Benz(a)anthrancene Cadmium Cobalt Copper Lead Mercury Manganese Nickel POM 2378-TCDD 2378-TCDF	1.176 x 10-3 lb/ MMBTU 3.00 x 10-3 mg/Mg 5.882 x 10-5 lb/MMBTU 2.343 x 10-3 lb/ MMBTU 1.42 x 10-4 lb /MMBTU 4.706 x 10-3 lb/MMBTU 1.399 x 10-4 lb/ton 8.235 x 10-3 lb/MMBTU 2.353 x 10-3 lb/ MMBTU 4.273 x 10-3 lb/ MMBTU 2.40 x 10-3 mgMg 6.30 x 10-2 mg/Mg

Emissions are estimated by first calculating total statewide emsiions for each individual pollutant and then pro rating emsisions to county based levels using 1996 county and state population.

W. Residential Wood Combustion

SOURCE IDENTIFICATION

There are no SIC codes associated with Residential Wood Combustion

	В	4	2		2
-					
				,	



Table X-3: Nationwide VOC solvent usage and emission estimates for selected industries, tons/ yr ^a (epa, 1994 B) ^b

	Industry	Equipment	Floor	Large	Line	Parts	Small	Spray	Spray	Tank	Total
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GREAT LAKESTOXICS

AMS codes were found for the following SIC groups.

SIC	AMS CODE	DESCRIPTION	INDUSTRY DESCRIPTION
25	2415005000	TOTAL: ALL SOLVENTS	FURNITURE & FIXTURES
33	2415010000	TOTAL: ALL SOLVENTS	PRIMARY METAL INDUSTRY
33	2415015000	TOTAL: ALL SOLVENTS	SECONDARY METAL INDUSTRY
34	2415020000	TOTAL: ALL SOLVENTS	FABRICATED METAL
35	2415025000	TOTAL: ALL SOLVENTS	INDUSTRIAL MACHINERY & EQUIPMENT
36	2415030000	TOTAL: ALL SOLVENTS	ELECTRONIC AND OTHER ELEC.
37	2415035000	TOTAL: ALL SOLVENTS	TRANSPORTATION EQUIPMENT
38	2415040000	TOTAL: ALL SOLVENTS	INSTRUMENTS AND RELATED PRODUCTS
39	2415045000	TOTAL: ALL SOLVENTS	MISC MANUFACTURING
40-45	2415050000	TOTAL: ALL SOLVENTS	TRANSPORTATION MAINTENANCE FACILITIES
55	2415055000	TOTAL: ALL SOLVENTS	AUTOMOTIVE DEALERS
75	2415060000	TOTAL: ALL SOLVENTS	AUTO REPAIR SERVICES

REFERENCES

Environmental Protection Agency (EPA). *STAPPA-ALAPCO-EPA Emission Inventory Improvement Program (EIIP)*. Volume III - Area Sources Preferred and Alternative Methods. Chapter 6, Solvent Cleaning. September 1997.

US Department of Commerce, Bureau of the Census. *County Business Patterns 1995.* October 1997.

US Department of Commerce, Bureau of the Census. 1996 Annual Survey of Manufacturers M96(AS)-1, Statistics for Industry Groups and Industries.

PREFERRED METOHD: Survey of Traffic Marking Usage Data requirements of the preferred method as per EIIP Document Volume III: Chapter 14 - know the solvent usage from the paint but not the solvent usage from the thinning and cleanup activities, the paint usage provided by the state highway department is categorized by districts or subdivision of the state that cuts across county boundaries, etc. You may start out trying to do a survey method only to combine it with one of the alternative methods when you have insufficient information. Once a baseline survey method has been established, using a smaller sample size or updating traffic marking coating usage maybe sufficient in following years. Using the Preferred Method, Alternative Method One or Three will give the county-based pain usage. Alternative Method Two assumes 16 gallons of traffic paint of either solvent- or water-based paint are used for every mile counted (EPA, 1988). The air toxic emission factors are available from EIIP Document Volume III: Chapter 14 - Traffic Markings. The equation for calculating air toxic emissions is the following:

Air Toxic Emissions = County Traffic Paint Usage * Air Toxic Volume % * Air Toxic Density

AIR Toxic	Volume Percent (%)	Density (Ib./gal)
Carbon tetrachloride	0.009	12.19
Ethylbenzene	0.009	7.24
Glycol ethers	0.040	7.01
Naphthalene	0.002	9.55
Styrene	0.277	7.55
Toluene	6.914	7.23
Xylenes (mixed isomers)	0.499	- 7.18

Table Y-1: Pollutants emitted of interest to RAPIDS and Species Profile

Appendix Z: Index of SIC Code

SIC DESCRIPTION

- 01 Agricultural Production-crops
- 011 Cash Grains
- 0111 Wheat
- 0112 Rice
- 0115 Corn
- 0116 Soybeans
- 0119 Cash Grains, n.e.c.
- 0130 Field Crops, Except Cash Grains
- 0131 Cotton
- 0132 Tobacco
- 0133 Sugar Crops
- 0134 Irish Potatoes
- 0139 Field Crops Except Cash Grains
- 016 Vegetables and Melons
- 0161 Vegetables and Melons
- 017 Fruits and Tree Nuts
- 0171 Berry Crops
- 0172 Grapes
- 0173 Tree Nuts
- 0174 Citrus Fruits
- 0175 Deciduous Tree Fruits
- 0179 Fruits and Tree Nuts, n.e.c.
- 018 Horticultural Specialties
- 0181 Ornamental Nursery Products
- 0182 Food Crops Grown under Cover
- 0189 Horticultural Specialties, n.e.c.
- 019 General Farms, Primarily Crop
- 0191 General Farms Primarily Crop
- 02 Agricultural Production-livestock & Animal Special
- 021 Livestock, Except Dairy and Poultry
- 0211 Beef Cattle Feedlots
- 0212 Beef Cattle Except Feedlots
- 0213 Hogs
- 0214 Sheep and Goats
- 0219 General Livestock, n.e.c.
- 024 Dairy Farms
- 0241 Dairy Farms
- 025 Poultry and Eggs
- 0251 Broiler, Fryer, and Roaster Chickens
- 0252 Chicken Eggs
- 0253 Turkeys and Turkey Eggs
- 0254 Poultry Hatcheries
- 0259 Poultry and Eggs, n.e.c.
- 027 Animal Specialties
- 0271 Fur-bearing Animals and Rabbit
- 0272 Horses and Other Equines
- 0273 Animal Aquaculture
- 0279 Animal Specialties, n.e.c.
- 029 General Farms, Primarily Livestock and Animal Specialties
- 0291 General Farms Primarily Livestock

SIC DESCRIPTION

- 07 Agricultural Services
- 071 Soil Preparation Services
- 0711 Soil Preparation Services
- 072 Crop Services
- 0721 Crop Planting and Protection
- 0722 Crop Harvesting
- 0723 Crop Prep Services for Market
- 0724 Cotton Ginning
- 0729 General Crop Services
- 074 Veterinary Services
- 0741 Veterinary Services Farm Livestock
- 0742 Veterinary Services Specialties
- 075 Animal Services, Except Veterinary
- 0751 Livestock Services, Except Specialties
- 0752 Animal Specialty Services
- 076 Farm Labor and Management Services
- 0761 Farm Labor Contractors
- 0762 Farm Management Services
- 078 Landscape and Horticultural Services
- 0781 Landscape Counseling and Planning
- 0782 Lawn and Garden Services
- 0783 Ornamental Shrub and Tree Services
- 08 Forestry

0083es

- 1051 Bauxite and Other Aluminum Ore
- 106 Ferroalloy Ores, Except Vanadium
- 1061 Ferroalloy Ores Except Vanadium
- 108 Metal Mining Services
- 1081 Metal Mining Services
- 109 Miscellaneous Metal Ores
- 1092 Mercury Ores
- 1094 Uranium-Radium-Vanadium Ores
- 1099 Metal Ores, n.e.c.
- 1111 Anthracite
- 1112 Anthracite Mining Services
- 12 Coal Mining
- 1211 Bituminous Coal and Lignite
- 1213 Bituminous & Lignite Mine Services
- 122 Bituminous Coal and Lignite Mining
- 1221 Bituminous Coal & Lignite Surface
- 1222 Bituminous Coal & Lignite Underground
- 123 Anthracite Mining
- 1231 Anthracite Mining
- 124 Coal Mining Services
- 1241 Coal Mining Services
- 13 Oil and Gas Extraction
- 131 Crude Petroleum and Natural Gas
- 1311 Crude Petroleum & Natural Gas
- 132 Natural Gas Liquids
- 1321 Natural Gas Liquids
- 138Oil and Gas Field Services
- 1381 Drilling Oil and Gas Wells
- 1382 Oil and Gas Exploration Service
- 1389 Oil and Gas Field Services, n.e.c.
- 14 Mining and Quarrying of Nonmetallic Minerals
- 141 Dimension Stone
- 1411 Dimension Stone
- 142 Crushed & Broken Stone, Including Riprap
- 1422 Crushed and Broken Limestone
- 1423 Crushed and Broken Granite
- 1429 Crushed and Broken Stone, n.e.c.
- 144 Sand and Gravel
- 1442 Construction Sand and Gravel
- 1446 Industrial Sand
- 145 Clay, Ceramic, and Refractory Minerals
- 1452 Bentonite
- 1453 Fire Clay
- 1454 Fullers Earth
- 1455 Kaolin and Ball Clay
- 1459 Clay and Related Minerals, n.e.c.
- 147 Chemical & Fertilizer Mineral Mining
- 1472 Barite
- 1473 Fluorspar
- 1474 Potash Soda & Borate Minerals
- 1475 Phosphate Rock
- 1476 Rock Salt
- 1477 Sulfur
- 1479 Chemical and Fertilizer Mining
- 148 Nonmetallic Minerals Services, Except Fuels
- 1481 Nonmetallic Minerals Services
- 149 Miscellaneous Nonmetallic Minerals, Except Fuels
- 1492 Gypsum

SIC DESCRIPTION

- 1496 Talc Soapstone & Pyrophyllite
- 1499 Nonmetallic Minerals, n.e.c.
- 15 Building Construction-General Contractors & Builders
- 152 General Building Contractors-Residential Buildings
- 1521 Single-family Housing Construction
- 1522 Residential Construction, n.e.c.
- 153 Operative Builders
- 1531 Operative Builders
- 154 General Building Contractors-Nonresidential Buildings
- 1541 Industrial Building/Warehouses
- 1542 Nonresidential Construction N.e.c.
- 16 Heavy Construction other than Building Construction-Contract
- 161 Highway & Street Construction, Except Elevated Highway
- 1611 Highway and Street Construction
- 162 Heavy Construction, Except Highway & Street Construction
- 1622 Bridge Tunnel & Elevated Hwy
- 1623 Water Sewer and Utility Lines
- 1629 Heavy Construction, n.e.c.
- 17 Construction-special Trade Contractors
- 171 Plumbing, Heating, and Air-conditioning
- 1711 Plumbing Heating Air Condition
- 172 Ainting and Paper Hanging
- 1721 Painting and Paper Hanging
- 173 Electrical Work
- 1731 Electrical Work
- 174 Masonry, Stoneworks, Tile Setting, & Plastering
- 1741 Masonry and Other Stonework
- 1742 Plastering Drywall/Insulation
- 1743 Terrazzo Tile Marble Mosaic Work
- 175 Carpentry and Floor Work
- 1751 Carpentry Work
- 1752 Floor Laying & Floor Work, n.e.c.
- 176 Roofing, Siding, and Sheet Metal Work
- 1761 Roofing and Sheet Metal Work
- 177 Concrete Work
- 1771 Concrete Work

1794

1795

1796

1799

20

374

201

2011

2013

2015 Poultry

- 178 Water Well Drilling
- 1781 Water Well Drilling
- 179 Misc. Special Trade Contractors

Excavating and Foundation Work

Wrecking and Demolition Work

Special Trade Contractors, n.e.c.

Sausages & Other Prepared Meat

Installing Building Equipment

Food and Kindred Products

1791 Structural Steel Erection1793 Glass and Glazing Work

Meat Products

Meat Packing Plants

- 2675 Die-cut Paper and Board
- 2676 Sanitary Paper Products
- 2677 Envelopes
- 2678 Stationery Products
- 2679 Converted Paper Products, n.e.c.
- 27 Printing, Publishing and Allied Industries
- 271 Newspapers: Publishing, or Publishing & Printing
- 2711 Newspapers
- 272 Periodicals: Publishing, or Publishing & Printing
- 2721 Periodicals
- 273 Books
- 2731 Book Publishing
- 2732 Book Printing
- 274 Miscellaneous Publishing
- 2741 Miscellaneous Publishing
- 275 Commercial Printing
- 2751 Commercial Printing Letterpress
- 2752 Commercial Printing Lithograph
- 2753 Engraving and Plate Printing
- 2754 Commercial Printing, Gravure
- 2759 Commercial Printing, n.e.c.
- 276 Manifold Business Forms
- 2761 Manifold Business Forms
- 277 Greeting Cards
- 2771 Greeting Card Publishing
- 278 Blankboodk5(e)d9384043786e3(end)9.3(a)5.1(s)8(,)dksbindng L&]TJT35067 -1.1733 TD0.0052 Tc0.0013 Tw[(Re)(Ida)(Ite)(Id W)2.7(r)-1.5(d 27589 Bok d PR5.46(e8.1(I)8.1(te8.1(d W)21.8(o-1.2(r)45(k]TJT*0.0044 Tc-0.0011 Tw[(2759)-466.7(BS)8.2(r)4.1(c)11.1(ui)8.2(i)8.1(c)11.1(ui)8.2(i)8.1(c)11.1(ui)8.2(i)8.2(r)4.1(c)11.1(ui)8.2(i)8.1(c)11.1(ui)8.2(i)8.1(c)11.1(ui)8.2(i)8.1(c)11.1(ui)8.2(i)8.1(c)11.1(ui)8.2(i)8.1(c)11.1(ui)8.2(i)8.1(c)11.1(ui)8.2(i)8.1(c)11.1(ui)8.2(i)8.1(c)11.1(ui)8.2(i)8.1(c)11.1(ui)8.1(u

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27842 Gplis7.65ahe8.98es7.65aa

2784 ESu ace A21.47rcene A21.47rg1.9(nen-1.055st)-(es]-2788 CCCCCCCCCCCCCCCCCCCCCCCCCCC]TJT-.4227 -1.1733 TD0.0057 Tc-0.0001 Tv

7911 role8.93p 295 BA20.16Irv11148rnrin48ra8.5(r)1.99(s]TJT*[.0055 Tc-0.00125Tw[(295)-213.4(G)-11154d)89.6rvn Mix11255stine PB461

23 Ge8.55rs3lt5331idu 30529 68edr

- 3142 House Slippers
- 3143 Men's Footwear, Except Athletic
- 3144 Women's Footwear, Except Athletic
- 3149 Footwear, Except Rubber, n.e.c.
- 315 Leather Gloves and Mittens
- 3151 Leather Gloves and Mittens
- 316 Luggage
- 3161 Luggage
- 317 Handbags and Personal Leather Goods
- 3171 Women's Handbags and Purses
- 3172 Personal Leather Goods, n.e.c.
- 319 Leather Goods, n.e.c.
- 3199 Leather Goods, n.e.c.
- 32 Stone, Clay, Glass and Concrete Products
- 321 Flat Glass
- 3211 Flat Glass
- 322 Glass and Glassware, Pressed or Blown
- 3221 Glass Containers
- 3229 Pressed and Blown Glass, n.e.c.
- 323 Glass Products, Made of Purchased Glass
- 3231 Products of Purchased Glass
- 324 Cement, Hydraulic
- 3241 Cement, Hydraulic
- 325 Structural Clay Products
- 3251 Brick and Structural Clay Tile
- 3253 Ceramic Wall and Floor Tile
- 3255 Clay Refractories
- 3259 Structural Clay Products, n.e.c.
- 326 Pottery and Related Products
- 3261 Vitreous Plumbing Fixtures
- 3262 Vitreous China Food Utensils
- 3263 Fine Earthenware Food Utensils
- 3264 Porcelain Electrical Supplies

2(5 Tc2Tew93-4.372TD0 T4.3(n1.6(P)ds)a9T*15)9.8(i)3.8(ne)01.6(c)(, np4(P)-105 Tc12(u)-1.5(r)4.9(c)9(ha)9-8859()8.9(t)2.9(G)20.(e)8.8(Fot.8)

- 345 Screw Machine Products, Bolts, Nuts, Screws,
- Rivets, and Washers
- 3451 Screw Machine Products
- 3452 Bolts Nuts Rivets & Washers
- 346 Metal Forgings and Stampings
- 3462 Iron and Steel Forgings
- 3463 Nonferrous Forgings
- 3465 Automotive Stampings
- 3466 Crowns and Closures
- 3469 Metal Stampings, n.e.c.
- 347 Coating, Engraving, and Allied Services3471 Electroplating, Polishing, Anodizing, and Coloring
- 3471 Electroplating, Polising, Anodizing, and Color 3479 Metal Coating and Allied Services, n.e.c.
- Ordnarce and Accessories, Except Vehicles and
 Ordnarch Missiles
- Guided Missiles
- 3482 Small Arms Ammunition
- 3483 Ammunition, Exc. For Small Arm
- 3484 Small Arms
- 3489 Ordnance and Accessories, n.e.c.
- 349 Misc. Fabricated Metal Products
- 3491 Industrial Valves
- 3492 Fluid Power Valves and Hose Fittings
- 3493 Steel Springs, Except Wire
- 3494 Valves and Pipe Fittings
- 3495 Wire Springs
- 3496 Misc. Fabricated Wire Products
- 3497 Metal Foil and Leaf
- 3498 Fabricated Pipe and Fittings
- 3499 Fabricated Metal Products, n.e.c.
- 35 Industrial and Commercial Machinery & Computer Equipment
- 351 Engines and Turbines
- 3511 Turbines and Turbine Generator
- 3519 Internal Combustion Engines
- 352 Farm and Garden Machinery ay ay MachFai Industrs1.1(r)5.3(b)-1.1(inn.3(d(y)25oTc-03)25.1a)M9(y)25.15tyTc0.(c)8.9(h)t(Fa3s)-30.hFa

- 3636 Sewing Machines
 3639 Household Appliances, n.e.c.
 364 Electric Lighting and Wiring Equipment
 3641 Electric Lamps
- 3991 Brooms and Brushes
- 3993 Signs and Advertising Displays
- 3995 Burial Caskets
- 3996 Hard Surface Floor Coverings
- 3999 Manufacturing Industries, n.e.c.
- Railroad Transportation 40
- 401 Railroads
- 4011 Railroads, Line-haul Operating
- 4013 Switching & Terminal Services
- 4041 Railway Express Service
- 41 Local & Suburban Transit & Interurban Hwy Pass
- 411 Local and Suburban Passenger Transportation
- 4111 Local and Suburban Transit
- 4119 Local Passenger Transportation
- 412 Taxicabs
- 4121 Taxicabs
- 413 Intercity and Rural Bus Transportation
- 4131 Intercity Hwy Transportation
- 414 Bus Charter Service
- 4141 Local Passenger Charter Service
- 4142 Charter Service, Except Local
- 415 School Buses
- 4151 School Buses
- 417 Terminal & Service Facilities: Motor Vehicle Passenger Transportation
- 4171 Bus Terminal Facilities
- 4172 Bus Service Facilities
- 4173 Bus Terminal and Service Facilities
- Motor Freight Transportation and Warehousing 42
- 421 Trucking and Courier Services, Except Air
- 4212 Local/Trucking wc8n36(-34)(ie/hc2)a w 4013 al/Tucwi5(s)7.2(55(u)-1.ng)11.p(r)4.5t Locs
- 4111
- Licaruc i(a)3.9(e)9.9.2(I)3.5(a.9(c85)3.2(c)3((e)9.9.(ic)7.8(e)]TJT*0.0044 Tc-0.0011 2 4212 F66(\$7.7832a(i 75472(76(972.56(s)3.56(8(97(7)55)))1*12(20)HP)715.66(9713r45(f))46(15(t)]1517.10)36491 T.5(0(10)155404(.(1.42)115.6(48(1)3145(10)46(10)15404(.(1.42)115.6(48(1)3145(10)46(10)15404(.(1.42)115.6(48(1)3145(10)46(10)15404(.(1.42)115.6(48(1)3145(10)46(10)15404(.(1.42)115.6(48(1)3145(10)46(10)15404(.(1.42)115.6(48(1)3145(10)46(10)15404(.(1.42)115.6(48(1)3145(10)46(10)15404(.(1.42)115.6(48(1)3145(10)46(10)15404(.(1.42)115.6(48(1)3145(10)46(10)15404(.(1.42)115.6(48(1)3145(10)46(10)15404(.(1.42)115.6(48(1)3145(10)46(10)15404(.(1.42)115.6(48(1)415(10)46(10)15404(.(1.42)115.6(48(1)415(10)46(10)15404(.(1.42)115.6(48(1)415(10)46(10)15404(.(1.42)115.6(48(1)415(10)46(10)15404(.(1.42)115.6(48(1)415(10)46(10)15404(.(1.42)115.6(48(1)415(10)46(10)15404(.(1.42)115.6(48(1)415(10)46(10)15404(.(1.42)115.6(48(1)415(10)46(10)15404(.(1.42)115.6(48(1)415(10)46(10)15404(.(1.42)115.6(48(1)415(10)46(10)15404(.(1.42)115.6(48(1)415(10)46(10)15404(.(1.42)115.6(48(1)415(10)46(10)15404(.(1.42)115.6(48(1)415(10)46(10)404(.(1.42)115.6(48(1)415(10)46(10)404(.(1.42)115.6(48(1)415(10)46(10)404(.(1.42)115.6(48(1)415(10)404(.(1.42)1156(10)404(.(1.42)115(10)404(.(1.42)115(10)404(.(1.42)115(10)404

- 4789 Transportation Services, n.e.c.48 Communications

- 48 Communications
 481 Telephone Communications
 4811 Telephone Communication

639 Insurance Carriers, n.e.c.

7373	Computer Integrated Systems Design
7374	Data Processing Services
7375	Information Retrieval Services
7376	Computer Facilities Management
7377	Computer Rental and Leasing
7378	Computer Maintenance and Repair
7379	Computer Related Services, n.e.c.
738	Miscellaneous Business Services
7381	Detective and Armored Car Services
7382	Security Systems Services
7383	News Syndicate
7384	Photofinishing Laboratories
7389	Business Services, n.e.c.
7391	Research & Development Laboratories
7392	Management and Public Relations
7393	Detective and Protective Services
7394	Equipment Rental and Leasing
7395	Photorinishing Laboratories
7396	I rading Stamp Services
7397	Commercial Testing Laboratories
7399	Business Services, n.e.c.
70 751	Automotive Repair, Services & Parking
751	Personal Car Pontal and Leasing, Without Drivers
7512	Truck Pontal and Looping
7513	Passanger Car Rental
7515	Passenger Car Leasing
7510	Fasseriger Car Leasing Utility Trailer Rental
752	Automobile Parking
7521	Automobile Parking
7523	Parking Lots
7525	Parking Structures
753	Automotive Repair Shops
7531	Top and Body Repair Shops
7532	Top and Body Repair and Paint Shops
7533	Auto Exhaust System Repair Shops
7534	Tire Retreading and Repair Shops
7535	Paint Shops
7536	Automotive Glass Replacement Shops
7537	Automotive Transmission Repair Shops
7538	General Automotive Repair Shop
7539	Automotive Repair Shops, n.e.c.
754	Automotive Services, Except Repair
7542	Car Washes
7549	Automotive Services, n.e.c.
76	Miscellaneous Repair Services
7620	Electrical Repair Shops
7622	Radio and Television Repair
7623	Refrigeration Service and Repair Shops
7629	Electrical Repair Shops, n.e.c.
763	Watch, Clock, and Jewelry Repair
7631	Watch, Clock, and Jewelry Repair Shops
764	Reupholstery and Furniture Repair
7641	Reupholstery and Furniture Repair
769	Misc. Repair Shops and Related Services
7692	Welding Repair
7694	Armature Rewinding Shops
7699	Repair Services, n.e.c.

SIC DESCRIPTION

78 Motion Pictures

- 781 Motion Picture Production & Allied Services
- 7812 Motion Picture and Video Production
- 7813 Motion Picture Production, Except TV
- 7814 Motion Picture Production for TV
- 7819 Services Allied to Motion Pictures
- 782 Motion Picture Distribution & Allied Services
- 7822 Motion Picture and Tape Distribution
- 7823 Motion Picture Film Exchanges
- 7824 Film or Tape Distribution for TV
- 7829 Motion Picture Distribution Services
- 783 Motion Picture Theaters
- 7832 Motion Picture Theaters, Except Drive-ins
- 7833 Drive-in Motion Picture Theaters
- 784 Video Tape Rental
- 7841 Video Tape Rental
- 79 Amusement and Recreation Services
- 791 Dance Studios, Schools, & Halls
- 7911 Dance Halls, Studios, and Schools
- 792 Theatrical Producers (Non Motion Picture), Orchestras, Entertainers
- 7922 Theatrical Producers and Services
- 7929 Entertainers & Entertainment Groups
- 793 Bowling Centers
- 7932 Billiard and Pool Establishments
- 7933 Bowling Alleys
- 794 Commercial Sports
- 7941 Sports Clubs and Promoters
- 7948 Racing, Including Track Operation
- 799 Misc. Amusement and Recreation Services
- 7991 Physical Fitness Facilities
- 7992 Public Golf Courses
- 7993 Coin-operated Amusement Device
- 7996 Amusement Parks
- 7997 Membership Sports & Recreation Clubs
- 7999 Amusement and Recreation, n.e.c.
- 80 Health Services
- 801 Offices & Clinics of Medical Doctors
- 8011 Offices of Physicians
- 802 Offices and Clinics of Dentists
- 8021 Offices of Dentists
- 803 Offices of Osteopathic Doctors
- 8031 Offices of Osteopathic Physicians
- 804 Offices & Clinics of Other Health Practitioners
- 8041 Offices of Chiropractors
- 8042 Offices of Optometrists
- 8043 Offices and Clinics of Podiatrists
- 8049 Offices of Health Practitioner
- 805 Nursing and Personal Care Facilities
- 8051 Skilled Nursing Care Facilities
- 8052 Intermediate Care Facilities
 - 8059 Nursing and Personal Care, n.e.c.
 - 806 Hospitals
 - 8061 Hospitals
 - 8062 General Medical & Surgical Hospitals
 - 8063 Psychiatric Hospitals
 - 8069 Specialty Hospitals, Except Psychiatric
 - 807 Medical and Dental Laboratories

- 8071 Medical Laboratories
- 8072 Dental Laboratories
- 808 Home Health Care Services
- 8081 Outpatient Care Facilities
- 8082 Home Health Care Services
- 809 Misc. Health & Allied Services, n.e.c.
- 8091 Health and Allied Services, n.e.c.

- 9431 Public Health Program Administration
- 944 Social, Human Resource & Income Maintenance Program Administration
- 9441 Admin of Social & Manpower Programs
- 945 Veterans' Affairs (Except Health & Insurance) Administration
- 9451 Administration of Veterans' Affairs
- 95 Admin. of Environmental, Quality & Housing Program
- 951 Environmental Quality Programs Administration
- 9511 Air, Water, & Solid Waste Management
- 9512 Land, Mineral, Wildlife Conservation
- 953 Housing & Urban Development Programs Administration
- 9531 Housing Programs
- 9532 Urban and Community Development
- 96 Administration of Economic Programs
- 961 General Economic Program Administration
- 9611 Admin of General Economic Programs
- 962 Transportation Programs Regulation & Administration
- 9621 Regulation, Administration of Transportation
- 963 Communications, electric, gas, & Utilities Regulation & Administration
- 9631 Regulation, Admin of Utilities
- 964 Agricultural Marketing & Commodities Regulation
- 9641 Regulation of Agricultural Marketing & Commodities
- 965 Misc. Commercial Sectors Regulation, Licensing, & Inspection

Appendix AA

 Table AA-1:
 Carcinogenicity Ratings for Target Compounds Included in the Regional Toxic Air Emissions Inventory Based on the U.S. EPA's Integrated Risk Information System (IRIS) Database

 Pollutant Name
 CAS No.
 Key for U.S. EPA 47.7km7m Ra5(ti7)0.5(y)-8.so.

Appendix BB

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